

INVENTORY AND EVALUATION OF GEOMORPHOLOGICAL CONDITIONS FROM BISTRIȚA ARDELEANĂ GORGE FOR PRACTICING RECREATIONAL SPORT ACTIVITIES

IOAN BĂCA^{1,*}, HOREA ȘTEFĂNESCU²

ABSTRACT. *Inventory and evaluation of geomorphological conditions from Bistrița Ardeleană Gorge for practicing recreational sport activities.*

Bistrița Ardeleană Gorge is a geomorphological subunit located in the eastern part of Bistrița - Năsăud County, in the Bistrita Bârgăului commune and on the Bistrița Ardeleană River, at the border between Călimani Volcanic Plateau (Dealul Negru - Poiana Cofii) and Bârgău Mountains (Bridirei Ridge - Dealul Pietrei - Ariniș). Normal and periglacial modeling exerted on volcanic agglomerates from here has generated spectacular landforms represented by residual slopes, residual ridges and rock formations (walls, towers, poles, apostles). By their configuration and geomorphometry parameters (height, width, slope, energy, fragmentation) these landforms has a great potential for engaging in recreational activities like hiking, scrambling, ghyll scrambling, gorge walking, rock hopping, rock climbing, rappelling, via ferrata, tyrolean traverse, canyoning and mountain biking. This study proposes an interdisciplinary inventory and assessment of geomorphological conditions to develop future planning and tourist valorization projects of this area by local and county authorities.

Key words: Bistrița Ardeleană Gorge, volcanic conglomerates, activ leisure, hiking, climbing, rapelling, tyrolean traverse, scrambling, ghyll scrambling, gorge walking, rock hopping, canyoning, mountain biking

REZUMAT. *Inventarierea și evaluarea condițiilor geomorfologice din Cheile Bistriței Ardelene pentru practicarea activităților sportive recreaționale.*

Cheile Bistriței Ardelene sunt o subunitate geomorfologică situată în partea de est a județului Bistrița-Năsăud, pe teritoriul comunei Bistrița Bârgăului și pe râul Bistrița Ardeleană, la limita dintre Platoul Călimanilor (Culmea Dealul Negru-Poian Cofii) și Munții Bârgăului (culmea Bridirei - Dealul Pietrei - Ariniș). Modelarea fluvială și periglaciară exercitată asupra aglomeratelor vulcanice de aici a generat un relief spectaculos, reprezentat prin abrupturi, versanți reziduali, creste și formațiuni stâncoase reziduale (ziduri, turnuri, stâlpi, apostoli).

¹ Faculty of Geography, Babeș-Bolyai University, Cluj-Napoca, Romania

² Faculty of Physical Education and Sport, Babeș-Bolyai University, Cluj-Napoca, Romania

* Corresponding author: john_grimo@yahoo.com

Prin configurația și parametrii lor geomorfometrici (înălțime, lățime, pantă, energie, fragmentare) aceste forme de relief prezintă un potențial deosebit pentru practicarea unor activități recreative de drumeție, ascensiune montană, rock hopping, escaladă, rapel, via ferrata, traversare tiroliană, canyoning și mountain biking. Studiul de față interdisciplinar își propune inventarierea și evaluarea acestor condiții geomorfologice în vederea elaborării unor proiecte viitoare de amenajare și valorificare turistică a acestui areal de către autoritățile locale și județene.

Cuvinte cheie: Cheile Bistriței Ardelene, aglomerate vulcanice, turism activ, drumeție, escaladă, rapel, tiroliană, scrambling, ghyll scrambling, gorge walking, rock hopping, canyoning, mountain biking

Introduction

In the last period of time there can be observed a growing demand for outdoor tourist activities which involve a certain level of adventure. In this regard, Bistrița-Năsăud County has numerous attractive resources (landforms, water, vegetal units, and recreational sites) plus the tradition of leisure activities, particularly those relating to winter sports (Piatra Fântânele and Valea Blaznei areas).

The increased service intervals with time off, the access to advanced equipment and new approaches to information and cultural needs of the population (awareness, exploration, experimentation) are factors that give rise to a diversification of the activities of the county-level seating. As such, more and more people practice mountain biking, off road, rafting, paragliding, hiking, roller skating, etc., even if there are no special facilities for these activities.

One of the locations with a potential for sport and adventure tourism are the Bistrița Ardeleană Gorge. They have, on the one hand, the resources for active tourism, and on the other hand, are located on the tourist axis Prundu Bârgăului-Colibița (resort, reservoir).

In this context, the present study aims to make and evaluate the geomorphological resources of this sector in order to prepare future projects for the development and exploitation of tourist area.

