

## THE INFLUENCE OF LANDFORM IN THE DISTRIBUTION OF HOUSEHOLDS OF ILVA MICĂ TERRITORIAL ADMINISTRATIVE UNIT

Gheorghe ROȘIAN<sup>1\*</sup>, Csaba HORVATH<sup>2</sup>, Liviu MUNTEAN<sup>1</sup>,  
Nicolae BACIU<sup>1</sup>

<sup>1</sup>*Babeș-Bolyai University, Faculty of Environmental Science and Engineering, Fântânele Street, No. 30, 400294, Cluj-Napoca, Romania*

<sup>2</sup>*Babeș-Bolyai University, Faculty of Geography, Clinicilor Street, No. 5-7, 400006 Cluj-Napoca, Cluj County, Romania*

*\*Corresponding author: gheorghe.rosian@ubbcluj.ro*

**ABSTRACT.** In the case of territorial administrative units located in hilly and mountainous lands, landform, through its morphometric parameters, is a variable that introduces significant differences in the distribution of households. A similar situation is the case of the Ilva Mică commune, where, due to its position at the border between the Eastern Carpathians and the Transylvanian Basin, the landform is extremely varied. Among the parameters of the landform taken into consideration for tracking the distribution of households, the following parameters stand out: altitude, slope and slope aspect. The results show that as the development of Ilva Mică took place, favorable lands were used for building households along with less favorable areas located at altitudes higher than the average altitude of the commune (704 m) and with slopes higher than 17°. This occurred both because of lack of space and of economic reasons, such as the land use for livestock.

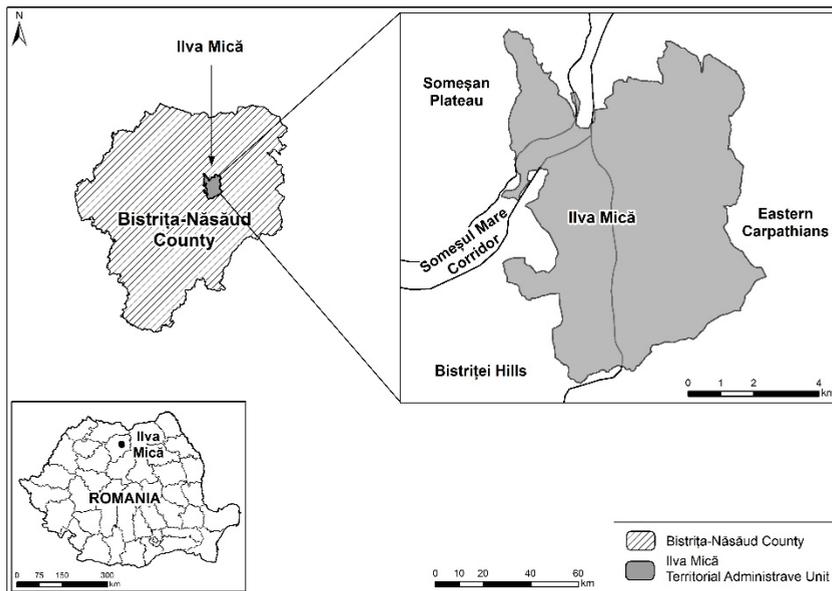
**Key words:** *altitude, slope, aspect, household, distribution.*

### INTRODUCTION

The territorial administrative unit of Ilva Mică is located in the north-eastern extremity of the Transylvanian Basin, on the border of Eastern Carpathians. From a regional point of view, it overlaps with the following morphostructural units (figure 1): The Someșan Plateau, the Someșului Mare stream corridor, the Bistrița Hills and the Bârgăului Mountains (Pop, 2001,

2006; Roșian, 2020). Administratively, it belongs to Bistrița Năsăud County, within which it has the rank of commune (figure 1). There is only one village, Ilva Mică, which is commune's residence. There are 3.220 inhabitants grouped in 1.174 households. The territorial administrative unit has a surface area of 2.474 ha.

