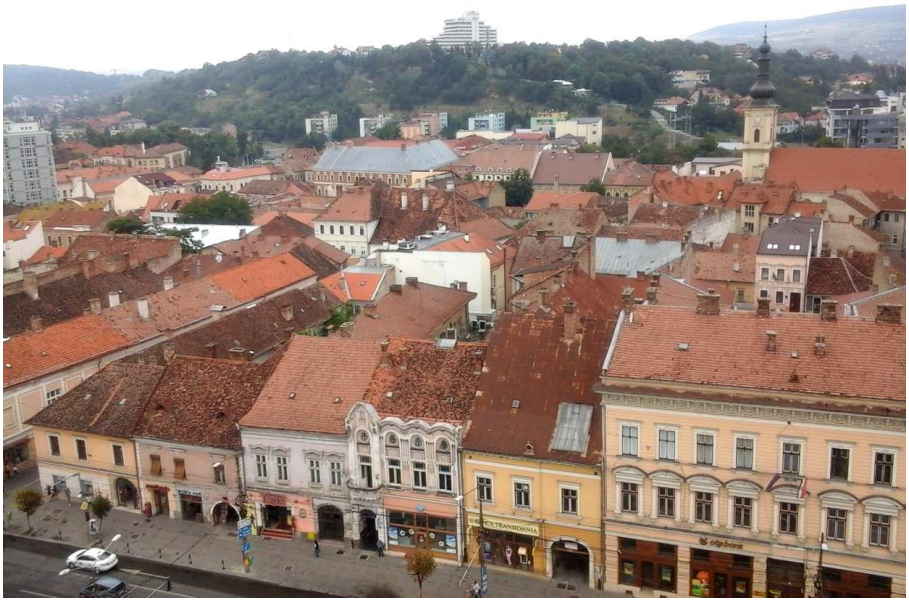
BABEŞ-BOLYAI UNIVERSITY CLUJ -NAPOCA
FACULTY OF GEOGRAPHY
FIELD: GEOGRAPHY

Cluj-Napoca - Urban Landscape Morphology, Dynamics, and Aesthetics

Summary of the doctorate thesis



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Cluj-Napoca
2014

Key words: Cluj-Napoca Municipality, urban landscape, the morphology of the urban landscape, the dynamics of the urban landscape, the esthetics of the urban landscape, landscape components, meadow landscape, slope landscape, terrace landscape, general urban plan.

CONTENT

INTRODUCTION

In terms of geographical location, the Municipality of Cluj-Napoca is situated in an area of orographic convergence (Apuseni Mountains, the Someşan Plateau, the Transylvanian Plain), where the 46º 46´ N parallel and 23º 36´ E meridian meet. The urban area is situated in the morphohydrographic basin of Someşul Mic River and some of its more important tributaries, such as Nadăş, Chintău, Valea Caldă, Gârbău, Popii, Borhanci, Murători, and Zăpodie. The hills situated to the north (Lombului, Sfântu Gheorghe), the hills to the south (Feleac) and the Hoia – Cetăţuia hills, with northern and southern exposure, granted the city a morphological diversity which in turn determined a rich landscape.

Cluj-Napoca emerged at the crossroads of some of the most important communication routes of Transylvania: to the south-east, the Turda – Alba Iulia – Sibiu highway, eventually leading to the capital of Bucharest; to the north-west, the Zalău - Oradea highway with connections to Hungary; to the north-east the Dej – Bistriţa axis with connections to Moldova, and towards the west, the Huedin – Ciucea axis, which hosts the Cluj-Oradea highway and railway, representing the second communication route (after Mureşului Valley) between the Tisa Plain and the Transylvanian Basin. This advantage led to the creation of this city, which, in 2014, became the second largest urban center in Romania, after Bucureşti. Within this context, the complexity of urban life in this city had its mark on the urban landscape, whose interdisciplinary research is an extraordinary challenge.

The main objective of the thesis „Cluj-Napoca – urban landscape morphology, dynamics and aesteticsis" is the demonstration of the urban space morphology role in defining of the Cluj-Napoca`s urban landscape shape, viewed through a plane-spatial dynamics according to the population growth and the urban functions diversification. In order to attain such a goal, we set the following specific objectives:

- the theoretical study of concepts such as urban landscape, urban development, urbanism;
- the analysis of relief morphology, morphography and morphometry;
- the establishment of temporal dynamic marks of urban space development;
- indicating the coordinates of the esthetics of Cluj-Napoca's urban landscape;
- framing the general aspects of Cluj-Napoca's urban landscape.
- continuation of the initiative for authorities and whole population awareness and mobilization for a friendly landscape in Cluj-Napoca

CHAPTER I: URBAN LANDSCAPE - CONCEPS AND ACCEPTIONS

1.1.The concept of landscape in the geographical literature

1.1.1. Geographical landscape – concept and paradigm

The historian views the landscape as a result of the cultural heritage of prior rural civilizations, the economist as a source of raw materials and goods. Medicine is interested in studying the landscape due to its therapeutic potential. The ecologist studies landscape as a life support, different from the initial natural conditions based on which man created a large array of habitats which forced some species to adapt, and some to disappear. Of all the sciences, only geography managed to give this concept a scientific meaning and created a subdiscipline dedicated entirely to it (Troll, C, in Wiens, A. editor, 2007). I. Zăvoianu and Mihaela Alexandrescu (1994) emphasized the role of the geographer in studying the landscape, saying that „of all the specialists, only the geographer analyzes the landscape in a scientific manner, as a result of complex number physical-geographic and economic-geographical factors, trying to solve the interdependency relations between its components, to bring forward its individuality and its fundamental attributes, both objective and permanent" (after David A. L. 2009).

At a conceptual level, there are **three specific tendencies,** mainly based on: emphasizing the systemic nature of the landscape (v. Troll C. 1950, Bertrand, G., 1969, Tufescu V., 1971, Soceava 1975, Wieber J. C. 1985, Rougerie G and Beroutchachvili 1991, Drăguţ L. 2000, Mac I., 2000, Cocean P. 2002 etc.), on its image or character, as a reflection of all its territorial components (Alexander von Humboldt, Taillefer F. 1974, Raffestin C. 1977, Posea G. 1978, Levy B. 1991, Koreleski K. 2008) or on its human component, as a dominant factor in shaping geographic space (Schmithüsen J. 1959, Roşu A., Ungureanu Irina 1977, Hart John Fraser 1998, Woebse H. 2008, Macaria Brighitte 2009) (after Camelia Gavra, 2012).

The term landscape *(landschaft)* was introduced, as a scientific, geographic locution, by the German geographer A. Hommeyer, in 1805, with the meaning of the appearance of a land viewed from a dominant observation point (after Donisă, cited by D.Petrea, 2005). During the same period, the German naturalist Al. von Humboldt (1769-1859) classified landscapes based on the homogeneity of plant associations. In the literature of those times one can find the terms *natural landscape (Naturlandschaft)* where man does not have a significant presence and *cultural landscape (Kulturlandschaft)* where man is the main force that transforms the natural landscape (O. Schlüter, 1907 according to Donisă cited by D. Petrea, 2005 and S. Bănică, 2006). In France, the expression *paysage* is used, with its predominant natural component, while in English speaking countries, the term *landscape* is employed, in tight connection to territorial planning. The Russian school adopted the term *landschaft,* while the same phenomenon happened in the Romanian literature, where it was used simultaneously with the French term mentioned above. Its definition remained however the same, that is "a territorial unit with a specific set of features imposed by physical-geographic factors" (Bănică S., 2006).

There are several scientific fields that study landscapes: **landscape ecology** within biology or **geoecology** within geography, **landscape architecture, landscape urbanism, landscape geography.**

1.1.2. Geographical landscape structural components. N.A. Solntsev, L.S. Berg, Bertrand, G, Carl Troll, Sauer, C. O., Soceava Rougerie G and Beroutchachvili are the theorists of the concept, their ideas forming the basis of the most recent definitions found in official documents such as The European Landscape Convention (2000) or Recommendation no. (95) 9 of the European Council of Ministers regarding the preservation of cultural sites, integrated into landscape policies (1995). The main idea that formed the basis of this research fits in the latest trends. According to them, the landscape is a homogenous unit with its own specific set of features. The landscape is studied through its qualitative, visual component, through its image. The landscape perceived as an image (Vâlsan, G., 1971) is the object of geographic description that "unravels the features of the landscape through objective and permanent characters". Landscape studies must begin with the study of *place* (Jakle, J.A., 1987), a concept representing the fundamental point in research. This statement induces the idea of homogeneity and uniqueness that is landscape.