Methodology

For the present study, the following methodological steps were completed:

- 1) consulting literature relating to the Bistrița Ardeleană Gorge and surrounding areas, represented by The Colibița Depression and Bârgău Mountains (Naum, T., Moldovan, Gr., 1984; Naum, T., Butnaru, E., 1989; Rusu, E., 1998; Băca, I., Șteff, I., 2010);

- 2) completion of works about mountain sports activities carried out in areas with rocky formations and gorges (Bâca, I., 2013), in particular those of climbing (Suman, Gh., Babadag, D., 1987; Bisharat, A., 2009; Graydon, D., 1992; Green, S.M., Green, I.S., 2010; Kidd, T.W., Hazelrigs, Jennifer, 2009; Luebben, C., 2004; Magiera, A., Roczniok, R., Maszczyk, A., Czuba, M., Kantyka, Joanna, Kurek, P., 2014; Mastacan, F., 2000; Pesterfield, Heidi, 2011);
- 3) consultation of certain Wikipedia sites relating to tourism and sporting activities of hiking, climbing, canyoning, mountain biking, etc., such as:
 - <http://en.wikipedia.org/wiki/Hiking>;
 - http://en.wikipedia.org/wiki/Rock_climbing;
 - http://en.wikipedia.org/wiki/Free_climbing;
 - http://en.wikipedia.org/wiki/Free_solo_climbing;
 - http://en.wikipedia.org/wiki/Sport_climbing;
 - <http://en.wikipedia.org/wiki/Bouldering>;
 - <http://en.wikipedia.org/wiki/Canyoning>;
 - http://en.wikipedia.org/wiki/Mountain_biking;
 - <http://www.escalada.verticon.ro/trad/cursuri.htm>;
- 4) carrying out field observations in the Bistrița Ardeleană Gorge to inventory and assess the geomorphological potential for practicing tourism and sports activities;
- 5) pursuit of practical applications with students from the faculties of Physical Education and Sports, and Tourism Geography-Bistrița Extension in Bistrița Ardeleană Gorge to test the ground and the establishment of sports and recreational activities suitable for this area.

Study area

The Bistrița Ardeleană Gorges are located in the eastern part of the Bistrița-Năsăud County, in Bistrița Bârgăului commune (fig. 1), are oriented on a WNW-ESE direction, have a length of 6 km and connect the Bistrița Bârgăului Depression with the Colibița Depression (fig. 2).

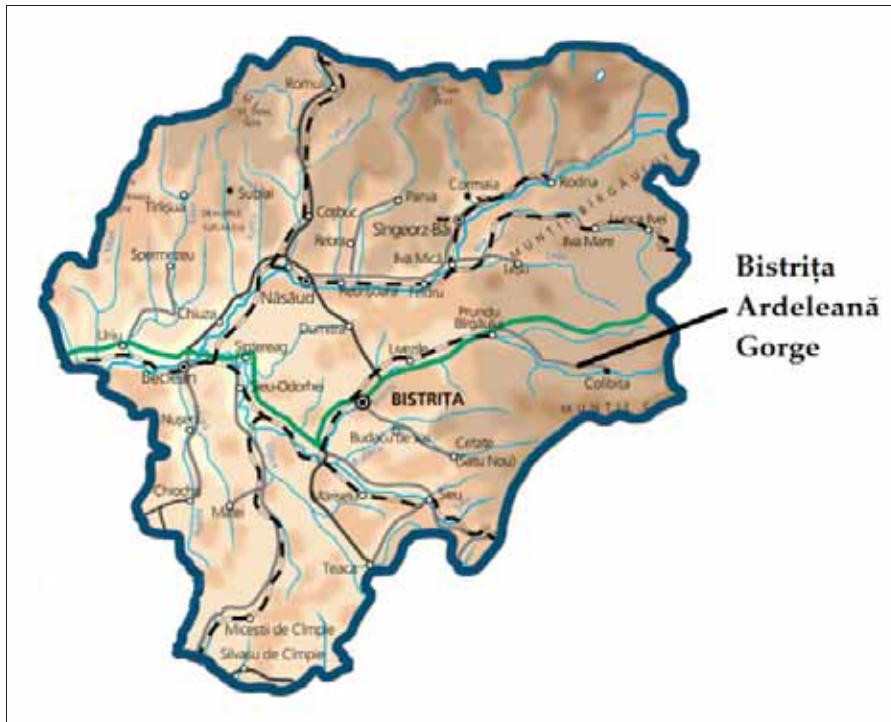


Fig. 1. Geographical location of Bistrița Ardeleană Gorge in Bistrița-Năsăud County

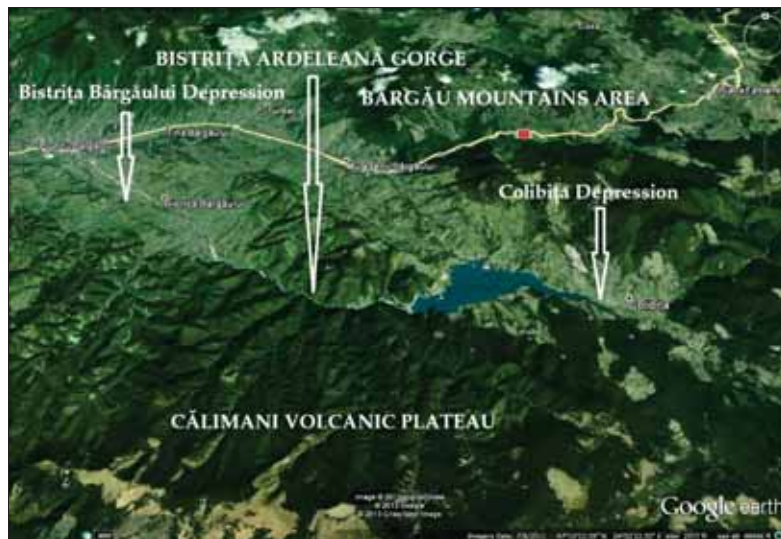


Fig. 2. The Geomorphological system Bistrița Bărgăului Depression - Bistrița Ardeleană Gorge - Colibița Depression

