GIS APPLICATIONS IN YHE ANALYSIS OF TERRITORIAL EVOLUTION OF LOCALITIES

Mihai Ciprian Mărgărint, Adrian Grozavu, Sergiu Pleşcan, Ionuţ Vasiliniuc

Abstract The present paper approaches the problem of township territorial evolution, analyzing it with the help of GIS techniques. In the analysis was taken a number of 42 villages situated in the south-western part of the Jijia's Hilly Plain, a region characterized by a relatively low favorability degree in what regards human settling. Analyzing four cartographic materials at very large scales, and benefiting from the georeferenced environment offered by the TNTMips 6.9 software, the general territorial evolution of the townships and its local particularities have been reconstructed.

Keywords: territorial evolution, GIS, Jijia's Hilly Plain

1. Introduction

Besides the socio-demographic component, territorial evolution represents a fundamental aspect of localities' dynamics. The modern methods of managing spatial data based on the use of Geographical Information Systems allow the introduction and integrated analysis of numerous information characterized by a high exactness degree. The georeferencing of maps realized in different time periods and cartographic projections gives the possibility of analyzing data in different formats (mainly vector and raster), and at the same time ensures the basis of high precision diachronic analyses.

In the recent years' literature, the spatial evolution of localities has been largely viewed and analyzed mainly as plan (horizontal) dynamics. The integration in vector format of the localities' limits together with the products derived from the Digital Elevation Model in raster format (altitude, slope, exposition) also allow the three-dimensional analysis of localities. More, the geomorphometric data

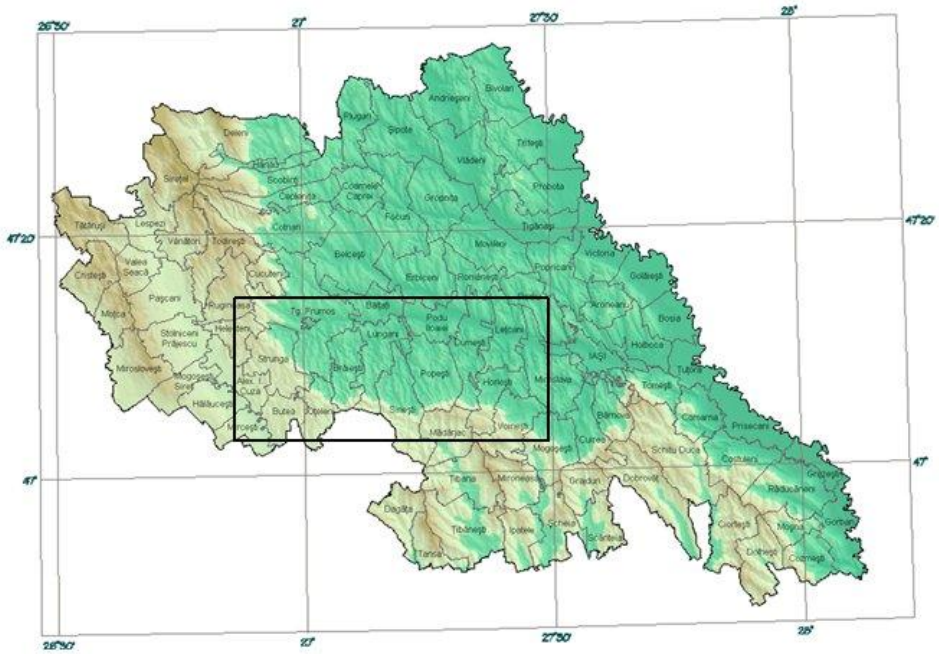

Figure 1. Iaşi County. Position of the study area.

characteristic to polygons offer important information related to land use categories on which have extended or receded the territories of localities. A series of analyses of this type have recently been published (Mărgărint et. al, 2010).

The applications have been continued for 42 villages situated in the south-western part of Jijia's Hilly Plain (Iaşi county), a region characterized by an interesting dynamics in the last centuries both as number and surface of the rural localities (fig. 1, 2). This dynamics is the result of the historical, demographic, socio-economical and political factors, which have led to the formation of a relatively uniform network of localities. Yet, from a geomorphological viewpoint, these localities haven't benefited from the best development conditions, because of the presence in high proportions of deluvial slopes, relief fragmentation and slope processes such as landslides.

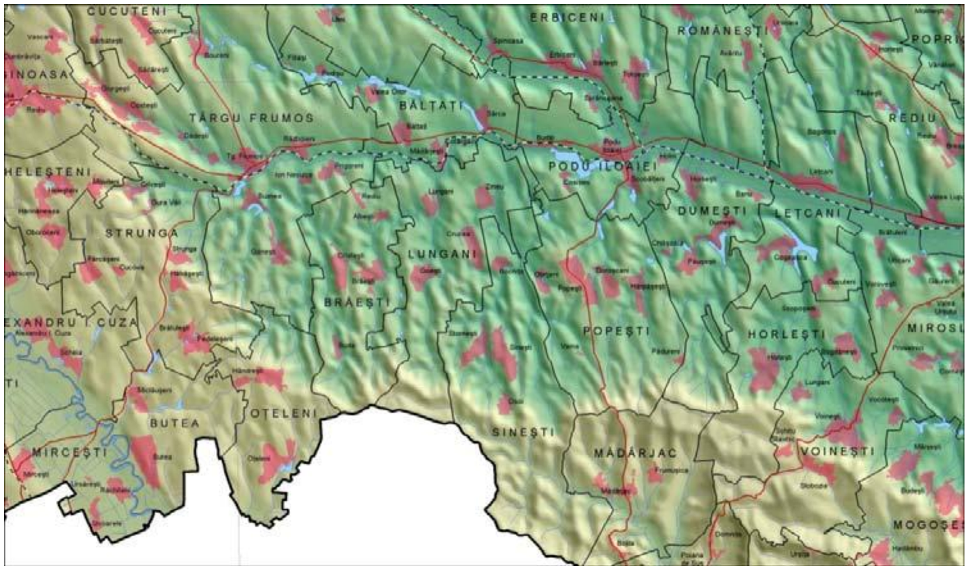

Figure 2. The network of localities from the south-western part of the Jijia's Hilly Plain.

For this study region have been recognized several stages in the foundation and evolution of the localities, as follows:

a. *The pre-feudal stage*, when localities are identified archeologically. These were placed in sheltered places, with good micro-climatic and hydro-geological conditions, favored by the intense relief fragmentation;
b. *The feudal stage*, in which the geomorphological factor is also well used. Numerous villages from this stage have disappeared during time. Thus, 61% of Iaşi County's localities (in the limits from 1948) existing between 1400 and 1457 and 58% of those mentioned between 1457 and 1504 have disappeared (Laetiţia Lăzărescu, 1948).
c. *The appropriation stage* (the second part of the 19th century and the first half of the 20th), in which have been issued several normative acts (1862, 1864, 1879, 1921 and 1945). As a

consequence, the localities' network has reached its present shape, registering a permanent and constant growth of the township surface.

2. Methodology

For the last of the mentioned periods, the characteristics of the evolution of the localities' surfaces have been analyzed on the basis of cartographic materials from distinct periods, at very large scales (fig. 3):

- the 1:50,000 scaled topographic map, projection Lambert, from 1894;
- the initial survey directory plans, scaled 1:20,000, projection Lambert, year 1940;
- topographic plans scaled 1:5000, Romanian stereographic projection 1970, with the limits of the localities existing during the last decade of the 20th century (1996, the year that most of the General Urban Plans of the administrative units from Iaşi county have been realized) and the proposals for the extensions of these limits, in fact the nowadays situation (year 2010).
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Figure 3. The cartographic materials used in drawing the limits of the localities. The village of Albeşti represented on the maps from 1894, 1940 and on the General Urban Plan of Brăieşti township (1996).

These materials have been scanned, imported, georeferenced and analyzed with the help of the TNTMips 6.9 software. The georeferencing of the maps from 1894 and 1940 was conducted using correspondence points from the 1:5000 scaled

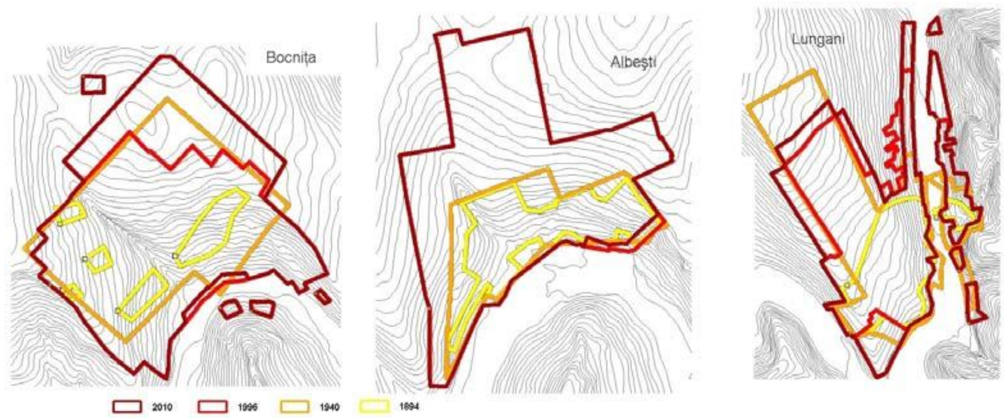

Figure 4. The limits of Bocniţa, Albeşti and Lungani villages drawn from topographic maps editions 1894, 1940 and from the General Urban Plan, edition 1996.

topographic plans (1984), the values of residual errors entering acceptable limits (lower than 20 meters). In each map's and locality's case has been drawn a polygonal file representing the perimeters of the localities (fig. 4). Later the statistical database was realized, including the files extracted from the DEM by digitizing the contour curves, equidistance 2.5 meters from the 1:5000 scaled topographic plans.

For validating the results of polygon-drawing the limits of the localities, have been conducted correlations with the number of inhabitants of each village, registered in the population censuses from 1890, 1941, 1992 and 2002[2] (table 1, fig. 5). These correlations indicate strong relations between population number and the surface of the localities, the smallest value of r^2 being registered in the case of the initial survey plans edition 1940

[2] Population data at the village level available through the amiability of prof. I. Muntele

(0.770 for the 1st order polynomial regression and 0.779 for the second degree one).

Table 1. r^2 correlation indices (I and II degree polynomial regressions) between locality surface and number of inhabitants for the analyzed periods.

	r^2			
	1894	1940	1996	2010
1st order	**0.853**	**0.770**	**0.838**	**0.864**
2nd order	**0.884**	**0.779**	**0.843**	**0.865**

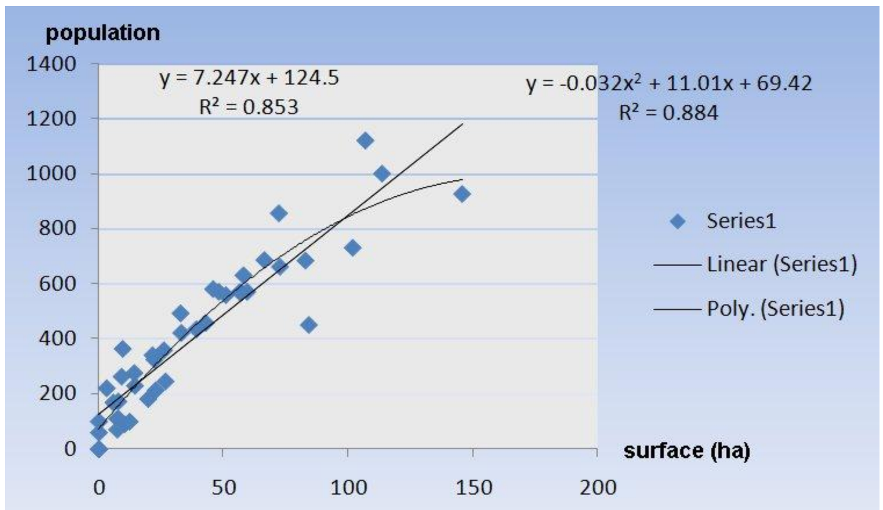

Figure 5. Polynomial regressions of the 1st and 2nd order for the values of the population and locality surface in 1894.

3. Results

In what regards the evolution of the localities' surfaces from 1894 up to the present date, one can notice a constant territorial extension, in direct connection to the increase in the number of inhabitants (table 2), as well as a relatively uniform increase in the case of the cumulated localities' surface, yet with higher values.

Table 2. Absolute and relative cumulative values (in relation to the last analyzed period) of the localities' surfaces (from the maps' editions 1894, 1940, 1996 and 2010) and of the population number (according to the population censuses from 1890, 1941, 1992 and 2002).

	1894 (1890)		1940 (1941)		1996 (1992)		2010 (2002)	
	total	% from 2010 (2002)	total	% from 2010 (2002)	total	% from 2010 (2002)	total	% from 2010 (2002)
Surface (ha)	1621.11	34.48 (39 sate)	2700.34	57.64 (41 sate)	4035.89	89.52	4530.93	100.00
Popula tion (inh.)	16,978	46.18	29,357	79.86	34.,309	93.33	36,762	100.00

The mean value of the surfaces has increased from 42.66 ha (1894) up to 67.51 ha (1940), then to 96.09 ha (1996), reaching in present 107.86 ha. With few exceptions, for each locality the tendency has been one of increase (fig. 6).

From this general law of locality's surface increase can be locally noticed some decreases in the surfaces of some villages, for each of the surveyed periods:

- 1996-1940: villages Ion Neculce and Prigoreni, decreases that can be explained by surveying errors of constructed surfaces, mainly in the case of the 1940 maps;
- 1940-1996: Lungani village, consequence of the extension of the arable terrains in the disadvantage of the areas initially destined for living (phenomenon specific to the communist period);
- 1996-present day: Albeşti, Rediu, Buda, Osoi, Obrijeni, Hoişeşti, Horleşti, Bogdăneşti and Cucuteni villages, mainly as a consequence of the elimination from the localities' surfaces of the areas with vineyards and orchards, and partly of those susceptible to landslides and floods.

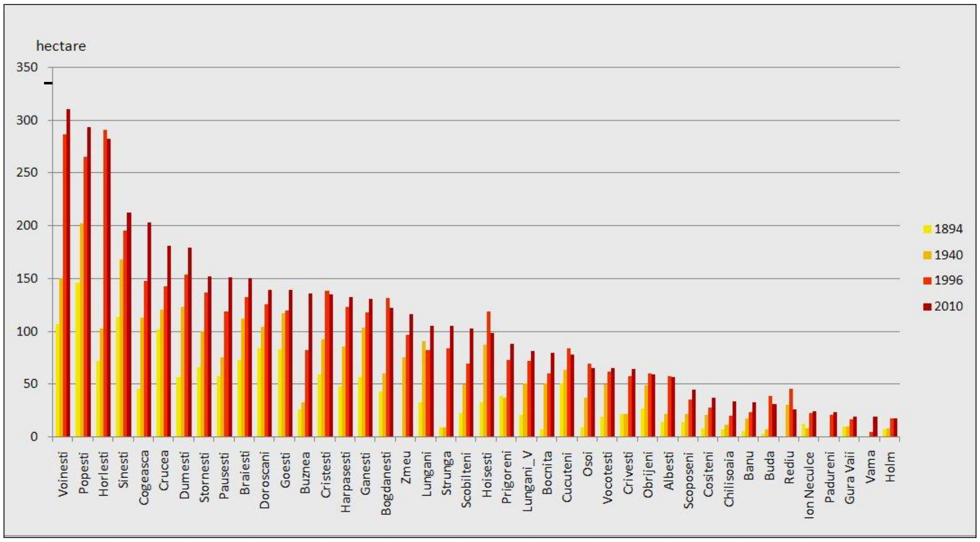

Figure 6. Dynamics of the localities' surfaces.

The specific of the evolution of the localities' surfaces can also be evidenced for each locality from the analysis of the percentages of surfaces from different periods in relation to the present situation (table 3). Thus it can be seen that the villages that registered the most accentuated surface increases – Strunga, Buznea, Buda, Osoi, Bocniţa, Banu, each with percentages of under 20% a century ago in comparison to the present situation (including villages that have occurred during the analyzed period – Rediu, Vama and Pădureni), are most of them of small dimensions, recent, or that have benefited of good local development conditions in the 20th century (Strunga). On the other side, the villages with moderate increases in the analyzed period are old, generally of large dimensions: Sineşti, Goeşti, Doroşcani, Popeşti, Brăieşti, but also of medium dimensions (Gura Văii, Cucuteni, Ion Neculce). In this last category enters an isolated case, that of the village Crucea, which has been from the beginning (1879) "projected" as a large locality.

Table 3. The percentages of the localities' surfaces in 1894, 1940 and 1996 in comparison to the present situation (100%).

