26th International Congress on Modelling and Simulation, Adelaide, SA, Australia, 30 Nov–4 Dec 2025
mssanz.org.au/modsim2025

Novel assessment of trajectories of change in Murray-Darling Basin riverine tree ecosystems

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Abstract: Floodplain trees are part of a dynamic ecosystem and are responsive to disturbance. Floodplain trees are representative of broader patterns in ecosystem change, caused by altered patterns of hydrology. Over the past 20-30 years, continual declines in native riparian tree biomass have occurred in Australia's highly regulated Murray-Darling Basin, although dominant spatial-temporal causes remain unclear. Adaptive cycles describe the dynamic responses of ecosystems to disturbance (Gunderson & Holling, 2002). Using a trajectory of change analysis, we examine the cycles of canopy greenness, as derived from remotely sensed Normalized Difference Vegetation Index (NDVI) time series (Doody et al., 2024). This analysis focuses on two floodplain tree species (*Eucalyptus camaldulensis* and *E. largiflorens*), comparing their greenness trajectories to their known flood requirements. We compared flood history in two large floodplain complexes in the MDB (Darling River - *E. largiflorens*; Yanga National Park – *E. camaldulensis* (Doody et al., 2015)). The Yanga complex is highly managed, with planned environmental water used to support tree function. In contrast, Darling River trees are more reliant on unregulated flows. We compare trajectories of change and potential thresholds in NDVI which might indicate potential 'flips' to less productive states. For the Darling River complex, trajectories were compared for trees inundated for 1:8 and >1:30 years, while three flood classes at Yanga of 1:2, 1:5 and 1:10 were compared. As flood frequency decreased, trajectories of NDVI progressed from a pattern of ~5-year cyclical positive/negative trajectories to long-term NDVI declines for the >1:30 and 1:10 flood classes (Doody et al., 2024). Long-term declines in the trajectory of the 1:8 flood class coincided with substantially reduced river flows in the Darling River from 1990 onwards. Additionally, substantial flooding in 2016 did not reverse that decline. Our modeling has important implications for the management of water dependent ecosystems and we demonstrate the utility of adaptive cycles for the exploration of resilience in floodplain ecosystems.

Keywords: *Keywords: adaptive cycles, eucalyptus, Darling River, inundation*

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