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Drivers and effects of long-term land use changes on climate, environment and socioeconomy in Central Europe

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An unique opportunity to analyse long-term land use changes in Central Europe has opened by the analysis of digitalised and georeferenced historic maps of Hungary. Military surveys depicting the land cover and land use types are available from the end of the 18th century, and give a comprehensive dataset for the whole territory of the Carpathian Basin. These map series provide excellent bases for historical land cover reconstructions. With GIS processing it is possible to analyse long-term land cover and land use changes. This is one of the goals of the recently approved international NASA project (200 years of land use and land cover changes and their driving forces in the Carpathian Basin in Central Europe, Coordinator: Volker Radeloff) focusing on agricultural land use change and its driving forces in the Carpathian Basin. Another important aim of this project is to create regional and global spatial econometric models based on land cover tendencies, environmental, agricultural, socio-economic, population, and land use legacy variables.

Within the framework of another transnational project TransEcoNet (Transnational Ecological Network in Central Europe) the land cover and landscape change of two Hungarian focus areas have been assessed to evaluate the change of the transboundary ecological networks on the Austrian and the Slovenian borderlands. Both cartographic and sociological methods have been applied to compare the GIS analysis results with the results drawn from people's opinion.

Climatic effects of the land cover changes are further evaluated using the MM5 non-hydrostatic dynamical model. The lower boundary conditions for the model have been generated for two selected time periods (1900 and 2000) based on historical and current land cover maps. According to the comparisons, the climatic effects of land cover changes on the near-surface meteorological variables have been significant. Changes in land use caused in nation-wide average +0.15 °C mean temperature rise and 0.18 °C increase in the dew point depression during the vegetation period. In selected vertically unstable weather cases, the land cover differences could significantly perturb the convective precipitation patterns and the regional mean as well.

The research results contribute to understand the effects of land cover changes on regional and global environmental processes.