

Caley's grevillea (*Grevillea caleyi*), restricted to a small area around Terrey Hills, north of Sydney, is one of the contenders for a concerted recovery effort through a national plant conservation program called *Red Hot Red List: No Surprises, No Regrets*. This species is threatened by clearing and development, unsuitable fire regimes, seed predation, and habitat degradation.
Photo: Andreas Lambrianides

WHAT DOES IT MEAN TO BE RED HOT?

AUSTRALIA'S MOST IMPERILLED PLANTS AND THEIR RECOVERY

Over the next decade, many endangered plants could slip away unnoticed. Botanist **Jen Silcock** introduces a project focused on creating awareness and action to prevent this.

From the comfort of a window desk at the Queensland Herbarium, as summer turned to autumn, I embarked on a botanical tour of Australia. But like a disaster tourist, I had eyes only for the downtrodden and imperilled. I began by slogging my way through dense thickets of words, over mountains of data and down vales of uncertainty to track down Australia's most endangered plants. What I have found is both sobering and uplifting.

Around 1100 plant species, about 5% of Australia's known total, are listed as endangered or critically endangered (under state or federal laws). A fifth of these survive in only a single population, while 60% are known from five or fewer populations. About 100 (11%) are represented by fewer than 100 plants. The rarity and tiny distribution of many of these species make them highly vulnerable to human impacts and chance events. Fifty plant species are presumed extinct, although numerous recent 'rediscoveries' caution against such presumptions without dedicated surveys.

What I have found uplifting are the dedication and knowledge of people working to save many of these plants. Over the next couple of years, for a project called the *Red Hot Red List: No Surprises, No Regrets* (arguably a good motto for a healthy, if somewhat predictable, life), I will get to meet some of these people and the plants they work on. The aim is to highlight the plight of Australia's most imperilled plant species (those at risk of extinction within 10 years), identify and prioritise conservation actions, and alert community groups, scientists and landholders.

The project is part of Australia's \$60 million Threatened Species Recovery Hub that started last year, funded by the National Environmental Science Program, with contributions from 10 universities and the Australian Wildlife Conservancy. The Red Hot list won funding in recognition that threatened plants tend to receive less attention than threatened animals and that declines could go unnoticed until it's too late.

Selecting the Red Hot list

To be eligible for the Red Hot list, a species must be rare, and declining from threats that we can feasibly overcome. This rules out most 'narrow range endemics' – naturally rare or restricted species, exemplified by trees or shrubs that grow only on a few mountain tops or rocky outcrops – for there are typically few threats in their often remote, inaccessible habitats. The majority (57%) of species I assessed have suffered massive declines from habitat destruction, usually for agriculture and sometimes urban development. Restricted to small remnants, often on roadsides or in rail reserves, they are susceptible to disturbance, weeds, disease, and chance events such as fire. The good news is that, where monitoring has been done, the populations of many species appear to be stable or even increasing. Conserving these species is often a matter of safeguarding their habitat and keeping an eye on them.

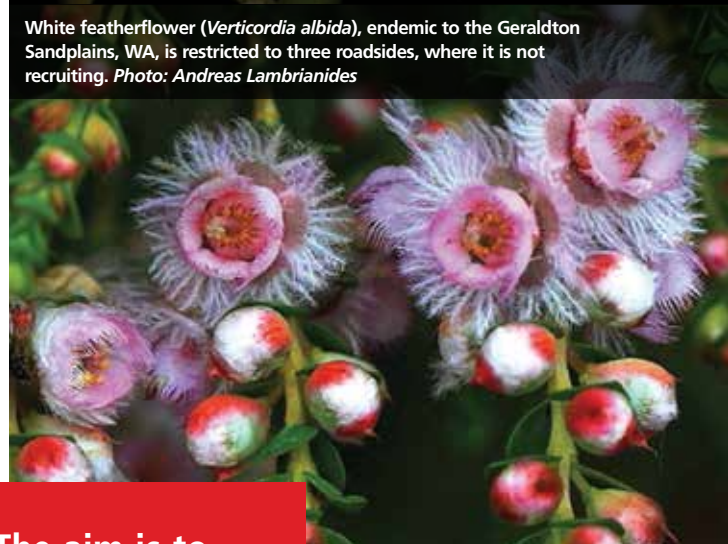
That leaves 250 species on the shortlist for the Red Hot list: 61 (6% of species assessed) for which there is evidence of continuing decline and 190 (18%) with suspected or predicted declines.

