Protecting threatened species and ecological communities from invasive species

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invasive species council

ISC campaigns for better laws and policies to protect the Australian environment from weeds, feral animals, exotic invertebrates and pathogens.

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The Invasive Species Council campaigns for better laws and policies to protect the Australian environment from weeds, invasive animals and exotic pathogens.

The Invasive Species Council is committed to fostering community participation and activism, supporting our members to have a voice on invasive species issues.

Protecting threatened species and ecological communities from invasive species

Introduction

To properly document the threats of invasive species and the ways in which current laws, policies and programs are failing to protect threatened species and ecological communities from invasive species would require a substantial treatise. We provide here only a brief summation and a few case studies to exemplify major gaps in our national capacity to protect threatened biodiversity from invasive species.

We address four terms of reference:

(a) key threats to listed species and ecological communities;

(d) regulatory and funding arrangements at all levels of government;

(e) timeliness and risk management within the listings processes;

(f) the historical record of state and territory governments on these matters

Invasive species impacts warrant a substantial focus by the inquiry for the following reasons:

- Invasive species are one of the four major threats to biodiversity (the others being land clearing, damaging fire regimes and climate change) and interact synergistically with other major threats such as climate change and fire.
- Invasive species impacts are increasing, and many more extinctions are likely unless there is a greater commitment by Australian governments to prevention, eradication, containment and control of invasive species.
- There are major gaps in legislation, policy and programs, at federal and state/territory level, which can be addressed to abate threats.

Our main message to the inquiry is the need for a more business-like, fair dinkum approach to invasive species threats – to identify long-term goals and targets that reflect the immense intrinsic and instrumental values of Australia's species and ecological communities; develop costed plans for prioritised, realistic goals; close major gaps in legislation and policy; and properly and productively involve the community sector in policy-setting, decision-making and on-ground conservation.

The current approach to conserving Australia's species and ecological communities is the opposite of business-like. Environmental goals are often not taken seriously, are almost never met, and failures have no consequences for those in charge. A prime example of this is the invasive species target of Australia's Biodiversity Conservation Strategy – to reduce invasive species impacts on threatened biodiversity by 10%. There has been no feasibility assessment, no baseline assessment and no costed plan for implementation, rendering the target merely aspirational and destined to fail.

1. Invasive species are a major cause of extinction and threaten about three-quarters of Australia's threatened species and ecological communities

Australia has suffered dozens of extinctions due largely to invasive species, including the most recent just three years ago – the Christmas Island pipistrelle. We lead the world in mammal extinctions due mainly to invasive predators, and many more mammals are on the brink, including in northern Australia previously thought to be secure because of low levels of habitat loss.[1] More than 70% of 1700 species listed as nationally threatened and more than 80% of listed ecological communities are imperilled by introduced animals, plants or diseases. The extent of threat is poorly documented and is probably worse than documented.

Extinctions due substantially to invasive species include:

- 25 mammals (19 species, 6 subspecies), probably mostly due to cats, foxes, rabbits
- 13 island birds (3 species, 10 subspecies) due mainly to rats, cats and pigs
- 4 frogs due to chytrid fungus
- 4 plants due to weeds

Invasive species threats to listed species and ecological communities:

- Invasive plants and animals threaten 61% of nationally listed threatened species [2]
- Diseases (mostly exotic) threaten 15% of listed threatened species[3]

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[1] Fitzsimons J, Legge S, Traill B, Woinarski J. 2010. Into Oblivion? The Disappearing Native Mammals of Northern Australia. The Nature Conservancy: Melbourne.

[2] Evans M, Watson J, Fuller R, Venter O, Bennett S, Marsack P, Possingham H. 2011. The spatial distribution of threats to species in Australia. BioScience 61: 281-289.

- Invasive species threaten >80% of nationally listed ecological communities

Weeds have caused few extinctions but are a major contributor to threat syndromes and degradation. They can dominate landscapes - In NSW, for example, weeds account for 52 (43%) of the 120 most widely distributed plant species[4] – and compromise ecological processes such as fire and nutrient cycles. See Appendix 4 for an outline of weed impacts.

Australia ranks globally as one of the worst affected countries in terms of numbers of invasive species and the ecological damage sustained. There is considerable government rhetoric about Australia's "enviable biosecurity system" and our relative freedom from major pests and diseases. While our agricultural industries enjoy trade advantages due to freedom from many of the world's most damaging pests and diseases, there is nothing enviable about our record on environmental biosecurity.[5] Contrary to the claim in the guide to the Quarantine Proclamation 1998 that 'Australians generally benefit from a natural environment that, compared to other countries, is relatively free of many debilitating pests and diseases of humans, animals and plants',[6] Australia is actually a world leader in the extent of invasive species threats to the environment. As well as having the highest number of mammal extinctions and declines due to invasive species, we have the highest number of invasive trees and shrubs (29% of the global total),[7] the highest or second highest number of naturalised plant species,[8] and one of the highest densities of weeds[9] and extent of widespread weeds.[10]

2. As new species arrive and existing invaders increase and spread, the threats of invasive species are increasing.

The State of the Environment 2011 reported that invasive species impacts on biodiversity were deteriorating. See Appendix 1 for a more detailed summary of the State of the Environment findings. The deteriorating trend is due to an accelerating rate of new invaders (such as myrtle rust and Asian honeybees) and the spread of already established species.

The majority of introduced species already in Australia are yet to achieve the full extent of their potential spread and density:

Australia is in the throes of ecological upheaval, and most of this change is coming … from old pests tightening their grip on the land. It is important to understand that most pests in Australia have yet to occupy their full range: they are still migrating outwards or increasing in density (infilling) or both.[11]

Trends are also deteriorating because of the increasing vulnerability of native species and ecosystems due to multiple other threats – climate change, habitat loss and fire. For example, damaging fire regimes in northern Australia increase the vulnerability of small mammals to cat predation due to loss of shelter.

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[3] Ibid.

[4] Stohlgren T, Pysek P, Kartesz J, et al. 2011. Widespread plant species: natives versus aliens in our changing world. Biological Invasions 13:1931–1944. Of 13 regions, NSW was second highest after North America, where aliens accounted for 51.3% of the 120 most widely distributed plant species.

[5] As one rough indicator, Australia has more than half the species in a List of 100 of the World's Worst Invasive Alien Species, not including the several which are Australian natives (see Global Invasive Species Database at http://www.issg.org/database/species/search.asp?st=100ss&fr=1&str=&lang=EN)

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[7] Richardson D, Rejmánek M. 2011. Trees and shrubs as invasive alien species – a global review. Diversity and Distributions 17: 788-809.

