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Should we move species threatened by climate change?

Tracy Rout Doug Armstrong Eve McDonald-Madden Hugh Possingham Nicola Mitchell Tara Martin

Climate change is one of the greatest threats the world's animals and plants are facing. In fact the world is facing an [extinction crisis](#), which should [concern all of us](#). The major problem with climate change is not so much that climate is changing, but that it is [changing faster](#) than species can move or adapt.



Credit: Sophie Arnall

One solution is to move species to places with a more suitable climate. But the idea of introducing species to areas where they have never occurred before is controversial, because species introduced to somewhere they've never lived could have devastating consequences for the species already there. Just think of foxes, lantana, cane toads and other [invasive species](#) in Australia.

So how do we weigh up the costs and benefits? In a new study [published recently](#) in the journal *PLOS ONE*, we developed a way of finding the answer.

Australia's species at risk

Moving species threatened by climate change [isn't a new idea](#). In fact we've already moved some, while others are being considered.

One of them is the critically endangered [western swamp tortoise](#) from Perth in Western Australia – Australia's rarest reptile. It currently faces extinction thanks to declining seasonal rainfall, which is drying up the swamps the tortoise calls home. To stop the tortoise becoming extinct, scientists have considered potential new sites far to the south of its home range.

Another species facing climate extinction is the [mountain pygmy-possum](#), a tiny mammal that currently resides on three snowy mountain tops in Victoria and New South Wales. As temperatures warm the possum is running out of room to move upwards. Snow cover, and the length of time snow stays on the ground, is decreasing rapidly.

This means the possums come out of winter hibernation earlier, and can't find enough food. The mountains have also seen an influx of feral predators, which previously found the area inaccessible thanks to snow cover.

Weighing up the costs

It's far from clear cut which species might benefit from this drastic action, and for which it would be a costly and risky mistake. How should wildlife managers approach the decision of whether to move animals into new areas, or leave them in places that may become uninhabitable for them?

In our study we outlined a framework that can quantify whether the benefit of moving a species outweighs the ecological cost.

The benefit of moving a species is based on the likelihood it will go extinct in its original habitat as the local climate becomes hostile, the likelihood that a breeding population can be established at a new site, and the value or importance of the species.

The ecological cost depends on the potential for the species to adversely affect the ecosystem at the new site. Species are considered candidates for re-location only if the benefit of doing so is greater than the ecological cost.

This decision involves both scientific predictions (what's the likelihood the species will go extinct in its current range?) and subjective judgements (how do we value the conservation of this species compared to species already living at the introduction site?). Our framework separates these questions out.

The framework is intended to support the revised [IUCN guidelines for re-introductions and other conservation translocations](#), which explicitly calls for structured decision-making frameworks for conservation introductions.

Testing on tuatara

We test drove our new framework using the hypothetical case of the New Zealand tuatara which is being considered for relocation from its home on a number of small offshore islands in the north of NZ to the South Island, outside of its current range. The tuatara is the country's largest reptile and the only surviving representative of an ancient lineage.

The tuatara faces a peculiar threat from climate change. Like many reptiles, the sex of a tuatara is determined by incubation temperature, with higher temperatures giving rise to males and lower temperatures to females. The population from North Brother Island in New Zealand's Cook Strait is already showing signs of too many males. This is expected to worsen as temperatures increase, putting the population at risk of extinction.

We considered an introduction from the North Brother Island population to a hypothetical mainland sanctuary on New Zealand's South Island. We used a previously published population model to predict the effect of climate change on the North Brother Island population, and estimated that the current population of 550 tuatara has a 0.43 chance of persisting in 150 years time. If we remove animals to introduce them elsewhere, this slightly decreases the probability to 0.42.

We found that the chance of successfully establishing a new population was good, and that the chance that the new population will impact negatively on the ecosystem was low.

Tuatara show why it's essential to have a rigorous framework like this to take the gut instinct and guesswork out of the decision, so we can make smarter choices for conserving species under climate change.

Tracy Rout, Post-doctoral Research Fellow at University of Melbourne, was lead author on the study. Doug Armstrong is Professor of Conservation Biology at Massey University, NZ; [Eve McDonald-Madden](#) is a Postdoctoral Fellow at CSIRO Ecosystem Sciences; Hugh Possingham is Director, ARC Centre of Excellence for Environmental Decisions at University of Queensland; Nicola Mitchell is Associate Professor in Conservation Physiology at University of Western Australia; and [Tara Martin](#) is Senior Research Scientist at CSIRO Ecosystem Sciences. This article was originally published at [The Conversation](#).

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