Olaf Hajek

Impacts of biodiversity on the emergence and transmission of infectious diseases

Felicia Keesing[1], Lisa K. Belden[2], Peter Daszak[3], Andrew Dobson[4], C. Drew Harvell[5], Robert D. Holt[6], Peter Hudson[7], Anna Joll
Kate E. Jones[9], Charles E. Mitchell[10], Samuel S. Myers[11], Tiffany Bogich[3] & Richard S. Ostfeld[12]

Sacred Cows and Sympathetic Squirrels: The Importance of Biological Diversity to Human Health

Andy Dobson*, Isabella Cattadori, Robert D. Holt, Richard S. Ostfeld, Felicia Keesing, Kristle Krichbaum, Jason R. Rohr, Sarah E. Perkins, Peter J. Hudson

Avian diversity and West Nile virus: testing associations between biodiversity and infectious disease risk

Vanessa O. Ezenwa[1,*], Marvin S. Godsey[2], Raymond J. King[2] and Stephen C. Guptill[1]

Biodiversity decreases disease through predictable changes in host community competence

Pieter T. J. Johnson[1], Daniel L. Preston[1], Jason T. Hoverman[2] & Katherine L. D. Richgels[1]

EFFECTS OF GRASSLAND PLANT SPECIES DIVERSITY, ABUNDANCE, AND COMPOSITION ON FOLIAR FUNGAL DISEASE

CHARLES E. MITCHELL,[1,3] DAVID TILMAN,[1] AND JAMES

Linking community and disease ecology: the impact of biodiversity on pathogen transmission

Benjamin Roche, Andrew P. Dobson, Jean-François Guégan and Pejman Rohani

Pangloss revisited: a critique of the dilution effect a biodiversity-buffers-disease paradigm

S. E. RANDOLPH[1]* *and* A. D. M. DOBSON[1,2]

Does biodiversity protect humans against infectious disease?

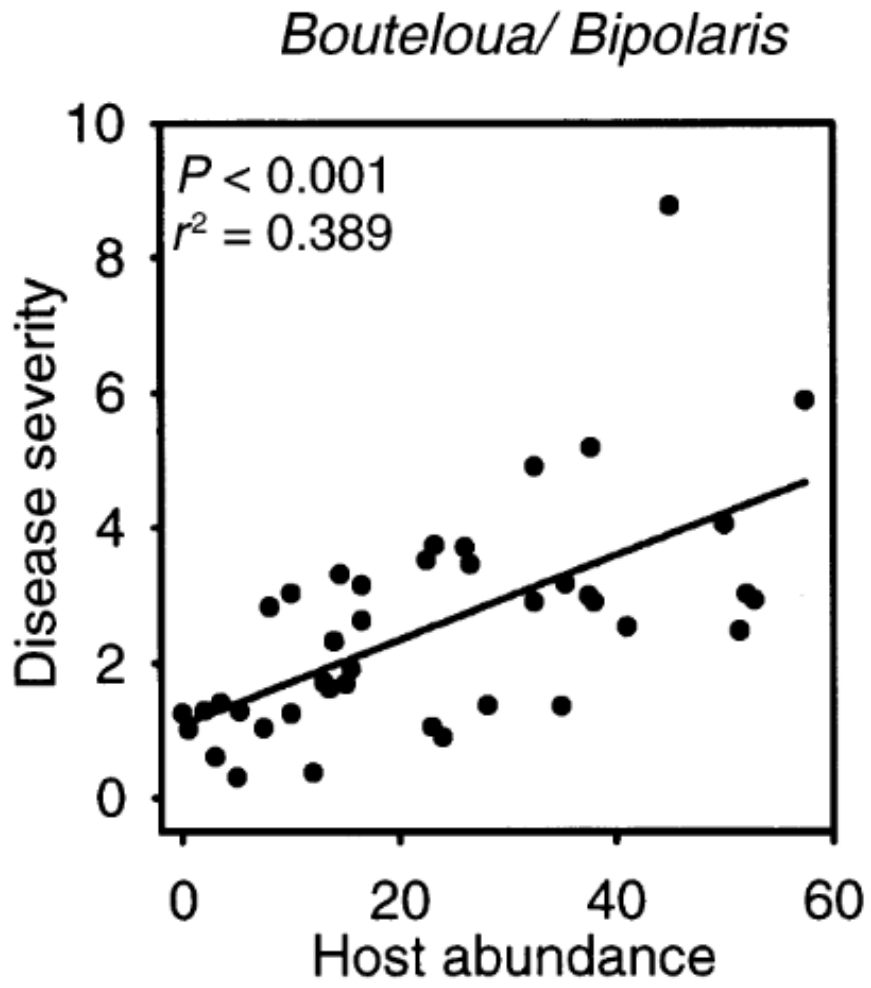
CHELSEA L. WOOD,[1,2,8] KEVIN D. LAFFERTY,[3] GIULIO DELEO,[1,4] HILLARY S. YOUNG,[5,6] PETER J. HUDSON,[7] AND ARMAND M. KURIS[5]

