

National Invasive Ant Biosecurity Plan 2018–2028



Tawny crazy ant. Image credit: ©Alex Wild 2012.

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Executive Summary

A number of invasive ant species are amongst the most serious global invasive pests. Australia's environmental, economic, and social wellbeing is threatened by these ants, some of which have already been introduced and have become established in Australia. The environmental impacts of invasive ants can be complex; ranging from predation and competition through to modifying habitat. Economically, invasive ants impact primary production through seed consumption or animal attack, and biting or stinging farm workers; and impact electrical infrastructure in buildings. Communities are also affected by invasive ants by making outdoor areas un-usable and invading houses.

Exotic invasive ants, as a group, have been identified nationally as the seventh most important National Priority Plant Pest. In recognition of this serious threat, the National Biosecurity Committee requested the development of this national plan.

This biosecurity plan provides a nationally agreed approach to enhance Australia's capacity to manage the ongoing threat of invasive ants establishing in Australia and the impacts caused by those species already established. This plan covers the biosecurity spectrum, specifically broken into the stages of prevention, detection, response, containment and asset-based protection/ongoing management.

This plan describes the actions required to best address the biosecurity threats posed by invasive ants offshore, at the border and onshore. It includes the elements of a national approach to prevent, prepare for and respond to invasive ants, including surveillance, and how this could be achieved.

Supporting documents provide basic information about the priority invasive ant species or groups identified as a known or potential biosecurity risk to Australia. This plan is complemented by a range of other activities that are in progress, including national eradication programs and other programs for established invasive ants.

This plan has been endorsed by the National Biosecurity Committee, and the Environment and Invasives Committee will formally oversee the implementation of the plan on behalf of the National Biosecurity Committee.

1. Introduction

Invasive ants are a diverse group of ant species originating from many regions that can be introduced through a variety of pathways. Invasive ants can reach our shores either as hitchhikers on a range of conveyances (e.g. agricultural machinery and mining or military equipment), or on specific goods or groups of goods (e.g. scrap metal, soil, hay, straw, plant material). Invasive ants have also been referred to as tramp ants because of their reliance on human-mediated dispersal and close association with humans generally (Hölldobler & Wilson 1990, Passera 1994 in Holway *et al.* 2002).

These ants share some behavioural and ecological attributes that influence their probability of entry, establishment and spread as well as their potential ecological dominance and impact (Box 1).

Box 1. THE WORLD'S MOST invasive ant SPECIES ALL SHARE THE FOLLOWING CHARACTERISTICS

- 1. They are omnivorous.**
- 2. They have adopted an opportunistic nesting behaviour.**
- 3. They are found living in human-disturbed environments but may disperse into the natural environment from these areas.**
- 4. Their nests may have a large number of reproductive queens (polygyny) and extend over large areas.**
- 5. They show exacerbated aggressiveness towards other ant species but a reduced intra-specific aggressiveness at the population level.**
- 6. Their aggressive dominance affects other native species directly and indirectly, potentially causing ecosystem disruption.**

Invasive ants have the potential to negatively impact the Australian environment, agriculture industries, infrastructure, and human health and amenity. While the impacts of invasive ants on biodiversity in Australia have not been fully quantified, invasive ants have the ability to significantly affect Australia's native biodiversity directly through predation upon, or competition with, native animals, or indirectly by modifying habitat structure and altering ecosystem processes. Invasive ants can directly impact agriculture by feeding on sown crop seeds and attacking new-born animals, and indirectly through damage to infrastructure such as irrigation pipes, farming of scale insects for their honeydew and stinging or biting field workers. Invasive ants can damage electrical infrastructure in buildings and sting or bite people when they are in their back yards or urban parks.

Two species have been listed key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999*: *Solenopsis invicta* (red imported fire ant) and *Anoplolepis gracilipes* (yellow crazy ant). The listing of the yellow crazy ant is for Christmas Island where the formation of super-colonies of the ant impacts severely on the iconic red land crabs and other native species. A Threat Abatement Plan was developed in 2006, identifying red imported fire ant, yellow crazy ant and four other national priority species. The additional species were recognised as being either an emerging or established threat in Australia and included *Wasmannia auropunctata* (little fire ant/electric ant), *Solenopsis geminata* (tropical fire ant), *Pheidole megacephala* (African big-headed ant) and *Linepithema humile* (Argentine ant). This biosecurity plan captures the necessary actions required to abate the threat from invasive ants to biodiversity in Australia and as such it replaces the threat abatement plan.

Significant funds and resources have been invested in national eradication programs, many of which have spanned numerous financial years. Additionally, there are many activities underway across a range of organisations to prevent and prepare for invasive ants.

2. National Invasive Ant Biosecurity Plan

2.1. Scope of the plan

This plan describes the elements of a national approach across the entire biosecurity continuum—prevention, detection, response, containment and asset-based protection/ongoing management—and sets out specific actions and priorities to improve the management of risk associated with invasive ants.

2.2. Structure of the plan

This plan is structured into six action areas across the five key biosecurity continuum areas of prevention, detection, response, containment and management; and one area of cross-cutting actions. The cross-cutting area contains actions that fit into two or more of the five key biosecurity continuum areas and are equally important to consider to reduce invasive ant risks and threats. The cross-cutting actions are divided into the themes of retaining core skills; governance; research, development and extension; and communication and engagement.

Through the document are specific actions that link to the *Biosecurity Act 2015* or the *Environment Protection and Biodiversity Conservation Act 1999*. Other actions may relate to Australian state and territory legislation or may be important for other reasons. Users of this biosecurity plan are expected to identify actions for which they have responsibility.

Many of the actions identified in this plan are applicable to several or all five of the major action areas – prevention, detection, response, containment and management. Recognising this limitation, the action areas have been listed under the theme of most relevance. All priorities will need to be assessed in relation to current work programs and budgets.

2.3. Supporting documents

There are a number of supporting documents to the National Invasive Ant Biosecurity Plan. These include brief information about priority invasive ant species including a physical description; their food, habitat and climate requirements; information on their nesting habits and some of what is known about their impacts on biodiversity and people. There is also general information about invasive ant monitoring methods, control methods and ways to prevent further spread. This information is to help stakeholders, particularly those managing established invasive ants, to understand their options and should not be used as the technical information required for a response plan.

Other supporting documents will be made publically available as they are developed and may include outputs of actions.

2.4. High priority invasive ants for Australia

High-priority invasive ants have been identified based on experience and expertise from Australia and overseas (Table 1), and these may change as new information becomes available. These include high risk species not yet present but known to cause issues overseas (exotic), and species already present in Australia (either under eradication or established). When undertaking some of the actions in this plan, the categorisation of the invasive ant list into functional groups based on similarities in their biology, ecology and behaviour may be useful.

Table 1 groups invasive ants into three groups, as follow:

1. species that are not yet present in Australia (exotic)

2. species that are subject to active eradication programs (under eradication)
3. species established in Australia (established).

Note that the species in the table have *not* been ranked by their order of importance.

Table 1: High priority invasive ants

Scientific names ¹	Common names & acronyms	Notes about the species and risk
Exotic to Australia		
<i>Brachyponera chinensis</i>	Asian needle ant	High risk exotic species that should be considered for eradication if detected.
<i>Camponotus pennsylvanicus</i> and other species of <i>Camponotus</i> as identified by a pest risk assessment	Carpenter ants	High risk exotic species that should be considered for eradication if detected. Carpenter ants are an extremely large genus (>1000 species) with a variety of habitats. There are many exotic carpenter ants species in this group. The main risk from this genus is damage to buildings and other timber in service by the ants hollowing out wood (e.g. structural beams).
<i>Lasius neglectus</i>	Invasive garden ant	High risk exotic species that should be considered for eradication if detected. Invasive in Europe where it is nuisance pest buildings, displacing local ant species and tending honey dew producing insects (aphids).
<i>Myrmica rubra</i>	European fire ant	Very high risk exotic species that should be considered for eradication if detected.
<i>Nylanderia fulva</i>	Tawny crazy ant or Raspberry ant	Very high risk exotic species that should be considered for eradication if detected.
<i>Solenopsis richteri</i>	Black imported fire ant	Very high risk exotic species that should be considered for eradication should it be detected. <i>Solenopsis richteri</i> would likely have a similar impact to <i>S. invicta</i> , where <i>S. invicta</i> is absent.
<i>Tapinoma sessile</i>	Odorous house ant	In its native habitat, this species only causes problems in urban and disturbed areas. High risk exotic species that should be considered for eradication if detected.
<i>Technomyrmex</i> species (excluding <i>Te.</i>)	Species often misidentified as <i>Te.</i>	High risk species such as <i>Te. pallipes</i> currently exotic to Australia, and these

¹ Pest risk assessments may be conducted on additional species, which may result in this table being amended.

