Abstract

Riparian ecosystems are biophysically complex, highly biodiverse and provide a broad array of essential ecosystem services to both humans and surrounding landscapes. Extensive catchment modification and alteration of natural river flows have resulted in widespread degradation of riparian ecosystems worldwide, with human population expansion and climatic change likely to exacerbate this situation over the next century. Basic information about the ecology of riparian plant communities in Australia is needed to inform riparian conservation and rehabilitation efforts.

In this thesis, I used a functional trait approach to investigate how hydrology and other environmental variables template the ecology of riparian plant communities in temperate and subtropical eastern Australia. Functional traits such as wood density or seed mass provide fundamental information about the ecological strategies of plants, and facilitate comparison of communities in terms of how component species respond to and influence their environment.

Chapters 2 and 3 present the findings of a field campaign across south-eastern Australia, and describe the role of fluvial disturbance and flow variability in determining functional trait composition and diversity in riparian plant communities. Chapter 4 investigates the role of environmental heterogeneity as a control on taxonomic and functional trait diversity in riparian plant communities of south-eastern Queensland, with an emphasis on the impacts of flow modification and land-use intensification. Chapter 5 describes a manipulative glasshouse experiment on the interactive effects of inundation and elevated atmospheric CO2 on gas exchange, growth, and functional traits of three riparian tree species native to south-eastern Australia.

In south-eastern Australia (Chapters 2 and 3), community wood density and functional trait diversity increased strongly with metrics describing flood magnitude and flow heterogeneity. In south-eastern Queensland (Chapter 4), species richness decreased and abundance of exotic species increased as hydrological conditions became more heterogeneous. Flow homogenisation by dams increased species richness, contrary to expectation. Functional trait diversity was associated with only a limited set of hydrological metrics, and was not influenced by flow modification or catchment land use. I found differing effects of atmospheric CO\textsubscript{2} concentration and waterlogging status on growth, gas exchange and functional traits between species (Chapter 5).

This work highlights the importance of natural hydrological heterogeneity and anthropogenic alteration of flows availability as determinants of diversity in riparian vegetation communities.