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Original Research

Applying Multi-Criteria Decision-Making in Prioritizing Strategies for Developing Protected Natural Areas and Their Ecotourism: the Case of Uvac, Serbia

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Abstract

Ecotourism is considered a sustainable form of travel that is more environmentally beneficial than the concept of mass tourism. In this context, protected natural areas are considered an essential potential for ecotourism development, which is underpinned and driven by the preparation of strategies. This paper prioritizes ecotourism development strategies on the example of the Uvac Special Nature Reserve in the Republic of Serbia. The SWOT analysis is strengthened by the Analytic Hierarchy Process (AHP), a particularly suitable method for strategic planning of an area. The first step of the combined SWOT-AHP method implied a SWOT analysis. Afterward, in the second and third steps, the weighting coefficients of individual elements within the SWOT group and then the weights of the groups were determined. In the final step, the ecotourism development strategies for this area were formulated, weighted by their efficiency coefficients, and ranked. This paper aims to contribute to a better understanding and promotion of applying multi-criteria decision-making (MCDM), i.e., the combined SWOT-AHP method, in prioritizing strategies for developing protected natural areas and their ecotourism.

Keywords: strategic planning, MCDM, SWOT-AHP, ecotourism, Uvac Special Nature Reserve

Introduction

Ecotourism is a sub-component of sustainable tourism and its sustainable nature-based version, which includes rural and cultural elements of tourism. In protected natural areas of many countries, especially developing countries, ecotourism is considered an element of economic development and a biodiversity conservation measure [1]. The World Tourism Organization (WTO) and the United Nations Environment Programme (UNEP) recommend policymakers prepare national strategies for sustainable

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ecotourism development and management. Therefore, the ecotourism development strategies formulated in this study and built upon the principles of ecotourism and sustainability contribute to achieving the defined goal. In this paper, ecotourism development strategies were prioritized on the example of Uvac Special Nature Reserve (SNR). Uvac SNR is a first-category protected natural area of exceptional importance located in the southwestern part of the Republic of Serbia. It was declared protected with the aim of preserving and reproducing the Eurasian griffon vulture (Gyps fulvus) species, as the area is home to the largest nesting colony in the Republic of Serbia and one of the largest in the Balkans [2, 3]. This paper aims to contribute to a better understanding and promotion of applying multi-criteria decision-making (MCDM) i.e., the combined SWOT-AHP method, in prioritizing strategies for the development of protected natural areas on the example of Uvac SNR, the implementation of which can promote the sustainable development of this and wider regional area. Moreover, the aim of the paper also emerges from the analysis of the literature, according to which in recent years an increasing number of authors believe that SWOT analysis should be combined with another multi-criteria decision-making method, one of which is the Analytic Hierarchy Process (AHP).

Theoretical Background

The first significant works and discussions on ecotourism appeared in the early 1980s. These works opposed the development of mass tourism as a dominant global trend. Mexican architect Ceballos-Lascurain [4] gave the first definition of ecotourism, according to which ecotourism implies traveling to relatively undisturbed natural areas with the specific objective of studying, admiring, and enjoying the environment, biodiversity, as well as cultural heritage of the area. The International Ecotourism Society (TIES) formulated one of the first definitions in 1991, according to which ecotourism is responsible travel to natural areas that conserves the environment and improves the well-being of local people [5]. According to WTO, ecotourism has been steadily growing since its inception, and estimates say it accounts for 7% of income from tourists [6]. However, the ecotourism development level in the Republic of Serbia is still in its infancy, despite its abounding in natural and cultural heritage and other benefits. A possible reason for this is that the Republic of Serbia was not historically a predominantly tourist-oriented country but developed tourism mostly due to business trips and health tourism [7].

