Research Article

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Geomorphological and hydrological heritage of Mt. Stara Planina in SE Serbia: From river protection initiative to potential geotouristic destination

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Abstract: Mt. Stara Planina is located in the eastern part of the Republic of Serbia and represents the westernmost part of the large mountain massif of the Balkans. Both endogenous and exogenous forces created interesting geomorphological and hydrological features for geotourism development in this area. This article proposes a preliminary list of geomorphological and hydrological sites and analyses them to reveal which geosite possesses geotourism potential. This research was carried out by applying the modified geosite assessment model. In this article, ten geosites were singled out based on the degree of their attractiveness for geotourism development. The results reveal information about the key fields of improvement for each evaluated geosite, and identify which areas require more attention and better management in the upcoming period for Mt. Stara Planina to become a well-known geotourism destination that would attract a large number of tourists in the future.

Keywords: geotourism, East Serbia, Stara Planina, assessment methods, M-GAM

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1 Introduction

Geotourism has been one of the fastest-growing market segments within tourism in the past decade [1–3], and the expectation is that geotourism will continue to grow at a rapid pace worldwide [4]. Geotourism is fundamentally a geosite-based activity [5]. Geosites are landforms that have acquired aesthetic, scientific, historical, cultural, and socio-economic values due to their perception or exploitation by humans [6–14]. Geosites can allow the natural landforms to be highlighted and facilitate their understanding [15]. Their values are promoted and presented through tourism, especially geotourism [16]. Geotourism highlights geoconservation and an understanding of earth sciences through appreciation and learning [17].

Geotourism promotes local entrepreneurship [18] and makes market access for micro, small, and medium enterprises [19]. According to Dowling [20], one of the goals of sustainable geotourism development is to improve the quality of life of the host community. The active participation of residents in geotourism planning is fundamental to the sustainable geotourism development process [21]. The development of geotourism should not minimise residents' sense of belonging to the local environment [18]. The UNESCO [22] set geopark management guidelines to encourage the use of a bottom-up approach, where public and private organisations, as well as local communities, participate in the process of defining and implementation of sustainable territorial development strategies.

Geoparks and other protected zones are pioneers in geotourism development [23], and they have become an imminent tool for a closer understanding of the geoheritage [24]. Their primary objective is to coordinate stakeholders in the common purpose, which is a sustainable local development [25,23]. Since geoheritage is perceived as a resource for economic development [26], the concept of geopark has been developed in recent years to incentivise economic development through sustainable geotourism [27].

Mt. Stara Planina is located in the south-east part of Serbia, representing an Alpine tectonic unit and a part of the Carpatho-Balkanides [28]. The dominant bedrock types in Mt. Stara Planina are quartz sandstone, limestone, and red sandstone, which have a large distribution [29]. Both endogenous and exogenous forces created interesting geomorphological and hydrological features for geotourism development in this area. There are various geoheritage objects such as deep canyons and gorges, caves and caverns, cracks, waterfalls, pits, springs, stone bridges, cavelets, rocky promontories, and columns. The biggest attractions of this area are the several waterfalls with a height of over 30 m. Although Mt. Stara Planina has exceptional potential for geotourism development, the geoheritage of this area has not been sufficiently explored and used for tourism.

The main goal of this article is to propose a preliminary list of Mt. Stara Planina geosites and analyse their potential for geotourism development. This research was carried out by applying the modified geosite assessment model (M-GAM) created by Tomić and Božić [30]. The geotourism development on Mt. Stara Planina could be helpful for the social level improvement of the local community and a good opportunity to share the cultural traditions of the region with national and international visitors, as well as to raise the economical level through a well-founded geotourism action plan.

2 Mt. Stara Planina and geoethics

Observing the constant global trend of growth in the exploitation of natural resources [31], and the development of nature-based tourism [32–34], the need for sustainable measures has become a crucial parameter for the protection of natural values. One of the most vulnerable aspects of nature is certainly geological heritage, which is constantly in the focus of anthropogenic activities [35]. The answer of the academic community is the development and promotion of the phenomenon of geoethics as a modernised approach dealing with the harmfulness of the human footprint on geological heritage. According to the International Association for Promoting Geoethics (IAPG), one of the definitions for geoethics is: "geoethics deals with the ethical, social, and cultural implications of geoscience knowledge, education, research, practice, and communication, providing a point of intersection for geosciences, sociology, philosophy, and economy" [36].

Numerous studies in the past [37–39] have shown various aspects of human behaviour that can have very negative impacts on groundwater. This is a major problem that experts from multidisciplinary fields are focused on. The IAPG has managed to publish a book on this topic "Advances in Geoethics and Groundwater Management: Theory and Practice for Sustainable Development." In researching this problem, editors and authors have often used the term "hydrogeoethics" – a novel transdisciplinary, scientific field integrating all dimensions of geoethics in groundwater science and practice [40]. However, in the case of Mt. Stara Planina, surface waters are the main topic.

On the vague of global policies to secure sustainable energy production and preserve the environment, and based on the EU Directive 2009/28/EC [41] in particular, since 2010 Serbian Government has set a policy to support investment in sustainable energy production from hydro, solar, wind power, and biomass. The main policy instruments consisted in securing 12 years guaranteed purchase of the produced electricity from sustainable energy plants by public energy companies and the subsidised preferential purchasing price – the so-called "feed-in tariff." Additionally, the privileged energy producers were exempted from the balancing responsibility and this free and priority access to the transmission/distribution system has been secured. This set of incentives created a strong interest in the investors and led to a large wave of construction of small hydropower plants (SHPP) across Serbia. Many of the potential locations reserved for SHPP by Special Purpose Area Spatial Plans and Spatial Plans of local self-governments were in the zones of protected nature, while almost half of these locations relate to Stara Planina natural reserve [42]. At the same time, the environmental cost of SHPP was considered in a quite formalistic way in the approval of privileged producer status. This was especially problematic for many locations with a relatively small capacity for power generation and potentially large harmful effects on the environment.

In addition to tourist potentials and values, what makes Mt. Stara Planina recognisable from the socio-economic aspect is the fact that this area has attracted investors for the construction of mini-hydropower plants (small hydro). Although the energy consumption obtained from small hydro is considered "green," "clean," and "sustainable," the construction methods can be very dangerous for the ecosystem. The practice has shown that many investors lay pipes into the riverbed to cut costs. Those pipes carry a larger volume of water than is permitted, thus, the regulations on minimal river water flow are not respected. Also, surrounding habitats are devastated during the construction process, and the local water supply is threatened [43]. Therefore, many experts, together with the local population, successfully rebelled against such projects, because they recognised the environmental damage that could occur if such projects were implemented. In this example, it can be seen that although Mt. Stara Planina is protected on the national level, the readiness and ability of certain interest groups to actively disturb the hydrological geoheritage exceed all the principles of geoethically responsible behaviour towards natural resources. Nevertheless, environmental awareness at the local level has overcome all threats to the quality of geodiversity and biodiversity, thus potential geotourism affirmation can be carried out by the developed concepts and practical elements of the geoethical code. Moreover, the values of geoethics in the researched area can be considered as additional values (AV) that can influence the development of sustainable geotourism.

There is a close connection between the protection of the rivers of the Mt. Stara Planina and the development of geotourism. Numerous geosites within the researched area represent hydrological or hydrogeological heritage located on the Temštica river and the Visočica river, as well as on their tributaries, which are the main elements of geotourism development. The construction of mini-hydropower plants would significantly affect the flow, which would lead to the gradual and later complete destruction of the specific elements of the geosites. Therefore, the development of geotourism would raise awareness of the need to protect geoheritage, and its specific assets, which is one of its elementary objectives.