The major threats causing recent declines are habitat loss (mostly from urban expansion and agriculture), grading and other disturbances on roadsides and in rail reserves, weed invasion (especially vigorous perennial grasses which take over entire habitats and increase fire frequency and intensity), dieback disease (*Phytophthora cinnamomi*) and myrtle rust (*Puccinia psidii*). Threats such as inappropriate fire regimes and grazing don't seem as pressing, and their severity has not been established for many species. Climate change is considered a threat at high altitudes and for species vulnerable to drought, but there is uncertainty about the impacts on most species and few feasible recovery options.

Our shortlisted plants are clumped geographically and taxonomically – most occur where centres of endemism intersect with broadscale threats, and some plant groups have a disproportionate number of threatened species. To engage as many community groups as possible and raise the profile of threatened plants generally, the Red Hot list



Yellow swamp orchid (*Phaius bernaysii*), endemic to southeast Queensland, survives in one population of less than 100 plants. Photo: Andreas Lambrianides



White featherflower (*Verticordia albida*), endemic to the Geraldton Sandplains, WA, is restricted to three roadsides, where it is not recruiting. Photo: Andreas Lambrianides



Native jute (*Corchorus cunninghamii*) grows on rainforest margins in southeast Queensland, a habitat created by disturbance and highly vulnerable to weed invasion. Photo: Andreas Lambrianides

The aim is to highlight the plight of Australia's most imperilled plant species.

These species are among 250 on the Red Hot shortlist, selected because they are extremely rare and declining from threats that can potentially be overcome.



Red-fruited ebony (*Diospyros mabacea*) is scattered in lowland coastal rainforests in southeast Queensland, a habitat decimated by agriculture and urban development. Photo: Nick Fisher



McCutcheon's grevillea (*Grevillea maccutcheonii*) grows only at the base of the Whicher Scarp in southwest Western Australia. This ironstone habitat is a haven for specialised and endemic plant species, but has been extensively cleared for agriculture. Photo: Andreas Lambrianides



Basalt guinea-flower (*Hibbertia basaltica*) grows in basalt grasslands in southeast Tasmania and is known from three populations beset by urban, industrial and agricultural development, weeds and grazing. Photo: Natalie Tapson

will include a diverse and dispersed range of species. Some will be selected for their cultural values or evolutionary distinctiveness, and others for their ability to serve as 'flagships' to leverage conservation effort for a group of plants.

Flagsips include ground orchids with small, fragmented populations; shrubs and herbaceous plants restricted to remnants in southwest Western Australia and southeast South Australia; plants from rapidly urbanising areas such as southeast Queensland, south of Darwin and western Sydney; victims of dieback in Stirling Range montane heath; and plants in imperilled habitats such as the eastern lowland rainforests, fertile grasslands in higher-rainfall areas and desert springs. Another flagship is plants which require disturbance to germinate and complete their life-cycle. The West Australian shrub *Daviesia microcarpa* was presumed extinct until roadside grading triggered germination. The Atherton Tableland shrub *Solanum hamulosum* became so common and troublesome during the rainforest clearing years of the 1930s and 40s that it was dubbed the 'Dirran curse'. The only large populations seen in recent years were in cyclone-damaged forests. The 'disturbance-dependent' flagship challenges our notion of rare plants needing to be 'locked up' for their protection.

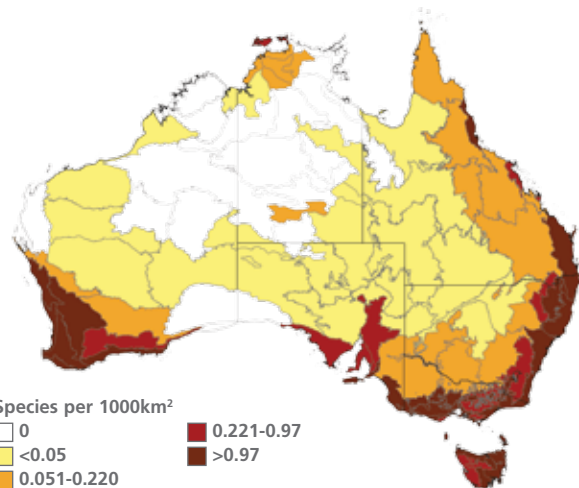
Known unknowns and forgotten species

Many rare species beyond population centres are neglected, and we don't know how they are faring. We have put these in a 'data deficient' category, and propose to engage botanists to look for them. Most will require baseline counts and monitoring.

There are also species not on any list. They may have slipped through the sometimes haphazard listing processes, or be recently discovered or described. Even after 200 years of scientific effort, botanists are still finding 'new' species, particularly in remote areas such as the Kimberley. By interviewing experts we aim to identify these species, so they don't slip away unnoticed. No surprises, no regrets.

