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ECOLOGICAL MECHANISMS FOR ANTHROPIZED ECOSYSTEMS IN THE PROXIMITY OF RURAL COMMUNITIES

ABSTRACT

In an anthropized ecosystem, the interactions are represented by the multitude of possible combinations between its structural elements; among these, the most important groups of interactions are those in which people are also involved.

In the transformed ecosystems, with different anthropization levels, new functional relations appear, as a result of introducing certain disturbing elements by humans from one ecosystem to another.

The present study provides both a general perspective on environment conservation and on the economic activities of rural areas located in the proximity of protected natural areas, as well as the establishment of ecological mechanisms meant to ensure equilibrium between the natural and the anthropic ecosystems.

Key words: sustainable rural development, natural ecosystem, anthropized ecosystem, ecological interfunctionality.

JEL Classification: Q01, Q57.

1. INTRODUCTION

The human impact upon the environment is represented by all the modifications outside the ecological rules, experienced by the natural environment, as a result of human activities. The impact is directly proportional with the number of the population and the volume of human activities. The human impact upon the natural environment can take different forms: massive deforestation, desertification of steppe areas, turning the soil under grassland, livestock raising, soil erosion, water pollution, air pollution, destruction of certain plant and animal species, fast development of modern communication ways, hunting and fishing, pastoral activities, uncontrolled tourism activities, etc.

The anthropic impact upon ecosystems is significant and it may take many forms, resulting from the unprecedented development of human society. Raising the people's awareness on environment protection determined a series of actions at different levels (world, continental, regional, zonal, national, local levels).

At EU level, the concerted environment policies began more than 30 years ago, and sustainable development became an objective of the European Union in 1997, when it was included in the Maastricht Treaty. In 2001, the Gothenburg Summit adopted the Sustainable Development Strategy of the European Union.

For Romania, as an EU Member State, sustainable development is the only rational perspective, resulting in the establishment of a new development paradigm through the confluence of economic, social and environmental factors.

2. STATE OF KNOWLEDGE

The ecosystem concept belongs to the British botanist Arthur Tansley (1935), who for the first time defined the ecosystem as "*a complex set of organisms and physical factors*". He was also the first to show that vegetation can be affected by soil, temperature and anthropic activity.

The ecosystems were classified into "*natural ecosystems, in which man's intervention is insignificant, and anthropized or anthropic ecosystems, in which the human activity significantly modified the natural components and processes*" (Scopelitis, 2002).

The anthopized ecosystem can be conceived as the ecosystem transformed by people during their evolution as species.

The structure of the anthropized ecosystem is organized by four levels:

– level 1 – habitat and activities level which includes: sequences of urban and rural habitats, differentiated by the population density; sequence of industrial equipments; sequence of agricultural and forestry facilities; sequence of tourism facilities development;

– level 2 – networks including the networks that connect, into higher rank networks, the sequences of the previous level: transport networks (roads, railways, maritime waterways and airways); communication networks (telephone lines, radio and TV and satellite networks); energy networks (electric power networks and transport networks for oil and natural gas);

– level 3 – autonomous level, comprising industrial and agricultural facilities isolated from anthropized networks into which the previous levels are structured (this category includes the mines, sea platforms, radar and meteorological stations, sheepfolds, monasteries, as well as construction sites);

– level 4 – nature level, on which those areas that are not inhabited are located (Căldăraru, 1998).

A very important element that characterizes the anthropized ecosystem is its pollution level. The natural pollution is the result of certain local phenomena, such as volcanic eruptions, hurricanes, flooding or earthquakes, followed by processes meant to reduce their effects, both at nature level and at the level of human actions.

The pollution resulting from human action has as sources the activities of industrial and agricultural type and the dysfunctionalities of human settlements

(transport, urban agglomerations, etc.). It is a continuous action, i.e. the pollution process is not followed by a corresponding process meant to reduce the pollution effects.

3. METHODOLOGY USED

The study was based on specific methods specific to selective research, respecting all the steps from the methodological point of view: identification of the problem under research, delimitation of the research framework, information collection, processing, data analysis and interpretation, drawing up the conclusions.

The information sources are the official data and the data obtained from field surveys. In the analysis of Țara Hațegului – Retezat area we used the *Commune fiche* that was developed under a research project.[1]

4. RESULTS AND DISCUSSIONS

The main objective of the paper is represented by the establishment of the ecological mechanisms necessary to the equilibrium of anthropized ecosystems and the establishment of an optimum interfunctionality between these and the rural communities from Țara Hațegului – Retezat.

