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Full Length Research Paper

Evaluation of geomorphosites in Vistea Valley (Fagaras Mountains-Carpathians, Romania)

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This paper aims at evaluation of geomorphosites on the Vistea Valley (the Fagaras Mountains). The Fagaras Mountains are emblematic for the Romanian Carpathians as they have the highest altitudes (2544 m), the biggest massiveness and a large range of geomorphosites which were formed by the action of the glaciers. The Vistea Valley is a typical glacial valley, being part of the glaciers complex with the same name. The inventory was made for the entire area. In Fagaras Mountain, there are many different types of geomorphosites. The scientific value (as a central value) and additional values were evaluated for each of the selected geomorphosites. The total value ranges from a low 0.187 (Zănoaga Col Ridge) to scores as high as 0.375 (Viștișoara Glacial Cirque) or 0.40 (Viștea Glacial Valley). This low amplitude indicates a similar genesis and low economic and cultural value. The assessment of geomorphosites may be a premise for achieving a geotourist products and geotourism map. In Romanian literature, this is the first work in which the evaluation of geomorphosites is presented.

Key words: Geomorphosite, inventory, evaluation, Vistea, Fagaraș, Romania.

INTRODUCTION

Geomorphosites are landforms that have received in time, a certain value, due to human perception, thus generating the necessary background for the development of tourist activities and specific infrastructure in the area (Panizza, 2001). Geomorphosites are systems that resulted from the interaction of passive internal and active external agents over time and territory. Geomorphosites bear great importance in understanding the paleogeomorphological evolution of the local area and more.

The value of a geomorphosite is very important considering their future protection and touristic capitalization. Establishing their value is certainly in most cases, subjective, but it's very useful in comparing small areas especially when the evaluation process is made by the same researcher. The value attributed to geomorphosites has two large components; the scientific value and additional values (cultural-historic value, environmental, economic, cultural and aesthetic) (Reynard, 2005). The overall value of geomorphosites is given by whatever additional features they possess, the key ingredients that differentiate the usual landforms from geomorphosites. Even though the scientific value is of great importance for the didactic process, research and cartographic purposes, it is the other features that make geomorphosites valuable to the tourism industry.

Considering the above definition, the present paper is intended to evaluate most important sites of geomorphologic significance in the Vistea Valley (Fagaras Massif, Romania). The purpose of undertaking activities such as geomorphosite evaluation is to develop proper solutions for their protection and even their promotion as tourist destinations (it is our intention to produce a geotouristic map and propose a solution for the protection of these geomorphosites).

STUDY AREA

The Fagaras Mountains represent the most spectacular sector within the Romanian Carpathians, unique for their alpine relief marked by extended glacial and periglacial morphology.

