



Photo: Mr David Nelson

## BACKGROUND

The impacts of the cane toad are listed as a key threatening process under the EPBC Act. This means that cane toads are identified as threatening or potentially threatening the survival, abundance or evolutionary development of native species or ecological communities. The Australian Government is acting to understand and manage these impacts on our biodiversity.

This document outlines what we know about cane toads, what's currently being done and what we can do about protecting our vulnerable wildlife, in all its diversity, from the future impacts of this toxic pest.

### What is a cane toad?

Cane toads are large, robust amphibians which are native to Central and South America. They are extremely hardy animals and voracious predators of insects and other small prey. These are the qualities that led to their introduction to Australia as a means of controlling pest beetles in the sugar cane industry in 1935, before the use of agricultural chemicals became widespread.

### Why is the cane toad a threat?

Cane toads have an impressive array of highly toxic chemical defenses available to them at almost all stages of their lives. The toxins occur in their skin and organs and can be secreted by large glands at the back of the animal's head when it is threatened. As a result, toads will poison many predators that attempt to eat them.

Much anecdotal and some documented evidence exists around cane toad impacts on native predators, including quolls, snakes, goannas and freshwater crocodiles, all of which may be lethally poisoned when they attempt to eat toads. Although some may recover, many individual predators die when they are first exposed to cane toads and population scale impacts soon become apparent. Uncertainty exists as to the degree of recovery of populations of native species that attempt to eat cane toads and are affected by the toad toxins. There is anecdotal evidence that as cane toad infestations persist and become established, some populations of native species begin to recover. Recent research has demonstrated that individual native planigales (relatives of the quoll) will learn to avoid toads if they recover from their first experience of the cane toad toxin (Webb et al 2008). Research also suggests that populations of black snakes have undergone rapid evolutionary adaptations in behaviour and physiology in response to the presence of cane toads (Phillips and Shine 2004 and 2006)

For some species (most notably the quoll) it appears that recovery is at best limited. For example, populations of northern quoll were under stress from other factors, but with the arrival of cane toads in the Northern Territory and subsequent rapid population declines, they have been recognised under federal legislation as Endangered and under Northern Territory legislation as Critically Endangered.

There have been concerns raised as to the impact cane toads may have on other native frogs or small predators competing for the same resources as the toads. Current research is showing that for populations of frogs in the Top End of the Northern Territory at least there has been minor competition impact on frogs as a result of cane toads (Greenlees 2007). The long term impact of the cane toad on invertebrates (their main source of food) has not yet been examined in detail, although one study has shown a short term impact on the diversity and abundance of beetles with the arrival of cane toads (Caitling et al 1999).

As they colonise areas of human habitation, toads can be of frequent nuisance value and health concern to residents. The risk of children or pets being poisoned from contact with the toads is an important consideration.

For Aboriginal people using traditional food sources, the impact of toads on some of the native predator species used as bush tucker (such as goannas) is also of concern.

Cane toads can produce large numbers of offspring and are colonising northern Australia at an increasingly rapid pace. Research from the University of Sydney indicates that they also appear to be evolving adaptations to suit their new environment, enabling the colonising toads to move more quickly.

### Cane toads as a national responsibility

Cane toads are a national problem. Since their release, cane toads have dispersed across northern and eastern Queensland, the Top End of the Northern Territory and their arrival in northern WA is imminent. They are also present in northern NSW and their dispersal along flooded creek lines in the arid south west of Queensland has raised concern that the toads will eventually spread to South Australia via river systems such as the Cooper.

In April 2005, the biological effects, including lethal toxic ingestion, caused by cane toads were listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The reasoning for this was that the northern quoll could become further threatened as a result of the cane toad. Also, the ornamental snake and green and golden bell frog were identified threatened species likely to be adversely affected by the arrival of cane toads.