1.1.3. The urban landscape – structure and functions. The urban landscape through its image, defines the character of a city at perception level whether it is a social, economic, cultural, architectural, administrative character etc. It also represents a reality and its perception (according to Ileana Budşiteanu, David T.), a flux of woven systems and eras, a synergy of historical moments compressed into a single space (Woldheim 2006).

1.1.4. The urban landscape typology is based here on functional demarcations at city level. We therefore have *central landscape, residential landscape, industrial landscape, the landscape of green and recreational areas, infrastructure landscape.*

1.2 Urban landscape morphology – content and landscape relevance

There are several analysis levels. Among them, historical morphology is crucial (it aims to study the evolution and succesive changes of the urban structure in order to fully understand how it reached it present form), then functional morphology (activity distribution, population dynamics and distribution, communication flows within the city etc.), and normative morphology (analyzes the relations between urban values and urban forms in order to optimize the latter).

1.3 Urban landscape dynamics – geographic and urbanistic approach

Since we deal with a system, between the components of the geographic landscape, and implicitly between those found in an urban landscape, there are interactions, which awards the system a certain dynamic in time. Changing a certain component/element leads to changes in the others and even in the entire system. The specific dynamic of the landscape may be the result of a mass evolution, through the interaction of its components, or of a separate dynamic of a single component which in turn influences the entire territorial unit (floods, fires, deforestations etc.)

1.4. Urban landscape aesthetics

The research at hand supports the idea that the future of landscape studies is currently linked to the idea of respect for nature in artificial environments, an idea that replaces the functional – progressive model which considers technical progress as crucial in the man-artificial environment-

nature trifecta. The new attitude however does not guarantee perfect solutions, proposed and created based on this idea.

CHAPTER III: THE URBAN LANDSCAPE OF CLUJ-NAPOCA – GEOGRAPHICAL AND HISTORICAL MARKS

3.2. The spatial evolution of Cluj-Napoca is presented in the study at hand as a list of the most important historical events that are relevant to the landscape of the city.

CHAPTER IV: THE NATURAL PREMISES IN CLUJ-NAPOCA LANDSCAPE BUILDING

4.1. The substratum component of Cluj-napoca`s urban landscape

4.1.1. The urban space geology of the urban area of Cluj-Napoca (figure no. 2.10) is characterised by a great variety of lithostratigraphic formations, distributed based on the evolution, association, and succession of geological agents, active in different time periods (according to Stoian, L.C., 2011). From a geological standpoint, Cluj-Napoca is located at the meeting point of of two great structural units: *the crystalline-Mesosoic area* of the Carpathian orogene and *formations belonging to the Transylvanian Basin* (Ciupagea, 1970, cited by Danci,I., 2012). There is a considerable predominance of Neosoic sedimentary formations: it is represented by detritic elements in successive layers from the mountain area to the Transylvanian Depression and is composed of gravel, conglomerates, sands, poorly compacted hone, different types of clay, salt, etc.

4.1.2.The urban space morphology is a structural and functional territorial component which influences the location, typology and characteristics of anthropic activity as well as the basic charcateristics of the urban landscape. In Cluj-Napoca, the asymetry of the Someşul Mic Valley has significant impact on the (macro)form of the city, on its internal organisation and on the morphology of the landscape. We identified the following sectors: Feleac Massif, Cetăţuia – Hoia interfluve, Lomb – Steluţa Hill, Chintăului Hills, the peripheral hills of Someşeni – Apahida, the Floreşti – Apahida depressionary alignment, the terraces of Someşul Mic and Nadăş (figure no. 4.3).

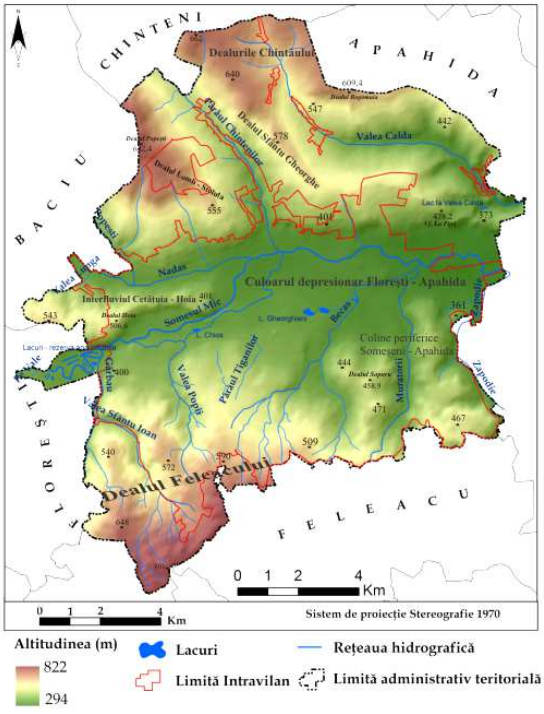


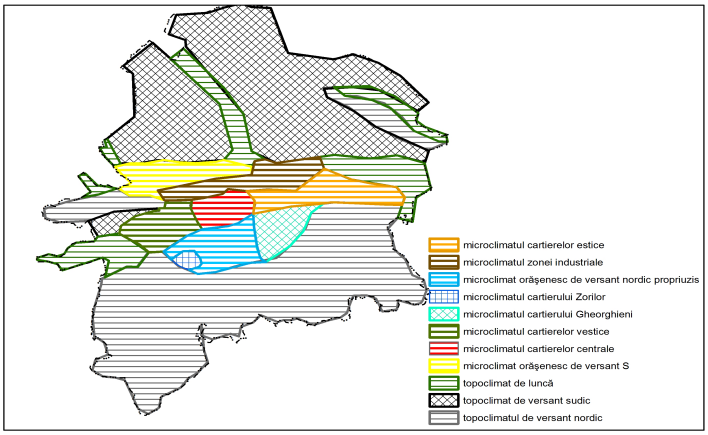
Figure no. 4.3 The main relief forms and the hydrographic network of Cluj-Napoca

4.2.The hydrometeorological component of Cluj-Napoca's urban landscape

4.2.1. The water sourses. The hydrographic network of Cluj-Napoca is part of the Someşul Mic hydrographic basin with springs in the Apuseni Mountains. *Someşul Mic* flows through Cluj-Napoca for 16 km and collects the following tributaries: Gârbău, Pârâul Popii, Pârâul Ţiganilor I and II, Becaş, Murători, Zăpodie, Nadăş, Popeşti, Chinteni, Lomb, Valea Caldă. "The ponds" of Cluj had over 10 ha at the middle of the 20th century, encompassing the central park lake and the ones found in Gheorgheni. The first lake from Gheorgheni, found in the vicinity of Între Lacuri Street, dates back almost 600 years and was named "The Bottomless Lake". The meadow of Someşul Mic has an aquifer that reaches depths of 4–10 m, the underground water level being 1–3 m, free or slightly ascensional, only when there are permeable clay formations at the top.

4.2.2. Topoclimatic and microclimatic conditions. The city is located in the sector with a moderate continental climate, characteristic to the western and north-western regions of the country. Therefore, during winter, there are predominant maritime-polar or maritime-arctic invasions from the north-west, while during summer, warm air comes from the north-east. The characteristics of the air masses that cover this urban area determine a moderate temperature level, relative high air humidity,

strong cloud coverage and rich precipitations. Winters are moderately cold and damp, summers relatively warm with frequent rains. The features of some surface areas, their orientation, their declivity, exposition, air flow, the distribution of several climatic elements determines the existence of *four topoclimatic sectors in Cluj-Napoca* (figure no.4.5) with distinct attributes (according to Irimuş I.A., et all., 2010) as well as other *microclimates*.



The climatic parameters have a crucial role in defining the landscape. The climate, through its elements, contributes decisively to the modeling and creation of landscapes. The climatic implications in the urban landscape are numerous and varied. As we deal with smaller areas such as cities, season succession generates climatic differences with obvious implications in landscape definition, with a direct influence on human activities (the touristic activity being the one that is the most affected).

Figure no 4.5 Topoclimatic and microclimatic sectors in Cluj-Napoca

In order to obtain the the average precipitation value and the average temperature for Cluj-Napoca and to create a graphical representation of such values, we used the Digital Elevation Model, correlated with the average multiannual precipitations and temperature levels, following a methodology proposed by de Bilaşco, Şt., 2009. Thus, the analysis of the climatic parameters took into account the last decade (the 2004 – 2013 interval) (figure no. 4.9). We obtained data - average multiannual values from the North Transylvania Regional Meteorological Centre and the meteorological stations of Cluj County: Baişoara, Cluj-Napoca, Dej, Huedin, Turda and Vlădeasa 1800.

