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The concept of optimising the development of geoportals of protected areas using the example of Polish national parks – A case study

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Abstract

For more than ten years a dynamic and intensive development has been observed in spatial information technology combining elements of geoinformatics with data from various sources in order to create elaborate, often interdisciplinary and multifunctional compilations.

The progressing implementation of IT solutions with reference to resources and related trends to make public information that is useful to a wide group of recipients are reflected in multimedia information materials of many public institutions and private businesses. An example of using electronic technologies in the presentation of spatial data of national parks is widely available geoportals, interactive maps and other cartographic or paracartographic visualizations offering various tools allowing the utilisation of spatial information resources.

This publication aims at a multi-level analysis of the availability of network services, as defined in 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, to all the existing geoportals of Polish national parks and a review of additional functions offered by the map services of all 23 Polish national parks that may be useful to users. As a result of research, tables and descriptions comparing the functions of the analysed geoportals were compiled and additional practical tools observed in other services were described. In addition, based on the comparisons, a concept of geoportal optimization was developed taking into account all categories of spatial information services and optional functions.

Key words: case study, geoportals of protected areas, geopolitics development optimization, national parks, Polish national parks

INTRODUCTION

A “geoportal” is a web application responsible for providing spatial data services [HE *et al.* 2012; PTIP 2014; TAIT 2005].

Spatial data services, as defined and described in detail in the Act of 4 March 2010 on the infrastructure of spatial information, include primarily discovery, view, download and transformation services referring to elements with specific geographical location and services invoking other

services [Ustawa... 2010]. The definition of spatial information coincides with the guidelines of Directive 2007/2/EC, hereinafter referred to as the INSPIRE Directive. This is a legal act constituting a uniform basis for establishing spatial information systems in the member states of the European Union for the purposes of comparing the contents of data included in compilations prepared by various organisations operating in different countries [BIELECKA *et al.* 2018]. Activities covering different entities are coordinated, often at international level, with the

