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DeForest Article Examines Leaf Decay Carbon Cycling in Temperate Forest

Ohio University College of Arts & Sciences

DeForest Article Examines Leaf Decay, Carbon Cycling in Temperate Forest

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Dr. Jared DeForest

Dr. Jared DeForest, Associate Professor of Environmental & Plant Biology, authored a journal article supporting the microbial mining hypothesis that nutrient acquisition drives decay rates, challenging the paradigm that substrate stoichiometry controls decomposition. This research provides evidence that phosphorus plays an important role in the capacity of Ohio forests to store carbon.

The article, "Chronic phosphorus enrichment and elevated pH suppresses Quercus spp. leaf litter decomposition in a temperate forest," appeared in *Soil Biology and Biochemistry* in May.

Abstract: The potential of excessive nitrogen (N) suppressing litter decay in is widely recognized. The role of phosphorus (P) in plant litter decay is less understood and is generally assumed to have a weak influence in decomposition outside tropical or wetland ecosystems. Based on the "microbial mining" hypothesis that suggests the availability of limiting nutrients is the driving mechanism of decay, P could have a strong influence on carbon (C) cycling in low-P ecosystems. The objective of this study was to determine if increasing P availability will influence the decomposition of leaf litter in a low-P temperate forested ecosystem. If the availability of a limiting nutrient is a driving mechanism mediating decay, then increasing the availability of P in a low-P environment should inhibit decay. The experiment was held in a low-P mixed mesophytic forest in the unglaciated Alleghany Plateau (USA). Since 2009, P availability has been increased either directly by phosphate fertilizer and/or indirectly by raising soil pH. Starting in 2011 and for three consecutive years, *Quercus* spp. leaf litter bags were deployed and harvested at least every year for three years for temporal replication. After three years, elevating pH and/or P litter mass loss was ~52% and significantly ($P < 0.001$) lower than the control at 73% mass loss. The mean residence time (MRT; k yr^{-1}) for the control was 2.1 years, but elevating P with pH increased MRT to 5.3 years. Results support the "microbial phosphorus mining" hypothesis that P has the potential to inhibit decay for *Quercus* spp. leaf litter in temperate forests and potentially increase soil C.