

Shrub facilitation drives tree establishment in a semiarid fog-dependent ecosystem

Macek, P., Schöb, C., Núñez-Ávila, M., Hernandez Gentina, I. R., Pugnaire, F. I., & Armesto, J. J. (2018). Shrub facilitation drives tree establishment in a semiarid fog-dependent ecosystem. *Applied Vegetation Science*, 21(1), 113-120. <10.1111/avsc.12301> Accessed 10 Nov 2020.

Abstract

Questions

The exceptional occurrence of tall rain forest patches on foggy coastal mountaintops, surrounded by extensive xerophytic shrublands, suggests an important role of plant–plant interactions in the origin and persistence of these patches in semi-arid Chile. We asked whether facilitation by shrubs can explain the growth and survival of rain forest tree species, and whether shrub effects depend on the identity of the shrub species itself, the drought tolerance of the tree species and the position of shrubs in regard to wind direction.

Location

Open area–shrubland–forest matrix, Fray Jorge Forest National Park, Chile.

Methods

We recorded survival after 12 years of a ~3600 tree saplings plantation (originally ~30-cm tall individuals) of *Aextoxicon punctatum*, *Myrceugenia correifolia* and *Drimys winteri* placed outside forests, beneath the shrub *Baccharis vernalis*, and in open (shrub-free) areas. We assessed the effects of neighbouring shrubs and soil humidity on survival and growth along a gradient related to the direction of fog movement.

Results

B. vernalis had a clear facilitative effect on tree establishment and survival since, after ~12 years, saplings only survived beneath the shrub canopy. Long-term survival strongly depended on tree species identity, drought tolerance and position along the soil moisture gradient, with higher survival of *A. punctatum* (>35%) and *M. correifolia* (>14%) at sites on wind- and fog-exposed shrubland areas. Sites occupied by the shrub *Aristeguietia salvia* were unsuitable for trees, presumably due to drier conditions than under *B. vernalis*.

Conclusions

Interactions between shrubs and fog-dependent tree species in dry areas revealed a strong, long-lasting facilitation effect on planted tree's survival and growth. Shrubs acted as benefactors, providing sites suitable for tree growth. Sapling mortality in the shrubland

interior was caused by lower soil moisture, the consequence of lower fog loads in the air and thus insufficient facilitation. While *B. vernalis* was a key ecosystem engineer (nurse) and intercepted fog water that dripped to trees planted underneath, drier sites with *A. salvia* were unsuitable for trees. Consequently, nurse effects related to water input are strongly site and species specific, with facilitation by shrubs providing a plausible explanation for the initiation of forest patches in this semi-arid landscape.

Keywords

Aextoxicon punctatum *Baccharis vernalis* drought stress gradient ecosystem engineers facilitation fragmented rain forest landscape patchiness plant–plant interactions succession