

# The Gorge of Izvorul Calului, upper Gersa Valley, Rodnei Mountains (Bistrița-Năsăud County, Romania)

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**ABSTRACT:** Gersa Valley is a geomorphological subunit located in the southern part of Rodnei Mountains (Bistrița-Năsăud County) and contains in the superior sector some landforms with high degree of attractiveness, such as Izvorul Tăușoarelor Cave, Izvorul Calului Gorge and Bârlea Massif. By their configuration, these landforms have a great potential for engaging in scientific and recreational activities (caving, hiking, gorge walking, canyoning, mountain biking). This study aims to evaluate the geomorphological parameters of Izvorul Calului Gorge modeled in Eocene limestones at the peripheral area of Bârlea Massif.

**KEY WORDS:** geodiversity, geologic heritage, geoconservation, geosite, action plan, Izvorul Tăușoarelor Cave, Rodnei Mountains, active tourism.

## 1. Introduction

Rodnei Mountains contains a variety of landforms, landscapes and processes with relevance for tourism and leisure. This area represent a sanctuary of geodiversity and a field for tourism planning în Bistrița-Năsăud County. The geodiversity is a concept used by geologist in the 1990s to describe the variety of abiotic nature (geological environments, landscapes, landforms, rocks, minerals, fossils and soils) which provide the framework for life on Earth (Stanley, 2001; Burek, 2001; Prosser, 2002; Burek, Potter, 2002; Gray, 2003).

The geodiversity, it`s an important part of geosystem, wich has more function, such as: economic, social, environmental, tourist, and educational function. Along with biodiversity and cultural creations, geodiversity it`s part of the total assets of a geographical area, and its knowledge is needed to establish the geological and geomorphological sites and to elaborating the strategies for protection and conservation of natural heritage.

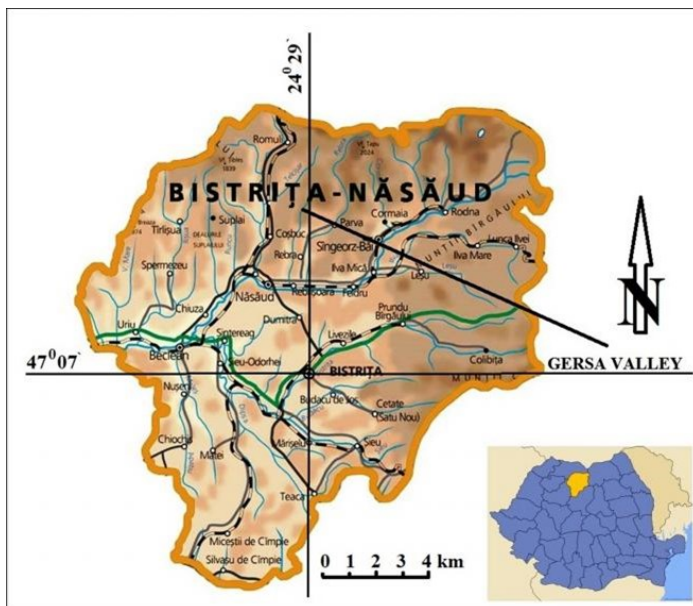
## 2. Methodology

To accomplish this study the following steps were taken:

