

# 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

## 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.

## Methodology and results

•Range maps of terrestrial mammals in North America were obtained from the IUCN and compiled into a 100km<sup>2</sup> 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.

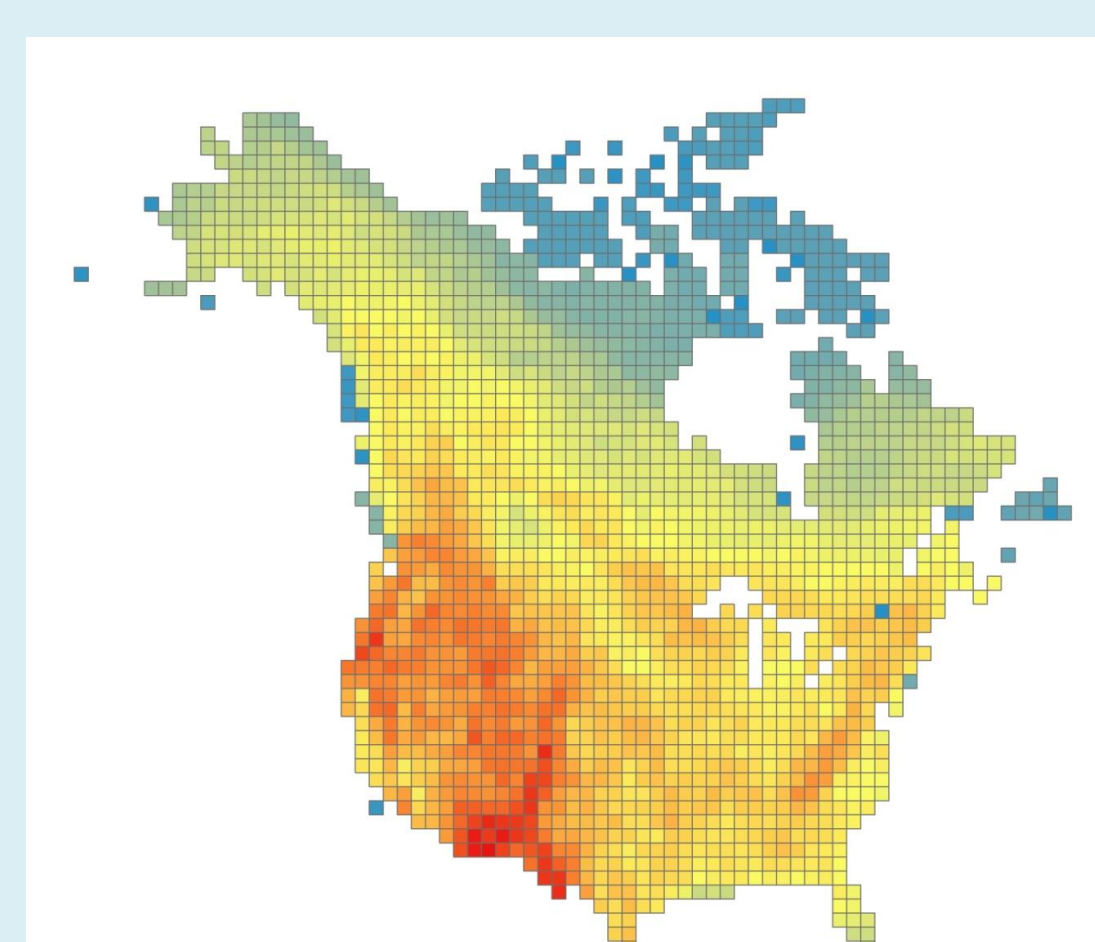


Fig.1 Species richness distribution of terrestrials mammals in North America

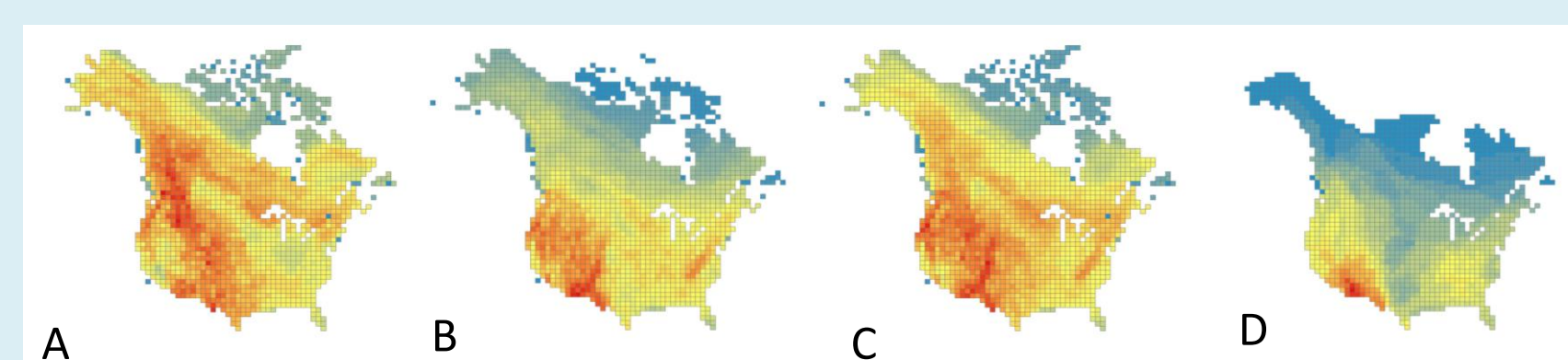


Fig.2 Species richness distribution of a) large (>1kg), b) small (<1kg), c) non-flying and d) flying mammals in North America

