Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Review of the Threat Abatement Plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories 2006–2011

1. Executive summary

Tramp ants are a diverse group of about 35-40 ant species which have established widely across the globe. They easily get transported and establish outside their native range. They can arrive on Australia's doorstep through many transport pathways, and once here can affect ecosystems, social and cultural values, and human health. At least six tramp ant species are considered to be of national priority because of their impact or potential impact on biodiversity. Management activities to minimise their damage include preventing entry, monitoring high-risk areas, removing new invaders, and managing areas with established tramp ants. Estimates of the costs to Australia from the red imported fire ant are $1.5 billion annually (Antony et al., 2009) and $79 million annually for electric ant (Antony, 2006) if left uncontrolled.[1]

Red imported fire ants were listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2003. A key threatening process was also listed for yellow crazy ant on Christmas Island in 2005. A threat abatement plan was developed to address the red imported fire ant (*Solenopsis invicta*) key threatening process and to include five other high priority tramp ant species (tropical fire ant (*S. geminata*), little fire ant/electric ant (*Wasmannia auropunctata*), African big-headed ant (*Pheidole megacephala*), yellow crazy ant (*Anoplolepis gracilipes*) and Argentine ant (*Linepithema humile*). The Australian Government released the *Threat abatement plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories* (referred hereafter as the tramp ant plan) in 2006. Its goal is to minimise the impact of invasive tramp ants on biodiversity in Australia and its territories, by protecting threatened native species and ecological communities, and preventing further species and ecological communities from becoming threatened under the EPBC Act. It is a requirement of the EPBC Act that threat abatement plans be reviewed at intervals of not longer than five years.

The Australian Government has implemented the tramp ant plan as it applied to Commonwealth areas, and sought cooperation of the state and territory governments and other stakeholders to implement the tramp ant plan as it applied to them. The Australian Government has supported key national level actions in the tramp ant plan, usually in partnership with other stakeholders. Key national actions included coordination and funding for nationally cost shared eradication programs for red imported fire ants and electric ants. Research was carried out into detection; eradication; management tools; and ecological impacts to improve understanding around better combating the entry and potential spread of tramp ants. Other actions include pre-border and border quarantine

[1] Estimates for other tramp ants (yellow crazy ant, tropical fire ant, African big headed ant and Argentine ant) have not been undertaken.

inspections of cargo and high-risk items; import entry requirements or exclusions on specific commodities; and the training of quarantine personnel.

As part of the national red imported fire ant and electric ant eradication programs a wide range of research has been undertaken by Biosecurity Queensland in partnership with research institutions. The research has contributed to an improved understanding of the biology of these ants, where they came from, how they spread, how best to find them and how to eradicate them. The main research activities have been on biology, genetics, on-ground surveillance, remote sensing, bait efficacy and modelling. The CSIRO also has undertaken a range of research including ways to improve the likelihood of ant eradication, better approaches to management, and the ecological impacts of tramp ants.

In reviewing the tramp ant plan it is considered the six objectives of the tramp ant threat abatement plan have been met to varying degrees. The first four objectives focus on the scientific knowledge and biosecurity response capacity around border protection, risk assessment, preparedness and emergency response. Good advances in science and improved biosecurity arrangements have been made with the two nationally cost shared programs on red imported fire ants and electric ants. A better understanding of yellow crazy ant, tropical fire ant and African big headed ant especially around northern Australia has developed from efforts by the CSIRO, while over the last five years the Argentine ant has received minimal attention.

In terms of objectives five and six on stewardship and coordination, the red imported fire ant and electric ant programs have done well in developing community awareness and engagement. This is much less the case with the other four tramp ants, with the exception of some small community projects. Government coordination has worked well for the two cost shared eradication programs with a national committee operating, but it is limited to these two tramp ants. Action on a wider set of priority ants would benefit from coordination through some level of government collaboration.

The two goals of the tramp ant threat abatement plan (to minimise the impact of invasive tramp ants on biodiversity in Australia and its territories by protecting threatened native species and ecological communities; and to prevent further species and ecological communities from becoming threatened) have been met for red imported fire ant and electric ant where their spread has been significantly reduced as a result of action from national eradication programs. However it needs to be noted that they are not yet eradicated so still pose a threat. For yellow crazy ants active attention has occurred in places where localised eradication was considered feasible with the threat reduced in these areas, but the threat remains in other locations where there are unmanaged infestations. For the other three tramp ants (tropical fire, African big headed and Argentine ants) while there are some examples of containment at specific locations, they are otherwise found at isolated sites across Australia and continue to have a growing impact on biodiversity.

It is concluded that since 2006 reasonable progress has been made against the goals, objectives and a number of the actions in the tramp ant plan. The potential for impact on

biodiversity has reduced for red imported fire ant, electric ant and to a certain extent for yellow crazy ants. However, in comparison the remaining three tramp ants - tropical fire, African big headed and Argentine ants - have had little attention with only a small amount of action targeting specific sites. Isolated sites remain in a large number of locations present across Australia.

Continued efforts are required by the Australian Government in partnership with state and territory governments, research organisations and other stakeholders to make further progress against the goals, objectives and actions of the tramp ant plan.

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2. Purpose of review

Section 279 (2) of the EPBC Act requires a threat abatement plan to be reviewed by the Minister at intervals of not longer than five years. The *Threat Abatement Plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories* (tramp ant plan) was made in 2006 and the review completed in 2012. The purpose of the review is to assess the progress and effectiveness of the tramp ant plan in reducing the impact of tramp ants on biodiversity by protecting nationally listed threatened species and communities, or preventing further species and ecological communities from becoming threatened, through the research, management and other actions identified in the tramp ant plan. The review provides a sense of the successes and failures of the tramp ant plan in guiding and facilitating actions on the eradication or control of tramp ants and reducing the effects of their impact. It also considers options for future actions to build on the successes of the tramp ant plan.

This review provides a snapshot of the current efforts in tramp ant management across Australia in comparison to five years ago. It takes account of threat abatement actions funded by the Australian Government as well as work by the state and territory governments, research institutions, natural resource management groups and other local organisations. The review considers how this national effort has helped to address the objectives and the goals of the tramp ant plan.

2.1 Approach

The review of the tramp ant plan makes an assessment against the goals, objectives and actions in the plan. The review is laid out in a series of sections to guide the analysis of achievements against the objectives.

Section three provides background to the development of the tramp ant plan, goals, objectives, statutory requirements, implementation, and impacts of tramp ant species.

Section four takes each objective and associated actions to provide a snapshot of progress against each action and objective, and provides an assessment of the degree to which actions have contributed towards changes in the threat from tramp ants. Tables in section four provide brief details of achievements against each specific action. Wherever possible published work is listed and referenced, and websites noted in the tables. At the end of each table is an assessment of the contribution of the achievements to the specific threat abatement objective.

Section five provides some specific information about the funding and implementation of the tramp ant plan over the five years, and section six provides findings based on the conclusions against each specific objective.

3. Background

In April 2003, the Minister for the Environment and Heritage approved the listing of 'the reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant)' as a key threatening process and approved the development of a threat abatement plan to address the key threatening process. In April 2005, the Minister approved the listing of '*Loss of biodiversity and ecosystem integrity following invasion by the yellow crazy ant (Anoplolepis gracilipes) on Christmas Island, Indian Ocean*' as a key threatening process. The Minister decided that a threat abatement plan would not be prepared specifically for the yellow crazy ant on Christmas Island because threat abatement actions already underway were sufficient to address the key threatening process.

In 2006, the Minister made the *Threat Abatement Plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories.* The plan identified the red imported fire ant (*Solenopsis invicta*) and five other national priority tramp ant species as an initial, but flexible, list on which to focus attention. Mitigation activities and processes for the control of tramp ant species tend to be consistent. Therefore it was considered appropriate to develop a threat abatement plan to encompass tramp ant species that are relevant to Australia and which have the potential to impact on Australia's biodiversity. The additional tramp ants were recognised as being an emerging threat elsewhere in Australia and comprise the little fire ant/electric ant (*Wasmannia auropunctata*), yellow crazy ant (*Anoplolepis gracilipes*), tropical fire ant (*Solenopsis geminata*), African big-headed ant (*Pheidole megacephala*), and Argentine ant (*Linepithema humile*).

3.1 Purpose of the threat abatement plan

The tramp ant plan provides a coordinated national approach to management, research, and education that increases awareness, mitigates entry and spread, provides early detection and diagnosis, and provides rapid response to both incursions and established populations of tramp ants.

The purpose of the tramp ant plan is to define actions to mitigate the impact of tramp ants on affected native species and ecological communities. However, because almost all tramp ants have a range of impacts including on plant and animal health, social and cultural values, and human health, it is difficult to separate actions (especially at early stages in the invasion process) that mitigate their impacts on biodiversity from those that affect various primary industries and social values. Therefore while the plan has focussed on actions to reduce the impacts of tramp ants on native biodiversity and ecological communities, many, if not all, of these actions are also likely to mitigate impacts on other sectors that are affected by tramp ants.

The tramp ant plan has two broad goals:

1. to minimise the impact of invasive tramp ants on biodiversity in Australia and its territories by protecting threatened native species and ecological communities; and
2. to prevent further species and ecological communities from becoming threatened.

The six main objectives, with supporting actions at all stages of the invasion sequence are:

1. Increase science-based knowledge and expertise, incorporate Indigenous traditional ecological knowledge, quantify impacts, and improve access to information for priority tramp ant species;
2. Prevent entry and spread of tramp ants by increasing diagnostic capacity, offshore surveillance, inspection, treatment, and national and state and territory surveillance;
3. Prepare for rapid response to tramp ant incursions and spread through risk assessment of tramp ant species and pathways of introduction, and development of contingency plans;
4. Enhance emergency response to tramp ant incursions by improving reporting and response rates, and by developing tools for response and follow-up;
5. Build stewardship by engaging, educating, and informing the Australian community about the impacts of invasive tramp ants and effective means of response; and
6. Coordinate Australian Government, state and territory government, and local management activities in Australia and the region.

3.2 Statutory requirements of a threat abatement plan

The EPBC Act section 271, lays out the requirements for a threat abatement plan. These are:

(1) 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.

(2) In particular, a threat abatement plan must:
   (a) state the objectives to be achieved; and
   (b) state criteria against which achievement of the objectives is to be measured; and
   (c) specify the actions needed to achieve the objectives; and
   (d) meet prescribed criteria (if any) and contain provisions of a prescribed kind (if any).

(3) In making a threat abatement plan, regard must be had to:
   (a) the objects of this Act; and
   (b) the most efficient and effective use of the resources that are allocated for the conservation of species and ecological communities; and
   (c) minimising any significant adverse social and economic impacts consistently with the principles of ecologically sustainable development; and

(d) meeting Australia's obligations under international agreements between Australia and one or more countries relevant to the species or ecological community threatened by the key threatening process that is the subject of the plan; and

(e) the role and interests of Indigenous people in the conservation of Australia's biodiversity.

(4) A threat abatement plan may:

(a) state the estimated duration and cost of the threat abatement process; and

(b) identify organisations or persons who will be involved in evaluating the performance of the threat abatement plan; and

(c) specify any major ecological matters (other than the species or communities threatened by the key threatening process that is the subject of the plan) that will be affected by the plan's implementation.

(5) Subsection (4) does not limit the matters that a threat abatement plan may include.

