

Groundwater depth thresholds for tree condition

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A range of ecological processes supported by groundwater are at risk where socio-economic and climate drivers increase net groundwater demand. Previous research has indicated close links between groundwater and riparian/floodplain tree condition, However, little is known about the nature of the relationship or whether critical groundwater-tree condition thresholds exist. Threshold responses may indicate the existence of groundwater depths associated with rapid ecological change. This study provided evidence of threshold responses between groundwater depth and tree condition in the Condamine catchment in eastern Australia, where groundwater decline due to over extraction is well documented. It collates tree condition data (188 sites) from recent studies of two dominant Australian Floodplain species, *Eucalyptus camaldulensis* Denh. (river red gum) and *E. populnea* F. Muell (poplar box). Boosted regression tree and quantile regression were used to investigate the nature of the relationship and threshold values. A distinct non-linear response of tree condition to groundwater depth was identified, with thresholds at 12.5-17.2 m for *E. camaldulensis* and 15.6-22.0 m for *E. populnea*. Threshold responses may be explained in terms of physiological limitations to rooting depth in these and similar floodplain/riparian species, with groundwater decline effectively decoupling tree roots from accessible moisture resources leaving trees more vulnerable to hydraulic stress and / or failure particularly under drought conditions. The existence of thresholds suggest that groundwater decline may trigger rapid ecological changes in riparian and floodplain tree species, which may have important implications not only for their future persistence but also the various ecological functions they support.