

TOURISTS' PERCEPTION OF THE DANGERS AFFECTING THE GEOMORPHOLOGICAL HERITAGE OF THE COZIA MASSIF (SOUTHERN CARPATHIANS)

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Abstract

Geomorphological heritage is a fundamental component of natural heritage, which includes landforms, landform systems, and processes important to understanding Earth's history. When landforms are scientifically representative and develop a special value (aesthetic, cultural, or economic) through human perception, they are considered geomorphosites. The perspective of the communities that use and interpret the relief is critical in terms of natural and anthropogenic hazards that affect geomorphosites and that, over time, can lead to the loss or decrease of their value. Our approach aims to assess how tourists perceive and understand the hazards affecting geomorphological sites. To this end, in 2022-2023, a questionnaire with 15 closed-ended questions was applied to a sample of tourists as homogeneous as possible. The results reflect a poor understanding and training of tourists in the sense of awareness of the importance and vulnerability of geomorphosites, as well as the need to promote the geotourism potential of the massif.

Key words: geomorphological heritage, geomorphosite, hazard, questionnaire

Introduction

The geomorphological heritage represents a set of geological and geomorphological resources that are of scientific, aesthetic, cultural, and educational importance (Bedoya et al., 2025). Geoheritage elements are valuable because they facilitate the understanding, study, and interpretation of the Earth's morphological processes (Bentivenga et al., 2017); represent sustainable territorial resources that generate tourism (Gordon, 2018); and constitute support for special landscapes, habitats, or cultural elements and communities that have a close relationship with ecological and cultural heritage (Serrano et al., 2025).

When landforms are representative and of great landscape importance, are of interest for scientific research, and acquire special values through society's perception and use, they are classified as geomorphosites (Reynard, Panizza 2005). The perspective of society, especially of the tourist communities that use and interpret the relief, is very important for the proper valorization and promotion of geomorphological sites of interest, but especially for their protection and conservation actions (Wei et al. 2024). Therefore, it is necessary to increase public awareness of the value of geomorphosites and the need to promote conservation.

In this context, the present study aims to assess how tourists perceive and understand the value of the geomorphological landscape beyond its aesthetic quality, as well as the extent to which tourists are aware of the vulnerability of sites to degradation by various natural or anthropogenic processes. The paper follows the perspective of the tourist community on the hazards affecting geomorphosites, but above all, the measures that can be taken by authorities and tourists to ensure high-quality management and mitigate their impact.

Study area

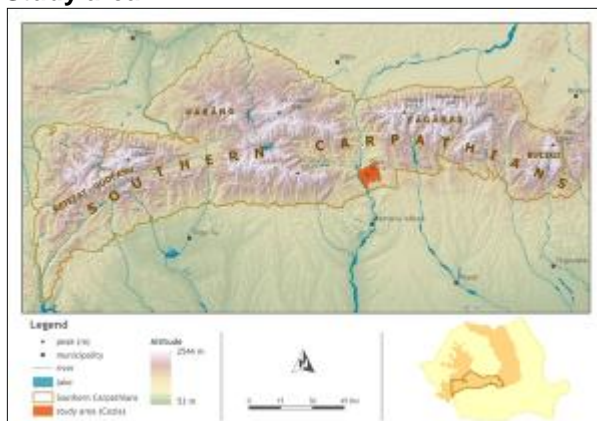


Fig. 1: Location of the Cozia Massif within the Southern Carpathians

The Cozia Massif is located in the Southern Carpathians, Romania (Fig. 1). The geological conditions and paleoclimate created in the Cozia Massif ruiniform relief forms have a high scientific value and additional values, leading to widespread tourist use over time. The intense disaggregation of the rocks, the tectonic activity of the crystalline complex, and the various

modeling processes gave rise to impressive forms of steep relief with open rock (towers, arches, fangs, sharp edges), many of which are geomorphosites (Fig. 2) (Ovreiu et al., 2019).