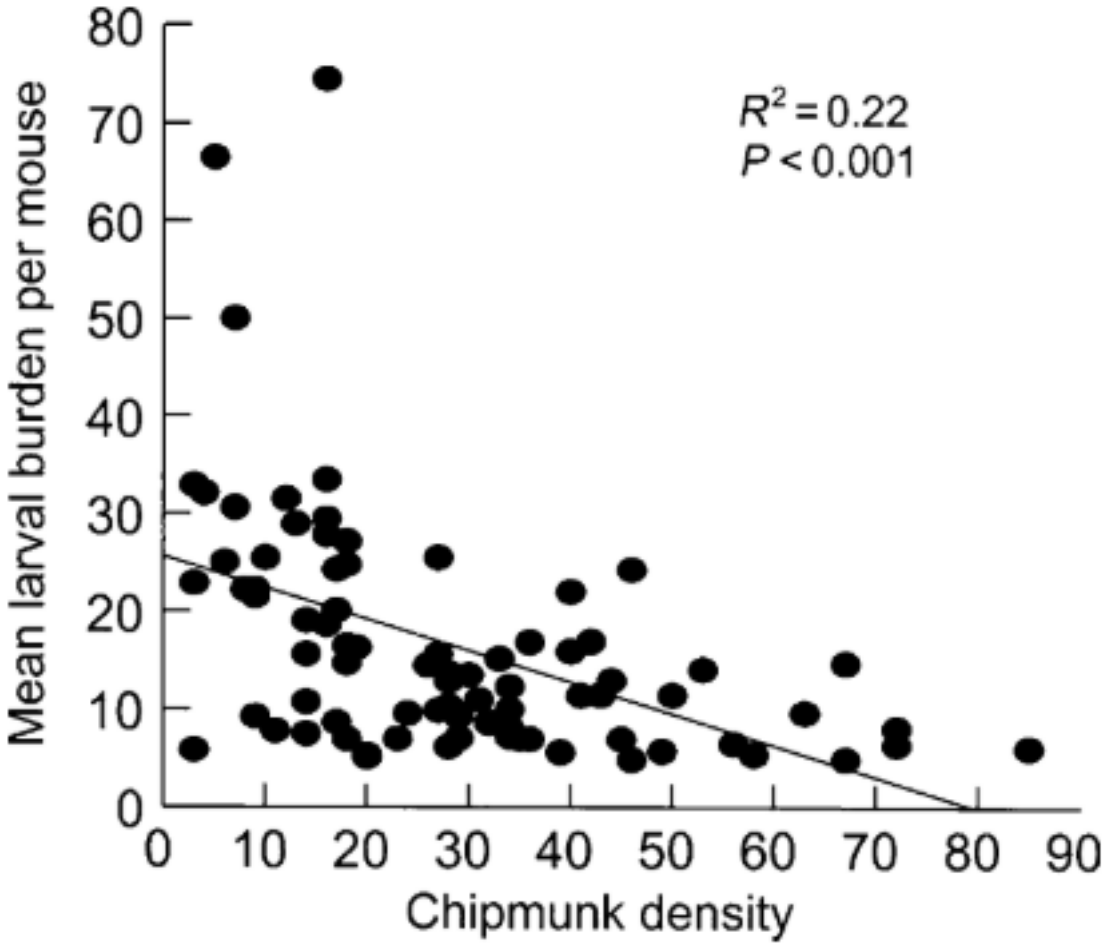
Defuse the dilution effect debate

Debate surrounding the dilution effect hypothesis in disease ecology has reached such intensity that it is stymying further research. Yet collaborative progress is important for human health and biodiversity conservation.

Samniqueka Halsey

Host abundance can affect disease severity





competence = ability to acquire and transmit a pathogen

Mitchell et al. 2002, Keesing et al. 2006

Trends in Ecology & Evolution

Review

Introduced Species, Disease Ecology, and Biodiversity–Disease Relationships

Hillary S. Young,[1,*] Ingrid M. Parker,[2] Gregory S. Gilbert,[3] Ana Sofia Guerra,[1] and Charles L. Nunn[4,5]

Invasive species:

- High density
- High relative abundance

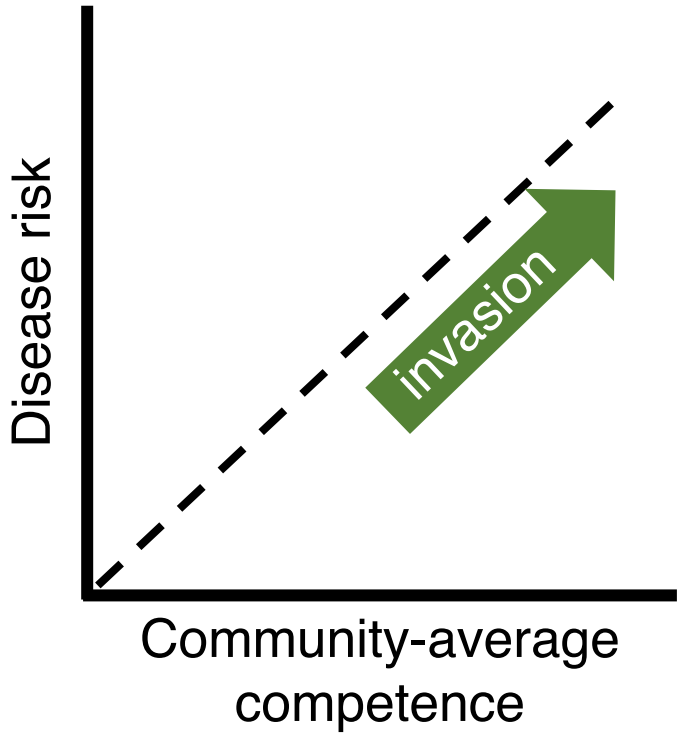
Kerry Britton

Invasive species may differ from native species in **transmission competence**

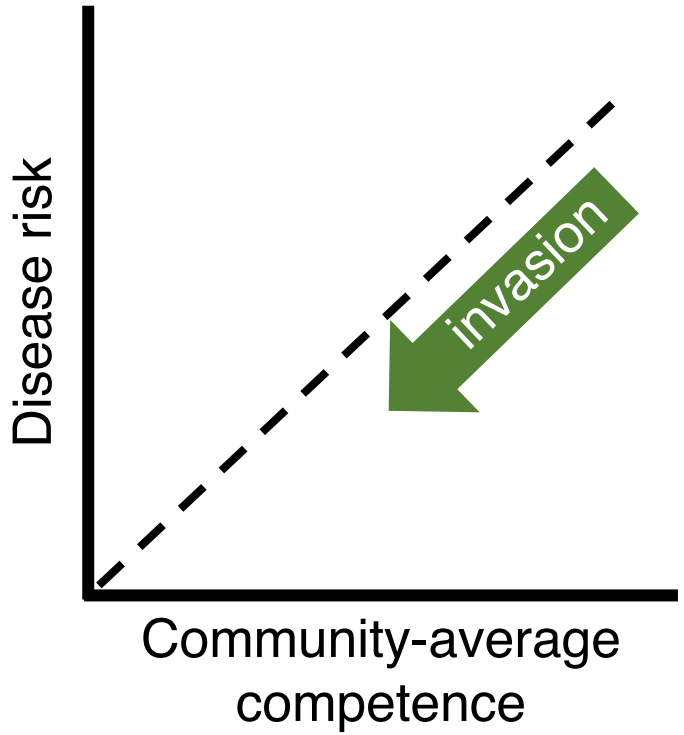
Young et al. 2017

How do invasive species affect disease risk?

amplification



dilution



Erin Mordecai

Erin Spear

Caroline Daws

Luke Flory

Dataset 1

- 6 experiments throughout Jasper Ridge
- 9 grass species
  - 2 native
  - 7 invasive
- 1005 foliar fungal isolates