In order to reach this objective, three ecosystems will be briefly analyzed, with different anthropization levels in the zone, namely: the rural communities from Țara Hațegului – Retezat, the natural protected areas located in the proximity of rural communities and the power plant on Râul Mare river in order to establish the interfunctionalities between these.

4.1. Țara Hațegului – Retezat

Țara Hațegului – Retezat is a unique zone in Romania, both in terms of the balanced relationship between the anthropically influenced areas and the natural areas, and by the high level of natural resources preservation.

From the geographic point of view, Țara Hațegului – Retezat is located in Hunedoara county and neighbours upon the Retezat Mountains in the south, the Șureanu Mountains in the east and north-east, the Țarcu Mountains in the west and the Poiana Ruscă Mountains in the north, with a total area of 155,194 ha.

From the administrative point of view, the area Țara Hațegului – Retezat consists of 11 communes and 84 villages. From the demographic point of view Țara Hațegului – Retezat is characterized by the high share of rural population (Table 1). The rural population diminution is a slow process, with a spatial development determined by the intensity of economic and demo-economic endogenous factors.

[1] "Conservation of bio and geodiversity, as support for sustainable development and economic and social growth in Hateg Country – Retezat area" RO 0023 (RO-00056MFSEE)(2009–2010).

In the year 2009, the rural population from Ţara Haţegului – Retezat was down by 20.9% compared to 1990.

The population density slightly changed, from 18.5 inhabitants/km^2 in the year 2002 to 17.9 inhabitants/km^2 in 2008. The unbalanced spatial pattern is specific to this zone from the point of view of territorial distribution.

The population density values had specific fluctuations in each rural area in part, with the maximum limit in the commune Toteşti, i.e. 87.4 inhabitants/km^2, with an increasing trend, and the minimum limit 8.4 inhabitants/km^2 in Râu de Mori commune, with a moderate decreasing trend (Table 2). The physical density diminution trend was not uniform, and significant fluctuations were experienced at the level of communes.

According to the population's density dynamics, there are two categories of communes: communes with relatively and densely populated spatial patterns: Toteşti, Sântămarie Orlea and General Berthelot and communes with low population density spatial patterns: Baru, Bretea Română, Densuş, Pui, Răchitova, Râu de Mori, Sălaşu de Sus, Sarmizegetusa.

Agriculture is the main activity of the people from Ţara Haţegului – Retezat, the agricultural area slightly diminishing in the period 2000–2008. It is worth mentioning that three communes (Pui, Sălaşu de Sus and Râu de Mori) have together over 54.5% of the total agricultural area of the zone.

Arable land was down by 7.9% in Ţara Haţegului – Retezat in the period 2000–2008, which is a much higher decrease compared to the diminution of areas under pastures (down by 0.9%) and of areas under hayfields (down by 5.9%).

The area under pastures and hayfields represents an important factor in livestock raising. In the period 2000–2008, the livestock herds significantly decreased in Ţara Haţegului – Retezat. The highest decline was noticed in the bovine herds (30.7%), followed by pigs (29.5%), sheep (21.2%) and poultry (11.5%).

Table 1
Evolution of rural population from Ţara Haţegului – Retezat

- number -

Commune	1990	1995	2000	2005	2009
Baru	3370	3198	3027	2954	2908
Bretea Română	3492	3399	3300	2961	2969
Densuş	2306	2017	1895	1710	1580
General Berthelot	1105	1018	959	995	987
Pui	5307	4901	4715	4554	4456
Răchitova	2002	1712	1501	1396	1347
Râu de Mori	4517	3644	3604	3409	3236
Sarmizegetusa	1582	1548	1462	1374	1297
Sălaşu de Sus	3300	3049	2802	2639	2449
Sântămaria Orlea	3999	3677	3526	3327	3267
Toteşti	2390	1943	1896	1848	1913
Total	**33370**	**30106**	**28687**	**27167**	**26409**

Source: Otiman, P.I., Violeta Florian, Ionescu, C., (2010), *Matrici economice, sociale, ecologice şi strategii de dezvoltare durabilă în Ţara Haţegului – Retezat*, in Conservarea geo şi biodiversităţii şi dezvoltarea Durabilă în Ţara Haţegului – Retezat, vol. II, Editura Academiei, p. 17

Table 2
Physical density evolution – spatial distribution

- inhabitants/km^2 -

Commune / Year	2002	2006	2008
Baru	20.0	20.1	20.1
Bretea Română	30.4	29.2	29.1
Densuş	13.3	12.4	11.8
General Berthelot	31.6	32.2	32.2
Pui	20.2	19.7	19.5
Răchitova	20.0	18.8	18.3
Râu de Mori	8.8	8.7	8.4
Sălaşu de Sus	12.4	11.6	11.2
Sântămaria Orlea	47.7	48.8	48.7
Sarmizegetusa	19.1	18.4	17.9
Toteşti	85.9	86.7	87.4
Total	**18.5**	**18.1**	**17.9**

Source: Otiman, P.I., Violeta Florian, Ionescu, C., (2010), *Matrici economice, sociale, ecologice şi strategii de dezvoltare durabilă în Ţara Haţegului – Retezat*, in Conservarea geo şi biodiversităţii şi dezvoltarea Durabilă în Ţara Haţegului – Retezat, vol. II, Editura Academiei, p. 17.

