Trophic cascades affect Priming Effect and the dynamics of dead organic matter : a theoretical approach

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Abstract

Priming Effect (PE), defined by enhanced decomposition of recalcitrant organic matter following labile organic matter addition, is key to understand decomposition processes and carbon storage. While brown food webs, based on dead organic matter, are known to affect decomposition, they have been generally ignored in studies focusing on PE. This universal process relies on specific mechanisms that are not fully understood. We developed a dynamical model linking the decomposition of a labile and a recalcitrant pool of organic matter to trophic interactions between functional groups of organisms. This model reproduces PE by mimicking experimental conditions and without including any other hypothesised mechanisms. Our model suggests that an increase in decomposer microbial biomass and activity due to labile organic matter addition is sufficient to increase the decomposition of recalcitrant OM. Furthermore, our results highlight strong cascading effects of the brown trophic chain on PE, with greater PE when decomposers are not controlled by their predators. This finally questions the fate of dead organic matters in ecosystems whose dynamics depend on processes such as PE. This also suggests that new PE effect experiments should be designed to test the impact of adding or removing predators of decomposers.

Keywords: Priming Effect, dead organic matter, decomposition, food web, trophic cascade

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