STUDIA UNIVERSITATIS
BABEŞ-BOLYAI

GEOGRAPHIA

1/2010

ANUL LV **2010**

S T U D I A

UNIVERSITATIS BABEŞ – BOLYAI

GEOGRAPHIA

1

Desktop Editing Office: 51ST B.P. Haşdeu, Cluj-Napoca, Romania, phone + 40 264-40.53.52

CUPRINS – CONTENT – SOMMAIRE – INHALT

Notes and Book Reviews – Note şi recenzii

GEOMORPHOLOGICAL HAZARD ASSESSMENT OF THE AREA OF THE MEDIEVAL VILLAGE OF RIOLA (BOLOGNA APENNINES, NORTHERN ITALY)

D. CASTALDINI[1], AL. GHINOI[2], AL. MACCAFERRI[2]

ABSTRACT. – Geomorphological hazard assessment of the area of the medieval village of Riola (Bologna Apennines, Northern Italy). The medieval village of Riola has recently been gaining increasing interest for possible future tourist exploitation. This study is aimed to assess the geomorphological hazards of that area, through detailed geomorphological mapping (cross-verified by applied-geology investigations). Particularly, the area's instability has been analysed, also with the aim of verifying the official maps of the Bologna Province' territorial plan, where the greatest part of the area has been defined at elevated hydrological risk, strongly limiting future development. This study has demonstrated how a detailed geomorphological mapping, coupled with an hazard classification method adopted, with modifications, from the Swiss hazard-mapping guidelines, can give a more realistic picture of the slope instability framework of a municipality than that given by the provincial maps. The latter are based on geological maps and on interpretation of aerial photographs: the primary aim of geological maps is not to identify landslides, while aerial photographs can only give a first glimpse of a landslide's body, not having much to say on its state of activity.

Keywords: *landslide, geomorphological mapping, hazard, risk, territorial planning, Bologna Apennines.*

1. INTRODUCTION

Fig. 1. Panoramic Wiew from North-East of the Medieval Village of Riola (Bolognese Apennines).

Situated in the municipality of Castel d'Aiano (Bolognese Apennines), the medieval village of Riola is of historic, architectural and landscape importance and recently it has been gaining increasing interest for possible future tourist exploitation (fig. 1). This study is aimed to assess the geomorphological hazards of that area, through detailed geomorphological and applied-geology investigations. Particularly, the area's instability

[1] *Department of Earth Sciences, University of Modena and Reggio Emilia, Italy, e-mail: doriano.castaldini@unimore.it*
[2] *Professional geologist, Office: Viale Caduti in Guerra, Modena, Italy*

has been analysed, also with the aim of verifying the documents of the Province-Coordinated Territorial Plan (from now on named as PTCP) of the Bologna Province (Provincia di Bologna, 2004), where the greatest part of the area has been defined at elevated hydrological risk, strongly limiting possible territorial plans.

2. GEOGRAPHIC AND GEOLOGICAL SETTING

The village of Riola is located in the southern sector of the municipality of Castel d'Aiano, middle Bolognese Apennines. Its hydrographical basin is the Aneva Torrent's, left affluent of the Reno River (fig. 2). One hectare of area, the village spans from 710 to 723 metres above sea level. Despite this, the entire study are covers some 3 square kilometres, with elevations spanning from 435 m, at the Aneva Torrent, to some 850 m on the peaks above the village.

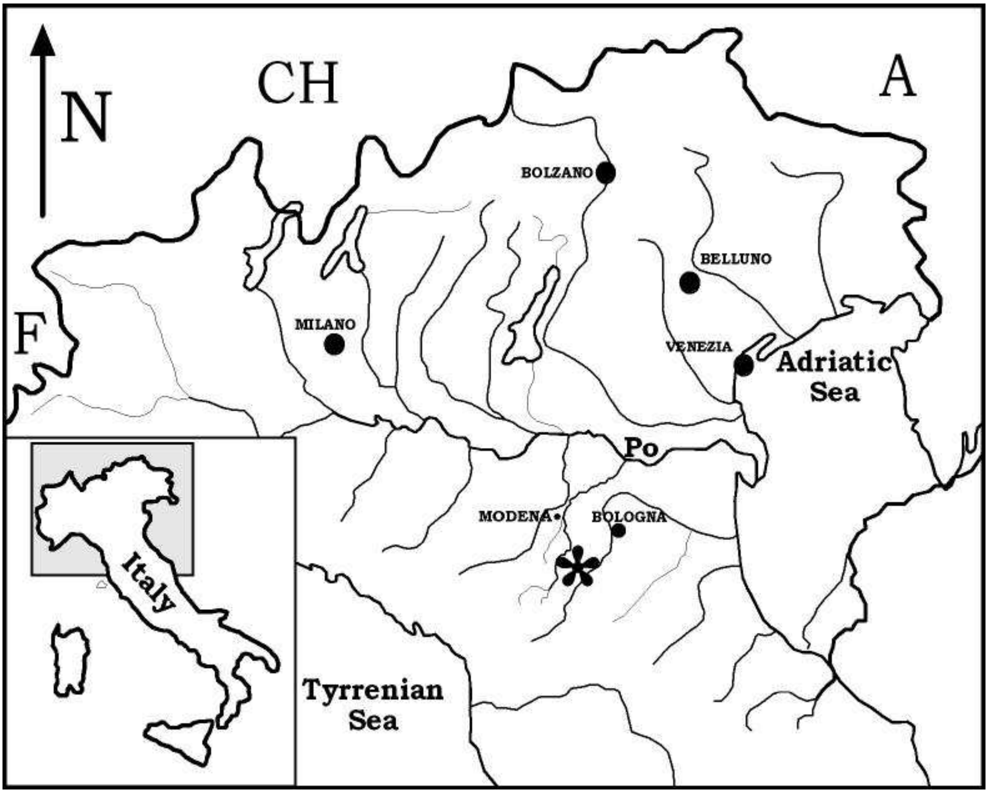


Fig. 2. The location of the study area, within the Bologna Apennines, is represented by the star.

The Bologna Apenninse belong to the Northern Apennines which are a fold-and-thrust belt resulting from a complex and multi-staged evolution. The geological features of the chain are quite complicated (e.g. see Boccaletti & alii, 1981; Cerrina Feroni & alii , 2002). In short, the main geological units forming this sector of the Apennines are as follows (Bettelli & De Nardo, 2001):

- Tuscan Units, made up of Tertiary siliciclastic deep-water turbidites, continuously cropping out along the Apennine chain’s axis; they result prevalently from the infilling of distinct migrating Tertiary foredeep basin;
- Ligurian Units made up of deep-sea sediments including Jurassic ophiolites followed by thick sequences of Cretaceous to Eocene calcareous or terrigenous turbidites;
- Mainly terrigenous epi-Ligurian sequences of the Middle Eocene to the Late Messinian, unconformably resting on the previously deformed Ligurian Units. The epi-Ligurian sequences and the Ligurian Units are exposed in the mid-Apennines;
- the belt of Plio-Quaternary marine terrigenous deposits unconformably overlying the Ligurian Units and the epi-Ligurian sequence cropping out at the Apennine margin and dipping under the alluvial deposits of the Po Plain.

The study area has been object of various studies, at different scales, among which Annovi (1975 and 1980), Colombetti (1975) and Panini et al., (2002). On the basis of the most recent cartography (Regione Emilia-Romagna – Servizio Geologico, Sismico e dei Suoli, 2008), all lithologies croppig out in the area belong to the Epi-Ligurian sequences. In stratigraphic order they are as follows:

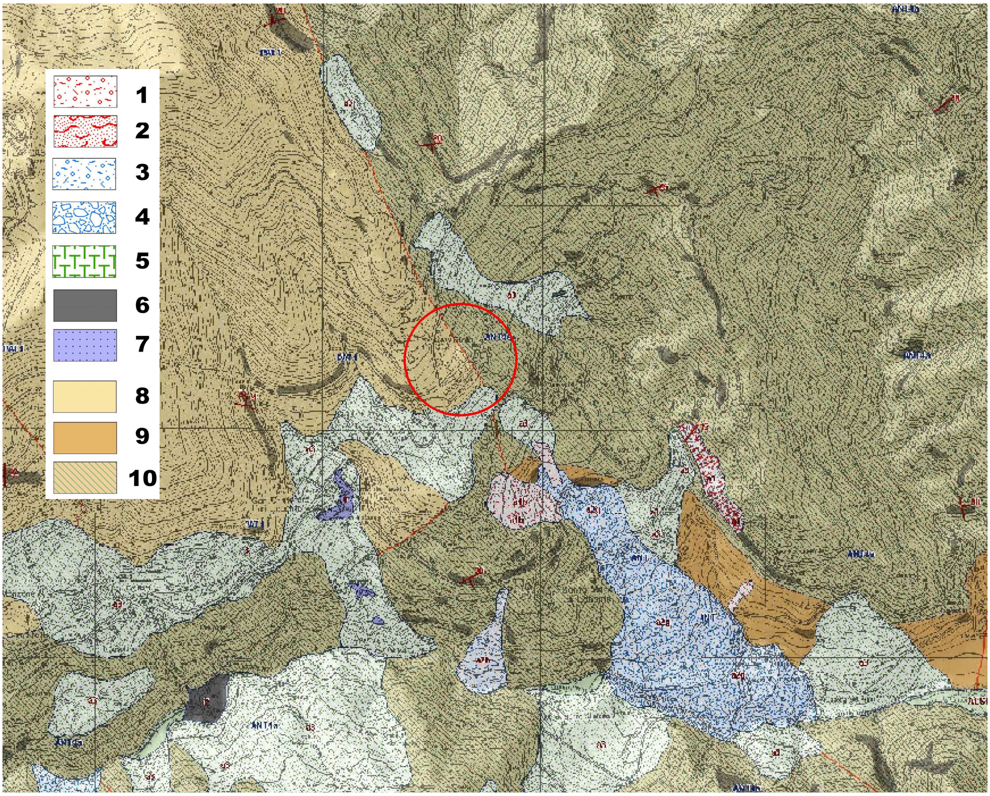


Fig. 3. Geological map of the study area (Extract from Servizio Geologico, Sismico e dei Suoli (Regione Emilia-Romagna – web site). Legend: red circle: location of Riola.1) Deposit of active slide; 2) deposit of active slow flow; 3) deposit of dormant slide; 4) deposit of dormant complex landslide; 5) talus heap; 6) inactive alluvial fan; 7) travertine; 8) Formazione di Pantano (Membro di Sassoguidano), PAT1; 9) Marne di Antognola, ANT; 10) Marne di Antognola – Membro di Anconella – silty-arenaceous litho-facies, ANT4a.

- pelitic sandstones of the Membro di Anconella (Formazione di Antognola), *Upper Rupelian - Burdigalian* (ANT4a in fig. 3). This lithotype has the highest occurence in the area, except for the north-western sector;

- marls and clayey marls of the Formazione di Antognola, *Upper Rupelian - Burdigalian* (ANT); they crop out, in some limited sites, in the sowth-eastern sector;

- arenites of the Membro di Sassoguidano (Formazione di Pantano), *Upper Burdigalian – Lower Langhian* (PAT1); they crop out just in the north-western sector.

Regarding tectonics, the village of Riola is located in the southern reaches of a direct, high-angle fault with a NW-SE direction. The fault has caused the lowering of the Membro di Sassoguidano (PAT1), on its west side, relatively to the Membro di Anconella (ANT4a), on its eastern side.

3. GEOMORPHOLOGICAL STUDY

The geomorphological study is an essential phase towards the geomorphological hazard assessment. The geomorphological characters of an area are shown on a geomorphological map (fig. 4), obtained, with some appropriate variations, according to the legend and guide proposed by the Italian Gruppo di Lavoro per la Cartografia Geomorfologica (1994).

In order to realize fig. 5, besides field survey, fundamental was the interpretation of aerial photographs and high-definition satellite images, both multi-scale and multi-temporal, analogical and digital.

The concept of “state of activity” has been of crucial importance when applied, in general, to define the dynamics of geomorphic processes (and their relative forms and processes) and, in particular, of hydrological-instability phenomena.

It is known that many definitions of “state of activity” exist for geomorphological processes (and consequently for active, dormant and inactive landslides) and for their deriving forms and deposits. This is because it has an extremely interesting applicative matter. Moreover, the term is frequently used without specifying its meaning.

Without listing all the existing bibliography about this matter, for this study the definition given by the PROVINCIA DI BOLOGNA (2004) has been used. For instable areas, it defines:

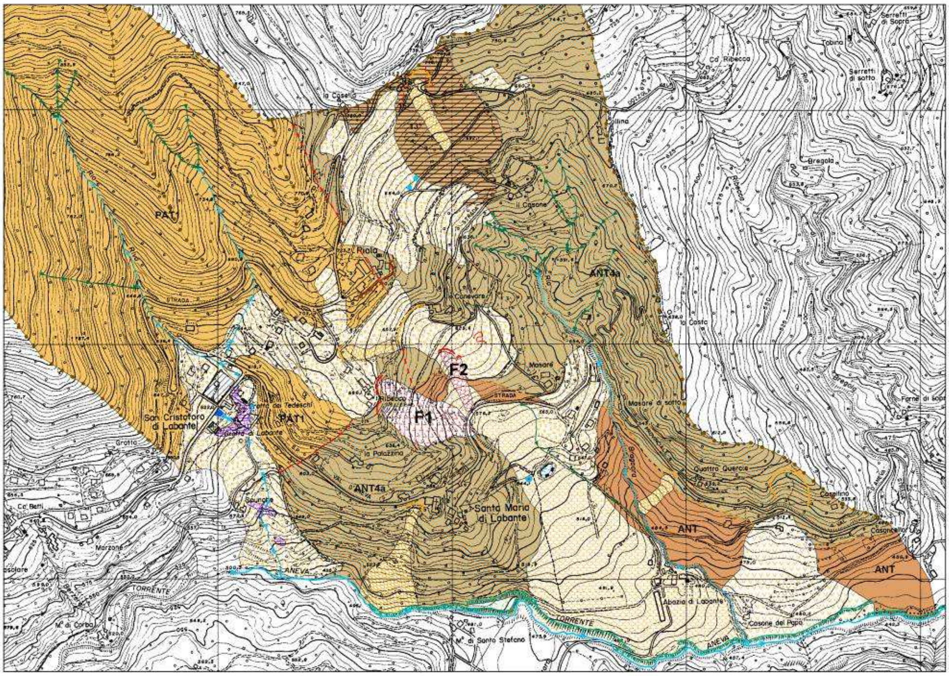
- “Areas affected by active landslides”: landslides which are currently active or that have been reactivated since the last 30 years (rock-falls are also included);

- “Areas affected by dormant landslides”: landslides that have not showed signs of activity since the last 30 years and that could be reactivated by their original causes, compresi gli scivolamenti di blocchi, le espansioni laterali e le Deformazioni Gravitative Profonde di Versante (DGPV);

- “Potentially instable areas”: quaternary deposits affected by evident superficial morphogenetic processes such as creep, solifluction etc.; alluvial fans; areas affected by relevant erosional processes; naturally stabilized or relict landslides.

The reason is that the Provincia di Bologna (2004) is a reference document for the territorial planning of the Bologna Province and that the methodology to be applied for the hazard assessment (see paragraph 6) considers two return-period classes: < 30 years, and from 30 to 100 years.

The geomorphological characteristics of the area, represented in the geomorphological map of fig. 4, will be described now on.



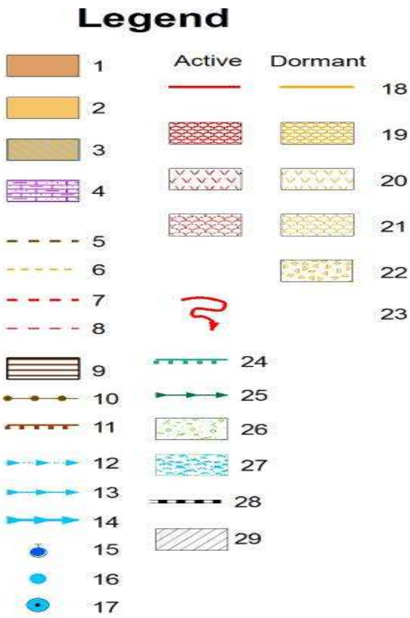


Fig. 4. Detailed geomorphological map of the study area. Legend: 1) Marne di Antognola, ANT; 2) Formazione di Pantano (Membro di Sassoguidano), PAT1; 3) Marne di Antognola – Membro di Anconella – silty-arenaceous litho-facies, ANT4a; 4) travertibe; 5) uncertain lithologic boundary; 6) uncertain stratigraphic/lithologic boundary; 7) assumed fault; 8) fracture; 9) structural surface; 10) ridge; 11) structure controlled scarp edge; 12) canalised stream; 13) secondary stream; 14) torrent; 15) tapped spring; 16) spring; 17) water well; 18) edge of degradation and/or landslide scarp; 19) landslide body due to flow; 20) body of rotational slide; 21) body of complex landslide; 22) talus heap; 23) slope affected by solifluction; 24) edge of torrential erosion scarp; 25) gully; 26) alluvial deposit; 27) water retention basin undergoing rapid sedimentation; 28) artificial embankment; 29) abandoned quarry; F1) Ribecco's landslide; F2) Canevare's landslide.

The area is drained by a dense network of gullies that convey their waters into two main water courses, the Rio Riva and the Rio Bragoara. These two are feed from the left side the Aneva Torrent that, with a W-E flow within small fluvial scarps, borders the area to the south (fig. 5). The infiltration of superficial waters occurs where topography shows counter-slope or concave shapes; the underground flux is sensibly reduced where waters encounter clay-rich lithologies.

Near San Cristoforo di Labante, the abundance of water flowing out from a spring and the peculiar chemical composition of rocks have determined favourable conditions to calcium-carbonate precipitation and the formation of travertine.

The waters of the S. Cristoforo di Labante's spring feed the homonymous waterfall that, together with the close by "cave of the Germans" represents the main tourist attraction of the area (fig. 6). Nearby, an abandoned mining pit has been converted to a resting place for tourists.

Fig. 5. Panoramic view of the Abbazia di Labante's landslide at whose foot the Aneva Torrent flows.

Fig. 6. The travertine waterfall near S. Cristoforo di Labante.

Regarding the structural-tectonic characters, the orographic setting is conditioned by a system of faults and fractures with a NW-SE direction at which various water courses have developed, divided by watersheds and structural scarps. The fault of the Riola village, that represents the most important element of that system, separates the outcrops of arenaceous lithologies into two sectors: the western one is characterised by counter-slope strata dipping towards N and NE; the eastern one characterised by along-slope strata dipping towards SE.

The buildings of the medieval village lie on top of arenaceous lithologies having a general counter-slope attitude of the strata. The western sector shows a higher relief energy and steeper slopes; the eastern one shows a relatively more gentle relief where, at some places, the slopes is a structural surface (fig. 7). Less steep slopes occur in the south-eastern sector where marls crop out.

The most abundant superficial deposits around Riola are scree deposits produced by physical weathering of outcropping sandstones and mobilised along slopes. Less abundant, although particularly important for instability, are landslide deposits, occurring mainly where pelitic sandstones of the Formazione di Antognola crop out. Landslide types are: rotational rock-slides, earth flows and complex landslides. In detail, a rotational rock-slide, clearly active, affect the south-eastern slope of Ribecco (from now on called "Ribecco landslide", identified by F1 in fig. 4). In the upper part of the slope, a few metres from the buildings, rock prisms can be observed, partially detached by their outcrop along sub-vertical surfaces from which other rock-falls and rock-slides might take place (fig. 8). Rock-fall deposits can be observed along the slope whose shape is characterised by many counterslopes. Somewhere trees are inclined. Moreover, witnesses and bibliographies refer about frequent remaking of the tract of the Provincial Road "Val d'Aneva" that borders the landslide foot. The causes of that landslide are probably related to tectonic-structural factors because, according to what Regione Emilia-Romagna – Servizio Geologico, Sismico e dei Suoli (2008) says, the area lies over the continuation of the Riola's fault and at the boundary between arenaceous and marly lithologies. On the basis of these data it is possible to assume the presence of a mechanical weakness that not only may have fractured the rock mass, but that may have also favoured preferential infiltration of superficial waters along sub-vertical fractures until the contact with underlying marls. Once saturated, marls could trigger slides that may destabilise also the overlying sandstones.

Fig. 7. Along –slope attitude of strata, given by a structural surface, NE of the medieval village of Riola (far left in the photograph). The bedrock is composed by pelitic sandstones of the Membro di Anconella.

Fig. 8. Panoramic view of the upper part of the Ribecco landslide. Note the detached rock prisms near the landslide scarp, very close to the buildings of Ribecco.

Probably a complex landslide (rotational slide and flow) has been identified east of Ribecco's landslide, south of Canevare: it affects the screes and it will be called, from now on, "Canevare's landslide", identified by F2 in fig. 4). The process, of limited extent, has been considered active due to the evident soil scars and to the slid earth lobes, not yet revegetated. The presence of water on the planar slope above could be the main cause of the landslide.

Two other relevant landslides can be observed on the slope between the Provincial Road Val d'Aneva and the Aneva Torrent. Particularly, the most extensive mass movement (13 hectares) is represented by the complex landslide east of Santa Maria di Labante at whose foot the locality of Abbazia di Labante lies ("Abbazia di Labante's landslide", fig. 5). Clues of activity can not be derived neither from interpretation of aerial photographs, nor from witnesses, nor from field survey. Moreover, bibliography data do not exist. It is a dormant landslide whose activation causes might be quite similar to those assumed for the Ribecco's landslide. The toe seems to have diverted the course of the Aneva Torrent.

A dormant rotational earth-slide can be observed at the eastern boundary of the area, at Casone del Papa ("Casone del Papa's landslide"). The source area is at the boundary between pelitic sandstones and clayey marls. Therefore, the cause of the movement could be the availability of water at the contact between the two lithotypes. Water seepage is favoured to reach the permeability threshold by the counterslope attitude of arenaceous strata.

Completing the framework of instability processes, four dormant landslides, of limited extent, occur north of Abbazia di Labante ("Abbazia's landslide"), south-west of Santa Maria di

Labante ("landslide SO of Santa Maria"), north of Ribecco ("landslide N of Ribecco") and at the northern boundary of the study area, east of La Casella ("La Casella's landslide").

4. GEOPHYSICAL INVESTIGATIONS

In order to characterise the area under the geological, seismic and geotecnical point of view, a specific gephysical campaign has been set up in the place where the buildings of the medieval village lie (and where refurbishment works are planned). The investigations were: 13 heavy penetrometries and 4 seismic refraction lines.

Penetrometries have shown the widespread presence of a superficial terrain with good geotechnical parameters, having different thikness and overlying the bedrock. Generally, the superficial terrain is composed by scree deposits made of fine silt and sandy silt, showing the lowest resistance values. Right below them, the terrain is more compact and with good resistance. The bedrock lies deeper down, where penetrometries stpped, showing high resistance values.

From a geotechnical point of view, the investigations have shown good resistance values for superficial deposits, rapidly increasing untill reaching the bedrock. The presence of water has never been detected.

The seismic refraction investigation has been undertaken in order to determine the stratigraphy of the upper ground, searching for the bedrock depth under the superficial detritical cover. The analysis of seismic data has identified 3 seismostratigraphic units. The most superficial one, associated to the scree deposits, is 1 to 4 metres thick. The second one, 2 to 5 metres thick, is partly related to scree deposits and partly to the weathering of the bedrock. The shape of the refraction surface is more or less similar to that of the ground. The third unit, from -3 to -9 metres below ground, can be related to the bedrock whose weathering and/or fracturing decreasing with depth.

Also during seismic investigations the presence of water has never been detected.

5. ANALYSIS OF GEOMORPHOLOGICAL HAZARD

According to PANIZZA (1987), geomorphological hazard can be defined as the "probability that a certain phenomenon of geomorphological instability and of a given magnitude may occur in a certain territory in a given period of time".

Therefore, a hazard analysis assumes the knowledge of the spatial distribution of instability phenomena (in this specifi case, ladslides) that occurred in the past in a certain area. Also their intensity and their reactivation frequency ("return period") should be known. It also implies another assumption: that insyability phenomena (landslides), already active in the past, reactivate in the same place, with similar intensity and with similar frequency. Although the assumption is not ideal, so far it is the only possible starting point to set up an hazard analysis, since the complex cause-effect mechanisms that rule the spatial and temporal evolution of landslides are not yet known.

Frequency and Intensity classes used for the matricial hazard assessment (from Panizza et al., 2004). Legend: Rp: return period; V: velocity; GS: geometric severity

Table 1

Frequency (F)	Return Period	Class
Very high (active)	< 1 year	Rp 5
High (frequent)	1 – 30 years	Rp 4

Medium (medium frequncy)	31 – 100 years		Rp 3
Low (less frequent)	101 – 300 yeras		Rp 2
Very low (rare)	> 300 years		Rp 1
Intensity (I)	*Velocity* (with reference to the velocity classes by Cruden & Varnes, 1995)		Class
Strong	> 3 m/minute (class 7 and class 6)		V 3
Medium	> 13 m/month and < 3 m/minute (class 5 and class 4)		V 2
Weak	< 13 m/month (class 3, class 2 and class 1)		V 1
Intensity (I)	*Thickness involved*	*Diameter of blocks*	Class
Strong	> 10 m	> 2 m	GS 3
Medium	> 2 – 10 m	> 0.5 – 2 m	GS 2
Weak	< 2 m	< 0.5 m	GS 1
Intensity (I)	*Combined intensity (Velocity x Thickness or Diameter of blocks)*		Class
Strong	V3xGS 3 / V3xGS2 / V2xGS3		I 6-9
Medium	V2xGS2 / V3xGS1 / V1xGS3		I 3-4
Weak	V2xGS1 / V1xGS2 / V1xGS1		I 1-2

Operatively, from the geomorphological map a thematic map has been derived where landslides and their hazard class have been highlighted. The derived map is called Geomorphological hazard map, (fig. 10). The implementation of this map made reference to the method applied by Panizza et al. (2004) and by Corsini et al. (2005) in South Tyrol (Italy) and by Castaldini D. & Ghinoi A. (2007) (in print) in the Modena Apennines. This method, derived from Heinimann et al. (1998), is based on a classification of the intensity and frequency of landslides (table 1). This is achieved by means of univocal matrix combinations which allow the definition of various levels of geomorphological hazard (fig. 9). The Heinimann et al. (1998) method is still used in Switzerland for landslide mapping and risk assessment (Loup & Raetzo, 2009).

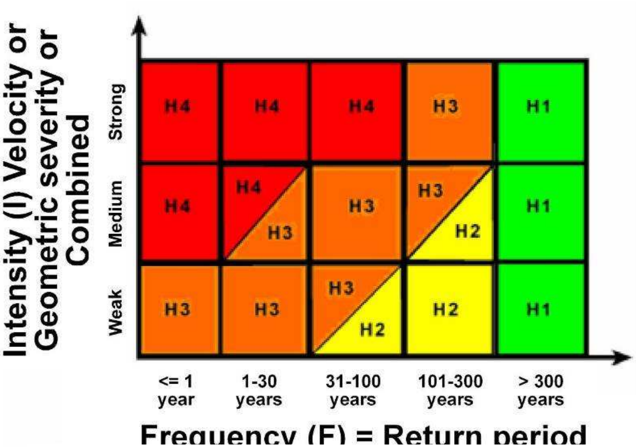


Fig. 9. Evaluation matrix for landslide hazard (from Panizza et al., 2004). H4 = very high; H3 = high; H2 = medium; H1 = residual.

The definition of hazard classes has been possible when quali-quantitative data were available for intensity and frequency of landslides. Moreover, where mitigation works have been done, a distinctive symbol has been used over the hazard color in order to point out that the hazard class assigned by the matrix can be reasonably lowered. When no data of intensity and frequency was available, the same symbol used in the geomorphological map has been assigned to the landslide.

The hazard characters of the area, shown in the Geomorphological Hazard Map (fig. 10), are described below, only for those phenomena whose activity clues were surely available.

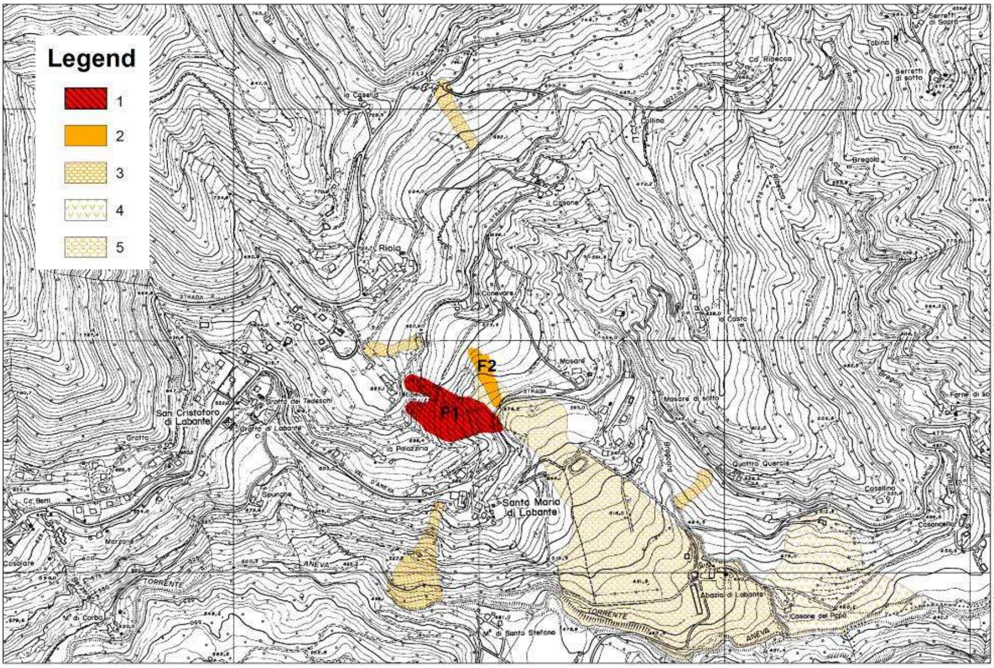


Fig. 10. Geomorphological Hazard Map of the study area. Legend: 1) Hazard class H4, very high, with mitigation works; 2) Hazard class H3, high; 3) dormant landslide body due to flow; 4) body of dormant rotational earth-slide; 5) dormant body of complex landslide; F1) Ribecco's landslide; F2) Canevare's landlside.

5. 1. Ribecco's landslide (F1)

Regarding the rotational slide of Ribecco, the return period was deduced by articles from newspapers where evidences of reactivation have been witnessed in 1996 and 1997. Therefore, the landslide has been assigned the class Rp4 (from 1 to 30 years). Moreover, witness and bibliography sources (Cardinali et al., 1998) refer to frequent remakes (also during the last years) of the tract of the Provincial Road "Val d'Aneva" that borders the landslide's foot. The landslide thickness has been assumed by the observation of the dimension of unstable blocks at the source area (from 2 to 10 m): therefore, the intensity class relative to just the geometric severity is GS2 (medium).

Velocity is that of quick rotational slides, similar to that of rock-falls, assumed from the same newspaper articles according to which the 1996 movement was heard by a big sound, typical of a sudden collapse. The intensity class relative to velocity is V3 (high). The combined intensity class is therefore I6 (high). The hazard class is H4 (very high).

From CARDINALI ET AL. (1998) it can be known that drainage works and other mitigation works were done after the second reactivation of January 1997: therefore, it has been chosen to put the mitigation symbol on top of the hazard colour, in order to reduce the matrix hazard degree.

From the field survey it is evident how the source area shows signs of potential reactivations, characterised by a retrogressive incipient movement.

5. 2. Canevare's landslide (F2)

For this phenomenon, evidence were found only from field survey. Particularly, the fresh soil fractures and the accumulation lobes not yet vegetated lead to assume the landslide active, in the short period. Therefore, the return period Rp4 (from 1 to 30 years) has been assigned to it. The thickness seems not to be greater than 2 metres, which lead to assign to it the intensity class GS1 relative to just the thickness of the slid mass. The velocity, assumed to be similar to that of earth-flows with medium-to-low fluidity, considering the short length of slope affected, should not be higher than 13 m/month, from which an intensity class V1 (low), related just to velocity, can be assigned. The combined intensity class is therefore I1 (low). The hazard calss is H3 (high). The extent of the phenomenon is anyhow quite small. To be noted is the presence of a counterslope upword from the landslide, with water ponds, which could favour the retrogressive evolution of the landslide. For this reason it should be useful to realize a proper water drainage in order to avoid infiltration that could lower the mechanical resistence of the terrain leading to possible slides.

6. REMARKS AND CONCLUSIONS

The data obtained during this study, represented in the Geomorphological map (fig. 4) and in the Geomorphological hazard map (fig. 10), are sometimes different from those recently published in "official" geological documents. Particularly, substantial differences between the geological maps of REGIONE EMILIA-ROMAGNA – SERVIZIO GEOLOGICO, SISMICO E DEI SUOLI, (WEB SITE) (fig. 3) and the Geomorphological map (fig. 4) attain to landslides. In detail, in this study the Ribecco (F1) and Canevare's (F2) landslides have been mapped and classified in a different way. Moreover, the La Casella's landslide and the N-of-Ribecco's landslide have been newly mapped, since they were not identified by the regional geological map. The same thing applies to the Casone del Papa's landslide, previously identified as scree deposit. The landslide SO of Santa Maria, previously identified as slide, has been reinterpreted as complex.

Examining the Carta del Dissesto di Provincia di Bologna, i.e., the Instability Inventory Map of the Bologna Province (2004) (fig. 11), the area between Ribecco and Santa Maria di Labante is partly identified as instable (zone 1 in red) and partly as evolving towards instability (zone 2 in yellow). Practically, that area corresponds to the sector occupied by the Ribecco's landslide (F1), by the Canevare's landslide (F2) and by the upper part of the Abbazia di Labante's landslide within the Geomorphological map (fig. 4) and within the Geomorphological hazard map (fig. 10).

Moreover, the Instability Inventory Map of the Bologna Province (2004) identifies the whole sector between La Casella and the Aneva Torrent, therefore also the medieval village of Riola, as an area with a very high landslide risk (R1). Differently, the detailed geomorphological survey and the geophysical investigations undertaken for this study have pointed out that: i) the north-eastern portion of the study area is characterised by a superficial bedrock and it might be affected just by very superficial soil-slips/flows; ii) the area with very high or high landslide hazard is limited to the Ribecco (F1) and Canevare's (F2) landslides, therefore the relative risk can be circumscribed to Ribecco, due to the retrogression of the landslide scarp.

Therefore, following the results of this study, the area classified as of very high hazard (R1) by the Instability Inventory Map of the Bologna Province (2004) should be re-examined and its extent very much limited.

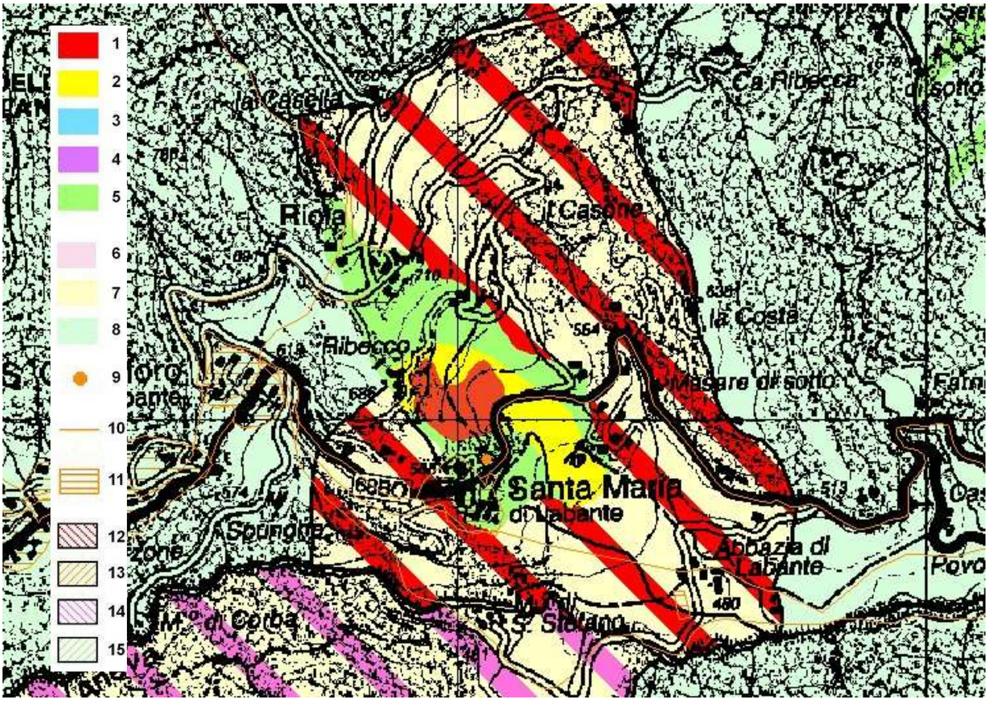


Fig. 11. Instability Inventory Map of the study area (Extract from Provincia di Bologna, 2004). Legend: 1) Zone 1: instable area; 2) area where the instability phenomenon might evolve to; 3) area on which the instability phenomenon might have an influence; 4) area to be subject to controls; 5) area where the evolution of the phenomenon might have an influence; 6) Elementary Hydrogeological Unit (EHU) not suitable for urbanistic use; 7) EHU to be verified; 8) EHU suitable, or with few limitations, to urbanistic use; 9) dwellings, manifacture and industrial sites; 10) cattles and transformation of agricultural products, urbanistic planns; 11) graveyards, architectural assets, highways, state amd strategic roads, railways, aqueducts, sewer network, depurators, dumpings; 12) EHU at very high risk; 13) EHU at high risk; 14) EHU at medium risk; 15) EHU at moderate risk.

In conclusion, the differences between the detailed geomorphological survey undertaken for this study and the geological map published by the REGIONE EMILIA-ROMAGNA – SERVIZIO GEOLOGICO, SISMICO E DEI SUOLI (WEB SITE), basis for the Instability Inventory Map of the Bologna Province (2004), reveal how the geological maps often give more importance to the spatial distribution of landslides than to their state of activity. The latter often varies within the same landslide body, affecting the definition of risk and, therefore, the validity of cartographic documents officially used in territorial planning.

The main limit of the official instability cartography is that it generates planning constraints at municipality scale starting from a base cartography that has a lower degree of detail (lower scales) and that most of the times is not conceived to analyse hydrogeological hazards. Often, detailed investigations at municipality scale are missing, although they would be necessary in order to verify what is mapped in higher-rank territorial planning.

A detailed geomorphological analysis undertaken using the methodology here proposed should be adopted and encouraged in order to improve the official planning maps. Besides the geophysical investigations, that here have had the only aim of improving the survey's results, the easy and replicable hazard analysis based on the Heinimann's matrix (Heinimann et al., 1998) would be more than sufficient to better define the hydrogeological (and, in particular, landslide) hazard and risk framework. If adopted at municipality scale, this methodology could lead to a reduction of areas to verify, as it has been shown in this study. In this specific case, the study has allowed to punctually define landslides and landslide hazard in the area surrounding the medieval village of Riola, pointing out that no landslide hazard affects the village whose exploitation may therefore undergo transformation works.

R E F E R E N C E S

1. Annovi, A. (1975), *Lineamenti geologici della zona di Montese-Riola e analisi delle facies (Appennino modenese e bolognese)*. Atti Soc. Nat. MAT. di Modena, 106, 157-169.
2. Annovi, A. (1980), *La geologia del territorio di Montese (Appennino Modenese).* Memorie di Scienze Geologiche, Vol. XXXIV, 67-84.
3. Bettelli, G., De Nardo, M. T. (2001), *Geological outlines of the Emilia Apennines (Italy) and introduction to the rock units cropping out in the areas of the landslides reactivated in the 1994-1999 period.* Quad. Geol. Appl., 8(1), 1-26.
4. Boccaletti, M., Coli, M., Decandia, F. A., Giannini, E., Lazzarotto, A. (1981), *Evoluzione dell'Appennino settentrionale secondo un nuovo modello strutturale*. Mem. Soc. Geol. It., 21, 359-373.
5. Cardinali M., Cipolla, F., Guzzetti, F., Lolli, O., Pagliacci, S., Reichenbach, P., Sebastiani, C., Tonelli G. (1998), *Catalogo delle informazioni sulle località italiane colpite da frane e da inondazioni. Vol. I Frane e Vol II inondazioni.* CNR. Tip. Grifo Perugia.
6. Castaldini, D., Ghinoi, A. (2007), *Geomorphological Hazards Affecting Main Productive Areas in the Mountain Basin of the Panaro River (Modena Apennines, Italy): a Case Study.* Analele Universitatii din Oradea, Seria Geografie, tom. XVII, Editura Universitatii din Oradea 2007, ISSN 1221-1273, 11- 20.
7. Castaldini, D., Ghinoi, A. (in print), *Studio della pericolosità geomorfologica in aree produttive del bacino montano del Fiume Panaro (Appennino Settentrionale).* Bollettino della Società Geografica Italiana. In stampa.
8. Cerrina Feroni, A., Martelli, L., Martinelli P., Ottria, G., Catanzariti, R. (2002), *Carta Geologico Strutturale dell'Appennino Emiliano-Romagnolo. Scala 1:250.000.* Regione Emilia-Romagna-CNR, S.EL.CA., Firenze.
9. Colombetti, A. (1975), *Cenni geomorfologici del territorio di Zocca-Castel d'Aiano (Appennino Modenese-Bolognese).* Ateneo Parmense, acta nat., 11, 617-637.

10. Corsini, A., Mair, V., Panizza, M. (2005), *Aspetti concettuali e operativi per la realizzazione di carte di pericolosità idrogeologica: l'esempio della metodologia CARG - Provincia Autonoma di Bolzano per il Foglio 028 "La Marmolada*. In: E.M. Ferrucci E O. Zani (a cura di). Atti del Secondo Forum Nazionale "Rischio di frana e assetto idrogeologico nei territori collinari e montani: Questioni, metodi, esperienze a confronto. Ambiente & Territorio, Maggioli Editore, 124, 49-74.

11. Gruppo di Lavoro per la Cartografia Geomorfologica (1994), *Carta Geomorfologica d'Italia 1:50000: guida al rilevamento*. Servizio Geologico Nazionale. Quaderni serie III, 4, 47 pp.

12. Heinimann, H. R., Holtenstein, K., Kienholz, H., Krummenhacher, B., Mani P. (1998), *Methoden zur Analyse und Bewertung von Naturgefahren*. Umwelt-Materialien Nr. 85, Naturgefahren, Buwal, Bern, 248 pp.

13. Loup, B., Raetzo, H. (2009), *Landslide mapping and risk assessment. The Swiss guidelines*. In: Malet J.-P., Remaitre A. & Bogaard T. (Ed.s), *Landslide processes. From geomorphologic mapping to dynamic modelling*. Proceedings of the Landslide processes Conference, 6-7 February 2009, Strasbourg, France, CERG Editions, Strasbourg France, 311-314 pp.

14. Panini, F., Bettelli, G., Pizziolo, M. (a cura di) (2002), *Note illustrative della Carta Geologica d'Italia alla scala 1:50.000, Foglio 237 Sasso Marconi*, S.EL.CA. s.r.l., Firenze, 176 p.

15. Panizza, M. (1987), *Geomorphological hazard assessment and the analysis of geomorphological risk*. In "Intern. Geomorph.", 1, J. Wiley & S., London.

16. Panizza, M., Corsini, A., Marchetti, M., Pasuto, A., Silvano S., Soldati, M. (2004), *Cartographie du risque de mouvements de terrain au Tyrol du Sud*. In: Y. Veyret, G. Garry & N. Meschinet de Richmond (eds.), *Risques naturels et aménagement en Europe*. Armand Colin, Paris, 131-142.

17. Provincia di Bologna (2004), *Piano territoriale di coordinamento provinciale*. CD-Rom.

18. Regione Emilia-Romagna – Servizio Geologico, Sismico e dei Suoli (web site) – *Cartografia geologica on-line – Il progetto CARG*.

19. http://geo.regione.emilia-romagna.it/

VULNERABILITY OF CLUJ URBAN AREA TO CONTEMPORARY GEOMORPHOLOGIC PROCESSES

I. A. IRIMUŞ[1], D. PETREA[1], I. RUS[1], ANA-MARIA CORPADE[1]

ABSTRACT. – **Vulnerability of Cluj Urban Area to Contemporary Geomorphologic Processes.** The paper points out the dynamics of Cluj urban space during the last ten years and the environmental impact induced by the deficient management of the local authorities, through the Urbanism Commission. A chaotic municipal development got installed as a result of the conflict of interest between the *technical approach*, defining extension feasibility, *political implications*, based on domination and on the tendency to crumble the local stakeholders groups and *public involvement*, in the majority of cases opposing projects, but rather insufficiently aware of the importance of planning decision-making. Utility services (water supply and sewage systems, electricity, telephone, road infrastructure) were extended without assessing the territorial support capacity, without preserving natural areas (forests, pastures) and without obeying the General/Zonal Urbanistic Plans that were in many cases modified in relation to the influence "power" of the beneficiary or of the constructor). The geographic environment answered to the aleatory impact of the human interventions with increases in the lineary (slope flow, gullies) and areal (slopping, landslides, land settling processes) erosion. The elaboration of the present paper followed several steps: delineation of the urban perimeter (1990, 2004, 2008) and establishment of the rapport between built areas and the total surface through ortophotoplans, cadastral and topographic maps analysis; mapping the contemporary geomorphologic processes and the areas affected by older land instabilities; elaboration of the vulnerability map of Cluj built up area.

Keywords: *vulnerability, urban space, geomorphologic processes, Cluj-Napoca.*

1. INTRODUCTION

Vulnerability expresses the damaging consequences of a certain event on the natural or human components, as it is stipulated in Environmental Dictionary, 1991. Vulnerability could de human, socio-economical or environmental and, by pointing out the possible damages, it describes the resistance capacity of a building against physical phenomena in general and against geomorphologic events in particular.

Dauphiné (2001) considers that vulnerability "expresses the level of natural phenomena predictable consequences upon the exposed human and technogene structures (those with residential or shelter function).

The geomorphologic parameters impose the development limits of Cluj urban system through geomorphologic favorability (stability) or restrictiveness (increased vulnerability to mass movement processes or to linear erosion). The analytical vulnerability urges a detailed analysis of the exposed elements, each of them being further awarded with a precise assessment of the implied damages or injuries according to the focused hazard (process) type. Complex quantitative studies allow nowadays the estimation of immediate or long-term costs for damages, reconstruction or vulnerability mitigation measures.

[1] *Babeş-Bolyai University, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail: irimus@geografie.ubbcluj.ro*

Vulnerability imposes increased responsibility on the behalf of various decision makers: politicians, technicians, scientists, researchers, local administration, NGOs, local community.

Politicians, by including such issues in their agenda, stir public attention and endow these topics with increased importance. At the same time, they play an important role in persuading communities on the utility of some regulations or measures in the field of risk management with implications at the vulnerability state level. Risks could serve as alibi in imposing power on the behalf of certain pressure groups.

Scientists and technicians involvement is meant to define notions and concepts, to reveal and assess potential damages, jurists participate in laws elaboration, while national and local administrations take charge of enforcing them.

Urbanists and planners should underline the consequences of human arrangements at risk and propose modalities to integrate risks into territorial management politics and strategies.

NGOs involvement varies in relation to the extent to which environmental dysfunctions are perceived, but also to the way they succeed in promoting their message within the local community.

Population is more or less informed and more or less determined to take into consideration environmental risks in general, thus also the geomorphologic ones. Vulnerability is an extremely complex notion, implying physical, technical, psychological, social or political aspects. Scientific or technical arguments are certainly not enough to define them properly.

Cluj urban system presents various dysfunctions induced by its exposure to some natural risk factors: land slides, solifluxion, land settling, slope flow. The presence of salt and gypsum in the territories that have recently joined Cluj built up area (Apahida, Mănăştur Vest, Mănăştur Sud) complicates the natural processes dynamics by increasing their development. The actual processes affect both the superficial deposits (disturbed through previous dynamic activities) as well as the bed rock. Downward slopes deposits with various lengths get activated (from some meters to some tens of meters), the intervention with corrective measures being in the majority of cases post-occuring and thus extremely expensive and with uncertain results.

2. METHODOLOGY

The proposed ways for assessing Cluj urban space vulnerability to contemporary geomorphologic processes induced by the new residential ensembles construction are based on determining risk thresholds, strongly related to land use types and to designed building characteristics. This approach supposed that vulnerability maps were elaborated describing land cover and the correspondent vulnerability level for each land use type, as well as for each construction type, in relation to the held geotechnical permits and to their height regime (GF + attic, GF + 1F + attic, GF + 2f + attic etc.). In this respect, our approach aimed in comparing Local Council Decisions with the existing territorial situation and identifying territorial dysfunctions generated by disagreements between local urbanistic plans and the issued construction authorizations. The following methodological steps were achieved in order to establish Cluj urban area vulnerability: identification of the historical and geographical premises shaping the contemporary morphodynamics; correlation between Detailed Urbanistic Plans and Zonal Urbanistic Plans in Cluj built up area in order to identify disagreements between Construction Authorizations and the legal urbanistic status of the focused buildings; identification of the areas exposed to land settling, land slides and mud flows, to dissolution or land collapses; distribution of the identified processes on several classes in relation to slope inclination through diagram and matriceal method (at a cell dimension of 25.000 m^2); correlation of processes frequency (signs of instability) with total urban area and calculation of the instability index Ii by using the CERG formula: Ii = Fi /F x Si/S, where Fi – total amount of instability signs/each instability process, S – periurban total area; Ii – instability index; vulnerable areas ranking (high, middle, low) and elaboration of the urban area vulnerability map in relation to geomorphologic processes.

3. HISTORICAL AND GEOGRAPHICAL PREMISES OF CLUJ BUILT-UP AREA CONTEMPORARY MORPHODYNAMICS

The name Cluj derives from the Latin Castrum Clus, first used in the 12th century to designate the city's medieval fortress. The toponym Clus means "closed" in Latin, being related to the hill units that surround the city and define its morphology. Another accepted hypothesis relates the name to the German words Klaus or Klause (meaning mountain pass). The city is also known by its Hungarian name Kolozsvár, as well as by its German one Klausenburg. Klausenburg was one of the seven medieval fortified Saxon cities in Transylvania (in German *Siebenbürgen*, meaning seven fortresses). The first Romanian name of the city was Cluş, sometimes written also as Klus. The city became known by its Romanian name Cluj after becoming part of the Kingdom of Romania in 1918. The city's name was changed to Cluj-Napoca in 1974, Napoca being the first name of the settlement, under Romans.

The favored geographical position of the municipality settled along Someşul Mic River is confirmed by the functions it performed during history or by the attributes it was endowed with by geographers, historians, economists or politicians. Cluj is described by a contradictory dynamics, its functions during various epochs being mirrored in the way it was referred: "gorge" town or Klus, town at the intersection of the commercial roads, transit town, multicultural town etc. (Fig. 1).

Cluj-Napoca municipality is located in an orographic convergence area (Apuseni Mountains, Someşan Plateau, Transylvanian Plain), at the intersection of parallel 46° 46' North with meridian 23° 36' East, in 2009 lying on 179,5 km². The urban area belongs to Someşul Mic morphohydrographic basin, respectively to its tributary valleys Nadăş, Popeşti, Chintău, Borhanci and Popii. Towards southeast, Cluj built up area develops on the inferior, middle and upper terraces of Someşul Mic River and on the northern slope of Feleac Hill, in altitude ranging between 300-332 m at the level of the river flat (2-6 m relative altitude) and 825 m, the maximum height reached in Sălicea Hillock. To the east, Cluj periurban border comes into contact with the Someş Plain, while the north is marked by a hilly alignment belonging to Clujului Hills, Viilor Hill - Lombului Hill (684 m) - Sfântu Gheorghe Hill - Melcului Hill (617 m) - Chintăului Hill (633 m), as well as by the middle and upper terraces of Someşul Mic and Nadăş. To the west, Cluj *intra muros* area is pointed by Hoia Hill (506 m) and Gârbău Hill (570 m), on the left, respectively on the right side of Someşul Mic. Calvaria and Cetăţuia Hills were sometime outside the town's borders, now they are inside.

The litologic and tectonic premises contribute and at the same time influence Cluj built up area development and extension. The geologic substratum belongs to Paleogene, Neogene and Cuaternary (Fig. 2). The Paleogene is represented in this region by the *Călata, Turea and Plain groups.*

Fig. 1. Cluj-Napoca General Urbanistic Plan (2009).

The *Călata Group* afflorates through the *Valea Nadăşului Formation* (Popescu, 1978), known in the past under the generic mame "upper variegated clay serie" (Obere bunte Thonschichtenmit mit dem mittleren Horizonte des Susswasserkalkes – Koch, 1894). *Valea Nadăşului Formation* implies two sequences: a lower sandy one, ranging in thickness between 12 and 20 m and an upper one of 50-70 m, made up of red siltic clays with lenticular or stratiform intercalations of green clays, sands or microconglomerates. The transition to the *Jebucu Formation* is marked by some thin dolomicrites layers and the prevalence of green clays.

The Turea Group is represented by the following formations: Cluj Limestone (of Preabonian age, in its upper part being made of calcarenites with thin marls intercalations, total thickness 10 – 25 m), *Brebi* or the Strata with Bryozoans (oolitic-carbonatic layer rich in Bryozoans, mollusks and foraminifers), *Hoia Limestone, Mera, Dâncu,Hoia and Hida*.

The Hoia Limestone is a skeletal packstone which appears locally and even if its thickness does not exceed 2 m it hosts one of the richest Paleogene fossil associations in Transylvania. The Mera Formation is characterized by two layers with Scutella subtrigona, litostratigraphic landmarks for the entire Transylvanian Basin northwestern area. The *Dâncu Formation* consists of clays, marls, with charcoal intercalations that marks the upper part of the "Ticu strata" and with variable thickness (2 – 3 m in Cetăţuia Hill). The *Gruia*

Formation (Rusu, 1989) covers the *Dâncu Formation*, its most representative component being the arenitic packstone (known as Cetate Strata, according to Hauer and Stache, 1863). Two litostratigraphic sequences are still to be mentioned: an arenitic one (the Gruia Strata) and a sandy-caolinitic one (the Var Strata). The Griua Formation thickness ranges between 20 and 25 m and is made of sandstones and sands interbedding with lenticular or stratiform lumaselic rocks. The *Hida Formation* consists of some Ottnangian epiclastic rocks, with regressive character. They were identified in the north of Chinteni village.

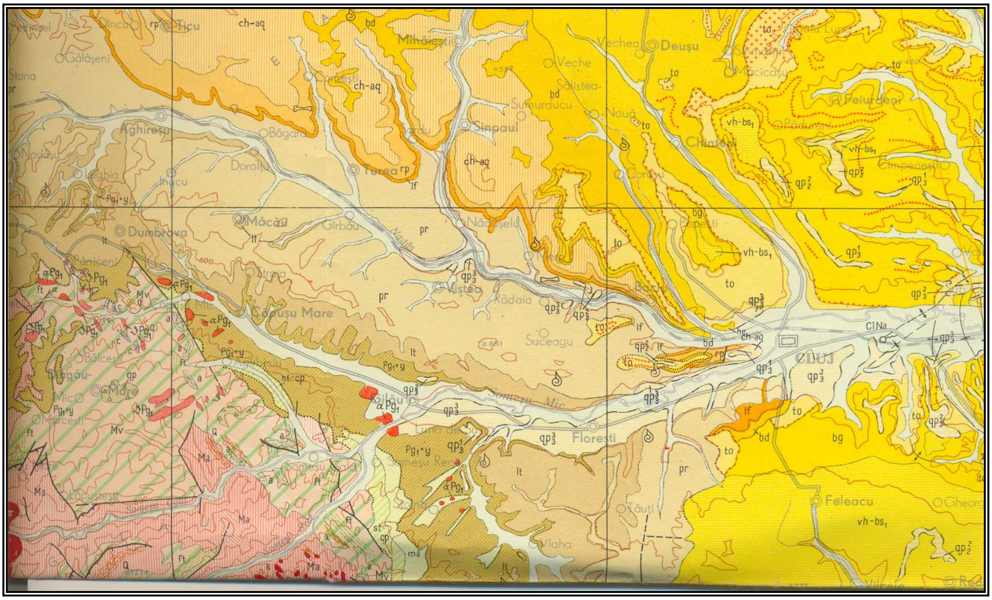


Fig. 2. Cluj Geologic Map, scale 1:200 000.

The Plain Group is represented by the *Dej Fomation, the Ocna Dejului Formation (Meszaros*, 1991*), the Iris Formation (Filipescu, 1999) and the Feleac Formation.*

The *Dej Formation* consists of rough epiclastic rocks interbedded with some conglomerates that sometimes exceed 0.5 m in diameter (Popeşti Valley). Over this detritic layer, a pelitic packrock lays down, with foraminifers that prove its Low Badenian age, being topped by some cyneritic and terigen deposits (the Dej Tuff).

The Ocna Dejului Formation (Meszaros, 1991*)* is an evaporitic unit that is associated with the salinity crisis that has generated the important Transylvanian salt deposits. This formation appears in the Becaş area, under the form of some stratiform gypsum intercalations, and along Chinteni and Popeşti Valleys with some lenticular developments. At Someşeni, the salt deposits come directly into view or are responsible for the appearance of some salty springs.

The Iris Formation (Filipescu, 1999), formed under marine conditions in the lower Badenian, is mainly made of marls and clays with thin volcanic tuff intercalations, outcropping in the quarry that serves the Bricks Factory (at the intersection between Fabricii and Muncii streets).

The *Feleac Formation* is a rather rough detritic unit consisting of alternating sandstones, sands and sometimes clays. A specific feature is the presence of some spherical concretions, of Upper Sarmatian age, also known as ‘growing stones”.

The Badenian and Sarmatian deposits cover the most part of the Cluj eastern area (Iris, Someşeni, Gheorgheni, Bună Ziua, Mărăşti, Borhanci).

Pleistocene deposits developed on the middle and low terraces, while river flats are characterized by the presence of Holocene alluvial deposits made of gravels and sands.

From the tecto-structural point of view, Cluj built up area develops at the contact between the monoclinal formation of the Someşan Plateau, the marginal diapiric folds of the the Transylvanian Plain (according to Irimuş, 1998, quoting L. Mrazec) and the Western Carpathians through its crystalline apophysis, the Feleac Hill. The diapiric formation appears as a succession of syncline and anticline units, being relevant in the new residential districts Someşeni and Apahida. Another tectonic feature describing this eastern area is the presence of an anticline macrofold, probably associated to various parallel faults screened by the alluvial deposits of Someşul Mic meadow.The north-south orientation of the diapiric fold as well as its strong compression from east to west, induced salt deposits outcropping and at the same time explains the increased neotectonic activity in the Transylvanian geographic space and in Cluj area also.

The geomorphologic premises point out the restrictiveness or favorability induced by relief factors in the development of Cluj built up area.

The Modern Age and especially the industrialization period determines the town spreading on both directions, east-west (tendency that is still dominating) and north-south, the middle and upper terraces being gradually occupied: terrace IV (Mănăştur, Clinicilor, Andrei Mureşianu), terrace V (Colina, Dealul Gol, Central, Eroilor Cemetery, Botanic Garden), terrace VI (Zorilor District, Mănăştur Forest, Bisericii Forest), terrace VII (identified as remains of the terrace tread in Borhanci, Sopor, Lomb Hill and Sfântu Gheorghe Hill). Terraces have always represented the most favorable geomorphologic units to human activities because of their increased tectonic and neotectonic stability, of the available potable water deposits. At the same time, they are out of flooding risks (excepting the catastrophic hydrologic events), the soils are suitable for agriculture, low inclination on their flat components (2-5%) and thus slow denudation.

Slopes geodeclivity ranges between 5 and 15% in a proportion of 53.75%, being included in the category of slopes with average inclination. The 15.1-35% inclination category shares only 3.84%. The most relevant example in this respect is the cuesta front of the Hoia Hill – Cetățuia. As geomorhologic units, slopes are extremely active morphodynamically through inclination, exposure, vegetation cover or contemporary human impact (road and public services infrastructure, tourism arrangement etc.). Linear (gullies, torrents) and areal (creep, land settling, land slides, land flows, pseudosolifluxions) geomorphologic processes fragmentize these morphogenetic components, the relief fragmentation values ranging here between 0.75 and 2.75 Km/Km^{2}. Increased morphodynamics appears especially on slopes developed on marls alternating with cineritic deposits (tuffs) or clays and covered with pastures, hayfields, degraded pastures or agricultural fields (Becaş, alond Chinteni, Popești, Gârbău, Pleştii watercourses, Hoia Hill – inside the Transylvania Ethnographic Museum, the land slides from Eremia Grigorescu, Dragalina or Uliului Streets, that near the Bricks Factory or those in Sălicea, Europa district, Groapa Moşului etc.

The hydro-climatic premises participate to some extent to the development of Cluj urban area. The freatic aquifer, with a thickness varying between 1 and 11 m, benefits from a favorable porosity, with values ranging between 0.15 and 0.27. The transmissivity of the freatic layer in the Someşul Mic river flat reaches values up to some hundreds of m^2/day. Underground waters keep within the allowable potability limits. The lack of public investments in pluvial drainage systems, as well as the deficient Detailed or Zonal Urbanistic Plans, induces dysfunctions in the water resources management.

Cluj-Napoca urban and periurban area is featured by very diverse characteristics of the active surface, fact that is mirrored in the diversity of the existing topo- and microclimates. The topoclimate of slopes with southern exposure (the hills Lomb, Sfântu Gheorghe, Fânațe, Hoia-Cetățuia) is characterized through increased temperature variations and intense local air flow. The topoclimate of slopes with northern exposure (Hoia-Cetățuia and Feleac Hills) presents lower thermic variations and increased local air flow. The meadow topoclimate is described by daily thermic variations, temperature inversions and increased frequency of winter phenomena that affect especially slopes' lower sectors. The urban topoclimate conditions come to justify the attribute that almost all large towns are endowed with, "heat island": decreased air moisture, air flow directed along roads, higher air temperatures.

The situation of the monthly average temperatures indicates a minimum in January (-3.4^{0}C) and a maximum in July (+ 18.6^{0}C). The highest temperature registered at Cluj-Napoca meteorologic station was 37 ^{0} C at 11 August 1994 and the lowest one -34, 2 ^{0}C on 23 January 1963. The seasonal average values of the relative air humidity are 85% in winter, 73% during spring, 76% in summer and 82% during autumn. The precipitations regime indicates a maximum during summer - 246.1 mm, 146.8 mm in spring, 108.8 mm in autumn and 80.6 mm in winter. The average number of the days with precipitations is 139.4 938.2‰, the maximum frequency being registered in May and the lowest in September. Maximum amounts of daily (63.2 mm on 14 June 1989) and monthly precipitations were registered in June, while the absolute minimum values correspond to February and September. The atmospheric precipitations might induce climatic risks both through surplus or deficit. The average duration of the snow cover varies between 90 days (1985) and 5 days (1972), while its thickness ranges between 3 and 13 cm, the maximum value having been registered in February 1984 – 57 cm.

Biogeographical premises. The urban space morphology also mirrors the soil and vegetation interferences. The natural or semi-natural spontaneous vegetation is better represented in the periurban area, but even there it feels intense human-induced changes. In the urban space, the ruderal and segetal vegetation is widely spread in relation to the human interventions intensity (Cristea, 2002). The increased urbanization contributed, beside agriculture, to natural ecosystems fragmentation. Forests, with the most important role in antierosion, appears in 2009 as isolated fragments, many of the approved Detailed and Zonal Urbanistic Plans contributing lately to this phenomenon (Făget and Mănăştur Forests). Shrubs associations, also with antierosional role, are dominated by blackthorns and hawthorns (Hoia and Melcilor Hills, Mănăştur Forest), while on the southern slope of the Hoia Hill, some associations of *Prunetum tenellae* and *Crataegeto-Prunetum fruticosae* were identified, probably penetrated from the plain area. Some files of water buffalo in the Central Park and in the "Iuliu Hațieganu" Park remind of the former young forests, while the plantations on the slopes of Melcilor and Sub Coastă Hills or those on the left slope of Pleştii Brook, with black and red pines, spruce trees, white and Douglas fir trees, red oak trees, were meant to reconstruct the protection forests that once existed there. As regarding soils, within the urban area they were profoundly modified: alluvial soils in river meadows, cambic chernozems, carbonatic phaeozems on slopes, gleic and pseudogleic hydromorphic soils, intrazonal halomorphic soils etc.

The socio-economic premises explain the increased human pressure and their consequences on the urban geomorphosites. The deficient urban management has generated important landscape dysfunctions induced mainly by contemporary geomorphologic processes.

4. CLUJ BUILT UP AREA MORPHODYNAMICS

In order to identify the way Cluj-Napoca manifests its urban functions, our approach has focused on the rapport between landscape offer – public services availability and costs – land acquisition price – land stability / instability on short, average or undefined term.

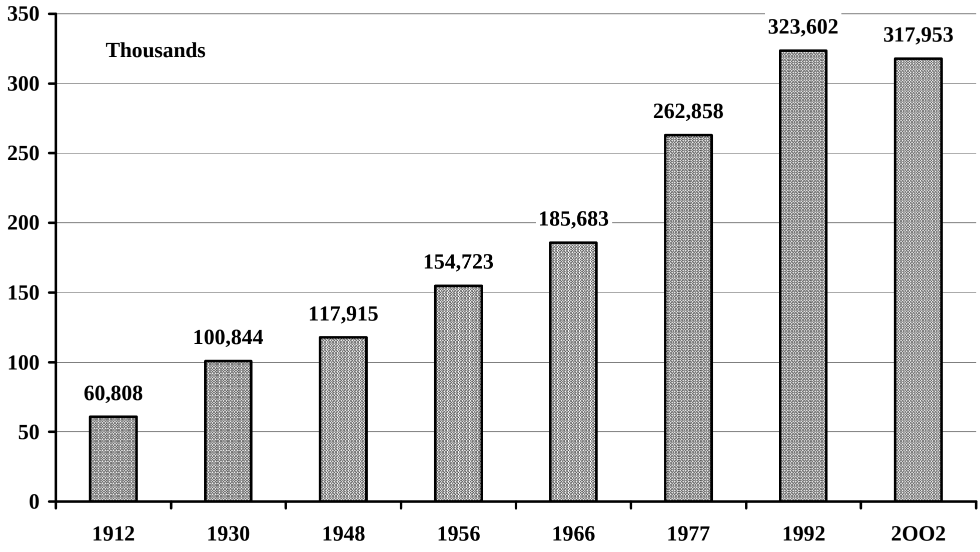


Fig. 3. Population Dynamics in Cluj – Napoca Municipality.

In 1930, Cluj-Napoca had 103.800 inhabitants, being the second town in Romania according to the population number, alongside Iaşi and Galați. In 1992, Cluj-Napoca keeps this second place, being one of the seven towns in Romania that exceeded 300.000 inhabitants. The demographic growing (Fig. 3) determined increasing needs for locational space. At the same time, the modern tendencies to divide familial nuclei have also participated to the housing crisis.

Between 2005 and 2009, the Local Council has issued (source www.primariaclujnapoca.ro) 3357 construction authorizations for new constructions, extensions or improvements to existing ones. The table and diagram in Figure 4 describes the relation between authorization requests and the Municipal Local Council Decisions that establish authorization issuance during 2005 and 2009.

By correlating the information in the Detailed Urbanistic Plans (DUP) with that in Zonal Plans (ZUP) and in the General Urbanistic Plan (GUP), important disaccords were registered. The major ones appeared in DUPs, as these plans were modified each time the owner requested it, changes being approved related to access roads, built area, building regime, green space arrangement etc. Buildings that according to their Construction Authorization should have had 1 floor, in reality have 5 or 7 floors, the minimal geodesic and technical norms being ignored and becoming thus exposed to technological and geomorphic risks (such situations were identified on the streets Edmond Nicolau, Negoiu, Dimitrie Gusti, Huedinului, Basarabiei, Baltag, Cezar Petrescu, Lombului, Fânațelor, Pometului, Uliului, Măceșului, Arțarului, Fagului, Busuiocului, Spicului, Cosminului, Odobești).

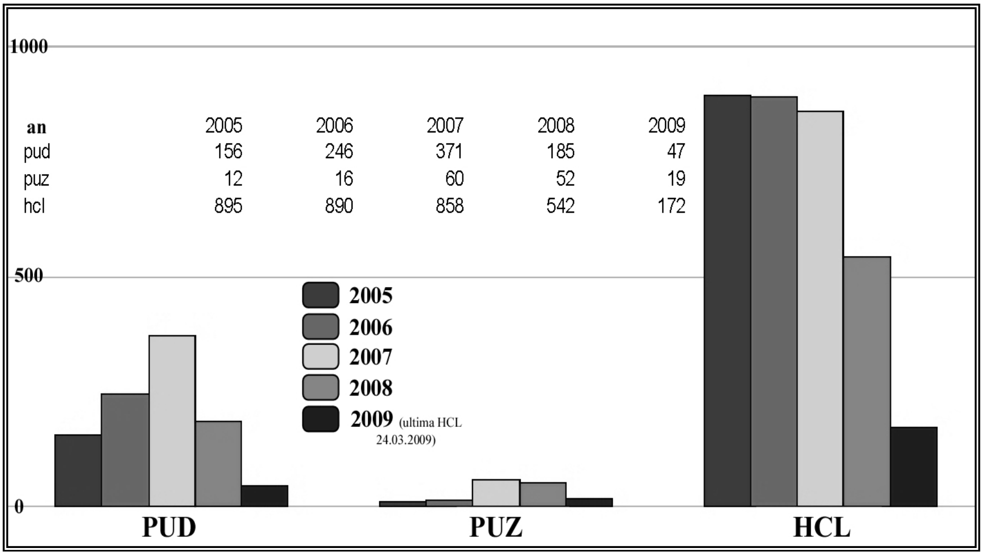


Fig. 4. Cluj Urban Dynamics as reflected in DUPs, ZUPs, LCDs.

The real estate development determined the extension of the built up area as well as changes in the urban functions. The built up area dynamics (1960 -148. 8 Km^2, 1989 – 159. 1 Km^2, 2009 – 179. 5 Km^2) points out certain periods as the industrialization (1960 -1989) or the modern times with changes in life style that induced the gradually incorporation of the neighboring periurban areas to the urban body (Fig. 5). The urban aggression against the *extra muros* territory might be estimated by analyzing land acquisition costs on the one hand (12 \$ / m^2 in 1998; 15-20 Euro/m^2 in 2000-2002; 250-400 Euro/m^2 in 2007-2008) and the intense competition between constructors, on the other. The deficit in qualified workforce (attracted by the delusion of the occidental salaries on the building yards in Portugal, Spain, Ireland or Italy) brought on the Cluj building yards unqualified workers and investors with various formations, from IT specialists to doctors, lawyers or driving instructors. Cluj got invaded by constructors and building equipments. The requests for Construction Authorizations exceeded the Urbanism Commissions analyzing power and this fact has been realized much too late, sometimes when buildings have been already finished, in some cases even inhabited (the case of the house building on Negoiu Street, extensively propagated through the media). The building yards began organizing on barren areas, without any land improvements, without appropriate road access and in many cases by infringing DUP and ZUP stipulations. The constructors were also the projects owners, in very few cases other persons or public institutions (Local Council for example) got involved in this issue. The consequences were to appear in some cases just during the construction phase, while in others only after 2 or 3 years.

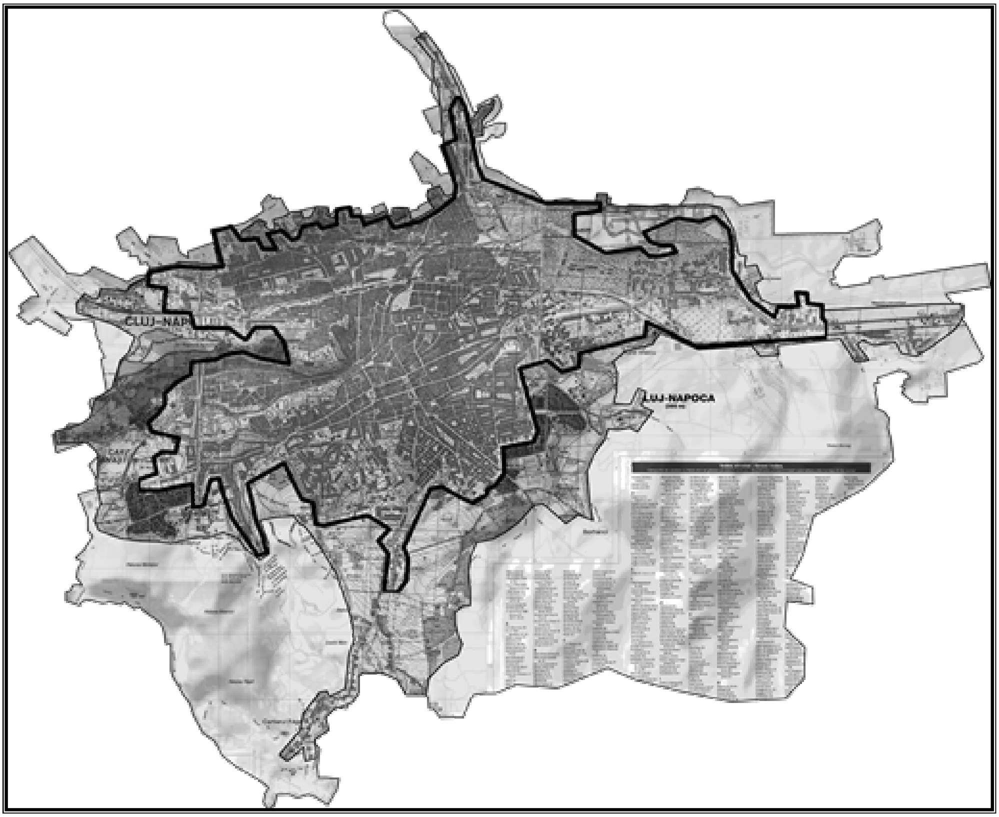


Fig. 5. Cluj Built up Area Dynamics between 1960 and 2009.

Excavations made in weakly consolidated delluvial deposits, excavations without embankments that imbalanced slopes, the inappropriate disposal of excavated material on meadows, roads design along torrents thalweg are some aspects that allow us in asserting that the urban area has developed chaotically, inducing a contrastive landscape both by projection and by the constructor interventions.

The contemporary geomorphologic processes (gullies, torrents, land flows, slope basal destruction) have increased in number and intensity especially in the periurban area, while some older ones, relatively stable, have reactivated lately (land slides, land settling, pseudosolifluxions).

5. CLUJ URBAN AREA GEOMORPHIC VULNERABILITY

By correlating processes frequency (signs of instability) with the total urban surface and by calculating the instability index Ii (by using the CERG formula: Ii = Fi /F x Si/S, where Fi – total amount of instability signs/each instability process, S – periurban total area; Ii – instability index), we were able to classify the vulnerable areas (high, middle, low) and elaborate the map of urban area vulnerability to geomorphologic processes (fig. 6).

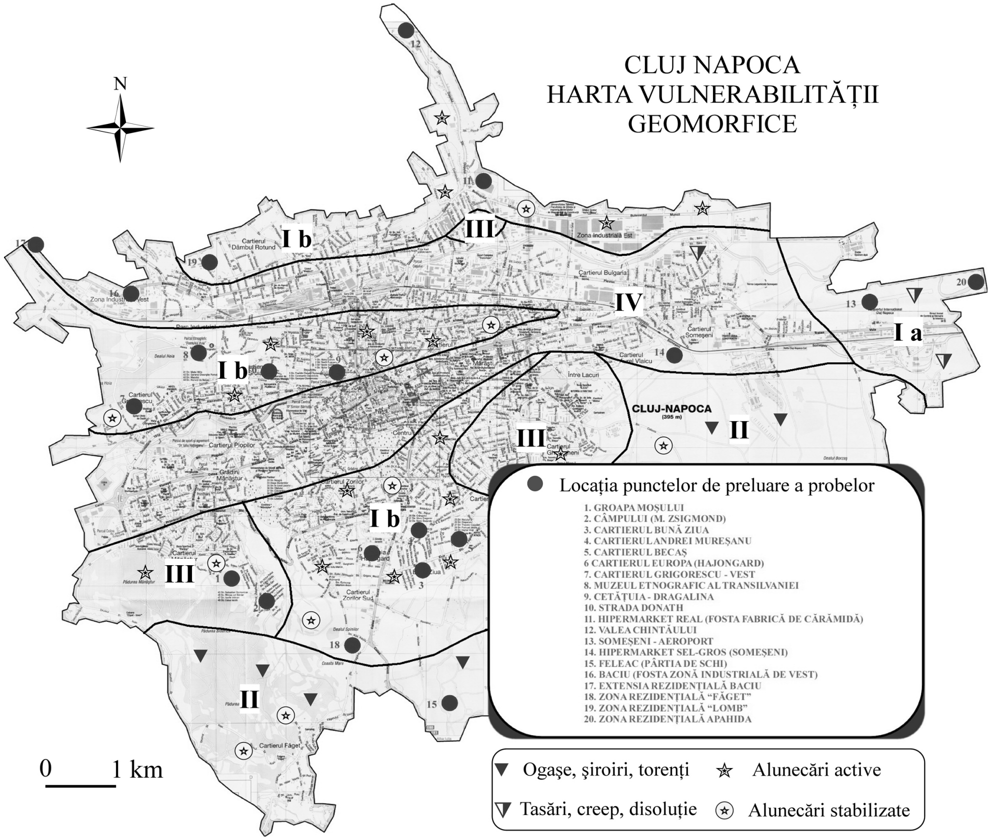


Fig. 6. Cluj Urban Area Geomorphic Vulnerability Map.

The study performed a quantitative and qualitative assessment of the human impact from the point of view of the socio-economic management of the geomorphic risks and hazards. The vulnerability zonation by identifying the process, its level of activity, affected area and evolution tendency, determined us in proposing four vulnerability classes:

– **zone I, subzone Ia** - high vulnerability to mass movement processes, torrentiality and land settling (Someşeni district and partially Gheorgheni and Mărăşti, some of the localities associated to Cluj Metropolitan Area – Sânnicoară, Dezmir, Apahida); **Zone I,**

subzone Ib - increased vulnerability to mass movement processes, creep, pseudosolifluxions, gullying, favored by the geologic background made of interbedded clays, marls, sands, cynerites (in the districts Gheorgheni, Andrei Mureşianu, Mănăştur, Bună Ziua, Făget, Europa Vest, Grigorescu Nord, Gruia, Hoia-Cetățuia, Lomb, Dâmbu Rotund, Chinteni, Iris);

– **zone II** – with average vulnerability supported by weak erosional processes (trickles, gullies, torrents) or by totally or partially stabilized ones (land slides) that are but susceptible to reactivation (third upper sector of the Feleac Hill, Zorilor district and the periurban localities Sălicea and Baciu);

– **zone III** - with decreased vulnerability (the treads of the middle and upper terraces, Bisericii Forest, Mănăştur Forest);

– **zone IV** – not vulnerable at all, tectonically and morphodynamically stabile (Someşul Mic river meadow and its terraces I and II, respectively the central district with the squares Avram Iancu, Unirii, Păcii and Cipariu; some parts of the Grigorescu, Mărăşti and Someşeni residential districts).

The zonation of Cluj urban area vulnerability may serve in the calculation and assessment of the geomorphic risks, compulsory process when insuring goods and human lives. The occurring probability of a geomorphic process or hazard that induces a certain risk should be known when setting up the insurance rate, the exposed goods and persons and the estimated damaging level being ones of the most important considered factors.

R E F E R E N C E S

1. Alicu, D., Ciupea, I., Cojocneanu, M.Gh. (1995), *Cluj-Napoca de la începuturi până azi.* Edit. Clusium, Cluj –Napoca.

2. Armaş, Iuliana (2008), *Percepția riscurilor naturale: cutremure, inundații, alunecări.* Edit. Universității din București.

3. Belozerov,V. (1972), *Clima oraşului Cluj şi a împrejurimilor. Teza de doctorat,* UBB, Facultatea de Biologie-Geografie.

4. Benedek, J. (2004), *Fenomenele de risc geografic din perspectiva amenajării teritoriului.* Re**v**. Riscuri si catastrofe, Anul III, nr.1/2004, p.69-79, ISSN 1584-5273, Edit. Cărții de Știință, Cluj-Napoca.

5. Boşcaiu, N., Boşcaiu, M.(1997), *Distribuția spatială a arborilor dintr-un gorunet cu carpen din pădurea Mănăşturului* (Cluj-Napoca), St.cerc.biol.,Seria biol.veg., Bucuresti, 49, 1-2:17-22.

6. Cristea, V., Baciu, C., Gafta, D. (2002), *Municipiul Cluj-Napoca şi zona periurbană.* Edit. Accent, Cluj-Napoca.

7. Croitoru, Adina–Eliza (2006), *Excesul de precipitații din Depresiunea Transilvaniei.* Edit. Casa Cărții de Știință, Cluj -Napoca.

8. Cocean P., Irimuş I. A. şi colab. (2004), *Planul de Amenajare a teritoriului Regiunii de Nord-Vest (PATR).Coordonate majore.* Edit. Presa Universitară Clujeană, ISBN –973-610-284-X, p.273.

9. Cocean, P., Irimuş, I. A, şi colab. (2007), *Synthetical Approach to the Romanian Tisa Basin.* Romanian Review of Regional Studies, Vol.III, nr.1/2007, p.1-96, ISSN: 1841-1576.

10. Crişan, I. (1972), *Studiu pedologic staționar agroproductiv şi ameliorativ al împrejurimilor Clujului.*Teză de doctorat, București.

11. Dauphine, A. (2001), *Risques et cartastrophes*. Ed.Armand-Colin, Paris, p228.

12. Fărcaş, I. (1999), *Clima urbană*. Ed. Casa Cărții de Știință, Cluj -Napoca.

13. Filipescu, S.(2001), *Cenozoic stratigraphic units in Transylvania*, 4 th Regional Meeting of IFAA Cluj-Napoca 2001, Field Trip Guidebook, 75-92, Cluj University Press.

14. Heijmans, A. (2001), *Vulnerability: A matter of perception*. In International Conference on Vulnerability in Disaster Theory and Practice, p.24-34, London, UK.

15. Holobâcă, I. (2004*), Perioadele deficitare pluviometric în Depresiunea Transilvaniei.* Re**v**. Riscuri si catastrofe, Anul III, nr.1/2004, p.150-159, ISSN 1584-5273, Edit. Cărții de Știință, Cluj-Napoca.

16. Ianoş, I. (2000), *Sisteme teritoriale, o abordare geografică.* Ed.Tehnică Bucureşti.

17. Ianoş, I. (2004), *Dinamica urbană*.Ed.Tehnică Bucureşti.

18. Irimuş, I.A. (1998), *Relieful pe domuri şi cute diapire în Depresiunea Transilvaniei,* Edit. Presa Universitară Clujeană, Cluj -Napoca.

19. Irimuş, I.A, (2004), *Slope sensitiveness in Transylvanian Diapiric Areas***.** Studia Universitatis Babes-Bolyai, Geographia, XLIX, 2, p.3-12.

20. Irimuş, I. A., Vesacan, I., Man, T. (2005), *Tehnici de cartografiere, monitoring şi analiză GIS*, Edit. Casa Cărţii de Știință, Cluj-Napoca, ISBN 973-686-809-5, p.244.

21. Irimuş, I.A. (2006), *Hazarde şi riscuri asociate proceselor geomorfologice din aria cutelor diapire din Depresiunea Transilvaniei,* Edit. Casa Cărţii de Știință, Cluj -Napoca.

22. Irimuş, I. A (2006), *Vulnerabilitate şi riscuri asociate proceselor geomorfologice în planningul teritorial.* Rev.Riscuri si catastrofe, Anul V, nr.3/2006, p.21-33, ISSN 1584-5273, Edit. Cărţii de Știință, Cluj-Napoca.

23. Irimuş, I. A., Petrea, D., Rus, I., Cocean, P. (2008)**,** *Landscape vulnerability induced by meteorological, geomorphical and antropical processes in Transylvania depression* Studii şi Cercetări, s. Geology-Geography, nr. 13, Bistriţa, - pp. 103 – 117, ISSN 1582 – 5167.

24. Irimuş, I. A., Pop, O. (2008), *Vulnerabilitatea teritoriului şi riscurile geomorfice în judeţul Mureş*. Rev. Riscuri şi catastrofe, an VII, nr.5/2008, p.169-180.

25. Irimuş, I.A., Surdeanu, V., Petrea, D., Rus, I., Cocean., P., O. Pop., (2009), *Climatic and anthropogenetic conditions in the Transylvanian dynamics of the landscapes***,** Studia Universitatis „Babeş-Bolyai" Geographia, Anul LIV, nr. 1-2009, Ed. Cluj Universit**y** Press, ISSN: 1221-079x, Cluj-Napoca, p.7-18.

26. Maier, A. (2001), *Podişul Someşan. Populaţia şi aşezările*. Edit. G. Baritiu, Cluj Napoca.

27. Micu, M., Spîrchez, Z. (1977), *Organizarea sistemului de spaţii verzi al municipiului Cluj-Napoca în prezent şi perspectivă*. În „Pădurea si spaţiile verzi şi de perspectivă". Academia Romana, Filiala Cluj.

28. Mitrea, V. (1998), *Rezidenţialul clujean până în anul 2006.* Teza de doctorat, Universitatea de Arhitectura si Urbanism „ Ion Mincu", Bucuresti.

29. Moldovan, Fl. (1986), *Rolul Munţilor Apuseni în diferenţierea climatică regională a părţii de nord-vest a României. Studiu de climatologie climatică*. Teza de doctorat. Univ. Bucureşti, Facultatea de Geologie-Geografie.

30. Morariu, T., Mac, I. (1969), *L'influence du relief dans l'amenagement et le developpement de la ville de Cluj*.Travaux de Symposium International de géomorphologie appliquée, Bucuresti, p.23-31.

31. Muja, S. (1984), *Spaţiile verzi în sistematizarea teritoriului şi localităţilor,* Ed. Ceres, Bucureşti.

32. Pandi G., Imecs Z., Irimuş, I.A. (1998)**,** *The conditioning of flow by precipitation in the NW part of Romania*, Hydrological journal, p. 67-78, Bratislava.

33. Piciu, T., Sânmihăian, M., Stan, G. (1984), *Cercetări privind solurile din jurul Clujului. Rapoarte anuale,* OCOT, Cluj Napoca.

34. Pigeon, P. (2005), *La gestion cartographique des risques en France et des problèmes posés par son évolution récente.* Rev. Riscuri si catastrofe, Anul IV, nr.2/2005, p.13-19, ISSN 1584-5273, Edit. Cărții de Știință, Cluj-Napoca.

35. Pop, P. Gr. (2001), *Depresiunea Transilvaniei.* Edit. Presa Universitară Clujeană, Cluj Napoca.

36. Pop, P. Gr. (2007), *Județele României. Județul Cluj*, Edit. Academiei Române, Bucureşti.

37. Rădoane, Maria, Rădoane, N. (2004), *Geomorfologia aplicată în analiza hazardelor naturale.* Re**v**. Riscuri si catastrofe, Anul III, nr.1/2004, p.57-69, ISSN 1584-5273, Edit. Cărții de Știință, Cluj-Napoca.

38. Surdeanu, V., Sorocovschi, V. (2003*), Phenomenes geographiques de risque dans la Depression de la Transylvanie.* Rev. Riscuri si catastrofe, Anul II, nr.1/2003, p.139-151, ISBN 973-686-436-7, Edit. Cărții de Știință, Cluj-Napoca.

39. Tudose, T., Moldovan, Fl. (2005), *Riscuri asociate evoluției vremii în Bazinul hidrografic Someş-Tisa în luna iulie 2005*. Rev.Riscuri si catastrofe, Anul IV, nr.2/2005, p.93-105, ISSN 1584-5273, Edit. Cărții de Știință, Cluj-Napoca.

40. Tudose, T., Moldovan, Fl. (2006), *Evoluția temperaturii aerului în Bazinul hidrografic Someş-Tisa în perioada 1961-2005*. Rev.Riscuri si catastrofe, Anul V, nr.3/2006, p.89- 99, ISSN 1584-5273, Edit. Cărții de Știință, Cluj-Napoca.

41. *** (1991), *Dicționar al mediului înconjurător,* Edit. Tehnică, Bucureşti.

42. www.primariaclujnapoca.ro/informatii publice, taxe şi impozite.

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

DISTRIBUTION SPATIALE DES COULEES DE DEBRIS CONTEMPORAINES DANS LE MASSIF DU CĂLIMAN (ROUMANIE)

O. POP[1], V. SURDEANU, I.-A. IRIMUŞ, M. GUITTON[2]

ABSTRACT. – Spatial distribution of contemporary debris flows in the Căliman Massif (Romania). The spatial distribution of contemporary debris flows of Căliman Massif has been mapped using photo-interpretation (2004 mission) and field survey. The data was processed and integrated in a GIS (Geographical Information System). We have compared the surfaces of the 70 inventoried debris flows and of their affected basin areas in order to identify the existing correlation between the two parameters. In the Căliman Massif it seems that the debris flow distribution is controlled by certain factors such as the presence of unconsolidated materials, the steep slopes, the rainfalls, vegetation discontinuities, etc. Despite the fact that the photo-interpretation has some limits, by their combination with field survey we can obtain good results in the mapping process at a regional scale of the remote areas affected by debris flows.

Keywords: *debris flows, spatial distribution, photo-interpretation, GIS, Căliman Massif.*

1. INTRODUCTION

De nombreuses études confirment que les coulées de débris sont des processus qui jouent un rôle morphogénétique majeur sur les versants abrupts de diverses régions montagneuses du monde (Rapp, 1992 ; Coussot et Meunier, 1996 ; Becht et Rieger, 1997 ; Kotarba, 1997 ; Berti *et al.*, 1999 ; Boelhouwers J. *et al.*, 2000 ; Pech et Jomelli, 2001 ; Eaton, 2003 ; Lorente *et al.*, 2003 ; Wilkerson et Schmidt, 2003 ; Liu, 2007). Dans le massif volcanique du Căliman, l'un des massifs montagneux appartenant à la chaîne volcanique des Carpates en Roumanie, la distribution des coulées de débris n'a pas fait l'objet d'études antérieures, certains auteurs (Bojoi et Brânduş, 1985) mentionnant seulement leur présence. Or, dans cette région plusieurs indices témoignent d'une activité géomorphologique contemporaine des coulées de débris.

Nous nous proposons ici de cartographier et d'analyser la distribution spatiale des formes créées par les coulées de débris contemporaines dans le massif du Căliman. En l'absence de datations absolues, des preuves (le degré de reconquête végétale des dépôts latéraux et frontaux) attestent que cette activité contemporaine des coulées de débris correspond à peu près avec les derniers 100 ans.

Nous analyserons dans cet article seulement la distribution des coulées de débris contemporaines qui affectent les versants « naturels » des étages subalpin et alpin, c'est-à-dire ceux qui n'ont pas subi d'influence anthropique, comme c'est le cas de certaines parties du massif fortement affectées par l'activité minière (Pop et al., 2009).

[1] *Univ. Babeş-Bolyai, Cluj-Napoca, Roumanie / Univ. Blaise Pascal, Clermont-Ferrand, France, olimpiu_p@yahoo.com*
[2] *Univ. Blaise Pascal, Clermont-Ferrand, France, mathieu.guitton@hotmail.fr*

2. LES COULEES DE DEBRIS -TERMINOLOGIE ET FORMES RESULTEES

Généralement, le terme « **coulée de débris** » désigne soit le processus morpho-dynamique, soit la forme de relief qui en résulte (Rapp et Nyberg, 1981 ; Coussot et Meunier, 1996). Les **« débris »** possèdent une plasticité réduite et sont représentés par des matériaux hétérogènes mobilisables, provenant des dépôts d'origine variée: dépôts colluviaux (érosion aréolaire), sols résiduels (météorisation), dépôts morainiques (activité glaciaire), dépôts pyroclastiques (activité volcanique explosive) ou terrils miniers (activité anthropique). Leur texture est caractérisée par un le mélange de sables, graviers et blocs auxquels s'ajoutent, en proportion variable, des silts, argiles et limons (Hungr, 2005).

En tant que processus morpho-dynamique, une **« coulée de débris »** représente l'écoulement très rapide d'une masse de débris saturée en eau, non-plastique (index de plasticité < 5% dans la fraction fine et sable), le long des chenaux à pente forte (Hungr, 2005). C'est un type de processus intermédiaire entre les glissements de terrain superficielles et les coulées hyperconcentrées (Coussot et Meunier, 1996 ; Rickenmann, 1999) qu'on observe lors des crues torrentielles dans les zones montagneuses. Le grand nombre d'études qui décrivent les contextes géologiques et morpho-climatiques favorables à la présence de l'activité des coulées de débris dans de diverses régions confirme le caractère azonal de ce processus (Decaulne, 2001).

Un système de type « bassin de coulée de débris » (**figure 1**) inclut les zones d'érosion et celles d'accumulation, celles-ci représentant des sous-systèmes distribués spatialement de manière suivante (Hungr, 2005) :

- les cicatrices d'érosion dans la zone d'initiation ; leur morphologie rappelle le caractère d'un glissement superficiel ; habituellement, leur localisation est située à l'intérieur des bassins hydrographiques d'ordre zéro jusqu'à ceux de deuxième ordre ;

- **les chenaux ou ravins** dans la zone de transport, bordés ou non par des dépôts parallèles (levées) ; des barrages dus à l'accumulation temporaire des matériaux peuvent se constituer dans les ravins empruntés par les coulées de débris, ce qui peut amplifier les effets du phénomène dans certaines conditions ;

- les lobes et levées latérales dans la zone d'accumulation, qui constituent le cône colluvial ou cône de débris ; ces accumulations sont souvent délimitées par des chenaux temporaires formés par des changements ou re-direction (avulsions) de l'écoulement sur la surface du cône de débris; les matériaux constituant le dépôt varient par rapport à la distance de l'apex du cône (les matériaux les plus grossiers s'accumulent sur des épaisseurs importantes dans la partie supérieure du dépôt, tandis que dans la partie distale du celui-ci s'accumulent plutôt des matériaux fins sur des épaisseurs plus réduites ; les dépôts plus anciens peuvent être en partie ou totalement recouverts par les matériaux déposés par les matériaux transportés par les dernières coulées de débris.

Le volume du dépôt est souvent utilisé comme critère pour classifier les coulées de débris. INNES (1983) en distingue ainsi quatre classes : a) grande échelle (> 100000 m^3) ; b) échelle moyenne (1000 – 100000 m^3) ; c) petite échelle (1 – 1000 m^3) ; d) micro-échelle (< 1 m^3).

Récemment, Jakob (2005) proposait une classification basée sur le volume, le débit maximal et la superficie inondée par la coulée de débris, définissant 10 classes différentes qui correspondent à des volumes allant de < 10^2 m^3 (classe 1) jusqu'à 10^9 m^3 (classe 10). Dans la plupart des études, les auteurs différencient les coulées de débris de versant et celles empruntant des chenaux pré-existants. On utilise aussi chez les auteurs français le terme « lave torrentielle » ou ceux de la littérature anglo-saxonne « debris flow », « debris torrents ». Ce dernier terme correspond pour les auteurs canadiens avec les coulées canalisées le long des torrents et des chenaux des rivières de montagne, leurs dépôts étant constituées de matériaux inorganiques mélangés avec des restes de végétation (Van Dine, 1985). Le déplacement des matériaux et l'érosion la plus intense s'effectuent généralement le long des chenaux et donc on peut parler d'un processus d'érosion linéaire (Becht et Rieger, 1997).

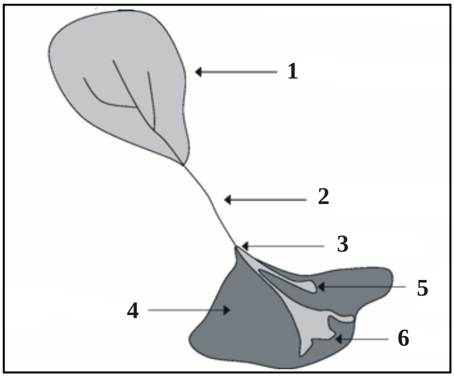


Fig. 1. Les composants d'un système coulée de débris (d'après Sterling, Slaymaker, 2007, avec modifications) : 1 – bassin (zone source) ; 2 – ravin (zone de transport) ; 3 – apex du cône ; 4 – cône de débris (zone de dépôt) ; 5 – coulée de débris récente ; 6 – lobe du dépôt.

Plusieurs facteurs (topographiques, géologiques, hydrogéologiques, hydrologiques, géomorphologiques, phyto-géographiques, anthropiques) peuvent se réunir pour favoriser le déclenchement des coulées de débris. D'une manière générale, on considère qu'au moins trois conditions sont nécessaires pour qu'une coulée de débris soit initiée (INNES, 1983 ; Bonnet-Staub, 2001) : présence du matériel mobilisable dont la cohésion est faible ou nulle ; présence d'eau en quantité suffisante pour fluidifier le matériel par la surpression interstitielle; une pente suffisante (plus de 25°) pour dépasser le seuil critique d'écoulement.

En ce qui concerne ce dernier facteur, on constate que tout versant abrupt situé dans n'importe quel contexte morphoclimatique devient susceptible d'être affecté par les coulées de débris. Le phénomène peut se produire si un apport en eau rapide s'effectue par des pluies intenses ou de longue durée (Caine, 1980 ; Cannon et Ellen, 1988), combinées ou non avec la fonte rapide de la neige, fonte nivale pure (Decaulne, 2005). Dans les chenaux creusés dans un substrat compact, c'est l'accumulation des matériaux fournis par d'autres processus (chute de blocs, petits glissements, ruissellement, pipkrakes, avalanches de neige, etc.) qui favorise l'activité des coulées de débris. Les cycles gel/dégel dans le sol et la présence printanière tardive de la neige dans le fond des ravins jouent aussi un rôle important dans la préparation du matériel qui sera mobilisé par les coulées de débris (Bardou et Delaloye, 2004). En l'absence de neige, la succession des cycles gélifs peut détruire les agrégats du sol (par la croissance des aiguilles de glace ou de la glace interstitielle, suivie de la fonte de cette glace) et ainsi réduire la cohésion entre les particules. Cela détermine la formation d'un stock de matériaux disponibles qui sera plus facilement mobilisé par les coulées de débris, après le dégel partiel ou total du sol. Un sol gelé en profondeur ou la présence d'une couche de neige indurée sur ce sol, peut former un plan de glissement exploité par la coulée de débris. Une longue présence de la neige au sol représente aussi un facteur restrictif pour la végétation, celle-ci n'arrivant pas à s'installer si le couvert neigeux persiste au sol. Les cycles végétatifs des plantes déjà installées sont retardés en fonction de l'évolution spatio-temporelle de cette couverture nivale et par conséquence le rôle protecteur que la végétation joue contre l'érosion est diminué.

La vitesse de recharge des chenaux présente une grande variabilité spatio-temporelle et donc l'activité des coulées de débris en termes de fréquence et magnitude (Jakob et al. 2005) est en étroite liaison avec ce facteur.

3. LA ZONE D'ETUDE

Le massif du Căliman (**figure 2**) fait partie de la chaîne volcanique située à l'ouest des Carpates Orientales. Avec une superficie de plus de 2000 km² et l'altitude maximale de 2100 m (sommet du Pietrosu) il est le strato-volcan le plus grand de la chaîne volcanique des Carpates. L'activité volcanique présente dans la région entre 7 Ma et 11 Ma (Seghedi et al., 2005) a édifié cet immense strato-volcan andésitique pendant plusieurs phases de construction et de destruction. Dans la partie centrale du massif, une caldera volcanique d'un diamètre de plus de 10 km, avec une ouverture vers le NNE, expose à l'érosion ses parois pentues, coupées dans une succession constituée de dépôts pyroclastiques, coulées de lave et corps intrusifs. Le réseau hydrographique a exploité les grandes directions d'inclinaison imposées par le relief, les rivières exerçant une érosion différentielle des roches volcaniques (Dincă, 2004). Les formes d'origine glaciaire sont aussi présentes (Someşan, 1932; Naum, 1070) ainsi que celles évoluées dans des conditions périglaciaires (Ichim, 1972). La forme et la pente des versants du massif peuvent avoir une origine volcanique ou volcano-tectonique (dômes, parois de la caldera), fluviatile (érosion régressive des parties supérieures des bassins-versants), glaciaire (parois des cirques) ou périglaciaire (couloirs d'avalanches, corniches d'éboulisation dans des coulées de lave).

La partie centrale du massif possède les altitudes maximales et la proportion la plus importante de versants pentus. Les différents contextes morpho-climatiques ont modelé successivement les versants déterminant la localisation des pentes élevées. C'est cette zone centrale du massif que nous avons choisie pour notre étude. Elle réunit les versants les plus pentus à la limite supérieure de la forêt des étages subalpins et alpins où les conditions morpho-climatiques favorisent l'activité des coulées de débris.

4. METHODES

4. 1. La photo-interprétation et la cartographie des coulées de débris actuelles

Dans une première phase, les cartes topographiques 1/25000 de la région ont été scannées et géoréférencées. En utilisant le logiciel ArcMap 9, un modèle numérique de terrain (MNT) d'une résolution de 10 m a été réalisé. Le réseau hydrographique a été numérisé à partir des mêmes cartes topographiques.

Pour cartographier les coulées de débris de notre zone d'étude, nous avons utilisé des orthophotoplans de la mission 2005 de l'Agence Nationale du Cadastre (**figure 3**). Sur ces orthophotoplans, la couche « courbes de niveau » a été superposée, permettant ainsi une meilleure reconnaissance de la topographie.

Nous avons délimité ensuite des polygones, en suivant les contours des formes créées par des coulées de débris actuelles: les cicatrices suivies de formes allongées (des ravins, des levées, des dépôts), bien visibles et caractérisées par l'absence de la végétation. A partir du MNT obtenu, le même logiciel nous a permis de générer automatiquement la carte hypsométrique (**figure 4**) nécessaire pour comparer les altitudes des zones de départ et celles atteintes par les coulées de débris (**figure 5**).

La carte des pentes nous a permis de déterminer les classes de pentes qui favorisent le départ des coulées (**figure 6**). Certains paramètres morphométriques (longueurs, largeurs, superficies) ont été obtenus par des calculs automatiques en prenant en compte le MNT.

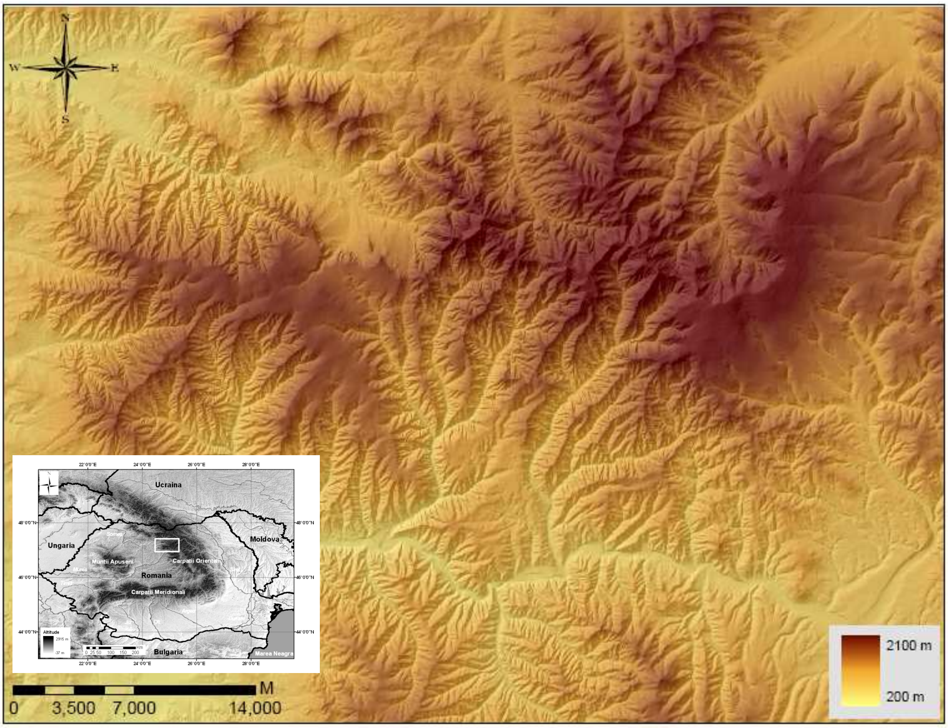


Fig. 2. Localisation du massif du Căliman et de la zone étudiée.

4. 2. Limites de la cartographie à partir des photos aériennes

Bien que dans notre cas l'utilisation des orthophotoplans reste d'une grande utilité en ce qui concerne la rapidité, la facilité, les coûts économiques de réalisation de la cartographie, certaines limites de cette méthode existent :

a. Sur les images, la neige concentrée surtout dans les couloirs, masque les zones affectées par les coulées de débris ;

b. La présence de la forêt ou des arbustes peut cacher les dépôts ou les formes d'érosion créées par les coulées de débris ;

c. Des erreurs d'échelle de photo-interprétation apparaissent aux différentes étapes de réalisation des cartes ;

Pour améliorer les résultats, l'analyse de ces types d'erreurs et leur prise en compte est nécessaire et cela pourrait faire l'objet d'une autre étude. Cette analyse n'a pas été réalisée dans notre cas et donc les résultats obtenus pourraient être plus ou moins différents de ceux qu'on obtiendrait en effectuant des mesures directes sur le terrain.

4. 3. Le travail de terrain

Le travail de terrain nous a permis la vérification des résultats de la photo-interprétation. Il ne remplace pas le travail de cartographie à partir des photos-aériennes, mais il permet de vérifier et compléter l'inventaire des coulées de débris obtenu initialement.

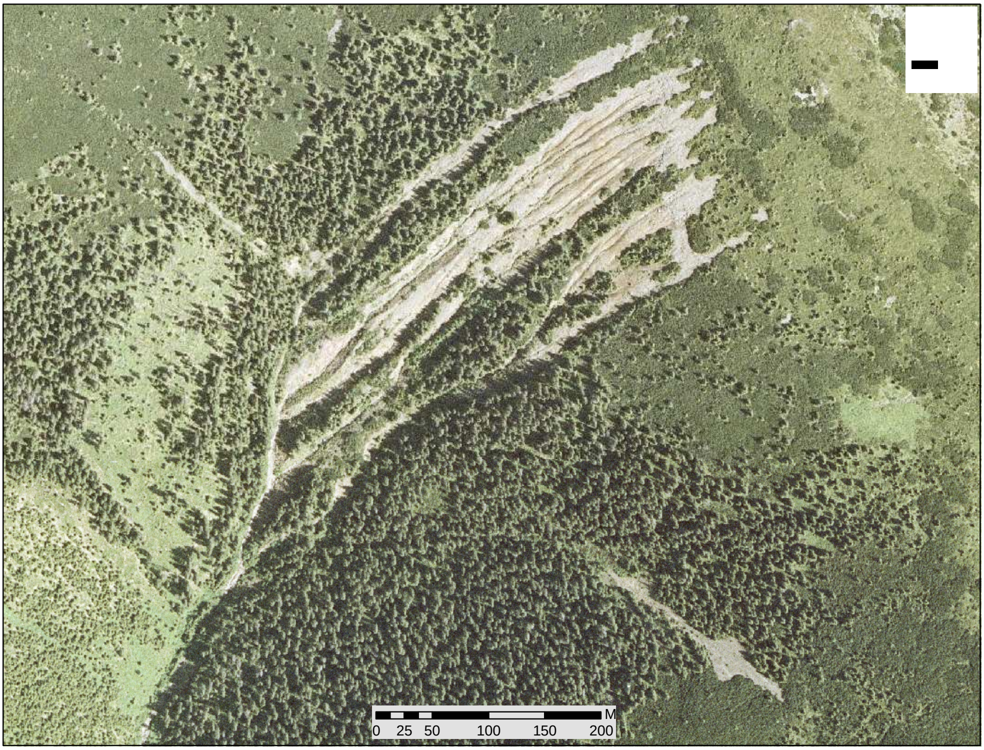


Fig. 3. Exemple de coulées de débris identifiées sur les photos aériennes.

Une fois la validation terminée, les nouvelles informations obtenues sur le terrain ont été introduites dans la base de données et représentées sous forme cartographique. Ces documents réunissent des couches d'information géoréférencées et drapées sur le MNT au pas de 10 m.

L'avantage d'intégrer l'information issue de la photo-interprétation et du travail de terrain dans un SIG (Système d'Information Géographique), est qu'il permet de superposer, en fonction des besoins, des informations provenant de diverses sources. A cela s'ajoute la facilité avec laquelle on peut réactualiser cette base de données, à mesure qu'on dispose de nouvelles données.

5. RESULTATS

Le travail de photo-interprétation et de terrain nous a permis l'identification de 70 coulées de débris qui affectent les versants abrupts dans la partie centrale du massif.

La distribution spatiale de ces coulées de débris a été associée avec l'altitude (**figure 4**) pour faire ressortir les classes d'altitude qui favorisent leur activité.

Dans la **figure 5** est représentée sous forme graphique la corrélation entre l'altitude maximale de départ et celle minimale, de la partie inférieure du dépôt de chacune des 70 coulées de débris identifiées. On constate que la plupart d'entre elles sont distribuées sur les versants entre 1500 m et 2000 m d'altitude, ce qui correspond généralement avec la limite supérieure de l'étage forestier (vers 1700 m), l'étage arbustif subalpin (entre 1700-1900 m) et avec la partie inférieure de l'étage des prairies alpines (vers 2000 m). Sur la carte, on observe aussi que les étages des arbustes subalpins et celui des prairies alpines favorisent la localisation des zones de déclenchement. Les conditions climatiques qui dépendent de l'altitude entraînent la raréfaction de la végétation dans ces étages. Par conséquent, le rôle de protection joué par les espèces arbustives et celles herbacées contre les coulées de débris devrait être beaucoup plus réduit comparé à celui des forêts.

Une autre corrélation a été faite entre la distribution des coulées de débris et les pentes des versants (**figure 6**). On constate que la localisation des coulées de débris est liée exclusivement à la présence de deux classes de pentes, celle de 15°-30° et celle de >30°.

Nous avons considéré que chaque coulée de débris s'organise à l'intérieur d'un bassin-versant qui favorise l'accumulation de l'eau et des matériaux vers les concavités des versants ou le long des chenaux préexistants. La corrélation entre la superficie de la coulée de débris et la superficie de son bassin-versant a été représentée sous forme de graphique dans la **figure 7**. Les valeurs des superficies affectées par chacune des 70 coulées de débris ainsi que les superficies de leur bassins-versant ont été calculées sur le MNT.

6. DISCUSSIONS

Certaines aspects morphologiques des segments de vallées d'ordre inférieur qui descendent du massif peuvent être mieux expliqués si on connaît la distribution des coulées de débris et leurs effets morphologiques (Butler, 2001 ; Stock et Dietrich, 2003, 2006). Les zones de stockage temporaire des matériaux sur les versants ou le long des couloirs de transit vers les lits des rivières sont étroitement liées à la présence spatio-temporelle de l'activité des coulées de débris. La distribution de la végétation par étages est aussi perturbée par ce type de processus.

Dans les Alpes, Becht et Rieger (1997) ont observé qu'il existe une corrélation entre la superficie du basin-versant et celle des coulées : quand la superficie du basin-versant augmente, la superficie des coulées de débris augmente elle-aussi. Le graphique de la figure 8 confirme cette observation dans le cas du massif du Căliman. Mais ici, la courbe des superficies des bassins versants ne suit pas de près celle des superficies des coulées de débris. Cela pourrait être expliqué probablement par la présence d'une grande variété de facteurs : contextes géologiques et morphologiques variables (présence ou absence des matériaux meubles, longueur et pente des versants variables, étagement de la végétation, etc.).

Actuellement, dans les zones source, la fissuration de la paroi rocheuse sous l'action des cycles de gel/dégel et d'humidification/dessiccation est encore active et contribue au recul de la paroi de lave, en fournissant en permanence des matériaux.

