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Taxonomic and Functional B-Diversity of Ants Along Tree Plantation Chronosequences Differ Between Contrasting Biomes

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Description

The replacement of natural by anthropogenic habitat changes biological communities in any biome. Variations in environmental conditions along the chronosequence of tree plantations may act as a gradient of environmental filtering where the gain or loss of species occurs. It is expected that environmental filtering increases with the decrease in environmental similarity between the plantations and the natural habitat. Young tree plantations are structurally more similar to grasslands than to mature plantations, which in turn are structurally more similar to subtropical forest than young plantations. This study compares patterns of beta diversity across exotic pine plantation chrono sequences in contrasting biomes. We predict that taxonomic and functional beta diversity between plantation and the natural habitat assemblages increase with plantation age in grasslands and decrease in the subtropical forest. We sampled epigean ants and measured environmental variables at 54 plantations of different ages and natural habitats in grassland and forest biomes in Argentina. Taxonomic and functional beta diversity between natural habitat and pine plantations were estimated through dissimilarity indexes of turnover and nestedness. To assess the response of beta diversity estimators to plantation age we performed general linear and non-linear models. Results revealed opposite beta diversity patterns between biomes along the plantation cycle. Turnover increased and nestedness decreased with declining environmental similarity between pine plantations and the natural habitats; changes in the identity of the species were coupled to changes in their functional characteristics. Thus, a given environmental gradient may produce different diversity patterns depending on the regional species pool. Forestry practices that generate environmental conditions similar to natural environments could help to conserve species from the natural habitat [1].

The study addresses the experiences and preferences of local people

Industrial tree plantations in developing countries result in land-use changes affecting local livelihood possibilities and the availability of ecosystem services. Given the benefits that plantations also produce, the key question lies in making plantations compatible with other land uses. Our paper investigates trade-offs related to ecosystem services and land-use options by applying a discrete choice experiment in Niassa, Mozambique. The study addresses the experiences and preferences of local people concerning the impacts of plantations on the availability of selected ecosystem services (water and firewood), and the characteristics of plantations (distance from farm plot and type of land converted to plantation). The data collected with household interviews in the neighbourhood of four plantation sites were analysed with the random parameters logit model. Accesses to water and greater distance from farm plots were perceived as more important factors than easier access to firewood or the type of land converted to a plantation. Preventing declines in water availability is by far the most important factor for local people, and is valued higher than the improvement of water availability, in accordance with theoretical expectations. Both observed negative impacts and experienced positive social impacts of plantations induced preference heterogeneity for plantations to be located at greater distances from farmland, water availability, and tolerance for additional plantations in the area [2].

Large uncertainties exist about the relative importance of aboveground litter and root carbon input on soil organic carbon decomposition in different forest types. Here, we report on our detritus input and removal treatments conducted to investigate how changes in aboveground and belowground carbon inputs affect soil organic carbon content and various microbial carbon metabolic functions in different plantation types (oak vs. pine, broadleaf vs. coniferous). The results of our study showed that doubling aboveground litter significantly increased SOC content and labile carbon metabolism in the oak plantation but not the pine plantation. Root trenching and aboveground litter removal decreased SOC content and carbon metabolisms. The effect of root trenching on carbon metabolisms was weaker than litter removal in the oak plantation but not the pine plantation. Detritus input and removal treatments changed the diversity and function of labile carbon (starch, carbohydrates, and amines/amides) and the metabolic activity of soil microorganisms in oak plantation, but mainly influenced recalcitrant carbon (polymers) metabolism in the pine plantation. Detritus input and removal treatments influenced the composition of microbial carbon metabolic genes and functions mainly by modifying the soil environment and nutrient

availability including moisture, pH, nitrate content, and available phosphorus content in the oak plantation, while it influenced carbon metabolism by altering soil moisture, and the ammonium, nitrate, and organic carbon content in the pine plantation. These findings indicate that different forest ecosystems could respond differently to different disturbances, and forest management should be adjusted accordingly. Eucalyptus plantations have been established in many areas of the world due to their fast growth and profitability. In NW Spain, Eucalyptus plantations now cover a larger area than native forests. Although Eucalyptus plantations have been shown to affect biodiversity, relatively few studies have compared their effect on multiple taxonomic groups and different aspects of biodiversity [3]. We compared herb and bird species richness and bird abundance between 14 paired patches of native deciduous forest and Eucalyptus plantations in a heterogeneous agro-forest region of NW Spain. We also investigated whether Eucalyptus plantations contribute to shifts in community composition by analysing species nestedness and turnover. We found that species richness of both herbs and birds was consistently lower in Eucalyptus plantations compared to native forests. Furthermore, the abundances of bird species characteristic of agricultural, forest, scrubland and other habitats, were all much lower in Eucalyptus plantations than in native forests. Herb and bird communities were also significantly dissimilar between the two habitats, but as a result of different ecological processes. Species turnover explained variation between habitats in herb composition, such that species present in native forests were typical for both farmland and forest habitats, whereas those present in Eucalyptus plantations were typical for scrub and farmland habitats[4]. In contrast, bird assemblages showed a significant nested subset pattern, with fewer species in Eucalyptus plantations compared to native forests. In total, the relative abundance of cavity-nesting forest birds was at least 64% higher in native forests [5]. Our results show that Eucalyptus plantations cannot replace native forests as they harbour different herb species and only a subset of the bird species found in native forests. Considering the current rate of increase of Eucalyptus plantations and the fragmentation of native forests in NW Spain, a lack of conservation of native forests could result in future loss of biodiversity in general and forest specialist species in particular.

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