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DEPARTAMENTUL DE GEOGRAFIE, TURISM
ŞI AMENAJAREA TERITORIULUI

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Seria GEOGRAFIE

TOM XXI
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CONTRIBUTIONS TO INVENTORY AND ASSESSMENT OF THE GEOMORPHOSITES FROM CALIMANI NATIONAL PARK. CASE STUDY: BISTRICIOR MASSIF

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Abstract: Călimani National Park belongs to Călimani Mountains, extends on a surface of 24,041 ha and superposes over the districts of Suceava, Harghita, Mureş and Bistriţa-Năsăud. It conserves elements of flora, fauna and relief that stand out through a very high attractive potential, a fact which determines massive flows of tourists and enables diversified leisure activities. An important role in administrating this protected area, as well as in capitalizing its attractive resources, is given to the process of inventory and assessment of the relief forms with a scientific, aesthetic, cultural, ecologic and economic relevance, and that of the geomorphosites. Henceforth, the present work is meant to assess from this point of view a potential geomorphosite within the Călimani National Park, namely the Bistricior Massif. As such, an assessment methodology used on an international scale has been applied, and the obtained results plead for granting the status of geomorphosite to the Bistricior massif. This fact is particularly relevant not only for the future touristy development and capitalization strategies, but also for the activities of management and conservation of the natural resources within the above mentioned National Park.

Key words: geosites, geomorphosites, assessment criteria, Cusma site, Colibita Depression, Bistricior Massif, Calimani Mountains, Calimani National Park

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FOREWORD

Within the latest two decades, along with the intensified preoccupation for environmental protection and conservation, a new research direction took shape in geomorphology as well, meant to point out the valences of the relief as an element of natural inheritance, which has to be given the same attention as for the biotic components (Panizza and Piacente, 1993; Panizza, 2001; Reynard, 2005; Reynard and Panizza, 2005; Panizza and Piacente, 2008; Ilieş and Josan, 2009a, 2009b; Reynard and Regolini-Bissig, 2009). Thus there were formulated such concepts as geodiversity, geosite, geolandscape, geotop and geomorphosite, there was established a methodology of research for geodiversity and geomorphosites and there were also elaborated numerous works concerning the inventory, assessment and capitalization of the geomorphosites in different regions of the world, including the Romanian Carpathian mountains.

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In this context, the present work is meant to continue these preoccupations by bringing into debate the Bistricior Massif from the Călimani Mountains, within the Călimani National Park, as a potential geomorphosite (www.calimani.ro). This massif, as a "stand alone" geomorphologic entity, is little known in the specialized literature but is mentioned in different works related to Călimani Mountains (Cosma et al., 1963; Naum, 1969; 1974; 1989), and Colibița Depression (Bâca and Șteff, 2010) or on the occasion of some studies concerning the glaciation within the Oriental Carpathians (Athanasiu, 1899; Savicki, 1912; Krautner, 1930; Someşan, 1932; Sârcu, 1964; Naum, 1970; Mândrescu, 2001).

On the other hand, from a touristy point of view, the Bistricior massif is a well-known and visited location especially by those fond of mountain climbing, the access toward this objective being made from the valleys of Mureş, Dorna and Bistrița Ardeleana. This area also has a status of complex reservation (category IV according to IUCN) within the Călimani National Park and the website "Natura 2000 Cuşma" (www.usamv.ro/cusma), conserving forms periglacial relief and items of sub-alpine flora and fauna. By its geomorphofunctional position and its natural valences, we consider that the Bistricior massif meets the major criteria to be included in the category of geomorphosites, a fact also emphasized by the results obtained thorough the assessment in the present study.

WORK METHODOLOGY

The research activity for Bistricior massif took place within the period of 1995-2010, when observations were made on the periglacial relief, the up-to-date morphogenetic processes and tourist practices from this area. In this respect the specialized bibliography referring to certain geologic, geographic and touristy problems was looked into, there were consulted cartographic and photographic materials, archived documents regarding area humanizing, forestry exploitation and specific development, as well as thorough observations on different morphogenetic and geomorphodynamic aspects (relief as a whole, detailed relief, slope processes, anthropogenic impact, etc.). A distinct attention was given to touristy circulation, monitored with the support of the Salvamont formation in charge with the area. A part of the research results were turned to account in the work *"Colibița-dimensiuni turistice"* (Bâca and Șteff, 2010), and others are to be published in the future period. Relying on the great volume of materials gathered and sorted within this period, the next logical step is to get to the evaluation stage of the massif, with the purpose of it being accredited as a geomorphosite.

To this end there were consulted numerous specialized works from the latest two decades, dealing with the problem of geomorphosites and their inventory and assessment (Panizza and Piacente, 1993; Pralong, 2005; Pralong and Reynard, 2005; Reynard, 2005; Reynard and Panizza, 2005; Reynard, 2006; Reynard et. al., 2007a; Reynard et. al., 2007b; Pereira et al., 2007; Ilieș and Josan, 2007; Panizza and Piacente, 2008; Reynard et al., 2009; Ilieș et al. 2009; Comănescu et al., 2009; Comănescu and Nedelea, 2010 etc.) so as to adapt information according to international standards.

As a result, given the specificities of Bistricior Massif in what concerns extension, geospatial relations, genesis, geomorphometry and touristy exploitation, preference was given to the assessment criteria proposed by Reynard (2006).

STUDY AREA

Bistricior massif is situated in the north-western part of the Călimani Mountains (figure 1), at the contact with the area of Bârgău Mountains, between Șaua Terha (1470 m) at N, Valea Dornei at NE and E, Șaua Struniorului (1760 m) at SW, Pârâul Mijlociu at S, Șaua Scurtu (1350 m) at SW and the sources of Bistrița Ardeleana (Colbu and Tirimiul de Sus) at NE.

From an orographic point of view, the Bistricior Massif is part of the Priporul Roşu-Buba-Terha-Bistricior-Scurtu ridge, which borders Colibița Depression at E and SE, being linked to the high central area of the Călimani Mountains through the Strunior-Ciunget-Pietrosu ridge (figure 2).

The massif's individualization took place after the ceasing of eruptions in Călimani (superior pontian), through the fragmentation of a lava plateau from the western part of the central cone, under the action of fluvial erosion manifested in this sector by the valleys of Dorna, Bistrița Ardeleană and Răstolița.

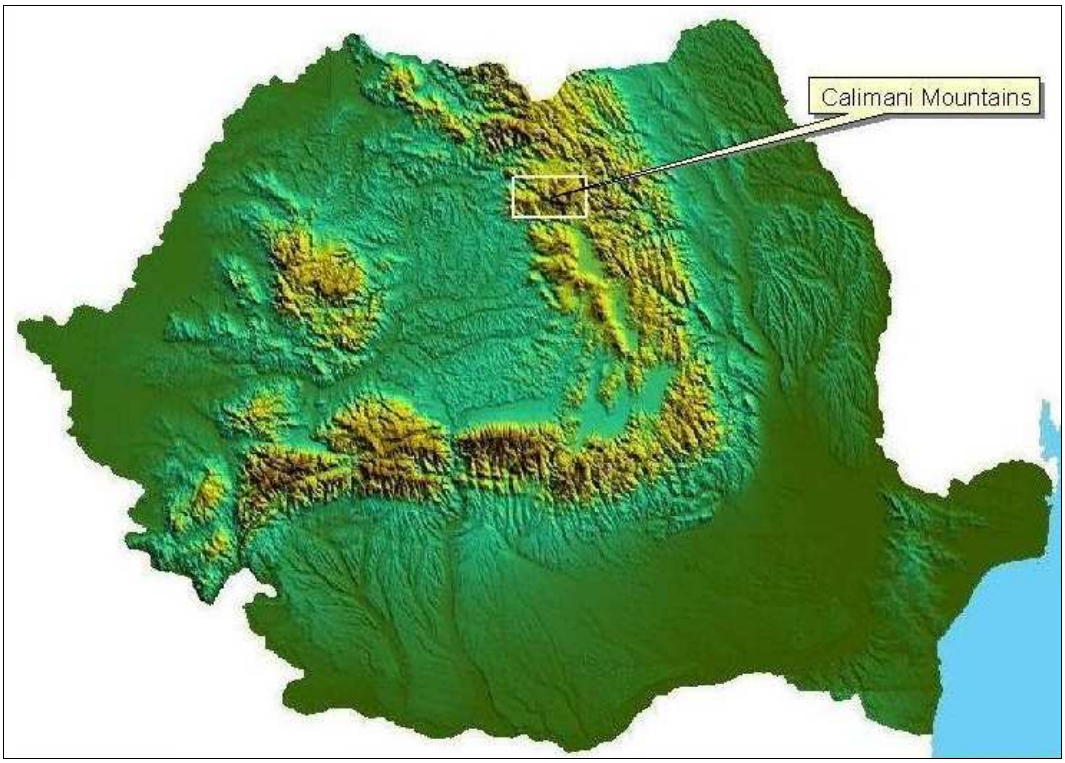

Figure 1. Geographic position of the Calimani Mountains in Romania

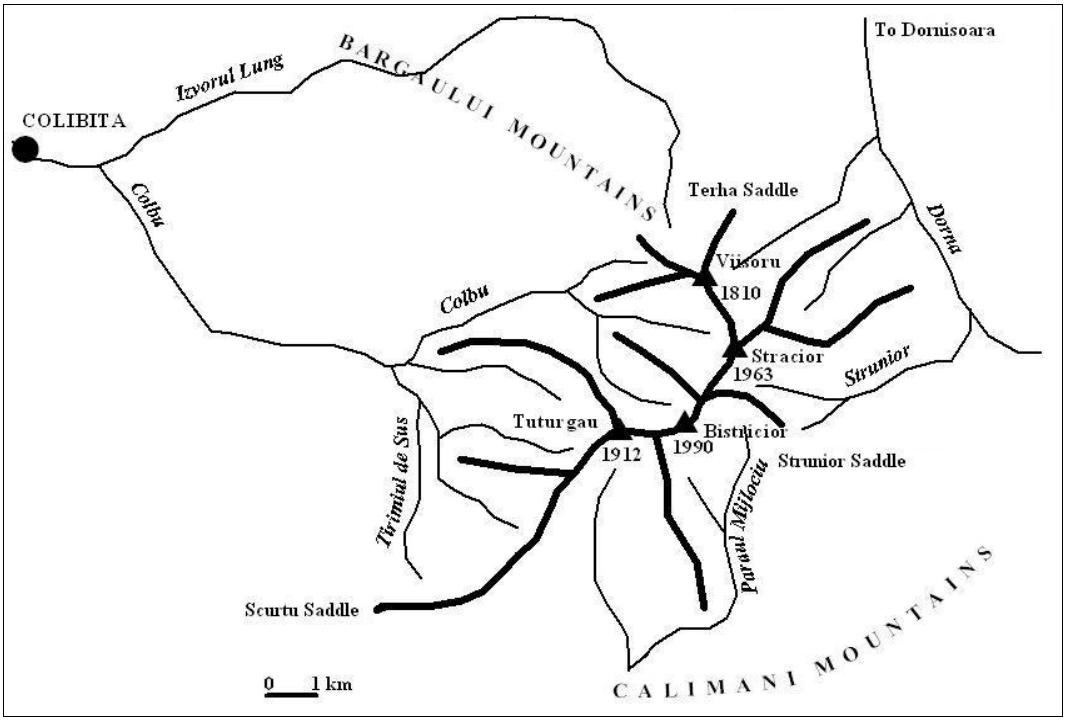

Figure 2. Geographic location of Bistricior massif within the Călimani Mountains

Detached from the mountain mass of the Călimani, the Bistricior Massif overlooks towards east and north-east the valley of Dorna (1050-1300 m), towards north-west the knolls of southern Bârgău (Căsaru, 1591 m; Măgurița, 1581 m; Dl. Ariilor, 1546 m; Cornu, 1510 m), towards west the Colibița Depression (800-1000 m), and towards south-west the ridge Piciorul Scurt-Chicera lui Pasăre-Țiganca (1300-1500 m) from the Călimani Plateau.

The massif's flanks stand out through geomorphometric parameters of high values and bear the imprint of periglacial moulding within the Pleistocene. Thus there can be noticed semi-funnels and cryonival corridors, nival niches, residual ridges, rocky formations and detritus fields (figure 3).

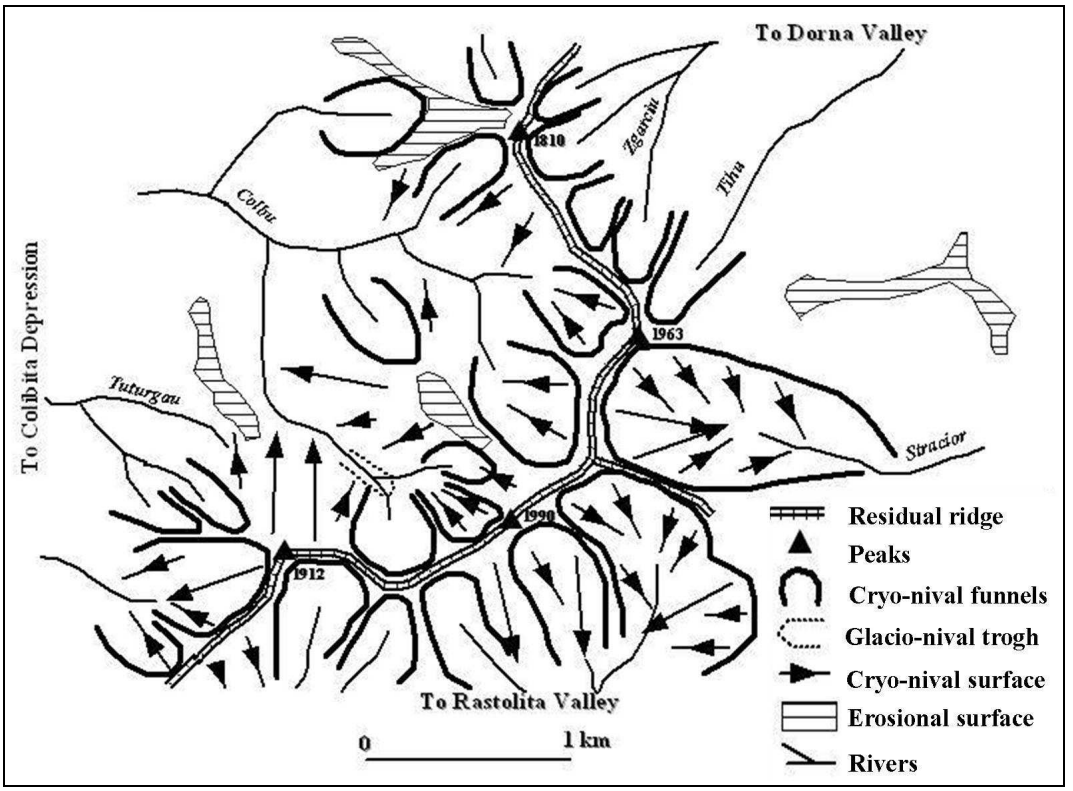

Figure 3. Periglacial complex from Bistricior massif

The main ridge of the massif has a sinuous shape, from North-East versus South-West, as function of the intensity of erosive processes reported to the limitary erosion bases. There stand out three peaks over 1900 m, namely Străcior (1963 m), Bistricior (1990 m) and Țuțurgău (1912 m). As for the ridge's configuration as a whole, three distinct sectors can be delimited, as follows:

- the Viișoru-Străcior sector, flatly shaped, dominated on the terminal side, towards Șaua Terha, by residual rocky formations covered by junipers, out of which there stands out the peak Viișoru (1810 m);

- the Străcior-Bistricior sector, narrow and slightly unleveled, marked on the southern side by numerous nival niches;

- the Bistricior-Țuțurgău sector, steep, unleveled and narrow, marked by residual peaks, deep ensaddlements, rocky formations and detritus fields.

Preoccupations regarding the research of glacio-nival relief in Călimani Mountains are to be foreseen in the works of Athanasiu (1899), Savicki (1912), Krautner (1930), Someșan (1932), Sârcu (1964) and Naum (1970). Strictly referring to the Bistricior massif, Savicki (1912) mentions

"glacial traces on its northern slope", whereas Sârcu (1964) asserts that the two valleys on the north-western slope of the massif, namely Colbu and Gura Plaiului, are not of a glacial origin, and Naum (1970) considers that "in the western part of the massif, under Bistriciorul Peak (1990 m), there appear two nivation troghs at the altitude of 1800-1850 m" and that "in Bistricior there may have existed embryonic or nival glacial troghs".

Recently, Mândrescu (2001) confirms the nival origin of the troghs under Bistriciorul Peak, correlating them as altitude with the inferior alpine troghs from the glacial basin of Lala or the troghs Cobăşel, Gropile and Pietroasa (Rodnei Mountains).

RESULTS AND DISCUSSIONS

Bistricior massif is situated in the western part of the Călimani Mountains National Park, lies on a surface of 25 km² and administratively superposes the districts of Bistrița-Năsăud (north-western flank), Suceava (eastern and north-eastern flank) and Mureș (southern and south-western flank) (figure 4).

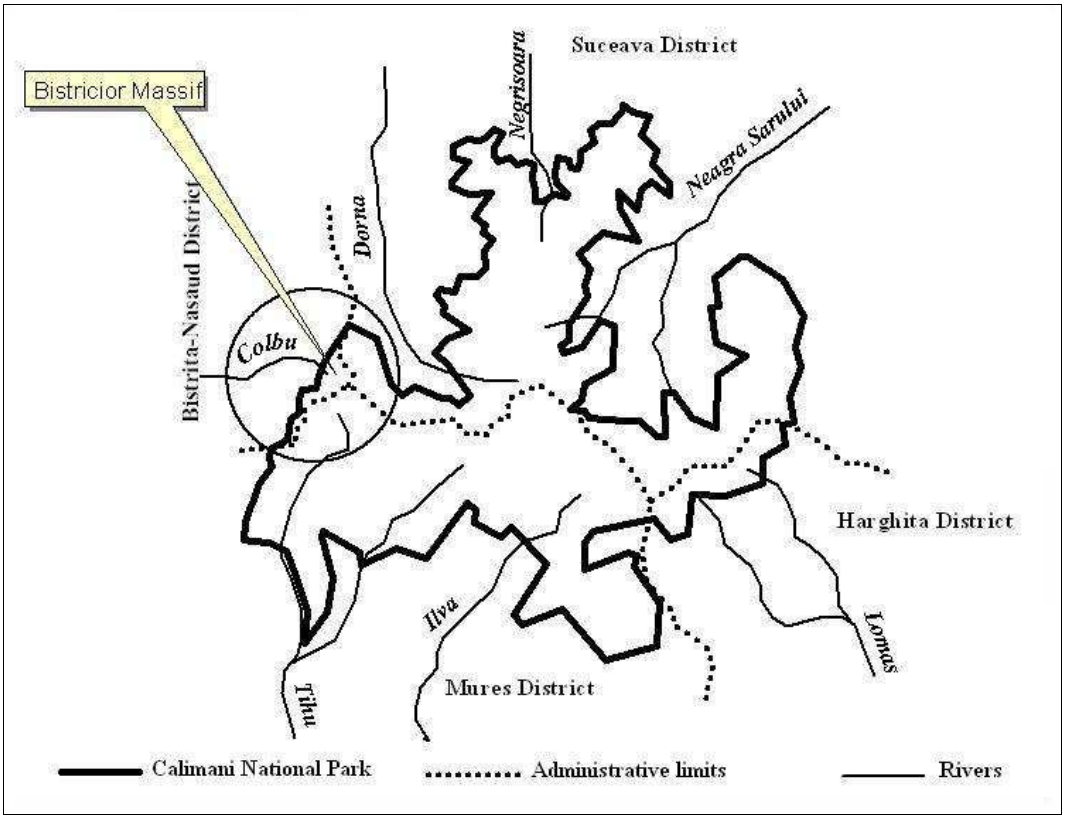

Figure 4. Calimani National Park and Bistricior Massif

Among other geomorphologic landmarks such as 12 Apostoli, Pietrele Roșii, Pietrosu or Reținș, Bistricior can embody a potential geomorphosite within the National Park. It distinguishes through representative altitudes and through a certain degree of isolation within the Călimani Mountains, a fact that confers it a spectacular position from a geomorphologic and touristy point of view. Likewise, the Bistricior massif holds the status of complex reservation within the site Natura 2000-Cușma, managed by the Local Council of Bistrița-Bârgăului, preserving forms of periglacial relief (residual ridges and peaks, semi-funnels and cryonival corridors, narrow valleys, steep slopes, rocky formations and gelifraction fields) along with

elements of sub-alpine vegetation such as the juniper on the two flanks. Its surface, drastically reduced in the past in order to achieve more pastures, is currently rehabilitated, which proves beneficial for both biodiversity and the softening of the morphodynamic processes.

Henceforth, paying respect to the fact that the geomorphosite represents a form of relief with scientific, aesthetic, cultural, ecologic and economic valences (Panizza, 2001), it was opted, in the assessment process of the massif, for the analysis of these dimensions, taking into account the criteria and the marking scheme advanced by Pralong (2005), Reynard (2006) and Pereira (2007).

The results of this assessment are presented in the tables 1-6 and reflect, as objectively as it gets, the personality of the Bistricior massif, showing the place held by this one within the mountainous geosystem it belongs to, as well as reported to the whole National Park of Călimani.

The criteria applied for the quantification of each value (scientific, aesthetic, cultural, ecologic, economic), are relevant for the analyzed geomorphostructure, and the score (0-1p) was supported by certain arguments revealing brief and concrete information on the geomorphofunctional and environmental situation from the massif.

Table 1. Scientific value of the Bistricior geomorphosite (after Reynard, 2006, modified)

Criteria	Assessment	Score
Uniqueness within the area	The massif is one of the most important subunits within Călimani Mountains, shaped on compact volcanic rocks, along with the central caldera and the ridge Pietrosu-Răţiţiş-Strunior	0.80
Integrity	The massif underwent anthropic and natural altering (pasturing, forestry exploitation, mining prospects), and yet it preserves its geomorphofunctional features	0.80
Representativeness of the geomorphologic processes and didactic value	The massif is a good example for the past and present periglacial geomorphologic processes of the sub-alpine level (gelifraction, nivation, geliflux, suffusion, detritus movement)	0.80
Paleogeographic value	The geomorphosite individualized itself through the dissection of a lava plateau situated on the western flank of the central cone in Călimani Mountains	1.00
Number of relevant geomorphologic features	Over 3 (massiveness, geomorphometric parameters of high values, periglacial, glacionival and fluvial relief, etc.	1.00
Geologic features with impact on relief	The volcanic processes generated complex minerals, and their prospecting along the superior course of Colbu valley generated certain forms of anthropic relief (sterol dumps, roads, ditches, etc.)	0.50
Cognition degree in specialized publications	Medium (articles on national scale, tourism works)	0.20
Scientific value	The geomorphosite is representative for the evolution of volcanic relief and for periglacial shaping	0.72

Table 2. Ecologic value of the Bistricior geomorphosite (after Reynard, 2006, modified)

Criteria	Assessment	Score
	Through its features, the geomorphosite	

Ecologic influence	sustains the development of forestry and sub-alpine ecosystems	1.00
Protected sites	The massif is a protected area within the site Natura 2000-Cuşma and preserves forestry and sub-alpine ecosystems that develop in close connection with the geomorphometric conditionings	1.00
Ecologic value	The geomorphosite is representative for the development of sub-alpine ecosystems	1.00

Table 3. Aesthetic value of the Bistricior geomorphosite (after Reynard, 2006, modified)

Criteria	Assessment	Score
Visibility	By its altitude, the massif ensures a great visibility over the landscape, and its aesthetic image is emphasized by the proximity of geomorphologic elements that define it	1.00
Contrast, vertical development and space distribution	The geomorphosite dominates Dorna valley, Colibița depression, Călimani plateau and the tops of southern Bârgău	1.00
Chromatic diversity	Rocky formations, stone flows, sub-alpine pastures, conifer forests	0.50
Aesthetic value	Owing to its imposing physiognomy, the Bistricior geomorphosite is characterized by a high aesthetic level	0.83

Table 4. Cultural value of the Bistricior geomorphosite (after Reynard, 2006, modified)

Criteria	Assessment	Score
Religious and symbolic importance	It does not support religious activities	0.00
Historic importance	On the main ridge, between the peaks Străcior and Bistricior there are preserved defensive ditches and firing emplacements from the 1st World War	0.50
Literary-artistic importance	It does not support literary-artistic activities	0.00
Cultural value	The cultural dimensions of Bistricior geomorphosite are scarce	0.16

Table 5. Economic value of the Bistricior geomorphosite (after Reynard, 2006, modified)

Criteria	Assessment	Score
Accessibility	The access to the massif is made on forestry roads with terrain vehicles and on foot, as well as on pastoral paths and touristy marked tracks	0.50
Present capitalization and geomorphologic interest	The massif is promoted and capitalized for its geomorphologic features in activities of mountainous and scientific tourism and extreme sports	0.80
Capitalization of other natural elements	The Bistricior massif is promoted and capitalized as protected area with sub-alpine and forestry vegetation within the Călimani National Park and the site Natura 2000-Cuşma	0.80

Legal protection and capitalization restrictions	Protected area, with limited exploitation restrictions	0.50
Equipments and services	The touristy accommodation facilities are placed over 10 km away, in Colibița depression. Under the main ridge in Poiana Gura Plaiului there is a Salvamont refuge offering shelter to the tourists	0.20
Economic value	Through its features, Bistricior geomorphosite represents an important touristy objective, alas with a rather modest capitalization due to the access difficulties and lack of accommodation facilities	0.56

Table 6. Protective value of the Bistricior geomorphosite (after Reynard, 2006, modified)

Criteria	Assessment	Score
Integrity	The anthropically induced changings do not affect the essential geomorphologic features of the relief	0.80
Vulnerability	The geomorphologic and biogeographic elements may be anthropically altered	0.80
Protective value	The situation of Bistricior geomorphosite is relatively stable, but the legal protection and conservation code is not yet clearly defined	0.8

CONCLUSIONS

By processing the data from tables 1-6 there have been obtained global values related to the scientific, aesthetic, cultural, ecologic, economic and protective dimensions of the Bistricior massif, and its global value is 0.685 (table 7), one that exceeds, for instance, the values obtained for other geomorphosites in the Romanian Carpathians such as: Ocolaşul Mare from Ceahlău National Park (0.55), Babele or Sfinxul from Bucegi Mountains (0.62) (Comănescu and Dobre, 2009; Comănescu et al. 2009; Comănescu and Nedelea, 2010).

Likewise, the global values on categories of criteria are comparable with those established by the above mentioned authors for the assessed geomorphosites (table 8):

Table 7. Global value of the Bistricior geomorphosite

Scientific value	Additional value (C+Sce+Eco)	Economic value	Protective value	Global value
0.72	0.66	0.56	0.8	0.685

Table 8. Compared global values

Geomorphosite	Scientific value	Aesthetic value	Cultural value	Economic value
Caraiman plateau	0.47	0.6	0.6	0.9
Ocolaşu Mare	0.66	0.75	0.5	0.3
Bistricior	0.72	0.83	0.16	0.56

In the case of the Bistricior Massif, one can notice that the highest scores are recorded by the scientific, additional and protective values, a fact that emphasizes the massif's importance on a touristy and environmental scale. Therefore, the future actions of touristy development and capitalization initiated by the administrative authorities of Călimani National Park and Natura 2000 Cuşma site must be oriented

towards the protection and conservation of the attractive patrimony and towards promoting some touristy practices with a very diminished impact on the landscape.

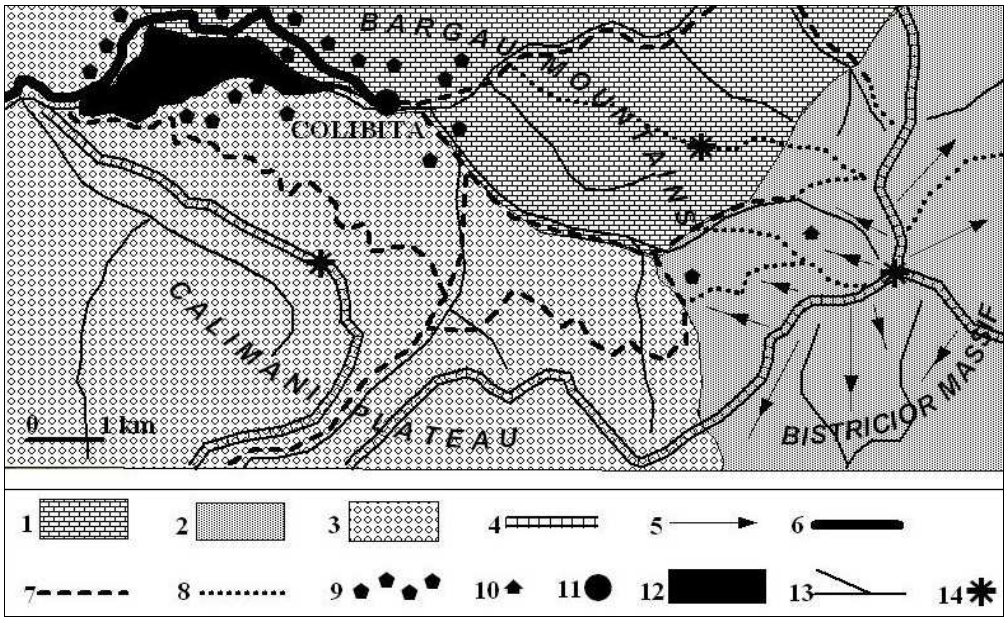

Figure 5. Geotourist map of the Bistricior geomorphosite and Colibita Depression
1.Landforms carved on sedimentary rocks 2.Landforms carved on andesitic rocks 3.Landforms carved on volcanic conglomerates 4.Residual ridge 5.Residual slopes with avalanches and rock falls hazard 6.Main road 7.Forest roads 8.Tourist path 9.Agritourist pensions 10.Shelter 11.Rural settlement 12.Reservoir 13.Rivers 14.Scenic overlook

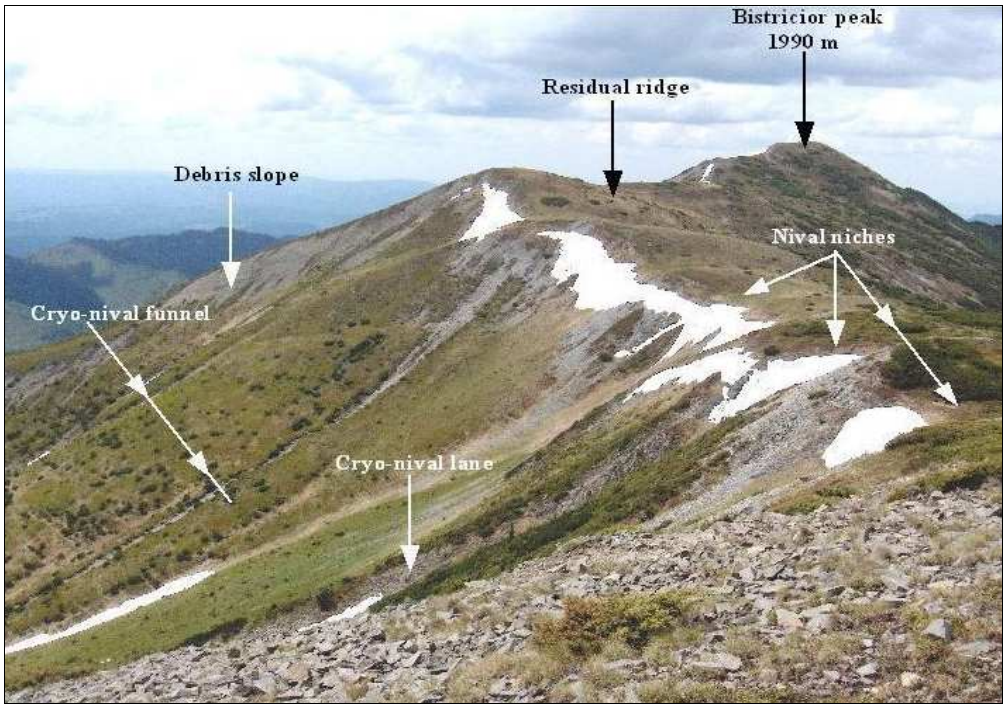

Figure 6. Overview on Străcior-Bistricior ridge revealing the relief's scientific and aesthetic dimensions

As a result, of this assessment there can be stated that the Bistricior Massif from Călimani Mountains and Călimani National Park meets the minimal conditions to acquire the status of geomorphosite. By location, altitude, cultural-historic implications, as well as geomorphologic and biogeographic features, this one represents an important touristy landmark within this Carpathian sector (figure 5, figure 6) and a noticeable protected area within the site Natura 2000 Cuşma.

Another advantage in capitalizing its attractive potential is the proximity from Colibița depression, which is the main access "gate" towards the massif, registering over 300 touristy facilities and having, yet unofficially, the status of climacteric resort (Bâca, 2009).

In the Gura Plaiului clearing, under the Bistricior peak, there is a Salvamont refuge, where mountaineers can find shelter. One need mention here as well the proximity of Dorna and Răstolița valleys, absorbing tourist fluxes from Dorna depression and Mureş valley, which is facilitated by the presence of certain access routes (forestry roads), as well as some marked touristy tracks.

Aknowledgements

The present work represents a part of the research results processed in order to elaborate the visiting strategy for the site Natura 2000 Cuşma, from the management plan of this site, initiated by the City Council of Bistrița Bârgăului, as well as a part from the reference material prepared for the project "Federation for the development of Bârgău-Călimani rural area", proposed by the Chamber of Agriculture of Bistrița-Năsăud District and advanced for financing to the Agricultural and Rural Development Direction of Bistrița-Năsăud District, on the axis 4 LEADER. The authors acknowledge to anonymous reviewer for their thoughtful suggestions and comments.

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USE OF IMAGES ALSAT1 FOR THE IMPLEMENTATION OF MAPS LAND IN SEMI-ARID AREA - CASE OF THE AURÉS REGION (ALGERIA)

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Abstract: Algeria is one of many countries which have a natural potential importance with its situation and its territorial sizes. Submit today to impulse of climate tinted by aridity, when the effects conjugate more and more with intense socialization of géosysteme especially in mountainous zones and steppe ones a big part of territory is threaten by desertification. In dowering, of the new generation of satellite of average resolution Alsat1, Algeria today is one of the countries, users of spatial information in different fields especially the mapping of natural resources. This work which consist the realisation of soils occupation map of the Aurès region. This map makes it possible to do a locality state, of vegetal cover and its spatial articulation with the other environment components. We used the Alsat1 picture (13 March 207 scene) which it consist of three spectral bands of 32 m resolution. For this purpose, the methodology approach has been determined when in first time; a colored composition has been obtained for the location of samples and extraction of support points, then a geometry correction has been applied on the picture in order to georeference it in relation to of the topographic map. In a second time, a supervised classification based on maximum likelihood method has been used on the three channels of picture. The occupation map realized by the classification makes appearing of different themes selected (12 themes) when the big wholes stand out clearly, characterizing the different classes of soil occupation of the region. So the picture Alsat1 makes it possible to arrange the new information in the region of study and identify very quickly the big themes in presence and seize their spread.

Key words: Images Alsat1, Supervised classification, Map of soil occupation, The semi-arid areas, Aurès.

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INTRODUCTION

Currently, the arid and semi-arid areas are subject to significant anthropogenic pressures which are highly dependent phenomena, sometimes irreversible, desertification and degradation route (Bensaid, 1997; Haddouche, 2002).

These areas require inventories synchronic and diachronic of their potential biological based on sound knowledge of existing resources and eco-geographical conditions. Effective management of this heritage requires the prior mapping and inventory of available resources. In

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addition to these statistics, it is essential to track and monitor the dynamics of the environment due to land cover changes taking place as a result of several factors: soil degradation, overgrazing, introduction of culture Mechanized, industrial, pharmaceutical and household plant resources etc. This strong pressure on resources requires planning and response activities in the territory based on a more precise knowledge of degradation of vegetation cover (Bensaid, 1997; Benmessaoud and al., 2009)

It is therefore vital to develop strategies for monitoring and managing the environment and agriculture. These strategies should be based on technological performance (Garouani and. al. 1993; Haddouche, 2002).

Satellite imagery is now a major source of information for observing the Earth's surface. Algeria's economic potential with these countries is among users of spatial information in various fields particularly in the mapping of natural resources (Bensaid, 1997; Benhanifia, 2003).

The data used in this study include images of the new generation of satellite Algerian Alsat1 of March 13, 2006 with a ground resolution of 32 meters and three spectral bands in the visible (G , B) and near infrared (IR) (table 1).

Table 1. Specifications of ALSAT1

Platform	Altitude: 686 km Orbital inclination 98.2 ° Weight: 90Kg Repeatability: 5 days Time: 1 hr 39 min
Payload (Camera)	It consists of two cameras with special tape (2 of 10200 pixel CDD arrays channel) Focal 150 m Spatial resolution: 32 m Fouchée: 600 km Special bands: Green - Red - Red PI Field of view (FOV): 23.62 ° Coding: 8 bits per pixel

The objective of this work is:

- To appreciate the application fields of remote sensed data to medium spatial resolution images;
- Alsat1 for the establishment of inventories of renewable natural resources in arid and semi arid and understanding of the functioning of the ecosystem in place;
- Undertake a land use map and land use across the Aures region;
- The availability of periodic images Alsat1 will track the evolution of the relevant areas.

PRESENTATION OF THE STUDY AREA

Aurés region located 500 km south East of Algiers. Nememchas is constituted with the eastern end of the Saharian Atlas, which represents the physical boundary between the North and South of Algeria (Ballais, 1981).

It is bounded on the north by the town of Batna (West) and the town of Khenchela (East) and the south by the Wilaya of Biskra. The study area covers a total area of 12,428 sqkm Geographically, the study area is located between the meridians (5° 40' and 7° 10') and parallel (34° 45' and 35° 33').

Our study area is characterized by a climate of Mediterranean type semi-arid in the north and arid in the south with a winter marked by cold, low rainfall, a long dry season and frequent frosts (Abdessemed, 1981; Ballais, 1981).

These conditions are expressed in terms of constraint for the development of crops and vegetation. The landscape that emerges there then comprises different ecosystems, which are traditionally a farming area, an area of transhumance pastoralism, with local points of settlement, oases, forests

and crops. These characteristics of the physical environment and in particular those of the land give the region a vocation like agro-forestry-pastoral (Abdessemed, 1984).

The region is characterized by steep slopes over short distances. On the north side elevation varies between 1200 m and 2300 m. On the south it descends to the north to less than 50 m (Ballais, 1981; Ansar, 2002). Seen as a whole, the Aures region appears as a powerful gabled roof, asymmetrical, ride, parallel. This mountain range oriented northeast / southwest (Orientation typical chain Atlas). He wears 2200 - 2300 m its summit ridge (Mehmel, Chélia). North of this ridge fallout quick 10 or 20 km establishes the link with the high plains at 900 m between Batna and Khenchela. In the South, a long slope leads in 50 or 60 km Saharan piedmont, located at 100 m. These steep slopes have distributional consequences of climate and natural resources.

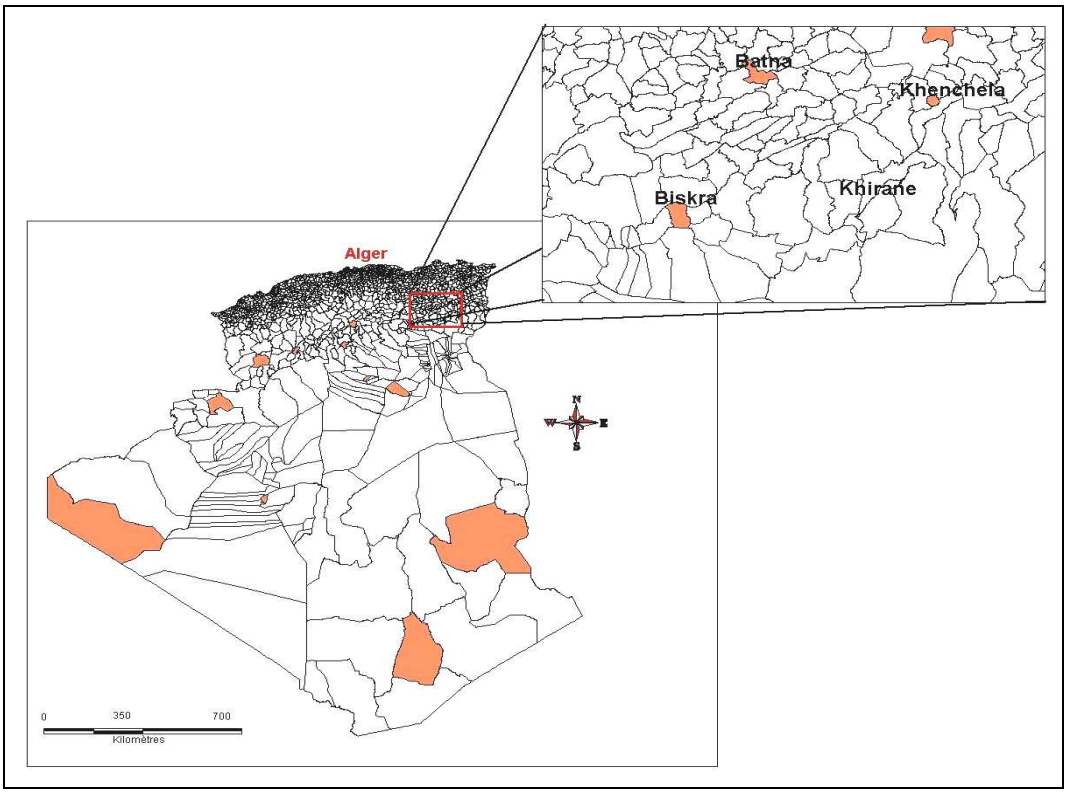

Figure 1. Location map of study area

MATERIAL AND METHODS

The adopted step consists in using rough satellite images of the Algerian satellite Alsat1, taken on March 13th, 2006 with 9:38' with a solar rise in 56,6°. The pilot zone is covered by the image with dimensions: 5541 X 3875 pixels out of the 03 bands (IR, G and B).

The analysis of the spectral signature of the various objects of the occupation and land use is a big step for the choice of the bands. However, a ground and sampling work for the checking of the real state of the ground, in order to carry out an analysis set of themes of this space, was carried out.

The use of a GPS (Global System Positioning) facilitated the collection of the coordinates of the canters of the pieces and for a precise geographical location of the ground data in the sampling complain as well as for the checking of the state of the ground.

THE DIFFERENT PHASES OF ANALYSIS

A). The color composition: The color composite was obtained from a superposition of three bands (IR, G, and B) of the scene. It was used as a starting image to guide image processing, ground sampling and extraction points for a possible geometric correction.

B). Geometric Correction: Geometric corrections can offset all or a portion of these deformations distortion (Ferdinand, 1996). For geometric correction of the image, a polynomial model of degree of deformation (2) was adopted using (11) support points of reference.

C). Image classification: This is the mode that was overseen chosen for the classifications of the medium. The method of maximum likelihood was used for image classification (Dubois, 1997; Ferdinand, 1996). This method is considered as a powerful technique of classification. The decision rule of this method is based on the probability of a pixel belonging to a particular class (Fojstng, 1999).

SAMPLING MISSIONS AND GROUND TRUTH

To produce and design the map of land of the Aurés region, we relied on the contact details of land that were collected during the sampling missions (Spring 2008). These missions were conducted to locate and met a number of plots representing various types of land that we meet on the study area (figure 2) in relation to their spectral signature.

Figure 2. Photos of degraded forests in the Aurés region.

The different classes have been selected

1. Dense forest;
2. Clear forest;
3. Forest very clear;
4. Irrigated crops;
5. Course plains;
6. Course of the steppes;
7. Bare soil dominated by sandy texture;
8. Bare soil and rocky terrain;
9. Water Barrage;
10. River; Marly outcrops of bare lands;
11. Shadow

VALIDATION OF THE CLASSIFICATION

It is possible to evaluate the performance of this classification by assessing the percentage and number of pixels correctly classified. The interior of each polygon test. The confusion matrix illustrates this performance (table. 02).

The analysis of this validation enabled us to emit some remarks, in particular: the very heterogeneous pieces tests are particularly well classified, for example the distinction is very clear between a culture and a forest cover. Whereas the other pieces whose taxonomic contents correspond, in fact, to a badly classified mosaic (covered clearly and very clearly) are much homogeneous, thing which increases the rate of nuance. However, the average performance of classification is around 82 %, a value which seems to be acceptable. Moreover, the use of the

matrix of confusion to determine the relevance and the quality of the classified image enabled us to establish a link between the classified image and the field real state. In addition to the confusion matrix, we preformed the statistical calculations to allow a determination of the percentages and areas of occupation and land use of each of the formations present in the foloowing table:

Table 2. Confusion matrix of the estimated classification image Alsat1 for the period of 2006

	Total pixels	shadow	marly outcrops of bare lands	river	water barrage	bare soil and rocky terrain	bare soil dominated by	course of the steppes	course plains	irrigated cultivation	forest very clear	clear forest	dense forest
Dense forest	8679	123	0	0	42	1	0	0	0	0	1295	629	6589
Clear forest	4501	24	0	0	0	40	0	0	0	0	1598	2258	581
Forest very clear	7496	76	0	0	3	108	0	0	46	85	5939	923	316
Irrigated cultivation	2396	0	0	0	0	40	2	0	0	1179	1105	70	0
Course plains	5360	32	234	0	3	332	0	31	4724	0	4	0	0
Course of the steppes	5490	0	25	17	1	148	8	5253	38	0	0	0	0
Bare soil dominated by sandy texture	4495	0	20	1	0	457	3892	112	0	13	0	0	0
Bare soil and rocky terrain	6466	1	117	2	1	4530	136	75	113	32	1391	68	0
Water Barrage	792	38	0	0	612	31	0	0	0	0	29	14	68
River	578	0	17	332	0	1	33	195	0	0	0	0	0
Marly outcrops of bare lands	2811	40	2359	0	18	207	0	43	77	0	67	0	0
Shadow	9310	4314	3	0	488	107	0	0	3	0	996	456	2943
Total pixels	58374	4648	2775	352	1168	6002	4071	5709	5001	1309	12424	4418	10497

Table 3. Percentages and surface units of occupation and land use

Unit occupancy and use soil	Acreages (%)	Acreages (ha)
Dense forest	04,36	54151
Clear forest	04,85	60275
Forest very clear	11,63	144537
Irrigated cultivation	03,04	37781
Course plains	05,36	66614
Course of the steppes	08,44	104892
Bare soil dominated by sandy texture	14,69	182567
Bare soil and rocky terrain	27,53	342142
Water barrage	00,58	6835
River	06,29	78172
Marly outcrops of bare lands	06,24	77550
Shadow	06,94	86250
Total	100.00	1242800

RESULTS

The results obtained by the maximun likelihood supervised classification were used to map the occupancy and use of georeferenced soil after the geometric correction step (figure 3). The map of occupation and land use of Aurés represents very important information for identification and inventory of space in general forest formations, roads, crops, soils devoid of vegetation, infrastructure and the rivers that are readily apparent.

The final map (figure 3) shows that 20.84 % of the area of the Aurés region (258,963 ha) is covered by forest in the state of degradation such as dense forests (04.36 %) is in General on the peaks. Crop areas and the surfaces of rivers cover 09.33 % of the total surface area of study, although in places the bedrock, bare soil and crop areas are generally contiguous and localized mainly on surficial siliceous and sandy. Areas where crops occupy the argillaceous and sandy soils outweigh porosity. Bare soil dominated by the sandy texture and crop areas is contiguous because of the agricultural practice of crop rotation and the distribution of rainfall. Overexploitation, reflecting the scarcity of arable areas due to the high porosity, exhausts the soil. Bare soil can also be explained by the presence of tilled soil ready for cultivation.

In general, the Aures region has low levels of vegetation cover. This rate is primarily explained by the semi-arid climate characterized by low rainfall. Then, surficial on which plants grow is generally reissued excessively because of their low capacity for water retention.

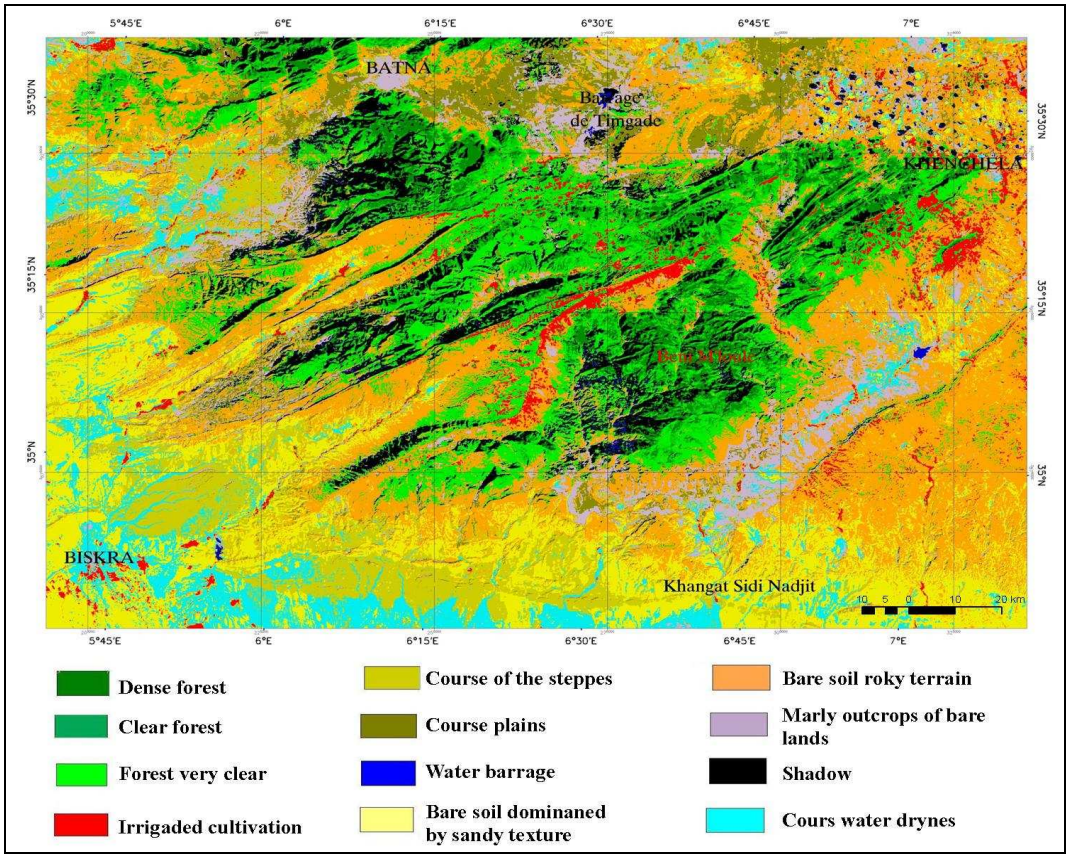

Figure 3. Map of occupation and land use of the Aurés region

Finally, human activities (Plowing and cutting firewood) contribute to reduce the density of vegetation. The rare high rates of vegetation occur on the summits because they are generally difficult to reach places.

CONCLUSION

- The use of the Alsat1 imagery made it possible to obtain the big classes of occupation of the ground in a reduced time;
- The possibility of having the Alsat1 images periodically will allow the follow-up of the evolution of the semi-arid zones large scales;
- The map of the land occupation and use remains a required document and a complement for a better apprehension of the quick change of the total changes and the consequences which result from this, in particular over the two last decades 1990 and 2010. For that, the regular monitoring of this phenomenon over long periods by using the satellite imageries of high-resolution could better evaluate the mechanism of the changes with small scales on the ground.

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INTERDEPENDENCEY BETWEEN PHYSICOCHEMICAL WATER POLLUTION INDICATORS: A CASE STUDY OF RIVER BABUS, SAGAR, M.P., INDIA

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Abstract: Water samples were collected from river Bebas at 10 collection places where human and animal activities were negligible. A total of 180 samples were analyzed for 16 chemical parameters pH, Alkalinity, DO, BOD, COD, TH, Ca Hardness, Mg Hardness, TDS, Chloride, Residual chlorine, o-Phosphate, Fluoride, Nitrate, Ammonia and Iron during PreMonsoon, monsoon and post monsoon seasons. The total data points were used to establish interdependency between the chemical parameters and data were also subjected to multivariate statistical. The later was used as test data. Regression analysis was carried out using SPSS.11, MVSP to relate the parameters and interdependency in form of scatter grams were obtained between DO/pH DO/Alkalinity DO/BOD, DO/COD, DO/TH DO/Ca Hardness, DO/ Mg Hardness, DO/TDS, DO/Chloride, DO/Residual chlorine, DO/o-Phosphate, DO/fluoride, DO/Nitrate, DO/Ammonia and DO/Iron. The validity of the empirical equations obtained were tested with the test data and the relationships were found to be similar, indicating that the equations can be used to predict the levels of these pollution indicators when one variable is known especially for similar river waters.