In the past three decades, the local population initiated many strategies for the river's preservation on the Mt. Stara Planina, but they were not recognised and supported by local and national authorities. Therefore, many associations of citizens were established, which are still fighting against the construction of mini-hydropower plants on the rivers of the Mt. Stara Planina, hoping that they will succeed in preserving the natural beauties of this area.

3 Methodology

In order to identify the potential for geotourism development in a particular area, it is necessary to assess the value and current condition of its geosites [44]. This article uses a M-GAM developed by Tomić and Božić [30] for evaluating ten representative geosites of Mt. Stara Planina. This method is based on the geosite assessment model (GAM) created by Vujičić et al. [45] and the importance factor (Im) first introduced by Tomić [46]. In addition, the model represents an amalgam of former geosite assessment methods [46–55]. Unlike previous methods, where all grades were given by experts, the M-GAM includes not only the opinion of experts but also that of tourists regarding the importance of each sub-indicator in the assessment process. More reliable and accurate results are thus obtained [30]. The validity of the M-GAM is confirmed by its successful application for the assessment of diverse geosites in Serbia, Slovenia, USA, Hungary, Iran, and India. Various articles present the evaluation of karst geosites [56], canyons and gorges [57,60–62], showcaves [63–67], hydrological heritage [68], and many other geological heritages [25,69–78].

The M-GAM model consists of two key indicators: main values (MV) and AV. The division is made due to two general types of values: MV – that are mostly generated by geosite's natural attributes, and AV – that are mostly human-induced. The MV comprise three groups of indicators: scientific/educational (VSE), scenic/aesthetical values (VSA), and protection (VPr), while the AV are divided into two groups of indicators: functional (VFn) and touristic values (VTr). The MV and AV are presented in more detail in Table 1. In total, there are 12 sub-indicators of MV and 15 sub-indicators of AV which are graded from 0 to 1 that define M-GAM as a simple equation:

$$\text{M-GAM} = \text{MV} + \text{AV}, \tag{1}$$

where MV and AV represent symbols for main values and additional values. Since MV and AV consist of three or two groups of sub-indicators, two equations can be derived:

$$\text{MV} = \text{VSE} + \text{VSA} + \text{VPr}, \tag{2}$$

$$\text{AV} = \text{VFn} + \text{VTr}. \tag{3}$$

Each group of indicators consists of several sub-indicators; therefore equations (2) and (3) can be written as follows:

$$\begin{aligned}\text{MV} &= \text{VSE} + \text{VSA} + \text{VPr}\\ &\equiv \sum_{i=1}^{12}\text{SIMV}_i, \quad \text{where } 0 \le \text{SIMV}_i \le 1,\end{aligned} \tag{4}$$

Table 1: The structure of M-GAM model values

Indicators/sub-indicators	Description
MV	
Scientific/educational values (VSE)	
1. Rarity ($SIMV_1$)	Number of closest identical sites
2. Representativeness ($SIMV_2$)	Didactic and exemplary characteristics of the site due to its own quality and general configuration
3. Knowledge on geoscientific issues ($SIMV_3$)	Number of written papers in acknowledged journals, thesis, presentations, and other publications
4. Level of interpretation ($SIMV_4$)	Level of interpretive possibilities on geological and geomorphologic processes, phenomena, and shapes and level of scientific knowledge
Scenic/aesthetic values (VSA)	
5. Viewpoints ($SIMV_5$)	Number of viewpoints accessible by a pedestrian pathway. Each must present a particular angle of view and be situated less than 1 km from the site
6. Surface ($SIMV_6$)	Whole surface of the site. Each site is considered in quantitative relation to other sites
7. Surrounding landscape and nature ($SIMV_7$)	Panoramic view quality, presence of water and vegetation, absence of human-induced deterioration, vicinity of urban area, etc.
8. Environmental fitting of sites ($SIMV_8$)	Level of contrast to the nature, contrast of colours, appearance of shapes, etc.
Protection (VPr)	
9. Current condition ($SIMV_9$)	Current state of geosite
10. Protection level ($SIMV_{10}$)	Protection by local or regional groups, national government, international organizations, etc.
11. Vulnerability ($SIMV_{11}$)	Vulnerability level of geosite
12. Suitable number of visitors ($SIMV_{12}$)	Proposed number of visitors on the site at the same time, according to surface area, vulnerability, and current state of geo-site
AV	
Functional values (VFn)	
13. Accessibility ($SIAV_1$)	Possibilities of approaching the site
14. Additional natural values ($SIAV_2$)	Number of additional natural values in the radius of 5 km (geosites also included)
15. Additional anthropogenic values ($SIAV_3$)	Number of additional anthropogenic values in the radius of 5 km
16. Vicinity of emissive centres ($SIAV_4$)	Closeness of emissive centres
17. Vicinity of important road network ($SIAV_5$)	Closeness of important road networks in the radius of 20 km
18. Additional functional values ($SIAV_6$)	Parking lots, gas stations, mechanics, etc.
Touristic values (VTr)	
19. Promotion ($SIAV_7$)	Level and number of promotional resources
20. Organised visits ($SIAV_8$)	Annual number of organised visits to the geosite
21. Vicinity of visitor centres ($SIAV_9$)	Closeness of visitor centre to the geosite
22. Interpretative panels ($SIAV_{10}$)	Interpretative characteristics of text and graphics, material quality, size, fitting to surroundings, etc.
23. Number of visitors ($SIAV_{11}$)	Annual number of visitors
24. Tourism infrastructure ($SIAV_{12}$)	Level of additional infrastructure for tourists (pedestrian pathways, resting places, garbage cans, toilets, etc.)
25. Tour guide service ($SIAV_{13}$)	If exists, expertise level, knowledge of foreign language(s), interpretative skills, etc.
26. Hostelry service ($SIAV_{14}$)	Hostelry service close to geosite
27. Restaurant service ($SIAV_{15}$)	Restaurant service close to geosite

Grades (0–1)

	0.00	**0.25**	**0.50**	**0.75**	**1.00**
1.	Common	Regional	National	International	The only occurrence
2.	None	Low	Moderate	High	Utmost
3.	None	Local publications	Regional publications	National publications	International publications

(*Continued*)

Table 1: *Continued*

	Grades (0–1)				
	0.00	**0.25**	**0.50**	**0.75**	**1.00**
4.	None	Moderate level of processes but hard to explain to non-experts	Good example of processes but hard to explain to non-experts	Moderate level of processes but easy to explain to common visitor	Good example of processes and easy to explain to common visitor
5.	None	1	2–3	4–6	More than 6
6.	Small	—	Medium	—	Large
7.	—	Low	Medium	High	Utmost
8.	Unfitting	—	Neutral	—	Fitting
9.	Totally damaged (as a result of human activities)	Highly damaged (as a result of natural processes)	Medium damaged (with essential geomorphologic features preserved)	Slightly damaged	No damage
10.	None	Local	Regional	National	International
11.	Irreversible (with possibility of total loss)	High (could be easily damaged)	Medium (could be damaged by natural processes or human activities)	Low (could be damaged only by human activities)	None
12.	0	0–10	10–20	20–50	More than 50
13.	Inaccessible	Low (on foot with special equipment and expert guide tours)	Medium (by bicycle and other means of man-powered transport)	High (by car)	Utmost (by bus)
14.	None	1	2–3	4–6	More than 6
15.	None	1	2–3	4–6	More than 6
16.	More than 100 km	100–50 km	50–25 km	25–5 km	Less than 5 km
17.	None	Local	Regional	National	International
18.	None	Low	Medium	High	Utmost
19.	None	Local	Regional	National	International
20.	None	Less than 12 per year	12–24 per year	24–48 per year	More than 48 per year
21.	More than 50 km	50–20 km	20–5 km	5–1 km	Less than 1 km
22.	None	Low quality	Medium quality	High quality	Utmost quality
23.	None	Low (less than 5,000)	Medium (5,001–10,000)	High (10,001 –100,000)	Utmost (more than 100,000)
24.	None	Low	Medium	High	Utmost
25.	None	Low	Medium	High	Utmost
26.	More than 50 km	25–50 km	10–25 km	5–10 km	Less than 5 km
27.	More than 25 km	10–25 km	10–5 km	1–5 km	Less than 1 km

