

MSIS-Udiani: Biodiversity Loss and Recovery in North American Grasslands

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In recent decades, excess nitrogen from agricultural runoff and fossil fuel emissions have caused biodiversity to decline in North American grasslands by disrupting the balance of resource competition between native and exotic grass species. Increased regulation of fossil-fuel emissions and modernization of agricultural practices, however, have led to localized decreases in nitrogen deposition. This raises the question of whether or not the biodiversity losses are reversible. The simplest versions of Tilman's R^* theory predict that the biodiversity loss is reversible; however, results of long-term empirical studies are mixed. To investigate further, we develop an ODE model that combines nitrogen cycling, resource competition, litter inhibition, and seed limitation. The model qualitatively matches observations from a long-term nitrogen-enrichment study at Cedar Creek Ecosystem Science Reserve. Moreover, the model suggests that asymmetric litter inhibition plays a key role in the observed hysteretic responses to changing nitrogen deposition levels.