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

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RECARE
Preventing and Remediating degradation of soils in Europe through Land Care

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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.

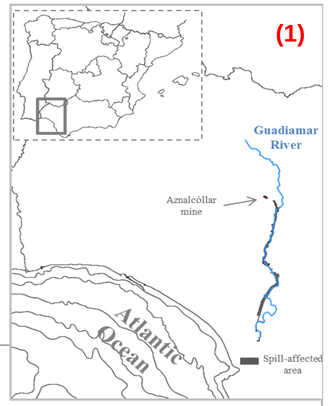
Key Question

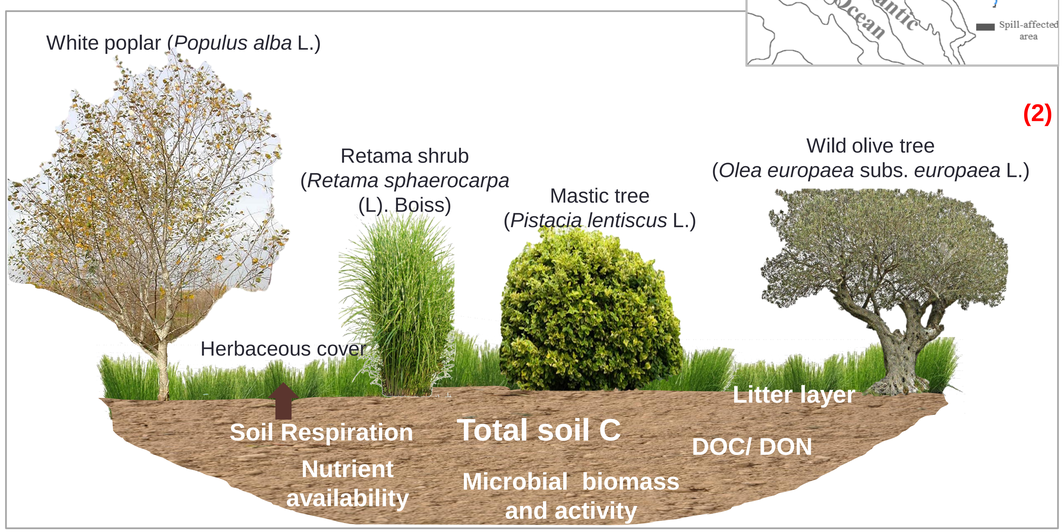
- **How do different woody plant species affect soil C dynamics in degraded and afforested Mediterranean soils?**

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 CO_2 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.



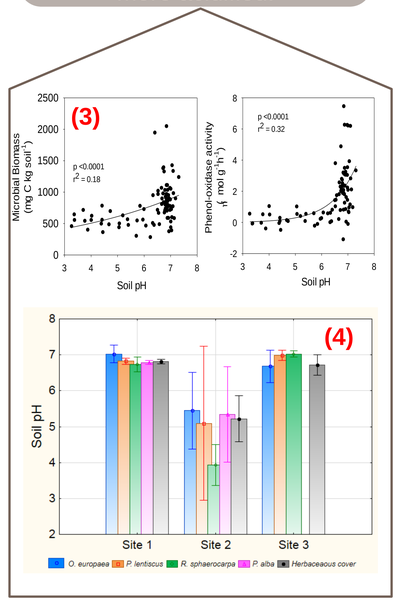


Main Results

Microbial biomass and **activity** (e.g. phenol-oxidase activity) was highly influenced by soil pH **(3)**, and plant species had a significant influence on soil pH in the more acidic site **(4)**. Soils under *Retama* shrubs were more acidified.

Differences in total soil organic C among species were more pronounce in the more acidic site (5). Concentrations of phenols and sugars in the dissolved organic C (DOC), which might indicate its biodegradability, were similar among species.

Soil CO_2 fluxes were more influenced by the plant species than total soil C content **(6)**. Soils under *Retama* shrubs showed the lowest fluxes. This might be related to the low decomposability of its litter.



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, CO_2 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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