Source: Vujičić et al. [45].

$$AV = VFn + VTr \equiv \sum_{j=1}^{15} SIAV_j, \quad \text{where } 0 \leq SIAV_j \leq 1. \quad (5)$$

Values $SIMV_i$ and $SIAV_j$ represent 12 sub-indicators of MV ($i = 1,\ldots, 12$) and 15 sub-indicators ($j = 1,\ldots, 15$) of AV, respectively. The main characteristic of M-GAM is that its focus is on the expert's opinion and the opinion of the visitors and tourists regarding the importance of each sub-indicator in the assessment process. Visitors' and tourists' involvement in the assessment process is made through a survey where each respondent is asked to rate the importance of all 27 sub-indicators (Table 1). The Im allows the visitors and tourists to express their opinion about each sub-indicator in the model and to show how important it is for them when choosing and deciding between several geosites that they wish to visit. After each respondent rates the importance of every sub-indicator, the average value of each sub-indicator is calculated and the final value of that sub-indicator is the Im. Afterward, the value of the Im is multiplied with the value that was given by the experts (Table 2).

The parameter of the Im is determined by visitors and tourists who rate it in the same way as experts rate the sub-indicators for MV and AV by giving them one of the following numerical values: 0.00, 0.25, 0.50, 0.75, and 1.00, marked as points. According to this, the Im is defined as:

Table 2: Sub-indicator values given by experts for each analysed geosite

Indicators/sub-indicators	Values given by experts										Im	Total value									
	GS_1	GS_2	GS_3	GS_4	GS_5	GS_6	GS_7	GS_8	GS_9	GS_{10}		GS_1	GS_2	GS_3	GS_4	GS_5	GS_6	GS_7	GS_8	GS_9	GS_{10}
Scientific/educational values (VSE)																					
Rarity ($SIMV_1$)	0.25	0.25	0.5	0.25	0.5	0.25	0.25	0.25	0.25	0.25	0.89	0.22	0.22	0.45	0.22	0.45	0.22	0.22	0.22	0.22	0.22
Representativeness ($SIMV_2$)	0.75	0.5	1	1	1	0.75	1	1	1	0.75	0.79	0.59	0.40	0.79	0.79	0.79	0.59	0.79	0.79	0.79	0.59
Knowledge on geoscientific issues ($SIMV_3$)	0.75	1	1	1	0.75	0.5	0.75	1	0.75	0.5	0.45	0.34	0.45	0.45	0.45	0.34	0.23	0.34	0.45	0.34	0.23
Level of interpretation ($SIMV_4$)	1	0.75	1	1	1	1	1	1	1	1	0.85	0.85	0.64	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Scenic/aesthetic values (VSA)																					
Viewpoints ($SIMV_5$)	0.5	0.25	0.5	0.5	1	0.5	1	1	0.5	0.5	0.79	0.40	0.20	0.40	0.40	0.79	0.40	0.79	0.79	0.40	0.40
Surface ($SIMV_6$)	0.5	0	0.5	0	0.75	0.25	1	1	0.75	0.5	0.54	0.27	0	0.27	0	0.41	0.14	0.54	0.54	0.41	0.27
Surrounding landscape and nature ($SIMV_7$)	1	0.75	1	1	1	1	1	1	1	1	0.95	0.95	0.71	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Environmental fitting of sites ($SIMV_8$)	1	1	1	1	1	1	1	1	1	1	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Protection (VPr)																					
Current condition ($SIMV_9$)	1	0.5	1	1	1	1	1	0.75	1	1	0.83	0.83	0.42	0.83	0.83	0.83	0.83	0.83	0.62	0.83	0.83
Protection level ($SIMV_{10}$)	0.75	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.76	0.57	0	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Vulnerability ($SIMV_{11}$)	0.75	0.5	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.58	0.44	0.29	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Suitable number of visitors ($SIMV_{12}$)	0.75	0.25	0.75	0.5	1	0.75	1	1	1	0.75	0.42	0.32	0.11	0.32	0.21	0.42	0.32	0.42	0.42	0.42	0.32
Functional values (VFn)																					
Accessibility ($SIAV_1$)	1	1	0.5	1	1	0.75	0.25	1	0.5	0.25	0.75	0.75	0.75	0.38	0.75	0.75	0.56	0.19	0.75	0.38	0.19
Additional natural values ($SIAV_2$)	0.5	0.75	0.25	0.5	0.25	0.5	1	1	0.5	0.5	0.71	0.36	0.53	0.18	0.36	0.18	0.36	0.71	0.71	0.36	0.36
Additional anthropogenic values ($SIAV_3$)	0.5	0.5	0.5	0.5	0	0	0.5	0.5	0	0.25	0.70	0.35	0.35	0.35	0.35	0	0	0.35	0.35	0	0.18
Vicinity of emissive centres ($SIAV_4$)	0.25	0.25	0.25	0.25	0.25	0	0.25	0.25	0	0.25	0.48	0.12	0.12	0.12	0.12	0.12	0	0.12	0.12	0	0.12
Vicinity of important road network ($SIAV_5$)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.25	0.62	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.62	0.31	0.16
Additional functional values ($SIAV_6$)	0	0.5	0	0	0.25	0	0.25	0.25	0	0	0.59	0	0.30	0	0	0.15	0	0.15	0.15	0	0
Touristic values (VTr)																					
Promotion ($SIAV_7$)	0.5	0.25	0.5	0.5	0.75	0.5	0.5	0.25	0.25	0.25	0.85	0.43	0.21	0.43	0.43	0.64	0.43	0.43	0.21	0.21	0.21
Organised visits ($SIAV_8$)	0.75	0	0.75	0.25	1	0.75	0.25	0.25	0.5	0.5	0.56	0.42	0	0.42	0.14	0.56	0.42	0.14	0.14	0.28	0.28
Vicinity of visitor centres ($SIAV_9$)	0	0	0	0	0	0	0	0	0	0	0.87	0	0	0	0	0	0	0	0	0	0

(*Continued*)