Nr.	Village	1894	1940	1996	Nr.	Village	1894	1940	1996
1.	Strunga	9.1	9.1	80.4	22.	Scobâlţeni	22.2	48.3	67.9
2.	Gura Văii	56.0	52.9	89.3	23.	Holm	42.7	47.3	99.6
3.	Criveşti	34.7	34.7	89.9	24.	Popeşti	49.8	68.9	90.6
4.	Buznea	19.2	24.3	60.9	25.	Obrijeni	44.8	82.4	101.2
5.	Găneşti	43.6	79.0	89.9	26.	Doroşcani	60.6	75.4	90.6
6.	Ion Neculce	50.2	33.6	93.4	27.	Hărpăşeşti	36.2	64.4	92.5
7.	Prigoreni	44.2	42.4	82.4	28.	Vama	-	-	24.9
8.	Brăieşti	48.4	74.5	88.1	29.	Pădureni	-	-	91.5
9.	Cristeşti	44.1	68.7	102.2	30.	Dumeşti	31.5	68.5	85.6
10.	Albeşti	24.9	38.4	101.7	31.	Păuşeşti	38.5	50.1	78.6
11.	Rediu	-	115.5	171.4	32.	Chilişoaia	22.0	35.7	59.7
12.	Buda	9.8	23.1	124.9	33.	Hoişeşti	33.2	88.1	120.5
13.	Lungani	31.4	86.2	78.4	34.	Banu	17.7	53.7	73.4
14.	Goeşti	59.7	84.5	86.1	35.	Horleşti	25.6	36.5	103.1
15.	Crucea	56.4	67.0	78.8	36.	Bogdăneşti	35.0	48.8	106.9
16.	Zmeu	-	64.8	83.6	37.	Scopoşeni	32.1	49.7	78.7
17.	Sineşti	53.7	79.3	92.1	38.	Cogeasca	22.6	55.5	72.6
18.	Storneşti	43.7	66.0	89.9	39.	Cucuteni	65.5	81.9	107.6
19.	Osoi	13.2	54.2	101.0	40.	Voineşti	34.6	48.4	92.6
20.	Bocniţa	9.24	63.8	75.1	41.	Lungani V	26.4	62.1	88.3
21.	Cosiţeni	21.9	57.7	75.9	42.	Vocoteşti	30.2	76,0	94.4

Quite interesting is also the dynamics of the localities' surfaces during the last period, respectively the "retouches" realized with the occasion of the

General Urban Plans’ implementation in the last decade of the past century. The highest variations, both positive and negative, are characteristic only to villages of small dimensions. Still a few larger villages (of over 100 ha) catch our glimpse, registering surface increases of over 20%: Buznea, Lungani, Crucea, Bocniţa, Scobâlţeni, Păuşeşti and Cogeasca. These increases are weakly correlated with the increase in the number of inhabitants, taking place through the inclusion in the localities’ surfaces of settlements outside the village. This is also the case of the localities close to the Bahlui valley, which present a higher development potential (fig. 7).

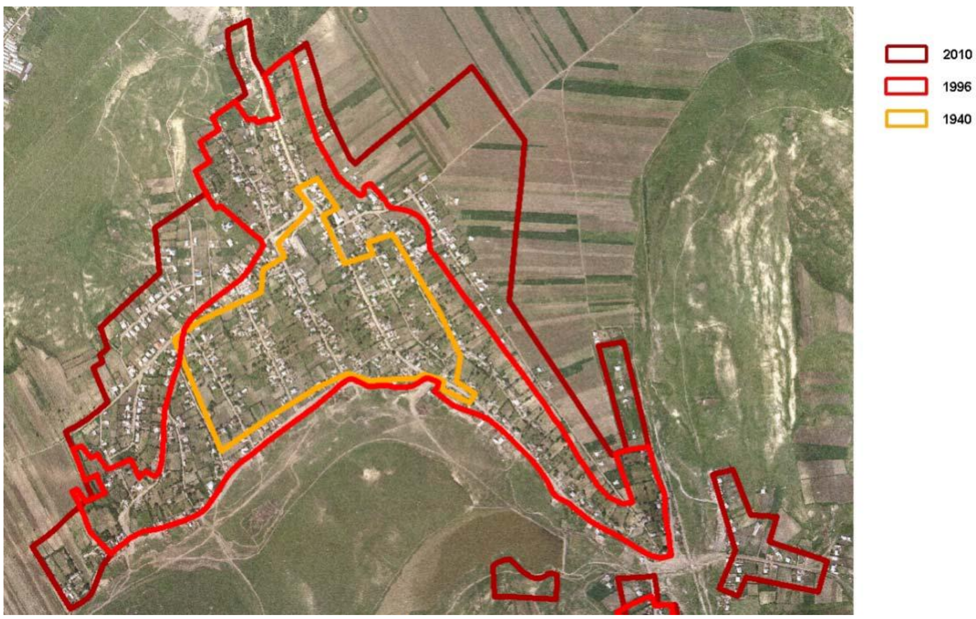

Figure 7. The territorial evolution of Buznea village over-imposed on the 2006 orto-rectified aerial image.

In some cases the Urban Plans have anticipated the extension of the localities’ surfaces along the communication networks, situation visible in fig. 8.

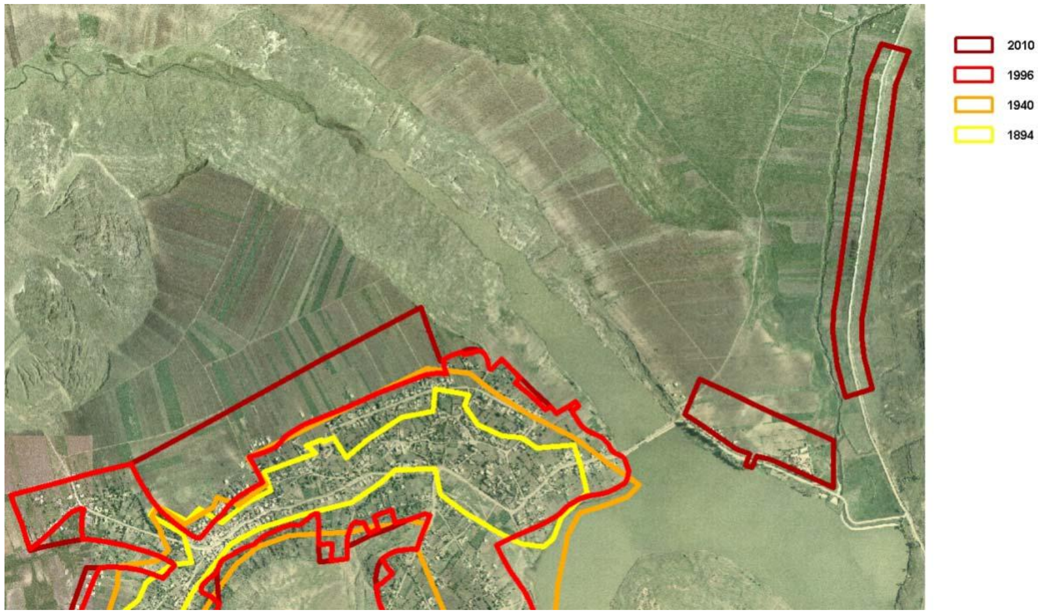

Figure 8. Territorial evolution of Cogeasca village (over-imposed on 2006 orto-rectified aerial images).

In what regards altitude, for the analyzed period can be witnesses a “vertical” extension in the majority of cases of locality surfaces. A characteristic aspect is the fact that the mean altitudes have increased, demonstrating the tendency of localities to extend on surfaces at the upper parts of the slopes, as well as on interfluves. There are also numerous perimeters of new extensions on slopes with high declivities, situation which does not take into account the minimum building requirements.

4. Conclusions

The management of cartographic materials in georeferenced environments offered by Geographical Information Systems permit for quite precise retracing of the evolution of the geosystemic components, mainly of those that can be identified and mapped. The present study evidenced the fact that the surfaces of the 42 villages taken into analysis have registered an obvious dynamics during the last century, situation highly correlated with the increase in the number of inhabitants. Along the general ascending trend of the localities' surfaces, have been witnessed negative deviations, related to a series of local demographic, political and administrative factors. It can also be seen that the geomorphological factor does not offer the best conditions for inhabiting, the study region having a high degree of landslide susceptibility. From this motive, the authors consider that in the future planning of this territory, the geomorphological parameters will represent limitative or favorability criteria.

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DIGITAL CLIMATIC ATLAS OF REPUBLIC OF MOLDOVA

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Резюме: Представлен Цифровой Климатический Атлас Республики Молдова, содержащий 34 карты средних значений четырех основных климатических индексов – солнечная радиация, температура воздуха, атмосферные осадки и скорость ветра, которые определяют термический и влажностный режим на территории республики. Исходным материалом послужил данные за 1980 – 2009 гг.

Key words: solar radiation, air temperature, precipitation, wind speed.

Rezumat: Este prezentat Atlasul Climatic Digital al Republicii Moldova, care conţine 34 hărţi ale valorilor medii a patru indici climatici de bază – radiaţia solară, temperatura aerului, precipitaţiile atmosferice şi viteza vântului, care determină regimul termic şi de umezeală pe teritoriul republicii. Ca material iniţial au servit datele din anii 1980 – 2009.

Cuvinte cheie: radiaţia solară, temperatura aerului, precipitaţiile atmosferice, viteza vântului

1. Introduction

Principal natural resources of Republic of Moldova are soil and climate. Particularities of the latter determine quantity of light, heat and humidity, which are used by plants on certain geographical regions. As agriculture is basic branch of country's economy, the knowledge of spatial distribution for solar radiation, air temperature and atmospheric precipitations is necessary for more adequate placement of agricultural plants depending on their requirements.

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Principal source of energy is solar radiation, which is mainly transformed in heat and wind.

We should also mention the fact that these resources are used not only in agriculture, but also for electric and thermic energy production.

Taking into account the fact that Republic of Moldova is poor in local energetic resources and they are represented mainly as unconventional ones, the spatial distribution's estimation for energetic resources is of major importance for the country.

As climatic data is recorded at meteorological stations, which are not so numerous in republic, the data should be interpolated (modeled) spatially using geoinformational technologies and taking into account geographical position and relief forms, because relief essentially influences climatic indexes values.

2. Materials and methods

Digital maps series of climatic indexes [1-4 etc] registered on meteorological stations of State Hydrometeorological Service in the period of 1961-1990 (basic 30-year period proposed by World Meteorological Organization) were elaborated during many years in Climatology Laboratory within institutional programs framework. Simultaneously spatial interpolation methods of climatic indexes were elaborated.

While all effects of global warming were observed since 70s of XX century, they had been more evidently manifested since 1980s.

Taking into account all related above, a necessity appeared to elaborate a more complex product with recently registered climatic data. Thus we have completed climatic indexes database for 1980-2009 period (30 years), which together with previously elaborated spatial interpolation methods have been the basis for Digital Climatic Atlas of Republic of Moldova elaboration.

We used regression equations method [3, 5] as spatial interpolation method for average temperatures and precipitation sums based on meteorological stations characteristics and digital maps of absolute altitude, aspect and slope of relief. Solar radiation was calculated using Solar Analyst module [6], implemented recently in ArcView and ArcGIS.

3. Atlas structure

Digital maps elaboration for atlas was executed in ArcView and ArcGIS GIS.

Digital Climatic Atlas of Republic of Moldova contains the following compartments of principal climatic indexes:

1. Total, direct and diffuse solar radiation (isolation) and direct sunshine duration in annual aspect and in warm period - 8 maps;
2. Mean temperatures in annual, seasonal and monthly aspect – 17 maps;
3. Mean atmospheric precipitation sum for annual, seasonal and warm and cold periods aspects – 7 maps;
4. Mean annual wind speed - 2 maps.

Atlas contains explicative notes and 34 maps. Maps contain legends, tables, graphs and photos.

Atlas will be prepared for edition in A4 format at 1:1500000 scale.

Several maps from atlas are presented below.

