



## **Grassland Carbon Change in Northern China due to Contemporary and Future Land Use and Land Cover Change**

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In the past 20 years, more than 7 million hectares of natural grassland in north China were tilled and utilized. The increasing land use and land cover (LULC) change has resulted in the loss of ecosystem carbon storage and had an enormous impact on terrestrial carbon cycling. However, there are large uncertainties in quantifying the effect of LULC change on the historical and future carbon stock of these grasslands. This study used the integrated state-and-transition simulation model (ST-Sim) and the CENTURY model to track the effects of LULC change on ecosystem carbon storage from 1991 to 2030 in northern China. Four remote sensing based land cover maps of China (1-km spatial resolution for 1990, 2000, 2005, and 2010) were used to generate recent historical land cover transition rates and annual land cover maps. In addition, four LULC projections were downscaled from the Intergovernmental Panel on Climate Change (IPCC) representative concentration pathway (RCP) data and were used to derive future land cover changes of China. The CENTURY model was used to derive input parameters for the carbon stock and flow module in ST-Sim to track changes in carbon stocks and fluxes over the model period. The MODIS net primary productivity (NPP) product and regional living biomass and soil organic carbon maps were used to initialize the model. Five simulations were conducted including one with no historical and future land cover change (ST-Sim\_NLULC) and four historical LULC change plus future RCP projection scenarios (ST-Sim\_LULC). Simulation outputs included annual historical and future LULC maps, regional total NPP and net biome productivity (NBP) for the 1991-2030 period. Results showed that during the 40 years, the study area experienced drastic LULC change especially during the period 1991-2000. Compared to the ST-Sim\_NLULC (i.e. no land use change) results, the ST-Sim LULC scenarios each show an increased NPP, a lower NBP before 2000, and a slighter higher NBP post-2000; the reason may result from the increase of vegetation area and the decrease of non-vegetation area. The results are helpful to understand regional carbon budget and better inform local land use strategies.