



GOANNAS

beyond the toad

It has been 17 years since the impending cane toad advance was declared a risk to Western Australia's biological values and 12 years since the poisonous species crossed the border into WA. Strategies and activities continue to be adapted as new research provides insights into how to minimise the impacts on native wildlife, including apex predators like goannas.

**by Clare Forward, Dian Fogarty,
Corrin Everitt and Dr Georgia Ward-Fear**



When poisonous introduced cane toads (*Rhinella marina*) crossed the Western Australian border in 2009 (see 'United effort on cane toad front', *LANDSCOPE*, Winter 2009), the focus for government and community was assessing what damage the toads had the potential to cause to wildlife in the Kimberley, as well as community education, surveillance and quarantine.

Over the years, independent research programs undertaken by the Department of Biodiversity, Conservation and Attractions (DBCA) Biodiversity and Conservation Science principal research scientist David Pearson have been complemented by significant contributions from universities and Indigenous science. This collaborative research has informed the adaptive management of cane toads. WA's cane toad strategy was released in 2009 to guide these actions.

Twelve years later, collaborative research continues to provide insights that inform government and community groups about how best to minimise the impacts on native species, in particular apex predators.

Arguably one of the most effective strategies over the past 12 years to reduce the impacts on native species is conditioned taste aversion. The strategy involves exposing native animals to a small amount of cane toad meat, enough to make them sick but not be fatal, in order for the animal to associate the taste and



smell of cane toads with sickness and avoid them in future.

FOCUSING ON GOANNAS

DBCA and Macquarie University have partnered for an Australian Research Council (ARC) grant focusing on taste aversion programs for wildlife that are particularly vulnerable to being poisoned by cane toads. This ARC linkage project has been focused on northern quolls (see 'Quolls on country', *LANDSCOPE*, Autumn 2017) and goannas. Goannas are an apex predator and an important component of a healthy ecosystem.

Maintaining healthy populations of native predators in the ecosystem keeps things in balance. When a novel predator is added (e.g., feral cats or foxes) or a native predator is removed (e.g., goannas or northern quoll) the disruption can be significant.

Take the yellow-spotted goanna (*Varanus panoptes*), for example. Through predation, these goannas keep meso (middle)-predators in check, such as medium-sized snakes and even feral cats. But when goannas decline, these meso-predators breed up and exert enormous predation pressure on small birds, mammals and lizards, causing declines in these species. Furthermore, other native predators, such as large pythons, suddenly have substantially less prey available to them.

Research has been focused on minimising the impacts of cane toads on yellow-spotted goannas and maintaining ecosystem balance in the savannah grasslands of northern WA.

The Cane Toad Coalition is a strategic partnership between DBCA, conservation organisations, Indigenous organisations and cultural groups, and regional NRM groups. It was established in 2017 by

Macca

'Macca', a wild goanna from the floodplains of the Kimberley, had his first taste aversion trial with a small toad. This was the first time he had seen one, so he gobbled it down. A month later, Macca approached the trial boxes. He investigated the small toad extensively but recognised it by sight and smell, then left it alone. Macca survived in toad-infested areas until the end of the study (three years later).



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Main Yellow-spotted goanna (*Varanus panoptes*).

Photo – Jiri Lochman

Inset Cane toads have a distinctive m-shaped ridge over their nose.

Photo – Ken Griffiths/Alamy

Above King George River, Kimberley.

