Geophysical Research Abstracts
Vol. 19, EGU2017-5526, 2017
EGU General Assembly 2017

Disentangling temporal and stoichiometric controls on decomposer community traits – An analytical modelling approach

Stefano Manzoni (1,2)

(1) Stockholm University, Physical Geography, Stockholm, Sweden (stefano.manzoni@natgeo.su.se), (2) Bolin Centre for Climate Research, Stockholm University, Stockholm, Sweden

Decomposer metabolism mediates carbon and nutrient cycling, as it controls how organic substrates are utilized by microbes and how much organic matter is retained in soils. To characterize decomposer metabolism in terms of how effectively carbon (C) is retained in the decomposer biomass, the ratio of carbon used for growth over carbon taken up is often used. This ratio is referred to as carbon-use efficiency (CUE). The CUE is a potentially useful eco-physiological trait and a key parameter in biogeochemical models, but it is notoriously difficult to estimate. Here, a method for CUE estimation based on an analytical stoichiometric model is proposed. The method builds on previous stoichiometric models of litter decomposition, by providing analytical formulas linking the fractions of nitrogen and C remaining during decomposition. Because these formulas depend on CUE, fitting them to decomposition data yields estimates of CUE. Compared to the previous approaches in which decomposer traits were assumed time-invariant, new formulas with time-varying traits are proposed to test hypotheses on temporal trends in CUE as decomposition progresses. CUE estimates based on this analytical method tend to increase with increasing litter N availability across a range of litter types. When temporal trends in CUE are considered, CUE increases during decomposition of N-poor litter cohorts, in which decomposers are initially N-limited, but decreases in N-rich litter, as recalcitrant compounds accumulate and C becomes limiting. These patterns suggest that CUE is sufficiently flexible to partly compensate stoichiometric imbalances. Interestingly, the same patterns hold even if shifts in decomposer C:N ratio are accounted for. Moreover, CUE trends appear to be driven by litter quality, but are largely independent of climatic conditions.