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Environmental Controls of Microbial Resource Partitioning in Soils

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The mineralization and flow of plant-derived carbon in soils is relevant to global carbon cycling. Current models of organismic carbon fluxes in soil assume that separate bacterial and fungal energy channels exist in soil. Recent studies disentangle the herbivore and detritivore pathways of microbial resource use, identify the key players contributing to these two different pathways, and determine to what extent microbial substrate use is affected by environmental controls. To follow the kinetics of litter and root decomposition and to quantify the contribution of key players, it is necessary to use isotopic approaches like PLFA-SIP and ergosterol-SIP. It was shown that bacteria and sugar consuming fungi initiated litter decomposition in an incubation experiment during the first two weeks, whereas higher fungi started to grow after the depletion of low molecular weight substrates. Analyses of PLFA-SIP revealed, for example, that fungi assimilated C directly from the litter, whereas bacteria took up substrates in the soil and therefore depended more on external transport processes than fungi. In addition, we will present data from a field experiment showing the incorporation of root and shoot litter C into organic and microbial C pools under field conditions over a period of two years. Similar amounts of C derived from the two resources differing in substrate quality and amount were incorporated into microbial C and ergosterol pools over time, indicating the importance of root-derived C for the soil food web. High incorporation of maize C (up to 76%) into ergosterol suggests fast and high assimilation of maize C into fungal biomass. Nevertheless, there is still a debate whether bacteria, archaea and fungi start feeding on new substrates at the same time or if their activity occurs at different successional stages. This presentation gives a summery of current knowledge on microbial resource partitioning under lab and field conditions.