Scientific names ¹	Common names & acronyms	Notes about the species and risk
<i>difficilis</i> and <i>Te. vitensis</i>)	<i>difficilis</i> (difficult white-footed ant)	species should be considered for eradication if detected. This species group warrants more consideration: i.e. a better understanding of approach rates, pathways, etc. is needed. This grouping excludes <i>Te. difficilis</i> (difficult white-footed ant) and <i>Te. vitensis</i> (white footed ant) as established species.
<i>Tetramorium tsushimae</i>	Japanese pavement ant	High risk exotic species that should be considered for eradication if detected. This species can be polygynous and form super colonies with the potential to spread quickly and become a nuisance and environmental pest.
Under national eradication in Australia		
<i>Lepisiota frauenfeldi</i> (also <i>L. incisa</i> ; <i>L. canescens</i>)	Browsing ant	Under eradication in Darwin; freedom declared at Perth airport in August 2016, and at Belmont WA in November 2017. Other <i>Lepisiota</i> species are known to form huge super colonies and could be added (e.g. <i>L. incisa</i> which is invasive within Africa with one supercolony occurring across Kruger National Park; <i>L. canescens</i> in Ethiopia could have the makings of an invasive species at an international scale (Sorger et al 2017)).
<i>Solenopsis invicta</i>	Red imported fire ant (RIFA)	Under eradication. Very high risk; eradication should continue to be pursued unless the SEQ infestation is found to be not technically feasible or cost beneficial to eradicate. This species negatively impacts multiple aspects of society in many parts of the country. These impacts include human and animal health, agriculture and horticulture, the environment (through their impact on native species) and a general decrease in quality of life for those living with fire ants in their backyards, public parks and gardens. This species is our most significant threat and includes multiple government portfolios
<i>Wasmannia auropunctata</i>	Electric ant or little fire ant	Under eradication. High risk and eradication should continue to be pursued until the Cairns infestation is found to be not technically feasible or cost beneficial to eradicate. This species should remain a priority.
Established (either in discrete locations or widespread)		

Scientific names ¹	Common names & acronyms	Notes about the species and risk
<i>Anoplolepis gracilipes</i>	Yellow crazy ant	<p>Under management and/or eradication in some areas.</p> <p>High risk but widely established in numerous parts of Australia with limited control efforts in place: Australian external territory, Christmas Island; Wet Tropic World Heritage Area in north QLD).</p> <p>In isolated areas where there are biosecurity arrangements in place (e.g. island environments) eradication should be attempted as the environmental impacts are significant.</p> <p>In late 2016, the Wet Tropics Management Authority received \$7.5M from the Australian Government and \$3M from the Queensland Government to continue the localised eradication program in the Wet Tropics around Edmonton and Kuranda for a further three years (2017-2019) as part of a ten year eradication program.</p>
<i>Linepithema humile</i>	Argentine ant	<p>Under management and/or eradication in some areas.</p> <p>High risk but widely established in numerous parts of mainland Australia with no current control efforts in place.</p> <p>On Australian external territory Norfolk Island and has been subject to an eradication effort since 2008 by the Norfolk Island Regional Council. (On 1 July 2016 mainland biosecurity arrangements were extended to Norfolk Island.)</p>
<i>Pheidole megacephala</i>	Coastal brown ant or African big-headed ant	<p>High risk but widely established in numerous parts of Australia with no current control efforts in place. This species is very common in garden and home environments.</p>
<i>Solenopsis geminata</i>	Tropical fire ant	<p>Under management and/or eradication in some areas.</p> <p>High risk but widely established in and around Darwin with no current control efforts in place on the mainland.</p> <p>On Ashmore Reef with movement controls in place to prevent movement between islands and further introductions to the mainland.</p> <p>Tropical fire ants were first recorded at Ashmore Reef in 1992. They are currently</p>

Scientific names ¹	Common names & acronyms	Notes about the species and risk
		<p>found on all of the cays in the Ashmore Reef Commonwealth Marine Reserve. In 2011 the then Department of the Environment commissioned a pilot tropical fire ant control program on Middle Island, involving seven bait applications over a 14 month period which demonstrated that eradication was possible. In late 2015 the department commenced a control program with the aim of reducing the impacts of tropical fire ants on nesting seabirds and marine turtles.</p>

3. National context

Australia's biosecurity system operates under Commonwealth, state and territory legislation administered and managed by the respective government agricultural and environmental agencies. These agencies also contribute to the national response arrangements and committees.

3.1. Legislation

Legislation relevant to the management of invasive ants, current as at April 2018 is listed in Table 2.

Table 2 Commonwealth, state and territory legislation relevant to the management of risks associated with invasive ants

Jurisdiction	Administering authority	Primary legislation
Commonwealth	Department of Agriculture and Water Resources	<i>Biosecurity Act 2015</i>
	Department of the Environment and Energy	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ACT	Environment Planning and Sustainable Development Directorate	<i>Pest Plants and Animals Act 2005</i>
NSW	Department of Primary Industries	<i>NSW Biosecurity Act 2015</i> <i>Biological Control Act 1985</i>
	Office of the Environment and Heritage	<i>Biodiversity Conservation Act 2016</i>
NT	Department of Primary Industries and Resources	<i>Plant Health Act 2008</i>
QLD	Department of Agriculture and Fisheries	<i>Biosecurity Act 2014</i>
	Department of Environment and Science	<i>Environmental Protection Act 1994</i>
SA	Primary Industries and Regions	<i>Plant Health Act 2009</i>
TAS	Department of Primary Industries, Parks, Water and Environment	<i>Plant Quarantine Act 1997</i> <i>Nature Conservation Act 2002</i>
VIC	Department of Economic Development, Jobs, Transport and Resources	<i>Plant Biosecurity Act 2010</i>
	Department of Economic Development, Jobs, Transport and Resources	<i>Agriculture and Veterinary Chemicals (Control of Use) Act 1992</i>
	Department of Health and Human Services	<i>Public Health and Wellbeing Act 2008</i>
WA	Department of Primary Industries and Regional Development	<i>Biosecurity and Agricultural Management Act 2007</i>
	Department of Water and Environmental Regulation	<i>Environmental Protection Act 1986</i>
	Department of Biodiversity, Conservation and Attractions	<i>Biodiversity Conservation Act 2016</i> <i>Conservation and Land Management Act 1984</i>

Biosecurity Act 2015 (Cth)

The Biosecurity Act established requirements and regulatory powers that affect how the department manages the biosecurity risks associated with goods, people and conveyances entering Australia. These powers allow for the biosecurity risks posed by some invasive pests, including invasive ants, to be more effectively managed, and complement arrangements with states territories and industry to support the management of incursions. The definition of 'biosecurity risk' considers the risk posed to the environment, as well as human, animal and plant health and the economy.

While the focus of the Biosecurity Act is on the Australian border, many of the supporting activities around the border are focused on reducing the biosecurity risk or responding to where unwanted pests and diseases have hitchhiked to Australia on goods, people or conveyances. The actions in this

biosecurity plan related to prevention, detection and response all fall under the management of biosecurity risks under the Biosecurity Act.

Environmental Protection and Biodiversity Conservation Act 1999 (Cth)

The Environment Protection and Biodiversity Conservation Act (EPBC Act) provides for the identification and listing of key threatening processes. A threatening process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. There are two key threatening processes associated with invasive ants. In 2003, the reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant) was listed under the EPBC Act, and in 2005, the loss of biodiversity and ecosystem integrity following invasion by the yellow crazy ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean was listed.

When listing a key threatening process under the EPBC Act, the Minister must decide if a Threat Abatement Plan is a feasible, effective and efficient means to abate the threat. A Threat Abatement Plan was in place between 2006 and 2016 to reduce the impacts of invasive ants on biodiversity in Australia and its territories, and this biosecurity plan now fulfils the need for a Threat Abatement Plan that provides a feasible, effective and efficient means to abate the threat.

Commonwealth land managers

In addition to roles specified under the Biosecurity Act and the EPBC Act, the Australian Government is also responsible for land management in some ports, national parks through Parks Australia, Department of Defence and Offshore Territories under Commonwealth management.

3.2. National arrangements

Well established relationships and national arrangements are in place between the Australian, state and territory governments and, where relevant, industry and other stakeholders to coordinate and implement national action on biosecurity issues.

For nationally significant exotic pests that primarily impact on the environment, social amenity or infrastructure, governments have agreed to share the costs of eradicating incursions where it is technically feasible and cost beneficial to do so. These arrangements are underpinned by the Intergovernmental Agreement on Biosecurity² (IGAB) and, specifically, the National Environmental Biosecurity Response Agreement³ (NEBRA).

Eradication programs have been funded under the NEBRA for browsing ant. The SE Queensland eradication program for the red imported fire ant (National Red Imported Fire Ant Eradication Program) and the electric ant program (National Electric Ant Eradication Program) pre-date the establishment of the NEBRA. The management of these two eradication programs are overseen by an inter-government consultative committee and cost-shared by governments in a similar manner to the NEBRA agreement.

² Intergovernmental Agreement on Biosecurity can be found at www.agriculture.gov.au/biosecurity/partnerships/nbc/intergovernmental-agreement-on-biosecurity.

³ National Environmental Biosecurity Response Agreement can be found at www.agriculture.gov.au/biosecurity/emergency/nebra.

3.3. Regional and local arrangements

Established ants, or localised eradication programs, are considered to be the responsibility of the state or territory government where they are located. These governments may choose to place biosecurity responsibilities on land managers, such as a requirement to control the ants. The Australian Government may assist with the management of established ants or localised eradication programs where these are affecting or have the potential to affect matters of national interest.

