

Please attach the following **one-page summary** to your submission.

Comments on the Interim Report for the Independent Review of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

Summary

Name of author/organisation: Invasive Species Council Australia

Date: 26 July 2009

Which chapter(s) of the interim report are you commenting on?

Chapter 18, biosecurity

Key points of submission

- (1) The need for a stronger focus on post-border biosecurity, and the potential to use both referral of actions involving invasive species and s301 to address current deficiencies.
- (2) Support for integration of pre-border and at border biosecurity subject to equivalent priority accorded to environmental threats and addressing threats associated with different genetic variants.
- (3) The potential to make declarations of key threatening processes more effective.

References (if possible, include a bibliography of any documents you may wish to make available)

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INTRODUCTION

The Invasive Species Council is pleased to see in the interim report a genuine attempt to grapple with some of the complexities and challenges of nationally significant environmental problems and the potential role of the EPBC Act.

We appreciate the opportunity to respond to the interim report, and we focus in on three key issues: (1) the potential for the EPBC Act to address some of the deficiencies of post-border biosecurity, (2) the relationship of the EPBC Act and the proposed new federal biosecurity legislation, and (3) the potential for more effective use of the EPBC Act to address key threatening processes.

In general we urge that invasive species be given more prominence in the review as an environmental threat requiring more federal focus, for the following reasons:

- ◆ Invasive species are one of the top three threats to Australian biodiversity – see evidence for this in the Attachment 1;
- ◆ Notwithstanding the current federal biosecurity reforms there are major deficiencies in biosecurity legislation (particularly at a state/territory level) and apparently limited prospects for reform at the state/territory level; and
- ◆ Without major reforms environmental weeds, pests and diseases are likely to get much worse, particularly under climate change.

Along with land clearing and climate change, invasive species should be regarded as a major gap in federal environmental regulation requiring consideration. The need for comprehensive reform was recognised in the 2004 Senate Inquiry into invasive species.¹

We recommend that the review consider a range of scenarios that exemplify invasive species threats to Australia's environment as a way of canvassing and comparing different regulatory and policy options, including the EPBC Act, the federal biosecurity legislation under development, state and territory legislation, and federal or state/territory policy. We are happy to contribute a range of scenarios.

¹ The 2004 Senate report – Turning Back the Tide: The Invasive Species Challenge – provides a very good overview of deficiencies in invasive species regulation and policy, only some of which have been redressed since the inquiry. It is available at http://www.aph.gov.au/SENATE/committee/ecita_cte/completed_inquiries/2004-07/invasive_species/report/index.htm.

1. POST-BORDER REGULATION OF INVASIVE SPECIES

ISC recommends a stronger focus for the review on how the EPBC Act can contribute to addressing the major deficiencies in regulation of invasive species post-border – those species permitted import (usually without having undergone risk assessment) that are already nationally significant threats to biodiversity or are likely to emerge as such threats in the future.

There is a very large discrepancy between the Appropriate Level of Protection (ALOP) applied to most pre-border biosecurity and the level of protection applied post-border in most states/territories to protect the environment from invasive species already in Australia. While there are valid reasons for this discrepancy in some situations where it requires considerable resources to control established invasive species, in many cases the discrepancy arises out of deficient post-border regulation in the states and territories. See Attachment 2 (confidential) for an example of the regulatory deficiencies in one state.

1.1 The need for regulation under the EPBC Act

There are hundreds or thousands of invasive species already in Australia that have or are likely to have a significant impact on Australia's biodiversity, but the majority are not regulated (or 'officially controlled') in most states and territories.

Apart from Western Australia, which has adopted a regulatory approach similar to the federal government (by maintaining a list of permitted species and prohibiting other non-indigenous species or requiring risk assessment prior to introduction), state/territory governments take a slow, reactive approach to invasive species threats. Each government has different categories of declaration and processes, but the result is that only a small proportion of invasive species are regulated and many threats continue to escalate. This includes both species that are commercially or socially valued (with the potential for conflict if proposed for prohibition) and those that are not much valued or could be easily replaced with other options. An example of the former are feral deer species – which we regard as eastern Australia's worst emerging feral animal threat – which are protected as a hunting resource in Victoria, NSW and Tasmania (despite also being listed as threatening processes in the first two states).