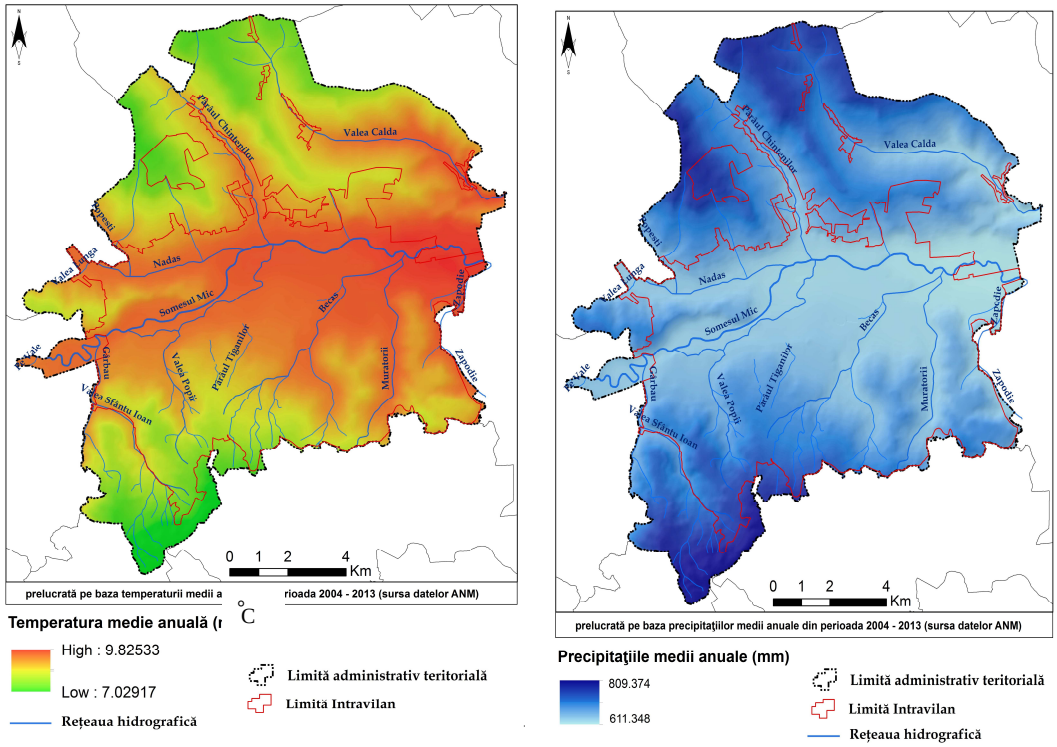


Figure nr. 4.9 The average annual temperature and the average annual precipitation levels in Cluj-Napoca

4.3. The biotic component of Cluj-Napoca's urban landscape

4.3.1.The spontaneous vegetation, both natural and semi-natural, is better represented in the periurban area, though here too it bears the mark of human intervention, while in the urban space the ruderal and segetal associations are more dynamic and fluctuate depending on the intensity of human

intervention (Cristea, V., 2002 cited by Irimuş, I.A., 2010). The accelerated urbanization led to, besides agriculture, the fragmentation of the natural plant communities.

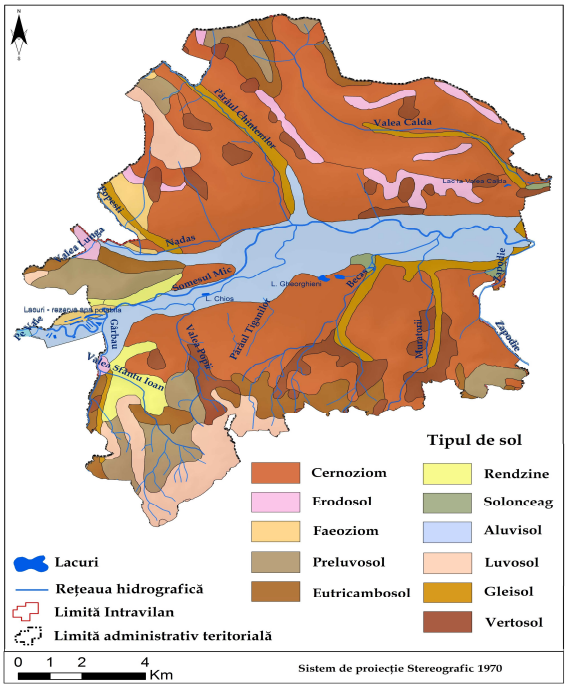


Figure no. 4.11 Main soil types distribution

4.3.2. The urban space has highly modified ***soils***, whether we speak of the aluvial soils found at meadow level (Someşul Mic, Nadăş), or the black earth cambic and clay soils found on slopes or the hydromorphic gleic and pseudogleic, and halomorphic soils, with intrazonal presence (figure no. 4.11).

4.3.3.The natural protected areas of high natural potential located in the adminsitrative territory of Cluj-Napoca (figure no. 2.24) are Făget Forest, Someşeni Baths, Gâlcer – Sfântu Ion Izvor Hill, Fânaţele Clujului, Hoia – Baciu Forest, Sf. Gheorghe Hill and Tufele Roşii Forest (according to the Environmental Assessment for the General Urban Plan of Cluj-Napoca, 2011, authored by MINESA – Institutul de Cercetări Miniere, with additions).

CHAPTER V: THE ANTHROPICAL PREMISES IN IN CLUJ-NAPOCA LANDSCAPE BUILDING

5.1. Cluj-Napoca`s urban landscape human resources

In the last 25 years, the population of Cluj-Napoca oscillated around 300,000 inhabitants. At the 1992 Census there were **328,602** inhabitants, while in 2002 the number dropped to **317,953** inhabitants. According to the statistical document published in 2014, the city's population on 1st July 2012 was 303,047 inhabitants, representing 43.8% of the county's population and 66.7% of the urban population of the county. According to a study done by the National Statistics Institute, for the World Population Day 2014, the most populated city in the country still remains Bucureşti, with 1,883,400 inhabitants, followed by Cluj-Napoca, with 324,600 inhabitants.

5.2. Urban landscape structure and typology

The main activities at city level, which are the main criteria for classifying functional areas, and implicitly the types of landscape, are as follows (according to the General Urban Plan Guide): local government, healthcare, education, commerce, industrial and storage activity, agricultural activities, housing, transport and communications, green and sports areas, services, special destination, others (agricultural land within the city, forests, waters, nonproductive land).

5.2.1. The central landscape of the is associated with the land and constructions used by the institutions and services of public interest, located primarily in the city's center. Outside this central area, there are several compact areas with mixed areas of housing and services, services nuclei, commercial activities, tourism etc. normally found in the central areas of cities. These types of functions can also be found in residential areas, far from the central part of the city, where neighbourhood centres have or not yet emerged. Even so, based on the realities found in the field, the central landscape of Cluj-Napoca is much more extended than the area proposed and demarcated in the General Urban Plan and extremely spread out. Architectural cohabitation matters more in urban historic centres than in any other part of the city. The new constructions must be contextually integrated, but in a creative fashion. In terms of housing in the city centre, their existence may be less desirable. It has been proven however that housing is necessary as it contributes substantially to livening and increasing security in the area. (according to Dana Vais, 2009).

5.2.2.The residential landscape. The residential areas of Cluj-Napoca encompass the housing estates built before 1989, as well as the collective and individual housing erected in the last 10 years,

which are currently the focus of complex urban regeneration projects through the General Urban Plan. The traditional collective residential areas of Cluj-Napoca came into being in the communist period in order to satisfy the growing demand for housing during the industrialisation period and were built on greenfield, on the city's periphery. Thus, we have: Grigorescu, Gheorgheni, Mănăştur, Mărăşti, Aurel Vlaicu, and Zorilor. There are also individual housing areas from the interwar and communist periods: Gruia, Someşeni, Între Lacuri, Dâmbu Rotund, Plopilor, Bulgaria, Iris, Andrei Mureşanu, or newer, mixed, post 1989 areas like Bună Ziua, Europa. Some of these areas had been separate settlements located close to the city, which were then integrated into the city as it expanded. We set out to historically and urbanistically describe each residential area, emphasizing their most important elements for the urban landscape.

5.2.3. The recent residential landscape of Cluj-Napoca situated on agricultural land not subjected to development policies of extending road networks or other infrastructure. In terms of terrain configuration, these are generally plots of land with inclined slopes, affected by different geomorphological processes, with difficulties in foundation building. The legislation allowed for derogatory planning documentations (Zonal Urban Plans and Detail Urban Plans), odd building styles, and lack of integration. The landscape valences of these areas are represented by forests and agricultural land used in the past for recreation and crops, encompassed in the "green belt of Cluj" (Popa L, 2011), along water courses, tributaries of Someşul Mic, with beautiful views on the city and the natural surrounding areas.

