
Network analysis provide new perspectives to identify plant bioregions : a case study in the Mediterranean region of France

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Abstract

The delimitation of bioregions helps understand historical and ecological drivers of species distribution. The Mediterranean basin offers a rich mosaic of plant distribution patterns, whose description constitutes a great challenge toward a global understanding of the flora. In particular, transition areas between biomes have raised difficulties to set comprehensive limit between bioregions.

We performed a network analysis of plants distribution in south of France (Languedoc-Roussillon and Provence-Alpes-Côte d'Azur) to analyze the biogeographical structure of the French Mediterranean flora. We analyzed a large database containing 2.5 millions of geolocated plant records, corresponding to more than 3,500 plant species. This method allowed

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us to identify biogeographical regions under the form of spatial network communities, and analyze their interactions based on the relative contribution of plant species to each bioregion.

First, we identified 2 sub-networks that distinguish mediterranean and temperate-mountainous biota. Then, we separated eight statistically significant bioregions that present a complex spatial structure. Some of them are spatially well delimited, and match with particular geological entities. On the other hand fuzzy transitions arise between adjacent bioregions that share a common geological setting, but are spread along a climatic gradient. This is exemplified by the identification of the cluster "Mediterranean border", that constitutes a transition entity between the two biomes.

The proposed network approach illustrates the biogeographical structure of the flora and provides precise insights into the relationships among bioregions. It gives analytic clues to spatially identify the Mediterranean bioregion, whose delimitation has been long debated among biogeographers. This approach demonstrates how climatic gradients and geological substrate shapes biodiversity patterns in the Mediterranean, and exemplifies why fragmented distributions are common in the Mediterranean region, isolating groups of species that share a similar eco-evolutionary history.