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THE CHANGES OCCURRED IN THE LAND USE FROM THE EASTERN PART OF ROMANIA AFTER 1989 - REMOTE SENSING AND GIS APPLICATION

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Key-words: land use; remote sensing; changes.

Abstract : The political change in the Romanian society after 1989 Revolution, has clear consequences on all socio-economic aspects. This article presents the land use changes and their effects on the environment. The return to private property, from the state ownership, as a result of legislative change with the - Law 18/1991 and Law 169/1997 - has confused all operational agro- systems, and has led to a strong division of the agricultural parcels. The purpose of this article is to analyze the effects of legislative measures on land use in the region of north-eastern Romania, through Remote Sensing and GIS but also to emphasize the technical difficulties, encountered during the research process. We used Landsat and Spot Images, topographic maps and direct observation of the field. The identified changes may be reversible (the transition from arable to pasture) or final (the passage of the arable to construction), in the latter case the effect on the environment being stronger. There was also strong structural changes such as fragmentation of operating fields, the increasing density of built space in cities, the reduction of forest areas etc.

1. Background and Objectives

The profound modifications that have occurred in the Romanian society, beginning with the change in the political regime from 1989 and continuing with the transition period that lasted till Romania's integration in the EU structures, have been reflected in all the aspects of the socio -economical life, motivating us to study the modification occurred in the landcover and their impact on the environmental conditions.

We have proposed to analyze the effects of the legislative measures application on the land use from the eastern part of Romania, by using Remote Sensing and GIS techniques, as well as to evidence the methodological deficiencies met during our research.

Thus, the change of the property regime as a consequence of the 18/1991 Law modified by the 169/1997 Law have determined the replacement of the

collective exploitation of the CAP ("Agricultural Production Cooperation") and IAS ("State Agricultural Enterprise") type, with family exploitations on small dimensioned parcels and the transition from a planned use to a free one, almost lacking rules for a good period of time. As you could see in the pictures above, the application of these laws determined the atomisation of agriculture propriety, over 40 million of crop yields have emerged as consequences, and approximately 5 million new owners .

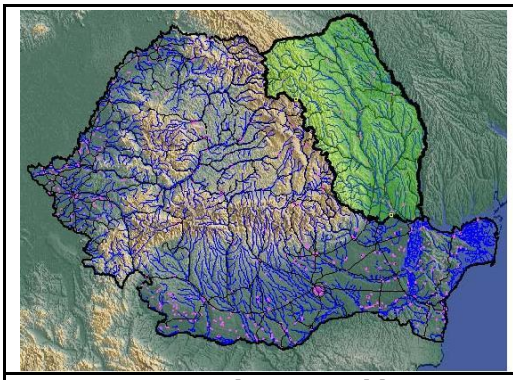


Fig. 1 - Study area-Moldova

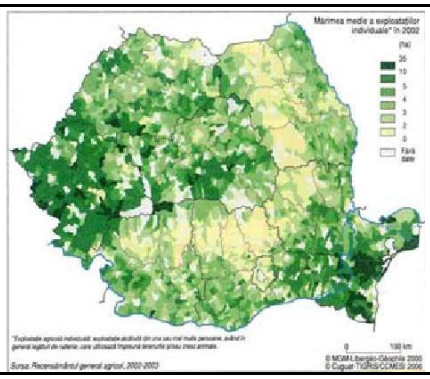


Fig. 2 - Medium area cultivated per family in Romania in 2002

Often, crop yields size were disproportionate, being 1km long and few meters wide, making almost impossible the appropriate agrotechnical labours. Crop yields orientation are often alongside the flows directions, determining increased soil erosion. Our study area is characterized by great population density reflected in small size crop yields. Our objective is to analyze the possible effects of these late land cover changes upon the environmental and socio-economic factors.

2. Materials and Methods

As materials we have used Landsat (MSS, TM, ETM+) and Spot satellite images and we have completed the information with topographic maps and field surveys. Being part of the Corine Landcover 2000- Romania working team, we have interpreted in collaboration with I.N.C.D.D. Tulcea the entire coverage of our country. Therefore, we have adopted al the 44 classes of the Corine Landcover project and the methodology addendum for identification, delimitation, separation and agglutination of land cover polygons. The minimum size of the polygon is considered 25 ha and for the changes between 1990 and 2000 is 5 ha. the results of the analysis is validated for this level of detail.

