CABBI
CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

Reparameterizing Litter Decomposition Using a Simplified Monte Carlo Method Improves Litter Decay Simulated by a Microbial Model and Alters Bioenergy Soil Carbon Estimates

Background/Objective

Litter decomposition determines soil organic matter (SOM) formation and plant-available nutrient cycles. Therefore, accurate modeling of litter decomposition is critical for improved soil carbon (C) projections for bioenergy feedstocks. However, soil C models simulating microbial physiology are new to bioenergy agriculture and their parameterization is often based on small datasets or manual calibration. Here, researchers developed and tested a simple framework for using large-scale datasets for improved parameterization of microbial models.

Approach

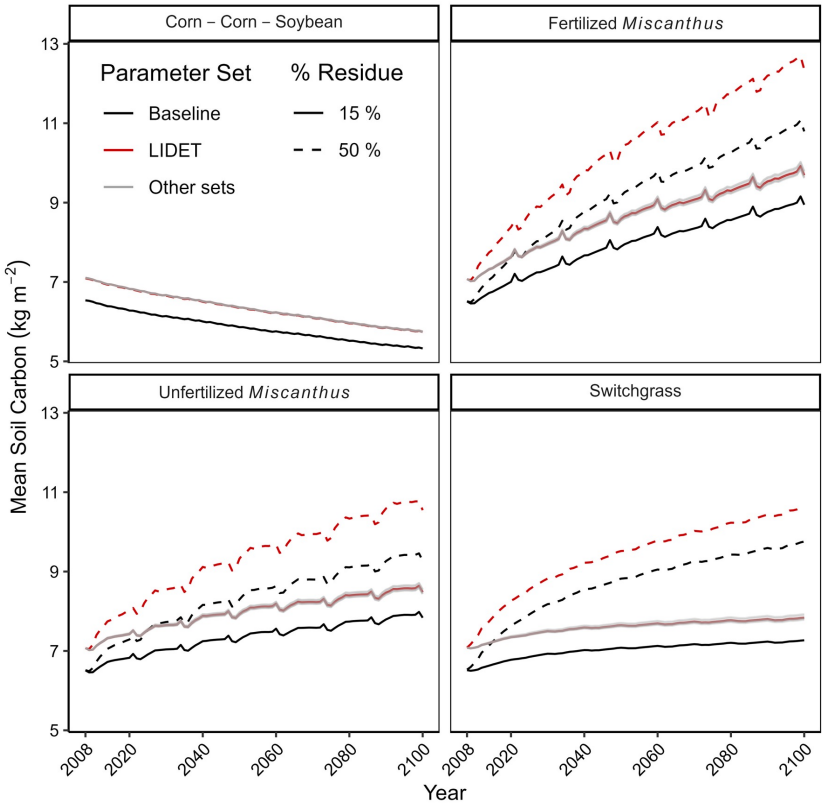
Researchers implemented a simple Monte Carlo simulation to reparameterize litter decomposition in the CORPSE model using the continental-scale LIDET dataset, which documents decomposition across a range of litter qualities over a decade. They applied the LIDET litter decomposition parameters to a microbial bioenergy model (Fixation and Uptake of Nitrogen — Bioenergy Carbon, Rhizosphere, Organisms, and Protection) to examine soil C estimates generated by Baseline and LIDET parameters.

Results

The LIDET-derived parameters improved modeled C and nitrogen (N) remaining, decomposition rates, and litter mean residence times as compared to Baseline parameters. Also, LIDET parameters increased estimated soil C under bioenergy feedstocks with even greater increases under elevated plant inputs (i.e., increased residue, N fertilization) due to the integrated effects of plant litter quantity, quality, and agricultural practices (e.g. tillage, fertilization).

Significance/Impacts

This work developed a simple framework for using large-scale datasets to inform the parameterization of microbial models which, in turn, impact soil C projections for bioenergy feedstocks.



FUN-BioCROP model estimates of soil C for four bioenergy feedstock scenarios using Baseline and LIDET parameters.

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