EGU24-976, updated on 26 Jan 2025
https://doi.org/10.5194/egusphere-egu24-976
EGU General Assembly 2024

Rooted in the city: Unveiling the hidden world of Quercus cerris enzymatic activity in urban soils

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The intricate interaction between human activities and the repercussions of climate change has made urban ecosystem health and biodiversity—both vital to human survival and well-being—particularly vulnerable. Recent research has spotlighted the frequently underestimated but crucial role that interactions between plant roots and several biotic and abiotic components of soil play in affecting urban biodiversity and ecosystem dynamics.

We conducted a controlled experiment to investigate this relatively obscure aspect of the urban environment. The experiment has been done with young plantlets of *Quercus cerris* and three urban soils collected from distinct sites in the city of Campobasso (Italy). We selected three sites in the city to clearly show a specific gradient of urbanization and vegetation fragmentation. *Q. cerris* young plants were grown in the rhizoboxes packed with three urban soils for two weeks to evaluate the impact of soil-plant interactions on the possible enzymes' release by the roots and root-harboring microorganisms. The spatial distribution of three enzymes, namely acid phosphatase (P-cycle), β-glucosidase (C-cycle), and leucine aminopeptidase (N-cycle), was mapped and detected in each soil region (*i.e.,* bulk soil and rhizosphere longitudinal surface) using a 2-D soil zymography technique.

The zymogram analysis revealed that the enzyme activities in soils differed spatially along the urbanization gradient, with the more urbanized soil having the highest levels of enzymatic activity and hotspot presence.

The root activity toward the exudation correlated with the highest enzymatic activity, that futrther lead to more intensive turnover of soil organic matter in soil. This could be linked to the exudation of roots to regulate plant growth in unfavorable conditions or to the rhizodeposition of substrates to change soil composition.

Further in-depth analyses of the physical and chemical properties of the soil, along with the profiling and characterization of the microbial community composition, are currently underway in order to obtain a better understanding of the role of root enzymatic activities and their

consequences on the biogeochemical processes in urban soils.