[8] Vitousek P, D'Antonio C, Loope L, Rejmanek M, Westbrooks R. 1997.'Introduced Species: A significant component of human-caused global change'. New Zealand Journal of Ecology (21) 1-16.

Simberloff D, Souza L, Nunez M, Barrios N, Bunn W. 2012. The natives are restless, but not often and mostly when disturbed. Ecology 93:598-607. According to the latter, the US has < 3000 naturalised plant species, fewer than Australia.

[9] Vitousek P, D'Antonio C, Loope L, Rejmanek M, Westbrooks R. 1997.'Introduced Species: A significant component of human-caused global change'. New Zealand Journal of Ecology (21) 1-16. Third to New Zealand and Coterminus US, but more recent information suggests Australia has a higher density than the US.

[10] Stohlgren T, Pysek P, Kartesz J, et al. 2011. Widespread plant species: natives versus aliens in our changing world. Biological Invasions 13:1931–1944.

[11] Low T. 1999. Feral Future: The Untold Story of Australia's Exotic Invaders. Penguin.

3. Climate change will exacerbate the threats of invasive species

As recognised in the 2009 assessment of the vulnerability of Australia's biodiversity to climate change commissioned by the Federal Government, in many cases the biodiversity impacts of invasive species benefiting from climate change are likely to exceed the direct impacts of climate change.[12] This is because:

- many invasive species are highly adaptable, tolerant of a wide range of climatic conditions and advantaged by disturbance;
- extreme events often facilitate biological invasions;
- native species under stress due to climate change are less competitive with and more vulnerable to harm by invasive species; and
- human responses to climate change are likely to provide more invasive opportunities and may result in less effective control.

For example, in Southwest Western Australia, where dieback caused by *Phytophthora cinnamomi* has infected a million hectares of native bush, threatening dozens of endemic species,[13] climate change is expected to bring more rain during summer, which would spread the disease more rapidly because the spores travel with flowing rainwater. This could result in plant extinctions and ecosystem collapse.[14] The disease could also worsen in south-eastern Australia if there are wetter summers and warmer winters under climate change.[15] Foxes are already increasing their numbers at higher altitudes in the Australian Alps as the climate warms. Bogong moths are arriving later, forcing endangered mountain pygmy possums, which eat them, to forage more widely. This makes them more vulnerable to predation by foxes, which also eat bogong moths.[16] Feral cats may be able to spread to some islands currently too wet for them now and which serve as sanctuaries from exotic predators.[17] Exotic pasture grasses in northern Australia up to 4 metres tall (eg. gamba grass *Andropogon gayanus*) fuel fires so intense they can kill trees. In a damaging cycle that can turn native woodlands into exotic grasslands, such fires promote yet more grass invasion.[18] Climate change could increase the frequency of fires, facilitating the further invasion of exotic grasses. Many more examples are provided in a recent submission to the Inquiry into Australia's biodiversity in a changing climate by the House Standing Committee on Climate Change, Environment and the Arts.[19]

4. Management of invasive species has been ineffective

Australia's most recent State of the Environment report (2011) gave the worst possible ratings for invasive species impacts on biodiversity: "very high" and "deteriorating" and found that management outcomes and outputs are "ineffective" (see Appendix 1). One of many critical comments was that:

> Government responses to invasive species are uncoordinated at the national level, reactive, focused on larger animals, biased towards potential impact on primary industry at the expense of the total ecosystem, and critically under-resourced.

[12] Steffen W, Burbidge A, Hughes L. et al. 2009. Australia's Biodiversity and Climate Change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change. Technical synthesis of a report to the Natural Resource Management Ministerial Council commissioned by the Australian Government (Canberra, Department of Climate Change).

[13] Cahill D, Rookes J, Wilson B, Gibson L, McDougall K. 2008. *Phytophthora cinnamoni* and Australia's biodiversity: impacts, predictions and progress towards control, Australian Journal of Botany 56: 279-310.

[14] Invasive Species Council. 2009. Killer plant disease could devastate WA biodiversity hotspots. Double Trouble Ebulletin Edition 1 (February 2009).

[15] Department of Sustainability and Environment 2008. Victoria's public land *Phytophthora cinnamomi* management strategy. (Victorian Government).

[16] Low T. 2008. *Climate Change and Invasive Species: A Review of Interactions* (Canberra, Biological Diversity Advisory Committee).

[17] Steffen W, Burbidge A, Hughes L. et al. 2009. Australia's Biodiversity and Climate Change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change. Technical synthesis of a report to the Natural Resource Management Ministerial Council commissioned by the Australian Government (Canberra, Department of Climate Change).

[18] Rossiter N, Douglas M, Setterfield S, Hutley L. 2003. Testing the grass-fire cycle: Alien grass invasion in the tropical savannas of northern Australia. Diversity and Distributions 9: 169-176.

[19] See http://www.aph.gov.au/Parliamentary_Business/Committees/House_of_Representatives_Committees?url=ccea/ccbio/subs/sub060.pdf

To stabilise and reduce environmental impacts of invasive species will require addressing multiple weaknesses in Australia's biosecurity system, including major gaps in law and policy, and inadequate surveillance, eradication and control programs. Due to a lack of time, we highlight flaws in just four areas: (a) the Biodiversity Conservation Strategy 2010-2030, (b) provisions under the EPBC Act for key threatening processes, (c) legislative gaps and (d) funding.

5. There is no commitment to the invasive species target in Australia's Biodiversity Conservation Strategy

Target 7 of the Biodiversity Conservation Strategy 2010-2030 is:

> By 2015, reduce by at least 10% the impacts of invasive species on threatened species and ecological communities in terrestrial, aquatic and marine environments.

On its release the federal Environment Minister contended that Australia was 'one of very few countries to have committed to national measurable targets for biodiversity conservation.' But the invasive species target is almost as bad as not having any target and there is no evidence of commitment to it. Seemingly plucked out of the air, it is unrealistic and therefore likely to be ignored. ISC has been told by federal environment officers that it should be regarded as 'aspirational'. This whimsical approach to one of the greatest threats to the continued existence of numerous species in Australia would not be tolerated for issues in other areas of government.

The government department charged with much of the responsibility for environmental biosecurity, Department of Agriculture, Forestry and Fisheries, does not embrace the Biodiversity Conservation Strategy target for invasive species and has no specific plan to meet it. With regular breaches of quarantine resulting in the establishment of biodiversity-threatening organisms – myrtle rust, Asian honeybees and yellow crazy ants being recent examples – achieving the target relies on DAFF giving sufficient priority to environmental threats. The at least 30 breaches that have resulted in yellow crazy ant infestations in Queensland suggest there has been a lack of focus on this very high environmental threat (see Appendix 2).