3.3 Pest management responsibility

As noted, the tramp ant plan sets out a national framework with supporting actions at all stages of the invasion sequence to prevent, mitigate and abate the impacts of tramp ants on biodiversity in Australia and its territories. The Australian Government takes a lead role in pre-border and border actions under the *Quarantine Act 1908* to prevent the entry of tramp ants through import restrictions and inspections of goods entering Australia. The Australian Government is responsible for the control of tramp ants on Commonwealth land including defence land and Commonwealth national parks. State and territory governments undertake action for tramp ants where they are a notifiable pest under their state/territory legislation. In Queensland this legislation may require reporting and pest management to be undertaken by landowners on their properties and may impose movement restrictions for material considered to be high risk. Institutional arrangements that help coordinate national efforts to control tramp ants are at section 4.2

3.4 Implementation of the tramp ant plan

Implementation of the tramp ant plan has been undertaken by a range of stakeholders. Under the EPBC Act, the Australian Government has taken the lead in implementing the tramp ant plan as it applies to Commonwealth areas, and has sought cooperation of the state and territory governments and other stakeholders to implement the tramp ant plan as it applies to them. The Australian Government has supported a national threat abatement effort by implementing key national level actions in the tramp ant plan, usually in partnership with other stakeholders. State and territory governments have played a key role at their jurisdictional level, addressing a range of elements from first emergency response to ongoing control of tramp ants. The research community has contributed by building scientific understanding and developing applied technology.

3.5 Tramp ant impacts

The full extent of potential impacts of all tramp ants in Australia is unknown. While there are no overall estimates of the widespread cost of tramp ants if they were all to become established, the red imported fire ant alone could cost Australia around $1.5 billion annually if left uncontrolled (Antony et al., 2009). Another study on electric ants estimated that there would be an annual benefit of $79 million per year in eradicating this ant (Antony, 2006). The high cost attributed to red imported fire ants equates to a much larger area modelled to be affected as compared to electric ants. While costs for other tramp ants are not available, the above two estimates indicate that there is significant economic justification for undertaking eradication or control programs if eradication is not feasible.

Tramp ants can reduce species diversity, modify habitat structure and alter ecosystem processes. They can replace native small predators, and some can repel larger predators. Insect-feeding mammals, birds, reptiles and frogs may decline as they have little to eat, are stung or eaten. Tramp ants can displace native ants and eat the eggs and larvae of species such as butterflies. They can disrupt invertebrate food webs and affect plant pollination and seed dispersal. They can damage plants by eating fruit and seeds, tunnelling into stems and removing bark from seedlings, and can increase weed invasion.

While the tramp ant plan lists threatened species that may be affected by the red imported fire ant or the yellow crazy ant (on Christmas Island) the only EPBC Act Recovery Plans that mention tramp ants are the recovery plans for species on Christmas Island. At this point in time the red imported fire ant is not directly threatening any species because the ant is still contained within south-east Queensland, and therefore does not need to be included in any recovery plans. Over time, other tramp ants may be identified in recovery plans if it is determined that they are causing a significant impact on a particular threatened species.

Tramp ants can also affect industries, households and human health. Agricultural impacts include damage to crops and equipment, and increases in crop pests and diseases. They sting people, stock and pets and induce anaphylactic shock in some people. Tramp ants infest furniture, food and electrical equipment, and chew on wiring. They can render parks and gardens unusable.

The following sections provide general information about the impacts of the six priority ants in the tramp ant threat abatement plan.

3.5.1 Red imported fire ant (*Solenopsis invicta*)

Red imported fire ants (also known as fire ants) are an aggressive generalist forager that occur in high densities and can thus dominate most potential food sources. They breed and spread rapidly and, if disturbed, can relocate quickly so as to ensure survival of the colony. Their stinging ability allows them to subdue prey and repel even larger

vertebrate competitors from resources. They reduce biodiversity among invertebrates and reptiles, and may also kill or injure frogs, lizards or small mammals. In particular the red imported fire ant has the potential to devastate native ant populations (McGlynn, 1999). They are also competitively dominant to most other invasive ant species.

Red imported fire ants may impact social and economic activities at all levels. They can sting people and may cause an allergic reaction. Public areas such as parks and recreational areas may become unsafe for children. They can infest electrical equipment and become a nuisance, or even a danger, to people. Agricultural impacts may include damage to crops, interference with equipment and the stinging of workers in the field.

3.5.2 Yellow crazy ant (*Anoplolepis gracilipes*)

Yellow crazy ants (also known as crazy ants) have invaded native ecosystems and caused environmental damage in many places around the world. They prey on, or interfere in the reproduction, of a variety of arthropods, reptiles, birds and mammals. High densities of the yellow crazy ant have the potential to devastate native 'keystone' species, resulting in a rapid alteration of ecosystem processes and negative effects on endemic species.

The yellow crazy ant has reduced native bird, reptile and mammal life. The excellent competitive ability of the ant is thought to be due to the ant's high foraging intensity and its greater foraging ability (O'Dowd et al., 1999). The ant threatens many endemic and endangered species, especially on islands, and may undermine potential or actual tourism investments.

The yellow crazy ant has the potential to impart significant damage, or alternatively provide advantage to agricultural systems and plant species, depending on variables such as the crop, the geographical region and the types of pest and/or beneficial insects present. Particularly in rural areas, the ant can become a severe household and field nuisance. When disturbed it sprays formic acid, a chemical that can cause burns and irritation when it comes in contact with the skin or the eyes.

The severity of environmental impacts is illustrated by yellow crazy ants on Christmas Island. Their direct mutualism with scale insects and the killing and displacement of red land crab has produced a rapid state transformation in the forest ecosystem structure and composition on Christmas Island. Yellow crazy ants get much of their food requirements from scale insects which are a serious plant pest that feed on the sap of trees and release a honeydew substance. Yellow crazy ants eat honeydew, and in return protect the scale from their enemies and spread them among trees. The honeydew not eaten by yellow crazy ants drips onto trees and encourages the growth of sooty mould over leaves and stems and reduces the health and vigour of plants, leading to a decline in forest canopy cover. Because of the abundant food source yellow crazy ants massively increase in numbers. Supercolonies of yellow crazy ants kill significant number of red land crabs (estimates of up to 15-20 million), affecting seedling recruitment, weed spread and leaf litter breakdown and leading to changes in rainforest structure, including understorey and litter characteristics.

3.5.3 Electric ant (*Wasmannia auropunctata*)

Electric ants (also known as the little fire ant) are blamed for reducing species diversity, reducing overall abundance of flying and tree-dwelling insects, and eliminating arachnid populations. They are considered to be perhaps the greatest ant species threat in the Pacific region (GISD, 2009). The principle effects of electric ants are on the environment and people. Electric ants are generalist feeders and forage 24 hours a day in most weather conditions. They cause declines in the numbers of invertebrates and small vertebrates through predation, competition for food and habitat and use of repellent pheromones. They compete with other ant species within affected areas, particularly if infestation levels are heavy and disrupt ecosystems processes through altering litter decomposition and nutrient cycling in the soil by suppressing soil microbes.

In human habitations electric ants may sting and even blind domestic pets (such as cats and dogs). Their sting is very painful. Foraging trails may enter houses. In agricultural and residential areas, electric ants may be a great nuisance to humans by reaching high densities and stinging people working in the field as well as in and around their homes.

3.5.4 Tropical fire ant (*Solenopsis geminata*)

Tropical fire ants (also known as ginger ants) have spread almost world-wide by human commerce and trade. They usually invade open areas but can easily colonise human infrastructure and agricultural systems, such as coffee and sugarcane plantations in hot climates. Their greatest known threats are their painful sting and the economic losses due to crop damage caused by its tending of honeydew-producing insects on the crops.

Tropical fire ants present a serious threat to biodiversity through reducing the number of species where they invade native communities. There is evidence that they reduce populations of native butterfly eggs and larvae on Guam (Nafus, 1993). They have the potential to displace native ant populations, but are susceptible to competitive pressures from some other ant species (McGlynn, 1999). They may have negative effects on some plant life, for example excluding ants that disperse the seeds of the tropical understorey herb *Calathea ovandensis* (a plant native to Mexico) and defending the plant from herbivorous arthropods (Ness and Bronstein, 2004) allowing it to become a major weed.

Because tropical fire ants tend honeydew-producing insects they may instigate population explosions of insects such as mealy bugs or other crop pests. This also results in an increase in the incidence of plant disease transmitted by such pests. For example, in northern monsoonal Australia they are now a major domestic and agricultural pest. Tropical fire ants are known to chew through plastic tubing, and because of this they may cause serious damage to irrigation systems.

Tropical fire ants are notorious for their stinging behaviour. They respond rapidly and aggressively to any disturbance of the colony or to a food source. They can sting repeatedly and will continue to do so even after their venom sac has been depleted.

3.5.5 African big headed ant (*Pheidole megacephala*)

African big headed ants are one of the world's worst invasive ant species (GISD, 2011). Believed to be native to southern Africa, they are now found throughout much of the temperate and tropical zones of the world. They are a serious threat to biodiversity through the displacement of native invertebrate fauna and are a pest of agriculture as they harvest seeds and harbour plant eating insects that reduce crop productivity. They are also known to chew on irrigation and telephone cabling as well as electrical wires.

African big headed ants displace most native invertebrates directly through aggression, and as such are a serious threat to biodiversity. Evidence exists of reductions in vertebrate populations where these ants are extremely abundant. They affect plants and horticultural crops directly through seed harvesting, and indirectly through causing outbreaks of sap sucking insects which harm plants. They are known to assist the establishment of introduced plant species via moving seeds.

3.5.6 Argentine ant (*Linepithema humile*)

Argentine ants invade sub-tropical and temperate regions and are established on six continents. New populations show increased co-operation between workers of un-related nests that allows the formation of fast-growing, high-density colonies. This places great pressure on the invaded native ecosystem. While Argentine ants are associated with disturbed habitats throughout their introduced range, they can penetrate native habitats that have experienced little human disturbance. They are a dominant ant and an aggressive competitor. Native arthropods can be greatly harmed and threatened by them as they disrupt or take over functions within ecosystems such as pollination and other plant-insect interactions.

4. Assessment of actions undertaken against objectives

The following chapter addresses progress made with controlling tramp ants and is divided into three sub-sections. Firstly, there is a summary of progress with tramp ant control at the species level, with a focus on red imported fire ants and yellow crazy ants, the subjects of the two key threatening processes. Secondly, a summary of progress is provided from a geographical, institutional and research perspective covering tramp ants in general. Thirdly, there is a summary of achievements against specific actions from the tramp ant plan.

4.1 Introduction to Actions (species focus)

4.1.1 Red imported fire ant

These ants have received the largest investment of all the tramp ant control activities in Australia with $257 million invested over the eleven years since its first detection in 2001 up to 2012.[2] The program is currently classified as an aggressive containment program with the view to eradication. Amongst all the tramp ant eradication and control activities occurring nationally, it is the most advanced addressing a wide range of activities across the actions identified in the tramp ant plan. This includes areas of science-based knowledge, ant spread, emergency response, community engagement and government coordination. The program has developed a wealth of knowledge and operational know-how in areas that include dispersal and new colony establishment, detection, nesting and foraging behaviour, response to disturbance and treatment, and efficacy of chemical pesticides.

