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GEODIVERSITY AUDIT AND ACTION PLAN FOR UPPER CATCHMENT AREA OF GERSA RIVER (RODNEI MOUNTAINS, BISTRI'HA-Nl· Sl· UD COUNTY, ROMANIA)

AUDITUL GEODIVERSITl· 'HI ñI PLANUL DE AC'HIUNE PENTRU BAZINUL SUPERIOR AL RÂULUI GERSA (MUN'HII RODNEI, JUDE'HUL BISTRI'HA-Nl· Sl· UD, ROMÂNIA)

AUDITORIA DE LA GEODIVERSIDAD Y EL PLAN DE ACCION PARA LA CUENCA ALTA DEL RIO GERSA (MONTANSA RODNEI, DEPARTAMENTO BISTRI'HA-Nl· Sl· UD, ROMANIA)

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ABSTRACT. Geodiversity Audit is an inventory and assessment process, wich represents the basis for elaborating the Geoconservation Action Plan. The geodiversity includes the abiotic factors (rocks, minerals, soils, landforms) that sustain the life on the Earth, and owns economic, social, environmental, tourist and educational functions. This study proposes an audit of geodiversity from Gersa catcment area and an Action Plan for future planning and tourist valorization projects by local and county authorities. Gersa Valley is a geomorphological subunit located in the southern part of Rodnei Mountains (Bistri"a-NŁsŁud County) and contains in the superior sector some landforms with high degree of attractiveness, such as Izvorul TŁu'Harelor Cave, Izvorul Calului Gorge and Bârlea Massif. By their configuration these landforms has a great potential for engaging in scientific and recreational activities (caving, hiking, gorge walking, canyoning, mountain biking).
Keywords: geodiversity, geologic heritage, geoconservation, geosite, action plan, Rodnei Mountains, Gersa River, Izvorul TŁu'Harelor Cave, speotourism, activ leisure

REZUMAT. Auditul geodiversitŁ"Hi reprezintŁ un proces de inventariere si evaluare care stŁ la baza elaborŁrii Planului de Ac"Hiune pentru Geoconservare. Geodiversitatea include factori abiotici (roci, minerale, soluri, forme de relief) care sus"Hin viaa"aHpe PŁmânt, 'Hi are func"Hii economice, sociale, environmentale, turistice 'Hi educa"Hionale. Acest studiu propune un audit al geodiversitŁ"Hii din bazinul superior al râului Gersa 'Hi un Plan de Ac"Hiune pentru proiectele viitoare de amenajare 'Hi valorificare turisticŁ de cŁtre autoritŁ"Hile locale 'Hi jude"Heene. Valea Gersei este o subunitate geomorfologicŁ localizatŁ pe flancul sudic al Mun"Hilor Rodnei (Jude"Hul Bistri"a-NŁsŁud) 'Hi cuprinde în sectorul superior câteva forme de relief cu grad mare de atractivitate, cum ar fi: Pe'Hera Izvorul TŁu'Harelor, Cheile de pe Izvorul Calului 'Hi Masivul Bârlea. Prin configura"Hia lor, aceste forme de relief au un mare poten"Hial pentru activitŁ"H'Hin"Hifice 'Hi recreative (speologie, drume"Hie, canioning, mountain biking).
Cuvinte cheie: geodiversitate, mo'Htenire geologicŁ, geoconservare, geosit, plan de ac"Hiune, Mun"Hii Rodnei, râul Gersa, Pe'Hera Izvorul TŁu'Harelor, speoturism, agrement activ

RESUMEN: Auditoría geodiversidad es un proceso de inventario y evaluación que sustenta el desarrollo del Plan de Acción para Geoconservcion. Geodiversidad incluye factores abióticos (rocas, minerales, suelos, formas de relieve) que sustentan la vida en la Tierra, y tiene funciones económicos, sociales, ambientale, recreativa y educative. Este estudio propone una auditoría de geodiversidad en la cuenca alta del río Gersa y un plan de acción para la futura planificación y explotación turística de las autoridades locales y del condado. Gersa Valley es una subunidad geomorfológico situada en el flanco sur de Rodnei Montañas (Departamento Bistri"a-NŁsŁud) e incluye en la parte superior un poco de alivio con gran atractivo, como cave Izvorul TŁuкoarelor, Gorge Izvorul Calului y Bârlea Massive. Por configuración, estas unidades geográficas tienen un gran potencial para las actividades científicas y recreativas (espeleología, senderismo, barranquismo, bicicleta de montaña).
Palabras clave: geodiversidad, el patrimonio geológico, geoconservación, plan de acción, Montañas Rodnei, Río Gersa, Cave Izvorul TŁuкoarelor, ocio activo

1.INTRODUCTION

The geodiversity is a concept used by geologist in the 1990s to describe the variety of abiotic nature. For Stanley (2001) ògeodiversity is the link between people, landscape and their culture: it is the variety of geological environments, phenomena and processes that make those landscapes, rocks, minerals, fossils and soils which provide the framework for life on Earthò. Other definition states that the geodiversity "is the geological diversity or the variety of rocks, fossils and minerals and natural processesò (PROSSER, 2002), ògeodiversity underpins biodiversityò (BUREK, 2001), and òrepresent the abiotic factors, which together with biodiversity give a holistic view of the landscapeò (BUREK;POTTER, 2002), and òthe variety of earth materials (minerals, rocks, sediments, fossils, soils and water), forms (folds, faults, landforms) and processes (tectonics, sediment transport, pedogenesis) that constitute and shape the Earth, either the whole or a specific part of itò (GRAY, 2003).