Key words: regression analysis, scatter gram, variable.

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INTRODUCTION

The availability of water determines the location and activities of humans in an area and our growing population is placing great demands upon natural fresh water resources. Bebas state like quite is faced with increasing pressure on water resources and the widespread, long-lasting water shortages in many areas are as a result of rising demand, unequal distribution and increasing pollution of existing water supply (Raja et al., 2002). Correlation/regression analysis has been found to be a highly useful tool for correlating different parameters. This way analysis attempts to establish the nature of the relationship between the variables and thereby provides a mechanism for prediction or forecasting (Patil et al., 2001).

Following regression equations were obtained through statistical regression analysis of data presented in above given river water sources of Sagar city (M.P.). Taking DO as dependent variable for all the 10 water sampling points of water sources at critical and logical analysis of given regression equations reveal important facts regarding correlation studies among various physicochemical parameters (Sudhir et al., 1999).

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To study the correlation between various water quality parameters, the regression analysis was Carried out using computer software SPSS, version - 11. Regression coefficient measures the degree of association exists between two variables, DO taken as dependent variable. The greater the value of regression coefficient, the better is the fit and more useful the regression variables.

The following regression models have been obtained from the results of analysis of water samples. Considering a mean DO (dependent variables) and important chemical parameters taken as independent variables, regression equations can be obtained for the entire study area for all season (Shrinivasa et al., 2000). It is important to analyse water to determine its suitability for drinking, domestic use industrial use, agricultural use etc. It is also important in water quality studies to know the amount of organic matter present in the system and the quantity of oxygen required for stabilization of the water. The impact of organic pollutants on water quality in this work is expressed in terms of the Biochemical Oxygen Demand, BOD and Chemical Oxygen Demand, COD which all depend on the Dissolved Oxygen, DO and Total Dissolved Solids; TDS on the other hand are used to define the organic content of the water and the total ions in solution respectively (Adak et al., 2001).

Empirical relationships were also developed to assess the quality of waste waters using testing and calculation methods but not much was mentioned in literature on the interrelationship between the parameters as it affect river waters. The fact that every problem in environmental studies must be approached in a manner that defines the problem necessitates the use of analytical techniques in the field or laboratory to produce reliable results. Once the problem is identified, samples are collected and analysed (Trivedy and Goel, 1986).

The procedure for statistical analysis of results could be tedious, time consuming and fraught with pitfalls especially when results are needed urgently in cases like an outbreak of contagious water bound disease. However, models can be designed which will provide a simple, economic and precise means of interpreting results leading to satisfactory findings. The aim of this study therefore, is to determine the levels of some pollution indicators and to study the statistical relationships between them. Regression equations will also be established in a view to providing an idea on the levels of pollution by the parameters investigated and possibly proffering a preventive measure prior to detailed investigation of the Bebas River.

EXPERIMENTAL

Bebas State is situated in Madhya pradesh passing near Sagar district. Water samples were collected in precleaned plastic containers from 10 sampling locations spread across the River Bebas from areas where human, animal and agricultural activities were high. The duration of sampling were categorized into three Pre Monsoon, monsoon and post monsoon period for 2008 - 2010. Samples were collected regularly throughout the seasons. The samples were analysed for pH, Alkalinity, DO, BOD, COD, TH, Ca Hardness, Mg Hardness, TDS, Chloride, Residual chlorine, o-Phosphate, fluoride, Nitrate, Ammonia and Iron using standard analytical techniques (Manivaskam, 2005).

All the chemicals used were of AR grade. Analysis was carried out for most water quality influencing 21 parameters with concerning units and test methods discussed in table 1.

Table 1. List of physicochemical parameters and their test methods (APHA, 1992)

S.N.	Parameters	Unit	Test Methods
1	pH	-	pH meter
2	Dissolved Oxygen (DO)	mg/L	Winkler method
3	Biochemical Oxygen Demand (BOD)	mg/L	5 days incubation at 20° C and titration of initial and final DO.
4	Chemical Oxygen Demand	mg/L	Open Reflux Method
5	Alkalinity	mg/L	Titration
6	Total dissolved Solids	mg/L	Digital conductivity meter (LT-51)
7	Chloride	mg/L	Argentometric titration

8	Residual Chlorine	mg/L	Iodometric
9	Orthophosphate ($P0_4^{3-}$ - P)	mg/L	Ammonium molybdate ascorbic acid reduction method
10	Nitrate -Nitrogen (NO_3 - N)	mg/L	Spectrophotometric method
11	Ammonia-Nitrogen (NH_3 -N)	mg/L	Spectrophotometric (Phenate method)
12	Total Hardness as $CaCO_3$	mg/L	EDTA titration
13	Ca Hardness as $CaCO_3$	mg/L	EDTA titration
14	Mg Hardness as $CaCO_3$	mg/L	EDTA titration
13	Fluoride	mg/L	Colorimetric Method
19	Iron	mg/L	Colorimetric Method

Regression analysis, multiple regression analysis for the total data points were carried out using SPSS.11, MVSP and WINKS SDA. The nature of correlations between parameters were determined based on the correlation coefficient obtained. Data obtained from chemical analysis compared with WHO guidelines.

RESULTS AND DISCUSSION

Regression curve between the mean chemical Parameters (independent) and the mean DO (dependent) in Babus river waters Samples of in and around Sagar city (Monsoon 2007 to Pre Monsoon 2010) represented by following figures. The results of the analysis for all the parameters used as test data are presented in table 1 and relationships between the parameters in form of scatter gram are shown in figures.

Table 2. Multiple regression analysis at different locations of the River

Dependent variable is DO, 25 independent variables, 4 cases.			
Variable	Coefficient	Variable	Coefficient
Intercept	-769.4688	O-PHOSPHATE	-323.5806
BOD	134.14209	NITRATE	-1.249023
COD	-180.498	AM	-1596.57
TA	-10.6131	TH	1.0390015
TS	.6571045	Ca HARDNESS	9.5629272
TDS	-7.569855	Mg HARDNESS.	-25.84875
pH	628.58984	FLUORIDE	-7036.031
CHLOIDE	36.796387	IRON	784.38818
RESI.CHLORINE	9404.875		
R-Square = 0.0, Adjusted R-Square = 1.1364			
Cohen's f-square = 0.0, a small effect size.			

Table 3. Regression Analysis of chemical Parameters in Bebas water Samples of in and around Sagar city (Monsoon 2007 to Pre Monsoon 2010)

Dependent Variable	Independent Variable	Regression equation	Slope	R^2
DO_{mean}	BOD_{mean}	DO = - 23.17 + 4.320 * BOD	4.320	0.871
DO_{mean}	COD_{mean}	DO = 0.175 * COD + 8.356	0.327	0.013
DO_{mean}	$BOD_{mean,}$ COD_{mean}	DO = 10.310156 + .253079 * BOD - .5406958 * COD		0.995
DO_{mean}	$Alkalinity_{mean}$	DO = 29.46 + 21.34 * alkalinity	21.34	0.993
DO_{mean}	pH_{mean}	DO = 0.174 * pH + 6.629	0.174	0.022
DO_{mean}	TDS_{mean}	DO = - 351.6 + 93.55 * TDS	93.55	0.828
DO_{mean}	$Chloride_{mean}$	DO= - 165.5 + 33.61 * Chloride	33.61	0.689
DO_{mean}	Residual $Chlorine_{mean}$	DO = - 0.519 + 0.1 * Residual Chlorine	0.1	0.343
DO_{mean}	o-$Phosphate_{mean}$	DO = - 0.659 + 0.311 * o-Phosphate	0.311	0.882

DO $_{mean}$	Nitrate $_{mean}$	DO= 2.327 - 0.153 * Nitrate	-.153	0.253
DO $_{mean}$	Ammonia $_{mean}$	DO = 0.649 - 0.070 * Ammonia	-.070	0.598
DO $_{mean}$	Chloride $_{mean,}$ Residual Chlorine $_{mean}$	DO = 5.2898461 + .0014619 * Chloride + 7.3416583 * Residual Chlorine		0.995
DO $_{mean}$	Chloride $_{mean,}$ Residual Chlorine $_{mean}$ o-Phosphate $_{mean}$	DO = 4.9030929 -.0002217 * Chloride + 7.3140616 * Residual Chlorine + .3584516 * o-Phosphate		0.0
DO $_{mean}$	Chloride $_{mean,}$ Residual Chlorine $_{mean}$ o-Phosphate $_{mean}$ Nitrate $_{mean}$	DO = 11.367188 + .0188141 * Chloride - 2.865234 * Residual Chlorine - 1.897461* o-Phosphate + 1.9199219 * Nitrate		0.0
DO $_{mean}$	Chloride $_{mean,}$ Residual Chlorine $_{mean}$ o-Phosphate $_{mean}$ Nitrate $_{mean}$ Ammonia $_{mean}$	DO = 3.9335938 - .0105438 * Chloride - 2.738281 * Residual Chlorine + 2.193573* o-Phosphate + 3.0136719 * Nitrate - 11.80859 * Ammonia		0.592
DO $_{mean}$	Temporary Hardnessness $_{mean}$	DO = 7.349073 - 0.005019988 * Temporary Hardnessness	- .005	0.009
DO $_{mean}$	Permanent Hardnessness $_{mean}$	DO = 7.6280614 - .0218256 * Permanent Hardnessness	- .022	0.180
DO $_{mean}$	Calcium Hardnessness $_{mean}$	DO = 428.2 - 41.19 * Calcium Hardnessness	- 41.19	0.949
DO $_{mean}$	Magnesium Hardnessness $_{mean}$	DO = 72.49 - 4.656 * Magnesium Hardnessness	- 4.656	0.177
DO $_{mean}$	Temporary Hardnessness $_{mean}$ Permanent Hardnessness $_{mean}$	DO = 10.037029 - .0161477 * Temporary Hardnessness - .0253295 * Permanent Hardnessness		0.187
DO $_{mean}$	Calcium hardness $_{mean}$ Magnesium hardness $_{mean}$	DO = 11.803454 - .01078 * Calcium hardness - .0887259 * Magnesium hardness		0.11
DO $_{mean}$	Fluoride $_{mean}$	DO = - 1.539 + 0.35 * Fluoride	0.35	0.217
DO $_{mean}$	Iron $_{mean}$	DO = 0.535 - 0.030 * Iron	-0.030	0.018
DO $_{mean}$	Fluoride $_{mean}$ Iron $_{mean}$	DO = 5.120312 + 2.2574179 * Fluoride - 1.356825 * Iron		0.564

The regression analysis carried out to relate DO with BOD, COD with DO, BOD with % and COD with % gave correlation coefficient r = 0.9, r = 1.0, r = 1.0 and r = 0.7 respectively (figures 1 - 4) indicating very good correlation between the parameters. Good correlation was also obtained for COD/TDS (figure 6, r = 0.5), however, the correlation between BOD and TDS (figure 5, r = 0.3), though within the acceptable range but the deviations of some points are large, indicating poor correlations between BOD and TDS.

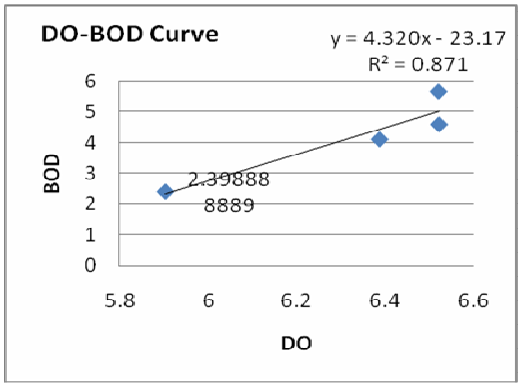

Figure 1. Regreession curve of BOD

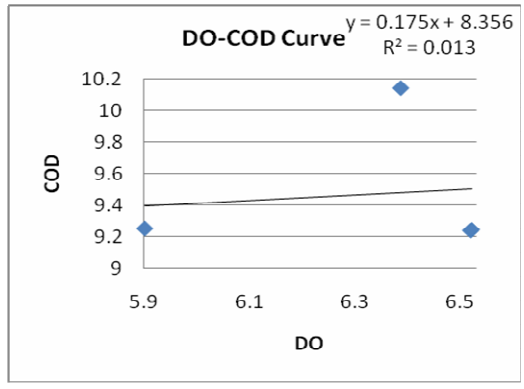

Figure 2. Regreession curve of COD

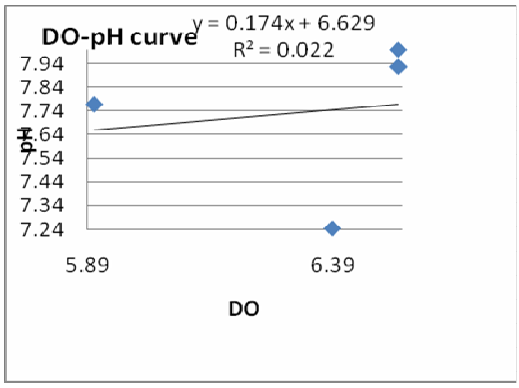

Figure 3. Regreession curve of pH

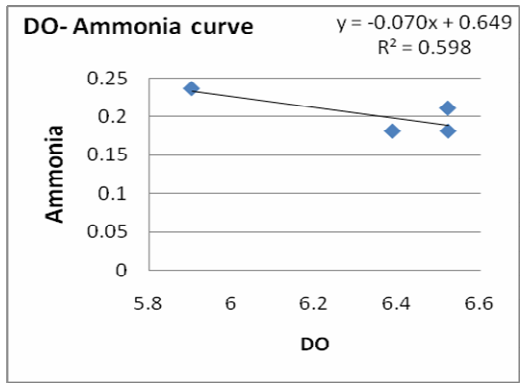

Figure 4. Regreession curve of Ammonia

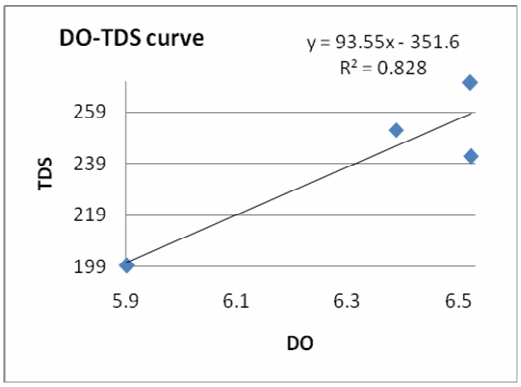

Figure 5. Regreession curve of TDS

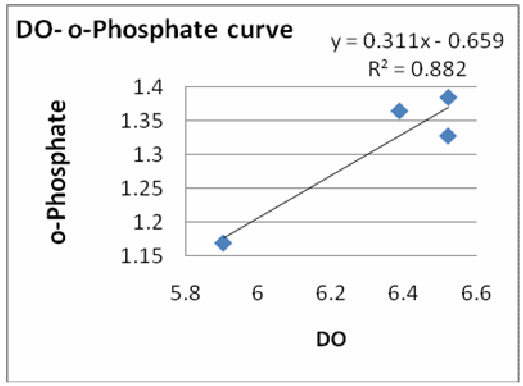

Figure 6. Regreession curve of o-Phosphate

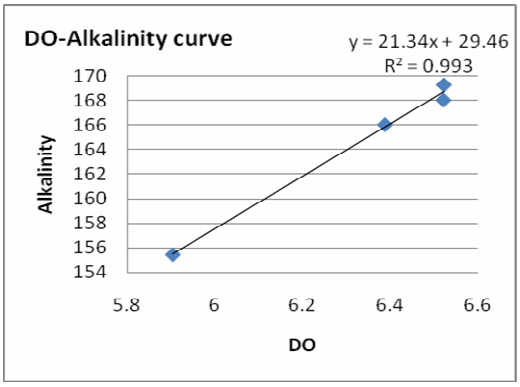

Figure 7. Regreession curve of Alkalinity

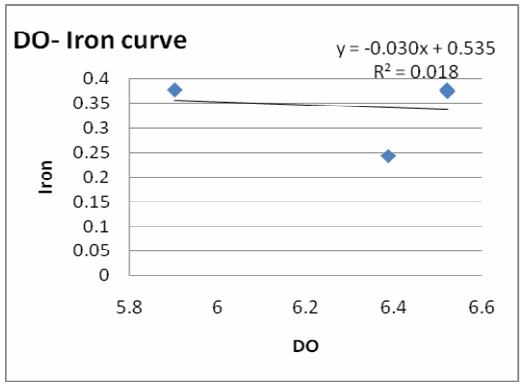

Figure 8. Regreession curve of Iron

BOD tests only measures biodegradable fraction of the total potential DO consumption of a water sample, while COD tests measures the oxygen demand created by toxic organic and inorganic compounds as well as by biodegradable substances. High BOD levels indicates decline in DO, because the oxygen that is available in the water is being consumed by the bacteria leading to the inability of fish and other aquatic organisms to survive in the river. Since DO can be measured in-situ the regression equations y = 4.320 x - 23.17 and .175 x + 8.356 can be used to estimate the values of BOD and COD respectively.

This will also ease the calculations of BOD/COD ratios in order to predict the biodegradability of the water since high BOD/COD ratios indicates that water is polluted and is relatively biodegradable.

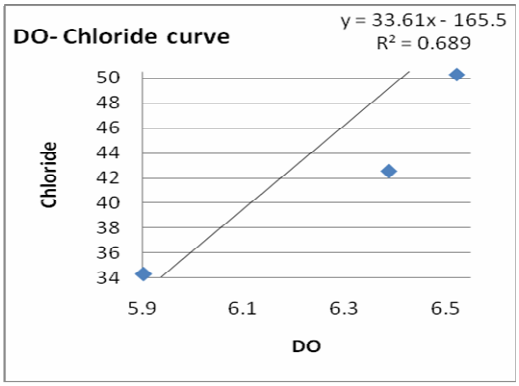

Figure 9. Regreession curve of Chloride

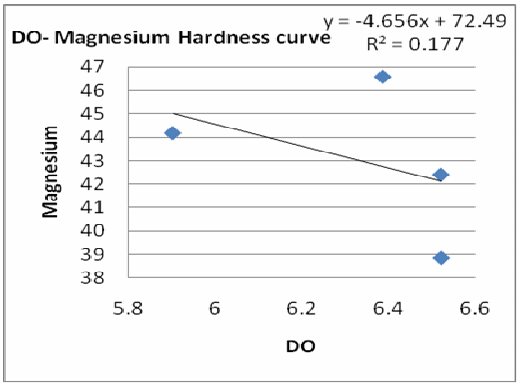

Figure 10. Regreession curve of Mg Hardness

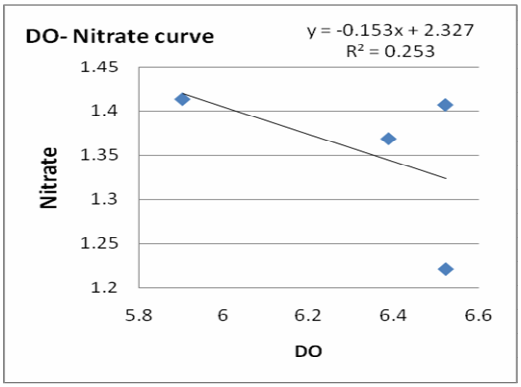

Figure 11. Regreession curve of Nitrate

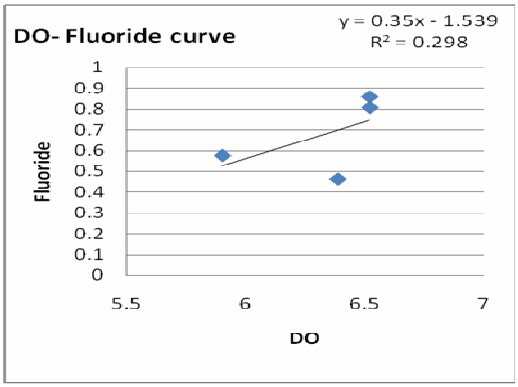

Figure 12. Regreession curve of Fluoride

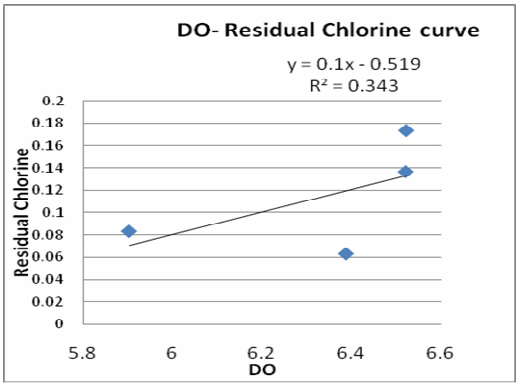

Figure 13. Regreession curve of Residual Chlorine

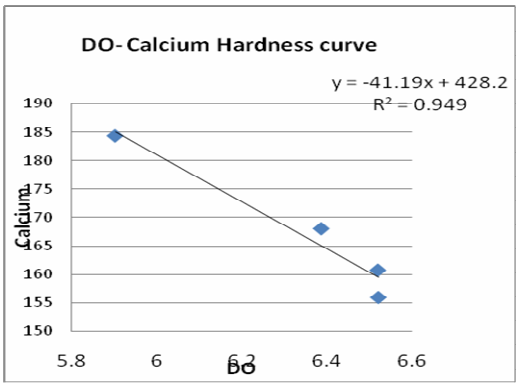

Figure 14. Regreession curve of Ca Hardness

Studies have shown that the River Bebas contains high concentrations of nitrates and phosphates which led to the quick growth as well as death of plants and algae. The result is accumulation and decomposition of organic wastes leading to high BOD values is used to define

the organic content of an aquatic system. Since there is good correlation between DO and TDS as well as between DO and o-phosphates, the regression equations, y = 93.55x - 351.6 and y = 0.311x - 0.659 can be used to estimation.

From the regression analysis obtained in this work poor correlations were obtained in relation to DO with pH, Iron, Mg Hardness, Residual chlorine, Fluoride, Nitrate which suggests that other models must be used to correlate DO to the other parameters investigated. Strong relationship with alkalinity suggested that water is slightly alkaline in nature. Strong relationship with Ca Hardness suggested that calcium is predominant ions in water.

CONCLUSION

Interrelationships were established between some physicochemical water pollution indicators where reliable correlations were established using regression analysis. The validity of the equations were tested with the test data results analysed in this work and results obtained from Rivers indicated that relationships were found between variables. This indicates the reliability of the relationships which suggests that it can be used to predict the levels of pollution by the parameters investigated and possibly proffering a preventive measure prior to detailed investigation of the Bebas River or in pollution monitoring. However, it may be said that Bebas River is slightly contaminated compared to WHO standards.

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NITRATE POLLUTION IN PHREATIC GROUNDWATER BASIN CRIŞUL REPEDE

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Abstract: The article presents the assessment of pollution with nitrates from agricultural sources, Crişul Repede River Basin in the period 1993-2009, with emphasis on analysis of drilling (points) observation of the industrial area of Oradea belonging Pollution Control Station. Also present was intended degree of pollution of underground reserves of water, and historical pollution due to human activities and potential impact of various sources of pollution (factory farming) on groundwater.

Key words: agricultural source, nitrates, groundwaters, pollution, quality

* * * * * *

INTRODUCTION

Crişul Repede hydrographic basin is situated in the western part of Romania (figure 1), occupying an area of 3354 sqkm.

Assessment of nitrate pollution of groundwater Crişul Repede basin by comparing average annual values obtained from 45 wells National Hydrogeological Network (from 1993-2009), with maximum values allowed (CMA), in Directive 118/2006 on the protection groundwater against pollution and deterioration. Maximum allowable concentration for nitrate (NO3), by European Standards is 50 mg/l.

Romanian legal document that includes all the requirements of Directive 91/676/EEC is - Romania Guvern Decision 964/2000 approving the Action Plan for water protection against pollution by nitrates from agricultural sources.

As pollution is the main factor of nitrate pollution of groundwater Crişul Repede River, recorded in the local area Oradea, it is necessary to eliminate or reduce the amount of nitrates entering the groundwater. Prevent deterioration of groundwater quality and prevent any significant upward trend and the concentration of pollutants in groundwater must be done primarily through the implementation of Directive 91/676/EEC, on the nitrates and also Directive 91/271/EEC, Urban Waste Water Treatment.

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Criş river basin, the report made by the European Commission on how to implement Directive 91/676/EEC on the protection of waters against pollution caused by nitrates from agricultural sources have been identified areas vulnerable to pollution by nitrates.

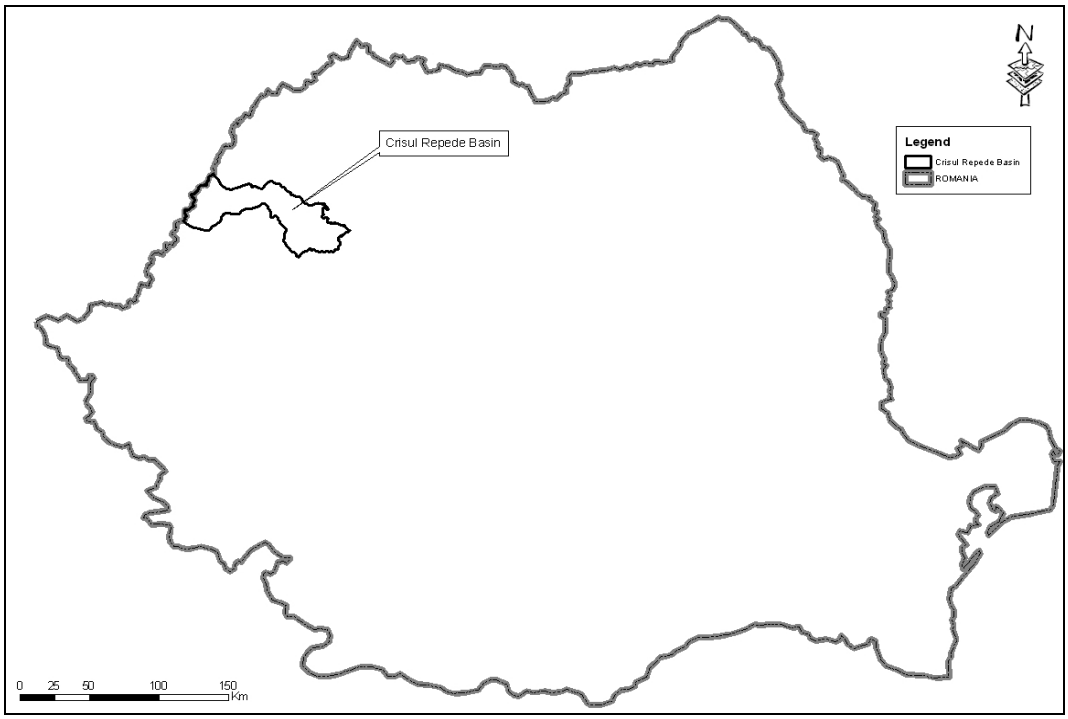

Figure 1. Crişul Repede river basin in the map of Romania
(Source: Data from ABA Crişuri archives)

CAUSES PHREATIC WATER CONTAMINATION NITRATES

Nitrate pollution comes mainly from agriculture. Nitrogen is essential for life in water and suffers many chemical and biochemical processes. Appears mainly as nitrate (NO_3^-), nitrite (NO_2^-), ammonium (NH_4^+), nitrogen gas (NO) and fixed in organic compounds, among which there are continuous transformations groups / transit, forming "the nitrogen cycle". Excess lead to eutrophication (algae bloom), groundwater contamination, possible harm to human health: methaemoglobinaemia in children, gastric cancer (Manoescu et. al., 1994).

The two major sources, with significant share in groundwater pollution by nitrates are constantly washing soil impregnated with nitrogen oxides by rainfall and irrigation water, and surface water (rivers, lakes) where they evacuated the water waste loaded with nitrogen. In this case the pollution is produced by rising bank to an area located longitudinally River (generally its floodplain and low terrace), the width of the zone of influence varies depending on the size of the river floodplain and low permeability layers of it. Hotspots are generally confined to floodplain river hydro. These two sources that are of cvasipermanent are added to the random character generated by the use of chemical fertilizers on some categories of farmland. Besides agricultural activities, an important contribution to pollution by nitrates and other nutrients, in general, and agglomeration were not consistent in terms of collection systems (sewage) and treatment plants (failing that, lack of speed sewage, malfunctioning etc.).

The groundwater NO_3^- is changed, transformed by microorganisms, reacts with iron, sulfates or bicarbonates etc. This soil is a good "filter" but if capacity is exceeded, the concentration of nitrogen will increase sharply. Nitrates are currently discharged into the soil will reach some aquifers in just years or decades (Bretotean, 1981).

DRILLING MONITORED IN CRIŞUL REPEDE BASIN

In Crişul Repede Basin nitrate pollution assessment was made based on monitoring data obtained in the National hydrogeological network during 1993 - 2009, which were compared with the maximum permissible values of the standards in force, is 50 mg/l.

Tracking the dynamics and evolution of nitrate pollution, water catchment groundwater Repede was conducted on a total of 45 monitoring wells, the water body belonging ROCR 01, of which 28 wells are in the order I placed in the main river valleys water courses, the alignments: Aleşd, Tileagd, Cacuciul Nou, Fughiu, Oradea, Cheresig; second order nine wells located in the interfluve areas (Crişul Repede - Crişul Negru) to: Nojorid, Girişu de Criş, Oradea - Airport, on the interfluve (Barcău – Crişul Repede) from, Borş, Tărian and Santăul Mic, which is located near the slag and ash depot of CET I Oradea (figure 2) and part of ground water pollution control station.

To detect sources of pollution of groundwater in the area of the cone of dejection Crişul Repede River station operates a groundwater pollution control, consisting of nine drillings.

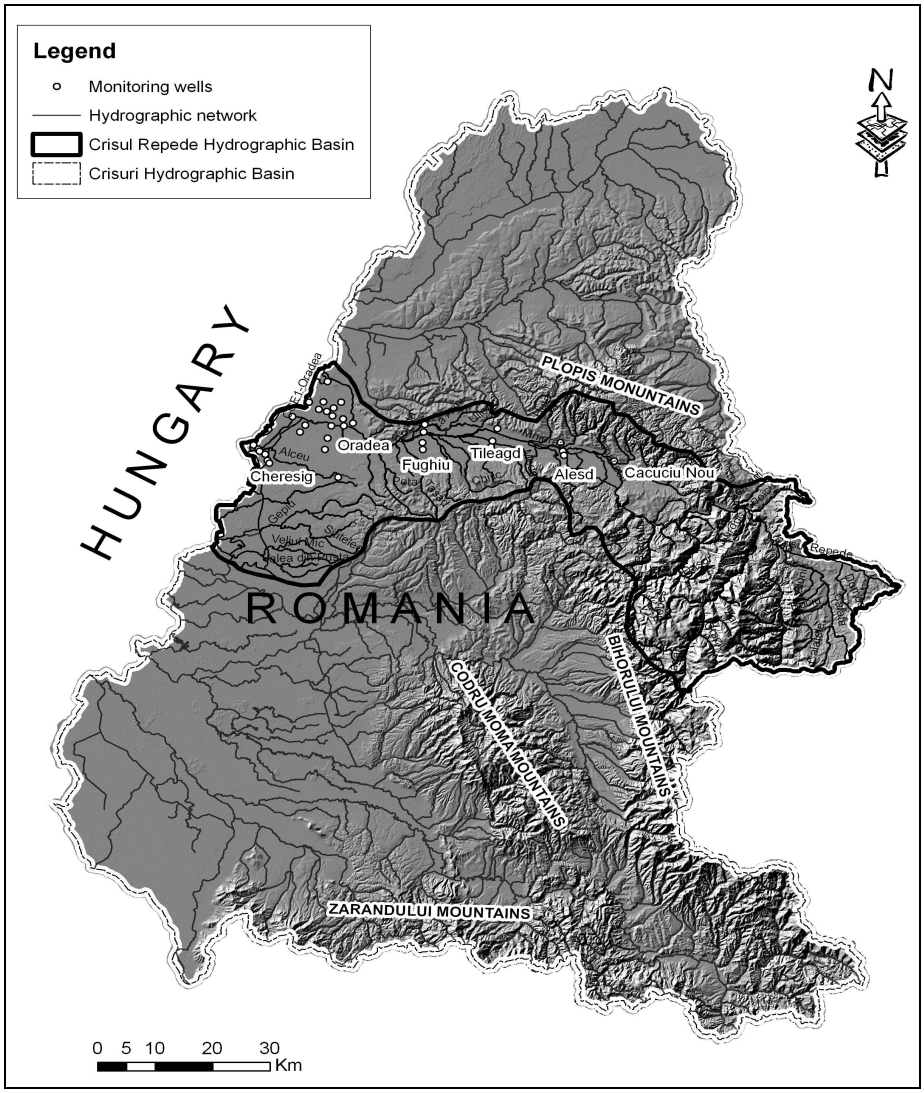

Figure 2. Location of monitoring wells in the Crişul Repede River Basin
(Source: Data from ABA Crişuri archives)

ASSESSMENT OF POLLUTION WITH NITRATES (NO3)

Normally the concentration of nitrates in water sources is low (usually not exceeding 10 mg/l), but can be high if there are specific nitrate pollution (considerably more than 50 mg/l) due to the water were streaming agricultural land or contamination with human or animal droppings as a result of ammonia oxidation.

In conditions of anaerobiosis, nitrate can be reduced to nitrite by microbial activity (this condition leads to the persistence of nitrite) (www.recolta .ro).

$NO_3^- \leftrightarrow NO_2^- \leftrightarrow N_2 \leftrightarrow NH_3$

Nitrates shows the average annual value exceeding the threshold (50 mg/l) in 11 of the 45 wells analyzed, 24.4 %. Drilling with significant overruns on the platform are located in the western industrial, and agricultural area Oradea - Borş. In table 1 are average annual value and annual average values for points where there were overtaking.

Table 1. Annual average concentrations exceeding report, the points shows the indicator values exceeded average NO3 (Source: Data from ABA Crişuri archives)

	Annual average concentrations / ratio exceeded the NO3										
Year / Average annual	**P1**	**P3**	**P4**	**P5**	**F6-P13**	**F7-P14**	**Oradea F1**	**Oradea F2**	**Borş F1**	**Oradea Aeroport F1**	**Girişu de Criş F1**
	75.5 mg/l	**66.8 mg/l**	**137.6 mg/l**	**131.5 mg/l**	**63.9 mg/l**	**76.0 mg/l**	**72.1 mg/l**	**64.7 mg/l**	**62.7 mg/l**	**62.6 mg/l**	**80.7 mg/l**
1993	49.4	63.6	78.5	135.6	13.5	44.7	-	25.3	26.6	20.2	35,4
1994	92.7	52.7	36.5	192.2	42.5	79.0	-	46.0	75.2	22.7	116,1
1995	74.3	60.1	83.6	78.5	49.1	64.5	-	129.7	72.7	63.9	78,3
1996	65.9	37.5	98.3	61.1	96.1	152.1	-	113.2	61.2	102.6	123,2
1997	66.4	58.5	99.9	120.7	153.7	110.7	-	81.3	75.4	163.3	267,2
1998	78.7	53.9	65.0	133.7	114.8	81.4	-	142.6	49.7	101.9	101,3
1999	79.5	34.9	310.7	120.6	114.1	80.2	-	64.2	45.0	83.0	4,2
2000	75.3	105.8	328.9	204.1	101.7	47.2	-	90.3	87.4	43.7	49,6
2001	86.5	-	-	158.1	62.5	70.9	-	-	88.7	46.0	91,3
2002	73.9	-	-	151.8	59.5	78.6	-	-	79.4	41.0	41,2
2003	76.1	-	-	207.4	51.5	47.0	-	-	60.6	53.0	46,9
2004	65.0	-	-	99.0	54.8	85.0	-	60.4	50.4	70.5	60,5
2005	85.5	-	-	126.5	78.7	66.7	88.7	45.2	42.2	25.5	104,7
2006	-	62.6	-	102.5	72.9	87.6	-	29.4	-	38.7	66,9
2007	73.9	63.2	-	78.6	13.0	77.1	-	35.4	-	-	45,5
2008	104. 4	144.2	-	169.6	4.77	110.1	-	37.5	-	-	61,3
2009	59.6	65.0	-	96.3	3.84	4.1	55.6	4.8	-	-	78,6
Valori medii depăşite	93.7 %	83.3 %	87.5%	100 %	64.7 %	76.5 %	100 %	50 %	69.2 %	50 %	64,70 %
Valori medii admise	6.25 %	16.7 %	12.5%	0.0	35.3 %	23.5 %	0.0	50%	30.8 %	50%	35,30 %

From the table we can see that there are points where the average of the annual monitoring is exceeded at 100 % throughout the period under review ie P5, F1 Oradea rate of 93.75 % and the point P1.

In figure 3 and table 1 are average annual values of the points in the industrial cities of Oradea and Bors and Santion. In these respects the nitrate ion concentration is relatively constant at points investigated, but far exceed limit of 50 mg/l, so the annual average and annual average.

Because of these values exceeding the maximum permitted is first time the existence of livestock farms and the irrational use of fertilizers on agricultural land.

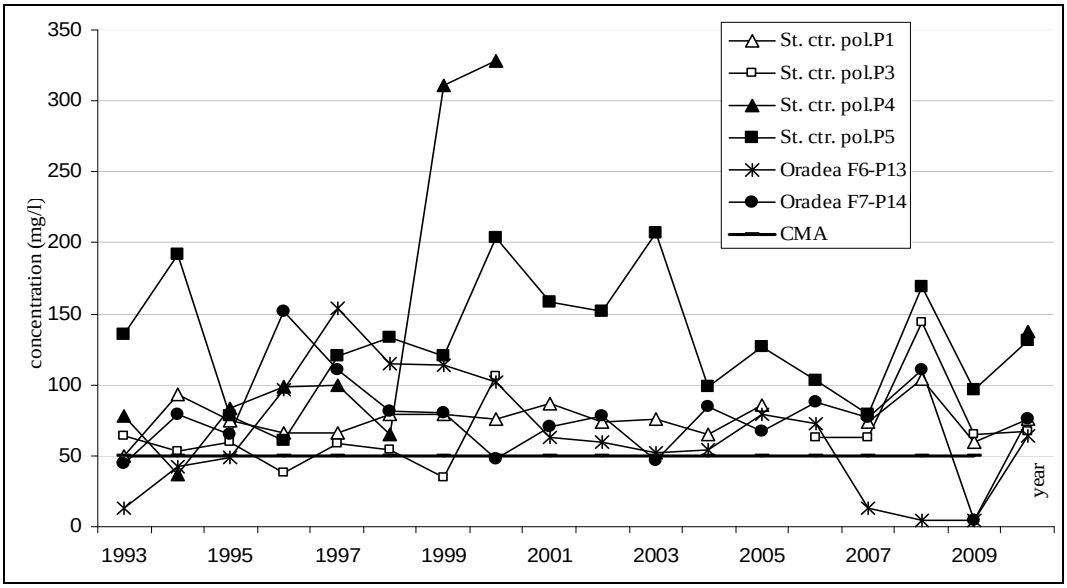

Figure 3. Periodic variation of the average values seen in the points with exceed for nitrates (NO_3^-)
(Source: Data from ABA Crişuri archives)

In a drilling Bors F1, the maximum value was recorded in 2001 by 88.67 mg/l, a ratio exceeding 1.8 times;

In drilling an F2 Oradea, maximum concentration of 142.57 mg/l, was recorded in 1998; F6 in Oradea, a drill - P13 (located in the SC Orser SA), was recorded annual maximum 153.74 mg/l in 1997;

In drilling an F7 - P14 Oradea (Episcopia Bihor area), the maximum value was recorded in 1996, 152.14 mg/l, report surpassed 3.04 times;

In drilling an F1 Oradea airport area, the annual maximum concentration of 163.25 mg/l was recorded in 1997, exceeding a ratio of 3.3 times;

In an observation point P1 (located in the customs area - Bors) maximum annual value of 104.38 mg/l, was recorded in 2008;

At the point P3 (located downstream Santion), maximum 144.2 mg/l was recorded in 2008;

At the point P4 (monitoring point located on the left side of Crişul Repede River downstream of the pig farms Ioşia - Sântandrei - Palota (for ex. SC Nutrientul Palota), a maximum annual amount in 2000 was 328.6 mg/l, exceeding ratio is 6.57 times, and in 1999 was 310.72 mg/l;

In an observation point P5 (located in the village Sântion) increasing the maximum value was recorded in 2000, 204.1 mg/l.

Figure 4 shows the annual variation of nitrate concentrations at sites monitored, located upstream of Oradea. From the graph it is observed that except for 1994, where the values exceed the limit of 50 mg/l and Fughiu F2 and Tileagd F2 points, other points shows the annual average below 50 mg/l.

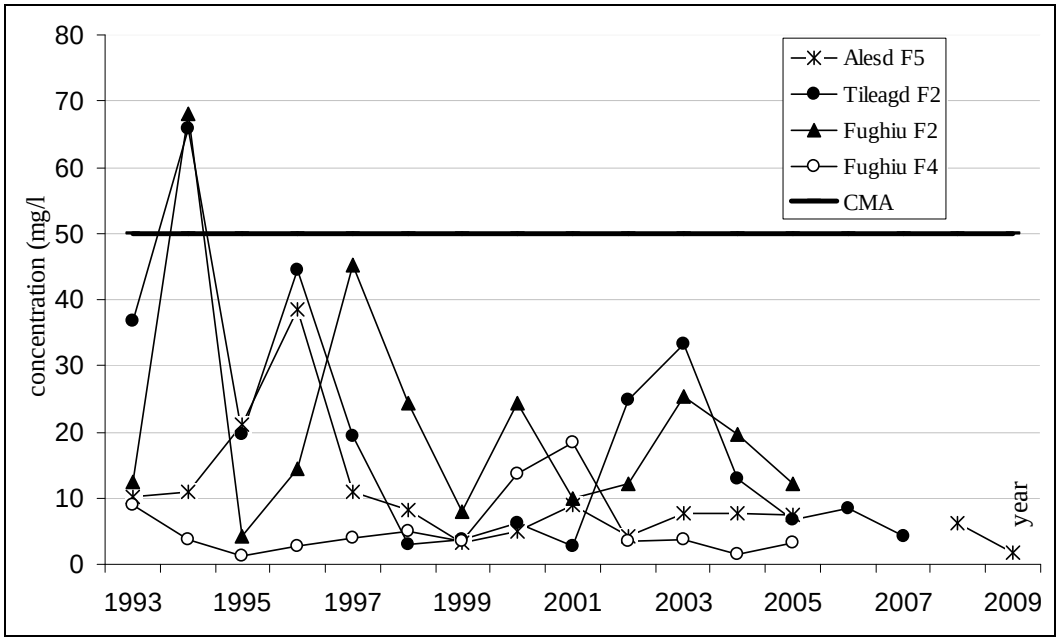

Figure 4. Evolution of annual average NO_3^- concentrations at sites upstream Oradea
(Source: Data from ABA Crişuri archives)

VARIATION OF NITRATE CONCENTRATION WITH DEPTH DRILLING

Changes concentration of nitrate (NO3), with deep drilling explain nitrate pollution that occurs from the surface (figure 5). In wells with depths of up to 30 - 40 m are found the highest values of nitrate. The groundwater aquifer layers, especially in aerobic-anaerobic interface, there are nitrification and denitrification processes, which are influenced by the level of dissolved oxygen, organic carbon levels, the abundance of invertebrate fauna etc (Tudorache, 2010).

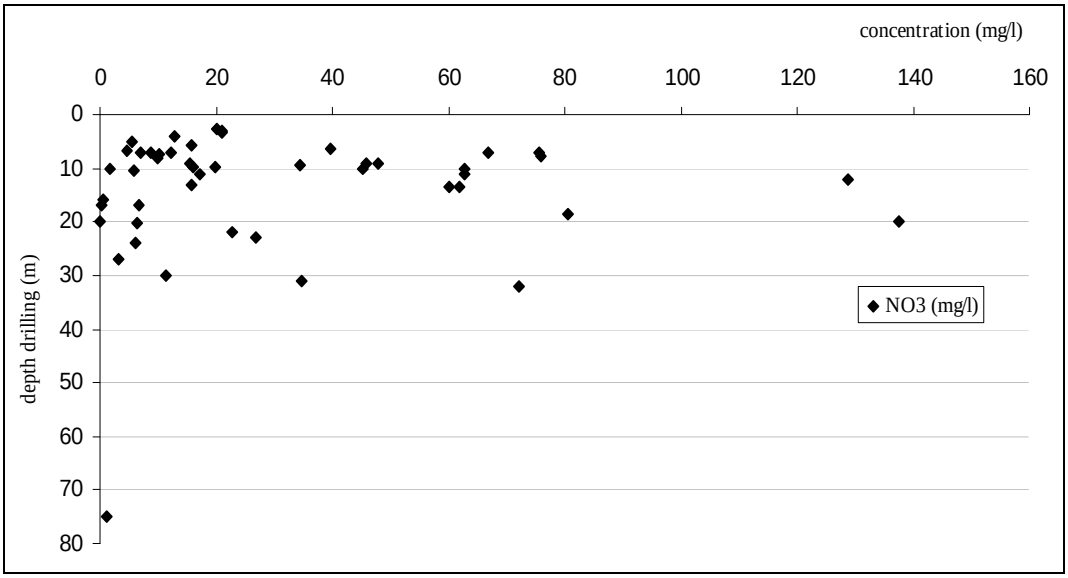

Figure 5. Variation of nitrate concentration with depth drilling
(Source: Data from ABA Crişuri archives)

CONCENTRATION OF NITRATES IN THE DRILLING'S YEAR

The drillings that were executed during 1966 - 1976 (reference period) were analyzed in order to determine the nitrate content in the groundwater within the Crişul Repede catchment.

In figure 6 are shown the concentration of nitrate has been determined during the execution of drilling and multi-annual average concentration of nitrates in the period 1993 - 2009.

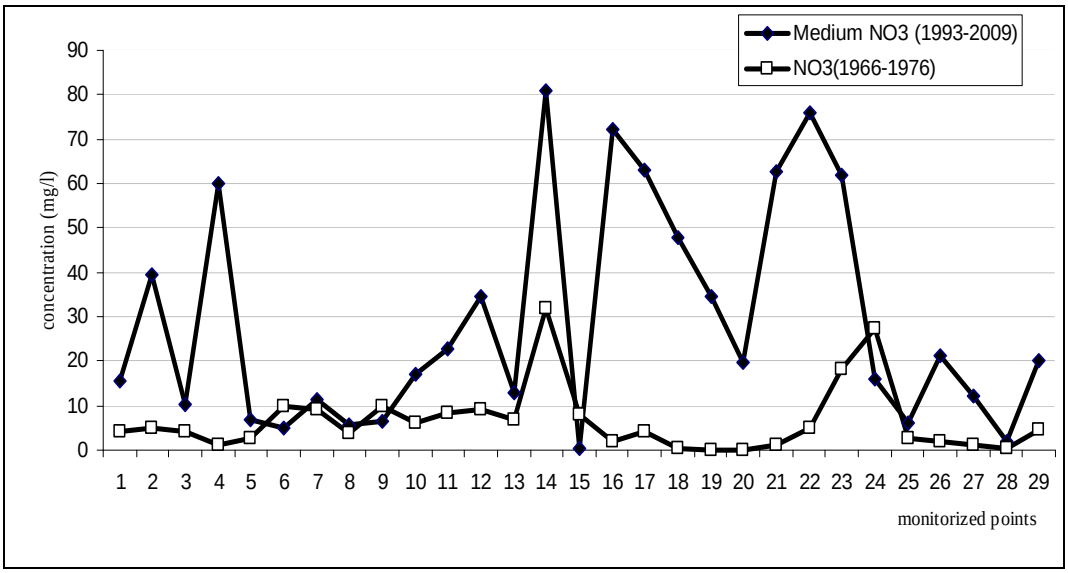

Figure 6. Variation of the concentration of nitrate (NO3) from nitrate concentration at the time of execution drilling (Source: Data from ABA Crişuri archives)

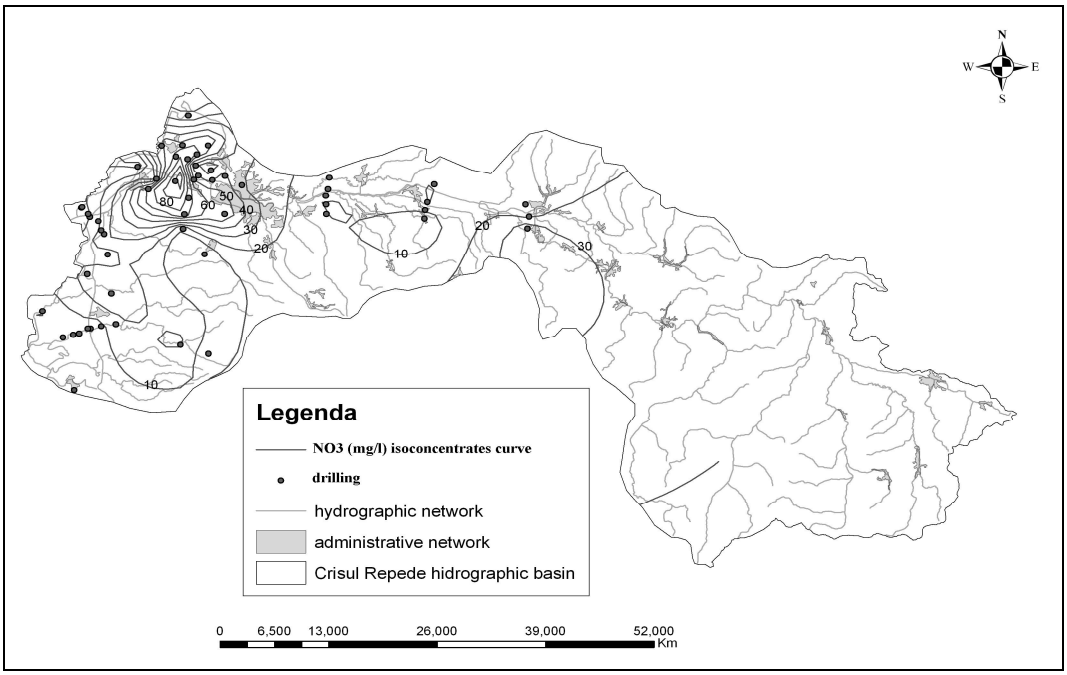

Figure 7. Spatial distribution of mean values of concentrations of nitrite ion (Source: Data from ABA Crişuri archives)

It can be seen ascending evolution in time, this parameter in areas with sources of pressure and impact of agricultural and livestock farms.

In figure 7 is represented by the spatial distribution of nitrate concentrations. On the whole analyzed area, the nitrate values extends from 1.68 and 665.0 mg/l. Lowest values are recorded for existing sources upstream Oradea (Aleşd) and downstream Oradea (Cheresig), while maximum values are recorded for groundwater sources in the area of Oradea (P5, P3 and P2).

MEASURES TO REDUCE POLLUTON BY NITRATES

Currently, the "Code of good agricultural practice" aimed at reducing pollution by nitrates and aply in vulnerable areas. Under this Code, shall take into account the conditions prevailing in different regions of the country, such as, for example, periods during which compliance is inadequate fertilizer application, the land application of fertilizer to steeply sloping, the land application of fertilizer to saturated, flooded, frozen or covered with snow, the land application of fertilizer near water courses, maintaining a minimum quantity of vegetation cover during periods (rainy) soil nitrogen in the absence of such a vegetation cover would cause water pollution by nitrates.

Other measures are:

- control of the sewage system leaks or inadequately maintained septic tanks and domestic wastewater discharged directly from the soil;
- control of the location of manure to prevent contamination of an aquifer located in a layer of karst or unprotected wells;
- control of surface water infiltration;
- establish and maintain sanitary and hydro areas, see HG 930/2005.

National Administration "Romanian Waters" draws attention to all those responsible that requires a rigorous management of waste and construction, expansion or upgrading of sewage treatment plants, mainly because groundwater pollution is a phenomenon almost irreversible and has serious consequences for the use of reserve underground drinking water supply. Remediation of water from groundwater sources is extremely difficult if not impossible.

CONCLUSIONS

Even while there was a decrease in the influence of pollution sources on groundwater aquifers, significant reduction in recent years due to the volume of industrial production and agro-livestock production, but also by putting into practice the measures for wastewater treatment, however groundwater quality has remained poor since the self-cleaning due to their slow pace.

