Plant species influence on soil C after afforestation of Mediterranean degraded soils

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Background

- The loss of soil organic C is one of the main environmental problems in the Mediterranean basin, where 75 % of the soils have low or very low organic matter content (< 2 %).
- Afforestation of degraded lands is one of the key strategies to achieve an increase of C sequestration in ecosystems.
- Plant species differ in their mechanisms of C-fixation, C allocation into roots and interactions with soil microorganisms, all these factors influencing the dynamics of soil C following the afforestation of degraded soils.

Key Question

- How do different woody plant species affect soil C dynamics in degraded and afforested Mediterranean soils?

Studied Area and Plant Species

The Guadiamar Green Corridor (SW Spain) is a large-scale soil remediation project, where different native plant species were afforested after a mine spill in 1998 that contaminated soils with trace-elements (1). C pools and CO₂ fluxes underneath the cover of 4 woody plant species were analyzed 15 years after land remediation and compared with soils without woody cover (2), in 3 sites with different degree of soil contamination.

White poplar (Populus alba L.)
Retama shrub (Retama sphaerocarpa (L.) Boiss)
Wild olive tree (Olea europaea subs. europaea L.)
Mastic tree (Pistacia lentiscus L.)

 Soil Respiration
 Total soil C
 Nutrient availability
 Microbial biomass and activity
 DOC/DON
 Litter layer
 Herbaceous cover

Conclusions

- 15 years after the establishment of the plantations the influence of the planted species is still limited, being more pronounced in the more acidic and nutrient-poor soils.
- Changes in soil C stocks after the afforestation of degraded Mediterranean soils are hardly detectable at decadal time-scales; more dynamic variables (microbial biomass, CO₂ fluxes) must be monitored to determine which plant species should be promoted to enhance C sequestration capacity in the long-term.

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