

## GeoTerrace-2020-033

### From the experience of using GIS technologies for studying tourist resources of national natural and regional landscape parks

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#### SUMMARY

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The recreational and tourist resources analysis of landscapes of national natural parks (NNP) and regional landscape parks (RLP) of Western Ukraine for tourism and recreational development have been carried out. Peculiarities of GIS technologies application have been revealed and new data have been received. The GIS of RLP created on the example of "Ravske Roztochchya" which covers five main blocks such as: initial data (including field research), RLP topography (including digital relief model (DRM) and special thematic maps-schemes of steepness and slopes exposure), land, anthropogenic impact, and functional zoning. The geoinformation analysis that has been conducted gave grounds to establish that in the land plots structure of RLP "Ravske Roztochchya" ecostabilizing lands should occupy not less than 58.7% of their total area. And vice versa, eco-destabilizing lands can occupy no more than 41.3% (arable land - 31.7%). Based on this, an optimized land structure has been developed, which stabilizes the recreational and tourist potential of the park's landscapes. Similar studies have been conducted on the landscapes of the "Skoliv Beskydy National Park".

## Introduction

In order to ensure sustainable development, conservation of landscape and biotic diversity, modern geographic information technologies should be put into practice for effective management of protected areas. An information today has become the driving force of society as a whole. In the scientific literature many times has mentioned the creation of geographic information systems (GIS) for protected areas, including national nature parks (NNP) and regional landscape parks (RLP). Such scientists as L. Muravsky, Y. Andreychuk, O. Pashko, N. Stoyko, I. Olenych, M. Mekhbalieva, and others were working on this to this issue. The results of the study of those authors that have mentioned earlier are mainly devoted to narrow environmental problems. Therefore, despite the significant number of scientific publications, a number of questions on the prospects of using GIS technologies for the development of tourism and recreational activities in NNP and RLP at the present stage are promising for further more deep studies.