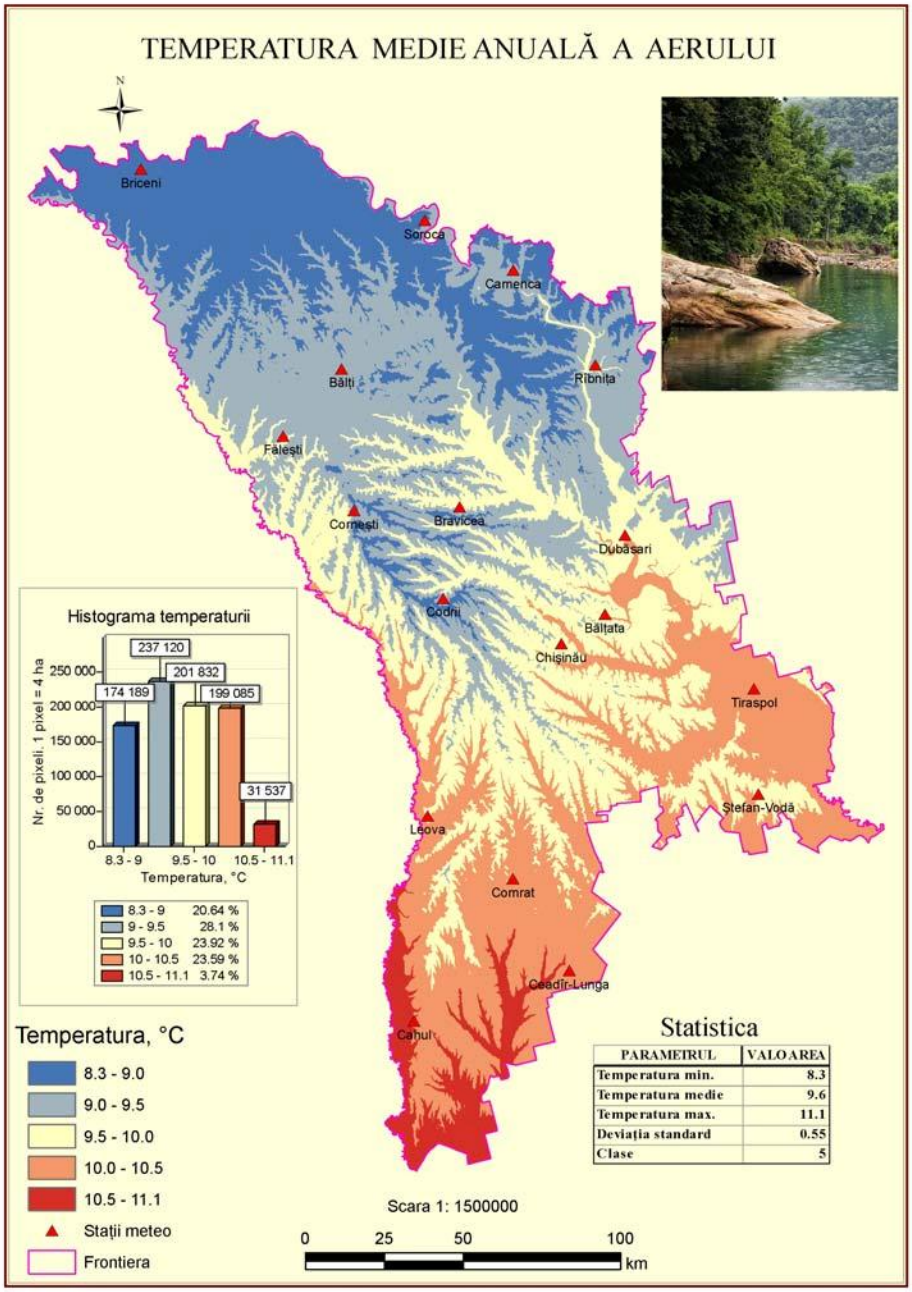

Fig. 1. **Mean annual air temperature**

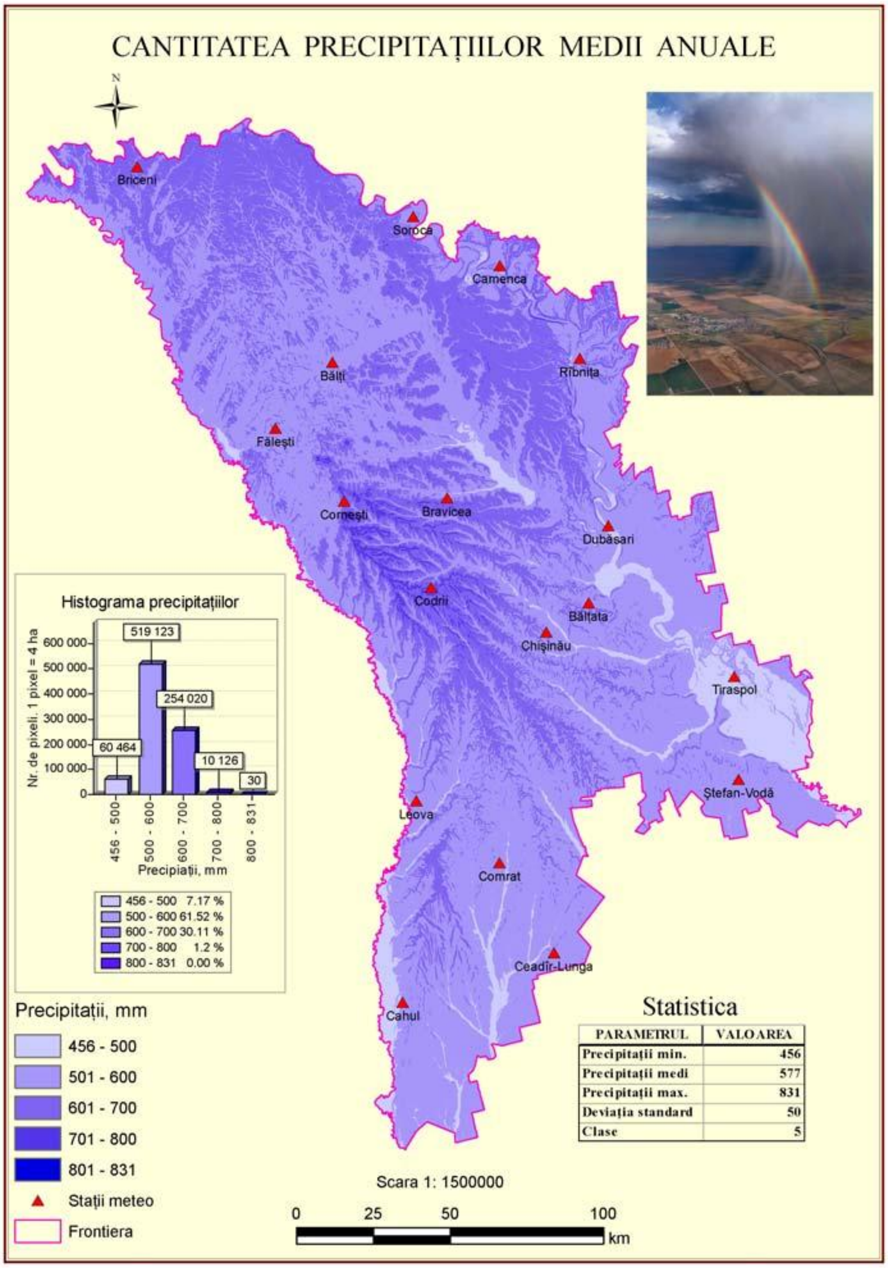

Fig.2. **Sum of mean annual precipitation**

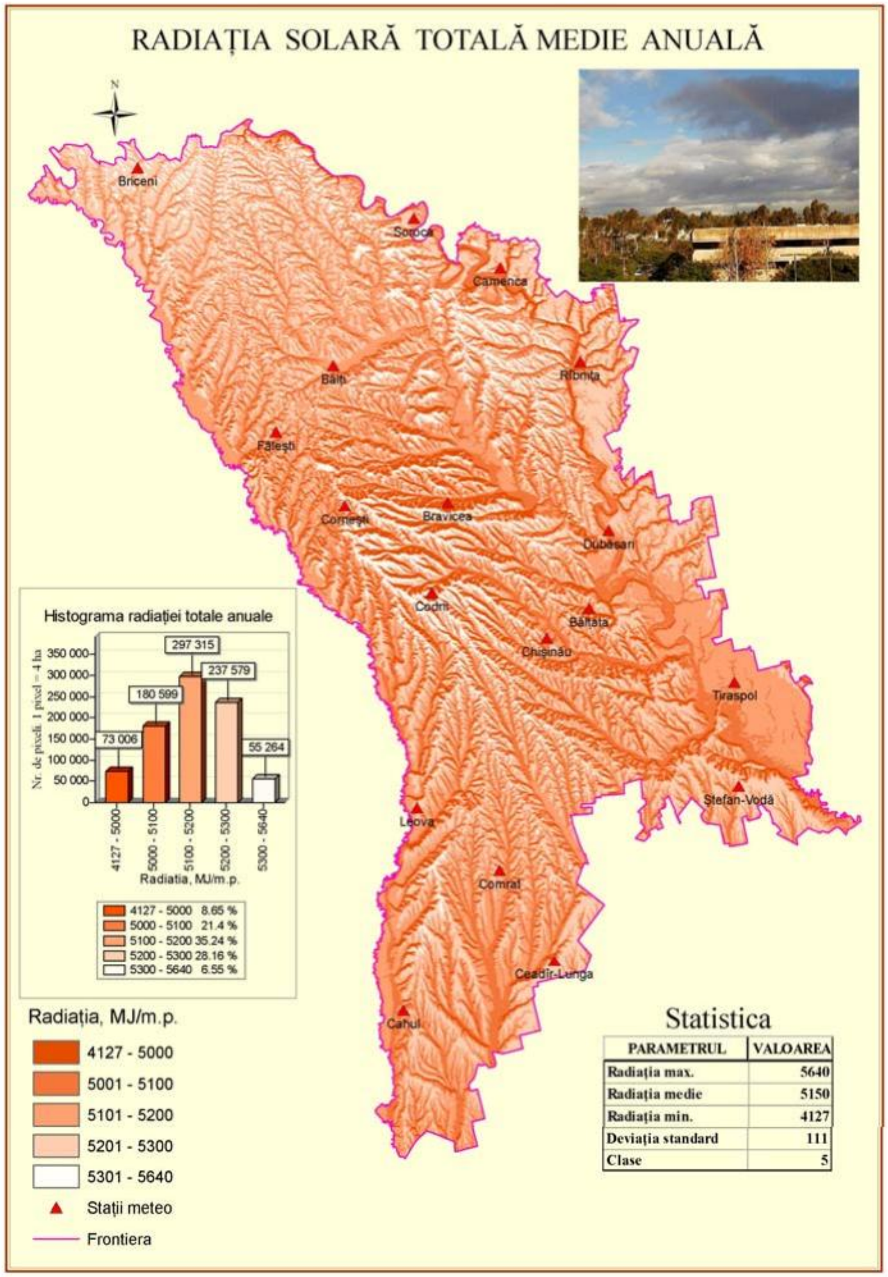

Fig.3. **Mean annual total solar radiation**

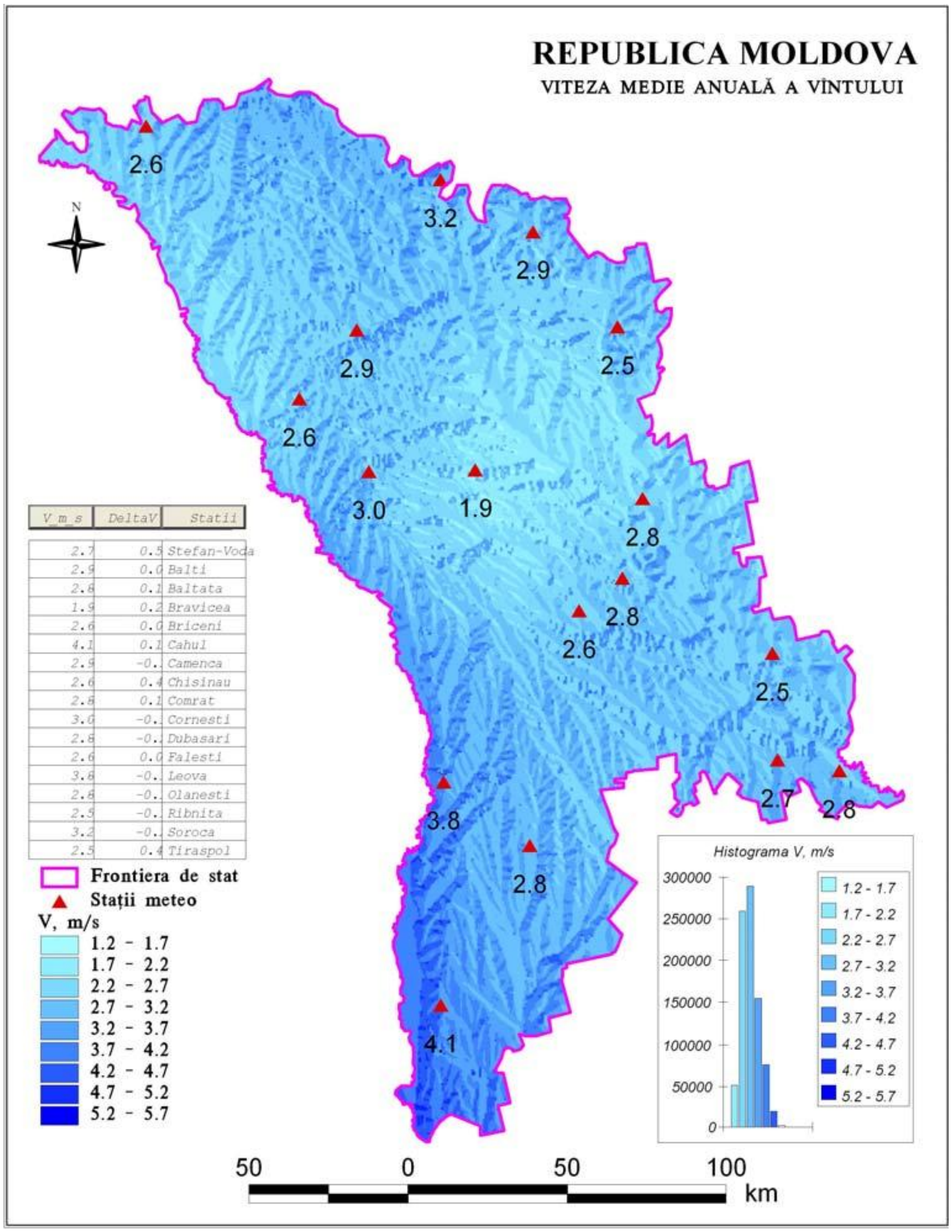

Fig.4. **Mean annual wind speed**

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CONCEPTUAL GIS MODEL IN DETERMING MARKET VALUE FOR PROPERTIES

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Abstract:
Any property can be part of a transaction. This is the main premise to start the current study. As we know, the geographical information systems are used in many applications, respectively any spatial entity can be represented as a graphical feature. Why GIS applied in property valuation? The reasons are multiple, but between the main ones there are the following: this perspective is not being used at this moment in Romania; visualizing the property as a graphical feature containing the appropriate characteristics and its positioning with respect to the environment, no matter the nature of the environment (natural, economic, juridical, etc.); at the same time by creating a conceptual model, facilitating the spatial analysis of property is pursued, applied on its natural factors. The geospatial perspective in property valuation has as a purpose to determine the market value of the properties, a subjective value, with respect not only to real estate prices at the valuation moment, but also involving the geospatial factors in this process.

Key words: GIS, conceptual model, property valuation, market value

1. INTRODUCTION

GIS, used as an acronym for Geographical Information Systems, it's an important tool to create, to display, to manage and to analyze information spatially distributed through automated processes.

GIS is actually a system that has many types of elements informational spatially referenced, with respect to a coordinate system. The insertion, the storage, the management and the analysis of the components is made using a computer, the result, firstly, consists of visualizing complex information spatially referenced with respect to a spatial reference system, and secondary, there is the possibility to apply spatial analysis and complex correlations, impossible to be made through classic techniques. The functionality of the informational society it's based on the capacity to accumulate, to store and to use the information efficiently. The approached subject offers a working tool, respectively the geographic informational

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systems, for making the information management more efficient, starting from storing the data, moving on to the graphical display and spatial analysis.

Real estate market represents the interaction between the offers for properties to be sold and the requests made for this type of products to be bought. The actors in the real estate environment are the vendors, the buyers, the intermediate agencies for transactions and renting places, financial institutions, constructors, developers and others. The real estate market represents an economic category of goods production, in which all the buying/selling contracts find a meaning. It is seen as being an organic unit with respect to the relationships generated by it and connected to the space where those take place.

2. METHODOLOGY

The location property differentiates the majority of the markets considered to be efficient (a predictable behavior for buyers and sellers and the characteristics of the market products). The participants from the real estate market reply in different ways on market's products, their motivations and decisional criteria vary with respect to their position: final users, investors, speculators. They are well informed about market's conditions, its history, and the quality of products, the competition and the behavior of other participants. On the real estate market, the information is less transparent; many of the participants are not very familiar with the properties of the products traded on this market, because they don't deal frequently with real estate transactions.

The real estate rights are executed upon properties. These rights are registered into a formal document, such as a property title or a renting contract. This is the reason why the ownership is a juridical concept distinct form the term of property, which is a physical asset. The real estate rights cover all the powers, the advantages and the benefits related to the ownership upon properties. On the other side, the property includes the land itself, all the good that naturally make an entire with it, as well all the goods that are related to it, like buildings and land management.

What can we understand *the virtual image* of a property?

The context that the answer to this question will be explained is one from a spatial point of view, respectively representing the property spatially

referenced, containing its characteristics as attributes. *The virtual image* is built using the attributes of the property, from a geospatial perspective. The property has an area, perimeter, dimensions, complex
Through this method it is tried to estimate the difference the buyer infrastructures, etc. This type of a property image allows us to manipulate its characteristics; as well analytical methods can also be implemented on these characteristics.

Coming back to the real estate market, seen as a virtual environment for real estate transactions, its primary concern is the "virtual image" of the property, facilitating access to information on any type of real estate object.

Property valuation is the process of estimating a value type, for a type of property at a given time. Market value is the estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without compulsion. (IVS1 – Market Value Basis of Valuation)

All methods, techniques and procedures for measuring the market value, properly implemented, should lead to a common expression of market value. The manner in which property is traded on the real estate market, it can be distinguished the applicability of various methods and procedures for estimating the market value. "[...] *the estimated amount* [...]" refers to the price expressed in monetary terms (local currency), which can be paid for a property in an arm's-length transaction. Market value is quantified as the most probable price reasonably obtainable on the market at the valuation date, in correspondence with the definition of this value.

2.1 ASSESSMENT METHODS AND TECHNIQUES

2.1.1 COMPARATIVE METHOD

This method relies on the following premise: estimating the market value by analyzing the market is to find similar properties and then comparing these with the properties of assessment. Major premise of this method is that the market value of a property is directly related to prices of comparable and competitive properties. Comparative analysis focuses on similarities and differences between properties and transactions that affect the value. As a limitation of this method, it is rarely applied to special purpose properties, because there are only few properties alike sold on the market. However, this limitation is not applicable to the scope of mortgage and/or real estate, where properties on the market are traded with the destination of residence.

2.1.2 COST METHOD

perceives between the property assessed and a new building constructed with optimal utility. An estimated cost its computed to build a replica or a replacement for an existing structure, which to use then to decrease the depreciation of property valuated, estimated on valuation date. The foundation of this method is the substitution principle (no buyer will pay more for a property than the cost of acquiring land and a building immediately with a similar utility and attractiveness). Cost method is important in estimating the market value of new buildings or relatively new, since in such cases the cost and market value are usually close.

2.1.3 INCOME METHOD

The property is considered as an income generating investment. Revenue-generating properties are purchased for investment and from the investor's point of view; the ability to make profits is a key element influencing the property value.

2.1.4 NOMINAL ASSET LAND VALUATION METHOD

Property values reflect the ability to perform a function. With respect to the properties, the functional qualities may include: influence of location (access to points of interest), physical attributes (size, shape, age and circumstances), legal factors, planning factors and economical standards.

A data model is considered conceptual when it permits direct mapping between real-world perception and its representation through the concept of modeling. The dimension of data modeling is an area of representation of the real world that focuses on specific classes of phenomena, such as data structures, space, time, and multi-representation. Modeling dimensions are considered orthogonal if, when building a database scheme, choosing a given dimension does not depend on choosing other dimensions. For example, it is possible to register a source location on a river (a spatial element inside a space dimension) without considering whether the source, inside the data structure was modeled as an independent object or as an attribute of the object *river*. Orthogonality highly simplifies the data model and its use, but in the same time is increasing its expressive power, such as the ability to represent all phenomena of interest.

The conceptual model assumes to be a way of solving spatial problems. Representation model attempts to describe the objects in the environment, for example buildings, rivers and forests. The creation of these models of representation is executed in a GIS, stored in data sets called layers. The spatial analysis can be applied on raster formats or vector formats. The representation model tends to capture the spatial relationships between objects and other objects in the environment, such as for example, the shape of a building and the distribution of other buildings. During the establishment of spatial relationships, a GIS representation model is able to model objects and attributes.

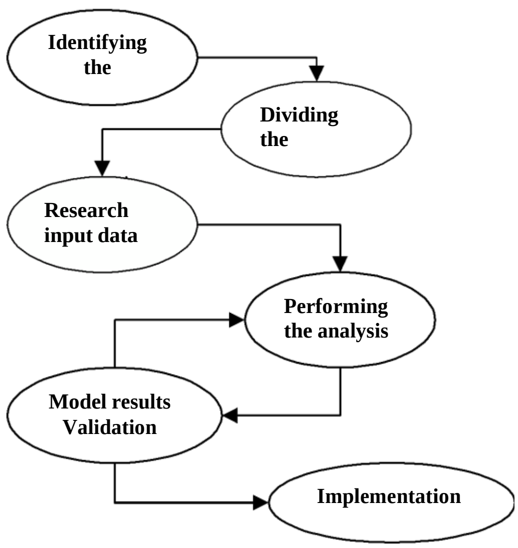

Figure 1. Conceptual model for solving spatial problems

Processing models attempt to describe the interactions between objects in the representation model. Relationships between them are modeled using spatial analysis methods. Process modeling can be interpreted as a cartographic modeling. They are used not only to describe the processes but also in forecasting events. Each function and spatial analysis operation can be considered a model for processing.

Identifying the problem

With the purpose of solving spatial problems, first we have to identify the problem that has to be solved and also the purpose we want to achieve.

Dividing the problem

By dividing the problem, all steps necessary to perform the modeling process are identified and also to establish data used for processing, as well setting goals to achieve that purpose.

Research input data

It is important to understand spatial relations and the relations between attributes of individual objects in the environment, and also the major relationships between these objects. To understand them, we have to examine the input data. This aspect, currently, it can't be done with any GIS software.

Performing the analysis

This step in identifying all the methods that must be used to complete the model.

Model results validation

Depending on the model used, the results are checked to determine whether changes are needed in the parameters, or if there have been created several models, we have to determine which of these is most appropriate.

Implementation

We can say that space problem is solved when the results of a model achieves the established purpose in the preliminary stage.

Thus, using the steps listed above, using a conceptual model can be solved any spatial problems. All the factors within a spatial modeling are represented either by graphical primitives, such as point, line or polygon, or raster format.

Any spatial problem can be interpreted in a GIS perspective. Depending on the complexity of the issues, the main 'actors' must be identified in the modeling process. Conceptual model comes as a help in solving spatial problems.

The main thing to realize is determining the market value of a property. Thus, achieving this purpose, the factors that influence this value must be identified.

Property assessment is quite difficult in terms of identifying the participants in the decision-making process.

