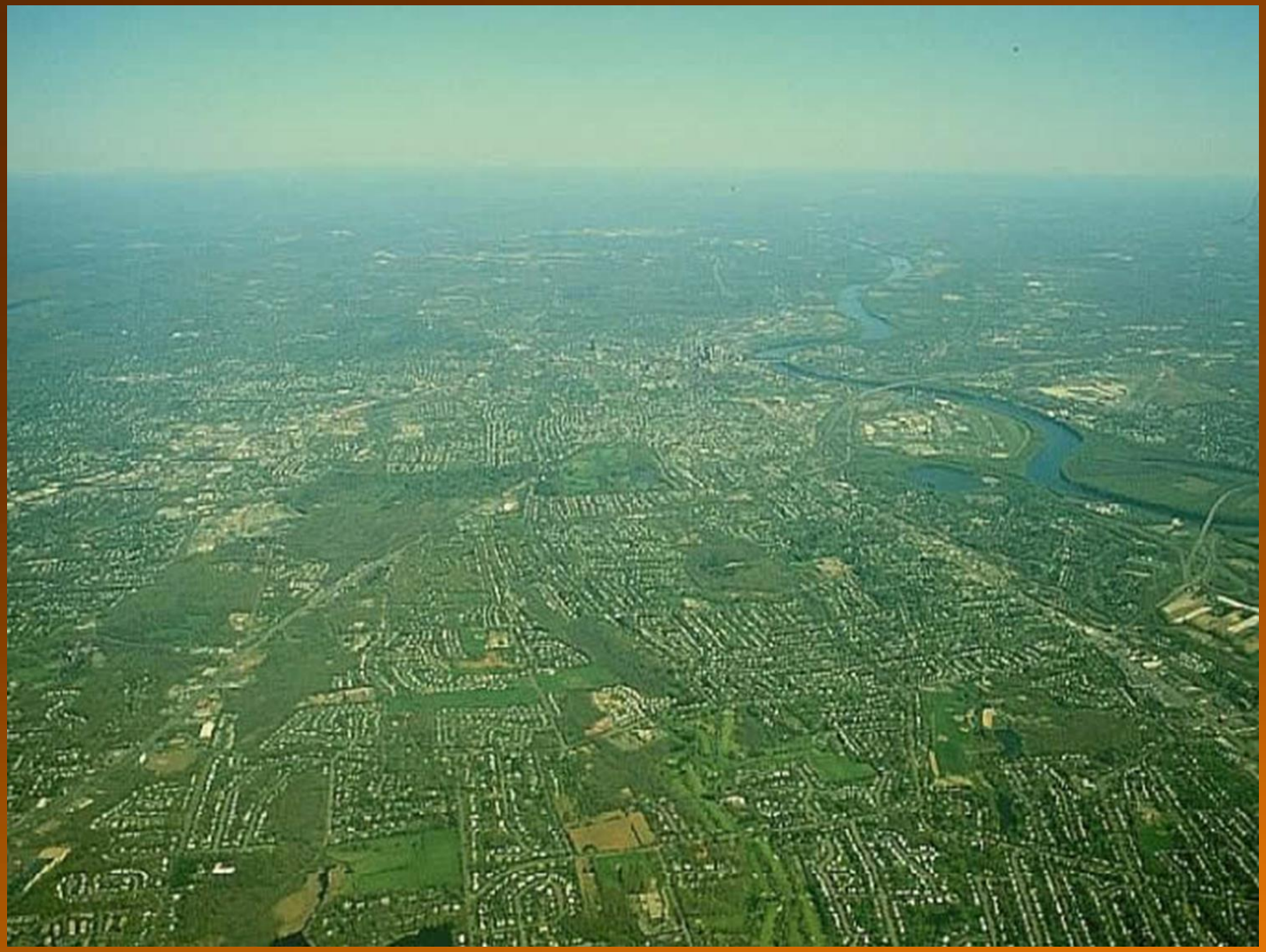
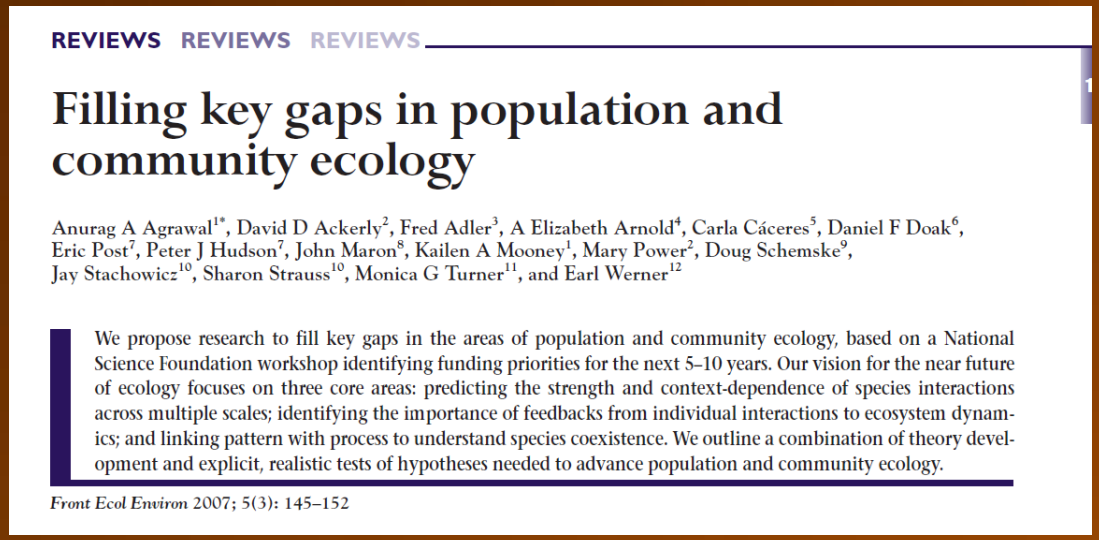
Challenges for tree recruitment in suburban forests: deer x invasive plants