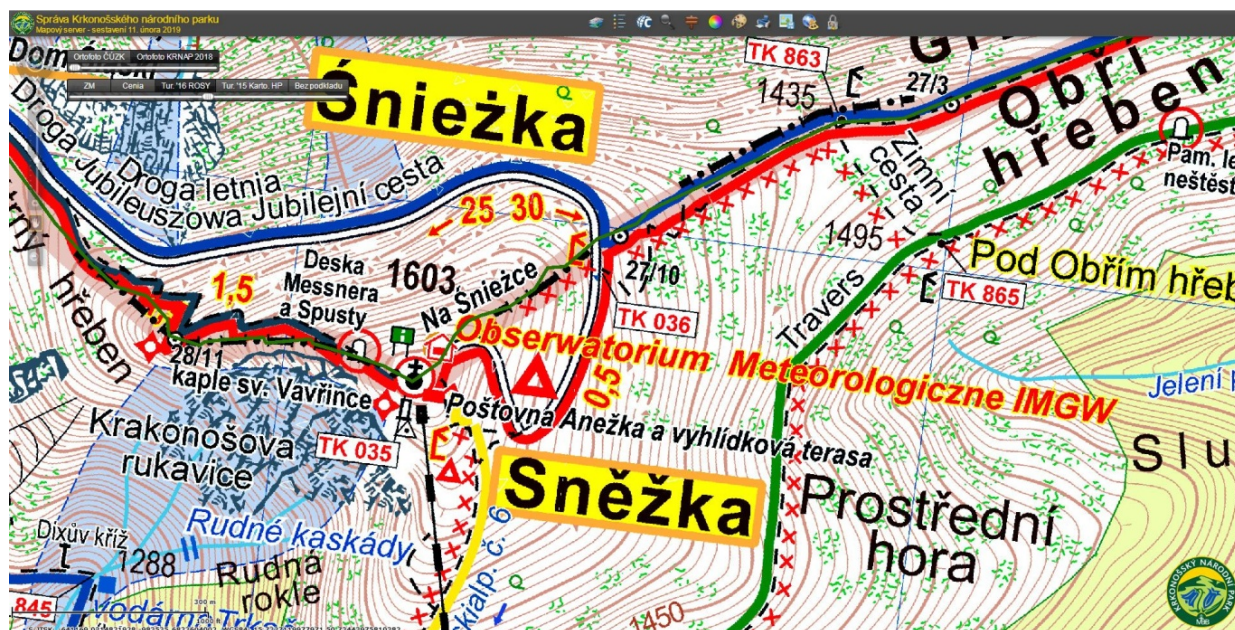


Fig. 1. Polish-Czech interactive map in the geoportal of the Karkonosze National Park (Czech version); source: Mapový server [2019]

support of commonly used standards for processing and providing data such as ISO and OGC standards [RAUTENBACH *et al.* 2013; YANG *et al.* 2007]. The recommendations primarily refer to using specific programming languages, applying uniform methods of maintaining databases and operating on compatible file types allowing users to use and modify them freely.

A special example of applying uniform standards at the international level can be Polish-Czech system of spatial information for the Karkonosze National Park (Pol. Karkonoski Park Narodowy, its equivalent on the Czech side is Krkonošský národní park). The collected data is provided on a common map, which make it possible to maintain continuity of the presented area (Fig. 1) [Mapový server 2019].

The term “geoportal” has no uniform definition in common use [AKINCI, CÖMERT 2008]. It is often used with reference to compilations presenting spatial data that do not necessarily have all characteristics following from the INSPIRE Directive. However, in this case, the decision on classifying the specific portal as a geoportal is a matter of subjective assessment and comparisons.

The main characteristic and at the same time the biggest advantage of geoportals is combining various information into a multi-level service providing desirable data in a way selected by the user. As tools providing access to spatial infrastructure systems, geoportals are used by various institutions at a local, regional, state and international level [AKINCI, CÖMERT 2008].

Collecting and providing spatial information in the form of geoportals is applicable in environmental protection, for instance, for the needs of national parks. Such treatment of data allows the administrators of such areas to effectively register valuable resources, to carry out analyses and develop forecasts and plan the optimum activities [BADEA *et al.* 2014]. Public availability of spatial information is also significant for extending knowledge about

the environment and related problems [OANA *et al.* 2014; YANG *et al.* 2010; YANG, RASKIN 2009].

Maintaining national parks’ geoportals has gradually become a common practice in the countries of the European Community, but the advancement of works in respective countries differs. For example, all four national parks in the Czech Republic have their own geoportals, while none of the nine national parks in neighbouring Slovakia has a spatial information system at its disposal. The functioning of geoportals is not a standard for German national parks either – in this case available information must be sought in regional geoportals or in national compilations. However, some German national parks such as, for example, Nationalpark Eifel, make available elaborate interactive maps of tourist routes [Nationalpark Eifel undated]. The existence of eight (including seven currently operating) geoportals of national parks in Poland points to a moderate but visible advancement of the process of implementing IT solutions for spatial data in the study area.

Currently, in Poland there are 23 national parks covering a total area of 315.1 thous. ha (ca. 1% of the area of the country) [GUS 2018]. Each of them has an information website containing data on space presented in different maps. Most of them are interactive, that is, they allow the user to select the contents and the presentation of the map.

Seven Polish national parks provide spatial data using services that, according to the INSPIRE Directive, are geoportals. These compilations are usually composed of a multilayer vector map used as a base map and thematic overlays presented in various forms and showing a varying degree of interactivity. A peculiar standard is the presence of a tool for map scaling and moving, selecting information to be displayed, searching the desired contents (e.g. specific geographic objects) and downloading source materials (most often in the form of specialist Internet services such as WMS).

