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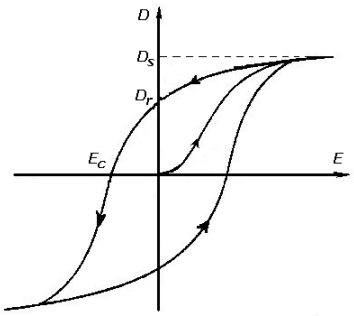
THE DEPARTMENT OF MATHEMATICAL SCIENCES PROUDLY PRESENTS

COLLOQUIUM

FALL 2019

Mechanisms and management of litter-mediated hysteresis in enriched grasslands



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Abstract

The global rise in anthropogenic reactive nitrogen (N) and the negative impacts of N deposition on terrestrial plant diversity are well-documented. Resource competition theory predicts reversible decreases in plant diversity in response to N loading. However, empirical evidence of the reversibility on N-induced biodiversity loss is mixed. In a long-term N-enrichment experiment in Minnesota, a low-diversity state that emerged during N addition has persisted for decades after cessation. Litter accumulation is thought to suppress recovery, but the underlying mechanisms remain unclear. Here we use ODE models to show that nonlinear nutrient cycling through litter is likely insufficient to produce hysteresis, while asymmetries in N requirements and litter sensitivities between species groups are sufficient. Our results suggest that drivers of hysteresis may differ significantly between enriched terrestrial and aquatic systems. Building on the sufficient model, we use flow-kick models to identify litter removal schedules that successfully restore biodiversity across a range of N deposition rates, but litter removals must be repeated indefinitely to sustain biodiversity gains under high deposition rates. Our results point to customized strategies for managing biodiversity in context of varied N deposition.
This work is a collaboration with Kate Meyer at Cornell U and Andrew Brettin at NYU.

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