ENVIRONMENT AND LANDSCAPE – RESOURCE FOR TOURISM

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Abstract: *The environemtal modelling have attracted a lot of attention in the past years. Their capacity to learn non-linear relationships between an input and an output space has a lot of applications: modeling and controlling dynamic processes and systems, signal processing, pattern recognition, forecast, climate prediction etc. This paper will approach a specific area from the large field of applications: identifying and modeling of some dynamic processes like pollution and energy management. We briefly introduce a series of theoretical considerations on process modeling and then we present several results obtained by the authors in modeling, and environmental mapping of the pollution process in Zlatna region.*

1. INTRODUCTION

Romania, as other parts of the world, is confronted with serious problems of environmental pollution as a result of forced industrialization policy; the environment factors like the air, water and soil are permanently subjected to the aggressiveness of human activities. Progressive deterioration of environmental components quality has induced for the communities living in the vicinity of industrial platforms, a number of unfavorable aspects and drawbacks in relation to the state of environmental components.

The analysis of the spatial system for the Zlatna Depression, as a central element for the present study must follow after a contiguity analysis of a “***relational conglomerate”*** through which causality plays an important part. Causality has been defined by relating to temporal, space, contiguity and interaction criteria etc, highlighting a triple branching of causality: *anteriority of cause, simultaneity of cause and effect* and *retroaction of cause.*

2. TYPES OF ENVIRONMENTS AND THEIR REPRESENTATION

The classification of the types of environments is a complex problem, but one of major importance in environmental cartography. Nevertheless, there is emphasis on elements that make the difference when it comes to environment, because there are different control parameters on the basis of which we can classify the environment. These control parameters aim at information concerning:

- The loading or the number of elements belonging to the same set of constituents or sets of different constituents, the physical weight of these elements, numerical participation;
- The consistency – as loading measure and the robustness of the connections in the environmental system;
- The durability – or the persistence in time concerning some environments, concerning physical and spatial parameters;
- The variety – at the level of the types of environments (at the level of the subordinate whole) that become part of a superior hierarchical and integrating environment;
- The determination – aims at the major factors that live their mark on the type of environment and they are elements like: climate, relief, neighbourhood, resources, etc.;
- The finality – through which a process of delimitating the shots in a given space and of evaluating the environmental behaviour is accomplished after the man’s intervention;
- The expression – that is focused on one of the elements that form the environment.

At the level of the environmental system of the depression of Zlatna, in order to determine the types of environment, they considered the environmental typology criterion (Mac. 2003). The criteria that individualized the types of environment are: the structure, the state, the quality, the relief, the anthropic activities and the habitat.

According to the **structural** criterion, there is emphasis on natural anthropic environments;

According to the state criterion, there are three types of environments that are characterized by *stability* in the area between the Ampoi Spring and the junction with the Trampoiele brook, entirely situated on the development area of the Auriferi Mountains, generally characterized by steep slopes and narrow valley, environments characterized by fragility in the Ampoi Gorge area, the strict delimitation of which is given by the localities Presaca Ampoiului and Poiana Ampoiului, where the valley crosses systems of a high degree of compactness and roughness, that give it the aspect of a gorge, continuing the limit between the Trascau Mountains and the Metaliferi Mountains, and an environment characterized by *decline: the Zlatna area*, the development of which is marked upstream by the junction with the Trampoiele brook and downstream by the junction with the Fenes brook, constituting concomitantly the limit between the Trascau Mountains and the Metaliferi Mountains.

According to the **quality** criterion, we distinguish favourable environments in the stability areas and hostile/unfavourable environments in the areas that are on the wane.

According to the relief criterion, we distinguish a mountainous environment, one of depression and one of hills.

According to the anthropic criterion, we distinguish technogenic environments, that determined a typical state of fragility and decline of the spatial system and agricultural environments (pastoral – forest).

According to the habitat, we distinguish urban and rural environments.

