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The Ecological Function of the City of Cluj-Napoca. A Functionalist-Heuristic Approach

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ABSTRACT

The concept of ecological function, here presented, is the result of epistemological endeavours on the city and its functions. We consider that the city, which has the features and the properties of a „living organism", must not be assessed and analyzed from a Cartesian point of view, but functionalistically. The definition that we propose for the city, is that of an organized and complex geographic space, with a permanent dynamic, capable of ensuring a diversity of functions for its evolution and development, as well as for the evolution and development of its influence space. This definition is based on an entirely different axiology and its underlying concept is finality. The city's finality generates a new definition of the urban function, which is the relationship of necessity formed between the elements of the urban geosystem and its state and which generates, cultivates and sustains the city`s life, working towards the attainment of its systemic finality. The two concepts, defined through a new philosophy, offer us a new perspective on the classification of urban functions, in which, objectively, the category of civic-urban functions sets in, containing among others the ecological function. This function has never been classified or even mentioned in the geographic literature. Having based our endeavour on the General System Theory and on the fractal theory, we considered the ecological function`s subsystem as a geosystem with all the necessary defining features, and we built an analysis, diagnosis and prognosis scheme for the subsystem of the ecological function of Cluj-Napoca.

1. A NEW APPROACH ON THE CONCEPTS OF CITY AND URBAN FUNCTIONS

The complex and systemic approach regarding the city, as an urban geosystem, must start from the fundamental reconsidering of two basic geo-antropological concepts: the city and its function.

Unanimously accepted as a complex form of human settlement, the city does not have however a definition that can encompass all of its complexities.

Consequently, we put forward, in the general epistemological endeavour, another definition, thus considering the city as a complexly organized geographical space, with a permanent dynamic, capable of ensuring a diversity of functions for its own evolution and development as well as for the evolution and development of its influence space.

In the functionalist approach regarding the urban geosystem as well as in the philosophy of other gnoseological conceptions, the city is considered as a "living organism" and, consequently, generates and cultivates its functions, which are indispensable for its evolution. Under the influence of Cartesian philosophy, a theory was consecrated, stating that the urban functions are determined by their ability to create and especially attract resources to the city [9]. We propose, under the guidance of complexity sciences, that we start the analysis of functions (urban or rural) from the concept of urban geosystem's finality. This finality, which every geosystem tries to reach, is the one that must define the city`s function. Therefore, we put forward a new definition of the urban function, that is the necessity formed between the elements of the urban geosystem and its state and which generates, cultivates

and sustains the life of the city, working towards the achievement of its systemic finality.

2. A NEW TAXONOMY OF URBAN TERTIARY FUNCTIONS

Starting from the two previously defined concepts, we put forward, within the spirit of the same complexity that characterizes the urban geosystem, the following taxonomy of urban functions: vital and conjunctural. They are, above all, the consequence of the urban geosystem's sensitivity to disturbing stimuli (not in a disorganizing sense however), stimuli that push the city towards generating synergetic properties, that will generate, sustain and cultivate its life and the life of its systemic space. Leaning towards the tertiary functions of Cluj-Napoca (as is the case for every urban geosystem), we consequently devised a taxonomy of urban functions (table 1).

Table 1. The main categories of tertiary functions for the present day Romanian cities.

No.	Function	No.	Function
1.	Civic functions	6.	Judicial function
2.	Cultural functions	7.	Transport function
3.	Administrative-political functions	8.	Infocommunicational function
4.	Touristic functions	9.	Military function
5.	Financial function	10.	Commercial function

Within the nomenclature of the civic functions, we formulate the following taxonomical structure: the residential function; the administrative-civic function; the urbanistic function; the ecological function; the medical function and the security function.

3. THE ECOLOGICAL FUNCTION OF THE CITY OF CLUJ-NAPOCA

This function will be analysed starting from the gnoseological consecration of ecology, made by E. Haeckel [2], as a science of the conditions of struggle for existence and economy of nature. In this manner, the ecological thought will consist of the discovery and the emphasis of the relations between life and the environment, as well as in taking into consideration every vital unit as being a member of a higher level of integration [8].

