Do amphibian extinction rates surpass the planetary boundaries?

Using species habitat suitability models and neutral theory to estimate extinction rates

Level: Master
Start: Any time
Project form: Spatial and Monte-Carlo analysis in R
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Background

Comparing species extinctions over the last hundreds of years to pre-historic extinction rates suggests that Earth is undergoing its sixth mass extinction (Barnosky et al., 2011; Ceballos et al., 2015). Past extinctions are caused by pressures that precede these extinctions and current pressures lead to increased extinctions in the future. Hence, extinction rates based on past extinctions are likely an underestimation of extinction rates related to current conditions. Quantifying extinction rates prospectively is challenging because there are no global biodiversity models to assess the time to extinction in relation to human drivers. However, extinction debt theory enables the estimation of future extinctions based on current species population sizes (Halley et al., 2014; Halley & Iwasa, 2011).

Aim and approach

In this internship, you quantify global amphibian extinction rate estimates due to current conditions, instead of based on recent past extinctions (Alroy, 2015). First, you will apply habitat suitability models and species density estimates to derive population sizes. Second, you will use the current population sizes in an extinction debt theory model to estimate extinctions over time. These extinction estimates can be subsequently used to quantify species extinction rates in different world regions (Fig. 1).

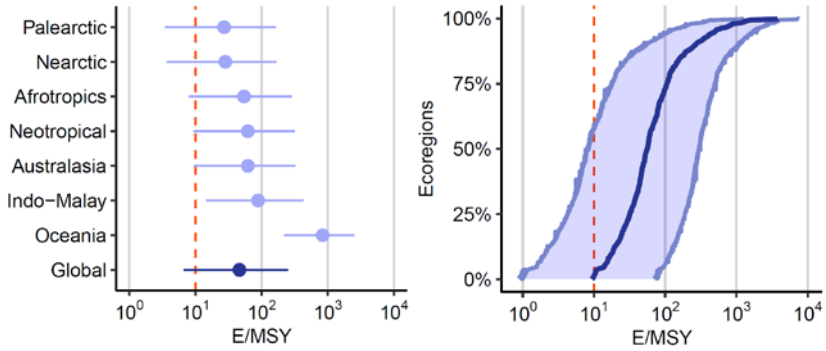

Figure 1. Mammal species extinction rates (Extinctions per Million Species Years; E/MSY) per biogeographic realm (left) and ecoregion (right).

Literature

Alroy, J. (2015). Current extinction rates of reptiles and amphibians. *Proceedings of the National Academy of Sciences of the United States of America*, *112*(42), 13003–13008. https://doi.org/10.1073/pnas.1508681112

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Ceballos, G., Ehrlich, P. R., Barnosky, A. D., Garcia, A., Pringle, R. M., & Palmer, T. M. (2015). Accelerated modern human-induced species losses: Entering the sixth mass extinction. *Science Advances*, *1*(5), e1400253–e1400253. https://doi.org/10.1126/sciadv.1400253

Halley, J. M., & Iwasa, Y. (2011). Neutral theory as a predictor of avifaunal extinctions after habitat loss. *Proceedings of the National Academy of Sciences of the United States of America*, *108*(6), 2316–2321. https://doi.org/10.1073/pnas.1011217108

Halley, J. M., Sgardeli, V., & Triantis, K. A. (2014). Extinction debt and the species-area relationship: A neutral perspective. *Global Ecology and Biogeography*, *23*(1), 113–123. https://doi.org/10.1111/geb.12098