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CRIONIVAL PROCESSES AND THEIR EFFECT ON THE TYPES OF AGRICULTURAL LAND USE IN SILVANIA MOUNTAINS

CORINA BOGDAN[1], IOAN AUREL IRIMUȘ[1]

ABSTRACT. – Crionival Processes and Their Effect on the Types of Agricultural Land Use in Silvania Mountains. Silvania Mountains are a particular geospatial entity within the geomorphological landscape of Silvania, bringing together Plopiș Mountains (Măgura Mare Peak 917 m) and Meseș Mountains (Măgura Pria Peak 996 m) and only comparatively Măgura Șimleului (597m) and Măgura Chilioarei (420 m), taking into account their high degree of erosion, into one family of mountains, forming a boundary of the vast Neogene Șimleu gulf from West to East and North-East. Between the 15th and 19th centuries, the so-called Little Ice Age (LIA) was documented for the Northern Hemisphere and in particular for the Silvania Mountains and the surrounding areas (Bihor Mountains) through the identification of fossils belonging to some buffalos, which died during the LIA. The effects of crionival processes on the types of agricultural land use in Silvania Mountains are manifested through freeze-thaw phenomena and small avalanches in close interrelationship with the climate factor and conditions offered by the adjacent Silvania sublayer.

Keywords: *Alpine collisional chain, Little Ice Age LIA, crionival processes, avalanches, Silvania Mountains.*

1. INTRODUCTION

The Silvania Mountains, *as an Alpine collisional chain (see fig. 1, 2)*, represent a fascinating and controversial geomorphological entity, formed during the Hercynian and Alpine thermo-tectonic cycles, on different levels of integration. Thus, one can identify in their structure the marks of a "Hercynian paleomorphology" in the shape of Varistic remnants incorporated in the structures of alpine nappes of the Apusenides, characterized by an *eclogite metamorphism of Varistic age*, later involved in the Alpine thermotectonic cycle. Nowadays it is

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represented by some islands of crystalline schists in the north-western part of the Transylvanian Depression, in the area occupied by *Șimleu Basin / Cretaceous Belt of the Silvania Mountain* from a geological point of view and by *the Intra-Carpathian Yoke* from a geographical perspective.

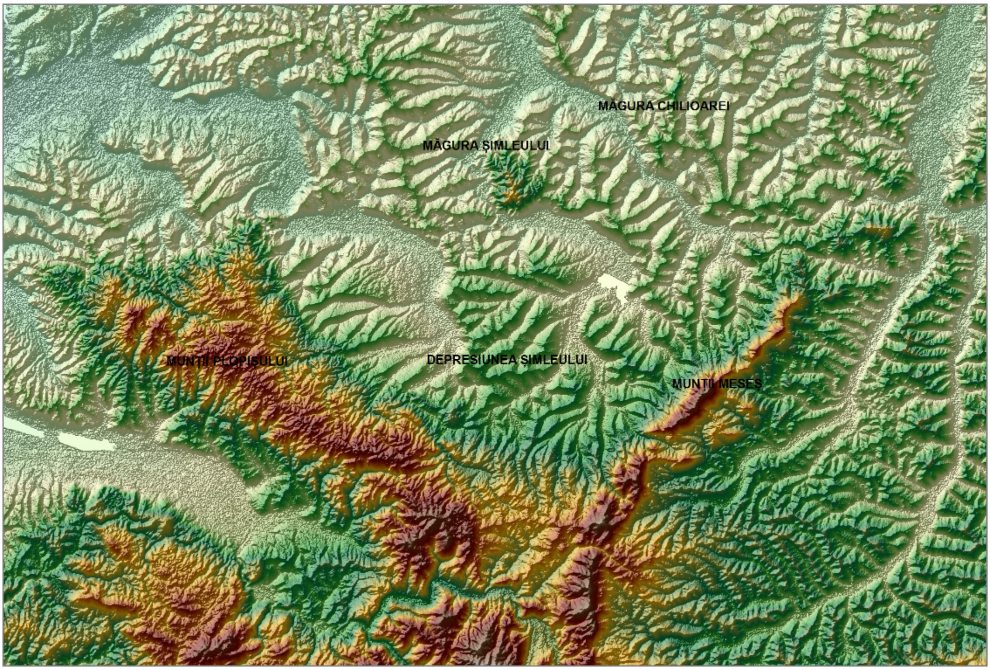

Fig. 1. DEM model of Silvania Mountains and their surrounding areas
(Source: the authors)

From a geological and structural point of view, the studied area overlaps the Șimleu Basin, one of the five basins or Neogene gulfs formed through the collapse of the crystalline basement of the Tisia Craton, in the peripheral area of the Apuseni Mountains, located in the immediate vicinity of the Pannonian Depression. The continental climate changes and the marks of human activities on the environment during the Holocene were generally identified through records of sediments on long term, ice cores and peat which, when they are available, present a less disturbed stratigraphy of the oligoelements. The duration and the regional or global extension of these natural and anthropogenic disturbances are analyzed through a multi-proxy approach.

Therefore the combination between the stratigraphy with high resolution and biogeochemical markers emphasize the characterization of "abrupt climate change" when some limit thresholds are exceeded in duration and intensity (Alley et al., 2003; Clark et al.,2002; Trenberth, 1997, Trenberth et al., 2004). We quote *one of the most intense climate crisis during the Upper Pleistocene*, respectively the cold event "**Younger Dryas (YD)**", which took place between 13.0 and 11.5 kyr BP, and has been expanded into continental Europe, implicitly the Romanian Carpathians and the Silvania Mountains (Alley et al., Broecker, 2003, Clark et al., 2001, 2002; Dansgaard et al., 1989, Peteet, 1992, 1995, Severinghaus and Brok, 1999, Wright,1998, Wunsch, 2006).

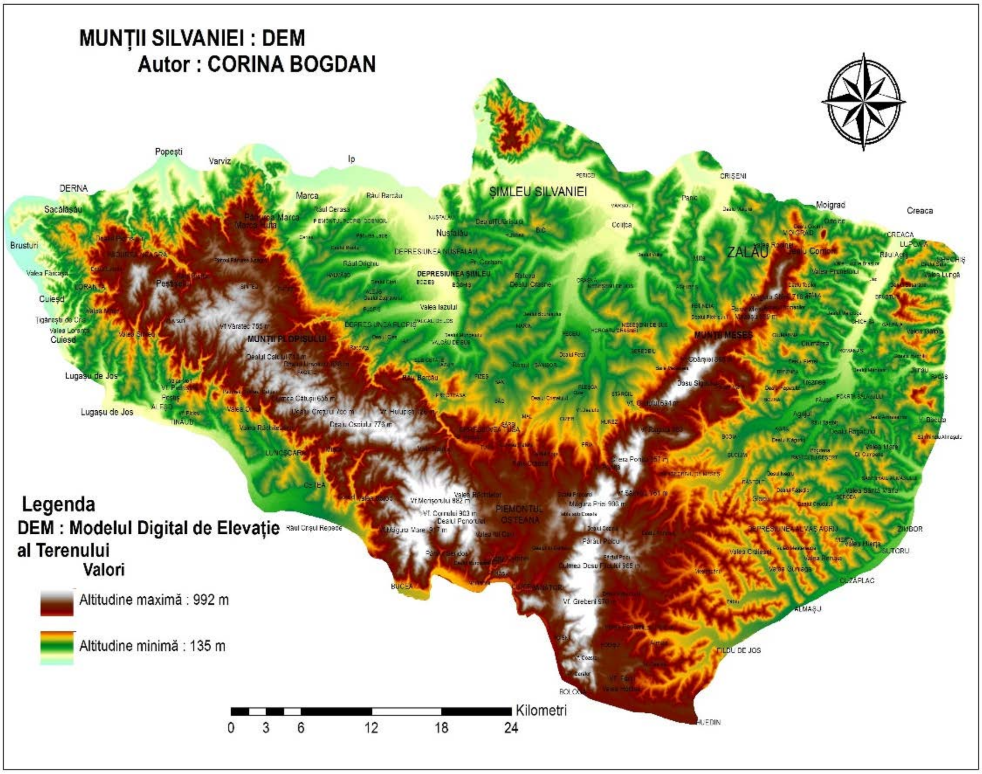

Fig. 2. DEM model of Silvania Mountains
(Source: the authors)

The crisis was triggered by the discharge of melted water of Laurentide ice blocks, an event that led to the partial closure of the meridional circulation of restraint (MOC, Hughen et al., 1998; Paasche, 2006, Muscheler et al., 2000) which substantially controlled the balance of thermal masses from North Atlantic regions (Bond et al., 1997; Broecker, 2003; Broecker and Denton, 1989; Fairbanks, 1989; Keygwin et al., 1991; Lehman et al., 1991). The reconstruction of climate variability over the past millennium provides important perspectives for the understanding of current climate change.

It is difficult to rebuild the past hydrological changes because rainfall and its variability is among the most critical environment variables. The multi-proxy analysis in northern Romania, in Rodna Range (based on plant macrofossils, carbon isotopes, pollen, spores and coal), led to the identification by A. Feurdean et al. (2015) of 5 main stages in relation to hydro-climatic conditions changes (conditions of growth/development of the wet surface between 800-1150 AD, respectively 1800 and 1950 AD, the drying of mud surface between 1300-1450 AD; 1550 AD; 1750 and 2012 AD). The multi-proxy reconstructions performed by the authors suggest that during the "Medieval Climatic Anomaly" (900-1150 AD) they were considerably moister than at present, while during the Little Ice Age (LIA, 1500-1850 AD) they were dried. Comparatively, in Silvania Mountains, the areas have dried considerably over the past 40 years, as a result of climate change induced especially by anthropogenic activities; therefore we have the driest conditions observed during the past 1000 years.

The approach of *crionival processes and their effects on the types of agricultural use of land* imposes some introductory concepts in relation to the term *periglacial* which was initially proposed to indicate the *geomorphological processes* that took place in a peripheral strip in the external areas close to the glacial calottes.

Subsequently, the term has acquired a wider significance being used to indicate the different geomorphological phenomena specific to cold climates, in the external part of the limit of permanent snow, where the snow melts completely during summer and alternations of *freeze-thaw cycles* take place, which is the main and most important morphogenetic process. The term "periglacial" passes from the areal meaning (peri-glacial, near the glaciers) to only its climatic, inexact meaning. Other terms were introduced: crionival, paraglacial, arctic, but we will plead for the term periglacial (Panizza, 2007). Why these clarifications? Because both terms, periglacial and crionival, have a certain degree of ambiguity but ultimately have the same semantic meaning.

The mountainous area within Plopiş and Meseş Mountains, Măgura Şimleului and Măgura Coşeiului, in the cold seasons and especially during the *Little Ice Age LIA*, was submitted to the alternation of *freeze-thaw cycles* which acted upon the landscape through the creation of a series of processes and typical erosion and accumulation landforms. Most forms and periglacial deposits in

Romania belong to the Würm, due to the existence of a bi- or multiannual gelisol, whose limit lies in the exterior of the Carpathians. In terms of zonation, there are *three provinces*: *a central one*, with gelisol and intense periglacial processes and *two external ones*, without the presence of gelisol while crionival processes only developed during a large part of the year.

Fig. 3. Cryoplanation forms in Meseş Mountains (upper row) and grassed hills in Plopiş Mountains, Ponor Karst Plateau
(source: the author)

During the cold climate stages, outside the level affected by glaciation processes, the modeling took place under the impulse of the periglacial processes, gelivation and nivation, having a different role according to the topoclimatic conditions related to the Silvania area (fig. 3).

2. MATERIALS AND METHODS

Regarding the materials, the methodology and the techniques used for outlining the crionival processes and their effects on the types of agricultural land use in Silvania Mountains, we took into account the topographic and geological databases, and used the geomorphological mapping techniques. In this respect, we transposed to the topographic map the morphology of these contemporary geomorphological processes as a reflex of a complex interaction between the crystalline bedrock, the sedimentary cover and the internal and external geodynamic agents. The geomorphological map was created using a methodology of the Italian school of geomorphology (fig. 5). Thus, using the related topographic and geological base, we mapped and represented cartographically both the lithology of the bedrock and the main endogenous and exogenous processes, specific to the Silvania Mountains. The main difference lies in the fact that the topographic base is also visible on the final geomorphological map, confirming the dynamics and the evolution of processes in the Silvania Mountains. In terms of methods and techniques, we used the cartographic method and the GIS analysis. We structured this paper into three parts, related to crionival processes in Silvania area, the areal distribution of land use classes and the effects of crionival processes on the types of agricultural land use in Silvania Mountains.

3. CRIONIVAL PROCESSES IN THE SILVANIA AREA

From the point of view of the periglacial processes, Silvania Mountains have common characteristics with the Transylvanian region, with a development of the *detritic perigacial layer* and a predominance of the *crionival sublayer*. In this respect, we have identified residual landforms and accumulation forms within Silvania Mountains.

3.1. Residual landforms

These are forms arising from periglacial modeling of the type of ice wedges, involutions and false folds (cryoturbation). The inherited periglacial landscape of Silvania Mountains is integrated into the evolution of the *Northern Central, Transylvanian and Western periglacial provinces*. The Transylvanian Basin and Șimleu Basin, due to their geographical position, allowed the stagnation and the maintenance of cold air masses, with North-Western influences, that created favourable conditions for the triggering of some intense crionival processes (fig. 3). The periglacial morphology of Silvania area is the result of freeze-thaw exogenous processes, whose interaction with the Silvania bedrock formed a product of synthesis, in this case an "obvious relict permafrost" as a reflex of the previous periglacial modeling of these mountains.

Fig.4. Ice wedges in colluvial deposits within Măgura Coșeiului
(source: the author)

Obviously, in this case, it is no longer possible to speak about large-scale permafrost in the morphological structure of Silvania Mountains, but the marks of it and the modifications to which it was submitted were numerous. The periglacial forms identified in the Silvania Mountains are represented by: *structured soils*; *ice tongues*; *forms produced by thermoclastism*; *nivation forms*; *block fields*; *cryo-nivation forms* (*gelifluxions and fluvial forms*). *The structured soils* are the most specific periglacial forms, which, in Silvania Mountains, can take the form of some polygons and striated soils made of parallel strips. The pronounced thermal contractions in stratified rock complexes have resulted in the fracture of soil in the shape of circles, stone polygons, which may have a size from a few centimeters up to tens of meters.

The freeze-thaw processes in Silvania soils led to the formation of chaotic cryoturbation structures, developed especially on plastics with low permeability (clays) in the form of *ice wedges* (fig. 4). They are characteristic to regions with average annual temperatures under 6 ° C, which produced a series of fractures in the Silvania soils. The size of these wedges is from a few centimeters up to 2 m and they develop on sandy and marly terrains with a high degree of humidity and numerous annual cycles of freeze and thaw. Ice wedges were identified within the plains and terraces of Crasna and Barcău, especially in the form of small fractures affecting sandy deposits, gravels, clays and marls specific especially for Șimleu Basin.

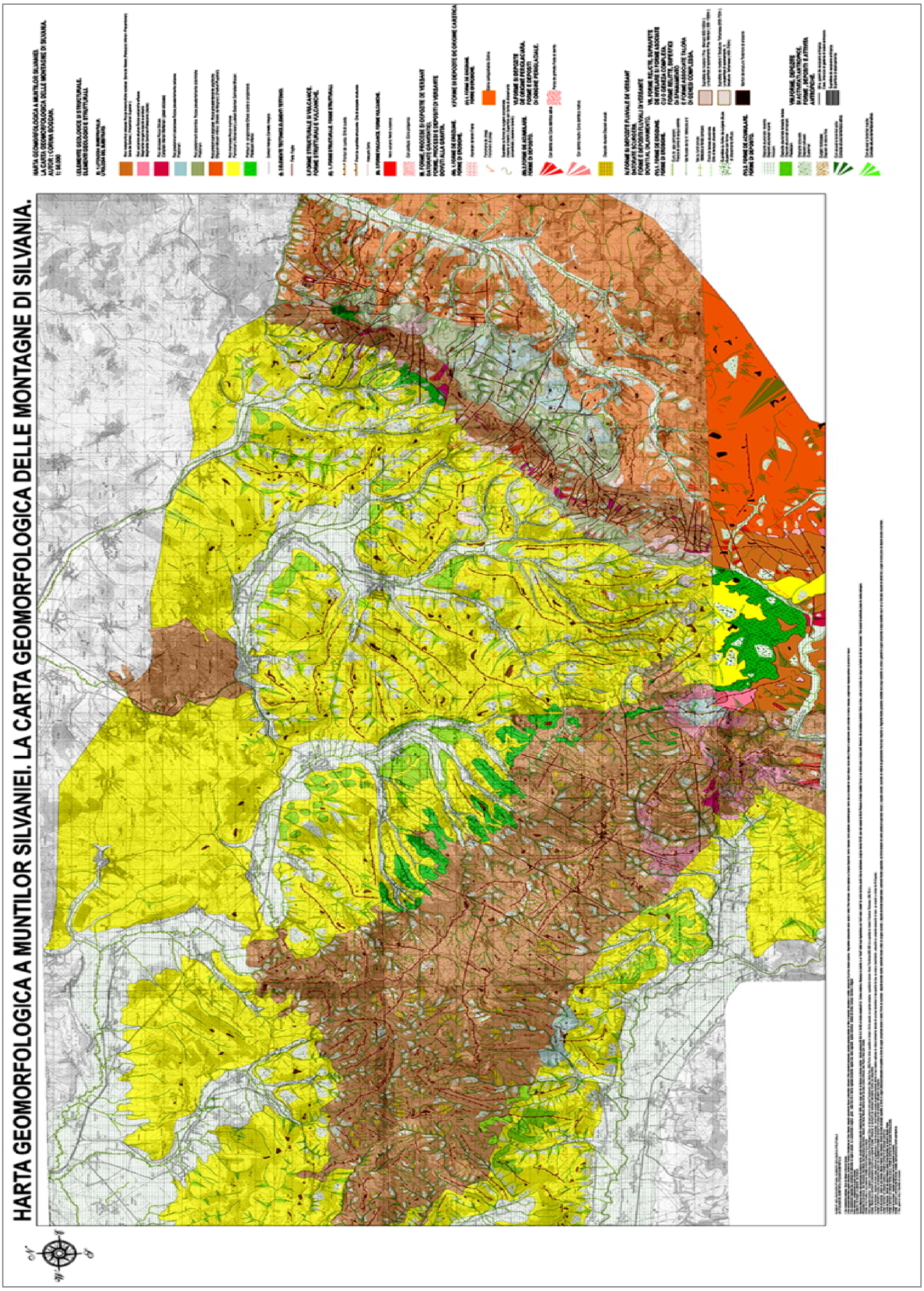
HARTA GEOMORFOLOGICA A MUNTILOR SILVANIEI. LA CARTA GEOMORFOLOGICA DELLE MONTAGNE DI SILVANIA.

Fig. 5. The geomorphological map of Silvania Mountains and its legend
(source: the authors)

The non-uniform response of these particles to freeze created tensions in these materialized deposits, especially through *involutions*.

Fig. 6. Periglacial modeling in Plopiş Mountains, Ponor Karst Plateau (thaw lake) *(source: the authors).*

3.2. Accumulation forms

The periglacial forms of accumulation within the Silvania Mountains are highlighted by two categories of forms, those developed on the slopes and those due to gelifraction and gravitation.

3.2.1. Forms developed on the slopes, *of solifluction and mud flow type,* are noticed especially on the slopes in the mountainous area within Barcău, Crasna and Zalău catchment areas. The *creeping* has an important contribution to the development of these forms through fine movements of the particles on the slightly inclined slopes, covered by vegetation, independent from each other, in particular on the slopes in Plopiș Mountains, inside the covering deposits (Negreni Plateau, the slopes related to Valea Secătura, Șerani, Făgetu, Dealu Zboriște, Dealul Vuica, Valea Mare, Gepișul, Drighiul, Valea Cerăsei, Izvorul, Bistra and Pădurea Neagră Plateau) (fig. 5). In Meseș Mountains, the creeping phenomena cover a smaller area compared to Plopiș Mountains. They are present on Dealul Boului, west of Dosu Sigăului, Mezeșu, Peringaru, Dealu Cocina, Măgura Moigradului, Stâna, Ciumărna, Treznea. West of Dosu Sigăului, Obârșia Peak, Dealu Mânăstirii, Băile Meseșenii de Sus and Carpeni, one can notice mud flows as a result of periglacial modeling (see fig. 6). The creeping phenomena also affected the slopes of Măgura Şimleului (Dealul Sfântului, Muntele Rău, Dealul Varului, Cehei East, Dealul Uileac) and Măgura Coșeiului (La Păşune, Dealul Făgeţel, Dealul Ţiganilor, Dealul Mihai Viteazul, Pădurea Ascuţită).

3.2.2. Forms of detritus type due to gelifraction and gravitation, resulting from the desegregation of rocks through freeze-thaw, which, due to rolling and collapse on the slopes, accumulate at their bottom in the shape of *cones* or *flat pieces of ground*, a common phenomenon at the contact of Meseș hemi-anticline and Șimleu Basin. Within Meseș, in the western part of Măgura Priei, East of Măgura Stânii, West of Dosu Sigăului, Obârșia Peak and Dealul Mânăstirii, there are extended detritus nappes, especially in the immediate vicinity of Măgura Stânei. Forms due to *thermoclastism processes* or thermokarst landforms in Silvania Mountains are attributed to the degradation of permafrost, thus presenting a basin shape closely connected to the melting of its superficial part. This phenomenon is specific to predominantly limestone soils in Plopiş Mountains and Măgura Coșeiului. In Plopiş Mountains, in Ponor Plateau sector, we identified a thaw lake (fig. 6).

This lake was formed as a result of a pronounced subsidence induced by the thawing of permafrost. Admittedly, the formation of this lake was conditioned by climatic causes. In time, this lake will be covered with peat deposits and sandy and marly sediments. The forms of periglacial nivation in the Silvania Mountains developed against a background of intense shaping processes, such as processes of *nivation* or *cryo-nivation* due to *the presence and permanence of the snow layer*. The periglacial modeling depends on the weight of the snow and the slopes inclination in Silvania Mountains. Thus, at the level of valleys, it became manifest through the lowering of slopes and the reduction of heights. The most effective processes of nivation or gelivation take place in the upper convex sections of the slopes, characterized by a slow discharge compared to the lower sector, which presents a *pronounced mobility* due to denudation processes.

Thus, the morphodynamic evolution of these slopes is marked by a withdrawal tendency through *cryoclastism*, followed by successive accumulations as a result of the evacuation of materials from the upper sections. The *sector morphodynamics* of the Silvania slopes takes places in the two sections of erosion and accumulation, with a continuous tendency of advancement against the eroded terrain, in this way reaching a slope of dynamic balance of the *glacis* type. Their development in Silvania Mountains, especially on the eastern slopes of Plopiș Mountains, Măgura Coşeiului, the eastern part of Meseş Mountains, is the mark of the intense periglacial changes to which the territory was submitted, confirmed by the frosty and long winters and the documents of that period when the "Little Ice Age" LIA was mentioned. *The flow phenomena* produced on the slopes by the partial or total melting of snow, rich in carbon dioxide, acted upon the carbonaceous rocks and created forms like *channels*, *gliding deposits, avalanche corridors or stratified detritus nappes* (fig. 7).

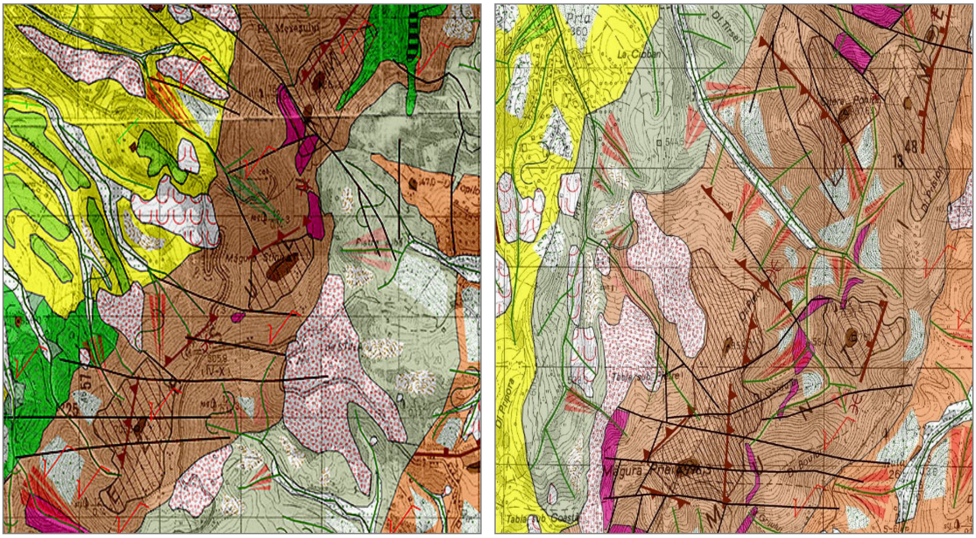

Fig. 7. Periglacial forms in Meseş Mountains
(see legend of fig. 5, source: the author)

The avalanche corridors, relatively reduced in size in Silvania Mountains, have the form of strips without forest vegetation, consisting of detritic materials. The repeated cycles of freeze-thaw in the upper sections of the slopes led to the formation of *nivation edges*, due to the evacuations caused by intense desagregations, resulting in the formation of concavities in the slopes profile. The clastic rocks resulting from these processes were moved by the lower sectors of the slopes as a result of diffuse flow processes. Therefore, due to the periglacial modeling, *residual landforms* were created (sharp summits, towers, pins, wedges, involutions) and *forms of accumulation* (of the nappes and detritus cones type). The presence of gelisol can be deduced from the variety and extension of *cryoturbation forms* (involutions, wedges and congeliflunctions), found mostly in terrace deposits and delluvial - colluvial deposits. *The lithological and structural variety* is important for the development of periglacial processes in Silvania.

In the Șimleu Basin and Măgura Coșeiului, compared to Plopiş and Meseş Mountains and Măgura Şimleului, there are *asymmetric valleys, cuestas* and a *front glacis* on the monoclinal structures and solid rocks (limestones, sandstones and tuffs), on whose lower parts loessoid or grèzes litées formations were deposited. On clays and marls instead, slopes of solifluctional balance were formed and landslides took place, triggered by the frequency and intensity of floods (on Agrij Valley) during the thawing periods, which led to the creation of the wide valleys due to gelifluviation. During the period of heating, through thawing, the rivers involved in the flow processes large quantities of materials from the banks degraded by gelifraction, due to lateral erosion, in the presence of this gelisol (Crasna and Barcău Valleys). In conclusion, the *periglacial landscape in Silvania Mountains* is well represented both as regards the forms of accumulation and erosion, through structured soils; ice tongues; forms produced by thermo-clastism; nivation forms; block fields; cryo-nivation forms (gelifluctions and fluvial forms).

Fig. 8. Detritus nappes in Măgura Coșeiului
(source: the author)

The most prominent marks of the periglacial modeling are found in Meseş Mountains compared to other units of Silvania Mountains due to the presence of forms of erosion and accumulation, such as those developed on the slopes (solifluctions and mud flows) as well as those resulting from gelifraction (detritus nappes) (fig. 8). Meseş Mountains are different from the other units through the wide presence of the periglacial detritic layer, represented by the stratified detritic nappes on both sides.

4. THE DISTRIBUTION OF TERRAINS IN SILVANIA MOUNTAINS ACCORDING TO THEIR USE

The Silvania soils are a *product of synthesis*, the result of the integration between abiotic and biotic matter, but they also store nutrients, energy and water for plants, providing their vital elements, as the environment in which they develop.

Fig. 9. Regosols in Meseş Mountains, pseudorendzines in Măgura Coşeiului, Măgura Şimleului, cambisols in Plopiş Mountains
(source: the author)

Silvania soils were formed at the contact between the lithosphere, biosphere and atmosphere due to physical, chemical and biological interactions. In Silvania Mountains, one notices the domain of cambisols and argiluvisols, specific to low mountains. According to the physical and geographical conditions and their role in the distribution of main soil types, a more detailed analysis reveals a weak vertical zonality. The uniform soil formation processes in Sălaj County led to the emergence of *forest soils*, in such classes like *brown forest soils*, *podzols* and *argiluvisols*, while brown acid soils are in Măgura Şimleului and Coşeiului.

Brown soils and brown forest soils are characterized by different stages of podzolization from low to average, and represent the most widespread class in Silvania Mountains. Tertiary sedimentary deposits in Şimleu Basin and Almaș-Agrij Basin conditioned the formation of *podzols* and *argiluvisols*, varied as texture and supported by delluvial and proluvial deposits (sands, sandstones, clays and marls). In the floodplains and terraces of the rivers Barcău, Crasna, Zalău, Agrij and Almaș there are *intrazonal soils,* from the category of mineral *hydromorphic* and *lithomorphic* soils formed during a sinuous process of integration between landscape, rock and phreatic waters. Lithomorphic soils are represented by *rendzines* and *pseudorendzines* (fig. 9), which cover limited areas, being specific to the south-eastern slopes of Meseș Mountains and to the upper basin of Almaș, in the area of limstones and argillaceous deposits with high levels of calcium carbonate due to scarps.

