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# Modelling the complex vegetation response to changing water regimes in a dryland wetland in Australia

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Wetland vegetation in arid and semi-arid floodplains of Australia is driven by the water regime. Plant communities rely on periodical floods, distributed in a spatial gradient from dry to aquatic conditions due to the topographic conditions of the site. At the same time, the spatial frequency of these floods is also variable as the water entering the wetlands is influenced by the regional climate and by water management of the upper catchment. The time-space variability of the water regime then gives origin to a mosaic-like distribution of the vegetation. Prolonged changes in the water regime, as in the case of a drought, can lead to a transition of wetland vegetation to terrestrial species, but some of these species have shown significant resilience and persistence as they can maintain seedbanks for years or recover from rhizomes once the water regime re-establishes. In Eucalyptus forests and woodlands, recovery has been observed after long periods without floods, but consecutive floods are necessary for maintaining healthy conditions and for new seedlings to establish. All of these persistence mechanisms provide complex feedbacks between the water regime and the distribution of the vegetation because species can transition or remain in a certain state.

We simulate wetland vegetation transitions to study feedbacks between the water regime and vegetation distribution over different scenarios. We use the Macquarie Marshes, an iconic wetland site in semi-arid Australia, as our study site. Water regime is determined with hydrodynamic modelling, providing a detailed description of flood duration and extent. To assess vegetation changes, we have determined a series of critical inundation thresholds that trigger changes in the vegetation communities of the site. These inundation thresholds are the result of combining historical data of vegetation distribution and condition, and hydrodynamic modelling. Our approach provides a framework for representing complex vegetation transitions with deterministic rules that can be modified to study different vegetation communities in other wetland sites. The results of the model also quantify changes in the vegetation distribution of the site, which allows for an assessment of vegetation resilience under different scenarios.