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APPLICATION OF SOIL LOSS SCENARIOS USING THE ROMSEM MODEL DEPENDING ON MAXIMUM LAND USE PRETABILITY CLASSES. A CASE STUDY

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ABSTRACT. - Application of Soil Loss Scenarios Using the ROMSEM Model Depending on Maximum Land Use Pretability Classes. A Case Study. Practicing a modern agriculture that takes into consideration the favourability conditions and the natural resources of a territory represents one of the main national objectives. Due to the importance of the agricultural land, which prevails among the land use types from the Niraj river basin, as well as the pedological and geomorphological characteristics, different areas where soil erosion is above the accepted thresholds were identified by applying the ROMSEM model. In order to do so, a GIS database was used, regrouping quantitative information regarding soil type, land use, climate and hydrogeology, used as indicators in the model. Estimations for the potential soil erosion have been made on the entire basin as well as on its sub-basins. The essential role played by the morphometrical characteristics has also been highlighted (concavity, convexity, slope length etc.). Taking into account the strong agricultural characteristic of the analysed territory, the scoring method was employed for the identification of crop favourability in the case of wheat, barley, corn, sunflower, sugar beet, potato, soy and pea-bean. The results have been used as input data for the C coefficient (crop/vegetation and management factor) in the ROMSEM model that was applied for the present land use conditions, as well as for other four scenarios depicting the land use types with maximum favourability. The theoretical, modelled values of the soil erosion were obtained dependent on land use, while the other variables of the model were kept constant.

Key-words:*ROMSEM model, land favourability, G.I.S. modeling, scenario, Niraj basin*

1. INTRODUCTION

As a consequence of technological development and the socio-economic and political changes, land use has suffered dramatically changes on the Romanian territory, changes that the authors believe to be still in progress due to the present European Union enlargement and to the Common Agricultural Policy Reform. The modification tendencies of the agricultural surfaces are driven by the technological, climatic, hydrologic changes and so forth. The purpose of the present geomorphological analysis is to focus on the soil erosion process and the land use analysis with an emphasis on identifying which type of land use would be suitable in the agricultural areas in order to improve degraded soils.

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Processes such as erosion, torrentiality and sedimentation are damaging the soil cover by physical and chemical modifications of characteristics, most of the times in an irreversible manner. When an erosion process triggers important qualitative transformations to the soil cover, the “accelerated erosion” term is employed (“anthropic erosion” for the cases in which human activities play a main role due to massive deforestation or irrational agriculture) (Ioniță, I., 2000).

The hydrologic regime of rivers has changed and an increased degree of torrential processes on the upstream tributaries can be identified, phenomena due to the lately massive deforestation (Roșca et al., 2012). Hence the river transport capacity is increasing and a larger quantity of sediments is transported, constituting the river’s sediment discharge. The close link between soil erosion and river turbidity in Romania has been studied as early as 1971 by Diaconu, C. et al.

Many times in the existing scientific literature the syntagm „admissible/tolerated erosion” can be encountered, the term denominating the existing erosion due to agricultural practices, without having an impact on the further agricultural development. In order for this to happen, a series of general rules are needed: the soil layer must be deep enough to ensure production in agriculture and forestry for a long period of time, hence the erosion effects have to be taken into account for every soil class and every soil type (Băldoi, V., Ionescu, V., 1986).To prevent riverbed clogging as well as large sedimentary deposits near bridges, roads, or on low terrains, soil erosion has to be minimal. It also has to be maintained under the level from which in-depth erosion begins.

Moțoc, M. (1983) mentions that the Romanian territories presenting a steeper slope than 5° are subject to erosion. In the present case, for the Niraj River basin, the surfaces characterised by a slope greater than 5° represent 65.43% out of the total surface.

2. ESTIMATING SOIL EROSION BY THE ROMSEM MODEL

The universal equation of soil erosion (U.S.L.E.) was elaborated and published in 1965 by Wishmwier and Smith in Agriculture Handboook No. 537 and suffered modifications in 1997, by Renard and Foster: R.U.S.L.E. (Revised Universal Soil Loss Equation).

The GIS technology makes use of several useful tools created for the study purpose: Moore and Wilson, 1992, Mitasova et al., 1996, Filip, 2008. In the international scientific literature Zigg, R., W., 1940 proposes a mathematical model based on the relationship between the slope length and its value expressed in degrees. More enhancements were subsequently brought by D.D., Smyth, 1941, Browning et al., 1947, Lloyd and Eley, 1952. According to the research done by Morgan R. P. C. et al., 1998, the American model for quantitative soil erosion evaluation has been adapted to the European specific conditions, hence the EUROSEM (The European Soil Erosion Model) was created.

The ROMSEM Model (Romanian Soil Erosion Model) has been generated by the use of an empirical model (determined from a series of statistical databases) for the Romanian territory. It has at its foundation the equation developed by Moțoc, M. et al. (1973, revised in 1979, reconfirmed in 2002) which is based on the universal relationship used by the Soil Conservation Service in the USA, taking at the same time into consideration the climatic conditions from Romania.

2.1. Database and Methodology

Taking into consideration that the employed equation has a general form, there exists the need for an objective quantification of values for each of the factors taken into account according to the specificity of the analysed territory.The database consists of vector primary entities (representing the soil, land use, water divide) and raster entities (the Digital Elevation Model (DEM), the erosion coefficient established on the basis of rain erosivity, correction coefficient for anti-erosion works), as well as derived data (correction coefficient for soil erodibility, crop/vegetation and management factor, correction coefficient for the effect of anti-erosion works, slope length (m) and slope angle (%). Obtaining the database composed of these several coefficients waspossible via a series of methodological steps which are described in the lines that follow (Fig. 1).

