Nitrogen deposition
～current situation & research～

Luncheon seminar 16.07.15

Tetsuto Sugai

Remember

the filed practice at
Nakagawa experimental forest
充実していた中川研究林の実習…

Look around

other lab mood, for example
Party and presentation
他研究室の雰囲気(飲み会，プレゼン…

It is true that they “try” to speak English
although no perfect...
→ Luncheon seminar is good chance
昼ゼミは練習する良い機会 (今更ですが)

(Again)

Nitrogen deposition
～current situation & research～

Luncheon seminar 16.07.15

Tetsuto Sugai

Sorry for poor English …
つたない英語ですが何卒….

Oecologia (2015) 177:1-3, 53-63

1.Consequences of atmospheric nitrogen deposition in terrestrial ecosystems: old questions, new perspectives

2.N deposition potentially contributes to oak regeneration failure in the Midwestern temperate forest of USA

Hormoz BassiriRad

(Illinois Univ., Biological Sciences)

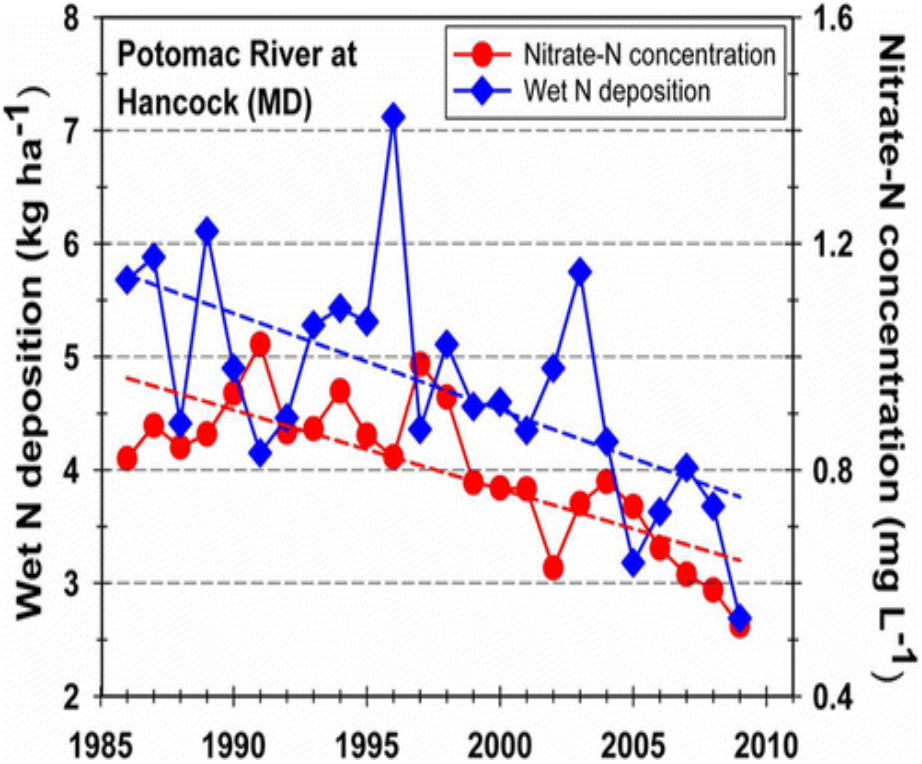
John F. Lussenhop, harbans L. Sehtiya, Kara K. Borden

Most important questions

1. Current situation of nitrogen(N) deposition
2. The effects of N deposition on reforestation

Background

During the last decade, **significant decline** of the emission and deposition of reactive N.