The market area. The zone. The value of a property can be influenced, or even modified, by various social factors, economic, administrative and environmental. Within a zone of influence, there are acting factors which determine the property value. Area of influence and, more comprehensive, the market area is the perimeter characterized by certain factors, where the valuated property compete with other assessed properties to attract attention of buyers and sellers on the real estate market.

Market areas are defined by a combination of factors: physical, demographic and socio-economic characteristics of residents or tenants, condition of building (age, degree of maintenance, high vacancy, etc.) and trends in the use of properties.

Analyzing the market area will fix the framework or context in which to estimate the property value. A market area may include a neighborhood, a local area or wider areas - groups of settlements, where the influence factors of property value are identical. For the delineation of market areas perimeters, contribute the following: transportation ways (highways, main roads, railways), water formations (rivers, lakes and other waters) as well the odds changing landforms (hills, mountains, valleys, gorges, etc.). These can be important landmark borders.

Predominant in the market area definition remains the type of land use, but counting too the physical characteristics of the environment, architectural styles and practices in terms of infrastructure. It is possible that the boundaries of market areas overlap with those of maps, identified by: zip code, or numbering constituencies' reviews. Market area should be identified strictly in order to assess properties. In analyzing the market area, changes likely to be seized, area development trends, possible phase transition from one land use type to another type.

The change and the transition can affect different properties and may lead to positive effects, but negative effects upon the value. The change may take more or less, but the transition is usually permanent.

The basic tool used in the current study is the application ModelBuilder, included in the ArcGIS Desktop package. ModelBuilder is the application in which are created, edited and administrated the models.

The models represent the manner in which the work is automated. When the model is created, the set of tasks or functions applied to data is stored; this set can be accessed several times. By creating a model using ModelBuilder instruments are interconnected, the output data of an instrument is being interpreted as the input data for another tool.

The model created is added in ArcToolBox as a *model tool* that can be executed directly by accessing the function, or by Command Line window. In ArcToolBox, this conceptual model created has the following structure:

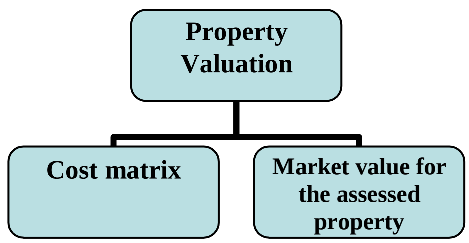

Figure 2. ***Model Tool*** **structure**

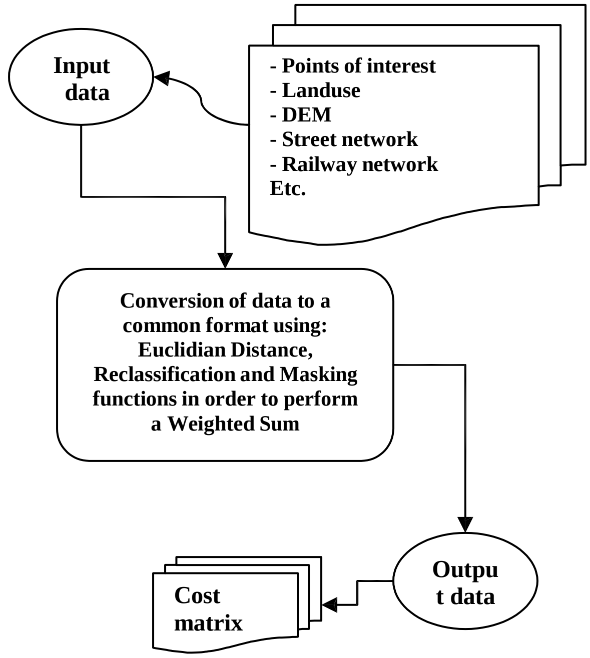

Figure 3. A conceptual model for a cost matrix

The model tool developed is composed of two main parts:

1. Cost matrix - calling this function created using conceptual modeling, the output result is a cost matrix, for the calculation of this matrix, a number of factors are involved, with the associated weights. *Weighted sum* function was used for the final calculation of the matrix, but up to this step, a series of functions have to be applied in order to transform the data in raster format.

2. Market value for the assessed property – There are many characteristics of properties involving difficulties in the evaluation process. Providing a comprehensible explanation to the owners of how their property was assessed is a challenge for evaluators, due to complexity of assessing properties.

The cells from the output raster files after running the model, in order to determine the market value for properties are defined as a multiplication between the weighted sum of the physical characteristics and the area of the property valuated, according to the following formula:

$$V_i = S_i * \sum_{i=1}^{n} (C_i * p_i)$$

where V_i is the market value, S_i - property area, C_i - physical characteristics of properties and p_i - the weights.

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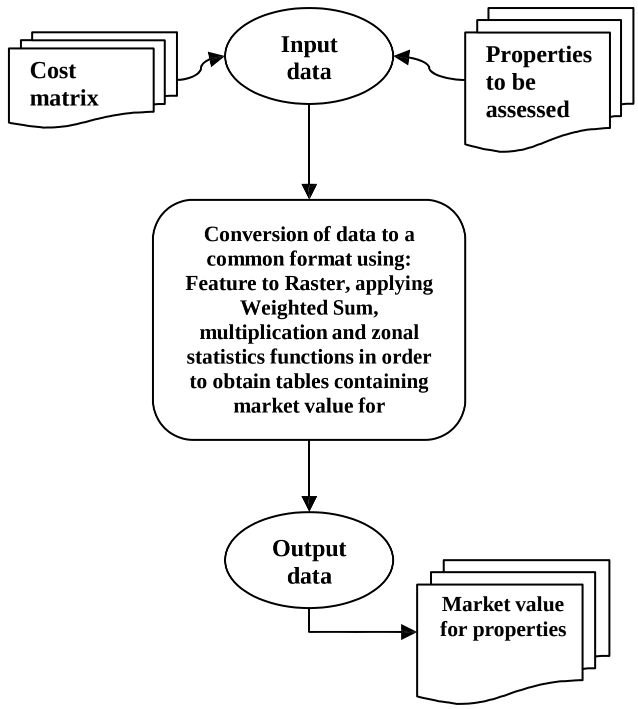

Figure 4. A conceptual model for determining the maket value for real estate properties

3. RESULTS

Land valuation is to identify the factors, with associated weights. The result is an opinion of market value assessment based on these factors and the relevance of this value on a sample of properties. Number of factors involved in the assessment of property is quite uncertain. Because of this fact, precise value of property can not be determined easily. Real value of buildings is almost impossible to determine, for which the estimated value is accepted

After running the first set of functions, from which the final result is a cost matrix, in this second part of the evaluation process, there is involved a number of individual features for properties, features that make the difference between them, and also there is assigned a subjective interpretation for the resulting values from the second conceptual model.

4. CONCLUSIONS

The conceptual model represents an abstract part of the real world and it is describing the logical structure of data in a database. Each database has its own conceptual model, through which are named and described all logical units in the database, with links between them. The logical units are concepts such as those which the database users are operating with, and as well use then for modeling their applications. A conceptual model includes the descriptions of all entities of a database, with the relationships between them. An entity is an independent content, an objective reality that exists by itself.

Property valuation, when realistic, leads to a good orientation for an economy that unlocks the credit movement, contribute to hardening investment, and promote development of property, of the industrial business and of all other kinds. Visualizing the way that a GIS can be used in property valuation, applying nominal asset land valuation method, this purpose was achieved using geospatial modeling methods and functions, all these combined into conceptual models.

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CLIMATE PRETABILITY FOR ADMINISTRATIVE REGIONS OF REPUBLIC OF MOLDOVA USING GEOGRAPHICAL INFORMATIONAL SISTEMS

M.Nedealcov[1], O.Crivova[2], V.Raileanu[3], R.Cojocari[4]

Резюме: Географические Информационные Системы (ГИС технологии) и балловый оценочный метод позволили решить одну из самых сложных задач прикладной агроклиматологии – оценку степени пригодности климата для возделывания сельскохозяйственных культур на уровне административных районов. Полученные результаты позволяют обеспечить потребителей (государственные органы или частные лица) актуализированной климатической информацией.

Key words: pretability, grading method, agroclimatic indexes, heat resources, humidity resources, GIS

Rezumat: Sistemele Informaţionale Geografice împreună cu metoda estimativă prin pontaje a permis rezolvarea uneia dintre cele mai dificile sarcini în agroclimatologia aplictivă şi anume evaluarea gradului de pretabilitate a climei pentru dezvoltarea anumitor grupuri de culturi agricole la nivel de raion administrativ. Rezultatele obţinute permit asigurarea consumatorului de informaţie climatică, în special organele de conducere şi persoanele private din agricultură, cu informaţie actualizată.

Cuvinte cheie: pretabilitate, metoda prin pontaje, indici agroclimatici, resurse de căldură, resurse de umiditate, SIG

Introduction

One of the most vulnerable fields of national economy to climate changes is agriculture. New sorts creation and application of agricultural plants' cultivation technologies does not mitigate its dependence on unfavorable climatic conditions. Complex evaluation of heat and humidity resources is one of the acutest issues in present, especially at local level, from which agricultural plants productivity mostly depends.

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This is not to mention that there only several attempts at integral evaluation of agroclimatic indexes. This is the reason why agroclimatic resources zonation is complicated or has subjective character. [1].

Continuous perfection of investigation methods, necessity of database actualization, regional climate's modification as a consequence of climate changes, agrarian orientation of national economy need climate pretability estimation for agricultural development in administrative regions. Obtained results can provide end-users with climatic information (especially authorities and private sector) actualized in this field.

Initial materials and investigation methods

As we mentioned before, one of the principal objectives of agroclimatic potential estimation at present is an open problem of identifying agroclimatic indexes as numbers and possibility of their spatial interpretation to certain taxonomical territorial units.

Possibilities offered by Geographical Informational Systems essentially widen the range of agroclimatic indexes, thus changing estimation criteria of agroclimatic potential according to: annual sum of atmospheric precipitations, mm; warm period sum of atmospheric precipitations, mm; cold period sum of atmospheric precipitations, mm; Seleaninov's hydrothermic coefficient; maximum heights of snow layer, cm; frost period duration, days; non-frost period duration, days; active temperatures sum (T>10C); number of days with T>5C; 10 % ensurance of absolute minimum of the year.

Thus, agroclimatic resources characterization and analysis on the administrative territorial level will be executed not by construction or identification of areas [2], but based on digital cartographic material that reflects pretability degree of agricultural development, estimated according to grading method. We should mention that by Geographical Informational Systems using for each cartographic model we can determine predominant maximum and minimum values rate automatically in territorial distribution.

Climate pretability evaluation criteria for pomiculture development on administrative regions' level were selected according to principles of evaluation criteria selection for climate pretability evaluation in Republic of Moldova in physical-geographical regions. We should mention that cultural plants requirements for thermic and humidity regime in growth and development phases were the basis of these criteria selection.

Moreover, in proposed investigations we took into account critical thermic thresholds of the cultural plants for frost, using critical temperature data of fruit orchards frost damaging in cold season, number of hours with $T>5^{0C}$ in cold season, number of hours with $T<10^{0}C$ in cold season, fruit trees requirements for heat in active vegetation period, fruit trees requirements for humidity in active vegetation period.

Obtained results analysis

After producing complex analysis of agroclimatic indexes we have elaborated evaluation criteria of climatic pretability level for certain groups of fruit crops. For example, in tab. 1 are presented pretability level evaluation criteria for thermophile plants. Thus, the highest grading is due to the agroclimatic resources that are characterized with the most favorable wintering conditions, when average from absolute minimum does not exceed $-20^{0}C$, and snow layer may reach 19-23 cm, duration of days with diurnal temperatures more than $5^{0}C$ is the longest (240 days), active temperatures sum is more than $3200^{0}C$, frost period is the shortest (70 days) and with the most significant humidity resources, among which we should mention annual precipitations sum (650 mm) and Seleaninov's hydrothermic coefficient's values (1.4-1.7).

Thus, according to this system, the highest grade („4") is attributed to optimal climatic conditions. And vice versa, the most non-pretable agroclimatic resources for certain groups of agricultural plants have the lowest grade („1"). According to these qualificatives, all agroclimatic resources referenced to pomiculture development are grouped into:
optimal (3,5-4,0), favorable (2,9-3,4), pretable (2,3-2,8), less pretable (1,7-2,2), non- pretable (1-1,6)

Table 1. Evaluation criteria of climate pretability level for fruit crops with decreased requirements for water and increased ones for heat and frost resistance (peach, apricot, almond)

Grading	Absolute Minimum	Annual Precipitations	Sum summer period Precipitations (mm)	Winter period Precipitations (mm)	CHT	Frost period duration (days)	Non-Frost period duration (days))	Snow layer height	Sum of $t>10^0C$	Days Number with $_0$
1	<-23	450-500	149-180	<95	<0,9	>85	275-280	9-11	2800-2900	220-
2	-22	500-550	180-210	95-105	0,9-1,1	80-85	280-285	11-13 13-15	2900-3100	230-235
3	-21	550-650	210-240	105-115	1,1-1,4	70-80	285-295	15-17 17-19	3100-3200	235-240
4	>-20	>650	240-284	>115	1,4-1,7	<70	>295	19-21 21-23	>3200	>240

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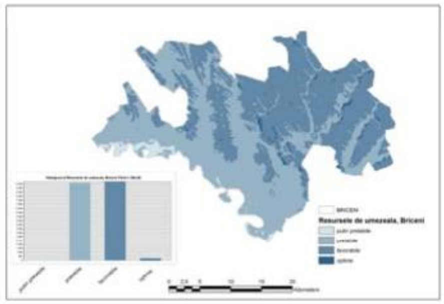

b

c

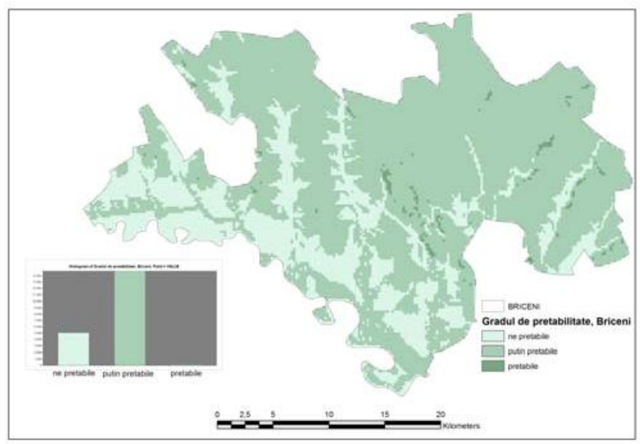

Fig.1. Heat and humidity resources pretability evaluation (a, b) and agroclimatic ones (c) with the reference of pomiculture development in republic's North (Briceni)

The most non-pretable agroclimatic resources graded to down till one unit are extreme wintering conditions with average values of absolute minimum lower than -23^{0}C, with most insignificant active temperature sums (2800-2900^{0}C), with the longest frost periods duration, and least number of days with diurnal temperature above 5^{0}C (220 days), etc.

We should also mention that for climate pretability evaluation for certain groups of agricultural plants we took into account their biological particularities and needs for light, temperature, precipitations etc., which would be reflected in evaluation criteria for climate pretability of certain agricultural branch development on administrative regions' level.

Thus, for Briceni region (fig.1) cartographic modeling of active temperatures sum shows us that in territory 2900-2950^{0}C are dominant, the number of non-frost days is mainly 276-278 days, and for the major territory the number of days with temperature more than 5^{0}C is 223-225 days. The number of frost days is 88-89 days in the most part of republic's territory.

Frost values registered ones per 10 years are distributed on the most region's territory and constitute thermal values of -27^{0}C.

For the majority of land, atmospheric precipitations sum for warm season is 229-240 mm, in winter – 95-105 mm, and annual sums are 600-625 mm. In the biggest part of the territory maximum snow layer height constitutes 20-21 cm, and CHT coefficient is 1.2-1.3.

Integral evaluation of cartographic models for Briceni region show us that here humidity resources are in general favorable and pretable (fig.1. a) according to the summed up grading of the indexes that characterize them, while heat resources for the most territory are non-pretable for thermophile fruit crops (fig.1.b) and less pretable for the whole group of fruit crops (fig.1. c).

In republic's center, on the example of Ialoveni active temperatures sum for most region is 3300-3350^{0}C, the number of diurnal temperatures that exceed 5 ^{0}C, increases for the majority of the land and constitutes 234-236 days.

Prevailing number of days with frost decreases and is 77-79 days, and non-frost prevailing period is 296-298 days. Absolute minimum probable once per ten years for the biggest part of territory is -24^{0}C.

