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INTERACTIONS BETWEEN HUMAN SETTLEMENTS AND GEOMORPHOLOGY IN HUŞI DEPRESSION, NE ROMANIA

ELENA CHIRILĂ-ACATRINEI[1]

ABSTRACT. – Interactions between Human Settlements and Geomorphology in Huşi Depression, NE Romania. The present paper analyses the way in which terrain morphology influences the typology and distribution of human settlements in the depression basin of Huşi, landforms being one of the main factors conditioning the location and development of localities. Also, the habitable space of the depression has been analyzed by using some mathematic and statistical indicators computed for the administrative units in this geographical area. Such are the indices regarding settlement dispersion, centrality and concentration. Thus in the study area one notices an unequal dispersion of the settlements, with large surfaces lacking habitation in the central part of the depression, a large percentage of small localities with a subsistence agricultural economy and a reduced degree of urbanization. The only town is Huşi, which offers low economic dynamics to the rural settlements in the depression.

Keywords: *Huşi Depression, geomorphology, human settlements, dispersion, centrality*

1. INTRODUCTION

The analysis of the physico-geographical conditions in the depression of Huşi in relation to the influence they exert on the territorial repartition of human settlements points out to the complexity of the interrelations between humans and the environmental components. The development of human settlements depends both on the social, economic and historical context and on the peculiarities of the environment that have favored or restricted the agricultural utilization of terrains, access to water resources and building materials, the development of communication networks and implicitly the expansion of settlements.

The first viable sources of information regarding the settlements in the study area date from the end of the 19th century and the first part of the 20th century, these being a series of statistical data and cartographic materials used both by historians and geographers in several papers. For the inter-war and the contemporaneous periods there is much more information, making up valuable references for the research of human settlements in Moldova.

At the beginning of the 20th century a special interest was given to rural or village geography, theoretically established by Mihăilescu, who published numerous papers in this period, also conducting the first morphological typology of the Romanian villages (1926). Tufescu studied the semi-urban settlements (boroughs) and their economic importance (1942) as well as the distribution of the free peasant (*răzeşi*) villages (1937).

[1] *Faculty of History and Geography, "Ştefan cel Mare" University from Suceava, Romania, e-mail: emil_lena@yahoo.com*

Other papers approaching regional aspects are those of Năstase (1946) regarding the Prut Valley and Gugiuman on Elan-Horincea region (1938), Lohan valley (1942) and later Huşi Depression (1959).

Aspects regarding the geomorphology of Huşi Depression are found in different papers of local, larger spatial coverage or national scale. Most of the papers have approached geological aspects of the Moldavian tableland (David, 1921, 1922), the premature ageing of the floodplains (Filipescu, 1950), landforms and present geomorphological processes in the Moldavian Tableland (Bacăuanu et al., 1980). A series of studies referring to slope processes and cuesta landforms in the Bârlad Basin have been conducted by Gugiuman (1932, 1938, 1942, 1959) and Ioniţă (1985, 1997, 2000). Among the geomorphological studies approaching larger regions that include the area of Huşi Depression are those of Martiniuc (1954, 1955), Hârjoabă (1968, 1977), Gugiuman et al. (1973), Obreja (1958), Paraschiv (1964), Donisă et al. (1984) and Rădoane et al. (1996, 2008a, 2008b).

2. STUDY AREA

Huşi Depression is located in the south-eastern part of the Central Moldavian Plateau, subunit of the Bârlad Plateau, limited on the west by Lohan Ridge, that is 100-200 m higher than the rest of the territory, on the north by Pietrăriei Cuesta, situated on the right of Moşna River, on the south by Drăslăvăţ Cuesta and on the east by Prut River. Between these limits, the depression of Huşi has an area of approximately 300 km^2 and includes the town of Huşi and 18 other villages, belonging to five administrative territories: Huşi, Arsura, Duda-Epureni, Stănileşti and Drânceni (fig. 1).