Table 2: *Continued*

Indicators/sub-indicators	Values given by experts										Im	Total value									
	GS_1	GS_2	GS_3	GS_4	GS_5	GS_6	GS_7	GS_8	GS_9	GS_{10}		GS_1	GS_2	GS_3	GS_4	GS_5	GS_6	GS_7	GS_8	GS_9	GS_{10}
Interpretative panels ($SIAV_{10}$)	0.75	0.25	0.75	0.75	0.5	0.75	0.25	0.25	0.25	0.5	0.81	0.61	0.20	0.61	0.61	0.41	0.61	0.20	0.20	0.20	0.41
Number of visitors ($SIAV_{11}$)	0.75	0.25	0.5	0.25	0.75	0.5	0.25	0.25	0.25	0.25	0.43	0.32	0.11	0.22	0.11	0.32	0.22	0.11	0.11	0.11	0.11
Tourism infrastructure ($SIAV_{12}$)	0.5	0	0.75	0.5	0.75	0.75	0.25	0.25	0	0	0.73	0.37	0	0.55	0.37	0.55	0.55	0.18	0.18	0	0
Tour guide service ($SIAV_{13}$)	0.25	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.87	0.22	0	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Hostelry service ($SIAV_{14}$)	0.75	0.75	1	1	1	1	0.5	0.5	0.75	0.75	0.73	0.55	0.55	0.73	0.73	0.73	0.73	0.37	0.37	0.55	0.55
Restaurant service ($SIAV_{15}$)	0.5	0.5	0.5	1	1	0.5	0.25	0.25	0.5	0	0.78	0.39	0.39	0.39	0.78	0.78	0.39	0.20	0.20	0.39	0

$$\mathrm{Im} = \frac{\sum_{i=1}^{K} Iv_i}{K}, \quad (6)$$

where Iv_i is the assessment/score of one visitor for each sub-indicator and K is the total number of visitors. Note that the Im parameter can have any value in the range from 0.00 to 1.00. Finally, the M-GAM equation is defined and presented in the following form:

$$\text{M-GAM} = \mathrm{MV} + \mathrm{AV}, \quad (7)$$

$$\mathrm{MV} = \sum_{i=1}^{12} \mathrm{Im}_i \times \mathrm{MV}_i, \quad (8)$$

$$\mathrm{AV} = \sum_{j=1}^{15} \mathrm{Im}_j \times \mathrm{AV}_j. \quad (9)$$

Based on the results obtained, a matrix of MV (X axes) and AV (Y axes) is created (Figure 7). The matrix is divided into nine fields represented with $Z(i, j)$, (i, j = 1,2,3). Depending on the final score, each geosite will fit into a certain field. For example, if a geosite's MV are nine and AV are seven, the geosite will fit into the field Z_{32}.

Božić and Tomić [57] conducted a survey in their research about different geotouristic segments and calculated the Im for each sub-indicator in the M-GAM model related to Serbian tourists. For the purposes of this research, the values of the Im have been adopted from the mentioned paper.

4 Study area

Mt. Stara Planina is a spacious mountain range that belongs to the Alpine tectonic unit, which is called the Carpatho-Balkan mountain arch, and only a small western part is located in Eastern Serbia (Figure 1). As a morphological unit, it is bordered by the valleys of the Beli Timok and Trgoviški Timok rivers in N–NW, the Visočica river in S–SW, and the state border with the Republic of Bulgaria in the E. Stretching in the meridian direction for almost 100 km, Mt. Stara Planina represents a significant orographic barrier that influenced the physical-geographical processes in this area. There are several peaks higher than 1,500 m: Orlov Kamen (1,737 m), Tupanar (1,727 m), Srebrna Glava (1,933 m), and the highest peak Midžor (2,169 m). Mt. Stara Planina covers an area of 1,802 km^2 [58,79]. According to Tchoumatchenco et al. [59], there are several faults of primary importance in the tectonic division of eastern Serbia and western Bulgaria. The most important one is the Vidlič fault (NW–SE), dividing the Getic-Srednogorie Unit and Poreč-Stara Planina Unit.

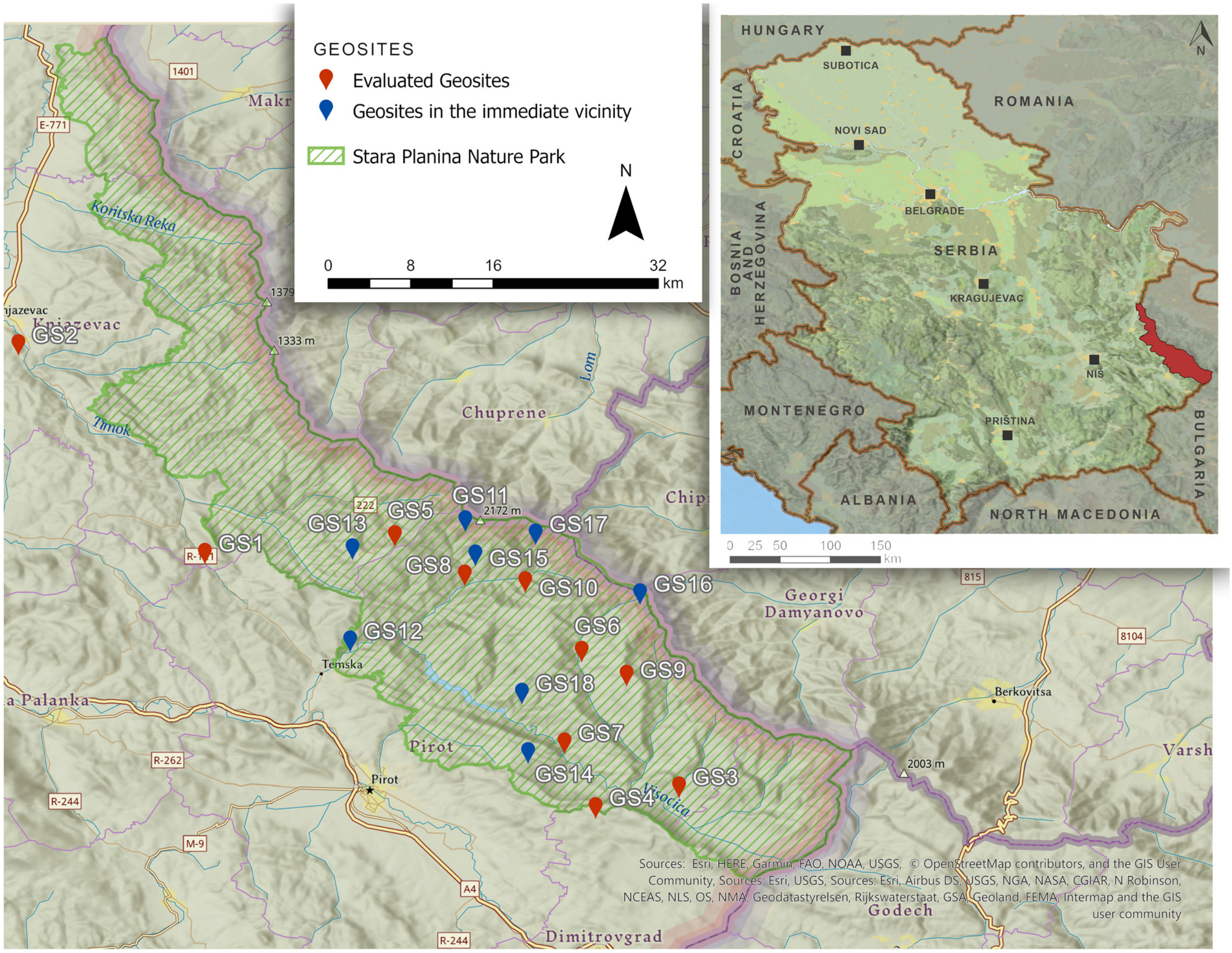

Figure 1: Mt. Stara Planina geosites map: GS_1 – Bigar waterfall; GS_2 – Baranica cave; GS_3 – Rosomačka river gorge; GS_4 – Jelovičko spring; GS_5 – Babin Zub; GS_6 – Tupavica waterfall; GS_7 – Vladikine Ploče gorge; GS_8 –Temštica river's canyon; GS_9 – Depression Ponor; GS_{10} – Lower Piljski waterfall; GS_{11} – Kaluđerski waterfall; GS_{12} –Bukovački Do waterfall; GS_{13} – Orlov Kamen peak; GS_{14} – Krajinci waterfall; GS_{15} – Upper Piljski waterfall; GS_{16} – Tri Kladenca waterfall; GS_{17} – Čunguljski waterfall; and GS_{18} – Belski waterfall (Source: Authors 2021).

