



**Across kingdoms and continents:
being a grassland ecologist is
AWESOME!**

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What I know about being an ecologist

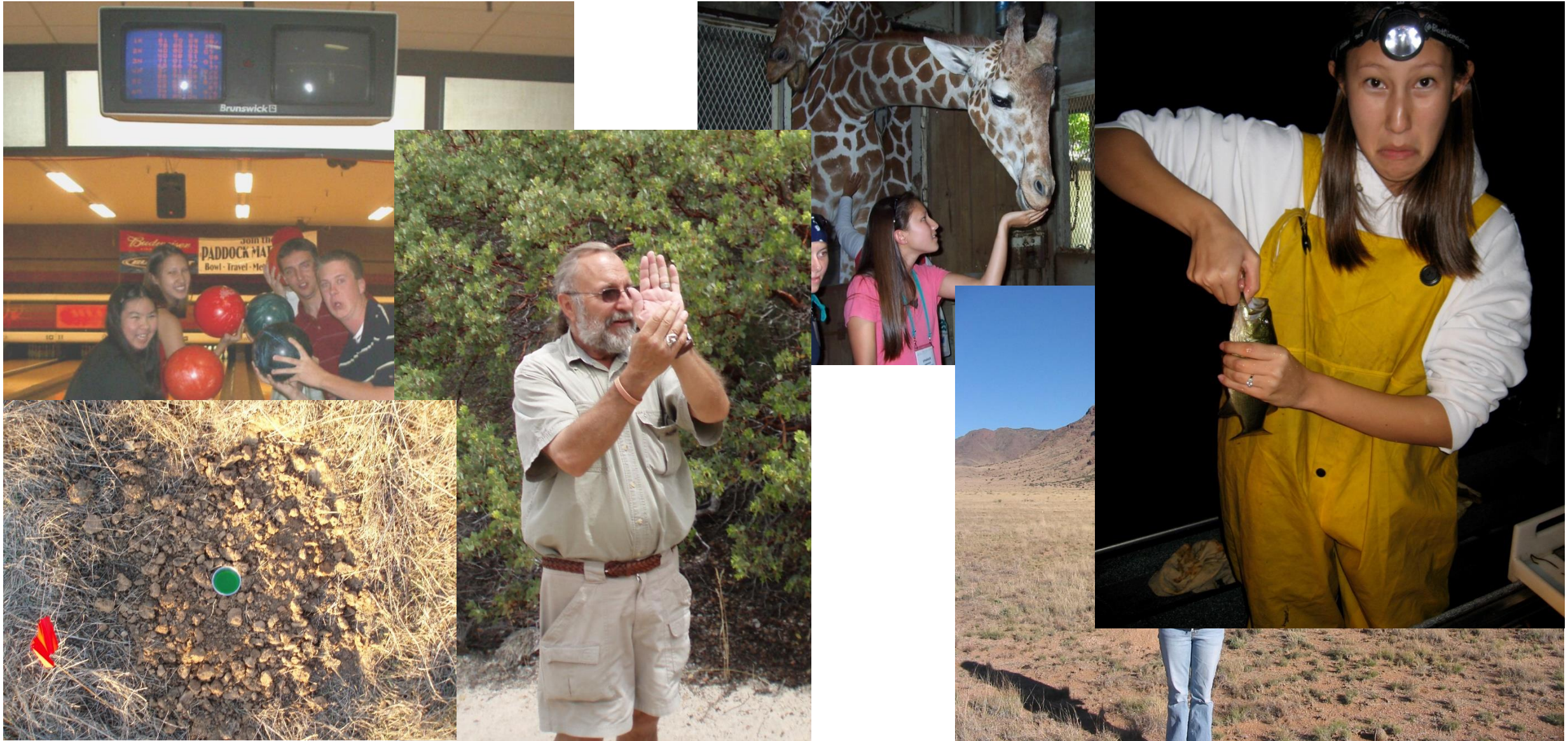
- we come from all backgrounds
- we use innovative approaches
- we learn incrementally
- we travel
- we study all kinds of things
- we collaborate



Ecologists come from all backgrounds



Ecologists come from all backgrounds



Ecologists use innovative approaches



- Black mustard (*Brassica nigra*) invasion in southern California grasslands
- Invasive milk snail (*Otala lactea*) often co-incident with invading mustard

What effect do invasive snails have on native and invasive plants?



greenhouse feeding trials:
mini-electric snail fences!

What effect do invasive snails have on native and invasive plants?



greenhouse
feeding trials



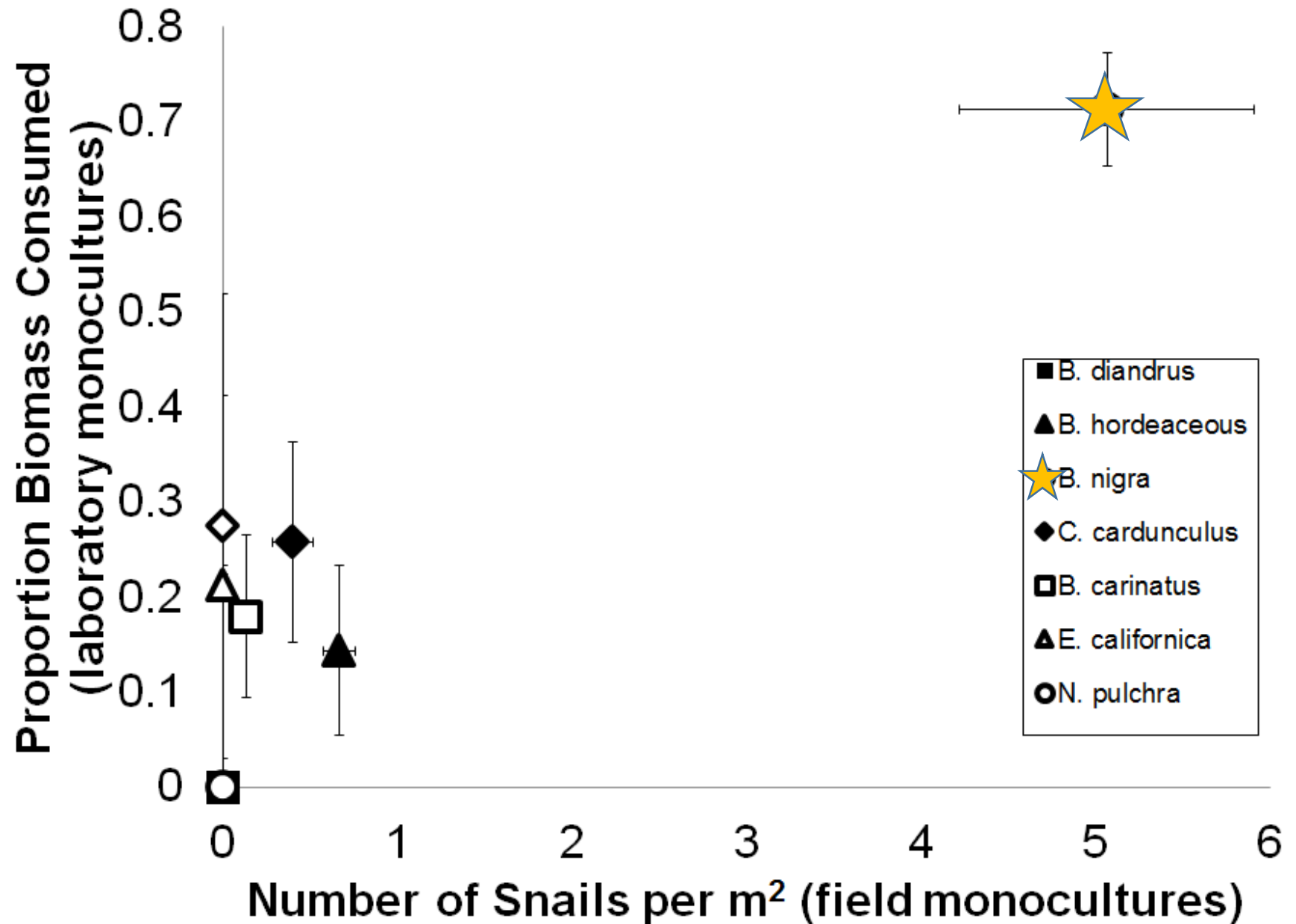
field counts in
monocultures



growth rate
assays

plus leaf tissue
chemistry

Invasive
milk snail
preferentially
associates
with and eats
invasive
mustard (+/-
interaction)



Invasive milk snail preferentially associates with and eats invasive mustard (+/- interaction)



Invasional
Antagonism!



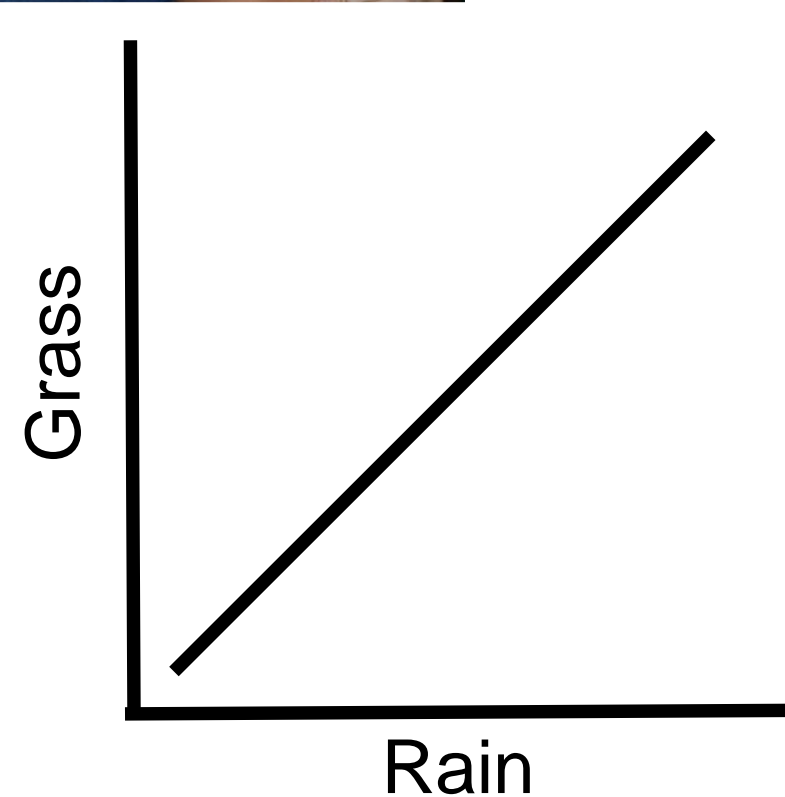
La Pierre et al, 2011, Biological Invasions

