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Resume of Ph.D. Thesis

Researches concerning the urban environment quality in Iasi city

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SUMMARY:

Key-words: quality, urban environment, Iasi, perception, environment impact.

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I. INTRODUCTION

Knowing the current state of the urban environment is a modern topic due to the variety of the causes that led to its degradation, the factors that hinder its amelioration and the perception of the inhabitants towards the environment.

The concept of environmental quality is assimilated to the absence of pollution, because when the term "quality" is associated with the term "environment", it refers to the same eternal problem of pollution, or – in the best case – to other forms of degradation, as well". Without excluding the issue of pollution, this notion, which complies with the geosystemic view on the environment, focuses on the relationships between the component elements of the environment and is synonymous with the notion of "environmental balance" (Ungureanu I., 1983).

1. Objectives

In order to bring the personal contributions to the knowledge of the urban environment, the main objective of the current research was represented by the investigation of the current status of urban environment quality in Iasi city, with two secondary objectives:

a. analysis of natural environment components, represented by: the relief, the waters, the air, the soil, the vegetation;
b. analysis of anthropogenic environment components: the buildings, the roads, the urban technical facilities and land use.

2. Materials and methods

1.1 Data utilized in research

Being given the complexity of the research and of the multiple constraints in obtaining data necessary for the study accomplish were performed numerous measurements and field observations, increasing the degree of originality of the thesis.

1.2 Preliminary phase

In preliminary stage was realized the study and the selection of the relevant information from the national and international references concerning:

- *Landslide risk areas determination*
- *Water quality index* (WQI)
- *Nitrates trends*
- *Groundwater quality index* (*GWQI*)

- *DRASTIC Model*
- *Air pollution index*

1.3 Field researches

a. *Field observation*

b. *Social quest,* using the questionnaire

c. Field measurements

- *Topographical profiles*
- *Vertical profile of the roads measurements*
- *Noise level monitoring*
- *Measurements of the dendric vegetation*

d. Sampling

- *Surface waters sampling* (Bahlui – 42 samples, Nicolina - 15 samples, Rediu - 7 samples, Cacaina - 7 samples, Ciric - 5 samples).
- *Groundwater sampling* – 22 samples collected from 9 springs and 13 wells
- *Snow sampling* 38 samples
- *Road dust sample collection – 10* samples

1.4 Laboratory researches

Chemical analyses were determined:

- Physical parameters
- Chemical parameters
- Oxygen regime
- Parameters of degree of mineralization
- Alkalinity, acidity
- Water hardness and calcium
- Inorganic poluttants (nitrogen compountents and heavy metals)

1.5 Office researches

Thematic layers were manipulated and the maps for each chapter were generated using GIS software: TNTMIPS 6.9, Auto CAD Civil 10, AutoCAD Map 10, ArcGIS 9.3.

Official data and values obtained in laboratory were validated, manipulated and analyzed using statistics software (Excel, SPSS vers. 19, R statistic - open source), obtaining various types of graphical representation (different types of graphs, tables, dendrograms – using Ward method etc.).

II. RESULTS AND DISSCUTION

1. The Quality of the Natural Environment Components

1.1 The Relief

The current features of the relief of the analyzed territory are due to the interaction between internal factors and external factors, which have a decisive role in the current shape of the relief.

The morphometric aspects of the relief in the area of the town of Iasi are analyzed using GIS and reveal the position of contact between Moldavian Plain and the Central Moldavian Plateau, as

well as a number of relevant aspects related to the characteristics of the relief: the areas with marked declivity of the relief, the slope orientation, the fragmentation of the landscape, the areas with high energy relief, etc.

The transversal profile determined for two different periods, 1964 and 2012, in the area of the Galata slope, indicates the manifestation of the phenomenon of sliding at the top of the slope, as well as the anthropogenic intervention at its bottom (the dams of the Nicolina River).

The map that displays the areas facing the risk of landslides, and which was elaborated by using the Overlay function and by overlapping four relevant thematic layers, indicates that 24.9% of the area of the town of Iasi falls into the categories of high and very high risk.

1.2 The Waters

The groundwater in the area of the town of Iasi territory is divided into three categories: captive groundwater under pressure, captive groundwater without pressure and free groundwater; the analysis of the last category is the most important part of the chapter;

The characterization of the quality of the groundwater in the town of Iasi was performed following the collection of 22 samples which were distributed in a different number for each hydrogeological unit in the town of Iasi, indicating significant exceeding of the maximum allowed nitrate level; only 5 samples comply with the regulations;

The calculation of the groundwater quality index is one of the most useful methods for finding out the water quality for the purpose of using it as drinking water, and the results can be easily communicated to consumers; thus, 14 of the city's water sources fall within the "deficit" category because of the high content of minerals and nitrates;

The vulnerability of the groundwater was assessed using the DRASTIC model, and the results indicate that a proportion of over 60% of the city of Iasi coincides with areas of very high vulnerability and about 22% coincides with areas of extreme vulnerability; only two sources of water are included in the latter category;