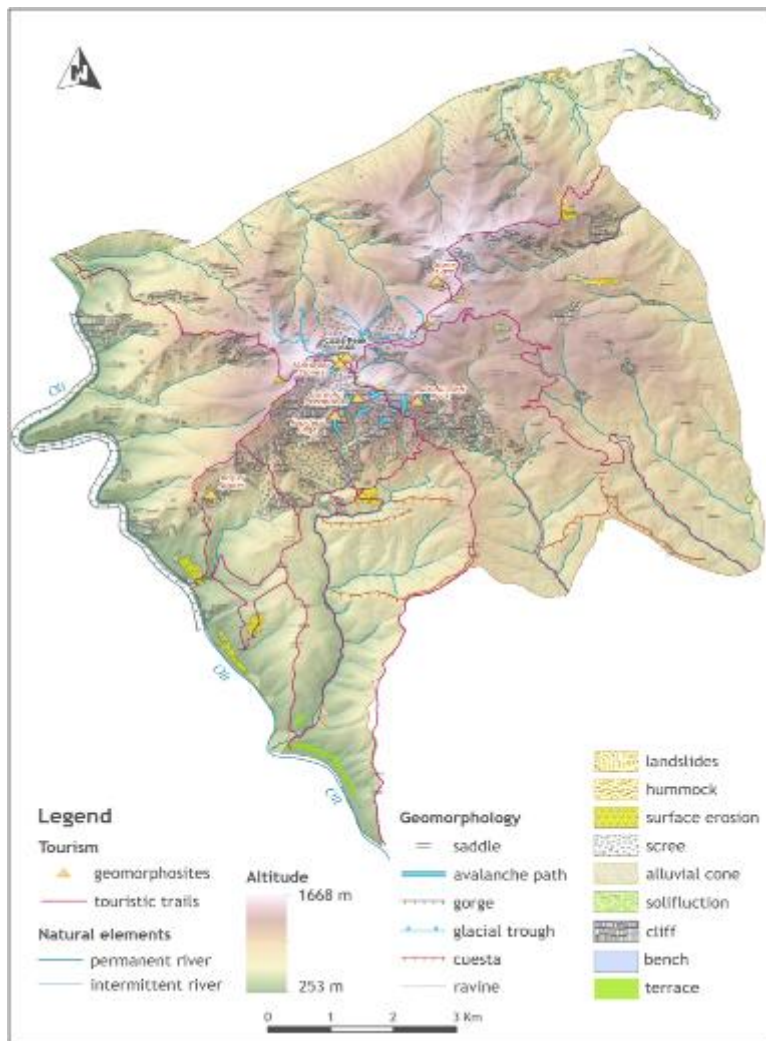


Fig. 2: Geotourism map of the Cozia Massif

Methodology

The tourists' perception of the importance of geomorphosites and the hazards that affect them was evaluated using the questionnaire method (Comănescu, Nedelea 2020) (Tab. 1). The questionnaire given to tourists includes questions about the tourist profile of the interviewee (type of tourism practiced, periodicity of visits, and time spent in the massif); tourist infrastructure within the massif (state of tourist routes and accommodation and shelter units); the tourist potential of the massif (the main natural attractions related to the relief and their most appreciated characteristics, but also the state of conservation); hazards affecting geomorphological sites (identification of natural and anthropogenic hazards, as well as the evolution over time of the state of degradation of geomorphosites); protection and conservation of geomorphosites (appointment of the authorities responsible for the development of ecological tourism, efficiency of the management measures of the analyzed mountain area, attitude of tourists and compliance with the rules of environmental protection). The questionnaire also includes the identification data of tourists related to age, gender, place of origin, and level of education.

The questionnaire was applied between 2022 and 2023 on a sample of tourists as homogeneous as possible regarding age, gender, nationality, and education. Thus, 100 responses were obtained from tourists hiking in the Cozia Massif. Assessing the representativeness of the sample was difficult because the number of tourists cannot be determined with very high precision due to the lack of statistical data on the massif (the databases provide information on the tourist flow from the resorts at the base of the massif), but also due to the existence of several access points in the massif.

Results

The sample consists mainly of Romanian citizens (83%), most of whom live in the city (98.7%). The questionnaire was applied especially to people with a high level of education (87% of the respondents were higher education graduates). The age structure of the sample shows that 75% of respondents are aged between 21 and 40 years. Regarding gender structure, a more balanced distribution can be observed (52.5% men and 47.5% women) (Tab. 1). Most (62.5%) come in masses at intervals of more than one year, 25% annually, and only 12.5% each season. Most (52.5%) come on weekends, and (85%) go hiking (Tab. 1).