Ecologists learn incrementally

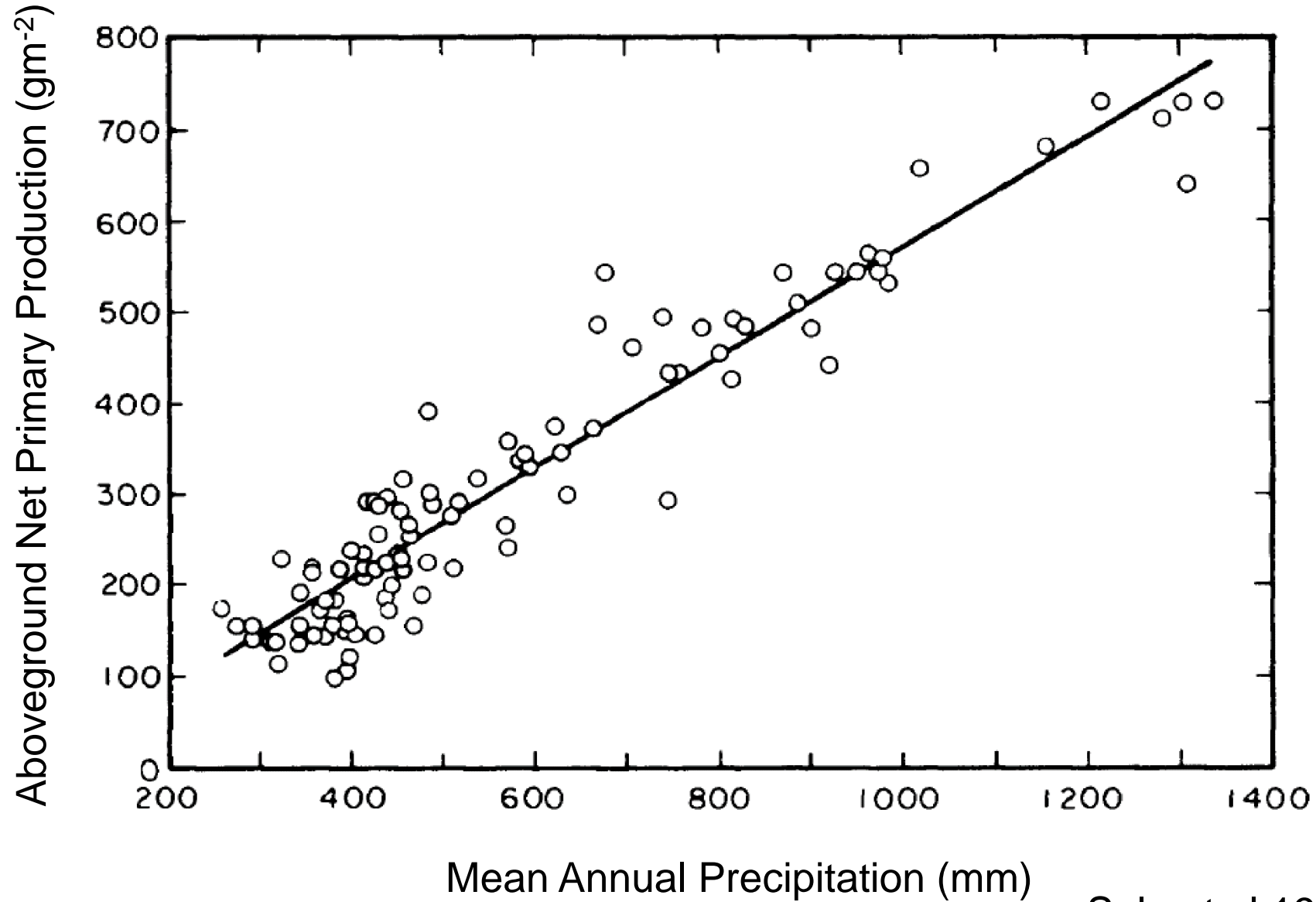




Water makes the grass grow



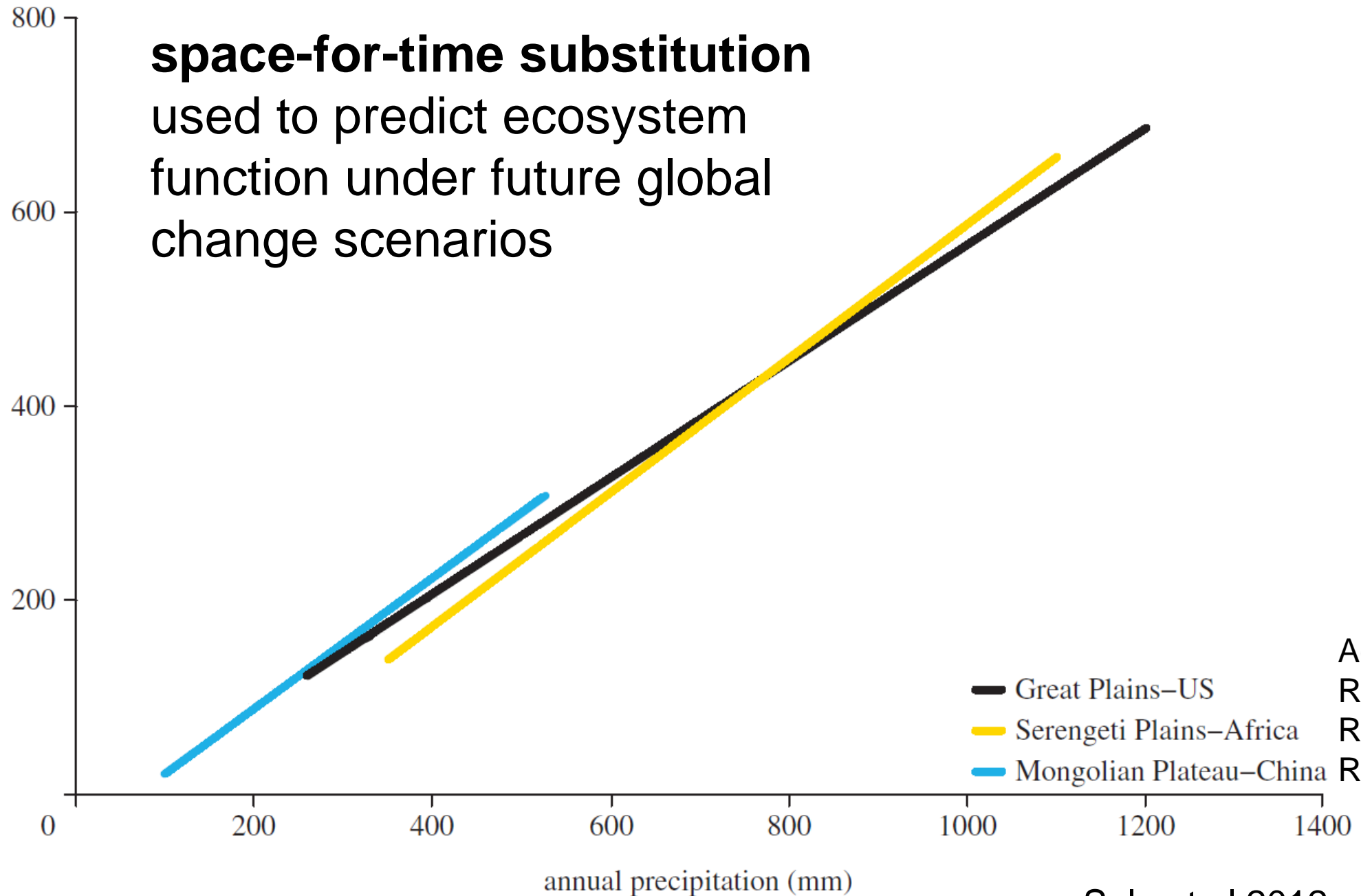
Precipitation



Sala et al 1988

space-for-time substitution
used to predict ecosystem
function under future global
change scenarios

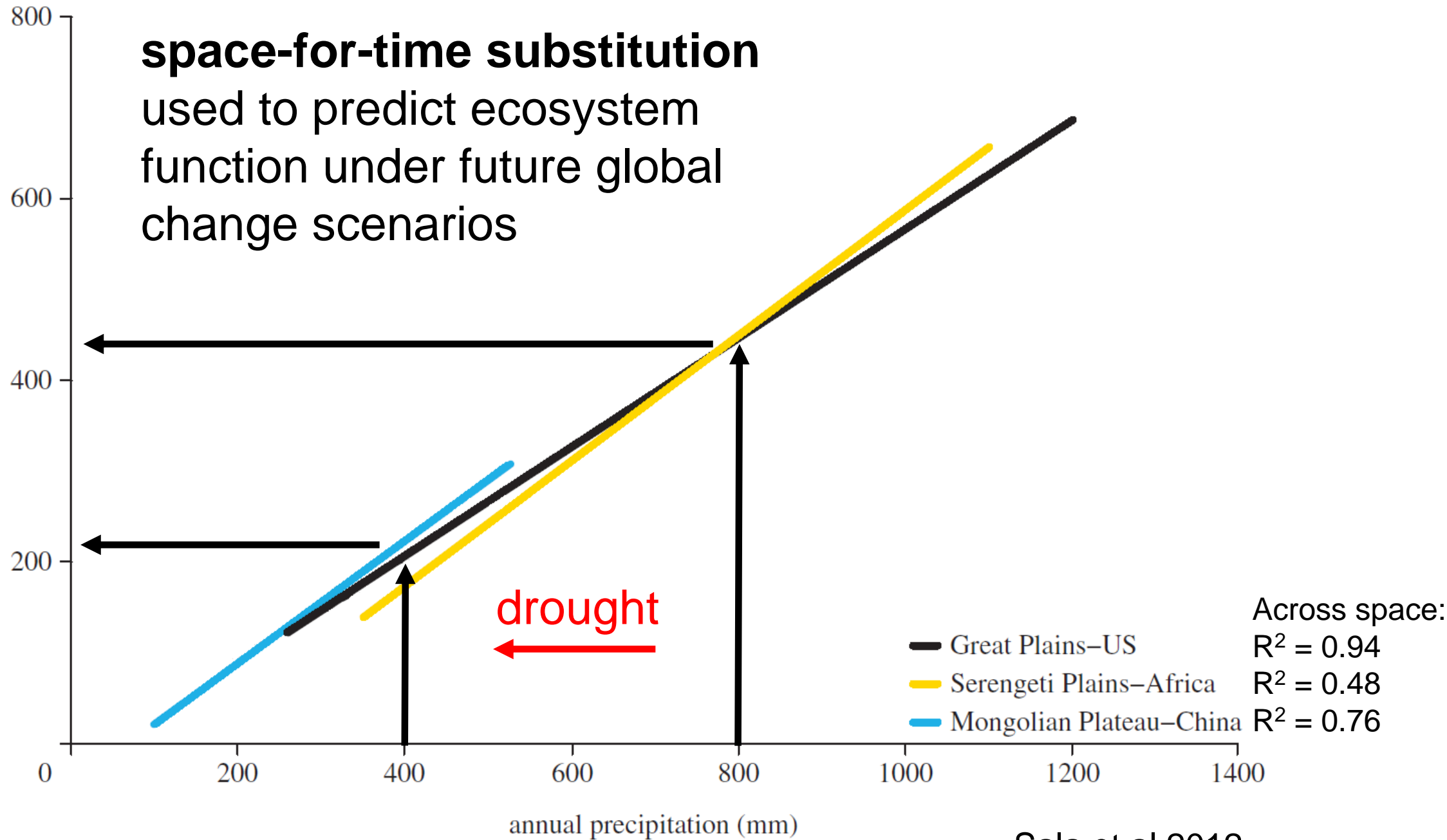
above-ground net primary production ($\text{g m}^{-2} \text{yr}^{-1}$)