The Bistrița Ardeleană Gorge was carved in the volcanic conglomerates of the Călimani Plateau (ashes, sands, gravels, andesitic blocks) from the upper pliocene by paleo Bistrița River who has its spring in Poiana Calului area (the present Repedele creek), and was heading westward where it met with paleo Bârgău River (paleoTiha) at Prundu Bârgăului (fig. 3).

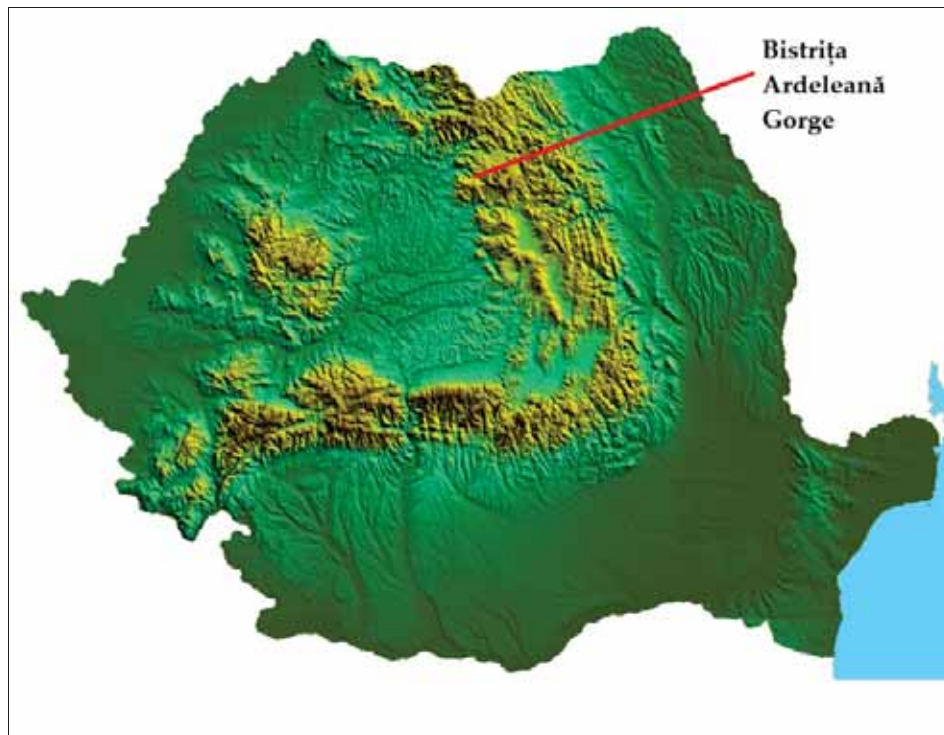


Fig.3. Geographical position of Bistrița Ardeleană Gorge in Eastern Carpathian Chain

The antecedent and epigenetic character of this river is confirmed by the two levels of erosion in the gorge, located at 1000-1110 m (upper level) and 800-900 m (lower level) (fig. 4).

Being at an altitude lower than the rivers network which drained the Colibița Depression, and steer over Blaju Saddle toward paleo Bârgău River to the North, paleo Bistrița River, spurred by the tectonic movements of Pliocene-Quaternary, was inlaid in the volcanic agglomerates, giving rise to a gorge sector, and expanded to the east front, penetrating the Colibița depression area and capturing the rivers here.