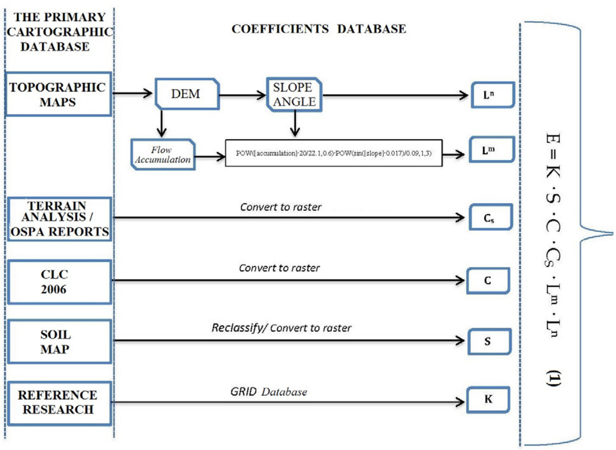

Fig. 1. Stages of model application for determining soil erosion.

where,
E- mean annual erosion (t/ha/year)
K- Erosivity coefficient established on the basis of climate erosivity
S- Correction coefficient for soil erodibility
C- Correction coefficient for cover-management factor and vegetation characteristics
Cs- correction coefficient for the effect of anti-erosion works
Lm- Slope length (m)
In- Slope angle (%)

In order to obtain the primary database, the water divide was delineated from the topographic maps 1:25000, maps that had been previously georeferenced in the Stereo 70 system. The hydrological network and the contour lines needed for the DEM generation at a resolution of 4 meters were obtained as well.

2.1.1. Rainfall erosivity

The coefficient of rainfall erosivity for the Niraj river basin has a value of 0.127 (Fig.2.A), a value determined by Moţoc, M., et al. in 1970 (Florea et al., 1989) on the basis of experimental parcels at the Perieni and ValeaCălugărească Research Stations. This indicator takes into account the combined effect of torrential rain and surface flow computed as a product of rainfall quantity and the intensity of the rainfall event's centre, the latter having a 15 minute duration. The coefficient of rainfall erosivity was extracted from the *Rainfall Erosivity Map in Romania* by LiviaDrăgan and P. Stănescu, 1970.

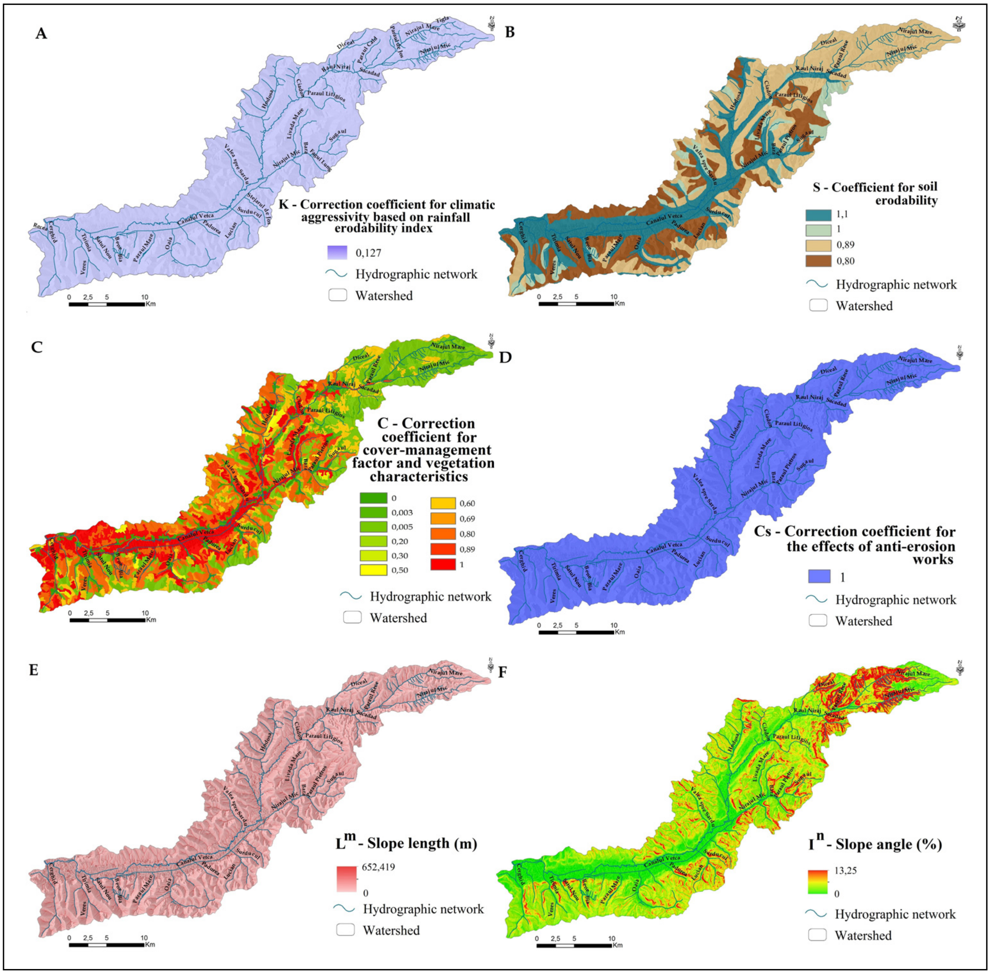

Fig. 2. The cartographic data base used in the modelling process

2.1.2. Soil erodibility

In order to establish the soil erodibility coefficient, several characteristics have been taken into account: the genetic type of soil, the erosion degree, the texture. The values of the Romanian Soil Erodibility Classification (M., Moţoc, 1975) have been employed. The different types of soil were vectorised from the Romanian Soil Map 1:200000 and the soil classes were modified in accordance with the Romanian System of Soil Taxonomy 2003 (Florea and Munteanu, 2003). The values of the factors were determined by taking into account the Romanian pedo-climatic characteristics and have values between 0.8 and 1.1 (Fig. 2.B).