Although the federal biosecurity legislation currently being developed could potentially address some post-border deficiencies (as flagged in the interim report in s18.90), we do not expect that it will to any substantial degree. The scope of the legislation in the post-border arena is currently being negotiated as part of the biosecurity agreement between the state/territory and federal governments. Our expectation is that the current deficient status quo will be largely maintained as there is not a strong commitment by most states/territories to the reforms needed.

Deficiencies of most state and territory legislation include:

- ◆ Limited regulatory focus with most states/territories imposing restrictions on the use of only a small proportion of threatening or potentially threatening invasive species.
- ◆ Inconsistencies between states/territories, with some invasive species being declared in one jurisdiction but not another.

- ◆ Slow and reactive processes, with most state/territory governments not keeping pace with introductions and naturalisations of non-indigenous species.
- ◆ Conflicts of interest in some regimes with agricultural departments not regulating invasive species of agricultural or horticultural value.
- ◆ Very limited focus on prevention with most declared species being serious entrenched problems, eg. there are numerous sleeper weeds that could be prohibited without major costs to prevent their establishment and spread.

Without intending to single out any one state or territory government, these deficiencies can be exemplified in Queensland, where there are more than 1200 naturalised weed species including many that cause significant harm to the environment, and where an estimated 12 new plant species are naturalizing each year.² At the current rate of assessments, it has been estimated it will take the government more than two decades to assess the pest risk of already identified risk species (onerous risk assessment processes are required before declarations can be made). There is no hope (or intent) of even keeping apace of new introductions by assessing them before they become established and difficult or impossible to eradicate. With the responsibility for biosecurity recently situated within the agricultural department, whose mission is to “to maximise the economic potential for Queensland’s primary industries on a sustainable basis,” conservationists are concerned that environmental weeds and pests will be neglected relative to those of economic significance, particularly when they have agricultural or horticultural value. This has mostly been the case in Australia. However, we also note that Queensland has recently declared feral deer species, in welcome contrast to NSW and Victoria.

1.2 Justification for EPBC regulation: threats and trends

There is an obvious disparity in most states/territories between the scale of the threat by invasive species and regulatory and policy responses.

As is well recognised, invasive species have already taken a severe toll on Australian biodiversity, with extinctions attributed wholly or partly to foxes, cats, rabbits, rats, and chytrid fungus, and major ecosystem transformation and degradation caused by a large variety of weeds. (See attachment 1 for a summary of the evidence that invasive species are in the top 3 threats to Australian biodiversity.)

No controls over many major threats: The more widely an invasive species is introduced, the greater is the potential for it to spread and cause harm. Yet many of Australia’s most threatening invasive species are not subject to any regulation, and can be freely introduced to new areas. This is particularly the case for invasive pasture and horticultural plants. In our earlier submission we highlighted the cases of tall wheat grass (*Lophopyrum ponticum*) and other invasive pasture grasses. Attachment 2 is an unpublished (confidential) report on the regulatory and policy deficiencies that allow continued introduction of pasture species that are invading high-value conservation areas, including those recognized as matters of national environmental significance.

² Batianoff, G.N. & Butler, D.W. (2004) An overview of prioritization of invasive naturalized exotic plants in Queensland. See www.northcoastweeds.org.au/site-files/docs/forum04/seqldexotics-batianoff.pdf.

No controls over emerging or potential threats: Many non-indigenous species have yet to become invasive or they are in a relatively early stage of invasion, which means that even if all further deliberate or accidental importations were stopped the threats would continue to grow.

About 6000 exotic plants that are weedy overseas have not yet exhibited weediness in Australia. The most reliable indicator of weediness is a history of weediness elsewhere, so it is likely that a substantial proportion of these plants will eventually become weedy in Australia. No more than a handful are currently regulated in most states/territories. They represent an opportunity to prevent threats while it is possible to do so relatively cheaply. While eradication or on-ground control of these species would typically require state/territory government action, the federal government could use its powers under the EPBC Act to prevent trade and use of these species that increases the potential for them to become environmental threats.