About half (45%) of the surveyed tourists rate the infrastructure as good. In proportions of 27.5% and 22.5%, tourists consider the condition of the infrastructure medium and poor, respectively, and only 5% of those interviewed said that it is very good (Tab. 1). Respondents believe that most of the tourist attractions related to the topography are generally accessible through marked tourist trails. However, some of them complained about the territory's uneven infrastructure distribution.

The importance of the geomorphological heritage of the Cozia Massif was highlighted by the answers provided by the subjects to question number 5 (Tab. 1). Thus, 85% of respondents were impressed by natural tourist attractions (especially landforms, vegetation, and hydrography perceived as landscape components). Tourists are familiar with the many landforms in the Cozia Massif, as: Cozia Peak, Bulz Peak, Gardului Waterfall, Stone Gate, Scissors Fangs, and Olt Gorge.

Regarding tourist attractions related to topography, their most appreciated value is the aesthetic one (90%), the characteristic regarding the degree of attractiveness being the most important for tourists (52.5%). Only 7.5% of respondents mentioned the scientific value. Economic and cultural values have a very small weight, the first not being perceived by tourists, while the second is very little represented compared to other massifs (only the Olt Gorge falls into this category due to the churches built within it). Also, 77.5% of respondents consider the landmark-related tourist attractions in good conservation (Tab. 1).

The respondents (52.5%) consider that the geomorphological heritage as a whole is primarily affected by human activities (irrational tourism, excessive grazing, improperly stored waste, noise pollution, exhaust gas pollution produced by sport utility vehicles circulating on land roads, scratches on nature monuments, the presence of poles and the relay antenna in the vicinity of the Cozia chalet, etc.). In addition, many of them also pointed to several natural phenomena possessing a high destructive potential, of which landslides and rockfalls were considered the most significant (30%). Climate risk phenomena and floods were mentioned in 7.5% of cases and 10%, respectively. However, most tourists have no knowledge (50%) of the evolution over time of the state of degradation of sites or consider that it has remained unchanged over time (40%) (Tab. 1). The respondents consider that the landforms most prone to degradation are Cozia Peak, the Stone Gate, the Fence Walls, the Bulz Peak, the Fence Waterfall, the Scissors Fangs (collapses), and the Olt Gorge (due to human impact). Also, those interviewed (67.5%) claim that tourists can also actively protect and conserve the mountain environment. Regarding the authorities' involvement in managing the protection and conservation activities of the mountain environment, 57.5% of the respondents consider the local authorities responsible for carrying out ecological tourism.

Discussions

The questionnaire was very useful to our approach, as it allowed us to assess how tourists perceive the tourist objectives related to the relief, especially their vulnerability to various natural and anthropogenic phenomena that can degrade them. Even though not all respondents were familiar with scientific terminology (which was avoided in most of the questions), many tourists (about 75%) who often came to this area could provide interesting and useful information. People with a high level of education (higher education graduates) were surveyed in particular, which leads us to consider the accuracy of the answers satisfactory.

Tab. 1: Tourists' perception of the dangers affecting the geomorphosites

Sample	Country of Origin	Romania: 83.54%		Other Nationality: 16.46%			
	Age	< 20: 2.5 %		21- 40: 75%	41 – 60: 22.5%	> 60: 0%	
	Gender	Male: 52.5%		Female: 47.5%			
	Educational level	Secondary education: 12.03%		Higher education: 87.97%			
	Place of origin	Urban: 98.73%		Rural: 1.27%			
Tourist profile	1. Frequency of visits	Monthly	Seasonal	Annual	Interval of more than one year		
	%	0	12.5	25	62.5		
	2. Time spent in the massif	1 day	1 weekend	3-5 days	1 week or more		
	%	42.5	52.5	5	0		
	3. Type of tourism practiced	Hiking	Cave Exploration	Sport	Scientific		
	%	85	2.5	5	7.5		
Infrastructure and tourist potential of the massif	4. Infrastructure status	Very good		Good	Average	Weak	
	%	5		45	27.5	22.5	
	5. Types of popular tourist attractions	Natural		Landscape	Anthropogenic	Recreation facilities	
	%	12.5		85	0	2.5	
	6. Mentioned tourist attractions	Cozia Peak, Bulz Peak, Fence Waterfall, Stone Gate, Olt Gorge.					
	7. The most appreciated values of landforms	Aesthetics		Scientific	Cultural	Economic	
	%	90		7.5	2.5	0	
	8. The most important feature of landforms	Singularity		Attraction	Representativeness	Accessibility	
	%	20		52.5	12.5	15	
	9. The state of conservation of the landforms	Very good		Good	Satisfactory	Unsatisfactory	
	%	5		77.5	15	2.5	
Impact of hazards	10. Natural and anthropogenic phenomena (hazards) affecting geomorphological sites		Anthropogenic activities	Flood	Landslides, rockfalls	Climatic phenomena	
	%		52.5	10	30	7.5	
	11. Evolution of the state of degradation		It got worse	Improved	It remained the same	I don't know	
	%		5	5	40	50	
Protection and conservation of geomorphological heritage	12. Authorities responsible for eco-tourism		Mountain rescue centers	Cabin Managers	Local authorities	Foresters of protected areas	Other (Ministry of Tourism)
	%		10	2.5	57.5	25	5
	13. Tourists' attitude to non-compliance with environmental protection		Warning	Notification to the authorities	Passive		
	%		67.5	20	12.5		
	14. Efficiency of mountain area management measures		Yes	Not	Partially		
	%		7.5	37.5	55		
	15. Sites affected by hazards, in the opinion of tourists		Cozia Peak, Stone Gate, Fence Walls, Bulz Peak, Fence Waterfall, Olt Gorge				