Genetic research that identifies distinct population groupings of the ants is showing a decrease in genetic variation, as would be expected where there is a reduced level of mixing between ants via natural mating, migration and human assisted transport, and points to the aggressive containment program being effective. Also, newly developed infra-red surveillance technology with the capacity to detect all ant mounds will enable the program to know within three years whether the extent of the infestation has been defined.

Despite this progress, red imported fire ants and their interaction with the environment constitutes a biological system (as is the case with other tramp ants) and an eradication program faces challenges including: changing environmental conditions that require adjustments to control methods; variations in flight distances requiring changes to surveillance regimes; and observing and incorporating unexpected new detections into the program. Overall, the program has made significant inroads to control red imported fire ants, reducing their spread and density substantially, however even with this positive

[2] Red imported fire ants and electric ants are nationally cost shared emergency response programs supported by all Australian governments. The current efforts are addressing the first incursions of these ants in Australia, they are considered to be eradicable from Australia and have been assessed as nationally significant under the National Environmental Biosecurity Response Agreement. The other four significant tramp ants in the threat abatement plan are not considered eradicable from Australia.

position it is still envisaged that a further ten years of effort will be required to achieve eradication.

4.1.2 Yellow crazy ant

These ants are possibly the second most researched tramp ant in Australia after red imported fire ants. Action to control them and subsequent studies have occurred primarily in north east Arnhem Land (Northern Territory), Queensland and Christmas Island (see page 34 for Australian Government expenditure). Research in the Northern Territory and Christmas Island has improved understanding of its ecology such as its reproductive habits and associated spread patterns; and has improved understanding of methods of control such as effective chemical use and application. Infestations at some sites in the Northern Territory have been eradicated, while others are contained and are under active management.

On Christmas Island, broad-scale surveys have helped with effectively targeting the aerial baiting program, research has confirmed that Fipronil is an appropriate chemical control and there is support for continued efforts around biocontrol developmental work. The range of yellow crazy ant activities are well integrated into the Island's land management and planning processes and there is strong scientific support through a Christmas Island Crazy Ant Scientific Advisory Panel. The Island's managers are making a concerted effort to effectively control this highly invasive species.

Despite the good progress with containment, control and eradication in some locations, the ants persist. Efforts to date have reduced the scale of impact to biodiversity in specific locations that would otherwise have not been achieved without this intensive management program.

4.1.3 Electric, tropical fire, African big headed and Argentine ants

These ants are not part of a listed key threatening process under the EPBC Act, as are red imported fire ants and yellow crazy ants on Christmas Island, and apart from electric ants they have not received the same level of attention. Over the last five years this group of ants have been the subject of a varying degree of research to do with management control and their ecology (although work on Argentine ants is minimal). Electric ants, the subject of a national control program (around Cairns, Queensland), are the only ants from this group that are under an active overall control program encompassing the suite of biosecurity actions to mitigate their spread with a view to eradication. The other three species, (tropical fire ant, African big headed ant and Argentine ant) are not, and the risk of their further spread is high without active attention. Further information about what actions have been taken against these ants and how well this has gone is at chapter six.

4.2 Introduction to Actions (geographical, institutional, research)

Geographically, the level of activity to control the spread of the six tramp ants varies across species. Red imported fire ants and electric ants are the subject of active control and have been contained to their areas of infestation around south east Queensland and Cairns respectively. African big headed ants are the most widespread and, along with yellow crazy ants and tropical fire ants, have some control action at a number of locations but are not part of any national control program. Efforts to control Argentine ants have largely been abandoned and this species is widespread in southern Australia.

Institutionally, all states and territories have developed capacity to respond more quickly and efficiently to new biosecurity emergencies (not just to tramp ants). Both New South Wales and Queensland have emergency management units supported by response procedures. Queensland has specific response procedures for tramp ants, while New South Wales' procedures are broader and may be applied in many different biosecurity incidents. South Australia carries out generic emergency response training to maintain skilled staff, while Victoria has an emergency response plan specific to red imported fire ants.

At a national level, new developments and arrangements between governments are contributing to a better understanding of roles, responsibilities and coordination and to more streamlined responses to emergency situations. For instance, the National Environmental Biosecurity Response Agreement (NEBRA) provides clarity around national pest incursions affecting the environment. The Tramp Ant Consultative Committee is an important collaborative group providing advice on the red imported fire ant and the electric ant national eradication programs. It reports to the National Management Group (under the ministerial level *Standing Council on Primary Industries*) that handles incursions under the NEBRA, the Emergency Plant Pest Response Deed and the Emergency Animal Diseases Response Agreement. As the red imported fire ant and the electric ant incursions are considered eradicable from Australia and have nationally significant impacts, their eradication programs have been funded by all Australian governments through a cost sharing agreement under the NEBRA. Similar cost sharing arrangements have not occurred for the other tramp ants.

In terms of research, there is a substantial body of work undertaken on red imported fire ants and, to a lesser degree, for electric ants by Biosecurity Queensland under their respective nationally cost shared eradication programs. The CSIRO has progressed research on yellow crazy ants, tropical fire ants, and African big headed ants in northern Australia over the last ten years or more, with the predominant focus on yellow crazy ants. The above research together with other science based knowledge provides for an improved ability to manage tramp ants in Australia.

4.3 Assessment of actions undertaken against objectives

The tramp ant threat abatement plan contains six objectives, with 72 actions organised into 14 action-groups. The following table reports on actions undertaken according to each of the 14 action-groups. The performance indicators reflect reporting at the 14 action-group level (rather than against 72 individual actions).

Objective 1:
Increase science-based knowledge and expertise, incorporate Indigenous traditional ecological knowledge, quantify impacts, and improve access to information for priority tramp ant species.

Specified actions:
Table 1 shows the actions under objective 1, the predetermined performance indicators, and a list of actions undertaken.

Table 1. Assessment of scientific /Indigenous knowledge, impacts and information management

Action Groups	Performance Indicators	Actions undertaken
1.1 Increase science-based knowledge, innovation, and expertise for management of tramp ants in Australia and its territories	Developments/ advancements in tramp ant: - knowledge - management - establishment, dispersal, reproduction knowledge - invasion success, area susceptibility - distribution models - research training relevant to tramp ant management.	<u>Red imported fire ant and Electric ant</u> - There is a substantial body of research undertaken on red imported fire ants and, to a lesser degree, on electric ants by Biosecurity Queensland. The scale and depth of this research has been assisted by funding from all Australian governments through national cost sharing arrangements under the National Environmental Biosecurity Response Agreement and approved by the Standing Council on Primary Industries. The research has addressed biology, genetics, surveillance, remote sensing, bait efficacy and incursion modelling. The research into the red imported fire ant has contributed to the Queensland Government being a leader in management circles nationally and internationally. The research undertaken on these two ants has substantially increased the science-based knowledge, innovation and expertise for the management of these two species. <u>Yellow crazy ant, tropical fire ant, African big headed ant</u> The CSIRO has spearheaded a volume of research on yellow crazy ants, tropical fire ants, and African big headed ants in northern Australia over the last 10 years or more. The predominant focus has been on the yellow crazy ants. A sizeable amount of this research has been conducted by internationally-recognised researcher Dr Ben Hoffman with work on genetics, physiological and behavioural dynamics, ecological impacts/dynamics, dietary intake, and invasive mechanisms. Good advances have been made with research on effective control of yellow crazy ants on Christmas Island overseen by the Crazy Ant Scientific Advisory Panel and future work is continuing through research collaboration between the Director of National Parks, and Monash and La Trobe universities. While a good proportion of the research and information is published, including material available on the Global Invasive Species Database (www.issg.org) there remains unpublished work, for instance by CSIRO and Biosecurity Queensland that would be useful to be made public.

		In relation to spatial data, all jurisdictions have good mapping of the current distributions of the six species of tramp ants. This provides a sound base for the management of tramp ants. There is also a national map of tramp ant distribution compiling information from state and territory sources on the DSEWPaC website.(http://www.environment.gov.au/biodiversity/invasive/insects/pubs/tramp-ants.pdf). The above research together with other science based knowledge provides for an improved ability to manage tramp ants in Australia. This applies not only to those specific ant species on which research has been undertaken, but to other tramp ants where the research may be transferable (for example remote satellite technology). While acknowledging the extent of research to date, there continues to be further areas that would significantly benefit from attention. Lach and Thomas (2008) reported on current knowledge, provided a synthesis of impacts of introduced ants on native flora and fauna and recommended work to assist the prioritisation of those species with the highest impact for management control. They noted ants impact a range of biodiversity including displacement and interaction with other fauna, flowers, nectar production, seed dispersal and harvesting and that these and other types of interactions merit further careful exploration. They recommended investigating: the consequences of ant invasions in relation to time since invasion; the role of disturbance in the success of invasive ants; and the situation of several species not having been studied at all despite the number of ant species that have been intercepted at Australian ports of entry. While the report was published in 2008 these recommendations remain current.
1.2 Incorporate Indigenous traditional ecological knowledge into tramp ant management	Improved surveillance and management of tramp ants on Indigenous-owned lands and in other areas	Indigenous communities have been engaged in many locations across northern Australia. A good degree of work by the CSIRO with the north east Arnhem Land yellow crazy ant management program was conducted by local Yolngu people through the Dhimurru Aboriginal Corporation. Other programs in the Northern Territory, in the Tiwi Island and the Daly River areas, utilised 'two-ways' management drawing on the experience of both western and Indigenous skills. These programs have contributed to the incorporation of Indigenous traditional ecological knowledge into management programs. The Northern Territory Government engaged with Indigenous communities through its report on the detection and monitoring of invasive ants (DNREAS, 2009) contacting a wide range of Indigenous people at national parks, schools and through public consultation. The Queensland Government also engaged with Indigenous communities to seek information about cultural sites for the eradication programs for red imported fire ant and electric ant. Both of these examples were focussed on community

		engagement rather than incorporating traditional knowledge. As such, they are unlikely to have contributed to significant incorporation of Indigenous traditional ecological knowledge into management programs.
1.3 Assess tramp ant impacts in Australia and its territories	Developments/ advancements in tramp ant: - impact assessments - risk assessments - prioritising management - economic assessment	Lach and Thomas (2008) (mentioned earlier at Action Group 1.1, above) synthesise the current knowledge of the direct and indirect impacts of introduced ants on native flora and fauna of Australia. They note invasions by invasive ants are one of the most significant threats to native biodiversity, natural ecosystems and ecosystem functions worldwide. With the rich and abundant native ant fauna in Australia there exists a wealth of potential interactions that introduced ants may disrupt or usurp. They also note several studies in Australia that identify a decline in native ant species richness due to invasion of exotic ants. While evidence is inconsistent on the impact of invasive ants on other invertebrates, some studies report substantial decreases in native invertebrates. Five of the tramp ant threat abatement plan ant species (red imported fire ants, yellow crazy ants, tropical fire ants, Argentine ants and African big headed ants) are known to prey on butterfly and moth larvae in other regions outside Australia and therefore potentially present risks to Australia. Vertebrates may also be susceptible to introduced ants primarily because of a lack of defences to these intruders. The report by Lach and Thomas (2008) notes the limited research on the impacts of invasive ants in Australia (in particular those of an indirect nature) and recommends a range of further research. Findings of future research (including on the level of impact they cause) may enable prioritisation of tramp ants for management and further justify prevention and control efforts. The report presents a balanced and incisive perspective on the state of play of research on the ecological impacts of invasive ants, running through systematically the range of plant and animal impacts in a comprehensive but overview manner and identifying those gaps and priorities for future research. Lach and Thomas (2008) did not provide detail on the human health and social amenity costs of the invasive ants. Biosecurity Queensland in putting together the eradication programs for the red imported fire ant and the electric ant undertook assessments of the relative impacts of these two species, based on knowledge available at the time. This knowledge has been supplemented by experience during the eradication programs and limited material has been published to date. The work by the CSIRO and Monash University on Christmas Island into the impacts of the yellow crazy ant has identified the environmental impacts on this unique environment. Some of