5.2.4. The industrial landscape, according to the General Plan of Cluj-Napoca, contains exclusively functions related to industrial activity (industrial production, storage, logistics, industrial services, trade, tertiary economic activities). This landscape is comprised in equal measure of the current functional industrial production landscape, and the post-industrial landscape, each with its own morphological, structural, dynamic and functional characteristics. While in the case of the current industrial platforms, these parameters are "up-to-date", the post-industrial landscape has characteristics deemed as "fossil" (according to Kolejka, 2010). The urbanistic priorities set by the General Urban Plan of Cluj-Napoca include *recycling* the underused industrial platforms and organizing the existing industrial parks, setting aside surfaces for the development of SME infrastructure, finding sites suitable for mixed areas which will become future development hotspots, and setting aside land for brownfield development, mainly along the east-west corridor, backed by road and railway connections, with good access to the airport.

5.2.5. The street landscape of Cluj-Napoca is the landscape created by roads (national, county etc.), by rail and by air transport – the "Avram Iancu" International Airport. Most of the road circulation takes place on a single major axis, West-East, located parallel to the river. There are also a series of connections between the main residential areas, the industrial areas, other polarizing areas, and the city centre, which gathers most traffic flows.

5.2.6. The green landscape – green areas within the built-up area – **Case study - *Între Lacuri Park.*** We identified a 65 ha plot of land, located in the eastern part of the city, which is currently a semi-abandoned plant nursery belonging to the municipality. The proposed park will integrate the two existing lakes and will extend eastward till Dunării street, thus incorporating the most valuable component of the future park, the old nursery. In terms of territorial integration, the land is situated on the lower stream of Becaş, with a flat surface and characteristic vegetation. As valuable landscape elements, the site will have two artificial lakes, as well as Becaş stream. The terrain is mostly free of constructions, the only infrastructure being plant storage spaces, now found in decay. In the new General Urban Plan, this is designated as a built-up area, located in the Mărăşti - Între Lacuri neighbourhoods, an area with few green spaces. Due to its extension, it might become the largest green zone of Cluj-Napoca.

CHAPTER VI: THE MORPHOLOGY OF CLUJ-NAPOCA'S URBAN LANDSCAPE

6.1. The morphogenetic levels. The administrative territory of Cluj-Napoca hosts the following levels: valley corridors, terraces and slopes. The fluvial relief is represented by the ***Floreşti – Apahida alignment*** (Morariu, T., Mac, I., 1967) with a predominantly erosional-acummulatory relief. Someşul Mic River has been moulding this area since the end of the Pliocene. It is a partial subsequent depression. ***The terraces*** are located along Someşul Mic River as well as its main tributaries. These are the lands with a maximum potential for habitation due to the flatness of the terrain. In Cluj-Napoca,

there are seven terrace horizons (Morariu, T., Mac,I., 1967) from 330 – 332 m to 455 – 470 m (figure no. 6.1).

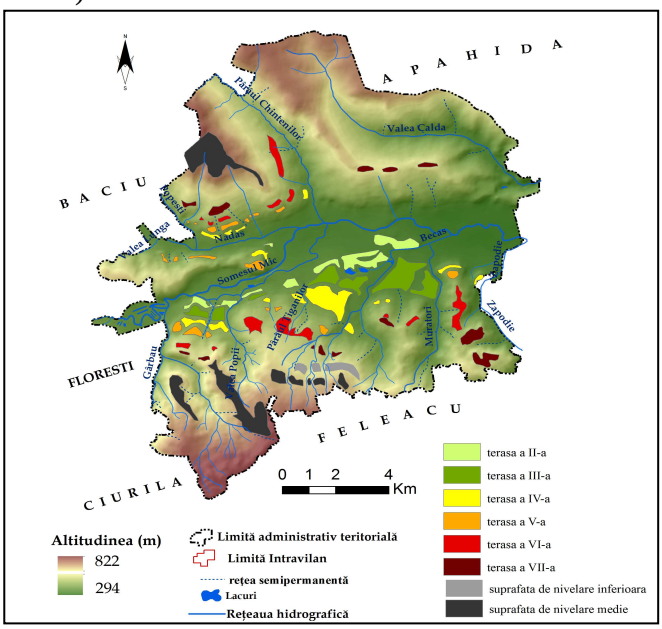


Figure no. 6.1 The terrace levels found in the administrative territory of Cluj-Napoca

The terraces found in Cluj-Napoca are suitable for urban constructions, with works necessary to rectify the problems posed by compaction (Morariu,T., Mac, I., 1967).

The existence of such terraces influenced the development and even the existence of Cluj-Napoca. Thus, the constructions found on the lowest terrace, meaning most of the old part of the city, due to the thick alluvium layer which holds water, have problems with dampness, especially those without proper insulation. Moreover, the constructions from the upper terraces, III and IV, are cracked, also depending on their age, due to the compaction that affects those terraces, as

In our study of ***slope relief,*** we used recent geomorphological research where the territory has been divided into three sectors (Poszet, S., L., 2011): Someşul Mic-Nadăş interfluve, the right sideslope of Someşul Mic, and the left sideslope of Someşul Mic and Nadăş.

a.Cetăţuia - Hoia Hill is situated in the western and central parts of the city, with a very complex geology (diversified lithology, fragmented by fault lines) with influences on the morphology of the area. This interfluve between Someşul Mic and Nadăş „penetrates" the city as a „peninsula". The obvious assimetry between the northern and the southern slopes is due to the monoclinal lithology and the lateral erosion of Someşul Mic. The area is dominated by the structural platform which slightly tilts towards the Nadăş and by the front of the cuesta on the southern side, with structural shoulders, slides. The torrential valleys fragment the structural platform changing it into secondary interfluves which give the landscape a characteristic appearance. Altitudes drop from west to east, from 506 m on Hoia Hill to 401 on Cetăţuia Hill. Compared to the Hoia and Cetăţuia front, the Someşul Mic corridor takes the form of a subsequent depression, going beyond the symmetric valley stage (according to Baciu,C., 2009). Directly refering to this sector, Morariu, T. and Mac, I., in 1967, consider that "The instability of the southern slope and the abrupt sides prevent any buildings being erected here, not even with special technical interventions." Current events proved the contrary, but with harmful effects.

b. The North side of The Feleacu Hill, represented by the northern slope of Feleacu Hill, is an area where the city extended, taking advantage of some favourable conditions: the existence of terraces at the base of the slopes, general decreased declivity, insignificant linear erosion, reduced gravitational processes mostly in the central and western parts of the city. Climbing towards the middle part of the slopes, the terraces are more difficult to identify, being covered by thick deposits originating from the upper slopes. In the most southern part of the administrative territory there are two leveling surfaces, a middle and a lower one (Morariu,T., Mac, I., 1967).

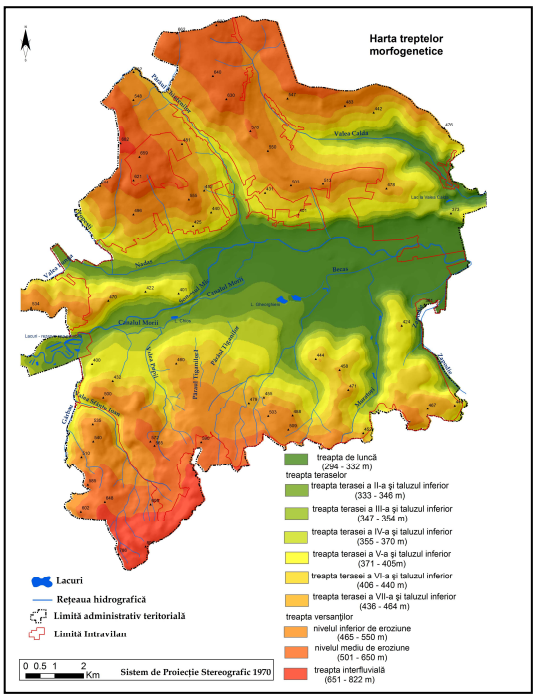
c. The South side of Lomb Hill and Sf. Gheorghe Hill

The terrains frm these areas are included in the built-up area. The new General Urban Plan proposes isolated patches from the slope areas to be introduced in the built-up area of the city. This sector is characterised by the significant fragmentation of terraces and poor builfing conditions due to a lithology composed of vulcanic tuffs, sands, conglomerates, hones and marl which led to landslides. This situation restricted buildings to Popeşti and Chintăului valleys and only isolated in the rest of the sector. The presence of these valleys which fragmented the slope caused a relief composed of apex associations and valley corridors. This is the transition area towards the Someşan Plateau. In some places, one can even find karst.

