



Risk of economic impacts to irrigated agriculture due to drought management

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In humid temperate countries, such as England and Wales, supplemental irrigation is used to reduce drought risk, stabilize production and increase food quality for high value horticultural crops and soft fruit. Under uncertain future climatic conditions, irrigation might also become more important to buffer increasing soil water stress, further increasing the stresses on aquatic habitats. From a drought management perspective, water abstraction for irrigation can be mandatorily reduced or banned if river flows and forecast rainfall drop below thresholds predefined by the environmental regulator. Such policy and management decisions regarding reductions of water abstraction will result in economic impacts - determined by the frequency, duration, severity and timing of the imposed water abstraction restrictions.

This study provides the first spatially explicit national risk assessment of the economic losses in irrigated agriculture from England and Wales arising from drought management under three uneven climatic time periods: baseline (1975-2004), near future (2020-2049) and far future (2070-2099). Daily rainfall was simulated using the weather@home2 regional climate model (RCM) HadRM3P and the Representative Concentration Pathway 8.5 (RCP8.5) scenarios, with the meteorological outputs driving the national Grid2Grid distributed daily hydrological model. The probability, magnitude and timing of water abstraction restrictions are derived by applying the restriction triggers within the drought management plans to daily rainfall and river flow data within 129 catchments. The risk of economic losses at the catchment level is then derived from the abstraction restrictions occurrences combined with spatially distributed economic losses per crop.

Results show that the risks of economic impacts of droughts on irrigated agriculture vary spatiotemporally widely across England and Wales. The highest risks are geographically located in dense irrigated areas with high value crops mix and where surface water does not recover quickly from groundwater sources. This research highlights the significant economic damages experienced by the agricultural sector associated with mandatory drought restrictions and supports the need for water authorities and irrigators to collaboratively manage scarce water resources during drought to balance environmental and economic considerations.