Eastern North America
(Eshleman et al. 2013)

Europe
(Strock et al. 2014)

Background

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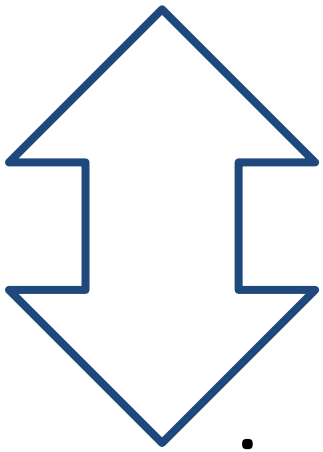
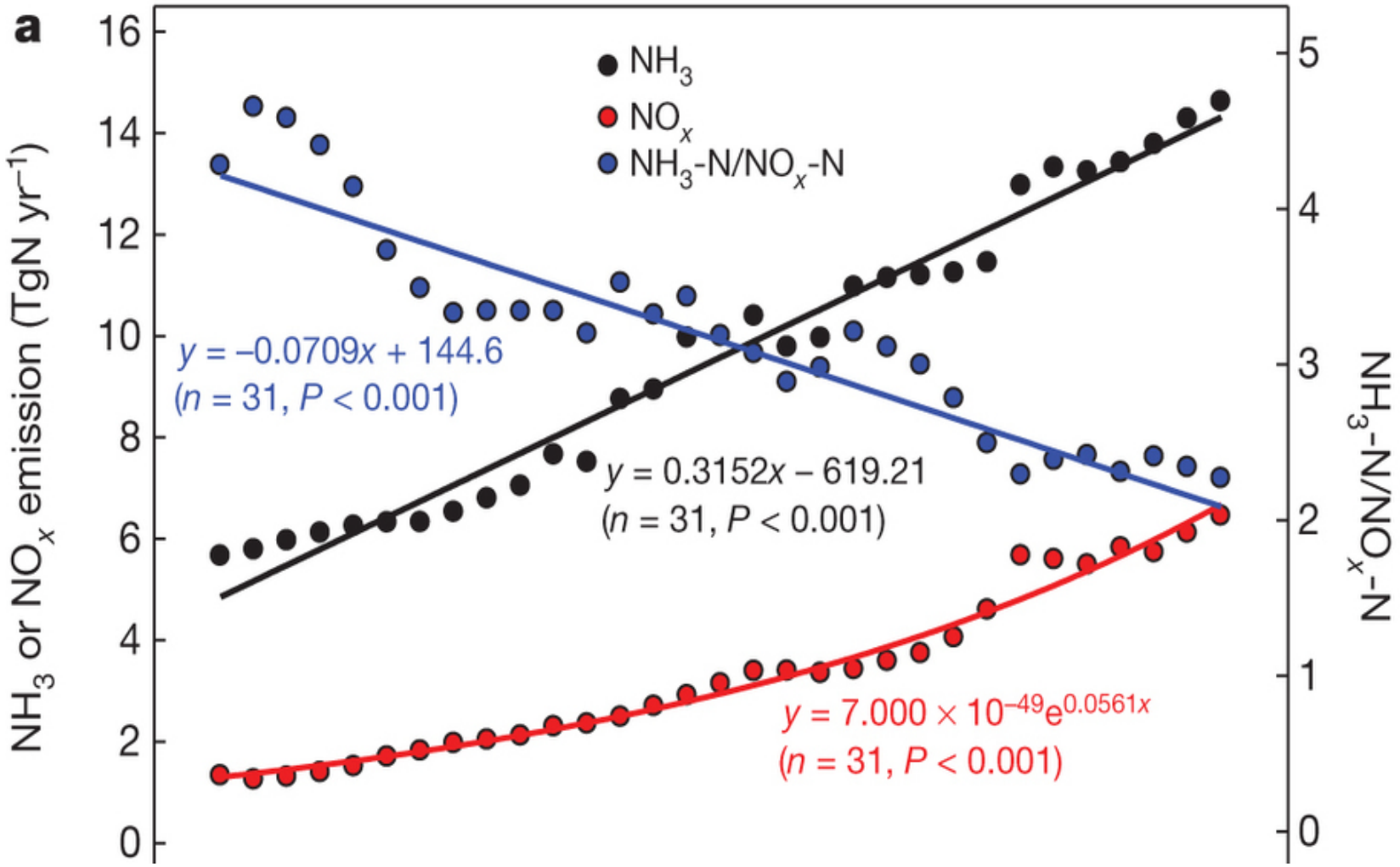