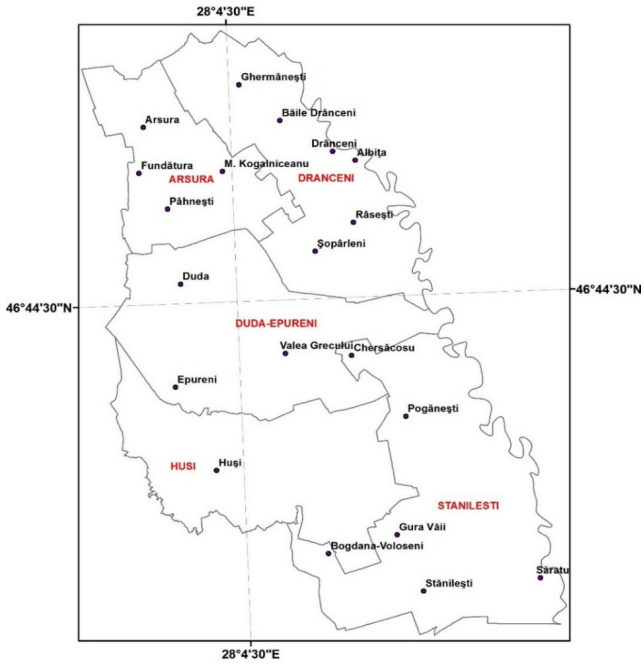

Fig. 1. Geographical position and administrative-territorial organization of the depression of Huşi.

3. RESULTS AND DISCUSSIONS

The overall aspect of the Huşi Depression is that of an amphitheater opened to the SE. The western part of the depression is higher, the hills here frequently exceeding the altitude of 300 m. The central part of the basin presents a hilly relief, which descends to the Prut River. On the right side of the Prut valley there are some more developed terrace levels. The geological deposits are represented by Sarmatian limestones and sandstones, which contribute to the formation of a structural relief represented mainly by plateaus and subsequent asymmetric valleys (fig. 2).

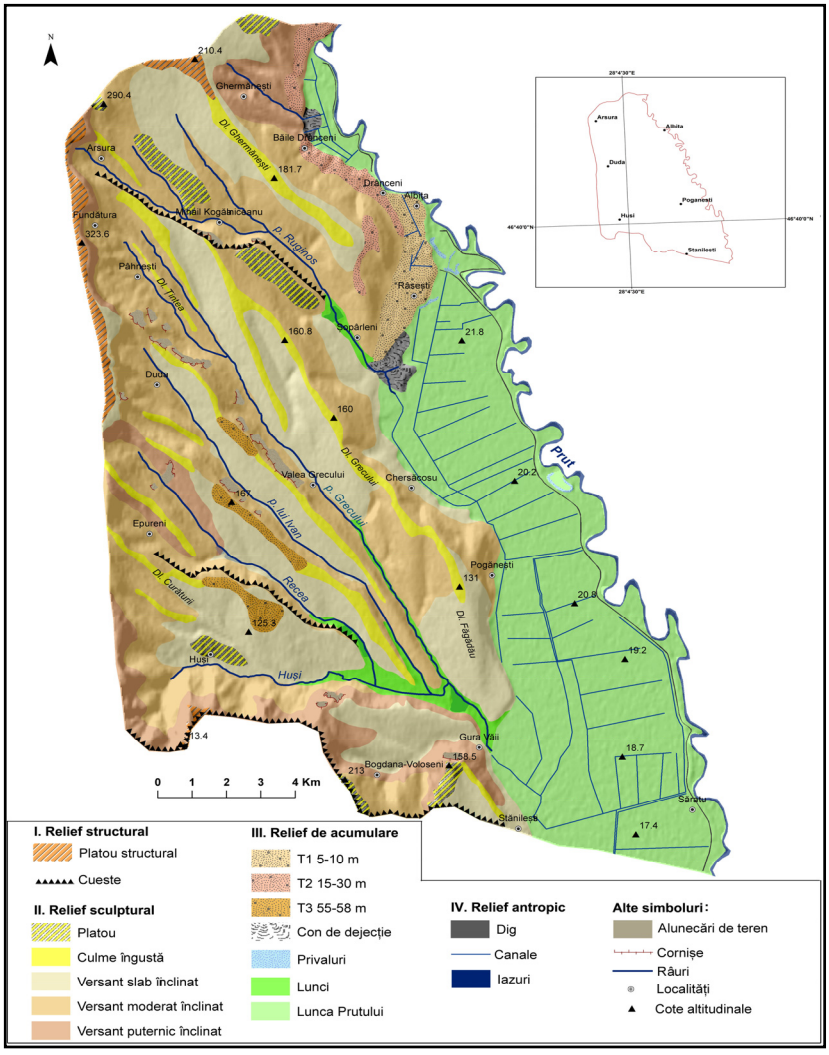

Fig. 2. Geomorphological map of Huşi depression.

The relation between geographical conditions and rural settlements can be approached both at local scale, separating site morphological types, and at regional scale, separating "series" types of settlements (Băcăuanu et al., 1980).

In the class of site morphological types enter the *terrace settlements* (Drânceni, Râșești, Pogănești) with favorable development conditions due to the flat or low declivity landforms, the terrain favorability for agricultural use and the facility in what regards the water supply.

