

Geographic variations of seasonality and coexistence in communities: The role of diversity and climate

Andrés Canavero, Matías Arim, Alejandro Brazeiro

Abstract

One of the most conspicuous and widely analyzed patterns in ecology is the latitudinal gradient in species richness. Over the 200 years since its recognition, several hypotheses have accumulated in order to account for spatial variations in diversity. Geographic variations in seasonality have been repeatedly proposed as a determinant of community richness. However, the geographic structure of community seasonality has not yet been analyzed. In the present work we evaluated three hypotheses that account for variations in the temporal structuring of communities: first, environmental seasonality determines community seasonality; second, community richness determines its degree of structuring; and third, the presence of an increase in species segregation with latitude, reflected in a pattern of species negative co-occurrence. The hypotheses were evaluated using path analysis on 29 amphibian communities from South America, connecting latitude, environmental conditions, diversity, seasonality, and coexistence structure – nestedness and negative co-occurrence – within communities. Latitude positively affects community seasonality through an increase in temperature seasonality, but a weak negative direct effect suggests that other variables not considered in the model – such as the strength of biotic interactions – could also be involved. Both latitude and diversity (directly and indirectly) determine an increase in negative co-occurrence and nestedness. This suggests that groups of species that are mutually nested in time are internally segregated. Further, the strength of this structure is determined by community diversity and latitude. Temporal structuring of a community is associated with latitude and diversity, pointing to the existence of a systematic change in community organization far beyond, but probably interrelated, with the recognized latitudinal trend in richness. The available information and analysis supported the three hypotheses evaluated.