- ✓ these area still remain as **some regions** with highest N deposition rates
- ✓ little is known about the legacy effects

(Vet et al. 2014)

Background

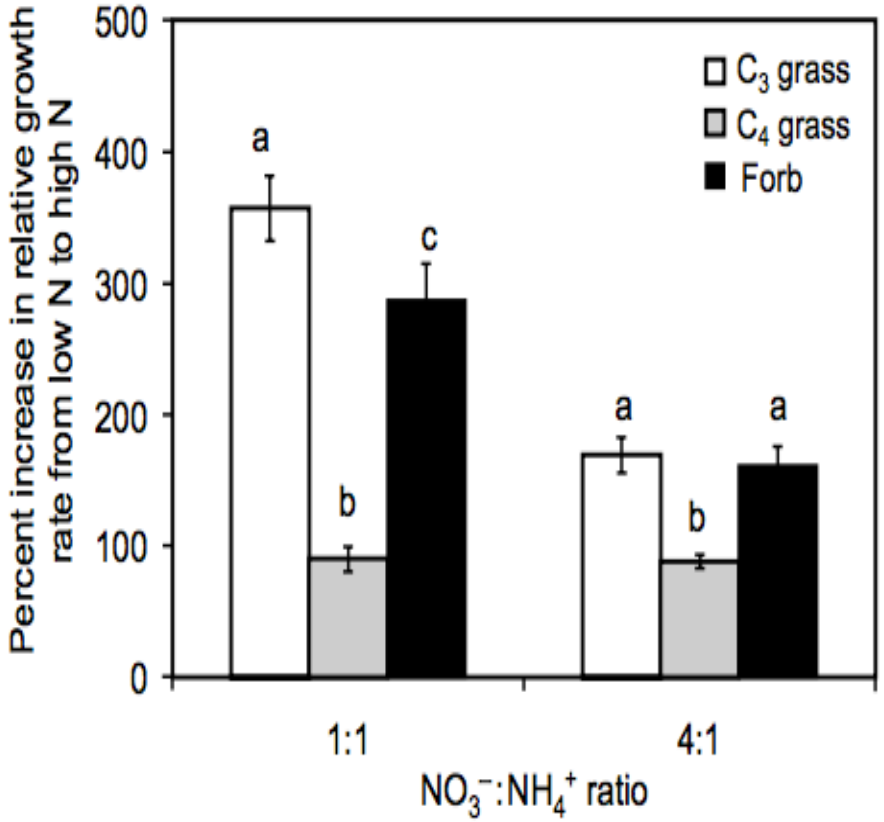
N deposition in **China**,
India and Brazil is on the rise.



Enhanced N deposition over China (Liu et al. 2013, Nature)

Background

The decrease is predominantly in the NO_3^- and not the reduced NH_4^+ even in sites with decline of N deposition (Vet et al. 2014).

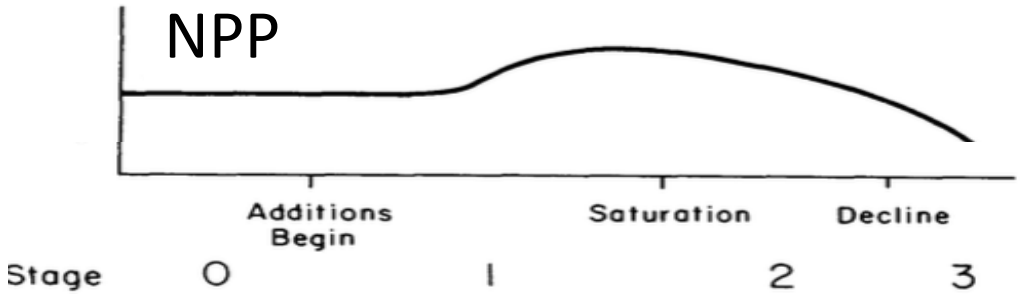


Relative abundance of IN maybe important factor than absolute amount.