SWOT analysis is a widely accepted practical decision-making methodology that considers internal factors, i.e., strengths (S) and weaknesses (W), and external factors, i.e., opportunities (O) and threats (T) [8]. SWOT analysis advantages include its simplicity, speed, and ease of use in planning future activities. This method has been successfully used to evaluate development strategies in various areas [9]. The SWOT method is also used for ecotourism planning, as evidenced by numerous sources [10, 11]. However, many authors have raised their doubts about SWOT analysis efficiency [12, 13]. In recent years, an increasing number of authors believe that SWOT analysis should be combined with another MCDM, one of which is AHP [14, 15]. The SWOT-AHP combination has so far been applied to formulate strategies in various areas: [16] successfully applied the SWOT-AHP combination to formulate a strategy for Sri Lanka tourism revival; [17] carried out a comparative analysis of health tourism potential in Iran and India; [18] used SWOT-AHP to prioritize ecotourism strategies in the National park Kopaonik; [19] used the combination to prioritize ecotourism strategies in Western Himalaya.

Materials and Methods

The case of Uvac SNR

The research area of this work is the Uvac SNR, located in the extreme southwestern part of the Republic of Serbia. It extends in altitude zones from 730 to 1780 m above sea level and covers parts of the municipalities of Nova Varoš and Sjenica [3]. Uvac is home to about 110 species of birds and the largest nesting colony of Eurasian griffon vulture (Gyps fulvus) in the Republic of Serbia, one of the largest in the Balkans [2]. This area is specific for its preserved diversity of flora, forest and other plant communities, the beauty and diversity of the landscape, attractive relief elements, with an array of swirling Uvac meanders, three large speleological sites (Ušačka, Tubića and Baždarska cave), with Ušačka cave standing out with its four entrances and a meshwork of 6185 m long channels, as well as the abundance of water from the regional water supply source (three artificial reservoirs Uvac, Zlatar and Radoinja). The specificity of this area is reflected precisely in that it is also part of the wider regional water supply source area, which includes three more municipalities, namely Novi Pazar, Prijepolje and Ivanjica. Moreover, this area belongs to a tourist area of regional importance, i.e., part of the Western Tourist Zone, that has the potential to ensure a year-round tourist offer integrated with tourist areas in the immediate vicinity. This area is also part of a livestock farming and agricultural macro-region with preserved natural grasslands making up the majority of agricultural land, outstandingly favorable for high biological quality food production [20]. The municipalities covered by Uvac SNR belong to economically underdeveloped areas, which has contributed to its preservation to some extent. In order to plan the sustainable utilization and development of the Uvac SNR area and tourism in this area, the Serbian Government took a significant step forward

by adopting the spatial plan of the special purpose area for Uvac SNR [20] financed by UNDP-PRO, program for the development of municipalities in southwest Serbia.

SWOT-AHP Method

To determine how significant certain elements really are compared to others within the SWOT matrix, we will use the Analytic Hierarchy Process (AHP). This method was devised by Saaty [21] and has been widely applied as an excellent and reliable tool for quantifying SWOT analysis results. The method itself can be represented by the three necessary steps that will be described below. In the first step, strengths are considered and a matrix is created. The resulting matrix is filled by pairwise comparison of each first-column element and each first-row element. The pairs are then quantitatively rated using Saaty's rating scale [22]. It is important to note that each element has a value of 1 compared to itself (diagonal matrix). This procedure is repeated for other groups within SWOT (Weaknesses, Opportunities and Threats), resulting in four matrices. Afterward, each of the four matrices is normed, and the weighting factors FTj are calculated separately for each element. For simplicity purposes, they are marked with FTSj, FTWj, FTOj and FTTj for strengths, weaknesses, opportunities, and threats, respectively. This is done by first determining the geometric mean of each row GSi, and then determining the weighting factors [23] as presented in the following formulas:

$$GS_i = \left(\prod_{i=1}^{n} e_{ij}\right)^{1/n} \tag{1}$$

$$FT_j = GS_i / \sum_{i=1}^{n} GS_i \tag{2}$$

The obtained values represent the weight of each SWOT matrix element. However, it is necessary to verify the consistency of this solution. One of the AHP method's advantages is that it allows checking the consistency of the answers, that is, making sure there are no contradictions. This is done by first determining the maximum eigenvalue of the SV_{max} matrix and then, using the following formula, determining the degree of consistency Ski

