

## **Symposium – # 31**

IALE-IUFRO Working Group

Adaptive forest management approaches: A landscape Ecology Holistic view

Chairs: Sandra Luque (IRSTEA, France) João Azevedo (CIMO, Portugal)

### **Title**

Effects of harvest intensity on tree species richness: a multiscale hierarchical approach accounting for the landscape context

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### **Abstract**

Disturbances derived from silvicultural practices may influence species richness of forest stands for decades. We need therefore to understand the potential impacts of different harvesting intensities in order to manage for biodiversity conservation. However, such impacts at the community level may not be properly understood without considering their interaction with other processes occurring at the landscape and regional level. In particular, it is important to evaluate whether the response of local species richness to canopy opening is consistent across a gradient of productivity (climatic) conditions; and more importantly, whether such response to harvesting depends on the composition of the surrounding landscapes. In that purpose, we used data from the Spanish national forest inventory in a large Mediterranean region in central Spain; and adopted a holistic, hierarchical approach considering regional-scale (climate and lithology), landscape-scale (intensity and extent of harvesting, and proportion of other woodland types in the landscape) and local-scale (forest structure and harvesting intensity) factors influencing local richness of tree species, and their interactions. Our study supports the overall hypothesis that a hierarchical set of

processes influence species richness. We found that partial harvesting in both coniferous and broad-leaved Mediterranean forests may support greater tree species richness than complete harvesting and no management. However, this effect depended on the ecosystem and the surrounding landscape, being much less likely in semi-arid regions under water stress conditions and in landscapes dominated by managed forests. We also found that tree species richness in forest stands tended to decline with increasing proportion of plantations and *dehesas* (with generally fewer tree species than semi-natural forests), while the contrary occurred with the proportion of riparian forests in the landscape. In view of these results, we hypothesized that both species richness of trees in a stand and its response to a silvicultural disturbance depend on the pool of species in the surroundings able to colonize that site. We specifically tested this potential metacommunity dynamics using a graph theoretical approach. We estimated the potential diversity of seed fluxes that could be received at a given stand through long distance dispersal from other source tree populations, and evaluated the relevance of such flux diversity in a top-down hierarchical modelling structure. Results showed higher species richness in forest stands susceptible of receiving a higher diversity of seed fluxes. However, patterns in the response of species richness to partial harvesting were less clearly explained by differences in the diversity of potential seed fluxes. We argue that time lags in the responses, or differences in the proportion of shade-tolerant species in the landscape could mediate this interaction. Overall, our results emphasize the need of a wide scale approach to forest planning. Specific management recommendations also arise from this study; in particular, to optimize local richness of trees, we need to (i) apply regionally tailored practices with lower harvest intensities in areas of greater hydric stress; (ii) avoid the extensive application of a single silvicultural system over large areas and (iii) preserve a mosaic of species-rich forests that can act as sources of colonizers to enrich the regenerating stands nearby.

### **Main references**

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Martín-Queller E. & Saura S. 2013. Landscape species pools and connectivity patterns influence tree species richness in both managed and unmanaged stands. *Forest Ecology and Management* 289: 123-132.