



The influence of environmental change over geological time on the tempo and mode of biological diversification, revealed by Neotropical butterflies

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A recommendation of

Chazot N, Willmott KR, Lamas G, Freitas AVL, Piron-Prunier F, Arias CF, De-Silva DL and Elias M. 2017. **Renewed diversification following Miocene landscape turnover in a Neotropical butterfly radiation.** *BioRxiv*, 148189, ver. 2 of 28th September 2017. doi: [10.1101/148189](https://doi.org/10.1101/148189)

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The influence of environmental change over geological time on the tempo and mode of biological diversification is a hot topic in biogeography. Of central interest are questions about where, when, and how fast lineages proliferated, suffered extinction, and migrated in response to tectonic events, the waxing and waning of dominant biomes, etc. In this context the dynamic conditions of the Miocene have received much attention, from studies of many clades and biogeographic regions.

Here, Chazot *et al.* [1] present an exemplary analysis of butterflies (tribe Ithomiini) in the Neotropics, examining their diversification across the Andes and Amazon. They infer sharp contrasts between these regions in the late

Miocene: accelerated diversification during orogeny of the Andes, and greater extinction in the Amazon associated during the Pebas system, with interchange and local diversification increasing following the Pebas during the Pliocene.

Two features of this study stand out. First is the impressive taxon sampling (340 out of 393 extant species). Second is the use of ancestral range reconstructions to compute per-lineage rates of colonization between regions, and rates of speciation within regions, through time. The latter allows for relatively fine-grained comparisons across the 2 fundamental dimensions of historical biogeography, space and time, and is key to the main results described above. The method resonated with me because (full disclosure) I performed a similar analysis in a study showing evidence for uplift-driven diversification in the Hengduan Mountains of China [2]. It's not without caveats -- the most important probably being that extinction is not accounted for in any meaningful sense. More discussion of these would benefit the paper. Also, it is not stated how ancestral ranges at nodes were converted to dispersal events in time, whether at the crowns or stems, or along branches somehow.

As noted by the other reviewers, the study makes use of a variety of comparative methods for inferring diversification and geographic range evolution but does not include some that would seem to make sense (e.g., BAMM for inferring shifts in diversification). These omissions are not explained, or rather, the rationale for selecting the methods used is not made clear. In addition to BAMM, the HiSSE model came to mind. Also, details are missing such as: why was both ClaSSE and BiSSE used to study the trait "Andean/non-Andean"?

Aside from greater clarification/justification of the methods, which I think would amount to relatively minor revisions, the paper is otherwise nicely written and thoughtfully analyzed, and represents a very nice contribution to our understanding of the effects of Miocene/Pliocene environmental change on the evolution of Neotropical biodiversity.

References

- [1] Chazot N, Willmott KR, Lamas G, Freitas AVL, Piron-Prunier F, Arias CF, De-Silva DL and Elias M. 2017. Renewed diversification following Miocene landscape turnover in a Neotropical butterfly radiation. *BioRxiv* 148189, ver 2 of 28th Sept 2017. doi: [10.1101/148189](https://doi.org/10.1101/148189)
- [2] Xing Y, and Ree RH. 2017. Uplift-driven diversification in the Hengduan Mountains, a temperate biodiversity hotspot. *Proceedings of the National Academy of Sciences of the United States of America*, 114: E3444-E3451. doi: [10.1073/pnas.1616063114](https://doi.org/10.1073/pnas.1616063114)

Appendix

Reviews by Delano Lewis and an anonymous referee: <http://dx.doi.org/10.24072/pci.evolbiol.100032>