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Niche conservatism above the species level

By Elizabeth A. Hadly, Paula A. Spaeth, and Cheng Li (September 2009)

# Summary

Extending previous studies of niche conservatism at the species level through utilization of geographic range data, the researchers looked at data surrounding the dramatic climate change due to warming in the late Pleistocene. When comparing niche conservatism at the species level to conservatism at the generic and family levels three things became obvious. The answer to their first proposed line of inquiry – to what extent did past climate change affect the extent of higher-level niches at the genus and family level – was intriguing. Species level niche expansion or reduction was prevalent, but when analyzing the aggregate species data for a genus, the geographic range size and ranks stayed relatively stable over 130,000 years, regardless of dramatic climate change. Extinction at the genus level was seen only in monotypic genera, and for those that showed a larger-than-average change in rank (about a third of the genera) the body masses were uneven. Large mammals (>1000g) generally showed an increase in rank, with smaller mammals (≤1000g) showed a decrease in rank. The authors’ secondary goal in this piece was to investigate whether or not changes in niche-spaces at the species level would permeate up to higher-level hierarchical classifications. Conjointly with the initial conclusion that higher-level niches are resistant to climate change, the authors also investigated the degree to which shifts in ecological niche-spaces of species affected higher-level niche-spaces. To do this the authors looked at individual species extinctions and looked at the corresponding genera to determine if those deletions (in the LP warming) permeated to the higher levels by examining subsequent LH geographic range sizes in genera. They concluded that because ecological niche-spaces at the genus level were conserved, geographic range is an emergent property of genera (in mammals) and variations in species-level niche ranges are due more to intragenus competition, not the abiotic environment. Lastly, trait-based controls (i.e. dispersal ability, body size, population density, degree of specialization, etc.) on niche conservatism are more heavily weighted towards higher-level ecological niches. Although it was not explicitly tested in this paper, it would follow in a general sense that niche conservatism at the species level is affected more by immediate environmental-based controls (biotic/abiotic interactions) than the aforementioned trait-based ones.

# Things you liked

Considering my field of choice in conservation biology, I found this article to be extremely interesting. Most importantly to me was the caveat presented by the authors in the discussion of the results. Although the ecological niches that were studied were conserved for more than a hundred millenia, many of them over the past hundred years have started to disappear. Inherent in this observation is the widespread and immense impact of human population growth. While this article was meant to provide a practical and historically relavent example for contemporary climate change effects on ecological niche-spaces, in actuality it only provides a semi-accurate forecast. Without preservation or conservation of existing ecological niches, whether that be at the species, genus, or family level, the applicability of this model to future climate change impacts on niche-spaces will continue to decline. More broadly, I find the suggestion that utilizing genus level modeling of niche conservatism would be more informative than species level ecological niche-space modeling when looking at the significance of climate change in mammal distribution to be quite interesting and something to be explored more closely.

# Things you did not like

Although any paper has to have a specific line of investigation to share a manageable amount of information with the reader, this one could have expounded on one thing. The authors mentioned at the outset that their study included only mammals. The reasoning for not including other animals and plants was that those groups are not monophyletic. While this rationale limited the scope of the paper to mammals, the reason as to why monophyly is an important characteristic was not expounded upon. If similar adaptations (trait-based) are important for determining niche-conservatism at the genus level, would this type of analysis not apply to para/polyphyletic genera that contain species with similar adaptations?

# Evaluation of figures

The figures in this article consisted mainly of before and after snapshots of both species level niche-spaces and genus level niche-spaces (for canis). Also included was a correlation of LP and LH range sizes, as well as a graphic, sorted by LP rank, depicting relative change in geographic range size for all included genera. All graphs and figures clearly distinguished between late Pleistocene and late Holocene time periods and, overall, were quite concise in presenting the necessary visual information for fully processing the hypotheses put forth in the body of the paper.