2.1.3. Correction coefficient for cover-management factor and vegetation characteristics

The crop/vegetation and management factor is computed in geomorfological, hydrological and pedological studies as the anti-erosion role that the vegetation has is a widely known. Wanting to use databases as recent as possible so as to establish the correction coefficient for the crop/vegetation and management factor for the entire basin the land use data was used, namely the land use was vectorised from the existing ortophotographs from 2005. The values given to the parcels range from 0, for the urban and industrial areas, to 1, for arable land (Fig. 2.C).

It is known that a crust reducing the soil infiltration exists on the terrains sown with plants that are in an incipient stage of growth. In the study area the arable land surfaces are predominant in the middle and inferior sectors of the basin where a high productivity is registered for corn, wheat and vegetables. This coefficient indicates the soil erosion for every land use category in connection to the surface it occupies, the existing topography, the degree of vegetation development and the agricultural management. The forest assures a high anti-erosion protection due to the tree leaves and the water consumption in the evapo-transpiration process, giving away step by step the water volume resulted from snowmelt. The transition areas occupied by bush shrubs and pastures offer a medium protection, while the arable or cultivated lands have a low anti-erosion protection factor.

2.1.4. Correction coefficient for the effect of anti-erosion works

The positive effects of anti-erosion works are well known on the Romanian territory. When it comes to the study area, however, after having verified the real situation on the terrain, it has been concluded that such works are confined to certain arable strips of land along the contour lines on very small areas. Hence the correction coefficient for the effect of anti-erosion works has the value of 1 (Fig. 2.D).

2.1.5. The topographic factor

This topographic indicator takes into account the length of slope and its inclination. The longer the slope, the greater the water volume drained and its speed, hence the erosive effect of drainage increases (Desmet et al. 1996).

The length coefficient of slopes has been computed with the help of the ArcInfo software, using the formula proposed by Mitasova et al., 1996.

POW([accumulation]·20/22.1,0.6)·POW(sin([slope]·0.017)/0.09,1,3), where
Accumulation – Drainage accumulation
20 – raster resolution
0.6,1.3,22.1,0.017 – experimental coefficients (Moore, I.D., Wilson, J.,P., 1992)
Slope - Slope angle (%)

The steepest path length is obtained on the basis of the Digital Elevation Model (DEM) via the Lm function, where m = 0.3 for the slope length shorter than 100 m and m = 0.4 for slope lengths bigger than 100 m. Hence the spatialisation of the Lm factor (slope length) has been computed in meters and displays values between 0 and 652 (Fig. 2.E).

The spatial repartition map of the In coefficient (slope angle), computed as percentage, has values between 0 and 13.2 % (Fig. 2.F). A higher slope determines a greater speed of drainage enhancing the erosion potential and vice-versa, a smoother slope slows down the water speed favouring the sedimentation process.

2.2. Sub-Basin Result Interpretation

Having had the entire database converted in a raster format, it was via the *Raster Calculator* function from *Spatial Analyst* extension that the value of potential soil erosion was computed for every pixel. Hence the value for the annual soil erosion in the Niraj hydrographic basin lies between 0 and 42.07 t/ha/yr (Fig. 3).

Making use of the GIS technology conclusions at the basin level can be drawn (Fig. 3), or interrogations can be done on some regions or sub-basins. For the detailed identification of soil erosion and its zoning, the units that have a relatively homogenous land use, slope and length of the hillside had been previously identified. Erosion was afterwards computed at this unit level in t/ha/yr.Analysing the entire river basin, counting 658 km2, it can be noticed that the largest area of 56.7% (373 km2) registers low values for mean erosion (between 0,5 and 1,5 t/ha/yr).This corresponds to the mountainous areas with a high degree of forestation, resistance to high erosion and a lower degree of anthropic interference.Erosion values between 0 and 1.5 t/ha/yr corresponding to 30% (197 km2) of the study area, characterise the basin divide covered by forests. 1.5-3 t/ha/yr over a 65 km2 area correspond to hillsides with higher slope values than 10%, where grasslands are predominant.

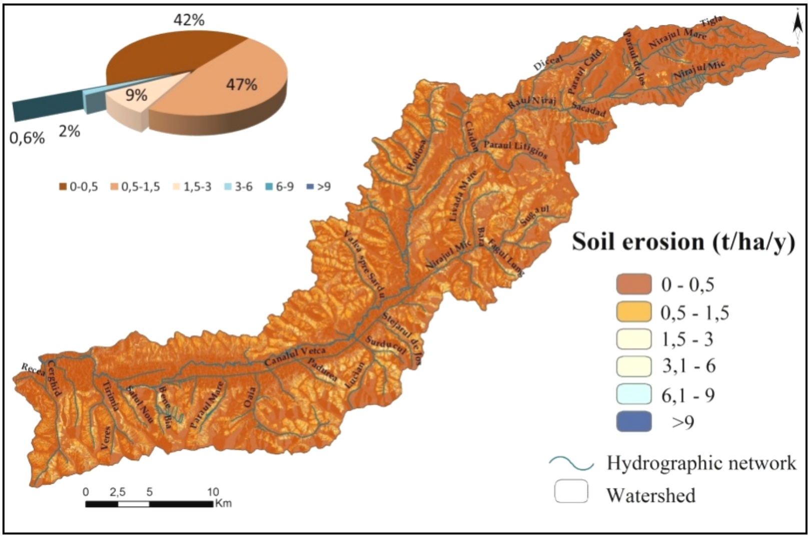

Fig. 3. Mean soil erosion computed via the RUSLE model

High erosion values >6 t/ha/yr characterise small areas, namely the higher degree slope areas and the deforested piedmont areas in the settlements' vicinity. The land use categories in these areas generally consist of arable land with no agro-techniques put into practice against soil erosion.

