

Impacts of Exotic Plants in Natural Systems: Methods and Findings of Experimental Research



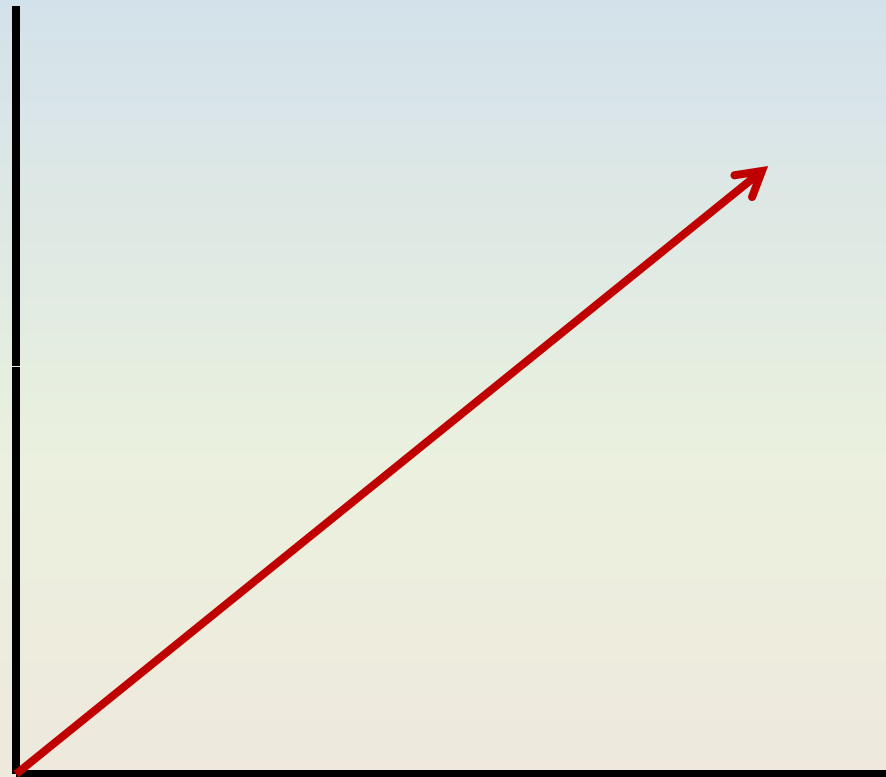
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Does exotic species 'X' have an impact?