For now, I have stared at a screen for as long as any field botanist can be expected to endure. I'm heading around the country to see rare plants, catch up with usually congenial botanists, and feel the dirt and prickles between my toes. First stop: Western Australia's Wheatbelt. Over the next year or two, *Wildlife Australia* will regularly showcase plants from the Red Hot list.

It will be a botanical journey around our vast and beautiful land that promises as many enigmas as it does answers, encounters both inspirational and saddening, and no end of surprises. ▶



The geography of endangered plants. This map shows the density of plant species listed as extinct, critically endangered and endangered in each bioregion. They are concentrated where centres of endemism correspond with highly modified landscapes such as those in southwest Western Australia, grasslands in southern Australia, and forests in South East Queensland. There are also large numbers in less modified but highly diverse bioregions, such as the South Eastern Highlands, Wet Tropics and New England Tablelands. Western Australia has more (319 species) than any other state. There are very few across arid and semi-arid Australia: excluding the southwest and southeastern South Australia, only 34 listed species (3%) occur in the 70% of Australia with an annual rainfall of less than 500 mm. Three island bioregions (encompassing Lord Howe/Norfolk, Macquarie and Christmas Islands) have densities of more than 5 species/1000km² but are too small to show on this map.

On the Verge: Western Australia's Wheatbelt

This remnant in a sea of wheat exemplifies the tenuousness of links to the Wheatbelt's past as a species-rich mosaic of woodlands and heathlands and the haphazard luck that has seen some species survive in one or a few tiny remnants. Photo: Alastair Baird

The prospects of dozens of plant species there range from perilous to chancy

The Wheatbelt of Western Australia exemplifies the 'perfect storm' of plant endangerment, being a centre of endemism that intersects with major threats. The prospects of dozens of plant species there range from perilous to chancy.

The southwest corner of Western Australia is a relatively wet refuge with a Mediterranean climate, bordered on two sides by ocean and isolated to the north and east by desert. It is ancient, mostly flat, highly weathered and nutrient-poor. These characteristics, combined with subtle variations in soils and habitats, have allowed uninterrupted evolution and explosive speciation.

About half of the 7380 vascular plant taxa occurring in the Southwest Australian Floristic Region occur nowhere else. It is one of 25 global biodiversity hotspots, signifying not only exceptional endemism but also devastating habitat loss.

Receiving an average 300–600 millimetres of rainfall a year, the Wheatbelt is in the drier part of this region. It was once a mosaic of highly diverse eucalypt woodlands, mallee and kwongan (heath and shrublands). Clearing began in the 1890s, but gained pace after World War II as bulldozers replaced axes and horse-drawn scrub rollers, and continued well into the 1980s. Today, about 7% of the former vegetation remains, mostly along roadsides, on private property, and in nature reserves and small shire reserves (including gravel pits, rubbish tips and rifle ranges).

The region hosts 118 endangered and critically endangered plant species, 11% of Australia's total. Most are narrow-range endemics now confined to habitat slivers susceptible to

degradation, agricultural impacts, weed invasion, changed fire regimes, rabbit browsing and *Phytophthora* dieback.

Some populations in larger reserves seem viable, as long as they are monitored and managed (by weed control, sensitive road works, fencing and such like). But it is much more difficult to protect rare plants on narrow roadsides from the ever-looming spectre of road widening and grading, gravel extraction, accidental destruction, weed invasion, crop spray drift, herbivore grazing and disease. These threats are compounded by lack of genetic diversity, low recruitment and the inability to maintain ecological processes, especially fire, in habitat pockets. Although fire is critical for germination of many shrubs, when remnants burn they often become susceptible to weed invasion. To add to the complexity, some species need disturbance for germination. *Eremophila lactea* and *Eremophila scaberula*, for example, become abundant only after grading of road verges.

Poor recruitment and relentless threats mean that many species in the Wheatbelt are the 'living dead' and will go extinct unless they can be translocated to more secure areas.

Under these circumstances picking just a few Wheatbelt species for inclusion in the Red Hot list seemed an almost impossible task. Most endangered plants there meet the criteria. I've relied on the advice of flora conservation officers – who are integral in conservation efforts – to select species for which there are identified recovery actions, and which have good geographic and taxonomic spread.



