Forest fragmentation shapes the relationship between local and regional richness in plant communities

Ali Almoussawi*[1]

[1]Ecologie et Dynamique des Systèmes Anthropisés (EDYSAN) – Université de Picardie Jules Verne, Centre National de la Recherche Scientifique : UMR7058, Centre National de la Recherche Scientifique : UMR7058 – Université Picardie Jules Verne Amiens France, France

Abstract

Local richness (alpha-diversity) is the result of an environmental filtering of a larger (regional) pool of species available at a coarser spatial resolution (gamma-diversity). This spatial nestedness constrains the alpha-gamma relationship towards either linear (cf. proportional sampling) or curvilinear (cf. community saturation) patterns. Here, we assume that forest fragmentation shifts the AGR from a linear, at low fragmentation, to a curvilinear pattern at high fragmentation, especially so for forest specialists. Across nine 5km × 5km landscape windows in northern France, we surveyed 116 forest patches scattered across three different levels of forest fragmentation: none (fake patches within a forest matrix); intermediate (connected patches within a matrix of grasslands); and high (isolated patches within a matrix of crop fields). Plant species richness of both forest specialists and generalists was surveyed at five nested spatial resolutions: 1m2; 10m2; 100m2; 1000m2; and total patch area. We used linear mixed-effects models to test, for each pair of nested spatial resolutions and for forest specialists and generalists separately, whether the fragmentation level interacts with gamma diversity while controlling for the effect of patch characteristics (size, area and age), habitat quality (soil and light conditions) and heterogeneity (proportion of forests within the landscape). For forest specialists, we found an interaction with a curvilinear pattern at high fragmentation level in two out of ten pairs of nested spatial resolutions (100m2 vs 1000m2 & 100m2 vs total patch area). For forest generalists, the interaction appeared in the other eight pairs of nested spatial resolutions and was reversed, with a curvilinear pattern at low fragmentation level. This suggests that fragmentation influences the alpha-gamma diversity relationship differently for forest specialists and generalists and thus should be taken into account, in addition to patch characteristics and habitat quality and localization, when predicting local richness from the regional species pool.

*Speaker