Yes

No

Native
species
decline

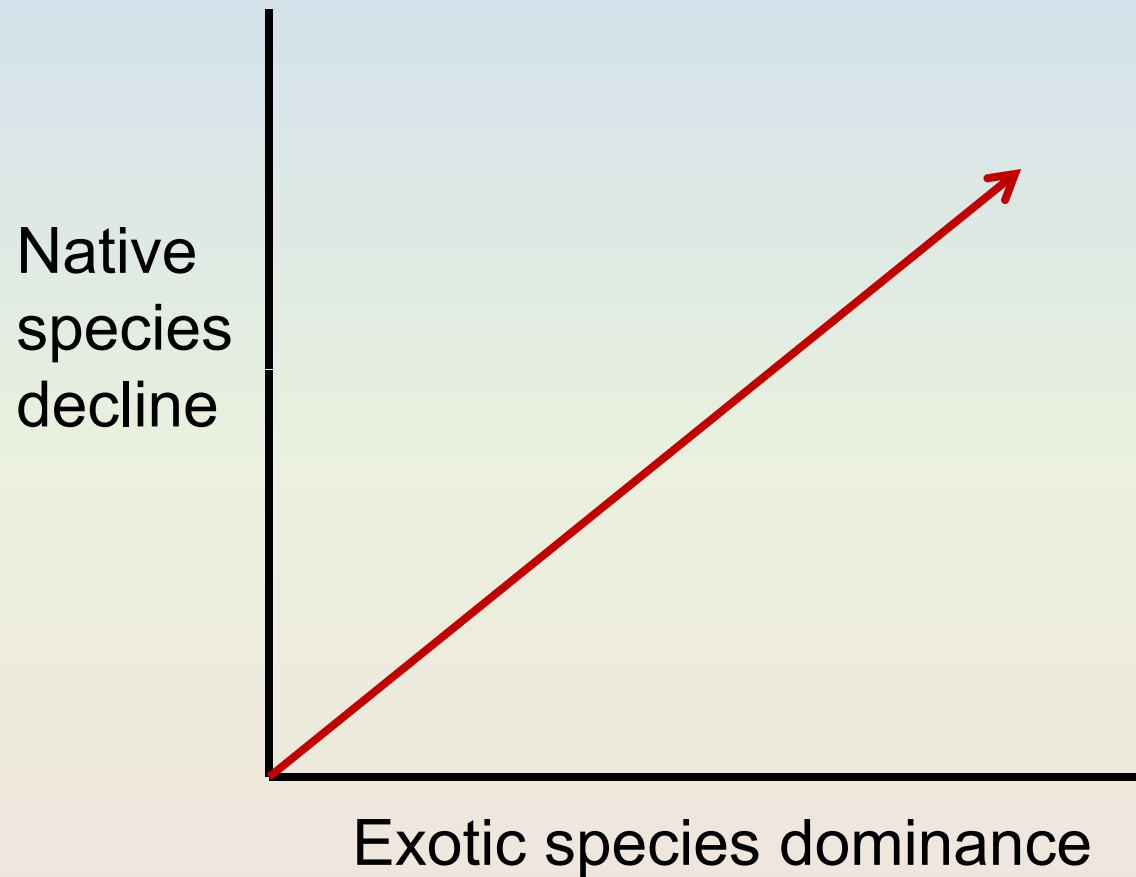


Exotic species dominance

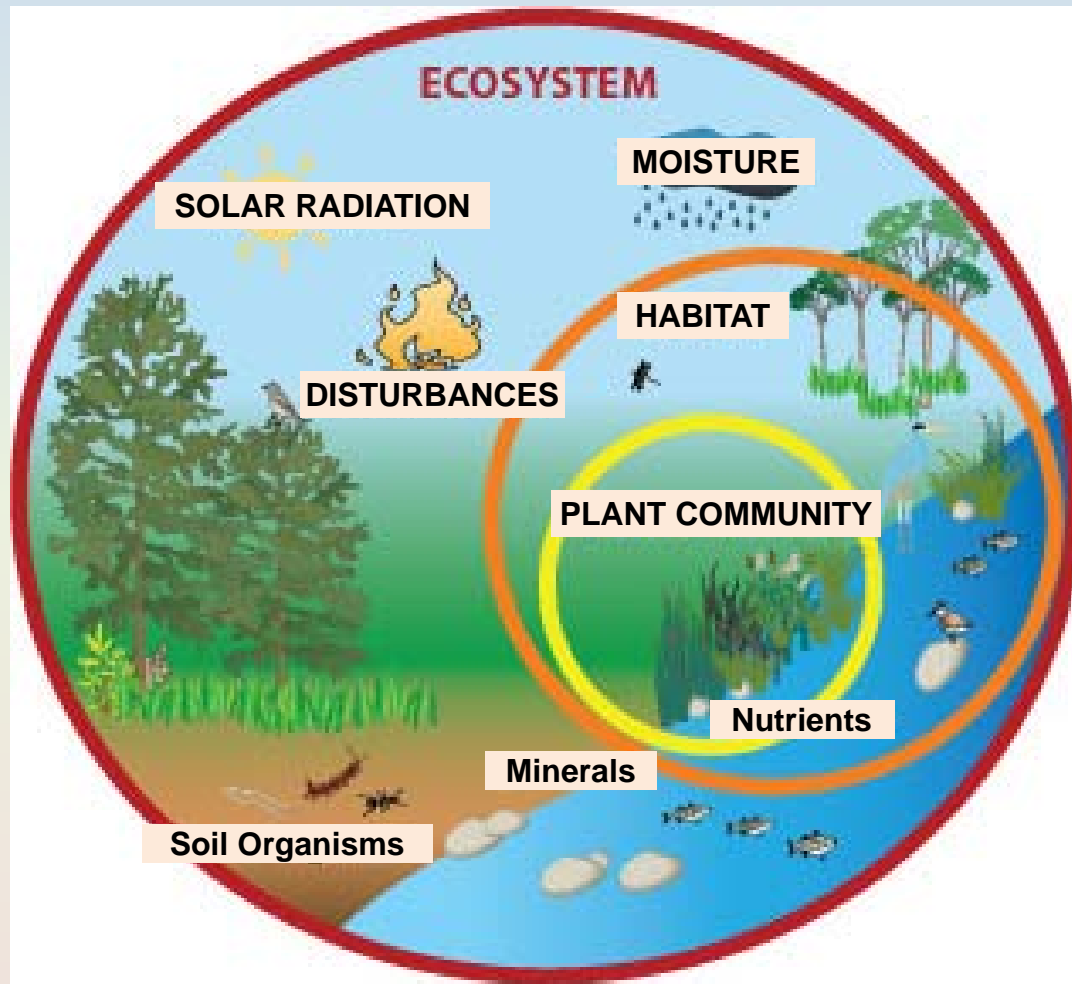
Multiple environmental stressors



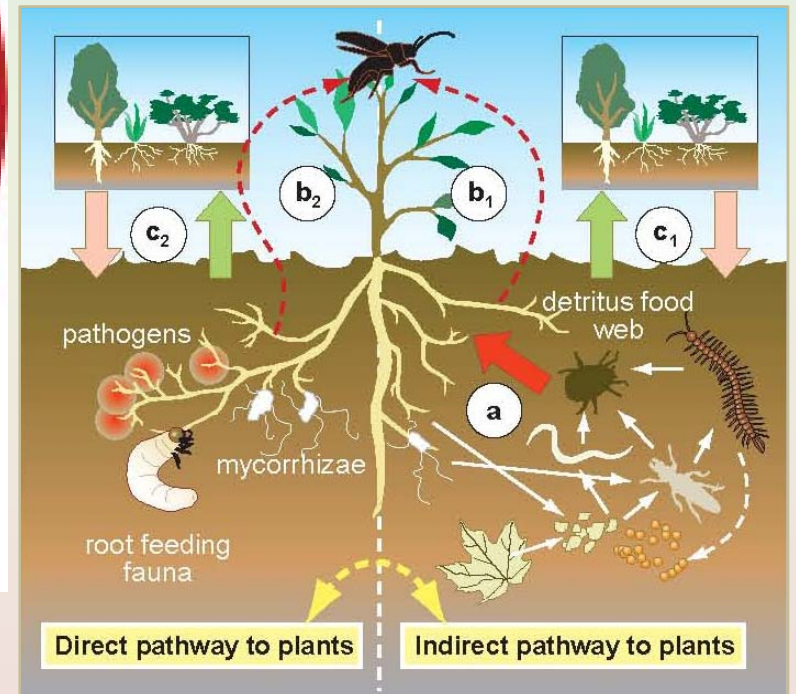
Drivers or passengers of change?



Ecological significance



usfws.gov



Wardle *et al.* Science, 2004

Variability



Carol DiSalvo, USDI National Park Service, Bugwood.org



Steve Dewey, Utah State University, Bugwood.org



John M. Randall, The Nature Conservancy, Bugwood.org

- Exotic species
- Exotic density
- Site
- Resident community
- Abiotic conditions
- Disturbance

Recap: considerations when quantifying impacts

- Source of impacts
- Significance (biological) of impacts
- Context-dependence of impacts