However, 55% of them believe that the measures applied so far for the sustainable use of the environment are only partially effective. Conservation of the mountain environment by directly warning those who do not comply with the rules imposed by ecotourism (Tab. 1).

Although the results are encouraging, they show that further efforts are needed to increase awareness and education on the protection and sustainable promotion of geomorphological heritage, including among tourists whose behavior may have important environmental consequences. The fact that the scientific value of geomorphological sites is perceived and mentioned by only a small number of respondents (7.5%) reinforces our finding that although most tourists are educated, steps are still needed to educate the tourists in the sense of awareness and appreciation of the heritage.

Most of those surveyed (77.5%) consider that the geomorphosites are in a good state of conservation, which means, on the one hand, that they are attractive and have a high geotourism potential. On the other hand, they denote that tourists only partially understand the hazards to which geomorphological sites are exposed. The lack of information on the degree of degradation of geomorphosites by natural processes is also evidenced by the very high percentage (52.5%) of those identifying anthropogenic activities as the main destructive element. Although the geomorphosites of the Cozia Massif are generally forms of periglacial relief with open rock in different stages of disintegration (Ovrei et al. 2024), only 30% of the respondents mentioned that they are affected by landslides. This means that tourist information is necessary for educational purposes (Miccadei et al., 2013). The understanding of the processes and forms related to geology and relief by tourists, but also the awareness of the fact that the landscape is constantly evolving, is an important step in making tourists responsible as an integral part of the measures for the protection and promotion of the mountain area. Management measures must, therefore, consider both the protection and the superior promotion of geomorphosites. Very important are the ways of transmitting geological and geomorphological information to tourists. Thus, it is necessary to place information panels in the field intended exclusively for geomorphosites, design routes, make geotourism maps, and organize guided visits by specialists.

Conclusions

In recent decades, a growing interest has been in protecting all cultural sites, not against natural hazards and activities that can contribute to their degradation. However, the results of the present study show that steps are still needed for the tourist to go beyond the simple aesthetic appreciation of the landscape and become aware of the importance of heritage. In order to promote sustainable tourism activity in the Cozia Massif, local authorities should take immediate measures as follows: designing a network of well-defined routes adapted to the topography; improving the condition of access roads; improving the quality of vegetation cover in those places where it has been degraded; educating tourists in the spirit of correct practice of tourist activities.

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Souhrn

Geomorfologické dědictví je důležitou součástí širšího přírodního dědictví a zahrnuje tvary reliéfu, systémy tvarů reliéfu a procesy, které pomáhají vysvětlit geologickou historii Země. Pokud jsou tyto tvary reliéfu vědecky významné a získávají další hodnotu - estetickou, kulturní nebo ekonomickou - díky lidskému vnímání, označují se jako geomorfologické útvary. Názory a interpretace místních komunit hrají zásadní roli, zejména v souvislosti s přírodními a člověkem způsobenými riziky, která mohou ohrozit celistvost těchto lokalit a časem snížit jejich hodnotu. Tato studie se zaměřuje na hodnocení toho, jak turisté vnímají a chápou rizika, která mají dopad na geomorfologické lokality.

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