Nowadays, once we become aware and more specialized concerning the cartographic way of reporting to the environment, the contribution of the charts in solving practical problems increases. This objective is analysed in the context of a specified problem, by representing the elements and the relationships among the involved elements, even of those with a prognosis problem.

Cartography implies a compromise between the aesthetic and the scientific character, as well as among the scale, the degree of particularization of the map and its intelligible character; too many details will imprint a confuse character and intelligible even for the specialists, and fewer details risk to reduce the scientific value of the map.

The simplification can introduce errors when the analyst has to decide which is the best way for combining classes that appear as mixtures, and that have dimensions that cannot be represented on the map. This implies an action of reduction and combination of low category classes into high category ones.

The great variety and the complex interconditioning of the environmental constituents implies a complex operational process in order to surprise them, to get their essence and to represent them, which will eventually allow quantitative and qualitative appreciations.

The ordering, the synchronization, the grouping and the hierarchy of the data are operations based on some general principles for the entire field of physical-geographical cartography.

The fundamental principles of the environmental knowledge and cartography are:

-*The principle of spatial repartition*. According to this principle, any entity, phenomenon, process and relationship in the environmental system has a certain spatial position and territorial expansion. The materialization of this principle, in corroboration with the cartographic method, is done by maps, environmental maps and spatial models.

- *The principle of the complexity and the diversity* of the constituent elements, according to which we establish the scale, the fitting in of some constituent elements.

- *The principle of scale representation*. According to this principle, the environmental aspects will be represented on different taxonomic stages or until a certain taxonomic level.

- *The principle of selecting the indicating elements on the basis of the quantitative and qualitative analysis (of the selectivity)*. It is based on primary quantitative evaluations that aim at the spatial expansion of the phenomena, the gravity in a certain area, the regularity and the manifestation intensity. The quantitative evaluation allows the explanation of some superior qualitative stages, that start from the objective selection of the phenomena. The selection aims at those elements that are enforced in the complex of factors and which, at a certain point, can guide the evolution of the phenomena. The selection of the basic elements on the basis of the cartographic analysis constitutes an essential criterion in drawing up the legends, as well as in ordering them; the selected details, through ordering and grouping, confer a synthetic content and a real cartographic expression.

- *The principle of the cartographic particularization and generalization*. According to Isacenko (1960), the cartographic generalization implies the process of selecting and synthesizing of the content of the map, in order to realize a correct representation of the spatial phenomena. In order to emphasize the details, we can use quantitative evaluations materialized as: profiles, tables, graphs. It's important to notice the fact that details are at the basis of the generalizations; they are not excluded, they complete one another, and their materialization is given by using the essential qualitative representations and the auxiliary notations.

➢ *The principle of the representation of the correlation among the phenomena*. According to this principle, it is necessary to record the different types of connections among the territorial constituents, reflecting the quality of the territorial units and subunits. The correlations are specified according to the content of the cartographic representations, using quantitative indexes and analytical representations. If we use some suitable representation methods, we can reflect relationships among different environmental constituents.

➢ *The principle of the representation of the dynamics of the phenomena*. According to this principle, the means of representation need to render, through content and form, the direction and the sense of evolution of the phenomena.

➢ *The principle of singularity*, that aims at the singular response of the environmental elements when they have to pass the thresholds and the dynamic critical values.

All these principles include in their sphere a large field of investigations, which determines, on one hand, a strict quantitative characterization, and on the other hand, a selection, a variety and a detailed description according to the aimed finality; in order to realize an efficient spatial analysis and a cartographic representation of the identified phenomena, the principles complete one another and become more diversified. The principles mentioned above imprint a judicious ordering of the elements surprised in the field studies, allowing the elaboration of some work models as well.

Through their content, it is necessary that the maps be constituted as objects through which we get the essence of the specific environmental research of the geographical approaches, as well as work instruments useful for both successive environmental studies with special orientation and different working scales and studies with a practical character done for different purposes. The correlative representation of the concrete data in the field, the identification of some characteristic parametres for the dynamics of the phenomena, all these constitute necessary and defining elements for the modern approach of the spatial phenomena in general and of the ones with an environmental significance in particular.