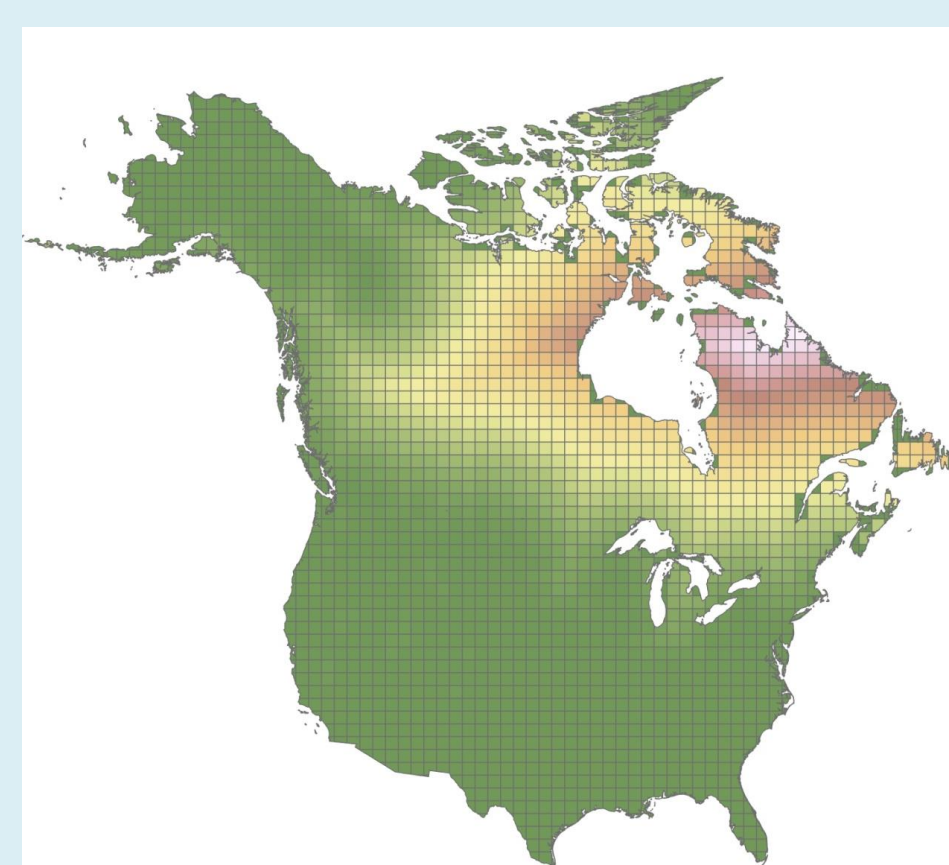


Fig.3 Distance from refugia

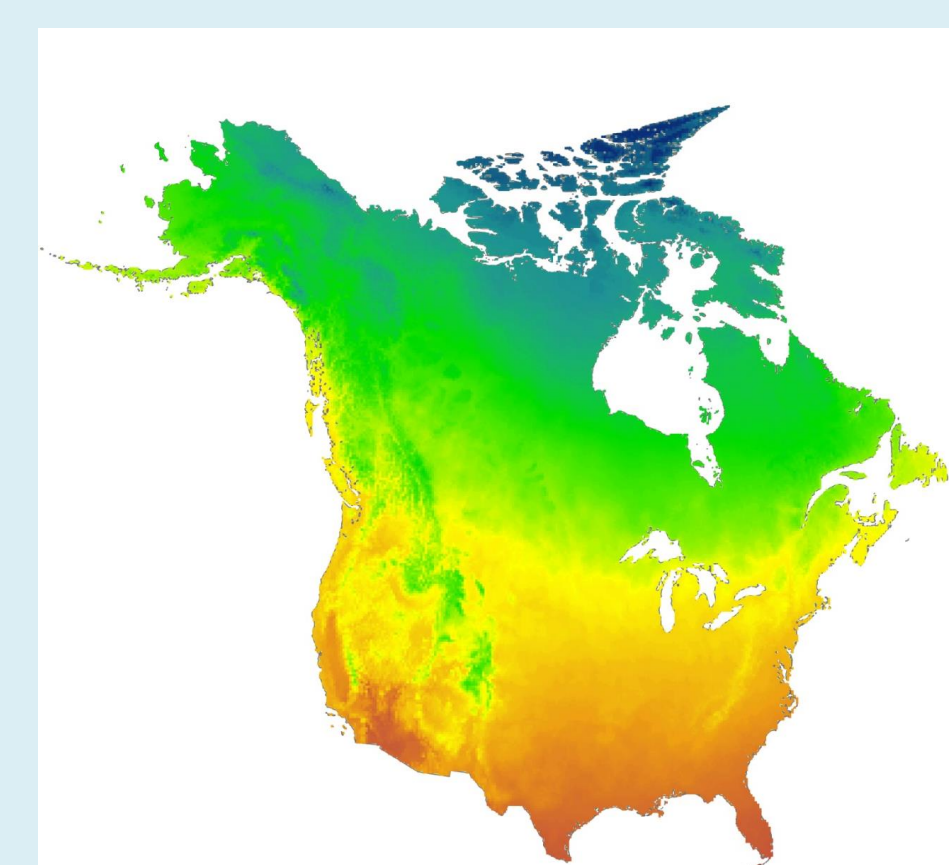


Fig.5 Annual mean temperature

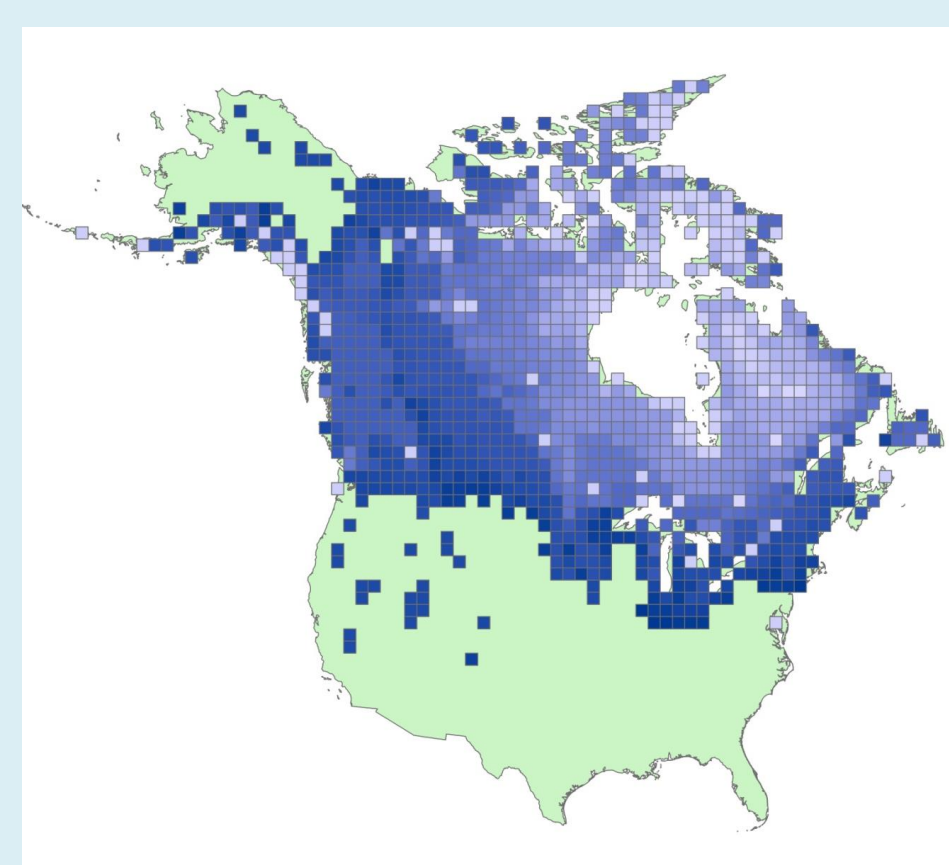


Fig.4 Time since last glaciated or inundated

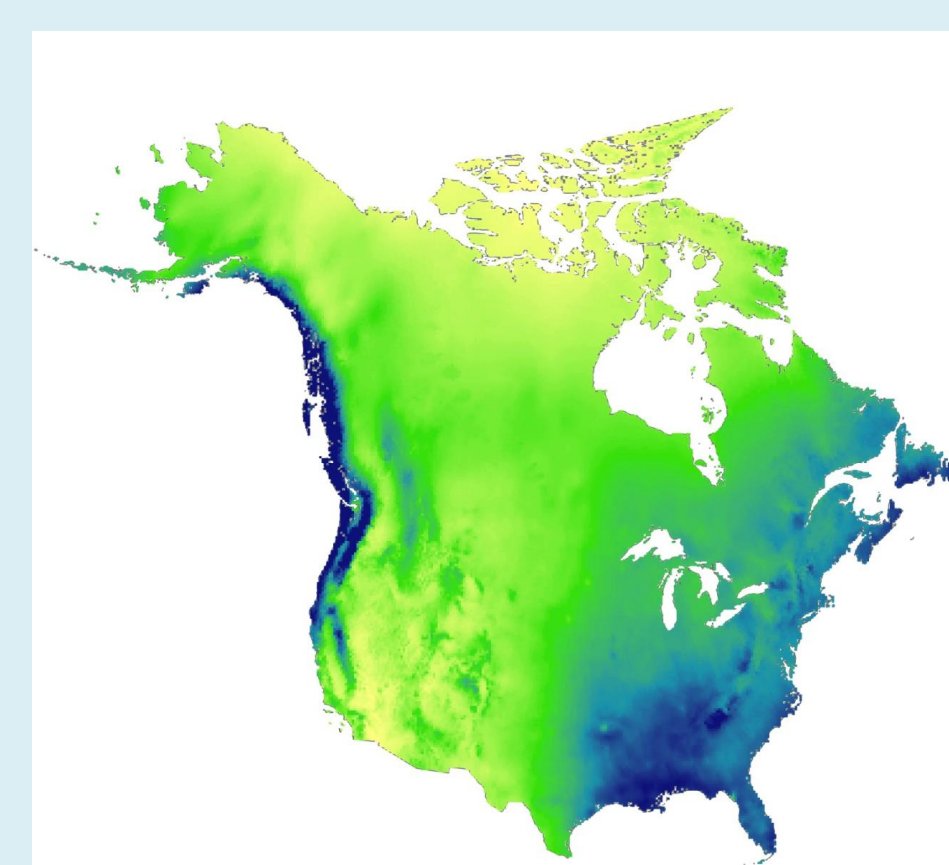


Fig.6 Annual total precipitation

## References

- (1) Currie, D. J.. (1991). Energy and Large-Scale Patterns of Animal- and Plant-Species Richness. *The American Naturalist*, 137(1), 27-49.
