Of mice and monkeys - why are some species more at risk from climate change?

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Research predicts proportion of land-based mammals which may not be able to keep up with climate change

Researchers from the University of Aberdeen, Sapienza University of Rome, the Centre for Ecology and Hydrology and the University of Liverpool have developed a modelling approach which predicts the proportion of terrestrial mammals, from shrews to stoats to deer and giraffes, which may not be able to keep up with climate change.

The research is published in *Global Change Biology* today and was

funded by the Natural Environment Research Council (NERC).

Scientists wanted to discover why some mammal species are more able to move to new areas in a bid to avoid the effects of climate change, but others are failing to do so and as a result, are facing substantial reductions in abundance, and even higher risk of extinction.

In order to understand this, the team have developed an approach which allows them to estimate population spread across the diversity of ecological characteristics (or life histories) found within mammals. The approach overcomes limited data availability by coupling a statistical analysis of mammal species life-histories with spatial population modelling to project spread rates for 15 000 virtual mammals with life histories that reflect those seen in the real world.

The model was used to determine how key characteristics of mammals - such as how many offspring per year they produced, average first age of reproduction, dispersal (how far juveniles tend to move away from their parents before reproducing) and annual survival - influenced the expected population spread rates as well as looking to see whether easy to obtain information, such as body size or home range (territory size), can provide a reasonable estimate.

Professor Justin Travis from the University of Aberdeen said: "An important conclusion is that estimates of spread rate will be imprecise unless we improve the quality of data available for key characteristics, such as dispersal. However, while it remains challenging to make reliable predictions for individual species, by taking this new approach we can obtain predictions for the proportion of species that are likely to struggle to keep up with climate change.

"Our model suggests that 30% of mammals, from mice to monkeys have rates of population spread that are lower than the pace of climate

change.

"Importantly, this is likely to be an optimistic estimate as this work currently considers only the consequences of climate change and does not include habitat loss and fragmentation. A vital next step will be to make use of this new modelling approach to examine how well populations spread across landscapes that have and continue to be, dramatically modified by human activities. Then we can begin to make recommendations for conservation activities that can improve population responses."

Dr Jenny Hodgson from The University of Liverpool said: "Mammals are often thought of as being adaptable, but this work suggests that climate change could severely stretch their ability to exploit new windows of suitable climate. To avoid declines of mammals with low spread rates, a multi-pronged conservation strategy is likely to be needed, including boosting reproduction with ample areas of high-quality habitat, and protecting 'refugia' of cooler conditions in otherwise hot regions."

Professor James Bullock, Centre for Ecology & Hydrology added: "As our models become more sophisticated, we are able to make more precise predictions about the consequences of climate change. This work adds to the evidence that climate change will have devastating impacts on the natural world. Mammals are among the most mobile species on Earth, yet our models suggest that many populations will not be able to migrate fast enough to keep up with the shifting climate."