As a result of a long geomorphological evolution, the landform is complex as a result of a fluvial modelling. Thus, a series of valley corridors were formed which are separated by interfluvial divides. The valley corridors that stand out are Someșul Mare, Ilvei, Leșului and Strâmbei to which are added those of their tributaries. The most significant interfluvial divides are: Ursoiului Hill (between Feldrișelului and Someșului Mare valley), Prislopului Hill (between Someșului Mare and Ilvei valley), the Big Hill (between Ilvei and Leșului valley), Heniu Mountain (between Strâmba and Bârgău valleys) and Băzarnic Peak, between Strâmba and Someșului Mare valley.



**Fig. 1.** Localization of the study area

The connection between the inferior stream valley corridors and the interfluves is made through steep inclined surfaces, the slopes.

The 400-500 m altitude differences between the upper and lower part of the slopes are a restrictive factor in the proper land use, as well as in the building of transversal roads which ensure an easier connection with neighbouring localities.

Starting from these landform features, in order to follow how it influences the distribution of households, three morphometric parameters have been taken into consideration: altitude, slope and slope aspect.

## **MATERIAL AND METHODS**

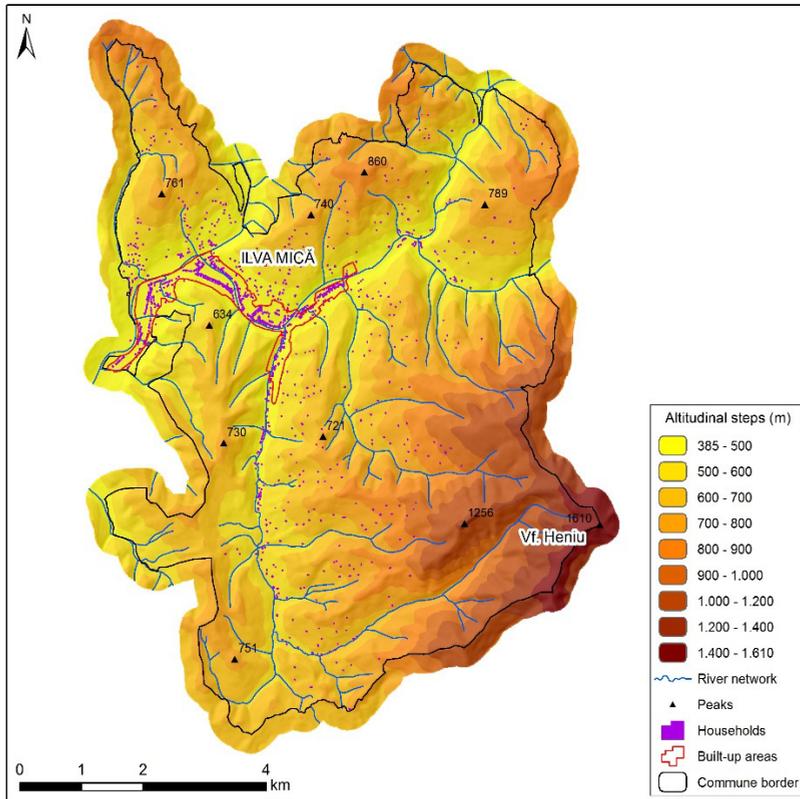
To identify the distribution of households based on altitude, slope and aspect, a statistical GIS methodology was used.

Initially, starting from the existing information on topographic maps, the contour lines were vectorised, which, in this case, have a 10 m interval. Using the Esri ArcMap 10.5 software Spatial Analyst extension, with the Topo to Raster Interpolation, a Digital Elevation Model is obtained for the study area. In order to establish the area of the desired altimetric levels, this is run through the reclassification process. Also, the slopes and the aspect are obtained from the same Digital Elevation Model using the Slope and Aspect functions. To identify the value of the areas specific to each altitudinal level, slope or aspect class, the Reclass and Reclassify functions in the Spatial Analyst extension, the Raster to Polygon function in the Conversion Tools extension, and the Summary Statistics function in the Statistics extension were used.