		these findings will be able to be transferred to other locations. In addition, the environmental impacts from yellow crazy ants are being studied in conjunction with eradication programs in Arnhem Land and Darwin, Northern Territory. In conclusion, there are some studies on the impacts on three of the six tramp ant threat abatement plan species (red imported fire ants, electric ants, yellow crazy ants) although these are by no means exhaustive and further attention is warranted especially in relation to the indirect impacts of these ants. In the case of Argentine, African big-headed and tropical fire ants, human health and social amenity impacts have not been established for Australia, and there are only limited observations in regard to environmental impacts. It is also noted that there are a number of other invasive ants established in Australia that Lach and Thomas (2008) mentions that would also be worthy of a range of similar impact assessments.
1.4 Create a central repository or linked network for knowledge relevant to the management of tramp ants	Developments/ advancements in tramp ant: - data / information clearing-house - data accessibility and consistency - technical expert accessibility	There are several locations where researchers and government agencies have been placing information on tramp ants in addition to publishing in journals. The Global Invasive Species Database contains excellent material on tramp ants (www.issg.org/database/welcome/ k) and the Padil website (www.padil.gov.au/) provides high-quality diagnostic information. Information related to emergency responses is currently more limited but states (for example the Queensland Government) have established biosecurity response databases for their own purposes. The national Tramp Ant Consultative Committee overseeing the red imported fire ant and electric ant eradication programs use 'Govdex' a secure web-based document storage site to assist parties accessing tramp ant information. A national biosecurity surveillance, incident, response and tracing software application (BioSIRT) has been developed for use across Australia to enable better management of information and resources for emergency responses to incursions. This is used by all jurisdictions except Victoria which uses a different but compatible system. BioSIRT may be useful for future responses to tramp ant incursions. It is concluded that while there is not one central repository of information for tramp ants the current arrangements are adequate for users.

Contribution to change of threat (Objective 1)

A reasonable level of tramp ant scientific knowledge has developed since the release of the tramp ant threat abatement plan in 2006 with published material from research institutions and government bodies on the control, biology and ecology of invasive ants. There have been good advances in terms of on-ground control reflecting the demands of the two high priority eradication programs as well as improved ecological and behavioural understanding associated with more sophisticated invasion management beyond the traditional chemical control focus. However, the breadth of research needed to adequately understand and effectively respond to an ant invasion and management

continues to present challenges. Ants clearly are not one homogenous group, and individual attention at the species level stretches limited research capacity. Important areas for attention remain, such as the consequences of ant invasions; the role of disturbance; ant species that as yet have not been adequately researched, including African big headed ants and tropical fire ants; and prioritisation of tramp ants for management.

Efforts to incorporate Indigenous traditional knowledge are occurring in some areas of the Northern Territory, with 'two-ways' management used as a mechanism to stimulate exchange of ideas. Outside of the Northern Territory, engagement with the Indigenous community is more about awareness raising and general public consultation, and in some cases input regarding management of culturally important sites.

Improvements have been made with access to tramp ant information as well as the depth of that information. Several web-based locations are available to researchers and government agencies to place tramp ant information in addition to information available through standard journal articles. The Global Invasive Species Database is an excellent repository for research and other ant material with its international coverage and should continue to be supported by the research community and government agencies so that it remains comprehensive and up to date. Access to information has been improved for governments with the use of 'Govdex' aiding online secure information access in relation to eradication programs.

Objective 2:
Prevent entry and spread of tramp ants by increasing diagnostic capacity, offshore surveillance, inspection, treatment, and national and state and territory surveillance.

Specified actions:
Table 1 shows the actions under objective 2, the predetermined performance indicators, and a list of actions undertaken.

Table 2 Assessment of efforts to prevent entry and spread of tramp ants

Action Groups	Performance Indicators	Actions undertaken
2.1 Improve diagnostic capacity and service	Developments/ advancements in tramp ant: - diagnostic experts - short courses - identification - reporting	There are a range of web-based diagnostic tools available for both invasive and native ants. Diagnostic assistance is available but the number of locations in Australia through which this is available is limited, and there is still a limited number of scientists available in Australia to undertake diagnostic services. The CSIRO in Darwin is developing useful tools and is one of the main sites for science related to invasive ants. The Queensland Government's has developed expertise in red imported fire ants and electric ants to undertake their eradication programs. The South Australian Government is seeking to maintain some capacity for ant identification, however, most state and territory government diagnostic capacity is limited. At the national border, DAFF Biosecurity (that is, the Australian Government

		Department of Agriculture, Fisheries and Forestry) inspectors are trained in relation to priority ant identification. In conclusion, diagnostic keys and on-line tools are available for the priority tramp ant species in the threat abatement plan but there is still limited diagnostic capacity and services available for the tropical fire, African big-headed, yellow crazy and Argentine ants.
2.2 Improve offshore surveillance, inspection, and treatment	Developments/ advancements in tramp ant: - preventative measures to entry to Australia. - regional management initiatives - offshore risk mitigation - surveillance programs (including high-risk regions) - detection and response where threats to biodiversity are present. - border inspection	There is limited off-shore work to prevent the movement of tramp ants into Australia. Key pathways for high risk species entering Australia have been identified by DAFF Biosecurity and tramp ants can be detected where surveillance is conducted. It is noted that in four years of surveillance there have been no detections through the pathway of foreign fishing vessels. The only regional work is being conducted in the Pacific with the Secretariat of the Pacific Community developing a General Response Plan for Invasive Ants Incursion in the Pacific as a guide to Pacific nations preparing plans (Vanderwoude, 2008). Effective offshore policies are documented in the International Standards for Phytosanitary Measures (Food and Agriculture Organisation, 2005) but are rarely used for tramp ants. By utilising the detailed guidelines in the appropriate International Standards for Phytosanitary Measures and ant specific control methodologies, practical improvements in offshore risk management can be achieved (Loch et al., 2010, p. 242). It is concluded that DAFF Biosecurity are conducting a good service at the border for tramp ants but there is little collaborative work with other countries to prevent movement to the Australian border.
2.3 Enhance national and state/territory surveillance	Synthesis of knowledge of available methodologies for effective surveillance. Effective protocols for surveillance in different habitats and contexts. Up-to-date status of tramp ants in Australia. Objective basis to identify pre-border and border prevention measures.	Efforts to control the entry of exotic pests into Australia are supported by surveillance programs of DAFF Biosecurity. DAFF Biosecurity draw on relevant inspection protocols, detection techniques and training to detect exotic pests including tramp ants. Operations include inspection programmes covering both inside and outside shipping containers and investigations of high risk entry points of tramp ants, for example Indonesian foreign fishing vessel landings at remote locations around Australia. An analysis of DAFF Biosecurity data on tramp ant detections was done by Market Access and Biodiversity for the Department of Agriculture, Fisheries and Forestry in 2004 (Commonwealth of Australia, 2006a, p. 36). A more current examination would further help to inform authorities about the introduction pressures presented by tramp ants. Continued and enhanced vigilance must be maintained as a first line of defence and should involve a thorough examination of high risk commercial items, such as living plants (Loch et al., 2010, p. 241). State and territory surveillance data had been reported regularly through an inter-jurisdictional committee (the Tramp Ant Consultative Committee), however, the role of this Committee has changed to be limited to providing advice on national eradication

		programs, and there is no longer routine reporting of surveillance data. States and territories through the Australian Government's (Department of Agriculture, Fisheries and Forestry) Multiple Pest Surveillance Program do undertake surveillance of four tramp ant species at high risk sites not covered by DAFF Biosecurity. There has been a modest improvement in relation to national surveillance for tramp ants brought about: by improved surveillance generally for pests; by a heightened profile and awareness of tramp ants; by some specific surveillance close to ongoing active eradication programs; and by DAFF Biosecurity augmenting some state and territory government surveillance activities.

Contribution to change of threat (Objective 2)

There is a mixed degree of improvement relating to off-shore and at-border activity to reduce the risk of tramp ant entry and spread. At the border, some efforts have been made in relation to the Australia-Pacific region to target cargo arriving from identified high risk ports such as Singapore. Borders are protected by trained DAFF Biosecurity staff and container and passenger movement is subject to protocols enhancing detection, however the multiple pathways of entry and propagule pressure (that is the potential high numbers of ants coming to the border) present ongoing challenges to border protection. Some surveillance activity has increased due to the stimulus provided by high priority species like red imported fire ants contributing to raised awareness and vigilance to minimise the risk of entry and spread, while diagnostic services (noting that they have improved at the website level) have reduced in terms of number of locations and availability of specialist staff. In conclusion, there has been a modest improvement in relation to national surveillance for tramp ants brought about: by improved surveillance generally for pests; by a heightened profile and awareness of tramp ants; by some specific surveillance close to ongoing active eradication programs; and by DAFF Biosecurity augmenting some state and territory government surveillance activities.

Objective 3:
Prepare for rapid response to tramp ant incursions and spread through risk assessment of tramp ant species and pathways of introduction, and development of contingency plans.

Specified actions:
Table 1 shows the actions under objective 3, the predetermined performance indicators, and a list of actions undertaken.

Table 3 Assessment of rapid response measures to incursions and spread

Action Groups	Performance Indicators	Actions undertaken
3.1 Produce risk	Developments/ advancements in	DAFF Biosecurity are generally aware of the high risk issues associated with tramp ants and border protection, however,

assessments for tramp ants, pathways, and regions and habitats susceptible to invasion and impact	tramp ant: - national prioritisation - identification of high-risk areas - pathway vector and commodity risk assessments - movement controls	specific risk assessments have not been developed. The development of specific risk assessments for individual tramp ant species would help the targeting of quarantine efforts. DAFF Biosecurity targets known high risk imported commodities such as straw bedding, soil, and articles containing soil and has investigated (as mentioned in section 2.3) high risk entry points of tramp ants, for example Indonesian foreign fishing vessel landings at remote locations around Australia. In addition to surveillance targeted at tramp ant species, import risk assessments for new commodities include the risk that tramp ants may be present with the commodity. An assessment of interception data in 2004 confirmed that, eight years ago, most ants were entering from Singapore, New Guinea and Fiji (Commonwealth of Australia, 2006b, p.36). In all, 79% of interceptions are from South East Asia or the Pacific. It is believed that the processes in place at the border by the DAFF Biosecurity are adequate to mitigate the risks from invasive tramp ants. New Zealand has as part of an invasive ant pest risk assessment project developed a series of worthwhile risk assessments on eight high priority tramp ants (Landcare Research New Zealand, 2012). A similar set of assessments but framed for the Australian context could benefit Australia's preparedness. Some states have conducted risk assessments where they see particular risks from certain ants, such as South Australia for African big headed ants and Argentine ants. Risk assessment at the state and territory level is limited and has tended to be where ants are already present. This is the case for the red imported fire ant and the electric ant eradication programs in Queensland, where risk management measures to contain these ants include movement controls applying to materials for high risk business operations in high risk zones. There are also risk management protocols that apply to risk assessments carried out on infested premises, including the level of risk for further movement. Containment priorities include approved risk management plans for high risk businesses, movement controls to mitigate the risk of human assisted spread, and provision of information on detections to assist management of interstate entry requirements. It is concluded that states and territories are assessing the risks from tramp ants as they identify the particular risk to their jurisdiction. However, it is noted that there have been no risk assessments undertaken for yellow crazy ants and tropical fire ants.
3.2 Develop generic, specific, and context-dependent contingency plans	Developments/ advancements in tramp ant: - contingency plans - rapid responses - response resourcing - response evaluations	Contingency plans build preparedness and help fast-track responses to new tramp ant incursions by outlining in advance arrangements for responding to new incursions. They reduce potentially larger impacts by aiding coordinated action. State and territory governments vary in their level of preparedness and development of contingency plans. Queensland has response plans for the red imported fire ant and the electric ant infestations that provide a good basis to develop future response actions.

