2. YELLOW CRAZY ANTS

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

Species: Yellow crazy ants (*Anoplolepis gracilipes*)

Photo: John Tann(creative commons licence

Origin: South-East Asia (probably)

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

Potential ecological impacts (more detail below):[22] Yellow crazy ants (YCA) can form large-scale supercolonies, extending over more than 100 hectares. On Christmas Island, they have killed tens of millions of the iconic and 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 a 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 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.[23] 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 economic impacts: YCA are likely to compromise 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 recent 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'.[24] The economic impacts also include the costs of control programs, which exceed $10 million in the past 5 years, including:[25] (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 $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: Predominantly timber imports. 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.[26] There is no publicly available up-to-date data on pathways for YCAs.

---

[22] O'Dowd et al. (2003), Merrin and O'Dowd (2004), Abbott (2005), Commonwealth of Australia (2006), Lach and Barker (2013), Hoffmann (2014).
[23] Merrin and O'Dowd 2004
[24] Bateman (2014)
[25] Department of Sustainability, Environment, Water, Population and Communities (2012)
[26] Commonwealth of Australia (2006)

BIOSECURITY FAILURES IN AUSTRALIA: 12 CASE STUDIES

Summary of biosecurity issues: Australia has failed both to prevent new incursions and to eradicate existing incursions. Since 2000, an average of >2 new outbreaks/year have been detected (>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).[27] 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.[28] Given their potentially devastating impacts on biodiversity, there should also be a thorough national assessment of the potential for eradication in the various outbreak sites. However, this requires that the gaps in quarantine allowing new incursions be identified and addressed.

Particular biosecurity issues

Prioritisation: YCA are recognised as a serious threat to biodiversity but there has been a limited focus on them at a national level despite a national threat abatement plan (for tramp ants in general). The limited focus for this primarily environmental threat contrasts with the concerted focus on red imported fire ants and electric ants. Although they were belatedly an eradication target in Queensland program funding was far too low and the job was never properly done. YCA are not mentioned as a risk for timber imports – in either general information pages or the ICON import database. (Those mentioned as a risk include mostly known risks for the forestry and horticultural industries.)

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 s 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).[29] This found that the introduction pressure of tramp ants seemed to be accelerating – 90% of interceptions had been recorded in the most recent 5 years.[30] 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.[31] 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.'[32]

Pre-border biosecurity: Given the high rate of ant interceptions in Australia, improving biosecurity practices in countries of origin should be a high priority. (Depending on the rate of quarantine inspections at the border, interceptions probably represent the 'tip of the iceberg' of exotic ants making it to 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

[27] Dominiak et al. (2011), Minister for Agriculture, Fisheries and Forestry (2013).
[28] Sakai et al. (2001). Thomas et al. (2010) found there have been probably at least two separate invasions on Christmas Island, the first between 1915 and 1934. It was not until the early 1990s that significant ecological damage was observed.
[29] Commonwealth of Australia (2006), page 36
[30] Some of the increase in interceptions would also be due to more rigorous quarantine.
[31] Lach and Barker (2013)
[32] Department of Sustainability, Environment, Water, Population and Communities (2012)

elimination of tramp ants'.[33] We are not aware of any improvement in this situation. The 2012 review of the threat abatement plan noted there had been 'limited off-shore work'.[34]

At border biosecurity: The large number of YCA interceptions and incursions show that quarantine processes have major gaps for ants. The average of 8 interceptions a year (in the past 5 years) and average of 2 outbreaks detected a year (since 2001) are likely to represent only a proportion of YCAs arriving in Australia. 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'.[35] With no dedicated surveillance programs for timber imports, there are likely to be several undetected incursions each year, and there would have been many incursions that failed to establish.

