

# **Diversity is magic: Native seeds lead to restoration success**

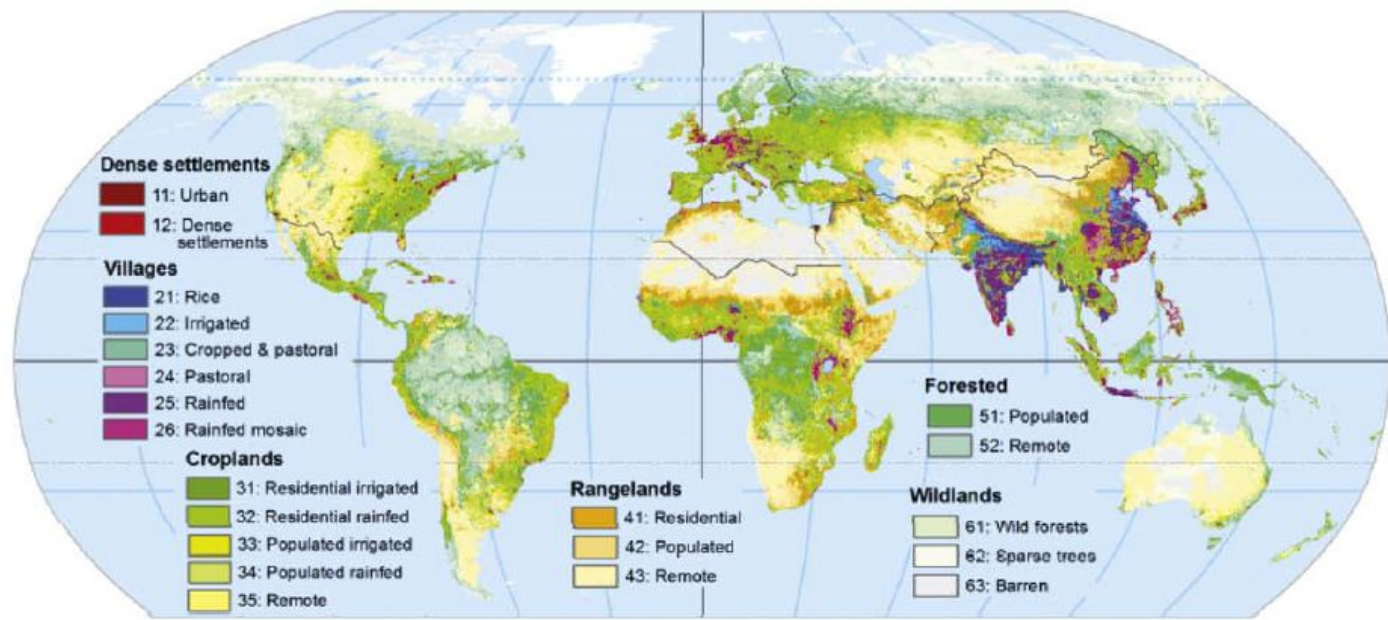
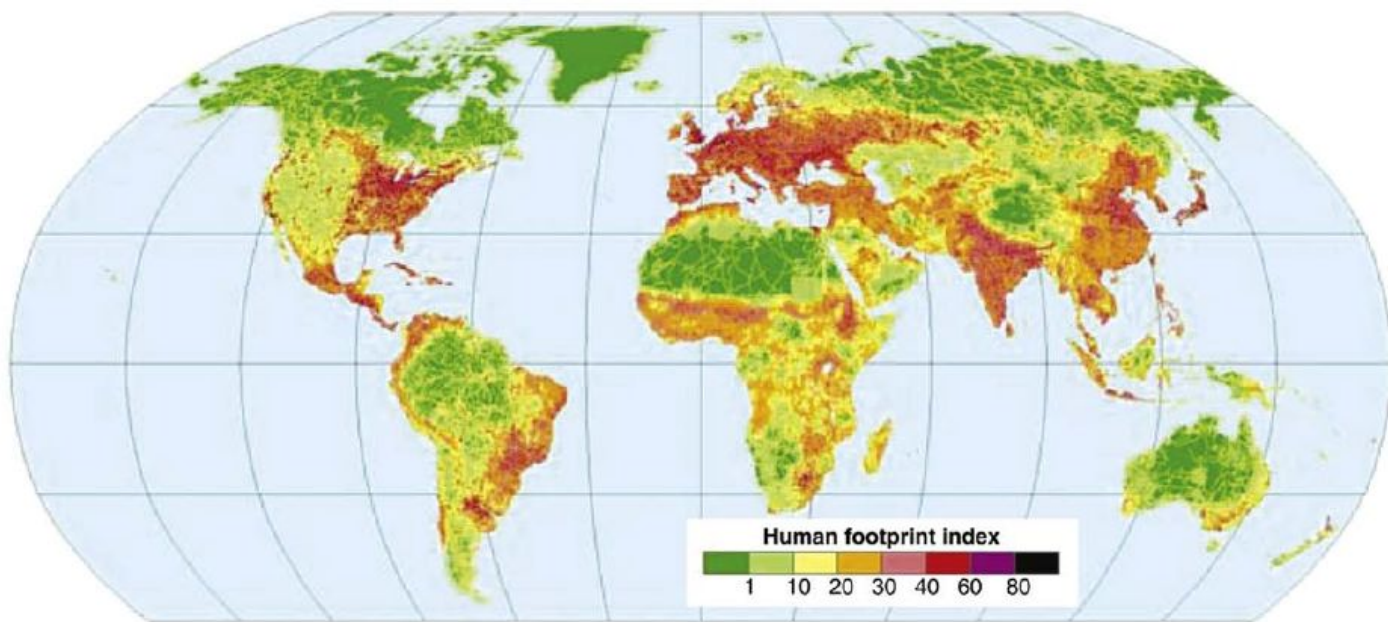
Tom Kaye, PhD

Institute for Applied Ecology









Hobbs et al. 2009. *Trends in Ecology and Evolution*.