3.4 The biosecurity continuum

The generalised biosecurity invasion curve (Figure 1) outlines the changing role of governments and stakeholders as actions to respond to a pest or disease change from prevention, eradication, containment to asset-based protection (ongoing management). 'Entry' or detection of a new pest incursion into Australia sits between prevention and eradication. The 'return on investment' of public funds generally reduces when progressing along the invasion curve, but is still beneficial at the asset based protection end of the curve for species that are of national interest.

For example, governments have a greater responsibility in the earlier stages of prevention and eradication, whereas those best placed to protect assets (public or private) from established pests and diseases are generally the owners of those assets. The environmental, primary production and social costs of inaction are high, especially at the prevention and eradication end of the curve. While it is possible to determine the economic cost in terms of adverse effects on primary production; at present there are few agreed models to measure the ecological cost to the environment of exotic pests and diseases in economic terms.

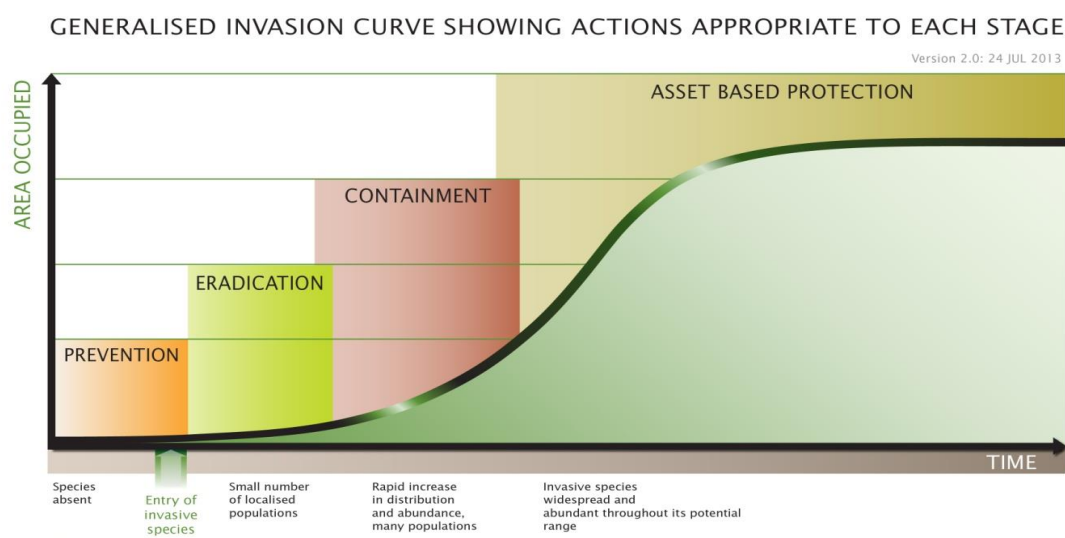


Figure 1. Biosecurity invasion curve (Agriculture Victoria, 2009)

The actions identified in this plan mapped against the generalised invasion curve are presented visually in Figure 2.

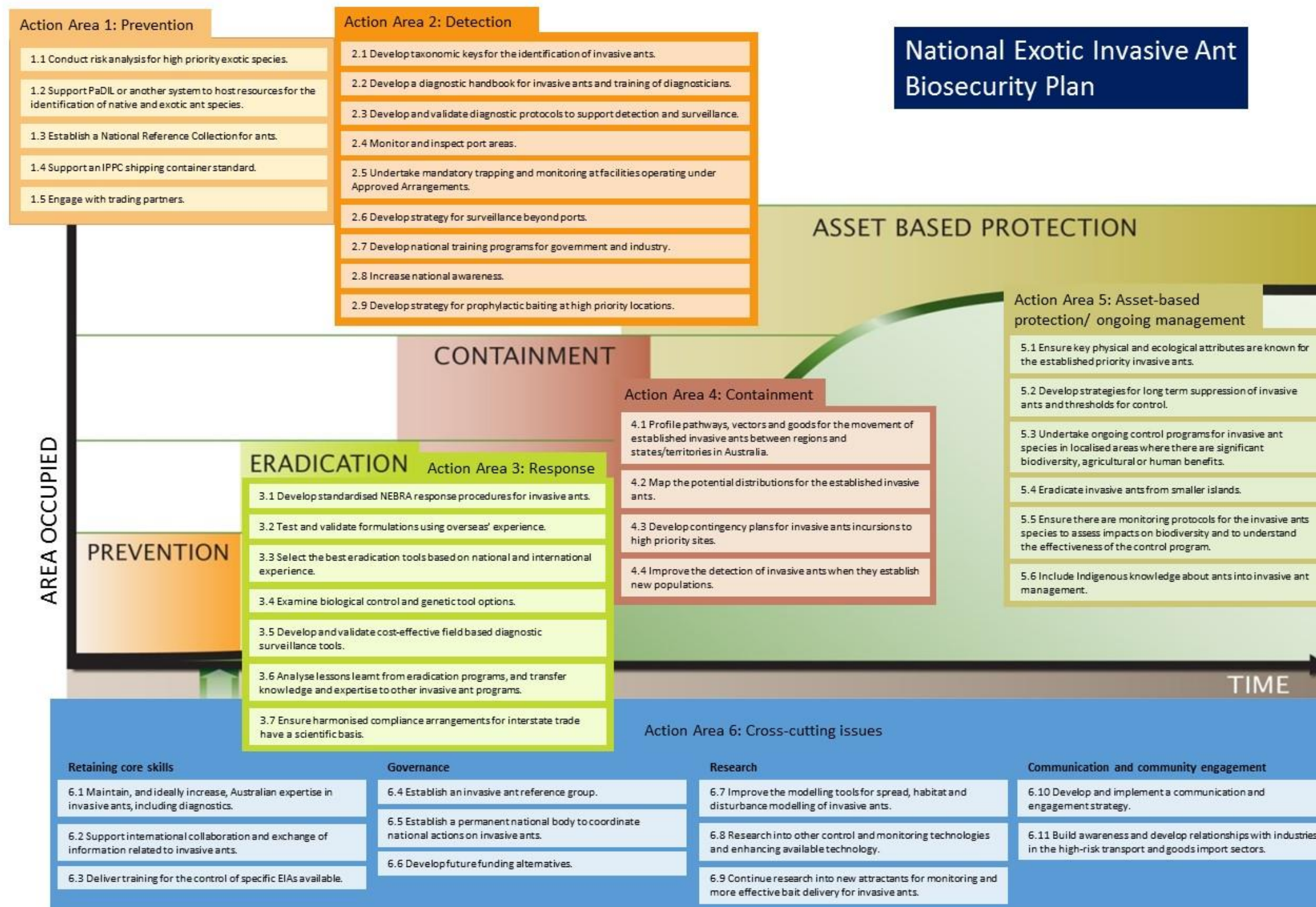


Figure 2: Actions identified in the National Invasive Ant Biosecurity Plan mapped against the biosecurity continuum as shown on the generalised invasion curve.

4. Action Areas

This biosecurity plan covers the biosecurity spectrum, specifically divided into the areas of prevention, detection, response, containment, asset-based protection/ongoing management and cross-cutting actions. The actions described below address the biosecurity threats posed by invasive ants offshore, at the border and onshore. It includes the elements of a national approach to prevent, prepare for and respond to invasive ants, including surveillance, and how this could be achieved. Elements of containment and ongoing management are included, as are actions that cut across two or more areas of the biosecurity spectrum.

Action Area 1: PREVENTION

Prevention is aimed at minimising the likelihood of entry of a new pest into Australia. The actions identified in this key area aim to achieve a better understanding of the biology of the high priority species that are not yet present in Australia or are under eradication, their potential pathways to Australia, how to minimise the risk of the exotic invasive ants utilising the pathways, and resources needed to quickly identify ants.

See Table 3 for a summary of the actions under Prevention.

Action 1.1: Conduct risk assessments for high priority exotic species

A risk analysis of each species/functional group is important to predict the emerging threats and to identify the most effective risk management available to deploy offshore, at the border and onshore.

The risk assessments will be conducted in line with IPPC standards and will incorporate:

- identification of import pathways
- analysis of interception data as part of risk assessment
- identification and comprehensive review of species' biology and ecology to inform incursion risk.

Ongoing review of import pathways to identify those of highest risk will strengthen intervention for invasive ants on known and emerging pathways. There are a number of import pathways that have a known association with ant interceptions:

- sea cargo – breakbulk (including timber, machinery and military equipment) and shipping containers (including scrap metal)
- air cargo
- passenger ships with live plants on deck
- yachts
- nursery stock imports
- air passenger baggage
- mail
- refrigerated containers.

A comprehensive analysis of the Department of Agriculture and Water Resources' interception data for invasive ants will inform origin and pathways of entry as well as provide early warning of increasing risk of other invasive ant species. As a sub-component of this action, a specialist entomologist could be funded and dedicated to the task of full identification (at the species level where possible) of intercepted invasive ants for a period of twelve months.

As part of the risk assessment, species that meet the definition of a quarantine pest under the IPPC will be identified and risk mitigation measures will be established for application at the national border.