- consulting works about Rodnei Mountains (Sârcu, 1978), and surrounding area (Ureche, 2000);
- consulting works about carstic landforms (Bleahu, 1982; Bîca, 2013);
- consulting literature in geodiversity issues (Azevedo, 2006; Brilha, 2005; Burek, 2001; Burek et Potter, 2002; Burek et Potter, 2006; Farsani et al., 2011; Gordon et al., 2012; Raharimahefa, 2012; Gray, 2003; Gray, 2005; Gray, 2008a; Gray, 2008b; Gray et al., 2013; Martinez-Frias et al., 2009; Kiernan, 1996; Kiernan, 1997; Kozłowski, 2004; Nieto, 2001; Pemberton, 2000; Piacente et Coratza, 2005; Prosser, 2002; Ruban, 2010; Soutberg, 1990; Sharples, 1993; Stanley, 2001);
- consulting some Geodiversity Audits and Action Plans and Reports drawn up for specific areas (Australian Natural Heritage Charter, 1997; Australian Natural Heritage Charter, 2002; Durham Geodiversity Audit, 2004; Local Geodiversity Action Plans –Setting the context for geological conservation, 2006; Doncaster Geodiversity Assessment, 2007; North Pennines Geodiversity Action Plan, 2010);
- conducting field for inventory, assessment, and mapping geodiversity upper area of Gersa Valley-Izvorul Calului-Izvorul Tăușoarelor-Bârlea Massif sector (Bistrița-Năsăud County, Romania).

## 3. Study area

Izvorul Calului Valley is located in the upper basin of the river Gersa, which drains the southwestern flank of Rodnei Mountains and the western sector of the Năsăud Hills being tributary of Somesul Mare River at Rebrîșoara (Fig. 1).



**Figure 1** Geographical position of Gersa Valley within Bistrița-Năsăud County (source: [http://worldlifetimejourneys.com/bistrita-nasaud\\_en.html](http://worldlifetimejourneys.com/bistrita-nasaud_en.html)).

The upper basin of Gersa valley is bordered by Megiani Hill (994 m) to the west and north, by Bârlea massif (1619 m) to the east, by Bașca massif (1325 m) and Tăul Hill (1155 m) to the south (Fig. 2).

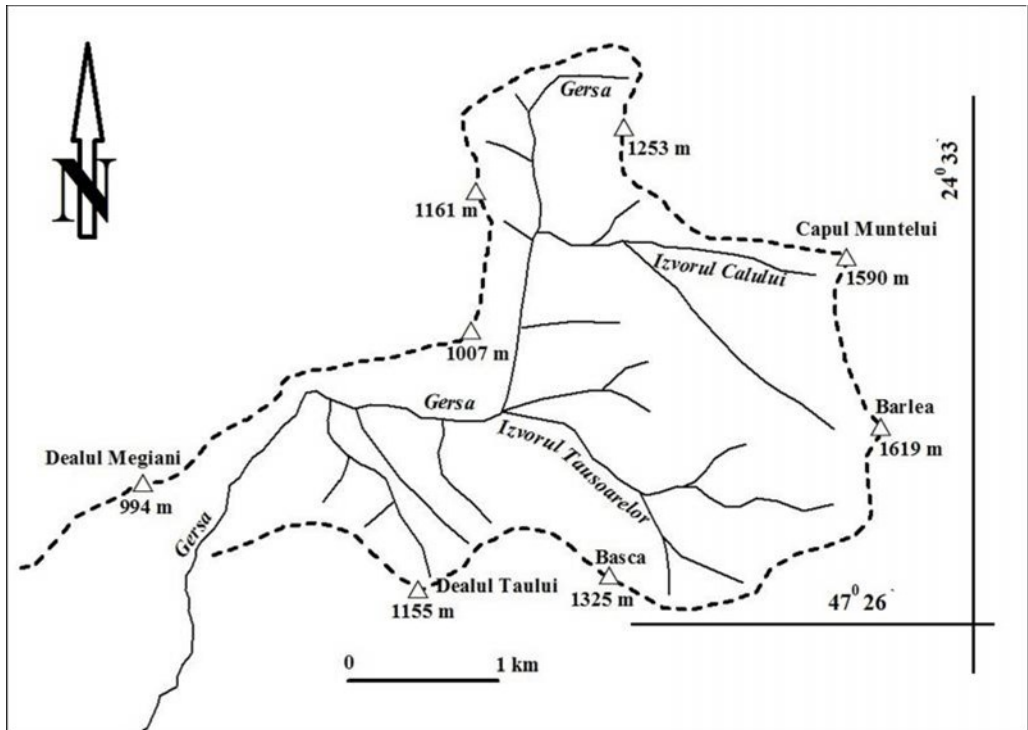


Figure 3 Study area: upper catchment area of Gersa River in Rodnei Mountains.

