How does species richness change across spatial scales and geographic regions?

Developing taxonomic- and biome-specific species-area relationships

Level: Master
Start: any time
Project form: Spatial analysis using R
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Background

Understanding large-scale gradients in biodiversity is a long-standing aim in macroecology and biogeography. Area is a key factor in explaining geographic differences in biodiversity, as larger areas typically host more species. Species-area relationships (SARs) quantify this positive relationship between species richness and area of habitat and are commonly approximated by a power law (Eq. 1), where the number of species (*S*) is related to area of habitat (*A*) based on the number of species per unit of area (c) and the species accumulation rate (*z*) (Arrhenius 1921).

$$\log(S) = \log(c) + z\log(A) \quad (1)$$

Recent studies based on mammals and plants have indicated that the slopes and intercepts of SARs differ across geographical regions (Storch et al. 2012; Gerstner et al. 2014; Kehoe et al. 2017). This indicates that a generic global SAR may not adequately capture large-scale differences in biodiversity (Figure 1). Region-specific SARs have, however, so far not been estimated systematically for other species groups, including birds, reptiles and amphibians.

Aim and approach

In the internship, you will estimate region-specific species-area relationships for birds, reptiles and/or amphibians. Using the R programming language, you will be analysing species occurrence data in order to find geographical patterns of species richness in relation to area (e.g., Figure 1). The results of this analysis can be used to explore possible factors that influence variability in the region-specific SAR slope and intercepts.

Figure 1. Mammal species-area relationships across the world's biomes (Kehoe et al. 2017).

Literature

Arrhenius, O. (1921). Species and area. *J. Ecol.*, 9, 95–99.

Gerstner, K., Dormann, C.F., Václavík, T., Kreft, H. & Seppelt, R. (2014). Accounting for geographical variation in species-area relationships improves the prediction of plant species richness at the global scale. *J. Biogeogr.*, 41, 261–273.

Kehoe, L., Senf, C., Meyer, C., Gerstner, K., Kreft, H. & Kuemmerle, T. (2017). Agriculture rivals biomes in predicting global species richness. *Ecography (Cop.).*, 40, 1118–1128.

Storch, D., Keil, P. & Jetz, W. (2012). Universal species–area and endemics–area relationships at continental scales. *Nature*, 488, 78–81.