CASE STUDY:
YELLOW CRAZY ANT

UPDATED: NOVEMBER 2017

A case study of multiple incursions of a highly threatening invader and failures to eradicate.

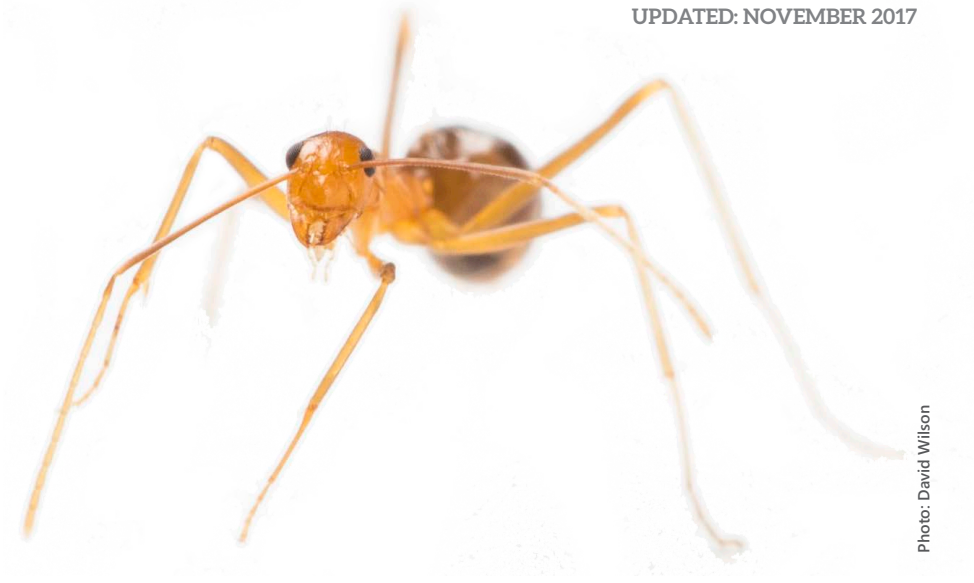


Photo: David Wilson

Species
Yellow crazy ant (*Anoplolepis gracilipes*)

Origin
Unknown, but probably South-East Asia.

Australian occurrence
Established on Christmas Island, in the Northern Territory and Queensland. Eradicated from NSW.

Potential ecological impacts
Yellow crazy ants (YCA) can form large-scale super-colonies, extending over more than 100 hectares[1]. On Christmas Island, they have killed tens of millions of ecologically important red crabs and robber crabs. Prior to a multi-million dollar baiting program, they had invaded more than a quarter of the island's rainforest, reaching densities of more than 2000 foraging ants per square metre and transforming the ecosystem.

