Long-term dynamics of plant species richness due to fertilization are explained by dominance of one functional group

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INTRODUCTION

Increased nitrogen deposition is one of the most important factors driving terrestrial plant extinctions (Sala et al. 2000). Although fertilization generally causes declines in plant species richness, these declines often do not occur immediately after fertilization begins (Huberty et al. 1998). In a successional fertilization study at the Kellogg Biological Station LTER, we found that fertilization did not significantly decrease species richness for 14 years (Fig. 1). We test the hypothesis that fertilization decreases species richness by eventually increasing the dominance / biomass of the tall highly clonal (runner) functional group, thereby leading to decreases in the biomass of all other functional groups.

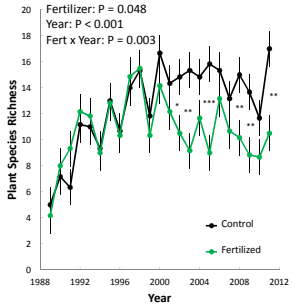
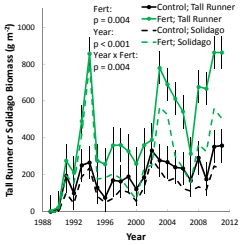


Figure 1. Species Richness

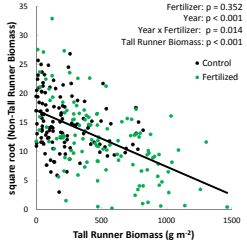
METHODS

Six replicate plots were tilled in early 1989 and vegetation was allowed to naturally colonize. In each plot, one subplot was fertilized each year with 12 g N m^{-2} at the same time as nearby experimental agricultural fields (early summer) from 1989 onwards, while another subplot was left unfertilized. Species were classified into functional groups of height classes (tallest, shortest, and middle third) and clonality classes (non-clonal, clumper = short distance clonal spread, runner = long distance clonal spread).

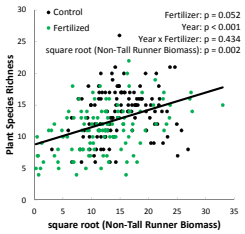
Tall Runner Biomass is not Consistently Increased Until Second Decade of Experiment

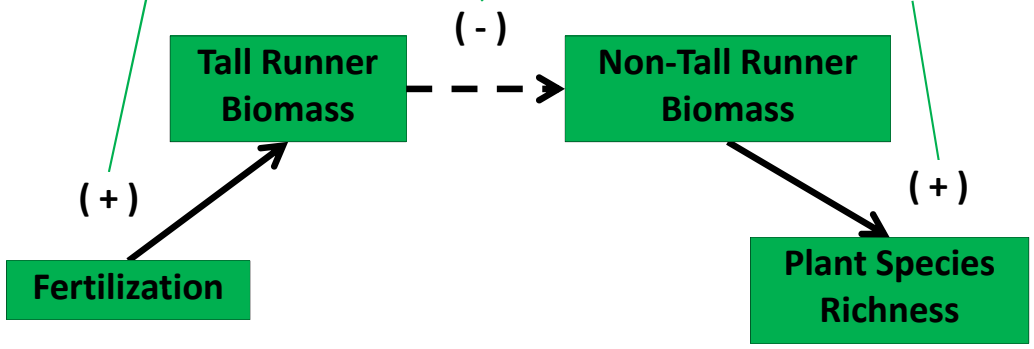


Negative Relationship between Tall Runner Biomass and Non-Tall Runner Biomass



Positive Relationship between Non-Tall Runner Biomass and Species Richness





CONCLUSION

Fertilization decreased species richness in Michigan old-fields by increasing tall runner biomass, which decreased non-tall runner biomass. Fertilization took 14 years to decease species richness because the most abundant tall runner species (*Solidago*) suddenly declined 7 years into the experiment (likely due to an insect herbivore) and tall runner biomass did not recover until the second decade of the experiment.

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LITERATURE CITED:

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Sala, O.E., III, F.S.C., Armesto, J.J., Berlow, E., Bloomfield, J., Dirzo, R., et al. (2000). Global biodiversity scenarios for the year 2100. *Science*, 287, 1770-1774.