Analising the spatial correlation between slope classes and land cover changes shows the area that could be profoundly affected by these late changes. For that we have combined vector and raster layers and studied the resulted histograms obtaining new graphics.

The industrial crisis in transitional Romania and the changes occurred in propriety regime determined great migratory fluxes from urban areas toward the rural areas, so called ”retur rural”.

The nearby map shows that Moldova region is one of regions most characteristic for this phenomena, having the highest medium value of numbers of persons/10 ha. These facts determined an arable land “crisis “ for some families that decided to transform the pastures surfaces they owned into arable lands. Often these new arable lands are situated on plane surfaces without important effects over the soil erosion.

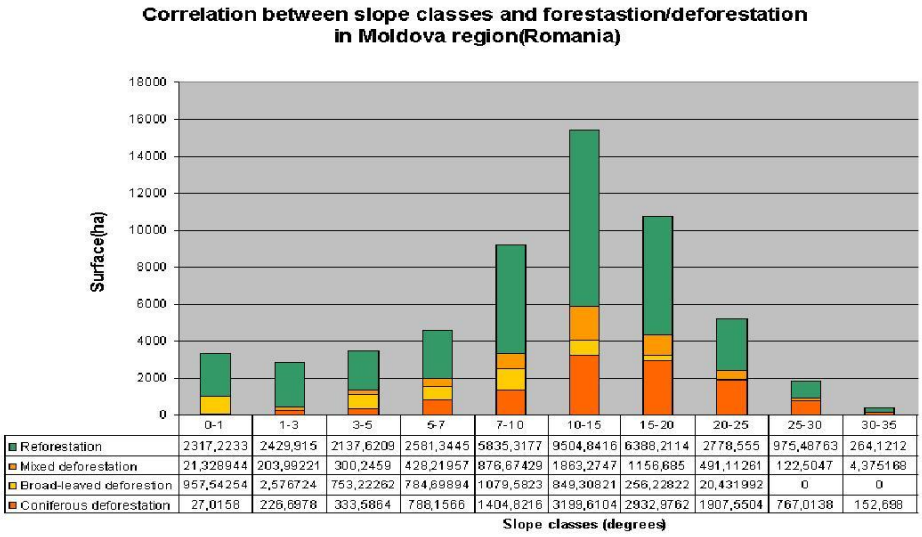
A important percent of the new arable lands are occupying areas characterized by slope values of 5-7,7-10,10-15(degrees). Combining these values with the dominant type of culture in the area (corn) and the orientation of the crop yields, we can conclude that these changes have an major impact ,determining an increase in soil erosion.

Analyzing the distribution of deforested and reforested areas on various classes of slope , we have observed that In Moldova region there is a domination of reforestation area over the deforested one. The plane surfaces are dominated by broad-leaved forest, the high slope surfaces are the dominated by the coniferous and mixed forests. Market characteristics determine the preferential exploitation of the coniferous species from the pure and mixed forests. The largest deforested surfaces are situated between 7- 25 degree and the impact of these actions upon the soil erosion is major, although compensated by reforestation due to natural factors(healthy ecosystems) or administrative factors(reforestation policy).

The deforested areas from the coniferous forests are small comparing to overall surfaces but, as we can see the coniferous deforested area is bigger than the reforested one, correlating these with the overall reforestation, resulting in a slight forest transformation towards broad-leaved domination.

If we study the deforestation/reforestation inside administrative limits things looks good, but if we extend the study by watershed will see that the deforested areas from Transilvania had increased the flooding risk in lower basins.

In some areas the changes were in the opposite direction , showing a transformation from the arable lands towards the pastures. These changes occurred mostly in the areas with aged or less population in Moldova, but the phenomena is characteristic for southern Transilvania.



	0-1	1-3	3-5	5-7	7-10	10-15	15-20	20-25	25-30	30-35
Reforestation	2317,2233	2429,915	2137,6209	2581,3445	5835,3177	9504,8416	6388,2114	2778,555	975,48763	264,1212
Mixed deforestation	21,328944	203,99221	300,2459	428,21957	878,67429	1863,2747	1156,685	491,11261	122,5047	4,375168
Broad-leaved deforestion	957,54254	2,576724	753,22262	784,69894	1079,5823	849,30821	256,22822	20,431992	0	0
Coniferous deforestation	27,0158	226,6978	333,5864	788,1566	1404,8216	3199,6104	2932,9762	1907,5504	767,0138	152,698