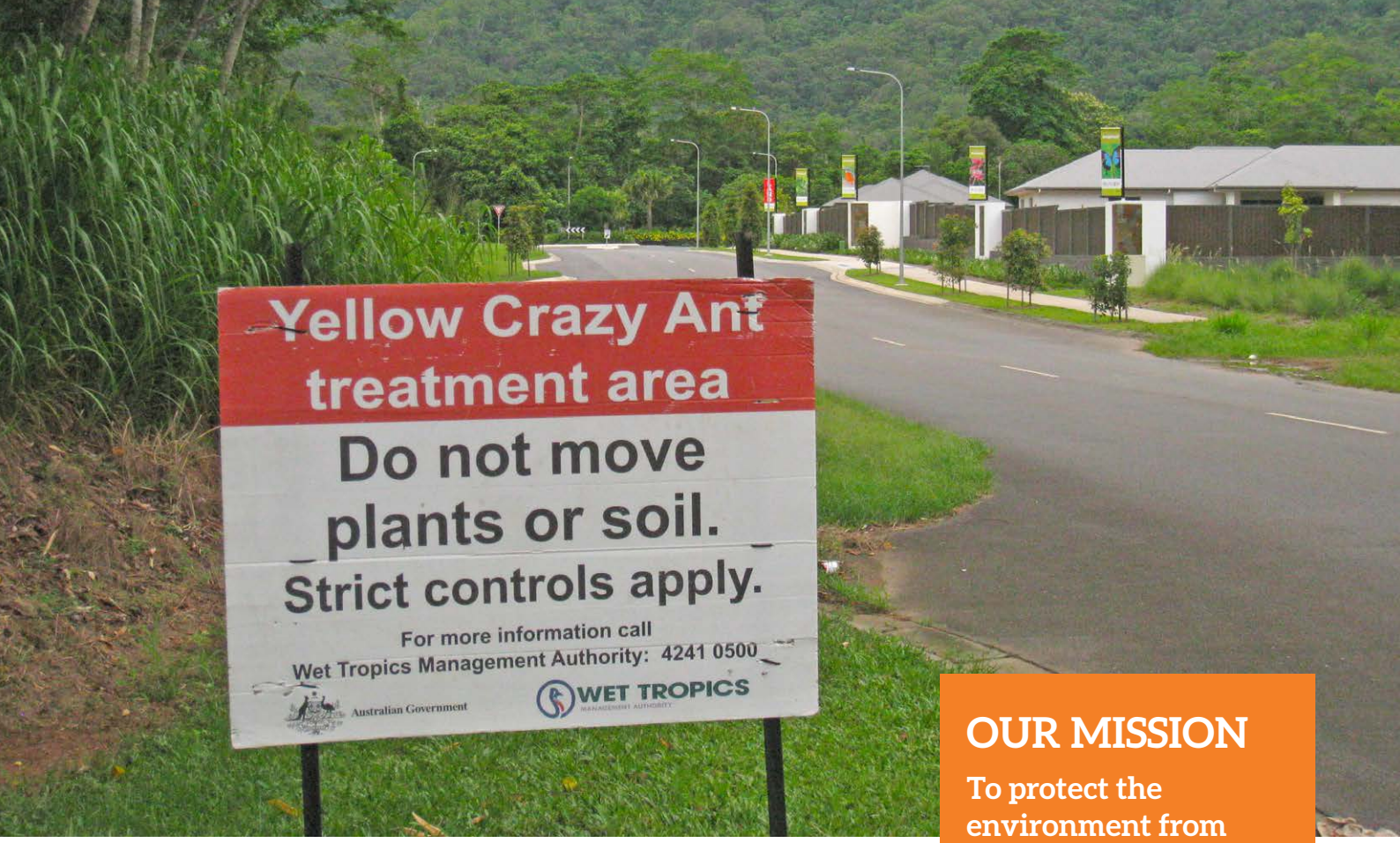
In many places where YCA flourish, not much else does. They can remove nearly all insect life, leaving none for other insect-eating animals, and kill small animals such as lizards, crabs and bird chicks. They are on the World Conservation Union's list of '100 of the World's Worst Invasive Alien Species'. Queensland's Wet Tropics World Heritage Area is at grave risk, for the ants' preferred habitat is moist lowland tropical forest. But climate matching suggests they are capable of inhabiting most of northern and north-eastern Australia, from the Kimberley through Darwin, Cape York Peninsula, and down the eastern seaboard of Queensland into coastal and inland parts of northern NSW.[2] Their impacts vary considerably from site to site and can take decades to manifest (as occurred on Christmas Island). They have probably been responsible in part for Australia's two most recent vertebrate extinctions – the Christmas Island pipistrelle (2009) and Christmas Island forest skink (2014).

Potential social and economic impacts
YCA are likely to harm eco-tourism in infested areas, including in the Wet Tropics. They are likely to reduce yields of sugarcane, coffee and coconut crops by nesting at the base of these plants and exposing the roots to disease. By farming sap-sucking bugs, they promote sooty mould disease in fruit trees. They also kill young animals, including chickens and pigs. According to a newspaper report about impacts on a farm in the Wet Tropics, yellow crazy ants 'have destroyed Frank Teodo's crops, his home appliances, and they've scorched his eyes and attacked his dogs'.[3] The economic impacts also include the costs of control programs, which exceed $10 million in the past 5 years, including:[4] (a) Arnhem Land, $250,000 (2008/09) to the Dhimurru Aboriginal Corporation, (b) Christmas Island, Parks Australia $4 million up to 2010/11 and another $4 million until 2014-15. In Queensland, there has been at least $2 million federal funding provided for eradication in the Wet Tropics, and the Queensland government had previously spent an unknown sum on an abandoned eradication program.

Pathways
YCAs generally arrive with imported timber. According to 2004 data, most tramp ant incursions (not specific to YCA) have derived from South East Asia and the Pacific, most often Singapore, New Guinea and Fiji.[5] There is no publicly available up-to-date data on pathways for YCAs.

