Time scales of a wetland regime: impacts of climate and management on Lake Toolibin, WA

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Supervised by
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ABSTRACT

This study describes spatial and temporal patterns of unsaturated zone hydro-salinity in response to multiple stimuli. The impacts of climate variability and lake filling on water and salt balances were investigated using a one-dimensional (HYDRUS-1D) plot-scale model of Lake Toolibin, an internationally significant ephemeral wetland in the south west of Western Australia. Model input parameters were based on laboratory analysis of soil texture and soil moisture retention curves, plant water uptake, groundwater level and historical climate records. A conceptual model was used to link lake responses to the plausible hydrogeological feedbacks that would occur during evolution of wetting/drying states. Fractures due to sediment drying were not analytically addressed in the model.

Results indicate that prolonged climate drying is expected to keep the system in a state of moisture imbalance for 100’s of years, potentially fatal for vegetation. In response to this and coupled with minimal salt leaching from model scenarios of rainfall, managed flushing was deemed necessary to force accumulated salts from plant root zones. Antecedent groundwater level, duration and depth of inundation were found to be key determinants in the success of leaching processes due to soil waterlogging, which occurred within a few weeks to a month under the current shallow depth to groundwater. A lower watertable and free drainage of the matrix system extensively enhanced vertical transfers of water and salt but due to the heavy clay nature of lake sediments, this response lagged at least 100 days behind infiltration forcing.