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## Socio-hydrological modelling to manage and mitigate hydrological droughts

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Managing water-human systems in times of water shortage and droughts is key to avoid overexploitation and reduce drought impacts. Drought policies are designed to structure water management response and avoid crisis management, aiming to sustain both environmental and anthropogenic water demand. However, the impact of drought policies on the hydrological cycle is rarely assessed. We developed a socio-hydrological model, simulating feedbacks between water availability and managed water use for 3 decades. Thereby, we aim to assess the impact of drought policies on both surface water and groundwater droughts. We tested this model in an idealised catchment driven by English climate data, representing English water resource management practices and drought policies. The model environment includes a surface water storage (reservoir), a range of hydrogeological conditions for the groundwater module, and an option to import surface water or groundwater that could all be used to satisfy anthropogenic and environmental water demand. Modelled scenarios represent four aspects of drought policies: 1) increased water supply, 2) restricted water use, 3) conjunctive water use, and 4) maintained environmental flow requirements that were evaluated in separate and combined scenarios. Results show that hydrological droughts are mitigated in scenarios applying conjunctive use, particularly in low groundwater storage systems. In high groundwater storage systems, maintaining environmental flows reduces hydrological droughts most, particularly for surface water droughts. Scenarios that gradually increase water supply or restrict water use have opposite impacts on droughts and these scenarios are in balance when combined according to the policies in the resources management plans. Most combined scenarios reduce the severity and occurrence of hydrological droughts, although the dependency on importing water increases, satisfying a third of the total anthropogenic water demand. The increased dependency on imported water shows the considerable pressure on water resources and the delicate balance of water-human systems during droughts that calls for short-term and long-term sustainability targets within drought policies.