Photo – Tourism WA

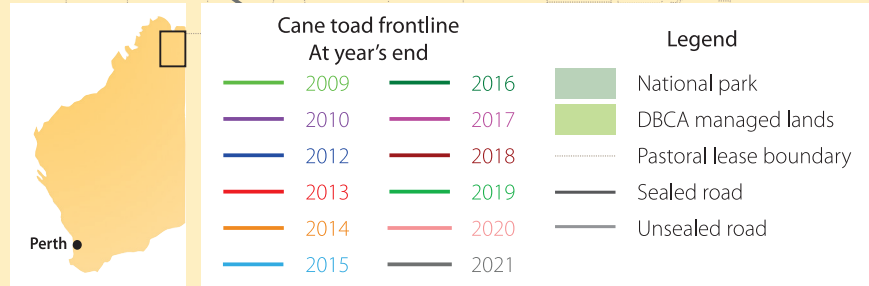
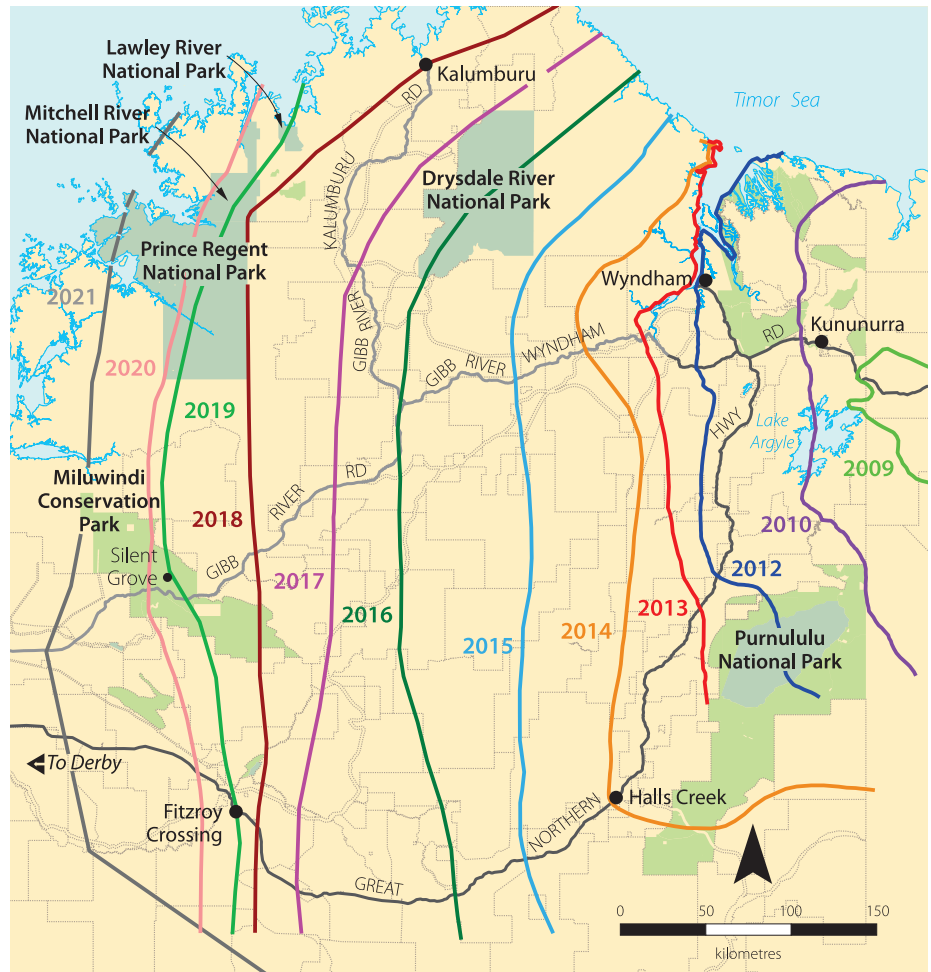
Left 'Macca', a wild goanna.

Photo – Dr Georgia Ward-Fear

Cane toads in WA

Cane toads (*Rhinella marina*), native to south and central America, were deliberately introduced into Australia in the 1930s to control sugar cane beetles in North Queensland cane plantations. Since their introduction, cane toads have spread, both naturally and with human assistance, through Queensland, the Northern Territory and into New South Wales and WA. The toads are poisonous to native wildlife and indirectly impact natural predator-prey relationships.