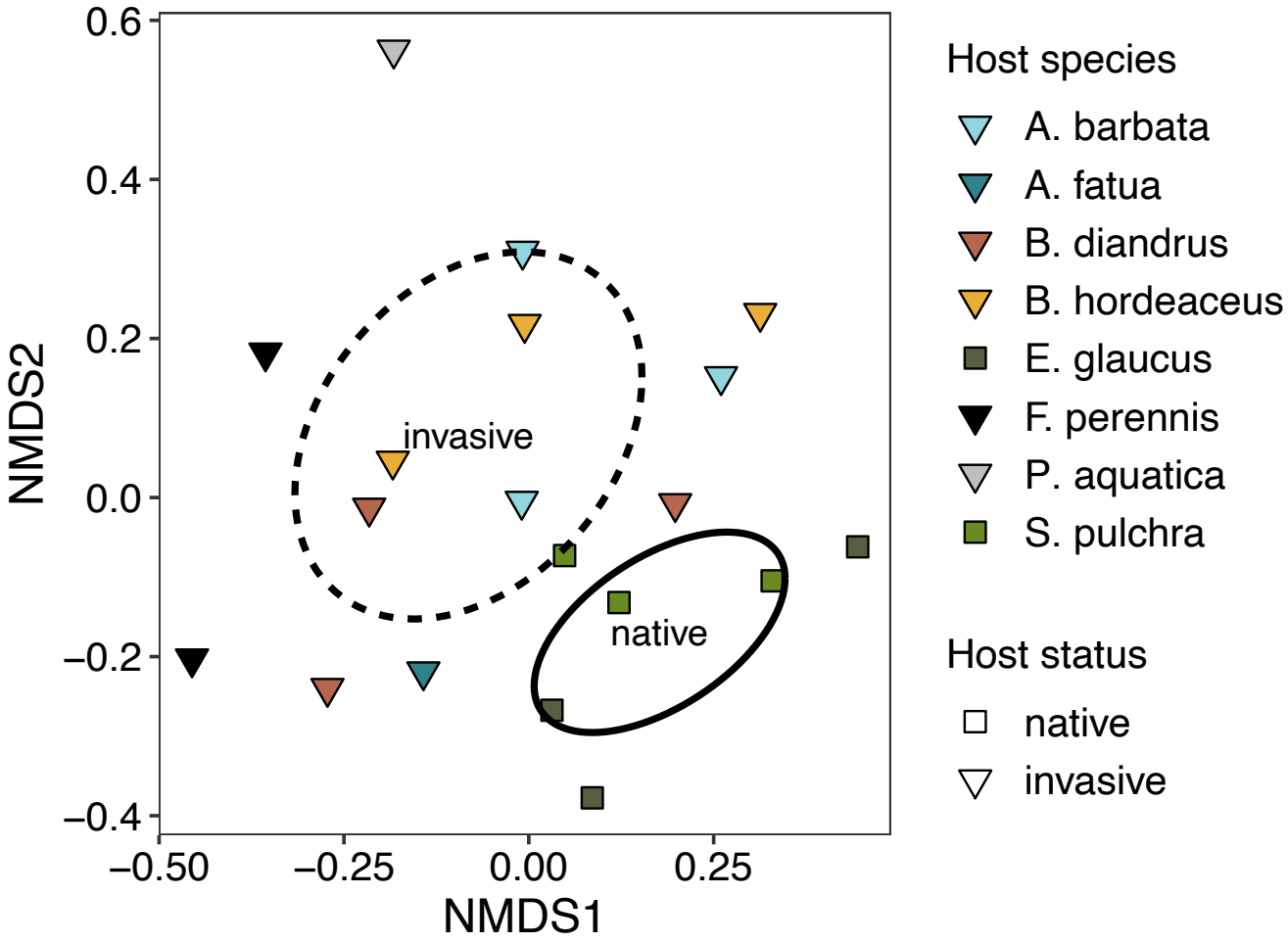
Dataset 2

- 2 experiments with known grass community composition
  - Observational gradient
  - Manipulated gradient
- 8 grass host species
  - 2 native
  - 3 - 6 invasive
- 389 foliar fungal isolates
- 673 damage assessments

Dataset 1

Foliar fungal communities

Host plant status influences **pathogen community** composition



Host species

- A. barbata
- A. fatua
- B. diandrus
- B. hordeaceus
- E. glaucus
- F. perennis
- P. aquatica
- S. pulchra

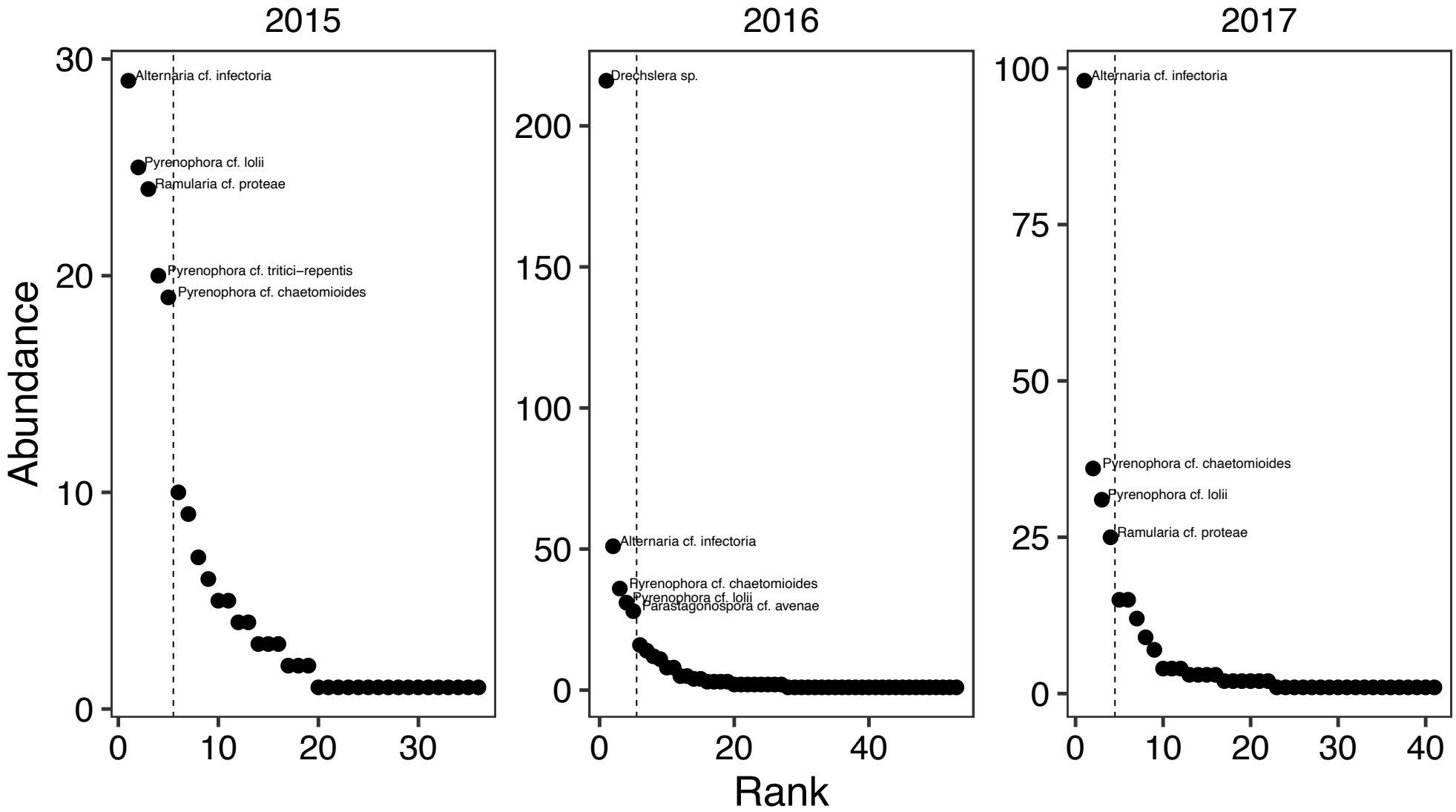
Host status

- native
- invasive

PERMANOVA

	Df	*F*	R^2	*Pr(>F)*
host status	1	11.73	0.19	0.001
host species	6	3.54	0.35	0.005
year	2	9.66	0.32	0.001
residuals	9	NA	0.15	NA
total	18	NA	1	NA