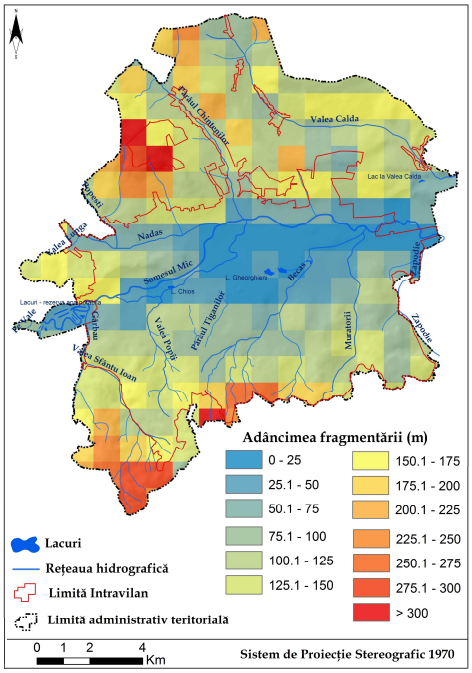
6.2. The Urban space morphometrics. Knowing the relief forms of an area can be achieved through various methods, one of which is the morphometric analysis. This is bassed on quantitive

calculations which lead to determining parameters or indicators expressed through maps, such as the density and depth of relief fragmentation, declivity, slope exposition. Together, these parameters determine an essential morphometric feature of the land which is its evolution stage tightly connected to the intensity and rhythm of geomorphological processes (according to Baciu, C., 2009).

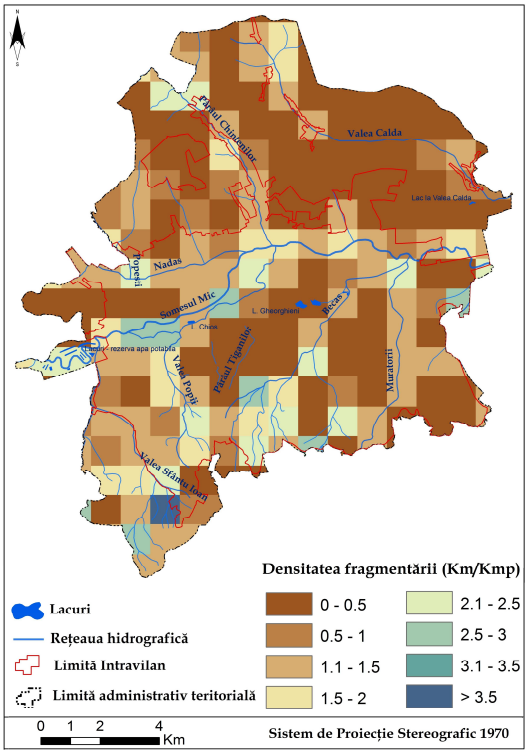
6.2.1. Hypsometry



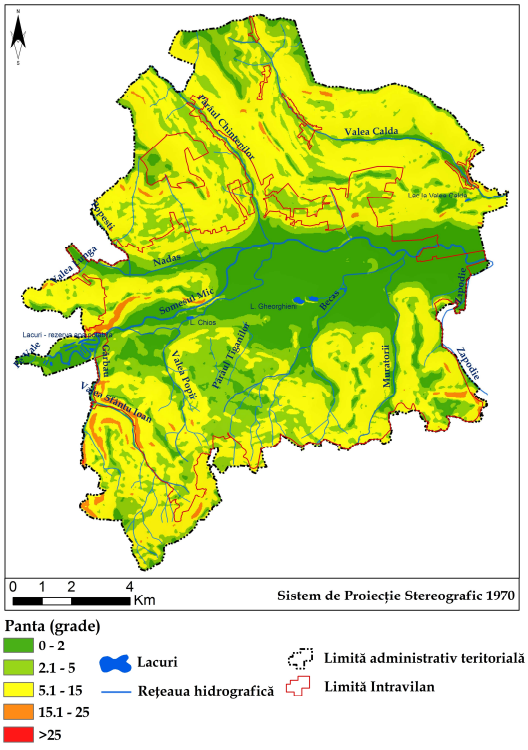
6.2.2. The energy of the relief



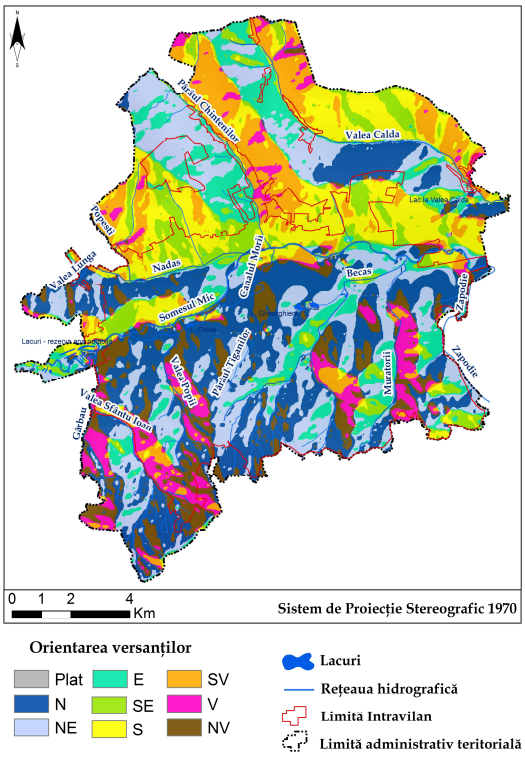
6.2.3. Fragmentation densitz of the relief



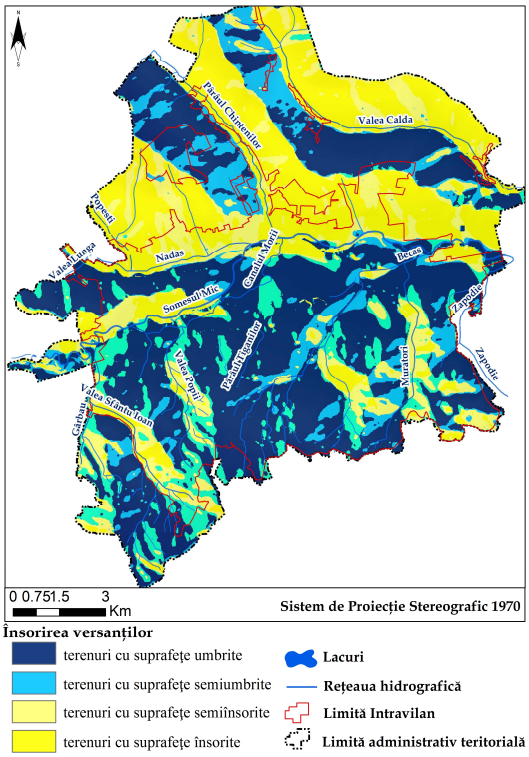
6.2.4. Slope geodeclivity



6.2.5. Slope orientation



6.2.6. Slope solar irradiance



6.2.7. Morphographic types of valleys

Valleys represent a basic relief element, as they set the fragmentation depth and density, but also the orientation of most surfaces and terrestrial communication network (Posea, Gr. 2006). We determined the morphographic parameters of the analysed valleys based on measurements on the topographic map and the existing references (The General Urban Plan of Cluj-Napoca, 2012; Regularization Project for Someşul Mic and its tributaries, 2012 etc.). With the help of the topographic map and the city's street plan, we described the path of each valley through the municipal urban area. We also briefly presented the regularization and flood prevention works done on each valley and their status, based on field research and bibliographic material. In order to fully analyze the shape of each valley, we created cross sections in different locations of the analyzed hydrographic basins, as well as the longitudinal profiles of each stream, with the help of GIS and the existing data base. These techniques eventually led to designing a graphic for each analyzed water course .

6.3. The morphodynamic of the urban landscape

The geomorphological division of small territories, such as urban areas, implies specific issues due to the predominant action of exogenous modeling geomorphological factors compared to the lithology, tectonic uniformity and reduced substratum mobility. In these conditions, the utilized taxonomic system is dominated by smaller units (interfluves, slopes, terraces, etc.). The fact that the city of Cluj-Napoca is set on a complex lithological substratum, where stratigraphic alternating, and tectonically differentiated formations predominate, plus the various manifestations of external agents from the Pliocene and Quaternary periods, enabled the differentiation of the prior described territorial units (according to Baciu,C., 2009).

6.3.1. Current geomorphological processes

The applied method was surveying the geomorphological processes on the topographic map, scale 1:25.000, establishing the dynamic stage and the age based on bibliography (Danci, I., 2013, Irimuş, I.A., Petrea, D., Rusu, I., Corpade, A., 2010, Morariu, T., Mac, I., 1967, Poszet, S.L., 2011, Surd, V., 2009, Surdeanu, V.; Goţiu, D.; Rus, I., Creţu, A., 2006, Treiber, I., Tovissi, I., Cormoş, D., 1973, etc.) and creating the map with the help of GIS.