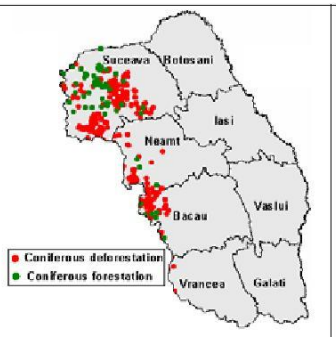
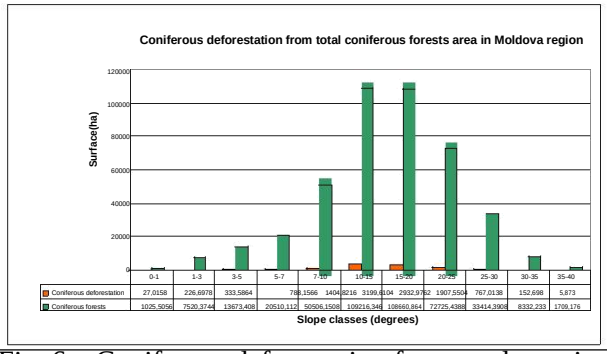


Fig. 5 – Coniferous deforestation/ reforestation



	0-1	1-3	3-5	5-7	7-10	10-15	15-20	20-25	25-30	30-35	35-40
Coniferous deforestation	27,0158	226,6978	333,5864	788,1566	1404,8216	3199,6104	2932,9762	1907,5504	767,0138	152,698	5,873
Coniferous forests	1025,5056	7520,3744	13673,408	20510,112	50506,1508	109216,346	108660,864	72725,4388	33414,3908	8332,233	1709,176

Fig. 6 – Coniferous deforestation from total area in Moldova region

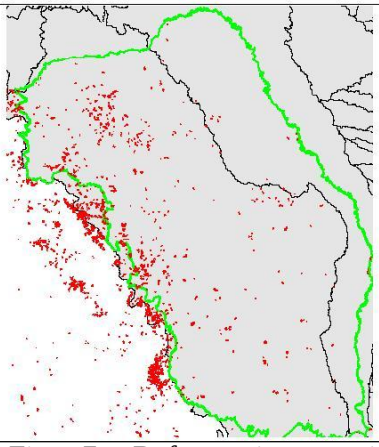


Fig. 7- Deforestation outside the administrative limits but inside natural limits af the watersheds

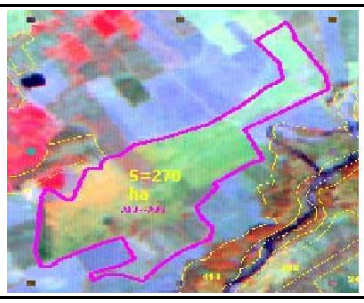


Fig. 8 - Landsat image 1990

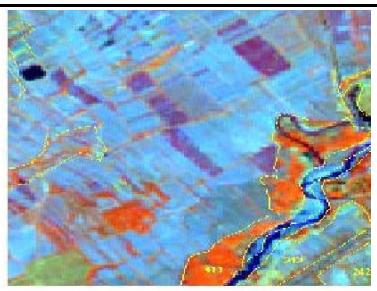


Fig. 9 -Landsat image 2000

Pasture changes into arable land

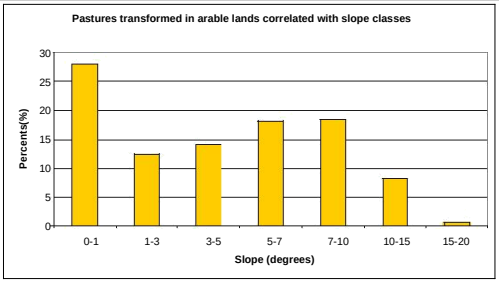


Fig. 10 - Pastures area transformed in arable land

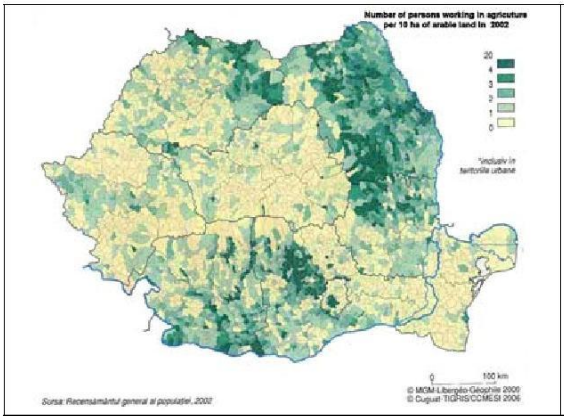


Fig. 11- Agriculture stress (nr. Of persons working in agriculute/10 ha)