This function is a level of a holarchic institutional „organization", which contains, at a macro- and mesoreferential scale, international, national and regional structures, all having sustainable evolution as a main goal. Thus, the problem of the ecological management, administration and development (sustainable) of every city, including Cluj-Napoca, must not and cannot be carried out without an institutional system, with capable and competent logistical structure. How can the city (Cluj-Napoca) reach these objectives in its own geosystem? The conclusion is logical, that is, through the establishment and the "institutional construction" of a specialized function, the ecological function. We will see, by analyzing the ecological function, that its final purpose is the attainment of a healthy system, of its sustainable evolution. This leads us to another conclusion. Today, urban ecology „touches", from a institutional point of view, all the elements of the urban geosystem, an achievement impossible without a civic, ecological function, which is not officially classified at the moment within the taxonomy of urban functions. We find as appropriate the introduction of this concept, due to the fact the emergence and growth of ecological institutions and the emphasis put on finding the balance and reoptimising the urban space from an ecological standpoint transforms this function in a superfunction, similarly to ecology becoming a metascience today.

This function (in general, at today`s city organization level) did not manage to overcome the status of an internal function, but we foresee for the near future its emergence within the "landscape" of the geography of settlements, while the issue of ecology will become more and more complex, including from an institutional point of view. The new global "frontiers" are so aggressive that the higher level political ecology of cities already has structures trying to make order within the system. These solutions are very important for human communities, for cities, for geographic structures, for geosystems, since they can be subjectively guided or better said, misguided, jeopardizing the settlements` existence. For example, cities are extremely energy consuming and at the same time generate huge amounts of waste. Getting energy and eliminating waste leads to damage for the natural space, for other geospaces, even for settlements, etc. Looking into the ecogeography of the future reveals dark, if not catastrophic, perspectives.

Therefore, each settlement, especially an urban one, cannot go on without an ecological function. This function, in relation to the holarchic level of the geosystem, can have an ecocivic status or a ecopolitical one. The former will be part of the civic functions of the city, while the latter will be contained within the structure of the administrative-political function.

4. THE ANALYSIS OF THE FUNCTIONAL ECOLOGICAL SUBSYSTEM OF CLUJ-NAPOCA

Relying on these substantiations, we will go on to the presentation of the ecological function of the City of Cluj-Napoca. Its approach however, will also be carried out based on the main principle of the fractal

theory [5], that stipulates that every fractal (subsystem in the case of geography) keeps the features and behaves exactly like the oversystem from which it comes.

Therefore, the subsystem of the ecological function of Cluj-Napoca will have the geodefining features of the whole geosystem and consequently can be analysed as a geosystem. To do so, we partially used and adapted the epistemological analytic construction of urban geosystems [3] and we will study the subsystem of the ecological function by using three layers: the present day organization; the function's diagnosis (of the functional subsystem) and the prospective geography of the ecological function`s subsystem.

4.1. The elements of Cluj-Napoca`s ecological function subsystem. Present day organisation mode

For such a "young" function, the ecological function has a series of well defined and strongly implemented elements within the city`s geography, such as: The Regional Environmental Protection Agency (REPA) Cluj-Napoca; The Regional Environmental Guard Commissariat Cluj; The Intermediate Body – Sectorial Operational Programme (SOP) Environment Cluj-Napoca; Cluj-Napoca City Hall; Cluj County Council; "Alexandru Borza" Botanical Garden; Cluj Forest District of National Forest Administration; private waste management operators; environmental protection non-governmental organizations (NGO's); nature reserves, parks and urban green areas etc.

4.2. The diagnosis analysis of Cluj-Napoca`s ecological function subsystem

Viewing the subsystem of Cluj-Napoca`s ecological function as a fractal of the geosystem, we constructed its analysis design according to figure 1.

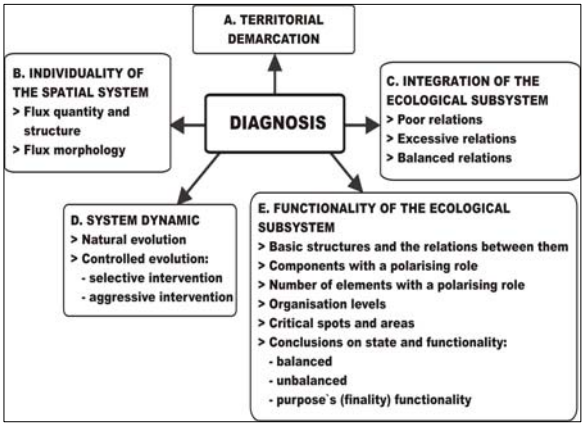


Fig. 1. The structure of the diagnosis design of Cluj-Napoca`s ecological function subsystem.

