**The Pilbara Line: paving the way forward**

Reid Tingley, Ben Phillips and Darren Southwell

The University of Melbourne, Parkville, VIC 3010

[reid.tingley@unimelb.edu.au](mailto:reid.tingley@unimelb.edu.au); [phillipsb@unimelb.edu.au](mailto:phillipsb@unimelb.edu.au)

**Background**

Eradication is currently not an option for cane toads in Australia, and thus the most powerful tool for minimising toad impact is to contain spread. Numerous studies have shown that cane toad populations in arid landscapes rely critically on artificial watering points (AWPs), such as farm dams, for hydration and breeding (Florance *et al.*, 2011; Tingley & Shine, 2011; Tingley *et al.*, 2013; Letnic *et al.*, 2014; Feit *et al.*, 2015; Southwell *et al.*, 2016). Thus, excluding toads from a large number of AWPs in an area ahead of the invasion front could potentially contain their spread. Several studies have highlighted a promising area for such a strategy, between the Kimberley and the Pilbara in Western Australia (Florance *et al.*, 2011; Tingley *et al.*, 2013; Southwell *et al.*, 2016). Here the Great Sandy Desert meets the coast, creating a chokepoint with very few natural perennial waterbodies. Simulation modelling of cane toad spread along this arid corridor suggests that the invasion front could be halted there by a waterless barrier ~80 km wide, for a total cost of ~$4.5 M (Southwell *et al.*, 2016). The benefit of such an action would be that we keep cane toads out of the Pilbara – an area with extremely high endemism – and 268,000km2 of the toads’ potential range (Tingley *et al.*, 2013).

The current proposal is to fit all AWPs with leak-free tank and trough systems, with troughs that are inaccessible to toads (Southwell *et al.*, 2016). This infrastructure could then be monitored by pastoralists (as part of their normal farm activities), and any leaks repaired as a conservation cost. Thus, we can engineer mutual benefit for both pastoralists and conservationists. This ‘Pilbara Line’ represents an astonishingly cost-effective strategy to reduce the toads’ impact and secure many of the last populations of toad-impacted predators, such as yellow-spotted monitors *Varanus panoptes* and northern quolls *Dasyurus hallucatus*. The window of time to execute this strategy is, however, rapidly closing.

The science underpinning the waterless barrier idea is extensive (Florance *et al.*, 2011; Tingley *et al.*, 2013; Letnic *et al.*, 2014; Feit *et al.*, 2015; Southwell *et al.*, 2016). However, DPaW has expressed concerns regarding the feasibility of this strategy on a number of occasions. Below, we respond to the most common concerns that have been brought forth, in the hopes of moving the conversation forward.

**Issue 1: Wet season cyclones create opportunities for rafting**

No streams – read JAE paper for argument

**Issue 2: Surface water persists through the dry season**

Spoke to farmers

**Issue 3: Toads can persist at locations other than artificial watering points**

Goanna burrows, cow pats, etc. Emily’s work.

**Issue 4: Not all natural waterbodies in the corridor have been accounted for**

Spoke with people. Would want to further ground-truth final location

**Issue 5: Human-assisted dispersal could transport toads across the barrier**

The Pilbara Line could be breached by a single colonisation event comprising a male and female toad. Nonetheless, establishment events driven by accidental human introduction on the mainland seem rare (Lever, 2001). Indeed, there are possibly billions of toads on the continent, and huge flows of traffic along the eastern seaboard where toads have been present for > 85 years, yet there have been only three non-intentional successful colonisation events recorded ahead of the mainland invasion front. All of these have been at the southern front in New South Wales (one to Port Macquarie; one to Yamba; and one to Sydney; although smaller-scale introductions have occurred near Yamba; M. Greenlees, unpubl. data). This low frequency of successful colonisation events occurs despite a large number of individual toads being accidentally transported (White & Shine, 2009). Such transportation events typically involve only a single animal (and so cannot establish a population); where they do involve multiple animals, the natural tendency of toads to segregate by sex (Zug & Zug, 1979; González-Bernal *et al.*, 2015) means that these multiple animals are quite likely to be all the same sex.

Any containment strategy requires vigilant monitoring and a plan for rapid eradication if a small population is detected. Upon detection, tools for local population reduction and eradication (see Tingley et al., in review) can be brought into play, but successful eradication is more likely if an incursion is detected early.

**Issue 6: Diversification will reduce the feasibility of a waterless barrier**

There is some uncertainty around the future of water use in the area of The Pilbara Line, with a government-subsidised push to increase the use of groundwater in the area for cropping; a move that would make the Pilbara Line substantially more expensive to implement.

**Issue 7: Toads could persist at cattle troughs**

Need to design an effective tank and trough system

**Conclusion**

The waterless barrier idea is very well developed: it needs an endowed trust fund to finance it; and a small amount of research to design an effective tank and trough system.

**Wonder if it is worth a little more appeal at the end: there will always be uncertainties, but if we do nothing it is certain that toads will colonise the pilbara.**

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