Relative assessments



Review of experimental impacts research 2001- 2010

111 studies worldwide
75 in USA & Canada

Exotic growth forms

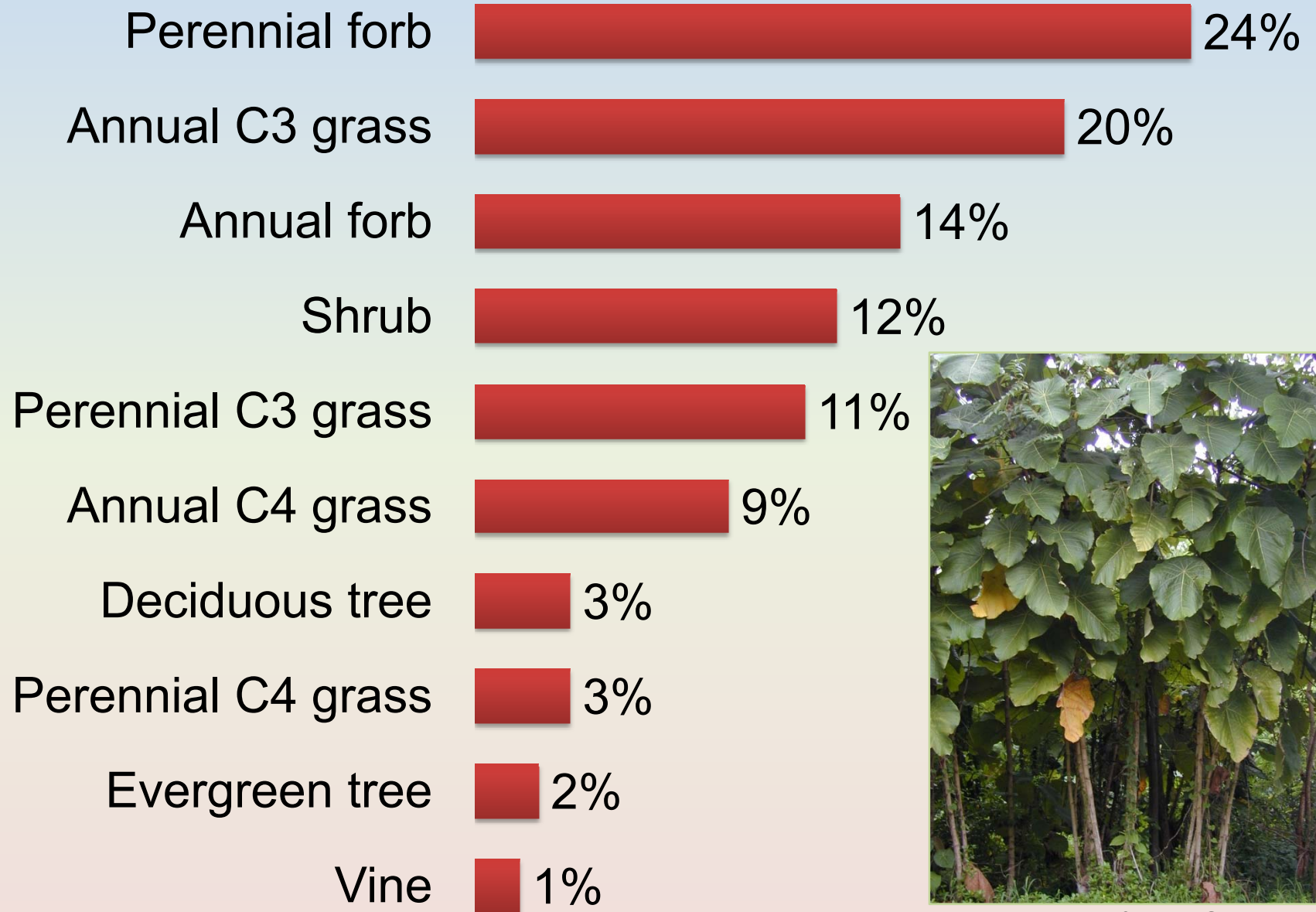


Photo: Forest & Kim Starr

Exotic species

73 total

51 species in 1 study each

Exotic species in multiple studies

Microstegium vimineum 7

