

Ecosystem engineering facilitates invasions by exotic plants in high-Andean ecosystems

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Summary

1 Ecosystem engineers are organisms that change abiotic conditions in ways that affect the performance and distribution of other species, including exotics. Several mechanisms have been proposed for the successful establishment of exotic plants in natural communities, but the positive effects that native engineer species may have on the distribution and performance of exotic plants remain unknown.

2 In this study, we propose that amelioration of extreme abiotic conditions by ecosystem engineers can make stressful habitats invadable by exotic plant species, with larger positive effects on the performance of exotic plants as environmental harshness increases. We tested this hypothesis by assessing the effects of a high-Andean ecosystem engineer, the cushion plant *Azorella monantha*, which is known to create habitat patches where environmental conditions are less extreme than in the surrounding habitats, on the distribution and the performance of two exotic plant species, field chickweed (*Cerastium arvense*) and common dandelion (*Taraxacum officinale*), along an elevation gradient in the Andes of central Chile.

3 We measured and compared the abundance, biomass and survival of both exotic species within and outside cushion habitat patches at three elevations (3200 m, 3400 m and 3600 m), and evaluated whether the effects of *A. monantha* varied across elevations.

4 The results indicated that cushion plants positively impact the performance of both exotics, and have greater facilitative effects at higher elevations. Indeed, at the higher elevation site, *C. arvense* was only detected within *A. monantha* patches, suggesting that cushions may expand the distribution range of exotics. These results suggest that ecosystem engineering by native species could promote biological invasions in harsh environments, leading to higher abundances of invaders than those expected in the absence of engineers.

5 Given the conspicuousness of ecosystem engineering in nature, we suggest that exotic species eradication programmes might be less successful by not taking into account the facilitative effects of native engineer species on invaders. Further, we suggest that the recent proposals to use engineer species in ecosystem restoration should be aware of their potential role in promoting invasions.