River basin source settlements, situated in the basins of tributaries, have limited development conditions due to landslides and the large distance from the modern communication network, despite benefiting from a sheltering micro-climate, aquifers and springs. This is the case of Arsura, Fundătura, Păhnești and Ghermănești villages, whose surfaces have suffered an advanced decline during the last decades. The basin source settlements from the cuesta areas are characteristic for the Moldavian rural network morphology. The genesis of this site type is an archaic one, which regarded mainly the defensive position and protection against winds. Cuestas represent repulsive areas for settlements position, being strongly affected by landslides, which prevent emplacing households. They are fragmented by numerous secondary tributaries which fragment the cuesta front, and thus villages have settled either in the reception basins of these tributaries or on the small alluvial fans. The basin source settlements have generally occupied the semi-circular landslide basins of the "hârtop" type (Ioniță et al, 2014). The occurrence on the surface of some groundwater from the landslide deposits (water coming from rainfall or springs), together with the terrain instability and un-uniformity, the micro-climatic shelter and the security conditions have represented attraction elements for establishing settlements in these positions. Their isolation has later become an impediment in the economic development in the modern and contemporaneous periods. Even the relative close position to the well-drawn development axes or to larger towns has not influenced the economic dynamism of these settlements. Conversely, they represent repulsive rural areas with a subsistence dominant agricultural economy. An example in this sense is the rural area from the Iași Cuesta. An urban variant of this situation is the town of Huși, positioned in a small erosion depression which ensures a sheltered micro-climate.

The interfluve settlements (Valea Grecului, Chersăcosu) are more recent in the depression and are met in the central part of the depression. This settlement type gives the rural localities an optimum declivity, yet from the relational viewpoint, during the modern and contemporaneous period this became an obstacle for the connection to the communication networks. Another impediment for the rural settlements from this category is represented by the lack or insufficiency of water sources. At present, the site implies sometimes insuperable difficulties for the accessibility to the communication network (Țurcănașu, 2006).

The floodplain settlements are found in the major floodplain of Prut, especially on levees (Săratu), are partially floodable, are affected by water excess and are exposed to negative climatic phenomena such as frequent fogs or cold air invasions.

The glacis and alluvial fan site is a common one for the rural settlement network of Moldova. Besides a certain protection against floods, this category offers favorable conditions in what regards declivity, water supply, the proximity of forests and others.

These settlements are positioned on alluvial fans of secondary tributaries and on proluvio-coluvial glacises developed at the contact between the floodplain and the right slope of Prut valley (Pogăneşti, Stănileşti).

At regional scale, the villages located in the most favorable local conditions result in *alignments of localities,* which point out the major geographical conditions for development. The settlement series represents the frame in which enters each morphological site type (Băcăuanu et al., 1980).