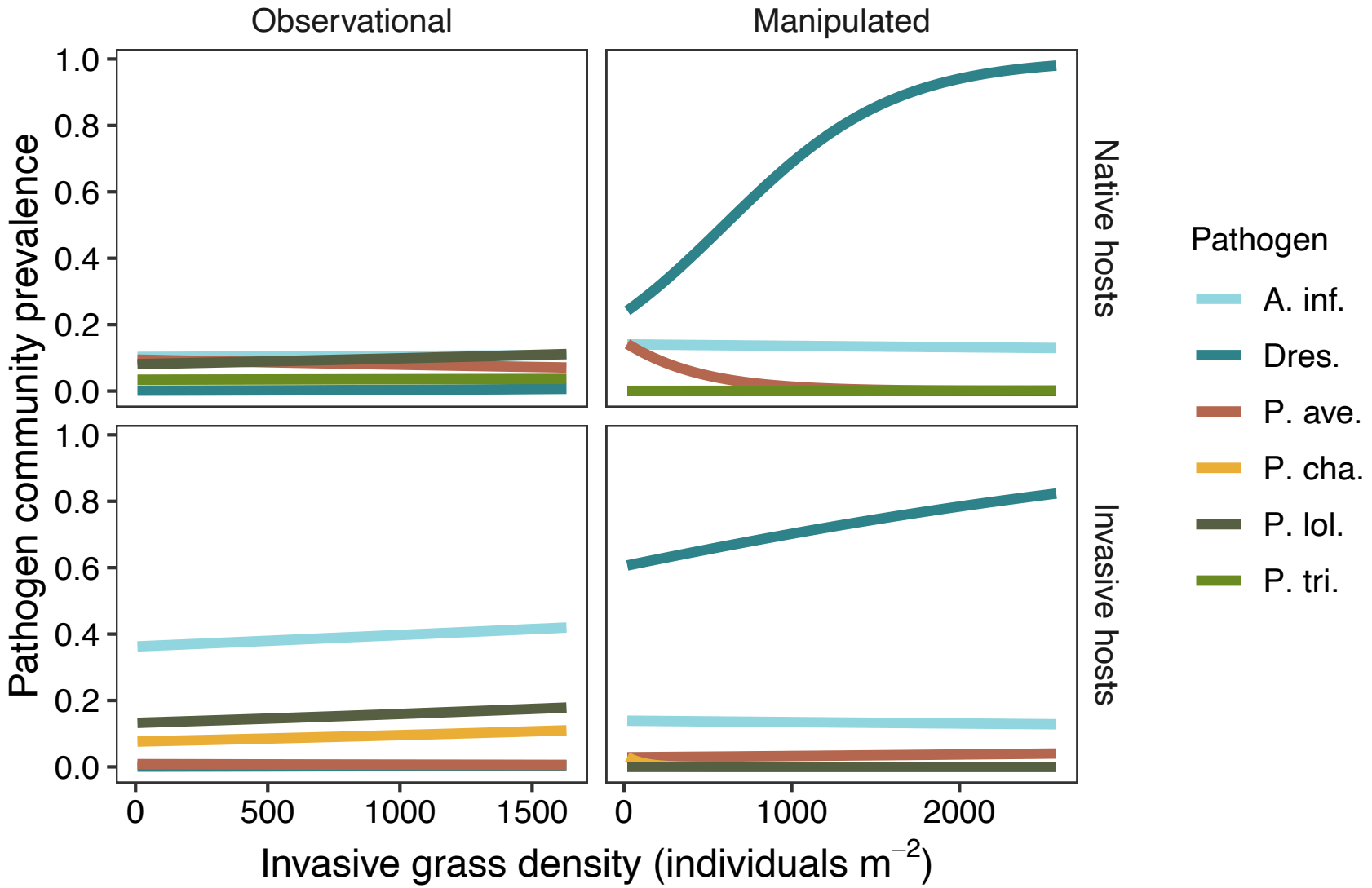
Choosing focal pathogens to test prevalence