Differential responses of tallgrass prairie species to N loading and varying ratios of NO_3^- to NH_4^+ (Lane and BassiriRad 2002)

Background

First N saturation model
(Aber et al. 1998)



Improved

- the potential consequences for biodiversity
- Interspecific different in responses to N deposition

Most important questions

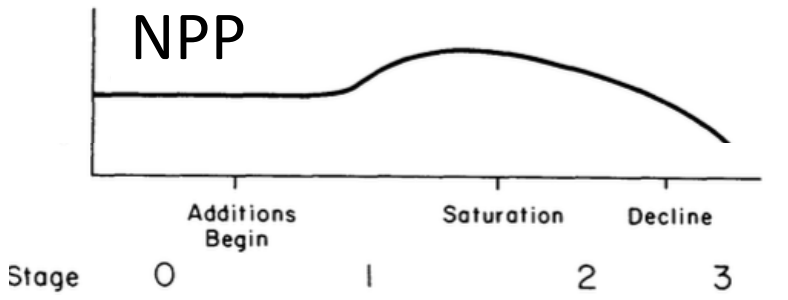
1. Current situation of nitrogen(N) deposition
2. The effects of N deposition on reforestation

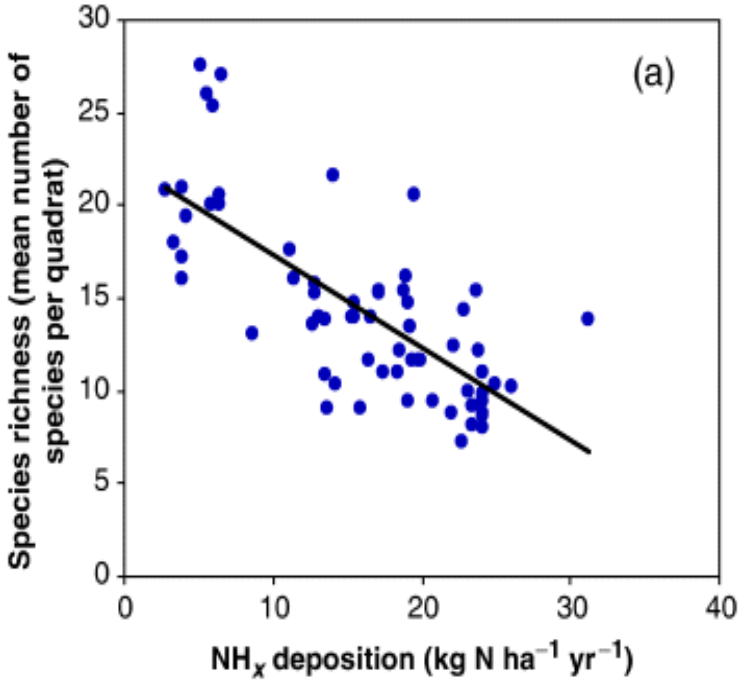
N deposition potentially contributes to oak regeneration failure in
the Midwestern temperate forest of USA

Hormoz BassiriRad, John F. Lussenhop, harbans L. Sehtiya, Kara K. Borden (2015)

Introduction

N saturation: disproportionately large consequences for ecosystem processes.





