The enemy within: native environmental weeds of Western Australia

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Summary In Western Australia thirty five species of Western Australian plants have become naturalised, largely outside their ranges, from plantings. Fifty four eastern Australian species are also naturalised and several form a major threat to the forests of Western Australia. Current major WA environmental weeds are *Agonis flexuosa* and *Chamelaucium uncinatum*. An improved knowledge of the ecology, nature and composition of the native flora is required to prevent an increasing threat of native weeds.
Keywords Western Australia, eastern Australian environmental weeds, revegetation, status, hybridisation.

INTRODUCTION

One of the problems in recognising and controlling environmental weeds in Australia is an understanding that Australian native species can be serious problems out of their natural ranges and habitats.

During this century there will be an increasing focus on replanting and rehabilitating degraded lands to restore ecosystem functions, connect remnants and create a sustainable agricultural system. For example current proposals in Western Australia (WA) are to replant one million hectares over 10 years and to create new perennial agricultural systems using both Australian native and introduced species (Government of Western Australia 2000) to help control rising saline groundwaters in the agricultural zone.

METHODS

While there are adequate requirements to test the potential weediness of new exotic introductions for agriculture, there are no such requirements for native species. Using a series of headings, this paper will discuss and illustrate the nature, depth and scope of the issues around native species as weeds. These examples are derived from many years of observation in Western Australia.

RESULTS AND DISCUSSION

Weedy eastern Australian natives in Western Australia A large range of eastern Australian ornamental, timber and tannin species were planted around forestry settlements from 1900 onwards. Over 54 species have since established feral populations and several of these species are on the verge of becoming major weeds of native forests. Current serious invaders include: *Leptospermum laevigatum* (Gaertn.) F.Muell, *Eucalyptus maculata* Hook., *Eucalyptus citriodora* Hook., *Brachychiton populneus* (Schott & Endl.) R.Br., *Acacia decurrens* Willd., *A. dealbata* Link., *A. pycnantha* Benth., *A. longifolia* (Andrews) Willd., *A. melanoxylon* R.Br. and *Pittosporum undulatum* Vent. These species should not be used in or near bushland as amenity plantings or promoted as garden subjects.

As native plants are not considered weeds the biogeographic and taxonomic issues that restrict exotic importations to WA do not apply. Therefore, eastern Australian natives should be assessed for weediness in the same manner as exotics

Uncertainty about the status of some species There are at least 18, mostly wetland species that are variously listed as native or naturalised depending on the reference used. These require genetic, ecological and taxonomic study to clarify their origins and status. Examples include: *Acacia farnesiana* (L.) Willd., *Datura leichhardtii* Benth., *Physalis minima* L., *Grammatotheca bergiana* (Cham.) C.Presl., *Juncus bufonius* L., *Salsola tragus* L., *Chenopodium glaucum* L., *Tribulus terrestris* L. and *Bromus arenarius* Labill. More detailed discussion of these taxa can be found in Kloot (1986) and Romanowski (1998).

Some species listed as weeds in Western Australia are considered native in eastern Australia. Examples include: *Pseudognaphalium luteo-album* (L.) Hilliard & Burtt, *Samolus valerandi* L., *Solanum americanum* Mill. Romanowski (1998) gives strong evidence for considering *Berula erecta* (Huds.) Coville as native, stating on p. 14 that this species has 'sometimes been regarded as introduced, but there are enough differences between the Australian and European plants for it to be uncertain whether they are the same species'. Similarly for *Lythrum hyssopifolium* L. he noted 'pollen evidence for occurrence in Australia for over 20,000 years'.

There are few species regarded as natives to Western Australia and weeds in eastern Australia, e.g. *Cotula coronopifolia* L. (Romanowski 1998) 'This species has long been regarded as native, but it is now increasingly listed as exotic; however, there is no strong evidence either way.'

Perhaps unique to Western Australia are a series of species with native forms in the tropics, but with exotic weedy forms in temperate Western Australia. These include: *Cynodon dactylon* (L.) Pers., *Cyperus rotundus* L., *Melia azedarach* L., *Euphorbia australis* Boiss. and *E. drummondii* Boiss., *Homalanthus novo-guineensis* (Warb.) Lauterb. & K.Schum., *Cyperus polystachyos* Rottb., *Colocasia esculenta* (L.) Schott and *Hibiscus trionum* L. These species are generally listed as either native or naturalised for the entire taxon in Western Australian checklists.

Finally there are also truly native species that are disturbance opportunists. They include species with:

a) Unknown natural ranges: examples are *Azolla filiculoides* Lam. and *Azolla pinnata* R.Br. Both of these ferns are native species but occur readily in man made habitats (dams and ponds). They are now rarely encountered in the wild. There seems no doubt that their current range does not reflect their natural range, however, our lack of detailed survey means that new records of occurrence will be accepted as natural.
b) Expanding natural ranges as suitable habitats occur: these can be dispersed by biological agents such as birds: *Lemna disperma* Hegelm., *Gratiola pubescens* R.Br., *Bolboschoenus caldwellii* (V.J.Cook) Sojak, *Ruppia* species and *Ottelia ovalifolia* (R.Br.) Rich.
c) Dispersing by human assistance along transport corridors via vehicles or soil, e.g. *Senecio lautus* Willd., *Boerhavia coccinea* Mill. and *Boerhavia schomburgkiana* Oliv.
d) Invaders of naturally and artificially disturbed areas; these may be unpalatable weeds of grazing and pastoral lands, e.g. *Pteridium esculentum* (G.Forst.) Cockayne; weeds of marginal agricultural lands, *Ptilotus polystachyus* (Gaud.) F.Muell., *Podotheca gnaphaloides* Graham and *Muehlenbeckia adpressa* (Labill.) Meisn. or abundant post-fire species such as *Acacia saligna* (Labill.) Wendl. and *Agonis flexuosa* (Willd.) Sweet which are enhanced by controlled burns and/or frequent fire regimes.

