THE ROLE OF THE RELIEF IN THE EVOLUTION, STRUCTURE AND FUNCTIONALITY OF THE ZALĂU URBAN AREA

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Abstract: The role of the relief in the evolution, structure and functionality of the Zalău urban area. The relief represents an important condition for a settlement’s emergence and for its social, economical and territorial evolution. Moreover, it influences the urban structure and the functional organisation of a city. As a result, the configuration of the main built-up area of Zalău has been determined by geomorphological factors which provided, through the hydrographical convergences, a suitable area for territorial expansion. The city’s longitudinal development has unfavourable consequences on the urban functionality. At the same time with the expansion on this direction, the city’s transversal development takes place through the emergence of the Dumbrava Nord neighbourhood. Some dwellings were also built on the slopes, generating stepped apartment blocks and access ways perpendicular to level curves, increasing in this way the value of investments. The extension of the inhabited area, through holiday or permanent houses being built at the foot of the Meseş Mountain and near the Zalău - Aghireş and Zalău-Moigrad roads, confirms the new trend in the urban development of Zalău: The following study analyses the relationships among the relief, the urban built-up area and the territorial development. Thus, the cartographic documentation has included: shooting directory plans from 1939, topographic maps from 1970 and orthophotoplans from 2005, which were used to determine the chronological limits of the built-up area and to analyse their spatial evolution in relationship with the demographic evolution and the favourable characteristics of the relief (<5° declivity and < 250 m altitude). All these are based on geomorphologic mapping and GIS analysis. As a main result, an expansion tendency of the built-up area was identified in relationship with an increase in comfort, which at the same time is being restricted to some extent by geographical conditions.

Key-words: territorial evolution, urban area, geomorphological factor, functional zones, development opportunities.

1. Introduction

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A city’s evolution, structure and functionality are influenced by the morphology of its built-up area. In the development of Zalău municipality, the relief has played an important part, as it has imposed the direction of development and has determined its regional and national importance. The main purpose of this study is to generate a model of territorial development for Zalău municipality in relationship with the morphology of the study area, by identifying the main geomorphological factors and components which have a role in the development of the urban area. The specific aims of the study are focused on the successive research stages, which start from the premise that the city functions as a system. The role of the floodplain, terraces and slopes, as well as the relationship between the sloped and the horizontal areas, have been identified and analysed. In addition to this, the morpho-hydrographical convergences, as well as the different types of buildings and the functional zones of Zalău municipality have been identified. Last but not least, the role of the relief in the evolution, structure and functionality of the urban area has been determined through morphological analysis.

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2. Methodology

The research focusing on Zalău municipality has resulted in a series of scientific works which, among other things, include elements related to relief and the evolution of the territory.

In his paper “Influenţa reliefului în dezvoltarea, sistematizarea şi estetica urbană a municipiului Zalău”, I. Mac (1996) presents the three morpho-hydrographical convergences which had an important role in the geomorphological structure of the built-up area. The first convergence takes place where the Meseş stream flows into Zalău river, the second is represented by the convergence of the Sărătura and Caselor streams with Zalău river and the third, by the convergence of Miţii and Crişenilor rivers with Zalău river. Starting from this paper, we wanted to continue the research through direct observations in the field and geomorphologic analysis, in order to learn more about the present situation.

Using the method of geomorphological mapping, together with GIS techniques, the digital thematic maps of the study area were generated starting from the 1:25 000 topographic maps. The thematic maps of each morphometric parameter were generated and analysed, as the geodeclivity, the hypsometry and the aspect play an important part in the way the terrain favours anthropic activities, contribute to the extension of residential zones and facilitate the evaluation of vulnerability.

The analysis of slope angle included five general slope angle intervals: 0-2˚, 2.1-5˚, 5.1-15˚, 15.1 - 20˚ and 20.1 - 29.7˚, while the analysis of hypsometry relied on the main characteristics of the morphology, leading to five altitude intervals. Further on, when analysing the proportion of each aspect class, the cardinal as well as the intercardinal points were considered. A series of cartographical materials have also been analysed, including shooting master plans from 1939, topographic maps from 1970 and orthophotoplans from 2005, which were used to determine the limits of the built-up area and map the spatial and temporal evolution of Zalău. The functional zones of the urban structure were identified through cartographic analysis and field observations and were consequently mapped.

3. Physical geographical premises of urban development

A first element which influences the development of any city is represented by its geographical position. The urban area of Zalău is situated in the centre of Sălaj county, in the north-west of Romania [fig. 1], on the Cluj-Napoca - Satu Mare - Petea Vamă axis, represented by the roads DN 1F and E81.