4.2.1. The territorial demarcation of Cluj-Napoca`s ecological function subsystem

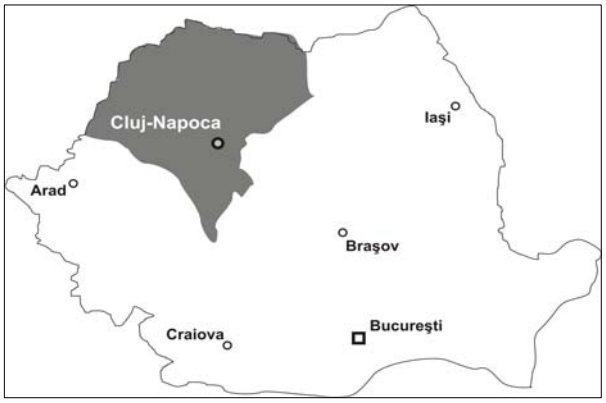


Fig. 2. The pattern of Cluj-Napoca's ecological function.

4.2.2. The individuality of Cluj-Napoca`s ecological function subsystem

The quantity, structure and morphology of the fluxes generated by the ecological function of Cluj-Napoca are extremely varied. The natural (physical-geographic) element introduces the following types of fluxes in the system: submountainous microclimate; predominant currents for each season; a pluviometric regime of around 663 mm/year; green spaces (parks; squares; gardens; planted strips; forests, which add up to 19.17 m²/inhabitant); streams and the river Someşul Mic; a topoagricultural surface of 9943 ha; 397 ha of pastures; 2453 ha of forests; 38 ha of riverside vegetation; 3179 ha of mixed pastures and trees etc.

The urban anthropic element introduces the following fluxes within the system: "zonal" anthropic fluxes - the central area (refreshing from a touristic, cultural and spiritual point of view; restrictive for movement, aggressive on health due to emissions, institutional stress, financial stress, etc.) the residential area (clean and exclusive neighbourhoods, such as Andrei Mureşanu; neighbourhoods that are "comfortable" and well endowed with facilities, such as Gheorgheni and Grigorescu; comfortable, but badly designed neighbourhoods, made for a communist lifestyle; motley neighbourhoods, an unsystemised melange of houses and blocks of flats, workshops, small factories, brownfields, such as Iris and Calea Baciului; interwar built neighbourhoods, like Gruia and Dâmbu Rotund; new areas, unsystemised, poorly designed, with minimum facilities, disorderly and without any urban architecture and spirit); the industrial zone, well placed from a ecogeographical point of view, but abandoned and disorganized, even urban aggressive; the transborder, mesoreferential area, that cannot be demarcated through boundaries, limits, since a large city, ecologically speaking, has a flux space, which is at least regional.

