An illustration of a forest floor with various trees and plants. In the foreground, there are several trees with visible root systems extending into the soil. On the left is a tall, thin evergreen tree. In the center is a smaller evergreen tree. On the right is a large, rounded deciduous tree. To the right of the large tree is a pink flower. The background shows a hazy landscape with more trees and a light sky.

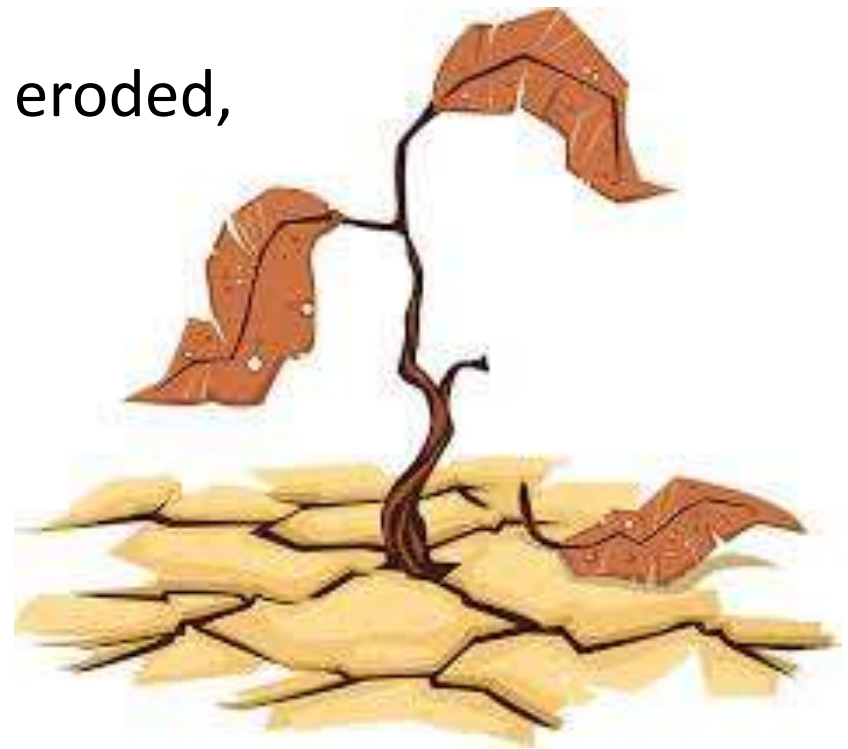
Mycorrhizae, invasions, and the dynamics of mutualism disruptions