It is not clear what the strategy target implies as there is no quantitative information about invasive species impacts on threatened biodiversity. Very little monitoring of threatened species and ecological communities is conducted, and much of the information in conservation advices is based on coarse expert estimates of impacts. The only baseline information available is the number of threatened species and ecological communities threatened by invasive species, which does not reflect the reality of current impacts on threatened biodiversity because of the substantial numbers of threatened species and ecological communities that are not listed.[20] Halfway to the target deadline, there is no implementation plan and no identification of costs. The latest state of the environment assessment found that trends were deteriorating. Long-established threats are increasing – feral cats in northern Australia, , *Phytophthora cinnamomi* in southwest Australia, feral goats in semi-arid areas, weeds virtually everywhere, for example – and new threats are emerging – foxes in Tasmania, feral deer in many new locations, myrtle rust in eastern Australia, yellow crazy ants in the Wet Tropics (see Appendix 2)

Recommendation:

- Commission an assessment of the measures and funding necessary to achieve the invasive species target in the National Biodiversity Conservation Strategy, and develop a costed plan to do so.

6. Key threatening process provisions are poorly used and ineffective

The capacity under the EPBC Act to declare key threatening processes (KTPs) and develop threat abatement plans (TAPs) has potential to be a major tool for addressing abating invasive species threats but is currently failing to deliver. The provisions recognise that many processes threaten multiple species and that it is necessary to take a national approach. A process is a 'threatening process' if "it threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community".[21]

The KTP provisions could be particularly useful for invasive species because of the wide variety of threat pathways, jurisdictions and sectors involved in threatening processes, and the lack of simple legislative means of addressing such landscape-

[20] Evans M, Watson J, Fuller R, Venter O, Bennett S, Marsack P, Possingham H. 2011. The spatial distribution of threats to species in Australia. BioScience 61: 281-289.
[21] *Environment Protection and Biodiversity Conservation Act 1999* s 188(3).

scale threats. A majority of KTP listings are for invasive species (13 of 19), but they are underused, underfunded and lack effective mechanisms for abating invasive threats.

Key threatening processes listed under the EPBC Act

Type of KTP	Listed KTP (abbreviated)	Date listed	TAP
Introduced vertebrates	Rabbits	2000	2008
	Feral goats	2000	2008
	Red foxes	2000	2008
	Feral cats	2000	2008
	Exotic rats on offshore islands	2006	2009
	Cane toads	2005	2011
	Feral pigs	2001	2005
Introduced invertebrates	Yellow crazy ants (*Anoplolepis gracilipes*) on Christmas Island	2005	2006
	Red imported fire ant, *Solenopsis invicta*	2003	2006
Introduced plants	5 invasive pasture grasses in northern Australia	2009	2012
	Escaped garden plants	2010	No TAP
Introduced pathogens	Root-rot fungus (*Phytophthora cinnamomi*)	2000	2001[22]
	Chytridiomycosis (chytrid fungus)	2002	2006
Others	Coastal otter trawling – turtle bycatch	2001	No TAP
	Oceanic longline fishing – seabird bycatch	2000	2006
	Marine debris impacts on vertebrate marine life	2003	2009
	Land clearance	2001	No TAP
	Anthropogenic climate change	2001	No TAP
	Psittacine circoviral (beak and feather) disease	2001	2005

There are many more major threats that warrant KTP listing but in the past decade just seven new KTPs have been listed (six have been for invasive species).

Time taken: Currently, the environment department has sufficient resources to assess only one KTP nomination a year.[23] It takes an average 1.8 years to assess a KTP (two current assessments are due to take three years.[24]) It then takes an average 3.7 years to develop a threat abatement plan.[25] On average, therefore, it takes six years to assess a KTP and develop a TAP.

The business sector would be thumping political tables (and taking out full-page media advertisements) if it took this long to get their applications assessed. Applications for environmental destruction whizz through in comparison to nominations for threat abatement (and also threatened species and ecological communities).

Process deficiencies: The process of assessment is lacking in transparency. Nominations are rejected despite meeting the criteria under the EPBC Act. In the past four years, ISC has made two nominations (for the invasive pasture grass, tall wheatgrass, and for feral deer) both of which amply met the criteria, with evidence for threats to 28 and 18 species or ecological communities respectively, which were rejected for reasons outside the criteria in the EPBC Act.

A process is eligible to be listed as a 'key threatening process' if:

- It could cause a native species or an ecological community to become eligible for listing as extinct, extinct in the wild, critically endangered, endangered or vulnerable;
- It could cause a listed threatened species / ecological community to become eligible to be listed in another category representing a higher degree of endangerment; or
- It adversely affects 2 or more listed threatened species / ecological communities.

Making a nomination is demanding, often requiring several weeks work to compile the evidence required. Yet, ISC's experience is that nominations are rejected for no legislatively valid reason and typically with no reasons provided (again, note the

[22] The Senate disallowed an inadequate 2009 TAP, so another has been under development for the past 3 years.

[23] Senate Standing Committee on Environment and Communications Legislation Committee Answers to questions on notice Sustainability, Environment, Water, Population and Communities portfolio Additional Budget Estimates, February 2012

[24] Artificial watering points was nominated in 2009 and assessment was due in Sept 2012; noisy miners was nominated in 2011 and assessment is due in Sept 2014.

[25] Ibid.

difference in approach taken to assessments of destructive development). Either the current approach to KTP listing decisions is ad hoc or they are based on non-legislative, non-public criteria such as whether there are funds available for assessment. The invitation for the public to make nominations based on the legislative criteria is misleading. Under the current opaque and underfunded arrangements, ISC won't make any further nominations because it has been a waste of scarce community time and resources. There should be a much more systematic approach to KTP listings to ensure that the major threats requiring national focus are recognised and acted on.

Novel biota KTP listing: It appears that there has been some move to more systematic listings by an internal nomination to list 'novel biota' as a KTP, a listing that has been in train for at least two years. However, this all-encompassing listing is apparently the reason for rejection of for ISC nominations of more specific invasive threats on the basis that they can be included as examples in the novel biota listing.[26] Ironically, the more systematic listing is being used to preclude meaningful threat abatement action on specific threats such as feral deer species. There is no point developing a threat abatement plan for such a broad threat category as novel biota (encompassing invasive plants, animals, pathogens) and the draft nomination recommends against this. A similar fate – recognition but no action – has already befallen the escaped garden plant KTP listing. Likewise, the land clearing and anthropogenic climate change KTP listings have no practical conservation benefit.