Table 3
Evolution of agricultural area, ha

Commune / Year	2000	2005	2008
Baru	5915	5916	5916
Bretea Română	6801	6610	6586
Densuş	6121	3972	3972
General Berthelot	2242	1982	1982
Pui	12039	11961	11961
Răchitova	4086	3473	3473
Râu de Mori	16038	15938	15938
Sălaşu de Sus	10565	10565	10565
Sântămăria Orlea	4200	4098	4098
Sarmizegetusa	4333	4276	4276
Toteşti	1822	1816	1816
Total Ţara Haţegului – Retezat	**74162**	**70607**	**70583**

Source: Otiman, P.I., Violeta Florian, Ionescu, C., (2010), *Matrici economice, sociale, ecologice şi strategii de dezvoltare durabilă în Ţara Haţegului – Retezat*, in Conservarea geo şi biodiversităţii şi dezvoltarea Durabilă în Ţara Haţegului – Retezat, vol. II, Editura Academiei, p. 37.

Table 4
Evolution of arable land, pastures and hayfields in Ţara Haţegului – Retezat, ha

Area	2000	2005	2008
Arable	16657	15356	15339
Pastures	34543	34226	34225
Hayfields	21889	20592	20598

Source: Otiman, P.I., Violeta Florian, Ionescu, C., (2010), *Matrici economice, sociale, ecologice şi strategii de dezvoltare durabilă în Ţara Haţegului – Retezat*, in Conservarea geo şi biodiversităţii şi dezvoltarea Durabilă în Ţara Haţegului – Retezat, vol. II, Editura Academiei.

Table 5
Evolution of livestock herds in Ţara Haţegului – Retezat, heads

Animals	2000	2005	2008
Bovines	12376	10864	8567
Pigs	6789	6756	4781
Sheep	35899	28683	28286
Poultry	99524	103646	88119

Source: Otiman, P.I., Violeta Florian, Ionescu, C., (2010), *Matrici economice, sociale, ecologice şi strategii de dezvoltare durabilă în Ţara Haţegului – Retezat*, in Conservarea geo şi biodiversităţii şi dezvoltarea Durabilă în Ţara Haţegului – Retezat, vol. II, Editura Academiei.

Environmental problems in Ţara Haţegului Retezat. In Ţara Haţegului – Retezat, the main artifical **air** pollution sources are the units producing electric and thermal energy based on fossil fuels, the units that produce construction materials, transport, the ironworks in the proximity, the population's households, etc.

The emissions of acidifying substances on the territory from Ţara Haţegului – Retezat mainly come from the following sources:

– burning fossil fuels, wood and wood wastes for the heating of dwellings represents a source of emissions of nitrogen oxides and sulphur dioxide;

– the management of dejections and enteric fermentation from livestock raising represent significant ammonia sources;

– the use of nitrogen fertilizers in agriculture represents a significant ammonia source;

– road traffic is another source of acidifying gases.

There is a manual point for air quality control for sedimentable powders on the territory of the commune Baru; no automatic air quality monitoring station exists in Ţara Haţegului – Retezat area.

Table 6
Air quality on the manual control point Baru in the period 2008–2010

Locality/ Year		Sampling point	Type of station	Pollutant type	Number of samples	Yearly average concentration	Number of samples exceeding the acceptable limit
Baru	2008	Baru Mare, no. 303	Industrial	Sedimentable powders*)	12	8,76 g/m^2/month	0
	2009	Baru Mare, no. 303	Industrial	Sedimentable powders*)	12	9,50 g/m^2/month	0
	2010	Baru Mare, no. 303	Industrial	Sedimentable powders*)	12	7,48 g/m^2/month	0

*) Sedimentable powders – with diameters larger than 20 µm, which, after being released into the air, fall on the soil, vegetation, waters and buldings. The yearly average concentration =17 g/m^2/month according to STANDARD 12574/87.
Source: Environmental Situation Reports in the County Hunedoara, APM Hunedoara, 2008, 2009, 2010.

