

Lucas Buffan
Institut des Sciences de l'Évolution de Montpellier

July 30th, 2024

Dear NAS members of the Editorial Board,

We are pleased 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. This transition has been associated with a pronounced turnover from several parts of the world, and recent advances even recognized it as a mass extinction. However, to date, the biotic repercussions of this climatic hinge have never been investigated in the case of the endemic South American mammals (SAM). Alfred R. Wallace (1878) postulated that the remarkably high biodiversity under the tropics would result from the higher climate stability and equability in tropical compared to temperate regions, and George G. Simpson (1983) characterized the SAM as a unique fauna that evolved in an insular semi-tropical context. Evolutionary predictions are thus challenging in this framework because one can expect a mass extinction for SAM, and at the same time no effect because of their tropical affinities.

Here, using a densely-revised fossil database resulting from decades of intense fieldwork, we shed light on the diversification dynamics of SAM throughout the Eocene–Oligocene interval (*ca.* 56–23 Ma) to understand their response to this period of drastic environmental changes. 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 Eocene related to the climate cooling subsequent to the Early-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 implication of grassland expansion in the SAM evolutionary dynamics, 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.

For the first time, our study provides quantitative insights into the macroevolutionary past of the iconic extinct mammals from South America during the Eocene–Oligocene interval. We evidence a complex interplay between abiotic (*i.e.*, climate and mountain building) and biotic (*i.e.*, diversity-dependent effects) factors in shaping SAM 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. We made this fossil database in conjunction to our analytic pipeline publicly available in GitHub and FigShare.

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 pertinent to evaluate this study:

- *Neotropical diversity through geological times and paleoenvironments:*

- Prof. **Carlos Jaramillo**: Smithsonian Tropical Research Institute, Ancón, Panamá. Contact: jaramilloc@si.edu
- Dr. **Carina Hoorn**: Institute for Biodiversity and Ecosystem Dynamics, Amsterdam, Netherlands. Contact: m.c.hoorn@uva.nl
- Prof. **Alexandre Antonelli**: Department of Plant Sciences, Oxford, UK. Contact: a.antonelli@kew.org
- Dr. **Christine D. Bacon**: Department of Biological & Environmental Sciences, Gothenburg, Sweden. Contact: christine.bacon@bioenv.gu.se
- Dr. **Mónica Carvalho**: Museum of Paleontology, University of Michigan, USA. Contact: marvalho@umich.edu

- *South American mammal paleontology:*

- Prof. **Darin A. Croft**: Department of Anatomy, School of Medicine, Case Western Reserve University, USA. Contact: 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
- Dr. **María A. Abello**: Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina. Contact: mabello@fcnym.unlp.edu.ar

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

- Dr. **Andrés Solórzano**: Universidad del Maule, Talca, Chile. Contact: asolorzano@ucm.cl
- Dr. **Juan L. Cantalapiedra**: Museo Nacional de Ciencias Naturales, Madrid, Spain. Contact: 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
- Dr. **Sergio Tarquini**: Centre de recherche en paléontologie, Paris. Contact: starquini92@gmail.com

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

Best regards,

Lucas Buffan, on behalf of all my co-authors

A handwritten signature in black ink, consisting of a stylized, elongated loop followed by a horizontal stroke.