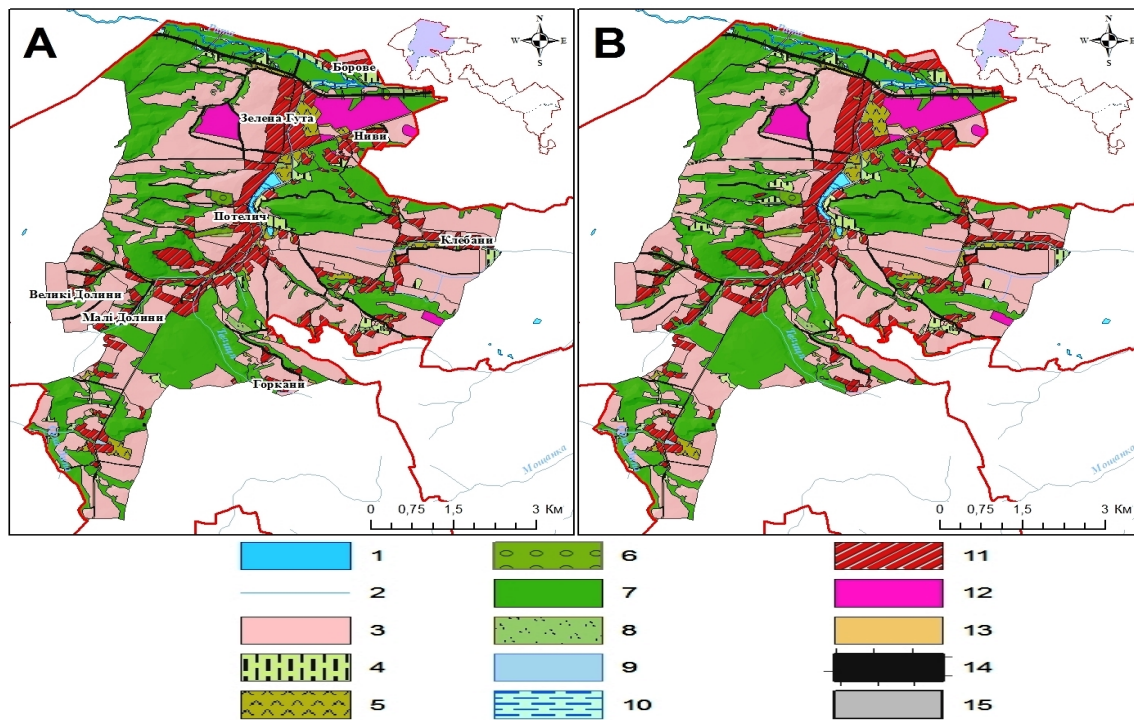
## GIS and protected areas

Geographic information system (GIS) provides digital information of certain landscapes characteristics. This program grouped into blocks for displaying, and analyze information by using specialized computer programs. This allows not only to see the spatial information on the computer screen but also to perform the necessary calculations and analysis of available digital information (Andreychuk, 2015). GIS - ensuring the optimization of the operation of NPP and RLP considered and implemented in the form of: 1) GIS project; 2) optimization of the territorial structure of the nature protection object; 3) improving of the recreational usage of the territory; 4) ecological, educational, and popularization activities for the development of tourism.

## Results of investigations

GIS of RLP "Ravske Roztochchya" over the last few years of studies on regional landscape parks has been developed and during 2016–2019 years' work on the development and filling of tourist-oriented GIS of NNP "Skolivski Beskydy" based on ArcGIS software platform was carried out. GIS of RLP "Ravske Roztochchya" that have been created covers five main blocks, such as: initial data (including field researches), topography of RLP (including digital relief model (DEM) and special thematic maps-schemes, steepness and exposures of slopes, etc.), land, anthropogenic impact and functional zoning. Digital GIS cartographic layers are based on topographic maps at a scale of 1:25 000 (filming 1957 year), topographic maps at a scale of 1:50 000 (filming 1970–1981 years) and space images from the Quick Bird satellite (2009 year) with a large expansion and high resolution. "Source data" block includes raster images that serve as a source of information for the construction of vector digital cartographic layers, which form the basis of GIS and are part of the second block - "RLP topography". The RLP topography block is the basis of the GIS vector layers that reflect the topographic features of the RLP territory. The GIS "land" block consists of vector layers that highlight the modern and optimized land structure of the RLP, the boundaries of village councils, DRMs, digital exposure maps and steep slopes. According to a detailed analysis, the land stability index of RLP "Ravske Roztochchya" within the experimental plots is differentiated according to local orographic conditions, landscape structure of the territory, and differs from scientifically substantiated norms. For this purpose, the indexes of landforms stability of landscape systems in relation to their potential and actual vulnerability to the water erosion development process have been determined. RLP lands are characterized by an average degree of resistance to anthropogenic loads, a low degree of natural vegetation preservation (41.2%) due to excessive plowing, high development of agricultural land and low forest cover, especially in the southern part of the park. The geoinformation analysis that have been conducted gave grounds to establish that in the structure of land plots of RLP "Ravske Roztochchya" ecostabilizing lands should occupy not less than 58.7% of their total area. And vice versa, eco-destabilizing lands can occupy no more than 41.3% (arable land - 31.7%). Based on this research, an optimized structure of land in the park has been developed (Figure 1). Vector layers that reflect economic and industrial objects are included in the block "anthropogenic impact". During the joint analysis of the listed digital maps and attribute data, the functional zoning of the RLP have been

performed. A separate group of GIS vector layers, which reflect the spatial location of RLP functional zones, historical, cultural, and recreational objects have been formed.. The system of optimization measures for GIS NPP "Skolivski Bezkydy" includes remote zoning data, published cartographic and stock materials, field research data, DRM and special thematic maps-schemes, such as: steepness and exposure of slopes, functional zoning, landscape map. It also contains information about tourist routes and tourist infrastructure of the study area. Over the last five years at the Department of Tourism of Lviv State University of Physical Culture named after Ivan Bobersky has been working on the GIS usage in order to optimize the recreational activities of «Skolivsky Beskydy» and «Karpatsky».