Alliaria petiolata 6

Centaurea maculosa , *Lonicera maackii* 5

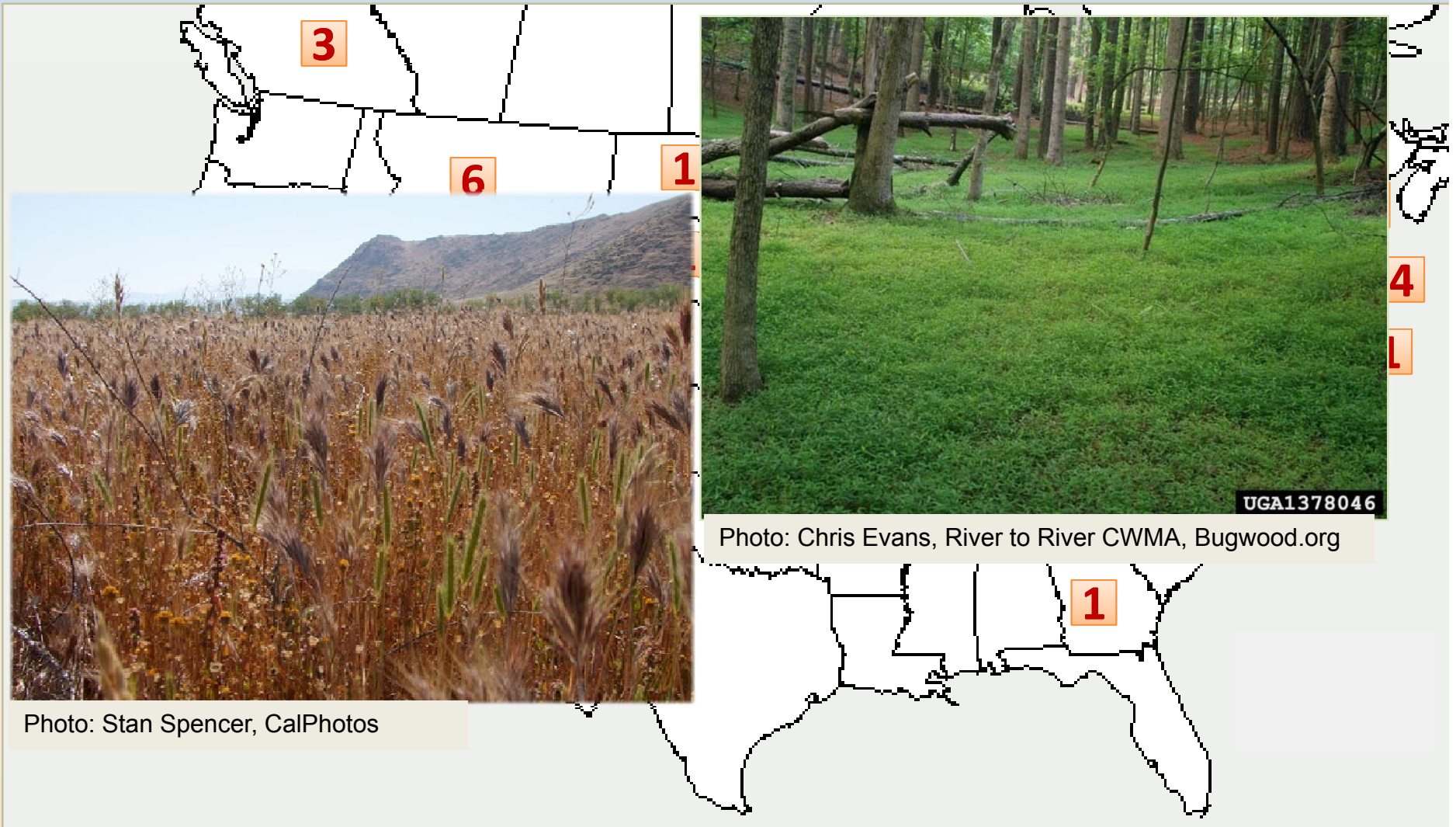
Avena barbata, *Bromus diandrus*, *Lythrum salicaria* 4

Bromus inermis, *Bromus madritensis* ssp. *rubens*,
Euphorbia esula 3

Acer platanoides, *Bromus hordeaceus*, 2
Medicago polymorpha, *Phalaris arundinacea*,
Rhamnus frangula