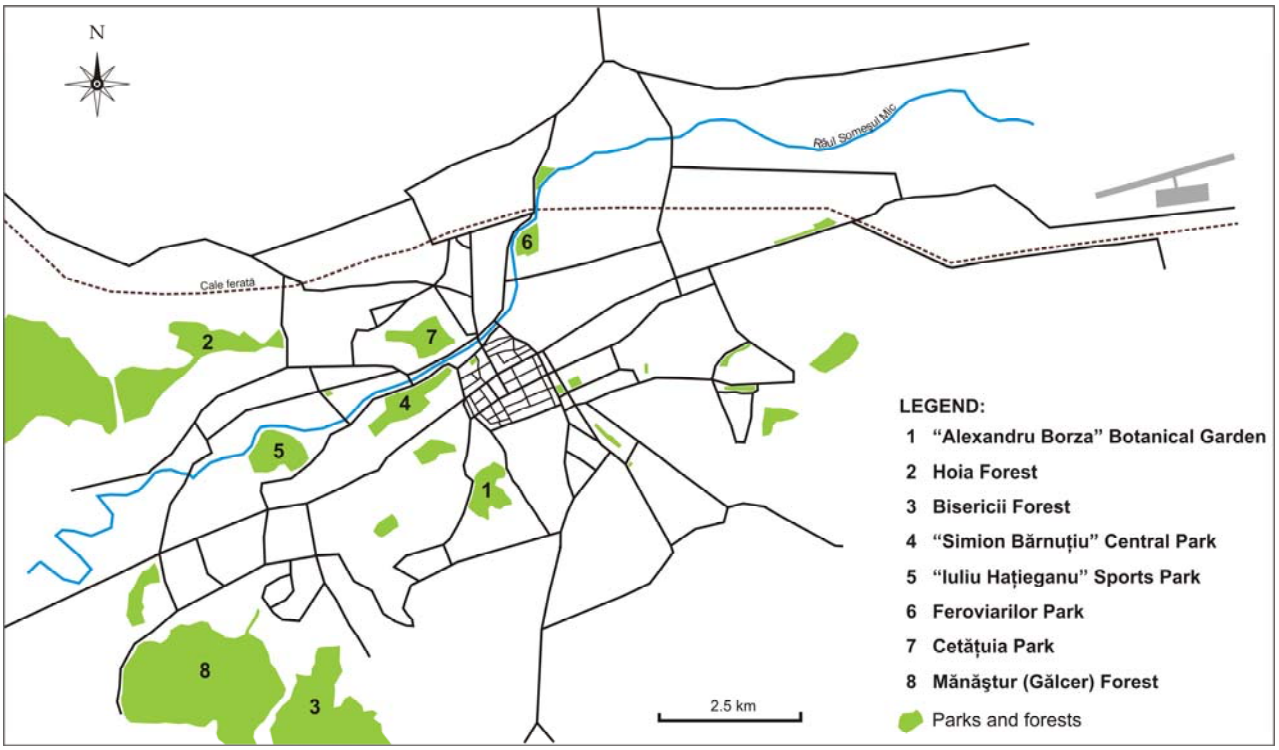


Fig. 3. The main green areas of the City of Cluj-Napoca in 2010.

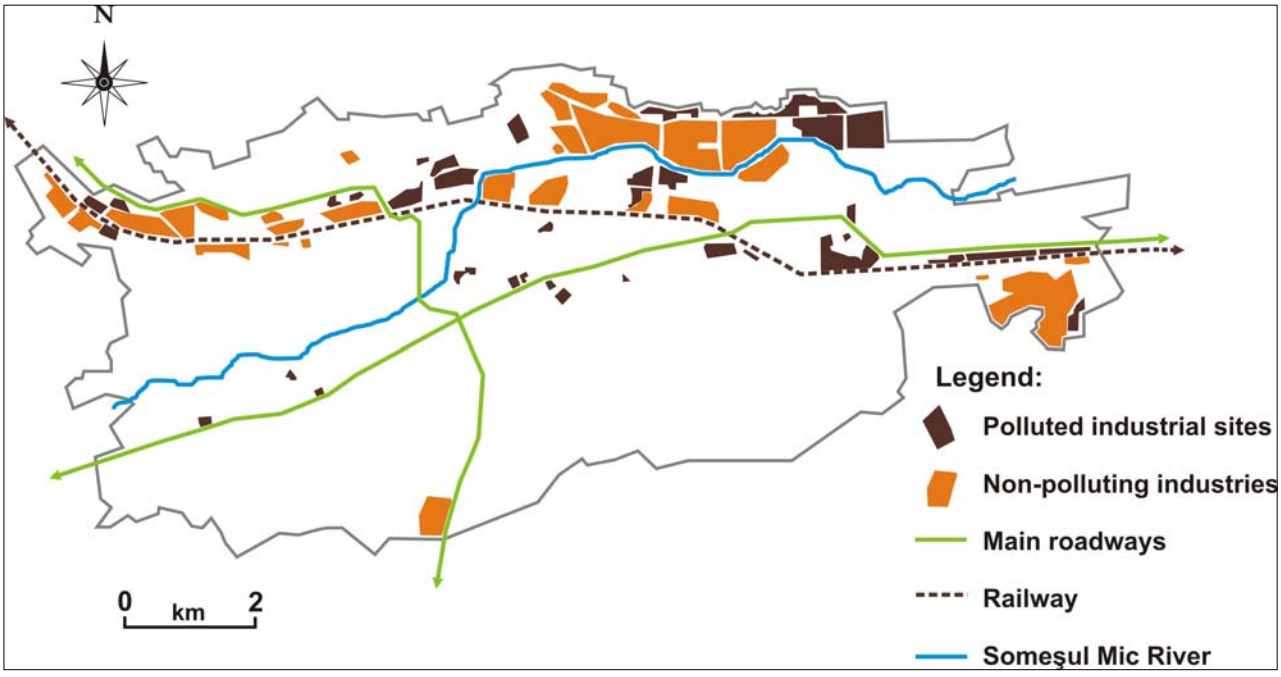


Fig. 4. The industrial areas of Cluj-Napoca in 2010.

Therefore, we choose to configure its mesoreferential area by superimposing the territorial individualities of the eco-specific zones:

- the North-Western Development Region;
- the region of specific institutional fluxes (four regional environmental bodies);
- logistical-ecological institutions (Someş Water Company;
- Someş-Tisa Basin Water Administration), etc.

4.2.3. The integration of Cluj-Napoca`s ecological function with adjacent and holarchic systems

The geographic system of this new urban function manages, in the case of Cluj-Napoca, to integrate itself in a very complex manner. It has integrating interrelations in all the fields of geographic life, which structures the sustainable and harmonious

development and evolution: natural space; administrative-civic space; administrative-political space; cultural, security space etc.