The Australian Government has committed to developing a national cane toad plan under the *Environment Protection and Biodiversity Conservation Act 1999* to control the spread of cane toads. The national cane plan will be backed up by a \$2 million innovation fund to develop management and eradication solutions for the cane toad menace.

#### *Research with a national focus*

CSIRO has conducted research relating to broad scale biological control of cane toads. Searches were undertaken in the toad's native (South American) range for species specific



pathogens and when this produced no control agent, research began into a self disseminating genetically modified virus to act as a broad scale biological control. This work was discontinued due to technical hurdles and the prospect of limited support for the release of a genetically engineered virus if the project was successful.

Various research projects have been carried out by CSIRO, state governments and universities to examine the impacts of toads on native species, but a better understanding of the long term implications for Australia's biodiversity is needed.

Future research will be subject to comprehensive technical assessments by a scientific panel.

#### *Management of Australian Government controlled lands*

Cane toads have an impact on Australian Government controlled lands, including Kakadu National Park, several World Heritage Areas and Indigenous Protected Areas. Impacts on other areas of land managed by the Australian Government are likely in the future. Actions on these areas could provide case studies for improving biodiversity through measures to exclude or lessen the impact of toads.

#### *The cane toad advisory group*

The cane toad advisory group is comprised of government representatives from the affected states and the Northern Territory as well as the Australian Government and the Invasive Animals Cooperative Research Centre. The cane toad advisory group falls under the Vertebrate Pests Committee and is guided by the Australian Pest Animal Strategy. This group provides a means for monitoring the spread of cane toads, and provides access to expert advice.

#### *States and the Northern Territory*

The affected states and the Northern Territory have funded research on monitoring impacts of toads and understanding the toad's vulnerabilities. They have also taken a role in coordinating community action such as trapping and manual removal of cane toads and in coordinating public information on options for dealing with toads. Importantly, the states and Northern Territory have also played a role educating members of the public involved in community programs, on the importance of distinguishing toads from native frogs. Local governments are also frequently involved in community cane toad removal projects, particularly in urban environments, where residents are concerned at the risk posed to children and pets. Industry has become involved, developing and supplying traps and toxins suitable for use in domestic or local situations.

### **Strategy for the future**

With no solutions possible on the vast scale of the cane toad infestation, the objective of eradication (except locally) is not practicable.

Focussing on positive biodiversity outcomes through decreasing the impact of toads and containing their spread offers the best strategy for the future.

Recent research has documented the ability of some native species to adjust their behaviour and avoid interactions with cane toads if they can survive their initial exposure to toad toxins. This has provided a promising lead for researchers looking at ways of avoiding the dramatic impacts of the arrival of "frontline toads" on native predators such as the quoll.

Preventing cane toads from arriving on toad free islands will be an important feature of future cane toad effort. Additionally, protecting discrete areas of high biodiversity value, using the best available trapping and exclusion techniques, is important.

### **Australian Government Actions**

#### *a) Specific actions*

A national cane toad plan will provide for the research, management and other actions necessary to reduce the key threatening process (i.e. biological effects, including lethal toxic ingestion, caused by cane toads) 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.

#### *b) Funded research*

There are alternative approaches to cane toad control that could be developed to provide opportunity for more effective local and/or possibly broader-scale reduction of cane toad impact.

The following approaches are those suggested by a panel reviewing CSIRO's research into a genetically modified, self disseminating virus. The panel identified these areas as considerations for future research investment, subject to more comprehensive technical assessments through a scientific panel facilitated by the Invasive Animals CRC:

- i) A cane toad-specific lungworm parasite (identified as present in Australian toads) and cane toad alarm pheromone.
- ii) The bioprospecting approach to search for additional pathogens.
- iii) Designing a cane toad-specific poison based on knowledge of the cane toad-specific ion channel.
- iv) The "daughterless male" approach for closed island populations.