$$Ski = \frac{(SV_{max} - n)}{(n-1)Ri} \tag{3}$$

wherein Ri is a random consistency [21]. To be acceptable, the Ski value must be less than 0.1. This procedure is repeated once more by repeating the weight calculation procedure described in the previous steps for the best-ranked elements from each SWOT group (those with the highest TFi). This way, the whole group's weighting factors (Sf, Wf, Of and Tf) are obtained. The resulting weight (Sj, Sj, Wj and Oj) is obtained by multiplying the group weight (Sf, Wf, Of and Tf) with the weight of the elements within the group (FTSj, FTWj, FTOj and FTTj), as shown by formulas 4, 5, 6 and 7.

$$S_{ri} = Sf \times FTS_j \tag{4}$$

$$W_{ri} = Wf \times FTW_j \tag{5}$$

$$O_{ri} = Of \times FTO_j \tag{6}$$

$$T_{ri} = Tf \times FTT_j \tag{7}$$

Now the results can be tabularized. The final result is presented using a matrix. In the second step, strategies that can be used for the purpose of development are formulated. One way is to use the so-called TOWS matrix, wherein four different strategies are formulated: maxi-maxi strategies (SO) – utilize internal strengths to make optimum use of external opportunities; maxi-mini strategies (ST) – maximize internal strengths to minimize threats using those strengths; mini-maxi strategies (WO) – minimize weaknesses to make optimum use of opportunities; and mini-mini strategies (WT) – minimize weaknesses while minimizing threats [16]. In the final third step, it is necessary to rank the strategies. After formulating several possible strategies, it is necessary to reconsider the factors found in the SWOT analysis and allow for their efficiency for a given element. In the expert analysis, the strategy efficiency is determined by the elements from the SWOT groups, resulting in efficiency coefficients:

ESij – efficiency of strategy j to make optimum use of strength Si,

EWij – efficiency of strategy j to minimize weaknesses Wi,

EOij – efficiency of strategy j to make optimum use of opportunities Oi,

ETij – efficiency of strategy j in dealing with threats Ti.

The global value of the jth strategy GVj can be defined by the following formula:

$$GV_j = \sum_{i=1}^{K} ES_{ij} S_{ri} + \sum_{i=1}^{L} EW_{ij} W_{ri} + \sum_{i=1}^{M} EO_{ij} O_{ri} + \sum_{i=1}^{N} ET_{ij} T_{ri} \tag{8}$$

The best-ranked strategy is the one with the highest GVj value.

Data obtained from the review of available literature, strategies, studies, planning documents of various institutions in charge of nature conservation, tourism, agriculture, environment, urban planning, and construction were used in this research. All elements of the hierarchy were evaluated by nature conservation experts and people well-versed in the tourism issues of this area On the example of Uvac SNR, this method would be applied in the manner defined in the following part of this paper.

Results and Discussion

Basic strengths, weaknesses, opportunities and threats of the future sustainable development of the Uvac SNR area and the development of ecotourism are defined in the following text. Given that the number of pairs being compared grows exponentially, in this paper only the most important elements from the SWOT analysis were selected: 1. strengths: S_1 - favorable natural conditions for the development of agriculture – livestock breeding, fruit growing; S_2 - regional water supply source "Uvac", reservoirs; S_3 - tourism values providing the opportunity for the development of several types of tourism; S_4 -natural and cultural heritage (archaeological sites, Dubnica and Kovilje monasteries, etc.); 2. weaknesses: W_1 - dispersed rural settlements make it difficult to implement water supply and sewerage systems; W_2 - illegal construction, especially in the Uvac SNR reservoir zone; W_3 - traditional emigration and decreasing permanent population of certain villages; W_4 - low-quality transport connections between most rural settlements; undeveloped cycling and walking trail system; 3. opportunities: O_1 - development of modern agricultural production, healthy food; production of agricultural produce of specific geographical origin; O_2 - introduction of the concept of cleaner production, energy efficiency, waste management; O_3 - construction of the highway to Montenegro and use of Sjenica Airport for civil purposes; O_4 - integrated protection and presentation of cultural and natural heritage; 4. threats: T_1 - poor condition of the water supply and sewerage infrastructure of the settlements, which directly threaten the reservoirs; T_2 - lack of regional landfill and waste management system; lacking investment in

Table 1. Matrix of comparison in pairs.