## 4. Results and discussions

### 4.1. Geomorphology

Izvorul Calului Valley is affluent of Gersa river and has its source on the western slopes of the Bârlea massif (Capul Muntelui, 1560 m) at an altitude of 1540 m, and the confluence with Gersa river is at 980 m altitude. The course of the valley is oriented from east to west, It has a length of 1.75 km and a level difference of 560 m, giving it an average slope of 312.5 m/km.

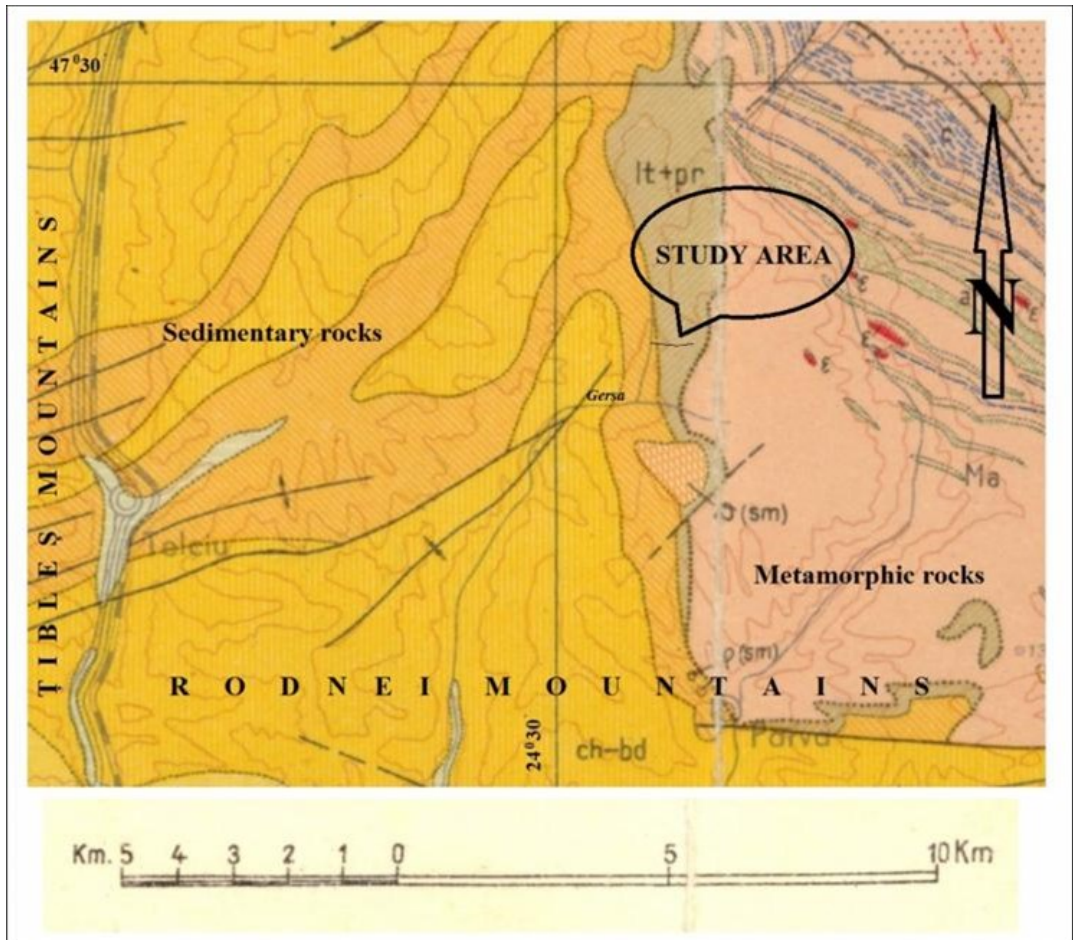
Geological formations in which was carved the Izvorul Calului Valley are represented by limestones of eocene age (lutetian-priabonian) outcropping form of a strip width of 1-2 km on the west outskirts of Bârlea massif (Fig. 3), the layers arranged in descending towards the west and southwest.