The main types of geomorphological processes that predominate in the study area are the following (Figure no. 6.34): compaction, dissolution, subsidence, diffused erosion, gutters, ravines, torrents, active landslides, with / or without creep, recent landslides – Holocen, old landslides – Pleistocen, landslides that have been temporary stabilized through human intervention, but which are still in danger of sliding with / without constructions.

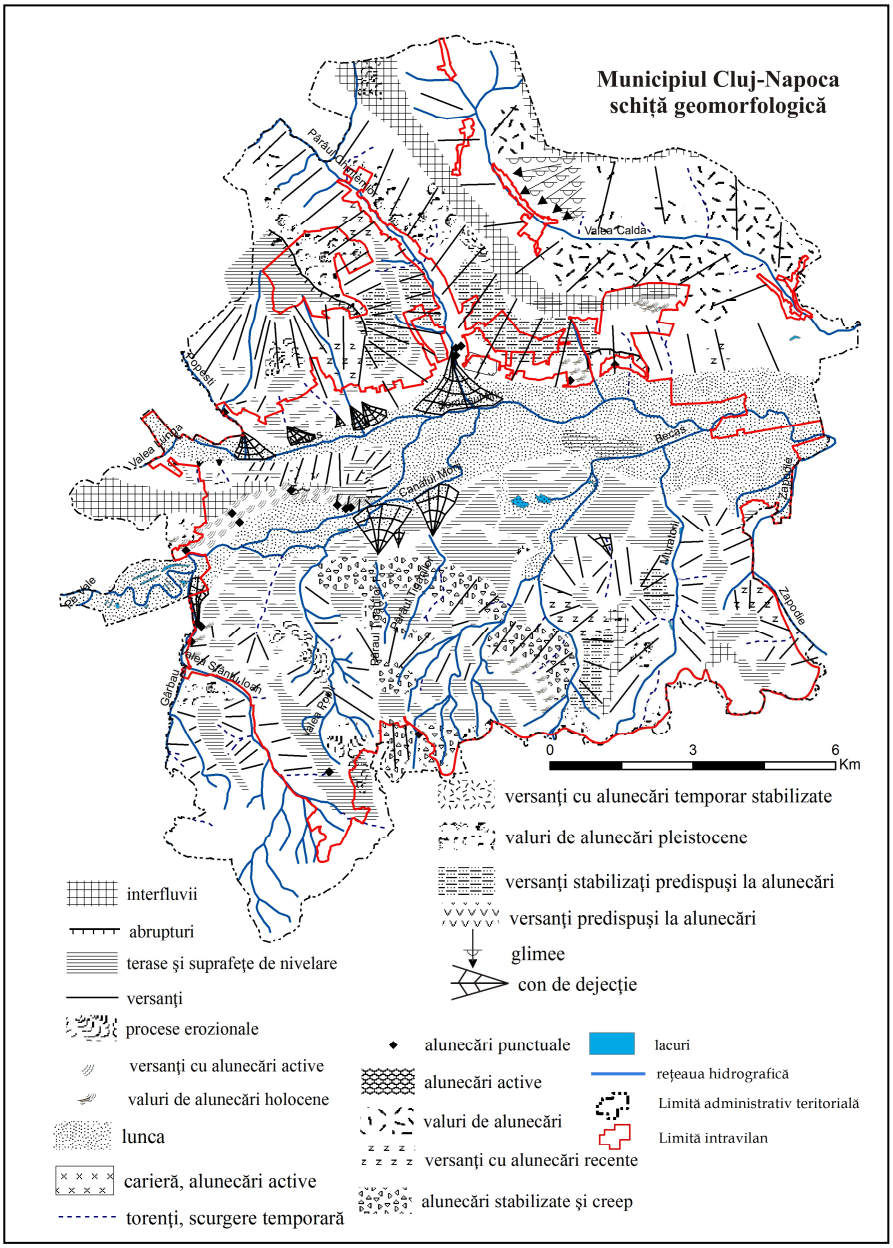


Figure no. 6.34 – The geomorphological plan of Cluj-Napoca

6.3.3. Risk territoriality within the urban space – case study. Starting from vulnerability surveys and taking into account several other studies (Baciu, C., coordinator, 2009, Buzilă, L. et al., 2001, Danci, I., 2012, Poszet, S.L., 2011, GUP Cluj-Napoca, 2012 Local Regulations Plan), we mapped the risks associated with geomorphological processes in Cluj-Napoca.

We identified very low risk areas, low risk areas, medium risk areas, and high risk areas. *The very low risk areas* are interfluves, terraces, partially the meadows of Someşul Mic and Nadăş. *The low risk areas* are the northern slopes of Someşul Mic-Nadăş interfluve, stable, with buildings in Gruia, east of Tăietura Turcului, and fewer constructions to the west, with green areas, pastures, forests. This category encompasses the middle sector of Feleacu Hill, the area comprising Zorilor, Bună Ziua, Andrei Mureşanu and Dealul Sopor neighbourhoods. *The medium risk areas* are found in the area of Rosetti Street to the west, on the northern side of Feleacu Hill, along Gârbău and Popii valleys, but also east of Murătorii valley, in the northern part of the city, on the left banks of Someşul Mic and Nadăş. *The high risk areas* of Cluj-Napoca are the southern slopes on the left side of Someşul Mic Valley, as well as some areas from the Someşul Mic waterside, on the eastern part of the city.

Case study – Borhanci residential area. The new residential areas of Cluj-Napoca, Borhanci included, were built roughly in the last 10 years on agricultural lands surrounding the city, in areas with easy access to the compact urban area. These areas have been continuously sought for erecting permanent residences, as a reaction to the urban life style. The main advantages of these sites were, at first, their natural character, quietness, fresh air and large, open spaces. Currently, even though these

features no longer exist, these peripheral areas are still prefered by many people in all large Romanian cities.

The area used in this case study (figure no. 3.36) is located in the south-eastern part of Cluj-Napoca, along Borhanci street, a continuation of Constantin Brâncuşi Street from Gheorghieni neighbourhood, with a surface area of roughly 684.7 ha. The applied methodology can be found in Government's Decision no. 447 / 10th April 2003 for the approval of the methodology regarding the creation and contents of landslide and flood natural risk maps, published in the Official Monitor no. 305 / 7th May 2003. The above mentioned stipulations define the landslide risk map, the hazard map, and *the average hazard coefficient*, as well as preparation standards for such documents and the calculation of this *coefficient*. Based on the formula found in the norms, with the help of GIS, we calculated the average hazard coefficient for the case study area, by using the Spatial Analist module and the Map Calculator function found in ArcGIS 10.1. Subsequently, we established values that vary between 0.166 and 0.476. The graphical representation of the territorial distribution of these values is the one in figure no. 6.39). According to the methodological specifications, the probabilities for land slides in the case study area are the following (figure no. 6.40):

- medium probability with values between 0.11-0.30 - on 188.5 ha;
- medium-high probability with values between 0.31-0.50 - on 493.5 ha.