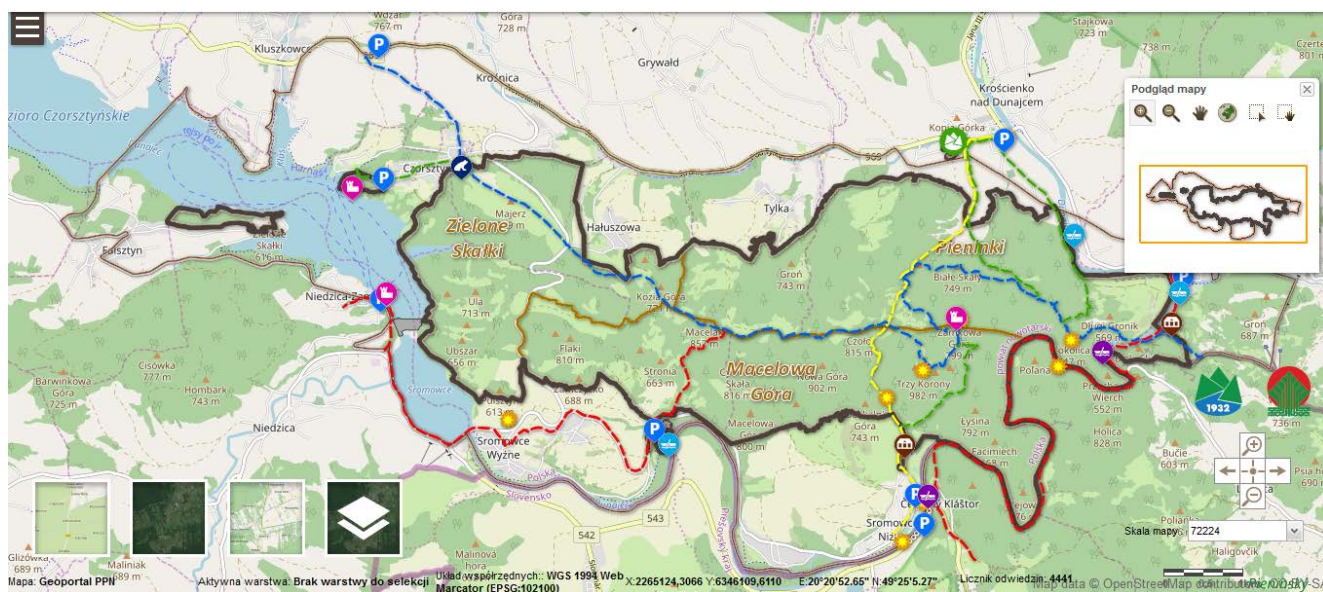


Fig. 2. Geoportal of the Pieniny National Park; source: PPN [undated]

MATERIAL AND METHODS

Detailed analyses covered all the existing geoportals of Polish national parks. In April 2019 spatial data was provided this way by seven of the 23 national parks existing in Poland. These include: Biebrza National Park, Bieszczady National Park, “Tuchola Forest” National Park, Karkonosze National Park, Pieniny National Park (Fig. 2), Roztocze National Park and Tatra National Park. Website addresses of the above-mentioned parks are presented in Table 1.

Table 1. List of national parks covered by the analysis including website addresses of the studied services

Name of the national park	Website address of the geoportal
Biebrza National Park	http://geoportal.biebrza.org.pl/
Bieszczady National Park	http://ond.bdpn.pl:8080/imap/
“Tuchola Forest” National Park	http://gis.pnbt.com.pl/
Karkonosze National Park	http://geoportal.kpnmab.pl/imap/
Pieniny National Park	http://gis.pieninyppn.pl/geoportal/
Roztocze National Park	http://185.202.216.73:8080/RPN/
Tatra National Park	http://geoportal.tpn.pl/

Source: own elaboration.

The central research criterion was the presence and forms of provision of spatial data services as set out in the INSPIRE Directive, i.e. discovery, view, download and transformation services as well as services allowing spatial data services to be invoked [Commission Regulation (EC) No. 976/2009; Commission Regulation (EU) No. 1089/2010; Directive 2007/2/EC]. The presence of all the above-mentioned services testifies to the correct classification of the analysed system of information as a geoportal. The findings were compiled and described in detail in chapter “Comparison of the geoportals of Polish national parks”.