There is also the Morava fault (N–S), dividing the Vardar Zone and the Carpatho-Balkanides. The oldest types of rocks of Mt. Stara Planina are the Upper Proterozoic rocks. There are no breaks in sedimentation between the Upper Proterozoic and Lower Cambrian. Upper Proterozoic-Cambrian rocks of the Mt. Stara Planina are overlain with conglomerates, limestones, sandstones, and argillaceous schist. The volcanogenic-sedimentary and sedimentary formations are characteristic of the Permian period. The sedimentary formations consist of conglomerates and red sandstones, which have large distributions. These formations are represented by arkosic conglomerates, sandstone, siltstone, and claystone [29].

The geological structure of Mt. Stara Planina indicates that various morphological processes took place due to endogenous and exogenous forces, primarily fluvial and karst erosion, which led to the formation of genetically diverse relief features, morphographically expressed and morphometrically representative [80].

To protect and conserve the value of the wildlife, places expressing the exceptional geological diversity, surface and groundwaters, and rock formations, part of Mt. Stara Planina was proclaimed as a Nature Park in 1997. It covers an area of 114,332 ha, and stretches in the municipalities of Zaječar, Knjaževac, Pirot, and Dimitrovgrad. The Nature Park "Stara Planina" with its surroundings is treated as a unique tourist region of primary importance for development according to the spatial plan of the Republic of Serbia, and it is also one of the most visited ski resorts in Serbia [81].

Due to its turbulent geological past and the action of endogenous and exogenous forces, different morphological processes have occurred, leading to the formation of diverse geomorphological and hydrological features, morphographically pronounced and morphometrically representative, thus creating the unique wealth of the landscape diversity. In this study, the preliminary list of ten geomorphological and hydrological geosites was singled out based on the degree of their attractiveness for geotourism development (Figure 1). These geosites potentially have the largest opportunity to attract the attention of a larger number of tourists. However, in our opinion, Mt. Stara Planina has many other geosites that possess immense geotourism development potential. Some of them are Kaludjerski waterfall, Bukovački Do waterfall, Orlov Kamen peak, Krajinci waterfall, Upper Piljski waterfall, Tri Kladenca waterfall, Čunguljski waterfall, and Belski waterfall (Figure 1). One of the main tasks of future research should be their evaluation in order to get insights into Mt. Stara Planina's geotourism development potential.

The Bigar waterfall (GS_1) is located on the western rim of Mt. Stara Planina near the village of Kalna (Figure 2). The Bigar stream is a left tributary of the Stanjanska river [58], and it is rich in calcium bicarbonate, which is responsible for the formation of tufa. At an altitude difference of 90 m, the Bigar stream built a wide valley filled with accumulations of tufa (bigar), after which it was named. The total area covered by tufa is about 144,000 m^2 and it is the largest tufa accumulation in Serbia. On its course, the Bigar stream has many cascades and small waterfalls, and between them, there are small lakes surrounded by tufa dams. The total height of the waterfall is 35 m and it is very attractive for tourists. After passing through the notch of the valley, the water comes to the edge of the fold, where it collapses. There are two falls, one has an altitude of 14.5 m, and the second one falls 9.6 m on the shelf, from where it forks into 2 rows of cascades 6.8 m high and 7.9 m high [82]. The Bigar waterfall along with its valley has been placed under protection as a Natural Monument since 2009, encompassing an area of 28 ha [83].

The Baranica (GS_2) is a composite cave system situated nearby Knjaževac, on the right bank of the Trgoviški Timok river, [84]. It was formed in the so-called Urgonian rocks of the Early Cretaceous age, represented by limestone, bioclastic limestone, sandstone, and marlstone. The Baranica is a dry karst cave, without a stream. It has two entrances: the larger one in the south and the smaller one in the east [85]. The cave is not rich with speleothems, but it has big significance because it represents a site where the remains of large mammals and diverse associations of rodents from the Late Pleistocene period were excavated [86,87]. In its vicinity there are many other caves and rock shelters (Vasiljska pećina, Pećina iznad Vrela, Bolvan I, II, III, and IV, Gabrovnica, Kožuvarska pećina, etc.). The remains of Pleistocene fauna and Paleolithic artefacts were discovered in some of them [84], and in Gabrovnica cave, the prehistoric cave paintings were found – the first of that kind in Serbia [88].

The Rosomačka river's gorge (GS_3) (also known as Rosomačko grlo and Slavinjsko grlo) was created by

Figure 2: (a) Bigar waterfall and (b) Rosomačka river gorge (Source: Authors 2021).

the Rosomača river, between the villages Rosomač and Slavinja (Figure 2). It is cut into layered Jurassic limestone. The layers are associated with hornblende, which indicates that they were created in the upper Jurassic which originated in the deep parts of the Tethys Ocean [89]. The gorge is relatively short and up to 20 m deep. The gorge is famous for its pots (hollows) and whirlpools. Those are evorsion pots, made by the process of vertical fluvial erosion. They are situated at the locations where the river suddenly falls from the cascades to the riverbed. The width of these hollows can be up to 4 m in diameter [90]. The Jurassic limestones that build the gorge are rich in fossil remains: ammonites, aptychuses, belemnites, radiolarians, and other fossils. The main characteristic of these rocks is pronounced stratification. The thickness of the layers is from a few centimetres up to 60 cm [91]. The Rosomačka river's gorge has exceptional aesthetic values.

The Jelovičko spring (GS_4) is located in the south part of Mt. Stara Planina, near Jelovica village. It belongs to the group of karst siphon springs. It was formed in limestone and dolomites of the middle Triassic and represents one of the biggest karst springs in Vidlič as an integral part of the Mt. Stara Planina. Below the water surface of the Jelovičko spring there is an underwater cave from which water flows. Speleological divers explored the underwater cave to a depth of 48 m, and came to a sandy plateau. From that point of view, the end of the cave was not even in sight. The total length of the explored channels is 118 m [92]. This spring drains most of the karst massif Vidlič and represents the source with the greatest abundance in this area. The water of this ascending spring erupts from a rotating amphitheatre depression on the left bank of the Jelovička river and forms small water accumulation. Maximum abundance occurs during the spring and it can reach 5–6 m^3/s. During the summer in August, the abundance of the spring drops to the value of 100–200 L/s, and in September only 60–80 L/s. The spring has a constant water temperature of 10°C [93,92]. The spring is also known as "Zelena Voda" (Figure 3) because of the specific green colour of the water, and this locality has outstanding aesthetic values. There is one cave near Jelovičko spring in the valley of the Jelovička river. The entrance of the cave is located 8 m above the riverbed. This is a typical karst cave which is 132 m long. The speleothems are not developed there, but it possesses many short side channels [94].

Nearby the highest peak of Mt. Stara Planina – Midžor (2,169 m), a group of rock formations is known as "Babin Zub" (GS_5). The Babin Zub is created from coarse-grained quartz sandstones shaped by erosion [58]. The whole complex captivates with its enormity and represents one of the most impressive morphological and scenic symbols of Mt. Stara Planina. The highest part of the Babin Zub has the appearance of a narrow plateau that ends towards the northwest with rocky sections with a length of about 1.5 km (Figure 3). The highest rock in the group (1,758 m) is also one of the highest peaks of Mt. Stara Planina. As an attractive representative of denudation processes in red conglomerates, rock formations have been protected as a Natural Monument since 1981. On the protected natural asset, which has an area of 44 ha, communities of mountain pastures and subalpine beech have been developed dominantly [80].