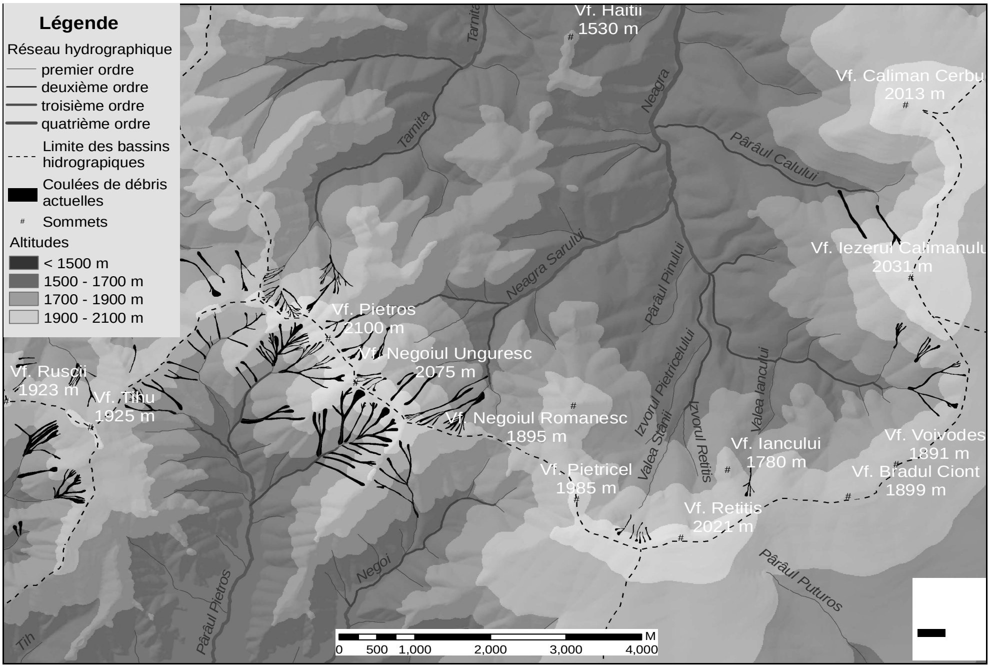


Fig. 4. Distribution des coulées de débris par classe d’altitudes.

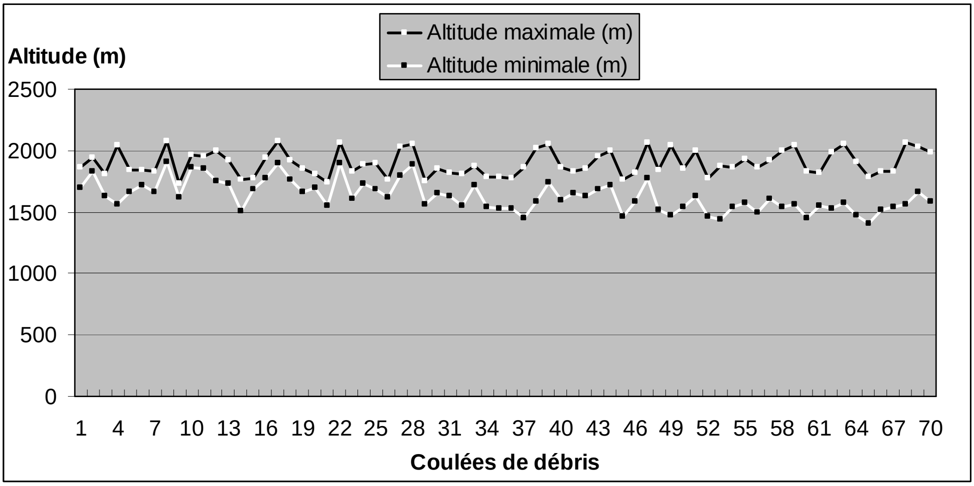


Fig. 5. Corrélation entre l’altitude maximale et l’altitude minimale des coulées de débris.

Quelques indices prouvent que ces phénomènes sont encore actifs, comme par exemple l’accumulation des gélifracts sur le couvert neigeux, la fissuration des parois rocheuses constituées de laves andésitiques et l'absence des lichens sur les blocs tombés à la base de ces parois. Les blocs des tabliers d'éboulis stables formés dans des contextes périglaciaires plus favorables sont couverts en grande partie par des thalles de lichens vivants ou morts, ce qui prouve que le type de roche ne constitue pas un facteur limitatif de la croissance des lichens. Mais l'intensité des processus de désagrégation mécanique actuelle est beaucoup plus réduite par rapport à celle qui a été nécessaire pendant les périodes favorables à la formation des talus d'éboulis qu'on retrouve partout sur les versants du massif.

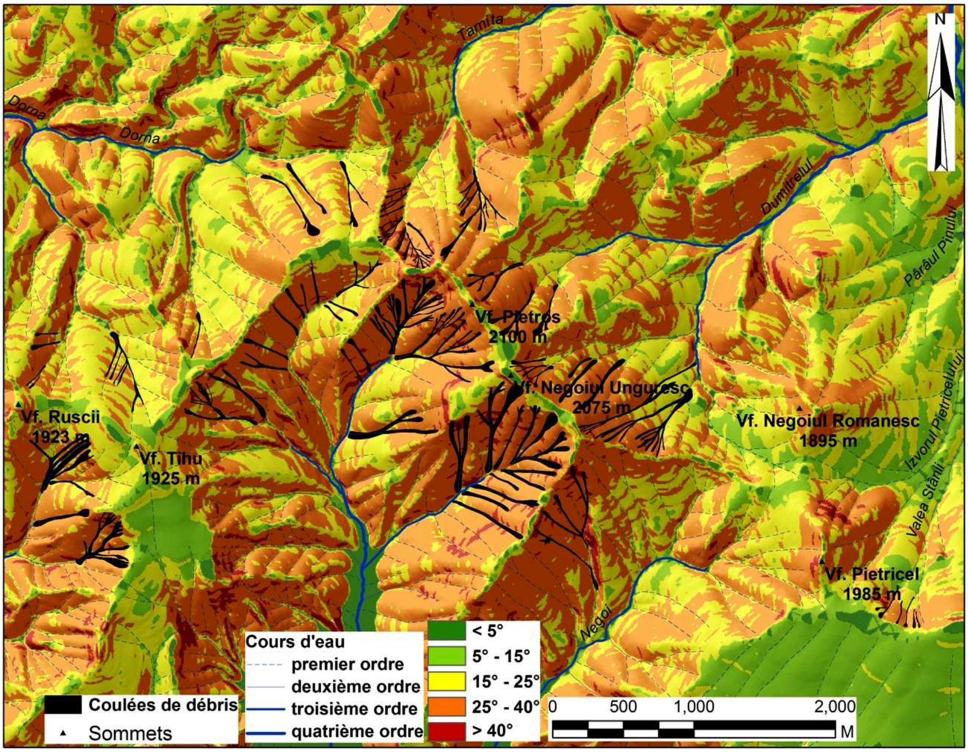


Fig. 6. Distribution des coulées de débris en fonction des classes de pente.

La quantité réduite des matériaux fournies par la désagrégation mécanique et leur vitesse d'accumulation dans les chenaux devrait limiter l'activité des coulées de débris (Bovis et Jakob, 1999 ; Jakob et al., 2005). Mais, nous avons observé que dans le massif du Calimani, les dépôts pyroclastiques altérées constituent des sources de matériaux facilement mobilisables, qui ne limitent pas ce processus.

Les cartes géologiques qui existent sont à grande échelle (1/20000) et leur utilité devient très réduite pour ce type d'approche si on veut réaliser une étude précise. Une cartographie détaillée des types de substrats serait donc nécessaire pour mieux expliquer le rôle du facteur géologique dans la localisation et les caractéristiques géomorphologiques des zones de départ des coulées de débris.

Dans le massif du Căliman, les coulées de débris de versant sont localisées sur les parois des cirques glaciaires tandis que celles de vallée suivent les directions des cours d'eau d'ordre zéro jusqu'au deuxième ordre. Il semblerait que la longueur du versant, la pente de celui-ci et celle du chenal en profil longitudinal jouent un rôle majeur dans la distance parcourue de la coulée de débris et de leur volume. Ainsi, dans les cirques, les distances plus courtes sont liées à la longueur des parois et à la pente des moraines, tandis que dans les vallées les distances parcourues sont plus longues.

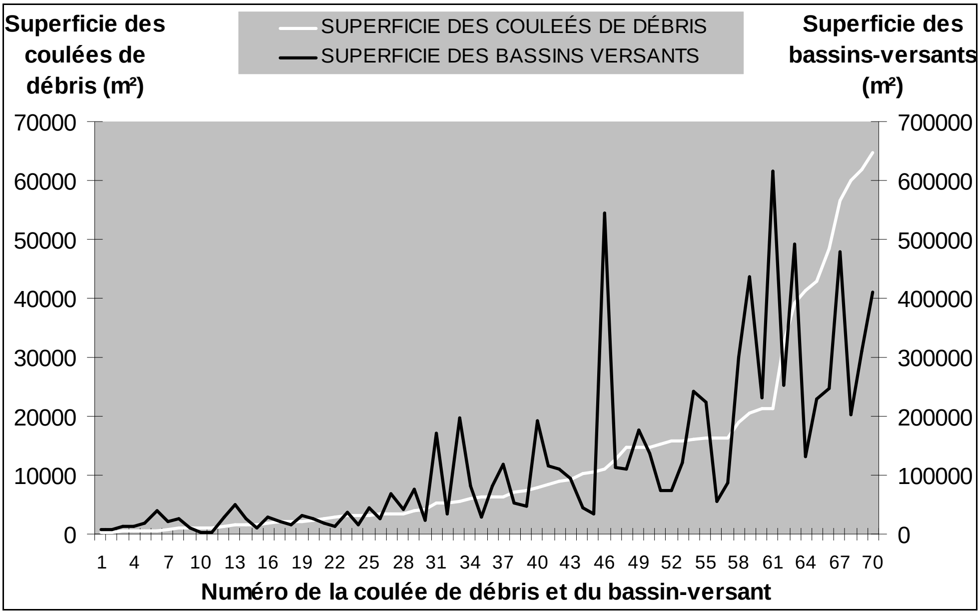


Fig. 7. Corrélation entre la superficie (m²) affectée par les coulées de débris et la superficie (m²) de leurs bassins-versants.

7. CONCLUSIONS

La cartographie des coulées de débris contemporaines à partir des photos aériennes et des observations de terrain représente une première étape dans l'étude de ce phénomène. Bien que plusieurs limites existent, cette méthode s'avère utile dans le cas des études visant à inventorier la distribution du phénomène à l'ensemble d'un massif montagneux.

Les cartes réalisées sous SIG et les paramètres morphométriques des coulées de débris mesurés indirectement (sur les cartes) et directement (sur le terrain), montrent la variabilité de la distribution spatiale des coulées de débris actuelles dans le massif du Căliman : variabilité altitudinale des zones de départ et des distances parcourues, variabilité des superficies affectées, différences dans l'origine des matériaux constituant la masse des débris de la coulée, etc. En fonction de leur volume, elles sont de petite et moyenne échelle, d'après la classification élaborée par INNES (1983).

L'étude axée sur la dimension spatiale pourrait être combinée avec celle visant à retracer la variabilité temporelle de l'activité des coulées de débris. Pour atteindre ce but, les meilleurs résultats sont obtenus en combinant plusieurs méthodes : si on réunit les informations extraites des photos aériennes des missions anciennes, celles obtenues par des méthodes dendrogéomorphologiques et celles provenant des archives (Strunk, 1992 ; Santilli et Pelfini, 2002 ; Jomelli *et al*., 2004 ; Stoffel et al., 2006 ; Bollschweiller et al., 2007), on arrive à des résultats satisfaisants concernant la fréquence de l'activité des coulées de débris anciennes.

Remerciements : *Les auteurs remercient vivement Armelle DECAULNE pour ses remarques et suggestions qui ont contribué à l'amélioration du manuscrit et d'avoir corrigé la version française de ce texte.*

R E F E R E N C E S

1. Bardou E., Delaloye R. (2004), *Effects of ground freezing and snow avalanche deposits on debris flows in alpine environments,* Natural Hazards and Earth System Sciences, vol. 4, p. 519–530.
2. Becht M., Rieger D. (1997), *Debris flows on alpine slopes (eastern Alps),* Géomorphologie : relief, processus, environnement, n° 1, p. 33-42.
3. Boelhouwers J., Holness S., Sumner P. (2000), *Geomorphological characteristics of small debris flows on Junior's Kop, Marion Island, maritime subantarctic.* Earth Surface Processes and Landforms, vol. 25, p. 341-352.
4. Bojoi I., Brânduş C. (1985), *Considérations sur la morphodynamique actuelle du Massif des Călimani (Carpates Orientales).* Analele Ştiinţifice ale Universităţii „Al. I. Cuza", Iaşi, tomul XXXI, seria II b, Geologie-Geografie, p. 67-73.
5. Bollschweiler M., Stoffel M., Ehmisch M., Monbaron M. (2007), *Reconstructing spatio-temporal patterns of debris-flow activity using dendrogeomorphological methods.* Geomorphology, vol. 87, n° 3, p. 337-351.
6. Bonnet-Staub I. (2001), *Une méthodologie d'analyse et de cartographie de l'aléa «initiation de laves torrentielles» – application au torrent du Bragousse (France).* Bulletin of Engineering Geology and the Environment, vol. 59, p. 319-327.
7. Bovis M. J., Jakob M. (1999), *The role of debris supply conditions in predicting debris flow activity.* Earth Surface Processes and Landforms, n° 24, 11, p. 1039–1054.
8. Butler D. R. (2001), *Geomorphic process–disturbance corridors - a variation on a principle of landscape ecology.* Progress in Physical Geography, vol. 25, n° 2, p. 237-248.
9. Caine N. (1980), *The rainfall intensity: duration control of shallow landslides and debris flows.* Geografiska Annaler, vol. 62, n° 1-2, p. 23-27.
10. Cannon S. H., Ellen S. D. (1988), *Rainfall that resulted in abundant debris-flow activity during the storm.* USGS Professional Paper, vol. 1434, p. 27–33.
11. Coussot P., Meunier, M. (1996), *Recognition, classification and mechanical description of debris flows.* Earth Science Review, 40, 209-227.
12. Decaulne A. (2001), *Les debris flows: une dynamique de versant azonale ?* Environnements Périglaciaires, vol. 8, p. 44-65.
13. Decaulne A. (2005). *Debris flow triggered by rapid snowmelt - a case study in the Gleiđarhjalli Area, North Western Iceland.* Geografiska Annaler, vol. 87, p. 487-500.
14. Dincă I. (2004), *Apa şi peisajele din Munţii Călimani.* Edit. Universităţii Oradea, 162 p.

15. Hungr O. (2005), *Debris flow hazard and related phenomena – classification and terminology*. Dans Jakob M., Hungr O., (eds.) “Debris flow hazard and related phenomena”, Praxis, Springer, Berlin Heidelberg, p. 9-23.

16. Ichim I. (1972), *Problema teraselor de crioplanaţie din Masivul Călimani*. Lucrările Staţiunii „Stejarul”, Geologie-Geografie, Pângăraţi.

17. Innes, J. L. (1983), *Debris flows*. Progress in Physical Geography, vol. 7, n° 4, p. 469-501.

18. Jakob M. (2005), *A size classification for debris flows*. Engineering Geology, vol. 79, p. 151–161.

19. Jakob M., Bovis M. J., Oden M. (2005), *The significance of channel recharge rates for estimating debris-flow magnitude and frequency*. Earth Surface Processes and Landforms, vol. 30, p. 755– 766.

20. Jomelli V., Pech P., Chochillon C., Brunstein D. (2004), *Geomorphic variations of debris flows and recent climatic change in the French Alps*. Climatic Change, vol. 64, p. 77-102.

21. Naum T. (1970), *Complexul de modelare nivo-glaciar din Masivul Călimani*. Analele Universităţii din Bucureşti, anul XIX, p. 67-76.

22. Pop O., Hodor N., Surdeanu V., Irimuş I.-A., 2009. Conséquences de l’instabilité morphodynamique liée à l’exploitation du soufre dans le massif volcanique du Calimani (Roumanie). *Revue Géographique de l’Est,* 12 p. (en cours de publication).

23. Rapp A. (1992), *Frequency and importance of major debris flows in arctic and other mountains*. Bulletin de l’Association des Géographes Français, vol. 3, p. 249-252.

24. Rapp A., Nyberg R. (1981), *Alpine debris flows in Northern Scandinavia. Morphology and dating by lichenometry*. Geografiska Annaler, vol. 63 A, p. 183–196.

25. Rickenmann D. (1999), *Empirical relationships for debris flows*. Natural Hazards, vol. 19, n°1, p. 47–77.

26. Santilli M., Pelfini M. (2002), *Dendrogeomorphology and dating of debris flows in the Valle del Gallo, Central Alps, Italy*. Dendrochronologia, vol. 20, n° 3, p. 269-284.

27. Seghedi I., Szakáks Al., Pécskay Z., Mason P. R. D. (2005), *Eruptive history and age of magmatic processes in the Calimani volcanic structure (Romania)*. Geologica Carpatica, vol. 56, n° 1, p. 67-75.

28. Someşan L. (1932), *Urme glaciare în Munţii Călimani*. Buletinul Societăţii Regale Române de Geografie, tomul LI, p. 295-299.

29. Sterling S., Slaymaker O. (2007), *Lithologic control of debris torrent occurrence*. Geomorphology, vol. 86, p. 307-319.

30. Stock J. D., Dietrich W. E. (2003), *Valley incision by debris flows: Evidence of a topographic signature*, Water Resources Research, vol. 39, n° 4, 1089, 25 p.

31. Stock J. D., Dietrich W. E. (2006), *Erosion of steepland valleys by debris flows*. Geological Society of America Bulletin, vol. 118, n° 9-10, p. 1125 – 1148.

32. Stoffel M., Bollschweiler M., Hassler G. R. (2006), *Differentiating past events on a cone influenced by debris-flow and snow avalanche activity - a dendro- geomorphological approach*. Earth Surface Processes and Landforms, vol. 31, p. 1424–1437.

33. Strunk H. (1992), *Reconstructing debris flow frequency in the Southern Alps back to AD 1500 using dendrochronological analysis*. Dans “Erosion, Debris Flows and Environment in Mountain Regions” (Proceedings of the Chengdu Symposium, July 1992). IAHS Publication, 209, p. 299-306.

MORPHOMETRICAL CHARACTERISTICS OF THE TRANSYLVANIAN PLAIN RELIEF

V. SOROCOVSCHI[1], ŞT. BILAŞCO[2], CS. HORVATH[3]

ABSTRACT. – Morphometrical characteristics of the Transylvanian Plain relief. The morphometric characteristics of the relief were computed directly from the digital elevation model which was created from the 1:25.000 topographic maps. The main computed parameters were height, inclination, slope exposure, fragmentation depth and density, as well as the plan and the profile curvatures. In order to distinguish as detailed as possible the change values in the studied region, the above mentioned morphometric parameters were calculated on a grid support, with a pixels' dimension of 10 x 10 m. The study aims at an appropriate assessment of the relief morphometric parameters as primary attributes of the geographic individuality of this large intracarpathian area, known under the name of the Transylvanian Basin. At the same time the main parameters' differentiation was also studied at the region's geographic subdivisions level. The relief morphometric characteristics and its lithological features represent the most important premises in the generation and evolution of geomorphical risk phenomena that endangers the rural settlements in the Transylvanian Plain.

Keywords: *Transylvanian Plain, morphometric parameters, slope, fragmentation depth, fragmentation density.*

1. INTRODUCTION

The Transylvanian Plain is the smallest unit of the Transylvanian Plateau three subdivisions, sharing 26% of this hilly region, part of the large intracharpathian area known under the name of Transylvanian Basin.

Situated in the central-northern part of the Transylvanian Basin, between the mountainous picks of the Călimani in the east and the Apuseni Mountains in the southeast, the Transylvanian Plain appears as a low wavy region. In the east, the transition to the Eastern Carpathians (Călimani and Bârgău Mountains) is made gradually through a complex relief of hills and basins. Oppositely to the hilly areas in the south (Târnave Plateau), west and north (Someş Plateau), the Transylvanian Plain appears as a lower region, slightly forested, with numerous ponds situated along the main river valleys and with predominant agricultural grain areas.

In spite of an apparent uniformity of landscape, in the region between the Someş and Mureş Rivers, the physical-geographic characteristics vary territorially, fact that imposes the necessity of establishing two inferior units (Figure 1).

The **Someş Plain,** in the north, includes the territories drained by the tributaries of Someşul Mic and Someşul Mare Rivers, and it is characterized by the presence of a lower area in the center, bordered in the west, north and east by higher hilly regions. This subunit, named also Colinele Înalte Plain, includes three subdivisions with distinctive geographic features (Figure 1).

[1] *Romanian Academy, Cluj-Napoca Subsidiary, Romania, e-mail: svictor@geografie.ubb.cluj.ro*
[2] *Romanian Academy, Cluj-Napoca Subsidiary, Romania, e-mail:sbilasco@yahoo.com*
[3] *Romanian Academy, Cluj-Napoca Subsidiary, Romania, e-mail:hcs1000@yahoo.com*

Fizeş Plain lies in the median part of the region, modeled on a structure of domes and short anticlines, made up by Sarmatian and Badenian formations. The relief presents smaller hills with altitudes that reach 400-450 m only on the watershed. Significantly fragmented and intensely affected by erosional processes, the hills are deforested and used mainly for agricultural cultures. The wide valleys characterizing the upper courses of Meleş and Fizeş Rivers as well as the decreased runoff slope favored the appearance of artificial ponds.

Sic Hills, situated in the northeastern part of the region, presents diapir structures and salt formations mirrored in abrupt cuestas, residual peaks (between 450-500 m), large monoclines, local combes or salt lakes. Beside the large dominant villages, small ones also develop, with mainly agricultural functions.

Unguraş Hills are located in the northern part of the Transylvanian Plain, representing the highest part of the unit. The wide normal folds maintain a relief that exceeds 600 m, generally poly-cyclically modeled, with high relief energy and abrupt slopes. The rivers have strongly deepened, pointing out the diapir structures, represented by salt outcropping. The wide watersheds alternate with narrow valleys deepened in salty Badenian deposits. The forested areas are largest compared with the other subunits of the Someş Plain.

The watersheds are characterized by a relatively humid (700 mm/year) and cold (7-8 ^{0}C yearly average) climate, large forested areas, considerable pastures and grazing fields developed on brown strongly podzolic soils.

On the lower altitudinal steps, the agricultural cultures and the orchards are characteristic.

The poor accessibility is explained also by the lack of modern communication lines which could facilitate the connection between the small villages in the basins, the deep valleys and those on the watershed.

(*Geografia României*, III, 1987).

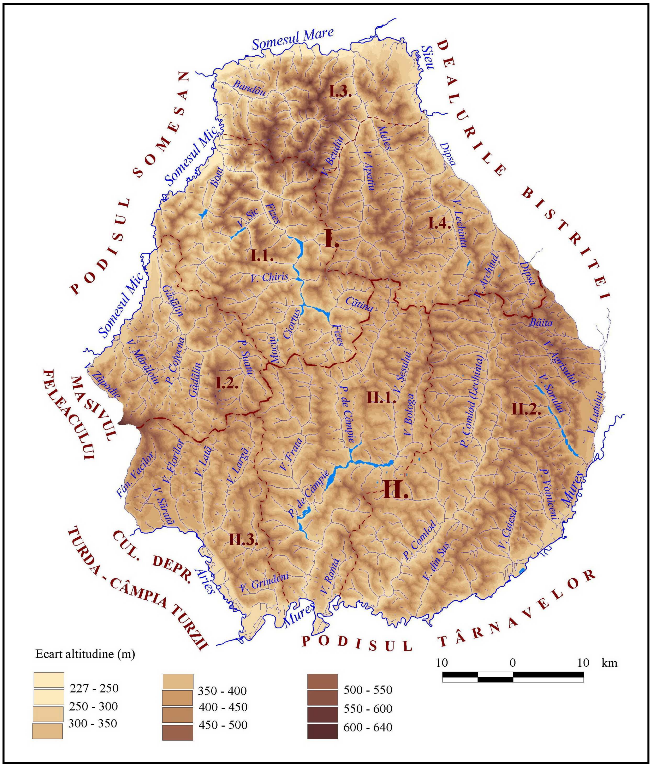


Fig. 1 . Transylvanian Plain geographic subdivisions (after Geografia României, III, 1987).
I. Someş Plain: I. 1. Fizeş Plain; I. 2. Sic Hills; I. 3. Unguraş Hills; I. 4. Lechinţa Hills.
II. Mureş Plain: II. 1. Sărmaş Plain; II. 2. Mădăraş Hills; II. 3. Coasta Grindului

Lechința Hills, between the Meleş and Şieu-Dipşa valleys, develop from the south up to the Someşul Mare – Mureş watershed and are described by heights between 450-550 m. The relatively friable lithological substrate (marls, clays, sands and tuff intercalations) induced an intense relief fragmentation. Between the hills intensely affected by torrents, landslides and erosion, wide valleys are located, with humid river meadows used for pastures or hosting ponds. The common and turkey oak forests remain isolated on the watersheds, while in the vicinity of salt areas a halophyte vegetation appears. In the northern part of the unit, orchards and vineyards prevail, while in the south, the grain cultures. The settlements in this part are usually defined by their name that contain frequently the word "Câmpie" (Plain).

Mureş Plain includes the area between the Mureş Valey in the south and the watershed between the Mureş and Someş Rivers in the north. The east limit is given by the Lut Valley and its affluent Lunca River. On its western side, the wide Arieş Valley, towards which the plain ends with an abrupt cuesta front and the well developed channel of Florilor River.

The altitude remains between 350 and 450 m, with an exception represented by the structural remains modeled on resistant rocks (tuff, grit stone, limestone), which are described by altitudes (500-550 m) above the average. The highest altitudes are reached on the margins, in the northern, western and eastern parts of the plain, from where the altitudes decrease to the middle, marked by the Pârâul de Câmpie River.

The terrain degradation by erosional and landslide processes have reached significant proportions, induced also by the decreasing forested areas (only 6-7 % of the total surface), which could have prevented the water torrents concentration and deepening. The small runoff slope of the main rivers sustained the creation of numerous ponds.

The climate (average yearly temperatures of 8-9 ^{0}C and precipitations between 500-550 mm) and the biopedological cover particularities, as well as the large extension of the arable areas justifies the term "plain" in the name of this Transylvanian Plateau unit. The Mureş Plain is characterized also by the highest spread of the word "Campie" (Plain) in its settlements name.

In the Mureş Plain there are three compartments with distinctive geographical characteristic (fig. 1).

Sărmaş Plain, represents the central compartment of the region, covering generally the hydrographic basin of the Pârâul de Câmpie River. Structurally, almost exclusively, it is part of the dome zone. The watersheds are frequently at altitudes of 450-500 m, with some exceptions in the northern part where they are lower (around 400 m). The valleys are wide, with complex terraces after the domes configuration which they penetrate and with marshlands on the flood plain. There are numerous fishery ponds on the Pârâul de Câmpie River and on its tributary, the Şesu River. The small- and middle-sized villages prevail, many with names that contain the words "Câmpie" (plain) and "Fânațe" (pasture).

Mădăraş Hills, also known under the name of Făgăraş Hills, lie the eastern part of the Mureş Plain, between the Comlod and Mureş Rivers. Benefiting from the more resistant lithology, the altitudes remain at higher levels (550-600 m). The position and the altitudinal values of the relief influence directly the climatic particularities (annual average temperatures of 8 and 8,5 ^{0}C, more significant precipitations between 650-700 mm) and forestation values sometimes reaching more than 20 % of the area of some communes. In contrast with the watershed peaks, the valleys are wide and present a significant maturity, offering good conditions for creating ponds in the low and marshy floodplains, like those in the Şar Valley.

Coasta Grindului hills, also named by Gr. Pop (2002) the Aiton – Viişoara Hills, represent the western compartment of the region, overlapping mainly the hydrographic basin of the Larga River. They includes a small area which join an association of asymmetrical watersheds separated by large cuesta fronts, which develop gradually from the Arieş Valley to the Luduş Valley. The peaks reach 500 m, while in the valleys the altitude decreases under 400 m. The forest vegetation is almost missing and the deforested terrains are significantly degraded by the cuesta fronts. On the watershed and on the monocline slopes, there are grain cultures favored by the mild climate and reach soils. The valleys are mature, with wide meadows favorable for creating ponds and semi permanent fisheries. The little villages located down on valleys or on watersheds, with scattered forms, contrast in structure with the compact ones in the vicinity of the Turda - Gura Arieşului Corridor.

2. RELIEF MORPHOMETRIC CHARACTERISTICS

2. 1. Relief altitude

This morphometric parameter plays a major role in the appearance and evolution of geomorphic risk phenomena, determining the vertical zonality of the main climatic and hydrological elements (runoff) etc. Thus, in the Someş Plain we observe a general increase of the relief altitude from south to the north. On the contrary, in the Mureş Plain, the general increase tendency is from center to west and, less intensely, to the east. (Figure 1).

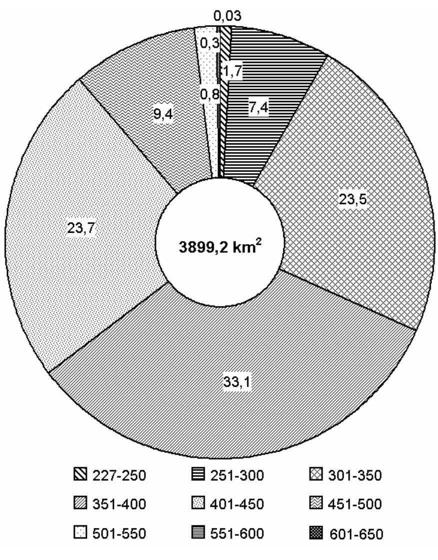


Fig. 2. Transylvanian Plain weight of the altitudinal intervals area (%).

If analyzing the weight of the main altitudinal levels throughout the region, one can remark that the 351 – 400 m interval represents 34 % from the total surface (3899,2 km^2) of the Transylvanian Plain. Followed with approximately the same weight the 401 – 450 m interval (24 %) respectively the 301 – 350 one (23 %). Considering that the altitudinal intervals under 400 m represent almost two thirds (64,8 %) of the Transylvanian Plane, we can explain the main components composing this specific low hilly area. The altitudinal levels over 451 m represent only 11,7 % from the studied area (Figure 2).

In comparison to this general situation, many differences were identified between the main geographic subunits. In the Someş Plain, the major weight corresponds to the 351-400 altitudinal interval (Figure 3), excepting the Unguraş Hills where the percentages representing the 50 m intervals between 251 and 450 are equilibrated, sharing values between15-20 % (Figure 3). The interval between 301-350 m has the second place, representing 20 and 28 % from the surface of the Someş Plain subunits (figure 3).

We have to notice that in case of the Unguraş Hills, the altitudes over 500 m share the major percentage, the highest from al the subunits in the Transylvanian Plain, representing 9,1 % of the subunits total area.

In the Fizeş Plain and in the Lechința Hills, the altitudinal intervals over 500 m slightly exceed 2%, while in Sic Hills they hardly achieve 1 % from the subunit surface.

In case of the Mureş Plain the highest weight appears also in the case of the 351-400 m altitudinal interval, with 40 % in the Sărmaş Plain and 34.5 % in the Mădaraş Hills.

In Sărmaş Plain, the succeeding interval is that of 301-350 m, with 27 %, and in the other two subdivisions the 401-450 altitudinal interval with 25 % in the case of the Grindului Hills and 28.4 % in the case of Mădăraş Hills (fig.4). The areas with altitudes over 500 m represent a very small percent, 0.6 % in Sărmaş Plain and 1.1 % in Mădăraş Hills.

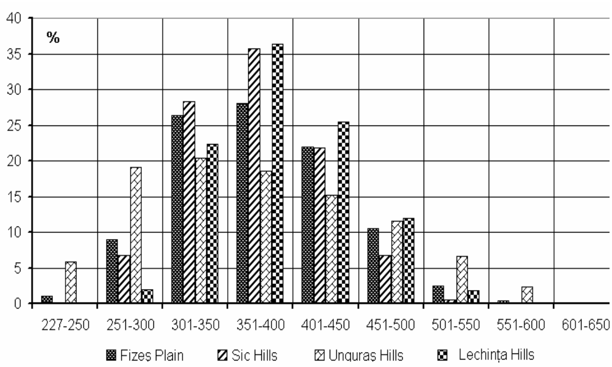


Fig. 3. Someş Plain geographical subunits - weight of the altitudinal intervals.

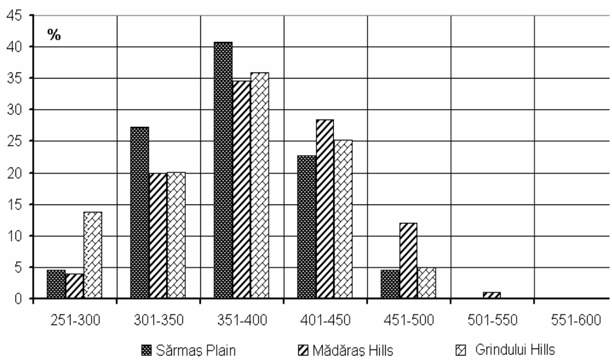


Fig. 4. Mureş Plain geographical subunits - weight of the altitudinal intervals.

2. 2. Geodeclivity

Inclination is one of the variables that determine the transformation of the potential energy into kinetic energy. The determined values of this parameter were reclassified taking into account the thresholds that contribute to the triggering or evolution of the geomorphic risk processes.

Finally we obtained five inclination classes, the highest weight representing the class between 5,1 and 10 ^{0} with 49 % of the entire area. The succeeding classes, with significantly lower values, are the 2.1 - 5 ^{0} and that between 10.1 and 15 ^{0} (Figure 4).

The areas representing the smallest inclination, under 2^0, have a considerable weight in the studied region (11%), while the areas with highest inclination, over 17 ^{0} represent only 1 % of the entire area.

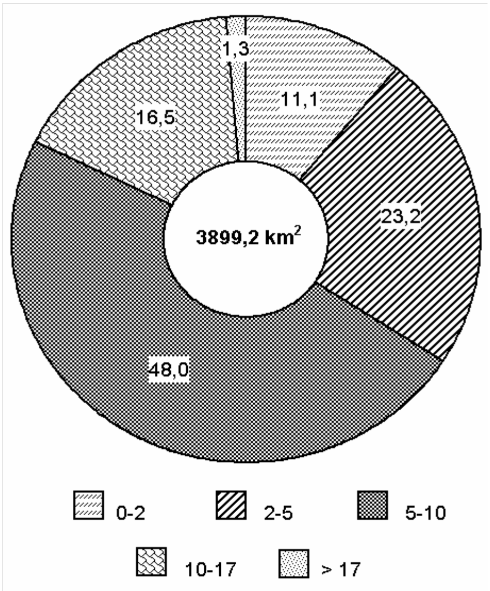


Fig. 5. Weight (%)of the territories with various inclination classes.

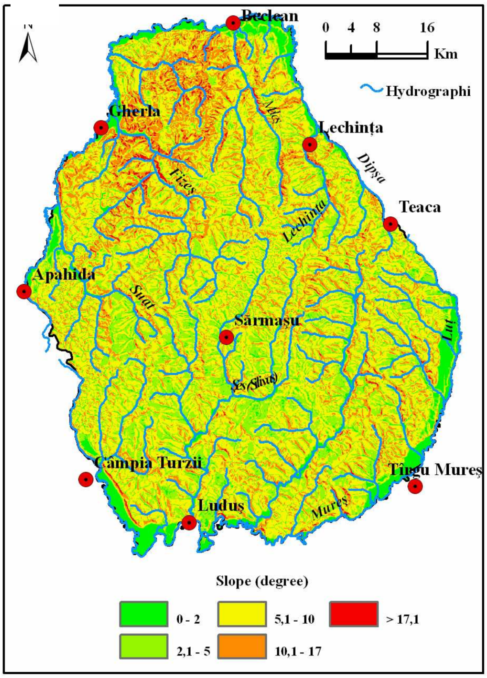


Fig. 6. Map of the inclination categories in the Someş Plain.

The analysis undertaken at the level of the Transylvanian Plain subunits points out that the best represented inclination class is that between 5.1 and 10 ^{0}, with 53 % at Lechinţa hills, 50 % at Fizeş Plain and 49 % at Sic Hills and Sărmaş Plain.

In all the Mureş Plain subunits, and in the case of Sic and Lechinţa Hills in the Someş Plain, the succeeding inclination class is that between 2,1 and 5^{0}, representing 23 % or even 32 % from the studied region. In exchange, in the Fizeş Plain and in the Unguraş Hills, the next class is that between 10.1 and 17^{0}**,** representing 25 and 29 % from the subunits area.

If analyzing the inclination map, an important remark should be done: the relatively horizontal areas (a slope between 0 and 2^{0}) describe, in general, the alluvial plains along the major water courses, stimulating floods and over-humectation phenomena during spring, or after summer convective or frontal rains.

An interesting category is that with values between 2,1 and 5^{0,} characteristic to areas that lacks geomorphic risk phenomena, located especially in the third inferior sector of monoclinal slopes.

Usually, these areas are the most favorable for agriculture or built human structures. There are also cases in which this territorial category is affected by allochton material accumulation (torrents' dejection cones, deluvial materials from land slides). This inclination category also describes some interfluvial areas in the Fizeş Plain, Sic Hills and Sărmaş Plain.

As mentioned before, the most frequent inclination class is 5,1 -10 ^{0}. The inclination values in this category stimulate landslides on cuesta slopes and on the third upper sector of monoclinal slopes. The areas with more than 17^{0} inclination appear sporadically in the Unguraş Hills (4%) and Fizeş Plain (2%), and very scarcely (under 1 %) in the Lechinţa and Mădăras Hills, and also in the Coasta Grindului. Landslides and intense erosional processes were identified in these areas.

2. 3. Relief energy. Fragmentation depth

This morphologic parameter is strongly related to the petrographic structure and reflects the various rivers' deepening stages as a result of base levels changes. As a result of the drainage network deepening, the relief energy represents a parameter that describes the altimetric amplitude on which the actual geomorphic processes could develop. Fragmentation depth is a determinant factor in the transformation of potential energy into kinetic energy. The values of this parameter are extremely variable within the analyzed geographic space.

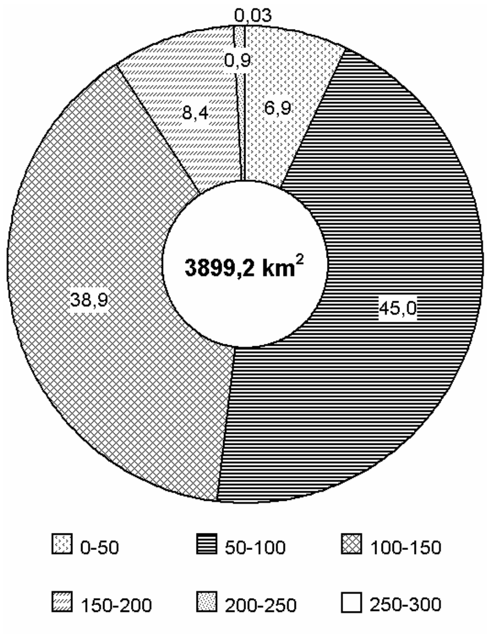


Fig. 7. Weight (%) of the various relief energy levels.

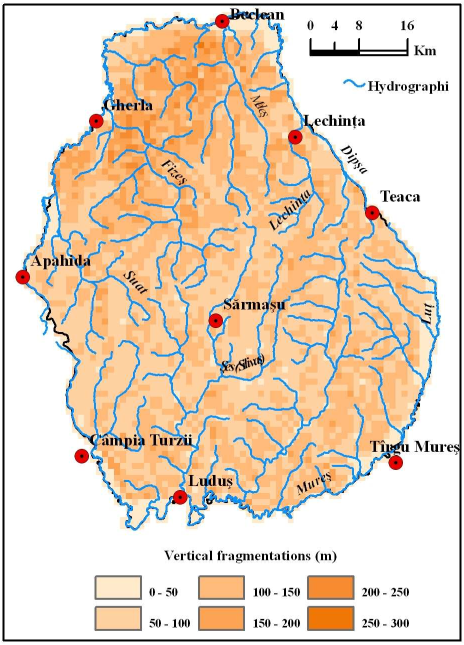


Fig. 8. Relief energy map of the Transylvanian Plain.

The maximal values, grading over 200 m, describe small areas in Unguraş Hills (4 %) and Fizeş Plain (2 %) and represent only 0,93% from the region's total surface (Figure 7). These values are determined by the closeness to the Someş low base level and to Dej local subsidence (Figure 8). The increased relief energy renders difficult the inhabitants' or goods' access or evacuation in case of disasters. The values between 100 and 150 m are the most frequent in all the geographic subunits, reaching 47 % in Lechința Hills and 62 % in the Sărmaş Plain.

Exceptions in this respect are the Fizeş Plain and the Unguraş Hills where this interval represents only 51 and 38 % from the unit surface.

The human settlements are located in areas with decreased relief energy, between 0 and 100 m, category that represents 52 % from the total surface and which is also extensively represented in all the subunits. Exceptions are the Unguraş Hills where this interval shares only 29 %, also inducing a decrease in settlements density.

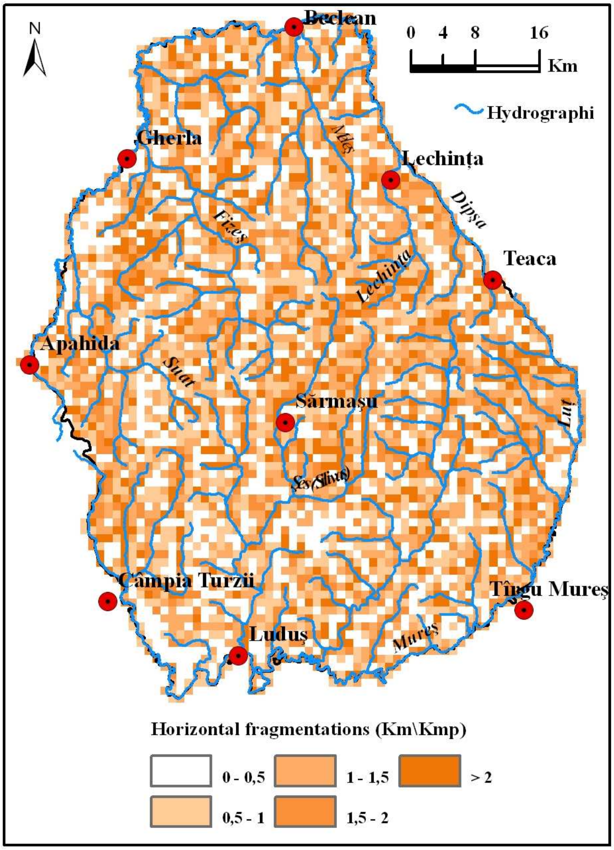


Fig. 9. Relief fragmentation density map in the Transylvanian Plain.

2. 4. Relief fragmentation density

The petrographic differences impose variations of the relief fragmentation density and determine different mechanisms in relief modeling. The distribution of the horizontal fragmentation classes is very mosaicked, a large specter of values, with very close weights, being identified (Figure 9).

The maximum weight belongs to the class with values grading between 0 and 0,5 km/km^2 (24 %), succeeded by that of 1 – 1,5 km/ km^2 (22 %). Similar weights (16-18 %) are characteristic for the classes of 1,5 - 2 km/km^2, respectively those over 2 km/km^2.

The horizontal fragmentation maximal values (over 2 km/km^2) have a quite similar distribution in Unguraş Hills (21%) and Fizeş Plain (20%), and also a significant one in Mădaraş Hills (18%) and Sărmaş Plain (18%), contributing to the triggering of ravines, torrents or land slides.

The horizontal frag-mentation minimal values (under 0,5 km/km^2) appear frequently in all the subunits of the Transylvanian Plain, representing from 22 to 29 % from their entire area.

2. 5. Slopes exposure

Together with geodeclivity, slope exposure is a very important factor that induces differentiations in insolation duration, contributing to the differentiation of the caloric regime and influencing in this way the vegetal layer and soil features, the suitability to certain land uses types or the actual geomorphic processes etc.

On the whole, the radiative, caloric or humidity regimes mirror two major slope orientations: north and east, with a decreased level of insolation, south and west, with a higher caloric regime values.

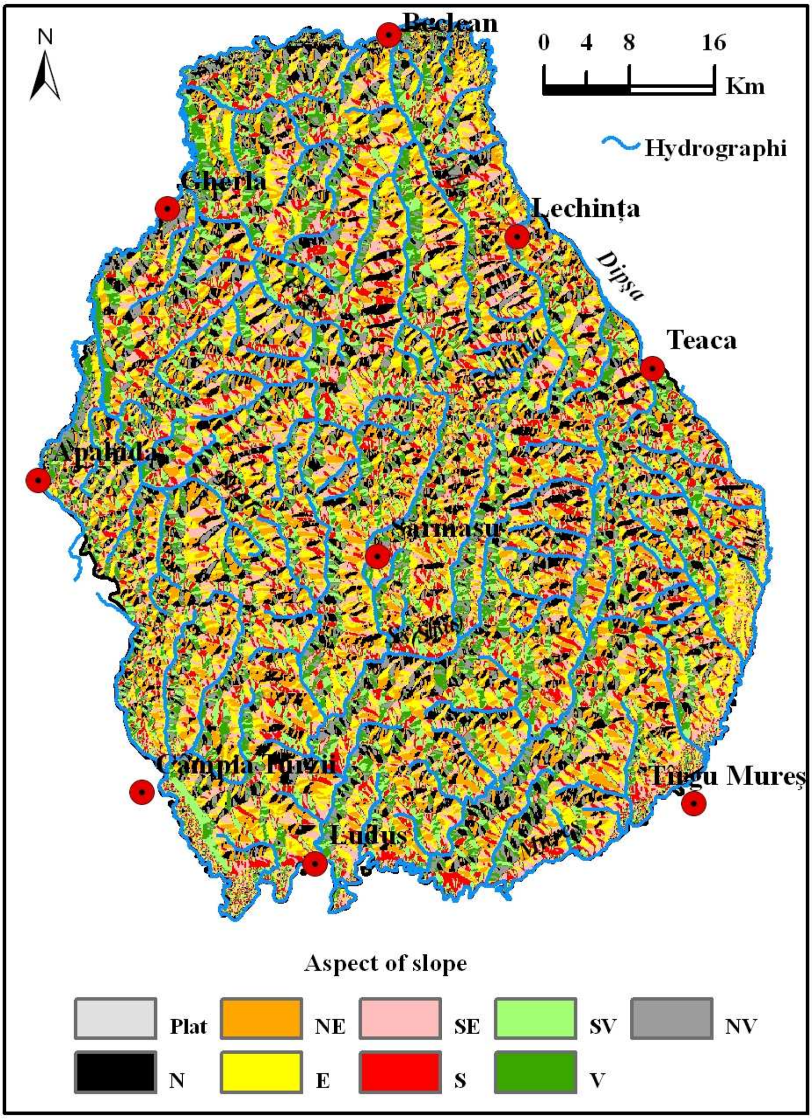


Fig. 10. Slope Exposure Map in the Transylvanian Plain.

The slope exposure map emphasizes the mosaic character of this parameter distribution (Figure 10). The horizontal surfaces cover only 1,6 % from the total surface of the region.

If following the territorial distribution of the various categories of slope exposure, one can notice that the analyzed area is quite uniform (Figure 11).

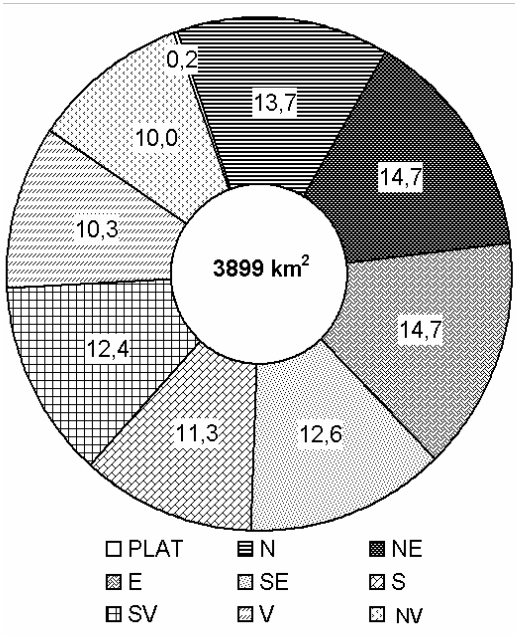


Fig. 11. Weight (%) of the territories with various slope exposure.

The relief with northeastern and eastern exposure is the most frequent (15 % each), while that with western and north-western exposure shares the minimal weight (10 %). The slopes with southern (11 %), southwestern (12%) and western (10 %) exposure are affected the most by geomorphologic processes.

The phenomenon can be explained by the presence of some factors whose cumulative effects contribute to these processes.

By studying the weight of the different slope exposure categories, we can notice that the southern and western slopes represent almost half of the region surface, sustaining the grain cultures.

The northern part of the Transylvanian Plain is suitable for orchards and vineyards (on the areas with southern and eastern exposure - Lechința Hills).

R E F E R E N C E S

1. Morariu, T. (1958), *Raionarea fizico-geografică a Cîmpiei Transilvaniei.* SUBB, Geol.-Geogr.,Series II, 1, Cluj-Napoca.
2. Morariu, T., Posea, Gr., Mac, I. (1980), *Regionarea Depresiunii Transilvaniei*, SCGGG, Geografie, t XXVII, nr.2, Edit. Academiei, Bucureşti.
3. Pop, Gr. (2001), *Depresiunea Transilvaniei*, Edit. Presa Universitară Clujeană, Cluj - Napoca.
4. Savu, Al. (1980), *Depresiunea Transilvaniei (Regionarea fizico-geografică). Puncte de vedere*, SUBB, Geol. - Geogr., XXV, 2,Cluj-Napoca.
5. Schreiber, W., E., Drăguț, L., Man, C.T.(2003), *Analiza peisajelor geografice din partea de vest a Câmpiei Transilvaniei*, Presa Universitară Clujeană, Cluj-Napoca.
6. Sorocovschi, V. (2005), *Câmpia Transilvaniei. – studiu hidrogeografic*, Casa Cărții de Știință, Cluj-Napoca.
7. Sorocovschi, V. , Schreiber, W., Bilaşco Şt., Horvath Cs. (2009), *Morphometric Cahracteristics of the Relief in the Southern Part of the Somesan Plateau*, SUBB, Geographia, 2, Cluj-Napoca.
8. * * (1987), *Geografia României, III, Carpații Româneşti şi Depresiunea Transilvaniei*, Edit. Academiei Republicii Socialiste România, Bucureşti.

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

SUMMER TEMPERATURE VARIATIONS DURING THE LAST CENTURY ABOVE TAKLIMAKAN DESERT

E. CHONGYI[1], Y. TAIBAO[1], W. YONG[3], H. JIANKANG[4], X. HONG[1], Z. HAIRU[2], H. CACOVEAN[5]

ABSTRACT. – Summer Temperature Variations during the Last Century above Taklimakan Desert. By analyzing the isotopic ratio $\delta^{18}O$ variation trend, the summer temperature variations during the last century above Taklimakan Desert were reconstructed. The summer temperature of middle-upper troposphere increased with about 1. 477 ^{0}C in 90 years. The temperature in surrounding Taklimakan Desert is significantly correlated with the $\delta^{18}O$ in the Chongce ice core, especially at Hotan station. Combined with Hotan temperature, the temperature curve above Taklimakan was reconstructed by using the $\delta^{18}O$ of 1903-1953 as interpolation. The summer temperature of Taklimakan Desert as represented by Hotan has increased by 0. 9 ^{0}C.

Keywords:*Taklimakan Desert, temperature variations, global warming, Chongce ice core.*

1. INTRODUCTION

Due to the global warming, the glaciers generally retreated in the world, especially the mountain glaciers. The Alpine glaciated area reduced by 35% between 1850 and 1975, and by 2000, the ratio reached 50%. The reduction ratio of 1985-2000 is five times the one of 1850-1975 and 1. 7 times of 1975-2000, presenting an accelerating trend (Michael et al. 2006). At the end of the 20th century, the glacier area of South America diminished to 2500 km^2 from 2700-2800 km^2 between 1950 and 1980 (Kaser et. al 2002). Glaciers in the Tarimu River basin in Taklimakan Desert have been mostly in retreat, and the glacier area reduced 36. 1 km^2 every year between 1963 and 1999 (Liu et. al 2006).

Both temperature and precipitation variation controls the pr0Cess of glacier fluctuations, but a temperature increase of 1 degree Kelvin needs an increase of precipitation by 25% to cover up for the deficiency mainly caused by ice melting (J. H. Oerlemans et al. 2005). As a predominant factor, temperature has an impact on the pr0Cess of glacier mass balance. The increase of temperature can intensify the melting pr0Cess of the glacier surface by increasing the rain-snow ratio, consequently it increases the surface roughness, decreases the albedo and expose more ice to facilitate melting (Bahr et al. 1998). So it is very necessary to obtain and study the temperature of mountain glaciers by different methods.

[1] *College of Resources and Enviroment, Lanzhou University 730000,China.*
[2] *College of Biology and Geography, Qinghai Normal University 810000, China.*
[3] *Key Laboratory of Meteorological Disaster of Ministry of Education and Nanjing University of Information Science &Technology, 210044, China.*
[4] *Research Institute of Environment and Resources, Hunan Normal University, Changsha 410081, Hunan, P. R. China.*
[5] *OSPA Cluj-Napoca, Romania, e-mail: turda75@yahoo.com*

The ice core is one of the most important information sources of climatic and environmental change. Ice cores retrieved from the glaciers over high Asian mountains have provided several climatic and environmental records representing either very long, over 10000-100000 year B. P, or rather short, less than 10 years, of time scale (Thompson et al. 2000; Kang et al. 2000, Thompson et al. 1989, Yao et al. 1997). The isotopic ratio $\delta^{18}O$ (defined as the relative deviation of the $^{18}O/^{16}O$ ratio of the sample from the Vienna standard mean 0Cean water) can be used to construct chronology, but also to restore the past temperature variations. According to the current researches, it shows a significant positive correlation in North Qinghai-Tibet Plateau between the $\delta^{18}O$ of precipitation and the temperature in precipitation formation time (Zhang et al. 1994, 1995). An 18. 7 m ice core retrieved from the Chongce ice cap, in West Kunlun Mountain, provides us an opportunity to reconstruct the last near century temperature of middle-upper troposphere above the Taklimakan Desert.

2. STUDY AREA

Taklimakan Desert is the largest desert in China, and it is one of the most intensive areas responding to global warming. As situated in the center of Eurasia, Taklimakan Desert represents a typical arid climate characterized by far distance from 0Ceans, extremely dry air, low precipitation and high evaporation rates (E Chongyi et. al. 2009).

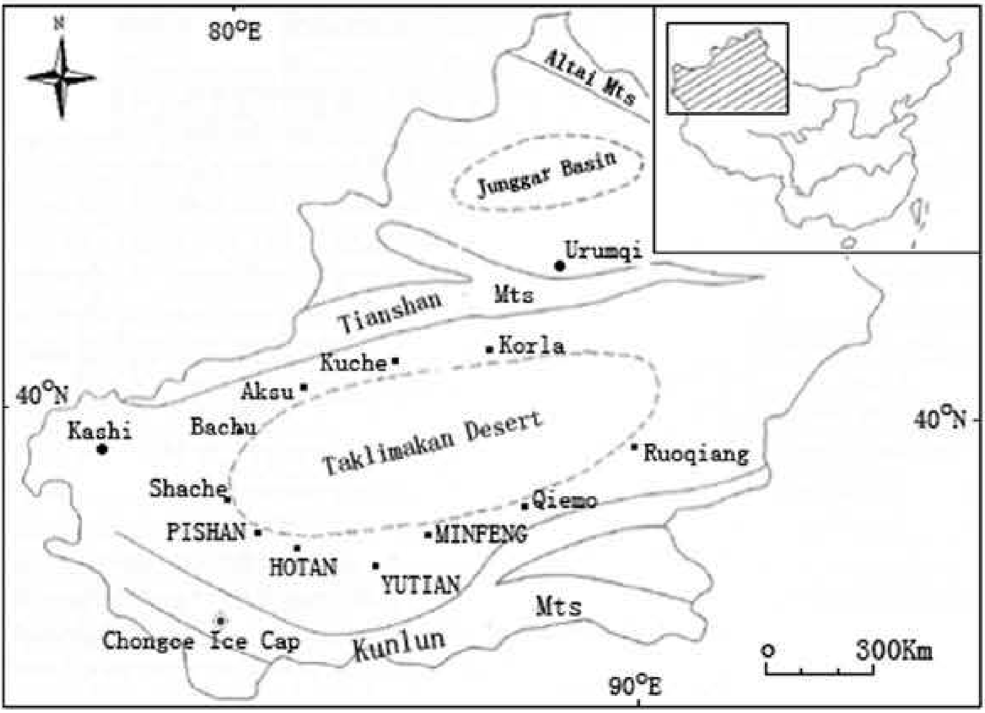


Fig. 1. Map of study area (E. Chongyi et al. 2009).

Water is vital for an arid area such as Taklimakan Desert, where glaciers developing in high mountains serve as the main water supply to its social and economic construction. The precipitations in Takalimakan Desert mainly 0Ccur in summer, May to 0Ctober, while sandstorms mainly happen in spring, February to May (Li Jiangfeng 1991).

Chongce Ice Cap ($35^{0}14^{'}$N, $81^{0}07^{'}$E) is l0Cated on the southern slope of the middle West Kunlun Mountains, the northern margin of Qinghai-Tibetan Plateau, near Taklimakan Desert, which is to the North (fig. 1). It belongs to the Guozhacuo river basin, 138. 5 km^2 large. The upper height of the glacier is 6846 m, the height of the end is about 5800 m and the equilibrium line is at 5930 m (Zhang et al. 1989). The terrain conditions are proper for glacier development. Because of high elevation, the temperature of glaciers in West Kunlun Mountains is very low, the annual average temperature near snow line is -13^{0}C ~ -15^{0}C, and the amount of precipitation near snow line is 300 mm ~ 500 mm. The precipitations mainly 0Ccur in summer, as July and August are the month with the highest amount of precipitation in the middle West Kunlun Mountains (Zhang et al. 1989).

2. MATERIALS AND DATA

2. 1. Chongce ice core

The Chongce Ice Cap (Figure 2) extends over a distance of 7 km, and contains two prominent domes at 6530 and 6374 m (Han et al. 2006). A comprehensive analysis suggests that the Chongce Ice Cap is an inland glacier of summer-accumulation type (Ageta et al. 1989).

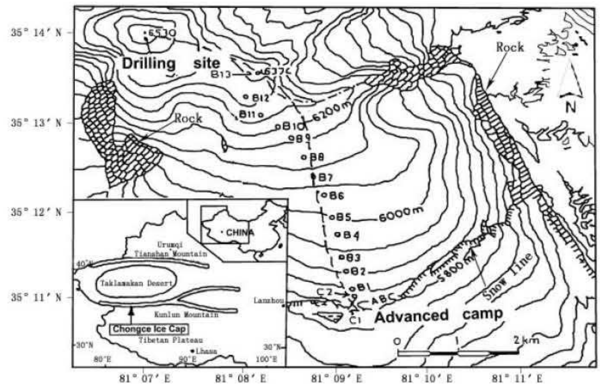


Fig. 2. Chongce Ice Cap and drilling sites (Han et al 2005, E Chongyi et al 2009).

Located on a flat dome of about 100m in diameter, the summit is situated on the ice divide. Six ice cores from 16m to 48. 2m long were retrieved electromechanically during the field season of September 20 to October 4, 1992. The 18. 7m long ice core was dated by analyzing insoluble micro-particles ranging from 0. 66 to 1. 33μm in diameter, in combination with the soluble ion species Ca^{2+} concentration. The assisting dating parameters include: the measured net accumulation in the last 5 years prior to the drilling activity and the stratigraphic marker from atmospheric nuclear weapon tests (Han et al. 2005). Based on the combined techniques, a time scale covering the period between 1903-1992 was derived. The cumulative dating uncertainty by the bottom is estimated less than 2 years (Han et al. 2005).

A comprehensive analysis suggests that the Chongce Ice Cap is an inland glacier of summer-accumulation type (Ageta et al. 1989). Furthermore, the winter snowfall retained in the ice core is less because of the strong winter winds and the special local topography, just as the fig. 2 indicates, snow is easily blown away because the ice core drilling site is on the peak of Chongce Ice Cap. Based on the research of snow accumulation rate, it also represents an obvious characteristic of a single peak. Thus, the ice core mainly provides climatic information for summer.

Prior to all instrumental analyses, visual stratigraphy was observed in a cold room by using a fluorescent tube. The as-drilled surface was polished occasionally by wiping it with an alcohol cloth to find the details. All visual features such as bubble free ice layers, layers with different grain sizes, and light transmissivity varying rapidly between adjacent structures were marked on a 10 cm wide roll of log sheet, providing a 1:1 map of the entire core.

After the description of the microscopic stratigraphy over a light tube, the core increments were cut into 458 sections of 3-5cm thick for density determination. The analysis of the isotopic ratio $\delta^{18}O$ was carried out by an isotope-ratio mass spectrometer. According to the dating result, we calculated the average of $\delta^{18}O$ contained in the annual layer. Finally, the annual mean $\delta^{18}O$ data of Chongce ice core was established.

The isotopic ratio $\delta^{18}O$ of the dated core of 18. 7m in length was chosen to be the proxy of summer temperature of middle-upper troposphere above the Taklimakan Desert.

3. METHODOLOGY

3. 1. Wavelet Analysis

The wavelet transform is a relatively new data analysis tool and has been shown to be very useful in analysis of geophysical time series (Weng et. al, 1994; Lau et. al, 1995, Liu et. al, 1998) and the most widely used Morlet function is the basic function is given as

$$\psi(t) = e^{ict}(e^{\frac{t^2}{2}} - \sqrt{2}e^{\frac{c^2}{4}}e^{-t^2}) \tag{1}$$

in this paper we assume c=5. 4, thus the second section of the formula is much less than the first section and then its derived wavelet function is

$$\Psi_{a,b}(t) = \frac{1}{\sqrt{a}}\psi(\frac{t-b}{a}) \quad (b \in R, a \in R, a \neq 0 \tag{2}$$

For the time series $f(t) \in L^2(R)$, the continuous wavelet transform is defined as

$$W_f(a,b) = \frac{1}{\sqrt{a}}\int_{-\infty}^{+\infty} f(t)\overline{\psi}\frac{t-b}{a}dt \tag{3}$$

in practical work, the time series are frequently discrete, for the time series $f(k\Delta t)$ (k=1, 2…, n; Δt is the sampling time interval), its discrete form is given as

$$W_f(a,b) = \frac{1}{\sqrt{a}}\Delta t\sum_{k=1}^{n} f(k\Delta t)\overline{\psi}(\frac{k\Delta t - b}{a} \tag{4}$$

$W_f(a,b)$ can reflect the characteristic of the time region parameter a and the frequency region parameter b, and it is the output passed unit pulse of the time series $f(t)$ or $f(k\Delta t)$. The Morlet Wavelet Function used in this paper is a periodic function smoothed from Gaussian Function. Therefore they have the corresponding relationship one by one between a, the flex scale of the Morlet Wavelet Function and T, the period in Fourier transform. Their transform formula can be defined as

$$T = \left[\frac{4\pi}{c + \sqrt{2 + c^2}}\right]a = 1.144a \tag{5}$$

This made the result more concise. Morlet wavelet is a plural wavelet: the real part gives information of different characteristic time scale signals on the distributing and phase of the different times. The wavelet coefficient under the different time scales reflect the different variety and character of the system: the positive wavelet coefficient is corresponding to the high side, the negative wavelet coefficient is corresponding to the low side. When the wavelet coefficient is the assumed value, 0, it is corresponding to the abrupt changing point. When the absolute value of wavelet coefficient is higher, it indicates that the variety of the time scale is more obvious (E. Chongyi et al. 2009).

3. 2. Wavelet variance

Wavelet variance is the integral of all wavelet coefficients square about *a* in the time domain. The changing process with the variation of time scale *a* reflects the distribution of fluctuation energy with time scale, thus the main periods existing in the time series can be determined. The function is given as

$$Var(a) = \int_{-\infty}^{+\infty} \left| W_f(a,b) \right|^2 db \tag{6}$$

4. RESULTS

The δ^{18}O of Chongce ice core is just from precipitation, and the ice cores were drilled at the elevation of 6,532m (equivalent to the mid-troposphere), so the δ^{18}O of Chongce ice core can directly reflect the temperature of the surrounding troposphere when precipitation occurs. The 500hPa and 300hPa temperature, from the monthly mean temperature data of the NCEP/NCAR reanalysis data for 1948-92, respectively represent the temperature of the middle and upper troposphere. Because of the limited ice core dating accuracy (much less than the weather station), the correlation analysis is based on the mean temperature data smoothed by 3-year moving average.

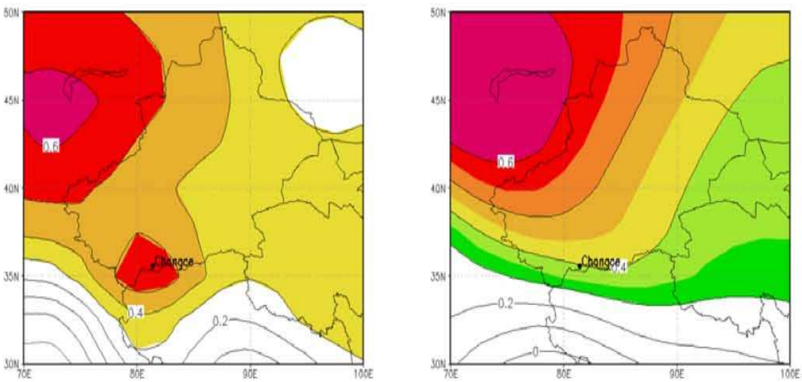


Fig. 3. Distribution of the correlation between the δ^{18}O of Chongce ice core and the temperature of the middle (a 500hPa) and upper (b 300hPa) troposphere. The shadow region indicates the significant correlation at the 0. 05 level in t-test.

Comparing with the temperature of the middle and upper troposphere above Taklimkan Desert, the correlation between the δ^{18}O of Chongce ice core and the June - September mean temperature of the mid-upper troposphere (500hPa and 300hPa) for 1948-92 is studied. The results indicated that the significant positive correlation between them existed in June-September, i. e. the δ^{18}O of Chongce ice core matches closely to the one of the mid-upper troposphere temperature of June to September for 1948-92.

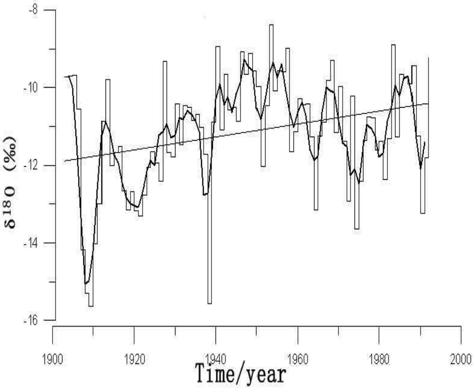


Fig. 4. Variation of δ^{18}O in Chongce ice core (thin curve: annual value, thick curve: 3 years moving average value).

The region of the significant positive correlation coefficients, including the west Kunlun Mountain and the middle-upper troposphere above Taklimakan Desert, is displayed on the fig. 3. This shows that the δ^{18}O of Chongce ice core can be taken as the summer temperature proxy of the mid-upper troposphere over Taklimakan Desert.

Fig. 4 is the isotopic ratio δ^{18}O variation trend and from the figure the summer temperature of middle-upper troposphere above Taklimakan Desert increased obviously during the 90 years between 1903 and 1992. The trendline formula is Y=0. 0166X-43. 538. According to the researches (Yao et al, 2004), there is an equal correlation between the variation of δ^{18}O and the temperature in the North Qinghai-Tibet Plateau, i. e. the 1 increased in δ^{18}O, then the 1 ^{0}C increased in temperature. So Fig. 4 shows that the temperature increased near the Chongce Ice Cap by about 1. 477 ^{0C} during the last century, i. e. the summer temperature above Takli-amkan Desert increased by about 1. 477 ^{0}C.

The wavelet analysis indicates that there exists obvious inter-decadal and inter-annual periodicity variation. A relatively consistent and strong 30-55 year period over the entire time series can be observed in fig. 5. On this time scale, the temperature of the middle-upper troposphere above Taklimakan Desert presented three warm periods and two cool periods, i. e. the early 20th century (before early 1910s) is a warm stage, middle 1920s to middle 1930s a cool stage, middle 1930s to early 1960s a warm stage, early 1960s to early 1980s a cool stage, and early 1980s to early 1990s a warm stage. There is also an obvious 10-18 year period; the period signal is strong and obvious since 1903 until the early 1930s; after the middle 1970s, the signal is evident. On the inter-annual scale, a weak 5-9 year period can be noticed during the entire time domain except for 1920s and 1930s.

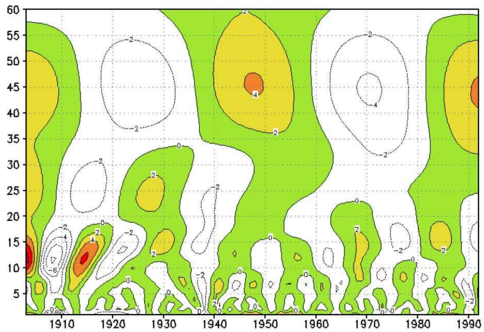


Fig. 5. The real parts of Morlet wavelet transform of the isotopic ratio δ^{18} O variation dashed 0.0, shadow≥0.0.

Fig. 6 is the wavelet variance analysis of the isotopic ratio δ^{18}O variation 1903-1992 and in this figure there are 13-year, 25-year and qusia-46-year periods, i. e. periods of summer temperature of middle-upper troposphere above the Taklimakan Desert.

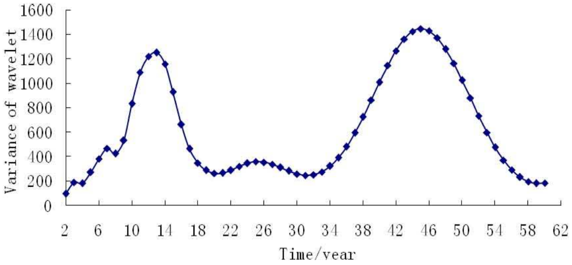


Fig. 6. Variance of wavelet of δ^{18}O in Chongce ice core.

5. DISCUSSION AND CONCLUSION

Chongce Ice Cap is near Taklimakan Desert. The height of the surrounding regions of Takli-makan Desert is very low, appro-ximately 1000 m, but the tempe-rature of low altitude is consistent with the temperature of 500hPa height, furthermore the correlative coefficients are analyzed between the isotopic ratio δ^{18}O and the weather stations surrounding the Taklimakan Desert. The correlation analysis is based on the mean temperature data smoothed by 3-year moving average (Table 1). There is a positive correlation at the significant level a=0. 05 between the temperature (July and August) surrounding the Taklimakan Desert and the isotopic ratio δ^{18}O of the Chongce ice core. This probably provides us an opportunity to reconstruct the historic summer temperature surrounding the Taklimankan Desert by the curve fitting of the δ^{18} O.

Correlation coefficient of 3 years moving average between the mean temperature of July and August surrounding Taklimakan Desert and δ^{18} O in Chongce ice core

Table 1

Indicative	**Bachu**	**Hami**	**Hotan**	**Kash**	**Kuche**	**Korla**	**Ruoqiang**	**Shache**
Correlative coefficient	0. 4155	0. 4109	0. 3543	0. 3745	0. 6349	0. 4837	0. 5384	0. 3012
Data interval	54~90	51~90	53~90	51~90	53~90	58~90	53~90	53~90

Based on the statistic correlations between the δ^{18}O in Chongce ice core and the temperature surrounding Taklimkan, the function correlation can be established as a regression equation (table 1):

$$\Delta(\delta^{18}O)=1.\ 3312\Delta T\ (r=0.\ 527)$$

ΔT is the average anomaly value of 3-year moving average of the monthly temperature in July and August surrounding Taklimakan, and $\Delta(\delta^{18}O)$ is the average anomaly value of 3-year moving average of the δ^{18}O in Chongce ice core. If we use the entire δ^{18}O sequence to reconstruct the temperature in surrounding Taklimakan, the temperature increased about 1. 11 ^{0C} during the last century.

The comparison between some random selected stations and the $\delta^{18}O$ in Chongce ice core show that the variation curve of 3-year moving average of Hotan is the most consistent with the Chongce ice core (fig. 7).

Furthermore, some researchers analyzed the correlations of climatic factors (air temperature, precipitation and spring sandstorms) at the two stations surrounding Taklimakan, and found that the accumulative correlation coefficient of Hotan is the highest (E Chongyi et. al 2009). Therefore, by using the $\delta^{18}O$ value between 1903 and 1953, the summer temperature in surrounding Taklimakan represented by Hotan can be reconstructed; combined with the temperature variation curve of Hotan for 1954-1992, the estimated curve of summer temperature in the surroundings of Taklimakan was obtained.

As shown in fig. 8, the summer temperature of Taklimakan Desert presented three heating periods and two cooling periods, i. e. the early 20th century (before early 1910s) is a quick abrupt cooling period, from 1910 to the end of 1940s there is a fluctuating warming period, cooling down to 1970, and then gradually increased to 1990. The summer temperature of Taklimakan represented by Hotan increased by 0. 9 ^{0C} in nearly 90 years.

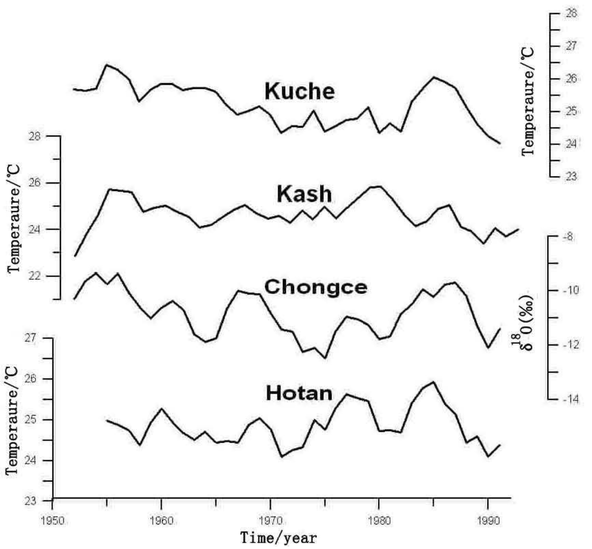


Fig. 7. Comparison of 3 years moving average values between in $\delta^{18}O$ Chongce Ice Core and mean temperature of July and August in Hotan, Kash and Kuche.

Jones et al. (1999) calculated that the global average temperature was 14. 0 ^{0C} for 1961 -1990 (14. 6 ^{0C} in the northern hemisphere, and 13. 4 ^{0C} in the southern hemisphere). There are two periods of warming during the 20th century: an increase by 0. 37K between 1925-1944, and by 0. 32K between 1978-1997. The first warming period is found in the reconstructed temperature sequence, and the second warming period is not obvious because the data only reached to 1992. However, the temperature variation trends of the region, as represented by Hotan, and the northern hemisphere are similar. This proves that it is reliable to use the $\delta^{18}O$ in ice cores to reconstruct the historic temperature.

Overall, by analyzing the isotopic ratio $\delta^{18}O$ variation trend, the summer temperature variations during the last century above Taklimakan Desert were reconstructed. The summer temperature of middle-upper troposphere increased by about 1. 477 ^{0C} in 90 years. The temperature in the surroundings of Taklimakan Desert is significantly correlated with the $\delta^{18}O$ in Chongce ice core, especially with Hotan station. Combined with Hotan temperature, the temperature curve surrounding Taklimakan was reconstructed by using the $\delta^{18}O$ of 1903-1953 as the interpolation, and the summer temperature of Taklimakan Desert as represented by Hotan has increased by 0. 9 ^{0C}. It is reliable to use the $\delta^{18}O$ in ice cores to reconstruct the historic temperature, but there is also some uncertainty to reconstruct the temperature by only one ice core. It is necessary to retrieve more ice cores and further research is needed to perfect the uncertainty.

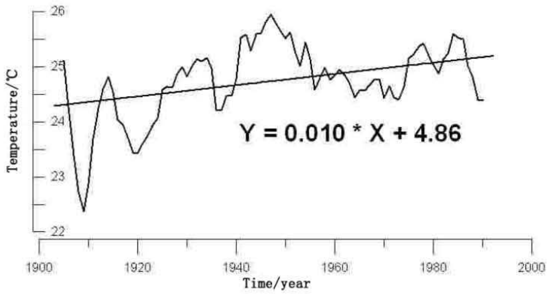


Fig. 8. Restored curve of summer temperature in surrounding Taklimkan.

R E F E R E N C E S

1. Ageta, Y., W. J. Zhang, W. J., Nakawo, M. (1989), *Mass balance studies on Chongce Ice Cap in the West Kunlun Mountains*, Bulletin of Glacier Research, vol. 6.
2. Bahr David B, Pfeffer W. T., Sassolas C., et al. (1998), *Response time of glaciers as a function of size and mass balance: Theory[J],* Journal of Geophysical Research, vol. 103 (B5).
3. Chongyi, E., Yong, W., Taibao, Y., Jiankang, H., et al. (2009), *Different responses of different altitudes surrounding Taklimankan Desert to global climate change,* Journal of Environmental Geology, vol. 56, no. 7.
4. Han J-K, Nakawo, M., Goto-Azuma, K., Zhang W. C. (2005), *Dating of a Shallow Ice Core from Chongce Ice Cap Using Micro-particle Content,* Journal of Glaciology and Geocryology, 27, no. 6.
5. Jiankang, H., Nakawo, N., Goto-Azuma, K., Chao, L. (2006), *Impact of air burden fine dust on the mass balance* of a high mountainous glacier: a case study of Chongce ice cap, west Kunlun Shan, China, Annals of Glaciology, vol. 43, no. 23-28.
6. Jones P. D, New, M., Park, D. E., et al (1999), *Surface air and its changes over the past 150 year,* Journal of Review of Geophysics, vol. 37, no. 2.
7. Kaser G, Ostmaston H., (2002), *Tropical Glaciers*, Cambridge University Press, Cambridge.
8. Lau K. M., Weng, H. Y. (1995), *Climate signal detection using wavelet transform: how to make a time series sing*., Bulletin of the American Meteorological S0Ciety, vol. 76, no. 12.
9. Jiang Feng, L. (1991), *Climate of Xinjiang*, Meteorological Press Beijing, 180-186.
10. Liu H. S., Chao, B. F. (1998), *Wavelet spectral analysis of the earth's orbital variations and pale0Climatic cycles,* Journal of the Atmospheric Sciences, vol. 55, no. 2.
11. Shiyin, L., Yongjian, D., Jing, L., et al (2006*), Glaciers in response to recent climate warming in western China,* Quaternary Science, vol. 26, no. 5.
12. Nakawo M, Ageta, Y., Han, J. K., (1990) *Climatic information from the Chongce Ice Cap, West Kunlun, China*. Annals of Glaciology, vol. 14.

13. Nakawo, M., Goto-Azuma, K., Han, J. K. (1994) *Decreasing trend of Precipitation in the last 30 years at a mountain site near the Taklamakan Desert, western China*, RIKEN Review, no. 5, F0Cused on Earth and Planetary Environment.

14. Oerlemans, J. H. (2005), E*xtracting a climate signal from 169 glacier records,* Journal of Science, vol. 308, no. 29.

15. Thompson. L. G, E. Mosley-Thompson, M. E. Davis, J. F. Bolzan, J. Dai, L. Klein, T. Yao et. al., (1989), *Hol0Cene-late Pleist0Cene climatic ice core records from Qinghai-Tibetan Plateau*. *Science,* 246.

16. Thompson, L. G., Yao, T., Mosley-Thompson, E., Davis, M. E., Henderson, K. A., Lin, P. N. (2000*). A high resolution millennial record of the South Asian Monsson from Himalayan ice core,* Science, vol. 289.

17. Shichang, K., Wake Cameron P, Dahe, Q., Mayewski, P. A., Tandong, Y. (2000), *Monsoon and dust signals recorded in Dasuopu Glacier, Tibetan Plateau,* Journal of Glaciology, vol. 46, no. 153.

18. Weng, H. Y., Lau K. M. (1994), *Wavelets period doubling, and time frequency western Pacific*, Journal of Atmospheric Sciences, vol. 51.

19. Yao, T. D., Thompson, L. G., Shi, Y., Qin, D., et al. (1997), *Climatic variation since the last interglaciation recorded in the Guliya ice core,* Journal of Science in China, vol. 40, no. 6.

20. Yao T. D, Yang M. X., (2004), *ENSO events recorded in Tibetan,* Developments in Paleoenvironmental Research, 9.

21. Zemp, M., Haeberli, W., Hoelzle, M., *et al*. (2006), *Alpine glaciers to disappear within decades?* Journal Geophysical Research Letters, vol. 33. no. 13.

22. Zhang, W., Ruizhen, A., Huaian, Y., Keqin, J. (1989), *Conditions of glacier development and some glacial features in the West Kunlun Mountains,* Bulletin of Glacier Research, 7.

23. Zhang X., Tandong, Y., (1994), *World spatial characteristics of oxygen isotope ratio in precipitation*, Journal of Glaciology and Ge0Cryology, vol. 16, no. 3.

24. Zhang X., Yafeng, S., Tandong, Y. (1995), *The variational feature of precipitation $\delta^{18}O$ in Northeast in Qinghai-Tibet Plateau,* Journal of Science in China (B), vol. 25, no. 5.

HAIL, A CLIMATIC HAZARD IN THE WESTERN ROMANIAN PLAIN, NORTH OF MUREŞ RIVER

EUGENIA ŞERBAN[1], CARMEN SOFIA DRAGOTĂ[2], T. MAN[3]

ABSTRACT. – Hail, a climatic hazard in the Western Romanian Plain, North of Mureş River. In the present paper meteorological data have been used, as far as the annual number of days with hail is concerned, from a number of 10 weather stations, during the period 1961-2002. In the Western Romanian Plain, North of Mureş River, an annual average of 0.7-1.3 days with hail is recorded. The most frequent cases are registered in Arad Plain, Ier Plain and at the eastern limit of Crişuri Plain, on the contact with Crişana Hills, where the air and soil humidity is high, or where the plain meets the hills. In Crişuri, Arad and Aranca Plains, most days with hail were produced in the second decade, while in the low Someş Plain, in the third decade of the analysed period. On the analysed territory, the hazards generated by hail occurrence decreased in the latest years, except for the low Someş Plain and the area around the city of Oradea, where they increased. The cause of the decrease of hail resides in the persistence of a long dry period during the latest years (1982-1994), and in the decrease of the values of the relative air humidity, especially between 1990 and 1995 and in the years 2000 and 2002.

Keywords: *number of days with hail, climatic hazard, frequency, tendency.*

1. INTRODUCTION

Hail is a meteorological and climatic hazard, specific for the warm season of the year. It causes large local material damages in a very short time, according to the trajectory of the cloud which generated it. The damages depend on the size and density of the ice lumps, which, in their turn, determine the mechanical action they exert (Berbecel and others, 1970; Bogdan, Niculescu, 1999; Bogdan, Marinică, 2007).

Generally, in Romania, hail is produced when there is a significant temperature difference (10-20°C) between the existing air masses above and the replacing air masses (usually polar maritime air masses), generating high instability. The air mass should contain a lot of humidity (Bălescu, Militaru, 1967). The temperature at the upper limit of the Cumulonimbus clouds should range between -30°C and -60°C, and two thirds of the volume of the clouds should be located above the -5°C isotherm (Cristea, 2004).

Taking into consideration the huge local damages that hail may cause, their study claim attention in the condition of the generally agricultural territory of the Western Romanian Plain, North of Mureş River.

[1] *University of Oradea, Faculty of Environmental Protection, 410048, Oradea, Romania;E-mail: eugeniaserban@yahoo.com*

[2] *Institute of Geography of the Romanian Academy, 023993, Bucharest, Romania;E-mail: dragotacarmen@yahoo.co.uk*

[3] *"Babes-Bolyai" University, Faculty of Geography, 400006, Cluj-Napoca, Romania;E-mail: tman@geografie.ubbcluj.ro*

2. DATA AND METHODS

In the present paper meteorological data have been used, as far as the annual number of days with hail is concerned, from a number of 10 weather stations, during the period 1961-2002 (fig. 1). Two of them are located out of the analyzed plain sector: Sânnicolau Mare and Şiria. The data taken at those stations have been used to comparison. Not all stations had a common observation period, as some of them were set up later on: Salonta (1983-1998), Holod (1969-2002), Ineu (1979-1997) and Şiria (1984-2002). All meteorological data used in the present paper come from the Archive of the National Meteorology Administration.

On the basis of existing data, the annual frequency of hail occurrence has been calculated and the distribution by decades of the number of days with hail has been analysed. The extreme values, representing the hazards, are highlighted. The linear tendency of the annual number of days with hail has been represented.

3. RESULTS AND DISCUSSIONS

3. 1. The annual average number of days with hail

In the Western Romanian Plain, North of Mureş River, an annual average of ***0.7-1.3 days with hail*** is recorded (fig. 1). The lowest number is recorded at Ineu station, because of the short period of years of observation (1979-1997), which overlaps with a decade of drought. Also, a low number of days with hail are recorded at the southernmost station, Sânnicolau Mare, a fact in conflict with the high annual average number of days with thunderstorm (Şerban, 2008). The main reason is that the station is located at the lowest altitude (84 m) in the analysed territory, which determines the descending movement of the air masses, unfavourable for hail.

As opposed to this, the highest number of days with hail is recorded at Arad station. The high number of cases is here due to the landforms. At the contact of the south-western or western air masses with the high tabular Plain of Arad, the air masses execute a forced ascending movement, which contributes to an increase in nebulosity. One should also add the high moisture of the soils of Mureş floodplain, which brings a supplementary contribution to the formation of hail, in the warm summer afternoons, when evaporation is intense. Finally, the high evaporation from the surface of Mureş should be added too, as the river has a considerable width once it flows over the Western Romanian Plain, after it gathered the waters from its tributaries.

Similarly, the high number of days with hail at Săcueni, Oradea and Holod stations is due to their position on the contact between the plain and the hills, and to the favourable orientation of the mountain ranges of Apuseni, in right angle to the predominant movement of the oceanic wet air masses, which amplify the dynamic convection. At Săcueni, one should also add the high moisture of the soil, specific for the floodplain of Ier, as well as the location of the floodplain, perpendicular to the predominant trajectory of weather fronts, which are reactivated when they cross over this area by the warm air, not ventilated during summer, of this narrow sector, oriented South-West to North-East. This is the explanation for the higher number of days with hail at Săcueni station, compared to the slightly higher stations of Oradea and Holod.

Practically, in the Western Romanian Plain, North of Mureş River, *the most frequent cases of hail* are registered *in Arad Plain, Ier Plain and at the eastern limit of Crişuri Plain, on the contact with Crişana Hills.*

At the northern station of Satu Mare, even if the advections of wet oceanic air are more frequent, there are a lower number of cases of hail, because of the lower air and soil temperature, which are not in favour of heat convection. It is also known that the oceanic air masses have a moderating climatic role. The low number of days with hail at Şiria – the station located at the highest altitude – is determined by the short period of observation (1984-2002).

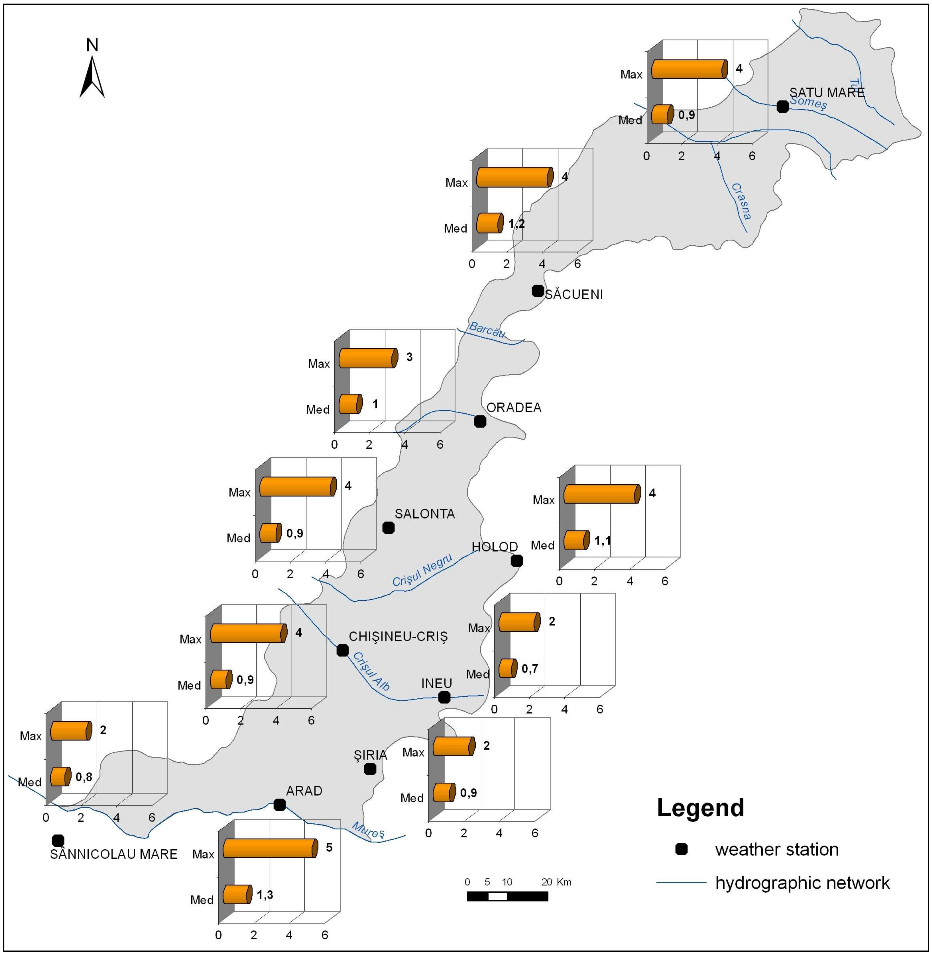


Fig. 1. The average and maximum annual number of days with hail, in the Western Romanian Plain, North of Mureş River (1961-2002).

The figures 2-4 show that the annual number of days with hail varied a lot between 1961 and 2002. The variations are caused by the general circulation of the atmosphere, the peculiarities of the ground and the regime of the solar radiation.

3. 2. The maximum annual number of days with hail

Compared to the average annual number of 0.7-1.3 days with hail, the maximum annual number raised to ***2-5 days*** between 1961 and 2002 (fig. 1). The value was higher in the Crişano-Someşană Plain – where the air humidity is higher in warm semester than in the southern areas – reaching 4 days (and only 3 days in Oradea) and lower, about 2 days, at the stations located in Mureş Plains. In this latter case, the dryness and drought phenomena are more frequent, as a result of the Mediterranean climatic influence. There is an exception at Arad station, where the highest annual number of days with hail has been recorded (5 days, in 1982). The reason has been discussed above. The low number of days with hail at Ineu and Şiria is considered to be caused by the short period of years of observation.

The highest values were recorded in the following years (fig. 2-4): ***1982*** (5 days at Arad, 3 at Chişineu-Criş), 1977 (4 days at Săcueni), 1978 (4 days at Arad), 1979 (4 at Chişineu-Criş), 1980 (4 days at Arad and Săcueni), 1987 (4 at Holod), 1988 (4 at Chişineu-Criş), 1989 (4 at Satu Mare), 1990 (4 at Holod), 1997 (4 days at Salonta) etc. One remarks the existence of two periods of four years, with a high number of days with hail – *1977-1980* and *1987-1990*. They begin 10 years one after the other, and they are followed, 10 years later, by the year *1997*, which also totalized many cases of hail.

In 1982, there were 5 cases of hail at Arad, 3 at Chişineu-Criş and also a few cases in the northern part of the plain: 2 at Oradea and Săcueni and 1 case at Satu Mare. From the point of view of the temperature, the year 1982 was normal in Crişuri and Arad Plains and cool in Someş Plain. It was also a normal year from the point of view of the rainfall in most of the plain, with small exceeding values at Arad, Chişineu-Criş and Oradea stations. At Arad station, there were high values of the relative air humidity (an annual average of 84.1%) during that year, which was one of the causes for the high number of days with hail.

1990 was another year with a high number of days with hail in the plain. During that year, 4 cases have been recorded at Holod, 2 at Arad, Sânnicolau Mare and Oradea, and one case at all the other stations (except for Săcueni, where hail was not recorded that year). 1990 was a very warm and very dry year. The high temperatures were those which favoured the heat convection and the production of hail.

The year 1997 recorded the maximum number of hail cases at three meteorological stations (4 days at Salonta, 3 at Oradea and 2 at Ineu). There were also 2 cases registered at Arad and one case at all the other stations (except for Chişineu-Criş and Sânnicolau Mare, where hail was not recorded that year). According to the annual report presented by the A.N.M. to the World Meteorological Organisation, 1997 represented the year when the highest economic damages were reported at national level, during the 1991-2000 decade. During that year, 14 counties have been affected by hail, especially in the southern part of the country. Hail produced 55% of the damages caused by meteorological phenomena in Romania that year (Dragotă, 2001). 1997 was a cool year from the point of view of the temperature and a normal year from the point of view of the rainfall. However, it presented high values of the relative air humidity (81%) in the northern half of the plain. At Salonta, the annual average humidity reached 85%, being the main cause for the high frequency of hail.

One may notice from the above-mentioned data that *the years with the highest values are found concentrated in the middle of the period of analysis* 1961-2002, more precisely *between 1977 and 1990*. So, *the maximal values were produced especially in the 2nd and 3rd decades*, the same as it happened with the number of days with thunderstorms (Şerban, 2008). This period overlaps with the period which registered the highest values of air humidity, 1975-1989, which was one of the main causes for the presence of hail.

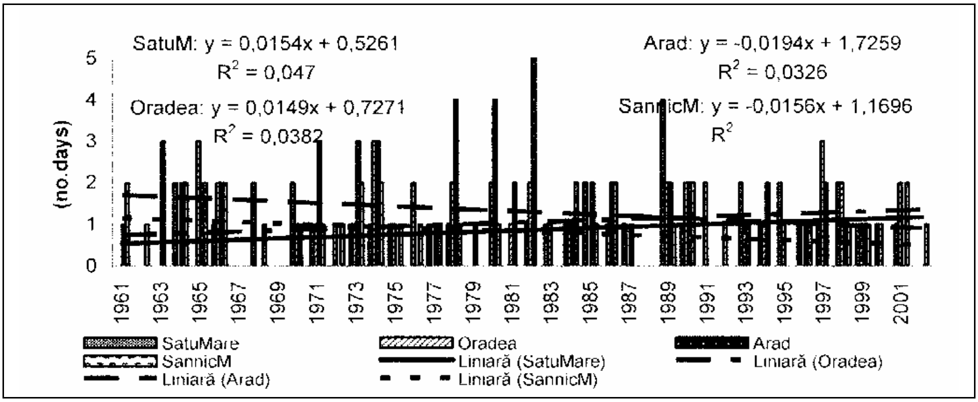


Fig. 2. The annual number of days with hail and its linear tendency, in the Western Romanian Plain, North of Mureş River (1961-2002).

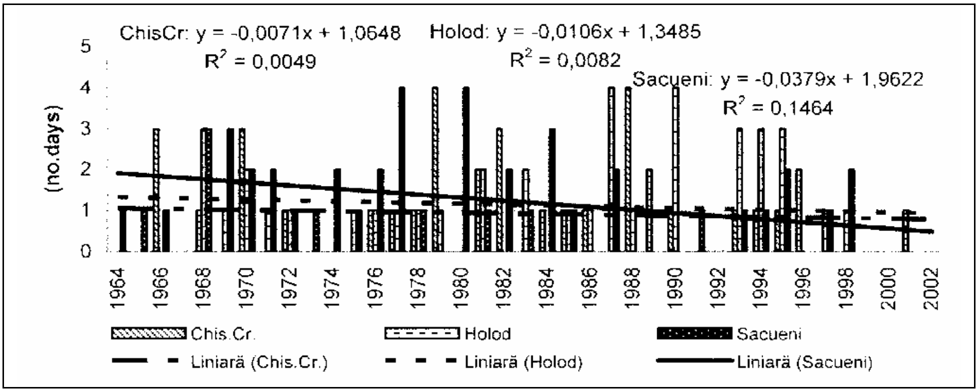


Fig. 3. The annual number of days with hail and its linear tendency, in the Western Romanian Plain, North of Mureş River (1964-2002).

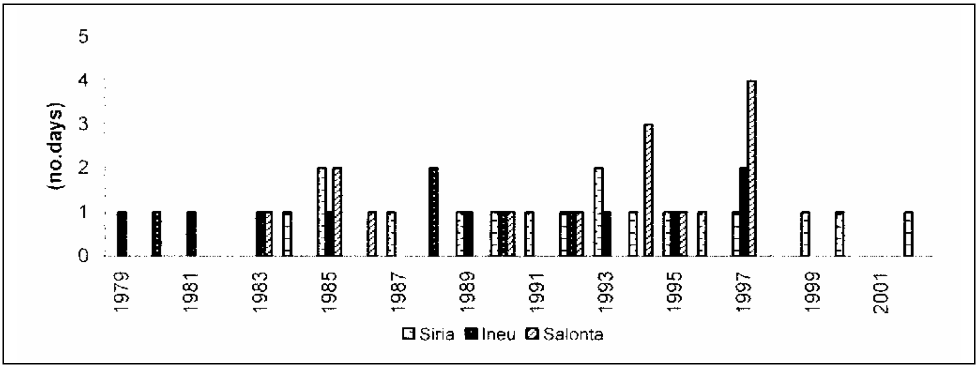


Fig. 4. The annual number of days with hail at the stations Şiria (1984-2002), Ineu (1979-1997) and Salonta (1983-1998).

The stations which registered years with 4 or 5 cases of hail between 1961 and 2002 are the following: Arad (3 years), Săcueni (2 years), Holod (2), Chişineu-Criş (2), Satu Mare (1) and Salonta (1).

3. 3. The minimum annual number of days with hail

The minimum annual number of days with hail was ***0 days*** at all the stations on the territory of the Western Romanian Plain, North of Mureş River. Between 1961 and 2002, there were about 12-18 years when hail was absent at the meteorological stations with long periods of observation, and about 7-8 years at the stations with a short period of observation. The lowest number of years without hail was recorded at Şiria (only 4 years out of the 19 years analysed). At Şiria, hail had the highest annual frequency (79%), due to the high altitude of the station (477 m) and its location in the mountains. Or, it is known that the frequency of hail increases with the altitude.

Table 1 presents the annual frequency of hail occurrence in Western Romania. One can notice that between 1961 and 2002, hail had the highest annual frequency at Şiria, Săcueni, Oradea and Arad stations (about 65-80% of the total years), those located in the floodplains of Mureş and Ier and those situated in the eastern part of Crişuri Plain. The lowest annual frequency has been recorded at Salonta, Chişineu-Criş – located at low altitude, in the alluvial low plains – and Sânnicolau Mare, also located at low altitude, unfavourable for ascending movements of the air. In these cases, hail happened in only half of the analysed years.

The annual frequency (%) of hail occurrence in the Western Romanian Plain, North of Mureş River (1961-2002)

Table 1

Station	SatuM	Săcn.	Orad.	Sal.	Holod	ChişCr.	Ineu	Şiria	Arad	SânnM
Frequency	61,9	69,2	66,7	50,0	62,9	53,8	63,2	78,9	64,3	59,5

At the meteorological stations located in Western Romania, it is noticeable that *hail does not happen every year*. However, one remarks the existence of periods with several consecutive years with hail. The most frequent are *the periods of 2-4 consecutive years*, but there can be periods of 5-9 years or even 11 years. Such an example is the period 1968-1978 at Săcueni. Periods of 9 successive years have been recorded at Şiria (1989-1997) and Satu Mare (1993-2001). There was a period of 8 successive years at Sânnicolau Mare (1971-1978). There were 2 periods of 7 consecutive years at Oradea, 2 periods of 6 years at Săcueni and Arad etc.

Figures 2 and 3 present ***the linear tendency*** of the annual number of days with hail. Because hail has a local character, one cannot remark a resemblance in the annual distribution of the number of days with hail at the meteorological stations. Except for Oradea and Satu Mare stations, where the equation is positive, the tendency is *decreasing* in the case of all the other stations between 1961 and 2002. Nevertheless, the rate of decrease is insignificant, as the determining coefficient has low values. The tendency coincides with the one regarding the number of days with thunderstorms. The highest decrease is registered for Săcueni. At this station, most of the cases of hail were recorded during the first part of the analysed period, and they declined a lot during the last decade.

At Satu Mare and Oradea, the tendency is an insignificant *increase*. The reason for the increasing number of cases of hail at Satu Mare is the increase of precipitation and air temperature in the latest years, which generated frequent hail phenomena in the context of the high air humidity, specific for North-Western Romania. This was not possible in the past, when low temperatures of the air and soil did not favour heat convection. The increase of the frequency of hail at Oradea in the latest years may be explained by the industrialisation and extension of the city. The large number of particulates evacuated by the industrial units from the outskirts of the city, the ever-increasing number of vehicles and therefore of dust in the atmosphere, as a result of the traffic, contributed to the increase in number of the „condensation nuclei”, which accelerated the rainfall-generating processes. One should also add the creation of the so-called „island of heat” above the city, resulted from the overheating of the built areas in the warm semester, which intensified the heat convection. All these contributed to the increase in the frequency of hail during the latest years.

In conclusion, *on the territory of the Western Romanian Plain, North of Mureş River, the hazards generated by hail occurrence decreased in the latest years,* except for *the low Someş Plain and the area around the city of Oradea, where they were amplified*. The cause resides in the persistence of a long dry period in the latest years (1982-1994), but also in the decrease of the values of the relative air humidity especially between 1990 and 1995 and in the years 2000 and 2002.

The tendency diagram has not been drawn up for Şiria, Ineu and Salonta stations, because their period of observation was too short, and the resulted tendency would be irrelevant and not comparable to the one obtained for the other stations.

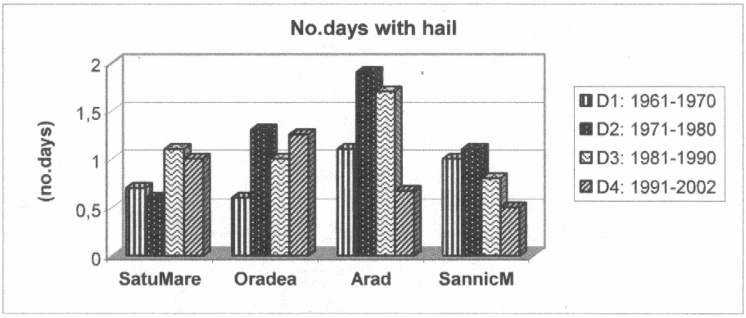


Fig. 5. The annual average number of days with hail over the four decades of the period 1961-2002, in the Western Romanian Plain, North of Mureş River.

Figure 5 presents the distribution by decades of the average annual number of days with hail for the 1961-2002 period. At Arad and Sânnicolau Mare stations one can notice the decrease of the average number in the latest two decades, as shown by the linear tendency at most of the lowland stations, while the minimum number of days with hail was recorded in the last decade. In contrast, in the case of Oradea and Satu Mare stations, one remarks that the lowest number of cases of hail were during the first or second decades. The highest values of the number of days with hail at Arad also stand out, as compared to the other stations. In the case of Arad, the frequency of hail increased from 1 day annually in the first decade to 2 days annually in the second decade, and then it decreased to 1 day every two years in the last decade.

In *Crişuri, Arad and Aranca Plains, the highest number of days with hail were produced in the second decade,* while in the *low Someş Plain, they were produced in the third decade*. In the last decade, there was an average of about 1 day with hail annually in the northern half of the analysed territory, and 1 day with hail every two years at the southern limit of the analysed territory. The most days with hail were produced at Oradea during this decade.

4. CONCLUSIONS

In the Western Romanian Plain, North of Mureş River, there is an annual average of 0.7-1.3 days with hail. The most frequent cases are recorded in *Arad Plain, Ier Plain and at the eastern limit of Crişuri Plain, on the contact with Crişana Hills,* where the air and soil humidity is high, or where the plain meets the hills. In Crişuri, Arad and Aranca Plains, most days with hail were produced in the second decade, while in the low Someş Plain, in the third decade of the analysed period. In Western Romania, hail does not happen every year. However, one remarks the existence of periods when hail happened in consecutive years, in most cases between 2 and 4 successive years.

On the territory of the Western Romanian Plain, North of Mureş River, *the hazards generated by hail occurrence decreased in the latest years*, except for the low Someş Plain and the area around the city of Oradea, where they increased. The cause of the decrease of hail resides in the persistence of a long dry period during the latest years (1982-1994), and in the decrease of the values of the relative air humidity, especially between 1990 and 1995 and in the years 2000 and 2002.

REFERENCES

1. Bălescu, O.I., Militaru, Florica (1967), *Studiul aerologic al căderilor de grindină,* Culegere de lucr. ale I.M. pe anul 1965, C.S.A., I.M., Bucureşti, p.47-64
2. Berbecel, O., Stancu, M., Ciovică, N., Jianu, V., Apetroaie, Şt., Socor, Elena, Rogojanu, Iulia (1970), *Agrometeorologie,* Edit. Ceres, Bucureşti, 294 p.
3. Bogdan, Octavia, Niculescu, Elena (1999), *Riscurile climatice din România*, Edit. Sega-Internațional, București, 280 p.
4. Bogdan, Octavia, Marinică, I. (2007), *Hazarde meteo-climatice din zona temperată. Factori genetici şi vulnerabilitate – cu aplicații la România*, Edit. „Lucian Blaga", Sibiu, 422 p.
5. Cristea, Maria (2004), *Riscurile climatice din bazinul hidrografic al Crişurilor,* Edit. Abaddaba, Oradea, 186 p.
6. Dragotă, Carmen (2001), *Frecvența anuală a căderilor de grindină în Câmpia Română, în ultimul deceniu al secolului XX*, Comunicări de Geografie, Alma Mater Bucurestiensis, Geographia, vol.V, Edit. Universității din Bucureşti, p.277-280
7. Şerban, Eugenia (2008), *Fenomene climatice de risc generate de precipitații în Câmpia de Vest situată la nord de Mureş*, teză de doctorat, Univ. din Oradea, 372 p.

CHANGES IN GROUNDWATER QUALITY BY URBAN AREA DEVELOPMENT. CASE STUDY OF AQUIFERS IN TEHRAN PLAIN, IRAN

A. KHORSANDI[1]

ABSTRACT. – Changes in Groundwater Quality by Urban Area Development: Case Study of Aquifers in Tehran Plain, Iran. The objective of this research is to review and study changes in ground water quality of plains induced by natural and more particularly artificial parameters. The case study concerns the Tehran Plain, for which the water quality maps (Iso-chlorine, electrical conductivity and total dissolved solids in groundwater) over a period of 25 years (1981 – 2006) and compared to each other. Furthermore the 16 years (1990 – 2006) chemical analyses of a number of wells in the plain were also available. The sample wells were selected in the east, west, north and south of Tehran for the purpose of studying changes in chlorine(CL) concentration, electrical conductivity (EC) and total dissolved solid(TDS) in time. The results show a general increase of the mentioned anions in groundwater, with chlorine concentration increasing from a minimum of 15 to a maximum of 76 mg/l; EC from a minimum of 212 to a maximum of 731 micro-mohs/ cm2 and the TDS from a minimum of 0 to a maximum of 146 mg/l. Moreover the comparison of the typical water map reveals a gradual decline of carbonated water and an increase in sulfated and chlorinated water in the Tehran Plain over time. Based on the results the artificial parameters affecting the quality of groundwater in Tehran Plain are the uncontrolled urban expansion and consequently overexploitation of aquifers in sensitive areas, increased infiltration of wastewater from absorption wells and the increased infiltration of surface runoffs and floodwater. The results of the study can be applied in urban planning and management of aquifers affected by urban development.

Keyword: *groundwater quality, urban affective, Tehran aquifer.*

1. INTRODUCTION

Groundwater in plains has a number of characteristics which are controlled and affected by geological parameters from the inlet to the outlet of the aquifer. Changes in groundwater quality brought about by geological parameters and natural factors such as drought show a normal trend, whereas the artificial parameters such as increased exploitation, wastewater infiltration and urban runoffs change the water quality at an unnaturally high rate.

To study the impact of artificial parameters on groundwater quality in urban areas, the Tehran plain in the north of Iran (Fig 1) was selected and analyzed for two periods of 25 years (1981 – 2006 to compare quality maps) and 16 years (1990 – 2006 to study changes in anions).

On natural parameters affecting groundwater quality, the reaction of water with soil and rocks in the course were studied in the saturated and unsaturated zones of the aquifer at solution and vapor phases based on the solubility of the region's minerals (Hem 1989).

The reason for groundwater salinity being higher than seawater is not related to evaporation sediments, but to brackish membranes and osmotic pressure (Hanshaw 1978).

[1] *Power and Water Institute of Technology (PWIT) Tehran. Iran, P. O. Box 16765-1719, e-mail: khorsandi@pwit.ac.ir*

In the alluvial aquifers, the quality changes of groundwater are defined at a specific trend (Chebotarev 1955).

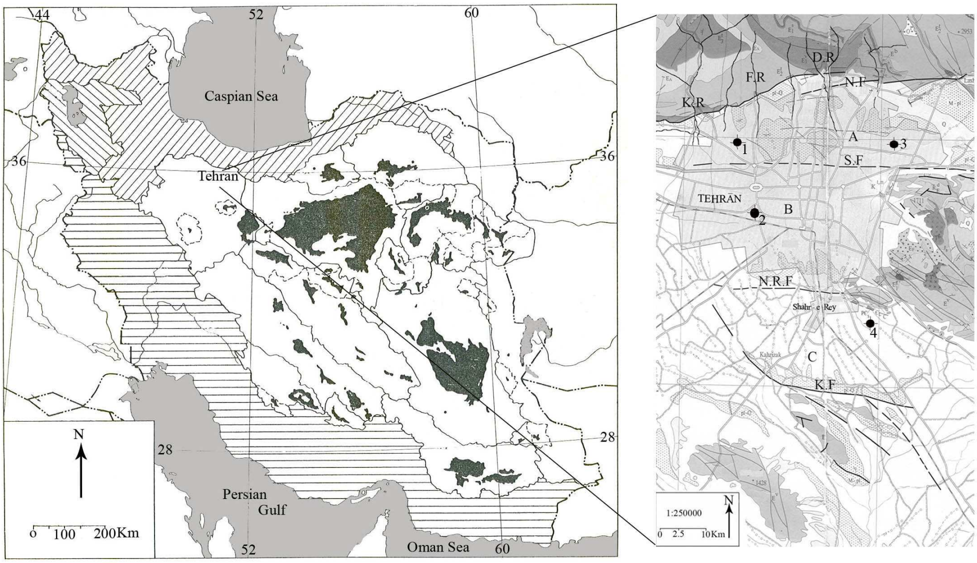


Fig. 1. The situation of Tehran plain in Iran and it's main watershed's . The Tehran plain's aquifer is divided into three part (A, B and C) by North Tehran =N. F, Sorkh Hesar =S. F, North Ray =N. R. F and Kahrizak=K. F faults mechanism. The other sign in map are KR= Kan River, FR= Farahzad river, DR=Darband river, 1, 2, 3 and 4 are selected wells of research.

The natural separation of natural salinity through the dissolution of halite from deep brine was presented as the ratio of Br/Cl and Na/Cl (Kretler and Richter 1986). Spreading salt on the road for deicing (Hulling and Hollocher 1972, Dudley at al 1999), the application of fertilizers, urban runoffs and the urban and industrial wastewater absorption wells have been cited as artificial parameters that affect groundwater quality (Fetter 1993). However the most important water quality variation parameters were identified as overexploitation of the aquifer, the type of hydraulic system governing the water wells and the urban development in the plain (Khorsandi 2001). Urban development and population increasing affected on groundwater which is observed contamination drinking water well in Copenhagen capital city of Denmark (Moller and Markussen 1993). The influence of sewers on groundwater quality has studied on several UK cities (Lerner at al 1993). Furthermore many study shows changes in groundwater quality that affected by urban area(Mazari and Mackay 1993, Page and Rabinowitz 1998, Levallois at al 1998, Mody 1990 and Bauer at al 2004).