BIOSECURITY ISSUES

Summary
Australia has failed both to prevent new incursions and to eradicate existing incursions. Since 2000, an average of over 2 new outbreaks per year have been detected (over 30 in Queensland). There may be many more outbreaks due to a lack of surveillance. YCA were intercepted in Australian ports at least 161 times from 1988-2011 (on average 7 times/year) and at least 40 times from 2008-2013 (on average 8 times/year).[6] YCA represent a failure over many years to fix quarantine holes that have led to multiple incursions into Queensland, a failure to accord this very high environmental threat the priority it warrants, a lacklustre and abandoned effort to eradicate them in Queensland, and limited implementation of a threat abatement plan. It is important to prevent further incursions as new genetic material (as a general principle) can greatly exacerbate invasive impacts by enhancing adaptive evolution of invasive species.[7] Given their potentially devastating impacts of YCA on biodiversity, there should also be a thorough national assessment



of the potential for eradication in the various outbreak sites. This also means that the gaps in quarantine allowing new incursions must be identified and addressed.

Pathway and risk analysis

We are not aware of any detailed pathway analysis or risk assessment for YCA incursions. The 2012 review of the tramp ant threat abatement plan by the environment department noted there had been no specific risk assessments for tramp ant species. This seems rather astonishing given the clearly high risks of YCAs (and other tramp ants) continuing to enter and establish, the risks of new genotypes exacerbating threats, and the millions of dollars spent so far on eradication and control. It should be a high priority to conduct species-specific risk assessments and pathway risk analyses to determine how best to prevent new incursions.

A decade ago, there was an analysis of tramp ant interceptions from 1986-2002 (by Market Access and Biodiversity, summarised in the background report for the tramp ant threat abatement plan).[8] This found that the introduction pressure of tramp ants seemed to be accelerating – 90% of interceptions had been recorded in the most recent five years.[9] Intercepted ants derived from diverse source areas but predominantly from neighbouring regions, and arrived by a diversity of pathways in association with a wide range of commodities. The summary did not contain information specific to YCA. We can find no specific mention of YCA or other tramp ants in the ICON database import requirements for timber imports.

New Zealand has developed risk assessments of eight high priority tramp ants.[10] The environment department in its review of the threat abatement plan noted that 'A similar set of assessments but framed for the Australian context could benefit Australia's preparedness.'[11]

Pre-border and border biosecurity

Given the high rate of ant interceptions in Australia, improving biosecurity practices in countries of origin should be a high priority. These interceptions probably represent 'the tip of the iceberg' of exotic ants arriving in Australia. The 2006 threat abatement plan for tramp ants noted a lack of focus on pre-border prevention: 'preborder checks for invasive ants are not yet required nor are high-risk commodities treated pre-emptively at their origin to assure elimination of tramp ants'.[12] The 2012 review of the threat abatement plan noted there had been 'limited off-shore work'.[13]

OUR MISSION

To protect the environment from harmful new invasive species through prevention and early action.

Stronger biosecurity is vital to protect the highly endemic wildlife of Australia and its many special wild places. This is Lord Howe Island, where invasive species have already caused several extinctions. Photo: Robert Whyte

The large number of YCA interceptions and incursions demonstrate major gaps in quarantine processes. The 2006 threat abatement plan notes that the 'system of detecting tramp ants at the border relies on external inspection of all cargo', which will 'detect a proportion of ant contamination, and relies on the presence of actively foraging ants on the container exterior'.[14] With a lack of dedicated surveillance programs for high risk pathways such as timber imports, there are likely to be several undetected incursions each year.

Surveillance

Due to the eradication program for red imported fire ants and electric ants, we presume there is improved surveillance more generally for tramps ants, which would also improve the capacity to detect YCAs. The 2012 review of the tramp ant threat abatement plan noted there had been a 'modest improvement' in national surveillance for tramp ants, in part due to 'some specific surveillance close to ongoing active eradication programs'.[15] The 2006 threat abatement plan for tramp ants noted that while state and territory governments had conducted surveillance for fire ants in high risk areas (eg. freight terminals and nurseries) there appeared to be 'no routine monitoring or surveillance' for tramp ants in other high-risk or high-value areas.[16]

We have been advised there has been no dedicated surveillance for YCAs, including in facilities that receive timber imports, which are high risk areas for YCAs. We understand a substantial proportion of YCA colonies have been detected in the vicinity of such facilities, many (or most) detected due to reports from the public rather than from surveillance. The threat abatement plan notes that 'shortfalls in current surveillance mechanisms for tramp ants are illustrated by chance discoveries of incursions, such as by members of the public'.17