The analysis performed on groundwater pollution by nitrates, Crişul Repede River Basin, stands above the allowable average values, both in the western industrial zone, the downstream area livestock farms Ioşia Sântandrei, Palota, and analyzed at the points Oradea border areas, where crops have been applied intense. Items monitored wells upstream Oradea (Aleşd, Tileagd, Fughiu) and downstream Oradea (Cheresig, Tărian) shows the annual average below 50 mg/l, corresponding in terms of nitrate content. The overall assessment of groundwater pollution in three rivers basin, most severe forms are maintained at multiple impairment of groundwater quality in certain areas, especially in rural areas where, because of lack of minimum facilities allow, liquid waste to reach the ground, both directly (through non-waterproof latrines, ditches and gutters, etc.) and indirectly through slow infiltration (from storage of manure, domestic waste pits improvised etc.).

Because groundwater flows slowly through the basement, the impact of human activities can affect a long time. This means that pollution that occurred decades ago - whether in agriculture, industry or other human activities - can still threaten water quality today and in some cases will continue to do so for several future generations. Therefore, an important emphasis should be placed primarily on *pollution prevention*.

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DEMOGRAPHIC TRANSFORMATIONS OF POLISH METROPOLISES (TRI-CITY CASE STUDY)

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Abstract: The article includes the brief of demographic transformations of Gdansk agglomeration since 1990 to 2009. Very intensive social and economical changes was the main charakteristic of that period in Poland at all, but in the polish cities, particularly. The Tri-city agglomeration is the example of intensive demographic transformation comparing to the Pomerskie region and other potential polish metropolises. The case displays the vital statistic of the urban areas, that is: dinamic of the population changes, natural increase rate and migrations. The following chapters attached the comperiton of Gdansk agglomeration to other polish metropolises by using statistical classification methodology.

Key words: Poland, Tri-City, population, vital statistic

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INTRODUCTION

Analysis and evaluation of the demographic situation on the chosen area is very important e.g. for the spatial planning and social policy. The big changes of political system in Poland and in other countries of Middle-East Europe has highly influenced the changes in the structure but also in the actual increase of societies. In recent years, when Poland joined the European Union, the increase of migration contributed, among others, to conversion in social politics not only regionally but also locally (Cicharska, 2010). Together with the economic development and society modernization it is easy to observe the new demographic trends at the Pomeranian region and the whole Polish state, as well (Michalski, 2002). Particularly, these changes are the most variable at the urban areas (Tarkowski, 2008). This article contains the demographical analysis of the population changes in the Gdansk (Tri-City) agglomeration during the period of twenty years (1990-2009). The Gdansk agglomeration is composed of three cities: Gdansk, Gdynia and Sopot. There is description of the population changes dynamics and the components of the real movement (natural and migration) in those cities. The article contains also the statistical classification by those features of the potential polish metropolises.

DYNAMICS OF THE POPULATION AND MIGRATIONS

The amount of population in the Tri-city was equal around the 750,0 thousands since 1990 and it felt about 26,0 thousands at the end of analysis period. At the present, the population amount states above 33,0 % of the Pomeranian region. The amount of the agglomeration population is composed of 61,2 % of the Gdansk citisents, 33,6 % that is society of Gdynia and the least analyzed unit Sopot - 5,2 %.

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Gdansk is the capital of the Pomeranian region and it has the most developed population. At the end of 1990, the amount of population had reached 465,1 thousands, then years later - only 463,0 thousands and finally felt down to 451,6 thousands in 2009. Despite the decreasing population amount the dynamic of changes seems not bad. Taking into consideration the economic transformation and the social changes with the modernization of society (particularly in the biggest cities), the almost stable amount of population is positive phenomenon.

In the Gdynia, the amount of population had been almost stable, as well, mostly because of the good migration and natural movement rates. According to the data of the Central Statistical Office, there were 251,5 thousands of inhabitants in Gdynia in 1990, that amount had increased around 4,0 thousands till 2000 and the finally nine years later there were 247,7 thousands of Gdynia's inhabitants. That means that the dynamics of changes was 98,5 % according to 1990. That situation occurs similar to Gdansk one. Quite different changes are easy to observe in Sopot. There was systematical drop in amount of inhabitants from 46,6 thousands in 1990 to 42,3 thousands in 2000 and finally to 38,0 thousands in the end of analyzed period - 2009. That means almost 20,0 % declaim of Sopot population. Predictably, that phenomenon was caused by age structure of inhabitants and the high costs of living in Sopot city, which makes impossible for young people to settle there (figure 1).

The distinct changes are observed in population's migrations. The balance of migrations in the Tri-city amounted almost -4,0 ‰ in 2009, while that had been -3,0 ‰ nineteen years before. It is worth to notice that in the early 90s, the migration of agglomeration's inhabitants had just started. According to the data of National General List in 1988 the balance of migration was not more than 1,3 ‰ at all. At the beginning of the analyzed period, the highest balance of migrations was observed in Gdynia (0,8 ‰), while in Gdansk that was -0,5 ‰. Next years, brought visible fluctuations in migrations rates and for example in Gdynia that rate amounted 1,2 ‰ in 1993 and 0,7 ‰ then years later. At the same time in Gdansk the rate of migrations balance reached 1,4 ‰ and -0,9 ‰.

In Sopot, changes of migrations balance were shaping similar to the changes of real natural movement and was the most spectacular in the agglomeration. In Sopot, the migrations parameter had been oscillating from -9,3 ‰ in 1990, to -3,4 ‰ in 2003 and finally to -6,9 ‰ in 2009. The outflow of the inhabitants from polish cities and other significant demographical changes in the recently years were caused by suburbanization process and the polish access to the European Union, too.

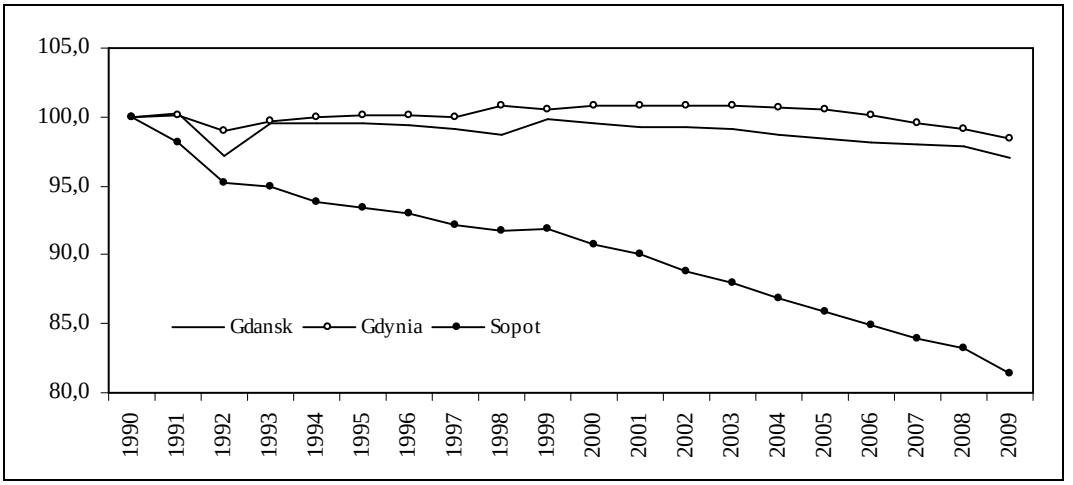

Figure 1. The dynamics of the population change in Tri-City (1990 = 100,0 %)
(*Source:* Author's own study based on: Gminy województwa gdańskiego 1990-1994; Wojewódzki Biuletyn Statystyczny 4; www.stat.gov.pl)

VITAL STATISTIC

The analysis displays the most variable changes of live births and crude deaths rates in Sopot. The table 1 shows the comparison of Sopot to the other areas of Gdansk agglomeration. The live births parameter had been fluctuating from 10,0 ‰ in 1990, to 5,5 ‰ and 7,7 ‰ at the end of analyzed period. But the crude deaths rate maintains on high level in spite of decreasing at the end of 90s. In 2009 its dynamics amount 0,6 ‰ relatively to last 20 years - the research period (1994 - 13,4 ‰; 1999 - 11,9 ‰). In Gdansk as well as in Gdynia crude deaths rate was no higher than 10 ‰ in whole period of research. In Gdansk that was 9,8 ‰ in 1990, then a little lower during a next few years and the same 9,8 ‰ at the end of 2009. In Gdynia the death rate had been oscillating between 9,6 ‰ and 8,6 ‰.

According to the births rate in Gdansk, those were always higher than in Gdynia. The births rate in the capital of the region had reached 11,4 ‰ in the 1990, 8,5 ‰ in 1999 and 11,1 per 1000 habitants in 2009. In Gdynia live birth parameter was a little lower during all analyzed period. Very characteristic for Tri-city population have been death rate settled at relatively similar level and increasing births during a few last years in every city. In 2009 that grow was 1,5 ‰ comparing to the 2004. That tendency is strictly related to achieve the optimum procreative age of population descend from demographic upland of early 80s. XX c. Theoretically, we could expect the echo of demographic explosion, but the increased amount of live births is not enough to secure direct replacing of generations.

Table 1. Live births rate and crude death rate in Tri-City (per 1000 population)
(*Source:* Author's own study based on: Gminy województwa gdańskiego 1990-1994; www.stat.gov.pl)

City	Live births rate				
	1990	**1994**	**1999**	**2004**	**2009**
Gdansk	11,4	10,4	8,5	8,9	11,1
Gdynia	11,2	9,7	8,1	8,7	10,0
Sopot	10,0	8,5	5,5	6,7	7,7
Tri-City	*10,9*	*9,5*	*7,4*	*8,1*	*9,6*
City	**Crude death rate**				
	1990	**1994**	**1999**	**2004**	**2009**
Gdansk	9,8	9,1	9,3	9,7	9,8
Gdynia	9,6	9,4	8,6	8,8	9,6
Sopot	12,4	13,4	11,9	11,8	13,0
Tri-City	*10,6*	*10,6*	*9,9*	*10,1*	*10,8*

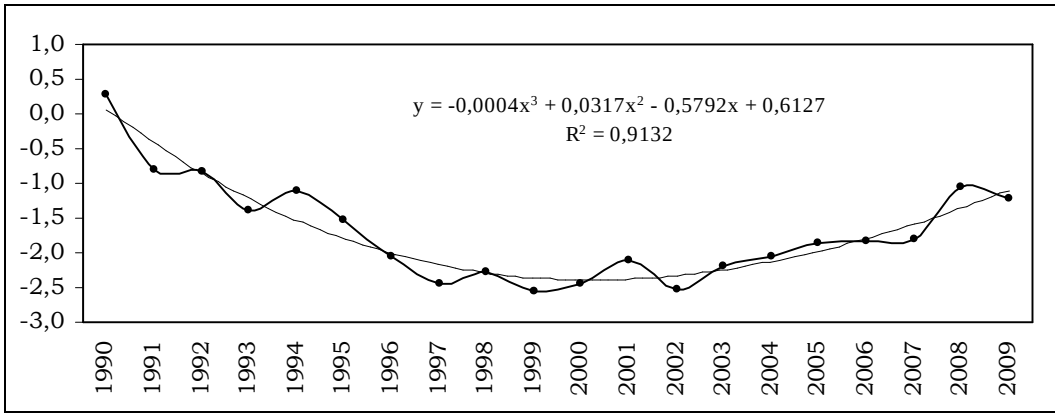

Figure 2. Natural increase rate in Tri-City in 1990-2009 [per 1000 population]
(*Source:* Author's own study based on: Gminy województwa gdańskiego 1990-1994; Rocznik statystyczny województwa gdańskiego 1994; www.stat.gov.pl)

Compering the level of natural increase rate in Gdansk agglomeration during the whole analyzed period (despite of some fluctuations) there is a good fit to the trend's line. That is confirmed by determination coefficient above 0,91 (figure 2).

The highest level of the amount of live births comparing to the crude death rate level had been noticed in 1990, when the natural increase rate was equal 0,3 ‰ that time. Next years, the natural increase rate was falling down (-0,8 ‰ in 1991; -1,1 ‰ in 1994; -2,4 ‰ in 1997) at last -2,6 ‰ in 1999 and -2,5 ‰ six years later. In 2009 the natural increase rate amount -1,2 ‰.

That was a little better situation than in 2005, but comparing to the background of Pomeranian region (3,5 ‰) the demographical situation within Tri-city agglomeration is not easy at all. Quite advantage situation in the region is a result of conservative lifestyle of Kashubian and Kocievian population. Inside the agglomeration dominates high level of crude death rate in Sopot witch is the most reason of disadvantageous demographical situation. In Gdansk and Gdynia natural increase rate was equal 1,2 and 0,4 per 1000 inhabitants in 2008, not bad at all.

CLASSIFICATION OF POLISH METROPOLISES

The main aim of the analysis was to compare Gdansk agglomeration to the other potential metropolises in Poland (Dziemianowicz and Jałowiecki, 2004). To make statistical classification of Ward's methodology were used current demographical rates: live births rate, crude death rate and balance of migrations. Finally, all polish metropolises were devoted into two groups.

Table 2 displays those groups: A and B. Group A consists of cities with relatively good demographical condition. The live births rates oscillate around 10,0 ‰. Group B is composed of cities much more variable. The main features of B metropolises are adverse migration balances (particularly in Poznan -5,7 ‰). Most of those cities have natural decrease of population. The greater advantage of crude deaths over the live births have been noticed in Łodz (-5,5 ‰). Gdansk agglomeration is a part of group B, but on the background of other metropolises has quite good demographical condition and the migration of population balance, in particular (Cicharska, 2010).

Table 2. Classification of polish metropolises
(*Source:* Author's own study based on: Rocznik Demograficzny 2009)

Type of metropolis	Metropolis	Region
A	Cracow	Lesser Poland
	Wroclaw	Lower Silesian
	Warsaw	Masovian
B	Tri-City	Pomeranian
	Katowice	Silesian
	Poznan	Greater Poland
	Lodz	Lodz

CONCLUSIONS

The analysis demonstrated that inside the Tri-city agglomeration there are two demographical types of cities. First type include Gdansk and Gdynia and the second type is Sopot. The dynamic of inhabitants amount is not high, that is mean that the amount of agglomeration's population is stable. Sopot is the exception because it has had decline of inhabitants during the 20 years period – that was caused by disadvantaged of real population movement.

Natural increase rate in Gdansk agglomeration had dramatically felt down at the beginning of analyzed period and started growing up during a few last years. The migrations balance displays the outflow of cities inhabitants to the suburbs areas. Finally, comparing Tri-city to other polish metropolises the Gdansk agglomeration has good enough demographical situation, at all.

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THE END OF A GEO-DEMOGRAPHIC SINGULARITY: THE CATHOLICS FROM MOLDAVIA[1]

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Abstract: "Well-known for their vitality, they managed after 1990 to adapt to a new social, economic and political context that re-shaped their demographic profile. Being among the first to emigrate in order to find a place to work, especially to the states in the South of Europe, the Catholic communities from Moldavia have been subjected to a double erosion of the demographic vitality: firstly, due to the final emigration of a part of the young population and secondly, due to the modification of the behaviour in the sense of the acceleration of the processes specific to the last stage of the demographic transition. Thus, the result was - only after 2 decades - the degradation of the demographical structures of the communities due to the acceleration of the demographic ageing process. If previously, they managed to maintain a certain advantage on at regional level, they currently seem to be the most vulnerable to demographic risks".

Key words: rural space, religion, demography, differentiation, transition

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INTRODUCTION

The present study, which is part of a bigger project that intends to identify the genesis and the effect of the multiple differentiations of the Moldavian rural space, proposes a diacronic analysis of the way in which the Catholic communities from Moldavia (especially from its rural part) have manifested their personality on a geo-demographic level for the latter half of the century.

The manner in which cultural peculiarities, especially the ones of a confessional nature, determine the appearance of certain demographic cleavages is apparently simple, being generated by various socio-cultural, psychological - social or economical phenomena such as marginalisation, identity retreat, discrimination. Thus, the case of the Catholic communities from Moldavia can be easily used as an example and applied wherever there is an important number of people with a significant demographic difference. This long known reality has faded in time, going from the preservation of a more traditional demographic behaviour, with some deficiencies in the quality of

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[1] This study refers to western part of historical Moldavia, part of Romania (8 counties of the North-East of this country). For disambiguation, in the text was used also the term Western Moldavia.

life (a shorter life span, higher infant mortality, specific morbidity) to what may be described as the Moldavian demographic pattern. A delicate subject in general, the particularism of the Catholic communities from Moldavia has been attributed to the preservation of a certain behaviour which is more faithful to the pro-natalist religious discourse of the Catholic clergy. Thus, a "reproductive and procreative behaviour" is maintained, specific to a primitive demographic regime, without an obvious intervention of planning (Trebici and Ghinoiu, 1986, p. 117). Invoking the Catholic confession as the main vector of the preservation of demographic vitality can be easily disputed if we think that a Catholic country such as France was the predecessor of the modern pattern of evolution of population (Boia, 2010, p. 227)[2]. If we relate to the relative isolation of these communities inside a mass of Orthodox population - an isolation which was often effective from a geographical point of view - we can easily attribute the main part in the manifestation of such singularity to the confessional factor. The manifestation of a "cultural barrier" in the accepted geographical sense (Claval, 2003, p. 102) may lead to the appearance of some mechanisms generating resistence to the process of demographic modernization. Such barriers may create different behaviours, which are difficult to analyse in the absence of specific information (our case) but authenticated by numerous comparative studies (for exemple Praz, 2009).

The Catholic communities from Moldavia amount to almost 270,000 persons, a number obtained by comparing the results of the 2002 census which found 243,627 Catholics in the 8 counties of the Catholic diocese of Iassy to the population dynamics from the places in which the number of the Catholics is high and by taking into account the temporary absence of the numerous population from the same localities at the time of the census (almost 30,000 person). This way, we may consider that they form about 5.6 % of the total population, a significant amount if we think that they are preferentially distributted in the 3 counties from the central part of Moldavia: Bacău, Neamț and Iași (see table 1).

Table 1. The numerical evolution of the population of Catholic confession from the Diocese of Iași (1930 - 2002)
(Data source: the censuses from 1930, 1992 and 2002)

County	Population (inhabitants)			Ratio (%)		
	1930	1992	2002	1930	1992	2002
Bacău	54,621	12,5805	134,516	14.5	17.1	18.3
Botoşani	1,601	865	854	0.5	0.2	0.2
Galați	4,397	2,463	2,227	1.4	0.4	0.4
Iaşi	19,526	39,627	43,061	4.6	4.9	5.2
Neamț	23,844	62,374	68,745	7.7	10.8	11.9
Suceava	50,787	9,542	9,443	10.7	1.4	1.3
Vaslui	4,595	6,924	6,915	1.4	1.5	1.5
Vrancea	3,678	5,075	5,803	1.4	1.3	1.4
Diocese of Iaşi	163,049	25,2675	271,569	5.7	5.3	5.6

From this table we can differentiate between 3 types of evolution of these communities with a diverse and often controversial origin: the first type characterizes the counties with a high share of Catholic population, Bacău, Neamț and Iași, where the growth rate of this population was spectacular and constant between 1930 - 2002; then, the counties with a stable share - Vaslui and Vrancea, with relatively important communities and with a growth rate similar to most regions; and last, the counties where a massive regress of such communities has been recorded: Botoșani, Galați and, especially Suceava. The last one, which occupies a large part of Bukovina, used to have important German, Hungarian and Polish communities that suffered the consequences of WW2, being forcefully repatriated (Germans and Hungarians) or they gradually assimilated or emigrated (Polish).

[2] He noticed: "A society which is more and more individualistic and less dependent on the word of God is not auspicious to natality..."

It is interesting how, in Suceava, the Neo-protestant communities have grown in time and although they didn't effectively replace the Catholic ones, they have reached a ratio compared to the Catholic one in 1930 (about 60,000 persons, mainly Pentecostals, which is almost 8.5 % of the total - see figure 1). The same situation is partially found in the other 2 counties of this group, the presence of the Catholic communities apparently diminishing the Neo-protestant proselytism.

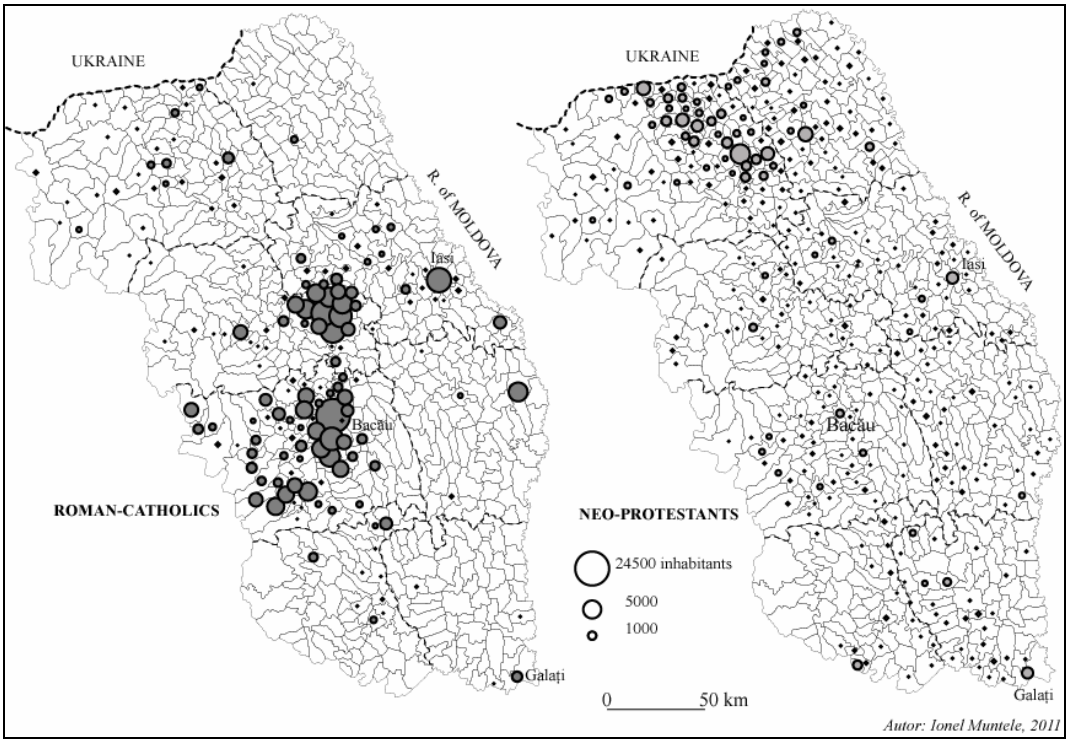

Figure 1. Spatial distribution of the Romano-Catholic and Neo-Protestant communities in Western Moldavia (2002)
(Data source: The Population and Housing Census of 15.03.2002)

We must observe that during this period, the number of the Catholic population grew considerably in some cities. In 1930, in general, the urban Catholic communities were highly diverse ethnically, but at present, as a result of the massive migration of the rural population, we have come to a unitary population, its majority being represented by the so-called Csangos. In this sense, the communities from Bacău (almost 24,500 persons - 13 % of the total), Roman (12,000 - 17 %) and Iassy (10,000 - 3 %) are indeed remarkable.

We must also mention the meaning we confer in this study to the term of geo-demographic singularity. We understand by this the situation in which a component of a territorial demographic subsystem (geographical) manifest itself singularly, apart from the general trends manifested by that subsystem. Such a singularity may be the starting point of a new trend, which by diffusion, may conquer larger spaces, or, on the contrary, may converge to the dominant pattern of evolution in that space. Actually, in the beginning, any demographic phenomenon manifests itself more or less singularly so as the chrono-spatial evolution may lead to its disappearance or expansion. In our case, we can speak about the manifestation of a demographic singularity specific to the Catholics from Moldavia, mainly during the post-war period when, on a national as well as regional level, even if on a smaller scale, there was this fast trend to converge towards the most advanced stage of the demographic transition in an extremely complex political and economic context. We can attribute to

the majority Orthodox community a „refractory attitude towards secularization", well-known for its role in starting the demographic transition (Bertillon, quoted by Bardet et al., 1999, p. 37[3]).

This manifestation of the singularity is also visible in the graphic that presents the evolution of the population from Moldavia and of the Catholic communities comparatively (figure 2).

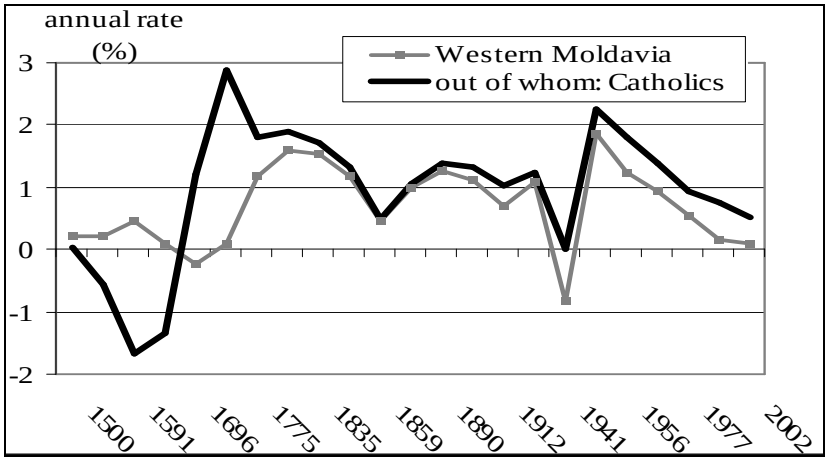

Figure 2. The evolution of the annual growth rate of population (estimation for the 1500 - 2002 period)
(Data sources: Tax registrations (1500 - 1835) and censuses of the population (1860 - 2002))

This way, we can distinguish between 3 periods in which, in the past, they significantly differentiated themselves from the rhythm of the numerical evolution of the population in the entire region: at the end of the 18th and beginning of the 19th century, in the context of an important influx of Transylvanian immigrants of Catholic religion; during the post-war period, especially after 1930, when we find an already existing trend to preserve a certain reproductive traditionalist behaviour at a moment when, on a regional level, the first stage of a demographic transition was fully manifesting itself; between 1956 - 2002, when the above mentioned trend became stronger, creating an important demographic cleavage on a local level, obvious in the numerical evolution of some rural centres found in a similar geographical context around Bacău and Roman (table 2).

Table 2. The evolution of the components of the 1956 - 2009 general balance of the population in the communes around Bacău and Roman (40 communes situated at 5 - 25 km distance of these)
(Data source: The statistical notebooks of the 40 analyzed communes taked from the Departmental Statistical Directions of Bacău, Neamț and Iași)

Category	Natural growth (‰, annual average)					Migratory growth (‰, annual average)				
	1956-1965	1966-1980	1981-1989	1990-2000	2001-2009	1956-1965	1966-1980	1981-1989	1990-2000	2001-2009
Orthodox	15.1	13.5	5.6	-0.8	-3.0	-3.5	-17.3	-18.4	5.2	3.6
Mixed	21.6	19.8	11.4	4.9	-1.3	-4.4	-14.5	-19.1	1.6	2.3
Catholic	28.0	22.9	16.7	8.5	-0.1	-5.3	-12.6	-18.7	-0.8	-1.3

Note: Orthodox. - communes with a predominant orthodox population; Mixed - communes with a mixed religious population; Catholic. - communes with a predominant Catholic population.

It is remarkable the difference that opposes, in the first place, the communes with a majority Orthodox population to those with a majority Catholic one: the former ones went through an attempt of modernization of the demographic behaviour much earlier, visible in the decrease of the the natural growth until the longlasting settlement of the natural deficit after 1995; the others resisted with high percentages of natural growth of population, even after 1990, and only in the

[3] The quoted author said, referring to role of the 1789 French Revolution: "The Revolution imbued the French spirit with 3 states of mind that continually evolved along centuries: the weakening of faith, the democratic spirit, and individualism."

last decade, under the effect of a still existing negative migratory balance did the attempt of finalising the demographic transition appear. The influence of the final migration, revealed by the evolution of the migratory balance, was important, as the communes with a majority Orthodox population entered the last stage of the rural exodus earlier (even since 1966 - 1980) as opposed to the communes with a majority Catholic population where the influence was felt after 1980 and still is as an effect of the relative superpopulation.

The absence of an obvious trend to return of a part of the population caught in the final migratory movements during the communist regime after 1990 is another feature of the Catholic population, this indicating another characteristic that makes it stand out: the early opening towards international migration of the workforce (Kinda, 2009). This also involves a major social risk linked to the separation of the couples or of the children from parents. If before 1980 they seemed more closely connected to the native places, going for pendular movements like commuting, after 1990 they became closely involved in the trend of the international movement for work, being among the first on a national level and even helping the Catholic church to support these communities. This new context generated a rapid alteration in the demographic evolution trends, the connection between international migration and devitalisation of some rural communities becoming widely known (Muntele and Iaţu, 2008).

THE COMPARATIVE ANALYSIS OF THE NATURAL BALANCE COMPONENTS IN THE RURAL MOLDAVIA, ACCORDING TO THE CONFESSIONAL STRUCTURE OF THE POPULATION

This analysis observes the way in which, for more than 4 decades, we can speak of a differentiation of the types of adaptation to the difficulties of demographic transition according to confessional criteria. The prolificacy of the Catholic communities was heavily highlighted in the past, being even recorded by statistics (38,154 Catholics in 1860 but 88,676 in 1899 and 109,262 in 1930 in interwar Moldavia only[4]). The spectacular growth in the latter half of the 19th century can also be attributed to immigration (Italians, Germans, Polish) but especially to the extraordinary vitality of the rural Csango communities[5] that experienced a series of trends of population towards the less populated regions, especially as a result of the agrarian reforms in 1864 and in 1888 (Muntele, 1998, p. 99 - 100). That particularity is also the result of a more favourable age structure (a larger number of young people) or of some mentalities or behaviours oriented towards family and community values.

The necessary information for this analysis comes partially from the territorial data base offered by the National Institute of Statistics or published in yearbooks by the county officials. Yet, a considerable amount was gathered, in time, from the statistic documents of the localities from the counties of Moldavia, according to current laws.

This way, a new statistic data base was created, including information on the evolution of the components of the natural change (natality and mortality) and of the number of the female population of childbearing age (15 - 49 years old).

The processing and unifying of the data allowed the making of some suggestive graphical materials that capture the differences in demographic behaviour in 8 categories of rural centres, separated according to their confession: majority Catholic (over 90 %), majority Catholic (60 - 90 %), mixed (40 - 60 % Catholics), mixed (15 - 40 % Catholics), majority Orthodox, with significant Catholic communities (5 - 15 %), majority Orthodox with significant neo-protestant minorities (15 - 40.9 %, respectively 5 - 15 %), majority Orthodox (over 95 %).

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4 The numbers were taken from the following sources: ”The Statistic Works of Moldavia.The 1859 - 1860 census, vol. I - II, Iassy, 1862; Colescu L.,”The Results of the 1899 census”, ICS, Bucharest, 1944; The general census of population from 29th December 1930, vol. II, ICS, Bucharest, 1941.

5 The majority of the Catholic population from Moldavia has always been formed of the so-called Csangos, a population with a controversial genesis due to the Romanian-Hungarian bilingualism, who successively crossed the passes of the Eastern Carpathians, coming from Transylvania beginning with the Middle Ages.

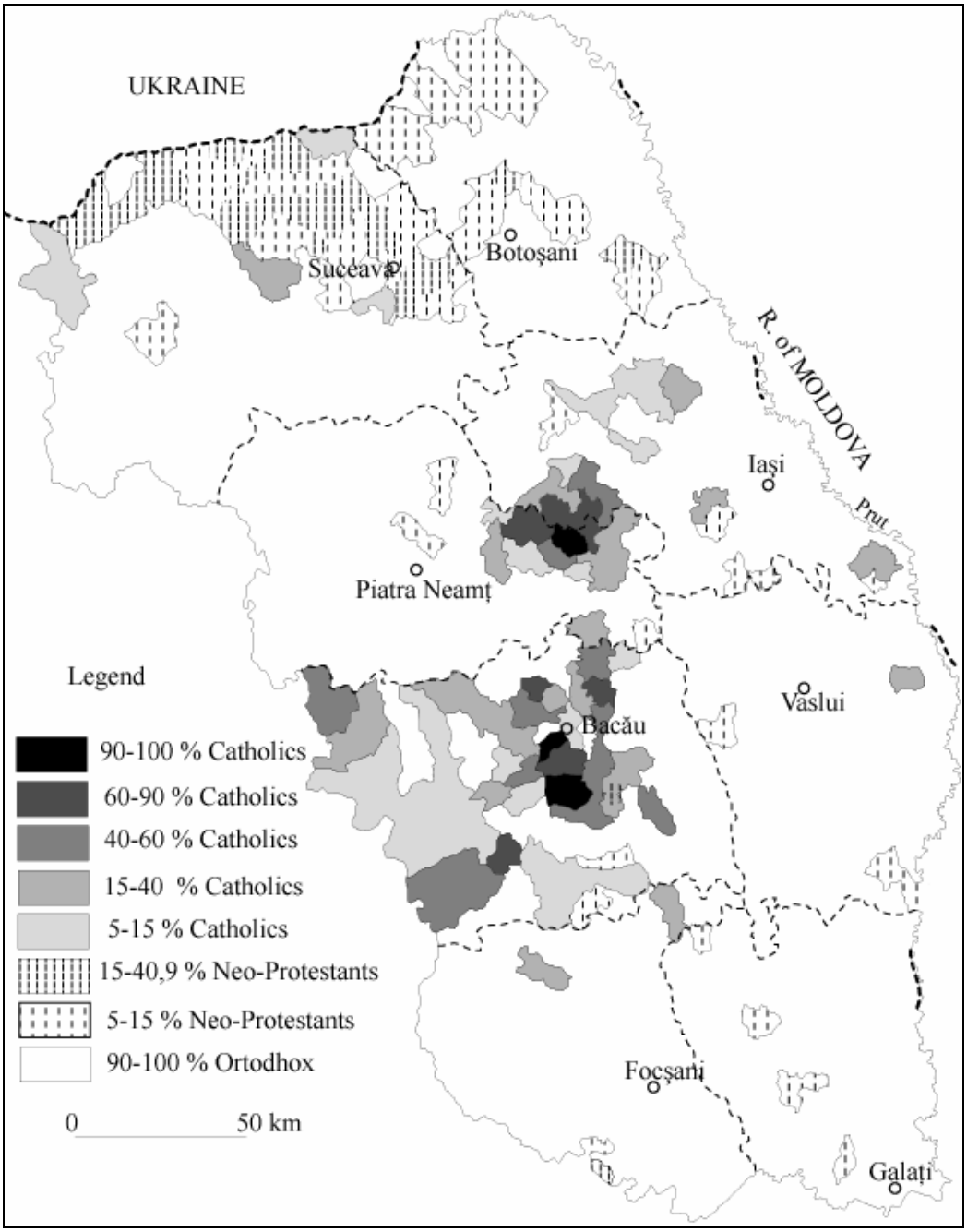

Figure 3. The ratio of the main confessional minorities in Western Moldavia in 2002
(Data source: The population and housing census of 2002)

Though arbitrary, this division was made with the purpose of establishing the differences induced by the presence of the Catholic communities, in the first place, and also, with the purpose of monitorizing the trends to converge or diverge of the relatively unitary categories (the predominant Catholic, Orthodox or with a larger number of Neo-Protestants).

This separation may be flawed by the superposing of some ethnical particularities of demographic nature but, taking into consideration the unity of the ethno-linguistic structure of the studied space, we can deem as negligible the influence of this factor.

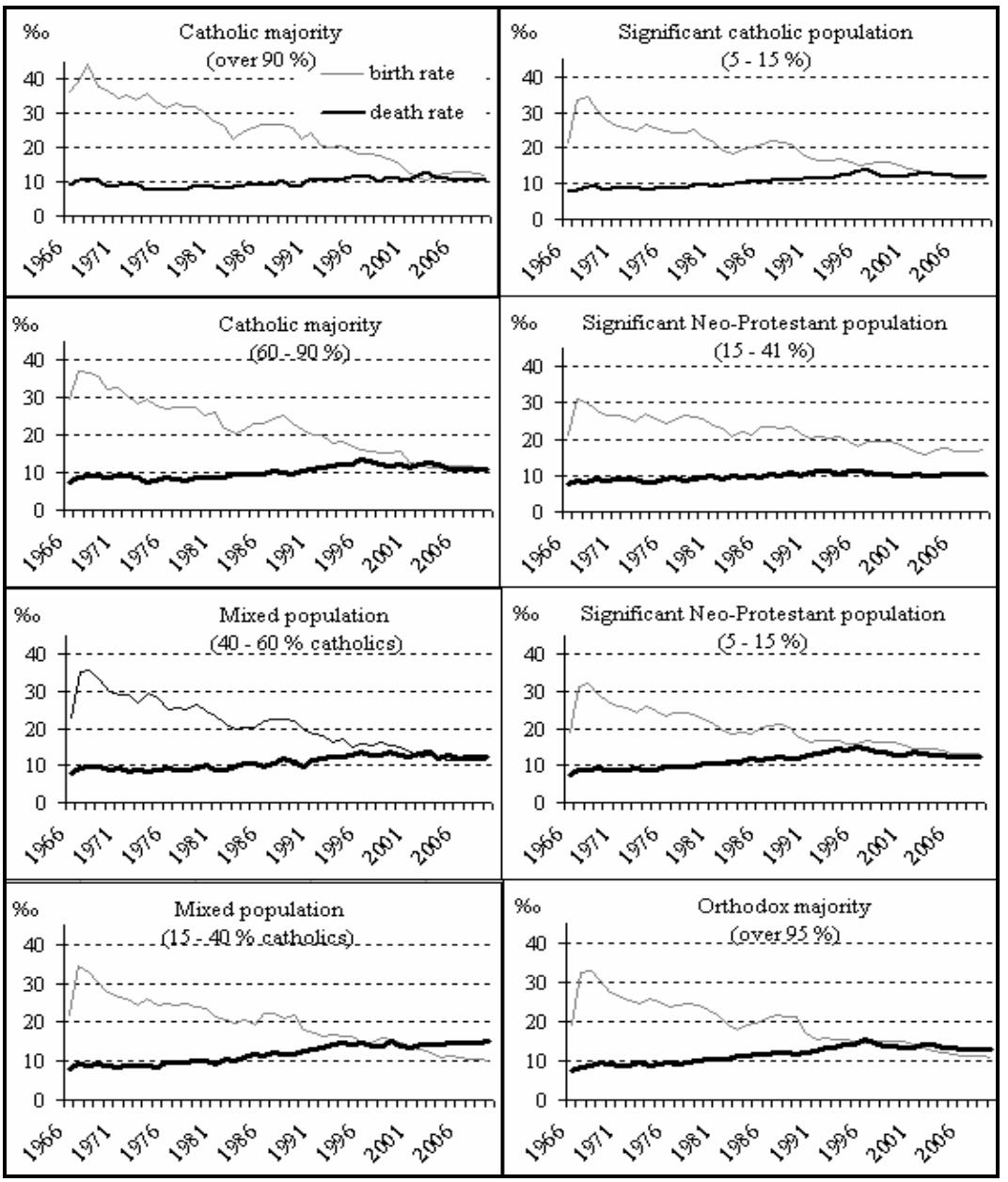

Figure 4. The evolution of the compontents of the natural balance in the 8 types of rural communes according to their confessional structure
(Data source: Statisticals yearbooks of the 8 Moldavian counties (1966 - 2009))

The spatial distribution of the eight categories of localities may be seen in figure 3, with the mention that the cities were eliminated from the analysis due to the behavioral pecularities induced by the urban centres.

A first set of conclusions drawn from the resulted graphic material has as starting point the evolution of the two elements of the natural change, natality and mortality in over 44 years (1966 -2009, figure 4).

- the communes with a predominant Catholic population (at least 60 %) were less affected by the pro-birth measures taken by the communist regime in 1966 as they had preserved this indicator at a high level (over 30 ‰ in 1966 to the only 19 ‰ in the case of the majority Orthodox villages).

The detailed analysis, case by case, proves that behavioral modifications were slower in Catholic communities in the post war period and didn't depend so much on the closest urban centres or on the size of the locality, as it happened with the majority Orthodox communes. Thus, we can observe that community values were much more important, more powerful than the openness to modern life that supposedly came if interacting with urban centres, under the circumstances of the rural exodus or the increasing of commuting (daily trips to work) in the first post-war decades. The conservatism of the Catholic communities may be observed in the higher rate of mortality, when there were no significant differences between age structures, this way allowing us to speak of a delay in the settling of the demographic transition of both components;

- the conjectural character of the exceptional natality growth between 1967 - 1972, shown by the relatively fast adaptation of the population to the coercive measures generated by the political control of childbirth can't be totally found in the communes with a majority Catholic population. The evolution curve of this indicator follows a rather natural course, generated by the adoption of new behaviours which are inevitable when talking about demographic transition. Only after 1980 do we notice its rallying to the general trends manifested especially in the growth of natality values as a substantial result of the new coercive measures taken by the communist regime between 1982 - 1986. However, the Catholic communities kept the advantage of a lower level of mortality, generating a more substantial natural growth.

- the evolution of birth rate during the post-communist regime confirms the existence of relatively divergent trends: a stagnation at relatively high medium values of natality in communes with an Orthodox majority (about 15 ‰, between 1991 - 2000) and a fast, continuous degradation in the majority Catholic communes, already open to the international migration. Thus, we have a convergence of values in 12 - 15 ‰ interval in the 1991 - 2000 period, as a result of superposing of some divergent trends which characterized the two communities: a massive rural come back in the Orthodox villages/insertion in the migratory international circuit in the predominant Catholic communes.

This way, after 2000, the differences between the two cathegories of communities are attenuated from the natality as well as mortality point of view until the settling of the demografic deficit.

From this moment on, slowly but steadily, another singurality starts manifasting itself regionally, the one generated by the Neo-Protestant communities, which implies the preservation of a relatively high level of natality, even with the small come back after 2000, thus generating a definitely positive natural growth. Apparently at least we can speak of the convergence of the demographic patterns that characterized the Catholic and Orthodox communities from that part of the country during the post-war era, as it is well-known the influence of the structural factors. This convergence is accurately rendered in the evolution specific to Bacău county.

The start of the modifications seems to have been mainly given by the 1990 moment which meant not only the given up of the birth control policies (until the manifestation of a general indifference between 1990 - 2000) and also by the opening towards earlier international migration of the Catholic communities especially towards Italy.

Though it may seem bold without some case studies, we can estimate a contamination with behavioural patterns specific to this Mediterranean country, well-known for its extremely low level of fertility indicators.

THE COMPARATIVE ANALYSIS OF THE GENERAL FERTILITY OF THE FEMALE POPULATION

In order to thouroughly study the conclusions presented previously, an analysis of the evolution of the general fertility of the female population was made for the last two decades, at the level of the same population cathegories, according to the confesional structures. Taking into account the variation of this factor the calculation of multiannual average for five years was prefered, this way distinguishing between four distinct subperiods compatible with the national trends. What the graphic material manages to capture is the significantly different behaviour of the population from the communes with Catholic majority: while in the others we can speak of a constant continuous decrease from generally high values in comparison to the other regions of the country (over 75 ‰), in such communes we noticed a faster decrease, accelerated in the period 1995 - 1999, in such manner that at the end of the studied period the level recorded was the lowest. Practically, in the communes with 90 % Catholic population, in twenty years, there was a shifting in values – from the highest ones (over 110 ‰) to the lowest (under 50 ‰). It's interesting to observe that in the communes with Neo-Protestant population a slower evolution was recorded, this way mantaining relatively high values (in comparison with the national average).

The connection between the ratio of the Catholic population and the evolution of this indicator is extremely obvious, allowing us to conclude that it suffered a significat modification of the demographic behaviour in these two decades (table 3). So, the decrease of natality wasn't only the result of the early manifestations of migration abroad for work, but also of the profound mentality changes to the family pattern in these formerly prolific communities. Though most studies on women's status and role in the Romanian society, especially the rural one, show that they are still in the pre-feminist phase of emancipation, the demographic reality of the past 2 decades demonstrates the interference of some rather feminist mentalities at least as far as procreation is concerned. And from this point of view, judging by the indicator of general fertility of the female population, the population of Catholic confession from Moldavian villages seems to be among the first modernists.

Table 3. The comparative evolution of the general fertility of female population in the rural areas from Western Moldavia
(Data source: Statisticals yearbooks of the 8 Moldavian counties (1990 - 2009))

Category	1990-1994	1995-1999	2000-2004	2005-2009
Catholic majority (over 90 %)	107.8	84.9	53.2	46.1
Catholic majority (60 - 90 %)	91.9	72.8	53.1	43.6
Mixed population (40 - 60 % catholics)	86.5	76.3	62.8	52.6
Mixed population (15 - 40 %catholics)	86.2	76.7	62.3	52.8
Significant catholic population (5 - 15 %)	80.0	73.2	62.0	52.4
Significant neo-protestant population (15 - 41 %)	100.2	90.4	78.9	67.9
Significant neo-protestant population (5 - 15 %)	83.2	78.4	70.1	57.6
Orthodox majority (over 95 %)	80.3	75.0	64.6	53.6

We can thus speak of a relative union of the demographic pattern in the rural Moldavian space, although there are still some phenomena connected to the persistence of certain reserves of young population. If until 1990 the conservative confessional communities (Catholic and Neo - Protestant) distinguished themselves by an exceptional demographic vitality, the general trend is to converge towards relatively low values of the fertility indicators. This way, the Neo-Protestant communities in the area impose themselves as a new demographic singularity regionally. This can also be traced in the hierarchy of the Moldavian counties from the point of view of the fertility indicators: for a long time, Bacău and Neamţ, with important Catholic minorities, registered higher values than Suceava. The latter county became well known after 1990, by maintaining the level of general fertility significantly higher, so that in 1966, the

indicator in Bacău was 86 ‰, in Neamț, ‰ and in Suceava, 77 ‰. In 1990 the values become somewhat similar (79 ‰, 77 ‰, respectively 78 ‰) and in 2009 there was a significant difference in favour of the last county (values of 41 ‰, 38 ‰, respectively 47 ‰). The decrease of vitality of the Catholic population was apparently essential in this change of hierarchy.

We can rightfully ask ourselves if the trends manifested among the rural Catholic communities from Moldavia weren't similar to those from other East-European countries with a more conservative rural Catholic population (e.g., Lithuania and Poland). In this sense, a new comparative analysis was made, one that refers to the evolution of the general fertility of the female population from the rural areas on a national level in Romania, Lithuania and in the rural majority Catholic communities from Moldavia (figure 5).

The resulting material proves that the modifications of demographic behaviour among the Catholic communities were stronger than in the case of the majority Orthodox ones that already registered a relatively low level at that time, the further evolution being even slower. The case of the Catholic communes from Moldavia resembles the case of the rural area in Lithuania, with a sole exception - they seemed even more conservative in 1990. It is difficult to say if we can speak of a more nuanced adaptation of those to the political imperatives of that period and the effects of the dissolution of the totalitarian regime. In other words, constraints specific to this regime, especially on a demographic level, found a more suitable location in the Catholic communities from Moldavia, the latter defending itself by preserving an exceptional demografic vitality. On the contrary, their disappearance and the freedom they later won, allowed for a recuperation of the delay, the demographic transition becoming final in a very short time.

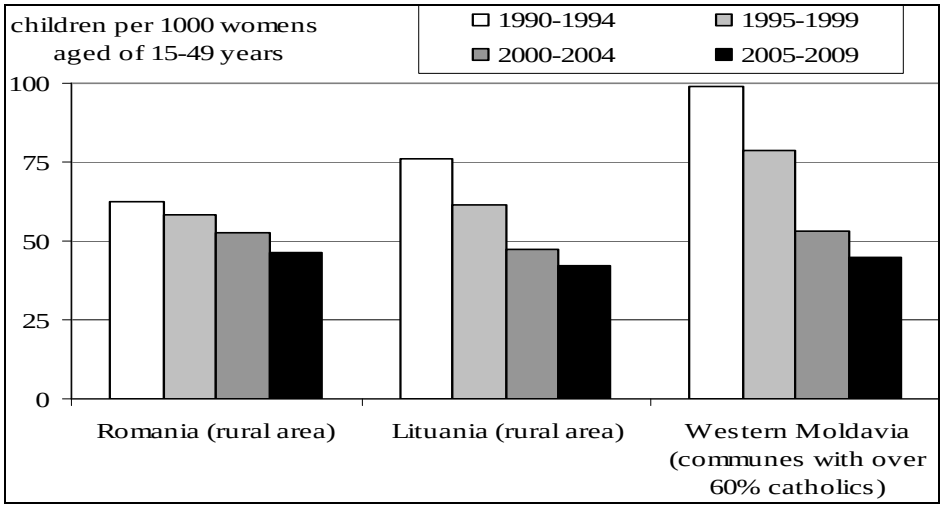

Figure 5. Comparative evolution of the general fertility rate of the female population (1990-2009)
(Data source: web page of the Institutul Național de Statistică (Romania) and Statistikos Departamentas (Lituania), consulted in january - february 2010)

CONCLUSION

The research so far has shown the manifestation of a clear divergence in the demographic behaviour of the Catholic communities and the rest of the rural population from Moldavia. In order to formulate hypotheses about this reality further, more thorough investigations on the patterns of social, cultural, economic behaviour of the analysed categories would be necessary. The provided statistical information always separates the well-defined trends. The fact that the ratio of the Catholic population, considered a discriminatory factor, always functions as a gradient which separates different behaviours at opposite ends is proof enough of the rightness of a possible hypothesis that postulates the existence of a distinct demographic pattern of this community, at

least until recently. The fading of the pattern and the community ceasing to act as a singularity in this domain is nothing but a conjectural situation, connected to the deep structural and dynamic transformations of the specific demographic stock.

If we analyse, for example, the evolution of the population structure according to age groups, we notice, from 1966 till present, a continuous trend of becoming similar of the values specific to the rural Catholic communities compared to the national mean. In 1966, the young population amounted to 39.8 %, respectively 31.4 %, with a significant difference, but in 1992 the values were much more similar: 27.8 %, respectively 25.1 % and later, they reached the same level; to the same effect, the elderly population evolved from 8.5 %, respectively 10.5 % in 1996 to 14.6, respectively 15.4 in 1992, with the same effective similarity of values in 2002. This short analysis allows for a significant advantage of the Catholic community who kept until 1992 an important advantage from the perspective of a more numerous female population of childbearing age, an advantage that was countered by a rapid decrease of the demographic indicators of fertility.

With present research it is difficult to say if this transitory situation may be attributed to the secularization of mentalities, the manifestation of an incipient form of feminism generated by the strong insertion in the international migratory circuits or the difficulties specific to the transition towards market economy, which hasn't avoided anyone, thus forcing the Romanian society to adapt to a situation which doesn't encourage or support the family behaviours necessary to preserve a demographic balance.

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CHINTENI MUNICIPALITY, TRADITIONAL RURAL SPACE VS. THE BEGINNING OF SUBURBANIZATION?

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Abstract: Rural space represents the territory where most lands are used for agriculture, forestry and fishing. Throughout the development of the dwelling spaces, people tried to merge the anthropogenic part with the natural environment without bringing prejudice to the latter. Therefore, the rural space has the capacity to preserve and restore the natural environment, as a result of a lower anthropogenic pressure compared to the urban space, associated with the level of economic development and the involvement of the authorities. Chinteni municipality, located near Cluj-Napoca City, changed gradually some of its rural characteristics. The anthropogenic pressure of the latest years led to important changes in the system structure, leading to a mass of different styles and shapes. The sustainable development of a rural space is defined by the balance between the conservation of the natural environment, from an ecologic, cultural and economic point of view, by preserving the traditional elements and the modernization and optimization of the rural life standards. The conclusions of this study demonstrate the orientation of the rural space of Chinteni municipality towards a trend of suburbanization, yet in its primary stage, still preserves specific elements of the traditional rural space.

Key words: rural space, rural society, suburbanization

* * * * * *

INTRODUCTION

This paper is a preamble to the analysis of the characteristics of rural space in Chinteni municipality. Accordingly, I will present the factors that determined the changes in the physiognomy of the municipality in time, as well as the effects. The identification and delimitation of the analyzed area is the first step of this study. The following step was the consultation of existing bibliography and mapping sources and then, ground research. The second stage consisted in analyzing and classifying the information in the integrate study of the phenomena. Than I made maps for the most representative of the situation of the area, using GIS method. Thus, methods like: the method of analysis, regional, choremathic and GIS were used. The principles that have been used are: the principle of causality, ecological, historicism and sustainable development. In order to better enhance the evolution of Chinteni municipality, I analyzed a series of demographic and economic elements. They will be presented next.

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TRADITIONAL RURAL SPACE

During its existence, Chinteni rural space emphasized one socio-economic reality that contributed to changes in local physiognomy. The continuity and sustainability of the civilization in this territory (the village is attested in documents since 1263) and the complexity of its characteristics are at present materialized in the existence of traditional households and architecture, the high weight of people working in agriculture (82 %), the type of agriculture (subsistence), the types of crops (forage, potatoes, tree growing etc), the traditional costume (figure 1), and some of the preserved customs (The *"Sons of the Village"* Annual Festival). These elements represent the "witnesses" of a traditional rural civilization within the analyzed municipality.