The case study in this research concerns the aquifer of Tehran Plain, where most artificial groundwater quality parameters are though to be involved. The research procedure includes collecting the results of chemical analysis of groundwater samples taken from Tehran Plain during a 25-year period from 1981 to 2006, and then the maps of Iso-chlorine, EC, TDS and water characteristics in the year 1981 was compared with those prepared in the year 2006 and their differences identified. Afterwards, the Tehran Plain was arbitrarily divided into the northern, southern, eastern and western sections and a sample well was selected in each zone. Based on available data from a 16-year period the variations in Chlorine concentration, electrical conductivity and total dissolved solids in ground waters were studied.

The results depict the followings:

- comparing the Iso-chlorine map at the beginning (1981) and the end (2006) of the statistic period show an increase particularly to the south of Sarcheshmeh township northwest of Tehran. Furthermore in a span of 16 years, the chlorine concentration has increased from a minimum of 15 to a maximum of 76 mg/l;
- the comparison of iso-conductivity maps and dry residues of the Tehran Plain's ground waters at the beginning of the period to it's end depicts an increase in the two parameters; with EC showing a minimum of 212 and a maximum of 731 micro mohs per square centimeter, while the minimum value of dry residues equals 0 and its maximum reached to a figure of 146 mg/l;
- the comparison of water characteristics at the beginning and the end of statistical period showed a decrease in the carbonated water and an increase in the chlorinated and sulfated water.

The researchers believe that the important parameter affecting the Tehran groundwater quality is the un-coordinated expansion of city of Tehran, and subsequently an increase in intake from sensitive areas, increase in wastewater infiltration through absorption wells and finally the increased infiltration of floodwater and urban runoffs, which have played a role as artificial parameters affecting the quality of ground waters in the Tehran Plain.

2. TEHRAN PLAIN BACKGROUND

The Tehran Plain is located to the extreme north of the Central Iran watershed basin and to the south of the Central Alborz chains. It is formed by a series of alluvial fans of permanent and seasonal rivers (Fig 1). A city of the same name is situated on the plain, which according to historical records was part of the low-importance villages of Ghasran Kharej, and has been populated for over three thousand years. It was selected as the Capital in the year 1737 by Mohammad Khan Qajjar. It had a population of 20, 000 at the time, whose potable water was supplied through ground canals (qanats) (Khorsandi 2005).

The watershed basin in the Tehran Plain measures 1, 120 km2, 735 km2 of which are located in plains, while the remaining 385 km2 are in highlands. The plain is limited to the north by Alborz heights, to the east by Telo hills, to the west by Kan River and to the south by the Kahrizak hills.

From north to south the Tehran Plain Aquifer consists of 3 sections (A, B and TC), whose natural boundaries are defined by faults (Fig 1). The main part of the aquifer is located in the central part of the Plain, between the Sorkhe Hessar fault in the north and the North Rey Fault in the south. The thickness of the alluvium in the main aquifer varies between a maximum of 300 m in the alluvial fan of Kan and a minimum of 25 m in the northeast. According to available data, the current intake from the Tehran Plain Watershed basin amounts to approximately 1, 152 million m^3, which represents a hydrograph unit drop f approximately 0. 5 m/year. This proves that operations are beyond the capacity of the aquifer. 45% of water withdrawn from ground resources is used for drinking purposes, while the rest is allocated to agriculture and industries, which proves the aquifer's importance as a source of potable water supply for Tehran and its surrounding townships (Khorsandi 2005).

The expansion of Tehran from the year 1892 (Qajjar period) to the year 2004 is shown in Figure2. As can be observed in a span of 113 years of uncontrolled expansion, the urban areas of Tehran have nearly covered the entire Plain. The legal boundary of the City of Tehran measures 707 km^2, while the surface area of the Plain is 735 km^2. Therefore the Plain's surface has become the city's surface, which has implications as far as changes in water cycle and its natural characteristics are concerned. From the point of view of this research, these have led to the increase of urban effluents and floods, their percolation to aquifer, reduced natural infiltration capacity of the soil preventing the infiltration of safe water to the aquifer and resulting in change in groundwater quality. It should be borne in mind that the change in water quality occurs in parallel to the population growth and follows the overexploitation of the aquifer. This is an artificial cycle consisting of an increase in water consumption, discharge of effluents, runoffs and wastewater to the aquifer and a drop in the quality of groundwater. This is also an increasing trend.

3. THE COMPARISON OF GROUNDWATER QUALITY MAPS

In this stage of research, the isographs of chlorine, electrical conductivity and total dissolved solids of the groundwater in the Tehran Plain prepared in the year 1981 was Compared with those prepared in the year 2006, with the following results:

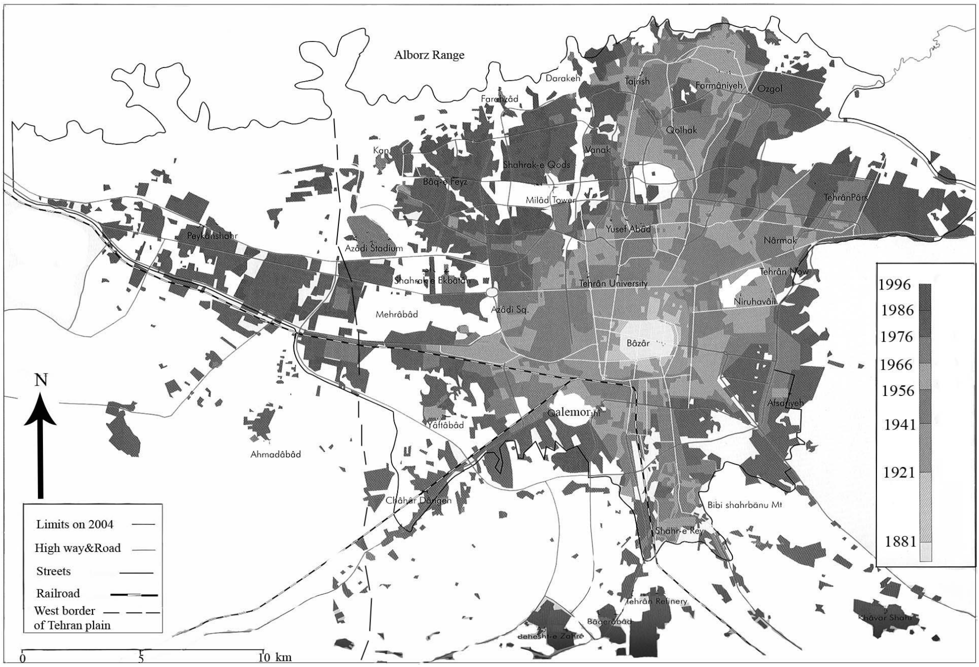


Fig. 2. The evolution of built up area in Tehran plain during 1881 to 1996(after Tehran Geographic Information Centre 2005).

The isographs of chlorine for the water year of 1981, which were prepared by the Tehran Regional Water Board (Fig 3, B) show a packaged cell of iso-chlorine curves in the western region of Tehran Plain and in parallel to the Kan River alongside the north-south cell. In the northern section the chlorine concentration is equivalent to 100 mg/l. In parallel to the mentioned cell, there is a stretch of groundwater with lower chlorine concentration, which proves the impact of the Kan River Alluvial Fan on the aquifer. To the southeast the iso-chlorine curves are more regulated depicting the aquifer’s outlet.

In Ray area there is a stretch of curves to the north equivalent to 150 and 200 mg/l, which show the high concentration of chlorine in the region’s ground waters.

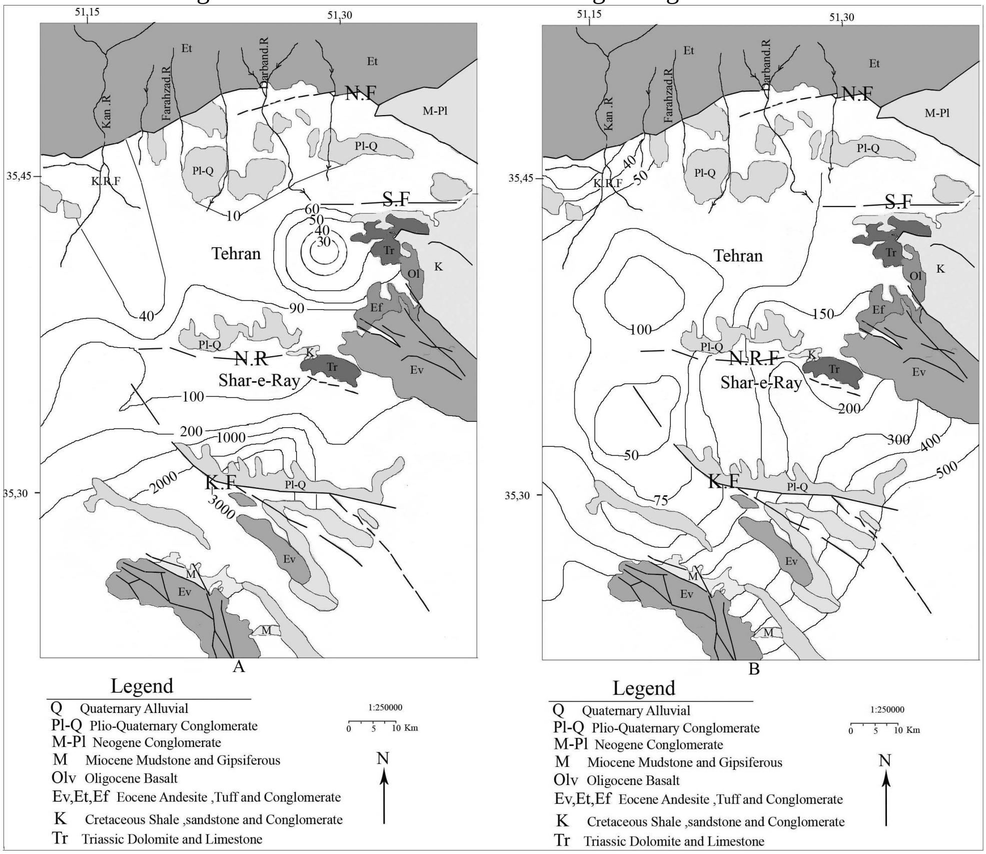


Fig. 3. The figure shows a comparison between isograph of Tehran plain groundwater CL in 1981(B) and 2004(A). The comparison shows groundwater CL is increased and displacement in different part's of plain.

The Chlorine isographs for the year 2006, which were prepared simultaneously with data (fig 3, A), a packaged cell of iso-chlorine curves is observed to the northeast, showing the infiltration of freshwater to the aquifer. The iso-chlorine curves of 100 mg/l passes through the mid-section of the aquifer, with some sections to the north showing a rise (vis-à-vis the chlorine isograph of 1981), revealing an increase in chlorine concentration of groundwater in this part of the aquifer. Furthermore a stretch of groundwater with high chlorine concentration was observed in the southwest of the plain showing a rise compared to the map of the year 1981, depicting the increase in chlorine concentration in the mentioned area.

The isographs to the electrical conductivity, which was prepared by the Tehran Regional Water Board in the year 1981 (Fig4, B) shows a packaged cell of EC in groundwater equivalent to 1000 micro mohs per square centimeter opening to the south and to the north. To the north this phenomenon depicts the impact of the Kan River, while in the south of Nematabad it is influenced by an appropriate groundwater Resources of unidentified origin.

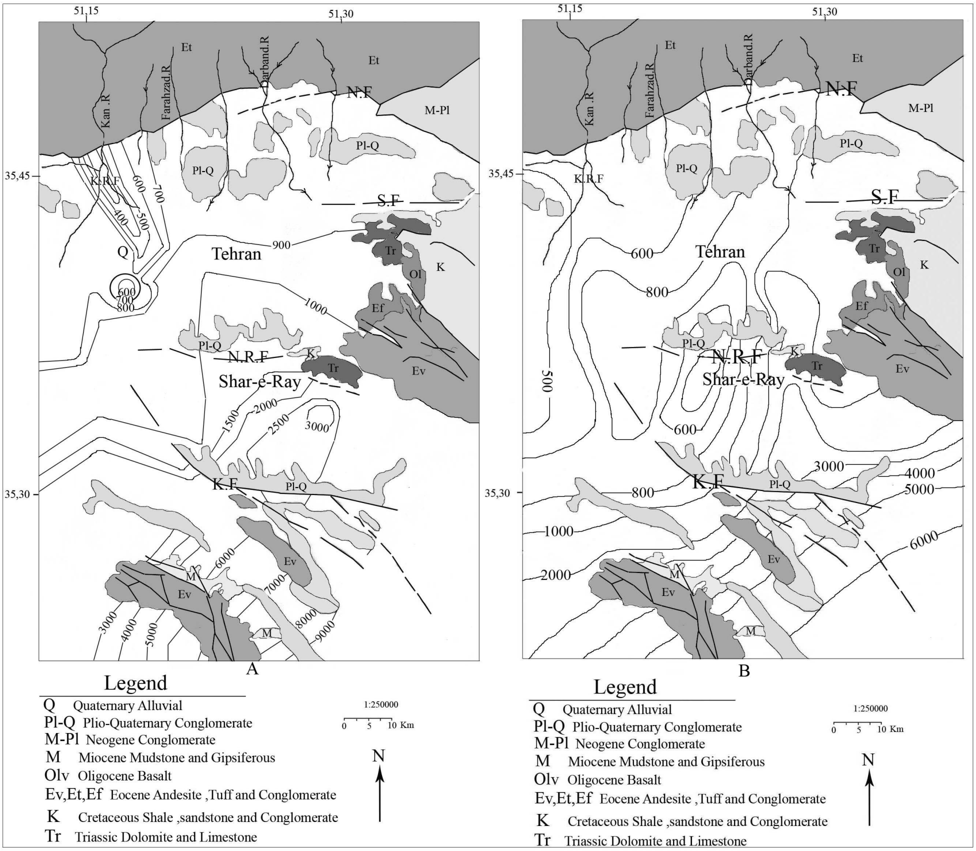


Fig. 4. The figure shows comparison isograph of Tehran plain groundwater EC in 1981(B) and 2004 (A). The comparison results shows groundwater EC is increased and displaced in different part's of plain and is progressive toward north.

Moreover a stretch of groundwater with EC of 1500 micro mohs exists to the north of Ray area, which is probably caused by over-exploration or some other reasons. In the southwest of the Plain or Kashanak area there is also a stretch of curves equivalent to 1500 micro mohs per square centimeter, which reveals the advance of inappropriate water towards the aquifer. In the southeast the curves change in a uniform manner. The isographs of EC of the groundwater prepared in the year 2006 for the purpose of the research (Fig 4, A), the following discrepancies were observed in comparison to the map of the year 1981.

In general, the package cells of electrical conductivity are observed in the ground waters of the western and northwestern zones, with an increased influence of the Kan River on the curve, pushing them towards the middle and southern zones. In the same manner a packaged cell was observed in the alluvial fan of the Farahzad River. Thereafter the curve increase regularly from the mid-section of the plain to southeast, but in the northeast and east a stretch with a high EC extends to the north, which is related to the effect of alluvial fans of the Farahzad and Kan rivers on ground waters. In other terms the impact of the freshwater from the two mentioned rivers has caused the high EC curves to southeast, while the curves of the northeast and east show the normal condition of the aquifer.

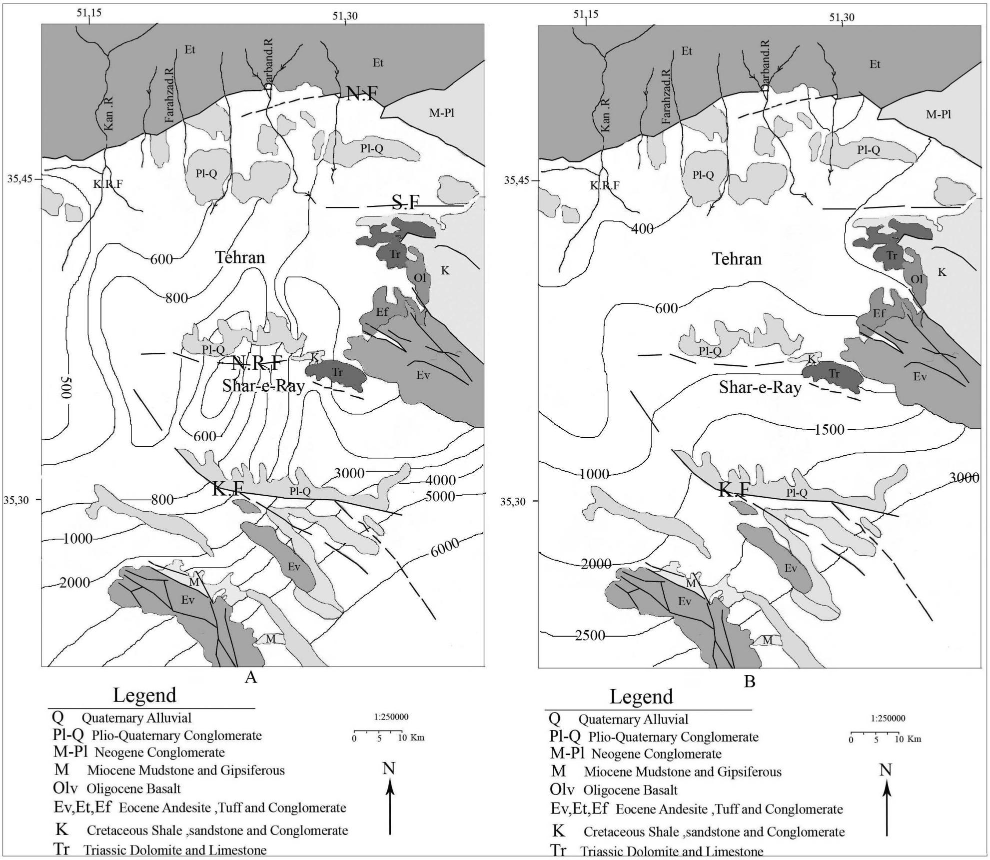


Fig. 5. The figure shows comparing isograph of Tehran plain groundwater TDS on 1981(B) to 2004(A). The comparing shows groundwater TDS is increased and deformed in different part's of plain.

In the isograph of the total dissolved solids drawn in the year 1981 by the Regional Water Board (Fig5, B) a packaged cell of groundwater containing relatively high dry Residues can be found in the west of rail-road Square, with a stretch of freshwater in its southern section showing the impact of Kan River. In the northeast there is also a stretch of freshwater caused by the impact of Darband and Darabad rivers on the Aquifer. Thereafter in the mid-section of the aquifer and in a northwest – southeast direction, the curves depict a gradual increase of dry residues in groundwater.

In comparison to the isograph prepared in the year 1981, the one drawn in the year 2006 (Fig5, A) shows a diminished impact of Kan River on the aquifer and a curve of 600 mg/l in value is observed in the northern areas of the aquifer. In the mid-section there are also curves of 1000 mg/l increasing to the south, and stretches of groundwater with high dry residues can be seen towards northwest.

4. REVIEW OF CHANGES IN EC, TDS AND CL

To review the changes in chlorine concentration, EC and TDS in groundwater samples of Tehran Plain, the Tehran aquifer was first divided into 4 sections based on the number of existing chemical analysis of groundwater samples from the year 1981 to 2006 and their distribution in the Plain, and then a sample well was selected in each section and the changes in the mentioned parameters during the statistical period were traced and reviewed. The selected wells were in the Poonak(well1), Farjam(well3), Azadi(well2) and Aminabad(well4) areas(Fig1). The Poonak well represented the northwest region of the Plain and the aquifer's inlet, the Farjam well represented the northeast region and the aquifer's inlet, the Aminabad well represented the southeast region and the aquifer's outlet and finally the Azadi well represented the southwest region of the Plain and the alluvial fan of the Kan River (fig. 1).

The ponak well water EC, CL and TDS changes from 1991 to 2007

Table 1

Date	TDS(mg/li)	EC(μ moh/cm)	Cl(mg/li)
31/5/1991	375	520	42.6
30/4/1992	396	548	49.7
30/4/1993	350	541	74.55
1/12/1994	392	592	67.45
1/12/1995	420	640	81.45
30/1/1996	696	1070	91.23
30/4/1997	597	919	77.03
30/1/1998	579	890	89.10
31/1/1999	507	780	78.81
30/4/2000	498	880	77.03
29/4/2001	433	748	71.00
30/4/2002	440	800	69.22
1/11/2003	514	826	67.45
30/4/2004	498	880	77.03
31/5/2005	433	748	71.00
29/4/2006	440	800	69.23
30/4/2007	514	826	67.25

It should be reminded that the natural groundwater quality parameters affect in general either in the direction of groundwater flow or constantly at each point of the aquifer; and in relation to time and with the condition of consistency, the impact of Other parameters are constant and negligible. For instance if a well is drilled in the freshwater area of the aquifer and the impact of the natural parameters remains constant, the quality of well water undergoes natural fluctuations and consistent with the natural conditions of the surrounding regions. However if the groundwater quality changes according to period of operation, unknown natural parameters, and from the point of view of this research, artificial parameters have caused changes in the quality of ground waters.

The changes in chlorine concentration, EC and TDS in the groundwater of Poonak well are shown in table1 and Figure (6). As observed, the changes in EC and TDS of Poonak well cover each other and are uniform, and despite fluctuations during the statistical period, show the increase in EC from 520 to 826 micro mohs per square centimeter (306 units difference) and the increase in TDS from 375 to 514 mg/l (139 units difference).

Moreover the curve of changes in EC and dry residues of the groundwater of Poonak well until the year 1997 obeyed an increase through a gentle slope, experiencing a rapid rise and a gentle decrease.

In spite of fluctuations, the changes in chlorine concentration of groundwater samples of Poonak well show 25 units in increase (from 43. 6 mg/l in the year 1981 to 67. 45 mg/l in the year 2006). The curve point of the groundwater chlorine in Poonak well is also the year 1997. The reason for sudden changes in quality of Poonak well groundwater is also unknown to this research.

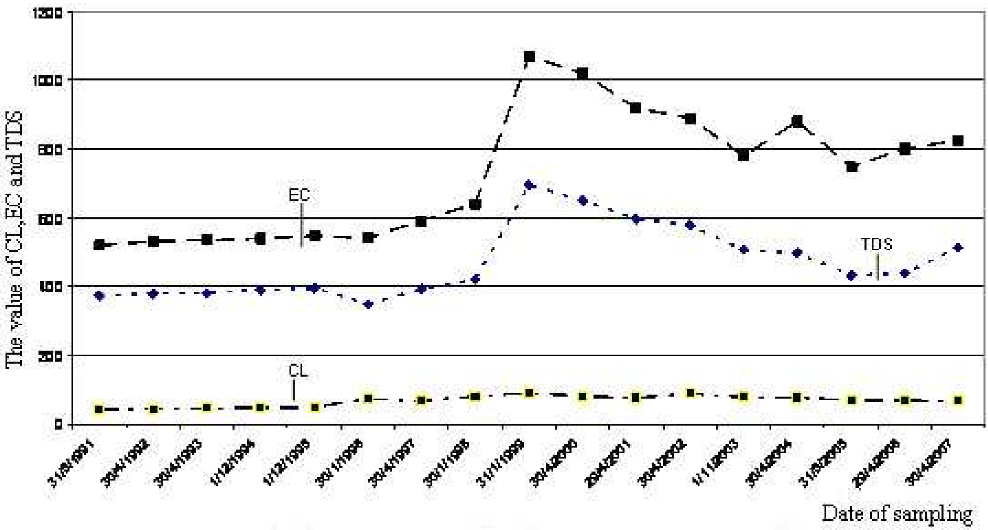


Fig. 6. The graph of groundwater CL, EC and TDS variation of Ponak (well1) in northwest of Tehran plain.

The changes in the considered parameters in the water samples of Farjam well are shown in table 2 and figure (7). As can be observed changes in EC, TDS and CL in the well’s water are consistent with each other and despite the fluctuation of EC from 894 mg/l in the year 1997 to 1106 micro mohs per square centimeter in the year 2006 (212 units difference), the Chlorine concentration increased from 55. 25 mg/l in the year 1990 to 78. 1 mg/l in the year 2006 (23 units difference) while total dissolved solids concentration decreased by 40 units.

The changes in EC, TDS and CL in the Azadi well are shown in table 3 and figure (8). As observed similar to Poonak well there is an increase in the parameters despite the fluctuations and the year 1996 is the milestone in this increase. There is an increase in EC from 281 in the year 1990 to 521 micro mohs per square centimeter in the year 2006 (240 units difference) while the dry residues show a decrease from 312 in the year 1990 to 302 mg/l in the year 2006 (10 units difference). The Chlorine concentration in the groundwater in the year 1990 amounted to 30. 89 mg/l, which rose to 46. 15 in the year 2006 (15 units' difference).

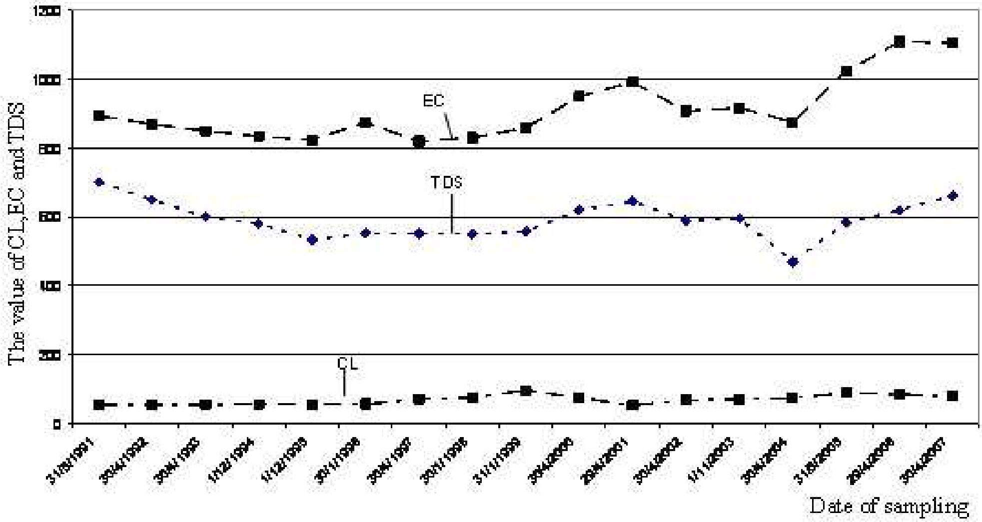


Fig. 7. The graph of groundwater CL, EC and TDS variation of Farjam well (well3) in northeast of Tehran.

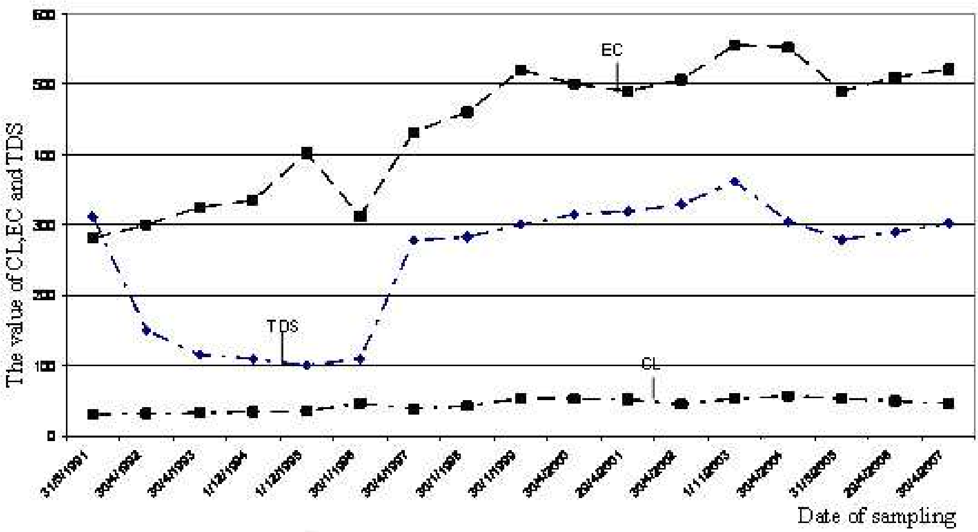


Fig. 8. The graph of groundwater CL, EC and TDS variation of Azadi well (well2) in the west of Tehran.

The changes in the considered parameters in the ground waters of Aminabad well are shown in table 4 and figure (9). As can be observed, the three curves representing CL, EC and TDS show uniformity and despite fluctuations are increasing. The EC of the groundwater in Aminabad well increased form 900 in the year 1990 to 1631 micro mohs per square centimeter in the year 2006 (731 units difference) while the TDS increased from 800 in the year 1990 to 946 mg/l in the year 2006 (146 units increase). The Chlorine concentration was 13/14 mg/l in the year 1990, whereas it had risen to 89 mg/l in the year 2006.

The Farjam well water EC,CL and TDS changes from 1991 to 2007

Table 2

Date	TDS(mg/li)	EC(µ moh/cm)	Cl(mg/li)
31/5/1991	312	281	30. 88
30/4/1992	100	302	35. 5
30/4/1993	110	312	46. 15
1/12/1994	278	432	39. 05
1/12/1995	283	460	42. 6
30/1/1996	300	520	53. 25
30/4/1997	319	490	52. 18
30/1/1998	329	506	45. 08
31/1/1999	361	556	53. 25
30/4/2000	305	552	56. 8
29/4/2001	279	490	53. 25
30/4/2002	290	510	49. 7
1/11/2003	302	521	46. 15
30/4/2004	305	552	56. 80
31/5/2005	279	490	53. 25
29/4/2006	290	510	49. 70
30/4/2007	302	521	46. 15

The Azadi well water EC,CL and TDS changes from 1991 to 2007

Table 3

Date	TDS(mg/li)	EC(µ moh/cm)	Cl(mg/li)
31/5/1991	702	894	55. 02
30/4/1992	534	824	55. 73
30/4/1993	553	874	56. 09
1/12/1994	552	820	71. 00
1/12/1995	558	859	96. 56
30/1/1996	645	992	53. 35
30/4/1997	590	908	67. 45
30/1/1998	596	917	71. 00
31/1/1999	470	875	74. 55
30/4/2000	584	1023	88. 75
29/4/2001	620	1109	85. 55
30/4/2002	662	1106	78. 10
1/11/2003	596	917	71. 00
30/4/2004	470	875	74. 55
31/5/2005	584	1023	88. 75
29/4/2006	620	1109	85. 55
30/4/2007	662	1106	78. 10

5. DISCUSSION AND CONCLUSION

The natural parameters having an impact on the quality of the ground waters are related to the type of geological materials forming the aquifer, the flow velocity of the groundwater and the time of water contact with the surrounding environment. In the plains, the interaction intensity is a function of time but in regions of the plain where cities are built there are also artificial parameters that affect the groundwater quality, whose intensity depends on the city's impact on the plain. The case study for this research was the Tehran Plain and the changes in its groundwater quality. According to the assumptions in this research, the uncoordinated expansion of Tehran to over 90% of the plain is the main factor for change in quality of the ground water with all its apparent and hidden subcomponents. The plain's coverage by the city has caused the drop in soil permeability and partial discontinuation of aquifer recharge by percolation. In return the urban runoffs and effluents have increased. These infiltrate the soil through river beds and flood waters and cause a change in the quality of groundwater.

On the other hand the water demands of Tehran and its population have resulted in increased exploration of the aquifer and water consumption leading to larger volume of wastewater, which infiltrates the soil and the aquifer through absorption wells affecting its quality.

The Aminabad well water EC,CL and TDS changes from 1991 to 2007

Table 4

Date	TDS(mg/li)	EC(μ moh/cm)	Cl(mg/li)
31/5/1991	800	900	13.13
30/4/1992	1380	2012	31.95
30/4/1993	918	1455	42.60
1/12/1994	876	1213	56.80
1/12/1995	1010	1580	71.00
30/1/1996	1100	1800	84.13
30/4/1997	1050	1900	53.25
30/1/1998	830	720	71.00
31/1/1999	1168	997	92.30
30/4/2000	1201	2370	90.17
29/4/2001	1220	2140	88.75
30/4/2002	946	1631	89.10
1/11/2003	1163	1997	92.30
30/4/2004	1201	2370	90.17
31/5/2005	1220	2140	88.75
29/4/2006	946	1631	89.20
30/4/2007	950	1700	89.20

Therefore in the urban areas of the plains such as the Tehran Plain, the artificial parameters have a broader and quicker impact on water quality than the natural causes, and in some cases intensify the impacts of natural parameters. The Figure 10 shows the chart of groundwater quality affecting factors. As observed the natural factors are fixing in Tehran aquifer but artificial factors are variable which more factors depends on Tehran urban development.

Figure 10. Flow chart of affecting factors on groundwater quality.

The results of this research in the Tehran Plain are as follows:

- the correlation of the isographs of Chlorine in the ground waters of Tehran Plain in the year 1981 with the one prepared in the year 2006 shows an increase in the groundwater Chlorine over a 25-year period, particularly in the south of the Sarcheshmeh Township and at the beginning of the aquifer and in the region of the large alluvial fan of the Kan River. Furthermore during a 16-year period the Chlorine concentration in water has risen from a minimum of 15 to a maximum of 76 mg/l;

- the correlation of the isographs of electrical conductivity and total dissolved solids in the year 1981 with the ones prepared in the year 2006 shows their increase in groundwater and their undesired spread to the north over a period of 25 years. During a 16-year period, the electrical conductivity was a minimum of 213 and a maximum of 731 micro mohs per square centimeter, while the maximum value of total dissolved solids increased by 146 mg/l;

- he comparison of the map of water type in the year 1981 with the one prepared in the year 2006 depicts a reduction of carbonated water and the increase of sulfated and chlorinated waters.

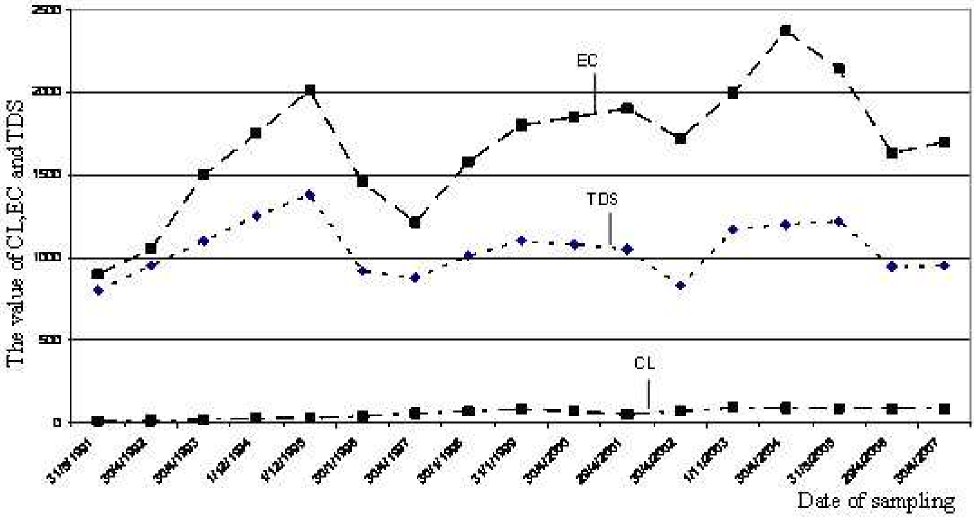


Fig. 9. The graph of groundwater CL, EC and TDS variation of Aminabad well (well2) in the southeast of Tehran

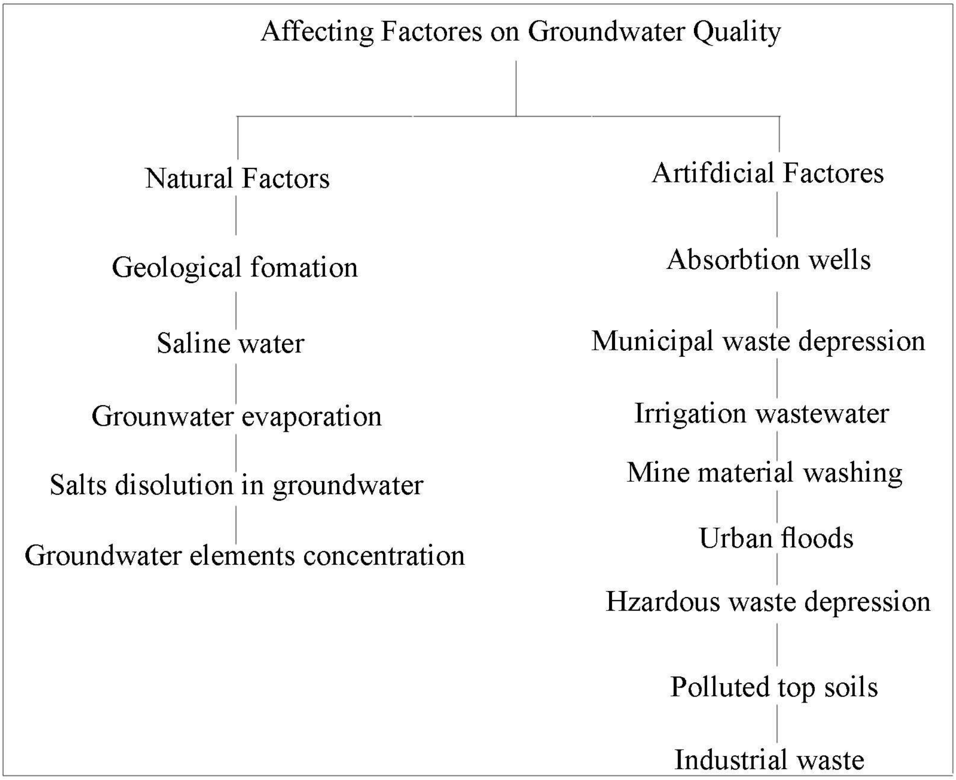


Fig. 10. Flow chart of affecting factors on groundwater quality.

REFERENCES

1. Bauer, S., Baye–Rich, M., Holder, T., Kolesar, C., Muller, D., Ptak, T. (2004), *Quantification of groundwater contamination in an urban area using integral Pumping tests*, Journal of Contamination Hydrology, Vol 75, Issues 3-4.
2. Chebotarev, I. (1955), *Metamorphism of natural water in the crust of weathering*, geochemistry. *Cosmohim. ACTA*, V8.
3. Dudley, Williams D., Williams, N., Cao, Y. (1999), *Road salt contamination of Groundwater in a major metropolitan area and development of a biological impact*. Water research. Vol 34. Issues 1.
4. Fetter (1993), *Contaminant hydrogeology*, Macmillan Publishing Company, New York.
5. Hanshow (1978), *Natural-membranes phenomena and subsurface water emplacement* in T. D. Cook (ed). *Underground waste management and environmental implications*, American Association of Petroleum Geological Memories, vol. 18, Tulsa, Oklahoma.
6. Hem, Jhon D. (1989), *Study & interpretation of the chemical characteristics of natural water*, v. s. geol. Surv, Water-supply paper 1973.
7. Hulling, E., Hollocher, C. (1972), *Groundwater contamination by road salt: Steady-state concentration in east central Massachusetts*, Science, Vol 179, No 4032.
8. Khorsandi, A. (2001), *Principles of applied hydrogeology*, publication by WPAI, Ministry of Iran Energy.
9. Khorsandi, A. (2005), *Qantas in Iran: case study of Tehran Qantas Book*, 2006, published by Tehran-GIS Centre.
10. Lener, D. N., Holiday, D. Hoffman, M. (1993), *The impact of sewers on Groundwater quality*. Proceeding of the international conference organized by the institution of civil engineers and held in London.
11. Levallois, P., Theriault, M., Rouffigant, J., Tessier, S., Landry, R., Ayotte, P., Gira, M., Chiasson, C. (1998), *Groundwater contamination by nitrates associated With intensive potato culture in Quebec*. The science of the total Environment. Vol 217, Issues 1-2.
12. Mazri, M., Mackay, M. (1993), *Potential for groundwater contamination in Mexico City*. Environ. Sci. Technol. Vol 27, No 5.
13. Moller, H. M., Markussen, M. (1993), *Groundwater problems in urban area*, Proceeding of the international conference organized by the institution of civil Engineers and held in London.
14. Richter, B., Kretler, C. W. (1986), *Geochemistry of salt-spring and shallow Subsurface brines in the rolling plains of Texas*: *Groundwater* 24, No 6.
15. William, Page G., Rabinowitz, H. (1993), *Groundwater contamination: Its Effect on property value and cities*, Journal of the American Planning Association, Vol 59.

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

MAXIMUM FLOW VARIABLITY AND FLOOD POTENTIAL IN TROTUŞ CATCHMENT AREA

GIANINA NECULAU (CHIRILĂ)[1], LILIANA ZAHARIA[2]

ABSTRACT. – Maximum Flow Variablity and Flood Potential in Trotuş Catchment Area. This paper investigates the maximum flow specific features and flood potential of Trotuș River. Statistical analyses (employed to determine frequencies, exceeding probabilities and tendencies) have turned to account the maximum, monthly and yearly discharge series recorded during a period of over 30 years by 21 stream gauging stations scattered over the catchment. The study shows, on the one hand, the spatial and temporal variability of maximum flow and on the other hand the flood occurrence potential on a monthly and annual scale, meaning by important floods the ones whose discharges are higher than defense specific stage (attention stage, flood stage and danger stage). The obtained results show an important interannual variability of the maximum flow and a high flood potential during the interval May – August, with a peak in July. Even though the last years have witnessed important floods in this catchment area, there have been identified no significant tendencies either in the variability of the annual maximum discharges or in the yearly number of floods.

Keywords: *maximum discharge, floods, Trotuş catchment area.*

1. INTRODUCTION

Getting to know the maximum flow specific features and the flood potential is extremely important for various fields of activity. It is the case with the blueprinting, building and exploitation of hydrotechnical works, stream improvement, territorial planning, management of water resources, as well as of the risk induced by high waters and floods (elaboration of inundability studies, defense plans against floods, etc.) (Zaharia, 1999).

This paper analyzes and highlights the specific features regarding the spatial – temporal variability of the maximum flow and the flood potential in Trotuş catchment area, a catchment area that during the last decades has been affected by several floods that led to important social and economic consequences. The most serious of these from the standpoint of discharge values and effects occurred in 1975, 1991 and 2005 (Chirilă & Preda, 2007).

2. GENERAL FEATURES OF TROTUŞ CATCHMENT AREA

The area of Trotuş river basin is 4,456 km^2, which makes it the fourth largest minor basin of the Siret catchment. It lies in the central-eastern part of Romania overlapping both the Carpathian area (represented by subunits belonging to the central group of the Eastern Carpathians: the Ciuc, Tarcău and Vrancea Mountains, as well as the mountain depressions of Comăneşti and Plăieşti) and the Subcarpathian one, corresponding to the Moldavian

1 National Institute of Hydrology and Water Management, 97 Bucharest – Ploiesti Street, 13686, Bucharest, Romania, geaninachi@gmail.com
2 Bucharest University, Faculty of Geography, No 1 N. Bălcescu Avenue, 010041, Bucharest, Romania, e-mail: , zaharialili@hotmail.com

Subcarpathians, which include the Oituz-Caşin and Tazlău depressions (*Geografia României*, 1992). In *altitude* Trotuş catchment area develops between 1649 m (Nemira Mare peak) and 80 m (at the confluence with Siret), with a mean altitude of 706 m (values determined by GIS techniques on the basis of topographic map, scale 1:25,000). In the mountain area slope *declivity* is frequently between 15 and 30^0, with the highest values reaching here and there 30 to 40^0, while in the Subcarpathian area the declivity is prevailingly between 15 and 30^0 (Dimitriu, 2007). Slopes influence greatly the genesis and propagation of floods and consequently their study is useful for hydrological forecasts.

From the geological point of view, the catchment area overlaps the orogenic unit of the Eastern Carpathians, where one can distinguish the Cretaceous flysch area (internal), the Paleogene flysch area (external) and the Neogene subcarpathian area. In the north-west of the catchment area, there appears a narrow strip of land made up of crystallino-mesozoic formations represented by crystalline schists and Mesozoic limestones (Velcea & Savu, 1982). By contrast, the Subcarpathian region develops on friable sedimentary deposits of molasse (gravel, sands, clays, tuffs, salt, gypsum, etc.).

Climatic features are generally favorable to flow genesis and evolution. In the high mountainous area, precipitation reaches 1,000 – 1100 mm/year, while in the depressions it drops to 600 – 700 mm/year. In the Subcarpathian region, the mean multiannual precipitation is 550 – 650 mm/year. Summer is the wettest season, with 40% of the yearly amount of precipitation, followed by spring and autumn with comparable amounts, 23.5% and 23% respectively, while winter is the driest, with approximately 13% of the total amount of precipitation (the values have been determined through direct processing of pluviometric data recorded at the weather stations Târgu Ocna and Adjud during the period 1961 – 2002). Under the circumstances, summer holds the highest flood potential, which is especially due to rain showers.

Hydrographic and hydrological characteristics. Trotuş River (162 Km lenght[3]) originates in the Nemira Mountains (at 1380 m altitude) and flows into the Siret (at 79 m altitude). Its main tributaries are: Sulța (L = 26 Km; A = 118 Km^2), Ciobănuş (L = 33 Km; A = 136 Km^2), Asău (L = 39 Km; A = 208 Km^2), Uz (L = 50 Km; A = 469 km^2), Dofteana (L = 26 Km; A = 110 Km^2), Slănic (L = 28 Km; A = 126 Km^2), Oituz (Le = 62 Km; A = 337 Km^2), Caşin (L = 54 km; A = 308 Km^2) and Tazlău (L = 89 Km; A = 1,104 km^2). The mean discharge of Trotuş River increases from 0.793 m^3/s, at Lunca de Sus, situated in the upper basin, to 34.6 m^3/s at Vrânceni, which is the final gauging station. The mean discharges of the main tributaries have different values, depending on the geographic and morphometric features of their catchment areas. They have been computed for the period 1950 – 2007 based on the National Institute of Hydrology and Water Management (N.I.H.W.M.) data. The results are as follows: Sulța 1,026 m^3/s; Asău 2.06 m^3/s; Uz 4.86 m^3/s, at Cremenea gauging station; and Tazlău 7.14 m^3/s, at Helegiu. In general, the streams belonging to Trotuş catchment area have a Carpathian flowing regime, with high waters in spring, mean maximum discharges in May, while floods are specific for the summer season and occur as a result of rain showers (Pişota & Zaharia, 2002).

On the whole, 54% of Trotuş catchment area is covered by forest (according to the *Atlasul Cadastrului Apelor din România*, 1992). After 1990, the retrocession of forests to their former owners has led to massive deforestations, which triggered the past years' floods and amplified their negative effects.

---

[3] Morphometric data related to the Trotuş River and its tributaries are taken from the *Atlasul Cadastrului Apelor din România, 1992.*

From the *social and economic point of view*, Trotuş catchment area is a relatively densely populated area, with many settlements that concentrate especially along the valleys. Trotuş River itself is an important Transcarpathian axis of communication of national importance, which connects Moldavia and Transylvania, both by railway and motorway. Along its course, there are five cities, namely Adjud, Oneşti, Târgu Ocna, Dărmăneşti and Comăneşti. Likewise, many settlements and roads are found along the main tributaries (the Oituz, Uz, Slănic and Caşin rivers). The relatively high human densities of the valleys and the presence of ways of communication of national and county importance make this area so vulnerable to floods.

3. DATABASE AND METHODOLOGY

Trotuş river catchment area possesses a fairly dense and well-distributed network of river-measurement stations, comprising 21 gauging stations of which many have been in operation for more than 30 years, which gives credibility to the spatial and temporal analyses of liquid discharge parameters (fig. 1, table 1).

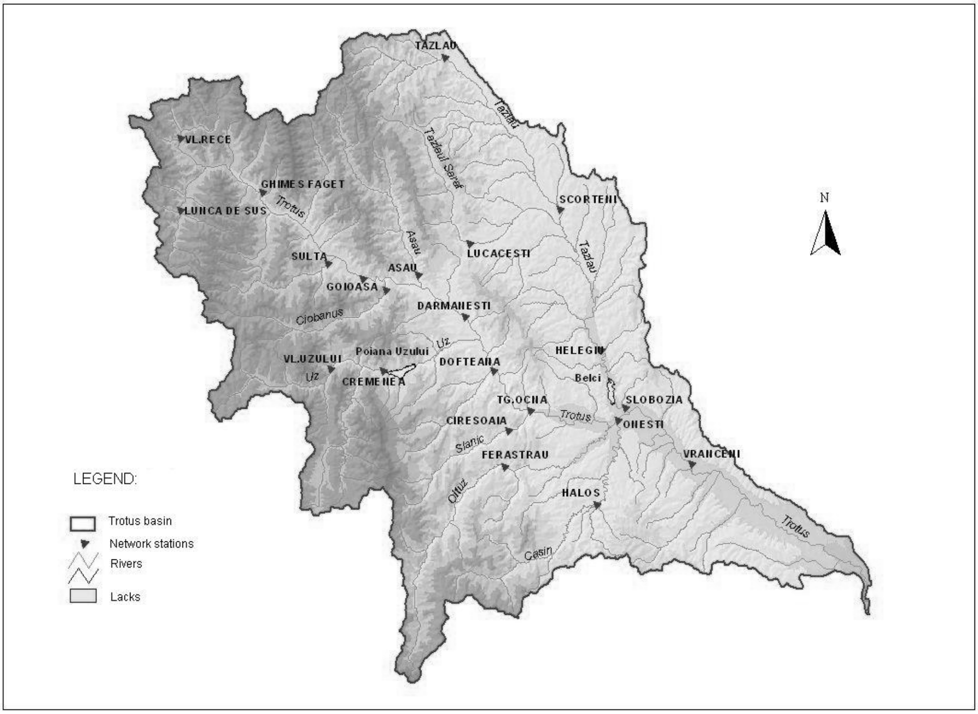


Fig. 1. Stream gauging stations network in Trotuş catchment area.

The present study turns to account the series of maximum monthly and yearly discharges recorded by the 21 gauging stations in the catchment area along periods ranging from 29 to 57 years. The analysis of flood potential has taken into account, for each hydrometric station, the floods with peak discharge values above the three specific stages: the defense, the flood and the danger stages.

Data on the stream gauging stations in Trotuş catchment area*

Table 1

Crt. no.	Stream	Gauging station	Study period	L (Km)	Hmed (m)	F (Km^2)
1	Trotuş	Lunca de Sus	1976-2007	17	1140	89.2
2	Valea Rece	Valea Rece	1976-2007	23	1145	121
3	Trotuş	Ghimeş-Făget	1961-2007	35	1116	381
4	Sulţa	Sulţa	1964-2007	26	1041	116
5	Trotuş	Goioasa	1952-2007	52.4	1052	765
6	Ciobănuş	Ciobănuş	1964-2007	32	1052	132
7	Asău	Asău	1951-2007	36	951	205
8	Uz	Valea Uzului	1968-2007	25	1070	160
9	Uz	Cremenea	1977-2007	40	1070	340
10	Uz	Dărmăneşti	1977-2007	50	975	406
11	Dofteana	Dofteana	1977-2007	26	735	110
12	Slănic	Cireşoaia	1967-2007	26	775	100
13	Trotuş	Tg. Ocna	1955-2007	89	924	2091
14	Oituz	Fierăstrău	1951-2007	40	810	263
15	Caşin	Haloş	1962-2007	31.5	717	205
16	Trotuş	Onesti	1978-2007	111	830	2836
17	Tazlău	Tazlău	1968-2007	25	793	129
18	Tazlău	Scorţeni	1979-2007	50	574	417
19	Tazlăul Sărat	Lucăceşti	1966-2007	25.4	801	123
20	Tazlău	Helegiu	1970-2007	72.5	520	999
21	Trotuş	Vrânceni	1963-2007	126	734	4077

*According to N.I.H.W.M. data; L – Stream length (from its origin to the gauging station); Hmed – Catchment area's mean elevation (upstream the gauging station); F – Catchment area's area (upstream the gauging station).

The main employed method has been the frequency analysis, which allowed the determination of frequencies and exceeding probabilities. In order to estimate the maximum discharges with different exceeding probabilities the Pearson III binomial theoretical law of distribution has been used and the data have been processed by using the ASIG software (devised by the N.I.H.W.M.). Empiric probabilities have been estimated with the Weibull formula: $p = r/(n+1)$, where r is the rank of the value in the data series, ordered downwards, and n is the number of values. In order to identify the tendencies in the maximum flow dynamic and their statistical significance Mann-Kendell test has been applied (by using MAKENSES software).

Cartographic representations and spatial analyses have been based on GIS techniques (extensions of the ArcGis 9.2 software).

4. MAXIMUM FLOW AND ITS SPATIAL AND TEMPORAL VARIABILITY

The specific aspects regarding the temporal variability of maximum flow have been made evident by analyzing the series of yearly and monthly maximum discharges recorded by the gauging stations in the study area.

4. 1. Interannual and monthly variability

In Trotuş catchment area, the maximum flow shows an important variability from one year to another, which is mirrored by the high values of the yearly maximum discharges variation coefficients (C_v). Thus, most of the stream gauging stations (17 out of 21) are characterized by a C_v greater than 0.7, while 11 stations top even 0.9, which shows the marked torrential character of the maximum flow on an annual scale (table 2). On the whole, maximum discharges variation coefficients range from 0.42 (at the Lunca de Sus station) and 1.43 (at Ciobănuş). These coefficients represent important parameters that are used in order to estimate the maximum discharges with different exceeding probabilities.

Maximum-maximorum discharge (Qmax) and variation coefficient (Cv) values at the gauging stations in Trotuş catchment area*

Table 2

Crt. no.	Stream	Gauging station	Qmax (m^3/s) *	Recording date	Cv
1	Trotuş	Lunca de Sus	23.2	12.07.2005	0.42
2	Valea Rece	Valea Rece	110	24.06.1981	0.68
3	Trotuş	Ghimeş-Făget	127	03.07.1975	0.50
4	Sulța	Sulța	99.2	05.07.1991	0.91
5	Trotuş	Goioasa	353	28.07.2004	0.71
6	Ciobănuş	Ciobănuş	380	23.11.1970	1.43
7	Asău	Asău	389	12.07.2005	0.96
8	Uz	Valea Uzului	196	02.07.1975	0.98
9	Uz	Cremenea	229	12.07.2005	0.65
10	Uz	Dărmăneşti	132	13.07.2005	0.81
11	Dofteana	Dofteana	458	29.07.1991	1.21
12	Slănic	Cireşoaia	148	02.07.1975	0.78
13	Trotuş	Tg. Ocna	1490	12.07.2005	0.75
14	Oituz	Fierăstrău	413	02.05.1975	0.92
15	Caşin	Haloş	497	19.07.1972	0.98
16	Trotuş	Oneşti	2294	12.07.2005	0.93
17	Tazlău	Tazlău	698	06.07.0970	1.26
18	Tazlău	Scorțeni	538	12.07.2005	0.91
19	Tazlăul Sărat	Lucăceşti	514	12.07.2007	1.03
20	Tazlău	Helegiu	1556	13.07.2005	0.98
21	Trotuş	Vrânceni	3720	29.07.1991	0.90

* According to N.I.H.W.M. data.

In order to identify the years that have witnessed the highest maximum discharges the four maximum values of this parameter have been selected for each gauging station. Thus, it has been observed that the year with the highest discharge was 2005 (for 11 of the 21 investigated stations), followed by 1975 (4 cases), 1991 (3 cases) and 1970 (2 cases). The highest ever-recorded maximum discharge (*maximum-maximorum*) of Trotuş River is 3,720 m^3/s, value that occurred on July 29, 1991, at Vrânceni stream gauging station. The highest discharges on Trotuş tributaries occurred on the Tazlău (1,556 m^3/s), the Tazlău Sărat (584 m^3/s) and the Uz (229 m^3/s) during the floods of 2005. As a matter of fact, more than half of the river-measurement stations in Trotuş catchment area (especially those placed in the small and middle catchment areas, with areas less than 500 km^2) experienced in 2005 the highest maximum discharges ever-recorded since they came into operation (historical discharges) (fig. 2). The lowest maximum discharges on Trotuş River vary from 62.7 m^3/s (in 1986) at Târgu Ocna, to 24.7 m^3/s (in 1961) at Goioasa station.

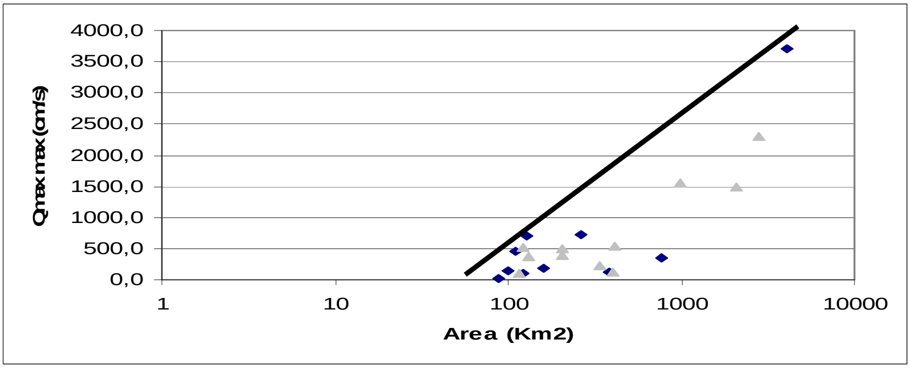


Fig. 2. The folding curve of historical discharges (Qmax max) in Trotuş catchment area (maximum discharges of 2005 are plotted with triangles).

The analysis of the variability tendencies of the maximum annual discharges has shown that in Trotuş catchment area there are no statistical significant such increasing or decreasing tendencies. Only for two gauging stations (Helegiu on the Tazlău and Cireşoaia on the Slănic) the Mann-Kendall test has revealed a decreasing tendency at a confidence level of 5%.

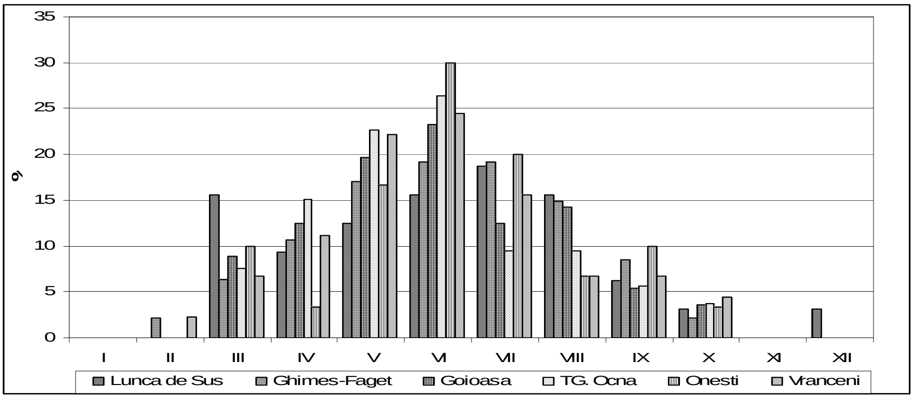


Fig. 3. Monthly distribution of the maximum annual discharges occurrence frequency at the gauging stations along Trotuş River.

As far as the *maximum monthly discharges variability* is concerned, the values show during a year higher or lower oscillations generated in essence by the climatic features of each month. The highest maximum monthly discharges occur in spring and summer months, while in winter and autumn the values are the lowest.

The analysis of the seasonal and monthly occurrence frequency of the maximum annual discharges points out that on most parts of the study area the maximum annual discharges have occurred every month in the interval May – August (with a maximum of 22% in June), mainly as a result of rain showers. In May, an important part in the formation of maximum flow is played both by precipitation and snow melting. The lowest occurrence frequencies of the maximum annual discharges (less than 1%) are specific for winter (because water is stored in the snow cover and freezing processes are active) and autumn (as a result of scant precipitation). Fig. 3 illustrates the monthly distribution of occurrence frequency of the maximum annual discharges at the stream gauging stations along Trotuş. On a seasonal scale, on the whole of the basin, the maximum annual discharges occur most frequently in summer (55% of the sum of the mean monthly occurrence frequencies specific for the investigated gauging stations) and spring (34%). Most seldom, maximum annual discharges have occurred in winter (1%), while in autumn their occurrence frequency is 11%.

4. 2. Maximum discharges with different exceeding probabilities

According to the methodology presented in Chapter 3,Ş the maximum discharges with probabilities of exceeding of 0.1%, 0.5%, 1%, 2%, 5% and 10% have been estimated for all the measurement stations in the Trotus catchment area. The analysis of results shows a rich flow in the Subcarpathian area of the basin, especially on the Tazlău, Tazlău Sărat and Oituz rivers. The maximum discharges with a probability of exceeding of 1% range from 30 m^3/s in the mountainous area at Lunca de Sus gauging station, to 3.766 m^3/s at Vrânceni (on Trotuş River). Figure 4 illustrates the spatial distribution of the maximum flow in Trotuş catchment area in the form of specific liquid discharge with a probability of exceeding of 1% ($qmax_{1\%}$, in l/s/Km^2). Its analysis reveals that the highest values are specific for the middle part of Trotuş catchment area, which overlaps the Subcarpathian area.

In the hydrological practice, the determination of maximum discharges with different exceeding probabilities on river stretches devoid of hydrometric stations is achieved through relations of hydrological regionalization. One of the most used is the correlation between specific maximum discharges with different exceeding probabilities (qmaxp%) and the complex parameter $H/\sqrt{F}$, where H is the mean elevation of the catchment area (given in meters) and F is the catchment area's area (in Km^2). Another widely used correlation is that between specific maximum discharges with different exceeding probabilities qmaxp% and the catchment area's area F (Diaconu & Şerban, 1994). For the purpose of this study, the first of the two correlations has been employed (fig. 5). Depending on the points distribution three correlations curves corresponding to the upper, middle and lower areas of Trotuş catchment area have taken shape, and still one corresponding to the Uz catchment area, which has a lower specific maximum discharge, due primarily to the fact that it develops on the calcareous and schists area (Tarcău facies).

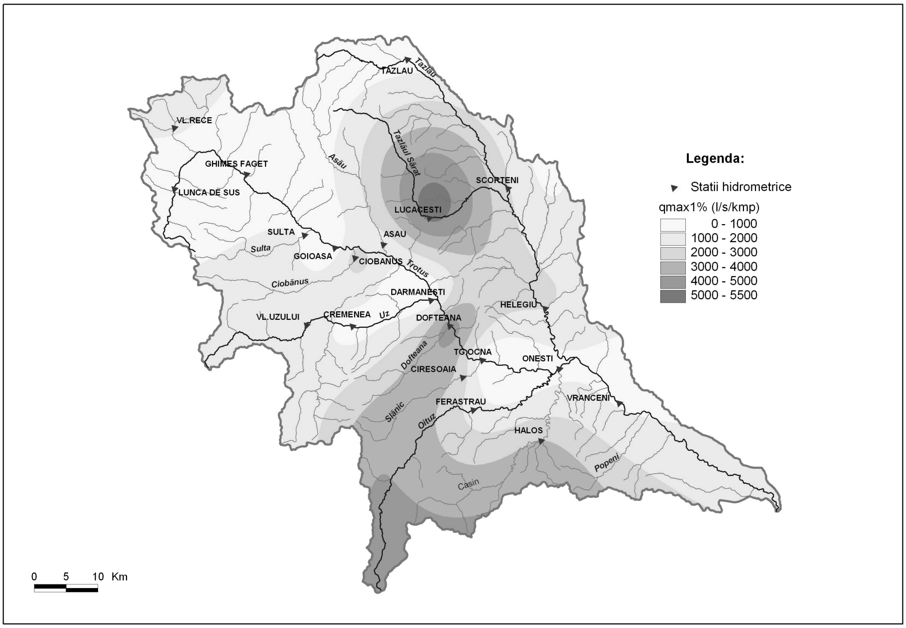


Fig 4. Spatial distribution of maximum specific liquid discharge with probabilities of exceeding 1% ($qmax_{1\%}$, in l/s/Km^2) in Trotuș catchment area.

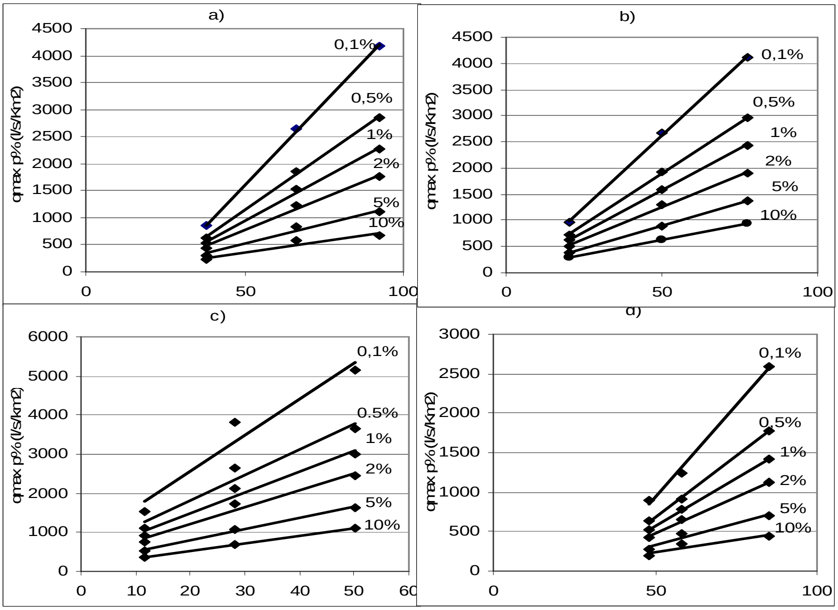


Fig. 5. Regionalization relationships of the maximum discharges based on qmaxp% (inl/s.Km^2)– /$\sqrt{F}$ values in Trotuș catchment area: a) upper basin; b) middle basin; c) lower basin; d) The Uz catchment area (the values on the abscissa represent the ratio H/$\sqrt{F}$).

5. FLOOD POTENTIAL

In Trotuş catchment area, most floods have a pluvial origin, occurring mainly in the warm season. For instance, the floods of 2005 were triggered by precipitation that exceeded 150 – 200 mm in 48 hours (July 12 – 13). These amounts of precipitation with torrential character were responsible for discharges of 538 m^3/s on the Tazlău at Scorțeni gauging station, 229 m^3/s on the Uz at Cremenea, 379 m^3/s on the Oituz at Fierastrău and 2,294 m^3/s on Trotuş at Oneşti (Chirilă & Preda, 2007). Another remarkable year for this catchment area was 1991 when, on the Tazlău River, in less than two hours fell 150 mm of precipitation (on July 29), resulting in a flash flood with a first peak discharge of more than 2,000 m^3/s, followed by a second peak of about 1,000 m^3/s, which broke down the Belci dam (Stănescu & Drobot, 2002).

In order to establish the potential of flood occurrence in Trotuş catchment area only the important floods have been taken into account. The maximum discharges of these floods are above those corresponding to the defense stages, namely: QA – the discharge equivalent to the attention stage, QI – the discharge corresponding to the flood stage and QP – the discharge specific for the danger stage. The occurrence frequencies (expressed as the number of events) of the floods with discharges superior to QA, QI and QP have been computed on the basis of the series of maximum monthly discharges. The results for the 21 gauging stations are shown in table 3. The analysis of the values highlights that most of the floods with discharges higher than the one corresponding to the danger level have occurred on Trotuş at Târgu Ocna (6), on Tazlău Sărat at Lucăceşti (5) and on Caşin at Haloş (4).

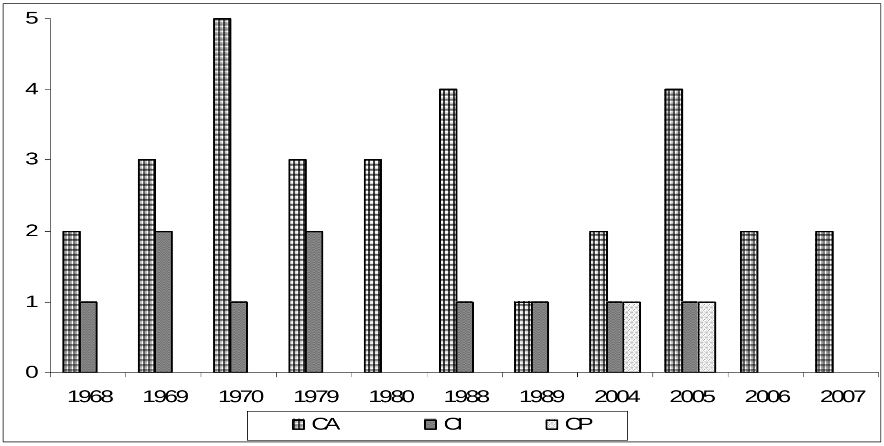


Fig. 6. Yearly flood potential – number of cases above the attention stage (CA), flood stage (CI) and danger stage (CP) - of Trotuş River at Târgu Ocna station.

In some years, several floods with discharges above the threshold corresponding to the defense stage have taken place. For instance, on Trotuş River at Târgu Ocna station in 1970 five floods with discharges superior to that corresponding to the attention stage occurred. Likewise, in 1988 and 2005, four such floods were recorded and in 1969, 1979 and 1980 three floods occurred every yea. Two of the floods of 1969 and 1979 had higher discharges than that corresponding to the flood stage (fig. 6).

Occurrence frequency of the maximum monthly discharges higher than the ones equivalent to the attention stage (QA), flood stage (QI) and danger stage (QP) in the Trotuş catchment area

Table 3

Crt. no.	Stream	Gauging station	Number of cases *		
			>QA	>QI	>QP
1	Trotuş	Lunca de Sus	66	2	0
2	Valea Rece	Valea Rece	11	4	1
3	Trotuş	Ghimeş-Făget	19	0	0
4	Sulța	Sulța	5	2	0
5	Trotuş	Goioasa	27	7	2
6	Ciobănuş	Ciobănuş	17	5	3
7	Asău	Asău	25	1	1
8	Uz	Valea Uzului	14	3	1
9	Uz	Cremenea	3	1	0
10	Uz	Dărmănești	24	6	2
11	Dofteana	Dofteana	33	10	3
12	Slănic	Cireşoaia	21	7	2
13	Oituz	Fierăstrău	22	3	0
14	Trotuş	Tg. Ocna	88	20	6
15	Trotuş	Oneşti	21	12	2
16	Caşin	Haloş	32	11	4
17	Tazlăul Sărat	Lucăceşti	21	6	5
18	Tazlău	Tazlău	6	1	1
19	Tazlău	Scorțeni	8	3	2
20	Tazlău	Helegiu	18	5	2
21	Trotuş	Vrânceni	19	10	2

* Values obtained on the basis of N.I.H.W.M. data.

As far as the monthly flood potential of Trotuş catchment area is concerned one can notice that flood discharges superior to that corresponding to the flood stage occur most often in spring and summer months, having predominantly a pluvial origin (table 4). On Trotuş river, the most frequent floods with discharges above the one equivalent to the flood stage have occurred in May, followed by July and August.

6. CONCLUSIONS

The analyses of the maximum monthly and annual discharges recorded by the 21 stream gauging stations in Trotuş catchment area reveal a series of specific features regarding the maximum flow, which must necessarily be taken into account for the proper management of water resources and flood risk assessment. From among these features, the most outstanding are the significant interannual variability of maximum discharges (expressed as variation coefficients, which more often than not exceed 0.8) and the high potential for generating big floods (with discharges above the one corresponding to the defense levels). At the basin scale, the biggest floods occurred in 1970, 1975, 1991 and 2005. In some years (1969, 1970, 1979, 1980, 1988 and 2005), however, several floods with discharges superior to the defense ones were recorded. At the monthly scale, the interval May – August has the highest flood potential, especially because of the rain showers. The months with the highest flood risk are July, followed by May.

Monthly flood potential of Trotuş catchment area

Table 4

Crt. no.	Stream	Gauging station	Number of floods above the flood stage*											
			J	F	M	A	M	J	J	A	S	O	N	D
1	Trotuş	Lunca de Sus	0	0	0	0	1	0	1	0	0	0	0	0
2	Valea Rece	Valea Rece	0	0	0	0	1	1	1	1	0	0	0	0
3	Trotuş	Ghimeş-Faget	0	0	0	0	0	0	0	0	0	0	0	0
4	Sulţa	Sulţa	0	0	0	0	0	0	2	0	0	0	0	0
5	Trotuş	Goioasa	0	0	0	0	2	1	2	2	0	0	0	0
6	Ciobănuş	Ciobănuş	0	0	0	0	0	1	3	0	0	0	1	0
7	Asău	Asău	0	0	0	0	0	0	1	0	0	0	0	0
8	Uz	Valea Uzului	0	0	0	0	1	1	1	0	0	0	0	0
9	Uz	Cremenea	0	0	0	0	0	0	1	0	0	0	0	0
10	Uz	Dărmăneşti	0	0	0	1	1	0	1	2	1	0	0	0
11	Dofteana	Dofteana	0	0	0	0	2	2	3	2	0	1	0	0
12	Slănic	Cireşoaia	0	0	0	0	3	0	4	0	0	0	0	0
13	Trotuş	Tg. Ocna	0	0	1	0	7	2	6	3	1	0	0	0
14	Oituz	Fierăstrău	0	0	0	0	1	0	2	0	0	0	0	0
15	Caşin	Haloş	0	0	1	0	3	0	4	3	0	0	0	0
16	Trotuş	Oneşti	0	0	1	2	2	1	3	1	1	1	0	0
17	Tazlău	Tazlău	0	0	0	0	0	0	0	0	0	0	0	0
18	Tazlău	Scorţeni	0	0	0	1	0	0	1	1	0	0	0	0
19	Tazlău Sărat	Lucăceşti	0	0	0	0	1	2	2	1	0	0	0	0
20	Tazlău	Helegiu	0	0	0	0	1	0	2	1	0	0	0	0
21	Trotuş	Vrânceni	0	0	1	0	4	1	3	1	0	0	0	0

* Values obtained on the basis of N.I.H.W.M. data.

Even though the last years have experienced floods with important discharges, which generated overflowings with serious consequences, the analyses that have been undertaken revealed no significant tendencies either in the maximum discharges variability or in the number of yearly floods (the ones considered really important), inasmuch as high discharge floods also occurred during the period 1970 – 1975. The most serious consequences of the last years' floods, as compared to the previous ones, are largely explained by the increase of flood vulnerability through the development of social and economic activities and transportation infrastructure, as well as through the changes in land use (with special emphasis on massive deforestations).

REFERENCES

1. Chirilă, Gianina., Preda, A. (2007), *Aspecte privind viiturile şi inundațiile produse în anul 2005 în bazinul hidrografic Trotuş*, Comunicări de geografie, vol. XI, Edit. Universității, București.
2. Diaconu, C. (1988), *Râurile de la inundații la secetă*, Edit. Tehnică, București.
3. Diaconu, C. Şerban, P. (1994), *Sinteze şi regionalizări hidrologice*, Edit. Tehnică, Bucureşti.
4. Dimitriu, D. (2007), *Sistemul aluviunilor din bazinul râului Trotuş*, Edit Universității Suceava.
5. Mustățea, A. (2005), *Viituri excepționale pe teritoriul României*, INHGA, Bucureşti.
6. Pişota, I., Zaharia, Liliana (2002), *Hidrologie*, Edit. Universității Bucureşti.
7. Podani, M., Zăvoianu, I. (1992), *Cauzele şi efectele inundațiilor produse în luna iulie 1991 în Moldova*, Studii şi Cercetări de Geografie, tom XXXIX, Bucureşti.
8. Ujvari, I. (1972), *Geografia apelor României*, Edit. Științifică, Bucureşti.
9. Velcea, Valeria, Savu, Al. (1982), *Geografia Carpaților şi Subcarpaților Româneşti*, Edit. Didactică si Pedagogică, Bucureşti.
10. Zaharia, Liliana (1999), *Resursele de apă din bazinul râului Putna – studiu de hidrologie,* Edit. Universității din Bucureşti.
11. Stănescu, Al. V., Drobot, R. (2002), *Măsuri nestructurale de gestiune a inundațiilor*, Edit. HGA Bucureşti.
12. *** (1967), *Monografia hidrologică a bazinului hidrografic Siret*, Studii de hidrologie, XXII, IMH, Bucureşti.
13. *** (1971), *Râurile României. Monografie hidrologică*, IMH, Bucureşti.
14. *** (1992), *Geografia României. Regiunile pericarpatice*, IV, Edit. Academiei Române.
15. *** (1992), *Atlasul cadastrului apelor din Romania*, Bucureşti.
16. *** (---) *Anuare hidrologice*. Arhiva INHGA.
17. *** (---) *Studii la stațiile hidrometrice*. Arhiva INHGA.

STUDIA UNIVERSITATIS BABEȘ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

DECREASING THE ENVIRONMENT IMPACT AND SECURING WATER SUPPLY SAFETY THROUGH WATER AND WASTE WATER INFRASTRUCTURE MODERNIZATION

V.-L. CROITORU[1], D. CIATARÂŞ[1], C. NEAMȚU[1]

ABSTRACT. – Decreasing the environment impact and securing water supply safety through water and waste water infrastructure modernization. In Cluj and Sălaj Counties as well as all over in Romania, following a legacy of poor or no investments in the water supply and sewage infrastructure before 1989, a high risk situation developed seriously threatening the environment and the water supply safety. As a consequence, water losses of more than 60%, discharges of household and industrial waste water in the river Somes and other effluents without treatment as well as the lack of expansion and modernization investments in the water supply leading to situations of daily supply schedules for some entire communities, posed a major threat to the environment, public health, to the normal social and economic development of the community itself. Several consecutive major investment programs between 1995 and 2009 not only addressed and solved most of the problems in Cluj County but resulted in putting the community in an excellent pole position in term of the race for compliance with EU water and environment Directives to be met gradually by 2018. Solving the water supply and waste water treatment related environment issues in Cluj County and the way these issues are planned to be addressed in Salaj County shows how important are, aside major investment programs, the natural and antropic geographical features of the area in question.

Keywords*: water supply, investment programs in infrastructure, environment protection, drinking water quality.*

1. INTRODUCTION

Environment issues - water and environment quality, public health - can be solved only with massive investments in the extension and modernization of the water supply and waste water treatment but the existing situation in Cluj (and later Salaj) counties shows how important are also factors such as the geographic location and antropic (man made) features of the area in question. Indeed water supply and environment issues in Cluj County would have been much difficult to solve without the man made and natural water resources upstream Cluj-Napoca consisting in the row of reservoir lakes in the area. By contrast, Sălaj County adds to its weak economic and social development a chronic lack of water resources. Vârşolț Lake as raw water source for Zalău and Şimleul Silvaniei towns has a poor raw water quality affected by the pollution from agricultural and animal farming activities in the area. The other urban localities in the county (Cehu Silvaniei and Jibou) as well as the rural areas must rely on underground water sources (wells) with the implicit risks during drought periods. These situations are affecting the water supply risk management as well as the accidental pollution prevention investment planning.

[1]SOMEŞ Water Company, 400604 Cluj-Napoca, Romania, e-mail: public.relations@casomes.ro.

2. SITUATION OF WATER AND SEWAGE PUBLIC UTILITIES IN ROMANIA, 1989 - 1995

Before 1989 environment issues were not differentiated nor did represented an important theme on the public agenda of the local or national relevant bodies or authorities. In terms of public utilities there were mammoth county based structures responsible for water, sewage, sanitation, housing, heating, public transport etc. Investments for the modernization of the environment infrastructure lacked completely before 1989 having as result networks of 30, 50, even 80 years old. On the other hand, networks built in the 60's and 70's were made of inadequate materials such as asbestos cement (fig. 1).

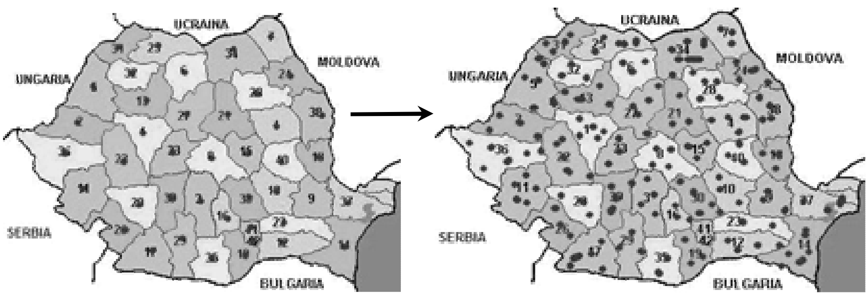


Fig. 1. Situation of water/sewage public utilities in Romania, 1989 – 1995.

In 1990 by law former single mammoth structures were reorganized into utility specific independent administrations subordinated to local authorities. As a consequence follows a huge increase of the number of public services for water and waste water to over 400 across the country, many cities, towns and even communes establishing their own companies without regard to the resources available to modernize these utilities and the infrastructure.

The infrastructure, the services and the environment itself during 1989 - 1995 are still described by major shortcomings in terms of vision, interest, strategy. The lack of adequate environment regulations is inherited from the previous period. Short, medium and long term strategies are still missing as well as the understanding and implementation of the "sustainable development" concept. The infrastructure with all it's components (networks, water purification plants, waste water treatment plants etc) is obsolete physically and morally (fig. 2).

Water losses go in some places beyond 60%. The average specific consumption of the population is over 350 l/pers/day as compared with the European average of 130-150 l/pers/day bringing into discussion a serious need for awareness campaigns regarding a rational use of water and avoiding squander. What is more important, both public authorities and public services are short in investment funds for the rehabilitation and/or modernization of the infrastructure. The concept of modernization/development fee included in tariffs is missing. Major water losses and leaks from the sewage networks, as well as high energy consumptions from obsolete equipments have a major impact on the environment and community health.

3. INVESTMENT PROGRAMS IN THE ENVIRONMENT INFRASTRUCTURE 1995 – 2007

The solution for the modernization of the water - sewage infrastructure started to emerge in the mid 90's with the European Union co-funded programs. These programs represented a viable and affordable concept for the water - sewage public services sector in Romania since - with small differences from program to program - had a financial construction comprising about 75% non reimbursable EU funds.

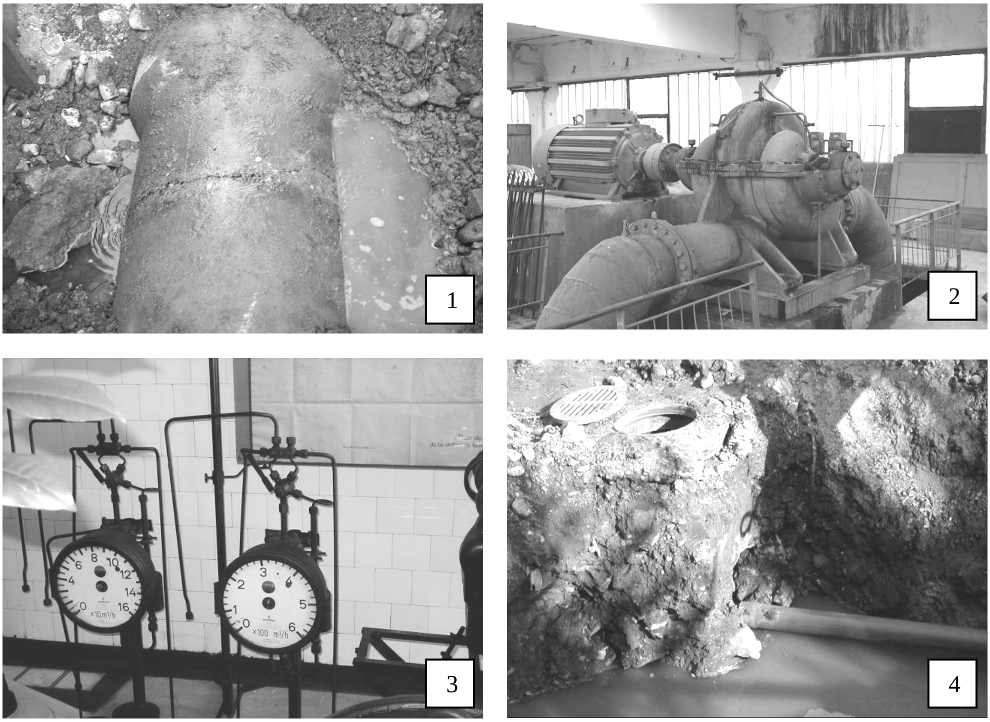


Fig. 2. Some of the shortcomings before 1995 with impact on the environment. 1, High losses in water networks; 2, High energy consumption due to obsolete equipment; 3, Lack of monitoring, control and automation; 4, Major leaks from the sewage networks.

These programs were structured later into pre and post accession funding. While the first had as main objective the recovery of the main environment shortcomings accumulated over the past 30 years and more, the ones in the second category concentrated on meeting the conditionalities set by Chapter 22 (environment) of the accession negotiation of Romania to the EU.

Through these programs, the wealth of natural and man made water resources upstream Cluj-Napoca was capitalized on to ensure alternative and complementary water supply sources in order to prevent accidental pollution and eliminate risks in terms of water supply safety in the area serviced.

Acceptance, understanding and furtherance of ecological concepts and of those regarding the sustainable development meant the gradual establishment and implementation of strategies aimed to environment and its components protection through the construction - for instance - of large diameter sewer mains which completely eliminated in time the pollution of Somesul Mic river crossing Cluj-Napoca.

Maybe the most important gain, these programs co-financed by the European Union brought - as part of their institutional arrangement - a philosophy based on the concept "we help you but help yourself as well" in the area of environment risk management, materialized for instance in Tarnița-Gilău basin Pollution Prevention Plan (PPP) within the ISPA (pre accession structural instrument) Program. The objectives of this PPP was to achieve and maintain a "good situation" (according the EU Water Frame Directive) of all waters within the catchment area Tarnița and Gilău and to secure and provide raw water quality according European and Romanian regulations for the new water intake in Tarnița lake to be built within ISPA (table 1, fig. 3).

The sources for the modernization and the development of the water - sewage infrastructure

Table 1

Source	Value
Local special Tax (1995-…)	> 3 Mil EUR
MUDP II* (1997-2002)	38 Mil. USD
Own & budget sources (1997-…)	> 14 Mil. EUR
ISPA* (2004-2010)	69 Mil. EUR
SAMTID* (2005-2008)	13.5 Mil. EUR
Total	**> 130 Mil. EUR**

* EU co-funded programs

The project area comprises all water bodies, rivers and lakes, in Tarnița-Gilău catchment area as well as their surrounding influence areas. The Tarnița-Gilău PPP Coordination Committee gathered all authorities, institutions and bodies with explicit power in environment and water protection or those which can contribute to this effect. Representatives of these institutions were divided into four working groups with their own specific Action Plan integrated into the PPP as a whole.

The ISPA Program was also responsible for the establishment of the regional integrated water supply strategy, namely of the concept of hydrographic basins based integrated management for water resources outlined in the national strategy in this field. Thus, reservoirs Gilău and Someşul Cald as well as Floreşti underground source serving in present as raw water sources for Cluj area system were to be replaced by Tarnița reservoir with a number of vantages in terms both of better raw water quality as well as more suitable surrounding environment around the catchment area.

The ISPA Program was also responsible for the establishment of the regional integrated water supply strategy, namely of the concept of hydrographic basins based integrated management for water resources outlined in the national strategy in this field.

Thus, reservoirs Gilău and Someşul Cald as well as Floreşti underground source serving in present as raw water sources for Cluj area system were to be replaced by Tarnița reservoir with a number of vantages in terms both of better raw water quality as well as more suitable surrounding environment around the catchment area.

It gives also the future possibility to supply a more extended area in the neighboring Sălaj County included. This strategy is aimed to supply the entire urban localities in Sălaj County from Cluj (Tarnița) source thus eliminating the current polluted sources and establishing a regional integrated water supply system. Pre-accession EU co-funded programs aimed to recuperate environment shortcomings, to ensure accidental pollution risk management and water supply safety between 1995 and 2008.

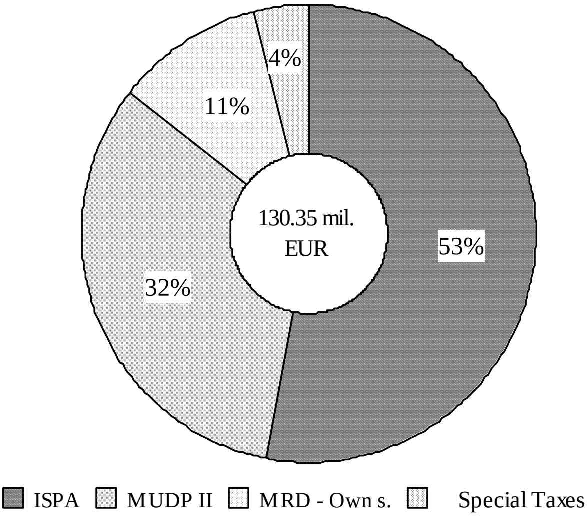


Fig. 3. Main financial resources for rehabilitation of water supply.

Among the main achievements of these programs were the modernization and expansion of the water purification plants and the waster water treatment plants, solved the treatment costs problems, the water quality the overspill issues from the sewage network, thus minimizing the direct impact on the environment and public health. They also decreased the energy consumption by replacing obsolete equipment and tools. Awareness campaigns attached to these programs succeeded in changing the population consumption pattern, the average consumption being today of about 150 l/person/day (fig. 4).

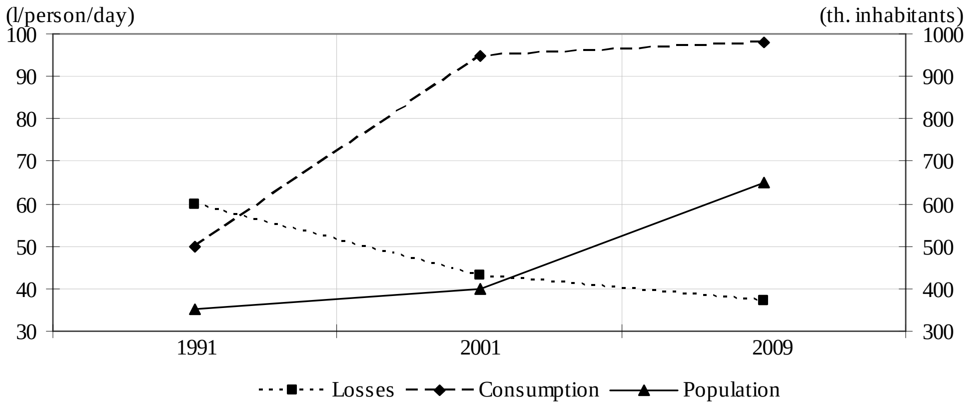


Fig. 4. The population serviced by the ROC and the metering and water losses.

On July 1, 2006, there was a major moment for Cluj water supply and sewage public service history with the restructuring into a Regional Operator Company (ROC). The ROC took over at this date seven new urban localities (small and medium towns category) in Cluj and Sălaj Counties (Dej, Gherla, Huedin, Zalău, Şimleul Silvaniei, Cehu Silvaniei and Jibou) (fig. 5).

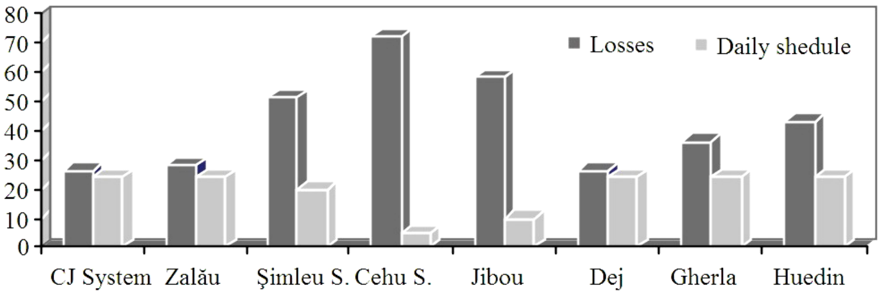


Fig. 5. Water losses (%) and daily supply schedule in the 7 newly taken over towns on July 1, 2006.

The situation of these towns in terms of environment infrastructure status was worse (in 2006) than it was in 1990 in Cluj County (fig. 6). Three of the towns newly taken over had daily water supply schedule (between 5 and 20 hours/day) and water losses in the networks reaching 70%.

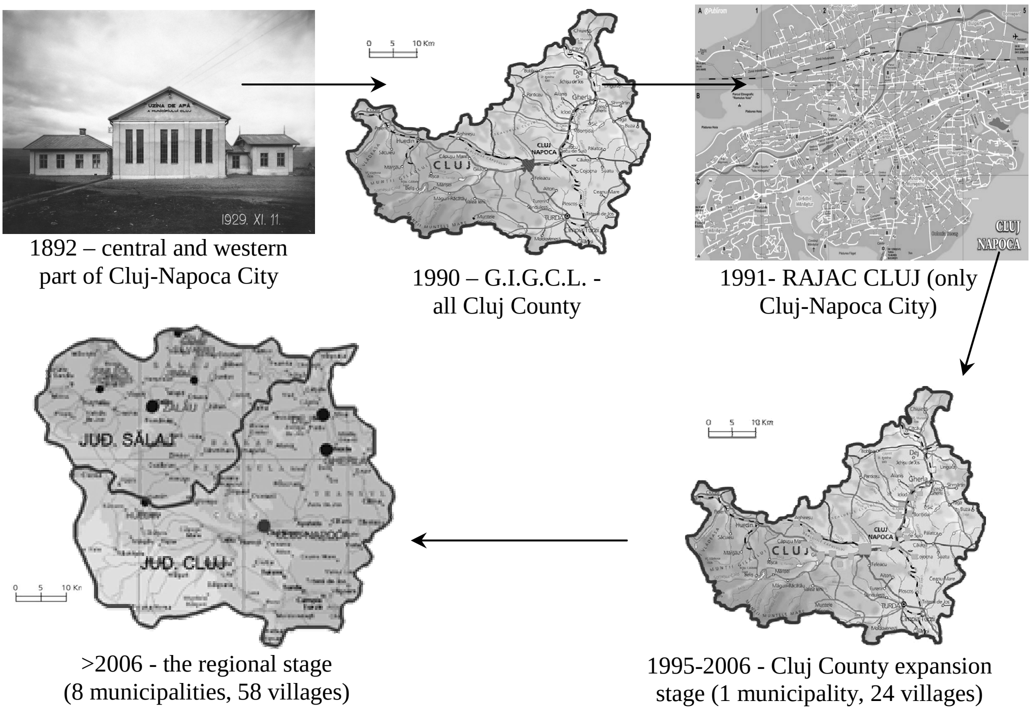


Fig. 6. Different toponymes and the work area of the S.C. "Someş" S.A. Cluj Water Company along the time.

By means of implemented emergency investment programs and having the benefit of the economic power and financial viability due to scale economy of the ROC, these three towns had water 24/7 in less than a year after being taken over.

4. POST-ACCESSION ENVIRONMENT PROGRAMS

They were developed based on the need to prepare viable long term projects funded from the European Cohesion Fund which would provide solutions for the compliance with the conditionalities set by Chapter 22 of the accession negotiations. These programs were outlined since 2006 in Romania through the Environment Sectoral, Operational Program (POS) submitted by Romania to the EC at January 31st 2007 and by which priority was granted to the regional projects in order to optimize the investment and operational costs presumed by such an investment (table 2).

The necessary investments estimated to achieve these environment objectives if of over 400 Million Euro for the entire infrastructure serviced by the ROC in Cluj and Sălaj counties, leading to the need to divide the application process into phases.

The following phases were set for the project:

Phase 1: 2007–2013 - aims to the improvement of the water supply standards regardless the size of the locality and of the waste water network and treatment facilities - for localities with population over **10.000** inhabitants equivalent; it focuses more on significant improvements of the networks in order to decrease losses and leaks; paramount importance is given to the consolidation of the level of services.

Phase 2: 2014-2018 - aims ever higher standards for water treatment and higher connection rates to sewage networks for localities with population around **2.000** inhabitants equivalent; it focuses on improvements of the service and equipments replacement.

Phase 3: 2019–2026 - major investments are no longer required. The systems are well enough developed, the waste water treatment standards are in place and the number of customers can be increased only marginally (connection rates are already high). All activities are focused on operation improvement and high service maintenance standards.

The ranking method for the selected measures was based on the following strategy:

- short term improvement of the waste water treatment process for compliance with minimal standards wherever is economically justified;
- use of the transition period set by Chapter 22 for the improvement in order to decrease water network losses and leaks from the sewage network;
- implementation of the principle “polluter pays” (the ROC will enforce the relevant regulations such as NTPA 002 for commercial/industrial customers);
- final WWTP capacities in place by the dates set in the Romanian law.

The first financing stage worth 196 Million EUR for Phase 1 2008 - 2013 was already secured from the EC. The financing breakdown is somehow similar to the pre accession programs: 74% EU grant; 11.3% - Romanian Government; 1.9% - Local Authorities; 12.5% - Loan (ROC).

Main parameters of post accession compliance obligations in terms of water & environment quality

Table 2

Water & environment quality element	**Parameter**
DRINKING WATER QUALITY **- by Dec 31, 2010**	- for oxidation, ammonia, iron, pesticide, si manganese - for localities with over **100,000** inhabitants;
	- for oxidation and turbidity - for localities with population between **10,000 and 100,000** inhabitants;
	- for oxidation - for localities with population under **10,000** inhabitants;
	- ammonia, nitrates, aluminium, iron, led, cadmium, pesticides, manganese - for localities with population between **10,000 and 100,000 and under 10,000** inhabitants;
WASTEWATER/SEWAGE	**- by Dec 31, 2013 -** for localities with population over 10,000 inhabitants equivalent;
	- **by Dec 31, 2018** - for localities with population under **10,000** inhabitants equivalent;
WASTE WATER TREATMENT PLANTS (WWTP)	**- by Dec 31, 2015 -** for localities with population over 10,000 inhabitants equivalent;
	- **by Dec 31, 2018** - - for localities with population between 2000 and 10,000 inhabitants equivalent;

The target area: the 8 municipalities and towns in Cluj and Sălaj counties serviced currently by the ROC. The amount adds to the previous funding applied for the ROC and raises the total to over 326 Million Euro invested in the environment infrastructure between 1995 and 2009.

5. THE FUTURE OF THE WATER COMPANIES IN ROMANIA

Should the vision outlined by the Hydrographic Basins based Water Resources Integrated Management National Strategy be implemented, the ROC - SOMEŞ WATER COMPANY - is best placed to become the operator for the entire SOMEŞ - TISA hydrographic basin (fig. 7).

Implementation of this strategy would mean integrated management of the water and environment resources from an area comprising five counties in North-western Romania with a geographic surface amounting to 26,614 square km and a population of some 2.14 million inhabitants.

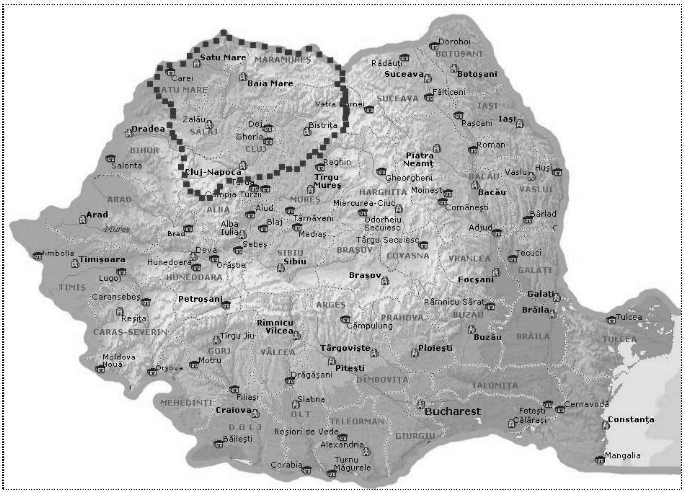


Fig. 7. Someş-Tisa hydrographic basin.

Since the "borders" of the serviced area are drawn by the ones of the hydrographic basin, Cluj county area comprising Turda and Câmpia Turzii municipalities and the surrounding rural area will not be part of the system serviced by the ROC since they are part of another hydrographic basin - Arieş.

6. CONCLUSIONS

The geographical features of an area have significant weight on the water supply/ purification & sewage collection/treatment, both in terms of operation costs as well as in terms of investments needed for modernization and rehabilitation.

The variety of geographical features of an area in terms of the existence of multiple natural or anthropogenic (man made) water resources - both ground and underground sources - has a major impact on securing water supply safety and risk management.

The lack of major investments in the modernization and rehabilitation of the public water supply and sewage networks and facilities, leads inherently to major hazards for the environment which in turn could affect the geographical features of an area themselves.

R E F E R E N C E S

1. Frame Directive CE 98/83/EC concerning water quality for human consumption.
2. Law 458/2002 concerning drinking water quality (modified by Law no. 311/2004).
3. Directive CE 91/271/CEE concerning urban waste water treatment.
4. Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States.
5. Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (and the 7 "daughter" directives).
6. Directive 76/160/EEC concerning the quality of bathing water.

7. Directive 86/280/EEC on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC.
8. Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances.
9. Directive 79/869/EEC concerning the methods of measurement and frequencies of sampling and analysis of surface water intended for the abstraction of drinking water in the Member States.
10. Directive 78/659/EEC on the quality of fresh waters needing protection or improvement in order to support fish life.
11. Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment.
12. Directive 2001/42/EC on the assessment of the effects of certain plans and programs on the environment.
13. Hydrographic Basins based Water Resources Integrated Management National Strategy.

CALCULATION OF THE MAXIMUM RUNOFF VOLUME INDUCED BY TORRENTIAL RAINFALLS THROUGH THE G.I.S SCS-CN METHOD. CASE STUDY: THE SMALL HYDROGRAPHIC BASINS IN THE SOUTH AND WEST OF THE SOMEŞAN PLATEAU

ŞT. BILAŞCO[1]

ABSTRACT. – Calculation of the Maximum Runoff Volume Induced by Torrential Rainfalls through the G.I.S Scs-Cn Method. Case Study: The Small Hydrographic Basins in the South and West of the Someşan Plateau. The SCS-CN hydrological mathematical model was developed by the Natural Resources Conservation Service (NRCS, also known as Soil Conservation Service SCS) with the purpose of providing users with procedures of computing maximal volumes of surface runoff for torrential rainfalls in a certain territory or hydrographic basin, the main input elements in the model being the factors that play the major role in the process rainfall-runoff: soil and land use type. The model has been applied on small hydrographic basins, as this type of catching area is extremely susceptible to catastrophic flashfloods occurring. The present paper points out the criteria to establish the hydrographic basins to be analyzed as well as the way the model could be applied to them, the main scientific aim standing in calculating the surfaces corresponding to the maximal runoff volumes in case of probable maximum rainfalls.

Keywords: *Model, GIS, small hydrographic basin, maximum intensity, maximum volume.*

1. INTRODUCTION

The SCS-CN hydrological mathematical model has been developed by the Natural Resources Conservation Service (NRCS, also known as Soil Conservation Service SCS) with the purpose of providing users with procedures of computing maximal volumes of surface runoff for torrential rainfalls in a certain territory (Ponce and Hawkins 1996).

Initially, the method was thought to be used in transforming rainfall volumes from a certain period into runoff volumes by taking into account the vegetation cover and soil, its purpose standing in identifying appropriate arrangement strategies for the agricultural fields in the USA. Because of its proved precision, the model's usage has increased a lot, surpassing the USA borders, and its purpose has shifted from the initial one towards the simulation and forecast of extreme hydrologic phenomena.

From its very beginning, 1954, up to now, many reviewings of the model have been performed (1964, 1965, 1969, 1977, 1985 and 1993), in correlation to the practical needs of its various applicability fields, in all cases being based on the water balance equation (1).

$$Q = P - Is - I - E - n \qquad (\mathrm{m}^3) \qquad (1)$$

[1] *Romanian Academy, Cluj Subsidiary, Geography Section, 400015 Cluj-Napoca, Romania, e-mail: sbilasco@geografie.ubbcluj.ro*

where:

Q – volume; P – total precipitation; Is – soil infiltration capacity; I – retention; E – evapotranspiration; n – other ways of precipitation retention.

In order to apply the model to the focused hydrographic basins, we used an ArcGIS extension, ArcCN-Runoff. This extension, created by Xiaoyong Zhan and Min-Lang Huang in 2004, allows the calculation of the maximum volume by computing the curve number for each spatial unit with the help of a vector type database (soil and land use type) that keeps unchanged the surfaces irregular limits.

2. IDENTIFICATION AND SELECTION OF THE HYDROGRAPHICAL BASINS

The territory selected for the application of the maximum runoff volumes for high intensity rainfalls was not established randomly. The selection was based on the analysis of the maximum runoff determinant factors and on the available meteorological data sets. In this respect, the western and southern part of the Someşan Plateau accomplish the requirements for applying the model with increased accuracy, benefitting from a large soil typology with various permeability levels, diversified land use types, a meteorological station with long data series of rainfalls with maximum intensity.

Taking into account all the above-mentioned facts, we passed to the identification and selection of small hydrographic basins, described by an increased dynamics of the rainfall-runoff process and by increased susceptibility to flashfloods occurring.

2. 1. Identification of the hydrographic basins

The term small hydrographic basin is defined in various ways, slope basin (Chartier, 1966, Haidu and colab., 1993), elementary basin (Ungureanu, Irina-Brânduşa, 1978) or small river. As an outcome of the bibliographical documentation, we can conclude that the small hydrographic basins are characterized in all cases by small catching areas, from some hectares to some square kilometers, and by increased homogeneity of the physico-geographical factors.

Assuming the previous arguments, we have decided for the study to be applied on small basins, hydrographic basins of rank II in the Horton-Strahler classification system, while the hydrographic network on the 1:50.000 map would represent the reference base. Thus, by using GIS techniques (Bilasco, 2007), 16 hydrographic basins that fitted to the given requirements were automatically identified.

Regarding the position within the regional territorial unit, all the hydrographic basins belong to Clujului Hills, representing in fact the upper basins of some small watercourses that are tributary to the rivers Mera, Popeşti, Măcău, Suceag, Nadăş and Chinteni.

2. 2. Selection of the hydrographic basins

In selecting the hydrographic basins to which the study will applied, some of their characteristics were considered. As we have already mentioned, the main factor was the basinal surface, as an element of spatial extension. Another element and at the same time a very important one, sometimes disregarded by hydrologists, was the hydrographic basins' shape or the circularity coefficient (Rădoane and colab., 2006).

The hydrographic basins' shape influences the flashfloods regime through the way the tributaries are distributed on horizontal view. If the hydrographical basin develops on a fan shape, close to the circular one, and the concentration time values on the main channel, secondary channels or slopes do not differ very much, the flashflood will have a concentrated flow. On a prolonged basin smaller maximum discharges could occur than in the case of a basin with similar runoff conditions but with circular shape, because the waters on the main and secondary channels flow successively to the control point of the calculation section.

The value of the circularity coefficient, C, is adimentioned, C≥1, but the closer to 1 its value, the closer to the circular shape the basinal surface.

By analyzing the surface of the hydrographic basins and by taking into account the computed circularity coefficient (Table 1, according to the watershed length and surface, Rădoane and colab., 2003), two small hydrographic basins were selected as case studies (Figures 1, 2), a tributary of Nădăşel valley and another one tributary to Sălişte.

Characteristics of the Hydrographic Basins

Table 1

Nr. crt	Name	Surface (Km^2)	Center of mass coordinates		Perimeter (Km)	Circularity coefficient
			x	y		
1	Tributary(Nădăşel)	3.93	380465.690	596818.787	11	1.57
2	Tributary (Sălişte)	2.96	382569.401	602586.202	9.52	1.56

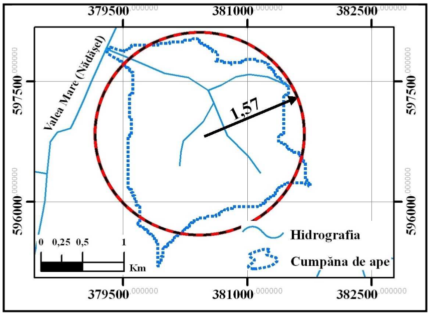


Fig. 1. Nădăşel tributary.

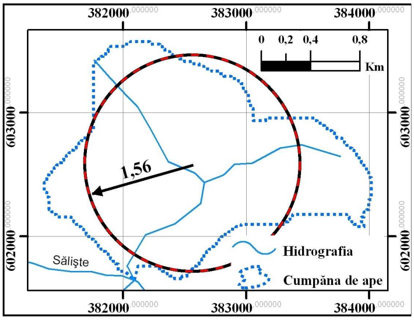


Fig. 2. Sălişte tributary.

3. CALCULATION OF THE MAXIMUM RUNOFF THROUGH THE G.I.S. SCS-CN METHOD

The determination of maximum volumes through geoinformational techniques, the SCS-CN extension being one of them, requires the accomplishment of several steps: database working out, setting up of the calculation equations to be used in the modeling process and then the G.I.S. modeling itself.

3. 1. The spatial database for the SCS-CN model

The structure of the database that we used in the modeling and calculation of the maximum runoff for small hydrographic basins comprises two main variables: soil and land use, as vector representations of surfaces and the tabular database that stores the curve number value for each of the combinations resulted from the intersection of the two initial vectors.

SCS-CN model database

Table 2

Nr. crt	Name	Format	Attribute
1	Soil	Vector	Hydrological group: A, B, C, D
2	Land use	Vector	Land use type: Cereals, Agricultural fields, Hayfields, Vegetables, Bared, Forests, Natural grasslands
3	CN	Numerical	Land use type + Hydrological group + CN value

The vectors representing soil categories spatial extension were provided with an attribute database with information regarding soil hydrological group, that is set in relation to the water infiltration capacity of the given soil profile.

Hydrological group A – high infiltration rates even when soil is almost completely filled with water. Soils with sandy or clayey profile, the aluviosols, well-drained sands and gravels areas could be included in this category.

Hydrological group B – moderate infiltration rates, they are moderately drained soils, with moderately coarse textures, characterizing the cambisols.

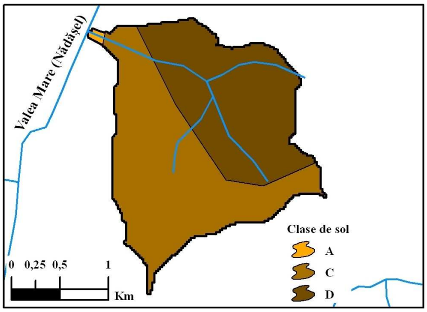


Fig. 3. Soil groups (Nădăşel tributary).

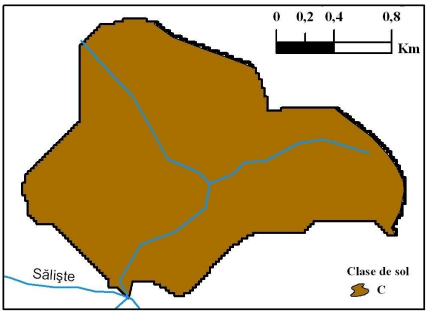


Fig. 4. Soil groups (Sălişte tributary).

Hydrological group C – slow infiltration rates, soils with layers impeding downward movement of water, with moderately fine or fine textures.

Hydrological group D – very slow infiltration rates, soils are clayey, even when they are completely filled with water.

Within the territory of the two referred hydrographic basins, various situations in relation to soil permeability were identified. Sălişte hidrographic basin (Fig. 4) is described by a single soil permeability category, hydrological group C, while in the Nădăşel basin (Fig. 3) a large typology was registered, from soils with increased infiltration rates (group A), sharing 0,4% from the total basinal area, to soils with slow (group C) and very slow (group D) infiltration rates, sharing the highest percentages, 54,7% respectively 44,9% from the total surface

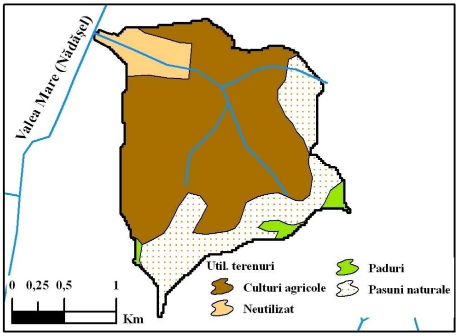


Fig. 5. Land use (Nădăşel tributary).