ISC opposes the intention to list novel biota as an all-embracing invasive species KTP if it is to preclude the listing of more specific invasive species threats and the preparation of threat abatement plans for specific threats. We recommend the novel biota listing be used as the parent listing for multiple KTP sub-listings and as the basis for systematically addressing gaps in abatement of invasive species threats to biodiversity.

Threat Abatement Plans: The only real value of KTP listings comes from the development and implementation of TAPs, which outline the research, management and other actions needed to protect native species and ecological communities from the listed threat. When the Environment Minister does agree to develop a TAP, as well as taking an average of close to four years to develop, they are often poorly implemented. There is no regular review of progress made on goals and actions and TAPs are often left to languish long after their intended 5 year review date – presumably due to a lack of resources (there are currently seven TAPs > 5 years old). In most plans there is very little community involvement except through a formal consultation process.

Threat abatement plans only bind the Commonwealth and Commonwealth agencies - States and Territories are not required to cooperate – and there is no guarantee of any of the TAP actions being implemented. For invasive species TAPs, they often depend on inadequate state and territory listing processes and competitive short-term, project-specific grants programs. There is no TAP-specific funding stream and no guaranteed funding for any TAP priorities.

Linking to regulation: There should be federal regulatory mechanisms where this is a feasible way to mitigate key threatening processes. The federal government has the capacity under the EPBC Act to regulate harmful activities involving invasive species but chooses not to use it. Section 301A of the *EPBC Act* provides for the establishment of a list of species, other than native species, that do, may, or would be likely to threaten biodiversity in Australia. Those species may be regulated or prohibited from being brought into Australia, or from being traded in various ways. This provision could be used to address in part the threats of several of the listed KTPs, in particular escaped nursery plants.

Escaped nursery plants were listed as a key threatening process under the EPBC Act but this has no practical effect in preventing the sale of unsafe plants. No TAP was developed and threat abatement relies in large part on individual states and territories declaring individual species after drawn-out assessment processes. Trade in the majority of unsafe nursery plants remains unregulated in most state and territory jurisdictions.

Compare the approach taken to environmentally harmful chemicals. If chemicals are assessed as a threat to human or environmental health, the Australian Pesticides and Veterinary Medicines Authority can ban their sale or regulate how they are used. Nationally significant threats to the environment caused by invasive species warrant a similar national regulatory capacity. Just as chemicals are systematically assessed, so should key threatening processes be comprehensively listed and threat abatement plans prepared.

There is a need to integrate key threatening process listings with other environmental programs, to ensure they are used to optimal effect and are funded.

[26] The Environment Department has advised the Invasive Species Council that the Threatened Species Scientific Committee, which assesses nominations and has developed the Novel Biota nomination, intends it to capture all invasive species and 'avoid the need to assess and list every invasive species individually'.

For example, TAPs for significant invasive species should play a major role in Australia's biodiversity conservation strategy to reduce the impacts of invasive species.

Proposed changes to the KTP provisions: The Federal Government plans to make KTP listings and TAPs more flexible on the basis of a recommendation made by the Hawke review of the EPBC Act. It is proposed to undertake regional threat abatement plans, and to expand the definition of 'key threatening processes' to include both immediate and longer-term threats to Australia's national environmental assets. These would be positive reforms if there were sufficient resources for assessing and listing KTPs and developing and implementing TAPs. But they will be pointless unless the dire funding shortage for assessments, listings, planning and implementation is addressed and unless there is a commitment by relevant governments to implement the TAPs. There needs to be a much clearer accounting of implementation with regular reporting on progress to achieve priority outcomes.

More flexible KTP and TAP arrangements would permit more rapid research and management response to emerging threats, such as recent incursions of myrtle rust, Asian honeybees, and pigeon paramyxovirus.

The NSW Scientific Committee, which conducts KTP and threatened species assessments for NSW, made several recommendations about the federal listing process during the Hawke review, which unfortunately were not adopted. These included making the federal Threatened Species Scientific Committee a statutory authority with power to make determinative listing decisions rather than simply advising the Minister, making the Committee functionally independent of the Minister and Department, publishing the criteria and reasons for priorities and having priorities determined by the Committee rather than the Minister. Specific to KTPs, the NSW Scientific Committee recommended that under-representation of particular types of threat be redressed. We endorse all these recommendations.

Recommendations:

- Provide sufficient funding for assessment of Key Threatening Processes and development of Threat Abatement Plans.
- Undertake systematic listing of Key Threatening Processes to properly reflect the threats to biodiversity and develop Threat Abatement Plans on a prioritised basis.
- Use the proposed 'novel biota' Key Threatening Process listing as the basis for developing on a prioritised basis multiple Threat Abatement Plans to address invasive species threats where these plans provide a feasible way to address threats. Ensure that the novel biota listing does not preclude listing of more specific invasive species threats.
- Publish all criteria and reasons for listing priorities and for listing decisions. Priorities should be determined by the Threatened Species Scientific Committee, not the Minister.
- Undertake a review of the effectiveness of Threat Abatement Plans over the past decade, assessing the extent to which actions have been implemented and the goals achieved.
- Use section 301A of the EPBC Act to regulate actions involving invasive species Key Threatening Processes where this will contribute to achieving threat abatement.
- Provide costings in Threat Abatement Plans for priority actions and identify funding options. Ensure that criteria for funding priorities under Caring for our Country include implementing Threat Abatement Plans.
- Develop an agreement through COAG about requiring implementation by all governments of high priority actions of Threat Abatement Plans – through enabling legislation – to ensure that just as there is a requirement of governments to assess developments there is also a requirement to abate high priority threats.
- Make the Threatened Species Scientific Committee a statutory authority with power to make determinative listing decisions.

7. There are major legislative gaps in regulating actions involving invasive species within Australia

Although the release of an invasive plant or animal in a new area could have a much greater impact on biodiversity than particular mines or residential developments, there is no clear mechanism under the EPBC Act for assessing this. The Act requires the assessment of invasion risks due to imports of new animal taxa (mostly at a species level) into Australia while plants are assessed under the Quarantine Act 1908 but there is no direct trigger for assessment of releases, trade

in or use of invasive species or potential invasive species within Australia. Only two proposed agricultural uses of invasive plants have been referred for assessment under the EPBC Act (as far as we know). Nor are such actions generally assessed under most state and territory legislation. There tends to be a major bias in regulation towards specific, site-focused impacts rather than the landscape-scale threats represented by many invasive species as well as other threats such as fire regimes.