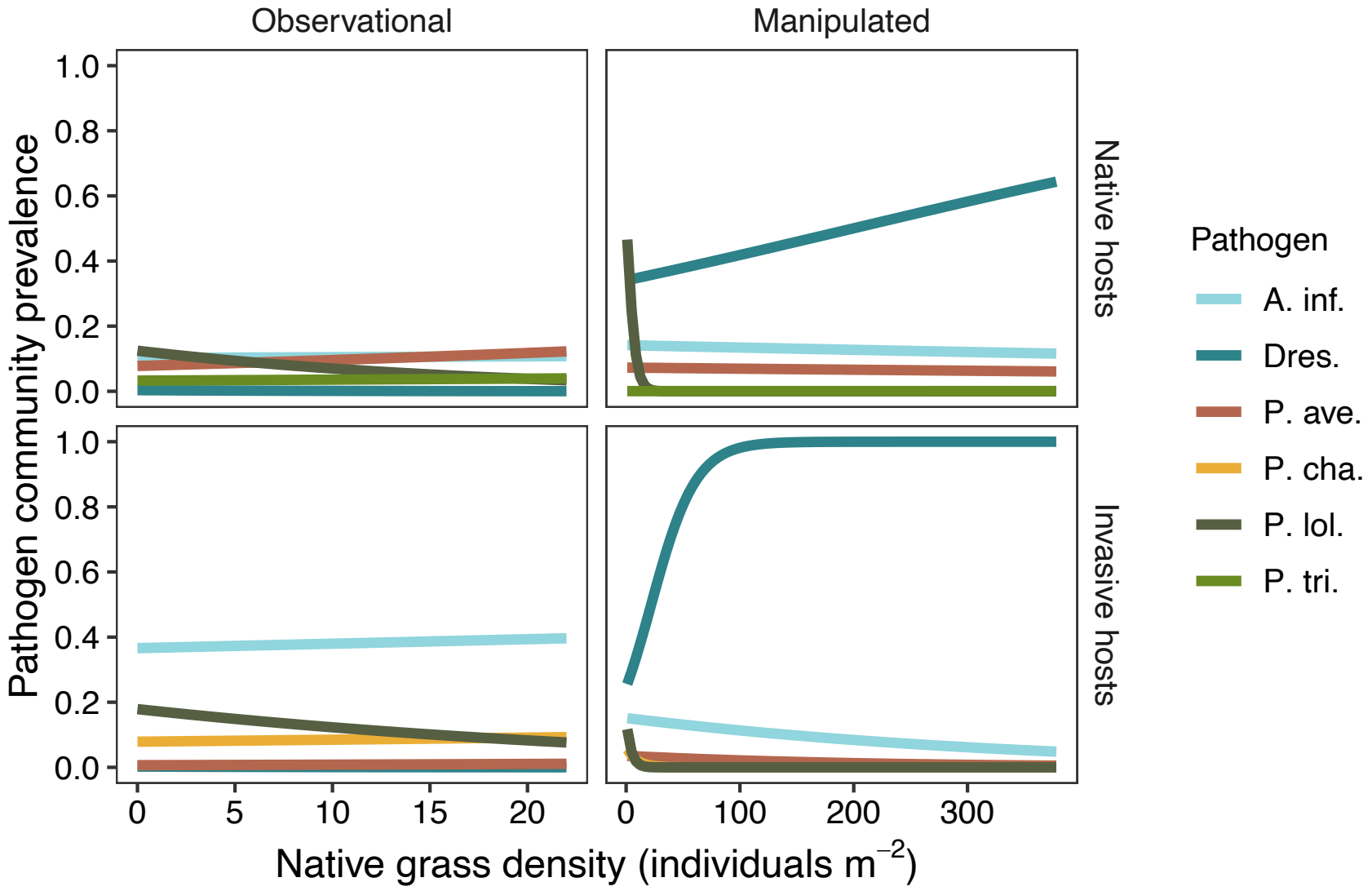
Dataset 2

Host density effects

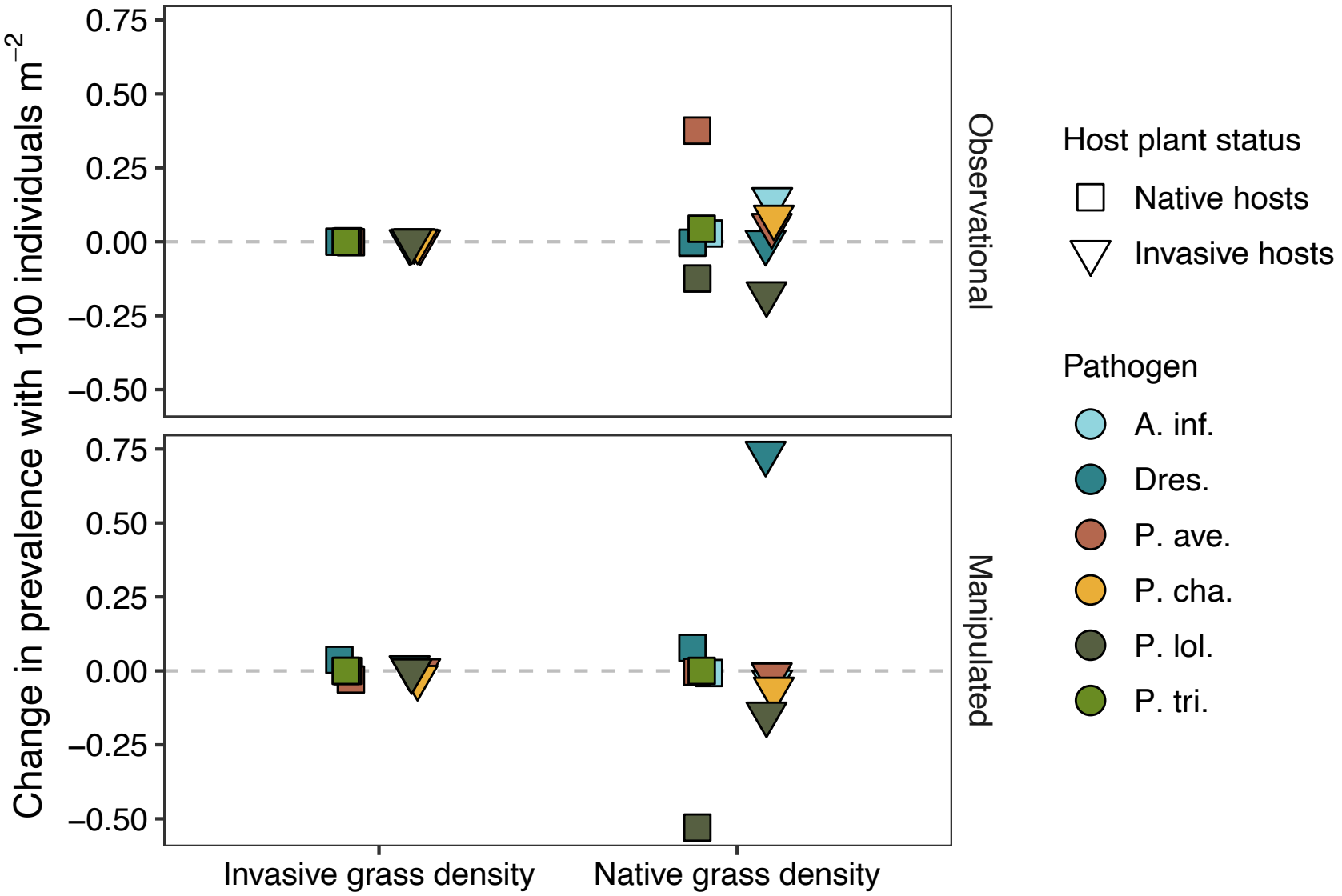
Invasive grasses amplify, dilute, and have no effect on pathogens



