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# Hydroecological impacts of climate change modelled for a lowland UK wetland

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Conservation management of wetlands often rests on modifying hydrological functions to establish or maintain desired flora and fauna. Hence the ability to predict the impacts of climate change is highly beneficial. Here, the physically based, distributed model MIKE SHE was used to simulate hydrology for the Lambourn Observatory at Boxford, UK. This comprises a 10 ha lowland riparian wetland protected for conservation, where the degree of variability in the peat, gravel and chalk geology has clouded hydrological understanding. Notably, a weathered layer on the chalk aquifer surface seals it from overlying deposits, yet is highly spatially heterogeneous.
Long-term monitoring yielded observations of groundwater and surface water levels for model calibration and validation. Simulated results were consistent with observed data and reproduced the effects of seasonal fluctuations and in-channel macrophyte growth. The adjacent river and subsidiary channel were found to act as head boundaries, exerting a general control on water levels across the site. Discrete areas of groundwater upwellings caused raised water levels at distinct locations within the wetland. These were concurrent to regions where the weathered chalk layer is absent.
To assess impacts of climate change, outputs from the UK Climate Projections 2009 ensemble of global climate models for the 2080s are used to obtain monthly percentage changes in climate variables. Changes in groundwater levels were taken from a regional model of the Chalk aquifer. Values of precipitation and evapotranspiration were seen to increase, whilst groundwater levels decreased, resulting in the greater dominance of precipitation. The discrete areas of groundwater upwelling were seen to diminish or disappear.
Simulated water levels were linked to specific requirements of wetland plants using water table depth zone diagrams. Increasing depth of winter and summer groundwater levels leads to a loss of Glyceria maxima and Phragmites australis, principal habitat for the endangered Vertigo moulinsiana. Further, the reduced influx of base-rich groundwater and increased dominance of high pH rain-fed waters alters the acidity of the soil. This leads to changes in species composition, with potential reductions in Carex paniculata, Caltha palustris and Typha latifolia.