Table 1. Land distribution according to quality classes
(source: Sălaj Office of Pedological and Agrochemical Studies)

Use	Class I		Class II		Class III		Class IV		Class V	
	ha	% from the total use	ha	% from the total use	ha	% from the total use	ha	% from the total use	ha	% from the total use
Arable	53	0.04	5,247	4.35	35,838	29.72	48,751	40.43	30,699	25.46
Grasslands	1,517	2.03	5,642	7.56	12,350	16.54	23,644	31.66	31,519	42.21
Meadows	992	2.70	2,882	7.84	5,271	14.33	13,135	35.71	14,501	39.43
Vineyards	-	-	52	2.08	315	12.60	1,258	50.32	875	35.00
Orchards	10	0.23	233	5.27	494	11.16	2,384	53.88	1,304	29.47

The *hydromorphic soils* are specific to areas with humidity levels in excess in Șimleu and Almaș-Agrij basins, where the reduced discharge slope and the presence of impermeable deposits favored the formation of *meadow black soils, humic-gleic soils* and *wetlands*, soils predominantly used for pastures and meadows. The *floodplain soils* are represented by alluvial deposits and especially by *alluvial soils* with different degrees of humification, which have the shape of strips along the Someș, Almaș, Agrij, Crasna, Zalău and Barcău valleys.

Fig. 10. Subsistence farming in Măgura Coșeiului, Coșeiu
(source: the author)

The distribution of land according to *the category of use* in Sălaj County and in the Silvania Mountains is presented as follows: *agricultural land* (arable lands, grasslands, meadows, vineyards and orchards), *forests and forested lands*, land with *water* and *reed*, *communication ways* and *railways*, lands with buildings and yards, *degraded and unproductive* lands and *non-agricultural land.* The statistics carried out at the level of Sălaj County indicate that most of the areas in Silvania Mountains have an agricultural character. According to data provided by the *Sălaj Office of Pedological and Agrochemical Studies*, the major share belongs to *arable areas with pastures and orchards* in Silvania Mountains and the surrounding areas.

The agricultural lands in Silvania Mountains have natural qualities which constitute the fundamental premise for agricultural activities. The soil quality influences the water and air quality and the nutrients cycle. The soils in Sălaj County have a low fertility due to practice of subsistence farming (fig. 10), requiring high expenses for crops and therefore sometimes the owners of agricultural lands abandon them. According to data provided by the Sălaj Direction for Agriculture and Rural Development, the total agricultural land covers 238,966 ha. In the table below, one notices the fact that the area of agricultural lands at the level of Sălaj County has gradually reduced from 1999 to 2010, while it increased during 2011. As regards the agricultural use of soil on categories of use, during 2011 we can notice an increase in the arable lands, meadows, pastures, orchards, and a decrease in the lands covered by vineyards.

Fig. 11. Arable land with corn and barley crops in Silvania Mountains (Plopiș and Meseș Mountains) *(source: the author)*

Concerning the areas removed from the agricultural circuit, the table below shows their significant variation in particular for arable lands and pastures between 1999 and 2012. Compared to 2011, 4 ha of land were included again in the agricultural circuit during 2012.

Table 2. The distribution of land according to their use
(source: Sălaj Direction for Agriculture and Rural Development)

Current row	Year	Category of use					Total agricultural lands
		Arable	Grasslands	Meadows	Vineyards	Orchards	
1.	1999	123,715	78,090	32,082	2,627	4,969	**240,943**
2.	2000	123,401	77,896	31,974	2,620	5,052	**240,943**
3.	2001	123,557	77,902	31,923	2,580	4,826	**240,788**
4.	2002	122,603	78,314	32,566	2,578	4,720	**240,781**
5.	2003	121,534	78,738	33,861	2,413	4,156	**240,702**
6.	2004	121,505	78,814	34,320	1,936	4,115	**240,690**
7.	2005	121,495	78,577	33,924	2,568	4,097	**240,661**
8.	2006	121,554	78,504	33,894	2,621	4,088	**240,661**
9.	2007	121,430	78,508	33,952	2,586	4,085	**240,561**
10.	2008	120,570	78,507	34,807	2,586	4,085	**240,555**
11.	2009	120,447	76,039	36,014	2,564	4,330	**239,394**
12.	2010	120,572	74,348	36,609	2,564	4,323	**238,416**
13.	2011	120,588	74,672	36,781	2,500	4,425	**238,966**
14.	2012	120,586	74,671	36,780	2,500	4,425	**238,962**

The main geomorphological processes affecting the soil quality are represented by *water and wind erosion* (which causes the loss of fertile soil layer on the surface, the land deformation, clogging and sedimentation); *compaction*; *landslides*; *excess water*; *the low amount of organic matter and nutrients in the soil*; *salinization*; *acidification*; *pollution.* The linear and areolar erosion is by far the most important factor in land degradation.

Table 3. The areas removed from the agricultural circuit in Silvania Mountains *(source: Sălaj Direction for Agriculture and Rural Development)*

Current no.	Year	Category of use (ha)					Total agricultural lands (ha)
		Arable	Grasslands	Meadows	Vineyards	Orchards	
1.	1999	0.35	1.32	0.55	0	0	**2.22**
2.	2000	2.74	0	0.01	0	0	**2.75**
3.	2001	0.57	3.90	0.06	0	0	**4.53**
4.	2002	4.49	22.0	0.01	0	0	**26.50**
5.	2003	0.70	0	0	0	0	**0.70**
6.	2004	10.58	0.40	0	0	0	**10.98**
7.	2005	1.33	1.21	0	0	0.03	**2.57**
8.	2006	5.17	0.14	0.11	0.06	0.25	**5.73**
9.	2007	27.14	14.00	0.55	0.08	1.25	**43.02**
10.	2008	5.15	1.00	0.18	0.01	0.04	**6.38**
11.	2009	6.29	0.26	1.9	0	0.06	**8.51**
12.	2010	6.73	2.85	1.37	0.10	0.14	**11.10**
13.	2011	2.03	0.08	0.38	0.03	0.25	**2.77**
14.	2012	2.35	1.24	0.21	0.03	0.08	**3.91**

Among the various forms of erosion, the most widespread is the *surface discharge*, having consequences so severe that the land can no longer be used from an agricultural point of view, so it must be removed from the agricultural circuit. At the level of Sălaj County, according to data provided by the *National Administration of Land Improvements – Someș-Tisa Branch*, the following phenomena were reported concerning the agricultural surface: strong surface erosion (10,375 ha), in depth erosion (4657 ha), the modification of the geochemical composition (159 ha), landslides (8,343 ha), geological erosion (356 ha), bank erosion (109 ha), excessive humidity (8 961 ha), valueless vegetation (2,342), totaling an area of 35,700 ha.

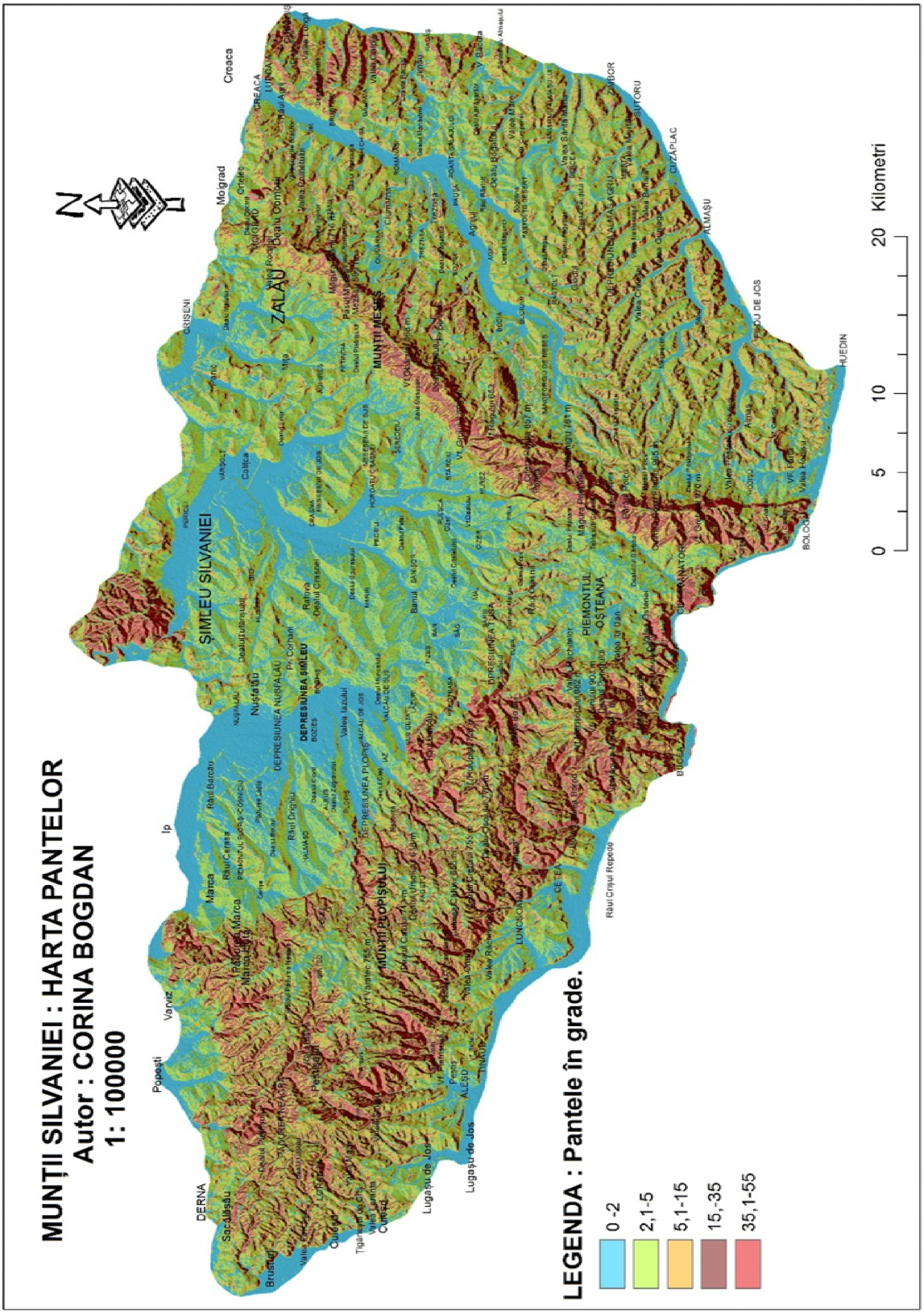

Fig. 12. The Silvania Mountains, the map of slopes *(source: the author)*

The agricultural technological faults are the most important causes of the chemical degradation, to which we add the industrial and bio-industrial activities. These phenomena appeared as a result of non-compliance with the rules for the implementation of agricultural works, depending on land requirements, storage of residues from zootechnical activities and fishing accumulations. As previously mentioned, of the total area of Sălaj County (386,438 ha), 240,690 ha (62.28%) represent agricultural land, while the rest of 145,748 ha (37.72%) consists of non-agricultural lands (forests, land, lands with water, railways, communications ways, land with building etc). Most of the agricultural land is represented by arable land (50.42%), followed by the grassland (32.83 %), meadows (13.91%), vineyards and orchards. As regards the areas affected by various degradation factors, the most important is the phenomenon of surface erosion (68.6%), followed by smaller percentages of excessive humidity (11.1%), landslides (10.3%) and other factors.

Most of the agricultural lands (62%) have the slope between 6-14° (see fig. 12), being cultivated with vineyards and orchards. 15% of lands have the slope under 6° and they are specific to cereal crops. It turns out that approximately on one-quarter (23%) of the agricultural area, the mechanized works can be done with great difficulty due to the degree of inclination of the terrain (slope > 14°). According to the above-mentioned aspects and in agreement with the Environmental Protection Agency Sălaj, the soils of Silvania are essential for meeting the primary needs of human communities, thus, at least until the invention of artificial photosynthesis, we all depend on the thin and fertile layer from the Earth's surface, from where we extract all the necessary resources.

5. THE EFFECTS OF CRIONIVAL PROCESSES ON THE TYPES OF AGRICULTURAL USE OF LAND IN SILVANIA MOUNTAINS

Due to their position, Silvania Mountains are situated in the temperate continental climate area, representative for the western and northwestern areas of Romania, under the influence of some prevailing western and northwestern winds. Consequently, during winter, as a result of the polar circulation, which moves polar or arctic air masses, winter is quite frosty and humid, and during spring and autumn, the frequency of freeze rises to 30% and affects the northern part of the Silvania area.

The effects of the southern or southwestern circulation are felt through higher temperatures and rainfall in proportion of over 15%, as a result of warm air from the South-West, characteristic to northern Mediterranean cyclone activity, in its movement towards North. The climate represents an essential factor, through the influences induced in the dynamics of the geomorphological processes, by means of its two elements, *rainfall* and *air temperature,* that have an important impact on some *natural processes* (meteorization, erosion, the formation of flow from riverbeds, soil formation). The influence of climate is equally felt in the characteristics of flora and fauna. It can favour or restrict the anthropogenic activity. Particularly, it fosters the agricultural activity, through favourable periods for certain cereal and technical crops, fruit-growing, vegetable growing, farming (Josan, 2009). The climate conditions equally influence other forms of the anthropogenic activity (the transport and building industry) and have implications in man's health and environment. To this effect, one should mention *the Little Ice Age* (comprised between the 16^{th} and 18^{th} century), a period of important cooling. Currently, the increase in the average temperature (0.6°C in the last 50 years) was rather associated and assigned to the excessive anthropogenic pressure (the greenhouse gases are suggestive to this effect) and not as much to natural factors such as the orbital forcing, the solar variations and volcanic eruptions (Bindoff et al., 2013).

As regards the *climatic factors*, which impose the features of the climate in a certain geographical area, the solar radiation is the determinant climatic factor - the lowest values of solar radiation were recorded during the cold season (10.75kcal/cm^2/year at Nușfalău).

A. The duration of sunlight brightness records the highest values during summer, in July and August - 282 hours/month, in Zalău, and the lowest, during winter, 70 hours/month, at the same weather station. In the context of the current running-out of non-renewable energy resources, the length of daylight is of interest, in the purpose of its exploitation as an inexhaustible source of energy, in view of the fact that during four months out of twelve (May-August), the duration of sunlight brightness is, on average, about 9 hours/day.

B. The conditions of temperature: the temperature is not a constant quantity, it varies according to the season, altitude, cloudiness. In Silvania area, the multi-annual average temperature records values that drop considerably from West towards East (Zalău, 10.6°C; Nușfalău, 9.5°C). This would be explained by the altimetric position of the weather stations and by their closeness to the mountain area. Consequently, we can state that, for the most part of the Silvania area, the multi-annual average temperature is of 10°C. Between 2011 and 2015 an increase in the annual average temperature was recorded in the Silvania Mountains from 10.5°C to 11.7°C with several implications in the dynamics of the Silvanian ecosystems. Related to temperature, we must mention *freeze*, which can cause serious damage to agriculture. In Silvania, the first freeze is recorded in mid-October and the last freeze in mid-April. The growing frequence of extreme weather events during the last two decades was instrumentally proved. The climate simulations denote the tendency towards warming and the more and more relevant impact of the anthropogenic factor in comparison with the natural variability.

Table 4. Annual average temperature, rainfall and winds in the Silvania Mountains, between 2011and 2015
(source: The National Meteorological Administration, Cluj Branch)

Year	Annual average temperature (°C)	Monthly rainfall (l/m^2)	Wind - main direction (m/s)
2011	10.5	389.6	NW/2.1
2012	11.2	568.7	NW/2.2
2013	11.2	693.4	NW/2.3
2014	12.4	649.3	SE/2.1
2015	11.7	626.1	SE.1.9

It is a well-known fact that 90% of the natural disasters are related to *weather, climate and waters*. Thus, the global and regional climate changes contribute to the increase of the frequency of meteorological risk phenomena such as *droughts, rainfall, floods* and *freeze*. In order to prevent these meteorological risk phenomena (dangerous meteorological phenomena - storms, floods, drought, frost) they have to be well studied and forecasted so as to reduce damages for the national economy and to guarantee people's security.

C. Rainfall: as concerns the spatial distribution of rainfall, in Silvania area one notices an increase in rainfall from West towards the mountains (Nușfalău, 621 mm; Zalău 639.4 mm), this being also fostered by the uniform morphology. Măgura Șimleului does not represent an obstacle in the way of the rainfall dissemination, so that, in average, the Silvania area records about 600 mm of precipitation from rain and snow. Higher average annual rainfall amounts (800 - 900 mm and even over 900 mm) were recorded in the Meseș and Plopiș Mountains, as a result of the higher altitudes in comparison with the bordering regions and their aspect towards the western circulation. Between 2011 and 2015 the annual rainfall amount recorded fluctuations with an upward trend from 389.6 l/m^2 to 626.1 l/m^2. The rainfall amount does matter, because if it exceeds the average values, it can produce a series of dangerous natural (hydrological, geomorphological, pedological) phenomena with serious consequences for the human communities and therefore implicitly for the anthropogenic activity (floods, landslides, hails and storms).

Fig. 13. Detritus and vegetable waste characteristic to some spring slides in Plopiș and Meseș Mountains *(source: the author)*

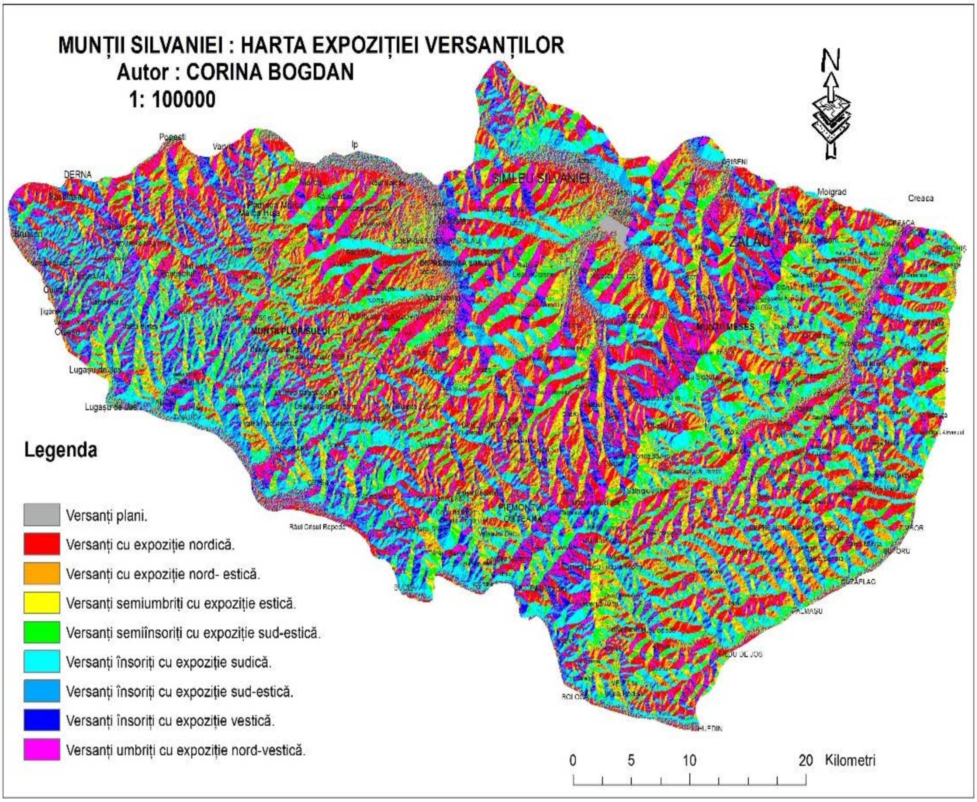

Fig. 14. The aspect of the slopes in Silvania Mountains
(source map: the author)

The snow layer is deposited and maintained in the days in which the soil and air temperature is negative. It is a good insulator and protects the autumn crops during the winter, reaching a thickness of around 16-17 cm. (Josan, 2009). The snow layer can cause mechanical and chemical erosion processes, which depend on its persistence and thickness (Castiglioni, 1979). In the Silvania Mountains, the snow, through its mass, can compress the soil and vegetation if it moves, it uproots plants, agricultural crops, especially the fruit trees and the vineyards, and it moves detritus masses and facilitates various landslide phenomena of the avalanche type (see fig. 13). In its surroundings and under it, the snow causes particular thermic and humidity conditions, in a way that enhances or slows down the cryoclastic processes. Through melting, the snow layer supplies the flow of snow. Thus, the water resulting from the melting of snow is rich in carbon dioxide and has a very effective chemical action, as we can observe in the sinkholes on Negreni Tableland, in the South of Plopiș Mountains. One of the most violent and spectacular phenomena in periglacial environments are the avalanches, snow, debritus and vegetable waste falls characteristic to the scarped slopes of Meseș Mountains. These represent a considerable environmental risk factor. The most representative case is that of a small snow and air mass, which falls off from the snow-capped slopes and slides, growing as it takes in more snow and roots out vegetation, trees and debris, creating a gap in the slope's profile under the form of the „avalanche corridor", scratches the rock walls of the slopes and finally settles to the mountain base as fan-like amassments. Of course, in Silvania Mountains, there are only *small size avalanches*, but particularly dangerous for the orchards and vineyards through their uprootal.

They rarely occur especially in Meseș Mountains during spring when thaw processes take place, that move the ice or during winter when the snow layer is increased by snowfall. Avalanches may be due to accidental phenomena such as the fall of some masses of rocks or of a block of snow as a result of the passage of animals or skiers. This phenomenon threatens houses, communication ways, forests and agricultural crops in Silvania Mountains. These avalanches are specific to slopes >20° and northern aspect (which favors winter avalanches) and southern aspect (spring avalanches) according to the map regarding the aspect of slopes (see fig. 14). We distinguish the following typologies of avalanches in Silvania Mountains: *incohesive snow avalanches* (due to the slip of a small portion of fresh snow, which moves a major amount of snow, during the descent, it has the shape of tongues specific to Meseș Mountains); *superficial avalanches* depending on the thickness of snow, only certain superior layers of snow move, specific to Plopiș Mountains; *wet and dry snow avalanches* according to the degree of snow humidity; corridor avalanches on the river valleys of the Silvania area, depending on the morphology of the slope.

D: Air humidity depends on the origin of air masses, which arrive in Silvania Mountains, the rainfall frequency and the underlying surface. The largest amount of water vapors is found in the maritime and Atlantic air masses (western and north-western circulation) and in the Mediterranean maritime air (southern and south–western circulation) according to Cristea (2004). The multiannual average values of the relative humidity are of 81.7 in Nușfalău and 70.9 in Zalău, values which indicate the optimal humidity content for the development of biophysical processes.

E. The cloudiness: the state of the sky when it is covered by clouds, influences the size of the thermal amplitude and the duration of sunlight brightness, with higher values during winter, in the month of December (7.6 tenths at Nușfalău). Near the Earth's surface, the wind is characterized by short-term variations of speed, in which the surface irregularities of the earth play an important role and can amplify or diminish local turbulence. In what concerns the wind frequency on directions, in the Silvania area the *calmness* prevails (Nușfalău, 53.6%).

In Zalău, during the cold season, the winds coming from the South-East prevail, being related to the channeling of air masses on Zalău Valley. In terms of wind speed, it presents low average values (1.6 m/s) in Zalău. The integration between climate and active surface results in the formation of complex and elementary topoclimates depending on the characteristics of the active surface (altitude, aspect, slope, expressed through the received quantity of caloric energy, the duration of sunlight brightness and local air currents). *The integration between the local climatic factors and the Silvania sublayer, submitted to the shaping of endogenous and exogenous factors, led to complex topoclimates*, characterized by quantitative climatic indices, specific to hills and low mountains. We delineated the *hills, valleys and depressions topoclimate*, which, in line with the specialized literature, integrates two sublayers: *low hills, under 400 m and high hills, over 400 m*. *The topoclimate of low hills* is specific to the largest part of Silvania, with the duration of sunlight brightness varying between approximately 1845 and 2175 hours/year, depending on slope and aspect. The average annual temperature is 10°C and precipitations vary between 550 and 650 mm/year.

Rain usually falls during the late spring and early summer, the wind speed is high on the watersheds (2-3 m/s) while the *calmness* prevails (over 50%) in the area of valleys (Josan, 2009). The *hills* at the contact with Plopiş and Meseș Mountains have a topoclimate with a lower annual average temperature by 0.1 - 5°C compared to the one in the low hills, and they have higher amounts of precipitation (700 - 750 mm/year). In the area of contact basins and large valleys, one notices temperature inversions during winter. The cold and humid topoclimate favours agricultural activities such as *animal husbandry, fruit growing* and *potato crops*. The topoclimate of Meseș Mountains, Plopiş Mountains, Măgura Șimleului and Măgura

Coşeiului is imposed by their low height (less than 1000 m) and their position in front of the oceanic air masses (Josan, 2009). The average annual temperature descends to 8 - 8.5°C, precipitation approaching 800 mm/year. The moderate climate, especially in Plopiş Mountains, led to permanent settlements on the watersheds, to the practice of animal husbandry, excepting some crops; all these arguments attest the integrator character of the climate and of its influence, with a double impact, *in the shaping of landforms* and last but not least in *the development of human activities*.

6. CONCLUSIONS

In conclusion, the influence of crionival processes on the types of land use in Silvania Mountains is due to the complex interaction between the crystalline sublayer, the sedimentary cover and the internal (lithological and tectonic factors) and external (climatic, hydrological and anthropogenic factors) geodynamic agents. Therefore Silvania Mountains have, from the point of view of the periglacial shaping, common characteristics with the Transylvanian region, with a development of the *detritic perigacial layer* and a predominance of the *crionival sublayer*. The *periglacial landscape in Silvania Mountains* is well represented both as regards the forms of accumulation and erosion, such as structured soils, ice tongues, forms produced by thermoclastism, nivation forms, block fields and cryo-nivation forms (gelifluctions and fluvial forms).

The most prominent marks of the periglacial shaping are found in Meseş Mountains compared to other units of Silvania due to the presence of forms of erosion and accumulation, both those developed on the slope (solifluctions and mud flows) and those resulting from gelifraction (detritus nappes). The climate change at global and regional scale increases the frequency of meteorological risk phenomena in Silvania Mountains as well as the *droughts, rainfall, floods, freeze*.

The intensity of crionival processes in Silvania Mountains is in line with the alternation of freeze-thaw cycles and with the maintenance of a snow layer which is deposited and maintained in the days in which the soil and air temperature is negative. It is a good insulator and protects the autumn crops during the winter, reaching a thickness of around16-17 cm (Josan, 2009). As regards the negative aspect, the snow layer can cause mechanical and chemical erosion processes, which depend on its persistence and thickness (Castiglioni, 1979).

In Silvania Mountains, the snow, through its mass, can compress the soil and vegetation if it moves, it uproots plants, agricultural crops, especially the fruit trees and the vineyards while it moves detritus masses and facilitates various landslide phenomena of the avalanche type especially in Meseș Mountains. *The integration between the local climatic factors and the Silvania sublayer, submitted to the shaping of endogenous and exogenous factors, led to complex topoclimates*, especially *low hills topoclimate*, favourable for the development of animal husbandry, vineyards, fruit growing and potato crops, fact which fully confirms the important agricultural potential of the Silvania area.

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CRITICAL ASPECTS IN BAIA MARE BASIN (THE SOUTH-WESTERN SECTOR)

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ABSTRACT. – Critical Aspects in Baia Mare Basin (the South-Western Sector). A critical region is a territorial system that has one or more negative elements or interrelations, that can radically deteriorate its state. Sometimes, a territorial unit cannot be defined as critical in its entirety, but contains several critical aspects, generated by instability factors which lead to natural and/or man-made risk phenomena. This paper is focused on the south-western part of the Baia Mare Basin. Several critical aspects have been identified in this area, either induced by natural causes (landslides, ravinement) or by the society (industrial restructuring, demographic aging).

Keywords: *critical region, landslides, ravinement, vulnerability, demographic aging, Baia Mare Basin.*

1. INTRODUCTION

The notion of critical region is used to characterize those territorial systems which have one or more negative elements and interrelations, that are considered geographical risks, or are on the outset of a crisis or going through a period of crisis. For this reason, said region can radically deteriorate its state, which makes it a spatial entity with a high risk content, being categorized as a critical region (Boţan, 2005). The concepts of „critical region" and „risk (hazard)" are tightly connected. A region becomes critical when a critical point is reached in its balance due to different natural and man-made disturbing factors. If their action continues and increases and if the territorial system capacity for self-adjustment is exceeded, disfunctions emerge, and the region may destabilize, and lose its dynamic balance and internal structure. The critical region is therefore a unit under threat,

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which may become unstable or non-functional due to its critical evolution (Mureşan, 2016). The factors which can cause such processes are considered risk factors, while the territorial unit that is under the influence of said factors may become a critical region. There are a series of regions which, based on the nature of the risk factors acting upon them, can be categorized as such: the Sahel, East and South-East Asia, Amazonia, Aral Lake catchment, the Middle East etc. Sometimes, a geographical unit is not, as a whole, a critical region, despite the fact that it contains several instability factors that generate either natural or man-made geographical risk phenomena. In such cases, one can analyse and emphasize the critical aspects concerning the natural components, the anthropogenic components or both. This is also the case for the region concerned in this paper.