The Hawke review of the EPBC Act found that most states and territories are failing to prevent the deliberate movement of thousands of exotic plant species, many of which are known invaders and the majority of which have never been assessed for their weed risk. Of the ~30,000 exotic plant species in Australia, about 10% have already established in the wild; another 6000 are weedy overseas and therefore likely to become weeds in Australia. Apart from Western Australia, which takes a 'white list' approach to exotic plant species, there are no restrictions on the sale and movement of more than 98% of exotic plant species in most parts of Australia.

For example, of 340 ranked environmental weeds in NSW,[27] about 90% can be sold or planted in part or all of NSW. Almost half (44%) are permitted imports, allowing for continued introduction of new genetic material from overseas. From 2000-2010, new cultivars for at least 17 (5%) were registered as new plant breeds in Australia.

Given the already huge impacts of weeds, this lack of basic precautions is a major biosecurity and environmental failing, as the Hawke review found:

> Movement of established, potentially damaging exotic species between States and Territories represents a substantial failure of State and Territory-based environmental regulation. Development of national protocols, in cooperation with the States and Territories, for assessing resident, potentially damaging exotic species, and for designing and implementing criteria to manage their movement within Australia, may be a useful first step towards remedying this situation (Hawke Review, 6.43).

The Federal Government already has the legal capacity s301A of the EPBC Act to regulate trade and use of damaging introduced species. There is no other feasible way: relying on each state and territory to individually reform will not work, as has been demonstrated by the many years of failure to do so.

New biosecurity legislation has just been introduced to Federal Parliament – the Biosecurity Bill 2012. It does not address the post-border gaps noted above. Although the Bill will provide the basis for many improvements in biosecurity, such as national regulation of ballast water, it has many flaws that ISC and other environment groups have identified.[28] As it is the subject of a separate inquiry, we won't address it here.

Recommendation:

- Use s301A of the EPBC Act to implement a science-based, cost-effective national approach to restrict the movement and sale of introduced species within Australia unless they pass a risk assessment.

8. Resources for invasive species management are woefully inadequate

There is widespread agreement that current funding levels and approaches are far from sufficient to halt and reduce the threat of invasive species to biodiversity. New Zealand researchers have estimated that an extra 9 to 25-fold funding is required in that country to address the threat of invasive species to biodiversity.[29] They comment, and we share their opinion, that a similar increase is probably required in Australia. That no such assessment has been undertaken for Australia is indicative of the ad hoc and short-term approach taken to invasive species management for the environment.

Australia has been a world leader in protecting agricultural assets from invasive species, and strategies and priorities are generally informed by a sound knowledge of threats, the impacts of invasion and the costs of management. For example, on

[27] Downey P, Scanlon T, Hosking J. 2010. Prioritising alien plant species based on their ability to impact on biodiversity: a case study from New South Wales. Plant Protection Quarterly 25(3): 111-26.

[28] See http://www.invasives.org.au/documents/file/sub_draft_biobill_2012.pdf for ISC's submission.

[29] Choquenot D, Clout M. 2011. Another inconvenient truth: How much pest control will it take to halt the decline in biodiversity? Security from the impact of vertebrate pest animals.15th Australasian Vertebrate Pest Conference. Sydney.

foot and mouth disease, the Department of Agriculture, Fisheries and Forestry says:[30]

> 'The Australian Government has committed to invest more than half a billion dollars to prepare for and manage the [foot and mouth disease] threat… Australia has in place detailed contingency plans and a comprehensive whole-of-government approach to managing animal health emergencies that are designed to ensure that resources from a wide range of agencies are available.'

Environmental biosecurity currently lags far behind agricultural biosecurity and there is nowhere near an equivalent understanding of threats, impacts and costs, as recognised in the 2009 Hawke review of the EPBC Act.

> Environmental biosecurity issues have not traditionally received the same attention as the potential impacts of pathogens, diseases, weeds or pests on primary production. … The new biosecurity legislation should require that the environment must be given equal consideration alongside human health and economic and social considerations….

Although environmental biosecurity is more challenging than that for industry – with more threats, more species at risk, more stakeholders, and less knowledge – more public resources are dedicated to protecting industries than the environment from invasive species. For most of its history, our biosecurity system has been directed primarily at protecting agriculture from invasive species. Current biosecurity arrangements have not been designed from an ecological perspective.

The community relies on governments to invest resources on their behalf to protect the environment for the public good. There needs to be more equity for the environment in public resources dedicated to biosecurity, as recognised by the Beale review:

> '…Australia has a relatively poor knowledge of the biosecurity threats to its natural environment. This is largely a function of the absence of commercial incentives to research and monitor environmental pests and diseases. As a result, the principal responsibility for biosecurity research as it relates to the natural environment lies with governments and the community. These activities have not received a high priority for funding.
>
> Unlike incursions that impact on primary production, where active engagement by business is motivated by self-protection, the effort required to respond to an incursion affecting the environment must be provided primarily by governments.

There needs to be substantial long-term investment to bring environmental biosecurity functions at least up to par with those for primary industries. Recently, the Queensland Government abandoned the eradication program for yellow crazy ants, recognised globally one of the major threats to biodiversity and regarded by the Wet Tropics Management Authority as likely to be 'an absolute disaster for biodiversity' in the Wet Tropics (see Appendix 2). If it were a major industry threat, the Queensland Government would undoubtedly fund eradication. Environmental programs have been abandoned in favour of agricultural priorities. This is a common problem – when budgets are tightened, environmental biosecurity programs tend to go first.

To achieve environmental goals will require much greater community contribution, including much greater involvement of the community and environmental sector in development of biosecurity policy and implementation. There needs to be reform of community engagement processes to bring them up to at least the standard of those for industry bodies. For several years, the federal and state/territory governments have jointly contributed two-thirds of the operational funding for Plant Health Australia and Animal Health Australia to develop contingency plans and strategies for high priority industry threats. This has been an excellent model for improving industry biosecurity. ISC has proposed an equivalent body for environmental biosecurity (see below).

To meet the national biodiversity conservation strategy target will require research directed to the highest priority research questions. The level of federal government funding dedicated to environmental biosecurity research is dwarfed by that dedicated to industry research. We commend the government for its commitment to match dollar-for-dollar industry funds to rural development corporations, a substantial proportion of which is devoted to biosecurity issues. However, the need for research funding in environmental biosecurity is even greater than that for industry biosecurity – with more species impacted, more invasive threats and less knowledge – and the public good rationale for funding is more compelling. In the short-term, the government should fund environmental biosecurity research to a level at least equivalent to that for industry biosecurity research.