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'.[36] 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.[37] 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'.[38] 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.[39] 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.[40] 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'.[41]

Responses to incursions: Since the first detection of YCA in Queensland in 2001, it has been found in >30 sites including at Cairns, Townsville, Hervey Bay, Maryborough, Caboolture and Brisbane.[42] 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.[43]

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

[33] Commonwealth of Australia (2006)
[34] Department of Sustainability, Environment, Water, Population and Communities (2012) says 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'.
[35] Commonwealth of Australia (2006)
[36] Department of Sustainability, Environment, Water, Population and Communities (2012). The modest improvement was also due to improved surveillance generally for pests; a heightened profile and awareness of tramp ants and DAFF Biosecurity augmenting some state and territory government surveillance activities.
[37] Commonwealth of Australia (2006)
[38] Commonwealth of Australia (2006)
[39] Department of Sustainability, Environment, Water, Population and Communities (2012)
[40] Commonwealth of Australia (2006)
[41] Department of Sustainability, Environment, Water, Population and Communities (2012)
[42] Biosecurity Queensland (2013)
[43] Office of Environment & Heritage (2005)

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.[44] 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 that it 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'.[45] This is indicative either of continued breaches of biosecurity or a lack of effective surveillance (or both). As a result of the Queensland government abandoning eradication, the federal government has 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 johns disease). Our most recent information was that an 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).[46] There is no feasibility or cost-benefit analysis publicly available to justify the decision by the Queensland government.

However, a serious 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.[47] From 1988 to 2011, there were 161 interceptions, an average of 7 a year.[48] 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 and electric ants, which are economic, social and environmental threats, and not established elsewhere in Australia. 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.

Learning lessons: Despite the multiple incursions of YCA there have been no reviews of biosecurity arrangements that we are aware of and no serious attempt to stop incursions. The rates of interceptions and detections of outbreaks has increased in recent years, implying growing biosecurity gaps (and/or improved detection). Recent federal government funding of eradication in the Wet Tropics could be wasted unless there are improvements to biosecurity to prevent further incursions. There should be a public review of the lessons that should be learnt from the multiple breaches of biosecurity leading to establishment of YCA in Queensland.

Threat abatement: Effective management of tramp ant incursions in Australia requires a coordinated national approach such as envisioned under the 2006 threat abatement plan. Lach and Barker (2013) comment that 'to date it appears very little, if any, of [the plan] has been implemented'. There is no national coordinating body for threat abatement and no significant allocation of funds for YCA management.[49] Implementation of the

[44] CSIRO (2014)
[45] Biosecurity Queensland (2013)
[46] CSIRO (2014)
[47] Minister for Agriculture, Fisheries and Forestry (2013)
[48] Dominiak et al. (2011).
[49] The 2006 threat abatement plan for tramp ants says: 'The Department of the Environment and Heritage will convene a National Implementation Team to assist and advise on the implementation of the plan. The team

threat abatement plan would presumably have resulted in fewer YCA incursions and more effective responses. Lach and Barker note that:

> 'if some of the high priority or very high priority short-term Action Groups had been acted upon, such as Action 2.1 "Improve diagnostic capacity and service", Action 3.2 "Develop generic, specific, and context-dependent contingency plans" or Action 4.2 "Accelerate response to new detections of tramp ants" it is likely that the tramp ant incursions on Lord Howe Island and Norfolk Island and their threats would have been recognised earlier, and coordinated management could have commenced sooner and more efficiently.'

Research: There has been limited research on YCA and other invasive ants in Australia. [50]

Issues for the inquiry

Pathway and risk analysis

- Has there been any detailed pathway analysis or risk assessment for YCAs?
- Has there been analysis of why there continues to be a high rate of YCA interceptions and incursions? If so, has anything changed as a result?

Pre-border and at-border biosecurity

- What work has been conducted pre-border to try to reduce YCA incursions into Australia? What pre-border work is being done on any tramp ant species?
- Given the recorded rates of interceptions and detections of established populations, what is the likely rate of undetected incursions?
- What is considered medium to high risk cargo for YCA? What proportion is inspected and what proportion of inspections are likely to reveal YCA contamination (taking into account the difficulty of detection)?
- What is the risk to the current $2 million eradication effort in the Wet Tropics from new incursions?

Surveillance

- What proportion of YCA detections in the environment have been detected through biosecurity surveillance? How have others been detected?
- What surveillance programs are in place that are likely to detect YCAs? Are there any dedicated surveillance programs for YCA? What programs are in place for acknowledged high risk sites such as facilities that receive and store imported timber?
- What is the current capacity of governments to diagnose new ant incursions? How long does it take on average? What resources are needed to ensure optimal diagnostic capacity for ants?