The relations of the ecological functional subsystem of Cluj-Napoca with the other systems are, according to the analysis design, either poor, or excessive. The balance (as a goal) of the intersystemic integration relationship can only be attained through a systemic convergence of all the efforts directed towards reaching this goal, according to the principle of convergent ingineering for achieving quality [6].

The poor relations together with the excessive, therefore unbalanced relations, have the following status:

- relations of integration through ecosystemic offer (The Development Strategy of Cluj-Napoca;
- the General Urbanistic Plan of Cluj-Napoca;
- construction of beltways for heavy traffic; the implementation of selective waste collection, etc.) and relations of poor eco-integration in the holarchic system (the aggression of real estate projects on green areas, such as the case of Făget Colony;
- lack of intraurban green areas – only 19.17 m²/ inhabitant – nowhere near the average of 26 m²/ inhabitant, that must be reached by 2013;
- pollution of ground and underground water – Zăpodie Stream etc.).

The general conclusion regarding the integration of the subsystem of Cluj-Napoca`s ecological function is therefore one of ecodeficiency.

4.2.4. The evolution of Cluj-Napoca`s ecological function subsystem between 1990-2010

While the first three elements of a system`s diagnosis (demarcation, individuality and integration) can be presented on intervals (shorter or longer), the case of evolution (dynamic) is different. Here, in order to show a relevant geographical image of the system, we must make use of the historic principle by choosing a long enough period that can offer us, for example, by comparison, the steps, forms and levels of evolution.

In the case of the ecological function subsystem of Cluj Napoca, the period between 1990-2010 is highly relevant for our endeavour, due to the evolution`s dynamic and also due to the threshold moment and transcience period [4], [7], a period that contains a series of systemic mutations within the Cluj-Napoca geosystem.

We will select, out of the geofunctional frame of Cluj-Napoca's civic functions, a few significant evolutions for the ecological function and its subsystem (table 2).

Table 2. The framework of the defining evolutions of Cluj-Napoca`s ecological function.

Defining and representative evolutionary processes	Forms of evolution			Effect on the status of the Cluj-Napoca geosystem		System status in 1990		System status in 2010	
	Natural	Controlled		Disorganising	Organising	Balanced	Unbalanced	Balanced	Unbalanced
		Selective	Aggressive						
"Explosion" of aggressive factors towards the geographic space			■	■		■			■
An increase of institutions and institutional logistics dealing with environmental protection and management		■			■		■		

4.2.5. The functionality of Cluj-Napoca's ecological function subsystem

The ecological function and its system are part of the civic functional subsystem of Cluj-Napoca. Consequently, we will opt for an integrated analysis of the ecological subsystem, according to figure 5. The highest level of a (sub)system's diagnosis is its functionality [3], the self-organisation level and the level of its systemic structural state.

The functionality of a geographical (sub)system, in our case the ecological susbystem of Cluj-Napoca, is mostly a "generalizing mirror" of the conclusions that came out of the diagnosis` algorithm and whose "images" will be presented below. As we are about to present the basic structures and their relations in the

ecological functional susbsystem of Cluj-Napoca, we pick, out of the intrasystemic relations "box", a few defining ones for the connection between the ecological function and the other civic functions. However, the box is relevant for highlighting any relation that Cluj-Napoca`s ecological function has with the other sectorial functions (primary sector; secondary sector; cuaternary sector).

For example, the residential function ensures the vital space for the human element of the ecological function, while the ecological function ensures the conception, norms, the institutional logistics, the actions for a sustainable cohabitation, controls and acts according to the residential function`s reactions.

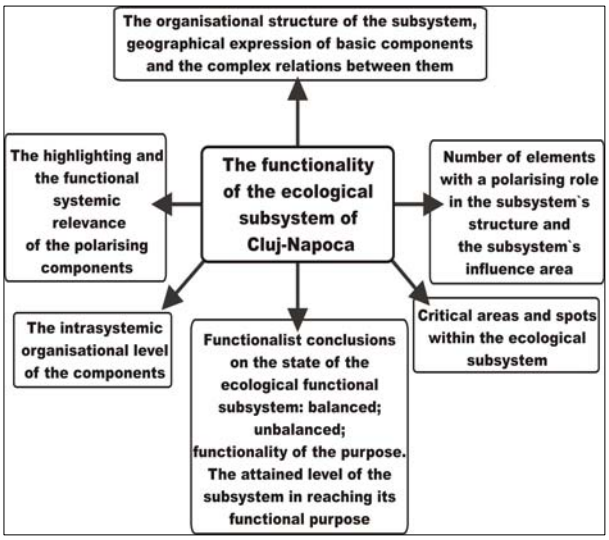


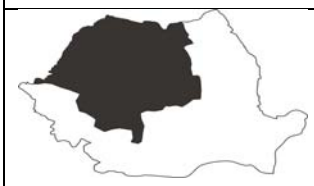
Fig. 5. The functionality of the ecological subsystem of Cluj-Napoca

