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INVENTORYING, EVALUATING AND TOURISM VALUATING THE GEOMORPHOSITES FROM THE CENTRAL SECTOR OF THE CEAHLĂU NATIONAL PARK

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Abstract: *Inventorying, Evaluating and Tourism Valuating the Geomorphosites from the Central Sector of the Ceahlău National Park*. The studied area is part of Ceahlău Mountains, one of Romania's first rang natural tourism zones namely the central sector which was designated national park and where the protection and superior valuing of the geomorphosites is necessary. The present article intends to catalogue (through detailed inventory charts) and evaluate the geomorphosites (considering the criteria used at international standards like scientific value, environmental, aesthetic, cultural and economic) from this area where the specificity and significance is given by the structural and petrographic elements. The inventorying and evaluating process will lead to establishing a series of provisions for the superior protection and tourism promotion (including proposing geo-tourism routes) of the area. Correlation between effective values of the geomorphosites (scientific, environmental, aesthetic, cultural-historic and economic) and the global value were made.

Key words: Ceahlău, National Park, geomorphosites, inventory, evaluating, correlation

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1. INTRODUCTION

Establishing this study's direction within geomorphology began in 1993 when M. Panizza enunciated the first definition of a geomorphosite with another important moment being 2003 when the first important paper in this domain *Geomorfologie culturala* (M. Panizza, S. Piacente) is published. This concept is not very common in Romania's literature after 2000 (except in Oradea University), that being our study's main argument, the necessity of knowledge, protection and valuing the geomorphosites within the Romanian Carpathian area. The present contribution is part of the research project PNII/Idei (*Inventorying, evaluating and mapping of the geomorphosites. Case studies: the Dobrogea Tableland and the South Carpathians)* financed by NURC (National University Research Council).

The theoretical but especially the practical importance of the geomorphosites has determined the International Geomorphologic Association (IGA) to create a work group designated to geomorphosites. The research made by this work group includes: defining the geomorphosites, establishing evaluating methods, cartographic techniques and their protection.

The geomorphosite (geomorphologic site) is a geomorphologic system (type of relief) that received a special value due to human perception and exploiting (Panizza, Piacente, 1993). The value of a geomorphosite is very important considering their future protection and superior valuing. 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 (reconstructing some elements of palaeogenesis, palaeoclimate and palaeontology) and additional values (cultural-historic value, environmental, economic, cultural and aesthetic) (Reynard 2005) (fig.1).

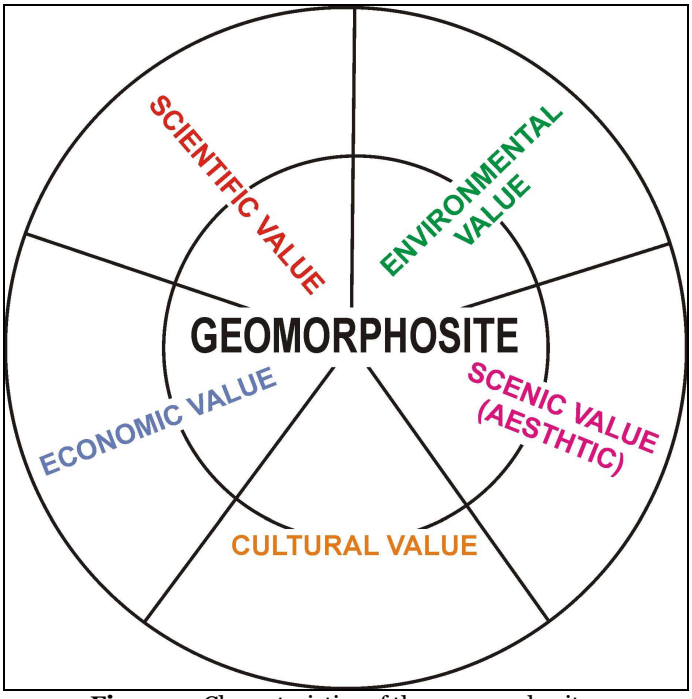

Figure 1. Characteristics of the geomorphosites

2. CASE STUDY

The Ceahlău Massif is part of the Central Sector of the Eastern Carpathians (Romania) and it strongly individualizes itself from the geographic-tourism point of view from the neighbouring mountains. The boundaries of the Ceahlău Mountains are represented by deep developed valleys which clearly separate them from the neighbouring mountainous units (to the north and north-west the Bistricioara River from Bistriţei Mountains, to the south Bicaz River from Stânişoarei Mountains, to the south-west and west the corridor formed by the Pntic Brook affluent of Bistricioara, Bistra River affluent of Jidanului Brook from the Hăşmaş Mountains).

