[Humboldt Special Issue](file:///C:\\Users\\pi37pat\\AppData\\Roaming\\Microsoft\\Word\\(https:\\onlinelibrary.wiley.com\\page\\journal\\homepage\\13652699\\humboldt)

* rising interest in links between geology and biodiversity (-> **gradients**)
* we review the current state of knowledge of geo- and biodiversity around the world, and explore the impact of **geodiversity** on **biodiversity** in particular and **biogeography** in general (here we understand geodiversity in an extended sense, not only as mountains, but can also as diversity in **edaphic, marine or climatic parameters**, reflecting the very broad interests of Humboldt)
* contemporary biogeography providing material to guide closer integration of geography, geology and biology within biogeography
* **develop** our **understanding** of the **interactions** of geological, biological, ecological, environmental and evolutionary processes in biogeography
* provide a **reference work** on current and historical biogeography
* We welcome a wide range of papers that may present **new data**, reflect on the state of affairs, or review a particular geographic region
* If possible, however, we encourage authors to explore the **contemporary relevance of Humboldt**'s contributions, and notably his contributions to biogeography itself, to the work they are reporting
* Extended abstracts should indicate briefly the **title**, **key aspects, ideas and approaches**, as well as **empirical material** that will be covered in the paper, and how this contributes to the objectives and research questions in the Special Issue.

Dear Dr Hoorn,

Humboldt’s scientific legacy is still omnipresent in German biogeography, and especially lingers on here in Weimar and Jena. Ernst Haeckl, a professor at the University of Jena for 47 years, was one of the first to continue Humboldt’s scientific legacy by coining the term ecology. And even today it is barely a coincidence that German biogeographers and ecologists still predominantly choose South American study regions where they mostly study species turnover along altitudinal gradients (Muenchow et al., 2018). The long-term DFG research cluster in Southern Ecuador might serve as one current and prominent example (Beck et al., 2008; <http://vhrz669.hrz.uni-marburg.de/tmf_respect/>). When collecting data in the field, researchers still picture Humboldt drawing the floristic belts of Mt. Chimborazo, and proudly continue their work in the knowledge on whose shoulders it stands.

In the Humboldtian tradition, our research has focused on studying species turnover along spatio-temporal gradients in South America (Muenchow et al., 2013a, 2013b). For the Special Humboldt Issue we propose to present the results of a study conducted in the (semi-)arid areas of northern Peru over four years. The study area is of special interest since it is heavily affected by the El Niño Southern Oscillation (ENSO) – in fact, it is the region where ENSO exerts its greatest terrestrial impact. Each of the studied years represents a different ENSO episode (2011 - dry La Niña year; 2012 - humid La Niña year; 2016 - El Niño year; 2017 – supposedly a neutral year which in fact was a costal El Niño year). We investigated the effect of ENSO on the floristic composition in 50 permanent plots along a humidity gradient from the extreme dry Pacific coast to the semi-arid Andean foothills. We are not aware of any other study comparing different ENSO episodes on the floristic composition along a humidity gradient. To visually represent the changes in floristic composition across the years and along the humidity gradient, we use an innovative approach by spatially predicting and mapping the scores of a Detrended Correspondence Analysis (DCA; Hill & Gauch, 1980) with the help of a Generalized Additive Model (GAM; Wood, 2017).

What is more, variation partitioning (Peres-Neto et al., 2006) helps us to determine the effect of topography and soil on the floristic composition, and how this effect changes as soon as water is no longer the limiting factor. This is especially interesting since edaphic variables sometimes are as important as water availability in structuring vegetation composition (Laurance et al., 2010), however, the influence of edaphic variables along gradients is not very well known, especially in comparison with other gradients (humidity, altitude), and hardly available for drylands (Muenchow et al., 2018). Additionally, we support the results from the field with an irrigation-nutrient experiment. To the best of our knowledge this has not been done before in one study.

