THE STUDY OF VEGETATION WITH AID OF SATELITE IMAGES IN THE CIRIC HYDROGRAPHIC BASIN (COUNTY OF IAŞI)

C. V. Secu[1], N. Ştefan[2], A. Oprea[2]

ABSTRACT
The usage of the satellite images Aster and Landsat allow the exact mapping of the vegetation, through the differentiation of the natural ecosystems from the human transformed ones, the separation of the degraded ecosystems, the differentiation of the homogeneous ecosystems from the heterogeneous ones, the individualization of the ecosystems with high humidity values, on the basis of the Landsat images, through the calculation of the vegetation index.

*

The Ciric River, tributary on the left to the larger Bahlui River, develops a small hidrographic basin of 58 sq. km in which the human influence becomes visible through urbanization in the lower compartment that includes water accumulations and agricultural terraces. These agricultural terraces, on the slopes are mainly used for vineyards and orchards. All these modifications changed the natural status of the environment and the results can be traced in the vegetation's composition and structure.

Sharp cartographic materials to reveal the above mentioned aspect are considered a neccessary condition to meet the requirements of a sustainable assemblage pursued by the SEEEC project.

1. INTRODUCTION

The natural factors determining the vegetal associations' spatial distribution in the Ciric hidrographic basin do not display significant variations. The geologic deposits characterizing the altitudes exceeding 150 m consist in ferruginous sands with small gravel fragments that are specific for a seashore environments. The sand deposits are covered by sand stones (burr/hone) and fine sand deposits which support above and dissonant sandy clay deposits (Brânzilă M., 1999). The soils in this area inherit the medium and fine texture from the above mentioned deposits and the soluble salts concentrated in the meadow and slope base areas.

The relief is typical for a hilly field region (the Jijia Hilly Field Region) through its prolonged ridges, the general disposition from NW to SE and the presence of Bahlui's

[1] *"Alexandru I. Cuza" University, Faculty of Geography and Geology, 700506, Iaşi, Romania,* crissecu@yahoo.com
[2] *"Alexandru I. Cuza" University, Faculty of Biology, 700506, Iaşi, Romania.*

River terraces , in the low compartment. The most representative surfaces in this respect were identifiied by Barbu N. & co. (1987) in the Ward of Tătăraşi (20-25 m relative elevation) and the Ciric Hill (the 60-70 relative elevation terrace). Between 36 m, which represents the altitude of the Ciric-Bahlui junction and 216,7 m, the maximum altitude of Aroneanu Hill, the geomorphologic processes dispaly enough „strength" in order to maintain active dynamics on the north and west oriented slopes and to break out landslides.

The climatic condition described by the multi-annual average temperatures of 9,6^{o} C (1973-2004) and precipitaions of 587,9 mm (1964-2004) (Secu C., 2005) ensure 5-6 t/an/ha biomass production in the forested areas and 2 t/an/ha for the pasture parcels (Doniţă N.& co., 1992).

The hidrographic features of Ciric bazin have sufferd radical modifications in the past century as far as the river's meadow is concerned. The topographic maps of 1: 50.000 edited in 1894 reveal few small water accumulations most certainly used as water supply reservoirs for domestic animals and only one bigger accumulation near the Şorogari Commune. Starting with 1960 the complex arrangement measures in the Ciric's meadow include the Doronaţ, Ciric I, II and III water accumulations. The hydro-technical arrangements at the level of Ciric's River meadow induce moistening and determine slope slidings which required human interventions for *utility and agricultural* purposes (Ungureanu I., 1977) but have not been stabilized up to the present times.

The territory taken into study is included in the bigger Silva-steppe unit (Doniţă N. & co. 1992), respectively the Northern Silva-steppe characterized by the sporadic presence of *peduncular oak* (Quercus robur) and the *tataric maple* (Acer tataricum) within the continental Sillva-steppe pastures.

2. OBJECTIVES

Using the satelite imagery the following features were obtained: the natural (forests and pastures) and hunam induced (perrenial and annual cultures) ecosystems' typology as extracted through cartographic means; the individualization of ecosystems homegenity (homogenous and heterogenous ecosystems); the delimitation of degraded ecosystems and their associated factors (degarded ecosystems as a result of natural and human induced factors); the quatification of vegetation indices using LANDSAT TM imagery.