Another part of the works was oriented at extra functions of spatial information services that might be useful to a potential user. To this end, the studied geoportals were

reviewed again and the available compilations of the remaining sixteen national parks were analyzed. Selected elements were grouped according to thematic categories and described in chapter “Review of additional functions of spatial visualization of national parks”.

The final deliverable is the concept of optimisation of a geoportal, developed on the basis of analyses, in order to create a service that will be fully compatible with the requirements of the INSPIRE Directive and that will be extended by additional functions useful to specialists working on spatial data and for ordinary users searching for information, e.g. tourists. The findings, split into categories according to the types of analyzed network services and thematic groups of optional functions, are described in chapter “Concept of optimisation of the geoportals of Polish national parks”.

RESULTS AND DISCUSSION

COMPARISON OF THE GEOPORTALS OF POLISH NATIONAL PARKS

At the time of research geoportals were in use for seven national parks mentioned before. According to information published on the site, the Gorce National Park also had a geoportal but it was inaccessible during the analyses due to there being no connection to the service server. The comparison of functions of Polish national parks geoportals is presented in Table 2.

The compilation presented in Table 2 above indicates that each of the services referred to as a “geoportal” by its administrators provides services set out in the INSPIRE Directive. However, the analysed services differ considerably in terms of the degree of development of each service manifested in the number and technological advancement of the offered functions.

Elements connected with the search function have a role in each of the studied geoportals.

Table 2. Comparison of functions of the geoportals of Polish national parks (NP) according to network services as set out in the INSPIRE Directive

Service category	Biebrza NP	Bieszczady NP	“Tuchola Forest” NP	Karkonosze NP	Pieniny NP	Roztocze NP	Tatra NP	Total
Discovery services								
Searching according to object names or keywords	+	+	–	+	+	+	+	6
Searching for metadata	+	+	–	+	–	+	+	5
Searching according to coordinates	+	+	+	+	–	–	–	4
Searching on the basis of database inquiries	+	–	–	+	–	+	+	4
Searching for objects in a specific layer/class of objects	–	+	+	+	–	–	–	3
Searching according to geographical names	+	–	–	–	–	–	–	1
Searching for plots/divisions	–	–	–	–	+	–	–	1
View services								
Selection of a base map	+	+	+	+	+	+	+	7
Selection of thematic overlays	+	+	+	+	+	+	+	7
Map zoom in/out and pan	+	+	+	+	+	+	+	7
Viewing the table of attributes	+	+	+	+	+	+	+	7
Displaying information about objects	+	+	+	+	+	+	+	7
Connecting WMS services	+	+	–	+	+	+	+	6
Importing objects (KML, SHP, GPX)	+	–	+	+	+	+	+	6
Sketching tools	+	+	+	+	+	–	+	6
Connecting WFS services	+	–	–	+	+	+	–	4
Selection of objects according to attributes	+	–	–	+	–	+	+	4
Spatial analyses	+	+	–	+	–	–	–	3
Download services								
Downloading map view	+	+	+	+	+	+	+	7
Downloading table of attributes	+	+	–	+	+	+	+	6
Downloading sketches	–	–	+	+	+	–	+	4
Downloading vector files (routes)	–	–	–	–	+	–	–	1
Transformation services (selection of the coordinate reference systems)								
Geographical coordinates	+	+	+	+	+	+	+	7
1992 reference system	+	+	+	+	+	+	+	7
WGS 1984 reference system	+	+	–	+	–	+	+	5
PL-2000 reference system	+	+	–	+	–	–	+	4
UTM reference system	+	+	–	+	–	–	+	4
1965 reference system	–	+	–	–	–	–	+	2
WGS 1994 reference system	–	–	–	–	+	–	+	2
1942 reference system	–	–	–	–	–	–	+	1
GUGIK-80 reference system	–	–	–	–	–	–	+	1
EPSG:3785 reference system	+	–	–	–	–	–	–	1
S-JTSK Krovak (Czech) reference system	–	–	–	+	–	–	–	1
Services invoking spatial data services								
Tools for operating respective functions	+	+	+	+	+	+	+	7

Source: own elaboration.