The Ceahlău Massif has an overall area of 290 km², the Ceahlău National Park holds 7742.5 ha (26.5% out of the total area of the massif) (Dieaconu, Săndulache, 2008), and the studied area is situated within its central area (29 km²).

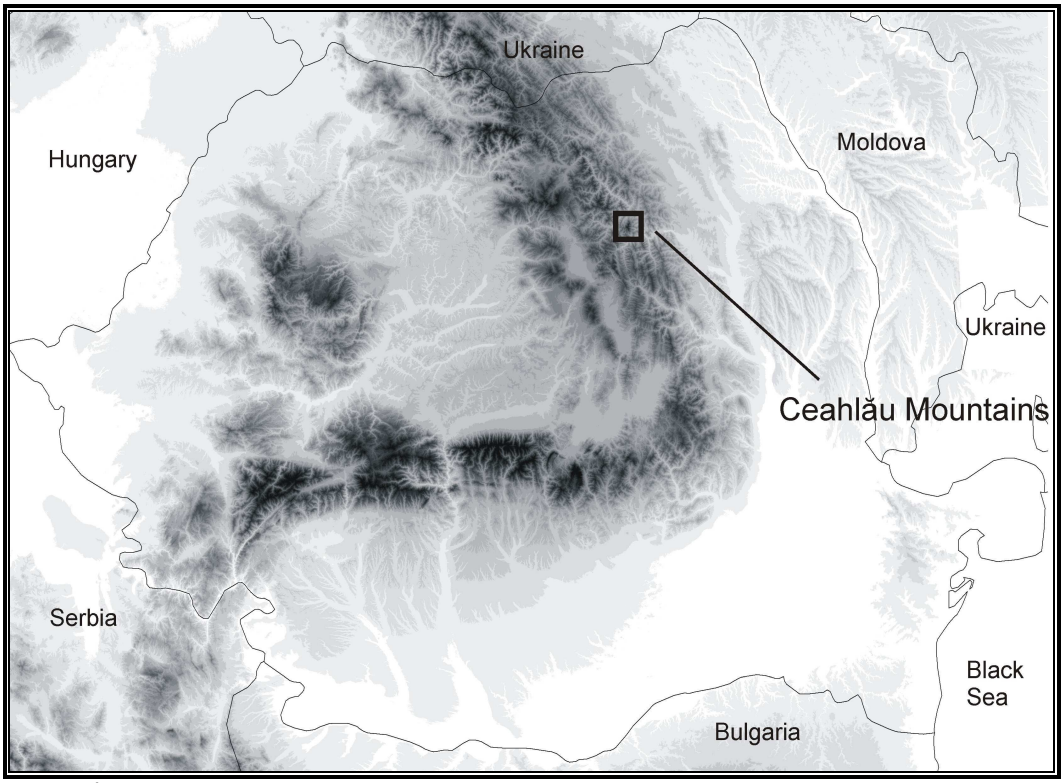

Figure 2. The geographical position of the Ceahlău massif within Romania's territory

2.1. GEOLOGICAL CONSIDERATIONS

The Ceahlău Massif is part of the Carpathian internal flysch made out of detrital deposits (conglomerates, marl, clays and argillaceous schists, gritstones), basalts and granites discovered mostly in the central part of Ceahlău.

The conglomerates are the dominate rock in the central high part of the massif with lengths of 500 meters and manifesting itself through precipitous (Ocolaşul Mare, Ocolaşul Mic, Stănilelor) and relief forms marked by differential erosion (Panaghia, Piatra Sură, Toaca).

The detrital rocks are arranged into layers as follows: Sinaia layers, Bistra layers, Ceahlău layers, Audia layers and Tarcău sheet.

The Sinaia layers are the oldest in this area and are made out of marl-calcareous rocks, with two different horizons: an inferior one with argillaceous schists, marl-limestones, lithographic limestone, calcareous gritstone and conglomerates and the superios one with argillaceous schists, calcareous gritstone and conglomerates (Dieaconu, Săndulache, 2008).