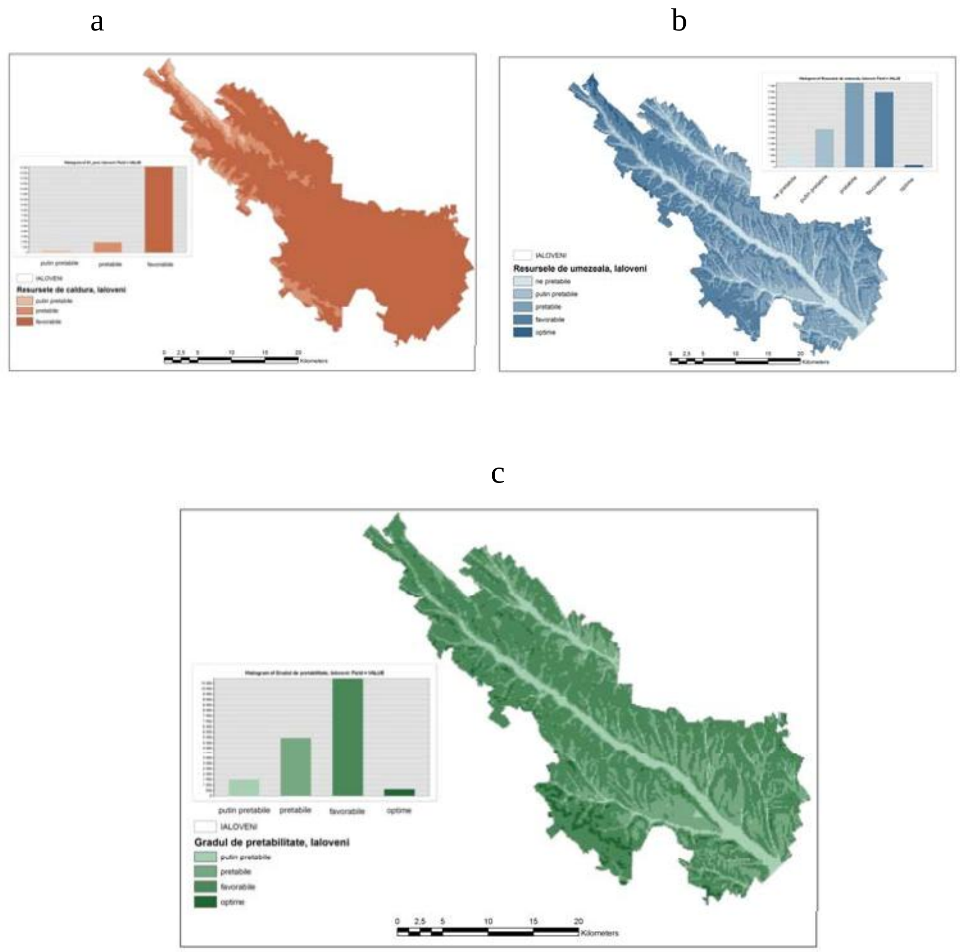

Fig. 2. Heat and humidity resources pretability evaluation (a, b) and agroclimatic ones (c) with the reference of pomiculture development in republic's Center (Ialoveni)

Prevailing annual precipitations here constitute 575-600 mm, summer ones- 200-210mm, and winter ones - 108-120 mm. Maximum snow layer height decreases down to 14-16 cm, as well as hydrothermic coefficient that constitute 1.0-1.1.

Integral evaluation of climatic and agroclimatic indexes that characterize humidity and heat resources in this administrative regions shows us favorability and pretability of humidity resources and that heat resources are favorable. Favorable and pretable conditions for pomiculture development in general are identified according to pretability level for prevailing part of Ialoveni (fig.2. a, b, c).

In Cahul region from republic's South prevailing active temperatures sums is 3450-3500^{0}C, duration of days with diurnal temperature exceeding 5 ^{0}C is 242-245 days, frost period is the shortest and constitutes 68-70 days, and non-frost period duration is even 295-297 days, and absolute minimum once per ten years is -21^{0}C (fig.3 a).

Atmospheric precipitations annual sum on predominant part of Cahul's territory is only 525-550 mm, summer precipitations are in average 180- 190 mm, but in cold period – 95-105 mm.

Maximum height of snow layer is 11-13 cm and its the only region from those that were presented that has drought conditions according to CHT values that constitute 0.7-0.8 for the region in study (fig.3 b).

According to fig. 3, b non-pretable conditions of humidification are identified for major part of Cahul region, while heat resources in most part of it are optimal and favorable. Climate's pretability for pomiculture on Cahul region's territory is prevailingly pretable and favorable (fig. 3 c).

Thus, pretability evaluation for the regions allowed identifying local particularities of climate pretability for pomiculture.

Estimative grading method's elaboration and Geographical Informational Systems usage allows resolving one of the most difficult tasks in agroclimatology and namely climate pretability degree for certain agricultural groups of plants on the level of administrative region.

We should mention, that not so long ago it was practically impossible to layer all results of agroclimatic indexes estimation apart and integrally and that's why in major cases agroclimatic resources zonation was executed on the basis of two or three indexes. In present, basing on statistical and mathematical methods and using informational systems we are able to evaluate them on republican as well as administrative or even communal level. Obtained results can be used for authorities and private end-users informing

.a b

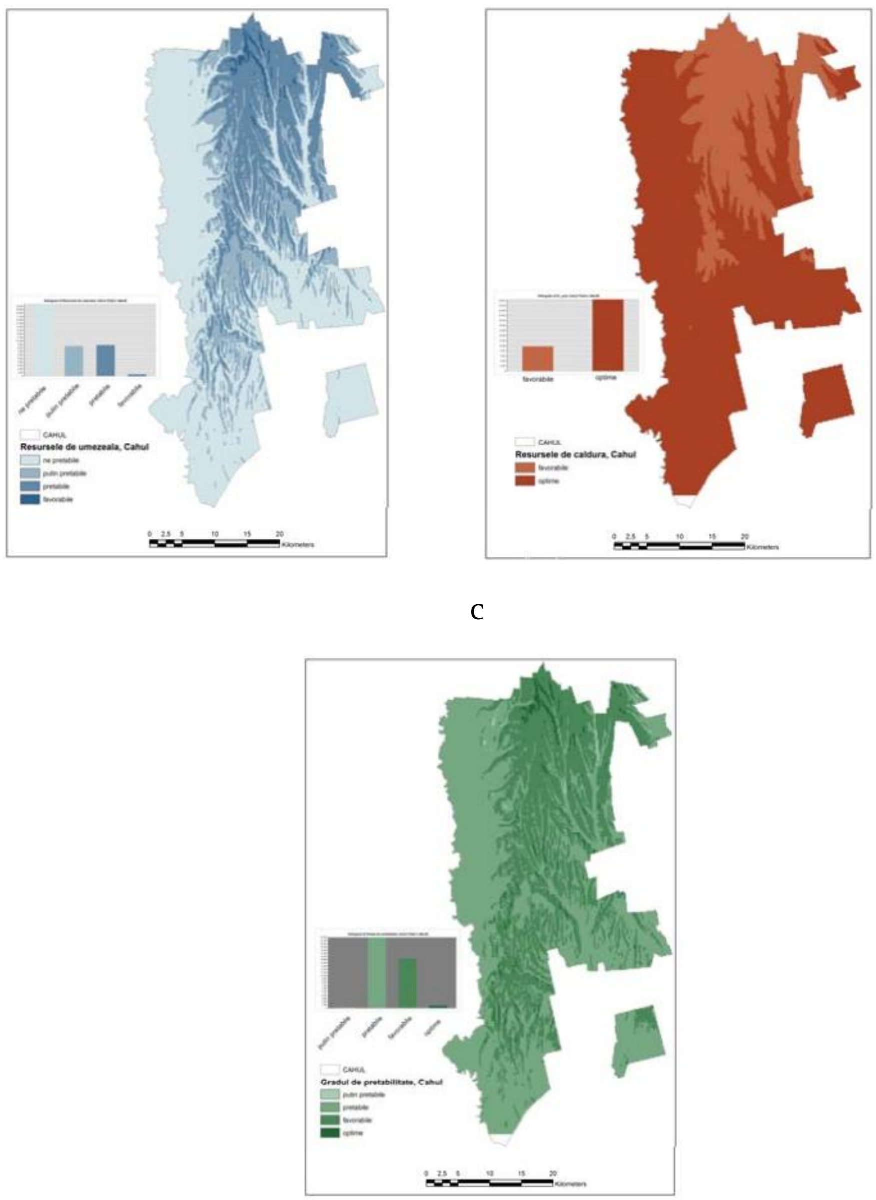

Fig. 3. Cartographic modeling of humidity resources on administrative level in republic's South (Cahul)

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IDENTIFICATION OF AREAS OF PREVENTIVE EVACUATION AND ACCOMMODATION OF POPULATION, ANIMALS AND PROPERTY NECESSARY FOR THE DEFENSE PLAN OF THE BACIU COMMUNE, CLUJ COUNTY

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Abstract. By this study a delineation of areas for the evacuation of population was achieved, which, after further checking on the ground, can be introduced into the flood defense plans. These areas were selected using geographic information systems, by analyzing the digital elevation model, and taking into account the slope and sunshine exposure of the ground, as well as the proximity to the exposed locality. These characteristics were quantified by means of a proportional and objective rating, so that the evacuation areas were highlighted at the end of the analysis by the highest scores obtained.

Key words. Evacuation areas, slope, aspect, score.

INTRODUCTION

For the factors implied in flood risk management there are duties and responsibilities established by law, specific to their operating sector. In the national strategy are presented only their duties related to the prevention, protection and reduction of flood effects, those which require an organized, correlated or simultaneous implementation of the actions and measures designed to achieve the objectives.

In different fields of action, the flood management activities constitute a complex of problems including policies, plans and programs on short, medium and long term, aiming to protect life, property and environment against the natural phenomenon of risk.

One of the roles of county and local councils in flood management activities is to organize and to coordinate the evacuation of people from the flood endangered area, to previously established places and to assure the necessities in food, drugs, and health care.

The local council is responsible for mobilizing the community in the actions of supplying food and water, clothes and their distribution, as well as in the restoring the basic services in the affected localities.

We believe that at county level a spatial database and an integrated information system have to be created, which should be shared by institutions, companies, public administrations, etc. in order to ensure interoperability and data exchange. The management of spatial database can be accomplished optimally and efficiently based on access levels and the users can be individuals or legal.

MATERIAL AND METHOD

According to the actual legislation, at communal level are drawn up plans for defense against flooding. These are technical documentations, including maps and drawings, on which affected are localized objectives, flooding areas are outlined, both from rivers overflow and due to leakage for the slopes, transport routes are evidenced, as well as preventive evacuation areas for the population accommodation, etc. In the flood defense plan of the commune, a single evacuation area is assessed, near the Baciu locality.

As a matter of principle, these areas should present a slope as small as possible, a sunshine exposure during the day as long as possible, they should be as close as possible to the built-up area of the locality from where the flood victims are evacuated and should be located on agricultural land. Such areas were identified by analyzing the digital elevation model using geographic information systems, taking into account slope, aspect and land use, as well as the proximity to the exposed locality. To this purpose, a geodatabase was created, which should organize all necessary information to the study. The digital elevation model of the terrain was generated by digitizing the contour from the topographic map with a map scale of 1:25,000.

RESULTS AND DISCUTIONS

The slope is the angle between the ground surface and the horizontal plane, and can be analyzed in degrees or percent. The TIN Slope command produces as output a feature class with polygon entities. These are generated by the slope values of each triangle in the TIN structure. Contiguous triangles which the same slope belong to the same class, and are joined together during the command execution into a single polygon. By applying this command, the slope was calculated in percent, and was achieved the following classification: 2.5, 5.0, 7.5, 10.0, 12.5, 15.0, 17.5, 20.0, 22.5.

A .txt type file was created, by which the encoding was executed, namely to each class an integer from 1 to 9 was assigned. The obtained layer containing the ground slope is presented in figure 1.

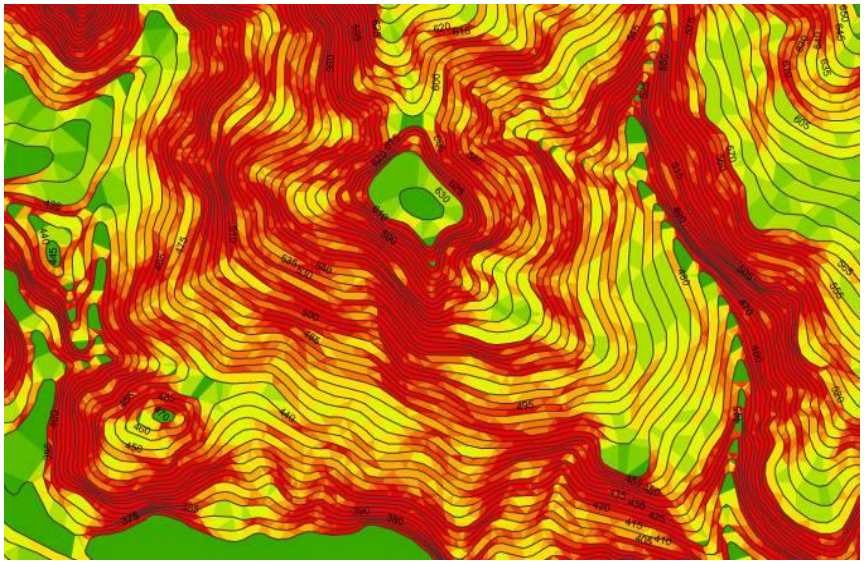

Fig. 1- Detail with the slope terrain in Baciu commune.

The aspect identifies the direction of maximum slope from a given location on the investigated surface. Aspect is measured clockwise, from 0 degrees up to 360 degrees, during a complete rotation. Planar grounds don't have a direction and the -1 value is assigned for them. A score was assigned to each class of slope or aspect.

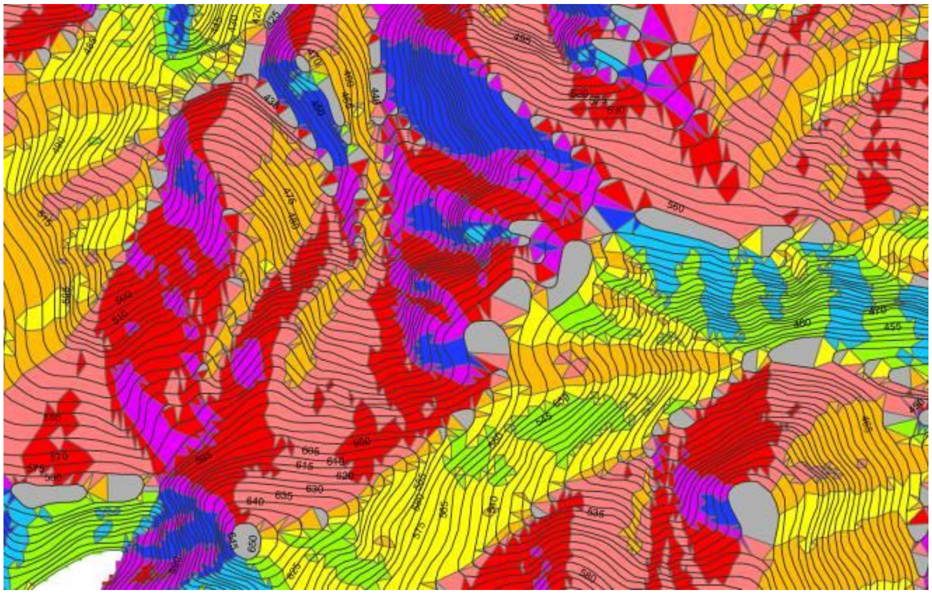

Fig. 2 - Detail with the aspect terrain in Baciu commune

The TIN Aspect command generates a features class containing polygon entities, according to the values of the TIN's triangles aspect. By default, these values are divided into 8 classes, each of them corresponding to 45 degrees measured clockwise. A .txt type file was created, by which an integer from 1 to 8 was assigned to each class. în figure 2 the obtained aspect of the ground is presented.

The two vector layers obtained representing slope and aspect were reclassified according to the intended goals. In each layer table was created an integer attribute named Punctaj, containing the number of points assigned in proportion to the interest represented by the slope and aspect attribute for the study.

The scores for the slope values were assigned as follows:

Slope		code		score
0 - 2.5 %	…	1	…	100 pts.
2.51 - 5.0 %	…	2	…	100 pts.
5.01 - 7.5 %	…	3	…	33 pts.
7.51 - 10.0 %	…	4	…	25 pts.
10.01 - 12.5 %	…	5	…	20 pts.

12.51 - 15.0%	…	6	…	16 pts.
15.01 - 17.5 %	…	7	…	0 pts.
17.51 - 20.0 %	…	8	…	0 pts.
20.01 - 22.5 %	…	9	…	0 pts.
> 22.5 %	…	10	…	0 pts.

For areas with a slope greater tham 15 %, 0 points were assigned, since it is very difficult to ensure temporary shelters to the victims for a such slope of the ground. The maximum number of points was assigned to areas with slope between 0 and 5%, while for the remaining the rule of three was applied.

For the aspect, the assigned scores were the following:

-1	…	flat ground	…	-1	…	100 pts.
0°- 45°	…	N – NE	…	1	…	0 pts.
45° - 90°	…	NE – E	…	2	…	50 pts.
90° - 135°	…	E – SE	…	3	…	75 pts.
135° - 180°	…	SE – S	…	4	….	100 pts.
180° - 225°	…	S – SV	…	5	…	100 pts.
225° - 270°	…	SV – V	…	6	…	75 pts.
70° - 315°	…	V – NV	…	7	….	50 pts.
315° - 360°	…	NV – V	…	8	….	0 pts.

Points were awarded according to the duration of sunshine exposure of the ground during the day. Areas oriented toward N - NE and NW - V present no interest in terms of sunshine exposure, but will be considered further because they can present a location near the settlements, the water courses or the transport routes. The areas of greatest interest are those with flat ground and high duration of sunshine exposure.

The third criterion which was taken into account when choosing the evacuation areas is the distance from the built-up area of the localities. Around built-up areas of the localities were created buffers, corresponding to the following distances: 250, 500, 750, 1000, 1250, 1500, 1750, 2000, 2250, 2500. 2750, 300, 3250, 3500, 3750, 4000, 4250, 4500, 4750, 5000, measured in meters.

In the layer's table, an integer attribute was created, containing the proportional score awarded. Further, the Union command was applied to the three layers. Entities with zero scores were eliminated. From the layer obtained that way, areas were eliminated which corresponding to floodable zones, backwoods, cultivated with vineyards and orchards, affected by landslides, and obviously those which are natural protected: the Baciu Canyon and fossil Coruşu zone. In the figure 3 the result is presented for the Suceagu locality. All the grounds selected as evacuation areas are arable zones.

