# Linkage of Soil Fungal-to-Bacterial Dominance to Nitrogen Mineralization in Temperate Forests

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**Abstract**

The soil nitrogen (N) mineralization process is essential for the maintenance of forest ecosystems, and soil microorganisms play critical roles in this process. Fungi and bacteria, two major groups of soil decomposers, are considered to have distinctly different life strategies in terrestrial ecosystems. It is generally believed that fungal-dominated systems are associated with slow N cycling, whereas bacterial-dominated systems are associated with fast N cycling. However, recent studies have cast doubt on this linkage of fungal-to-bacterial dominance to N mineralization process. Additionally, previous studies indicated that plant traits (e.g., slow growing vs fast growing plants) could explain the linkage; however this explanation from plant traits cannot be applied to a wide range of soil systems (e.g., with different parent materials). I hypothesized (1) that soil fungal-to-bacterial dominance would link to the N mineralization potential in temperate forests, where few studies have addressed this linkage, (2) that C:N stoichiometry could explain the linkage over a wide range of soil systems, due to different biomass C:N ratios of fungi and bacteria. I investigated three temporal/spatial scales in temperate forests: (i) seasonal change, (ii) topographic scale, and (iii) sites with different parent material. Soil N mineralization potential was assessed with soil incubation under constant temperature, and the relative fungal-to-bacterial dominance was estimated by phospholipid fatty acid analysis. The results from the three scales in temperate forests showed that soil C:N ratio was closely associated to fungal-to-bacterial dominance. Additionally, the present results showed that fungal-dominated systems exhibited low N mineralization potential, whereas bacterial-dominated systems exhibited high N mineralization potential, indicating soil fungal-to-bacterial dominance is tightly linked to N mineralization process in temperate forests. Moreover, this study suggests that C:N stoichiometry could explain the linkage of fungal-to-bacterial dominance to N mineralization process, across a wide range of forest soils.

**Keywords**

Nitrogen mineralization, Fungi, Bacteria, Temperate forests, Forest soils, Gross N transformation potential, PLFA, Seasonal change, Topography, Volcanic soils