The low values in the areas with a smooth slope are noticeable and specific to the inferior Niraj river basin, a dense populated area with important built-up territory. The same values are characterising the mountainous area due to the increased resistance of soil to erosion process. Our attention will be further focused on the sub-basins' analysis, namely on those sub-basins where soil erosion values are superior to the admissible limits. The admissible limit for the Romanian territory according to Moţoc, M., et al., 1979 lies between 2 and 8 t/ha/yr.

Analysis at the sub-basin level depicts low values for soil erosion (for example on Nirajul Mic and Nirajul Mare sub-basins in the mountainous area) as well as values indicating soil erosion acceleration, for example in the Nirajul Mic II sub-basin, Pârâul Litigios, Săcădad, Pârâul Cald, etc. (Table 1, Fig. 4).

Table 1

Morphometric characteristics and erosional values at sub-basin level

Nr.	Sub - basin	Surface (km2)/%	H. Med.	H. max	C (km)	E mean (t/ha/an)	E max. (t/ha/an)	
1.	**Nirajul Mic**	25/3,8	1054	1544	2,08	0.051	12.4	**Mountainous basin**
2.	**Nirajul Mare**	39/5,9	1040	1402	1,74	0.050	13.5	
3.	**Nirajul Mic II**	44/6,6	945	1085	1,89	0.035	**34.7**	
4.	**Pârâul Cald**	10/1,5	833	1175	1,25	0.110	19.4	
5.	**Diceal**	13/2	813	1175	1,01	0.193	10.2	
6.	**Săcădad**	10/1,5	745	1026	1,38	0.119	**20.1**	
7.	**Aluniş**	8/1,2	648	1081	1,45	0.194	15.3	
8.	**Pârâul Litigios**	13/2	626	1082	1,35	0.239	**22.1**	
9.	**Ţigani**	10,4/1,5	555	911	1,41	0.473	16.9	**Hillside basin**
10.	**Ciadon**	9/1,4	520	618	1,53	0.121	10.0	
11.	**Bâra**	11,2/1,7	487	639	1,30	0.518	19.4	
12.	**Hodoşa**	38/5,0	461	617	1,52	0.355	9.34	
13.	**Văraticul**	20/3,1	432	583	1,27	0.389	15.7	
14.	**Zambo**	19/2,9	425	547	1,49	0.305	12.1	
15.	**Stejarul**	7/1,1	425	539	1,43	0.397	13.3	
16.	**Pădurea**	9/1,4	415	536	1,45	0.586	13.7	
17.	**Maiad**	10/1,5	406	507	1,40	0.399	9.6	
18.	**Valea spre Sardu**	31/4,7	405	424	1,42	0.443	13.1	
19.	**Oaia**	41/6,3	402	545	1,52	0.316	13.1	
20.	**Bogdan**	9/1,4	401	527	1,64	0.304	16.0	
21.	**Bene**	12/1,8	397	523	1,23	0.379	15.5	
22.	**Tirimia**	22/3,3	390	501	1,37	0.349	10.9	
23.	**Ceghid**	29/4,4	369	495	1,70	0.380	15.2	
	Bazinul Nirajului	658	523	1578	2,21	0.286	42.07	

where: % river basin percent out of the total basin surface, C – Circularity coefficient (km), H. max. – maximum height (m), H. med. – the basin mean height (m), E med – Mean soil erosion (t/ha/yr), E max – Maximum soil erosion (t/ha/yr).

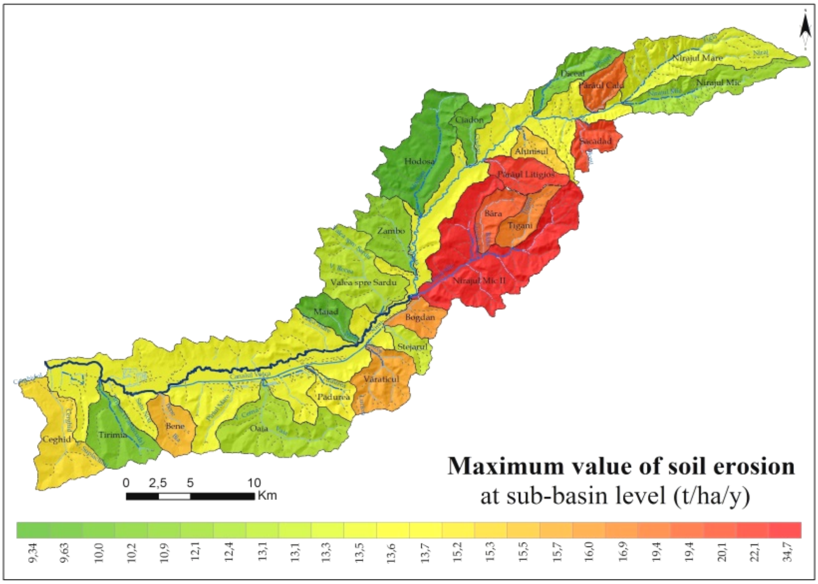

Fig. 4. Maximum soil erosion values at sub-basin level

At regional level, the influence of hillslope morphographical characteristics is important (convexity, concavity), the microdepressions playing a role in water accumulation and sediment storage, as well as in the complexity displayed within the soil classes. In the example illustrated in Fig. 5 (the Săcădad sub-basin), where it had previously been identified an accelerated soil erosion phenomenon, the major role played by the storage areas can be seen. These areas have been identified through the morphometric indicator profile curvature.