The longitudinal profile of Izvorul Calului Valley shows three distinct areas, as follows:

- the upstream gorge sector, between 1220-1540 m, characterized by low slope, width greater, hard rock riverbed with coarse silt;
- the gorge sector, between 1100-1220 m, characterized by narrowing valley, increasing slope, hard rock riverbed, lack of silt;

-the downstream gorge, between 980-1100 m, characterized by decreasing the slope and widening of the valley.

In the downstream gorge sector, before the confluence with Gersa Valley, at 1000 m, stands a break of slope in the valley profile over a distance of 30 m, in hard rock, then the stream changes course for SSV, the confluence with the Gersa river, and drains over 1 km in length a deepest valley sector to the confluence with Izvorul Tăușoarelor creek, in Poiana Ursului (Fig. 4, 5).

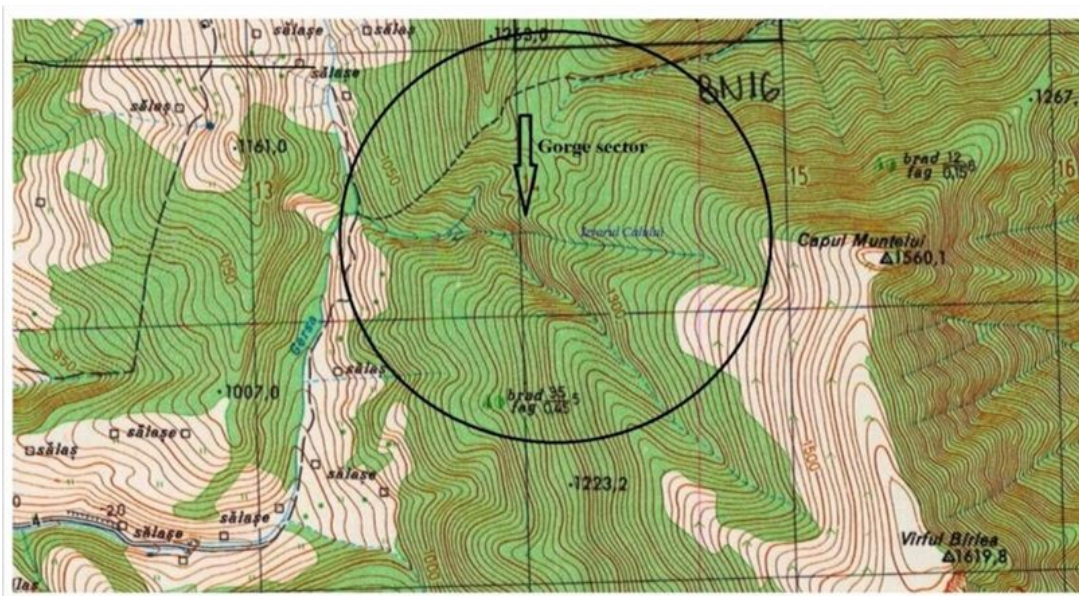


**Figure 3** Geologic map of upper Gersa River catchment area (source: Geologic Map of Romania, Vișeu file, 1:200 000 scale, 1968-with changes).

