4. REMOTE SENSING

Research activities of the ***Institute of Geography***, ***Slovak Academy of Sciences, Bratislava*** (IG SAS) in the field of remote sensing and geographic information systems concentrated during the last three years on the field of inventory, analysis and assessment of landscape changes.

One of the most important achievements has been the development and practical application of a methodological approach to landscape changes identification, analysis and assessment in the territories of four Phare countries (the Czech Republic, Hungary, Romania, and the Slovak Republic). The changes were identified on a national level from Landsat TM (Thematic Mapper) and MSS (Multispectral Scanner) satellite images by application of the CORINE (Coordination of Information on the Environment) Land Cover databases for two time horizons (the late 1970s and early 1990s) at the second hierarchic level. Based on identified causality, the landscape changes were grouped into 7 types: intensification of agriculture, extensification of agriculture, urbanisation – industrialisation, enlargement of mining or exhaustion of natural resources, afforestation, deforestation and other anthropogenic causes. The results of the groupings were presented in the form of contingency tables and maps showing the spatial distribution of the changes (see example in Figure 7).

The most pronounced changes in Slovakia were represented by diminution of forest by 94 935 ha and that of heterogeneous agricultural areas by 18 451 ha; enlargement of transitional woodland-scrub areas and urbanised areas were about 13 107 ha and 14 990 ha, respectively.

Assessment of the identified changes through DPSIR framework (Driving forces – Pressures – States – Impacts – Responses) was based on the analysis of relations between the environmental system and human system.

These works were part of the tasks of the Phare Topic Link on Land Cover Consortium-Coordinated by the GISAT company from Prague, including the Institute of Geography of the Slovak Academy of Sciences from Bratislava, Romanian Geological Institute from Bucharest, and HNIT Baltic from Vilnius.

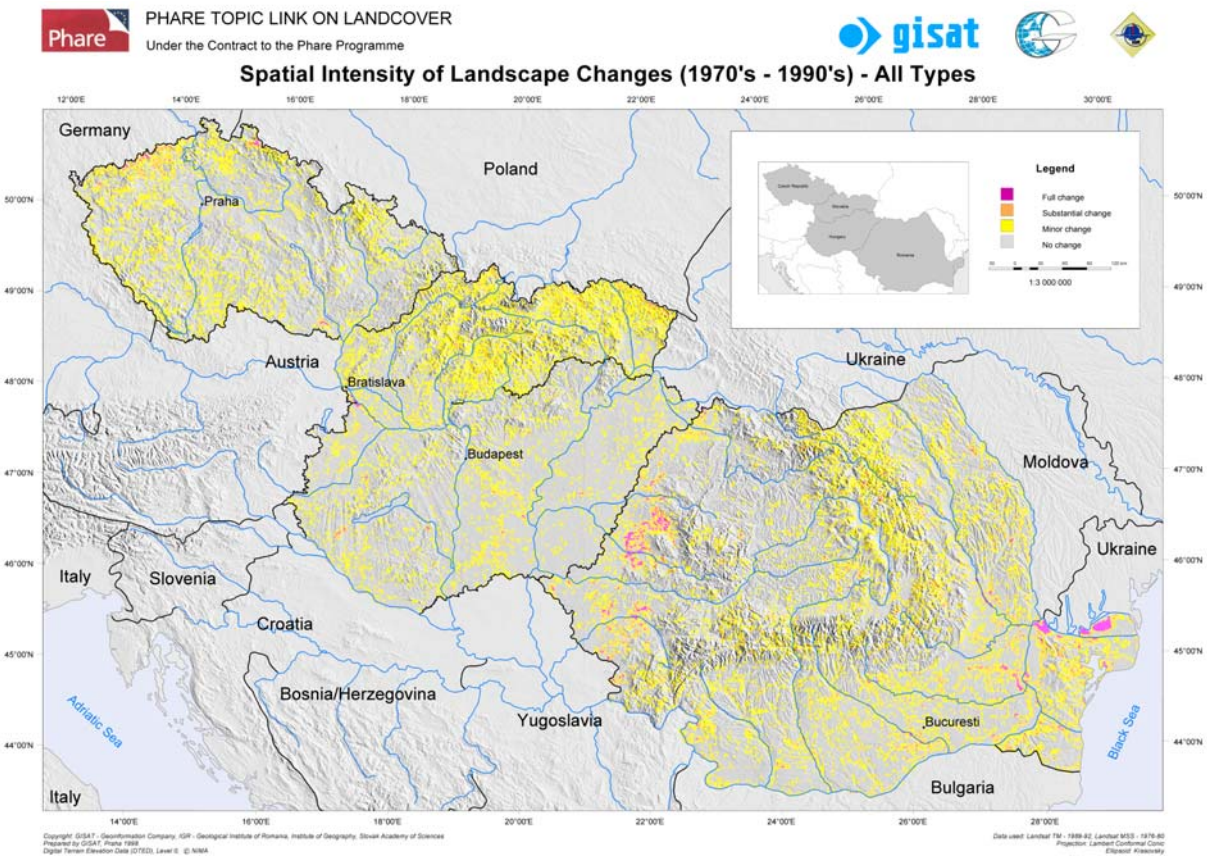

Fig. 7. Spatial intensity of landscape changes 1970's – 1990's - all types.

