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Editorial: Forest soil carbon in a changing world

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Editorial on the Research Topic
Forest soil carbon in a changing world

The world is experiencing global changes as human activities intensify. Global changes have profound impacts on carbon (C) cycling in terrestrial ecosystems (Reich et al., 2020). Forest ecosystems are the largest C pool in terrestrial ecosystems. Forest soils contain 45% of the C stock of the entire forest ecosystem (Pan et al., 2011). Plant root input and litter decomposition are two key processes in maintaining forest soil C balance (Adamczyk et al., 2019). Therefore, understanding the root growth and litter decomposition is of great scientific importance for a more accurate assessment of the future global C cycle.

In this Research Topic, we highlighted the vertical distribution of root biomass and its regulatory factors in forest ecosystems with a gradient of phosphorus (P), litter phenolic acids during litter decomposition and thermal deposition of soil organic matter (SOM), and the effects of different nitrogen (N) additions and forms on litter decomposition.

Fine root is an important organ for plants to uptake water and nutrients, as well as an important pathway linking aboveground and belowground C cycling. Likulunga et al. conducted N and P addition experiments in three European beech forests. They found that low P addition significantly increased fine root biomass in the mineral layer but not in the organic layer of soil. Climate factors played a major regulatory role in fine root biomass in mineral layer, while soil moisture played a major regulatory role in fine root biomass in organic layer. These findings enriched the mechanisms underlying the vertical distribution of fine root biomass.

Litter decomposition can produce different types of phenolic acids. Zhao et al. studied that the phenolic acids produced during the litter decomposition in *Rhododendron* forests. The release of phenolic acids during litter decomposition was related to SOM, mineralized N, and available phosphorus.

In recent years, wildfire has become more frequent in forests. In addition to accelerating the release of C dioxide from litter, wildfires can also change the nutrients in the soil. Kupka et al. investigated the effects of simulated fire of forests on the physiochemical parameters of soil under laboratory conditions. They found that the thermal deposition of SOM did not significantly change soil organic C content but significantly increased N content, indicating that fire would change forest soil fertility.

Although the global N deposition has stabilized in recent years, it is still at a high level (Liu et al., 2020). How N deposition affects forest soil C processes is still a hot issue, including their forms and magnitudes. Through a 2-year field factorial fertilization experiment with different N forms, Wu et al. found that both forms of N deposition, i.e., organic N (ON) and inorganic N (IN), accelerated the wood decomposition rates, and the magnitude of the increase was species specific. Mixed fertilizer with ON and IN resulted in the highest responses in the wood decomposition rate compared with that in the control and in response to IN addition alone, which was modified by faunal and microbial community abundance of the decomposing wood. Based on a meta-analysis, Su et al. investigated the influences of various environmental and experimental factors on the relationships between N enrichment and litter decomposition in forests in focus, grasslands, and wetland ecosystems. They found N enrichment had an insignificant effect on litter decomposition globally but inconsistent effects when forests were subdivided into plantations, primary, and secondary forests. N enrichment significantly slowed litter decomposition rate in plantations but had no significant influence in primary and secondary forests. Litter decomposition was also affected by the amount of N added. Low N stimulated litter decomposition, but high N slowed it down. The effect of mixed N addition (such as urea and glycine) on litter decomposition was stronger than that of single N addition. These results suggested that the effects of N addition on forest litter decomposition were modified by both the magnitude and forms of N addition.

This Research Topic highlights the importance of studying the fate of forest soil C and underlying driving mechanisms, which could help to improve the prediction of global biogeochemical cycle models. These studies could provide important scientific evidence for mitigating climate change promoting a better atmospheric decarbonization and further enrich the theories of C processes.

Author contributions

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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