The same prevention rationale applies to the many invasive species that are in a relatively early stage of invasion. Mark Williamson and seven colleagues³ compared the distributions in Europe of native plants, plants introduced before 1500 and plants introduced more recently. They found a relationship between time of introduction, and size of range, and concluded that, on average, naturalised alien plants take “at least 150 years to fill their range and possibly twice that, 300 years”. They cautioned that even those plants with small ranges and slow spread may become in time widespread and possibly troublesome species”. Their study has clear implications for Australia, as most of our weed species were introduced less than 150 years ago. There are also invasive animals that are in a relatively early stage of invasion – we highlight deer and some fish species as poorly regulated threats with high potential to become much worse.

The benefits of eradicating and controlling invasive species before they become entrenched have been well recognised in principle, but are not reflected in most regulatory regimes.

No controls over many species that will become invasive or more invasive under climate change: With climate change likely to worsen invasive species threats and render native species and ecosystems more vulnerable to invasive species, there are now even stronger reasons for better regulation.⁴ The growing recognition of the strong potential for harmful interactions between invasive species and climate change⁵ has not been reflected in regulatory reform.

No controls over invasive species native to Australia: The deficiencies of post-border regulation in Australia extend also to native species that are introduced outside their natural ranges. There are now many serious native weeds.

There is great disparity in treatment of new species introduced from overseas, which are now required to be assessed for weed risk, and those introduced domestically, which are usually not assessed for risk.

³ Williamson, M. et al. (2008) The distribution of range sizes of native and alien plants in four European countries and the effects of residence time. *Diversity and Distributions*.15(1): 158-166.

⁴ Low, T. 2008. Climate change and invasive species: a review of interactions. Canberra: Department of the Environment, Heritage, Water and the Arts.

⁵ Eg. Ross Garnaut said in his climate change report to the government that “the ultimate outcomes are expected to be declines in biodiversity favouring weed and pest species (a few native, most introduced) at the expense of the rich variety that has occurred naturally across Australia.”

1.3 The role of the federal government

One of the key thematic questions for the review across many issues is the appropriate role of the federal government in addressing environmental problems that are traditionally the responsibility of the states and territories. The EPBC Act represented a major advance in providing for an appropriately stronger federal government role in some environmental issues, and there are sound reasons for that role to continue to strengthen, including with respect to invasive species.

The rationale for a much greater federal government role in post-border biosecurity regulation includes:

- ◆ The national significance of the threats;
- ◆ The major deficiencies and inconsistencies in state and territory government regulation of invasive species – as discussed in 1.1
- ◆ The apparently limited prospects for substantial reform within states and territories – while some governments are improving their approaches and the state/territory and federal governments are currently negotiating a new biosecurity agreement, indications are that reforms will not address the bulk of threats; .
- ◆ International obligations – Australia has obligations under the Convention on Biological Diversity which it is not comprehensively addressing due to inadequate regulatory regimes.
- ◆ Efficiency and effectiveness – Rather than relying wholly on multiple and inconsistent states/territories using different approaches to regulate invasive species with national significance it would in some circumstances be much more efficient for invasive species to be regulated federally (although as with other environmental issues, it would not replace the need for states and territories to regulate invasive species).

As noted in the interim review report (s 18.68) with respect to risk assessment of exotic vertebrates, the “substantially different approaches used by different jurisdictions” cause “inefficiencies, inadequacies and confusion”. The same conclusion applies to other aspects of biosecurity, including post-border regulation of all categories of invasive species.

1.4 EPBC Act options

1.4.1 Assessment of actions involving invasive species

As noted in ss 18.72-73 and 18.90 of the interim report there is the potential for assessment under the EPBC Act of actions such as introducing a species from a list of national environmentally harmful species into a sensitive location. The potential for assessment of actions involving invasive species is already flagged in DEWHA’s Significant Impact Guidelines,⁶ but there have been no referrals of such actions, suggesting a need to develop appropriate threshold conditions for triggering an assessment.

Consistent with our earlier submission, the Invasive Species Council strongly supports the development of threshold conditions for referral of potential controlled actions involving invasive species. Examples include the planting of an invasive pasture grass or biofuel in the vicinity of

⁶ Department of Environment Water Heritage and the Arts (DEWHA). 2006. Epbc Act Policy Statement 1.1 Significant Impact Guidelines. DEWHA, Canberra.

habitat for threatened species or a Ramsar wetland, or stocking a potentially invasive fish for fishing or aquaculture purposes (other examples were provided in our earlier submission).