The geodiversity, it`s an important part of geosystem, wich has more function, such as:

a)economic function: it provides the raw materials for building (stone, clay, gravels, sand), the fuel (coal, oil, gas), metals for industry, and the soils for agriculture;

b)social function: the location of many settlements is influenced by the distribution of mineral resources (coal, oil, metals), water (ground waters, surface waters), soils (fertile or less fertile), and landforms configuration (orientation, altitude, fragmentations, energy, slope);

c)environmental function: geodiversity plays a major role in defining the landscapes (landforms, soils, natural and anthropic processes); the complex relationships between geology, natural processes, landforms, landscape, soils and climate are fundamental to the distribution of habitats and species; geodiversity plays a key role in environmental regulation (reducing pollution, buffering climate change, filtering, purifying and storing water);

d)tourist function: spectacular geology forms the backdrop to many of most popular tourist locations, and the geosites are often of great recreational and tourism value, inspiring people to enjoy or learn about nature;

e)educational function: many geodiversity sites are used for outdoor education, because they provide a chance to study ancient volcanoes, caves, fossils, minerals, residual landformes, environmental changes etc.

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.

The geodiversity of an area may be considered to be a support for the other components of the environment, and encompasses:

-sites or natural features which are deemed worthy of some form of designation or protection for the quality of Earth heritage features displayed;

-sites or natural features where representative examples of the area's Earth heritage may be seen;

-sites and natural features currently employed in interpreting Earth science;

-resource potential for geotourism and education;

-the whereabouts and nature of past and present working of mineral products;

-the influence of earth science in shaping the man-made environment, urban landscapes and architectural heritage;

-natural hazard management;

-the inter-relationship and inter-dependence between Earth heritage and other interests, for example biodiversity, archaeology, history.

2. METHODOLOGY

To accomplish this study were taken the following steps:

-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; The Dorset Local Geodiversity Action Plan, 2005; Local Geodiversity Action Plans ï Setting the

context for geological conservation, 2006; Doncaster Geodiversity Assessment, 2007; North Pennines-Geodiversity Action Plan, 2010; UK Geodiversity Action Plan, 2012); Consulting literature in geodiversity issues (AZEVEDO, 2006; BRILHA, 2005; BUREK, 2001; BUREK; POTTER, 2002; BUREK;POTTER, 2006; FARSANI;COELHO;COSTA2011; GORDON;BARRONB;HANSOMC, 2012; RAHARIMAHEFA, 2012; GRAY, 2003; GRAY, 2005; GRAY, 2008A; GRAY, 2008B; GRAY et al.,2013; MARTINEZ-FRIAS ET AL., 2009; KIERNAN, 1996; KIERNAN, 1997; KOZLOWSKI, 2004; NIETO, 2001; PEMBERTON, 2000; PIACENTE;CORATZA, 2005; PROSSER, 2002; RUBAN, 2010; SOUTBERG, 1990; SHARPLES, 1993; STANLEY, 2001); Consulting works about Rodnei Mountains (SÂRCU, 1978; BUTA;BUTA, 1979; Geologic Map of Romania, 1968; Geografia României, 1983; MUREŞIANU;THEODORESCU;SCHUSTER, 2011), and surrounding area (URECHE, 2000); Conducting field for inventory and assessment geodiversity of upper area of Gersa Valley-Izvorul Calului-Izvorul Tău'Hodarelor-Bârlea Massif sector (Bistriţa-Năsăud County, Romania).

3.STUDY AREA

Gersa Valley is located in Bistri"a-Năsăud County, Romania (Figure 1), drains the south-western flank of the Rodnei Mountains and the western sector of the Năsăud Hills, and is tributary to Someşul Mare River, at Rebri"oara (Figure 2).

