

## Quantitative assessment of the impacts of sustainable irrigation on global bioenergy production

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Bioenergy production plays a critical role in many stringent climate scenarios to achieve the 2-degree target at the end of this century. Earlier reports showed that unconstrained irrigation can substantially increase the global bioenergy production and therefore reduce land requirement for bioenergy production. However, the extent and consequences of water-resources-constrained irrigation has been poorly explored. We first developed a future bioenergy land use scenario with strict natural and food protection considerations. Next, we quantitatively investigated the effects of a new sustainable irrigation scheme on the global bioenergy production in 2090 under representative concentration pathway (RCP) 2.6 based on an enhanced global hydrological model. Finally, we investigated the possible uncertainties from different irrigation schemes, general circulation models, and social economic pathways and made explicit comparisons with previous studies. Under our scenario, although we can stay within the planetary boundary for freshwater, the global bioenergy production falls short of the requirement prescribed in IPCC-RCP2.6.

Keywords: Bioenergy potential, Sustainable irrigation, IPCC-RCP2.6