Introduction

Global land change is the result of collective local and regional land use decisions. These decisions, affected by socio-economic and political shocks such as wars or the fall of empires. However, analyzing long-term and broad-scale patterns typically requires to synthesize many individual land change studies, and the question is how representative are these of the study area.

Goal

Identify and quantify broad land change patterns and processes, their driving forces, and their representativeness for the Carpathian region in a meta-analysis of existing studies.

Objectives

- Quantify 250 years of land change from existing studies and describe change patterns.
- Compare local and regional change patterns across studies.
- Identify the most important drivers of change.

Approach

Study area

Our study area (~400,000km²) was of the Carpathian Mountains and Pannonian Plains, a biodiversity hotspot, with the largest forests and the most fertile soils in Europe, and with a long land-use history (Fig. 1).

Data and analysis

We analyzed data from 66 publications at 102 locations, over 5 time periods (Tab 1). We harmonized land use classes and calculated annual rates of change for individual studies (Eq. 1).

Results – patterns

Forest cover generally increased. Forest transition occurred between WWI and WWII (93% of cases). Forest increased at highest rates after 1990 (70% of cases, approx. +1% /year (Fig 2)).

Agricultural lands were generally lost, especially in mountains, but increased in lowlands. During the Habsburg period, agricultural area increased in 70% of the studies (Fig 2). However, after WWII, and again after 1990 agriculture decreased sharply (-1.2% and -1.61% /year.

Results – drivers

Deforestation and agricultural expansions were largely the results of political and economic drivers such as political regime, market access, law enforcement. In contrast, abandonment was driven by socio-demographics factors (Fig. 3).

Discussion

- Regional patterns were strong: Despite overall trends, there were strong regional differences between mountains and lowlands and among countries. These patterns were driven by differences in physical and environmental conditions, policies, economic profitability as well as local-level decisions.
- Drivers interacted: In most cases, change resulted from the interactions of multiple drivers. For example, during Socialism, national policies caused agricultural expansion on fertile soils in eastern Hungary, but also migration into cities and abandonment of agriculture in mountain areas of Poland and Romania.
- Studies were geographically representative: The case-studies generally captured a countries’ physical characteristics well. However, Romanian and Polish captured generally higher elevations than the country means.
- Case studies were spatially and temporally biased: Many studies were selected because they depict change, suggesting that our analysis captured the peaks of change across the region.
- Our meta-analysis was useful to gain a broad understandings of patterns and processes. However, there remains a need for a long term spatially explicit analysis of change, and for consistent datasets to base such an analysis on.

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Partners

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