Identification and comprehensive review of the biology and ecology of each species may be needed to provide the necessary information to identify potential entry and establishment pathways, to assess the risk posed to Australia (potential impacts on the environment, agriculture, infrastructure, and human health and amenity) and to determine their potential for eradication. Procedures to mitigate the risk can then be further developed and implemented.

This action is important for the invasive ants that are not in Australia to prevent their arrival, and also crosses over to the invasive ant species under eradication to assist with eradication or prevention of further spread, and for established species to assist with their containment and control.

Action 1.2: Support PaDIL or another system to host resources for the identification of native and exotic ant species

Support of PaDIL or another system into the future will be very valuable for ant identification.

The Pest and Disease Image Library (PaDIL; www.padil.gov.au) has been developed as a publically accessible visual collection of high-resolution images of pests and diseases, and is used by front-line biosecurity staff in the Department of Agriculture and Water Resources. The capture and storage of high-resolution images of key morphological characteristics of invasive ants into a freely accessible gallery would be very valuable for ant identification. The addition of taxonomic keys specifically for invasive ants is a logical and much needed tool to assist in the rapid and accurate identification of ants.

Action 1.3: Establish a National Reference Collections for ants

A national reference collection of key species of concern and native species will greatly assist rapid identification.

There is a need for the development of reference collections of the key invasive ant species of concern, as well as native species, to assist in the identification of invasive ants. Collections would be available for use by diagnosticians at all major ports of entry and by other diagnosticians supporting onshore surveillance. International specialists may be able to assist in the compilation of such reference collections. The images collected of specimens could also be used to populate the PaDIL Library.

Action 1.4: Support an international shipping container standard

Development of an International standard for Phytosanitary Measures for shipping containers will reduce hitchhiker and contamination risks associated with shipping containers.

The Commission of Phytosanitary Measures (CPM) of the International Plant Protection Convention (IPPC) has indicated a desire to create more commodity class and conveyance-specific phytosanitary standards to supplement the existing suite of phytosanitary standards. Such standards have international benefits, particularly where there are generic phytosanitary risks and also widely accepted international phytosanitary measures. The development of a standard for shipping containers has been on the agenda for the IPPC standards committee which progresses the development of ISPMs in recent years. However, following the CPM meeting #11 in April 2017 this was put on hold pending assessment of the available tools such as the Code of Practice for Packing of

Cargo Transport Units (CTU Code) and the CPM Recommendation on Sea Containers which encourage National Plant Protection Organizations to support the implementation of the relevant parts of the revised Code of Practice. The impact of the CTU Code would then be assessed over the next five years.

In view of the strong association between international movement of shipping containers and the presence of invasive ants, along with other hitchhiker pests, Australia needs to be actively involved at the IPPC in the consideration of the risk posed by sea containers.

Action 1.5: Engage with trading partners

Dialogue with trading partners on contamination of conveyances or other non-commodity related risk pathways will assist Australia to address the risk of emerging invasive ants.

Australia has regular engagement with trading partners on biosecurity issues. The agenda for these meetings is often dominated by trade and market access commodity issues owing to the impact of phytosanitary measures on trade in commodities. Other issues such as incidental contamination of conveyances or other non-commodity related risk pathways are rarely included on the bilateral meeting agenda. However, there are a number of pest-specific issues that could be included in the bilateral dialogue, not limited just to the formal meetings, but as a regular exchange of information about emerging pest concerns. Given the prominence of invasive ants as a pest grouping of biosecurity concern to Australia, bilateral dialogue covering pests of this nature would assist Australia in its preparedness for emerging high-risk ants in the trading environment.

Table 3: Summary table of Action Area 1: PREVENTION

Action Area 1: PREVENTION		PRIORITY	TIMEFRAME ⁴
Action 1.1	Conduct risk assessments for high priority exotic species	High	Short term
Action 1.2	Support PaDIL or another system to host resources for the identification of native and exotic ant species	Medium	Medium term
Action 1.3	Establish a National Reference Collection for ants	Medium	Medium term
Action 1.4	Support an international shipping container standard	High	Very long term
Action 1.5	Engage with trading partners	High	Short term, ongoing

Action Area 2: DETECTION

Detection is focused on ensuring that the right tools and strategies are in place to find exotic invasive ants when they enter Australia, regardless of the means of transportation. The actions identified include appropriate strategies for surveillance and identification capacity.

See Table 4 for a summary of the actions under Detection.

⁴ Timeframe: SHORT up to 3 year; MEDIUM 4 to 8 years; LONG up to 10 years.

Action 2.1: Develop taxonomic keys for the identification of invasive ants

Tailored up-to-date taxonomic keys will greatly improve Australia's capacity for early detection of invasive ants.

There are currently no tailored taxonomic keys available in Australia specifically for the identification of invasive ants. Taxonomic keys are a critical tool and should be used in conjunction with the PaDIL high resolution image library resource. Used in combination, they will greatly improve Australia's capacity for early detection of invasive ants. This is particularly relevant for problematic genera (species complexes) with known intricate challenges in identification.

General knowledge on the biology, ecology, behaviour and taxonomy of native species is also poor, which can be problematic when trying to identify invasive ants. Key characteristics need to be identified and listed to distinguish native and established from exotic ant species.

Action 2.2: Develop a diagnostic handbook for invasive ants and training of diagnosticians

A standardised and nationally agreed diagnostics handbook for ants that focuses specifically on invasive ants will assist Australian diagnosticians to make rapid and accurate identifications of invasive ants.

Consistent with the approach for fruit flies in Australia, is the value of developing a diagnostics handbook (the fruit fly diagnostics handbook is accessible on the Plant Health Australia [website](#)) for assisting in the identification of invasive ants. Australian diagnosticians would benefit from a standardised and nationally agreed diagnostics handbook for ants focusing specifically on invasive ant species. The handbook could be complemented by a specialist training program for diagnosticians focusing on identification of invasive ants. A register of diagnosticians trained for the identification of invasive ants should be maintained for ready access to appropriate experts.

Action 2.3: Develop and validate diagnostic protocols to support detection and surveillance

Reliable and affordable diagnostic tools will assist Australian diagnosticians to make rapid and accurate identifications of invasive ants.

There is a need for reliable and affordable diagnostic tools to be adopted from overseas initiatives and/or developed and validated to successfully detect invasive ant species in Australia. What is currently lacking is a range of diagnostic tools that are able to detect and identify ant species in a variety of situations and environments. Current diagnostic and detection tools, such as the red imported fire ant lateral flow device developed in the United States has been tested against 36 species of Australian ants. All results were negative, while tests of red imported fire ant were positive (Valles *et al.* 2017).

Some basic research into available diagnostic tools needs to be carried out before efforts are invested into developing new tools and techniques. The long term aim is that diagnostic protocols can identify individual incursions of the same species of ant, as can currently be done for red imported fire ant. This is necessary to determine if spread relates to a current incursion, or a new incursion, and to be able to identify the country where the population originated from to allow re-assessment of pathway risk.

Action 2.4: Monitor and inspect port areas

Regular surveys around seaports and international airports will increase our knowledge of native species.

Regular surveys around seaports and international airports would increase our knowledge of native species as well as support early detection of any invasive ant incursions. Improved familiarity and awareness by front line biosecurity staff is a powerful tool for rapid response when new species are detected. The presence of front line biosecurity staff in the port areas also serves the dual purpose of educating and promoting awareness of invasive ants to the larger pool of wharf operators and workers who share an important role in the early detection of invasive ants. The National Border Surveillance program within the Department of Agriculture and Water Resources is ideally placed to implement this action.

The surveillance methods that could be tested include odour detection dogs and the lateral flow immunoassay test kit and sentinel sites. Sentinel sites may be monitored by local governments and/or industry.

Action 2.5: Undertake mandatory trapping and monitoring at facilities operating under Approved Arrangements

Effective baiting program at first points of entry and Approved Arrangements may assist with early detection of invasive ants and will reduce the likelihood of establishment or spread should an invasive ant arrive.

The Biosecurity Act 2015 contains provisions for importers to operate under Approved Arrangements. These arrangements specify structural requirements for premises, treatment facilities where appropriate and a range of other conditions necessary for the management for biosecurity risk. The conditions for Approved Arrangements receiving imported goods, identified in the risk pathway as posing a risk of invasive ant entry, could include mandatory trapping and monitoring of trapping stations.

An additional consideration could be specific biosecurity training where appropriate on invasive ants to a level consistent with operational officers for at least one employee at high risk sites. This approach would be consistent with officers in the existing 'authorised officer' program who conduct business related to export programs on behalf of the Department of Agriculture and Water Resources.

Consideration of appropriate luring techniques, including minimising any potential impacts on native ants, will be important in achieving effective survey design for particular taxa.

Action 2.6: Develop strategy for surveillance beyond ports

To support early detection to significantly increase opportunity to eradicate, and to prophylactically bait to kill ants.

There is currently no strategy for surveillance beyond ports. As there are many species of ants in Australia, most people tend to ignore them unless they are extremely abundant in the area or causing a problem. Early stage establishment of an invasive ant may not be immediately noticed.

This new action to develop a strategy for surveillance is needed to integrate state, territory and Commonwealth surveillance, and to also consider industry involvement; for example, the mining industry. The surveillance strategy should also include educating land managers and the community in

areas considered as being at risk (either as a high risk receiving site for border incursions or for values such as threatened species or ecological communities).