The Bistra layers are located to the east and the Sinaia layers are made out of argillaceous schists, calcareous gritstone and polygen conglomerates.

The Ceahlău layers are composed "from their superior sides towards the inferior ones from argil and marls, rough gritstones, conglomerates with intercalations of gritstones and blocks of limestone" Albotă, 1992). These are found of the superior plateau of Ceahlău. These layers also include some olistolitic limestone massifs that find their way to the surface (Piatra cu Apă, Ocolaşul Mic).

The Audia layers are made out of black argillaceous schists, calcareous gritstone and silicious gritstone and striped gritstone formations made out of red, green and black

gritstone.

The Tarcău Sheet (the curvicortical flysch) I spresent in the eastern part of the massif and it contains black schists, massive gritstone, marls and conglomerates.

2.2. GEOMORPHOLOGIC CHARACTERISTICS

The relief of the Ceahlău Mountains is the result of the combined interaction between the geological foundation and the sculpturing agents and processes over the course of time.

The central subunit analyzed is a high plateau (±1800m), a suspended synclinal with a length of 6 km and a width of one kilometre. The plateau is limited to a ruin like precipitous having the shape of steps with a level difference of 400-500 m. Within this precipitous a series of ruin like cliffs were formed: Detunatele, Bâtca Ghedeonului, Coloanele Sihastrului, Gardul Stănilelor, Turnul lui Budu.

The actual sculpturing of the relief at heights above 1600m was done by periglacial processes supported by the content of the rock and the long winter periods (more then 6 months per year), resulting cliffs with remarkable shapes (towers, columns, haystacks, pyramids) geomorphosites of great value. These particular shapes will be analyzed within this article the most recognizable, representative and with the aesthetic value being Dochia, Clăile lui Miron, Căciula Dorobanţului, Panaghia, Toaca and Piatra Sură.

The central peak is made out of two plateaus: the first one is the sector between Căciula Dorobanţului and Ocolaşului Mare and the second one called Ocolaşul Mic expands from the Coloana Dorică to the Izvorul Alb valley. Within the second plateau the limestone **klipps** (Stânca cu Apă, Dochia) are found where one can still distinguish scraps of fossils that only come to enhance the scientific value of the geomorphosites.

3. METHODOLOGICAL CONSIDERATIONS

The methodology that was the foundation of the present study was based on the scientific literature that exists nowadays at a worldwide level but as much as possible it was adapted to the specific characteristics of the Ceahlău Massif.

As shown by figure 3 several steps were made during the scientific approach.

The first and utterly compulsory step is studying the scientific literature, very useful being the existing materials with geological, geomorphologic, biotic information but also of cultural, historic, literary and tourism geography interests.

During the next step the field study was made when the geomorphosites from the studied area are identified and located in order to be classified later on. These two operations are absolutely compulsory in order to realize next the most useful inventorying chart. The next and most important step from our point of view is to create a spatial data base in which we can introduce the characteristics of that specific geomorphosite. Inventorying charts were made for all the studied geomorphosites in two stages making sure that they are exactly catalogued.

Their inventorying had as a first essential role to clearly select the types of relief that can by defined as geomorphosites and later on to establish the characteristics that were introduced into the data base.

The evaluation was made mostly based on the model proposed by Jean-Pierre Pralong (2005), method that allowed us to compare the tourism potential with the actual usage potential of the geomorphosites.

The tourism value is established as arithmetic mean, using the formula:

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

where *Vtour* signifies the tourism value, *Vsce* is the aesthetic one, *Vsci* scientific one, *Vcult* cultural-historic one and *Veco* is the socio-economic one.

