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# Do eucalypt plantations provide habitat for native forest biodiversity?

María Calviño-Cancela [a,*], Margarita Rubido-Bará [a], Eddie J.B. van Etten [b]

[a] Departamento de Ecoloxía e Bioloxía Animal, Universidade de Vigo, EUET Forestal, Campus Universitario, 36005 Pontevedra, Spain
[b] School of Natural Sciences, Edith Cowan University, 270 Joondalup Drive, Joondalup 6027, Perth, Australia

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ABSTRACT

Plantation forestry contributes to the economic growth of many regions, but may also produce ecological impacts (e.g. on biodiversity) that can be reduced with proper management. We assessed the value of eucalypt plantations to favor habitat connectivity at the landscape scale by determining their ability to provide habitat for species associated with the natural vegetation. For this purpose, we compared diversity and composition of understory vegetation in low-management eucalypt plantations in young, intermediate (ready for harvest) and mature stages with pine plantations, native forests and shrublands. We estimated the true species richness with Chao2 estimators and compared among habitats the average species richness (at two different local scales: per plot and per site), Shannon indices and biovolume of herbs, shrubs and trees in the understory using ANOVAs or GLZs, depending on data distributions. Differences among habitats in understory species composition and functional types were compared with PERMANOVA, and were graphically represented using NMDS ordinations. At local scales, diversity tended to be higher in native communities (native forests and shrublands) and lower in plantations (lowest in intermediate eucalypt plantations). Diversity across all study sites was again lowest in eucalypt plantations in intermediate age, but was relatively high in other plantations, due to a high species turnover in young and mature eucalypt plantations. Eucalypt plantations were similar to shrublands in understory species composition and functional types when young, becoming more distant to them when older, and more similar to pine plantations and native forests. Native forests were the most distinctive community, with pine plantations being the most similar to them. Native forests harbored the rarest species and were also associated with seed dispersal by vertebrates (internally). Ant- and wind dispersal were the most common in shrublands and eucalypt plantations. Given the prevalence of eucalypt plantations in some regions, determining (and improving, if feasible) their ability to harbor biodiversity of native communities becomes a crucial goal, in order to increase landscape connectivity and favor species persistence at regional scales. In the study region, eucalypt plantations provide habitat for species typical of shrublands when young but do not contribute significantly to the maintenance of the understory biodiversity associated with native forests. Considering the distinctiveness of native forests, we favor protection and, where feasible, restoration of native forests over managing eucalypt plantations for biodiversity to best improve conservation outcomes.

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## 1. Introduction

In many countries, plantation forestry depends on a few fast-growing tree species, often exotic. These species contribute significantly to the economic growth of many regions, but may also produce substantial changes in natural ecosystems, with impacts on biodiversity and ecosystem services, which can be nevertheless reduced with proper management, thus increasing the sustainability of this important economic sector (Richardson, 1998; Hartley, 2002).

Tree plantations are expanding worldwide, while natural forests are in decline and increasingly fragmented (FAO, 2010). Temperate forests have been highly influenced by human activities through history and their extension has been dramatically reduced throughout the world, mainly due to overexploitation and conversion to farmland and tree plantations (Hannah et al., 1995; Teixido et al., 2010). Among them, oak (e.g. *Quercus robur*) forests harbor a rich biodiversity, which is endangered as a consequence of their decline (Castro et al., 2001). In fragmented landscapes, species

*Abbreviations:* FAO, Food and Agriculture Organization; YngEuc, young *Eucalyptus globulus* plantations; IntEuc, intermediate *E. globulus* plantations; MatEuc, mature *E. globulus* plantations; PineP, pine plantations; NatFor, native forest dominated by *Quercus robur*; Shr, shrublands dominated by *Ulex* spp. and *Erica* spp.; GLZ, Generalized Linear Models; PERMANOVA, Permutational Multivariate Analysis of Variance; NMDS, Non-parametric Multidimensional Scaling ordinations; S, species richness; $S_{obs}$, observed species richness; $S_{est}$, estimated species richness.

* Corresponding author. Tel.: +34 986 801 941; fax: +34 986 801 907.
*E-mail addresses:* maria@uvigo.es (M. Calviño-Cancela), margarubido@uvigo.es (M. Rubido-Bará), e.van_etten@ecu.edu.au (E.J.B. van Etten).

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