Action 2.7: Develop national training programs for government and industry

An effective training package for front line biosecurity officers and industry personnel, both at the border and onshore, will strengthen biosecurity awareness.

The frequency of onshore detections and incursions has highlighted the need for increased awareness of invasive ants by front line biosecurity inspectors and industry personnel, both at the border and onshore, in all states and territories. Ideally, a training package would address:

- general ant biology, behaviour, identification and detection
- treatment methods with an emphasis on invasive ants, and
- requirements for high priority invasive ants where there are specific treatments or environmental differences.

This action overlaps with the onshore management of established invasive ants for groups seeking to undertake control programs. These groups need to receive specific training related to the invasive ant they are targeting.

Action 2.8: Increase national awareness

Increased awareness of the threat of invasive ants by industry workers at ports and mining operations will support early detection at mining sites and rural areas.

Experience with some detections of red imported fire ant on imported goods has demonstrated the importance of industry awareness, including not only port areas and wharf operators, but also end-users such as the mining industry. Red imported fire ant has been detected on mining equipment onshore and in some cases in-transit to remote mining sites. There are other examples of break bulk and containerised cargo moving directly to rural areas. Increased awareness of the threat of invasive ants amongst workers associated with these related industries would increase the probability of early detection for this pathway.

Action 2.9: Develop strategy for prophylactic baiting at high priority locations

An effective baiting program at high priority locations will assist with early detection of invasive ants before they can establish.

An important element of the National Border Surveillance is luring to detect invasive ants around port areas or Approved Arrangements receiving imported goods or conveyances that are associated with the movement of invasive ants, and to consider any other hot spots along the supply chain.

A national ant surveillance strategy could include ant luring at Approved Arrangements and similar related sites handling sea containers and break bulk cargo, air cargo facilities, first point of entry yacht marinas, passenger ships with significant live plant material and mail handling facilities.

Table 4: Summary table of Action Area 2: DETECTION

Action Area 2: DETECTION		PRIORITY	TIMEFRAME
Action 2.1	Develop taxonomic keys for the identification of invasive ants	High	Medium term

Action Area 2: DETECTION		PRIORITY	TIMEFRAME
Action 2.2	Develop a diagnostic handbook for invasive ants and training of diagnosticians	High	Short term
Action 2.3	Develop and validate diagnostic protocols to support detection and surveillance	High	Long term
Action 2.4	Monitor and inspect port areas	High	Short term, ongoing
Action 2.5	Undertake mandatory trapping and monitoring at facilities operating under Approved Arrangements	High	Short term, ongoing
Action 2.6	Develop strategy for surveillance beyond ports	High	Long term
Action 2.7	Develop national training programs for government and industry	Medium	Short term
Action 2.8	Increase national awareness	Medium	Short term
Action 2.9	Develop strategy for prophylactic baiting at high priority locations	High	Long term

Action Area 3: RESPONSE

Responding to an incursion of an exotic invasive ant may be a complicated and lengthy process depending on the extent of spread of the species and how long it has been present before detection. The national biosecurity system and the NEBRA in particular outline how governments will behave in response to an incursion. However, for invasive ants there is still a need to develop standardised response procedures and improve tools to quickly and effectively remove the ants.

See Table 5 for a summary of the actions under Response.

Action 3.1: Develop standardised response procedures for invasive ants

Standardised response procedures will support rapid response to an incursion.

Standardised response procedures can be used to provide a streamlined approach to responding to a new incursion of invasive ants, which can be then tailored to suit the specific circumstances of the incursion. These procedures could potentially be based on a generic approach, using pest groups and/or biological traits. Procedures should address the following concepts and techniques, amongst others:

- surveillance for detection, delimitation and proof of freedom
- definitive diagnostics to confirm the species and high-throughput diagnostics to process large numbers of samples
- tracing to assist in delimitation of the species and to identify probable pathways of introduction
- movement and quarantine controls to limit spread
- treatment options
- community engagement.

Any response procedures need to be consistent with the principles outlined in NEBRA.

Action 3.2: Test and validate formulations to treat invasive ants using overseas' experience

Testing and validating formulations will ensure there are no unacceptable off-target impacts or interactions with native species, and will also ensure that these formulations are effective against the invasive ants under eradication and under Australian conditions.

Control tools available for invasive ants in Australia are limited. Direct nest injection or baiting with insecticides, and baiting with regulated growth hormones are the current control methods and limited aerial baiting with fipronil (under a special permit). Further research is needed into alternative chemical controls.

The United States has been testing and using a range of chemical formulations for the baiting and control of invasive ants. This expertise and experience should be drawn on to ensure that appropriate formulations are tested through field research trials, not only to account for unacceptable off-target impacts and interactions with native species, but also to ascertain that these formulations are effective under Australian conditions. Timely registrations of formulations with the Australian Pesticides and Veterinary Medicines Authority (APVMA) are needed to expedite approvals for field use.

Additionally, a review on the control successes for invasive ants, both nationally and internationally, would be very useful to identify parts of the programs that would be valuable and transferable to deal with invasive ants in Australia.

A number of these tools are also likely to be of use for asset-based protection programs.

Action 3.3: Select the best eradication tools based on national and international experience

Eradication tools used will be the most effective, both for the invasive ant under eradication and for Australian conditions.

Through red imported fire ant and other eradication programs in Australia and invasive ant experiences overseas, a range of tools are available. These include aerial baiting (under special permit and restricted to non-residential areas), all-terrain vehicle baiting, ground baiting, direct injection of nests, surveillance by ground teams, odour detection dogs and remote sensing. Some of these tools might be more effective for certain invasive ants and not others and they should also be reviewed and adapted to Australian conditions.

The South East Queensland red imported fire ant program has provided strong underlying evidence of the effectiveness and value of detector dogs. Detector dogs are able to locate nests and, in some cases, have been shown to detect individual ants with a high level of reliability. The dogs are able to be trained to different types of invasive ant, so may be able to be shared between programs. The value of detector dogs needs to be carefully weighed against the benefits of electronic noses as these become more advanced.

A number of these tools are also likely to be of use for asset-based protection programs.

Action 3.4: Examine biological control and genetic tool options

Managers will benefit from a broader suite of management tools, including biological and genetic, to control invasive ants during eradication programs and may provide a back-up plan if eradication programs fail.

Control tools available for invasive ants are limited. Further research is needed into alternative chemical controls, biological controls and genetic tools.

The concept of biological control should be researched even though there is not a historically established strong case to support the efficacy of biological control agents for invasive ants. A range of biological control options are being investigated overseas and their effectiveness should be monitored. Australia has a well-established process for the assessment of biological controls agents, which legitimately takes a considerable period of time and, therefore, the use of biological control agents is very much a long-term strategy. Investment in biological control for the established priority species (e.g. Argentine ants, African big headed ants) may also be appropriate.

Gene editing technology is developing and may be an option for the control of invasive ants. Invasive ants should be included in conversations about how this technology could be applied and the ethical considerations that need to be resolved in order to make a decision about use of the technology.

A number of these tools are also likely to be of use for asset-based protection programs.

Action 3.5: Develop and validate cost-effective field based diagnostic surveillance tools

Cost effective field-based diagnostic surveillance tools will allow delimitation to be done as quickly as possible.

Ants can be difficult to tell apart, even for experts. Additional tools are needed to assist with surveillance and management for both rapid in-field determination of species and for researchers to use on particularly difficult species. A number of invasive ant specialists have highlighted the urgent need for cost effective field-based diagnostic surveillance tools to identify specific invasive ants.

The development of lateral-flow immune-assay tests or automatic photo identification systems may be options. A lateral-flow immune-assay test uses a simple device to detect the presence (or absence) of a target chemical in a sample without the need for specialized and costly equipment. A lateral flow device has been developed in the United States for the detection of red imported fire ant, but no other tools have been developed for any of the other priority invasive ants.

Personnel involved in delimitation surveys, post-eradication surveillance programs or targeted surveys in specific locations would benefit from a range of tools to identify specific invasive ants, or confirm identification of ant samples. It is also important to have such diagnostic tools, so the delimitation can be done as quickly and accurately as possible.

This action of developing additional field tools, such as the lateral-flow immune-assay tests, are also applicable to containment and ongoing management. For the established invasive ants improved diagnostic tools will assist land managers to identify when they have an invasive ant problem or for post-control surveillance.

Action 3.6: Analyse the lessons learnt from eradication programs, and transfer knowledge and expertise to other invasive ant programs

Analysis of initiatives, programs and tools developed for the south-east Queensland red import fire ant eradication program, Far North Queensland electric ant eradication program and other programs will identify any knowledge transferable to the detection, surveillance and eradication of other invasive ants.

