Floristic patterns and mediterranean exurban landscapes: Relative importance of economic geography and landscape structure in functional diversity

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Introduction

Due to demographic growth over the last few decades, urban development and its impacts on wildland areas (diversity loss, fire risk) has become a major concern in developed communities in Mediterranean France. Especially, during the last decades, urban spread around the city of Marseille (a large employment pole in the area), has extended over agricultural and post-agricultural lands. Thus, urbanization and forests (results of abandoned agricultural grounds) constitute two intermingling systems in interaction, linear and surface urban configurations around or within forest islands, having recently re-structured the landscape: Wildland and forested areas in the Mediterranean region are popular and influence residential location choice. In this context, single houses answer a demand for space that urban areas cannot offer. Mutually, urbanization adjacent to or within forested areas modifies the structure and state of forest vegetation by increasing spatial fragmentation. At a local scale, urbanization and the associated human activities modify the composition and the structure of forest understorey and could then influence the functioning of the urbanized forest ecosystems in the long term.

Thus, urban and wildland area relationships drive landscape dynamics and generate various urban-forest interfaces. We therefore constructed research questions focused on urban-forest interfaces and hypothesize that forest states can be explained by urban impact via vegetation analysis at the landscape level. We tested this interdisciplinary landscape level by comparing plant responses in urban-forest interfaces from ecological landscape and socio-economic perspectives. This work was able to be made because of the approach of the landscape proposed by landscape ecology and which answers a demand of economic geography. With this goal in mind, we carried out floristic surveys in urban-forest interfaces. We performed multivariate analysis to test the influence of landscape pattern and socio-economic variables. Moreover, we built a Floristic Competitive Index (FCI), based on plant functional traits to test which variables may explain the presence of more or less closed forest (diversity, simplification of strata).

Floristic Competitive Index (FCI)

A Floristic Competitive Index (FCI) was derived from plant traits. Plant species are appropriate indicators of environmental parameters (Lavorel and Kramer, 1999). Growth-forms (Raunkier, 1934), adaptative stategies (Grime,2001) and seed dissemination (Muller and Molinier, 1938) were chosen to describe functional diversity in urban-forest interfaces. We used these plant functional traits because they are a means by which we can characterize system function. This conceptual framework assumes that functional groups are composed of species with shared responses to ecological processes. Every trait was weighted by a coefficient. The FCI index is defined as follows:

$$FCI = \left(\sum_{i=1}^{n} \alpha C_{ij} / R \right) * \sqrt{N}$$

where α is the coefficient, Cij is the coefficient of species i at site j, R is species richness and N the total species richness (298 species). The square root was used to dampen the effects of species richness (Wilhem and Ladd, 1988). The disturbance index was limited between 0 and 1.

Regressions involving the disturbance were built from socio-economic, ecological and landscape variable groups. Local and regional levels were used in the model because both local and regional factors influence ecological processes. Socio-economic variables were recorded at the municipal level, ecological variables were recorded at local levels and landscape variables were calculated from the local to landscape levels.

References

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