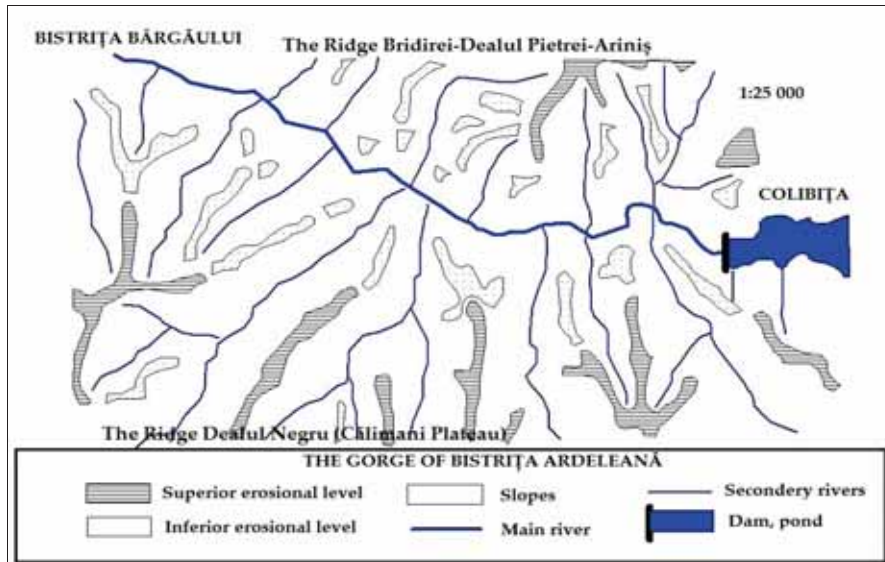


Fig. 4. Erosional levels in Bistrița Ardeleană Gorge

Hydrographic reshaping that took place along the upper pliocene crafted specific landforms, represented by systems of valleys, ridges and slopes, as well as through the two lowland areas, Bistrița Bărgăului and Colibița. At the dawn of Quaternary, the space between the intrusive massifs of the Bărgău Mountains and the volcanic area of the Călimani Mountains (Vulturul-Poiana Cofii- Moldoveanca-Scurtu) was completely carved, from a hydrographical point of view, giving the current configuration (fig. 5).

In the late Pleistocene, with the cooling of the climate and installation of Quaternary Ice Age, the Bistrița Ardeleană Gorge sectors is governed by periglacial erosion, in the cryo-nival level (700-1600 m), where the gelives and gelifraction processes were intense, colluding with the nival processes in the cold season, and with the river erosion in the warmest period of the year.

Morphogenetic processes have acted upon the preexisting morphology and rock formations composed of volcanic conglomerates, creating cryogenic and cryo-nival landforms. Cryogenic landforms are represented by residual landforms and detritic deposits (the detritic layer). The gelifraction landforms consists of forms resulted from releasing of weathering products of the surface of slopes and ridges, and from longitudinal profile of the valleys, such as: steeps, gelifraction creeks, peaks, col and residual ridges, walls, niches and caves, waterfalls and steps in the rivers profile.

The Geomorphological pattern of Bistrița Ardeleană Gorge is represented by the main valley, dominated by the cliffs located at the end of

the ridges that converge to it, separated by a couple of secondary valleys, of which the most important are Arșița Stegea, Șoimu and Repedele.

In vertical section, in the gorge the distinction is made between the three floors: the residual ridges floor (900-1100 m), marked by sharp peaks, towers, warthog, etc.; the residual slopes floor (650-900 m), marked by steep, residual creeks, niches, caves, cryo-nival couloirs, rocky formations (walls, columns, needle-like, etc.), and the valleys floor (650-700 m), marked by narrow or broader sectors, where floodplain areas reaching 60-100 m maximum width (Poiana Stegea), terraces, aluvial fans and coluvial slopes (fig. 5).

Detritic deposits are represented by the masses of debris, made up of rock of various sizes created by weathering processes, which can be found on the slopes, in the rivers-bed, and on the basis of the cliffs where it forms debris slopes. These debris can be fossilized by a thin blanket of soil, covered with forest vegetation or is up to date, especially those that have large size (blocks).

The Cryo-nival landforms resulted through the combined action of freeze-thaw cycles and nival processes and are represented by the cryo-nival couloirs. They are located on the flanks of the Bistrița Ardeleană River and on the slopes of secondary valleys, were sketched by shaping pre-existing torrential valleys under mechanical action of snow and of weathering processes; they have a semi-circle profile, and may be flared to upper section (fig. 6).