2. METHODOLOGY

2.1. Data

Methodologically, the paper employs classical methods, such as analysis, synthesis, scientific referencing, field work, as well as more recent methods, such as GIS modelling. Thus, this study contains a first stage, comprising the setting up of a cartographic database through thematic maps and the creation of a statistical database. The second stage includes the instability factor analysis; in order to follow the action of natural factors and the critical aspects generated by them, we performed extensive field research, while the analysis of man-made instability elements, involved the study of the associated risk phenomena and their mapping, based on statistical data.

A major issue in defining critical regions is the set of criteria that stand at the basis of their identification. Assessing the critical aspect of a region is highly subjective due to a lack of precise quantitative and qualitative criteria. One of the elements that may be taken into account is vulnerability, since the higher the vulnerability to geographical risk phenomena, the higher the possibility for defining a territorial entity as critical (Mureşan, 2016). Consequently, after presenting the natural risk phenomena that act at territorial level, we made two maps regarding vulnerability to ravinement and vulnerability to landslides (see point 3.1., fig. 8 and 9), using ranks. In the vulnerability to ravinement map, five factors were taken into account: slope, aspect, lithology, soil texture and land use, followed by a graphical illustration, in order to clearly depict the influence of said factors on ravinement erosion. First we made a thematic map of each factor taken into account, then we reclassified them into four classes and transformed vector data into raster data, according to the vulnerability index (very low, low, medium, and high vulnerability). Raster reclassification was based on subjectively attributed scores for each component element of the five factors. Following the processes of thematic map reclassification, transformation into raster system and summing them using the Raster Calculator tool in GIS, we obtained a map of the degree of vulnerability to ravinement.

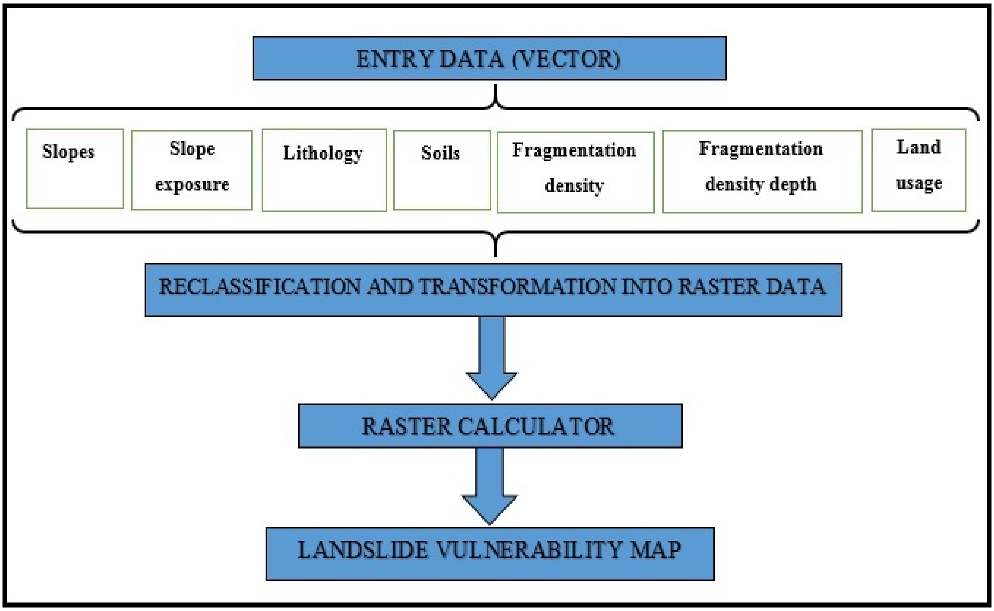

Fig. 1. The methodology used for generating the landslide vulnerability map

In order to generate the landslide vulnerability map, we employed two new factors, apart from the five ones used in generating the ravinement vulnerability map - fragmentation density and fragmentation depth (fig. 1). We also reclassified the seven thematic maps, transforming them into raster data. We then summed them up using GIS (Raster Calculator), the result being the vulnerability to landslides map.

2.2. Study area

The study area is part of the larger Baia Mare Basin, covering approximately 600 km^2 in Maramureș County. This unit slowly individualized through tectonic, sedimentation and erosion processes from the surrounding areas. To the East, the limit to Copalnic Basin is set by Valea Mare - Chechiş watershed, the former valley heading South, while the latter West (Posea, 1962). The south-eastern limit is at the contact with Preluca Range (810 m), continuing South by means of Bârsău Valley, which also marks the limit to the chrystalline in Dealul Mare-Ţicău (660 m) near Şomcuta Mare and the exit of Someş River from the gorges upstream Ulmeni and Chelinţa. To the South-West, Baia Mare Basin reaches Sălaj Hills, continuing West with Codru Range and Piedmont. At around 8-10 meters altitude, one notices the transition from the Someş River floodplain to the piedmont deposits (*Geografia României*, IV, 1992). In the North-West, the basin makes contact to the low plain of Someş River along Ardusat-Cicârlău alignment, between Codru Range and Gutâi Mountains.

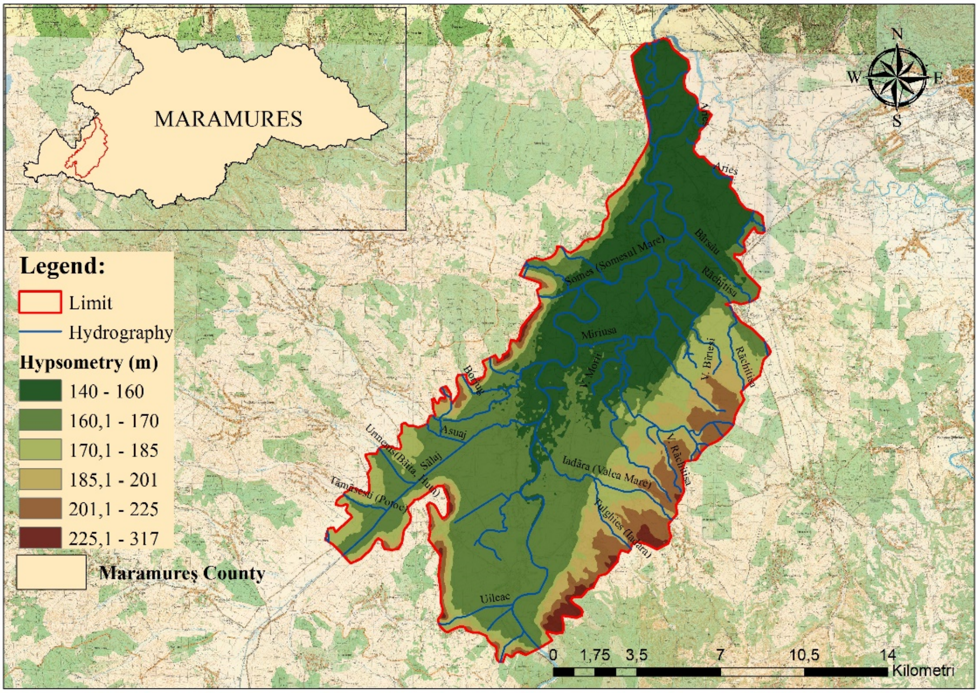

Fig. 2. The location of the study area

The sector chosen to emphasize certain critical aspects is the south-western part of the basin (fig. 2). Its delineation is based on three elements - the soil map, the geological map and the land use map. The criteria for using them were: the presence of cambisoils and clay soils corresponding to their altitudinal levels, the presence of alluvial and gravel deposits as well as sand and clayish sandy deposits and, from point of view of land use, the limit between forests and cultivated lands. The minimum altitude is 140 meters corresponding to the northern part of the study area, in the floodplain of Someș River. A major characteristic is the morphological asymmetry, as the highest altitudes are in the south-eastern part of the study area (317 m). Altitudes slowly descend towards the west and north-west in the hydrographic convergence area marked by the confluence of Someș and Lăpuș rivers. Among the morphometric units, the floodplain of Someș River covers the largest part of the area, as one can clearly notice in the spatial distribution of the heights up to 170 meters.

Administratively speaking, the area includes the town of Ulmeni as well as Ardusat, Satulung, Mireșu Mare, Ariniș, Sălsig, Gârdani and Fărcașa communes.

3. CRITICAL ASPECTS. MAJOR INSTABILITY FACTORS

Among the main instability factors, generating risk phenomena that in turn lead to certain critical aspects, there are natural (mostly geomorphological) factors, as well as anthropogenic factors (related to industrial restructuring and population aging).

3.1. Natural (geomorphological) factors

The geomorphological modeling processes that currently occur in the area include landslides, gravity induced mass movement and ravinement processes. The lithology of the area, comprising shale clays, covered by Quaternary deposits made of „contracting and granular clays, placed in a consequent structure" (Măguţ, 2013, p. 74), alongside different human activities such as logging, overgrazing, vegetation removal, soil excavation, building overload, are factors preceding certain geomorphological processes.

In spite of small altitude differences, the landscape is somewhat vulnerable to many geomorphological processes, as there are large areas affected by landslides and ravinement in Chelința, Gârdani, Vicea and Mânău (fig. 3).

The most serious problems are found in Chelința, where an old landslide was reactivated in 2011, damaging 19 houses. Three families had to be relocated in modular homes. The landslide occured from East to West, the same direction as the flow of rain and underground water. This is due to the fact that the riverbed (Hotarului River) is obstructed near road DJ 108E, contributing to the erosion of the enbankment. Most buildings are illegal and made of clay (adobe); thus, no owner has any home insurance, as the community's primary sources of income are welfare grants and child allowances (fig. 4).

Fig. 3. Landslide in Chelința

Fig. 4. Adobe houses damaged by the Chelința landslide

Superficial erosion processes occur across the entire study area, but are more prominent in its southern and eastern parts (fig. 5).

Figure 6 depicts the areas most prone to surface erosion, which are areas covered by pastures. Besides the existing type of vegetation, slope declivity and irrational overgrazing are the causes of said process. However, human activities have the highest impact. At Chelința, gullies were formed on dirt roads leading to the nearby forest; due to the large quantities of wood carried each year on these roads, water was able to easily create gullies and ditches (fig. 6).

Fig. 5. Gullies

Fig. 6. Former dirt roads leading to the forest, affected by gullies

Linear erosion is the most visible process as the patterns created leave a strong mark on the terrestrial surface. Brittle deposits covering the periphery of the study area led to the appearance of gullies. These deposits are composed of shale, sands, sandstones, Sarmatian conglomerates, clays, and Pannonian sands. Gully erosion is frequent on the outskirts of Chelința and Vicea villages. These gullies are mostly devoid of grass, and their presence in some areas tends to exacerbate erosional processes. Gullies enable the concentrated flow of surface water; this increases their erosional strength, thus leading to deeper and deeper ditches, gullies and eventually ravines.

Gullies are the main form created by depth erosion, this type of process being facilitated by the sedimentary formations from the hills in the area. Most active gullies can be found in Chelința and Vicea. Their depth varies between 2-5 meters, reaching over 50 meters in length and 2-5 meters in width (fig. 7). The entire slope is scarred by these landforms and are further exacerbated by overgrazing and log transportation.

Fig. 7. Gullies in Chelința

Between Vicea and Someș-Uileac, there is a series of gullies reaching 70 meters in length, roughly parallel on the southeastern slope. These landforms are mostly stabilized, but during heavy rains they can reactivate and become torrents. Their evolution is heavily influenced by overgrazing, which strips away the grass cover, allowing water to flow freely.

According to the ravinement vunerability map, the area in question contains four different types of zones (fig. 8):

1. very low vulnerability zones; the vast majority of the area, being located on the banks of the Someș River.
2. low vulnerability zones; the southern and southeastern parts.
3. medium vulnerability zones; in very few areas, overlapping the terrace edges of the Someș River.
4. high vulnerability zones; some parts at the outskirts of Remeți pe Someș, Mânău, Mireșu Mare, Gârdani, Sârbi, and Buzești villages.

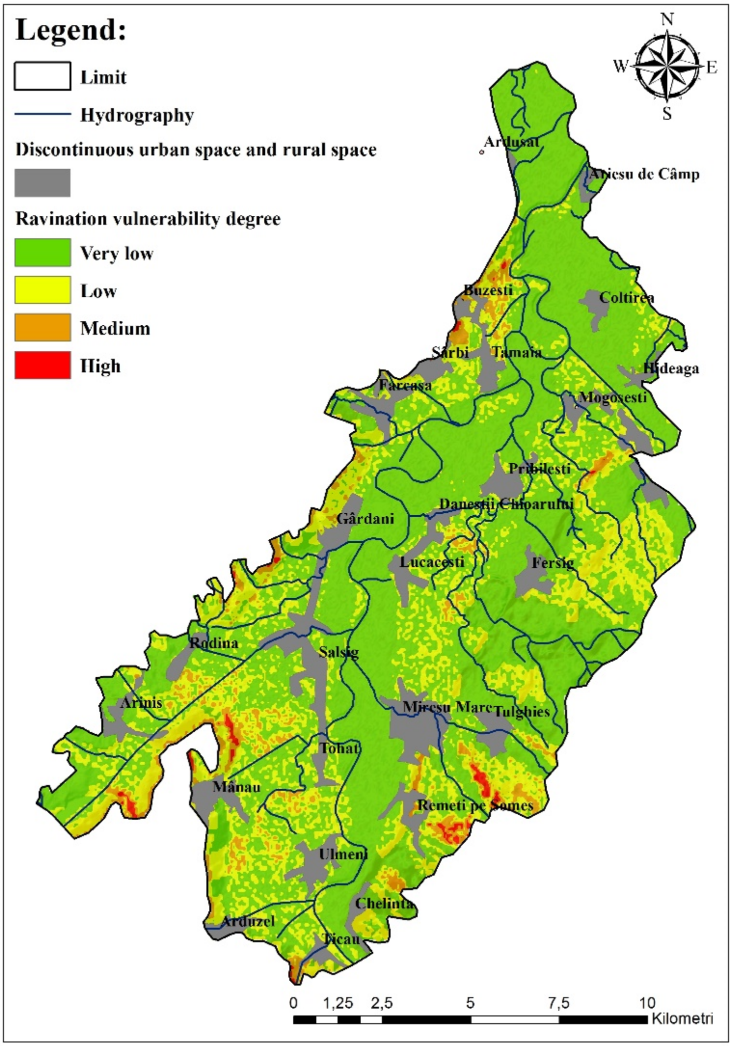

Fig. 8. Map of vulnerability to ravinement

According to the vulnerability map for the south-western part of Baia Mare Basin, there are four vulnerability categories (fig. 9):

1. very low vulnerability areas; roughly 70% of the analysed territory, comprising the banks of the Someș River and its tributaries in the area.
2. low vulnerability areas; surface areas located on the middle courses of some main valleys.

3. medium vulnerability areas; lands in the Ariniş, Rodină, Mânău, Chelinţa, Ţicău, and Tulgheş communes.

4. high vulnerability areas; the terraces of the River Someş at Remeţi pe Someş, Tulgheş, Chelinţa, Arduzel, Mânău, Gârdani, Fărcaşa, Sârbi and Buzeşti. The most vulnerable areas are the slopes steeper than 10 degrees, facing northeast, southwest, east and southeast, and with a fragmentation depth of more than 15 m/km^2, surface areas which are largely covered by pastures.

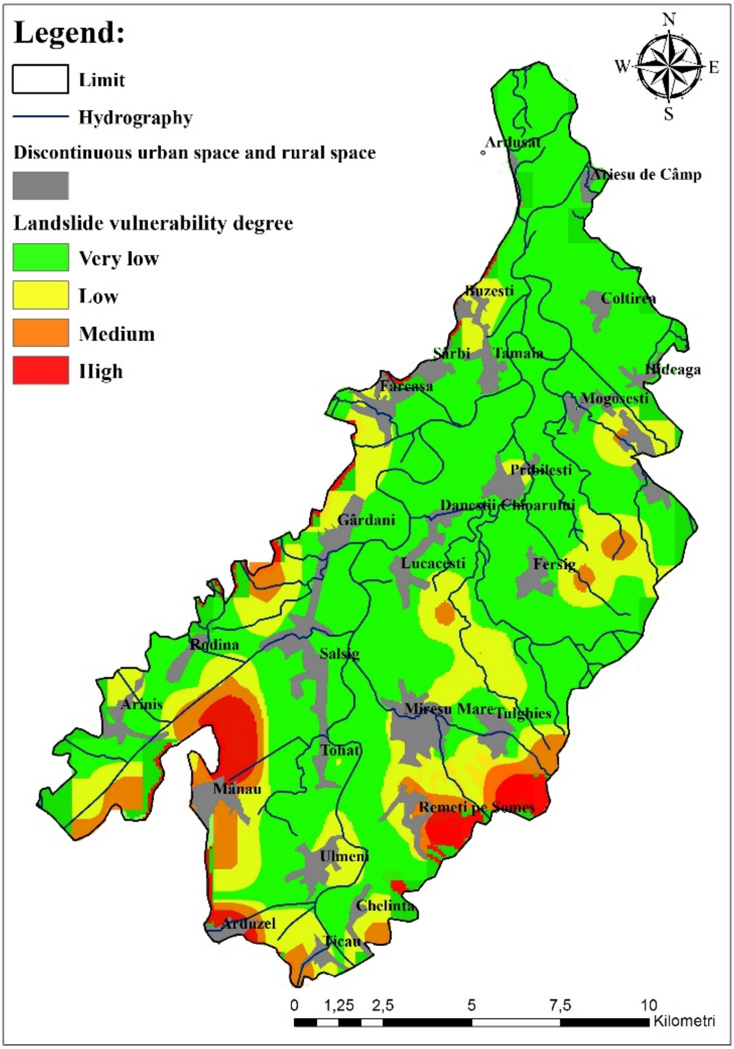

Fig. 9. Map of vulnerability to landslides

3.2. The effects of the interaction between natural and anthropogenic factors on Someş riverbed

The interaction between the anthropogenic factors and the riverbeds is increasingly noticeable. Very few rivers are untouched by human activities, as their courses are changed, redirected, dammed and overall engineered as well as mined for mineral resources such as gravel, sand etc (Hosu, 2009, Ichim *et al*., 1989).

On the sector of the Someș River between Țicău and Ardusat there are two phenomena that affect the riverbed. Firstly, there are enbankment works; despite their scarcity, they had major effects on the riverbed. The first sector, between Ţicău and Mireşu Mare, has two areas with visible signs of human intervention. On the right bank of the river, near the town of Ulmeni, a series of river improvement works were implemented such as the creation of a sandbag wall which reduces erosion of the river bank (MMP, 2013). Such measures are necessary as, in the spring of 2010, river flow increased dramatically due to torrential rains and snow melting. During the month of April 2010, the village of Chelinţa, part of the town of Ulmeni, was in danger of becoming isolated as flash floods damaged the only access route in the area, that is the road to Ulmeni, and Mireşu Mare (Lazăr, 2016) (fig. 10).

Fig. 10. Shore erosion during the 2010 flood, near Ulmeni
Source: http://www.emaramures.ro/stiri/Tipareste-Stire.aspx?NewsID=31899

A similar situation occured roughly 500 meters downstream, on the left bank of the river this time; the bank was stabilized with concrete slabs in order to diminish the side erosion caused by the river (fig. 11) (Lazăr, 2016).

Fig. 11. Stabilization works of the left river bank at Ulmeni

The other situation implies the existence of gravel pits, the most aggressive forms of human intervention. This is due to the fact that the river bed as well as the landforms associated with the river system (banks, floodplains, terraces, alluvial cones) contain massive sand and gravel deposits. Until 2009, Ulmeni had one of the largest gravel pits on the left bank of Someș River. The works were eventually shut down due to poor management. Currently, there are only a handfull of small pits on the outskirts of the town, used solely by the locals (Lazăr, 2016).

In the same sector, between Țicău and Mireșu Mare, there are two gravel pits on the right bank of the Someș River, located in Mireșu Mare. They have a small surface area (less than 1 km^2), but leave a chaotic and considerable mark on the river bed. The pits are owned by a company specialised in gravel and sand mining, which in turn uses the material for its own concrete producing plant (Lazăr, 2016). Likewise, the pits and their materials are used for the construction and upkeep of local infrastructure, as well as by the communities of Mireșu Mare and its adjacent villages.

The second sector, the one between Mireșu Mare and Tămaia-Mogoșești suffers from excessive extraction of alluvial deposits. According to the list of planning permits issued in 2013 by the Maramureș County Councils (*http://www.cjmaramures.ro/activitate/urbanism/lista-cu-certificatele-de-urbanism-si-autorizatiile-de-construire-desfiintare-emise*), there are three such pits in development, located on the right bank of Someș River, two in Lucăcești and one in Dăneștii Chioarului, located less than 2 km from each other. Dăneștii Chioarului pit sits on a richer deposit, as it is located on a slip-off slope (fig. 12). Downstream, near Pribilești, there is another functioning gravel pit (Lazăr, 2016).

Fig. 12. Slip-off slope and sand point bar on the right bank of the Someș River, near Pribilești
Source: Google Earth

The left bank has a similar situation, as Fărcașa hosts a concrete plant which uses sand from a pit located downstream. The company running these two locations also administers the gravel pits of Pribilești, Mogoșești and Sîrbi. This sector, due to the environmental impact of man-made structures and human intervention, is heavily destabilized, and contains areas affected by artificial deepening which, in time, may undermine the banks and the slopes. As the alluvial deposits located along Someș River are suitable for constructions, a few extraction points emerged chaotically in several locations. The same situation can be found downstream of Tămaia, on the left side of the river, where, all the way to Ardusat, there are four more gravel pits and one asphalt production facility. The extraction is done by excavators. For an efortless extraction from the riverbed, several dirt roads were built, some of them right next to the river (fig. 13) (Lazăr, 2016).

Generally speaking, there is a large concentration of gravel and sand pits on the right bank of the Someș River. This can be easily explained by the tendency of the river to move to the right, while the flood plain decreases and the neighbouring agricultural fields lose their importance.

The landforms generated by these pits are extremely varied; the most visible are the existing excavations in active as well as in abandoned pits (Lazăr, 2016).

Fig. 13. Alluvial deposits extraction by artificial headlands
Source: http://www.infomm.ro/
http://www.ziare.com/Baia Mare/stiri-business/grav-raurile-din-maramures-exploatate-salbatic-160-000-mc-de-balast-se-extrag-anual-din-raurile-din-judet-5374825

3.3. Anthropogenic factors

Among the human-related factors that can be found at regional level and trigger certain critical aspects, we chose to present industrial restructuring and population aging.

Most industrial units in the area are currently privately owned and their activity decreased considerably, some to the point of closure. Some industrial areas and buildings were rented to small businesses active in production and industrial services, storage, in precarious conditions, while the remaining spaces are left idle and in a high degree of degradation. In most communes, there are a handful of companies with insufficient jobs for the entire active population; many are involved in logging, mineral extraction (sand for instance from riverbeds) and transportation. The most significant problems in this sector are the inefficient capitalization of agricultural products, large scale commuting towards the city of Baia Mare and lack of investment.

The degree of population aging was represented by calculating the population aging index for all eight administrative-territorial units for a period of 10 years (2006-2016). The report date was the 1st of July each year. According to the graph below, one can notice that all administrative-territorial units have a higher index than the 0.42 threshold value (fig. 14). Thus, the demographic aging phenomenon is quite severe.

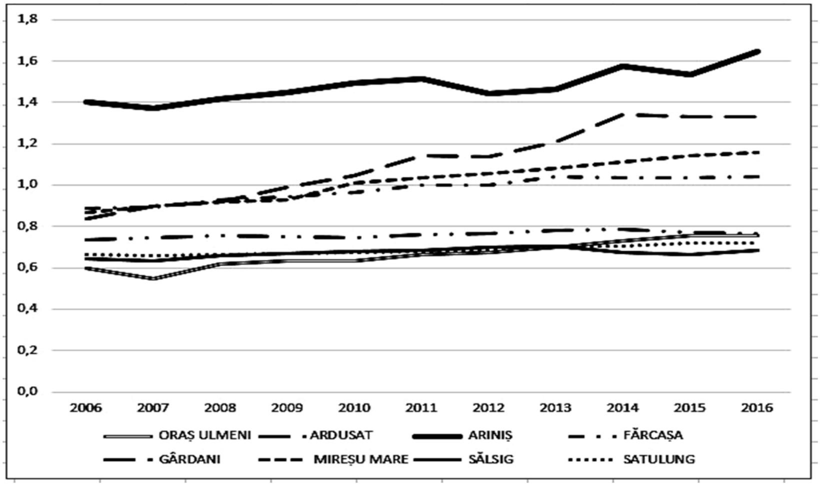

Fig. 14. The demographic aging index

The commune with the highest index is Ariniș; between 2006 and 2016, its index increased, reaching the value of 1.6 on the 1st of July 2016. This commune is followed by Gârdani, which experienced considerable growth until 2014, when it reached 1.3. In the following two years however, its index decreased. The lowest value was registered in Ulmeni, with a value below 1, but its index has been continually rising since 2007.

4. CONCLUSIONS

This paper focuses on analysing the main natural and human instability factors, found in the south-western part of Baia Mare Basin.

The main critical aspects emphasized concern both the presence and manifestation of natural (mostly geomorphological) factors, as well as anthropogenic factors. These critical aspects are due, first of all, to the existence of landslides and ravines on large areas, as these pose a serious threat to the population. Also crucial is the interaction between the geomorphological and anthropogenic factors, that manifests itself in the river bed of Someș as gravel pits. Finally, several critical aspects induced by anthropogenic factors have been emphasized, the most relevant concerning industrial decline and demographic aging for the entire area.

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THE PAST AND PRESENT OF THE TRANSYLVANIAN SALT WATERS

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ABSTRACT. – The Past and Present of the Transylvanian Salt Waters. The Transylvanian salt was always in the center of attention from different points of view during different periods. In the past centuries, identifying the location and extent of this resource was the most important issue, since mining and trading were top priority activities. In recent times the formation of the salt deposits is mostly in the attention of the scientists, so salt is a subject of a continuous interest. Waters that get their mineralization by interacting with the salt beds have been less researched. They were in the center of attention mostly in the second part of the 19th century, while in the recent times just a few studies have dealt with this topic. Field observations carried out in 2016 revealed that the number of salt water occurrences at surface decreased over time. By exploring the causes why these sources have disappeared, we succeeded to gather valuable information about the appreciation of the salt waters during the centuries. Until the 14th century all salt products were considered as part of the land, while in the late Middle Ages this perception was replaced with the practice of regalia, the exclusive right of the king over all the salt resources, including the salt waters. The rights that the regalia empowered the kings were not equally applied over time. The most rigurous actions to protect the rights over this resource were applied during the 19th century. This study presents the legal background and regulation of usage of the salt waters in Transylvania from the Middle Ages until the 20th century. A case study is also presented in order to illustrate the rate of disappearance and present situation of the salt sites in the area South of Cluj-Napoca city.

Keywords*: salt water, Transylvania, regulation, restriction of usage, present situation.*

1. INTRODUCTION

As it was a valuable product all over Europe, the Transylvanian salt was mentioned in the international literature published in the previous centuries, but it was only tangentially discussed in those works with even less data about the salt springs that were to be found here.

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The former importance of the Transylvanian salt (in any form) is underlined in the pages of the first scientific journal published in the world – Philosophical Transactions, in its second volume. With the purpose of establishing commercial relations, it was required by the English authorities in 1666 to conduct studies concerning several products/goods available in certain countries, mostly in Europe including Hungary and Transylvania as well (***, 1666). England showed interest for the Transylvanian minerals, metals, springs, warm baths, etc. Among others it was required to make reports about the salt pits and the situation of the salt mines (Henshaw, Hill, 1666). Dr. Edward Brown, the person entrusted with performing the survey of the country, reported the mines of Dej, Turda, Cojocna, Sic and Ocna Sibiului in Transylvania. The Transylvanian salt was commercialized on the area between Belgrade and Bratislava; it was forbidden to enter it into Austria. As the result of his investigation only two salt mines were presented in detail in the former Hungary, while the Transylvanian sites were not detailed in his article (Brown, 1670).

Even in the local literature the status of salt springs can be followed only at larger intervals back to the 18th century. Beside the detailed descriptions of the salt rock and salt mines, the literature gives scanty information about the salt springs. It is obvious that the focus was on the salt productions sites, since commercializing the salt products represented a great percent of the state revenue. The salt springs got importance when the regulation of usage of any kind of salt started to become more and more rigorous. The first comprehensive work with the topic of rock salt, all the activities related to it and chapters dedicated to salt springs was published by J. E. Fichtel in 1780. The work entitled “Geschichte des Steinsalzes und der Steinsalzgruben im Grossfürstenthum Siebenbürgen” was so detailed from many points of view (geology, mining, hydrogeochemistry, transport, regulation), that it was cited for a long time in the national and international literature. The most important works published after Fichtel’s book, where salt waters were also discussed, are the following: Beudant (1822), Benigni von Mildenberg (1837), Czekelius (1854), Hunfalvy (1864), Bernáth (1880) and Fischer (1887). Among these writings, full mapping of the springs and wells was performed by Fichtel, Czekelius, Bernáth and Fischer.

Depreciation of the natural occurring salt water resources in many places (but not everywhere) has started in the mid 20th century until today and reached a total loss of care at some places.

2. REGULATIONS AND LAWS CONCERNING THE SALT SPRINGS AND WELLS

The mining of salt and its trade, including from the Transylvanian sites, was one of the most stable and profitable sources of the Hungarian royal incomes. The right of the kings over the salt resources can be interpreted from two points of view: (1) the salt as part of the land, the owner of the land has the right over all resources that can be found on the property, (2) the salt as a regalia, the exclusive right or possession of the king over the resource itself including all the mining and commercial activities.

