There is an abundance of discussion in the literature regarding sex ratios of plants and its ecological and evolutionary consequences. Thompson and Barrett (1981) claim that dioecy functions as a mechanism to reduce inbreeding. However, unisexual breeding systems can be significantly and positively correlated with endangered species (Sjostrom and Gross 2006) and experience higher extinction rates and lower speciation rates compared with non-dioecious groups (Vamosi and Vamosi 2005).

Ongoing study of Coastal Fontainea will seek to clarify sex ratios across the population of wild and translocated specimens including further investigation of temporal patterns of sex ratios and the consequences for the ongoing viability of the species.

References

NSW Department of Environment and Conservation. (2003). *Draft Recovery Plan for* Fontainea oraria (*Coastal Fontainea),* NSW Department of Environment and Conservation, Hurstville.

Rossetto, M., McNally, J., Henry, J., Hunter, J., and Matthes, M. (2000). Conservation genetics of an endangered rainforest tree (*Fontainea oraria* – Euphorbiaceae) and implications for closely related species. *Conservation Genetics.* 1,217–229.

Sjostrom, A. and Gross, C.L. (2006). Life-history characters and phylogeny are correlated with extinction risk in the Australian angiosperms. *Journal of Biogeography* 33., 271-290.

Thompson, J.D. and Barrett, S.C.H. (1981). Selection for outcrossing, sexual selection and the evolution of dioecy in plants. *American Naturalist.* 118, 443-449

Vamosi, J.C. and Vamosi, S.M. (2005). Present day risk of extinction may exacerbate the lower species richness of dioecious clades. *Diversity and Distributions.* 11, 25-32.

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Threatened species management on the rural-urban interface: insight from a critically endangered shrub

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Introduction

As urban development increases throughout rural areas around the world, habitat fragmentation and changes to disturbance regimes become ever-pressing issues for indigenous flora and fauna. Fragmentation impacts upon ecosystem processes; for example, it prevents gene flow, dispersal, and migration (particularly with climate change). It also can dramatically alter top-down or bottom-up ecological processes, promote competition from invasive species and alter fire behaviour. Fire is a major disturbance factor across the globe, and particularly for Australian vegetation. The expansion of urban development can lead to reduced fire frequency through fire exclusion and suppression around residential areas, or can increase the frequency of fire through fuel-reduction burns or unintended ignitions; both can have dramatic effects on the type of species able to persist in these areas. Further, travelling with the expanding urban boundaries are concomitant suites of native and introduced urbanophile species that threaten to compete with, and displace, locally indigenous taxa (McKinney, 2006).

Habitat fragmentation and changes to disturbance regimes can place great pressure on geographically restricted, rare, endemic species. For example, of 148 plant taxa listed as critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act* 1999 (Australian Government 2016), 45% specifically include future development and land clearing (habitat loss and / or isolation of small remnant populations) as threats to populations, and 52% include altered fire regimes (11% specifically from increased fire frequency, and 3% from decreased frequency).

Insight from a critically endangered shrub

In a recent study (Patykowski *et al.*,2016), we examined the likely influence of habitat fragmentation and reduced fire frequency on the decline of Round-leaf Pomaderris (*Pomaderris vacciniifolia* Reissek), a shrub listed as critically endangered under the *EPBC Act* 1999. Populations of this species are predominantly found at the rural-urban interface of eastern Melbourne, in south-east Australia. We found that its seeds require a heat treatment consistent with the effects of fire for mass-germination events. Although a small proportion of its seed can germinate in the absence of fire, it is likely that competition from both native and exotic species has led to remaining populations of this species declining between major bushfires in 1926, 1939 and 2009. Furthermore, we found that seeds typically disperse less than 1 m from the parent plant, and thus migration through suitable habitat is probably limited by fragmentation from agriculture, roads and other rural infrastructure. The longevity of seeds in the soil seed bank is unknown, but it can be concluded that in the long-term absence of suitable recruitment events (fire), and eventual depletion of the soil seed bank, local extinction of this species will occur and populations are unlikely to be replaced.

