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Funktionelle Bedeutung von Mikroorganismengemeinschaften für die Stoffdynamik in Böden

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Titel
Modeling microbial dormancy in soils

Abstract
Dormancy is a very effective trait of microorganisms in soil to cope with varying environmental conditions (e.g. substrate availability or moisture) that leads to a graded, switch-like microbial response to fluctuations in environmental parameters. Microbial dormancy strategies vary from rapid to delayed response to environmental change and the activation from dormant to active state is typically faster than the transition to dormant state (Blagodatskaya, E., & Kuzyakov, Y. 2013). Dormancy is typically represented in models by explicitly considering active and dormant biomass pools or by introducing a physiological state variable that describes the active fraction of the total biomass. Existing modeling approaches mainly differ in the description of the transformation process between active and dormant states and disregard the classification into active, potentially active and dormant microbial states. The growth rate, death rates and the transition rate from active to dormant state are represented by generic functions. The question arises of gauging the sensitivity of model predictions for the temporal evolution of active and dormant bacteria not only to perturbations in constants of proportionality (parameter sensitivity), but to perturbations in uncertain or assumed expressions (functional sensitivity). Instead of postulating a particular description, the functional form of the transition function can be tested by fitting a type of free-form function as a linear combination of shape functions to the experimental dataset used in Wang et al. 2014. Depending on the form of the transition function, we observe that simple SOM turnover models show qualitatively different dynamical behavior. We aim to generalize existing modeling approaches to account for diversity in dormancy strategies and to understand which strategies for transiting between dormant and active states are favoured under which environmental conditions.

Literatur

Wang, G., Mayes, M. A., Gu, L., & Schadt, C. W. (2014). Representation of dormant and active microbial dynamics for ecosystem modeling. PloS one, 9(2), e89252.
Blagodatskaya, E., & Kuzyakov, Y. (2013). Active microorganisms in soil: critical review of estimation criteria and approaches. Soil Biology and Biochemistry, 67, 192-211.