		These plans also contain elements useful for responses to other tramp ant species. New South Wales has indicated it would consider using these response plans (where relevant) for future red imported fire ant and electric ant incursions in its state. Victoria has its own red imported fire ant emergency response plan, while some other jurisdictions take a more generalised approach to contingency plans with New South Wales using its emergency management and First Response Team arrangements for biosecurity incidents more broadly. At a national level there are significant advances in developing preparedness at an institutional and policy level for biosecurity incidents in general. The National Environmental Biosecurity Response Agreement (NEBRA) provides an overarching national framework for emergency national pest incursions affecting the environment and was used by Biosecurity Queensland in their planning to guide the requirements of the state's roles and responsibilities and to satisfy requirements that red imported fire ants and electric ants are pests of national environmental significance. The CSIRO has also developed a general framework for invasive ant management to inform practitioners about important elements that contribute to eradication success (Hoffman, 2011). Other emergency response arrangements exist for emergency plant pest and animal disease incidents and are covered by the Emergency Plant Pest Response Deed and the Emergency Animal Disease Response Agreement. Amongst state and territory governments there is generally a greater level of preparedness planning in those jurisdictions with a higher risk of an incursion occurring. Given the historically high level of interceptions of tramp ants by DAFF Biosecurity at various sites around Australia there continues to be the need for further work in building preparedness, through contingency plans at generic and specific levels. In conclusion, while the arrangements are not necessarily in place (for example contingency plans) for each specific tramp ant, generic response plans and capability has been established. The eradication programs for red imported fire ant and electric ant have provided good detailed information for responding to these two species.

Contribution to change of threat (Objective 3)

There has been some gains in preparing for possible tramp ant incursions and spread through risk assessment. DAFF Biosecurity are generally aware of the high risk issues associated with tramp ants and border protection, however, specific risk assessments have not been developed. The development of specific risk assessments with a national perspective for individual tramp ant species may assist DAFF Biosecurity's quarantine efforts by identifying the specific levels of risk at entry points. Identification of tramp

ants has been included in training provided to quarantine staff. Some states have conducted risk assessments where they see particular risks from certain tramp ants, such as South Australia for African big headed ants and Argentine ants. Risk assessment at the state and territory level is limited and has tended to be where tramp ants are already present.

The clearer roles and responsibilities outlined in the National Environmental Biosecurity Response Agreement for dealing with emergency responses to biosecurity incidents affecting the environment have assisted governments in contingency planning. As yet, such national planning has not filtered down to the tramp ant or species-specific level for government use, however, the CSIRO has (as mentioned in section 3.2 above) developed a general framework for invasive ant management on the main elements involved in an invasive ant response. State and territory governments vary in their level of preparedness and development of contingency plans. Queensland has response plans for the red imported fire ant and the electric ant infestations that provide a good start for handling future contingencies. Some jurisdictions take a more generalised approach to contingency planning, adopting arrangements that cover the broad spectrum of biosecurity incidents. Amongst the states and territories there is generally a greater level of preparedness planning in those jurisdictions with a higher risk of incursion, but given the high level of interceptions of tramp ants by DAFF Biosecurity at various sites around Australia there continues to be the need for further work to build preparedness through contingency plans, particularly at the species level and for high risk locations and operations.

Objective 4:
Enhance emergency response to tramp ant incursions by improving reporting and response rates, and by developing tools for response and follow-up.

Specified actions:
Table 1 shows the actions under objective 4, the predetermined performance indicators, and a list of actions undertaken.

Table 4 Assessment of emergency incursions: reporting and response arrangements

Action Groups	Performance Indicators	Actions undertaken
4.1 Improve reporting of new detections of tramp ants	Developments/ advancements in tramp ant: - uniform reporting - ease of reporting and data storage. - stakeholder reporting.	National and state reporting systems exist that provide data capture capability for tramp ants. For red imported fire ants and electric ants the Queensland Government has information systems providing real time data in text and spatial form. State and territory governments have biosecurity emergency management and surveillance information systems or will be able to access a national information platform - BioSIRT (a biosecurity surveillance, incident, response and tracing web-based application) for tramp ant incursions. Jurisdictions operate under intergovernmental national emergency response agreements (these are the Emergency Plant Pest

		Response Deed, Emergency Animal Disease Response Agreement and the National Environmental Biosecurity Response Agreement). These agreements are broader than tramp ants and apply to all invasive species. There are exotic pest hotlines for plant pests, animal pests, weeds and marine pest incursions. While the plant pest hotline is technically the correct number for the public to call, it has a minimal public profile and as such the community still tends to use familiar avenues such as local government and agricultural and environment state departments to report detections. The exotic plant pest hotline is managed by Plant Health Australia with assistance from the Australian and state and territory governments. The Queensland government operate a tramp ant specific reporting hotline which is successful for reporting red imported fire ants and electric ants. There has been a decrease at national and state levels in diagnostic services for pest species particularly in regard to servicing public reporting. The Australian Museum advises it is the only officially acknowledged free public service of its kind remaining in Australia. There are some other avenues, but they are few and only tend to be found through word of mouth. For instance, ant identifications or assistance is freely provided by the CSIRO Darwin laboratory. There is a fee for service provided by the Australian National Insect Collection at the CSIRO in Canberra. Some state primary industry departments may assist where a specimen may be an ant of high risk concern. Despite the limited availability of public diagnostic services, it is still possible to get diagnostic assistance for ants given the profile of red imported fire ants, electric ants and yellow crazy ants. State and territory governments are aware of the need for consistent and nationally available biosecurity reporting measures and are making efforts to improve reporting. Overall, systems have improved since 2006 for reporting suspected incursions through the development of data reporting systems and response hotlines, however there is room for further progress.
4.2 Accelerate response to new detections of tramp ants	Developments/ advancements in tramp ant: - emergency response frameworks - rapid stakeholder notification - interim management responses - objective management	All state and territory governments have developed capacity to respond more quickly and efficiently to new biosecurity emergencies (not just to tramp ants). Both New South Wales and Queensland have emergency management units supported by response procedures. Queensland has specific response procedures for tramp ants while New South Wales' procedures are broader and target general biosecurity incidents. South Australia carries out generic emergency response training to maintain skilled staff, while Victoria has an emergency response plan specific for red imported fire ants. At a national level, new developments are contributing to a better

	responses - management response information systems	understanding of the roles, responsibilities and coordination between participants and to more streamlined responses to emergency situations. For instance, the National Environmental Biosecurity Response Agreement provides clarity around national pest incursions affecting the environment. The Plant Health Committee is formally responsible for tramp ants and the Tramp Ant Consultative Committee (reporting to the National Management Group) provides a mechanism for technical advice on tramp ant incursions, including providing advice on the red imported fire ant and electric ant national eradication programs. Information needs to be disseminated in a prompt fashion to stakeholders and interested community members and the national pests and disease outbreak site (www.outbreak.gov.au) provides a central area on current outbreaks of pests and diseases. The outbreak website is well known within government biosecurity areas and is promoted during incidents to stakeholders and the community. Quick responses to new incursions are also assisted via hotlines both listed on the outbreak website and promoted by state and territory governments. However, it is not obvious to the community where to report tramp ants because the relevant hotline phone number is for plant pests and does not mention tramp ants. It is concluded that appropriate mechanisms are in place to assist a prompt response to new incursions of tramp ants, with the exception of an obvious reporting point for the community outside of Queensland, who have a tramp ant hotline.
4.3 Develop effective control/ delivery technologies and efficient monitoring/ surveillance protocols	Developments/ advancements in tramp ant: - control techniques - control products - control product availability - controls minimising non-target risks - chemical control alternatives - monitoring protocols evaluating treatments and non-target impacts - protocols assessing response success	The Queensland government has contributed to the development of a range of effective control and delivery technologies through the Biosecurity Queensland Science Unit. This has included work on bait efficacy, trapping methodologies, and surveillance techniques particularly in regard to infrared and thermal remote sensing technology. While the Unit's focus is largely on red imported fire ants and electric ants, the findings may be transferable to other tramp ants. These findings are accessible to other governments via reporting under these national eradication programs. The various registered chemical treatments are effective and where results have not been optimal it has tended to relate to human error and difficult terrain. Effective monitoring and surveillance protocols have been developed for tramp ants through the red imported fire ant, electric ant and yellow crazy ant programs that will be able to be extended to other tramp ants when required. It is concluded that significant progress has been made to develop effective control technologies for tramp ants and that the progress

		of eradication and control programs is effectively monitored. As a result of work in Queensland, Northern Territory and on Christmas Island, Australia is regarded as a country with a strong depth of knowledge and experience around tramp ant control.

Contribution to change of threat (Objective 4)

National and state reporting systems exist that provide data capture capability for tramp ants. State and territory governments are aware of the need for consistent and nationally available biosecurity reporting measures and are making efforts through these facilities to improve reporting. There are national exotic pest (phone) hotlines for plant pests, animal pests, weeds and marine pest incursions. However, public uptake in using the hotlines varies because, while the plant pest hotline is technically the correct number to call for tramp ants, this is not an intuitive choice for members of the public, and is not well publicised. The community tends to still respond through familiar avenues such as local government, and agricultural and environment state government departments to report detections. The Queensland Government operate a tramp ant specific reporting hotline in association with their eradication programs, which is successful for the reporting of red imported fire ants and electric ants.

There has been a decrease at national and state levels in diagnostic services for pest species, particularly in regard to servicing public reporting. There are some other avenues, but they are few and only tend to be found through word of mouth. Some state and territory primary industry departments may assist where a specimen may be an ant of high risk concern. It is concluded that while the government system is not perfect, there are established mechanisms for reporting suspected incursions. These systems are broader than tramp ants and apply to all exotic species. With these mechanisms in place the reporting of new detections of tramp ants has improved since 2006.

All governments have developed capacity to respond more quickly and efficiently to new biosecurity emergencies (not just to tramp ants). At a national level, new biosecurity developments are contributing to a better understanding of the roles, responsibilities and coordination between participants and to more streamlined responses to emergency situations. It is concluded that appropriate mechanisms are in place for the reporting and coordination of responses for new incursions of tramp ants, with the exception of an obvious reporting point for the community.