However, as noted previously, there are a number of difficulties fitting many actions involving invasive species into the controlled action framework, including that:

- ◆ In contrast to actions that are normally referred for assessment, eg. the clearing of habitat of a threatened species, the escape of invasive species into the wild is not usually an intended part of any action, and most proponents would not recognise (or accept) the need to refer actions on the basis of an unintended possible consequence.
- ◆ It is difficult to comprehensively define the circumstances under which the use of invasive species is a potential risk. For example, one invasive crop species planted a long way from a sensitive location may represent a risk if it is connected by 1 in 100 year flood waters or if birds can spread its seeds.
- ◆ In contrast to most actions that involve an environmental impact within a defined timeframe, the introduction of invasive species may not result in escape or environmental impact for many decades (or centuries). The risk extends far into the future. This means that any conditions imposed on a proponent, such as actions to limit risk, would have to bind all future managers.
- ◆ It is difficult for proponents to understand potential risks as they often require biological knowledge. Assessing potential action-specific risks is also difficult.
- ◆ Compliance can be difficult both for referrals and with conditions - because these actions are undertaken by individuals on private property who have typically had no prior obligation to seek approval for their actions.

While an important reform, the potential to require referral of actions involving listed invasive species is limited. Many actions that are a risk won't fall into an assessable category, such as planting invasive garden plants in sensitive locations, or are not likely to be referred. There needs to be a complementary focus on broader strategic assessments of categories of actions that may increase invasive species threats, as recommended in our previous submission, and regulatory controls over nationally significant invasive species.

1.4.2 Using Section 301A to regulate invasive species

As discussed in our earlier submission, Section 301A could be used to address many of the major deficiencies in post-border regulation of invasive species. The potential is noted in s18.92 of the review report without discussion.

The Invasive Species Council urges use of section 301A as one of the top conservation reform priorities. It is an efficient way to achieve some of the reforms necessary to meet Australia's obligations under the Convention on Biological Diversity.

Regulations under s301A could be used in the following ways:

- ◆ To list different categories of invasive species, such as a National Quarantine List, National Alert List and National Control List (as recommended by the 2004 Senate Inquiry) which

would be used to guide federal actions, such as to prohibit trade, to require referral of actions or to prioritise for eradication and control.⁷

- ◆ To efficiently prohibit the trade and use of invasive species that are having a significant impact on biodiversity, including matters of national environmental significance. This would avoid the current inefficiency associated with relying on each state and territory government to individually declare species such as Weeds of National Significance and the ornamental fish that each jurisdiction has agreed should be prohibited. It can take years for each state and territory government to complete listing processes even when listings are non-controversial. It would also address the inconsistencies between states and territories that undermine control of invasive species.
- ◆ To prohibit the trade and use of invasive species so as to prevent the naturalization or spread of invasive species that are likely to have a significant impact on matters of national environmental significance if not regulated. This will be an important tool to prevent future threats, particularly as climate change increases the potential for new invasive species.

These recommendations are consistent with recommendations of the 2004 senate inquiry into invasive species, including the following:

The Committee recommends that the Commonwealth in consultation with the States and Territories promulgate regulations under section 301A of the EPBC to prohibit the trade in invasive plant species of national importance, combined with State and Territory commitment to prohibit these same species under their respective laws.

Produce a list in legislation of taxa that prevents their sale and spread for each state or region. Nominations for each taxon on a state or regional basis can be developed in consultation with natural resource management agencies, state herbaria and members of the general public.

- ◆ To identify invasive species whose use in certain circumstances would trigger referral for assessment, as discussed in the previous section.
- ◆ To require risk assessment of Australian native species introduced out of their natural range (if this is not assessed under the new biosecurity legislation).
- ◆ To implement regulatory actions arising out of threat abatement plans. For example, if the federal government lists escaped garden plants as a key threatening process, it could implement a mandatory labeling scheme under s301A.

There would be many benefits in using s301A, including much greater consistency between states and territories, much greater efficiency and much better protection of matters of national environmental significance from invasive species threats.