The security function guarantees the legal framework and the institutional logistics for the safety and the enforcement of ecological cohabitation norms set by the ecological function. Furthermore, it intervenes with specific means when the ecological function`s resources are unable to ensure the order and the normality of the ecological life within the system. In return, the ecological function ensures the ecological normative framework and the legislative support for the security`s function activity in order to maintain the security of a healthy and sustainable life in the system.

Another good example of a structural-objective relation between functions is the urbanistic-ecological duo. The urbanistic function offers the reason of existence and functionality to the ecological function: there is no urbanistic function, nor urbanistic action, free from ecosystemic reaction, a reaction of balance that is introduced in the anthropic geosystem by the ecological function. The ecological function ensures the systemic, theoretical and practical support for balancing the the divergent factors in the construction, cohabitation and development of the anthropic (geosystemic) space.

In terms of the components of the ecological function with a polarizing role within the geosystem, the functionality of the ecological subsystem of Cluj-Napoca is characterized by the number and power of such elements. The polarizing role and area of each element are revealed by: the involved population; workforce; area of influence / attraction of the element; character (internal or external); the maximum influence extent; the influence directions; the ecological impact, etc. We will also analyze, separate from the analysis of each element, the position of the ecological function in the hierarchy of Cluj-Napoca's civic function from a polarizing standpoint. By cartographically analyzing Cluj-Napoca's civic functions' areas of influence, we observe that the ecological function has an intermediate position, between the minimum polarizing area (the residential function) and the maximum one (that of the medical function) (table 3).

Table 3. The areas of influence generated by the residential, ecological and medical functions of Cluj-Napoca.

Area of maximum influence (determined by the medical function)

Area of intermediate influence (determined by the ecological function) –the territories of Cluj, Sălaj, Bihor, Maramureş, Bistriţa-Năsăud and Satu Mare Counties

Area of minimum influence (determined by the residential function) - the built-up area of Cluj-Napoca


In conclusion, the ecological function ensures a stable balance in the Cluj-Napoca geosystem and excludes intrasystemic disputes for dominance

We consider that the level of systemic organization of the ecological function in Cluj-Napoca can be suggestively evaluated trough an analytic-statistical form that will lead to relevant relations between: the number of function elements; their organizational mode and the geographic space organized by the functional element. Therefore, we propose the following table.

Table 4. The evaluation of the level of organization of Cluj-Napoca`s ecological subsystem.

Functional elements	Hierarchic level reached	Organized geographical space (by elements)	Number of integrated persons	Geographic space organized by the function	Level of organization of the ecological subsystem
Cluj-Napoca City Hall (units of environmental protection)	Municipal organization	Cluj-Napoca`s space	29	Contains geosystems from a microspatial level (local) to mesospatial levels (county level, regional level)	The two categories of elements: physical-geographical and anthropic are under an objective and also a subjective process of self-organization and systemic organization. The ecological function of Cluj-Napoca is a new one, mainly objectified by the expansion of the European Frontier phenomena [1], extremely aggressive towards all the elements of the urban geosystem. Therefore, the necessity relation between the elements and the states generated a new urban conscience, the ecological conscience, which in turn generated and organized a specialized ecological system. The systemic leap was made when the function organized an entire complex logistical-institutional system and with a regional geographical area of influence.
Regional Environmental Agency Cluj-Napoca	Regional environmental forum	Space of the North-Western Development Region	36		
Regional Environmental Guard Commissariat Cluj	Regional environmental security agency	Cluj, Bihor, Bistrița-Năsăud, Sălaj, Satu Mare, Maramureş Counties	16		
Intermediate Body – SOP Environment Cluj-Napoca	Regional Environmental SOP body	Space of the North-Western Development Region	21		
Cluj County Council (units of environmental protection)	Environmental apparatus within the county forum	Cluj County	10		
"Alexandru Borza" Botanica Garden	Nature conservation subsystem within Babeş-Bolyai University	Submunicipal space (Clinicilor Area - Zorilor Quarter)	47		
Cluj Forest District of National Forest Administration	County organization	Cluj County	342		
Waste management operators	Private enterprises	Intercounty space	Around 750		
Environmental protection NGO's	Non-governmental organizations	Intercounty space	Around 2300		

The critical areas and spots of the ecological subsystem of Cluj-Napoca are as follows (fig. 6).