Subsequently, after obtaining the classes of the above-mentioned parameters and their corresponding areas, we assessed the distribution of households in Ilva Mică according to the characteristics of the landform. Households were vectorised based on remote sensing images with the Esri ArcMap 10.5 software Editor function. Both the households in which activities are carried out throughout the year and those with seasonal activities, related to animal husbandry, were vectorised. To identify the distribution of households according to the parameters of the landform, initially a query expression was used, and then a selection was performed based on location.

## **RESULTS AND DISCUSSIONS**

Following the mentioned methodology, it can be noticed that in the case of the Ilva Mică commune, landform is one of the most important variables that introduces variations in the household distribution. All three parameters of the landform (altitude, slope and aspect) have influenced individually, as will be further detailed, the development and evolution of the settlement.



**Fig. 2.** *Distribution of households on altitudinal steps at Ilva Mică*

Altitude is one of the parameters of the landform with the greatest influence in the distribution of human elements on the surface of a territorial administrative unit. This statement is also valid in the case of the household distribution in Ilva Mică. As can be seen in figure 2, the altitude varies between 385 m (in the Someșului Mare corridor) and 1610 m (in Heniu Peak, in the Bârgăului Mountains). The altitudinal difference recorded between these extremities is of 1225 m, while the average altitude is of 704 m.

Of the nine altitude levels chosen for the observation of the household distribution, one can notice that the largest surface corresponds to the 600 and 700 m level (table 1). At the same time, most households are located on the 385 and 500 m altitudinal level even if this is not the largest surface area. Other altitude level favorable to the location of households are the following: 500 - 600 m and 600 - 700 m (table 1).

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**Table 1.** *The surface of the altitudinal steps and the afferent households at Ilva Mică*

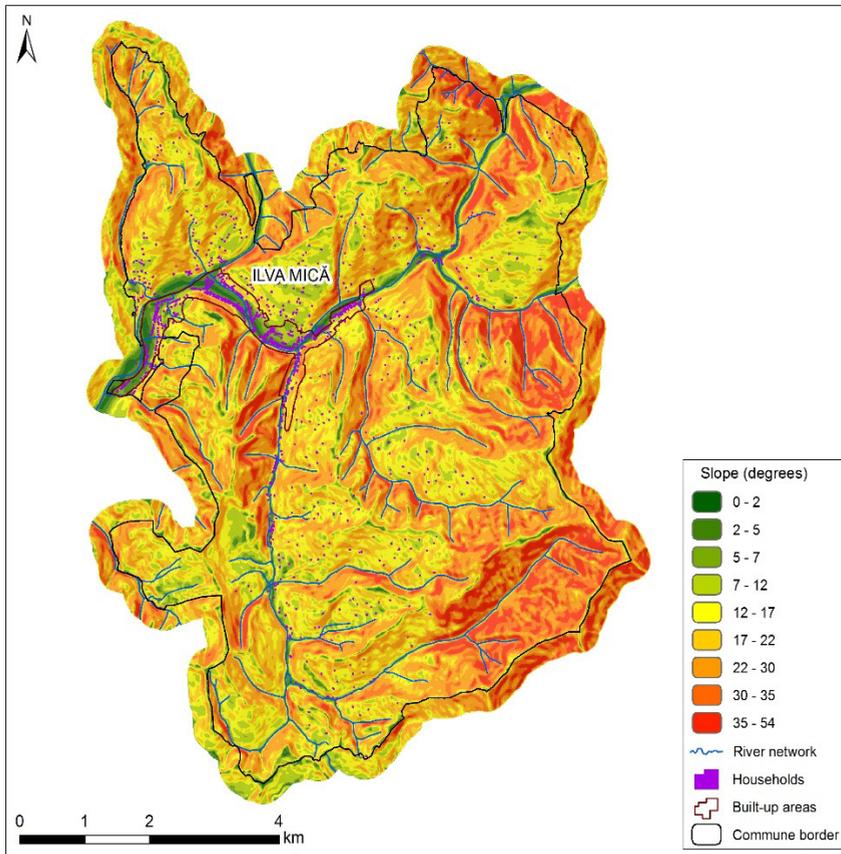
Altitudinal steps	Surface (ha)	Weight (%)	Number of households	Weight (%)
385-500	716	13	789	67
500-600	1106	21	162	14
600-700	1407	27	129	11
700-800	936	17	68	5
800-900	442	8	19	2
900-1000	235	4	7	1
1000-1100	359	7	0	0
1200-1400	118	2	0	0
1400-1610	44	1	0	0
Total	5363	100	1174	100