⁷ Turning the Tide*

2. PRE-BORDER BIOSECURITY

2.1 Integration of EPBC Act provisions within the proposed biosecurity legislation

The Invasive Species Council supports the review's preliminary recommendations that biosecurity provisions under the EPBC Act should be integrated within the proposed Biosecurity Act, provided environmental threats are treated with the same priority as economic and social threats. Attached is a letter from a coalition of environment groups recommending this (Attachment 3). Essential to this is that the environment minister has a role equivalent to that of the agricultural minister in appointing commissioners to the new authority and developing and approving policy guidelines. Likewise, we support the review's position that the new biosecurity approach must be consistent with Australia's international biodiversity obligations including the Convention on Biological Diversity.

2.2 Hybrids and other high risk imports

The review report notes the risks associated with importation of fertile hybrid animals such as the savannah cat and suggests that pro-active measures will be needed to prevent this in future.

The reliance on an ad hoc approach to assess the risk of savannah cats is part of a more general limitation with current approaches to biosecurity risk assessment in the predominant focus at the species level. New genetic variants of permitted weed and pest species can mostly be freely imported or introduced from a domestic breeding program.

As with savannah cats, these new genetic variants may have different and more severe environmental impacts than variants already naturalised. The scientific advice for the listing of Lowland Native Grasslands of Tasmania as critically endangered under the EPBC Act noted the developing threat of new cultivars of existing pasture species with increased drought tolerance. There is currently a concerted effort to breed new varieties of existing weedy pasture plants that are more tolerant of drier or harsher conditions and have a greater potential range (see Attachment 2 for examples). These new hardier variants should be a high priority for risk assessment. The same risks apply for new hardier variants of feral animals such as goats and dogs.

There are also grave risks arising out of the importation of multiple strains of weed species which can hybridise in the wild to create much more invasive weeds. Many of Australia's worst weeds – eg. lantana and blackberry – are aggregates of multiple strains, and recent evidence (some of which is summarized in Attachment 4) suggests that the introduction of multiple variants has the potential to create 'superweeds'. This is a major gap in Australia's biosecurity system that we urge the review to consider. (See also Attachment 5, a media release by an Australian researcher about this issue.)

2.3 Aviary birds

We note the comment in the review report (s.18.11) that one submitter has argued that the potential threat posed by exotic birds from avicultural stock should be discounted in a risk assessment by taking account of their long presence in Australia with no harmful effects. We caution against relaxing restrictions on aviary birds. As noted in section 1.2, in ecological

timeframes exotic birds have been in Australia for a very short time, and it is likely that species will become invasive in future decades or centuries. Global analysis by Jonathon Jeschke has found that 50 percent of birds introduced outside their native range have naturalized and 34 percent of those have become invasive, a total of 17 percent.⁸ (The equivalent rates for mammals are 79% and 63%). There have already been escapes and invasions of aviary birds. Breeding populations of ring-neck parrots in Western Australia were eradicated and nutmeg mannikins have established in several locations.

2.4 Inconsistencies

We agree with the comment in s18.12 that rules for import of exotics appear to differ among species groups, with aquarium fish pointed out as one category with fewer restrictions than others. The category with the most permissive approach is weeds. We strongly agree that there needs to be a more consistent approach among categories, but not that a more “accommodating” approach is needed. Rather a more precautionary and preventative approach is needed.

⁸ Jeschke, J.M. (2008) Across islands and continents, mammals are more successful invaders than birds. *Diversity and Distributions* 14: 913–916.

3. KEY THREATENING PROCESSES – INTEGRATING WITH REGULATION

The Invasive Species Council supports the recommendation in the interim report that provisions for listing key threatening processes and developing threat abatement plans should be retained under the EPBC Act and be administered by DEWHA. There is the potential as noted by the review for administration of TAPs that deal solely with pre-border and at-border biosecurity to pass to the new biosecurity authority. However, this should be contingent on arrangements to ensure they are accorded sufficient priority. Regardless, it will be essential for the new biosecurity authority to have a strong role in implementing biosecurity elements of TAPs such as that for tramp ants, requiring a clear arrangement between the agencies to ensure that there is a strong focus on environmental matters no matter which agency is formally responsible. Tramp ants is a good case study of the failure of biosecurity and environmental agencies to date to implement preventative measures and to respond adequately to incursions with predominantly environmental impacts (we noted the contrast between the response to red imported fire ants and yellow crazy ants in our previous submission as an example of the disparity between responses to economic or social threats and environmental threats).

