Geophysical Research Abstracts
Vol. 17, EGU2015-12121, 2015
EGU General Assembly 2015
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Plant species influence on soil C after afforestation of Mediterranean degraded soils

Maria T. Dominguez, Carlos García-Vargas, Engracia Madejón, and Teodoro Marañón
Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS-CSIC). 10 Reina Mercedes Av, 41012, Sevilla, Spain.

Increasing C sequestration in terrestrial ecosystems is one of the main current environmental challenges to mitigate climate change. Afforestation of degraded and contaminated lands is one of the key strategies to achieve an increase in C sequestration in ecosystems. Plant species differ in their mechanisms of C-fixation, C allocation into different plant organs, and interaction with soil microorganisms, all these factors influencing the dynamics of soil C following the afforestation of degraded soils. In this work we examine the influence of different woody plant species on soil C dynamics in degraded and afforested Mediterranean soils. The soils were former agricultural lands that were polluted by a mining accident and later afforested with different native plant species. We analysed the effect of four of these species (Olea europaea var. sylvestris Brot., Populus alba L., Pistacia lentiscus L. and Retama sphaerocarpa (L.) Boiss.) on different soil C fractions, soil nutrient availability, microbial activity (soil enzyme activities) and soil CO_2 fluxes 15 years after the establishment of the plantations. Results suggest that the influence of the planted trees and shrubs is still limited, being more pronounced in the more acidic and nutrient-poor soils. Litter accumulation varied among species, with the highest C accumulated in the litter under the deciduous species (Populus alba L.). No differences were observed in the amount of total soil organic C among the studied species, or in the concentrations of phenols and sugars in the dissolved organic C (DOC), which might have indicated differences in the biodegradability of the DOC. Microbial biomass and activity was highly influenced by soil pH, and plant species had a significant influence on soil pH in the more acidic site. Soil CO_2 fluxes were more influenced by the plant species than total soil C content. Our results suggest that changes in total soil C stocks after the afforestation of degraded Mediterranean soils are hardly detectable at decadal time-scales, and that more dynamic pools and fluxes must be monitored to determine which plant species should be promote to enhance C sequestration capacity.