In the period 2008–2010 a total number of 36 samples were collected on the control point Baru and no sample exceeded the acceptable average yearly concentrations for the suspension powders.

Table 7
Situation of the river water quality in Ţara Haţegului – Retezat, 2008–2010

No.	Water course	Length in Hunedoara county	2008		2009		2010	
			VG – Class I	G – Class II	VG – Class I	G – Class II	VG – Class I	G – Class II
1	Strei	93	62	31	62	31	62	31
2	Galbena	34	0	34	0	34	0	34
3	Breazova	29	29	0	29	0	29	0
4	Sibişel	28	28	0	28	0	28	0
5	Zlata	8	8	0	...	...	...	...

Note: VG – very good; G – good;
No measurements were made in the years 2009 and 2010.
Source: Environmental Situation Report in the County Hunedoara, APM Hunedoara, 2008.

As regards **water** quality, no modification was noticed in the period 2008–2010, Strei, Galbena, Brezova and Sibişel water courses falling into the same quality classes.

The use of certain waste products of animal origin for increasing **soil** fertility is a very old practice. Yet, as in the case of chemical fertilizers, their incorrect use as well as their uncontrolled storage or disposal may produce negative effects upon soil.

Soil quality is adversely affected in the areas where industrial or domestic waste storage places exist. The mining exploitations also have a significant share in this respect, due to mining sterile deposits and infiltration of polluting chemicals in soil and water.

As regards tourism, different types took shape, depending on the natural and anthropic resources, the tourism objectives and tourism infrastructure existing in the area. The types of tourism that are practised in Ţara Haţegului – Retezat are the following:

- The mountain tourism is practised on the largest area, determined by the most exceptional resources provided by the mountain massifs Retezat, Ţarcu, Şureanu and Poiana Ruscă mountains. A variant of mountain tourism is represented by the sportive tourism for winter sports at the ski track equipped with cable facility from the Complex Râuşor (Râu de Mori) or the sportive tourism for nautical sports on the storage lake on Râul Mare river.
- The cultural, spiritual, scientific tourism developed on the basis of cultural and architectural objectives, (ancient and mediaeval) archaeological remains, churches, natural parks and natural and scientific reserves provided by the rural settlements and areas from Ţara Haţegului.

A special asset in the scientific tourism is provided by the rich biodiversity (mainly from the Retezat massif) and the rich geodiversity (Dinosaur Geopark from Ţara Haţegului).

Among the most significant historical objectives we must mention the Dacian amphitheatre from Sarmizegetusa, the Roman relics (villa rustica), the mediaeval castles (manor houses) Sântămăria Orlea, Berthelot, Nalaţvad, Densuş, the fortresses from Suseni-Colţi, Răchitova, Crivadia, Sălaşu de Sus etc.

The mediaeval churches, the church from Densuş in the first place (the oldest in Romania), from Sântămăria-Orlea, Nucşoara, Peşteana, Ostrov, Suseni dating back from the 13th–15th centuries, represent remarkable attractions for the tourists willing to know more about Christian spirituality.

- The weekend tourism is quite frequent in Ţara Haţegului. The development of tourism boarding houses and vacation homes both in the areas Clopotiva – Râul Mare – Gura Zlatna (more than 100 boarding houses and vacation homes), Valea Râuşorului as well as in many other zones (in almost all villages at the foot of the mountains Retezat, Şureanu, Ţarcu, Poiana Ruscă) favoured this tourism type practice.
- The transit (or intermediary) tourism is practiced by the tourists that travel along the larger tourist circuit, such as Banat-Ţara Haţegului-Valea Jiului-Oltenia or Banat-Ţara Haţegului-Deva-Hunedoara.
- Agro-tourism in Ţara Haţegului is rather a potential than a reality. The agro-tourism potentiality in Ţara Haţegului is generated by the beautiful and tranquil villages and rural households. But the development and generalization of agro-tourism in Ţara Haţegului presupposes a deep reshaping of rural infrastructure and an adequate equipment of agro-tourism household farms with the necessary tourism facilities.

The ecological behaviors, the traditional habits and customs, based on essentially traditional values, made the anthropic factor size and pressure upon the environment be relatively moderate throughout the Haţeg rural area.

The anthropic factor influence is perceived by the rural players as being a strong one by the economic development of the entire area and by the increase in the number of jobs, of incomes implicitly, with a low impact upon the environment and traditional activities.

There are two categories of communities: the category of rural communities in which average anthropization values are noticed: Bretea Română, Săntămăria Orlea, General Berthelot, Sălaşu de Sus and Râu de Mori and the category of rural communities with a low anthropization value: Răchitova, Densuş, Sarmizegetusa, Pui and Baru (Table 8).