	Strengths					Weaknesses			
	S_1	S_2	S_3	S_4		W_1	W_2	W_3	W_4
S_1	1	2	0.2	0.2	W_1	1	5	3	3
S_2	0.5	1	0.2	0.2	W_2	0.2	1	0.33333	0.333333
S_3	5	5	1	1	W_3	0.333333	3.00003	1	0.333333
S_4	5	5	1	1	W_4	0.333333	3.000003	3.000003	1
	Opportunities					Threats			
	O_1	O_2	O_3	O_4		T_1	T_2	T_3	T_4
O_1	1	5	1	1	T_1	1	0.2	0.333333	0.2
O_2	0.2	1	0.25	0.25	T_2	5	1	0.5	0.5
O_3	1	4	1	1	T_3	3.000003	2	1	1
O_4	1	4	1	1	T_4	5	2	1	1

Source: the authors

Table 2. Determined values of elements within the SWOT matrix.

Strengths		Weaknesses	
S_1	0.098853	W_1	0.512669
S_2	0.069899	W_2	0.076424
S_3	0.415624	W_3	0.150402
S_4	0.415624	W_4	0.260504
Opportunities		Threats	
O_1	0.321018	T_1	0.071681
O_2	0.071782	T_2	0.223048
O_3	0.3036	T_3	0.330149
O_4	0.3036	T_4	0.375121

Source: the authors

Table 3. AHP matrix for calculating the weight of groups.

	S_3	W_1	O_1	T_4
S_3	1	2	3	0.333
W_1	0.5	1	1	0.333
O_1	0.333333	1	1	0.3333
T_4	3.003003	3.003003	3.0003	1

Source: the authors

the environment; T_3 - insufficient tourism activation of the area; inadequate presentation of natural and cultural heritage; T_4 - insufficient financing of the transportation system development. Pairwise comparison matrices were then made, and their results are shown in Table 1. while elements on the main diagonal are equal 1.

Applying formulas (1) and (2), we can calculate the weight of each element F. Determined values of elements within the SWOT matrix are shown in Table 2.

The weight calculation procedure described in the previous steps is repeated for the best-ranked elements from each SWOT group (in this case, S_3, W_1, O_1 and T_4). AHP matrix for calculating the weight of groups is shown in Table 3.

In this way, the whole group weighting factors (S_f, W_f, O_f and T_f) are obtained. The final table is obtained after determining S_f, W_f, O_f and T_f. AHP weights of SWOT matrix elements are shown in Table 4.

By applying the TOWS matrix, the following ecotourism development strategies for the area of Uvac SNR were formulated: 1. SO - Formulate a strategy that would make optimum use of the development of modern agricultural production, healthy food (cheese, buckwheat, honey, etc.), mini-farms of specific products, as well as the production of agricultural produce of specific geographical origin (Zlatarski, Sjenički, Pešterski, etc.) for the purpose of presentation of tourism values and opportunities for the development of several types of tourism, especially ecotourism. 2. ST - Formulate a strategy that would utilize the development of several types of tourism, especially ecotourism, and the tourism value of this area, as an opportunity for the development of better transport connections, primarily state and municipal roads. 3. WO - Formulate a strategy that would make optimum use of the advantages of investing in rational water supply and sewerage systems, especially in dispersed rural settlements, and solving the issue of municipal wastewater treatment, especially in the reservoir zone, as an opportunity for the development of modern agricultural production, the production of healthy food and agricultural produce of specific geographical origin. 4. WT - Formulate a strategy that would attract investment in transport system development in order to better connect dispersed rural settlements and establish rational water supply and sewerage systems along with the municipal waste water treatment in settlements in the reservoir zone.