The drawing up of any type of map has to start from a very exact basis, namely from the topographic maps, on one hand, and has to take into account the territorial distribution and the relationships among the environmental constituents, on the other hand. Certainly, the elements written on the map depend on its destination, on the selection possibilities, on the representation methods, and in this case, on the practical-methodological experience and the paradigmatic profile of the one who draws it up. It is not to be neglected the dose of subjectivity included in certain thematical maps, such as the perceiving, behavioural and mental ones.

In order to realize such maps, what is also necessary, besides the correlation of the spatial elements, is the surprise, the essence of what is defining for a certain territory from the point of view of the environmental relationships; it is about the relationships:

- of position (distances);
- among attributes;
- between locations and attributes;
- among the derived attributes.

The content of the maps can be completed with a series of additional materials in which we give details, explanations, profiles, tables, diagrams or other complementary elements.

The choice of the representation methods constitute the premise that confers a certain type of orientation of the map, from the point of view of the content and of the expressiveness of the geographical approach. For example, the qualitative fund reflects the basic unit of the map, the subunits can be underlined according to territories by hachuring or by using different shades, certain phenomena can be rendered by conventional signs, and the details can be rendered by auxiliary notes. The choice of the methods has to take into account their capacity of rendering as exactly as possible the territorial reality, and it also allows the details, the generalization, the order and the hierarchy of the phenomena. The whole ensemble has to take into account some general desiderata for the drawing up of a map:

- The aesthetical condition;
- The scientific condition; the two have to take into consideration the fact that the use of hachuring, signs and colours has to be adequate for the type of the represented phenomenon or constituent and for the intensity of the manifestation of the processes, suggesting the different degrees of intensity or rhythmicity of the manifestations.

3. THE CLASSIFICATION OF THE OBJECTS ON THE ENVIRONMENTAL MAPS

On the environmental maps objects are classified according to their main characteristics, performing at the same time their grouping by taking this into account. We drew up a classification as follows:

- classes of objects;
- groups of objects belonging to a class;
- types of objects in a class.

For the individual classification, inclusively at the level of the object, we can attach attributes and relationships – elements from the field, essential for the environmental map – that best describe the characteristics of the objects.

3.1. The spatial relationships among the dimensional elements

1.A dimensional element is totally related to another dimensional element if their intersection is equal to the first element;

2.Dimensional elements can be in total or partial relationship or no relationship at all.

Generally, the representation is done through the relationship field that is created at the level of the objects, primitives and their attributes. In some cases – with use in environmental cartography as well, there is a special situation in which the final representation is realized threedimensionally, the third dimension along with the classical spatial elements (x, y) will not be a spatial dimension, but an attribute extension (Zlatanova, 2000) that will modify the spatial element 2D in a three-dimensional one.