The hydrographic basin of the Vistea Mare River lies in

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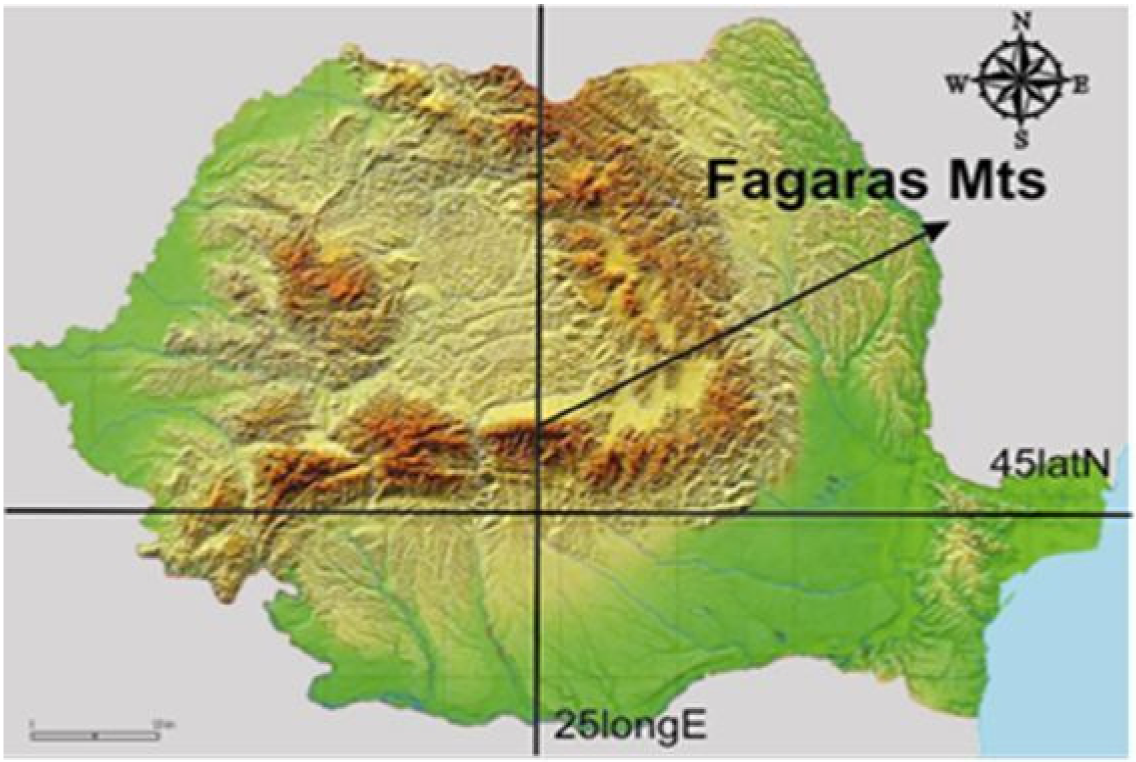

Figure 1. The geographical position of the Fagaras Massif within Romania's territory.

the Meridional Carpathians (Figure 1), the central part of Fagaras Mountains running down the northern slope of the main range, between Vistea Mare Ridge (west) and Draganului Ridge (east). The river has a general south-north flow and on exit from the mountain area, it waters Fagaras Depression up to its confluence with the Olt River, whose basin's component it is. In terms of altimetry, the basin develops between 2527 (maximum altitude - Vistea Mare Peak) and 408 m (at the confluence with the Olt River) over a difference in level of 2119 m.

The geology of the area consists of two main formations; the crystalline and the sedimentary series mobilized by folding movements or in post-tectonic basins. The study area overlaps the Getic Nap made up of various types of schist with numerous insertions of crystalline limestone and amphibolites, metamorphic rocks, with an important role in the genesis and subsequent evolution of the relief, particularly for the preservation in time of the local geomorphosites (Nedelea, 2005).

Generally, the geomorphosites of Fagaras Mountains are of several types (Ielenicz and Comănescu, 2006):

a) Cliffs, towers, narrow and deep passes, needles, ridge with great frequency over 2100 m, this form of ruiniphorm relief is as a result of mechanical weathering. They are targets to the tourist routes and areas used for mountaineering and climbing.
b) Forms of glacial relief with great size - complex and suspended glacial cirques, glacial valleys (many km), glacial thresholds, moraines, erratic blocks, karlings. They are along the main ridge between the peaks Suru (West) and Berivoescu (East), but on top of the South at altitudes above 1850 m. The largest complex is located around the peak Ciortea, Scara, Şerbota, Negoiu, Paltinul, Vânătoarea lui Buteanu, Arpaş, Podragu, Viştea, Moldoveanu, Urlea (Voiculescu, 2002).
c) Huge masses of detritus that take glacial cirques slope, appearing in the form of cones and foot more or less covered by vegetation.
d) Waterfalls (Balea, Capra, Viștea).