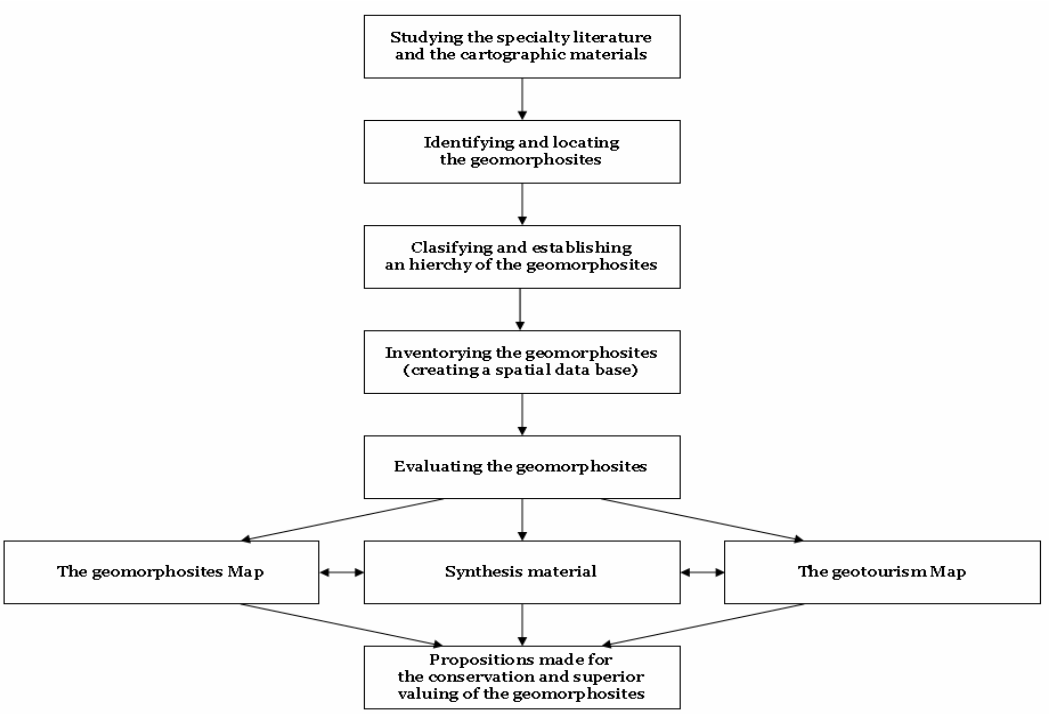

Figure 3. Steps made in studying the geomorphosites

In order to calculate the four values the following criteria were used:

- For the aesthetic (scenic) value – number of points with maximum visibility; average distance from the belvedere points; area of the site (km²) compared to other similar sites from the same area; relative altitude; colouristic contrast;
- For the scientific value (within this value this model also includes the environmental value) - the paleogeographical interest, its representativity, area (%); uniqueness; integrity; environmental interest;
- For the cultural value – the symbolic relevance and cultural inheritance; iconographic representations; archaeological and historical relevance; archaeological and religious relevance; cultural and art events;
- For the economic value – accessibility, natural risks, annual number of visitors; official level of protection; attractiveness.

The data obtained was synthesized into charts and correlations were made between the four types of values and the tourism value. The lack of a series of actual data didn't allow us at this stage of the study to establish the value and degree of tourism exploitation, but this issue will make the subject of the next stage of our study.

4. RESULTS AND DISCUSSIONS

In the central sector of the Ceahlău massif there were inventoried 18 very eloquent geomorphosites (tab.1) and for each of them specific charts were made.

The given code is made out of the letters NT (locating the geomorphosite within the administrative territorial unit), str (structural) and finally ed (differential erosion), respectively numbers that indicate their position (fig.4). The decisive factors in the formation of these geomorphosites are their structure and the differential erosion. If we were to analyse their surface the 18 interfluves are relatively small, most of them are punctual; the ones that cover and area type surface are mainly precipitous sectors.

Table 1 Synthesis table regarding the geomorphosites form the central sector of the Ceahlău massif.

No.	Name	Code	Type
1	Duruitoarea	NTstr1	punctual
2	Gardul Stanilelor	NTstr2	area
3	Piatra Sura	NTstr3	area
4	Ocolasul Mare	NTstr4	punctual
5	Toaca	NTstr5	punctual
6	Detunatele	NTstr6	punctual
7	Piatra Lata	NTstr7	punctual
8	Panaghia	NTstred8	punctual
9	Claile lui Miron	NTstred9	punctual
10	Caciula Dorobantului	NTstred10	punctual
11	Pietrele lui Baciu	NTstr11	punctual
12	Piatra cu bani	NTstr12	punctual
13	Piatra Lacrimata	NTstr13	punctual
14	Stanca Dochiei	NTstr14	punctual
15	Polita cu crini	NTstr15	area
16	Turnul lui Budu	NTstred16	punctual
17	Coloana Dorica	NTstred17	punctual
18	Piatra Ciobanului	NTstred18	punctual