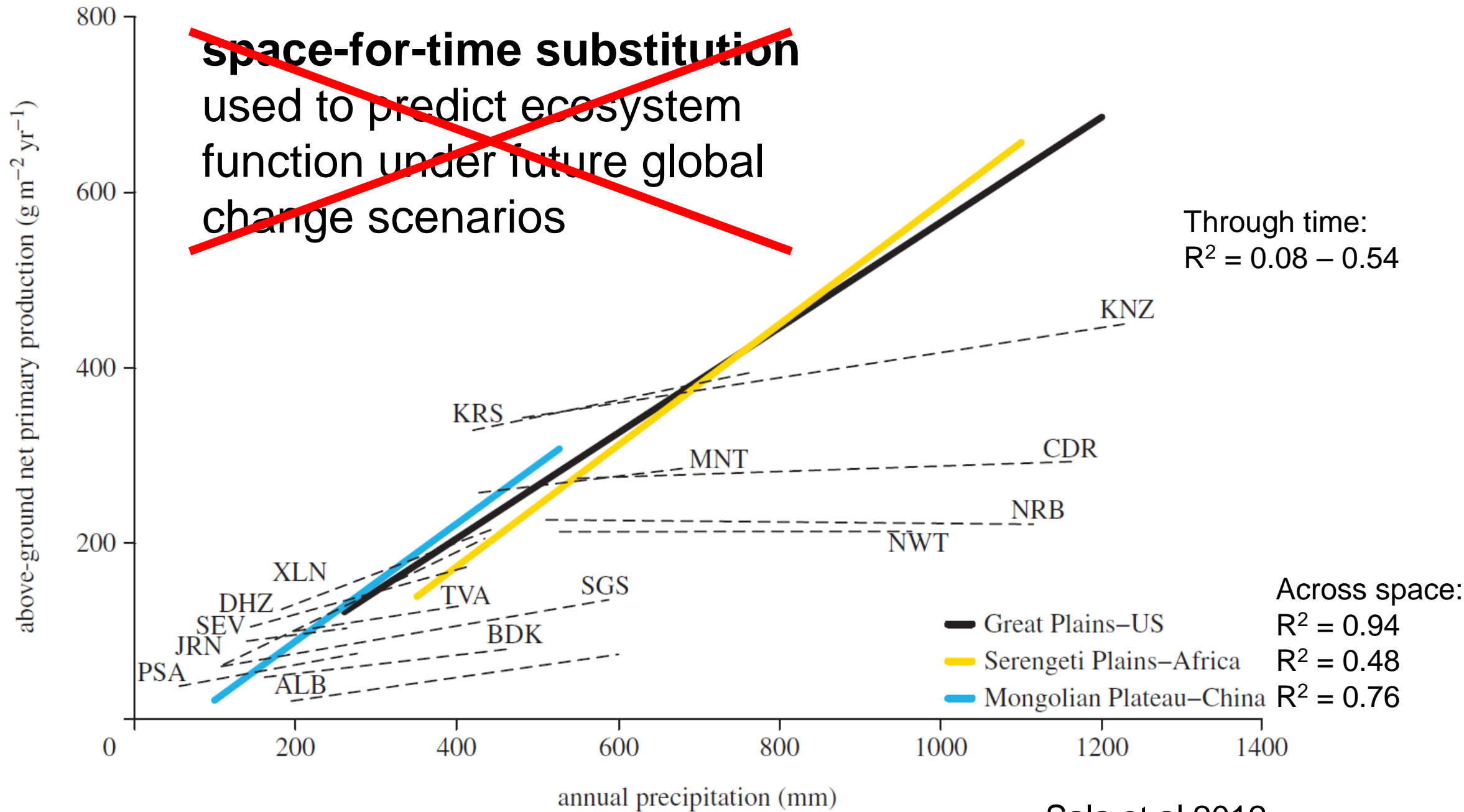


Sala et al 2012

above-ground net primary production ($\text{g m}^{-2} \text{yr}^{-1}$)

space-for-time substitution
used to predict ecosystem
function under future global
change scenarios





Study Sites



SGS: Shortgrass Steppe (Shortgrass LTER)

MIX: Mixed-grass Prairie (Saline Experimental Range)

TGP: Tallgrass Prairie (Konza Prairie LTER)

Study System

(semi-arid)

(mesic)



Shortgrass Steppe
(~340 mm precip/yr)



Mixed-Grass Prairie
(~610 mm precip/yr)



Tallgrass Prairie
(~835 mm precip/yr)

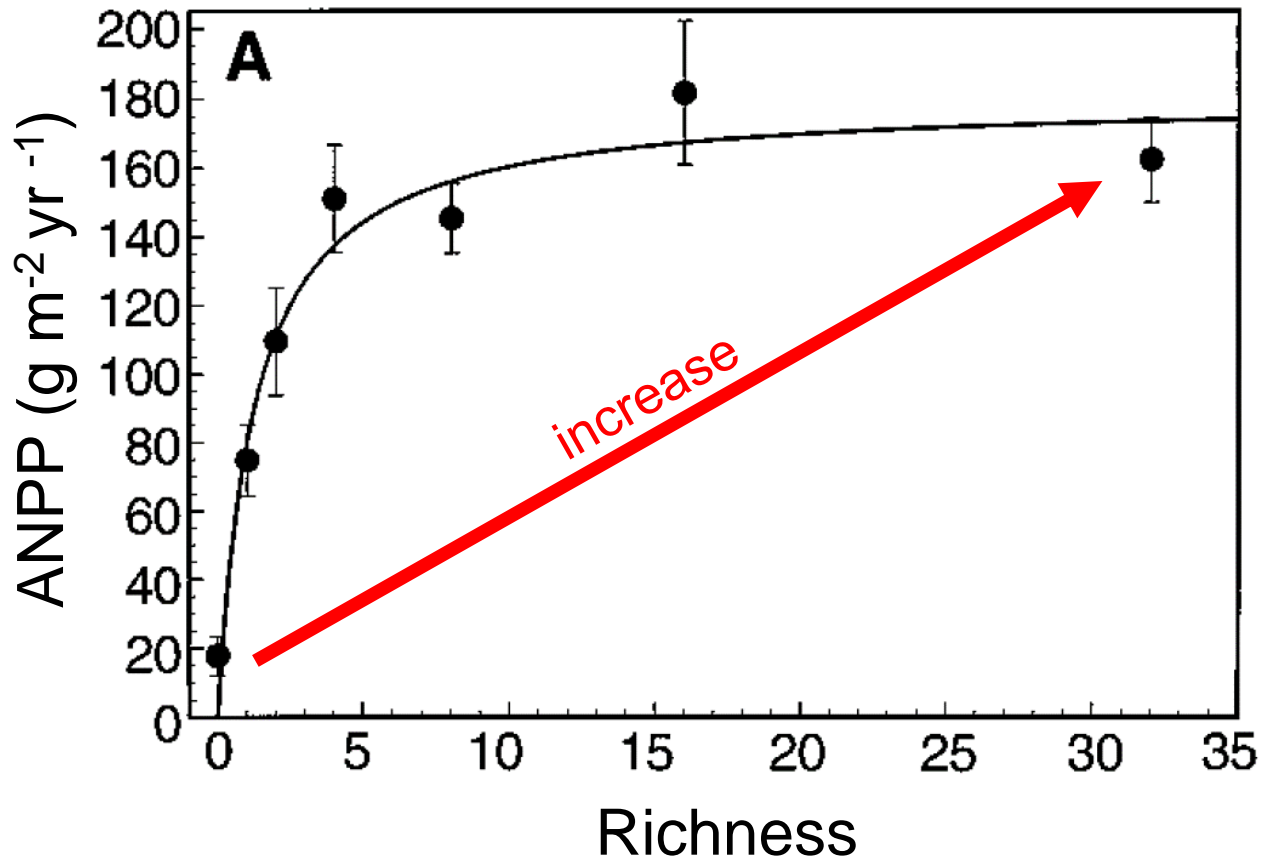
What factors control ANPP? Abiotic...