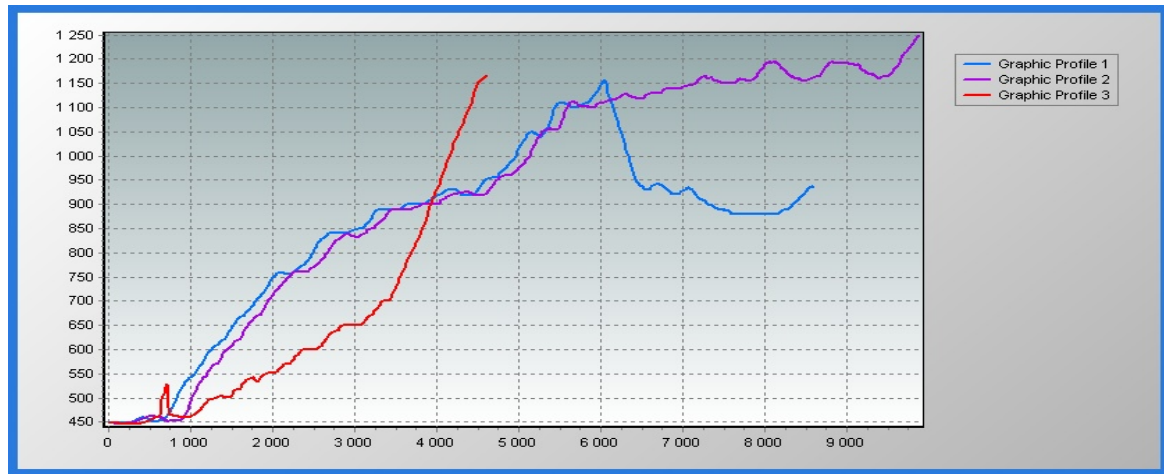


**Figure 1** The structure of lands (A) and optimized land structure (B) research site №1 RLP "Ravske Roztochchya" (Potelitska village council):

- 1 – water bodies; 2 – rivers; 3 – tillage; 4 – hayfields; 5 – pastures; 6 – perennial plantings;
- 7 – forests; 8 – shrubs; 9 – under water; 10 – wetlands; 11 – building;
- 12 – land industry; 13 – asphalt roads; 14 – railway; 15 – dirt roads.

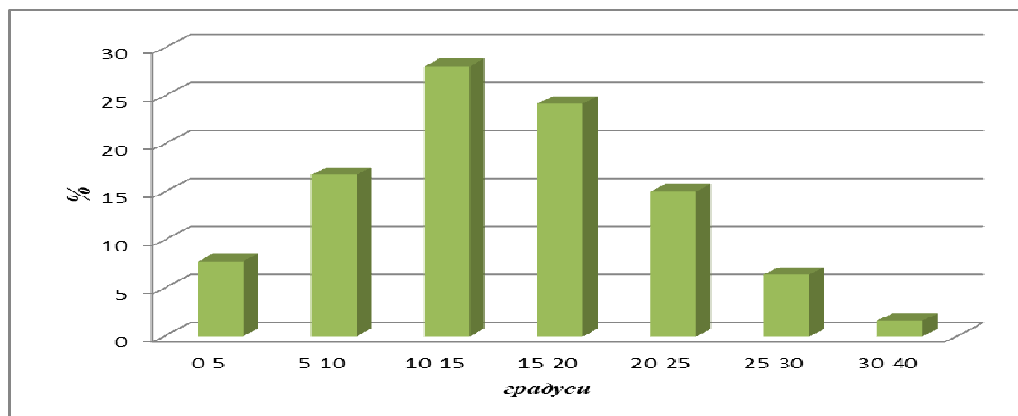
Modern GIS have new graphical modeling methods of geoinformation, which should be used for laying tourist routes. One of such methods is the creation of a DRM of tourist area. The use of the DRM opens wide opportunities for the designer to improve existing and design new tourist routes. As an example is a tourist route part from city Skole to mount Parashka. Based on the GPS route record using by the ArcGIS 10.0 3D Analyst program module of the hypsometric profiles on routes have been constructed (Fig. 2). The analysis of these profiles makes it possible to plan the mode of movement on the route and orient in which part of the route tourists expect difficult areas. For instance, the starting point of the route "city Skole - mount Parashka" is located at a 449 m altitude above sea level and the top of Parashka - 1268.5 m above sea level. The height difference is 819.5 m and the most difficult section of the route is the first 2000 m (Khudoba, 2018). Geoinformation morphometric analysis by means of ArcGIS 10.0 software of the NPP "Skolivski Beskydy" terrain have been conducted in order to assess the recreational potential of the terrain, zoning of the park on the basis of previously created maps of steepness and exposure of slopes for further development of various types of tourism and recreational activity. Low and medium-mountain ridges confined to individual slices or their components on the territory of the NNP have been highlighted. The absolute heights of the apical surfaces of low-mountain ranges range from 700-900 m, medium-mountain - 900-1200 m. The

maximum heights are timed to the Parashka ridge (mount Parashka, 1268 m; mount Timkin Verkh, 1227 m; mount Zelena, 1217 m), which is located in the central part of the NNP.