The North-Fagaras Range is 3.95 km long in this sector and has the aspect of a massive glacial ridge interrupted by pyramidal peaks that are continued northward and southward by secondary ridges clearly differentiated in terms of morphology; the southern ridges are prolonged, ramified and with a steady decrease in altitude; the northern ridges are short, uniform and although their initial aspect is that of a glacial ridge these end up into steep drop-offs at the border with Fagarasului Depression: Vistea Mare Ridge, Zanoaga Ridge, Dragus Ridge.

To the North and South, there are several ridges or "crests" separated by glacial cirques and valleys with a

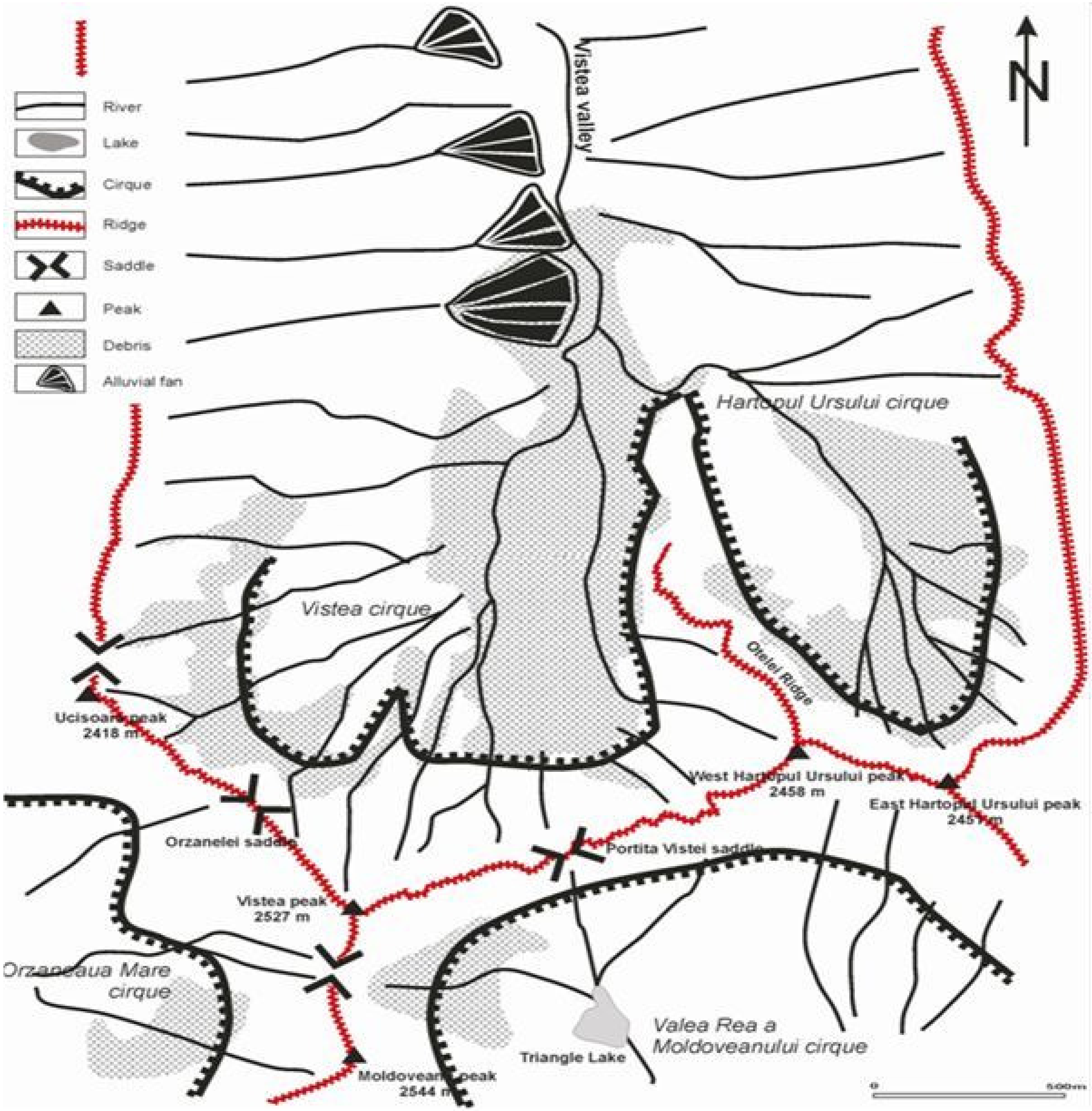

Figure 2. Geomorphological map of Vistea valley (original).