2.1. The salt becoming a regalia – how the salt resources were treated during the Hungarian kings

From charters, as certified sources, it is already known that during the Árpád dynasty (the first kings of the Kingdom of Hungary after the foundation of the state in 1000 AD) the right of operation of salt mines was based on the ownership of the land. The reason why it was hard to separate this kind of operation from the era of the regalia is that most of the salt-bearing lands were intentionally royal estates (Paulinyi, 1924; Ember, 1946; Zsámboki, 2005a; Zsámboki, 2005b). Two documents will be mentioned as examples for confirming the absence of the regalia in case of salt mining during that period: (1) the investigation performed to clarify the ownership of the salt mines in Ocna Sibiului at the order of Charles Robert in 1328 resulted in proving the long-standing proprietary rights of the provost in Sibiu (Paulinyi, 1924), (2) the land with all salt resources and salt mines in Solivar (now part of the town of Prešov in Slovakia) was a property of the Sóos family until 1570, the land being taken over by the treasury as a result of a long lasting litigation (Wenzel, 1880; Paulinyi, 1924; Szűcs, 1990). During this period the salt mines in Dej, Cojocna, Sic and Turda were in the property of the kings (Paulinyi, 1924; Zsámboki, 2005b).

Even if the mining of salt was not a regalia at that time, Ember Gy. (1946) thinks that some related activities, such as salt trading, were retained as a royal right. In contrast to Ember's statement, Zsámboki (2005b) says that the customs duty of the salt in the 11th century proves its free trading – the king did not subject his own product to additional costs. Paulinyi (1924) finds that the small number of royal salt depositories during the 13th century supports the theory of free trading with salt products, but the placement of these offices in the border areas of the kingdom shows that the commerce with foreign countries was transacted by the royal trade office.

Some of the sources (Iványi, 1911; Ember, 1946) link the occurrence of the regalia of salt to a law of 1492 (Art. 30), that clearly says that all the salt mines are kept under royal authority – the text of the law is to be found in the work of Izsó (2006). Before this act, in 1362, in his donation charter that includes the Catholic Church in Veszprém, Louis I of Hungary already mentioned the Royal Chamber System, responsible for the Transylvanian royal salt products. The Chamber had an overall control and supervision over all the activities of the salt mines and trading in accordance with the royal salt monopoly (Izsó, 2006).

A document issued by Matthias Corvinus in 1471 can be considered one of the first notes concerning the regulation of salt waters. Through this act, the king approved the usage of salt water wells for the wealthy citizens of Bistrița with respect to their long-lasting rights in this field (Izsó, 2006). This decision of the king seems to represent a privilege for the inhabitants of Bistrița which means that the usage of salt waters probably was under a general limitation.

It was already proven that during the 13th century the production of salt was based on the land-ownership and trading was also permitted under a few restrictions. At the beginning of the 14th century the case of Ocna Sibiului salt mines alludes to the rights induced by the still existing land-ownership, but documents from the second part of the same century testify the royal monopoly of both activities. The case of Solivar can be interpreted as an exception since the litigation process took a long time. The usage of salt waters was a privilege for some people or some settlements long before the year 1471. All the information presented before suggest that the regalia over all activities related to salt resources was introduced probably in the second part of the 14th century.

The supervision of the salt resources performed by the Royal Chamber was functioning efficiently until the beginning of the 16th century (Ember, 1946), while after this period the overall authority of the Hungarian Royal Chamber was also interrupted due the territorial partition caused by the Ottoman invasion.

2.2. The unstable management of the salt resources during the Principality of Transylvania and the beginning of the Habsburg domination

From the beginning of the era of the Principality of Transylvania, the administration of the salt resources located on the Transylvanian territory was separated from the Hungarian one until the Austro-Hungarian Compromise of 1867. Since they became a property of the Transylvanian prince, the salt mines were administrated by the state or were hired out for some periods of time.

During the Principality the chamber-system responsible for the supervision of the salt mines and all salt resources did exist, but it was probably weakened (Wenzel, 1880; Wolf, 1993; Ember, 1946).

During these poorly organized times, we believe that a lighter degree of control was applied over the salt waters, even if the valid legislation in the mid 17th century stated that the salt mines were in the possession of the Transylvanian Chamber. The opening of new mines was possible with the exclusive permission of the prince, but the nobility had the privilege to use for his own need the salt resources located on his property (***, 1779). All along the existence of the Transylvanian Principality the exploitation and supervision of mineral resources was the most effective and successful during the reign of Prince Bethlen Gábor (Wenzel, 1880).

Indirect information about the situation of salt resources during this period is to be found in Orbán B. deputy's speech that was held at a parliamentary sitting in the mid 19th century. During the Principality, the income induced by the domestic consumption of salt was small because large amounts were distributed free of charge among the nobility, the Szeklers, privileged churches and schools. The trade with salt was mostly carried out as export. The salt water from springs and wells was permitted to be used freely by the people belonging to the lower class (Szathmáry, 1886).

A great change was brought to this land with the installation of the Habsburg domination at the beginning of the 18th century. During the ongoing organization of the new system, some of the sources that generated the incomes of the Transylvanian Treasury were subjected to a general hire out. The salt mines and all the tools conditioning the exploitation and transportation were in bad condition (because of the Turkish-Habsburg wars) and needed investment. Neither the Austrian Chamber nor the Transylvanian estates took over this sector (Trócsányi, 1988). Finally, with the entry of private investors, the exploitation and commerce with the Transylvanian salt started again, but it had difficulties because of personal interests. As a consequence of a negative report of the imperial messenger, the Austrian Imperial Court Chamber took the control over the whole salt industry and centralized it (Trócsányi, 1988). After another uncertain period (Rakoczi's War of Independence) the attention to salt regalia became much more emphasized. It was clearly declared that all the salt mines, salt water springs and wells were in the property of the Imperial Treasury (Fallenbüchl, 1979; Zsámboki, 2005c). The serious oversights, the suppression of foreign salt products by introducing new regulations, the high internal prices for salt led to a remarkable contribution of the incomes generated by salt-related activities to the general imperial revenue: 20% in 1760-1804, 40% in 1828, 35% in 1838-1846 (Zsámboki, 2005c).

Starting from the second part of the 18th century, the situation of the salt water resources is described in various bibliographic sources related to natural sciences and ministerial decrees. There is a large literature dealing with this topic (mostly about the mines, but about the waters as well) as a result of the developments achieved in researching methods, more publishing opportunities and a great national interest for salt resources.

2.3. Scientific papers, as sources of information regarding the regulation of usage of salt waters during the 18th and the mid 19th centuries

Throughout the 18th and 19th centuries, until the middle of the 20th century, the salt water resources were considered as a property of the Imperial or National Treasury. Their regulation and supervision became more and more rigorous. Johann Ehrenreich von Fichtel (1780) seems to be the first author giving a map and a very detailed scientific description about the Transylvanian salt as a rock (geology), the salt mining, salt waters and some regulations. Considering Fichtel's work (1780) we can have a general overview about the legislation and regulation of usage of the salt waters in Transylvania at the end of the 18th century.

The salt (in any form of it, including salt waters) was one of the regalia goods meaning that nobody was allowed to use it without the special permission of the Emperor. Those persons who broke or limited the rules of the regalia (digging a salt pit or salt water well, using or selling the extracted product, stealing from the imperial mines, selling the officially purchased salt, importing salt from foreign countries), were to be punished. The whole salt industry was administrated and supervised by the Transylvanian Chamber that was subordinated to the Austrian Imperial Chamber. There were six salt offices in Transylvania marking the active salt mining places: Turda, Cojocna, Ocna Dej, Ocna Sibiului, Sic and Praid.

The springs and wells were guarded by a special staff called salt-guards, hired by the Chamber to prevent the stealing of the salt resources. Strong measures were taken to fight against theft, such as filling in the springs and wells that were located in the vicinity of an arranged, well known, guarded source. If a new spring was discovered, first of all it had to be announced to the Chamber. If that new spring was located on a plot of land of a settlement (not belonging to the imperial properties), and it had a natural origin, the community had the right to transform it into a well. This well had to be arranged with a built house above it which had to have two locks on it. One of the keys was held by the mayor of the settlement, while the other one by the salt-guard. Two days a week the community could take a predetermined amount of salt water from the well under the supervision of the mayor and the salt-guard. Fighting against theft was the community's duty as well, since they could lose the right of using the salt water if a fraud had happened. Finally the rule concerning the frequency of usage was extended to the older wells as well (Fichtel, 1780). Probably this rule regarding the management of the salt waters existed long before Fichtel's era, but he revealed that in practice guarding these resources was not taken so seriously.

The fact that the usage of salt waters was permitted under strict rules is confirmed by other bibliographic sources as well in the first part of the 19th century (Benigni von Mildenberg, 1837; Bielz, 1857; Hunfalvy, 1864; Mosel, 1865a). Natural occurrences of salt water continued to be guarded. Citizens of such settlements, where salt water sources were present, were allowed to take water under supervision twice a week for their own needs without giving it away or selling it. Salt guarding and observing the law were taken more and more seriously. We believe that the aim of restricting the usage of natural sources was to force people to purchase the salt products offered by the state. In order to illustrate how attached the Chamber was to generate income we need to mention that thousands of tons of salt debris that accumulated during the mining activities were thrown into the rivers yearly rather than selling it at a lower price (Mosel, 1865a; Schmidt and Liszkay, 1871).

Starting with the second part of the 19th century the scientific literature does not deal with the issue of regulation.

2.4. Official documents, as sources of information regarding the regulation of usage of salt waters during the 19th century

Topics from two parliamentary sittings (7th and 8th of May, 1844, CXLII and CXLIII parliamentary sittings) and a correspondence between Deák F., Ministry of Finance, and Kossuth L., Ministry of Justice in mid 19th century point out how problematic the salt question was at that time. In this decade, for a small period (during the Hungarian Revolution of 1848-49) Transylvania was attached to Hungary, so decisions made in the salt issue refer to the Transylvanian sites as well.

Deputies from Borsod and Maramureș counties, in their speech, discussed the question of salt resources. They believed the phrasing that the salt belongs to the crown would mean that it is a common property of the whole country and it does not belong exclusively to the emperor. The other interpretation of the law which says that 'salt mines are owned by the emperor' reveals that actually salt water springs and wells are not part of the mines and hence the free usage of them should be permitted (***, 1844a; ***, 1844b).

The correspondence between the two ministers in 1848 (Molnár, 1998) explains that the problem was understandable since the legal background did not specify exactly the status of salt waters. Based on the law that states that everybody must have – sell, buy or consume – only inland (Hungarian) salt does not follow that the salt springs usage is to be prohibited. It also reveals that the measures that were taken by the Treasury/Chamber to hinder the usage of salt waters were not actually legally acknowledged by the Hungarian state. The legally accepted action for the Treasury to make would have been the prohibition of preparation of solid salt out of salt water or the prohibition of selling the salt water. In this way people have the right to take salt water for their own needs and for their livestock. Finally the Transylvanian Parliamentary Act, with the number 1848/XI, enabled the free usage of salt water wells without any restriction (Márkus, 1896a).

After the Hungarian Revolution of 1848-49, the Austrian party acted very strictly in all items affecting the Hungarian issues. This was true to the handling of the salt resources as well. During a later parliamentary sitting, in 1868, deputy Gál J. explained in his speech that the low consumption of salt in Transylvania at that time could not be attributed to the usage of salt waters, because during the Austrian absolutist government generally two-thirds of the salt water wells and springs were filled in (Greguss, 1868). Surveillance of the salt resources continued all along the 19th century. The Ordinance 203/1852 (***, 1852) emitted by the military and civil governor (placed in Transylvania) reveals that the places with salt rock and brines were guarded by two types of personnel. The ones guarding the solid salt resources were hired by the Ministry of Finance and had some privileges. The personnel guarding the salt waters were hired on local scale.

A new and long-lasting mining law was proclaimed by the emperor on the 23rd of May 1854. This Austrian General Mining Law, enforced on the whole territory of the Empire, did not discuss the salt issue. The statement, found in Chapter I, Paragraph 4, reveals that the salt resources were to be regulated by special laws because they made the subject of state monopoly (***, 1854). The salt issue was put under the supervision of the Ministry of Finance (Balkay and Szeőke, 1901). In the forthcoming decades general acts (1868/XI, 1875/L, 1897/I) were dealing only with defining the prices of salt rock and regulating the trading activities (Pfeifer, 1868; Márkus, 1896c; Márkus, 1898).

Balkay and Szeőke (1901) gathered all the regulations (ordinances and supplements) regarding the salt issue that came out in the second part of the 19th century. This legislation was applied to the Transylvanian sites as well, since the territory was attached to Hungary again (Márkus, 1896b). According to the work of Balkay and Szeőke (1901), the salt issue continued to be an important factor during the entire 19th century and the regulations described in the 18th century continued to be maintained as well. Salt was considered as a subject of national excise. Salt (of any kind or in any form of it) found over or under the surface was the property of the state. The state had the exclusive right over the salt production/exploitation through mining activities or production from salt water. Anyone who found a salt site or salt water or a mixture of other ingredients with salt had the obligation to report it to the nearest financial office. In order to maintain the authority over all salt resources, the Treasury/Chamber had the right to fill in those salt springs that could not be useful for state purposes. In Transylvania and Maramureș, the practice of usage was allowed with the permission of the Ministry of Finance and under restrictions only for those people who had salt springs or wells near their settlements. It was forbidden to dig the spring into a well or to produce solid salt out of salt water without the permission of the financial authority. Based on the Ordinance no. 4231/878 issued by the Ministry of Finance, the import or transit of any foreign salt product, including the salt waters, was also generally forbidden. It was only allowed in exceptional cases with a special license from the Ministry of Finance (***, 1879).

In the first decades of the 20th century, focus shifted on the potassium salts, due to the discovery of their high importance in agriculture (Láng, 1910). The beginnings of this trend were already noticeable in the second part of the 19th century, when regarding to a new, Hungarian mining law proposal (that was not accepted by the Emperor in the end), it was recommended that the common term "salt" should be specified and used as "NaCl salt" when referring to this compound (***, 1871). Finally, through the Parliamentary Act VII/1911 potassium salts were attached to the state monopoly subjects beside the NaCl salt (Alliquander et al., 1931). This suggests that, on the basis of the monopoly, all the strict ordinances that were applied before concerning the salt resources, including the salt waters, were true in the first decades of the 20th century as well.

2.5. Changes in the appreciation of the salt resources during the 20th century

The interwar period brought big changes throughout the Transylvanian territory, since it became part of Romania. The subject matter of raw materials and mining were put under the supervision and enforcement of the Romanian Ministry of Industry and Commerce, while the direct coordination was made by the Mining Authority (***, 1924). The Romanian Constitution of 1923 (Art. 19.), published in the Official Journal of Romania (Monitorul Oficial al României, no. 282/ 29th of March, 1923), stated that all minerals and all subsurface resources are in the property of the state. This statement was corroborated with the Decree on the Mining Law no. 2.294 on the 3rd of July 1924, published in the Official Journal of Romania (Monitorul Oficial al României, no. 143/4th of July 1924). This document contains the regulations concerning salt resources including the salt waters as well. Art. 213 of the Mining Law declares that exploitation or extraction of salt through groundwork or dissolution and pumping or from salt springs and any other natural salt solution (salt groundwater, lakes, seawater) is the subject of state monopoly. This right is exercised by the Direction of State Monopolies. Art. 214 declares that salt trading is the exclusive right of the state and is transacted by the Ministry of Industry and Commerce. This right can be transferred partially to a private company or investor in such a way that a joint organization is established. Art. 215 says that any explorer or mining operator who encounters salt deposits or high concentration salt water has the obligation to notify the regional mining authority within three days. Art. 217 explains that the usage of salt water for bathing purposes in health resorts is allowed under the general regulation of mineral and therapeutic waters, but it is forbidden to extract crystalline salt from these waters.

This Mining Law, that suffered minor changes in 1929 and 1937, was in force until the Second World War (Baron and Dobre-Baron, 2001). With the nationalization law of 1948 (***, 1948) all the subsurface resources were declared again to be the property of the state (Art. 1) and it was in force until the end of 1980s / beginning of 1990s (end of communism in Romania).

István L. (1978) described most of the activities related to salt waters in Corund (Hungarian *Korond,* Harghita County) area in the first part of the 20th century. The habits that evolved among the people were the consequence of official regulations and were probably true to the whole Transylvanian area.

People were allowed to take salt water from the well once a week. The amount of water that could be taken was different for each family and was determined based on the number of family members and livestock at the beginning of each year. Based on these yearly calculations a so called salt card or salt ticket was issued by the salt-adjudicator that had to be paid at the communal cash desk. Half of this payment was spent on maintaining the salt well. The position of salt-adjudicator existed until the end of the 1950s. The disappearance of this function seems to mark the beginnings of a lower appreciation of the salt itself. In the 1970s no permission was needed anymore to take and use salt water.

Guarding the salt water places by salt-guards was active until the First World War when the issue of salt resources was subordinated to the Hungarian Ministry of Finance. After the First World War, no record was found to support the existence of this rigorous supervision of the resources. During the interwar period the salt materials were a subject of Romanian State Monopoly, with penalties if breaking the rules (***, 1924), but probably without guarding these places. During the Second World War, when a part of Transylvania was attached to Hungary, the old Hungarian restrictions came back, but because of wartime conditions, controlling and supervision of the sites was not taken so seriously (***, 1941).

We suppose that a change was brought to the issue of salt with the nationalization law in 1948 in Romania, since this legislation has eliminated its privileged status and treated it in a similar manner to the other resources.

3. A REVIEW OF THE LITERATURE ON TRANSYLVANIAN SALT WATER RESOURCES

Of all the scientific works dealing with the subject of salt water resources, four could be mentioned as being the most comprehensive and the most detailed. This literature covers the period from the end of the 18th century until the end of the 19th century and provides valuable information about the salt water resources from the era when salt was most appreciated. The focus in Fichtel's work (1780) is put mostly on rock salt, but he also publishes a list and a map with the places where salt waters appear on surface. At the beginning of the 19th century many authors use the data from Fichtel, so the first, very detailed list about the salt water places with the number of wells and springs discussed separately is published by Czekelius (1854). The following list with updates concerning the number of sources is related to Bernáth J. (1880) who published the results of a former survey (1873) that was made under official control. Compared to the previous articles, the value of Fischer's work (1887) is that he made chemical analyzes on the water samples that were sent to him, beside the presentation of the springs and wells for each settlement.

A new evaluation about the Transylvanian salt waters was initiated again by the state (Ministry of Finance) with the purpose of identifying potassium salts dissolved in water – the state was interested in potassium salts (deposits) since the discovery of their positive effects in agriculture as fertilizers. This survey was mostly made by Kalecsinszky S., but starting from 1907 Budai E. was responsible for gathering the salt water samples on the western side of the Transylvanian Basin (Kalecsinszky, 1902; 1903; 1905; 1909). Kalecsinszky (1909) reported that in order to gather the water samples for detailed analyses in the laboratory, they dig out many wells and springs that were filled in before. Based on our current knowledge the results of this survey regarding the NaCl salt waters were not published.

A new, survey-like investigation of the brackish waters and brines in Transylvania was not made since the beginning of the 20th century. Sturza M. (1930) in his work concerns the issue of the Transylvanian brines, but he mentions just a few examples from this area. In recent works the trend in research ideas is to analyze in detail from hydro-geo-chemical point of view some water samples from selected sources (Baciu et al., 2001; Cuna et al., 2001; Berdea et al., 2005; Kis, 2013; Brașovan et al., 2015). This kind of approach has its strengths, but a general, detailed, survey-like, systematic analysis is still missing.

4. MATERIALS AND METHODS TO THE CASE STUDY

In order to make a comparison between the number of salt sources described in the past and the present situation, we carried out a survey in 2016 by visiting the old salt water locations and looking for new sites in the area South of Cluj-Napoca. The locations for observation were selected based on the geology of the plot and lack of vegetation.

Shallow and deeper groundwater samples were analyzed by measuring the electric conductivity values and sporadically the sulphate concentration. The measurements were carried out using a Thermo Orion Star portable multiparameter meter and a Hanna Sulphate portable photometer. When processing data for map display, the inverse distance power interpolation method was used with high value for power.

5. CASE STUDY: SPRINGS AND WELLS IN THE AREA SOUTH OF CLUJ-NAPOCA CITY

In 1780 Fichtel mentioned about 120 places in Transylvania where salt waters can be found with more than 300 sources. Czekelius (1854) talked about 192 salt wells and 593 salt springs, while Mosel (1865b) mentioned 216 salt wells and 622 salt springs. Published by Bernáth J. in 1880, the list of salt water resources made in 1873 refered to a number of 235 wells and 415 springs. Fischer (1887) registered 269 locations in Transylvania where salt waters were to be found at the surface. There are differences between the lists of these authors regarding not just the number, but also the locations of the sources that can be explained by the disappearance of some wells/springs or the emergence or discovery of new sources.

In the narrow area delimited by Cluj-Napoca and Turda, Fichtel (1780) mentioned eight places where salt waters were to be found and the other authors mentioned seventeen. It is possible that mistakes were made when identifying these locations. For example only Czekelius (1854) mentioned a salt water spring at Copăceni. This village is missing from all the other works, even if Fischer (1887) marks also those sources that have disappeared in most of the cases. Another ambiguous case is represented by the well in Pata area that could be probably the same with the well in Gheorgheni area, even if Fischer (1887) tried to eliminate these kinds of mistakes as well.

Table 1. Evolution of the number of salt water resources

	Czekelius, 1854		**Bernath, 1880**		**Fischer, 1887**		**Present day**	
Settlements	well	spring	well	spring	well	spring	well	spring
Cluj-Napoca	0	3	0	3	0	4	0	2 (Sopor)
Someșeni	1	23	1	0	1	0	0	1 (+more)
Dezmir	1	4	1	4	1	3	0	1 (Pata-Rât)
Apahida	1	6	1	1	1	0	0	0
Cara	1	5	1	6	1	0	0	0
Cojocna	0	20	1	10	1	5	1	4
Pata	0	0	1	4	1	0	0	2
Gheorgheni	1	0	1	0	1	0	not visited	not visited
Feleacu	0	1	0	0	1	0	0	0
Aiton	1	1	1	0	1	0	not visited	not visited
Rediu	1	0	1	0	1	0	0	0
Ceanu Mic	1	0	1	0	1	0	0	2
Micesti	1	2	1	5	1	0	1	0
Deleni	1	0	1	0	1	0	1	0
Petreștii de Jos	-	-	1	0	1	0	0	1
Copăceni	0	1	-	-	-	-	not visited	not visited
Turda	0	0	1	1	1	3	not visited	not visited

A settlement generally had one salt-water well during the 19th century (table 1). The long term survival of the wells supports the habit of visiting (under restrictions) and maintaining these places. Unlike the wells, the number of springs shows a general decrease until the end of the 19th century (table 1). The literature of this topic says that people were allowed to use one well/village under supervision. Filling in the additional salt water sources was practiced mostly during the Austrian absolutist government (first part of the 19th century), but the law that allowed this act was in force until the first part of the 20th century. The wells were very well known, arranged places, and usually fed by shallow groundwater. Springs are generally more sensitive to the environmental changes and have lower discharge. The sporadic distribution of springs probably caused some difficulties when finding these items. All these could be the reason why the number of springs decreased; destroying them must have gone more slowly. The sources in Cojocna area were included in the table in order to illustrate the disappearance of springs over time.

We do not know how the number of these sources changed gradually during the 20th century. The present day situation shows a small number of salt water sources (table 1). Out of thirteen visited places that each had one well in 1887, only three have salt water as well in present day: Cojocna, Micești and Deleni. Active springs can be found in Cluj-Napoca (Sopor area), Someșeni (now part of Cluj-Napoca), Pata and Cojocna. The former springs in Dezmir are active as well and currently are part of the administrative area of Cluj-Napoca – the spring(s) that feed the salt pond at Pata-Rât. The sources that can be found in Ceanu Mic and Petreștii de Jos are just leakages and are located on the site where the former active sources were. None of the springs are protected or maintained. We believe that the drastic change in the number of salt water resources during the 20th century (probably the second part of the century) can be attributed to the disinterest, negligence and indifference of the people since the salt products are easily accessible on the market.

Settlements where salt water wells and springs were and are still present are marked on a geological background map (fig. 1) since the origin of the salinity is related to the Badenian salt deposits. There are fewer cases (Dezmir, Pata, Deleni) when these sites are in direct connection with the Badenian sedimentary, salt-bearing strata. In most of the cases the surface layer where the brines appear are Sarmatian sedimentary deposits or Holocene alluvial-delluvial deposits. The salt sites at Pata and Someșeni are directly linked to anticlines (fig. 1), but the presence of brines at the other locations may suggest that either the covering strata (Sarmatian or Holocene deposits) could be thin or the movement of water is ascending from deeper layers.

If the pathway of ascending water is interrupted close to the surface, the "water-course" can continue to circulate through other shallow subsurface routes to emerge as a spring at other location. From this point of view, using the old descriptions, we investigated the closer surroundings of the former springs and those areas where the Badenian, salt-bearing strata are at the surface. Figure 2 presents the electric conductivity of shallow groundwater and the known brines from 35 sample points on the area located South of Cluj-Napoca City, a transitory zone between the Miocene sediments and the Paleocene-Eocene sediments of the Transylvanian (western) Basin.

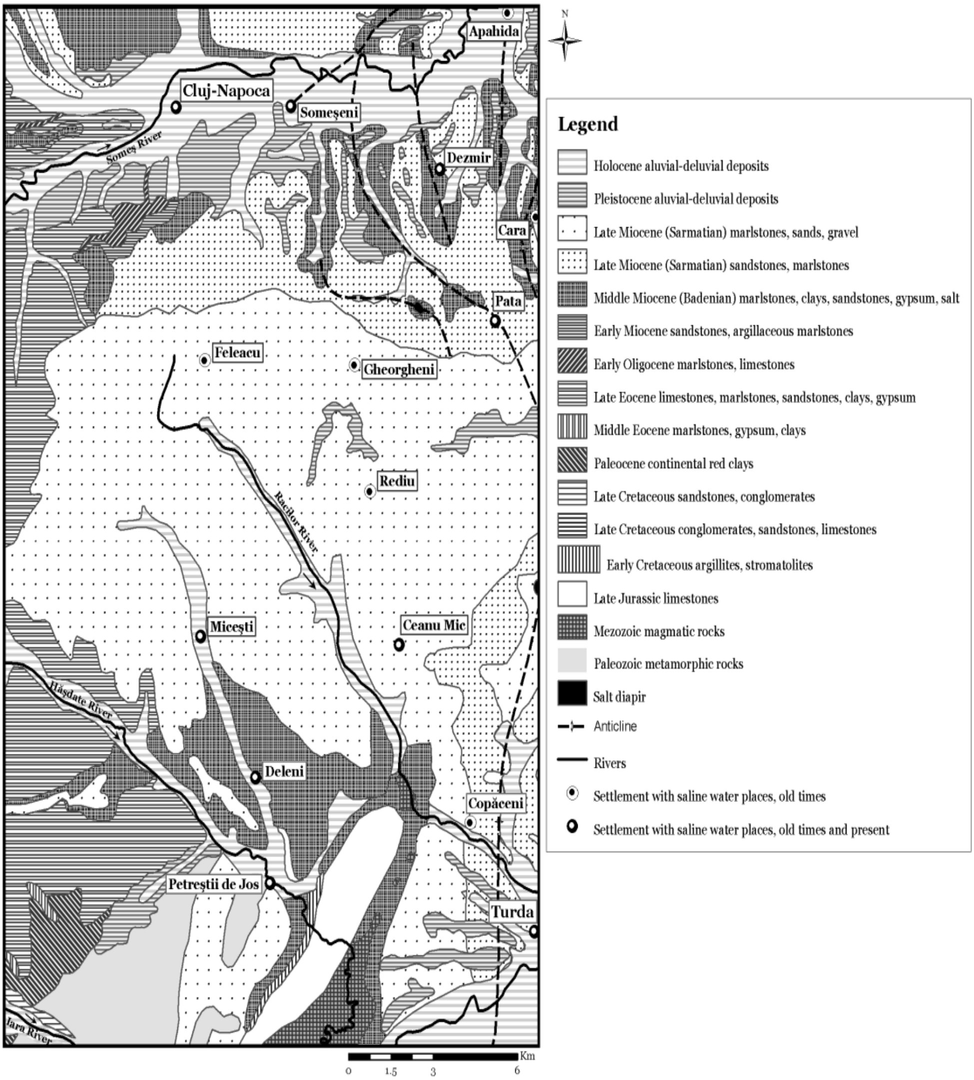

Fig. 1. Settlements with salt water resources represented on a geological background map (*source for geology: Răileanu and Saulea, 1967; Giuşcă and Bleahu, 1967*)

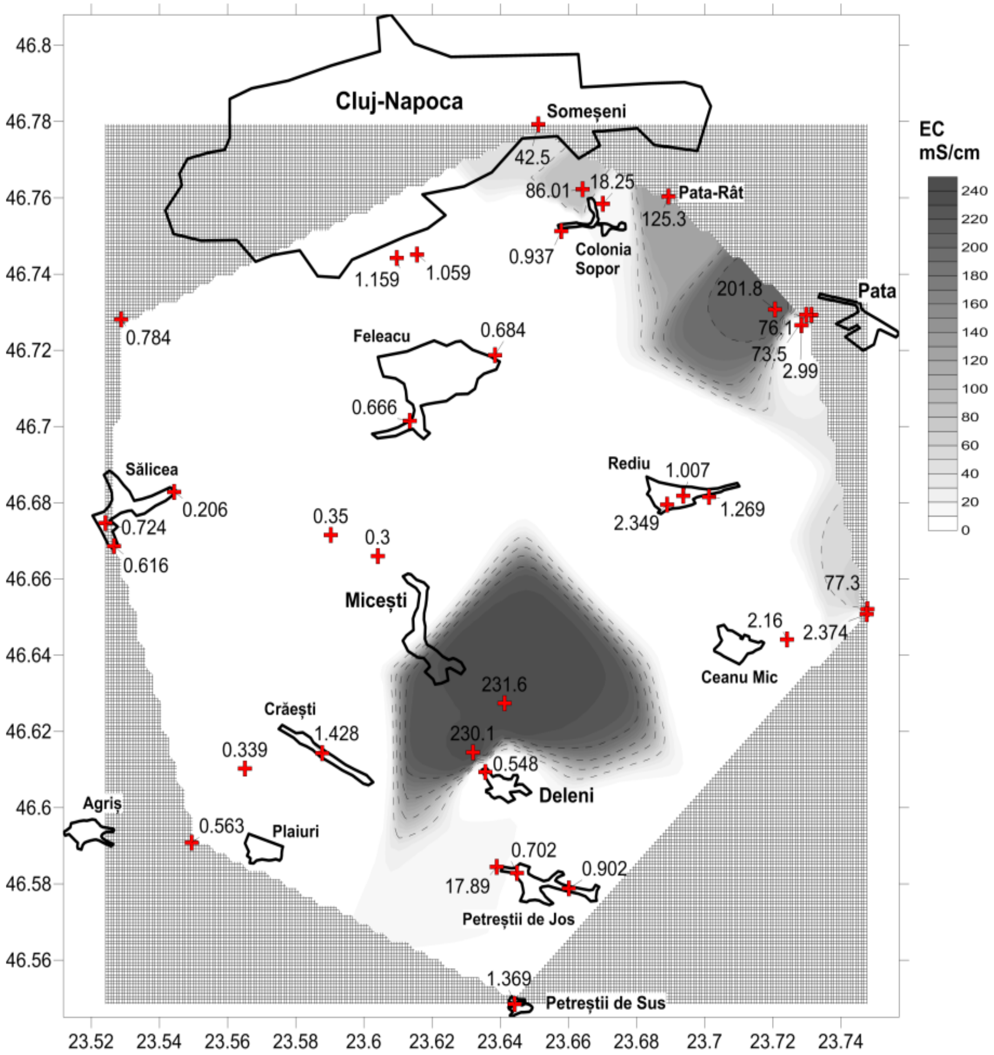

Fig. 2. Electrical conductivity values of samples from the area South of Cluj-Napoca

The brines located at Someșeni, Sopor, Pata-Rât, Pata and to the west of Ceanu Mic (positioned along a continuous line that heads to Turda) could be associated with the most western anticlines that bring the salt close to the surface. These could be pointy, narrow salt intrusions, since the mineralization of groundwater in the vicinity of the brines is already low in many cases in comparison to the high concentration of the brines.