Discovery services. All services, except the geoportal of the “Tuchola Forest” National Park, offer at least a possibility to search for the desired objects on the map using keywords or object names. A commonly available function is also the possibility to use a browser or metadata catalogue. This tool improves using the contents of a database, but for an average user it may be unclear and difficult to use. A simpler method to search for the desired objects are tools displaying a point with set coordinates and searching for elements based on inquiries generated by means of an available form. They are offered by four out of seven services. Such search engines are capable of selecting objects based on the adopted values of selected attributes, so they can also be used as a tool for basic spatial analyses such as the selection of objects with specific area. The function of displaying objects from selected layers or classes, combined with an option to view their attributes, also seems an interesting, although not very popular convenience (availa-

ble in three geoportals). This tool may turn out to be useful in particular when the layers available in the interactive legend of the layer do not offer a possibility to obtain information about the objects but only to display them on the map.

In the area of view services, the geoportals of all national parks offer at least a choice of the base map and thematic overlays. In each case the map can also be zoomed in/out, information about indicated objects can be displayed and tables of attributes can be viewed.

View services. In addition, the geoportals of all national parks except the “Tuchola Forest” National Park offer a possibility of connecting the contents of WMS servers as base maps. On the other hand, all of them, except the Bieszczady National Park, have a function of importing vector files in KML, SHP or GPX formats from the user’s resources. Another common practice is the possibility of making sketches and measurements on the map.

More than a half of the studied geoportals also offer a function of selecting objects based on the adopted values of respective attributes and an option of connecting the map with layers of objects from WFS services having vector geometry and database information. A less popular solution is the option of spatial analyses consisting of calculations based on geometric data and displaying results on the map (e.g. as an equidistant).

Download services. As regards download services, an average unregistered user of the geoportals of national parks normally has limited rights.

In each case the current map view can be downloaded as an image. The file is available for direct downloading or sent as an attachment to an indicated e-mail address. The resulting section of the map has a raster form, which to some extent limits the possibility of using it later. The obtained information can be supplemented by downloading the table of attributes for the selected class of objects, usually in the form of editable XML, XLS or CSV files, available for all geoportals except for the "Tuchola Forest" National Park. Thus, it is possible to permanently download data concerning selected objects and information about their location. However, the applied solution does not provide a possibility of downloading geometric data and linking the graphical representation of objects with their database description. Vector images can, however, be downloaded for generated sketches and effects of spatial analyses (the function is available for four out of seven geoportals). In addition, the service of the Pieniny National Park provides tourist routes for download in GPX format. They can be used, for instance, as a supplement to the maps of a portable GPS receiver.

Transformation services. The use of transformation services in the case of all the analysed geoportals is limited to selecting the coordinate reference system from available ones.

The number of usable reference systems is from two in the "Tuchola Forest" National Park to nine in the case of the Tatra National Park. Two reference systems (PUWG 1992 and geographical coordinates) are shared by all services. Most geoportals also contain WGS 1984, PL-2000 and UTM reference systems. Among the available coordinate reference systems, the 1965 and WGS 1994 occur twice. Other coordinate reference systems occur in one geoportal only.

REVIEW OF ADDITIONAL FUNCTIONS OF SPATIAL VISUALIZATION OF NATIONAL PARKS

Apart from the basic elements of geoportals mentioned in the previous chapter, the spatial visualizations of Polish national parks (often not being geoportals) tend to contain many elements that can considerably improve the usability and attractiveness of the compilations.

Georeferenced photographs. Seven out of 23 websites of Polish national parks offer a possibility of viewing georeferenced photographs. As a rule they are displayed by opening references by interactive signatures indicating on the map the place in which the photograph was taken. The function of displaying photographs in different forms is available in the compilations of the Babia Góra National

Park, the Kampinos National Park, the Karkonosze National Park, the Pieniny National Park, the Polesie National Park, the Słowiński National Park and the Wigry National Park. The websites of the above-mentioned parks, except the Kampinos National Park, provide a possibility of viewing spherical photographs. The user can freely rotate the view using available tools. The website of the Kampinos National Park makes it possible to view multimedia contents corresponding with the map in a window with a list of contents grouped according to categories and assigned to respective natural paths.