Janet A. Morrison
The College of New Jersey

metropolitan forests



metropolitan forests



REVIEWS REVIEWS REVIEWS

Filling key gaps in population and community ecology

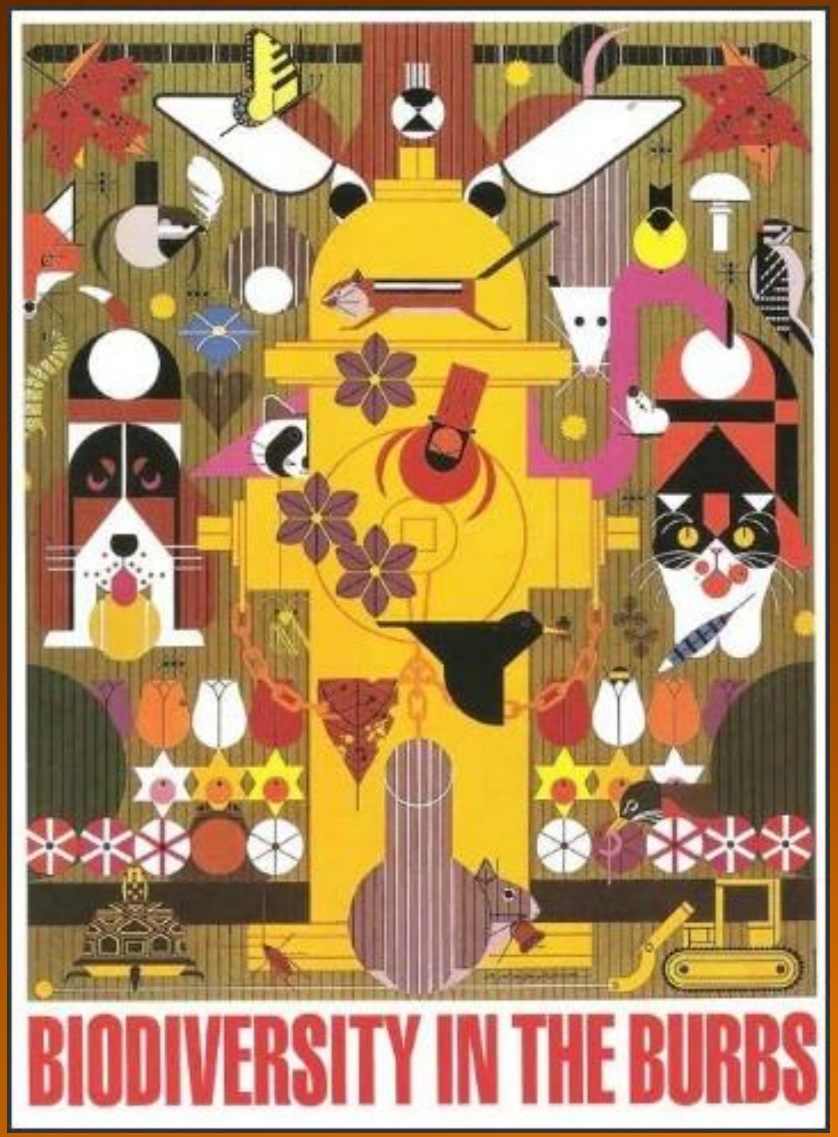
Anurag A Agrawal[1*], David D Ackerly[2], Fred Adler[3], A Elizabeth Arnold[4], Carla Cáceres[5], Daniel F Doak[6], Eric Post[7], Peter J Hudson[7], John Maron[8], Kailen A Mooney[1], Mary Power[2], Doug Schemske[9], Jay Stachowicz[10], Sharon Strauss[10], Monica G Turner[11], and Earl Werner[12]

We propose research to fill key gaps in the areas of population and community ecology, based on a National Science Foundation workshop identifying funding priorities for the next 5–10 years. Our vision for the near future of ecology focuses on three core areas: predicting the strength and context-dependence of species interactions across multiple scales; identifying the importance of feedbacks from individual interactions to ecosystem dynamics; and linking pattern with process to understand species coexistence. We outline a combination of theory development and explicit, realistic tests of hypotheses needed to advance population and community ecology.

Front Ecol Environ 2007; 5(3): 145–152

" **The semi-natural matrix --** Ecological studies often investigate pristine systems, but many organisms now persist in the fringes of habitat around highly disturbed areas (Brauer and Geber 2002). Although much work has been conducted in some of these areas (eg eastern North American old-fields, much of Europe) and despite a growing interest in urban ecology, the semi-natural matrix is still mainly unexplored, its ubiquity notwithstanding."

metropolitan forests



Charley Harper

metropolitan forests

invasive, non-native plants

in metro forests:

- nearby seed sources
- high disturbance rate
- fragmented habitat; increased edge
- multiple, co-occurring species

invasive, non-native plants

ecological advantage over native plants

- super-competitors
- enemy release
- exploitation of empty niches
- multiple species – 'invasional meltdown'

overabundant deer

Princeton, NJ:
117 deer / square mile

Hopewell, NJ:
54 deer / square mile

overabundant deer

overabundant deer

metropolitan forests

interactions

native plants X invasive plants : competition

native plants X deer : chronic herbivory, trampling

invasive plants X deer : herbivory? facilitation?