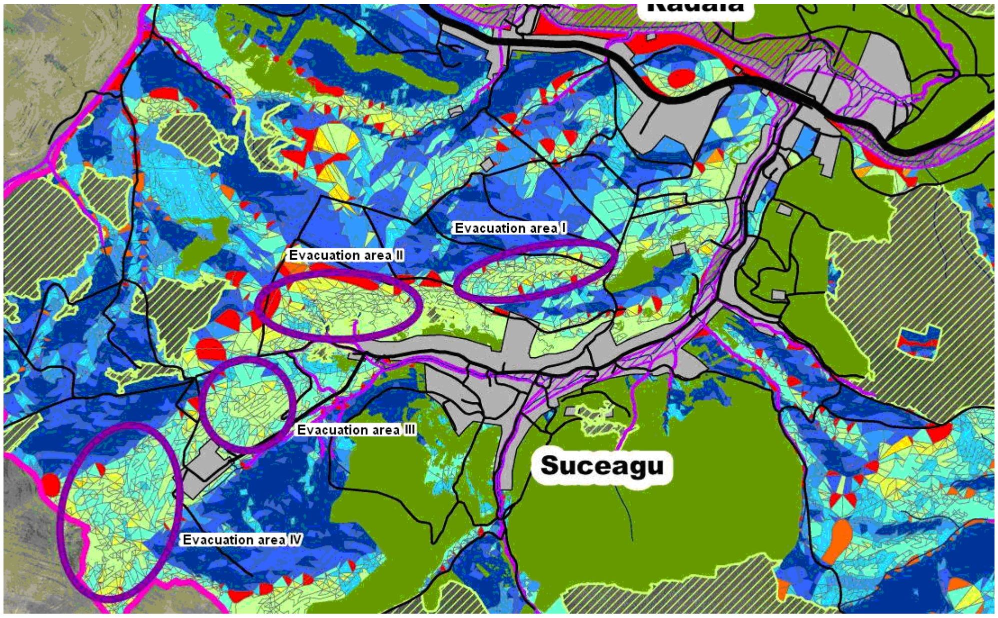

Fig. 3 - Evacuation areas identified for the Suceagu locality from the Baciu commune

CONCLUSION

At the level of the commune administration, several evacuation areas should be established, which could be used depending on the number of people, animals and fowl to be evacuated and on the living conditions which can be provided;

The spatial analyses, applied to spatial reference data, allow to obtain vital information for the flood management and to improve the quality of decision making;

The G.I.S. provides instruments for a digital management of human allocation, material and financial resources, a fair distribution of aid to the affected target population and effective measures to restore basic services in the area;

Flood management approach by the public administration has to be done in an integrated manner, by using of geographic information systems;

THEORETICAL ASPECTS IN CLIMATE'S ARIDITY EVALUATION IN REPUBLIC OF MOLDOVA'S TERRITORY

Maria Nedealcov[1]

Резюме: Степень аридности конкретного региона определяется обычно как соотношение температурно-влажностных характеристик. В данной работе предлагается использование нового климатического индекса – Индекса засушливых периодов (Izu), который отражает реальный процесс аридизации на современном этапе, особенно в южной части Республики Молдова.

Key words: Dry period index (Izu), aridization, evaporability, humidity deficit, pluviometric deficit, dry days.

Rezumat: Gradul de ariditate pentru o anumită regiune concretă se determină de obicei prin raportul dintre caracteristicile umidităţii şi a celora de căldură. În această lucrare, se propune utilizarea unui nou indice climatic – Indicele perioadelor uscate (Izu), ce reflectă intensificarea adecvată a procesului de aridizare la etapa actuală, mai ales în partea de sud a Republicii Moldova.

Cuvinte cheie: Indicele perioadelor uscate (Izu), aridizare, evaporabilitate, deficit de umiditate, deficit pluviometric, zile uscate.

Introduction

Aridity level for a certain given region is determined by relation between humidity and heat characteristics. Republic of Moldova's territory is fully provided by heat resources, but insufficiently with humidity ones. Investigations in this field show us that negative humidity balance is dominant in regional aspect, e.g. precipitation sum does not provide for heat and energy potential of the territory, which is able to evaporate bigger amounts of water than it gets in the form of precipitations.

Previous investigations executed in this field show us [2] that precipitation deficit in warm season (April-October) according to multiyear data is equal to 163 mm at North and 457 mm at South, which as a matter of fact is reflecting necessary climatic norms for irrigation in this region.

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Another parameter of air humidity which is of big practical. importance is saturation deficit, its regime being of interest taking into account the aspects of precipitation's regime and increased temperatures in warm seasonPoor irrigation facilities' infrastructure conditions saturation' deficit study which offers us pragmatic vision on relation between maximum tension and real tension of water vapors. In case when there are bug differences between these two and evaporation process – evotranspiration is intensified, and when the differences are little and these processes are diminished then cultures' growth and development are substantially influenced.

Saturation deficit values show a constant increasing trend, especially since the beginning of 80s XXth century and a more pronounced increasing trend in the first decade of XXIst century (in central and southern parts) shows intensification of aridization process on Republic of Moldova's territory. Thus, in order to adequately identify aridization process, we need to elaborate new indexes which would be able to take into account both thermal maximums and pluviometric deficit.

Materials and methods

In context of climatic changes it is important to know number of dry days for active period of vegetation and for May-August period which is critical from the point of view of aridity and dryness for many agricultural plants' growth and development. We should mention, that "dry days" are considered the days with increased thermic fund (T air $>25^0$C) and decreased air's relative humidity (Ur<30%), the impact of these days on plants is considered negative for ontogeny phases progress.

As dry days duration in May-August is directly influencing principal ontogeny phases of agricultural plants, we proposed for the first time dry periods index (*Izu*), which represents relation between their sums registered in given years to their multiyear average for the above-mentioned period. It is calculated by the following formula:

$$Izu = \frac{\sum zu_{(V-VIII)}}{\overline{X} zu_{(V-VIII)}} \text{ ,}$$

where $\Sigma zu_{(V\text{-}VIII)}$ – is dry days sum registered during the period (May-August), when intensive growth and development of agricultural plants takes place, $\overline{X}\ zu_{(V\text{-}VIII)}$ – dry days' multiyear average (May- August).

Table 1 Qualificatives of dry periods indexes (*Izu*) after M. Nedealcov

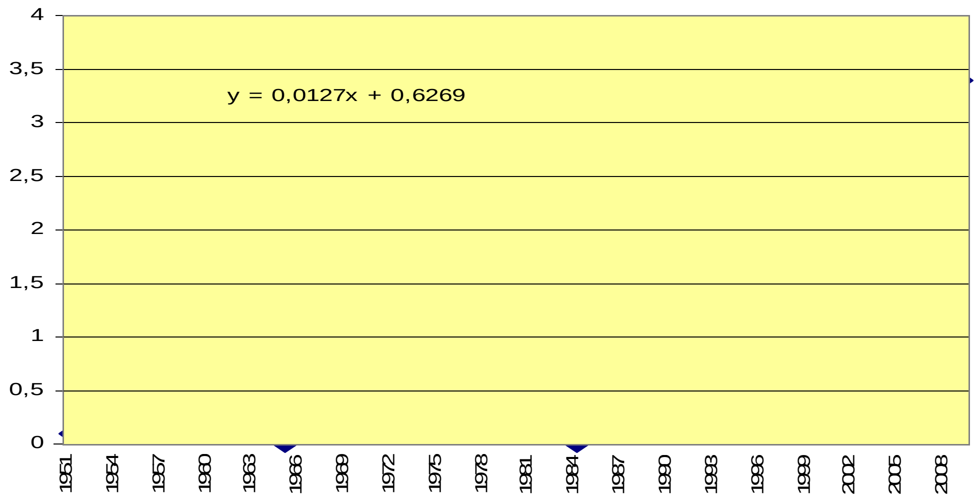
Values, zu	**Qualificatives, *Izu***
0,1-1,0	**normal period**
1,1-2,0	**moderate dry period**
2,1-3,0	**Significant Dry Period**
3,1-4,0	**Dangerous Dry Period**
>4,1	**Exceptional Dry Period**

Izu qualificatives allow identifying aridity of the periods with dry days. Thus, in case of values *Izu*= 2,1 the number of dry days exceeds twice their multiyear average, installing significant dry period. (tab. 1).

According to *Izu* time series evaluation (fig.1 a, b, c) on republic's territory exceptional dry periods are characteristic for Central and Southern parts, in certain drought years only significant and dangerous dry periods had been installed. Obtained results confirm aridity process intensification especially in central and southern part of republic [1].

The theory of stochastic processes plays an essentially role in analysis, modeling and prediction of time series for dry days manifestation phenomena. From this point of view time series that characterize dry periods can be interpreted as stochastic process realization. In hypothesis that stochastic process is stationary and conceptual time series can treated as a realization of stochastic process response to uncorrelated entrance as a type of random noise.

a


y = 0,0127x + 0,6269
4
3,5
3
2,5
2
1,5
1
0,5
0
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008

b


y = 0,0041x + 0,8743
4
3,5
3
2,5
2
1,5
1
0,5
0
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008

c

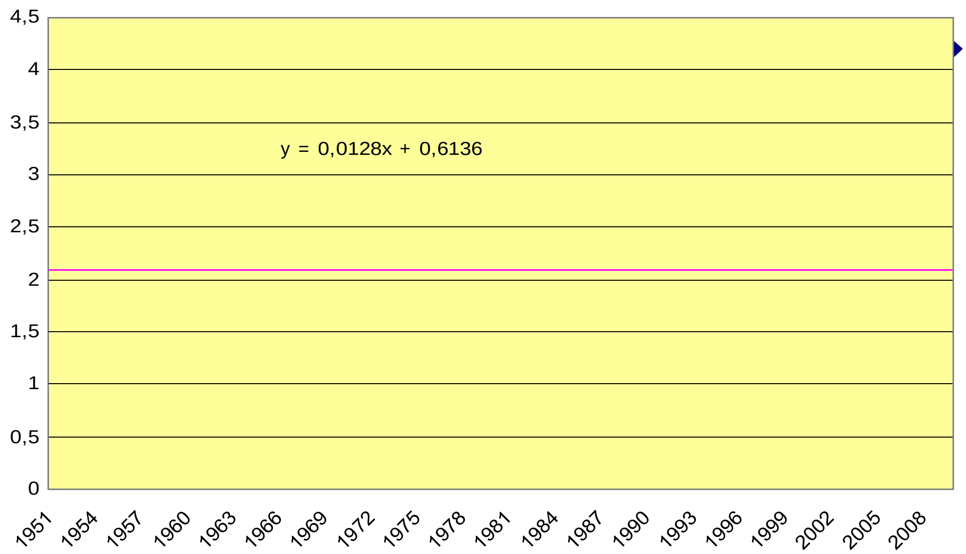
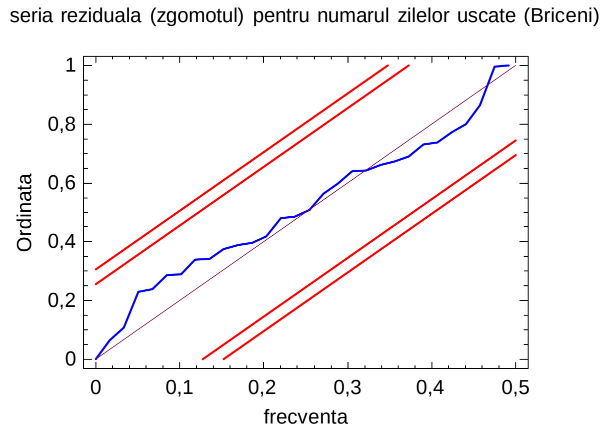


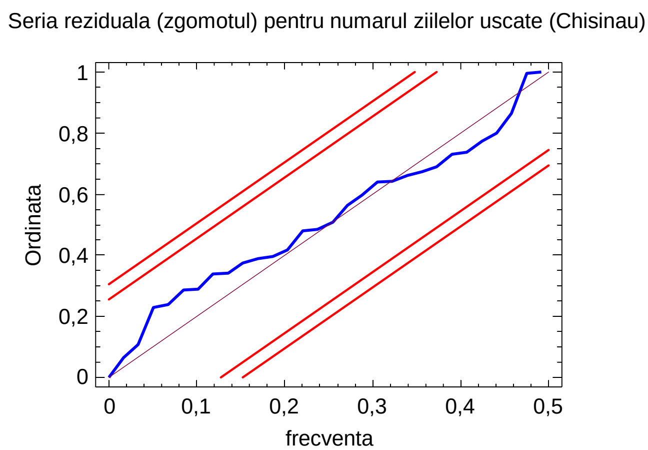
Fig.1. Temporal evaluation of Dry Periods Index (*Izu*) from Republic of Moldova's territory (a-Briceni, b-Chişinău, c-Cahul)

Calculation of residual part of time series and presentation of confidence level show us that they represent random noise of aleatory process of dry days manifestation on Republic of Moldova's territory (fig.2 a, b, c).

a


seria reziduala (zgomotul) pentru numarul zilelor uscate (Briceni)
Ordinata
frecventa
0
0,2
0,4
0,6
0,8
1
0
0,1
0,2
0,3
0,4
0,5

b


Seria reziduala (zgomotul) pentru numarul ziilelor uscate (Chisinau)
Ordinata
frecventa
0
0,2
0,4
0,6
0,8
1
0
0,1
0,2
0,3
0,4
0,5

c

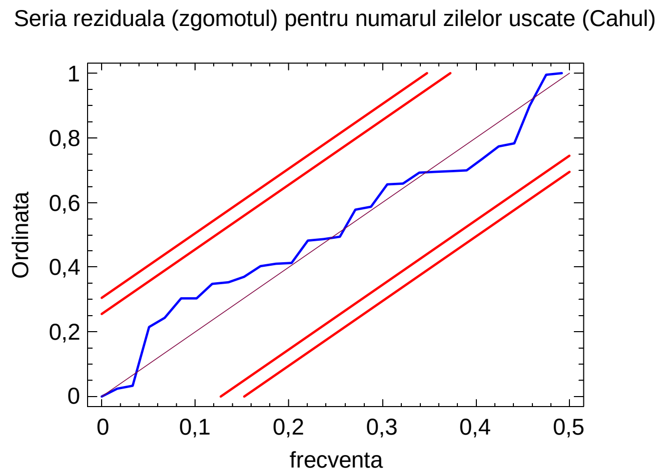
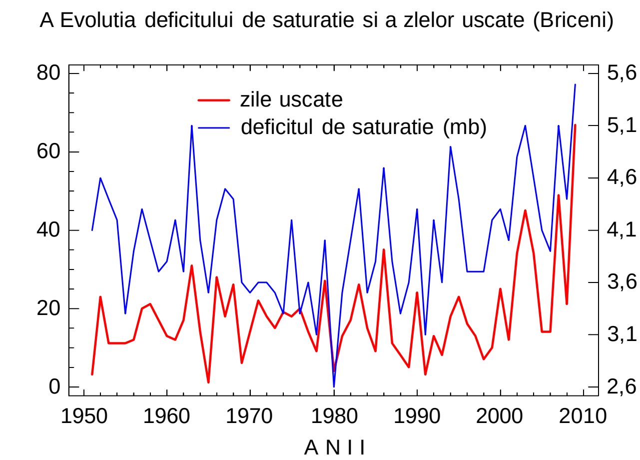


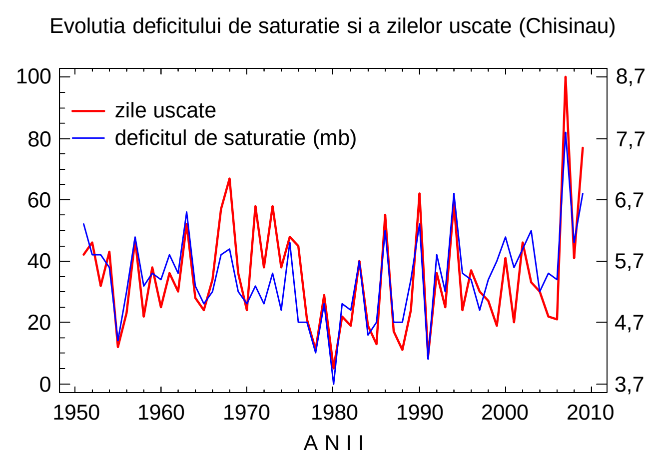
Fig.2. Residual series analysis for dry days on Republic of Moldova's territory (a-Briceni, b-Chişinău, c-Cahul)

Estimation of simultaneous evolution of saturation deficit duration (mb) with dry periods number indicates at increasing values of these two climatic components, starting with 80s XX century, and up till the end of the first decade of XXI century more essential values on practically whole republic's territory were registered (fig.3).

Correlation of annual values of saturation deficit with number of dry days indicates a close correlative link between these two parameters (0.8) on the whole of republic's territory.