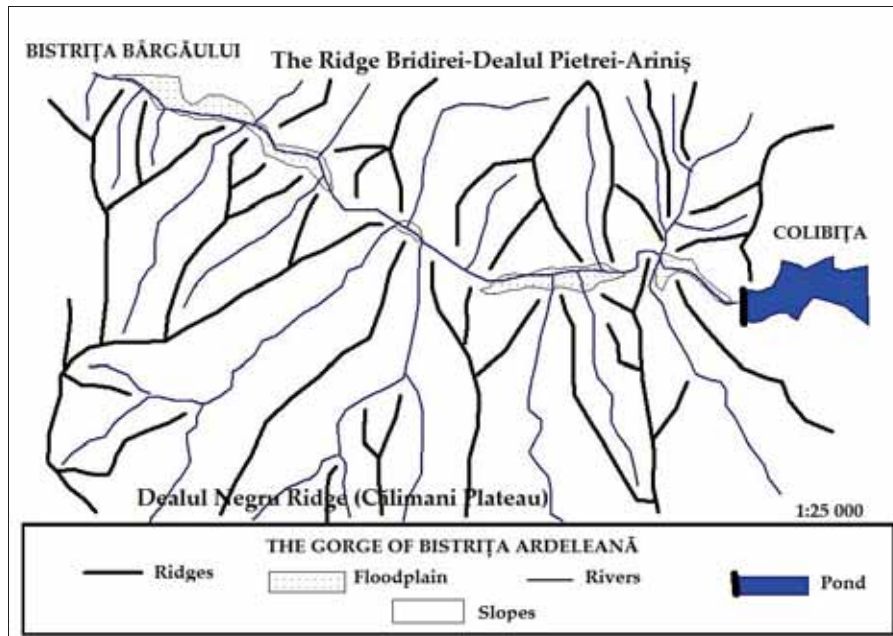


Fig. 5. The geomorphological pattern of Bistrița Ardeleană Gorge

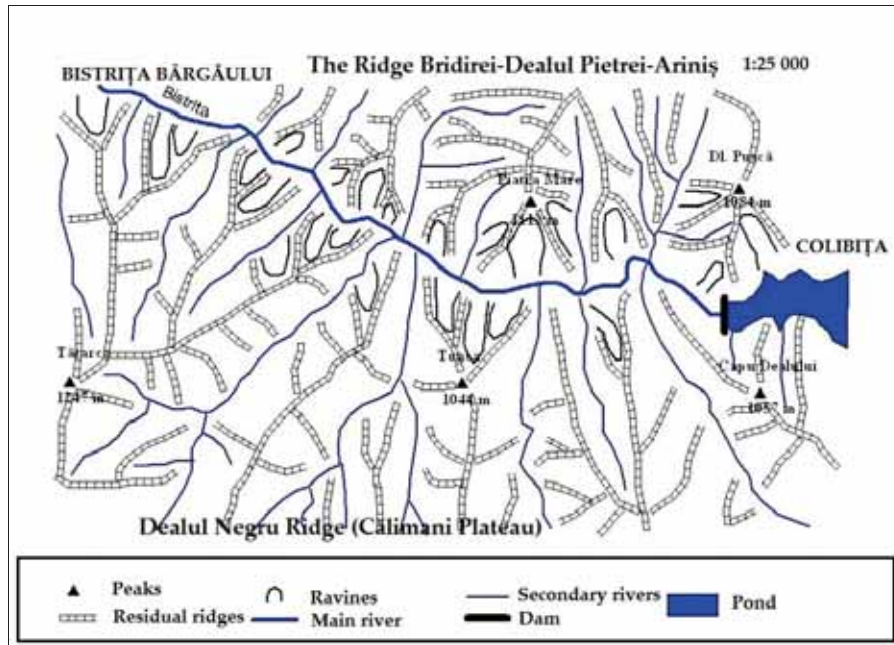


Fig. 6. Periglacial landforms in Bistrița Ardeleană Gorge

Results and discussion

1. Geomorphological features

Field research conducted in the Bistrița Ardeleană Gorge has highlighted the fact that this sector is characterized by a diversity of fluvial and periglacial landforms that possess a great potential for tourism and sports activities (fig. 7). The results of these researches were synthesized in an inventory and evaluation sheet presented in table 1.

The richness of the periglacial relief carved on the volcanic conglomerates and represented by residual ridges, peaks and slopes is an important resource for climbing activities.

The location of rocky steps is linked to the morphogenetic processes that have shaped the pre-existing topography, which distinguish itself through:

- rocky steps located near the riverbed of Bistrița Ardeleană River (Gura Șoimu-Gura Repedelui), which is characterized by variable sizes (3-20 m high);

- rocky steps located near the secondary rivers (Șoimu de Jos, Șoimu de Sus, Stegea, Repedele);
- rocky steep located near the County Road 173 A, wich is characterized by cariable sizes (3-15 m high), but accessible;
- rocky steps located near the forest road on the secondary valleys (3-20 m high);
- rocky steep located on the residual slopes bordering the rocky ravines and the rocky formations (3-5 m high);
- rocky steps located on the flanks of residual ridges, with big sizes (10-30 m), but less accessible;
- rocky steps located on the flanks of residual peaks (Piatra Mare, Șoimu, Stegea, Repedele), which is characterized by big sizes (20-50 m) and difficult access.

Petrographic composition of the volcanic agglomerates (fly ash, sand, gravels, blocks) reflecting on the morphology of rocky walls and thus in the process of climbing, because the rocky prominences and cracks represent natural insurance points.

