Climate change threatens more than two-thirds of rabbit species

April 20 2015, by Katie Leach

You can’t hide from global warming, Mr Wabbit. Credit: Ingrid Taylar, CC BY

Climate change will have major effects on the ecology and distribution of many animal species. Now new research suggests that rabbits will be particularly hard hit as climatic changes alter their habitat over the coming decades.

Rabbits, hares and pikas could become this century's new climate migrants – with up to two-thirds of species forced to relocate. There are almost certainly going to be extinctions among some of the more sensitive and less adaptable species.

Rabbits and their relatives hares (referred to in North America as jackrabbits) and the lesser known pikas belong to a group of mammals known as lagomorphs – of which there are 87 species worldwide.

Lagomorphs are particularly interesting to ecologists – and those of my colleagues who work in Global Food Security – as they are a major human food resource, valued game species, agricultural pests, model lab animals and key elements in food webs.

You can find rabbits, hares and pikas almost everywhere, across a huge range of environmental conditions. They're native to all continents except Antarctica, found from the equator to the Arctic, and from sea level to the very top of the Himalayas.

A quarter of lagomorphs are already listed as threatened, and 13 species are endangered or critically endangered. We were particularly interested in how predicted changes in climate would affect this already highly vulnerable group.

In our study, colleagues from Queen's University Belfast and I collated all known records of lagomorph species worldwide. Environmental conditions such as temperature or rainfall were correlated with the sites where each species occurred to establish the suitable habitat within which each can persist. Widely accepted climate models of projected future conditions were then used to extrapolate how suitable habitat would change.

Mountain-dwelling pikas may look like hamsters, but they're more closely related to rabbits. Credit: Jacob W. Frank, CC BY

The results, published in the open access scientific journal PLOS ONE suggest that two-thirds of all lagomorph species will be affected. Rabbits, hares and jackrabbits are likely to shift towards the poles with little change in the total size of their range – the geographical area in which the species can be found.

Pikas meanwhile, are likely to shift to ever higher altitudes as the lower slopes warm up leading to huge range declines. This is likely to lead to the extinction of some such as Kozlov's Pika *Ochotona koslowi*, a mysterious species unique to China.

Of course the animals won't just remain still while the climate changes around them – moving towards the poles or to higher ground is a standard strategy to track shifts in suitable habitat. Rabbits, hares and jackrabbits can move long distances and can potentially move to cooler conditions without losing too much of their range; the effects of such shifts on ecosystems are largely unknown but likely to cause significant disruption.

The smaller and less bouncy pikas won't be so lucky. Pikas inhabit generally cooler conditions in the high mountains of the Himalayas or Rockies and will be driven further upwards until no suitable habitat remains. My colleague Neil Reid, a conservation biologist and lagomorph expert at Queen's, points out that "they will likely be pushed off the top of the mountains, literally, with total extinction the most probable outcome".

Species traits can be useful indicators of potential responses to climate change, yet have rarely been linked to changes in distributions. Smaller-bodied species were more likely to exhibit range contractions and shifts to higher ground, but species capable of having large numbers of offspring were more likely to shift towards the poles.

The effect of climate change on lagomorphs is predicted to be so substantial that almost a third of the Earth's land area (31.5 million km^2) will lose at least one species by 2100. It is predicted that northern China will lose up to ten species, whereas Montana and North Dakota in North America are likely to gain up to five species – climate rabbit refugees perhaps, fleeing the ever-warming southern states and Mexico. Generally, species on islands and mountains will be the hardest hit by changing temperatures.

You mean it's getting even hotter? I'm outta here. Credit: Airwolfhound, CC BY-SA

However predictive models are simplified versions of reality and as such are rough approximations of what seems likely to happen. Those we used did not account for the complexity of ecological systems, such as how species – like plants or predators – interact with lagomorphs.

Moreover, small burrowing species such as the Pygmy rabbit *Brachylagus idahoensis* may be able to shelter from the effects of climate change, while larger species like the European hare *Lepus europaeus* may have to adapt to mitigate the effects of warming temperatures – for example in the way that the Antelope jackrabbit

Lepus alleni uses its long ears to shed excess heat.

So we have to be careful in the interpretation of our models – but the consistency of the results across all lagomorph species does not paint a good picture of the future for the group.

That heat won't shed itself. Credit: Ancheta Wis, CC BY-SA

Conservation strategies, such as assisted migration – where humans deliberately move species to areas of more suitable conditions, pre-empting future changes – may be one of the few options to save highly range-restricted species, even if it is highly controversial.

Collection of more species records, particularly for already rare species, as well as targeting data-deficient geographic regions (such as Russia) will be vital in increasing our knowledge of the most threatened

lagomorphs and informing future conservation management.

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