**Table 2.** *The surface of the slope classes and the afferent households at Ilva Mică*

Slope class (°)	Surface (ha)	Weight (%)	Number of households	Weight (%)
0-2	43	1	71	6
2-5	140	3	206	18
5-7	119	2	117	10
7-12	562	10	301	26
12-17	1095	20	278	23
17-22	1105	21	142	12
22-30	1332	25	57	4
30-35	574	11	2	1
35-54	393	7	0	0
Total	5363	100	1174	100

The slope also introduces significant differences in the distribution of households. At Ilva Mică the values of this parameter are between 0° (in the Someşului Mare floodplain) and 54° on the northern slope of Heniu Peak (figure 3); the average slope value is 21°.

Out of the nine chosen classes of slopes on which to follow the household distribution, one can notice that the largest area belongs to the class corresponding to 22 and 30° (table 2). At the same time, most households are specific to the class belonging to 7 and 12°. Even in this case, this slope class does not represent the largest surface area. Other classes favourable to the location of households are the following: 12 - 17°, 2 - 5° and 17 - 22° (table 2).



**Fig. 3.** *Distribution of households by slope classes at Ilva Mică*

In turn, the aspect of the areas introduces significant differences in the distribution of households (figure 4). The exposure decisively determines the heat conditions and the humidity of the soil and the substrate, it influences the freeze-thaw cycles, the type and nature of the cover deposits on the hill slopes and it causes qualitative differences in the geomorphological processes preceding erosions (Jakab, 1979).

In the Ilva Mică commune, of the 8 types of aspect, the north western surfaces have the highest value (table 3). At the same time, most of the households are located in the areas exposed to the southwest, because sunny areas are more preferred. Other types of positive slope aspect for the household location are: south, northwest and western slopes (table 3).

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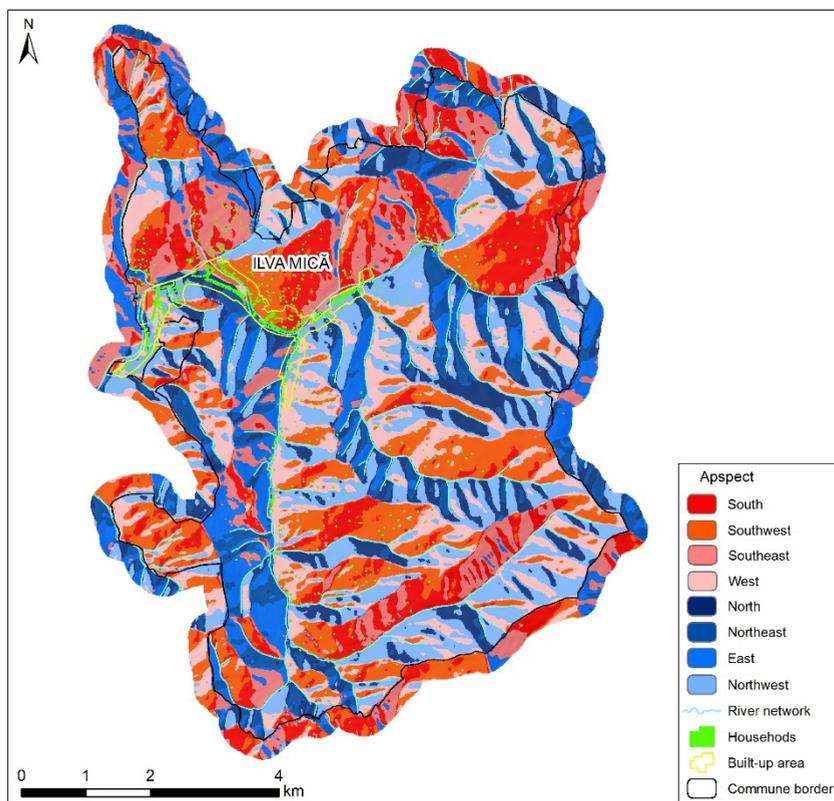