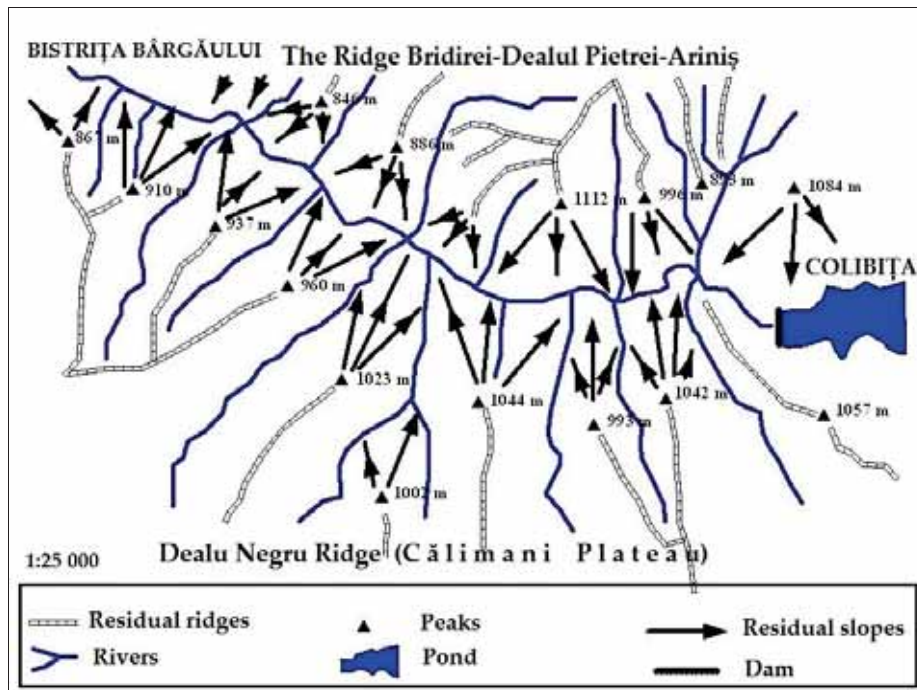


Fig. 7. The functional geomorphological units in Bistrița Ardeleană Gorge

Table 1.

Inventory and assessment sheet of landform of Bistrița Ardeleană Gorge for sport tourism activities

Landforms type	Localization	Potential for sport tourism	Planning actions
Riverbeds	Main river (Bistrița Ardeleană), secondary rivers (Moise, Arșița, Șoimu, Stegea, Pârâul Pietrei, Repedele)	Ghyll scrambling, rock hopping, canyoning	Tourist marks, tourist indicators, information boards, stopover points
Rocky walls	Main valley, secondary valleys	Free climbing, sport climbing, bouldering, rappelling	Climbing marks, information boards
Residual slopes, residual ridges	Main valley, secondary valleys	Scrambling, free climbing, bouldering, rappelling, via ferrata	Tourist marks, tourist indicators, information board
Floodplains	Main valley (i.e. Poiana Stegea)	Camping, stopover points	Accommodations, car parking
Terraces	Main valley (Poiana Stegea, Gura Șoimu, Gura Repedelui)	Camping, bike competition (Trial, Dual Slalom, Dirt Jumping)	Bike park, accommodations, stopover points
Valleys	Bistrița Ardeleană, Șoimu, Stegea, Repedele	Hiking, mountain biking (cross country, downhill)	Trails, tourist marks, stopover points, observation towers

Thus, on the face of rocky steps there can be seen:

- surfaces with roughness (gravels, blocks); surfaces with step and terraces; surfaces with holes;
- surfaces with edges and corners; smooth surfaces; surfaces with cracks; surfaces covered with moss and bushes.

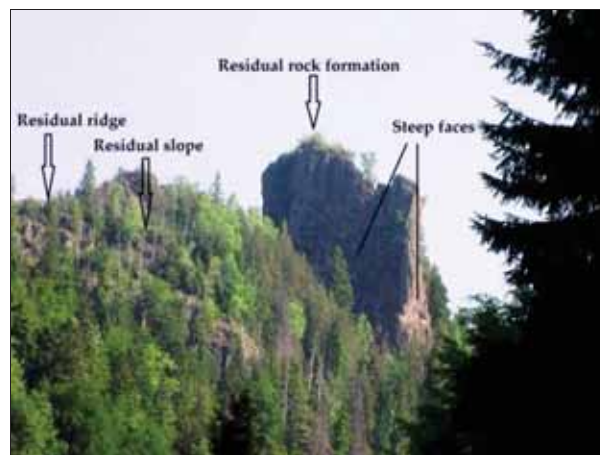


Fig. 8. Residual landforms in the Șoimu Valley

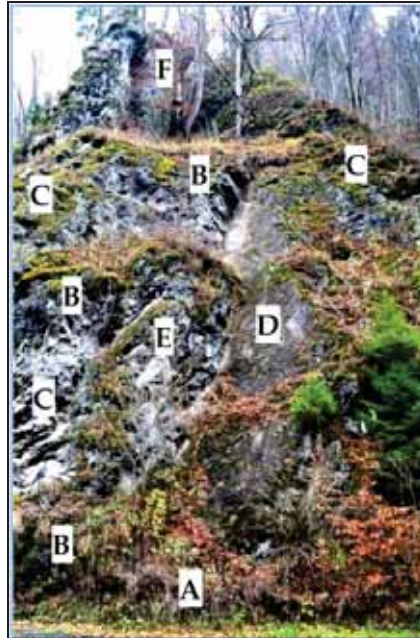


Fig. 9. The micromorphology of a rocky wall for climbing
 A-debris slope; B-grassy terrace; C-prominent rocky surface; D-flat surface;
 E-rocky step; F-crack

According to these parameters, the cliffs, slopes and residual ridges are favorable for climbing activities (free climbing, bouldering), rappelling, tyrolean traverse and scrambling. The difficulty of the routes registered is as follows:

-1A/B: light trails, which requires no special equipment (small cliffs, residual slopes, rocky prominences and the ravines in the vicinity of creeks and roads);

-2A/B: trails least difficult, requiring equipment and technique for climbing (higher steps, deep ravines and the slopes under the peaks or residual rocky formations);

-3-8A/B: trails more difficult, and very difficult, requiring physical condition, technical training and equipment (large cliffs, with angles between 45-90°, located under the residual ridges and under large rocky formations).

