Why does Fertilization Take 14 Years to Decrease Plant Diversity in a LTER Abandoned Crop Field?

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INTRODUCTION

Increased nitrogen deposition is one of the most important factors driving terrestrial 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). Time lags in effects of fertilization on richness provide an opportunity to examine the factors that covary over time with species richness. We test the hypothesis that fertilization will increase the dominance / biomass of certain species groups over time, to the detriment of all other species

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).

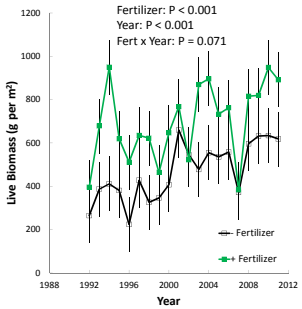

Figure 1. Total Live Biomass

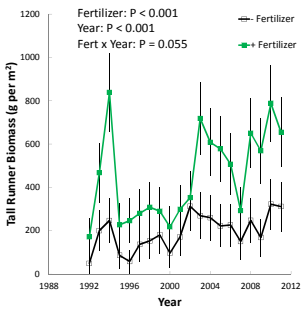

Figure 2. Tall Runner Biomass

- Fertilization quickly increases total live biomass (Fig. 1)
- Tall runner species are major beneficiary of fertilization (Fig. 2)
- Fertilization has no significant effect on species richness until 2002, around the time that fertilization begins to consistently increase tall runner biomass (Fig. 3)
- As tall runner biomass increases to higher levels, species richness decreases to lower levels (Fig. 4)
- By the most recent year of the experiment (2011), tall runner species make up almost 90% of total biomass in the presence of fertilization (Fig. 5)

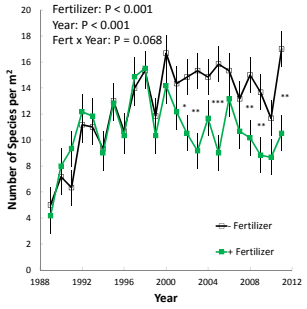

Figure 3. Species Richness

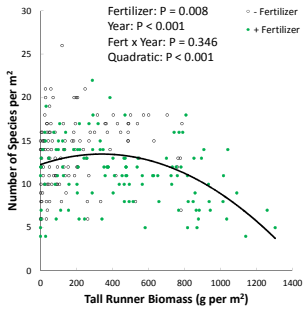

Figure 4. Species Richness vs. Tall Runner Biomass

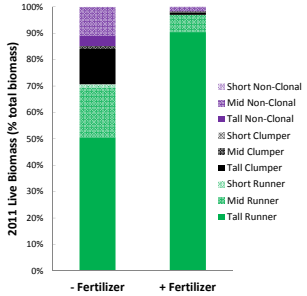

Figure 5. Plant Functional Groups

CONCLUSION

Fertilization primarily increases the abundance of tall runner species, even though a sustained increase in tall runner biomass takes around 14 years. High tall runner biomass acts as a driver to decrease plant diversity.

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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.