3. MATERIALS AND METHODS

In order to classify the vegetation we used the Aster 2 (RGB, assembled in 2000) and Spot satelite images and the the cartographic techniques were applied with the use of TNT mips 6.9 software. Apart from the basic cartographic support (topographical maps at 1;25.000 and 1:5000) we added a series of models obtained in TNT mips (the elevation model, terrain declivity, slope exposition etc.)

The study of the vegetal association in the field consisted in the realization of plants inventories.

In order to identify the vegetation's characteristics and to correlate them with certain geographic particularities of the territory taken into study we made use of the *visual interpretation.* This method implies a greater subjective degree compared to the automatic classification based on the spectral analysis using pixels. As far as the automatic classification is concerned it is possible that errors occur between to total different surfaces which are *viewed* as identic (e.g. roads, the landslide gliding beds and constructions have the same spectral respose or the same colour).

Forasmuch as the Ciric basin is narrow it becomes accesible and can be easily walked through thus *visual interpretation* of the satelite images is not difficult.

In this context we realized correlations between the colours displayed on the satelite images with the types of vegetation and other characteristics of the studied territory (e.g. landslides, buildings etc.), with the texture and the shape of the studied areals. The Aster and Spot images reveal the vegetation distribution and other elements in *false colours*.

Using the Landsat imagery and the TNT mips formulae we quatified the vegetation indices. This methods applies for the identification of highly humid ecosystems. In this respect from the 7 Landsat bands we used the 3rd (Red) and the 4th channels (Near infrared) at a resolution of 30 x 30 m. The spectral reflectance differs between vegetation types and between seasons.

4. RESULTS

For the sake of differentiation between natural and human modified ecosystems we considered the colour hues and the shape of the polygons that imply as a real correspondent a relatively homogenous surface as far as the aspect of species combination mode and their functionality is concerned.

Analyzing the Aster image we observed that this reveals close colour hues for the forest and grasslike vegetation but the forested parcels have regular shapes with straight segments implying human intervention and the herbal vegetation displays dendritic development on valleys and extending up the slopes.

The cultivated vegetation is easily identifiable through the shape of each areal, the majority of polygons representing annual cultures display rectangular shapes. The perennial cultures have almost the same shapes as the annual parcels but as far as the vineyards are concerned the texture is given by the roads between parcels. This characteristic texture does not apply for orchards.

When the floristic composition is uniform the colour hues are also uniform. The changes induced by the presence of plantations, sometimes outland for the representative floristic region (e.g. resinous plantations) imprint different colour hues. The herbal vegetation appers most frequently as a mix of colours on the satelite image due to the vegetal pheno-phasis characteristics and the influence of external factors, as soil humidity, terrain degradation processes etc.

The ecosystems heterogenity is determined by the human induced factors, cosequently the heterogenous ecosystems are associated with constructed sites and, on small parcels, with human generated deposits in the lower part of the hidrographic basin. In the rural perimeters the objects revealed by the satelite images have regular shapes and describe a heterogenous mix of vegetation, communication ways and constructuins.

In the cultivated vegetation area the heterogenous aspect of the ecosystems is given by the different spectral reflectance of each vegetation type yet the regular shapes of the polygons confirm that the majority of species are cultivated species.

In order to delimitate the *degraded ecosystems* we considered the human influence along the transportation ways in especially the roads *oscillation* at slopes level and the separation of degraded ecosystems in the landslides areas.

Along the roads, we usually find, ruderal vegetation but the routes modification, in time, on the slopes implied terrain degradation and consequently species degradation. As far as the roads traversing *cuestas* fronts and other slopes with high declivity the change of routes determines deep erosion acceleration. Some of this deep trenches are also of great width (more than 100 m deep trench near the Stanca village, the northern part of the basin) (Fig. 2, 1a and 1b).

