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Co-evolution and thresholds in arid floodplain wetland ecosystems.

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Vegetation in arid floodplain wetlands consist of water dependent and flood tolerant species that rely on periodical floods in order to maintain healthy conditions. The floodplain often consist of a complex system of marshes, swamps and lagoons interconnected by a network of streams and poorly defined rills. Over time, feedbacks develop between vegetation and flow paths producing areas of flow obstruction and flow concentration, which combined with depositional and erosional process lead to a continuous change on the position and characteristics of inundation areas. This coevolution of flow paths and vegetation can reach a threshold that triggers major channel transformations and abandonment of wetland areas, in a process that is irreversible.
The Macquarie Marshes is a floodplain wetland complex in the semi-arid region of north western NSW, Australia. The site is characterised by a low-gradient topography that leads to channel breakdown processes where the river network becomes practically non-existent and the flow extends over large areas of wetland that later re-join and reform channels exiting the system. Due to a combination of climatic and anthropogenic pressures, the wetland ecosystem in the Macquarie Marshes has deteriorated over the past few decades. This has been linked to decreasing inundation frequencies and extent, with whole areas of flood dependent species such as Water Couch and Common Reed undergoing complete succession to terrestrial species and dryland.
In this presentation we provide an overview of an ecogeomorphological model that we have developed in order to simulate the complex dynamics of the marshes. The model combines hydrodynamic, vegetation and channel evolution modules. We focus on the vegetation component of the model and the transitional rules to predict wetland invasion by terrestrial vegetation.