invasive plants X invasive plants :
competitive hierarchy? facilitation?

approach

herb layer : where the action is

two important co-invaders: Japanese stiltgrass
garlic mustard

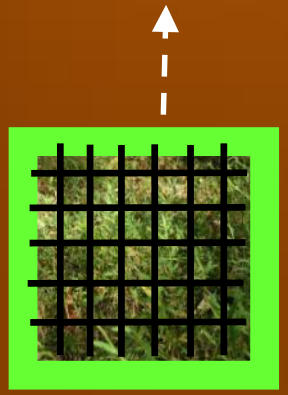
manipulative experiment
- staging novel invasions*
- deer exclosures
- factorial design
- highly replicated

* in invaded forests; long-term removal & management plan

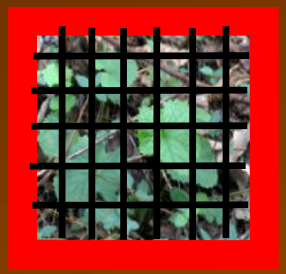
experimental design

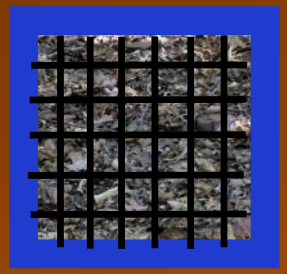
- 6 forests: 3 lower & 3 higher deer pressure
- 8 treatments
- 5 replicates/treatment/forest
- 16 m^2 plots
- 40 plots per forest

add GM



add GM + JSG





add none

add JSG

data collection

herb layer community census
pre-treatment spring 2012, fall 2012

stiltgrass and garlic mustard seed added Nov 2012
fences installed March 2013

herb layer community census
so far, spring 2013, fall 2013, spring 2014, fall 2014

other variables measured: shrub cover, browse, woody heights, earthworms, light, leaf litter mass, soil compaction, soil water potential

plots

16 m^2

fences

herb layer community census

16 ¼ m^2 quadrats / plot

Score cover of each species in 10% intervals

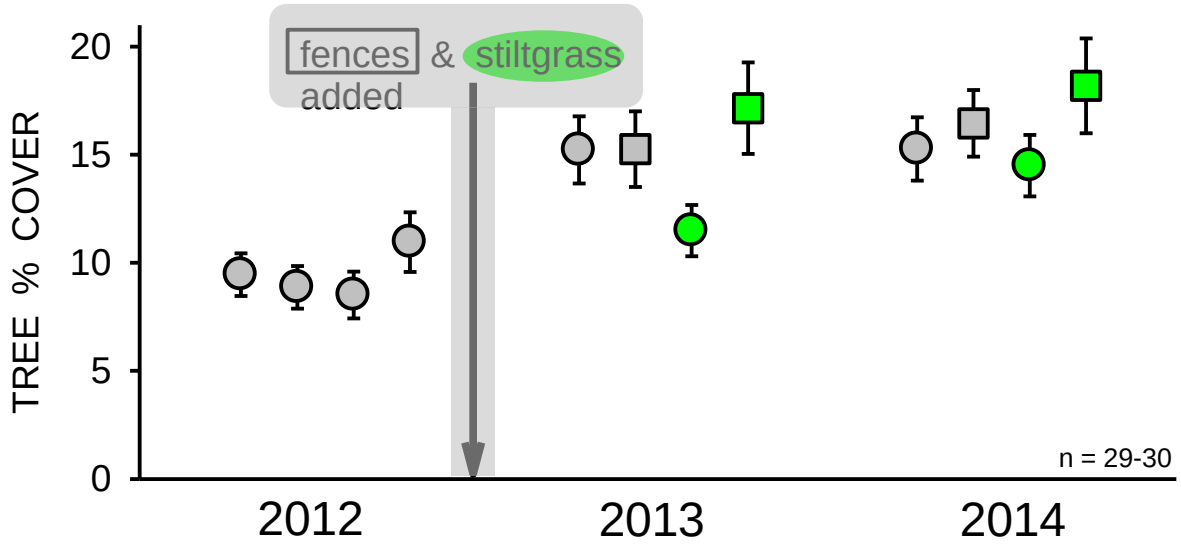
Convert to interval midpoints, average across the 16 quadrats

stiltgrass invasion

native trees in the herb layer

Percent cover of native trees in the herb layer 2012 - 2013 - 2014 (spring census)