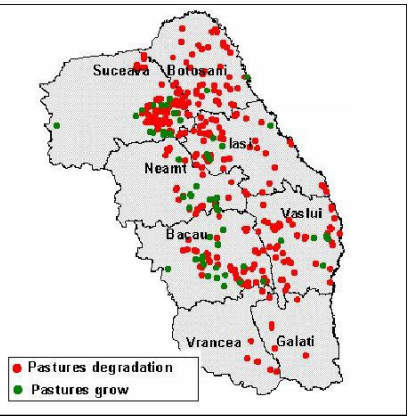
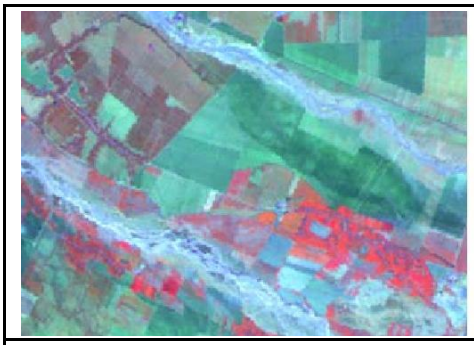


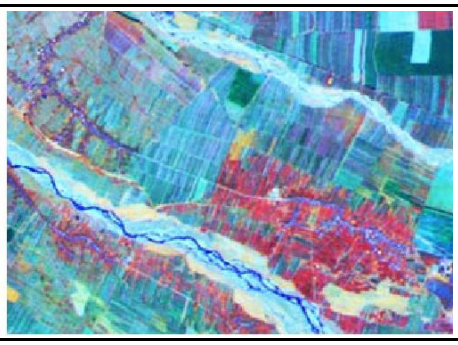
Fig. 12 - Distribution of changes from pasture in arable land and vice-versa

Structural changes

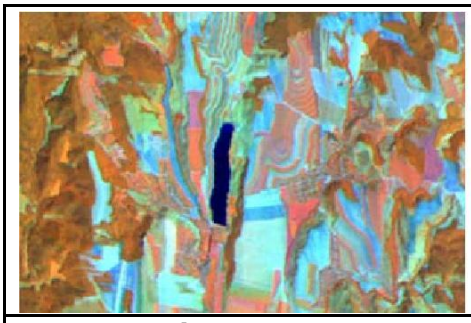
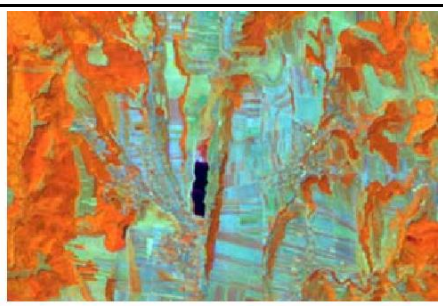
Except the changing of some land use categories of some areas, we have also identified changes of a structural character, such as the fragmentation of the arable land parcels, the increase in the density of the constructed space in towns, the rarefaction of forests etc.



Landsat image1987



Landsat image2000

	
Landsat image1987	Landsat image2000

Most of the arable lands kept their original use but the exploited minimum surface has decreased dramatically until the shape of the crop yields has become linear and the disposition of these downhill has determined the disappearance of former agro-terraces created to reduce soli erosion.

There fore as we can see in these bottom images, the changes occurred in exploitation methods had a major effect upon the soil cover and other natural components, the lake surface had decreased by 50% due to the materials transported downhill.

The effects of these type of changes can be positive for preventing the soil erosion but also can determine an increase of weeds seeds quantity.

Conclusions

Results show that although the changes are frequent in Romania and their environmental impact is significant, the identification and quantification is difficult due to the magnitude, dispersion and reversibility of changes.

The changes produced between the land use categories identified by us have either a temporary character, being reversible

(arable land to pastures), or a permanent one (arable land to urban or roads), in this case the impact on the environment being different.

Methodologically, the surfaces affected by changes are of small dimensions, sometimes smaller than the satellite images resolution allows us to see, thus making impossible the quantification of their proportion from the total surface. Also, the territorial dispersion and the multitude of neighbor types harden the identification and validation of the changes.

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***http://www.indd.tim.ro/CLCweb/index.html

***http://reports.eea.eu.int/COR0-landcover/en/tab_content_RLR