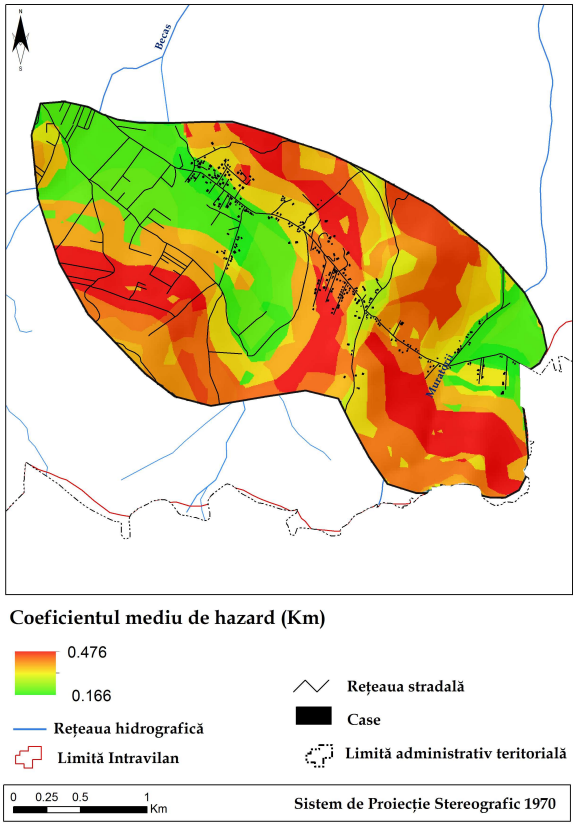


Figure no. 6.39

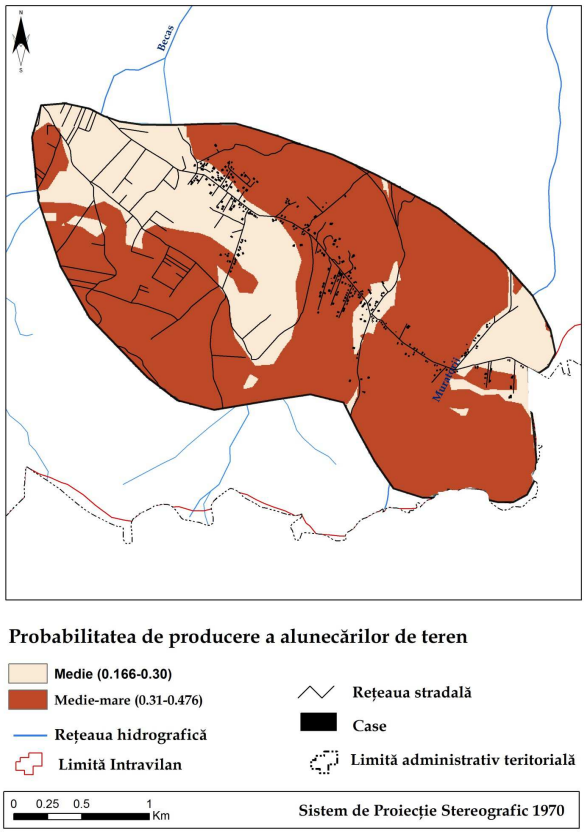


Figure no. 6.40

CHAPTER VII: THE DYNAMICS AND AESTHETICS OF THE URBAN LANDSCAPE

7.1. The plane-spatial dynamics of the urban landscape refers to the historical evolution of its built area, the manner in which the expansion of the city took up the available land, and the evolution of the street network, the urban fabric, and the built stock (figure no.7.2).

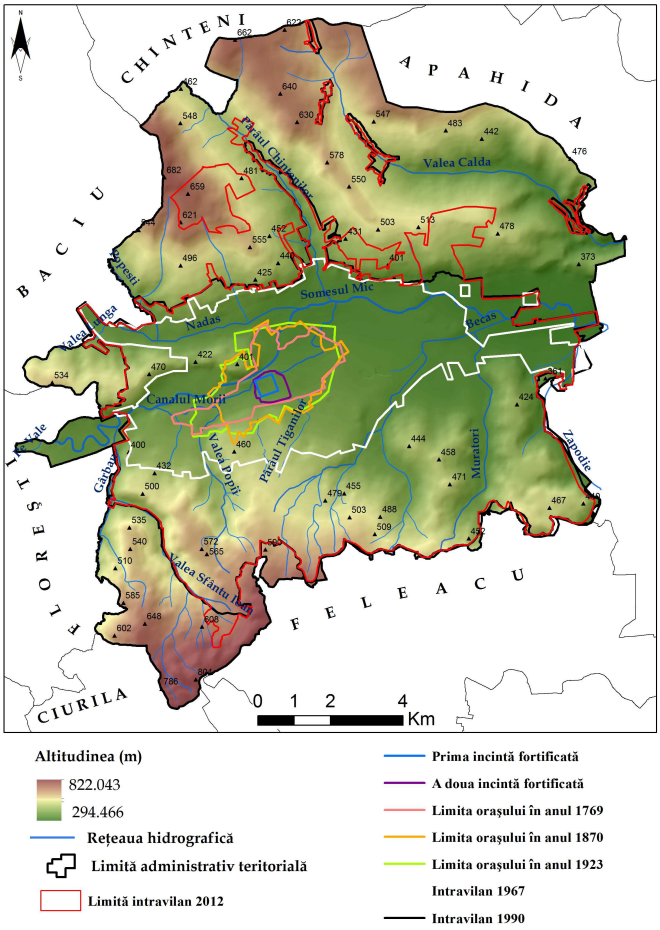


Figure no. 7.2 The historical evolution of the city – chronological marks

Year	Number of inhabitants	Surface of the built-up area (hectares)
1910	60808	1018
1941	110418	1893
1948	117915	2007
1956	154723	2007
1970	200759	4070
1995	330843	4070
1996	330084	6470
1999	332617	8815
2002	317953	8815
2011	324576	9838.65
2012	303047	10540.31

Table no. 7.1 The demographic and territorial evolution of the city in the 20th century * according to the General Urban Plan of Cluj-Napoca, 1998, Current Situation, and the General Urban Plan 2011, territorial audit.

We also created a dynamic study on the residential stock of Cluj-Napoca, the conclusion being that, in communist times, as the number of residential buildings dropped, the number of households increased dramatically.

The evolutionary dynamic of Cluj-Napoca's urban landscape in photography

Case study: Cetăţuia and surroundings – one of the most representative areas of Cluj-Napoca

Cetăţuia, a natural element which dominates the central area of the city, has always been a place for recreation, rest and relaxation for locals and tourists alike. We managed to identify archived photographic documents from different time periods, that show us the area in question. Most of these documents were not dated which means elements within the photographs had to be identified so they could placed within their respective time frames. We also chronologically presented these documents to offer a clear view of the historical evolution of the area. The explanations that accompany each photograph clarify aspects regarding the historical period in which the picture was taken.

7.2 Favourableness and restrictiveness in urban development established by terrain morphology. The natural framework of Cluj-Napoca played a vital role in the complex urban evolution process. The relief represents a basic component which enabled the emergence and development of Cluj-Napoca. Alignment type depressions, such as Someşul Mic in Cluj-Napoca, are economic and social bridges. Cluj-Napoca makes the historical connection between the settlements from the Transylvanian Plain and the ones in Apuseni Mountains, betwen the ones in Someşan Plateau and the Western Plain. The geomorphological characteristics decisively influenced the pleople's way of life, translated into land usage. Thus, in the larger areas of Someşul Mic Valley, found in the eastern part of town, people worked in growing vegetables, while on the norther slopes of Feleacu Hill as well as on the southern slopes of Cluj Hills people created orchards and vineyards. In the city's old hearth, the land was dominated by administrative buildings, industry and commerce, and later education and culture.

The step like relief forms, from the high apex of Feleacul Hill, and the lower Lomb – Sfântu Gheorghe, to the banks of Someşul Mic and Nadăş, the gradual transition from one form to another, the fragmentation of the relief by valleys, the favourable climate are *favourableness elements* for the development of human settlements. *The restrictive factors* in the territorial development of Cluj-Napoca are mainly the terrains affected by high risk geomorphological processes due to substratum instability.

The relief energy and declivity are also restrictive variables that hinder built areas. Cluj-Napoca is surrounded by relatively high hills; its current morphology is a consequence of the limits imposed by this situation, of the real expansion possibilities provided by the valleys of the tributaries of Someşul Mic.

7.3. The aesthetics of Cluj-Napoca's urban landscape

7.3.1. The anthropic elements of esthetic value from the urban landscape of Cluj-Napoca
In order to emphasize such elements, we took into account the studies done to this day. We identified within the city centre some historical subareas, selected according to criteria such as age, architectural and artistic value, urbanistic value, homogeneity – degree of urban match. The relation between these criteria is the one that adds value to an area, a landscape value to be more exact. The valuable areas include The Fortified Area of 1405, Mihai Viteazu square, Bariţiu, Constanţa, and Horea streets, the Railway Square, the railway works, Avram Iancu Square, Dorobanţilor Street, 21st December 1989 Boulevard, Moţilor Street, the Botanical Garden, the University Clinics, the Agronomy, Avram Iancu Street, the Central Cemetery, Republicii Street, the banks of Somesul Mic, the municpal park, Pavlov Street, Babeş, and Rozelor Parks, Calvaria-Cetăţuia, Racoviţă Street, Andrei Mureşanu, Grigorescu, Feroviarilor Park and the CFR households, 1 Mai Square, the Clujana ensemble together with Clujana factory and sports centre, (Protecttion areas of the urban image – perspective control).

The esthetic evolution of a representative urban ensemble for Cluj-Napoca: Timotei Cipariu Square. The place holds a high degree of representativeness in the urban context of the city, comprising major social-cultural and administrative buildings. The ensemble is a central place, located in the immediate vicinity of the historic centre and it has enjoyed an active and functional dynamic. Regarding its historical evolution, Timotei Cipariu came into being near the main acces routes into the fortified city. The research methodology implies cross-checking the references and creating a presentation of the esthethic evolution of the area. This led to the conclusion that this square currently has several good elements – its traffic organization, the adjacent buildings, the coherent functional mix mainly based on services, culture, and trade (figure nr. 7.19). The element that ruins its esthetics is the new religious building from its centre, which, through sheer size, is overwhelming for the entire ensemble.