LOWER DEER PRESSURE



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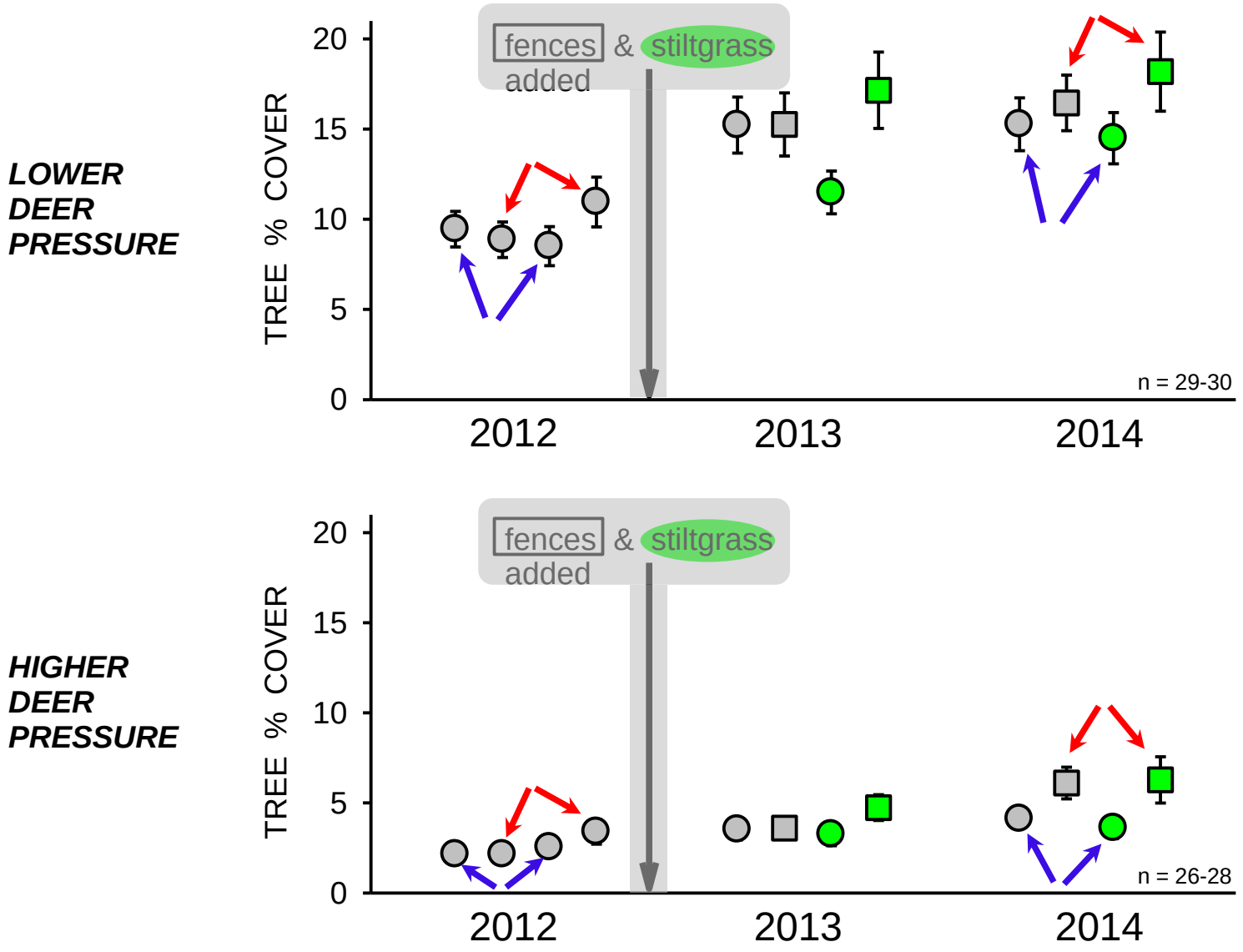