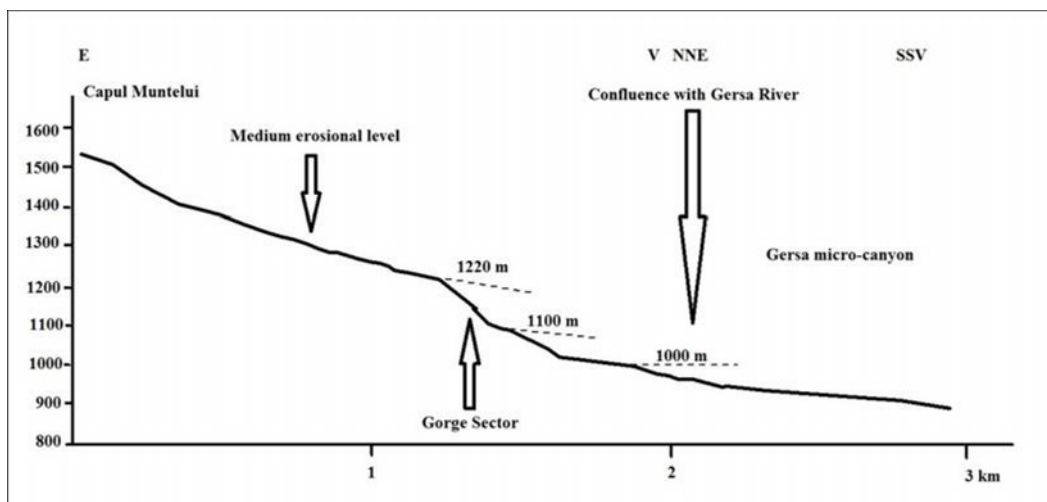
Gorge sector is carved on the lower stream of Izvorul Calului creek, is conducted basically between 1100-1220 m, a length of 150 m, and present the following geomorphological features:

- obscure longitudinal profile with stepped bed carved into limestone (Fig.6);
- transverse profile of width 4-6 m, marked by steep heights of 5-8 m, which on the façade is observed meteorization microforms (cavities, cracks, ravins, steps), corrosion microforms (alveoli) and fluvial erosion microforms (marmites, levels of erosion).

On leaving the gorge is observed in cross-sectional profile a former configuration of a gallerie or a pressure tube that was draining the initial limestone massif during postocene period (Fig. 7).



**Figure 5** Topographic map (1:25 000) of upper catchment area of Gersa River (source: Topographic Map, 1:25 000, 1984).



**Figure 6** Geomorphologic profile of Izvorul Calului Valley (source: Topographic Map, 1:25 000, 1984).

## 4.2. Paleogeographic evolution

Analysing all the data collected in the field it can outline the gorge developments in this sector that, although small, is relevant from a scientific perspective and tourism. During Danian-Eocene period a part of Rodnei Mountains area is subject to complex modeling, resulting the higher levels of erosion (Nedeia Surface). In the Oligocene, during Savic orogenesis, mountain building rises again, so the limestone bar from its western periphery suport the subaerial modeling. In the Lower Miocene is perfected the middle erosional level (Bâtrâna Surface), which is found at the top of the Bârlea Massif (1619 m). The complex Lower Pliocene erosion will generate the lower level of erosion (Mestecăniș Surface), which is present in the north and west of the Bârlea Massif from

1200 to 1300 m. This level is connected with the break of slope at 1200 m, where starts the gorge sector, fact which suggests idea that the widening of the stream and gorge deachment was made in the upper Pliocene, with the collapse of the ceiling of a gallery that provides drainage through the limestone block from Bârlea Massif downstream. The brakes of slope on Izvorul Calului creek, from 1000-1100 m, confirms the deepening and detachment process of upper erosional level of the upper Gersa valley, located at 950-1100 m.

#### 4.1.2. Geomorphologic diversity

The petrographic mosaic in this sector reflects the diversity of landforms shaped by subaerial agents over time (Fig. 7).