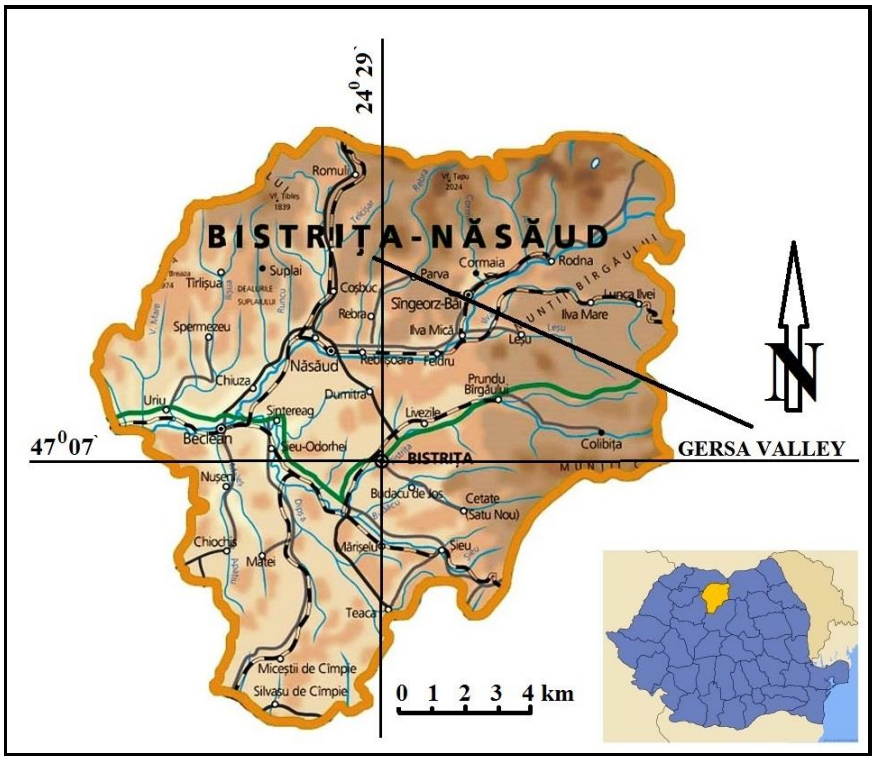

Figure 1-Geographical position of Gersa Valley within Bistri"a-Năsăud County (Romania) (source: http://worldlifetimejourneys.com/bistrita-nasaud_en.html)

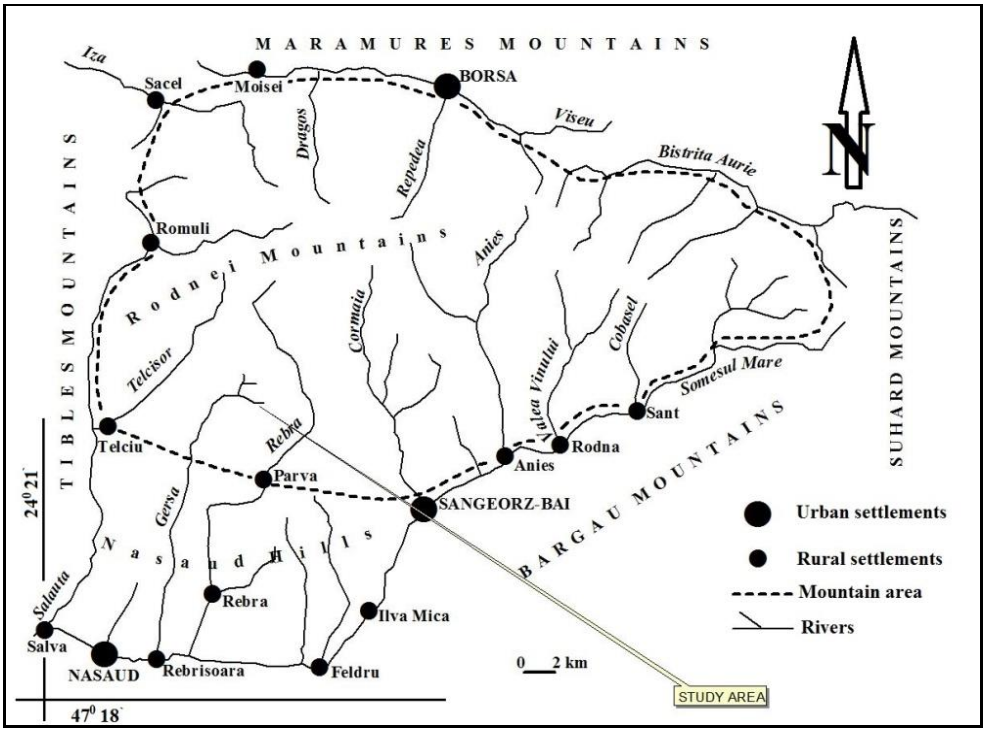

Figure 2-Geografical position of Gersa Valley in Rodnei Mountains and NŁsŁud Hills

The upper basin of the Gersa Valley, which is the subject of this study, belongs to Rodnei National Park, and is limited by Dealul Megiani (994 m) to the West and North, Bârlea Massif (1619 m) to the East, Basca Massif (1325 m), and Dealul TŁului (1155 m) to the South (Figure 3).

