European Commission

Science for Environment Policy

# Better predictions of climate change impact on wildlife thanks to genetically informed modelling

**25 November 2016**
**Issue 478**
**Subscribe to free weekly News Alert**

**The effects of climate change on the distribution of species can be predicted more accurately by considering the genetic differences between different groups of the same species, a new study suggests.** The researchers found that a computer model which incorporated genetic information on different groups of a US tree species was up to 12 times more accurate in predicting tree locations than a non-genetically informed model.

**Climate change is expected to be one of the biggest causes of wildlife extinction in the 21st century.** One major reason for this is that it will make habitats that are currently suitable *unsuitable* for many species. However, some species will be able to adapt to their changing environment, thanks, in part, to their genes, which could help them to cope with the climatic shifts, or to evolve. Similarly, some groups within an individual species will be able to adapt better to change than other groups of the same species because their genes are slightly different.

However, computer models used to predict the shifting distribution of species under climate change — known as ecological niche models — tend to assume that all groups within a species' range have the same genetic make-up. These models, therefore, may ignore the possibility that some groups within a species may be able to adapt better to their local conditions than others and survive, for instance.

This US study explored whether incorporating genetic information into ecological niche modelling can improve predictions of species' distribution, and thus the species' ability to survive climate change. These predictions can help land managers plan for the future by identifying which genetic groups will be matched or mismatched to their local environment in years to come. Forest geneticists, for example, make recommendations on which trees are appropriate to plant locally, based on their genetic suitability to a future climate.

To create the genetically informed ecological niche models, the researchers first modelled the current distribution of the Fremont cottonwood (*Populus fremontii)*, a widespread species in the southwest of the USA, which lives by streams and lakes. Based on climatic data, this model accounted for all the different climates experienced by the entire species.

Three subsequent models were created (the genetically informed models), which reflected the three genetically distinct groups within this species (referred to as 'ecotypes'). Each ecotype lives in a different area and experiences a unique climate environment. To test the genetically informed ecological niche models, they compared the results of the modelling exercises which included information on the genetic structure of the three ecotypes, with the model without genetic information.

They found that the genetically informed version of the model could predict the location of individual populations with up to 12 times more accuracy than the non-genetically informed version. The genetically informed predictions were more accurate because those models were better able to characterise the unique climate of each ecotype, and thus more accurately predict where populations in those ecotypes live.

*Continued on next page.*

**Source:** Ikeda, D. H., Max, T. L., Allan, G. J., Lau, M. K., Shuster, S. M., & Whitham, T. G. (2016). Genetically informed ecological niche models improve climate change predictions. *Global Change Biology*. DOI:10.1111/gcb.13470.

**Contact:**
dana.ikeda@nau.edu

**Read more about:**
Biodiversity, Climate change and energy

European Commission

Science for Environment Policy

# Better predictions of climate change impact on wildlife thanks to genetically informed modelling *(continued)*

**25 November 2016**
**Issue 478**



**Source:** Ikeda, D. H., Max, T. L., Allan, G. J., Lau, M. K., Shuster, S. M., & Whitham, T. G. (2016). Genetically informed ecological niche models improve climate change predictions. *Global Change Biology*. DOI:10.1111/gcb.13470.

**Contact:**
dana.ikeda@nau.edu

**Read more about:**
Biodiversity, Climate change and energy

The researchers also modelled the distribution of the three ecotypes under future climate change. The results indicated that the ecotypes will respond very differently from each other. For example, in 2080, the ecotype currently found in the Sonoran Desert part of Arizona was projected to have an extensive range throughout the southwestern USA, Mexico and areas east of the Rocky Mountains. In contrast, the ecotype currently in the Utah High Plateaus will experience much greater habitat loss, with just a few small suitable areas remaining in 2080.

These findings suggest that current ecological niche modelling that does not include genetic differences may be inaccurately estimating the current and future range of species, the researchers say. Additionally, restoration and conservation strategies based on niche modelling, with no accounting for genetic differences, may be providing inaccurate information.