Therefore, in the area Bârlea-Başca-Upper Gersa river are distinguished the following types of landforms relevant to tourism planning:

-polycyclic landforms, consists of three levels of erosion, prepared between upper Miocene and lower Pliocene;



**Figure 7** Analytic section on Izvorul Calului Gorge (Upper Gersa Valley).

-fluvial landforms, resulting from action of tributary river system of Gersa River (minor beds, valleys, slopes, catchment, steps in bed, terraces, saddles, ravines, alluvial cones);

-petrographic landforms (karst), represented by caves (Izvorul Tăușoarelor, Măglei), gorges (Izvorul Calului) and cliffs;

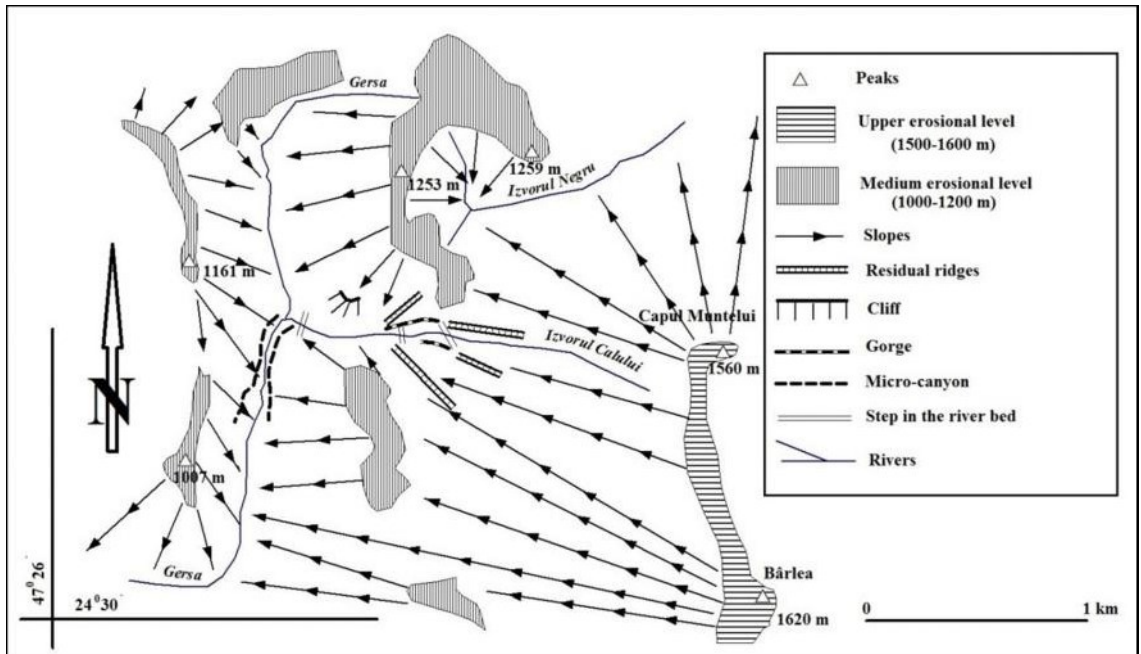
-structurall landforms, represented by Bașca magmatic intrusive massif (1325 m), faults and lithological contacts;

-periglacial landforms, comprising gelifraction forms (cliffs, waterfalls, residual slopes, residual crests, boulder fields), crionival forms (funnels, and crionivale couloirs), nivation forms (niches

nivale often occupied by lakes), and solifluctional forms (mounds and terraces, sliding blocks), developed especially in the Bârlea massif;

-biogenic landforms, represented by grassy mounds, cattle paths, steps and dams in the river bed, burrows, nests of ants;

-anthropogenic landforms, consisting of forest roads, anthropogenic cliffs, trenches, pits, and agroterraces.



**Figure 8** Geomorphologic map of upper catchment area of Gersa river.

#### 4.2. Local action plan for geoconservation

The purpose of this local audit was to assess and identify key geodiversity in upper Gersa River catchment area, and to elaborate an action plan for geoconservation of this site, and for its sustainable recovery through recreation and tourism.