- (2) Normand, S., Ricklefs, R. E., Skov, F., Bladt, J., Tackenberg, O., & Svenning, J.-C.. (2011). Postglacial migration supplements climate in determining plant species ranges in Europe. *Proceedings: Biological Sciences*, 278(1725), 3644-3653.
- (3) Araújo, M. B., Nogués-Bravo, D., Diniz-Filho, J. A. F., Haywood, A. M., Valdes, P. J., & Rahbek, C.. (2008). Quaternary Climate Changes Explain Diversity among Reptiles and Amphibians. *Ecography*, 31(1), 8-15.
- (4) Fløjgaard, C., Normand, S., Flemming, S., Svenning, J.-C. (2011) Deconstructing the mammal species richness pattern in Europe – towards an understanding of the relative importance of climate, biogeographic history, habitat heterogeneity and humans. *Global Ecology and Biogeography*, 20(2), 218-230.
- (5) Dyke, A. S., (2004) An outline of North American deglaciation with emphasis on central and northern Canada, In: J. Ehlers and P.L. Gibbard, Editor(s), *Developments in Quaternary Sciences*, Elsevier, 2004, Volume 2, Part B, Pages 373-424

## 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](mailto:annie_dicaire@hotmail.com) or (613) 290-0104 for further questions.



uOttawa