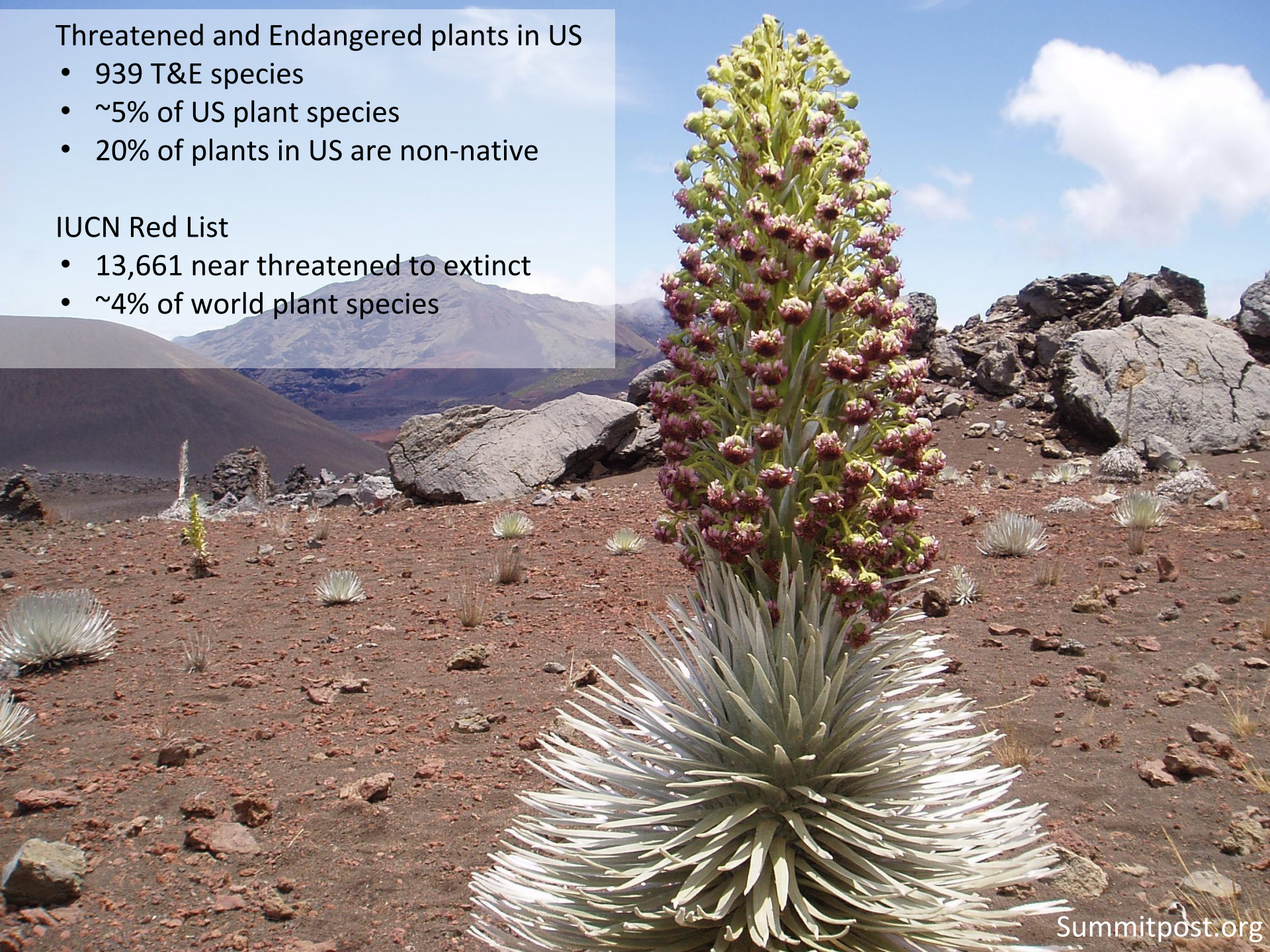


## Threatened and Endangered plants in US

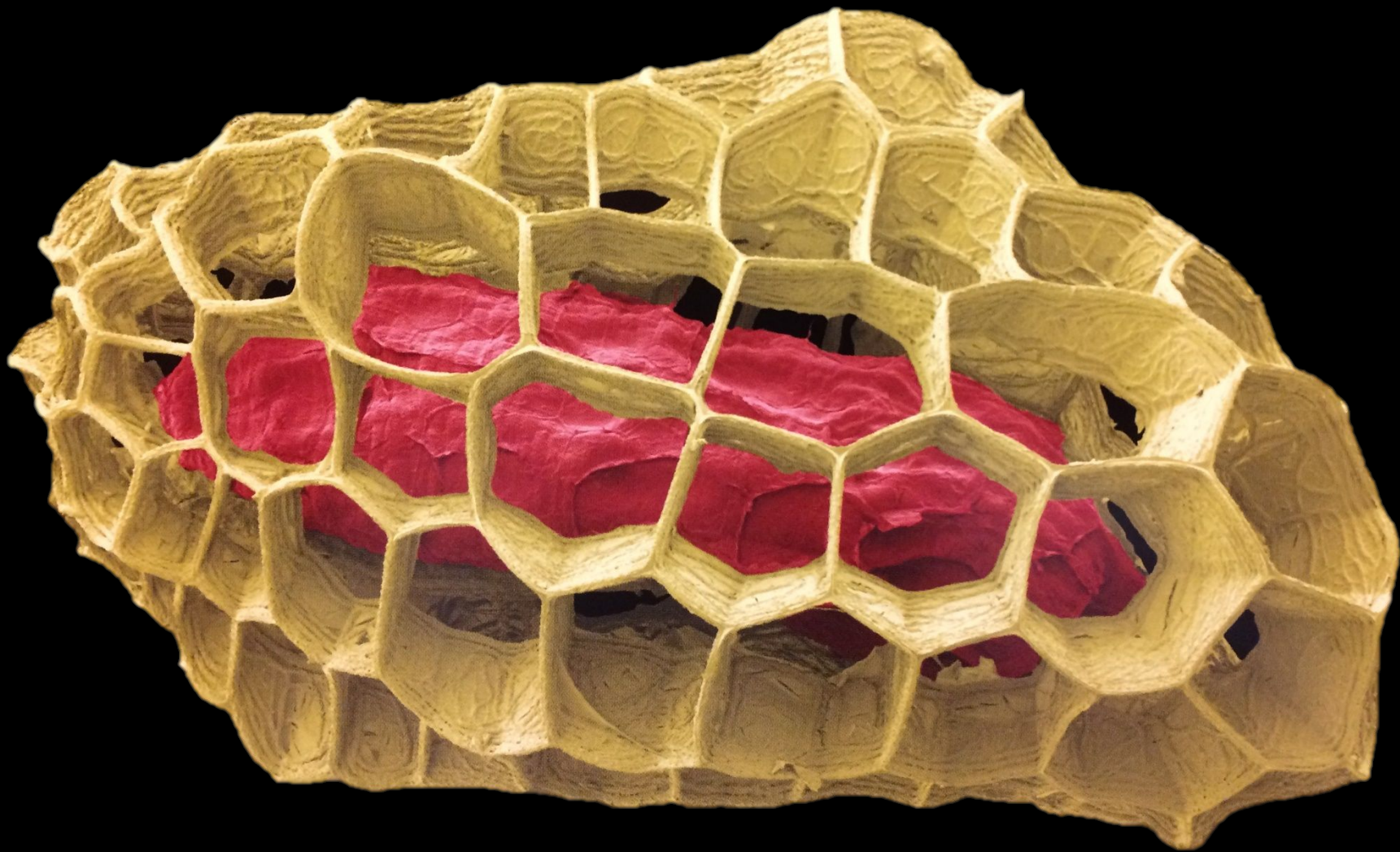
- 939 T&E species
- ~5% of US plant species
- 20% of plants in US are non-native