**Figure 2** Hypsometric profiles along the lines of routes: Skole - Parashka (Profile 1), Skole - Kichera mountain (Profile 2), Skole - Korchanka mountain (Profile 3)

The lowest altitudes above sea level (about 450 m) can be traced at the Opir River valley near Dubina the village. The relative heights within the low mountain relief do not exceed 350-400 m. In the middle of mountains, the maximum relative heights exceed 150-200 m. The medium mountain relief type dominates. The morphological structure of landscapes is dominated by landscape systems slopes (10°-20° slopes make up 52.3% of the slopes (Fig. 3)).



**Figure 3** Distribution of areas of landscape systems on the steepness of the slopes

On the slopes with a more than 30°-40° steepness, the construction of reliable engineering structures is difficult and sometimes impossible. Here you can go skiing, adventure, hiking, and other mountain types of tourism. In the practical comfort assessment and suitability of the territory, the slopes of the southern and northern exposures are considered, as the slopes of the eastern and western exposures occupy an intermediate position in terms of heat supply. An exposure impact on the recreational activities and the creation of its infrastructure is closely related to the absolute height of the terrain. An exposition does not significantly affect recreational and tourism activity on slopes with a small absolute height. The park territory is mainly located in the middle mountain zone. The northeastern and western slopes exposure is predominant. As a result of the assessment in the Skoliv Beskydy National Park, it has been established that the leading place among a load of tourist infrastructure is occupied by the Skole city, where 59 tourist infrastructure objects are marked, as well as urban-type settlement Skhidnytsia - urban settlements with 30 tourist infrastructure objects. It's much smaller part (from 11 to 21) is concentrated in such villages as Sopot, Rybnyk, and Oryavchyk; a smaller share (from 5 to 10) are concentrated in such villages as Krushelnytsia, Maidan, Kamyanka, and Korostiv.

The lowest number of tourist infrastructure facilities is located in such settlements as Bagnovate, Pereprostynya, and Pidhorodtsi. Their number ranges from 3 to 5 objects. After landscape load analysis of the Skoliv Beskydy National Park in relation to the objects of tourist infrastructure, we have identified three zones with the highest objects concentration, such as the Skole town and its adjacent territories, Skhidnytsia village, and the Maidan village. For a more comprehensive recreational park assessment, a transport accessibility analysis of its tourist resources has been conducted. Most of the historical, cultural, natural, and tourism infrastructure facilities have good transport accessibility. The central part of the park has an underdeveloped transport network, which at the same time is the most valuable park part in terms of nature protection, which increases the recreational and tourist potential of the park. In the development of the recreational and tourism activity of the NNP and RLP is promising to create electronic maps that allows you to use quickly and efficiently this information in order to identify the most dangerous areas on the route and develop ways to overcome them.

### Recommendations and conclusions

Structuring of descriptive data and linking them to GIS objects, creating a database of GIS technologies, will help to solve a number of practical problems in the work of RLP and NNP. This applies to the administration tasks, which are solved with the GIS help (including topographic basis according to aerospace survey and GPS system, administrative-territorial division, control of adjacent facilities, etc.). The control tasks and security service include registration of facts violation of the protected regime, route planning, patrolling, threats assessment to human activities, control over the use of the territory. However, the visual electronic map not only shows the recreational object location or tourist infrastructure element but also provides characteristics of these objects. Thus, the introduction of these innovative technologies will allow the NNP and RNP administrations to create high-quality interactive maps with updated information content, conduct effective management, perform their tasks, and meet the growing demands of modern tourists. Thus, the use of GIS technology has great prospects for further development.

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