Figure 1. The traditional folk costume from Chinteni municipality
(Source: www.dansromanesc.ro)

DISTURBING AGENTS IN THE RURAL SPACE

The definition of the rural space at the level of the European Union[1] refers to the territories with villages and small towns, where most lands are used in agriculture, forestry and fishing, while the predominant activities are handicrafts and services and where the functions concerning rest and leisure are important. Based on this definition I will analize the spatial position of the municipality and its demographic and economic characteristics in order to be able to determine the evolutive trajectory of Chinteni municipality.

The concept of suburban "is the expression of the relationships between the city and the surroundings, relationships that not always have the finality of urbanization the area" (Cocean et al., 2010, p. 5).

According to the study of Suburban Spatial Planning. Case of study Bistrița municipality (Cocean et al., 2010) the main features of the suburban area ar:

- proximity to the city;
- functional relatinships with the city;
- built spaces;
- standing relations of cooperation with the city;
- suburban area creates agglomerations according to the theory of polarized development;
- it is part of the geographical landscape;
- agricultural activities and fruit tree are the specific forms of activity;
- the volume of demographic movement and the causes;
- reserve space for the suburban sprawl.

[1] European Charta of the rural space, 23 April 1996.

THE SPATIAL POSITION AND LOCATION

Chinteni municipality consists of the following villages: Chinteni, the seat of the municipality, Pădureni, Feiurdeni, Măcicașu, Satu Lung, Sânmartin, Deușu, Vechea and Sălișstea Veche. It is located to the North of Cluj-Napoca City at 12 km distance and has an area of 98 sqkm.

Two of the villages of this system (Chinteni and Deușu) are located on the main axis, DJ109, a road that connects the municipality with the city. The rest of the villages are interconnected by secondary roads (DC 149, DC 174, DC 148, DC 142) (figure 2). From the point of view of connections, the road network is relatively homogenously distributed within the territory. It has a high density, performing the link between the settlements of the municipality, as well as the link with the neighbouring settlements.

Although the density of the road network is high, it is mostly unmodernized which leads to a slower flow of mass, information and energy and puts pressure on the pace of development. The amount distributed in the territory and the absorption capacity of the system are also related to this.

The proximity of Cluj-Napoca City represents a favourable element for the perspectives of development of Chinteni municipality, but it also determines a pressure on the rural space, as the rural landscape starts getting urban characteristics, due to the pace of change and the land use. To support this statement, we will further analyze the factors which led and lead to changes in the physiognomy of the rural settlement (Cocean, 2007).

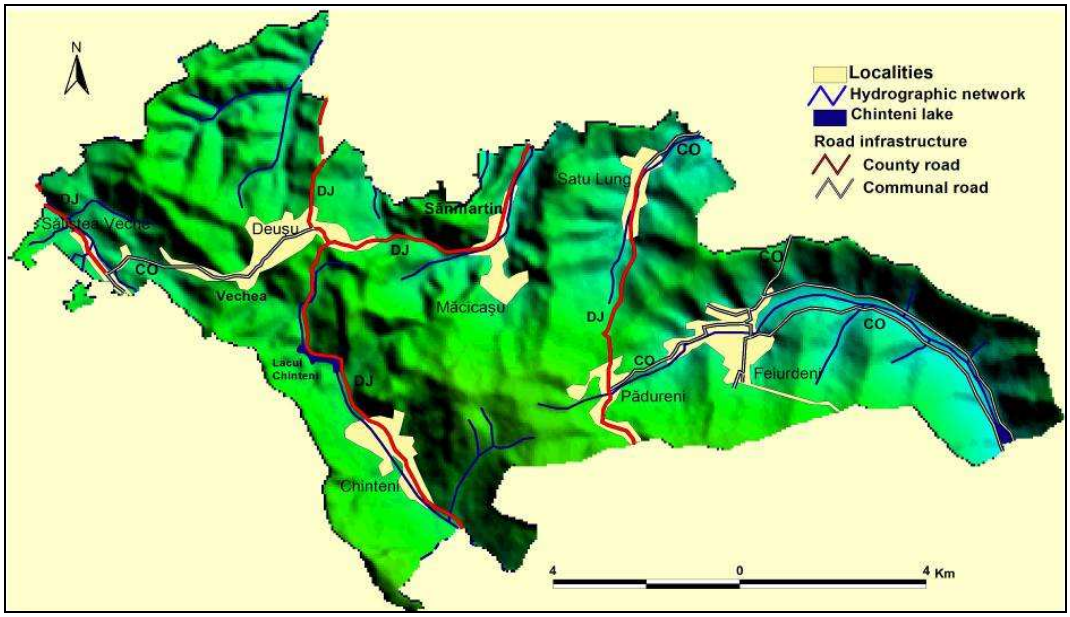

Figure 2. The map of Chinteni road infrastructure

Demographic characteristics

One may identify two trends in the evolution of Chinteni municipality: the 1910-1960 period when the highest number of inhabitants is registered (6734 inhabitants in 1941), and the period after 2002 when the population decreases (2786 inhabitants). Nevertheless, when analyzing the evolution of population, we have to take into consideration that until the 1941 census, Chinteni municipality consisted of 7 villages and after 1956 it consisted of 9 villages. The new villages are Pădureni (1910) and Sălișstea Veche (1956). Throughout the time, these two were part of Feiurdeni (Pădureni) and Vechea (Sălișstea Veche). In 1910 and 1956 respectively, they became independent villages.

Analyzing the demographic evolution of the municipality between 1910 and 2002, it comes out that the highest number of inhabitants was recorded in 1941, when Chinteni municipality had

6734 inhabitants. Gradually, the population decreased until 2002, when the lowest number of inhabitants was recorded (2786). At present, the total population[2] is 2803 inhabitants, in the context of the expansion of Cluj-Napoca City.

Until 1960, Chinteni municipality represented an attraction center which gave its population a high level of stability and obvious development, in the context of the trend of rural depopulation and the grouping of people in urban centres with forced industrial development. This stability was provided by the presence of certain favourable conditions, like:

- the favourable geographic position, given by the proximity of Cluj-Napoca City (12 sqkm);
- modern roads at that time (1960), D.J. 109;
- possibilities to employ the available population in economic activities in the city, due to the favourable conditions for commuting (the small distance of only 12 km to the town).

According to the existing data at the level of municipality (nine composing villages), in 1992 the population number was 3070 inhabitants. One may notice that the number decreased to 2786 inhabitants in 2002 (figure 3). This decrease is due to the migration of the population to areas that offer them highest life standards and possibilities to develop personally and professionally (Pop, 2007). The rural-urban migration phenomenon emerged, leading to the destruction of outgoing structures (depopulation of settlements, population aging and the disappearance of the autochthonous work-force) (Vincze, 2000). The weight of the population aged 60 and over at the level of the municipality is 24.4 %, and the demographic aging ratio is 1.30 due to the high weight of the elderly and the emigration ratio of 1.6 ‰, the dependency ratio in the municipality is 169.6‰. The high value of the dependency ratio influences the work productivity and the standards of life of the population.

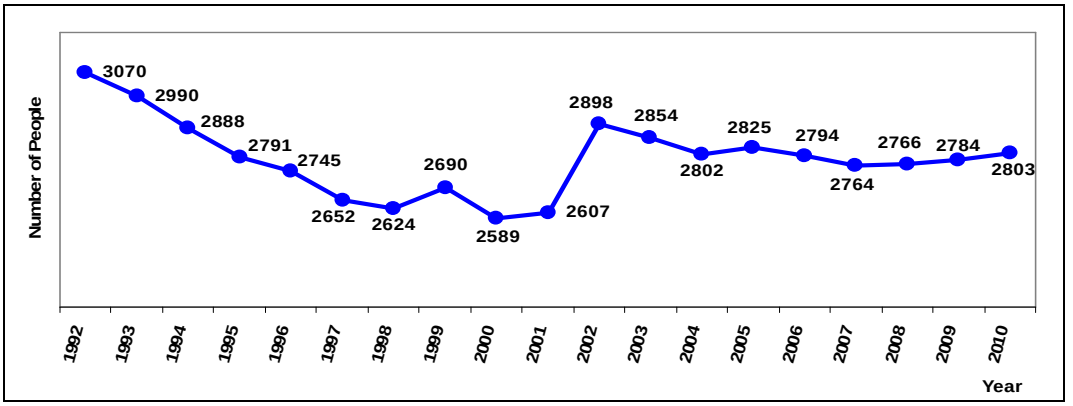

Figure 3. The numerical evolution of the Chinteni municipality between 1990 - 2010
(Source: www.insse.ro)

Due to the increased number of building authorizations[3] during the latest years, the population number estimated today is 2803 inhabitants. If in 2002, seven building authorizations were issued for residential buildings, in 2009 this number reached 58. Thus the usable area increased from 537 sqm in 2002 to 16,161 sqm in 2009. Compared to 2003, one may notice a decrease of agricultural lands by about 320 ha, due to the expansion of real estate market and the built-up areas.

Thus, the phenomenon of urban-rural migration emerged, the opposite to the one that took place after 1990. This phenomenon is registered in the context of Cluj-Napoca expansion, the increase of real estate prices in Cluj-Napoca, the increase of taxes for water, energy and gas, as well as in other fields, and the lack of green and recreational spaces in Cluj-Napoca.

[2] www.insse.ro
[3] Cluj Regional Department of Statistics

There were 108 people who moved their residence from Cluj-Napoca or nearby areas to Chinteni in 2009 comparing to 22 in 2002. This increasing migration to the rural space generates major changes in the phisiognomy of the village. These people brougth a new set of rules and principles. Modern and luxurious constructions stand up against the traditional rural buildings.

The expansion trend of the residential built-up space along with the continuous flow of people moving in the municipality, the heterogeneous population, the high number of commuters to Cluj-Napoca and the decreasing elements of the traditional rural space will lead to a phenomenon of suburbanization in the near future (Cocean, 2005).

Economic characteristics

The employment structure is characterized by a high weight of the primary sector of economy (82.4 %), followed by industry (12.3 %), while the others are employed in trade (1 %), administration (0.3 %), education and culture (3 %), health (1 %).

The inconvenience for the high percentage of the primary sector of economy, both in Chinteni municipality, as well as in all other Romanian villages, is the practice of low-level subsistence agriculture, the low number and quality of agricultural equipments and machinery (even if they exist in the municipality, they are out of use and of low quality, and 2.73 % are compensated by animal traction) and the legal status of the lands. The law no 18/1991 concerning the lands determined the excessive split of agricultural lands, leading to the development of subsistence agriculture, instead of a modern, performing agriculture. Therefore, the average size of a land lot in the municipality ranges between 2 and 3.5 ha.

Animal husbandry is an ancient activity in Chinteni municipality, as it is located on the hills and the area covered by grasslands and hay fields is large (3779.8 ha out of the total of 7609.16 ha of agricultural lands). This sector of agriculture is also oriented towards subsistence, fact demonstrated by the high number of households that raise sheep and swine (87.3 %), compared to the low number of those who breed cattle, sheep and swine (12.7 %). The animals in Chinteni municipality represent only a means to supplement the products obtained by crops, necessary for the everyday life.

An economic characteristic of space is the dependency of the type of capitalization of the natural (forest, agricultural and mineral) potential. The activities developed throughout the time reflect the closed relationship with the environment. Therefore his dominant activities are animal husbandry, craftsmanship and the production of construction materials (Surd, 2002).

Even if agriculture continues to be an important activity in the rural space, the secondary sector gains ground (12.3 %). Due to the soil and mineral resources (construction rocks, tuffs, sands, marls and clays used for cement, ceramics and kaolinic sands) of the analyzed system, an industry based on the production of construction materials has developed. This activity is performed locally by 4 companies specialized in construction materials.

The percentage of those who work in the tertiary sector is low (5.3 %). Most of the people commute to Cluj-Napoca. This phenomenon is also encouraged by the short distance between the two systems (rural-urban, 12 km), by the reduced time of the ride (15-20 minutes), by the low cost for transport (individual cars, because there is no public transport service to facilitate the connection with the neighboring areas).

The relations of the village with the neighboring areas (with Cluj-Napoca City especially) are also favourised by the villagers' dependence on the products of the market and the provided sanitary and educational services. The presence of supermarkets (Real is the closest), of shopping malls, of banking, health and educational institutions make Chinteni inhabitants dependent on Cluj-Napoca and not on the village resources. Apart from the labour force oriented to Cluj-Napoca City, Chinteni municipality also provides the city with vegetables and other products on the city's markets. The dependency ratio between the two systems is largely in favour of Cluj-Napoca City.

The choromatic method allows capturing the reality and highlighting the major territorial relations within the analyzed area. The elements that support the constructions of the Chinteni municipality choreme (figure 4) are:

- multiple levels of growth poles (administrative pole, main pole Chinteni, secondary pole Deuşu, three rank poles);
- axes of I, II, III order;
- areas of communication with external;
- effervescent areas (areas with high potential for development);
- repulsive areas (areas with slow socio-economic development with population decline and high-containment areas);
- convergence areas;
- external centers of polarization (Cluj-Napoca).

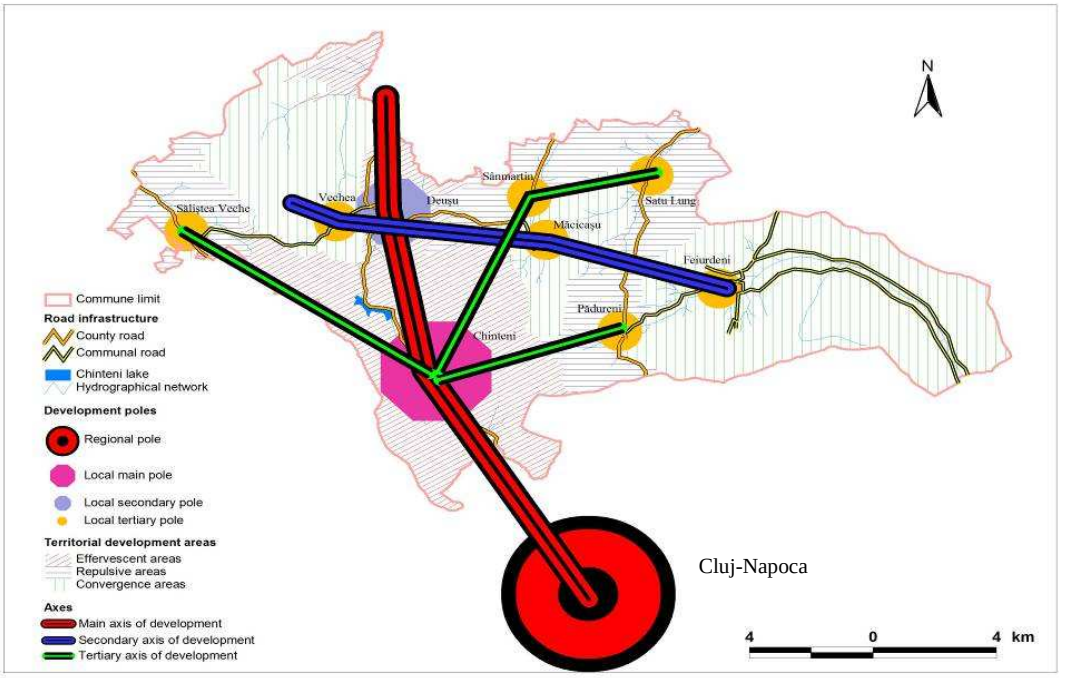

Figure 4. The choreme of Chinteni municipality

CONCLUSIONS

This study was based on different indicators chosen to give a better overview on the changes occured in the area of Chinteni municipality. These features outlined the beginning of a suburbanization process and the adoption of urban construction and architectural elements as well as an urban way of life.

However, one should not be mistaken about this shift of the rural towards urban structures, because there are still many traditional elements in the analyzed territory: the rural lifestyle, the low degree of modernization of the technical, the capacity and degree of services. Chinteni has a low level of developement, and elements of a higher degree of endowment are noticeable only in those parts of the municipality where the "new" (alochtonous) population lives.

Proposals made within the territorial development projects and the measures to be implemented will lead to a total suburbanization of the territory of Chinteni municipality.

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THE AVAILABILITY OF BANKING SERVICES IN POMORSKIE VOIVODESHIP - THE STATUS AND OPPORTUNITIES FOR FURTHER DEVELOPMENT

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Abstract: In the age of globalization the financial services are crucial for the efficient functioning of both businesses, as well as households. The following article presents the diversification of banking services' availability in Pomorskie voivodeship in 2010 and its reasons. The article also discusses the subject of franchise as a way of organizing sales, which could significantly boost the availability of banking services in the examined area. In Poland, the dominant role in the provision of banking services is played by traditional bank branches, even though the electronic distribution channels play an increasingly important role. In Pomorskie voivodeship, for every 10 thousand residents there are 4.7 bank branches on average. The highest value of the indicator was found for municipal districts of the Tricity, the districts of Lębork, Malbork, and Słupsk. The lowest value of index was found for the districts of Bytów, Chojnice, Człuchów, and Sztum. The determining factor in the aspect of distribution of bank branches in Pomorskie voivodeship is the degree of urbanization of each district. The development of franchises in the banking business is an important link in increasing the availability of banking services to people. The main advantage of franchising is the division of costs of establishing the branch between the bank and the franchisee, as well as higher operational efficiency. In addition, the franchise is largely based on smaller branches, the establishing of which is also profitable in smaller towns.

Key words: availability, banking services, Pomorskie voivodeship, franchise

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INTRODUCTION

Services are defined in the literature in various ways (Grönross, 1990) defines a service as an action or series of actions which are more or less intangible in their nature, and which normally take place during the interaction between a client and a customer service representative or between a client and the physical environment of the service provider. In countries with a high level of economic development, the service sector generates the largest share of GDP. In socio-economic geography, the availability of services is an important research issue, since it has a significant impact on business environment and the quality of life of residents in the examined areas.

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Particularly important is the role of financial services, including banking services, in the economy. In the age of globalization they are indeed crucial for the efficient functioning of both businesses, as well as households. What the author defines as banking services is banking activities as defined by Polish law[1], and consulting services provided for customers of banks.

In this study, the diversification of banking services' availability in Pomorskie voivodeship in 2010 is characterized and its reasons are determined. Moreover, areas for possible further development of banking networks are identified. The article also discusses the subject of franchise as a way of organizing sales, which could significantly boost the availability of banking services in the examined area.

MAIN DISTRIBUTION CHANNELS FOR BANKING SERVICES

Services are delivered to customers through a distribution system, i.e. a set of channels used by a company to distribute a given product category (Pilarczyk and Stefańska, 2006). In the banking business, the dominant role has been played by a model of multi-channel distribution based on the distribution of products through both traditional branch network and electronic channels (Chwirot-Zakrzewska, 2009).

The proceeding development of information technology and the ever wider people's access to the Internet has made electronic channels play an increasingly important role in the distribution of banking services. Nevertheless, in 2009 in Europe, the dominant role in providing banking services still belongs to traditional bank branches.

The sales volume of banking services in branches accounted for as much as 78.4 % of total sales volume. At the same time, the volume of sales conducted through electronic channels accounted for only 7.8 %. The share of electronic distribution channel is likely to increase; however, the leading role is still going to be played by bank branches (Bulgărea, 2010).

In Poland, the dominant role in the provision of banking services is also played by traditional bank branches, even though the electronic distribution channels play an increasingly important role (Chwirot-Zakrzewska, 2009).

This is due to the advisory activities which are performed in bank branches. Customers making their important financial decisions expect not only that banking transactions would be managed efficiently, but also that they would contact bank representatives directly, on the spot. For this reason, the distribution of bank branches in a certain area still plays the leading role in the analysis of availability of banking services.

THE DISTRIBUTION OF BANK BRANCHES IN POMORSKIE VOIVODESHIP IN 2010

One of the features of banking system in Poland is the uneven distribution of bank branches. Therefore, there are significant differences in the availability of banking services to residents of each area and in the intensity of competition which each branch has to withstand. In the area of Pomorskie voivodeship, the availability of banking services in each district is also highly diversified (figure 1).

In Pomorskie voivodeship, for every 10 thousand residents there are 4.7 bank branches on average. The highest value of the indicator was found for municipal districts of the Tricity, the districts of Lębork, Malbork, and Słupsk (5 - 7 bank branches for every 10 thousand inhabitants). The lowest value of index (less than 3 branches per 10 thousand inhabitants) was found for the districts of Bytów, Chojnice, Człuchów and Sztum.

[1] The bill passed on August 29, 1997 r. – Bank law (Dz. U. of 2002, No 72, item. 665 with further changes) acknowledges such banking activities as: the acceptance of cash deposits paid on demand or at a predefined date, running accounts for such deposits, running other bank accounts, granting credits and cash loans, granting and confirming bank guarantees, opening and confirming letters of credit, issuing bank securities, settling bank accounts holding cash, issuing electronic money instruments, issuing debit cards and managing operations using such cards, operations involving checks and bills of exchange, warrant operations, purchase and sale of receivables, the storage of valuables and securities, provision of safe-deposit boxes, conducting purchase and sale of foreign exchange values, granting and acknowledging sureties, performing commissioned operations related to issuing securities, brokerage in money transfers, and settlements in foreign exchange

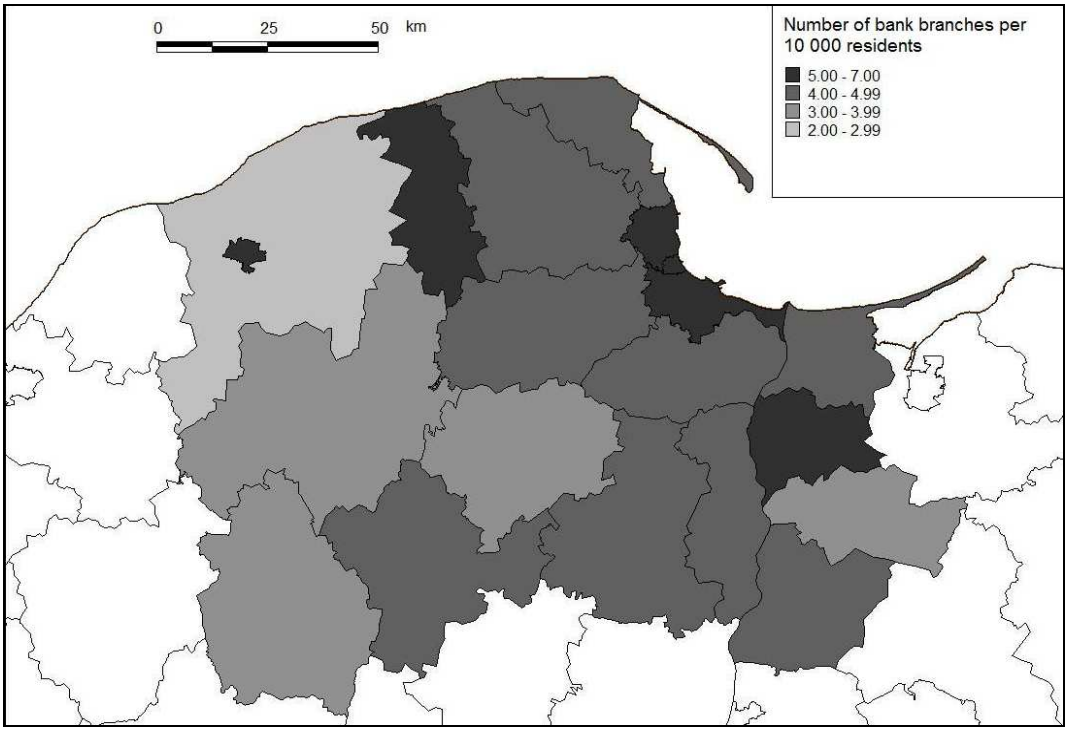

Figure 1. The average number of bank branches per 10 thousand residents in Pomorskie voivodeship in 2010 with division by districts
(Source: author's own study based on the contact details of bank branches)

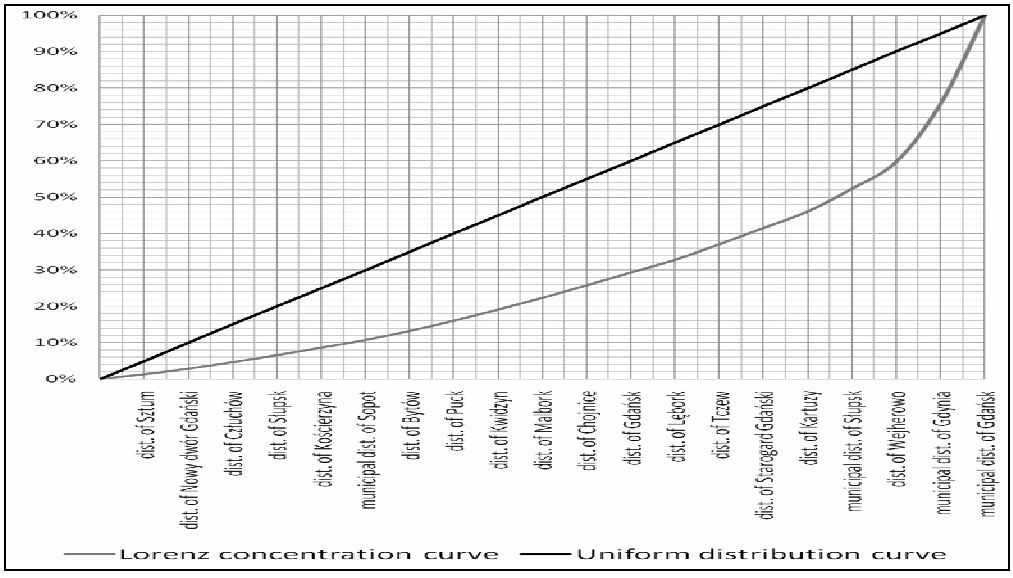

Figure 2. Lorenz concentration curve for bank branches in the districts of the Pomorskie voivodeship in 2010
(Source: author's own study)

It should be noted that the average ratio for Poland is 3.9 per 10 thousand residents. In Pomorskie voivodeship for every 10 thousand inhabitants there are more bank branches than in Norway (2.5 branches), Romania (2.9), and Belgium (3.9), but less than in Italy (5.7), France (6.0) and Spain (9.6)[2]. The concentration ratio of bank branches, as calculated from Lorenz concentration curve (figure 2), equals 0.53. The concentration ratio can assume theoretical values within the range (0,1), where 0 means the lack of concentration, and 1 means full concentration (Makać and Urbanek-Krzysztofiak, 2007). In the light of the above, the spatial concentration of bank branches in Pomorskie voivodeship can be considered significant. The concentration curve analysis shows that the highest spatial concentration of bank branches occurs in municipal districts of Gdańsk, Gdynia, Słupsk, and in the district of Wejherowo. In the area of these districts, 46 % of total bank branches are concentrated.

The determining factor in the aspect of distribution of bank branches in Pomorskie voivodeship is the degree of urbanization of each district. Figure 3 depicts the relationship between the number of bank branches per 10 thousand inhabitants and the degree of urbanization of districts in Pomorskie voivodeship. Basing on empirical data, a simple mathematical model was constructed in which the number of bank branches per 10 thousand residents is the dependent variable, while the degree of urbanization is the independent variable. There is a clear linear relationship between variables. The determination coefficient R2 equals 0.6772, which means that the model explains the variability of the dependent variable in almost 68 %.

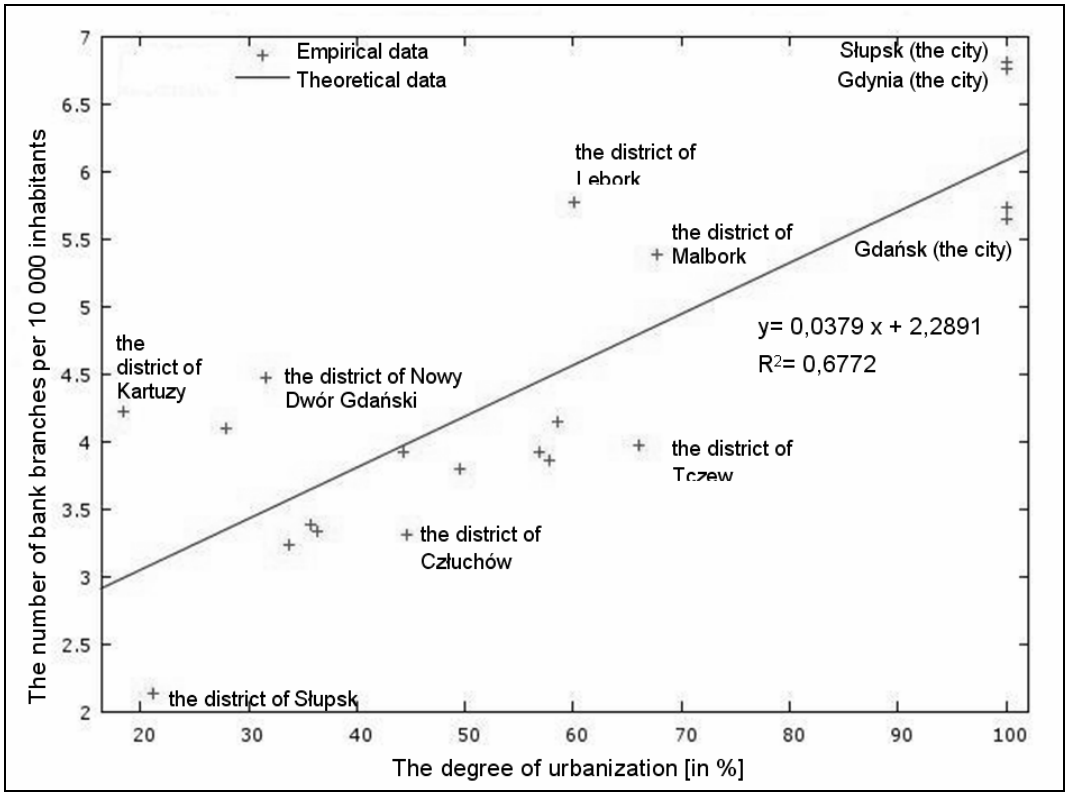

Figure 3. The relationship between the number of bank branches per 10 thousand inhabitants and the degree of urbanization in the districts of Pomorskie voivodeship in 2010.
(Source: author's own study)

[2] The author's own calculations based on report *EU Banking Sector – Facts and Figures*, 2010, European Banking Federation.

The justification of such a strong influence of the degree of the districts' urbanization on the density of bank branches must be sought in the way of services distribution by banks operating in Poland. Until the end of the XX century large bank branches played the most significant role in the distribution of banking services. Running such branches is associated with high costs, and thus to achieve profitability they need to have an adequately high turnover, which can only be secured in larger towns. Large bank branches still play a significant role in the distribution of banking services. However, it decreases steadily in favour of smaller branches, whose location in smaller towns has already become profitable.

The largest positive deviation of empirical data from the theoretical data as calculated on the basis of the model was observed for the district of Kartuzy, Lębork and the municipal district of Słupsk. On the other hand, the largest negative deviations are typical for the district of Słupsk, Tczew and Człuchów. By comparing this information with figure 1, the considerable importance of bank branches located in Słupsk can be noticed in terms of provision of banking services to residents of the whole districts of Słupsk and Lębork. Analogically, bank branches located in the Tricity are of similar importance to inhabitants of the district of Tczew, and bank branches located in district of Malbork - to inhabitants of the district of Sztum.

In the course of this research, the impact of residents' income size on the concentration of bank branches in each district was also estimated. With the aim to do it, the previously constructed model was enhanced with another independent variable, "the average monthly income per capita in zł". It turned out that in the new model the determination coefficient R2 equals 0.6773. It means that this model explains the variability of bank branches per 10 thousand inhabitants only by 0.01 % better than the previous model, based only on one variable.

This has become the basis for formulating a hypothesis that the variable, "the average monthly income per capita in zł", is not statistically significant. The verification of this hypothesis performed by using Student's t-test (at the significance level $\alpha = 0.01$) did not give reason for its rejection. Income is therefore a factor which has not been directly taken into consideration while deciding about the location of bank branches yet. The average monthly income, however, is strongly positively correlated with the degree of urbanization of each district (Pearson's linear correlation coefficient $R = 0.75$).

Since the demand for banking services depends on people's income, the districts with a low number of bank branches per 10 thousand residents and with relatively high average income per capita could be the areas of potential further development of distribution networks of banking services. These are primarily districts of Słupsk, Bytów, Sztum and Kościerzyna. At the same time, districts with a high number of bank branches per 10 thousand inhabitants and low average income per capita are the areas with lower potential for development of networks of bank branches. These include the city of Słupsk, and the districts of Malbork and Lębork.

FRANCHISE AS A WAY OF INCREASING THE AVAILABILITY OF BANKING SERVICES

Franchise is a specific method of organizing sales of goods and services (Stawicka, 2009) defines franchise as a long term, chargeable permission granted to a franchisee, a licence, and consent to offer products or services on behalf of the franchisor and to use its trade name, trademark, logo, as well as to apply the prices of products assumed by the franchisor.

One type of business in which franchise networks develop dynamically is the banking business. The use of franchise in the banking business brings several benefits for both the franchisor and the franchisee. A significant role belongs here to the method of financing the expansion of branch network. The bank incurs lower costs, since it uses - as a large part - the franchisee's capital. In this way, the bank obtains the possibility of expansion to local markets, where running its own branch would not be profitable.

In addition, the way of managing the branch and the effectiveness of performed activities are important elements, because in most cases, a self-employed franchisee achieves better results than a

hired manager. Meanwhile, an entrepreneur who joins a franchise above all obtains the know-how, as well as the possibility of running a bank branch under the brand which is well established in the market, and without a huge outlay as is required when setting up one's own bank (Szewczyk, 2008).

The development of franchises in the banking business is an important link in increasing the availability of banking services to people. The advantages of this form of organization of sales make it play an increasingly important role also in Pomorskie voivodeship. The best - developed network of franchise branches in Pomorskie voivodeship in 2010 belonged to PKO BP - 97 outlets.

The second largest network was Monetia, which already had less than half of them. It should be noted that the PKO BP was the only bank that has developed its network of partner branches since the early fifties of the twentieth century; however, at that time franchise branches' scope of operation included only activities related to clearing transactions and deposits, so they are difficult to compare with the institutions established nowadays. Such banks as BPH and Getinbank possessed 10 franchise branches in Pomorskie voivodeship, whereas franchise networks of the remaining banks had less than 10 branches and the other banks had fewer than 10 branches. The importance of franchise branches in the distribution of banking services is varied among banks (figure 4).

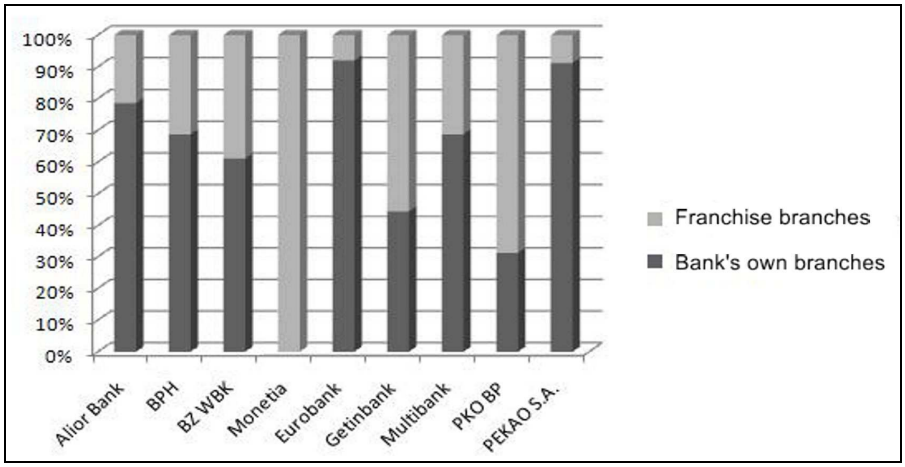

Figure 4. The share of each bank's own and franchise branches in the total number of branches of the selected banks in Pomorskie voivodeship in 2010.
(Source: author's own study)

DnB Nord bank established Monetia brand in order to build a distribution network as a franchise, and therefore Monetia network consists only of franchise branches. It should be emphasized, however, that they offer a smaller range of services than branches of DnB Nord, as well as franchise branches of the remaining banks (see table 1).

In 2010 Monetia Banking Agency offered only deposits and settlement products. In the case of PKO BP, the number of franchise branches exceeds the number of bank's own branches. A significant share of franchise branches also belongs to Getinbank. These accounted for almost 60 % of all branches of the bank. Additionally, it appeared that partner branches of Getinbank offered more products and services than the bank's own branches. These are namely mortgages, and car leases, which in larger towns were sold by specialized divisions of Getin group, such as DOM Bank or Getin Leasing (Dudek, 2008).

In case of the other banks, the share of franchise branches in the total number branches is not that high. However, they are an important element of the distribution network, inter alia, for BZ WBK, Multibank, and BPH. It should be emphasized that in case of Multibank, equipment and products offered by franchise branches do not differ at all from those found in the bank's own branches.

Table 1. Products and services offered in franchise branches of selected banks in 2010
(Source: author's own study based on analysis of banks' offers)

Product or service	**BZ WBK**	**Eurobank**	**Getinbank**	**ING Bank Śląski**	**Monetia**	**Multibank**	**PKO BP**	**PEKAO S.A.**
Credit / cash loan	yes	yes	yes	yes	no	yes	yes	yes
Loan / loan consolidation	no	yes	yes	no	no	yes	yes	yes
Mortgage	yes	yes	yes	yes	no	yes	yes	yes
Car loan	no	no	yes	no	no	yes	no	no
Credit cards	yes	yes	yes	yes	no	yes	yes	yes
Current account	yes	yes	yes	yes	no	yes	yes	yes
Savings account	no	no	no	yes	no	yes	yes	yes
Foreign currency account	no	no	no	no	no	yes	no	yes
Deposit	yes	yes	yes	yes	yes	yes	yes	yes
Settlement products	yes	yes	yes	yes	yes	yes	yes	yes
Investment funds	no	yes	yes	yes	no	yes	no	no
Brokerage Services	no	no	no	no	no	yes	no	no
Western Union services	yes	no	no	no	no	no	no	yes
Leasing	no	no	yes	no	no	no	no	no
Other services – e.g. phone top-ups	no	no	no	no	yes	no	no	no

There are two main models of franchise systems in the offer of banks operating in Pomorskie voivodeship. In the first one, the bank provides franchisees with a fully equipped office, which is not usually much different from the bank's own branches. In addition, the bank itself will select the most convenient location for the branch. One disadvantage of this system is a relatively high cost of accession. In case of ING Bank Śląski, which prefers this system, the minimal sum of franchisee's own contribution is 50 thousand zł, while in case of Multibank, it is about 100 thousand zł[3]. In the second model, the responsibility to find and equip the office rests upon the franchisee. The selected location must be approved by the appropriate authorities of the bank. The franchisor helps to adapt the premises to the standards applying for the franchise, not always contributing to the costs of the project, though. Additionally, in this model a partner branch often has limits concerning the product offer as compared with the bank's own branches. Joining the franchise network which functions on the principles mentioned above, however, is usually much cheaper. The minimal sum of the contribution required from a franchisee is in the range between 10 thousand zł in case of PEKAO SA and 30 thousand zł in the case of PKO BP. It should be noted, though, that these amounts may vary depending on local conditions.

Especially the second of the models may contribute to increasing the availability of banking services in the analysed voivodeship. It is because the model is based on smaller branches, the establishing of which is economically viable also in smaller towns, that is, in the areas, where the availability of banking services has been relatively low so far. An important aspect for potential franchisees is also the relatively low cost of joining the franchise.

SUMMARY

Despite the fact that banking services are provided to people on an increasingly large scale using the electronic distribution channels, bank branches still have the chief influence on the availability of these services in Europe. In Pomorskie voivodeship, for every 10 thousand residents there are 4.9 bank branches on average, which is more than their average number for the whole

[3] This sum includes the franchise fee, which amounts to 35 thousand PLN.

Poland. The largest availability of banking services is found in districts with a high degree of urbanization. It is the major factor influencing the distribution of bank branches. What is surprising is the fact that the availability of banking services is not directly dependent on people's income in each area, even though this is the factor that significantly affects the demand for banking services.

The increase in the availability of banking services in Pomorskie voivodeship will probably take place in districts with a low number of branches per 10 thousand inhabitants and with a relatively high average income per capita (districts of Słupsk, Bytów, Sztum, and Kościerzyna). At the same time, districts with a high number of bank branches per 10 thousand residents and with low average income are the areas with lower potential for development of networks of bank branches (the city of Słupsk, and the districts of Malbork and Lębork).

The increase in the availability of banking services may be affected by the further development of the banking franchise networks. The main advantage of franchising is the division of costs of establishing the branch between the bank and the franchisee, as well as higher operational efficiency. In addition, the franchise is largely based on smaller branches, the establishing of which is also profitable in smaller towns. Banks are therefore likely to use this way of expansion to an increasingly large extent, which may increase the availability of banking services in the areas with a lower degree of urbanization.

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RELIGIOUS STREETS` NAMES IN POLAND

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Abstract: The aim of the paper is to show the spatial differentiation of street names related to religion in Polish cities. All voivodship capitals have been chosen to analyze the kinds of religious streets` names. There are only 869 streets` names (3,1 %) originated from religious culture among 28.264 streets in 18 voivodship capitals. Kraków (Cracow), the capital of Minor Poland, is the unique city because there are as many as 125 religion - related streets` names. Cities as Szczecin, Opole, Rzeszow and Katowice as well as Cracow have the biggest participation of religious names (4 % and more). Religious streets` names of voivodship capitals indicate the Christian tradition, mainly Roman-Catholic. The most frequently street`s name is John Paul`s II which is present in every city and in some of them even twice. Only 61 streets` names (7 % of religious names) derive from non - Christian origin like Jewish, ancient Greek and Roman religions, Slavic and Baltic religions. A few streets` names (10) come from other Christian religions for example Orthodox Church street.

Key words: streets` names, geography of religion, Poland, voivodship capitals

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Municipal naming is contemporary a very expanded linguistics branch which obtain 3 elementary types: 1) areas, e.g. districts, outskirts, 2) tracts, e.g. streets, alleys, boulevards, 3) points, e.g. places, bridges, squares, monuments, hills, cinemas, towers and many more (Jaracz, 2004, p. 139). Streets` names, called plateonims (platea means street in Greek), are dominant component of municipal naming (Mrózek, 2004, p. 85).

Cities` naming connected with religion and cult M. Jaracz includes to the group of sacred names (Jaracz, 2004, p. 140). Otherwise E. Breza uses the term „cult names" understood as those „which include the name of God, His Mother and saints" as well as names "consolidating cult names, people performing cult and names of the objects needed for cult" (Breza, 1993).

According to M. Buczyński cult places` names consist of 2 principal groups: pagan names, pre-Chrisian and Christian names (Buczyński, 1997, p. 140). Names of streets, alleys and roundabouts dealing with religion the author of this paper called hierotoponims in the previous works (Przybylska, 2008). In the following paper the term "religious names", "cult names" and "hierotoponims" have been used interchangeably. Religious naming of public places is the element of immaterial culture.

The choice of persons taken for streets` patrons is "the expression of believed values and their hierarchy as well as the attitude of local community to their history" (Miszewska, 2004, p.

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145). After-war Poland`s history shows that it is easier to change symbols and names than eliminate sacral objects from the landscape. Since 1989 local governments often came back to pre-war streets` patrons and started to give names after recently died priests of merit to local community. The analyze of Wrocław, Słupsk and Gdynia city`s plans are the example of this phenomena (Romanow, 2000).

The aim of the paper is to show the spatial differentiation of streets` names related to religion in Polish cities. All voivodship capitals have been chosen to analyze religious streets` names. The article also answers the question: What kind of religious streets` names are present in 18 Polish voivodship capitals?

It can be stated that the present paper, because of the focus on spatial aspect of linguistics topics, pretend to be a work on linguistics geography in the broadest understanding of H. Karaś who characterized this field of study as „the subject of research which contains all what is both linguistic and geographical" (Karaś, 2010).

The database TERYT of Central Statistical Office in Warsaw was the source of information about official streets` numbers and names in the cities. In the database and in the present article the term „street" implies not only a street but an alley, a square, a cirrus, a roundabout and a bridge as well although streets are in vast majority.

There are only 869 streets` names (3,1 %) originated from religious culture among 28264 streets in 18 voivodship capitals (table 1).

Cities with the biggest number of streets (above 2000) distinguish either minimal share of cult names of streets (Warszawa 1,7 %, Łódź 2,0%) or significant (Kraków 4,3 %). Similarly in the group of the cities characterized by small number of streets (below 1000) some of them have almost the highest rate (Rzeszów 4,9%) and others the lowest (Gorzów Wielkopolski 1,8 %). The size of the city does not influence the amount of the religious streets` names.

Table 1. The number of religious streets` names of voivodship capitals in Poland.

City	Streets		
	All	Religious names	Religious names (%)
Białystok	1058	36	3,4
Bydgoszcz	1469	46	3,1
Gdańsk	1673	64	3,8
Gorzów Wielkopolski	613	11	1,8
Katowice	1145	61	5,3
Kielce	682	22	3,2
Kraków	2877	125	4,3
Lublin	1263	29	2,3
Łódź	2389	48	2,0
Olsztyn	562	18	3,2
Opole	694	28	4,0
Poznań	2351	56	2,4
Rzeszów	831	41	4,9
Szczecin	1641	70	4,3
Toruń	861	27	3,1
Warszawa	5387	92	1,7
Wrocław	2190	79	3,6
Zielona Góra	578	16	2,8
Sum	28264	869	3,1

Source: own study based on TERYT database (www.stat.gov.pl; access 09.06.2011)

In the map of Poland Kraków (Cracow), the capital of Minor Poland, is the unique city because there are as many as 125 religion-related streets` names (figure 1). None of the cities has as many as 18 streets` names coming from the orders` names, e.g. Franciscan Street, Benedictine Street, Cistercian Street. The uniqueness of Kraków considering its sacral function was underlined by E. Jurkiewicz, Z. Górka who stated that among cities they analized (Gniezno, Opole, Poznań and Warszawa) „Kraków becomes „a monastic city" - 1 clergyman per 200 members of the church, whereas in Warszawa – per 600, and in Opole - per 1000" and „in comparison to the whole country Kraków concentrates about 1% Roman-Catholic churches, parishes and priests – and as many as 10% monks and nuns" (Jurkiewicz, 1993, p. 77).

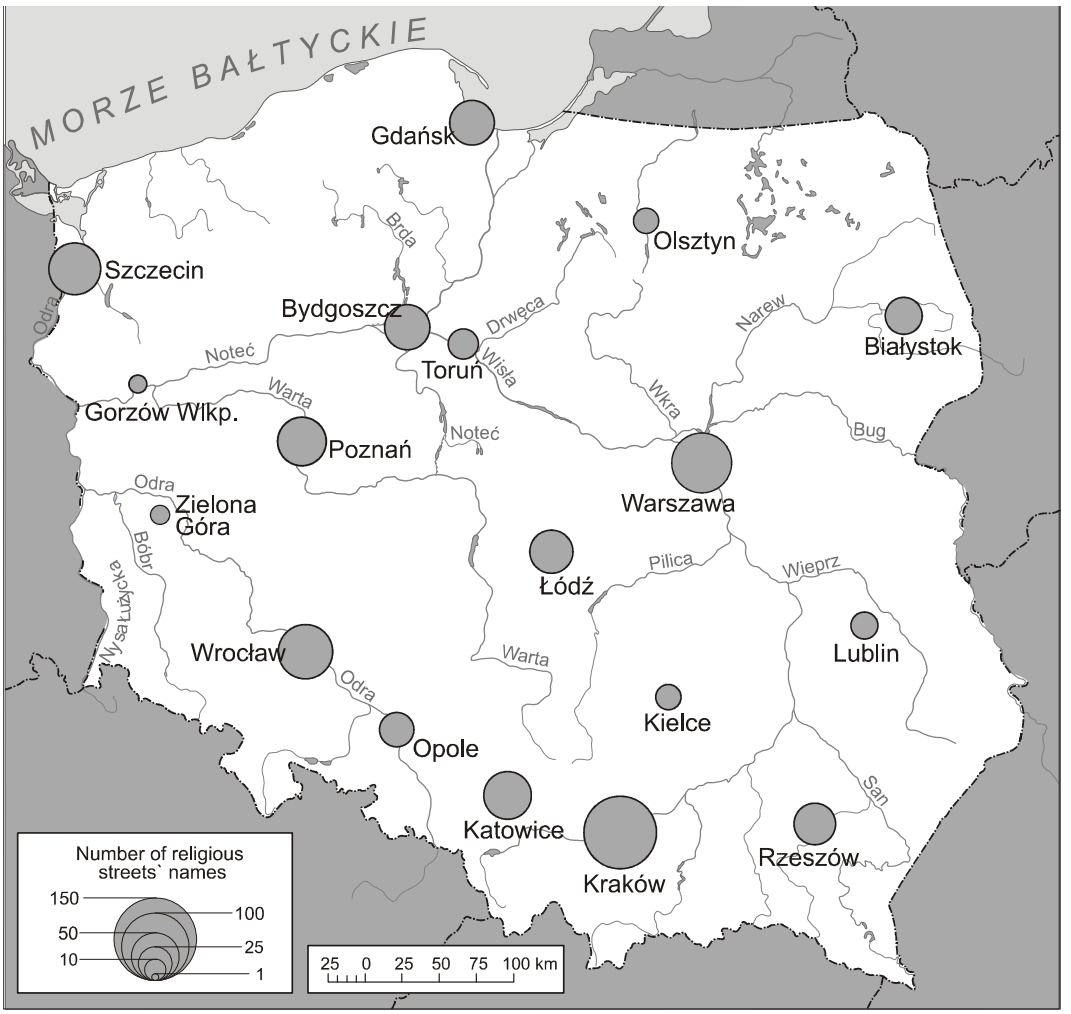

Figure 1. Religious streets` names of voivodship capitals in Poland in 2011
Source: own study based od TERYT database (www.stat.gov.pl; access 09.06.2011)

It must be underlined that the cities with the highest rate of streets` names connecting with religion (except from Szczecin) are situated in the southern Poland. Cities as Opole, Rzeszow and Katowice as well as Kraków have the biggest participation of religious streets` names (4 % and more). Those southern voivodship capitals are located in the dioceses characterized by dominicantes rate in the period 1980 - 2009 higher than Poland`s average. Additionally since the

eighties Przemyśl and Tarnów diocese and separated in 1992 Rzeszów diocese are continuously (in rotation) on the first, second or third position in the country in the aspect of the participation of the faithful in Sunday masses (dominicantes rate 59,0 % - 87,0 %) (Zdaniewicz, 2010).

Religious streets` names of voivodship capitals indicate the Christian tradition, mainly Roman-Catholic. The most frequently chosen street`s name is John Paul`s II which is present in every city and in 6 of them even twice (e.g. there is John Paul`s Street and John Paul`s Square in Katowice). Other popes are not so popular as there is only one street dedicated to John XXII in Kraków and to Paul VI in Szczecin.

Streets` names coming from priests, monks or nuns make the most numerous group of hierotoponims in voivodship capitals (380 names). Beside popes there are streets dedicated to honourable priests of XX century: cardinal Stefan Wyszyński (in every city excluding Zielona Góra, Kielce, Lublin, Opole) and priest Jerzy Popiełuszko (excluding Wrocław, Gorzów Wielkopolski, Zielona Góra, Gdańsk).

There are only 25 streets` names pointing out nuns` or monks` name. The most popular persons Brother Albert and Mother Theresa from Calcutta have been made streets` patrons in 4 voivodship capitals. Other streets` names beginning with the word "sister", "father", "abbot" are the exceptions in different cities.

People chosen as streets` patrons are either famous throughout the country like sister Faustina and priest Jerzy Popiełuszko or known only to local community. The latter are in majority in the category of religious streets` names related to different kinds of priests, monks and nucns. Bishop Edward O`Rourke Street and Bishop Andrzej Wronka Street in Gdańsk can be a good example.

Apart from clergymen there are 2 other principal categories of religious streets` names as it is shown at figure 2. The second most frequently present group on cities` plans is the category which includes words "blessed", "saint" or "holly" (247 names). Saint Wojciech (Adalbert) Street is the most popular street in Polish voivodship capitals. Saint Adalbert was a bishop of Prague and a missionary martyred in his efforts to convert the Baltic Prussians in the year 997. He was made the patron saint not only of Poland but Czech and Hungary as well.