Table 8
The perception of the anthropic factor

- average value -

	Barrages	**Boarding houses**	**Roads**
Economic development	3.38	2.84	3.81
Increase in the job numbers	3.09	2.52	2.73
Pollution	1.89	1.55	1.81
Disappearance of traditional activities	1.78	1.43	1.44
Growth of incomes	2.62	2.31	2.43
Change in mentality	2.04	2.04	2.10

Source: Otiman, P.I., Violeta Florian, Ionescu, C., (2010), *Matrici economice, sociale, ecologice şi strategii de dezvoltare durabilă în Ţara Haţegului Retezat*, in Conservarea geo şi biodiversităţii şi dezvoltarea Durabilă în Ţara Haţegului – Retezat, vol. II, Editura Academiei, p. 163.

4.2. Protected areas in Ţara Haţegului – Retezat

Retezat National Park was established in 1935, at the initiative of Professor Alexandru Borza (1887–1971), director of the Botanical Gardens from Cluj and of the scholar Emil Racoviţă (1869–1947), out of the necessity to preserve the exceptional ecological, geo-morphological and esthetical entities from the Retezat massif. At its establishment, the total area of the park was 13,000 ha. It is only in the last decades that its area was considerably enlarged, by the incorporation of new areas, mainly from the forested area.

In the year 1979, it became a Biosphere Reserve, and in the year 2007 it became a member of PAN Parks Foundation and it was declared special avifaunistic protection area (under the indicative ROSPA0084 Retezat Mountains); since 2008 it became a site of the European Ecological Network Natura 2000 (under the indicative ROSCI0217), in order to preserve the natural habitats and wild plant and animal species of community interest.

By Law 5/2000, Retezat National Park became a natural protected area of national and international interest, being included in the category national parks, corresponding to IUCN Category II.

Retezat National Park lies in the western part of the Meridional Carpathians and at present it covers an area of 38138 ha from the Retezat-Godeanu Massif. It includes twenty peaks over 2000 m high and more than 80 glacial lakes, among which the Lake Bucura, which is the largest glacial lake in Romania. The park is famous for its floristic and faunistic diversity, hosting almost 1,190 species of higher plants, 90 endemic taxons, 130 rare or vulnerable plants, 50 mammal species, 185 bird species, 9 reptile species, 5 amphibian species. The Scientific Reservation Gemenele is located at the core of Retezat National Park, with an area of 1630 ha.

The Retezat National Park Administration (RNPA) is responsible of managing the Retezat National Park, as subunit of the Forestry Directorate from Deva, under the structure of the Romania National Forest Administration – Romsilva. RNPA implements the Management Plan by which the unitary and integrated management of the natural protected area takes place, it monitors the respect of this plan, organizes specific activities and controls all the activities taking place on the park territory, so as to ensure the fulfillment of the management objectives of Retezat National Park, in conformity with the objectives related to national park, Sites of Community Importance and Avifaunistic Protection Areas.

The main functional areas from Retezat National Park (internal zoning) are the following:

A. *Strictly protected areas,* at present consisting of the Scientific Reservation Gemenele, which corresponds to IUCN Category I, including a wild area in which no anthropic interventions took place, or the level of these anthropic interventions was extremely low, and any human activity is strictly forbidden, except for the research activities, with the delimitations described in the management plans.

B. *Integral protection areas*, comprising the most valuable goods of the natural heritage inside the natural protected areas. In these areas, the following activities are strictly forbidden: a) any forms of exploiting and use of natural resources, as well as any forms of land use incompatible with the protection and/or conservation purpose; b) construction-investment activities, except for those dedicated to the administration of the natural protected area and/or scientific research activities or those activities meant to ensure national security or prevention of natural disasters.

C. *Buffer-areas* also named sustainable conservation areas that make the shift between the integral protection areas and the sustainable development areas.

D. *The sustainable development area* comprises the built-in perimeters, that are delimited as such if the General Urbanism Plans (GUP), in the areas from Valea Lăpuşnicului Mare, Râuşor, Pietrele and Buta. The mimit of these areas are established by GUP related to the communes Râu de Mori, Sălaş and Uricani.