The top invasive ants will most likely share only a few of red import fire ant attributes. However, numerous initiatives, programs and tools developed over the last 15 years as part of the red import fire ant eradication efforts might be fully or at least partially transferable to the detection, surveillance and eradication of invasive ant functional groups or individual species. The red imported fire ant independent review noted that red import fire ant research spill-overs combined with a

strong core group of professionals, who have the skills and expertise to manage red imported fire ant incursions, have increased the probability of eradicating other invasive ant species throughout Australia. Analysis of the many red import fire ant initiatives, programs and previous program reviews, their successes and failures, should be carried out by an expert in red import fire ant eradication to identify the specific components that can be transferred to other invasive ants (e.g. surveillance activities, community engagement programs, modelling, etc.). Likewise, the program to eradicate electric ants also should be analysed for the specific components that can be transferred to other invasive ants. There is a need for a critical quantitative analysis to determine what leads to a failure to delimit, eradicate and contain invasive ants.

There may also be elements of these two eradication programs that can inform containment and control programs so it is important that the knowledge is freely available to groups wishing to control established invasive ants as well.

In addition, a further issue affecting the ability to eradicate invasive ants relates to the timeliness and flexibility of budgets. For all invasive ant eradication programs, contingency budgets/flexibility should be considered for the following financial year, as budgets for the next financial year may be prepared before surveillance for a season is completed, meaning that if surveillance results in more than expected detections, there will be a financial short-fall in the following treatment season.

Action 3.7: Ensure harmonised compliance arrangements for interstate trade have a scientific basis

A nationally harmonised system for specifying interstate trade conditions will provide certainty for industry and prevent the spread of invasive ants.

When eradication programs are in progress for invasive ants, a recognised area of risk for the spread of invasive ants is the unintentional movement of infested conveyances or goods. Currently there is no nationally harmonised system for specifying movement conditions for hosts of pests (including invasive ants) for interstate trade and it can be confusing for businesses that move goods or conveyances within and out of a state or territory, as there can be different risk mitigation processes in place for each type of movement. Any system should be based on science and mitigate the risk of spread. The Subcommittee on Domestic Quarantine and Market Access is the appropriate forum to address this issue.

Table 5: Summary table of Action Area 3: RESPONSE

Action Area 3: RESPONSE		PRIORITY	TIMEFRAME
Action 3.1	Develop standardised response procedures for invasive ants	High	Medium term
Action 3.2	Test and validate formulations using overseas' experience	Medium	Medium term
Action 3.3	Select the best eradication tools based on national and international experience	Medium	Short term, ongoing
Action 3.4	Examine biological control and genetic tool options	Low	Long term
Action 3.5	Develop and validate cost-effective field based diagnostic surveillance tools	Medium	Medium to long term
Action 3.6	Analyse the lessons learnt from eradication programs, and transfer knowledge and expertise to other invasive ant programs	High	Short term

Action Area 3: RESPONSE		PRIORITY	TIMEFRAME
Action 3.7	Ensure harmonised compliance arrangements for interstate trade have a scientific basis	High	Short term

Action Area 4: CONTAINMENT

Some invasive ants that are considered to be established in Australia are limited to discrete locations. This provides an opportunity to implement management practices that contain the ant to that location. Management may also include the attempt to eradicate it from a particular site.

See Table 6 for a summary of the actions under Containment.

Action 4.1: Profile pathways, vectors and goods for the movement of established invasive ants between regions and states/territories in Australia.

The profiling of pathways, vectors and goods will allow jurisdictions to minimise the risk of invasive ant spread.

While the natural spread of established invasive ants is important to know for localised control, it is when they hitchhike via human mediated transport that long distance movement occurs. While invasive ants are easy to opportunistically move, each invasive ant species has some particular pathways that they prefer. Understanding these and where they may spread ants to high risk areas (e.g. into a high biodiversity national park) will enable the identification of how the risk can be minimised. Once pathways are identified, encourage incentives or regulation (self or imposed) to minimise the risk.

Action 4.2: Map the potential distributions for established invasive ants

Regional maps of the established invasive ants will allow managers to understand potential impacts.

In order to contain invasive ants, it is important that the ecological parameters of the species are known which may allow accurate prediction of where the species may spread to (if not contained) within Australia. This is particularly important in order to identify threatened species and ecological communities that may be affected within these distributions. Mapping of the potential distributions of the priority established invasive ants needs to be done on a regional scale, and possibly on a finer scale incorporating ecological communities or habitat mapping. Knowing the potential spatial distribution of invasive ants will allow land managers to understand potential movement pathways, where to look for these species and to understand what native species may be affected.

Action 4.3: Develop contingency plans for invasive ant infestations to high priority sites

Contingency plans to remove new infestations of established invasive ants will protect high priority sites.

Management of the spread of an invasive ant is most effective if undertaken as soon as possible. A single nest or small area is much easier to control—with a much higher likelihood of success—than a widespread infestation. Where a specific invasive ant species or group of species with similar characteristics are found to be a high risk, contingency plans can be developed so control action can be quickly undertaken.

Action 4.4: Improve the detection of invasive ants when they establish new populations

The development of surveillance protocols will allow land managers to integrate invasive ant prevention.

There are many species of ant in Australia and most people tend to ignore ants unless they are extremely abundant or are causing a problem. New tools as well as surveillance protocols that can be built into land management practices need to be developed and provided to land managers in areas identified as high risk.

Table 6: Summary table of Action Area 4: CONTAINMENT

Action Area 4: CONTAINMENT		PRIORITY	TIMEFRAME
Action 4.1	Profile pathways, vectors and goods for the movement of established invasive ants between regions and states/territories in Australia.	High	Short term
Action 4.2	Map the potential distributions for the established invasive ants.	Very high	Short term
Action 4.3	Develop contingency plans for invasive ant incursions to high priority sites.	Medium	Short to Medium term
Action 4.4	Improve the detection of invasive ants when they establish new populations.	Medium	Medium term

Action Area 5: ASSET-BASED PROTECTION/ONGOING MANAGEMENT

Established invasive ants have a significant impact on biodiversity, agriculture, infrastructure, human health and public amenity. An analysis of the costs of managing established pests provides a cost:benefit ratio of 1:1-5 (Agriculture Victoria, 2009) so, while it is still worthwhile controlling pests, an asset-based approach to manage invasive ants only where they are impacting on high value assets is the accepted approach. The impact of invasive ants on environmental, agricultural and social values have been outlined in the introduction and further information is available in supporting documentation. A number of actions are identified to improve the management of invasive ants.

See Table 7 for a summary of the actions under Asset-based Protection/Ongoing Management.

Action 5.1: Ensure key physical and ecological attributes are known for the established priority invasive ants

Published physiological and ecological attributes related to Australian conditions will assist with ongoing management of invasive ants.

To help understand the potential threat from invasive ants, the key physical or ecological attributes of the ants will assist to identify threatened species and ecological communities; threatened biodiversity more broadly, as well as primary production, human health and public amenity. Note that this action overlaps with action area 4 – Containment.

Action 5.2: Develop strategies for long term suppression of invasive ants and thresholds for control

Threshold criteria for suppression of invasive ants are developed for the priority established invasive ants.

It is a rare situation to eradicate an invasive ant from an area. More commonly, the invasive ant abundance is reduced for a period of time after the control action. There will be points of abundance of the invasive ant where the impacts are high enough that control action should commence (and vice versa). This may be site specific, but there may also be general criteria to determine when to undertake control for each of the priority established invasive ants. This would be useful information for land managers.

Action 5.3: Undertake ongoing control programs for invasive ant species in localised areas where there are significant biodiversity, agricultural or human benefits

Control programs should be established or continued in high priority areas to control established invasive ants.

There is a need to undertake local control programs for invasive ant species in Australia where they are not able to be eradicated, but where there is benefit to the environment, agriculture or people in ongoing management. This work should be conducted collaboratively so that the programs remain effective and are supported by multiple people or organisations to ensure longevity.

Action 5.4: Eradicate invasive ants from smaller islands

Eradicating invasive ants from islands can have huge biodiversity benefits.

Localised eradications may be effective on smaller islands where the entire island can effectively be treated. This action seeks to achieve the rich biodiversity benefits that island eradications can lead to. An example is the benefits that would ensue to seabirds and their chicks, hatchling turtles, crabs and other invertebrates from the eradication of tropical fire ants from Ashmore Reef. A number of these species are listed under the *Environment Protection and Biodiversity Conservation Act 1999*. Processes would need to be put in place to mitigate the risk of re-infestation.

Action 5.5: Ensure there are monitoring protocols for the invasive ant species to assess impacts on biodiversity and to understand the effectiveness of the control program

Monitoring of invasive ant control programs is essential to understand the benefits to threatened species, ecological communities and biodiversity more broadly.

For groups undertaking or seeking to undertake control programs for invasive ant species, it is important that monitoring is undertaken to both understand the impacts on biodiversity and to measure the effectiveness of the control program in relation to benefits to native species. Effective monitoring protocols are needed for all of the invasive ant species in different environments. Some of these need to be in a form suitable for small scale programs as well as those with greater human or monetary resources. The development of criteria to determine when to undertake control for each of the established priority invasive ants would be useful for land managers.

Action 5.6: Include Indigenous knowledge about ants into invasive ant management

Indigenous knowledge about ants may be able to inform surveillance and contingency plans for invasive ants.

There are many species of ant in Australia and ants are intertwined with Indigenous cultures. In many areas where invasive ants may spread there is likely to be people with Indigenous knowledge about native ants. This knowledge may be able to improve the likelihood of early detection and the development of contingency plans. In addition, Indigenous knowledge of the inter-relationships and dependencies of native species that may be affected by invasive ants may also assist in their management.