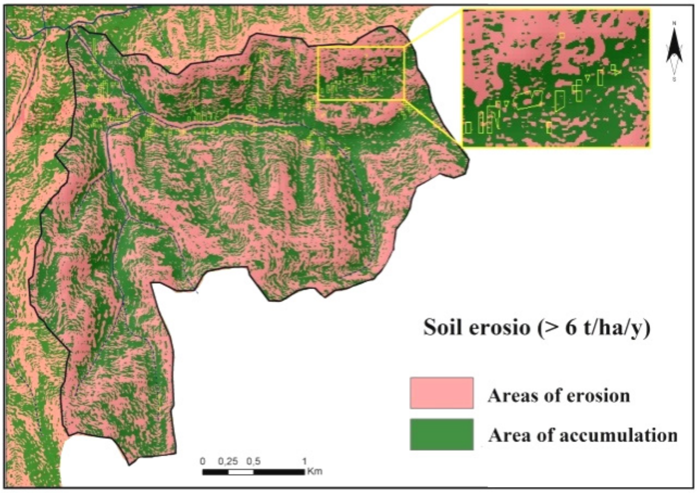

Fig. 5. Erosion and accumulation areas highlighted with the help of profile curvature

Hence the eroded soil from the areas with high erosional potential (mainly located in erosion areas displaying negative values of the profile curvature), once placed the accumulation areas (having positive values of the profile curvature) will remain there depending on the hydrologic and anthropic factor.

3. LAND FAVOURABILITY IDENTIFICATION FOR AGRICULTURAL USE

The entire basin has a strong agricultural trait as the economic activities are strongly connected with the existing agricultural potential, characterising the middle and lower basin parts, as well as with the forestry resources situated in the upper basin. In the Local Development Plan for the Valea Nirajului Microregion, 2012, the territory is divided in three sectors: the inferior sector recognized due to vegetable crops as main land use, at the local level the region being called "The Carrot Country"; in the middle sector the cereals are predominant among cultures and in the upper sector the orchards.

Taking into account the physico-geographical characteristics of the territory with their advantages and restrictions that are imposed at the local level regarding favourability with respect to different land use, the authors applied the model of scoring the agricultural terrains. This was done according to the Methodological Norms of the ICPA and OJSPA, vol I and II, 1987, as well as to the Methodology of conducting pedological and agrochemical studies, and to that of the National and Departmental Monitoring System of agricultural soil-terrain (Decision. no. 598 on the 13th of August, 2002) for the identification of favourability classes regarding agricultural land use at sub-basin level.

The emphasis lies on the terrain's geomorphology (by identifying the landforms at a micro and macro scale, elevation identification, terrain fragmentation) and underground description of the bedrock (Teaci, 1980, 1989). Together with this geomorphological analysis, the main climatic factors influencing the crops are taken into consideration, together with the vegetation (wooden, shrub-like, crops), with consequences in humus formation, and the soil characteristics (Blaga and Bunescu, 1994, Bunescu et al., 1994, Păcurar, 2001).This approach can be put in application by identifying the favourable degree of the terrain as well as by identifying the concrete needs (Țârău, 2003, 2006, Spârchez, 2009) streaming from the problems related to the soil resources capitalisation at the level of natural units, in the present study case at the level of the Niraj river basin and its sub-basins.

3.1. Data base and methodology

Each factor describing topographic conditions, soil characteristics and climate and hydrological resources (corrected multiannual mean temperature (3C indicator), multiannual mean precipitation (indicator 4C), gleisation (indicator 14), pseudogleisation (indicator 15), texture in the first 20 cm (indicator 23A), slope angle (indicator 33), landslides (indicator 38), inundability (indicator 40), useful edaphic volume on the 0-150 cm depth (indicator 133) and surface humidity excess (indicator 144) have been integrated in a database containing primary data layers and their repartition at the basin level.

To facilitate the analysis, the indicators have been given values ranging from 1 to 0, according to the influence they have on every crop type, resulting in scores for each crop after having applied formula no. 2 (Fig. 6).