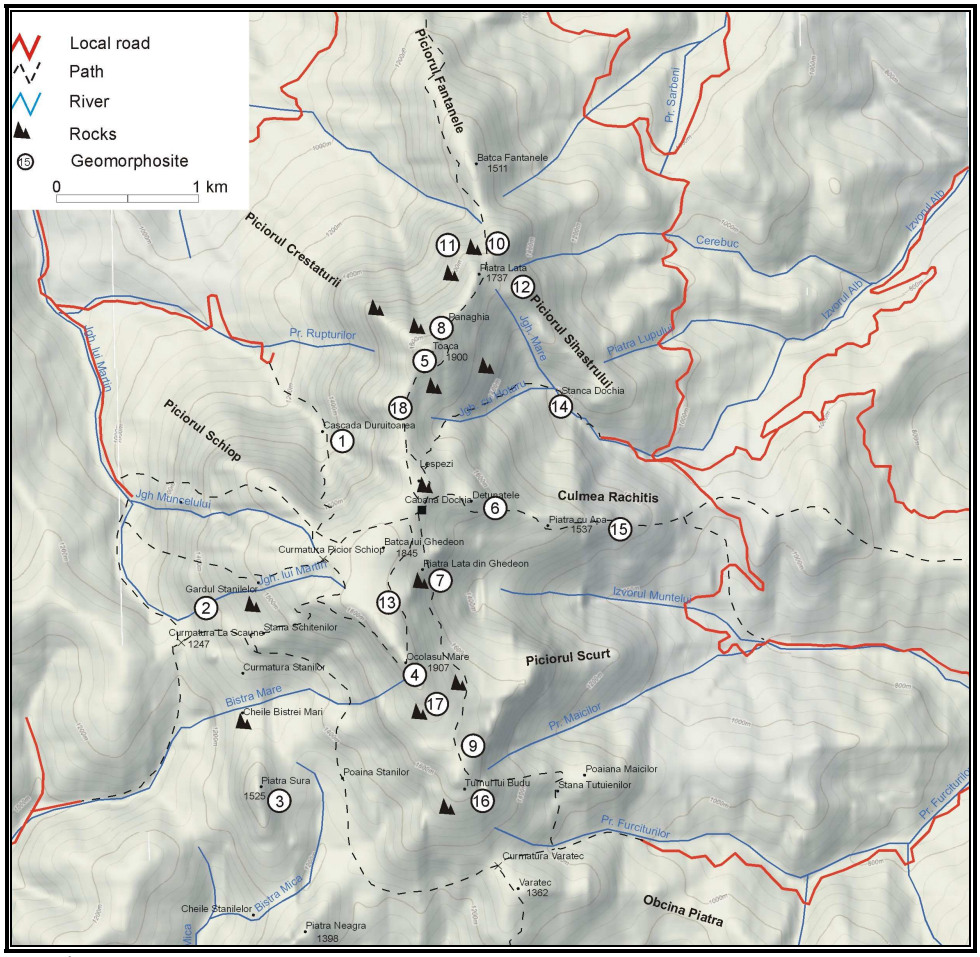

Figure 4. Location of the geomorphosites from the central sector of the Ceahlău Massif

Based on the above mentioned criteria the following values were established for the 18 geomorphosites we chose from the Ceahlău Massif.

The aesthetic value is the most appreciated by tourists and the one that leads to that specific geomorphosite being included into a natural tourism objectives category. The highest aesthetic values (tab. 2) were given to the Panaghia (0,8), Detunatele (0,85), Căciula Dorobanţului (0,75), Ocolaşul Mare (0,75) and the Gardul Stănilelor (0,75) geomorphosites.