Table 7: Summary table of Action Area 5: ASSET-BASED PROTECTION/ONGOING MANAGEMENT

Action Area 5: ASSET-BASED PROTECTION/ONGOING MANAGEMENT		PRIORITY	TIMEFRAME
Action 5.1	Ensure key physical and ecological attributes are known for the established priority invasive ants	Very high	Short term
Action 5.2	Develop strategies for long term suppression of invasive ants and thresholds for control	Medium	Medium term
Action 5.3	Undertake ongoing control programs for invasive ant species in localised areas where there are significant biodiversity, agricultural or human benefits	High	Short term - ongoing
Action 5.4	Eradicate invasive ants from smaller islands	High	Short to medium term
Action 5.5	Ensure there are monitoring protocols for the invasive ant species to assess impacts on biodiversity and to understand the effectiveness of the control program	High	Short, medium and long term
Action 5.6	Include Indigenous knowledge about ants into invasive ant management	Low-medium (location dependent)	Medium term

Action Area 6: CROSS-CUTTING ISSUES

A range of cross-cutting issues apply to some or all of the biosecurity continuum. These actions come from four issues of retention of skills; governance; research, development and extension; and communication and engagement. It is important for managers when implementing relevant aspects of this plan to consider which of these cross-cutting issues apply to their situation.

See Table 8 for a summary of the actions under Cross-cutting issues.

Long term retention of core skills in invasive ants

There is a need for mapping and coordinating human and infrastructure resources to ensure successful planning and consistency of resource availability. This is in the following specific areas.

Action 6.1: Maintain, and ideally increase, Australian expertise in invasive ants, including diagnostics

Maintaining a national core invasive ant skill set, and diagnostic capacity, is essential for invasive ant management in Australia. Increasing diagnostic and taxonomy capacity, and succession planning for future myrmecologists is a priority.

There is a recognised need to preserve scientific capability, corporate knowledge and rapid response capacity. Retaining expertise and core skill sets across the different biosecurity disciplines has been an issue in many instances. The retention of capacity has a close relationship with the future governance arrangements outlined under governance. The principal areas relevant to invasive ants that require preservation of scientific capability and/or corporate knowledge are:

- scientific capability
- corporate knowledge
- rapid response capacity
- treatment technology and tools
- industry liaison and collaboration, and
- public awareness and national coordination.

There is a need for better integration of diagnostic knowledge outside government agencies. Core capability and capacity in diagnostics relies on an on-going connectivity between experts both nationally and internationally and fostering partnerships with relevant institutions outside government and industry. Taxonomists able to reliably identify ants at the species level and myrmecologists are in short supply, both nationally and internationally. There is little to no succession planning for a majority of myrmecologists, taxonomists and diagnosticians in universities, museums and government departments and very few students undertaking the necessary qualifications to replace them. Invasive ant diagnostic tools and training programs need to be developed with the view to maintain a long-term core capability in ant diagnostics and taxonomy in Australia to provide services to governments, public and other organisations.

Retention of skilled and qualified staff in eradication programs is difficult owing to lack of certainty of ongoing funding in many cases.

Action 6.2: Support international collaboration and exchange of information relating to invasive ants

Regular exchange of information at the international level will support preparedness for emerging high-risk ants both regionally and beyond.

Information gathering and sharing across agencies and between specialists, both nationally and internationally, is needed internationally as there are so few myrmecologists specialising in invasive ants worldwide. Invasive ant programs would benefit from partnership development with Biosecurity Queensland and any other relevant agencies (national or international), as well as science based organisations.

Collaborative opportunities, amongst others, which could be explored include the following:

- An Australian invasive ant website could be created to share information on priority invasive ants. It could feature information on invasive ants, their eradication, control and management techniques and options, updates on current eradication and control programs, and other relevant material.
- International collaborative websites such as the Pacific Invasive Ant Toolkit, Pacific Invasive Ant Key, and Hungrypests (United States). In the Pacific region, the Pacific Invasive Ant Toolkit is an example of where Australia can collaborate on a regional level. It is a collection of resources to help prevent and control invasive ants in the Pacific. While targeting Pacific nations, many of the invasive ants that are causing problems in the Pacific are the same ants causing problems in Australia.
- Ongoing international partnerships exchanging base-line information on biology, behaviour, ecology of invasive ants and other activities across detection and diagnostics, baiting, control,

management, surveillance tools and programs and community engagement strategies. Examples in Australia include partnerships with the New Zealand and United States governments and organisations in Taiwan.

- In 2016, the IPPC commenced a Pilot Project on Surveillance that is focusing on three example pests with wide-ranging potential impact on agriculture and trade. Pests considered include invasive ants and Australia was determined as the champion for invasive ants. Australia is expected to contribute technical resources, including a factsheet.
- The regular exchange of information would be assisted by an increase in the number of peer-reviewed publications available on high-risk pest programs across the world. It has been identified that this is mostly due to a lack of funding and time for scientific staff involved in responses to collect information and data to publish in peer-reviewed journals. Often, interactions and linkages with research institutions where such publications are a necessity only occur during specific parts of the programs (e.g. development of models, some evaluation of eradication successes, etc.).

Action 6.3: Deliver training on the control of specific invasive ants

Invasive ant control training programs will support maintaining a long-term core capability in effective invasive ant control programs in Australia.

Groups seeking to undertake containment or control programs for invasive ants need to receive specific training related to the invasive ant species they are targeting. The control method required of each particular invasive ant species will be different due to species and environmental differences. There is also a need for skilled people to deliver the training.

Governance

As national biosecurity arrangements have been developed over time, national eradication programs for invasive ants have had a variety of governance arrangements. These actions seek to establish consistency in governance for invasive ants and incursion responses in particular.

Action 6.4: Establish an invasive ant reference group

An invasive ant reference group should be established comprising Australia's leading ant specialists, regulators and international experts who may be called upon periodically for advice and guidance on invasive ants.

From within this broader reference group, individuals with particular expertise may also be called upon to participate in specific technical working groups or advisory panels. Although technical advice on invasive ants being considered for an eradication response is the role of the National Biosecurity Management Consultative Committee (under NEBRA), this advice could be informed by the technical and scientific expertise residing in the invasive ant reference group.

A reference group may be an appropriate forum to support international collaboration and exchange of experts related to the invasive ants, especially in the Pacific. This may take the form of researchers and program managers sharing knowledge, through documents, funding, sabbaticals, conferences and other means.

Informal networks of experts are also important, including the international collaborative websites such as the Pacific Invasive Ant Toolkit, Pacific Invasive Ant key, AntWeb, and Hungrypests (US).

The invasive ant reference group could provide review of standardised response procedures and a technical review of eradication and surveillance designs on a regular basis. This review process could include consideration of:

- ant specific interception data from border activities
- national border surveillance data for ant activities
- capture state and territory ant surveillance data
- community data
- offshore response/management experiences
- updates to general invasive ants' communication information.

Action 6.5: Establish a permanent national body to coordinate national actions on invasive ants

A permanent national body would assist to preserve the accrued knowledge, scientific skills and expertise for transfer to other programs.

A permanent national body could be achieved in a number of ways, including through the existing national committee arrangements or a new governance body could be established. Either option would greatly improve Australia's capacity to respond to any new invasive ant threats.

The most efficient option would be utilisation of the existing Environment and Invasives Committee (overseen by the National Biosecurity Committee) to coordinate national action. This committee could also be responsible for progressing work to implement the plan and engaging with the reference group on technical matters.

Action 6.6: Develop future funding alternatives

Invasive ant management covers a broad range of risk creators and beneficiaries who could contribute to the cost of risk reduction.

As biosecurity risk increases with increasing and changing trade patterns and passenger movements, the resources required to protect Australia from biosecurity risk including invasive ants must also increase. New sources of investment will need to be identified and better use made of emerging technologies and available information on potential risks. Biosecurity is a shared responsibility between governments at all levels, business, industries, trading partners and the community. Additional funding for biosecurity could involve passenger or consignment levies to fund cross-sectoral biosecurity research and innovation, but potentially also other specific components of the national biosecurity system. The New Zealand government has already implemented an additional border clearance levy for air and sea passengers that is directed towards recovering biosecurity and border protection costs. Invasive ants would appear to be well suited to the application of such funding reforms and initiatives.

Research, development and extension

The action areas of prevention, detection and response for exotic invasive ants include some recommendations that are directly relevant to research, development and extension.

Action 6.7: Improve the modelling tools for spread, habitat and disturbance modelling of invasive ants

Modelling tools are essential for an effective management program for invasive ants.

A range of modelling tools have been developed and applied both in Australia and overseas including spread modelling, habitat modelling and disturbance modelling. There is evidence in published literature that invasive ants can compete with native species or other established invasive ants, none

of which is reflected in the current models. A core capability for modelling should be secured so that the expertise can be transferred to any new invasive ant incursion and/or spread and refined to reflect known interactions between ant species overseas.

Action 6.8: Research into other control and monitoring technologies and enhancing available technology

New technologies should be adapted to use with control or monitoring programs for invasive ants.