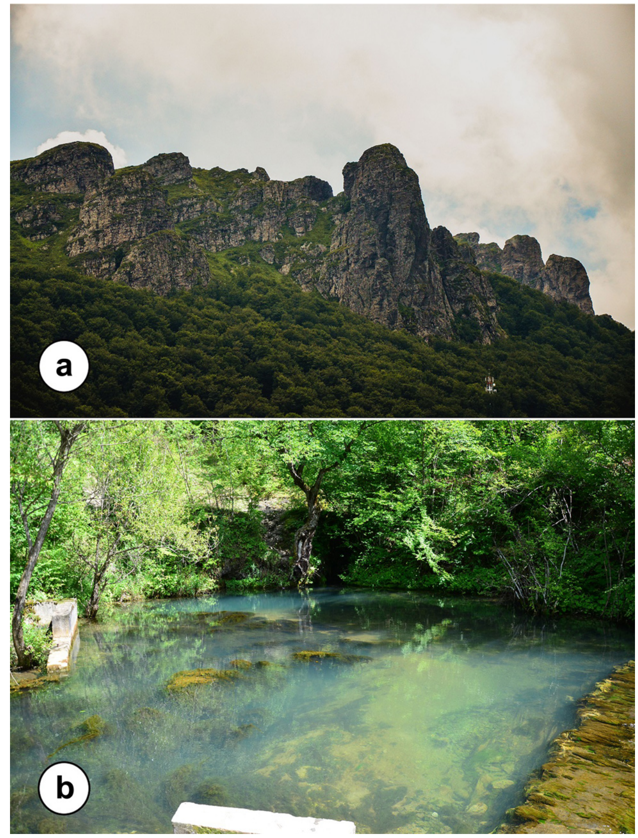

Figure 3: (a) Babin Zub and (b) Jelovičko spring (Source: Authors 2021).

The Tupavica waterfall (GS_6) is located on the stream Medjudolski dol (a tributary of the Dojkinačka river), at an altitude of 1,050 m (Figure 4). Clear and cold water falls from a height of about 15 m over the red sandstone blocks. This waterfall belongs to the type of erosive waterfall. The waterfall is easily accessible. It is 5 km away from the village Dojkinci from where the track leads to the waterfall. The waterfall is the most attractive in spring and autumn, when the water level of the stream is higher [95,96].

Figure 4: Tupavica waterfall (Source: Authors 2021).

The Vladikina Ploča gorge (GS_7) is located on the Visočica river, between villages Rsovci and Pakleštica. The Visočica river cuts into the limestone massif of the gorge called Vladikina Ploča, and numerous giant pots have been created in it. The gorge is about 2.5 km long, the deepest part is up to 350 m, and the width of the narrowest part is 4–5 m. A big attraction of the gorge is a few large truncated meanders, with vertical and pretty steep and inaccessible sides [97]. Another big attraction of this area is the cave system, Vladikina Ploča with several caves (Pećina u odseku, Kaparica, Pećina kačkavalja, and Švajcarska pećina) and pits (Bela propast, Vukašinova jama, and Popadikin klin). The most significant among them is the Vladikina Ploča cave. This is the longest cave of Mt. Stara Planina, with a longitude of investigated channels of 2,400 m. The cave entrance is located in a vertical section, on the left side of the gorge, 86 m above the Visočica riverbed. The entrance to the cave is 28 m high and 12 m wide. The cave consists of one main channel and several secondary ones. There are several large halls in the main channel (Monk's Hall; Kingdom Hall; Mud Hall; and Block Hall). The cave is rich in speleothems, and the most significant units are mainly stalagmite 7.5 m high, called Monk, in the Monk's Hall, and a giant stalagmite in the Kingdom Hall, 11.5 m high and 9 m wide, called Goliath. The most diverse speleothems are is in the Kingdom Hall. Numerous stalactites, stalagmites, helictites, petrified vaults, and tufa tubes adorn this hall [98]. The cave is not arranged for organised tourist visits, but entry is possible only with the accompaniment of experts with full cave equipment.

The Temštica river's canyon (GS_8) is located in the south-western slopes of Mt. Stara Planina. This is one of the most attractive sites of Mt. Stara Planina (Figure 5). The Temštica river's canyon is formed by the Temštica river, which occurs near the village Topli Do, by merging several surface flows. The Temštica river cut out a canyon valley, in the red Permian sandstone, and that is why the locals call it "The Little Colorado canyon" [90]. The geological structure of the area is composed of different sedimentary rock series. Based on their age this area can be divided into three stratigraphic units: the younger Paleozoic, represented by Permian rocks in the upstream of Temska; Mesozoic, which has full development and greatest distribution; Neogene and Quaternary, in the lower course of the Temštica river [99]. The great value of this area is the striking continental formations of the red Permian sandstones. The Temštica river runs through the canyon, creating cut banks and steep cliffs that are 260 m high in some places. In the lower part of the river, there is a meander belt, where 4 curving meanders cut cliffs up to 200 m high. There are also rock formations like rock windows, cavelets, rocky promontories, and columns built of red sandstone. On several locations on the left bank of the Temštica river, there are profiles and outcrops of cross-bedded Permian red sandstone. A number of waterfalls are located in the canyon, and the

Figure 5: (a) Temštica river's canyon and (b) Bukovački Do waterfall (Source: Authors 2021).

most famous one is Bukovački Do with a height of 12 m (Figure 5).

The depression Ponor (GS_9) is a landform located in the southeast of Mt. Stara Planina at an altitude of 1,540 m above average sea level (AASL). This is a type of contact basin formed at the contact of the Lower Triassic conglomerates and quartz sandstones with the Middle Triassic limestones (Figure 6). This depression occupies an area of about 2.3 km^2 between the Dojkinačka and the Jelovička rivers. The mountain streams that flow here, meet the Middle Triassic limestones and the water sink there. The mainstream sinks along vertical crack disappear into the cave channel. The cave is not rich in speleothems. The channel system is tectonic predisposed and the walls are extremely eroded by water. The main attraction of this cave is that the sinking water flows in, runs through a system of cave channels, and reappears only 10 m from the sinking point in the form of a waterfall about 3 m high. After a few meters, water enters the continuation of the cave channel again and disappears between the blocks of limestone. The cave has three openings, and they extend into parallel channels, which are explored with a length of 164 m [89, personal communication with Institute of Nature Protection of Serbia officials].

The Lower Piljski waterfall (GS_{10}) is one of the highest and the most beautiful cascading waterfalls in Serbia. With its 64 m height, it occupies the third place of the highest waterfalls of Mt. Stara Planina, i.e. the fourth place of the highest waterfalls in Serbia. The waterfall belongs to the Lisevski stream (a tributary of the Javorska river that joins the Rekitska river in the village of Topli Do, forming the Toplodolska river) and flows over the hill of "Pilj," located in a wooded and moderately accessible area of Mt. Stara Planina, at an altitude of 1,140 m AASL [95,96]. The Lower Piljski waterfall is settled at a distance of

