Title:

Macro-detritivore identity drives leaf litter diversity effects.

Abstract:

With the current worldwide decline of biodiversity it is important to find out how ecosystem processes will be affected. For leaf litter decomposition, an important process in terrestrial and aquatic ecosystems, the importance of litter species diversity has been shown by previous litter-mixing studies with the occurrence of non-additive litter diversity effects. This means that mixtures of leaf litter decomposed faster than was expected on basis of their monocultures. However, it is not clear why they occurred in only half of the studies and which underlying mechanisms can explain these conflicting results. We hypothesized that the effect of higher trophic levels such as macro-detritivores could help to explain the variable result of litter mixture studies. Although often ignored, macro-detritivores are known to strongly influence decomposition. To better understand the importance of macro-detritivores for litter mixing effects during decomposition, four common litter species were added separately and in two and four species combinations to monocultures of three different terrestrial macro-detritivores and a control without fauna. Furthermore the additive partitioning method was used to gain further insight into the underlying mechanisms.

Our results clearly show that litter-mixing effects occurred only in the presence of two macro-detritivores (earthworms and woodlice, see fig. 1 A). Application of the additive partitioning method revealed that, in the specific combination of woodlice and the presence of Fagus, litter mixing effects were strongly driven by a selection effect (fig. 1 C). This was caused by food preference of the isopod: the animals avoided the slow decomposing species when given the choice. However, most litter mixing effects were caused by complementarity effects (fig. 1 B). The potential mechanisms underlying these complementarity effects can be either direct, for instance due to a macro-detritivore preference for a mixed diet, or indirect, via the microbes, by for instance litter mixing and fragmentation, passage through the detritivore digestive system or detritivore feaces. Our results clearly show that higher trophic levels should be taken into account when explaining litter mixture effects and that both litter and animal identity can affect litter decomposition. This may help to explain the conflicting results obtained in previous experiments and thereby clarify the relationship between biodiversity and leaf litter decomposition.

Figure 1. Diversity effects for the different fauna treatments. Shown are the average net diversity effects (A) and its complementarity (B) and selection (C) compartments, of the two and fours litter species mixtures (gram/microcosm). Bars represent mean ± se.