If the photographs have links to photographs from neighbouring locations and the user has a possibility to navigate logically between them, then one can talk about a so-called virtual walk. Such solutions were used, for instance, in the geoportal of the Pieniny National Park (the service designed in Business View technique by 360studio, is not a part of the geoportal, but it is an extension; the function is invoked after activating the links placed on the map) [360studio undated]. In addition, a significant part of other national parks offer elaborate virtual tour services not linked to the geoportal and often having no representations on the map.

Tourist route profiles. An element of maps that is useful to tourists is a detailed description of tourist routes containing information about the length and course of the route, potential difficulties and special amenities. The description may be extended by means of a diagram presenting the route profile. Such a convenience is offered by the map service of the Babia Góra National Park. The chart based on the axes of horizontal and vertical distance also indicates important elements of the route, localities on the way and contains links to photographs taken in the specific place (also available from the basic map view). The solution to a considerable extent facilitates planning trips, introduces the course of the route and provides a view of the difficulty level (e.g. various analyses can be made based on the analysis of differences in height and slope).

Route search engine. Another element of the potential system of tourist information forming a part of the geoportal can be a tourist route search engine thanks to which the user can find a comfortable connection between objects or localities of interest or find existing tourist routes near the selected site.

The tourist route search service is offered, for example, by mapa-turystyczna.pl, a service covering the Sudetes including the Foothills, the Beskid and Tatra Mountains, the Kraków-Częstochowa Jurassic Upland, the Świętokrzyskie Mountains and the Kampinos National Park [Mapa turystyczna undated]. The service is not directly connected to any of the national parks, but its functions are useful for tourists visiting them. It may be supposed that the establishment of cooperation between the service administrators and managers of national parks would be mutually beneficial.

Mobile application for tourists. Six national parks (Białowieża, Biebrza, Drawa, Pieniny, Polesie and Słowiński NP) provide mobile applications for tourists. The programmes offer interactive map visualizations and additional information. This service also makes it possible to see

one's own location on the map and mark the selected points. The user of the application can both extend the knowledge about the national park's topography and plan a trip or determine own location on the route. However, a precondition for correct operation of the programme is the optimum satellite range, which may be considerably hindered in forested territories.

CONCEPT OF OPTIMISATION OF THE GEOPORTALS OF POLISH NATIONAL PARKS

Progress in creating geoportals for Polish national parks testifies to the continuing development of implementing IT solutions with regard to resources. Seven out of 23 national parks have their own geoportal meeting the criteria of the INSPIRE Directive. Other parks have different kinds of visualisation at their disposal. These visualisations are characterised by a different level of technical advancement – from interactive, multi-functional vector maps to raster reproductions of analogue compilations.

The existing geoportals show significant discrepancies in terms of content and method of their presentation. Such a situation, primarily following from the multitude of entities creating compilations and the variety of software used by them, can be a hindrance to activities that require using data from more than one geoportal.

A proposed alternative solution could be creating a uniform standard for geoportal development applicable to all national parks. The presented suggestions identify areas in which improvements can be made to enhance the usability of geoportals and increase the comfort of their use both for specialist and occasional users.

The graphical interface (services invoking spatial information services). Geoportals, similar to most of the contemporary computer programmes for common use, communicate with the user via a graphical interface containing properly marked access paths to respective functions. The intuitiveness and transparency of displayed elements considerably affect the comfort and effectiveness of the user's work.

Uniform graphical interfaces of the websites would be a considerable convenience for users of geoportals. Such an attempt was made, for example, in the case of Slovakian national parks [Štátna ochrana... undated] The implementation of such a concept would be an obvious undertaking if the task of developing geoportals was commissioned exclusively to one entity. However, in reality the compilations are developed by different companies and they might object to an attempt at introducing strict graphical standards. On the other hand, it would be feasible to work out standards regarding a description of the tools offered and the intuitiveness of the distribution of links activating them in the website's interface.