The surface water on the area of the town of Iasi includes the Bahlui River and its tributaries, as well as a number of water accumulations, of which the most important is the accumulation Chirița and the lakes on the Ciric River: Aroneanu I, II and Ciric I, II, III;

The monitoring of surface water quality for each stream analyzed and for each sampling season allowed the framing into quality categories according to ord. 161/2006; there was exceeding of the fifth quality category for parameters such as oxygen, nitrate (for tributaries in the cold season), mineralization (chlorides in the spring season) and heavy metals (for the Nicolina river), establishing clear correlations with the debits, the climate elements and the functional areas of the city;

The calculation of the WQI water quality reveals the classification into different categories of the Bahlui River – good quality category, and of its tributaries– average quality category between 2010 and 2011;

The analysis of the data regarding the quality of the rivers Bahlui and Nicolina between 2003 and 2011 indicates an improvement in the physical-chemical parameters, as there was a transition from the fifth category to the fourth category for the Bahlui River, and from the fourth

category to the third category for the Nicolina River, although without significant changes in the biomarkers.

1.1 The Air

The analysis of the climate parameters indicates a series of multiannual, seasonal and monthly variations in the period under discussion (1961 - 2011), in agreement with the nature of the continental air masses, being influenced by a number of natural factors (relief, vegetation, etc) as well as by anthropogenic factors. The spatial variation of air temperature, wind speed and relative humidity was highlighted by the analysis of the observations in three monitoring sites;

Air quality in the town of Iasi has been monitored through five different stations since 2005, and it provides information on annual, seasonal, monthly, daily and hourly variation of the main categories of air pollutants: inorganic pollutants (compounds of sulphur, nitrogen, carbon, secondary pollutants of which the most important is the tropospheric O_3), organic pollutants (C_6H_6) and particulate matter pollutants.

The average values of air pollutants for the period 2006 – 2011 are: 5.76 ±0.7 $\mu g/cm^3$ SO_2, 40.9 ± 2.4 $\mu g/cm^3$ NOx, 0.29 ± 0.09 $\mu g/cm^3$ CO, 49.2 ± 2.9 $\mu g/cm^3$ O_3, 2.87 ± 0.72 $\mu g/cm^3$ C_6H_6, 42.31 ± 13.04 $\mu g/cm^3$ PM_{10}. Correlations have been established between the variation of the main air pollutants and the main climate factors, highlighting the purifying role of rainfall.

The air pollution index indicates, in a synthetic way, the monitoring stations of air quality which recorded monthly values over the alert threshold for certain pollutants, namely: nitrogen oxides, sediment particles and benzene from the Podu de Piatra area (Iasi 1 station);

The laboratory analyses of the snow samples revealed the following physicochemical characteristics: acid pH with an average of 4.95±0.54, an average quantity of dust of 3.4 $\mu g/ cm^3$ and extremely high values for calcium (5.8±7.7 mg/L) and chlorine (472.4±234.5 mg/L);

The monitoring of the noise in the north-eastern area of the town of Iasi between August and October 2009 showed a seasonal variation of the noise, with the lowest values in August and the highest values in October, due to a number of factors: street traffic lights, the resumption of school and academic activity, the technical category of the street, the distribution of the economic, medical and academic points of interest, as well as the variation of the meteorological elements, which do not allow local residents to walk or to use environmentally friendly vehicles instead of using private cars. The daily and weekly variations highlight the correlations with the traffic rush hours, which is the main source of noise in the area. The allowed value is exceeded in autumn for the streets falling into category I, as well as for those in category II in one monitoring site which is located near a major intersection in the town (Podu de Fier).

1.3 The Soil

The main anthropogenic sources of urban dust are: road traffic, the industrial activities carried out in the southern part of the town, the functioning of the urban thermal power plants etc. In addition, starting from the collected samples, a number of correlations can be determined regarding the roads, the distribution of green spaces, the location of the construction sites and of the work in underground systems, the routes of the main means of transport; all the correlations were analyzed from the perspective of the complexity of the active area in the town (buildings, parks, streets and other functional areas, as well as technical urban amenities of the town).

Among the urban dust sampling sites, those with the maximum concentrations are located in the central – southern area of the town, with the highest values for 7 of the 9 heavy metals found in the urban dust: the Podu Ros intersection, one of the largest roundabouts in the city, then the city's industrial area in Baza 3 (the Felicia Carrefour supermarket), and last but not least the heavily trafficked Tudor Vladimirescu intersection. In this area, there are many supermarkets, a shopping mall and the university campus, which is also crossed by 4 bus routes and one tram route. The lowest concentrations are recorded at the sites located in the northern part of the city, in the Copou Breazu area, which can be explained by the spatial variation of the factors and sources mentioned above.

All the measures taken to limit the urban dust (washing the streets, mechanized sweeping of the streets, modernization of the roads etc) are ineffective.

1.4 The Vegetation

Urban green spaces of urban settlements have many functions that can be grouped into four categories, of which the most important is the ecological function, followed by the social, the economic and the aesthetic functions. According to the present legislation, an area of more than 20 square metres should correspond to each urban resident; at present, the ratio for Iasi is of 21.29 m² per inhabitant (2011).