## IUCN Red List

- 13,661 near threatened to extinct
- ~4% of world plant species







Kessler et al., 2006. *Seeds: Time Capsules of Life*



- Ecosystem service is the goal
- Diversity is magic
- Seeds are the key





Diversity is the spice of life





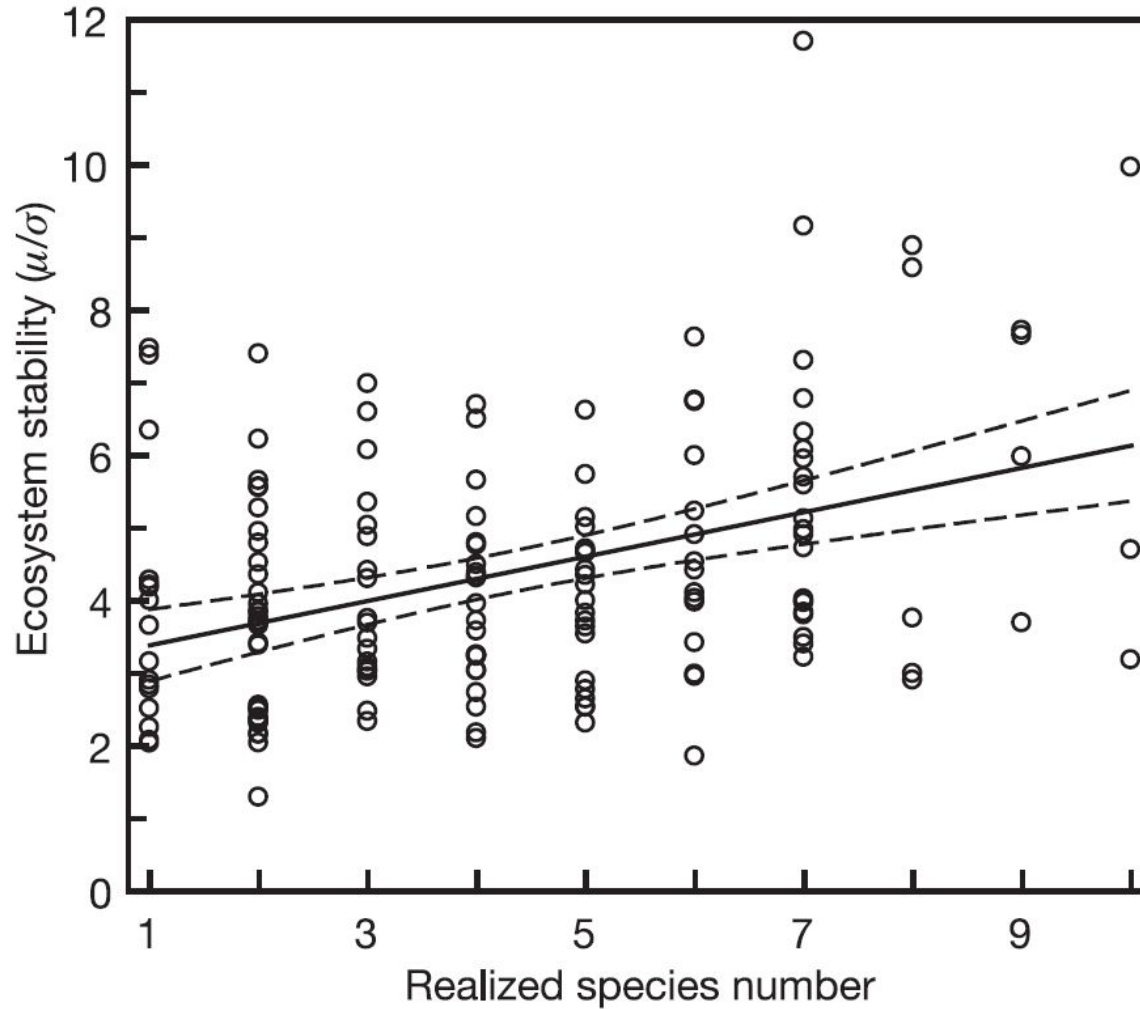