successive and asymmetrical distribution; thus for every northern crest there is a corresponding southern glacial cirque and valley. Northern glacial valleys are shorter than the southern ones with lengths of only 3 or 3.7 km. This is due to a greater declivity that inhibited development of glaciers in length favoring instead that of cirque glaciers (Florea, 1998).

The ridges of the analyzed basin have highly fragmented slopes due to their increased declivity that allowed development of avalanche corridors and torrential streams. Secondary interfluves ramifying from this ridge develop in a line; their slow descent is locally interrupted by ragged peaks carved into hard rocks, fragments of a more mature relief developed on smaller plane surfaces, horns, cracks, col ridges (Racorele Col Ridge of Dragusului Ridge) or ragged head areas modeled by retreating gullies that run on opposite slopes.

In cross-section, these ridges appear sharp and narrow initially, but grow steadily at the contact with the depression area where small, almost horizontal surfaces corresponding to the medium or lower levels of the Carpathian Pediplain are preserved (easier to spot on the extremities of the Dragus and Vistea Ridges) (Figure 2).

The ridge is formed of alternating pyramidal peaks and shallow saddles (Portita Vistei), a direct consequence of glacial transfluence (during the glaciation, ice overflowed through these saddles into the neighboring cirques as in the case of Valea Rea and Hartopu Glacial Cirques located south and north of the main range as well as in the case of Vistisoara Cirque and the one located south of the main range currently occupied by the Iezerul Galbena Lake) (Figure 2).

The two glacial cirques Hartopu and Hartopu Ursului enclosed between Vistea Mare (West) and Zanoaga Ridge (East) are considered to be the headwaters of Vistea Mare River. These cirques are located north of the ridge connecting Galbenele (2456 m) and Vistea Mare (2527 m) Peaks. The ruiniform relief (towers and needles) at the bottom of the northern range, just above Hartopu Ursului Cirque gives a more picturesque note to the general landscape of this basin.

The spring sources of Vistea Mare unite in the cirque area, continue down the glacial thresholds located below and form Vistea Marea somewhere around 1600 to 1650 m, in the glacial valley. The already consistent river forms a spectacular waterfall as it flows over the lowest glacial threshold (1400 m). From this point on, the valley section turns, from U-shaped to V-shaped marking the limit of the glacier's action. Vistisoara's spring sources are located in the identically named cirque contained between Zanoaga Ridge (West), and Dragusului Ridge (East). Compared to the cirques along Vistea Mare, this is a deeply enclosed cirque with a narrow bowl and steep slopes covered in accumulations of rock debris and affected by gelifraction (weathering) and avalanches. The bottom of the bowl is paved with large weathered blocks, many of which are loose. Temporarily, the bowl fills and a tarn is formed - Vistisoara Lake. As in the case of Vistea Mare, there are two easily identifiable glacial thresholds located at 1600 and 1400 m, both highly fragmented by weathering and erosion (Figure 2). The glacial valley of Vistisoara is less deep and shorter than Vistea Mare measuring merely 3 km compared to 3.7 km, the length of Vistea Mare.

METHODOLOGY

The methodological approach requires several steps (Comanescu and Nedelea, 2010). The working methodology follows many stages: The first step consists of studying the literature in the field, useful materials being those related to geological, geomorphological, biotic aspects, but also, those in connection with the cultural, historical, literary or tourism geography aspects; in the second stage of the study, the moving in the field is done; here there are identified and localized the geomorphosites in the studied areal, and subsequently the geomorphosites are classified and hierarchies are settled. The identifying, classifying and hierarchizing are very useful in performing and applying the most correct and complete inventory fiche; the third step is the creation of a database in which the attributes characterizing the respective geomorphosite are introduced (Figure 3).

