

Publication

Cane Toad Wars by Rick Shine (2018), 288 pp., University of California Press, Oakland, USA. ISBN 9780520295100 (hbk), USD 34.95, GBP 27.00.

The first time I saw a cane toad it was under an outside light gobbling up moths. At least it was in Costa Rica, where it was supposed to be, not in Australia where it wasn't supposed to be. Cane toads came to Australia by boat, in 1935, transported by Reg Montgomery with the express purpose of saving the Australian sugar cane industry from a scourge of beetles—a failed effort. The creatures are native to Latin America but have been moved in other failed attempts to control crop pests.

Cane toads are big, with the largest weighing 2.8 kg. But it is not their size that gave cane toads the ability to take over so much of north-eastern and northern Australia. Individual toads can move 50 km in a year! They benefit from human infrastructure, travelling along roads, breeding in cattle ponds and eating insects attracted to outside lights. Females can lay up to 40,000 eggs in one clutch, in every body of water they find. And there is the poison from their skin glands. Cane toads exude bufotoxins capable of killing predators. It is this ability to kill snakes, carnivorous marsupials, and even crocodiles that has Australians most concerned about cane toads. In many sites across tropical Australia more than 90% of top predators died of poisoning within months of cane toads arriving in the area.

Cane Toad Wars embraces military metaphors, describing itself in the very first sentence as telling a '... story of warfare, at several levels and among several combatants' (p. 1). But the book is not really about warfare—even though it is full of martial language—it is a book about science and its power to help us clean up some of the messes we've created. This is a delightful book full of science, management, Australian humour, and a tremendous amount of information about cane toads. And in the end it is optimistic!

Rick Shine, the author, was already a world authority on reptiles when he turned his attention to the ecological impacts of the cane toad, which was advancing on his long-term study area at Fogg Dam on the Adelaide River floodplain, 60 km from Darwin in the Australian tropics. Shine assembled a shifting group of colleagues and students, whose eccentricities and skills he fondly describes—the aptly named Team Bufo—to examine the anticipated ecological impacts of the toad's arrival.

Brilliantly, they did this ahead of the impacts, so they had good baseline data.

The book describes the evolutionary history of cane toads, their biology, global travels thanks to the sugarcane industry, and their arrival in Australia. The author shares his fondness for Australian reptiles and the adventures of studying them at Fogg Dam, along with the growing anxiety about what cane toads would do to the local ecology. Inevitably, they arrived, and Team Bufo's research on behavioral and ecological impacts is told with a light touch. Some of the questions they wanted to answer required work in other places already, or not yet, impacted by the toads.

Team Bufo discovered many interesting things about cane toads, including a new mechanism of evolution—spatial sorting—which was driving the ever expanding wave of cane toads: the fast-moving individuals mating with other fast-moving individuals, creating tadpoles that also wanted to move fast when they grew up. The breadth of the studies undertaken by Team Bufo allowed them to recognize important changes in response to the invading toads, one of which was the two ways that native animals were fighting back. First is the well-understood conditioned taste aversion: a dose of toad poison that doesn't kill you makes you avoid future toads. Second is an evolutionary response whereby the offspring of those predators that survived encounters with toads were less likely to eat toads, more resistant to the venom, and even—in the case of red-bellied black snakes—had smaller heads, making it more difficult to eat the more toxic bigger toads.

Not content just to do science, Team Bufo entered the management realm. Shine deals at length with the Australian public's response to cane toads, some of which you may have seen in Youtube videos featuring creative (and mostly inhumane) ways of disposing of these invasive animals. The public response of organizing to capture and kill adult toads, although popular, was not effective. What Shine learned was that cane toads were 'a lightning rod for public passions about conservation' (p. 145), a fact that scientists around the globe have discovered when addressing invasive species management.

This brought Shine and his team into the public eye, in particular having to deal with organized groups called toad busters. Team Bufo's efforts also put them in the grip of journalists and politicians, and Shine details his experiences dealing with the unexpected,

expected, but always fervently-held opinions of all parties. These experiences also taught him that the public and its representatives do not always want the science that scientists have produced, instead there is something called 'toad politics' (p. 154) constraining or preventing the application of good management science. Furthermore, with remarkable self-awareness, he found that his scientific common sense often led him to erroneous conclusions about cane toad impacts on the biology of the systems he had spent so long studying.

The last substantive part of the book addresses Team Bufo's efforts to use their science to develop cane toad control measures. Firstly, research on tadpole ecology revealed a cocktail of chemicals, some of which attract tadpoles and can be used to trap them in large numbers, and others that suppress the development of younger tadpoles. It became clear that controlling adults was time wasted but that the tadpole stage was amenable to interventions.

The two other management applications from Shine's research were first to educate predators to avoid being killed by toads, by releasing small (and less poisonous) toads in advance of the cane toad invasion front. The second application, termed genetic backburning, is designed to slow or stop the further spread of toads by introducing smaller toads with the genetic makeup that made them less prone to invade, in advance of the invasion front. They would then be in place to interbreed and halt the fast-moving toads and dilute the disperser genes found in these invaders. These three methods were in development and being tested at the time the book was written. We look forward to learning of the results.

We learn a lot about cane toads and about the author and his colleagues, but the important lessons are about the limits on how science can and cannot be used to influence efforts to control invasive animals. One of the wonderful things about this book on invasive species is that the author ends up feeling heartened, actually positive! He finds that Australian wildlife has been resilient, with a few exceptions, to the cane toad invasion. What a welcome conclusion.

KENT H. REDFORD *Archipelago Consulting*,
Portland, Maine, USA
E-mail redfordkh@gmail.com