Remote sensing and bait delivery tools such as drones, electronic or biosensor detectors, are rapidly evolving and their potential uses in the control and monitoring of invasive ants should be investigated and exploited.

Action 6.9: Continue research into new attractants for monitoring and more effective bait delivery for invasive ants

Improvements to management tools may improve bait delivery in all conditions.

Dietary preferences for the priority invasive ants are broadly known, and attractants and bait types suitable for the species are also known. However, there are situations where the attractants or baits are ineffective and new tools or innovative methods of deployment are necessary.

Communication and engagement

Action 6.10: Develop and implement a communication and engagement strategy

There is a need for the development of a communication and engagement strategy for invasive ants.

Consideration of the best approach to follow for community engagement is guided by the extensive work already established in national eradication and other localised control programs.

Community engagement initiatives have been highly successful for red imported fire ant. For red imported fire ant, 70 per cent of new detections come from reports by the public. Fourteen years after the first ant detection, the fact that 95 per cent of people in Brisbane are aware of red imported fire ant is a testimony to the effectiveness of this program's engagement strategies, as is the strong in-kind support generated by a large number of stakeholders (e.g. councils). In recent years, communication strategies have been essential in assisting to delimit the red imported fire ant infestation through the 'Beyond the Edge' campaign, which actively engaged stakeholders on the edge of the infestation. Core community engagement learnings and activities from the red imported fire ant program should be transferred to other invasive ant programs as appropriate.

An important part of engaging with the community is to provide information about how the invasive ants may affect them directly as well as the impacts on the environment nearby or in which they live. Invasive ants can impact on social and cultural values and norms, and there are possible impacts on human health, predominantly from bites or stings. Further, this needs to be linked to an effective reporting system to link members of the public with diagnosticians, to either inform a national eradication program or a local control program.

However, to further refine community engagement, there is an urgent need to understand the role that general and specific surveillance plays within a successful eradication campaign. Investment needs to analyse the baseline level of reporting and measure the increased activity in a response that can be attributed to engagement programs, and to interpret this increased activity in terms of positive eradication and containment outcomes.

The strategy should also include ways for increasing transparency and communication with a range of stakeholders including non-government organisations, other Commonwealth agencies, state and territory government agencies, local councils and research organisations, as well as the community.

Action 6.11: Build awareness and develop relationships with industries in the high-risk transport and goods import sectors

Strengthening relationships with high-risk sectors may reduce propagule pressure of new invasive ants at the Australian border.

There is a recognised need for the development and implementation of a national communication and engagement strategy to build awareness and strengthen the partnership with high-risk transport and commodity import sectors to prevent the entry of invasive ants. Training packages developed for front-line Department of Agriculture and Water Resources officers should also be used to train personnel in the cargo and import sector as well as the mining industry. Other risk creators in the private sectors could be trained as needed. Other government agencies such as the Department of Defence could also benefit from such training for the movement of their equipment both internationally and locally.

There is also a need to strengthen partnerships with 'risk' industries more broadly to encourage them to report any suspect ants (i.e. detected within Australia). Training packages developed for the National Red Imported Fire Ant Eradication Program and National Electric Ant Eradication Program industry stakeholders can inform any new packages developed.

Table 8: Summary table of Action Area 6: CROSS-CUTTING ISSUES

Action Area 6: CROSS-CUTTING ISSUES		PRIORITY	TIMEFRAME
Retaining core skills			
Action 6.1	Maintain, and ideally increase, Australian expertise in invasive ants, including diagnostics	Medium	Long term, ongoing
Action 6.2	Support international collaboration and exchange of information relating to invasive ants	Medium	Long term, ongoing
Action 6.3	Deliver training on the control of specific invasive ants	Medium	Medium term, ongoing
Governance			
Action 6.4	Establish an invasive ant reference group	High	Short term
Action 6.5	Establish a permanent national body to coordinate national actions on invasive ants	High	Short term
Action 6.6	Develop future funding alternatives	Medium	Medium term
Research			
Action 6.7	Improve the modelling tools for spread, habitat and disturbance modelling of invasive ants	Medium	Medium term
Action 6.8	Research into other control and monitoring technologies and enhancing available technology	High	Short term, ongoing
Action 6.9	Continue research into new attractants for monitoring and more effective bait delivery for invasive ants	High	Short term, ongoing

Communication and community engagement			
Action 6.10	Develop and implement a communication and engagement strategy	High	Medium term
Action 6.11	Build awareness and develop relationships with industries in the high-risk transport and goods import sectors	High	Short term

5. Implementation

The success of this national biosecurity plan will depend on a high level of cooperation between all levels of government, landholders, non-government organisations, community groups, invasive ant experts and other research agencies. Success will depend on all participants in this area of the biosecurity system assessing their roles and responsibilities around invasive ants and allocating adequate resources to achieve the necessary outcomes to protect Australia's environment, primary industries, urban infrastructure and way of life.

The Environment and Invasives Committee, a subcommittee of the inter-governmental National Biosecurity Committee, will provide formal oversight of the implementation of the plan.

6. Monitoring, evaluation and review

The Environment and Invasives Committee will undertake an annual review of progress on implementation of the plan and will report to the National Biosecurity Committee.

A formal review and evaluation of the plan will occur within five years of its release.

7. References

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8. Acronyms and abbreviations

APVMA	Australian Pesticides and Veterinary Medicines Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWR	Department of Agriculture & Water Resources
IGAB	Intergovernmental Agreement on Biosecurity
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
NBC	National Biosecurity Committee
NBS	National Border Surveillance
NEBRA	National Environmental Biosecurity Response Agreement
PaDIL	Pest and Disease Image Library
PRA	Pest Risk Analysis
RD&E	Research, Development and Extension

9. Definitions/Glossary

Ant luring	Placing a container or similar in the environment with a food or scent to attract ants.
Approach rate	A measure of the numbers of a species that reach the Australian border.
Approved Arrangement	Voluntary arrangements entered into with the Department of Agriculture and Water Resources in accordance with the <i>Biosecurity Act 2015</i> that allow operators to manage biosecurity risks and/or perform the documentary assessment of goods in accordance with departmental requirements, using their own premises, facilities, equipment and people, and without constant supervision by the department and with occasional compliance monitoring or auditing.
Biological control	The control of a species by introducing a natural predator or pathogen.
Biosecurity activity	An activity that mitigates the risks and impacts to the economy, the environment, social amenity or human health associated with pests and diseases.
Biosecurity continuum	An integrated approach to prevent, detect, contain, eradicate and/or lessen the impact of a pest or disease through complementary biosecurity activities undertaken offshore (in other countries), at the border and onshore (within Australia).
Biosecurity risk	The likelihood of a disease or pest entering Australian territory or a part of Australian territory; or establishing itself or spreading in Australian territory or a part of Australian territory; and the potential for any of the following: the disease or pest to cause harm to human, animal or plant health; the disease or pest to cause harm to the environment; economic consequences associated with the entry, establishment or spread of the disease or pest.
Breakbulk (of cargo)	A system of transporting cargo as separate pieces rather than in containers.
Containment	Restricting an invasive ant to a defined area without the goal of eradication.

Conveyance	A means of transport such as an aircraft, vessel, vehicle, or train.
Delimitation	Determining the extent of the species spread on the ground through surveillance
Detection	Finding an invasive ant.
Diagnostician	A person whose job it is to identify species.
Ecological community	An assemblage of native species that inhabit a particular area in nature.
Entomologist	A person who studies insects.
Eradication	Eliminating a pest or disease from an area. Eradication is indicated by the pest or disease no longer being detectable.
Established	A pest or disease that, for the foreseeable future, is perpetuated within any area and which it is deemed not feasible (either technically or as a result of a benefit:cost analysis) to eradicate
Exotic	A species that is not native.
Goods	A raw material or primary agricultural product that can be bought and sold.
Key threatening process	A threatening process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community.
Monogyne	An ant colony that has only a single queen.
Myrmecologist	A person who studies ants.
Native	A species, subspecies, or lower taxon, occurring within its natural range (past or present) and dispersal potential (i.e. within the range it occupies naturally or could occupy without direct or indirect introduction or care by humans).
Pathway	The way that an invasive ant may reach the border.
Phytosanitary	Relating to the health of plants, especially with respect to the requirements of international trade.
Polygyne	An ant colony that has multiple queens. Polygynous species may form super colonies.
Prevention	Stopping an invasive ant from approaching the border.
Proof of freedom	Where surveillance activities carried out by the parties in accordance with the approved national biosecurity incident response plan indicate that the pest or disease has been eradicated.
Remote sensing target	A possible site for investigation identified from remote sensing. For example, a site that thermal imaging suggests may be a nest.
Response	The management actions undertaken when an invasive ant is detected. The response may be formalised through a national agreement or response plan.
Sentinel site	A site of continuous surveillance.
Super colony	A colony of ants that has multiple queens and workers display no aggression to workers from other nests.
Surveillance	The systematic investigation, over time, of a population or area to collect data and information about the presence, incidence, prevalence or geographical extent of a pest or disease. Surveillance includes active and passive approaches.
Threat abatement plan	A plan, under the EPBC Act, that addresses a key threatening process.

Taxonomist

A biologist that groups organisms into categories and can identify invasive ants.