Zalău municipality is located in the southern part of the Zalău Depression, at the contact between Silvaniei Hills and the Meseş Mountains, at the west-north-western foot of the latter, this morphological context influencing the position of the settlement [fig. 2].
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The city lies mostly on the floodplain of the Zalău valley, which takes the form of a depression together with the inferior terrace, an area limited in the south by the Meseş steep slope through an altitude difference of 200-300 m. The city lies also on the right superior terrace of Ortelec valley, which also represents a favourable area for constructions (I. Mac, 1996).

The administrative territory of Zalău municipality is divided into five altitude intervals. The first level includes the floodplain, with the lowest altitude: 197-280 m. The second height interval spans between 280.1 m and 345 m and belongs to the terraces and the terraced slopes. The third interval spans between 345.1 m and 425 m and includes the piedmont level, represented by the Parameseşan Piedmont. The fourth height interval is represented by the low mountains between 425.1 m and 534 m, while the last level continues with the high mountains, between 534.1 m and 727 m, represented mostly by the Meseş Mountains.

The city is built on the floodplain and the cone-terraces spanning on multiple levels, on wide and prolonged interfluves of piedmont origin and slopes with deluvial glacis, with a slope angle ranging between 5° and 15° [fig. 3].

The 5.1° - 15° interval of the geodeclivity is clearly dominant, representing 70% of the area, while steeper slopes are present in the south and south-east of the city’s administrative territory, representing about 8% of its surface. Inside the built-up area the slope angle is included in the 0-5° interval, which is represented in approximately 30% of the territory, having favourable conditions for human activities and buildings.

In addition to this, water resources from the alluvial fans, glacis, piedmonts and terraces, as well as the rivers originating from the Meseş Mountains, have also been an advantage for this settlement. To this, the average temperature of 9-10°C adds another favourable condition of climatic origin, while from the economic point of view, the forested area of the Meseş Mountains, together with the arable land and the pastures from the piedmont hills, represent a favourable premise for the city’s inhabitants.

The administrative territory of Zalău also includes the settlement called Stâna, which is located in the south-east of the Meseş Mountains. The whole territory is included in the Agrij hydrographical catchment, with a total area of 90.86 km², out of which 77 km² are occupied by the city. The municipality is limited to the north by Dealul Ceacău (410 m), to the east by Dealul Peringaral, to the south-east by Măgura Stânii (716 m), to the south-west by Dealul Labului (403 m) and to the west by Dealul Zalău (400 m).

The morphology of the area was shaped after the retreat of the Pannonian Sea, through the fragmentation of the coastal plain from the edge of the Meseş Mountains, by the rivers heading westward and north-westward, the cols from Aghireş-Panic and Crişeni-Ortelec being remnants and proofs of this process. Thus, the present morphology of Zalău municipality is due to the evolution of the fluvial relief controlled by the Zalău valley. The remnants of the first Parameseşan piedmont are representative for the development of the urban built-up area, being visible as erosional remnants with altitudes between 375-400 m inside the urban area (Mac, 1996). The slopes with average angle (15°-25°), covered with forests, orchards and vineyards until 1989 have been “aggressed” through scientifically undocumented urban politics represented by edilitary constructions. The territory of the valleys, the terraces and the floodplains are dominated by industrial constructions, communication infrastructure and commercial units.
4. Historical premises and the horizontal evolution of the urban built-up area

Zalău municipality is the capital city of Sălaj county and one of the few settlements which were documented even before the end of the first millennium, when the built-up area of Zalău was occupied by the free Dacians. Beginning with 1370, the settlement was given the right to organise an annual fair, thus from the 14th century Zalău was known as a market town. In 1473 Matei Corvin changed its rank to a town, endowing it with economic independence. After that, the strong development of the crafts and guilds led to an increase in the production of merchandises, to the emergence of an internal market as well as to the enhancement of its trading relationships, all these leading to the town’s development (Penea, 1973).

Depending on the political and economic interests, the town was passed from the dominance of the Hungarian kings to the Principality of Transylvania. At the end of the 16th century, the town belonged to Transylvania and had an autonomous administrative rule. Currently, Zalău municipality is the capital city of Sălaj county, an important industrial, trading and service-providing centre, a modern city with a life of its own.

Until the 12th century the horizontal evolution of the city’s built-up area had been slower, but after this period the territorial expansion knew an important evolution [fig. 5]. The urban development was limited on certain directions by some territorial constraints, determined mostly by geomorphology, thus the city’s expansion followed the least difficult and expensive directions (Pop, 2001).

Analysing the evolution trend of the built-up area, one can notice an increase from 3.1 km$^2$ in 1939 to 10.55 km$^2$ in 2005. This is directly linked to the growing trend of the population, its number reaching 62,927 in 2002 (Direcția Județeană de Statistică Sălaj).

