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GEOECOLOGICAL EVALUATION OF PROTECTED AREA FOR RECREATION AND TOURISM PLANNING – THE EVIDENCE FROM THE BOSNIA AND HERZEGOVINA NATIONAL PARK

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Abstract: The quantitative "diversity" method of the German geoecologist Hans Kiemstedt was adopted for the needs of a geoecological evaluation and landscape planning of the Kozara National Park in the Republic of Srpska in Bosnia and Herzegovina to be used for relaxation and recreation purposes. The aim of this paper is to indicate that geoecology can provide spatial planners with the expertise of landscape research, evaluation, planning and management. The method was employed to carry out landscape analysis and categorization, then the process of evaluation was done, based on which a synthetic map of the recreation potential of the research area was created. Geographic Information System (GIS) was used as a powerful tool that can provide a more detailed and meaningful analysis. This study shows the importance of integration a geoecological evaluation method with a geographic information system in order to get such a spacious offer in which the recreation areas are situated in most favorable places without negative effects on the environment. The evaluation of the Kozara National Park recreational potential conducted on a research area covering 3,907.54 ha leads to the conclusion that the area is mostly conditionally suitable for recreational activities. Obtained results showed that 41.32% is suitable and very suitable for recreation, especially distributed in central, northern, eastern, northeastern and southeastern parts of the National Park of Kozara.

Keywords: spatial planning, GIS, *'V-Wert'* method, tourism, Bosnia and Herzegovina/Republic of Srpska

Introduction

In the early days of development of human civilization man was concerned with how to protect himself against the elements, while today, it is how to protect space where nature still prevails (Lješević, 2002). This dialectic relation gave rise to the need to plan landscapes, though a process that consists of several consecutive stages: analysis, evaluation, synthesis, planning and protection, with the last one being the main goal of all systematic action (Djordjević, 1995).

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Many centuries of exploring and learning about nature have given birth to geoecology, an interdisciplinary science that deals with the interrelation of humans and their habitat open-air, natural and man-made landscape (Pecelj, Pecelj-Purković, & Pecelj, 2015). As one of the youngest disciplines, geoecology provides a range of theories, models, and experience of the study of the landscape (Pecelj, 2015).

Troll (1939) was the first to attempt the categorization out of landscape for planning purposes using aerial photographs, which he considered the key instrument of spatial planning. Given the current circumstances, in which humans are left with ever less natural, original landscape, it is impossible to decide that an area is homogeneous in terms of landscape and ecological qualities based solely on aerial photos, the way Troll did it, without conducting an in-depth analysis of its abiotic and biotic elements, as well as its socio-economic characteristics such as land use, demographic structure.

In time, the methods used in landscape evaluation became increasingly complex and more objective. Thus Linton (1968) developed two classifications, one based on landforms and the other on land use, in parallel with two evaluation systems for each of these classes, in order to categorize Scottish landscape. Fines (1968) ran an evaluation of landscape based on photographs of Eastern Sussex (England), without reducing landscape to its constituent elements. Smrekar, Horvat and Erhartič (2016) also used photographs of different landforms and on-line research to ascertain the aesthetic value and significance of landscape, that is, what landforms attract respondents the most.

There are two principal kinds of landscape evaluation models, descriptive inventories and public preference. The first quantifies landscape based on its constituent elements through scoring, the sum of which represents the total value of a research area or landscape. The techniques belonging to the other category use human survey methods, with people assessing or ranking whole landscapes, either based on photographs or through direct observation of the outdoor environment. However, both methods are problematic for a number of reasons. One of the key problems has to do with the criteria selection and scoring being subjective, as are the selection of the photographs used for evaluation and the development of landscape quality scales (Arthur, Daniel, & Boster, 1977).

According to Ciglič and Perko (2013, p. 119), “areas characterized by landscape diversity may have an advantage when it comes to economic growth, especially tourism. Landscape variety and an abundance of details across a terrain tend to be underrated, especially when it comes to areas highly popular with tourists”.