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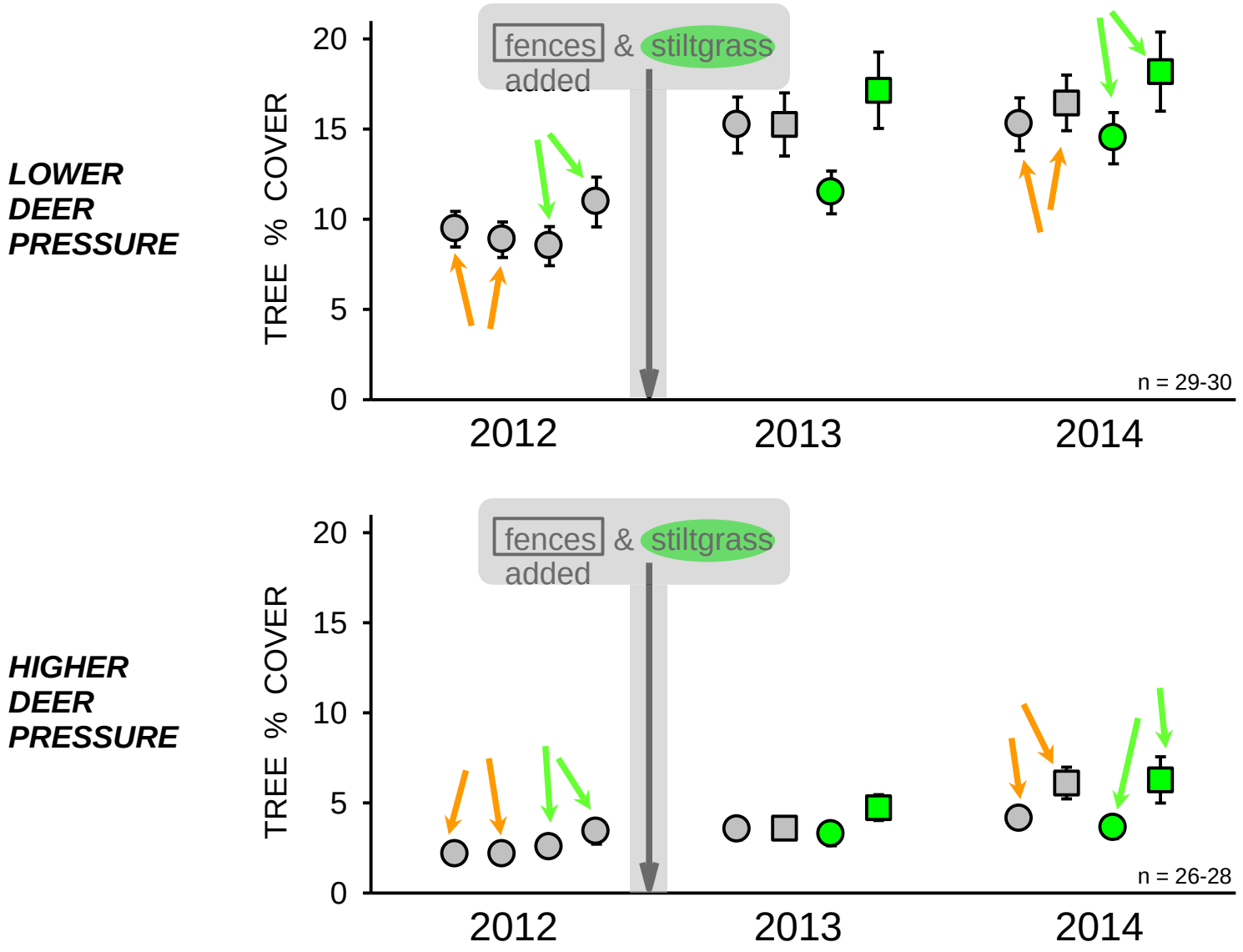
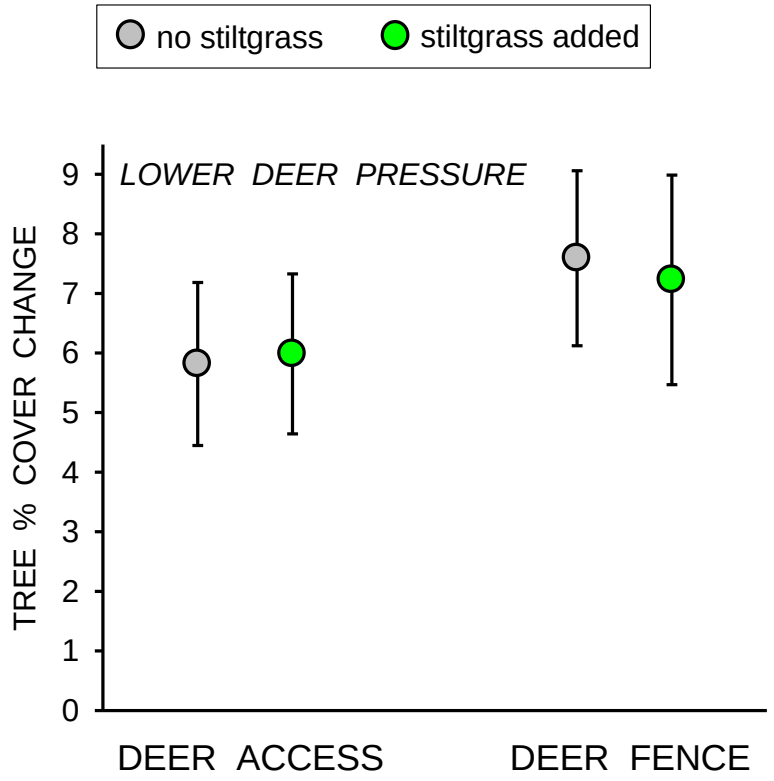


2012 to 2014 change in percent cover of native trees in the herb layer (spring census)



- a trend, but no significant increase when protected from deer
- no competition from stiltgrass

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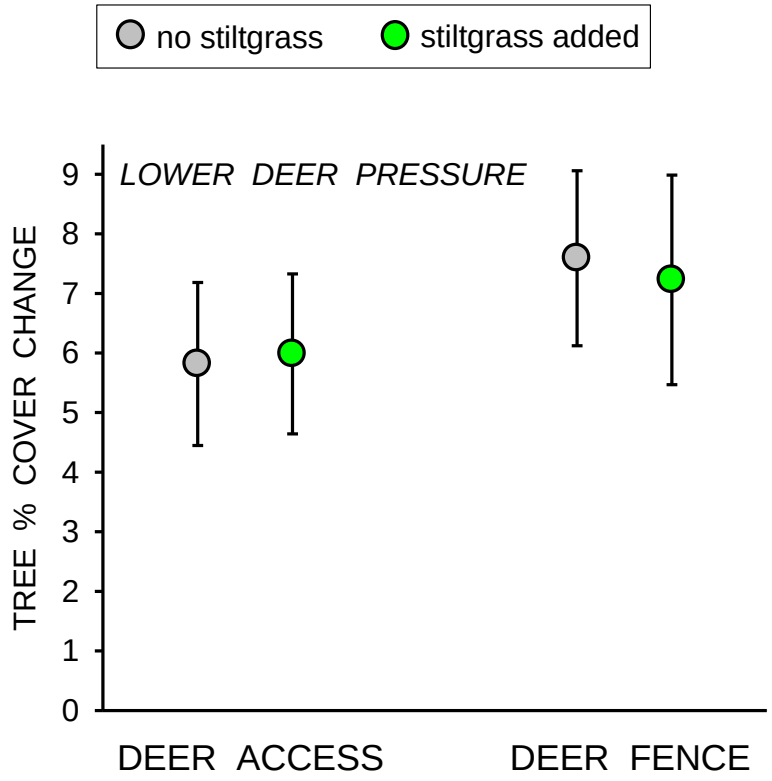

