Researchers reveal lignin protection mechanism in forest soils

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Over the course of forest succession, both components of plant residues and the structure of soil microbial communities play important roles in affecting soil aggregates, and thus the sequestration and stability of soil

organic carbon. However, up till now there is still a lack of holistic understanding of the interactions among root turnover, microbial community composition, chemical composition of plant residues and different sized soil aggregates.

Feng Yue, Zhang Junhui and other researchers from the Forest Boundary Ecology Group of the Institute of Applied Ecology (IAE), Chinese Academy of Sciences, together with Prof. Han Shijie at Henan University, quantified lignin phenol composition, concentrations and oxidation levels in macroaggregates, microaggregates and silt–clay fractions in soils at five successional stages of the mixed broadleaf–Korean pine (Pinus koraiensis) forests in the Changbai Mountains.

The researchers also measured root biomass and turnover, and microbial biomass, etc. By analyzing data they collected, the researchers explored the mechanism affecting the protection of soil aggregates on plant-derived organic matter during the succession of the type of forest.

As a result, large macroaggregates (2-8 mm) accounted for 45.17—59.87% of the bulk soil dry weight and comprised 40.22—60.89% of soil organic carbon (SOC) in the stands of pioneer forests. There were higher proportion of small macroaggregates (0.25-2 mm) and SOC but lower lignin content and oxidation levels in the bulk soil and aggregates in the mature stands compared to other forest stands.

They found the highest soil carbon and lignin concentrations and that the silt-clay fractions sequestrated 56.18% of SOC and up to 84.17% of the lignin content in the 239 years old forest stands.

The study showed that, along with forest succession and the changes in plant residue chemistry, fine root and microbial biomass, SOC sequestration and lignin protection shifted from large aggregates to small

particles of silt-clay fractions. This may lead to the long-term accumulation of SOC in late successional forests.

In conclusion, by quantifying lignin, the researchers of this study revealed the relationship between carbon sequestration in soil aggregates and carbon input from plant residues over the course of vegetation development.

This study has been published in *Soil Science Society of America Journal* with the title "Variation in soil lignin protection mechanisms in five successional gradients of mixed broadleaf-pine forests."

More information: Yue Feng et al. Variation in soil lignin protection mechanisms in five successional gradients of mixed broadleaf–pine forests, *Soil Science Society of America Journal* (2020). DOI: 10.1002/saj2.20032

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