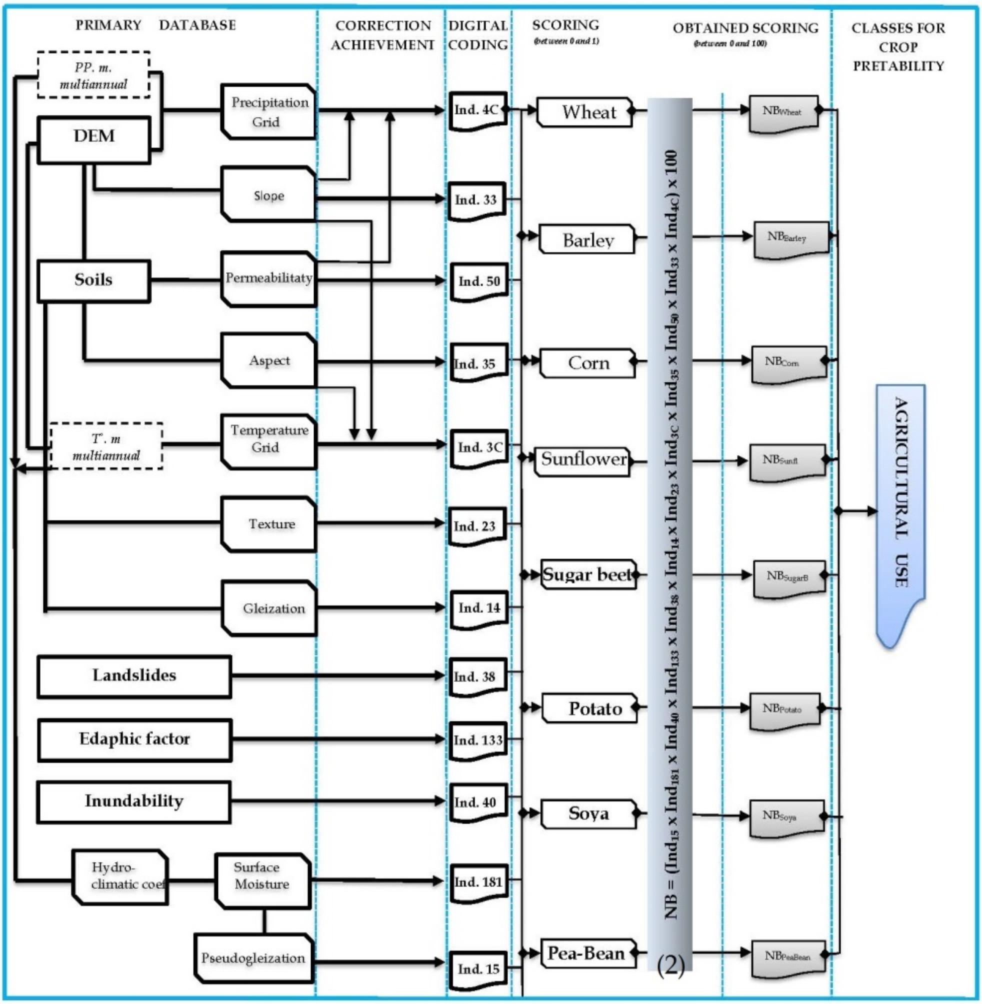

Fig. 6. Stages of the model determining the favourability classes for agricultural land use

3.2. Identification procedure of sub-basin pretability classes to specific crops

By manipulating the resulted GIS databases and by making the relevant computations, the territories can be fitted into pretability classes to specific crops as a mean resulted from the scores given for wheat, barley, corn, sunflower, sugar beet, potato, soy, pea-beans (Fig. 7).

In the Ist class the territories with scores situated between 81-100 points are included, consisting of terrains with a very good pretability, present on extended surfaces on the sub-basins in the inferior sector Oaia, Bene, Pădurea (Fig. 6), due to the smooth surfaces or slightly sloped ones (2.1-5°), with fertile lands where the climate and hydrological conditions do not restrict the cultures' development, assuring really good harvests.

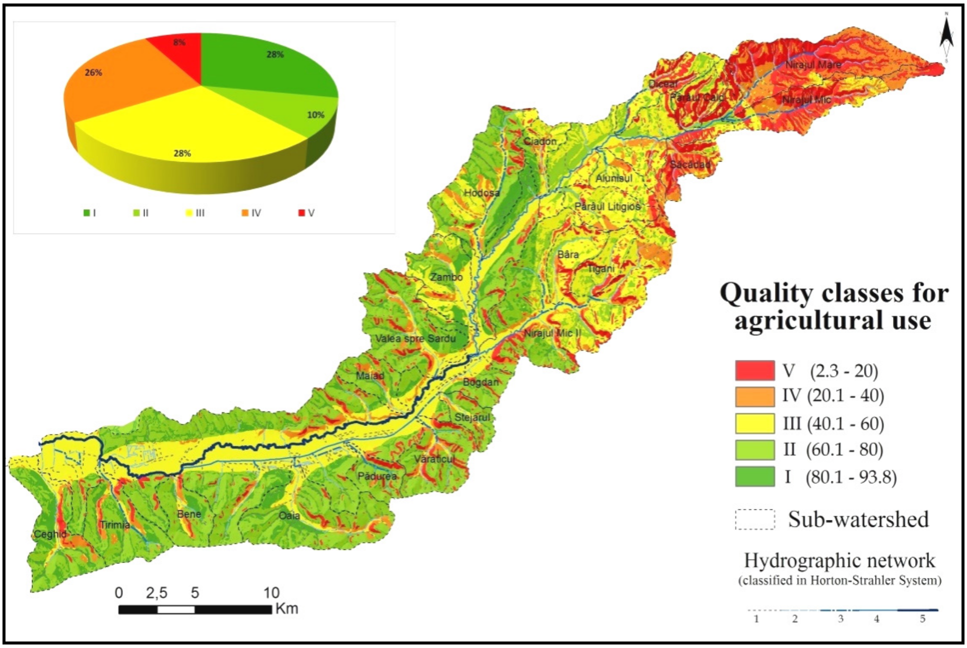

Fig. 7. Quality classes for agricultural use at the basin level

The II[nd] class (61-80 points) corresponds to the terrains with a good pretability being well spread in the sub-basins in the inferior and middle sectors of the river Tirimia, Ceghid, Valea spre Sardu, where the climatic and hydrological conditions do not restrict the crops' development, the lands are fertile with good and medium permeability, slightly affected by the humidity excess. At their level the limitation factors for the crops can be avoided by undertaking some improvement measures.

Extended surfaces corresponding to the Bâra, Țigani, Aluniș, Pârâul Litigios belong to the III[rd] class, as well as the floodplains of the Niraj where the score values range between 41-80. The terrains have a medium pretability due to the medium fertile soils, affected by surface humidity and landslides that are in need of improvement works.

The IV[th] class, with scores between 21-30 points representing terrains with low pretability, characterisies surfaces in the Nirajul Mic II, Săcădad, Nirajul Mic and Nirajul Mare sub-basins due to low fertility soils affected by landslide and humidity excess, as well as by meteo-hydrologic conditions with a low favourability regarding the existing crops.