Sara Grove ^{1&2}, Karen Haubensak²,
Ingrid Parker¹ & Catherine Gehring²

¹University of California, Santa Cruz &
²Northern Arizona University

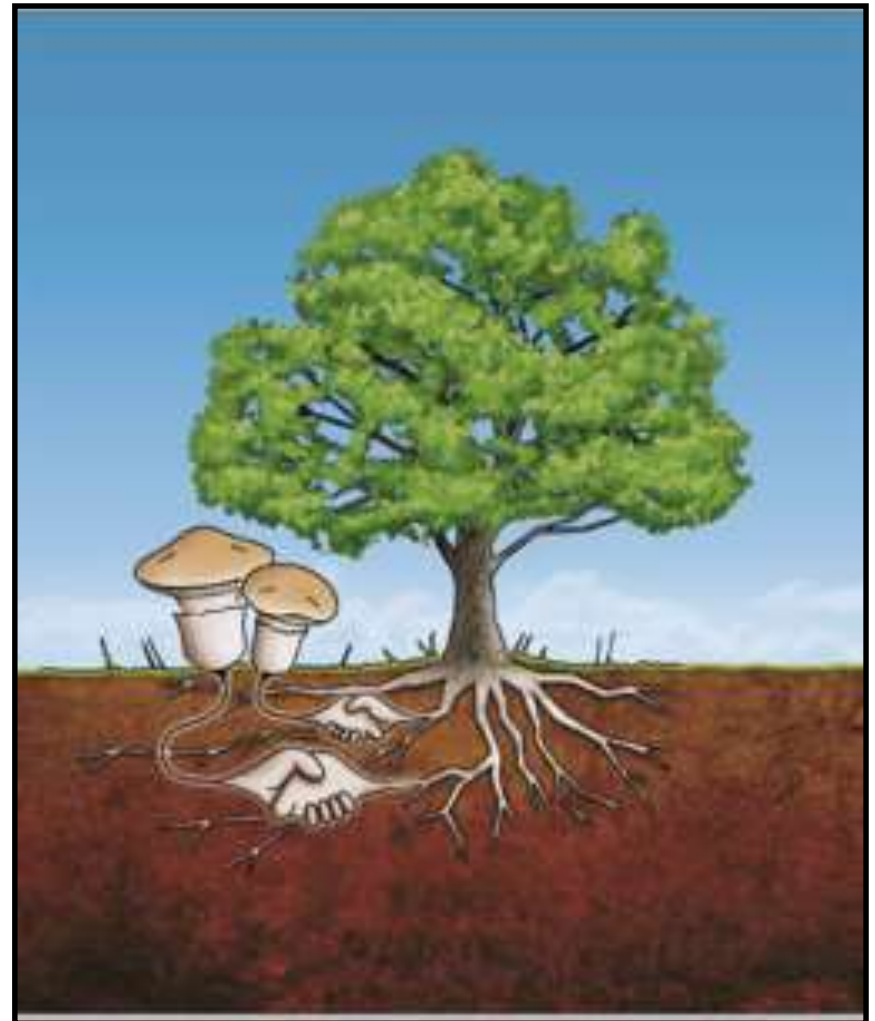
Ecosystems frequently fail to recover following invasive species removal

- Propagule limitation of natives
- Persistence of disturbance (e.g. eroded, compacted, open canopy, etc.)
- Legacy effects of invaders
 - Species loss
 - Nutrient availability
 - Microbial communities



Mycorrhizal mutualism

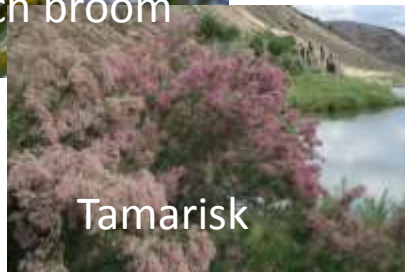
- Increase soil surface area contact
- Increase access to nutrients and water
- Pathogen protection
- Increase drought tolerance
- Plants provide C (sugar/food) to fungi



Ectomycorrhizal

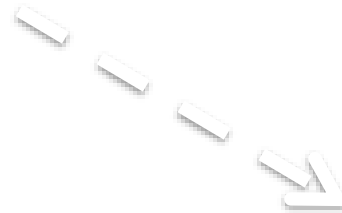
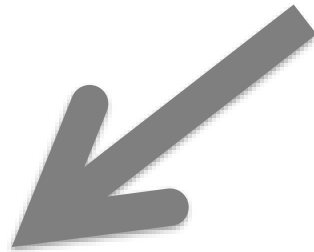
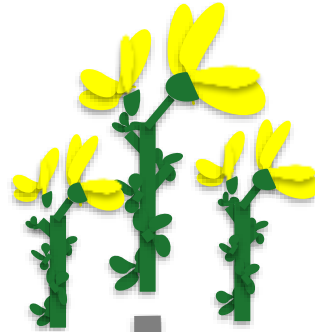
Arbuscular Mycorrhizal

Non-Mycorrhizal



Does mycorrhizal status matter?

