Geophysical Research Abstracts
Vol. 18, EGU2016-8912-1, 2016
EGU General Assembly 2016

Tree specie effects on soil microbial community composition and greenhouse gases emissions in a Mediterranean ecotone forest

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Over recent decades in the Iberian Peninsula, altitudinal shifts from Pinus sylvestris L. to Quercus pyrenaica Willd species has been observed as a consequence of Global Change, meaning changes in temperature, precipitation, land use and forestry. The forest conversion from pine to oak can alter the litter quality and quantity provided to the soil and thereby the soil microbial community composition and functioning. Since soil microbiota plays an important role in organic matter decomposition, and this in turn is key in biogeochemical cycles and forest ecosystems productivity, the rate in which forests produce and consume greenhouse gases can be also affected by changes in forest composition. In other words, changes in litter decomposition will ultimately affect downstream carbon and nitrogen dynamics although this impact is uncertain.

In order to predict changes in carbon and nitrogen stocks in Global Change scenarios, it is necessary to deepen the impact of vegetation changes on soil microbial communities, litter decomposition dynamics (priming effect) and the underlying interactions between these factors. To test this, we conducted a full-factorial transplant microcosms experiment mixing both fresh soils and litter from Pyrenean oak, Scots pine and mixed stands collected inside their transitional area in Central Spain. The microcosms consisted in soil cylinders inside Kilner jars used as chambers inside an incubator. In this experiment, we investigated how and to what extent the addition of litter with different quality (needles, oak leaves and mixed needles-leaves) to soil inoculums with contrasting soil microbiota impact on (i) soil CO_2, NO, N2O and CH4 efflux rates, (ii) total organic carbon and nitrogen and (iii) dissolved organic carbon and nitrogen. Furthermore, we assessed if these responses were controlled by changes in the microbial community structure using the PLFA analyses prior and after the incubation period of 54 days.