We recommend the review also considers other regulatory options for addressing key threatening processes. According to the EPBC Act, “[a] threat abatement plan must provide for the research, management and other actions necessary to reduce the key threatening process concerned to an acceptable level in order to maximise the chances of the long-term survival in nature of native species and ecological communities affected by the process.” In many cases to do so requires a regulatory response, which currently depends on all states and territories agreeing to adopt a particular regulation and then implementing it. Use of s301A of the EPBC Act could provide in many instances “the most efficient and effective use of the resources that are allocated for the conservation of species and ecological communities” as required for threat abatement plans under the Act. This would be the case, for example, if the federal government lists escaped garden plants as a key threatening process – ‘Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including cultivated and aquatic plants’ is currently being assessed by the Threatened Species Scientific Committee – as ISC has submitted to the Committee:

The proposed threat abatement plan should identify the most effective (including cost-effective) options to address the existing and emerging or potential threats of escaped garden plants. This should include use of the potential under section 301A of the EPBC Act to regulate actions (such as sale or planting) of threatening garden plants. This would be a much more efficient approach than encouraging each state or territory government to do so, and reduce the risk of permissive approaches in one state undermining actions in another. Quarantine reforms will be required to address the threats of new genetic material increasing the invasive potential of existing weeds (requiring that new variants of permitted weedy species be assessed before being permitted entry into the country).

Much of the focus to date has been on voluntary reforms by the nursery industry, eg. by labelling of plants and providing information to consumers about native alternatives to weedy species. However, these reforms have had limited uptake and effectiveness, and are not sufficient to address nationally significant threats. A threat abatement plan should

ensure that proposed actions do not rely on voluntary restraint by the nursery industry that conflict with common practice or commercial interests.⁹

There are numerous instances in Australia of conservation resources being wasted on addressing invasive species threats that are being perpetuated by lack of regulation of invasive species. Thousands of volunteers labour to weed conservation areas only for the same weeds to be planted in nearby gardens ensuring a constant source of ongoing weed problems. The economic arguments to retain invasive species for commercial exploitation are undermined when the full costs of addressing the consequences are factored in. We strongly recommend that the environment minister more fully uses the regulatory capacity under the EPBC Act to address key threatening processes.

In addition, as we stressed in our earlier submission, there needs to more comprehensive listing of key threatening processes and much better resourcing of threat abatement plans.

⁹ ISC's submission is available on our website at www.invasives.org.au.

The invasion risks of introducing new genetic variants of exotic plants and animals

- (i) hybrid vigor - recombination of genetic variants can produce a cultivar more invasive than the parent forms,
- (ii) an increase in genetic variance and subsequent natural selection of invasive ability, and
- (iii) an increase in phenotypic plasticity, which may promote invasion by allowing growth in a variety of environmental conditions (Lavergne and Molofsky 2008).

In an example of the first risk, Culley and Hardiman (2008) found that naturalised specimens of *Pyrus calleryana*, a Chinese tree species commonly planted as an ornamental in residential and commercial areas in the US, were a cross between genetically distinct cultivars from different parts of China. In Australia, pampas Grass (*Cortaderia selloana*) was not a major weed for decades because all the plants in gardens were female. When a new colour variant was imported – a hermaphrodite – the plants began setting seed and pampas grass became a serious environmental weed.

Hybridization between species can also occur. For example, the Invasive Species Council is concerned that a sterile cultivar of *Distichlis spicata* (a serious weed overseas), known as NyPa Forage™, which is permitted into Australia, could hybridise with an Australian *distichlis* (*D. distichophylla*) to produce a weedy cross.

The introduction of multiple genetic variants of plants can provide them with the genetic potential to become super-invasive.³ Lavergne and Molofsky (2007), for example, found that multiple introductions of the serious invasive wetland weed canary reed grass (*Phalaris arundinacea*) into the US had resulted in genetic reshuffling and recombination within the introduced populations to give rise to novel genotypes that were highly invasive. There was higher genetic diversity (and heritable phenotypic variation) in its invasive US range than in its native European range.⁴ They concluded that “multiply introduced invasive species are particularly predisposed to exhibit high rates of phenotypic evolution after their introduction, and may be very successful in adapting to predicted climate change in future decades.”

