The influence of native species composition on the invasibility of island floras across spatial scales

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Abstract

The establishment of alien species on oceanic islands is thought to be associated with the availability of empty niche space, reflecting abiotic and biotic filtering that generates species-poor, disharmonic native island biotas. Consequently, alien species that are distantly related to and are functionally distinct from native species should be more likely to establish on more remote islands (i.e. Darwin's naturalization hypothesis). Here, we test these hypotheses for flowering plants at two spatial scales. First, at the island scale, we model the number and proportion of naturalized alien plant species per island as a function of socioeconomic factors, biogeographic characteristics of islands, and phylogenetic and compositional properties of their native floras. These properties include a quantitative measure of compositional disharmony, phylogenetic community metrics quantifying the degree of clustering of the native flora, and the mean phylogenetic distance between native and alien species of island assemblages. Our analyses were based on species composition data for a global set of more than 400 islands from the Global Inventory of Floras and Traits database (GIFT;

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http://gift.uni-goettingen.de) and the Global Naturalized Alien Flora database (GloNAF; http://www.glonaf.org). Second, at the local community scale, we model individual species occurrences of alien and native woody plant species. Using 9,655 forest plots from 101 Pacific islands, we consider the extent to which alien species' traits and their relatedness to native species affect establishment. We expect a positive effect of compositional disharmony and phylogenetic clustering of native island floras on the number and proportion of naturalized alien plant species at the island scale. At the local community scale however, we anticipate an even stronger effect of phylogenetic distance between native and alien species on alien species establishment, because interactions (e.g., competition, facilitation) between alien and native species are likely to be strongest at this scale. Our results shed light on the invasibility of native plant communities on oceanic islands at different spatial scales, and may help to predict island assemblages that are most vulnerable to future invasions and ecological strategies that are associated with future plant invaders.

Keywords: Darwin's naturalization hypothesis, invasions, naturalized species, phylogenetic structure, species composition