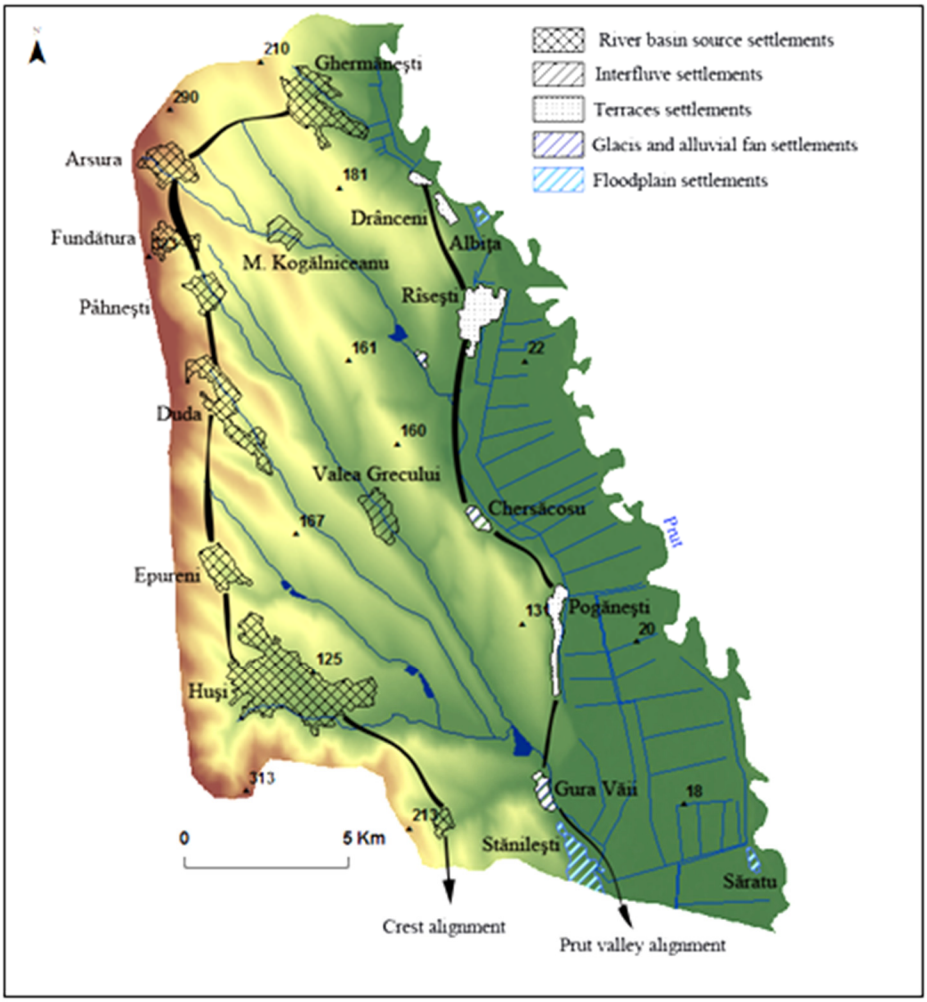

Figure 3. Settlement types in Huşi Depression.

In the depression basin of Huşi, first of all one notices the *settlement alignments of geographical contact*, which benefit from the advantages of the contact between two geographical subunits. The contact position makes use of complementary resources available from the geographical subunits different as landforms, climate, vegetation, soil cover etc. Most of times in Moldova, this category is associated with the *intersection position*. Huşi is developed at the contact between the higher forested and the lower, silvo-steppic geographical sub-units of the Moldavian Tableland (the Bârlad Tableland and the hilly depression of Elan-Horincea). It also has an intersection position, favored by the presence close to the town of passes and of major rivers (Prut), which enlarge its hinterland.

In the depression, some localities form *alignment in cuesta areas* with landslides, which may also be associated with the position of geographical contact. These are generally formed of old villages with a dispersed structure. In some cases (Duda, Novaci, Arsura) one sees a densification of the households from place to place, according to family groups or stages in the formation of some neighborhoods, the dispersed structure having a *polinuclear* character (Gugiuman, 1959). These localities can be considered as also forming *crest alignments*, their position marking spring lines, deforestation phases etc.

The valley alignments of settlements are represented in our case by the alignment along Prut valley. The settlements from this area belong chronologically to the Middle Ages. These are some of the nuclei of dense population in Moldova that have occurred quite early and are in fact inserted in the northern periphery of the medieval state nucleus. The morphology of the alignment has not become more complicated in the modern period, on one side due to the border situation and on the other as a consequence of the terrain morphology and the inexistence of well-developed terraces (Ţurcănaşu, 2006).

The crest alignments surround some hills, with the villages emplaced on secondary tributaries. They had favorable development conditions in Fălciu Hills, and they are also associated to contact alignments, having in view the fact that the respective rural alignments are situated in the proximity of the contact between subunits of the Moldavian Tableland.

The characteristics of the habitable space can also be analyzed with the help of mathematico-statistical indicators computed at the level of the administrative units inside the depression basin. The interpretation of these indices has mostly a theoretical aspect and the eventual comparisons with existing situations can lead to uncovering similitudes between the recommendations given from their study and the *de facto* situation (Iaţu, 1998). These indicators that regard the dispersion, centrality and concentration of settlements express the relative position of each locality in the settlement network of the depression and the degree of concentration and dispersion of the component villages of the townships. At the same time, these indices allow for the correlation between human settlements and the components of the geographical landscape.

The dispersion index indicates the degree of dispersion of the localities, and has been computed according to the formula elaborated by the French geographer Albert Demangeon:

$$\mathrm{Id} = \frac{(N - N')n}{N}$$

where Id is the dispersion index, N= total number of inhabitants, N' = number of inhabitants from the village acting as administrative seat, and n = number of villages minus the administrative seat.

In the case when the administrative unit is composed of only one settlement, the dispersion index will take the zero value (the case of Huşi). The more the index values tend towards zero, the higher the concentration degree of that administrative unit. The *Demangeon* dispersion index takes higher values as the number of settlements within a commune is higher. Thus, for the communes inside the depression of Huşi the higher values have been obtained for Drânceni (4.52) and Stănileşti (3.03). The higher dispersion in these cases is due to the higher number of localities inside these administrative units and to the fact that the population of the component villages is higher than that of the administrative seat (table 1).

