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Effect of microbial enzyme allocation strategies on stoichiometry of soil organic matter (SOM) decomposition

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We explored different strategies of soil microbial community to invest resources into extracellular enzymes by conceptual modelling. Similar to the EEZY model by Moorhead et al. (2012), microbial community can invest into two separate pools of enzymes that depolymerize two different SOM pools. We show that with assuming that a fixed fraction of substrate uptake is allocated to enzymes, the microbial dynamics decouples from decomposition dynamics.
We propose an alternative formulation where investment into enzymes is proportional to microbial biomass. Next, we show that the strategy of optimizing stoichiometry of decomposition flux according to microbial biomass stoichiometry yield less microbial growth than the strategy of optimizing revenue of the currently limiting element. However, both strategies result in better usage of the resources, i.e. less C overflow or N mineralization, than the strategy of equal allocation to both enzymes. Further, we discuss effects of those strategies on decomposition of SOM and priming at different time scales and discuss several abstractions from the detailed model dynamics for usage in larger scale models.