N deposition affects Net primary production (NPP)

(Aber et al. 1998)

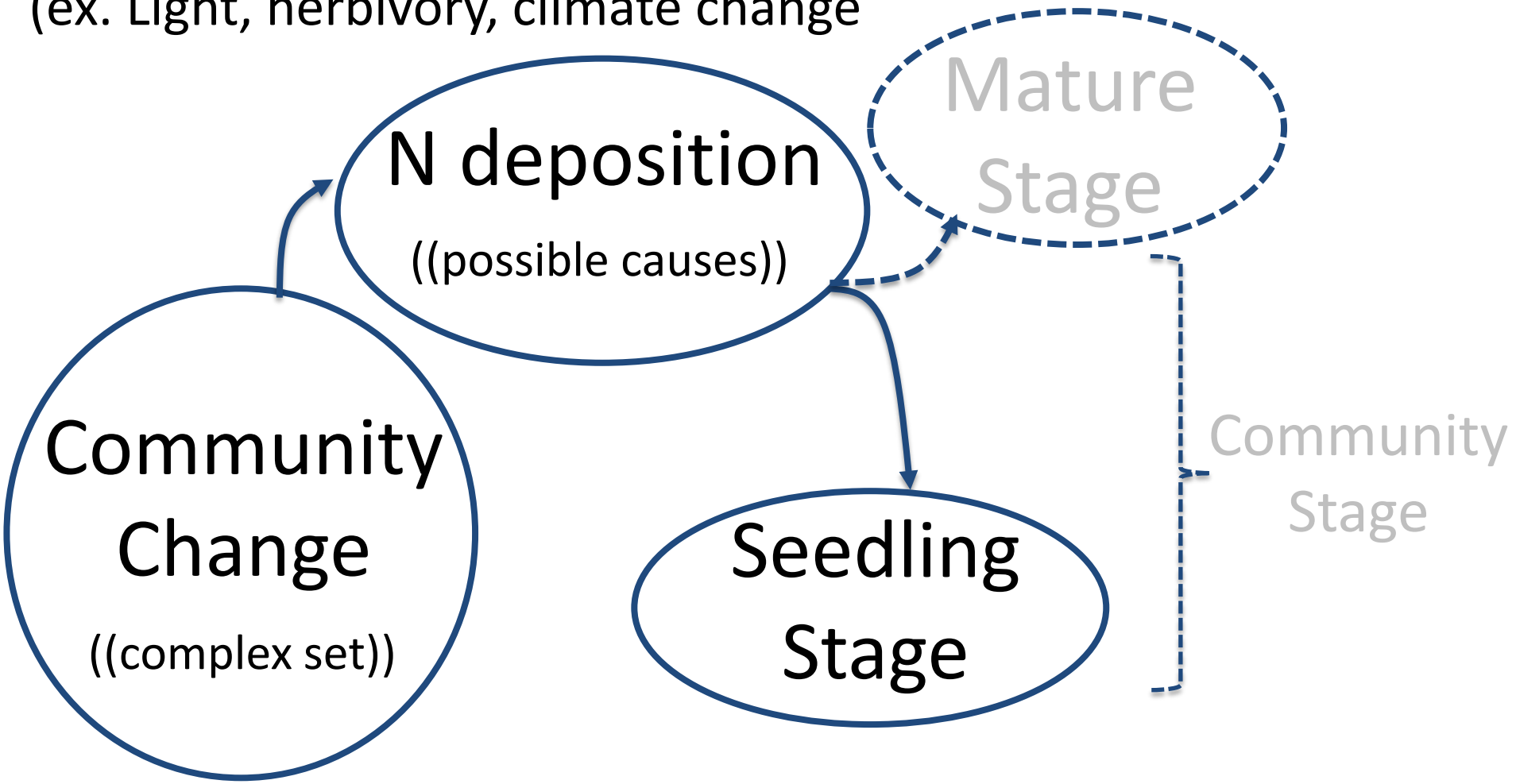
It is also a major driver of change in species composition and loss of biodiversity

(Stevens et al. 2011)

Introduction

The exact mechanism of community change and decline is uncertain: complex set of interaction

