Final Report for Working Groups from the 2006 LTER All Scientists Meeting

Working Group Title:

"Plant community responses to nitrogen enrichment: Results from a cross-site synthesis"

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Results of the workshop:

Nitrogen (N) is a limiting nutrient to plant growth in many ecosystems, and human-caused N enrichment has the potential to fundamentally alter the structure and functioning of plant communities. Nutrient limitation of primary production has been of interest to ecologists for many years, as a result there are many fertilization experiments in diverse sites across the LTER network. A group of LTER researchers founded PDT-Net (Productivity, Diversity & Traits Network), to synthesize datasets from these fertilization experiments. This effort was funded through an LTER cross-site synthesis

grant. Although responses to N addition were highly variable, several clear patterns emerged. We found that N addition increased productivity, reduced plant species diversity, and that plant species with particular functional traits (e.g. N-fixation ability, native and annual species) declined with fertilization, while others increased in dominance. Differences among responses of particular species common to several sites, as well as responses of species diversity in general, could be explained by differences in environmental context across sites. Finally, we found that fertilization altered community structure, by altering the distribution of species rank abundances, and by creating greater spatial heterogeneity. This workshop was an opportunity to share our results with the LTER community and to discuss future directions.

Speakers:

- Elsa Cleland - "Description of the PDT-Net datasets"
- Katharine Suding - "Functional- and abundance-based mechanisms explain diversity loss due to N fertilization"
- Chris Clark - "Biodiversity loss caused by N enrichment depends on environmental context"
- Joe Fargione - "A negative relationship between species richness and productivity response to N addition"
- Steven Pennings - "Do individual plant species show predictable responses to N addition across multiple experiments?
- Elsa Cleland - "Functional distance between native and non-native species is not altered by N addition"
- Scott Collins - "Fertilization induced switches in rank abundance - the rare do not rise to power"
- Laura Gough "Responses of clonal plants to nutrient enrichment."

Products:

The talks by Cleland, Clark, Collins and Fargione each summarized work for manuscripts in preparation. The group members were able to gain productive feedback from participants regarding the analyses and the interpretation of the data, which will improve the manuscripts in preparation. In addition, two papers have been previously published from this cross site synthesis:

Suding, K. N., S. L. Collins, L. Gough, C. Clark, E. E. Cleland, K. L. Gross, D. G. Milchunas & S. Pennings (2005). Functional- and abundance-based mechanisms explain diversity loss due to N fertilization. *P.N.A.S.* 102: 4387-4392

Pennings, S.C., C. M. Clark, E. E. Cleland, S. L. Collins, L. Gough, K. L. Gross, D. G. Milchunas & K. N. Suding (2005). Do individual plant species show predictable responses to nitrogen addition across multiple experiments? *Oikos* 110: 547-555.

Future directions:

The group intends to continue to work together to pursue research in two primary directions. First, many of the LTER sites have many years of data from long-term fertilization experiments, and we intend to investigate the temporal trajectory of species loss with nutrient enrichment, including variation in the rate of change in species composition as it differs across sites. Second, the group is collaborating to collect a comparable dataset of soil characteristics and quantitative species traits (specific leaf area and tissue N) from the ten sites included in our database. This will be used to ask questions about how plant functional traits vary with environmental and phylogenetic context, and how the composition of the "species pool" predicts plant community responses to nutrient enrichment.

Data sharing:

The group welcomes new collaborators and will share the database with researchers for specified analyses.