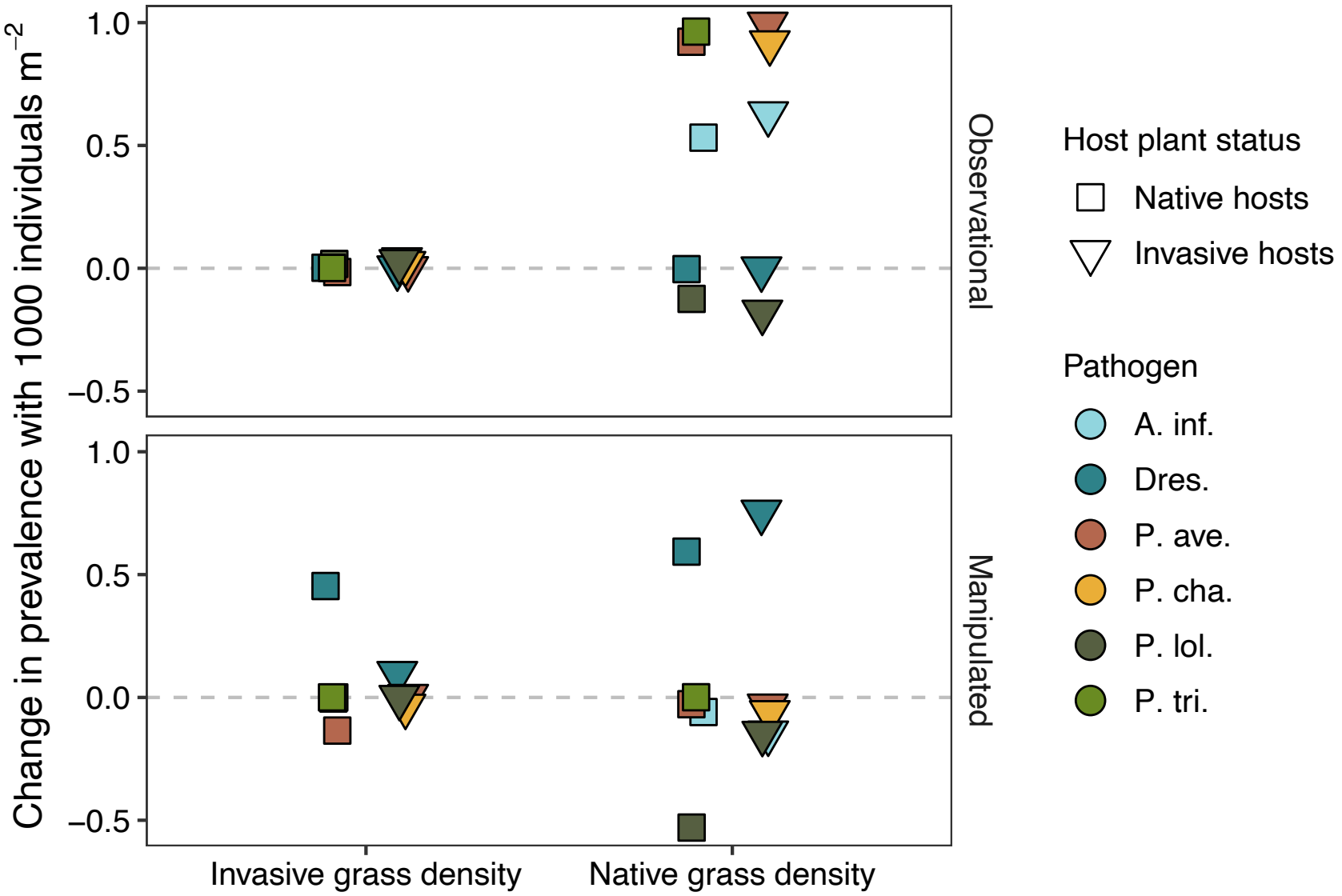
Native grasses amplify, dilute, and have no effect on pathogens



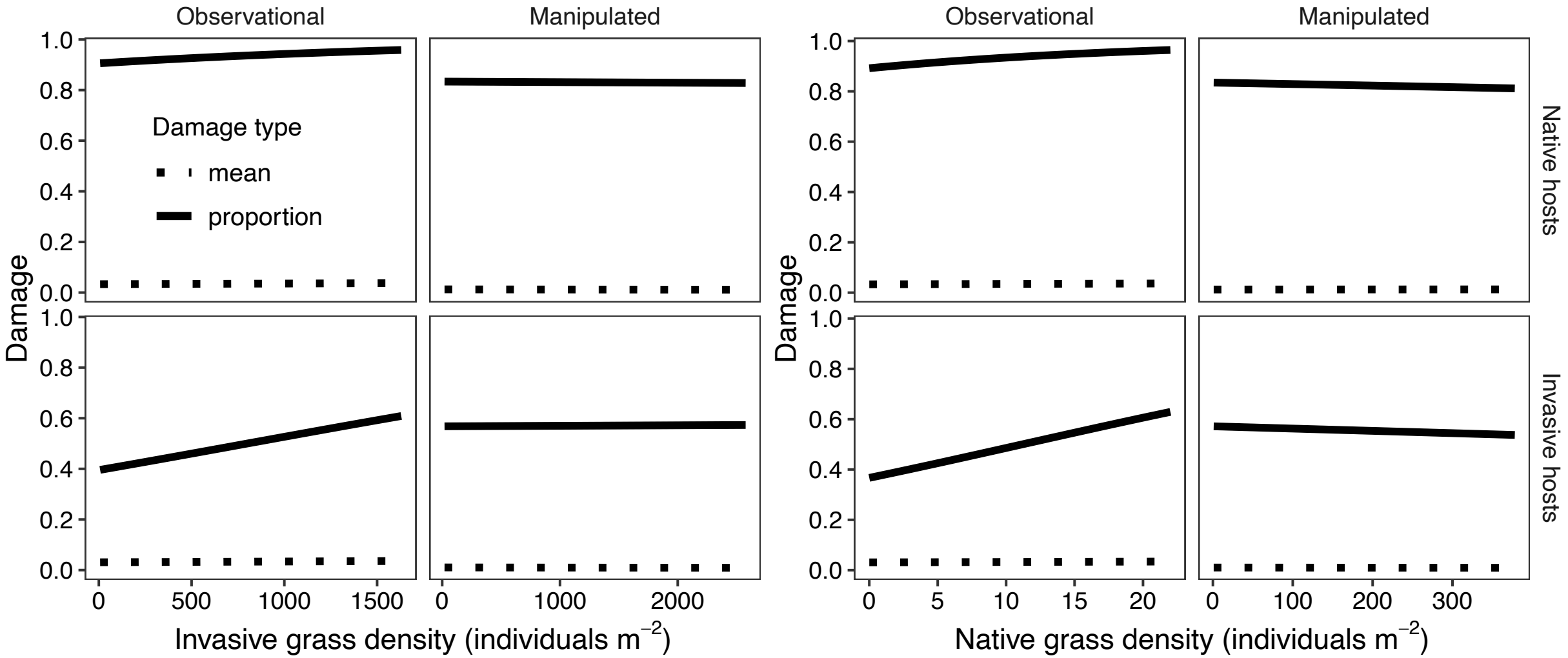
Native grasses have stronger effects on pathogen prevalence than invasive grasses