- Precipitation:
 - total annual precipitation (October → September)
(La Pierre et al 2011)
 - divided by phenologically relevant time periods:
 - P1 – Dormant period
 - P2 – Emergence
 - P3 – Vegetative growth
 - P4 – Flowering initiation
 - P5 – Anthesis
- Nutrients: N, P, K



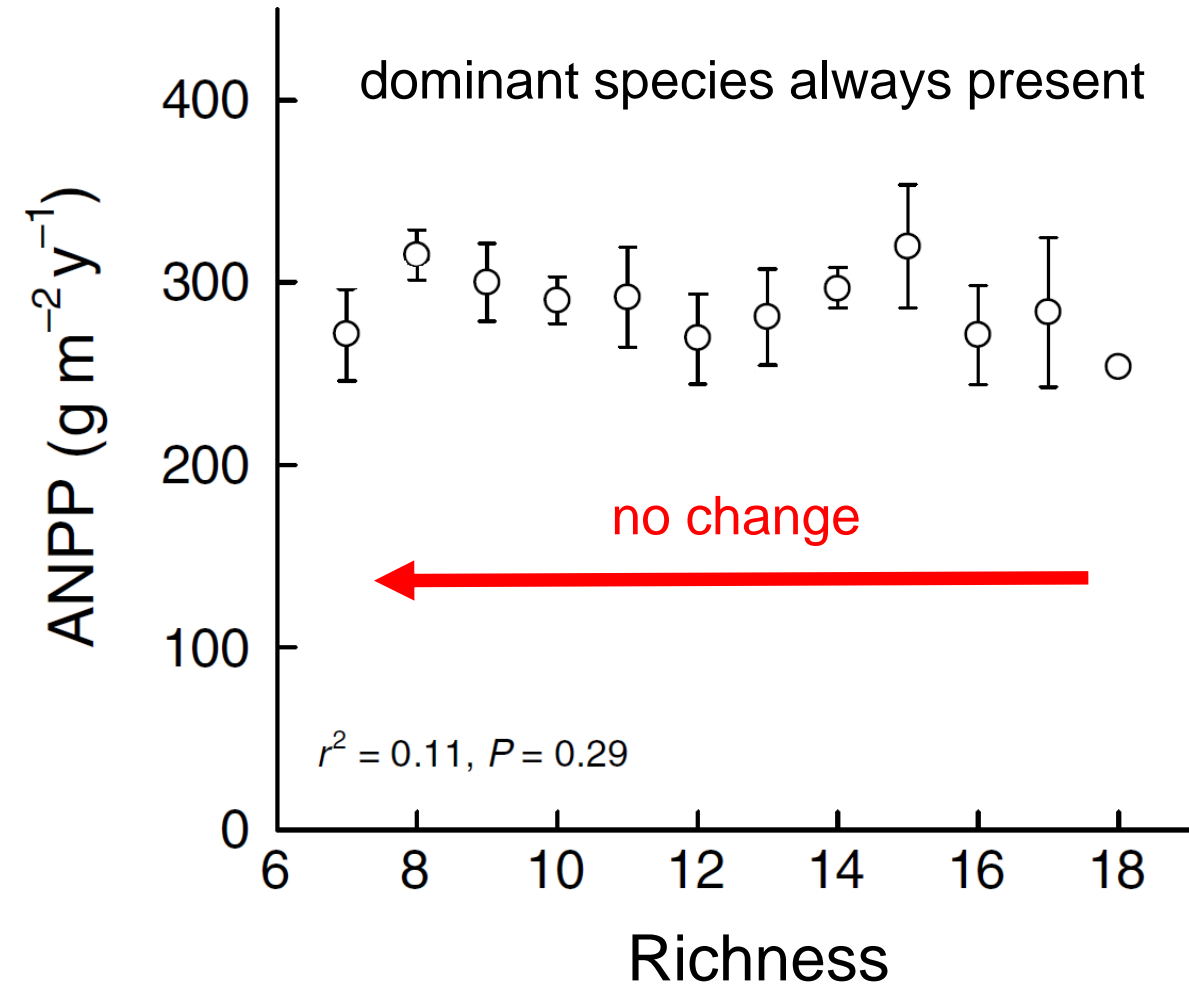
What factors control ANPP? Biotic...

Species Richness



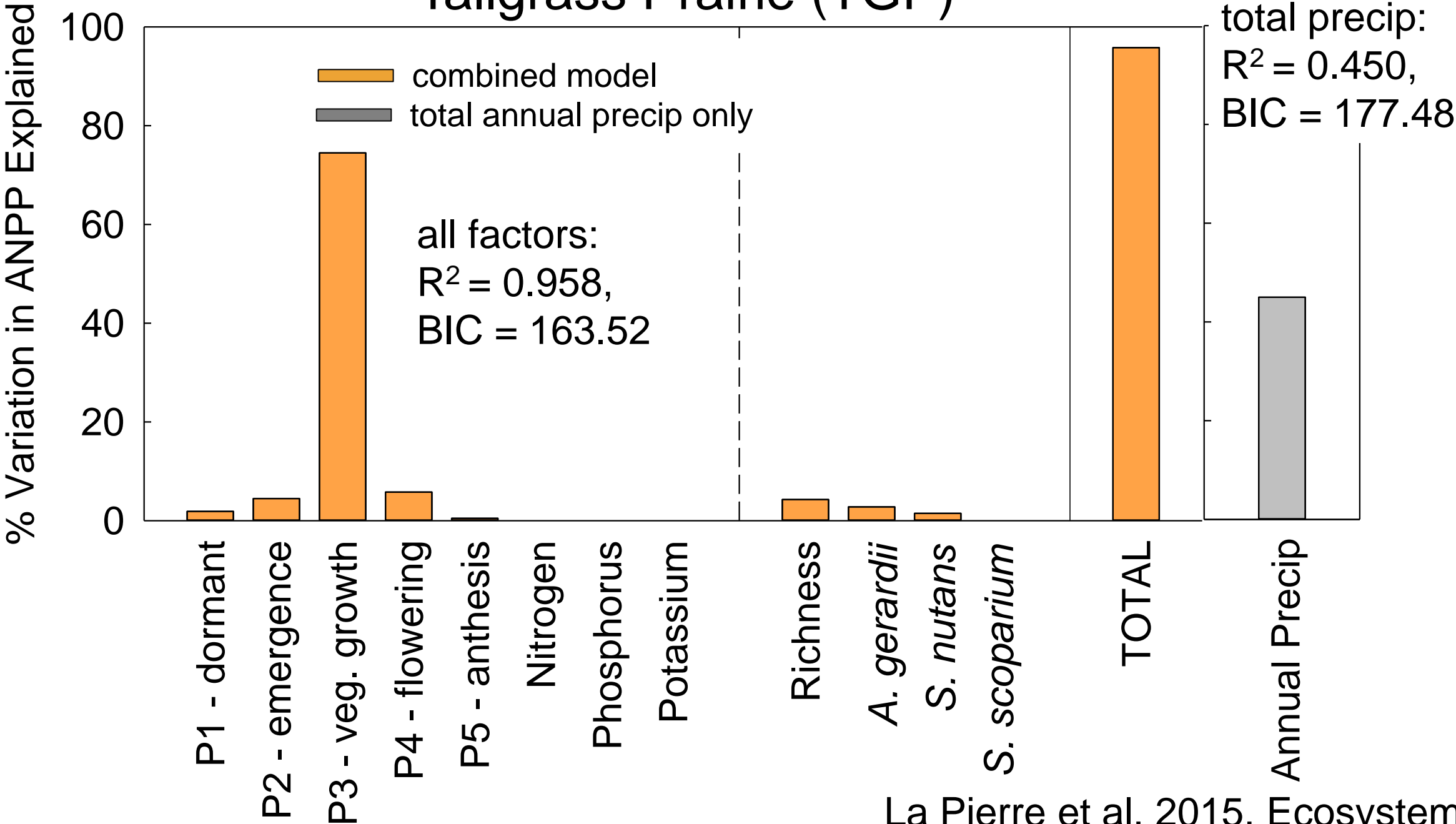
Tilman et al 1997

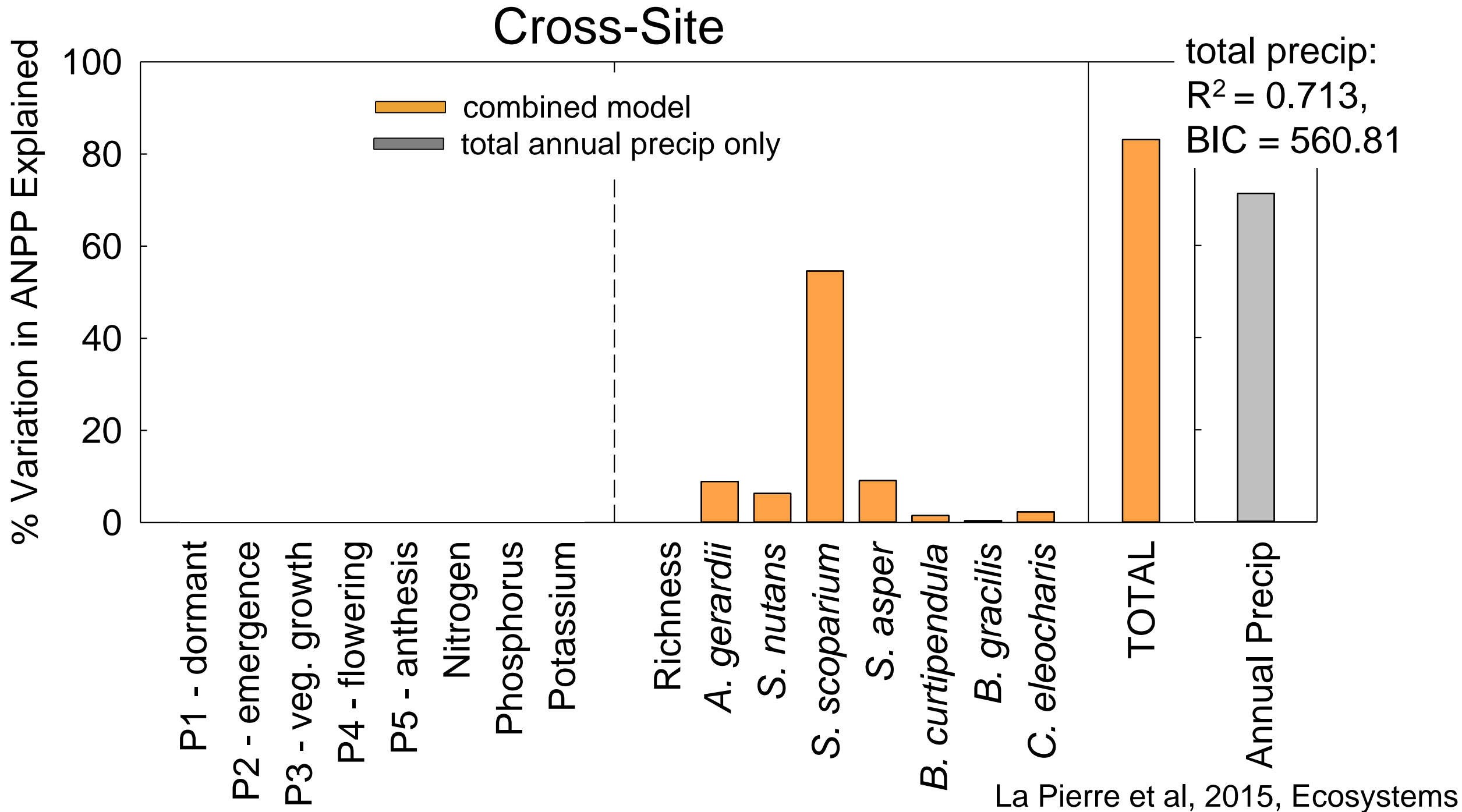
Species Identity



Smith and Knapp 2003

Tallgrass Prairie (TGP)