In simple terms, the importation of new genetic material bestows invasive or potentially invasive species with more evolutionary potential to flourish under existing or changing conditions. It can turn weeds into ‘super-in-

vaders’. Many of Australia’s serious weeds are hybrids – lantana (*Lantana camara*), blackberry (*Rubus fruticosus*), mesquite (*Prosopis* spp.) and spartina (*Spartina anglica*) among them.

Policy implications

Even if no control of particular existing variants of invasive species is undertaken,⁵ there is scientific justification in banning the import of new genetic variants of these species because of the additional environmental risks associated with new genetic material. There is also justification in limiting imports of some taxa to particular subspecies or variants, requiring that other genetic variants be assessed.

Risk assessments of taxa lower than species level already occurs for some proposed imports. For example, two subspecies of the legume *Bituminaria bituminosa* have recently been granted approval for import, but the species itself is not permitted and other subspecies would probably not pass a weed risk assessment.

Recommendation: Require that new genetic variants of permitted imports undergo risk assessment, taking into account (a) features of the new variant that may increase invasion risk and harm to the environment and (b) the potential for hybridization and genetic recombination to increase invasion risks.

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3 According to University of Adelaide’s Chair in Plant Conservation Biology, Andrew Lowe, “in most cases super weeds become a problem after multiple introductions from different sources. By combining this genetic variation, new genetic mutations can arise that can give the alien species the potential to adapt and turn super-invasive.” (Media release, May 2009).

4 Wilson et al. (2009) note that “natural dispersal pathways tend to introduce limited genetic variation from restricted sources over very large timescales, whereas human-mediated pathways tend to introduce larger proportions of genetic variation from more diverse sources over extremely short periods of geological time.”

5 Under World Trade Organisation rules (the Sanitary and Phytosanitary Agreement) there are restrictions on what plants and animals can be banned from import. Weed taxa can only be banned if they are being “officially controlled”. Unless a weed is being controlled (and only a small proportion in Australia are controlled), only new variants could be banned, if there was scientific justification for it.

The invasion risks of introducing new genetic variants of exotic plants and animals

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- (ii) an increase in genetic variance and subsequent natural selection of invasive ability, and
- (iii) an increase in phenotypic plasticity, which may promote invasion by allowing growth in a variety of environmental conditions (Lavergne and Molofsky 2008).

In an example of the first risk, Culley and Hardiman (2008) found that naturalised specimens of *Pyrus calleryana*, a Chinese tree species commonly planted as an ornamental in residential and commercial areas in the US, were a cross between genetically distinct cultivars from different parts of China. In Australia, pampas Grass (*Cortaderia selloana*) was not a major weed for decades because all the plants in gardens were female. When a new colour variant was imported – a hermaphrodite – the plants began setting seed and pampas grass became a serious environmental weed.

Hybridization between species can also occur. For example, the Invasive Species Council is concerned that a sterile cultivar of *Distichlis spicata* (a serious weed overseas), known as NyPa Forage™, which is permitted into Australia, could hybridise with an Australian *distichlis* (*D. distichophylla*) to produce a weedy cross.

The introduction of multiple genetic variants of plants can provide them with the genetic potential to become super-invasive.³ Lavergne and Molofsky (2007), for example, found that multiple introductions of the serious invasive wetland weed canary reed grass (*Phalaris arundinacea*) into the US had resulted in genetic reshuffling and recombination within the introduced populations to give rise to novel genotypes that were highly invasive. There was higher genetic diversity (and heritable phenotypic variation) in its invasive US range than in its native European range.⁴ They concluded that “multiply introduced invasive species are particularly predisposed to exhibit high rates of phenotypic evolution after their introduction, and may be very successful in adapting to predicted climate change in future decades.”

In simple terms, the importation of new genetic material bestows invasive or potentially invasive species with more evolutionary potential to flourish under existing or changing conditions. It can turn weeds into ‘super-in-

vaders’. Many of Australia’s serious weeds are hybrids – lantana (*Lantana camara*), blackberry (*Rubus fruticosus*), mesquite (*Prosopis* spp.) and spartina (*Spartina anglica*) among them.