A practical solution might also be creating an additional application or website facilitating access to official geoportals of all national parks. At present, invoking a selected service is often connected with the necessity to search for a not very noticeable link on the website of the respective park or to use an Internet browser. In this case there is a risk of coming across visualizations that are incompatible with reality, such as for example a non-updated

deliverable of a completed project [SIEJKA, ŚLUSARSKI 2014]. A user-friendly solution used on the website of the main Czech geoportal is a list of links to all geoportals available in the country including the compilations of all the four national parks. In addition, the service provides 36 various thematic maps in the form of overlays on the map of the country, as well as rich information resources regarding the INSPIRE Directive and its implementation [Narodni geoportal... undated].

One of the tasks that can be completed using a geoportal is searching for location and descriptive data for the indicated objects. This requires an efficient search engine allowing identification of objects not only by means of markings present in the database but also based on geographical names in use. Another helpful tool can be a function searching objects from a selected category at a specific distance from a set point or linear object or area (e.g. camp sites along the tourist route). More complex analyses may be supported by functions of selecting objects on layers and selecting attributes offered under the discover function as well as access to a metadata catalogue equipped with a search engine (available in some geoportals). A suggested solution useful for average users is also the simplification of spatial analyses and selective searching. The search engines currently used require skills of using logical operators and names of database attributes.

The function of opening "tabs" to zoom in map view of recognisable objects selected from the list is unavailable but possible to implement in the geoportals of Polish national parks. Such a function is offered, for instance, by the Czech service of the Karkonosze National Park [Mapový server 2019]. This solution may prove useful to tourists, for example.

Dynamic display of information (view services). Maps available on all geoportals of Polish national parks are interactive and offer various, often elaborate functions of displaying the contents of the service. A priority task seems to be extending the availability of existing tools to all geoportals, which would contribute to improving the multi-functionality of geoportals and adapting them to processing external data.

Permanent retrieval of data (download services). The possibility to download information from the geoportals of Polish national parks is to a significant extent limited and is mainly reduced to exporting the current map view or the geometry of certain objects (e.g. tourist routes or sketches made by the user). The downloaded materials can be used as a base map for creating more advanced compilations, but all activities connected with the modification of contents and performance of geospatial analyses can be carried out solely in the geoportal window and only using tools provided by the administrator.

A beneficial practice, particularly for research purposes, would be a possibility of downloading spatial data as sets of layers recorded in formats containing information about geometry, georeferences and basic attributes of objects. For example, providing full-value shapefiles enables users to generate their own sets of selected elements and also to prepare selective sets, making calculations and utilising data for creating new compilations presenting the

observed relationships by means of independently selected methods of cartographic presentations. A helpful solution could be even providing geometric and location data of objects grouped into layers and saved in vector graphic formats. Despite lacking detailed characteristics of the objects, the user could compose their own visualizations and analyse the shapes and distribution of objects.

Selection of the reference system (transformation services). Each of the geoportals of Polish national parks offers a possibility to choose the reference system from a number of available systems. Nevertheless, only two reference systems (PUWG 1992 and geographical coordinates) are shared by all the services. A suggested solution would be extending all visualizations by the reference system 1965 used in older compilations and the reference system 2000 applicable to small-scale maps. Transformation of data to other reference systems (in particular with the transformation of raster data) would require a considerable amount of work, but the result would enable comparing objects selected by users with their equivalents on other maps. It is also essential that the freedom of choice of a coordinate reference system is applicable to all contents of the geoportal and not to selected layers only.

Virtual walks on and off routes. A function available in some geoportals is displaying photographs taken from objects marked on the map. The virtual walk technique, possible thanks to using spherical photographs, seems to be an attractive way of presenting them.