The Micești-Deleni area seems to be the most western salt site between Cluj-Napoca and Turda. These wells have the highest mineralized water (≈ 230 ms/cm) with high sulphate concentration (4.6 g/l in the sample from Micești). These data suggest that this separate salt site may be fed by deeper, ascending water. No other salt sites were identified across the rest of the area.

6. (INSTEAD OF) CONCLUSIONS

Salt waters are surface or subsurface natural resources. The appreciation of these sources has changed during the centuries from highly valuable but freely used status to the degree of highly appreciated with usage restrictions. Nowadays it seems to have a generally lower degree of recognition. At a closer look, it can be noticed that the salt is still important to the country's economy, since it is used on large scales by the industry while salt waters are utilized in balneotherapy, but there is no such a high degree of enthusiasm for it, as it was during the 18th and 19th centuries. This transformation could be explained by multiple changes that happened in other fields, like the development of the mining technology, the abundant supply of the market with these products or the consumers' behaviour. We believe that answering this question belongs to other scientific fields.

Among traditionally organized communities, these waters are still in use and some settlements still have their own salt water well. Springs are not used or protected. The usage of water is free of charge; the restrictions, if any, serve the protection of the sources (for example at Corund and Lueta in the eastern part of the Transylvanian Basin). The brine wells at Cojocna, Deleni and Micești are under usage and can be visited any time, but they are treated with less care.

The number of the salt sources is not as high as it was in past centuries. It would be recommended to pay more attention to these sites not just in order to protect them as a resource but also to have a better understanding of their hydrogeological characteristics.

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SPACE TIME EVOLUTION OF THE MAIN GEOGRAPHICAL ELEMENTS OF BAIA MARE DEPRESSION USING GIS METHODS

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ABSTRACT. – Space Time Evolution of the Main Geographical Elements of Baia Mare Depression Using GIS Methods. This paper aims at following the time and space evolution of several geographical elements of either physical or human nature in Baia Mare Depression. This action was based on a series of satellite images from Landsat and Sentinel satellites, taken in different years between 1986 and 2017. Significant alterations have been discovered after processing such images. The lower drainage basins of Someș and Lăpuș Rivers have changed; their routes underwent alterations of their meanders on a distance of 500 meters during the period mentioned above (1986-2017). The wooded areas have also been altered, in both a negative (clearances) and positive (plantations) manner. Because Baia Mare was a major mining town, several tailing dumps and tailing management facilities have been established around it. Their evolution has been followed in this article, including the 2000 accident, which was one of the most unprofitable ecologic disasters of Romania. At the same time, the evolution of the city of Baia Mare has been assessed in an analysis where the built-up areas have been considered.

Keywords: *Landsat, Sentinel, rivers, vegetation, urban, catastrophes*.

1. INTRODUCTION

The number of fields where remote-sensing data can be used have increased once the equipment used to secure such data has been modernized. One of the main aims for using such data is the study of terrestrial surfaces. Such data are in fact satellite imaging based on which the information is secured after processing such images.

The main aim of this study is represented by following the time and space evolution of several elements from the natural and man-made environments, based on a set of satellite images taken between 1986 and 2017. The following

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elements have been analyzed: the urban areas, the tailing dumps and the tailing management facilities, the rivers and the vegetation. The NDBI index has been calculated to better emphasize the evolution of urban areas, and the NDVI index has been calculated so as to make a differentiation between the vegetation types.

The use of data secured from remote-sensing and the development of such analyses are critical for addressing different types of environmental issues. For instance, following an analysis of the vegetation correlated with the geological sub-layer and the hydrographic network, one can identify the areas that are suitable for dwelling and building constructions; at the same time, if only one type of vegetation is analyzed, like forestry, one can follow up the clearances or forestation of some areas. Based on the urban area analysis, one can acknowledge the depopulation or overcrowding of some built-up areas. Surveillance and analysis on the extension of several tailing dumps can be useful in taking decisions against closing one dump or for establishing the footprint of such dump so as it would not impact the area where it is located. The analysis of river evolution may be useful for engineers that must decide if a hydropower plant can be developed on the respective river, or in the case of deciding if that river meets the requirements for sports, like rafting. All these issues are critical and addressing such issues is useful for several fields. After reading specific literature, no paper was discovered on this matter, specifically for this particular area, and that is why we intend through this study to take the first step in approaching this topic for the selected study area, bringing some additional information within the field of geography.

The study area includes a part of Baia Mare Depression and the city of Baia Mare. This area has been selected due to the fact that it has been considered relevant for this type of study, and due to a personal reason, the author of this study being a local from Baia Mare, which offered a better understanding of the reality existing in this area.

Description of the area

This part of the paper is critical in a geographical study. The first question "troubling" the geographer is represented by the interrogation "where?". This leads to the desire of humans to learn where they are, where a particular event takes place or where a particular landform element exists.

The study area overlaps over the central south - western side of Maramureș County, within Baia Mare Depression to be more exact, and to this area the northern side of the town of Baia Mare is added (N of Săsar River), an area framed by Filip S. (2008) as hilly and named as Munceii Baii Mari. At the same time, we should stipulate the fact that the outline of Baia Mare Depression has been performed by using the geomorphological regionalization proposed by Posea G. (2005).

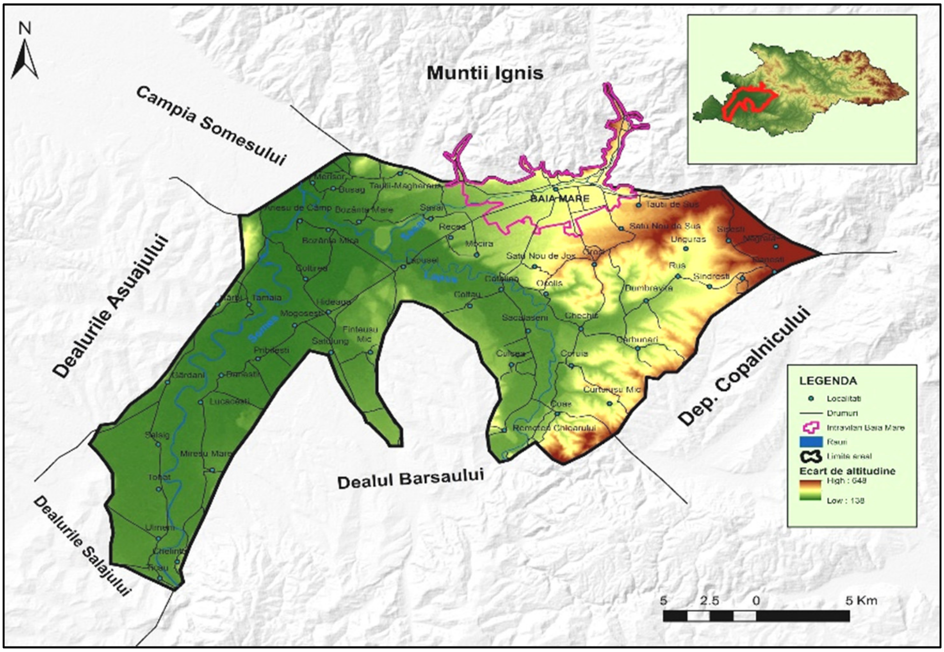


Fig. 1. Location map of the area of study

For an improved positional accuracy, the map of the location (Fig. 1) was prepared, against the surrounding landforms, observing most of the regionalization proposed by Posea G., (2005). In this manner, the study area is delineated on its northern side by the volcanic massif of Neogene age, Igniș Mountains (Borcoș, et al., 1973). The limit in the south-eastern side is Copalnic Depression, the southern limit is Bârsău Hill, the south-eastern one is Sălaj Hill, the western limit is Asuaj Hill, and the north - western limit is Someș River Lower Plain.

The entire depression is drained by several rivers, and the final common outlet is Someș River, which is located on the western side of this area, being south to north oriented. Lăpuș River drains the central and eastern sides of the area, draining the secondary outlet, Cavnic River. Other major rivers, which have been included on the map so as to observe the selectivity principle critical in preparing a map, are set forth below: Săsar River, crossing Baia Mare from East to West, Firiza River flowing from the northern side of the town and draining into Săsar River, and Craica Stream.

In order to pinpoint the study area accurately, including for individuals not familiar with this region, I have tried to stipulate the exact geographical coordinates with the help of Global Mapper 17.2. Thus, the coordinates are:

- North 47º43'05'' northern latitude
- South 47º36'16'' northern latitude
- East 23º46'27'' eastern longitude
- West 23º15'18'' eastern longitude

2. MATERIALS AND METHODS

This section describes the steps taken to achieve the results.

Initially, the foundation of the research consisted of the satellite imaging Landsat 5, 7 and 8, as downloaded from USGS and Sentinel 2-A. The image overlapping the study area has been selected. The images with low cloud cover have been selected from the rich archives. The selected images are from different years (1986, 1999, 2000, 2006, 2016, 2017) and all from approximately the same period of a year, namely August-September.

The second step consisted of image processing. Initially the ERDAS IMAGINE 9.2 software has been used. The stack of images has been first created. The atmospheric corrections followed. The RMSE has been calculated so as to verify the overlapping level of these satellite images, where the maximum value for Landsat images was 0.2 pixels (maximum value). Next, these were reproject from WGS84 coordinate system in the national Stereo 70 system, by using ArcMap 10.2.2, and later the images have been cut off by using a preestablished outline.

The third step consisted of extracting the information from satellite imaging. For this aim, the ArcMap 10.2.2 software has been used so as to digitize the main studied elements (rivers, woods, town, tailing management facilities), and subsequently the surfaces from several satellite images from different years have been measured, together with the use of supervised classifications. The resulting data have been integrated in drawings and Excel tables. NDVI and NDBI indexes have been calculated and processed with ArcMap 10.2.2.

The most used methods:

- Analysis Method - used to extract data.
- Summary Method - this is dialectical to the first method. After territory analysis, the data have been recomposed so as to explain the geographical events.
- Mapping Method - used to draw the maps necessary for the study.

The selected topic consists of a space-time analysis of the geographical elements in Baia Mare Depression. This required the use of history (time evolution), spatiality and causality principles.

3. RESULTS AND DISCUSSIONS

Space-time evolution of Someș and Lăpuș Rivers

One of the geographical processes with an elevated space-time dynamic is represented by the riverbeds. The riverbed is one of the most dynamic landforms, as there is a permanent interaction between the hydraulic energy of the watercourse and the material resistance of the riverbed (Hosu, 2009; Rădoane, 2001).

In this study, one of the elements studied from the space-time perspective was the riverbed of Someș and Lăpuș Rivers overlapping the Baia Mare Depression. After processing several Landsat (5, 7, and 8) satellite images, one was able to see that the dynamics in this sector of riverbeds was high. This is due to several factors, but the most important ones are the sloping and the geological sub-layer. Thus, Batuca et al. (1989) stipulates the fact that the slope is one of the most important parameters leading to meandering. The occurrence of meanders is explained based on this, due to the fact that within the study area there is a passing from hilly areas (Sălaj Hills, Groși Hills, and hills of Copalnic Depression) to lower areas, similar to plain areas and overlapping Baia Mare Depression. At the same time, the passing to Someș Plain occurs here, a plain included in the Western Plain geomorphological unit.

A second important parameter in the evolution of riverbed dynamics is represented by sub-layer. Thus, it has been proven in a scientific manner by expert researches in the riverbeds morpho-dynamics that the river meandre is developed within sectors overlapping a sub-layer consisting of fine particles, especially sands and clays (Batuca, et al, 1989; Mac, 1976; Rădoane, 2001). This can be proven by reading the geological map 1:2000000 -Baia Mare Sheet (Borcoș, et al 1973), where this sub-layer is proven to exist.

The information on the evolution of Someș and Lăpuș River Beds has been extracted by digitization, using two Landsat satellite images. Due to selection reasons and in order not to overload the mapping materials, a comparison between the two riverbeds was done for only two moments in time (1986 and 2016). The 1986 image was taken by Landsat 5 Satellite on August 8th, 1986 and the în data de 8 august 1986, and the 2016 image was taken by Landsat 8 Satellite on August 26th, 2016. Thus, the 30-year evolution of the respective riverbeds has been followed.

The area has been divided in several sectors (A, B, C, D) so as to ease the reading of the mapping materials and to follow in detail the evolution thereof, as presented in the following map.

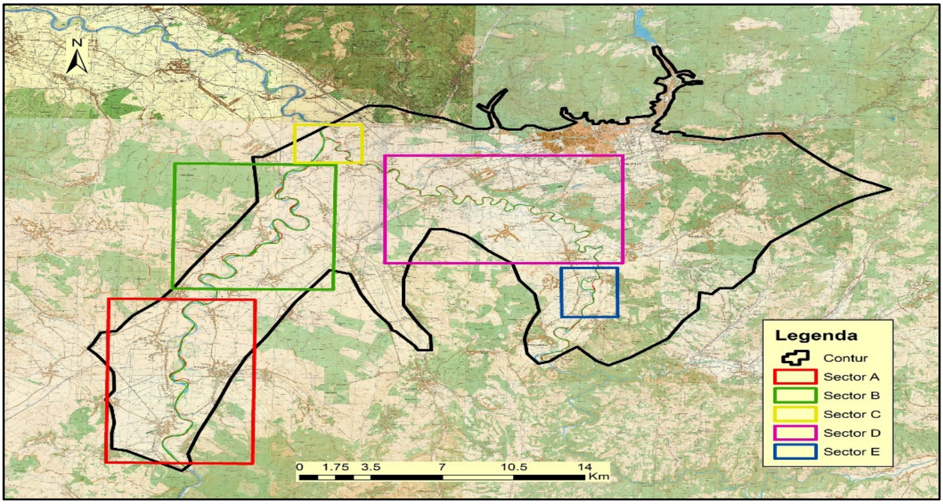


Fig. 2. Map of studied sectors

For comparison purposes, the topographic map 1:25000 has been used as background.

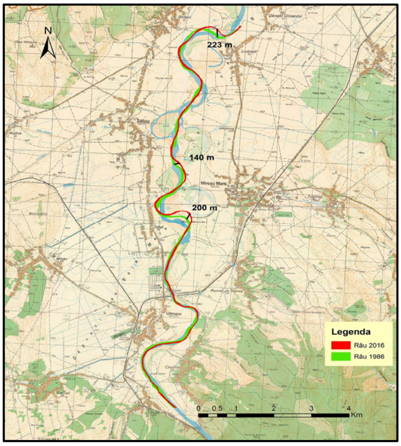


Fig. 3. Sector A

Sector A overlaps the Someș River course between Ulmeni and Dăneștii Chioarului localities. In order to emphasize the morphodynamic evolution, the riverbeds in 1986 and 2016 have been digitized, and a measurement has been performed for the key sectors by using ArcMap 10.2.2, in order to stipulate the value with which they "migrated" during this period. One can see that as compared to 1986, Someș riverbed evolved with values totaling 200 and 140 m towards east and northeast, near Mireșu Mare locality. At the same time, an evolution towards north is observed, with a value of 223 m near Lucăcești locality.

Sector B overlaps the route followed by Someș River between Dăneștii Chioarului and Ardusat localities. After analyzing the map, one can see alterations of the riverbed within several key sectors. Thus, the route has altered since 1986 mark with 170 m towards north-west near Fărcașa Commune, 150 north-west near Tamaia locality, 180 m south-east and 186 m east near the same locality (Tamaia) and 113 m south near Colțirea locality.

Sector C is located near Arieșu de Câmp and Busag localities. By analyzing the specific map of this sector, one can see a significant movement of the discharge area of Lăpuș River upon entering Someș River. This moved towards north with 182 meters. One can also see a movement towards northeast of Lăpuș River route from 2016 with 126 meters.

Sector D overlaps the route followed by Lăpuș River between localities of Bozânta Mare and Săcălășeni. The route crosses an area of terraces. After analyzing the specific map of the sector, one can see an alteration of the river bed from 2016 with 186 m towards south upon confluence with Săsar River, 90 m towards north - east near Lăpușel, 105 m and 97 m respectively near Mocira, and 66 m towards south near Săcălășeni.

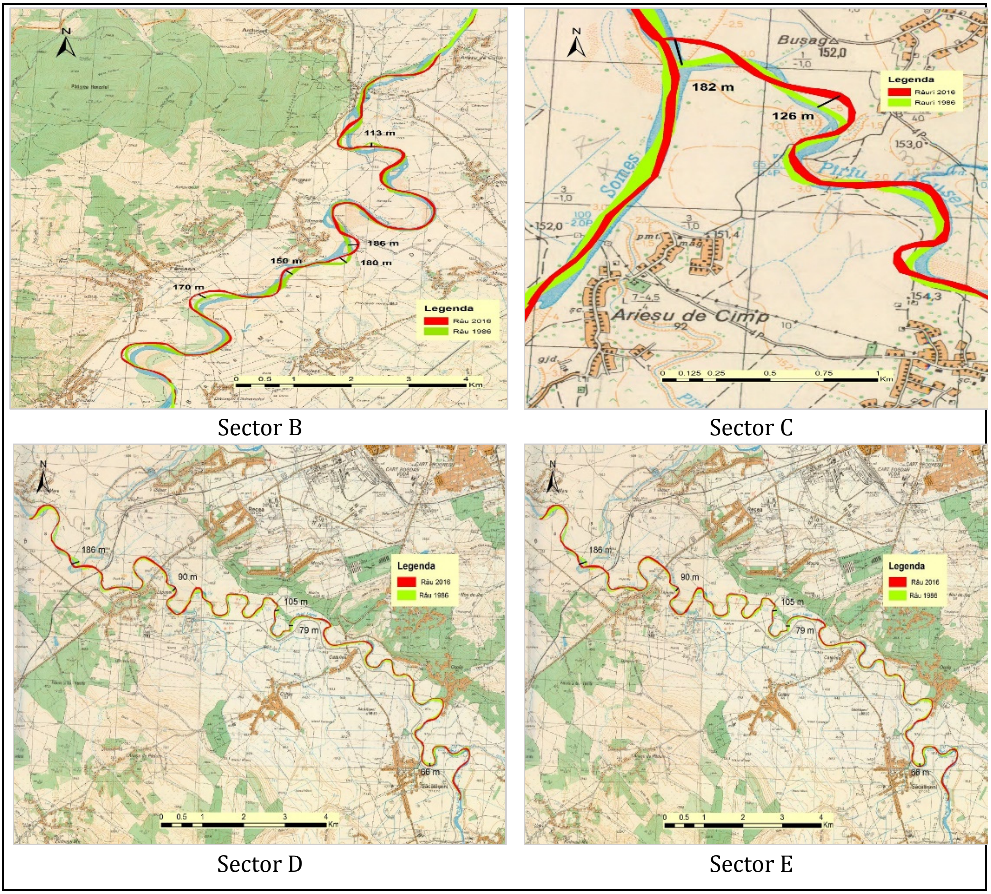


Fig. 4. Other sectors

Sector E represents the last study area of the riverbed dynamics. This sector coverts the area between localities of Săcălășeni and Remecioara. Here, one can see the highest level of evolution. This is represented by the cut of a meander loop from 1986 towards the route followed in 2016. The difference between the meander and the relatively linear route from 2016 is 571 m. In addition, a cut meander was identified near Coaș, but this is at a lower scale than the first meander, i.e. only 164 m.

Spece-time evolution of forest

Another physical-geographical element resulting in an elevated dynamics within time and space is represented by the vegetation. Amongst these, a rapid evolution is seen at the vegetation areas overlapping farming lands, orchards, and forested areas. Two Landsat satellite images from 1986 and 2016 have been compared so as to see the time and space evolution of the wooded parcels existing within Baia Mare Depression. A supervised classification has been carried out so as to identify and calculate the wooded parcels, and subsequently a raster-to-vector conversion allowing calculation of the surfaces in ha, by applying the calculate geometry function on the accompanying table.

In order to summarize the information efficiently, the wooded parcels have been numbered as presented in the following map.

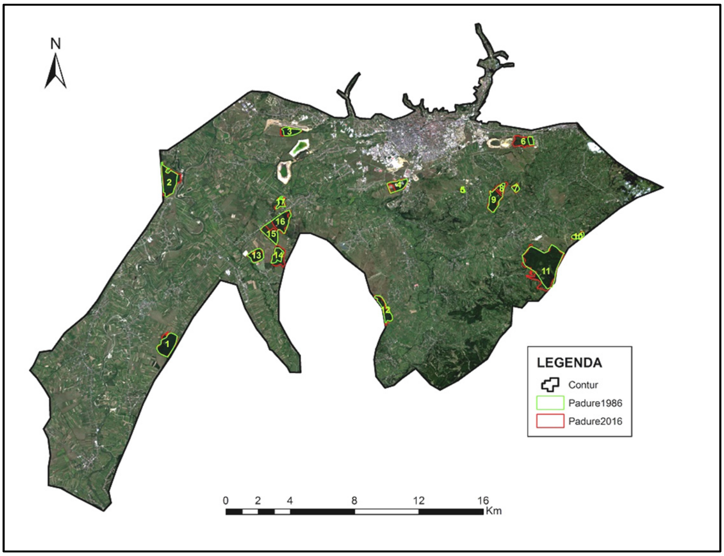


Fig. 5. Localization and coding of forest plots

The following data resulted from calculating the area of parcels by using the Calculate Geometry function as applied to the attribute table in ArcMap 10.2.2, being summarized in the table below.

Table 1. The area of the forest plots of the Baia Mare Depression

	The forest area 2016 (ha)	**The forest area 1986 (ha)**
Zone 1	117.403	112.055
Zone 2	139.909	127.687
Zone 3	50.909	42.952
Zone 4	57.243	66.452
Zone 5	4.301	5.361
Zone 6	70.976	14.832
Zone 7	16.680	15.147
Zone 8	25.755	29.875
Zone 9	78.476	82.596
Zone 10	19.873	17.906
Zone 11	425.141	392.543
Zone 12	60.420	64.666
Zone 13	52.063	59.487
Zone 14	79.351	45.774
Zone 15	62.152	84.152
Zone 16	92.912	114.912
Zone 17	25.505	18.855

A chart has been prepared to facilitate the comparison of the evolution of surfaces between 1986 and 2016.

After analyzing the above chart, and extension of the wooded areas is noted within areas (Z1, Z2, Z6, Z7, Z10, Z11, Z14, Z17), the most evident one being within Z6 area. This area overlaps a former tailings dump near Tăuţii de Sus village, a dump that has been rehabilitated and partially reforested. In the case of the remaining areas, a reduction of wooded areas was noted.

In order to observe the other vegetation alterations, the calculation of a NDVI (Normalized Difference Vegetation Index) satellite index was done for satellite images from 1986, 2000 and 2016. The index was calculated in ArcMap 10.2.2 software by using the methodology proposed by the site: http://earthobservatory.nasa.gov/Features/MeasuringVegetation/measuring_vegetation_2.php. An NDVI calculation has been performed also on a Sentinel 2-A satellite image so as to have up-to-date data, by observing the same methodology as presented above.

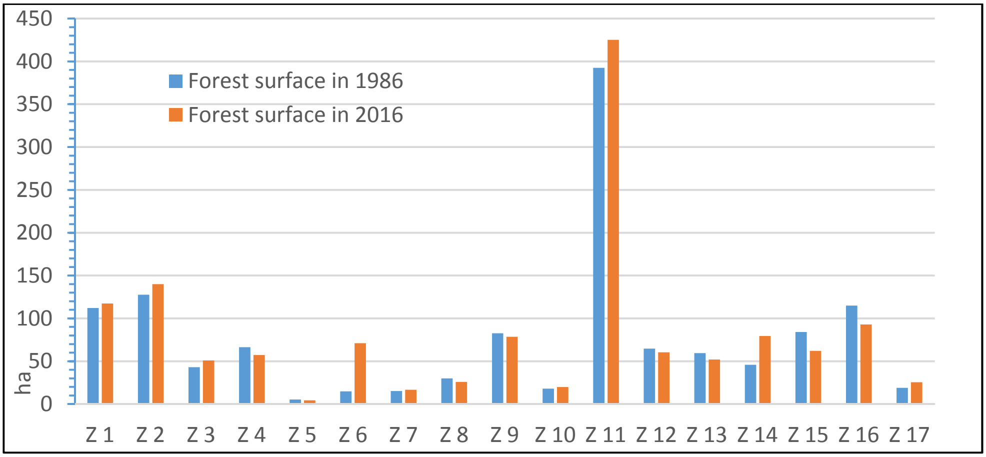
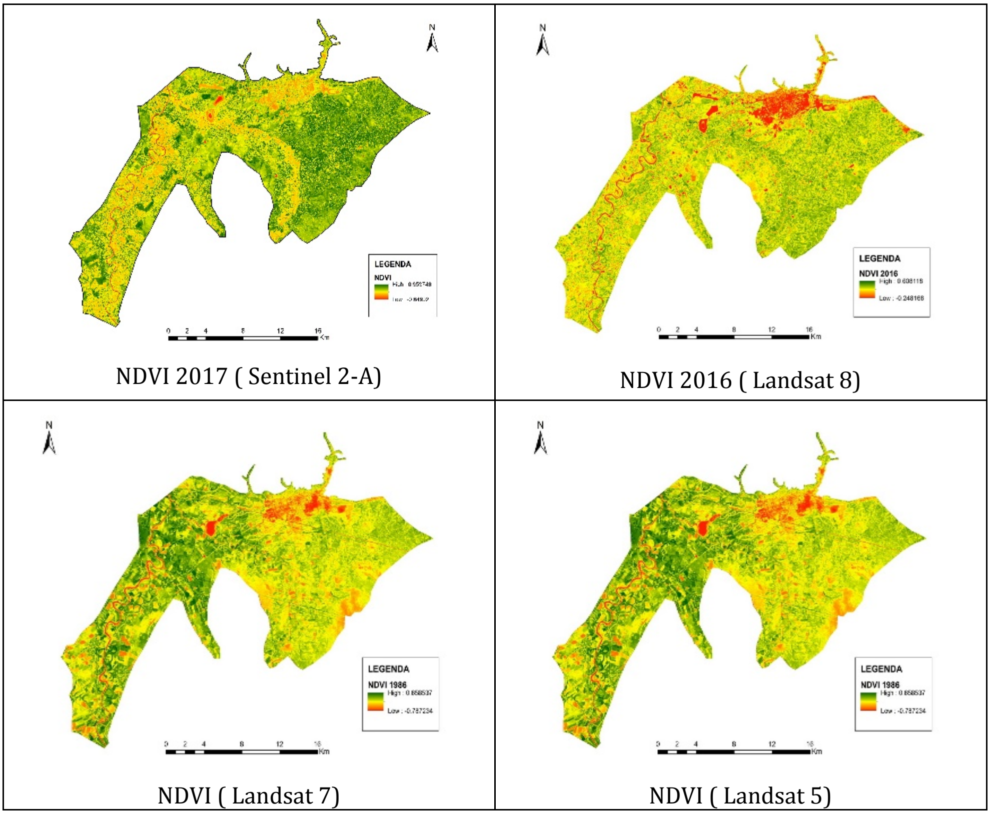


Fig. 6. Chart of forest surface



NDVI 2017 (Sentinel 2-A)

NDVI 2016 (Landsat 8)

NDVI (Landsat 7)

NDVI (Landsat 5)

Fig 7. NDVI

The resulting values are comprised between -1 and 1. The values close to -1 express a lack of vegetation and they are presented with red color, and the values close to 1, express a higher density of vegetation and are presented with a dark green color.

