Plant litter mixture mitigates the negative effects of increased drought on soil biodiversity and litter decomposition process in Mediterranean forest

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Abstract

Determining the responses of communities and ecosystem processes to future environmental conditions is a major challenge of ecological research. Ecosystems respond to climate change in complex ways, and the outcome may significantly depend mostly on biodiversity. To study the relative effects of enhanced drought and plant diversity on soil biota and their role in litter decomposition, we experimentally manipulated a Mediterranean oak forest. Increased drought period decreased soil biota abundance and diversity. However, soil biota were affected to differing degrees by increased drought period, since Collembola abundance decreased more than Acari abundance, and one Collembola group (Neelipleona) totally disappeared. Drier conditions affected decomposers negatively, directly by reducing fungal biomass and detritivorous mesofauna, but also indirectly by increasing the predation pressure on detritivorous mesofauna by predatory mesofauna.

Litter decomposition was also negatively affected under drier climate, but the presence of several plant species in the litter mixtures appeared to mitigate this impact. In fact, mixing

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of plant species improved soil biota communities and led to a more efficient litter decomposition process, probably through a greater litter quality thereby mitigating the negative effects of increased drought period on these parameters.
Our results highlight that drier climate could affect soil biodiversity and ecosystem functioning, until the loss of biodiversity and associated functions. Since the linkage between plant diversity and soil biota improves ecosystem functioning and maintain its stability during drier climate, we suggest that there is a need for the conservation of diverse plant community in the future management of Mediterranean oak forests.

Keywords: climate change, ecosystem functioning, food web, Mediterranean forest, nutrient dynamics, plant, soil interaction, prey, predatory interaction, soil mesofauna