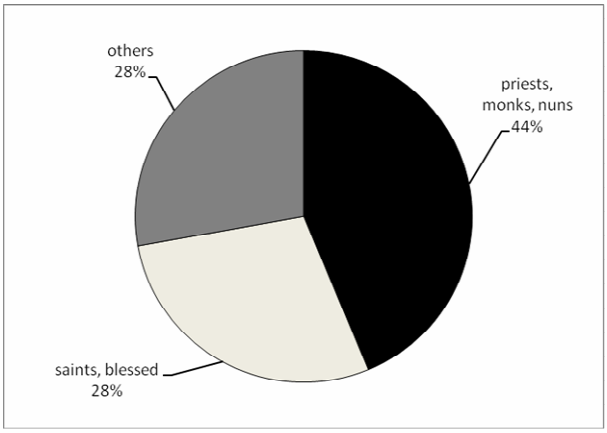

Figure 2. The kinds of religious streets` names in voivodship capitals in Poland
Source: own study

Streets` names dedicated directly to Saint Mary, mother of Jesus, are not very common in Polish cities what seems strange as most Roman-Catholic sanctuaries in Poland are devoted to this holy person (Jackowski, 2003, p. 226). Blessed Virgin Mary Street is only in 4 voivodship capitals (Kielce, Wrocław, Białystok, Gdansk). However, if taking into consideration a group of streets indirectly pointing out Saint Mary for instance Marian Square, classified to the third group called "others" because of the lack of the adjective

”saint”, “blessed” or “holy” the number of “Marian” streets arises significantly up to 17 outnumbering any other street dedicated to a canonized or beatified person.

The group „others” is made of 242 different religious streets` names. They come from places and objects (Three Crosses Square in Warszawa, Church Square in Opole), ecclesial function (Bishop Street in Kraków), other denominations (The Mennonites Street in Gdańsk), names of non-Christian gods and goddesses (Zeus Street in Warszawa), referring to Blessed Virgin Mary (Marian Square in Szczecin) or Jesus (The Saviour Street in Warszawa) and feasts (Divine Mercy Street in Kraków).

Streets referring to monastic tradition make the most numerous group nearly 1/3 of the category „others” (64 streets and squares). Saint Franciscan Street is the most popular among them (9). Nearly 1/3 of monastic names is located in Kraków where there are names commonly used throughout the country as Franciscan Street or Cistercian Street and observed only in Kraków like Trinitarians Street (from the Order of the Holy Trinity).

Summarizing, streets` names related to religion are not a numerous group in 18 voivodship capitals. The rate varies from 1,7 % in Warsaw to 5,3 % in Katowice. It is characteristic that among 5 cities with the highest rate of streets` names connecting with religion 4 of them are situated in the southern Poland. Analyzed religious streets` names indicate the Christian tradition, mainly Roman-Catholic and hundreds of streets` names dedicated to saints and blessed as well as priests, friars and nuns clearly prove it. Only 61 streets` names (7 % of religious names) derive from non-Christian origin like Jewish, ancient Greek and Roman religions, Slavic and Baltic religions. A few streets` names (10) come from other Christian religions for example Orthodox Church Street (figure 2).

Not many streets` names refer to past denominational structure of Poland. In the period between the two World Wars there were 12 % Orthodox Church, 10 % Greek-Catholic, 10 % Jewish and 2,6 % Protestant (Jackowski, 1999, p. 35). Contemporarily there are no streets` names in voivodship capitals beginning with a word „pastor” or „pop” documenting religious minorities` activity. It can be observed that religious streets` names of voivodship capitals in Poland are dominated by Roman-Catholic denomination just like the denominational structure: there are 96,1 Catholics per 100 inhabitants in Poland (The Statistical Yearbook of the Republic of Poland, 2010, p. 847). Author`s conclusions coincide with the tendency in Polish municipal naming in the period 1997 - 2003 distinguished by E. Borysiak who noticed „growing streets` number coming from clergymen`s name and surname, especially Catholic priests” (Borysiak, 2005, p. 44).

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DESCRIPTION AND PRESENTATION OF SOME RARE ASSOCIATIONS FROM LĂZĂRENILOR HILLS (NORTH - WEST ROMANIA). STUDY CASE ASSOCIATION *NAJADETUM MINORIS*

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Abstract: This paper aims to describe and present three rare associations (*Najadetum minoris, Potamogetonetum crisp şi Ranunculetum aquatilis)* from Lăzărenilor Hills. The value of this study is the fact that these phytocoenoses weren't previously described, in this area. By the identification, characterization and presentation of the associations above mentioned, this enterprise contributes to the enrichment of scientific patrimony from Romania and from abroad. These associations are found on the red list of missing, endangered, vulnerable and rare vascular plant. Among floral species endangered to disappear, from Lăzăreni Hills, we mention: *Najas minor*, *Potamogeton crispus*, *Ranunculus trichophyllus*, *Callitriche palustris*, *Ranunculus aquatilis*, *Ranunculus peltatus* etc. They also include plants which are found on the same critical list and which need to be protected. This thing is imposed the more so as each day we assist to a sustained aggression of human upon environment, in order to meet his growing needs.

Key words: association, phytocoenoses, phytocoenologic study, floristic study, ecological indexes.

* * * * * *

INTRODUCTION

Lăzărenilor Hills are located in western Romania, occupying the south central part of Bihor County and they neighbor upon the following localities (figure 1).

- to north, Vad - Oradea Breach on the alignment of the localities Cihei, Băile Felix, Rontău, Haieu, Felcheriu, Alparea, Borşa;
- the limit for Pădurea Craiului Mountains is marked by the localities Borşa, Chijic, Copăcel, Surduc, Serghiş, Corbeşti, Topa de Sus, Topa de Jos and Cornişeşti;
- to south, Lăzărenilor Hills come into contact with Holodului Trough and with Low Plain of Crişurilor, to north of the localities Tinca, Râpa, Dumbrava, Holod, Dumrâviţa, Rogoz and Sâmbăta;
- to west, they neighbor upon Miersigului Plain, to east of the localities Apateu, Păuşa, Sititelec, Hausasău de Tinca, Tinca;

The physico-geographical factors were analyzed in terms of their impact on the vegetal carpet based on the existent literature. The Lăzărenilor Hills relief is characterized by relatively low altitudes ranging from 130 m in the west part, in contact with the High Plain of Miersigului and 450 m in the east part, in Tăşadului Hills, in contact with Pădurea Craiului Mountains (Pop, 2005).

Regarding the geological substrate from the literature study, it is illustrated the fact that it is composed of a mesozoic crystalline base, fragmented by a network of fissures in a system of horsts and grabens unevenly deepened, above which deposited the panonian deposits made of clays and clay sands (Ţenu, 1981).

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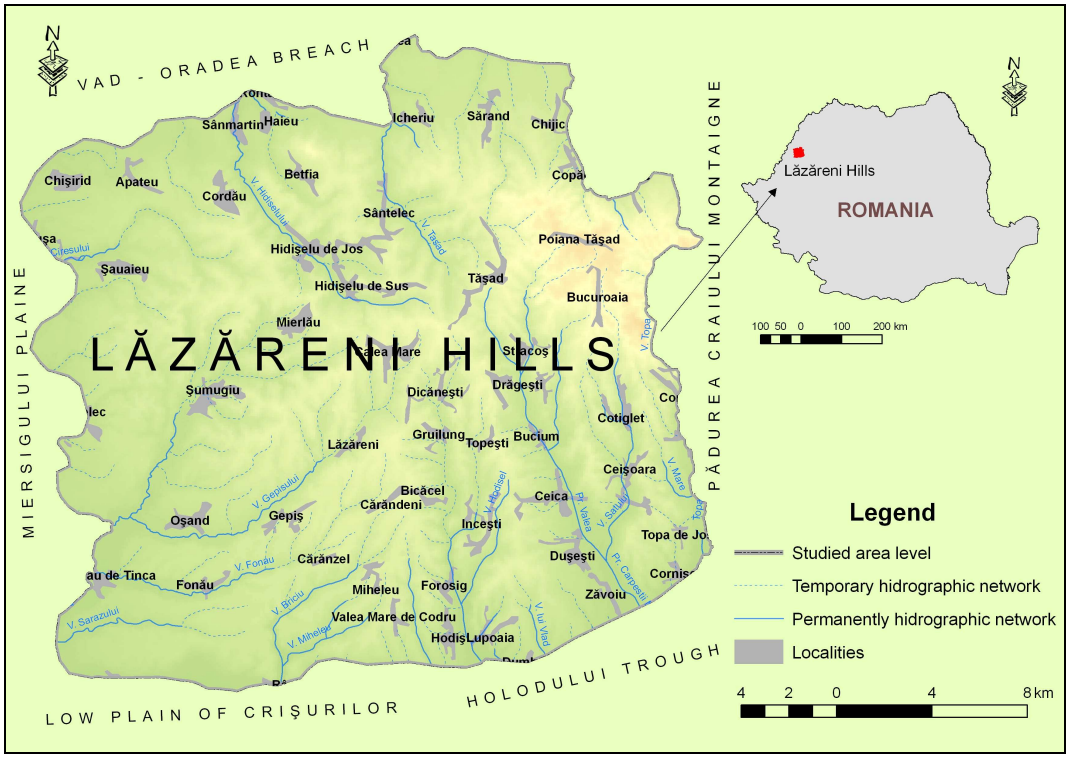

Figure 1. Geographical location of Lăzăreni Hills
(Source: processing after Pop, 2005)

The analysis of potential climate of the habitat studies was made by using information from various specialty papers Dragotă (2006) and Dumiter (2007). Soils represent a support factor in terms of its qualities to maintain life, by the capitalization of various specialty works, among which we mention those published by Sabău et al. (2002) etc.

MATERIALS AND METHODS

In the achievement of this study, we undertook a series of bibliographical and on site investigations and researches between the years 2008 - 2010.

Taxons identified on site were harvested on plates and arranged in the herbarium. Taxons were identified based on specialty determiners by Ciocârlan (2006) and Cod of Botanical Nomenclature (1995).

In the projection of this vegetation study, realized in Lăzăreni Hills, we used the phytocoenological research method of Central European School (Braun-Blanquet, 1964) end adapted to the vegetation particularities of our country (Borza and Boșcaiu, 1965).

Sample surfaces (figure 2) homogeneous from floristic and physiognomic points of views, were chosen from *Najadetum minoris* phytocoenoses, and their size being of 4 - 15 sqm.

To the performance of the synthetic table (table 1), it was considered information regarding the species entering in the floristic composition of the association, the live forms, the floristic element, the ecological factors (humidity, temperature, chemical reaction of soil), the karyotype, the serial number of the survey, the altitude (m.s.m.), the exhibition, the slope, the cover of herbaceous layer (%), the surface (sqm). At the end of the table, were noted and calculated the phytocoenologic indexes, the consistency (K) (whose class ranges from I - V, expressing the degree of coenotic fidelity of each species) and the abundance-dominance index, which helps to the quantitative appreciation of each specie's participation to the association table, following the

evaluation system of Braun-Blanquet and Pavillard, 1928. At the bottom of the table, were mentioned the habitats and the performance date of the surveys. For ordering and grouping the species from the association table to hierarchically superior coenotaxons, alliance, order and class were considered the traditional floral ecological systems of the authors: Ardelean (1999), Borhidi (1996), Pott (1995), Sanda et al. (2008) etc.

RESULTS

The results consisted in the first approach and description of these rare associations, found in three localities (Sâmbăta, Duşeşti and Ceica) from Lăzărenilor Hills.

Najadetum minoris association, found in five phytocoenologic surveys, can elaborate an association table, while *Potamogetonetum crispi* and *Ranunculetum aquatilis* associations are presented only in three phytocoenologic suveys, not having the required number of surveys for elaborating association tables.

Najadetum minoris Association, located in Sâmbăta, Duşeşti and Ceica localities, is a marsh association, poor in species. In Romania, this association is less known, being mentioned in Moldova (Mititelu et al., 1995), in north-western Romania (Ardelean and Karácsonyi, 2003; Burescu, 2001; Burescu, 2003; Drăgulescu, 2005; Karácsonyi, 1995), in Danube Delta (Ştefan et al., 2006) etc.

Phytocoenoses sporadically develop in stagnant waters of some marshes, valleys, creeks, with depths of 0.3 - 0.5 m and which have a logged substrate. The characteristic and dominant specie of the association is *Najas minor* (table 1), with a general coverage of 72.5 % ADm and a maximum constancy (K = V). This plant grows in the submerged sinusia of the phytocoenoses, accompanied by *Potamogeton crispus, Ranunculus trichophyllus, Callitriche palustris,* which are characteristic species of the alliance *Potamion pusilli,* of the order *Potamogetonetalia pectinati* and of the class *Potamogenetea pectinati*.

At the water's surface (figure 2), in the natant layer appears *Ranunculus aquatilis,* and among transgressive species, in emerssive layer are found *Alisma plantago-aquatica* and *Alisma lanceolatum* etc.

Figure 2. *Najadetum minoris* of Topa - Sâmbăta crick - Bihor County

Phytocoenoses analysis in terms of life forms (figure 3) highlights the dominance of helohydatophytes species (72.7 %), followed at a big distance by hemicryptophytes (18.2 %). Geophytes are presented in the association in the lowest percentage (9 %).

The spectrum of floristic elements (figure 4) highlights the considerable weight of cosmopolitan species (54.5 %), followed by Eurasian species (27.3%) and by the European species (9 %), equal with the circumpolar species (9 %).

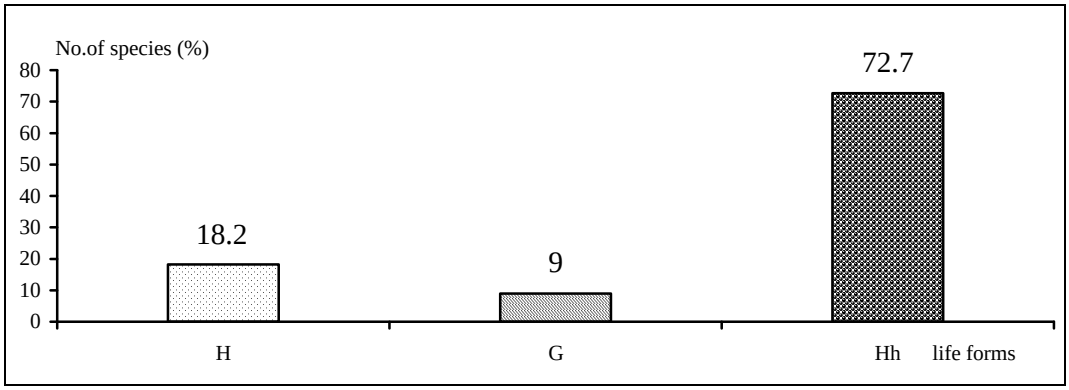

Figure 3. The life form spectrum of association *Najadetum minoris* in the Lăzăreni Hills
H = hemicryptophytes; G = geophytes; Hh = helohydatophytes.

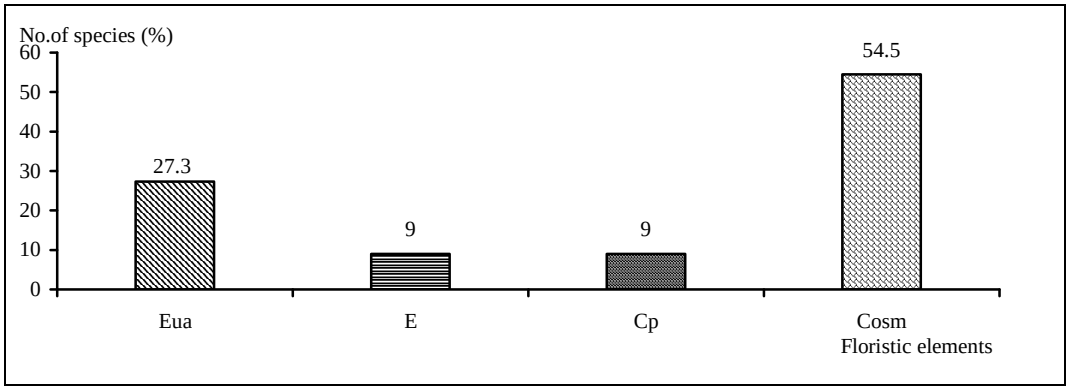

Figure 4. Floristic elements spectrum of the association *Najadetum minoris* in Lăzăreni Hills
Eua = Euroasian; E = European; Cp = Circumpolar; Cosm = Cosmopolitan.

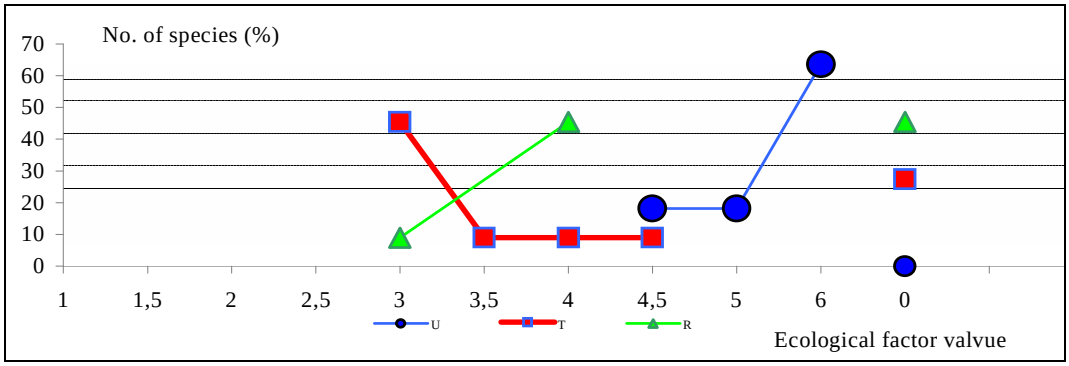

Figure 5. Ecological factors spectrum of the association *Najadetum minoris* in Lăzăreni Hills,
U = humidity; T = temperature; R = chemical reaction of soil.

Analyzing the phytocoenoses in terms of main ecological factors (figure 5), the hydrophilous character prevails (63.6 %), towards hygrophilous (18.2 %), equal with meso-hygrophilous one (18.2 %) of the association. In terms of heat, most species from the association are micro-mesothermophilous (54.4 %), followed by eurythermal amphytolerant species (27.3 %).

Compared to the chemical reactions of water and soil, in the association dominate amphitolerant species (45.4 %), equal with those weakly acid-neutrophilous (45.4 %).

From the analysis of karyological spectrum (figure 6), distinguish the polyploids (63.6 %), followed by dyploids (18.2 %). Dyplo-polyploids couple appears, in association, with a low value (9.1 %) and it is equal with the species whose karyotype is not knows (9.1 %). Dyploids index is of 0.3.

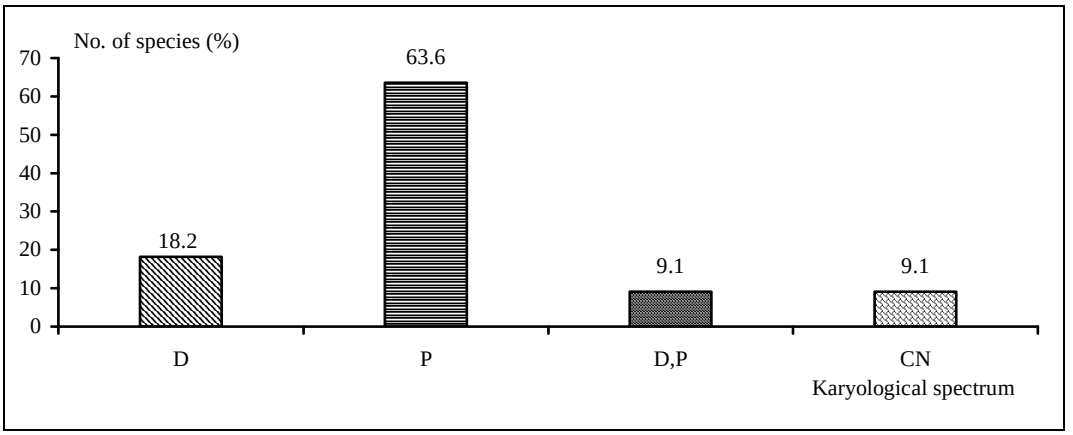

Figure 6. The karyological spectrum of association *Najadetum minoris* in Lăzăreni Hills
D = dyploid; P = polyploid; D.P = Dyplo-polyploid; CN = karyotype is not knows

Table 1. Association *Najadetum minoris* Ubriszy 1941 in Lăzăreni Hills

L.f.	F.e.	U.	T.	R.	2n	Nr. Land Surveys Altitude (m.s.m.) Exposition Slope Coverage (%) Surface (sqm)	1 80 N 1 90 4	2 90 E 2 95 15	3 60 S 3 75 4	4 80 E 5 95 5	5 100 NE 4 70 4	K	ADm
Hh	Eua	6	4.5	4	P	*Najas minor*	5	5	4	5	4	V	77.5
Potamion pusilli; Potamogetonetalia pectinati; Potamogenetea pectinati													
Hh	Cosm	6	4	0	P	*Ranunculus aquatilis*	+	1	+	+	+	V	1.4
Hh	Cosm	6	3.5	4	P	*Potamogeton crispus*	.	+	1	+	+	IV	1.3
Hh	Cp	6	3	0	P	*Callitriche palustris*	+	+	+	.	.	III	0.3
Hh	E	6	3	0	P	*Ranunculus trichophyllus*	.	+	+	1	.	III	1.2
Phragmitetea australis													
Hh	Eua	6	0	4	D	*Alisma lanceolatum*	+	+	+	+	+	V	0.5
G (Hh)	Cosm	5	0	4	D.P	*Eleocharis palustris*	+	+	+	+	+	V	0.5
Hh	Cosm	6	0	0	D	*Alisma plantago-aquatica*	+	.	+	+	+	IV	0.4
Hh	Cosm	5	3	0	P	*Glyceria fluitans*	.	.	+	+	1	III	1.2
Molinio – Arrhenatheretea													
H	Eua	4.5	3	4	P	*Grațiola officinalis*	.	+	+	.	+	III	0.3
H	Cosm	4.5	3	3	CN	*Juncus inflexus*	.	+	.	+	+	III	0.3

Where: L.f. = life forms; H = hemicryptophytes; G = geophytes; Hh = helohydatophytes; F.e. = floristic elements; Eua = Euro-Asiatic; E = European; Cp = Circumpolars; Cosm = Cosmopolitans; U = humidity; T = temperature; R = chemical reaction of soil; 2n = karyological spectrum; D = dyploid; P = polyploid; D, P = Dyplo-polyploid; CN = karyotype is not knows.
Place and date of mapping: 1, marsh with water on the crick Valea, out of Ceica, 28.08.2010; 2, 3 places where water forms a marsh on the edge of Topa - Sâmbăta crick, 20.08.2010; 4, 5 stagnant eye wash on Zăvoiu - Dușești Valley, 20.08.2010;

Potamogetonetum crispi Association was found in the localities Sâmbăta, in Topa crick and in Dușești on Zăvoiu Valley.

The phytocoenoses of this association (figure 7) develop in stagnant waters of some cricks, valleys, antropically influenced, with a depth of 0.2 m till 0.5 m where occupy surfaces with a substrate represented by mud enriched in organic substances.

Floristic inventory of the association includes a limited number of 7 species subordinating to coenotaxons, for *Potamion pusilli* alliance, to *Potamogetonetalia pectinati* order and to *Potamogenetea pectinati* class, with the following species: *Potamogeton crispus, Ranunculus trichophyllus, Ranunculus aquatilis, Najas minor*. In these coenosa, sporadically appear transgressive species from *Phragmitetea australis* class: *Alisma lanceolatum, Glyceria fluitans, Eleocharis palustris.*

Figure 7. *Potamogetonetum crispi* Soó 1927 (Zăvoiu Valley - Dușești - Bihor County)

Figure 8. *Ranunculetum aquatilis* Géhu 1961 (Zăvoiu Valley - Dușești - Bihor County)

Ranunculetum aquatilis Association it appears in Lăzărenilor Hills in the localities: Sâmbăta and Dușești. Coenosa of this association (figure 8) develop in places where water is on surface, in the form of stagnant eye wash, on the fringe of some valleys, cricks, marshes. The water has a lower depth, between 0.1 - 0.2 m and it has a substrate represented by marshlands. *Ranunculus aquatilis* is the dominant specie and it is accompanied by three species belonging to *Ranunculion aquatilis* alliance, to *Callitricho-Batrachietalia* order and to class *Potamogetonetea pectinati*: *Callitriche palustris, Potamogeton crispus, Ranunculus peltatus*.

Meet four transgressive species from class *Phragmitetea australis*: *Eleocharis palustris, Alisma plantago-aquatica, Glyceria fluitans, Mentha aquatica.*

DISCUSSIONS

From the comparative analysis made between this study and other 7 similar studies of Ardelean and Karácsonyi (2003), Burescu (2001; 2003), Drăgulescu (2005); Karácsonyi (1995), Ștefan et al. (2006) it shows that between them there are many similarities and differences.

Similarities regarding the number of species, the biological forms, the florist elements and the ecological indexes were identified by Burescu (2001; 2003). As in the case of this work, *Najadetum minoris* and *Potamogetonetum crispi* associations have a similar number of species, between 7 - 11 species. In association, helohidatophytes, cosmopolites and hydrophytes predominate. A similar situation is also found in *Ranunculetum aquatilis* association.

Differences aiming the number and the type of species were found by Ardelean and Karácsonyi (2003), Burescu (2001; 2003); Drăgulescu (2005), Karácsonyi (1995), Раченкова (2008) and Ștefan et al. (2006).

Compared to works of Burescu (2001; 2003) and Deegan et al. (2007), in *Ranunculetum aquatilis* association, differences were represented by the higher number of species (20 species) in relation to this work (8 species).

In work of Ștefan et al. (2006), *Potamogetonetum crispi* association, located in the region of Belciug and Dranov Lakes, from Biosphere Reservation from Danube Delta, is different from the similar association studied in Lăzărenilor Hills. On one hand, the difference is given by the number of species (20 species found in the perimeter of the lakes mentioned above, compared to 7

species found in Zăvoiu Valley Holm from Duşeşti locality) and on the other hand, by the fact that from all these species only one is common, namely *Potamogeton crispus*.

We found a similar situation in the comparison made between the associations studied in Lăzărenilor Hills and the associations described by Ardelean and Karácsonyi (2003) and Drăgulescu (2005), aiming the region of Ecedea Swamp. There are differences between the number of species forming the structure of *Najadetum minoris, Potamogetonetum crispi, Ranunculetum aquatilis* associations, while the similarities were represented by the presence of 10 common species in their structure *(Alisma lanceolatum, Alisma plantago-aquatica, Callitriche palustris, Eleocharis palustris, Glyceria fluitans, Juncus inflexus, Najas minor, Potamogeton crispus, Ranunculus aquatilis, Ranunculus trichophyllus).*

In *„Biodiversity and Bioresources of the Urals and adjacent territories"* of Раченкова (2008), handling the region of Ural Lake from Russia, for *Najadetum minoris* association we have 5 species, from which 2 are common (*Najas minor, Potamogeton crispus)* and 3 are different *(Utricularia vulgaris, Ceratophyllum demersum, Ceratophylleta demersi).* For *Potamogetonetum crispi* association, we found 11 species (*Potamogeton perfolatus, Potamogeton lucens, Ceratophyllum demersum, Myriophyllum verticillatum, Hydrocharis morsus-ranae, Lemna minor, Nuphar lutea, Nymphaea candida, Sagittaria sagittifolia, Butomus umbellatus, Potamogeton crispus),* from which the last is common with that described in Lăzărenilor Hills.

Potamogetonetum crispus end *Ranunculetum aquatilis* associations were described in work *„Flora şi vegetaţia judeţului Satu-Mare"* of Karácsonyi in 1995. The descriptions aimed the Law Plain of Someş, aboard the collector and draining channels.

As a conclusion, after the comparative analysis between the results of the researches made on field and of those obtained by bibliographic research - documentation, was founded a series of similarities and differences regarding the phytocenosis studied. These were represented by the number of species from the structure of the associations, the surface analyzed, the biological form, the florist elements and the ecological indexes.

These three phytocoenoses from Lăzărenilor Hills have an optimum development in spring, being more representatively developed in April. During the dry months of the year (July-August), they know a decline, as a consequence of the fall of the water level.

By gradually clogging or reducing of water from marshes, during the dry period from summer, it gets to the development of some hydrophilic and meso-hydrophilic phytocoenoses belonging to *Phragmitetea australis* and to *Molinio-Arrhenatheretea* classes.

The economic importance of these associations emerges from their role as source of food and housing for insects, crustaceans and amphibians from marshes (marshes fauna).

These associations are found on the red list of missing, endangered, vulnerable and rare vascular plant (Cristea, 1995; Oprea, 2005). They also include plants which are found on the same critical list and which need to be protected. This thing is imposed the more so as each day we assist to a sustained aggression of human upon environment, in order to meet his growing needs.

More and more, in scientific world circulate questions like: What is the endurance limit of the environment? What is the rehabilitation capacity of the environment? The answers to these questions will represent the touchstone of the scientific world of tomorrow, including of the biologist.

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PASSENGER SERVICES ON THE ROMANIAN RAILWAY NETWORK IN THE POST-COMMUNIST ERA

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Abstract: Romania's railways continue to play a crucial role in the life of the nation and a high proportion of the system is still open for passenger services. And despite the declining number of passengers - reflecting the great changes of the post - 1989 transition - the 'offer' of the railway companies (augmented by the involvement operators) remains attractive. However the impressive pace of railway modernisation witnessed in the 1960s and 1970s flagged in the 1980s and since 1989 the priority for highway construction has slowed the pace of development to produce a fully 'modern' European railway. This is especially evident in the slow pace of track renewal which has resulted in speed restrictons - and hence slower journies - over the past 20 years, despite long-term planning for speeds of 140 - 160 kph. The paper reviews the trends since 1989 taking several different approaches including the importance of railways for tourism and recreation which is evident not only through rail access to the resorts but the development of 'heritage' railways (especially narrow - gauge systems) as a form of leisure and recreation in themselves.

Key words: Romanian´s railways, post-communist era, trains, passengers

* * * * * *

INTRODUCTION

Romania has a substantial railway network which effectively integrates the regions of the country and serves almost all major settlements: exceptions for towns with more than 20,000 inhabitants are Borşa, Vişeu de Sus, Mioveni, Petrila and Turda where journies of several kilometres are now needed to reach the nearest stations. Although the system developed on the basis of historic territorial arrangements with separate planning for the Old Kingdom of Romania, Transylvania (originally part of the Hungarian system) and Austrian Bucovina, it has been effectively unified to serve the present entity through standardisation and additional Carpathian routes as well as improved access to Bucharest.

This restructuring was much assisted by the economic and strategic importance attaching to railways in Greater Romania during the inter-war period and again during the communist era. Railways retain priority in the European context but the parallel interest in road transport (and highway construction in particular) means that there is greater competition for both investment and traffic. In a recent paper the author contributed to a review of railfreight (Nae and Turnock, 2010) and this paper now deals with passenger traffic. It follows from a earlier contribution looking at trends during the communist period and concentrates on the years since 1989 (Turnock, 1991).

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THE TRANSITION

Transition to a market economy has created many challenges concerned with falling traffic: rail passengers increased during 1950 - 1989 from 116.5 mln to 481.0 mln 1989 but fell back to 210.7 mln in 1995 and 117.5 mln in 2000. Passenger kilometres went from 8.16 bln to 35.46 bln durng 1950 - 89 before declining to 18.88 bln in 1995 and 11.63 bln in 2000. There has been a great need for restructuring to raise standards on a European basis while competing for capital investment with other sectors (notably road-building) and increasing labour productivity through a period of heavy redundancy (Turnock, 2003).

Despite a focus on economic viability the railways continue to make heavy losses. Some transition states have responded by reducing services quite drastically but in Romania the number of trains has not changed greatly; 111 trains in 1989 were scheduled to leave Bucharest's Nord station (combining the main station with the adjacent terminal of Basarab) but the number actually increased to 129 in 2011. The number of stopping ('personal') trains was slightly down (from 53 to 49) while the express trains were up from 58 to 80 (13 to 35 for the fastest 'rapid' trains (with only a small number of stops) while the 'accelerat' services remained the same at 45. The leading provincial cities has also seen growth in the number of passenger train operations and Oradea is a case in point with 52 departures (44 if the recently - reintroduced local service to Băile Felix and Cordău is discounted) - involving 23 stopping trains, 11 'accelerat' trains and 10 'rapid' services - which compares with 39 in 1989 (with a 19 - 17 - 3 split between the three categories).

Of course some lines have experienced closure (table 1) but the Romanian network has not been greatly compromised and many of the services withdrawn affect narrow - gauge lines (operating at low speeds and hence particularly vulnerable to bus competition) and some other routes have been affected by landslides or severe storms of the kind that ravaged the Suceava area in 2010 (table 1).

Table 1. Service withdrawals since 1989 by development regions
(Source: CFR Mersul Trenurilor de Călători 1989 - 1990 and 2010 - 2011)

Centre: +Sibiu - Agnita / Vurpăr (71 kms); +Târgu Mureş - Băile Sovata (74 kms); +Târgu Mureş - Miheşu de Câmpia (55 kms); +Turda - Abrud (93 kms).
North East: Comăneşti - Moineşti (8 kms); Dângeni - Saveni (..kms); *Dărmăneşti - Păltinoasa (34 kms); Dorneşti - Siret (16 kms); *Gura Putnei - Nisipitu (25 kms); *Vama - Moldovița (20 kms).
North West: +Band - Lechința (69 kms); +Ghilvaci - Ardud (18 kms); *Holod - Cordău 29 kms; Huedin - Cătățele (14 kms); Oradea - Cheresig (23 kms); Sighetul Marmației - Câmpulung la Tisa (12 kms); Ulmeni Sălaj - Cehu Silvaniei (20 kms); Vișeu de Jos - Borșa (23 kms).
South: Căciulați - Snagov (16 kms); Câmpulung - Argeşel (14 kms); Mija - Dițești – Moreni / Filipeştii de Pădure (13 kms); Poiana Slănic - Slănic (10 kms).
South West: Turceni - Drăgoteşti (28 kms)
West: Bouțari - Subcetate (40 kms); Deva - Brad (36 kms); Lupeni - Bărbăteni (4 kms).

physical problems *; narrow gauge +.

There have also been some significant reductions in services: on the Ploieşti - Slănic branch the number has fallen from nine per day to three and even these all terminate at Poiana Slănic (10 km/s short of the final destination) because of flood damage to a bridge; while the Ploiești - Măneciu and Ploiești - Târgoviște routes have both seen reductions from nine to two. Other casualties include the Băbeni - Alunu branch near Râmnicu Vâlcea (six to two); Simeria - Hunedoara (13 to six); and Cugir - Şibot (10 to five) but these are not typical and reflect the large decline of commuting to work in massive industrial citadels like the Hunedoara metallurgical works as well as competition from bus services as rising private car ownership.

In line with European standards, Romania has seen improvements in trains and stations as well as information and ticketing. Stopping trains are often second - class only; using 1970 s - 80 s stock but also some 1940 s / 50 s railcars. 'Accelerat' trains have been improved since c. 2005 with refurbishment of double - deck coaches and the introduction of Siemens 'Desiro' railcars from

2003 on routes from Bucharest to Constanța, Craiova, Galați, Sibiu and Tulcea; and also from Sibiu to Cluj, Craiova and Timişoara (benefits which occasionally apply to some stopping trains as well). Romania has been rather slow to move from heavy trains to lighter railcars because of large peak flows and the availability of coaches displaced from main line express services.

Various railcar designs have been produced but without any sustained series production and the re-engined Malaxa cars from the immediate pre - World War Two era are still prominent. And since no successful Romanian design has emerged the Germany's Siemens 'Desiro' design has been adopted with a considerable proportion of units built under licence in Arad; although the decision is surprising in the sense the trains were designed for local services in Germany. The cars have quite hard seats, a low speed and limited sound insulation, although improvements have been made since 2004 through better insulaton and larger seats (70 per unit instead of 110) and the stock is now used widely over medium - distances; flattered by the title 'Săgeata Albastră' - Blue Arrow - first used for a prestigious but short - lived diesel-powered train operating between Bucharest and the Black Sea. Meanwhile private operators have opted for reconditioned railcars imported from France and Germany: the ubiquitous 'Deuwags' (from Deutsche Waggonbau) in the latter case.

Meanwhile refurbished loco - hauled coaches are used for longer distances; though some 'accelerats' now offer couchettes and sleepers with 'rapid' stock available for the long - distance trains from Bucharest to Craiova / Timişoara, Târgu Jiu / Arad, Cluj / Satu Mare, Focşani / Iaşi, Sighetul Marmației; also Iaşi - Timişoara trains. Meantime the present 'rapid' trains now offer six - seat compartments, air conditioning and ecological toilets; with 'Desiro' railcars for some services. 'InterCity' (IC) is the top category with fares slightly above the 'rapid' level.

Trains from Bucharest to Galați, Iaşi, Suceava, Oradea and Timişoara offer airline standards (including power points and a business service on the Oradea and Timişoara routes) using Romanian - built Astra AVA - 200 coaches which were once appreciated internationally on the Bucharest - Vienna service before the Austrian Railways (ÖBB) took over the service in 2003. 'Desiro' railcars may however feature on the Galați service. IC services have also operated to Arad, Constanța and Târgu Mureş as well as the resorts of Predeal and Sinaia but do not appear in the 2011 timetable. There is no obvious regional equality however: IC trains emphasise the Suceava and Timişoara routes (each with two trains daily) with one additional 'rapid' train (but two more for Suceava as portions attached to the trains for nearby Botoşani). Oradea is another IC destination.

International trains generally run as 'rapid' services within Romania but there is also a 'EuroCity' service to Arad and Budapest; also 'EuroNight' to Belgrade and Budapest. Sleeping cars comprise refurbished Deutsche Waggonbau - built stock of c.1990 but there are some new sleeping cars (air - conditioned with shower facilities), couchettes and Inter City coaches (also some double - deck coaches for high - density express routes). Meanwhile, 'Accelerat' services are also rather unevenly distributed since the longest journies seem to attract the fastest trains. Thus with all the international trains passing through Arad being treated as 'rapid' services the city has no 'accelerat' service from Bucharest apart from the one routed through Caracal and the Jiu Valley. Many 'accelerat' services tend to connect pairs of leading cities metropoles and are typically operated using 'Desiro' railcars.

Links between metropoles include Cluj to Bistrița, Sibiu and Zalău / Satu Mare as well as Iași, Timişoara and cities on the main line to Bucharest; also Galați to Braşov, Constanța and Târgu Mureş; and Timişoara to Arad / Oradea / Baia Mare and Sibiu. Traction is provided by modernised diesel and electric locomotives while electronic ticketing by XSELL ticketing has been available since 2004, assisted by deals during 2003-4 with the two main mobile phone companies (Orange and Vodafone, with the latter known as Connex at the time) over train information and booking. Smoking on trains was prohibited from 2006.

Organisational changes since 1989 have included the creation of separate railfreight and passenger companies (Marfă and Călători) with sepate organsations for the infrastructure (CFR Infrastructura) and other assets (SAAF). And in line with EU policy railway routes are open to private operators who may run competing services on the main lines and bid to become the sole

operator on minor routes where there is no basis for competition. Some of these 'secții neinteroperabile' have no operators at all due to lack of potential (i.e. small branch lines where bus services are highly competitive) or flood damage which occuirred in 2010 on several sections in the Suceava area: Vama - Moldovița, Gura Humorului - Dărmănești and Gura Putnei - Nisipitu. Meanwhile several others are freight - only lines operated by industrial companies e.g. RG Holz for the Vișeu de Jos - Borșa branch; Rompetrol Logistics for Capul Midia; and Viromet for the Ucea - Victoria branch. Meanwhile the railfright company Grup Feroviar operates around the port of Năvodari. But in addition many branches are now operated by private passenger companies with 'Călători' left as the default operator in only a relatively small number of cases (table 2); while on some of the main lines which are 'interoperable' Călători and private companies are now in competition on a regular basis. Privately - operated passenger services started in 2004 - 2005 when the lines involved (Brașov to Zărnești, Ploiești to Slănic and Mâneciu and Sf.Gheorghe to Brețcu) were omitted from the official timetable. The Ploiești - based sevices reverted to Călători in 2005 but Regiotrans (owned by the French company Keolis) continued in Transylvania and extended operations to Blaj - Praid, Brașov - Întorsura Buzăului and Sighișoara - Odorhei in 2006 - 2007. The private sector has continued to grow and its operations are noted later.

Table 2. Branch lines still operated by the Călători company

North East: Bacău - Piatra Neamț - Bicaz (86 kms); Crasna - Huși (33 kms); Floreni - Dornișoara (22 kms).
North West: *Carei - Jibou (118 kms).
South: Bucharest Progresul - Giurgiu (59 kms); Bucharest - Oltenița (79 kms); Ciulnița – Călărași / Slobozia (44 kms); *Golești - Câmpulung (57 kms); *Pitești - Curtea de Argeș (38 kms); +Ploiești - Mâneciu (51 kms); +Ploiești - Poiana Slănic (34 kms); Roșiori Nord – Alexandria / Turnu Măgurele (84 kms); *Titu - Pietrosița (67 kms); *Videle - Giurgiu (66 kms).
South East: Mărășești - Panciu (18 kms); +Medgidia - Negru Vodă (58 kms); Medgidia - Tulcea (144 kms)'; +Zorleni - Fălciu (50 kms).
South West: +Băbeni - Alunu (41 kms); Craiova - Calafat (108 kms); *Filiași - Târgu Jiu via Turceni (76 kms*; +Strehaia - Motru (31 kms).
West: *Caransebeș - Reșița (43 kms); Jebel - Liebling (10 kms); +Livezeni - Lupeni (18 kms); +Oravița - Anina (33 kms); +Oravița - Iam (27 kms); Timișoara - Jimbolia.

+Suggested for closure in Guvernul României 2011; * Carrying express trains

However economic viability remains elusive with passenger numbers continuing to fall since 2000 despite the encouragement of discounted fares e.g. 'Cartea VSD' for weekend travel involving the three days Friday to Sunday ('Vineri', 'Sâmbătă' and 'Duminică' in Romanian) as well as regular travel on specific routes: 'călătorii frecvente'. The trend has continued with the onset of recession from 85.8 mln passengers in 2007 to 75.3 in 2008 and 65.5 in 2009 (with 59.7 estimated for 2010) while passenger - kilometers have declined from 7.42 bln to 6.88 and 5.97 (5.00 estimated for 2010). With some service withdrawals train - kilometers have fallen from 67.1 mln to 66.3 and 64.1 (59.3 estimated for 2010) but not as rapidly as passenger numbers and so the level of usage has fallen: from 30.9 travellers per 100 train places to 30.4 and 28.5 (26.8). Since Călători is still a state company the government is very concerned about rising losses, with subventions doubling during 2009 alone and various measures have been suggested including further decline in employment: already 17.1 thousands during 2005 - 2008 (to 16.0 in 2009 and 15.0 in 2010) with further reduction to some 13.0 now anticipated (Guvernul României 2010). There is also reference to fiscal concessions; elimination of surplus locomotives/rolling stock, reduced maintenance costs and the introduction of ticket machines. Reduction of train kilometres in line with passenger numbers could include further route closures e.g. Băbeni - Alunu (41 kms); Livezeni - Lupeni (17 kms); Medgidia - Negru Vodă (58 kms), Podul Olt - Porumbacu (19 kms), Strehaia - Motru (31 kms) and Zorleni - Falciu (70 kms). Furthermore selected closures would secure greater economies through the elimination of carriage depots: Caransebeș in the case of the

Bouțari branch (although this line is now privately operated); Oravița for Anina and Iam services; and Ploieşti Sud for the Mâneciu and Slănic lines. Lugoj depot could also close if certain services terminating in this town were extended to Timişoara. But none of these measures have yet been adopted. Another idea is the rationalisation of motive power depots in parallel with a further round of redundancies. At present there are 14 Călători depots and closures are suggested as follows: (a) in Moldavia a transfer from Bârlad to Iaşi (other depots being Galați, Suceava and Tecuci); (b) in Wallachia - Dobrogea a transfer from Drobeta - Turnu Severin to Craiova (other depots being Bucharest Călători, Medgidia, Piteşti and Ploieşti); and (c) in Banat - Transylvania a transfer from Sighişoara to Braşov (other depots being Arad, Cluj, Jibou, Sibiu and Timişoara).

INTERNATIONAL PASSENGER SERVICES

Romania's strategic position makes for a substantial programme although it has been simplified in recent years as low-cost airlines have become prominent (while the interaction among former Comecon / Warsaw Pact members is now greatly reduced in terms of both conventional trade and Black Sea holidays) (Turnock, 2006).

There used to be through trains to the northern capitals: thus one service between Bulgaria and the GDR covered the 1,754 kms between Bucharest and Berlin via Arad in 32 h 44 (53 kph) while the Balt Orient Express travelling via Oradea took a fraction less (32 h 37) for a longer journey of 1,898 kms (58 kph). Today, apart from the 'Dacia' which provides a daily service between Bucharest and Vienna (a journey of 19 - 20 h over 1,145 kms, at an average speed of 60 kph including stops) there are no through coaches proceeding in a westerly direction beyond Budapest: until 2008 the 'Trianus' had included through coaches to München.

In 1989 there were still through coaches to Paris on the Orient Express which averaged 60 kph to reach Budapest in 14 h 15 and Vienna in 18 h 56. This evening departure from Bucharest was balanced by a somewhat slower early morning train to Vienna by the 'Wiener Walzer' (15 h 33 / 56 kph to Budapest) which also included coaches for Warsaw and Košice (also from Sofia to Warsaw and Wrocław). However Budapest services remain numerous; reflectng Hungary's key position in the Central European rail network, but also the traffic generated by the Hungarian minority in Transylvania. A key service is the 'Ister' EuroNight service over a 873 km journey with a considerable difference in average speed between 66kph in Romania (637 kms taking 9 h 40) and 75 kph in Hungary (2 h 57 for 225 kms) with the protracted waiting over the short Curtici - Lököshaza frontier section discounted.

Also on this route - which takes in Deva and Arad in Romania along with Békéscsaba and Szolnok in Hungary - there are trains from Arad / Timişoara ('Criş' in the morning and 'Traianus' in the evening) while Arad alone has the 'Zarand' (unnamed in 2008, when it started further east at Simeria) and another unnamed train. Meanwhile Târgu Mureş' has its 'Mureş' service (which in 2008 included a Bucharest - Venice section - attached at Vinţul de Jos - which also served Zagreb and Ljubljana); Sibiu has the 'Transilvania' (which in 2008 started at Arad and was unnamed); and Braşov has the 'Pannonia', which started in Bucharest in 2008 when the train not only continued to Prague via Györ, Bratislava and Brno, but also included a section for Kraków. Named 'Krakovia', this was detached at Szolnok to ran north via Miskolc and Košice (replacing the service started some years earlier across Ukrainian territory from Satu Mare / Halmeu). Journey times for these trains between Arad and Budapest is almost exactly four hours for the 253 kms (63 kph): a few minutes less than the 'Dacia'.

A second major route branches from the main stem (Bucharest - Ploieşti – Braşov - Sighişoara) at Teiuş near Alba Iulia and runs through Cluj and Oradea to the frontier at Episcopia Bihor - Biharkerestesz; proceeding thence through Püspökládany to rejoin the Arad route at Szolnok. There are trains from Braşov ('Corona' and 'Harghita' travelling via Deda / Beclean) as well as the 'Ady Endre' and 'Biharia' from Cluj. It is interesting to compare the two routes from Braşov: whereas the 'Pannonia' (already referred to) takes 12 h 54 for the 707 kms (55 kph) - but 52 kph for the Braşov - Curtici section (9 h 00 for 471 kms) and 69 kph for Lököshaza - Budapest (225 kms / 3 h 15). The longer journey via Beclean / Cluj is also slower:

averaging just 50 kph: (15 h 39 for 783 kms) with the Romanian section achieving 50 kph (11 h 38 for 542 kms) compared with the Hungarian performance of 70 kph (3 h 16 for 229 kms): once again the border section is excluded from the calculation. However the capacity over this route has been greatly increased because in 2008 the 'Biharia' and 'Harghita' services did not operate.

Mention should be made of a third western route to Belgrade by a train of this name travelling via Craiova and Timişoara to the Stamora Moravița / Vrsac crossing point: 13 h 06 for 712 kms gives an average of 54 kph. This compares with shorter journies of 12 h 08 in 2008 and 11 h 40 in 1989 when Belgrade was the preferred 'Window to the West' with connections (after lengthy waits) advertised to both Thessaloniki / Athens and Milan. The total journey time for Bucharest - Thessaloniki was 48 h 35 (…kph over 1.954 kms) and 40 h 50 for Bucharest - Milan (….kph over 1,853 kms).

Turning to other routes the 'Friendship' ('Prietenia') daily service from Bucharest to Chişinău in Moldova (including coaches from Constanța) is slowed by the need for a change of coach bogies at the frontier. The 590 kms from Bucharest take 12 h 58: i.e. 48 kph, which represents a slight acceleration since 2008. The 'România' service to Istanbul via Bulgaria travels at an average speed of 42 kph (19 h 37 for 832 kms) - slower by 0 h 30 than in 2008 – and includes through coaches for Thessaloniki with the journey of 890 kms completed in 17 h 27 (51 kph): again, slightly slower than 2008 when the schedule of 16 h 48 permitted a 53 kph average. In 1989 a Transbalkan Express originating in Berlin offered a service from Bucharest to Thessaloniki via Sofia taking 22 h 56 (39 kph) while Sofia was reached in 10 h 09 (53 kph). Meanwhile the seasonal service that used to run between Budapest and Varna / Burgas via Arad, the Jiu Valley and the Giurgiu - Ruse frontier crossing ceased in 2008, although Bulgaria is still served by a train with this name which reaches Sofia in 10 h 00 from Bucharest (54 kph over 536 kms) - slower than in 2008 when the 9 h 19 schedule produced a 58 kph average - while also including coaches for Burgas and Varna detached at the frontier station of Ruse.

In the northern direction through coaches between Sofia and St. Petersburg ceased in 2000, but the 'Bulgaria' still runs to Moscow via the Vicşani - Vadu Siretului frontier crossing and Kiev: a 2,099 km journey from Bucharest taking 47 h 00 (45 kph). There are also coaches for Minsk: 47 h 23 for the journey in 2008 (29 kph) but now shorter by 7 h 06 (i.e. 34 kph). Meanwhile the hosts of Black Sea holiday trains from former Comecon states are now a distant memory.

Finally, it should not be ovderlooked that there are a number of local border trains. First to Hungary there is a single Oradea - Püspökládany service via Episcopia Bihor / Biharkerestesz (a reduction from two in 2008 when the 'Biharia' and 'Harghita' did not operate). There are three daily services between Salonta and Békéscsaba via Kotegyan ditto 2008 and two between Satu Mare and Debrecen via Valea lui Mihai / Nyrabrany (operating from Valea lui Mihai only in 2008). Oradea also has a new service to Debrecen via this route and there are two trains on the Carei - Mateszalka route via Tiborszallas. There are two local links with Moldova via Ungheni and another further south at Fălciu; but no connections with Ukraine at Reni or Sighet (where the new road bridge over the Tisa has presumably undermined the former railcar service from Rachiv); or with Croatia at Jimbolia - Kikinda where the two services listed in 2008 have now ceased. However in conclusion the general showdown in international services should be underlined. Over just one year (2010 - 2011) the 'Dacia' schedule has been extended from 10 h 06 to 11 h 29 and the delay applies disproportionately in Romania with an additional 1 h 30 required between Bucharest and Arad. The 'Ister' night train needs an extra hour for this leg of the journey while the 'Harghita' needs an extra hour in both directions for the semicircuit through eastern Transylvania.

SERVICES FOR THE METROPOLES: THE CASE OF ORADEA

In 1989 there was a stopping train to Bucharest along with regional services to Arad (three), Cluj (three) and Satu Mare (four); also more local services to Carei, Ciucea, Holod (two) and Jibou. There was also a 'rapid' service to Bucharest ('Transilvania') as well as a substantial 'accelerat'programme involving Bucharest (two) as well as Baia Mare, Iaşi via Cluj and Vatra Dornei, Satu Mare (two) and Timişoara (two); not to menton the more local

service to Vaşcău. But there was also a substantial international programme: the 'Balt Orient' (Bucharest - Berlin), classified as a 'rapid' service, and seasonal holiday 'accelerat' trains: 'Nord - Sud' (Warsaw to Burgas), 'Mamaia' (Prague to Mangalia), 'Nord-Sud' (Warsaw to Burga's Tracia' (Dresden and Leipzig to Varna) and 'Varna (Warsaw to Varna).