A future-oriented solution that might be implemented in the area of virtual walks could be the use of digital 3D technology in which parallel, correctly displaced images are created. Looking at overlain images through special glasses, the user can see an unusually realistic three-dimensionality effect. Such a “walk”, possibly enriched with detail animations (as a sequence of motions of certain elements of the natural environment, such as for example moving water or flying birds) and sounds, would be a high-quality show of virtual reality that could be watched by average users (to ensure the full visual impressions offered, a Smartphone with a gyroscope and a virtual reality box are required).

Locating the virtual walk paths on tourist routes and supplementing them with a connections search engine would enable users to take high-quality virtual tours around the national park. An additional attraction may also be digital hikes in naturally rich areas closed to tourist traffic. At present, a considerable part of the parks already has high-tech virtual tour services at hand. However, it may be suggested that the system be linked to the map and be operable from the level of the geoportal. This way, the user receives more practical information and is not forced to look for services on or outside the main website of the park.

Mobile application for tourists. Mobile applications described in chapter “Mobile application for tourists” can considerably support tourists in planning and making their trips. A necessary element of such tools is LBS (location based systems) technology. However, to ensure that the system operates efficiently, the problem of insufficient signal range in forested areas must be solved. To this end, it is possible to install close-range digital communications

devices – so-called beacons, that is, miniature computers with Bluetooth, which when programmed appropriately would be able to locate Smartphones with a special application [Beecon undated]. However, it must be noted that the range of the wave emitted by such devices is only several dozen metres and the signal may be considerably weakened by terrain obstacles, e.g. dense vegetation. Maintaining a fixed range would necessitate the use of a very dense network of transmitters the prices of which, depending on the specifications, vary from more than 10 to around 100 dollars per set [Beecon undated]. In addition, the use of a large number of electronic devices would be connected with certain interference in the environment (however, for significant objectives of the national park project could be approved) [Ustawa... 2004]. Thus, it would be more feasible to use the transmitters in order to set up a network of local location and information points which, situated at the major points of the route, might constitute a multimedia alternative to route information boards.

Also, an application displaying 3D maps, provided e.g. by the German Nationalpark Berchtesgaden (Fig. 3) [Nationalparkverwaltung... undated] could be an attractive tool for users.



Fig. 3. 3D map of the German National Park Berchtesgaden; source: Nationalparkverwaltung ... [undated]

CONCLUSIONS

Seven out of all 23 national parks in Poland have their own geoportals meeting the criteria set out by the INSPIRE Directive. Others provide quite elaborate compilations in the form of vector or raster maps with a different degree of suitability for scientific research and private purposes, e.g. tourist. At the pending initial stage of development of spatial information infrastructure in the territory of Polish national parks, discussion on standardization of service development and supplementing them with elements useful to users seems justified. This is a way to considerably facilitate advanced comparisons and increase the attractiveness of compilations to people looking for information for research or tourist purposes. It is also essential that the requirements of the INSPIRE Directive regarding network services making the geoportal be taken into account. Compliance with the adopted standards plays a key role in future use of the services, among others, by entities analyzing the forms of environmental protection at the national

and international level and testifies to the openness to contemporary and future activities for the sake of environmental monitoring and protection.

A noteworthy concept can also be extending information offered by the geoportal with information about areas adjacent to national parks with a particular focus on objects useful for visitors. A key element in the development of tourism is a convenient tourist base that, apart from natural amenities, also consists of other sources of tourist traffic and, among other things, accommodation and catering base. Additional links to websites of companies offering various services could on the one hand offer marketing support for the owners of objects, and on the other hand help potential tourists plan their journey, and as a consequence – encourage people to visit the national park and its vicinity.

Dynamic and systematic modernisation of geoinformation resources and processing tools seems necessary in the contemporary circumstances, among other things, with regard to the developing standards and all-European trend of sharing spatial information. Services such as geoportals – compatible with other compilations and attractive for the user – may soon become a basic expectation both on the part of government authorities and society. Thus, the extension and improvement of spatial information services seems a key task that should be realised not only in the future but also at present.

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