Arbuscular Mycorrhizal INVADER



Ectomycorrhizal
NATIVE



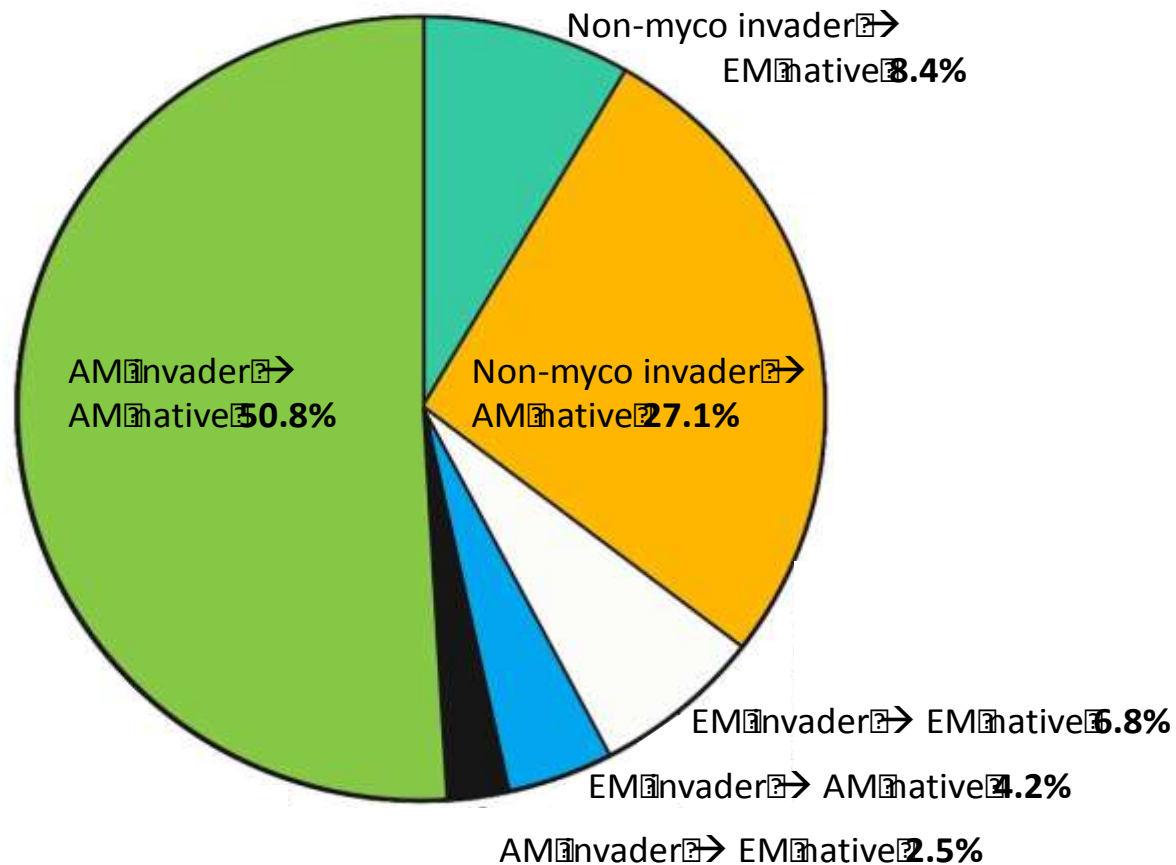