Incursion responses:

- Has there been any analysis by the Queensland government of the cost to eradicate all or some populations?
- Was there a feasibility assessment of eradication?
- Was there a cost-benefit analysis underpinning the decision to abandon eradication?
- How much would eradication cost?
- Should there be a national assessment of all populations to determine the feasibility for eradication, containment or control?

---

will include people with expertise in the research and management of tramp ants. It will also include stakeholders such as state and territory agencies.' Initially, a National Tramp Ant Committee was set up with a fairly wide mandate but it has been replaced by the Tramp Ant Consultative Committee, which focuses primarily on 'emergency responses to tramp ant issues' (Department of the Environment website). The 2012 review of the threat abatement plan notes there is no national coordination on other tramp ant species. That review (conducted by the department rather than independent review) recommended the 2006 plan be maintained as is and supplemented by a threat abatement advice, a non-statutory document. 1.5 years since the environment minister agreed to this (19 Feb 2013), no such advice has been published.

[50] Lach and Thomas (2008)

Lessons learned

- Has there been any analysis of biosecurity relevant to YCA to determine how future incursions can be prevented and what lessons apply for other tramp ant species?

Threat abatement:

- How can YCA threat abatement be improved?
- Should there be national coordination and national funding for nationally significant threats such as YCA?

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 ants. 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. Monopolization 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.

References

BIOSECURITY FAILURES IN AUSTRALIA: 12 CASE STUDIES

Abbott K. 2005. Supercolonies of the invasive yellow crazy ant, Anoplolepis gracilipes, on an oceanic island: forager patterns, density and biomass. *Insectes Sociaux* 52: 266–273.

Bateman D. June 28, 2014. Trail of devastation as Cairns region declares war on yellow crazy ants. Cairns Post. http://tinyurl.com/q2sox4m

Biosecurity Queensland. 2013. Biosecurity Queensland response to Background Briefing's questions, Yellow Crazy Ants. ABC Radio National. (www.abc.net.au%2Fradionational%2Flinkableblob%2F5146684%2Fdata%2Fbiosecurity-queensland-response-data.pdf). Program aired 8 December 2013.

Commonwealth of Australia. 2006. Background document for the threat abatement plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories, Department of the Environment and Heritage, Canberra.

CSIRO. 2014. Eradicating pest ants from the Top End (http://www.csiro.au/Outcomes/Safeguarding-Australia/TropicalPestAnts.aspx)
Csurhes S, Hankamer C. 2012. Pest animal risk assessment: Yellow crazy ant Anoplolepis gracilipes. Biosecurity Queensland, Queensland Government.

Department of Sustainability, Environment, Water, Population and Communities. 2012. Review of the Threat Abatement Plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories 2006–2011. Australian government.

Dominiak B, Gott K, McIver D, et al. 2011. Scenario tree risk analysis of zero detections and the eradication of yellow crazy ant (Anoplolepis gracilipes (Smith)), in New South Wales, Australia. Plant Protection Quarterly 26(4): 124-30.

Drescher J, Feldhaar H, Blüthgen N. 2011. Interspecific aggression and resource monopolization of the invasive ant Anoplolepis gracilipes in Malaysian Borneo. Biotropica 43(1): 93-99.

Hoffman B. 2014. Quantification of supercolonial traits in the yellow crazy ant, Anoplolepis gracilipes. *Journal of Insect Science* 14: Article 25

Minister for Agriculture, Fisheries and Forestry. 2013. Senate Question No 2671. Question upon notice 14 January 2013.

O'Dowd D, Green P, Lake P. 2003. Invasional "meltdown" on an oceanic island. Ecology Letters 6: 812–817.

Office of Environment & Heritage. 2005. Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW – profile. NSW Government. (http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20010)

Sakai A, Allendorf F, Holt J, et al. 2001. The population biology of invasive species. Annu Rev Ecol Syst 32:305–332.