Management options

Ecological burning is an option for ensuring the persistence of this species, although controlled burns have inherent planning limitations when applied to bushland amongst areas with mixed residential and primary production use (Gill and Scott, 2009). Collecting seed and planting greenhouse-grown seedlings in suitable areas is a viable but potentially expensive, labour-intensive option. Determining what a suitable area is requires further research. One could model suitable habitat under climate change scenarios then plant tubestock or distribute seed into these areas, where ecological burning could be undertaken in the future. This would aim to shift its distribution into more remote areas, and may give it greater conservation security. A myriad of factors need to be considered under this management regime including competition with other species and other general effects on ecosystem processes within the recipient sites.

Inflorescence of Round-Leaf Pomaderris (*Pomaderris vacciniifolia*). Photo: John Patykowski

Roadside population of Round-Leaf Pomaderris (*Pomaderris vacciniifolia*) in the peri-urban town of Toolangi, Victoria. Photo: John Patykowski

As a case study, this species highlights the broader challenge we face when dealing with threatened species that are predominantly distributed around urban-fringe areas. Species-specific management is one option, but what of the species we don't realise are threatened? Multi-species approaches may be a better option, and this comes down to effective strategic planning and strengthening the prominence of rare and threatened species management in Victorian Planning Provisions. Maintenance of connectivity between 'green-wedge' zones around Melbourne, and maintenance of disturbance regimes can ensure vegetation does not become ecologically degraded and species-poor. Furthermore, it can help to ensure that other ecosystem attributes are maintained, such as structure which is important for different trophic levels.

Conclusion

With increased pressure for alterations to vegetation for fire management, access, and residential growth, so too does the urgency with which we must plan for managing vulnerable, endemic species. Species such as Round-leaf Pomaderris can highlight the precarious nature of managing small populations of threatened species, how quickly they can respond when suitable disturbance regimes return, and how little we understand regarding the potential of other species to be in a similar precarious position; unbeknownst to scientists, land managers and the wider public.

References

Australian Government (2016). 'EPBC Act List of Threatened Flora' (Australian Government Department of the Environment: Canberra) Available at:http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora [Verified 1 November 2016]

Gill, A. M. and Scott, L. S. (2009). Scientific and social challenges for the management of fire-prone wildland–urban interfaces. *Environmental Research Letters* 4, 034014.

McKinney, M. L. (2006). Urbanization as a major cause of biotic homogenization. *Biological Conservation* 127, 247-260.

Patykowski, J, Dell, M. and Gibson, M. (2016). Germination ecology and seed dispersal of a critically endangered plant: A case study of *Pomaderris vacciniifolia* (Round-Leaf Pomaderris) *PLoS ONE* 11, e0161665.

Parks and people: Promoting plant conservation

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'Plant blindness'

Are we really 'blind' to plants? [theconversation.com/people-are-blind-to-plants-and-thats-bad-news-for-conservation-65240 and online in *Conservation Biology* DOI: 10.1111/cobi.12738]. This interesting piece by Balding and Williams from the School of Ecosystem and Forest Sciences, University of Melbourne discusses how frequently plant conservation initiatives slip under the radar in favour of animal projects. But this is nothing new, we've known about this shortage of interest in plants for a long time. It goes hand-in-hand with a shortage of funds for plant conservation projects relative to that allocated for animal conservation. Why is this? Are animals inherently more interesting? Is it because they are more elusive? Is it because they are considered 'cute and cuddly' and we can relate to domestic pets and a sense of nurturing? Or is it because we don't try hard enough to promote the good work being done in plant conservation?

Conservation actions for threatened plants in Australia include legislation, policies and legal controls, land protection, and specific *in situ* species management activities such as fencing and invasive species control, both pest and disease. *Ex situ* methods are also employed, including seed banking, maintaining living collections in botanic gardens and the deliberate transfer of material from one site to another in order to reinstate or augment declining or lost resources (termed *translocation*). These translocations are used by conservationists as a tool in worse case scenarios, when *in situ* management is just not enough to halt the loss of plant genetic diversity. In Western Australia, translocations are widely used in conjunction with seed banking to ensure that critically endangered plant species are given the opportunity for a safe future away from threatening processes such as *Phytophthora* dieback disease.

Because translocations are such a 'desperate' measure to prevent extinction, they should be used to help inspire a public sense of optimism in the face of biodiversity loss. They present a good opportunity to promote important plant conservation efforts. However, plant conservation activities in WA often suffer from a low public profile and a lack of media attention compared with the attention that animal projects receive. Indeed, a recent article in the

December 2010 and interpretive signage. Photos: Anne Cochrane