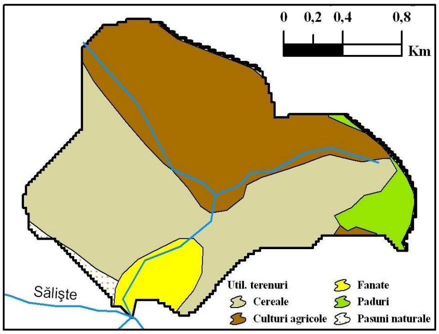


Fig. 6. Land use (Sălişte tributary).

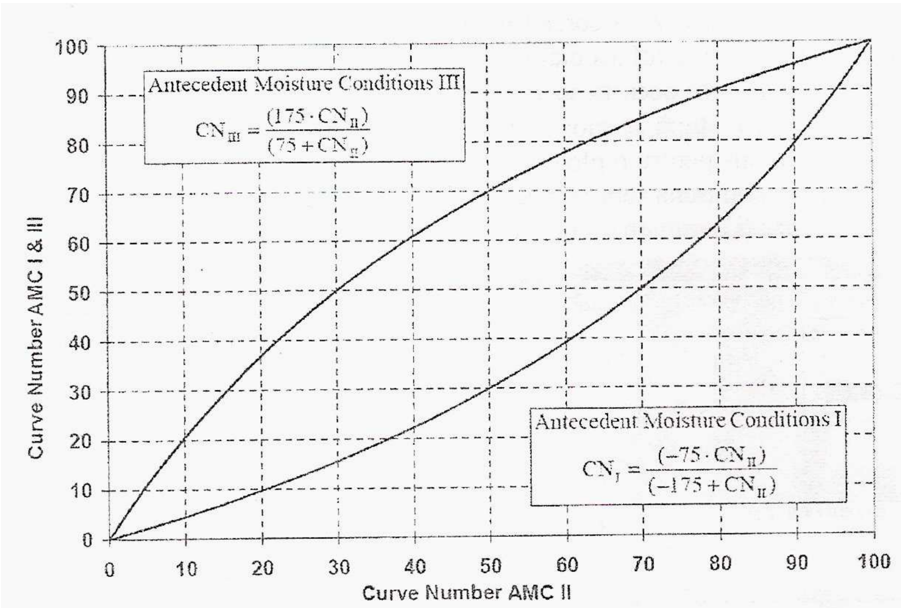


Fig. 7. Ecuations and graphical relations for conversion of the antecedents conditions by moinsture (Luijten, J.C., 2000).

The land use is an expression of the degree and type of the vegetal cover of surfaces in a catching basin. The land use database was derived from CORINE Land Cover 2000 and adapted so that to fit to the requirements of the SCS-CN method. Land use types were split into several categories according to their influence on surface runoff, as follows: agricultural fields, cereals, meadows, fields with vegetables, natural grasslands, hayfields and forests.

As regarding land use types, in the case of Nădăşel hydrographic basin (Fig. 5), a large extension of agricultural fields was identified, sharing more than 60% from the total surface, followed by natural grasslands and forests, both with small percentages. Sălişte hydrographic basin (Fig. 6) is covered mainly with cereals fields mixed with small forested areas, these two land use types representing more than 80% from the total surface, being succeeded by agricultural fields.

Soil moisturing conditions represent a major factor in water infiltration. It was estimated by using the AMC index (Antecedent Moisture Conditions), which is analyzed according to the precipitation rate in the previous 5 days: AMC I describes a dry soil with precipitations under 12,7 mm during summer and which could increase up to 35,6 mm during autumn and spring; AMC II – soils with normal infiltration conditions specific to precipitation rates ranging between 12,7 – 12,8 mm and 35,6 – 53,4 mm; AMC III corresponds to soils filled with water, with precipitations exceeding 28 mm during the drier season or 35,4 during the wetter one (Crăciun and colab., 2007).

Transformations between the various soil moisture categories could be performed by using the graphical relations and formulas proposed by Luijten and its collaborators (2000) (Figure 7).

In relation to the soil classes and land use, each extension is assigned with a curve number that influences the final runoff. The curve number is the correspondent of the runoff coefficient used in the calculation of the maximum runoff in the rational formula.

In order to make the ArcCN-Runoff extension operable, we have worked out a tabular database, .dbf, in which all the information regarding soil hydrological groups, vegetation cover and the curve number specific to each possible combination between these two variables were filled in.

3. 2. Calculation of the maximum runoff

The method for calculating the maximum runoff for a torrential rain by using the curve number assumes that the rapport between the initial soil retention and its potential maximum retention is equal to the ratio between the direct runoff and the rainfall rate. The ratio is expressed in equation (2), where the curve numbers ranging between 1 and 100 are conventional representations of the soil maximum retention potential.

Runoff estimation is done through the following formula:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S} \quad (m^3) \quad \textit{pentru} \;\; P \supseteq 0.2S$$

$$Q = 0 \qquad (m^3) \quad \textit{pentru} \;\; P \subseteq 0.2S \tag{2}$$

where:

Q – runoff

P – precipitations

S – water retention capacity

if inch measure units are used to represent Q, S and P, then the equation to determine S takes the following form:

$$S = \frac{1000}{CN} - 10 \tag{3}$$

while if cm is the measure unit, the formula becomes:

$$S = \frac{2540}{CN} - 25.4 \tag{4}$$

where:

CN –the curve number determined with the relation:

$$CN = \frac{1000}{10 + S} \tag{5}$$

3. 3. Maximum Volume Modeling

Through the G.I.S methodology of calculating the maximum runoff with the help of the SCS-CN method, we have achieved the intersection of the layers representing soils and land use and which were previously cropped along the borders of the focused area. This operation was meant for obtaining an unitary calculation database within which surfaces featuring the two spatial entities could be identified. The attribute table of this database stores information on the soil hydrological groups and land use.

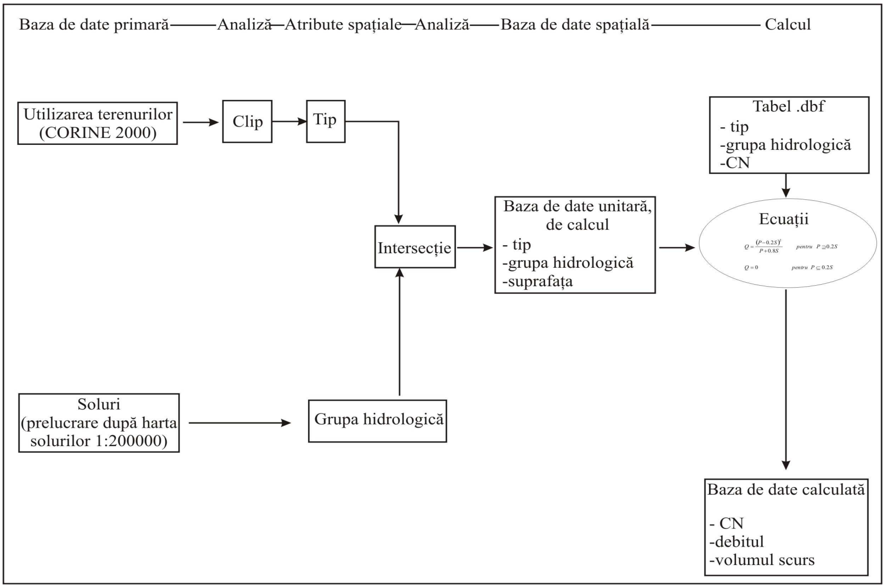


Fig 8. G.I.S. calculation methodology, SCS-CN (adapted after Xiaoyong Zhan and Min-Lang Huang 2004).

In order to establish the maximum intensity value of the calculation rainfall, we have analyzed a homogeneous 25 years data series, the conclusion revealing that the rainfall with the maximum intensity was registered at Cluj-Napoca pluviometric station on 16 April 2005, when rainfall reached 15,3 mm during 1 hour time interval of 54 seconds and a maximum intensity of 10,01 mm/min, the last value being the one used in our calculation and modeling.

The spatial analysis continued with the automatic identification of the curve number and the insertion of a new column in the previously created attribute table .dbf, meant to store the values specific to each combination between layers.

The calculation of the maximum volume with the help of the identified curve number was worked out through the equations (2) and (4), for a maximum rainfall of 10,1 mm or 0,39 inch and a surface in square kilometers obtained for each combination resulted in the intersection process.

4. CONCLUSIONS

Calculated maximum runoff – SCS-CN model

Table 3

Name of the hydrographic basin	Maximum volume (m^3)		
	Minimum	Average	Maximum
Nădăşel tributary	0,1	10,29	13,86
Sălişte tributary	0,01	11,41	13,89

As a result of the spatial analysis performed on the two studied hydrographical basin, a GRID database was created, with attributes representing the volumes in m^3 (Table 3) for all the spatial extensions that are described by various land uses and various soil hydrological groups. In the case of Nădăşel hydrographic basin, maximum volumes of 13,86 m^3, with an average runoff of 10,29 m^3 were computed, while for the Sălişte basin, a maximum value of 13,89 m^3 and an average one of 11,41 m^3.

The quantitative analysis of the areas with various runoff values points out the large territorial extension of increased runoff values in the Nădăşel basin, where on 2,63 Km^2 (40% from the total surface) values ranging between 8 – 13,89 m^3 prevail, being followed by volumes with values included into the intervals 5 – 8 m^3 (30%), 0,1 – 2 m^3 (0,35 Km^2 - 20%), and 2 – 5 m^3 (0,28 Km^2 - 0,28%). A quite similar situation was also identified in the case of the Sălişte basin, the maximum extension corresponding to the volumes with values between 12 -13,89 m^3 (1,38 Km^2), followed by the value intervals 2-12 m^3 (1,16 Km^2), 0,01 – 0,5 m^3 (0,05 km^2) and 0,5 – 2 m^3 (0,35 km^2).

In the case of the both analyzed basins, land use distribution influences the calculated maximum volume. The maximum volumes arithmetical sum, close to the maximum values, could be explained through the large extension of the surfaces with maximum runoff within the two analyzed hydrographical basins (Figures 9, 10).

We have compared the results obtained for each focused hydrographical basins, on the one hand, and with the results of the maximum runoff direct calculation, on the other hand. Small differences were noticed, within acceptable limits, fact allowing us to conclude that the described model could be successfully used in forecasting flash floods volumes for certain rainfall intensities.

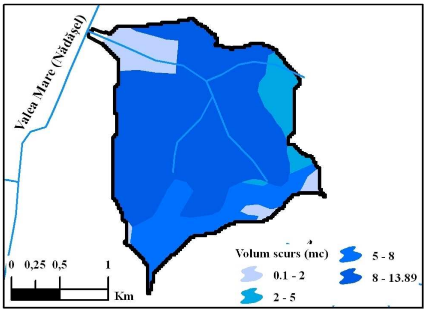


Fig. 9. Maximum volumes (Nădăşel tributary).

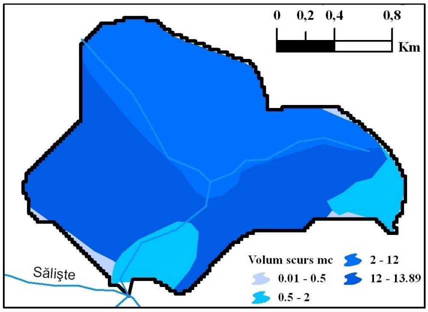


Fig.10. Maximum volumes (Sălişte tributary).

In the case of both the hydrographic basins, the large extension of surfaces with increased water volumes is induced mainly by land use (agricultural fields, orchards) that allows runoff rapid propagation and flashfloods occurring. This type of land use is specific to Clujului Hills, especially to its western and southern part, as its relief configuration is appropriate for such agricultural uses. In order to attenuate the water maximum volumes induced by flash floods during torrential rainfalls, we recommend that land use is reviewed and systemized by foresting bare areas with increased slopes and terracing slopes used for agriculture.

One of the model's strong points is that results are obtained in a very short time. The model provides with the opportunity of simulating the daily/monthly/annual flowed water volume for each torrential rainfall. Some weaks are to be mentioned in the disregard of evapotranspiration and of the water reserve in the soils of irrigated agricultural fields.

REFERENCES

1. Aron, G., Miller Jr., A.C., Lakatos, D.F., (1977), *Infiltration formula based on SCS curve number*, J. Irrig and Draing. Div., A.S.C.E., Vol. 103, No. IR4.
2. Bilaşco, Şt., (2008), *Implementarea GIS în modelarea viiturilor de versant*, Edit. Casa Cărții de Știință, Cluj-Napoca.
3. Burrough, P.A. (2001), *GIS and geostatistics: Essential partners for spatial analysis*, Environmental and Ecological Statistics, Nr. 8, Kluver Academic Publisher.
4. Chartier, M.M., (1966), *Recherches geographiques sur des basins-versants*, Bull. de l'Assoc. de Geographes Francais, nr. 348-349.
5. CORINE (2000), *Soil Erosion Risk and Important Land Resources in The Southern Regions of the European Community,*. EUR 13233, Luxembourg.
6. Crăciun, A.I., Haidu, I., Bilaşco, Şt., (2007), *The SCS-CN model assisted by G.I.S.-alternativ estimation of the hydric runoff in real time*, Geographia Technica Nr.1/2007, Editura Presa Universitară Clujeană, Cluj.

7. Haidu, I., (1993), *Evaluarea potențialului hidroenergeticnatural al râurilor mici. Aplicație la Carpații Maramureşului şi Bucovinei*, Edit. Gloria în colaborare cu RENEL, Cluj.
8. Luijten, J.C., Jones, J.W., Knapp, E.B., (2000), *Spatial water budget model and G.I.S. hydrological tools,* ICASA.
9. Man, T., Alexe, M., (2006), *Hydrologic modeling using GIS. Evaluating the surface runoff using SCS-CN model*, Geographia Technica Nr.1, Editura Presa Universitară Clujeană, Cluj.
10. Mitasova, S., K., Jain, M., K., Sihgh, V. P., (2004), *Evaluation of the SCS-CN-based model incorporating antecedent moisture*, Springer, Water Resurce Management, Vol. 18, Nr. 6.
11. Mitasova, S., K., Sihgh, V., P., (2003), *Soil Conservation Service Curve Number (SCS-CN) Methodology*, Springer, Hydrogeology.
12. Ponce, V. M., Hawkins, R. H., (1997), *Runoff curve number: has it reached maturity,* Journal of Hydrologic Engineering.
13. Rădoane, N., Maria Rădoane, Olariu, P., Dumitru, D., (2006), *Bazinele hidrografice mici, unități fundamentale de interpretare a dinamicii reliefului*, Simpozionul internațional "Geografia în contextul dezvoltării durabile", UBB Cluj Napoca, Presa Universitară Clujeană.
14. Xiaoyong Zhan, Min-Lang Huang, (2004), *ArcCN-Runoff: an ArcG.I.S. tool for generating curve number and runoff maps,* Environmental Modelling & Software XX.
15. *** *(1986), Urban Hydrology for Small Watersheds*. TR-55, Soil Conservation Service, USDA, Washington, DC.

THE FORMATION AND THERAPEUTIC CAPITALIZATION OF THE MUDS FROM THE SALT LAKES OF THE TRANSYLVANIAN BASIN

M. ALEXE[1], GH. ŞERBAN[1]

ABSTRACT. – The formation and therapeutic capitalization of the muds from the salt lakes of the Transylvanian Basin. The salt lakes of the Transylvanian Bassin can be considered an important tourism resource taking into consideration the multiple valences of utilization. The chemical features of the waters, as well as the quality of the muds recommend these lakes for treating different affections, but also for bathing. The protection of these ecosystems, through the realization of sustainable development politics, would allow their capitalization to a superior level by the population.

Keywords: *salt lake, sapropelic mud, therapeutic use.*

1. INTRODUCTION

Even if the salt waters cannot be considerated sources of life, as in the case of the sweet ones, they should not be neglected because of their properties. The properties of the salt lakes have led to a large utilization of the waters in balneotherapy. They say that the therapeutic lake is any natural accumulation of surface waters (with or without therapeutic muds) having the physical - chemical properties for balneary cure (Pricăjan, 1985).

Analysing the sediments from the bottom of the salt lakes, they have remarked that many of these have muds with therapeutic features.

The mud of these lakes is sapropelic, formed in natural conditions of anaerobiosis from the microflora and microfauna accumulated on the bottom of the lake, under the action of a sulphurous bacterium and of mineral salts in certain concentration (chlorines, sulphates and little carbonates).

2. THE FORMATION AND RESERVES OF SAPROPELIC MUDS

Although the geochemical premises of the formation of saline lakes are the same, the process of peloidogenesis goes different from one lake unit to another, each having a distinct ecosystem. The annual amount of mud that is formed depends on the morphometric features of the lake basins and the influence of the hydrobiologic conditions.

Even if the number of salt lakes from the Transylvanian Basin is relatively big (41), a great attention is given to the study of the quality of muds from the balneary resorts: Sovata, Turda and Ocna Sibiului.

In 1999 the reserves of therapeutic muds from Sovata were homologated by the work of the S. C. VITALIS S. R. L. Bucharest called "*Re-evaluation of reserves and resources of therapeutic sapropelic muds from Sovata- Mureş County*". They rendered

[1] *Babes-Bolyai University, Faculty of Geography, Clinicilor 5-7, 400006, Cluj-Napoca, Romania, e-mail:malexe@geografie.ubbcluj.ro*

evident the categories B, C1 - group "reserve of balance-sheet" and C1 - group reserve "out of balance-sheet". There have been modifications in the amount of muds in the case of Lake Ursu in time, because of the intensive exploitations (table 1).

The samplings made in the case of Lake Ursu have shown in some areas 1 m thick muds and a series of black, darkish and gray layers. Thus, in a column of ground extracted from a depth of 13 m we have the following succession of sheets: blend of blackish pelogene mud and greasy black (thickness between 0 – 10 cm), greasy black muds with gray zones (10-30 cm), greasy olive-gray mud with black zones (30-75 cm) and again greasy black muds with gray zones (75-85 cm).

The motion of the reserves of the therapeutic sapropelic muds in Sovata for the period 1979-1999

Table 1

Name of lake	1979			1984			1999		
	Group			Group			Group		
	Of balance		Outside balance	Of balance		Outside balance	Of balance		Outside balance
	Reserve category (m^3)			Reserve category (m^3)			Reserve category (m^3)		
	B	C1	C1	B	C1	C1	B	C1	C1
Lake Ursu	8400	3300	7000	8714	22726	615	8124	16670	1667
Lake Negru	-	500	-	-	-	2100	-	-	2100
Lake Mierlei	-	100	-	-	100	-	-	-	100
Lake Verde	-	-	-	-	100	-	-	-	-
Lake Alunis	-	-	-	-	4120	-	-	-	4120
Total reserves	**8400**	**3900**	**7000**	**8714**	**27146**	**2715**	**8124**	**16670**	**7987**

In 1979, the researches concerning the accumulation of sapropelic muds on the bottom of lake basins from Turda emphasized the presence of important pelogene deposits in the case of Lake Fara Fund (Tarzan), Lake Roman, Lake Csiky, Lake Durgau and reduced deposits in Lake Privighetoarea.

The research works (samplings disposed on transversal profiles), which intercepted the submerse sediments, are arranged in the next succession: black mud (average thickness between 0, 28-0, 31 m), which is absent in Lake Privighetoarea, gray mud (average thickness between 0, 10-0, 28 m) and gray clay.

The reserves homologated in 1979 by the Republican Committee of Geological Reserves, confirms the existence of 2.2 thousand m^3 reserves from the category C1, from which nearly 1.5 thousand m^3 in group of the reserves of balance-sheet and 0.7 thousand m^3 in group of the reserves outside the balance-sheet (table 2).

We have applied the criterion of natural quality of therapeutic substances confirmed by the studies and laboratory researches to recalculate the existing mud reserves back in 1997. Thus, from the analyzed lakes, only the reserves from Lake Tarzan had the necessary qualities to be attested by the Medical Notification Committee of IMFBRM. The resources from the lakes Privighetoarea, Roman and Durgau were excluded from the calculus because of the geometrical, chemical, adverse microbiologic features.

The reserves of sapropelic muds from the lakes from Turda

Table 2

Lake	Category of reserves	Geological reserves of balance (m^3)	Geological reserves outside the balance (m^3)
Tarzan	C1	534	-
Roman	C1	340	-
Csiky	C1	594	-
Durgau	C1	-	715
Total	**C1**	**1468**	**715**

The quality of reserves from Lake Csiky is superior to those evaluated in 1979 and proper from physical point of view, but the microbiological indicators resulted from the analyzed samples made the respective resources of muds be unusable as therapeutic muds.

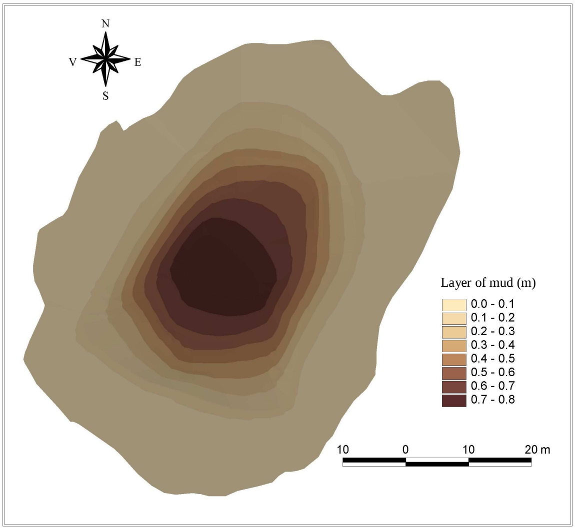


Fig. 1. Lake Tarzan (Turda) – the thickness of the mud layer.

Lake Roman, which at the time of homologation represented the main reserve of mud, due to the way it was used, became inadequate for the natural course of the peloi-dogenetic processes. This situation is mainly the result of two measures that were taken, respectively the utilization of this lake for swim-ming from 1978 and veneering the bottom of the lake with concrete slabs in 1986. Because of this last step, the natural circuit of the peloido-genesis processes was inter-rupted; the accumulated deposit on the submerse platform having a physical constitution and chemical properties which excludes its utili-zation as a therapeutic mud.

In what concerns Lake Tarzan, we have accomplished some analyses of the thickness of the accumulated muds (fig. 1) from the lithostratigraphic section, the mac-roscopic qualities (the black-grey colour) and the physical properties concerning greasyness, the chemical and microbiological features. All these characteristics were essential in the determination of spare geological volume, enclosed in the category B - group of balance-sheet reserve - with the value of 718 m^3; for Lake Csiky, the reserves entered into group outside the balance-sheet (812 m^3), as a result of the microbiologic infestation of the water and the mud.

Bulletin of mud analysis of Lake Ursu (Sovata), in 2002

Table 3

I. Global composition (g % wet mud)	
Humidity	57,843
Volatile substances	5,27
Mineral substances	36,887
II. Physical test	
Humidity (%)	57,843
Density (g/cm^3)	1,4326
Slip resistance (dyne/cm^2)	2861,25
Specific heat (cal/gr grad)	0,662
pH	6,8
III. Chemical test	
Organic substances (mg % mud)	
Humic acids	1,541
Proteic substances	2,537
Heteric extract	0,088
Benzene-alcohol extract	0,189
Soluble Carbohydrates	0,194
Hemicellulose	0,202
Cellulose	0,102
Water-soluble mineral substances (mg/l)	
Chlorine	2552,0
Bromine	-
Nitrate	118,2
Nitrite	-
Sulphide	290,0
Bicarbonic	18,6
Carbonic	-
Sodium	1780,0
Potassium	3,0
Amoniu	6,2
Calcium	3,2
Magnesium	10,6
Iron	76,0
Soluble mineral substances in clorhidric acid (mg/l)	
Sulphurate hydrogen	123

Between 1979-1997 the reserves of mud from Lake Tarzan achieved a growth of 184 m^3, representing 26 % of the current volume of mud, and in the case of Lake Csiky of 218 m^3 (27 % of the current volume of mud). Throughout this period of time, the peloidogenetic processes have grown in intensivity, through the modification of the physical-chemical and biologic-microbio-logic features in the lake ecosystems (the lake biotop).

The mud of saline lakes has a great degree of hydropexis, which means it can contain a big amount of water, from 35 % (Ocna Sibiului) to 45-60 % (Turda and Sovata). Also, in the global chemical composition of muds enters mineral substances and volatile substances. For example, 1 kg of mud from the lakes from Ocna Sibiului contains 34.65 % water, 6.75 % volatile substances and 58.5 % mineral substances. The proportion between water and mineral substances is variable, it depends on the composition of the mud and can differ from one point to another in the case of the same lake.

The organic fraction, which gives the multiple qualities of the mud, is developed, prevailing the proteic substances the humic acid. The concentrations made by the humic acids, in the case of the colloidal complex of the peloid, but especially the quantitative report between this class of organic compounds and cellulose, point out a reduced degree of degradation of the organic substances; this is specific in the case of the muds that have evoluated in hipersaline environments.

In comparation to other categories of lakes, to those formed on salt massifs, the inorganic substances (especially sodium and chlorine) are in higher percents. From the gaseous phase of the pelogene we can determine just the concentration of sulphurate hydrogen, binded to colloidal hydrosulphides.

The presence of the sulphate (So_4^{--}) and the binded sulphurate hydrogen (H_2S) reveals an environment of redox transit, specific to the mineral muds generated by the salt massif, which have gypse formations in the geochemical premises of mineralization.

The physical and chemical features of the mud deposited on the bottom of Lake Ursu can be followed in table 3.

3. THERAPEUTIC CAPITALIZATION OF THE MUDS

The therapeutic qualities of the sapropelic mud are especially the chemical components (organic and inorganic). These components step in the metabolic processes when applied on the skin. The physical properties such as the low thermal conductivity, high specific heat and the absence of convexion current assure a constant and slow transmission of heat from mud toward the human body. These properties allow the heating of therapeutic mud to temperatures bearable by the body (usually up to 40 ^{o}C).

Vitamins B2, B12, C, E, vitamin PP, hormones, as well as a series of organic substances with roles of biostimulation contribute in a high degree to the therapeutic effect of the mud.

Thus, these muds are recommended in the case of the following affections:

a) Rheumatic problems (prearthrosis states, generative rheumatism - arthrosis of the vertebrae and peripheric articulations, rheumatism of the synovial joints);
b) postthraumatic disorder of the locomotor apparatus –musculo-articular and bone lesion;
c) chronic problems of the peripheral nervous system;
d) gynecologic (chronic metroanexitis, sterility) – the muds from Sovata are well known in this case;
e) dermatologic (psoriasis, chronic eczema etc.).

The mud is applied in the shape of packages, cataplasms and warm pads or in the shape of naturist cure in the heliotherme lakes, during summer, to strengthen the human body (cold onction).

An important element for the salt lakes is the existence of *Artemia salina*, because through the decomposition of the corpses the sapropelic mud is formed with constitutive active minerals which confer a therapeutic value. Also, these creatures secrete a female hormone called foliculina, which recommends these muds in the treatment of gynecologic diseases.

The amount of mud that is taken out for treatments in the balneary resorts is under the control of the National Agency of Mineral Resources (NAMR). At the beginning of each year it is required the advice of extracting therapeutic muds to protect the deposits. They have to estimate the total amount of mud that is used in treatments during each year. The notice is given taking into consideration the reserves of mud in the lake and the period of time that is necessary for the mud to regenerate.

Nowadays, mud exploitations are made in Lake Ursu (Sovata), Fără Fund (Turda) and recently in Lakes Horia, Cloşca and Crişan (Ocna Sibiului). We can detach Lake Ursu, which remained the only supplier for the treatment bases in Sovata, because Lake Negru was infected in 1981. A positive thing is that muds are recovered after the medical procedures in a proportion of 95%. Through some researches done regarding the depositation of mud back to its source, we have noticed that the mud restored its therapeutic properties in six months; when deposited in another environment, respectively in another lake, the process of regeneration reaches nine months.

To avert the modification of the qualitative parameters, there have to be made periodical observations and to be taken mud samplings and be analyzed by the Institute of Physical Medicine, Balneoclimatology and Rehabilitation.

4. CONCLUSIONS

Although there are favourable conditions for the formation of sapropelic muds in the majority of salt lakes of the Transylvanian Basin, a great attention is given to the therapeutic utilization of the peloide from the balneary resorts Sovata, Turda and Ocna Sibiului.

One recommends the implementation of a plan of rational exploitation of waters and mud in the direction of sustainable protection of the lakes. We have to quantify the degree of supportability of the aquatic ecosystem against the anthropogenic impact.

R E F E R E N C E S

1. Alexe, M., Şerban, Gh., Fülöp-Nagy, J. (2006), *Lacurile sarate de la Sovata*, Edit. Casa Cărţii de Ştiinţă, Cluj-Napoca.
2. Bobeică, A. (1969), *Cercetări privind lacurile de la Ocna Sibiului*, Hidrotehnica, Gospodărirea apelor, Meteorologia, vol. 14, nr.4, Bucureşti, pp.179-187.
3. Gâştescu, P. (1971), *Lacurile din România. Limnologie regională*, Edit. Academiei RSR, Bucureşti.
4. Kalecsinszky, S. (1901), *A Szovátai meleg és forró konyhasóstavakról mint természetes hőaccumulátorokról. Meleg sóstavak és hőaccumulátorok előálitásárol*, Földrajzi Közlemény, XXXVII, Budapest.
5. Pânzaru, T. (1977), *Complexul lacustru de pe masivul de sare de la Ocna-Sibiului (I). Sectoarele lacustre "Incinta Băilor" şi "Parcul Public"*, Lucrări Ştiinţifice, seria A, Geografie, Institutul Pedagogic Oradea, pp. 185-204.
6. Pânzaru, T. (1982), *Complexul lacustru de pe masivul de sare de la Ocna Sibiului (II), sectoarele lacustre "Ocniţa-Avram Iancu" şi Ignatiu*, Studia Univ. „Babes-Bolyai", Geologia-Geographia, 27, nr. 1, Cluj-Napoca, pp. 46-60.
7. Pişota, I. (1960), *Noi date hidrologice asupra lacurilor din Depresiunea Sovatei*, Probleme de Geografie, vol. VII, Bucuresti, pp. 179-192.
8. Sturza, M. (1950), *Manual de balneologie*, Edit. de Stat, Bucureşti.
9. Touchart, L. (2002), *Limnologie physique et dinamique. Une géographie des lacs et des étangs*, L'Harmattan, France, 2002.
10. Trică, Valeria (1983), *Contribuţii la studiul biologic privind formarea nămolului în lacurile terapeutice din Staţiunea Sovata*, Hidrobiologia, T. 18, Bucureşti.
11. Trică, Valeria (1973), *Influenţa factorilor biologici asupra formării nămolului în lacul Negru – Sovata şi Lacul Rodeanu – Ilfov*, Hidrobiologia, T. 14, Bucureşti.

SPATIAL TECHNIQUES FOR CLUSTER IDENTIFICATION. APPLICATION ON POVERTY CLUSTERS IN DOBROGEA PLATEAU AND THE BLACK SEA HINTERLAND

DIANA DOGARU[1], IRENA MOCANU[1]

ABSTRACT. – Spatial Techniques for Cluster Identification. Application on Poverty Clusters in Dobrogea Plateau and The Black Sea Hinterland. Spatial data analysis expresses the relevance of the geographical context in any study concerning the spatial dimension of a social or natural phenomenon. One of the applications of spatial data analysis consists in identifying and statistically testing the spatial clusters regarding different phenomena at regional level. This paper underscores the spatial dimension of poverty rate in the Dobrogea Plateau and the Black Sea hinterland by identifying the poverty clusters at commune level. The methodology of this study is based on exploratory spatial data analysis (ESDA), including Morans'I and LISA (local indicators for spatial association) tests for recognizing whether there is a tendency of cluster formation, and the location of these spatial associations. The results show the presence of two clusters of high poverty values in the central-western and south-western parts of the study area. A cluster of low poverty values has been identified along the Black Sea Coast and within the influence area of the Constanța town. ESDA techniques used for identifying and analyzing the spatial distribution of clusters contribute to the investigation of intraregional disparities, thus underling the relevance of the spatial analyses for geographical applied studies. Discussions on the interconnections between poverty and intraregional disparities, viewed within the context of regional development programs and strategies at the level of the studied area, complete the paper.

Keywords: *exploratory spatial data analysis (ESDA), spatial clusters, intraregional disparities, Dobrogea.*

1. INTRODUCTION

Two aspects favored the increasing use of the mathematical-deductive models in regional sciences, and implicitly in regional disparity assessments (Moreno, 2008). The first refers to the development of new models for economic activities' location. For example, the agglomeration process of the economic activities based on interaction among development factors, concept that is part of the new economic geography direction. This expands the sphere of the classical location theories that focus primarily on an atomic structure of development for regions, including concepts as nuclei, central place, etc. The second aspect is about the use and

[1] *Institute of Geography, Human Geography Department, Str. D. Racoviță, Nr. 12, 023993, Bucharest, Romania, e-mail: dianadogaru77@yahoo.com and mocanitai@yahoo.com.*

continuous improvement of GIS techniques, and closely related to it, the increasing production and availability of the geospatial socioeconomic databases, aggregated at different territorial levels (e.g. local, regional, national). Both of the above-mentioned factors have contributed to the development and improvement of spatial analyses.

Spatial data methods underline the relevance of the geographical context of the studied phenomena (e.g. unemployment, poverty, crime, spread of epidemics, etc.). They offer a way to describe the spatial continuity of the socioeconomic and / or natural phenomena (Isaaks and Srivastava, 1989). One of the applications of these methods consists in identifying and in statistical testing the presence of the spatial clusters of the respective phenomena, and in illustrating the influence of potential factors that may favor or limit their formation by controlling for the size of the territorial units (Lin and Zhang, 2007). Such methods describe and explain the variations in the distributions that measure the analyzed phenomena at regional level, thus enhancing the sphere of spatial analyses that in turn may tackle intraregional disparities issues.

The main objective of this study is to identify the poverty clusters in the Dobrogea Plateau and the Black Sea Hinterland, using exploratory spatial data analysis techniques (ESDA), including the Morans' I and LISA (local indicators for spatial association) statistical tests that ascertain whether there is the tendency of formation of spatial associations (clusters) and their localization. The present study does not include yet any application concerning the influencing factors of poverty, this being the subject of a future analysis.

The paper is structured as it follows: the following part includes a brief description of the study area and of the data used in the analysis; the third part explains the methods, namely the Morans'I and LISA tests used for poverty clusters identification and location. Next, the results are presented. The last part discusses the interconnections among the poverty clusters and intraregional disparities, within the context of previous studies and current governmental reports concerning regional development instruments and programs.

2. STUDY AREA AND INPUT DATA

The Dobrogea Plateau and the Black Sea Hinterland[2] is a geographical region in south-east Romania that includes 3 main geosystems: the coastal zone geosystem, the plateau geosystem and the floodplain geosystem. The concept of geosystem has been used with the purpose of underlining the link between the geographical components, including the anthropic factor. The definition of the geosystem refers to the *relationships between the geographical elements that shape the territorial unit and have a functional structure of its own, thus individualizing the unit in time and space through a specific landscape and a certain degree of energetic potential and biological productivity* (Roşu, 1987). Such relationships are influenced by the *anthropogenic factor* that is able to modify the ecologic potential of the respective geosystem, being thus considered its component (Buza, 2000). The influence of the anthorpic factor at the level of the geosystem is noticeable, particularly in terms of types of land uses and valorization of the biological productivity.

Generally, the Dobrogea Plateau and the Black Sea Hinterland are characterized by a temperate-continental climate having a strong aridity character. The annual temperatures are around 11^0C, being slightly higher along the coast, while the annual precipitations reach 400-

[2] To simplify things, in some parts, it has been used the term 'Dobrogea' for the entire study-area which is reffering to Dobrogea Plateau and the Black Sea Hinterland.

450mm on the western side of the region and 350mm along the littoral. The soil cover of the study region is dominated by chernozems (calcareous chernozem, cambic chernozem, calcareous leached chernozem) and chestnut steppe soil. Other types of soils found throughout the plateau are luvic brown soil under the deciduous forests, lithosols on compact rocks, humic gley soils, alluvial soils, etc (Geografia României, Vol. V., 2005). The longstanding paleogeographic evolution of the area imposed a particular geological structure. Thus, the northern part of the plateau is marked by a residual granite relief, calcareous hills and inselbergs, while the central and southern part by a relief developed on crystalline schists and limestones covered extensively by loess. An abrasion and/or accumulation relief is specific for the coastal area. At the same time, the presence of the Danube River on the western and northern part of the plateau favoured and lead to the formation of wetlands and fertile floodplain areas. These features have imposed several land use types of the geosystems in Dobrogea, in terms of their energetic potential and biological productivity. In this respect, the components of the coastal geosystem dominantly have tertiary functions, including tourism as one of the most prominent seasonal activity, but also industrial, while the plateau geosystem offers large agricultural areas, and to a lesser extent, forests and rock exploitation areas. The floodplain geosystem is mainly used for agriculture and for fishery where such enclosures exist, having also a protection role against floods and a conservation role for biodiversity, which unfortunately are strongly diminished due to anthopic impact.

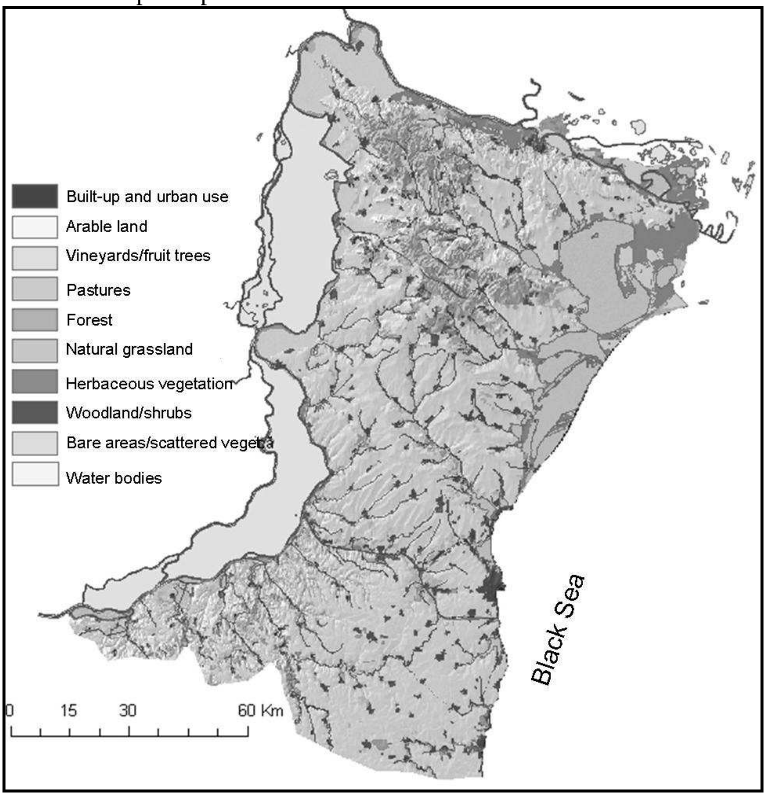


Fig. 1. Corine Land Cover 2000 (CLC2000) land use map of the Dobrogea Plateau and the Black Sea hinterland overlaid on a 90m DEM layer.

Figure 1 shows the Corine Land Cover 2000 land use (EEA, 2007), underscoring the extention of some of the geosystems components in the study area. Thus, the large agricultural areas, forests, aquatic areas and steppic segments can be easily noticed.

The Dobrogea Plateau and the Black Sea Hinterland represent the geographic context of the present study on poverty cluster identification using spatial analysis methods. Poverty is expressed here as one of the Foster, Greer, Thorbecke index, namely FGT_0 (Box 1).

Foster-Greer-Thorbecke index (FGT) *(Foster, J. et.al., 1984) is an index that has been adopted as a standard measure for poverty by the World Bank. For example, it has been recently included in the Constitution of the United Mexican States as a tool for guiding the allocation of federal governmental funds at interregional level for various development programmes including education, health and food for poor.*

Poverty index includes 3 principal elements: a relevant dimension (e.g. a welfare indicator), a poverty line and an indicator for measuring poverty.

The FGT index represents a family of poverty measures widely used for this purpose:

FGT_0 – *it measures the incidence of poverty as the poverty rate (headcount ratio), that is the proportion of the population that is counted as poor (i.e. those who have an income lower than or equal to poverty line); it offers information on the extent of the poverty. The formula for the headcount index is as follows:*

FGT_0 = $\frac{S}{N} * 100$, *where S is the number of the poor and N is the number of the total population (Zamfir, C. and Vlăsceanu, L., 1993).*

FGT_1 – *it measures the poverty depth as the mean proportionate poverty gap in the population, where the poverty gap is the poverty line minus the actual income for poor individuals (the non poor have a zero poverty gap). Some think of this measure as the per capita cost of eliminating poverty (relative to the poverty line), through perfectly targeted transfers to the poor, in the absence of transanctions costs and disincentives effects (CIESIN, 2005). Or, simply put it, is the sum of the income that should be transferred to the poor in order to reach the poverty line. The formula for the poverty gap index is as follows:*

FGT_1 = $\sum_{i=1}^{q}(PL - y_i)$, *where PL is the poverty line and* y_i *is the actual income of the individual "i" (Zamfir, C. and Vlăsceanu, L., 1993).*

FGT_2 = *it measures the poverty severity (squared poverty gap) as well as the way the income is distributed as related to the poverty line (i.e. the income deficit of the poor population). By squaring the poverty gap for each individual/household, this measure gives greater weight to those observations that fall far below the poverty line than those that are closer to it (CIESIN, 2005). Thus, the weights given to different individual values are equal to themselves so that a greater deficit becomes even greater, while a lower deficit takes a lower weight (Anghelache et al., 2006). The formula for the severity of poverty or squared poverty gap, is as follows:*

FGT_2 = 1/n $\sum_{i=1}^{q}\left[(PL - y_i)/Pl\right]$, *where n = the total population, q= poor population populația săracă, PL= poverty line,* y_i *= i's actual income (Technical Note Measuring poverty and analyzing changes in poverty over time, http://siteresources.worldbank.org/INTPA/Resources/tn_measuring_poverty_over_time.pdf).*

Box 1. Foster, Greer, Thorbecke Poverty Index.

This index is based on individual welfare indicators, those being derived from the Family Budget Survey and Population Census 2002, and represents the estimation of the population percentage under the total poverty threshold[3] out of the total population (Pop et. al., 2004). The poverty index was estimated at commune level by correlating the consumption per adult-equivalent form the Family Budget Survey with the population census data from the Population and Household Census 2002[4] (Pop et. al., 2004).

3. METHODOLOGY

Exploratory spatial data analysis (ESDA) consists in descriptions and graphical representations of distributions with the purpose of identifying distinct spatial directions of the analyzed phenomena, atypical locations (extreme values) or spatial associations (clusters or 'hot spots'). More than that, ESDA is very useful for explaining the spatial autocorrelation that is the association of the neighboring territorial units as a function of similar values of the phenomenon. The main techniques include Morans' I and LISA (local indicators of spatial autocorrelation) tests are used for identifying general and local paths of spatial autocorrelation. The methodological steps of such applications are:

a) elaborating maps for observing the general paths of the spatial distribution of the values and for highlighting the extreme values (box maps);

b) representing the data distributions as Morans' I plots thus determining the statistically significant clusters in the region, without specifying their location though;

c) doing LISA maps for showing the location of the statistically significant clusters in the analyzed area.

Step 1 consists in an overall exploration of the data through quantile maps, box plots and box maps in order to observe the general spatial paths of poverty distribution in Dobrogea, as well as to find out whether there are extreme values and where (fig.2).

Figure 2 shows the regional differences of poverty, suggesting two main areas of high values concentration (the 4th quantile) of the poverty index in Dobrogea. Specifically, there is the group situated in the central-western part of the area including communes such as Topolog, Ciucurova, Casimcea, Dorobanțu, Beidaud, Horia, Saraiu, Ciobanu, and the group in the south-western part of the region formed by Independența, Ion Corvin, Adamclisi, Băneasa, Dobromir, Deleni, Cerchezu, Dumbrăveni, Aliman, Lipnița communes. The box plot and the box map draw attention to Dobromir commune as having an extreme value of FGT_0 index (0.75). These cartographs and graphs point out the general paths of poverty in Dobrogea, which might represent potential clusters or 'hot spots'. Moreover, the extreme value map and graph underscore the areas with exceptionally values or outliers. Yet, these kinds of representations do not show whether such communes form statistically significant spatial clusters so that to be counted as significant spatial directions of the respective phenomenon within the region. Techniques for measuring general and local spatial autocorrelation (i.e. Morans'I test and LISA maps, respectively) of poverty are used to prove such paths.

---

[3] Total poverty line is determined by adding the food component to the quantity of the nonfood goods and services consumed by individuals whose food consumption is equal to food necessity. It is expressed in monetary terms and has a value of 1,535.570 lei for December 2002 prices. The individuals are classified as poor if the consumption per adult-equivalent is lower than the total poverty line (Romania, Raport de Evaluare a Saraciei, Vol 1. pg7, (2003), cited by Pop et. al., 2004).

[4] The data and documentation on FGT poverty index can be found and downloaded from: http://sedac.ciesin.columbia.edu/povmap/datasets/ds_nat_all.jsp (CIESIN, 2005).

Step 2. The statistical significance of the clusters is established by the Moran's I test (fig.3). This statistical test verifies the null hypothesis (H_0) whether the spatial clusters are randomly formed or not. Rejecting H_0 means that existence of the poverty clusters might be

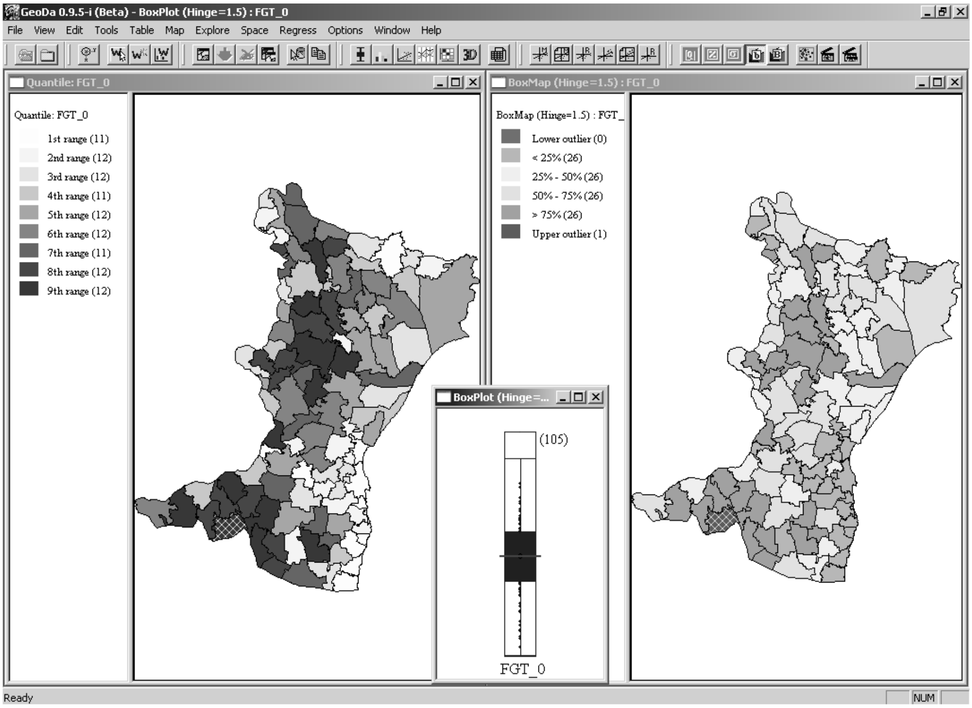


Fig. 2. Quantile and extreme values maps for the FGT_0 poverty index in the Dobrogea Plateau and the Black Sea hinterland, calculated for the 2002 year. Dobromir commune singles out as having an extreme value of this index. The dynamic interface of the GeoDa[5] soft allows highlighting values of interest simultaneously in all the 3 graphical representations.

the effect of some processes such as diffusion, interaction etc., so that they are not formed by chance. Actually, the Moran's I plot shows the distribution of the standard deviations of the poverty index against the spatial standardized weighted[6] average of the index attributed to the neighboring communes. It results that the Moran's I plot is a linear association between the poverty index in the *i* location (for example the *i* commune) and the spatial weighted average in the neighboring locations (*j*): $\sum_j \mathbf{w}_{ij}\mathbf{y}_j$ **vs.** $\mathbf{y}_i$ (Moreno, 2008).

[5] The GeoDa soft can be downloaded for free from GeoDa Center for Geospatial Analysis and Computation at Arizona State University, USA: http://geodacenter.asu.edu/software/downloads.

[6] The spatial weighted average does not act as a standard arithmetic average (i.e. the sum of all values divided by the count number of the values). The weights are attributed to both locations, *i* as well as to *j*, so that each *i* and each *j* has its own value. The spatial weighted average reffers to the weights matrix for the *i* locations. Thus, for each *i*, the *j* locations might be either 1 if it is a neighbor with *i*, or 0 if otherwise. The thing that is important is that the weights are ‚horizontally standardized', meaning that the 1 weights are standardized, while the 0 ones are left with the 0 value. For example, if there are 5 neighboring units each of them takes the 1/5 or 0.20 value.

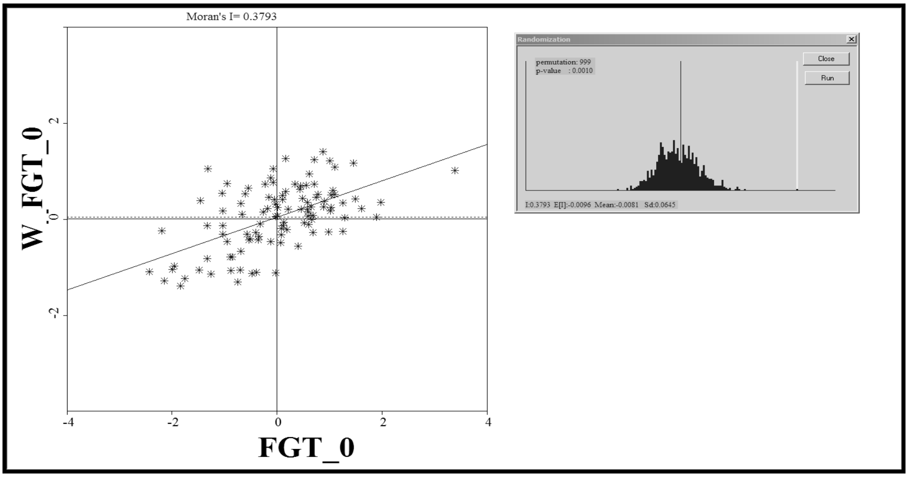


Fig. 3. The Moran´s I plot for FGT_0 poverty index in Dobrogea. The p = 0.001 value shows that the two data distributions are significantly correlated and in this way the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted (H_1 = the poverty clusters exists due to some processes factors; they are not randomly formed).

Worth mentioning that the spatial weights have been created and applied using the principle of physical continuity among the neighboring units and not the distance principle among the units. It thus could be created a spatial weights matrix (**W**) with "dummy" variables (w_{ij} = 1, if i and j are neighboring units and w_{ij} = 0, if otherwise). For this purpose, the 'rook' criterion was considered this including 6 neighbors (fig. 4).

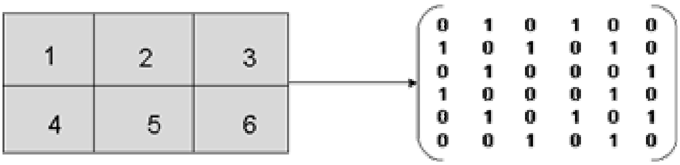


Fig. 4. The Rook criterion attributes weights to the neighboring units; it is based on 6 neighbors and the spatial weights matrix (**W**) is formed by giving the value of 1 to the neighboring unit and 0 otherwise.

The regression line between the two data distributions (i.e. the poverty index and the spatial weighted average) represents the Moran's I coefficient which indicates the existence of the clusters or, on the contrary, the lack of the spatial poverty clusters (specifically the rejection or acceptance of the null hypothesis). It is an indicator of the spatial autocorrelation among all the communes in the studied area. It is actually a weighted correlation that identifies the spatial associations that are not randomly formed, meaning the spatial dependence or the spatial autocorrelation of the variable (in this case the poverty index). When time series are used, Moran's I coefficient might additionally show the changes in the general trend of the spatial association concerning the studied phenomenon.

The coefficient takes values between -1 and +1 and its formula is as follows:

$$I = \frac{N}{S_0} \frac{\sum_{ij}^{N} w_{ij}(y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^{N} (y_i - \bar{y})^2}, i \neq j \text{ , where}$$

S_0 = sum of all spatial weights in the weights matrix (**W**)
N = count number of the territorial units (communes)
w_{ij} = spatial weighted average among the neighboring units
y_i = the value of the variable in the *i* location
y_j = the value of the variable in the *j* location
(I) not significant = lack of spatial autocorrelation (random distribution)
(I) >0, significant = positive spatial autocorrelation (spatial grouping of similar values)
(I) <0, significant = negative spatial autocorrelation (spatial grouping of opposite values; it might suggest a “competitive” relationship among the territorial units; when represented graphically under the form of a cartograph, the distribution might look like a chess board).

In the present study, the Moran’s I test is significant and the coefficient is positive, so the null hypothesis is rejected and the alternative hypothesis accepted, meaning that there is a spatial dependence of the poverty among the communes in Dobrogea. The Moran’s I test offers valid information on the existence of some spatial associations concerning the considered phenomenon as well as premises for future applications or models.

Step 3. The spatial local autocorrelation is determined with LISA tests (local indicators for spatial association), which are a particularized version of the Morans’ I test and which compare the values in one location (a commune in this case) with the values in the neighboring locations (Messner, 1999). Similar to Morans’ I test, the LISA tests verifies the null hypothesis of the random distribution of the clusters, specifying at the same time their locations. The LISA tests show what types of spatial association might form based on the possibilities of the 4 quadrants that divide the Moran’s I plot (fig. 5).

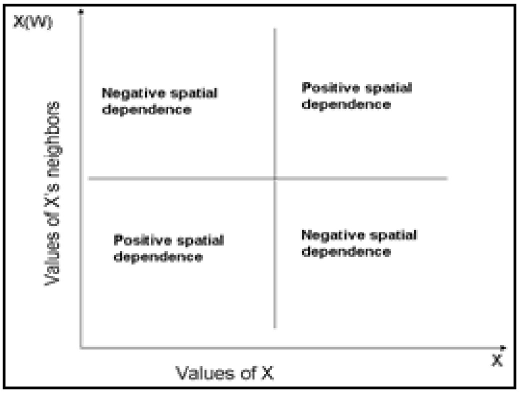


Fig. 5. Moran quadrants.

Two of these quadrants are positive spatial associations, meaning similar values associations. Specifically, this is the case in which one administrative-territorial unit (commune) has a value that is over the mean of the distribution and that neighbors with units that also have values higher than the mean; or, it is the case in which a commune with a value below the mean neighbors with communes with such values. Contrary, negative spatial associations indicate that a commune with a value above the average is surrounded by communes with values below the average, and vice-versa. Such situations might suggest a “competitive” relationship among the units, and if represented graphically as cartographs, they would look like a chess table.

LISA maps show the location of the statistically significant clusters which are grouped in the 4 quadrants of the Morans' I plot, being represented in 4 different colours (fig. 6). In other words, the clusters assessed using LISA test are classified in 4 types corresponding to Morans' I plot. As in the case of Morans' I test, LISA test verifies the null hypothesis of random formation and localization of clusters. In the case of the poverty clusters in Dobrogea, LISA test rejects the null hypothesis and accepts the alternative hypothesis indicating that the clusters are not randomly formed; instead, they could be a consequence of some spatial diffusion and/or interaction processes.

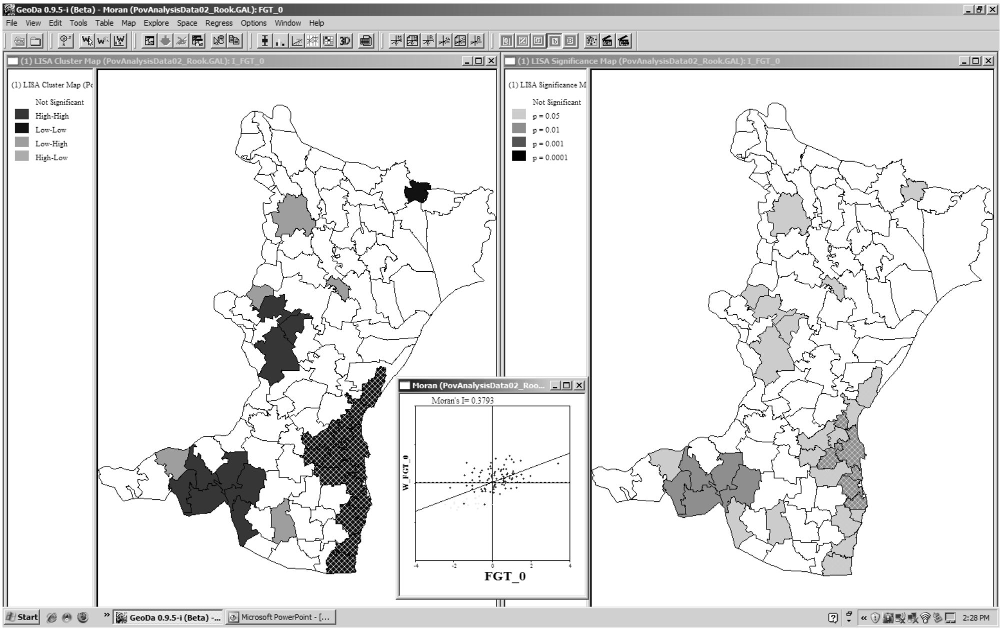


Fig. 6. LISA maps representing FGT_0 poverty index in Dobrogea. The communes for which the LISA test is significant are highlighted based on the type of the spatial association of the Moran's I quadrants.

4. RESULTS AND DISCUSSION ON THE INTERCONNECTIONS BETWEEN POVERTY CLUSTERS AND INTRAREGIONAL DISPARITIES

The results of the analysis indicate two poverty clusters, one in the central - western part of Dobrogea formed of Saraiu, Vulturu and Crucea localities, and one in the south - western part of the region including Ion Corvin, Adamclisi, Dobromir, Dumbrăveni, Baneasa and Deleni localities. These areas are profound rural areas located in the plateau part, without any polarizing center. Contrary to these two groups, there is a 'cool' poverty cluster along the coastal area and around Constanta city, being formed of low values of FGT_0 index. This fact highlights the socio-economic differences between the continental part and the coastal area as well as it underscores the influence area of Constanta city.

ESDA techniques identify the spatial distribution of clusters within a region, thus underlying the intraregional differences concerning the analyzed phenomena. In this respect worth discussing are the implications of the spatial techniques for the regional development measures and strategies, in general, and for the intraregional disparities.

The regional disparities may be evaluated using a broad variety of indices that could be structure by different variable categories: economy (GDP/inhabitant, industrial production, employees etc.), income, labor force (occupied persons, unemployment etc.), infrastructure (such as type, density, and accessibility), demography (cars/1 000 inhabitants, education) (Carta verde. Regional development Policy in Romania, 1997). These disparities, either they are intra- or inter-regional, are derived from the cumulated contribution of all activities, components, phenomena and processes expressed thorough indices which have a clear role in distinguishing the (sub)territorial differences. Poverty is a situation characterized by the lack of material means that might hinder a human's living condition. It is dependent by several factors, such as: economic development level, characteristics of the labour market, labour occupancy and unemployment, types of existent jobs on the labour market, nature of material resources control, inflation, distribution and redistribution of income, demographic, social and cultural characteristics, lifestyle (*Dicționar de sociologie*, http://www.dictsociologie.netfirms.com/S/Termeni/saracie.htm).

Having in view the relative similarity among the factors explaining regional disparities and poverty emergence, we can say that the tendencies in deepening/mitigating the intra-regional disparities and in aggravating/alleviating poverty are interdependent. Nevertheless, reducing intra-regional economic development gaps does not necessarily mean alleviating poverty. The situation at the beginning of this decade could be mentioned as typical for that kind, when although poverty was decreasing at national level, such trend had little implications for the high social vulnerable categories in the profound poor areas (self employed, youngsters, teenagers, large families, unemployed etc.) (Memorandumul Comun în Domeniul Incluziunii Sociale. România, 2005).

The two poverty clusters in the central-western and south-western part of Dobrogea are rural areas situated outside any influence area of a town/city (Ianoş et. al., 1996). They have an economy dominated by agriculture, a high degree of demographic dependence (above the national average, ~58%) and are ethnically populated by Romanians in most of their component localities. These two clusters are areas that lack urban centers within a distance arc of 25-30km and that need priority actions for developing those localities that act as service seats for the poor zones (National Territorial Planning, Section IV – Settlement Network).

The rurality of the two clusters is a key element for understanding the relationships between poverty and intra-regional disparities. Studies and detailed analyses often reveal the fact that major complex discrepancies between the urban and rural clearly influence poverty incidence: the rural is much more exposed to and affected by poverty. Under the circumstances in which the regional economy has turned to a dynamic one in the later years, the intra-regional disparities have deepened, one reason being that poverty hindered the positive general trend, thus the rural areas continued to be deep poor areas. The situation is also due to high sensibility of such areas to the political change in agriculture, as well as to a stronger relationtionship between poverty and unemployed people in the informal sector of the labour force market, particularly in agriculture (Report on Poverty assessment. Programme for analytic assistance and consultancy, World Bank, 2007). The dependence of the profound rural areas on natural resources, especially on crops, is obvious. In this respect, it is necessary to assure a good integration of the measures for sustainable management of natural resources (e.g. the quality of soils and water resources, biodiversity protection, forest sustainable management, etc.) and agricultural production levels, the purpose being to contribute to rural development and thus poverty alleviation where necessary.

The intra-regional discrepancies are sometimes induced by the differences in the poverty reduction rate. Literature suggests an inverse proportionality between the demographic size of rural localities and poverty rate: e.g. communes over 5 000 inhabitants (such as Băneasa) experience a lower poverty rate than communes with lower number of inhabitants (Report on Poverty assessment. Programme for analytic assistance and consultancy, World Bank, 2007; estimations based on Family Budget Survey). This latter category includes the two identified poverty clusters, too. Likewise, there is a correlation between the external migration, which is usually for work, and poverty: e.g. places where external migratory fluxes are low increase their poverty (Sandu 2009). Officially, from the communes that form the two poverty clusters only 7 persons have been registered as out-migrants between 1994 and 2006 (INS, 2007).

The cluster formed of low values of FGT_0 is localized along the coast between Corbu (in the north) and Limanu (in the south) localities, and around Constanta city. The cluster includes 6 towns with a total population of 414 111 inhabitants (i.e. 87.2% of the cluster population), the high urbanization degree being a consequence of low poverty values. Constanța city weights most in defying this cluster due to its economic performance and influence on the other surrounding localities. Most of the component localities of the cluster have diversified their economic profile from a traditionally agricultural based one, and modernized as effect of retail activities, fact that was the consequence of investment fluxes from Constanța city. This is the case of Cumpăna, Valul lui Traian, Agigea, Corbu localities and Ovidiu town. Tourism is a driving force for the growing economy of some communes, as well as of the urban centers, particularly Constanța. This cluster largely ovelaps the Constanța Metropolitan Zone (ZMC), yet a reduced poverty has not been influenced by this status since the poverty index was estimated for 2002, and the ZMC was established in February 2007.

R E F E R E N C E S

1. Anghelache, C., Isaic-Maniu, A., Mitruț, C., Voineag, V. (2006), *Sistemul de indicatori utilizați în măsurarea sărăciei*, Econometrie teoretică şi aplicată, vol. 13, nr. 8, Bucureşti.
2. Buza, M. (2000). *Munții Cindrelului. Studiu geoecologic.* Ed.it Universității „Lucian Blaga”, Sibiu, p. 134.
3. Foster , J., Greer, J. and Thorbecke, E. (1984). *A Class of Decomposable Poverty Measures*, Econometrica, 52 (3), 761-766, New York, http://darp.lse.ac.uk/papersdb/Foster_et_al_ (Econometrica_84).pdf., (accessed online February 2009).
4. Ianoş, I., Ungureanu, Al., Grimm, F. D. (1996). *Gruenzüege der Stadtgeographie und des Städtessystems Rumäniens*, Stadte und Stadtesysteme in Mittel und Sudosteuropa, Institut fur Landerkunde, 39, p. 172-226, Leipzig.
5. Isaaks, E.I., Srivastava, R.M. (1989), *Introduction to Applied Geostatistics*, Oxford University Press, New York.

6. Lin, G., Zhang, T., (2007), Loglinear Residual Tests of Moran's I Autocorrelation and their Applications to Kentucky Breast Cancer Data. Geographical Analysis 39.

7. Messner S, Anselin L, Baller RD, Hawkins DF, Deane G, Tolnay S. (1999), *The Spatial Patterning of County Homicide Rates: An Application of Exploratory Spatial Data Analysis*. Journal of Quantitative Criminology, Vol. 15, No. 4

8. .Moreno, R., (2008), *Spatial Econometrics*, seminar ținut în cadrul Şcolii de Vară „Spatial Econometrics and Spatial Computable General Equilibrium Models", 6-15 iulie 2008, Pecs, Hungaria.

9. Pop, L., Sandu, D., Panduru, F., Vîrdol, A., Grigoraş, V., Duma, V., Vîrdol, D. (2004), *Harta Sărăciei în România,* Raport elaborate la cererea Comisiei Naționale Anti-Sărăcie şi Promovare a Incluziunii Sociale de către Universitatea Bucureşti şi Institutul National de Statistică, proiect finanțat de Ministerul Educației şi Cercetării (Programul AMTRANS) şi Banca Mondială, p. 26. http://www.caspis.ro/downloads/metodologie%20harta%20saraciei.pdf, (accessed online December 2008).

10. Roşu, A., (1987). *Terra – geosistemul vieții,* Edit. Ştiințifica şi Enciclopedică, Bucureşti.

11. Sandu. D. (2009), *Comunitățile transnaționale - pilonii de prosperitate ai României,* Revista Comunităților Locale şi Regionale din România, interviu publicat online: http://eurocom.gm.ro/articol/?artID=3&highlight=TELEORMAN&nr=31, (accessed online February 2009).

12. *** *Carta Verde. Politica de dezvoltare regională în România,* 1997. Guvernul României, Comisia Europeană, Programul PHARE, Bucureşti.

13. *** *Dicționar de Sociologie,* Vlăsceanu, L., Zamfir, C. (coord.),
http://www.dictsociologie.netfirms.com/S/Termeni/saracie.htm, and http://www.dictsociologie.netfirms.com/_IndSociol/saracie.htm, (accessed online February 2009).

14. *** *Memorandumul Comun în Domeniul Incluziunii Sociale. România,* 2005. Guvernul României, Comisia Europeană, Direcția Generală Ocupare şi Afaceri Sociale.

15. *** *Planul de amenajare a teritoriului național, Secțiunea IV – Rețeaua de localități,* Legea nr. 351/6 iulie 2001, Monitorul Oficial nr. 408/24 iulie 2001.

16. *** *România. Evaluarea sărăciei, 2003.* Raport Nr. 26169 RO, Banca Mondială, Unitatea Sectorului de Dezvoltare Umană, Unitatea de Dezvoltare Socială şi de Mediu Durabilă, Regiunea Europa şi Asia Centrală.

17. *** *Raport de evaluare a sărăciei. Programul de asistență analitică şi consiliere,* 2007, Raport Nr. 40120 RO, Banca Mondială, Divizia pentru Dezvoltare Umană, Regiunea Europa şi Asia Centrală, Ministerul Muncii, Familiei şi Egalității de Şanse, Institutul Național de Statistică.

18. *** *Strategia de dezvoltare a Zonei Metropolitane Constanța,* Asociația de Dezvoltare Intercomunitară Zona Metropolitană Constanța, 2008, www.zmc.ro, (accessed online February 2009).

19. *** *Technical Note Measuring poverty and analyzing changes in poverty over time,* http://siteresources.worldbank.org/INTPA/Resources/tn_measuring_poverty_over_time.pdf, (accessed online February 2009).

20. *** Geografia Romaniei, V., (2005). Edit. Academiei, Bucureşti, p.961.

21. *** European Environmental Agency, 2007, *Corine land cover 2000 (CLC2000) 100 m - version9/2007*,http://dataservice.eea.europa.eu/dataservice/metadetails.asp?id=1007, (accessed online February 2009).

22. *** Center for International Earth Science Information Network (CIESIN), Columbia University, 2005. Poverty Mapping Project: Small Area Estimates of Poverty and Inequality, CIESIN, Columbia University**,** Palisades, NY, http://www.ciesin.columbia.edu/povmap/ (accessed online December 2008).

23. * * * Anuarul Statistic 2007, Institutul Național de Statistică (INS).

UNDERLYING THREATS ON FOREST RESERVES IN TABORA REGION, WESTERN TANZANIA. THE CASE OF IGOMBE RIVER AND SIMBO FORESTRY RESERVES

A. E. MAJULE [1], P. Z. YANDA, E. K. SHISHIRA, A. G. MWAKAJE, H. CACOVEAN[2]

ABSTRACT. – Underlying Threats on Forest Reserves in Tabora Region, Western Tanzania: The Case of Igomb River and Simbo Forestry Reserves. This study has examined the driving forces behind forest encroachment in Tabora region, Tanzania. The study focused on two Forest Reserves (FRs), namely Igombe River and Simbo. While both FRs are undergoing degradation, the later FR is more severely encroached upon than the later. The information gathered covered both socio economic and biophysical aspects. The study observed that the major reasons contributing to forestry degradation through encroachment were mainly three: (i) socio-economic factors including migration, scarcity of arable land, fuel wood extraction for tobacco drying, livestock keeping and charcoal and timber business (ii) policy related factors such as unclear and conflicting laws on natural resource utilisation and (iii) biophysical factors such as soil fertility gradients within or near forestry reserves, vegetation types and distribution and micro climatic variations.

***Keywords**: Encroachment, forestry, livestock keeping, tobacco farming, Tabora, Tanzania.*

1. INTRODUCTION

Tanzania is endowed with vast natural resource base particularly land, water, forest, wildlife and minerals (URT, 2000). Over the past few decades, these resources were under utilized due to several reasons including low demand, poor methods and technologies of harvesting, low market demand at national, regional and international levels and over dependence of agriculture for livelihood and foreign income. To date, policies have changed and there is more focus in developing other non agriculture resources.

New international developments such as trade liberalization in 1980s and globalisation in 1990s the disrupted the nature of economy in most developing countries. Generally, there has been a change toward increased use of natural resources. In most cases, under poor resource management practices, the increased use of natural resources led to over exploitation of the same and eventually to land degradation. (Majule, 2004; Kangalawe *et al*., 2005; Majule and Mwalyosi, 2005).

Pressure on natural resources originates mainly from three major sources. The first is pressure from local communities who exploits natural resources for different purposes such as such as timber and building poles as well as meet from wildlife as source of protein and income (Missana *et al.,* 2003; Kangalawe *et al.,* 2005). The second source of pressure is from urban residents who engage in trading on natural resources products. The impact of this is often negative to rural areas because it perpetuates linkage between the rural

[1] Corresponding author: Senior lecturer, Institute of Resource Assessment (IRA), University of Dar es Salaam, P.O Box 35097, Dar es Salaam, Tanzania, e-mail: amajule@ira.udsm.ac.tz
[2] OSPA Cluj-Napoca, Romania, e-mail: turda75@yahoo.com

commodity source areas and the markets comprising the urban areas. Finally, the third group includes foreign investors who are given licence to own or harvest forest and wildlife resources. This group has increased particularly under this era of globalisation.

The current international policy agenda is poverty alleviation through sustainable and equitable utilization of resources. There is a number of literature which clearly shows that unplanned utilization of natural resources may results into poverty and resource degradation (Yanda and Majule, 2004; Yanda *et al.*, 2005). The objective of this study was therefore to examine major threats on selected forests in Tabora and assess their implications on environment and livelihoods of the communities living in surrounding areas.

2. DESCRIPTION OF THE STUDY AREA

2. 1. Geographical Location

Tabora region is located in the western part of Tanzania (Figure 1) on the central plateau between latitudes 4^0 and 7^0 South and Longitude 31^0 and 34^0 East. Tabora region

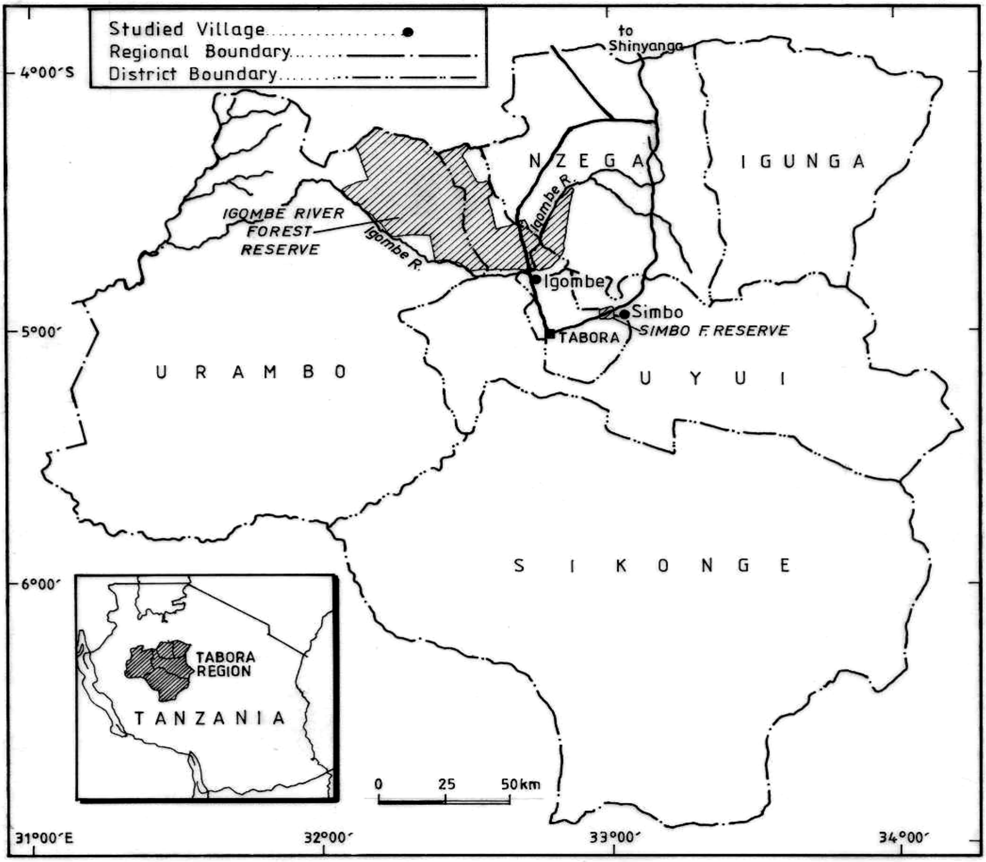


Fig. 1. Location of Forestry Reserves and Villages Studied.

has a total area of 7.6 million ha, representing 9% of the total area of Tanzania mainland. Out of the 7.6 million ha, 3.58 million ha are protected forest reserves (Shishira and Yanda, 1999) and presently, there are 33 forests. The population density in the region is about 14 persons per sq. km (URT, 1998a). Average land holding per person in the region is 0.7 ha making it one of the regions with large land holding in the country.

2. 2. Climate and drainage

Tabora region has a warm climate with average temperature of 23^0C. Rainfall is seasonal, ranging from annual average of 1000mm in the western part to 700mm in the northeast. The main rains fall between November and April. The region experiences the rainfall patterns, which are extremely variable and unpredictable. Showers are very often localised and there is a high risk of long dry spells at any time during the rainy season. The rate of evapo-transpiration in the miombo woodlands of Tabora exceeds the monthly rainfall, which may result in persistent water deficit in soils.

2. 3. Soils and vegetation

The ecology of the region is closely linked to types of soils, vegetation and distribution pattern of rainfall. Soils vary widely, ranging from sandy loams in the south and centre and west and north to heavy black/dark brown soils in poorly drained areas. The sandy soils are dominated by species of *Branchystegia-jubernadia* forming Miombo woodland with size of trees generally governed by the amount of rainfall. The dominant grass cover in the Miombo woodland is usually *Hyperrhenia* with the growth pattern and vigour of the grass cover providing a useful indicator of soil fertility and structure. On the heavier soils, the tree cover is lower and consists of *Combretun*, *Acacia* and *Albzia* species associated with various grass species. In all the marginally drained areas there is a complete absence of trees and dominant vegetation is grass. According to Yanda and Shishira (1999), upland vegetation cover consists of woodland, bush land, thickets, and grassland while lowland or wetland vegetation consisting of wooded grassland and swamps.

3. METHODOLOGY

To find out the driving forces leading to forest encroachment in Tabora region, both secondary and primary data were used. Secondary data collected were on socio-economic, institutional, biophysical and nature was searched from existing literature. The data were collected from region, district, division, ward and village offices. Given the limited resources as well as logistical considerations two forest reserves were selected for the survey. Simbo, a severely encroached reserve and Igombe River a less encroached reserve (Yanda and Shishira, 1999). Forest staff in the region helped to identify extents of these reserves. Field data were collected randomly in each village through interview using structured questionnaires and field observations. The number of household sampled is summarised in table 1.

Total number of households sampled for household interview in two villages

Table 1

Sample sizes	Igombe River	Simbo
Total Number of households sampled	77	77
Between 0-5 years	19.5	41.5
Between 5.1-10 years	61.0	46.8
Over 10 years	19.4	11.7
Total	100,0	100,0

Socio economic data was analysed by using SPSS for different parameters assessed and results were presented in different forms including tables and bars. For assessment of soil types and their conditions as well as uses, different soil types were identified and described by villagers who participated in the fieldwork. A detailed description by villagers was enabled through opening and describing soil pits. While describing soil profiles, a note on vegetation types and land Use practices was made.

4. RESULTS AND DISCUSSION

4. 1. General description of the villages

Igombe River village

Igombe River (IR) village in the vicinage of Igombe River Forest Reserve (IRFR) is a newly established village (Figure 1). It borders the IR and IRFR along the old Tabora - Mwanza road. It is less densely populated and relatively backward in terms of socio-economic services availability. As a result, people have to travel to Tabora town (about 35 km) to get these services. However, due to remoteness, its accessibility to Tabora town is difficult and a high proportion of people travel to town either by foot or bicycles. The dominant crops in the village include maize, groundnuts, cassava, beans with few growing tobacco and few keeping livestock. The ethnic groups are mainly Nyamwezi, Sukuma and the Waha (Wamanyema).

Simbo village

The Village is located 10 km away from Tabora town along the Nzega-Tabora highway (Figure 1). Simbo village is relatively well developed in terms of socio-economic infrastructure compared to IR. It has a modern primary school and health services are easily obtained from Tabora town. Due to its locality, transport services to and from Tabora town are reliable. Main activities in the village comprise agriculture as well as business like timber and charcoal. They also grow high value foods such as vegetables to supply markets in Tabora town.

4. 2. Socio economic profiles

Population and growth rates

In this study findings show that a high proportion of respondents in Igombe River village have on average, 5-10 persons per household while it is 3-5 in Simbo village. The population growth rate was also slightly higher in the former village than in the latter. Based on house hold survey, Igombe River village had 2.8 % while in Simbo village it was 2.4%, making an average growth rate of 2.6% for the two villages. This is higher than the regional average of 2.4% but lower than the national average of 2.8%. Also due to its location, which is along the Nzega-Tabora highway, it is likely to have a high number of in-migrants than Igombe River village.

Origins of immigrants

A high proportion of the respondents in both villages said they were in another village in the same district. However, for Simbo village, also a high proportion of respondents came from another district in the region as well as another region (table 2).

This suggests that before moving into the villages, a high proportion of people had established settlement in places different from their original birth places. Most of the people who migrated or moved into the two villages were looking for agricultural land as indicated by 51.9 and 57.1% of respondents in Igombe and Simbo villages respectively. Those who moved into the two villages looking fertile soils for tobacco farming were 28.6 and 31.2% in Igombe and Simbo respectively. The proportion of the people who moved into both villages to acquire grazing land was relatively small (5.2%). However incoming livestock was reported to have significant threats on forestry resources due to large number of herd owned by immigrants particularly the wasukuma tribe. Other factors such as the marriages, coming for businesses or following traditional treatments accounted for 1.3 and 6.5% respectively in Igombe River and Simbo villages.

Origin of People (%) in Two Villages

Table 2

	Igombe River	**Simbo**
Total Number of households	**77**	**77**
Born in the village	11.6	10.3
Another village in the district	59.7	32.6
Another district in the region	16.9	35.1
Another region	11.7	22.0
Total	**100**	**100**

4. 3. The driving forces on forest reserve encroachment

Driving forces include socio economic; policy related issues and biophysical, detailed discussions follow in subsequent sub sections below.

Socio-economic driving forces

Migration

In-migrants especially of Sukuma ethnic group have been migrating into Tabora region with less resistance. This occurs partly because the dominant ethnic group in the two districts of Nzega and Igunga is Sukuma. As a result, they share similar culture and traditions with people from Mwanza and Shinyanga regions. The process of in-migration starts by a person intending to move out, to come to Tabora region and investigate the possible areas suitable for agricultural farming and pastures. The person may contact the village government or he/she can just simply walk into the forest, select suitable site not easily detectable, and clear it up. This enables the in-migrant to easily encroach the forests and established their settlements by attracting others. Such settlements are locally known as sub-village or "Kitongoji". This type of encroachment forms about 80% of forest encroachment in the region (URT 1998b).

Scarcity of arable land

Most of the forest reserves were gazetted during colonial period in the 1950s when population in the region was very low. As time passed, population has increased significantly. The current population has increased by almost three times from 502, 068 in 1967 to 1,717,908 in the year 2002 (URT, 2002). While population has been on the increase, the available land for human activities not only has remained fixed but also, due to the lack of inputs and poor farming technology, there has been fast depletion of soil nutrients leading to pressure on virgin land for agricultural and grazing.

The population pressure on land varies from one geographical location to another. Northern districts of Nzega and Igunga are facing severe land shortage compared to districts of Tabora rural and Urambo. In this study, for example, there was a large difference on land ownership by households between the two study villages (table 3). This variation in land ownership in two villages indicates differences in land availability.

Land ownership in the study villages

Table 3

	Igombe River	**Simbo**
Between 0-2 acres	3.9	23.3
Between 2.1-5 acres	18.2	31.2
Between 5.1-10 acres	40.3	26.0
Over 10 acres	37.6	19.5
Total	**100**	**100**

Farmers (%) who grow tobacco in the Study Villages

Table 4

	Igombe River village	**Simbo village**
Total Number of households	**77**	**77**
Grow tobacco	48.1	41.6
Do not grow tobacco	51.9	58.4
Average acres of tobacco	3.1	2.5
Total	**100**	**100**

Fuel wood extraction for Tobacco drying

Although less than 50% of the respondents in both villages grow tobacco (table 4), there is a remarkable fuel wood consumption. Estimates from respondents indicate a range between 28 tonnes to over 42 tonnes of fuel wood consumption per ha (fig. 2). This conforms to earlier finding reported by other authors (Conyers *et al.,* 1971; URT, 1998a). This threatens the sustainability of the forest reserves in the region. Perhaps, it is high time to start encouraging tobacco growers to start planting their own trees for tobacco curing. Also the technologies for the curing burns need to be improved so that they can be consuming little fuel wood than currently operates.

Source of fuel wood for curing tobacco in the two villages

Table 5

	Igombe River	**Simbo**
Total Number of households sampled	**77**	**77**
Did not grow tobacco	37	32
Communal forests	81.1	78.1
Own field	13.5	6.3
Reserved Forests	5.4	15.6
Total	**100**	**100**

Over 75% of the respondents in both villages argued that they get fuel wood from communal land (Table 5). However, information from key informants suggests that a considerable number of tobacco growers rely on forest reserves for fuel wood needed for tobacco curing.

Lack of inputs and poor farming technology

A high proportion of farmers use primitive farming technology of hand hoe and low input. The situation has been exacerbated by the removal of input subsidy and lack of collateral for credit from commercial banks. As a result, input use by farmers has declined remarkably. In this study for example, only 30% and 40% of the respondents in Igombe river village and Simbo village, respectively reported to apply some fertilizers in their fields. Most of the farmers who used fertilizers, received them as credit from private traders or co-operative unions. They are repaying back the loans at the point of selling their tobacco. With low to very low input use and generally poor farming technology, soil nutrients are depleting fast. Consequently, the harvests by many farmers are marginal. This forces them to look for other agricultural land areas especially on virgin land including forest reserves.

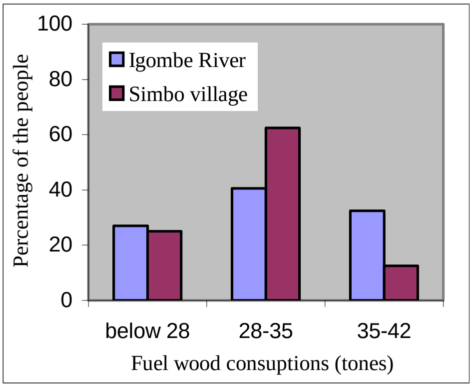


Fig. 2. Fuel wood consumption from forests for different uses.

Charcoal and timber business

Another argument is that the rapidly increasing urbanisation in Tabora North as well as neighbouring towns of Mwanza, Shinyanga and Nzega has led to a high demand of products from forest reserves such as charcoal and timber business in the study area. It is argued that charcoal business provides a significant income to the poor people and safety for local people in years of drought. A report by URT (1998), estimates that about 350,000 cubic meters fuel are cut to produce charcoal annually making charcoal the second biggest commercial stake-holder of forested areas. There is a concern that uncontrolled charcoal production is likely to push charcoal burning more into forest reserves, which are currently poorly managed.

4. 4. Policy related factors

Unclear and conflicting law on natural resources protection

According to DONET (1997) Tanzania National policies regarding the access and utilisation of natural resources are diverse depending on the type of resources. Accordingly, there are different regulations enacted to control the access and usage of natural resources. Most of the policies concentrate on protection and limitation over usage; but less is about user's rights to control the natural resource base. Findings from this study indicates that 60% and 85% people in the sample villages of Igombe and Simbo respectively are aware of forest reserves and understand well the meaning of forest reserves and that they are benefiting from forest reserves in terms of water catchment, prevention of soil erosion and sources of fuel wood. However, people in the village still feel that the task of controlling forest reserves is some body else's business and therefore it has nothing to do with them. It was also revealed that more than 50% and about 75% of the respondent in Igombe River and Simbo, respectively witnessed people encroaching forests.

Policy priorities on natural resources and agriculture have in most cases overlapped or led into conflicts. The country's priority of agriculture, the main stay of the economy has in many cases overruled all other laid down regulations and this has erratically led to the mismanagement and under or over-utilisation of natural resources especially at frontiers (Lema, 1993 as reported by DONET, 1997).

4. 5. Biophysical factors

Earlier studies show that the encroachment is mainly observed for cultivation and settlements within the forest reserve boundaries (Shishira and Yanda, 1999). In addition, the encroachment appears to be selective in favour of certain localities such as areas occupied by thickets.

Soils fertility gradients

Generally, tobacco farming has depleted the natural fertility of soils and this caused people to look for fertile soils (virgin land) using different indicators. At Igombe village, the majority of people could select their new land for agricultural activities based on the presence of health grass cover. They also look for soil colour whereby dark brown and blackish soils are preferred (Figure 3). Few people will consider the overall fertility of the soils and other will look for the presence of certain tree/shrubs species (Figure 3), which are indicators of soil productivity. Over 80% of people interviewed at IR selects their new sites by looking at areas with health grass vegetation cover and soil colour. At Simbo village (Figure 4), very few people use vegetation types. Most uses natural fertility and soil colour and soil water availability (soil moisture content).

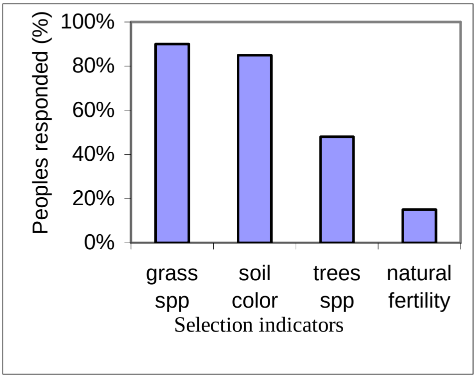


Fig. 3. Criteria (s) for selecting new agricultural land at Igombe River village.

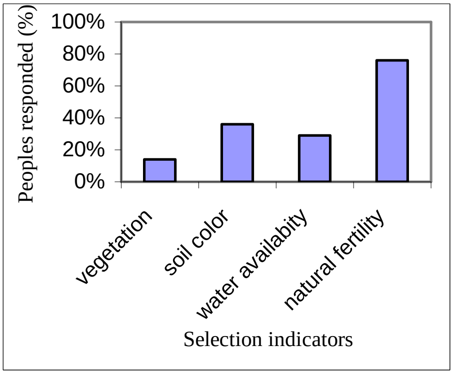


Fig. 4. Criteria (s) for selecting new agricultural land at Simbo village.

Local soil classification

A soil fertility gradient was reported to be one of the factors or driving forces for encroachment at Igombe river forest reserve. Major soil groups identified follow a catena sequence. *Kikungu* was mentioned to be one of the soils suitable for agricultural activities.

Major soil groups at Igombe River, their characteristic and common crops grown

Table 6

Soil group	Fertility level	Characteristics	Major crops
Kikungu (Upper pediment)	Very fertile	Reddish brown, deep profile, slightly hard, slightly stick, with many termite mounds	Maize, tobacco, groundnut, cassava, beans, potatoes
Kimanda (Lower pediment)	Fertile	Blackish brown, soft, non stick, low water holding capacity	Maize, tobacco, millet, potatoes, cassava, beans
Isenga (Lower pediment)	Low fertility	Whitish, sandy, non plastic, non stick, very low water holding capacity, deep profile	Potatoes, beans, millet, cassava, groundnuts, Bambaranuts.
Kadondoli (Foot slope)	Fertile	Blackish, shallow, hard, stick, plastic, high water holding capacity	Rice, vegetables (onions, tomatoes), sweat potatoes.

People will first look where this soil is located before encroaching forestland with high natural fertility. Apart from agricultural activities, this soil is also suitable for the construction of houses probably due to its stickiness and hardness characteristics reflecting high clay content. This soil was noted to occur in residential areas in both villages surveyed. Other soils identified and their distribution in a soil catena is as shown in Tables 6 and 7. A study conducted at the Ulyankulu Refugee Camp in Tabora (UNDP/FAO, 1981) showed a similar distribution and variations of soils likewise in Igombe River and Simbo forest reserves. Soil data can therefore be used to describe and compare the soils listed in table 6 and 7.

Major soil groups at Simbo, their characteristics and common crops grown

Table 7

Soil group	Fertility level	Characteristics	Major crops
Kikungu (Upper pediment)	Very fertile	Red, moderate WHC, deep profile, slightly hard, slightly stick, many termite mounds, well drained	Maize, tobacco, groundnut, cassava, beans, millet, sorghum
Isenga (Lower pediment)	Low fertility	Whitish, sandy, soft, light, non plastic, non stick, very low WHC, deep profile easy to work with.	Potatoes, cowpea, sorghum, maize, pigeon peas, beans, millet, cassava, groundnuts, Bambaranuts
Kadondoli (Foot slope)	Fertile	blackish, shallow, hard and heavy, stick, plastic, high WHC, poorly drained	Rice, vegetables (onions, tomatoes), sorghum

The characteristics of soils is similar to those studied at Ulyankulu Refugee Camp in Tabora (UNDP/FAO, 1981) shown in figure 8 and 9 and suggests that top layers (0 > 20 cm) of soils that appear in a catena are different in-terms of their natural fertility. Most people prefer *Kikungu* soil because of high fertility (table 8) as c ompared t o *Isenga* which has low fertility.

Tree and shrub species left to grow in the land under crop cultivation

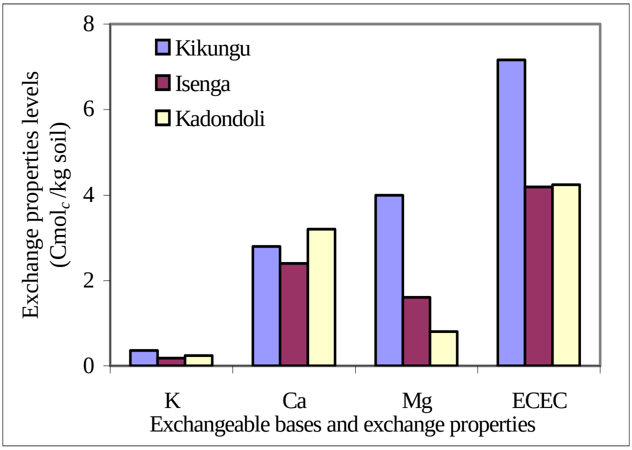
Table 8

Igombe	Simbo
Pterocarpus angolensis, Comretum zyheri, Dalbergia boehmii, Diospyrous mespiliformis, Brachystegia spiciformis, Steculia quinqueloba,, Diplorhynchus condylocarpion, Combretum mole,Vitex mombassae, Brachystegia longifolia,Boscia salicifolia,Albizia anthelmitica, Afzelia quanzensis	Comretum zyheri, Terminalia sericea, Diplorhynchus condylocarpion, Eucalyptus indica, Mangifera indica, Brachystegia spiciformis, Acacia pentagona, Perinaria curratellifolia, Pterocarpus angolensis Julbernadia globiflora, Afzelia quanzensis, Markhamia obstusifolia, Acacia petersiana, Acacia gerrardii

This variation in soil fertility determines selective encroachment of forests. This is indicated further by variations in soil exchangeable bases and exchange properties which are higher in *Kikungu* soil (fg. 5). Bottomland soils located in almost flat areas derived from alluvial and colluvial parent materials covered by grass were locally classified as *Kadondoli* and were observed at Igombe village.

Soil fertility management practices

The existing rules for forest reserve management in Tabora region tends to inhibit or reduce the rate of movement of people into the forest reserve area for either farming activities or for the harvesting of timber and fuel wood. Cultivation causes a further depletion of the low inherent natural soil fertility in their fields. Combining with low input use people have now adopted different indigenous soil fertility management practices that have enabled them to cultivate their land for a long time without shifting to new areas. These practices reported by farmers are indicated in figures 6 and 7.



Source: Acres et al. (1984).

Fig. 5. Levels of exchangeable bases, exchange properties for the three soil groups.

At Igombe river village (Figure 6) the majority of peoples tends to apply farmyard manure (FYM) in their fields. They also tend to depend on existing trees, which provide litter for improving soil properties. Others use compost manure and few use fertilisers. Similarly, at Simbo village (fig. 7) peoples tend to use FYM likewise in Igombe village. However, villagers do not depend on litter from trees to improve their lands as most of the forest has been cleared (Shishira and Yanda, 1999). Since they cannot get virgin land for farming activities, they are now fallowing their land to regenerate fertility. Earlier studies shown that the application of FYM in soils and proper incorporation of crop residues have a tendency of improving soil conditions and subsequent crop yields (Wong *et al.*, 1995; Likanda, *et al.*, 1995; Sakala, 1998; Wong *et al.*, 1998; Nkallamba 1999; Majule, 1999).

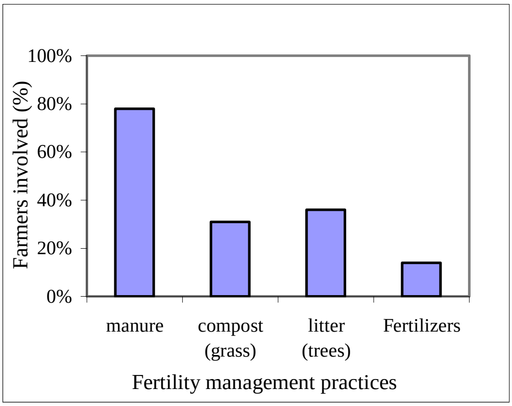


Fig. 6. Indigenous soil fertility management Practices at Igombe river village.

Interestingly, in this study it was noted that due to declining soil fertility and reduced land availability, agroforestry practices is now being practised by many peoples. Some of trees left in their fields play several roles in maintaining the productivity of land. Table 6 and 7 indicates some of the benefits of mixing trees and crops whereby Table 8 shows a list of trees that are left in farmlands at Igombe and Simbo villages. By ranking in their order of importance (fig. 8), inclusion of trees in farmland at Igombe river village tends to; add soil fertility> reduce soil erosion > retain soil moisture > provide shade and > act as windbreak. At Simbo village other uses of tree which probably contributed to forestland depletion were mentioned to be fire wood and building poles (fig. 9).

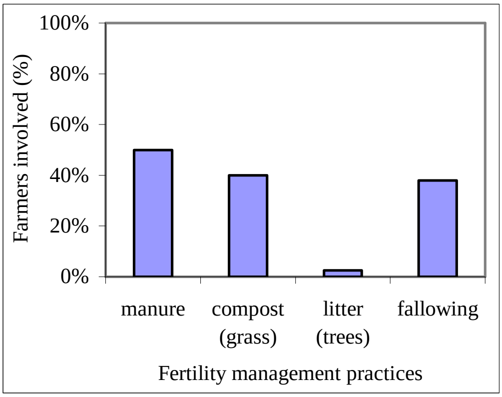


Fig. 7. Indigenous soil fertility management Practices at Simbo village.

Vegetation types and distribution

Through a reconnaissance survey in forest reserve areas and after conduction of a survey at Igombe River and Simbo villages, it was clearly noted that encroachment of forest reserves is partly guided by existing vegetation. Reference to vegetation cover in the selection of suitable areas for cultivation is based in the appreciation of the indicator significance of vegetation in the assessment of the other factors, in particular soil conditions. Grasslands are, for example considered to be easier to work than woodlands which require more labour. Also grass can be burned easily and the resulting ash has been observed to improve soil pH and add soil nutrients particularly calcium and potassium (Pocknee and Sumner, 1997; Sakala, 1998). Shishira and Yanda (1999) reported that encroachment is common in areas previously occupied by thickets dominated by leguminous shrub species that are un-penetrable. These areas have probably accumulated a lot of organic matter and nitrogen important for the growth of various crops upon clearing them. Table 9 and 10 show the distribution of vegetation at IR and Simbo villages.

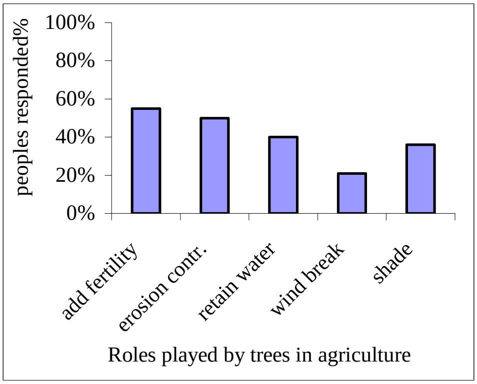


Fig. 8. The role of agroforestry in Igombe river village.

Distribution of forest species at Igombe River village

Table 9

Position in catena	Vegetation species
Rocky hill slope	*Combretum zeyheri, Pterocarpus tinctorius, Strichynos p*
Upper pediment (Fertile *Kikungu*)	*Albizia harvey,,Grelvia bicolor, Combretum zeyheri, PhylPhylanthus engleri, Pterocrpus tinctorius, (Mputika), Fagara, Zahna africana*
Lower pediment (*Kimanda*	Brachystegia spiciformis, Diplorhynchus condylocarpion, Combretum zeyheri,, Pterocarpus angolensis
Foot slope (*Isenga*)	*Mshinde, Mtalali, Myenze, Erythrophleum africanum, Abrus schimperi, Combretum zeyheri Markhamia obstusifolia Lusanga*
Valley bottoms (*Kodondoli*)	*Bushed grass (Kanyavuloba spp), Cacia spp, Acacia spp.*

Distribution of forest species at Simbo village

Table 10

Positionsa catena	Vegetaties species
Rocky hill slope	Markhamia obstifolia, Cambretum zeyheri, Cambretum mole, Brachystegia microfilla, Sterculia quingguloba, Pterocarpus tinctorius (mgwegwe), Strichxnos spp
Upper pediment *(Kikungu)*	Albizia *harvey,,Grelvia bicolor, Combretum zeyheri, hylPhylanthusengleri, Pterocrpus tinctorius, (Mputika), Fagara, Zahnaafricana*
Lower pediment *(Isenga)*	Terminalia sericea, Mkulungu,Pterocarpus tinctorius, Combretum zeyheri, Terminalia sericea, Phylanthus engleri
Foot slope (*(Manda)*	*Cacia spp, Acacia spp*

Climate variability

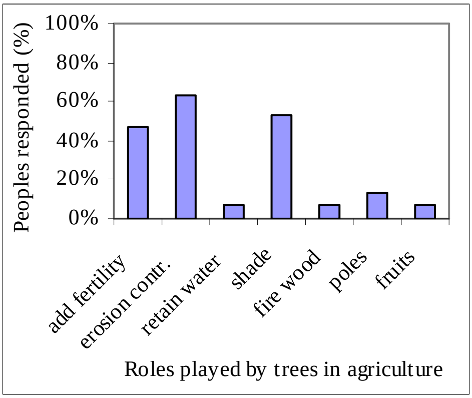


Fig. 9. The role of agroforestry in Simbo village.

Through discussion with key informants at both region and district offices in Tabora it was established that variation in climate, particularly rainfall in Tabora, Shinyanga and Mwanza regions is one of the factors for encroachment. For example, local people believe that in forest reserve areas there is high rainfall compared to bare land. The northeast areas of Tabora including Nzega and Igunga districts receive rains ranging from 700 mm to 850 mm per year while Tabora and Urambo receive rain ranging from 800 mm to about 1,000 mm (Acres *et al.*, 1984). Rainfall around Tabora town ranges between 700 mm and 1,000 mm. It is clear that for agriculture activities people will have a tendency to move from areas with low rainfall to areas with high rainfall so as to avoid a risk in the production of their food crops. Apart from crop production, people are attracted to move to the area with high rainfall in search of pastures and water for their livestock.

5. CONCLUSION

The study observed an on going forest degradation in both reserves but with different levels. Major reasons contributing to forestry degradation through encroachment were mainly three, which are; (i) socio-economic factors including migration, scarcity of arable land, fuel wood extraction for tobacco curring, livestock keeping and timber extraction due to high demand in neighbouring regions (ii) biophysical factors such as soil fertility gradients, vegetation types and distribution and climatic variations and (iii) policy related factors such as unclear and conflicting laws on natural resource utilisation. In this study, one way of reducing forestry encroachment is to promote the indigenous soil fertility management which was found to be practised in the study areas. On the other hand, Policy implication could include revisiting and redefining forest reserves in relation to the current population growth. This means that some of the forest reserve could be revoked, and be allocated to the neighbouring villages, particularly those with severe land shortage. Further more, sensitisation should be conducted for all the stakeholders at all levels, on the importance for sustainable management of forest resources.

6. ACKNOWLEDGMENTS

Authors wish to thank the Institute of Resources Assessment and the University of Dar es Salaam for granting permission to undertake this study. The team would like to extend their sincere thanks to Forest Resource Management Project (FRMP) for providing funds to undertake this study. Assistance provided by the Regional and Districts Administrative Officers in Tabora is highly appreciated.

R E F E R E N C E S

1. Acres, B. D., A. T, Barrett, I. R., Corker., K, Davies., J.E Mansfield ., C.N, Mayers., L.J, Rackham and Walton, R.K. (1984), *Land Evaluation and Land use Planning in Tabora Region.* Land Resource Development Centre, UK Overseas Development Administration. Final Project Report 116.
2. Conyers, D. (1971)., *Agro economic Zones of Kigoma and Tabora Regions.*Bureau of Resource Assessment and land-use Planning(BRALUP).University of Dar es Salaam.
3. Donet, M. (1997), Land Use and Resource Conflict: Liganga-Mkola case.
4. Kangalawe, R. M., Majule, A.E., Shishira., E. K. (2005), *An Analysis of Land Use Dynamics and Land Degradation Process In the Great Rift Valley, Central Tanzania: A Case of Iramba District,* Research Report submitted to OSSREA check.
5. Lema, A. J. (1993*), Lake Victoria Waters in the context of Irrigation of development in Tanzania,* Research Paper *No.31.*Institute of Resource Assessment, University of Dar es Salaam.
6. Likanda, S.,N., Kerven, C., Magembe, M. S., Majule, A. E., Mapua, M. S., Tenge, A. (1995), *Indigenous soil fertility improvement study. A first technical report submitted to the ODA Cashew Research Project*, Mtwara Tanzania.

7. Majule, A. E. 1999. The Effects of Organic Residues and Elemental Sulphur additions to Soils of Southern Tanzania. PhD thesis, Reading University, UK.

8. Majule, A. E., Mbonole, M. J., Campbel, D. J. (2004), *Ecological Gradients as a Framework for Analysis of Land Use Change*, LUCID Project Working Paper 45.

9. Majule, A. E. (2004), *Impacts of Landuse/Cover Changes on Land Degradation and Plant Species Richness on the slopes of Mount Kilimanjro*, Tanzania. Journal of the Geographical Association of Tanzania. Volume 33.

10. Majule, A. E., Mwalyosi, R. B. B. (2005), *Enhancing Agricultural Productivity through Sustainable Irrigation. A case of Vinyungu Farming System in selected Zones of Iringa*, Research Report Submitted to ENRECA, University of Dar es Salaam. Update.

11. Misana, S. B., Majule, A. E., Lyaruu, H. V. (2003), *Linkages between Changes in Land Use, Biodiversity and Land Degradation on the Slopes of Mount Kilimanjaro*, LUCID Working Paper Number 38.

12. Nkhalamba, J. W. (1999), *The effect of incorporating crop residues on the development of surface charge in some Malawian acid soils*, Ph.D thesis, Reading University, UK.

13. Pocknee, S., Sumner, M. E. (1997), *Cation and nitrogen contents of organic matter determine its soil liming potential,* Soil Science Society American Journal 61:86-92.

14. Sakala, M. G. (1998), *The effect of incorporating plant residues on soil acidity in the management of tropical soils*, PhD thesis, Reading University, UK.

15. Shishira, E. K., Yanda, P. Z. (1999), *Mapping of Tabora Forest reserve areas.Institute of Resource Assessment*,University of Dar es Salaam.

16. United Republic of Tanzania (1996), *Forest Reserve Management Programme*: *Tobacco Study Seminar Held at Tabora Regional Block on 15th Aug. 1*.

17. United Republic of Tanzania (URT), (1998a), *Tabora Region socio-economic Profile, Government Printer*, Dar es Salaam.

18. United Republic of Tanzania (URT) (2000), *Soil Fertility Initiative. Ministry of Agriculture and Cooperative,* Report No. 00/81 CP-URT.

19. United Republic of Tanzania (URT) (2002), *Population and Housing Census General Report*, Government Printer, Dar es Salaam.

20. Wong, M. T. F., Akyeampong, E., Nortcliff, S., Rao, R. M., Swift, S. R. (1995), *Initial responses of maize and beans to decreased concentration of monomeric inorganic aluminium with application of manure or tree prunnings to an Oxisol in Burundi*, Plant and Soil 171:275-282.

21. Wong, M. T. F., Nortcliff, S., Swift, S. R. (1998), *Method for determining the acid ameliorating capacity of plant residue, compost, urban waste compost, farmyard manure and peat applied to tropical soils,* Communication in Soil and Plant Analysis, 29, nos.19&20:2927-2937.

22. Yanda, P. Z., Majule, A. E. (2004), *Baseline Studies on the Socio Economic and Cultural Aspects on the Mara River Basin,* A Final report submitted to WWF, Dar es Salaam, Tanzania.

23. Yanda, P. Z., Majule, A. E., Mwakaje, A. G. (2005), *Wetland utilisation, poverty alleviation and environmental conservation in semi arid areas of Tanzania – The case of Singida Region, Tanzania,* Proceedings of East Africa "Integrated River Basin Management" Conference Held on 7th-9th 2005 at ICE Hall, Sokoine University of Agriculture Morogoro, Tanzania.

WATER, SEDIMENT QUALITIES AND HEAVY METAL CONCENTRATIONS IN THE SEVERELY ERODED MANGROVE AREA IN THE NORTHERN THAI GULF

N. MATSUI[1]

ABSTRACT. – Water, Sediment Qualities and Heavy Metal Concentrations in the Severely Eroded Mangrove Area in the Northern Thai Gulf. Mangrove degraded area whose shoreline retreated by 127 m during the 7-year due to severe wave/wind attack, was shown to be significantly polluted in water, sediment. BOD was rather high (4.3 mg/l, 4.9 mg/l) which is almost of half of effluent from shrimp aquaculture. DO also was quite low with the lowest 3.8 mg/l. Due to an increased water temperature in dry season, sediment became more anaerobic and reductive. Available NH_4 was consequently dominant over available NO_3 and NO_2. Hydrogen sulfide that is toxic to aquatic animals, was high in the sediment influenced by excessive organic matter accumulation. Species composition of phytoplankton reflected conditions of water quality. When water was eutrophicated with the higher amounts of phosphorus and nitrogen, diatoms dominated at the expense of other groups. Sludge discharged from aquaculture pond contained higher amount of Cd (0.55 mg/kg), which is beyond the critical levels for soil contamination. Mangroves are effective to reduce toxicity of pollutants. With a disappearance of mangrove forest, effluents from the other places and uncontrolled discharge of sludge will bring severe pollution in coastal environment, thereby intensive researches on pollutants should be carried out in order to protect not only natural environment also human health.

Keywords: *mangroves, water/sediment qualities, phytoplankton, sludge, heavy metals.*

1. INTRODUCTION

Coastal erosion is one of the most severe environmental problems in Thailand, which is accelerated with the destruction of mangrove forests that normally provide protection from erosion. Thai Government has therefore designated this problem as a high priority among national environmental problems to be solved urgently.

The study site, Samuth Sakorn is located approximately 50 km from Bangkok. Because of its proximity to the capital, coastal development started early in the 1970s. Since no legislative restrictions against coastal development at that time, poorly planned coastal developments were carried out up to the very edge of the coast. Consequently, unprecedented coastal erosion has occurred in this region due to severe wave/wind attack and without protection from mangrove forests. Along 14 km stretch of coastline in this area, the shoreline retreated by 127 m during the 7-year period from 1987 to 1994, and by 351 m during the 25-year period from 1969 to 1994 (SANYU and PANYA 2001).

Under such a circumstance, coastal environment has significantly deteriorated, leading into a drastic decline of fishery yields. Local fishermen reported that greater numbers of cockles and catfish were harvested prior to the large-scale conversion of mangroves to shrimp ponds. However, few catfish are harvested in the recent times.

[1] *Department of Environment, Kanso Technos Co., Ltd., Osaka 541-0052, Japan, e-mail: matui_naohiro@kanso.co.jp*

Degraded environmental quality should have reflected in water, sediment and biological conditions. It is therefore vital to understand these conditions to prepare proper environmental management in the future.

Shrimp aquaculture has been principle cause of mangrove destruction in Thailand. 64% of mangrove destruction (by area) up to 1986 was due to the conversion to shrimp ponds (Aksornkoae et al., 1993). In aquaculture operation, a large quantity of sludge is discharged into surrounding areas. With organic rich sludge originated from feeding and fish metabolic activity, negative impacts have been imposed on the coastal area.

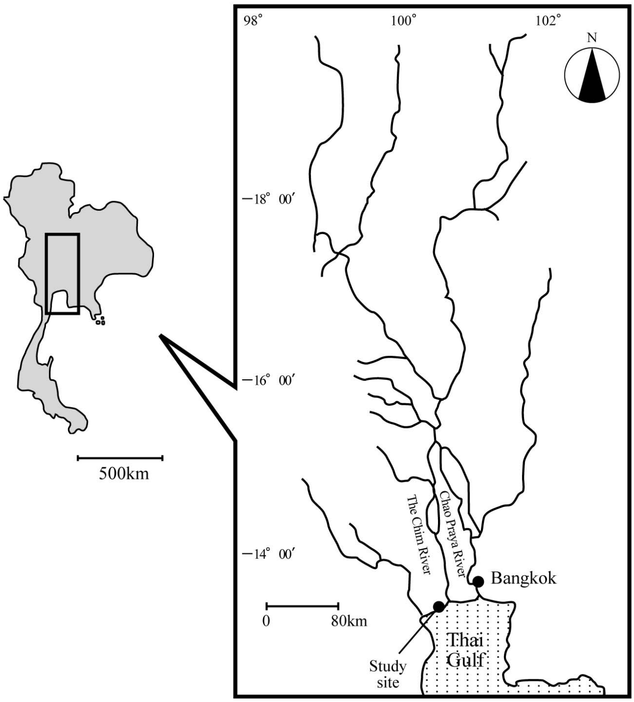


Fig. 1. Locations of study site; Samuth Sakorn province, Thailand and of hydraulic dams.