# Cedar Creek

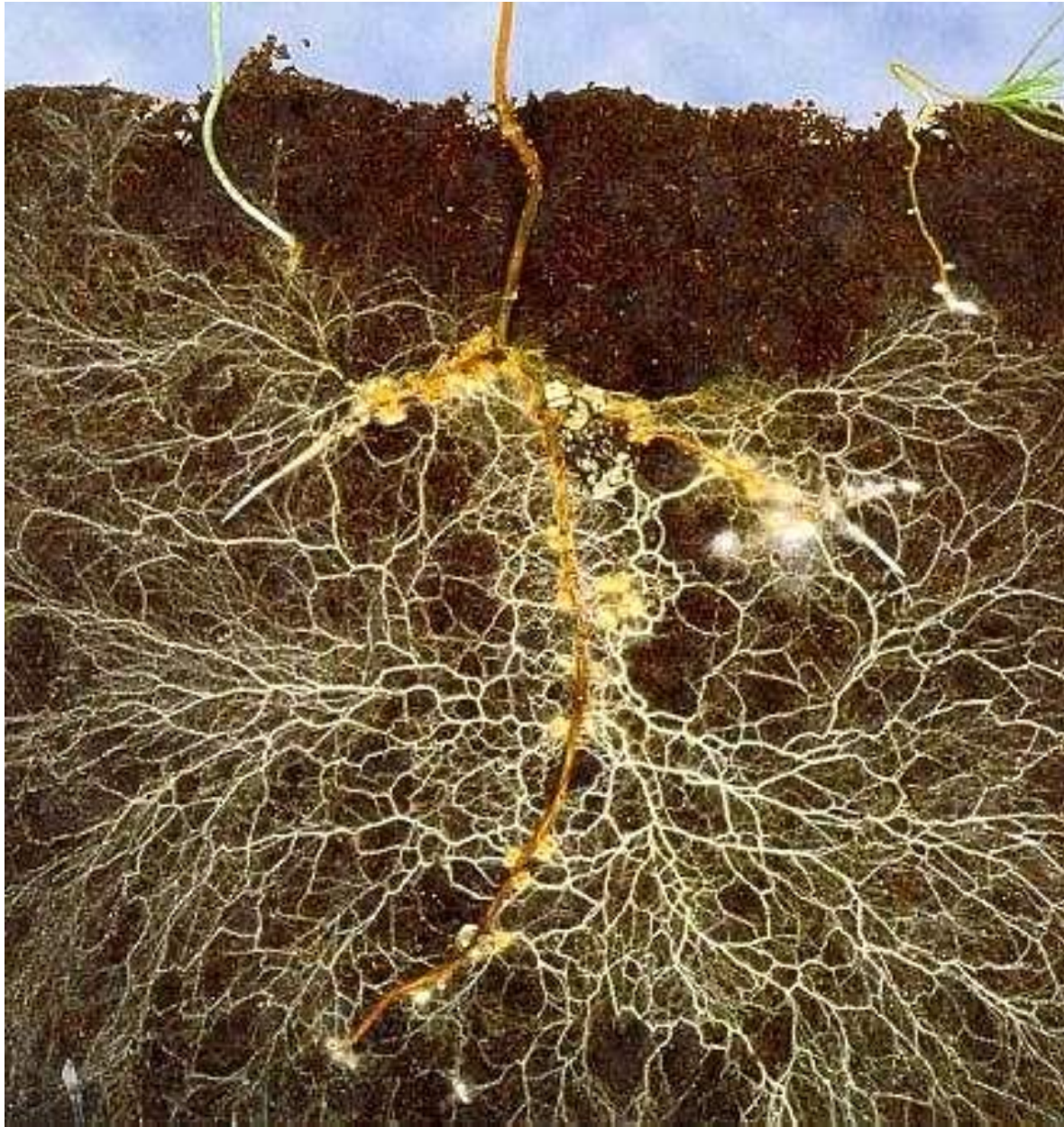


# Diversity-Stability Hypothesis

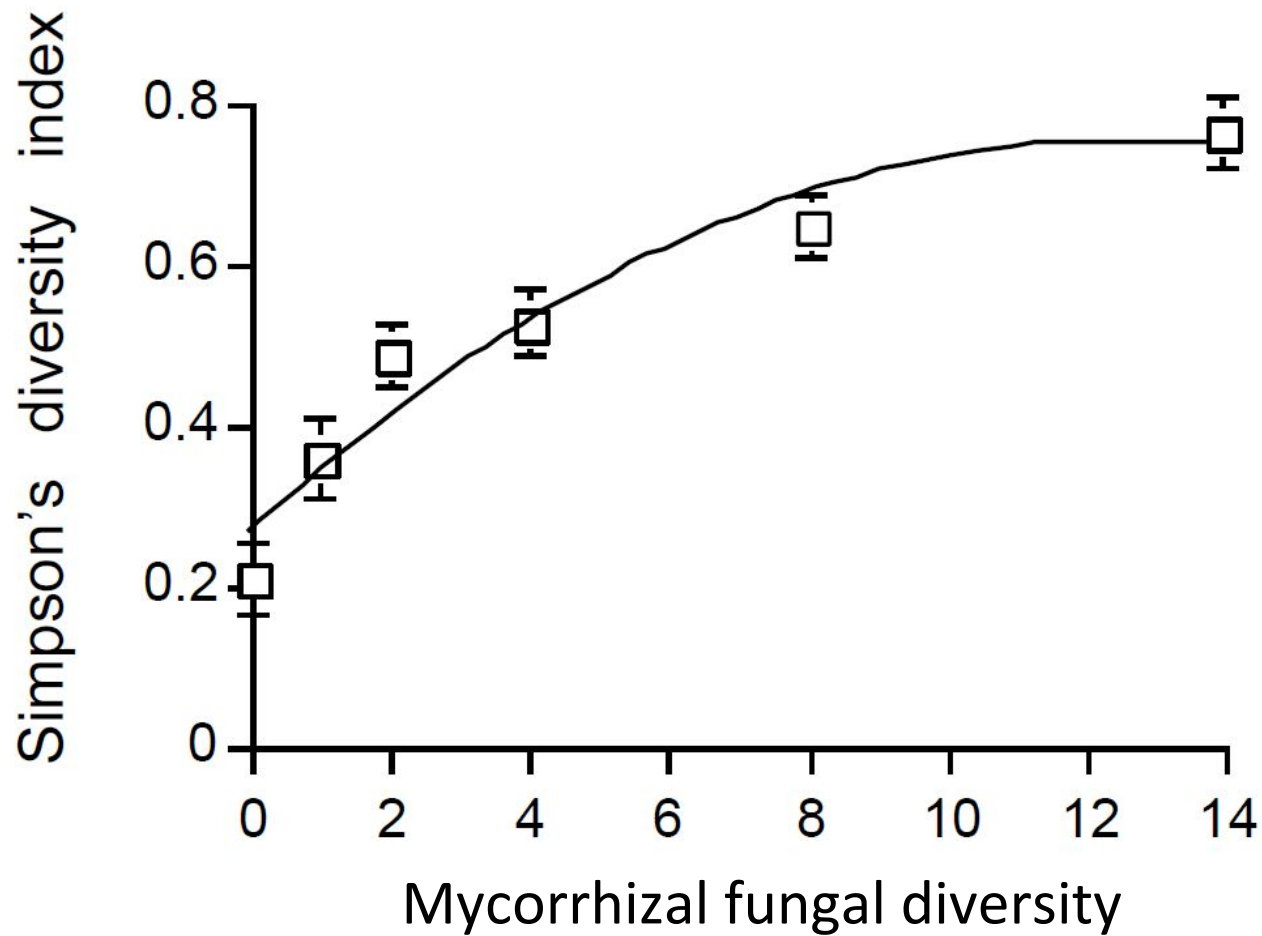


Tilman et al. 2006. Nature.









**Mycorrhizal fungal diversity determines plant biodiversity, ecosystem variability and productivity**

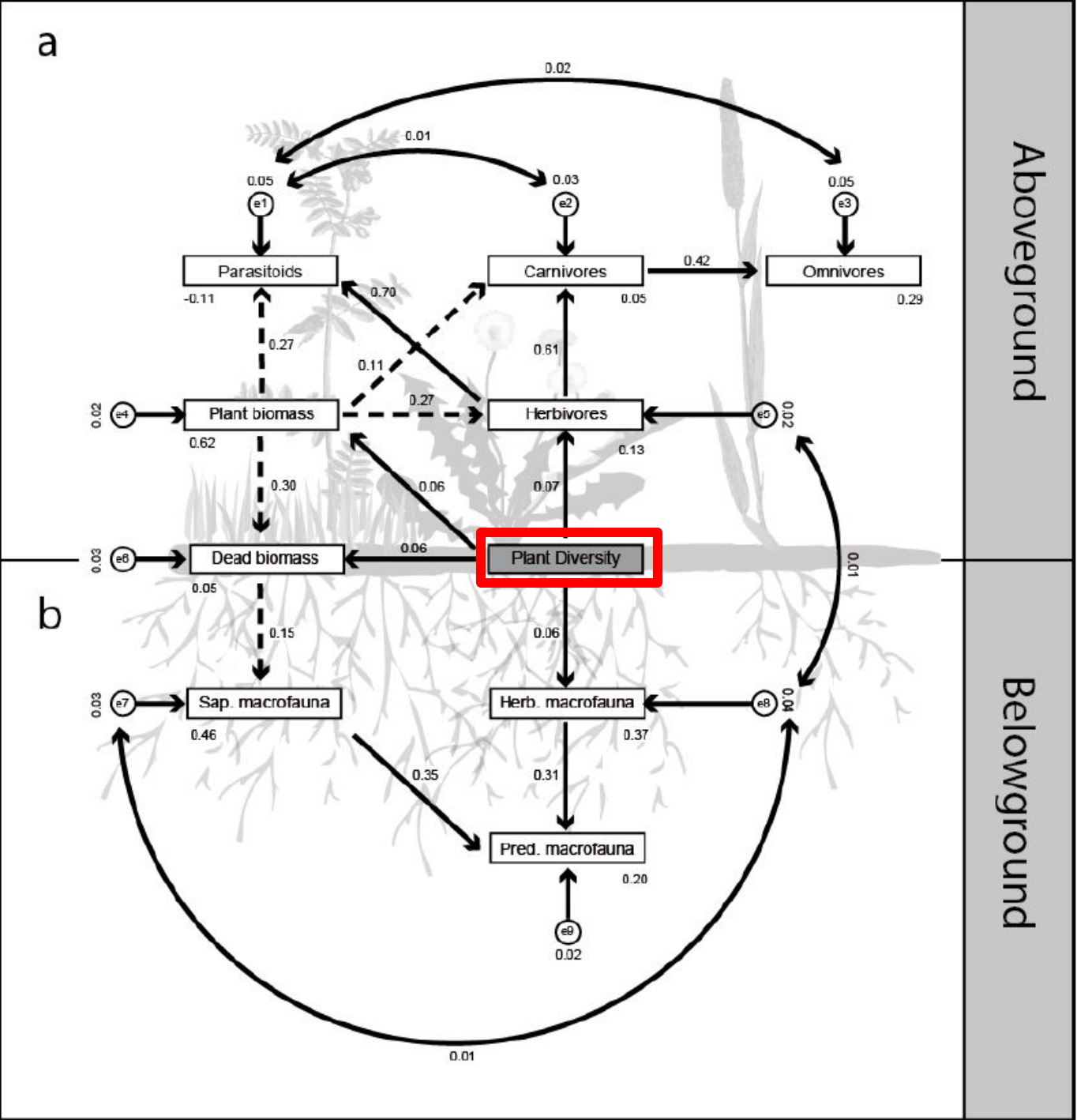
Van der Hiejen et al. 1998. *Nature*.