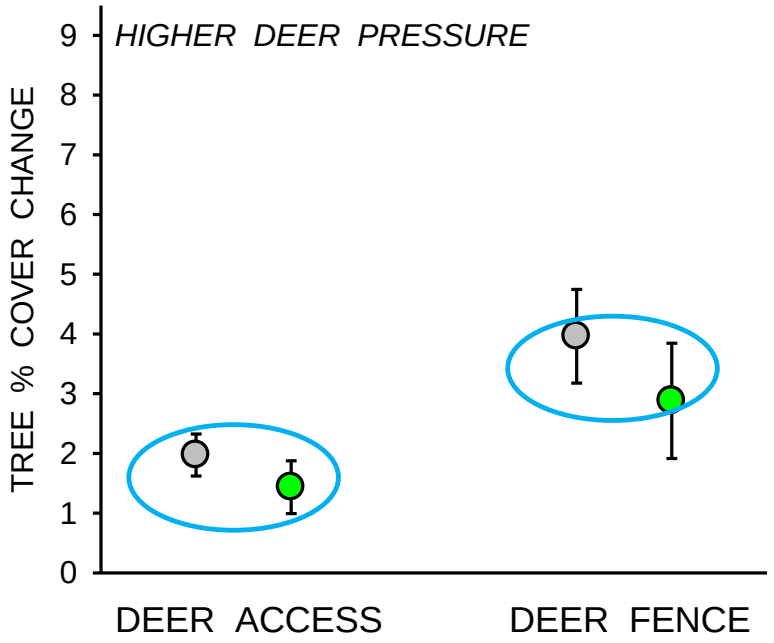

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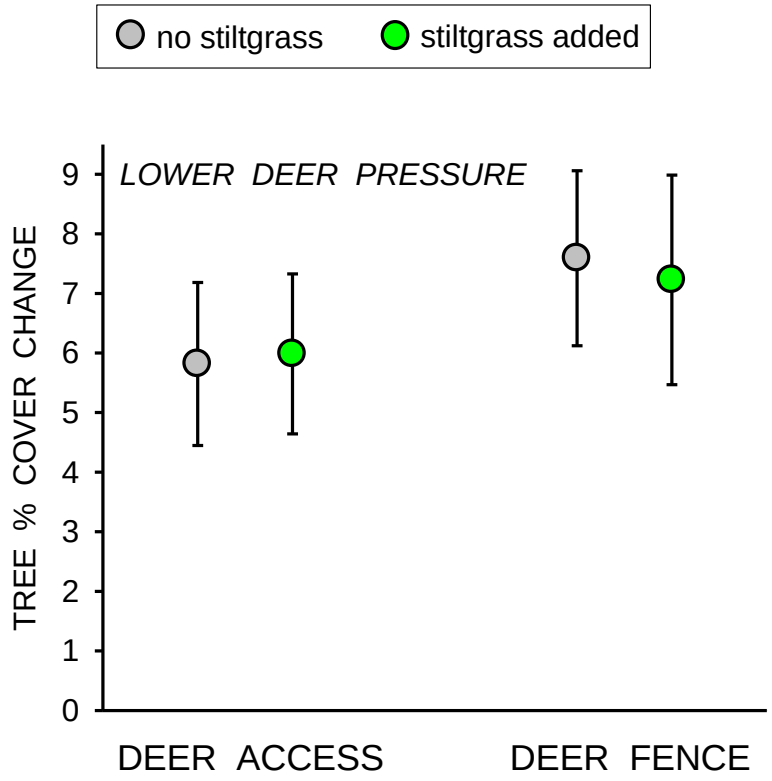
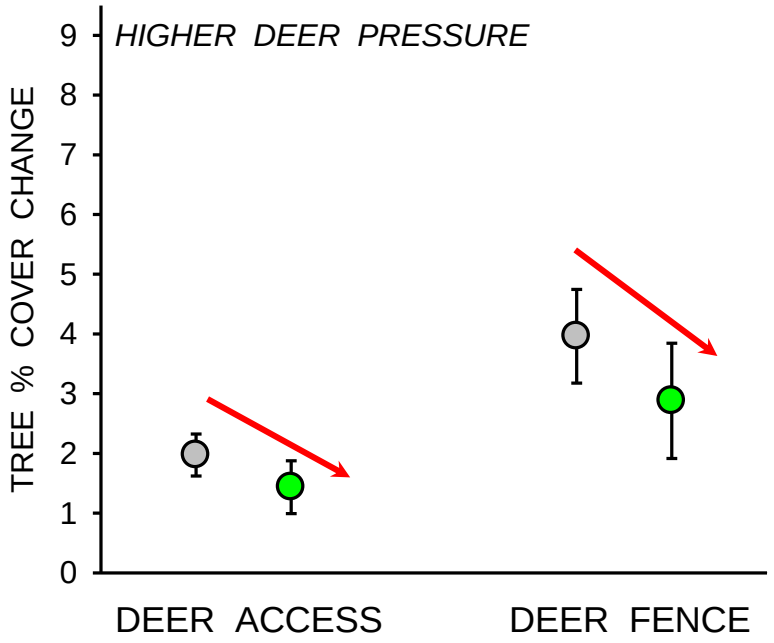
- significant increase when protected from deer (P=0.02)

2012 to 2014 change in percent cover of native trees in the herb layer (spring census)