Remote sensing activities of the ***Forest Research Institute Zvolen*** in 2001 were oriented on the project *"National Cooperative Program on Assessment and Monitoring of Air Pollution Effects on Forests*". The main result was construction of the Satellite-based thematic maps of forest health condition changes. The methodology for change detection of forest health condition on national level in Slovakia was developed based on Landsat TM data. Classification was carried out for years 1990-1996 and 1996-1998 by using image differencing change detection algorithm. Results were processed in form of thematic maps of forest damage changes in Slovakia at scale 1:500000. The output thematic map is classified into 6 classes by z-scores. The illustrations of the results are in Figures 8 and 9.

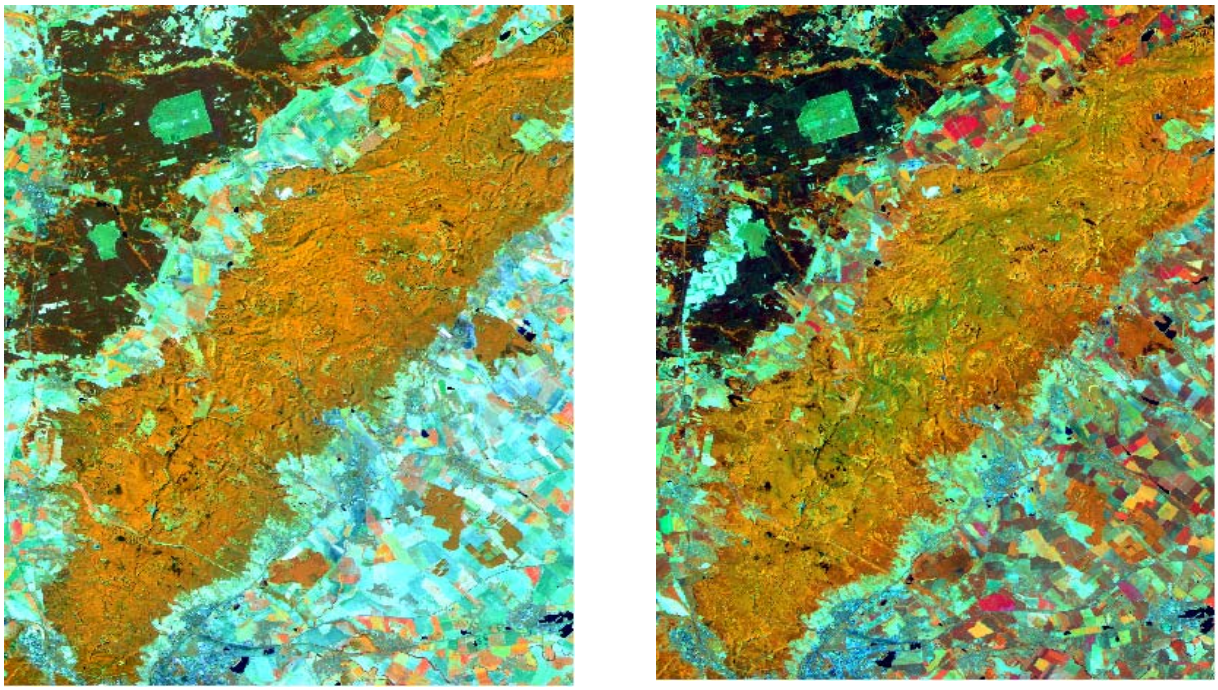

Fig. 8. Composition of 4,5,3 bands of Landsat TM from 1990 (left) and 1996 (right).

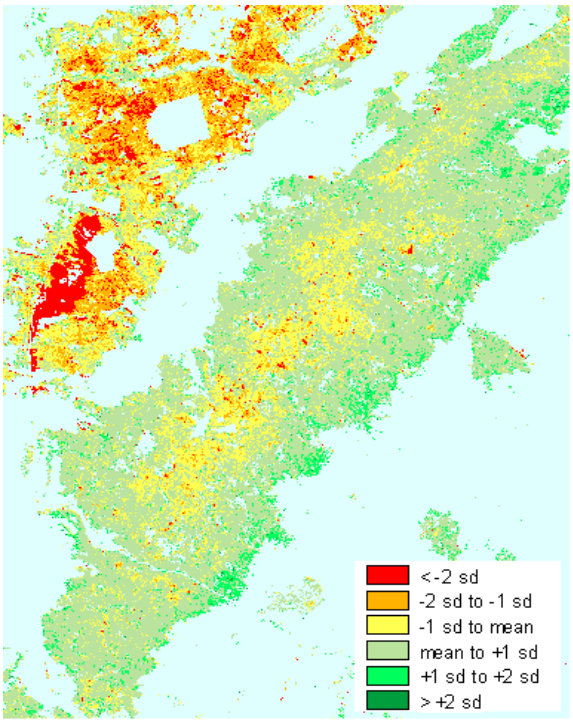

Fig.9. Detection of changes of the forest health condition: Red – significant worsening Dark green – significant improvement

Another result obtained is Development of methodology for processing of high-resolution satellite data. The methodology was developed for geometric correction, classification of tree species composition, forest decline and change detection from satellite IKONOS in model territory in the Low Tatra Mountains. The results based on spectral analyses of image data showed only weak possibilities for classification of forest damage and tree species composition. Using object-oriented processing of image information, taking into account 'inherent' image features such as color, texture and form features, carries out other research.

Finally, the third result obtained during the recent period has led to the creation of library of spectral curves for classification of forest damage from satellite and aerial hyperspectral data. The set of spectral measurements was carried out for healthy and damaged needles and leaves of Norway spruce (Picea abies) and beech (Fagus sylvatica) by spectroradiometer LICOR 1800. Analyses of spectral data showed possibilities to separate not only healthy and damaged trees but also initial damage classes of forest decline.

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