The V[th] quality class of agricultural terrains regroups some snall surfaces from the sub-basins in the inferior and middle sector of the river, and large areas in the upper sector due to the soils with low fertility affected by degradation (having between 0 and 20 points on the scoring terrain sheet, displaying severe restraints and unsuitability as long as no improvement works are undertaken) necessitating improvements such as fertilization, structure stabilizing, soil loosening, drainage etc. (according to the Decision. 598/13 august 2002). For the terrains with a very low and extremely low pretability (the Vth class), their use as orchards terrains, vineyards, grasslands, pastures or forests is seen as a generally valid alternative.

4. APPLICATION OF SOIL LOSS SCENARIOS DEPENDING ON THE SUB-BASINS' LAND USE

In order to identify the erosion according to the corresponding land uses and the highest degree of favourability resulted from the local soil, climate and topographic conditions, three scenarios have been applied. They contain variants of the correction coefficient (Fig.8A, B, C and D) for crop management applied on the sub-basins with the highest rates of surface erosion: Nirajul Mic, Bâra, Țigani and Pârâul Litigios, that will be subsequently described.

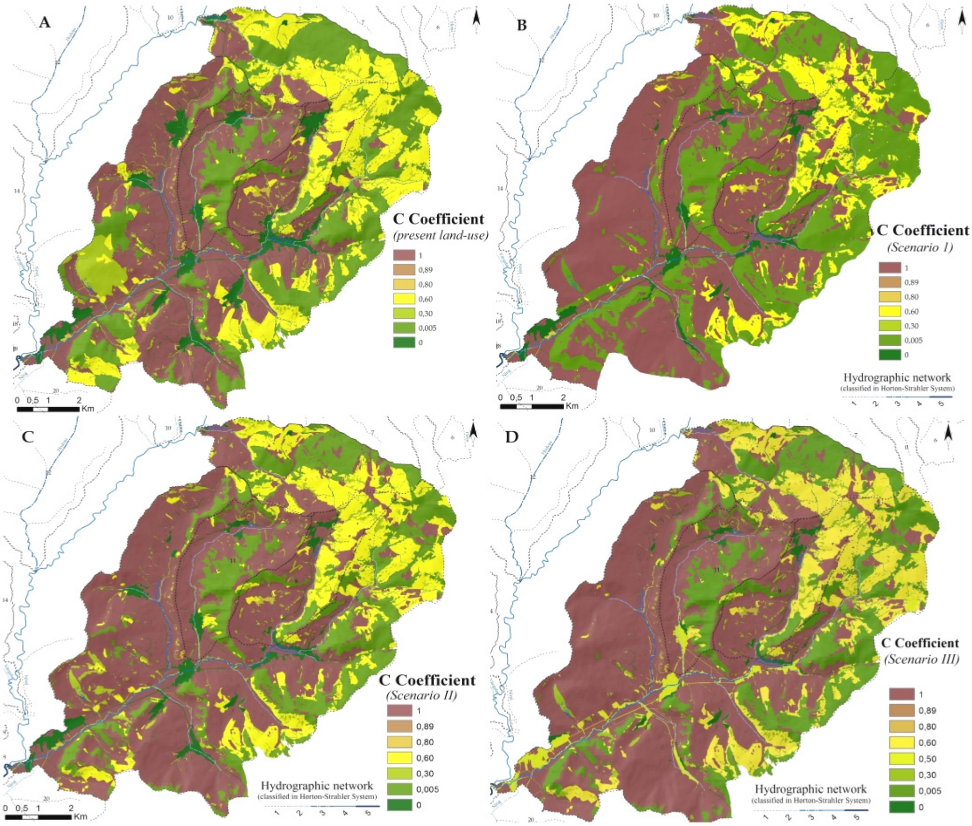

Fig. 8. Spatial expansion of the C coefficient according to the present land use (A), scenario 1 (B), scenario II (C) and scenario 3 (D) at the level of the Nirajul Mic, Bâra, Țigani and Pârâul Litigios sub-basins.

For the first scenario the modelling of the present situation was undertaken and the databases previously listed were used. Hence it can be observed that some important percentages of 58.17% of the Bâra sub-basin, 43.42% for the Nirajul Mic and 40.7% for Țigan correspond to the high rates of surface erosion. Class 0 that indicates accentuated stability of the analyzed territories is represented by low percentages (8%) (Table 2).

For the IInd scenario the first two classes have been kept according to their pretability for agricultural land, the rest of the terrains keeping their land use criteria specific to the present moment. By eliminating the last two favourability classes occupied by forested areas, it can be observed with respect to the agricultural areas an increase of the surfaces (Fig. 9) having maximum values: 57.7% in the Nirajul Mic sub-basin, 62.4% in the Bâra sub-basin, 49.6% in Ţigani and 29.8% in Pârâul Litigios sub-basin.