After analyzing the three maps, one can see that the areas with no vegetation (red color) overlap the built-up area of Baia Mare, the tailing dumps and the riverbeds. One can see by comparing year 1986 with year 2016 that the western area of the study region (overlapping the Someș meadow) presents a higher density of vegetation (dark green color) in 1986. This may be because agriculture was critical for Romania's economic system during that particular period, and all land positions with a certain agricultural potential have been used. Currently, many of the farming lands are no longer worked by peasants, and this is how the low values of NDVI for 2016 can be explained.

Space-time evolution of tailing dumps

An application of remote-sensing technology within the Baia Mare Depression is represented by the research of the space-time evolution of the tailing dumps and tailing management facilities. Baia Mare was famous for its intense activity on mining non-ferrous ores (gold, silver, zinc, copper, lead, etc.) The surplus was stored at different tailing management facilities, together with the substance used in processing these ores, loaded with cyanide. One can see that these facilities have had an elevated dynamics after analyzing the satellite imaging. Maybe the most important dynamic, in a negative manner, was the failure of dams of one of the tailing management facilities operated by SC AURUL SA on January 30th, 2000. In order to identify clearly each tailing management facility (TMF) whose evolution we are describing here, we have used the encoding presented on the following map.

We need to stipulate that the wet surface of the TMF has been measured, being the one with the highest dynamics. The TMF bodies suffered no major alterations in time. In order to see the wet body accurately, we have used a combination of 432 bands, in the case of images taken by Landsat 5 and 7 and a combination of 543 bands in the case of images taken by Landsat 8.

The TMF no.1 belonged to SC AURUL SA, and substances resulting from gold processing have been stored at this TMF. This TMF is older than 1986 and its surface decreased from 43 ha in 1986, down to 13 ha.

An abnormal evolution has been seen with TMF no. 2 that resulted in serious environmental damages in 2000, when over 100,000 m^3 of substances with cyanide have been spilled. One can see on the following table a comparison between 1999 and 2000.

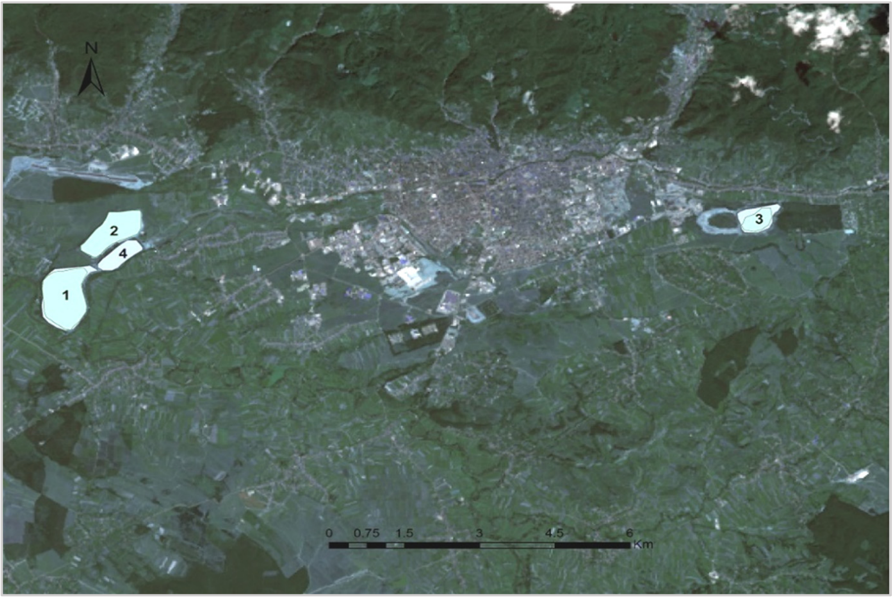


Fig. 8. Map of tailing ponds and tailing dumps

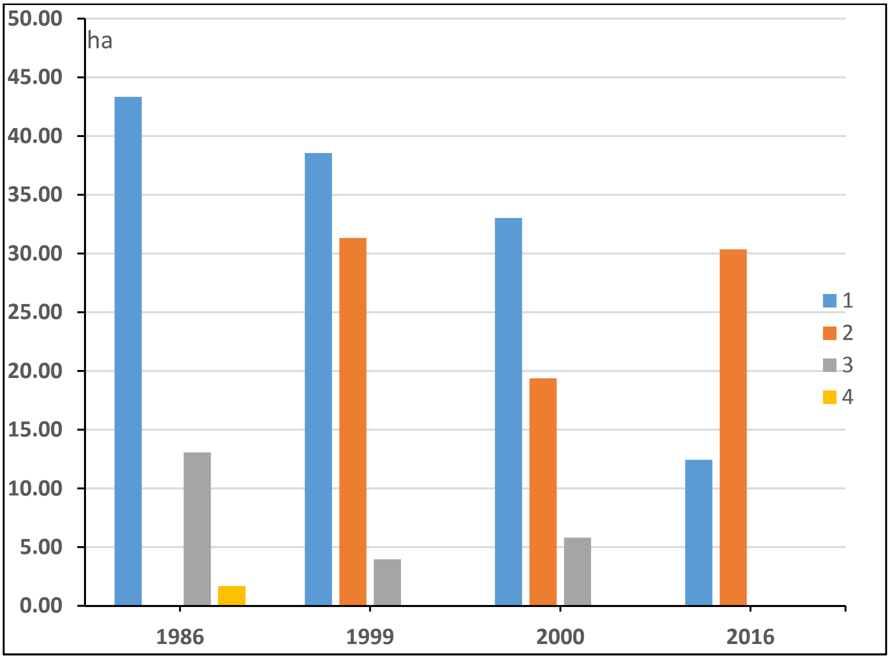
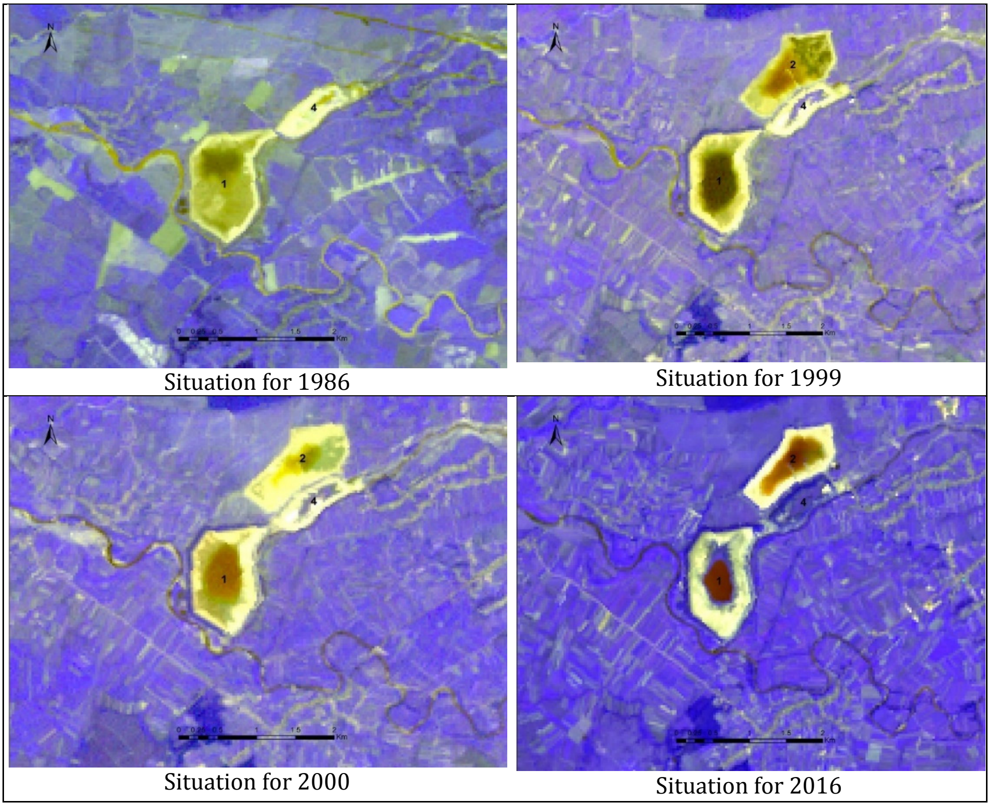


Fig. 9. Chart of tailing dumps surface evolutions

The tailings dump no. 3 is located east of Baia Mare, within the area of Tauţii de Sus.

As it can be seen on the chart, the dump reduced its surface down to a complete disappearance, currently being a rehabilitated dump and undergoing a reforestation process.

The TMF no. 4 has been decommissioned in the late 80s. The TMF no. 2 has been built near this TMF no. 4 and commissioned in 1999.



Situation for 1986

Situation for 1999

Situation for 2000

Situation for 2016

Fig. 9. Evolution of TMF in the Bozânta-Săsar area

Space-time evolution of built-up areas in the town of Baia Mare

The geographical element with the highest dynamics is represented by the Baia Mare built-up area. This evolution can be seen without detailed analyses based on satellite imaging and maps. By merely observing at a particular period of time, one can see the dynamics associated with the increase of the surface covered by the built-up area.

The digitization based on Landsat satellite images from 1986, 2000, 2006, and 2016 has been used so as to emphasize with exact data the town dynamics, together with the space covered by urban constructions of Baia Mare. The evolution is seen on the following map, where the polygons on those four years are marked.

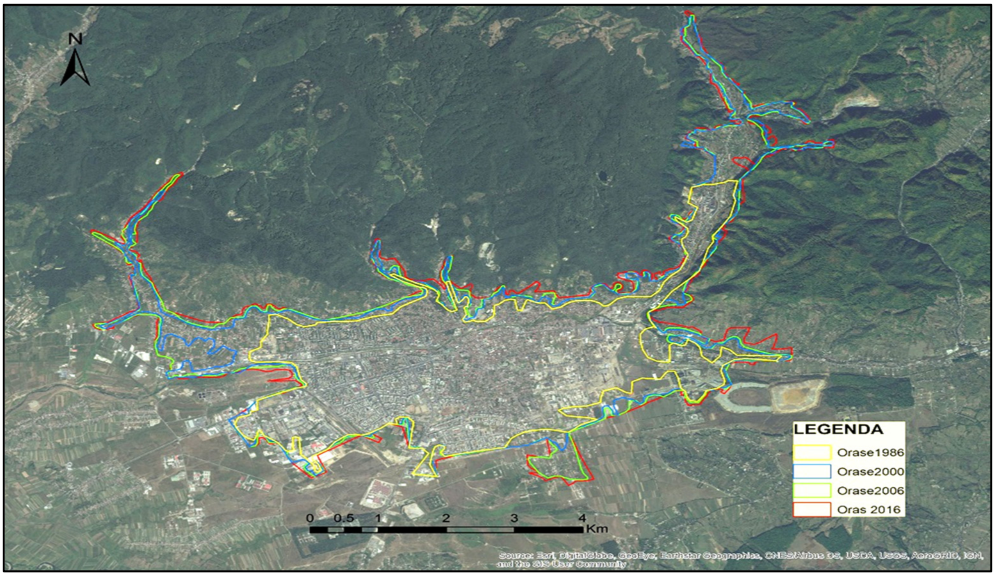


Fig. 10. Evolution of Baia Mare

The values of the surfaces from each year are summarized in the chart and table presented below.

Table 2. Evolution in time of the surface covered by Baia Mare

Year	Area (km^2)
1986	15.344
2000	20.844
2006	22.435
2016	24.464

The town increased its surface with about 10 km^2 between 1986 and 2016, as resulting from the analysis of this material. This is a paradox because during this period, according to the National Institute of Statistics, the town suffered a major decrease of population, from approximately 155,000 in 1991, down to approximately 120,000 in 2011.

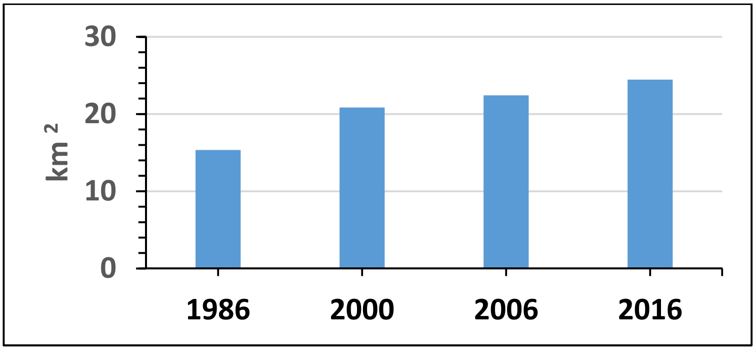


Fig. 11. Chart of urban surface

In order to emphasize the extension of the town during several years, the map of 1787 of the town was used against the current map. The map was secured from and its scale was adjusted by using the website http://mapire.eu/en/.

It has been established by using the calculation of surfaces from this site that Baia Mare had a surface of only 3 Km^2 in 1787. Thus, from 1787 to date, Baia Mare extended its area 9 times.

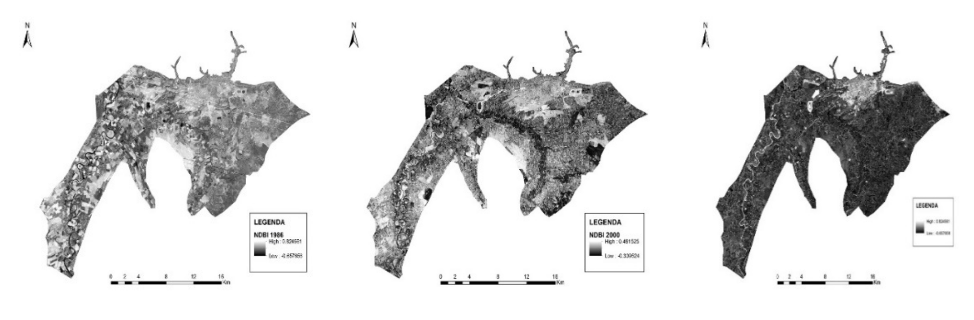
Fig. 12. The expansion of the city in 1787 and 2016
(source: Joseph II maps accessed on http://mapire.eu/en/)

Aside NDVI index for vegetation, the NDBI index (Normalized Difference Built Index) has also been used. The calculation of this index has been performed by observing the methodology proposed by Nitin, et al. (2014) for Landsat 8 and Mihai, et al (2012) for Landsat 7.

Thus, the formula to calculate the index is:

$$NDBI= (IR-NIR)/(IR+NIR)$$

The NDBI values vary depending on the spectral signatures from middle infrared (high reflectance of soil humidity, vegetation, rocks, including building materials) and narrow infrared (high reflectance of chlorophyll). The values are comprised between -1 and +1. The pale colors (positive values) symbolize the land positions with constructions. The dark colors (negative values) symbolize the other landscape elements woods, farming land, etc. (Nitin et al., 2014)



NDBI 1986 NDBI 2000 NDBI 2016

Fig. 13. NDBI index

By analyzing these three situations, one can see that the highest values overlap the built-up area of Baia Mare and localities, and the lowest values overlap farming lands and land position with no constructions.

4. CONCLUSIONS

The following conclusions have been drawn after studying the space-time evolution of the main geographical elements from Baia Mare Depression:

- The two rivers, Someș and Lăpuș, whose alteration has been studied, presented an evolution meeting the general geomorphological descriptions of a water course in a depression. Thus, by crossing an area with a low sloping, they developed meanders that altered between 1986 and 2016. Many changed their position, but there were situations in which a meander was cut, becoming in this manner an abandoned river branch.

This can be explained with the fact that a river "seeks" to alter its route and "selects" the easiest path, with a low consumption of energy. The evolution of rivers was easily followed from the maps with the help of the two situations of the lower river beds (1986-2016)

- In the case of vegetation, one could see that there is a situation of national paroxysm in some areas, i.e. some forested areas extended in 2016 as opposed to their surface in 1986. After tracking the evolution of NDVI index, one could see a negative evolution within the Someș meadow area. The density of vegetation being higher in 1986 because the area overlaps an area of fertile soils and the farming policies in place at that time required maximum use of these parcels.
- The space and time evolution of Baia Mare emphasized an extension of its surface from 1986 with approximately 10 km^2. In 2016, the surface covered by the town was 24.4 km^2. Again, this is paradoxical due to the fact that the population decreased during this period. Notable evolution has been observed within the northern side of the town, a place where the following quarters have been built: "Sub-Dura", "Valea Roșie" and "Valea Borcutului", as well as the East and South of the town where major alteration of the industrial facilities have been noticed.
- After analyzing the evolution of tailing dumps and TMFs located within the eastern and western side of Baia Mare, a general trend of reduction of the tailings covered surfaces has been observed. A different evolution has been recorded for Aurul's TMF commissioned on 1999 and, shortly after, a major dam failure occured in year 2000 that lead to the reduction of its footprint covered with substances, resulting in an environmental catastrophe. Many of these dumps and facilities have been subjected to a landscaping and ecologic reconstruction program, leading to their disappearance, leaving only a footprint on the newer satellite imaging.

As a general conclusion, one can state that the easiest method to be used in studying the space-time evolution of geographical elements overlapping a particular space is to analyze the satellite images and not only those. The detailed processing and analyze of such images provide to researcher a big picture of current situation compared to a previous situation.

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DEMOGRAPHIC FACTOR IN INTERNATIONAL (OUTBOUND) TOURISM

OLEKSANDR KOROL[1]

ABSTRACT. – Demographic Factor in International (Outbound) Tourism. Basing on statistical data and World Bank's and World Tourism Organization's standards, we have considered gross and per capita international (outbound) tourism flows checked against such population's demographic attributes as its number, age structure and urban extent. Calculations were performed with respect to nearly 70 countries of the world to help establish the effects of demographic factor upon international tourism. The conducted analysis showed that international tourism activity is the most strongly effected upon by the age structure, in particular, children and seniors should be in the first place outlined with their differently directed influence. These two demographic characteristics inversely depicted the level of the country's development. If households' per capita consumption expenditures are taken to be an indicator of the country's level of development, it will be with the share of seniors that such expenditures correlate to its best ($r = 0.7$). This is why it seems to be well-substantiated that the share of people ageing 65 years and older can serve as the major demographic indicator of influence on international tourism. Having made use of the multivariate regression analysis, we checked the number of international tourism departures per 100 people against such demographic attributes as shares of seniors and urban population. The findings showed an average correlation $R = 0.62$, that is, the same as in the case of pair correlation with age group above 64 years old. In other words, the urban extent as additional parameter did not at any rate reduce the strength of relationship.

Keywords: *international tourism, tourism departures, international tourism activity, demographic factor, population number, age structure, urbanization.*

1. INTRODUCTION

Problem Statement and Purpose. According to the data available at the World Tourism Organization (UNWTO), there were nearly 1 billion international tourists at the turn of the millennium throughout the world. The involvement

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of this great number of people from many countries could not but make international tourism significantly effect on different spheres of human relations. At the same time, some aspects of international tourism are still insufficiently highlighted. In particular, the study of the effects of population characteristics as one of the factors of international tourism upon the formation of outbound tourism flows seems to be very important. Therefore the present work aims at analyzing the impact of the demographic factor in international tourism, in particular, the influence of population number, age structure and urbanization upon the formation of outbound tourism flows.

Analysis of latest studies and publications. Among the scope of works devoted to international tourism we would highlight the publications by A. Yu. Aleksandrova (2002) and O. O. Lyubitseva (2003). The authors characterize basic concepts of international tourism, analyze geography of tourist demands with respect to world regions, and describe the latest trends and processes of globalization in this industry. The latest statistical information can be found in the annual analytical electronic edition "*UNWTO Tourism Highlights*". However, some aspects of international tourism are still insufficiently studied, in particular, the effects of the demographic factor on the number of outbound tourists in one country.

2. THEORY AND METHODOLOGY

Methods of study lie in the use of statistical data and methodologies available with the World Bank and World Tourism Organization, as well as in the use of methods of mathematical statistics, including correlation analysis.

Tourism is understood as one of the form of population migration, not connected with place of residence or work changes. The necessity of definition of the term "tourism" arouse in the first half of the 20th century, caused by the growth of the flow of tourists, the increase of tourism economic significance and, as a result, the efforts to statistically account the travelers.

The Committee of Experts in Statistics at the Nations' League was the first to offer definition of the term "tourist" (1937). The term found international acknowledgement and preserved its form till nowadays, with some further amendments. At present, a definition worked out at the International Conference for Travels and Tourism Statistics (Ottawa, 1991) is widely used in international practice. The World Tourism Organization (WTO) and the UN Committee for Tourism Statistics approved the definition. According to it, a tourist is a visiting person, i.e., "a person who travels outside his/her usual environment for not more than one consecutive year with any purpose, excluding activity remunerated from within the destinations" (O. D. Korol & T. D. Skutar, 2008, p. 5).

The definition allowed for a clearer outlining of the part of travelers who can be the object of statistical research in tourism. The summarizing documents of the Ottawa Conference and the WTO technical recommendations refer to the tourist as a visitor. This definition is recommended to be used in tourism statistics as a basic one. Alongside with tourists (overnight visitors), the term is also extended to same-day visitors. Probably, the latter is the reason of absence in definition of the minimal stay outside the usual environment (24 hours), set in national tourism legislation in many countries.

Tourism takes the forms of domestic and international tourism. International tourism supposes travels outside the country of residence. It covers visitors who are non-residents in the country of destination.

Depending upon whether a person is traveling to or from a certain country, international tourism is subdivided into inbound and outbound tourism. From the point of view of the country of residence, the tourist who travels to another country is the outbound one, whereas from the point of view of the country of destination, the one who is received by a destination country is the inbound tourist. According to the UNWTO standards, outbound tourism flows are estimated in number of departures counted from the moment when the residents leave their country to travel abroad for a period not exceeding 12 months and whose main visiting purpose is other than an activity remunerated from within the visited country.

3. RESULTS AND DISCUSSION

3.1. Population number as a factor in international (outbound) tourism

Since the outbound tourists of any country are part of its population, it is expected that the number of departures would first depend on the number of country residents. To prove this, it was important to check the numbers against each other. Such a check was made with respect to over 80 countries. To make the sample more representative and to neutralize the effect of the events that could occur in one year year, all figures were regarded as average geometric values for 1999, 2004 and 2008, with which further computations were performed. The choice of the above-stated years was substantiated by the fact that there was a more or less stable political and economic situation established in the world after disintegration of the Soviet Union and until the beginning of the global economic crisis.

The correlation analysis did not witness a relation between the attributes under the study (r = 0.21). As seen from the diagram of distribution, the lowest correlation between the number of population and the number of tourism departures was remarked in India and China (fig. 1). Without these two cases, there is a moderate correlation with r amounting to 0.54. Thus, the assertion that the number of departures would increase with the increase of the population number appears to be rather poor (fig. 1).

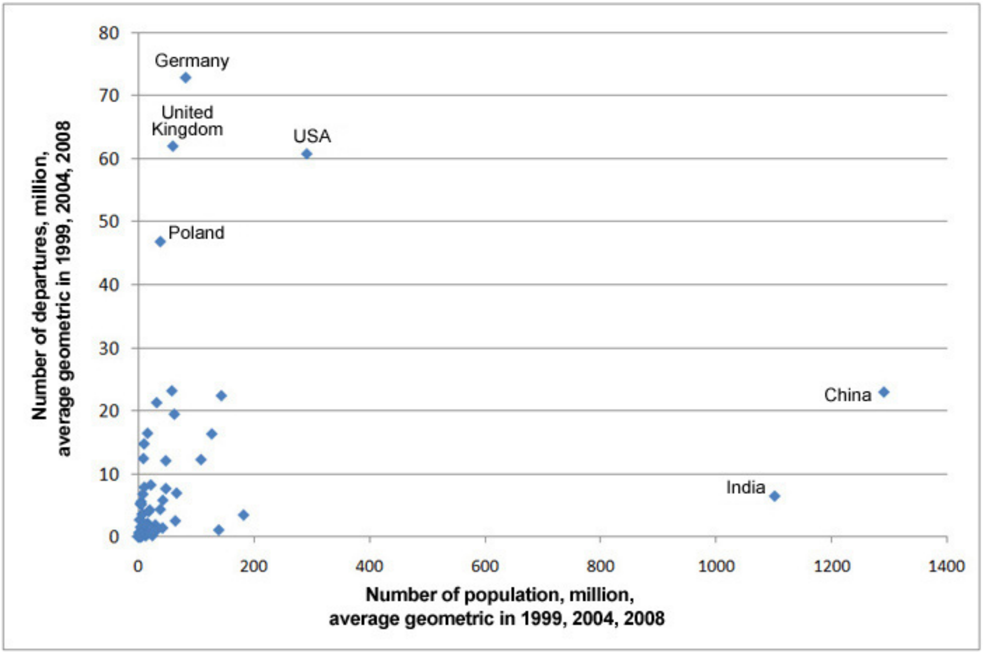

Fig. 1. The population number in world countries and the number of international tourism departures.
Source: World Bank Open Data, http://data.worldbank.org

We assume that it is the proportion of the involvement of residents of one country to travels abroad that should be suggested by way of checking the number of outbound tourists against the number of population. That is, the international tourism departures per 100 people (*Dep*) may serve as a parameter that would show the international tourism activity of the country population:

$$Dep = \frac{\text{number of departures}}{\text{population number}} * 100$$

It seemed necessary to ascertain whether or not the departures (*Dep*) depended on the characteristics of the population, because differences in the demographic structures of the countries could appear to strongly effect on their residents' wishes and capabilities to travel abroad. In particular, the influence of such demographic characteristics as age structure and urbanization within one country had to be established.

3.2. Age structure as a factor in international (outbound) tourism

It should be reminded that the increase in the number of people ageing 60 years and more was among the most remarkable demographic changes, mainly in the developed countries. The situation is explained by the decline of fertility between the 1960s and the 1980s and the gradual growth of the average life span.

Traditionally, the retired people were consumers characterized by their low purchasing power, continual economy, and disenfranchisement. However, it was due to the state and private pension systems and the pension amounts' regular indexation that the welfare of a significant part of seniors continuously grew and subsequently allowed for their active travels abroad. Today, the UNWTO experts emphasize that the present-day average pensioner is more than ever a well-educated, well-to-do and active individual. Consequently, there was every indication that the seniors appeared to be the newcoming tourism consumers, specifically demanding as follows [O. D. Korol & M. P. Krachulo, 2008, p. 27]:

– to have lasting journeys to the most attractive destinations:
– to have trips as far as possible distant from their places of residence;
– to enjoy routes with active cultural and recreational programmes.

The "welfare society" with its high living standards and capacity to satisfy different material needs transformed the social conscience towards hedonism in the 1980s-1990s. Pleasure became the only worthy benefit a human being might have from living on Earth. Work was no more for earning but for self-realization and career development. Free time was no more devoted to consumption of material values as well-being attributes but to services which broadened "life horizons" and provided enjoyments and impressions. Simultaneously, tourism irrevocably transformed from splendor to necessity and daily wishes.

In the context of these transformations, a social-demographic group emerged - the young singles of up to 35 years old that live apart from parents, and middle-age loners. Highly cultural, well-educated and materially independent, these people do not wish to commit themselves to family life and obligations.

Informal marriages as an alternative of a relationship between persons of opposite sex grew in popularity. The "loners" are peculiar for high educational background, pursuit of professional success and high demands for comfort and quality of living. They extensively focus on the organization of their free time and try to enjoy life thus predetermining their high tourism activity.

The tourism activity of the couples having pre-school and school-aged children is to a smaller extent lower than that of the "loners", since parents are now responsible for the children's education and upbringing which requires more time and spending. Families are formed at a later age today, and women give birth later than a few decades ago. Such a situation favours the tourism activity of the population though generates a problem regarding the decline in the birth rate.

All aforesaid demographic changes tell on population's age structure. First, the share of seniors increases. Besides, the increase in the number of employed women and couples without children, as well as the increase in the number of "loners" and trends towards late marriages lead to a decline of the share of children in the population's age structure. Therefore our analysis of the age structure as a factor of international tourism activity is based on the age categories of 0–14, 15–64, and above 64 years old.

