INSTITUTIONEN FÖR BIOLOGI OCH MILJÖVETENSKAP

Big data insights into the distribution and evolution of tropical diversity

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Abstract

Tropical America (the Neotropics) and tropical Africa have comparable climate and share a geological history as parts of Gondwana. Nevertheless, the Neotropics today harbour roughly three times more flowering plant species than tropical Africa. The role of evolutionary history in generating this pattern remains poorly understood, mostly because collecting biological specimens in the tropics is difficult. Species occurrence information from collections in museums and herbaria has the potential to overcome this gap and, for the first time, enable an understanding of tropical biodiversity on a global scale across the tree of life. However, uncertain data quality and methodological limitations to process large amounts of data often hamper the use of collection records in biogeographic analyses, especially in historical biogeography invoking phylogenetic trees.

In this thesis I first (co-)develop three software tools to process large amounts of species occurrence data in biogeography: (1) *CoordinateCleaner* to test and insure data quality in large data sets of species and fossil occurrences, (2) *SpeciesGeoCoder* to include large-scale species distribution data in historical biogeography, and (3) *Infomap Bioregions* to delimit taxon-specific bioregions. I then apply these tools to identify processes underlying the evolution of tropical diversity across multiple taxonomic groups. The results suggest a significantly higher species turnover in the Neotropics compared to other tropical regions and identify this region, especially Amazonia, as a global species pump. Furthermore, shifts among different bioregions and biomes are more common than expected in evolutionary lineages of the Neotropics, and are potential drivers of diversification. The results show that biome shifts into seasonally dry biomes are particularly common, and increased during the last 20 million years, especially in the Bombacoideae (Malvaceae), a pantropical group with highest diversity in the Neotropics. The presented results shed further light on the evolutionary history of the differences in biodiversity across Earth's tropical regions, and provide a methodological route forward to integrate large-scale species occurrence data with information on species' evolutionary relationships to reveal general processes underlying the evolution of biodiversity across taxonomic borders.

Keywords

Amazonia, automated data cleaning, biome shifts, Bombacoideae, data quality, GBIF, Neotropics, tropical plant diversity.