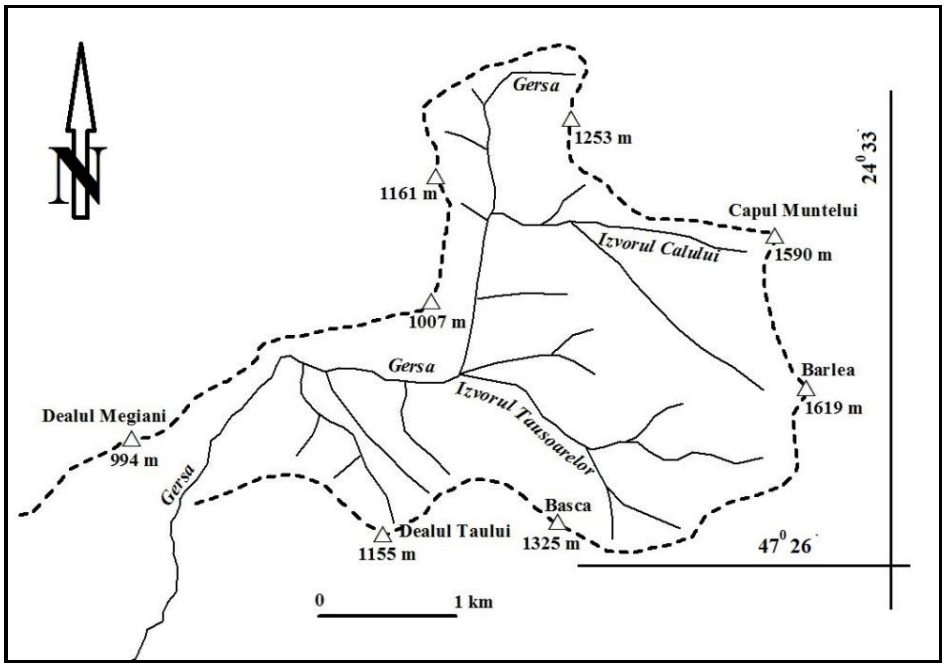

Figure 3-Study area: upper catchment area of Gersa River in Rodnei Mountains

4.RESULTS AND DISCUSSION

4.1.Inventory of geodiversity

4.1.1.Geologic diversity

Geological formations in which was carved out the upper valley of Gersa River are represented by metamorphic rocks mesoproterozoic age, belonging to the Bretila series in Bârlea massif, sedimentary rocks of eocene, oligocene and miocene epoch (limestone, conglomerates, sandstone, clays), which is contained in the Dealul Megiani, Dealul Tłului, and the periphery of Bârlea and Ba'Hda massifs, and igneous intrusive rocks, pannonian ages (micro granodiorites) that are present in the Ba'Hda Massif (Figure 4).

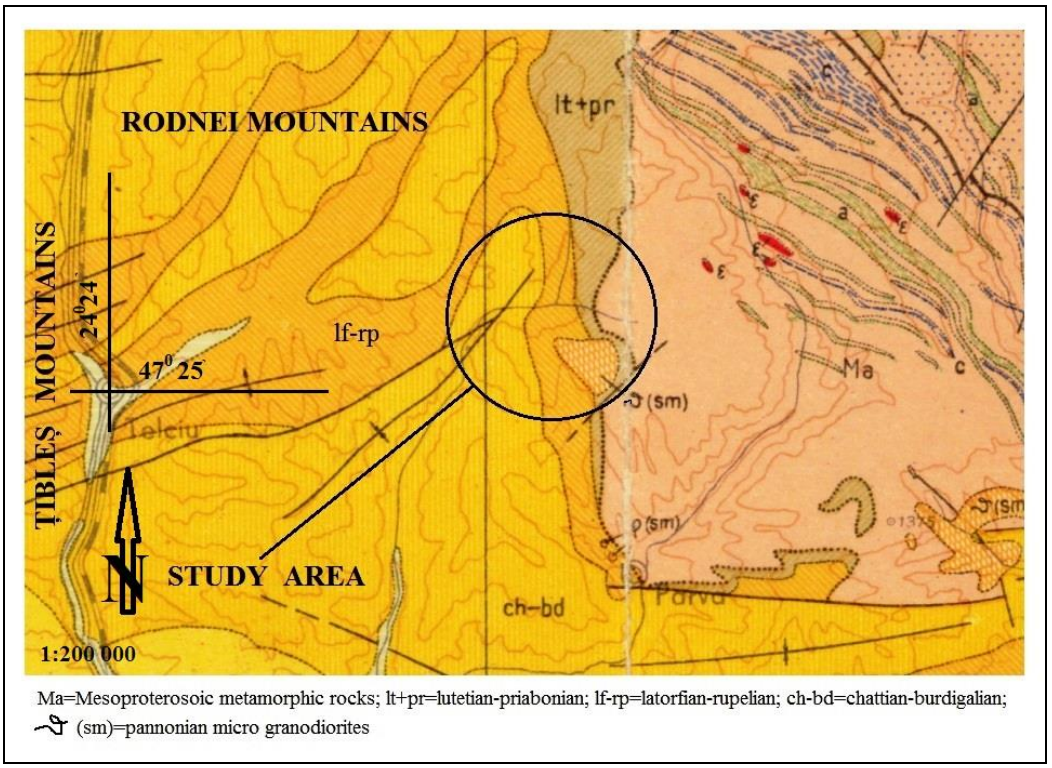

Figure 4-Geologic map of upper Gersa River catchment area
(source: Geologic Map of Romania, Vi'Hu file, 1:200 000 scale, 1968-with changes)

These rock formations illustrates the geological processes that have marked the south-western border of Rodnei mountains after the rising from hercynian and laramide orogeny, respectively the deposition of postaustrian sedimentary couverture, and intrusion of pannonian magmas (Figure 5).