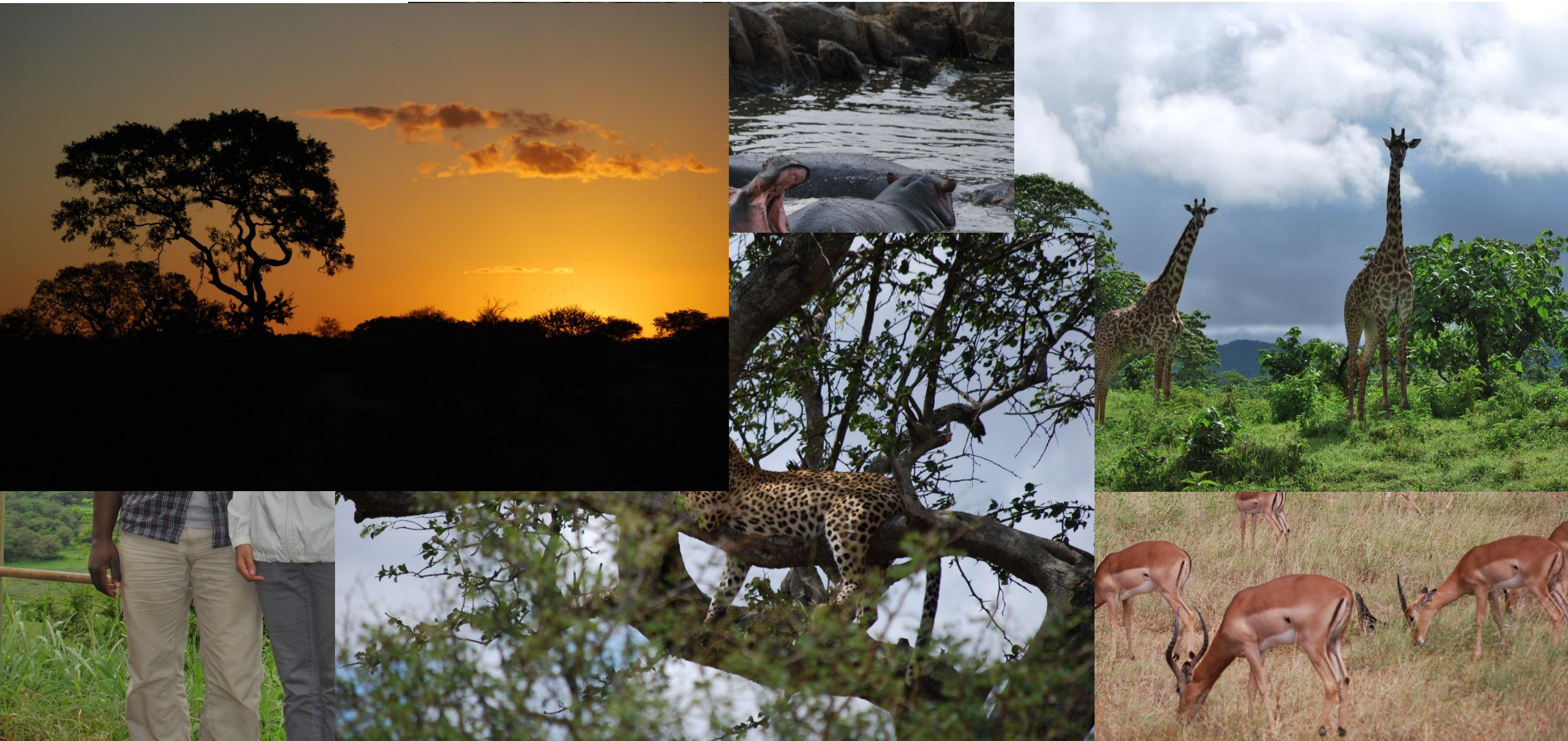
Water Makes Grass Grow!

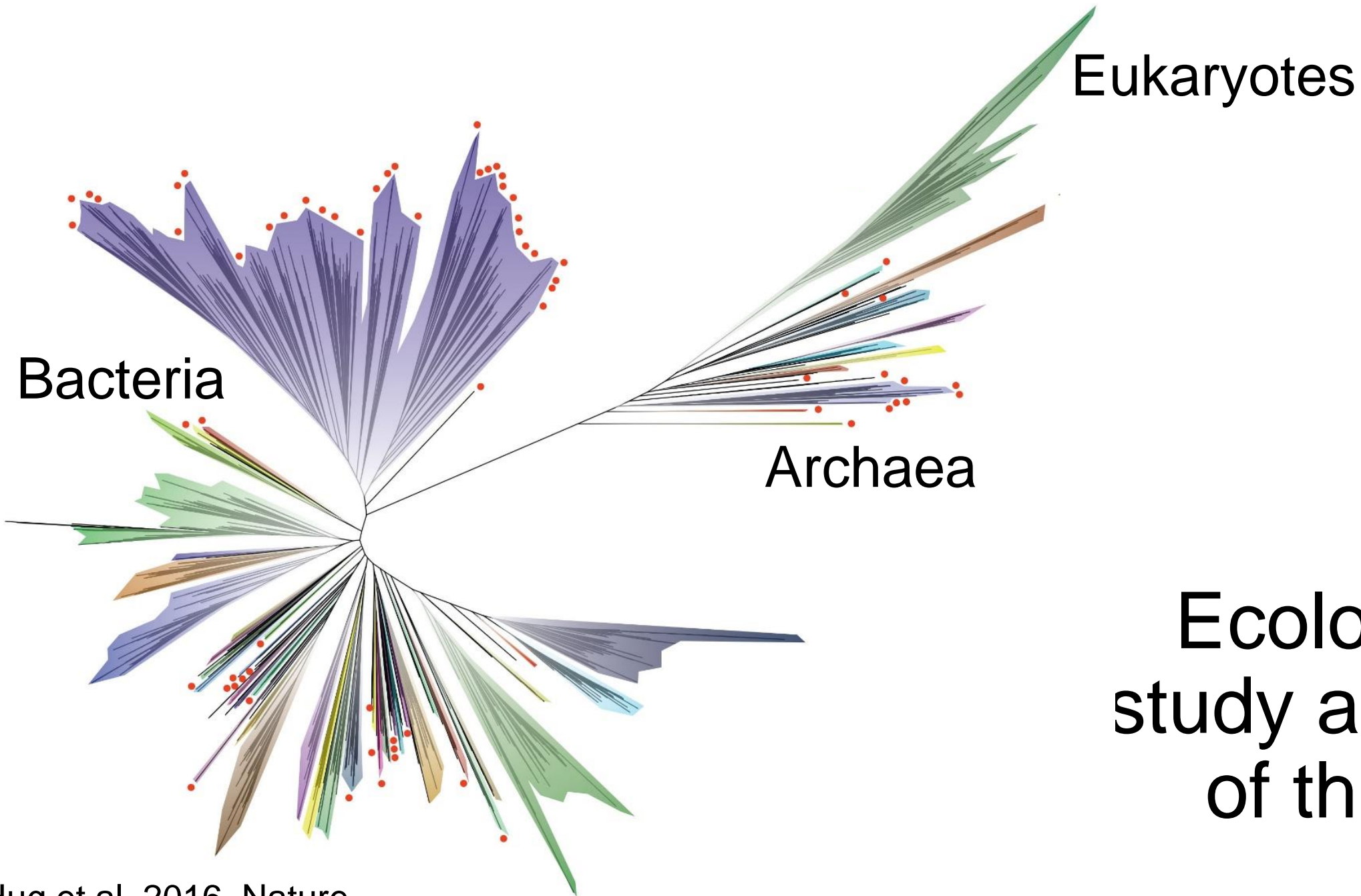
- Biotic factors both reflect and magnify the effects of precipitation through variation in species identity across a broad spatial scale
- To predict ANPP at regional scales, understanding of the community is critical
- Space-for-time substitution does **NOT** hold due to lower variation in biotic factors within sites than across sites
- Phenologically relevant precipitation periods explain variation in ANPP

Ecologists travel the world



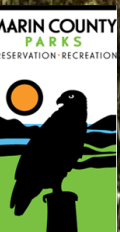
Ecologists travel the world





Ecologists
study all kinds
of things

How do species interactions influence invasion success?



Mutualism and Invasion Theory

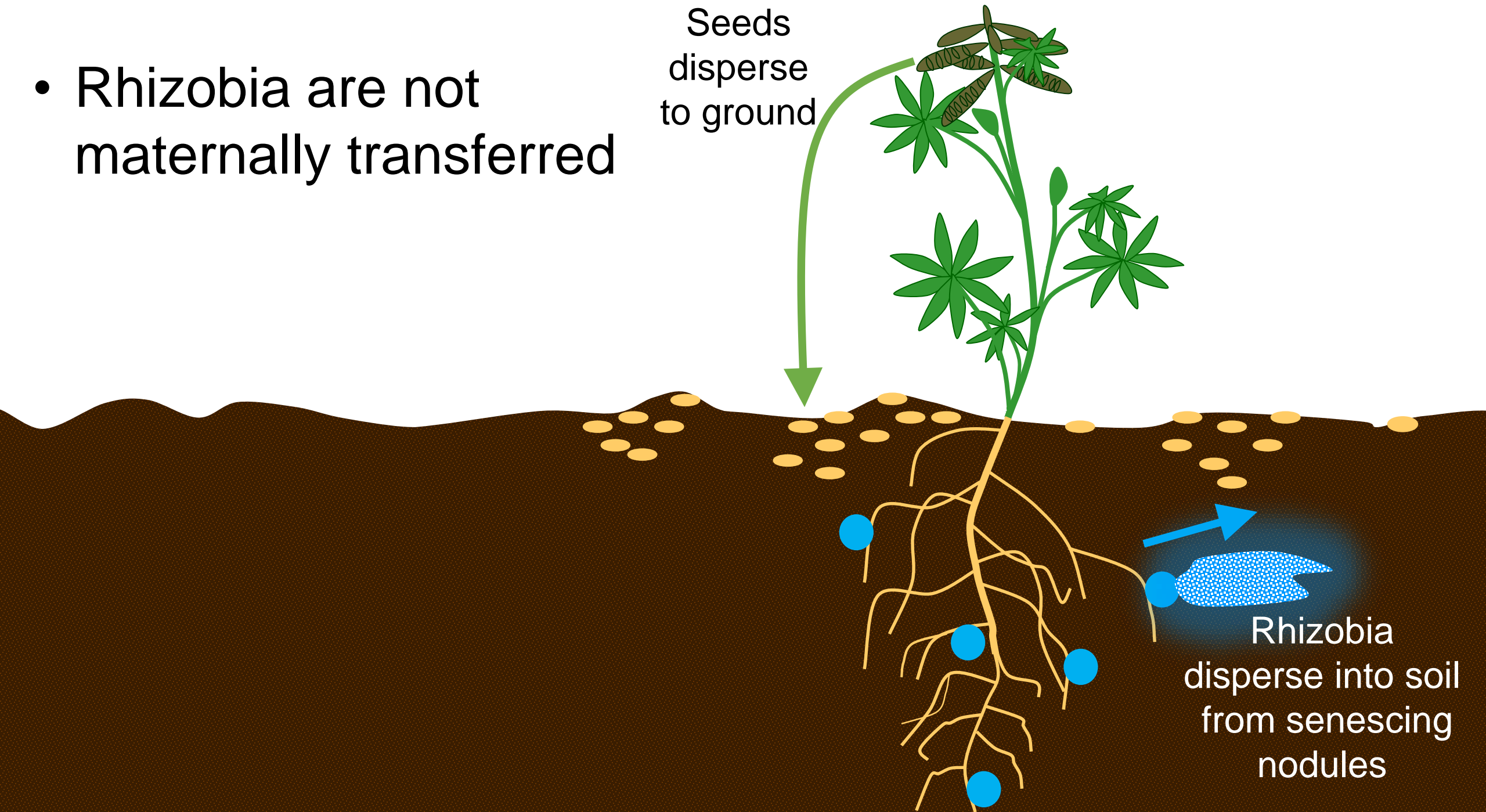
- Mutualistic partnerships may allow hosts to overcome environmental or biotic barriers to invasion
- Lack of mutualists may be a barrier to invasion
- How do species with horizontally transmitted mutualists invade?