Due to the composition of stream beds (gravels, blocks) and the riverbeds morphology (steps, rapids, waterfalls), the main valleys (Bistrița Ardeleană, Stegea Șoimu, Repedele) and secondary ones (Moise, Arșița, Pârâul Pietrei) are favorable for ghyll scrambling, gorge walking, canyoning and rock hopping (fig.10).



Fig. 10. Ghyll scrambling on Șoimu creek

The multitude of forest roads and their morphometry (slope, longitudinal profile, energy) favor the practice of mountain biking (cross country, downhill). The most important paths can include those on the Șoimu, Stegea and Repedele valleys, entering below the peak of Dealu Negru, connecting with magistral route Cușma-Vulturul-Poiana Cofii-Pănuleț.

2. Didactic and educational activities

Considering the potential of the Bistrița Ardeleană Gorge, activities of initiation in sport climbing were held with students and master students from the faculties of Tourism Geography and Physical Education and Sports from the Babeș-Bolyai University-Bistrița Extension; these activities took the form of internships that have benefited from the support of the Mountain Rescue Service Bistrița-Năsăud.

To do this, there were established 7 routes with different difficulty gradients, with the average length of 40 meters, easily accessible and located relatively close in two locations. These are:

- the "Eagle" route-difficulty gradient 6 +;
- the "Central" route-difficulty gradient 7 +;
- the "Ladies First" route-difficulty gradient 8 +;
- the "Rock with the cross" route;

- the "Polygon" route, location which includes three scholar routes with low difficulty gradient, used in the past for mountain troops training, then rehabilitated by the Mountain Rescue Service Bistrița-Năsăud, which use it to train the mountain rescuers. Also, this route is easily accessible and used extensively for climbing, and by participants at summer camps mentioned above.

In the teaching process we've addressed primarily to students and students from specializations which through their specific interact deeply with the natural environment, they being the most open-minded regarding the change of mentality in the attitude towards the environment and active leisure.

In this sense, there can be observed an increased presence of summer camps focused mainly on adventure tourism, in which during a week the children are initiated in climbing. Practical activities carried out as a starting point the idea of valorization of the natural potential of the area by organizing activities and sporting events to engage a significant number of participants. The main comparative data refers to the number and categories of participants in this type of practice (table 2, fig.11).

Table 2.

Category and number of participants in the specific activities in climbing carried out in the Bistrița Ardeleană Gorge in accordance with university curricula

Year of study	2011	2012	2013	TOTAL
Students II year Climbing Optional Cours	23	32	40	94
Masters Active Leisure Line	10	18	27	55
Others categories (children, youth)	40	50	70	160
Total	63	100	137	330

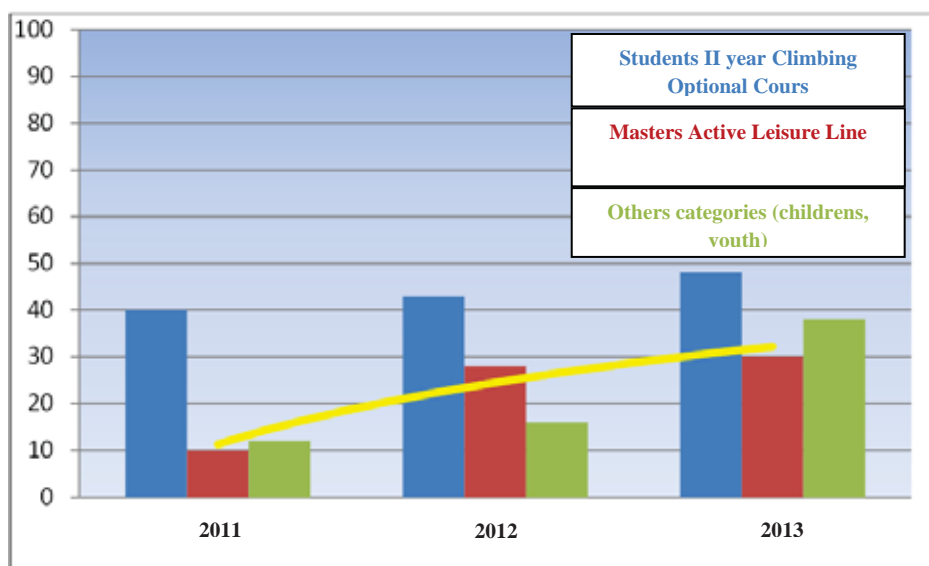


Fig. 11. Comparative graph of the number of participants in the years 2011-2012-2013

According to the recorded data, the following statements can be made: the total number of participants recorded a significant increase in all categories (II year students, master students, other categories of participants); the last item mentioned recorded the highest growth rate because the other two categories are limited to tuition figure; the increase in the number of master students as a result of the emergence of new lines of master from the University Extension Bistrița; other significant items recorded refer to the average age, genre of participants, recording the presence also of those who have previously practiced water activities (table 3, fig.12).

Table 3.

Average age, gender and experience of participants in the climbing program (students, master students, other categories)

Items	Age	M	F	Experience
Students II year Climbing Optional Cours	18-30	32	19	2
Masters Active Leisure Line	23-35	58	10	5
Others categories (childrens, youth)	30-45	50	16	20
Total	18-45	140	45	27

Comparison of these data allow us to affirm: the average age of participants is 18-45 years, the share of male is clearly superior to the female, also the percentage of students with previous experience significant increases in the case of the last two categories which reveal attractive, positive impact on the level of registered participants.