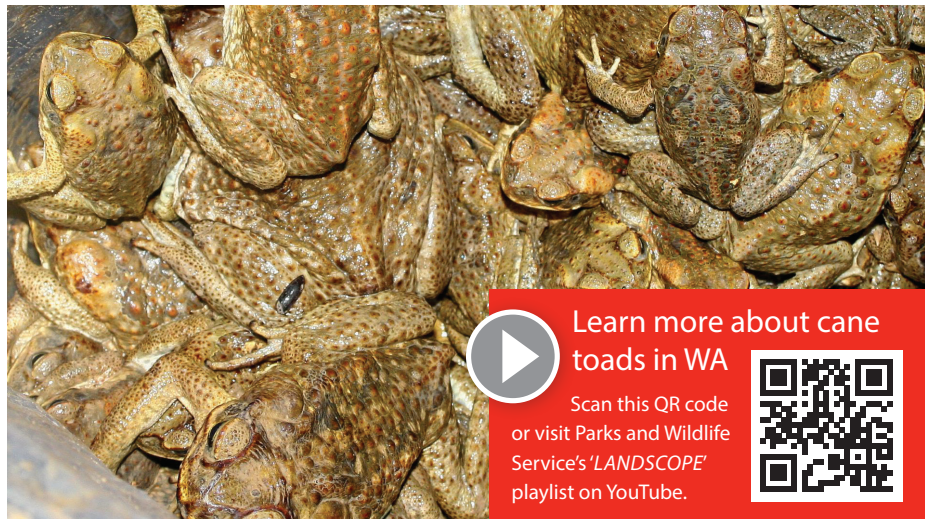
In 2004, when the WA State Government and community realised the risk to the State's biological assets from the impending cane toad advance, significant resources were put to efforts to try to stop cane toads from entering the State. Despite these efforts, cane toads crossed the WA border in 2009.



Top Cane toads were introduced to control cane beetles.
Photo – DBCA

Above Goannas are being taught to avoid cane toads.
Photo – Dr Georgia Ward-Fear

Right Cane toads are collected by the community.
Photo – DBCA



Learn more about cane toads in WA

Scan this QR code or visit Parks and Wildlife Service's 'LANDSCOPE' playlist on YouTube.





Left Dr Georgia Ward-Fear working collaboratively with Aboriginal rangers.

Above Rangers checking traps on country. Photos – DBCA

Inset left Northern quoll (*Dasyurus hallucatus*). Photo – Jiri Lochman

Inset below left Conditioned taste aversion (CTA) sausages. Photo – DBCA

Major successes from the Cane toad strategy 2014–2019

- Conditioned taste aversion (CTA) training of northern quolls using CTA sausages (see 'Tackling toads', *LANDSCOPE*, Winter 2014). CTA occurs when an animal associates the smell and taste of an animal (cane toad) with sickness. The process involves making sausage baits from cane toad meat and adding a nausea-inducing chemical to invoke a negative reaction when eaten.
- Pheromones extracted from cane toad toxin have been used to cause cane toad tadpoles to congregate in traps or disrupt cane toad tadpole metamorphosis. Research trials of both techniques were carried out in and around Kununurra and helped to inform decisions about effective strategies to manage cane toads in high priority areas.
- Monitoring the long-term impact of toads on the fauna of Adolphus Island, including one of the last remaining populations of northern quolls in the east Kimberley. Cane toads arrived on the island in 2014. DBCA has been monitoring quolls and susceptible reptile species to determine long-term survival of these species in the presence of cane toads. This information will help predict the impact and survival of cane toads on other Kimberley islands and inform management options.
- Toad drop-off boxes were installed in numerous locations in the Kimberley to aid community toad-mustering and provided an important source of cane toad meat for CTA baits.
- Large community toad musters have been organised (see 'Travelling toad show', *LANDSCOPE*, Winter 2020), engaging the help of local community organisations, Indigenous ranger groups and individuals across the Kimberley to collect thousands of cane toads required for CTA bait production.
- DBCA in collaboration with Rangelands NRM, Balangarra Aboriginal Corporation and researchers at the University of Sydney and Macquarie University have progressed a range of actions funded through the National Landcare program. This included the development of a ranger handbook, continuation of the goanna teacher-toad research, freshwater crocodile monitoring at Windjana and Dimalurra (Tunnel Creek) and the delivery of the monitoring program on Adolphus Island.



Dr Georgia Ward-Fear, a conservation scientist, reptile biologist and research fellow with Macquarie University.

"The cane toad invasion is a huge threat to apex predators, ecosystem stability and cultural practices across northern Australia," Dr Ward-Fear said.