The Queensland government has contributed to the development of a range of effective control and delivery technologies. While its focus is largely on red imported fire ants and electric ants, the findings may be transferable to other tramp ants. Effective monitoring and surveillance protocols have been developed for tramp ants through the red imported fire ant, electric ant and yellow crazy ant programs that will be able to be extended to other tramp ants if required. It is concluded that significant progress has been made to develop effective control technologies for tramp ants and that the progress of eradication and control programs is effectively monitored.

Objective 5:
Build stewardship by engaging, educating, and informing the Australian community about the impacts of invasive tramp ants and effective means of response.

Specified actions:
Table 5 shows the actions under objective 5, the predetermined performance indicators, and a list of actions undertaken.

Table 5 Assessment of engaging, educating, and informing the Australian community

Action Groups	Performance Indicators	Actions undertaken
5.1 Build stewardship by engaging, educating, and informing all sectors of the Australian community about tramp ants and their impacts	Developments/ advancements in tramp ant: - community engagement and response - community understanding - political will - industry best practice - community outreach programs	The red imported fire ant program in Queensland has focussed attention on these ants by other states and territories. Most state and territory governments have fact sheets on tramp ants, particularly red imported fire ants but also other ants of concern to the particular jurisdiction, for general education where they are present in that jurisdiction or are a risk for entry and spread. School education material has been developed in Queensland for the red imported fire ant and in the Northern Territory for invasive ants. Where there is an eradication or management program, specific education material is developed and the community, business sector and local schools targeted. Media releases have been issued by governments when key tramp ant events occur (for example detection of a new colony or eradication from a specific location) and reports about tramp ants appear in local newspapers and other media. It is concluded that there is likely to be greater awareness of tramp ants, particularly red imported fire ants.

Contribution to change of threat (Objective 5)

The high profile red imported fire ant eradication program in Queensland has helped raise attention to this species and to other tramp ants in other states and territories. Media releases issued by governments reflect the high importance that these pests have and media uptake has helped to disseminate issues into the wider community. Educational material has been developed in some jurisdictions including Queensland and the Northern Territory. Businesses are targeted in communication programs and informed especially where they are linked to high risk operations. It is concluded that there is likely to be greater community awareness of tramp ants, particularly red imported fire ants, than in 2006.

Objective 6:
Coordinate Australian Government, state and territory government, and local management activities in Australia and the region.

Specified actions:
Table 5 shows the actions under objective 5, the predetermined performance indicators, and a list of actions undertaken.

Table 6 Assessment of coordination of tramp ant activities

Action Groups	Performance Indicators	Actions undertaken
6.1 Coordinate Australian Government, State, Territory, and local management activities for tramp ants in Australia	Developments/ advancements in tramp ant: - national management coordination, - links with state/territory agencies, - links with Indigenous groups, - agreed roles for response actions, - integration with broader invasive species initiatives, - integration with other ecosystem-level management plans, - communication through a network of key stakeholders - agreed priority list of actions, and - reviews of the threat abatement plan.	While there has not been a National Implementation Team established for the tramp ant plan, the National Tramp Ant Committee (NTAC) was formed in 2006 and its successor the Tramp Ant Consultative Committee (established 2010) have contributed towards coordinated national tramp ant management. With the formation of the NTAC, the Australian Government considered that this committee would be able to provide expert advice on the implementation of the tramp ant plan. The NTAC had a wide mandate covering all tramp ants, including the nationally cost shared red imported fire ant and electric ant programs, and the tramp ant plan's other four priority ants: yellow crazy ants, tropical fire ants, African big headed ants and Argentine ants. When the NTAC was replaced with the Tramp Ant Consultative Committee in 2010, the primary focus moved to providing technical advice on the two national cost shared eradication programs for red imported fire ants and electric ants. Despite this new focus, the Tramp Ant Consultative Committee still provides some coordination benefits for other tramp ant species for matters that apply across the species. Engagement with Indigenous communities occurs in northern Australia with work by the CSIRO and Northern Territory and Queensland Governments (see Action Group 1.2 for further details). The Victorian Government has improved its capacity to respond to high risk invasive animals through integrating a number of its biosecurity practices. A New and Emerging Invasive Plants and Animals Section has been set up and would likely be the first to handle an incursion of tramp ants such as red imported fire ants or electric ants. The importance of tramp ants was recognised in the five year *Caring for our Country Outcomes 2008-2013* document. It identified that the impacts of tramp ants would be reduced in at least one priority area. Caring for our Country has funded at least six tramp ant projects as part of its focus on improving land management at the ecosystem level.

		It is concluded that there is good liaison between tramp ant scientists, policy makers and managers in Australia and this has been able to guide the implementation of the actions required under the tramp ant plan within an environment of limited financial resources dedicated specifically to the tramp ant plan.
6.2 Cooperation through bilateral agreements and partnerships within Australia's region	Developments/ advancements in tramp ant: - international and bilateral collaboration - regional initiative participation - offshore management	There has been a reasonable level of collaboration on tramp ants at a regional and international level. The NTAC included a New Zealand observer but this hasn't continued with the Tramp Ant Consultative Committee. The red imported fire ant program continues to maintain a strong relationship with the United States and in 2010 the red imported fire ant program was reviewed by US experts. At a research and academic level, efforts to foster and maintain open communication has been supported by hosting events for researchers such as the post-graduate specialist course in invasive ants (Ant Course) in 2006 and the international invasive ant management workshop in 2010. The Pacific Ant Group email listserver is an active and useful mechanism for discussion and exchange of information. The CSIRO has supported some research in the Pacific by investigating the status and management of yellow crazy ants around Samoa. Given the above action, it is believed that there are worthwhile partnerships occurring at a regional and country to country level (however, we could do better to address offshore surveillance and risk mitigation as mentioned at Action Group 2.2).

Contribution to change of threat (Objective 6)

While there has not been a national implementation team established for the tramp ant plan, the National Tramp Ant Committee (NTAC) formed in 2006, and its successor the Tramp Ant Consultative Committee (2010) have assisted in the coordination of national tramp ant management. There has been a reasonable level of collaboration on tramp ants at a regional and international level with international engagement at a program delivery and academic level. It is believed that there are reasonable partnerships occurring in the Pacific region with other countries through the Pacific Islands Initiative (a group of countries and organisations with the mission to strengthen the capacity of Pacific Island countries and territories to effectively manage invasive species threats). It is concluded that there is good liaison between tramp ant scientists, policy makers and managers in Australia, and this has assisted with the implementation of the actions required under the tramp ant plan.

5. Funding and implementation of the Tramp ant plan

The tramp ant plan is structured such that there are objectives focussed on pre-border, at-border and post-border levels. The tramp ant plan largely draws on this tiered border approach and implementation of the plan has benefitted from the high priority attention given to biosecurity over the last few years by Australian, state and territory governments improving and developing their generic emergency response systems and measures.

In regards to activities directed specifically toward actions relevant to the tramp ant plan, the Australian Government has contributed funding to the projects listed below. They represent action with eradication as a goal and thereby reduce future potential environmental impact together with a focus on directly protecting high conservation value areas and specific protection of endangered species such as the Christmas Island Shrew.

- National Red Imported Fire Ant Eradication Program, $118 million (since 2001) to Biosecurity Queensland.
- National Electric ant eradication program $3.142 million (since 2006) to Biosecurity Queensland.
- Argentine Ants on Norfolk Island Program Continuing Towards Total Eradication $157,000 (2010/11) to the Administration of Norfolk Island.
- Yellow Crazy Ant Management in North East Arnhem Land, $250,000 (2008/09) to the Dhimurru Aboriginal Corporation.
- Yellow Crazy Ant Control on Christmas Island, Parks Australia $4 million up to 2010/11 and another $4 million until 2014-15.
- Managing the World Heritage Values of Lord Howe Island, $455,689 (2011/12) to the Lord Howe Island Board.

While there has been a particularly good national effort on two of the ants in the tramp ant plan (the red imported fire ant and the electric ant) opportunities remain to re-focus and increase efforts in relation to the other four tramp ant plan priority species.

The Australian Government has worked with state and territory governments through the National Biosecurity Committee's Tramp Ant Consultative Committee to support the tramp ant plan actions around science based knowledge, border protection, emergency response arrangements and intergovernmental coordination. The national focus since 2010 has primarily been the National Red Imported Fire Ant Eradication Program and the National Electric Ant Eradication Program with the Australian Government providing half of the funding for each program.

6. Conclusions

6.1 Tramp ant plan – contribution to actions

The tramp ant plan has 71 actions combined into 15 action-groups under six objectives. Of these it is considered that six action-groups have been satisfactorily met and nine have been partially met. Where the actions have been identified as being partially met, this is typically because progress has been made in relation to individual tramp ant species but not necessarily in relation to all of the six priority tramp ant species.

The following subsections (6.1.1 - 6.1.6) comment on actions undertaken at the species level. Tramp ants are often confined to distinct locations and the biodiversity impacts may be abated where the ants are contained. As such, in identifying the six priority species in the tramp ant plan, the plan has identified the *potential* threat to biodiversity from these species if they were to spread to their full range in Australia. Hence, the commentary below under chapter 6.2 explains the change to the impacts of the tramp ant plan's six priority species on biodiversity where an action has been undertaken.

6.2 Completion of tramp ant plan – species level

6.1.1 Red imported fire ant (*Solenopsis invicta*)

Red imported fire ants are currently established only in south east Queensland. There has been a concerted effort since 2001 to eradicate them through the National Red Imported Fire Ant Eradication Program lead by the Queensland Government on behalf of all Australian governments. The ants initially infested an area of approximately 36,000 hectares with 65,000 colonies and have been significantly reduced to around 561 hectares and 441 colonies. The ants have been eradicated from Gladstone, the Port of Brisbane, and have been substantially reduced in rural and residential parts of western Brisbane. Reports by Biosecurity Queensland point to the original area and number of red imported fire ant colonies having been reduced by over 99%. Unlike in the United States of America where government and community response has not stopped its spread, the program in Australia has, to date, contained and significantly reduced their spread.

Measures are in place to reduce the risk of red imported fire ants entering Australia. The DAFF Biosecurity has undertaken pre-border consultation in the Pacific and has intercepted red imported fire ants at the national border as part of its inspection of cargo and other high risk items. As a result, border protection has improved and the risk of these ants entering Australia has been reduced.

The red imported fire ant eradication program has raised awareness in government and in the community of the risk from these ants. State and territory governments have included trade measures to reduce the chance of interstate movement. Public awareness campaigns have been effective, encouraging and supporting community engagement

through both broadly-based (print, radio and television) and targeted (letterbox and householder contact) efforts. This is reflected in about 70 % of all infested areas being reported by the public. Such actions have restricted the ants spread in Queensland and contributed towards no infestations having occurred outside the State.

The red imported fire ant program has developed good linkages between scientific experts and program delivery managers. This has helped improve technical aspects around operational practices such as having a suite of chemical controls that are effective, and delivery systems such as direct nest injection and broadcast baiting that are highly successful in killing ants.

The program has developed well targeted surveillance techniques that have improved the chances of detection. The program managers are aware of the preferred habitat for red imported fire ants (recently cleared and disturbed land) and are using modelling to assist prioritising and targeting of treatment and surveillance areas. The use of leading-edge remote infra-red and thermal technology will further raise the effectiveness of the program to detect the ants in situations that are now more sparsely distributed, as compared with earlier stages of the program.