The oldest part of the city dates from the 12th-15th centuries when Zalău had only agricultural, trading and administrative functions. In the 16th-19th centuries the first urbanising phase took place through the construction of the central market and the main public buildings. Between 1900 and 1960 the built-up area became extended through the construction of the Brădet residential neighbourhood and the cultural role of the city also emerged during this period.

![Fig. 4 Spatial and temporal evolution of Zalău in the interval 1919-2005. (Vătă și colab., 2013)](image-url)
for the population coming from the rural environment and from other urban centres (Nicoară 1999, Puşcaş, 1999).

The convergence where Sărata and Caselor streams flow into Zalău river represented a favourable area for the city’s expansion, therefore the new civic centre was built here and modern apartment blocks of up to 10 floors appeared. The neighbourhoods Dumbrava I and II lie towards the west and a second road intersection as well as the main bus station and some industrial companies were built here as well.

The morpho-hydrographical convergence of Miţii and Crişenílor valleys with Zalău valley offers a large and symmetrical floodplain with a good building potential. This is where the main industrial zone was built, together with the railway station and a third modern road intersection. At the same time with the longitudinal extension of the city, the transversal development also took place through the building of the Dumbrava Nord neighbourhood. Some residences were placed on the slopes, leading to the construction of stepped apartment blocks and access ways perpendicular on the level curves, thus increasing the value of investments in this area. In addition to this, the extension of the inhabited area also took place through new, individual houses at the foot of the Meseş Mountain and near Zalău – Aghireş connecting road (Mac, 1996).

According to the General Urban Plan (GUP) from 2006-2007, the built-up area has 2587.25 ha in comparison to its previous 1787.69 ha, due to the expansions made through Zonal Urban Plans (ZUP) and the GUP, as a consequence of the demands for private constructions, service suppliers, industrial and agro-zootechnical units (PUG, 2006-2007). The industrial zone from the northern part of the city continues towards Panic and Hereclean villages through a zone of industrial services and Stâna town is also included in the built-up area of Zalău. As the peri-urban areas of the city are not yet developed, extensions are needed towards Moigrad for tourism, towards Hereclean as an industrial and industrial services zone and towards Meseşeni-Aghireş as a residential zone (Popşe, 2010, Roman, 2010, Irimuş, 2010, Puiu, 2010, Zotic, 2010).

5. Geomorphological model of the Zalău built-up area and development opportunities

The geomorphological model of the Zalău built-up area is determined by the three morpho-hydrographical convergences separated by connecting sectors (Mac, 1996).

The first convergence is made by Meseş stream flowing into Zalău river. Upstream from this point, one can find the oldest part of the settlement. The central market and the main buildings of public importance were built on the surface of the Meseş stream alluvial cone. The surrounding terraces and the deluvial and colluvial glacis flanking the main river have been covered by houses. The urban built-up area is continued by the Brădet neighbourhood which extends almost up to the structural steps near Brădet Forest, the other slopes being affected by landslides and compaction processes. The built-up area becomes wider to the west due to the well-preserved terraces of 30-35 m and 50-55 m.

![Fig. 5 Territorial evolution of Zalău municipality: □ first convergence, □ second convergence, □ third convergence.](Source: Radu Căpilnašiu, 2012)
The second convergence is represented by Sărata and Caselor streams flowing into the Zalău river and has offered a favourable geomorphologic background for the city’s expansion. A second road intersection was built on the central part of the Sărata alluvial cone, while Dumbrava I and II neighbourhoods developed westward on terrace steps and on the left slope. The right slope is steeper and affected by landslides, which has limited the constructions.

The third hydrographic convergence, determined by the contact of Miţii and Crişenilor valleys with Zalău valley, creates a large and symmetrical floodplain and the terraces unfold on the left side. This floodplain, with a good building potential, was used for the main industrial zone, the railway station and a third modern road intersection, after the marshy floodplain was drained and the river bed of Zalău was rectified. The transversal development of the city took place through the building of the Dumbrava Nord neighbourhood on the 8-to-10-metre and 30-to-35-metre terraces. A part of the neighbourhood lies on the alluvial cone of Miţii stream where clays and transported sands are dominant and affect the stability of constructions.

The development of the Zalău built-up area was influenced by the geomorphologic factor, the settlement developing especially in the areas of morpho-hydrographical convergence. During the city’s evolution and progressive growth of its industrial, trading, administrative, cultural and transport functions, as well as of the population number, the functional zones of the city became more and more differentiated [fig. 6].

The residential zone is one of the largest zones, having an area of 420 ha and a population density of 172 inhabitants/ha. The main neighbourhoods include blocks of flats of the type P+4 (“P” - ground floor, “4” – number of floors) followed by type P+9. The neighbourhoods Brădet and Stadion lie at the city’s entrance from the Meseş Mountain, while east from the main street lie the neighbourhoods Păcii and Porolissum and west from it one finds the neighbourhood Simion Bărnuţiu.