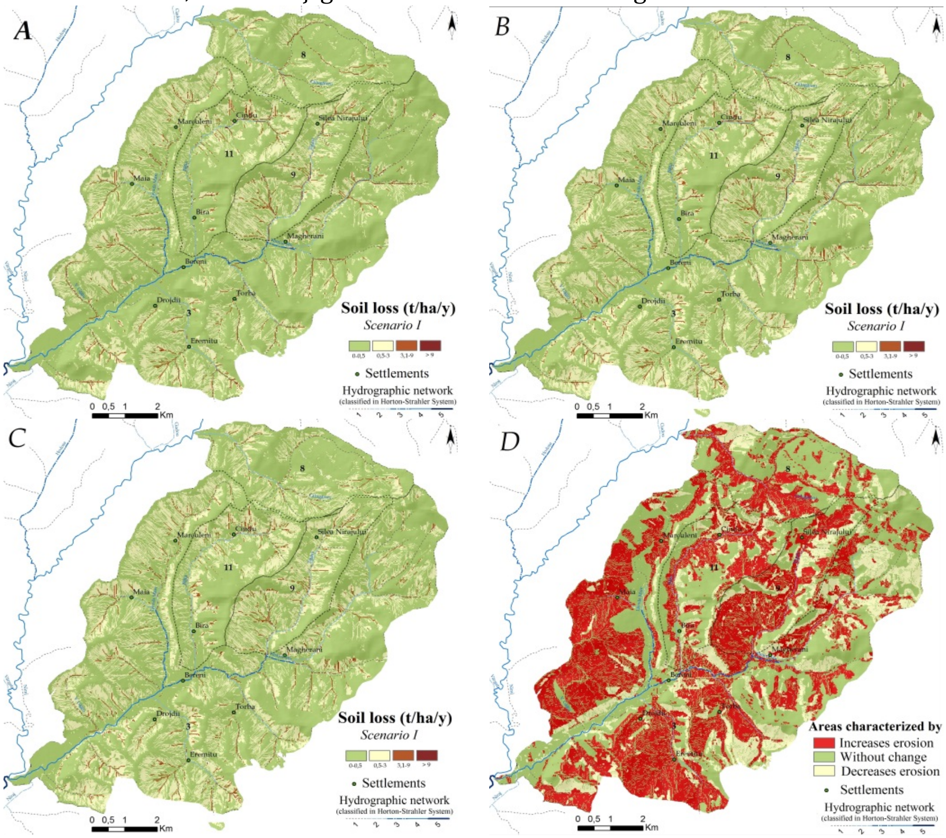

Fig. 9. Soil loss estimation according to scenario 1 (A), scenario 2 (B) and scenario 3 (C) with highlighted differences (D) at the level of the Nirajul Mic, Bâra, Ţigani and Pârâul Litigios sub-basins.

Table 2

Relative dimension of areas characterised by extreme values of the C coefficient

		River basin				Moment in time
		Nirajul Mic	**Bâra**	**Ţigani**	**Pârâul Litigios**	
Spatial expansion	**C=1**	43.42%	58.17 %	40.70%	16.97%	Prezent
	C=0	6.92%	6.37%	7.61%	2.36%	
	C=1	53.93%	54.68%	48.53%	25.50%	Scenario I
	C=0	3.26%	4.38%	42.65%	0.88%	
	C=1	57.78%	62.45%	49.69%	29.81%	Scenario II
	C=0	4.53%	4.81%	4.42%	1.01%	
	C=1	60.29%	62.45%	49.69%	29.81%	Scenario III
	C=0	1.34%	2.85%	4.38%	0.85%	

The III[rd] scenario is based on the use of the first classes of pretability to arable land and on that of the IInd class for pretability to orchards. At the level of the Bâra and Țigani sub-basins, having introduced the class with favourability for orchards, the percentages characterised by the maximum values of the C coefficient are constant. Some modifications can be seen however as there is an increase in the Nirajul Mic and Pârâul Litigios sub-basins.

By applying the ROMSEM model and by the use of the three variants of the C coefficient according to the three scenarios while maintaining constant the other factors that contribute to the modelling, major modifications can be observed when it comes to the level of erosion class distribution in the studied sub-basins.

Table 3

Relative spatial expansion of erosion classes in river sub-basins

Sub-basin	**Erosion Classes (t/ha/an)**				Moment
	0 - 0,5	**0,5 - 3**	**3 - 9**	**>9**	
Nirajul Mic	77,387	20,661	3,678	0,423	Scenario I
	60,010	36,972	3,476	0,350	Scenario II
	65,486	31,858	2,417	0,239	Scenario III
Bâra	75,705	21,902	4,448	0,715	Scenario I
	59,431	36,760	2,700	0,353	Scenario II
	73,689	24,013	2,035	0,263	Scenario III
Țigani	67,835	29,080	6,133	1,204	Scenario I
	52,587	43,338	3,628	0,585	Scenario II
	64,714	32,511	2,391	0,383	Scenario III
P. Litigios	83,131	15,360	1,827	0,692	Scenario I
	72,735	25,312	1,467	0,374	Scenario II
	78,570	19,981	1,153	0,296	Scenario III

4. RESULTS AND CONCLUSIONS

The quantitative analysis of results indicates an increase of the surface percentages where low levels of erosion occur (0-0.5 t/ha/yr) in the Niraj river basin, when scenario II is put in application, namely for the first two maximum favourability categories. As a comparison, the results of scenario I, where classes IV and V were proposed for forest as a land use, show a decrease in percentage of the surfaces with mean erosion (21.8%). The results of scenario III offer the best results in the entire river basin, namely when the first classes are used as arable land and the IInd class as orchards (Fig. 10).

Having at hand the research results regarding the anti-erosion role played by vegetation (M. Moțoc, 1975), along with the identification of areas with a high level of erosional potential in the Niraj river basin, a series of invasive methods can be suggested which would diminish the negative effects of soil erosion, such as: crop rotation (substituting the crops with perennial herbs and lucerne, offering a high protection due to their high density and their water consumption), hence offering an acceptable agricultural productivity; works orientated along the hillslope-valley directions, works along the contour lines, terraces etc.

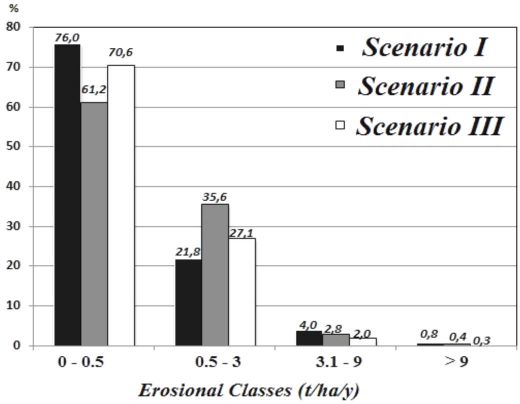

Fig. 10. Percentual distribution of the erosion classes in the Niraj river basin

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