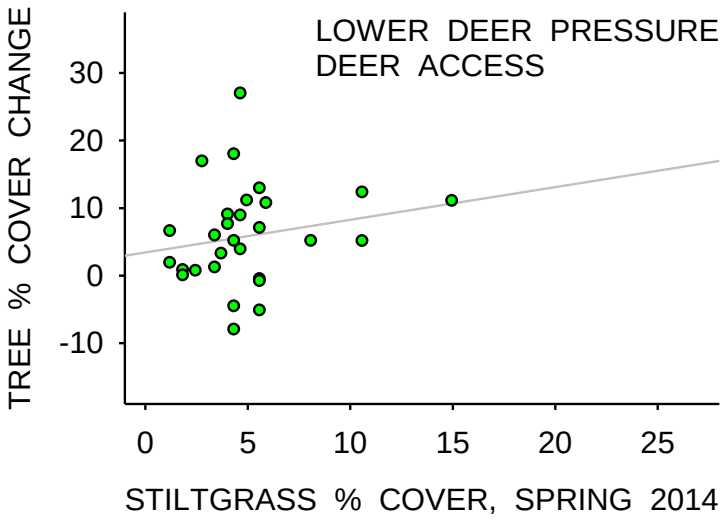


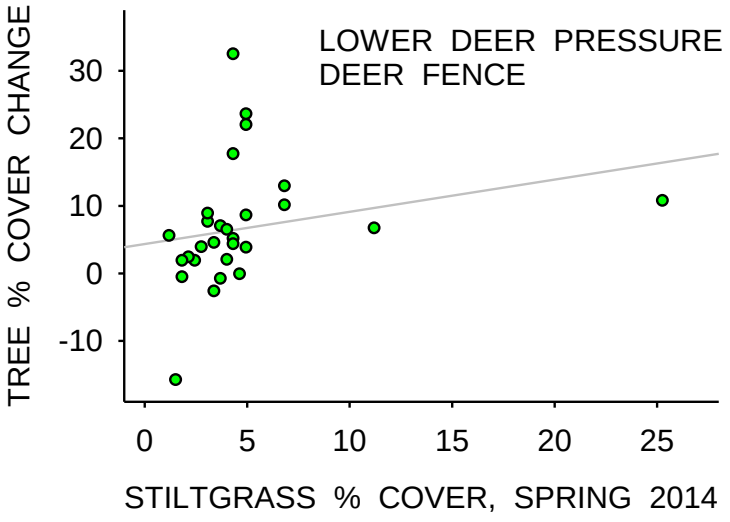
- a trend, but no significant increase when protected from deer
- no competition from stiltgrass

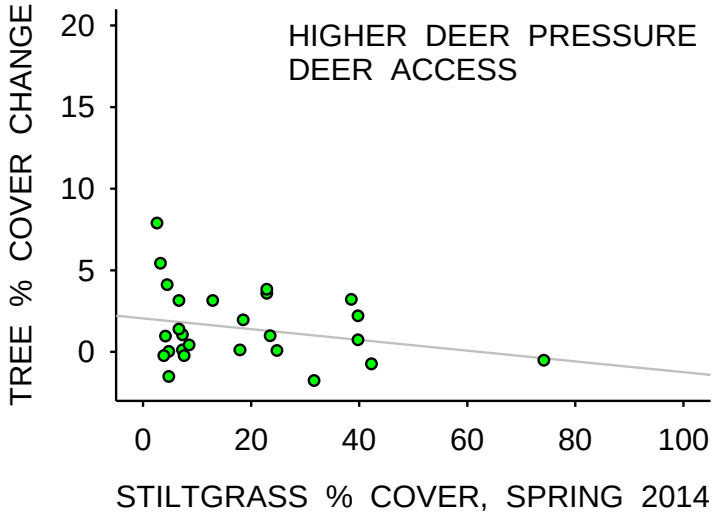
- significant increase when protected from deer (P=0.02)
- competition from stiltgrass (P=0.02)

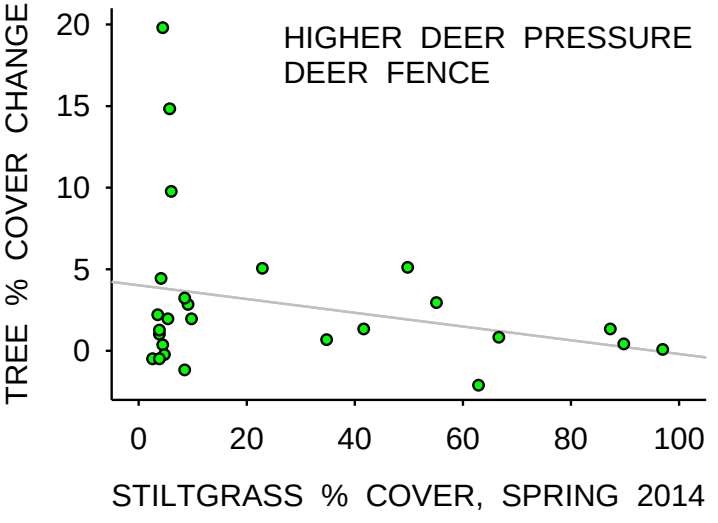
(more stiltgrass with protection from deer)

Effect of initial stiltgrass invasion on 2012 to 2014 change in percent cover of native trees in the herb layer