Appendix 3 provides an example of the sort of 'getting down to business' approach desperately needed for conservation. A group of researchers last year assessed

[30] See DAFF website at http://www.daff.gov.au/animal-plant-health/pests-diseases-weeds/animal/fmd.

the feasibility and cost of saving wildlife in the Kimberley.[31] The optimal investment – sufficient to maintain 45 at-risk species over the next 20 years – amounts to about $40 million a year after set up costs of $95 million. Much of it would go to keeping invasive species at bay. With costs and feasibilities set out, there is now a 'business case' for investing in the future of Kimberley wildlife, and much less excuse for governments to avoid doing so.

Recommendation:

- Commission assessments of the measures and funding required and funding options to achieve high priority biodiversity goals, as exemplified in the report ' Priority threat management to protect Kimberley wildlife.'

9. A proposal for Environment Health Australia

Australia urgently needs a more ecological, coordinated and collaborative approach to environmental biosecurity. Invasive species are overwhelming the capacity of current biosecurity systems, as acknowledged in the State of the Environment 2011. The complexity and scale of environmental challenges warrants a comprehensive biosecurity focus facilitated by a new national body to engender a genuine partnership approach between governments, communities and relevant industries. It will not be sufficient to bolt on environmental responsibilities to existing structures and cultures.

Environment NGOs propose the establishment of a national body, Environment Health Australia, that brings together major participants in environmental biosecurity, effectively involves the community sector, and facilitates a cross-jurisdictional, cross-sector collaboration to achieve much stronger environmental biosecurity. It would be the environmental equivalent of, and collaborate with, Animal Health Australia and Plant Health Australia.

Proposed functions

- Create strong environmental biosecurity foundations: Eg. Develop and promote more ecologically informed approaches to protect species, ecological communities and ecological processes from invasive species
- Improve Australia's biosecurity preparedness: Eg. Develop biosecurity plans for high-risk potential environmental invaders, and surveillance protocols for environmental incursions, undertake foresighting and reporting to identify emerging and future threats, and develop strategies to limit the exacerbation of invasive species impacts under climate change.
- Promote effective responses to environmental incursions: Eg. Participate in National Environmental Biosecurity Response Agreement processes and commission, co-ordinate, facilitate and manage nationally agreed environmental health and biosecurity projects, and lead preparation of AusEnvPlans to establish detailed emergency response arrangements under NEBRA.
- Enhance community awareness, vigilance and action in biosecurity: Eg. Build public awareness of environmental biosecurity and support the community to become involved in biosecurity policy development and implementation, develop best practice communication and community activation approaches in environmental biosecurity, and harness the support of foundations and NGOs.
- Improve environmental biosecurity capacity – knowledge, people and resources: Eg. Facilitate governments, community groups and researchers to work together to improve environmental health in Australia, identify high priority research needs for environmental biosecurity, and identify and prioritise invasive species management actions which can be implemented to deliver development and carbon offsets.
- Improve coordination and collaboration between jurisdictions, agencies and sectors: Eg. Collaborate with industry biosecurity bodies to jointly develop biosecurity responses where invaders have both environmental and industry impacts, and conduct joint research projects.
- Monitor and report on Australia's progress in environmental biosecurity: Eg. Develop indicators for monitoring progress on meeting environmental biosecurity targets, and monitor and report on the establishment, spread and containment of ecologically important invasive species.

Proposed membership

Environment Health Australia would be structured to foster partnerships between major participants and stakeholders in environmental biosecurity and promote collaboration with industry bodies where there are shared interests. One potential

[31] Carwardine J, O'Connor T, Legge S, Mackey B, Possingham H, Martin T. 2011. Priority threat management to protect Kimberley wildlife. CSIRO Ecosystem Sciences, Brisbane.

model is that of Plant Health Australia and Animal Health Australia. Potential members include:

- Federal Government: environment and biosecurity agencies
- State/Territory Governments: environment and biosecurity agencies
- Environmental NGOs with an environmental biosecurity focus
- Indigenous land management organizations
- NRM and conservation land management organisations
- Research institutions focused on biosecurity, ecology and environmental management
- Professional bodies for people involved in environmental biosecurity
- Environmental and allied primary production industry bodies.

A more detailed proposal for Environment Health Australia is attached and can be downloaded from http://www.invasives.org.au/page.php?nameIdentifier=environmenthealthaustralia.

Recommendation:

- Establish an environmental biosecurity organisation, Environment Health Australia, to drive cross-jurisdictional and cross-sectoral collaboration.

Appendix 1. State of the Environment 2011 – verdict on invasive species[32]

The report card assessments on invasive species were bleak: high to very high impacts of invasive species with deteriorating or unclear trends. Impacts on biodiversity and management outcomes received the worst possible ratings.

Environment component	Degree of impact	Trend	Management effectiveness – outputs & outcomes
Biodiversity	Very high	Deteriorating	Ineffective
Heritage values	Very high	Deteriorating	NA
Inland water environments	High	Deteriorating	Partially effective
Land environment	High	Deteriorating	Partially effective
Antarctic terrestrial environment	High	Unclear	Effective

The report notes deficiencies of management, information and resources for invasive species, for example:

On management: 'Government responses to invasive species are uncoordinated at the national level, reactive, focused on larger animals, biased towards potential impact on primary industry at the expense of the total ecosystem, and critically under-resourced.'

On resources: 'Most jurisdictions admit they are unable to provide sufficient resources to control existing invasive species and most now focus on preventing establishment of new invasive species. New pressures are emerging and are of high concern due to the limited resources available for control.'

On information: State of environment reports by states and territories 'mostly list plans, strategies and inputs to management, but rarely report on the effectiveness of processes or on outputs and outcomes' for invasive species. The *Assessment of Australia's terrestrial biodiversity 2008* is quoted: 'The scale of the impacts from [invasive species] is such that the voluntary and uncoordinated approaches adopted to date will not be effective.'

Appendix 2. Yellow crazy ants[33]

As part of their recent cost cutting, the Queensland Government has abandoned an eradication program for invasive yellow crazy ants (*Anoplolepis gracilipes*).[34] The decision was made solely on financial grounds – that the existing small allocation was insufficient to achieve eradication. Other environmental programs have also lost funding. This is a constant problem in biosecurity across Australia – when budgets are cut, the environmental programs go first. At the same time, the government has substantially increased funding for wild dog control, a program for the commercial benefit of graziers, and is pouring considerable resources into eradicating Bovine Johne's disease from cattle in Queensland.[35]

Yellow crazy ants fit the stereotype of a rapacious marauding invader. On Christmas Island, they have killed tens of millions of the iconic (and ecologically important) red crabs, as well as robber crabs. Prior to a multi-million dollar baiting program, they had invaded more than a quarter of the island's rainforest, reaching densities of more than 2000 foraging ants a square metre and transforming the

[32] State of the Environment 2011 Committee. 2011. Australia State of the Environment 2011. Independent report to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities. <http://www.environment.gov.au/soe/2011/summary/index.html>.