While the threat from red imported fire ants to biodiversity remains high because of their ongoing presence in south east Queensland and detections occurring on occasions at the national border, there is a much greater appreciation of the potential threat from this species and tramp ants more broadly than there was in 2006. The knowledge that the Queensland Government and other ant specialists have gained from the eradication program is likely to be transferable to other species and will assist in future responses to incursions or management of tramp ants in Australia.

6.1.2 Yellow crazy ant (*Anoplolepis gracilipes*)

Yellow crazy ants occur in the tropical regions of Australia in the Northern Territory, Queensland, on Christmas and Cocos (Keeling) Islands. In tropical Australia there are populations of yellow crazy ants at various stages of spread: some isolated and small while others possibly established (for example certain parts of north east Arnhem Land in the Northern Territory). Many of the sites where yellow crazy ants occur are treated and monitored for re-establishment, some are locally eradicated or contained but with the number of locations and limited resources, the potential for further spread exists.

The objective of preventing further spread and coordinating government action is being pursued for yellow crazy ants. The CSIRO is doing work in north east Arnhem Land to control yellow crazy ants, as is the Northern Territory Government in a suburb of Darwin. The Queensland Government responds to new detections as they occur. Yellow crazy ants are present along the Queensland coast, predominantly in suburban or light industrial areas around Cairns, Townsville, Hervey Bay, Brisbane, Caboolture and the Gold Coast. A program is also underway in the Wet Tropics World Heritage Area for a recent detection. In the Northern Territory and Queensland, yellow crazy ants are treated

as priority tramp ant species with containment and control undertaken. However, yellow crazy ants would be considered a lesser priority by these governments to Queensland's current incursions of red imported fire ants and electric ants.

It is known that yellow crazy ants impact on small invertebrates and other native species. They have the capacity to form supercolonies as is evident on Christmas Island. To date there is no evidence of the formation of supercolonies on mainland Australia, but there would be significant environmental impacts if they did demonstrate this trait.

There has been an increase in the behavioural knowledge of yellow crazy ants and knowledge on how the ant reproduces and colonies spread from the CSIRO's work by Dr Ben Hoffman. A good level of understanding on what control methods are effective in the field – in different environments such as in deep shade, full sun–combined with knowing the impact of the ant on local biodiversity, has helped identify areas to focus management activity in parts of north east Arnhem Land. This area has become a centre of yellow crazy ant knowledge, largely due to Dr Hoffman, with a series of protocols for how to undertake control and eradication activity (Hoffman, 2006).

The focus for governments tends to be on localised eradication or control programs with little attention given to undertaking an assessment of the environmental outcomes of management action.

It is encouraging that the ant has been successfully eradicated from Goodwood Island near Yamba, northern NSW, and from selected parts of north east Arnhem Land where local populations have not yet become established. The eradications show that there is sufficient technical knowledge and expertise available to achieve such outcomes in localised areas, and that the potential exists for this to be achieved elsewhere. Furthermore, governments are of the opinion that outbreaks of yellow crazy ants can be controlled and may be eradicated, if they are detected before large scale spread occurs.

In the case of yellow crazy ants on Christmas Island, there has been significant planning and control of these ants on the Island. There is an Action Plan for invasive ants on Christmas Island and in 2011 the Australian Government agreed to a range of recommendations from the Expert Working Group report on Christmas Island Biodiversity (DSEWPaC, 2011a), relating to improved natural resource management in general and yellow crazy ant action specifically.

When compared to 2006, the extent to which yellow crazy ants have spread and the effectiveness of controls undertaken to minimise their impact on threatened native species and ecological communities is varied. Successful eradications and containment in some locations have occurred, while elsewhere there are populations that persist despite attempts at their removal. However, governments are responding to new detections with effective controls, management is supported by increased scientific knowledge, and action has been undertaken in targeted locations to minimise the impact of yellow crazy ants on threatened native species and ecological communities.

6.1.3 Electric ant *(Wasmannia auropunctata)*

Electric ants occur in Australia at four locations in far north Queensland. They were first detected in Cairns in 2006 and are the subject of a concerted eradication attempt by all Australian governments through the National Electric Ant Eradication Program. They are in a number of separate sites within the township of Cairns, at nearby Kuranda to the west, at Craiglie (near Port Douglas to the north of Cairns) and Bingil Bay (100km to the south of Cairns). There are currently 26 discrete areas of infestation covering approximately 183 hectares within these locations.

As part of the eradication program, pathways of further spread have been determined and protocols developed to minimise the entry and spread of electric ants. DAFF Biosecurity surveys and inspects material and equipment that could be transporting insects to Australia including electric ants. There are interstate movement quarantine controls on commercial operators to minimise interstate movement of high risk material such as soil and landscaping material from the infested area. Within Queensland, movement controls are also in place on high risk material from businesses to restrict the spread of the electric ant to other places in Queensland. There are good response measures in place to respond to new detections of the ant and currently all new infestations are being effectively controlled.

The electric ant eradication program has been driving advances in scientific knowledge, surveillance and treatment, educating and engaging the community and coordinating activities by government. Scientific knowledge has developed around the control of electric ants with effective insecticide bait treatments available for use in all environments and useful lures to help surveillance efforts. The program has so far prevented the ant entering the nearby Wet Tropics World Heritage Area.

An improved understanding about the electric ant's behaviour has assisted more targeted action to better detect and respond to infestations within the eradication program. Electric ants do not have a flying mode that aids spread, so the greatest risk of movement comes largely from human assisted movement. Hence, the Queensland Government has put in place movement controls to minimise this form of spread. It has been found that the vast majority of detections are along footpaths and this has focussed effective surveillance in these areas using bait stations and sniffer dogs.

While the potential threat to biodiversity from electric ant remains, it has been reduced from that in 2006 with an effective suite of responses developed along the stages of the invasion sequence. A range of governance regulations, effective management and coordination with stakeholders is contributing towards preventing electric ants becoming widespread and threatening native species and ecological communities.

6.1.4 Tropical fire ant (*Solenopsis geminata*)

Tropical fire ants occur at about seven locations dispersed along the top end of the Northern Territory as well as on Tiwi and Christmas Islands and Ashmore Reef in the Timor Sea. The Northern Territory Government has undertaken a comprehensive survey of exotic ants and is aware of where tropical fire ants occur. However, efforts to control them in a comprehensive way at mainland locations have as yet been minimal (Hoffman, 2011). In some places where the ants appear established, such as Darwin, it may not be feasible to eradicate them because they are so widespread, however other small infestations may still prove to be eradicable. Control programs are underway to reduce tropical fire ants on the Tiwi Islands where some small infestations have been eradicated, and on Ashmore Reef where the ant appears established but control work will significantly reduce the impact that currently occurs (DSEWPaC, 2011b).

Engagement and participation in both management and surveillance has occurred with Indigenous communities such as on the Tiwi Islands where the eradication program is owned and conducted by local rangers and uses a composite of both western and traditional knowledge. Discussions have been held with representatives from Indigenous communities at sites on the mainland at Wadeye Northern Territory, and in north east Arnhem Land. The DAFF Biosecurity has worked with Indigenous communities for a number of years on an ongoing basis, particularly in relation to surveillance activities that include ants at high priority locations and coastal areas.

There has been some level of growth in scientific knowledge about the ant through eradication programs in the Northern Territory and on the Tiwi Islands and Ashmore Reef including knowledge about the genetics of Australian populations and measurements of invasive mechanisms. But there remains a need to better understand and improve the management of the tropical fire ant and its wider impacts.

States adjoining the Northern Territory are aware of the potential spread of tropical fire ants into their lands. The Queensland Government has entry requirements on certain materials where they are sourced from areas within the Northern Territory that are in close proximity to where tropical fire ants occur. The Western Australian Government publicises tropical fire ant as an ant of possible risk and directs people to advise authorities of possible detections.

Effective chemical controls are available for the control of tropical fire ant and easy to use baits laced with the active ingredient, hydramethylnon, are available publicly.

Government agencies control or eradicate this ant where it has been detected outside the Northern Territory, however, its continued existence in parts of the Territory holds the risk that its spread elsewhere may occur in the future. Overall the threat remains that the ant could populate new areas and its distribution while not significantly enlarged since 2006, has at the same time not markedly decreased. Therefore it is concluded that the tropical fire ant still has the same impacts in the Northern Territory and still poses the same threat to biodiversity as in 2006.

6.1.5 African big headed ant (*Pheidole megacephala*)

African big headed ants are located at numerous locations around Australia. They occur along the length of the eastern seaboard from Cape York to the border between New South Wales and Victoria, and are also found scattered at sites in the Northern Territory and Western Australia (largely in the south west). The ants have been eradicated from the Tiwi Islands and on the Daly River in the Northern Territory showing that removal in particular locations is possible.

Whilst African big headed ants are one of the more common of the six priority tramp ants and efforts by governments to control them appear less than the other four previously mentioned ants, they nonetheless have significant environmental impacts, particularly in the case of significantly reducing native ant populations (Hoffman, 2008). Surveillance for African big headed ants however is only undertaken in Western Australia, and so it is possible that they may spread further.

Scientific knowledge on how to effectively control African big headed ants has grown. The CSIRO has published journal articles on successful eradications in the Northern Territory and on the Tiwi Islands. A better understanding of the ant's behaviour, spread dynamics and susceptibility to certain chemical controls has lead to more effective control of the ant. For instance, the ants only form single colonies and spread slowly from a central nest, so they are highly susceptible to the chemical Amdro® and post treatment surveillance works well in helping to target remaining populations. Criteria have been developed that place eradication and control programs in the best position to achieve their goals, cutting across both management practices and technical knowledge (Hoffman, 2008). Work done on the post eradication recovery of native species has shown that there is good re-establishment after African big headed ant is removed. The level of scientific knowledge developed and the effectiveness of eradication and control programs undertaken in the Northern Territory is of an order that has lead to this work being internationally recognised.

Governments are aware of the African big headed ant and targeted control action is done in parts of the Northern Territory and has been undertaken at a bushland site in Perth, Western Australia. However active control nationally of the ant is low, partly because it is present at numerous locations around Australia and its direct impact on humans through stinging is small.

General community information on the African big headed ant is available to the public in those jurisdictions where the ants are present, particularly in the Northern Territory. Access to information has improved through the publishing of scientific papers on the eradication of the ant and information is available online to inform people about this ant. The profile of African big headed ants is not as high as red imported fire, electric or yellow crazy ants. However, it is expected that authorities and informed members of the public would report these ants. In Western Australia, Northern Territory and Queensland, governments request that sightings of African big headed ants are reported.

In conclusion, the spread of African big headed ant has not significantly changed in a national sense although pockets have expanded in some locations. Knowledge about their control has increased and chemicals are available that are effective. While they are distributed at numerous locations around Australia, this should not hinder future action to target areas of high priority. Furthermore, the successful eradications achieved for African big headed ant, the relative ease of achieving this compared with some other tramp ants, and the significant impact it has on biodiversity, suggest that the ant is worthwhile being treated as a high priority in terms of future consideration by government for control and eradication measures.

6.1.6 Argentine ant (*Linepithema humile*)

Argentine ants are widely established in populated areas in temperate Australia where the rainfall is higher, including in south west Western Australia, South Australia (Adelaide), New South Wales (south of Sydney), across Victoria and Tasmania, and on Norfolk Island. The Argentine ant is found close to habitation and it is likely that people are a major vector for its spread. For example in Perth it is established following a failed attempt at eradication in the early 2000s. In Melbourne, it is a prevalent ant species and has formed a large super-colony across the metropolitan area. State and territory agencies record detections as they occur, but active surveillance for the ant is not undertaken.