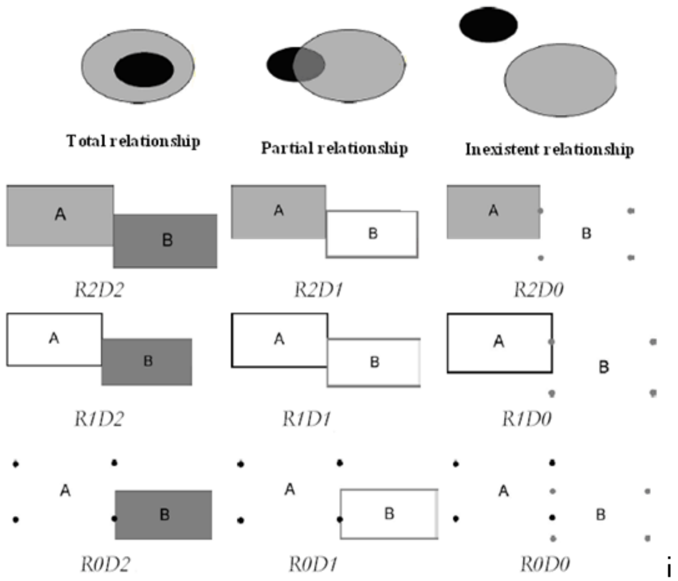

Fig. 1. Field that creates relationships among the 1D, 2D and 3D objects

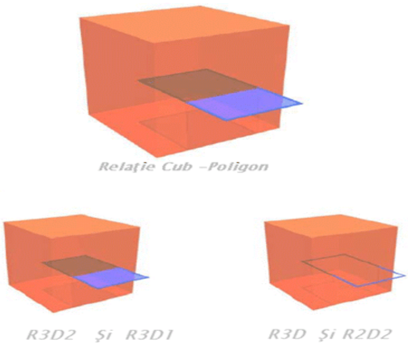

Fig.2. Cube-polygon relationship

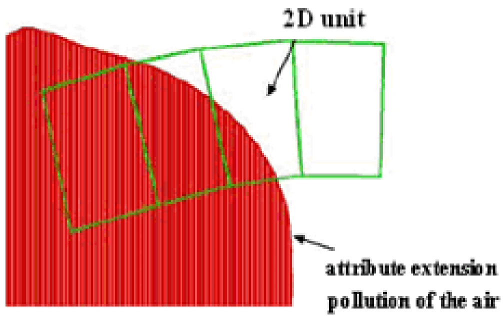

Fig. 3. The representation of a 2D unit through attribute extension

Thus, even on a bi-dimensional unit we can represent through attribute extension elements that are not physically placed, but with visible and determinable effects in plan 2D.

Due to the fact that this representation cannot point out ***the segmenting of the spatial constituents***, we can use another way to present some spatial units, emphasizing other aspects as well, namely: phenomena with direct impact (slopes affected frontally by masses of air), screening phenomena (sites that are not affected by polluted air) that can be instituted according to the model of transport dictated especially by the relief, the main compulsion factor.

- frontal areas severely affected
- frontal areas with reduced damage
- area of partial or total spatial screening

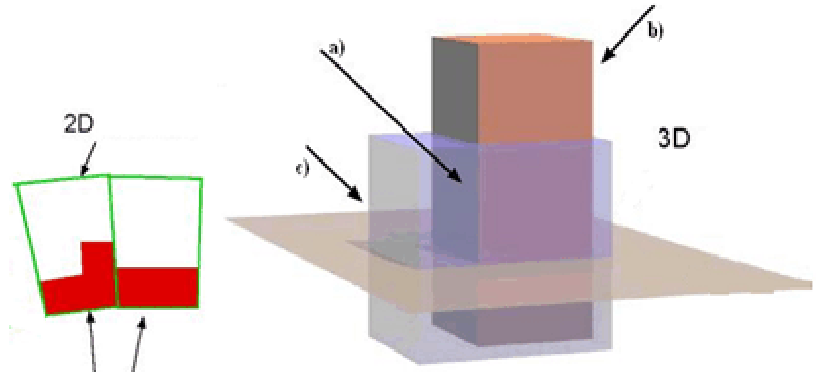

Fig. 4. The segmenting of the spatial constituents

4. PROGNOSIS ASPECTS

An important part in the problems related to the evaluation of the quality of the environmental constituents is also played by the prognosis aspect concerning their evolution.

We will continue by presenting a few modern prognosis and estimating methods of the evolution of certain elements. The estimating methods and the results are conclusive and veridical in certain periods of time specific for each evaluated entity. The use of these developed prognosis methods have the advantage of being applied for the estimation of the evolution of some elements with very varied dynamics, such as the forecast data, the evolution of the concentration of some elements, water flows, solid flows, etc.

The general prognosis principle is based on complicated rows of real values concerning the quality indexes that will be useful in realizing some models and their temporal evolution.