Among them, influences by the loadings of nitrogen and phosphorus have been studied extensively (Brambilla et al. 2007; Chen et al. 2007; Mirzoyan et al. 2008), however little was studied about heavy metal accumulation. An increase of heavy metal concentration above the acceptable levels, whether due to natural or anthropogenic factors, can result in serious environmental and subsequent health problems. Once polluted by heavy metals, removal or improvement of pollutants requires tremendous time and cost. For this reason, accumulation of metallic contaminants derived from aquaculture sludge should be examined.

The objectives of this study are therefore: 1) to understand current environmental conditions in degraded mangrove areas from the viewpoints of water, sediment and phytoplankton, 2) to examine heavy metal concentrations in the sludge discharged from active shrimp aquaculture pond with the comparison to natural mangrove forests.

2. MATERIALS AND METHODS

2. 1. Study site

The study was conducted at the abandoned mangrove area located close to the shoreline within the Samuth Sakorn sub-district/district, Samuth Sakorn province, Thailand (13º28’N, 100º13’E) (fig. 1). Exploitation of the area started with the construction of saltpans in the 1970s, followed by shrimp farming in the 1980s and associated clear-felling of the majority of mangrove forests. Ffgure 2 shows the average monthly rainfall (mm/month) between 1942 and 1988 within the Chao Phraya River basin where the study site is located. The study area has highest rainfall in September of the rainy season between May and October, and lowest in December of the dry season between November and April.

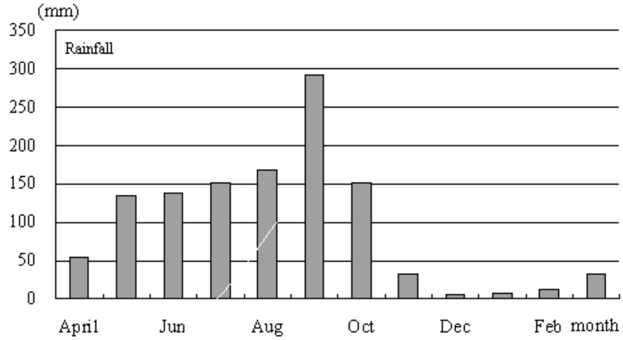


Fig. 2. Average monthly rainfall (mm/month) within the Chao Phraya River basin between 1942 and 1988.

2. 2. Water/sediment sampling and phytoplankton measurements

Water was collected from two sites, ST1 and ST4 (fig. 2), and transported to the laboratory while kept chilled. The water samples were analyzed for temperature, dissolved oxygen (DO), salinity, pH, total ammonia nitrogen (TAN), nitrite, nitrate, total dissolved nitrogen (TDN), dissolved organic nitrogen (DON), particulate organic nitrogen (PON), total nitrogen (TN), dissolved inorganic phosphorus (DIP), total dissolved phosphorus (TDP), dissolved organic phosphorus (DOP), particulate phosphorus (PP), total phosphorus (TP), particulate organic carbon (POC), chlorophyll a, and biochemical oxygen demand (BOD).

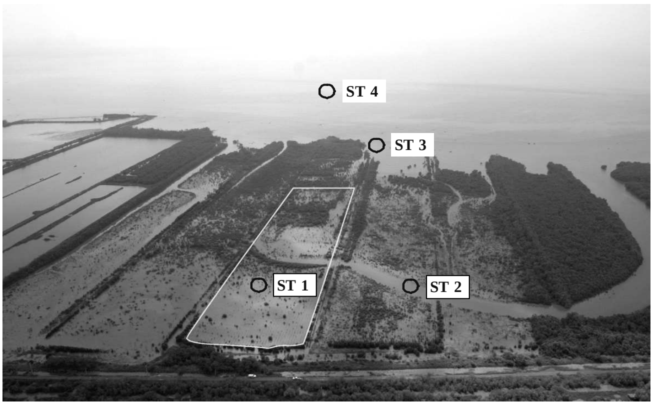


Fig. 3. View of the study site taken by remote controlled helicopter from 500 m above sea level. Blue circles show the stations where the samples were taken for measurements of water, sediment, and biological properties. Rectangular area delineated by white color line is approximately 5 ha with 100 width and 500 m long.

Sediment samples were collected at the four sites, ST1, ST2, ST3 and ST4 to analyze available ammonia, nitrite, nitrate, phosphorus, total phosphorus, nitrogen, organic carbon, ignition loss, and hydrogen sulfide. All of the above water and sediment analyses were conducted according to the standard methods (APHA et al., 1985). The abundance of phytoplankton was measured from samples collected in 40 μm mesh plankton net and preserved in 5% formalin solution. And the biomass of phytoplankton was studied according to the enumeration method and chlorophyll a content.

2. 3. Heavy metals

Sludge samples were collected from the four active shrimp aquaculture ponds near the study site. After air-drying, samples were digested by microwave followed by determination of heavy metals such as Mercury (Hg), Cadmium (Cd), Arsenic (As), Chromium (Cr), Lead (Pb), Manganese (Mn), Copper (Cu), Zinc (Zn), Molybdenum (Mo), Nickel (Ni), Selenium (Se) and Cobalt (Co) by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES). Ignition loss was determined at the same time. Heavy metal analysis was also conducted for 6 natural mangrove soils for the comparison.

3. RESULTS

3. 1. Water quality

DO was quite low in the studied water with the lowest 3.8 mg/l (table 1). Moreover, BOD was high with the ranged values between 3.3 mg/l and 7.1 mg/l. Both of these reflect that degraded mangrove area is at the high degree of eutrophication. DO was especially low in April, probably because phytoplankton consumed more oxygen for increased assimilation at the high water temperature. Nitrogenous elements such as TN, TAN, TDN were high at the low water temperature, corresponding to the reduced activity of phytoplankton. Chlorophyll a correlates with biomass of phytoplankton. An increase of pH in April over 8.0 has been brought by increased phytoplankton biomass. The high ratio of PON to TN suggests that excess amount of effluent has been brought in the study site whose

Water qualities measured in Aprill 2001, December 2001, and June 2002

Table 1

Crt. no.	Indicative	April 2001		December 2001		June 2002
		ST1	ST4	ST1	ST4	ST4
1	Water temperature (C^0)	30.4	31.1	27.0	28.0	32.6
2	Dissolved oxygen (mg/l)	3.8	4.5	7.1	5.4	3.8
3	Salinity (ppt)	21.8	21.3	26.1	27.7	28.5
4	pH	8.00	8.40	7.85	7.96	8.29
5	Total ammonia Nitrogen (mh/l)	0.012	0.021	1.005	0.014	0.010
6	Nitrite (mg/l)	0.008	0.028	0.199	0.014	0.005
7	Nitrate (mg/l)	0.009	0.012	0.024	0.005	0.028
8	Total dissolved nitrogen (mg/l)	0.607	0.691	2.540	1.165	0.375
9	Dissolved organic nitrogen (mg/l)	0.579	0.630	1.312	1.132	0.332
10	Particulate organic nitrogen (mg/l)	1.320	1.139	1.774	1.577	0.847
11	Total nitrogen (mg/l)	1.927	1.830	4.314	2.742	1.222
12	Dissolved inorganic phosphorus (mg/l)	0.091	0.086	0.425	0.150	0.029
13	Total dissolved phosphorus (mg/l)	0.107	0.086	0.852	0.819	0.078
14	Dissolved organic phosphorus (mg/l)	0.017	0.000	0.427	0.669	0.049
15	Particulate phoephorus (mg/l)	0.218	0.167	0.315	0.109	0.021
16	Total phosphorus (mg/l)	0.325	0.253	1.167	0.928	0.099
17	Particulate organic carbon (mg/l)	7.98	6.63	10.2	4.99	5.04
18	Chlorophyll *a* (μg/l)	28.1	16.3	11.3	8.44	10.2
19	BOD (mg/l: 5 days $20C^0$)	4.3	3.3	4.9	4.3	7.1

level beyond a capacity of biological decomposition. Chlorophyll a was comparatively high at ST1 and in April because higher concentrations of TN, TIP, PP, TDP stimulated growths of phytoplankton at ST1 and in April.

3. 2. Sediment quality

The transformation from organic to inorganic nutrients generally occurs at the sediment surface. Nitrogen levels were significantly high in the study area. Available NH_4 was dominant over available NO_3 and NO_2, indicating the sediment is reductive (table 2).

Sediment qualities measured at April 2001 and June 2002

Table 2

Date	Station	Available Ammonia	Available nitrite	Available nitrate	Available phosphorus	Total phosphorus	Total Nitrogen	Total organic carbon	Ignition loss	Hydrogen Sulfite
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	%	mg/kg
April 2001	ST1	59.8	0.04	3.41	5.17	45.3	0.27	2.52	4.19	25.0
	ST2	112	0.06	42.0	18.1	44.6	0.30	2.70	11.0	77.3
	ST3	63.4	0.16	5.74	10.3	55.3	0.02	1.18	11.9	77.8
	ST4	47.0	0.04	3.25	8.79	86.9	0.04	0.97	4.52	214
December 2001	ST1	41.8	0.23	6.55	8.13	52.1	0.27	2.08	8.26	257
	ST2	91.9	0.33	8.36	27.2	80.4	0.31	2.36	9.70	213
	ST3	146	0.15	2.74	18.9	44.8	0.25	2.03	8.30	146
	ST4	42.1	0.15	2.46	10.4	88.7	0.26	2.02	7.76	92.1
June 2002	ST1	24.8	0.03	4.53	6.64	31.0	0.14	1.49	24.6	30.5
	ST2	25.9	0.00	5.11	9.57	35.7	0.20	2.06	2.06	51.4
	ST3	16.2	0.03	3.68	13.8	16.2	0.12	1.47	16.3	57.7
	ST4	20.6	0.11	2.77	2.17	30.2	0.15	1.97	13.8	134

Sulfide content was relatively high in December 2001, it is likely that the spontaneous input of organic matter from other sites strengthened reductive condition. ST4 is located at offshore where tidal action is strong enough to provide oxygen to sediment. Aerobic condition generated by oxygen provision normally reduces sulfide contents. However, sulfide is still high at ST4. This could be due to that this site has been loaded by large amounts of effluents.

3. 3. Phytoplankton

3 groups and 33 genera of phytoplankton, which are 5 genera of blue-green algae group, 3 genera of green algae, and 25 genera of diatoms, were identified (table 3). Except for ST1 in April 2001, diatom was the dominant group in terms of the number of species and individuals, with the peak at the periods of low rainfall (December 2001). At ST4, the number of genera increased in the order of April 2001 (9 genera), December 2001 (13 genera), and June 2002 (15 genera).

Densityor phytoplankton (cell/l) measured at April 2001, December 2001 and June 2002

Table 3

Pgytoplankton group	No.	Genera	Density of phytoplankton (vell/l)				
			April 2001		December 2001		June 2002
			ST1	ST4	ST1	ST4	ST4
Blue green algae	1	Anabaenaopsis	397,000				
	2	Oscillatoria	1,008	336,000			225,000
	3	Gloeocapsa	14,463				
	4	Lyngbya		140,000			
	5	Spirulina	117,000				24,000
Green algae	1	Gonatozygon	332,000				
	2	Schroederia	91,000	14,000			
	3	Staurastrum	117,000				
Diatom	1	Skeletonema	2,581	462,000			7,125
	2	Coscinodiscus	11,427	742,000	827,000	22,000	18,000
	3	Dactyliosolen				11,000	33,000
	4	Rhizosolenia	468,000	882,000	30,645	8,974	1,410
	5	Bacterisatrum				33,000	13,688
	6	Chaetoceros	273,000		7,425	22,000	8,250
	7	Odontella			281,000	28,000	51,000
	8	Thalassionema			6,210	72,000	1,185
	9	Gyrosigma			143,000		27,000
	10	Navicula	163,000	252,000	11,000	44,000	
	11	Nitzschia	345,000				
	12	Pseuidonitzschia			17,145	35,132	
	13	Campylodiscus			11,000		
	14	Dictyocha					3,000
	15	Noctiluca					1,050
	16	Ceratium					105,000
	17	Alexandium					6,000
	18	Fragilaria	137,000	238,000			
	19	Eucampia			11,000	6,000	
	20	Melosira	245,000				
	21	Hemiaulus			11,000	44,000	
	22	Pleurosigma	124,000	95,000	114,000		
	23	Pseudosolenia				550,000	
	24	Thalassiosira				6,000	
	25	Sttephanodiscus	98,000				

Species composition of phytoplankton is affected by water quality. In December 2001 when water was eutrophicated with the higher amounts of phosphorus and nitrogen (table 1), diatoms became dominant at the expense of other groups.

3. 4. Heavy metals

Higher ignition loss in the sludge (17.8 % in dry weight basis) indicates that the sludge contains twice larger amount of organic matter than mangrove (tble 4, fg. 4; Top left). Cd in the sludge ranged from 0.35 to 0.75 mg/kg with the mean value of 0.55 mg/kg, while one of mangrove is 0.085 mg/kg (table 4, fg. 4; Bottom left).

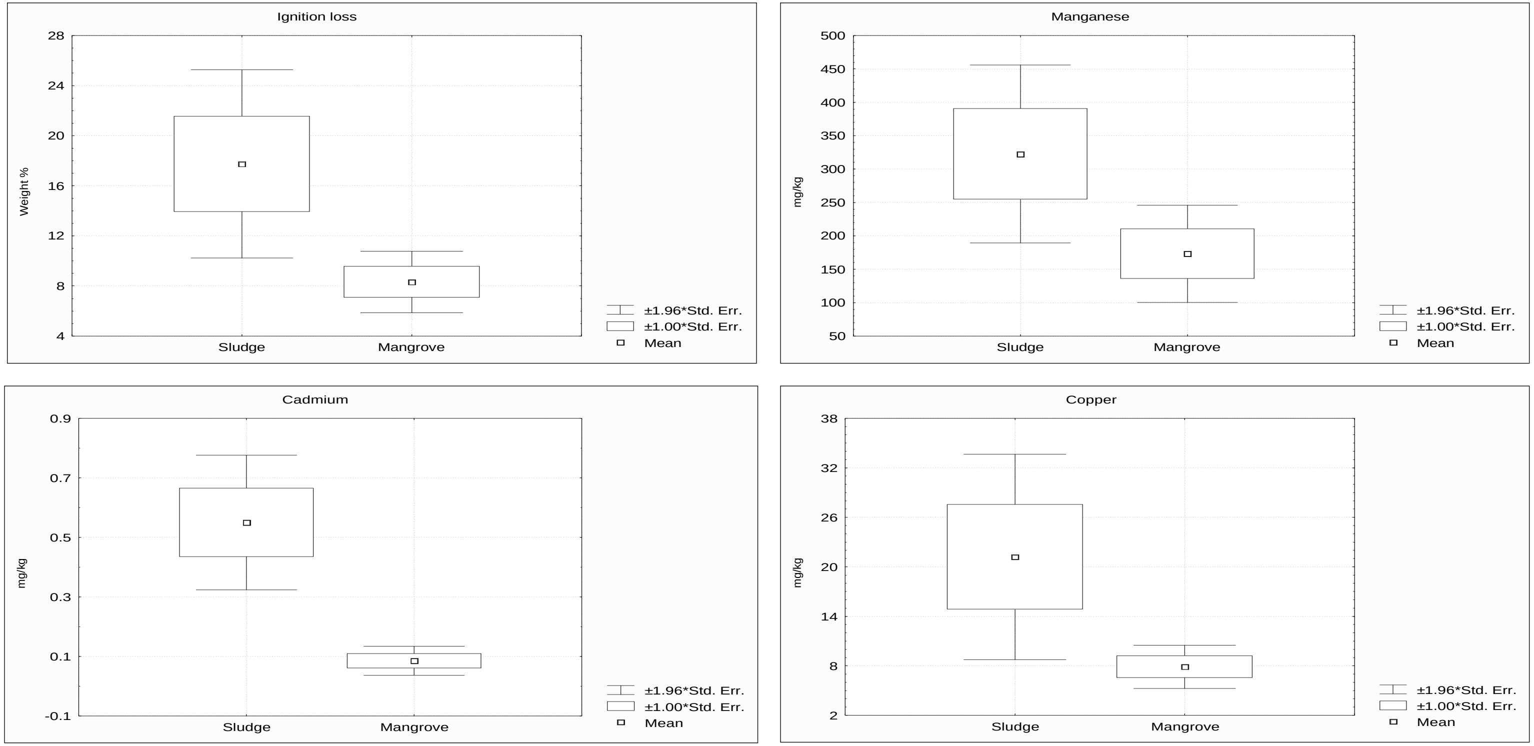


Fig. 4. Heavy metal concentrations between the sludge and mangrove. Top left; Ignition loss. % is expressed by dry weight basis, Top right; Manganese, Bottom left; Cadmium, Bottom right; Copper.

Since fish's internal organ is abundant of Cd, Cd in the sludge might have originated from cultured shrimps. Moreover, Cu, Mn were higher in the sludge (fig 4; Bottom right, Top right) as 21.2 mg/kg in the sludge, 7.9 mg/kg in mangrove for Cu, and 323 mg/kg in the sludge, 173 mg/kg in mangrove for Mn. The sludge is the mixture of organic and inorganic materials. Organic materials are uneaten feed, debris of shrimp, and inorganic one is the bottom sediment of aquaculture pond. The higher concentrations of Mn, Cu in the sludge have originated from the bottom sediment which were richer in these elements than mangrove soils. Mo and As were lower in the sludge than mangrove (table 4). Other heavy metals showed no much difference between the sludge and mangrove. Cr was 22.8 mg/kg in the sludge, 16.0 mg/kg in mangrove, likewise Ni 19.8 mg/kg in the sludge, 17.0 mg/kg in mangrove, Pb 25.3 mg/kg in the sludge, 29.0 mg/kg in mangrove and Zn 47.0 mg/kg in the sludge, 46.7 mg/kg in mangrove. Se was lower than the detection limit (<1.0 mg/kg) in both sludge and mangrove.

4. DISCUSSION

Mangrove degraded area was shown to be significantly polluted in water, sediment. The degree of pollution becomes higher in dry season. This is due to the fact that high water temperature at dry season generates anaerobic and reductive condition in sediment. Under these conditions, pollutants are easily to be released from sediment under reductive condition.

Heavy metal concentration and ignition loss in the sludge and mangroves

Table 4

		Sludge				Mean	Mangrove						Mean
Hg	mg/kg	0,01	0,02	0,03	0,06	0,03	0,02	0,01	0,2	0,01	0,04	0,08	0,060
Cd	mg/kg	0,35	0,75	0,35	0,75	0,55	0,11	0,06	<0.05	<0.05	<0.05	<0.05	0,085
As	mg/kg	1,3	2,8	1,7	3,7	2,38	12,0	6,3	14,0	7,5	8,0	16,0	10,6
Cr	mg/kg	13,0	28,0	16,0	34,0	22,8	22,0	12,0	21,0	11,0	9,8	20,0	16,0
Pb	mg/kg	14,0	30,0	18,0	39,0	25,3	33,0	18,0	43,0	23,0	19,0	38,0	29,0
Mn	mg/kg	200,0	430,0	210,0	450,0	322,5	310,0	170,0	160,0	86,0	140,0	280,0	191,0
Cu	mg/kg	8,8	19,0	18,0	39,0	21,2	12,0	6,7	10,0	5,5	5,2	10,0	8,2
Zn	mg/kg	31,0	66,0	29,0	62,0	47,0	65,0	35,0	53,0	28,0	33,0	66,0	46,7
Mo	mg/kg	1,4	3,0	1,6	3,4	2,4	7,4	4,0	14,0	7,5	4,8	9,6	7,9
Ni	mg/kg	12,0	26,0	13,0	28,0	19,8	22,0	12,0	21,0	11,0	12,0	24,0	17,0
Se	mg/kg	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Co	mg/kg	<2.0	<2.0	2,7	5,8	4,3	10	5,4	7,7	4,1	6,9	14	8,0
I l*	**%**	**10,4**	**22,2**	**12,2**	**26,2**	**17,8**	**10,8**	**5,9**	**11,9**	**6,3**	**6,7**	**13,5**	**9,2**

*** I l** = Ignition loss.

Tookwinas and Youngvanisset (1998) reported that the average BOD in the effluent from shrimp ponds is 8.47 mg/l. BOD in the studied water was approximately half of this value, indicating that the study site has been subjected to the inflow of polluted water from adjacent sites.

Moreover, TN in the study site was higher than the average value for Kung Krabaen Bay, Chantaburi province, Thailand (0.4–0.5 mg N/l) and lower than values recorded from effluent water sampled from an intensive shrimp pond (4.9 mg N/l) (Tookwinas, 2001). Considering that typical coastal sediment in Thailand contains 1.06% of organic carbon and 0.05% of total nitrogen (Tookwinas, 2001), the study site experienced a high degree of eutrophication (1.90% of organic carbon and 0.19% of total nitrogen). Eutrophication in the study site was also identified by phytoplankton composition. Diatom which represents high concentration of nitrogen and phosphorus, was dominant. A greater number of genera of diatoms were found in the periods in the dry season when salinity is high, pointing out that diatom is likely to grow better under high salinity. Similar trends have been reported for diatoms in Songkhla Lake, Thailand (Yamaguchi, 1995).

Domestic and industrial wastes, atmospheric emissions, metal corrosion products and leached agricultural chemicals are the most important sources of pollution in general. These wastes are either directly discharged into natural environment without being treated, resulting in an increase of pollutants like heavy metal concentrations in the sediment at the receiving water body. The study site is situated at the river mouth and the river flows from upper stream down to the mouth along a few hundred kilometers (fig. 1). Many of pollutants are indissoluble and transported by attaching soil colloids in river. And they are finally deposited in mangrove sediment.

The sludge contained higher Cd concentration than mangroves. The mean value of Cd in the sludge was 0.55 mg/kg, exceeding European critical values for soil contamination. In Europe, legislative control for soil contamination is strictly formulated according to land use and geology. Most strict value 0.4mg/kg is adopted in Sweden and Germany, followed by 0.5 mg/kg in Canada and 1 mg/kg in UK. Considerable amount of sludge has been disposed in coastal area every year from aquaculture pond. Even though the sludge affected area is not practically utilized for agriculture, excessive accumulation of Cd may bring environmental problems in the future.

Pb was detected as 25.3 and 27.2 mg/kg in the sludge and in mangrove, respectively. These levels are designated as polluted soils in Japan. Cu in the sludge also slightly exceeded the level of Japanese polluted paddy field. Accumulation of heavy metals would cause severe problems in terms of environment and health. Therefore, integrated research to understand polluted condition in the studied area should be conducted and prepared to implement measures for environmental conservation. Mangrove plays a great role to reduce toxicity of heavy metals (Horst, 1997; Clarka et al. 1998; Tam et al. 1999; Machado et al. 2002). With large-scale mangrove destruction as the case of this study, coastal environment will be greatly suffered by heavy metal contamination because of no reducing effect on toxicants. Therefore, mangrove rehabilitation is recommendable to be incorporated with integrated pollution controls in degraded tropical coastal areas.

5. CONCLUSIONS

Water and sediment in the heavily eroded mangrove areas were highly polluted. Polluted level increased in dry season because of enhanced anaerobic and reductive condition brought by high water temperature. Chlorophyll a also increased at the high water temperature, due to that phytoplankton activity became strong in dry season. Species composition of phytoplankton reflected water quality. When water was eutrophicated with the higher amounts of phosphorus and nitrogen, diatoms became dominant at the expense of other groups. Available NH_4 was dominant over NO_3 and NO_2 since the sediment was reductive. Excessive nutrient input causes organic matter to accumulate in sediment, generating hydrogen sulfide that is toxic to most of aquatic animals. Among heavy metals in the sludge, Cd concentration was twice larger than mangrove soils. With a significant loss of mangroves which has a capacity to reduce toxicity of pollutants, degraded coastal area will be more heavily contaminated. Mangrove rehabilitation therefore should be included in integrated environmental management for degraded tropical coastal areas.

6. ACKNOWLEDGEMENTS

The research was undertaken as part of a Joint Research Project participated by the Department of Marine and Coastal Resources (DMCR), Thailand, Kansai Electric Power Co., Inc., Japan, and Kanso Technos Co., Ltd., Japan, from 1998 to the present. The author would like to thank the staffs at Department of Fishery, Marine Shrimp Research and Development Center, Thailand for their analytical work in the laboratory, especially to Dr. P. Songsangjinda for his great cooperation in this project.

R E F E R E N C E S

1. Aksornkoae, S., N. Paphavasit & G.. Wattayakorn (1993), *Mangroves of Thailand: Present status of conservation, use and management, i*n Clough, B.F., (ed), The Economic and Environmental Values of Mangrove Forests and their Present State of Conservation in the South-East Asia Pacific Region . International Society for Mangrove Ecosystems, Okinawa, Japan.
2. APHA, AWWA, WPCF. (1985), *Standard method for the examination of water and wastewater*, 17th edition. American Public Health Association, Washington.
3. Brambilla, F., Lalumera, G., Terova, G., Crosa, G. & Saroglia, M. (2007), *Inflow and outflow water quality control in coastal aquaculture systems: a case study*, Aquaculture Research 38.
4. Chen, S., Coffin, D. E., Malone, R.F. (2007), *Sludge production and management for recirculating aquacultural systems*, Journal of the World Aquaculture Society 28.
5. Horst, M.F. (1997), *Heavy metal distribution in sediments and ecological risk assessment: The role of diagenetic processes in reducing metal toxicity in bottom sediments*, Environmental Pollution 97.
6. Machado, W., Moscatelli, M., Rezende, L. G., Lacerda, L. D. (2002), *Mercury, zinc and copper accumulation in mangrove sediments surrounding a large landfill in southeast Brazil*, Environmental Pollution 120.
7. Malcolm, W. C., McConchiea, D., Lewisb, D. W., Saengera, P. (1998), *Redox stratification and heavy metal partitioning in Avicennia-dominated mangrove sediments: a geochemical model*, Chemical Geology 149.
8. Mirzoyan, N., Parnes, S., Singer, A., Tal, Y., Sowers, K., Gross, A. (2008), *Quality of brackish aquaculture sludge and its suitability for anaerobic digestion and methane production in an upflow anaerobic sludge blanket (UASB) reactor*, Aquaculture 279.
9. SANYU consultant (Thailand) Ltd., PANYA consultant Co., Ltd. (2001), *The feasibility study on mangrove revival and extension project in the Kingdom of Thailand*. JICA report, 269 pp.
10. Tam, N. F. Y., Wong, Y. S. (1999), *Mangrove Soils in Removing Pollutants from Municipal Wastewater of Different Salinities*, J Environ Qual 28.
11. Tookwinas, S. and Youngvanisset, K., 1998. Mollusk culture as a tool for sustainable integrated coastal zone management, Southern Thailand. Phuket Marine Biol. Center Spec. Publ. 18.
12. Tookwinas, S. (2001), *The Mitigation Measures for the Impacts of Marine Shrimp Farming on Coastal Environment; A Case Study at Kung Krabaen Bay, Eastern Thailand*, Doctoral Thesis, Graduate School of Biosphere Sciences, Hiroshima University, Japan.
13. Yamaguchi, Y. (1995), *Ecological characteristics and phytoplankton dynamics of lagoonal lake, Thale Sap Songkhla, Thailand*, in “The coastal environment and ecosystem in Southeast Asia, Studies on the lake Songhla lagoon system, Thailand”. Faculty of Bio-industry, Tokyo Univ. of Agriculture.

GEOECOLOGICAL ASPECTS IN TURENILOR GORGE

GABRIELA ADINA LAZĂR[1], AL. MUREŞAN[2]

ABSTRACT. – G**eoecological aspects in Turenilor Gorge.** A special feature of this area is represented by its natural component in which, the orography, the hidrography and the vegetation harmoniously combine, resulting a landscape with the most dynamic features. The Turenilor Gorge, the north-eastern limit of the Trascău Mountains, presents itself as an important floristic, faunistic, geologic and geomorphologic area. Carved by the Tur river and having 1850 m in length, the Turenilor Gorge have been declared a natural reserve with mixed value sheltering a series of important flora and fauna species, with national importance. Nowhere else, the epigenesis is more edifying nowhere else the sedimentary rocks have better covered the limestone than in Turenilor Gorge. Located in the proximity of two important communication ways – the town of Cluj-Napoca and Turda the fabulously and wild relief developed on limestone recommends the Turenilor Gorge as a wonderful and adequate place for leisure, not only for the nature passionate but also for those who enjoy rock climbing or posses a certain affinity for the speleology (within this area 29 caves with different lengths have been identified). The flora and fauna within this area is extremely diverse, thus presenting a great ecological importance.

Keywords: *Trascău Mounatins, Turenilor Gorge, geoecology, geo-systems in biostasy, geo-systems in rhexistasy, geo-systems in parastasy***.**

1. INTRODUCTION

The geoecology as defined by Troll C. [1930] represents the "science of the entire complex of inter-relations between the living communities and their natural environment". The landscape ecology firstly developed as a biogeographical discipline, as a connection line between the geography and the ecology. It is connected to the geography by means of the usage of the spatial models and by the human – environment interactions, while the study of the landscape's functions and of the relations between the living organisms with the environment belonging entirely to the ecology [Vuorela Niina, 2003].

The geoecology studies the natural basis of the human's vital space. Is an entirely geographical discipline, its fundamental object of study being represented by the landscape from a geographical point of view. The geo-systems are based on the interactions between the geomorphologic, climatic, hydrologic elements with the living organisms.

According to the concept of rhexistasy developed by Ehart [1967] thus referring to the state of the natural systems in regards to the human intervention, Tudoran P. [1983] defines a third category of geo-systems in order to exemplify the quantifications of the human interventions on the natural environment. Besides the two existing categories of

[1] *Babeş-Bolyai University, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail: adina.lazar@geografie.ubbcluj.ro*

[2] *Babeş-Bolyai University, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail: alex.muresan@geografie.ubbcluj.ro*

geo-systems (geo-systems in biostasy and geo-systems in rhexistasy), the new defined third category (geo-systems in parastasy) is used to explain the degree of intervened changes within the structure and quality of natural components due to human intervention.

2. THE NATURAL FRAME OF THE TURENILOR GORGE

The Trascău Mountains – a part of the Apuseni Mountains poses a well defined individuality within the Romanian mountain range, with a special lithology, presenting itself as an area of a great variety of the relief, a sort of "geological synthesis" of the Carpathians, and with a mosaic of endocarstic and exocarstic features, with a distinct individuality and delimitation among all mountain units. A special feature of this area is represented by its natural component in which, the orography, the hidrography and the vegetation harmoniously combine, resulting a landscape with the most dynamic features.

Within the Trascău Mountsins, two major components of the relief can be identified: a static component represented by the lithology, formed by the limestone and dolomites and a dynamic component represented by the hydrography (with its different forms) which, by means of its energy, contributes to the development of the morphogenetic processes. The litology is defined by the following structural-tectonic parameters: chemical composition, texture, structure, litoclasation and volume [Cocean, P. 2000]. These parameters can vary from limestone to limestone, from a karstic area to another determining a series of extremely diverse interactions with the hydrographical component.

The shallow water limestone identified in the Trascău Mountains can be observed on two parallel alignments with north-south orientation. The limestone from the first alignment is found in the north-eastern part of the Trascău Mountains forming the Petridu Peak (in the Tureni – Buru area) and the Rimetea Peak (in the Rimetea – Aiudului Gorge area). According to a several authors [Bleahu et. al. 1981; Lupu, 1983] these carbonate deposits and ophiolitic rocks belong to the Rimetea linen. According to Balintoni and Iancu [1986] the deposits belong to the Bedeleu linen [Săsăran, E. 2006].

The gorges represent the second group of characteristic formations for the karsts of the Apuseni Mountains. In accordance with the observations on the karsts of the Apuseni Mountains Cocean, P. [1988] defines 5 distinct types of gorges: the epigenetic gorges, the gorges formed by endocarstic capture, the antecedent gorges, the peripheral subsidence gorges and gorges formed by simple evolution, by means of deepening of the hydrographical network in the same type of rocks or in different types with a resemblance regarding the structural – compositional particularities of the rocks.

Within the area of the Turenilor Gorge, the limestone sequence has a thickness of around 150 m and it is represented by different deposits formed as a result of gravitational processes. In the Turenilor Gorge, Săsăran, E. [2006] identifies at the base of these deposits, the hemi pelagic limestones, at the middle and at the top the coralliferous bioconstructions with spongy and hydrozoas.

In comparison with other regions of the Apuseni Mountains with a more fragmented and spectacular relief, the landscape of the north – eastern extremity of the Petreşti ridge poses a relative monotonous appearance, with a smooth increase in altitude, reaching around 550 m in the Turenilor Gorge. These gorges are among the wildest within all Trascău Mountains, the narrowing of the transversal profile of the gorge and the verticality of the walls often obliging the tourist in making an extraordinary effort in crossing them. Nowhere else the epigenesis is more edifying; nowhere else the presence of the sedimentary rocks that have covered the limestone is more allied and more illustrative than in the Turenilor Gorge [Cocean, P. 1988].

The hydrographical network that drains the Trascău Mountains has a transversal profile, in the area of the Tureni Gorge being represented the hydrographical basin of the Arieş River, the Tur river (with a length of 24 km and with the spring located under the Feleacului Hill) being responsible for the creation of these picturesque gorge. Due to the fact that the river crosses the gorge diagonally, the length is much bigger (1850 m) than that of the Turzii Gorge.

The Tureni Gorge, the north-eastern extremity of the Trascău Mountains presents itself as an important floristic, faunistic, geologic ad geomorphologic area. In the year 2000 the entire area of the gorge was declared as a protected area with mixed value. Within the area a series of floristic and faunistic species of national importance are present (for example - the case of the butterfly *Zerinthia polyxena* whose presence was recorded within Cluj County only in Tureni Gorge).

3. THE STRUCTURE OF THE GEO-SYSTEMS IN TURENILOR GORGE

The Turenilor Gorge can be considered as genuine natural systems submitted to the action of the modeling natural and human factors. The ecological potential resulted by the interaction of the geomorphologic (slope, exposition, dynamic of the slopes), edaphic, climatic and hydrologic factors is strongly correlated with the antrophic pressure materialized by means of quantification of the effects of the antrophic activity on the biotic and abiotic components of the environment.

In the studied area and according to the field observations, 3 types of geo-systems were identified: *the geo-systems in biostasy* which are recognized for their state of equilibrium with the ecological potential; in this type of geo-system the anthropic intervention is reduced and with minimal effects on the natural elements (it is identified on the steep slopes inaccessible to human intervention), *the geo-systems in rhexistasy* where the equilibrium between the natural elements of the environments is disturbed due to fundamental changes in the ecological potential caused by human intervention. The chances of returning to the initial state are dim (these geo-systems are located on the eastern and western plateaus of the Turenilor Gorge, and also in the central-southern part of the gorge, along the Tur river valley – the area most intensely submitted to human intervention represented mostly by touristic activity) and *the geo-systems in parastasy* (completely anthropizated) in which the equilibrium and the relations between the natural elements have been dramatically modified and the human intervention has completely changed the natural aspect of the environment (this category of geo-systems is identified in the north-eastern

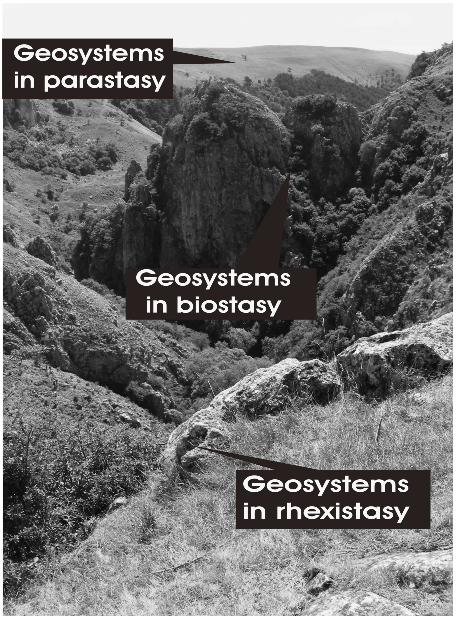


Fig. 1. The identified geo-systems within the Turenilor Gorge.

part, at the entrance in the Turenilor Gorge, but also at the exit from the gorge, towards the Copăceni village. In these locations, two quarries are present from where the local inhabitants extracted the necessary stone for building their households). Each of these types of geo-systems is inevitably submitted to the systemic laws, being therefore a part of higher rank systems and having in their composition several other inferior subystems. Within all these systemic components well established and strong correlations and interactions are present.

3. 1. The geo-systems in biostasy

The geo-systems in biostasy identified in the Turenilor Gorge, in regard to the state of climax in which they are found, can be subdivided into the followings: the geo-systems in biostasy with subclimaxic equilibrium and the geo-systems in biostasy with paraclimaxic equilibrium.

3. 1. 1. The geo-systems in biostasy with subclimaxic equilibrium

This type of geo-system corresponds to the stable spatial segments and their importance from a pastoral point of view is reduced due to the high degree of inaccessibility of the slopes, the herds not being able to graze in these areas. Hence, the herbal vegetation is well fitted and the trophic relations seem to be well established. In the studied area, within this geo-system two types of geo-facets are acknowledged in strict relation with the herbal vegetations and floristic and faunistic species identified:

- *the geo-facets of the steep slopes* represent the area less affected by human intervention due to the verticality of the walls and to the high degree of inaccessibility of these slopes. Within these geo-facets, the individuals from the present species are well developed having bigger dimensions than other individuals located in areas with major human impacts. In the areas where the human activity is present, the individuals of the plant species posses smaller dimensions than those located in the areas with reduced or minimal human interventions (for example the case of the *Centaurea atropurpurea* or *Sempervivum marmoreun* species) Actually, this fact regarding the dimensions of the individuals of the species can be generally acknowledged for almost all plant populations regardless of their location. The flora of the Turenilor Gorge identified on the steep slopes is extremely diverse, with different vegetal associations characteristic for this kind of habitats. The south-eastern part of the Turenilor Gorge, due to the fact that comes in contact with the Transylvanian Plain posses a series of species characteristic for the Transylvanian wooden – steppe (the case of the species belonging to the *Stipa* (*S. lessingana*) or *Salvia* (*Salvia pratensis*) genera). Regarding the fauna of these geo-facets is acknowledged the presence of reptiles (*Lacerta agilis, L. viridis, Coronella austriaca*), lepitopteres (it is considered to be present over 1100 species of butterflies) among which several species with greater ecological importance are to be mentioned: *Erebia medusa, Lasiommata megera, Papilio machaon, Polyommatus icarus, Argynnis paphia.* From an ecological point of view, the *Zerinthia polyxena* species is considered important, representing a scarcity for the Romanian Lepidoptera fauna and whose presence was recorded within Cluj County only on the territory of the Turenilor Gorge. Also several species of insects and mollusks were identified;
- *the geo-facets of the beech forest* (*Fagus sylavtica*) in combination with durmast (*Quercus petraea*), hornbeam (*carpinus betulus*), linden tree (*Tilia cordata*) or corneal tree (*Cornus mas*) is identified on the western slopes of the Turenilor Gorge, in the area where the Tur River exits the defile. This forest represents the habitat for several species of birds

like: *Corvus corax, Monticola saxatilis, Falco tinunculus, Phoenicurus ochruros* or *Oenanthe oenanthe.* The vertebrate fauna is represented by a series of mammals among which the fox (*Vulpes vulpes*), the badger (*Meles meles*), the wild boar (*Sus scrofa*) or the deer (*Capreolus capreolus*) are present.

3. 1. 2. The geo-systems in biostasy with paraclimaxic equilibrium

This type of geo-systems belongs to at present stable environments, but whose structure was slightly modified by the human interventions, without being irreversibly damaged. In the Turenilor Gorge, this type of geo-system is characterized by the alternation of agricultural lands used as hayfields or grasslands with wooded surfaces. Even though in the area the human intervention was present for several decades, the soil erosion is shallow, almost inexistent.

This type of geo-system is located within the Turenilor Gorge in the contact areas between the slopes and the western and eastern plateaus. The identified flora and fauna present similarities with the fauna identified in the previous category of geo-systems. Only a few plant species are an exception, especially those adapted to rocky and steep slopes (*Centaurea atropurpurea, Sempervivum marmoreum* and others). In the areas with abundant herbal vegetation species of reptiles, lepidopteres, insects and mollusks were identified, and in the areas occupied by forests, mammals (belonging to the above mentioned species) and bird species were identified.

3. 2. The geo-systems in rhexistasy

This category of geo-systems comprises the types of landscapes whose regressive dynamic and partially irreversible to the initial state is entirely determined and maintained by antrophic activities (agrarian, pastoral and touristical). These geo-systems are identified on the western and eastern plateaus of the Turenilor Gorge where crops (mostly maize and wheat) are cultivated. A second location of this category of geo-systems is along the Tur river valley (especially at the exit from the defile) this segment being the most intensely visited by the tourists and implicitly the most directly affected by the human intervention.

3. 3. The geo-systems in parastasy

In this category of geo-systems the natural equilibrium is entirely disturbed as a result of a strong human intervention manifested by massive deforestations and by the development of two stone quarries (at the entrance in the defile from the Tureni village and at the exit towards the Copăceni village). The extracted stone from these quarries is used to consolidate the households from the two above mentioned villages.

In this area, the soil erosion is accelerated, the vegetal coverage is entirely absent and the herbal vegetation is represented only by a few weeds. The abiotic elements are not in conformity with the natural potential, and the biotic components were obliged to reduce their natural habitats and to retrieve to more isolated areas non-affected by human intervention. Even though the anthropic pressure ceased in this part, the recovery to the initial state or to a similar one will occur in a long period of time (maybe never) due to the high degree of degradations of the natural components.

4. CONCLUSIONS

The geoecology of the Turenilor Gorge is extremely complex; the different systemic components identified possessing a large variety of characteristics. The types of geo-systems observed in the area of the Turenilor Gorge are in a continuous qualitative and quantitative change, their natural state being directly influenced by the anthropic intervention in the region.

The man, by means of its actions, has continuously modified and influenced the state of the environment and his actions were mostly irremediable with severe consequences on all environmental components.

Being a natural protected area, but not being acknowledged accordingly, the Turenilor Gorge represents a fragile natural system where the human intervention has to be made rationally in order to preserve the quality and quantity of the natural biotic and abiotic components of the environment.

R E F E R E N C E S

1. Cocean, P. (1988), *Chei şi defilee în Munții Apuseni,* Edit. Academiei Române, Bucureşti.
2. Cocean, P. (2000), *Munții Apuseni. Procese şi forme carstice*, Edit. Academiei Române, Bucureşti.
3. Baciu, N., Schuster, E., Creța, S., Isip, M., Schreiber, W. (2008), *The state of the agro - pastoral landscapes in the Transylvanian plain as a basis of cultural landscapes*, Infrastructure and ecology of rural areas, Krakow, pg. 211-214.
4. Duma, S. (2000), *Geoecologie*, Edit. Dacia, Cluj-Napoca.
5. Gergely E., Todea, V., Surd, Gh. (2002), *Tureni. Studiu monografic*, Edit. Casa Cărții de Ştiință.
6. Măhara, Gh. Popescu –Argeşel, I. (1993), *Munții Trascău, ghid turistic*, Edit. Imprimeriei de Vest, Oradea.
7. Pop, Gr. (2000), *Carpații şi subcarpații României*, Edit. Presa Universitară Clujană.
8. Săsăran E (2006), *Calcarele Jurasicului Superior - Cretacicului Inferior din Munții Trascău*, Edit. Presa Universitară Clujană.
9. Tudoran, P. (1982), *Structura, tipologia, dinamica şi evoluția geosistemelor*; Extras din volumul: Simpozionul „Evoluție şi Adaptare”, Cluj-Napoca, pg. 75-81.
10. Tudoran, P. (1983), *Țara Zarandului – studiu geoecologic,* Edit. Academiei R.S.R., Bucureşti, pg. 128-143.
11. *** Consiliul Județean Cluj (2008), *Planul urbanistic zonal Cheile Turenilor*, pg. 5-18.

NOTE: ***“Investing in people!”*** PhD scholarship, Project co-financed by the European Social Fund, Sectoral Operational Programme Human Resources Development 2007 – 2013. Babeş-Bolyai University, Cluj-Napoca, Romania.

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

THE ANALYSIS OF THE GENDER AND AGE GROUPS WITHIN THE LAND OF LOVIŞTEA

SIMONA – ELENA BOROGEAN[1]

ABSTRACT. – The analysis of the gender and age groups within the Land of Loviştea. The current paper presents the demographic resource of the Land of Loviştea in terms of the identified gender and age groups in order to assert the important demographic aspects within the studied area, the anthropogenic factor being the one responsible for the functionality of any regional system. This analysis will better indicate the trend, from an evolutionary point of view, of the population and also its direction of evolution which lately has became quite alarming: the result is the demographic decay of the population. Due to the fact that this demographic decay is characteristic for the entire national territory, several demographic policies are taken into account in order to darn or ameliorate the current situation and of course to eliminate the negative consequences induced by it (the decrease of the fertility and of the birth rate, the overgrown mortality, social, economical, financial or cultural disfunctionalities). None the less, many of these policies are being unsuccessfully implemented.

Keywords: *population, gender structure, age structure, demographic decay.*

1. INTRODUCTION

The approach of a geographic region in terms of its demographic component is extremely important, because it reveals exactly those characteristics of the human resource that gives to a certain region its uniqueness by emphasizing the main features of the present population and the materialization of its mental space.

The demographic structure of a land type region presumes the existence of a peculiar demographic consignment, displayed in different compartments, in the affiliation to a certain religion, and in the perpetuation throughout the time of the cultural and moral values. As a subcategory of the demographic structure, the age group structure is defined as a resultant of the assumed human existence, including the way of life, the health state of the population, the extent of the population's culture and education, the different aspects regarding the age and sex of the individuals of the population. A fact needs to be taken into account when the sex structure of a given population within a region is considered: there are two types of subpopulations, a masculine and a feminine one.

2. THE GENDER STRUCTURE OF THE POPULATION

The gender structure of the population presumes a dihotonic classification, with the manifestation of the masculine and feminine groups and with the exact framing of an individual to one of the two types of subpopulation groups. By analyzing this structure for the Land of Loviştea a dominance of the masculine gender can be observed. This aspect is materialized by the masculinisation rate with implications on the other structures of the

[1] *Babeş-Bolyai University, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail: simona_borogean@yahoo.com*

population and it is explained by the rural feature of the region and by the employment of the population in the primary sector of economical activity, the employment opportunities being mostly addressed to the masculine genders. This parameter can have severe consequences in the evolution of a given population, due to the fact that can strongly affect the matrimonial structure (the number of marriages) and the reproduction of the populations.

The gender structure population, in the Land of of Loviştea, in 2002

Table 1

Locality	Masculine	Feminine
Brezoi	48.73%	51.27%
Berislãveşti	50.63%	49.37%
Boişoara	49.61%	50.39%
Câineni	51.74%	48.26%
Mãlaia	50.05%	49.95%
Perişani	51.50%	48.50%
Racoviţa	50.97%	49.03%
Voineasa	49.91%	50,09%

In table no.1 the dominance of the masculine population can be noticed in the case of the Berislãveşti, Câineni, Mãlaia, Perişani and Racoviţa localities and the dominance of the feminine population in the case of the Voineasa and Boişoara localities as well as in the case of the town of Brezoi. This situation is especially due to the fact that the urban area offers employment possibilities for the feminine population as well (especially in the tertiary sector). The Voineasa locality posses an important touristical potential, represented by hotels, huts and restaurants. This entire tourstic infrastructure presents employment possibilities for the feminine population, while, in the rural areas the possibilities of finding a suitable employment opportunity is mostly addressed to the masculine population (especially in the case of the localities from the mountain areas – the case of the Mălaia village where wood exploitations are present).

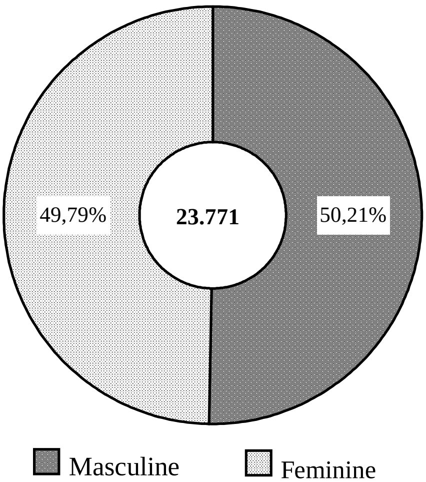


Fig. 1. The gender population structure in the Land of Lovиştea in 2002.

The two variables can be analyzed together, by means of the substructure of the age and gender group populations which presumes the calculation of the percentage of men and women for each separate age group. The representation of this structure can be made using a certain histograme, called the age pyramid.

By analyzing fig. 2, the following conclusions can be drawn:

- in the case of the town of Brezoi, the age pyramid can be defined as having an inferior basis, a middle part (representing the adult population) well represented and a sharp apex as a result of the numerical decrease of the elder population. This situation determines a regressive population, with reduced birth rate values and advanced rate of population decay;

- the age pyramid of the Berislãveşti commune has a relative patent shape, meaning that all tree age groups (the young, the adult and the elder group) are represented with relative equal values (a difference can be observed only towards the apex) defining a stationary type of population, in a semi-equilibrium state between the age groups; the elder population percentage isn't that advanced and the birth rate is within normal values;

- in the case of Boişoara, another type of age pyramid is present, with a narrow basis and an extension towards the upper part; in this case an elder population is present and the birth rate is reduced;

- the age pyramid of the Câineni commune has a sand glass – type shape where the young and elder population percentages are well represented; the percentage of the adult population poses reduced values, this model being characteristic for the stationary type populations;

- in the case of the Mãlaia commune, the age pyramid is patent, with an exception given by the 30-35 age group which is very well represented; the individuals from this group are in fact the result of the communist regime's prohibitions regarding the abortions. This situation is characteristic for the stationary-type populations and presumes certain equilibrium between all age groups;

- within the Perişani commune all three age group populations are represented, with proximate values rezulting a stationary type of pyramid;

- the Racoviţa commune posses a pyramid with progressive features, the existing exception being represented by the adult population which has a larger extent in comparison with the other two groups. This histogram defines the progressive type or young populations and presumes a high birth rate, a relatively reduced life expectancy at birth thus reducing the elder population's proportion;

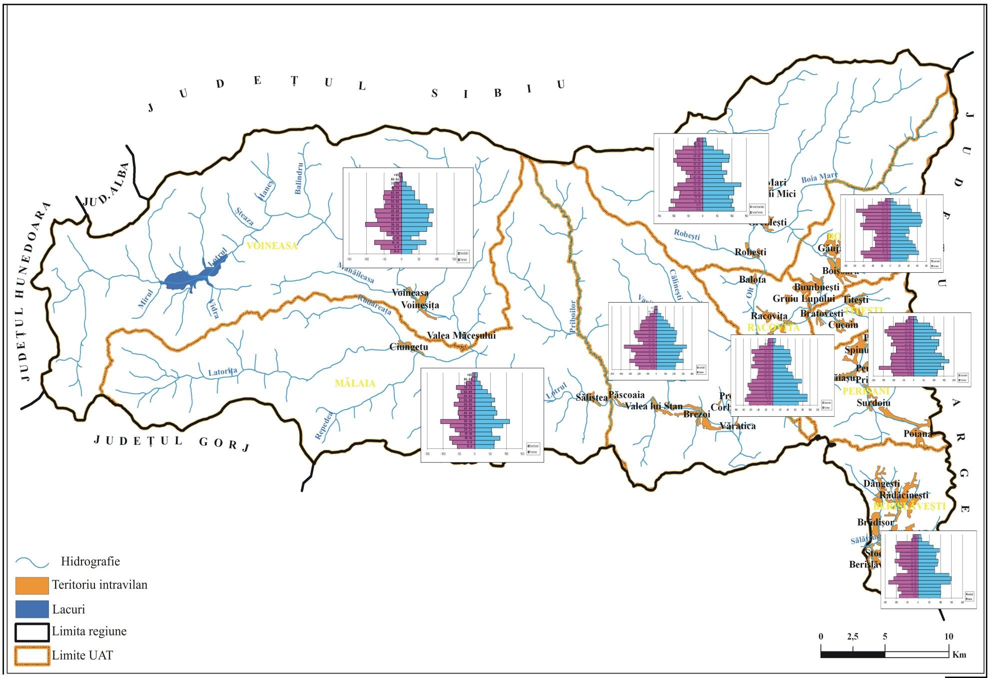


Fig. 2. The map of the age pyramids in the Land of of Loviştea, in 2002.

- the Voineasa commune presents a pyramid with narrow basis and apex, in regards to the adult population percentage. In this case the regressive-type populations are present, with reduced birth rates and advanced rate of population decay.

Each pyramid offers an entirely suggestive picture of the population of every locality, for the year 2002.

3. THE AGE GROUP STRCURURE OF THE POPULATION

This structure supports a trihotomic classification, three types of age groups being indentified: a young population, an adult population and an elder population. Depending on the author different classifications of these groups were made. Between this structure and certain dynamic indicators (birth rate, mortality etc.) a strong connection exists, due to the fact that the age group structure of a population is directly influenced by its occurrence throughout the time. As a division on several functional segments, we sustain that the population representing the middle group (the adult population) has the most important contribution to the economy of the region, while the peripheral groups (the young and the elder populations) play a smaller role and are considered as inactive or reliant.

Age groups in the Land of Loviştea, in 2002

Table 2

Variants	The young group population	The adult group population	The elder group population
I	0-14	15-64	≥65
II **Land of Loviştea**	0-19 **26.3%**	20-59 **51.2%**	≥60 **22.3%**
III	0-14	15-59	≥60
IV	0-19	20-64	≥65

The young – elder population ratio in the Land of Loviştea, in 2002

Table 3

Locality	Young population	Elder population	Ratio
Brezoi	28.5%	15.0%	1.89
Berislaveşti	24.2%	24.6%	0.98
Boişoara	24.2%	31.3%	0.77
Câineni	28.4%	25.9%	1.09
Mălaia	26.3%	17.9%	1.46
Perişani	26.2%	25.8%	1.01
Racoviţa	31.8%	22.2%	1.43
Voineasa	20.8%	16.0%	1.29
Land of Loviştea	26.3%	51.2%	0.51

Regarding the population in the Land of Lovіştea, an aging tendency of the population can be noticed. The current tendency is marked out by the increase of the percentage of the adult and elder populations in regards to the decrease of the percentage of the young population.

This trend represents the response of the human component to the limited potential of sustainability, combined with the decrease of the birth rate and the prolongation of the average life expectancy (the demographic transition), as a natural evolution of a given population due to socio – economic progress.

A population is considered young if the percentage of the total elder population is below 7%; is considered as being in the incipient phase of decaying if the percentage of the elder population is constantly between 7-12%; and if the percentage of the elder population passes 12%, then the population is considered as being elder.

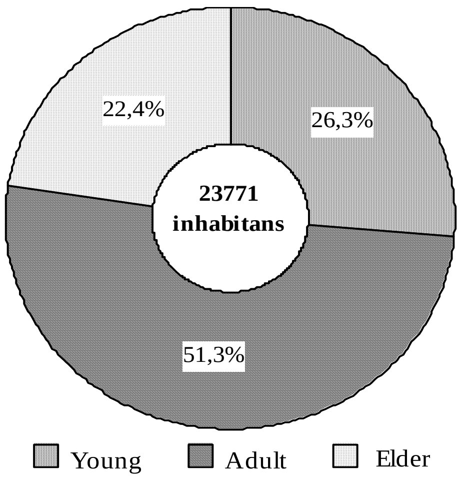


Fig. 3. The age groups population structure in the Land of Lovistea, in 2002.

The young–elder population ratio is very important for the future evolution of a population and can very well highlight the degree of the demographic decay. The threshold value for a population to be considered elder is 0.42.

In fig. 3, for the year 2002, the percentage of the young population was around 25% of the total population, while the percentage of the elder population was around 23%. The difference between the two groups is given by percentage of the adult population. The demographic decay phenomenon, quite evident within the Land of Loviştea, induces certain effects in the development of the economical and social activities.

4. CONCLUSIONS

The demographic situation of the Land of Loviştea is characterized by the aging tendency of the population (the increase of the percentages represented by the elder population vs. the decrease of the percentages of the young populations), by the emphasis of the masculinisation process (50.21% of the entire population of the Land of Loviştea are represented by men), by the increase of the reliant group population (as a result of the increase of the life expectancy) and by the numerical decrease of the population.

The demographic aging process of the population is a characteristic feature of the demographic transition and assumes the interaction of a series of demographic elements like the birth rate, the mortality rate and the migration rate. This phenomenon has a series of consequences, the most important being those of social (the social security and medical aid) and economical nature (the decrease of the labor productivity). Nevertheless, the aging process is irreversible, biologically natural and absolutely normal and it cannot be stopped, only ameliorated (from a demographic point of view) in terms of pro-natality policies in order to facilitate an increase in the number of children in every family.

All these aspects collaborate in order to create a unique demographic model maintained by a suitable for living and procreation physical place for the human element, which, throughout the history, by means of its "dimensions" occupied within the regional systems, defines itself as an important element in the genesis of the "land type regions".

R E F E R E N C E S

1. Cucu, V. (1981), *Geografia populației şi aşezãrilor umane*, Edit. Didacticã şi Pedagogicã, Bucureşti.
2. Ilieş, A., Staşac, M. (2000), *Studiul geografic al populație*i, Edit. Universitãții din Oradea, Oradea.
3. Nicoară, L. (1999), *Geografia populatiei*, Edit. Focul Viu, Cluj-Napoca.
4. Pop, P. Gr. (1972), *România. Geografie Economică, Partea I-a*, Inst. Pedagogic Oradea, Fac. de Istorie-Geografie, Oradea.
5. Pop, P. Gr. (1986), *România. Geografie Economică, Partea I-a, Ediția a II-a*, Universitatea Cluj-Napoca, Fac. De Biologie, Geografie şi Geologie, Cluj-Napoca.
6. Rotariu, T. (2009), *Demografia şi sociologia populatiei. Structuri şi procese demografice*, Edit. Polirom, Iaşi.
7. Surd, V. (2001, *Geodemografie*, Edit. Presa Universitară Clujană, Cluj-Napoca.
8. Vert, C. (2000), *Geografia populației şi aşezărilor umane*, Facultatea de Chimie-Biologie-Geografie, Secția Geografie, Timişoara.

THE PRIMARY FORMS AND STAGES OF INHABITING SIBIU DEPRESSION

ADRIANA MISACHEVICI[1]

ABSTRACT. – The Primary Forms and Stages of Inhabiting Sibiu Depression. From an archeological point of view, the territory of Sibiu depression can be included in the early stages of the process of anthropogenesis. Thus, the flint hand axe, the universal tool of the age, along with quartzite tools, silex scrapers, spearheads - all of them denoting the basic occupations of the age, namely hunting and harvesting - represent the Stone Age. The Neolithic period is archaeologically testified by the discoveries from Orlat, Șura Mică, Poplaca, Sibiu-Gușterița, Cristian, Cisnădie, as well as by the populations of farmers and shepherds, who were carriers of Vinca, Turda, and Petrești cultures. During the Bronze Age, around 1700-800 B. C. the demographic density increases along with the number of close-knit settlements, some of them being fortified, and the main occupations were agriculture and fishing. The Geto-Dacian civilization during the Bronze Age is best illustrated by the discoveries from the rural settlements such as Mureș Culture in southern Transylvania and the New Culture in southeastern Transylvania. The Dacian civilization from the Iron Age represented one of the most developed societies of the time, along with the Greek and the Roman ones. Hoards of metal objects, coins, smelting pots for metals, as well as adornments, represent the historical vestiges of the Dacian settlements discovered on the territory of Sibiu Depression. The process of Romanization, which had started long before the Roman conquest of Dacia due to the economic, political and cultural contacts, was accelerated after 106 A. D. The Dacians continued to live on the old territory, gradually accepting the new economic and socio-political framework established by the Roman rule, thus adapting to the new civilization, a process, which led to the birth of the Daco-Roman population. The Romanization continued even after the rule of the Roman Emperor Aurelianus, known in English as Aurelian (271-272 A. D.), and the process of Romanization itself suffered the influence of the Eastern Roman Empire, as well. Archaeological research on this period has revealed the progression and the evolution of settlements in time, and the hierarchical organization of dwellings against a background, which was predominantly agricultural. Thus, an economy based on agro-pastoralism, indicating a sedentary, rural life, is of significant importance for Bratei culture, spread throughout the entire territory of Dacia. It also played an important part in the development of the later autochthonous Ipotesti-Candesti material culture (6^{th}-7^{th} century A. D.) and especially Dridu culture (8^{th}-11^{th} century A. D.), which confirmed the continuous existence of the population in Sibiu Depression.

***Keywords**: anthropogenesis, hunter-gatherer; the Neolithic; primitive agriculture, the Neolithic Revolution, the Geto-Dacian population; The Bronze Age; the Iron Age, Daco-Romans, agro-pastoralist economy.*

1. INTRODUCTION

From a demographic point of view, the submontane depression of Sibiu, which is a significant part of the Romanian territory, represents the junction point of the population as well as a great potential of habitation. The present paper, based on a combination of a

[1] *Colegiul Tehnic"Independenta", 550341 Sibiu, Romania, e-mail: amisachevici@yahoo.com*

selective bibliography of historical records and personal field studies, is meant for apprehending the process of anthropogenesis and the life style from Sibiu Depression since ancient times until the late Iron Age, also known as La Tène culture.

Overall, this study is the result of the interaction between man and his environment, which is actually a symbiosis that bears the name of “material culture”, which is specific to each analyzed historical period.

2. THE STONE AGE

The multitude of archeological materials found on the dwelling sites, dating back to the lower Paleolithic era and ending with the Neolithic Age, is fully representative of the territory of Sibiu Depression.

2. 1. The Paleolithic Age or the Old Stone Age

The territory of Sibiu Depression has always been a heavy populated place, a bridge between past and future. The earliest traces of the anthropogenesis date back to Lower Paleolithic, which geologically corresponds to the period of the end of the Late Pliocene and the beginning of Early Pleistocene.

The Paleolithic discoveries from Turnişor and Şelimbăr consist of the old lithic industries, such as the pre-Mousterian ones, which precede the Mousterian culture. Silex pebbles, flaked stone tools or the flint hand axe for craving, known as the universal tool of the era and the first one to appear on the Transylvanian territory, belong to the Pebble or the Oldowan culture.

The appearance of some more elaborated techniques, such as the cvasi-rectilinear or lightly arched shelters, marks the beginning of the Middle Paleolithic, which, from a geological point of view, took place mostly in the Middle Pleistocene. Such a Mousterian shelter could reach two meters high and the structure of the walls consisted of big bones and thick piney branches, fixed at the basis in limestone and earth, and then covered with animal skins.

Another aspect of this culture is the one specific to the Mousterian man from the Carpathian caves. It reveals a rich inventory consisting in flint scrapers, slicers (racloirs) quartzite objects as well as simple hearths. Thus, hunting played an important role for the different group of Neanderthals living either in caves or in the open air.

Archeological discoveries from this period were made in Sibiu County, namely at Şelimbăr, Turnişor and on the southern terrace of Seviş brook, and they include the bifacial hand axe, as well.

The Upper Paleolithic presents several stages of development within its two cultures the Aurignacian and the eastern Gravettian culture which occurred during the Wurm glaciation.

Evidence of this period were discovered on the territory of Şura Mare and they consist of simple hearths or hearths with stones, lithic tools such as hammers, knives, spear points and objects with engraved motifs, and bone rests which together with wood represented the usual fuel source at that time.

Specific to this period are fires set on purpose to get treeless open areas between dwellings. At the same time, people used fire to signal more easily and in due time the possible dangers or attacks.

2. 2. The Neolithic Age

The Neolithic period, as Gordon Childe stated, represented the second revolution after the one of the anthropogenesis, leaving behind hundreds of thousands of years belonging to the hunter-gatherer and opening new perspectives to the man, who produced his own means of subsistence.

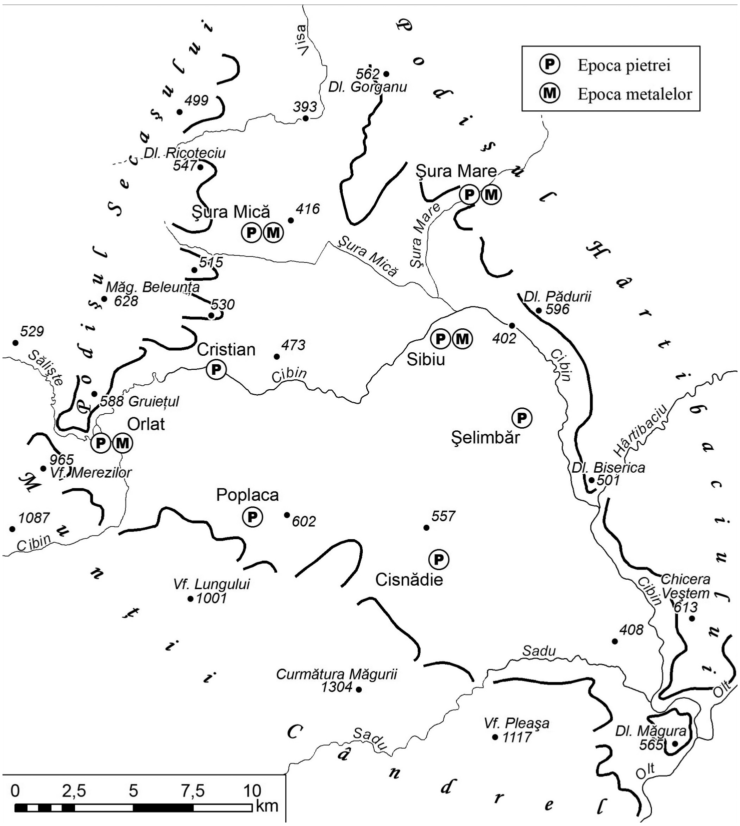


Fig. 1. Neolithical and Eneolithical discoveries in Sibiu Depression.

Man interfered into the natural environment by using primitive techniques for crop farming or the cultivation of various plants, using first the digging stick or the planter, then hoes, ploughs made of antlers, stone axes, flint or obsidian blades.

During the Eneolithic period, humans achieved the transition towards a simple form of agriculture by using the primitive plough and animal traction, by domesticating the horse and by using the stone axe for defores-tation as people ne-eded more land for agriculture and more wood for house building.

P = Stone age
M = Iron age

The archeological discoveries in Sibiu Depression dating back to both the Neolithic and Eneolithic periods were: the early Vinca culture (Orlat); Turdaş culture (Şura Mică); Petreşti culture (Orlat, Poplaca, Sibiu-Guşterița, Şura Mică); Coțofeni culture (Cisnădie, Cristian, Sibiu, Şura Mică).

People established the Neo-Eneolithic settlements, first smaller then bigger, in lowlands and in the valleys close to rivers, where they actually had better living conditions for a favourable development. Consequently, the sedentary lifestyle increased and as a result, there was a growth in population. People pitched fortified settlements with defensive ditches, palisades and natural slopes or earthworks in the exposed areas. The first dwellings within these settlements were the dugout shelters ("bordeie") or the adobe huts erected above the ground, with a rectangular shape and consisting of one or more rooms. The latter either had the flooring of trodden earth or made of chopped wood and clay.

In the last period of this era, we witness the "Neolithic Revolution" reflected in copper objects and tools or in the polychromic decorations used in pottery, and in agriculture where the wooden plough with either a stone share or one made of antlers replaced the hoe.

All these activities implied a greater effort for man and consequently, the patriarchate took the place of the matriarchate.

3. THE IRON AGE

The presence of the era of metals throughout the entire country was the result of the efforts and the intelligence of the Geto-Dacians, who represented the branch of the great, ancient people of Thracians to the northern part of Danube. They were the inhabitants of the charpato-danubio-balcanic space, and were called by Herodotus, "the Father of History", the most numerous and powerful people after the Indo-Europeans.

3. 1. The Bronze Age

The Bronze Age (approx. 1700-800 B. C.) appeared as a necessity of the time, when the Geto-Dacian had experienced the alloy of copper and tin, thus obtaining a more resistant metal than copper, namely bronze. The superiority of the civilization of this era was given by the numerous metal objects and tools people used such as sickles, bronze hammer, spearheads, arrows or daggers, by the ploughshare and the cart drawn by animals, and by metalworking (bronze and gold). Household handicrafts, the manufacture of pottery and jewelry (rings, earrings, and beads), the domestication of animals, and deforestation were specific to this era as well.

The form and social structure of organization was the community, which meant that its members held and used the land, the pastures and the waters in common, and they shared among them the crops. Yet, at the same time, we witness the emergence of the private property along with the common one, but in an incipient form.

The Geto-Dacian civilization during the Bronze Age is best mirrored in the discoveries from the rural settlements from Mureş culture in southern Transylvania and the New culture in southeastern Transylvania. The population density increased along with the number of close-knit settlements, some of them fortified as the one representing the Coțofeni culture discovered near Orlat, in the place called "Cetatea Scurtă". The most settlements belong to the Wietenberg culture, discovered at Şura Mică and Sibiu-Tilişca.

A special place in our country representative for the history of the Bronze Age is the great hoard of bronze objects and tools (approx. 1000 B. C.) discovered at Guşterița. The great variety of forms and the huge amount of raw material proves the existence of a workshop for casting bronze, whose activity might be due to the salt mines from Ocna Sibiului. Another settlement in Guşterița belongs to the New Culture, dating back to the transition period between the Bronze Age and the first Iron Age, namely Hallstatt (approx. 800-300 B. C.).

3. 2 The Hallstatt Culture

The Iron Age, by processing and using the new metal superior to bronze, "revolutionized" not only the agriculture, but also the development of the Geto-Dacian society from an economic, political and cultural point of view.

The social form of organization was still the community, yet established according to the socio-economic interests and not on kin relationships, specific to the previous stage.

From an economic point of view, there was a gradual extension of the private property over the common possessions resulting in the rise of a dominant social layer, namely the "tribal aristocracy".

The evidence of the society during the Hallstatt culture within Sibiu Depression demonstrates its significant progress, thus being one of the most developed societies of the time, together with the Greek and Roman one. The archeological discoveries brought to light different objects such as vessels for storing supplies, smelting pots for precious metals, Dacian cups, pots, plates, fuel lamps, pottery with painted geometrical shapes resembling natural elements, jewelry (rings and ear rings) and silver vessels. The archeological discoveries belonging to Hallstatt culture consist of both settlements (Sibiu-Tilişca, Şura Mică) and of metal objects from Sibiu- Guşteriţa and Şura Mică.

3. 3. La Tene Culture

The historical vestiges discovered on the territory of Sibiu Depression prove the existence of a large population inhabiting this area during the period of La Tène culture.

The Dacians from this period belonged to a first form of the slave state, which was under the rule of Burebista and later of Decebal.

The thesis of the continuity of the Dacians under the Roman occupation in the 2nd and 3rd century A. D. is sustained by both archeological documents and numismatic evidence, namely a copper coin from the time of Constantine I, also known as Constantine the Great (306-337A. D.), and more coins from the period of Gratian (375-383A. D.), which were discovered at Sibiu- Guşteriţa. Moreover, a denar (lat. denarius) from the reign of the Roman emperors Vespasian (69-79A. D.) and one from the period of Valens (364-378A. D.) were discovered at Şura Mare. Two bronze coins, one since the reign of Constantius Chlorus (293-306A. D.) and another one dating back to the time of Theodosius II (408-450) were found in Sibiu-Turnişor. These coins, present on such an extended area, represent an indisputable argument for attributing them to a majority of autochthonous population. This was the Daco-Roman population, who remained here after the Aurelian's withdrawal of the Roman troops from Dacia to the south of the Danube. Thus, the territory of Sibiu Depression, like the rest of the entire post-Roman Dacia, continued to be inhabited by rural close-knit communities, which were more numerous here than in other areas, and which represent the proof or the guarantee of their continuity when confronted with the eastern migratory populations. In this respect, indisputable evidence is Bratei Culture, which attests the continuity of the old Daco-Roman culture developed within an autochthonous framework, preserving the influences of the migratory tribes. This culture based both on a mainly agro-pastoral economy and on handicrafts, during which people led a sedentary, rural lifestyle, spread both throughout the entire territory of the former Roman Dacia and outside it, dating from the period of Huns until the invasion of the Slavic people. Thus, there is a gradual progression and evolution of settlements as well as a hierarchical organization of dwellings between the 4th and the 13th century. Specific to this time span are dugout shelters ("bordei") with earth ovens or cooking pits, and an open hearth for pottery pots, placed in the middle of the room. Bratei culture played a significant part in the development of the later autochthonous material cultures that followed it, namely Ipoteşti-Cândeşti (6th-7th century A. D.) and the well-known Dridu culture (8^{th}-11^{th} century A. D.). The features of the latter were revealed within Sibiu Depression, more exactly in the cemetery from Sibiu- Guşteriţa similar to the one in Mediaş. The former can be attributed to the local population between the 8^{th} and the 10^{th} century.

4. CONCLUSIONS

The earliest forms and stages in the process of populating Sibiu Depression are the result of a long and dynamic process, accomplished by the human communities through the diversity of their activities, which have succeeded and have overlapped each other in time. Thus, there has been a transition from the prehistoric man living under the strong influence of the geographical environment (namely by caves, islets and the hard-to-reach terraces), to the transformation of the physical-geographical environment along with the development and improvement of the stone and copper tools. The largely sedentary life style led to an increase in the number of Neolithic settlements, where one observes the general tendency to set up houses with treeless areas between them, paving the way for the future lanes of the villages, which turned into earth and timber, fortified settlements during the Bronze Age. The next eras, namely those of the Thraco-Geto-Dacians and the Daco-Romans, reflect a more intense process of populating areas, especially during the Iron Age, when villages differentiate themselves from the later fortresses. The indisputable evidence of the later autochthonous material cultures present in Sibiu Depression, prove the permanent continuity of the local population against the background of the formation of the Romanian people.

R E F E R E N C E S

1. Childe, G. V. (1966), *Făurirea Civilizaţiei*, Bucureşti.
2. Crăcea, T. (2008), *Dinamica peisajului geografic reflectată în documentele cartografice în Depresiunea Sibiu*, Edit. Universităţii "Lucian Blaga", Sibiu.
3. Dumitraşcu, S., Togan, G. (1974), *Cimitirul de la Boarta-Pârâul Zăpezii-Şoivan*, în Studii şi Comunicări ", Arheologie-istorie, Muzeul Brukenthal, Sibiu.
4. Dumitrescu-Jippa, A., Nistor, N. (1976), *Sibiul şi ţinutul în lumina istoriei I*, Edit. Dacia, Cluj-Napoca.
5. Herodot-*Istorii, V, 3, in Fontes ad historiam Daco-Romaniae pertinenentes, I,* pag. 68, Bucureşti, 1964.
6. Luca, S. A., Pinter, Z. K., Georgescu, A. (2003), *Repertoriul Arheologic al Judeţului Sibiu,* Edit Economică, Bucureşti.
7. Nestor, I., Zaharia, Eugenia (1973), *Raport preliminar despre săpăturile de la Brateiu, jud. Sibiu (1959-1972, în Materiale si Cercetări arheologice, X,* Bucureşti.
8. Pascu, St. (1983), *Ce este Transilvania?,* Edit. Dacia, Cluj-Napoca.
9. *** (1984), *Geografia României, II, Geografie Umană şi Economică*, Edit. Academiei R. S. R., Bucureşti.

STUDIA UNIVERSITATIS BABEȘ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

THE STARTING STRUCTURE OF THE POST-COMMUNIST CITY'S SOCIO-SPATIAL DYNAMICS. OBSERVATIONS ON TWO COUNTY SEATS: TÂRGU JIU AND RÂMNICU VÂLCEA

SIMONA MĂLĂESCU[1]

ABSTRACT. – The Starting Structure of the Post-Communist City's Socio-Spatial Dynamics. Observations on Two County Seats: Târgu Jiu and Râmnicu Vâlcea. The reasons for the interest shown in the attempt to understand the initial structures which were the starting point in the transition period – namely the structural framework created by the communist system – stems from the theoretical, mostly realistic commitment of the analysis of the urban socio-spatial structuring during the period following 1989, of the two county seats found in the sub-carpathic sector bordered by the rivers Jiu and Olt. The spontaneous, natural structuring of the urban space after 1989, especially when seen from a social perspective, can be grasped when we first understand the social limitations which characterized the previous period, and the superposition of an adjustment effect caused by a series of non-manifest effects which had been accumulating over the free development stimulation, in the post-communist context. The limitations enforced on the dwelling expression of the social status as well as on the aspirations for personal comfort were dictated by the residence's legislative spatial, location, and surface limitations, those of the style and architecture and of the comfort it could illustrate; there was also a symbolic limitation determined by the ideological threshold of the age of equalitarianism and proletarianism, which circumscribed the expression of personal needs, architectonic aspirations, or needs regarding quality and comfort. The study's conclusions reveal the fact that in the context of such a legislative framework, the social differentiation and the social structuring could have taken place openly in any other parameters but those of the possession of goods, dwelling comfort, income and real estate properties. In an era of electricity consumption limitation, of that of the number of illumination sources, food and fuel rations, the expression of welfare and social status could be materialized in any other form except the residence's size, the dwelling comfort, and the prosperity of daily life. Evaluating the building stock, once the communist endeavour of erasing the social differences was over and the communist equalitarianism has triumphed even in the sphere of the housing space, the latter could no longer (re)present a "social mark".

Keywords*: transition, urban systematization, Târgu Jiu, Râmnicu Vâlcea, dwelling surface, residential area.*

1. INTRODUCTION

From the perspective of social geography applied to the urban spaces, the period from 1990 to 2007 can be regarded as a period of transition from the social structuring equalitarianism and the norms of urban planning, to the expression of social difference within the built urban space.

[1] *„Babeş-Bolyai" University, Faculty of Geography, 400006 Cluj-Napoca, Romania, e-mail: smalaescu@geografie.ubbcluj.ro*

The theoretical commitment, a mostly realistic one at that, justifies in this sequence the concern to understand the initial structures with which the transition period began, namely the structural framework created by the communist system. This frame gradually opened, allowing for narrower of wider niches (larger for some of the socio-professional categories that possessed substantial social and economic resources, and narrower for those caught up in the pauperization's downward spiral) that at least for a certain amount of time have determined the apparition of a residential socio-economic mixture in almost every case of residential districts later designated as belonging to the population with a superior status. Furthermore, in the *welfare suburbanization* (Timar, J., 1999 quoted in Kovacs, Z., 2002) phenomenon for instance, it is most likely that the differences recorded in its emergence in the studied area (and possibly not only there) vis-à-vis the way the same phenomenon took place in the north American and west European spaces, *are explained by the different starting structures*. They clarify most of the differentiations' variability which appear between the two categories of spaces (a post-communist one and the other two) and implicitly the explanatory theoretical models. This is also why in this study we are concerned with the legislation and the regulations of the spatial and residential planning, as well as with the regulations of the economic status and life conditions during the communist regime. *The spontaneous, natural structuring of the urban space* after 1989, particularly when seen from a social perspective – a *quite accelerated* one for such a short period of time, especially when it is related to the economical, political and social realities of the Romanian milieu – can be grasped when we first understand ***the limitations*** *of the previous period, and the superposition of an* ***adjustment effect*** *caused by a series of* ***non-manifest effects which had been formerly accumulating over*** *the* ***stimulation of free development, in the post-communist context.***

As G. Enyedi (1998) pointed out there were social differences in the egalitarian society, but they were associated with the social position and not with the property. Why so? Why was the status associated with the profession, the occupation or with the function[2] (sometimes the political one, within the communist party)? Because the *economic dimension of the social comparisons* and *of society's structuring* was *blocked* by the means of legislative regulations. In addition, the social dynamics was carefully monitored and the **equalitarianism** concerning the possessions, savings and financial income (see also the legislative regulations concerning rents, foreign currency income and the income earned abroad), the number and type of residences one could own (see also the law for residences, secondary residences and holiday houses – Law no. 4/1973), their surface and that of the households, was the key element in the structuring of the communist society.

2. THE SYSTEMATIZATION LAW AND THE RESIDENCE LAW – NORMS OF THE SOCIAL-URBAN DIFFERENTIATION AND STRUCTURING LEVEL

The limitations imposed on the *locative expression of the social status* as well as on the *aspirations towards personal comfort* were given by the legislative ***limitation*** of the ***residence***'s space, ***location*** and ***surface***, the limitation of the style, architecture and comfort

[2] Or just up to the point where it would have become a disadvantage (the "unhealthy origin" cases); it was associated with the one's lineage (belonging to a family of intellectuals with modest economic means, a fact reflected in what they possessed was an advantage, while coming from a noble family with a superior economic status was a clear disadvantage). For such a period as that following the Second World War, when the political regime was changing, the nominal scale for the evaluation of the socio-economic status – as it is conceptualized in its widest meanings – became extremely relative, if it was not actually shattered.

shown, and by the symbolic limitation determined by the ideological threshold of the age of equalitarianism and proletarianism, which circumscribed the expression of personal needs, architectonic aspirations, or needs regarding quality and comfort. On the one hand, the former limitations were regulated through the *location conditioning* by the means of the systematization norms (Law no. 58/1974 regarding the territorial planning and Law no. 4/1973 regarding the residences) operating both in the rural and the urban spaces, reflected in the surface, and the residence type related to the property control. On the other hand, the latter were controlled by legislative norms which went beyond the dominant symbolical ones referring to the aesthetical and architectural rules of the new regime, opposing the "decadent bourgeois" one.

The possibility of developing one-family house districts like those that appeared in the second half of the transition period, was blocked by the Systematization Law, which even in 1974 *limited the expansion of the spaces for residential buildings in the urban peripheral areas* for the benefit of the agricultural lands. Once the limits of the building area were set, they could no longer be transgressed, except for the case of agricultural terrains that were "degraded and unsuited for agriculture" (Art. 3, p. 372), or in the exceptional case of a presidential decree (Art. 3). The same article forbids[3] *the expansion of the infrastructure in new spaces*, ***the density of the residences and implicitly of the dwelling surface*** per hectare, being regulated depending on the nature of the terrains ("In the case of housing ensembles located on weak, irregular terrains with great level differences, onto which constructing residential buildings would not be economic, a minimum density of 3800 m² of dwelling surface pro hectare will be ensured"(Art. 8)) or the number of levels a building had[4].

Withdrawing towards the periphery, away from the agglomeration and the noise was unconceivable, because the development was strictly directed ("The construction of dwelling places will be started chiefly from the centre of the localities towards the marginal areas, ensuring that the ensembles built will have increased densities, thus creating conditions for the continuing restriction of the building areas" (Art. 9)). The norms regarding density implicitly favoured the urban architectonic (as well as social) fusion.

The private land surface assigned to building was completed by Law no.4/1973 regarding the development of the construction of houses, the selling of houses belonging to the state to the population and the construction of holiday houses (personal property). To this respect, at the beginning of the 90's the limits demarcating – within the building perimeter – the residential areas considered to be "good" ones (social prestige and living conditions) or those belonging to a favoured segment of the population, consisted of the same type of buildings or properties in both county seats we are referring to. These buildings were not excessively large, a necessary condition in order to keep their individual trait[5], however sufficiently large so that they would provide some comfort above average and the specific characteristics of the individual residences. The existence of such "good

[3] "It is forbidden to execute works for the networks of electric energy distribution, water supply, sewage, streets and other technical-edilitary endowments for the buildings situated outside the building perimeters." (Art. 3, p.372, Law no. 58/1974).

[4] "In the new housing ensembles, depending on the average height norms of the buildings, the following inhabitable surfaces will be ensured per hectare: up to 3 levels, 4000m²; between 3 and 5 levels, from 4500 to 7000 m²; between 5 and 9 levels, from 7000 to 10000 m², and above 9 levels, it should be pursued to ensure approx. 12000 m² of inhabitable surf ace per hectare" (Art. 8, Law no. 58/1974).

[5] A necessary condition in order to keep their individual trait – the large buildings were nationalized (and their current residents belonged to a very different category of socio-economic status than the previous ones).

areas" was determined by the previous existence of individual properties – composed of a ground, and a first floor, or just a ground floor – later circumscribed within the building perimeter in accordance with the regulations of Law 58/1974. In the city of Râmnicu Vâlcea such buildings forming compact spaces (streets) are less present in the memory of the inhabitants as areas that could be labelled good, considering the socio-economic status of their residents, because they were scattered among other types of buildings. Nevertheless, sectors of the Carol I, G-ral. Magheru, G-ral. Praporgescu streets and the Regina Maria Boulevard, as well as the former *"Officers' district"* stand out.

In the spaces abutting the urban area, having the legal-administrative status of rural spaces at that time, these possessions were private within the limits of 250 square meters; anything surpassing this limit remained in use just as long as the building did – *buying/selling and destroying that building in order to build another one entailed the limitation of the surface to 250* m²: "the surface of the terrains in private property (…) which exceed 250 m² (…) will be included in the calculation of the lot given for use(…). The right to use the ascribed terrains is given for the duration of the building's existence, with the payment of the use tax established for the terrains destined for the construction of dwellings, in compliance with Law no. 4/1973" (Art. 17. L. 58/1974, p. 380)).

Since this was just one of the examples of the restrictions imposed on the real estate market of that time, we can understand the results when we consider the degree of freedom in which it was allowed to develop freely and functionally.

The dwelling surface. According to Law no3/28.03.1973 the „locative norm", in the case of the state residences was of 10m²/person, which could drop down to 8 m²/person if the surfaces rooms resulted after the construction proved to be too small (Art.6). What surpassed this „locative norm", was the "excedentary surface" (Art. 7): this surface was the legal space which was dedicated to the „tenants", in the large abodes of the previous regime; this measure reduced a family's supplemental comfort to one or more supplemental rooms above the „locative norm", only when the particular activity of the inhabitants of their health required an individual space – and only then.

Another element regulating the comfort and the quality of living, besides the regulations regarding the dimensions, was the *quality*, namely the tendency towards uniformity and norm, as there were stipulations on the materials to use, the alignment and the height of the residences, pre-defined construction projects and their "re-utilizable" character[6].

Social differentiation was limited not only when it came to the size of the residence, but also to its comfort and mobility, through the decrees which limited the fuel consumption – restricting mobility (Decree no. 720/17. 11. 1973, the 3rd Annex of which also restricted illumination and heating) – and the construction, selling and repairing of residences and vacation houses (Decree no. 175/30.07.1974).

[6] (Art. 10): "The accommodations constructed with state funding or with the population's resources and the support of the state in credits, will be built in compliance with the legal norms, based on type projects, directive and *reusable*" (*i.a.).* The residences built in overhead by the population will be built in conformity with the alignment and height regime (…)"."To this end, the executive comitees of the couciles are compelled to elaborate and make available to the citizens who are building residences a wide range of type projects with efficient solutions, that will *stipulate the use of local, cheap materials* (we have added the italic), so that the citizens may choose the most suitable project."

3. THE FUNDAMENTAL STRUCTURES OF THE COMMUNIST URBAN SPACE – THE STARTING POINT OF THE POST-COMMUNIST CITY'S EVOLUTION AND ITS DIFFERENTIATION FROM THE CLASSICAL THEORETICAL MODELS

When seen as a whole, the relationship between society and dwelling is complex and bilateral. As opposed to the societies with a long capitalist tradition, the Romanian society – or at least the regional traditional model we are focusing on – emphasizes the individual trait, the household, the accumulation of personal capital and wealth, or in other words, *the property* and not *the temporary use*[7] - all this is a reverse of its historical past: the dispossession from the dawn of the communist period, the rush for possession once the era of "*common goods*" and *equality* was over, after it had erased the personal marks and the individuality the socio-economic and professional status could provide. *The structure differences which form the basis of the residential areas' shaping are as profound as their visible result.* The dynamics of the property's private character during the transition period, as well as that of the consumption of goods or of the use of services followed the general patterns, without necessarily being explained by the increasing wealth levels (at least not proportionally) as the differentiated dynamics was in itself a source of capital amassment – the best way to boost or maintain one's capital was that to invest it in real estate properties.

Moreover, the traditional property pattern, especially the one of the individual residences in the traditional society defining the studied area, and the traditional residential attachment converge towards buying or building a dwelling place, with the intention of keeping it for the rest of one's life – a pattern that does in no way fit the contemporary north-American societies (probably the most "mobile" ones today) or even the west-European ones, if not those harboured by these spaces prior to the Second World War (Pain, R. *et al.*, 2001). Not only does property allow *the accumulation of capital* based on this differentiation, it also provides an immense moral comfort and symbolic security (as opposed to the communist period when residences were allotted and people depended on the professional or party leading structures) and *a crucial* – actually, the most efficient – *form of passing on the wealth* to the heirs.

In the case of Târgu Jiu, constructing or modernizing a residence in the urban (preferably central) space as an expression of the privileged social status, was typical to the early phase of the transition period, when the development of the residential spaces was just beginning to take shape and it was reserved to the newly emerging elite of the higher socio-economic status. The second phase involved more people: it was a period when residences were bought and built in new, compact districts erected on terrains that were previously used for different purposes: agriculture – animal breeding – in the case of the Primăverii district; arable surface - Pandurii–Digului in the Târgu Jiu area, Bujoreni in the Râmnicu Vâlcea area; improper terrains, marshes – Pandurașu in the Târgu Jiu area. Within this second phase, one further in time from the moment when the legislative restrictions of the former regime were abolished (probably because it was a phase when people accumulated the necessary capital, on an individual level, whereas the society social differentiation appeared), there are two other phases to be found: one when terrains were procured –

[7] Generally, in the field of private real estate investors, the state policies still favour the second form, namely the ANL residences and the social houses.

between 1997 and 2000 –, and another one when the utilities were being acquired and the buildings were erected – from 2003 until present time. In the case of the city of Râmnicu Vâlcea, the temporality was synchronic in the southern sector and a lot more advanced in the north, where the owners were partially replaced and possessions remained vacant, for various reasons. This latter phenomenon (with the exception of the Primăverii district in Târgu Jiu) – namely that of obtaining properties as compensation (or following the dislodgement from various rural localities, determined by the expansion of quarry exploitations) and leaving residences vacant for a very good price, dictated by their increased value on the real estate market – is exceptionally rare considering the *attachment* and *the extremely long life span of a residence* built in these spaces.

4. URBAN RENEWAL: THE VISIBLE SIDE OF THE URBAN SPACE'S TRANSFORMATION

As it was to be expected, the urban renewal did not take place instantly but with certain latency, and there was no spatial advance gradient, with a uniform direction or rhythm (from the periphery towards the centre or vice versa). Analysing the visible side of this process, it seems it had a sporadic development, being possibly directed from the individual to the public or state property (individual only at the beginning; the public buildings or those that were still nationalised or retroceded, were involved only after the year 2000). From this point of view, the most dynamic zones have been perhaps the semi-central ones – with one-family residences, the owners of many of which have changed during the studied period – as the peripheral areas were later drawn into this process, and in its later stages it took place almost everywhere uniformly, even in the ultra-central areas (later here, due to the retrocessions).

Moreover, another step (taken somewhat later than in the case of the one-family buildings) was to improve the way the apartment buildings – a constant in these spaces – looked like, because their deteriorated aspect and the marks of the urban incivilities they had endured, especially in the peripheral, workers' districts, was and still is a barometer of the social issues. The presence of collective buildings with renovated facades and interphone is also a barometer of the civic spirit and of the feeling of pertaining to a community, proper to a higher socio-economic status (which used to be constant throughout communism and transition) and it represents the specific attribute of the semi-central and central areas.

In trying to establish which factors hinder or stimulate this process and whether there is such a thing as a social dimension at the very basis of (or attached to) this process, the contribution of the real estate market and its mechanisms is obvious, as it determines a change in the residential function of the buildings by raising the prices in the central areas; the rest of the elements involved here are not as clear in the absence of a detailed analysis.

The central areas defined by the presence of buildings constructed between 1850 and 1945. The central areas of the county seats we have studied (especially the city of Râmnicu Vâlcea), are defined by the use of the buildings constructed before 1945 for the construction of the civic centres, symbols of the communist era (the ideological-symbolical-architectural reshaping of the centres which were soon transfigured into symbols of the "socialist victory"), because they had all the strong points of the targeted group[8] of cities of the communist systematization process.

This is why the presence of compact spaces of old buildings that have escaped the urban reshaping and planning, with a similar extension as that of the districts, are not generally characteristic and especially not in the central areas, because this stock of old buildings with historical and architectural value – in particular those with residential use – is quite small and less compact, spatially speaking. This architectural fund is on the one hand, directly proportional to the regional historical importance of the two cities[9], and consequently with the richness of the specific forms of urban life in comparison to the city of Craiova – the centre of the historical province, and on the other hand, with the radical, although different fashion in which the two cities[10] have been affected by the communist urban remodelling.

Due to the radical transformation the two county seats have undergone, they belong to the category of the most severely affected cities, namely "*cities with fundamental ruptures*" (Ianoş, I., 2004, p. 68), following a categorization based on this criterion (Ianoş, I., 2004). Just as, for comparison, all the other urban localities from the whole of the sub-carpathic area between Olt and Jiu have been included in the last category of the transformations' intensity, namely that of the "*cities with insignificant ruptures*".

Whereas the city of Târgu Jiu has preserved a compact part of its central sector (between Victoria street and Constantin Brâncuşi Boulevard) as well as a series of other semi-central arteries with almost all of their buildings (Tudor Vladimirescu, Bradului, Republicii, 1 Decembrie), the city of Râmnicu Vâlcea underwent a radical reshaping and as a consequence it is the object of a number of causal analyses.

C. Mateescu (1999) puts forward controversial opinions according to which the city's initial central nucleus was, at the time of the complete demolition and reconstruction, dominated to such an extent by improper and poor houses that the process could partially be justified, as the area needed total eradication and reconstruction. Nonetheless, buildings belonging to the main street front, with historical or architectural value have fallen alongside these groups of dwelling places, as this city was subjected to one of the most drastic destructions the pre-communist architecture has suffered. What we can extract from here is that there was a "*slum*" centre, at least in as much as the secondary front of buildings and the interior facades of the courts and buildings were concerned, where there was a fund of poor dwelling spaces, highly degraded, with improper sizes, which concentrated a modest segment of the population – the urban replacement occurred after the architectonic reshaping. This type of enclaves dominated by over-population of old improper buildings exists to this day, at least on the interior front of the streets situated in semi-central and peripheral areas where the houses have survived.

---

[8] Part of the national urban planning programme ("the civic centres of all the *county seats* have been urbanistically renovated") (*Geogr. Rom*. 1984, p. 503) and the "reorientation (of the urban planning) towards the medium towns' category (20000-100000 inhabitants) which give far more harmonious dimensions to the city, thanks to their ballanced size (such as Deva, Suceava, Târgovişte, Târgu Jiu etc.)" (*Geogr. Rom*. 1984, p.504).

[9] There is a completely different situation in the case of the polarizing regional centre where this type of real estate is larger and more compact. Lipscani-Centru for instance, in which case, despite the fact that there was a symbolic centre of the communist period, compact, priceless "architectural reservations" have survived.

[10] The city of Râmnicu Vâlcea, except for a few symbolic buildings which have been spared, was almost completely remodelled.

According to C. Tamaş (1989) between 1966 and 1985, in the city of Râmnicu Vâlcea, 21000 apartments have been consigned, the housing stock consisting of 24000 apartments at the end of the communist period, which lead to the conclusion that almost 90% of the population had changed their home with a new one. Under such circumstances, the urban landscape mutations and the social and urban restructuring of Râmnicu Vâlcea become transparent and explainable.

In the city of Târgu Jiu, the old buildings of high architectural value have been and still are generally possessed by the same families, their descendents or by people belonging to the same cultural, social and occupational universe. This situation is partially due to the fact that as the cities were not very large, *their demographic size* of that time *has consequently generated a dimensioning of the social structure, namely a* ***medium*** *economic level of the people with a superior economic status* which had existed before the communist era (when the property laws were altered) – reflected in its built residential expression – the size of the buildings – which *allowed its survival, on the fringe of that legislation and in its concrete form (the residence and its respective terrain)*, because it did not hinder the socialist egalitarianism[11], although their professions, professional and ideological freedom, social status and living standards were deeply effected[12].

On the other hand, the fact itself that this social category was not composed of important industrialists or landlords, but by a socio-professional category centred on the professional level (the presence of superior studies in practical domains generally respected in both regimes) and not on material gains, real estate possessions or flourishing businesses, has enabled it to survive easier, especially in its concrete form – the *possession* of goods and buildings – even though the privileges, the living standard of the socio-economic standard no longer justified the appartenance to this social category. This situation is supposedly also present in other Romanian cities of similar sizes.

As a result, a number of almost intact streets have managed to cross the communist period and to preserve the same socio-professional profile of their residents to this day, and most importantly the status of good residential areas (the “respectable” areas and streets that during communism had defied proletcultism and ideological proselytism, and had not become “decadent” and “small bourgeois elements”): Bradului, 11 Iunie, Republicii, Calea Eroilor (Târgu Jiu). The streets where the buildings had been nationalized because of either their sizes, their residents’ “unhealthy origin” or their emigrating to the USA or Europe after the political regime had changed, are the former *Ulița Domnească* and *Victoriei* street of Târgu Jiu, and Carol, Regina Maria or Mihai Viteazu Boulevards of Râmnicu Vâlcea (fig. 1).

As the pilot interviews have revealed, the awareness of the existence of such “good” areas – from the perspective of the socio-economic and professional character of the residential weight, better coagulated spatially – is a lot more obvious for the inhabitants of Târgu Jiu, and weaker, not as clear for those of Râmnicu Vâlcea (except for the new northern districts built starting from “green grass”).

[11] Tredding on the edge of the legal framework concerning the possession of residences and the terrains’ dimensions (Law no. 58/1973) some of the properties remained in the possession of their rightful owners, because they were not very large, and have therefore been preserved along with the streets or the residential areas they were situated in.

[12] Professional degradation from one’s job or function, the worsening of the living standard, the constant monitoring, the obstacles one would face when trying to get a promotion or professional advancement.

In order to explain this perception one could also resort to the idea that the far more radical reshaping of Râmnicu Vâlcea and its more substantial architectural losses have reached their **secondary goal:** ***destroying the expression and the symbols of the actual existence of a different, superior socio-professional class – the "social" homogenization of the collective mentality is far more obvious.*** So obvious in fact, that both due to their isolated spatial positioning – outside the areas frequented by the majority of the population – and their restricted and controlled access, the existence of present forms of residential areas pertaining to the highest socio-economic segment is supposed to be just as absent in the mind of a quite large portion of the population.

In the Romanian context, the vast majority of the central residential areas with one-family buildings have never been residentially poorly developed. They have always belonged to a segment of the population with a high social standard (except for, perhaps, the tenants in the nationalized buildings or a building front which was not in contact with the street front), a status which also extended over the apartment buildings.

A part of the fund of buildings situated in the centre and inhabited by modest families which give the dwelling buildings a modest aspect, have gone through a continuous process of liquidation and radical replacement with buildings specific to the urban architecture of the "civic centres", ever since the 1970's, a process that went on even after the revolution of 1989; therefore we now only have remains of the modest, old residences with a neglected aspect, which cannot constitute a rule.

Fig. 1. Mihai Viteazu street from the former *"Officers' district"* (Râmnicu Vâlcea): a relict rezidential area highly valorized in the communist period, among the few that has not been a victim of the ideological-architectural remodelling.

Fig. 2. Târgu Jiu. Urban renewal and the functional turnover in the preexistent architectural communist remodelling building stock in the central area case. An Olteniței St. prophile.

a. Perspective towards Olteniței St. entrance from the central entirely demolated and reconstructed in the communist period (Victoriei St.). In 2008 again in an urban architectural remodelling process and a pedestrian landscape changing of the central area; **c-g:** buildings in the process of urban renewal in different sectors of the Oltenița Street from Victoriei Street towards Constantin Brâncuşi Boulevard illustrating two transformant gradients orientated on the same direction, caracterising the entire sector: (1) the gradual renewal **(e)** of the buildings caracterised by the old architecture with the modern ones in order to be entirely replaced in the Brâncuşi Blv. end **(g).** In the same time in the Victoriei part of the street **(e)** the old buildings are renovated (**d**) and respectively (2) the gradual modification of the function from a mainly residential one regardless of the owner status **(d-e),** in tertiary destinated buildings (f) trough the mix: ground floor - offices, second floor - residential phase (residence and work place) in the median sector **(f)** the need for office spaces pressure in ultra-central urban areas and of the real estate market dynamics.

One of the traits of the urban residential areas which are once again developed seems to be the obvious lack of homogeneity: the buyers do not belong to a homogenous social group, be it an economic, professional or ethnical one.

The central area of Târgu Jiu, between the pedestrian zone Victoria and Brâncuşi Boulevard, the only one to have survived the communist remodelling in this part of the city, offers one of the most conclusive images of the social pre- and post-communist transformations. The process of architectural modernization is visible in its linear propagation from the west eastward (fig. 2), due on the one hand to the limitation determined by the architectural value of the buildings and on the other hand, by the form of possession which was still in transfer. A detailed profile (fig. 2b) in this direction points out that the market value of the space dictates the modification of the residential utility to a tertiary one[13] (predominant in the western area, fig. 2f and 2g), followed by a binary or bipolar residential one (dwelling place plus work place, such as the notary or medical praxes, experts' firms – fig. 2f) and institutional-residential towards the centre where the architectonic sizes and the imposing appearance dictate the institutional trend – right on the façade of Victoria street (fig. 2a). Often, the legislative norms connected to the obligation citizens have to renovate the façade of the valuable buildings or to the new owners whose possessions have recently been retroceded, unearth the fact the owners do not always belong to the social class with liquid financial means or they do not correspond to the typical family nucleus, in full possession of their physical force and capacity to accumulate capital (as there are sometimes older people, who are alone, or old women), or to the age segment which is physically suited to participate at and to successfully lead this type of modernizing enterprises (fig. 2d). Concerning the urban renewal and especially that of the centre's architectural appearance, the central urban landscape of Târgu Jiu has a remarkable dynamism and cosmopolitanism, which has gone through two remodelling processes in just half a century (a quite rare fact not only in Romania): a radical one in the 1970's when it went from its borough features to the ones of a "*symbol of socialist construction*", and another more moderate one, still on going, concentrated on urban, landscape, pedestrian and architectural modernization of the central area (fig. 2a). Another important fact is the way the urban development is receptive to the existing spatial realities. This is how the imprint left by certain social groups on segments of this public pedestrian space, on which we have drawn attention in 2005, this natural decantation in time throughout the transition period, has been recognized as such and has naturally found its reflection in the new plan for architectural design. Subsequently, from spaces allotted without any apparent reason (if in the case of the students the space in front of the Faculty of Economical Science is determined by its proximity, in that of the children's area or the one destined for mothers with infants, there is no other element or objective to justify the spatial preference, other than custom) the space is designed to fit the population segments using it: the pedestrian zone symbolically designed to mimic an amphitheatre in front of the Faculty of Economical Science, and a playground for children in the other case mentioned above.

[13] Consequently, the theoretical support of the "rent-gap" theory of gentrification (Smith, quoted in Hamnett, 1996) – according to which the value of the properties found in central areas, following the suburbs' development and the capital's depreciation in the central areas, will drop down to the point where the terrains' renting potential exceeds the capitalized rent, thus creating a discrepancy (*rent-gap*), which once it exceeds a certain threshold, generates the gentrification or re-development – cannot be verified, and the real estate one cannot be found („*value-gap*"): the value of the centre in the traditional urban system has never ceased to be the highest, even dictating the functional modification of a building's destination.

5. CONCLUSIONS

In the conditions provided by this type of legislative framework the social differentiation and structuring could have been made manifest in any other circumstances except for those of the possession of goods, the dwelling comfort, the income and the real estate properties. In an era when the power consumption and the number of light sources were limited, and when there were food and fuel rations, the expression of wealth and social status could be materialized in anything except for the residence's size and comfort or the daily life's prosperity. Once the urban built fund had passed through the vast communist period of "erasing" the social differences and equalizing even the living space, it can no longer (re)present a "social mark". For this reason, most of the residences found within the building perimeter of the communist urban space have lost their appeal after 1989 (perhaps not including the ultra-central areas), when the population with average to superior income oriented itself towards the generous spaces situated on the outskirts or in the suburban areas, outside the building perimeter of the previous regime.

The communist architectural-ideological reshaping of the urban space through demolishing and reconstructing has given the final blow to the residential expression of the existence of a population segment which was socio-economically favoured, in the case of Râmnicu Vâlcea, as opposed to the case of Târgu Jiu, where the residential areas of private houses have survived in a more compact fashion, but in a secondary area with respect to the main one ("the civic centres"). Those found in its proximity, symbolic streets for the historical and architectural evolution of the borough – this is the case of the buildings on Tudor Vladimirescu (the former Ulița Domnească) and Victoriei streets – that have gone through the process of nationalization, have witnessed the emigration of the wealthy families and the dissipation of the other traits of the "bourgeois class".

Whereas the city of Târgu Jiu has preserved a compact part of its central sector (between Victoria Street and Constantin Brâncuşi Boulevard) as well as a series of other semi-central arteries with almost all of their buildings (Tudor Vladimirescu, Bradului, Republicii, 1 Decembrie), the city of Râmnicu Vâlcea underwent a radical reshaping. However, we can find preserved architectural areas on the former 30th December Street, in the areas away from the centre, the symbolic centre of the socialist urbanistic remodelling.

R E F E R E N C E S

1. Enyedi, G. (1998), *Transformation in Central European Postsocialist Cities*. Discussion Papers, N.21, Centre for Regional Studies of Hungarian Academy of Sciences, Pecs.
2. Hamnett, Chris, (1996), *Social Geography: A Reader*, Arnold, London, New York, Sydney, Aucland.
3. Ianoş, I. (2004), *Dinamica urbană. Aplicații la oraşul şi sistemul urban românesc*, Edit. Tehnică, Bucureşti.
4. Mateescu, C. (1999), *Cartea Râmnicului*, Edit. Silviu Popescu, Râmnicu Vâlcea.
5. Kovacs, Z. (2002), *Az urbanizacio jellemzoi Kelet-Kozep-Europaban a posztszocialista at-menet idejen*, în Foldrajzi Kozlemenyek, CXXVI, pp.57-79, Magyar Foldrajzi Kozlemenyek, Budapest.
6. Pain, Rachel, Barke, M., Fuller, D., Gough, J., MacFarlane, Mowl, Graham, (2001), *Introducing Social Geographies*, Arnold, London.
7. Tamaş, C. (1989), *Râmnicu Vâlcea. Ghid de oraş*, Edit. Sport Turism, Bucureşti.
8. *** (1974), C*olecția de Legi şi Decrete,* 1973, IV B., 1 oct.-31 dec., Consiliul de Stat, Serviciul Buletinului Oficial şi al Publicațiilor legislative.
9. *** (1975), *Colecția de Legi şi Decrete*, 1974, IV B., 1 oct.-31 dec., Consiliul de Stat, Serviciul Buletinului Oficial şi al Publicațiilor legislative .
10. *** (1984), *Geografia României*, II, *Geografia economică şi umană*, Academia Română, Bucureşti.

THE TYPOLOGY OF MUREŞ COUNTY SETTLEMENTS

R. RUSU[1], I. FODOREAN[2]

ABSTRACT. – The Typology of Mureş County Settlements. The paper presents the classification of the urban and rural settlements of Mureş County according to the main criteria: demographical size, the structure of the built-up area, the tissue and the economic activities, as well as the distribution of the settlements according to the main landforms and landform units. More than half of the urban settlements are small towns, having less than 20,000 inhabitants. The large city of Târgu Mureş stands out as the main administrative, industrial, cultural, financial and commercial centre of the county. There are also three middle-sized cities: Reghin, Sighişoara and Târnăveni. In 2003 and 2004, the communes of Sărmaşu, Miercurea Nirajului, Sângeorgiu de Pădure and Ungheni received town status, but they still preserve many rural characteristics. The majority of the rural settlements are small and very small villages. Six villages (Bârlibăşoaia, Maldaoci, După Deal, Hodaia, Şandru and Fântâna Babii) had no inhabitants whatsoever at the latest census, that of 2002. Some of the very small villages are in danger of extinction. All the three types of structure of the built-up area can be found in Mureş County. The concentrated structure is characteristic for the villages formerly inhabited by Saxons, near Sighişoara, or for those located along the main hydrographic and communication axes. The dispersed structure is characteristic for the hilly areas, while the scattered structure is found both in the Transylvanian Plain (the so-called "hodăi") and in the Carpathians. The tissue of the settlements is irregular. Most of the rural settlements have an agricultural function, while the towns and cities have complex functions. Regarding the landforms, the majority of settlements prefer the large valley corridors and are usually located between 300 and 400 metres above the sea level. The village situated at the highest altitude is Lăpuşna, at about 800 metres.

Keywords: *Mureş County, settlements, typology, classification, distribution, demographic size, villages, towns, structure of the built-up area.*

1. INTRODUCTION

The typology of Mureş County settlements has been previously analyzed in a number of studies, concerned with either Mureş County as a whole (I. Şoneriu, I. Mac, 1973, J. Benedek, 2000) or Transylvania, as the larger region including Mureş County (Gr. P. Pop, J. Benedek, 1997). This paper is the result of a renewed analysis, which came out as a necessity within the larger framework of the updated Mureş County Plan.

2. CLASSIFICATION OF SETTLEMENTS ACCORDING TO THEIR SIZE

In Romania, the main modality of ranking the human settlements was based on their demographic size and sometimes on their administrative status (whether they are county seats, cities, towns or communes). As a consequence, most rankings had in view the

[1] *"Babeş-Bolyai" University, Faculty of Geography, 5-7 Clinicilor Street, 400006 Cluj-Napoca, Romania, e-mail: rrusu@geografie.ubbcluj.ro*

[2] *"Babeş-Bolyai" University, Faculty of Geography, 5-7 Clinicilor Street, 400006 Cluj-Napoca, Romania, e-mail: fioan@geografie.ubbcluj.ro*

„size-rank” relationship, using the population of the settlements as a criterion to group them on different ranks (S. Neguț, 1997). The best-known ranking of this kind belongs to V. Cucu (1970), which includes: very large cities (Bucharest), large cities (over 100,000 inhabitants), middle-sized cities (between 20,000 and 100,000 inhabitants) and small towns (which have less than 20,000 inhabitants). The rural settlements may be ranked as following: very large villages (more than 4,000 inhabitants), large settlements (between 1,500 and 4,000 inhabitants), middle-sized villages (between 500 and 1,500 inhabitants), small villages (between 100 and 500 inhabitants) and very small villages (which have less than 100 inhabitants).

If one applies these classifications to the settlements of Mureş County, it comes out that more than half of the urban settlements (7 out of 11, or 63.6%) are small towns, while the majority of rural settlements (62.7%) are small and very small villages. There is a surprisingly high weight of very small villages (17%), which also include six villages (Bârlibăşoaia, Maldaoci, După Deal, Hodaia, Șandru and Fântâna Babii) without inhabitants (population zero) at the latest census, that of 2002.

Regarding the urban settlements, one notices the presence of one large city – the county seat, Târgu Mureş, which has about 150,000 inhabitants, and it is much more important than any other urban centre of the county, as it has an attraction area larger than Mureş County. Then, there are three middle-sized cities - Reghin, Sighişoara (both having more than 30,000 inhabitants) and Târnăveni (more than 25,000 inhabitants), and seven small towns, of which Luduş, the largest one, with more than 15,000 inhabitants, is more significant than the other six - Iernut, Sovata, Sărmaşu, Miercurea Nirajului, Sângeorgiu de Pădure and Ungheni, all below 10,000 inhabitants.

Because several communes - Sărmaşu, Miercurea Nirajului, Sângeorgiu de Pădure and Ungheni - have been declared towns in 2003 and 2004, Mureş County has a more balanced urban structure, and the distribution of towns is more homogeneous in the territory. Nevertheless, there are still areas which are not well equipped and located rather far away from any urban centre, like the eastern part of the Transylvanian Plain, towards the border with Bistrița-Năsăud County, Gurghiu Valley and the Mureş Gorges.