Knowledge is available (Harris, 2002) which indicates the environmental impact of Argentine ants is similar to the other tramp ants in affecting invertebrates, including native ants, lizards, plants, pollination and seed dispersal. Because governments have placed a low priority on this tramp ant, no research has been conducted on its environmental impacts in the last five years.

Government programs focused on containment or control of Argentine ants have been unsuccessful and, since 2006, management programs have been discontinued. The only exception to this is some recent control action on Norfolk Island. The two nationally cost-shared eradication programs in Queensland for red imported fire ants and electric ants have meant that governments have focussed attention on preventing the spread of these tramp ants to southern Australia.

In conclusion, there has been minimal progress with Argentine ants in relation to the objectives of the threat abatement plan to increase and improve: science-based knowledge; border detection and internal spread; and government action for this ant. Managers of tramp ants need to reassess management options for Argentine ants and to focus attention on detections in new locations, especially in areas of high biodiversity value where they may threaten native species and ecological communities.

6.2 Tramp ant plan - contribution to objectives and goals

The six objectives of the tramp ant threat abatement plan have been met to varying degrees.

The first objective focuses on increasing scientific knowledge of the tramp ants. There have been good advances in scientific knowledge within the eradication programs for red imported fire ants and electric ants. Studies, particularly through the work of the CSIRO, have led to a better understanding of yellow crazy ants, tropical fire ants and African big headed ants. This is particularly so in northern Australia. There have been no studies into Argentine ants.

The second objective focuses on protecting the Australian border from new incursions of these tramp ants. There is improved risk management of incoming goods that carry tramp ants and a heightened awareness about tramp ants during surveillance for exotic pests and diseases. This is done within the broader context of biosecurity for all exotic pests and diseases. Within Australia, there is localised surveillance around eradication programs for high risk goods and a general awareness of risk materials. All of this is an improvement on the situation in 2006.

The third objective focuses on the ability to rapidly respond to tramp ant incursions. As mentioned above, there is now a much higher awareness of the risks of incursions of tramp ants and contingency plans have been prepared in all states and territories. Much of this can be attributed to the two nationally cost-shared eradication programs for the red imported fire ant and electric ant.

The fourth objective focuses on enhancing the emergency response to tramp ant incursions through reporting, response rates and tools for response and follow-up. At a level broader than tramp ants, governments have agreed on emergency response arrangements for exotic pests and disease incursions that have an environmental or social amenity impact. This provides a structure for governments to make decisions and respond effectively. At a jurisdictional level, all states and territories now have mechanisms in place that would enable a response to a new tramp ant incursion. However, Queensland is the leader in this because of their expertise with the red imported fire ant and electric ant. In relation to reporting and response rates, again much of the improvement can be attributed to the two nationally cost-shared eradication programs for the red imported fire ant and electric ants. The general public in Queensland have a high knowledge about the red imported fire ant and the electric ant and are knowledgeable about reporting tramp ants. The public in other states and territories are much less aware due to lower investment in information materials. In terms of response tools for effective action, chemical controls and delivery technologies are available and can be quickly deployed by authorities in response to reports of ants.

The fifth objective focuses on building stewardship of the Australian community around responding to tramp ants. Where there are or have been eradication programs for tramp ants the community knowledge and engagement is high. This is positive, and has

resulted in significant assistance provided by the community in such areas as passive surveillance and reporting. However, such engagement appears to be the limited to the high profile and resourced red imported fire ant and electric ant programs.

The sixth objective focuses on coordinating government management activities. In the last five years government coordination has worked well around the two cost-shared tramp ant programs with a national committee operating. The national committees have focused only on these two ants. There has also been little local government engagement on any of the tramp ants except in the isolated areas where eradications are or have been undertaken.

On Christmas Island, recovery plans exist for listed species adversely affected by yellow crazy ants; and for red imported fire ants, recovery plans exist for almost half of the listed species. While recovery plans are in place, the threat from these ants has not diminished. Limited monitoring of other species affected by tropical fire ants, African big headed ants and lesser still for Argentine ants, means that there is little quantitative data on the extent of their impacts but again it can be concluded that the threats have not diminished.

The two goals of the tramp ant threat abatement plan (to minimise the impact of invasive tramp ants on biodiversity in Australia and its territories by protecting threatened native species and ecological communities; and to prevent further species and ecological communities from becoming threatened) have been significantly met for red imported fire ants and electric ants as their spread has been substantially reduced as a result of action from national eradication programs. However it needs to be noted that they are not yet eradicated so still pose a threat. For yellow crazy ants, active attention has occurred at places where eradication is considered feasible. In the case of the other three tramp ants (tropical fire ants, African big headed ants and Argentine ants), while examples of containment and eradication exist at some site specific locations, they are otherwise spread across sites at various locations around Australia and continue to have a growing impact on biodiversity.

It is concluded that since 2006 reasonable progress has been made against the goals, objectives and a number of the actions in the tramp ant threat abatement plan. The potential for impact on biodiversity has reduced for red imported fire ants, electric ants and to a lesser but still significant amount for yellow crazy ants. However the remaining three tramp ants - tropical fire, African big headed and Argentine ants have had little attention with action targeting specific sites but widespread localised spread persisting.

6.3 Tramp ant plan - contribution to changing the threat

The tramp ant plan has played an important role by recognising at a national level the threat that tramp ants pose to the environment. Actions identified in the tramp ant plan have lead to funding of tramp ant management in some key sites, particularly in the case of some islands where eradication may be more feasible than on the Australian mainland. The plan also is the first threat abatement plan to adopt a response framework that is

guided by the sequence of a biosecurity continuum that operates from pre-border to post-border levels of activity. While there are further opportunities to lower the risk that tramp ants present along this continuum, the plan has elevated the importance of serious attention being given to a range of areas along this continuum. This has been a much needed approach for invasive ants.

The tramp ant plan has provided a national focus for work that has enabled other stakeholders to exert leverage from the existence of a national plan. Therefore, while the key goals of the tramp ant plan have only been partially met, progress has been made towards these goals: controlling tramp ants in some targeted areas; building good science with a number of the tramp ants; and maintaining a national and localised response to some priority locations.

In conclusion, the assessment of the review as to whether the tramp ant plan has abated the impact of tramp ants on biodiversity, is that while the threat has been significantly reduced for fire ants and electric ants, and to a lesser but still significant extent for yellow crazy ant, the threat is still present and remains high. In relation to the other three tramp ants (tropical fire ants, African big headed ants and Argentine ants) the threat is still present and has not been abated.

6.4 Outstanding key abatement actions

All of the objectives of the threat abatement plan still stand as valid requirements for threat abatement. In undertaking this review there are five specific recommendations that have emerged:

1. Continued support for targeted control and eradication of yellow crazy ants and African big headed ants in Northern Australia. The biodiversity benefits of maintaining management control of these two species are high and the successful eradications from islands or localised areas have demonstrated this can be achieved;
2. Continued action against red imported fire ants and electric ants in Queensland. While the eradication program for red imported fire ants has been underway for eleven years, recent advances in science suggest a much improved likelihood of a successful outcome, although within a timeline in the order of a further ten years;
3. Implement programs to eradicate tramp ants from islands with high biodiversity values where the risk of re-infestation is low;
4. Continued management of yellow crazy ants on Christmas Island because of their significant impact on threatened species; and
5. Identification of threatened species at most risk from tramp ants, and implement effective management options for recovery of these threatened species.

Finally, there are other species of tramp ant that occur in Australia or potentially pose a threat to the Australian environment [such as a further six mentioned in the tramp ant plan appendices - *Tapinoma melaocephalum* (ghost ant), *Technomymex albipes* (white-footed ant), *Lasius neglectus* (European garden ant), *Paratrechina longicornis* (crazy

ant), *Monomorium destructor* (Singapore ant) and *M. pharaonis* (pharaoh ant)]. It is an appropriate time to consider whether the six priority species identified by the tramp ant plan are still those posing the highest risk to threatened species and ecological communities in Australia, or whether there are additional species that need consideration.

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8. Summary Table of Progress against Action Groups

Actions	Result (met/partially met/not met)	Comment
Objective 1: Increase science-based knowledge and expertise, incorporate Indigenous traditional ecological knowledge, quantify impacts, and improve access to information for priority tramp ant species		
Action Group (AG) 1.1 Increase science-based knowledge, innovation, and expertise for management of tramp ants in Australia and its territories	Partially met	Research on high priority ants such as red imported fire ants and electric ants.
AG 1.2 Incorporate Indigenous traditional ecological knowledge into tramp ant management	Partially met	'Two-ways' management used in the Northern Territory.
AG 1.3 Assess tramp ant impacts in Australia and its territories	Partially met	Impacts assessed as part of the red imported fire ant and electric ant eradication programs and for other ants through research institutions.
AG 1.4 Create a central repository or linked network for knowledge relevant to the management of tramp ants	Met	Global invasive species database used as a repository for tramp ant information.
Objective 2: Prevent entry and spread of tramp ants by increasing diagnostic capacity, offshore surveillance, inspection, treatment, and national and state and territory surveillance		
AG 2.1 Improve diagnostic capacity and service	Partially met	Diagnostic assistance available in some locations.
AG 2.2 Improve offshore surveillance, inspection, and treatment	Partially met	Off-shore surveillance targeted at key pathways.
AG 2.3 Enhance national and state/territory surveillance	Partially met	Occurs for red imported fire ants and electric ant, but not for other ants.
Objective 3: Prepare for rapid response to tramp ant incursions and spread through risk assessment of tramp ant species and pathways of introduction, and development of contingency plans		
AG 3.1 Produce risk assessments for tramp ants, pathways, and regions and habitats susceptible to invasion and impact	Partially met	DAFF Biosecurity aware of high risk issues (e.g. certain imported commodities). States and territories assess risks from tramp ants as they identify the particular risk to their jurisdiction.
AG 3.2 Develop generic, specific, and context-dependent contingency plans	Met	Generic response plans and capability has been developed.
Objective 4: Enhance emergency response to tramp ant incursions by improving reporting and response rates, and by developing tools for response and follow-up		
AG 4.1 Improve reporting of new detections of tramp ants	Met	National and state reporting systems exist to provide data capture capability for tramp ants.
AG 4.2 Accelerate response to new detections of tramp ants	Met	Governments have developed capacity to respond more quickly and efficiently to new biosecurity emergencies.

Actions	**Result (met/partially met/not met)**	**Comment**
AG 4.3 Develop effective control/delivery technologies and efficient monitoring/ surveillance protocols	Met	Available chemicals are effective. Monitoring protocols have been developed.
Objective 5: Build stewardship by engaging, educating, and informing the Australian community about the impacts of invasive tramp ants and effective means of response		
AG 5.1 Build stewardship by engaging, educating, and informing all sectors of the Australian community about tramp ants and their impacts	Partially met	Specific education material has been developed.
Objective 6: Coordinate Australian Government, state and territory government, and local management activities in Australia and the region		
AG 6.1 Coordinate Australian Government, State, Territory, and local management activities for tramp ants in Australia	Met	Government communication and coordination networks exist for tramp ants.
AG 6.2 Cooperation through bilateral agreements and partnerships within Australia's region	Partially met	Partnerships and collaboration exist with regional neighbours and international experts.