Fig. 4. Distribution of households according to aspect at Ilva Mică

Table 3. The surfaces of slope aspect and the afferent households at Ilva Mică

Types of exposure	Surface (ha)	Weight (%)	Number of households	Weight (%)
South	676	12	219	19
Southwest	932	18	271	23
Southeast	521	10	72	6
West	894	17	195	17
North	505	9	99	8
Northeast	394	7	54	4
East	445	8	55	5
Northwest	996	19	209	18
<b>Total</b>	<b>5363</b>	<b>100</b>	<b>1174</b>	<b>100</b>

It can be noticed from the above that the preferred areas for the location of households in Ilva Mică are those with an altitude between 600 and 700 m, a slope between 7 and 12° and with a southwestern slope aspect.

Based on the above, it can be assumed that in Ilva Mică the households are to be found mainly on three types of landforms: on the low valley corridors, on the hill slopes and on the water divide areas.

Along with the distribution of households, the landform has also influenced the distribution of the street network. The main street has a longitudinal profile that runs on a west-east direction. From this, secondary roads emerged which follow the direction of the river tributaries, running on the north-south direction. Along with these, there are also numerous roads towards the households located on the hill slopes. Such a layout of the street network is primarily due to the various levels and fragmentation of the landform (valley corridors, hill slopes and water divide areas).

At the same time, the horizontal fragmentation of the landform by means of valley corridors, has determined a strong fragmentation of the built-up area in Ilva Mică.

Although, initially, the development and expansion of the built-up area took place on the low valley corridors, later, due to financial constraints and lack of space, the subsequent development included less suitable areas, located on the hill slopes. This situation is specific both to Ilva Mică and to other localities (Petrea, 1998; Gupta and Ahmad, 1999; Roșian et al., 2016; Poszet, 2017).

The fact that on inclined surfaces, such as hill slopes, more and more households were built in the last two decades, it reveals a dangerous trend in the long run, in terms of viability and safety of construction. For this reason, we consider that it is recommended that the extension of the built-up area to take place on surfaces that do not show any susceptibility to geomorphological processes (Dhakal et al., 2000; Bathrellos, 2007) like landslides and eroding riverbanks.

## **CONCLUSIONS**

The emergence and development of Ilva Mică was significantly influenced by the parameters of the landform. Although initially the households were located mainly on favourable lands, on the lower parts of the Someșului Mare and Ilva river corridors, later the number of households increased which included building them up on less favorable areas, such as hill slopes and water divides.

The landform through its parameters (altitude, slope, aspect, etc.) has influenced the building ratio at Ilva Mică. If on the lower part of the valley corridors there are compact buildings, which are part of the built-up area, on the inclined surfaces, like hill slopes, or those located at higher altitudes, like water divides, there are in the vast majority of the cases lonely buildings unincorporated in the built-up area. In the case of the latter, the same anthropic activities are carried out as in the built-up area, with the specification that some of the households are seasonal.

Even if they were analysed separately, there are obvious correlations between the landform parameters. For example, the slope influences both the expansion in height of households and the vertical distribution of buildings. Imposing constructions such as schools, administrative offices, churches or cultural centres are located on low-slope areas, thus avoiding special arrangements, while small individual households are built on hill slopes with slopes higher than 17°.

The presented data show that among the elements of the natural environment, landform has influenced in a specific manner the distribution of households in Ilva Mică. Practically, the unevenness of the landform influenced the spread of the buildings. It can be noticed that the most favourable areas for the household's location in Ilva Mică are those with an altitude between 600 and 700 m, a slope between 7 and 12° and a southwest aspect. Having these in mind, the most unfavourable areas are located at altitudes higher than 1000 m, with an inclination greater than 30° and with a northeast aspect. Thus, the higher the altitude, the slope and the lower the amount of sun energy, the lower the number of households.

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