

EGU2020-474

<https://doi.org/10.5194/egusphere-egu2020-474>

EGU General Assembly 2020

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## Detecting hotspots of changes in spatial pattern of forest fragmentation in the Romanian Carpathian Mountains

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Landscape fragmentation is the expression of patchiness and spatial heterogeneity of land cover pattern. After the breakdown of the socialism regime in 1989, Romania has undergone significant changes at the level of political, institutional and socio-economic profile, which determined researchers to consider this country an experimental territory for land use and landscape research.

The aim of present study is to detect hotspots of changes of forests landscape fragmentation patterns in the Romanian Carpathian Mountains over the last 28 years. In order to meet our demand we applied a holistic approach to assess the multiple teleconnections between forest cover changes and the degree of fragmentation at regional scale for two distinct periods that make up the 1990-2018 period: (1) 1990-2006 (land restitution period or transition period to the market economy) and (2) 2006-2018 (post-accession period to the European Union).

The analysis were carried out using freely available time series CORINE Land Cover data of 1990, 2006 and 2018 provided by Copernicus Land Monitoring Services. The initial spatial datasets were processed with the help of Geographic Information Systems (GIS), while GUIDOS, a free software toolbox dedicated to quantitative analysis of digital landscape images, was used to generate spatial and statistics data of the degree of forest landscape fragmentation.

Our findings indicate that the first period of analysis was more dynamic regarding forest cover changes with a gross area gain of 316 304 ha (7.59%) and a gross area loss of 147 496 ha (3.54%) leading to a net forest area change of 168 808 ha (4.05%) which reflects the level of forest recovery. The change pattern of fragmentation classes showed that 332 045 ha (71.47%) of fragmentation decrease is found for the transition of dominant forest in 1990 into the less fragmented class interior in 2006, while 67 418 ha (65.10%) of all fragmentation increase is found for transition from interior in 1990 to dominant in 2006. The other side, for the period from 2006 to 2018 we found a gross area gain of 127 146 ha (2.93%) and a gross area loss of 212 933 ha (4.91%) leading to a net forest area change of -85 787 ha (-1.98%) which emphasizes the level of forest disturbance. In the same time frame, the high values of fragmentation pattern have been

registered for the same classes, 56.82% for fragmentation decrease and 70.60% for fragmentation increase, respectively. The results highlight the reversible impact of land use change on land cover pattern, spatially shaped through afforestation in the first period of analysis and through deforestation in the second period. The afforestation process were determined by high rate of external migration, while deforestation process is a consequence of land restitution laws (Law no. 247/2005), which caused considerable mutations in the ownership of land.

The study emphasizes the impacts of land use policies and land management practices on the pattern of forest landscape and the usefulness of Guidos Toolbox, a universal digital image object analysis, to detect hotspots of changes at regional scale.