Table 1.

Dispersion (Id), centrality (Ice) and concentration (Ico) indices for the township residences from Huşi depression

Locality	Id	Ice	Ico
Huşi	0	15	0 .25
Arsura	1 .75	19	0 .08
Duda-Epureni	2 .01	17	0 .11
Drânceni	4 .52	15	0 .10
Stănileşti	3 .03	18	0 .09

Another attribute of the settlement system is *centrality*, which is given by the preferential orientation of the material, human and information flows from a certain territory towards a polarizing center. The centrality index is defined as being the mean distance of a locality in relation to the other localities inside a territory (administrative or geographical unit etc.). The index has been computed as the arithmetic mean of the distances between the administrative seat and each component locality:

$$\text{Ice} = \frac{d1 + d2 + \cdots d\text{n}}{n}$$

where $d_1, d_2, \ldots d_n$ = are the distances between the administrative seat and the other localities of the commune, and n = the number of distances between the component localities.

According to the calculations of the centrality index for the administrative seats in Huşi Depression, it can be seen that Huşi has the lowest value of the index (Ice = 0.15), although it does not have a central position. This situation is due to the fact that the town of Huşi benefits from a certain disposition of the road network that connects it to the other villages which makes it the most important settlement in the depression. A similar value of the index has been obtained for Drânceni, which takes advantage of its position on the Prut valley on the 24 A national road. The highest values of the centrality index have been obtained for the commune seats Arsura (Ice = 19) and Stănileşti (Ice = 18),

which although have a peripheral position inside the depression, are situated at small distances to the other localities from the administrative territories they are part of (table 1).

The concentration index is used to measure the way the localities are positioned inside the territory in comparison to a homogeneous model, in which they would be uniformly spread on the surface of the administrative unit, at equal distances. The concentration index has been calculated as the ratio between the theoretical and the real distances between the localities acting as township residences. The formula is:

$$Ico = \frac{Dr}{Dt} = \frac{\sqrt{\frac{T}{N}}}{d1 + d2 + \cdots d\mathrm{n}}$$

where Ico = the concentration index, Dt = the theoretical distance between the localities, Dr = the real distance between the localities, T = administrative unit surface, N = the number of localities inside the administrative unit, n = total sum of distances between component localities of the administrative unit.

As the values of the concentration index are lower, the localities are less favorable located, with large distances between them. This is the case of Arsura and Stănileşti, situated at the periphery of the depression, and also of Drânceni and Duda-Epureni. A more favorable position is that of Huşi, with a value of the concentration index of 0.25.

4. CONCLUSIONS

The configuration of the relief inside the depression of Huşi is due to the erosion activity of Prut River and its tributaries, which have evolved regressively towards west, forming the present valleys that have their sources under the high ridge that forms the western limit of the depression. In this context, the formation and evolution of the settlements inside the depression is closely related to the genetic landform types, which make up the support on which they evolved in time. Thus, at the source area of the main rivers that drain the depression, in favorable shelter and defense conditions, the first and the more numerous settlements have formed and evolved until now (Huşi, Arsura, Fundătura, Pâhneşti, Duda and Epureni).

Another alignment of settlements is positioned at the contact between the right slope of Prut valley and its floodplain (Ghermăneşti, Drânceni, Răşeşti, Chersăcosu, Pogăneşti and Gura Văii). These localities have made use of the conditions including low declivities and drained terrains from the colluvial glacises neighboring the 50-100 m relative altitude terrace. In the central-eastern part of Huşi Depression, the villages of Şopârleni, Mihail Kogălniceanu and Valea Grecului are situated on the valleys of Şopârleni, Ruginosu and Grecul brooks. Şopârleni is situated at the terminal part of an interfluve summit, while Mihail Kogălniceanu and Valea Grecului villages have evolved at the base of some cuesta slopes of the Ruginosu and Grecul valleys respectively. The town of Huşi has extended during time at an accelerated rate, occupying at the beginning the medium altitude hills and the higher hills from west and south, and later the southern parts of the lower rolling hills, the base of the cuesta slope from the right side of Huşi river and its floodplain near the confluence with Recea brook.

The statistical indices regarding the dispersion, centrality and concentration of the settlement system allow for making correlations between human settlements and the landforms of the depression, which condition the accessibility of localities, and implicitly the supply possibilities, ensuring diverse services, circulation of the labor force etc. Thus, in the depression of Huşi one may witness an unequal distribution of settlements in the territory, with large surfaces lacking habitation in the central part of the depression, a high percentage of small localities (12 villages with less than 500 inhabitants) and a reduced degree of urbanization.

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