The age category of 0–14 years old covers children who are not yet involved into economic activity and can not therefore earn money to support themselves. In the meantime, people having children are bound to spend more. The income in the families with many children is distributed among more people that decreases the household's consumer per capita expenditures. Besides, during the travel, a child is an additional individual who increases the cost of tourism service, the one who only tightens the travel.

Thus, the bigger the share of the children in the age structure, the inhabitants of one country will be less active in traveling abroad. To prove or disprove that thesis, we had to check the shares of 0–14 category against international departures per 100 people (*Dep*) in the sampled countries. To make the results more reliable, we took the data for 1999, 2004, 2008 and calculated average geometric values, with which further analysis was performed.

The diagram of the distribution by country demonstrates the average inverted dependence between the share of persons aged 0–14 and the number of international tourism departures per 100 people (*Dep*), the same being confirmed by the correlation analysis: r = -0.57. This shows a moderate dependence – international tourism activity decreased with the increase of the share of children in the population's age structure (see fig. 2).

The age category of 15–64 years old covers people of employable age who represent the economically active population that leaves a positive effect on their income, and, consequently, on the expenditures and consumption per capita. Hence, the bigger the share of employable people in the age structure, the population of the country will more actively travel abroad. To substantiate this conclusion, we have conducted the analysis similar to that for the previous age category.

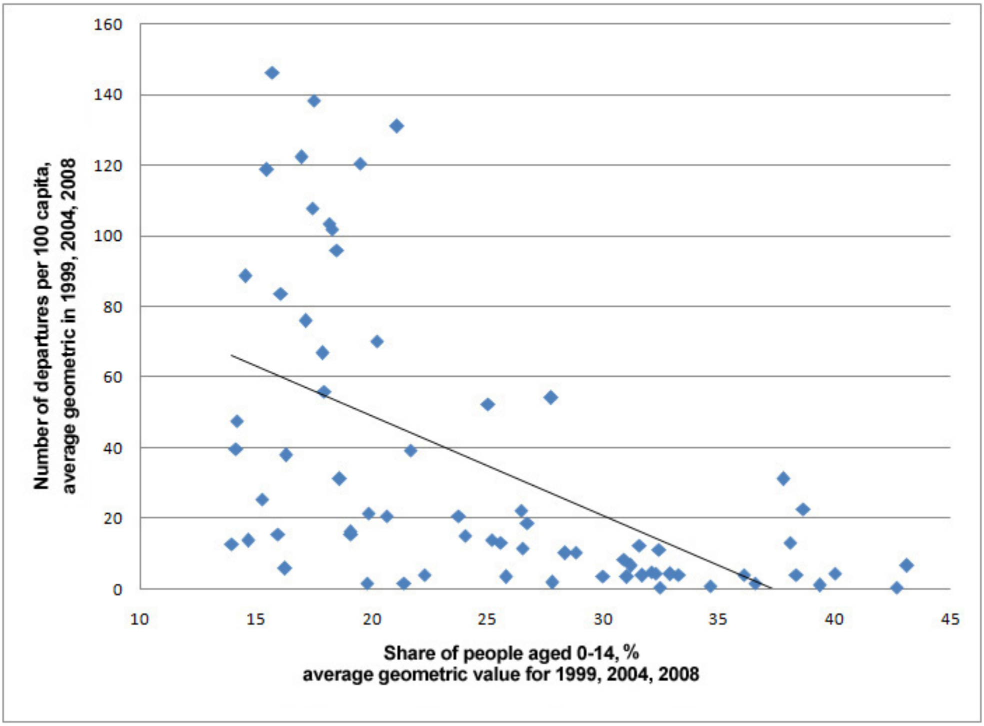

Fig. 2. Population's age structure and per capita international tourism departures. Share of people aged 0-14.
Source: World Bank Open Data, http://data.worldbank.org

In the case of the employable population, one noticed a weak direct relation between the people aged 15–64 and the number of international tourism departures per 100 people (*Dep*) with the correlation coefficient r = 0.39 (see fig. 3). That is, there is no ground to maintain that the increase in the share of employable people in the age structure of population would lead to the increase of its international tourism activity.

Age category above 64 years covers retired people who are not anymore involved in economic activities, though, unlike children, have a regular income in the form of their pension. Though pensioners' consumption expenditures are slightly less than that of the employable people, they have a great advantage –

their free time. Hence, it is reasonable to assume that the increase in the share of this age category in the population's age structure would lead to the increase of its international tourism activity. To verify this assumption, we have conducted the same analysis as in two previous cases.

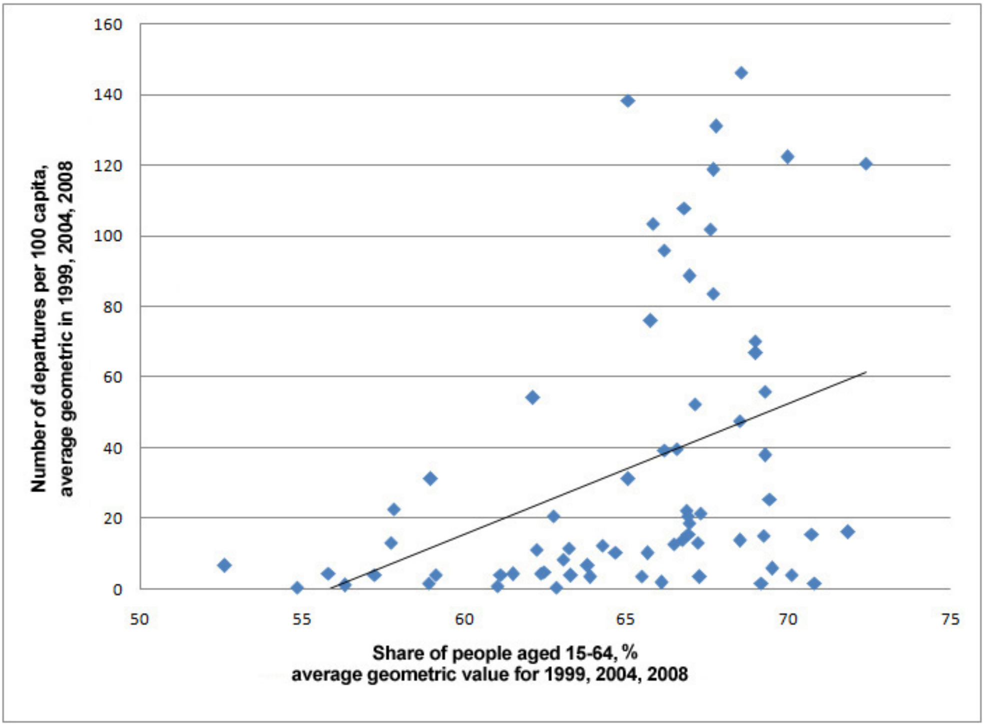

Fig. 3. Population's age structure and per capita international tourism departures. Share of people aged 15-64.
Source: World Bank Open Data, http://data.worldbank.org

In this case we noticed an average direct relation between the share of people above 64 years old and the number of international tourism departures per 100 people (*Dep*), in particular, the correlation coefficient *r* was 0.61. That is, the correlation between the increase of international tourism activity and the increase of the share of seniors in population's age structure was as high as in the case of the children, but inversely directed (see fig. 2, 4).

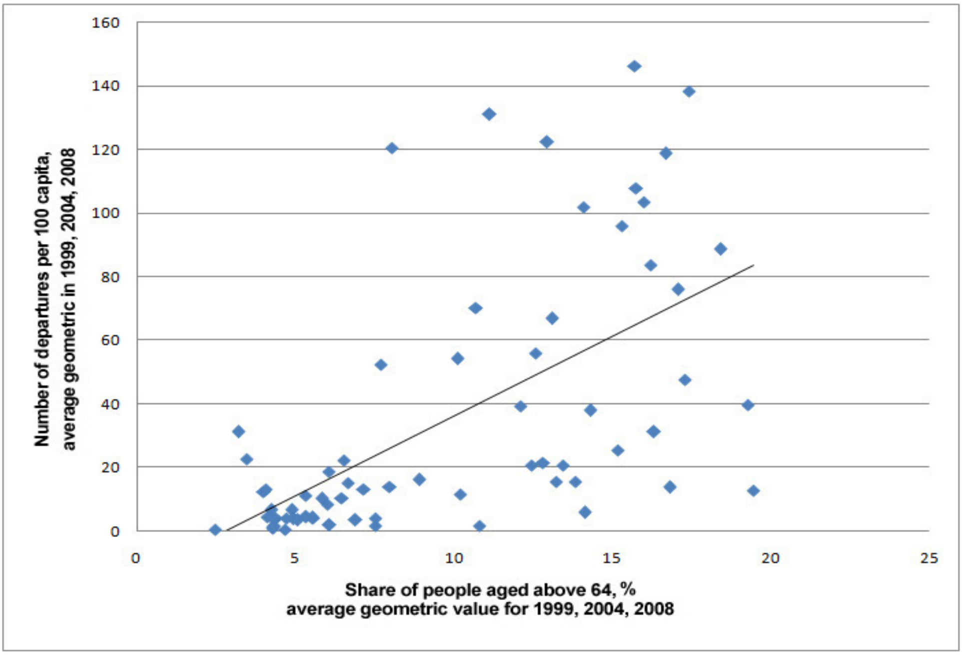

Fig. 4. Population's age structure and per capita international tourism departures. Share of people aged above 64
Source: World Bank Open Data, http://data.worldbank.org

3.3. Urbanization as a factor in international (outbound) tourism

The urban extent can contribute to the growth of the population international tourism activity, since city dwellers feel higher demands for active rest in the open countryside to get some free time outside the big city where they live and work. The hustle and bustle of the urban "monster", the anonymity of the existence, the sterility of the city landscapes, the alienation from nature, the necessity to possess continuous accelerated reactions and the unceasing attention on the streets, the daily coverage of enormous distances – all these form and strengthen the nervous strain, and further the accretion of mental fatigue.

People's personal living space in the city is compressed to their apartment, while streets represent a competitive environment where, due to the high density, an individual is made to literally fight for his "place in the sun" from the seat in the public transport to a parking slot for his vehicle. Such urban conditions do not allow for the ease and make citizens leave their homes running away from the "stone jungles" outside to find peace of mind and social contacts.

The engagement in non-agricultural production can also contribute to the growth of the tourism activity of the population. Having lessened physical loads, technical progress nevertheless increases nervous strain. The development of mechanization and automation of the industrial production processes led to mechanisms substituting people in many production areas, and left them perform psychically exhausting monotonous and simple operations. Office employees who work with information spend great efforts to be ceaselessly concentrated. Such a nature of work adds to the increase of nervous strain and results in the advent and accumulation of mental fatigue, which, unlike the physical one, is calmed only through active rest.

On the opposite, the engagement in agriculture and in the first place in homestead management significantly restricts tourism. This is explained by the fact that rural homesteads may not be left unsupervised for a long period of time, since farm livestock requires everyday attention. This is why the whole-family tourism is so problematic in rural regions.

As a consequence of the above, it seems probable that the expansion of urbanization would result in the increase of the international tourism activity in one country. To verify the assumption, we have checked the share of urban citizens against the number of international tourism departures per 100 people (*Dep*). The same as in the case of the age structure, in order to have more reliable results, we have taken the data for 1999, 2004, 2008 and calculated average geometric values, with which further analysis has been performed.

The relation between the share of urban population and the number of international tourism departures per 100 people (*Dep*) appeared to be very poor with the coefficient of correlation r = 0.4 (see fig. 5). Hence, such a demographic characteristic of the country as urbanization does not significantly effect on international tourism activity of its inhabitants.

The summary table hereunder with regression equations and correlation coefficients represents the result of the analysis of the extent of demographic characteristic effects upon international tourism activity in the selected countries (see table 1).

Table 1. Relation between demographic characteristics and the number of international tourism departures per 100 people

Departures depending upon	**age structure**			**urbanization**
	0–14 years	**15–64 years**	**above 64 years**	
Function	y= -2.81x+105.3	y= 3.71x-206.8	y= 4.99x-13.85	y= 0.82x-19.02
Correlation	r = -0.57	r = 0.39	r = 0.61	r = 0.40
Countries	N = 69	N = 69	N = 69	N = 69

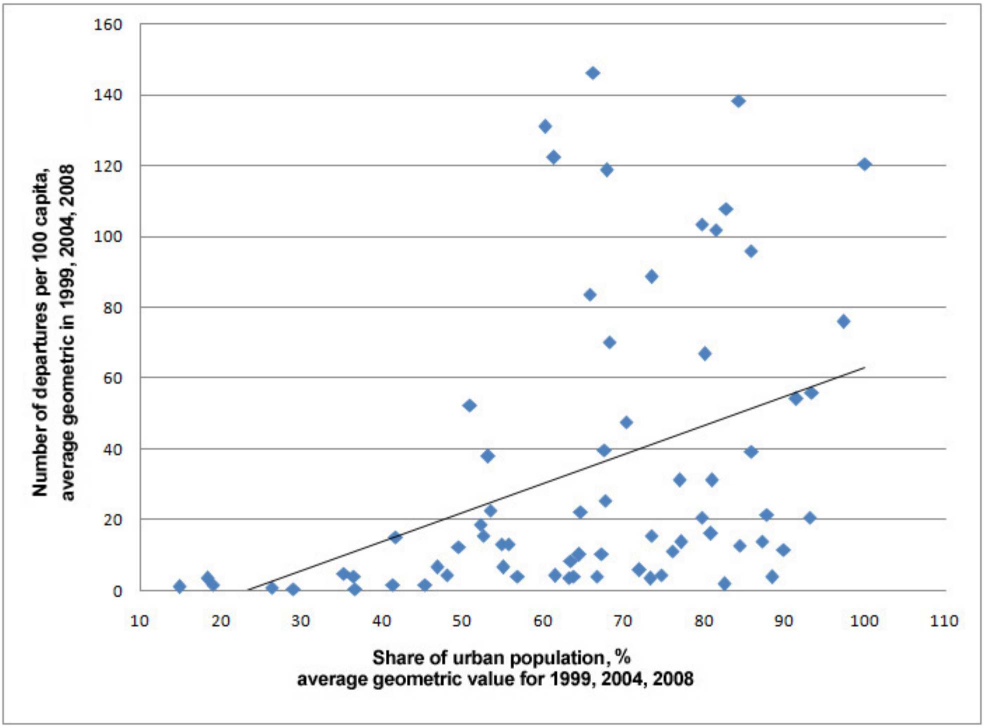

Fig. 5. Degree of urbanization and per capita international tourism departures.
Source: World Bank Open Data, http://data.worldbank.org

4. CONCLUSION

International tourism activity is strongly effected upon by the age structure and in particular by the age groups of children and seniors who have opposite effects. This in its turn gives the idea that these two demographic characteristics represent the opposite sides of something like the level of the country's development, for example, as the coefficient of correlation between them amounts to -0.9. The higher number of children in the age structure is characteristic for developing countries, related to the traditional type of population natural increase. Meanwhile, the rational type of reproduction and a higher average life span in developed countries are responsible for the higher share of seniors. When the per capita household consumption expenditures was taken in consideration to be the indicator of the country's level of development (average geometric values for 1999, 2004, 2008, in fixed price as 1996), such values best correlated with the share of retired persons with $r = 0.7$. This cost parameter is a weighty economic factor that makes an effect on the formation of international tourism flows. Therefore, it seems to be well-substantiated that the share of people above 64 years old could be the major demographic indicator that impacts upon international tourism.

Finally we have tried to consider the complex effect of demographic characteristics on international tourism activity. Having made use of the multivariate regression analysis, we checked the number of international tourism departures per 100 people against the shares of seniors and urban population. All three parameters were taken as average geometric values for 1999, 2004 and 2008. The analysis results showed the average relationship R to amount to 0.62, that is, to be the same as in the case of pair correlation with the age group of 65 years and older. In other words, the level of urbanization as an additional parameter did not affect the strength of the relation.

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GEODEMOGRAPHIC RISKS IN PETROȘANI BASIN (I)

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ABSTRACT. – Geodemographic Risks in Petroșani Basin (I). During the last decades, geodemographic risks became more and more debated, including such issues as the depopulation of certain areas, the overpopulation, the demographic ageing, the massive emigration and others. One of these risks, namely the demographic decline, is analyzed at the level of Petroșani Basin, mainly between 1966 and 2011. One notices that the population numbers in the area were relatively low until the mid 19thcentury, when the intensive stage of habitation started because of the development of mining activities. This stage continued throughout the 20th century and the number of inhabitants increased until the 1992 census. Then there was a significant drop in population numbers, at a rate of -12.3% between 1992 and 2002 and -17.7% between 2002 and 2011. The causes of this demographic decline are mainly the massive emigration, as a result of the restructuring of mining activities, but also the decrease of the birth rate and the increase of the mortality rate, as consequences of demographic ageing.

Keywords: *geodemographic risks, demographic decline, Petroșani Basin.*

1. INTRODUCTION

During the latest decades, demographic risks (as named by sociologists and demographers) or geodemographic risks (as called by the geographers) are more and more debated in the international scientific literature. This notion is rather difficult to define and there is no unanimously accepted opinion regarding the meaning of demographic risks. For instance, the demographic risk is considered "*… an extreme social process (phenomenon), dangerous for the individual and for the society, as a whole*" (Surd, 2004, p. 184), which may have economic and social effects, including fatalities, as in the case of natural risks.

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Another definition of demographic risks refers to "*diffuse actions and behaviours, difficult to describe and to assess in detail*" (Rotariu, 2004, p. 174). The quoted author considers that one may talk about a demographic risk only if a process or phenomenon that happens with regard to the population has consequences that may be classified as "dangerous", "hazardous" or "risky" for that population. In the absence of objective and universal criteria to assess if a certain demographic evolution has negative or positive consequences on the society, two types of situations are considered when demographic risks may be involved: a) when there are large-scale processes which, if maintained for a long period, might threaten the existence of the population itself; b) when there are demographic processes and phenomena which negative effects especially in terms of economy (for example, the emigration of a certain population category might have negative economic consequences) (Rotariu, 2004).

Some scientific papers concerning specific spatial units define the demographic risk as the "*incapacity of certain human communities, variable in number, to capitalize their space of control and belonging to a level of sufficiency (self-sufficiency), therefore becoming on the whole supported and/or dependent communities. The direct consequence, easy to notice and to quantify, is the rapid and massive emigration*" (Surd *et al*, 2007, p. 75).

Taking into account the facts mentioned above, one may include in the category of demographic risks processes such as overpopulation, low fertility, demographic ageing (Rotariu, 2004), underpopulation, characteristic for certain spatial units (Surd *et al*, 2007), the accelerated growth of the young population share (in the less developed countries) (Benedek and Schultz, 2003). Very often, demographic risks are caused by an excessive emigration, especially of the young population or of those who are more educated, from certain areas. This fact creates important imbalances that have deep effects on the affected regions, such as: the deterioration of the geodemographic structures, the deterioration of the infrastructure and public services due to the decrease in demand, the deterioration of the territorial structures in the areas generating migrants, as they become more and more monofunctional, focusing mainly on agricultural activities (Benedek, 2002), as well as the depopulation and the demographic decline of villages. Others risks may be added to these, as they are often identified at national level: the increase in the crime rate, divorce rate, unemployment rate, work accidents rate, collective work conflicts rate, infant mortality rate (which is a very sensitive indicator in the indirect assessment of the level of economic development), as well as the feminization of the population (Surd *et al*., 2007, Surd, 2004).

Some authors talk about demographic spasms (Cocean, 2010), defined as those „*processes, with fundamentally negative evolutions [...] that constrain* *sustainable territorial development, drawing limits in its path, beyond which the demographic system becomes unable to support*" (Potra, 2015, p. 98). According to the same author, there are two situations at global level which generate demographic spasms. The first one is linked to overpopulation, at the level of certain continents (Africa, Latin America, Asia), where the excessive population growth is not correlated with the level of resources. The second one is related to the subpopulation or better said the demographic decline, a phenomenon which is characteristic for the continents that are rich in resources (Europe, North America) but affected by an accelerated decrease in the number of inhabitants, which hinders a sustainable economic development.

Starting from the list of these risks, as well as from other studies of our own (Mureşan, 2014, Mureşan and Boţan, 2014) which we used as a model, we tried in this paper to highlight one of the demographic risks which is the most acute in many Romanian regions: the demographic decline and its main result, depopulation. This process was and still is generated especially by a high emigration of the population from certain areas, either as a result of the industrial restructuring which took place after 1989, or as a result of the decrease in living standards, or (in fact, a consequence of those stated above) as a result of a lack of viable alternative for development. There are also other causes of demographic decline, such as the decrease of the birth rate and the increase of the mortality rate.

2. METHODOLOGY

2.1. Data

In order to make the proposed analysis, we used statistical data provided by the population censuses, focusing mainly on those from 1966, 1977, 1992, 2002 and 2011. Basically, the numerical evolution of the population was assessed according to the censuses, highlighting several indicators which reflect the dynamics of the number of inhabitants (Vert, 1995):

(i) *The absolute growth for the entire period*, calculated according to the formula:

$$S_a = P_2 - P_1$$

where S_a = the absolute growth of population for the given period; P_1 = the number of inhabitants at the beginning of the period; P_2 = the number of inhabitants at the end of the period.

(ii) *The growth rate for the entire period*. It was calculated according to the formula:

$$R_c = \Delta P/P_1x100 = (P_2-P_1)/P_1x100 = (P_2/P_1 -1)x100$$

where R_c = the growth rate for the entire period; P_1 = the number of inhabitants at the beginning of the period; P_2 = the number of inhabitants at the end of the period; ΔP = the absolute growth for the entire period.

(iii) Given the fact that the different stages of the analyzed time period are not equal and therefore do not allow a useful comparison, we also calculated the mean annual growth rate, using the following formula:

$$R_{mas} = S_m/P_1x100$$

where R_{mas} = the mean annual growth rate; S_m = the mean annual growth (=ΔP/n ; n = the number of years in the time period); P_1 = the number of inhabitants at the beginning of the period.

2.2. Study area

Petroșani Basin represents a very well individualized geographical unit, part of the Southern Carpathians. It is located on the upper Jiu Valley and it is surrounded by Parâng and Vîlcan Mountains to the South and Retezat and Șureanu Mountains to the North (Badea *et al*, 1987). Within these limits, it covers an area of 260 km^2 and represents ”one of the most typical areas of relative geographical discontinuity in the Southern Carpathians” (Mihăilescu, 1963, p. 239) (fig. 1).

Apart from these physical-geographical limits, one should also take into consideration the limits according to the economic field of the basin or the functional-economic limits (Cândea, 1996), due to the historical process of human capitalization on the mountain slopes bordering the basin. According to this category of limits, the basin has an area of 1,032 km^2 (Costache, 2010) and belongs administratively to Hunedoara County, comprising the territory of seven administrative units (six towns and a commune): Petroşani, Petrila, Aninoasa, Lupeni, Vulcan, Uricani (urban units) and Băniţa.

Coal mining activities represent the main economic feature of the basin, which also influenced the evolution of the number of inhabitants, especially during the 20th century. After an intensive exploitation of these resources, especially during the socialist period, the process of restructuring the mining industry began in 1997, having a negative impact on the population in this area.

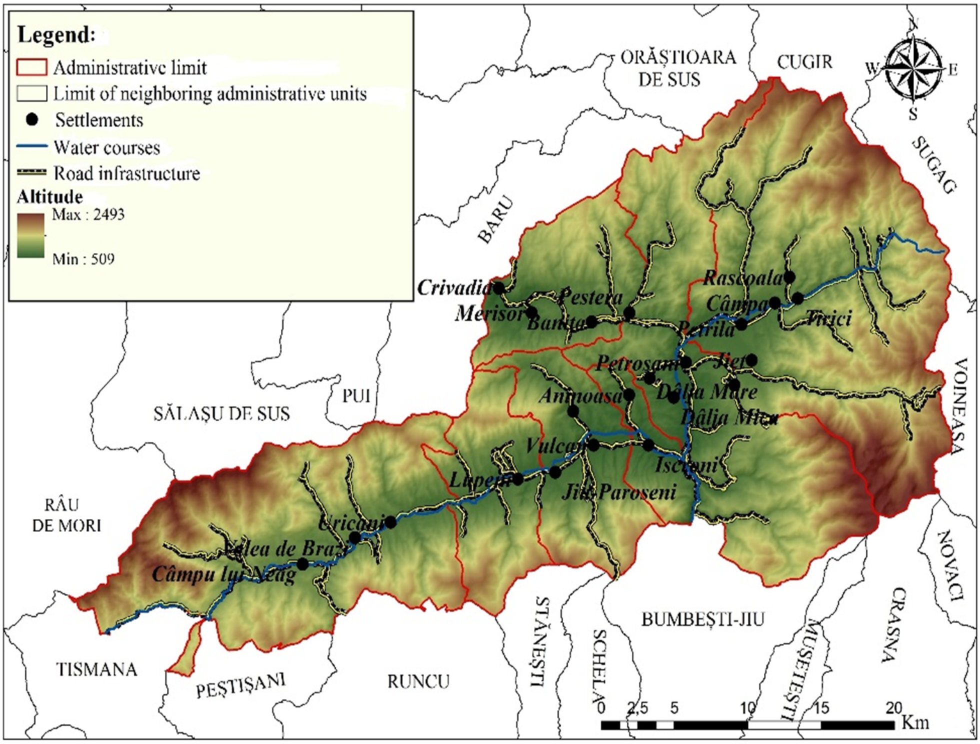

Fig. 1. The geographical location of Petroşani Basin and its settlements

3. THE DEMOGRAPHIC DECLINE OF THE SETTLEMENTS AS A RISK FACTOR IN PETROŞANI BASIN

The first documents that attest the existence of certain settlements in the basin date from 1462 (Vulcan), 1493 (Câmpu lui Neag) (Suciu, 1967, 1968), as well as from 1499, when Petrila, Maleia (a hamlet of Petroşani), Rotunda, Morişoara and again Câmpu lui Neag are mentioned as "places for grasslands, hay fields and crops" (Tufescu, 1964, p. 37, Badea *et al*, 1987). Among them, Rotunda and Morişoara disappeared as settlements but are preserved as place names (Cândea, 1996). During the 14th and 15th centuries, Petroşani Basin was not well inhabited, functioning more like an economic appendix of Haţeg Basin (Gruescu, 1972, Cândea, 1996). However, as Conea shows (cited by Badea, 1971), there was a much older population in the basin, whose existence was favoured by the safeguarding position, on one hand, and the fast and secure connections between the basin and the surrounding mountains and the areas South of the Carpathians, on the other hand. For the next two centuries, the basin remains relatively low populated, as in the first half of the 18th century (1733) there were only 405 inhabitants (Tufescu, 1964). However, since the middle of the 18th century, the *pastoral stage of habitation* has begun and led to the numerical increase of population and the emergence of new settlements due to the arrival of incomers from over the mountains, from Haţeg Basin, Sibiu mountain area and other parts (Tufescu, 1964). They founded new settlements as free colonists (Alexandrescu, 1995, Badea *et al*, 1987): Lupeni, Petroşani, Livezeni, Paroşeni, Bărbătenii de Sus, Uricani. Therefore, the population of the region numbered 976 inhabitants in 1750 but at the beginning of the 19th century (1818) it reached 2,250 inhabitants (Badea *et al*., 1987, Tufescu, 1964). The 1850 census shows a population of more than 7,800 inhabitants for Petroşani Basin, which means an increase of more than threefold in only 32 years.

In the second half of the 19th century, coal mining led to the economic development of the basin, which is reflected in the population increase. The first mines opened at Petrila and Dâlja - 1840, at Lonea in 1869, followed by Aninoasa (1890) and Lupeni (1892) (Badea, 1971). The need for labour force triggered the *second habitation stage, the mining one* (Tufescu, 1964). It is characterised by an accelerated increase of the number of inhabitants, as a result of the immigration of working people both from abroad (Cândea, 1996, Costache, 2010), and from other Romanian regions. The number of inhabitants increased by almost four times between 1850 and 1900, reaching 28,750 people, and it almost doubled during the next ten years, as the 1910 census recorded about 50,000 inhabitants.

Overall, during the 20th century the evolution of the population maintained its increasing trend. First, this happened because of the intense migratory flows, oriented towards the basin. Then, after 1948, there were the specific economic and demographic policies of the socialist state, which intensified very much the coal production (which generated migration) and stopped the abortions by decree no. 770 of 1966.

In 1930, the population of the basin numbered 66,753 inhabitants. However, in the next years, due to the 1929-1933 economic crisis and the start of World War II, some of the mines were closed down and the coal production stagnated. As a result, the number of inhabitants decreased by more than 15,000 people (Badea *et al*, 1987). After 1950, nevertheless, there was a substantial population increase, reaching 95,000 inhabitants in 1956 and more than 130,000 in 1966, so *a new stage of habitation was initiated* (Tufescu, 1964). The urbanization process also intensified: in 1948 there was only one town in the basin (Petroşani), but other three settlements were given the town status in 1956 (Petrila, Lupeni and Vulcan). For this reason, this new habitation stage was called *the urban stage* (Alexandrescu, 1995). The numerical increase of population was mainly due to the positive migration balance, to which one should add the natural growth; for instance, between 1950 and 1960, more than 13,000 people settled in the basin, while in the next decade, 1960-1970, the number of new settlers increased to 54,000, as a consequence of economic development and diversification (Alexandrescu, 1995). However, after 1975, the migration balance became negative and the population increase was determined only by the natural growth (Badea *et al*, 1987).