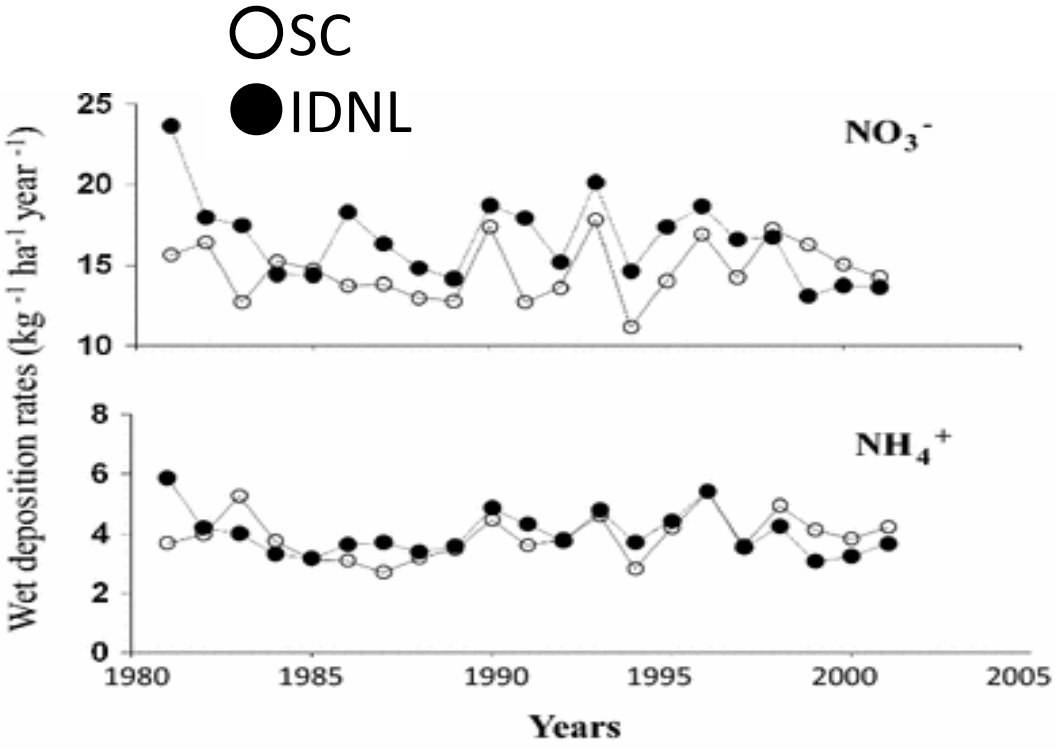
(ex. Light, herbivory, climate change



Material & Method

Site: Swallow cliffs (SC, Fig. left),
Indiana Dunes National Lakeshore(IDNL, Fig. right)

	SC	IDNL
[Soil Type]	Silt loam	
[Soil pH]	6.0	5.6
[Number of Oak and maple]	150	223
[Total deposition]	370	415



Material & Method

Plot size:1m × 1m

Between plots: ≧2m

Number of plot

at each site: 8

(oak : maple = 4 : 4)

Number of seedling

at each plot: 25 (oak or maple)