…even with large increases in density

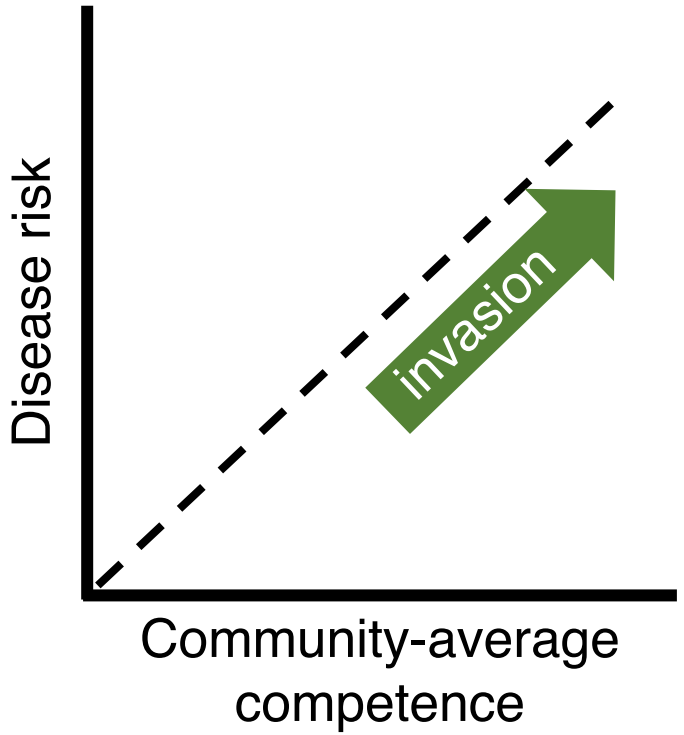


Grass density has little effect on damage

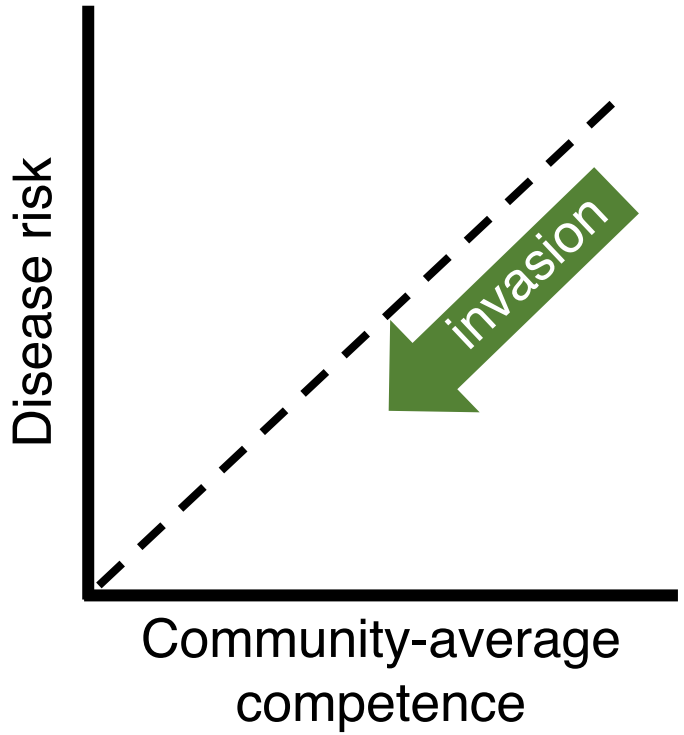


How do invasive species affect disease risk?

amplification



dilution



How do invasive species affect disease risk?

- Native hosts have a larger effect on disease risk than invasive hosts (metric: pathogen prevalence)
  - Amplifying and diluting
- Prevalence at equilibrium is not necessarily expected to change with host density

- Hosts density does not strongly affect disease risk (metric: damage)
  - Slight amplification on invasive hosts – no effect of density status

Extra slides

How do we quantify “disease risk”?

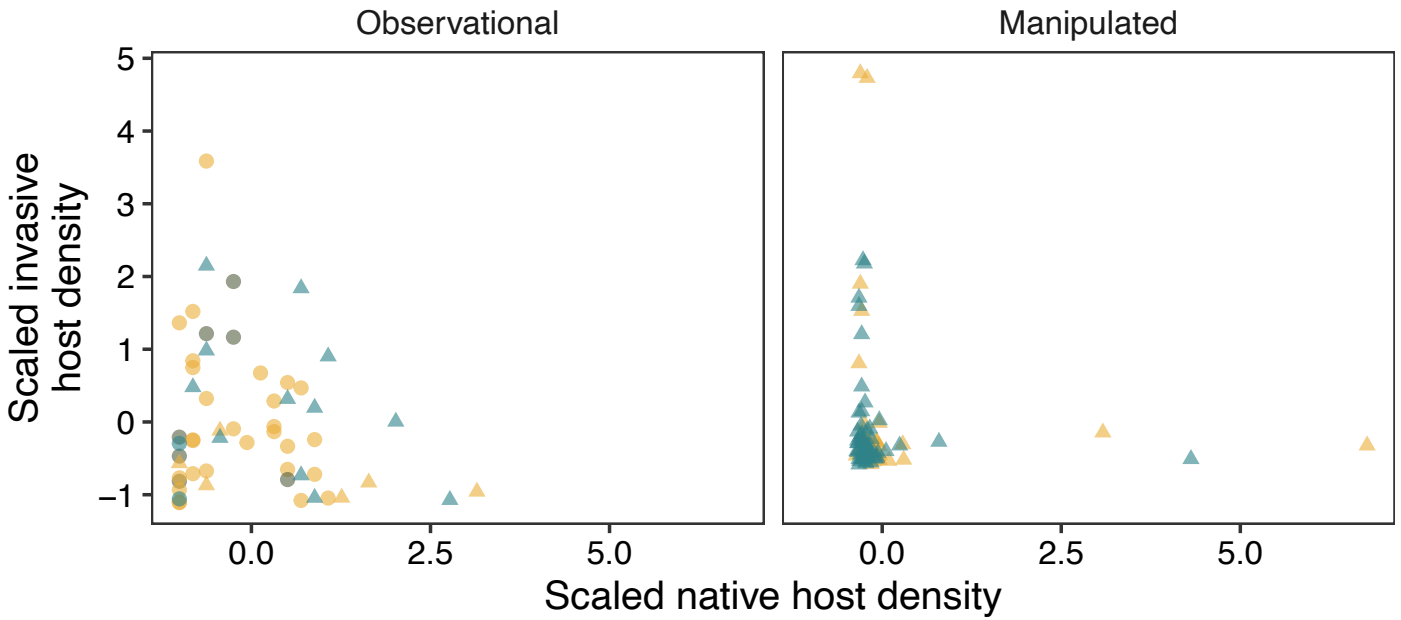
Mathematical quantities

- Pathogen establishment = R_0
- Maximum spread rate = max(dI/dt)
- Equilibrium prevalence = I*/N*