A Evolutia deficitului de saturatie si a zlelor uscate (Briceni)
zile uscate
deficitul de saturatie (mb)
0
20
40
60
80
2,6
3,1
3,6
4,1
4,6
5,1
5,6
1950
1960
1970
1980
1990
2000
2010
A N I I

b


Evolutia deficitului de saturatie si a zilelor uscate (Chisinau)
zile uscate
deficitul de saturatie (mb)
0
20
40
60
80
100
3,7
4,7
5,7
6,7
7,7
8,7
1950
1960
1970
1980
1990
2000
2010
A N I I

c

Evolutia deficitului de saturatie si a zilelor uscate (Cahul)

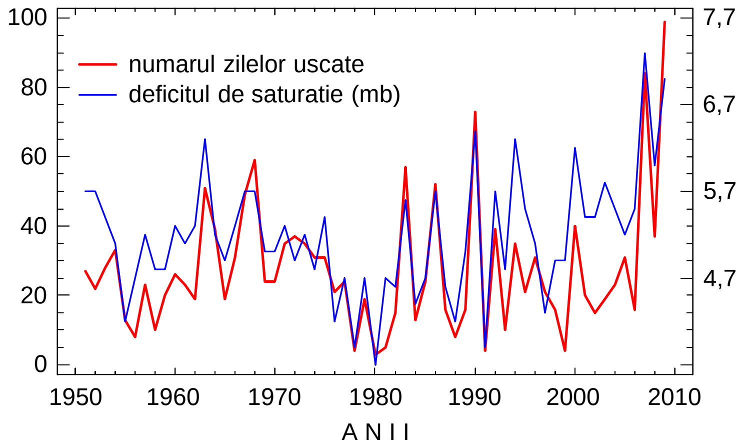


Fig.3. Evolution of saturation deficit (mb) and dry days on Republic of Moldova's territory (a-Briceni, b-Chişinău, c-Cahul)

Identification of increased frequency of dry periods with humidity deficit especially in first years of XXI century is quite important for aridization mitigation for the period of agricultural plants growth and development, for emplacement and ameliorative decision-making.

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ASSESSMENT OF LANDSLIDE DISTRIBUTION AND TERRITORIAL DYNAMICS WITHIN THE CĂLĂRAŞI KEY SECTOR USING GIS

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Ercanoğlu Murat –Geological Engineering Department, Hacettepe University, Turkey
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Sîrodoev Igor – Institute of Ecology and Geography, Moldova

Resumé L'étude représente une analyse détaillée de la propagation des glissements de terrain sur un secteur clé, dans le district de Călăraşi - une zone fortement touchée par les processus de versant. L'analyse était basée sur les cartes topographiques à l'échelle 1: 25 000 (année 1970) et images orthophoto (année 2007) avec une résolution de 40 cm et les recherches sur le terrain. Avec l'utilisation du SIG on a évalué l'influence de la lithologie, les conditions géomorphologiques et l'utilisation des terres sur la dynamique temporelle et répartition spatiale des glissements de terrain. Grâce à ces techniques ont été déterminé le nombre de glissements de terrain (104) et leurs principales caractéristiques (superficie, type, l'impact sur les communautés, etc.).

Cuvinte-cheie : alunecări de teren, Podişul Codri, sectorul Călăraşi.

Introduction

Landslides occur on the entire territory of the Republic of Moldova. This process is manifesting in the hilly area more frequently though, first of all, in the central part of the Republic of Moldova, known as Codrii Heights (*Podişul Codrilor*) or Bâc's Codrii (*Codrii Bâcului*), Bâc's Codrii Massif (*Masivul Codrilor Bâcului*). At present, landslide frequency is about 40-50 landslides/100 sq.km within Bâc's Codrii. Landslides cause significant material losses every year, destroying houses, roads, industrial buildings, agricultural lands etc.

The present study is realized within the project "Landslide Susceptibility Assessment in the Central Part of the Republic of Moldova", sponsored by NATO within the Science for Peace Programme (Project no. SfP-983287, launched on March 25, 2009). The project is being realized at the Institute of Ecology and Geography within the labs of Landscape Science and Dynamic Geomorphology in collaboration with Geological Engineering Department of Hacettepe University, Ankara, Turkey. Project's general objectives are the following:

- Development of landscape research methodology, using remote sensing methods and geoinformation technologies;
- Landslide inventory and description;
- Assessment of landslide triggering factors;
- Development of the landslide susceptibility map for Codrii region, using various methods, and evaluation of its accuracy;
- Delivering the information to the final user (Civil Protection and Emergency Situations Department), with the aim of decision-making and proposing recommendations for diminishing landslide impact on economy, environment and human lives (Boboc N.,. Ercanoglu M., et al. 2009).

The object and research methods

In the current work we are analyzing territorial distribution and dynamics of landslides in the Călăraşi key sector, depending on natural conditions and land use types.

Assessment of landslide distribution can be made depending on various triggering factors. There are many classification schemas of landslide causes. U.S. Department of the Interior, U.S. Geological Survey (Lynn M. Highland, Peter Bobrowsky, 2008) groups them into three main categories:

1. Geological causes
2. Morphological causes
3. Human causes

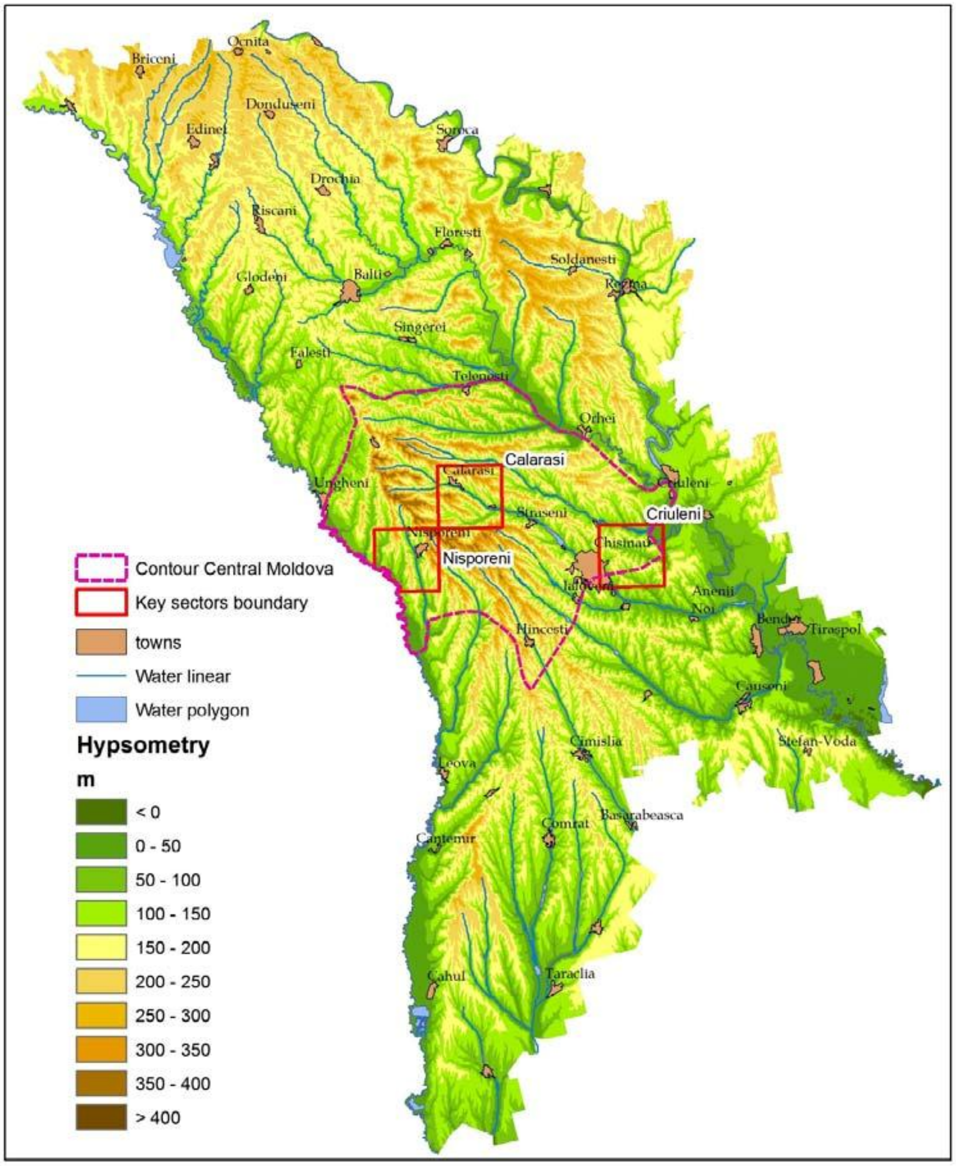


Figure 1. Study area and the key sectors

The very first assessments of landslide distribution on the Republic of Moldova's territory were made at the beginning of XXth century by O.K. Lange (1916) and T. Poruchic (1917) linking those to geological factors.

Since 1960-1970 much more works have been appearing (S. Orlov & T..Ustinova, 1969; S. Orlov & Timofeeva, 1974; E. Miţul et al., 1990; Sîrodoev Gh. et al., 2009, etc.), which examine influence of geological structure and hydrogeological peculiarities on the landslide occurrence and evolution on the entire territory of the Republic of Moldova or consider this process as a natural risk phenomenon in certain regions or administrative unitsThe very first assessments of landslide distribution on the Republic of Moldova's territory were made at the beginning of XXth century by O.K. Lange (1916) and T. Poruchic (1917) linking those to geological factors. Since 1960-1970 much more works have been appearing (S. Orlov & T. Ustinova, 1969; S. Orlov & Timofeeva, 1974; E. Miţul et al., 1990; Sîrodoev Gh. et al., 2009, etc.), which examine influence of geological structure and hydrogeological peculiarities on the landslide occurrence and evolution on the entire territory of the Republic of Moldova or consider this process as a natural risk phenomenon in certain regions or administrative units.

Analyzing any hazard, five categories of informational sources can be mentioned (Rădoane M. & Rădoane N., 2007):

1. Professional literature;
2. Existing maps;
3. Aerophotograms, orthophotoplans;
4. Field research;
5. Sampling and lab testing.

Geological features of the studied area were analyzed using 1:50000 geological maps, bibliographical sources and field research. In order to evaluate the role of disjunctive tectonic structure in landslide occurrence and dynamics geological map, landslide distribution map and tectonic faults map were analyzed together.

Morphometric features of the relief were analyzed using digital elevation model generated (DEM) as a result of digitizing topographic maps published in 1970. Slope angle and slope aspect maps were derived from this DEM. Thus, territorial distribution of landslides was analyzed in relation with these morphometric features.

Land use was assessed using topographic maps for 1970 and Landsat5 TM satellite images for 2004.

Landslide distribution analysis was realized using 1:25000 topographic maps (for 1970) and 40-cm resolution orthophotographic images for 2007; the accuracy of remotely sensed data was checked in the field.

The objective of this study consists in the assessment of landslide distribution depending on geological and geomorphologic features and land use peculiarities within the Călăraşi key sector.

Lithology and landslide frequency

Special role in the formation of contemporary relief of the Călărași key sector is played by friable Sarmatian rocks represented mainly by clays and sands (Figure 2). Sands with alluvial gravel (in southern part of the region) and younger deltaic ones dominate on the interfluves.

Floodplain bedrocks and lower segment of the slopes of Bâc River valley and its tributaries is composed of Middle Bessarabian deposits, represented by clayey rocks. Middle Bessarabian cover deposits are situated at 100 m altitude close to Bucovăţ town and about 200 m in the Călărași town area.

Middle part of the slopes is composed of sands, clays, aleurites with thin intercalations of Upper Bessarabian oolitic limestone; these strata are up to 80 m thick.

The upper part of the slopes and interfluves at the altitude 220-345 m are composed of rhythmical series of Khersonian-Meotian clayey-sandy deposits. Cross-stratified sands contain, sometimes, lenses of sandstone. In the upper part they gradually shift into fine-granulated clayey sands and aleurites. Maximal thickness of Khersonian-Meotian deposits reaches up to 120 m.

Hill ranges with elevation of 340-380 m are composed of the alluvial deposits of the lower part of Middle Kimmerian, represented by Stolniceni series (XVIth terrace) on the interfluves Recatău – Bîc, to the north of Horodişte village. Variously granulated sands and lenses of gravel and conglomerates with small buckets are 3-10 m thick (Bukatchuk et al., 1979). Compact clays and aleurites are represented by floodplain facies of up to 40 m of total thickness.

Deposits of the upper part of Middle Kimmerian, represented by *Călăraşi series* (XVth terrace), are located on the interfluves Bâc–Ichel; they are constituted of sands and gravel with inclusions of the buckets of

Carpathian jasper and silica fragments and sandstones, of 4-7 m thick, attributed to the riverbed facies (Bukatchuk et al., 1983). Floodplain facies overlays these deposits, being represented by semi-compact aleurites 2-2.5 m thick and clays of 1-1.5 m thick. In the majority of cases sands outcrop on the interfluves, where they are covered just by contemporary soils. Elevation of their surface constitutes 295-327 m.

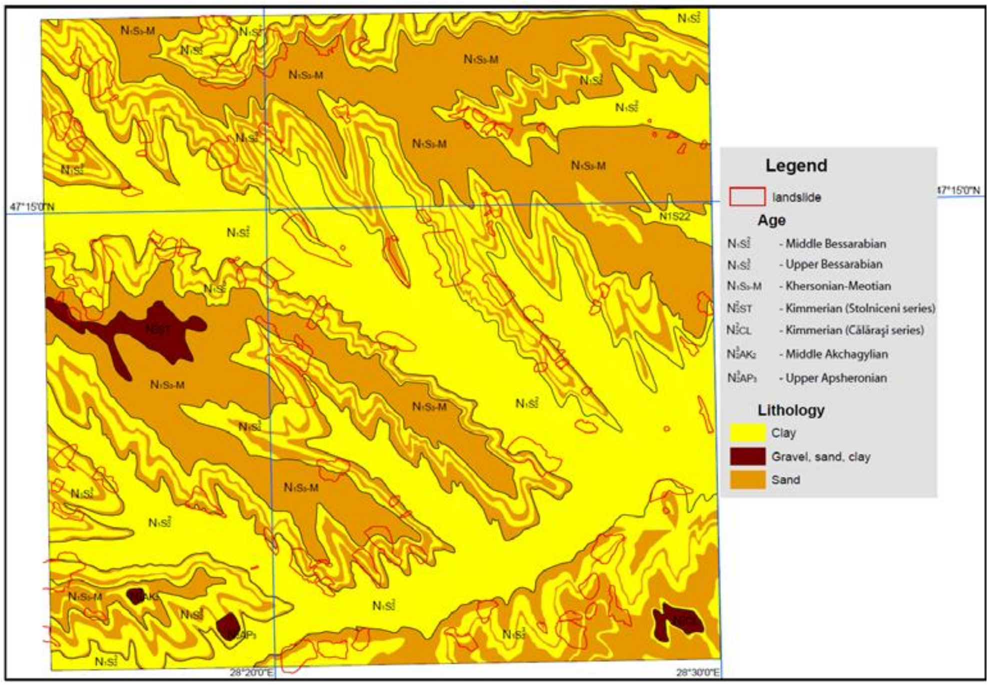


Figure 2. Geological map

Middle Akchagylian Hruşova deposits (XIth terrace) are presented on the Răcătău-Bucovăţ interfluve. They are mainly represented by a riverbed facies composed of sand strata with small granules (1-2 mm in diameter) and strata of fine-granulated sand, floodplain aleurites and sandy clays. Sand strata are about 12-15 m thick, while clays reach up to 1 m in thickness. Elevation of the base of these alluvial deposits is of 297 m.

Lithological structure has a significant influence on landslide distribution (Figure 2). Thus, 4 landslides occur in Khersonian-Meotian sands, 10 – in Middle Bessarabian clays, 2 – in Kimmerian alluvial deposits, while 88 – on the slopes composed of intercalations of Upper Bessarabian sand and clay. The great majority of the landslides (90%) occur in clays, having Middle Sarmatian or Khersonian-Meotian clays in their upper part. Translational landslides (94.2%) dominate among the modes of movement.

Relief morphometry and landslides

Bâc's Codrii are the highest relief unit in Moldova, having the highest altitude of 429 m (Bălăneşti hill) and average elevation of 177 m (Figure 1); it also has the highest relief energy varying from 200 m up to 330 m. Average slope angle is 7.5°, while the extreme values exceed 30°. Fragmentation density has significant values as well, varying between 1.0 km/sq.km and 5.1 km/sq.km, with an average of 2.3 km/sq.km.

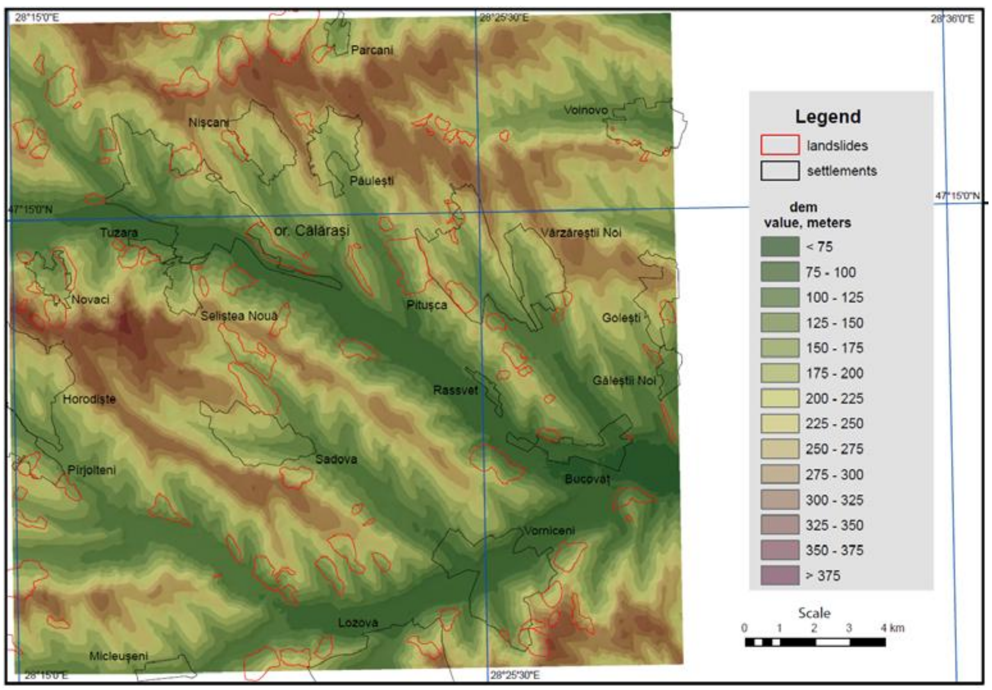


Figure 3. Landslide distribution by elevation

Elevation varies within Călăraşi key sector from 67 m (in the Bâc River floodplain) up to 384.1 m (Seliştea Nouă hill) (Figure 3). Average elevation constitutes 195 m. About 2/3 of the sector's surface is situated between 100 m and 250 m. The great majority of landslides (89 from 104) are situated between these elevation levels as well (Figure 4): mainly, landslides are located within the range 150-200 m (36 landslides); 8 landslides are located at the altitudes higher than 250 m, and 2 of them are situated below 100 m.