One impediment noted in the review of the tramp ant threat abatement plan is the low and declining diagnostic capacity in most state and territory governments for invasive ants (and other invaders), due to a lack of taxonomists.[18] The diagnostic accuracy for ants – as revealed in the Pest and Disease Information System database (1986–2003) – is low, with only 25% of >6700 recorded ant interceptions recorded to species level.[19] There is also no national body charged with responsibility for collecting and analysing surveillance data on tramp ants. The role of the national Tramp Ant Consultative Committee has been downgraded to providing advice on the two national eradication programs. There is no focus on preventing further incursions and 'There is no longer routine reporting of surveillance data'.[20]

Small animals like this gecko face a cruel death in areas invaded by yellow crazy ants.

Responses to incursions

Since the first detection of YCA in Queensland in 2001, the species has been found in over 30 sites including at Cairns, Townsville, Hervey Bay, Maryborough, Caboolture and Brisbane.[21] In 2004 it was also detected for the first time in NSW. This is the only incursion known in NSW even though 40% of interceptions were occurring in NSW ports.[22]

In some respects, yellow crazy ants are ideal candidates for eradication because they do not spread as easily as other ants, since the queens mostly cannot fly (the colonies bud to become super-colonies). In 2004, the NSW government acted quickly to eradicate a population on Goodwood Island near Yamba. In the Northern Territory, yellow crazy ants have been eradicated from at least 20 locations over 100 hectares, showing there is high eradication potential of small populations.[23] Much is being learned about control of YCA due to control efforts on Christmas Island and in the Northern Territory.

Because yellow crazy ants were already established in the Northern Territory and on Christmas Island, eradication in Queensland was not eligible for national funding under cost-sharing arrangements with other governments. This meant eradication had to be funded by the state government. Because of this, the Queensland government was very slow to act, and the eradication program when it was implemented, was starved of funding. The government ended it in late 2012, saying that it was 'no longer feasible'. The Queensland government website on yellow crazy ants reports that 'known infested areas have increased since 2007' and that several had been discovered in the previous year (2012-2013), 'significantly increasing the total area of infestation'.[24] This is indicative either of continued breaches of biosecurity or a lack of effective surveillance (or both). Since the Queensland government abandoned eradication, the federal government provided $2 million to the Wet Tropics Management Authority to eradicate an outbreak near Cairns.

ISC questions the decision by the Queensland government to abandon eradication and is concerned that it is simply due to unwillingness to allocate resources. Most biosecurity funding in Queensland goes to agricultural priorities (dingoes, wild dogs and bovine johne's disease). Our most recent information was that an effective eradication program needed about a million dollars annually. We suspect the problem is one of priorities rather than feasibility or unaffordability. The work in the Northern Territory shows there is high eradication potential of small populations (such as are in Queensland).[25] There is no feasibility or cost-benefit analysis publicly available to justify the decision by the Queensland government.

A serious YCA eradication attempt in Queensland would require considerable improvements in quarantine to prevent new incursions. In December 2013, the Queensland government said one reason for abandoning the program is the high rate of incursions, which 'threatens the long term success of any eradication program.' From 2008-2013, there was an average of 8 interceptions a year, 57% in Queensland.[26]

From 1988 to 2011, there were 161 interceptions, an average of seven a year.[27] We suspect that only a small proportion of YCA arriving in Australia are intercepted.

The lacklustre eradication program for YCA in Queensland contrasts with those for the two nationally funded programs for red imported fire ants (RIFA) and electric ants, which are economic, social and environmental threats, and are not established elsewhere in Australia (albeit the RIFA program is still far from being adequately and securely resourced). National funding is restricted to species that can be totally eradicated from Australia. For a country of such vastness and ecosystem diversity, this is a short-sighted approach that means neglect for many incursions that are of national environmental significance.

Research

There has been limited research on YCA and other invasive ants in Australia.[29]

CHANGES NEEDED

Pathway and risk analysis

- Detailed pathway analysis and risk assessment for YCAs should be conducted and made readily publicly available, along with analysis of why there continues to be a high rate of YCA interceptions and incursions.

Pre-border and at-border biosecurity

- There should be a concerted effort to reduce YCA (and other tramp ant) incursions into Australia, based on the risk assessment and pathway analysis, and targeting high risk countries and cargo.