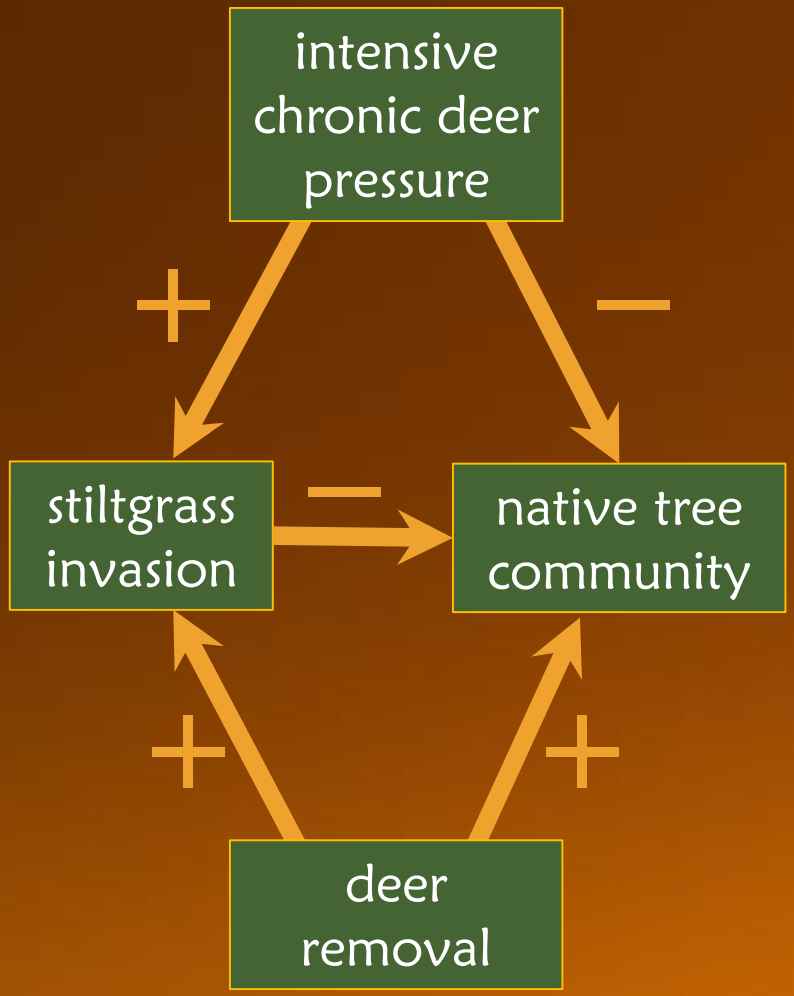


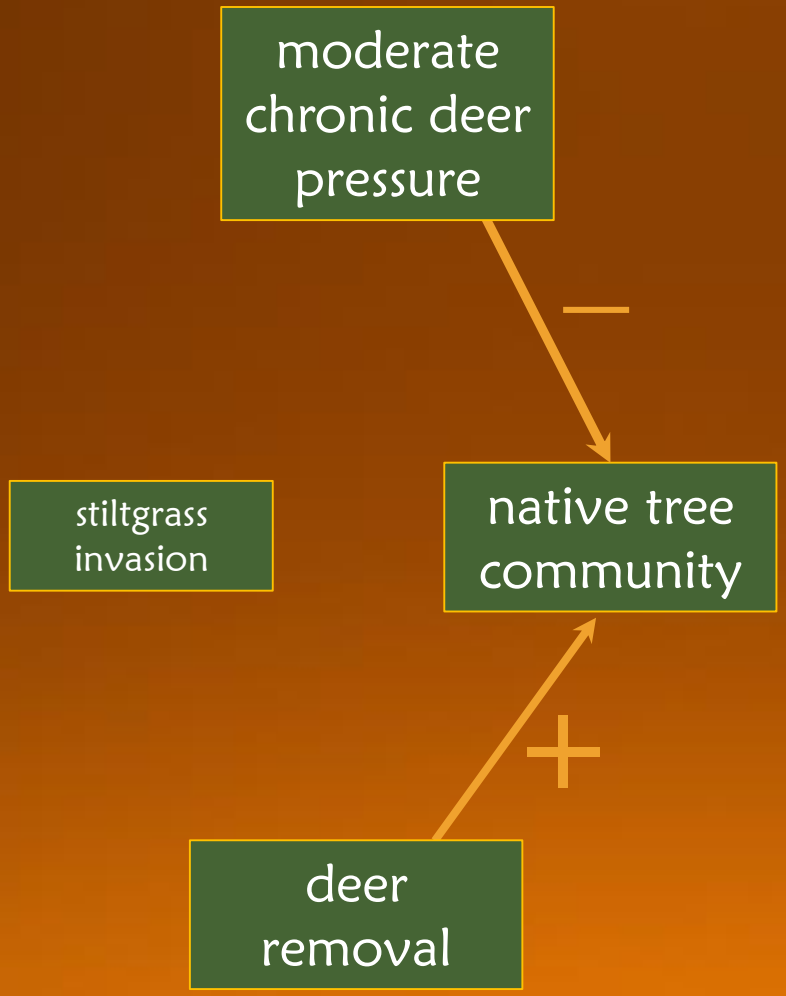
change in tree species richness from 2012 to fall 2014 (18 months of treatment)

higher deer pressure		mean	se, n
not fenced	no stiltgrass	1.5	0.40, 26
not fenced	with stiltgrass	0.1	0.37, 26
fenced	no stiltgrass	2.0	0.45, 28
fenced	with stiltgrass	0.4	0.42, 27

lower deer pressure		mean	se, n
not fenced	no stiltgrass	-0.1	0.43, 30
not fenced	with stiltgrass	0.5	0.39, 29
fenced	no stiltgrass	0.7	0.41, 29
fenced	with stiltgrass	0.3	0.46, 29

conceptual models





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