The first two groups are normally recorded as natives in floras and checklists, and members of the last two either as weeds or natives, depending on the view of the recorder. Resolution of the above issues are required to ensure we do not waste resources on controlling unique native forms of widespread species or invest resources in control when disturbance management is the key.

Western Australian native plants weedy in Western Australia There are native species that are truly weeds. Normally as Low (2001) noted they are deliberately translocated plants because many more species and individuals are translocated. This is also the case in Western Australia where amenity or enrichment plantings, roadverge revegetation mixes and arboreta have contributed most of the weed records.

Examples of species from enrichment plantings that are now escaping include:

a) *Ceratopteris thalictroides* (L.) Brongn. at Millstream, *Acacia blakelyi* Maiden, *Acacia microbotrya* Benth. and *Acacia lasiocalyx* Andrews, *Calothamnus chrysantherus* F.Muell., *Agonis flexuosa*, *Chamelaucium uncinatum* Schauer, *Allocasuarina huegeliana* (Miq.) L.A.S.Johnson, *Melaleuca lanceolata* Otto, *Hakea costata* Meisn., *Hakea pycnoneura* Meisn. in Kings Park, *Kunzea baxteri* (Klotzsch.) Schauer and *Melaleuca diosmifolia* Andrews at Bluff Knoll in Stirling Range National Park.
b) *Acacia myrtifolia* (Sm.) Willd., *Calothamnus graniticus* Hawkeswood, *Calothamnus validus* S.Moore and *Calothamnus quadrifidus* R.Br. have been widely used recently as road side plantings and for revegetation purposes and are already localised escapes. Some of these species have proved highly invasive in very short time periods, for example, Friends of Koondoola Bushland have removed over 5000 seedlings of *Calothamnus quadrifidus* from Banksia woodland in Koondoola Regional Park from amenity plantings less than 15 years old. The species has also self seeded into Warwick Open Space and Kings Park from roadside plantings.
c) Surveys of old townsites and arboreta have documented another 13 species that are self-seeding within these locations. There are another five species that have established feral populations after being introduced in soil along roads or railroads (*Acacia flagelliformis* Court, *Acacia lasiocarpa* Benth., *Acacia myrtifolia* (Sm.) Willd., *Acacia pulchella* R.Br. and *Conospermum huegelii* R.Br.).

Because there has not been widespread plantings of Western Australian natives till recently, we can only list those species that at the few sites known are seriously invasive and cause major structural changes to plant communities that they invade. These species are: *Agonis flexuosa*, *Allocasuarina huegeliana*, *Chamelaucium uncinatum*, *Hakea costata*, *Hakea pycnoneura* and *Melaleuca lanceolata*.

These species should also not be used in or near bushland as amenity plantings or in general seed mixes.

Hybridisation between local and non-local species and variants Biodiversity consists of three levels: the community, species and the underlying genetic architecture of those species. Weedy Western Australian native species impact on the first two levels, but not to the same extent as weedy exotic species. To the third level, poorly planned revegetation schemes and amenity plantings could have the greatest long-term effect. In Kings Park, plantings of non-local forms and species of *Acacia pulchella*, *Anigozanthos manglesii* D.Don, *Eucalyptus ficifolia* F.Muell. (hybridising with Marri, *Eucalyptus calophylla* R.Br.) and *E. gomphocephala* DC. have resulted in many hybrid genes present in these species (Coates *et al.* 2002).

This has also shown to be the case at Bold Park where planted *Chamelaucium uncinatum* is hybridising with genetically and morphological distinct local native forms (Barrett *et al.* 1999). Similarly hybridisation is widely occurring between the frequently planted river red gum (*Eucalyptus camaldulensis* Dehnh. and the local river gum (*Eucalyptus rudis* Endl.). This may be detrimental to the genetic integrity of this species as a whole over time.

Unnatural disturbance itself is bringing together different ecotypes that are normally separate by subtle habitat differences and providing habitats for hybridisation offspring to survive and spread, e.g. *Acacia pulchella* at Eagle Bay, near Busselton.

Western Australia is world renowned for its floral diversity, which is underpinned by a vast array of localised genetic and morphological variants. Poorly planned rehabilitation, revegetation and amenity will simplify these complex communities by stealth as well as direct competition.

RECOMMENDATIONS

There is the potential for major problems to emerge at all levels of biodiversity conservation involving native species as weeds in natural and degraded ecosystems. The following is recommended to reduce naturalisation and incursion of eastern Australian species:

1. We should treat all eastern Australian species as exotics, not as natives, for weed management. They should be screened for weediness as any exotic introduction is. Eastern Australian species established here in natural ecosystems should be eradicated or controlled as a priority.
2. To combat and manage Western Australian native environmental weeds we need to understand the ecology (including appropriate disturbance regimes), taxonomy and biogeography of our native flora. Native weed management requires a holistic approach.
3. With increasing attempts to replant areas and rehabilitate degraded lands the use of non-local material (especially the use of generalist or 'chook mixes' along transport routes) should be discouraged. The compilation and access to records of known weediness in native species is important. We also need to compile locations of significant local variants where generalist plantings will enhance hybridisation and potential loss. Both of these data sets are important in ensuring that solutions do not cause more problems than they are attempting to fix.

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