[33] Abbott K. 2005. Supercolonies of the invasive yellow crazy ant, *Anoplolepis gracilipes*, on an oceanic island: forager patterns, density and biomass. Insectes Sociaux 52: 266–273.
Csurhes S, Hankamer C. 2012**.** Pest animal risk assessment: Yellow crazy ant *Anoplolepis gracilipes*. Biosecurity Queensland, Queensland Government.
Drescher J, Feldhaar H, Blüthgen N. 2011. Interspecific aggression and resource monopolization of the invasive ant *Anoplolepis gracilipes* in Malaysian Borneo. Biotropica 43(1): 93-99.
O'Dowd D, Green P, Lake P. 2003. Invasional "meltdown" on an oceanic island. Ecology Letters 6: 812–817.

[34] See http://www.couriermail.com.au/news/queensland/crazy-ants-on-march-after-government-slashes-fighting-fund/story-e6freoof-1226518463558.

[35] See http://www.daff.qld.gov.au/30_22376.htm

ecosystem. Yellow crazy ants on Christmas Island are listed as a key threatening process.

An 'invasional meltdown' on Christmas Island triggered by crazy ants has resulted in a "rapid, catastrophic shift in the rain forest ecosystem", as summarised by Dennis O'Dowd and co-researchers:

> In invaded areas, crazy ants extirpate the red land crab, the dominant endemic consumer on the forest floor. In doing so, crazy ants indirectly release seedling recruitment, enhance species richness of seedlings, and slow litter breakdown. In the forest canopy, new associations between this invasive ant and honeydew-secreting scale insects accelerate and diversify impacts. Sustained high densities of foraging ants on canopy trees result in high population densities of host generalist scale insects and growth of sooty moulds, leading to canopy dieback and even deaths of canopy trees.

Where yellow crazy ants flourish, little else does. They can remove nearly all insect life, leaving none for other animals, and kill small animals such as lizards, crabs and bird chicks. They are on the World Conservation Union's list of '100 of the World's Worst Invasive Alien Species'.

Queensland's Wet Tropics World Heritage Area is at grave risk, for the ants' preferred habitat is moist lowland tropical forest. The Wet Tropics Management Authority has said, 'It would be an absolute disaster for biodiversity in our Wet Tropics World Heritage Area if yellow crazy ants became established here'.[36] They have recently been found in Little Mulgrave National Park near Edmonton. The Wet Tropics Management Authority received $268,000 from the Federal Government this year to search for invasive ants in the Wet Tropics, but this funding will now serve little purpose.

Yellow crazy ants are able to dominate large areas by forming super-colonies with multiple nests and multiple queens. The largest have up to 300 queens and extend over several hundred hectares. They spread by budding. A mated queen leaves her birth nest with some workers and sets up a new nest nearby. (Yellow crazy ants are ideal candidates for eradication because, unlike fire ants, the queens cannot fly.) The boundary of a super-colony can advance by 3 metres a day. They don't sting but squirt formic acid, which blinds and debilitates their prey.

Suspected to be native to South-East Asia, yellow crazy ants have spread across the world via traded goods. They have arrived in Queensland multiple times, mostly with timber supplies, and now exist in 21 known sites, mostly near ports and timber yards.

Although their preferred habitat is moist tropical forest they also live in the subtropics and in harsh, dry areas such as Arnhem Land. They invade horticultural plantations and urban areas.

The short-sighted budget-cutting will condemn future Queenslanders, including farmers, to much greater costs in the near future for control and eradication will become impossible unless funding is obtained in the near future.

Yellow crazy ants expose multiple failings of Australian biosecurity:

- deficient quarantine for timber imports that have allowed them to arrive and establish multiple times,
- federal government lack of responsibility for quarantine breaches,
- overly narrow criteria for national funding for eradication of nationally significant incursions,
- lack of transparent and objective prioritisation processes to inform funding decisions,
- low priority accorded to environmental threats compared to industry threats, and
- the ever-prevailing short-termism.

Eradication programs for two other invasive ants in Queensland – red imported fire ants and electric ants, which are economic, social and environmental threats – are nationally funded. For several years, the yellow crazy ant program has been the poverty-stricken cousin of these other programs, existing on scraps from the state budget. National funding is restricted to species that can be totally eradicated from Australia, and yellow crazy ants are not eradicable from Christmas Island and the Northern Territory. This is a short-sighted approach for a country of such vastness and ecosystem diversity.

[36] See http://www.wettropics.gov.au/funding-boost-to-stamp-out-invasive-ants.html

Appendix 3. The cost of saving the Kimberley's wildlife

Business 101: the first step to achieving a goal is to assess its feasibility and cost. That this is often neglected for conservation goals is symptomatic of a serious deficit of intent. Take the invasive species target of Australia's Biodiversity Conservation Strategy – to reduce invasive species impacts on threatened biodiversity by 10%. There has been no feasibility assessment and no costed plan, rendering it an aspiration destined to fail.

In contrast, a group of researchers (Josie Carwardine and colleagues) last year assessed the feasibility and cost of saving wildlife in the Kimberley.[37] The optimal investment – sufficient to maintain 45 at-risk species over the next 20 years – amounts to about $40 million a year after set up costs of $95 million. Much of it would go to keeping invasive species at bay.

With costs and feasibilities set out, there is now a 'business case' for investing in the future of Kimberley wildlife, and much less excuse for governments to avoid doing so.

The Kimberley is worth investing in

The Kimberley is a very special region – still wild, wondrously diverse and brimming with unique species:

- 65 endemic vertebrate animal species,
- 309 endemic plant species, and
- the highest numbers of endemic invertebrates in many groups, including land snails.

It is also special because mammals have survived there. The North Kimberley – one of five bioregions in the Kimberley – is one of only two bioregions Australia-wide to have retained all mammal species (the other is the Tiwi Islands). But this could soon change.

Northern Australia is facing an imminent calamitous wave of extinctions, and the Kimberley – although less affected so far than the other northern regions – is not immune. At particular risk are:

small and medium sized ground-dwelling mammals such as golden-backed tree-rat (*Mesembriomys macrurus*), golden bandicoot (*Isoodon auratus*) and Monjon rock wallaby (*Petrogale burbidgei*),

grain-eating birds such as partridge pigeon (*Geophaps smithii blaauwi*), gouldian finch (*Erythrura gouldiae*)and star finch (*Neochmia ruficauda*), and

carnivorous reptiles such as spotted tree monitor (*Varanus scalaris*) and rough-scaled python (*Morelia carinata).*

Without effective management, "45 species of wildlife are likely to be functionally lost from the Kimberley in the next 20 years."