Geomorphosite evaluation is an issue that raised the interest of geographers all over the world whose efforts concentrated on developing and reining effective evaluation methods that they further published, (Serano and Gonzales Trueba, 2005; Zouros, 2005; Reynard et al., 2009). Our evaluation used as baseline, a model proposed by Pralong (2005) and Reynard et al. (2007). The

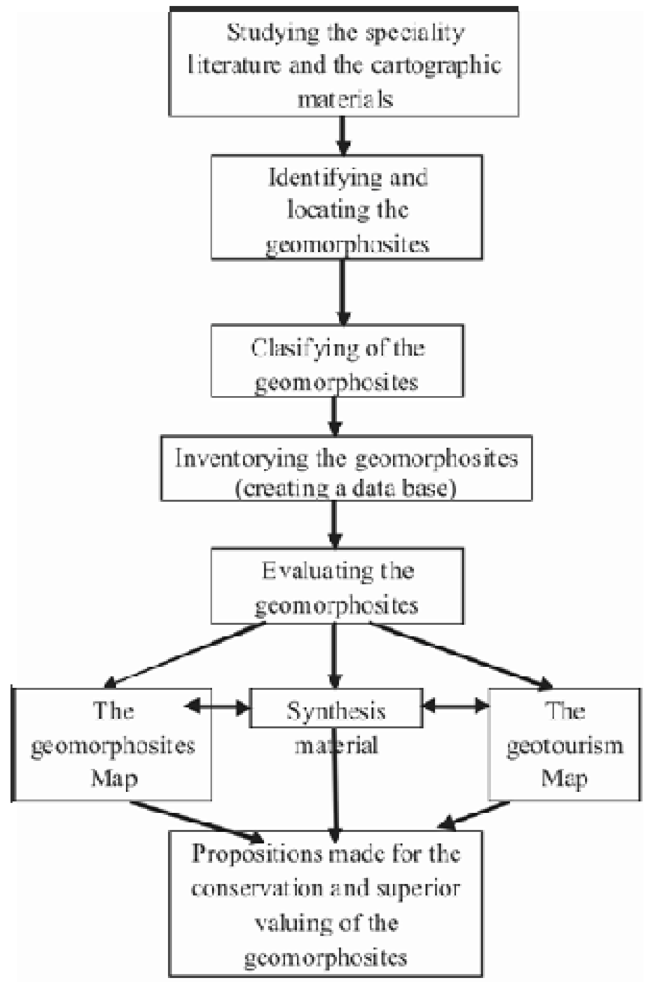

Figure 3. Steps made in studying the geomorphosites (original).

value a geomorphosite has for the tourism industry is calculated as the average of 4 values, using the formula:

Vtour =(Vsce +Vsci +Vcult +Veco)/4,

where *Vtour;* tourism value, *Vsce;* aesthetic value, *Vsci;* scientific value, *Vcult;* cultural-historical value and *Veco;* socio-economic value (Reynard et al., 2007; Pralong and Reynard, 2005). The four values are computed based on the criteria summarized in Table 1.

A 0 to 1 rating scale was used for each criterion. Further, the final scores for each criterion and subsequently the global tourism value were calculated using Pralong`s formula. The data obtained were statistically analyzed and used to determine those parameters that helped define the grouping of data and also in making correlations between the resulted values and the global value of the geomorphosite (Table 2).

To make artworks, we used topographic maps (scale 1: 25000), orthophotomaps and mapping field. The processing was done using software such as Corel Draw Graphic Suite 12.

RESULTS AND DISCUSSION

The total general value ranges from a low 0.187 for

Table 1. Criteria for geomorphosite evaluation (Pralong, 2005; Reynard et al., 2007; Coratza and Giusti, 2005) modified.