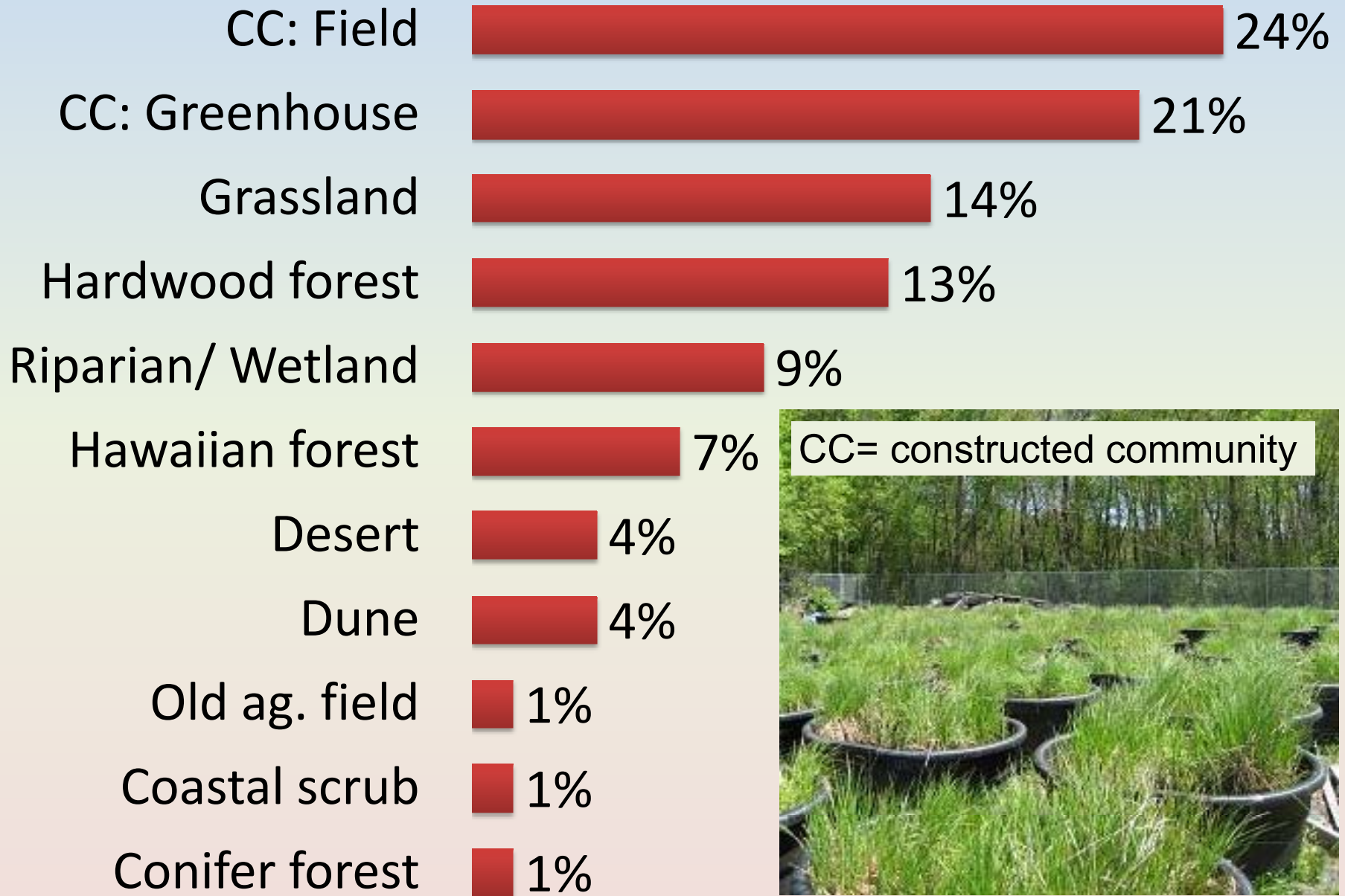
6 N-fixers (4 forbs, 1 shrub, 1 evergreen tree)

Study locations



75 Studies

Experimental systems



The Zedler Lab, U of Wisconsin

Analyses by experiment

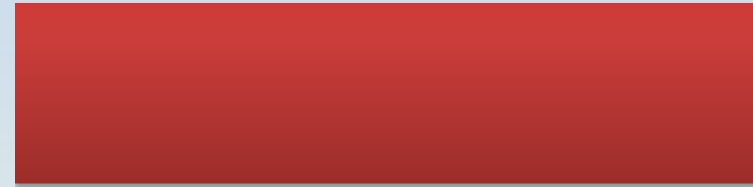
Experiment = exotic species + response variable

$n = 469$ experiments

Ecological level of impact ($n = 469$)