Table 2. Evaluating the scenic value of the geomorphosites from the central sector of Ceahlău Massif

No.	Name	Scenic value					
		Sc1	Sc2	Sc3	Sc4	Sc5	Total
1	Duruitoarea	0,75	0,25	0,5	0,5	0,5	0,5
2	Gardul Stanilelor	1	0,5	0,75	1	0,5	0,75
3	Piatra Sura	0,75	0,75	0,25	0,5	0,5	0,65
4	Ocolasul Mare	1	1	0,5	0,75	0,5	0,75
5	Toaca	1	1	0,5	0,75	0,5	0,75
6	Detunatele	1	1	1	0,75	0,5	0,85
7	Piatra Lata	0,75	1	0,25	0,5	0,5	0,6
8	Panaghia	1	1	0,5	0,5	1	0,8
9	Claile lui Miron	0,5	0,75	0,5	0,75	0,5	0,6
10	Caciula Dorobantului	0,75	1	0,5	0,5	1	0,75
11	Pietrele lui Baciu	0,75	0,5	0,75	0,5	0,5	0,6
12	Piatra cu bani	0,5	0,5	0,25	0,5	0,5	0,45
13	Piatra Lacrimata	0,75	0,75	0,25	0,5	0,5	0,55
14	Stanca Dochiei	0,75	0,5	0,25	0,5	0,5	0,5
15	Polita cu crini	0,5	0,5	1	0,25	0,5	0,55
16	Turnul lui Budu	0,75	0,75	0,25	0,5	0,5	0,55
17	Coloana Dorica	0,5	0,5	0,25	0,5	0,5	0,45
18	Piatra Ciobanului	0,75	0,75	0,25	0,5	0,5	0,55

The scientific value is generally perceived only by specialists. The highest scientific values (tab. 3) were given to: Ocolaşul Mare (0,666) and Poliţa cu crini (0,645), strict reservation followed by Gardul Stănilelor (0,52), Toaca (0,458), Detunatele (0,458) and Clăile lui Miron (0,458).

Table 3. Evaluating the scientific value of the geomorphosites from the central sector of Ceahlău Massif

No.	Name	Scientific value						
		St1	St2	St3	St4	St5	St6	Total
1	Duruitoarea	0,5	0,5	0,75	0,5	0,75	0,25	0,4375
2	Gardul Stanilelor	0,75	0,75	0,5	0,75	0,75	0,25	0,52083
3	Piatra Sura	0,5	0,5	0,5	0,75	0,75	0,25	0,4375
4	Ocolasul Mare	1	1	1	0,5	0,75	0,5	0,66667
5	Toaca	0,5	0,5	0,5	0,5	0,75	0,5	0,45833
6	Detunatele	0,5	0,5	0,75	0,75	0,75	0,25	0,45833
7	Piatra Lata	0,5	0,5	0,75	0,25	0,75	0,25	0,41667
8	Panaghia	0,5	0,5	0,5	0,5	0,75	0,25	0,41667
9	Claile lui Miron	0,75	0,5	0,75	0,25	0,75	0,25	0,45833
10	Caciula Dorobantului	0,75	0,5	0,5	0,25	0,75	0,25	0,4375
11	Pietrele lui Baciu	0,5	0,5	0,75	0,25	0,75	0,25	0,41667
12	Piatra cu bani	0,75	0,5	0,5	0,25	0,75	0,25	0,4375
13	Piatra Lacrimata	0,5	0,25	0,5	0,25	0,75	0,25	0,35417
14	Stanca Dochiei	0,5	0,5	0,5	0,25	0,75	0,25	0,39583
15	Polita cu crini	0,25	1	1	0,75	0,75	1	0,64583
16	Turnul lui Budu	0,5	0,5	0,5	0,25	0,75	0,25	0,39583
17	Coloana Dorica	0,5	0,25	0,75	0,25	0,75	0,25	0,375
18	Piatra Ciobanului	0,5	0,25	0,5	0,25	0,75	0,25	0,35417

The Ceahlău Massif in its whole is the object of several iconographic representations, legends, myths, etc. but if we were to consider specific geomorphosites from the Ceahlău massif, their cultural values are low. The values received by the geomorphosites Toaca (0,5), Ocolaşul Mare (0,5), Duruitoarea (0,4) and Căciula Dorobanţului (0,45) (tab.4) stand out. The "0" values relate to cultural events (holidays), concerning the entire massif not a particular geomorphosite. This observation is justified for their historical and archaeological relevance.

