Art as architecture to help wildlife survive heatwaves

by Kath Tuft

Can art help to conserve threatened species? We're exploring this question with ceramicist Jane Bamford in our work with greater stick-nest rats (*Leporillus conditor*), or 'stickies'.

Stickies are these marvelous native rodents that build truly impressive stick castles as homes to shelter and raise families in. The stick-nests are built up over successive generations of rats, and sometimes expanded to form granny flat stick-nests nearby. Known to the Adnymathanha people of the Ikara-Flinders Ranges as 'Wopilkara', stickies were once widespread across southern Australia, but they steadily contracted in range and disappeared from the mainland as rabbits and introduced predators invaded the continent. Thankfully, a population of greater stick-nest rats survived on the Franklin Islands off South Australia. Their cousin species, the lesser stick-nest rat (*Leporillus apicalis*), was not so fortunate… it is now completely extinct.

Efforts by Arid Recovery, the West Australian government and the Australian Wildlife Conservancy [add links] have seen stickies established in new populations on other islands and returned to the mainland within predator-free fenced areas. Our stickies were the first to return to the mainland in 1998, and they did well on the dunes and clay swale country here, feasting on their favourite juicy-leaved native chenopods (a plant family that includes saltbushes).

It wasn't to last however. Stickies at Arid Recovery have recently been knocked around by a combination of factors and the population has suffered a major decline. Another reintroduced herbivore species, the burrowing bettong or boodie (*Bettongia lesueur*), thrived here so well that they competed with stickies and depleted the vegetation stickies prefer to eat. In part to regulate the bettong population, we reintroduced a native predator, the western quoll (*Dasyurus geoffroii*). Quolls preyed on their fair share of stickies too, so we were glad to have set aside one of the

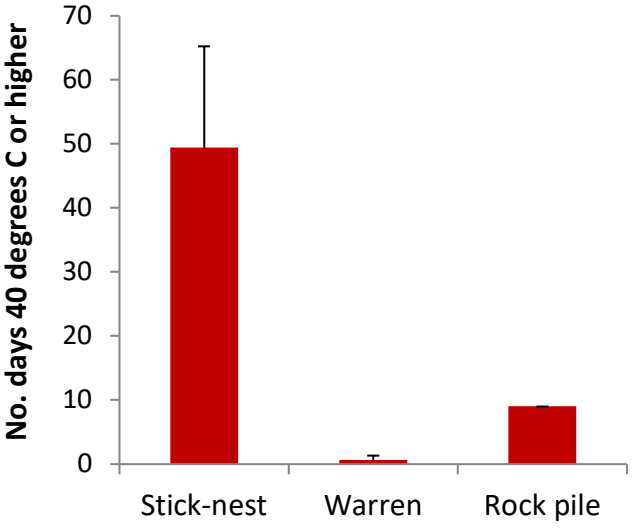
reserve's six paddocks as a quoll-free control where stickies could be safe. But then came the mega-drought of 2018-19. We experienced both the driest and the hottest conditions on record for the region. Not only were stickies struggling to find enough food as the vegetation shriveled up, they were subjected to successive extreme heatwaves. By the time the drought finally broke, we had only a handful of stickies left.

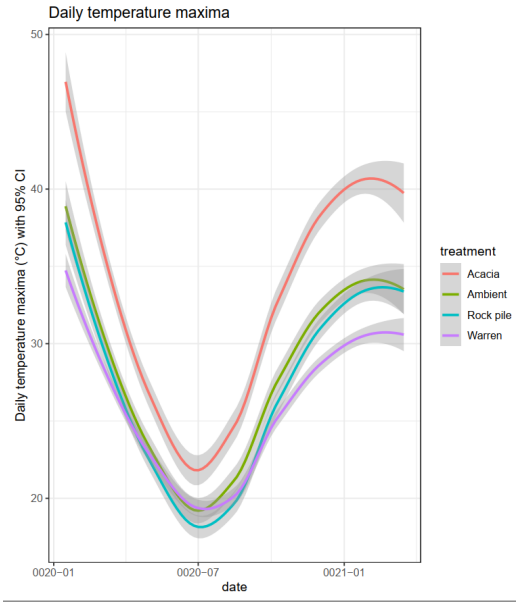
So what can we do for stickies now? We can address some of the factors that caused their decline here. We can manage other herbivores like bettongs at low sustainable levels and promote vegetation recovery. We can continue to keep quolls out of the refuge area (which isn't easy, but that's another story). We can even provide water during dry times. But we cannot stop heatwaves. Not in the foreseeable future anyway.

So we turned to ways we might be able to mitigate the impact of heatwaves to help stickies escape the worst of them.

You would think that nests built into living vegetation might be cooler thanks to the shade provided. We also know that stickies sometimes seek refuge in bettong warrens during hot summers. So by working with University of Adelaide PhD student Isabelle Onley, we've measured the temperature profiles of these different locations.

Temperature logger data shows that unshaded nests experience extremes ranging between 3^{o}C and 47^{o}C. Being shaded doesn't make a great deal of difference, but calcrete warrens make an enormous difference, reducing the temperature range to 12 – 35 ^{o}C. There's a growing understanding that non-burrowing animals take advantage of the burrows of digging species like wombats to escape from the heat or bushfires. It's easy to see why stickies would do this too.





But what if stickies don't always have access to these deep warrens? Or what if competition with bettongs for the space excludes them? And how can stickies be buffered from heatwaves in captive breeding programs in enclosures without burrows? Would it be possible to make artificial structures that have the same effect?

We started above ground by building rockpiles with hollow centres. These buffer the extreme heat somewhat compared to a regular stick-nest, and reduce the number of days of heatwave conditions. But they don't perform as well as a warren. We need to go underground.

This is where Jane Bamford comes in. Jane is a ceramic artist from Tasmania https://www.janebamford.com/. In recent years, Jane has turned her art towards practical solutions for threatened species by collaborating with scientists. This started with work to support the spawning of the critically endangered spotted handfish by constructing 7500 porcelain structures for the fish to lay their eggs on, in the absence of the sea tulips they once used but have been devastated by an invasive seastar https://greatsouthernreef.com/jane-bamford .

Jane has designed some simple terracotta tubes to allow stickies to go underground to escape the heat, but that are too small for other burrowing mammals like bettongs to squeeze into and

dominate. She has also designed dome structures to be used in captive populations to give rats a head start and a breezy central chamber as they construct a nest for the first time.

We're just starting to test these clay structures now at Arid Recovery and at Monarto Zoo. We will compare their thermal performance to stick-nests and warrens, and most importantly, see if stickies will use them. The beauty of working with clay (as well as its aesthetic beauty), is that it's a natural material. If we find that Jane's designs work to buffer heat extremes and that stickies use them, they could even be made from locally sourced clay. Stay tuned as we try it out!