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Home-field advantages of litter decomposition increase with increasing nitrogen

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Due to fossil fuel combustion and agricultural practices, atmospheric deposition of nitrogen (N) has increased over the past decades, and is projected to increase further in coming years. N-deposition often leads to changes in soil biological communities, plant litter and soil characteristics. And all these changes in litter quality, soil abiotic factors, and the composition of the decomposer community will interact to influence decomposition processes in terrestrial ecosystem. Recently, some studies have shown that litter decomposes faster in its habitat of origin than in other habitats. This is called the "home-field advantage" (HFA) effect. However, our knowledge about the relative role of litter quality and soil characteristics in litter decomposition and HFA effects is still limited, especially under long-term N deposition.

To investigate this question, we collected soil and two types of litter (monospecific and mixed species litter) from a long-term N-deposition field experiment with seven N-addition treatments. We examined the effects of N-addition on litter quality and soil characteristics. We then carried out a three-pronged microcosm decomposition experiment with (i) litter from different N-addition treatments decomposed in a standard field soil; (ii) standard litter decomposed in soils from the different N-addition treatments; and (iii) litter decomposed in soil from the same N-addition treatment plot.

Photograph provided by authors.

Our study shows that N-addition greatly influences litter decomposition and increases the HFA effect via changes in the quality of litter and the soil characteristics. Local litter decomposed faster than standard litter on its home soil, and local litter decomposed faster on home soil than on a standard soil as indicated by positive "litter effects" and "soil effects". The results of our study suggest that the effects of N-addition on the soil characteristics appear more important for decomposition than its effects on litter quality. Nitrogen deposition is an important threat to ecosystems worldwide and our study emphasizes that ecosystem functions such as decomposition can be greatly influenced by these global changes.