Table 9
Structure of ownership right, its utilization modality
and the administrative control of Retezat National Park

Land category	**Owner**	**Area**	**% of entire area**	**Administration responsibilities**	
				Administrator	**Since:**
Forests	Romania's Government	17,564	46	National Forest Administration – Hunedoara Directorate from Retezat, Pui and Lupeni Forest	1948
	Co-owners	1,044	3	Co-owners	2002
Mountain area (pastures, land under water, etc).	Communes/villages	18,744	49	Local councils	1922
	Co-owners Câmpu lui Neag Association	786	2	Co-owners Câmpu lui Neag Association	2001
Total		38,138	100		
Fish	National Forest Administration – Hunedoara Directorate from Retezat, Pui and Lupeni Forest	38,138	100		1948
Scientific Reservation Gemenele	Romanian Academy – Commission for the Protection of Natural Monuments	1630	4	Romanian Academy – Commission for the Protection of Natural Monuments	1956
Retezat National Park Biosphere Reserve	Retezat National Park Administration	38,138	100		1999

Source: Retezat National Park Administration, 2008.

According to Law 5/2000 on the approving the national territory management plan – Section III – protected areas, the area of the site is divided as follows: Hunedoara county: Pui (1%), Râu de Mori (54%), Sălaşu de Sus (40%), from the town Uricani (17%); Caraş-Severin county: Teregova (<1%), Zăvoi (2%) and Gorj county: Padeş (<1%), Tismana (2%).

Thus, three communes located in Țara Hațegului – Retezat (Pui, Râu de Mori and Sălaşu de Sus) own 1123.79 ha in the Retezat National Park.

Table 10
Area of the three communes under the Retezat National Park

Commune	Total area ha	% of the commune area located in Retezat National Park	The commune area located in Retezat National Park, ha
Pui	22879	1%	228.79
Râu de Mori	38613	54%	2085
Sălaşu de Sus	22305	40%	8922
Total			1123.79

Source: Commune Fiche and own calculations.

The Natural Park Grădiştea Muncelului-Cioclovina is a protected area of national interest, as declared by Law 5/2000 and according to Government's Emergency Ordinance 57/2007 on the protected natural areas, natural habitats, wild flora and fauna, within the category of natural parks, corresponding to IUCN Category V. Its area totals 38184 ha and it is located in the mountains Şureanu, on the administrative territory of the communes Baru, Boşorod, Bănița, Orăştioara de Sus and Pui.

The park borders on Hațegului Depression in the west, Orăştiei Depression in the north and includes large areas under forests, as well as land areas under other land use categories (pastures, hayfields, arable, carstic areas, water courses, historical monuments, archaeological sites) and human settlements (built-in areas).

The natural park was created with the purpose to protect and preserve certain landscapes in which the interaction between the human activities and nature, throughout the centuries, has created a distinct zone, of high landscape and cultural value, with a high biological diversity. The natural park includes six of the most spectacular reservations from Hunedoara county: Ponorâci-Cioclovina carstic complex, the Crivadiei Gorges, Bolii Hill and Cavern, Tecuri Cavern, Şura Mare Cavern and Ohaba Ponor fossil site.

Three of these lie on the territory of Țara Hațegului Retezat, namely: Tecuri Cavern is found on the territory of the commune Baru and the Cavern Şura Mare is on the territory of the commune Pui, being natural speological reservations, while the fossil site Ohaba-Ponor, with a total area of 10 ha, is on the territory of the commune Pui, being a paleontological reservation. Since 2004, the natural park Grădiştea Muncelului Cioclovina has had its own self-administration.

Dinosaur Geopark Țara Hațegului – protected natural area of national interest since 2004, with an area of 102,392 ha, included in the European Geopark Network and in the Global Network (under UNESCO aegis).

Since 2007 it contains protected area of 23940 ha, named "Strei-Hațeg site", as a site proposal for the European ecological network NATURA 2000, envisaging the conservation of natural habitats and wild plant and animal species of Community interest.

This protected natural area has a special status, due to the high level of habitation; its purpose is to ensure the protection of the natural and cultural heritage from Țara Hațegului. The geopark includes items of special geological interest together with items of ecological, archaeological, historical and cultural interest.

The key factor that personalizes this territory is represented by the sites with dinosaur relics. The dwarf dinosaurs from the Hațeg depression are unique in the world, their scientific importance and attractiveness being enhanced by the discoveries of egg nests and embryos of dinosaurs, of certain mammals from the time of the dinosaurs and of a flying reptile.

The geopark also includes the following natural reservations: the Moor from Peşteana, the Calcareous Rocks from Fața Fetii, Poeni Peak, Slivuț Forest, Hayfields with Daffodils from Nucşoara, reptilian paleofauna from Tuştea, Fossil site with dinosaurs Sânpetru, Hayfields from Pui

The geopark is located on the territory of Hateg town and of Berthelot, Densus, Răchitova, Toteşti, Sarmizegetusa, Râu de Mori, Sântămaria Orlea, Pui, Salaşul de Sus and Baru Mare communes, and it is administered by the University of Bucharest.