In 2011 these long - distance trains were no longer operating but instead an intensive interaction with Budapest is maintained through a programme of 'rapid' trains already noted. There are also more local services into Hungary to Debrecen via Valea lui Mihai and also to Püspökládany which lies on the Budapest line some 50 kilometers from the frontier. Domestic services include the 'rapid' to Bucharest (now named 'Avram Iancu') and the seasonal holiday train ('Bihor') to Mangalia, with a section from Târgu Mureş. 'Accelerat' services include five trains to Cluj (one of which only operates off - season as a replacement for the Mangalia service), along with two trains to Bucharest (one of which is extended to Constanța during the holiday season), two to Satu Mare and one each to Iaşi and Timişoara (actually a single train running between these two cities).

Stopping trains are now more restricted in scope with the most distant destinations being Arad (two), Cluj (three), Satu Mare / Halmeu (two) and Timişoara (four). Other destinations are Bratca (three) Ciumeghiu / Holod (three), Marghita (two) and Valea lui Mihai (two). But a local service of eight trains daily has been revived between Oradea and Băile Felix / Cordău. Private companies are involved in some of these services: Regional (Cluj) on the Ciumeghiu – Holod - Vaşcău and Săcueni - Sărmăşag routes: indeed one train to Sărmăşag originates in Cluj while other starts at the intermediate station of Marghita and runs through Oradea to Holod.

Meanwhile the 'Transferoviar' company operates the new service to Băile Felix along the old direct route to Holod and Vaşcău: broken by landslides between Ceica and Rogoz since 1993 - 1994 and never reopened throughout because of the alternative route through Ciumeghiu (on the Oradea - Arad line south of Salonta); although some local services served all the stations except Duseşti and Zăvolu until 1998. As already noted a Băile Felix service was then started during 2003 - 2006 and has now been reintroduced.

SERVICES ON THREE CARPATHIAN VALLEY ROUTES

The Mureş Valley: Arad - Deva - Vinţu de Jos

The paper now considers a new of major Transylvanian routes beginning with Arad - Vinţul de Jos (between Alba Iulia and Sebeş) and contines with the lines through the Jiu and Olt valleys. In 1989, stopping trains once included some extremely long journies Arad - Bucharest but also Deva - Bucharest via the Jiu Valley. There were also five trains Arad - Simeria and seven Simeria - Vinţul de Jos / Teiuş (one extended to Târgu Mureş).

Complex local operations reflected heavy industry at Arad as well as Cugir and especially Hunedoara. Local services involved Arad to Curtici (nine). Radna / Milova (two) and Săvârşin (two) while the Deva area was served by trains from Săvârşin to Ilia (one) and Simeria (two); Ilia to Simeria (three) and Deva to Simeria (three, plus one extended to Hunedoara). Hunedoara also had six local services to Simeria and three to Teiuş; not to menton two accelerat services in the form of through coaches attached to the Timişoara - Iaşi and Arad-Bucharest services already referred to.

Finally the engineering town of Cugir generated traffic in the form of four trains to the main line at Şibot with four others proceeding to Teiuş and two to Sibiu. But in 2011 the picture was somewhat simpler with the long - distance stopping trains replaced by more services with a regional scope: five trains between Arad and Simeria, two between Deva / Simeria and Alba Iulia / Teiuş (one originating in Hunedoara) and one each between Arad - Teius, Arad - Alba Iulia and Lugoj - Simeria. Local services also covered Arad - Curtici (seven), Arad - Radna (one), Deva - Simeria (three) and Ilia / Săvârşin - Simeria (three, with one extended to Petroşani and Lupeni). Hunedoara's services are now reduced to six of which only the Teiuş service (already noted) runs beyond Simeria. Meanwhile Regiotrans provide five trains from Cugir to Şibot which all continue to Vinţul de Jos and Alba Iulia.

Express trains are also simpler with the international traffic restricted to the Bucharest - Vienna service and trains from Budapest which run to Bucharest but also Arad / Timişoara (three),

Braşov, Sibiu and Târgu Mureş. The Arad - Bucharest express service contines along with a seasonal train to Mangalia and a Bucharest - Cluj train runs via the Jiu Valley. There is also a provincial Inter - City profile with trains from Deva to Cluj and Craiova (as well as Cluj - Craiova via Deva); also two trains between Timişoara and Iaşi and three between Timişoara and Sibiu. Overall the number of trains at the main stations served by express and stopping trains (Curtici, Arad, Radna, Săvârşin, Ilia, Deva, Simeria, Orăştie, Şibot and Vinţul de Jos) averaged 22.9 in 1989 and 23.6 in 2011 while the average for the 38 other stations (including the Cugir and Hunedoara branches) fell from 10.0 to 9.1. But both changes are slight (with the first category petformance slightly overstated by counting both the originating and terminating stations for each service) and demonstrate that even rural stations experiencing a big decrease in commuting still retain viable services.

The Olt Valley: Podu Olt - Râmnicu Vâlcea - Piatra Olt

The Olt valley line is a 164 km north-south railway between two east-west trending routes: Podu Olt on the Braşov - Sibiu line just north of the Turnu Roşu pass and Piatra Olt on the line from Bucharest to Craiova via Piteşti). There are no stiff gradients to contend with because the Olt river (at an altitude of 200 - 370 m) neatly bisects what is otherwise a continuous watershed and the engineering problems are all about accommodating the railway in a narrow valley (especially at the Cozia defile) with options further constrained by hydropower developments. The line was completed in 1901 after a branch from Piatra Olt had first reached Râmnicu Vâlcea in 1887. In 1989 there were just two 'accelerat' trains each way connecting Bucharest with Sibiu and Cluj. They stopped at Râmnicu Vâlcea and other centres in the area (Băbeni, Călimăneşti, Drăgăşani, Govora and Lotru: the latter being the railhead for Brezoi and the resort of Voineasa). But four stopping trains ran the full distance each way, with three extended to Craiova in the south and Sibiu in the north.

Another three ran between Piatra Olt and Râmnicu Vâlcea while one ran to this city from Podu Olt. Other trains were locals operating in the Râmnicu Vâlcea area to connect a string of small towns. Most originated in the city exctending to Băbeni (three) in the south and Câineni, Lotru, Turnu and Valea Mărului in the north while two others ran from Băbeni in the south to destinations at Călimăneşti and Cornet to the north. There were also local trains into Sibiu from Lotru and Turnu Roşu (two). In 2011 there were still two 'accelerat' trains running the whole length (though both now terminate in Sibiu and one goes only to Caracal). Two other trains run to Bucharest: one from Râmnicu Vâlcea (competing with a bus service which is able to take a direct route through Piteşti) while another starts at the spa of Călimăneşti. In addition one of the stopping trains between Craiova and Sibiu has been upgraded to 'accelerat' status. Three stopping trains still run throughout and two give a direct service to Sibiu. Two trains run between Piatra Olt and Râmnicu Vâlcea although the service is not quite symmetrical because in the southbound direction one train starts at Lotru.

Four trains run between Râmnicu Vâlcea and Podul Olt (two extended to Sibiu) while another goes to Turnu Roşu only. There are also the local services in the Râmnicu Vâlcea area which are somewhat reduced given the competition from bus services: on the southern side to Băbeni (two: of which one continues without a change along the branch to Alunu) and Drăgăşani; and on the northern side to Lotru; while two trains run each way between Băbeni in the south and Călimăneşti in the north. The two daily services between Turnu Roşu still operate. On average the main stations (Piatra Olt, Drăgăşani, Băbeni, Govora, Râmnicu Vâlcea, Călimăneşti, Lotru, Câineni and Podu Olt) average 12.0 and 12.7 trains daily (taking 1989 and 2011); compared with 7.5 and 6.3 for the 33 others (but one fewer in 1989 since Bucşani, km 318 and km 355 opened since 1989 while Răstoaca and Bogdăneşti have closed). Once again there is a widening gap but not an excessive one.

The Jiu and Strei Valleys: Simeria - Petroşani - Târgu Jiu - Filiaşi

We also consider a parallel route across the Southern Carpathians extending over 202 kilometers from Simeria (near Deva, lying between Alba Iulia and Arad) to Filiaşi on the line from

Craiova to Drobeta Turnu Severin. Once again the physical geography is quite distinctive because the Jiu river flows in a defile at 400 - 550 m cutting through the main mountain range while the watershed is displaced northwards to the Bănița Pass at 725 m north of Petroşani; leaving a substantial depression separated from other parts of Transylvania. This route was proposed for the first railway to connect Hungary with Romania although it was an unlikely route selection involving the Vîlcan Pass (1,621 m) rather than the Jiu defile through which a strategically - important railway was eventually completed in 1948 (Turnock, 2004).

It is unlikely that any serious survey was undertaken when the branch from Simeria to Petroşani was completed in 1870 (complemented in the south by Filiaşi - Târgu Jiu in 1888 and the Bumbeşti extension in 1916) because the primary aim was the development of a new Hungarian coalfield (nowadays Romania's principal source of hard coal). In 1989 there were two 'accelerat' services between Simeria and Bucharest serving primarily the northern end: Simeria with Călan as well as the Haţeg area through Subcetate; the coalfield towns centred Petroşani; and further south Târgu Jiu with the smaller towns of Bumbeşti and Târgu Cărbuneşti.

In 1989 there were two 'accelerat' services each way between Simeria and Bucharest; not to mention the international train 'Nesebur' running between Budapest, Istanbul and the Bulgarian cities and resorts of Burgas and Varna. There was also an 'accelerat' service between Târgu Jiu and Budapest and a seasonal holiday train from Petroşani and Mangalia. The stopping train programme included one daily service from Simeria to Bucharest and another to Craiova; while there were five trains between Simeria and Petroşani, one between Petroşani and Filiaşi and another from Târgu Jiu to Filiaşi. Local services from Simeria involved single trains to Pui and Subcetate and three daily services to Călan; while there were five trains from Petroşani to the mining towns of Vulcan and Lupeni; some involving a change at the junction station of Livezeni: the junction station which also had one daily service of its own. There were also trains to Târgu Jiu from Lainici and Meri and a service to Filiaşi from Pietrele Albe.

In 2011 there was much less traffic as a result of falling coal production and some reduction in passenger services which leaves this electrified line somewhat underused. A train from Cluj to Bucharest uses this route as does a summer service from Arad to Mangalia, trains to Craiova from Cluj and Deva and a service from Târgu Jiu to Caracal. Meanwhile there are no longer any stopping trains going the whole distance; let alone the former extensions to Bucharest and Craiova. There is a daily train from Timişoara to Târgu Jiu; six trains from Simeria to Petroşani: two of these originate further west at Deva and Ilia while three continue to Lupeni and one terminates at Baru Mare. There are two other local services between Petroşani and Lupeni although the area also has numerous minibus services.

For the rest there are four trains from Petroşani to Filiaşi and Craiova; plus another to Târgu Jiu only; also two trains from Târgu Jiu to Craiova (one of which originates at Lainici). Services at the main stations (Simeria, Călan, Subcetate, Petroşani, Livezeni, Valea Sadului, Târgu Jiu, Cărbuneşti and Filiaşi) averaged 14.2 in 1989 and 12.0 in 2011; compared with 7.5 and 5.5 for the 56 other stations (including the Lupeni branch): an all - round reduction. Once again the number of stations has increased (by two from 54 in 1989): two extra stations have appeared between Petroşani and Subcetate while another new station at Vâscoza on the Lupeni branch is balanced by the closure of Paroşeni.

An interesting issue arises over these Carpathian lines because of a much debated option of shortening the railway from Bucharest to Transylvania (c. 50 kms for the Braşov route and c. 130 kms for Piatra Olt) by building a direct line from Piteşti to Râmnicu Vâlcea. The need for such a line was difficult to demonstrate when capacity at the Predeal Pass (between Braşov and Ploieşti) could be increased first by doubling the track and later by dieselisation and finally electrification. But the inexorable growth of freight traffic in the communist period made the new line necessary and work began in 1979 after a series of studies extending over half a century (Peaha, 1975, Turnock, 2005).

The chosen 39km route is difficult because of its vulnerability to landslides despite long tunnels at Ploştina (1.91 kms) and Gibei (2.25 kms) respectively west and east of the Topolog

viaduct which is itself an impressive structure 48m high and 1.29 kms long. Such was Ceauşescu's penchant for anticipating each 'noua realizare grandioasă' that the line appeared in the 1989 timetable with two daily trains calling at the stations of Ciorangeni (Schitu Matei) in 1989 and Samnic (Blidari) although additional stations were also envisaged near the two ends: Râmnicu Vâlcea Est and Tutana. However some sections of new line were still up to 40 % short of completion when the revolution occurred and since there were no funds available to continue a project which quickly became irrelevant as freight declined and so the project was left in abeyance. It has been argued that displacement of freight to the new route would allow Predeal to concentrate on high speed passenger trains, but electrification for through running would be desirable.

And while the tunnels have sufficient clearance, the existing Olt valley railway would be very difficult to convert as an electrified double - track international railway: given the narrowness of the valley and its conversion for hydropower. However the mineral branches built for the transport of lignite (Băbeni-Alunu and Cărbuneşti - Albeni) could be connected (as was anticipated in the 1980s) so as to provide a link between Băbeni and the already - electrified (but much underused) Jiu Valley line which would also secure the shorter route to Transylvania: hence the proposal for an entirely new 50 km railway aligned south of the existing project to connect Poiana Lacului near Piteşti - Goleşti with Sirineasa on the Alunu branch (Ciocoreanu and Fedeles, 2003). It would be a great waste to ignore the route already prepared, but there is no chance that any development along either of these lines will precede in the foreseeable future although it is an interesting speculation which links the two Carpathian routes under discussion.

JOURNEY TMES

The matter of speed needs some comment because the plans for high speed routes as part of a European network are behind schedule and it is clear that the main government transport priority rests with highway construction. But inadequate maintenance since 1989 means that maximum train speeds have fallen, as already noted for international services. On the while journey times have increased since 1989 due to lower maximum speeds compounded by additional stops. The late 1970s was the time of peak performance when the author published a paper (Turnock, 1978, p. 419) noting the speeds scheduled for the longest non-stop journeys between station stops in 1977: there Bucharest - Constanta: 225 kms in 2 h 47 (81 kph); Bucharest - Craiova: 220 kms in 2 h 28 (85.0 kph); Bucharest - Brăila: 199 kms in 2 h 19 (86 kph); Cluj - Oradea: 153 kms in 2 h 30 (61 kph); Arad - Deva: 149 kms in 1 h 56 (77 kph); and Braşov - Sighişoara: 128 kms in 1 h 36 (80 kph). But the situation had deteriorated in several cases by 2011 due to speed restrictions and station stops.

Thus the shortest Bucharest - Constanța journey is now 3 h 47 (59 kph) including four stops; while the Bucharest - Craiova service takes some 3 h 10 (66 kph) with stops at Videle, Rosiori Nord and Caracal and the Bucharest - Brăila journey - already extended in 1989 to 3 h 04 with four stops - took 3 h 18 (60 kph) in 2011 with stops at the Aeroport, Urziceni and Faurei. Cluj - Oradea is still a non-stop journey for the 'Avram Iancu' and 'Biharia' although the time is now 2 h 44 (56 kph); likewise for Arad - Deva with non-stop running over 2 h 15 (66 kph) for the 'Aurel Vlaicu' and 'Pannonia' trains; and also for Braşov - Sighişoara where the best time is 2h15 in the eastward direction (57 kph) compared with 2 h 32 (50 kph) going west.

To extend the analysis table 3 has been constructed to sumarise the situation over ten routes with the present situation compared over 20 - year intervals going back not only to 1989 but 1969 and 1948 as well. And the survey considers 'rapid', 'accelerat' and 'personal' trains wherever possible. It becomes clear that journey times improved substantially between 1948 and 1969, with slight recession in 1989 and then more substantial deterioration to 2011. The main problems arise with 'rapid' trains which may serve Cluj but not Oradea; while a 'rapid' train to Suceava may be used for a Iaşi journey as far as Paşcani where a wait for a stopping train to complete the journey destroys any advantage gained by high speed (since Călători now route their best services to Iaşi through Tecuci and Bârlad).

Back in 1948 both ‘rapid’ and ‘accelerat’ services to Iaşi were only possible as far as Paşcani with a stopping train to complete the journey (acciounting for five of he intermediate stops notred). In the case of the ‘accelerat’ the poor connection meant a three - hour wait which lost all the advantage of the fast train and made the entire journey by stopping train an advantage by 26 minutes. Another anomaly may be noted on the line to Oradea: in 1969 a ‘rapid’ service was available in theory between by taking the ‘Transilvania’ to Cluj and then waiting nine hours to continue by the Balt Orient Express. But the ‘accelerat’ service would have been much better under the circumstances.Today ‘rapid’ services score c.60 kph (though 80 kph might have been sustained in the past) while ‘accelerat’ trains are distributed across the 40s and 50s (only rarely touching the upper 60s).

Table 3 Train speeds on sample1948-2011
(Source: CFR Mersul Trenurilor de Călători for the relevant periods)

1948			1969-1970			1989-1990			2010-2011		
Rapid	Accel.	Person.	Rapid	Accel.	Person.	Rapid	Accel.	Person.	Rapid	Accel.	Person.
Bucharest - Craiova - Turnu Severin - Timişoara 533 kms (574 kms via Piteşti : p)											
10.20p	11.02	19.13	7.53	8.43	13.39	7.40	8.05	12.29	8.30	8.47	17.06*
21/55	22/48	90/28	8/67	10/61	92/39	9/69	13/66	100/43	10/63	13/61	85/31
Bucharest - Braşov - Sighişoara - Arad 626 kms (599 kms via Sibiu: s; 604 kms via Petroşani : p)											
11.33	13.22	20.15	8.48	9.23s	15.01	9.48s	10.35s	14.16	11.51	10.49p	31.11#
24/54	34/47	104/31	9/71	14/64	83/42	11/61	19/56	97/44	11/53	17/55	138/20
Bucharest - Braşov - Deda - Baia Mare 624 kms											
n.a.	21.05	45.42¬	10.17	12.03	14.05	n.a.	11.43	15.00	n.a.	14.44	36.12!
n.a.	35/30	119/14	12/61	21/52	55/44	n.a.	17/53	111/42	n.a.	25/42	126/17
Bucharest - Braşov - Cluj-Oradea 648 kms											
10.55	15.10	21.40	n.a.	10.37	17.24	9.48	12.39	14.29	12.52	13.02	23.49#
26/59	37/43	84/30	n.a.	13/58	101/37	13/66	23/51	102/45	14/50	19/50	115/27
Bucharest - Ploieşti - Bacău - Suceava 450 kms											
10.08	9.12	13.14	5.45	6.49	9.26	5.47	6.59	11.23	6.43	7.06	14.23#
13/44	19/49	59/34	11/78	12/66	63/48	9/78	12/64	72/39	9/67	12/63	72/31
Bucharest - Ploieşti - Paşcani - Iaşi 462 kms											
8.47	12.43	12.17	n.a.	7.59	10.18+	n.a.	6.22	12.08+	9.17+	8.40	14.36#
15/52	18/36	57/38	n.a.	10/58	6/45	n.a.	4/73	69/38	11/50	5/53	70/32
Bucharest - Ploieşti - Tecuci - Iaşi 431 kms (400 kms via Urziceni and Tecuci)											
6.25	8.40	11.50	5.11	6.44	10.28u	5.57	6.12	9.12	7.00	7.07	14.38#
13/67	15/50	54/36	8/83	12/64	51/40	10/72	10/70	61/44	10/62	12/61	66/29
Bucharest-Ploieşti-Faurei-Galaţi 259kms											
n.a.	n.a.	12.13	n.a.	n.a.	5.52	3.20	3.35	7.34*	n.a.	4.30	7.41+
n.a.	n.a.	36/21	n.a.	n.a.	24/44	3/77	6/72	39/34	n.a.	7/58	44/34
Bucharest - Ciulniţa - Feteşti - Constanţa 225 kms											
3.35	3.53	6.40	n.a.	3.08	5.00	2.33	2.50	4.54	3.47	3.49	5.44
4/62	4/58	36/34	n.a.	4/71	35/45	0/88	4/79	35/46	4/59	6/59	36/39
Timişoara - Oradea - Cluj - Suceava - Paşcani - Iasi 794 kms											
n.a.	19.35+	36.32@	n.a.	16.03	41.49#	n.a.	16.02	36.18!	n.a.	16.31	40.50!
n.a.	53/40	101/22	n.a.	34/49	135/19	n.a.	32/49	133/22	n.a.	31/48	157/19

For each route the first line shows the fastest train in each category; the second line shows the number of intermediate stops and the average speed over the entire journey.
two trains / one change+; three trains/two changes*; four trains/three changes #; five trains / four changes @; six trains / five changes!; seven trains/six changes^

Looking more widely at the situation in 2011 this remains broadly true as examples in table 4 suggest. Some ‘accelerat’ tains make a very considerable of stops which inevitably reduces the average speed e.g. 38 stops for the Bucharest - Sighetul Marmaţiei service which averages only 39 kph over 606 kms. Of course the best potential for high speed running is in he lowlands, especially the lines from Bucharest to the north (as far as Floreşti, north of Ploieşti) and also to Brăila, Constanţa and Craiova. The general speed limit is120 kph (though rarely

attained), with but 140 km / h (160 km / h in prospect: Floricel 1992) from Bucharest to Constanța and also on the Brașov route as far as Florești (20 kms north of Ploiesti). At the other end of the scale stopping trains may fall into rhe 30 - 39 kph bracket witrh some extremely slow branch workings e.g. 2 h 19 for the 41 km Babeni - Alunu branches means just 18 kph!

At the other end of the scale it is evident that in 2011 some long - distance stopping train journeys became virtually impossible (without excessive waiting) because such trains are now very limited on certain routes and night trains have been drastically reduced (table 5).

Table 4. A selection of 'accelerat' and 'rapid' train times in 2011
(Source: Mersul Trenurilor de Călători 2011)

Over 60kph: Arad - Cluj (62 kph*); Bucharest - Botoșani (60 kph*)
50 - 59 kph: Arad - Mangalia (53 kph); Bucharest - Arad via Târgu Jiu (56 kph); Bucharest - Cluj via Petroșani (55 kph); Bucharest - Piatra Neam / Bicaz (58 kph); Bucharest - Satu Mare via Sibiu and Cluj (52 kph); Bucharest - Vatra Dornei (57 kph); Timișoara - Mangalia (51 kph)
40 - 49 kph: Bucharest - Satu Mare via Medias and Oradea (48 kph); Timișoara - Sighetul Marmației (42 kph)
30 - 39kph: Bucharest - Sighetul Marmației via Deda (39 kph)

Table 5. Long-distance stopping trains

Long - Distance Stopping Trains Cancelled since 1989: Bucharest - Oradea 650 kms; Bucharest - Baia Mare 625 kms; Bucharest - Arad 599 kms; Bucharest - Timisoara 533 kms; Bucharast - Ciceu 399 kms.
Stopping Trains Travelling over c.150 kms in 2011: Brașov - Târgu Mureș (283 kms); Cluj - Sighetu Marmației 249 kms; Brașov - Teiuș (228 kms); Bucharest - Mărășești (219 kms); Bucharest Obor - Constanța (215 kms); Timișoara - Drobeta Turnu Severin (211 kms); Bucharest - Craiova (209 kms); Suceava - Ilva Mică (194 kms), Sibiu - Piatra Olt (186 kms); Mărășești - Miercurea Ciuc (183 kms); Constanța - Tulcea (179 kms); Timișoara - Oradea (178 kms); Iași - Tecuci and Mărășești - Pașcani (168 kms); Arad - Brad (167 kms); Bucharest - Brașov (166 kms); Arad - Simeria (157 kms); Oradea - Halmeu (155 kms); Cluj - Oradea (152 kms); Brașov - Sibiu (149 kms); Satu Mare - Jibou (148 kms).

This is very much the result of changing travel patterns from the days when people might often to save money by avoiding the higher fares for fast trains and might even gain some social advantages in taking an overnight journey from (say) Bucharest to Baia Mare with fellow passengers in a state of constant flux! But now the option is of minimal practical significance. However if a passenger wished to travel from Bucharest to Baia Mare by stopping train along the route of the former through service there would be changes at Brașov, Deda, Sărățel, Dej and Jibou including a wait through the night at Deda between the arrival of the train from Brașov at 18.59 and departure for Sărățel at 04.21; followed by a further lengthy wait at Dej from 09.14 to 14.15. On this basis it would be quicker to travel via Cluj: still requiring five changes but saving 4 h 20! In the case of Bucharest - Arad the fact that there is now only one stopping train daily between Bucharest and Brașov would mean a first leg during 6.26 - 11.14 while at the other end the best option is the 10.27 from Simeria arriving in Arad at 13.37.

The journey between Brașov and Simeria may then be accomplished either (a) by taking trains from Brașov to Sibiu at 14.14 (arriving 18.17); from Sibiu to Vințul de Jos at 19.30 (arriving 21.55) and from Vințul de Jos to Simeria at 08.48 (arriving at 0951) or (b) travelling from Brașov to Teiuș at 14.20 (arriving at 19.52) and then from Teiuș to Simeria at 08.05 (arriving 09.51). But since the 10.27 from Simeria originates in Lupeni (at 06.22) there is a third option involving the 15.38 from Craiova through the Jiu Valley to Petroșani: this would require leaving Bucharest at 06.55 to arrive in Craiova via Caracal at 11.50 before proceeding via Târgu Jiu and Petroșani to join the Lupeni - Arad service. Bucharest - Galați via Buzău is also difficult by stopping train with an overnight wait in Făurei but most horrendous is Timișoara - Iași: an overnight in Cluj is

required between the first leg (including the first change in Oradea) and a sequence of four trains (beginning early at 04.12) requiring changes at Ilva Mică, Suceava and Paşcani.

Even so there has to be a prompt start on the first day at Timişoara at 05.16 because the only other stopping train to Oradea arrives at 17.09 which misses the last stopping train to Cluj leaving at 15.25. As the table shows this journey has always been difficult although – except in 1948 (when it was necessary to change from one 'accelerat' to another in Cluj) – through expresses operate with journey times of 16 - 17 hours. On the other hand, some stopping trains fit reasonably well into a sequence of connections e.g. Bucharest - Iaşi via Tecuci with changes at Buzău, Mărăşeşti and Tecuci; also Bucharest - Suceava with changes at Mărăşeşti, Bacău and Paşcani (where there is an equally good connection for Iaşi).

Even so the journey time has more than doubled since 1989. At the same time, distinctions between the three categories have become somewhat blunted so that an accelerat from Bucharest to Timişoara takes 8 h 47 with 13 stops which compares with the rapid at 8 h 30 with three stops fewer. Indeed, the Bucharest - Constanța "accelerat" to takes only two minutes longer than the 'rapid' with the same number of stops. And where connections are involved the 'accelerat' from Bucharest to Iaşi via Paşcani - which happens to be the slow - moving 'Prietenia' to Chişinău - is faster than the Suceava 'rapid' combined with a connection by stopping train at Paşcani

PRIVATE OPERATORS

As already noted, private operators are now involved under a new regime encouraging competition. Since 2004 - 2005 Regiotrans of Braşov has run its dark red railcars to Brețcu and Zărneşti and the company now also offers a steam-hauled 'Dracula Express' to Zărneşti that can be chartered with a minimum of 40 passengers. The company also works the Întorsura Buzăului line in the Braşov area and has expanded rapidly nationwide: e.g. in 2008 to take in lines from Alba Iulia to Cugir and Zlatna, as well as Arad - Nădlac, Sighişoara - Odorhei, Voiteni - Reşița, Berzovia - Oravița and Buziaş - Jamu Mare; with several other routes since. Belonging to the French transport company Keolis it was in a good position to transfer stock from France.

It could also benefit from the experience of Keolis in mainline operations and although the plan for a Braşov - Constanța 'accelerat' has not yet materialised there are fast trains running to Craiova and Iaşi (running together as far as Ploieşti). There are three other companies providing regular services which have developed out of freight operations: Servtrans started in 2002 with shunting operations in connection with EuroCorridor Four, with passenger services started in …..

Then in 2003 Călin Mitică's Transferoviar Grup (TFG) emerged in Cluj as a freight carrier, associated with the Cluj railway engineering company 'Remarul': passenger services started in 2010 using VT624 'Deuwag' railcars from Germany (turned out with a blue/grey livery) on the Oradea - Băile Felix/Cordău. Finally the freight - carrying Via Terra Grup (established in 2003) spawned the 'Regional: transport public feroviar de calatori' company in Cluj in 2005. All the operators collaborate over a private railway timetable: Mersul trenurilor operatori feroviari private (available online at www.tren.transira.ro) but services are now also included in the CFR timetable as well. As already noted there are now relatively few branchlines still operated by CFR and some of the lines shown in table and important lines with the potential for competition.

Services by Regiotrans

Space does not allow discussion of all services but in the Iaşi area the Iaşi - Dorohoi service consists of six trains each way plus one additional train from Iaşi to Truşeşti. Before there were three trains each way plus a fourth train from Dorohoi to Iaşi only. Timings have also improved from a range of 3.55 - 4.20 before to 3.12 - 3.35 now (38 – 45 kph on aveage) (table 6).

The Dorohoi - Botoşani service involves two trains each way with three to Leorda where there are Călători connections with Botoşani and Suceava. For Buhăieşti - Roman there are six trains each way but in one case a break at Dagâța provides late night workings into this centre from both ends; balanced by early morning departures. Journey times are unchanged at c. 2 h 10

but the frequency has improved three-fold from the twice - daily service before. In addition, one service is extended to Iași to allow a morning's business in the city.

The Iași - Hârlău service has improved from three trains to five (allowing late morning and early afternoon services) while there has also been considerable acceleration from c. 2 h 07 before to c. 1 h 30 now (30 - 43 kph). The Târgu Neamț service is essentially a 31 km branch line operation from Paşcani involving five intermediate stations.

The schedule has been accelerated to c. 0 h 40 from c. 0 h 50 and there are now eight trains daily compared with only four before (although there was a fifth from Târgu Neamț to Paşcani with through coaches to Bucharest attached to the night train from Suceava (while the return working was combined with a stopping train). Two of the services are extended: one to Fălticeni (see below) and another to Iaşi although the advertised through service from Iaşi leaves at 13.21 while there are already Călători services at both at 12.55 and 14.11.

Finally there is a short branchline service linking Fălticeni with the main line at Dolhasca. There has been a small acceleration while the frequency has doubled from four to eight: a great improvement in the afternoons and evenings, especially from Dolhasca. One service provides a direct link between Fălticeni and Târgu Neamț (39 kms by direct distance but 78 kms by rail through Dolhasca and Paşcani) with a schedule averaging just over two hours (38 kph).

Meanwhile in the Odorhei / Târnoveni area the first service provides (a) services into Bistrița in the mornings from Sărmăşel (2) and Luduş (1) with return in the evening; (b) a mid - day return to Miceştii de Câmpie; (c) two trips between Sărmăşel to Luduş; (d) one train Bistrita - Alba Iulia outward in the mornings; returning in the afternoon. 5.16 hours south 5.57 north with 18 mins at Ludus N and another wait at Sărmăşel; but only four south: 48 stations. Connections are provided at Luduş: the 7.30 arrival in Luduş and 8.05 return connects with the Accelerat 'Harghita' (Târgu Mureş-Cluj) and a stopping train Vintul de Jos to Târgu Mureş and beyond. The 21.15 departure from Luduş for Sărmăşel connects with the stopping trains Târgu Mureş - Teiuş and Sibiu - Târgu Mureş.

The 14.30 from Luduş also links with stopping trains in both directions but the wait is considerable. However the service provides a big improvement over previous pattern of just two trains from Bistrita to Luduş and one to Sărmăşel. Timings before were 3 h 44 south but 4 h 43 norths (due to a long wait at Sărmăşel): respectively 29 kph and 23 kph for a 110 km journey. Now the time is 3.12 and 3.22 southbound (33 kph) and 3.56 - 3.58 northbound (30 kph): still with long waits at Sărmăşel. Meanwhile, the second route used to involve nine trains between Blaj and Târnăveni and four from Târnăveni to Praid, near the resort of Sovata (with one through service taking 3.18).

Now there are nine and four trains respectively (plus one local service between Balauşeri and Târnoveni. Regiontrans has also taken over the Sighişoara - Odorhei service running five trains in each direction (some terminating at the junction station of Cristur) which compares with three in 1989 when the midday period was poorly served. But there is also an interesting innovation is the direct connection between Odorhei and Sibiu through Sighişoara for the very first time. The 142 km route normally requires changes at Sighişoara and Copşa Mică with the best connections in 1948 extending the total journey time to 9 h 53 southbound and 9 h 34 return (averaging 15 kph). At this time there was actually an alternative service was provided through use of a 161 km route taking the narrow gauge line from Sighişoara to Sibiu via Agnita.

But the one daily train meant a total (overnight!) journey time from Odorhei of 15 h 57 southwards and 14 h 02 northwards (reflecting the difficult summit section north of Agnita and a long wait of several hours in this town): an average speed of 11 kp h. However the option disappeared with closure of the northern section in 1965. Meanwhile the standard gauge route registered improvement to provide a journey time 4 h 24 southwards in 2008 with 5 h 42 north (averaging 31 kph), but now the new through service by Regiotrans takes just 2 h 09 - 2 h 12: averaging an unprecedented 66 kph!

Turning to the Timişoara area, it may be noted first that in the past the Cermei line provided connections only for five trains into Arad and six out (all to / from Brad). Now Regiotrans provide

seven direct services and one other which connects with a Călători service at Ineu. Meanwhile Nădlac trains are now scheduled to take 1 h 22 - 1 h 41: accelerated from 1 h 48 - 2 h 02 by introduction of a railcar; while the five trains previously running between Arad, Sânnicolaul Mare and Valcani have been supplemented by two extra trains between Sânnicolaul Mare and Valcani. There are six trains on the Buziaş - Gătaia - Jamu Mare route against only five before, with one non-stop early morning train to Jamu Mare to provide the first service going to the town of Gătaia.

There are good connections at Gataia with Timisoara with waiting time reduced; though curiously there are five trains to Timişoara against only four in the other direction; also three extra trains go as far as Voiteni but only two in the other direction. Consequently while only one of the nine trains heading west from Reşiţa terminates Gătaia (since the others continue to Voiteni or Timişoara) three of the trains running in the opposite direction start from Gătaia. The Timişoara - Reşiţa service now takes 2 h 14 (43 kph); much better than the c. 2 h 45 (34 kph) average in 1989 - discounting the section between Reşiţa Nord (the present terminus) and Reşiţa Sud which Regiotrans does not use (although in the 1990s there was a daily accelerat working at 46 kph to the Sud station).

Meanwhile the Jebel - Giera line has an extra train and slight acceleration; likewise Lovrin - Jimbolia and Sântana - Grăniceri. The Nerău line has an extra train and big acceleration: 2 h 13 now (42 kph) but 2 h 31 before (37 kph). In the Alba Iulia area the Cugir service now includes a late evening train while in the Craiova area the trains the Caracal - Corabia trains offer good connection with both the main line (Bucharest - Craiova) and other local services to Piatra Olt. On the Alexandria - Zimnicea line there are extra late morning and early afternoon services, as well as a connection for Zimnicea for Roşiori Nord and Caracal, though not in the other direction. Finally while the Braşov area has already been mentioned, there is the matter of the 'accelerat' services to Craiova and Iaşi with the two trains combined as far as Ploieşti. The Iaşi service takes 10 hours with 20 intermediate stations but 18 on the return journey when Breaza and Comarnic are omitted.

Table 6. Services by Regiotrans in 2011

ALBA IULIA
Alba Iulia - Bărăbanț - Ampoița - Zlatna (43 kms)+
#Alba Iulia - Teiuş - Războieni - Cluj (121 kms)@
#Alba Iulia - Vinţu de Jos - Deva - Arad (211 kms)[]
#Alba Iulia - Vinţul de Jos - Sebeş - Sibiu (73 kms)
#Alba Iulia - Vinţul de Jos - Şibot - Cugir (37 kms)+
BRAŞOV
Braşov - Sfântu Gheorghe - Târgu Secuiesc - Brețcu (98 kms)+
Braşov - Hărman - Teliu - Întorsura Buzăului (36 kms)+
Braşov - Cristian - Râşnov - Zărneşti (27 kms)+
#Sibiu - Copşa Mică - Mediaş - Blaj (96 kms)[]
CRAIOVA
#Caracal - Roşiori Nord - Alexandria - Zimnicea (133 kms)+
Caracal - Frăsinet - Vişina - Corabia (41 kms)+
IAŞI
Dorohoi - Văculeşti - Leorda - Botoşani (37 kms)+
#Iasi - Buhăieşti - Dagâța - Roman (115 kms)+
Iaşi - Podul Iloaiei - Cotnari - Hârlău (64 kms)+
#Iaşi - Târgu Frumos - Paşcani - Târgu Neamț (106 kms)+
Iaşi - Vlădeni - Dângeni - Dorohoi (154 kms)+
#Paşcani - Lespezi - Dolhasca - Fălticeni (47 kms)+
Odorhei / Târnoveni - Luduş - Bistrița
Alba Iulia - Luduş - Lechința - Bistrița (182 kms)+
Blaj (Câmpu Libertății) - Târnoveni - Sângeorgiu de Pădure - Praid (115 kms)+

Odorhei - Sighişoara - Copşa Mică - Sibiu (141 kms)+
TIMIŞOARA
#Arad-Sântana - Ineu - Cermei (76 kms)+
Arad-Pecica - Semlac - Nădlac (52 kms)+
#Arad - Vinga - Sânandrei - Timişoara (57 kms)
Arad - Periam - Sânnicolau Mare - Valcani (87 kms)+
Berzovia ormac-Gătaia-Jamu Mare (56 kms)+
Jebel - Ciacova - Banloc - Giera (33kms)+
Lovrin - Lenauheim - Grabăţ - Jimbolia (27 kms)+
Sântana - Nădab - Socodor - Graniceri (39 kms)+
Timişoara - Utvin - Peciu Nou - Cruceni (49 kms)+
Timişoara - Lovrin - Sânnicolau Mare - Cenad (75 kms)+
Timişoara - Gătaia - Berzovia - Reşiţa (95 kms)+

+ programme of several trains daily
@ usually one train daily
[] weekends only or two days per week
includes use of mainlines in competition with Călători

Services by other private operators

The 'Regional' company was working in Bihor on the Ciumeghiu - Holod - Vaşcău branch in 2008. But trains operate quite separately on the two halves of the branch with very few good connections at Holod (surprisingly in view of the tourist potential). Meanwhile trains to Holod frequently originate beyond the main line junction of Ciumeghiu: while a connection with Arad has not been sustained there are services from Salonta, Oradea (two) and Marghita with the latter providing a link with the company's other service in Bihor County (Săcueni - Sărmăşag; linking the Oradea - Satu Mare main line with the cross-country link between Carei and Jibou) (table 7).

There are now much improved connections at Sărmăşag with Călători services on the Căţei - Jibou route: the 8.03 arrival from Săcueni connects with the 8.11 departure for Carei and Satu Mare as well as the 8.14 departure for Jibou; while the 1330 from Săcueni connects with 13.52 trains to Jibou at 13.52 and 15.18 as well as the 14.57 from Marghita and 15.18 to Jibou.

In the other direction the 7.08 from Sărmăşag to Săcueni desparts after the 6.49 arrival from Jibou; also the 8.30 to Marghita after the 8.10 arrival from Jibou; while the 14.02 follows the arrivals at 13.44 and 13.51 from Satu Mare and Carei. Also the 15.10 follows the 15.03 arrival from Jibou and the 20.52 leaves after the 20.39 arrival from Jibou while the 22.01 to Şimleu Silvaniei follows the 21.56 arrival from Carei. By contrast in 2008 there were just two Jibou connections each way plus two to Oradea from Săcueni, with only one northward to Tăşnad (but nothing in the other direction).

Turning to northeasterm Transylvania, the five daily trains on the Ilva Mică - Rodna Veche branch start in two cases from Năsăud and one from Salva. The timings are unchanged (0 h 52) but there is no longer a through coach service (attached to the Bucharest - Sighetul Marmaţiei service) which used to arrive in the evening and depart in the very early morning arrival balanced by an early morning departure. However the 11.00 departure from Rodna Veche gives a connection at Năsăud at 12.49 with the Iaşi - Cluj - Timişoara accelerat (while the same train, arriving at Ilva Mică at 11.50, links with the Cluj - Iaşi service). In the other direction the afternoon train from Năsăud links at Ilva Mică with a stopping train from Bistriţa to Vatra Dornei while travel to Bistriţa is possible through early morning connections at all the stations between Ilva Mică and Năsăud.

Transferoviar have developed a string of interests around the country with a core in Transylvania involving services from Cluj to Bistriţa and Târgu Mureş and two others in the Oradea area. The Nehoiaşu service comprises eight trains although one service up the branch is

split into a late evening train from Buzău to Pârscov which continued to Nehoiașu as an early morning service. There were four trains before taking 2 h 36 going up the valley and 2 h 23 going down (…..kph), whereas some journies are now completed virtually within two hours while most others take 10 - 15 minutes longer (33 - 36 kph). The Caransebeș - Bouțari service operates over the remaining western end of the old line through the Poiana Ruscă hills to Subcetate which included a rack section through the Iron Gate Pass.

A programme of 10 trains (serving mainly the steelmking town of Oțelul Roșu) is a big improvement on the five provided before, with a slight acceleration to an average of 1 h 20 from 1 h 15 (an improvement from…). As with the Nehoiașu line where a train waits overnight at an intermediate station, the last train from Caransebeș waits overnight in Oțelul Roșu before proceeding to Bouțari. The company is ambitious under its enterprising manager Kinga Mădărașan with mainline services from Cluj to Oradea and Târgu Mureș to be extended to Bistrița - Beclean and Buzău - Ploiești and even internatonal services such as Budapest - Istanbul and Timișoara - Belgrade. Finally the green-liveried railcars of Servtransinvest operate only on one route: Roșiori Nord - Balaci - Costești - Pitești, with four trains way offering a number of connections at Costești with main line Călători trains to both Piatra Olt and Pitești. Galați - Bârlad 109 kms: reduced frequency / slower trains 3 h 25 / 32 kph.

Finally Servtrans started with two daily services between Roșiori Nord and Pitești but in 2011 they went only to the main line junction at Costești to connect with Călători stopping trains on the Pitești - Slatina - Craiova route (and also one ‘accelerat’ service).

Table 7. Services by other private operators

REGIONAL (Cluj)
Bistrița - Josenii Bârgăului - Prundul Bârgăului - Bistrița Bârgăului (29 kms)+
#Oradea - Ciumeghiu - Holod - Vaşcău (150 kms)+
#Oradea - Săcuieni - Marghita - Şărmăşag (130 kms)+
#Salva - Năsăud - Ilva Mică - Rodna Veche (47 kms)+
Satu Mare - Bixad (52 kms)+
SERVTRANS
#Roşiori Nord - Balaci - Costeşti - Piteşti (64 kms)+_
TRANSFEROVIAR (Cluj)
Buzău - Berca - Pătârlagele - Nehoiaşu (73 kms)+
Caransebeş - Oţelu Roşu - Zăviou - Bouţari (37 kms)+
#Cluj - Dej - Beclean - Bistriţa (119 kms)+
#Cluj - Războieni - Luduş - Târgu Mureş (128 kms)@
Galaţi - Târgu Bujor - Bereşti - Bârlad (109 kms)+
#Oradea - Aleşd - Huedin - Cluj (152 kms)+
Oradea - Băile Felix - Cordău (14 kms)+

Symbols as in table 6.

RAILWAY PRESERVATION AND TOURISM

Railways offer access to areas of touristical interest and the Carpathan lines especially. Indeed for many years timetables have listed all the mountain chalets and indicated the stations from which a ramble (often involving many kilometers on mountain paths) should begin. The private operator on the Vascău line is well aware of the tourism potential. However railways themselves attract visitors and this resource - boosted by retention of steam traction - is slowly being appreciated by a small group of enthusiasts (based in Romania and also abroad) who have been able to obtain the support of the relevant local authorities in order to access the infrastructure and overhaul it.

Although communism was able to preserve old technology through its typically unbalanced approach to modernisation linked with the maximisation of employment in industry people were not encouraged to take a close interest in state property especially with railways in general viewed as strategically important. But industrial archaeology in its various guises is now a developing interest (Hillinger et al. 2003). Many narrow gauge lines did close in the communist period e.g. the Sighet system in 1976 but a significant number of survivors were quickly threatened iduring transition as low average speeds opened the way for bus competition while locomotives and rolling stock could not be replaced by main line 'cast-offs' (unlike the situation standard gauge secondary routes that benefit from the 'cascading' of second-hand material from the main lines.

The remaining CFR narrow - gauge lines closed as follows: Ghilvaci - Ardud near Satu Mare (18 kms) in 1994; Turda - Abrud (94 kms) and the Târgu Mureş system, involving lines to Sovata (74 kms) and Lechința / Miheşu de Câmpie (124 kms) in 1997; and finally Sibiu - Agnita in 2001. Attempts by SAAF to work special tourist trains resulted in the retention of locomotives and coaches at Sibiu, Târgu Mureş and Turda. But while some workings were reported (e.g. to Band and Sovata in 2001 and from Sibiu to Agnita in 2003) no great momentum was achieved, despite interest from leading politicians (including President Băsescu in his earlier career as transport minister) and local authorities, especially Alba County and the Abrud primar.

Activity in Alba has safeguarded the last few kilometres of the line from Turda i.e. between Câmpeni and Abrud, but the most promising restoration project concerns the Sibiu - Agnita line which started as a Sighisoara - Agnita connection built during 1895 - 1898 and eventually extended to Sibiu in 1910 (total length:110 kms); while plans in 1912 for a branch from Agnita to the Cincu military base and the main line at Voila were stopped by the First World War The northern section was closed in 1965 because of a difficult hill summit section and circulation through the main street in Agnita.

A new station on the south side of the town then supported a local passenger service from Sibiu using new diesel locomotives from Sibiu through the Hârtibaciu Valley as well as transport of timber and sugar beet until the short Vurpăr branch closed in 1997 and the twice - daily Agnita service ceased in 2001 given a lack of funds for locomotive maintenance. Tourist specials did not succeed and by 2006 SAAF were keen to sell - off the line which had become totally overgrown and vandalised by Roma. However cultural interests in Sibiu secured the railway as a historic monument in 2007 and the following year a 25 - year concession was secured from SAAF by 'Sibiu - Agnita Intercommunity Development Consortium': comprising the Hârtibaciu Valley Association.

The Sibiu Department of Culture and the Mihai Eminescu Trust or MET (a UK - based conservation group working among the former German communities in the Sighişoara area. Since then four coaches have been rescued and stored in Agnita (2008) while MET financed restoration of a small railway building at Coveş which had become derelict and vandalised. The old Agnita freight depot to be used as a workshop. Centenary celebrations in 2010 generated further momentum and work continues with the help of a widening network of supporters in Romania (e.g. the Scouting Organisation based locally at Nocrich) and abroad e.g. New Europe Railway Heritage Trust. A diesel locomotive has been salvaged and taken to Crişcior near Brad for overhaul but regular tourist trips on the line have not yet started.

Outside the CFR domain there is substantial narrow gauge legacy arising from industrial and forest railways some of which are still operating e.g. at Lonea in the Petroşani coalfield. Most interesting here is the forest railway system in the Vaser valley of Maramureş (close to the Ukrainian frontier 60 kms above Sighetul Marmației) where a 45 km line was opened at Vişeu de Sus in 1932 (after German 'Țipțerii' from Bucovina had first floated timber down the river in the eighteenth century) with a branch along the Ilhoasa tributary in 1952.

The difficulty of road building ensured the retention of this line and even now - following privatisation of the state logging and wood processing complex in 1999 - World Bank surveys have demonstrated that the railway is the most efficient means of transporting timber. Hence the

wood processing company (RG Holz of Sweden, who absorbed the Vişeu forest logging company in 2003) and local tourist interests (supported internationally - and especially from Switzerland by the 'Hilfe der Wassertalbahn' organisation established in 1999 by Michael Schneeberger - are committed to maintain the railway with a dual function.

After the working engines on the line were gradually reduced from four to one during the 1990s, a substabntial fleet of steam and diesel locomotives has been collected together and some have been overhauled: notably a locomotive name 'Cozia' - built at Reghin for forest railway use as recently as 1984 - which emerged from 'Remarul' in Cluj in 2006. In total, five Reşiţa - built narrow - gauge steam locomotives (part of a large fleet built in the 1950s as a standard class for the nationalised forestry system: CFF) are joined by three smaller locomotives dating to 1910-21 built by Budapest, Krauss and Orenstein & Koppel. Tourist trains started in 2007 although the following year flood damage through a massive unexpected July thunderstorm caused extensive damage and after rescuing 160 passengers stranded overnight there was a hiatus while repairs were carried out during the remainder of the year: difficult work in low temperatures (with the onset of winter) with much consolidation work remaining.

Tourism income remains significant with daily trains in the summer (three days a week in the early / late season) for 22 kms to Paltin which includes typical scenery and the local tunnels. Special trains can also be hired at costs upwards of €500 for stream andn €250 for a 'drezina' or railcar. Overnight accommodation for up to 40 persons is offered in a stationary hotel train 'Carpatia - Express': incorporating a vagon - restaurant and a standard - gauge Reşiţa - built locomotive of 1950s vintage (although there is other accommodaton locally and also at several places in the lower valley.

A second forest railway project is emerging at Covasna (60 kms northeast of Braşov) in a massive forested area extending across the former Hungarian - Romanian frontier: indeed the main logging of Comandău gets its name from the German word 'Grenzkommando' referring to the military surveillance on the margin of the former Habsburg Empire.

Construction of the standard - gauge railway Sfântu Gheorghe - Breţcu in 1891 stimulated the expansilon of logging in the area (which dated back to the first sawmill at Gyula in 1875) and a narrow - gauge forest railway system extended from Covasna to Comandău sawmill (requiring an inclined plane) with an extensive network of branches which extended across the old frontier both southwards via the Bâsca valleys to Nehoiu and westwards across the watershed to the Năruja and Zabala valleys of Vrancea (Turnock and Muică, 2003).

In 1989 the system was much reduced but the wood was still collected in the Comandău area from railheads at Gyula and Manicica while sawn timber and firewood was sent down the inclined plane to Covasna. These operations continued at first, although the Gyula branch was lifted in 1991 and the Manicica line was cut back to the Halom / Benedec area in 1995. Meanwhile the incline survived forest fire damage in 1996 until 1999 when the state logging company (Brafor) was declaed bankrupt.

Preservationists were frustrated by attempts of the former (pre-communist) landowners to regain their estate but the railway system to Comandău was secured as a national monument in 2006 and Covasna County Council is now giving full support to the preservation movement - Sikló Association, embodying the Hungarian name for the inclined plane - which attracts many foreign enthusiasts. The inclined plane is not yet operating but the line to the foot of the incline has been repaired and local enthusiast specials operate at Comandău on special occasions.

The County Council purchased a diesel locomotive from Târgu Mureş in 2008 from to run a services, especially when the forest is too dry for steam to operate safety and further acquisitions have followed to operate both the lower and upper lines, while a Borsig - built steam locomotive of 1909 (which used to work in the standard - gauge sidings at Covasna until 2000) has been secured for overhaul in order to work special steam trains on the Breţcu branch. There are not yet any resident narrow - gauge steam locomotives but some have been loaned in the past to work special trains at Comandău. Eventually this should become an important tourist resource.

One other forest railway restoration has been attempted at Moldovița in Suceava County where an extensive system with origins in 1900 (but still expanding in the 1980s) served a local sawmill until its economic collapse in 1999. RG Holz took over 2003 with the aim of using the railway for both timber transport and tourism but use of lorries for timber transport by the state company Romsilva damaged the track and RGH pulled out in 2004.

There were sporadic operations in 2006 before a new group from Crişcior (Hunedoara County) took over and there is still a hope of restoring the 42 km network (although matters have not been helped by storm damage in 2010 which cut the CFR Vama - Moldovița branch, with trains maintained until that time by the private Iași - based operator Ferotrans. At this juncture it is appropriate to mention the leading role played by a young Austrian Georg Hocevar (b. 1974) who came to Romania in 2000 and set about preserving narrow gauge railways: thereby becoming known as 'salvator de mocăniție'.

By taking over Hunedoara County's Brad - Crişcior line in 2000 (formerly used to carry locally - mined brown coal to the small power station) he and his colleagues established 'Calea Ferata Ingustă' (CFI) in 2002 with capacity at Crişcior to manufacture parts needed to restore locomotives and in addition to working the local (from 2005) motive power - including a historic Austrian (Donawitz) locomotive, a L 45 H - type diesel of 1970s vintage and a Volga 'drezina'- has been supplied for special events on other lines including Abrud, Covasna and Moldovița.

