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How fast do species have to move to keep pace with climate change?

Species will have to shift their range much faster in some areas of the world than others to keep pace with climate change, according to new research. Those that live in certain areas, such as mangroves, tropical basins and deserts, may not be able to move fast enough over the next 100 years to survive.

The EU's White Paper on adapting to climate change[1] outlines the need to base adaptation measures on solid scientific evidence to guarantee their effectiveness. Since the impacts of climate change vary by region, studies that help identify more vulnerable areas could allow policy makers to prioritise these areas.

Plants and animals are already moving in response to changes in climate. However, this does not guarantee their survival if they are not able to move into new geographical areas quickly enough to keep pace with moving climates. In addition, the fragmentation of the landscape, as is the case in densely populated areas, may make species movement impossible. The study developed a new index to summarise the speed at which climate is changing. This combined data on the rate of temperature change from 16 different models with global data on how far species will have to move to find a suitable climate.

Using the IPCC A1B scenario, it indicated that from 2000 to 2100 species in mountainous regions will have to move at a relatively slow rate to find appropriate climates, whilst in flatter regions, such as flooded grasslands, mangroves and deserts, species will have to move much faster. On average, species will have to move about 420 metres per year to remain within habitable climates. This is estimated to be about 10 times faster than plants and animals had to move to keep pace with climate change at the end of the last ice age.

Species are more likely to keep pace with climate change in protected areas where landscapes are less fragmented. To explore the influence of the size of protected area, the study calculated so-called 'residence times' which can be interpreted as the time taken for the current climate to cross a protected area.

Only 8 per cent of the protected areas had residence areas that exceeded 100 years, indicating that few would provide long-term protection. The potential to protect appears is dependent on the size of the protected area and heterogeneity of the landscape. For example, large protected areas may mitigate climate change in deserts, but in small protected areas in Mediterranean-areas and coniferous forests may be insufficient to allow species to adapt.

The researchers highlight some drawbacks to the study. For example, by focusing on mean annual temperature the study was unable to capture the complex interactions between temperature, precipitation and seasonal variability. In addition, the index estimates the velocities of climate change not the speed at which species move. This cannot be interchanged with migration rates.

Despite the caveats the research highlights the greater vulnerability of large extensive areas, particularly lowland tropics, such as the Amazon basin and desert regions. In areas where the rate of climate change is small, moderate-sized protected areas could contain enough microclimates to allow ecosystems to adapt. However, above all further steps must be taken to reduce emissions, increase the size and connectivity of protected areas and possibly manage the relocation of plants and animals.

1. See: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009DC0147:EN:NOT

Source: Loarie, S.R., Duffy, P.B., Hamilton, H. *et al.* (2009). The velocity of climate change. *Nature.* 462 (24): 1052-1055.

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