Table 4. Evaluating the cultural value of the geomorphosites from the central sector of the Ceahlău Massif

No.	Name	Cultural value					
		C1	C2	C3	C4	C5	Total
1	Duruitoarea	0	0,75	0	0,5	0	0,4
2	Gardul Stanilelor	0,25	0,25	0	0,5	0	0,25
3	Piatra Sura	0	0,25	0	0,5	0	0,2
4	Ocolasul Mare	0,5	0,75	0	0,5	0	0,5
5	Toaca	0,5	0,75	0	0,5	0	0,5
6	Detunatele	0,25	0,25	0	0,5	0	0,25
7	Piatra Lata	0	0,25	0	0,5	0	0,2
8	Panaghia	0,25	0,5	0	0,5	0	0,35
9	Claile lui Miron	0,25	0,25	0	0,5	0	0,25
10	Caciula Dorobantului	0,5	0,5	0	0,75	0	0,45
11	Pietrele lui Baciu	0,25	0,25	0	0,5	0	0,25
12	Piatra cu bani	0,25	0,25	0	0,5	0	0,25
13	Piatra Lacrimata	0,25	0,25	0	0,5	0	0,25
14	Stanca Dochiei	0,25	0,25	0	0,5	0	0,25
15	Polita cu crini	0	0,5	0	0,5	0	0,3
16	Turnul lui Budu	0,25	0,25	0	0,25	0	0,2
17	Coloana Dorica	0	0	0	0,5	0	0,1
18	Piatra Ciobanului	0,25	0,25	0	0,5	0	0,25

The lowest registered values concern the economic values (table 5), because the number of tourists is difficult to quantify and the accessibility is reduced. This is the main reason for the need to design tourism pathways to facilitate the accessibility. The low values also derive from the fact that although the geomorphosites are included into protected areas their protection degree is very low.

Table 5. Evaluating the economic value of the geomorphosites from the central sector of the Ceahlău Massif

No.	Name	Economic value					
		E1	E2	E3	E4	E5	Total
1	Duruitoarea	0	0,75	0	0	0,75	0,3
2	Gardul Stanilelor	0	0,75	0	0	0,5	0,25
3	Piatra Sura	0	0,75	0	0	0,5	0,25
4	Ocolasul Mare	0	0,75	0	0	0,75	0,3
5	Toaca	0	0,75	0	0	0,75	0,3
6	Detunatele	0	0,75	0	0	0,5	0,25
7	Piatra Lata	0	0,75	0	0	0,25	0,2
8	Panaghia	0	0,75	0	0	0,75	0,3
9	Claile lui Miron	0	0,75	0	0	0,5	0,25
10	Caciula Dorobantului	0	0,75	0	0	0,75	0,3
11	Pietrele lui Baciu	0	0,75	0	0	0,5	0,25
12	Piatra cu bani	0	0,75	0	0	0,5	0,25
13	Piatra Lacrimata	0	0,75	0	0	0,5	0,25
14	Stanca Dochiei	0	0,75	0	0	0,5	0,25
15	Polita cu crini	0	0,75	0	0	0,75	0,3
16	Turnul lui Budu	0	0,75	0	0	0,5	0,25
17	Coloana Dorica	0	0,75	0	0	0,25	0,2
18	Piatra Ciobanului	0	0,75	0	0	0,5	0,25

Table 6 illustrates the global values of the geomorphosites. The highest value was obtained by Ocolaşul Mare Peak (0,55) which has the highest altitude in the massif and is an important belvedere point, having the greatest cultural value.

Table 6. Evaluating the global value of the geomorphosites

No.	Name	Scenic value	Scientific value	Cultural value	Economic value	Global value
1	Duruitoarea	0,5	0,4375	0,4	0,3	0,409375
2	Gardul Stanilelor	0,75	0,52083	0,25	0,25	0,442708
3	Piatra Sura	0,65	0,35417	0,2	0,25	0,384375
4	Ocolasul Mare	0,75	0,66667	0,5	0,3	0,554167
5	Toaca	0,75	0,45833	0,5	0,3	0,502083
6	Detunatele	0,85	0,45833	0,25	0,25	0,452083
7	Piatra Lata	0,6	0,41667	0,2	0,2	0,354167
8	Panaghia	0,8	0,41667	0,35	0,3	0,466667
9	Claile lui Miron	0,6	0,45833	0,25	0,25	0,389583
10	Caciula Dorobantului	0,75	0,4375	0,45	0,3	0,484375
11	Pietrele lui Baciu	0,6	0,41667	0,25	0,25	0,379167
12	Piatra cu bani	0,45	0,4375	0,25	0,25	0,346875
13	Piatra Lacrimata	0,55	0,35417	0,25	0,25	0,351042
14	Stanca Dochiei	0,5	0,39583	0,25	0,25	0,348958
15	Polita cu crini	0,55	0,64583	0,3	0,3	0,448958
16	Turnul lui Budu	0,55	0,39583	0,2	0,25	0,348958
17	Coloana Dorica	0,45	0,375	0,1	0,2	0,28125
18	Piatra Ciobanului	0,55	0,35417	0,25	0,25	0,351042

