Glacial signature in species richness distribution of North American mammals

Annie Dicaire, Jeremy Kerr
Department of Biology, University of Ottawa

Introduction

18,000 years ago, the last glacial period reached its maximum. The following melting of glaciers opened up vast extents of land to colonization by the plants and animals who survived in neighbouring refugia. Whether or not this dispersal has ended is a question still debated today.

The majority of the species richness distribution can be explained by annual potential evapotranspiration (1). Studies on European plants (2), reptiles and amphibians (3) and mammals (4) indicates historical factors also play a role.

This study examines the effect of two historical factors, distance from refugia and time since last glaciated, on the species richness distribution of mammals in North America. This will indicate if post-glacial dispersal has ended and if a glacial signature can still be found in the current species richness distribution.

A positive correlation between species richness and historical factors would suggest that colonization is an on-going process. Smaller species, through slower dispersal rates, are expected to show a stronger correlation than larger mammals.

Methodology and results

• Range maps of terrestrial mammals in North America were obtained from the IUCN and compiled into a 100km² grid representing species richness (Fig.1). Similar grids were made for species with body weight over and under 1kg, as well as for flying and non-flying species (Fig.2a-d).

• Using Dyke’s (5) reconstructions of glacial advance from 18,000 to 5,000 years ago, maps were made representing the distance to the nearest refugia during the last glacial maximum (Fig.3) and the time since an area was last covered by ice or water (Fig.4).

• The annual mean temperature (Fig.5) and the annual total precipitation (Fig.6) data for North America from WorldClim were to be used as proxy for evapotranspiration to calibrate for current climate.

• The species richness was to be compared with historical factors to look for correlations using R’s statistical analysis. Time constraints prevented this step to be completed.

Discussion

Mammals, as mobile organisms, can disperse relatively fast compare to plants or small animals and therefore adapt quicker to rapid climate changes. If positive correlations between historical factors and species richness were to be found, it would imply long lasting effects on every level of the community from the last major climatic change.

The effects of the current global change are undeniable, but the long-term consequences are unclear. Continuing this study would clarify the depth and the duration of these repercussions on mammalian populations.

Further research is needed on the effects of physical barriers during dispersion and on identifying current climatic refugia. Establishing dispersal rates of good and bad migrants would help to predict future patterns of species richness.

References


Acknowledgments

I would like to thank Jeremy Kerr and Juan Zuolaga for their help and data, and the Undergraduate Research Opportunity Program at the University of Ottawa for this opportunity.

Contact information

Please contact me at annie.dicaire@hotmail.com or (613) 290-0104 for further questions.

uOttawa