One strategy to mitigate the impact on goannas involves releasing small cane toads in trial boxes into the wild just before the cane toad frontline. The hope is the goannas first eat a small cane toad that makes them sick but is not fatal, and the goanna will develop an aversion before encountering a large toad.

INDIGENOUS KNOWLEDGE

Critical to success has been the integration of western science with Indigenous knowledge, sharing of Aboriginal rangers' skills, knowledge of where to find goannas, how to catch or monitor them and knowing the best seasons and areas to work on their country.

Yellow-spotted goannas are an important food source for Indigenous

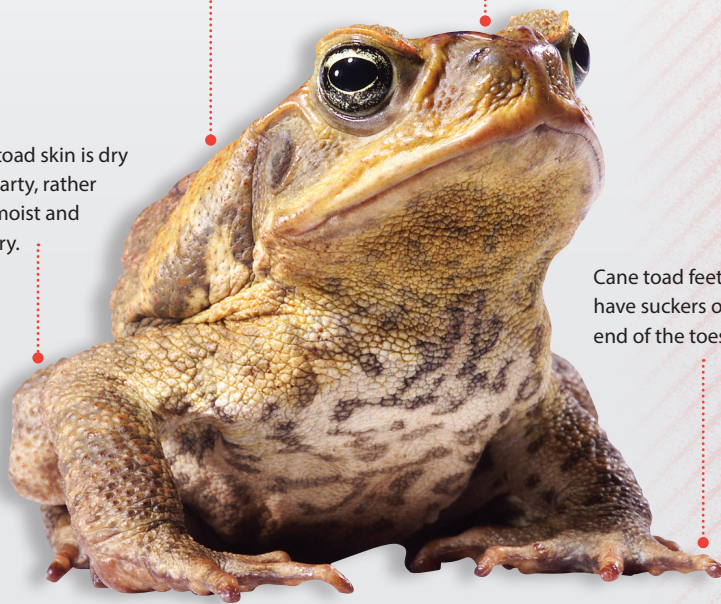
How to spot a toad

The big glands on the cane toad's shoulder release a poisonous milky substance when the toad feels threatened.

Cane toads have a very distinctive bony 'm'-shaped ridge over their nose.

Cane toad skin is dry and warty, rather than moist and slippery.

Cane toad feet don't have suckers on the end of the toes.



Adult cane toads are heavily built, and average between 100–150mm in length.

Does the toad have:



'M-shaped' bony ridge between its eyes?

Yes No



Dry warty skin?

Yes No



Poison glands on its shoulders (behind its round ears)?

Yes No

If you have ticked 'yes' to all the boxes you may have found a toad.

Send a photo to DBCA on 0400 693 807 or email canetoads@dbca.wa.gov.au for further advice.

peoples of Northern Australia (an unofficial geographical area that includes northern parts of Queensland and Western Australia as well as the Northern Territory) and so the protection of their populations is important culturally as well as ecologically.

Balangarra rangers in WA were integral to initial landscape trials and subsequent research work has been done in collaboration with Bunuba, Nyikina Mangala, Yawuru, Uunguu and Wungurr ranger groups on country through Rangelands NRM funding and the ARC linkage grant.

"Aboriginal rangers bring skill sets, knowledge and background to the research program that has been pivotal to its success," Dr Ward-Fear said.

So far, the work is looking positive with goanna populations showing good resilience to the constantly advancing cane toad front line.

WHAT'S NEXT

"Taste aversion is innovative, capitalising on behavioural mechanisms already possessed by the native animals

themselves. It's exciting!" Dr Ward-Fear said.

The findings and success of taste aversion research have led to a landscape-scale mitigation strategy being delivered to areas of high biodiversity ahead of the invasion frontline in the Kimberley for species including large goannas, northern quolls and freshwater crocodiles.

The DBCA invasive animals program continues to be adapted and refocused as new research is published, recently releasing the new *Cane toad strategy for*

Western Australia 2021-2026, which is the most comprehensive strategy for cane toad management in Australia.

Above It can be really hard to tell the difference between frog and toad eggs, tadpoles and metamorphs (babies). Before you euthanase any animals, check with DBCA to make sure it is a cane toad.

Below Community toad mustering. Photos – DBCA

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