Land use hotspots of two largest landlocked countries: Kazakhstan and Mongolia

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As the top two largest landlocked countries, Kazakhstan and Mongolia share similar biophysical features, and experienced the political shifts from the collapse of the Soviet Union in 1991. The two countries departed from their political reforms and economic recovery since then. Land use and land cover change have been intensified under the drastic socioeconomic shifts. Current objective is to investigate the direction, extent, and spatial variation of land cover change at three administrative levels over three decades (1990- 2020). We selected three provinces from each country that represents a variety of the country’s ecological and socio-economic conditions (Aktobe, Akmola, and Almaty province in Kazakhstan, and Arkhangai, Tov, and Dornod in Mongolia). We leverage the computational capability of Google Earth Engine to classify Landsat images into five land cover classes: forest, grassland, cropland, barren, and water. Historical Landsat images are composited for four decadal years (1990s, 2000s, 2010s, and 2020s) that covered many geopolitical events that have shaped the social-ecological systems. Pixel-based classification method and random forest model were used to classify twelve spectral bands and to calculate vegetation indices. About 6000 training data points (300 training points ×5 classes ×4 periods) for each province were collected for land cover classification and for change detection. Land cover changes at decadal and over the entire study period for five land cover classes were quantified at the country, province, and county level. Land cover changes differ between the two countries and vary among provinces/counties within a country. In Kazakhstan, high rate of land cover changes appeared in the first two decades (1990-2000 and 2000-2010). In Akmola, grassland decreased by 17,627 km^2 (12%) during 2000-2010 while cropland expanded 14,915 km^2 (10.2%). In Mongolia, similar variations in land transformations existed. In Tov, grassland cover increased 5,529 km^2 (7.5%) and cropland decreased 4,689km^2 (6.3%) during 2000-2010. Spatial variation of land cover change intensity (iLCC) among the three administrative levels was examined to delineate land use hotspots. Land cover intensity change in Kazakhstan was large (43.7% overall) and was also evident in Mongolia but with lesser degree (29.9% overall) compared to Kazakhstan. Variations in land cover change intensity are largely driven by geopolitical events and the trajectory of its economic transition at the country level, but further complicated by its bio-geophysical baseline conditions at province/county level.

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