"Although the traditional geographic concept of destination, from today's point of view, is one-sided and not comprehensive, geographical elements, however, are the nucleus from which a tourism destination occurs and develops. In this regard, it is indisputable that the geographical attributes of tourism destinations represent the key component of their resource base" (Jovicic, 2016, p. 445). Nature conservation i.e. geographical attributes, in protected areas is of great importance for the development of tourism. Tourism also has major impacts on the natural and built environments, and this is supported "conflicts particularly arise between nature conservation and tourism development in cases of construction booms in natural wilderness areas where development plans are lacking, and tourism is not regulated. Tourism has a number of negative social and environmental consequences once it grows beyond the capacity of the environment" (Špulerova et al., 2016, p. 486). Positive examples of attempts to conserve nature and preserve traditional living spaces whilst promoting tourism can be found around the world (Kienast, Frick, Strien, & Hunziker, 2015; Tyrväinen, Uusitalo, Silvennoinen, & Hasu, 2014).

Since the contemporary way of life in cities is taking an increasingly greater toll on their inhabitants (Pecelj et al., 2015), it is absolutely understandable that people should feel the need for short vacations in nature. In this context, the main goal of paper is to evaluate the suitability of the Kozara National Park to be used for the growing need for recreation. In accordance with the main goal so specified and the subject of the research, the following working hypotheses were formulated:

- Most of the Kozara National Park is suitable for recreation;
- The central and southwestern parts are the most suitable for recreation;
- The diversity method — 'V-Wert' method (Ger. *die V-Wert-Methode*) formulated by the geoecologist Hans Kiemstedt (1967a) is suitable for the evaluation of hilly and mountainous areas for the needs of recreation; and
- GIS offers tools which allow faster, more detailed and more complex processing of input data, as well as higher quality output data when the said method is used.

The study area

The attractive natural values of mountain areas stimulate the human desire to behold the beauty of nature, resulting in development to accommodate tourism and recreational needs (Neuvonen, Pouta, Puustinen, & Sievänen, 2010). The subject of research covered in this paper is Mount Kozara, whose natural

characteristics and ambient values offer great possibilities for the development of recreational tourism. Mount Kozara is located in northwestern Bosnia and Herzegovina and it belongs to the entity of the Republic of Srpska. It is a low mountain situated between the Pannonian Basin in the north and the Dinaric Alps in the south, and it is enclosed by the Sava, Una, Sana and Vrbas rivers. The central part of Mount Kozara (area 3,907.54 ha) is a national park and it enjoys three-level protection. The main reason for opening and listing the Kozara National Park was historical and it is related to a WWII event, with the aim of preserving the cultural-historical and natural heritage of the mountain. The Kozara National Park is a member of the EUROPARC Federation, certified by it as IUCN Protected Area Category V (Civil Engineering Institute "IG" & Urban Institute of Vojvodina, 2013). It is an area of special interest for the Republic of Srpska.

Methods

The diversity method (*'V-Wert' method*) was formulated by the landscape ecologist Hans Kiemstedt and it is based on natural characteristics of a landscape (Hoffmann, 1999). His method has been modified later on and is widely used today to evaluate the recreation potential of an area (Naveh, 1982; Batman & Demirel, 2015). The following equation (1) is used for evaluation:

$$V = \frac{R_w + 3R_g + R_e + N}{1000} \cdot K \qquad (1)$$

where R_w — forest edges [m/m²], R_g — waterfronts/water edges [m/m²], R_e — relief energy [m/m²], N — land use [%], and K — climate (Kiemstedt, 1967a; 1967b).

"Irrespective of the time and place, areas of high visual complexity, with a lot of vegetation and bodies of water, as well as those with a view of natural or man-made surroundings in the far distance, can be considered as general precious values" (Thorne & Huang, 1991, p. 63). Forest edges and waterfronts/water edges as are taken into consideration because of how they light intensity and shade in an environment, which has an effect on human senses and benefits the psychological and physical well-being of humans. The lengths of forest edges along clearings and roads are taken to calculate the recreation potential of a landscape, and the lengths of waterfronts/water edges are multiplied by the weighting factor of 3, on the assumption that bodies of water contribute more than other elements in equation to the visual richness of a landscape. Relief energy is obtained when the lowest altitude is deducted from the highest altitude

in a raster map tile, to which value is attached in accordance with the original classification given by Hans Kiemstedt (see Table 1).

Table 1. Scale of relief energy

Altitude difference [m]	Relife energy values
10–20	220
20–30	300
30–60	400
60–100	590
100–250	860
250–500	1200

Source: Kiemstedt (1972, p. 36).