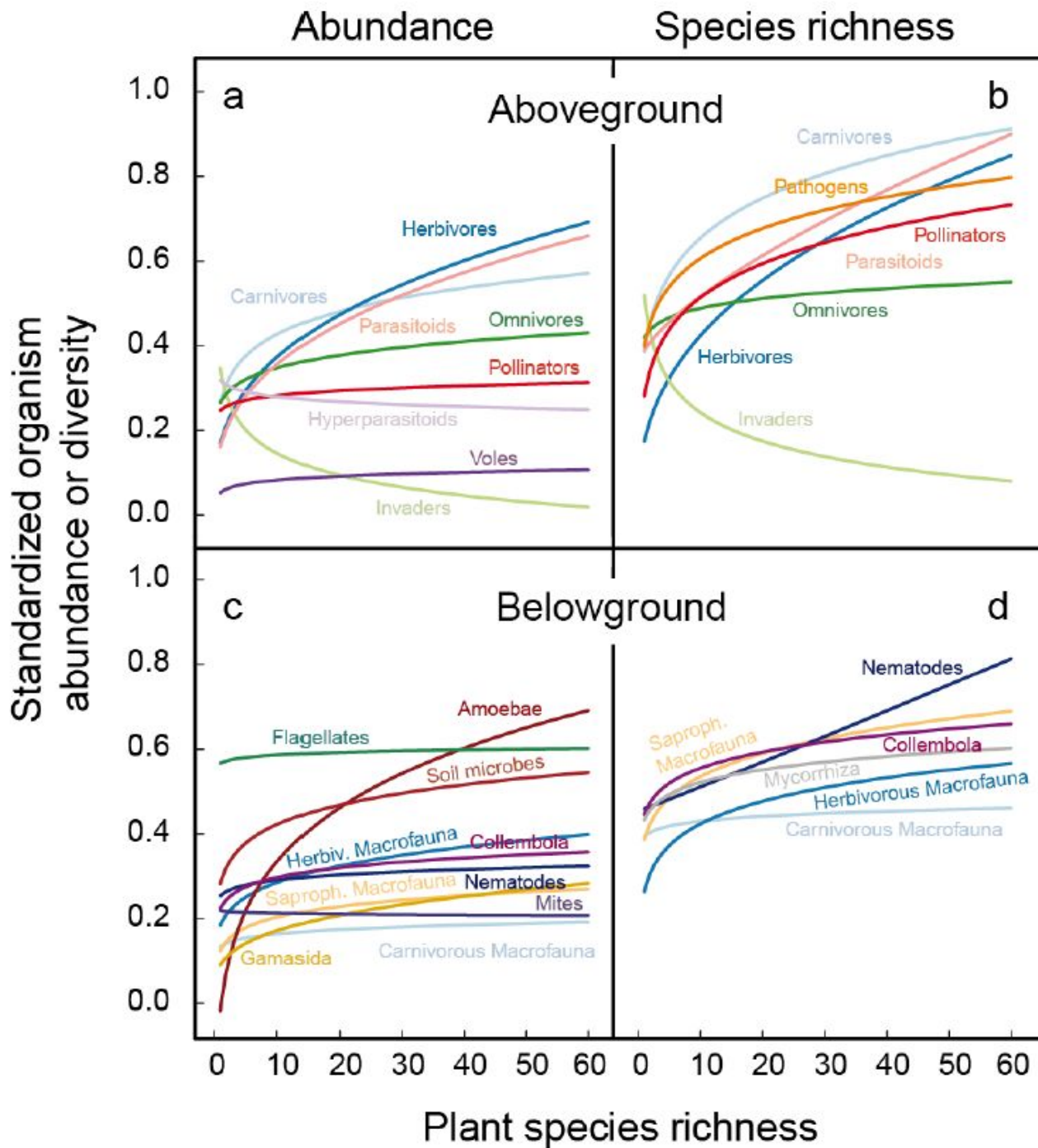


# Jena Experiment









Scherber et al. 2010.  
 Bottom-up effects of plant  
 diversity on multitrophic  
 interactions in a biodiversity  
 experiment.  
*Nature.*