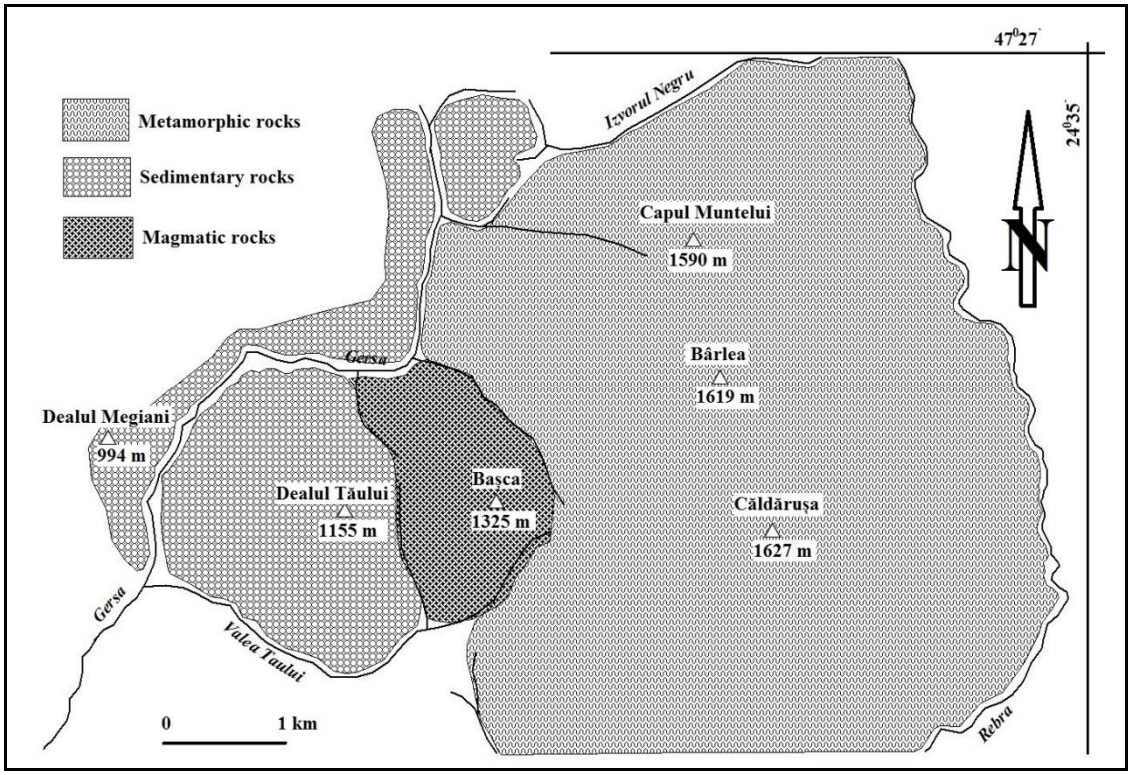

Figure 5-The geologic units of upper catchment area of Gersa River
(source: Geologic Map of Romania, Vi'Hu file, 1:200 000 scale, 1968-with changes)

4.1.2Geomorphologic diversity

The petrografic mosaic in this area extends over the diversity of landforms shaped by aerial agents over time. Therefore, we distinguish the following types of landforms:
-policyclic landforms, represented by three erosional levels, carved out between upper miocene-upper pliocene;
-fluvial landforms, resulting by the action of tributary rivers of Gersa River (river beds, valleys, slopes, catchment areas, steps in the river bed, terraces, saddles, ravines, alluvial fans);
-petrographic landforms (carstic landforms), represented by caves (Izvorul TŁu'Harelor Cave, MŁglei Cave), gorges (Izvorul Calului Gorges), and cliffs;
-structural landforms, represented by Ba'Hca intrusive magmatic massif (1325 m);
-periglacial landforms, wich includes gelifraction landforms (escarpments, cascades, residual slopes, residual ridges, debris slopes), crionival landforms (crionival funnels and channels), nivation landforms (nival niches, often occupied by lakes) and solifluidal landforms (mounds and terraces, sliding rocks), especially developed in Bârlea massif area;
-biogene landforms, represented by grassed mounds, sheep trails, steps, and dams in the river bed, burrows, and ant mounds;
-anthropogenic landforms, composed by forestry roads, anthropogenic cliffs, trenches, pits, quarrys, and agricultural terraces (Figure 5);