(1) Dark-bract banksia (*Banksia fuscobractea*).
Photo: Andrew Crawford



(2) *Stylidium wilroyense*.
Photo: Andrew Crawford



(3) *Guichenotia seorsiflora*.
Photo: Andrew Crawford



(4) *Cunderdin daviesia* (*Daviesia cunderdin*). Photo: Bert Hort



(5) *Pinna-leaf eremophila* (*Eremophila pinnatifida*). Photo: Russell Dahms

(1) *Banksia fuscobractea* is listed nationally and in WA as critically endangered. It survives in two populations with 55 plants. Some were recently destroyed due to gravel extraction. Recovery can be achieved by better protection and translocation. (2) *Stylidium wilroyense* is one of numerous highly restricted and threatened triggerplants in southwest WA. Surveys this spring will help decide which species is selected for the Red Hot list. (3) *Guichenotia seorsiflora* is listed nationally and in WA as critically endangered. Just 78 plants survive in six populations on roadsides and private property. During six years of monitoring numbers have remained stable. Threats are poorly understood. Seed has been collected, so there is potential for translocations. (4) *Daviesia cunderdin* is listed nationally as endangered and in WA as critically endangered. Fewer than 50 plants survive in two populations. The one natural population is near Cunderdin on a weedy road reserve, with numerous threats and no recruitment. The other is a partially successful translocated population in a nature reserve. The seed is highly germinable, so there is good potential for translocations. (5) *Eremophila pinnatifida* is listed nationally as endangered and in WA as critically endangered. Although just one plant survives, on a roadside, seeds have been collected and there are presumably still seeds in the soil that could sprout after disturbance (fire or flooding).

The five Red Hot Wheatbelt plants are dark-bract banksia (*Banksia fuscobractea*), Cunderdin daviesia (*Daviesia Cunderdin*), pinna-leaf eremophila (*Eremophila pinnatifida*), *Guichenotia seorsiflora* and a triggerplant (*Stylidium* species) which will be chosen pending surveys of numerous candidate species this spring. All have lost most of their habitat to agriculture and survive in tiny isolated populations on roadsides or in small reserves. The numbers surviving range from 1 to about 100.

Driving through the Wheatbelt, an ancient land thick with natural and human history but so recently and utterly transformed, is a strange experience. As we pass yellow wheat fields stretching to the horizon – beautiful in their own way – I try in my mind's eye to fathom the extent of woodlands and kwongan that preceded the bulldozers. The tiny remnants that are our window into the past are the legacy of a haphazard clearing history, dictated partly by the country (steep, rocky areas were left) and partly by individual and bureaucratic whims. But the response to conserving what remains is more systematic. The Department of Parks and Wildlife has flora conservation officers who monitor rare plants, search for new populations, control weeds, fence remnants, conduct recruitment burns and educate the public, landholders and councils. With scientists in Perth, they collect and germinate seed for translocation. Over the past decade more than 30 critically endangered Wheatbelt species have been translocated to more secure sites. Botanists and

geneticists continue to describe new species, resolve taxonomic issues and provide information to underpin conservation.

Seeing a translocated population of an endangered wattle regenerate prolifically after a planned fire, and watching a protected salmon gum remnant glow in the dusk, I could envisage a future for these fragile besieged remnants and their special ancient flora. ■

ACKNOWLEDGEMENTS: Thanks to the flora conservation officers who shared their knowledge, particularly Bree Phillips, Natasha Moore and Alanna Chant. Leonie Monks, Dave Coates and Margaret Byrne took me on a drive to look at plant translocations, and provided much commentary on the Wheatbelt and conservation en route. Thank you to Ken Atkins, Colin Yates, Greg Keighery, Neil Gibson, Anne Cochrane, Rebecca Dillon, Andrew Crawford, Juliet Wege and Steve Hopper for discussions and ideas.

READING: Hopper SD, Gioia P. 2004. The Southwest Australian Floristic Region: Evolution and conservation of a global hot spot of biodiversity. *Annual Review of Ecology Evolution and Systematics* 35:623–50

Having worn out many pairs of cheap thongs trekking thousands of kilometres over sand dunes and stony hills with beguiling shrublands, **DR JEN SILCOCK** has recently been lured to the city to take up a post-doctoral research position at the University of Queensland's Threatened Species Hub, identifying Australia's 100 most imperilled plant species and reviewing plant translocation projects across Australia.

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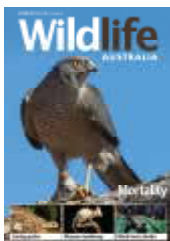
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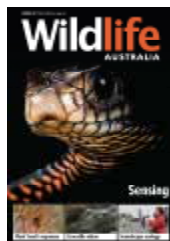
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