Arbuscular Mycorrhizal
NATIVE



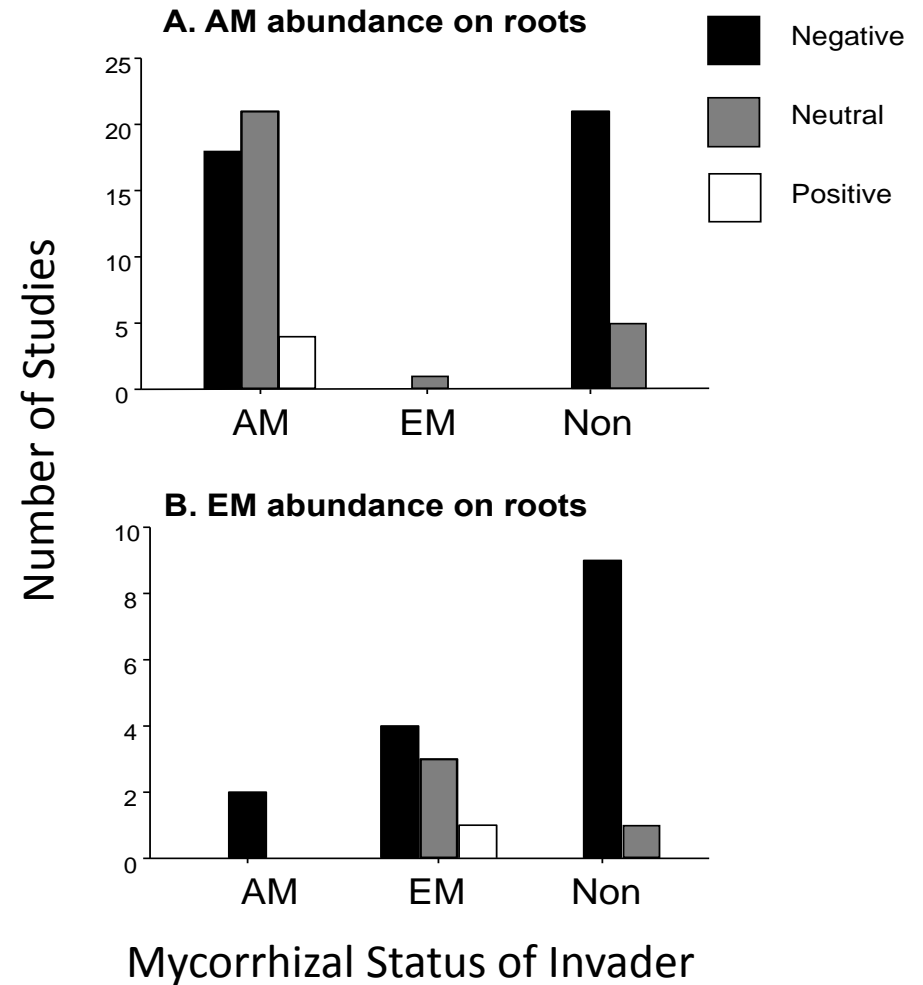
Non-Mycorrhizal
NATIVE