The objectives of the audit and action plan are to:

-provide information on the geological and geomorphological history of the area and its relevance into Rodnei Mountains National Park;

-highlight the importance of the area in the development of earth sciences (geology, geomorphology, biology);

-identify key sites of geodiversity interest, including an assessment to establish economic value and tourism potential, access conditions and recreational opportunities, geoconservation challenges and opportunities, education and learning opportunities, current site use;

-illustrate any geological connections with landscape and biodiversity, built and cultural heritage (Gersa Valley, Rebrîșoara commune, Someșul Mare Valley); Strategic planning guidelines applicable to the area include:

- to conserve the natural environment (fluvial, carstic and periglacial landforms, ecosystems, rivers);
- to protect and manage areas designated for their scientific interest (Izvorul Tăușoarelor Cave, Izvorul Calului Gorge, Bașca magmatic massif);
- to protect, enhance and encourage appreciation of the region's landscapes;
- to conserve the Gersa Valley by respecting and protecting its setting, conserving its physical features, managing change, and controlling access and tourism impacts in a sensitive way; -to promote a sustainable approach to the provision of tourism infrastructure (scenic points, observation towers, stop overpoints, tourist panels, tourist paths, hiking routes); -to establish a world-wide image for upper Gersa Valley, as and attractive places to visit; -to enhance and develop the 'distinctiveness' of the region as a key element of its tourist product.

This action plan is intended to guide the work in the upper Gersa Valley catchment area and could be divided into five sections: -enhancing local understanding of geodiversity;

-collecting and managing information on local geodiversity; -conserving and managing local geodiversity; -construction of facilities for tourism and leisure.

## 5. Conclusions

Knowing the geological heritage of the Rodnei Mountains National Park, in general, and that of the Upper Gersa Valley, in particular, is very important, because it allows the formulation of development strategy and tourism recovery.

The inventory of geo-diversity process highlighted the attractive potential of the area represented by polycyclic, fluvial, petrographic, structural, periglacial, biogenic and anthropogenic landforms. Of the many landforms detaches four geosites with relevance for tourism: Bârlea massif, Bașca magmatic intrusive massif, Izvorul Tăușoarelor Cave, and Izvorul Calului Gorge. After inventory of geo-diversity operation has developed the local action plan for the conservation and enhancement of tourism of this area.

In 2012-2013 the geosite Izvorul Tăușoarelor Cave was the subject of the project "Efficient management system of community importance site and protected area of national interest Tăușoare Cave", a project funded by European Regional Development Fund through Operational Programme Environment-Priority Axe 4 - Implementation of adequate management systems for nature protection, Key Area of intervention - Development of infrastructure and management plans to protect biodiversity and Nature 2000 network.

The project value was 1,171,557 RON and the beneficiary is Bistrița Năsăud County Council, in partnership with Bistrița-Năsăud Museum, custodian of the Nature 2000 site ROSCI0193 Izvorul Tăușoarelor Cave, established by Order 1964/2007 regarding the creation of the natural protected area SCIs, as part of the European ecological network Nature 2000 in Romania.

The project goal was to achieve a framework for efficient management of the site of community importance and protected area of national interest Tăușoare Cave for biodiversity conservation, natural habitats and species existing in the area.

Specific objectives of the project were:

-ensure coherent action plan for biodiversity conservation through management for Tăușoare Cave;



-Improve the safety conditions for people who have access to the cave to create and implement the management plan;

-increasing the management capacity of the protected area Tăușoare Cave for biodiversity conservation;

-increasing awareness of the site and actions for biodiversity conservation in the local community, the scientific community and other relevant target groups ([www.pesterausoare.ro](http://www.pesterausoare.ro)).

Besides geodiversity, in the upper basin of Gersa River can mention biodiversity and traditional cultural heritage represented by the farm houses construction with temporary functions and traditional occupations, such as grazing and making hay. However, complements the geographic profile of this area.

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