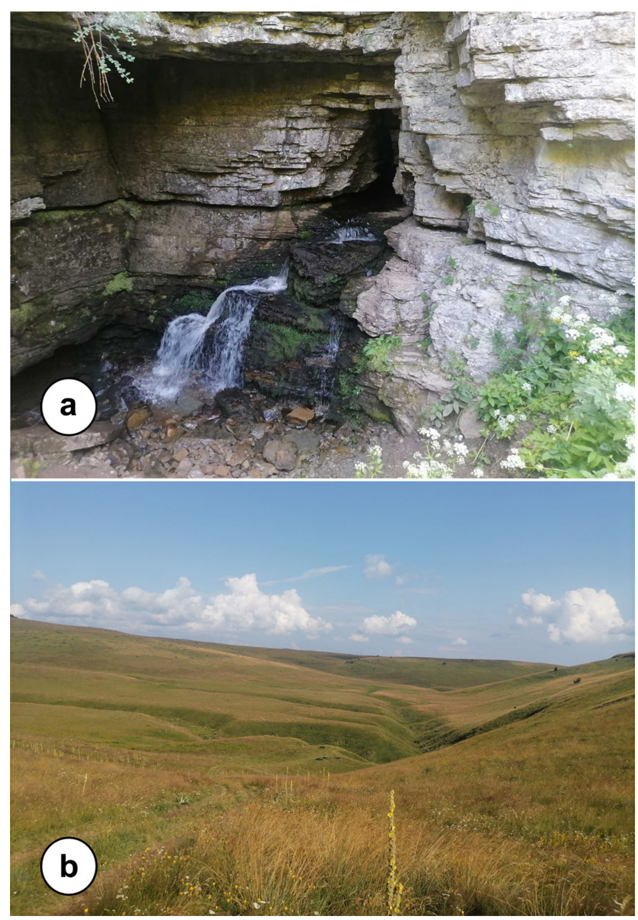

Figure 6: (a) Waterfall in depression zone and (b) the depression Ponor (Source: Authors 2021).

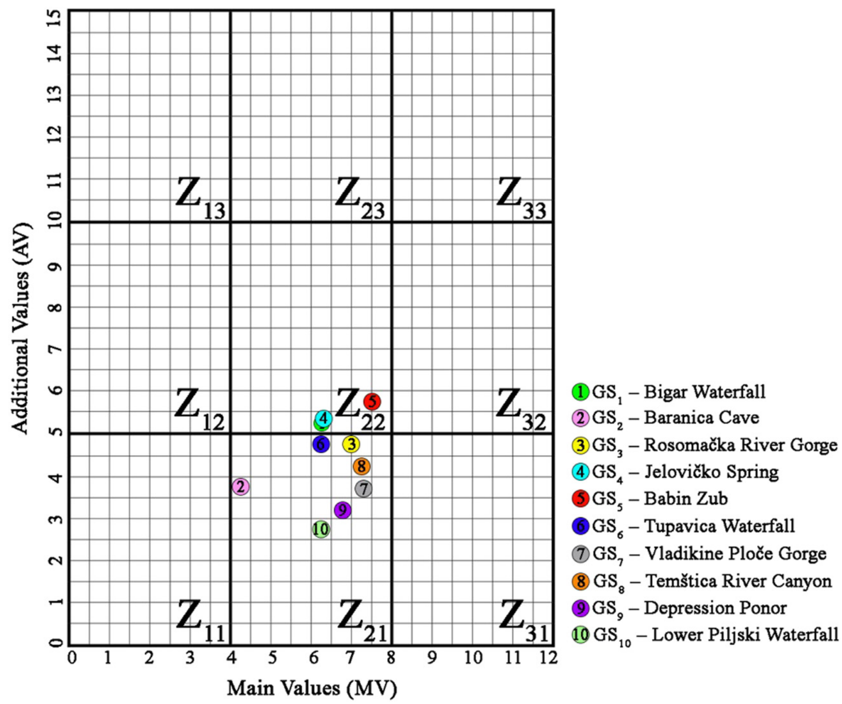

Figure 7: Position of analysed geosites in the M-GAM matrix.

approximately 4 km from the village of Topli Do and is conspicuous due to its height and the picturesque landscape.

5 Results and discussion

The objective of the article was to propose a preliminary list of geosites and evaluate their geotourism development potential by applying the M-GAM. The results of this research are shown in Tables 2 and 3 and Figure 7. They indicate that Mt. Stara Planina has the potential for geotourism development because it has many unique, meaningful, well-preserved, and interesting touristic geosites.

Overall, the MV are high for almost all geosites. However, the lowest score of MV was assigned to the Baranica cave, because this is the only one of the analysed geosites that is not protected. Furthermore, it can be damaged by natural processes or human activities, can accommodate a small number of visitors simultaneously, and possesses one viewpoint from which it can be observed.

Table 3: Overall ranking of the analysed geosites by M-GAM

Geosites	Values				
	MV = VSE + VSA + VPr	Overall	AV = VFn + VTr	Overall	Field
GS_1 – Bigar waterfall	2.00 + 2.30 + 2.16	6.46	1.89 + 3.31	5.20	Z_{22}
GS_2 – Baranica cave	1.71 + 1.59 + 0.82	4.12	2.36 + 1.46	3.82	Z_{21}
GS_3 – Rosomačka river gorge	2.54 + 2.30 + 2.16	7.00	1.34 + 3.57	4.91	Z_{21}
GS_4 – Jelovičko spring	2.31 + 2.03 + 2.05	6.39	1.89 + 3.39	5.28	Z_{22}
GS_5 – Babin Zub	2.43 + 2.83 + 2.26	7.52	1.51 + 4.21	5.72	Z_{22}
GS_6 – Tupavica waterfall	1.89 + 2.17 + 2.16	6.22	1.23 + 3.57	4.80	Z_{21}
GS_7 – Vladikine Ploče gorge	2.20 + 2.96 + 2.26	7.42	1.83 + 1.85	3.68	Z_{21}
GS_8 – Temštica river's canyon	2.31 + 2.96 + 2.05	7.32	2.70 + 1.63	4.33	Z_{21}
GS_9 – Depression Ponor	2.20 + 2.44 + 2.26	6.90	1.05 + 1.96	3.01	Z_{21}
GS_{10} – Lower Piljski waterfall	1.89 + 2.30 + 2.16	6.35	1.01 + 1.78	2.79	Z_{21}

The sub-indicator of scientific/educational values does not indicate significant disparity among the analysed geosites. However, a significant difference is visible when it comes to the sub-indicator of landscape/aesthetic. According to this sub-indicator, the Vladikina Ploča gorge and the Temštica river's canyon are the best-rated geosites (2.96), while the Baranica cave is the lowest-rated (1.59). The Vladikina Ploča gorge and the Temštica river's canyon occupy a wide area, enabling a more significant number of viewpoints from which geological and geomorphological processes and phenomena can be observed. Also, these geosites are able to accept many tourists at the same time, whose presence cannot endanger the fundamental values of geosites. The Babin Zub and the depression Ponor are also highly assessed geosites for landscape/aesthetic values, primarily due to the significant surface they occupy. In contrast, the Baranica cave has a small surface area so it is impossible to single out viewpoints and accept more than ten tourists at the same time.

Eight out of ten geosites are located within the Nature Park "Stara Planina," which is protected at the national level. Due to its geomorphological and hydrological values, the valley of the Bigar stream with its waterfall (located nearby the Nature Park "Stara Planina"), has been protected at the national level as a Natural Monument. The Baranica cave is the only unprotected geosite, but the protection process is underway.

All geosites are located in a mountain environment rich in springs, streams, rivers, waterfalls, vegetation, and various forms of relief. The distance from urban areas and the depopulation of the region have had a positive impact on the preservation of the natural environment. However, in the last few years, the rivers of Mt. Stara Planina have become the focus of interest of hydropower plant constructors. Although they have certain advantages, small derivative hydropower plants leave far-reaching consequences on rivers' natural environment and ecology (loss of watercourses and fish stocks, deforestation, reduction of water quality, etc.) [100]. It should be emphasised that the dangers of building small derivative hydropower plants are still present. For that reason, all analysed geosites could be potentially damaged by human activities. Even the Babin Zub, as an enormous group of rocks, could be endangered as well. This is supported by the fact that the bio/geodiversity of the Kopaonik National Park has been damaged by the illegal construction of facilities for various purposes, even though this area has the highest level of protection by the legislation of the Republic of Serbia.

