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Away-field advantage: mangrove seedlings grow best in litter from other mangrove species

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Plant community composition can impact ecosystem processes via litter feedbacks. Species variation in litter quality may generate different patterns of nutrient supply for plants that are dependent on litter inputs. However, it is not known whether plants grow faster in their own litter, litter from other species, or in litter mixtures from multiple species. To test whether litter identity and mixture status influenced mangrove seedling growth, biomass allocation, and stoichiometry, we performed mesocosm experiments. Two species of mangrove seedlings, *Avicennia germinans*, black mangrove and *Rhizophora mangle,* red mangrove, were exposed to all possible combinations of three mangrove litter types and were isolated from all other nutrient inputs. Litter treatments significantly altered seedling growth. Seedlings from both mangrove species grew most rapidly in litter from a different species rather than their own, irrespective of litter chemical quality, decomposition rate, and nitrogen release. Litter mixtures from white and black mangroves caused black mangroves to grow 65% more than expected. Litter treatments did not impact seedling root:shoot ratios or tissue C:N. Our finding that seedlings grow best in litter from other species may indicate a mechanism that helps sustain the coexistence of dominant species.

At the plant–soil interface, plants, microorganisms, and soil fauna interact to regulate ecosystem productivity via nutrient availability. Through litter production and nutrient release during decomposition, plants influence soil nutrient availability and soil communities, so that plants may exert a strong influence over the soil environment in which they exist (Menyailo et al. 2002, Chapman et al. 2006, Schweitzer et al. 2008, van der Heijden et al. 2008). However, we still have a limited understanding of how litter production by co-occurring plant species can cascade through soils and feed back to indirectly impact plant productivity (Nilsson et al. 2008). Though they are often difficult to detect, plant–soil feedbacks may be important for structuring and maintaining plant communities and driving nutrient cycling (Bever 1994, Ehrenfeld et al. 2005, Kulmatiski et al. 2008, van der Heijden et al. 2008, Ayres et al. 2009, Mangan et al. 2010, Pregitzer et al. in press). Because estuarine systems allow for tidal movement of litter, plants often grow among other plant species' litters, rendering litter feedbacks in these ecosystems more complex and unpredictable than those in terrestrial systems where litterfall is more predictable based on overstory community composition. In this study, we examine 1) whether plant litter identity alters the growth of mangrove seedlings, and 2) whether mixing litter can have a positive influence on seedling growth.

Leaf litter from different plant species varies in both physical and chemical traits. Physical characteristics of litter such as water-holding capacity and morphology can alter soil microclimate. Chemical quality of litter regulates nutrient release from litter during decomposition and may alter salinity of soils. Soil microenvironment and nutrient availability may be particularly important for plant seedlings due to intense competition for resources such as light, water, and nitrogen (N). Leaf litter has been shown to impact seedling germination, establishment (Vellend et al. 2000, Padhy et al. 2000, Conway et al. 2002), and growth (Xiong and Nilsson 1999, Quested et al. 2003, Dorrepaal et al. 2007).

Negative plant–soil feedbacks, in which plants grow more slowly in soils cultured under a conspecific, have been now been documented in many ecosystems (reviewed by Kulmatiski et al. 2008). These ecological patterns may be caused by an accumulation of soil-based enemies (Bever et al. 1997). Conversely, positive plant–soil feedbacks confer advantages to conspecific juvenile plants via soil culturing with beneficial organisms (Bever et al. 1997). Fewer studies have documented plant–litter feedbacks; however, researchers have shown that litter decomposes most rapidly when in the presence of the plant species that generate that litter type (Gholz et al. 2000, Vivanco and Austin 2008, Ayres et al. 2009, 2010), otherwise known as a 'home-field advantage'. Both feedback studies and these 'home-field advantage' to decomposition studies may have important implications for plant succession and species coexistence. Yet, not much is known about whether conspecific litter production can confer productivity advantages to the species studied. Similar to a positive plant–soil feedback based on soil organisms, if plants grow best in their own litter, perhaps their offspring (and thus seedlings) are likely to persist in the parental habitat.