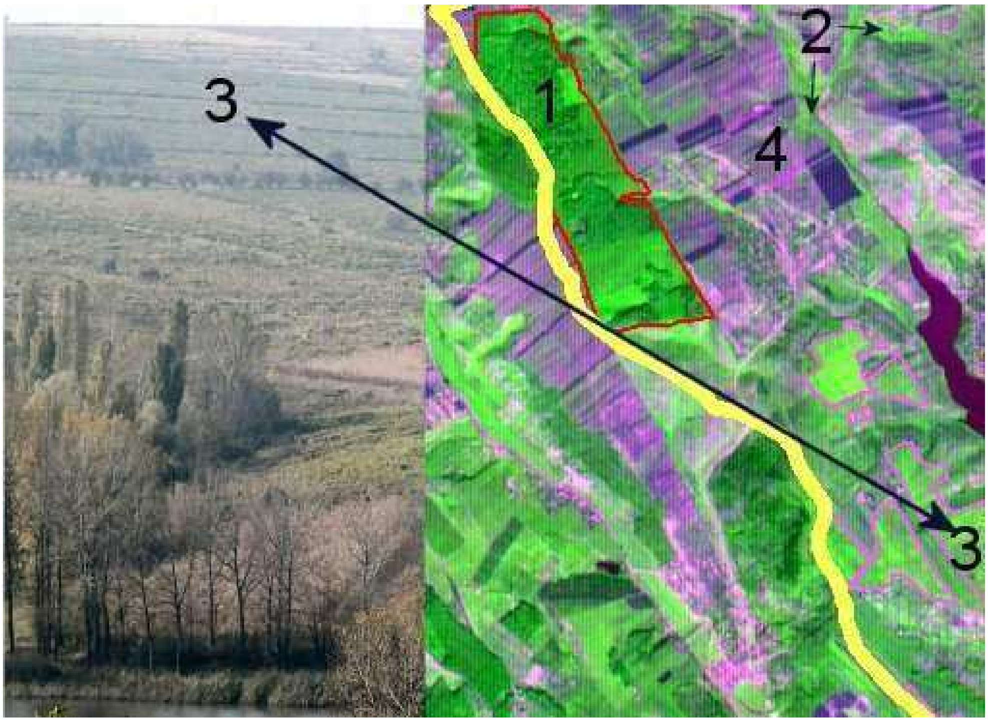

Figure 1. ***Vegetation types revealed by the Aster image (2005) 1=forest, 2=meadow herbal vegetation; 3=vineyards and 4=cultivated vegetation.***

The landslides give a tessalation aspect to the satelite image. Depending on the landslides stability degree these can be classified in *active landslides*, sometimes combined with deep erosion processes where the vegetation is scarce, dispersed and the satelite image reveal the same colours as for the constructed sites or roads (Fig. 2, 2a and 2b). The stabilized or low development rate landslides reveal a satelite image *textured in fish scales* where the shapes and colours reveal the inclusion of cultivated surfaces.

The map obtained when calculating the vegetation index displays greater values of humidity for the forested (code 1 on the map) and the meadow areas and also an increased humidity for soils (Fig. 3). On the map there can identified cultivated areas (4) resembling, in hue, the forest vegetation. Because a deciduous forest includes a mix of species the texture of the image is not uniform, unlike in the case of cultivated land where there will not be found pixels with different hues. The high humidity characteristic for meadows emphasizes better the distribution of hygro-phil vegetation(Aster image) but the pixels dimension (30 m) blur the exact cartographic actions. The opened colours point out the cultivated vegetation and, in the same time, the reduced humidity values.