Legumes as a model system

- widespread invaders
- ecologically transformative
- problematic in many habitats
- partnership with rhizobia differentiates their N-niche from other plants

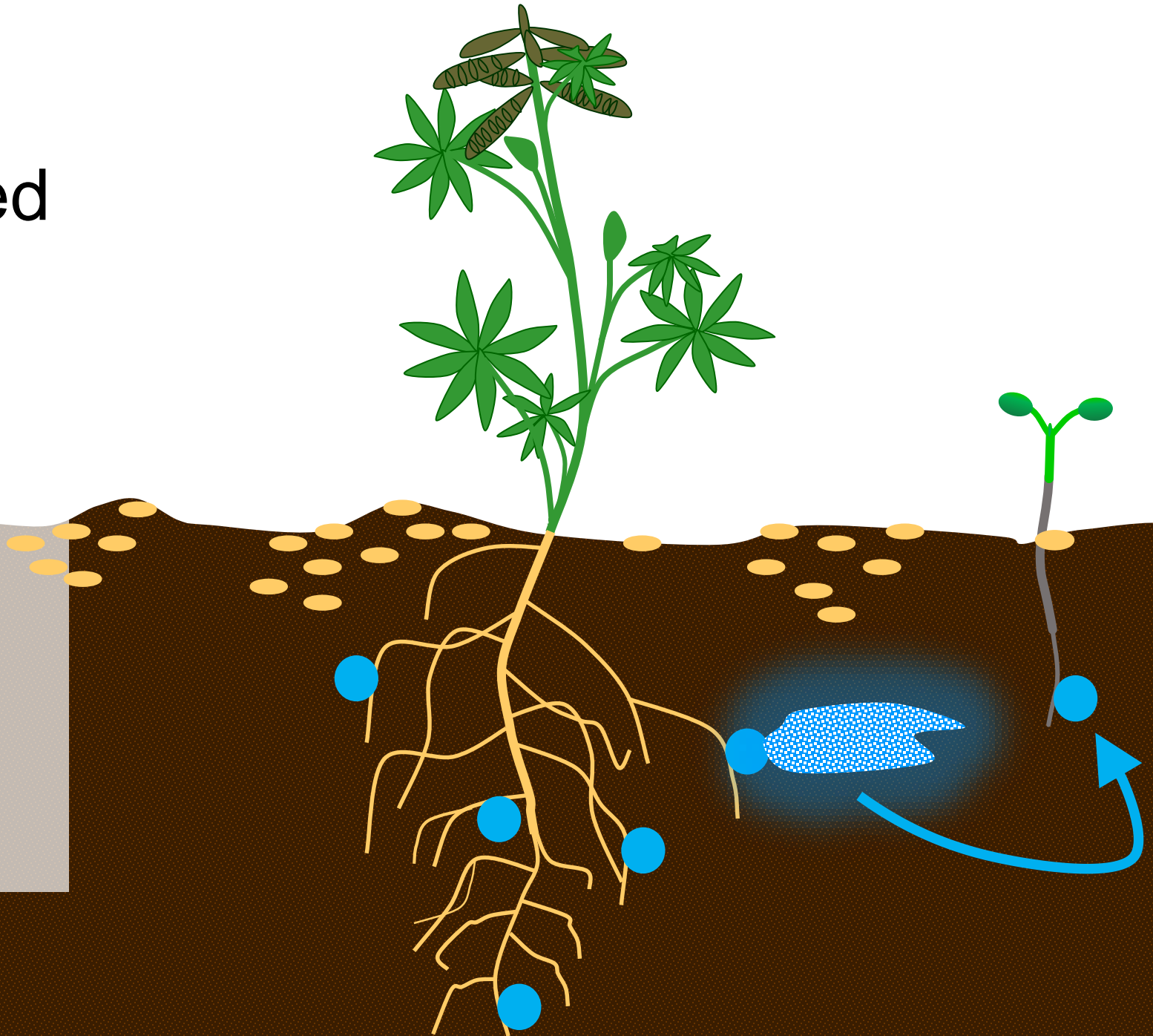
- Rhizobia are not maternally transferred



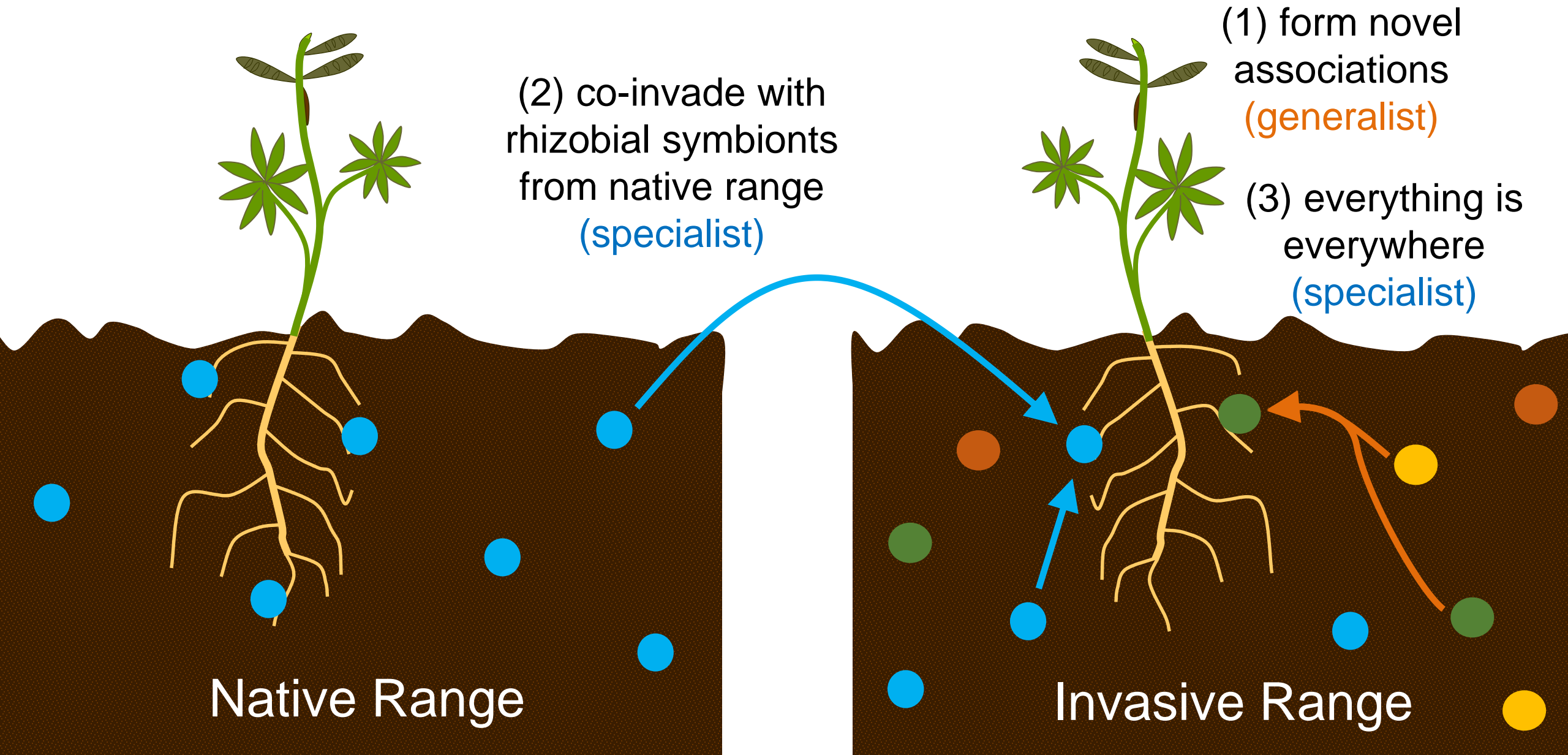
- Rhizobia are not maternally transferred
- Seedlings are infected by soil-dwelling rhizobia



- Rhizobia are not maternally transferred
- Seedlings are infected by soil-dwelling rhizobia
- Where do invading legumes get their rhizobial associates from?



Where do invading legumes get their rhizobial associates?