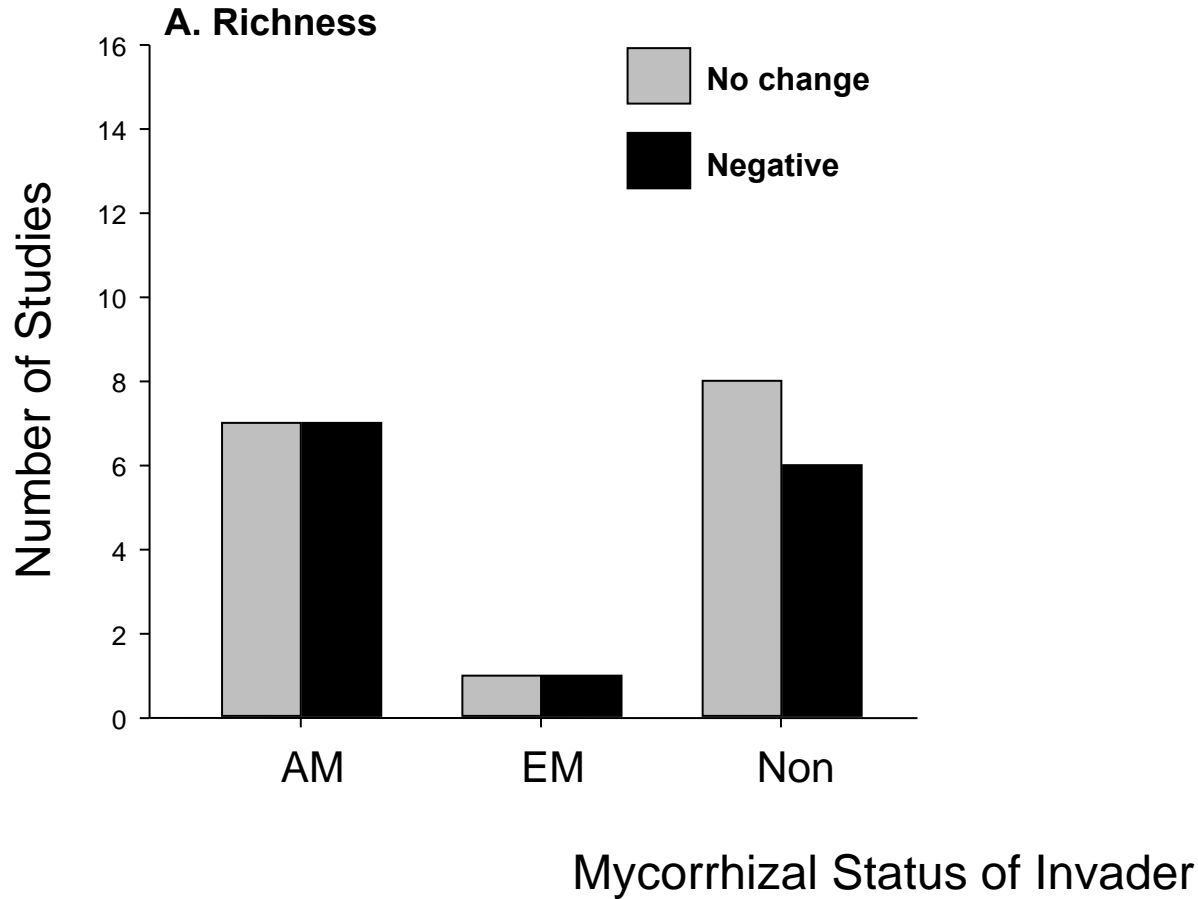
A systematic review of invader impacts on mycorrhizal mutualisms