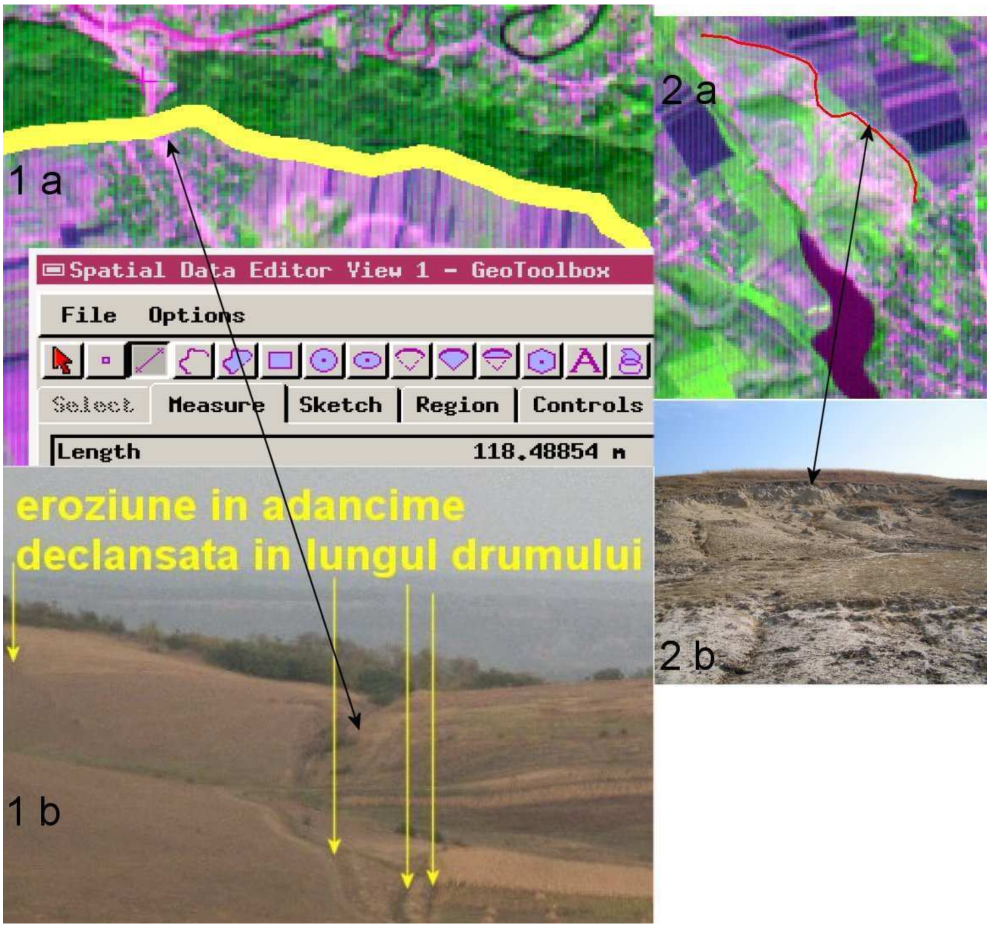

Fig. 2. ***Vegetation degradation under the influence of deep erosion along roads (1 a and b) and within the landslides perimetres. (2 a and b).***

The advantage of remote sensing cartography derives from the opportunity of exact measurements for cultivated parcels when using images with small dimension pixels (Aster); the differentiation of natural vegetation types (forests and pastures) from the cultivated ones (perrenial fron annual); delimitation of certain degraded vegetation areas (on landslides); the delimitation of characteristic ecosystems on the basis of their humidity values (meadow vegetal associations).

