Landscape structure mapping: application to Gedaref state, Sudan

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In the last decades, land use/ land cover (LULC) mapping has gained much attention due to its key role in assessing different ecosystem services and climate change. Gedaref state in Sudan is the main rainfed agricultural area in the county, where a huge transformation of natural land cover has taken place in the past years. This is due to the rapid population growth coupled with the expansion of rainfed mechanized agriculture in this area. Nevertheless, little is known about the LULC structure size, degree of change, transition, and intensity. Therefore, the objectives of this study were to assess LULC changes in the Gedaref state for the last thirty years (1988–2018) using time-series Landsat imageries and the random forest algorithm in Google Earth Engine platform and determine the magnitude and size of the change in the landscape structure using intensity analysis. The Intergovernmental Panel on Climate Change classification was adopted to define our LULC classes: cropland, forest land, grassland, water, and settlements. We used 700 polygons to train the model and 300 points to validate the model. The accuracy of the maps was assessed using overall accuracy, F1-score, quantity disagreement and allocation disagreement. The results showed that the overall accuracy of LULC maps ranges between 81.75% and 87.70%. Our results also revealed drastic LULC change in Gedaref state driven mainly by expansion in cropland and settlement areas, by 13.92% and 319.61%, respectively, during the study period (1988–2018). On the other hand, forest decreased by 56.47%, while grassland declined by 56.23%. In addition, our results revealed that the gains in cropland areas in Gedaref state between 1988 and 2018 were at the expense of grassland and forest areas, whereas the increases in settlements partially targeted cropland. The findings of this study are vital information on LULC dynamics in Gedaref state that could be used for developing policies for land use and environmental management for assessing and monitoring crop and grassland production, other natural resources produce, landscape fragmentation and degradation, and ecosystem functions.

Keywords: land use/ land cover change, random forest, intensity analysis