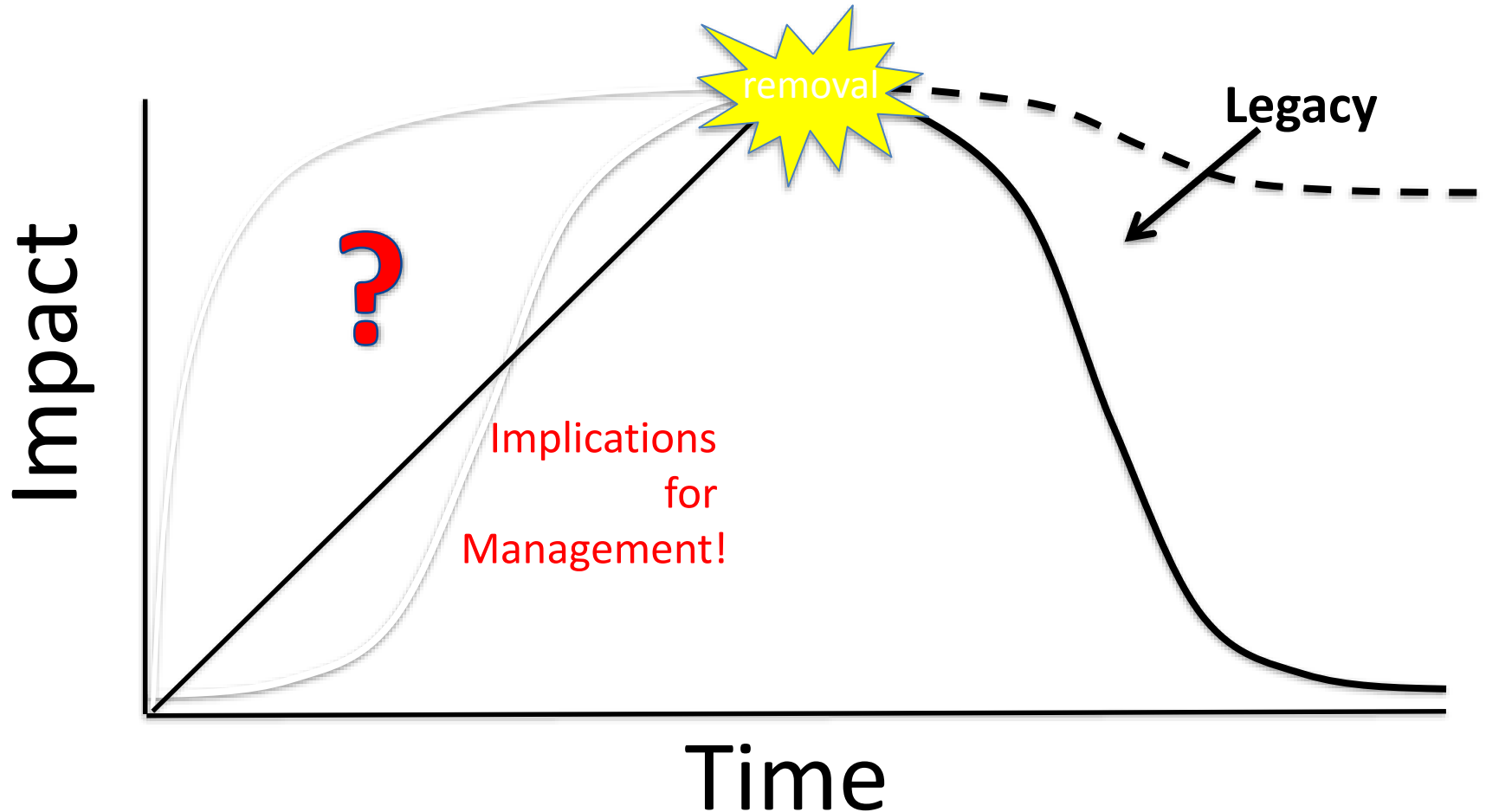
Can impact be predicted by mycorrhizal status of invaders and natives?