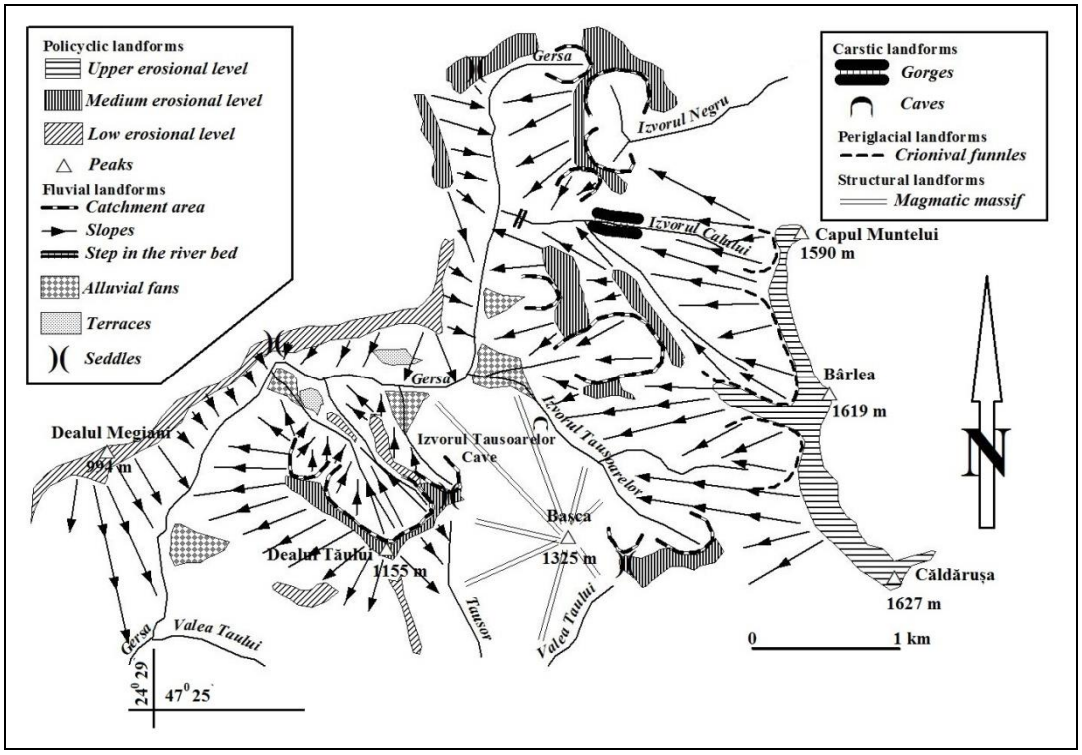

Figure 5-The geodiversity of Upper Gersa River Catchment Area

The inventory operation of geodiversity in the upper catchment area of Gersa River took place on the basis of a special sheet, presented in table .

Table 1 Geodiversity inventory sheet

Crt nr.	Landforms genetic type	Landforms type	Area	Landform features
1	Policyclic landforms	Erosional levels	Bârlea massif, Dealul Megiani, Dealul Tăului	Altitude, repartition, morphodetails, scenic points, etc.
2	Fluvial landforms	Valleys, slopes, river beds, terraces, alluvial fans, ravines, gullys, etc.	Gersa Valley, Izvorul Calului Valley, Izvorul Tăurilor Valley, etc.	Repartition, dimensions, scenic features, etc.
3	Petrographic landforms	Caves, cliffs, gorges	Izvorul Tăurilor Valley, Izvorul Calului Valley	Localization, dimensions, morphodetails, scenic features, etc.
4	Structural landforms	Magmatic massif	Başca massif	Altitude, geometry, slopes, morphodetails, scenic points, etc.
5	Periglacial landforms	Crionioval funnels, cliffs, residual ridges, residual slopes, falls, debris slope, nival niches, etc.	Bârlea massif, Başca massif, Izvorul Calului Valley	Repartition, dimensions, morphodetails, scenic features, etc.
6	Biogene landforms	Grassed mounds, cattle trails, burrows, etc.	Bârlea massif, Dealul Megiani, Dealul Tăului, etc.	Repartition, dimensions, evolution, impact
7	Anthropic landforms	Forestry roads, stone quarry, agricultural terraces, trenches, pits, etc.	Başca massif, Bârlea massif, Gersa Valley, Izvorul Tăurilor Valley	Repartition, dimensions, evolution, impact

In the process of inventory and evaluation of geodiversity in the upper basin of Gersa River were established the following geosites (table 2):

Table 2. Regionaly geosites in upper Gersa River catchment area

Geosite	Izvorul TĦu'Hoarelor Cave	Izvorul Calului Gorges	Bârlea Massif	Ba'Hda Massif
Acces	Forestry road	Forestry road, sheep trails	Forestry roads, tourist paths	Forestry roads
Scientific value	Carstic system of Rodnei mountains, the deepest cave in Romania, protected area I a UICN category	Carstic morphogenesis	Erosional levels, periglacial landforms	Intrusive magmatic system of Souther Rodna mountains
Ecological value	Cave ecosystems	No	Mountain ecosystems	Forestry ecosystems
Aestetic value	Galleries, halls, walls, speleothemes, calcitic balls, Ursus Spelaeus bones	Cliffs, steps in the river bed	Scenic points, landscape	Geometry, landscape, scenic points
Educationl value	Carstic morphogenensis, speleothemes, cave ecosystems	Exocarstic landforms	The morphogenesis on metamorphic rocks, biodiversity	Intrusive magmatic processes
Economic value	No	No	Sheep grazing, wood exploitation	Wood exploitation, magmatic rocks quarry
Threats	Flood, Radon emanations, rock collapse	Deforestation	Deforestation, gully erosion, sheep grazing excess	Deforestation, gully erosion

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, Rebri'Hoara commune, Some'Hul Mare Valley);

Strategic planning guidelines applicable to the area include:

-to conserve the natural environment (fluvial, carstic and periglacial landforms, ecosistems, rivers);

-to protect and manage areas designated for their scientific interest (Izvorul TĦu'Hoarelor Cave, Izvorul Calului Gorge, Ba'Hda magmatic massif);

-to protect, enhance and encourage appreciation of the regionôs 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 ódistinctivenessôof 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 (table 3):
-enhancing local understanding of geodiversity;
-collecting and managing information on local geodiversity;
-conserving and managing local geodiversity;
-construction of facilities for tourism and leisure.