The existence of valuable and preserved geosites in one area is essential for geotourism development, but it is also necessary for the area to be equipped with certain AV. These values are specifically important for the overall visitors' experience. The highest scores of AV were assigned to the Babin Zub (5.72), the Jelovičko spring (5.28), and the Bigar waterfall (5.20); therefore, these geosites are located in the field Z_{22} of the M-GAM matrix. The results show that these three geosites have the most favourable conditions for geotourism development. However, they still need the improvement of AV (promotion, visitor centre, tour guide service, and interpretative panels). On the other hand, larger investments in AV are needed for the activation of other geosites.

In the case of functional values, the Temštica river's canyon has the highest score (2.7), while the Lower Piljski waterfall has the lowest (1.01). The Temštica river's canyon is the only geosite located less than 20 km away from the international road Corridor 10 which connects Europe and Asia. The proximity and condition of the roads are in direct correlation with the accessibility of the geosites. The results show that half of the evaluated geosites have the highest level of accessibility (the Bigar waterfall, the Baranica cave, the Jelovičko spring, the Babin Zub, and the Temštica river's canyon), which means that it is possible to reach them by bus. In contrast, the Lower Piljski waterfall and the Vladikina Ploča gorge have a low level of accessibility (0.19), which means they require walking with adequate special equipment and professional guidance. For these reasons, it is necessary to improve local access roads and paths.

Apart from the functional values, touristic values play a crucial role in proper geosites' tourist activation. Touristic values, among other things, indicate the degree of tourism development in a specific area. Although most geosites are located within the Nature Park "Stara Planina," considerable variations in touristic values can be observed. The highest score was assigned to the Babin Zub geosite (4.21) as it is one of the most well-known and popular ski resorts in Serbia. For that reason, this is the only geosite among those analysed whose promotion is carried out at the national level and has the most significant number of organised visits and visitors. In addition, as a ski resort, the Babin Zub has accommodation/restaurant facilities of the highest quality compared to other geosites. On the other hand, extremely low touristic values were assigned to the Baranica cave (1.46). The cave is only known to the local population, whereas no official organised visit has been recorded.

The existence of visitor centres is very important in interpreting geoheritage and informing visitors. The Nature Park "Stara Planina" does not have a visitor centre where tourists could get information about geoheritage. Therefore, one of the primary tasks of geotourism development will be the establishment of one main visitor centre, at the Nature Park level, so that tourists could learn more about geoheritage and geosites, hire tour guides, buy hiking maps and brochures, etc. Another way of informing visitors about geoheritage and geosites is through interpretive panels. They are also an essential element of the overall tourist experience (0.81). It was observed that all geosites have interpretive panels. The Bigar waterfall, the Rosomačka river's gorge, the Jelovičko spring, and the Tupavica waterfall have high-quality interpretive panels (exceptional visual and cartographic presentation, bilingual text, marked hiking and biking trails, and basic information about geosites). However, the main reason why the interpretive panels of these geosites did not receive the highest values is related to the existence of minimal information or the complete lack of it when it comes to the geology and geomorphology of the geosites.

As far as the accommodation and restaurant facilities are concerned, the most favourable geosite is the Babin Zub, as already mentioned. Although other geosites also have accommodation and restaurant facilities in the immediate vicinity, their capacity and the quality of service are poor. The geotourism development of Mt. Stara Planina should be focused on the building of rural tourist households or other ecologically acceptable accommodation facilities. It has also been noticed that restaurant facilities do not have sufficient capacity to receive tourist groups. Tourism infrastructure is another precondition for geotourism development and is very important for Serbian tourists (0.73). Apart from the Babin Zub, the Rosomačka river's gorge and the Tupavica waterfall, which have a high level of tourism infrastructure (hiking trails, rest areas, and garbage cans), other geosites have a low level of tourism infrastructure. This situation implies the need for investment in tourism infrastructure in order to enable geotourism development.

The M-GAM matrix shows that three geosites are located in the field Z_{22} (the Bigar waterfall, the Babin Zub, and the Jelovičko spring). In comparison, other geosites are located in the field Z_{21} (the Tupavica waterfall, the Rosomačka river's gorge, the Temštica river's canyon, the Vladikina Ploča gorge, the depression Ponor, the Lower Piljski waterfall, and the Baranica cave). These results show that Mt. Stara Planina has exceptional geotourism development potential, but to ensure that one of the main tasks in the future is to improve the AV. This primarily refers to the establishment of a visitor centre, the improvement of tourism infrastructure, interpretive panels, local/regional roads, construction of accommodation/restaurant facilities, and improvement of existing services.

6 Conclusion

The article's main objective was to propose a preliminary list of geosites of Mt. Stara Planina and analyse their geotourism development potential. For these purposes, ten representative geosites have been evaluated. The research results showed that Mt. Stara Planina has exceptional natural values for geotourism development. It is an area of wild and preserved nature, interesting geomorphological and hydrological forms of relief, rich geo- and cultural heritage, which should be more thoroughly researched and evaluated to get a more precise picture of the potential this mountain hides.

One of the ways to preserve and promote the geoheritage of Mt. Stara Planina is by geotourism development. Since it is an underdeveloped and depopulated area, geotourism development and its promotion would improve the socio-economic prosperity of the entire region.

The significance of Mt. Stara Planina and its geoheritage richness is recognised in the latest spatial plan of the Republic of Serbia [101]. In this plan, Mt. Stara Planina is placed on the list of internationally essential areas, and its nomination for the UNESCO Global Geoparks Network is in progress. Likewise, as it was pointed out in the spatial plan, one of the development goals of Mt. Stara Planina will be a cross-border cooperation with the Republic of Bulgaria. The establishment of the geopark Mt. Stara Planina would bring socio-economic and environmental benefits to the whole area. Also, Mt. Stara Planina is proposed for a Serbian National park, and its proclamation is in progress [102]. Thus, this directive will contribute to the protection of all heritage elements, as well as hydrological heritage. So, the construction of mini hydropower plants will not be allowed on the rivers of Mt. Stara Planina, and main elements of geoheritage will be available in their original form for geotourism development.

In order for Mt. Stara Planina to be well-known geotourism destination, the notable improvement of AV is necessary. Defining clear goals for managing this area is crucial for the geotourism development and coordination of all stakeholders. The geotourism development should go through two phases. The initial development phase would involve several vital steps such as the improvement of access roads, the construction of accommodation and restaurant facilities in an environmentally friendly manner, the establishment of visitor centres, equipping the immediate vicinity of the geosites with the necessary tourism infrastructure, and the creation of the website with all needed information. The second phase of geotourism development would be related to the qualitative improvement of the services. The emphasis should be placed on educating tourism employees and the local population about the importance of geoheritage and other natural and anthropogenic values that Mt. Stara Planina has at its disposal.

The importance of Mt. Stara Planina transcends national borders, as confirmed by this research and the latest spatial plan of the Republic of Serbia. Thus, the improvement of the promotional activities of both tourism providers and tourism organisations (local, regional, and national) is needed. In addition, the proximity of the international road that connects Europe and Asia, and closely connects Serbia and Bulgaria, can be a significant trigger of international tourism development.

The Nature Park “Stara Planina” is less than 70 km away from the area of the Niš city region. This area has numerous attractive geosites which were presented by Marjanović et al. [77], so connecting Mt. Stara Planina region and Niš city region will benefit the development of geotourism in SE Serbia. However, the full potential of geotourism development remains to be fully revealed through further research.

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