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Decomposition of terrestrial carbon depends on chemical resources available to microorganisms

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Decomposition of terrestrial plant-derived materials is fundamental for nutrient and carbon cycling. Because microbial decomposers use C for energy supply, their C requirement must exceed their internal stoichiometry. Here we measured decomposition rates of leaf and wood litter (non-microbially processed materials), and humus and mineral soil (microbially processed materials). The incubations provided labile C and N over a wide range of amounts and ratios from 1.25 to 320. Decomposition was driven by C in mineral soil (high microbially processed) and jointly by C and N in other substrates (less microbially processed). While decomposition of mineral soil and humus were strongly increased, wood decomposition was slowed by all resource additions. Leaf litter showed both responses. This reflects that C limitation occurs in microbially processed materials while less microbially processed materials are characterized by N limitation. Therefore, effects of labile C and N on decomposition of organic materials strongly depend on whether they had previously been processed by microorganisms. Beyond these decomposition effects, all four substrates retained C from the labile additions. These findings provide important implications that labile C and N inputs caused by increased atmospheric CO_2 and N deposition can accelerate decomposition of microbially processed organic C and slow down decomposition of less microbially processed organic C. Given the retention of new C, the C sequestration occurs.