Table 3. The structure of Action Plan for upper Gersa Valley catchment area

Themes	Objectives	Actions	Timescale	Costs	Partners	Observations
Enhance local understanding of geodiversity	Rise awareness and interest of local communities, local authorities, and tourists	Field trips, video projections, symposium, development of brochures, location of information boards	2015-2017	In work	Rebri'lHara City Hall, NŁsŁud Border Museum, Babe'HBolyai University	
Collecting and managing information on local geodiversity	Implementation of a database	Development of questionnaires Processing information from the locals	2015-2017	In work	Babe'HBolyai University, Rebri'lHara School, NŁsŁud Border Museum	
Conserving and managing local geodiversity	Development of strategies	The establishment of thematic routes, identify high-value geosites	2015-2017	In work	Rebri'lHara City Hall, NŁsŁud Border Museum, County Council Bistri"aH NŁsŁud, Harta Verde Association Bistri"aH, National Agency of Environment, Romsilva Bistri"aH NŁsŁud	

Construction of facilities for tourism and leisure	Tourist exploitation of the area, increasing the income of the local population, promoting the image of the area	Arranging places to rest, observation towers, information boards, camping, hiking routes	2015-2017	In work	Rebricea City Hall, County Council Bistriţa-Năsăud, Romsilva Bistriţa-Năsăud	

Stakeholders implicated in this Local Action Plan are The Local Council of Rebricea commune, The Council of Bistriţa-Năsăud County, The County Museum Bistriţa-Năsăud, Năsăud Border Museum, bike associations, County Mountain Rescue Team Bistriţa-Năsăud, tourist services providers, etc.

5.CONCLUSIONS

Knowledge of the geological and geomorphological heritage within the Rodnei Mountains National Park in general, and upper valley of Gersa River, in particular, is very important, because it allows the formulation of land-use planning strategy and recovery for tourism. The inventory process of geodiversity has highlighted the attractive potential of the area, represented by the policyclic landforms, fluvial landforms, petrografic landforms, structurally landforms, periglacial landforms, biogen and anthropogenic landforms.

From the multitude of landforms detach the four gesites relevant for tourism: Bârlea massif, Bârda intrusive magmatic masiff, Izvorul Tăuşoarelor Cave and Izvorul Calului Gorges. After the inventory operation it was elaborated the local action plan for the geoconservation and tourism valorization of this area.

During the period 2012-2013 Izvorul Tăuşoarelor Cave has been the subject of the project "Efficiently management system of the site of community importance and protected area of national interest Tăuşoare Cave", financed by the European Regional Development Fund, Priority axis 4-Implementation of adequate management systems for the protection of nature, The key area of intervention-infrastructure development and management plans for the protection of biodiversity and Nature 2000 network.

The value of the project was 317.624 $, and the beneficiary is Bistrita-Năsăud County Council, in partnership with the Bistriţa-Năsăud County Museum, custodian of the Nature 2000 Site ROSCI0193 Tăuşoare Cave, established by order no. 1964/2007 for establishment of the protected natural area of sites for community importance, as an integral part of the European ecological network Nature 2000 sites in Romania.

Aim of the project was the development of a framework for effective management of the site of community importance and protected area of national interest Tăuşoare Cave for the conservation of biodiversity, natural habitats and species in the area.

The specific objectives of the project were:

-ensure coherent measures of biodiversity conservation by the management plan for Tăuşoare Cave;

-improving safety conditions for people who have access to the cave in order to achieve and implement the management plan;

-increase the capacity of protected area management Tăuşoare Cave to conserve biodiversity;

-increase the of the site Tăuşoare Cave for bopconservationin order to conservation actions among the local community, the scientific community and other relevant target groups

-increase the information and awareness level of the importance of the site Tăuşoare Cave and of the bioconservation actions, among the local community, the scientific community and other relevant target groups (http://www.pesteratausoare.ro).

Besides geodiversity in upper basin of Gersa River can rely mention the biodiversity, and traditional cultural heritage, constituted by the temporary buildings with specific functions and architecture and traditional occupations, such as herding sheep and mowing hay. All these completed the geographic profile of

this area.

6. REFERENCES

AZEVEDO, M.T.M., 2006, Geodiversidade e geoturismo na bacia do Tejo portugues ï uma abordagem preliminary, Publicacoes da Associacao Portuguesa de Geomorfologos, v. 3, p. 161-165.

BRILHA, J., 2005, Património geologico e geoconservacao, Palimage Editores, Braga, 190 p.

BUTA, I., BUTA, AURELIA, ANA, 1979, Mun"Hi Rodnei, Colec"Ha Mun"Hi No"Hri, Ed. Sport-Turism, Bucure"Hti

BUREK, C.V., 2001, Non-geologists now dig Geodiversity, Earth Heritage, 16, 21

BUREK, C.V., Potter, J., 2002, Local geodiversity action plans setting the context for geological Conservation, English Nature.

