Invasive non-native plants retain native mammal communities in novel ecosystems

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Human-mediated environmental impacts are now so extensive and pervasive that many consider that the planet has entered a new geological epoch – the Anthropocene.

Driven by the need to find solutions to these emerging challenges, biodiversity conservation is entering a phase of prolific innovation… With this upheaval of new ideas, there is a genuine risk of the conservation community fragmenting into different schools of thought. In an attempt to minimize that risk, we introduce a conceptual framework that moves beyond established dichotomies and offers ways to reconcile conflicting perspectives.

(Kueffer & Kaiser-Bunbury 2013)

Abstract

Biological invasions are a major threat to native ecosystems globally, yet in some landscapes they can also have important positive effects on native biodiversity. For example, invasive non-native plants have the potential to act as ecological engineers in novel ecosystems by 'creating' habitat where it is otherwise lacking, thereby increasing the diversity and abundance of native fauna. Yet little is known of their net effect on population persistence. Understanding the impact of non-native plants on native fauna is becoming increasingly urgent for conservation management, particularly in degraded and novel ecosystems where the broad-scale removal of weeds could threaten native fauna populations and the ecological processes they contribute to. This thesis takes a local and global view to investigate the conservation conundrum of native fauna responses to non-native plants. It examines the effect of non-native blackberry on individual, population and community-level responses of small native mammals in native, hybrid and novel ecosystems before proposing a multi-scale framework to quantify the net effect of non-native plants on native fauna persistence.

The research was undertaken in the Mount Lofty Ranges of South Australia, a biodiversity hotspot that is considered a 'canary landscape' for temperate woodlands. The environmental decline seen here is expected to follow similar trends elsewhere. Blackberry (*Rubus anglocandicans*) is a non-native and highly invasive environmental weed that has been reported to provide habitat for native birds and mammals in the study region. The research was conducted as a multi-species study of small mammal responses to blackberry, with a particular focus on the nationally endangered southern brown bandicoot (*Isoodon obesulus*). Small mammal communities were surveyed for 11 consecutive seasons across 13 sites (7,500 ha) that represented native, hybrid and blackberry-dominated novel ecosystems of the region. A mixed modelling approach was used to quantify the net effect of blackberry on fauna responses at multiple scales, including: individual (reproduction and physiology); population (abundance, adult female density, and recruitment); and community (species richness, diversity and interspecific competition). To the best of knowledge, this is the first study on the impact of non-native plants on the recruitment and population persistence of native mammals.

Ten species of small mammals, including six native, were captured across 12,235 captures and 31,407 trap sessions. Blackberry was identified as an ecological engineer in blackberry-dominated novel ecosystems, where it retains diverse native mammal communities of yellow-footed antechinus (*Antechinus flavipes*; vulnerable), bush rat (*Rattus fuscipes*), brushtail possum (*Trichosurus vulpecula*; rare), short-beaked echidna (*Tachyglossus aculeatus*) and southern brown bandicoot (*Isoodon obesulus*; endangered). The abundance, density, dispersal and recruitment of bandicoots were also greatest in blackberry, with arthropod abundance and blackberry density the strongest positive predictors for recruitment of juveniles from source populations into the overall meta-population. The results confirm that non-native plants can act as ecosystem engineers in novel ecosystems and create critical habitat that supports mammal communities where they would otherwise become locally extinct.

Interactions between non-native and native species are increasing worldwide, and quantifying these complex dynamics is essential in order to successfully tackle the conservation challenges of the future. The final chapter of the thesis responds to this challenge by critiquing the traditional and emerging methods used in the empirical study, and synthesizing these with existing frameworks on non-native – native interactions. The thesis concludes by proposing two conceptual frameworks to: (1) inform future quantitative assessments of native fauna responses to non-native plants, and (2) guide restoration to retain positive ecosystem processes while reducing those that are harmful. Thus the research contributes to native fauna conservation in fragmented landscapes via both primary data collection for multiple species at multiple scales, and by suggesting frameworks to improve the effectiveness of restoration by prioritizing actions where non-native plants provide habitat for native fauna in degraded ecosystems.

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Dedicated to

Enid
who taught us to observe and work with nature's rhythms for "less haste, more speed"

Ori
for embracing this journey and already living as a next-generation custodian for the Earth

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