Policy implications

Even if no control of particular existing variants of invasive species is undertaken,⁵ there is scientific justification in banning the import of new genetic variants of these species because of the additional environmental risks associated with new genetic material. There is also justification in limiting imports of some taxa to particular subspecies or variants, requiring that other genetic variants be assessed.

Risk assessments of taxa lower than species level already occurs for some proposed imports. For example, two subspecies of the legume *Bituminaria bituminosa* have recently been granted approval for import, but the species itself is not permitted and other subspecies would probably not pass a weed risk assessment.

Recommendation: Require that new genetic variants of permitted imports undergo risk assessment, taking into account (a) features of the new variant that may increase invasion risk and harm to the environment and (b) the potential for hybridization and genetic recombination to increase invasion risks.

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3 According to University of Adelaide’s Chair in Plant Conservation Biology, Andrew Lowe, “in most cases super weeds become a problem after multiple introductions from different sources. By combining this genetic variation, new genetic mutations can arise that can give the alien species the potential to adapt and turn super-invasive.” (Media release, May 2009).

4 Wilson et al. (2009) note that “natural dispersal pathways tend to introduce limited genetic variation from restricted sources over very large timescales, whereas human-mediated pathways tend to introduce larger proportions of genetic variation from more diverse sources over extremely short periods of geological time.”

5 Under World Trade Organisation rules (the Sanitary and Phytosanitary Agreement) there are restrictions on what plants and animals can be banned from import. Weed taxa can only be banned if they are being “officially controlled”. Unless a weed is being controlled (and only a small proportion in Australia are controlled), only new variants could be banned, if there was scientific justification for it.

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Stop the aliens invading says biologist

A University of Adelaide biologist is calling for a tightening of the importation of foreign plant material into Australia to stop the spread of super weeds, which cause \$4 billion damage to agriculture and the environment each year.

Professor Andrew Lowe from the University's Australian Centre for Evolutionary Biology and Biodiversity says quarantine restrictions need to be stricter to halt the importation of foreign species that are already established or known problem weeds in Australia.

"Our research shows that in most cases super weeds become a problem after multiple introductions from different sources. By combining this genetic variation, new genetic mutations can arise that can give the alien species the potential to adapt and turn super-invasive," Professor Lowe says.

"These human-mediated modes of introduction, which are very different to the way that plants naturally colonise new ranges, appear to be the root of the problem. In light of these findings, we should be changing our species introduction practices nationally and globally to severely limit the importation of new genetic material for plant species that have been identified as established or weedy."

Professor Lowe says many of the most potent weeds were originally introduced for horticulture or as crops and so variations in stock characteristics, like flower colour, were positively encouraged.

A typical example is fireweed, an innocuous but poisonous yellow flowering weed that was introduced into the Hunter Valley in 1918 from South Africa. The plant is now found right across eastern Australian farming systems and is poisonous to livestock.

Scotch Broom is another example of a noxious weed which has had multiple introductions from Eurasia, infesting both grazing lands as well as natural ecosystems.

Professor Lowe says of 2700 introduced plant species to Australia, 429 are now regarded as a major problem. "In some cases we can introduce bio-control agents (such as moths for the prickly pear) to keep infestations at bay, but this is not always possible"

Professor Lowe's findings were published this month in the international scientific journals *Trends in Ecology & Evolution* and *Trends in Plant Sciences*. They are the product of a three-year, \$560,000 Australian Research Council grant and research partnership involving PhD student Elly Dormontt and Dr Peter Prentis, from the University of Adelaide, and collaboration with South African scientists Prof Dave Richardson and Dr John Wilson from Stellenbosch University.

Media Contact:

Professor Andrew Lowe
Chair in Plant Conservation Biology
School of Earth & Environmental Sciences
The University of Adelaide
Phone: +61 8 8303 5280
Mobile: 0434
andrew.lowe@adelaide.edu.au

Candy Gibson
Media Officer
The University of Adelaide
Phone: +61 8 8303 3173
Mobile: 0414 559 773
candy.gibson@adelaide.edu.au