Quantifying historical and future net exchanges of greenhouse gases of CO_2, CH_4 and N_2O between land and the atmosphere in Northern Eurasia

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The largest increase of surface air temperature and related climate extremes have occurred in Northern Eurasia in recent decades, and are projected to continue during the 21st century. The changing climate will affect biogeography, land cover, and carbon sink and source activities in the region, which in turn, will affect how global land use evolves in the future as humans attempt to mitigate and adapt to climate change. Regional land-use changes, however, also depend on pressures imposed by the global economy and environmental changes. Feedbacks from future land-use change will further modify regional and global biogeochemistry and climate. This study uses a suite of linked biogeography, biogeochemical, economic, and climate models to explore how climate-induced vegetation shifts in Northern Eurasia will influence land-use change, carbon cycling and biomass supply across the globe during the 21st century. We find that, at the global scale, while more land will be allocated towards food and biofuel crops (from current 22 to 37 million km^2 at the end of the 21^{st} century) due to increasing population and associated economic development, and changes of land use and vegetation shift in northern Eurasia, under the no-policy scenario. The affected global land-use change and climate result in a global cumulative carbon sink of 52 Pg C under the no-policy scenario (where CO2 equivalent greenhouse gas concentrations reach 870 ppmv by the end of 21*st* century), while under the policy scenario (limits CO2 equivalent greenhouse gas concentrations to 480 ppmv by the end of the 21*st* century), the cumulative carbon is sink of 63 Pg C. The global biomass supply will decrease 36 and 14 Pg under the no-policy and policy scenarios, respectively. In the presentation, we will also discuss our analysis on N_2O and CH4 exchanges between the biosphere and the atmosphere in response to the changes of land cover and climate during this century.

Keywords: Greenhouse gas, biogechemistry models, earth system modeling