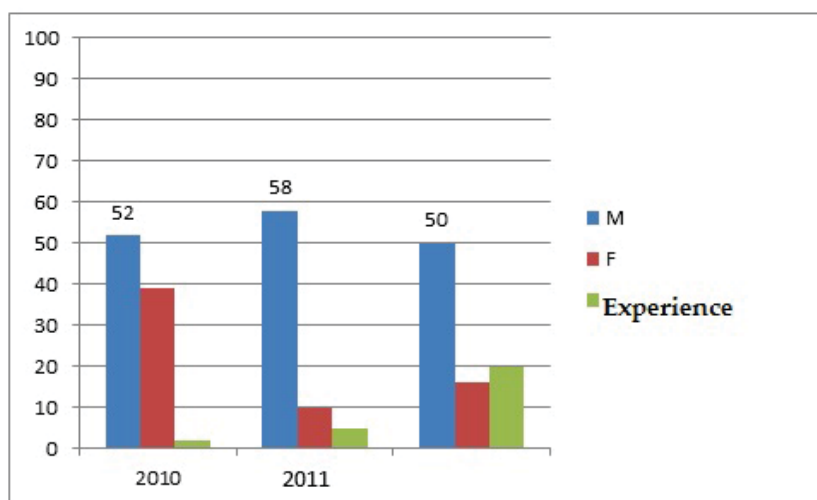


Fig. 12. Graphic comparison of the share of participants in climbing activities

Another form of the active leisure refers to the version of the active and adventure camps focused on initiating/strengthening/improving the technique of climbing to children. This type of activity is organized mainly during school holidays and will be carried out in conjunction with other active mountain practices such as: rafting, kayaking, orienteering, mountain touring (fig.13).

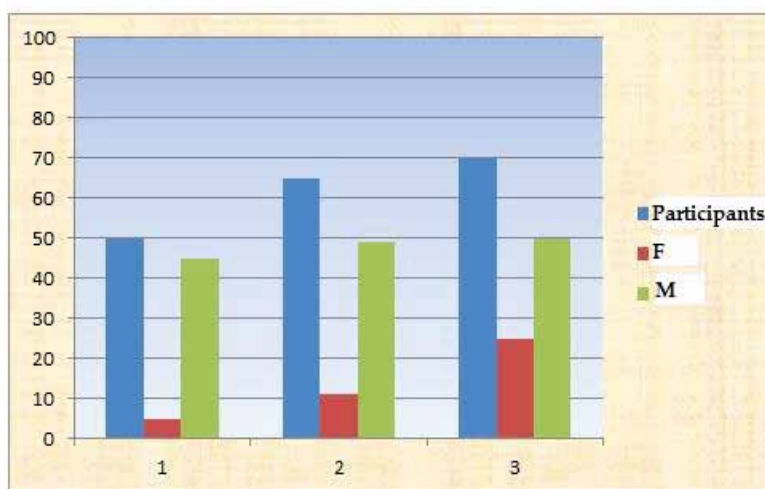


Fig. 13. Comparative graph of the number of participants at Colibița Adventures Camps in the period 2012-2013

Selected data reveals growing interest manifested during the period mentioned, a fact highlighted by the increased number of children participating in this kind of activity that must be disclosed the fear manifested by their parents, but also by teachers from these activities (considered dangerous).

Conclusions

The Bistrița Ardeleană Gorges, through the micro-relief landforms, through easy access (County Road) and through its proximity to the centers that provide tourists (Bistrița, Prundu Bârgăului, Colibița) is a representative tourist destination in the County of Bistrița-Năsăud for travel sports activities such as: hiking, climbing, canyoning, scrambling and mountain biking. At this time, in this area (Poiana Stegea) there is held the yearly Colibița Bike Fest competition, presently at the third edition, which includes several disciplines: dual slalom, trials, dirt jumping and cross country (fig.14).



Fig. 14. Trial contest at Colibița Bike Fest in the Bistrița Ardeleană Gorge

Likewise, this area is used for didactic activities by students and master students from the Faculties of Geography and Physical Education and Sport from the Babeș-Bolyai University-Bistrița Extension. For the future, a series of strategic actions for the development and exploitation of this tourist destinations are required, among which we can mention: the marking of hiking, scrambling and mountain biking trails, the placing of directional indicators and informative panels, the marking of climbing routes and their equipment with insurance assets (anchors, hooks), the arrangement of resting places and scenic platforms, establishment of via ferrata routes and their corresponding equipment, fitting bike park in Poiana Stegea, etc., all of which can be included in a theme park of adventure.

The actors involved in these activities are: Local Council of Bistrița Bârgăului commune, Bistrița-Năsăud County Council, the Directorate For Youth and Sport Bistrița-Năsăud, Babes-Bolyai University from Cluj-Napoca by the faculties of Geography and Physical Education and Sports from Bistrița Extension and the service providers in the area.

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