# Plant diversity affects endangered species reintroduction success

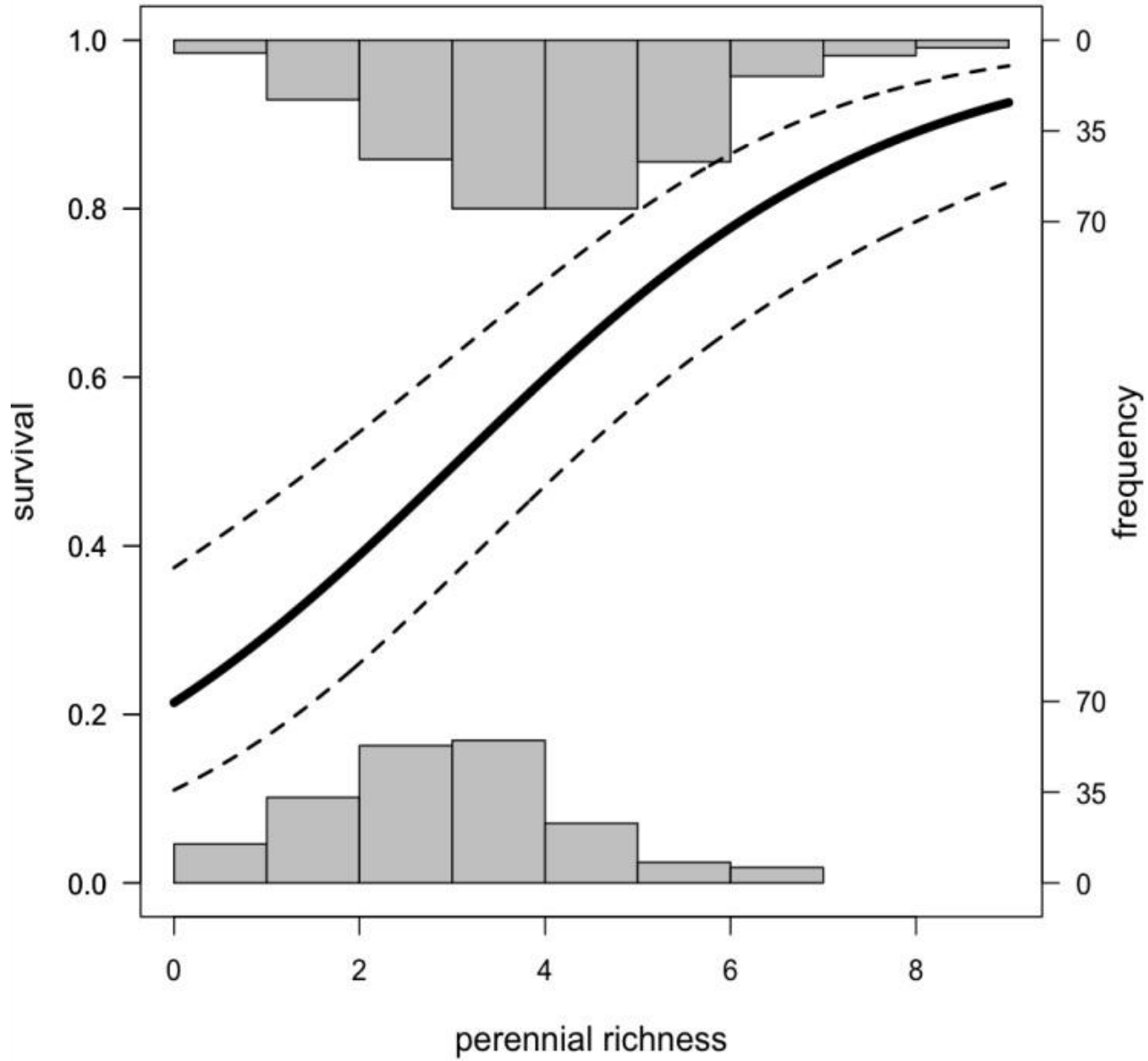




# Hemiparasite



Haustoria on *Achillea milifolium*





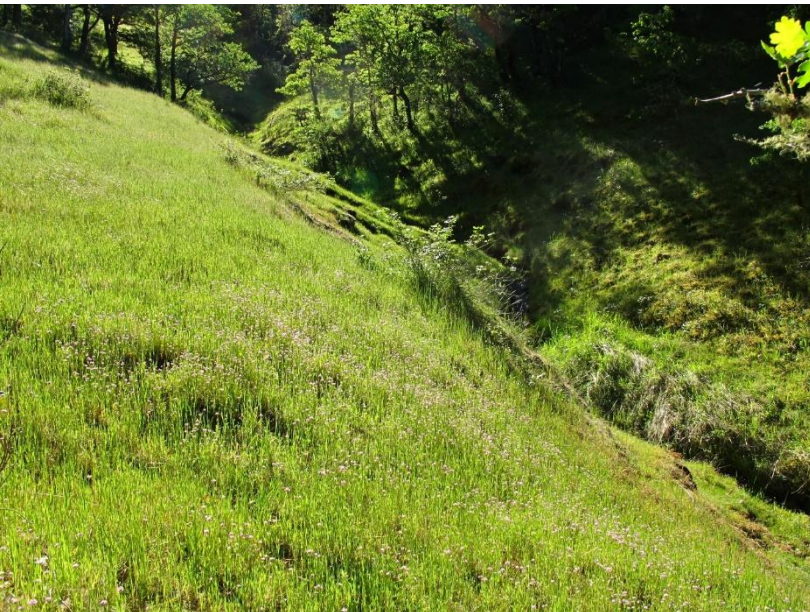




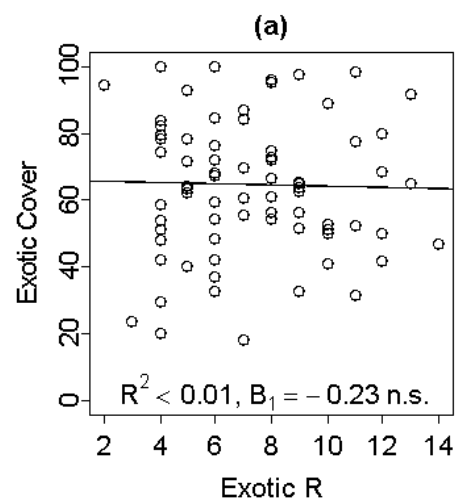
# Why *native* diversity?



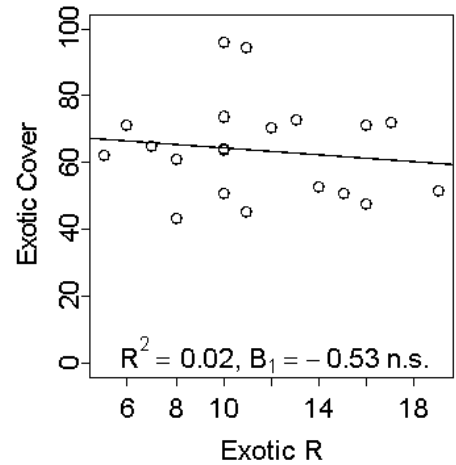
# Weeds suppress native plant abundance and diversity



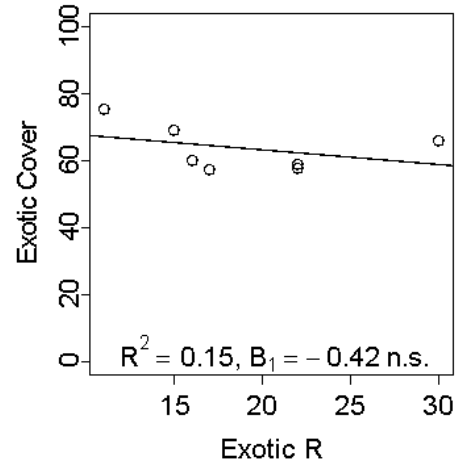
Plot scale



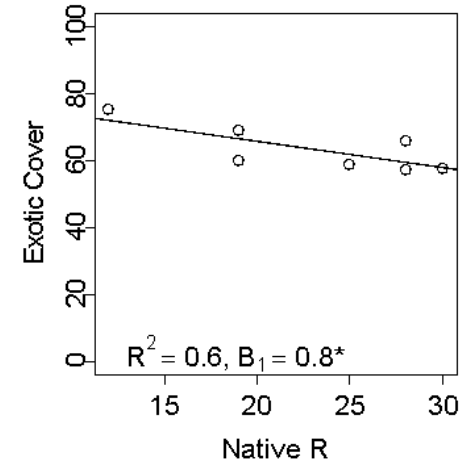
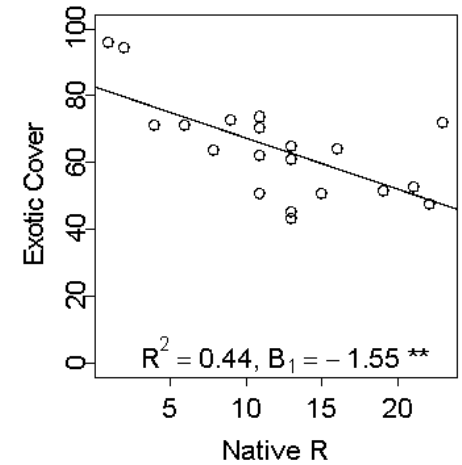
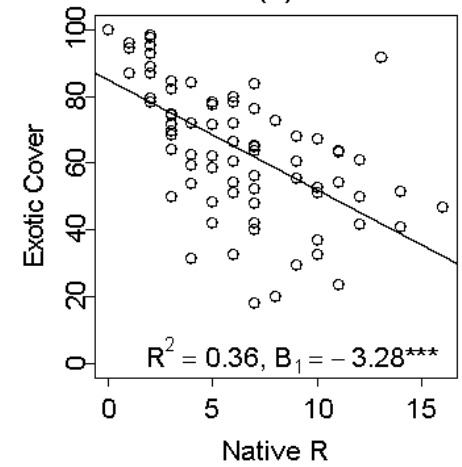
Block scale



Site scale



(b)