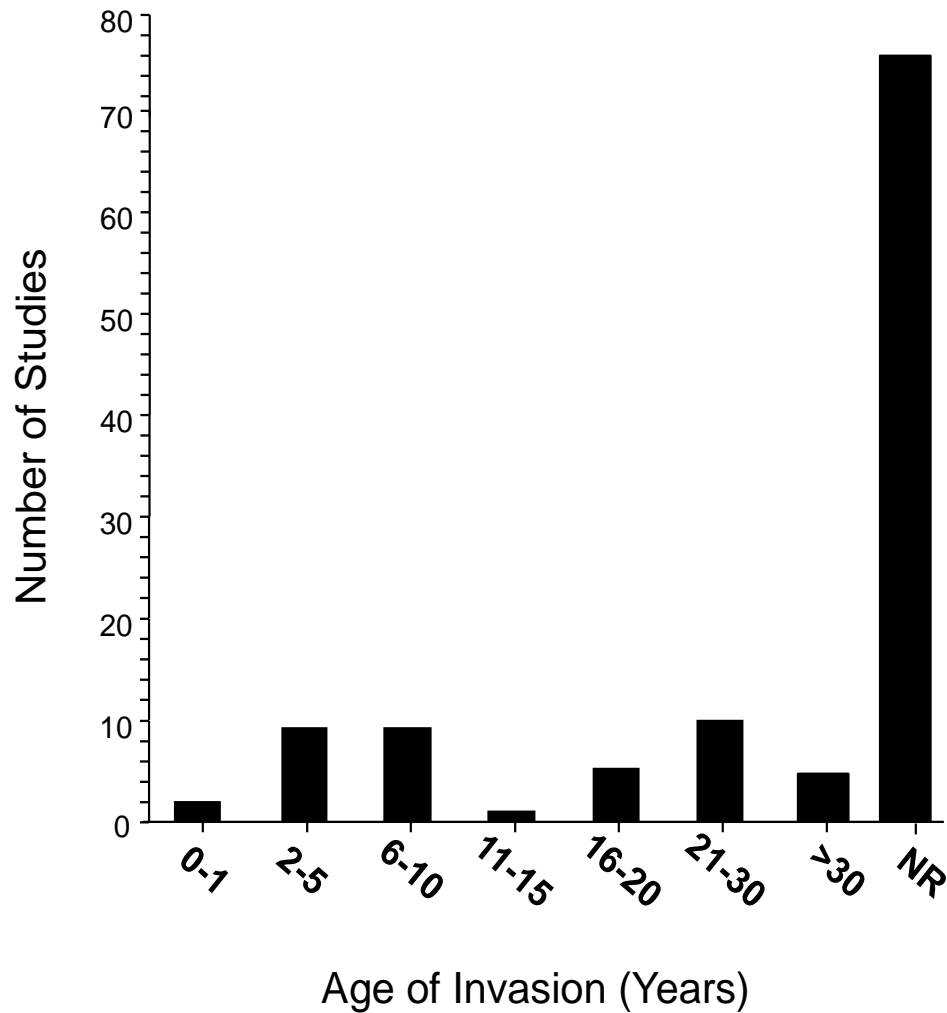
Can impacts on native mycorrhizal communities be predicted by the mycorrhizal status of invaders?



What are the temporal dynamics of invader impacts mycorrhizal mutualism disruption?