The conclusion on the status and functionality of the ecological subsystem of Cluj-Napoca reveals some very interesting facts. This part of the diagnosis offers us, after taking this analytical road, some suggestive and generalizing conclusions regarding the ecological function of Cluj-Napoca.

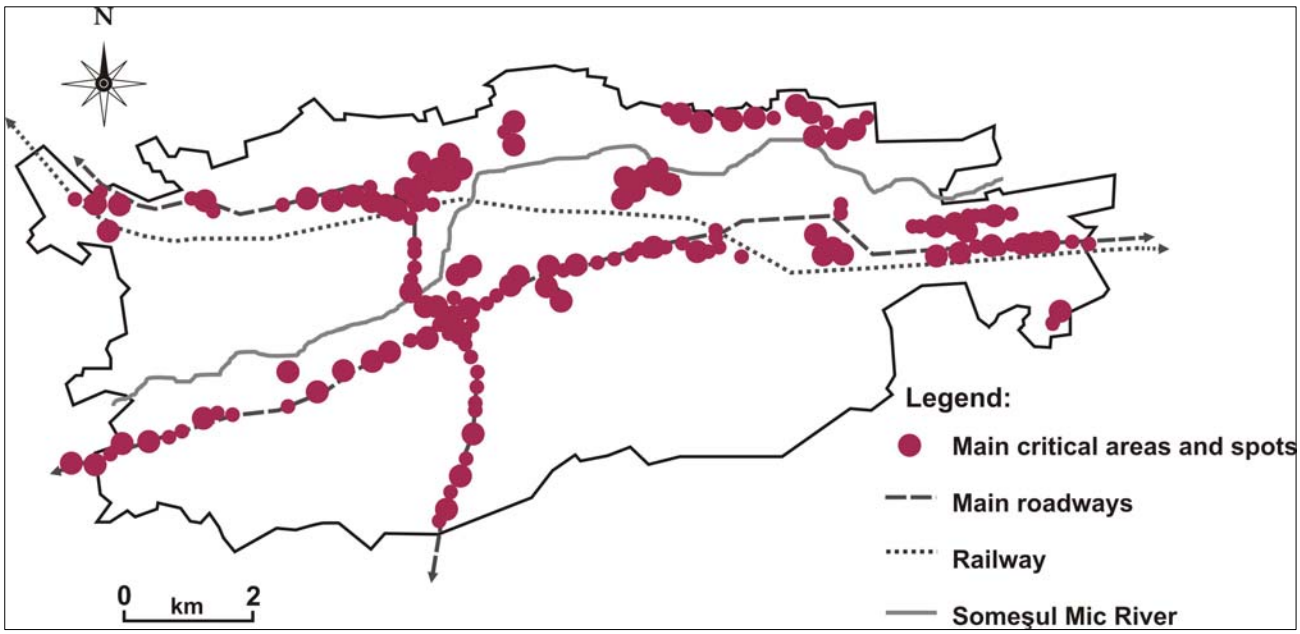


Fig. 6. Main critical areas and spots of Cluj-Napoca`s ecological subsystem in 2010.