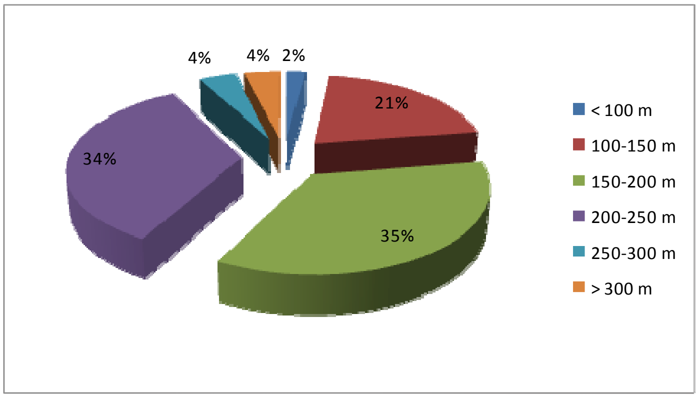


Figure 4. Landslide distribution by elevation levels

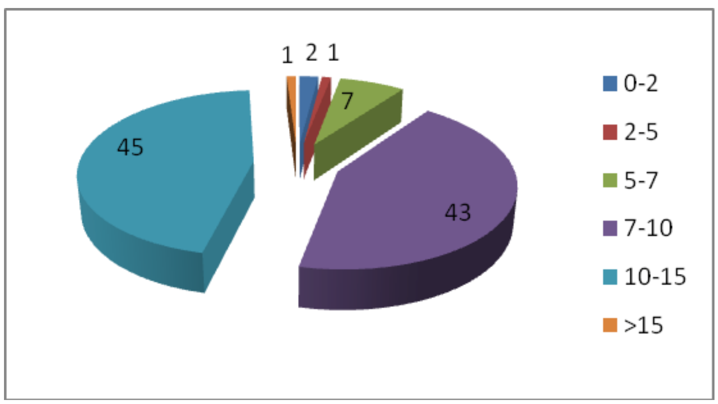
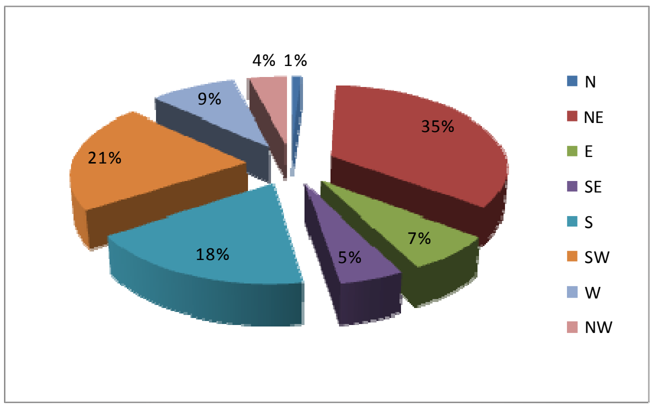


Figure 5. Landslide distribution by slope angles

Slope angle in the sector varies within large limits. Average slope angle constitutes 7.5°, while the extreme values reach up to 32.2° (to the north of Nişcani village). The highest landslide frequency (90%) was observed on the slopes with angles varying between 7° and 15° (Figure 5).

South-western (19.1%), north-eastern (17.4%), eastern (14.1) and southern (14%) slopes dominate the sector. North-eastern slopes are more susceptible to landslides: here 35% of all landslides are situated. A high landslide frequency was observed on south-western (21%) and southern (18%) slopes (Figure 6).



Land use

Orthophotographic images served for the analysis of the actual structure of the land fund and landslide distribution by different land categories. In 2004, more than 2/3 of the sector's area was represented by anthropogenized and anthropic lands. Natural and semi-natural categories of lands (pastures, waters and forests) represent 31.3% (Figure 7**).**

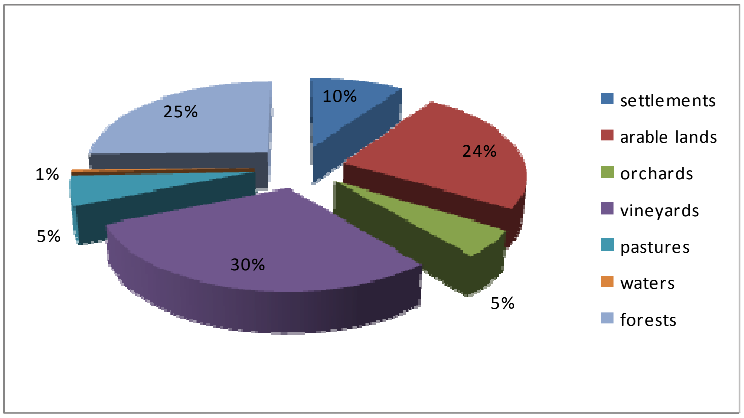


Figure 7. Land use in Călăraşi key sector

Among all the land use types perennial plantings occupy the first place embracing more than 1/3 of all landslides (Figure 8). The big number of landslides on these land use types is explained by both morphometric characteristics (high slope angles) and deep plowing. Many landslides (24%) occur on arable lands; the fact that does not contribute to their stabilization.

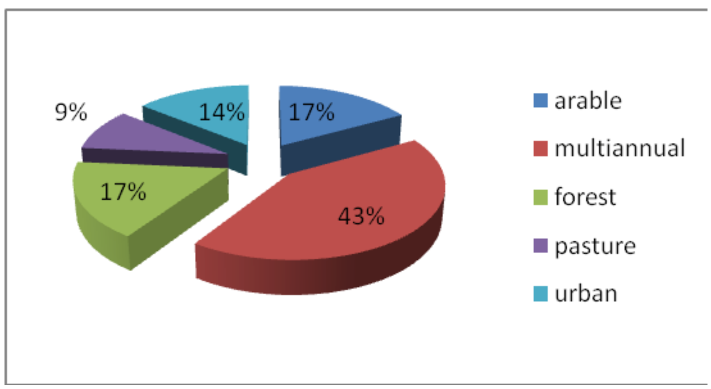


Figure 8. Landslide distribution by land use types

The same number of landslides is observed on forested lands, which were forested in 1970-1980s, being eliminated from agricultural circuit. Landslides, on which various buildings are situated, are the most dangerous. There were identified 10 such landslides: 3 in Voinovo village, 1 in Pituşca village, 2 in Călăraşi town, 1 in Vorniceni village, 1 in Lozova village and 2 in Novaci village. These landslides can cause significant material losses, and even casualties.

Land use change and landslide distribution.

As a result of analysis of 1:25000 topographic maps for 1970, in Călăraşi key sector 185 landslides were identified. Their total area constituted 3.4 sq.km or about 1% of the sector's total area. After analyzing orthophotographic images from 2007, there were identified just 104 landslides, having the total area of 25.5 sq.km, or 7.3% of the sector's area. The obtained difference can be explained mainly by the quality and precision of the used cartographic materials.

Land use change was analyzed using the same sources (Figure 10). Important changes, frequently qualitative, took place in land use between 1970 and 2004 (Figures 11 and 12): forest areas have extended by 9.3%, while arable lands and pastures have diminished by 10.7%, orchards – by 5.5%. Among the negative changes, which would have influenced landslide activation, one can mention extending of settlement territories from 5.3% to 9.6% and vineyards from 16% to 25.3%. The area covered by perennial plantings still remains relatively large; it concentrates the highest number of landslides (45) as well.

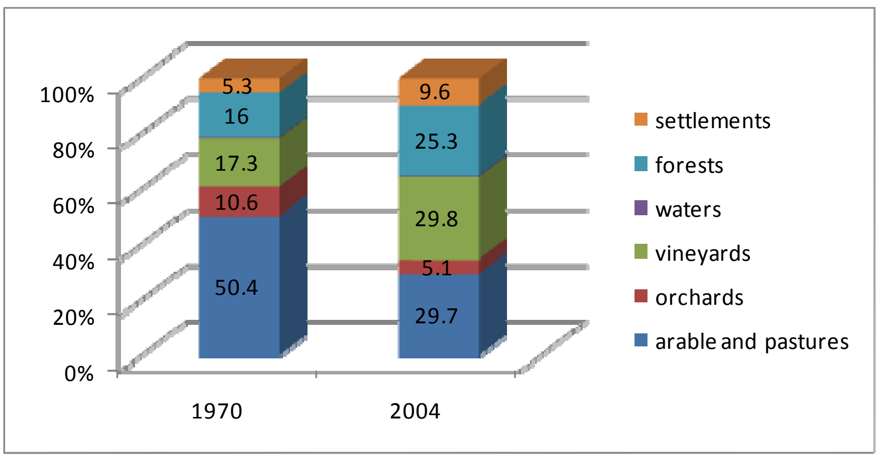


Figure 9. Land use change between 1970 and 2004

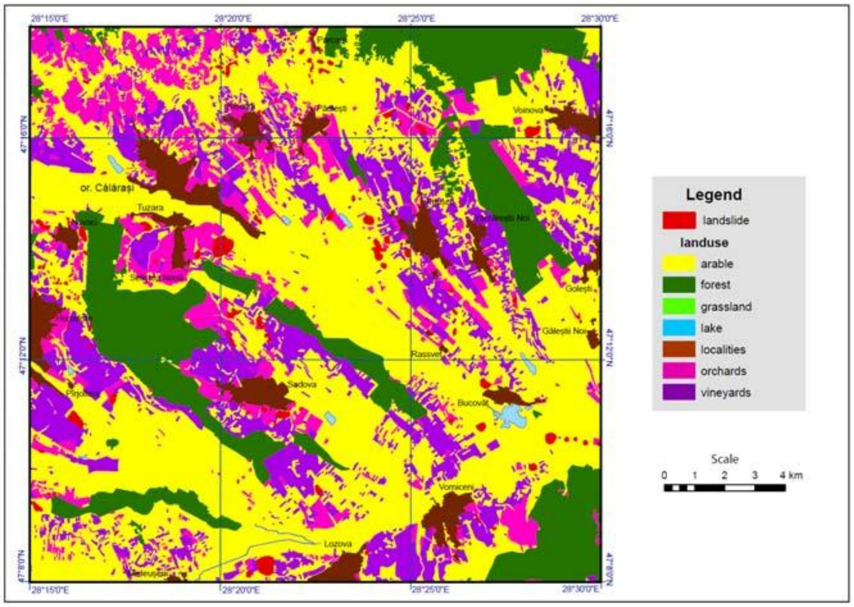


Figure 10. Land use in 1970 (after 1:25000 topographic map, 1970)

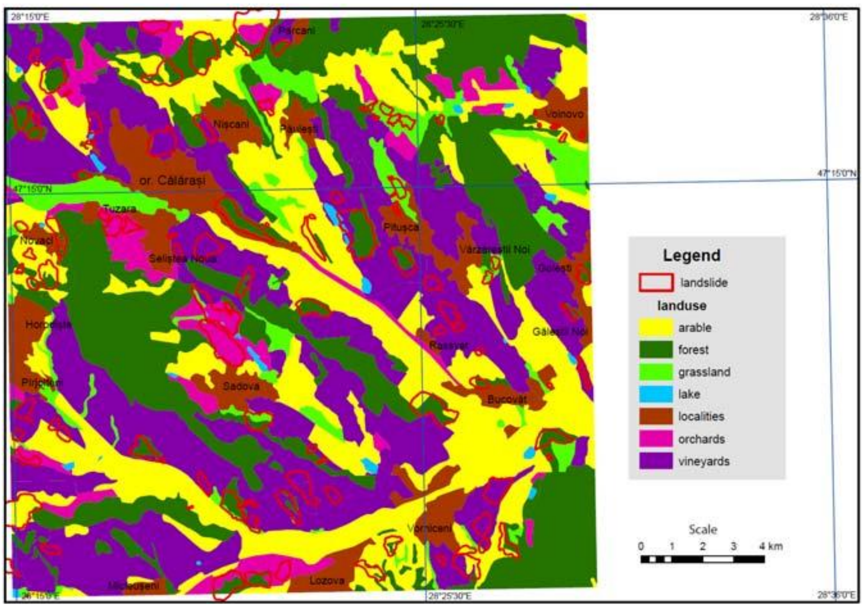


Figure 11. Land use in 2004 (after Landsat5 TM, 2004)

Conclusions

Totally, 104 landslides were identified within Călărași key sector. The great majority of them are attributed to the slope sectors, composed of Bessarabian rocks. The landslides located in the upper parts of the slopes are the biggest (about 23 ha); translational landslides dominate among all the modes of movements.

From the viewpoint of morphometric features the great majority of the landslides (89 of 104) are located within the elevation range of 100-250 m: altitudes 150-200 m are characterized by the highest value of landslides (36). North-eastern and south-western slopes have the highest share of landslides, 35% and 21% respectively.

Perennial plantings dominate, with 45 landslides, other land use types. High figure on this particular type is explained by both morphometric characteristics (high slope angles) and by deep plowing. Many landslides (18) were observed within arable lands, the fact that does not contribute to their stabilization. Landslides with buildings on them are particularly dangerous; 10 such landslides have been identified within the sector. These landslides can cause significant material losses, and even casualties.

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AUTOMATIZAREA CALCULULUI SCURGERII MAXIME, PE BAZINE HIDROGRAFICE MICI, PROVENITĂ DIN PLOI TORENŢIALE, PRIN INTERMEDIUL ArcGis

Bilaşco Ştefan

Academia Română-Filiala Cluj Colectivul de Geografie

Rezumat

Calculul scurgerii maxime provenite din ploi torenţiale a făcut obiectul a foarte multe studii şi cercetări datorită complexităţii fenomenului şi modului de manifestare a acestuia. Pe suprafaţa bazinelor hidrografice mici fenomenul de scurgere maximă se manifestă violent cauzând de la distrugeri ale teritoriilor afectate până la pierderi de vieţi omeneşti. Pentru calculul scurgerii maxime pe bazine hidrografice mici s-au adoptat o serie de formule dintre care cea mai utilizată este formula raţională. Calculul, clasic, cu această formulă este greoi şi se realizează în timp îndelungat, de aceea am propus automatizarea acestuia utilizând şi valorificând bazele de date spaţiale GIS realizate pentru un anumit teritoriu. Prin utilizarea tipurilor de analiză spaţială de tip vector, raster, vector-raster, a ecuaţiilor de analiză spaţială, am reuşit realizarea calculului coeficienţilor de scurgere şi debitului maxim precum şi spaţializarea teritorială a valorilor celor două entităţi spaţiale stocate sub formă de straturi GIS utile în procesul de analiză spaţială ulterioară şi luare a deciziilor.

GEOINFORMATIONAL TECHNOLOGIES IN AGRICULTURE OF REPUBLIC OF BELARUS

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Summary

In the article considered are problems of creation and application of geoinformation systems (GIS) in agriculture. In the elaborated GIS project created are electronic soil and agrochemical maps, plots of land maps, maps of land-utilization restrictions, a. o. Substantiated are approaches to the electronic maps' use with the purpose of precision land-utilization, agriculture crops location, cadastral assessment of lands.

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SOIL QUALITY AND POTENTIAL OF PEDO-GEOGRAPHICAL UNITS

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Rezumat

Condiţiile geo-climatice specifice ale Republicii Moldova permit divizarea ei in trei zone pedo-geografice. Zona de nord include Platoul Moldovei de Nord, Podişul Nistrului si Cîmpia Balţului; zona centrală este prezentată de Podişul Codrilor; zona de sud include Cîmpia Moldovei de Sud. Toate zonele se caracterizează printr-un înveliş de sol complex şi potenţial pedologic divers. În cadrul zonelor se evidenţiază opt districte şi paisprezece raioane cu şapte sub-raioane pedo-geografice.

THE ELABORATION OF THE LECTURES COURSE ON THE SUBJECT ,, MODERN TECHNOLOGIES IN THE DOMAIN OF THE LAND GAUGES FOR THE DISTANCE EDUCATION"

Mihai Turculeţ, Sergiu Popescul, Sergiu Cucorean, State Agrarian University of Moldova, Chisinau

Summary

The contemporary society is in permanent regeneration. This problem dictates to the higer education certain requirements to the higher education certain requirements, that must be solved in a limited period. In this context have appeared different difficulties concerning the assimilation of the material by the students. For these reasons the authors tried to elaborate in the pilot phase a lectures course in video moulded for the distance education at the subject ,,Modern technologies in the area of land mesures"