The main threats are inappropriate fire regimes, feral cats, feral and domestic introduced herbivores (cattle, horses, donkeys), feral pigs, cane toads and weeds. Mining, tourism and agricultural expansion are likely to exacerbate the damage.

Investment needed

Based on expert advice, Carwardine and colleagues have set out what could be achieved for different levels of investment. To keep all species across the region (with a probably of at least 90%) will cost about $40 million a year with $95 million set-up costs, allocated as shown in the table. An investment of only $27 million a year would achieve persistence probabilities of all species to at least 50%, avoiding imminent species losses but risking declines.

Fire and herbivore management	$25.3 million
Weed management	$2.8 million
Feral cat control	$2.8 million
Exclosures (for cats)	$3.5 million
Monitoring	$5 million
Annual total	$39.4 million

The most cost-effective action is cat control but its feasibility is currently low because of the lack of broadscale control methods and the social value accorded to domestic cats. The researchers suggest that feasibility will improve with education about feral cat problems and research on biocontrol and the interactions of dingos and cats. However, the cat threat for at least eight mammal species is considered

[37] Carwardine J, O'Connor T, Legge S, Mackey B, Possingham H, Martin T. 2011. Priority threat management to protect Kimberley wildlife. CSIRO Ecosystem Sciences, Brisbane.

dire enough to warrant exclosure fences to create havens free of cats and possibly also cane toads.

Management of fire and introduced herbivores will deliver the greatest benefits and are feasible although also relatively expensive.

Weed control is ranked of lower benefit because as yet weed problems in the Kimberley are not “alarming” and it is difficult to quantify the benefits of keeping out potential new weeds. Weed management would rate more highly for plant conservation, which was not considered in this study. The authors comment that “an increase in funds for quarantine is likely to be a cost-effective strategy for long term biodiversity persistence.”

A monitoring program is essential to assess the effectiveness of management.

Cats in the Kimberley

A study at Mornington Wildlife Sanctuary suggests there is a cat every 3 km², each eating 5–12 native vertebrates daily. If this is consistent throughout the region, it means 100,000 cats, killing at least half a million native animals daily.

There are currently no effective control methods for feral cats – they are trap shy and rarely eat poisoned baits.

The most feasible option could be to cease baiting of dingoes, which appear to suppress cat activity and kill kittens. Although dingoes are also predators, they frequently take larger prey, reducing pressure on small fauna. Relationships between cats and dingoes in the region are under investigation. One study at Wongalara Sanctuary in the Northern Territory, where half the property was baited for dingos and half left unbaited, found that cat activity decreased and small lizard populations increased in the unbaited areas. Should baiting cease, the impact on pastoralists should be manageable as only low losses are currently reported.

Biological control of cats is considered technically feasible but would require a substantial change in community attitudes. Fenced cat-free areas on islands or conservation properties may be needed to save species in the short-term.

10.

Appendix 4. What weeds do[38]

In the 230 years since European colonisation, Australians have imported thousands of exotic plant species, averaging more than 100 new exotic species a year. As a result, there are now thousands more exotic plants in the country than there are native species. More than 95% have been deliberately imported for cultivation, most as garden plants and some for agriculture or forestry. By moving plants into new ranges beyond their natural dispersal barriers, and planting them in numerous locations, sometimes in vast acreages, humans provide some species with advantages that allow them to establish in the wild and outcompete native species.

In the short time since European colonisation – short in ecological terms – more than 3000 exotic plant species have established in the wild in Australia, and more than 1500 are now invading natural ecosystems.

Although weeds already dominate many ecosystems, the worst is yet to come. Many weeds are at a relatively early stage of invasion, and many more exotic plants have yet to establish in the wild or become invasive. There is often a considerable time lag between introduction and invasion, sometimes more than a century.

[38] An extract from Invasive Species Council. 2010. Stopping NSW’s Creeping Peril: A community call for action on weeds.

Why weeds are biological victors

Humans give many weed species a passport to plant heaven: they liberate them from natural pathogens and predators, and plant them in large numbers in lots of habitats, sometimes selecting or breeding them for high productivity and wide tolerances.

The defensive chemicals some weeds produce may be extra powerful in their new environment because native plant-eaters have not evolved with them.

Many weed species are more successful in their introduced range than in their native range. For example, bridal creeper (*Asparagus asparagoides*) is rampant in Australian bushland, but uncommon in its native South African range.

How weeds destroy our natural heritage

Weeds compete with and eliminate native species and change ecosystem structure and function.

- **Smotherers:** Exotic vines such as cat's claw (*Macfadyena unguis-cati*), Madeira vine (*Anredera cordifolia*) and kudzu (*Pueraria lobata*) blanket native plants; sometimes the sheer weight of vines causes trees to collapse.
- **Gap grabbers:** Many weeds are fast germinators and can quickly fill gaps created by drought, fire, storms or clearing. Serrated tussock (*Nassella trichotoma*) colonises spaces in grasslands created by drought; lantana (*Lantana camara*) claims rainforest clearings.
- **Light hoggers:** Dense-leaved weeds such as willows (*Salix* spp.) and bitou bush (*Chrysanthemoides monilifera rotundata*) can shade out other plants and prevent growth.
- **Swampers:** Vigorous weeds like coolatai grass (*Hyparrhenia hirta*), lantana and camphor laurel (*Cinnamomum camphora*) can form vast monocultures, excluding all other species. Whole forests of camphor laurel are forming in some places.
- **Water chokers:** Aquatic weeds like alligator weed (*Alternanthera philoxeroides*) and cabomba (*Cabomba caroliniana*) fill creeks with a dense mass of stems and leaves, depleting oxygen and killing fish and other life.
- **Fire fuelers:** Large perennial grass invaders such as molasses grass (*Melinis minutiflora*) and shrubs like gorse (*Ulex europaeus*) can add flammable biomass to an environment, fueling more intense fires that favour the spread of these weeds and kill other species.
- **Ecosystem engineers:** Weeds can physically transform ecosystems, willows (*Salix* spp.) affecting stream hydrology, invasive pasture grasses changing fire cycles, marram grass (*Ammophila arenaria*) and bitou bush altering sand dune dynamics. Dominating weeds can greatly simplify habitat structures.
- **Pest harbours:** Blackberries (*Rubus* spp.) and gorse provide haven for rabbits and foxes.