The spatial frequencies of various categories of land use across a raster map are multiplied by weighting factors to obtain their respective values (see Table 2).

Table 2. Weights for each category of land use

Type of use	Weight
Arable lands and gardens	6
Pastures and grasslands	15
Forests	19
Wasteland and barren land	21
Ponds	12
Water	50

Source: Kiemstedt (1972, p. 36).

The climate is a constant when this formula is used, its value varying for different climates as originally proposed by the Kiemstedt classification. It was concluded that the area of the Posavina lowlands, to which the Kozara National Park belongs, has a climate similar to the type of subalpine climate (Initial National Communication of Bosnia and Herzegovina under the United Nations Framework Convention on Climate Change — UNFCCC, 2009; Civil Engineering Institute "IG" & Urban Institute of Vojvodina, 2013) found across Germany, and the value given by Kiemstedt for this type of climate was accordingly used in the calculation (Table 3).

The stated equation was used to analyze the area of the Kozara National Park as shown on a raster map consisting of 250×250 m tiles, and the obtained results grouped in four categories of recreation suitability:

– Unsuitable, with $V \leq 6.38$;
– Conditionally suitable, with $6.38 < V < 9.76$;
– Suitable, with $9.76 \leq V < 13.13$, and
– Very suitable, with $V \geq 13.13$.

Table 3. Climate type categorization

Climate type	Climate values
Urban climate	0.65–0.80
Basins climate	0.70–0.90
Lowlands climate (North Germany)	0.90–1.10
Coastal climate (Baltic Sea and the islands in North Sea)	1.30–1.60
Pre-mountain climate	1.10–1.20
Mountain climate	1.20–1.40
Climate of high mountains	1.30–1.50
Climate of Central Alps	1.30–1.80

Source: Kiemstedt (1972, p. 36).

The range of values for each category is obtained when the difference between the maximum and minimum values is divided by the number of categories. Before examining the recreation potential of the research area, the area data, relevant graphic documents and legislative documents were acquired. The basic data about the research area was obtained from digital ortho-photographs (Republic administration for geodetic and property affairs, 2008) a 30x30-m-pixel size DEM (ASTER GDEM) (NASA's Earth Observing System Data and Information System, 2014, http://reverb.echo.nasa.gov/reverb/), Corine Land Cover (European Environment Agency [EEA], 2006), topographic maps 1:25,000 (Military Geographical Institute, 1976), and Google Earth satellite views. The ArcGIS software package by Esri was used to digitize and process the input data, which made possible a more detailed and systematic type of analysis and a wider scope of analytical processes, far more advanced than manual methods would have allowed. “Recently, there is a growing interest on the use of geographic information systems (GIS) as a decision support tool in multi criteria analysis (MCA) for the various benefits that presents” (Haoues, Dridi, Saint Gerand, & Kalla, 2016, p. 5).

Results and discussion

The results show that the area has potential for the development of recreation and tourism in the future. According to Figure 1, the suitability categories (in per cent) indicate that 36.73% of the area of the National Park is conditionally suitable for recreational activities, 32.14% is suitable, 21.94% unsuitable, and 9.18% very suitable. Mountain Kozara is largely covered in forests and forest soil (88.1%), and it also has glades, brooks and cultural and historical monuments, which means it has excellent conditions for outdoor relaxation and recreation. Most of its tourist and recreation facilities are located in the central and eastern parts of the National Park and around the Mrakovica Memorial Park. These areas are, for the large part, suitable (39.3%) and conditionally suitable

(39.3%) for recreation, and to a smaller extent very suitable (10.7%) or unsuitable (10.7%). The hiking trails and cycling routes (Civil Engineering Institute "IG" & Urban Institute of Vojvodina, 2013) are the densest in the eastern, southeastern and southern parts of the Park, and they are located on land suitable or conditionally suitable for recreation.

