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Accounting for cross-sectoral linkages of climate change impacts based on multi-model projections

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Understanding how natural and human systems will be affected by climate change is not possible without accounting for cascading effects across different sectors. However, cross-sectoral inter-linkages remain strongly underrepresented in model-based assessments of climate change impacts. Based on the currently unique cross-sectoral multi-model data set generated for ISI-MIP (the first Inter-Sectoral Impact Model Intercomparison Project), we investigate climate-induced adaptation pressures on the global food production system, taking into account cross-sectoral co-limitations and response options, and quantifying uncertainties due to different model categories involved (climate-, crop-, hydrology-, ecosystem-models).
Results from 7 global crop models are synthesised to analyse changes in global wheat, maize, rice, and soy production as a function of global mean warming, on current agricultural land. To integrate constraints on the availability of water we propose a simple approach to estimate the maximum possible increase in global production based on limitations of renewable irrigation water as projected by 11 global hydrological models. The effect is compared to the production increase due to land-use changes as suggested by the demand fulfilling agro-economic model MAgPIE. While providing production increases the extension of farmland exerts a strong pressure on natural vegetation systems. This pressure is again compared to the pressure on natural vegetation that is induced by climate change itself.

The analysis will provide a cross sectoral synthesis of the ISI-MIP results.