# Weeds homogenize plant communities



plot

block

site

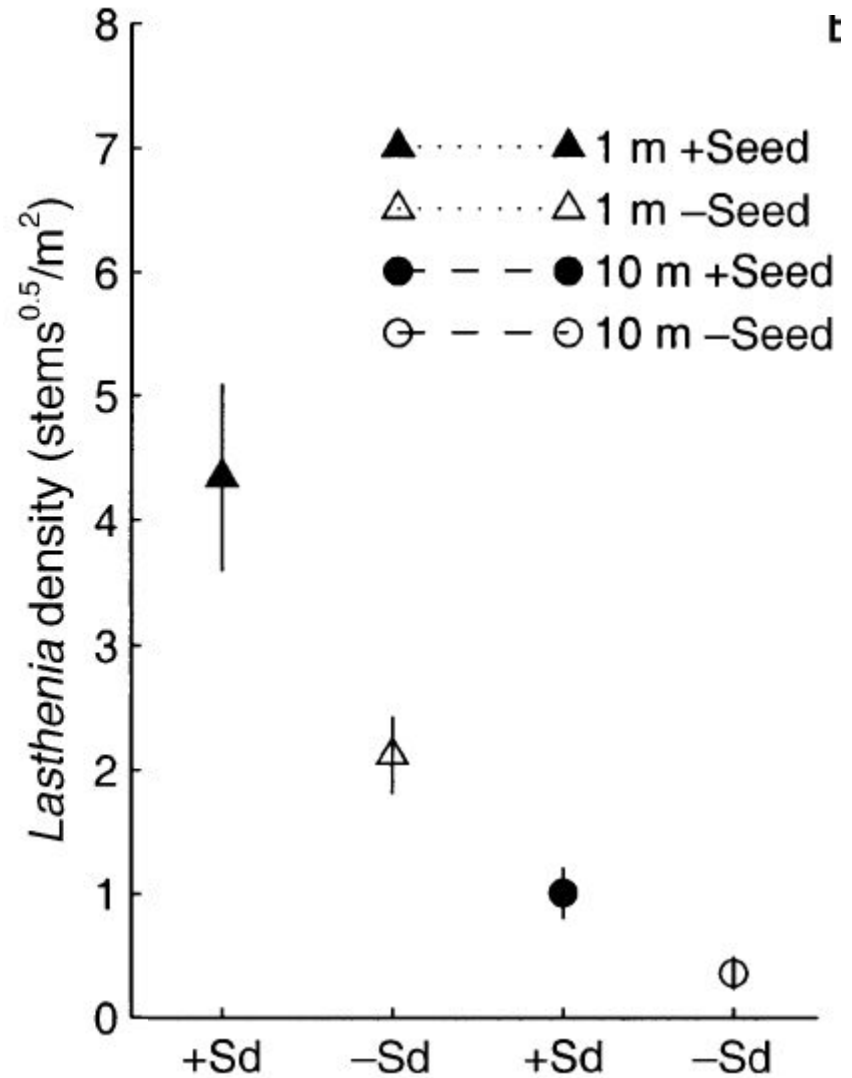


# How do we restore diversity?

- With seeds. Seeding may be the only way to increase diversity in some systems.



# Seed limitation



Seabloom et al. 2003. *Ecological Applications*.