Aesthetic value	Scientific value	Cultural value	Economic value
Number of belvedere points	Palaeogeographical interest	Cultural legacy	Accessibility
Average distance from belvedere points	Representativeness	As presented in iconographic representations and/or in different writings	Attractiveness
Impact of colour against the surroundings	Surface	Historical and archaeological relevance	Annual number of visitors
Altitude and climbing effort	Singularity	Religious and symbolic relevance	Level of official protection
Shape	Integrity, state of conservation	Artistic and cultural events	Inclusion in promotional materials and products
Location in the landscape	Ecological interest The presence of study stations or points		Natural risks

Zănoaga Col Ridge to scores as high as 0.375 for Viștișoara Glacial Cirque or 0.40 for Viștea Glacial Valley. This low amplitude indicates a similar genesis and low economic and cultural value. (Figure 4, Table 2).

The aesthetic value definitely scores highest. The numerous belvedere points, the good color contrast and spectacular drop offs contribute greatly to these scores. Debris Accumulations along Vistea Mare Valley score a low 0.25 while Galaşea Mare - Viştea Mare Arête, Viștea Mare Peak, Viștea Niddle, Viștea Glacial Valley score as high as 0.75 being spectacular landforms, included in their trekking itineraries by most of the tourists. As a matter of fact, the aesthetic value is the main reason behind any tourist activities in the area (Figure 4, Table 2).

The scientific value scores well, as these geomorphosites are vital in understanding the genesis and evolution of the glacial relief in this area. The scores vary within a limited range with a maximum of 0.75 points for the Vistea Valley, Vistea Col Ridge and Vistea Glacial Cirque and a minimum of 0.25 points for Dragus Crest and Hârtopul Mare Cirque (Figure 4, Table 2).

The scores for the cultural value are very low as the region's cultural component is little advertised; no dedicated promotional materials were edited neither was there any iconographic representations. The region under study is not attributed with any particular historical, religious or mythological importance. As a matter of fact there are only three geomorphosites that do align to this criterion (Viștea Mare Waterfall, Viștișoara Cirque, Viștea Glacial Valley) (Figure 4, Table 2).

The scores for the economic value are low and homogeneous (-0.005) given that the region's economic life and tourism infrastructure (except for hiking trails) are almost inexistent.

Considering the above, we conclude that the deficient infrastructure, the reduced number of tourists (geomorphosites under study in Fagaras are located in areas accessible only to fit experienced trekkers) and the lack of defining elements in terms of cultural value (there are no iconographic representations of symbolic, mystical or religious relevance) are the main reasons behind these differences.

Conclusion

The process of inventorying and evaluating the geomorphosites has a generous and practical purpose that involves creating a series of geo-tourism products and designing geo-tourism pathways. The geo-tourism products must

Table 2. The evaluation of the geomorphosites on the Visea valley's value as shown in Figure 5.

Name	Scenic value	Scientific value	Cultural value	Economic value	Global value
Vistea Mare-Hartopul Urs structural slope	0.5	0.5	0	0.05	0.262
Galaşea Mare-Viştea Mare ridge	0.75	0.25	0	0.05	0.262
Viştea Mare ridge	0.5	0.25	0	0.05	0.20
Zănoaga glacial saddle	0.65	0.5	0	0.05	0.187
Drăguşului ridge	0.4	0.25	0	0.05	0.237
Hârtopul Mare cirque	0.65	0.25	0	0.05	0.212
Viştea Mare waterfall	0.55	0.5	0.05	0.05	0.287
Viştişoara cirque	0.65	0.75	0.05	0.05	0.375
Viştea Mare peak	0.75	0.5	0	0.05	0.325
Portița Viştei saddle	0.65	0.75	0	0.05	0.362
Acul Viştea	0.75	0.5	0	0.05	0.325
Viştea glacial valley	0.75	0.75	0.05	0.05	0.40
Hărtopu Ursului cirque	0.65	0.5	0	0.05	0.30
Viştişoara glacial valley	0.5	0.5	0	0.05	0.262
Saddle between Viştişoara and Iezerul Galben	0.5	0.5	0	0.05	0.262
Viştea Mare debris	0.25	0.5	0	0.05	0.20