The proposed manuscript is local in scale but of global relevance since it contributes to a better understanding of the influence of geodiversity on biodiversity in the core region of ENSO. ENSO in turn is a global phenomenon and especially the frequency of related extreme events (El Niño/La Niña) is likely to increase with climate change (IPCC, 2014). The impact of El Niño is often devastating for the population in western South America but a godsend for initializing reforestation and the restoration of degraded ecosystems (Holmgren & Scheffer, 2001; Fraser, 2017). In other parts of the world, El Niño causes droughts, fire and harvest losses (e.g., Indonesia, NW Brazil). Frequently, La Niña causes the opposite effects of El Niño throughout the world. Despite this ecosystem monitoring in ENSO-affected regions is barely available but of utmost importance for 1) a better understanding of the affected but highly adapted ecosystems; 2) contributing to the protection of the population from devastating ENSO effects (floodings, landslides, harvest losses, etc.) through informed conservation management; and 3) initializing the restoration of degraded ecosystems. The latter is the basis for preserving the astonishing tropical biodiversity, which is in dire need of protection, as for instance, in Peru already 95% of all tropical dry forests have disappeared (Portillo-Quintero & Sánchez-Azofeifa, 2010). Protecting nature from human intervention, especially climate change, is also one of Humboldt’s legacies. Probably he was the first to not only note the need for it but also to convince influential persons such as the US president Thomas Jefferson of nature conservancy (Wulf, 2015).

We end this letter in the hope that you concur with us that our study follows Humboldt’s footsteps, and therefore is especially suitable for the Special Humboldt Issue in the Journal of Biogeography. Please find attached the introduction and result sections of our manuscript (extended abstract). If the need arises, we would be more than happy to provide you with the full manuscript. Thank you for your time and considering our request.

Kind regards,

Jannes Muenchow

**References**

Beck, E., Bendix, J., Kottke, I., Makeschin, F., Mosandl, R., Caldwell, M.M., Heldmaier, G., Jackson, R.B., Lange, O.L., Mooney, H.A., Schulze, E.-D., & Sommer, U. (2008) *Gradients in a Tropical Mountain Ecosystem of Ecuador.* Springer Berlin Heidelberg, Berlin, Heidelberg.

Fraser, B. (2017) Peru’s floods teach tough lessons. *Nature*, **544**, 2.

Hill, M.O. & Gauch, H.G. (1980) Detrended correspondence analysis: an improved ordination technique. *Vegetatio*, **42**, 47–58.

Holmgren, M. & Scheffer, M. (2001) El Niño as a Window of Opportunity for the Restoration of Degraded Arid Ecosystems. *Ecosystems*, **4**, 151–159.

IPCC (2014) *Climate Change 2014: Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change.* Geneva, Switzerland.

Laurance, S.G.W., Laurance, W.F., Andrade, A., Fearnside, P.M., Harms, K.E., Vicentini, A., & Luizão, R.C.C. (2010) Influence of soils and topography on Amazonian tree diversity: a landscape-scale study. *Journal of Vegetation Science*, **21**, 96–106.

Muenchow, J., Bräuning, A., Rodríguez, E.F., & Wehrden, H. von (2013a) Predictive mapping of species richness and plant species’ distributions of a Peruvian fog oasis along an altitudinal gradient. *Biotropica*, **45**, 557–566.

Muenchow, J., Dieker, P., Kluge, J., Kessler, M., & von Wehrden, H. (2018) A review of ecological gradient research in the Tropics: identifying research gaps, future directions, and conservation priorities. *Biodiversity and Conservation*, **27**, 273–285.

Muenchow, J., Feilhauer, H., Bräuning, A., Rodríguez, E.F., Bayer, F., Rodríguez, R.A., & Wehrden, H. (2013b) Coupling ordination techniques and GAM to spatially predict vegetation assemblages along a climatic gradient in an ENSO-affected region of extremely high climate variability. *Journal of vegetation science*, **24**, 1154–1166.

Peres-Neto, P.R., Legendre, P., Dray, S., & Borcard, D. (2006) Variation partitioning of species data: Estimation and comparison of fractions. *Ecology*, **87**, 2614–2625.

Portillo-Quintero, C.A. & Sánchez-Azofeifa, G.A. (2010) Extent and conservation of tropical dry forests in the Americas. *Biological Conservation*, **143**, 144–155.

Wood, S.N. (2017) *Generalized Additive Models: An Introduction with R.* Chapman and Hall/CRC,

Wulf, A. (2015) *The invention of nature: Alexander von Humboldt’s new world.* Alfred A. Knopf, New York.