Lucas Buffan **July 9th, 2024**

*Institut des Sciences de l’Évolution de Montpellier*

Dear NAS members and the Editorial Board,

We are please to submit our manuscript entitled “**The fate of South America’s endemic mammalian fauna in response to the most dramatic Cenozoic climate disruption**”, as a Research Article in *Proceedings of the National Academy of Sciences of the United States of America*.

The Eocene-Oligocene Transition (EOT, *ca.* 34 million years ago, Ma) is considered as the most dramatic Cenozoic climate event on Earth. The EOT has been associated with a pronounced biotic turnover from several parts of the world, and recent advances even recognized it as a mass extinction. However, the biotic repercussions of this event have never been investigated in the case of tropical biota, in particular for the endemic South American mammals (SAM). Alfred R. Wallace (1978) predicted the tropical diversity is so diverse because climate is more stable and equable compared to temperate regions, and Gaylord G. Simpson (1983) characterized the SAM as a unique fauna that evolved in a tropical and insular context. Evolutionary predictions are thus challenging in this context because we can expect a mass extinction for SAM due to their endemic nature, and at the same no effect because of their tropical affinities.

Here Relying on cutting-edge Bayesian methods, we failed at characterizing any mass extinction among SAM at the EOT. Instead, we illustrate that SAM experienced a gradual diversity decline during the late Eocene related to the climate cooling subsequent to the mid-Eocene Climate Optimum, followed by an Oligocene waxing-and-waning related to the Andean orogeny. A prominent role of diversity-dependent effects arose from our analyses of the two periods. Interestingly, we challenge the impact of grassland expansion in the SAM evolutionary dynamic, yet frequently invoked to explain the emergence of key traits among herbivore clades. Last, remarkably, we show that tropical and extratropical lineages exhibited very distinct macroevolutionary histories, providing support for the ‘historical tropical stability’ hypothesis formulated by A.R. Wallace. We have carefully conducted several sensitivity analyses before drawing any conclusion, ensuring the robustness of our results.

For the first time, our study provides quantitative insights into the macroevolutionary past of the iconic extinct mammals from South America, with evidence for a complex interplay between abiotic (*i.e*., climate and mountain building) and biotic (*i.e*., diversity-dependent effects) factors in shaping their diversification dynamics, meanwhile denying the occurrence of a worldwide mass extinction of mammals at the EOT. Our framework relies on a fossil occurrence database fed in part by us and cleaned with an unprecedented level of details with our expertise, being the outcome of the joint effort of several experts of respective taxonomic groups. This fossil database will be publicly available, in conjunction to our analytic pipeline in GitHub.

We believe that the content and originality of our study will appeal a broad audience, including evolutionary biologists, macroecologists, paleobiologists and any people interested in the interplay between biodiversity and climate. Hence, we think that our work fits the scopes of *Proceedings of the National Academy of Sciences of the United States of America*. We suggest the *NAS* editorial board member **Dr. Nils C. Stenseth** (University of Oslo)as a relevant Editor to handle this submission.

Also, we would like to recommend some reviewers that we think could be relevant to evaluate this study:

* *Neotropical diversity through geological times and paleoenvironments:*

- Prof. **Carlos Jaramillo**: Smithsonian Tropical Research Institute, Ancón, Panamá. Contact: [jaramilloc@si.edu](mailto:jaramilloc@si.edu)

- Dr. **Carina Hoorn**: Institute for Biodiversity and Ecosystem Dynamics, Amsterdam, Netherlands. Contact: [m.c.hoorn@uva.nl](mailto:m.c.hoorn@uva.nl)

- Prof. **Alexandre Antonelli**: Department of Plant Sciences, Oxford, UK. Contact: [a.antonelli@kew.org](mailto:a.antonelli@kew.org)

- Dr. **Christine D. Bacon**: Department of Biological & Environmental Sciences, Gothenburg, Sweden. Contact: [christine.bacon@bioenv.gu.se](mailto:christine.bacon@bioenv.gu.se)

- Dr. **Mónica Carvalho**: Museum of Paleontology, University of Michigan, USA. Contact: [marvalho@umich.edu](mailto:marvalho@umich.edu)

* *South American mammal paleontology:*

- Pr. **Darin A. Croft**: **Department of Anatomy, School of Medicine, Case Western Reserve University, USA. Contact:** [dac34@case.edu](mailto:dac34@case.edu)

**- Dr. Francisco J. Goin: Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina. Contact:** [fgoin@fcnym.unlp.edu.ar](mailto:fgoin@fcnym.unlp.edu.ar)

- Dr. **María A. Abello**: **Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina. Contact:** [mabello@fcnym.unlp.edu.ar](mailto:mabello@fcnym.unlp.edu.ar)

* *Macroevolutionary analyses and empirical applications, in particular to mammals:*

- Dr. **Juan L. Cantalapiedra**: Museo Nacional de Ciencias Naturales, Madrid, Spain. Contact: [jcantalapiedra@mncn.csic.es](mailto:jcantalapiedra@mncn.csic.es)

- Dr. **Joseph Flannery-Sutherland**: School of Geography, Earth and Environmental Science, University of Birmingham, UK. Contact: [j.t.flannerysutherland@bham.ac.uk](mailto:j.t.flannerysutherland@bham.ac.uk)

- Dr. **Juan D. Carrillo**: Department of biology, Université de Fribourg, Switzerland. Contact: [juan.carrillo@unifr.ch](mailto:juan.carrillo@unifr.ch)

- Dr. **Sergio Tarquini**: Centre de recherche en paléontologie, Paris. Contact: [starquini92@gmail.com](mailto:starquini92@gmail.com)

- Dr. **Farideh Moharrek**: Novo Nordisk Foundation Center for Basic Metabolic Research, University of Copenhagen, Denmark. Contact: [farideh.moharrek@sund.ku.dk](mailto:farideh.moharrek@sund.ku.dk)

We hope that you will share our excitement for the present work.

Best regards,

Lucas Buffan, on behalf of all my co-authors