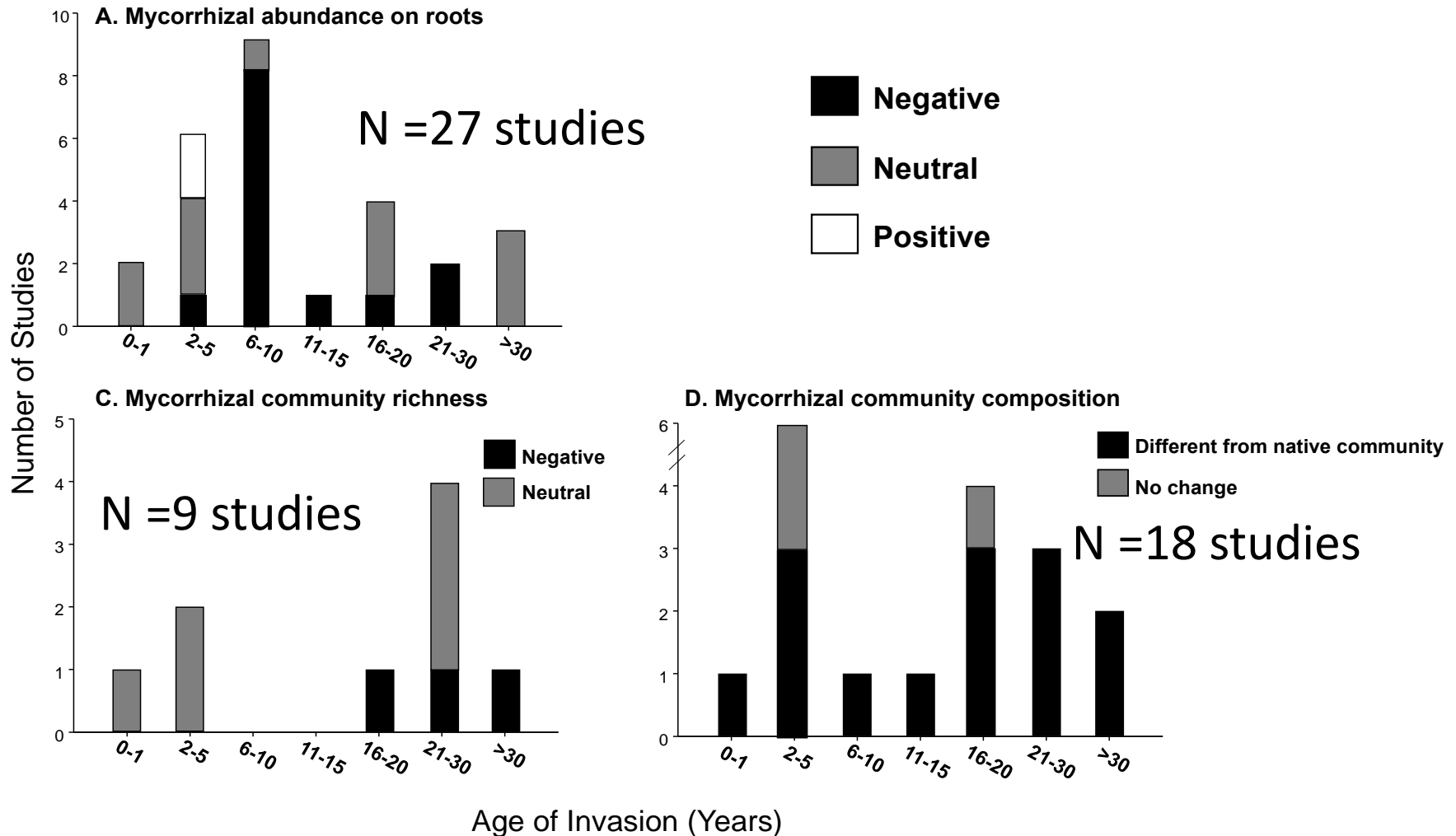


How does mycorrhizal mutualism disruption change with age of invasion?



Can we identify any temporal patterns?

with the small subset of studies that included the age of invasion



What did we accomplish with this review?

Does mycorrhizal status of invader influence impact? Yes. Sometimes.

- Non-mycorrhizal invaders have negative effects on native mycorrhizas
- AM invaders only have negative impacts on AM natives half of the time
 - Degree of dependence on mycorrhizal fungi by invaders and natives?
- Community composition of the fungi is almost always changed by invasions

How do invasion impacts change over time? Data are too limited.

Gaps:

- How do changes in fungal community composition affect plant performance?
- How does age of invasion influence the impacts?
- What factors influence the persistence of these impacts?
 - Propagule (spore) longevity & dispersal limitation

Acknowledgements



DEB-1354985



Legacy effects following invasive species removal

Legacy Effects:

- Positive feedbacks that reinforce invasion
- Useful for prioritizing management
- Do not have a sense of how common they are
- Or how long they last following invader removal



Invasive Plant Science and Management 2012 5:117-124

Gone but Not Forgotten? Invasive Plants' Legacies on Community and Ecosystem Properties

Jeffrey D. Corbin and Carla M. D'Antonio*

Oecologia (2013) 172:915–924
DOI 10.1007/s00442-012-2543-1

ECOSYSTEM ECOLOGY - ORIGINAL RESEARCH

Ecosystem legacy of the introduced N₂-fixing tree *Robinia pseudoacacia* in a coastal forest

Betsy Von Holle · Christopher Neill ·
Erin F. Largay · Katherine A. Budreski ·
Barbara Ozimec · Sara A. Clark · Krista Lee

LETTER

doi:10.1038/nature12798

Self-reinforcing impacts of plant invasions change over time

Stephanie G. Yelenik^{1,†} & Carla M. D'Antonio¹

Invasive species that impact soil, fungi or plants could influence the structure and function of mycorrhizal mutualisms of native plants