The landscaping of the green areas is provided by the Town Hall of Iasi and, at present, these areas are well taken care of by planting, replanting, pruning, trimming the trees, the flowers and other types of dendro-floricultural material provided by its own greenhouses and nurseries.

Following the inventory of the vegetation (576 trees and shrubs) in five parks within the town of Iasi, what can be noticed is the predominance of trees in old parks such as the "Grupul Statuar" park and "Horia, Cloşca şi Crişan" park, and their absence in newer parks (the areas with blocks of flats). The average height is over 7 meters, with the highest values in the "Grupul Statuar" park and the lowest values in the 'Podu Ros" park, the latter being due to the maintenance work which involved cutting down old trees and replacing them with younger ones.

None of the classifications and the databases available and consulted by us included information about wild green spaces and forests; yet, they represent an important 86%, of which 11% is covered by forests.

2. The Quality of the Anthropogenic Environment

The urban technical facilities in the town of Iasi includes relevant information about the drinking water distribution system, including information on the quality of the drinking water, the sewage and the wastewater, the CET network, the management system of the waste generated in urban areas, as well as information related to the state of the roads.

The main failures that occur are: the large number of complaints regarding the malfunction of the water – sewage system, the reducing number of households that are connected to the centralized heating and hot water system, the decreasing efficiency of the waste collection system by the decreased amount of waste collected and the decreased amount of WEEE collected after the

campaigns were carried out, and the high percentage of streets falling into the " bad viability condition" category, despite the high percentage of modernized roads.

The positive aspects regarding the urban technical facilities aim at: keeping the quality parameters of the drinking water within the legal limits, improving the quality of the effluent from the treatment plant, modernizing and expanding the drinking water supply, sewage and CET networks, rendering the ecological waste storage in Ţutora functional, getting more and more inhabitants (98%) to participate in the process of waste collection, including that of selective waste collection. The present extensive modernization work on the utilitarian network and on the streets of the town will lead to significant improvements in the quality of the environment (starting from air pollution and ending with aesthetic aspects – the transition from aerial networks to underground networks).

The buildings in the town of Iasi can be classified according to several criteria, but one can notice the predominance of one storey homes (54%), while the rest is represented by the homes with a different height regime. According to the building material, one can identify a large number of buildings that were constructed using durable materials (concrete, concrete frames, masonry), but unfortunately there are old buildings made of low resistance materials (adobe, wood, etc.). The inventory conducted during 2007-2010 indicates similarities with the official statement in terms of storey, but it also provides relevant information about the type of roof, the thermal insulation and the age of the building.

In terms of natural hazards, most of the homes (over 40%) and annexes are exposed to landslides, yet the authorities do not take effective action (see the building prohibition in the area of the Ţicău slope, the only slope with such prohibition, although the slopes affected by landslides in the town are much more numerous).

In the area of Iasi, the building rate is less alert than before 2007, and the cityscape documents issued by the Town Hall of Iasi stand as evidence.

Land use variations are related to the evolution of space that is built; many of the land pieces occupied by orchards, vineyards, pastures and which were outside town limits were transferred within town limits, thus becoming pieces of land destined to real estate projects (e.g. the Carol I neighborhood is located on land which was previously occupied by vineyards etc.) or land on which the owners built houses. At the micro territorial level, in the northern part of the town of Iaşi, there is a reduction of the surface occupied by orchards and vineyards, as a result of the dissolution of the former agro-industrial units located in this area.

III. THE PERCEPTION OF THE ENVIRONMENTAL QUALITY

The test sample of 393 people ensures a high degree of representativeness of the results for the population of Iaşi;

The perception of the main causes of the identified environmental problems is consistent with the official data (that identify traffic and repair work as the main source of noise and air pollution in the town). The exceptions are the drinking water quality and the waste management system. According to the official data, the drinking water quality is within the limits imposed by the

present law, but 40.1% of the respondents identified as the cause of water quality problems the age of the distribution network, in spite of the modernization actions. In accordance with the official data, the selective waste collection system provides service to 98% of the population, yet 38% of the inhabitants complain about its inefficiency;

Among the main effects and inconveniences experienced by the population, the following can be mentioned: irritated eyes, ear discomfort and attention distraction as the main effect of air pollution, followed closely by noise pollution, unpleasant taste of drinking water and bad odors due to the poor management of the waste collection system.

IV. THE ASSESSMENT OF THE ENVIRONMENTAL IMPACT

The global pollution index is not one of the most effective methods of assessing the environmental impact; it is merely the first step in this process;

The matrix for the environment rapid assessment of the impact is a method which is easy to apply, and the interpretation of the results is facilitated by converting the environmental score into impact categories.

The results of the environmental impact assessment indicate an average environmental score of -6.9, which falls into the category of slightly negative impact.

The values of the environmental score range from -19.1 in the industrial area (moderately negative impact) and +19.9 in the areas covered by forests (moderate positive impact). The status quo (environmental score 0) characterizes the Bahlui river corridor and other natural areas (Lake Chirița, swamps), because the data used in assessing the impact was collected before the beginning of the transformation work on the Bahlui river and of the Ciric area into recreational areas.

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