BUREK, C. V., POTTER, J., 2006, Local Geodiversity Action Plans - Setting the context for geological conservation, English Nature Research Reports, No. 560

FARSANI, N, T., COELHO, C., COSTA, C., 2011, Geotourism and geoparks as novel strategies for socio-economic development in rural areas, International Journal of Tourism Research, Volume 13, Issue 1, p. 68ï 81

GORDON, J. E., BARRONB, H.F., HANSOMC, J.D., Thomasd, M.F., 2012, Engaging with geodiversityð why it matters, Proceedings of the Geologists' Association, Volume 123, Issue 1, p. 1ï 6

GRAY, M., 2003, Geodiversity. Valuing and conserving abiotic nature, Wiley, p. 434

GRAY, M., 2005, Geodiversity and Geoconservation: What, Why, and How?, in Geodiversity&Geoconservation, The George Wright Forum, Vol. 22, Nr. 3, p.4-12

GRAY, M., 2008a, Geodiversity: developing the paradigm, Proceedings of the Geologists' Association, Volume 119, Issues 3ï 4, p. 287ï 298

GRAY, M., 2008b, Geodiversity: A New Paradigm for Valuing and Conserving Geoheritage, Journal of Geological Association of Canada, Volume 35, Nr. 2, p.51-59

GRAY, M., GORDONB, J.E., BROWN, J. ELEONOR, 2013, Geodiversity and the ecosystem approach: the contribution of geoscience in delivering integrated environmental management, Proceedings of the Geologists' Association, Volume 124, Issue 4, June, p. 659ï 673

KIERNAN, K., 1996, Conserving Geodiversity and Geoheritage: The Conservation of Glacial Landforms, Forest Practices Unit, Hobart, Tasmania, 244 p.

KIERNAN, K., 1997, The Conservation of Landforms of Coastal Origin: Conserving Tasmaniaôs Geodiversity and Geoheritage, Forest Practices Unit, Hobart, Tasmania, 273 p.

KOZLOWSKI, S., 2004, Geodiversity: The concept and scope of geodiversity, Przeglad Geologiczny, v. 52, p. 833-837

MARTINEZ-FRIAS, J., NEMEC, V., NEMCOVA, L., DE LA TORRE, R., HORNECK, G., 2009, Geoethics and Geodiversity, in Space Exploration: Implications in Planetary Geology and Astrobiology, 9th European Workshop on Astrobiology, EANA 09, 12ï 14 October 2009, Brussels, Belgium

MUREñIANU, M., THEODORESCU, C., SCHUSTER, Ed., BÂCA, I., BARTA, A., 2011, *Protected Areas in Romania between Desiderata and Reality. Case Study: Izvorul T***Ł***uc***Ł***oarelor Cave*, Studia Universitatis Babe'HBolyai, Geographia, 1, Cluj-Napoca

NIETO, L.M., 2001, Geodiversidad: Propuesta de una definición integradora, Boletin Geológico y Minero, v. 112, p. 3-12

PEMBERTON, M., 2000, Conserving geodiversity. The importance to evaluing our geoheritage, Tasmanian Parks and Wildlife Service

PIACENTE, S., CORATZA, P., eds., 2005, Geomorphological Sites and Geodiversity, Il Quaternario, v. 18, p. 1

PROSSER, C., 2002, Terms of Endearment, Earth Heritage 17, 12-13

RAHARIMAHEFA, T., 2012, Geoconservation and geodiversity for sustainable development in Madagascar, Madagascar Conservation&Development, vol. 7, issue 3, p. 126-134

RUBAN, D.A., 2010, Quantification of geodiversity and its loss, Proceedings of the Geologists' Association, Volume 121, Issue 3, p. 326ï 333

SOUTEBERG, T.L., 1990, Towards a Geomorphic Descriptive Classification System for Nature Conservation Purposes, Occasional Paper 23, Department of Parks, Wildlife and Heritage, Hobart

SHARPLES, C., 1993, A methodology for the Identification of Significant Landforms and Geological Sites for Geoconservation Purposes, Report to the Forestry Commission, Tasmania

STANLEY, M., 2001, Welcome to the 21st century, Geodiversity Update Nº1, p. 1

URECHE I., PAPP, DELIA, CRISTINA, 1998, Caracteristicile magmatitelor intruzive din Mun'HRodna 'H Bârg***Ł***u (Carpa'HOrientali), Studii 'Hcercet***Ł***ri, ñtiin'He naturii, 4, Muzeul Jude'ean Bistri'aHN***Ł***s***Ł***ud, p25-34

1968, Harta GeologicŁ***a României, foaia Vi'Hu, 1:200 000, Institutul Geologic, Bucure'Hti

***1983, Geografia României, vol. I, Ed. Academiei RSR, Bucure'Hti

***1996-1997, Australian Natural Heritage Charter, Australian Heritage Commission, Canberra, Australia

*******2002, Australian Natural Heritage Charter, 2nd edition: Australian Heritage Commission, Canberra, Australia

***2004, Durham Geodiversity Audit, British Geological Survey

***2005, The Dorset Local Geodiversity Action Plan, English Nature

***2007, Doncaster Geodiversity Assessment, vol. I, Keyworth, Nottingham British Geological Survey

***2006, Local Geodiversity Action Plans ï Setting the context for geological conservation, English Nature, 2006

***2010, North Pennines-Geodiversity Action Plan 2010-2015, Natural England

***2012, UK Geodiversity Action Plan. A framework for enhancing the importance and role of geodiversity, www.ukgap.org.uk

******* http://www.pesteratausoare.ro/