The most often used method is the statistical-mathematical modelling of the data through rows of chronological succession

$$X:\begin{pmatrix} 1 & 2 & \dots & t & \dots & n \\ X(1) & X(2) & \dots & X(t) & \dots & X(n) \end{pmatrix}$$

where different aspects of the series X : T (t) tendency, seasonal constituent S (t), cyclical constituent: C (t), residual constituent ε(t). We consider there is a relationship between the X (t) constituents and the mentioned constituents, that can be expressed through an additional model of the type:

X (t)=T (t)+S (t)+C (t)+ e(t)

The unseasoning of the series is done with the relationship:

$$X'(t) = \frac{0{,}5X(t-p) + X(t-p+1) + \dots + X(t) + \dots + X(t+p-1) + 0{,}5X(t+p)}{h}$$

The seasonal constituent is determined by:

$$\overline{K}_{.s} = \frac{K_{1s} + K_{2s} + K_{3s} + K_{4s} + K_{5s} + K_{6s}}{5}$$

A more rigorous prognosis model is based on the values T (t)=a+bsinf(t), where *f* is a variable function as follows:

$$T(t)=\begin{cases} a+b\cdot t+c\cdot t^2 & t\in[t_0,t_1) \\ a'+b'\cdot t+c'\cdot t^2 & t\in[t_1,t_2) \\ etc. & \ldots \end{cases}$$

Using the method of the lowest squares, we impose the condition ,

$$F=\sum_t (X''(t)-T(t))^2=\min \qquad \text{its result being } F_a^{'}=0, F_b^{'}=0, F_c^{'}=0.$$

We obtain the system:

$$\begin{cases} a+b\cdot M(t)+c\cdot M(t^2)=M(X''(t)) \\ a\cdot M(t)+b\cdot M(t^2)+c\cdot M(t^3)=M(X''(t)\cdot t) \\ a\cdot M(t^2)+b\cdot M(t^3)+c\cdot M(t^4)=M(X''(t)\cdot t^2) \end{cases}$$

$$\begin{cases} a+b\cdot 20{,}5+c\cdot 553{,}5=47{,}08655 \\ a\cdot 20{,}5+b\cdot 553{,}5+c\cdot 16810=971{,}0467 \\ a\cdot 553{,}5+b\cdot 16810+c\cdot 544533{,}3=26815{,}14 \end{cases} \Rightarrow \begin{cases} a\cong 56{,}6451 \\ b\cong -1{,}449 \\ c\cong 0{,}0364 \end{cases}$$

The final evolutionary tendencies will be as follows:

$$T(t)= 56{,}6451-1{,}449\times t+0{,}0364\times t^2$$

4.1. Prognosis through artificial neuronal networks

The neuronal networks have drawn much attention in the past few years. Their capacity of non-linear "learning" in an entrance space and in an exit space is used a lot: the modelling and the control of the dynamic processes and systems, the processing of the signals, recognition of the forms.

This method was developed and improved in the Mathematics, Computer Science, Topography department, at the "1 Decembrie 1918" University in Alba Iulia, the obtained results being recognized internationally.

The identification of a system implies the finding of a class of functions (or models) than can approximate the entrance-exit behaviour of the system in the "best" way possible. The "best" way is usually defined in terms of a cost function. In many situations, such as the recognition of the temporal sequences, the identification of the dynamic systems, etc., the exit of the modelling system depends on the past entrances and exits. In the event that the modelling is done with neuronal networks, it is necessary that they dispose of a memory that should take into consideration these dependences.

Next we will consider the system represented through the NARX (Non-Linear-Auto-Regresive with eXogenous inputs) model:

x(k)=f(X(k-1),U(k-1))+w(k)

y(k)=x(k)

where:

X(k-1)= [x(k-1), x(k-2),..., x(k-N)]

U(k-1)= [u(k-1), u(k-2),..., x(k-M)]

x(k) is the state of the system at the k moment

y(k) is the exit of the system at the k moment

u(k) is the entrance of the system at the k moment

w(k) represents the noise

k represents the time index

M and N represent the orders of the delay of the entrances and exits.

The figure below illustrates the model of the (a) system and the neuronal network that simulates the (b) system. In the third section we will describe the results obtained with such a neuronal network, trained to modulate a dynamic system, in order to foresee the behaviour of the real system.

