

A framework for unravelling the complexities of unsustainable water resource use

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The majority of unsustainable water resource use is associated with food production, with the agricultural sector accounting for up to 70% of total freshwater use by humans. Water resource use in food production emerges as a result of dynamic interactions between humans and their environment in importing and exporting regions as well as the physical and socioeconomic trade infrastructure linking the two. Thus in order to understand unsustainable water resource use, it is essential to understand the complex socioecological food production and trade system. We present a modelling framework of the food production and trade system that facilitates an understanding of complex socioenvironmental processes that lead to unsustainable water resource use.

Our framework is based on a coupling of the global hydrological model PC Raster Global Water Balance (PCR-GLOBWB) with a multi-agent socioeconomic food production and trade network. In our framework, agents perceive environmental conditions. They make food supply decisions based upon those perceptions and the heterogeneous socioeconomic conditions in which they exist. Agent decisions modify land and water resources. Those environmental changes feedback to influence decision making further. The framework presented has the potential to go beyond a diagnosis of the causes of unsustainable water resource and provide pathways towards a sustainable food system in terms of water resources.