4.3. The power plant station Râul Mare – Retezat

The power plant Râul Mare – Retezat (AHRMR) began to be built in 1975 and it was completed in the year 2000. A large-sized barrage was built on the upper course of the river Râul Mare, behind which a storage lake was created by deviating the waters from several rivers, a long head race, a surge chamber, a penstock, a large-sized hydroelectric plant Râul Mare – Retezat (also named Brazi – Retezat) and then other 10 hydropower plants from this point up to Sântămăria Orlea, at the confluence with the river Strei.

The 11 hydropower plants are the following: Râul Mare – Retezat, Clopotiva, Ostrovul Mic, Ostrovul Mare, Cârneşti 1, Cârneşti 2, Păclişa, Toteşti 1, Toteşti 2, Hațeg and Sântămăria Orlea, summing up an installed power of 483.3 MW.

The 10 hydropower units have quite similar installed powers (11.5 – 15.9 MW). There are three accumulations: Ostrovul Mic, Păclişa and Hațeg (where the corresponding hydropower plants are operating) and other seven hydropower units (Sântămarie Orlea, Cârneşti 1, Cârneşti 2, Clopotiva, Ostrov, Toteşti 1 and Toteşti 2).

The barrage from Gura Apelor represents a national novelty, and in Europe it is among the few barrages from this category. It is located on Râul Mare river, downstream from the confluence of the river Şes with Lăpuşnicul Mare river. The solution chosen for water retaining is the rockfill dam. It is in fact a large pyramid built across the river, so that water can be used for producing electric power on demand. For building the dam, rockfill was used from a stone quarry in the proximity, and the clay was brought from Râu de Mori quarry. The dam body is 570 m wide at its base, 12 m at its crest, the projected height is 167 m and the length at the crest of wave 480 m. These dimensions include a volume of 9 million

m^3 of materials. The dam is provided with installations for high water disposal, for bottom discharge and with the flooding flap from which the main conduit to the hydro-power station starts.

The lake from Gura Apelor is able to retain 15 m^3/s of water, which is the capacity of Râul Mare river at the location profile of the dam, which adds to 10 m^3/s brought from the secondary water catchments. By the dam, the lake is able to store 210 million m^3 of water and to provide to the downstream hydropower units a water flow of 70 m^3/s. At the normal retention level, Gura Apelor Lake has an area of 420 ha.

Retezat hydroelectric plant is located on the left versant of the Râul Mare river, upstream from the locality Brazi. It looks like an underground palace, 65 m long, 15,5 m wide and 41 m high, and its construction required the excavation of more than 42,000 m^3 of rock.

In the conditions of an average hydrological year, Gura Apelor Lake is able to ensure an operation of about 1,880 hours/year, resulting an average yearly electric power production of about 630 mil kWh.

5. CONCLUSIONS

The endogenous factors that contributed to the present situation of the area Ţara Haţegului result from its geographical location in the first place, in a geographical unit that is perfectly delimited as a depressionary enclave, yet with a relative favourable location with regard to the inter-zonal and interregional access and transit corridors. The genuine Romanian ethno-cultural and historical specificity, of Dacian–Roman origin, represented the basis for the creation of a characteristic cultural patrimony, of high physical density, while the proximity of certain elements of unique natural patrimony and high value natural resources increase the opportunities for resuming the development of economic activities and human development in the area. The community life in Ţara Haţegului was affected by the general decline of industries based on the exploitation of mining resources and the primary processing of metals, by the failure of industrial and agricultural patterns from the period 1948–1989 and by the brutal interventions in the natural environment as a result of the construction of the hydro-power units.

The villages from two communes, namely Râu de Mori and Sălaşu de Sus, as well as the village Câmpu lui Neag, belonging to the town Uricani are located in the very proximity of Retezat National Park. These rural communities have a particular influence upon the Retezat National Park as they have land areas inside the national park and in its proximity, and they use the natural resources existing in the area.

Most families have income sources from farming, as they have agricultural land and/or animals into ownership, livestock raising being a very old activity of the rural people in this area. The rural communities that have land into ownership

in the Retezat National Park, but are at a greater distance from the park limits, are less influenced by the existence of the Retezat National Park. These are mainly interested in continuing the grazing activity in the Retezat National park and to a lesser extent in the use of other natural resources, such as the wooden products, wild berries, mushrooms and medicinal herbs.

These rural communities have a special importance, adding specific traditional and cultural value to the natural value of the Retezat National Park, thus significantly contributing to the increase of this area attractiveness.