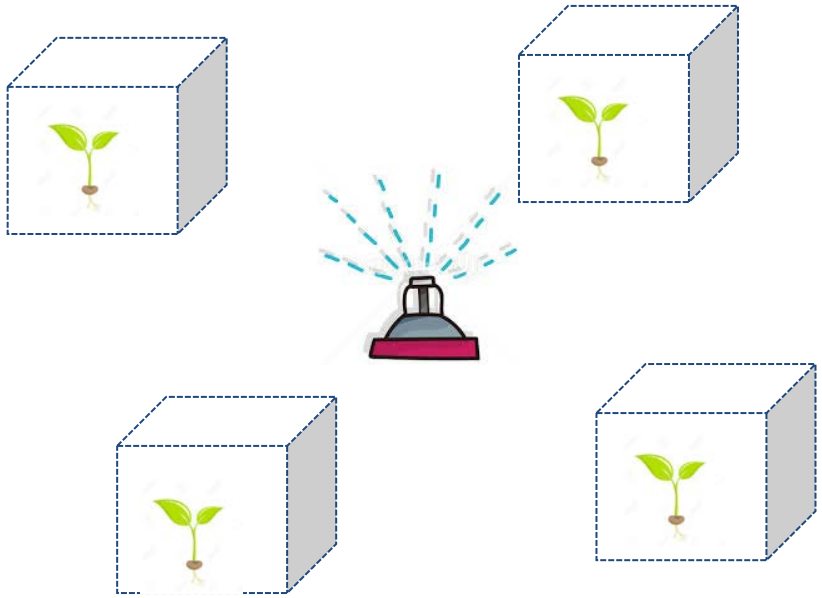
N addition:

KNO_3 and $(NH_4)_2SO_4$

Monthly intervals

Garden sprayer

Mimic previous 5 years

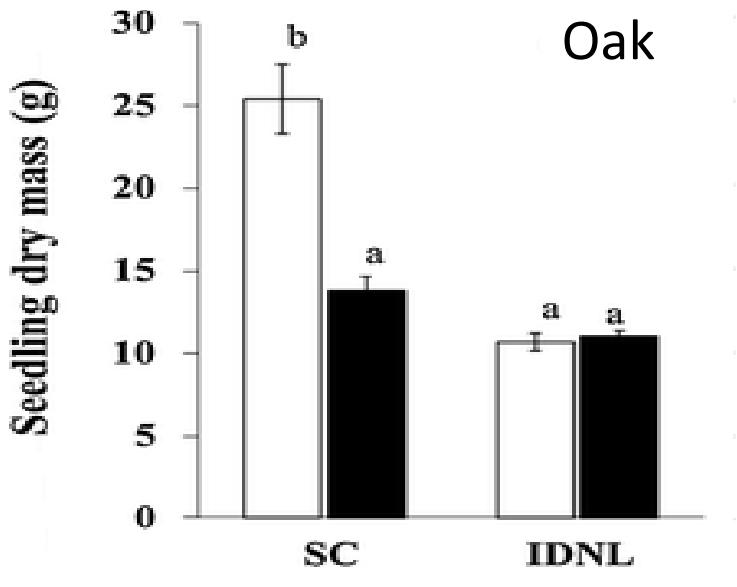


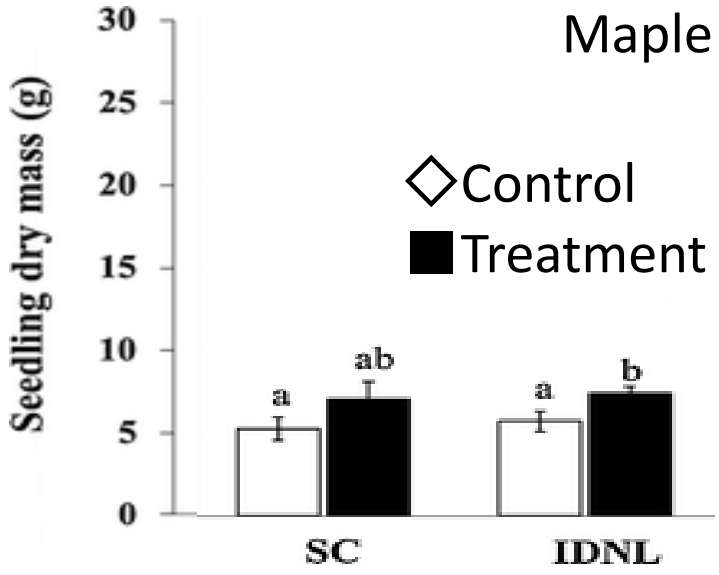
Measurements: Biomass

Statistic: Three-way ANOVA

(Species, Site, Fertilize)