The review of CSIRO's cane toad research is available at: <http://www.environment.gov.au/biodiversity/invasive/publications/cane-toad/2008.html>

The biodiversity impacts of cane toads on our unique Australian wildlife are complex and not yet fully clearly understood. As a result, studies are required to clarify the severity of cane toad impacts on native predators and ascertain ecosystem level impacts of cane toads.



## Community action on cane toads

### a) Manual removal / exclusion

To date, community projects involving manual removal and exclusion of cane toads have been coordinated through the affected states, the Northern Territory and local governments. The Australian Government has delivered funding to some of these groups and is continuing this through the Caring for our Country initiative. Independent assessment of these projects has shown no evidence that the spread of the toads has been slowed in the WA/NT border region. Successful local eradication has however been reported from Port Macquarie NSW, where conditions are more marginal for the species.

Community group involvement in small scale exclusion fencing of areas of high priority biodiversity, or in quarantine actions to prevent inadvertent movement of toads, may be a more appropriate use of time and resources in areas where environmental conditions for toads are optimal. Focus on manual removal in areas where environmental conditions for toads are marginal offers better opportunity for positive biodiversity outcomes from this method.

### b) Information dissemination

With community interest in cane toads at very high levels, production of quality information relating to the impact of the species, the local and broader scale options for reducing cane toad impacts and the role that individuals and communities are capable of playing, is very important. Additionally, education on identification of local native frog fauna and the potential for spread of amphibian disease in toad removal projects, if appropriate hygiene regimes are not followed, needs to be highlighted. State and territory governments and community groups have worked together very effectively on producing and disseminating this information.

## Future coordination on cane toads

Coordination of effort on cane toads (including research, monitoring and education) could be directed through a technical group such as the Invasive Animals CRC. This would enable efficient gathering and dissemination of information, together with the technical expertise to independently assess research and monitoring options and requirements.

## Conclusion

Research can help us understand the real biodiversity impacts of cane toads and will potentially lead to innovative methods to manage these impacts. As we learn more about the biology of the cane toad in Australia we will better understand the species' vulnerabilities and be better placed to target local containment or eradication campaigns. Research can also help us identify areas where appropriate exclusion or quarantine measures will protect important areas of biodiversity that are particularly under threat.

## References

Key Threatening Process document: "The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*)", 12 April 2005

**Alford, R. A., G. P. Brown, L. Schwarzkopf, B. Phillips, and R. Shine. 2008.** Comparisons through time and space suggest rapid evolution of dispersal behaviour in an invasive species. *Wildlife Research*: in press.

**Catling, P. C, Hertog A, Burt R. J., Wombey, J. C and Forrester, R. I.**

In *Wildlife Research*, 1999, **26**, 161-185

**The short-term effect of cane toads (*Bufo marinus*) on native fauna in the Gulf Country of the Northern Territory**

**Greenlees, M. J., G. P. Brown, J. K. Webb, B. L. Phillips, and R. Shine. 2007.** Do invasive cane toads (*Chaunus marinus*) compete with Australian frogs (*Cyclorana australis*)?

In *Austral Ecology*

**Volume 32:900-907.**

**Phillips, Ben L. and Shine, Richard, 2004**

Adapting to an invasive species: Toxic cane toads induce morphological change in Australian snakes

In *Proceedings of the National Academy of Sciences*

December 7, 2004 vol. 101 no. 49 17150-17155

**Phillips, Ben L. and Shine, Richard 2006**

School of Biological Sciences A08, University of Sydney, NSW 2006, Australia

**An invasive species induces rapid adaptive change in a native predator: cane toads and black snakes in Australia**

In *Proceedings B of the Royal Society*

Volume 273, Number 1593 / June 22, 2006 1545-1550

**Webb, Jonathan K, Brown Gregory P, Child Travis, Greenless, Matthew J., Phillips, Benjamin L. and Shine, Richard**

In *Austral Ecology*

Volume 33, Issue 7, Date: November 2008, Pages: 821-829

**A native dasyurid predator (common planigale, *Planigale maculata*) rapidly learns to avoid a toxic invader**