In the continuation of analysis, the AHP method was again used to determine the efficiency of strategies ESij, EWij, EOij and Etij. This was done as an expert analysis determining the significance of each of the strategies using Saaty's table, and then determining the efficiency using the procedure described by equations (1) and (2). Efficiency of strategies against the SWOT matrix elements is shown in Table 5.

The TOWS matrix-based ranking of strategies of development of ecotourism at the Uvac SNR is: 1. SO (value 0.312606183), 2. ST (value 0.311226806), 3. WO (value 0.202626045) and 4. WT (value

Table 4. AHP weights of SWOT matrix elements.

Strenghts			Weakness		
	S_f	S_i		W_f	W_i
S_1	0.253729687	0.025082	W_1	0.136325146	0.06989
S_2		0.017736	W_2		0.010419
S_2		0.105456	W_2		0.020504
S_4		0.105456	W_4		0.035513
Oportunites			Treaths		
	O_f	O_i		T_f	T_i
O_1	0.12321141	0.039553	T_1	0.486733757	0.03489
O_2		0.008844	T_2		0.108565
O_2		0.037407	T_2		0.160695
O_4		0.037407	T_4		0.182584

Source: the authors

Table 5. Efficiency of strategies against the SWOT matrix elements.

	SO	ST	WO	WT		SO	ST	WO	WT
S_1	0.63815	0.21228	0.09916	0.05038	W_1	0.20990	0.60593	0.09208	0.09208
S_2	0.28292	0.58011	0.06847	0.06847	W_2	0.249403	0.55796	0.09631	0.09631
S_3	0.375	0.375	0.125	0.125	W_3	0.29831	0.47935	0.11825	0.104076
S_4	0.54562	0.27724	0.09421	0.08291	W_4	0.39495	0.13161	0.3001	0.17326
	SO	ST	WO	WT		SO	ST	WO	WT
O_1	0.25	0.25	0.25	0.25	T_1	0.125	0.625	0.125	0.125
O_2	0.16661	0.50008	0.16665	0.16665	T_2	0.08333	0.41667	0.08333	0.41667
O_3	0.3	0.3	0.3	0.1	T_3	0.37497	0.12496	0.37507	0.12499
O_4	0.406	0.15675	0.35749	0.07966	T_4	0.25	0.25	0.25	0.25

Source: the authors

0.173541966). SO strategy - it is essential to strengthen the connection between agriculture and ecotourism, hospitality, etc., in order to directly include products in the tourist offer and encourage rural economy diversification through the development of rural tourism, arts & crafts, etc., and encourage initiatives to build capacity for agricultural produce processing, drying or freezing. Harvesting forest fruits and herbs can be a significant additional source of income for the local population. To improve the unfavorable financial situation of households, it is necessary to formulate and implement an integral local and regional sustainable rural development strategy that would give access to EU pre-accession assistance and international programs and funding for rural development. Adequate education would raise rural people's awareness of the need and methods for conserving nature, the environment, and the landscape in which they live. ST strategy - three lakes and rivers, the unique Uvac meanders, contribute to developing specific tourist activities (panoramic sightseeing, photography, protected endangered species watching, study of geomorphological phenomena, etc.). The most attractive are educational and ecological types of tourism, primarily ornithological (griffon vulture watching). A visit to the caves is also an attraction in itself. Water sports (rowing, sailing, etc.), sport fishing, rafting on the Uvac meanders, etc. are possible on the lakes and rivers. For the tourism identity of the area, it is important to preserve the groupings of folk architecture, the Caričina and Karajukića Bunari ethno-units, and establish ethno-parks in the Tuzinje, Ojkovica, Štitkovo and Erčega sites. Adequate presentation of the area and its inclusion in the tourism offer requires increasing transport availability, reconstructing or constructing missing roads, and adequately maintaining them, especially in the winter period. To develop multiple modes of visitor movement, creating a network of cycling, walking and hiking trails is necessary. The proximity of the planned Belgrade-South Adriatic highway (E763) will contribute to better connection and accessibility of this area in a wider regional sense.