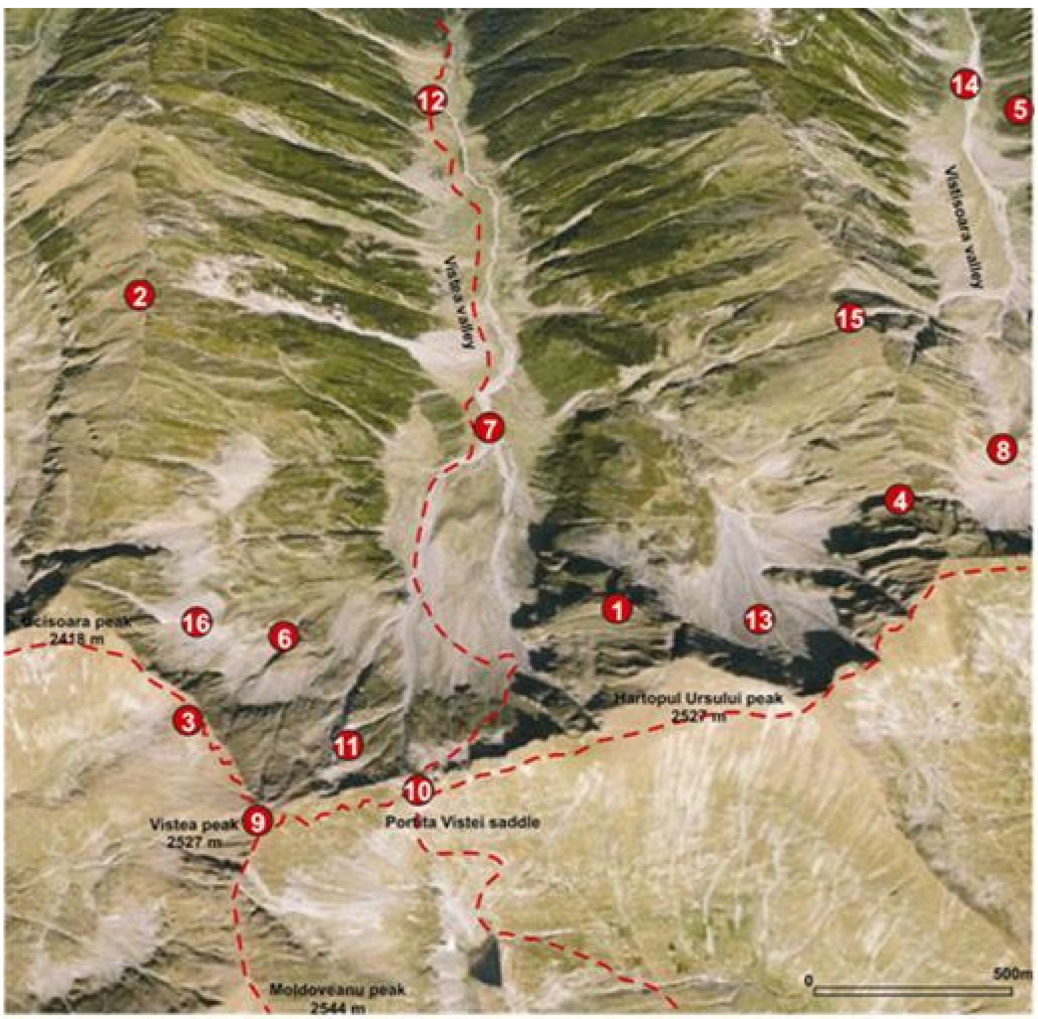

Figure 4. The geographical location of geomorphosites in Vistea valley (original).