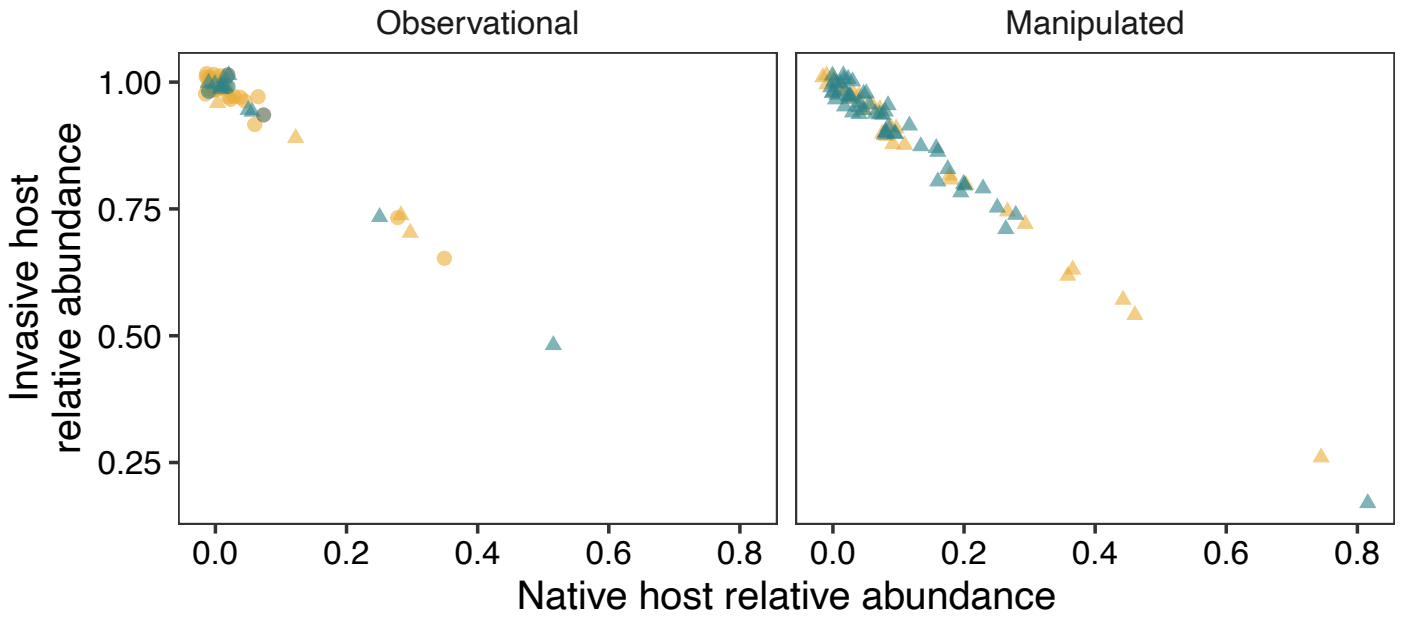
Measured quantities

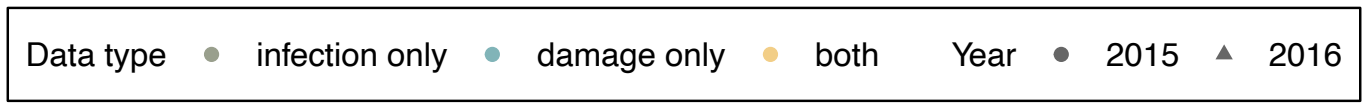
- Prevalence
- Disease severity
- Parasite load
- Incidence
- Immune reaction
- Parasite richness

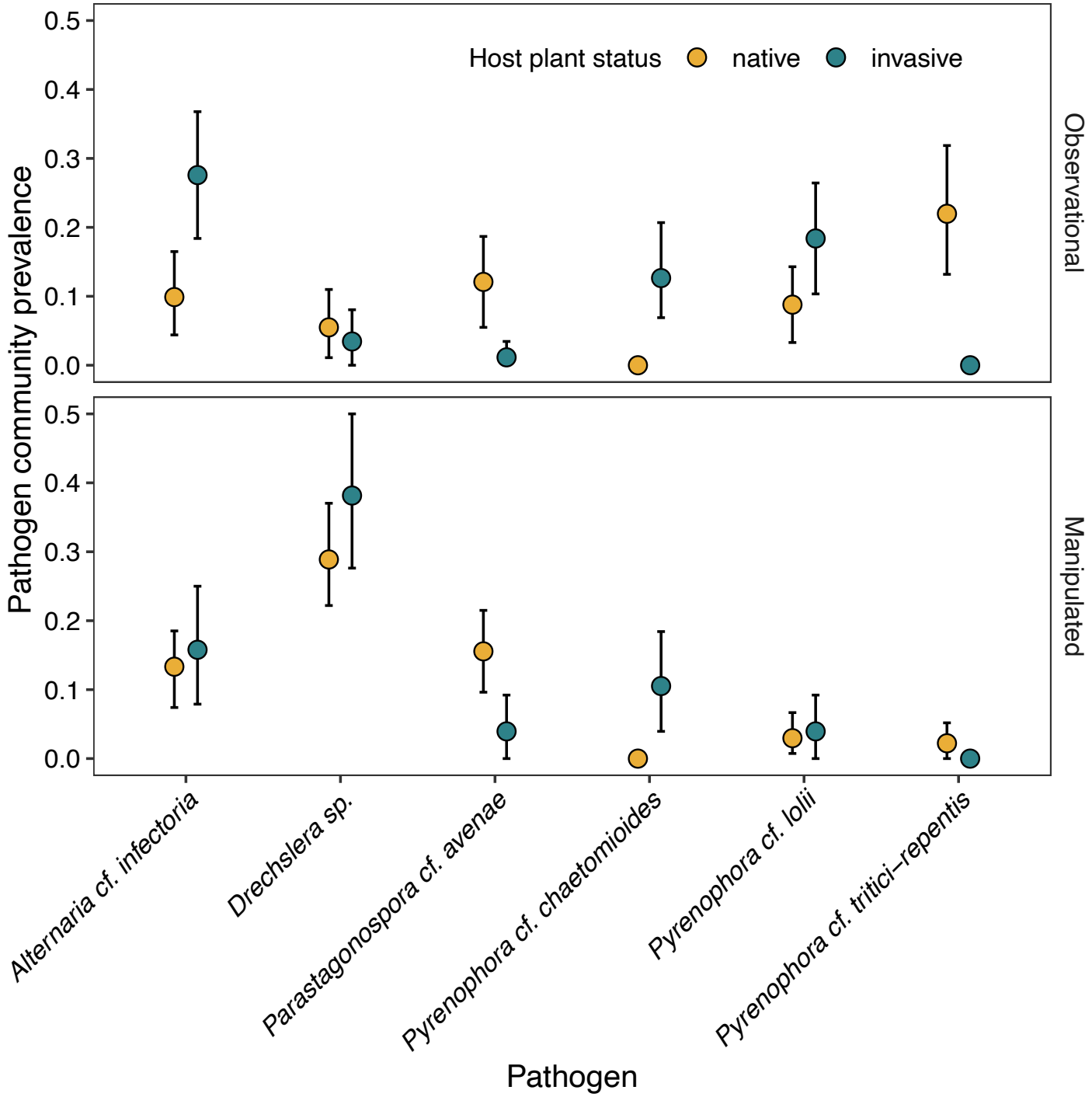
Host plant density



Host plant relative abundance







Average community prevalence

Pathogen communities in focal experiments