However, one should remark the low degree of urbanization of the four new urban entities, and the high weight of composing settlements (villages which administratively belong to the towns) in their population. The weight of rural settlements in the population of the new towns reaches almost 50% in the cases of Sărmaşu (48.3%) and Ungheni (45.6%), almost 35% at Miercurea Nirajului (34.6%) and it has a lower value only at Sângeorgiu de Pădure. From the point of view of town planning, these high values represent even a threat for the concept of „urban” settlement, as one supposes that the importance of the belonging villages within a town is usually low.

More than that, in the case of large and middle-sized cities, as a consequence of the continuous expansion of the built-up area of the city and the continuous demand for space, some composing settlements get so close to the city that they cannot be physically differentiated from the built-up area of the city, so they become „districts” of the city. This happens especially in Târgu Mureş, where Remetea and Mureşeni have only theoretically the status of composing settlements, as in practice they have been merged in the built-up area of the big city. In fact, they have a large population, normal for well-developed residential neighbourhoods. There are similar, but smaller scale, cases at Reghin, with its two composing settlements, Apalina and Iernuțeni, at Sighişoara and even Luduş.

Regarding the rural settlements, the small settlements are predominant in Mureş County, but there is also a low number of very large (5 settlements, or 1%), large (49, or 9.8%) and middle-sized settlements (133, or 26.5%).

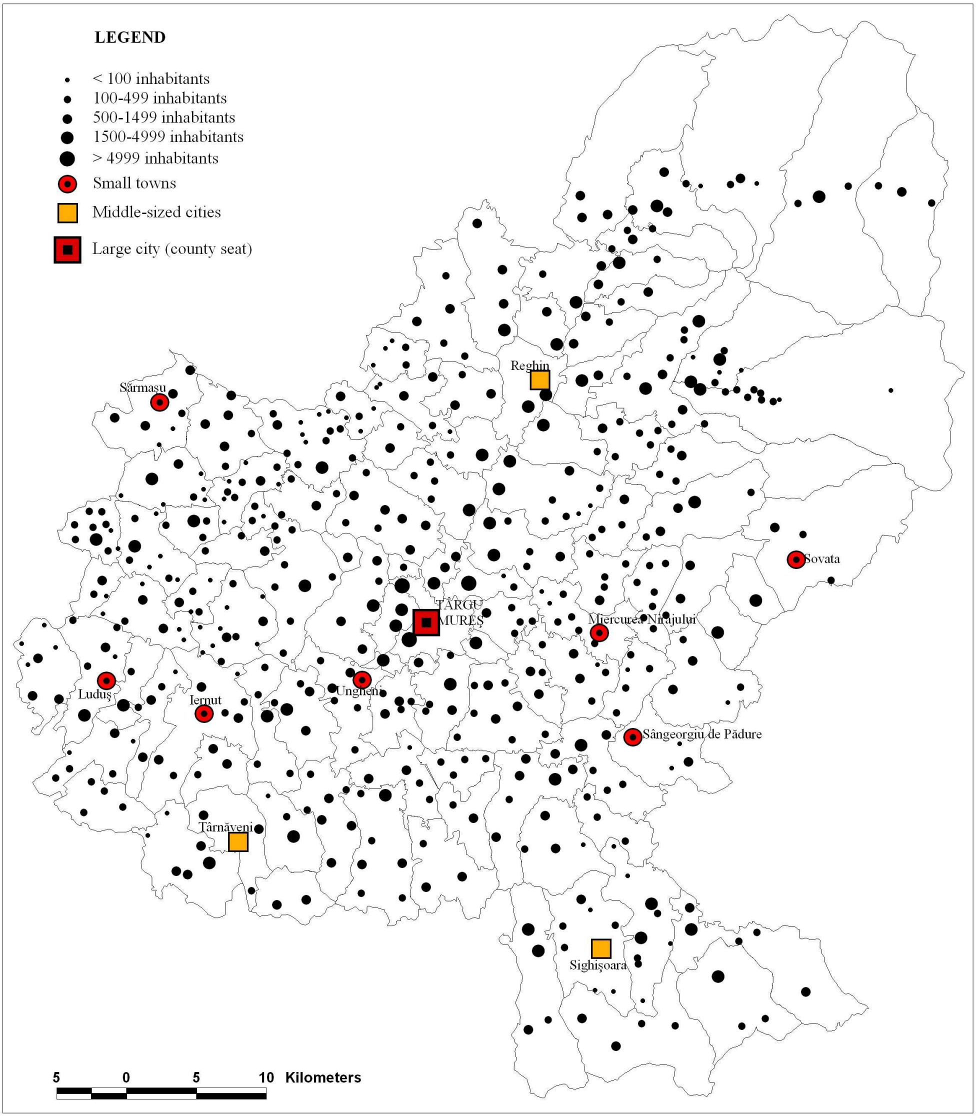


Fig. 1. The demographic size of Mureş County settlements.

The very large rural settlements are either settlements belonging to the city of Târgu Mureş (Remetea and Mureşeni), or commune centres near this city (Cristeşti and

Sâncraiu de Mureş), while the fifth one is a settlement belonging to the city of Reghin (Iernuțeni). In all these situations, the residential function of these settlements is the main one, as they are „satellite" settlements inhabited mainly by a commuting population.

The large rural settlements, which have a population between 1,500 and 4,000 inhabitants, are most of the times commune centres and are located along the main polarizing and hydrographical axes: Mureş Corridor (Deda, Aluniş, Glodeni, Petelea, Sântana de Mureş, Sânpaul, Bogata etc), Târnava Mică Corridor (Chibed, Fântânele, Găneşti, Adămuş, etc), Târnava Mare Corridor (Vânători, Albeşti, Daneş, etc), Gurghiu Valley (Gurghiu, Ibăneşti, Hodac, Solovăstru), Niraj Valley (Eremitu, Crăciuneşti, etc). Within the same category, there are also several commune centres of the western part of the Transylvanian Plain (Band, Zau de Câmpie, Şăulia, Râciu, Valea Largă, etc). The few settlements which do not have an administrative function (they are not commune centres) are either settlements belonging to urban centres (Apalina, belonging to Reghin; Gheja, to Luduş), or they are very close to an urban centre (Nazna, Periş, Dumbrăvioara, near Târgu Mureş, Seleuş, Boiu, near Sighişoara, Dedrad, near Reghin).

The middle-sized settlements include the majority of commune centres not listed in the upper categories, usually located on secondary streams (like Nadeş, Acățari, Livezeni, Sânger, Batoş), and also other villages which are not commune centres, but have a better location on the main axes, those of Mureş (Bistra Mureşului, Vălenii de Mureş, Vidrasău, Hădăreni) and Târnava Mică (Agrişteu, Deaj, Cuştelnic, Corneşti), but also in the Transylvanian Plain (Sărmăşel, Sălcud, Sabed), Târnave Plateau (Hărănglab, Valea Izvoarelor, Țigmandru) or Gurghiu drainage basin (Jabenița, Orşova, Caşva).

Nevertheless, in Mureş County, the large majority of villages are small, having less than 500 inhabitants. Generally, they have a rather accelerated negative dynamics, which makes their viability questionable on the medium and long term. There were more than 300 villages included in this category at the 2002 census, of which 85 villages had less than 100 inhabitants. These villages are not far from physical extinction, if there will be no intervention to revitalize them in due time. Most of these villages belong to the „hodăi"-type of villages, hamlets of the Transylvanian Plain, formed by the migration from the original village as a result of the agricultural reforms. They received the status of village immediately after World War II and were first listed as such in 1954 (*Indicatorul localităților din R.P.R.*). This category comprises villages like Valea Sânpetrului, Valea Ulieşului, Ştefanca, Fânațele Socolului, Nima Milăşelului, Coasta Grindului, etc. They have never had many inhabitants, and, because of their isolation and small population, did not have the minimum rural institutions (school, church). They only served as a (initially temporary, then permanent) residence for families of farmers, who wanted to live closer to the plot of land they owned. The collectivization and the general migration of the rural population to the cities in the first decades of the communist age, as well as the raising standards of the population (not content to lack everything) determined the accelerated decline of these settlements.

Other poorly inhabited settlements may also be found in other parts of Mureş County, especially in Târnave Plateau (Chinciuş, Jacu, Angofa, Bezidu Nou), but also in the Mureş Gorges (Andreneasa, Borzia), on Gurghiu (Lăpuşna), etc. The most difficult situation is recorded in the 17 settlements which have less than 10 inhabitants, of which six (Bârlibăşoaia, Maldaoci, După Deal, Hodaia, Şandru and Fântâna Babii) had no inhabitants whatsoever at the 2002 census.

3. CLASSIFICATION OF SETTLEMENTS ACCORDING TO THE STRUCTURE OF THEIR BUILT-UP AREA

The structure of the built-up area represents the quantitative expression which indicates the degree of concentration of the households in the built-up area (V. Surd, 2002). Generally, three main types of villages are differentiated, according to the way in which the households are distributed within the built-up area: the concentrated village, the dispersed village and the scattered village. Each of them may be divided further.

In Mureş County, the rural settlements belong to all the above-mentioned types, but in distinctive weights. Thus, the villages with a concentrated structure are characteristic for the main hydrographic and polarizing axes – the Mureş Corridor, Târnava Mică Corridor, Târnava Mare Corridor, Niraj Valley, Gurghiu Valley. There are even compact villages (a variant of the concentrated villages), with households stuck to one another, in the southern part of the county, near Sighişoara (for instance: Saschiz, Şaeş, Apold, Cloaşterf, etc). This structure is generally a peculiar feature of the Saxon villages of Transylvania, and may be equally noticed in the neighbouring counties (Sibiu and Braşov).

A concentrated structure (agglomerated, but not compact, so having a lower degree of concentration) is characteristic for many villages of Mureş Corridor (Glodeni, Cristeşti, Cuci, etc), Târnava Mică Corridor (Fântânele, Bălăuşeri, Adămuş, etc), Niraj Valley, especially on the lower stream (Acățari, Păsăreni, etc).

The dispersed structure, with households separated by small agricultural areas, and developed along the roadsides, is characteristic for the villages located near the mountains (Bistra Mureşului, Toaca, Idicel-Pădure, Căcuciu, Chiheru de Sus), but also in Reghin Hills (Logig, Socolu de Câmpie, Frunzeni). A subtype of the dispersed village is the linear village, with households aligned along the road or the stream. Although this structure is not necessarily characteristic for Transylvania, generally, or for Mureş County in particular, one may notice the presence of a few linear villages (Beica de Sus, Isla, Tofalău, Gruişor, Roua), especially in the areas of the high hills, near the mountains, where the built-up area of these villages could not develop otherwise because of the physical-geographical conditions.

In many cases, the villages with a dispersed structure are small, and have large areas of grasslands, hay fields and orchards, which separate the households.

A scattered (or dissipated) structure, with households at a wide distance from one another, or forming small clusters, separated by crops or even forests, can be seen, on the one hand, in the Carpathians, and on the other hand, typical for Mureş County, in the Transylvanian Plain. The few Carpathian villages which are included in this category are located in Gurghiu drainage basin (Lăpuşna, Brădățelu, Ibăneşti-Pădure, Dubiştea de Pădure, Orşova-Pădure, Zimți, etc).

The villages with scattered households in the Transylvanian Plain are generically called „hodăi". They usually consist of only a few households, so they are small (or very small) villages. More than 100 villages of Mureş County are included in this category, such as Coasta Mare, Pârâu Crucii, Hagău, Nima Râciului, Ghidaşteu, Pripoare, Leorința, and Bujor-Hodaie.

In several situations, one may remark that the households of these villages are grouped in small clusters, especially in order for the mutual capitalization of resources (mainly water) or as a result of the multiplication of the households. The new households belong to the younger generations, who built them near the household of their parents.

4. CLASSIFICATION OF THE RURAL SETTLEMENTS ACCORDING TO THEIR TISSUE

The tissue (the manner in which the street network is organized) does not have, usually, a geometrical setting. This fact may be explained, first, by the old age of most of the settlements, which inherit the medieval street network (when there was no thorough planning of the village structure), and secondly, by the predominantly hilly or mountainous landforms, which did not allow the geometrization of the street network.

Nevertheless, in a few special situations, one may speak of a geometrical tissue, in fact a linear one, as in the case of the villages mentioned above, that have a linear structure (Beica de Sus, Isla, Tofalău, Gruişor, Roua). Most settlements have an irregular, complex, intricate tissue. The tendencies towards geometrization are specific for the settlements located on the main valleys, which have a relatively regular shape, determined by the valley profile. So, in Mureş Corridor, settlements like Chețani, Şeulia de Mureş, Sfântu Gheorghe, present an almost regular tissue, with most of the streets being parallel or perpendicular to each other.

5. CLASSIFICATION OF SETTLEMENTS ACCORDING TO THE ECONOMIC ACTIVITIES

According to the distribution of jobs in the three economic sectors – primary, secondary and tertiary – it comes out that most of the rural settlements of Mureş County have a predominantly *agricultural* function, while the urban settlements have complex functions.

In the detailed analysis of the functional typology of settlements, one should take into account that, in most situations, the data regarding the population working in agriculture (and in the primary sector, generally) are underestimated. The number of employees or people hired (with record of employment) in agriculture represents a very low percentage of the population who is really involved in this field. In most cases, in the countryside, people cultivate the lands or rear livestock, without any official recognition of their economic activity; so many persons who work in agriculture do not appear in statistics.

According to the data of the 2002 census, 19 communes (20% of the 97 administrative units at that time) had more than 50% of the population employed in agriculture. Most of these communes lie in the Transylvanian Plain (Sânpetru de Câmpie 73.3%, Lunca 71.6%, Crăieşti 70.95%, then, below 70%, Miheşu de Câmpie, Sânger, Papiu Ilarian, Band, Şăulia, Pogăceaua, Valea Largă, Cozma, Tăureni, Şincai), the main agricultural region of Mureş County. Other communes are situated in the Transylvanian Subcarpathians, on the contact with the Eastern Carpathians: Hodoşa 76.3%, Măgherani, Chiheru de Jos, Hodac, Vătava. In these situations, the higher weight of the population employed in the primary sector is due to the development of livestock rearing, fruit growing, forestry, hunting and fishing sectors. Only one commune, Saschiz, which has a bit more than 50% (51.5%), is located in Târnave Plateau.

The second category includes 25 communes (25.7%) which have a population employed in the primary sector between 30% and 50%. The majority of these communes are also located in the Transylvanian Plain: Râciu, Băla, Fărăgău, Grebenişu de Câmpie, Iclănzel, Zau de Câmpie. Nevertheless, the communes comprised in this category have a more diversified location, representing all the geographical areas of the county. Consequently, settlements with a high weight of population employed in the primary sector are to be found in the Transylvanian Subcarpathians and on the contact with the Eastern

Carpathians: Gurghiu, Ibăneşti, Ghindari, Batoş; along the Mureş Corridor: Voivodeni, Chețani, Brâncoveneşti; in Târnave Plateau: Apold, Vețca, Viişoara, Bichiş, Ațintiş, Cucerdea, Bahnea, along the Niraj Valley: Păsăreni, Gheorghe Doja, Crăciuneşti.

One may state about the other rural settlements that they have mixed functions, both agricultural and industrial ones. Yet, the high weight of population employed in other fields than agriculture may be explained, at least for some communes, by the proximity of an urban settlement, which attracts the active population from the countryside. This fact is obvious for the communes near Târgu Mureş (Sântana de Mureş, Sângeorgiu de Mureş, Cristeşti, Acățari, Ernei, Sâncraiu de Mureş, Sânpaul, Livezeni), for those near Sighişoara (Albeşti, Vânători, Daneş), near Reghin (Solovăstru, Petelea, Ideciu de Jos, Suseni), or near Târnăveni (Adămuş, Cristeşti, Găneşti, Mica). For these communes, the phenomenon of commuting is still very important, because many inhabitants are commuters. In other cases, industrial units have been built even on the territory of these communes, so that the industrial function of these communes is more visible. Many of these settlements may be considered as „dormitory villages", as a large part of their population works in the nearby urban centres.

Except for the communes located near the cities, there are other communes which have mixed functions, situated in the mountain area, on the contact with the mountains or along the Mureş Corridor. Accordingly, as a result of the development of wood processing industry and mining, the communes of Mureş Gorges (Deda, Stânceni, Lunca Bradului, Răstolița) have mixed, agricultural-industrial or pastoral-forestry-industrial functions. A similar situation can be described for communes such as Eremitu, Ruşii-Munți, Aluniş, or others, downstream on Mureş, like Ogra and Cuci, or in Târnave Plateau: Zagăr, Nadeş, Suplac.

The towns have complex functions. The city of Târgu Mureş stands out clearly because of its diverse and complex functions, as an administrative, cultural, industrial and tertiary (financial, commercial, etc) centre of the entire county. Of the other urban centres, the city of Sighişoara also stands out. Apart from its industrial function, developed mainly during the communist period, it is an important tertiary centre, as a result of its tourism attractions. The tertiary sector is also developing in the other older urban centres, such as Reghin, Târnăveni, Luduş, supplementing the industrial function. A special situation is recorded in the case of the town of Sovata, which has the status of spa resort of national importance, which makes industry secondary at best. The newer towns have mixed functions, rather industrial for those located along the Mureş Corridor (Iernut, Ungheni) and for Sângeorgiu de Pădure, and rather tertiary for Sărmaşu and Miercurea Nirajului. The agricultural function remains important in the case of Sărmaşu, but also for the others, in a lesser extent. It is certain that these towns are in the first stage of urban development and they will gradually develop the specific urban functions.

6. THE DISTRIBUTION OF SETTLEMENTS ACCORDING TO THE MAIN LANDFORMS

In Mureş County, the predominant landforms are the hills. The main landform units are the following: Târnave Plateau (including the corridors of Târnava Mică and Târnava Mare), the Transylvanian Plain (which, despite its name, is a hilly region) and the Transylvanian Subcarpathians, at the contact with the Carpathians. The Carpathians lie in the eastern part of the county, but few settlements are located in the mountains proper.

At a closer look, one can notice that most settlements are located along the main streams, either in the floodplain, or using the terraces – on Mureş Corridor, Târnava Mică

Corridor, Târnava Mare Corridor, Niraj Valley, Gurghiu Valley, and their tributaries. Few settlements are situated on the slopes or watersheds, as in the Transylvanian Plain. There are also situations when the settlements have a complex distribution: a nucleus located in the valley, and parts of the settlement scattered on the neighbouring slopes or even watersheds.

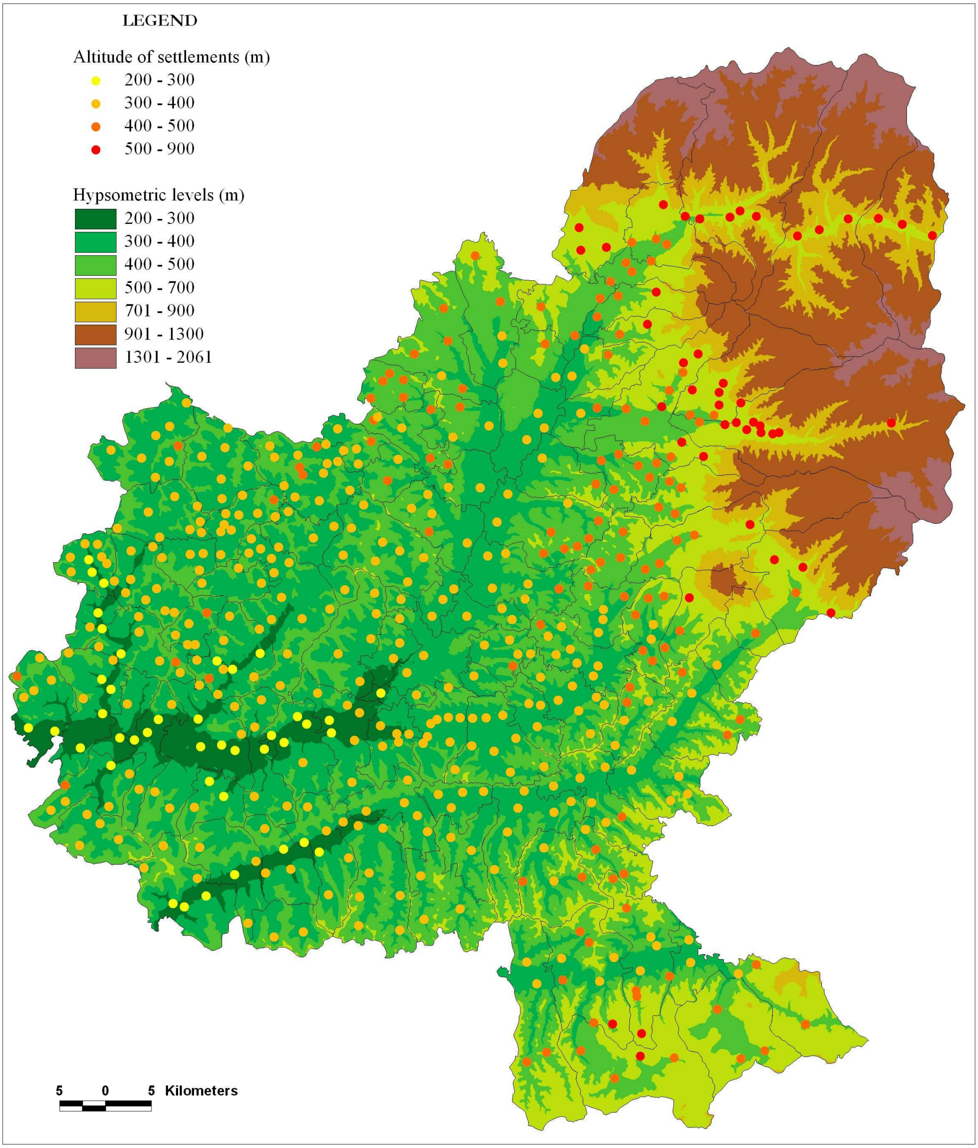


Fig. 2. The distribution of settlements by hypsometric levels.

In the case of „hodăi”, households are dissipated over several hills, so it is difficult to say where the nucleus (or the centre) lies. Another special case is given by the small settlements located in the uppermost basin of rivulets, having a built-up area in the shape of an amphitheatre (Bobohalma, Sub Pădure, Delenii, Milăşel).

From a hypsometric point of view, most of the Mureş County settlements are located between 300 and 400 metres above the sea level, in all the geographical units, except for the mountainous area and the lower stream of Mureş and Târnava Mică Corridors.

Accordingly, the lowest altitude in Mureş County is recorded where the Mureş River leaves the county, near Chețani, about 265 m. The 300 m contour line goes upstream on Mureş until Cristeşti. In the same way, the 300 m contour line goes upstream on Târnava Mică until Mica.

As stated above, most of the Mureş County settlements are located between 300 and 400 m. This is true for almost all the settlements of the Transylvanian Plain, for the settlements of the Mureş Corridor from Brâncoveneşti and Ideciu de Sus until Târgu Mureş, for those located on Niraj Valley and its tributaries downstream of Grâuşorul and Vărgata, and for almost all the settlements of the Târnave Plateau.

Less than a quarter of the total number of settlements is located at an elevation higher than 400 metres. Most of them belong to the next hypsometric interval, between 400 and 500 metres. Few are located north of Mureş: in the eastern part of the Transylvanian Plain, near the springs of some creeks (Milăşel, Băla, Cozma, Băița), or in the Subcarpathians: Logig, Batoş, Uila. The majority of the settlements included in this category are to be found South of Mureş, on Gurghiu Valley (Hodac, Ibăneşti, Gurghiu, etc), or in the Subcarpathian area (Teleac, Habic, Chiheru de Jos, Urisiu de Jos, Ilioara, Mura Mică, Hodoşa). Several such settlements are situated in the upper basins of Niraj, Târnava Mică and Târnava Mare.

A special category is represented by the settlements located at more than 500 metres above the sea level. One may state that they generally belong to the mountainous area. They are grouped into four regions: the Mureş Gorges, upstream from Deda, the drainage basin of Gurghiu upstream from Hodac and Ibăneşti, the drainage basin of Târnava Mică upstream from Sovata, and, exceptionally, few settlements of Hârtibaciu Plateau (which cannot be considered as belonging to the mountains). The village located at the highest altitude in the county is Lăpuşna, on Gurghiu Valley, at about 800 metres.

7. CONCLUSIONS

The paper presents the classification of the urban and rural settlements of Mureş County according to the main criteria: demographical size, the structure of the built-up area, the tissue and the economic activities, as well as the distribution of the settlements according to the main landforms and landform units. More than half of the urban settlements are small towns, having less than 20,000 inhabitants. The large city of Târgu Mureş stands out as the main administrative, industrial, cultural, financial and commercial centre of the county. There are also three middle-sized cities: Reghin, Sighişoara and Târnăveni. In 2003 and 2004, the communes of Sărmaşu, Miercurea Nirajului, Sângeorgiu de Pădure and Ungheni received town status, but they still preserve many rural characteristics. The majority of the rural settlements are small and very small villages. Six villages (Bârlibăşoaia, Maldaoci, După Deal, Hodaia, Şandru and Fântâna Babii) had no inhabitants whatsoever at the latest census, that of 2002. Some of the very small villages are in danger of extinction. All the three types of structure of the built-up area can be found in Mureş County. The concentrated structure is characteristic for the villages formerly inhabited by Saxons, near Sighişoara, or for those located along the main hydrographic and communication axes. The dispersed structure is characteristic for the hilly areas, while the scattered structure is found both in the Transylvanian Plain (the so-called "hodăi") and in the Carpathians. The tissue of the settlements is irregular. Most of the rural settlements have an agricultural function, while the towns and cities have complex functions. Regarding the landforms, the majority of settlements prefer the large valley corridors and are usually located between 300 and 400 metres above the sea level. The village situated at the highest altitude is Lăpuşna, at about 800 metres.

REFERENCES

1. Benedek, J. (2000), *Obiectivele amenajării şi principalele strategii pentru dezvoltare şi organizarea spaţiului în judeţul Mureş*, Studia UBB, Geographia, 1, Cluj-Napoca.
2. Cucu, V. (1970), *Oraşele României*, Edit. Ştiinţifică, Bucureşti.
3. Neguţ, S. (1997), *Modelarea matematică în geografia umană*, Edit. Ştiinţifică, Bucureşti.
4. Pop, Gr. P., Benedek, J. (1997), *Sisteme şi modele de aşezări rurale în Depresiunea Transilvaniei*, Studia UBB, Geographia, 1-2, Cluj-Napoca.
5. Surd, V. (2002), *Introducere în geografia spaţiului rural*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
6. Surd, V. (2003), *Geografia aşezărilor*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
7. Şoneriu, I., Mac, I. (1973), *Judeţul Mureş*, Edit. Academiei RSR, Bucureşti.
8. xxx (1954), *Indicator alfabetic al localităţilor din R.P.R.*, Edit. de Stat pentru Literatură Ştiinţifică, Bucureşti.
9. xxx (2002), *Recensământul populaţiei şi al locuinţelor*, www.insse.ro.

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

FROM THE SUBSISTENCE AGRICULTURE TO THE ECOLOGICAL MOUNTAIN AGRICULTURE IN THE UPPER BASIN OF THE SOMEŞUL MARE RIVER

M. MUREŞIANU[1], E. SCHUSTER[1], A. BARTA[1]

ABSTRACT. – From the Subsistence Agriculture to the Ecological Mountain Agriculture in the Upper Basin of the Someşul Mare River. Comprising a number of 10 political-administrative units (9 communes and one town), the upper basin of the Someşul Mare river has, because of the morphologic-topographical features of the terrain and the soil and climate conditions, a subsistence agriculture, while industrial activities had either "vanished" (mining and ore processing), or significantly reduced their activity (primary wood processing, milk processing, exploitation and primary processing of construction rocks, etc). Under these circumstances, material and especially financial resources necessary for sustainable rural development are decreasing. Therefore, the only viable alternative to boost the social and economic life of the human habitats in the region remains rural tourism, with its variant – agro-ecotourism, respecting the new guidelines imposed by the Administration of the Rodna Mountains National Park, together with a mountain ecological agriculture.

***Keywords**: local agriculture, small farmers, mountain agriculture, organic products, natural pastures, hay meadows, small orchards, mountain pasturing, ecological agro-tourism, sustainable rural development, mountain ecological agriculture.*

1. INTRODUCTION AND GENERAL PREVIOUS CONDITION OF THE REGION'S AGRICULTURE

The agriculture sector in post-1989 Romania was subject to numerous political, economical and social debates, generated by the need for some historical reparations regarding the reestablishment of the relationship between man and the property taken from him in the communist period.

A special case in the communist period was that of the mountain areas, that were kept out from collectivization due to morphologic-geographical characteristics. The agricultural land (arable land and hay meadows) from these areas remained in the private possession of the former owner, while the forests and mountain pastures were confiscated by the communist state.

In order to keep their land, the owners had to deliver to the state a substantial part of their production, either at no charge or, later, after 1965, as an obligatory contract with the state, which paid the land workers underpriced. For example, in 1980 the pork meat in the shop cost 40 – 45 lei/kg, while the state paid the peasants only 10 – 12 lei/kg.

After 1989, the local communities from the non-collectivized mountain areas bordering the upper basin of the Someşul Mare River (extended to the present area of 46.399 hectares in 2000), representing 10 administrative units (9 communes and one town) claimed the forests and mountain pastures, regaining them gradually between 1994 and 2000.

[1] *"Babeş-Bolyai" University, Faculty of Geography, Clinicilor Str.5-7, 400006, Cluj-Napoca,Bistriţa Extention, Romania, e-mail: eschuster@geografie.ubbcluj.ro*

The new regulations, apparently favourable for the small farmers from the mountain area surrounding the upper basin of the Someşul Mare River, didn't improved, as expected, the condition of the local agriculture, because they weren't supported by legislative measures that should have stimulated the development of both a mountain ecologic agriculture and an ecologic agro-tourism, as requirements for a reliable sustainable development.

The small households hoped for a more generous market for their products, but the food safety regulations and the quality standards imposed to the farmers after Romania's entrance in the EU in 2007 effected a dramatic regression of the agriculture in this geographic area.

The small farmers from the settlements around the upper basin of the Someşul Mare River resized their households, and the production is momentarily intended for subsistence.

If the mountain agriculture from this area would be supported, it could provide the national market and the EU-states with remarkable quantities of lamb, mutton, beef, poultry meat, organic milk products, organic potatoes, organic fruits and some pot herb.

If in 1988 the region provided to the Arabic world in the Middle East over 50,000 lambs and almost 16,000 sheep, the capabilities of rearing these unpretentious animals can grow significantly, some field studies and inquiries estimating a potential of over 100,000 lambs and circa 50,000 sheep for export.

The stopping of mining, the regress of forestry, and the decrease of the agro-pastoral activities, imposed by the new orientations regarding the protection of biodiversity in the upper basin of the Someşul Mare River, caused the poverty-stricken local public administrations to give up some rural development projects. The rural development is on a turning point. There are high hopes for laws and regulations that will support the mountain ecologic agriculture and the ecologic agro-tourism, as sole alternatives for a sustainable rural development in the peripheral geographic space of the Rodna Mountains National Park.

2. THE PRESENT LOCAL AGRICULTURE

As geographic-economically category, ***the land use structure*** is widely influenced by natural conditions (relief, soil, rainfall, topoclimate), but it adapted to the evolution of human communities in their relation with the exterior.

The three main categories – agricultural terrain, forest area, land with other uses or unused – suffered changes as a result of intensifying anthropization processes, of changing pedological, phytological, and climatic conditions, but also because of last decades land planning and melioration.

Analyzing the land use structure in the upper basin of the Someşul Mare River, we can see that almost half of the region (49.62%) is covered with forests, mainly in the Rodnei Mountains area (Şanţ, Rodna, Maieru, Sângeorz-Băi), agricultural land represents 42.44%, the rest of approx. 8% having other uses (roads, railroads, streets, buildings, mountain ridges, rocks, etc.).

The agricultural land (45590 ha) consists mainly of pastures and hay meadows (40506 ha), representing 88.8% of it, the arable land occupies 10.8%, and the rest is used for orchards, vineyards, and tree nurseries (0.33%).

Concluding, the *characteristic feature of the region's land use* is the broad expanse of forests, pastures, and hay meadows (~88% of the total area), which, according to the integrated land planning plans, suffer substantial qualitative changes: reforestation with high genetic value species of high productivity, amelioration of natural meadows' floristic composition, fertilizations, and extension of hay meadows.

Land use structure (2008)

Table 1

Settlement	**Land use categories (ha)**					
	Arable	**Pastures and hay meadows**	**Orchards and vineyards**	**Forests**	**Other areas**	**Total**
Sângeorz-Băi	856	6431	81	6344	970	17682
Maieru	688	3923	16	7447	830	12904
Rodna	373	9198	18	5790	1991	22415
□anț	227	8430	4	10675	1568	20904
Ilva Mică	408	1801	9	2162	462	5250
Ilva Mare	462	2762	1	4405	698	8328
Lunca Ilvei	670	2462	10	5197	782	9121
Măgura Ilvei	550	1191	4	926	301	2972
Poiana Ilvei	231	910	2	520	119	1752
Leşu	467	3398	7	4410	728	9010
Total	**4932**	**40506**	**152**	**53278**	**8500**	**107368**
	4.6%	**37.7%**	**0.14%**	**49.62%**	**7.9%**	**100%**

Natural pastures are favoured by the amount of precipitation and stretch almost continuously over the entire main range of Rodna Mountains and the secondary ranges deriving from it, occupying the heights between approx. 1400 m and 2000 m. There are rich pastures, producing ~4,7 tones/ha of green crop, but also poorer ones, caused by lower nutritional quality of the flora, the “invasion” of hartwort and patiente dock, molehills and shrubs, and, on some areas, even degeneration through overgrazing. Furthermore, mountain pastures are highly eroded because of heavy rainfall and steep slopes. Wide areas are covered with mountain pine, debris, bushes of blueberry and mountain cranberry.

Arable land occupies a small part of the region (4.6%), in water meadows, on terraces of the main rivers, alluvial fans, mild hillsides, and on gentle mountain slopes with proper exposure, sustaining cultures adapted to lower temperatures and shorter growing periods.

On the south oriented “hill-front”, up to an altitude of 600 m, there are orchards, consisting mainly of plum trees, apple trees, pear trees, cherry tree, and sour cherry. Because of the rough terrain, animals are used for agricultural labour instead of mechanized work. The agglomeration of population in depressions or at the foot of mountains effected an obvious change in the agricultural landscape; e.g., deforestations in the vicinity of mountain areas caused a mosaic-like culture structure, primarily because of climate and soil conditions.

Regarding land ownership structure, the agricultural land belongs (and belonged even before the year 1989) to individual landholders, due to the fact that the region was not collectivized. One may say that agriculture in the upper basin of the Someşul Mare River had, even in the former most centralized economy, some capitalist features, being an “oasis” of private land property in the surrounding socialist “ocean”.

The *crop structure* was long time dominated by *maize*, but in recent years, potato took the lead (37.2% of the arable land, compared to the 35.6% of the maize), its growing being stimulated by the convenient exchanges made by local producers with the big cereal growers from the Oltenian Plain and Banat region.

Potato and maize are followed by forage (mainly clover) and vegetables, used exclusively for local consumption. In some villages (Sângeorz-Băi, Şanţ, Ilva Mică, Leşu), wheat and rye are grown on small areas (1.1% of the arable land).

Main crops (2008)

Table 2

Settlement	Wheat and rye		Maize (grains)		Potatoes		Vegetables		Fruits	
	S (ha)	P (t)	S (ha)	P (t)	S (ha)	P (t)	S (ha)	P (t)	S (ha)	P (t)
Sângeorz-Băi	5	11	480	1770	194	3880	22	360	425	723
Maieru	-	-	380	1140	210	4200	22	342	122	207
Rodna	-	-	145	261	163	2934	14	53	142	242
Şanţ	10	19	72	187	105	2100	10	62	50	84
Ilva Mică	15	33	160	480	170	3400	18	227	21	36
Ilva Mare	-	-	60	102	255	5100	21	146	23	40
Lunca Ilvei	-	-	50	70	300	6000	34	264	177	300
Măgura Ilvei	-	-	211	401	155	3510	21	157	75	127
Poiana Ilvei	-	-	89	139	91	1078	14	82	46	78
Leşu	25	55	110	330	190	3800	17	188	19	32
Total	**55**	**118**	**1757**	**4880**	**1833**	**36002**	**193**	**1899**	**1100**	**1869**
	1.1%		**35.6%**		**37.2%**		**3.9%**		**22%**	

In all settlements, the surface of cultivated areas decreased in recent years, caused by the abandonment of barley, oat, hemp, and potato crops from higher areas and outside the villages, or because of wild animals constantly destroying the crops, or as a result of laziness and inefficiency.

Fruit tree growing occupies small areas in house gardens; larger orchards are owned by bigger landholders and are located in the vicinity of villages. The optimal growing areas are some foothills, the terraces of the Someşul Mare and Ilva rivers, gentle, sunny slopes not affected by temperature inversions (0.14% of all agricultural land).

In these orchards and small areas with fruit trees, apple trees amount to 70%, followed by plum trees with over 20%, and pear and sour cherry trees, while walnut trees grow scattered, only in areas where soil and climate conditions are more favourable for their development. Cherry trees are increasingly present in small orchards or in the villagers' courtyards and gardens. Fruit production is fluctuant, since it is dependent on climate conditions, and reached 1869 tonnes in the year 2008.

With 40506 hectares of pastures and meadows and only 4932 hectares of arable land (about 4.6% of the studied area), the prevalence of the ***stock breeding*** sector is obvious, and counted in 2008 a total of 11334 cattle, 9415 swine, 36155 sheep and 91199 poultry.

Also on statistical level, there is an animal production in 2008 of 2903 tonnes of meat (living stock), 229790 hectolitres of cow and water buffalo milk, 82890 kg of wool, and 8035000 eggs.

Livestock in 2008

Table 3

Settlement	Cattle	Swine	Sheep	Poultry
Sângeorz-Băi	1300	1820	7965	13600
Maieru	1305	1900	5270	13200
Rodna	766	855	3273	8000
Șanț	685	685	3240	8450
Ilva Mică	1527	1400	5030	10200
Ilva Mare	1560	715	1904	9500
Lunca Ilvei	1580	820	1920	12000
Măgura Ilvei	898	515	3346	7829
Poiana Ilvei	702	305	1507	2920
Leşu	1011	400	2700	5500
Total	**11334**	**9415**	**36155**	**91199**

Animal production

Table 4

Settlement	Meet (t, living)	Cow milk (hl)	Wool (kg)	Eggs (x 1000)
Sângeorz-Băi	396	35894	18000	1230
Maieru	487	32599	16000	1300
Rodna	419	16800	10750	461
Șanț	489	8996	6530	703
Ilva Mică	173	28851	9600	847
Ilva Mare	379	30602	3080	975
Lunca Ilvei	321	26697	3840	1066
Măgura Ilvei	195	17454	6980	611
Poiana Ilvei	98	9243	3020	325
Leşu	256	22374	5090	517
Total	**2903**	**229790**	**82890**	**8035**

The mountain pasturing represents an occupation specific for a certain way of life of the autochthonous “someşan” and “ilvan” Romanians and a fundamental traditional activity which deciphers the very permanence of the locals in a space stricken by both history and nature. Despite harsh climate (cold rain showers, persistent fog, early – sometimes August – hail and snowfall often catching the herds on the mountain off guard), the locals continued to practice pastoralism, an occupation attested by 14th and 15th century documents as being an inseparable part of the life of the villages from these ancient lands. A proof for the existence of this activity is the ongoing presence of the toponym *nedei* (a flat place on the mountain where homonymous festivities were held on certain occasions by herders), frequently occurring in the southern Rodna Mountains and adopted by the geographic literature.

The pastures are intensively utilized to the present day, through summer pasturing, but for a shorter period (up to 90 days) than in the surrounding mountain areas because of the harsher climate. Cattle are grazed on the mountain, as well as sheep. The sheep herds climb on the mountain after the 25th of May and return on August 29, an ancestral habit strictly respected by the herdsmen. In the region, they practise a local agricultural grazing type, in spring and autumn on the pastures and meadows neighbouring the settlements, and in summer at the fold on the mountain pasture. In winter, the herds are brought together in winter stalls with dry fodder in the villages. This type is referred to as “double oscillation pasturing”.

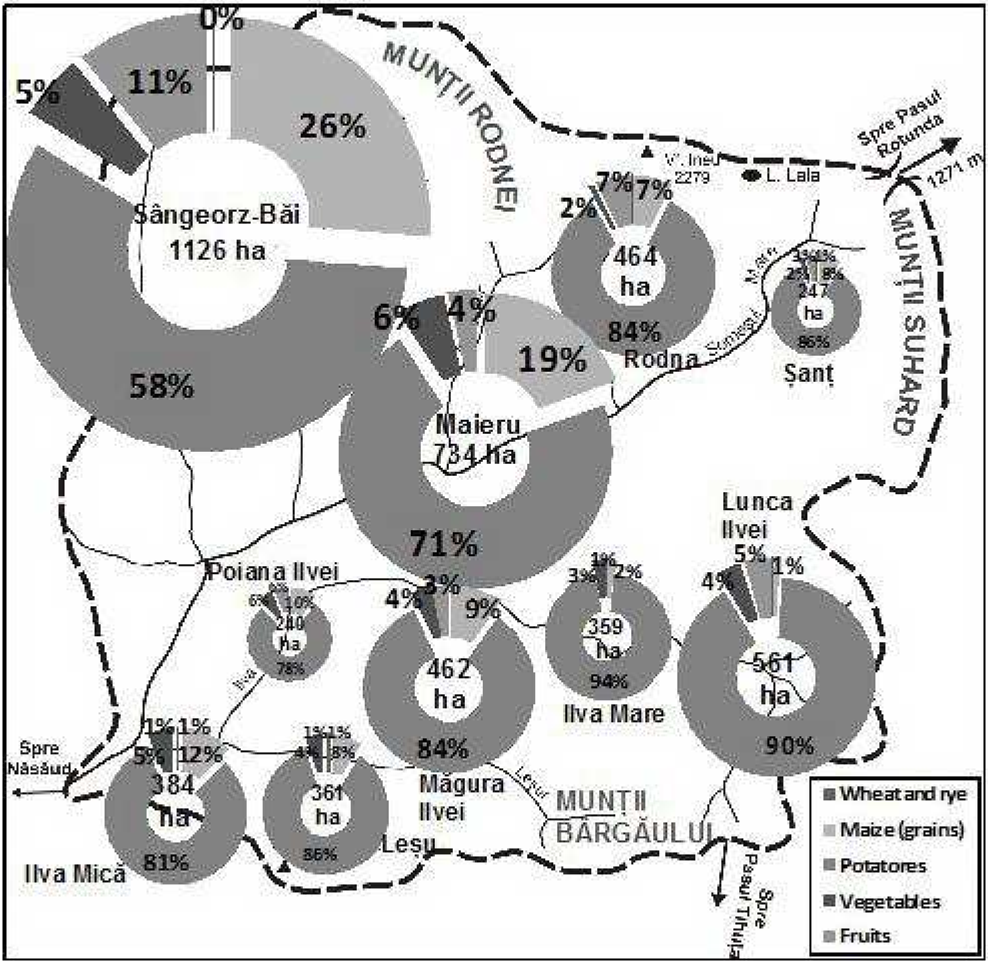


Fig. 1 Production structure of the main crops.

The regional particularity is given by the existence of mountains for summer grazing, with folds (e.g. Ciungi, Curățel, Crăciunel, Cişa, Lazi, Paltin, Putredu, Zănoaga) and mountains for hay meadows (Fântânele, Capul Beneşului, Culmea Lazului).

The folds and their extensions are durable constructions, so they can be used for years, and are located on alpine pastures, used for summering.

The shelters (or “old houses”), named in the Rodna and Bârgău Mountains “winter tents” (1250 – 1300 m) or “cow places” (1000 – 1200 m) represented during history centres around which permanent settlements formed, a transformation that occurred before the 18th century as a result of the population “migration” from the villages in the valley.

The animal breeds have a lower productivity, but they are resistant to frost and long-lasting rain. The white and black Țurcana sheep have long, rough wool and can move fast, sometimes over 5 – 6 km, from Ciungi, Crăciunel or Paltin to Coasta Netedă Peak (in Rodna).

The beekeeping is one of the old activities of the locals, and this is proved by the persistence of characteristic toponyms, such as Dealul Stupini, and by historical documents. Thus, it is mentioned that during the Tartar invasion of the year 1717, there were 458 beehives destroyed in Rodna.

More recent, between 1995 and 2000, during winter, there were “initiation courses” for beekeeping organized in Sângeorz-Băi, with a good participation from people from the Someş and Ilva valleys, and, beginning with 2001, the Beekeeper Association County Branch reorganized itself after the model of the Sângeorz Apiculturist Club.

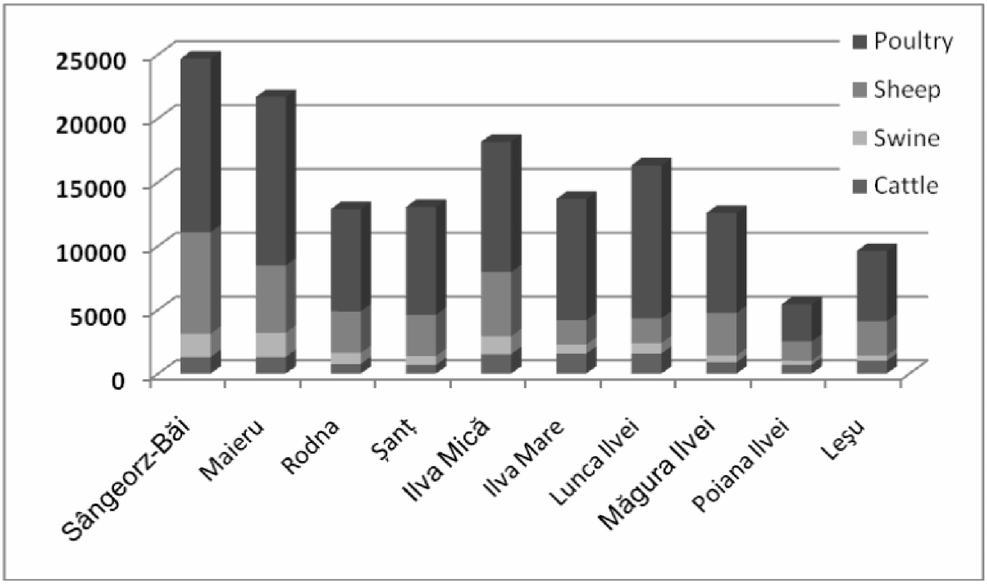


Fig. 2. Livestock in 2008.

3. CONCLUSIONS

Given the fact that out of Someşul Mare river upper basin area of 107368 hectares only 4.6% is arable land (2008), while the pastures and meadows encompass 37.7%, and the forests 49.62%, it is easy to imagine the harshness of local morphologic-topographical, soil and climate conditions.

If we compare the total number of inhabitants (over 45000 in 2002) with the main agricultural indicators (land use structure, cultivated areas and total agricultural production, livestock, and animal production), the subsistence character of the local mountain agriculture is obvious.

The competition from cheap products coming from the neighbouring E.U. countries (and not only from there) as well as increasingly expensive autochthonous products (as a result of the lack of state subventions) leads to a severe agricultural regress and, implicitly, the fall of the agricultural production in the upper basin of the Someşul Mare river, with possible repercussions and socio-economic effects for the small farmers in the studied area.

Under these circumstances, the traditional model of rural development, based on subsistence agriculture, mining, forestry, exploitation of construction rocks, etc., is about to extinct. But the new realities of the protected area neighbouring the local communities set the stage for a new model: sustainable rural development based on new forms of utilizing local natural resources through agro-ecological mountain activities, bringing "Park"-labelled products on the market, as well as on ecotourism.

R E F E R E N C E S

1. Benedek, J. (2003), *Subsistence Agriculture in Romania and the Development of Rural Space*, Würzburger Geographische Manuskripte, Heft 63, Würzburg.
2. Mureşianu, M., et al. (1996), *Rodna – pagini de monografie. Ipostaze istorice, geografice, lingvistice şi culturale*, Edit. Ando Tours, Timişoara.
3. Mureşianu, M. (1997), *Potenţialul turistic din bazinul superior al Someşului Mare*, Edit. Focul Viu, Cluj-Napoca.
4. Pop, P. Gr. (2006), *Carpaţii şi Subcarpaţii României, Ediţia a II-a revizuită şi adăugită*, Presa Universitară Clujeană, Cluj-Napoca.
5. Ureche, Etelca (2005), *Consideraţii social-economice privind reţeaua habitatelor umane din bazinul superior al Someşului Mare*, lucrare ştiinţifico-metodică pentru obţinerea gradului didactic I, Cluj-Napoca.

STUDIA UNIVERSITATIS BABEȘ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

THE EDUCATIONAL ELEMENT IN HÂRTIBACIU VALLEY AREA

C. N. BOȚAN[1]

ABSTRACT. **The Educational Element in Hârtibaciu Valley Area.** Education represents a very significant element in the functional system of a nation, which eventually reflects the vitality and the real possibilities of development, as well as it creates some potential interrelations at a national and continental level. At Romanian level, numbers regarding the educational indicators registered in the last years reflects a state of facts, generalized for the entire national area. They reveal a a significant decrease in the number of pupils of all educational levels and a precarious qualitative state of school infrastructure and teaching staff. The already mentioned phenomenon is becoming more severe especially in rural Romanian areas, where the threats from this perspective are extremely serious. Hârtibaciu Valley area reflects an analogical situation; therefore this study reveals the current complex analysis of the major educational indicators.

Keywords: *education, development, level, school, teaching, study.*

1. INTRODUCTION

Hârtibaciu Valley area is territorially included in Sibiu County and it comprises 13 administrative-territorial entities, a city and 12 communes, which territory mainly extends along the hydrographical axis of Hârtibaciu River. The name of the region, Hârtibaciu Valley, is somehow improper because the current administrative-territorial entities are located within the hydrographical basin of this river, therefore it would have been better this region be named Hârtibaciu Basin. This research material is the result of a thorough and current analysis of the major indicators regarding the quality of the educational element in the area, started once the Faculty of Geography, "Babeş-Bolyai" University, Cluj-Napoca, established the strategy of territorial development for the above mentioned area.

Education in Hârtibaciu Valley area is both vertically and horizontally integrated. The vertical organizing of educational system reveals the existence of pre-school, elementary, secondary, high school and college levels of education. On the other hand, the horizontal organizing is represented by all administrative-territorial units in the area, at least by the inferior educational levels. Alike the national education system, that of Hârtibaciu Valley is completely restructuring, reorganizing and modernizing, thus complying with the needs of a much more diverse school population.

It is known the fact that, states with a high life standard, birth rate and implicitly, natural growth register low values. Unfortunately, Romania found itself on a similar evolution trend that if it continues the same way, it will bring out specific issues rather difficult to be solved. Still, in the analysed area, the problems induced by the severe decrease in the number of children, are not severe, because, in the demographical structures, a major ratio is represented by the gypsy population, whose demographical balance is positive.

[1] *„Babeş-Bolyai" University, Faculty of Geography, 400006, Cluj-Napoca, Romania.*

2. THE PRE-SCHOOL EDUCATIONAL LEVEL

The infrastructure necessary for assuring the existence of preschool level of education in all 13 administrative-territorial entities comprised in Hartibaciului Valley, consists of 37 nursery schools, all functional (public schools) that enrol about 1300 children in the educational pre-primary cycle.

The current pre-primary educational level in Hârtibaciu Valley area (January, 2009)

Table 1

Crt. no.	Town/ Commune	Locality	No. of nursery schools	No. Of pre-school children	Total no. of population	Balance/ ratio (%)
1	**Agnita**	Agnita	3	304	8997	3.37
2		Coveș	1	21	732	2.86
3		Ruja	1	47	1165	4.03
4	**Alțâna**	Alțâna	1	55	1315	4.18
5		Benești	-	-	287	0.00*
6		Ghijasa de Sus	-	-	195	0.00*
7	**Bârghiș**	Bârghiș	1	27	843	3.20
8		Apoș	1	25	300	**8.33**
9		Ighișu Vechi	-	-	263	0.00*
10		Pelişor	1	20	500	4.00
11		Vecerd	-	-	107	0.00*
12		Zlagna	-	-	160	0.00*
13	**Brădeni**	Brădeni	1	24	833	2.88
14		Retiș	1	11	540	2.03
15		Țeline	-	-	128	0.00*
16	**Bruiu**	Bruiu	1	17	437	3.89
17		Gherdeal	-	-	18	0.00*
18		Șomartin	1	15	298	5.03
19	**Chirpăr**	Chirpăr	1	24	830	2.89
20		Săsăuș	-	-	192	0.00*
21		Vărd	1	14	540	2.59
22		Veseud	1	16	238	**6.72**
23	**Iacobeni**	Iacobeni	1	52	970	5.36
24		Movile	1	18	360	5.00
25		Netuș	1	25	450	5.55
26		Noiștat	1	16	520	3.07
27		Stejărișu	1	19	510	3.72
28	**Marpod**	Marpod	1	40	635	**6.29**
29		Ilimbav	1	13	384	3.38
30	**Merghindeal**	Merghindeal	1	25	825	3.03
31		Dealu Frumos	1	30	601	4.99
32	**Mihăileni**	Mihăileni	1	10	302	3.31
33		Metiș	1	20	300	**6.66**
34		Moardăș	-	-	198	0.00
35		Răvășel	-	-	156	0.00
36		Șalcău	-	-	116	0.00
37	**Nocrich**	Nocrich	1	69	1174	5.87
38		Fofeldea	1	25	387	**6.45**
39		Ghijasa de Jos	-	-	115	0.00
40		Hosman	1	20	782	2.55
41		Țichindeal	1	17	175	**9.71**

42	**Roşia**	Roşia	1	55	1388	3.96
43		Caşolț	1	48	666	**7.20**
44		Cornățel	1	20	449	4.45
45		Daia	1	33	770	4.28
46		Nou	1	60	1500	4.00
47		Nucet	-	-	54	0.00
48	**Vurpăr**	Vurpăr	1	85	2500	3.40
49	**Total**		**37**	**1320**	**35205**	**3.74**

Note: data in the table were communicated by each administration in the analysed area.

The contingent of preschool children is of 1320, fact that indicates a surplus of 20 children against the public funded spots in nurseries in the region. The quality of both infrastructure and teaching material that does not quite stand for the actual educational expectancies, which is an issue that needs to be solved in the nearest future/ as fast as possible. The average regional ratio between the number of preschool children and the number of nurseries reaches a value of 35.67 children/nursery, which is a quite good value, according to the teaching staff/specialists in the field. What cannot be accepted though is the fact that, in certain circumstances, like in Bârghiş, Daia, Dealu Frumos localities, for a large number of children there is only one teacher.

Most nurseries are suitably fitted out for teaching children, benefit from a rather sufficient number of specialized teaching staff, due to the School Inspectorate of Sibiu County and local public authorities. Yet, a negative aspect is induced by the lack of private nursery schools, even thou they represent educational institutions which European Union's authorities agreed on, especially due to the fact that workgroups have a small number of children, as compared to public nursery schools. Another aspect is the complete lack of the alternative educational modules, besides the classical ones, as well as the *step by step* or the *early education* modules. This would be another issue that could be quickly corrected with minimum investments.

The regional average rate of preschool children has a consistent value within the total number of population in the region, of 3,74% (1320 preschool children enrolled out of the 35205 inhabitants of the region); in relation to the regional rate, there are some localities that register superior values, of over 6,00%, such as: Apoş (Bârghiş commune - 8,33%); Veseud (Chirpăr commune - 6,72%); Marpod (Marpod commune - 6,29%); Metiş (Mihăileni commune - 6,66%); Fofeldea (Nocrich commune - 6,45%); *Țichindeal (Nocrich* commune - *9,71%)*; Caşolț (Roşia commune - 7,20%). These are localities in which gipsy population registers the greatest values in the total population. On the other hand, this time with reduced percentage values as compared to the regional average, subscribe the localities in which the rate of gipsy population register smaller values, like in Retiş (Brădeni commune) and Hosman (Nocrich commune). We have to mention that the percent value of 0,00% registered for some localities in table 1, is explained by the lack of any preschool educational institution in those localities and not for the fact that there would not exist preschool children by all means.

Hence, a series of new measures are to be imposed for the preschool cycle of education of children that would underline the attention is being/paid to. Improving the quality of education and infrastructure for the preschool cycle can represent a stimulus fro the future demographical behaviour, especially in the case of Romanian and German communities in Hârtibaciu Valley, the moment parents would realize they are supported in raising and educating their children. The specific measures that should be having in view are the following:

- maintaining at least a nursery school in each communal centre and each village, which register the minimum number of preschool children required, as an elementary cell for adopting/gaining a positive social behaviour;
- employing of only specialized and trained qualified staff;
- bringing out new opportunities for a continuous professional training for the teaching staff in the preschool cycle of education;
- the education of preschool children in the spirit of local community, aiming at preserving and amplifying the local specificity.

These actions must be the result of some real partnership actions of at least three socio-educational partners: *the preschool educational institution, the local decisional factors* and *the parents*, the last ones being the indirect beneficiaries of the educational act.

The lack of nursery schools in a few of the villages in Hârtibaciu Valley is justified by the very small contingents of preschool children that make their financial maintenance unbeneficial. In these cases, the existent preschool children are either enrolled by the nursery schools of the nearest villages, or are not institutionalized at all. Such examples may be represented by Beneşti and Ghijasa de Sus - Alțâna commune; Ighişu Vechi, Vecerd and Zlagna - Bârghiş commune; Țeline - Brădeni commune; Gherdeal - Bruiu commune; Săsăuş - Chirpăr commune; Moardăş, Răvăşel and Şalcău - Mihăileni commune; Ghijasa de Jos - Nocrich commune; Nucet - Roşia commune).

3. THE PRIMARY EDUCATIONAL LEVEL

The quantification of data referred to/ regarding the primary school level/cycle (1^{st} to 4^{th} level) and its comparison with data from the previous years reflects the following situation at the level of Hârtibaciu Valley area: the contingent of pupils gradually decrease, especially in the case of Romanian and German pupils. However, despite other rural regions in Romania, this does not represent a critical situation, having that the number of gypsy pupils maintains at a constant high rate, thus in every locality in the region existing the minimum number of pupils required for the functioning of *the primary educational level*, which is *the elementary school*. The negative trend of the continuous decrease in the number of pupils has nevertheless to be inhibited at all ethnic levels for at least remain in the actual coordinates. Still, in some rural localities we found a more difficult situation because of the small number of children required for the functioning of an elementary school, reason for which those schools have been closed. Such examples can be Ighişu Vechi and Vecerd - Bârghiş commune; Gherdeal - Bruiu commune and Nucet - Roşia commune. In case of several localities, the number of pupils enrolled in the primary level of education is inferiour to the number of pupils needed for the functioning of the primary school, yet the financial effort made by the Local Councils and the acceptance given by the Sibiu County Inspectorate allow their functioning for the moment. Such examples are Apoş and Zlagna - Bârghiş commune; Retiş and Țeline - Brădeni commune; Bruiu and Şomartin - Bruiu commune; Săsăuş, Vărd and Veseud - Chirpăr commune; Movile - Iacobeni commune; Ilimbav - Marpod commune; Dealu Frumos - Merghindeal commune; Mihăileni, Moardăş, Răvăşel and Şalcău - Mihăileni commune; Ghijasa de Jos and Țichindeal - Nocrich commune; Cornățel - Roşia commune. The most likely and financially justified perspective of closing these primary schools in the future is dramatic, primary school being considered the elementary educational bastion even by the European Union, and this should exist in every locality, even though it would need much more financial support.

In Hârtibaciu Valley area, the current situation of the elementary educational level is presented in table 2:

- a number of 47 educational institutions of elementary level are functioning, in which 2014 pupils are enrolled; 22 of them represent sections of some secondary or tertiary (high school) level schools;

- the primary schools of Agnita town and its villages of Coveş and Ruja, as well as the ones located in the communal centres register a satisfactory number of pupils, them also being best technically endowed;

- the regional average number of pupils/ elementary educational institution reveals a rate of 42,85 which is comparable with the average number at a national level;

- in rural areas only two localities register 2 elementary schools, in Roşia and Vurpăr;

- in rural areas the number of pupils enrolled in the elementary educational level, as compared to the number of primary educational institutions reveal a much more reduced average, in comparison with Agnita town and its villages, that of 36,06 pupils/school; 97,75 pupils/school is the average registered in Agnita town and its localities, fact that, once more, proves a very well known national phenomenon and that is the decrease in the number of population inhabiting rural areas nearby6 large cities (at a short distance is located Sibiu Municipality);

The situation of the elementary educational level in Hârtibaciu Valley area (January, 2009)

Table 2

Crt. no.	Town/ Commune	Locality	No. of schools/ sections	No. of pupils	Qualified staff	Unqualified staff
1	**Agnita**	Agnita	2	296	16	0
2		Coveș	1	34	3	1
3		Ruja	1	61	3	1
4	**Alțâna**	Alțâna	1	76	5	0
5		Benești	1	16	0	1
6		Ghijasa de Sus	1	10	1	0
7	**Bârghiş**	Bârghiş	1	45	3	0
8		Apoş	1	28	0	2
9		Ighişu Vechi	-	-	-	-
10		Pelişor	1	34	2	0
11		Vecerd	-	-	-	-
12		Zlagna	1	15	0	1
13	**Brădeni**	Brădeni	1	58	2	1
14		Retiş	1	17	1	0
15		Țeline	1	9	1	0
16	**Bruiu**	Bruiu	1	22	1	1
17		Gherdeal	-	-	-	-
18		Șomartin	1	22	1	1
19	**Chirpăr**	Chirpăr	1	92	4	0
20		Săsăuş	1	6	1	0
21		Vărd	1	17	1	0
22		Veseud	1	16	0	1
23	**Iacobeni**	Iacobeni	1	81	3	0
24		Movile	1	24	3	0
25		Netuş	1	47	3	0
26		Noiştat	1	49	4	0
27		Stejărişu	1	36	2	0

28	**Marpod**	Marpod	1	39	3	0
29		Ilimbav	1	13	1	0
30	**Merghindeal**	Merghindeal	1	30	4	0
31		Dealu Frumos	1	22	2	0
32	**Mihăileni**	Mihăileni	1	11	1	0
33		Metiş	1	30	1	1
34		Moardăș	1	20	1	0
35		Răvășel	1	9	1	0
36		Șalcău	1	6	1	0
37	**Nocrich**	Nocrich	1	69	4	0
38		Fofeldea	1	36	2	0
39		Ghijasa de Jos	1	7	1	0
40		Hosman	1	63	4	0
41		Țichindeal	1	18	1	0
42	**Roşia**	Roşia	2	109	8	0
43		Caşolț	1	59	3	1
44		Cornățel	1	25	1	1
45		Daia	1	43	4	0
46		Nou	1	92	7	1
47		Nucet	-	-	-	-
48	**Vurpăr**	Vurpăr	2	202	10	0
49	**Total**		**47**	**2014**	**120**	**14**

Note: data in the table were communicated by each administration in the analysed area.

- the teaching staff registers the existence of 121 skilled teachers (for the elementary level of education) and of 14 unspecialized teachers, the last mentioned being present in localities of Coveş and Ruja - Agnita town; Beneşti - Alțâna commune; Apoş and Zlagna - Bârghiş commune; Brădeni - Brădeni commune; Bruiu and Şomartin - Bruiu commune; Veseud - Chirpăr commune; Metiş - Mihăileni commune; Caşolț, Cornățel and Nou - Roşia commune; the number of pupils enrolled in the elementary level taught by unspecialized teaching staff is of 203 pupils, situation which shall be corrected as soon as possible, by employing of only qualified personnel. Positive examples can be taken from the primary schools in communes of Iacobeni, Marpod, Merghindeal, Nocrich and Vurpăr, which only function based on skilled teaching staff;

- the regional average number of pupils/teacher is of 15.02, while in agnita town and its localities (Coveş and Ruja) register a rate of 16.24, as well as in the rest of territory the rate is of 14.75, therefore the differences being practically insignificant; the values mentioned above indicate a positive reality, thus, from this perspective, this region complying with the educational regulations of the European Union.

Among the major coordinates that should assess the vitality and functionality of the primary educational level we notice the following:

- the maintenance of all the existent teaching institutions (despite the decrease in the number of pupils);
- the employment of only specialized staff;
- the sanitation and modernization of teaching institutions (here we can observe the majority of educational institutions placed in Agnita Town and communal centres that dispose of buildings properly endowed);
- the inclusion of new disciplines that mean to prepare the pupils for practical skills specific to the area, for them becoming skilled craftsmen;

- the fast rehabilitation of the improper school buildings (some of them are functioning without the approval of the sanitary authorities, especially in the case of schools in the villages that do not represent communal centres).

4. SECONDARY EDUCATIONAL LEVEL

The secondary educational level distinguishes itself through a special dynamics, situation that frames it in the present reality at the level of entire country. This dynamics describes a trend that proposes the merging of educational institutions (i.e. many schools in villages were closed, their pupils being enrolled by the schools of the communal centre, of Agnita Town or of Sibiu Municipality). *Thus, they should become more viable, should benefit of qualified teaching staff, new didactic and applicative materials, as well as concentrating most of financial support.*

After analyzing the coordinates of functioning of the secondary educational level in Hârtibaciu Valley, we can highlight the following specificities (table 3):

- in comparison with the elementary level, the number of secondary schools is lower, fact that describes a normality in fact: therefore, only 21 public secondary schools are active and private schools do not exist in the entire region;

- as compared to the regional average, in the urban area, they register a value of 135 pupils/secondary school, while in rural area it is registered a lower average, of only 76 pupils/secondary school;

- a part of the pupils enrolled in the secondary educational level prefer to apply to school of Agnita or Sibiu localities, their educational offer being more diversified, especially regarding studying foreign languages, the superior technical endowments ad superiorly qualified teaching staff;

The situation of the secondary educational level in Hârtibaciu Valley (January, 2009)

Table 3

Crt. no.	Town/ Commune	Locality	No. of public schools	Nno. of pupils	Private schools
1	**Agnita**	Agnita	2	341	-
2		Coveş	-	-	-
3		Ruja	1	64	-
4	**Alțâna**	Alțâna	1	60	-
5		Beneşti	-	-	-
6		Ghijasa de Sus	-	-	-
7	**Bârghiş**	Bârghiş	1	95	-
8		Apoş	-	-	-
9		Ighişu Vechi	-	-	-
10		Pelişor	-	-	-
11		Vecerd	-	-	-
12		Zlagna	-	-	-
13	**Brădeni**	Brădeni	1	80	-
14		Retiş	-	-	-
15		Țeline	-	-	-
16	**Bruiu**	Bruiu	1	44	-
17		Gherdeal	-	-	-
18		Şomartin	-	-	-
19	**Chirpăr**	Chirpăr	1	110	-
20		Săsăuş	-	-	-
21		Vărd	-	-	-

22		Veseud	-	-	-
23	**Iacobeni**	Iacobeni	1	122	-
24		Movile	-	-	-
25		Netuş	-	-	-
26		Noiştat	1	73	-
27		Stejărişu	-	-	-
28	**Marpod**	Marpod	1	47	-
29		Ilimbav	-	-	-
30	**Merghindeal**	Merghindeal	1	66	-
31		Dealu Frumos	-	-	-
32	**Mihăileni**	Mihăileni	1	64	-
33		Metiş	-	-	-
34		Moardăş	-	-	-
35		Răvăşel	-	-	-
36		Şalcău	-	-	-
37	**Nocrich**	Nocrich	1	67	-
38		Fofeldea	-	-	-
39		Ghijasa de Jos	-	-	-
40		Hosman	1	71	-
41		Țichindeal	-	-	-
42	**Roşia**	Roşia	2	108	-
43		Caşolț	1	38	-
44		Cornățel	-	-	-
45		Daia	1	62	-
46		Nou	1	101	-
47		Nucet	-	-	-
48	**Vurpăr**	Vurpăr	1	160	-
49	**Total**		**21**	**1773**	**-**

Note: data in the table were communicated by each administration in the analysed area.

- there are a few localities that register an insufficient number of pupils enrolled in the secondary educational level, fact that determines the insufficiency in the well-functioning of those institutions, such as: Bruiu - 44 pupils; Marpod - 47 pupils; Caşolț (Roşia commune - 38 pupils, while others register a little over the minimum value (Alțâna, Merghindeal, Mihăileni, Nocrich, Daia – Roşia commune). An analysis of the Ministry of Education, Research and Innovation, based on a template that aims at revealing the financial situation of the educational infrastructure, number of teaching staff, number of students, staff expenditure, maintenance expenditures concludes that such an educational institution cannot be viable if it does not register at least 50 pupils enrolled and active. All educational institutions registering a lower number of pupils have to be closed, fact that is now in process, those pupils having to apply to the nearest functional secondary school. For this reason, there is a programme for providing schools located in the rural areas a sufficient number of small buses, exclusively destined to a good ongoing educational process;

- what is surprising is the fact that in the analysed area, not even one private secondary school does function. Much more, there is no request registered, according to Sibiu County Inspectorate; this may be considered a negative aspect, if we refer to the European Union practices, which promote private educational offer.

If we would try to analyse the efficiency of the secondary educational level through all its involved elements, we should establish two separate entities: *the urban element*, qualitatively superior, and *the rural element*, where the deficiencies are more obvious and very hard to be solved.

In the first case, the advantages are given by *the sufficient number of pupils enrolled, the quality of teaching staff* which is totally specialized and a proper and continuous professional training, *schools equipped with current didactic materials, the existence of laboratories of specialty in every school, broad educational offer. The rural element* of the secondary level presents a few real threats, all related to *the decrease in the number of pupils in certain cases,* above mentioned, and implicitly regarding the inefficient functioning, *the employment of also untrained people, the more difficult access, especially in winter time, the migration of some pupils to the city secondary schools, the precarious hygiene, insufficient technical equipment.* If the aim would be that the rural educational system would efficiently continue its existence, than theoretically, the only simple measure that has to be taken is: *to reach the same qualitative level, under all aspects, of the urban one*.

5. VOCATIONAL SCHOOLS

The complementary and apprenticeship educational element, officially entitled "*Arts and Crafts Schools*" seems to be well-represented in the researched area, fact supported by the regional economic specificity. The agricultural specificity, strengthened by the cultural one, contributes to the regional identity, fact that involves the presence of educational institutions that would shape the necessary workforce. The current specialisations in *Arts and Crafts Schools* are oriented by the regional economic specificity: *trade, knitting and dressing, carpentry, leather and leather replacements confections.*

There are 4 institutions of this kind, located in Agnita („A. T. Laurian" Vocational School), *Iacobeni*, *Nocrich* şi *Roşia* (Waldorf School). They register a number of 337 pupils, future specialists in the region. This reality allows us to positively assess the importance is given to this form of professional specialization. Pupils classified according to this craft structure underline an accurate adaptation to the work market in Hârtibaciului Plateau and Sibiu County. Still, a new and more adjusted territorial distribution of these specializations becomes necessary, in accordance with the local and regional specificity, by introducing in the school curriculum of new specializations such as: *rural tourism, animal breeding, veterinary medical assistance*, and others.

6. THE HIGH-SCHOOL EDUCATIONAL LEVEL

In Hârtibaciu Valley area, *the high school educational level* is represented by a single institution, the „A. T. Laurian" Technical College, located in Agnita town. The functional curriculum of this institution covers two major educational areas: *the theoretical field* (specializations such as: mathematics and computer science, *with an intensive module of computer science, philology and computer science-mathematics*) and *the technological field* (specializations such as: *technician-computer engineer*, *technician designer and leather industry engineer*). The educational high school proposal consists of the main specializations of general knowledge and those that are specific to the area. The teachers' competencies are mostly impeccable; this has been proved by the students' results in the school competitions.

The high school structure of the Technical College located in Agnita town consists of 11 *daily teaching* classes, with 270 students enrolled in the theoretical and technological fields. There are also 5 *distance* teaching classes with 144 students enrolled. There are no such institutions in any other locality in the area, therefore students having the educational alternatives of Sibiu or Agnita localities.

The current situation of the high school educational level of the „A. T. Laurian" Technical College, Agnita Town (January, 2009)

Table 4

Crt. no.	Locality	Grade	No. of students	Specialization	Field
1	Agnita	IX A	29	mathematics - computer science (intensive computer science)	theoretical
		IX B	30	technician-computer engineer	technological
		X A	26	technician-computer engineer	technological
		X B	26	philology	theoretical
		XI A	28	technician-computer engineer	technological
		XI B	28	philology	theoretical
		XII A	23	mathematics - computer science	theoretical
		XII B	24	philology	theoretical
		XII C	19	designer	technological
		XII D	24	leather industry engineer	technological
		XIII D	13	leather industry engineer	technological
		XI F.R.	36	philology	theoretical
		XII F.R. 1	32	philology	theoretical
		XII F.R.2	32	philology	theoretical
		XIII F.R.	44	philology	theoretical

Note: data in the table were communicated by each administration in the analysed area.

The current specializations of „A. T. Laurian" Technical College reflect the territorial reality and the educational needs in the area and in the Sibiu County:

- there are 3 specializations that aim at satisfying the students' needs for an efficient general knowledge and the achievement of linguistic competences;
- the economic specificity of the region imposed the existence of 3 specializations related to the technological field;
- the employment of the teachers is made by the principle of quality (all teachers have graduated courses of specialty);
- the potential threats that may occur in the above mentioned high school institution are the following: school non-attendance; few contracts and partnerships with economic entities as potential employers; the degree of equipping technological shops that can be improved;
- the high school specializations should focus on the reinforcement of certain fields highly required on the work market: economic fields, communications, electronics, agricultural specializations (agricultural mechanics, montanology, veterinary field, horticulture etc), constructions, tourism etc.

7. THE TEACHING STAFF

The analysis of the territorial repartition and quality of professional qualification of the teaching staff in the area shows underlines a few major aspects, some of them positive and others that need to be improved (table 6). There are 403 active qualified teachers in the pre-university teaching system in Hârtibaciu Valley area. The good quality of students' professional schooling reflects their teachers' professional skills, good knowledge and pedagogical tact. It should also be mentioned that the Ministry of Education, through its territorial representatives (Sibiu County Inspectorate, Sibiu Academic Body, rural and urban administrations) offers the teaching staff the possibility of continuous professional training. Much more, the programmes for the improvement of rural teaching complete that offer. There are also a number of 59 unqualified teachers.

- a qualitative assessment of the teaching staff reflects that 87,22% (403 active teachers) of the entire teaching staff of the region are qualified while 12,78% of the teaching staff (59 persons) are unqualified teachers, a negative aspect that needs to be solved;

- the most favourable situation is registered by schools in Vurpăr commune, where the entire teaching staff are qualified, fact that needs to be appreciated; low ratios of unskilled teaching staff are registered by schools located in Agnita town and the communes of Nocrich, Mihăileni, Marpod, Merghindeal, where the rate of qualified teachers is of over 90%;

- analysing of the qualification degree of the teaching staff we conclude that: 18,36% (74 persons) are teachers of first rank; 21,59% (87 persons) are teachers of second rank; 40,94% (165 persons) are permanently appointed teachers, and 19,11% (77 persons) are temporary appointed probation/beginning teachers (in the first 2 years of work);

- we notice the high percentage of the young teaching staff (here we can also include teaching staff of second rank, permanently appointed teacher and temporary appointed teacher / permanently appointed teachers and probation/beginning teachers); all three categories of teachers classified by their degree of teaching qualification represent 81,64% (329 persons);

- the strengths of the teaching staff working in the analysed area are the following: the high average percentage of the qualified teaching staff; the presence of only skilled teaching staff in some school institutions; the need for continuous and superior qualification and improvement (4 of the teaching staff have the PhD scientific title); the high-quality results of their students at various school competitions; the reputation they have brought to some pre-university institutions;

- the weaknesses regarding the teaching staff are not to be often mentioned, yet these should be improved as soon as possible. Among the specific measures we can mention: the employment of only qualified staff in all school institutions in the future; the increase in the qualified teaching staff in school institutions with untrained teachers; the continuous superior training and specialization of the teachers active in the educational act prior to college, by attending master studies, PhD studies.

The current situation of the pre-school and elementary school teaching staff in Hârtibaciu Valley area (January 2009)

Table 5

Town/ Commune	**Locality**	**Total teaching staff**	**Qualified**	**Unqualified**	**Situation on ranks**			
					1st rank	**2nd rank**	**Permanently appointed**	**Temporarily appointed**
Agnita	Agnita	86	86	-	24	9	26	27
	Coveș	3	3	-	1	-	2	-
	Ruja	16	14	2	2	5	3	4
Alțâna	Alțâna	16	14	2	-	4	10	-

	Beneşti	1	-	1	-	-	-	-
	Ghijasa de Jos	1	1	-	-	-	1	-
Bârghiş	Bârghiş	14	13	1	1	5	7	-
	Apoş	4	1	3	-	1	-	-
	Ighişu Vechi	-	-	-	-	-	-	-
	Pelişor	3	3	-	1	1	1	-
	Vecerd	-	-	-	-	-	-	-
	Zlagna	1	-	1	-	-	-	-
Brădeni	Brădeni	16	12	4	2	4	5	1
	Retiş	2	2	-	-	1	-	1
	Țeline	-	-	-	-	-	-	-
Bruiu	Bruiu	10	7	3	1	3	1	2
	Gherdeal	-	-	-	-	-	-	-
	Şomartin	3	2	1	-	1	-	1
Chirpăr	Chirpăr	11	9	2	-	3	5	1
	Săsăuş	1	1	-	-	1	-	-
	Vărd	2	1	1	1	-	-	-
	Veseud	2	-	2	-	-	-	-
Iacobeni	Iacobeni	30	28	2	4	7	14	3
	Movile	5	4	1	1	2	-	1
	Netuş	4	2	2	-	1	-	1
	Noiştat	15	13	2	2	5	6	-
	Stejărişu	3	1	2	-	-	1	-
Merghindeal	Merghindeal	15	14	1	3	3	4	4
	Dealu Frumos	4	3	1	1	-	1	1
Marpod	Marpod	14	14	-	1	3	9	1
	Ilimbav	2	1	1	1	-	-	-
Mihăileni	Mihăileni	10	9	1	3	-	4	2
	Metiş	3	2	1	-	-	2	-
	Moardăş	1	1	0	-	-	-	1
	Răvăşel	1	1	-	-	-	1	-
	Şalcău	1	1	-	-	1	-	-
Nocrich	Nocrich	21	18	3	3	4	5	6
	Fofeldea	3	3	-	1	1	1	-
	Ghijasa de Jos	1	1	-	-	-	1	-
	Hosman	10	9	1	2	2	3	2
	Țichindeal	2	2	-	-	-	2	-
Roşia	Roşia	35	32	3	8	7	11	6
	Caşolț	16	12	4	1	3	6	2
	Cornățel	3	2	1	-	1	-	1
	Daia	18	14	4	2	3	7	2
	Nou	28	22	6	4	3	14	1
	Nucet	-	-	-	-	-	-	-
Vurpăr	Vurpăr	25	25	-	4	3	12	6
Total		**462**	**403**	**59**	**74**	**87**	**165**	**77**

Note: data in the table were communicated by each administration in the analysed area.

8. THE OCCUPANCY LEVEL (PUPILS/CLASSROOMS)

Another important aspect that illustrates the vitality and efficiency of the educational process regards the *occupancy level of classrooms with students.* This phenomenon under analysis reveals some significant features:

- there is a balanced number of the students in a classroom, around the value of about 27 students/classroom, data registered at the level of the entire area;
- this average number is mainly influenced by the particular higher value, of 30,26 students/classroom, registered by schools located in Agnita town and in the communal centres; yet, it expresses a favourable situation that comply with the objectives the Ministry of Education, Research and Innovation is promoting; it also corresponds with the directives and the current reality of the European Union;
- many other schools located in the rural areas register lower values of the occupancy level, of about 24,65%, that indicates the existence of threats induced by the decrease in the number of elementary school population;
- school institutions that register a low occupancy level of pupils/classroom and, therefore, a reduced number of pupils enrolled there, tend to become inefficient for the educational process and risk to be closed;
- however, the presence of a large gypsy community in the analyzed area (whose demographical behaviour is positive) reduces the immediate possibility of the decrease in the number of pupils in the regional rural area.

9. SCHOOL INFRASTRUCTURE

Analysing the data regarding *school infrastructure* in the area, it reflects the existence of some educational institutions properly equipped, especially those located in Agnita town („A. T. Laurian" Technical College, The Elementary School no.1) and others located in the communal centres. On the whole, the buildings of these school institutions comply with the requirements of sustaining an appropriate teaching process. However, it should be noticed that, lately, the investments in school infrastructure have been diminished, which is a negative aspect. There have been major upgrading works at only one school, rehabilitation works at one school institution, as well, and a number of three schools have benefited of financial support and modernization works. Not even one new construction has been built for educational purposes. It becomes absolutely necessary to start such works for all schools that require them.

Data about sports halls demonstrate them all being functional. Out of the 47 current establishments, 35 are inappropriately located, them being arranged in place of classrooms, therefore not disposing of enough space for sports activities. There are only 4 recently newly built sports halls that have been built by governmental investments. Thus, *modern sports halls* turn out to be a useful and necessary facility for as much educational institutions as it can.

10. THE SWOT ANALYSIS

A SWOT analysis of the educational element in Hârtibaciu Valley area should encompass the following major vectors:

Strengths:

- the existence of all educational levels prior college, from elementary to upper secondary;
- perceiving Agnita Town as the main educational centre in the region;
- the presence of a relatively well skilled/ specialized workforce;
- the increasing rate of covering all levels of education, elementary, lower and upper secondary, as well as tertiary;

- the decreasing rate of school drop-out;
- the positive assessment of the pupils regarding the quality of education in schools;
- the broad network of specialisations in educational institutions;
- the existence of several partnership relations with other educational institutions within the European Union.

Weaknesses:

- the decrease in the rate of covering all levels of education, especially the high school level;
- the decrease in the number of population of school age;
- the more accentuated phenomenon of quitting teaching in school based on economic reasons; i.e. the teaching staff in high school, especially those located in rural areas;
- the presence of unqualified teaching staff in the rural educational system;
- the insufficient wages of both the teaching staff, and the staff who are indirectly responsible for teaching activities as well as those who work in administration;
- the lack of properly equipped sports halls in numerous school institutions.

Opportunities:

- the variegation of qualifications/specializations at all educational levels;
- as for future immediate regulations, educational institutions should be only employing qualified staff for each subject/course;
- the adequate upgrading and equipping of all the educational institutions that lack in them;
- the preoccupation of legal institutions to promote broad professional formation of people, thus assuring flexibility on the work market;
- the implementation of a modern concept of pre-academic management;
- the development of multiculturalism and intercultural dialogue in educational institutions;
- reassessing the relationship with civil society, which is the provider of the potential quota for progressing the educational act;
- the elaboration of some strategies for authentic and original educational development.

Threats:

- the under-usage of human potential (usage below its qualifications);
- the restricted access to higher education due to the need of financial support;
- the continuous presence of a significant share of unqualified teaching staff, due to the small incomes in this field.

REFERENCES

1. Beaujeu-Garnier, Jaqueline, Chabot, G. (1971), *Geografie urbană,* Edit. Științifică, București.
2. Benedek, J. (2004), *Amenajarea teritoriului şi dezvoltarea regională,* Edit. Presa Universitară Clujeană, Cluj-Napoca.
3. Bodocan, V. (1996), *Geografie politică,* Edit. Presa Universitară Clujeană, Cluj-Napoca.
4. Bold, I., Buciuman, E., Drăghici, M. (2003), *Spațiul rural. Definire, organizare, dezvoltare,* Edit. Mirton, Timişoara.
5. Ianoş, I. (2000), *Sisteme teritoriale. O abordare geografică,* Edit. Tehnică, Bucureşti.
6. Nistor, S. (2000), *Comuna şi județul. Evoluția istorică,* Edit. Dacia, Cluj-Napoca.
7. Rotariu, T. (2003), *Demografie şi sociologia populației. Fenomene demografice,* Edit. Polirom, Iaşi.
8. Rotariu, T., Ilut, P. (1997), *Ancheta sociologică şi sondajul de opinie. Teorie şi practică.* Edit. Polirom, Iaşi.
9. Surd, V. (1997), *Geografia dezvoltării şi a decalajelor economice contemporane,* Edit. Presa Universitară Clujeană, Cluj-Napoca.
10. *** http://www.cjsibiu.ro/portal/sibiu/cjsibiu/portal.nsf/Index/100?OpenDocument.

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

THE PARLIAMENTARY ELECTIONS IN ROMANIA (NOVEMBER 30, 2008)

GR. P. POP[1]

ABSTRACT. – The Parliamentary Elections in Romania (November 30, 2008). This paper analyzes the essential aspects regarding the development and the results of the elections for the Romanian Parliament (the Chamber of Deputies and the Senate), for the legislative period 2008-2012. Many political parties, alliances, unions and independents took part in this action, with a low turnout (only 39.20% of the total of 18,462,274 listed voters). Because of the general electoral threshold of 5% and 8% for alliances, only two parties, the Democratic Liberal Party (DLP) and National Liberal Party (NLP), one alliance, the Social Democratic Party + the Conservative Party (SDP + CP) and a union, the Democratic Union of Hungarians in Romania (DUHR), succeeded to enter the Parliament. Out of the total of 6,886,794 valid votes, the political alliance SDP + CP obtained 33.10% for the Chamber of Deputies and 34.16% for the Senate, then, in decreasing order, DLP had 32.36% and 33.57%, NLP 18.57% and 18.74% and DUHR had 6.17% and 6.39% (table 1). Due to the results obtained and the redistribution of the votes received by the parties who had less than 5%, the first two parties eventually had an almost identical number of deputies and senators: 115 and 51 DLP, 114 and 49 SDP + CP, then NLP is represented by 65 deputies and 28 senators, and DUHR by 22 deputies and 9 senators. As for the Chamber of Deputies, it must be highlighted that a number of 18 deputies representing the organizations of national minorities, are added, according to the Electoral Law, to the 316 MPs of the above-mentioned parties, so the total number is 334 deputies. On the other hand, it should be mentioned that the Romanian Senate is made up by 137 MPs, so that the reunited chambers of the Parliament had a total of 471 legislators, whose territorial distribution is underlined in the tables of this paper.

Keywords*: Parliamentary elections, November 2008, deputies, senators, DLP, SDP + CP, NLP, DUHR, territorial distribution, counties, geographical-historical provinces.*

1. INTRODUCTION

This paper is the seventh on this subject, written after 1989, when the *Electoral Geography*, a component of the Social Geography from the field of Human Geography, as a result of the removal of the former social and political regime, started to have an object of study and, at the same time, to be permissive for the geographical research. The first and sixth papers were concerned with the election of mayors at the 1992 (Banat, Crişana-Maramureş and Transylvania) and 2008 (Cluj County) elections and were written by Gr. P. Pop and V. Bodocan. The other four papers (author: Gr. P. Pop) have in view the national *parliamentary* (Chamber of Deputies and Senate) and *presidential* elections of the years 1992, 1996, 2000 and 2004 (see References).

Unlike the previous situations (between 1990 and 2004), when the parliamentary elections took place at the same time with the presidential elections, two significant changes occurred in the electoral process in Romania starting with 2008. First, as a result of the

[1] *Babeş-Bolyai University, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail: grigor@geografie.ubbcluj.ro*

extension of the presidential term from four to five years and the maintenance of the term for the Chamber of Deputies and the Senate to four years, there were of course two dates for the parliamentary elections, which took place on November 30, 2008, and for the presidential elections, scheduled in autumn 2009. Second, the election of the deputies and senators has been made by uninominal vote.

In order to enter the Romanian Parliament, the Electoral Law kept the 5% threshold from the previous poll (the year 2004). In 2008, this meant a number of at least 344,340 votes obtained for the *Chamber of Deputies* by any party from the *Unique Classified List of Parties* (alliances, associations, communities, federations, forums, parties, unions, etc). However, one party, the Political Alliance Social Democratic Party + the Conservative Party had to obtain 8% of the votes in order to enter the Parliament, which is 550,943 votes from the total valid votes. In the case of the *Senate*, the threshold was 344,402 and 551,044 votes, under the same conditions.

Concerning the quantitative expression of the **2008 parliamentary elections**, one should highlight the fact that, both for the Chamber of Deputies and for the Senate, the *total number of voters listed on the electoral lists* was 18,464,274, of which 18,253,616 on the permanent electoral lists, 181,336 on the supplementary electoral lists and 29,322 requested to vote with the help of the ballot box.

Of the total number of voters from the electoral lists (18,464,274 persons), only 7,238,871 (39.20%) actually voted, which is a low turnout. 97.1% of those who voted (7,029,169 people) are persons listed on the permanent electoral lists, 2.5% (181,068 persons) are those found on the supplementary lists and 0.4% (28,364) voted with the help of the ballot box. Of course, regarding the presence of voters at the poll, generally speaking, there was a higher turnout in the rural areas as compared to the urban areas, as well as important differences from one county to another.

The following analysis has in view the main aspects regarding the elections for the *Chamber of Deputies* and *the Senate*. The study ends with the most general conclusions which are needed in such situations.

2. THE ELECTIONS FOR THE CHAMBER OF DEPUTIES

As mentioned before, there were a total of 7,238,871 voters, and there were 6,886,794 valid votes, 210,994 null votes and 139,139 white votes.

The analysis of the elections for the *Chamber of Deputies* allows us to emphasize a few general aspects (table 1):

Results of the 30 November 2008 Parliamentary Elections in Romania, for the Chamber of Deputies and the Senate, on political parties that obtained more than 1% of the total valid votes

Table 1

Political party	Chamber of Deputies			Senate			MPs
	No. of votes	%	No. of deputies	No. of votes	%	No. of senators	
DLP	2228860	32.36	**115**	2312358	33.57	**51**	**166**
SDP+CP	2279449	33.10	**114**	2352968	34.16	**49**	**163**
NLP	1279063	18.57	**65**	1291029	18.74	**28**	**93**

DUHR	425008	6.17	**22**	440449	6.39	**9**	**31**
GRP	217595	3.16	**0**	245930	3.57	**0**	**0**
NGP-CD	156901	2.28	**0**	174519	2.53	**0**	**0**
Minorities	11086	0.16	**18**	-	-	-	**18**
Others	288832	4.20	-	70802	1.04	-	-
Total	**6886794**	**100.00**	**334**	**6888055**	**100.00**	**137**	**471**

DLP = Democratic Liberal Party; Political Alliance SDP + CP = Political Alliance Social Democratic Party + Conservative Party; NLP = National Liberal Party; DUHR = Democratic Union of Hungarians in Romania; GRP = Greater Romania Party; NGP-CD = New Generation Party-Christian Democratic.

- due to the electoral threshold of 5% established in order to enter the Chamber of Deputies at the 2008 elections, when the total number of valid votes was 6,886,794, only four parties succeeded: the *Democratic Liberal Party* (32.36%), the *Political Alliance Social Democratic Party + Conservative Party* (33.10%), the *National Liberal Party* (18.57%) and the *Democratic Union of Hungarians in Romania* (6.17%). Together, they summed up 90.2% of the options of the Romanian voters[1];

- only two parties received between 1 and 5% of the votes - the *Greater Romania Party* (3.16% of the total valid votes) and the New Generation Party-Christian Democratic (2.28%);

- according to the stipulations of the present electoral law, 18 representatives of the *national minorities* also received seats in the Chamber of Deputies. Together, they obtained 11,086 votes, which represent only 0.16% of the total valid votes[2];

- there were also *other situations*, as a total of 288,832 votes (4.20% of the total valid votes) were received by parties which had less than 1% of the votes, as well as by some national minorities which did not meet the demands of the electoral law.

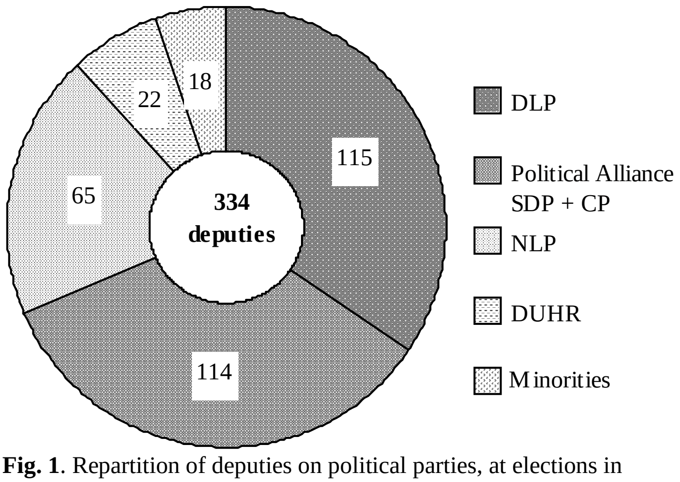


Fig. 1. Repartition of deputies on political parties, at elections in November, 30, 2008.

In agreement with the present legislation regarding the elections for the Romanian Parliament, 334 people won seats for the *Chamber of Deputies*. 316 persons (94.6%) belong to the four parties which obtained at least 5% of the total valid votes, and 18 seats were assigned to the national minorities established by the stipulations of the Romanian Electoral Law.

[1] The hierarchy was made according to the number of assigned seats.

[2] Official Bulletin of Romania, Part 1, Year 176 (XX) – No. 820, December 5, 2008, p. 11-12.

Taking into account the total number of 334 representatives in the Chamber of Deputies, one remarks that 115 seats (34.4%) went to the *Democratic Liberal Party* (DLP), 114 (34.1%) to the Political Alliance *Social Democratic Party + Conservative Party* (SDP + CP), 65 (19.5%) to the National Liberal Party (NLP), 22 (6.6%) to the Democratic Union of Hungarians in Romania (DUHR) and 18 (5.4%) to the minorities (table 1 and fig. 1).

Of course, regarding the representativity of the political parties in the Chamber of Deputies, special attention should be given to the territorial distribution of the votes in Romania, which may be analysed at the level of counties and geographical-historical provinces.

2. 1. The distribution of deputies by political parties at the level of counties

Numerically, the presence of deputies in different Romanian counties is determined by the demographical size of the counties. The analysed situation is highlighted in the synthesis given in table 2. Therefore, taking into account the total number of 312 deputies from the 41 counties and Bucharest City (to which one should add 18 deputies representing the national minorities and 4 representing the Romanian diaspora, reaching a total of 334 deputies), one notices the following:

- the highest number of administrative units (25, or 59.5% of the total of 42) have between 6 and 10 deputies, the counties of Bacău, Cluj, Constanța, Dolj, Suceava and Timiş being at the upper limit (10 deputies), while the counties of Botoşani, Gorj, Sibiu, Vâlcea and Vrancea are at the lower limit;

The distribution of the deputies and senators by political parties and counties at the 2008 parliamentary elections in Romania

Table 2

Crt. no.	County	Chamber of Deputies						Senate					MPs
		DLP	SDP+CP	NLP	DUHR	Minorities	Total	DLP	SDP+CP	NLP	DUHR	Total	
1	Alba	3	1	1	0	0	**5**	2	0	0	0	**2**	**7**
2	Arad	5	1	1	1	0	**8**	2	1	0	0	**3**	**11**
3	Argeş	3	5	1	0	0	**9**	1	2	1	0	**4**	**13**
4	Bacău	3	4	3	0	0	**10**	1	2	1	0	**4**	**14**
5	Bihor	2	2	2	3	0	**9**	1	1	1	1	**4**	**13**
6	Bistrița-Năsăud	2	1	1	0	0	**4**	1	1	0	0	**2**	**6**
7	Botoşani	2	2	2	0	0	**6**	1	1	1	0	**3**	**9**
8	Braşov	3	2	2	1	0	**8**	2	1	1	0	**4**	**12**
9	Brăila	1	3	1	0	0	**5**	0	1	1	0	**2**	**7**
10	Buzău	2	3	2	0	0	**7**	1	1	1	0	**3**	**10**
11	Caraş-Severin	2	2	1	0	0	**5**	1	1	0	0	**2**	**7**
12	Călăraşi	1	2	2	0	0	**5**	1	0	1	0	**2**	**7**

13	Cluj	4	2	2	2	0	**10**	2	1	1	0	**4**	**14**
14	Constanța	3	5	2	0	0	**10**	1	2	1	0	**4**	**14**
15	Covasna	0	1	0	3	0	**4**	0	0	0	2	**2**	**6**
16	Dâmbovița	4	3	1	0	0	**8**	2	1	0	0	**3**	**11**
17	Dolj	3	5	2	0	0	**10**	2	2	1	0	**5**	**15**
18	Galați	3	5	1	0	0	**9**	1	2	1	0	**4**	**13**
19	Giurgiu	1	1	2	0	0	**4**	0	0	2	0	**2**	**6**
20	Gorj	2	3	1	0	0	**6**	1	1	0	0	**2**	**8**
21	Harghita	0	1	0	4	0	**5**	0	0	0	2	**2**	**7**
22	Hunedoara	3	2	2	0	0	**7**	1	1	1	0	**3**	**10**
23	Ialomița	1	2	1	0	0	**4**	1	1	0	0	**2**	**6**
24	Iași	4	5	3	0	0	**12**	2	2	1	0	**5**	**17**
25	Ilfov	2	1	1	0	0	**4**	1	1	0	0	**2**	**6**
26	Maramureș	2	2	2	1	0	**7**	1	1	1	0	**3**	**10**
27	Mehedinți	2	1	1	0	0	**4**	1	1	0	0	**2**	**6**
28	Mureș	2	2	1	3	0	**8**	1	1	0	2	**4**	**12**
29	Neamț	4	3	1	0	0	**8**	1	1	1	0	**3**	**11**
30	Olt	2	4	1	0	0	**7**	1	2	0	0	**3**	**10**
31	Prahova	5	4	3	0	0	**12**	2	2	1	0	**5**	**17**
32	Satu Mare	1	1	1	2	0	**5**	0	1	0	1	**2**	**7**
33	Sălaj	1	1	1	1	0	**4**	0	1	0	1	**2**	**6**
34	Sibiu	3	2	1	0	0	**6**	1	1	1	0	**3**	**9**
35	Suceava	5	3	2	0	0	**10**	2	1	1	0	**4**	**14**
36	Teleorman	2	2	2	0	0	**6**	1	1	1	0	**3**	**9**
37	Timiș	5	3	2	0	0	**10**	2	1	1	0	**4**	**14**
38	Tulcea	2	1	1	0	0	**4**	1	1	0	0	**2**	**6**
39	Vaslui	2	3	2	0	0	**7**	1	1	1	0	**3**	**10**
40	Vâlcea	2	3	1	0	0	**6**	1	1	1	0	**3**	**9**
41	Vrancea	2	3	1	0	0	**6**	1	1	0	0	**2**	**8**
42	Bucharest City	12	11	5	0	0	**28**	5	5	2	0	**12**	**40**
43	Minorities	0	0	0	0	18	**18**	0	0	0	0	**0**	**18**
44	Foreign Countries	2	1	0	1	0	**4**	1	0	1	0	**2**	**6**
Total		**115**	**114**	**65**	**22**	**18**	**334**	**51**	**49**	**28**	**9**	**137**	**471**

DLP = Democratic Liberal Party; SDP + CP = Social Democratic Party + Conservative Party, NLP = National Liberal Party; DUHR = Democratic Union of Hungarians in Romania.

- a number of 14 counties (33.3% of the total of 41, plus Bucharest City) have between 4 and 5 deputies. The counties of Bistrița-Năsăud, Covasna, Giurgiu, Ialomița, Ilfov, Mehedinți, Sălaj and Tulcea have 4 deputies, and the counties of Alba, Brăila, Caraş-Severin, Călăraşi, Harghita and Satu Mare have 5 deputies;

- in two situations (4.8% of the 42 administrative units), in Iaşi and Prahova counties, 12 deputies represent the county in the Chamber of Deputies, while there are 12 deputies representing Bucharest City, a normal situation considering the demographic size of the capital city (2.4% of the 42 Romanian administrative units).

Regarding the percentage of the parties which entered the Chamber of Deputies at county level, several specific aspects should be underlined:

- the **DLP** has 36.2% (113 in absolute numbers) of the 312 deputies from the 41 counties and Bucharest City. It has 50% or more in the following counties: Arad (62.5% of 8 deputies), Alba (60% of 5), Sibiu (50% of 6), Timiş (50% of 10), Bistrița-Năsăud (50% of 4), Suceava (50% of 10), Neamț (50% of 8), Tulcea (50% of 4), Ilfov (50% of 4), Dâmbovița (50% of 8). Then, it has a weight between 40% and 50% in the counties of Caraş-Severin (40% of 5 deputies), Hunedoara (42.9% of 7), Cluj (40% of 10), Prahova (41.7% of 12) and in Bucharest City (42.9 % of 28 deputies). In contrast to the mentioned situations, DLP is not represented in the Chamber of Deputies in the counties of Covasna and Harghita, and it has a modest representation in some other counties, such as Brăila, Călăraşi and Satu Mare (20% of 5 deputies in each), Bihor (22.2% of 9), Ialomița, Giurgiu and Sălaj (25% of 4 deputies in each), Mureş (25% of 8 deputies) etc;

- the second party, which has the same representation as the previous one, is the **Political Alliance SDP + CP**. It has the highest representation in the counties located in Eastern and Southern Romania. Relative weights of 50% or more are recorded in the counties of Brăila (60% of 5 deputies), Galați and Argeş (55.6% of 9 deputies in each), Olt (57.1% of 7), Constanța and Dolj (50% of 10 deputies in each), Vrancea, Vâlcea and Gorj (50% of 6 deputies in each), Ialomița (50% of 4), then Vaslui and Buzău (42.9% of 7 deputies in each), Iaşi (41.7% of 12 deputies), and Călăraşi and Caraş-Severin (40% of 5 deputies in each). Naturally, because of the higher weight of the DLP in the administrative units belonging to the geographical-historical provinces of Banat, Transylvania, Crişana and Maramureş, and of the presence of DUHR deputies in these areas, the Political Alliance SDP + CP is modestly represented in the counties of Arad (12.5% of 8 deputies), Alba, Satu Mare and Harghita (20% of 5 deputies in each), Cluj (20% of 10 deputies), Bihor (22.2% of 9), Bistrița-Năsăud, Covasna and Sălaj (25% of 4 deputies in each), Braşov and Mureş (25% of 8 in each);

- the **NLP** has 20.8% of the 312 deputies representing the Romanian counties and Bucharest City. It has the highest representation in the counties of Giurgiu (50% of 4 deputies), Călăraşi (40% of 5), then in Teleorman and Botoşani (33.3% of 6 in each) and in Bacău (30% of 10), then there are values below 30% in the counties of Vaslui, Bacău, Maramureş, Hunedoara (28.6% of 7 deputies in each of these counties), Iaşi and Prahova (25% of 12 in each), Braşov (25% of 8), Sălaj, Bistrița-Năsăud, Ialomița, Ilfov, Mehedinți and Tulcea (25% of 4 deputies in each county) etc. In some cases, they have less than 15%, as in the counties of Olt (14.3% of 7 deputies), Arad, Mureş, Neamț and Dâmbovița (12.5% of 8 deputies in each county), Argeş and Galați (11.1% of 9 deputies in each). As in the case of the DLP, the National Liberal Party has no representatives for the Chamber of Deputies in the counties of Covasna and Harghita;

- the **DUHR** has an average weight of 6.7% at the level of the Romanian counties and Bucharest City (21 deputies of 312). In accordance with the presence of the Hungarian minority on the Romanian territory, it has the highest weight in the counties of Harghita (80% of 5 deputies, a county with cu 84.6% Hungarian population in 2002) and Covasna (75% of 4, with 73.8% Hungarians), followed by Satu Mare (40% of 5, with 35.2%

Hungarians), Mureş (37.5% of 8, with 39.3% Hungarians), Bihor (33.3% of 9, with 26% Hungarians), Sălaj (25% of 4, with 23% Hungarians), Cluj (20% of 10, with 17.4% Hungarians), Maramureş (14.3% of 7, with 9.1% Hungarians), Arad and Braşov (12.5% of 8 deputies in each, while the Hungarian population represents 10.8% in the former and only 8.6% in the latter).

To the number of 312 deputies representing the Romanian counties and Bucharest City, one should add the 4 MPs representing the Romanians from foreign countries and 18 MPs representing the organizations of the citizens belonging to national minorities, except for the Hungarian minority.

Concerning the ***representation of the Romanians from abroad in the Chamber of Deputies***, one should underline that, according to the stipulations of the Electoral Law, 4 seats for deputies have been established. These seats were given, after the redistribution of the deputies, to two representatives of the Democratic Liberal Party, Mr. *Brînză William Gabriel* (placed first, with 48.1% of the total valid votes, in *Western Europe*) and Mr. *Lubancovici Mircea* (placed first, with 48.2%, in *America-Australia*). The other two seats went to Mr. *Panţîru Tudor*, from the Political Alliance SDP + CP (placed third, with 16.5% of the valid votes, in *Eastern Europe-Asia*) and *Kötö Jozsef*, of the DUHR (placed fourth, with only 1.9% of the valid votes, in *Africa-Middle East*). As a result of the totally illogical decision to give this latter seat to the DUHR representative, the mass media intensely criticized this nomination in the first decade of December 2008, showing that the candidate obtained only 34 votes of the total of 1768 valid votes in the electoral area, as compared to the results of the other candidates, which obtained much higher scores (Berkovits Herman, DLP, 32.3%; Stoica Mariana, NLP, 31.5%, Schor Armand, SDP + CP, 18.1% etc).

As for the **deputies of the national minorities**, the seats were given to the organizations which obtained at least 10% of the electoral score established at national level, 21,722. Based on this request, the situation of the national minorities which are present in the Chamber of Deputies, in decreasing order according to the number of the valid votes they had, is the following[1]:

1. *The Democratic Forum of the Germans in Romania*, 23190, Ganţ Ovidiu-Victor, 2502, Sibiu;
2. *The Democratic Union of the Slovaks and Czechs in Romania*, 15 373, Merka Adrian-Miroslav, 1 248, Bihor;
3. *The Polish Union in Romania*, 7 670, Longher Gherbazen, 993, Suceava;
4. *The Bulgarian Union of Banat-Romania*, 14,039, Marcovici Nicolae, 855, Timiş;
5. *The Community of Lipovan Russians from Romania*, 9 203, Ignat Miron, 746, Tulcea;
6. *The Pro-Europa Rroma Party*, 44 ,037, *Păun Nicolae*, 668, Galaţi;
7. *The Democratic Union of the Turkish Islamic Tatars of Romania*, 11,868, Amet Aledin, 651, Constanţa;
8. *The Federation of Jewish Communities in Romania*, 22,393, Vainer Aurel, 560, Neamţ;
9. *The Union of Croatians in Romania*, 9,004, Radan Mihai, 531, Caraş-Severin;
10. *The Union of Serbians in Romania*, 10,868, Popov Duşan, 461, Timiş;
11. *The Union of Ukrainians in Romania*, 9,338, Bucita Ştefan, 410, Maramureş;
12. *The Turkish Democratic Union of Romania*, 9,481, *Ibram Iusein*, 261, Constanţa;

[1] The following information is mentioned: current number, name of the organisation of the citizens belonging to national minorities, number of votes obtained by the organizations of the national minorities, the family name and given name of the candidate who obtained the highest number of valid votes, the number of valid votes and the electoral district (see the 2nd note from the page 3).

13. *The Association of Macedonians in Romania*, 11,814, Dumitrescu *Liana*, 269, Neamţ;
14. *The Association of Italians in Romania - RO. AS. IT.*, 9,567, Grosaru Mircea, 244, Botoşani;
15. *The Union of Armenians in Romania*, 13,892, Pambuccian Varujan, 218, Argeş;
16. *The Cultural Union of Rusyns in Romania*, 4,514, Firczac Gheorghe, 175, Hunedoara;
17. *The Association of the Albanian League in Romania*, 8,792, Manolescu Oana, 166, Suceava;
18. *The Greek Union of Romania*, 8,875, Zisopol Dragoş-Gabriel, 137, Galaţi.

2. 2. The distribution of the deputies by political parties at the level of geographical-historical provinces

As it comes out from those presented above, the Chamber of Deputies of the Romanian Parliament is made up by 334 deputies, of which 312 are the representatives of the seven geographical-historical provinces of Romania and of the city of Bucharest, 18 represent the organizations of the citizens belonging to national minorities and 4 have been chosen by the Romanians from abroad.

Regarding the political colour of the 312 deputies from the provinces and the city of Bucharest, one remarks the equality between the DLP and the SDP + CP, each having 36.2% (113 deputies), followed by the NLP with 20.8% (65 deputies), and the DUHR with 6.8% (21 deputies) of the total number of 312. Of course, at the level of geographical-historical provinces, there are important differences, of which we choose to generally underline a few significant aspects:

- in **Banat** (the counties of Timiş, Arad and Caraş-Severin), more than 50% of the deputies are representatives of the DLP (52.2% of the total 23), then the percentage values of the other parties are of course decreasing from 26.1% (SDP +CP) and 17.4% (NLP) to 4.3% (DUHR);

The distribution of the deputies and senators by political parties and geographical-historical provinces at the 2008 parliamentary elections in Romania

Table 3

Crt. no.	Geographical-historical provinces	Chamber of Deputies						Senate					MPs
		DLP	SDP+CP	NLP	DUHR	Minorities	Total	DLP	SDP+CP	NLP	DUHR	Total	
1	Banat	12	6	4	1	0	**23**	5	3	1	0	**9**	**32**
2	Crişana and Maramureş	5	5	5	6	0	**21**	2	3	2	2	**9**	**30**
3	Transylvania	21	15	11	14	0	**61**	10	7	4	7	**28**	**89**
4	Moldavia	25	28	15	0	0	**68**	10	11	7	0	**28**	**96**
5	Dobrudja	5	6	3	0	0	**14**	2	3	1	0	**6**	**20**
6	Muntenia	22	26	16	0	0	**64**	10	10	8	0	**28**	**92**
7	Bucharest City	12	11	5	0	0	**28**	5	5	2	0	**12**	**40**
8	Oltenia	11	16	6	0	0	**33**	6	7	2	0	**15**	**48**
	Total	**113**	**113**	**65**	**21**	**0**	**312**	**50**	**49**	**27**	**9**	**135**	**447**

1	Minorities	0	0	0	0	18	**18**	0	0	0	0	**0**	**18**
2	Foreign Countries	2	1	0	1	0	**4**	1	0	1	0	**2**	**6**
	Total	**2**	**1**	**0**	**1**	**18**	**22**	**1**	**0**	**1**	**0**	**2**	**24**
General total		**115**	**114**	**65**	**22**	**18**	**334**	**51**	**49**	**28**	**9**	**137**	**471**

- the provinces of **Crişana and Maramureş** (the counties of Bihor, Satu Mare and Maramureş), analysed together, are characterized by the fact that the first three parties of the Chamber of Deputies have each 23.8% of the total of 21 deputies, while the DUHR has 28.6% (6 deputies out of the total of 21);

- the same as in Banat, the DLP is also first in **Transylvania** with 34.4% (21 deputies) of the total number of 61 deputies of this geographical-historical province (the counties of Cluj, Sălaj, Bistriţa-Năsăud, Mureş, Harghita, Covasna, Braşov, Sibiu, Hunedoara and Alba), followed in decreasing order by the SDP + CP with 24.6% (15 deputies), DUHR with 23% (14 deputies) and NLP with 18% (11 deputies). The latter situation is a consequence of the presence of Hungarian population, as in the case of the previous province;

- in **Moldavia** (comprising the couple counties of Suceava and Botoşani, Neamţ and Iaşi, Bacău and Vaslui, Vrancea and Galaţi), as well as in the next three provinces (Dobrudja, Muntenia and Oltenia) and in the city of Bucharest, the MPs from the Chamber of Deputies belong exclusively to the first three parties (as the DUHR is not represented) (see table 3 and fig. 2). Of the total of 68 deputies, these parties have in decreasing order 41.2% (SDP + CP, 28 deputies), 36.8% (DLP, 25 deputies) and 22% (NLP, 15 deputies);

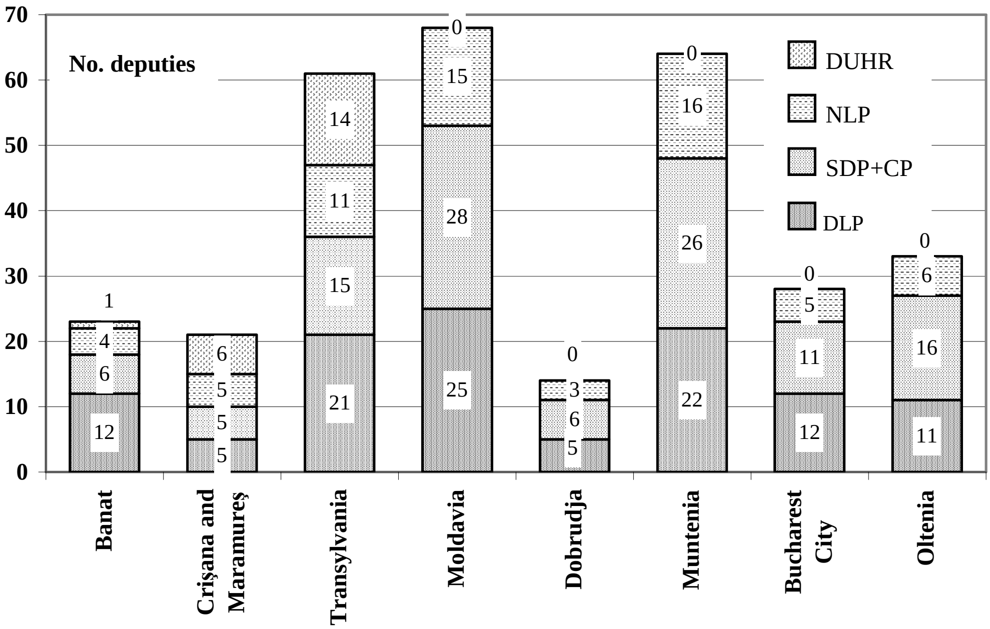


Fig. 2. The distribution of the deputies by political parties and geographical-historical provinces at the 2008 parliamentary elections in Romania.