Surveillance

- A risk-based surveillance program for yellow crazy ants – as part of a broader invasive ant program - is needed. It would benefit from the inclusion of a citizen science focus and requires strengthening Australia's capacity to identify ant species.

Incursion responses

- Greater transparency and public accountability is needed in decision-making about YCA eradication. It is not known whether there has been any analysis by the Queensland government of the cost to eradicate all or some YCA populations, whether a feasibility assessment of eradication was developed, whether a cost-benefit analysis underpinned the decision to abandon eradication, or how much an effective eradication program may cost.
- There should be an assessment of all YCA populations to determine the feasibility for eradication, containment or control of each population.

Lessons learned

- There is a need for independent public analysis of biosecurity relevant to YCA to determine how future incursions of this and other tramp ant species can be prevented and the environmental threats they pose abated, and national coordination and funding for threat abatement improved.

MORE ABOUT YELLOW CRAZY ANTS

Yellow crazy ants demonstrate the power of numbers and the benefits of social cooperation. They are able to dominate large areas by forming super-colonies with multiple nests and multiple queens. The largest have up to 300 queens and extend over several hundred hectares. They spread mostly by budding. A mated queen leaves her birth nest with some workers and sets up a new nest nearby. The boundary of a super-colony can advance by 3 metres a day.

The adults eat nectar and honeydew and feed their brood on animals killed or scavenged. They don't sting but squirt formic acid, which blinds and debilitates their prey. Their great numbers allow them to overwhelm animals far exceeding them in size – crabs, lizards, bird chicks.

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

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

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

Yellow crazy ant impacts have varied, depending on their density and on the invaded ecosystem. The Queensland Government's risk assessment says the

impacts are hard to predict but are likely to result in "a general decline in biodiversity". They can cause damage by killing animals, monopolising resources and compromising tree health by farming sap-sucking bugs.

Robber, red and blue crabs are completely eliminated in crazy ant areas on Christmas Island. They kill small animals, including bird chicks, turtle hatchlings and lizards.

Crazy ants are highly aggressive to other ant species. Only two of 40 ants on Christmas Island are able to coexist with yellow crazy ants. In Hawaii, yellow crazy ants aggressively defend flowers from other nectar-eaters. Their large-scale removal of insects deprives other insect-eaters, such as lizards and birds, of food. Monopolisation was noted at a site near Cairns.

Yellow crazy ants farm sap-sucking bugs for their honeydew (excreted sugary liquid) and protect them from predators. The build-up in bugs and sugar encourages the growth of sooty mould, which can severely compromise tree health and is sometimes fatal.

Yellow crazy ants also cause agricultural damage. They have killed young chickens and pigs. They reduce yields of coffee, coconut and sugarcane crops by nesting at the base of these plants and exposing the roots to disease, and promote sooty mould disease in fruit trees. On one of the Seychelles islands, the abundance of a sap-sucking insect associated with sooty mould on citrus and cinnamon increased up to 100-fold in the presence of yellow crazy ants, and up to 90% of leaves were infected.

ABOUT OUR CASE STUDIES

Our case studies illustrate the need for changes in how Australia prevents the establishment of new invasive species. They were compiled using publicly available information at the time of the last update. We would welcome new information or updates to biosecurity response for inclusion in future updates.

CONTACT US

- Visit invasives.org.au for more information about the Invasive Species Council and to get in touch.

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ENDNOTES

1 http://www.ccfqld.com/News-page/update-from-biosecurity-qld-fire-ants-in-the-gladstone-area/

2 Allen et al. (2004), Department of the Environment

3 Lowe et al. (2000)

4 Allen et al. (2004)

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6 Allen et al. (2004), Vinson (2013)

7 Moloney & Vanderwoude (2002), Department of the Environment

8 Department of the Environment

9 Department of the Environment

10 Vinson (2013)

11 Vinson (2013)

12 Avant (2014), Lard et al. (2006)

13 Antony et al. 2009

14 Costs to 30 June 2014, Mike Ashton, personal communication. Hafi et al. (2014) said the costs were $411 million (but they don't give a source for it).

15 International Plant Protection Convention (2010). The 2001 detections were at Brisbane's main cargo port (Fisherman Islands), and in the southwestern suburbs of Wacol and Richlands.

16 Keith and Spring (2013)

17 Keith and Spring (2013)

18 Keith and Spring (2013b)

19 Keith et al. (2013)

20 Keith et al. (2013)

21 SCoPI (2013)

invasive species council