Tourism in the Retezat area is a common practice in the summer season, in winter the tourism routes being hardly accessible. Although winter tourism can provide great satisfaction through the unique landscape, few tourists venture to face the harsh winter in the Retezat mountains. Over the winter, there is only one permanent point of Salvamont service, at Râuşor.

The main activities, which not controlled, can have a noticeable impact upon the physical environment, are the following:

- Inadequate exploitation of natural resources (clear cuttings, inadequate exploitation of forests, clearing of juniper trees),
- Uncontrolled tourism and mountain climbing, with free access to any area of the park,
- Concentration of visitors in certain areas of the park,
- Free, uncontrolled access in the areas with geomorphologic units with special value, mainly in the calcareous areas (in the caves),
- New investments/constructions, maintaining the old buildings non-adapted to the landscape or the renovation of the existing buildings in an inadequate style.

The tourism regulation measures will have to take into consideration the negative effects that visitors may have upon the landscape, which in time may lead to the decrease of attractiveness of the Retezat National Park.

In the areas where the human activities brought about significant changes to the natural landscape, namely around the chalets, in the areas with sheepfolds or in the areas under roads or around Râu Mare storage reservoir, corrective measures are imposed so as to reduce the negative effects.

The rural communities play an extremely great role in reaching the management objectives of the Retezat National Park. The strategies and development plans of the local rural communities will have a direct and indirect influence upon the strategies and plans designed for the Retezat National Park.

At the same time, the strategies, plans and activities related to the Retezat National Park will categorically influence the local rural communities. The promotion of certain strategies and plans based on the sustainability concept benefits both the local rural communities and the Retezat National Park Administration.

The local rural communities should promote integrated development programs of the area, yet the experience in planning and implementing these activities is quite poor. At the same time, the access to information to support the development efforts is extremely low.

The traditions and traditional products have a low share in the economic life of the communities, yet their revigoration and promotion could support the activities dedicated to biodiversity conservation in the area. The presence of the Retezat National Park, protected area of national and international interest, can persuade the authorities to focus more on investments and economic development of the area.

The rural communities in the area have projects in certain stages aiming at the improvement of infrastructure in the area, waiting for financing sources. The presence of the Park and the link between this and the communities might provide the potential funding entities with an extra reason to support these projects and initiate new investments. It would be opportune for the Administration of the Retezat National Park to help the local communities to find funding sources for these projects and find trainers to prepare the community members to write the projects for accessing the EU funds.

At the same time, the presence of the national park is an opportunity for promoting the area, for the attraction of funds by sustainable development programs and for the development of economic activities related to tourism, prioritarily promoting the area on the national and international tourism market.

The advantages of the hydrotechnical barrages are the following: obtaining cheap electric power, ensuring permanent water for irrigations and other uses, diminution of flooding risk downstream the barrage, leisure lakes, large aquatic areas, resulting in natural colonization of aquatic birds, from other areas, obviously in the lake Gura Apelor as well.

The disadvantages and negative impact of barrages are the following: high cost of barrage and hydrotechnical constructions, danger of barrage collapse at high pressure, which can result in great disaster in the downstream area; clearings and losses of forestland or agricultural land from the area under the lakebed; the huge quantities of stored water can result in earthquakes; massive water losses through evaporation; the downstream land areas washed, eroded, of the sludge rich in nutrients; fish migration for spawning is constrained.

The construction of the accumulation barrage from Gura Apei by shooting, explosions, the construction of roads, refuse heaps, the change of the hydrological regime, gas and noise pollution due to road vehicles, uncontrolled circulation, in the reservation inclusively, contributed to a negative ecological impact upon the entire zone. Furthermore, for the building of the reservoir lake, a total area of 450 ha of forest was cleared in the period 1976–1980.

In certain areas, the reservoir lakes produced moisture excess and raised the ground water layer, at the same time creating new concentration areas for aquatic birds.

For the territory of the Retezat National Park, a negative influence is exercised by the secondary head races that take over part of the waters from the rivers Paroş,

Beagului, Nucşoara (Sibişel), Ruşor, Vlădăreasca, Pârâul Turcului, Radeş, Zlata and Văgăuna Neagră, crossing the underground territory of the national park up to the barrage area, diminishing the normal water flow of these rivers.

The hydrotechnical constructions from Ţara Haţegului – Retezat (the barrage from Gura Apelor, the catchments of Bărbat, Alb, Mucşoara and Ruşor rivers, the underground tunnels, the micro-power stations on Râul Mare river, the access roads) have brought about and continue to bring about quantitative and qualitative changes in the hydrological regime and in other components of the ecosystems in the zone, adversely impacting the ecological equilibrium in the area.

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