WO strategy - water supply to this area should be provided from local sources and the regional water supply system. The current state of sanitation in the settlement is unsatisfactory. In conditions where there are no rational, and often any other sources, the issue of settlement sanitation becomes one of the most important concerns when it comes to not only ecotourism development, but also the survival of a number of settlements in low-water areas, as well as sources of regional water supply systems. Solving the water supply issue is particularly important for the Pešter area, which is vulnerable to droughts, and consequently lacks water for watering livestock, which can adversely affect the development of agriculture and ecotourism. WT strategy - transport system development is a prerequisite for the development of ecotourism in this area, primarily to ensure connection of dispersed rural settlements. This implies the construction of missing road routes, especially considering that the coverage of roads with modern pavement is significantly below the national average. Ecotourism development would imply improving the water supply, sewerage, and waste water treatment systems so that natural values and the water supply source of regional importance are not put at risk. These strategies should help the Uvac SNR management develop ecotourism in this and wider regional area.

Conclusions

This paper prioritized ecotourism development strategies using the SWOT-AHP method on the example of Uvac SNR in the Republic of Serbia. The SWOT-AHP analysis found that threats dominated (group weight 0.486733757), but that strengths did not have a negligible weight either (group weight 0.253729687). Threats to the Uvac SNR area are still dominant and appropriate measures should be taken to reduce their impact. Based on the results of this study, the best-ranked strategy

is the SO strategy (maxi-maxi), which would make optimal use of the development of modern agricultural production, healthy food, as well as the production of agricultural produce of specific geographical origin, for the purpose of presenting tourism values and opportunities for the development of ecotourism. It can be concluded that ecotourism in this area should be regarded as a much more significant industry in the future. Ecotourism development would be in line with the requirements of conserving and improving the quality of the environment and preserving natural values, assets and resources, while respecting the local community interests. This requires the provision of better transport connections and the integration of the area's tourist offer with the wider region's offer.

The concept of rural development and improvement of the quality of life in rural areas on the area of Uvac SNR would be entrenched in the principle of integral rural area development. This concept implies the establishment of an appropriate degree of coordination and combined development of agriculture and other economic, service, and intermediary activities, from small industrial plants, crafts, trade, service, and financial activities, to rural tourism and local arts & crafts, as well as the activation and optimal use of production potential of agriculture and other economic and service activities for the sake of creating more local job opportunities. Particular importance and role in the implementation of priority ecotourism strategies lies with the Uvac SNR management and the local population, who are to contribute to achieving the goal of sustainable development and minimizing regional imbalance, assisted by experts in tourism and agriculture. In order to create environmental awareness of the local population, it is crucial to periodically organize meetings and awareness-raising programs in every village in the area of the Uvac SNR. In addition, priority steps to be taken in the following period include raising the quality of accommodation, promotion, and booking in rural tourism; improving the ICT promotion and booking system and raising the efficiency of capacity commercialization; supporting commercial training programs for rural households interested in rural tourism; organizing education by the ministry in charge of tourism and municipalities in cooperation with the ministry of agriculture on the possibilities of applying the IPARD component for the financing of rural tourism [7]. The paper confirmed that in order to plan future activities, in this case the development of ecotourism in Uvac SNR, it is useful to combine the SWOT analysis with another MCDM method, in this case the AHP method, to determine how significant certain elements within the SWOT matrix really are compared to other elements, i.e., prioritize the development strategies necessary for planned development of ecotourism in a nature reserve. The combined SWOT-AHP method application confirmed its significant input for making strategic decisions related to ecotourism development in protected natural areas. The study highlights the importance and convenience of applying the combined AHP-SWOT method in the subject and similar areas.

List of the Abbreviations Used

AHP Analytic Hierarchy Process
IPARD The Instrument for Pre-Accession Assistance for Rural Development
MCDM Multi-Criteria Decision-Making
SNR Special Nature Reserve
SWOT Strengths, Weaknesses, Opportunities, Threats
TIES The International Ecotourism Society
TOWS Threats, Opportunities, Weaknesses, Strengths
UNDP United Nations Development Programme
UNEP The United Nations Environment Programme
WTO The World Tourism Organization

Conflict of Interest

The authors declare no conflict of interest.

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