



## Tansley review

# Facilitation as a ubiquitous driver of biodiversity

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## Summary

Models describing the biotic drivers that create and maintain biological diversity within trophic levels have focused primarily on negative interactions (i.e. competition), leaving marginal room for positive interactions (i.e. facilitation). We show facilitation to be a ubiquitous driver of biodiversity by first noting that all species use resources and thus change the local biotic or abiotic conditions, altering the available multidimensional niches. This can cause a shift in local species composition, which can cause an increase in beta, and sometimes alpha, diversity. We show that these increases are ubiquitous across ecosystems. These positive effects on diversity occur via a broad host of disparate direct and indirect mechanisms. We identify and unify several of these facilitative mechanisms and discuss why it has been easy to underappreciate the importance of facilitation. We show that net positive effects have a long history of being considered ecologically or evolutionarily unstable, and we present recent evidence of its potential stability. Facilitation goes well beyond the common case of stress amelioration and it probably gains importance as community complexity increases. While biodiversity is, in part, created by species exploiting many niches, many niches are available to exploit only because species create them.

‘Simultaneous competition and beneficence [facilitation] can have major impacts on plant community structure’.

Hunter & Aarssen (1988)

‘...community assembly mechanisms determining the nature and magnitude of facilitative effects on the composition of species and diversity of a community are not well understood’.

Schöb *et al.* (2012)

## I. Introduction

Interactions between organisms have long been considered a major driver in the structuring and organization of natural communities (Hairston *et al.*, 1960; Tilman, 1982; Mittelbach, 2012). Specifically, interactions within trophic levels have been widely deemed to be a key element of these drivers through their effect on coexistence and biodiversity (Chesson, 2000; Silvertown, 2004).