Between the 1966 and 1977 censuses, the population numerical evolution remains positive, even if the increase of the number of inhabitants is low. The absolute growth for the entire period is 6,681 inhabitants, resulting a rate of increase by only 5.1% or an annual average rate of 0.51%. These low values are determined by the fact that many of the settlements in the basin, especially the rural ones, but also the villages belonging to the towns (also having a rural character), started to register a decrease in their population. This was probably due to the migration within the basin, but also due to demographic ageing. At the level of administrative units, only three out of seven registered an increase in the number of inhabitants: Petroşani (8.5%), Petrila (1.5%) and especially Vulcan (30.4%). The population decreased in the other administrative units, and the highest values were recorded in Aninoasa (-26.2%) and Băniţa (-20.8%).

Until 1992, the number of inhabitants continued to increase in the basin, even at a higher rate, by 23.5%, reaching at 168,853 inhabitants at the 1992 census. The highest increasing values were registered at Uricani (74.6%) and the city of Petroşani (about 29%), followed by the town of Vulcan (20.4%). However, at the same time, there was a decrease in the rural areas: Băniţa experienced a demographic decline as its number of inhabitants decreased by 12.4%. These variations may be also due to the intra-regional migrations, as the rural population moved to the urban centers, in this case especially those where industrial and mining activities intensified.

The situation changed radically after 1992. The social and economic changes in Romania were deeply felt in this area, which started to register a more and more accelerated demographic decline. The start of industrial restructuring triggered the process of population decrease in numbers. This meant a decrease by 20,000 people between 1992 and 2002 for the entire basin, which meant a negative rate of -12.3% or an average annual rate of -1.23%. All the administrative units recorded a decrease in the number of inhabitants. The smallest decrease was recorded this time in Băniţa commune, which had less industrial activities to be affected by restructuring. The urban centers of the region registered relatively similar values, ranging from -6.7%

at Lupeni and -20.3% at Uricani. At the level of each settlement, the situation was the following: out of the 22 settlements, only five experienced a positive trend in their demographic evolution. The highest value was recorded in Câmpa, a village belonging to the town of Petrila (23.6% or 147 people). The other settlements registered a higher or lower decrease in the number of inhabitants. The values ranged a lot from -0.1% at Iscroni (part of Aninoasa) to -38.0% at Valea de Brazi (part of Uricani), but they may be grouped in three classes: between 0 and -10% (Iscroni, Câmpu lui Neag, Lupeni, Jiu – Paroşeni), between -10,1% and -20% (most of them, 11 settlements, including Petroşani, Petrila, Dâlja Mare, Dâlja Mică, Vulcan, Aninoasa etc.) and below -20% (Uricani and Valea de Brazi) (fig. 2). In several administrative units, all the included settlements recorded a negative demographic evolution: in Petroşani, Aninoasa and Uricani.

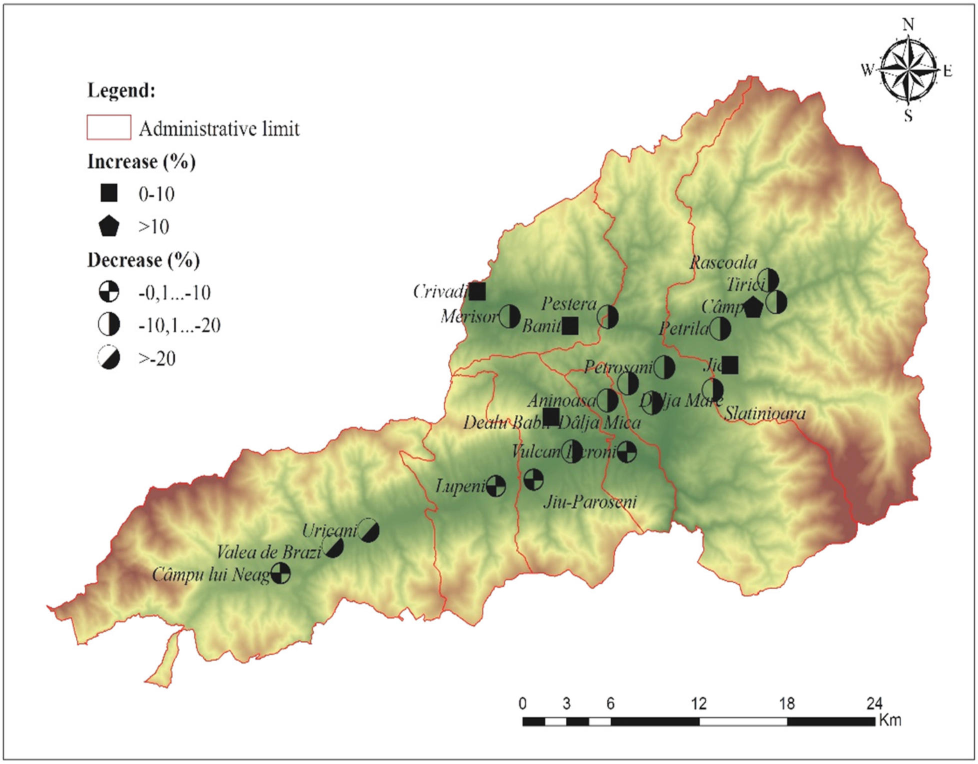

Fig. 2. The numerical evolution of population in Petroşani Basin between 1992 and 2002.

Although there are no precise data for each year in this period for all the settlements in the basin, one may state that the factors which laid at the basis for this reduction in the number of inhabitants are represented on one hand by the decrease in the birth rate and the increase of the mortality rate, and on the other hand by outmigration. The birth rate had a negative trend between 1990 and 2002, while the mortality rate increased, reflecting the similar evolution at national scale, as well as the socio-economic changes at local level (for instance, the migration of the labour force caused by restructuring in the field of mining affected mainly the young population, therefore influencing the population natural dynamics) (Costache, 2010). Two moments should be highlighted in the evolution of the natural growth: the liberalisation of abortion (lower values of the natural growth in 1991-1992) and the mining restructuring (which determined a new decrease of the natural growth rate between 1999 and 2002) (Costache, 2010). The migration rate remained positive in Petroşani Basin until 1997, when the restructuring of mining activities began. After 1997, the migration values became negative. This fact is explained by the remigration of those who remained unemployed to their original (native) regions, as well as the possibility for migration in search for a place to work in Romania or abroad (Costache, 2010).

The demographic decline highlighted for the 1992-2002 period continued even at a higher pace between 2002 and 2011. For the entire basin, the number of inhabitants decreased by about 26,000 people, so there was an even higher rate of decrease compared to the previous period, -17.7%, or an average annual rate of almost -2%. Again, all the administrative units recorded a decrease in the number of inhabitants, which is (with one exception, that of the town of Uricani) deeper than in the previous period. The highest decreasing values were recorded in the cities of Lupeni (-23.7%), Vulcan (-18.8%) and Petroşani (-17.8%), but all the administrative units recorded values below -10%. The analysis was also made at the level of the 22 settlements. It came out that, compared to the previous period, only three settlements recorded a relatively important increase in the number of inhabitants: Câmpa (Petrila) 37.6%, Peștera (Petroşani) 25.5% and Jieţ (Petrila) 7.3%. The other 19 settlements continued their demographic decline. The values ranged between 0 and -10% (5 settlements, such as Valea de Brazi, Dâlja Mare, Dâlja Mică etc.) to below -20% (Răscoala -21%, Dealu Babii -22.2%, Lupeni -23.7%) and even below -50% (Slătinioara -51.2%). It came out that most of the settlements recorded values of the decrease rate between -10% and -20% - 10 settlements, including the urban centres Vulcan -19.0%, Petroşani -17.8%, Aninoasa -14.6%, Petrila -14.4% and Uricani -12.4% as well as the rural settlements and the villages that are part of urban administrative units (fig. 3).

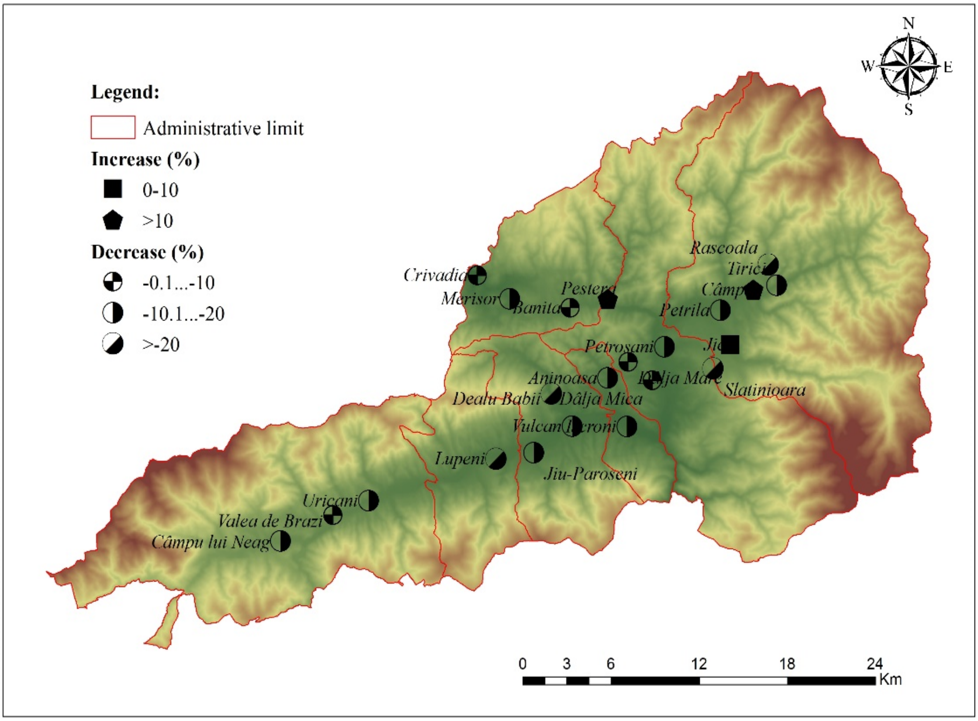

Fig. 3. The numerical evolution of population in Petroşani Basin between 2002 and 2011.

4. CONCLUSION

This study represents an attempt to highlight one of the demographic risks frequently recorded in Romania after 1990: the demographic decline of the settlements, which may ultimately lead to the depopulation of larger or smaller areas. The analysed territory is Petroşani Basin, a well-defined natural region at Romanian level, but also a region that has distinctive economic features due to the presence of mining activities for almost a century and a half. If the region was rather weakly populated in the past (until the middle of the 19th century), the opening of the first mines and the expansion of coal mining triggered a high increase in population, especially in the urban centres.

At the level of the entire basin, one notices that between 1966 and 1992 there is a difference in terms of population change between the urban centers, characterized by a demographic increase, and the villages belonging to the urban administrative units, which experienced a demographic decline, as a result of demographic ageing and outmigration. However, for the period between 1992 and 2011, this difference is no longer valid. As shown, after 1992, the change of the political system and the transition to the market economy led to a decrease in the number of inhabitants in all the mining urban centres of the region. The reasons for this general demographic decline are tightly linked to the economic evolution of these settlements: the restructuring of the industrial and mining activities generated high values of unemployment, a decrease of the living standards and intense outmigration. These specific causes may be added to others, met also in other parts of Romania, such as the decrease of the birth rate and the increase of the mortality rate, a consequence of demographic ageing.

Petroşani Basin, unlike other Romanian mining regions (such as the Land of Moţi), is not threatened by depopulation. However, the demographic decline registered during the last decades may be considered as a risk factor. The risks are linked first of all to the continuation of the outmigration process and the acceleration of demographic ageing, as well as to the changes in the socio-economic structure, because those who choose to leave the settlements of the basin, especially the urban centres, are the young people and the adults.

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THE VILLA, IDENTITY COMPONENT IN THE TOURISM INFRASTRUCTURE OF BORSEC SPA RESORT

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ABSTRACT. – The Villa, Identity Component in the Tourism Infrastructure of Borsec Spa Resort. Our study intends to emphasize several trends concerning the dynamic of a classic accommodation component (*villa*), currently experiencing a revival and rehabilitation in Borsec. In regards to this last aspect, one must point out that most investors are from the Republic of Moldova, Hungary and Israel. In Borsec, this form of accommodation was dominant at the beginning of the 1990s, but due to severe wear and tear and gradual closures, the accommodation structure began to change in 2004, villas being slowly replaced by *tourist pensions*. This situation was further exacerbated by difficult road and railway connections, traffic requiring transhipment. The closest railway station is in the town of Topliţa, 25 km away, while the Târgu Mureş *"Transylvania"* International Airport is located roughly 140 km away. In the last couple of years, a lot of attention was focused on county road 128 (Borsec-Jolotca), since it is an investment crucial for the tourists visiting Borsec, by shortening the distance by 30 km to the county capital, Miercurea-Ciuc. Another noteworthy aspect is that in February 2017, the Government Decree no. 9 restated the town of Borsec as a national tourism resort.

Keywords: *spa resort, mineral waters, villas, wear and tear, rehabilitation.*

1. INTRODUCTION

The town of Borsec is located in the Central Group of the Eastern Carpathians, overlapping the homonymous basin, developed along Vinului Stream, a right-side tributary of Bistricioara River. It is a part of Corbu-Tulgheş depression alignment, alongside Drăgoiasa, Bilbor, and Secu basins, in the long line of mountain basins

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that divide the volcanic and the crystalline mountain ranges. Borsec is a former Pliocene volcanic dam lake bed, hosting coal deposits, with an area of 20.4 km^2 (Tofan, 2013). Initially, it was a Subcarpathian depression drained by a westward hydrographic network, towards the lake located in the Transylvanian Basin.

The Neogene volcanic eruptions isolated and fragmented the rivers, which meant that the sectors located west of the volcanic barrier, with lower flows, kept their old lines, while the eastern ones, originating in the central crystalline, created the Dacian-Levantine Lake of Borsec. Borsec Basin is located at the triple junction area between Bistricioara Mountains (to the North-East), Căliman Mountains (to the North-West) and Giurgeu Mountains (to the South). Similarly to the other basins that make up Drăgoiasa-Tulgheş depression alignment, it has a dual compartment structure, comprising two small interconnected basins (*Borsecul de Sus*, smaller, in the northern part, and *Borsecul de Jos* or *Tinoave*, larger, to the South), divided by a large erosional gap formed along a tectonic line between Dealul Rotund and the slopes of Arcozei.

The area has an important hydrographic potential, mainly due to the mineral waters of the Căliman-Harghita mofetta, which led to the existence, ever since the 16^{th} century, of the so-called *„Mineral water civilization"*. Thus, the mineral waters of the area helped create a certain type of territorial development and a certain type of tourism*, the spa tourism*, seen as a *„journey"*, taken for treatment, recovery or illness prevention, in the case of people with functional deficiencies, for rest and relaxation, through therapeutical treatments.

2. WORK METHODOLOGY

Villas (rest and treatment houses) are traditional tourism accommodation structures, located in spa resorts, used for treatment, rest and recreation (N. Ciangă, 1997). The villa is the oldest accommodation unit, permanent in nature, larger than hostels, with up to several tens of beds, low comfort, containing rooms with multiple (three or four) beds and lacking room bathrooms, used exclusively for sleeping.

For a clear view on this category, we resorted to field research and used two sets of statistical data: one from *The National Institute of Statistics* and one from *The National Tourism Authority*, part of the Ministry of Tourism. This enabled us to conduct a broader analysis of the spatial dynamic of Borsec villas, after the transition period.

Furthermore, this endeavour is based on a series of papers and studies (Orban, 1868; Răucescu & Cozan, 1977; Călimănescu & Zaharia, 1981; Ciangă, 1997; Ciangă & Dezsi, 2007; Farkas, 2004, 2007; Grama & Negru, 2012; Tofan, 2012, 2013, 2014; Tofan, & Niţă, 2014, 2015), as well as on several sustainable tourism development strategies and planning codes.

3. SHORT HISTORY OF BORSEC VILLAS

The tourism development of the studied area began at the end of the 19th century, when the first rest (treatment) houses were built close to the mineral water springs. The tourism capacity was rather limited, and the entire organisation relied on catering to a limited number of clients at high prices (Ciangă & Dezsi, 2007).

The villas were built following a *"Swiss" architectural style* (*Fachwerk type*), on wooden structures, and having steepled roofs. Their terraces and balconies were large, elaborately ornated and spacious (Farkas, 2007). However, the vast majority were not created to host visitors during winter, which created a certain seasonality in the resort.

Between 1852 and 1853, the resort physician, after reviewing the improper conditions found in the area, tried to embolden the improvement of services, in order to attract a greater number of tourists, stating that: *„In Borsec, the villas are as expensive as they are improper. Most are damp, unhealthy, where the wind blows unhindered not only through walls, but through floors as well. During rainy days, water slips through the degraded roofs. Rooms are low, windows are small, disrupting the wellness and health of tourists even in good weather, but when summers are wet and cold, pacients have to spend their time inside. The waters of Borsec deserve buildings with the most beautiful furniture which would bring profits as nowhere else in Transylvania"* (Orban, 1868).

In 1890, Borsec had 34 villas and three hotels, with roughly 350 rooms (Farkas, 2007). The most important revival took place in the interwar period, when most villas were built, continuing the same well-proportioned architectural style, with delicate woodwork, especially in their pediments, which gave each villa its uniqueness. Some villas had several floors, the ground floor hosting multiple shops. Many buildings in Borsecul de Sus were privately owned, many villas carrying their owners name (*Szalkay, Barbu, Smilovits, Ștefănescu, Ágnes, Emilia, Sofia, Stoica, Mélik* etc). Besides single owners, many public institutions had villas in the area, such as Ditrău and Lăzarea forestry associations, Caritas, Ciuc Private Goods, etc. When the nationalization law was enforced, villas became property of several ministries (*Ministry of Health, Ministry of Transport, Defence Ministry*), and were administered by *L. S. E Borsec* (*Local Spa Enterprise*), which later became *S. R. E Borsec* (*The Spa-Resort Enterprise*). Following this change, villas were modernised and rehabilitated, their degree of comfort increased, in order for them to function in winter as well. In 1956, with the help of massive investment, as well as due the diversification of the functional profile, Borsec became a town, with a population of 2,318 (Tofan & Niţă, 2015).

In 1976, Borsec had a total of 65 villas, divided into comfort categories, with a total capacity of 2,646 beds, 1,744 permanent and 902 seasonal. The comfort level of permanent villas was as follows: level A-92 beds; level I-586 beds; level II-898 beds; level III-168 beds, while the situation of seasonal villas was: level I-2 beds; level II-451 beds; level III-449 beds. Besides villas, there were two lodges (86 beds), 78 cabins (156 beds) and a series of local households (150 beds) (data collected by Răucescu and Cozan, Borsec Tourism Office, file no. 562/1976).

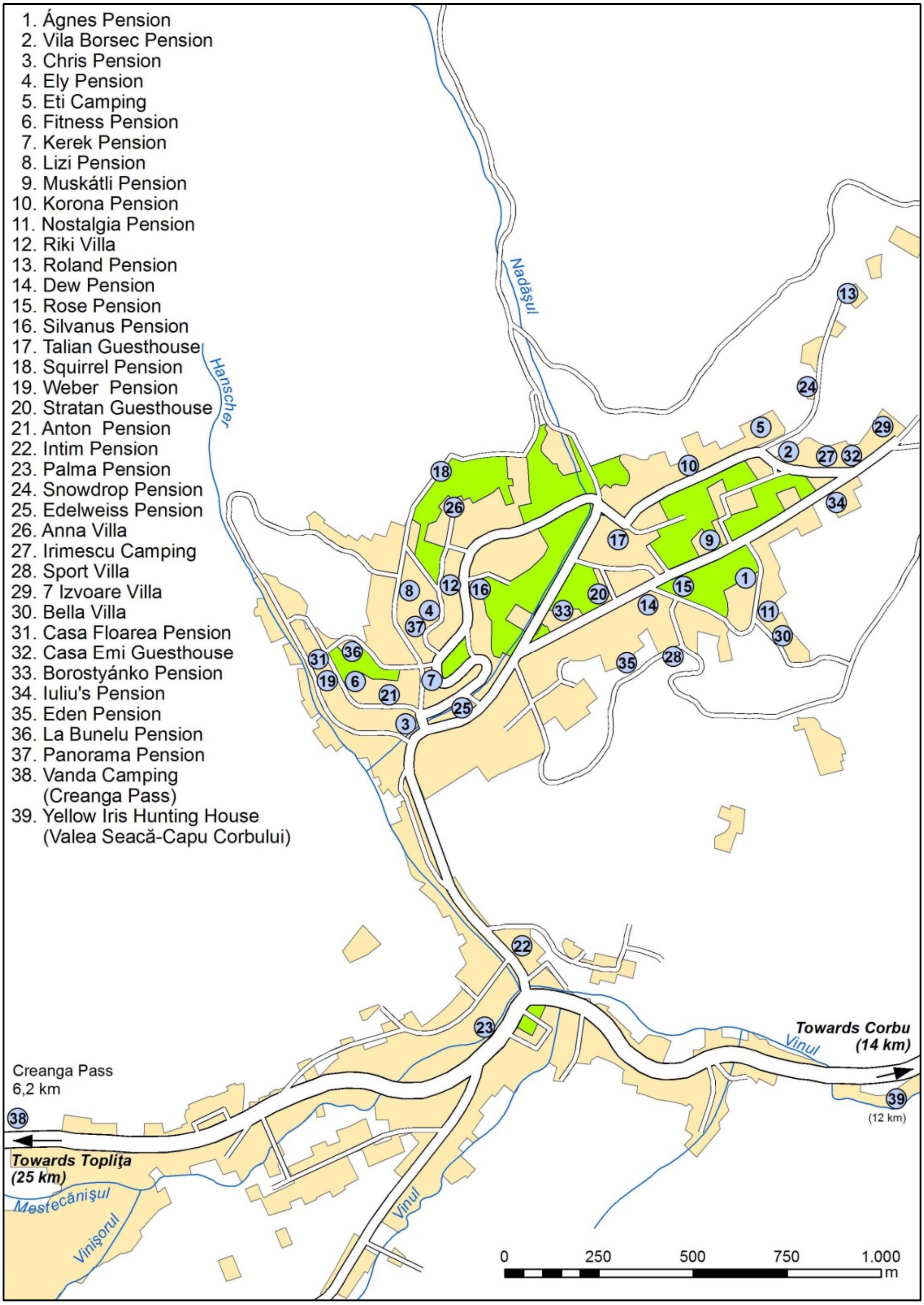
After 1989, SRE Borsec was transfered to the State Property Fund and became a joint-stock company, named *"Commercial Joint Stock Tourism Company"* (S. J. S. T. C).

One investor bought the stock majority, sold some of the villas, while the ones remaining in S. J. S. T. C property were acquired by other investors. Some unsold villas were bought by the Romanian Commercial Bank, which put them out for auction. Due to severe lack of funds for rehabilitation and tourism strategies, the numbers of villas from both categories decreased. Spa life based on state grants was no longer feasible in the market economy and due to its decaying infrastructure, Borsec went into decline.

After 2001, the tourism activity in the resort was continued by small investors and private entrepreneurs, which solely provided accommodation and food services. Borsec was therefore *"downgraded"* from a national to a local resort. The tourism peak of Borsec took place in the 1970s and 1980s, but due to closures and the decay of its infrastructure, the accommodation structure of the area began to change, villas being slowly replaced by hostels.

4. THE ACCOMMODATION CAPACITY OF VILLAS

According to the data provided by the *National Institute of Statistics*, the *TEMPO- Online* database, in 1990, Borsec had a complex and rather considerable accommodation infrastructure, comprising 2,833 beds. Villas had 2,559 beds (90.3%) while camping sites only 274 (9.7%). One year later (1991), the accommodation capacity decreased by 504 beds (10 units), in hotels by 103 (4%), in villas by 2,068 (88%) and in camping areas by 190 (8%). From 1990 to 2016 the number of functional villas dropped from 71 to only 2, and the number of beds from 2,559 to just 96, which means a decrease of 97.2% and 96.2% respectively in 26 years.


1. Ágnes Pension
2. Vila Borsec Pension
3. Chris Pension
4. Ely Pension
5. Eti Camping
6. Fitness Pension
7. Kerek Pension
8. Lizi Pension
9. Muskátli Pension
10. Korona Pension
11. Nostalgia Pension
12. Riki Villa
13. Roland Pension
14. Dew Pension
15. Rose Pension
16. Silvanus Pension
17. Talian Guesthouse
18. Squirrel Pension
19. Weber Pension
20. Stratan Guesthouse
21. Anton Pension
22. Intim Pension
23. Palma Pension
24. Snowdrop Pension
25. Edelweiss Pension
26. Anna Villa
27. Irimescu Camping
28. Sport Villa
29. 7 Izvoare Villa
30. Bella Villa
31. Casa Floarea Pension
32. Casa Emi Guesthouse
33. Borostyánko Pension
34. Iuliu's Pension
35. Eden Pension
36. La Bunelu Pension
37. Panorama Pension
38. Vanda Camping (Creanga Pass)
39. Yellow Iris Hunting House (Valea Seacă-Capu Corbului)
Nadăşul
Hanscher
Towards Corbu (14 km)
Vinul
Creanga Pass 6,2 km
Towards Topliţa (25 km)
Mestecănişul
Vinişorul
(12 km)
0 250 500 750 1.000 m

The main cause was the lack of investment in this type of establishments and the degradation of existing villas, most of them losing their classification and being put out of use. The 71 villas belonged to several owners, very few from Borsec, most of them being from *Kuwait, Ireland, India, the US, Canada, Israel, Hungary, Republic of Moldova* or *Croatia*, who never performed maintenance on them. There have been owners who received their villas back through retrocession, but sold them to various individuals and organisations, leading to the current dire situation. Fraudulent privatizations, the total withdrawal of authorities from the management of the resort, as well as shady local and foreign Hungarian interests were among the causes for the disappearance of villas in the area. Strangely, even though a part of the villas are degraded, due to lack of upkeep (especially those built between 1960 and 1980), and tourists are still rare in Borsec, the price of some of them exceeds 70,000 euro, currently over 10 villas having been rehabilitated.

In 2011, through a pilot project coordinated by the *Ministry of Regional Development and Tourism*, alongside the United Nations, a law was published in the Official Monitor, stating that all owners of villas in Borsec, Băile Herculane and Sulina must retrofit their units and return them to the tourism circuit. In case of noncompliance, they will be expropriated and the state will complete the above mentioned task.

Fig. 2. Borsec Villa, recently rehabilitated.
(Source: J. Csatlós)

The National Tourism Authority is the organisation which provides free information and data on the existing accommodation units in Romania, up until the previous year. In 2016, according to official data, there were 33 units (759 beds) in Borsec, villas representing 12.2% of the total number of units and 25.5% of the total number of beds. The five villas are: *7 Springs* (7 rooms and 22 beds); *Villa Bella* (15 rooms and 30 beds), *Villa Riki* (23 rooms and 46 beds), *Villa Sport* with two buildings, comprising 42 rooms and 96 beds, all three star rated, with the exception of one (2 star rating) and *Villa Anna*, available only in summer (4 rooms and 16 beds). Another aspect worth mentioning is that some villas were renovated and converted into pensions or guesthouses – for example, the former Villa No. 17, Dalia, became *Borostyanko Pension*; Villa No. 41 – *Iuliu's Pension*; Villa No. 28 – *Korona Pension*; Villa No. 65 – *Trandafirul Pension*.

7. CONCLUSIONS

A positive fact is that on the 16th February 2017, *the town of Borsec was once again classified as a national resort*. This is partly due the *"Speranța" Ski Complex*, which attracts a large number of tourists, thus removing the seasonality disadvantage, and the future *multifunctional spa*, which will be opened soon. The latter will provide, besides different types of treatment, the possibility for R&R all year long. Based on the two prior mentioned units, we consider the continuation of the rehabilitation and expansion of Borsec to be crucial. It is equally important to reconstruct the historical buildings on 7 Springs Alley and the villas, in a traditional style, and give them new functions.

Likewise, a part of remaining villas are included in the architectural heritage of Borsec: *Villa No. 60* (*Vasalopol*) - 1880, *Villa No. 56* (*Barbu*) – 1896, *Villa No. 14* (*Szentkovits*) – 1933 – 1935, *Villa Nr. 51* (*Emil*), built in 1936, *Villa No. 53* (*Doru*) - 1936, *the ruins of Babám Villa*. Unfortunately, a series of buildings such as: *Villa No. 17* (*Bernstein), Villa No. 19* (*Stoica*), *Villa No. 20* (*Heiter*), *Villa No. 71* (*Budapest*), *Villa No. 15* (*Nefelejts*), *Villa No. 23* (*Csilla*), *Făget Restaurant* etc., erected in the 20th century, included on the list of historical monuments, have been demolished.

The tourism rehabilitation and remodeling of Borsec involves tremendous financial and managerial efforts, the state playing a major role in providing a quality infrastructure, through investment and creating a stimulative legislative framework (Tofan, 2012a). All these actions aim at raising the spa product at European standards of quality, as the international demand for this type of tourism is increasing. This will allow for a proper capitalization of Borsec spa potential, for a large number of Romanian and foreign tourists.

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