INVASIVE

Genista monspessulana



Spartium junceum



Ulex europaeus



NATIVE

Acmispon glaber *A. heermannii*



A. micranthus



A. strigosus



Lupinus bicolor



L. arboreous





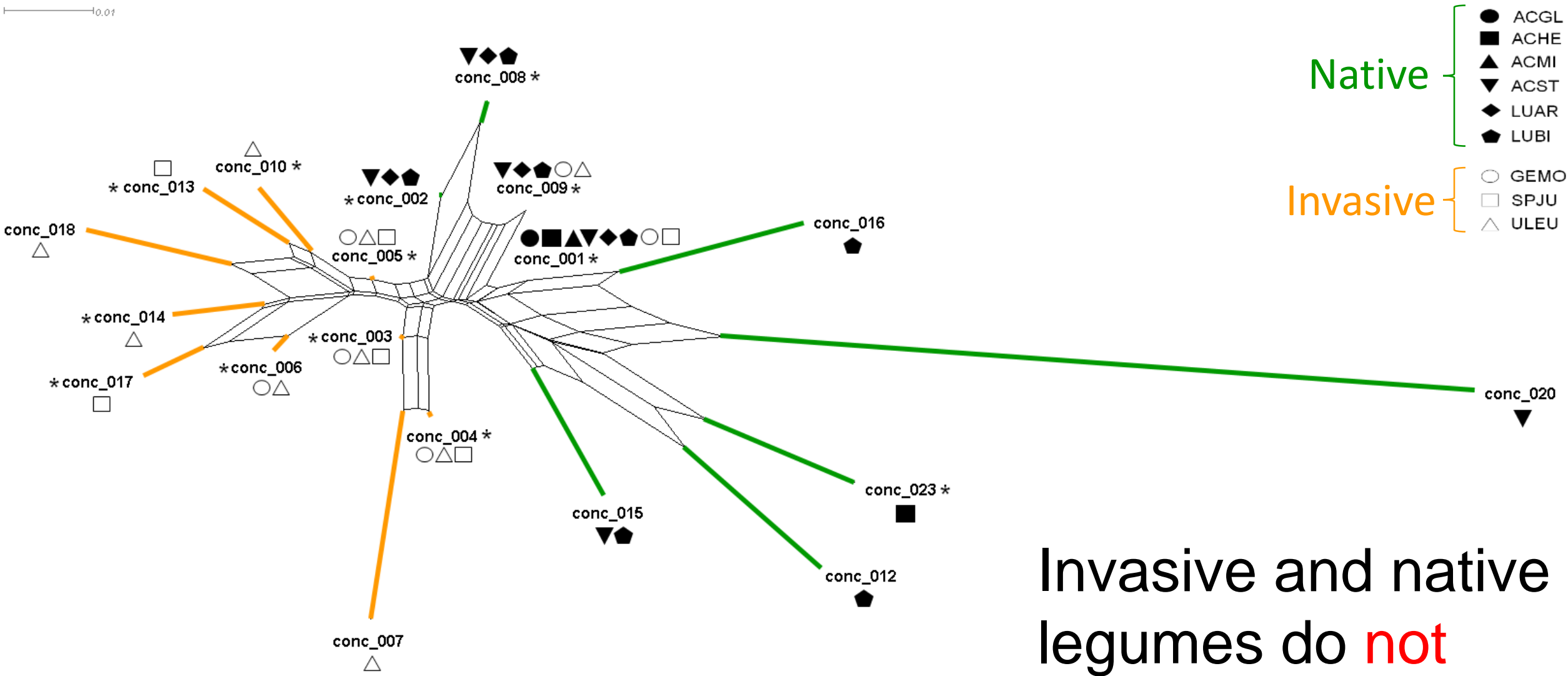
514 native
isolates

305 invasive
isolates

sequenced at
ITS and nifD
loci

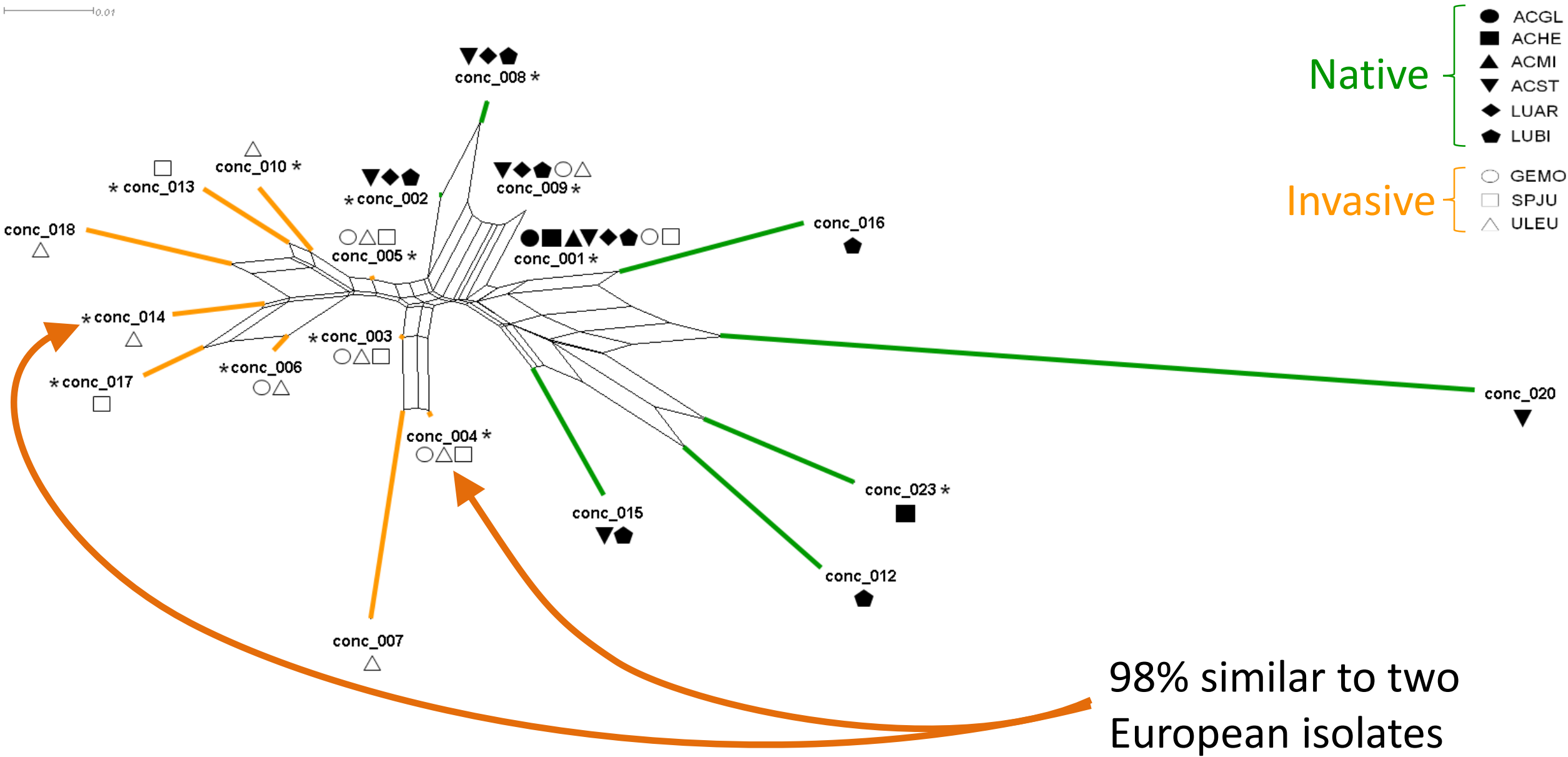
19 unique
genotypes

0.01



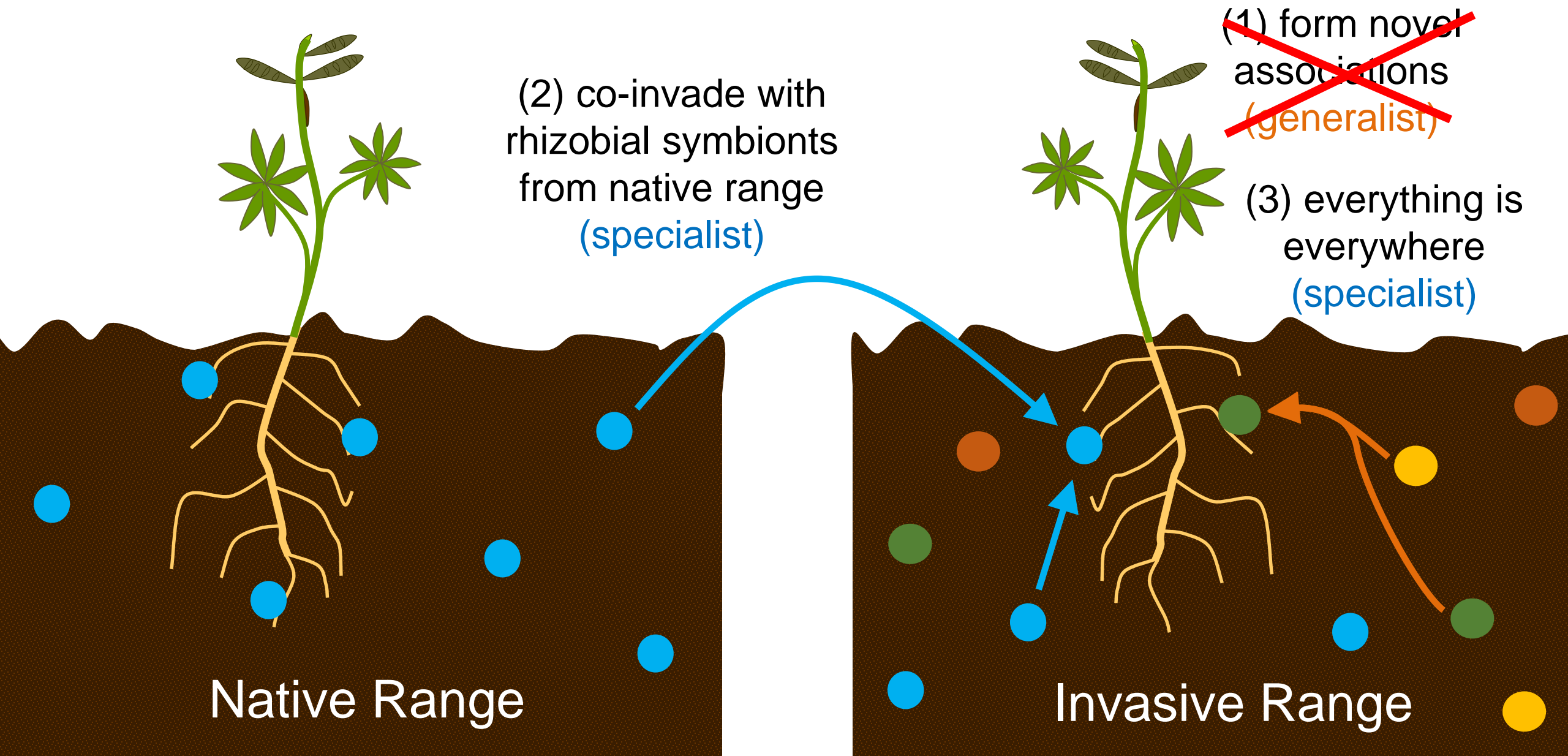
Invasive and native legumes do **not** share rhizobial genotypes.