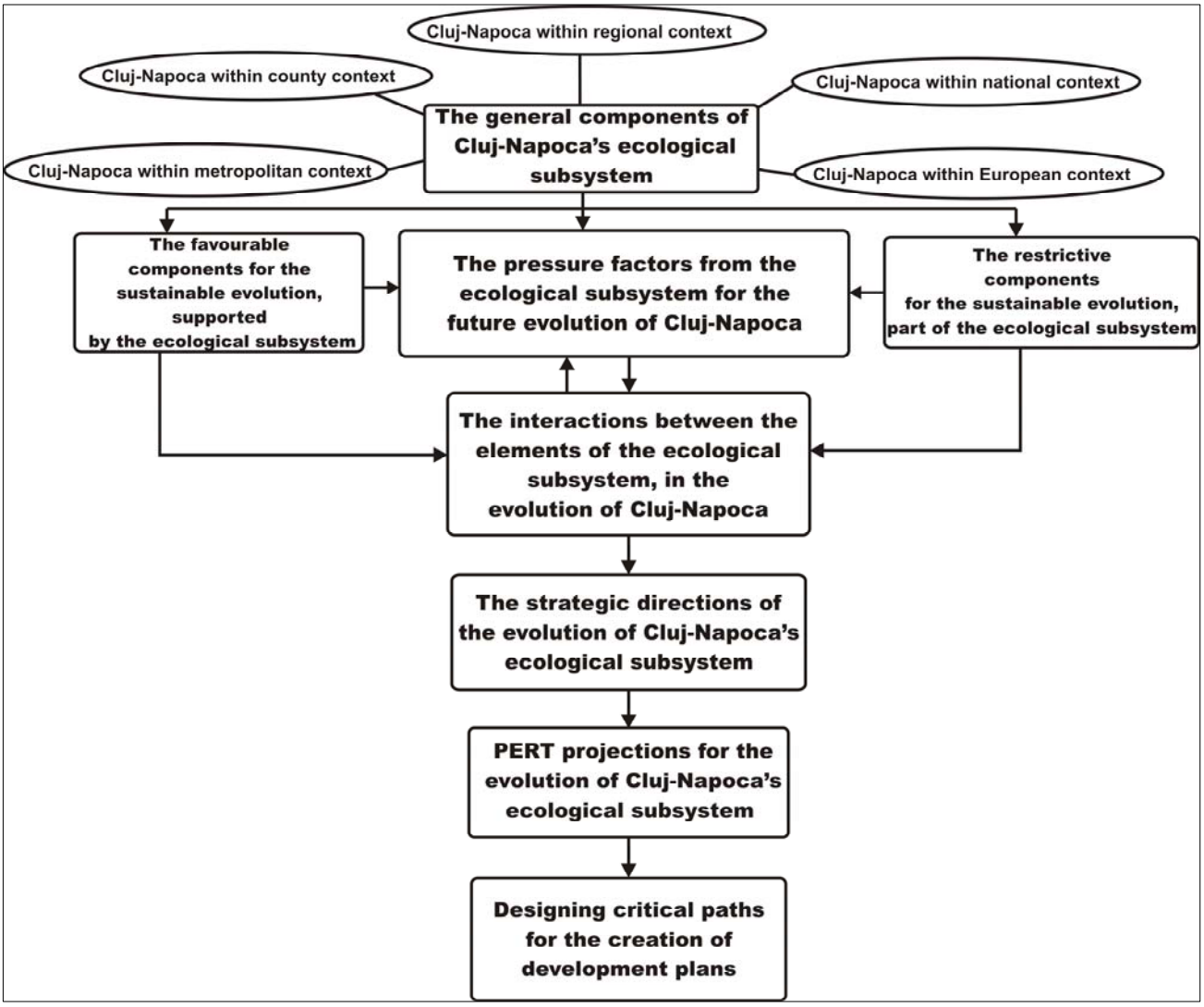


Fig. 7. The prospective analysis of the ecological function of Cluj-Napoca.

Firstly, the Cluj-Napoca geosystem is an extremely aggressive geographic element towards the surrounding mesospace, from an ecological point of view. It is polluting for the microspace and mesospace, has elements of potential high risk, it is capable of producing ecogeographic "events", it is a "predator" for the natural environment etc.

Secondly, as a factor of balance, Cluj-Napoca is a centre of conception, organisation, planning and education for the sustainable evolution of a very large space (mesospace).

Thirdly, the ecological function of the city is an objectivation of the necessity relations between the elements of the geosystem and their status, of the relations generated between elements on one hand and between elements and their states on the other hand.

Moreover, due to its complexity, the ecological function has the role of a superfunction, ensuring spatial equilibrium, the balanced evolution of the geosystem, the health of all the elements through ecological rules, the harmonious evolution of the geosystem and organizing the prospective, normative and projective geography of the geosystem.

The ecological function of the City of Cluj-Napoca (and this goes for every contemporary city) has the ability to play the role of almost every other function (primary; secondary; tertiary). It is a normative function, it is medical function, it is an administrative function, a urbanistic one and especially a security function (the security of the environment; security of the anthropic space; security of human life; security of the harmonious evolution in order to achieve the purpose of the city: sustainable evolution etc.).

That is the reason we consider the classification of the ecological function within the taxonomy of urban functions as crucial.

4.3. The ecological function and the prospective geography of Cluj-Napoca. Heuristic approach

The third structural part of the epistemological construction used in the analysis of Cluj-Napoca`s ecological subsystem tackles the role of this function in the prospective geography of the city.

This part will be presented solely through the epistemological design for the prospective analysis of the ecological function of Cluj-Napoca (fig. 7).

We will delve deeper in this design in a future paper.

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