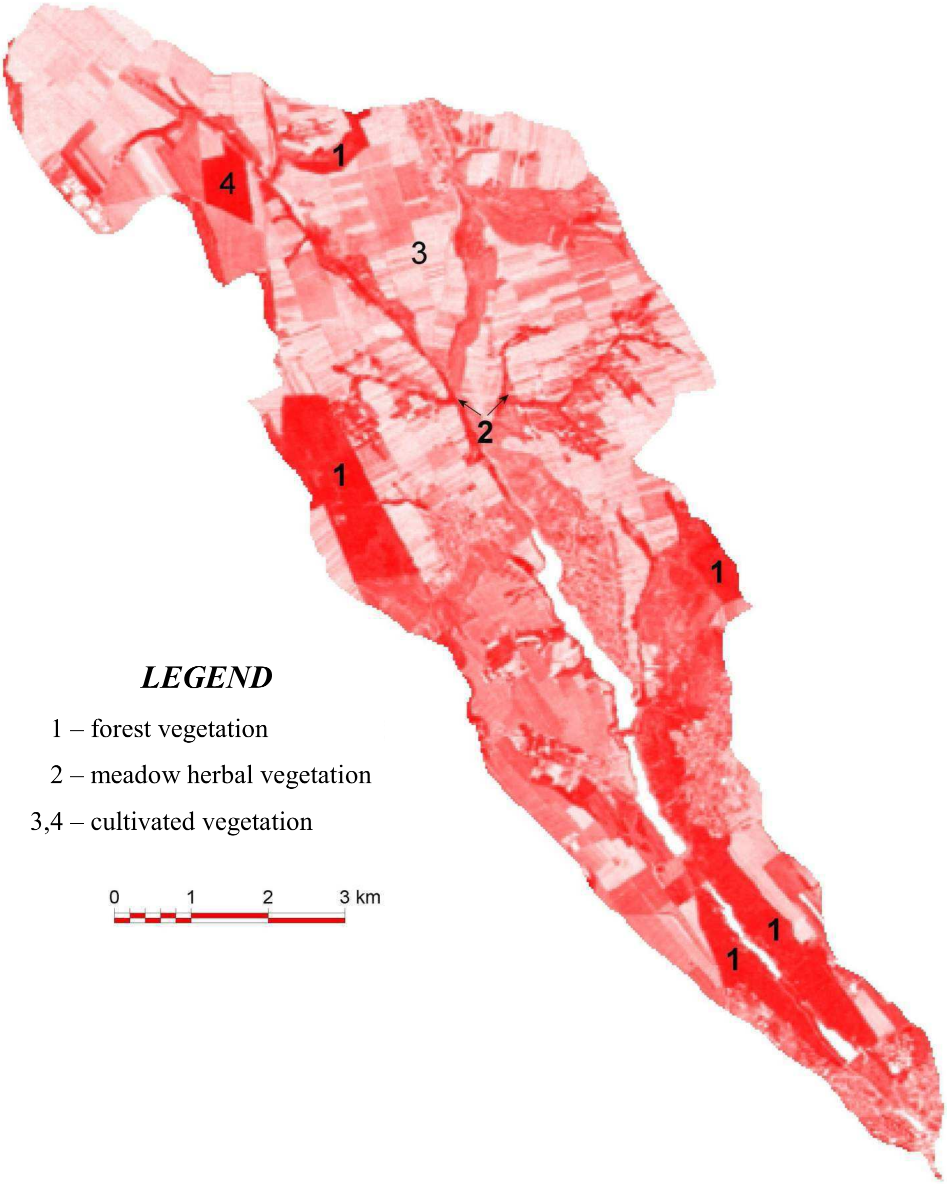

Fig. 3. ***Ciric Hydrographic Basin, Vegetation Index Map Interpreted from Landsat Imagery (2005)***

REFERENCES

83. Barbu, N., Ungureanu, Al. coord. (1987), *The Geography of Iaşi Municipality,* p. 26-28 (total of 312 pages), „Al. I. Cuza", Iaşi Printing House.
84. Brânzilă M., 1999, *The Geology of South Moldavian Plain*, p. 136 (total of 221 pages), Corson Editing House, Iaşi.
85. Doniță, N., Ivan, D., Coldea, Gh., Sanda, V., Popescu, A., Chifu, Th., Păucă-Comănescu, M., Mititelu, D., Boşcaiu, N. & co. (1992), *The Vegetation of Romania*, pg. 40 (total 407 pages), Technical-Agricultural Editing House, Bucharest
86. *Topographic Maps* –VII series, V column and VI serie, X column, 1984, Provisory Edition of the Romanian Army Headquartes, the Army's Geographic Institute.
87. Secu, C., (2005), *Climatic characterization of the Ciric Hydrographic Basin*, report 1-A-1 la CEXDUREC, Sustainable Ecosystems Exploitation Expertise Center, (CEEX 634, 2005-2008) (manuscript).
88. *TNT manual*, http://www.microimages.com
89. Ungureanu, I., (1977), *The role of Human Factor in the Nowdays Morphogenesis of the Iaşi Municipality Area and its' Surrounding*s, p. 122-124, ASUCI, XXII, s II b, Geologie, geografie, Iaşi, p. 122-124, ASUCI, XXII, s II b, Geology, Geography, Iaşi.