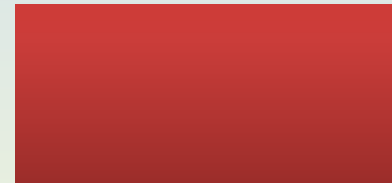
Individual species



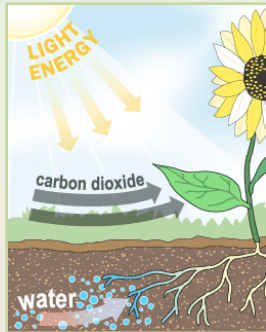
57%



Community structure



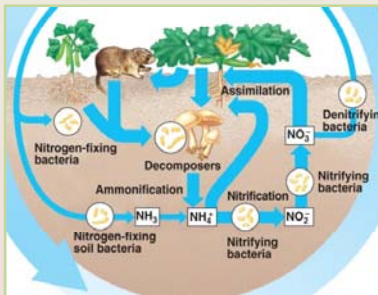
30%



Abiotic conditions



10%

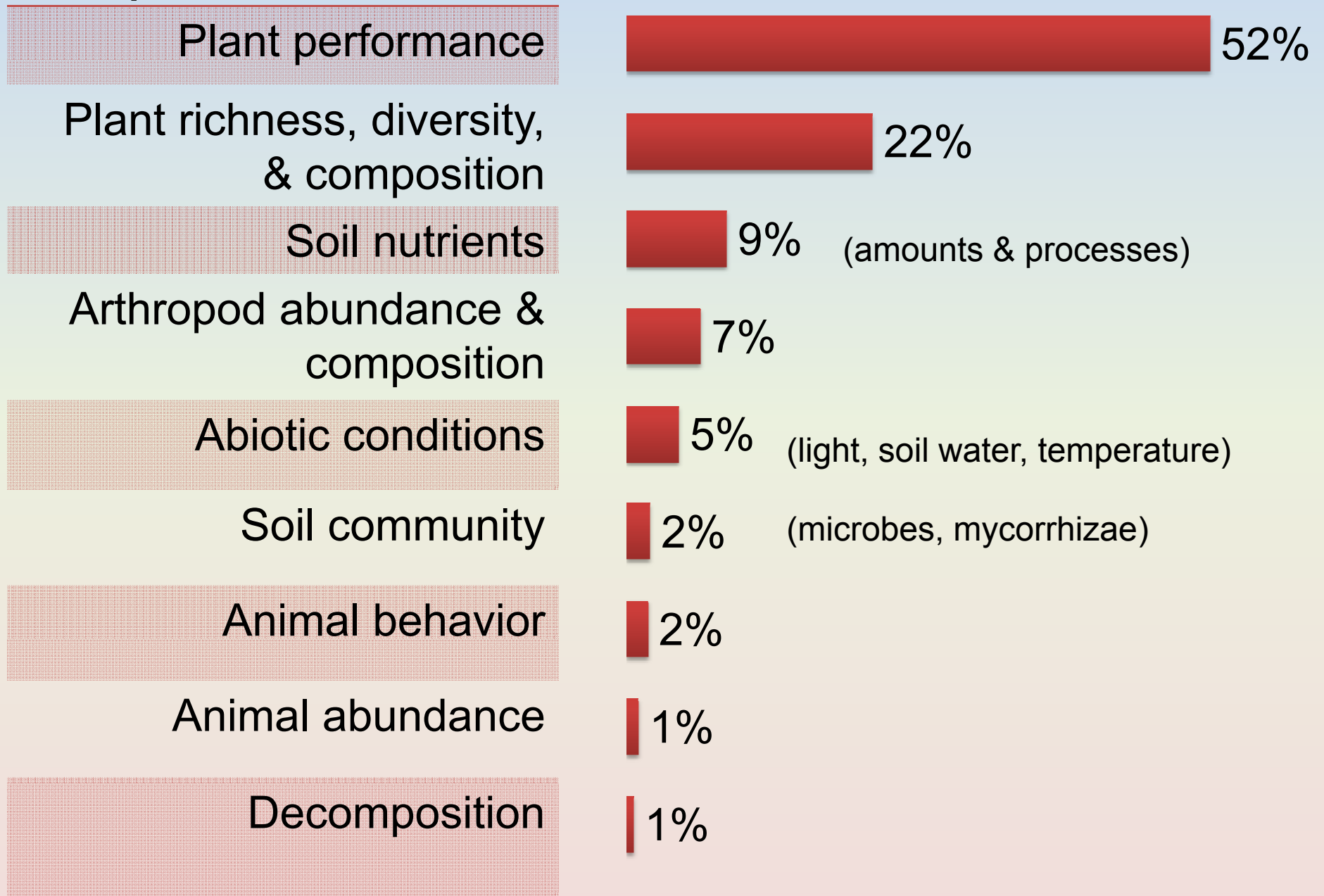


Ecosystem processes



4%

Response variables



Study characteristics

Multiple response variables

57%

Multiple target species

43%

Interaction with additional factors (soil N, water, density)

27%

Multiple exotic species

20%

Multiple sites

15%

Multiple ecological levels

14%

Disturbance

5%

Driver-vs-passenger

1%

A few impacts findings

	Impact		
	Increase	Decrease	No effect
Individual Species	8%	37%	54%
Community Structure	plant abundance & richness & arthropod abundance		
Abiotic Properties	30%	20%	50%
Ecosystem Processes	32%	11%	58%

Impacts by growth form & species

- C₃ annual grasses < expected
- Annual forbs > expected
- No strong growth form signal

