The Implications of Exoenzyme Activity on Microbial Carbon and Nitrogen Limitation in Soil: a Theoretical Model. (S03-schimel162347-Oral)

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Abstract:
Traditional soil organic matter models are based on 1st order kinetics: dC/dt = kC. We built a theoretical model to explore decomposition/microbial growth where extracellular enzymes catalyze decomposition (dC/dt = K * C * Enzymes). This model showed that: 1) decomposition kinetics must be non-linear on enzymes- likely because of competition for enzyme binding sites on solid substrates. 2) The non-linearity induces microbial C limitation, regardless of the C supply. 3) Polymer breakdown and microbial use of the products can be disconnected, since it requires little N to maintain the enzyme pool, regardless of the microbial biomass' ability to use the breakdown products. 4) Adding a pulse of C to an N limited system increases respiration, while adding N actually decreases respiration because C is redirected from waste respiration to microbial growth. For many years, researchers have argued that the lack of a respiratory response by soil microbes to added N indicates that they are not N limited. This model suggests that conclusion may be wrong. While total C flow may be limited by the functioning of the exoenzyme system, actual microbial growth may be N limited.

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