- the parliamentary representation of **Dobrudja** (the counties of Constanța and Tulcea), which has of course a lower number of deputies (14, as compared to 68), is similar to that of Moldavia, from the point of view of the weight. Thus, the first place belongs to SDP + CP (42.9%, 6 deputies), followed by DLP (35.7%, 5 deputies) and NLP (21.4%, 3 deputies);

- **Muntenia** comprises four Carpathian, Subcarpathian and lowland counties (Buzău, Prahova, Dâmbovița and Argeş), five Danubian counties (Brăila, Ialomița, Călăraşi, Giurgiu and Teleorman) and one county located around the capital city (Ilfov). The results are largely similar to those registered in Moldavia, as SDP +CP has 40.6% (26 deputies out of the total number of 64 deputies of the province), then 34.4% (22 deputies) are representatives of the DLP and 25% (16 deputies) those of the NLP;

- in the capital city of Romania – **Bucharest City** – one remarks a certain balance regarding the parliamentary representation in the Chamber of Deputies of the first two parties, as the DLP has 42.9% (12 deputies) out of the total number of 28, and the SDP + CP, 39.3% (11 deputies). They are followed by the NLP, which has only 17.8% (5 deputies);

- as for the seventh geographical-historical province of Romania, that of **Oltenia**, which consists of two Carpathian and Subcarpathian counties (Vâlcea and Gorj) and three Danubian counties (Mehedinți, Dolj and Olt), one may state that it is some sort of a fief of SDP + CP, which holds 48.5% (16 deputies) out of the total of 33 deputies of the province, followed by the DLP, with a third of the total, that is 33.5% (11 deputies) and the NLP with 18.2% (6 deputies).

3. THE PARLIAMENTARY ELECTIONS FOR THE SENATE

As in the situation mentioned for the Chamber of Deputies, there were 7,238,871 voters which presented for the ballot, out of which 6,888,055 were valid votes. 92.86% of these votes went to the parties which acquired at least 5% of the voters' options, as follows: 2,312,358 votes (33.57%) for the Democratic Liberal Party (DLP), 2,352,968 (34.16%) for the Political Alliance Social Democratic Party + Conservative Party (SDP + CP), 1,291,029 (18.74%) for the National Liberal Party (NLP) and 440,449 (6.39%) for the Democratic Union of Hungarians in Romania (DUHR). The other 7.14% of the votes went to the Greater Romania Party (GRP), the New Gene-ration Party-Christian Democratic (NGP -CD) and other parties (table 1).

Based on the results obtained and then on the redistribution of the votes obtained by the other parties to the first four political parties, the 137 seats of senators have been assigned as follo-wing: 51 (37.2%) to the DLP, 49 (35.8%) to the SDP + CP, 28 (20.4%) to the NLP and 9 (6.6%) to the DUHR (fig. 3).

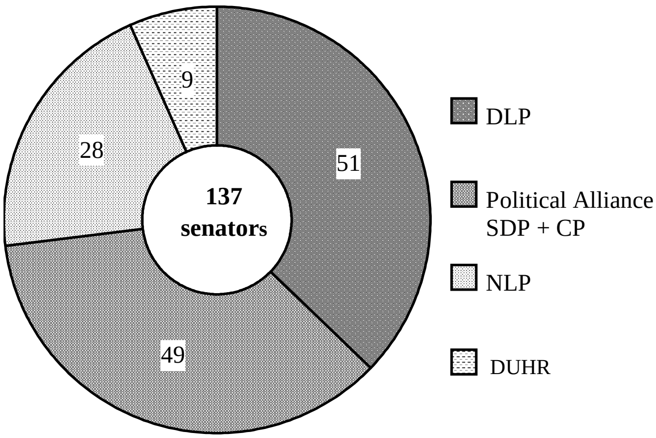


Fig. 3. Repartition of senators on political parties, at the elections in November, 30, 2008.

3. 1. The distribution of senators by political parties and administrative units

We have in view the main aspects regarding the territorial distribution of the 135 senators representing the 41 counties and Bucharest City (table 2), while the other two senators, to reach the total number of 137 senators which enter the Romanian Senate, are the representatives of the Romanian diaspora (*Badea Viorel-Riceard*, representative of the DLP, in the district Europe and Asia, placed first, with 46% of the votes of the electorate, and *Luca Raymond*, NLP, America, Australia, Africa and the Middle East, placed second, with 18.6%). At the level of the counties and of Bucharest City, the 135 senators belong to the Democratic Liberal Party - 37% (50 senators), then to the Political Alliance Social Democratic Party + Conservative Party – 36.3% (49 senators), the National Liberal Party - 20% (27 senators) and the Democratic Union of Hungarians in Romania – 6.7% (9 senators).

Of course, compared to the above-mentioned average scores, there are obvious differences in what the representation of senators by political parties at the level of counties and of Bucharest City is concerned, as following:

- thus, the **DLP** obtained 100% of the seats assigned to Alba County in the Romanian Senate, that is the two seats of senators, then 66.7% (2/3)[1] in Arad and Dâmbovița. In a significant number of counties, it has 50% of the total number of senators, as in the counties of Timiş (2/4), Caraș-Severin (1/2), Cluj (2/4), Bistrița-Năsăud (1/2), Braşov (2/4), Suceava (2/4), Vrancea (1/2), Tulcea (1/2), Ialomița (1/2), Călăraşi (1/2), Ilfov (1/2) and Mehedinți (1/2). On the other hand, it should be stressed that this party has no senators in the counties of Satu Mare, Sălaj, Harghita, Covasna, Brăila and Giurgiu, while it shared the same number of senators with the SDP + CP and the NLP in other nine counties, those of Maramureş, Hunedoara, Sibiu, Botoşani, Neamț, Vaslui, Buzău, Vâlcea and Teleorman, where each had 33.3% (1/3);

- as for the second party from the point of view of the representation in the Romanian Senate, the **Political Alliance SDP + CP**, one notices that it has more than half of the number of senators only in Olt County, where it has 66.7% (2 out of the total of 3 senators), the third senator belonging to the DLP. It is also remarkable that this party is represented by 50% of the senators in no less than 15 counties, those of Caraş-Severin, Satu Mare, Sălaj, Bistrița-Năsăud, Vrancea, Tulcea, Brăila, Ialomița, Ilfov, Gorj, Mehedinți (each 1/2), Bacău, Galați, Constanța and Argeş (2/4), while in the counties of Alba, Harghita, Covasna, Călăraşi and Giurgiu has no senators at all;

- the third place in the Romanian Senate belongs to the **NLP**, which has 28 senators from all the Romanian counties and Bucharest City. They obtained the best results in the counties of Giurgiu, a weight of 100% (2 senators out of 2), then in Brăila and Călăraşi, with 50% (1/2 in each county), then, as mentioned in the case of the DLP, it has one senator out of three in nine counties (Maramureş, Hunedoara, Sibiu, Botoşani, Neamț, Vaslui, Buzău, Vâlcea and Teleorman). One should also point out that the NLP has no representatives in 17 Romanian counties (Caraş-Severin, Arad, Satu Mare, Sălaj, Bistrița-Năsăud, Alba, Mureş, Harghita, Covasna, Vrancea, Tulcea, Ialomița, Ilfov, Dâmbovița, Olt, Gorj and Mehedinți);

- the 9 senators of the **DUHR** are the representatives of six counties in the Romanian Parliament, normally in accordance with the presence of the Hungarian minority.

---

[1] The first number represents the number of seats held, and the second number, the total number of seats in that county.

Therefore, they represent the counties of Harghita and Covasna, where they have 100% of the senators (2 out of 2), then the counties of Mureş (2/4), Satu Mare, Sălaj (each 1/2), all with 50%, and Bihor (1/4), with 25%.

3. 2. The distribution of senators by political parties and geographical-historical provinces

The 135 senators elected at the 30 November 2008 elections in the 41 Romanian counties and Bucharest City (other two senators represent the Romanian diaspora at the level of continents) are distributed by geographical-historical provinces in the following manner: Transylvania, Moldavia and Muntenia have 20.7% (28 senators) each, Oltenia 11.1% (15 senators), Bucharest City 8.9% (12 senators), Banat and Crişana – Maramureş 6.7% (9 senators) each and Dobrudja 4.5% (6 senators) (table 2).

In opposition with the situation at national level, mentioned above at the analysis of the county representatives (3. 1.), the distribution of senators by parties and geographical-historical provinces reflects certain specific characteristics:

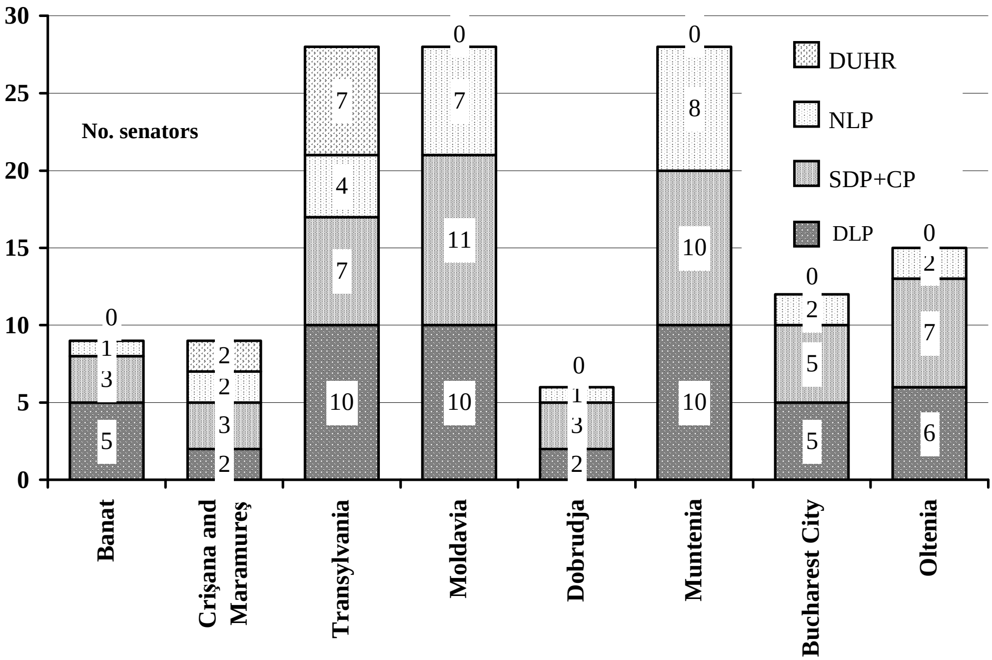


Fig. 4. The distribution of senators by political parties and geographical-historical provinces at the 2008 parliamentary elections.

- the **DLP** has the best parliamentary representation in the Romanian Senate, in Banat, where it holds 55.6% of the number of senators (5 out of the total of 9), then it has 41.7% (5/12) in Bucharest City, 40% (6/15) in Oltenia, 35.7% (10 senators) in each of the provinces of Transylvania, Moldavia and Muntenia, 33.3% (2/6) in Dobrudja and only 22,2% (2/9) in Crişana and Maramureş, a similar score with that of the DUHR;

- with only one senator less than the DLP, 49 compared to 50, the **Political Alliance SDP + CP** recorded the highest weight of senators at the level of geographical-historical provinces in Dobrudja, where it has 50% of the total number of senators (3 out of 6), then followed by Oltenia (46.7%, 7/15), Bucharest City (41.7%, 5/12), Moldavia (39.3%, 11/28), Muntenia (35.7%, 10/28), Banat and Crişana - Maramureş (33.3% in each, or 3 out of 9). The lowest representation of this political alliance has been recorded in Transylvania, where it has only 25%, or 7 out of the total number of 28 senators, similar to the Democratic Union of Hungarians in Romania;

- compared to the national average of 20% (27 senators out of 135), the **NLP** recorded better results in only three Romanian geographical-historical provinces: Muntenia (28.6%, with 8 senators out of 28), Moldavia (25%, 7/28), and in Crişana and Maramureş (22.2%, 2/9). The parliamentary representation in the Senate is below 20% in Dobrudja (16.7%, 1/6), Bucharest City (16.7%, 2/12), Transylvania (14.3%, 4/28), Oltenia (13.3%, 2/15) and Banat (11.1%, 1/9);

- according to the distribution of the Hungarian national minority on the Romanian territory, the representation of the **DUHR** in the Senate is limited to only two Romanian geographical-historical provinces, Transylvania, where it has 25% (7/28) of the total number of senators and then in Crişana and Maramureş, with 22.2% (2 senators out of the total of 9).

4. CONCLUSIONS

The analysis of the setting up of the Romanian Parliament for the period 2008-2012 as a result of the elections held on November 30, 2008, allows us to emphasize several specific characteristics:

- the quantitative expression of these elections indicates that the number of voters registered on the electoral lists was 18,464,274, for both the Chamber of Deputies and the Senate. However, due to different personal reasons, the turnout was only 39.20%, or a total of 7,238,871 voters. The turnout was a little bit higher in the rural areas than in the urban areas, and there were important differences between one county and another;

- of the total number of people who expressed their electoral option (7,238,871 persons), the total number of valid votes was 6,886,794. For the *Chamber of Deputies*, 33.10% of the votes went to the Political Alliance Social Democratic Party + Conservative Party (SDP + CP), 32.36% to the Democratic Liberal Party (DLP), 18.57% to the National Liberal Party (NLP) and 6.17% to the Democratic Union of Hungarians in Romania (DUHR), while for the *Senate*, in the same order of parties, the percentages of votes were 34.16%, 33.57%, 18.74% and 6.39% (table 1);

- based on the results of the elections and the redistribution of the votes given to parties which did not reach the Romanian Parliament (as they obtained less than the required minimum of 5%) to the four parliamentary parties, the *Chamber of Deputies* was made up by 334 MPs, of which 115 (34.4%) are the representatives of the DLP, 114 (34.1%) represent the Political Alliance SDP + CP, 65 (19.5%) belong to the NLP and 22 (6.6%) to the DUHR. Another 18 deputies (5.4%) representing the national minorities are added in view of the stipulations of the Electoral Law;

- the setting up of the Romanian *Senate* took place under the same conditions regarding the results and the redistribution of votes to the parties which obtained at least 5% of the valid votes (table 1). The Senate consists of 137 MPs, of which 51 (37.2%) represent the DLP, then 49 (35.8%) belong to the Political Alliance SDP + CP, 28 (20.4%) to the NLP and 9 (6.6%) to the DUHR (fig. 3);

- an important part of the study is concerned with the distribution of deputies and senators by political parties and at the national and international (the Romania diaspora) level, then by counties and geographical-historical provinces. In this regard, one should underline that there is a total of 334 deputies in the *Chamber of Deputies*, of which 312 (93.4%) are the representatives of the 41 counties and of Bucharest City, or the seven geographical-historical provinces and Bucharest City, 18 (5.4%) belong to the national minorities and 4 (1.2%) represent the Romanian citizens from abroad (in the electoral districts of Western Europe, America-Australia, Eastern Europe-Asia, Africa-the Middle East). The situation of the *Senate* is much simpler, as only 2 (1.5%) out of the total of 137 senators represent the Romanians from abroad (the electoral districts Europe, Asia and America, Australia, Africa, the Middle East);

- regarding the distribution of deputies and senators at the level of counties and geographical-historical provinces (well represented in the tables 2 and 3 and in the figures 2 and 4) one remarks generally that the DLP has a higher representation in the counties of the geographical-historical provinces of Banat, Crişana - Maramureş and Transylvania, while the Political Alliance SDP + CP has better scores in Moldavia, Dobrudja, Muntenia and Oltenia. The NLP obtained a higher result than the national average in Crişana - Maramureş, Moldavia and Muntenia, while the DUHR has MPs, naturally, from Transylvania (the counties of Braşov, Cluj, Covasna, Harghita, Mureş and Sălaj) and Crişana - Maramureş (Bihor, Satu Mare and Maramureş), and also Arad County.

R E F E R E N C E S

1. Pop, Gr., Bodocan, V. (1991), *Opțiuni electorale pentru alegerea primarilor în Banat, Crişana-Maramureş şi Transilvania*, Studia UBB, Geographia, Anul XXXVI, 2, Cluj-Napoca.
2. Pop, P. Gr. (1992), *Romania. An Electoral Geography (September-October, 1992)*, Studia UBB, Geographia, Anul XXXVII, 1-2, Cluj-Napoca.
3. Pop, P. Gr. (1997), *România. Geografie Electorală (Noiembrie, 1996)*, Studia UBB, Geographia, Anul XLII, 1-2, Cluj-Napoca.
4. Pop, P. Gr. (2001), *România. Geografie electorală (noiembrie-decembrie 2000)*, Revista Română de Geografie Politică, Anul III, nr. 1, Edit. Universității din Oradea, Oradea.
5. Pop, P. Gr. (2006), *România. Geografie electorală (noiembrie-decembrie, 2004)*, Studia UBB, Geographia, Anul LI, 1, Cluj-Napoca.
6. Pop, P. Gr., Bodocan, V. (2009), *Mayor's Elections in Cluj County, in June 2008*, Studia UBB, Geographia, Anul LIV, 2, Cluj-Napoca.
7. *** *Monitorul Oficial al României, Partea I, Anul 176 (XX) – Nr. 820, Legi, Decrete, Hotărâri şi Alte Acte*, Vineri, 5 decembrie, 2008.

CULTURAL LANDSCAPES IN THE HILLS OF CICEU (SOMEŞULUI MARE HILLS)

ILEANA CRISTINA CRĂCIUN[1]

ABSTRACT. – Cultural landscapes in the Hills of Ciceu. People have intensified environmental change since their coming into being until the development of agricultural technologies and inventions. Thus, the progress of our civilization led to the transformation of natural landscape into a cultural one. This represents the mirror of the society and it can be defined as a group of elements under the incidence of the anthropic component, according to its economical, social-cultural or military needs and realized by total or partial modification of the natural landscape. Human intervention in the landscape and upon natural elements of the Hills of Ciceu, through the process of agricultural use of the territory, of the land clearing, of the development of the residential areas as well as of the ways of communication, led more and more to the replacement of the natural landscape with the built one. Once the civilizations appeared, modified landscapes have begun to be acknowledged, accepted, recorded, belonging to the specific of each human being, belonging to both urban and rural environment. The panoply of their representations is various, the more so as there are continuous modifications of the landscape's view, modifications in the sense of evolution of one component or of a set of components, in the end, of the alteration of the landscape's quality and the quality of the consumers of those landscapes.

Keywords: *natural landscape, cultural landscape, Hills of Ciceu.*

1. THE HILLS OF CICEU. GENERAL ASPECTS

The Hills of Ciceu represent the Northern-Eastern sub-unit of the Someşan Plateau. They are delimited to the West by the Hills of Sălătruc, the summit Breaza and Lăpuş Depression. Țibleş Mountains are located to the North, in the East the Hills reach Ilişua Valley, while the southern limit is given by the Someşului Mare Corridor.

The altitude of the hills is between 500 and 700 m, a maximum altitude being recorded by the Măgura Ciceului (780 m), while in the central part, the maximum altitude being reached by the Secăturii summit (763 m). The hydrographic network of the analysed region is dense, the parallel summits which descend from North to South, to the corridor of Someş coming out in relief.

Predominant in the landscape are the Miocene formations also being the oldest in the region, followed by the Helvetian, represented by loamy clay, sands and conglomerates located in the Northern part, while, in the Southern part the newest formations belong to the Badenian and the Buglovian. There are also the volcanic tuffs interposed among sands and clays.

The relief and the climatic influences lead to an average annual temperature with decreasing tendencies from 8.5^{0}C in the lower areas of the corridor of Someşul Mare to 7^{0}C or less in the mountain area. The quantity of precipitations varies around 650 mm/year (Gr. Pop, 2001, p. 161).

[1] *Babeş-Bolyai University, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail: ileana.craciun@geografie.ubbcluj.ro*

2. POPULATION AS THE MOST IMPORTANT GENETIC FACTOR OF THE CULTURAL LANDSCAPE

People has acted upon the landscape in their own interests, by modifying it, thus, the landscape becoming more and more a built landscape, thing that can be seen also in the Hills of Ciceu, through the process of agricultural use of the territory, of land clearing, of the development of residential areas and ways of communication, all these being factors leading to the emergence of cultural landscapes.

2. 1. The population

a. Numeric evolution of the population. The intensity of modifications in the territory is determined by the number of inhabitants, their temporal-spatial evolution, the type of activity reverberated and the way of using the area (W. Schreiber, L. Drăguț, T. Man, 2003, p. 50).

The studied area is made up by 8 administrative units (Petru-Rareş, Uriu, Ciceu, Mihăieşti, Ciceu-Giurgeşti, Negrileşti, Căianu Mic, Spermezeu and Târlişua), grouping 36 places. The evolution of the number of inhabitants was analized on a five - year period (between 2003 and 2007).

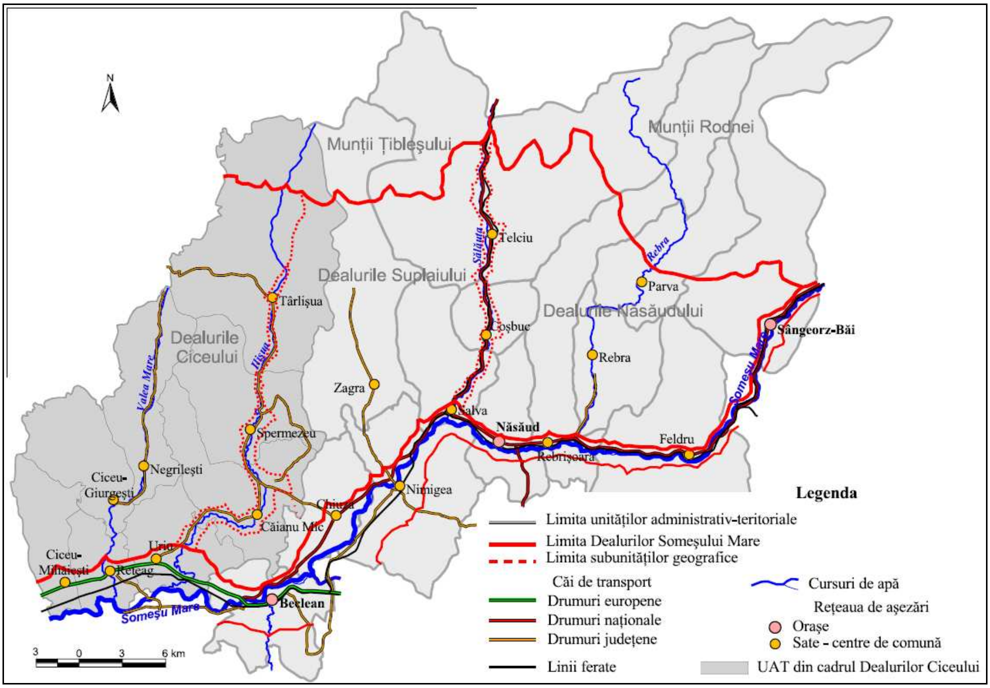


Fig. 1. Hills of Ciceu. Territorial map.

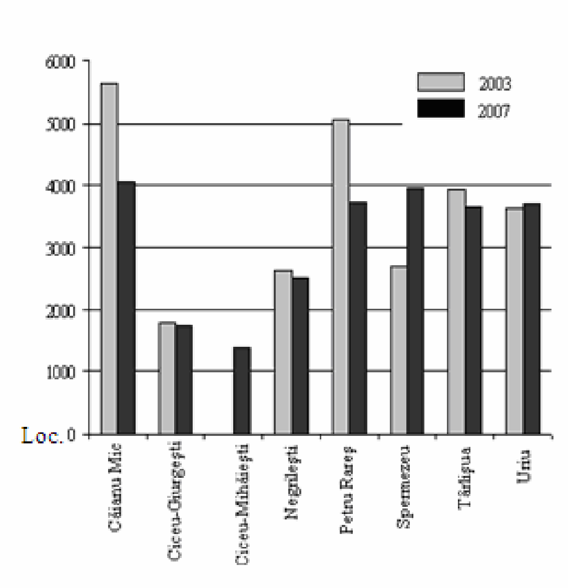


Fig. 2. Numeric evolution of population within the Hills of Ciceu between 2003-2007.

Within the territory, the population decreased from 25,691 inhabitants in 2003 to 24,683 in 2007, namely with 968 inhabitants in the entire period of time, so, at the level of the administrative units, 6 of them recorded a decrease of population (Petru Rareş, Negrileşti, Ciceu-Giurgeşti, Ciceu Mihăieşti, Căianu Mic and Târlişua) and 2 communes (Uriu, Spermezeu), recorded "slight" increases (fig.2). The evolution of the number of inhabitants in the analyzed communes of the Hills of Ciceu was not constant, but by progressive or regressive leaps[2].

b) Density of population. It represents the indicator reflecting the demographical evolution of the communes related to their surface. Because the surface of the administrative units remained the same during the five-year survey – 2003-2007, the surface recorded in 2003 was taken as a base. The only exception was Petru Rareş commune where the surface was modified in 2007.

Thus, in 2003 the density values were between 24.46 inhabitants/km^2 (Târlişua) and 77.84 inhabitants/km^2 (Petru Rareş). Higher densities were registered at Uriu 74.99 inhabitants/km^2, Căianu Mic 76.12 inhabitants/km^2, while at Negrileşti 43.14 inhabitants/km^2, Spermezeu 38.58 inhabitants/km^2, Ciceu Giurgeşti 33.52 inhabitants/km^2, lower densities were registered by mentioning that Ciceu Mihăieşti became a commune in 2005, thus the values of density were modified and in 2007 the highest values were at Petru Rareş 123.34 inhabitants/km^2, Uriu 76.36 inhabitants/km^2, Spermezeu 56.83 inhabitants/km^2, Căianu Mic 54.62 inhabitants/km^2, Negrileşti 41.38 inhabitants/km^2 and the lowest values at Târlişua 22.65 inhabitants/km^2, Ciceu-Giurgeşti 32.77 inhabitants/km^2 and Ciceu Mihăieşti 39.79 inhabitants/km^2 .

c) Agricultural density. The anthropogenic pressure over the geographic landscape of the Ciceu Hills (an areal with an agricultural economy) is rendered evident by the agricultural surface which is due to one inhabitant. This indicator points out high pressures at Petru Rareş (0.50 ha/inhabitant), Căianu Mic (0.96 ha/inhabitant), Uriu (0.84 ha/inhabitant), and relatively lower pressures at Ciceu Giurgeşti 1.83 (ha/inhabitant), Târlişua (1.81 ha/inhabitant), Negrileşti (1.71 ha/inhabitant), Ciceu-Mihăieşti (1.61 ha/inhabitant) and Spermezeu (1.41 ha/inhabitant).

---

[2] The great range of decrease and increase in what concerns the numeric evolution of population are due to the administrative and territorial modifications: the villages Dobricel and Dumbrăviţa as part of Căianu Mic commune were transferred to Spermezeu commune (Law 139/2007); Ciceu Mihăieşti, Ciceu-Corabia and Leleşti separated from Petru Rareş commune and they made up a separate commune (Law 67/2005)

d) Physiological density. High pressures are registered in the following communes: Petru Rareş (0.25 ha/inhabitant), Negrileşti (0.35 ha/ inhabitant), Târlişua (0.37, ha/ inhabitant), Uriu (0.40 ha/ inhabitant), and lower values were registered at Căianu Mic (0.44 ha/inhabitant), Spermezeu (0.50 ha/ inhabitant), Ciceu-Giurgeşti (0.57 ha/ inhabitant), Ciceu Mihăieşti (0.60 ha/ inhabitant).

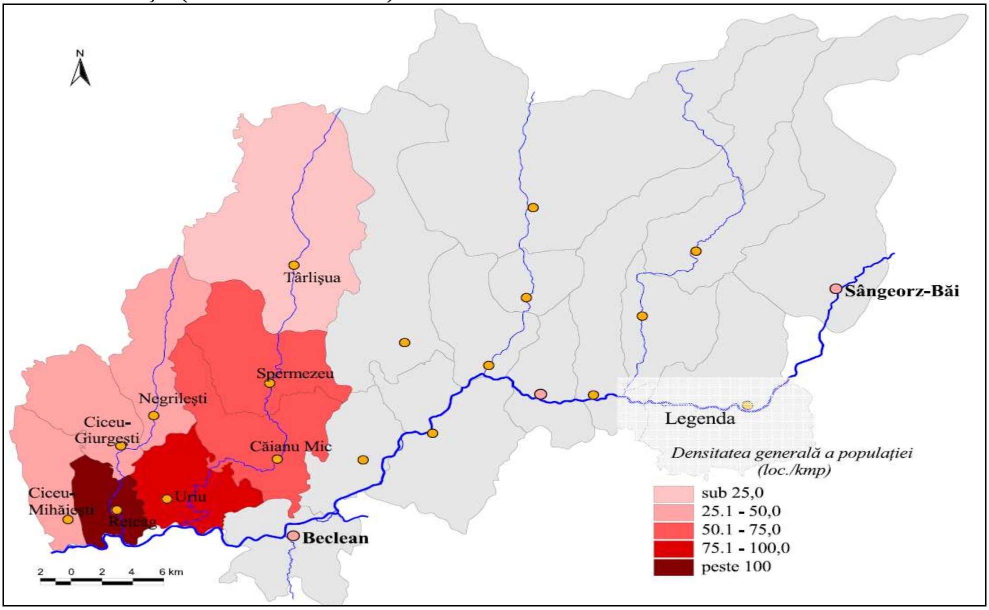


Fig. 3. Hills of Ciceu. General density of the population in 2007.

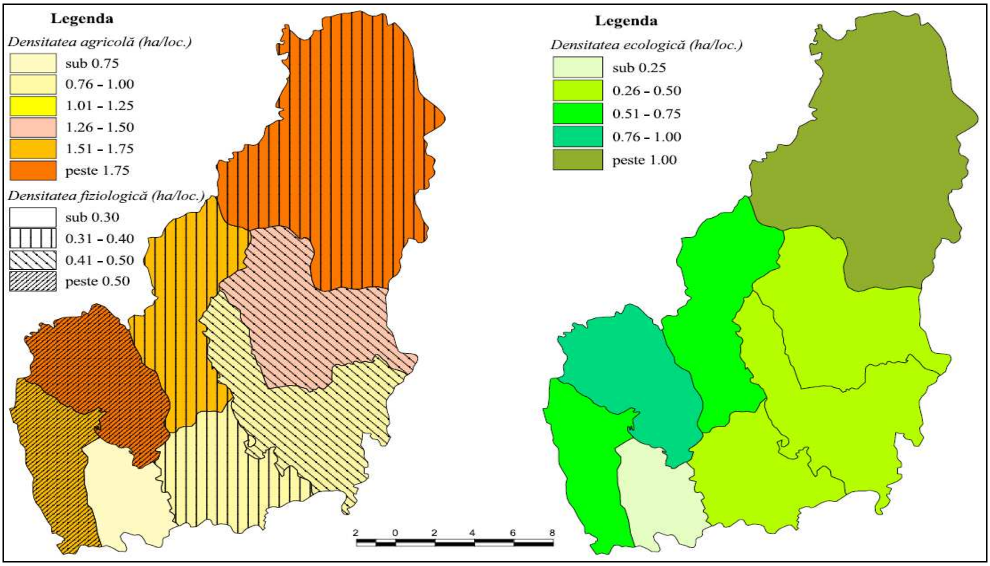


Fig. 4. Hills of Ciceu. Agricultural, physiological and ecological density in 2007.

3. CULTURAL LANDSCAPES IN THE HILLS OF CICEU

The cultural landscape represents an areal perceived by people and which aspect is the result of the action of the interaction of the natural and/or anthropological factors (Maguelonne Dejeant-Pont, 2008 p.19). Spatial image of the contemporary rural environment of Ciceu Hills (K. Noga, Monica Piotrowska, J. Taszakowski, 2008 p.43), is the result of the multidirectional anthropogenic activities realized in deep correlation of the social-economic environment with natural conditions.

From the typological point of view, within the surveyed areal the following types of landscapes are to be met: habitational, agricultural, non-agricultural and non-landscape.

3. 1. The habitational landscape

a) Human dwellings. According to A. Maier (2001, p. 96), the continuity element and an active transformation factor of environment conditions to local communities' requirements but also to the requirements of the society, the *village* was always the dominant element of the concerns of the humanized landscape of Someşan Plateau.

Fig. 5. Humanized landscape in the area of the Borleasa village from the Someşului Mare Hills.

Natural favorable conditions permitted, from early times, the fixation and the continuity of the human element (dwellings) their existence being certified, either by the archeological investigations, accidentally discovered, or as a result of some systematic diggings, or by documentary historical records which "officially attested" their existence (A. Maier, 2001, p. 96).

Because of a long evolution process, 36 villages are present in the Hills of Ciceu; the villages are included in 8 administrative units. In theory, 5.3 villages belong to one commune. Confronted by this average and according to the natural and social and political particularities a great diversity appears (W. Schreiber et all, 2003 p.61): Uriu and Căianu Mic communes are made of 4 villages, while Petru Rareş and Ciceu-Giurgeşti communes comprise 2 villages each; Ciceu Mihăieşti, Negrileşti 3 villages, Spermezeu 8 villages and Târlişua 10 villages.

b) The extent of the dwellings as defined by the number of inhabitants (the demographical potential) is of a great importance in the formation of a hierarchical system of the places and in explaining the valorization evolution patterns of the agricultural areas. The extent of the villages comprises direct correlations with the economical potential and the degree of valorization of the lands belonging to the estate of the communities, in comparison with the action of the natural and social-historical factors. In time, these contributed to the increase or to the decrease of the demographic potential (A. Maier, 2001, p. 101).

According to A. Maier (2001, p. 101), the demographic potential of a dwelling area and its evolution in time permits to group the villages in 3 categories according to their extent: *Small villages* (under 500 inhabitants) comprise, for the surveyed areal, 16 villages (Ciceu Corabia, Leleşti, Hăşmaşu Ciceului, Purcărete, Halmasău, Lunca Borlesei, Păltineasa, Sita, Şesuri Spermezeu Vale, Agrieşel, Cireaşi, Lunca Sătească, Molişet, Oarzina, Racateşu, Şendroaia). Among these there is a small village, made up of fewer than 100 inhabitants named Lunca Borlesei - made up of 97 inhabitants.

Small villages, during their entire existence bear the fingerprint of some limited functions (mainly the agricultural function) and a low level of such functions due to modest demographical potential, on one hand, and the disappearance of the individual property, thus the lack of motivation of the agricultural activity, namely of the disappearance of their existence after the year of 1962, on the other hand (A. Maier, 2001).

There are 16 *middle-sized villages* (501-1500 inhabitants): Baţa, Ciceu-Mihăieşti, Uriu, Cristeştii Ciceului, Ilişua, Ciceu-Giurgeşti, Breaza, Dumbrăveni, Negrileşti, Căianu Mare, Ciceu Poieni, Dobric, Dobricel, Dumbrăviţa, Târlişua and Agrieş.

Big and very big villages (1501-3000 and over 3000 inhabitants) include only 4 places: Reteag, Căianu Mic, Ciceu-Giurgeşti and Spermezeu.

c) *Density* in the analysis of spatial repartition of dwellings constitutes one of the important indicators. The prevalence of small and middle-sized villages which adapted themselves in historical time to the real conditions of relief fragmentation and land use (A. Maier, 2001, p. 110), indicate that the Hills of Ciceu are part of the area categories with high densities (country average value is 5.6). The lowest values are registered for Spermezeu commune, namely 1.1 villages / 100 km^2, Ciceu Giurgeşti 3.8 villages/100 km^2, Negrileşti 4.9 villages/100 km^2 , and the highest values are registered in Ciceu Mihăieşti commune 8.6 villages/100 km^2, Uriu 8.3 villages/ 100 km^2, Petru Rareş 6.6 villages/100 km^2, Târlişua 6.2 villages/100 km^2, Căianu Mic 5.4 villages/100 km^2.

d) *The estate of the villages*. The reason of existence of a dwelling constitutes an important element in place – space analysis (W. Schreiber et all, 2003, p. 62).

There are 36 villages in the Hills of Ciceu. Those villages summed up an estate of 531.56 km^2, meaning 14.76 km^2/place. In two villages we remark high values, 26,50 km^2, above this average: Ciceu Giurgeşti, Dumbrăveni (Ciceu Giurgeşti commune); 20.22 km^2 in 3 villages: Negrileşti, Breaza, Purcărete (Negrileşti commune); 18.65 km^2 in 4 villages: Căianu Mic, Căianu Mare, Ciceu Poieni, Dobric (Căianu Mic commune); 16.08 km^2 in 10 villages: Târlişua, Agrieş, Agrieşel, Borleasa, Cireaşi, Lunca Sătească, Molişet, Oarzina, Răcăteşu, Şendroaia (Târlişua commune); 15.04 km^2 in 2 villages: Reteag Baţa (Petru Rareş commune), while, in the category of villages with a smaller estate as compared to the average value with 12,07 km^2 there are 4 villages: Uriu, Cristeştii Ciceului, Hăşmaşu Ciceului, Ilişua (Uriu commune); 11.66 km^2 in 3 villages: Ciceu Mihăieşti, Ciceu Corabia, Leleşti (Ciceu Mihăieşti commune); 8.70 km^2 in 8 villages: Spermezeu, Dobricel, Dumbrăviţa, Hălmăşău, Lunca Borlesei, Păltineasa, Sita, Şesuri Spermezeu-Vale (Spermezeu commune).

e) Form, texture and structure of dwellings were conditioned by the real adaptation to natural conditions (relief, water springs) as well as to social-political conditions (W. Schreiber et all, 2003, p. 63).

The predominant forms are irregular polygonal (linear, circular, rectangular, complex), which proves a spontaneous way of dwelling the place, with a progressive expansion of its precincts. From here, there results an irregular texture of villages (W. Schreiber et all, 2003, p.

63), thus the following places are identified: Reteag, Baţa, Ciceu Mihăieşti, Ciceu Corabia, Sita, Uriu, Cristeştii Ciceului, Hăşmaşu Ciceului, Ilişua, Ciceu Giurgeşti, Breaza, Dumbrăveni, Negrileşti, Purcărete, Căianu Mic, Căianu Mare, Târlişua, Agrieş, Agrieşel, Borleasa, Cireaşi, Lunca Sătească, Molişet, Oarzina, Răcăteşu, Şenroia, Ciceu Poieni, Dumbrăviţa. The structure of the villages, on the whole, is spread, the villages being settled along valleys in small depression basins, with a certain tendency of grouping the farms in precincts, and on the Northern part of Breaza and Borleasa there is a quite a high degree of dissipation.

In W. Schreiber's opinion (2003, p. 63), there are two structural areas for all the villages: a nucleated central area, with compactness tendencies and which represents the old nucleus and a peripheral spread out area, even dissipated, with large areas among buildings, area made up of gardens or fields.

3. 2. The agricultural landscape

The support of biological existence of humanity is represented by the agricultural land. This includes arable lands, orchards, and fruit-growing nurseries, vineyards, and wine-growing nurseries, grazing fields and hayfields.

In the Hills of Ciceu, the main occupation of the rural population is the agriculture. Thus, in 2003, in the Southern part of the surveyed region, the agricultural area registered a percentage of 63.6% and 84.7% for the following communes: Petru Rareş, Ciceu-Giurgeşti, Uriu, Negrileşti, Căianu Mic, while in the Northern part, at Târlişua and Spermezeu, there were registered values of 41.0% and 48.1%. Comparing the data of 2007 with the previous ones, we remark a diminution for a group of administrative units such as: Petru Rareş, Uriu, Căianu Mic, Ciceu-Giurgeşti, an increase for Spermezeu, and constant values for Târlişua and Negrileşti.

Unlike 2003, in 2007 there registered a decrease of the arable areas (from the agricultural surface) at Spermezeu, while, for the following communes: Petru Rareş, Uriu, Căianu Mic, Ciceu-Giurgeşti there was an increase, and the same values were maintained for Ciceu Mihăieşti, Târlişua, and Negrileşti.

The majority of non-arable agricultural areas are made up of grazing fields and hayfields. Their values are different. The grazing fields are diminished during the surveyed period (2003 – 2007) for Petru Rareş, Uriu, Spermezeu, Ciceu-Giurgeşti, they register an increase at Căianu Mic and they are the same at Negrileşti, Ciceu Mihăieşti and Târlişua. For the hayfields there is registered an increase at Spermezeu, Uriu, Ciceu-Giurgeşti and a decrease at Căianu Mic, Petru Rareş, while at Ciceu-Mihăieşti, Negrileşti, Târlişua the values are the same. In 2003 confronted by 2007, on the surveyed areal there was an increase of the surface of orchards and fruit-growing nurseries at Uriu, Spermezeu, Ciceu-Giurgeşti, a decrease at Petru Rareş, and the values were the same at Ciceu-Mihăieşti nd Negrileşti, while at Căianu Mic, during the five-year studied period, the values are present only for the year 2003.

The orchards were spread in time, further and further from the dwelling areas, mostly on the hills that were exposed to the sun, replacing, most of the time the grazing fields, the hayfields and the old, abandoned vineyards or the uncultivated agricultural terraces.

3. 3. The non-agricultural landscape

a) Forest landscape. Anthropogenic, progressive pressure on the wood led to systemic reduction of the surface occupied by the trees, of the forest landscape on the whole. Wide land clearings were done especially in the 19^{th} century when the need of wood and agricultural land became more and more urgent.

We found that in 2007, in the Hills of Ciceu, the wooden area remain almost the same in the area of Căianu Mic commune(15.2%), Spermezeu commune(22.5%), Uriu commune (22.7%), Negrileşti commune (24.0%), Ciceu Mihăieşti commune (26.5%), Petru Rareş commune (28.5%), the highest value of the forest vegetation being present at Târlişua (40.7%) and Ciceu-Giurgeşti (31.3%).

The most spread types of wood are: mountain beech forest with Mull flora on skeleton soils, of middle productivity, followed by hill beech forest with mull flora and hill beech forest on skeleton soils. We consider that these (along with normal oak grove with mull flora) are the types of woods most valuable from the productivity and wood quality point of view. In what concerns the continuity of these types of woods we have to mention that pure beech forests are stable formations. Natural regeneration of the main species (the beech and some hard or smooth woods) is well when the treatments are well done and when the works made in order to help natural regeneration (need for some areas) are done in due time and as many time as it is necessary.

Surfaces occupied by forests in 2007

Table 1

Commune	Forests	
	Ha	**%**
Petru Rareş	857	28,5
Uriu	1098	22,7
Spermezeu	1570	22,5
Căianu Mic	1126	15,2
Târlişua	6548	40,7
Ciceu-Giurgeşti	1693	31,3
Ciceu Mihăieşti	927	26,5
Negrileşti	1456	24,0

Source: Office of Cadastre and Real Estate Publicity of Bistrița-Năsăud.

Ecological density. In the surveyed areal the highest density is at Târlişua 1.79 ha/inhabitant, and the lowest is at Petru Rareş 0.23 ha/inhabitant, while at Uriu is 0.29 ha/ inhabitant, Căianu Mic 0.27 ha/inhabitant, Spermezeu 0.39 ha/inhabitant, Negrileşti 0.58 ha/inhabitant, Ciceu Mihăieşti 0.66 ha/inhabitant, Ciceu-Giurgeşti 0.97 ha/inhabitant.

b) The landscape of the ways of communication. The entire territory of the hills of Ciceu gravitates towards the major axis of circulation of the Corridor of Someşul Mare; the local rural roads mount along the valleys to the mountain (Gr. Pop, 2001, p. 164); the rural roads are made of rubble stone and soil. The railway is present in Petru Rareş and Uriu communes, and on small areas there are modernized roads made of road stones (basalt, andezite etc.) and asphalt, for the increase of the transportation speed (Flavia Stoica, W. Schreiber, 2008, p. 36). We have to mention a lot of swing bridges made up of fixed boards on metallic cable permitting the passage of people over water courses.

3.4. The non-landscape

Any type of activity of transforming the natural resources brings to the landscapes new appearances and functions. When a traumatism affecting the body of a landscape becomes decisive, overwhelming by its consequences, it leads to the registration, as a paradox, of the statute of “non-landscape” (as Philippe Reyt quoted by I. Dincă, 2005, p.52 proposes).

The non-landscape represents a remaining of the habitation and productive landscape. In the Hills of Ciceu it is fragmented, the modifications being due to the process of agricultural use of the land, to the land clearings, to the development of the dwellings and of the communication ways.

Thus, the land clearings, intensive grazing and different manners of cultivation of the land in certain slope and lithologic conditions influenced the morphogenetic processes, changing here and there the natural way of relief evolution. As conclusive examples there are the processes of accelerated erosion, the soil drifts and the occurrence of some anthropogenic forms. As a result of the intensification of the erosion processes, the soil-vegetal covering was removed, sometimes till the exposure of the parental rocks, favoring (P. Tudoran, 1978, p. 58) soil drifts (bank erosion) from Borleasa, Căianu Mic as well as the development of some precipices on volcanic tuffs.

As a result of the massive soil drifts also stimulated by diapirism phenomena, namely by the dissolution of the salt that emerged at the surface of the soil, the permanent lake, Cetăţele, was formed, located in the upper part of the interriver area between Ilişua Valley and Someşul Mare (P. Cocean, Rodica Danciu, 1994, p. 50) The intensity of the said processes is due to long time irrational use of lands by the small property that were working on a speculative basis, a crucial role playing the overstress of the lands in comparison with natural possibilities of soil recovering, namely the grazing - mono-cultivation, and sudden change of the way of soil use (P. Tudoran, 1978, p. 58).

Intensive grazing is an activity with deep impact over the slopes, the installed disequilibrium being proportional to the animal density (sheep, cattle, goats) on the area. Pluvial denudation is installed on the paths and narrow ways of made by animals covering the hill slopes and mountain slopes, leading to their damage by gullies formation (Valeria Amelia Velcea, Mărioara Costea, 2006, p. 123). We remark the gullies Căianu Mic and Târlişua as well as the active gully from Agrieş.

The natural area is more and more affected by the economical activity of people, who, by their interventions modify the geographical landscape. In order to avoid land degradation, as well as the balance between different components of the landscape it is necessary to know the geographical conditions of the surveyed territory.

4. CONCLUSIONS

The predominant cultural landscape is, in the Hills of Ciceu, the agricultural one, thus, agriculture being the main occupation of the rural inhabitants.

Even if the Romanian rural area dealt with a massive depopulation in the second period of the 20^{th} century, this areal has kept a great deal of its geo-demographical potential in the 36 rural places from the unit. There were identified many places belonging to the category of small and medium places, the situation being due to the maintenance of the private property form as well as due to a rather good percentage of birth rate.

The network of the ways of communication is less developed. The county roads prevail, less the European ones and the railways, the latter not being part of the cultural landscape.

Morphogenetic processes are present from place to place, they being influenced by land clearings, intensive grazing and different ways of land cultivation under certain slope and lithologic conditions and the change of the natural sense of relief evolution.

The landscape generated by the human activities is more and more transformed, becoming in time more and more cultured.

R E F E R E N C E S

1. Badea, L., coord., (2006), *Unităţile de relief ale României II, Munţii Apuseni şi Podişul Transilvaniei*, Edit. Ars Docendi, Bucureşti.
2. Cocean, P., Danciu, Rodica (1994), *Contribuţii la studiul proceselor geomorfologice din Bazinul Văii Ilişua,* Studia Univ. Babeş-Bolyai, Geographia XXXIX, 1.
3. Dejeant-Pont, Maguelonne (2008), *European Landscape Convention-Selected activities and research on implementation in Cadses area, Infrastructure and Ecology of Rural Areas, Cultural Landscape Protecting Historical Cultural Landscapes To Strengthen Regional Identities And Local Economies*, Polish Academy of Science, Cracow Branch, Comission of Technical Infrastructure.
4. Dincă, I. (2005), *Peisajele geografice ale Terrei. Teoria peisajului,* Edit. Universităţii din Oradea.
5. Handout: (2006), *„Mapping key – Cultural Landscapes in Thuringia –"Methodische Vorschlage fur die Einbeziehung kulturlandschaftlicher Qalitaten von Raumen in die Planung und Projektentwicklung*.
6. Maier, A. (2001), *Podişul Someşan, populaţia şi aşezările,* Edit. Gh. Bariţiu, Cluj-Napoca.
7. Noga, K., Piotrowska, Monica, Taszakowski, J. (2008), *Dynamic analysis of changes in cultural landscape of Wisniowa village in 1847-2006,* Infrastructure and Ecology of Rural Areas, Cultural Landscape Protecting Historical Cultural Landscapes To Strengthen Regional Identities And Local Economies, Polish Academy of Science, Cracow Branch, Comission of Technical Infrastructure.
8. Pop, Gr. (2001), *Depresiunea Transilvaniei*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
9. Schreiber, W. (1980), *Harta riscului intervenţiilor antropice în peisajul geografic al Munţilor Harghita*, în Studii şi cercetări de Geologie, Geofizică şi Geografie, 1, TOMUL XXVII, Edit. Academiei Republicii Socialiste România.
10. Schreiber, W., Drăguţ, L., Man, T. (2003), *Analiza peisajelor geografice din partea de vest a Câmpiei Transilvaniei*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
11. Stoica, F., Schreiber, W. (2008), Revista-*Peisaje culturale istorice,* Programul Naţional Phare 2004 INTERREG III B CADSES, Edit. Argonaut Cluj-Napoca.
12. Surd, V., Bold, I., Zotic, V., Chira, Carmen (2005), *Amenajarea teritoriului şi infrastructure tehnice*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
13. Teaci, D. (1983), *Transformarea peisajului natural al României*, Edit. Ştiinţifică şi Enciclopedică Bucureşti.
14. Tudoran, P. (1978), *Factorul antropic şi implicaţiile sale în peisajul geografic al Culoarului Crişului Alb,* St. Cerc. Geol., Geofiz., Geogr., Geografie, T. XXV, Bucureşti.
15. Velcea, Amelia Valeria, Costea, Mărioara (2006), *Geomorfologie generală*, Edit. Universităţii „Lucian Blaga", Sibiu.
16. ***Fişele localităţilor, Direcţia Judeţeană de Statistică Bistriţa-Năsăud.
17. *** (2005), Studiu General Ocolul Silvic Beclean, Direcţia Silvică BISTRIŢA.
18. ***Oficiu de Cadastru şi Publicitate Imobiliară Bistriţa-Năsăud.

NOTE: ***"Investing in people!"*** PhD scholarship, Project co-financed by the European Social Fund, Sectoral Operational Programme Human Resources Development 2007 – 2013. Babeş-Bolyai University, Cluj-Napoca, Romania.

THE ARRANGEMENT STRATEGY – TOURISM DEVELOPMENT AND CAPITALIZATION IN MĂRGINIMEA SIBIULUI REGION (SIBIU COUNTY)

N. CIANGĂ[1]

ABSTRACT. – The Arrangement Strategy – Tourism Development and Capitalization in Mărginimea Sibiului. The study includes a synthesis regarding the arrangement-development strategy of the tourism in the settlements of Mărginimea Sibiului. The main stages of the tourism development from this zone are presented, the methods of organization and the associative components, the involvement in projects of arrangement with domestic financing, but also with the European funds. Then, the main directions of development are highlighted, related to infrastructure, elaboration of projects, creation of specialized units of education and of an efficient system of informing and promoting the tourism product, with a definite impact on a tourism level and generally on development. The effects, in time, will be complex, with the development and with the strengthening of the trust in the market economy, manifested through the private initiative related to the rural tourism.

Keywords: *tourism promotion, private initiative in tourism, tourism industry.*

1. INTRODUCTION

The geographical space belonging to Mărginimea Sibiului is characterized by a diversity of natural conditions and by the individualization, in time, of a predominantly rural habitat, inhabited by a Romanian community. Here, one of the most interesting rural civilization was developed, which has put its mark upon a wide Carpathian and extra-Carpathian area, through the development of more than one hundred villages, by practicing the pastoral activities, but also by imposing the spiritual component related to customs and traditions. All of these were arguments, so that immediately after 1990, all these specific traits would be noticed through the capitalization of the rural tourism in an individual manner.

2. GENERALITIES

Unfolded between 500 – 2200 m, and made up of a complex of mountainous units of border, sub-mountainous depressions and corridors, Mărginimea Sibiului offers complex conditions of development, which have determined an intense habitation, the individualization of an original, habitual system, with a rural-pastoral civilization unique in Romania.

In the frame of this complex geographical ensemble, its natural and anthropic components were made up as tourism attractions, generating specific arrangements, all polarizing differentiated tourism flows, as typological dimension, regime of unfonding.

The very varied and spectacular tourism potential of the mountainous relief is distinguished, in whose frame the mountainous, glaciary relief and the height platforms are

[1] *"Babeş-Bolyai" University, Faculty of Geography, 400006 Cluj-Napoca, Roumanie, e-mail: cianga@geografie.ubbcluj.ro*

to be noticed. They are favourable to the stimulation of a mountainous tourism, in whose frame the second Carpathian climatic mountainous resort – Păltiniş – was developed in 1895. It is to be found even todat at the highest altitude, favourized in its development and functioning by the favourable climatic and the bioclimatic conditions, by the communication potential and, not in the last turn, by the traditions of practicing tourism by the communities closed spatially to Mărginimea Sibiului.

The hydrographic component imposes itself by the complex of the accumulation lakes, but also by the mineral, hydro-chemical waters specific to the geological structures of Transylvania Depression.

The natural landscape is completed by the vegetable cover in which the floor of forests, but also of the mountainous sub-alpine meadows made up the support of agro-pastoral activities, but also of the customs and of the traditions related to these.

As an old space of habitation with a population belonging predominantly to the Romanian human community, it imposes itself from a tourism point of view by those 18 settlements (from which three cities – Sălişte, Miercurea Sibiului, Răşinari), in whose frame the both elementary habitat (households), as the specific activities related to shepherding were preserved, together with the traditions and the customs. All these confer originality to the tourism offer and, as a result, impact and power of tourism attraction, fact that imposed the achievement of tourism arrangements which evolved quantitatively and qualitatively and adapted themselves to the tourism market.

The situation of the tourism material basis (arrangements) in 2008 is a reflection of the state of things in this field, expressing a certain notion of the tourism potential's capitalization, depending on the succession of a number of phases, qualitatively different:

In the period before 1990, a tourism coordinated by the state institutions – Ministry of Tourism, C.O.T. (the County Office of Tourism), Ministry of Education – was developed, which had in keeping the tourism arrangements from Păltiniş resort (the most complex and extended tourism structure arranged as part of Mărginimea Sibiului and the second from county, following that of Sibiu city); the 6 chalets situated in the geographical mountainous area afferent to Mărginimea Sibiului (Fântânele, Şanta, Gâtul Berbecului, Ciupari, Valea Sadului, Preajba) and the 6 school camps patronized by the Ministry of Education and by Sibiu Management of Camps with the School Inspectorate of Education.

The period 1990 – 2000 was the most unproductive for Romania and for the Romanian tourism, with a maximum of disorganization, legislative voids and unsuccessful attempts of organization and transition to private ownership in tourism. This concurred with the period of socio-economic decline, with a galloping inflation and with a reduced request for the arranged tourism product. As a result, the material basis continually degraded, or came out from the tourism circuit, temporarily or definitively, while the external tourism request was almost non-existing.

After 2000, the efforts of beginning the re-launching and the revivification of tourism, the rehabilitation of the old arrangements, the achievement of new types of tourism units and the beginning of modernization of the major infrastructure of road transport, precisely the E68, are to be noticed, on whose length the tourism units adapted to the specific of the tourism with a great mobility are built, like the motels from Miercurea Sibiului and Sălişte. Also, in this period partial laws are promulgated referring to the tourism from the mountainous zone or to the rural tourism, recording a new qualitative phase of stimulating the private-family or group initiatives. The same trends led to achievements in the field of the professional organization with an associative character on a local level, or the integration in associations of rural tourism on a national level, like NAAREC (National Association of the Agencies for Rural, Ecological and Cultural Tourism).

Attempts to access the national and Phare or Sapard European funds of development are manifested (see the Jina locality, 2008) within the period before and after the adhering to the European Union.

In this contradictory economic and political social context, but dynamic and effervescent at the same time (with a final period, 2006-2008, of a significant general increase, emphasized after the adhering to the European Union at the beginning of 2007), Mărginimea Sibiului stands out as a representative geographic tourism space of developing the rural tourism and the arrangements specific to it, the tourism board and lodging. This leads to the individualization of a social-human category involved in this activity, with an increasing request on the internal and international tourism market.

Nowadays, the quasi-totality of the settlements belonging to Mărginimea Sibiului owns tourism units of board and lodging type, representing approximately a third from the total capacity of accommodation. There are more than 160 units, tourism board and lodgings, with different sizes and levels of comfort, varying from 2 to 5 daisies. Most of them were homologated and classified. The localities Răşinari and Sălişte-Sibiel are to be especially noticed considering the dimension and the complexity of this type of tourism units. In the first case, the Răşinari locality stands out on one hand, through its capacity of organization, "The Răşinari Association of Agro-tourism Board and Lodgings" – RAABL, which supports and promotes the homologation of board and lodgings and the possibility to enter into partnerships with other associations of profile from Romania and Europe. Beginning with 2000, "the 2000 project of community development" has been unrolling at Răşinari, while the Foundation of Sibiu Community sets up here the first centre of tourism information in the county, having an informing impact in promoting all of Mărginimea Sibiului. This centre has a collaboration relation of support with the city hall of the Denveder city from Holland, as part of a bigger project of local development of Mărginimea Sibiului.

The effect upon the tourism arrangement of board and lodgings type was more than significant in Răşinari. So, to the 3 chalets that are to be found in the administrative mountainous alpine habitat, Curmătura Ştezii, Miorița, totalizing 102 places, 15 board and lodgings are to be added, with a comfort degree between 3 – 5 daisies, other 7 board and lodgings being in course of admittance in the tourism circuit.

The board and lodgings totalize 162 places with an average of 11 places / board and lodging. Their size varies in very large limits, from 40 places and comfort of 5 daisies in the case of Mai board and lodging (a real mini-hotel), to the capacity of only 4 places, in the case of Şerban board and lodging. Excepting the Mai board and lodging, all others are to be included in the level of 3 daisies.

The second locality that stands out through its tourism arrangements of board and lodging type is Sălişte, together with one of the component villages, Sibiel, that became representative for the rural tourism from Mărginimea Sibiului, especially after the promotion of the Sălişte locality as an urban centre. Here, 30 board and lodgings are functioning, totalizing 50 rooms and 150 places. This patrimony can become the centre for development of a local resort, Sălişte, with a favourable situation, with a remarkable communication potential in the frame of Mărginimea Sibiului, a tourist, cultural, historic, exceptional patrimony and, not in the last turn, a tourism information centre with a valuable basis of information and disposing of elaborate materials for promoting the Mărginimea Sibiului.

The second category of villages owns a reduced number of board and lodgings, less than 10 each of them, with less than 50 places of accommodation in their frame: Gura Râului – 45 places, Cisnădioara – 30 places, Cristian – 20 places, Orlat, Râul Sadului.

The Jina locality is in a particular situation. It did not have any board and lodging until 2008, but through accessing some European funds of development, it reached to building up a first board and lodging totalizing 16 places. It was inaugurated in July 2008, on the occasion of celebrating the days of the locality. The previous building of the sky path will increase the attractiveness of this locality, stimulating private initiatives, but also the elaboration of development projects and accessing of funds at the level of the localities from Mărginimea Sibiului.

The local communities, through their representative institutions, will become true actors in imposing and applying the projects of tourism arrangements integrated into the general arrangement of the territories, in the next phase of tourism development.

The present level of arrangement and capitalization of the tourism potential, as well as the implication of tourism as a phenomenon and as a more and more important activity in the social-economic life of the communities from Mărginimea Sibiului asks for a new policy and strategies of development that are closer to the present situation of Romania as a member with full rights of the European Union. On this background, the significant achievements up to this moment will be integrated in some programs, pursuing the sustainable development of Mărginimea Sibiului, in which the tourism will become a viable alternative with an increasing weight.

The possibility to revive the traditional activities, which defined and defines Mărginimea Sibiului, through tourism, must not be neglected, whose results are to be capitalized through tourism, especially through the increase of the international tourism, receiver and receptive to the components of authenticity and originality of the rural environment from the studied zone.

In order to reach this, Mărginimea Sibiului disposes of many powerful arguments:

- the affiliation to a complex natural geographical space belonging to the meridional-carpathian region and to the southern outskirts of Transylvania Depression;
- the individualization in time of a true civilization and authentic traditional culture, related through its activities to the Carpathians and belonging to a human community integrated into this reality, which was transmitted and imposed on a large peri-carpathian – external area;
- the affiliation to the administrative unit and the historical realities of Sibiu County, with powerful traditional connections with the European reality, especially the Germanic one;
- a favourable potential of a national-central situation and the situation in the immediate proximity of E68 highway that borders Mărginimea at north and east, on whose route the future highway will be situated, corresponding to the European Passage IV;
- the existence of a county and local road network which detaches itself towards south and west from E68, modernized in the most part of it and which could be connected to the first transcarpathian way of great height, carriageable for the time being, joining across Parâng the localities Sebeş and Novaci – Drumul Regelui, inaugurated in the 3rd decade of the last century;
- the community of the Mărginimea Sibiului, which stands out through its vitality, enterprising spirit, and which is close by tradition to the European cultural realities.

3. THE DIRECTIONS OF THE STRATEGY

If before 1990 and a number of years following this date, the tourism arrangements had belonged to central and county structures, while the local communities had had only very little profits, as soon as the edification of family board and lodgings, the development of rural tourism and also the starting of the privatization process began, the human groups, from family nucleuses to the local communities, through their representative institutions, started to perceive the effects of the market economy that were due, not in the last turn, to tourism: incomes, respectively wages incomes, the capitalization of one's own products, the collection of taxes and income taxes, immediate contacts with the tourism request and with professional associations of profile from within the country or from abroad, access to funds of development, the possibility of training and instruction, etc.

These effects can be manifested in a concertized and coordinated manner in the terms of joining the tourism development from the simplest forms of arrangement and capitalization (the family tourism board and lodgings), to the implementation of projects with regional impact, causing the polarization of a growing tourism circulation, from a national and international level, with the characteristics of a yearly continuity and even of perenniality. In order to achieve this, it is imperative to establish some strategic directions as a basis for the tourism development:

- the edification of a modernized transport infrastructure, with the opening of new routes, overlapped on some older alignments, with an impact upon the conscience of the community, connected to and integrated into the national and international system of transportation;
- the elaboration and application of some projects of arrangements, capitalization and tourism development, conformed to the valuable tourism resources, but insufficiently or even non-capitalized at all, from the administrative area of the communes, counting on the attraction of some target-groups of tourists from the country or from abroad;
- the creation of an institution of education specialized in tourism, both for the school population and for the adult members of the communities, who are eager to involve in tourism as investors or participants;
- the achievement of an efficient system of informing and promoting the tourism product and its image, with the enforcement of a real tourism “brand” of Mărginimea Sibiului.

4. THE OBJECTS OF THE STRATEGY OF ARRANGEMENT AND TOURISM DEVELOPMENT

A. One of the major objects is that of achieving a modern and efficient *communication infrastructure*, starting from the existent routes and benefiting by the favourable situation at the northern and eastern outskirts of the E68 European road and by the trans-carpathian national road, “Drumul Regelui”, from the west outskirts, alongside the Sebeşului Valley.

a. Of a major importance in the future strategy will be the reconstruction of the route on modern co-ordinates, of the “Drumul Oilor” on the north-south direction, with a double convergence, overlapped on the two of the future representative tourism arrangements: *Crinț*, a place where the roads from Jina-Poiana Sibiului, Tilişca-Sălişte, Săcel-Cristian, through Fântânele, respectively Orlat; *Cindrel* are joined, accesible through the above-mentioned road and with a connection towards west, alongside the Frumoasa Valley, with “Drumul Regelui”, towards north-east with Păltiniş, and connecting towards east with the eastern area of Mărginimea, alongside the Sadu valley.

b. The modernization of the west-eastern road axis, the so-called “Drumul Mărginimii”, uniting the majority of the settlements from Mărginime, from the Jina to Tălmaciu, which will double E68.

c. The modernization of the penetration roads, in the mountainous space, alongside the Gura Râului and Sadu valleys and Răşinari, Păltiniş, Cindrel route.

B. The achievement of **3 complex tourism arrangements** alongside the “Drumul Oilor”, unifying from a tourism point of view the hilly space of Mărginimea Sibiului with the Cindrel-Ştefleşti high mountainous floor.

a. The Sălişte town, nowadays a logistic centre for the tourism from Mărginime, could be brought to the stage of a resort of a regional-local importance, with several hundreds of places, including the actual tourism infrastructure, made of board and lodgings, motels and components of logistics, administration and information.

b. The *Crinț* arrangement, with a final capacity of 500 places, recognized for its climatic parameters and for its favourable landscape surroundings, is meant to stand out through its balneo-climatic profile, but also as a recreational destination and for vacation houses.

c. The Cindrel tourism complex, which could be the most ambitious project, would finally totalize a capacity of reception between 600 – 1000 places, being placed at the superior level of subalpine floor. It is foreseen as a complex winter sport climatic-mountainous tourism arrangement, with a modern skiable area, which could get to higher than 2000 meters altitudes, equipped with 6 ski paths, afferent means of transport on cable, placed on both slopes from the superior basin of Sadu Valley, with triple access, from west, from “Drumul Regelui”, from north on the “Drumul Oilor” and from the south-east from Păltiniş. The tourism arrangements will have to take into consideration the realities with a restrictive nature due to the most important mountainous reservation from Sibiu County, “Iezerele Cindrelului”, requiring the application of the ecotourism principles and of the sustainable development.

C. The third category of arrangements will include **the objects of a lesser importance**, but necessary for a complex capitalization.

a. the building of a third sky path in Preajba zone can be foreseen, endowed with 2 units of accommodation, totalizing 500 places. In this way, the arranged skiable area of Mărginimea will comprise more nucleuses with favourable morpho-climatic conditions that will be added to the already existent similar arrangements, from Păltiniş, Gura Râului and the most recent one, at Jina.

b. the binary tourism arrangement Sălişte-Crinț can be completed through private initiative with a real alignment of holiday houses concentrations from Jina-Rod, Şanta-Sălişte (having as a nucleus the chalet from Valea Soarelui) with 150 places, Sibiel, Gura Râului, Răşinari, Tălmăcel and finally the arrangement Boița-Lotrioara with 150 places.

c. The existent system of *chalets* will be completed with other 12 units of profile with an average capacity totalizing 400 places, adjusted to the present exigencies of comfort and which will become units of accommodation on the length of the designed “Drumul Oilor” (2 chalets), in the area of the skiable domain Cindrel (6 chalets) and in the eastern part, in the Tălmaciu-Boița-Lotrioara. These will also be points of leaving/arriving for the sky paths.

d. *The Rod village*, reduced numerically and with an aged population, but with a patrimony of settlements specific for the zone and relatively well preserved, can become the object of some external investments for rehabilitation, acquirement and habitation by categories of population belonging to the third age from Romania, but coming from other countries, too, especially from Germany.

e. *The mineral waters* from Miercurea Sibiului (a city from 2004) will be able, through adequate arrangement, but not outrunning a reception capacity of 200 places, to lead to the individualization of an organized balneary local resort and conforming to the SPA exigencies, adding the tourism-recreational function, too.

5. THE EFFECTS OF APPLICATION OF THE STRATEGY OF ARRANGEMENT-CAPITALIZATION AND TOURISM DEVELOPMENT

These will be materialized on multiple levels:

a. the combination of the private initiatives with the community ones, in a public-private system, with the attraction of the native and foreign investments, profitable to the communities;

b. a better territorial disposition of the tourism arrangements, folded on the less known attractive spots, and therefore less visible, on diversification and its typology, followed by a diversification of the capitalization's types (sportive recreation and mountain trips, cultural tourism, curative tourism) and of the tourism forms (rural tourism, pastoral agrotourism, tourism with secondary residence, motor itinerary tourism, hunting and piscicultural tourism etc., transforming the tourism seasonality in a continuous, yearly regime.

c. the diversification respecting the arrangements' principles: integration in the landscape, ecotourism, sustainable development and the direct and indirect (social) efficiency;

d. the stimulation, for the purpose of tourism, of the traditional activities, creating working places and final attractive products that can be turn into account on the tourism market;

e. the stimulation of the small industry of products destined for tourism with well-known potential centers, Miercurea Sibiului, Sălişte, Tălmaciu;

f. the formation and occupation of the working force in tourism, contributing to the native population remaining in the area and to the improvement of the geodemographical structures.

6. CONCLUSIONS

The application of the arrangement and development strategy will contribute to an efficient capitalization of the natural tourism potential and of the anthropic patrimony; to the modernization of the infrastructure, the creation of new working places and professions. On the other hand, the rural, preserved landscape will become an argument for the increase of the tourism attraction and for the integration in the European, traditional values.

R E F E R E N C E S

1. Badea, L., Caloianu, N., Dragu, Gh. (1971), *Județul Sibiu,* Edit. Academiei R. S. România, București.
2. Ciangă, N. (1984), *Economia turismului în Depresiunea Transilvaniei*, Studia Univ. „Babeş-Bolyai”, Cluj-Napoca, Geol.-Geogr. p. 64-69, Cluj-Napoca.
3. Ciangă, N. (2007), *România. Geografia Turismului,* Presa Universitară Clujeană, Cluj-Napoca.
4. Voicu-Vedea, V. (1998), *Mărginimea Sibiului. Studiu de Geografie Rurală,* Edit. Univ. „Lucian Blaga”, Sibiu.
5. xxx (1984), *Geografia României, III, Carpații şi Depresiunea Transilvaniei*, Edit. Academiei R. S. România, București.

TENDENCIES AND PREVISIONS OF THE INTERNATIONAL TOURISM UNTIL THE HORIZON OF THE YEARS 2020

AL. PĂCURAR[1]

ABSTRACT. – Tendencies and Previsions of the International Tourism until the Horizon of the Years 2020. International tourism will see, according to OMT previsions, a positive evolution until the horizon of the years 2020, both in the field of international tourism arrivals (ITA) and in the one regarding encashments. This phenomenon is analyzed on global and regional scales, taking into consideration the components belonging to the receiver tourism and to the issuing tourism, as main determiners that influence: the economy and its globalization, technological progress, the granted facilities, the safety of travelling, the demographic aspects, awareness concerning the preservation of nature, marketing techniques and the commercialization of the products and of the tourism services.

Keywords: *tendencies, international tourism arrivals, intraregional tourist, interregional tourist, tourism destination, electronic means, globalization.*

1. INTRODUCTION

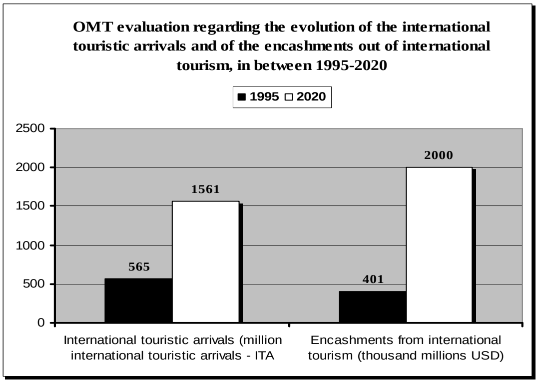


Fig. 1. The OMT estimations regarding the evolution of the international tourism arrivals and of the incomes coming from international tourism, in between 1995-2020

Source: xxx, 2002, *Tourisme: horizon 2020,* OMT, Madrid, p. 9.

In the spirit of the OMT policy and in concordance with its previsions (xxx, 2002, *Tourisme: horizon 2020*, OMT, Madrid, pages 8-127), in the approach of the tendencies regarding international tourism, we pursue several aspects: the evaluation of the extent of the phenomenon and of its perspectives of global and regional development, the characteristics of the supply and demand, the two components of the tourism market, which is globalized while the interdependences of the worldwide economy are increasing and the borders are volatilizing.

For the year 2020, OMT previsions that "the world is going to be characterised by the presence of new technologies in all the fields of existence. The existence of people will be possible without having too much contact with their fellow creatures, the automatization of the services will be a general rule and a general characteristic and it will be possible to get information, concerning a great number of matters, directly from home.

[1] *University „Babeş-Bolyai", Faculty of Geography", 400006, Cluj-Napoca, Romania, e-mail: sandu@grografie.ubbcluj.ro*

As a consequence of all these aspects, people will have an imperious need to establish human relationships, and tourism will represent the main mean of getting an answer to this need ” (xxx, 2002, *Tourisme: horizon 2020*, OMT, Madrid, p. 9).

2. TENDENCIES AND PREVISIONS OF THE INTERNATIONAL TOURISM

For the year 2020, the number of international tourism arrivals is estimated to approximately 1,6 thousand millions, and of the encashements, to 2000 billion USD, that is to say, in average, 5 billion USD/ day at the level of the entire planet (fig. 1).

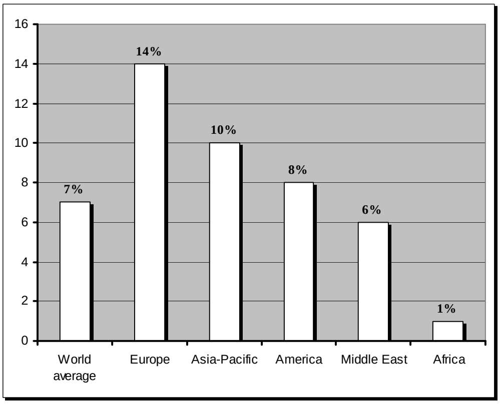


Fig 2. The ponderability of the international tourists from the total of tourists in 2020, according to OMT.

Source: xxx, 2002, *Tourisme: horizon 2020,* OMT, Madrid, p. 10.

A sensitive antenna of the economic and social life, especially international tourism will depend, further, on the evolution of the PIB that, according to the International Bank, until the year 2020, it will double. This will mean an increase of the incomes to even larger segments of population from the entire planet, and a great part of these encashements will be allocated to international tourism. According to OMT previsions, the annual average increase of the volume of international tourism arrivals (ITA) will be of 4,1 % preceding the incomes (as it is done at present, as a matter of fact) that will increase in an annual average rhythm of 3%.

Larger and larger segments of population are practicing and will practice international tourism. At a world-wide average of 7%, Europe will register double, 14%, followed by the most dynamic emergent region, Asia-Pacific, with 10% (fig. 2).

On a world-wide level, a tendency of a constant increase of the competition can be noticed, between the states that offer the tourism services and products, competition observed especially through the intensification of the efforts of advertising, in parallel with the professionalizing of the strategies of commercialization. This tendency is obvious in the central and East European countries, the states from the Asian-Pacific and the African areas. These regions make great efforts in order to enter the conscience of the public of costumers; Armenia, Kazakhstan, Georgia, Greece, Spain, Hungary, Poland, India and Peru are few examples which promote their offer, on the international tourism market, with tenaciousness and professionalism.

The tourism agencies that are found in the developed countries situated in Europe, America and Asia, confer great importance to the encouragement of the apparition of some market niches, channeling the demand toward exotic destinations, others than the traditional ones, like the seaside areas and / or their cities.

For the promotion of their offer, of their supply, the tourism states and their tourism agencies, resort on a large scale, to their web sites, using the internet as a more frequent tool of commercialization.

Since it has no boundaries, the issues of the environment are frequently recalled in tourism advertising, in the purpose of promoting a kind of tourism that is in harmony with the natural environment and with the anthropogenic one. Therefore, there is, at present, a real tendency of protection regarding the tourism resources.

In the OMT perspective, that emerges from its report of prevision, the main determiners that influence the development of tourism, till the horizon of the second decade of the third millennium, are: economy and the deepening of the phenomenon of globalization, the technologic progress, the granted facilities, the safety of traveling, the demographic aspects, the factor of localization of the tourism offer, the social progresses and the awareness of the preservation of nature and life environment, the marketing techniques and the ones of commercialization of the tourism products and services. With regard to the *economy*, the world-wide post-war ascending trend, of course, with some circumstantial crises connected to the cyclic evolution of the economy, led to a considerable increase of the *incomes and of free time*, together with the progress of technology and of the social rights of the wage earners. These two elements are indispensable to the practicability of tourism.

One after another, countries from more numerous regions of the globe have developed from the economic point of view and became emancipated socially and culturally: Europe, North America, Latin America, Asia-Pacific and even regions from Africa.

After the year of 2000, the emergent economies of China, India, Brazil, Russia, assert themselves vigorously, with a positive impact on the development of international tourism.

The financial polarization of the states, in a dollar, euro, sterling pound or in a yen area, has positive effects, in the sense of stabilization and enlargement of the markets, of the diminution of the customs and financial barriers.

Modern *technology* has a major impact upon the means of information and upon those of communication. The greatest impact is produced in the field of the supply – reservations, administration, and commercialization, relations with the ones who offer the services and with those who are the consumers - and in the field of demand. With the help of these techniques, the consumers have an unlimited, rapid and interactive access considering the offer.

Equally spectacular to this, are the technological progresses recorded in the field of transportation: lesser energy consumption, more safety, greater commercial speeds, diversified types and models according to the itinerary, all these leading to the diminution of the prices.

The *facilities* refer to the elimination of the obstacles from the way of free traveling, an essential factor for the development of the international tourism – visas, the liberalization of transportation, and more conditions that allow the access to the territories of other states. At present, these facilities that were earned in time are threatened by the scourge of terrorist attempts, which cause great damages to the tourism activity. The aimed states are forced to counteract, by hardening the supervisions and the controls, fact that leads to the diminution of the international tourism arrivals. These measures stipulate the increase of the safety of traveling. The conflicts, the incidents, the attempts, the natural disasters, are as many reasons that reduce, sometimes dramatically, the tourism displacements. Due to the fact that it became an important economic sector, the states take sever measures of protection and in this way the negative consequences are eliminated to the maximum.

The *demographic* aspects aim at the present emphasized tendency of ageing of the population in the industrialized countries, with consequences to the increase of the eastern-western and northern-southern migrations. In the tourism sector, the market segment of the adult and mature population will develop, as well as the interregional visits, which refer to the visiting of family and friends by the emigrants belonging to industrialized countries.

Another tendency is that of the reduction of the number of families, the increase of the cases of divorce, and the increase of the single parent families. Along the same line of ideas, the tendencies of the increase of the number of single tourists, of the parents that travel alone, or with one or more of their children, are to be noticed, because all these have an impact on some of the tourism services.

Concerning the localization of the tourism offer, supply, OMT expects for an intensification of the "conflict between identity and modernism, especially in the countries that are within the process of development" (xxx, 2003, *Tourisme: horizon 2020*, OMT, Madrid, page 16). This means that more numerous groups of people represented by language, ethnic belonging, religion, social structure, will ask, more and more obviously, for the recognition of their identity status. For the tourism offer, supply, this will grant the possibility of their promotion to the tourism market, thus new tourism resources emerge, ones that will give the opportunity to expand "the international tourism frontier".

In the context of the globalization of the economy, tourism will not stay left outside, but it will integrate to the mechanisms of **the market economy in which many more private companies and fewer states will impose themselves**. The consequence will be that great tourism companies will impose themselves on the national markets, more and more, and the integration on the vertical and on the horizontal of the companies from the tourism field will increase. Simultaneously, the data banks and the services of commercialization will be improved and massive investments will be made into them.

OMT estimates, for the horizon of the years of 2020, an increase of the sensitivity of the public toward the problems concerning the environment, in the sense of its preservation, and toward the social and cultural ones as well, in the sense of the acceptance of diversity. The impact in the case of tourism will be major, in the sense of deepening of its ecologic side, and in the case of edification of new tourism resorts, the prevalent role will rest to their lasting development.

In the *field of working and of the living environment*, the tendency of growing of the ponderability of the urban population, will maintain itself. Therefore the geographic citified areas, both in the developed countries and in those in process of developing, will gain in size. The consequence for tourism will be that an accumulation of the necessity for recreation of each inhabitant will be produced there, and tourism will offer them the possibility of temporary escaping in the purpose of resting.

As far as work is concerned, the tendency of the reduction of jobs with a full time table will be intensified and the ones with a more flexible and fragmented schedule will increase in number. This fact will involve a greater number of vacations, but with a shorter duration, and will lead to the increase of the travels that will last for a shorter length of time. Moreover, the tendency of the joining of tourism or of the tourism displacements to the professional ones will increase, both types being more frequently associated.

OMT reckons that, in this context of the intensification of the rhythm of working, the state of stress will increase and, as a result, "the demand for short tourism escapades, of escape, will increase". The ones that supply the tourism services will offer to the consumers, to the costumers, packets of shorter vacations, but which include intense experiences, that will engage the tourist personally. This will require new techniques marketing and of commercializing of the tourism products and services. These have to satisfy the more and more varied tastes of the costumers, even the personalized ones, their wishes and needs. The wider utilization of the electronic means of communication will allow the access to smaller and more remote niches of market; it is being said of "a micro-commercialization of the tourism destinations".

The components mentioned above lead, in the prevision of OMT, to a polarization of tourism: on one side, a mass tourism, a standard one, with great volume of fluxes directed toward developed destinations, and on the other side, an individualized tourism or an alternative one.

The receiver tourism. The OMT previsions (xxx, 2003, *Tourisme: horizon 2020*, OMT, Madrid, page 19) estimate to 1 billion, the number of international tourism arrivals in 2010 and 1,6 billion in 2020, that is to say an average annual increase of 4,1% between the years of 1995-2020 (figure 3, 5). But the foreseen period of 25 years will know different rhythms: we can already identify a first period 1995-2000 when, due to the Asian financial crisis that struck Japan, South Korea and Indonesia, Thailand, Malaysia, Philippines as well, international tourism had an annual rhythm of increase of 3,4%. For the period 2000-2010 the outlined value is of 4, 2% / year, and for 2010-2020 an annual average global rhythm of increase of 4, 5% is estimated.

Alongside these temporal differentiations, OMT identifies regional ones as well, differentiations of the annual rhythms of growth of the international tourism arrivals (fig. 4). On great regional geographical ensembles, the tendencies of the increase of the international tourism, in the OMT vision, are presented the following way:

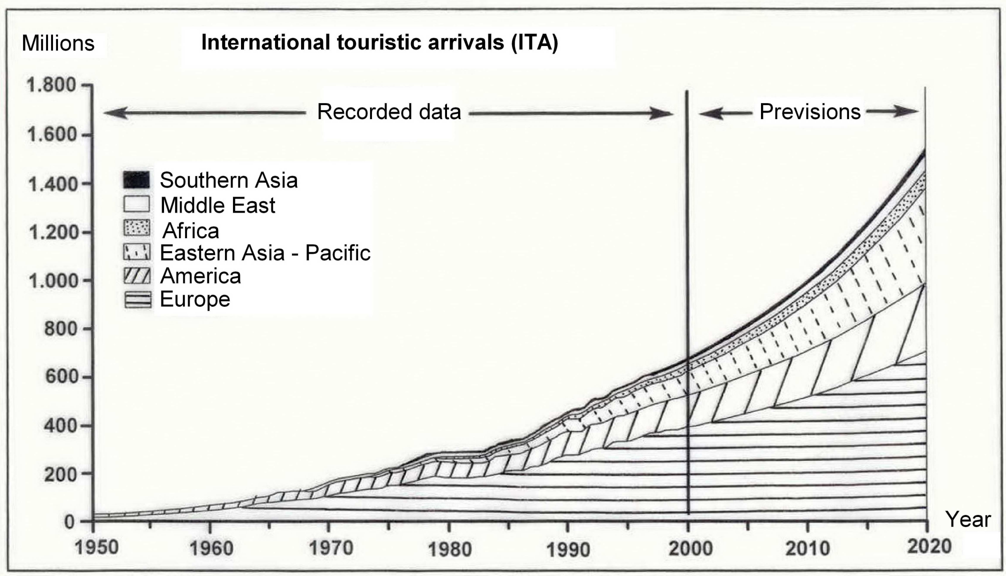


Fig. 3. The evolution of the international tourism arrivals in between 1995-2020.

Source: xxx, 2003, *Tourisme: horizon 2020*, OMT, Madrid, p. 20.

- the most dynamic region is Asia-Pacific, with an annual rhythm of increase of 6.5%. It will exceed America that will register only 3,9%, becoming in this way the second region as far as the volume of the international tourism arrivals is concerned, with a ponderability estimated to 25% of the world-wide market in the year 2020, in comparison to only 18% for America;

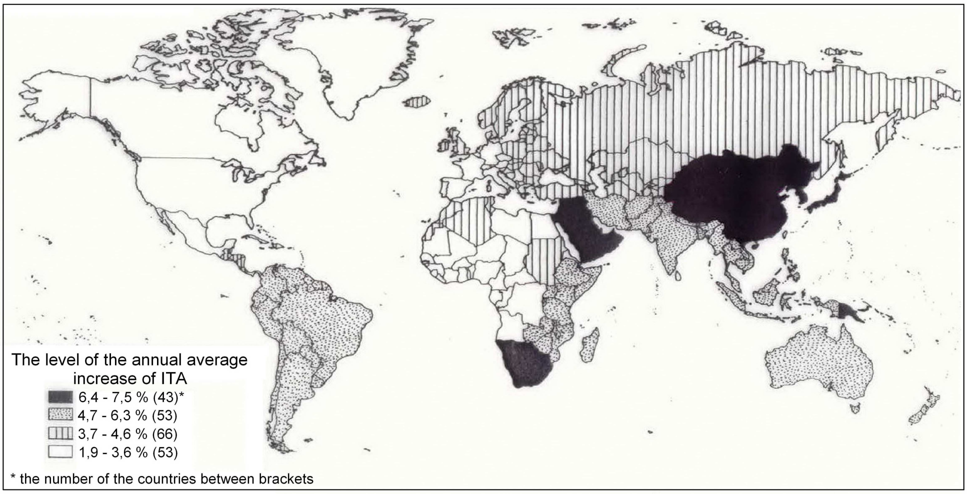
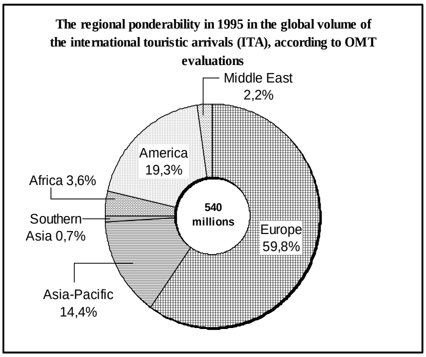


Fig. 4. OMT previsions regarding the annual average increase of the international tourism arrivals in the period in between 1995-2020, on great geographical regions.
Source: xxx, 2003, *Tourisme: horizon 2020*, OMT, Madrid, page 19.

- Europe will register an annual average rhythm of increase of only 3% given the saturation of its market, but it remains the main destination of the international tourism arrivals, polarizing approximately 45% of the world-wide market at the horizon of the years of 2020;

- Africa will experience annual average rhythms of increase that will exceed the world-wide average, its growth being estimated to 4.4% - 5% / year, rather reduced in comparison to its tourism resources;



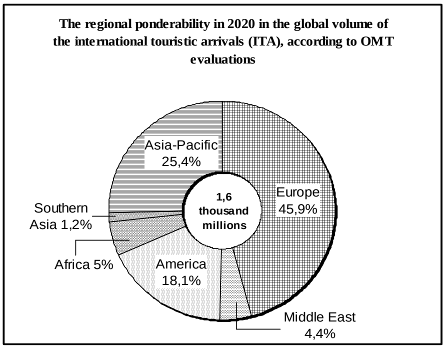


Fig. 5. Regional ponderability, in 1995 and 2020, in the global volume of the international tourism arrivals (ITA), according to the OMT estimations.

Source: xxx, 2002, *Tourisme: horizon 2020*, OMT, Madrid, page 20.

- Middle East will witness the highest annual rhythm of increase, around 7.1%, until 2020, due to some immense investments in the tourism infrastructure, especially regarding the source of accommodation and transportation. In the OMT previsions, the classification of the first ten countries having the most numerous international tourism arrivals in the year 2020, will be the following (table 1);

The first ten countries as international tourism destinations (in million tourism arrivals) in 2020 and the comparison to their situation in the year of 1995

Table 1

World-wide Rank	Country	Year of reference 1995	Previsions for 2020	Annual average increase (%)	Ponderability (%) out of the world-wide total	
					1995	2020
1	China	20,0	130,0	7,8	3,5	8,3
2	France	60,0	106,1	2,3	10,6	6,8
3	USA	43,3	102,4	3,5	7,7	6,6
4	Spain	38,8	73,9	2,6	6,9	4,7
5	Hong Kong	10,2	56,6	7,1	1,8	3,6
6	Italy	31,1	52,5	2,1	5,5	3,4
7	Great Britain	23,5	53,8	3,4	4,2	3,4
8	Mexico	20,2	48,9	3,6	3,6	3,1
9	Russia	9,3	48,0	6,8	1,6	3,1
10	Czech	16,5	44,0	4,0	2,9	2,8
Total, first ten states		**273,0**	**716,2**	**3,9**	**48,3**	**45,9**

Source: xxx, 2002, *Tourisme-horizon 2020,* OMT, Madrid, page 21.

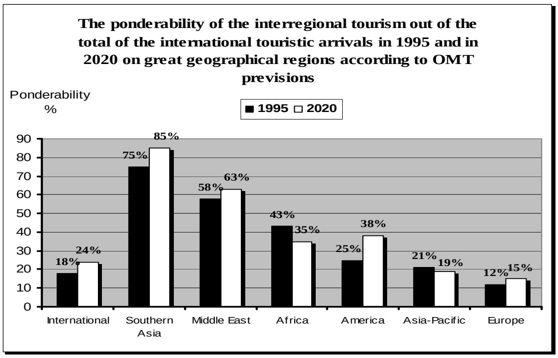


Fig. 6. The ponderability of the interregional tourism out of the total international tourism arrivals in 1995 and in 2020, on great geographical regions.

Source: xxx, 2002, *Tourisme: horizon 2020,* OMT, Madrid, page 22.

- For the great regional ensembles, OMT makes a distinction between the annual average increase of North America, that will be more tempered, and of both Latin America and the Caribbean area that will witness rhythms superior to the world-wide average. OMT also delimits South Asia from the ensemble of the Asia-Pacific region, this individualising itself sufficiently, in order to be treated separately.

In the estimation of the world-wide volume of the international tourism arrivals for the year 2020, OMT makes a distinction between **intraregional** tourism, for which estimates a volume of 1, 2 thousand millions arrivals, and the

interregional one, with 400 million arrivals (fig. 6). As it can be observed from the table, the positioning of the states, according to the volume of the international tourism arrivals, will experience the more profound transformations: OMT estimates that China, Russia, Hong Kong, Mexico and China alongside “classical” destinations as France, Spain, USA, Italy and Great Britain, will be found among the first ten positions. More interesting than this, is the repositioning of the states within the framework of the great regions of the globe, which we will analyse at each and every region separately.

Once with the social progress – the increase of the incomes, of free time and the progress of the technology of communications and transportations, the tourists will have the tendency to travel further, more often and for shorter periods of time. For them, due to the development of transportation, “the frontiers of the planet will wannish”, even the extra-planetary tourism, to the natural satellite of the Earth – the Moon. Along the same line of ideas, the interregional tourism will be emphasised, 24% in 2020, in comparison to the intraregional one, whose ponderability will diminish from 82% in 1995, to 76% in 2020, a fact that is valid for the majority of the greatest regions of planet Earth (see figure 11). With the exception of Africa and Asia-Pacific, the ponderability of the interregional tourism will increase, but in these areas, due to the social-economic development, their own tourists will have the tendency to visit states that belong to their own regions.

The issuing tourism. The OMT estimations regarding international tourism arrivals *on issuing regions*, in the year 2020, appear the following way (table 2).

It can be easily observed that, as far as the evolution of issuing international tourists is concerned, in comparison to an annual average increase of 1,4%, the rhythm of interregional increase is of 5,4%, clearly outrunning the intraregional one, that is of only 3,8%.

OMT previsions regarding the volume of the international tourism arrivals on issuing countries, in the year 2020 (million arrivals)

Table 2

Region	Previsions		Annual average rhythm of increase (%) in between 1995-2020	Ponderability (%) out of the world-wide total	
	2010	2020		1995	2020
Africa	36	62	6.2	2.5	4.0
America	173	232	3.1	19.1	14.9
Eastern Asia – Pacific	193	405	6.5	14.9	25.9
Europe	520	729	3.4	55.3	46.7
Middle-East	21	35	5.8	1.5	2.2
Southern Asia	10	17	5.6	0.8	1.1
Unspecified	54	81	3.6	6.0	5.2
Intraregional	791	1183	3.8	82.1	75.8
Interregional	216	378	5.4	17.9	24.2
TOTAL	**1007**	**1561**	**4.1**	**100.0**	**100.0**

Source: xxx, 2003, Tourisme: horizon 2020, OMT, Madrid, p. 23.

It can be noticed that on great geographical regions the values of the annual average increase of Europe (3,4%) and America (3,1%), in issuing international tourists, is much under the world-wide value of 4,1%, fact that is explained through the maturity and saturation of their market.

In regions with countries whose economies are considered to be emergent (South Asia, South-East-Pacific Asia, Middle East), the previsions regarding the annual average rhythm of increase reach to over 6% (fig. 6). As far as the hierarchy of the first ten countries that are international tourist issuers is concerned, the OMT previsions have the following shape (table 3). For the year 2020, the hierarchy of the issuing countries, according to the number of the international tourists, is in great part, unchanged. On the first places are situated Germany, Japan and USA, being closely followed by China, which records the most spectacular mutation.

OMT previsions regarding the main ten international tourists issuing countries, in 2020, in comparison with the year of 1995 (in million international tourism arrivals)

Table 3

World-wide Rank	Country	Year of reference 1995	Previsions for 2020	Annual average increase (%) between 1995-2020	Ponderability (%) out of the world-wide total	
					1995	2020
1	Germany	75	153	2.9	13.3	9,8
2	Japan	23	142	7.5	4.1	9,1
3	USA	63	123	2.7	11.1	7,9
4	China	5	100	12.8	0.9	6,4
5	Great Britain	42	95	3.3	7.4	6,1
6	France	21	55	3.9	3.7	3,5
7	Holland	22	46	3.0	3.8	2,9
8	Italy	16	35	3.1	2.9	2,3
9	Canada	19	31	2.0	3.4	2,0
10	Russia	12	31	4.0	2.1	2,0
Total, first ten states		**298**	**809**	**4,1**	**52.7**	**51.8**

Source: xxx, 2003, *Tourisme: horizon 2020,* OMT, Madrid, p. 24.

Great Britain still maintains itself on the fifth place, but what is surprising is the position of Holland on the seventh place, if we take into consideration its population that is much more reduced numerically that the one of Russia, country that will occupy a tenth place, as a result of its economic and social development in agile rhythms until the horizon of the years of 2020.

The distribution of the previsions regarding the tendencies of the annual average increase in issuing international tourists, on countries, in the period of 1995-2020, estimated by OMT, is presented in figure 7.

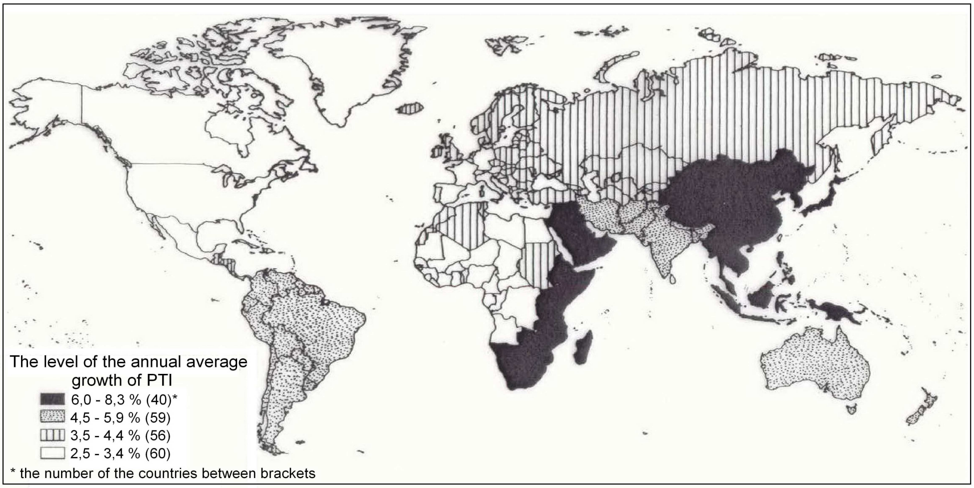


Fig. 7. The average levels of annual increase in issuing tourism, estimated by OMT, in between 1995-2020, on countries. **Source:** xxx, 2003, *Tourisme: horizon 2020*, OMT, Madrid, p. 25.

Quoting the American **John Naisbitt**, a distinguished futurologist, OMT presents few of the "mega-tendencies" contained in the sphere of the international tourism that will manifest themselves until the horizon of the years of 2020. In this way, as a reflex of the emphasis of globalization of the economies of the states, two opposite tendencies will be manifested, apparently contrary ones: globalization – localization, into a world that will polarize between "macro" and "micro" phenomenon.

Globalization will increase due to the continuous progress of the technology of informatics and communication, of the liberalization of the economies and of the markets. In this process, in which the great companies represent the point of the spear, all the countries will be caught in this gearing, seeking to insert themselves, as best as they can, on the regional emergent markets from this relationship network.

A tendency of specialization is situated at the opposite pole, one of preservation of the values regarding identity, either it is about culture, agriculture and economy, of the countries, or, what is more correctly to say, about human communities.

The tourism sector, as a component of the world-wide economy, will experience the effects of this polarization between the world-wide and the local. In this sense, the great tourism companies will continue to develop, those who operate either in the field of accommodation, in the one of transportations or in the one of the turoperators, or both on the local and world-wide scale markets. Simultaneously, numerous small and medium domestic companies will coexist together and they will impregnate the local characteristics and the characteristics related to identity into the tourism activities.

On a world-wide level, the tendency of merging of the companies from this field will continue, companies that will do a disservice to the mass tourism, which will standardise in a much greater measure. As a response to this phenomenon and in order to respond to the market, simultaneously to this, some operators will develop, that will become specialized in reduced segments of costumers, in punctiform market niches, reduced as far as the volume is concerned, but that are much more specialized ones. According to the OMT previsions that quote Stanford Institute, in between 10 – 15% of the consumers, and the most notified ones, will be established into a request for a specialized tourism; it is about experimented, mature costumers, consumers, with high life and social standards, with a vivid curiosity and sensitive to the cultural values of other communities of people. As a result of this demand, simultaneously to this, an almost personalized specialization of the tourism offer will take place, eased by the perfecting of the technologies of communication, stocking of information, analysis and selection.

According to the OMT expression, the supplier of tourism products and services "thinks, plans on a global scale, but acts locally, on punctiform markets, with niche type services."

Another tendency pointed out by **John Naisbitt** is the one of *the polarization of the tastes of the tourists*, whose tastes will be, as this activity advances and becomes more mature, much better known. In this way, their palette will expand on a very large "beach of tastes": from mutual tastes and facilities, till the most sophisticated ones, as part of the tourism of adventure or the educational-cultural one.

The very rich tourism offer, the technologic progresses from all fields, especially the ones regarding communications and transportation cause "the planet, the unknown space, to diminish a lot for the tourist". Practically, almost any destination on Earth is accessible to him, and what is a novelty, the tourist can reach into the interplanetary space as well.

The *electronic means*, either are the ones of identification of the individual – microchips, digital prints or prints of the iris etc, that will replace the passport, or are the ones used for paying – credit cards, used for tourism orientation, book of maps, maps and designs on CD-ROMs, will majorly influence the tourism fluxes regarding: the volume, the orientation, the seasons, the rapidity of travelling, etc. In this way, *"tourism destinations will become a fashionable accessory"*. The concept is not new, but it will be registered into this "renewal of the international tourism". In this sense, *"the association of the destination with its brand image*, will be intensified, and will always be analysed, evaluated, in order to be able to profit from it to the maximum".

A new tendency is being predicted, according to OMT, as far as the conceiving and the commercialization of the tourism product are concerned. These processes, together, will be *focused upon one thematic in which three aspects will be pursued: entertainment, strong emotions, education.*

3. CONCLUSIONS

As far as the *tourism destinations* are concerned, if for Europe and America the transformations will not be very spectacular, the Asian emergent market will witness, in its entirety, but in other countries as well, the most spectacular changes. In the field of tourism, Japan, Korea, India and China will register the greatest transformations and mutations.

Under the pressure of the costumers, of the tourists who are more and more aware and sensitive toward the environmental issues, toward the social ones and those concerning development, "the tourist will follow the path of a *lasting pattern of development*, in close concordance with the natural environment". In this way, as the number of international tourists increases, a growing incompatibility emerges between, on one side, the increased sensitivity toward the environmental and the social aspects, and on the other side, the growing pressure upon the consumption of tourism because, by becoming aware, tourists opt, more and more, for destinations that practice a lasting development of the tourism sector.

R E F E R E N C E S

1. Archambault, M., coord. (2002), *Le tourisme à l'heure des alliances, des fusions et des acquisitions*, OMT, Madrid.
2. Benavides, D. D. (2001), *The sustainability of International Tourism in Developing Countries,* WTO-UNCTAD, New York.
3. Ciangă, N. (1995), *Evoluţie şi tendinţele cercetării în geografia turismului în România*, Studia UBB, 1-2, Cluj-Napoca.
4. Cocean, P. (1996), *Geografia turismului*, Edit. Carro, Bucureşti.
5. Cocean, P., Dezsi, Şt. (2001), *Prospectare şi geoinformare turistică*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
6. Cristureanu, C. (1992), *Economia şi politica turismului internaţional*, Casa Editorială pentru turism şi cultură Abeona, Bucureşti.
7. Duhamel, P., Sacareau I. (1998), *Le tourisme dans monde*, Edit. Armand Collin, Paris.
8. Frangialli, F., (1991), *La France dans le tourisme mondial*, Edit. Economica, Paris.
9. Hoerner, J. M. (1993), *Introduction au géotourism*, Edit. Presses Universitaires de Perpignan.
10. Hoerner, J.M. (1997), *Géographié de l'industrie touristique*, Edit. Ellipses, Paris.
11. Kindersley, D. (1988), *Atlas encyclopedique mondial*, Edit. Libre Expression, Montréal.
12. Mesplier, A., Duraffour, P.B. (2007), *Le tourisme dans le monde,* Edit. Bréal, Paris.
13. Muntele, I., Iaţu, C. (2003), *Geografia turismului, concepte, metode şi forme de manifestare spaţio-temporală,* Edit. Sedcom Libris, Iaşi.
14. Nicoară, L., Puşcaş, Angelica (2002), *Regionare turistică mondială*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
15. Renucci J. (1990), *Tourisme international et tourisme national dans Etats de l'Europe méridionale,* Annalles de Géographie, 551 (janvier-février), 99ème année.
16. x x x, (1990–1997) – *Atlasseco,* Atlas economique mondial, Paris.
17. x x x, (1982), *Dicţionar poliglot de comerţ exterior şi turism*, Edit. Sport–Turism.
18. x x x, (1984, 1988, 1992) – *Diercke Weltatlas*, Georg Westermann, Braunschweig.
19. Organisation Mondiale du Tourisme, (1984), *Étude économique du tourisme mondial.*
20. x x x, OMT, Organisation Mondiale du Tourisme, (1987), *Etude économique du tourisme mondial*, Madrid.
21. x x x, (1989), *Tourism policy and International Tourism în OECD,* Paris.
22. x x x, (2002), *Le tourisme à l'heure des alliances, des fusions et des acquisitions,* OMT, Madrid.
23. x x x, (2002), *Tourisme-horizon 2020,* OMT, Madrid.
24. x x x, (2003), *Aperçu sur le tourisme mondial et divers sujets d'actualité*, OMT, Madrid.
25. x x x, (2003), *L'activité des croisières dand le monde,* OMT, Madrid.
26. x x x, (2003), *Le secteur des croisières,* în *Aperçu sur le tourisme mondial,* OMT, Madrid.
27. x x x, (2003), *The International Meeting Market 1994-2003,* Rapport ICCA, Amsterdam.
28. x x x, (2005), *Tourism Market Trends. Europe,* OMT, Madrid.
29. x x x, (2006), *Compendium of Tourism Statistics. Data 2000-2004,* OMT, Madrid.
30. x x x, (2006), *Tourism Market Trends: Europe,* OMT, Madrid.
31. x x x, (2003), *MICE Outbound Tourism 2000,* OMT, Madrid.

STUDIA UNIVERSITATIS BABEȘ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

THE FEATURES OF ENGLISH FOR TOURISM PURPOSES

SILVIA IRIMIEA[1]

ABSTRACT. – **The Features of English for Tourism Purposes.** The present study has been undertaken with the purpose of locating the language variety called *English for Tourism (EFT)* within the broader frameworks of both *tourism* and *special languages*. The study further seeks to explain the domain-related complexity and the linguistic 'densness' that characterises this language variety, to touch upon issues like fuctional and rhetorical peculiarities, and address a few distinctive features of the language of tourism, ie features which make this language a 'special' language. This study provides tourism-specific examples to substantiate these points.

Keywords: *specialised languages, English for Tourism, language functions, lexical features, distinctive features.*

1. INTRODUCTION

The *travel and tourism industry* is the world's largest and most diverse industry. Many nations rely on this dynamic industry as a primary source for generating revenues, employment, private sector growth and infrastructure development. Tourism development is encouraged, particularly among the developing countries around the world, when other forms of economic development, such as manufacturing or the exportation of natural resources are not commercially viable.

Tourism has experienced in a relatively short time a very spectacular growth and an increasing accessibility to many components of the travel field. In this field we can include also transportations, which, in parts of the world once considered remote, have become more affordable. Accommodations and restaurants in assorted budget categories are universally found in major cities, resort locations, in airports and also in rural areas. Professional services provided by travel agencies and tour operators, marketing efforts by public sector tourism offices, and advanced technology rapidly bring the tourism components together.

Tourism is a complex industry embracing many components which includ: travel, distribution, transportation and infrastructure, tourism facilities (accommodations, food and beverage establishments) and support services. Both the private and public sectors are involved in the industry. The challenge for tourism planners will, thus, be to meet the needs of more sophisticated travellers, while balancing the valuable resources of the world and preserving native impacts on the host community.

The study of tourism can be approached through several disciplines: economics, business, history, geography, sociology, and, last but not least, linguistics. The study of tourism started a long time ago, more exactly in the Middle Ages, but the study approached through a variety of disciples has started only later. The study of tourism was prompted by the growth of mass movements. Masses of people went in vacation because tourism was a

[1] *Babeş-Bolyai University, Faculty of Letters, Cluj-Napoca, Romania, e-mail: s_irimiea@yahoo.com*

combination of desire, mobility, accessibility and affordability. The 20th century new technologies featured: aviation, computers, robots and satellite communications, which have transformed the way people live, work and entertain. Modern technology is credited for the development of mass tourism for a number of reasons: it increased leisure time, provided additional income and created more efficient means of transportation.

Contrary to the study of tourism as a mass movement, the study of tourism as a *special language* started in the early 30`s, when scholars representing the Prague School considered the language of science and technique as a functional system, and, consequently, have tried to identify the characteristics of this language and highlight their morphological and lexical features in comparison with what the ’common’ language diLSPayed. After all, in that period, language became a means of communication for various fields, while scholars turned their concern towards the lexical, or rather registerial, aspects of the so-called *specialised languages*.

As it is known, language is a highly organized and encoded system which employs many devices to express, indicate, exchange messages and information. Just like any other language, the *language of tourism* has its own features, lexis and syntax. Broadly speaking, this language is structured in a particular way, it follows certain grammatical rules and has a specialised vocabulary like any language variety. Similar to any language, this language conveys messages, has a semantic content and operates through a conventional system of symbols and codes.

It should be noted that tourists can often provide feed back on the discourse provided by tourism experts, which might not always be positive. Tourists have their own ways of constructing images from the information which is supplied to them by the tourism industry. They create their own world of expectations, and when these are not met, they will voice their complaints. On the other hand, when tourists are satisfied with their experience, they contribute to the language of tourism by turning into active promoters of its words and becoming contributors with new words to the tourism lexicon.

The language of tourism is taken to be fascinating, and what makes it so is that, like tourism itself, it thrives on the act of discovery. Similar to travelling, which is an exploration, we need to undertake a complex *socio-linguistic journey* in order to uncover and reveal the language of tourism.

2. TOURISM AND ITS LANGUAGE

Tourism is a resourceful and complex industry, one which is dependent on nature’s endowment and human society’s heritage. It is also a socio-cultural event for both the traveller and the host. The traveller is attracted by his desire to visit different places of the world and observe ’foreign’cultures and ways of life. Tourism has grown from the pursuit of a privileged few to a mass movement, with the urge to unravel the unknown, to explore new places and to undergo new experiences. In this line of thought, “tourism has become the noblest instrument of this century for achieving international understanding. It brings together people from most distant parts of the world, people speaking various languages, belonging to different races, holding different political beliefs and having a different economic standing. Tourism brings them together.” (Davidson, 1997:177)

Let us consider the following tourism-specific text.

"To really get to know the area's waterways, take a cruise with a charter boat captain, hop on a water taxi, rent a boat or head for one of the scheduled services to the outer, bridgeless islands. A discovery course around the first floor of the Eiffel Tower that kids can participate in as a class or with their families!"

The text looks very persuasive and resembles the kind of texts we usually read in the mass-media. However, at a closer consideration, we can realize that this is a special type of communication, one which differs from other forms of human exchanges or interactions, first because it represents the largest industry in the world – that of tourism, second, because behind this publicity there is a complex linguistic phenomenon: **the language of tourism**.

The language of tourism, just like any specialised language, is intended to convey a message, it observes given grammatical rules, has a specialised vocabulary, and structures information and other cognitive processes in a particular way, as noted by D. Dobos (1999, p. 7): "*Language may be said to function as an instrument of conceptual analysis or synthesis. To fulfill this function the language of science develops further the rational structure of language and its factual vocabulary. The fixation of concepts by appropriate terms is fundamental to progress in science as only through the term can the concept be easily assimilated and developed further*".

The language of tourism has only recently started to be investigated from a linguistic perspective, probably because it mirrors the complexity of tourism itself, which, in turn, comes from the range of domains that contribute to its overall content and embraces: *geography* (description of places, surroundings, and monuments etc.), *economics* (tourist market, market strategies, etc.), *sociology* (definitions of pushing factors and types of tourism), *psychology* (tourists' perception of the environment) and other domains like: *history, history of art, cuisine, sport, architecture, archaeology, environment, religion, business*. Each of these components constitutes an aspect of tourism and opens up a new range of possible language features.