Further on, the neighbourhoods Dumbrava I, Dumbrava II and Dumbrava Nord unfold on the three terrace steps and the neighbouring slope. The upstream part of the city includes neighbourhoods with older residences, the most important being Traian and the one focusing on Crasna Street, Brădet, as well as Păcii and Ortelec neighbourhoods. The best building conditions are offered by the terrace surfaces of Zalău valley, the alluvial cone from the Meseş – Zalău convergence and the deluvial-colluvial glacis. The growth of the population determined an expansion of the residences on the upper terrace and on the slopes, which produced additional costs and investments. In this area the density of the buildings is reduced and the buildings are small and medium in height (Pop, 2011).

There are 22,540 residential buildings in Zalău (in 2009). The average inhabited area per person is of 10.5 m² and the density of the buildings in the residential zone is high – 52 buildings/ha. Zalău is a renewed city, over 86% of the residences being built after 1970.

The industrial zone is almost completely included on the surface of Zalău floodplain, unfolding on the north-south axis of the municipality. Here are the main industrial companies acting as work-force attracting centres for the inhabitants of Zalău and adjacent rural areas: S.C. Ceramica S.A., S.C. Cuprom S.A., S.C. Silcotub S.A. etc. A new economic zone including mostly warehouses and car dealerships has started to grow in the northern part of the city. In addition to this, the industrial zone has transport facilities at hand through the
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railway station from its proximity and by being located along the railway branching and the E81 road. The industrial zone continues with the urban agricultural zone including animal farms, arable land and greenhouses (Pop, 2011).

The transport zone includes the railway station, the bus station and the bus depot. The organization of the traffic is still a difficult issue as the longitudinal development of the city, with only three main intersections, causes some areas to be overused. The first main intersection is located in the old centre linking the roads which lead to Cluj-Napoca and Crasna. The second intersection gets most of the traffic and enables the connection between, on the one hand, Porolissum and Ortelec neighbourhoods and, on the other hand, Simion Bărnuţiu, Dumbrava I şi II neighbourhoods. The third intersection, both road and railroad, is the most important for the communication inside the county, connecting Zalău with imleul Silvaniei, Cehu Silvaniei and Jibou. The three main intersections are connected through the main street, Mihai Viteazul Boulevard. Other crowded streets are Gheorghe Doja, Crasnei and Simion Bărnuţiu, therefore a parallel way has been modernised for Mihai Viteazul and Gheorghe Doja streets. Inside the city the streets totalize 94 km.

The trading zone is placed in the central part of the city, along the Mihai Viteazul Boulevard, and includes shops with a variety of profiles located at the ground floor of blocks of flats, as well as large shopping centres: Silvania, Activ Plazza Mall, Galeriile Meseş, Astralăş, Scala, Kaufland, Penny, Unicarm etc. Trading units can also be found on the main streets from the big neighbourhoods. An important role is also given to the grocery markets (agroalimentare) and other markets (the central market, the market of Dumbrava Nord neighbourhood).

Financial activities take place in the banks: B.C.R, B.R.D, Bancpost, SanPaolo Bank, C.E.C. Bank etc., most of them located in the central part of the city. The administrative and cultural zone is located in the civic and the old centre, including the palace of the County Counsel, the City Hall, the County Historical Museum, the Cultural House, the county library, the art galleries “Ioan Sima”, cathedrals and churches of different confessions.

![Fig. 7 Zalău Municipality – Functional zones](image)

6. Conclusions

Being located in the Zalău Depression, inside Crasnei Hills and the Parameseşan Piedmont, Zalău municipality has been favoured by a sheltered topoclimate which has contributed to the development of the settlement and has attracted new inhabitants since ancient times. The relief distinguishes itself as one of the most important geographical elements in the evolution of the city, which developed mostly on a
longitudinal basis. The spatial dissemination of landforms can be considered to be harmonious, the terraces, glacis and piedmont structures acting as favourable elements for the city’s development. Furthermore, the average geodeclivity of the territory (slope angle between 5° şi 15°) makes the municipality accessible to social and economic activities.

During its historical evolution, Zalău has transformed from a medieval village (from the second half of the 12th century until the 14th century) to a medieval fair (from 1370 until 1473), a town (from 1473 to 1979) and finally, a municipality (from 1979 until present). Zalău includes a central area with the historic centre around which neighbourhoods were built concentrically in the socialist era. A second circle of neighbourhoods with new buildings is located around it and another circle is located towards the exterior, including the outskirts: Ortelec and the area towards Aghireş.

Taking into consideration the important role of the relief in the development of Zalău municipality, as illustrated above, the city’s administration needs to consider carefully all these elements when planning future projects of development.

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