- Species in multiple studies
 - Findings varied among studies
 - *Microstegium*
 - 7 studies
 - 3 found some evidence of ↓ plant richness & diversity
 - Generally mix of ↑, ↓, & no effect

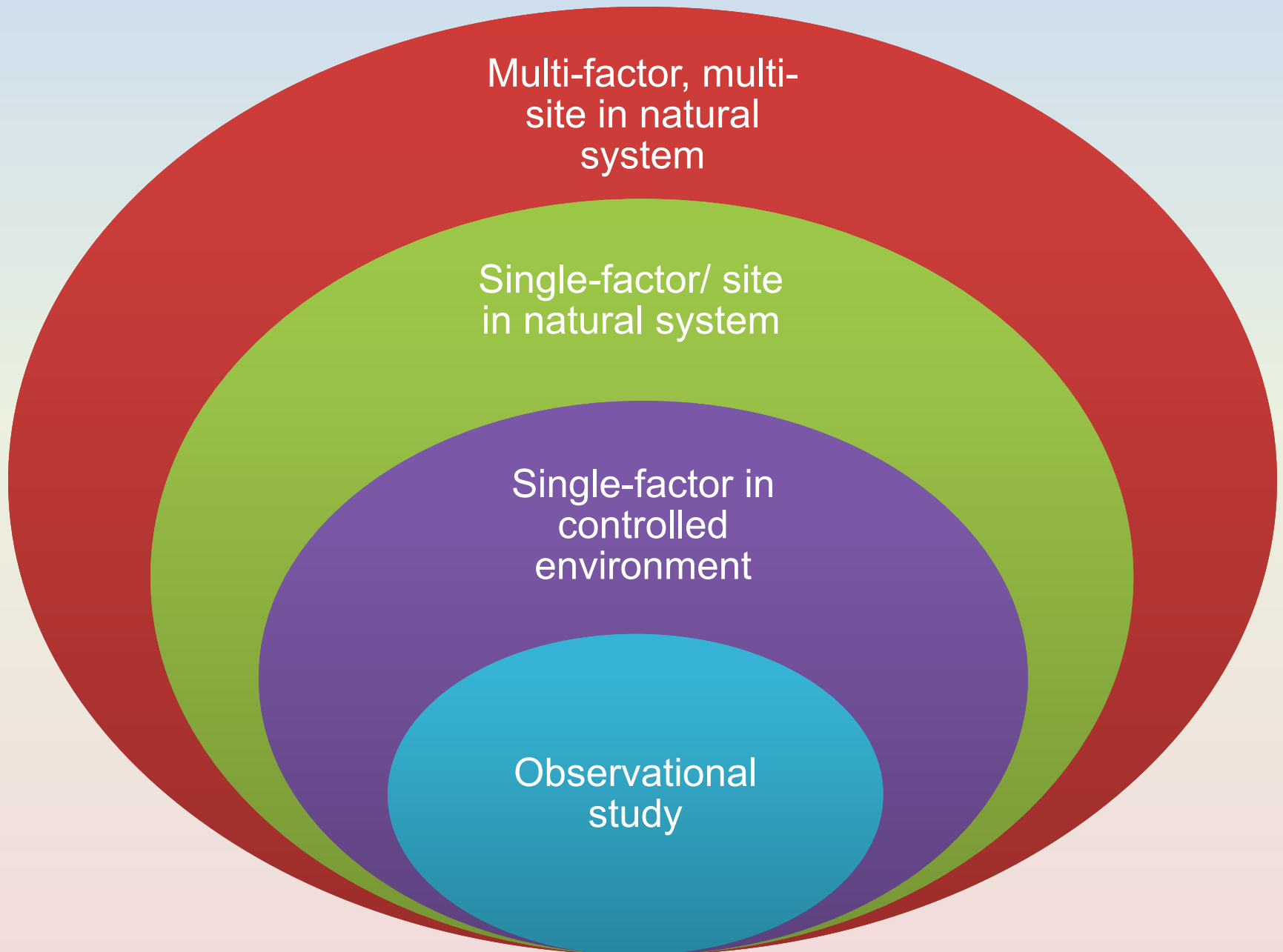
Variability of impacts



Summary

- Relative assessments
- Variability
- Multiple drivers of change

Understanding impacts is a cumulative process



Conclusions

Future impact studies:

- Multiple sites
- Interactions
- Discriminatory power



