New dynamic vegetation model constructed for soil mineralized nitrogen prediction

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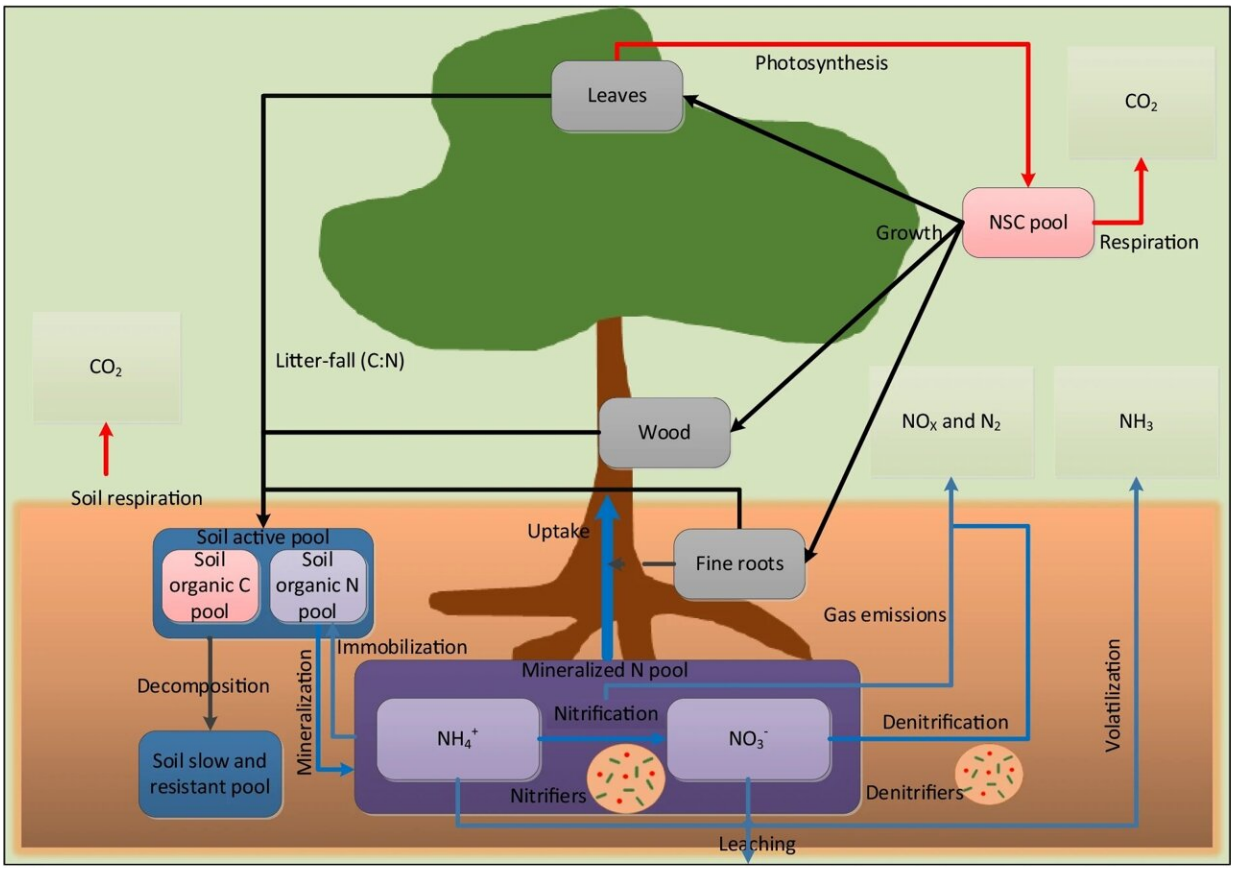

Schematic representation of FORCCHN2 model. Credit: Fang Jing

Mechanistic understanding of the dynamics and interactions of the nitrogen (N) cycles in forests has become more important with increased anthropogenic perturbations.

Generalizing from local field experiments to larger spatial scales or future environmental scenarios of N generally relies on simulation using ecological models. However, the applications of static statistical models and dynamic models are limited as it lacks an accurate description of plant and microbe growth.

Recently, a research team from the Wuhan Botanical Garden of the Chinese Academy of Sciences has constructed a dynamic vegetation model, FORCCHN2 version 2.0 (FORCCHN2), based on several key plant-soil-microbe N processes. The model was tested in a temperate forest (Harvard Forest) in central Massachusetts, U.S..

Results revealed that FORCCHN2 was able to reproduce the temporal changes in soil respiration and N mineralization rates. The soil inorganic N changed with the fine roots, microbes, and the concentration of the substrates.

The soil inorganic N pool had regular seasonal variations during a given year. In the spring, soil inorganic N pool changed around the initial value due to the low gross N mineralization rate and low tree N uptake. In the summer, the soil inorganic N pool increased because the gross N mineralization rate was more than N uptake and N losses. Then, soil inorganic N pools decreased slowly in the autumn and winter.

This model development was a new step toward a more mechanistic treatment of terrestrial N cycling based on the dynamics of plant biomass, soil substrate, and microbes.

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More information: Jing Fang et al, Predicting soil mineralized

nitrogen dynamics with fine root growth and microbial processes in temperate forests, *Biogeochemistry* (2022). DOI: 10.1007/s10533-021-00883-8

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