Figure no. 7.19. Panorama of the western and north-western sides of Cipariu Square (2014)

7.3.2 The natural aesthetics. For the evaluation of the natural esthetics of Cluj-Napoca, we chose a method found in a 2012 study, named *The esthetic and ecological landscape assessment matrix* (Maija Jankevica, 2012). For Cluj-Napoca, we adapted the matrix to the specific feaures of the city. It uses the landscape cluster analysis. The assessed territory was divided based on the functional criteria in landscapes with similar functional, natural-ecologic, and esthetic values. The obtained data can be represented graphically.

CHAPTER VIII: THE TYPOLOGY OF CLUJ-NAPOC'S LANDSCAPES

8.1.Landscape typology. General views.

This research contains a presentation of the bankside landscapes, terrace, and slope landscape found in Cluj-Napoca following the structure below:

- location with streets as limits;
- morphological characteristics – altitudes, slopes, exposure, geomorphological processes, etc.
- functional usage according to the current General Urban Plan;
- relevant aspects from the landscape.

The characteristic correlation matrix is the type of matrix in which each element exerts a different effect on the other elements. The method (adopted from foreign literature by Ileana Stupariu

Pătru, 2011, 2013) was adapted to our study area. We identified the elements that are part of the structure of the landscape, as well as the its main changes, and we filled in a matrix for each type.

To exemplify, we present **The correlation matrix applied to the assessment of terrace landscape in Cluj-Napoca** (Ileana Stupariu Pătru, 2011, 2013) created based on the prior mentioned methodology.

Structure of landscape X

X1 – topographic and dynamic favourableness (surfaces with great topostability, low inclines)

X2 – geotechnical constraints (a certain instability of the inferior horizons)

X3 – pedological – topographical favorableness (land usage – the large residential areas found on terraces)

X4 - pedological – topographical favorableness (agricultural land within the built up area with great building potential)

X5 – hydrological favourableness (lakes)

X6 – hydrological constraints (permanent water streams that fragment terraces)

X7 – plant elements found in anthropic arrangements (large green areas, Colina, Cetăţuia, or smaller private gardens)

X8 – elements that enrich the landscape (good residential areas)

X9 - elements that enrich the landscape (the historic city centre, Avram Iancu Square)

Changes in the structure of landscape y

Y1 – surfaces without topographic restrictions

Y2 – geomorphological processes – compaction in some areas

Y3 – changes in the land usage from agriculture and natural areas to residential areas

Y4 – the predominant activity is agriculture, but in some areas there is push towards constructions (approved Zonal Urban Plans)

Y5 – the disappearance of lakes, while the existing ones are abandoned

Y6 – discontinuity elements in the dominant usage

Y7 - esthetic arrangements, for rest and relaxation

Y8 – poorly built neighbourhoods

Y9 – inadequate insertions in the esthetic and functional structure of valuable areas, pedestrian areas

Table nr. 8.2. The correlation matrix applied to the terrace landscape

	Changes in the structure of landscape y								
The structure of landscape x	Y1(9)	Y2(3)	Y3(7)	Y4(1)	Y5(5)	Y6(2)	Y7(4)	Y8(8)	Y9(6)
X1 (9)									
X2 (3)									
X3 (5)									
X4 (2)									
X5 (4)									
X6 (1)									
X7 (6)									
X8 (7)									
X9 (8)									

Significant changes
Medium changes
Limited changes

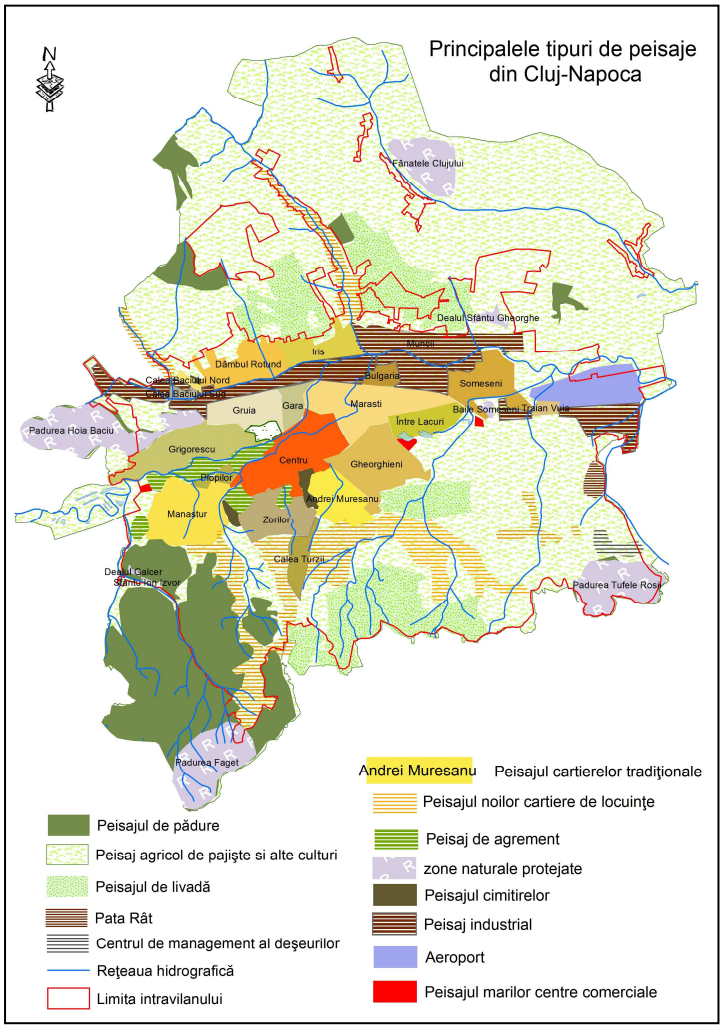
According to the matrix apllied above to the terrace landscape (table no. 8.2), significant changes in the structure of the landscape correspond to X1 with Y1, X3 with Y3, X8 with Y8, X 9 with Y9. Medium changes correspond to X5 with Y5, X7 with Y7, X3 with Y9, X7 with Y9, X8 with Y9, while limited changes to X2 with Y2, X4 with Y4, X5 with Y6, X6 with Y6, X5 with Y7. Each correlation can be interpreted in relation to the reality on the ground. For example, the correlation between X1 and Y1 implies a relation between high terrain topostability and lack of topographic restrictions. The correlation between X3 and Y3 indicates an obvious correspondence betwen the usage

of land as residential area and changes in the land usage from agriculture and natural areas to households.

CONCLUSIONS

The current study has a strong interdisciplinary character and is based on numerous geographic, history, and urban planning papers regarding the Municipality of Cluj-Napoca. Studying the theoretical concepts of the geographic landscape in general and the urban landscape in particularly led our study in an interesting direction, that is the theoretical approach of landscape as an hmogenous unit with its own specific structure, with emphasis on its visual qualitative side, on the image of a landscape.

We presented the urban landscape of Cluj-Napoca and brought forward details regarding the substratum, the hydroatmospheric, biotic and human components, and we delved deeper into the landscapes that are classified based on functional criteria.



The morphology of the urban landscape of Cluj-Napoca at the meeting point of three major units: Apuseni Mountains, the Transylvanian Plain and the Someşan Plateau. This location determined a complex and diverse morphology given by different characteristics in the nothern flank of Feleacu Hill, others in the Floreşti – Apahida corridor and completely different on the southern side of Clujului and Dejului Hills. The GIS analysis of the morphography and morphometry allowed us to see these differences, to map them and to assess the complex morphology of Cluj-Napoca and its landscape.

We tackled the landscape dynamic with the help of aspects regarding the spatial evolution of the city a wave like process that gained momentum in time. We also identified characteristic problems for the residential stock as well as functional problems of great landscape relevance.

The esthetics of the urban landscape was approached using its two components – the man-made esthetic values and the natural values.

The case studies identified the valuable anthropic aspects, but also the esthetic defficiencies of the city's landscape regarding to poor capitalization of the city's architectural and urbanistic heritage. As for the esthetic given by the natural values, by applying a methodology from foreign studies, the esthethic and natural-ecological values were correlated, withe the natural component taking a front row seat.

Based on previously analysed aspects, we created a typology of the urban landscape alongside the presentation of the defining factors that individualize each landscape. The applied methodology is based on the visual analysis of each type of landscape which bears the mark of every topographic level and its morphological features.

The landscape map of Cluj-Napoca illustrates the main types of landscape, with their geographical location within the city. Therefore, within the city proper we have the traditional neighbourhood landscape, the industrial landscape, the green and recreational landscape, the cemetery landscape. The built-up area also comprises the new residential area landscape located in the forest landscape and the pasture landscape, agricultural land, orchards. The outer ring is dominated by the agricultural landscape and the isolated forest landscape. A special place is taken by the natural protected areas which might one day be the basis for a future *green belt or girdle of Cluj-Napoca.*

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