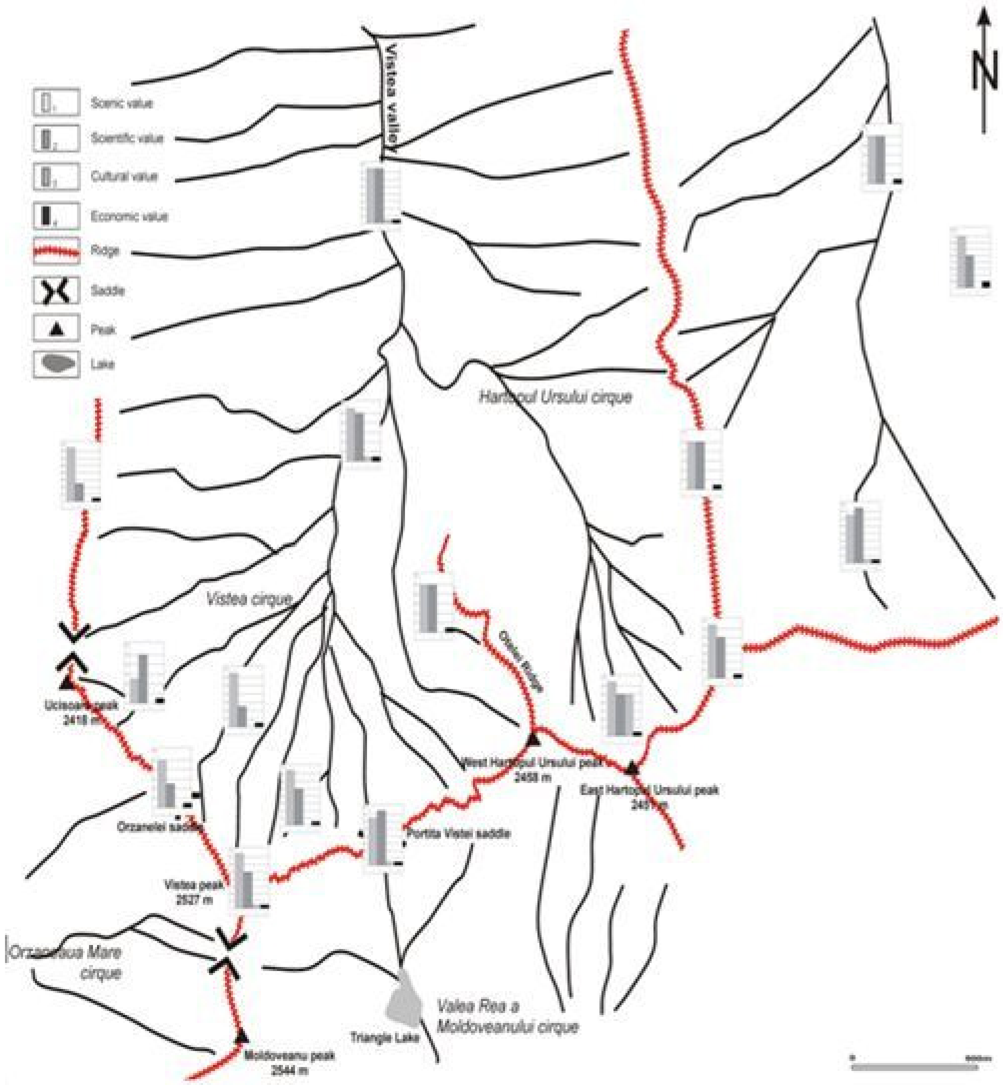

Figure 5. The global value of geomorphosites (original).

consider both categories but primarily, the mass of tourists it addresses. Unfortunately, these geo-tourism products are still in their incipient phase in Romania and the present study proposes to emphasize this unseen aspect of the relief in general and specifically the relief form of tourism valuing, the method through which this is done is by respecting the conservation and protection norms.

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