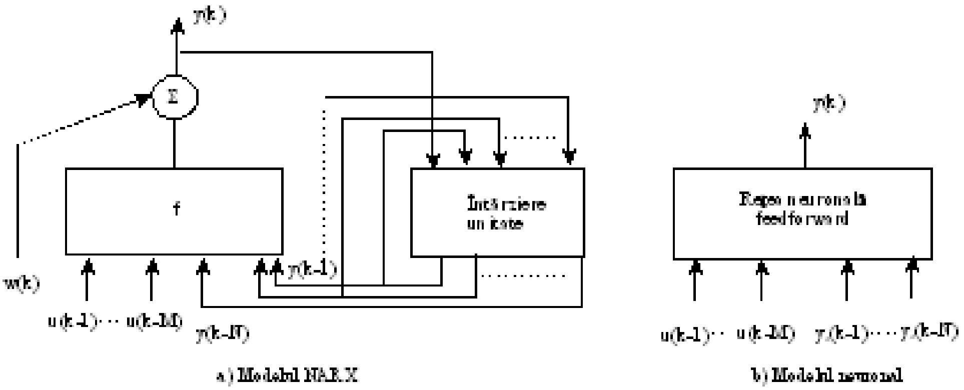

Fig. 5. The used model

The training of the network is done with the encoded data of a single variable of the type:

5 10 2
9.8 8.5 9.4 9 9.7 9 8.3 9.7 9.6 9.7 10 10
8.5 9.4 9 9.7 9 8.3 9.7 9.6 9.7 10 10 9.2
9.4 9 9.7 9 8.3 9.7 9.6 9.7 10 10 9.2 9.7
9 9.7 9 8.3 9.7 9.6 9.7 10 10 9.2 9.7 9.4
9.7 9 8.3 9.7 9.6 9.7 10 10 9.2 9.7 9.4 11.2

On the basis of these input data we form the coupling between the knots and the items of the neuronal network ordered in layers:

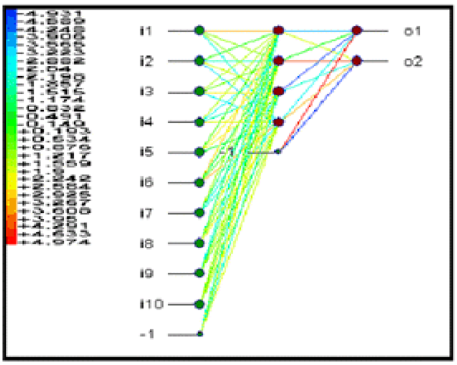

Fig. 6. Connections among neuronal networks

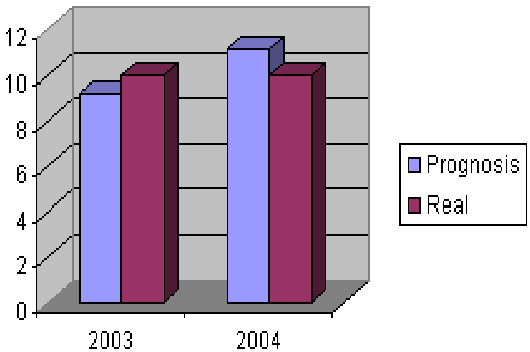

Fig.4.2. The representation of the foreseen values compared to the real values

CONCLUSION

As a conclusion, artificial neural networks, and statistical modeling offer a way for process modeling and prognosis. They can be used for "black box" modeling, in processes or systems that cannot be described by an analytical model.

In pollution field, the artificial neural networks may be used to forecast the pollution level in order to initiate preventive measures. Results obtained are encouraging (the network can "learn" the process) but the quality of forecast depends upon many factors like: the amount of available data about the studied phenomena; the network structure and the delay order of the process used; the training of the network.

Based on these results it is possible to perform an environmental mapping where each pointed object has a numerical attribute, partly from the monitoring systems an partly derived from the estimation models.

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