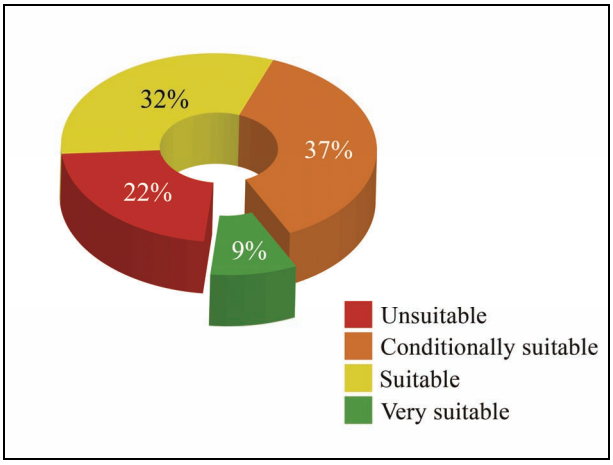

Figure 1. Evaluation of the suitability of the Kozara National Park for use as a recreational area

The synthetic map shows the highest prevalence of surfaces categorized as very suitable or suitable for recreation in the northern part. These surfaces are level-2 protection zone (Civil Engineering Institute "IG" & Urban Institute of Vojvodina, 2013), as mostly covered in trees (tall, naturally regenerated) and water streams. The land most suitable for recreation is that mainly located in the central, northern, eastern, north-eastern and south-eastern parts of the National Park. The central, eastern and southeastern parts of the Park have been evaluated for tourist purposes; they have a suitable tourist infrastructure and suprastructure, which make possible both passive and active recreational activities (Figure 2).

Alongside the Kiemstedt method, an informal approach was employed in the process of selection of recreation types, based on the researchers' personal experience and assumptions as to the types of recreational activities possible in the area. If we take into account natural and human resources, the elements of the material base, as well as organizational factors, we can conclude that a priority of tourism development in this area must be given to its following forms: mountain tourism, hunting, spa (air-spa), cultural- historical, scientific-research tourism, sports and recreational, gastro tourism, picnic tourism and the tourism of special interests (bicycling, camping, mountain climbing, trim trail).

The aim of the evaluation was to ascertain to what extent the research area is suitable for recreation, relative to specific types of users and activities. The results that are based on researchers' personal experience and assumptions are in accordance with the Spatial Plan of the Special Use Area of the Kozara National Park.

The factors that enhance the recreational potential of the Kozara National Park are good road network, its proximity to a number of towns (Banja Luka 56 km, Prijedor 24 km, Gradiška 56 km), its eating facilities, the existing tourist superstructure, the Mrakovica Memorial Park, which is of cultural and historical importance, etc. The advantage of the proximity of major cities in the development of recreational tourism is big, and this is supported by "in today's context of sustainable tourism, a moral and behavioral shift may be expected, toward travelling near home" (Jeuring, & Haartsen, 2016, p. 2).

The results obtained confirm the hypothesis that most of the Kozara National Park (suitable and very suitable– 41.32%, and conditionally suitable– 36.73%) is suitable for recreation. The current situation in the field leaves an impression that the central and south-western parts of the park are the most suitable for recreation, given the fact they already have the needed infrastructure and tourist facilities and attractions. The contradictory results yielded by the analyses indicate that the diversity method is based on abiotic and biotic elements, as well as elements of land use (primary and secondary landscape structure), while the socio-economic phenomena found across the landscape (e.g., access roads, protected zones, pollution zones, etc.) were omitted.

Hence the inadequacy of this method, as it does not make it possible to valuate cultural landscape that is product of nature and human interaction with nature. Because passive recreation, as a form of mental and physical recuperation, does not require specially built and equipped sports facilities, it is possible to apply this method to select specific areas for recreation in accordance with the capacities of the ecosystem, and also make the protection regime more purposeful. Accordingly, it may be concluded the method is only conditionally suitable for evaluating hilly and mountainous areas, when it comes to nature preservation (in the sense of management and impact on change) in such areas. Bearing in mind the fact hilly and mountainous areas are sparsely populated and unsuitable for the construction of infrastructure and suprastructure, the application of the diversity method may produce output data of sufficient quality to plan recreation.