Tourism uses language to present the reality in alternative and more attractive ways than other language varieties, ie it seeks to turn an anonymous place into a tourist destination. The language of tourism has successfully combined items from everyday language with specifically-devised elements referring to most specialised concepts. Language is the most powerful driving force in the field of tourism and its aim is to persuade and seduce millions of tourists.

The language of tourism organizes its discourse according to specific lexical, syntactic and textual choices. However, is it enough to label it as 'specialised discourse'?

3. LANGUAGES FOR SPECIAL/SPECIALISED PURPOSES (LSP)

The general interest in *specialized languages* began when scholars belonging to the Prague School considered the *language of science and technique* a functional system, and have, consequently, tried to identify the characteristics of this language and highlight the morphological and lexical features that differentiate it from the so-called *common language*. Since language became an instrument of communication for various fields, scholars have shown more interest in the *lexical aspects* of specialised languages.

As there is no general agreement on the definition or scope of special languages, and since, apart from partial or incomplete studies, no comprehensive study has been written on special languages, many sociolinguists agree that the phenomenon of *diatypic* *linguistic variation* is dependent upon the *situation in which the language is used and the function it fulfills*.

Contextually delimited language types have ever since been variously termed: *restricted languages* (J.R.Firth, 1959), *registers* (Reid, 1958), *specialised languages*, a *variety* in a natural language, the communication medium for a certain field of human knowledge which consists of specific vocabulary, syntactical and style-related features, or *professional languages*, which are made up of a given terminology and have a particular manner of expression (Karcsay, 1997). It should be noted that it is the linguistic factor that has tended to dominate this development with an emphasis on the nature of specific varieties of language use.

Recent world events have underscored the need to increase understanding and to improve communication among all citizens. An international exchange of ideas has become essential in areas ranging from the environment- global warming and the thinning ozone layer-through medical research-genetic engineering and equitable distribution of modern drug therapies- to the political challenges of a global economy. LSP emerged because learners were seen to have different needs and interests, which would have an important influence on their motivation to learn and, therefore, on the effectiveness of their learning.

Essentially, *languages for special purpose (LSP)* are languages used to emphasize a specialised field. The purpose of a specialised language is, consequently, to facilitate the communication between individuals belonging to a community and who wish to discuss a specialised subject. In the first place, LSP develops in relation to a particular theme, ie it is 'specialised' when the content conveys a specialised meaning. Second, this highly specialised language is used to provide specific information to a particular target audience. In order to send the proper information to the envisaged audience, the user must thorougly and clearly identify it.

The individuals who use specialised languages can be classified into three categories. The fist one, includes *experts*, who have training or expertise in the specialised field in question. The second class, that of *semi-experts*, includes individuals who learn about a particular field, or are experts in related fields, who may be familiar with some of the terms or concpts, but not all. Individuals like, for example, technical writers or translators, who have training in language or linguistics, go in this category. Finally, the last category, that of *non-experts*, uses a specialised language without having any prior training or familiarity with the field. This is the so-called *lay* audience that should receive clear, unambiguous and full information.

The concept of *language for special purposes (LSP)* has developed at different paces in different countries, therefore, LSP is not a monolithic, universal phenomenon. An additional feature of special languages is that they are used more *self-consciously* than general languages.

Hutchinson (1991) tried to define LSP showing that:

- if the language is used for a specific purpose it does not necessarily mean that it is a special form of language;

- LSP is not just a matter of using scientific words and grammar rules by scientists, specialists, hotel staff and so on (which is called 'performance'), but it is also a matter of awareness of the special uses ('competence');

- finally, learning a specialised language should be based on effective and efficient learning.

When we speak about a specialised language we refer to the fact that the language is used in specialised fields or in particular human activities and that it is defined by its *lexical* heritage. Any specialised language is based on a selection and combination of communication elements that ultimately seek to yield a language that may enhance peer communication in a technical and/or professional field. Henceforth, the aim of LSP is to identify the grammatical and lexical features of a particular register and use those features effectively in technical or professional environments.

These languages perform two types of functions: *a referential function*, when the message is concentrated on the goal of the discourse, ie on description, explanation and argumentation etc, and *a metalingual function*, which is used to establish mutual agreement on the code (for example, a definition). It should be added, however, that what is termed *common language,* as opposed to a 'specialised one', is characterised through *polysemy* and *ambiguity,* two properties which do not characterise specialised languages.

A special language is essentially concerned with the extension of knowledge in its purest form, and, therefore, involves *informative* and *evaluative intentions*. Consequently, special language speech acts tend to avoid *phatic* and *poetic* communication altogether and subdivide texts according to intention.

Closely connected with functions or uses inherent to language are *intentions* which derive from the voluntary nature of language and govern specific speech acts. To quote Sager (1994:24) "*Informative intention* involves the communicative use of language; *interrogative intention* is expressed as requests for information; *directive intention* is reflected in imperatives; *evaluative intention* focuses on the classificatory use of language, while *discursive intention* involves modality."

Owing to the marked difference in degree between the *structure* of general knowledge and that of concepts in subject fields, special subjects are distinguished from the nature of reference and the number of primitive concepts. The properties of specialised languages do not limit or simplify common language, but, have the same lexical, syntactical and rhetorical features which are inherent to the so-called *common language*. In addition, a specialised language has a particular way to perceive and address the scientific or professional community and, henceforth, communication is realized faster and clearer. Consequently, it is likely to contain many specialised terms, which, in the end, are understood and used by the members of the community in which it emerged just like any terms would be used in *common language*.

In her book, Dobos Daniela (1999) highlights the special restrictions and features of the 'common language', of artificial languages and specialised languages, also poining out the views that:

- LSP partially accept the temporal dimension/characteristic by restricting the form and range of meaning of the accepted lexicon;

- acquisition is also a characteristic of LSP which distinguishes it from the general, common language;

- LSP tend to expand in the direction of artificial languages, while adopting a greater number of artificial language features in an effort to consolidate the specific basis of their field;

- with special languages the principle is that the written forms are primary, and prevail, a fact which has important consequence for their use;

- LSP adopt the features of a range of functions more or less rigorously;
- LSP tend to have the same goal, with some degree of synonymic variation certain types of special discourse is required by the functional diversity of usage;
- LSP restrict polisemy on account of their division according to fields;
-LSP adopt special rules without, however, jeopardising or inhibiting communication.

In addition to these features, there are features that result from other ways of analysing and describing a language, such as those regarding functional, notional, and structural aspects. *Functions* are concerned with social behavior and represent the intention of the speaker or writers and are achieved, for example, through acts like: advising, warning, describing. Meanwhile, *notions* reflect the way in which human mind works. However, another distinction should be pointed out, that between what a person does (performs) and what enables him to do it (competence). But in order to be proficient in the target situation, the speaker of a specialised language has to know the type of needs determined by the requirements of the target situation. Specilised languages structure their content according to the particular context-related text type which is used.

Another feature of these language types concerns *technicalisation*. Technicality in language depends not on writing as such, but on the kind of organisation of the meaning that writing brings with it: “Through technicality a discipline establishes the inventory of what it can talk about and the terms in which it can talk about it.” (Martin, 1985:58)

As a conclusion, we can agree that tourism uses a specialised language. After all, it is special because it is a subsystem of the general languages, it is used for a specific professional domain and it is used by both experts and non-experts; it is characterised through its own lexical, morphosyntactic and textual rules.

4. ENGLISH FOR SPECIFIC PURPOSES (ESP)

“The growth of ESP (English for special purposes), then, was brought about by a combination of three important factors: the expansion of the demand for English to suit a particular need and development in the fields of linguistics and educational psychology. All three factors seemed to point towards the need for increased specialization in language learning.” (Hutchinson, 1991:8)

English for Specific Purposes (ESP) has become increasingly important because there has been an increase in demand for vocational training and learning throughout the world. With the spread of globalization it has come to an increased use of English as the language of international communication. More and more people started using English in a growing number of occupational contexts. Students were starting to learn and, consequently, master general English at a younger age and move on to ESP at an earlier age.

ESP is often divided into EAP (English for Academic Purposes) and EOP (English for Occupational Purposes). Further sub-divisions of EOP are sometimes made into business English, professional English (e.g. English for doctors, lawyers) and vocational English (e.g. English for tourism, nursing, aviation, and bricklaying).

ESP practitioners are also becoming increasingly involved in intercultural communication and the development of intercultural competence.

The peculiarity of this language can be defined as:
- a specialized form from the point of view of the topic, range of use and field;
- a complex linguistic system, not an isolated phenomenon;

- its communicative function refers to the intercourse between experts, semi-experts and non-experts.

The structure of specialised discourse may be denser and more formalized, but not different in kind and form from that of less specialised material. The knowledge needed to comprehend the specialist text lies in “the subject knowledge, not in language knowledge.” (Hutchinson, 1991:161)

According to several studies the absolute characteristics of ESP are that:

- it is designed to meet the specific needs of the learners;
- it makes use of the underlying methodology and activities of the specialism it serves;
- it is centred not only on language (grammar, lexis, register), but also the skills, discourses and genres appropriate to those activities.

In general, every type of language can be considered a specialised one, if it meets at least one of the following features: the particularity of the theme, the particularity of the communicative situation, specific characteristics of the speaker.

5. THE LANGUAGE OF TOURISM: ENGLISH FOR TOURISM PURPOSES (EFT)

The language of tourism can be considered a specialised language, an ESP in its own right, which is used in professional communication (verbal or written) both by experts and non-experts. The language of tourism is a highly organised and encoded system which employs many devices to express, indicate, exchange messages and information. Language is furtheron, mainly described in terms of: discourse, rhetoric and narrative aspects.

Discourse is a complex term used both in linguistics and in social sciences. Discourse analysis, on the other hand, stands for the study of whole units of communicative exchanges produced in a particular speech community and the language used, which, in turn, is examined both in what its form is concerned and its function.

Discourse analysis looks at writing, talking, and communication, in general, in terms of sequences of sentences, propositions, and speech acts. Discourse analysis goes beyond the boundaries of language and structure and focuses on naturally occurring language use rather than on fabricated examples.

Rhetoric is closely connected with discourse, and involves the speaker’s power over the addressee, ie his art to use persuasive or impressive speaking and writing. In the language of tourism, the rhetorical feature is the cornerstone of communication, because, without it, we can not persuade people to buy the products or to impress the client and make him want to visit new places and meet people. Rhetorics is equally linked to the *narrative feature* which relates an account to an audience and enhances the language of tourism by story-telling.

Mainly, according to Dann (1996) the language of tourism is associated with four major theoretical perspectives and their sociolinguistic correlation. This approach is particularly useful to understanding contemporary tourism and, at the same time, offers remarkable insights into it. The perspectives include:

- *the authenticity perspective (authentication).* According to this first perspective the author regards tourism as structurally necessary, ritualised breaks in routine that define and relieve the ordinary. "The rhetoric of tourism is full of the manifestation of the importance of authenticity of the relationship between the tourists and what they see: this is a typical native house; this is the *very* place the leader fell; this is the actual pen used to sigh the law; this is the *original* manuscript; this is the authentic Tlingit fish club; this is a *real* piece of the *true* Crowns of Thorns." (MacCannell, 1989, p. 14). It means that tourism is something typical, very actual, authentic, real, and true and regards the relationship between tourist and nature, tourist and inhabitants and, in the end, the tourist and other tourists;

- *the strangehood perspective (differentiation).* According to the second perspective, the author considers that the modern human being is interested in things, sights, customs and cultures different from his own, mainly because they are different. Gradually, a new value has emerged and evolved: the appreciation of the experience of something different and, at the same time, something new. In addition, the tourist is attracted by untouched, fascinating, and unknown places. For him the act of discovery is spectacular and he seeks colorful, picturesque, simple, exotic places in which he meets new people and observes other traditions, or simply undergoes new experiences;

- *the play perspective (recreation).* The use of leisure time is an important aspect of life in our society, therefore, planning recreation and leisure time should be undertaken both on a personal and on a public level. Tourism is regerded as a leisure activity because tourists are freed from the demands of work and duty. Tourists visit many places, have different activities and they thrive for a unique experience, emphasising events and timelessness. At the end of the trip, tourists bring back symbols, trophies of consumption to remember the places they visted;

- *the conflict perspective (appropriation).* The last perspective is more recent and less clear than the theoretical framework. The conflict perspective speaks about how ideas and myths from literature are more important than reality in tourism. The discourses are often treated like a mythical setting (Sphinx, Cleopatra, Troy etc.), but sometimes these actions are reinventing the culture or are deliberate misinterpretations of a particular culture as *in "This afternoon we visit Mayers Ranch. Leaving Nairobi, past hundreds of colorful farm holdings, the road emerges from a belt of forest to reveal the most magnificent valley in the world. The Great Rift Valley…We wind our way to the base of the Valley ...before proceeding to Mayer's (sic) Ranch where we are treated to an awesome diLSPay of traditional Masai dancing. You will be able to watch from close-up, the legendary Masai enact warlike scenes from their past. These warriors are noted for being able to leap high in the air from a standing position. The experience is truly a photographer's delight. After English Tea on the lawn of the Ranch house we return to Nairobi."* (Brochure for visitors of Mayers Ranch).

Like other languages it performs several functions that link: addresser, addressee, content and context of message. From amongst the numerous features of tourism, we shall discuss the most important ones in this succint survey, namely: the linguistic functions, magic, monologue, euphoria, tautology, lack of sender identification, simplicity, non ambiguous words and structure.

Starting with the *functions* of language we should quote Jacobson's views on the functions of the language and apply them to the language of tourism. *The referential function* is used either by the sender to provide new information to the receiver or to ask the addressee for information; one of the intercatants is reporting, describing, asserting, requesting, confirming, refuting or using referential speech acts. This is the most important function of the EFT, as its primary objective is to provide information about a country, region, community etc., however it is often less emphasised than it should be. *The emotive function* refers to the sender of the message and his attitudes as a communicator vis-à-vis the message. The language uses interjections and emphatic speech, and the feelings of the sender are revealed by speech acts like: apology, forgiveness, approval, praise, reprimand etc. In the language of tourism the emotive function no longer refers to the author. In addition, the emotive function uses an emotive register, many superlatives and values judgments. *The connotative function* relates to the receiver of the message. The language is used to influence the addressee, his attitudes and behavior. This function uses the vocative or imperative and attempts to persuade, recommend, permit, order and warn. This is also the language of social control. The language of tourism has as explicit target, the consumer and his desires, so, instead of the utilization of vague imperatives to make people see and do things, it often expresses an assumption regarding the visitors' knowledge. *The phatic function* is used to create, prolong or terminate a contact via a given medium of communication. It is used to check whether the channel is working ('hello, do you hear me?', 'are you listening?'), or to chit-chat on a topic (eg the weather). This language function is necessary to maintain communication. This function is neither used for the written form of the language of tourism, nor for pictorial contexts. Since it is very difficult to maintain the reader's interest strange pictures, strong light contrasts or strong colors, dialogue structure via rhetorical questions, friendly format etc. are the rule. *The metalingual function* establishes the mutual agreement of communicators or interactants on the code (for example, a definition). In EFT most of the definitions are familiar even to non-experts, such are: tourist, tourist attraction and tourism products etc. The last language function, *the poetic function*, focuses on the message for its own sake. The language uses linguistic devices such as: rhyme, metaphors and a code to transmit meaning in a usual way, but there is always the risk of ambiguity. Employed by the language of tourism the poetic function is expressed via *metaphors* and *metonyms*, which often become redundant expressions, just like clichés.

The second feature of EFT is the use of *magic*. Almost every brochure contains some magic powers. Passive consumers must be incorporated in the process "we can't make the world go away. But we're pretty good at hiding it". (Advertisement of a tourism agency) Through language a world of its own is created, hotel sites are transformed into magical playgrounds: *"In the kingdom of Las Vegas there stands a castle like no other.'Tis a castle with a casino of epic LSPendor. Where games of change and enchanting pleasures beckon 24 hours a day. 'Tis a castle where the coin of the realm is captured. Where the cards are hot. The dice are never cold. And the action never stops. 'Tis a castle of sword and sorcery where the knights come alive. Reserve a place in the majesty of Excalibur today"* (Brochure of Excalibur Hotel, Las Vegas).

The third specific feature is *monologue*. Both brochures and leaflets contain *monologue*. This represents an asymmetrical relation between a professional seller and a buyer in terms of the interest in the knowledge about the advertised product. In this case a perfect language of persuasion is needed to sell as many products as a seller can. When talking about monologue in tourism we know that it is a one-way communication (answers/ questions are not possible in the first phase), the tourist must stop and read, in this way his attention is captured.

Another very important function of the language of tourism is *euphoria*. By euphoria we understand beautiful terms and lexical items that provide you with the necessary elements to make you dream .

Like general advertising, the language of tourism uses *positive* and *glowing terms* for the services and attractions it seeks to promote. Occasionally, people disappear completely from the texts, because they may be associated with problems. Equally, the language of tourism uses *romantic hyperbole*, like the following: *The Seychelles: an archipelago of gold and light. These little isles blessed by the gods have been solely sensations and feelings of tenderness and beauty*.

In tour operators' brochures, for example, and other advertising materials the lexis used is *emphatic* and *highly evaluative,* usually extolling the positive features of the places described and the services offered, as in the following examples: *unique shopping centre, welcoming pubs, picturesque fishing harbour, luxuriant vegetation, idyllic golden beaches, breath-taking views.* These types of texts often contain *emphasises* and *superlative forms*.

Beside these features, the language of tourism also exhibits *tautology* features. Tautology is unnecessary or unessential because it repeats the same meanings, using different and dissimilar words. Tourists hear the same stories when they go on a trip or they visit the same places in a city. In other words the tourists read, see, experience what they were expected and told to expect. When a tourist reads a brochure or a leaflet regarding a touristic destination, he will realize that the same destination is described in brochures almost in the same way. The language of tourism shapes up patterns concerning the tourist destination which comprises: an attractive description about the country, climate, people, and atmosphere.

Another feature of the language of tourism is the *lack of sender*. In many cases the sender, ie the author, is unknown. Tourists and potential tourists sometimes have a vague idea who compiles the brochures, leaflet, and advertisements. But paradoxically, even if the tourists don't know who compiled the texts, they know where to go in order to buy products. Many products are realized to notify the public about some products or offers and in many cases the sender doesn't matter.

S*implicity* is reflected in the use of simple words but with expressive or suggestive meanings. For example: *Self-catering accommodation* **(=** accommodation where you cook your own meals), *Intercity sleeper* (= an InterCity train in which you can sleep).

Other devices are represented by the *omission of agent* and *auxiliaries in passive forms*, as in: *Pre-arranged car rental* (car rental which has been previously arranged). When the agent has to be expressed it is placed before the past participle, as in *An AA recommended hotel* (= a hotel recommended by the Automobile Association).

When speaking about simplicity we must necessarily speak about *blending* (use of blended forms instead of long words). Examples of blending in the language of tourism include: *campsite* (camp + site), *ecotourism* (Ecological + tourism), *motel* (Motor + hotel), *Travelog* (travel + blog).

Another important feature of the language is that the language of tourism has concepts that *avoid ambiguity*. Like other specialised languages, this one has most terms that avoid ambiguity and have just one meaning. Even if they are similar they can not designate the same thing. Some examples are *tour operator* and *package holidays,* created to refer to companies which organise holidays, tours and travels, and to refer to all inclusive holidays with a fixed price.

However, perhaps the most important characteristic of this language is the ability to manipulate the attitudes and behaviour of tourists, both individually and collectively. The need to *exercise social control over the client* becomes clear with the realisation that tourism is an worldwide-expanding phenomenon without constraints, which cannot be entirely managed.

From the *structural* point of view, this type of discourse abides by the classical requirements of advertising discourse: first it is aimed at capturing attention, then to maintaining interest, next to creating desire and, finaly, moving to action. The first step, that of ’capturing attention’, is achieved through linguistic means, ie the use of superlatives (“extraordinary, natural sceneries, with majestic mountains”, “Mallorca is a great destination, with endless places to explore”) and of attractive, colorful pictures. The reader’s interest is maintained or enhanced through various kinds of discounts and special offers. This is the most difficult part in advertising. Skilled professionals know how to create a desir and, at the same time, maintain the reader’s interest. After all these steps are taken and the requirements are fulfilled, it is very easy to take further action.

6. CONCLUSION

This survey of the features of the EFT shows that this language variety is very *complex* and is undergoiong an enrichment process, as it incorporates all features of tourism. Even if the language capable to describe in a few words spectacular sceneries, a higher impact will be attained if the language is relies heavily on the use of adjectives. It is self-evident that the numerous techniques used give a new, desirable and dreamlike aspect to places, castles, sceneries, beaches, oceans, rivers etc. As if these places were hidden under a mask, and suddenly, when rich and beautiful words are used to describe them, they reveal themselves as a paradise.

In the language of tourism every word has its own place, its own magic and it is used to make the tourist dream. When you read a magical description you become attracted to that place, you already see yourself in that place.

Words change the reader’s perception of the world, that is why *the word* is the most powerful hypnosis.

R E F E R E N C E S

1. Adamson, D. (1994), *International hotel English*, New York, Prentice Hall.
2. Dann,G.MS, (1996) *The Language of Tourism, A Sociolinguistic Perspective.*, Wallyford: CAB International.
3. Davidson, R. (1997), *Tourism*, London, Pitman.
4. Doboş, D. (1999), *English special languages and nominality*, Iaşi, Demiurg.
5. Firth, J.R. (1959), *Papers in linguistics*, London, Longman.
6. Hutchinson, T. (1991), *English for specific purposes*, Cambridge, Cambridge University Press.
7. Irimiea, Silvia (1999), *English for international tourism*, Cluj Napoca, Presa Universitară Clujană.
8. Jaworski, A, Pritchard Annet (2005), *Discourse, communication and tourism,* London, Channel View Publications.
9. Karcsay, S. (1977), *Theoretical and methodogical differences of sociological and technical-scientific translating*. In Babel, XXIII/3:116.
10. Martin, J. R. (1986), *Intervening in the process of writing development*, Victoria, Deakin University Press.

11. Murphy, P. (1993), *Tourism: a community approach*, New York, Routledge.
12. Nițu, C. (2004), *English for tourism*, Pitești, Edit. Universității din Piteşti.
13. Popescu, D. (2005), *Genre analysis*, Piteşti, Edit. Edit. Universității din Pitești.
14. Prepeliceanu, C. (2005), *English for tourism and hospitality industry*, București, Editura Universitară.
15. Rața, G. (2006), *The English of tourism and agrotourism*, Timișoara, Mirton.
16. Rotar, Gabriela (2006), *Comunicare în turism*, Cluj Napoca, Presa Universitară Clujană.
17. Rothman, H. (2003), *The culture of tourism, the tourism of culture*, Albuquerque, University of New Mexico Press.
18. Sager, J.C. (1994), *Language engineering and translation*, Philadelphia, John Benjamin's.

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

BARCELONA. INTERNATIONAL EVENTS AND THEIR IMPACT ON THE URBAN TISSUE AND DEVELOPMENT

XENIA HAVADI[1]

ABSTRACT. – Barcelona. International events and their impact in the urban tissue and development. Great international enterprises without any primarily urban aims, such as International Exhibitions or the Olympic Games, were the impulse for important transformations, remodelling Barcelona four times in 115 years between 1888 and 2004. The local administration recurred repeatedly in moments of socio-political crisis and economical stagnation to the proven model of urban development of using a major international event as trigger force to accomplish urgent complex undertakings. By that the events appoint key moments in the urban development of Barcelona. For instance the International Exhibition of 1929 marked the urban reform and metropolitan definition of Barcelona. The planning and implementation of the Olympic Games in 1992 constituted a crucial period of securing the city's economic future and marked a qualitative shift towards major restructuring projects. These projects were integrated in the broader Development Plans, which looked beyond the event itself and focused onto the complex reality of the host city. Local governments used these modern events as ways of promoting the town and as occasions for restructuring and replaning it with international public and private financial support. The major investments which accompanied the great enterprises, allowed the city and metropolitan area to be endowed with good communications, telecommunications, hotels, alternative tertiary centres, storm drains, stadiums and other sporting installations, a marina, airport, main roads, and also the reform of major cultural structures.

Keywords: *Barcelona, urban landscape and development, period 1888 to 2004.*

1. INTRODUCTION

Every city grows based on specific platforms or projects. The evolution of a city depends very much from the resources it disposes of, but also in large scale from the initiatives the citizens come up with. Barcelona has mostly grown jerkily with precise reasons or goals. It is a historical fact that lacking the advantages capitals of states have, resorted to imaginative operations such as touristic campaigns or hosting great events ranging form International Exhibitions to enterprises such as the Olympic Games. The great international events not only made possible the administrative, governmental and civil cooperation, but mainly acted as a trigger to accomplish urgent complex projects.

Major international events without any primarily urban aims were the impulse for great transformations, remodelling Barcelona four times in 115 years between 1888 and 2004. The Universal Exposition of 1888 regained the Ciutadella area for the citizens; the International Exposition of 1929 build the frame for the urbanisation of the Montjuic and the expansion and upgrading of the metro network; the Olympic Games in 1992 opened the city to the sea and enriched the town with excellent sport equipments, leisure facilities and

[1] *Disflex S.L., 08755 Castellbisbal, Barcelona, Spain, e-mail: xeniahavadi@yahoo.es*

various important infrastructures. At last, but not least the Barcelona Forum 2004 facilitated the urbanisation of an area environmentally and socially degraded and to complete the recuperation of the cost line begun with the Olympics.

The mentioned four great events hosted by the town marked main phases of its development and defined the shape and function of the modern Barcelona. The key formation feature was in accordance with the necessities of the town and the urban politics of the administration of the moment. The International Exhibitions emphasized on an expansive development, enlarging the city by integrating poorly used periphery and working into integrating surrounding settlements. The democratic administration after 1979 adopted a different urban politics for Barcelona. The attention was focused on the existing areas badly edified, crowded or degraded by time and on the amelioration of the living standards of their inhabitants. The administration dedicated himself to the rehabilitation of urban spaces. First of all the Olympics gave a decisive impulse for the recovery of the densely populated neighbourhoods and the recuperation of the cost and Montjuic for the citizen use. The urban transformation related to the Forum Barcelona 2004 is the most important rehabilitation achievement in the history of Barcelona until now. For one, because it exceeds the limits of Barcelona, acting in a larger metropolitan area and secondly, for the great amount of projects executed in the same time.

2. THE UNIVERSAL EXHIBITION OF 1888 AND THE INTERNATIONAL EXHIBITION OF 1929: MODEL OF URBAN DEVELOPMENT

The Universal Exhibitions initiated in 1855 in London, were considered as major political, economical and social events, in which the attending countries exposed their technological developments and presented their economical and industrial potentials. Hosting such an enterprise was an opportunity for economical development and assured international prestige.

1888 Barcelona was the second most important city in Spain on political level, but the first most important from industrial point of view. The Universal Exhibition hosted in this year in Barcelona served as a display case for the country’s industrial, technological and artistic realities. Even though the event took place inside a delimited exhibition ground, the exposition contributed to general improvements in the city. In a period when the city wall was tern down and the amplification of the city according to the Cerdá plan was in process, the celebration of the event served on one hand as an impulse to complete works begun years before and on the other side to initiate new infrastructures and services that not only improved the living standards of the citizens, but also exhibited an image of modernity for the visitors. Besides the Park Ciutadella, the exhibition site, major works were done on the maritime front between Park Ciutadella and the Las Ramblas, urbanising the area and constructing the Passeig de Colón. Furthermore representative buildings were raised, such as the Palacio de Bellas Artes, the Arc de Triumph or the Monument of Colón. Organised in a moment of economical depression, the event signified a revival for the construction sector and it meant the first big step towards the Europeanization of the Catalan economy.

Due to the overall success of the first big event organised in Barcelona, the Universal Exhibition from 1888 turned into a model of development which afterwards was applied for several occasions contributing to bigger and bigger changes in the urban and the socio-economical landscape of the town. The first of many was the International Exhibition celebrated in Barcelona in 1929, which had a great importance for the urban politics of the city, as the radical measures realised due to hosting the event, provided the city with the adequate infrastructure necessary for its further development. The choice of the location was very important as it implied the possibility of solving urging urban issues and also defining the formation at least of the area, if not of the whole city. In the urban landscape occurred big changes to make the city suitable to host such a great international event.

The International Exhibition was originally planed to be held already in 1917, but the outbreak of the 1. World War, followed by the political and governmental changes that Spain under went in 1923, postponed and settled the date for 1929. The new format of the exhibition was dedicated to industry, arts and sports. The apple of discord was the location of the event aimed to strengthen the position of Barcelona as a Mediterranean industrial and trade centre in an era of industrial development and technological progress. One party supported the exhibition site to be located between the Plaza de Glórias Catalanas and the Besós river, arguing as a plausible solution for the unfinished enlargement plan of Cerdá. Yet the organisation commission decided to settle the Exhibition in the Montjuic hill with the goal to integrate the hill area in the town, and obtained the financial support of the central government.

In the urban reform and reconstruction plan of Cerdá occurs for the first time the lack of free space and public parks in the overpopulated and crowded Barcelona. Although with the occasion of the Universal Exhibition of 1888 was created the Park Ciutadella, it was the only public park in Barcelona. The municipality was firmly determined to amplify the green areas and conceived it by increasing from 17ha designated for parks and gardens in 1910 to 447ha in 1926 including the Park Güell and Park Montjuic. The exhibition facilities incorporated several “palacios”, the most representative being the Palacio Nacional, and halls, buildings which nowadays serve as museums or host institutions and fairs. Furthermore the stadium built on the top of the hill, as well the Greek theatre settled in one of the parks of Montjuic and the Spanish village compound on the foot of the hill, emphasis the other themes of the exhibition: arts, culture and sports.

Fig. 1. The ground of the International Exhibition of Barcelona in 1929.

Source: http://es.wikipedia.org/wiki/Archivo:BarcelonaExpositionPanorama.1929.ws.jpg

Beside the exhibition facilities, representative buildings and the adjustments of Montjuic to become a leisure area for the greater public, vast works were done in the communication network of Barcelona and surroundings. The phase which Solá-Morales defines as of urban reform and metropolitan definition of Barcelona is distinguished by the construction of relevant road segments and by remodelling of streets of major importance such as the Gran Via de les Corts Catalanes or the actual Av. Diagonal. The construction and reconstruction concerned basically almost all the main roads and avenues of Barcelona, with the greatest interventions in the Pl. Cataluña, the Las Ramblas, Via Laietana, Ronda Universidad or Paseig de Grácia and mostly the access roads to the exhibition site. Between 1924 and 1929 525m2 were built and paved. The street lighting by gas was gradually changed into electricity. Further attention was focused on the connection of Barcelona with the surrounding settlements, which with time got incorporated. Not only the streets, but also the city railway and metro network was enlarged, amplified and modernised, upgrading the services. Furthermore the airport of Prat de Llobregat was built in this period. The realisation of all this public works required manpower, which led to an increase of immigrants from all the Spain and meant a demographical and physical growth of Barcelona.

Even though the Exhibition itself was only a relative success, from architectural, urban and infrastructural point of view is from a major importance for the history of Barcelona. Yet the proven model of urban development reached its apogee with the organisation of the Olympic Games of 1992 in Barcelona.

3. THE OLYMPIC GAMES OF 1992: QUALITATIVE SHIFT TOWARDS MAJOR RESTRUCTURING PROJECTS

It is generally admitted, that the Olympic project is not confined to merely sportive ambits. The prestige as host and its implications upon the physical structure and the appearance as well upon socio-economical aspects are the most evident. The planning and implementation of the Games constituted the crucial period of securing the city's economic future and marked a qualitative shift towards major restructuring projects. The democratic administration which came to power in 1979 was facing an economical recession. The general economical crisis affecting the textile and services sectors gave place to a raise of the unemployment in the metropolitan area. The general picture was dominated by low level of public investment in infrastructures of major interest, the paralyzed private investments in estates and the lack of urban projects and proposals of a certain entity. There was a perceivable need to impel a collective project for the future that would push forward difficult or stagnant proposals and could give a definite direction in the process of the configuration of the city. The proposals for the physical transformation of the structures and infrastructures had to permit a re-evaluation of the urban functions and forms, and a redefinition of the public landscape, capable to retain the progressive decay of the urban sites and of the living standards of the inhabitants.

Barcelona had significant pending duties which were to be undertaken without delay. There were three ambits of urban reforms that could not be subject to the possibility of obtaining the nomination. First of all, the waterfront, underused for public utility. A second ambit of action was the urban tissue of the actual city, the planned regeneration of several areas. And last, but not least the cleansing of the metropolitan area, whose excessive congestion would constrict the town's full development. These objectives were integrated in the Olympic proposal, reinforcing the commitment to them. The Olympic Games were the opportunity to realize major projects especially in the general networks and infrastructures, which exceeded the responsibility and the possibilities of the local administration. The needs of the city agreed with the main lines of the Olympic project, that is why the Candidature, beside of generating an unusual process of cooperation or consensus between the citizens and the authorities, has acted as a catalyst of projects and ideas that were already materializing and attracted investments towards the Barcelona area.

Specific to the Barcelona Olympic scheme was the simultaneous short-term feasibility project with a great territorial reach, which shaped and resolved many pending themes in Barcelona. The plans had to cover the needs of the Olympic Games as well as the long term necessities of the neighbourhoods. Therefore, the Olympic Areas were seen as parts of the city integrated with their environment rather then as mere sites exclusively to serve transitory Olympic purposes. Within the city of Barcelona interventions involved four areas strategically placed in four corners of the city: Montjuic, Diagonal-Pedralbes, Vall d´Hebron and Poble Nou. The four areas had a more or less equidistant and periphery location to the centre. All of them were unfinished urban spaces, little active and close to depravation, lacking proper connection with the rest of Barcelona. Each of these areas with considerable surface – 140 to 210 hectares – were to be provided with important sport facilities, cultural, institutional or representative buildings, as well as parks, gardens and leisure areas. Behind the strategy for Barcelona ´92 there was a clear will to achieve a balance between the eastern and the western part of the city. Changes effected in the Vall d´Hebron and in the Poble Nou were mainly done in order to counterbalance consolidated areas such as the Diagonal or Montjuic, as well as to correct urban deficiencies of those specific environments or to aid already begun processes. The whole of these interventions aimed to have important effects, not only on the city, but on peripheral areas as well.

Changes effected on Montjuic, where the most important Olympic sporting facilities were placed, signified the completion of the hill’s development, begun in the 1900´s by consolidating its bent towards being the main urban park of Barcelona. Beside the changes effected on the sporting facilities, at least of same impact was the treatment of the space between these constructions and the landscaping of almost half of the yet undeveloped area of the hill. In the same sense, changes effected on cultural facilities and accessibility projects, ought to carry out in the same time, increased the interest and the attractiveness of the park.

In the Diagonal zone, the second Olympic zone, action was especially centred on undeveloped public spaces, on the consolidation of the existent sports facilities and the construction and updating of the access routes. Interventions in this area meant finishing and consolidating an important part of the city, solving the break between Barcelona’s urban fabric and that the neighbouring of L´Hospitalet.

The Vall d´Hebron area was the largest and yet unexploited urban site of the city. It implied creating one of the town’s most important parks in a strategic position, in the midst of overpopulated neighbourhoods such as La Clota or El Carmel. With best accessibility from various directions, it ought to concentrate urban and metropolitan sporting resources located in the north-eastern part of the city.

The most obvious changes were done in the area selected for the Olympic Village. The Barcelona City Council proposed the placement of the Olympic Village in a sector of the city which at that moment was occupied by decaying industries and obsolete urban stock, with a great need of large metropolitan infrastructures the execution of which were quite eminent. This zone is located between the Ciutadella Park and the centre of the area known as Poble nou, bounded by the continuation of the Passeig de Carles I, the Avinguda de Bogatell and the sea. It was an area in crisis in terms of its function and the assigned purpose played a fundamental role in the reconstruction of the neighbourhood and made it possible to give this sector of the city a clear identity of its own.

Perhaps for the first time the Olympic Village was physically integrated into the complex reality of the host city. The proposal allowed multiple and superimposed uses, as well giving priority to housing for several economic strata, to commerce, to leisure and cultural activities. The area bordering the sea, set side for hotels and commercial property, whichtook on special importance as instrument in the upgrading of the area.

In accordance with the basic objectives of the application of an urban structure, the recuperation of the coastline and the establishment of coastal facilities as well the introduction of a communication system and the future use of an Olympic area, this zone was planed as a series of strips parallel to the coast, each with its own particular characteristics. Progressing from the interior to the sea, the structure is as follows:

- the residential area which corresponds in urban structure to much of the rest of Barcelona, that is the Cerdá Ensanche. The Olympic village was not conceived as a differentiated neighbourhood, but has intended in every moment to respect the pre-existent urban pattern. The streets follow the same layout and only some originality in the interiors of the blocks has been permitted;
- the Avinguda del Litoral – the coastal stretch of the ring road – forms a combination of highway and park, and picks up through traffic without creating a barrier between the residential area and the beaches;
- an area of coastal installations centred on the hotel trade, commerce and leisure pursuit, was a focus of activity along this section of the Passeig Marítim seafront;
- the Passeig Marítim, a pedestrian route bordering the beaches;
- the beaches provided with adequate breakwaters and stop-over mooring facilities, bringing the characteristic quality, accessibility and legibility of the city to the sea. There is approximately 1 Km of beach which, joined up with the beaches which were later created in neighbouring areas, give a total of around 5,2 km of sea front running from Barceloneta quarter to the river Besós.

The Olympic project and its investment program were integrated with the broader Barcelona 2000 Strategic Plan, which looked beyond the event itself. Neighbourhood revitalisation was a main aim, so the city took care of the neighbourhoods first, as part of the overall strategy, established soon after the 1979 election that ought the “homogenization of the city”. Not only did bring balance in the provision of public facilities throughout of the city, thus helping to integrate the marginalized neighbourhoods, but it has also reversed the incipient tendencies toward segregation in the historic centre and some of the peripheral areas. Barcelona City Council played a leading role in planning projects and ensuring high standards were met in their implementation. Fully 39% of investment was in the Barcelona municipality, 34% in the rest of the Metropolitan Region, whilst 25% covered general infrastructure. Main infrastructure deficits in the “Metropolitan City” of the 1980s concerned the ring roads, the airport, telecommunications and hotels. The investment also included “underground infrastructure” such as sewers, storm drains and service galleries along the 35 km of new ring roads. The Olympic Games were useful as means of concentrating public and private investment, since public founding alone would have proved insufficient, yet the event itself only represented 15% of the total expenditure and “agreed” investments and sport facilities only accounted for 9% of total expenditure.

The Olympic Games provided a great opportunity to redevelop and restructure the city, a task continued through a new event designed by Barcelona itself, a project where the centrality of culture and sustainable development in a trans-national context is obvious.

4. THE FORUM 2004 PROGRAMM FOR THE COSTAL FRONT OF THE BESÓS RIVER: SUSTAINABLE DEVELOPMENT

The cities, as dynamic entities confront continually renovation processes so to adapt to the changing necessities and exigencies of the society. The tendencies of a sustainable development assure a growth which in the same time that creates new it also improves and rehabilitates the negative aspects accumulated in the urban tissue. The best example for it in Barcelona is the urban project Front Litoral Besòs Fòrum Barcelona 2004, which reshaped 214ha of urban tissue in accordance with the basic principals of sustainable development. Despite the thematic replacement in a new context for the World Fairs and Universal Exhibitions from “technology supermarkets” to “forums where ideas are debated on peace, sustainability and culture”, what was not changed with respect to these modern events is their use by local governments and financial interest as ways of promoting the town and as occasions for restructuring and replaning it. In the case of the Forum 2004 project, a humanist proposal for dialog among cultures goes hand in hand with the urban redevelopment of the Besós estuary area, one of the most depressed neighbourhoods but also one of the most coveted sites in the city.

The urban transformation related to the Forum Barcelona 2004 is one of the most important rehabilitation achievements in the history of this town. The Besós area is in the far north-eastern corner of the city and is bounded by the shoreline and the right bank of the river Besós itself. This area constituted a real compendium of urban problems, in which the following elements were all combined: large energy and environmental infrastructures (a water treatment plant, five power stations, a waste incineration plant), the mouth of the river, the Besós, which was highly polluted, extensive road infrastructure (the recently finished Diagonal, the Cinturón del Litoral), mass housing estates from the 1960s and 1970s with significant social problems (La Mina, La Catalana, St Ramon de Penyafort) and the existence of the administrative boundary between Barcelona and the neighbouring municipality of St Adriá del Besós. The magnitude and the diversity of these problems have led to the design of a very complex programme, which included the application of diverse specific projects and the organization of an important international event in order to give momentum to urban transformation. In this case, we are referring to an event conceived by the city of Barcelona itself, under the name of “Universal Forum of Cultures, Barcelona 2004”.

The “Universal Forum of Cultures, Barcelona 2004” was projected as a world event, conceived as an international gathering to discuss actual issues of peace, cultural diversity and environmental sustainability as mankind entered the twenty-fist century. This event took place during the summer of 2004 and received the recognition and support of UNESCO. It aimed to be a new type of global event, organized in order to promote dialogue between people of all cultures. Debates have been organized on many topics of common interest, as well as a thematic World Festival of the arts and exhibitions on human diversity and its history.

The 2004 Forum stressed sustainable urban development, thus the principle of sustainability that presided one of the axes of the Forum was in the same time a principle of coherency. On one hand the space that sheltered the “Universal Forum of Cultures, Barcelona 2004” was the materialised expression of the sustainability in urban development terms, architectural and socio-environmental, that is to say in terms of urban ecology. It was an experimental area with the vocation to project the sustainable renovation and development upon the entire urban tissue. On the other hand the facilities built for the event (Convention Centre, fairground, water park, etc.) were subsequently put to good use by the city. Accordingly, the construction work for the Forum laid emphasis on environmental rehabilitation schemes for restoring the sea front and the Besós river bed and banks.

A specific management body was created to ensure efficient organisation of works and proper coordination of schemes and the private and public bodies involved in the project.

Fig. 2. The Besós estuary area before the rehabilitation.

Source: Ajuntament de Barcelona (2004): *Barcelona Forum 2004: un nou model de ciutat: La sostenibilitat en el projecte de reordenació urbana del Front Litoral Besós*, Barcelona, pag. 17.

From the point of view of urban interventions, this plan affected a total of around 200 hectares and included the following operations:

- the construction, out into the sea, of a platform that constitutes the new seafront of the area, with beaches and an urban park, as well business and hotel activities. Furthermore a seaside promenade that bridges the river Besós thus links the St. Adriá and Badalona sea fronts. The new shoreline included also a new port next to the mouth of the river Besós, with the capacity of about 2000 boats. The proposals for the new seashore also incorporated environmental considerations with regard to wetlands, marshes, reefs and improving the biodiversity of the sea bed. The prolongation of the Diagonal (main city thoroughfare) to the inner harbour of the new Port of St. Adriá intended to make the remodelled shoreline an integral part of the city;

- the construction of the installation of the Forum, with central building, a large plaza and a platform that covers the sewage treatment plant and, in part, the ring road of the Cinturón del Litoral;

- the project's general aims also included renovating and rezoning of the neighbourhoods in the area, meaning the restructuration of the neighbourhood of La Mina, and of the sectors of Llull-Taulet and the La Catalana. This project was done with the support of the EU´s URBAN programme and the creation of a special cross-authority committee. Great rehabilitation work was done on the blighted bordering areas. A combination of environmental rehabilitation in the neighbourhoods themselves in the short term and rehabilitation of dwellings in the medium term brought these run-down areas up to decent town planning standards. A new residential district was planned for Llull-Taulet area. The new neighbourhood had to incorporate sustainable development and energy-saving criteria. The scheme comprised some 1200-1500 dwellings and included industrial estates, and areas for sitting tertiary activities and hotels, complementary to the residential nature of the project. These dwellings were designed and priced to attract young middle-class people in an area where the population has aged over the past 25 years. The La Catalana, the third target site included in the rehabilitation planes, is located in St Adriá de Besós municipality and covers around 25ha. It is a residential neighbourhood which has gradually lost population over the years. It is positioned on the right bank of the river Besós and is surrounded by local industries which were undergoing modernization and rationalization. The planned urban renovation work for the La Catalana area had as purpose the creation of an area with a pleasant landscape and attractive environmental features:

Fig. 3. The Besós estuary area and the Forum ground after the rehabilitation.

Source: Ajuntament de Barcelona (2004), *Barcelona Forum 2004: un nou model de ciutat: La sostenibilitat en el projecte de reordenació urbana del Front Litoral Besós*, Barcelona, pag. 17.

- planned environmental rehabilitation work along the seashore and the final stretch of the river Besós (severely blighted) included various technical projects and changes to existing installations (waste water treatment plant, solid urban waste treatment and electricity generation). This measures were required if environmental standards were to be met. The gradual technical improvement of these installations also formed part of the overall programme. Schemes forming part of the programme: restoration of the river bed, the building of a sewage sludge dying plant and the installation of new incinerator filters;

- the establishments of major metropolitan facilities, amongst which we find the Congress Centre of Catalonia and a new centre for biomedical scientific investigation.

The interventions predicted in the urban plot did not respond again exclusively to the celebration of the Forum, but to precedent needs and plans. The 2004 Forum was designed much more consciously with wider economic and urban objectives in mind. Setting a date, in this case 2004, and to have presented a collective challenge supported by the three administrations, contributed evidently to the prompt and focused execution of the projects. Those involved with the projects in the city hoped that this further push would bring the town's reputation and functioning onto a new plateau, without at the same time leaving a problematic burden of debt. With this operation Barcelona attempted to combine economic innovation, urban renovation and social cohesion. The event gave a fillup to the town planning schemes needed to transform an area with considerable potential. Besós gained a certain metropolitan centrality, integrated in the general public transportation network and characterised by being mainly public area, although fulfilling tertiary and residential functions as well. Yet the great accomplishment under the main terms of sustainable development was to incorporate the existent industrial plants in the general plan of refurbishment. In fact it created a new metropolitan centrality integrating the necessary, but molesting installations, formerly expulsed on the periphery. The Forum area and its transformation were in accordance with one of the main aims of the administration that of creation of areas of new centrality in the ambit of the town centre.

5. CONCLUSIONS AND CRITICS

Most of the programmes for which Barcelona is renowned, certainly up to the mid-1990s, were not conceived with the aim of boosting the town's economy, or its global competitiveness. Many have, however, done precisely that. It is no doubt this trick, of having made improvements for locals with international investments, has impressed many city managers around the world. More widely, the good reputation that the city has obtained appears to encourage investment generally in manufacturing, research and services by multinationals. It is presumably here that the major investments in motorways, the airport, industrial land provision around the region, and that proposed in the port, is paying off. Due to the social function performed by the new spaces and artefacts, they become the signifiers best suited to symbolize or synthesize the current dominant meaning of the city as a Mediterranean centre for leisure, communications and high-tech industry.

Most of the land that has been turned into service, leisure or residential areas since the 1980s has been produced by the revaluation of old industrial land. The major urban projects that would from the mid 1980s characterize Barcelona's urbanism were largely justified through a rhetoric which promoted construction as a public service designed to benefit the everyday life of citizens. The extent of the social and economic transformation undergone by the city was a result of the economic restructuring of the entire Spanish state that has being effected from the 1970s onwards. In the case of Barcelona, the transformation consisted in the dismantling of much manufacturing industry, which turned Barcelona into yet another example of what has been come to be known globally as a post-industrial city. Under these circumstances, it became imperative to look for a way to make the local economy sustainable. This signalled the beginning of a shift in the town's economy towards "clean" industries devoted to the production of culture and technology. The reconfiguration of the city necessitated the proliferation of sports infrastructures and large commercial and cultural centres. The alliance between the economic forces with interests in the city and the local governments translated materially into the promotion of mixed economy as the main way of financing public urban development. The creation and improvement of the town's urban facilities and spaces was a very lucrative way of recapitalization and recycling of the devaluated industrial land. This helped to promote the cultural, technological and entertainment industries that were to become the core of the economy.

Hand in hand with those is the tourist activity that clearly demonstrates expansion in the city of Barcelona. Although Catalonia, particularly the coastal areas constitutes one of the main tourist destinations of the Mediterranean, the city had remained relatively outside of major tourist flows. It was mostly visited for business reasons, and in particular for its role in conference and trade fair organization, which is one of its traditional occupations. The situation experienced radical change since the celebration of the Olympic Games in 1992. These had from the point of view of stimulation tourism a double merit. On the one hand, they constituted a major opportunity of promotion for the city that allowed it to project an image based primarily on its cultural and architectural charm. On the other hand, it attracted public and private investment in the city with notable effects in the area of infrastructures and facilities, also including the carrying out of a Hotel Plan. This allowed the city to move from 118 establishments and 18.569 beds in 1990 to 148 establishments and 25.055 beds in 1992. Since then, the supply has not stopped growing and in the year 2000 it reached 187 establishments and 31.338 beds.

The defining topics of the international events under went a significant change in accordance with the global socio-economical and political evolutions and trends. The shift from international exhibitions, symbols of industrial progress, to enterprises emphasised on sports and culture marked the adaptation to the realities of the decaying manufacturing industries and the new focus on centres of high technology, culture and leisure accompanied by the principles of overall sustainable development. The major investments which accompanied the great enterprises, allowed the city and metropolitan area to be endowed with good communications, telecommunications, hotels, alternative tertiary centres, storm drains, stadiums and other sporting installations, a marina, airport, main roads, and also the reform of major cultural structures. Despite all the achievements, the huge spatial redefinitions that were to be implemented in the city ended up partially negating the original planning principals of creating more public spaces and improvements to the quality of urban life. Even though the majority of these "areas of new centrality", labelled as priority targets for urban development, were located in very run down, peripheral zones, the new developments did not benefit as intended the existing local population, but led to the partial dislocation of the original neighbourhoods due to the escalating prices in their now improved areas; the proliferation of big shopping malls had accelerated the destruction of the social fabric of small local businesses and instead of quality public spaces, created pseudo-public consumer locals.

REFERENCES

1. Buchanan, P. (1992), *Barcelona, a City regenerated* The Architectural Review, August Moix, L. (1994), La ciudad de los Arquitectos, Barcelona.
2. Brunet, F. (1995), *An economic analysis of the Barcelona ´92 Olympic Games*, in: Marages, M. de and Botella, M. (eds): *The keys of success: the social, sporting, economic and the communications impact of Barcelona´92*, Barcelona.
3. Esteban, J. and Barnada, J. (1999), *Urbanisme a Barcelona 1999*, Ajuntament de Barcelona.
4. Grandas Sagarra, M. del Carmen (1986), *Problemática urbanística y arquitectónica entorno a la exposición international de Barcelona de 1929*, Barcelona, vol.1.
5. Inmaculada, J. (1988), *L'Urbanisme a Barcelona entre dues exposicions: 1888-1929*, Barcelona.
6. Lasarte de Ainaud, Josep Maria (1999), *1956-1999, contemporary Barcelona*, Barcelona.
7. Marshall, T. (1994), *Barcelona and the Delta: metropolitan infrastructure planning and sociological projects*, in Journal of Environmental Planning and Management 37(4), 395-414.
8. Marshall, T. (2004), *Transforming Barcelona*, London.
9. Martorell, B., Bohigas, O. a.o. (eds) (1991), *Villa Olímpica: Barcelona 92: arquitectura, parques, puerto deportivo = The Olimpic Village: Barcelona 92: Architecture, parks, leisure port*, Barcelona**.**
10. Martorell, B., Bohigas, O. (eds) (1992), *Transformation of a seafront. Barcelona, the Olympic Village*, Barcelona.
11. Solá-Morales i Rubió, M. de (1993), *Les formes de creixement urbá*, Barcelona.
12. Suibrós, P. and Acabello, J. (eds), *El vol de la fletxa Barcelona´92: Crónica de la reinvenció de la ciutat*, Barcelona.
13. xxx Ajuntament de Barcelona (1987), *Urbanisme a Barcelona. Plans cap al ´92*.
14. xxx Ajuntament de Barcelona (1994), *Barcelona new projects*, Barcelona.
15. xxx Ajuntament de Barcelona (2003), *Barcelona, una cultura en moviment 1996-2002*, Barcelona.
16. xxx Ajuntament de Barcelona (2004), *Barcelona Forum 2004: un nou model de ciutat: La sostenibilitat en el projecte de reordenació urbana del Front Litoral Besós*, Barcelona.
17. xxx Col·legi Oficial d'Aparelladors i Arquitectes Tècnics de Barcelona (1986*), Barcelona en joc = Barcelona en juego = Barcelona where the games aro no game*, Barcelona.
18. xxx Forum Barcelona 2004 (2004), *Una nueva cita mundial sobre la sostenabilidad, la diversidad y la paz*, Barcelona.
19. xxx Forum Barcelona 2004 (2004), *Forum Universal de les Cultures Barcelona 2004*, Barcelona.

CHALLENGES IN TRANSLATING GEOGRAPHICAL TEXTS FROM ROMANIAN TO ENGLISH

ERCHEDI NICOLETA[1]

ABSTRACT. – Challenges in Translating Geographical Texts from Romanian to English. The new requirements in some universities to publish abroad in internationally recognized journals raise some significant challenges with respect to the use of proper scientific language in a foreign language. This paper aims to address some common mistakes in translating geographical texts from Romanian to English. When writing in English scientists should be aware that there are several styles of academic writing and should edit their paper according to the specifications of a certain style. The Annals of the Association of American Geographers recommends the use of The Chicago Manual of Style (CMS). The CMS has detailed examples on how to quote from different sources: books, journals, magazines, newspapers, online sites etc. In this article we shall give a short summary of some of its most important points. We continue our argumentation by exemplifying how a scientist could achieve objectivity, clarity and precision when writing in English by using passive voice, by hedging, by avoiding the use of *"I"*, of repetition, redundancy and overlong subjects. We shall conclude by addressing the problematic translation of some geographical terms from Romanian to English, terms like "*amenajarea teritoriului*", "*dotări publice*", *"intravilan", "extravilan".*

Keywords: *The Chicago Manual of Style, citation, sentence structure, national spatial plan.*

1. INTRODUCTION

An essential part of a research scientists' work is to write scientific papers and to give talks at meetings and conferences and this short article is meant to help Romanian geographers to present their results effectively. For a properly written scientific paper in English attention should be paid first of all to style, grammar and terminology. Then, it should be reader-friendly, by presenting the information in a quick, accurate and economic manner. All the above presented aspects are detailed in the paragraphs below.

2. THE CHICAGO MANUAL OF STYLE

Most importantly, the scientists to whom English is a foreign language need to know that there are quite a few different scientific styles and formats when it comes to writing in English. There is an American style and a British style of academic scientific writing, and in each case there are additional styles of writing depending on the discipline. Some of the main British guides to writing are: *New Hart's Rules: The Handbook of Style for Writers and Editors* (2005), *The Oxford Style Manual* (2003), *The Cambridge Handbook for Editors, Authors and Publishers* (2003), *The Times Style and Usage Guide* (2003), *The Economist Style Guide* (2005), *The Modern Humanities Research Association Style Guide (2008), Scientific Style and Format. The CBE Manual for Authors, Editors and Publishers (1994).*

[1] *"Babeş-Bolyai" University, Faculty of Geography, 400006 Cluj-Napoca, Romania, e-mail: haranick@gmail.com*

These British publications may be very loosely regarded as the nearest U.K. equivalents of the U.S. works *The Elements of Style* (2009), *The Chicago Manual of Style* (2003), *The Publication Manual of the American Psychological Association* (APA Style) (2001) and *The MLA Style Manual and Guide to Scholarly Publishing* (2008).

There are several styles for writing and documentation of research because academic disciplines have different expectations for how to list citation information. For example the MLA (Modern Language Association) style, used mostly in humanities (languages, literature), emphasizes the author's name and the page in the original text while the APA style, mostly used in social sciences, emphasizes the year the source was published because it allows the reader to quickly see how the research in the field has evolved. These two styles are "in-text" citation styles, that is, some information about the source comes right after the quotation while the rest is listed at the end of the paper as References (APA) or Works Cited (MLA). By contrast, The Chicago style is a footnote style, that is, the source information is given at the bottom of the page. The Annals of the Association of American Geographers abides by the guidelines depicted in the fifteenth edition of the *Chicago Manual of Style* (*CMS*). In the paragraphs that follow a short summary of some of its most important points are presented.

In what regards the style and language the Annals specify:

- there should be no more than three or five key words or phrases per article;

- the correct format for citing tables and figures is: Table 1, Figure 1A. , and they need to be mentioned in numerical order;

- scientific/technical headings—3.1, 3.2, and so on—should not be used;

- serial commas are to be used: …the first, second, and fourth experiment (rather than "the first, second and fourth experiment");

- years should be written like: 1992–1993, rather than 1992–93;

- percent should always be spelled out in text;

- the possessive of single nouns ending in "s" needs to be written: "the dress's material was silk" (rather than "the dress' material was silk");

- dates are recommended to be expressed in British style: 15 November 2002 (rather than November 15, 2002);

- when a source used has more than three authors the first author's name and "et al." should be used: Rogers et al. 1973;

- in the reference section, for subsequent sources of the same author(s), three successive "em" dashes are used in the place of the author's name. For example:

Rogers, V. 1998. *Exploring Sustainable Development*, New York, Routledge
———. 2001. *Rural Planning,* New York, Routledge

- titles of sources, organizations and institutions' names in a foreign language should be translated into English in parentheses right after each title in its original language;

- quotations from online source need to be followed by the URLs of the Web sites in this format: http://www.apastyle.org/elecmedia.html (last accessed 26 June 2009);

In the reference section the title of a Web site should also be provided. In order to correctly cite online sources, one should be familiar with the structure of the URLs.When citing a series of rules need to be followed.

First of all, double quotation marks need to be used, single quotation marks can only be used for the embedded quote. Secondly, direct quotes that have more than 60 words and interview excerpts should be set as extracts/ block quotes (i.e., separated from surrounding text by one line at beginning and one line at end, and indented .5" on either side). Shorter quotes and single sentence interview excerpts should be integrated into the text. Like for example the following excerpt from the Annals (http://www.aag.org/ Publications/Annals/Annals%20Style%20Sheet%205-13-08. pdf, last accessed 26 June 2009):

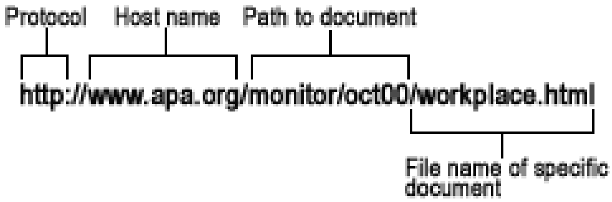


Fig. 1.The components of a URL.
Source: http://www.apastyle.org/elecmedia.html

"In phrases such as "the discipline of geography," geography should not be capitalized. The phrase "geographic information system(s)" should not be capitalized when it is spelled out. The acronym for this phrase, GIS, should be capitalized. Phrases combining the acronym "GIS" and a word beginning with "s" should be rendered as combined words:

GIS science should be GIScience
GIS systems should be GISystems
GIS scientist should be GIScientist

All acronyms—even those authors might expect to be commonly understood—should be spelled out. The phrase "Global Positioning System" should be capitalized when it is spelled out. The acronym for this phrase, GPS, should also be capitalized."

The Chicago Manual of Style has detailed examples on how to quote from different sources: books, journals, magazines, newspapers, online sites etc. In the following fragment two excerpts from the CMS are shortly presented:

"Journal article from printed journal with continuous pagination (690)

Bibliography	Last name, First name. "Title of Article." *Journal Name* volume (year): page span. For example: Jones, Patricia. "The Objectification of Objects." *Metascience Quarterly* 6 (2007): 101-134.
Citation in footnote/ endnote	Number. First name Last name, "Title of Article," *Journal Name* volume (year): page span. For example: 1. Patricia Jones, "The Objectification of Objects," *Metascience Quarterly* 6 (2007): 101-134.

Book, single author (649)

Bibliography	Last name, First name. *Title of Work*. City where published: Publisher name, year. For example: Prescott, John. *A History of the Ballpoint Pen*. Athens: Podunk University Press, 2007.
Citation in footnote/ endnote	Number. First name Last name. *Title of Work* (City: Publisher, year), page. For example: 3. John Prescott, *A History of the Ballpoint Pen* (Athens: Podunk University Press, 2007),

Source: http://www.umanitoba.ca/student/u1/lac/media/Chicago_style_08.pdf

When referring to a source it is important for non-native writers to use the appropriate vocabulary: *source* (*sursă), from* (*din*), *after* (*după*). Most commonly encountered are "*source*", used mostly for maps, tables, graphics, and "*from*", while "*after*" is rarely used. Typical expressions when writing about sources are: *data from, adapted from, based upon, redrawn from, courtesy, used/reproduced/reprinted by permission, redrawn with permission* etc.

When introducing a quotation there are a wide variety of 'reporting' verbs and verb phrases that can be used: *acknowledge, conclude, emphasise, predict, assume, suggest, assert, observe, demonstrate, argue, postulate, admit* etc. or longer phrases like: *according to X; in X's view;X distinguished between … and; X was of the opinion that; X makes the following claim / point / statement: …; X illustrated his / her argument by saying / stating / showing that; X characterised / considered / defined etc.*

Some important details that scientists should pay attention to when citing in English are those that deal with page numbers and volumes. The correct abbreviation for page in English is *p.* (p.7) for a single page and *pp*. for multiple pages (pp.95-111), and not *pg. The Chicago Manual of Style* recommends that only the numbers of pages be written without the abbreviation p., or pp. e.g. 206-211. Only the last two digits of a number are sometimes necessary e.g. pp. 205-12 (but 286-303). Between the title of a source and the number of pages a comma (,) or a colon (:) can be used e.g. (Rogers, 1973, p.288). The number of volumes should be rendered in Arabic numerals e.g. Vol.3.

Also, there are a number of abbreviations of Latin and Greek origin that are used in scientific writing: *c. or ca. – circa* (approximately, about –for dates), *e.g. –exempli gratia* (for example), *et al. –et allia* (and others), *i.e. –id est* (that is, in other words), *i.a. –inter alia* (among other things) etc. instead of abbreviations from German origin like *a.o.* for *"and others"* and *ex.* for example.

3. THE SCIENTIFIC STYLE OF WRITING – GUIDELINES

The main purpose of scientific writing is to present information in a quick, accurate and economic manner. That is why scientists should try to write their papers, even those that are complex and conceptually difficult, reader-friendly. Otherwise they face the danger of making their texts unreadable and thus not taken into consideration by the science community. This is especially true for non-native English speakers that are used to writing long and complicated phrases in their native language that are hard to translate and even harder to understand in English. The aims of achieving objectivity, clarity and precision in scientific papers are especially important in the English publishing community.

Objectivity

Linguistically, objective and neutral approach (essential in scientific writing) can be achieved by avoiding ambiguous statements and confusing metaphoric elements and by using the passive voice.

As scientific style requires the use of impersonal style, the use of pronoun "I" is to be avoided. Instead, "we" or "the team" are recommended. In order to produce impersonal writing the passive voice is used: *The present article <u>is intended</u> to contribute*… instead of …. *In the present article <u>I want to</u>* …

Nevertheless, the overuse of the passive should be avoided. It is better to use active constructions in long sentences because if the verb in passive comes at the end of the sentence it makes the sentence sound clumsy.

E.g. For this reason, the emigration pattern of the African-American community and the structure of the American labour market *were studied*. (passive).
For this reason, *the subject of the study was* the emigration pattern of… (active).

Clarity

The clarity of a text resides in the use of plain, clear structures. By using overlong sentences or lengthy chains of clauses and groups of words the reader can be easily prevented from understanding what the author wants to say. As a rule, you should not add more than 2 to 3 clauses of any sort to form one sentence. The following excerpts from Blake, R. *Scientific Language and Readerships,* exemplify how overlong sentence are hard to understand:

"In the first experiment of the series using mice it was discovered that the total removal of the adrenal glands effects reduction of aggressiveness and that aggressiveness in an adrenalectomized mice is restorable to the level of intact mice by treatment with corticosterone. These results point to the indispensability of the adrenals for the full expression of aggression."

Without loosing any of its scientific value or formality this complicated sentence could be easier to read and understand in this format:

"The first experiment in our series with mice showed that total removal of the adrenal glands reduces aggressiveness. Moreover, when treated with corticosterone, mice that had their adrenals taken out became as aggressive as intact animals again. These findings suggest that adrenals are necessary for animals to show full aggressiveness"

Expressing the ideas concisely, that is, avoiding repetition and redundancy and cutting out irrelevant words, would improve the readability of the text especially for the non-native English speaking scientific community. If the sentences are too 'wordy', they are difficult for the reader to understand. For example:

'wordy' sentences	more concise sentences
We continued our research in the development of new procedures for the isolation of phytoplankton DNA from fixed samples.	We have developed new procedures for the isolation of phytoplankton DNA from fixed samples.

Formality

Academic writing abides by certain rules of formality that non-native writers should not disregard without very good reasons.

Contracted verb forms should be avoided in academic writing. The correct forms are *will not, is not, are not* instead of the spoken forms *won't, isn't, aren't* etc. Foreign *writers need also to avoid the use of the future tense in the subordinate clause in time or* conditional sentences (with *When* … or *If* …, etc.) that may be very common in their own language but that are grammatically incorrect in English.

In scientific writing it is recommended to use hedging. Hedging is the avoidance of absolute, categorical statements and overgeneralizations, because others might disagree with your findings. Some readers, especially those from Britain or Asia might consider offensive one's argumentation that claims to know the truth about a certain problem/subject. Particularly useful verbs for hedging are: *seem to … / appear to … / tend to …*, as in: *Our data seem to appear to confirm/demonstrate/indicate that …* instead of the less inspired: *Our data shows….*

Another common mistake for the non-native writers is to use long paragraphs. Paragraphs normally shouldn't exceed 7 to 14 lines and the number of words in a sentence should be between 15 and 25. Also is a frequent mistake the use of overlong subjects with the verb left dangling at the end of the long sentence. This type of structure makes the reader lose the sense of the sentence as a whole. Sentences that fall in this category can be re-formulated by turning the verb into a noun, which then forms the subject of the sentence.

Below we have an example of an overlong structure and how we can improve it (Svobodova Zuzana et. al, 2000):

overlong subject	In this article, *the results of the studies into the role of different parts of the society in applying several types of economic incentives for waste management* are summarised.
improved sentence	In this article, *a summary* is given of the results of studies into the role of different parts of society in applying various types of economic incentives for waste management.

3. TRANSLATING GEOGRAPHICAL TERMS

In the following paragraphs we will like to discuss some problems that appear when translating geographical terms from Romanian to English. Problems rise when we refer to the so called "false friends" -English words that have a similar form with words from Romanian but have a different meaning- or when there is no equivalent English term for a Romanian one and an approximate term has to be found.

One of the most discussed translations is that of the term "*amenajarea teritoriului*". If for the French language the term has a direct translation in "*aménagement du territoire"* in the case of the English language there is not. The translation *"territorial arrangement"* is not the most inspired one as the English geographers do not use it. "*Arrangement*", according to the *www.thefreedictionary.com*, has several meanings that include among others, the act or process of arranging –so implies a sense of planning- (the arrangement of a time and place for the meeting) but it is not used in the expression "*territorial arrangement*". The terms used for the Romanian expression "*amenajarea teritoriului*" are: "*national planning"* (www.granddictionaire.com), "*land development*" (www.eurocosm.com) and "*town and country planning*" (www.collinslanguage.com; Concise Oxford Hachette French Dictionary).

The Romanian Ministry for Regional Development and Housing uses the following English terms for their Romanian equivalents: *P.U.G (Plan Urbanistic General) – General Urban Planning, P.U.Z (Plan Urbanistic Zonal) – Area Urban Planning, P.A.T.J. (Planul de Amenajare a Teritoriului Județean) – County Spatial Plan, P.A.T.N. (Planul de Amenajare a Teritoriului National) – National Spatial Plan, P.A.T.R. (Planul de Amenajare a Teritoriului Regional) - Regional Spatial Plan*. We would also recommend as appropriate the following expressions: "*National Spatial Development Plan"* for *P.A.T.N.*, "*Regional Spatial Development Plan"* for *P.A.T.R.* and "*County Spatial Development Plan"* for *P.A.T.J*.

Another problematic translation is that of "*dotări publice*" as "*public endowments*". The Cambridge dictionary (http://dictionary.cambridge.org) defines *endowment* as "*money that is given to a college or hospital, etc. in order to provide it with an income, or the giving of this money", so the translation of "to endow" would be "a înzestra cu bani*". The expression "*dotări publice*" should be translated as "*public facilities*" and the expression "*utilități publice*" as "*public utilities*".

The Romanian words *"intravilan"* and *"extravilan"* are difficult to translate too as there are no similar terms in English. An acceptable translation would be *"built-up area/space"* for *"intravilan"* and *"estate"* for *"extravilan"* for the rural settlements, while the same terms can be translated *"intraurban"* and *"extraurban"* when we refer to urban settlements, but an additional explanation to what exactly *"intravilan"* and *"extravilan"* mean in Romanian should be provided when the terms are used for the first time.

A special attention should be paid to the so called *"false friends"* that are words that look and/or sound similar in Romanian and English, but differ in meaning. *"A deservi"* is not the same thing as *"deserve"* (to be entitled to or worthy of), but should be translated depending on the situation as *"to serve"* or *"to supply"*. When translating the Romanian *"municipiu"* as *"municipium"* a note should be added stating what it means in Romanian administration. The note is necessary because *"municipium"* doesn't exist as an administrative form in the USA or the UK, and it refers to Latin urban settlements as *"a city with a special status"*. With respect to the expression *"grade Celsius*" it has to be translated as *"centigrade"* and not as *"Celsius grades/degrees*".

Before drawing the collusions we would like to add several terms that are often wrongly translated: *capacitate de cazare-housing capacity; con de dejecție - alluvial fan; localizarea de tip pană – localization in wedges; locuințe de tip vilă – detached houses; parcelă de orez – rice paddy; piramida vârstelor - age-sex pyramid; punct de atracție zero – breaking point; sat aglomerat - nucleated village; sat răsfirat - loose-knit village; sat risipit - dispersed village; spor natural-natural increase; vatră – precinct; zonă de influență - sphere/zone of influence; urban field; tributary area; catchment area.*

4. CONCLUSIONS

The main purpose of scientific writing in a foreign language is to receive international recognition for someone's research in a certain field. That is why it is of outmost importance that the text written in a foreign language should be, besides stylistically and grammatically correct, easy to comprehend by both native speakers and non-native speakers of a certain language. When writing in the English language there are several aspects that should be remembered.

When writing in English scientists should be aware of the fact that there are several styles of academic writing and that they should edit their papers according to the specifications of a certain style. For example, the American geographers follow the rules outlined in the fifteenth edition of the *Chicago Manual of Style.*

There are very strict guidelines when it comes to citing, and each style has its own rules that can be studied from the various manuals published on this subject. Still, there are aspects that Romanian writers should be particularly careful. For example, when referring to a source it is important to use the appropriate vocabulary: *source (sursă), from (din), after (după).* Most commonly used are "*source*", used mostly for maps, tables, graphics and "*from*", while "*after*" is rarely used. Typical expressions when writing about sources: *data from, adapted from, based upon, redrawn from, courtesy, used/reproduced/reprinted by permission, redrawn with* *permission* etc. Also they should be aware of the correct abbreviation for page in English is *p.* (p.7) for a single page and *pp*. for multiple pages (pp. 95-111), and not *pg.*

Scientists should try to write their papers, even those that are complex and conceptually difficult, in a way that makes them reader-friendly. This is true especially for non-native English speakers that are used to write long and complicated phrases in their native language that are hard to translate and even harder to understand in English. A scientist needs to achieve objectivity, clarity and precision when writing in English. Some of the means to achieve that are: the use of passive voice, of hedging, the avoidance of repetition, redundancy and overlong subjects.

Last but not least, an important aspect that the Romanian geographers should be aware of, is the use of proper English geographical terminology in their texts. There are Romanian geographical terms that cannot simply be translated in English because there is no equivalent English word for them and an approximate term has to be found. It is the case of terms like: "*amenajarea teritoriului*", "*intravilan"*, "*extravilan"* etc.

Finally we conclude that scientists, when it comes to writing scientific papers in English, should not lose site of the fact that the main purpose of scientific writing is to present information in a quick, accurate and economic manner by using the right terminology and style.

R E F E R E N C E S

1. Blake, R. *Scientific Language and Readerships,* University of Lancaster webpage, (2000) http://www.lancs.ac.uk/celt/sldc/materials/science/files/language_and_readerships.ppt#256,1,GSSE: Scientific Writing 1 Scientific Language and Readerships (last accessed 26 June 2009).
2. Corréard Marie-Hélène, Grundy Valerie ed. (2004), *The Concise Oxford-Hachette French Dictionary*, Oxford University Press, New York.
3. Efros, V. (2002), *Dictionar de geografie economică şi umană*, Edit. Universității Suceava, Suceava.
4. Nedelcu Carmen, Murar Ioana, Bratu Andrea, Bantaş A., (2005), *Dictionar Român-Englez,* Teora, București.
5. Svobodova Zuzana, Katzorke Heidrum, Dugovicova Stefania, Scoggin, M., Treacher, P., (2000), *Writing in English. A Practical Handbook for Scientific and Technical Writers,* Leonardo da Vinci Programme, European Commission, http://www.scribd.com/doc/ 4590903/Writing-in-English-a-Practical-Handbook-for-Scientific-and-Technical-Writers (last accessed 26 June 2009).
6. http://www.aag.org/Publications/Annals/Annals%20Style%20Sheet%205-13-08.pdf (last accessed 26 June 2009), Style Sheet for the Annals of the Association of American Geographers.
7. http://www.granddictionaire.com, Office québécois de la langue française, (last accessed 26 June 2009)
8. http://www.eurocosm.com, Eurocosm UK, (last accessed 26 June 2009)
9. http://www.collinslanguage.com, Collins, (last accessed 26 June 2009)
10. http://www.mie.ro/index.php?p=1081&lang=en, The Ministry of Regional Development and Housing, (last accessed 26 June 2009)
11. http://www.thefreedictionary.com, The Free Dictionary, (last accessed 26 June 2009)
12. http://www.apastyle.org/elecmedia.html, APA Online, (last accessed June 2009)
13. http://dictionary.cambridge.org, Cambridge Dictionaries Online, (last accessed 26 June 2009)
14. http://www.umanitoba.ca/student/u1/lac/media/Chicago_style_08.pdf, University of Manitoba, (last accessed 26 June 2009)

STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOGRAPHIA, LV, 1, 2010

WORDS ABOUT CITY

V. ZOTIC[1]

City is practically a human swarm, the place where one strives for a reasonable lifestyle, the nest where he feels at home, where temperature reaches its optimum, where he can store products, where he works, where he loves, where he raises his children. Concrete, bitumen, steel, glass, cables and pipes, various networks crossing one another, eventually achieving a coherent functional infrastructure unit. The neon light, commercials that simply attract and delight our eyes, restaurants, exhibitions, Christmas presents offered from the heart, or even dirty rooms full of millions of harlots... People, interests, communication and a web of interrelations everywhere… It smells like people, poor communities spreading a natural agglomerated gutter flavour or richness with fine perfumes and tobacco, luxurious motorcars supported by who knows from, what and how…

There are people mistakably believing that man and the cities he built are the essence of the world and that there is nothing he cannot solve. Reality, however, proves to be quite different since man and its cities are just a mere irregularity of the ecosphere, mere human nests, for man remains, after all, an animal species among primates, as dependent on the environment as any other organism.

Urban atmosphere, people, sparrows, ivy crawling on concrete walls, buildings, arranged spaces, noisy crowded markets where people come and go, from and to all four cardinal points. Urban centres are the environment by excellence dominated by the human presence. Smaller or larger buildings, monumental churches centuries old, new houses and blocks of flats, streets, highways, parking lots everywhere, people and cars, honks and motor noise, music coming from the open street terraces. Urban centres nowadays dominate human life, while urbanization process is on its way to the future.

Urbanized areas stand for the space where the great majority of us spend our entire life since we live, we work in the city, and we travel between cities. At the same time, people who live in the outskirts of the city, rural communities are still connected to the urban by their administrative needs, education, health, informational fluxes, scientific progress, industrial products and open market.

The urban area is the place where most of the modern world inhabitants spend their lives. The modern world means living in the city, most of people’s lives being spent there. Urban architecture, a most too obvious value for us and urban commodity, are part of our daily life, along with phonic and atmospheric pollution and urban stress. People tend to forget that their life is completely dependant on the space outside the city, on the rural and forestry areas, on the oceans and on our planet great energetic cycles, on the climatic stability and on the capacity of environment to produce supplies, clean water, energy, to absorb and neutralize waste and pollutants produced by human activity.

The existence of the urban area, though small sized, as compared to the remaining area, is essential for the protection of the environment. Its huge absorption of resources from the natural areas, forests, marshes and grasslands, the pollution it causes to air and water are negative effects that affect the area far outside the urban territorial limits.

[1] *„Babeş-Bolyai” University, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail:vzotic@geografie.ubbcluj.ro*

Where does the clear water come from? Is it from some accumulation lake or from some river nearby? Is it possible that sparkling water comes from a spring somewhere and then bottled and transported to us? Our food, oranges, apples, watermelons, meat, poultry and oceanic fish, coffee and sugar, milk and cheese, flour, pălinca (spirit made out of plum distillation) and beer, nothing is produced in the city, but they "come from somewhere". Where do we eliminate our dejections (defecations), urine, and the waste remained after "*using the food*", drugs composites, and so forth? Well, everything goes into the waters nearby the cities, waters that downstream are used as the main clear water source by the inhabitants of other cities.

Human settlements, be them urban or rural, become singular and unique through their history, architectural style, monuments, statues, regional traditions, local specific culture and by the specific atmosphere created by various interdependencies. There is a certain social coherence between the inhabitants who know each other and coexist in a particular city, families that used to mingle for centuries, but once with globalization, travelling, and the more frequent change of homes and workplaces, the interpersonal becomes quite superficial and rather based on the essence of the moment or on the current day's agenda: *common interest cooperation today, tomorrow we'll see*. The model of modern life needs a strong adaptability so as to discover and use all opportunities, in order, maybe, to size each changing "*the window of opportunity*", windows which remain open only for a short period of time and which do not allow much space for thinking.

In small communities, all individuals know each other; they also know about each other's positions, everyone's history within the group. Once the dimensions of a human community amplify, the population increase makes the conscious interrelation between one individual of the community and all the others within it impossible. Beside the gradual in-depth social relationships between some of the individuals, and some others which are only tangential, there is a large social group which has no communication relationships with other individuals of any type, expressing just neutrality and maybe indifference towards them. The sense of identity and belonging to a community appears to be more powerful in case of the small, isolated rural communities, where the interdependency between inhabitants becomes more evident and where "*mouth to mouth circulation of events*" or "*gossip*" stands as a strong factor of influence, element which is no longer present in the case of larger communities.

In the case of urban areas there is a multilayered human society reflecting rich families along with poor ones, luxury areas along with pauperism and despair. In respect to rural areas where asset discrepancies are not that obvious at first sight, in the cities we can clearly notice the small group of the rich and of the potent, followed by more or less consistent layers of various levels of wealth or poverty. Even though it is generally agreed that there should be a reasonable split of assets and of resources, the people involved tend to change their minds when it comes to gaining. Still when it comes to diminishing claim, all the possible reasons for making it "*impossible to be*" are immediately invoked.

Modern societies display certain permeability between layers, but the real chances for success are a lot more significant when "*one is born in the perfect place*". Eventually, it resorts to human rights, the right to education, health, happiness etc.; still, we have to admit though the existence of a gap between these theoretical rights and practical reality, in which conditions, specific material and sometimes cultural status of birth preset the future of a certain individual.

City becomes attractive through its own opportunities and the wide range of possibilities. Yet, the quality of urban life becomes more and more affected by urban stress, agglomeration, traffic jams, pollution, and an absurd haste. One wonders whether people do realize they live near a road, full of cars, a crossroad surrounded by significantly polluted air and they are all exposed to this poison. How could they ultimately try to brush their teeth, eat organic food, live a reasonably good life, if their environment is mainly made of pollution, thus resulting in a less happier, shorter and filled with diseases life for them and their families, as well as their children?

At a world scale, at least 40% of the diseases are produced directly by environment pollution, and the incidence environment-related diseases, especially those caused by chemicals, pesticides or combustion compounds, continuously increases.

Air quality is low in the cities, while automobiles increasing in number every day render traffic jams even more frequent, therefore causing on the roads that were not previously designed for such a large number of vehicles. Irregularly parked cars leave no open spots for pedestrians to circulate on; the energy consumed by the means of transportation is continuously increasing, while the more polluted air we breathe determines much more severe and aggressive respiratory diseases. Redesigning markets and pedestrian streets including shops, restaurants and coffee bars, where circulation of supplying vehicles is made by night, represents a method by which at least the more "*touristy*" central city areas are being given a break, thus creating a "*free space*" to inhabitants whose children are not anymore obliged to choke from cars smoke, to develop allergies, asthma, pulmonary cancer anymore.

The quality of the products you touch and use everyday in your house is relative. All furniture is built by clay and other substances that are vaporized in the air. What are the cleaning products used for laundry, dishwashing, and what are their obvious effects? What is the quality of all plastic material that we use, are radiations of TV and computer screens reasonably limited? What are clothes, shoes made of? What do we use for wrapping food? How much of the food is real food, how do they regulate the colours of food products, how are juices made, how come food does not go bad for such a long period of time, is it good to eat all these things?

The moment you notice a new industrial plant, which you know is a source of pollution, and you can see it so near your block, what can you do about it? You can ask yourself, is it worth staying here anymore, or should I move? Is it the case that "*the aggressive investment to both people and environment*" should not be made, or at least to be made in an ecological and sustainable manner? How is it to live with your family, children or friends in an area where you certainly do know that in a sunny morning you can see from the window a huge "smoke cloud"? Could we live a contaminated area? Could you make future plans, still living in these areas? Could we have the certainty of safety in case of any accident, harmful and pollution substances leaking, or an explosion which you can never exclude? How high is the mortality rate determined by pollution, irradiation, cancer, how is our body's resistance affected and eventually what are the chances for human life anymore?

When you walk in the streets of your native city, when you look at the monumental church that rises to the sky, hundreds of years old buildings, maybe it crosses your mind that these were the streets your ancestors walked in, these were the paths of your grandparents in love, two happy young people then, hand in hand, in a quiet spring evening, or, even a few decades later, walking through fallen leaves, sizing the moment. You did not know them, but you know they existed sometime in the past, if they had not existed, you could have not told their now. And then were wars and famine, rationalized food, applauses in the dark, each period with its "*guru of the time*", and other better times or just their hope, Christmas evenings promising a new beginning, while the buildings and streets of the city remained, such as a steady infrastructure where people live their temporary, temporal, passing existence.

But, how much does urban life change, in time? That, which used to be once only a multitude of constructions, now it is full of cables, networks, and global communication. Could our ancestors even imagine that if there is any event happening somewhere on another continent, we can watch it at home, in colours, sounded, live, on TV? Or, that we could have in our pockets, something small-sized, let us call it "*cell phone*", allowing us to communicate to our friends anytime, be them anywhere in the world? Did they ever think it would ever be possible to fly over the oceans?

In the past, it used to be clear who belonged to the castle and who did not. The attack, as well as the defence materialized in walls, guns, warriors. Now "*cities*" cannot define their community anymore, who belongs to the inner space between their walls and who should be outside, which are the legitimate interests of an individual or of a group, and which are those that can undermine the future. Which are the best fitted investments for the community, and which are those that only lie plunder the local inhabitants, spoil the resources, cause pollution and then move to areas still unaffected by degradation.

We wonder what the future of the cities would be like. Would it become a levelled uniformity in the globalization process? Would this mean a loss of local identity? Or is it possible that everything would turn concrete, steel, aluminium or neon? If we visit cities, except for some eventually preserved historical centres, we notice, no matter where we look, the specific atmosphere of "*modernity*", a certain type of fast-food, certain brands of hypermarkets, coffee-shops, cars or clothes. Is this perhaps the irreversible transformation of localities into pieces of "*the global city*"*?* By this kind of standardization and uniformity, the surprise is left outside, but where could we find the charm of discovery, of the natural local, of the past, which would be the support of present, should this withdraw in museums or within the pages of history books?

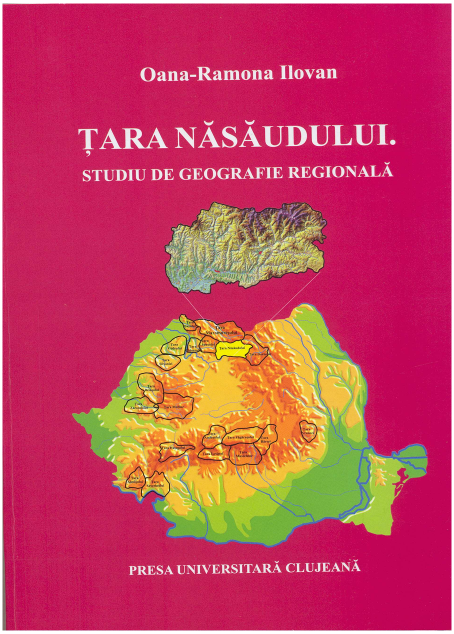
It would not be appropriate for urban areas to be named urban ecosystems, due to the complete dependency of the urban areas to the extra-urban areas, forests, watercourses, cultivated land, pastures, hayfields and others. Without the outer areas, without the landscape, as a provider of the resources needed, the city cannot exist. Much more, any ecosystem has its own self-balance, which is not the case here, the specific being prompted towards growth, growth, growth…

There is a continuous increase in the size of urban agglomerations. Therefore, their "weight" leaves its marks on landscape and environment, both through the absorption of energy and resources and through pollution emissions. How could landscape, nature, biodiversity as well as ecosystems defend against such an increasing overexploitation? Could it be possible that love and more and more children cause more damage to the world than wars? Even if it sounds well, perhaps the well-known phrase *„make love not war!"*, does not essentially mean a good thing, at least in the case that "*love*" is not made according to the simultaneous control of worldwide birth rate and the city and territorial development partly covers the coordinates of sustainable development.

This thorough discourse, simply entitled "*words about city*" is nothing but an in-depth reflection upon the major issues that the city implies in its development as an integrant element of territory and environment and upon the reasonable resolutions so as to create cities of the future, without being later ashamed of our work.

BOOK REVIEWS

Oana-Ramona Ilovan (2009), ***Țara Năsăudului. Studiu de Geografie Regională [The Land of Năsăud. A Study of Regional Geography]*****, Presa Universitară Clujeană, Cluj-Napoca, ISBN 978-973-610-864-8** (B 5 format, 516 pages, out of which: 418 pages of text, 180 figures and 51 tables within the text, 3 maps, 30 pages of references, including 644 titles, 32 pages of Summary and 6 pages of Contents, as well as 1,162 footnotes).



One of the PhD theses on the "lands" of Romania, initiated and coordinated according to high scientific standards by **Pompei Cocean**, PhD, the book written and published by **Oana-Ramona Ilovan**, PhD, answered all requirements of a regional geographic system focusing on an area that was well individualised by its geographic features: **the Land of Năsăud.**

As a result of her scientific abilities and industry, *Oana-Ramona Ilovan* succeeded in writing an exceptional book on succeeded in writing an exceptional book on the Land of Năsăud where all revealing regional geographic issues were discussed starting from: researching and using appropriately a very rich list of references; collecting and processing important statistical data used also for the rich cartographic material that was compulsory in order to elaborate and illustrate this valuable research on a slope "land" as this area was defined by P. Cocean and the author of this book; focusing on a *logical succession* of the characteristic features of this area; researching at the appropriate *depth* each situation and analysing according to nowadays *scientific norms*, etc.

Similarly to previous studies included in the series of the Romanian "lands", this book started with *Methodological and theoretical Coordinates* (methodology, defining the concept of "land", the region as a territorial system, the history of research focusing on the region, etc.).

The next chapter (II, pp. 21-171), a very extensive and very well written one (as well as the other parts of this book) answered one of the significant requirements of such a research: **The limits of the Land of Năsăud. Priority of the mental criterion.** The author underlined the main issues concerning the research hypothesis, the mechanisms of constructing and deconstructing the territorial identity of the Romanian "lands", the significance of the mental criterion identifying the limits of the Land of Năsăud, the past or the significance of a certain historical period, the evolution of the regional mental space and the criteria for identifying the limits of the region – synthetic approach and the factors involved into the construction and consolidation of the mental space of this region.

In order to reach the results required by the complexity of the issues in Chapter II, beside foreign and Romanian literature, and the richness of documents characteristic of the researched area, both offering the opportunity of a high degree of perception, the author, one of the people of the region herself, also got involved in thorough field research, using questionnaires that helped in identifying people's regional identity traits and the limits of the Land of Năsăud (p. 77).

In this context, the author researched using the appropriate methodology issues such as: construction mechanisms – "lands" as functional and original regions, people's regional identity, self-assumed image and the one projected by "strangers" (mentality, behaviour, aspirations, flaws and intraregional identity differences, perceptions on regional identity between 2005 and 2007); identifying the features of the people in the Border region – theory and research methodology; features of this mental space at present (strong connection to reality, people's spiritual openness to their own fulfilment, prolonging the real into imaginary through the fabulous and the mythical, "criticising" reality through humour, awareness of the uniqueness of their space, etc.); remodelling the mental space of the Land of Năsăud – morphological heterogeneous space and the projection of nature in people's mentality; significance of ethnography for individualising the Land of Năsăud and the dispersion of regional identity through ethnography elements (ethnographical zoning, traditional architecture, traditional economic activities, ethnocultural heritage) and the Land of Năsăud – ethnic, linguistic, and polarised entity.

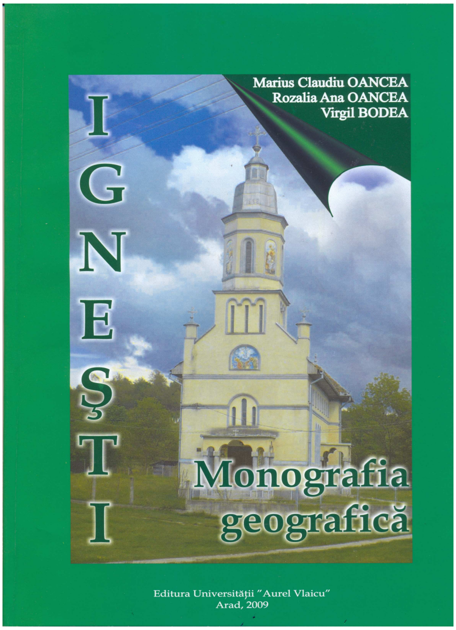
After a detailed presentation of what the **Land of Năsăud** was (pp. 21-171), **Oana-Ramona Ilovan** approached the core of the geographic space on the right of the Someșul Mare (less on its left bank and river meadows) in the chapter on **Favourable Premises for the appearance of territorial identity in the Land of Năsăud** (Chapter III, pp. 172-410).

The analysis of the complex of issues included in Chapter III started with the *Natural premises for individualising the Land of Năsăud*, where, with a sound, profound and high standard scientific approach, the author presents the geology and relief potential, the climate potential and its impact on settlement development, the hydrographical network and management of hydrographical risks, the biogeographical potential, the soil potential, and underground resources. After presenting the characteristics of the natural environment, the book approachesd the human resource of the regional system in the *Geodemographical coordinates of the Land of Năsăud* (people's settling of the region, population's dynamics, geodemographical structures, focusing also on people's education and health levels), in the *Coordinates of the rural and urban areas in the Land of Năsăud* (features of the settlements, demographical size of the settlements, household type, etc.) and in the *Economic coordinates of the Land of Năsăud* (features characteristic of agriculture, industry, and of the tertiary sector, the main economic features of the region as expressed through several synthesis elements, the technical infrastructure of the territory and the impact of economic activities on the environment).

The last chapter of this book (IV, pp. 411-418), *The choreme of the region. Regional development (the past – the present – the future)*, was meant as a very general synthesis of this excellent book on the Land of Năsăud, elaborated and offered to interested readers by Oana-Ramona Ilovan.

GRIGOR P. POP, PhD

M. C. Oancea, Rozalia Ana Oancea, V. Bodea (2009), *Monografia geografică a comunei Ignești [A Geographical Monograph of Ignești Commune],* Edit. Universității „Aurel Vlaicu", Arad, 2009, ISBN 978-973-752-379-2 (A 4 format, 21 x 29 cm, 102 pages, including 11 maps and graphs, 22 photographs, 10 tables, and 33 references).



The authors of this book, teachers and men, filled with love for their territory of origin, succeeded in bringing into light the geographic realities of the area of the four component villages of **Igneşti** commune (Arad county, in the southern part of the Codru-Moma Mountains): *Igneşti* and *Susani* (on the upper course of the Teuz Valley flowing in the Crişul Negru), and *Minead* and *Nădălbeşti* (on the Minezel Valley, tributary on the right of the Dezna Valley flowing into the Crişul Alb). Besides literature on the Zarand Depression and the Codru-Moma

Mountains, the authors also did thorough field work in the commune (M. Oancea also elaborated a PhD thesis on *The Zarand Depression. Organising the geographic space*) and this book started with researching the **Geographic premises influencing people's settling of the region**. The authors presented in an updated scientific approach *the geographic position of the territory* of the four settlements of the Igneşti commune and then the components of the physical-geographic space: *relief, climate, hydrographical network, vegetation, fauna,* and *soils*.

Starting from other researchers' results on the Zarand Depression where Igneşti commune lied, the **Geographic and historical premises** was the part where the authors presented an analysis of the Palaeolithic, Mesolithic, and Neolithic materials as well as for the Bronze and Iron Ages. The authors also presented social and historical events in the Dacian and Roman period, in that of the formation of the Romanian people, in different periods of foreign ruling in the area of the Crişul Alb river (the Hungarian, the Ottoman, the Hapsburg), underlining that the autochthonous population continued inhabiting this territory.

After presenting the geographic, social, and historical premises, the authors focused on the **Geodemographical component** of the commune. They structured it well and presented it almost entirely, first of all approaching the population's numeric evolution during a long period (1880-2002), and then underlining the main features of *its ethnic structure* (with more than 97% Romanians) and of *its religious structure* (more than 94% Orthodox until World War I and II, and then only about 80%, as a result of the appearance of cults such as Baptist, Pentecostal, Adventist, etc.).

A synthesis was dedicated to the **Component settlements** of the commune, where the three authors underlined the main issues on *documentary mentioning* and their *territorial-administrative evolution, the areal coefficient* and *the average distance between two settlements,* people's activities and the rural type that the commune was included in.

The Orthodox confession was embraced by the majority of the people in the four villages of the Igneşti commune and that was why the authors focused on the features of the *Orthodox Church*, and then, after the appearance of the Neoprotestant cults, on the study of the *Baptist, Pentecostal,* and *Adventist* ones.

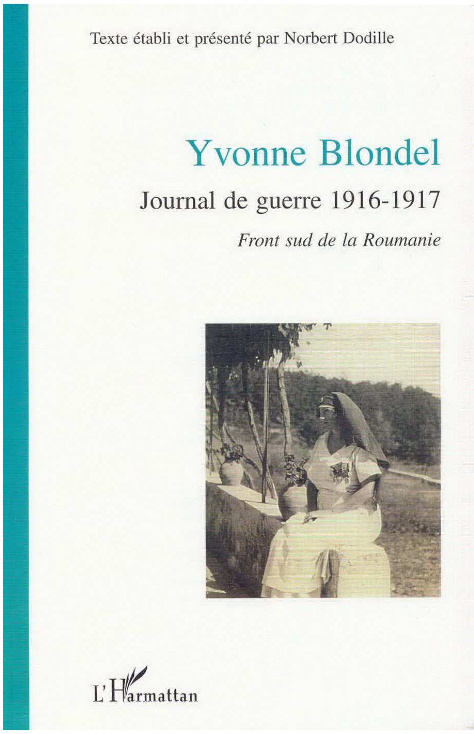
The last part of this book treated appropriately and in detail the matter of **Schools** (Chapter 6) in the villages of the commune (appearance and evolution, typology, students and teachers, infrastructure, etc.), of **Traditions and customs** in Igneşti commune (Chapter 7), such as the ones for weddings, for children's Christening, for funerals, for Easter, for remembering the dead ones, for celebrating Christmas, for spring, summer, and autumn. For each custom the authors described the characteristic development phases. This part also included issues on **Cultivating love and respect for one's area of origin** (Chapter 8).

This book also hosted well selected and elaborated maps, photographs, and tables that facilitated reading and understanding the **Geographic Monograph of Igneşti Commune**, and that was why we congratulated its authors.

GRIGOR P. POP, PhD

***Journal de guerre 1916-1917*, Yvonne Blondel, 2001, Editions L'Harmattan, Paris, 272 p., XVI planches photographiques. Texte établi et présenté par Norbert Dodille**

Dans la collection « Culture et diplomatie françaises » dirigée par Norbert Dodille, est paru chez L'Harmattan, Paris, le Journal de guerre d'Yvonne Blondel, la fille de Camille Blondel, ambassadeur de France à Bucarest dans la période 1907-1916. Elle est française, mais aussi roumaine d'adoption : « depuis que je suis devenue roumaine », écrit-elle le 8 mars 1917, mariée avec Jean Cămărăşescu, nommé préfet de Caliacra, ensuite, à partir de 1922, avec Jean Postelnicu.



Le professeur Norbert Dodille, un grand ami des Roumains et de la Roumanie, qui nous offre ce journal que la nièce de l'écrivain, Mme Nicole Georgescu, lui a offert à son tour, a développé une riche activité culturelle dans notre pays entre 1990-1996, en tant que directeur de l'Institut Français de Bucarest.

On peut dire que, grâce à ses efforts et à ceux de ses collaborateurs, les liens culturels et spirituels entre la France et la Roumanie, interrompus brutalement dans la période communiste dans laquelle la Roumanie a été jetée et abandonnée, se sont renoués dans la bonne tradition de l'Institut Français de Bucarest.

Le livre comprend une Préface très dense et exhaustive par Norbert Dodille, dans laquelle perce sa qualité de connaisseur et fin analyste de la situation de la Roumanie et des pays balkaniques dans la période précédant, pendant et immédiatement après la première guerre mondiale, des Balkans « images de peuples » qu'il met en évidence dans le journal, car « dans le journal d'Yvonne Blondel apparaîtront les Roumains, bien sûr, mais aussi les Bulgares, les Russes, les Serbes et les Turcs, ainsi que, épisodiquement, des Français ; les Allemands sont aussi cités, bien entendu. Par ailleurs, sont évoquées des ethnies qui ne renvoient pas à des définitions nationales, les Tziganes et les Juifs ».

Suit le *Journal* d'Yvonne Blondel qui est structuré sur les étapes de son refuge qui a signifié en petit le calvaire de tout le pays : Silistra (août 1916), Călăraşi (septembre 1916), Medgidia (septembre 1916), Brăila (octobre 1916), Galatzi (décembre 1916) et Iassy (janvier 1917).

Le livre se termine par un Glossaire des mots roumains et par deux cartes, celle de la Roumanie et du Cadrilater.

Le journal commence par l'évocation de Silistra, où l'auteur revient après « de bonnes vacances passées à Constantza ». Là, à Silistra, son père lui raconte l'entrevue avec Ionel Brătianu qui lui avait dit, après la déclaration de guerre de la Roumanie à l'Austro-Hongrie que « voilà le premier acte du drame auquel vous avez contribué, Blondel, qui est joué. Le second, va commencer et j'espère dans le succès ».

Le mardi 16 août 1916, l'auteur note que « ce matin le passage des Carpates a été confirmé. Tout le monde est heureux de ce début encourageant », mais elle constate que « les Bulgares, avec lesquels nous ne sommes pas encore officiellement en guerre, ont bombardé Giurgiu » et ceci, après que quarante ans avant les soldats roumains se sacrifiaient pour la libération de la Bulgarie des Ottomans !

La situation du front de la Dobroudja se dégrade, « à Turtucaia, les combats ont lieu aux portes de la ville », à ce point que malgré l'appel du Roi Ferdinand « de résister jusqu'à l'extrême limite », les Roumains se retirent au nord du Danube, à Călăraşi.

En tant que soeur médicale, Yvonne Blondel a conduit un hôpital de campagne, avec de nombreux blessés, qui suivait de près l'armée roumaine. Impressionnée par l'exemple de la Reine Marie, elle l'évoque de la manière suivante : « la reine Marie nous donne l'exemple à toutes… » car « Marie, comme la précédente reine Elisabeta, qui fut aussi mère des blessés de la guerre de 1877, a fait aligner de nombreux lits pour nos pauvres et héroïques soldats ».

L'auteur décrit les villages et les foyers du Cadrilater, la retraite de l'administration roumaine de Dobroudja, l'inactivité des alliés russes, la brutalité des Bulgares – « le Bulgare est d'une race trop cruelle …», tandis que des Serbes elle écrit que « les Serbes ont été endurcis par les luttes que leur race a endurées pour se maintenir en vie ».

Dans l'étape de la retraite à Brăila, où elle note « me voici installée à Brăila arrêtée sur une nouvelle marche de notre retraite », elle s'identifie à notre cause, aux Roumains qui ont subi le calvaire d'épreuves surhumaines dans la période 1916-1918. Malgré les échecs, mobilisés par l'élite politique dirigeante qui avait montré une grande responsabilité et détermination, les Roumains avaient gardé intact l'espoir de la victoire.

En haut : Mot manuscrit de la reine Marie de Roumanie à Yvonne Blondel.
En bas : illustration du journal.

Yvonne Blondel cite dans son journal le message de résistance et de confiance que la Reine Marie a insufflé à tous, alors que nos chances étaient presque perdues : « Ne regardez point en arrière et ne dispensez pas vos forces en larmes vaines. Ce qui fut est passé ; il vous reste à triompher de demain ». Quels mots exaltants ! Quels grands caractères ont donné du sens à l'idéal populaire national et ont créé la Grande Roumanie !

Obligée de se retirer devant l'ennemi, elle note : « nous étions tous attristés par la tournure prise par les événements, mais surtout Flers et moi (Robert de Flers (1872-1927), écrivain, disciple de Marcel Proust), les Russes prenant les choses avec plus de désinvolture et il est vrai que ce n'est pas leur sol que l'on ravage et que l'on piétine. Le nôtre non plus, à proprement parler, mais voilà où l'affinité latine se fait sentir… », en remarquant l'attitude détachée des Russes car « au fond, les Russes aiment les Bulgares. Ils ont des affinités religieuses, de langage et autres, plus qu'avec tout autre peuple des Balkans ».

A Brăila, l'auteur note l'arrivée de la mission militaire française conduite par le général Henri Berthelot : « le général Berthelot est bien arrivé à Bucarest à la tête de sa nombreuse mission d'officiers de tous grades et de toutes spécialités », en particulier des aviateurs et du personnel médical, qui subiront de lourdes pertes sur le champ de bataille.

Petit à petit, « la retraite de Dobroudja est tout à fait consommée », suivie par Bucarest et ensuite, l'évacuation en Moldavie, à Iassy.

Yvonne Blondel est impressionnée par l'héroïsme des soldats roumains, par leur esprit de sacrifice dont elle est complètement convaincue suite à son activité dans l'hôpital de campagne qu'elle conduit : « un autre soldat, moldave, a le pied écrasé par un obus… Chaque fois que je frôle son lit il me tire mon tablier en me demandant s'il arrive bientôt à Bârlad. Il doit se croire encore en train et il ajoute en criant presque : « j'ai dor de mes deux fils et je sais, ils m'attendent en gare ». Comme on peut constater, elle utilise souvent des mots roumains, plus expressifs pour rendre la couleur locale. Des paysans roumains, elle écrit : « ces paysans roumains que j'avais si peu approchés jusqu'à ce jour m'intéressent et je sens que je m'y attache. Ce n'est pas sans émotion que je considère l'argile de la race. Presque tous ont une dignité qui me frappe et parfois frise la grandeur. Il faut avancer plus profondément dans la connaissance de leur nature dans le bon, comme dans le mauvais, pour bien les juger ».

De Galatzi, où elle se réfugie à nouveau, entre temps, elle note : « je me sens alourdie par les mauvaises nouvelles de toutes parts... »

et quelques jours plus tard, suit le refuge à Iassy : « à Iassy, la gare était noire du monde », mais de Iassy, comme des tréfonds de l'histoire, vient notre libération.

Le journal d'Yvonne Blondel est un document historique, celui de la Roumanie entre 1916-1918 car, comme le constate Norbert Dodille, « ce qu'elle raconte, c'est la mort et la souffrance quotidiennes des simples soldats et des civils, errant sur les routes, et pour lesquels elle doit lutter âprement, avec son caractère opiniâtre, afin de les ramener dans des hôpitaux de fortune.

Quelques rencontres inattendues sur le front des Balkans, avec par exemple l'écrivain Robert de Flers, des souvenirs de la vie de cour et des visites du roi en province au temps de la paix qu'elle se remémore, ajoutent d'intéressants contrepoints au caractère dramatique de son témoignage ».

Vers la fin du journal, l'auteur se demande : « révolutions, troupes révoltées, l'anarchie partout. Toutes ces nouvelles nous semblent bien graves pour nous. Pauvre petit triangle roumain, que vastu devenir dans cette tourmente ? ». Finalement, les chances ont été favorables à la Roumanie et elle est sortie renforcée de la première guerre mondiale.

Le journal d'Yvonne Blondel présente une société roumaine articulée qui, malgré des épreuves particulièrement difficiles, a réussi à conjuguer ses efforts pour les surmonter, par le dévouement de chacun de ses membres.

À part la description des événements quotidiens – nous avons affaire à un journal – les aspects géographiques abondent, car l'auteur décrit des lieux, des gens et des événements dans le contexte de l'entrée de la Roumanie dans la première guerre mondiale.

Louable est également l'action de Monsieur Norbert Dodille, qui présente aux lecteurs d'aujourd'hui les états d'âme d'une Française qui a choisi d'être à côté des Roumains, d'espérer avec eux et croire à leur étoile brillante.

Le livre est utile à un large spectre de spécialistes mais surtout aux jeunes, y compris géographes, qui connaissent moins l'histoire vraie de notre peuple ; le journal d'Yvonne Blondel nous offre une fresque dépouillée d'un épisode de notre histoire plus récente.

AL. PĂCURAR

***The Mountains of Romania. A Guide to Walking in the Carpathian Mountains* by James Roberts, Cicerone Publishing House, Milnthorpe, Cumbria – United Kingdom, 250 p.**

The book of James Roberts – a passionate lover of mountains, who crossed the Himalayas, the Atlas, the Carpathians and other areas so different in terms of location and landscape, is a warm plea for Romania, which is so peculiar, unknown, attractive to the author who, married to a Romanian – Elena, became attached to our country. His premature death – in 2002, deprived us of a sincere friend.

The guide consists of 13 chapters of various lengths, the text being accompanied by numerous maps - 27, photographs, city plans which complete it, offering the traveler the information and the orientation required in the field.

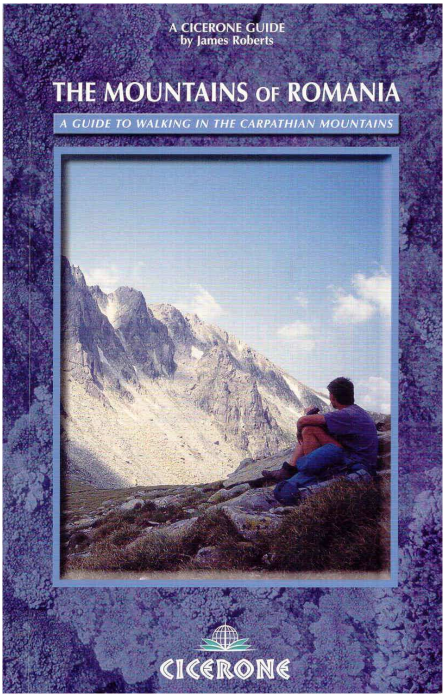
Chapter one offers information that any tourist needs on the Carpathian area, on the access to the country, the state of roads and the transport infrastructure, the monetary system, gastronomy, information on the possibilities of cycling, climbing, mountain biking, skiing, narrowgauge forest railways, elements of flora and fauna, all of which being accompanied by suggestive images from the Carpathians. The author proves a good knowledge of Romanian reality in general and of the mountain area in particular, so that he is capable of presenting the mountain areas that can be used for various sport and leisure activities. Thus, he mentions that "of the gorges that offer climbing one of the most accessible is the Râşnov gorge just south of Poiana Braşov" or "in the Apuseni Mountains, the gorge of Cheile Turzii has some fine climbing routes", while "the Piatra Craiului offers good climbing, easily accessible from the cabanas at Curmătura, Brusturet and Plaiul Foii".

Referring to cycling, knowing Romanian reality, the author states among others that "one of the best routes that could be tackled with a bicycle would be to start at Suceava … visiting some of the monasteries as you go. The best start would be to head up to Rădăuți and take the Putna road from there. Putna is reached by train, but the straight empty road along the Suceava valley is a delight. If you have a mountain bike you will be able to get through the woods to Sucevița and head over from the village of Vicovu de Jos to Marginea".

Chapters 2-12 refer to the main mountain massifs and their surrounding areas: Bucegi and Valea Prahovei, the Bârsa, Piatra Craiului and Iezer-Păpușa Mountains, the Făgăraş Massif and the mountains between the Olt and Jiu rivers, the Retezat, Banat, Maramureş, Apuseni, Eastern Carpathian Mountains, the series of the chapters closing with the monasteries of Bucovina. Clear maps, suggestive images of various topics are provided: spectacular forms of relief, panoramic images, views of the mountain cities – Brașov, Sinaia, rural landscapes, monasteries, traditional activities, as well as plans and sketches.

Thus, Chapter five, "The Piatra Craiului and Iezer-Păpuşa Massifs", covers "two quiet contrasting ranges. The Piatra Craiului is a high crest of white limestone rising sheer from the forest; the Iezer-Păpuşa is a more massive crescentshaped feature, of gentler contours, much of it grassed over … The hinterland to the south of these mountains is delightful. The DN 73 is one of the most scenic roads in Romania…".

After the general introduction of the mountain group, the author briefly describes each massif, with its defining specific traits. Thus, "The Piatra Craiului is a dramatic limestone ridge rising sheer from the surrounding forested hills. In spite of its small size (22 km, 14 miles long), it deserves a section all to itself because it stands apart from its neighbours, and within its small area it offers one of the most spectacular ridge walks in Europe. It is separated by a considerable area of forest from the nearest similar terrain and has a rich flora, including the endemic Piatra Craiului Pink Dianthus callizonus, growing just above the treeline; there is also a small herd of chamois.



The best way to explore the Piatra Craiului (the name means "royal stone" is to make a number of day walks from the fine cabana at Curmătura, situated at the top of a clearing sloping down to the south, between the arms of the Piatra Craiului and Piatra Mică ...".

After describing the ways of access, including the train timetable, to the closest point of access, James Roberts proposes with a typical British minuteness several routes that he describes in detail, including the signing and the shelters.

The last chapter, Chapter thirteen, is devoted to the monasteries of Bucovina of which the author writes that "hidden away in the valleys among the forests near the border with Ukraine is one of the Europe's most remarkable ecclesiastical treasures – the painted monasteries of Bucovina. Situated among forested hills they make enchanting punctuation in the text of a delightful walk. Mostly founded in 1500s, these are still thriving religious communities".

Finally, the guide contains a series of appendices, extremely useful information for mountain tourists regarding accommodation (location, capacity), common words with emphasis on the practical vocabulary, a bibliographic selection, data on ski tracks (length, difference of level, classification), mountain rescue coordinates, important addresses (embassies, airlines) of the anglophone area, altitude of the main mountain peaks, and characteristic flora and fauna species.

In conclusion, James Roberts's guide on "The Mountains of Romania" is a useful book, which serves as a beautiful invitation to the practice of mountain tourism in Romania by the Anglo-Saxon public.

The review of the book is also intended to be a homage to the author who, unfortunately, left this world too early. However, his work remains, and we are grateful to him for the passion and the professionalism with which he tried to know and understand Romanian reality – in which he mostly succeeded - and then presented it to the public.

AL. PĂCURAR