Results & Discussion

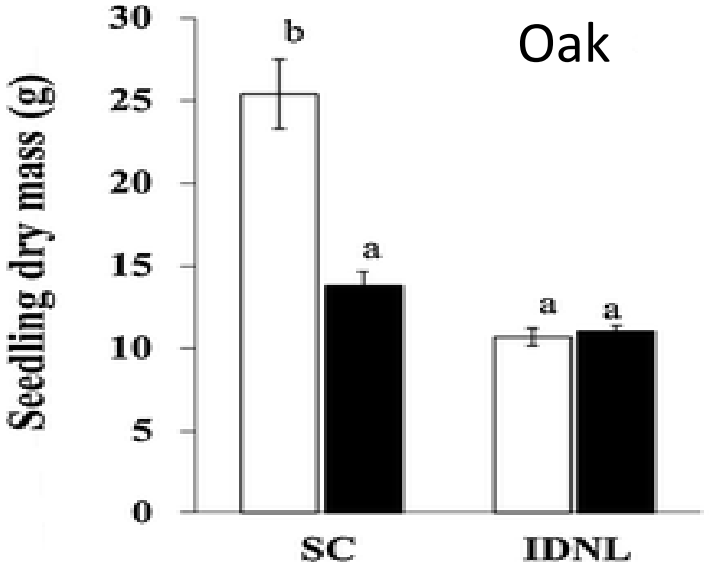


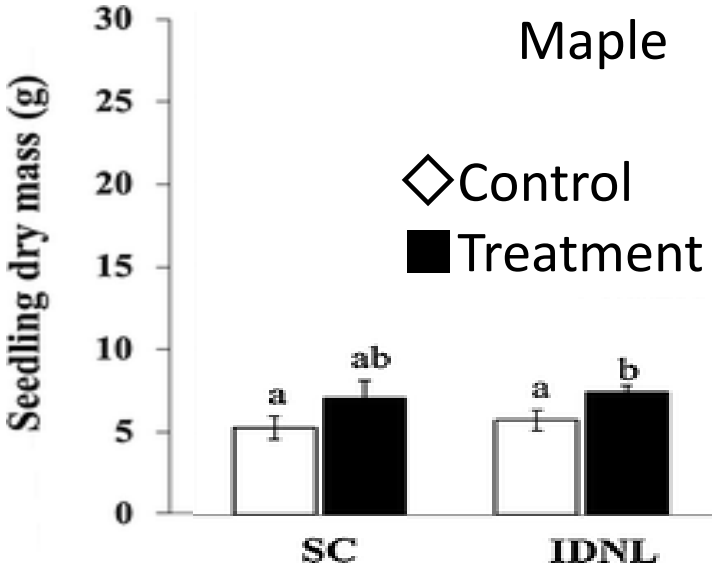


N load affects oak seedling negatively, but not sugar maple.

Source of variation	*F*	*P*
Species	45.24	<0.0001
Site	186.29	<0.0001
N fertilization	5.39	0.021
Species × site	3.78	0.054
Species × N fertilization	7.17	0.008
Site × N fertilization	8.36	0.004
Species × site × N fertilization	4.27	0.040

Results & Discussion





N load affects oak seedling negatively, but not sugar maple.

Possible mechanisms

- Increase N availability
  →Increase susceptibility to insects (Cha et al. 2010)
- Loss of ECM: 40%(SC)→20%(IDNL) (Avis et al. 2008)

Followed by the relation to photosynthesis and allocation of nutrient, especially biomass and N….

Once

STOP

Time out maybe

((Did you follow? Can you understand?))

Short summary

Most important questions

1. Current situation : Still increasing in each site, change the balance
2. The effects of N deposition : NPP + Diversity, Interspecific different

→ What mechanism…?