Using GIS and remote sensing for land use/land cover change (LULCC) detection in the context of post-socialist transformation in Central Europe

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1. INTRODUCTION & OBJECTIVES

Many countries in Central and Eastern Europe have been undergoing marked economic changes following the collapse of the former “Eastern Bloc” and totalitarian regimes. In the Czech Republic (CR), this transition has had a profound effect on land use management that subsequently resulted in widespread land cover changes. The Olomouc region in the eastern CR thus experienced significant land change, triggered by the “Velvet Revolution” in 1989. The objective of this study was to analyze Landsat imagery from 1991 and 2001 to empirically assess LULCC that occurred over a large area in the CR in the early post-socialist period. We identified the major land use/land cover transitions and trends using post-classification comparison based on a cross-tabulation technique and trend surface analysis (TSA). We focused on the trends in LULCC generally recognized as most significant in Central Europe in the post-socialist period: changes in agricultural areas, forest cover and urban development.

2. STUDY AREA


3. DATA


4. METHODS

5a. RESULTS: LULC Classification & Change

Results showed significant marginalization of intensive agricultural activities (12%), shift in forest composition from coniferous to mixed and deciduous forest (6%), and overall increase in residential development on arable land (3.5%).

5b. RESULTS: Major transitions trends

Transition from intensive agriculture to meadows was detected in the northeastern uplands and is consistent with studies that described the marginalization of agricultural areas occurring first at locations with unfavorable natural conditions, where agricultural production was previously forced by an extensive use of fertilizers and pesticides. These sites are not suitable as arable lands and were converted to farmlands during the socialist period of agricultural industrialization. After the restitution process and changes in agricultural subsidies, the majority of new landowners ceded their shares to successor organizations of former state co-operatives or keep the land but have not continued the previous agricultural activities.

Conversion to new development was identified on agricultural land, mostly in the central and southern lowland regions of the study area. This observation is consistent with a general suburbanization process in Central Europe, where the area of low-density residential development is rapidly expanding, although at a lower rate than in Western Europe. Progressive development of open land was associated with booming economy and the restitution and privatization process in the early post-socialist period. New residential areas tend to be built in the form of “satellite” towns and villages in the vicinity of larger cities, existing infrastructure, and recreational areas.

Transition from mixed forest to deciduous tree cover was observed in the northeastern hilly and mountainous part of the study site, where the intermediate elevation and associated environmental conditions potentially favor deciduous forest stands. This finding correlates with the general diversion in forest management in the last 15 years from clear-cut practices and spruce plantations to the alternative use of native broadleaved species of trees in the lower and intermediate elevations of the country. The causes of such diversion stem from an increase in environmental awareness in early 1990s, and has influenced the management of environmental resources in the country.

6. CONCLUSIONS

Our findings are consistent with recent socioeconomic and political studies that describe post-socialist land change drivers in Central and Eastern Europe, such as decreased need for intensive agriculture, shift to ecological management of forested areas or increasing suburbanization. We demonstrated how the application of remotely sensed data and techniques of geographical analysis (e.g., TSA), in combination with relevant socioeconomic studies, can be a valid component in a complex understanding of the consequences of broad-scale political and economic changes for the environment.