0.01

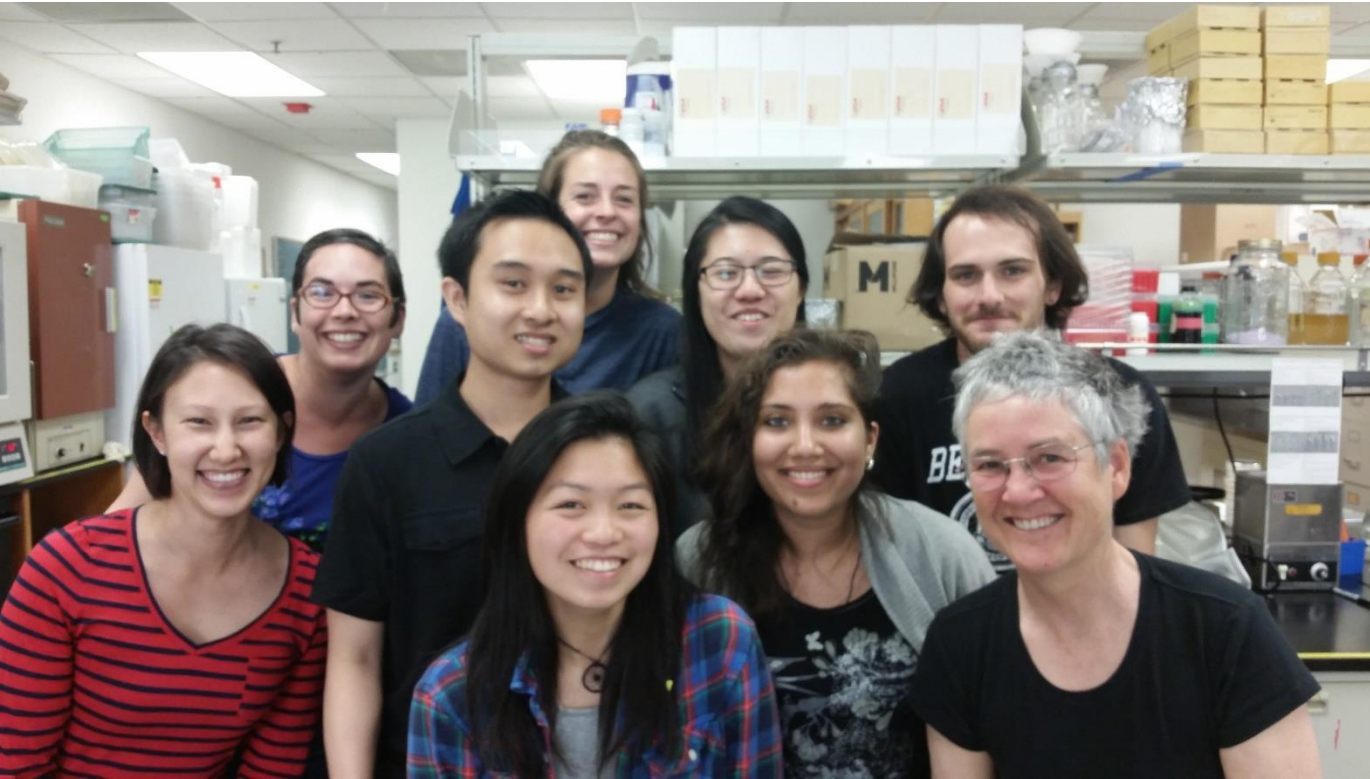


- ACGL
- ACHE
- ▲ ACMI
- ▼ ACST
- ◆ LUAR
- ⬢ LUBI
- GEMO
- SPJU
- △ ULEU

Where do invading legumes get their rhizobial associates?



Ecologists collaborate



Ecologists collaborate



Plant community responses to global change



Kim La Pierre



Meghan Avolio



Forest Isbell



Sally Koerner



Kevin Wilcox



Greg Houseman

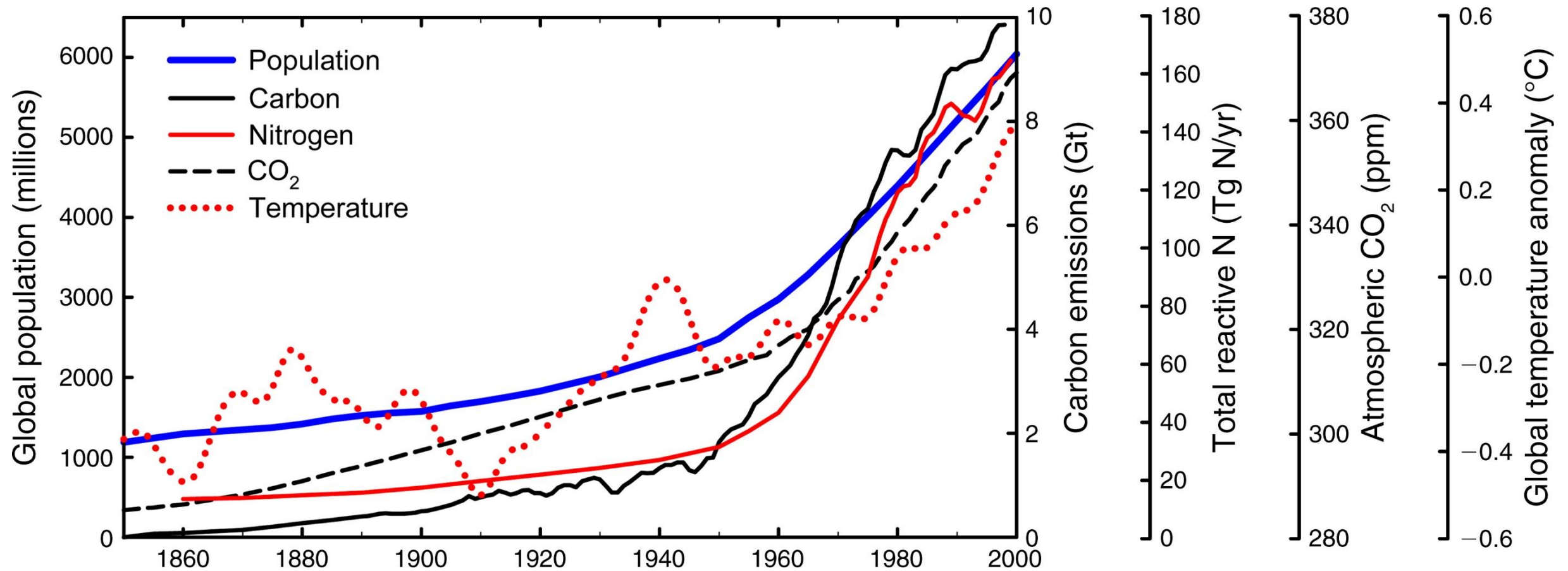


Emily Grman



David Johnson
+ 49 others

Global change is happening...

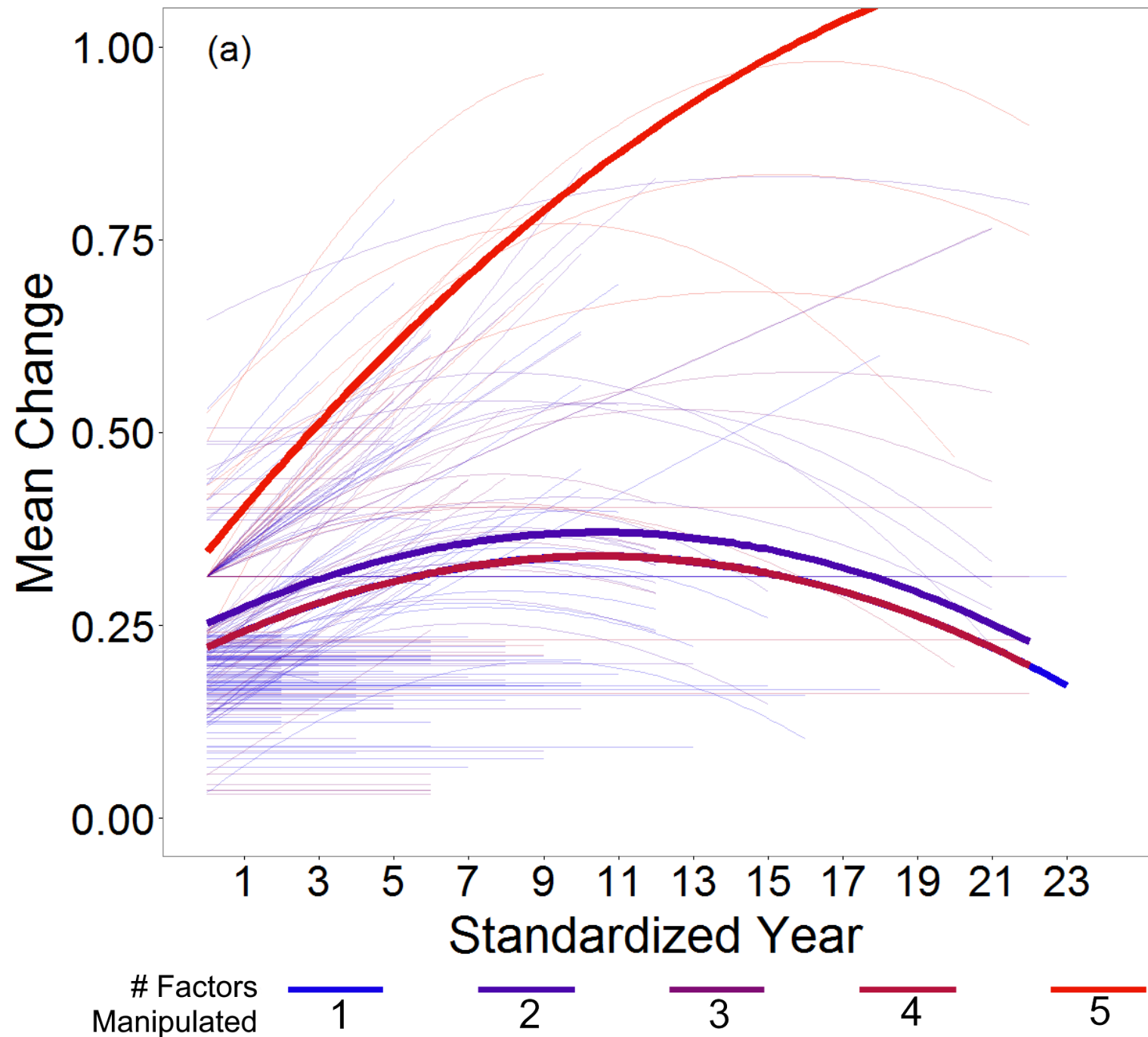


Smith, Knapp & Collins, 2009, *Ecology*

Mean Plant Community Change

Plant communities are relatively robust to simulated global change.

Except, when many global change factors occur simultaneously.



Being an ecologist is awesome!

- ask questions
- discover new things
- meet all kinds of people
- help the world!



Questions?

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