CFI may now succeed in rescuing the Moldovița project, but theu also have an interest in the industrial town of Hunedoara - noted for the monumental Hunedoara Castle which is a major tourist attraction - througt the former industrial railway serving 'Ținutul Pădurenilor'. Started in 1859 and developed up to 1871 to supply the Govăjdie / Retişoara furnace: originally opened in 1806 on the basis of local ore, talc and dolomite from the immediate locality and furher afield at Zlaşti. The furnace closed in 1889, but when a new, larger furnace opened in Hunedoara in 1900 the old railway was revived as a mineral line (working in the opposite direction) through a new connection from the town spanning a narrow valley wih a 747m viaduct (incorporating semihyperbolic girders for central and side spans). The new line (now 13 kms long) in all was used by the metallurgical works until 1998 when the blast furnaces closed (though passenger trains had stopped earlier in 1990) and Tender Grup then used the line for their 'Talc Dolomita' company for just two more years before dismanthing the line for scrap. At this point the preservation interest moved in with the support of the local 'primar' Ovidiu Hada.

The intention is to operate tourist trains over a five kilometre section Hunedoara - Zlaşti - Cătănaşi which includes a 747 m tunnel but repairing a bridge could then extend the line a further kilometer to Tulea where further bridge problems obstruct access to the Govăjdie/Retişoara area.

CONCLUSION

There have been major adjustments since 1989, but there is still a good range of services despite the falling number of passengers (arising through the reduction in commuting between rural areas and the towns, as well as rising car ownership and competition from bus services. Some lines have closed while others have seen a fall in the number of trains operated; yet the decline has so far been modest in comparison with other economies in transition and privatisation of local services is well advanced; not to mention a degree of competition on the main lines.

However train speeds are quite low while much use is being made of refurbished motive power and rolling stockone; while another major consequence is a high level of state subsidy enhanced by heavy losses sustained by the state - owned railway companies, especially durng the recent recession years. There are certainly challenging decisions ahead if Romania is to enjoy a quality rail service, achieving the European standard of main line speeds of 120 - 140 km / h.

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ASSESSMENT OF LAND USE AND CHARACTERISTICS OF RELIEF VALORIZATION MORPHOMETRIC AGRICULTURE NORTH-EAST MONTENEGRO

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Abstract: The paper discusses the utilization of land assessment and evaluation of the morphometric characteristics of relief for agriculture northeast of Montenegro, the example of the municipality of Berane, Plav and Andrijevica. Applying the method of alternate divisors in the system of 6/6, we found the following direction of land utilization PP3 S3 which testifies the balance of agricultural areas and forests and forest land. Summary of morphometric assessment of conditions in relation to agricultural production carried out during the process of indexing. Analysis of the morphometric characteristics of the relief enabled us to extract of hypsometric zones with certain privileges or restrictions for agricultural development. The goal of future agricultural development northeast of Montenegro must be purposeful and rational use of land resources

Key words: Montenegro, land, valorization, hypsometry, slope, exposure, sustainable development.

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INTRODUCTION

Great number of theorists dealt the issue of structural changes in agriculture, especially from the beginning of last century. Dealing with an analysis of status and trends of overall social and economic relations, in the same time they analyzed the processes that existed and were taking place in agriculture. They observed this complex socio-economic relation from several aspects, either directly or in the analysis framework of overall socio-economic trends. Taking into consideration these studies, we based our theoretical setting as starting point in goal defining and studying of the changes made in agriculture of the discussed area. For a successful analysis of state, directions and changes intensity in the structure of agriculture it is necessary to consider the impact of factors that act on it. Among them are certainly the most important assessment of land utilization and evaluation of the morphometric characteristics of relief. The main methodological approach used in this paper makes the geographic (spatial) method and includes the municipalities of northeastern Montenegro Berane, Andrijevica and Plav. Application of the method of alternating splitter in the system 6/6 (Kostrowicki, 1969) was necessary to extract the directions of land utilization. This method of Serbian literature, geography, developed a Jaćimović (1985). The process of evaluation of the morphometric characteristics of the relief we chose a method of

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scoring, which applied Jaschke (1979). Mapping method used, as in the analysis of morphometric characteristics of relief, and for the final presentation of the results obtained with the use of topographic maps of 1:100 000 (Military Geographical Institute, 1986). Throughout the entire work is applied and the method of integrity, which has enabled us to identify, define and evaluate possible benefits and limitations of agricultural development in this part of north-eastern Montenegro, as well as to find a rational and efficient solutions in the development of agriculture.

Analysis of the morphometric characteristics of the relief show that agriculture, northeast of Montenegro does not comply with all available natural conditions. In this regard, we did try, through the analysis of morphometric characteristics and detection of morphometric conditions, to single out three zones that differ mutually according to the convenience level of natural conditions for agricultural development. Accepting such a criterion, the need was imposed to us to point out the concept of sustainable development instead of concluding discussions. Road to ecological reasonable society is our essential need, but also an obligation.

LAND UTILIZATION

One of the most important components of natural resources of the area discussed is its land area. In order to be able to study the agrocomplex of this part of northeastern Montenegro, first we must give a review and directions of the land in general, i.e. relations among agricultural, forest and infertile land. Of the total discussed area (148,599 ha) agricultural land included 67,379 ha or 45.34 %, forests 62,432 ha or 42.01 % and fruitless land 18,788 ha or 12.65 %. The presented data for forest and fruitless land must be taken only tentatively (although these are official statistics and cadastral data), since certain changes occurred in these areas which have not been registered yet in the official statistics.

In order to look more efectively into a land fund of the discussed area, we approached to separation of the utilization directions of total land fund, which has both scientific and practical importance. In getting of land utilization evaluation, we used the procedure that applied Kostrowicki (1979). By application of the method of alternating divisors in the system 6/6, we found the following direction of land utilization PP3 S3 which testifies about the balance of agricultural lands and forests and forest land[1].

So, based on the obtained direction of land utilization of the discussed area, we can predict future process that will be developed in terms of significant changes of forest areas, namely the part of forest areas that is not overgrown can be transformed into agricultural areas through the land-reclamation procedures. Also, in parallel with the process of agricultural areas intensification, it could be expected an improvement of the existing structure of land utilization. Let us point out, in order to ensure forest management in an environmentally sound, socially stable and economically sustainable way, certainly the special attention deserves the introduction of FSC standards. By implementation and development of FSC standards a more responsible approach of forest management is expected from all entities participating in the process, as well as easier access to international markets.

Table 1. Agricultural lands according to categories of utilization in 1964 and 2005
(Data source: Statistical Office of Montenegro, Census of Agriculture (of appropriate year)

YEAR	1964		2005	
Category of land	ha	%	ha	%
Agricultural lands	70.478	100	67.379	100
Arable lands and gardens	8.440	11,98	6.722	9,98
Orchards	1.826	2,59	2.334	3,46
Meadows	19.926	28,27	20.502	30,43
Pastures	40.286	57,16	37.821	56,13

[1] Variables and thier symbols usable in the formula: PP- agricultural land, W- forest and forest land, N-fruitless land)

One of basic conditions for agricultural development is a distribution of certain categories of land use that environmentally can was best seen from the direction of agricultural land utilization. In a structure of agricultural land of the discussed area within the period 1964 - 2005, a way of utilization changed into direction of arable land, gardens and pastures shrinking.

Contrary to that, orchards and meadows areas were increased. Arable lands in the period were reduced from 8 440 ha in the year 1964 to 6 722 ha in the year 2005, i.e. 1718 ha. Orchard areas were increased in the same period from 1826 ha to 2334 ha or 518 ha. Meadow areas were increased from 19,926 ha to 20,502 ha or 2023 ha.

Pasture areas in the period 1964 - 2005 decreased to 576 ha. Bearing in mind the condition of livestock and degradation degree of pastures, it is logical to expect further decline in this category of land. According to data from table 1 - in the agricultural land structure in 2005 arable areas covered 9.98 %, orchards 3.46 %, meadows 30.43 %, pastures 56.13 %. Thus, a large percentage of meadows and pastures in the overall structure of agricultural land indicate the highland character of the discussed area.

To get an adequate picture of the structure of agricultural land in this part of northeastern Montenegro, we also applied here the method of alternating divisors and determined the next course[2].

P4L2 predominantly are grazing direction of agricultural land utilization with a larger share of meadows. Appreciating the fact that the entire area of northeastern part of Montenegro is almost "in hilly or mountainous land, it is understandable that in this territory, during the differentiation directions of agricultural land utilization, we have not found arable directions, which is certainly primarily a reflection of the relief energy, and also a reflection of the extensive character of agricultural land utilization, which is illustrated by the presence of very large meadows and pastures areas“ (Todorović, 1985).

Table 2. Utilization of the agricultural land in 2005
(Data source: Statistical Office of Montenegro, Census of Agriculture (of appropriate year)

Land categories and cultures	ha	%		
		Participation in a group	Arable lands and gardens	Agricultural land
I. Arable lands and gardens	6.722		100	9,97
A. Grains	1.127	100	16,67	1,67
Corn	930	82,52	13,84	1,38
Wheat	153	13,56	2,28	0,22
Rye	17	1,52	0,25	0,02
Barley	27	2,40	0,40	0,04
B. Vegetable crops	2.680	100	39,89	3,97
Potato	2.010	75,00	29,90	2,98
Beans	138	5,15	2,05	0,20
Other vegetables	532	19,85	7,91	0,79
V. Cattle fodder	2.036	100	30,25	3,02
Lucerne	319	15,66	4,75	0,47
Other cattle fodder	1.717	84,34	25,54	2,54
G. Uncultivated land	879	100	13,08	1,30
II. Orchards	2.334	100		3,46
III. Meadows	20.502	100		30,43
IV. Pastures	37.821	100		56,13
TOTAL	67.379			100

How such an utilization of agricultural land is reflected on agriculture, best can be seen in table 2. Namely, the total area under grain is 1127 ha, which represents 16.67 % of the total arable area or 1.67 % of the total agricultural area. For corn is used up 930 ha or 82.52 %, wheat 153 ha

[2] Variables and thier symbols usable in the formula: O - arable land, V - fruit, L - meadows, P - pastures

or 13.56 %, rye 17 ha or 1.52 % and barley 27 ha or 2.40 % of total grain land. Vegetable crops are grown on an area of 2680 ha, representing 39.89 % of the arable land and gardens, or 3.97 % of the total agricultural land. The potatoe is of the utmost importance of vegetable crops. It is sown on the area of 2.010 ha or 75.00 % of the total area under vegetable crops. Other vegetables follow (onions, green beans, cabbage, carrot, cucumber ...) on 532 ha or 19.85 %, and beans on 138 ha or 5.15 % of the total area under vegetable crops. Cattle fodder accounts 30.25 % of the arable lands or 3.02 % of total agricultural land of the discussed area. Under lucerne has been sown 319 ha or 15.66 %, and other cattle fodder (clover, a mixture of grass and legumes, corn for fodder ...) has occupied 1717 ha or 84.34 % of the total area under cattle fodder.

The results of agricultural land utilization in the year 2005 indicate the following:

- First, on the territory of the discussed area, an insufficient attention has been paid to problems of agricultural development, and it appears that this economic activity is still traditionally conceptualized;
- Second, the total sown area is not in the function of agriculture development. By greater appreciation of agriculture as a primary activity, comparative advantages can be realized in this part of northeastern Montenegro;
- Third, the most important and most urgent measure would be farmers directing to transform various type of production into a specific specialized type of production.

Table 3. Sowing structure of arable lands in the years 1964 and 2005
(Data source: Statistical Office of Montenegro, Census of Agriculture (of appropriate year)

YEAR	1964.		2005.	
Category of utilization	ha	%	ha	%
Arable lands and gardens	8.440	100	6.722	100
Grains	6.350	75,24	1.127	16,77
Industrial crops	26	0,31	-	-
Vegetable crops	1.305	15,46	2.680	39,87
Livestock fodder crops	759	8,99	2.036	30,29
Uncultivated arable lands	-	-	879	13,08

Along with the arable areas reducing it comes to the change in a structure of its utilization. In the structure of arable land utilization in the period 1964 - 2005, positive changes into direction of a progressive increase of the areas under vegetable and livestock fodder crops are perceptible. Namely, the sown area under vegetable crops increased from 1305 ha or 15.46 % in 1964 to 2680 ha or 39.87 %, while for livestock fodder crops we record the increase of sown areas from 759 ha or 8.99 % to 2036 ha or 30.29 %.

Negative changes in the structure of utilization are contained in the fact that areas under wheat have been reducing from 6350 ha or 75.24 % in 1964 to 1127 ha or 16.77 % in 2005. In the same period the areas under industrial crops were abolished, while statistics did not record the areas of uncultivated lands in 1964 but found that they were 879 ha in 2005.

Thus, in addition to environmental conditions, demographic trends, inability to use modern machinery, irrigation, tradition etc. influenced formation of the structure of arable land utilization. However, it does not significantly change a final evaluation on arable lands utilization on the discussed area. By the method of alternate divisors, we separated the following direction of arable land utilization. It is[3]:

P03Sk2 Ž1 is direction with a balanced share of vegetable crops, greater participation of livestock fodder crops and participation of grain crops. “Thus derived direction is a typical reflection of poorly developed agriculture, where the all produce everything and where land areas are not used rationally“ (Todorović, 1985).

[3] variables and thier symbols usable in the formula: Ž- grains, I- industrial plants, Po- vegetable crops, Sk- fodder for livestock

ASSESSMENT OF MORPHOMETRIC CONDITIONS RELIEF

The geographical basis of agriculture northeastern of Montenegro, the example of the municipality of Berane, Andrijevica and Plav questions are numerous and complex economic problems. In such a complex situation, the responsibility of geographic science to society are increasing and are expected to be solutions of the current agricultural problems. The agri-geographical analysis is not always easy to distinguish as the missed opportunities with limited participation objectively present conditions (mountain character of the area), and how much they have to rewrite the lack or inadequacy of economic organization and incomplete information. Without going deeper into theoretical considerations, it is necessary at this point, before morphometric analysis of relief of conditions for agricultural development, provide a description of the economic and transportation routes in the northeastern of Montenegro, for example the municipality of Berane, Andrijevica and Plav.

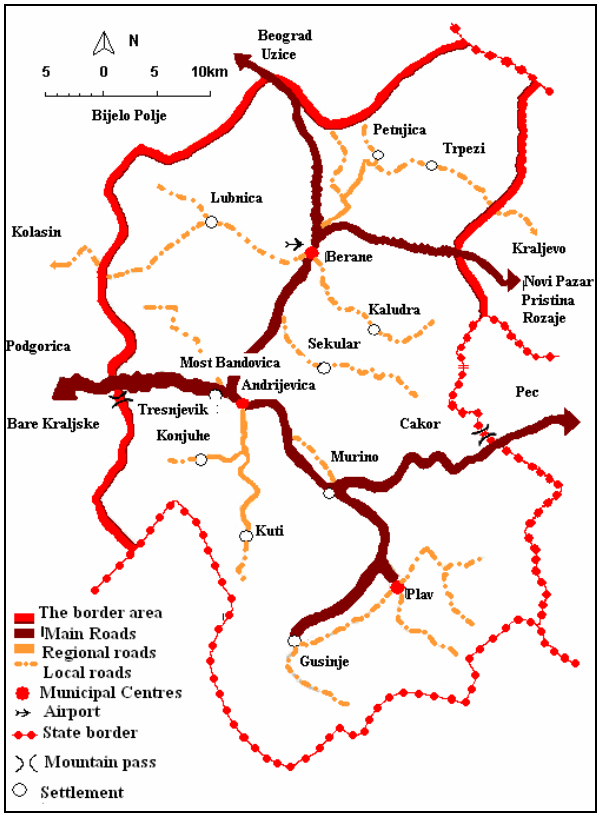

Figure 1. Economic and transportation routes in the northeastern of Montenegro, for example the municipality of Berane, Andrijevica and Plav
(Data source: Rajović, 2010. p.24)

If we look carefully at the map of the considered space in which they depicted the economic and transportation routes (figure 1), we will be clear that in this part of north-eastern Montenegro, lack of territorial untegracije roads, lines of gravity and blood circulation .... that are important for accessibility to major economic markets (Rajović, 2010). The Society's programs of transportation development are not respected morphometric specific conditions of relief, because they could not give satisfactory results. Agricultural pictures northeastern of Montenegro, the example of the municipality of Berane, Andrijevica and Plav will be further monitored through the assessment of exposure conditions morphometric relief for agricultural development.

In the process of morphometric characteristics evaluation we chose a method of scoring. Each characteristic been assessed on the scale of 1 - 5 with descriptive ratings: adverse, bad, good, very good and excellent. In ratings reduction of certain morphometric characteristics to the evaluation of morphometric conditions for agriculture, we used the procedure applied by Jaschke (1976).

Value rating of hypsometric and exposure in relation to agricultural production is associated with the modifying of temperature characteristics. In addition, it is generally valid relation that at a height temperature characteristics deteriorate, while with exposures applies relation that the more quality areas are those which are sunlit for a longer period.

From the aspect of agricultural production, a valueable scale of hypsometric structure could be evaluated as follows:

- to 800 m above sea - excellent (5);
- 800 - 900 m above sea - very good (4);
- 900 - 1000 m above sea - good (3);
- 1000 - 1100 m above sea - bad (2);
- over 1,100 m above sea - adverse (1) (figure 2).

Owing to a vertical development of the relief on the discussed area, hypsometric may have the character of limiting factor for agricultural production. Therefore at its vvaluable assess the key issue is related to determination of the upper threshold of rational agricultural production.

That height threshold is essentially determined by the deterioration of temperature conditions (Rajovic, 2007). Apropos that, these analyses will folow. At this point we can roughly take that the upper threshold of rational agricultural production is approximately about 1100 m.

From the aspect of agricultural production the exposures value scale could be evaluated as follows:

- South exposure - excellent (5);
- Western exposure - very good (4);
- East exposure - good (3);
- Northern Exposure - bad (2).

It is conspicuous that there are no adverse exposures and therefore we can not consider them as the limiting in regard to agricultural production. However, for a valuable assessment of exposures, more exact indicators in the literature could be found. They are primarily related to parallel sunny-shady exposures. J. I. Čirikov's results of experimental observations show that differences in the sums of direct insolation between the parallel exposures are more pronounced if slope is greater. In addition, they are more pronounced during the spring and autumn months, and in the summer they are rather equalized (Čirikov, 1979).

Table 4. Relation of average daily sums of direct insolation on the northern and southern exposures at different slopes in regard to the sum on a horizontal surface (1,2 col/cm^2 pa 50° SGŠ)
(Data source: Čirikov I.J., 1979.)

SLOPE	EXPOSURE	III	IV	V	VI	VII	VIII	IX
10°	North	0,75	0,86	0,91	0,94	0,93	0,9	0,8
	South	1,22	1,11	1,04	1,01	1,02	1,07	1,14
20°	North	0,48	0,7	0,83	0,87	0,85	0,76	0,6
	South	1,38	1,18	1,07	1,02	1,04	1,12	1,28

Differences in the sums of direct radiation between the paralell exposures (north-south) are more pronounced with slope increasing (table 4). At the same slope sides, differences in temperature between the sunny and shady slopes of ground layer's air can reach 6 - 7 °C, and at a depth of 1 cm in the soil even to 7 ºC (Volf & Dimitrovskij, 1981).

Therefore, sunny slopes are heating more quickly, snow on them melts quickly and evaporation is more intensive. For these reasons, spring tillage, sowing and ripping of fruits is earlier on the southern exposures than in the northern ones. Also, for the development of

agricultural crops the western and eastern exposures provide more favorable conditions than the northern exposure does.

From the aspect of agricultural production, slope value scale could be evaluated as follows:

- slope of 1 - 3 ^{o} = excellent (5);
- to 1 ^{o} = very good (4) ;
- 4 -7 ^{o} = good (3);
- 8 -15 ^{o} = bad (2);
- over 16 ^{o} = negative (1) (figure 3).

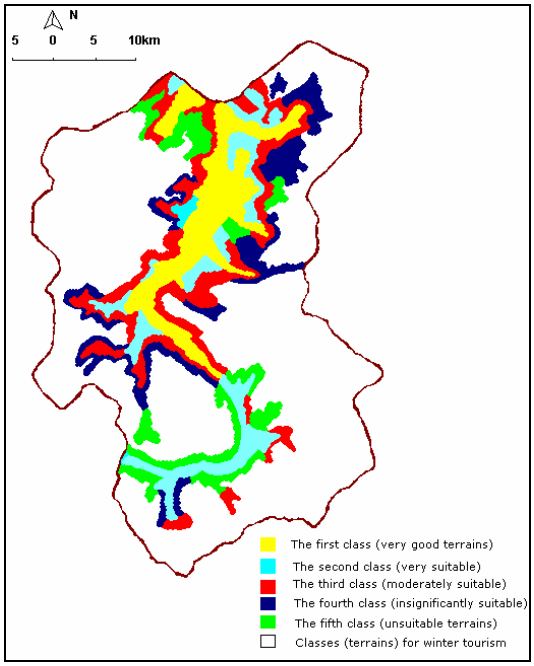

Figure 2. The classes of general suitabilities of morphometric characteristics for agricultural production in northeastern Montenegro, on the example of the municipalities of Berane, Andrijevica and Plav

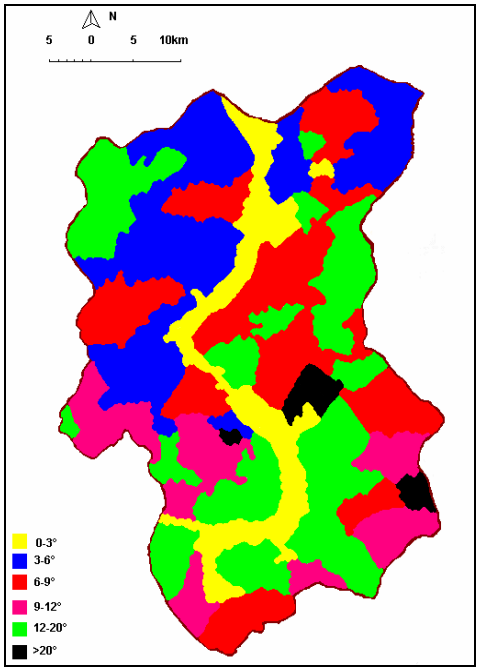

Figure 3. The structure of slopes in northeastern Montenegro, on the example of the municipalities of Berane, Andrijevica and Plav

Slope of topographice area directly affects agricultural production in such a way that with the slopes increase during agricultural works, work effects decrease but expenditure of funds increase. Also, it directly affects the choice of cultures to be grown on a particular slope. Slopes of 0 ° - 3 ° are considered to be most suitable for intensive utilization, in addition that slopes which are evaluated as optimal are those of 1 ° - 2 °, while on the slope to 1 ° a kind of ground waterish ness may occur. On the slopes from 3 ° - 7 ° it is possible to perform all field work and cultivation of all cultures, but because of protection from erosion it requires contour cultivation and planting. On the slopes from 7° - 15° it is necessary to use extensive anti-erosion measures, grass planting or land terracing.

Although it is possible to use mechanization on them, they are marginal for husbandry, i.e. They are more suitable for fruit growing. Slopes over 15° are unsuitable for agricultural utilization. In rational utilization of natural resources, agriculture gives way to forests on these slopes (Mihalić, 1967). However, on the area discussed in recent past, arable lands have been used on the slopes greater than 15°. They have been abandoned recently or converted into meadows, orchards and the like.

Table 5. Indexing and classification of appraisal ratings of: slopes (A), hypsometry (B) and exposures (C) in relation to agricultural production

ABC	ABC	ABC	ABC	ABC	Class of suitability
112	212	312	41-	51-	V
113	213	313			
114	214	314			IV
115	215	315			
122	222	322	42-	52-	
123	223	323			
124	224	324			
125	225	325			
132	232	332	43-	53-	II
133	233	333			
134	234	334	III		
135	235	335			
142	242	342	44-	54-	I
143	243	343			III
144	244	344			
145	245	345			II
152	252	352	45-	55-	I
153	253	353			III
154	254	354			
155	255	355			II

Conclusive evaluation of morphometric characteristics in relation to the agricultural production is carried out by indexing process. Abstracted value classas are shown in table 5. The starting point of conclusive evaluation is the previously determined evaluation of slopes (A), hypsometry (B) and exposure (C). By ratings reduction of mentioned characteristics, a unique ratings index is obtained. In table 5 all possible combinations of ratings reduction are given. Classes of suitability in relation to agricultural production are ranging from I (very suitable terrains), II (very suitable), III (moderately suitable) IV (insignificantly suitable) and V (unsuitable terrains).

ANALYSIS OF MORPHOMETRIC SHARACTERISTICS RELIEF

The morphometric characteristics of relief are important for an evaluation of its practical role, especially when we talk about developed relief like it is in the discussed area. Analysis of the morphometric characteristics was performed using a topographic map 1:100 000 (Military Institute, 1986). Altitudinal ranges were grouped into three hypsometric zones (Rajović, 2005).

Lower hypsometric zone - includes altitudinal range of 645 m above sea (bottom of Berane basin) to 1100 m above sea, which can roughly be taken as the upper threshold of rational agricultural production. Within this zone, we can abstract the spatial units of lower hierarchy rank. It is the sub-region of alluvial rivers' plains, river terraces, lake sediments of Berane, Andrijevica and Polimlje valley which has the best natural conditions for agricultural development. Since that this sub-region is dominated by excellent hypsometric, slopes of 3° and non-exposed areas, this spatial unit has the best morphometric conditions for intensive agricultural production. Also, the alluvial plains of rivers are connected to the fluvial soils which are, from the production aspect, the most important for possible cultivation of most crops. On the river terraces there are dominant soil types of different production values.

They appear as loams, meadow chernozems, pseudogley and amphigley. The sub-region which includes the valley of Plav and Gusinje is characterized by slopes of 0 ° - 3 °, non-exposed exposures, altitudinal range to 948 m above sea.

Because of the altitudinal range, this sub-region has the II class of convenience for development of agriculture. The dominant soil type is fluvisol, in places present - district camisole, euritic camisole, podsol, planosol. Different varieties of meadow chernozems allow fruit and vegetable production.

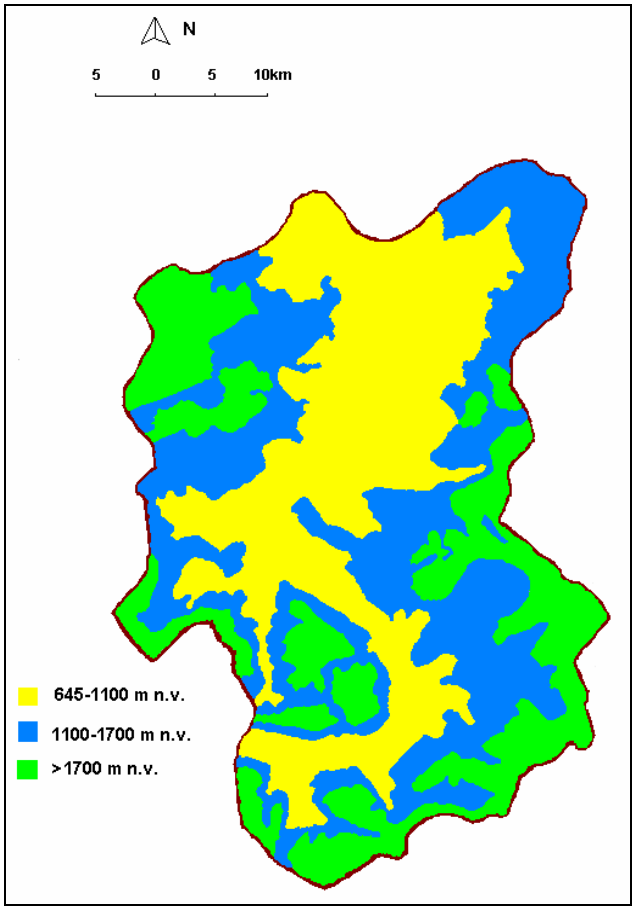

Figure 4. Altitudinal zones of northeast Montenegro, on the example of the municipalities of Berane, Andrijevica and Plav

The sub-region which includes areas of low-mountain relief and low areas of average-mountainous relief to 1100 m above sea has the third class of suitability for development of agricultural production (due to the altitudinal range, negative northern exposures and soils with moderate and steep slope (6 ° - 9 °)). Greater depth of pedeologic cover (luvisol, loam, euritic cambisol, district cambisol, as well as presence of rendzina) makes this special entity relatively suitable for agricultural production. The soil is suitable for the production of various agricultural plants, orchards, while 1000 m above sea is mostly forest land (fir-beech forests, oak forests and forests of black and white pine), pastures and meadows.

Middle hypsometric zone - includes altitudinal range of 1100 m to 1700 m above sea. From the standpoint of agriculture development, this zone we can define as moderately suitable. It is characterized by sharp forms of relief with a slope of 12 ° to 20 °. This zone has a thinned pedeologic cover, with the dominant soil: rendzina, podsol, calkocambisol, calkomenasol, rankers and in places - district cambisol, which indicates that this spatial entity is mainly under grass and forest vegetation (forests of pine, spruce, beech, oak, fir).

This zone is suitable for livestock development. Higher hypsometric zone - includes high mountain range more than 1700 m above sea. This zone is unsuitable for development of agriculture as the relief conditions are deteriorated. In slopes structure, the slopes over 18° and over 20° are

dominating. This spatial entity is under forest vegetation and mountain pastures with blueberry and juniper. It is particularly suitable for touristy valorization.

INSTEAD OF CONCLUSION

"To learn from nature, but not attempt to master the nature or manipulate it" (Fritjof, 2002). In view of C. Fritjof's statement, we want to stress that sustainable development of agriculture in this paper is not its own purpose, but it is in a whole and organically linked to the theme content, subordinated functionally to the proclaimed goal.

Therefore, sustainable development of agriculture in this part of northeastern Montenegro basically can be viewed through the four basic parameters which necessarily and appropriately may be combined:

- resources that are renewable on the discussed area may be used as much as their regeneration rate allows;
- from material and functional viewpoint, sources of raw materials which are threatened by destruction in this part of northeastern Montenegro, may be only used in agriculture if it is possible to replace them with raw materials that are renewable and if their use guarantees a higher productivity;
- environmental pollution should not exceed the level and capacities of degradability of harmful substances which can offer major environmental media - water, air and land;
- there must be time equivalence between the time of complementary feeding and damage of the land from one side, and natural weather processes of land renewal on the other (Meyer, 2002).

Such imperative of the sustainable development of agriculture has a strong environmental dimension. However, the economic component requires special attention because for the sustainable development it is very important the connection and regulation of economic interests. Economic profit, which today is achieved in a very short period, but at the expense of the environment, cannot be tolerated on the further road of sustainable agricultural development of the discussed area.

Thus we confirm clearly formulated opinion of Vasovic and Biočanin (2007): "The current generations need to plan and create an appropriate quality of the environment for themselves, but this right also must retain future generations. In accordance with the concept of sustainable development, a work culture based on humane principles of ecological-ecumenical and social efficiency is expected. Road to ecological reasonable society is our essential need, but also an obligation".

Of course, no matter how much land potentials of this part of northeastern Montenegro are big; they are not unlimited and inexhaustible. Therefore, their utilization must be planned and rational. It is therefore necessary to determine the agricultural resource potential of the discussed area, to determine the ability of its reproduction and the possibility of productivity increasing of certain land resources, which is a precondition for the rational utilization of environment and its protection.

If we apply above mentioned parameters to the agricultural policy of this part of northeastern Montenegro, we will come to the conclusion that a sustainable agricultural policy must be shaped to enable agriculture:

- being marked in the economic sense by entrepreneurial trade, i.e. not to depend on subsidies, and therefore being competitive. The employed in agriculture do not realize their incomes only by production of healthy food, by its further processing and placing on the market, but also by including other options for profit in their work such as the tourism sector, domestic work, providing into the existing residence the newly created agricultural capacities of „eco"dimension with the manufacturing orientation principles of „organic food". In addition, there are opportunities of part-time earnings by the EU regions which support the protection of nature and environment.
- when it comes to the environmental dimension, natural soil resources should be used so as to prevent long-term negative impact on them. This actually means to use fertilizers, pesticides and herbicides in the minimum extent so as not to pollute surrounding land regions. With such attitude agricultural land is supposed to be preserved as well as nature and genetic potential of plant and animal species (Meyer, 2002).

In what way set in motion, develop and transform into reality the idea in any of the previous findings of sustainable agricultural policy, or much better - a combination thereof, to thereby achieve all effects of the sustainable development, and how in a proper way use the agricultural land of the discussed area? Concretely in this part of northeastern Montenegro, the developmental components of sustainable agricultural development are reflected through:

- favorable climatic conditions which conduce to growing vegetables, fruit and other intensive crops and relatively price-competitive livestock production;
- environmental production factors preservation (land, water and air) from pollution which significantly allows to the discussed area to promote modern organic farming;
- extensive unused arable land and areas where is possible a significant increase of production per area unit, without compromising other resources;
- availability of local market and significant high touristy demand contribute that numerous and specific products (milk, meat, potatoes) have potentially good customer demand in the market (Gulan, 2006).

Therefore, in the period ahead it is necessary to devote special attention to the preservation of agricultural land and increase its fertility in this part of northeast Montenegro. The rational resources land utilization of the area must be in focus of economic policy.

That is, each pitch and each hectare of arable land must have its place in the economic and physical plan. A stable and highly efficient agricultural production involves the use of scientifically based methods in the exploitation process of land and its protection. Only on the basis of accurate inventory of existing land resources and rational territorial organization of agro-industrial complex, it is possible to provide a safe and quality food for residents and create an agricultural surplus.

Today we certainly have the knowledge and means that are able to make land more fruitful than it was created by nature (Rakićević, 1989). The key to the successful solving of sustainable agricultural development is always in the economic measures that support its production.

Today, the current economic model of “free market” based on the assumption that the market will solve that automatically, without intervention of the state, i.e. by itself, through the law of supply and demand. However, “sustainable development achieving ... can not be left to the market - a role of the state is inevitable” (Comon, 2005).

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BEFITTING AND DISRUPTIVE PRACTICES OF WATER-BASED TOURISM IN THE CRIŞURI MOUNTAINS

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Abstract: The Crişuri Mountains is an area of similar geographic features, nonetheless different in terms of water-based tourist consumption and production. The analysis is focused on water-based experiences in the Crişuri Mountains and their outskirts, because as it is highlighted most water-based activities are located on the rivers bordering the mountains. Along the study, the activities which can be practiced on the rivers and lakes in the area submitted for research are presented from both the perspective of the stakeholders producing and the tourists consuming this product. Further on the lakes from the Crişuri Mts. are illustrated as elementary lacustrine areas due to their basic flow of tourists and infrastructure. A focus is given to the nautical activities on the Leşu Lake which stands out as a lacustrine area which has developed along the way in uncontrolled manner, and whose unsustainable effects for the present tourists are fully sensed.

Key words: The Crişuri Mountains, water-based activities, sustainability, Leşu Lake, elementary lacustrine area

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MERGING WATER AND TOURISM

The water-based activities in the Crişuri Mountains provide a short incursion related to the possibilities rendered by the resource of rivers and lakes from the western periphery of the Apuseni Mountains, i.e. Crişuri Mountains from Romania.

The term water-based tourism has been coined by Jennings (2007, 2) and refers to the diversity in "water resources which include salt, estuarine, fresh and frozen water in their various formations" merged with tourism, sport, recreation and leisure. As the author further on states, water has a mentally healing effect on its proponents counterbalancing hard work and stress in the city and pollution from urban areas. As recreation is seen by some authors as revitalizing the spirit (Douglass, 1982), in the same perspective we can assert that water-based tourism calls for another adage from our Latin forerunners which says *mens sana in corpore sano*. The participants to water-based activities have both the possibility to train their body in participating at various activities such as sailing, rafting, kayaking, snorkelling and breathe in fresh air and therefore keep both the mind and the body in a healthy condition. Enoiu (2008) highlights the importance of ecologic tourism with implications in the field of sports and advocates the outdoor education at all levels, from kindergarten to high education institutions.

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The rivers can be an important source in the process of leisure through the sport activities which can unfold in this environment thus becoming a geographic factor with a tourist vocation. There are sportsmen or people eager to challenge their limits through the practice of rafting, kayaking or canyon-ing.

Lake tourism is another term referred to by authors such Hall and Harkonnen (2006) being represented by the lakes' potential, both natural and artificial. The lake areas, associated to some relaxing and leisure milieus, with an ecological aura above them have attracted tourists since ancient times, ever since Antiquity to the contemporary period. Places of solitary meditation, lakes often stand out as important tourist destinations according to their geographical location (Leman Lake, etc). Lakes with a tourist vocation can act in two hypostases (Lozato-Giotard, 2003): the lacustrine riviera (or the alpine model) and the elementary model. The former is associated to natural lakes and a lacustrine tourism with a long tradition benefiting of an international tourist flow as in the case of Lake Leman, Lake Balaton, Lake Lugano whereas the latter hypostasis is associated to both natural and artificial lakes; this type being related to reduced activities and a low tourist participation. In our study we have tried to highlight the hypostasis which fits the lakes from the Munții Crișurilor Mountains.

THE CRIȘURILOR MOUNTAINS – A STARTING PREMISE FOR CONSUMPTION AND PRODUCTION

The Crișurilor Mountains (figure 1) refer to 2 similar mountain units from western Romania, the Pădurea Craiului Mountains in the north and the Munții Codru Moma Mountains in the south, separated by a golf-like depression.

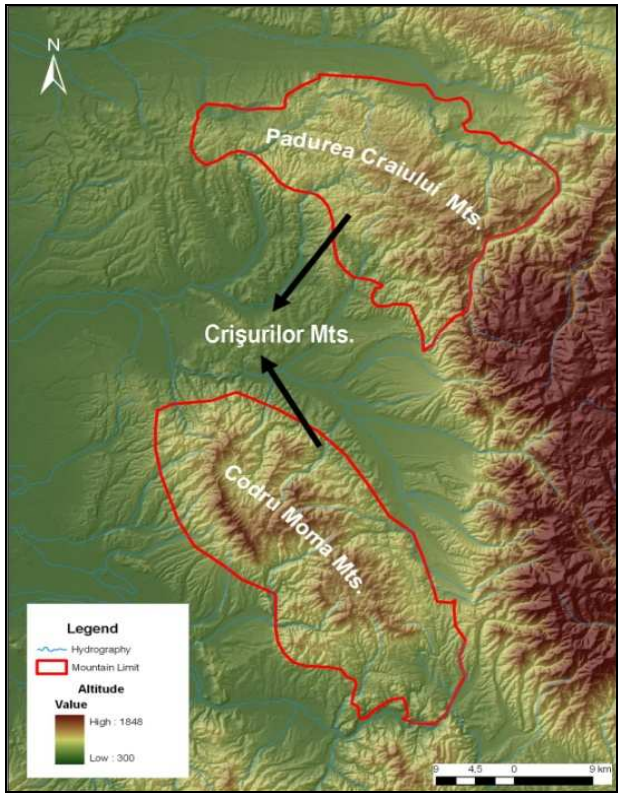

Figure 1. Location of the Munții Crișurilor Mountains, split into their two subdivisions (viz. Piatra Craiului Mts. and Codru Moma Mts.)
(Source: own elaboration based on the data basis RomaniaUTMWGS84 and Geografia României)

Both have a peninsular shape and the average altitude is of 700 - 800 m (Oancea et al, 1987). These mountain units are situated in the western part of Romania, part of the wider range of the Apuseni Mountains. They are framed by three important rivers, in the north the Crişul Repede River; the golf-like depression between the two mountain units is drained by the Crişul Negru River and north of the Codru Moma Mountains flows the Crişul Alb River. These are three important rivers which drain the western plain of Romania. Among the 3 rivers Crişul Repede River is the longest and springs at an altitude of 710 m above the sea level (Kohl, 1997).

The two mountainous units are important for water-based tourism as they are close to two major urban centres from the western part of Romania, which function as important generating sources in terms of tourists, viz. Oradea in the west[1] and Cluj[2], east of the Pădurea Craiului Mountains.

CONTEMPORARY AND REMOTE WATER-BASED EXPERIENCES IN THE CRIŞURILOR MOUNTAINS

Extreme sports witness their inception stage in the Crişurilor Mountains as specialized stakeholders for water-based tourism have been set up after 2007, most of them providing rafting and kayaking experiences on the rapids and soft waters of the Crişul Repede River and Crişul Pietros River under the form of whitewater descents or kayak contests both for experts and novices. Most of the water sport operators providing such a supply promote their product on the Internet, some of them aiming specifically to promote the local and regional attractions.

For the analysis of water-based tourism we have taken into consideration the water attractions inside the limits of the Crişurilor Mountains as well as the nearby water attractions and resources situated north of the Pădurea Craiului Mountains, namely the Crişul Repede River and the nearby artificial lakes. This is motivated by the fact that most of the water-based tourism actually takes place on the river due to its dramatic scenery, rugged riverbeds and gorges. The name of the river, translated in English, The Fast River provides some hints about the nature of this river thus accounting for the more daring water-based activities taking place there.

The testing of extreme sport skills is possible in the Crişuri Mountains along the Crişul Repede gorge, pigmented by a succession of gorges, sawed in limestone rocks, the most spectacular for this type of tourism being the sector between Şuncuiuş and Vadu Crişului. The latter is well described by Sarkany-Kiss et al. (1997,7): "The river arrives in a limestone strait; the river is 25 -30 m wide. The river speed is high, 1,5 m/sec. Along the steeper right bank the water is deeper than 2 m. The riverbed is composed of boulders and native rock, rounding big boulders can be found only along the left bank."

Furthermore Iada Valley, which meanwhile constitutes the limit between the Pădurea Craiului Mountains and Vlădeasa Peak, is also prone to kayaking, rafting and canyoning.

In the northern-situated mountainous unit, i.e. Pădurea Craiului Mountains, there has been installed a holiday village known as *Coada Lacului* (the Lake's Tail), denomination given by the shape of the artificial Leşu Lake (figure 2), situated on the Iada Valley, a lake which spreads on 148 hectares[3]. These attributes make it prone to sailing and motor boating, jet skiing, nautical skiing, boat paddling, fishing, swimming, etc. around which it was planned an infrastructure for leisure. In its case too, the geographical factors play a major role in the development of lacustrine tourism through the spread surface of water, the natural milieu, the climatic conditions and the morphology of shorelines.

[1] The city's population counted 206.614 inhabitants at the last census of 2002 and it is a 1st rank municipality, i.e. of national importance and with potential influence at European level (http://recensamant.referinte.transindex.ro/?pg=3&id=338 and http://ro.wikipedia.org/wiki/Municipiile_Rom%C3%A2niei)

[2] The city's population counted 317 953 inhabitants at the last census of 2002 and it is a 1st rank municipality, i.e. of national importance and with potential influence at European level (http://recensamant.referinte.transindex.ro/?pg=3&id=819 and http://ro.wikipedia.org/wiki/Municipiile_Rom%C3%A2niei)

[3] The water volume, accomplished through the building of a dyke (dam) is of 28,3 million cubic meter. For more information see: http://ro.wikipedia.org/wiki/Barajul_Le%C8%99u.

Figure 2. Bird's eye view from the Leşu Lake
(Source: www.welcometoromania.ro, Foto: Ham Peter)

The water-based activities on this lake are defined by slow-paced and fast-paced watercraft like ski-jets, motorboats, fishing, sailing, kayaking, etc which all take place at their own will. The watercraft equipment is provided either by guest houses owners or brought by tourists. In our opinion, the uncontrolled practice of water sports calls for the need to found a Watercraft Hobbyists' Club or Association, either state or private-owned, where all the water-based activity be regulated through specific sets of rules, as at present due to the lack of implication of the authorities there is a complete chaos, people swim in the lake, fish, go sailing, use ski jets, canoes, etc. The disturbance can have unrecoverable effects and some rules in this scope are a must, issues debated in the subsequent chapters.

In the Codru Moma Mountains, less nautical activities (boat paddling and hydro-bicycle rides) have occurred on the small artificial lake inside the Moneasa spa, being prone more to curative tourism due to the mineral and thermal waters existing there and appreciated since ancient times.

The spa boasts a long tourist tradition, when in 1835 reference was done to the good effects of the thermo-mineral waters from the Moneasa Spa. Its water attractions consists of springs with oligo-mineral and mid-thermal water (30 - 32 ^{o}C) (Măhăra, 1979) which are recommended for locomotion disabilities, peripheral nervous system and diseases of the digestive tract. The spa also boasts a small inland/in-built lacustrine area on whose water people can paddle boats and hydro-bicycles.

In the Codru Moma Mountains the lack of an abundance of natural and artificial lakes, namely of the water-based tourism atone for an enhanced thermalism, stored and valorised for cure aims in Moneasa Spa.

RIVERS AND LAKES, PLACES OF PRODUCTION AND CONSUMPTION

The lakes situated along the Crişul Repede River are mostly artificial lakes mainly used for the fuelling of hydropower. Lake Tileagd provides facilities for fishing from boats. It stretches over 6 km and is 1 km wide. Given its large array of fishes (carp, trout, pike, crucian, huck, perch) it is a paradise for anglers. Some other waterbased present activities which occur on the lake refer to windsurfing with sportsmen from Oradea, Cluj-Napoca and Debrecen (from oral interviews and personal observation). Fishing occurs under surveillance and a fishing licence is required for access (Bobeanu, 2010). Lugas Lake boasts the same attributes, except for the fact that it stretches on a 5-km length, at whose tail a delta with channels and islets has been formed (Salaci, 2010). The only water-based activities taking place are bound to fishing. Lakes Bulz, Munteni and Vida are also artificial lakes, where leisure activities unfold; the latter is situated at a 300 meter altitude and stretches over 8 ha.

Since these lakes were initially used exclusively for economic reasons, very scarce information can be found in the literature about their recent leisure water-based activities.

The river and lacustrine attractions along with their inherent activities are dotted on the map in the study area, i.e. the Crişuri Mountains as well as the attractions in their proximity (figure 3). As tourism has the reputation of being an experiential industry (Cooper and Hall, 2008), in the case of our study area as well as in its proximity, both novices and experts can live fully the experiences of extreme sport (kayaking, whitewater rafting) and less extreme as fishing, sail boating and swimming.

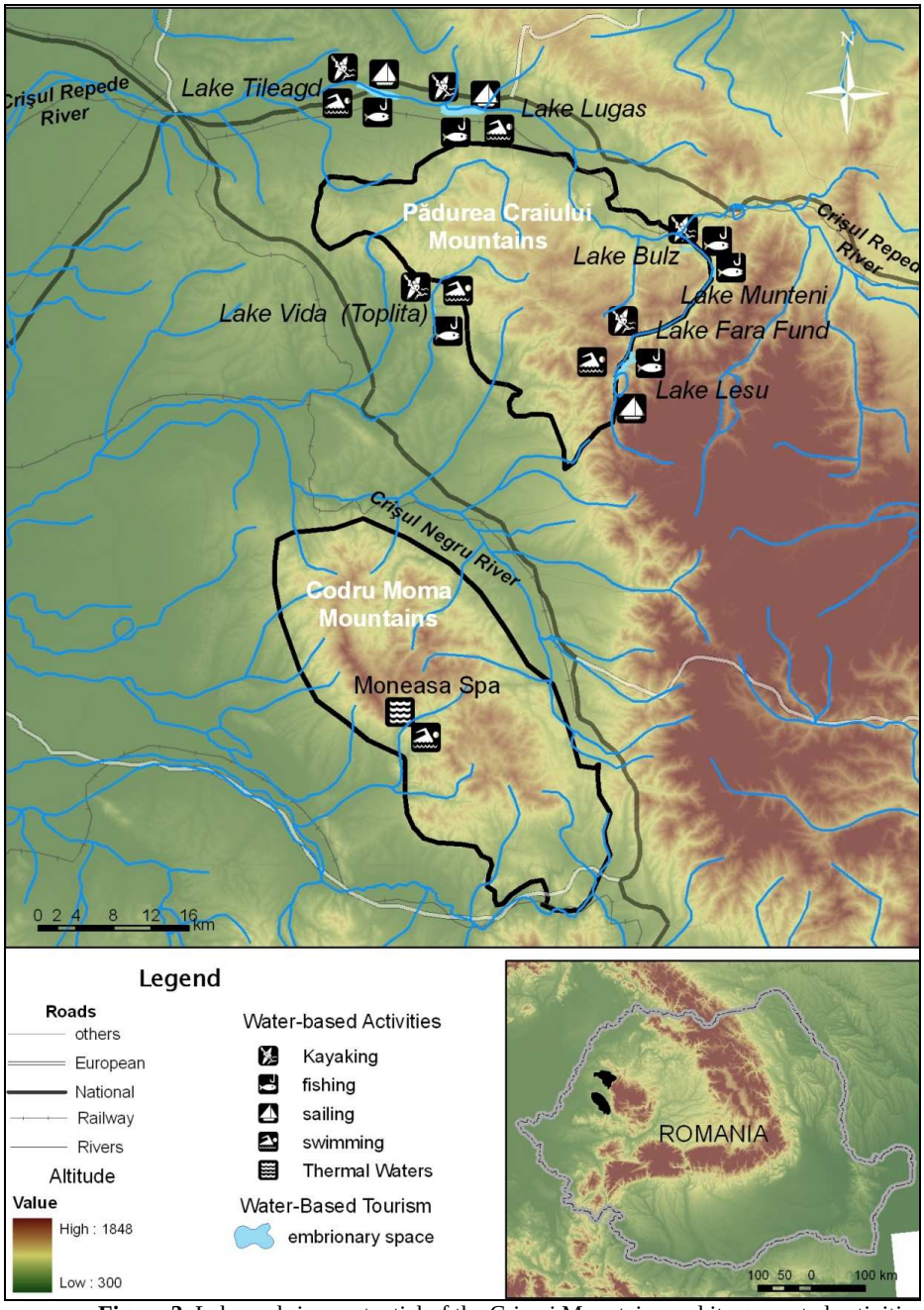

Figure 3. Lake and river potential of the Crişuri Mountains and its generated activities
(Source: own elaboration based on the data basis RomaniaUTMWGS84)

For the ones eager to feel the rush of adrenaline in their veins, kayaking and rafting would be an option, practicable on the rush waters (rapids) and straits of the Crişul Repede River and its tributary, viz. Valea Iadei, under the form of wilderness whitewater descents. Canoes have evolved from economic and transportation devices to objects being used for recreation, sport and tourism (Hudson and Beedie, 2007). Kayaking has an Inuit origin, the canoes representing "an enclosed boat paddled from a sitting position with a double-bladed paddle" (Hudson and Beedie, 2007, 171). According to the same authors, there are more trends in kayaking referring to an exploratory or journeying dimension across a range of water environments, a second one refers to the kayak's design and manufacture, a third one refers to the evolution of rules, regulations and structures which have established kayaking as sport, recreation and tourism and a last trend relates to paddling environments (usually on artificial water courses).

In the case of the Crişuri Mountains we can refer to the first trend being applied as it takes the shape of an exploratory and journeying dimension, i.e. whitewater descents on the dramatic rapids of the Crişul Repede River and the Crişul Pietros River; canoe contests on its soft waters; all activities taking place on natural water courses.

After a short Internet survey we have come across more stakeholders focused directly or tangentially on water-based tourism in the Crişuri Mountains, i.e. Protreking, Outdoor4U, XTours, Extreme Zone Adventure as well as more travel agencies dealing with the same issue. Most of these specialized firms were set up quite recently, namely after 2000 (*Outdoor4U* set up in 2003 but only in 2008 actually organize water-based activities, *Extreme Zone Adventure* in 2007, *Protreking* in 2007) which indicates the fact that water-based tourism is extremely recent in the study area, we could even assert witnessing its debut in the business. A few stakeholders were listed below, as players directly involved and providing water-based experiences to outdoor tourists in the area submitted for analysis.

X-Tours[4] organizes one day rafting trip on the Crişul Repede River for beginners on its less rugged course and for experts on the Crişul Pietros River (route Beiuş-Pietroasa), a river whose rating scale ranges between II to IV, namely from medium to very difficult (viz. "long rapids, powerful and irregular waves, rocks, eddies, rapids with clear passage through narrows, requiring expertise in manoeuvring" – Jonas, 2007, 156).

The firm Outdoor4U[5] organizes specialised camps for youths who enjoy nature and outdoor activities with all the specialized personnel, equipment and regulations. As far as water-based tourism in the Crişuri Mountains is concerned they organize rafting activities on the course of the Crişul Repede river between Bucea-Vadu Crişului on a 27 km stretch, the rapids rating scale is of 2/3 and on the Crişul Pietros River (the sector Între Ape-Pietroasa) on a-8 km stretch, the rapids' rating scale is of 4/4. Jonas (2007, 156) has illustrated such a list of rapids rating. In the case of the study area, the rapid rating scale 2/3 refers to "an easy course, with small waves, clear passage and no serious obstacles" whereas the 4/4 rating scale refers to "a medium course with rapids of moderate difficulty".