In order to establish the determination degree between the different values (scenic, scientific, cultural, economic) and the global value, correlations were made between them (fig. 5, 6, 7, 8).

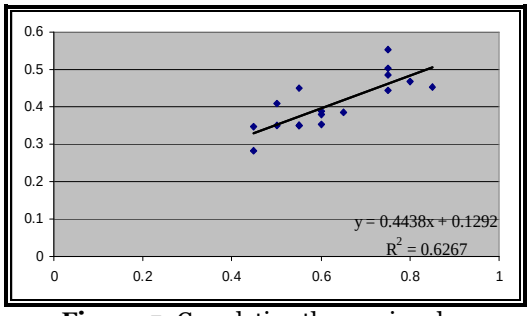

Figure 5. Correlating the scenic value with the global one

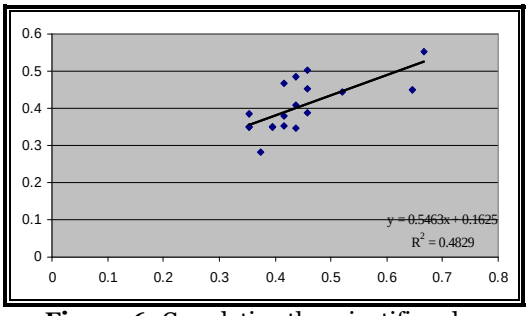

Figure 6. Correlating the scientific value with the global one

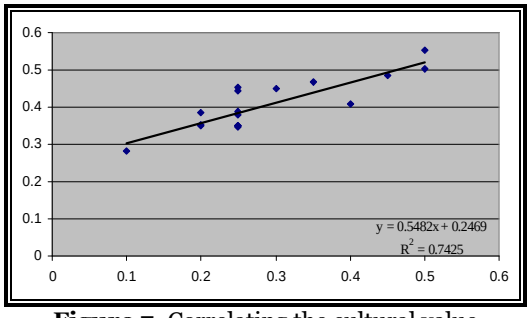

Figure 7. Correlating the cultural value with the global one

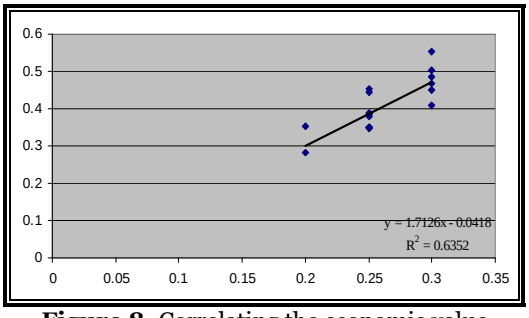

Figure 8. Correlating the economic value with the global one

The highest degree of correlation exists between the cultural values and the global ones (r=0,86), and the lowest (r=0,64) exists between the scientific value and the global one. This fact needs to be considered when applying the formula, if need be adjusting it by increasing the multiplication degree of this value.

5. CONCLUSIONS

The process of inventorying and evaluating the geomorphosites has a generous and practical purpose namely that of creating a series of geo-tourism products and designing geo-tourism pathways. There is a clear distinction between the different domains specialists' perceptions and the tourists perception, the first accentuating the scientific side and the second ones emphasising the aesthetic and cultural-historical aspects. The geo-tourism products must 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 emphases this unseen aspect of the relief in general and specifically the relief form that of tourism valuing, the method through this is done by respecting the conservation and protection norms.

This article represents a preamble for a series of studies and geo-tourism products which will constitute themselves into models for other massifs, adapted of course to their specificity and will finally lead to the proclamation of the geopark within the Ceahlău Massif.

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