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Application of a terrestrial ecosystem model to assess human appropriation of net primary production in Asia

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Human appropriation of net primary production (HANPP) is a major indicator of human pressures on ecosystems. Land use induced changes in the productivity affect the processes and functions of ecosystems and they are associated with the provision of ecosystem services, such as the provision of biomass through agriculture and forestry, and the regulation services such as the absorption capacity for GHG emissions. A number of studies have been assessed the amount of human induced changes of NPP in the global level and calculated in spatially explicit way. However, the analysis of socio-economic drivers of the changes is still remaining as the main topic in the field. The interrelations between HANPP and social structures and processes are priority of global change research (Haberl et al. 2008).

The methodologies for credible HANPP assessment have been established in the previous studies. The proposed three parameters are (1)NPP0: NPP of the vegetation that would be assumed to prevail in the absence of human use (potential vegetation), (2)NPPact: NPP of the currently prevailing vegetation (actual vegetation), (3)NPPh: human harvest of NPP (e.g., through agriculture and forestry). We estimated these parameters in Asia using a process-based ecosystem model that describes carbon and nitrogen dynamics of plants and soils for terrestrial ecosystems of the globe. The socio-economic data on crop and timber harvest was applied to estimate the amount of human harvest of NPP. The parameters were calculated for each political unit to discuss social structures responding to various ecosystems. Based on the estimated parameters, we suggest the effective methodology combining spatially explicit gridded data and socio-economic statistical data.

Keywords: human appropriation of NPP, process-based ecosystem model, land use change, social adaptation