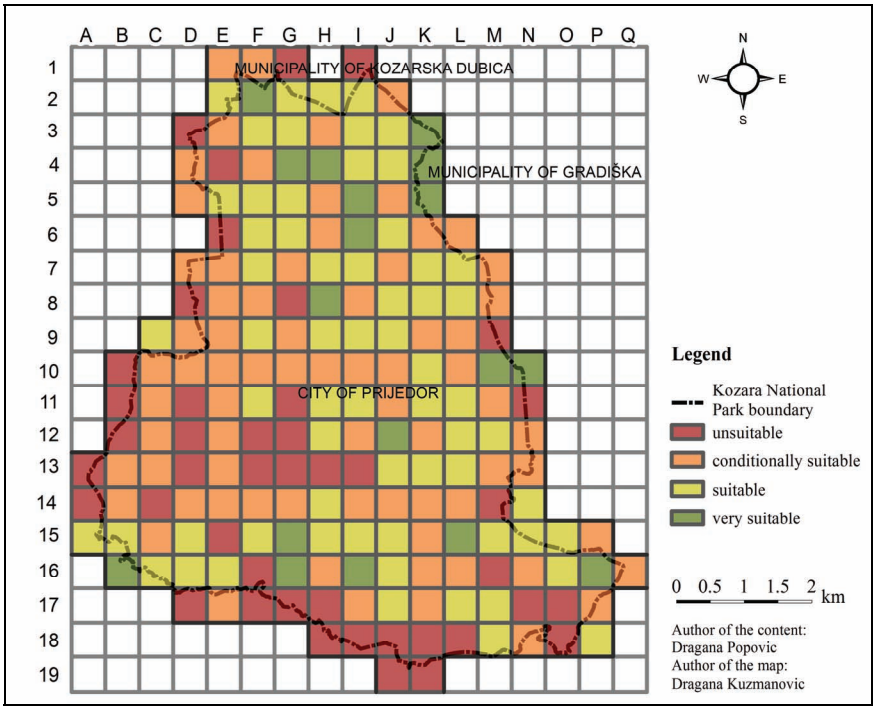

Figure 2. Evaluation of the suitability of the Kozara National Park for use as a recreational area to "V-Wert" method

From the perspective of recreation, the factor of accessibility is very important, which is not at a satisfactory level in southern parts of the Park, although the regional road to Kozarska Dubica passes through it (currently in bad condition). Civil Engineering Institute "IG" & Urban Institute of Vojvodina (2013) stipulates the construction of regional road to Gradiška, which will make the national park, and especially its northern part, more easily accessible for the wider region and more attractive for recreational tourists. As far as the tourist suprastructure in this part is concerned, it is very poor, which means its recreational potential is underused. According to Mwanukuzi (2008), resource management includes planning, allocating and scheduling of resources to tasks. In term of landscape resource development, it involves the actual use of source during a transformation of the natural material into a commodity or service to serve human needs and aspirations. "Geographic information system (GIS) is a powerful tool of great help in understanding of the geographic space and its relationships and connections" (Kuzmanović & Popović, 2015, p. 533). ArcGIS was used to make a map which allowed a faster and higher quality interpretation of the obtained results.

Conclusion

The conducted geoecological evaluation of the recreational potential of the research area indicates that it is naturally predisposed for the development of tourist and recreational activities. The research shows that the area conditions are favorable for the development of both active and passive recreation. These types of activities can greatly contribute to the development of tourism in the Kozara National Park, while respecting the area protection regime.

This method can be put to particularly judicious use when developing spatial plans and related documents in countries with transition economies, with the aim of preventing uncontrolled management and development of land with environmental and cultural potential. Geoecological evaluation can be useful when resolving space-related conflicts in the case of multifunctional landscapes and thus contribute to sustainable spatial development (de Groot, 2006, p. 178). It is necessary to take account of the listed natural, cultural and historical heritage in formulating the fundamental concept of the spatial organization of a research area. Thus, in land-use planning and spatial design, the primary goal must be to maintain ecological balance. On the other hand, when it comes to the spatial organization of an area, it needs to be promoted as an attractive destination and accordingly connected to both its immediate and wider surroundings, in order to make it more easily accessible and attract the right number of visitors. Wider application of this method requires certain corrections in the sense of how the term landscape is understood nowadays, necessitating the inclusion of elements of its tertiary structure.

Through this research it has been pointed to the possibility of using GIS and its applications in research in the development of tourism. The method applied in GIS can give excellent results in geoecological evaluation of the recreational potential, and also can be applied to other territorial units in Bosnia and Herzegovina and beyond.

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