Another firm interested to promote regional and local tourism organizes kayaking activities on the Crişul Repede River (one course on the Crişul Repede Gorge; one course from Şuncuiuş-Vadu Crişului; Bratca-Vadu Crişului; Bulz-Vadu Crişului) and on the Crişul Pietros River (from Boga to Pietroasa) is Extreme Zone Adventure. Rafting also occurs on the Crişul Repede River on its most spectacular sectors on approximately 30 km[6].

The firm Protreking also provides rafting on the Crişul Repede River between the localities Bulz-Vadu Crisului on a length of 20 km and difficulty level 1-2+ (easy, small waves, clear passage, no serious obstacles) with a start point from Stâna de Vale or canoe contest on the Crişul Repede River. The tourists are organized accompanied by guides and monitors; in terms of

[4] More information can be found on the website: http://rafting.x-tours.ro/rafting-de-o-zi-pe-crisul-repede**;** http://rafting.x-tours.ro/rafting-pe-crisul-pietros

[5] More information can be found on the website: http://www.taberecopii.ro/programe.php

[6] More information can be found on the website: http://www.isic-romania.ro/sport-extreme-zone-adventure

infrastructure it is used the rafting canoes (trekk) for 2+3 persons or rafting boats for 6 persons. Furthermore in the same study area more difficult tours are organized upstream from Pietroasa village, from the confluence of the Galbena River with Crişul Pietros River[7].

As it can be noticed the trips and tours listed above provide water-based activities on the same rivers, i.e. Crişul Repede and Crişul Pietros, an understood thing as it is fragmented by spectacular scenery and rugged riverbeds, but in our opinion this water-based supply could also be extended to another less explored river from this area, viz. Crişul Negru River. In the village Borz along the aforementioned river, it narrows into a strait with spectacular scenery. The water-based tourism could be also combined with some halts to heritage sites, such as the watermills located along the riverbank.

Another popular water-based activity is sailing, which took the shape of a recreational experience first in 1720 when the first sailing club was set up in Cork (Jennings, 2007).

Motorboat and sailing is a water-based activity which mostly takes place on the artificial Lake Leşu. This activity occurs in an unplanned manner mainly due to the local authorities' lack of implication. The appropriate premises should be created for all participants at water-based activities so that the attraction does not become a destruction target but an attraction one for the future generations too. This lake is a reward for the tourists who seek freedom, challenge and adventure, mere delight and fulfilment (Jennings, 2007) when sailing on his/her yacht, or for the sensation seekers and ecotourists paddling their canoes on the lake, for the anglers fishing for sport motivated by the need for esteem and ego enhancement (Killion, 2007) or for the anglers fishing for mere sustenance and food as well as for the swimmer's desire to relax by training his/her body and breathe fresh air in a healthy environment. Some regulated activity refers to fishing on the Tileagd and Lugaş artificial lakes; such a scarce output of water-based experiences probably also resides in the fact that it can be reached only by boat.

A binder between all participants at water-based tourism emerges as compulsory, probably under the form of a profile private or public club or association. A connector between the private entrepreneurs unfolding their activity in tourism and the public sector is needed to grant some authorisations for the practice of nautical activities on the lakes.

ELEMENTARY/EMBRYO/DISCONTINUOUS LACUSTRINE TOURISM IN THE CRIŞURI MOUNTAINS

Lozato-Giotard (2003, 123) refers to the small artificial lakes as corresponding to the leisure lacustrine elementary or embryo model. These lakes are often created by the need of energy resources, also sought by water-based tourists. The water surface represents the main attraction pole for the bordering communes. Its attributes relate to 'an artificial water surface, bordering communes, transitory tourist flow (foreigners), national tourist flow, leisure flow of proximity, water sports, camping, secondary residences, green tourism.

Applied to the study area, i.e. the Crişuri Mountains, we can refer to an elementary embryo lacustrine tourism as most are artificial lakes - Tileagd, Lugaş, Bulz, Munteni,Vida and natural karst lakes, i.e. Tăul Bătrân and Tăul Nieşului with tourists coming from bordering localities and a low infrastructure for leisure. Most activities practiced here relate to fishing, boat paddling and swimming.

Despite the absence of a properly tourist planned infrastructure, the artificial lakes dotted along the Crişul Repede river can be seen from the angle of polyvalent areas, where even the lack of a tourist planning can atone for many possibilities to recreate (boat paddling, fishing, swimming, kayaking) into the open air if there are proper regulations in force. In our opinion, the more basic the planning of a lake the more attractive for ecotourists, thus keeping in line with the sustainability laws. As the lakes in the study area are owned by the state, the local authorities should also involve by enforcing a minimum of regulations (markings, sign posts, corridors for different sport and leisure activities on the lakes and nearby, fees for access, etc).

[7] More information can be found on the website: http://www.outdoorexperience.ro/Crisul-repede.html**;** http://www.outdoorexperience.ro/Rafting-Crisul-Pietros-cel-mai-tehnic-rau-din-Apuseni.html

The lacustrine area Leşu Lake stands out from the picture as the area already displays a tourist infrastructure given by the present accommodation units (mostly guest houses, chalets and camping sites), the entertainment possibilities and the water-based activities. All this infrastructure has been built over a period of 10 years, when the only settlement resided of a peasant's residence, forestry canton and shepherds' sheds[8]. The nice mountainous setting (700 m altitude), road access, booming accommodation infrastructure, present water-based activities (yet unplanned and uncontrolled) prompt us to classify this lake as an intermediary case between the embryo model and the lacustrine riviera. The reduced water-based activities practicable on the small artificial lake inside Moneasa Spa from the Codru Moma Mountains as well as the lake's reduced dimension confers it the status of an embryo lacustrine area.

SUSTAINABILITY

Romania has established a strategy for the development of tourism 2007-2026, elaborated by the World Tourism Organisation along with their counterparts in the name of the Romanian Government, where both the strengths and the shortcomings of this sector are laid out as well as future directions (Master Planul pentru Dezvoltarea Turismului Național 2007 - 2026).

Some of the shortcomings debated referred to a lack of collaboration between the public and the private sectors, an observation which also holds true for the study area submitted for analysis. The unplanned and even unauthorized water-based activities (practice of jet-skiing, powered boating, water bikes and non-motorized like fishing, kayaking, boat paddling) which take place on the 148 hectares' lake, viz. Leşu Lake notoriously call for an intervention and authorisation from the public authorities aiming to regulate this shortcoming. Since it is a state-owned lake, the public authorities need to enforce laws both for individual tourists and the the private stakeholders who develop nautical-oriented business on the lakes in the study area as well as to find paths for collaboration with the latter. Furthermore the economic impact is reduced for the local community and water sports operators as most tourists use their personal watercraft. If a large array of watercraft would be available on site, along with specific and unitary rules for its usage, water-based activities could unfold properly along with enhanced revenues for the locals. The lack of rules for speed limit of motorized watercraft, fishing licence, noise, water pollution have a destructive environmental impact.

As highlighted by Richins (2007) the usage of motorized water craft has a direct physical stress on aquatic organisms. The jet-generated turbulence has indicated that fish eggs and larvae are highly affected. Szito and Mozes (1997) draw attention on the pollution indicators of the Crişul Repede River through the presence of Oligochaeta and Chironomid fauna. The former specimen's increasing density showed organic water pollution.

Noise is another disturbing factor, as it can affect the waterfowl and other bird life which in its turn has a negative impact on feeding, nesting and breeding. This would be to the detriment of a striking richness of the avifauna along the Crişul Repede River as it counts approximately 180 species, among which on the upper reach some alpine species *Nucifraga caryocatactes, Cinculus cinculus, Parus ater, Cerhia familiaris,* etc. In the Vadu Crişului ravine, native species can also be encountered, viz. *Tringa hypoleucos and Bubo bubo* (Kohl, 1997).

The increased turbidity of water can reduce the diversity and extent of water-bottom vegetation. Vegetation is most affected in the case of swamps and ponds, places where most aquatic phytocenosis takes place, ''the aquatic plants preferring mainly the still or very slowly flowing waters ''(Drăgulescu and Makalik, 1997, 75). Hence increased attention should be attributed to the lakes and swamps such as Lake Leşu, Lake Munteni, Lake Bulz, Lake Tileagd and Lake Lugaş in terms of the vegetation protection due to the fact that more species are on the verge of extinction. Drăgulescu and Makalik (1997) conducted researches along Crişul Repede River showing that many species are endangered, i.e. 40 paludal species.

[8] For more information on this issue, see http://www.turismland.ro/satul-de-vacanta-coada-lacului-lesu

The boat engine emissions and spills are also detrimental, although in low quantities, it can affect biodiversity on the long run. Another drawback is the erosion of shorelines and vegetation. Richins (2007) provides examples of how to counterbalance the destructive practices of water sports, so that all the participants (tourists, water sports operators, local authorities, residents, fishing participants) involved in this activity be satisfied[9]. Other examples of how to tackle the issues of sustainable tourism planning in marine environments are also provided by Marafa (2008) as well as examples of unsustainable tourism in the same environments referring to the fragility of marine ecosystems are provided by Dehoorne et Saffache (2008). In the same regard, Ioannides (1995) points out that tourists are not the only players to blame in this process of resource depletion as are the authorities which allow it by their indifference translated through the lack of plans and policies. Such is also the case of the Leşu Lake formerly debated and associated with disruptive water-based tourism. In its case we would propose a basic water planning with immediate results. A first step would be for the local authorities to decide whether to advocate or prohibit the motorized watercraft. In the case of their advocation we would propose one corridor for fast- and low-paced watercraft away from the shoreline, so that the noise pollution be as limited as possible, with specific markings for speed limit. Furthermore we would propose another corridor nearby for kayakers. A recreational area would come as proper for the genuine ecotourists, viz. the participants at swimming and fishing and another last circled area for sailing. We deem that these minimal interventions would decrease the present-state disorganisation of water-based tourism on the lake (i.e. Leşu Lake) contributing to its maintenance on the long term and thus turn it into a befitting example of water-based tourism for the other lakes in the area (Tileagd, Lugaş, Munteni, Vida) where water sports are no so intrusive and pervasive yet. Kayaking and rafting which mostly occurs on the Crişul Repede Valley and Crişul Pietros River prove to be befitting practices as they usually take place into less populated areas therefore not impeding either the local population or ecosystem as they are non-motorized.

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[9] The case study refers to the Folkstone Marine Park and Reserve in Barbados, where in order to avoid conflict between the players involved in water-based tourism, it has been created a scientific area used for research, from where motorized watercraft has been banned; two separate corridors for fast-paced watercraft and an area for recreational usage where there are no restrictions for watercraft;

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THE FAVORABILITY OF RELIEF FOR TERRITORIAL EXPANSION OF MARGHITA CITY

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Abstract: This article aims to show the important role played by relief in the territorial expansion of the city of Marghita. With the advantage of the topography in a relatively flat area (the built up area has grown over an area of land with a maximum gradient of 5%) and the potential location within landscape units consisting of plains and hills. This territory has a high potential induced by the attractive development of a spa and the construction of the Transylvanian Highway. It is necessary to know the limits imposed by the natural environment, highlighting the important elements of its expansion, but also its territorial limits to its development.

Key words: favorability, territorial expansion, local development, restrictivity

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INTRODUCTION

The city of Marghita is located in north-eastern part of Bihor County, at a distance of 60 kilometers from the county seat, Oradea, at 30 km from the Hungarian border and near the limits of the county of Sălaj, respectively Satu Mare (Nemeş, 2010).

The position occupied in Bihor County (figure 1) confers to this city several advantages, stand on one side the location in a cross-border area (Hinfray, 2006, 82), so Marghita together with the city Létavértes (Hungary) make that kind of settlement called "doublet" (Ilies, 2003, 154) provide favorable conditions for cross-border cooperation. On the other hand, the proximity to the towns of Săcuieni, Valea lui Mihai (Bihor), the area of exploitation of oil in Suplacu de Barcău and not least its proximity to major communication axes, respectively the future Transilvania Motorway, creates an ideal framework for the capitalization of existing potential. Regarding the positioning of city of Marghita in relation with the Barcău hydrographical basin the following can be outlined: it is located in the northern part of Barcău corridor, at the contact with Viişoara Hills (Pop, 2005), on the left of the stream of Eger at the confluence of the river Barcău with Eger (Posea, 1997), side at an altitude of 135-140 m. The surface area of the city Marghita overlaps Marghita Hills (High Plain of Marghita) Toglaciului Hills, Barcău Corridor and of Budusläului Plain (figure 2).

METHODOLOGY

In preparation of this material have been harmoniously combined classical geographic research methods (observation, description, analysis of land) and specific methods of spatial analysis (geomorphological mapping, GIS, 3D analysis of geomorphological profile). As background maps was used the topographic maps Marghita section at 1: 25,000 scale,

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orthophoto, the Land Use Plan of Marghita (PUG[1], 2005) processed in special software which allow ethe graphical representation of the dynamics of expansion of urban systems updated with field observations.

Figure 1. Marghita location in Bihor County
(Source: processing after the map of Bihor County Council http://www.cjbihor.ro/)

[1] Planul Urbanistic General (en. Land Use Plan)

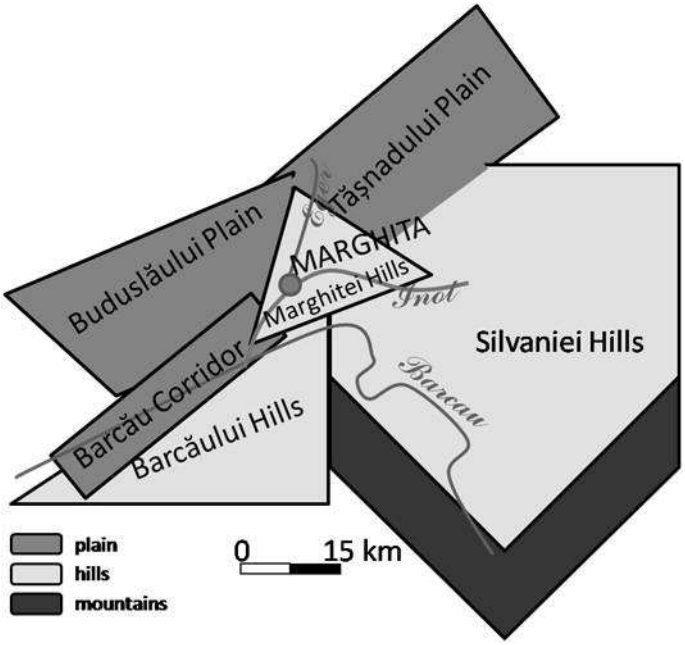

Figure 2. Choremаtic representation of the position of Marghita within major relief units

MORPHOMETRIC CHARACTERISTICS

The slope has an important role in the formation and concentration of the leak. Between the altitude and slope of a river basin or a section of it are, in general, close connections. By slope depends largely the water infiltration or alternatively the surface runoff and gravitational processes. Indirectly, they influence the soil erosion processes and, consequently, the solid flow of rivers.

The role of slopes in the formation of drain cannot be removed from the general context, because, in goodpart, the"effects" that they might have are attenuated by vegetation, especially by the trees. Cvasi-horizontal surfaces are found in the river meadow where the probability of occurrence of phenomena of hydrological risk is higher. Values below 5 % dominate the area under study, corresponding to the Barcău Corridor and Inot meadow and the entire area situated on the west of the Chet River. Slopes between 5 and 20 % being found in the hilly area between Chet and Inot, respectively, Viilor Hill. Isolated there appear slopes greater than 20 %.

The relief's energy has the highest values in the Toglaciului Hills or Marghita Hills,where in the glacis sector has values of 50 - 75 m, while in the meadow of Barcău Basin these values are very low (below 20 m).

The exposure of slopes is one of the potential factors on which depend the genesis and dynamics of geomorphological processes. It reflects the specific conditions in which takes place the relief modelling, closely related to several factors of geology, climate, hydrology, pedology and antropic. The exposure of slopes has a determinant role in promoting the calorie regime or the amount of moisture retained, involved in the configuration of vegetation cover characteristics, the suitability of the different land use.Overall, the radiative - caloric balance - the moisture individualize two major orientations - the north and east, characterized by a lower degree of sun exposure and the south and west, more sunny.

GEOMORPHOLOGICAL PROCESSES

Although they are composed of friable deposits (alternating sand and clay), erosion is essentially limited due to the low frequency of versants with large slopes. Drip erosion is particularly evident on the slopes with perpendicular plowing on the contour line.

Most of ravines are installed on slopes covered with grassland. Ravines are generally narrow at the top (deepened in clay) and wide at the bottom (embedded in sands). Some of them are flat bottomed, grassy, inactive, indicating favorable conditions prior to their genesis. Length of ravines is conditioned by inclination of versants, and the depth is between 0.25 to 2 m.

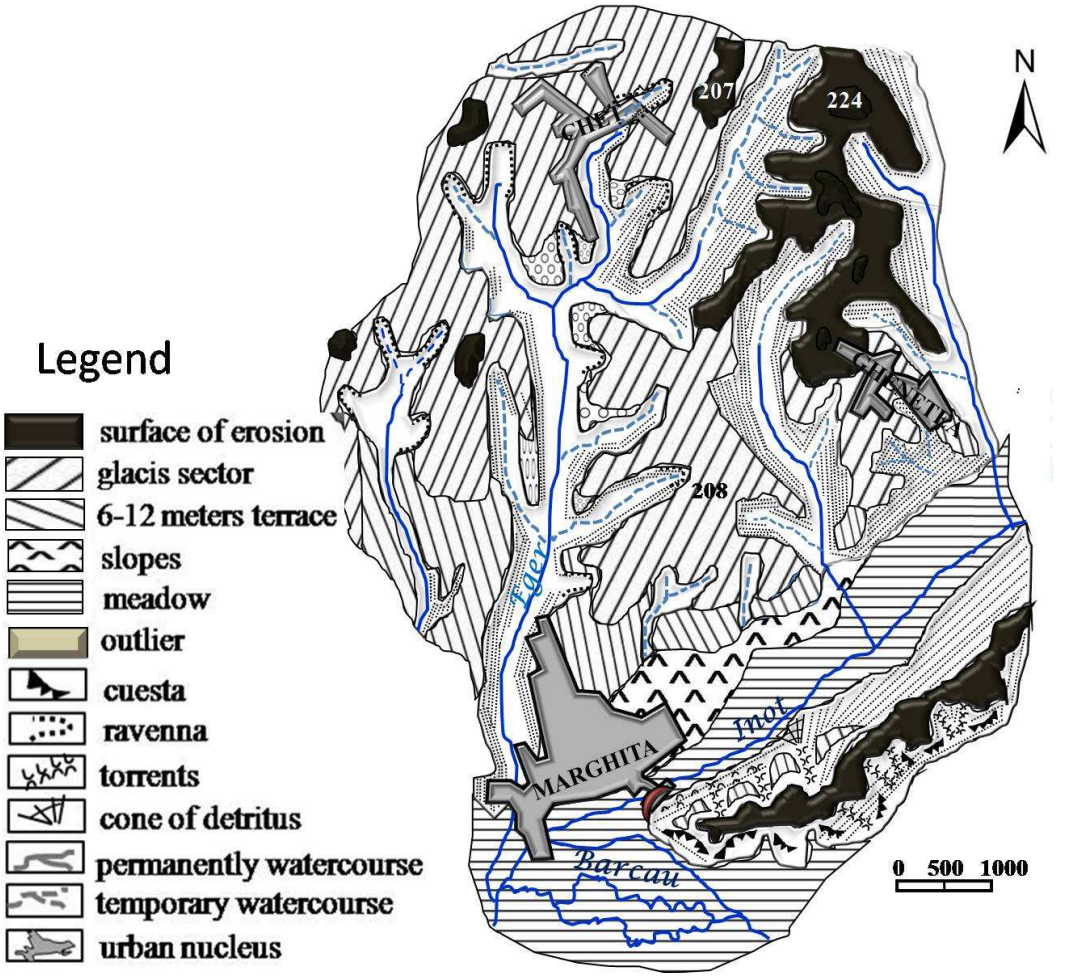

Figure 3. Geomorfological map of Marghita

Their shape is triangular and trapezoidal in clays when flattened bottom. The more inclined clay slopes of the Toglaciului Hill (10 - 20 °) are affected by shallow landslides. Since the frequency of these slopes is reduced, landslides are not carried out on large areas. Most of the secondary valleys fragment Marghita Hills (Eger and tributaries of Inot River) has flat bottomed, low meadows where water is stagnating on the surface frequently.

In the lowlands of the meadow, groundwater levels with aggression generally in acid-carbon, were intercepted in clay dust, at a depth of 0.5 - 1 m sometimes maintained at the surface, favoring the creation of swamps or ponds.

Frequent stagnation of water on the surface, favoring pseudogleization processes can be reported on smooth surfaces of interfluves or in the glacis sector.Overall, we can estimate that the analysed sector presents a modest morphodynamic except the inclined versants affected by ravination (Petrea, 1998).

FAVORABILITY OF THE RELIEF IN MARGHITA CITY TERRITORIAL EXPANSION

Marghita extended in the early stages especially on the eastern and western part of the urban nucleus and less to the north, along the main road, exploiting the most favorable terrain, of terraces.

The maximum extension was done on account of this type of relief.

The inclined slopes of the Valley of Eger, affected of landslides, have limited the extension of the construction to the west. Great while unfavorable meadows of Inot and Barcău have limited the extension of the urban nucleus to the south.These areas were avoided because of flood danger (WMO[2], 2007), high hydrostatic level and stagnation of water at the surface.

Due to rapid economic development in recent decades, the city could no longer maintain in the old geomorphological framework, so construction was placed on the surface of the floodplain. During the communist period in the floodplain surface was located a neighborhood with apartment buildings, the dominant regime GF +3, the most severely affected by excess water and subsidence etc. In the alluvial plain in south-western part was located an industrial units and warehouses, leading to elongation of the urban nucleus in this direction (Petrea, 1998).

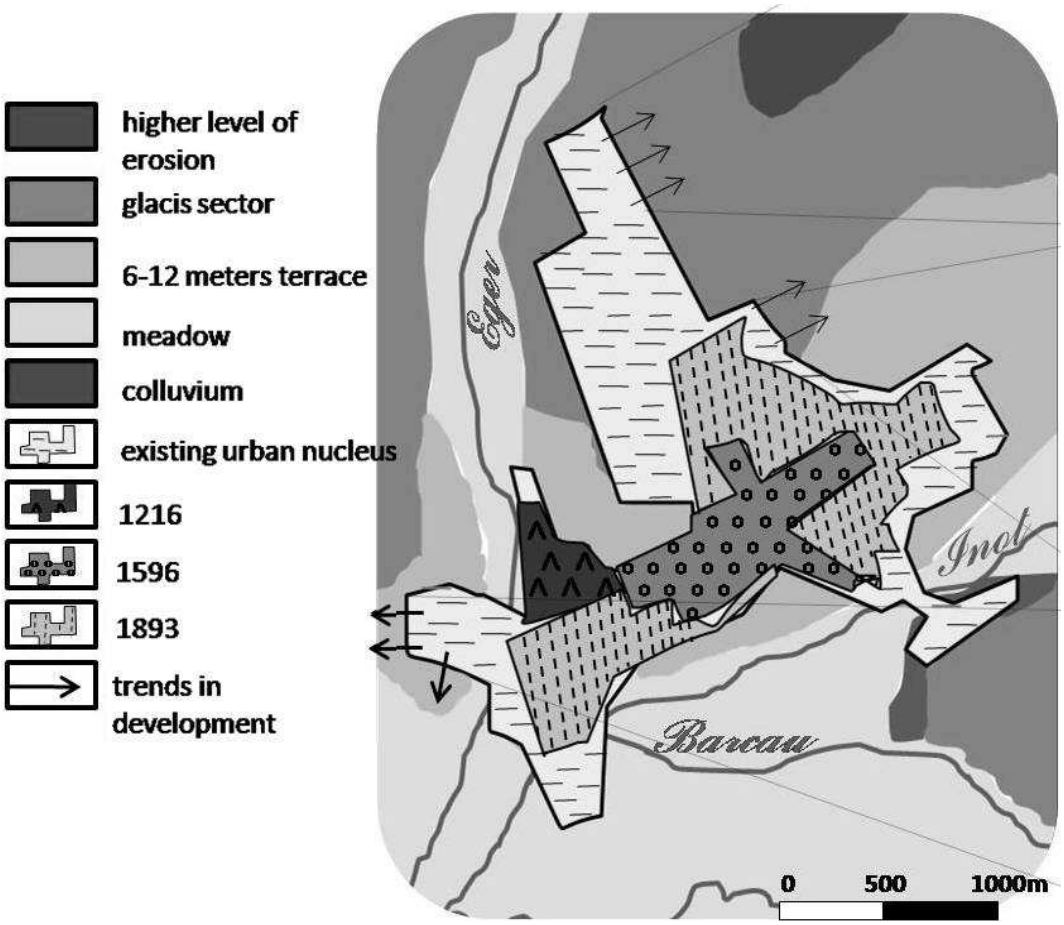

Figure 4. Marghita. Urban Development and current trends of development
(Source: processing after Petrea, 1998)

[2] World Meteorological Organization

The existing urban nucleus occupying different landforms, with implications for the urban physiognomy. At the level of urban nucleus there is recorded a relief energy of 35 m. Most of the city overlap terrace is of 6-12 m. Its great expansion, the low horizontal fragmentation, the reduced relief energy facilitated the development of a compact city of this type of surface.

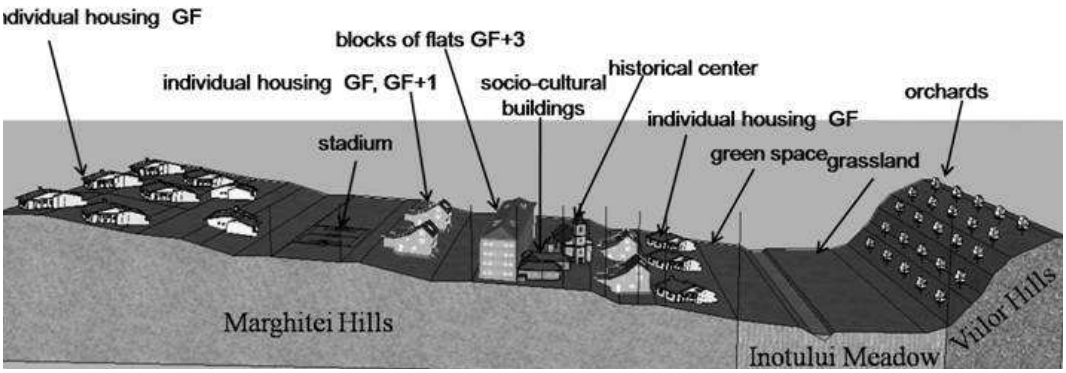

Figure 5. Geomorphologycal profile with emphasis on current land use

RESTRICTIVENESS IN THE PROCESS OF TERRITORIAL EXTENSION

The restrictiveness of the relief in the urban sprawl is given by the area occupied by meadows, where besides the risk of flooding, may occur risks due to the contact construction foundation with groundwater land also the subsidence represent major problems.

The restrictiveness is insignificant throughout the rest of the built-up area being imposed by the current geomorphological processes.

CONCLUSIONS

The territorial extension of the town of Marghita felt in recent years due to urban economic growth induced by the opportunities created by investments made by local authorities in urban facilities and equipment with private investment the establishment of the new economic activity was supported by the natural component, and conferred the most varied opportunities of expansion by the lack of natural constraints. The only restrictions are given by the proximity of Barcau River and the presence of landslide on the inclined slopes in the south-eastern part of Viisoara Hills.

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THE HYDROGRAPHY AND TOURISTIC ACTIVITY OF THE NATIONAL PARK OF ABRUZZO, LAZIO AND MOLISE (ITALY)

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Abstract: National Park of Abruzzo, Lazio and Molise (NPALM) is situated in central Italy, in the South-Central Apennines, also called the Appennini Abruzzesi. Its surface measures 50,683 ha and it also includes a surface of 75,683.6 ha of External Protection areas. NPALM is included in the administrative territory of three regions: a 75.2 % surface in Abruzzo, 16.7 % in Lazio and 8.1 % in Molise, thus its denomination. The main rivers which cross the NPALM are: Sangro, Melfa, Giovenco and Volturno. Of these, Sangro is the main river which drains the territory of the NPALM while the others flow on limited surfaces of the Park. Vivo Lake, of karstic and glacial origins is the only natural lake found in the internal protection area of the NPALM. However, the external protection area includes the largest natural lake of the Apennines: Scanno Lake. Pantaniello Lake is also a natural lake included in the external protection area and has been declared State Natural Reserve in 1972. Of the 5 artificial lakes that have been built for hydroelectric purposes, Barrea Lake is the most representative; situated on the river Sangro, it is well integrated in the landscape of the region. According to the Ramsar Convention, Barrea Lake was declared a sensitive humid-area in 1972. The hydrographic potential is influenced by the morphometric and morphologic particularities of valleys (lengths, width, slope, thresholds, passes, defiles, waterfalls etc), by the specific biota of watercourses, by the qualitative, quantitative and dynamic characteristics of watercourses. The main type of tourism encountered in this region is ecotourism (hiking, bird and animal watching), cycling and mountain biking along valleys' courses and alongside lakes; however, other types of touristic activities are practiced, based on recreational navigation (canoeing, kayaking and windsurfing) and on sport fishing. Swimming and birdwatching are practiced during summer.

Key words: Hydrography, National Park, Tourism

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INTRODUCTION

The case of the National Park of Abruzzo, Lazio and Molise (NPALM) is extremely interesting due to the fact that it is not located in the most renown and spectacular segment of the Apennines, it does not include in its delimitations the Gran Sasso d`Italia mountain range with the highest peak of the

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entire Apennines mountain range (Corno Grande Peak, 2912 m), as we might expect. It is actually located in the Central Apennines. This compact and isolated range includes the picturesque drainage basin of Sangro river as well as man-made Barrea Lake (which is perfectly integrated in the landscape), human settlements which add specificity to the scenery of this National Park. The territory of the NPALM is almost exclusively included in Sangro river's drainage basin which comprises its springs, the Barrea gorge situated downstream of the Barrea reservoir, etc. Other parts of NPALM's territory are included in adjacent but less extended drainage basins: Giovenco in the NW and Tasso-Sagittario in the north, Melfa drainage basin in the south and Volturno drainage basin in the SE.

The water flow of the Sangro River has suffered significant modifications due to human activities, a situation which is uncharacteristic to protected areas, especially in the case of a historical one such as NPALM. However, Barrea Lake was created in 1951 as a result of the damming of Sangro River, downstream of the Barrea gorge. Other reservoirs used in hydroelectric purposes included in the external protection area are: Grottacampanaro Lake on the River Melfa and Montagna Spaccata Lake on Rio Torto River, Castel San Vincenzo Lake on Volturno River and La Selva Lake created by the damming of Schiavona, a tributary of the Rapido River.

Vivo and Pantaniello Lakes are natural, season lakes while Scanno Lake is the largest natural lake of the Apennine Mountain range. Pantaniello and Scanno are situated in the external protection area of the NPALM. In what concerns tourism, artificial lakes are important nowadays as they have been perfectly integrated in the scenery of the area and represent, alongside valleys and other significant watercourses, the foundation of the touristic potential of NPALM.

THE LOCATION OF THE NPALM

The NPALM is located in the center of Italy, at the middle of the distance which separates the Tyrrhenian Sea and the Adriatic Sea, in the South-Central Apennines, also called the Appennini Abruzzesi (figure 1).

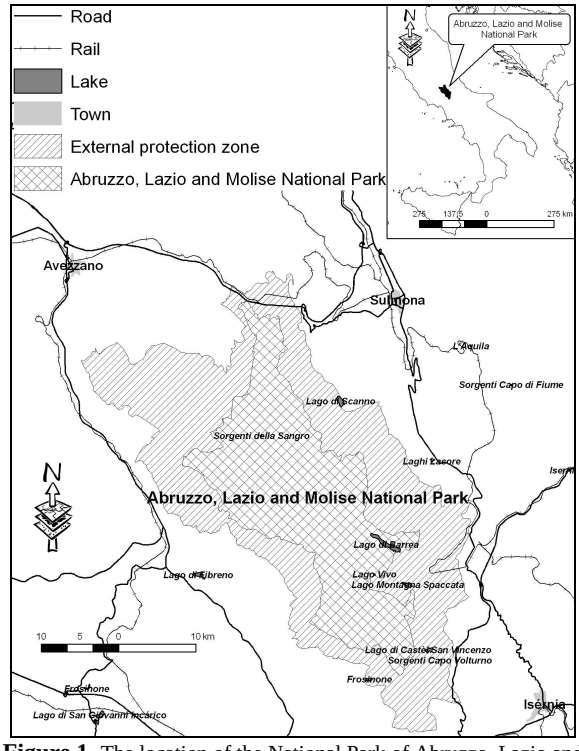

Figure 1. The location of the National Park of Abruzzo, Lazio and Molise (Italy)

NPALM is one of the historical national parks of Europe, as it was founded in 1923. It stretches over 50,683 ha, to which 75,683.6 ha are added, representing its external protection area. It is included in the administrative territory of three regions: a 75.2 % surface in Abruzzo, 16.7 % in Lazio and 8.1% in Molise and it comprises a total of 24 communes of which 5 are located in the park's perimeter (the so-called internal communes) while the other 19 are external communes, located in the external protection area.

The Abruzzo area is not only the most extensive but also the most important and renowned sector of the park.

WATER COURSES

If one studies the "*Carta d'identità del Parco Nazionale d'Abruzzo, Lazio e Molise*" (the Identity document of the park), it is noticeable that the watercourses of the area are described before local vegetation and fauna even though the latter are strongly promoted and popularized and represent the main attraction of the NPALM. This is understandable, however, as water represents the foundation of the plants' and animals' life, therefore bearing a higher importance.

NPALM is crossed by several rivers: Sangro, Giovenco, Volturno and Melfa. In what concerns its hydrography, NPALM is almost exclusively included in Sangro River's drainage basin which comprises its springs, the Barrea gorge situated downstream of the Barrea reservoir. Other parts of NPALM's territory are included in adjacent but less extended drainage basins: Giovenco in the NW and Tasso-Sagittario in the north. The southern sector which includes Melfa's drainage basin is more significant, while the south-east mountain area is included in Volturno's drainage basin. Thus, the NPALM's territory is located in the hydrographic center of the Apennines, comprising three different drainage basins: Sangro River, which flows into the Adriatic Sea, Liri-Garigliano drainage basin corresponding to the Melfa and Volturno Rivers' drainage basins. These last two flow into the Tyrrhenian Sea.

Sangro, the main river which drains NPALM's territory is the second longest (117 km) river of the Abruzzo Region and occupies the same position in what concerns the surface of its drainage basin (1,515 sqkm). Its birth place, La Penna Spring, is situated at a 1370 m altitude, at the foot of the eastern slope of Turchio Mountains, close to the Diavolo Pass, on the administrative territory of the Gioia Vecchio commune. It flows towards the eastern limit of NPALM (also called the Marsican limit) and descends, passing through a narrow valley, towards the Pescasseroli Depression (closed in the SE by the steep slope on which Opi lies through a narrow pass). It then streams towards Villetta Barrea village and, further on, is dammed, creating Barrea Lake.

Drainage basins are constrained by the geological massiveness and especially by great regional faults which prevents the creation of ramified basins. The north limit of Sangro's upper basin is situated downstream of Barrea Lake and of Barrea Pass, near Alfedena village. Here, the river exits the mountains of the NPALM territory and enters Castel di Sangro Depression.

The studied sector of Sangro River is, in what concerns its course and its drainage basin, Apennine oriented (NW-SE), from its spring to Pescasseroli where its orientation changes to a W-E one. It is in this sector that Sangro gathers its main tributaries. The Vandra River meets it from the right, near Opi, while Val Ciavolara and Profluo flow into Sangro near Villetta Barrea. These tributaries are not perennial and their hydric contribution is minimal. To the hydrographical right, the main tributaries are Fondillo Valley and Scerto Valley (of the Camosciara sector), both originating in the Meta Mountains' Massif. These two tributaries represent an important source of Sangro's flow capacity, flowing constantly at an average flow of 150 l/s each. Downstream of Barrea Dam, Sangro flows for 5 km through Barrea Pass until it reaches Alfedena where it exits the mountain sector so that it crosses the inner mountain depression of Castel di Sangro (Pratesi and Tassi, 1998, pp. 49-50).

LAKES

ARTIFICIAL LAKES

From a hydrological point of view, Sangro's water flow has suffered significant alterations in time due to the impact of human activities, which is common to all Italian watercourses, particularly those situated in mountain areas. However, these anthropic modifications are uncharacteristic to protected areas, especially in the case of such an historical area, as it is NPALM.

In the Barrea floodplain, the dam (figure 3) situated at the river's outfall is manmade. It was constructed in 1952, thus creating Barrea Lake (figure 2), a reservoir used in hydroelectric purposes which perfectly blends in the natural landscape. It is 4.6 km long and 500 m wide, measuring a water level of 973 m and a capacity of 25 million m^3 of water (Ferraretto, 1998).

Figure 2. Barrea Lake seen from Barrea village

Figure 3. Barrea Dam

The fauna of this drainage basin includes: the white-throated dipper (Cinclus cinclus), the grey wagtail (Motacilla cinerea), the mallard or wild duck (Amas platyrrhinchos), the coot (Fulica Atra) and many other species, some migrating birds such as the grey heron (Ardea cinera) etc.

The endemic ichthyologic species specific to this area are: the brown trout and rainbow trout (Salmo trutta fario, Salmo trutta iridaeus), the tench (Tinca tinca), the Carpathian brook lamprey (Eudontomyzon danfordi), the common carp (Cyprinus carpio), (Tassi, 2002).

This system of modifying the natural course of rivers for hydroelectric purposes also affects the tributaries of Melfa and Rio Torto (tributaries situated in the external protection area of NPALM) due to the construction of the two artificial lakes: Grottacampanaro Lake on Melfa and Montagna Spaccata Lake on Rio Torto (tributary of Sangro, flowing through the external protection area).

Other artificial drainage basins included in the external protection area are Castel San Vincenzo on Volturno, La Selva, created by damming Schiavona, a tributary of Rapido (which is a tributary of Volturno). The construction of these reservoirs has engendered benefits, even though it had been very much debated as a controversial matter. In 1976, Barrea Lake was declared a Ramsar sensitive humid-area.

NATURAL LAKES

In what concerns natural lakes, Lake Scanno is the largest one. It is located at an altitude of 992 m in the upper drainage basin of Sagittario, between Monte Genziana and Montagna Grande. Scanno Lake (figure 4) was created as a natural dam, due to tectonic processes. It is 1722 m long, 700 m wide, measuring a 5.65 km perimeter, a 0.93 sqkm surface and a maximum depth of 32 m.

Vivo Lake (figure 5) is also a natural lake as it originated in a depression created by a tectonic uplift at an altitude of 1600 m. Springs and snow melt supply the lake's water resource, its measurements being variable.

Pantaniello Lake, situated in the external protection area was created due to karstic as well as glacial processes.

Figure 4. Scanno Lake

Figure 5. Vivo Lake

Other lakes created in the Pleistocene era on Sangro's upper course have disappeared because of natural causes but still mark the landscape (Ardito, Monasterio, 1998) . Thus, the river bed has deepened by passes and gorges, Opi Pass and Barrea Defile being the most important.

THE TOURISM IN NPALM

According to a study conducted by the Osservatorio Permanente sul Turismo Natura: "*the touristic product represented by National Parks, Natural Reserves etc., in other words, protected areas*" is preferred by 55.6 % of the "nature-loving" tourists of Italy. This fact highlights the increased attention of tourists towards vacations which allow them to directly experience a protected natural environment (www.parcoabruzzo.it, Bozza Rapporto Diagnostico document). NPALM is the most sought-after national park in what concerns Italian tourists while foreign tourists prefer Cinque Terre National Park (Liguria). Following a series of statistics and researchs conducted by the competent authorities, NPALM decided to gain the European Charter for Sustainable Tourism in Protected Areas (CETS). This charter mirrors the interest manifested by institutions and tour-operators which administer protected areas towards the development of tourism according to the principles of sustainable development (www.parcoabruzzo.it, Bozza Rapporto Diagnostico document).

As it is a protected area, sustainable tourism is encouraged (Amodio, 2001). The main touristic activities of the area include: ecotourism (especially hiking (figures 6 and 7) and animal watching) and leisure tourism which comprises recreational navigation (canoeing, kayaking (figure 8) and, during summer, windsurfing) and swimming during the warm season.

Figure 6. Map route along Barrea Lake

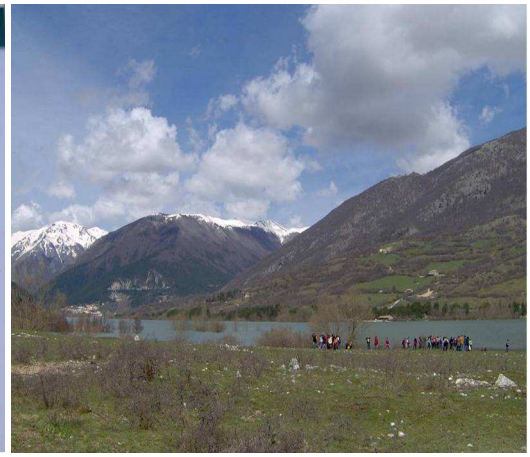

Figure 7. Group of tourists along Barrea Lake

Figure 8. The school of canoe and kayak from NPALM (Barrea village)

Canoeing competitions are organized each year due to the fact that they attract the tourists regularly practicing these sports and enhance the touristic flow of NPALM. The Canadian canoeing competition is representative, as it has reached its eight edition (figure 9).

Figure 9. Poster of National Contest for Canadian Canoe

Figure 10. Representative indicators for Barrea Lake

A path suitable for cycling circles Barrea Lake so that tourists can engage in cyclotouristic activities (figure 10). Birdwatching is a new type of tourism which is practiced in the area while recreational fishing and sport fishing are practiced according to a calendar that is carefully organized by the NPALM administration.

On the left bank of Barrea Lake, a beach bar has been constructed; equipped with lounge chairs and small recreational boats (figures 11 and 12) it allows tourists to cool off and to enjoy their spare time in a peaceful ambiance, surrounded by the mountains and forests of NPALM.

Figure 11. The bar La Gravara - Barrea Lake

Figure 12. Pleasures craft on Barrea Lake

Figure 13. Park of recreation organized by the municipality Villetta Barrea

Located near the lake, a park organized by the Villetta Barrea municipality comprises an area equipped with tables and benches suitable for picnicking, playgrounds, a bar which serves lunch as well as an area for practicing gymnastics (figure 13).

There are numerous proper accommodation options due to the fact that Sangro's drainage basin includes 5 of NPALM's most important municipalities: Barrea, Villetta Barrea, Civitella Alfedena, Opi, Pescasseroli, the historical nucleus of NPALM (Zarrilli and Iozzolino, 1995).

THE TOURISTIC POTENTIAL OF THE SANGRO RIVER

Hydrographical elements are considered to be natural resources bearing a high touristic importance. This is due to the fact that they imprint a certain aesthetic on the landscape, they posses several complex scientific uses and they also provide the infrastructure for several leisure activities and sports.

The touristic potential of watercourses is highlighted by four types of attributes: morphometric and morphologic characteristics; dynamic, quantitative and qualitative features; the specific biota of watercourses; the touristic potential of the cities and communes crossed by rivers (Bătinaş, Sorocovski, 2008).

Figure 14. Indicators with Sangro river

Here are some of the most interesting morphometric and morphologic characteristics of Sangro (figure 14) in what concerns its length, it is the longest river of NPALM, measuring approximatively 30 km. Other rivers which originate in the NPALM do not cover significant surfaces as opposed to Sangro. Also, its tributaries are usually mountain springs of reduced lengths and widths, varying along their course. In what concerns its longitudinal profile, the waterfalls of Scerto Valley represent significant elements (Tre Cannelle waterfall and delle Ninfe waterfall), situated in the Camosciara Complex, classified as a maximum protection area. They can be visited as the touristic route follows an asphalted road which was paved at the beginning of the '80s during the economic boom prone to touristic speculation.

Sangro's morphology is quite spectacular: close to its spring it creates Opi Pass and then on Barrea Defile, located near the commune of Barrea.

The quality of the watercourses crossing NPALM is high due to the fact that humans have not influenced it negatively through pollution as it is a legally protected area.

Since Barrea Lake has been declared a sensitive humid-area, it is clear that both its specific biota as well as that of Sangro River are important (figure 15). A representative reason for this is the presence of the Little Egret (Ardea Garzetta) (Tassi, 1984).

As Barrea Lake is situated near Villetta Barrea and since Sangro River flows through this area, (figure 16) the aesthetics of the region is enhanced and rendered dynamic. Also, as the commune of Barrea is situated on a steep slope as Sangro enters the Defile, the landscape is picturesque (figure 17), perhaps unique. The most popular touristic areas of NPALM are located in the upper drainage basin of Sangro: the historic sector of the park, comprising Fondillo Valley and Camosciara Complex.

Figure 15. Vegetation specific to Barrea Lake

Figure 16. Sangro River in Villetta Barrea village

Figure 17. Barrea Lake and Barrea village

The dynamics of the landscape is revealed in the richness of the forest and implicitly of the flora, in the crystalline water which flows and ripples across the white limestone substrate (Boccazzi-Varotto,1982). And when the lucky tourist encounters the wild animals which populate the region, he feels fully satisfied. NPALM is one of the few reserves of Europe where wild animals such as deer and wild boars can be spotted only meters away from highways, picnic areas, tourist routes and even settlements, without having to hike for miles. Following the course of Sangro River, there are several well defined areas where deer can be spotted as they descend to drink water.

Fondillo Valley (figure 18) is shrouded in myth as archeological discoveries have demonstrated that this was a sacred ground for the local population due to the numerous springs which were dedicated to gods in antiquity. This valley includes several tourist routes and thematic paths used for environmental interpretation and education (Furlani and Pratesi, 2000).

Figure 18. Fondillo Valley

Figure 19. Tre Cannelle and Ninfe Waterfalls

Essentially, this area housed the first environmental interpretation and education programs planned, created and implemented by NPALM. Nocturnal trips are organized in Fondillo Valley, providing tourists the opportunity to communicate with the natural environment as well as to increase their awareness and sensibility to environmental problems. This valley has become one of the main outdoor classrooms for environmental interpretation and education.

The Camosciara Complex (Latini, 2003), represents the main touristic attraction of NPALM, the preferred spot for organized trips. It is shaped as an amphitheatre with rocky, alpine crests and includes Scerto Valley with its two waterfalls: Tre Cannelle and Ninfe (figure 19) which were created due to the presence of rigid dolomite rocks.

Camosciara owes its denomination to Camoscio, namely the chamois (Rupicapra rupicapra) due to the fact that this species is commonly found on its rocky crests. Camosciara was declared a maximum protection Area in 1972 (Rossi, 1993) and the access routes are limited as the area, which streches beyond the two waterfalls, is not to be trespassed. In ancient times, the floodplain located by the foot of the mountains housed the main settlement of the region. However, in medieval times, due to feudal conflicts, Villetta Barrea and Civitella Alfedena were founded at a distance of 4 km and 6 km respectively from Camosciara and the original settlement was abandoned. The floodplain located by the foot of the Camosciara Amphitheatre now houses picnic area, a football field, a bar, bicycle and open carriage renting facilities, an electric train, equestrianism facilities and other touristic activities.

Villetta Barrea also harbors the Water Museum (figure 20); it houses the old mill which has been reconverted into a small hydroelectric power station that produces most of the power required by public illumination

Figure 20. The Water Museum in Villetta Barrea

CONCLUSIONS

Water represents an indispensable element for life and, in the case of protected areas, it also plays an important part in the protection and the preservation of the environment. While regular human activities do not regularly imply a thorough research in this direction, water surface studies, ground water studies, pollution and exploitation studies are indispensable and represent a priority for NPALM. Water interacts with the geologic and geomorphologic system due to springs, erosion mechanisms, sediment transport and infiltration. It also interacts with the flora system which is tightly linked to water resource localization and availability. Furthermore, in what concern resource exploitation, water quality and water integrated circuit interact with the anthropic system (water interception, the purification of polluted waters etc. (Pratesi and Tassi, 1998, pp. 49).

Thus, the touristic potential of NPALM is enhanced due to hydrographic elements. Sangro's drainage basin is exceptionally picturesque while Barrea Lake blends in the natural NPALM landscape. The park's administration was initially very much reluctant and opposed the authorization of the proposals and projects for the construction of the Barrea dam and, therefore, to the creation of Barrea Lake. However, in 1976 Barrea Lake was declared a Rasmar sensitive humid-area, the only one of its kind in the Abruzzo Region. As it shelters important bird populations and represents a rest area for migrating birds which travel from Africa to the north of Europe, it enhances the touristic potential of NPALM and encourages the development of new types of tourism.

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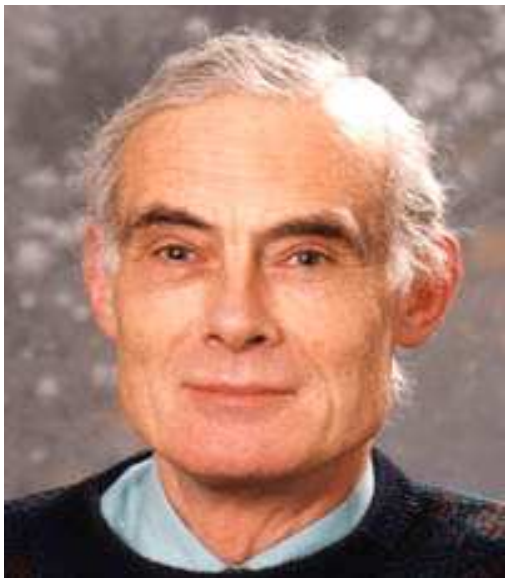
IN MEMORIAM

PROFESSOR DR. DAVID TURNOCK

Remarkable geographical personality in the UK, ***PROFESSOR DAVID TURNOCK*** was for many decades a reliable friend for the romanian geographers across the country.

Among contemporary geographers interested in romanian places, but also interested in all Eastern Europe, Professor David Turnock was noted with most numerous studies in the field of human geography.

His first contact with Romania s territory and its realities was in 1967. Since then, he had annual direct contacts with romanian geographers from Timişoara, Cluj Napoca, Iaşi, Bucuresti Universities and from 2007, with geographers from Oradea University. With plenty of friendly participation helped young romanian geographers accessing prestigious universities from United Kingdom.



(source: www.123people.co.uk/s/david+turnock/)

In his numerous studies related to Romania he had many Romanian collaborators but with modesty, even if his contribution within the paper was consistent, he accepted to appear as a second or even as a third author, because, he kept discreet to highlight the Romania authors.

The scientific record related to Romania is outstanding: 43 printed volumes and over 200 scientific papers and the areas over which he scientifically insisted were Banatului Mountains, Southers Carpathians, Vrancei Subcarpahians, and Central Muntenia but there are not the only ones. The papers of the outstanding professor are distinguished by the numerous romanian geographical references (an other discreet way to promote the research results of romanian geographers)

Because of his special relation with romanian geography, in the year 2000, he was granted with the „*Doctor Honoris Causa*" title of „West University" from Timisoara and in 2009 he was also granted with the same academic title by „Al. I. Cuza" University from Iasi.

As far as concerning the relation with geographers from Oradea we can only regret that it started late (in 2007) and it was short because the tragic event which ended the life of Professor David Turnock. This relation has resulted in publication of three scientific papers and one review within the pages of „Annals of University of Oradea, Geography Series":

- in 2009 - *Settlement and toponomy in the Pătârlagele Depression: the Buzău valley settlements between Valea Lupului and Poienile de Jos. Part one: settlement history* (authors: N. Muică, D. Turnock) and the review of the book „*Nădrag commune. Between the power of history and geographic destiny*" published in 2008 (authors: Ribana Linc, Andru Getvan, Nelu Balaş şi Tudor Balaş);

- in 2010 - *Settlement and toponomy in the Pătârlagele Depression: the Buzău valley settlements between Valea Lupului and Poienile de Jos. Part two: the placenames* (authors: N. Muică, D. Turnock);

- in 2011 - *Passenger services on the Romanian railway network in the post-communist era* (author: D. Turnock)

Also, from spring 2011, he honoured us by accepting to be member of the Scientific Committee of the „Annals of University of Oradea, Geography Series". There were other projects with geographers from the University of Oradea which we hope will be finished in his memory.

Sincerely, the geographers from Oradea worship in the memory of the late scientist and friend of Romanians, ***PROFESSOR DR. DAVID TURNOCK.***

REFERENCES:

Laudatio pentru Domnul Profesor David Turnock cu ocazia acordării titlului de „Doctor Honoris Causa" al Universității „Al. I. Cuza" din Iaşi, 26 martie 2009, Iaşi.

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