# Adding seeds adds diversity





# Coyote Creek

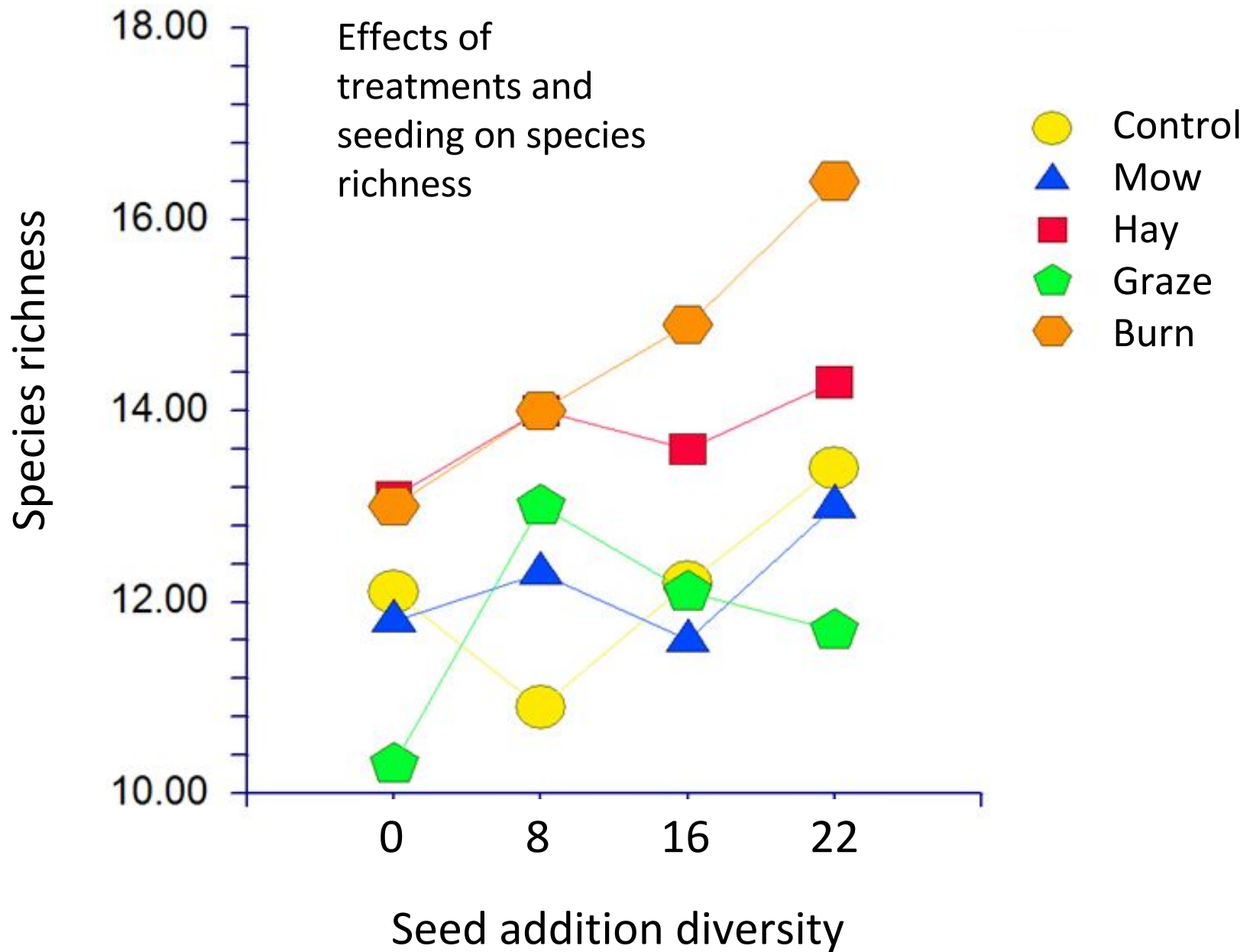




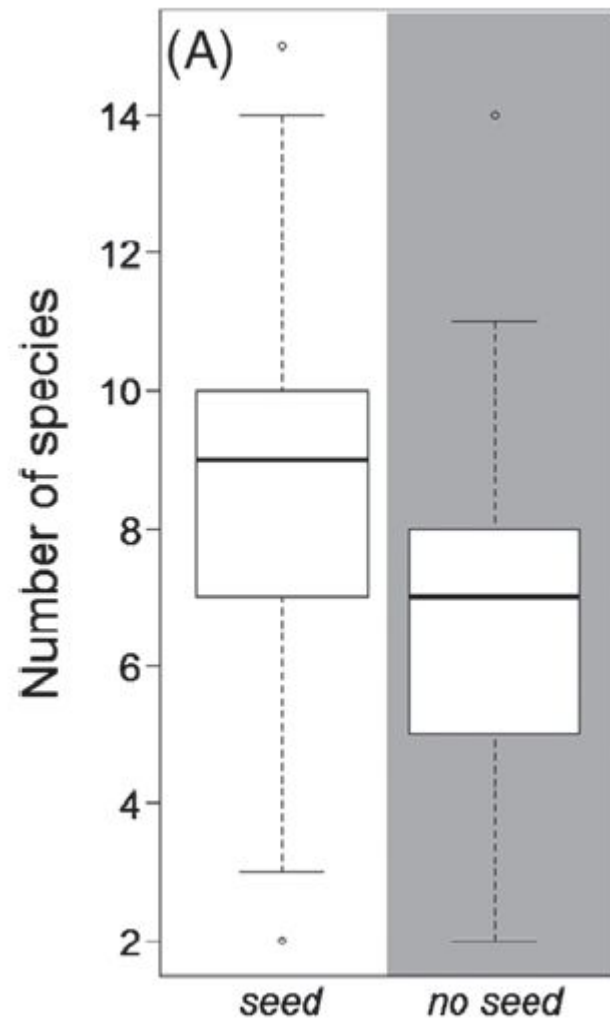
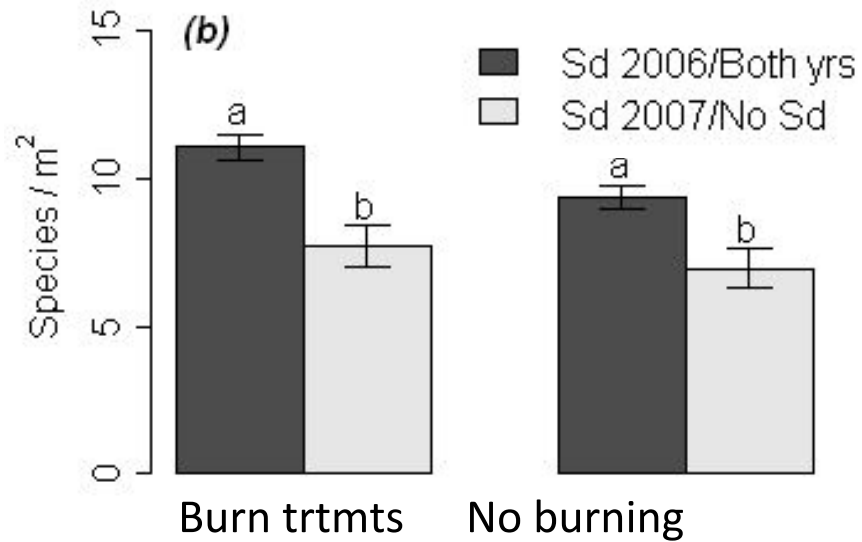
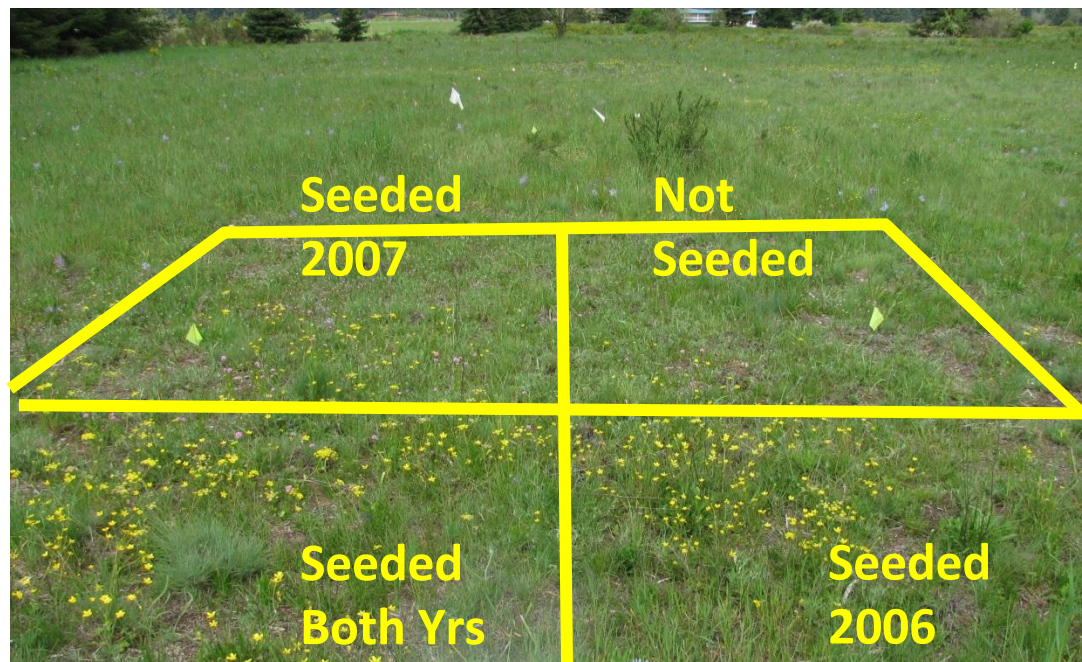








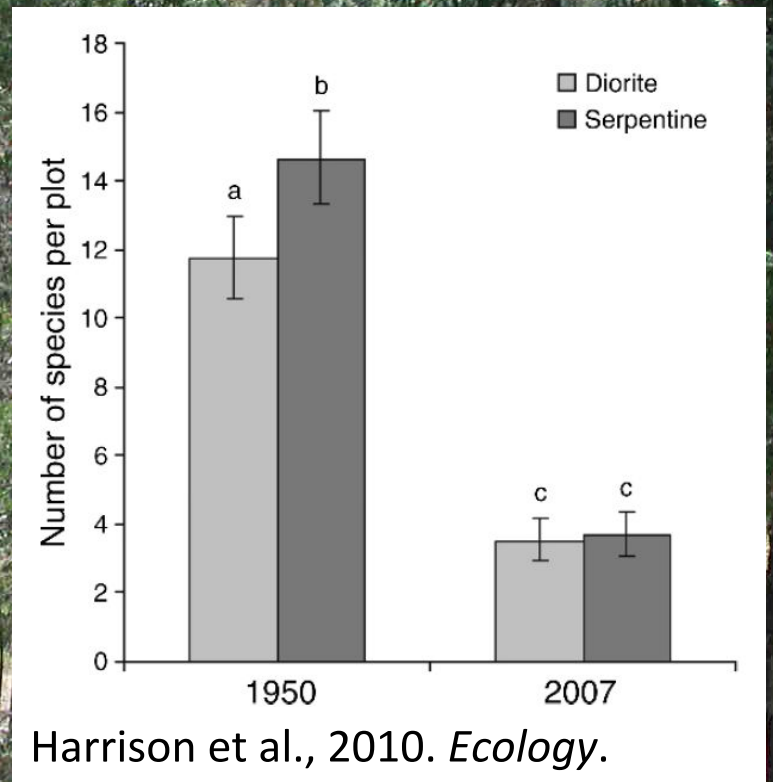
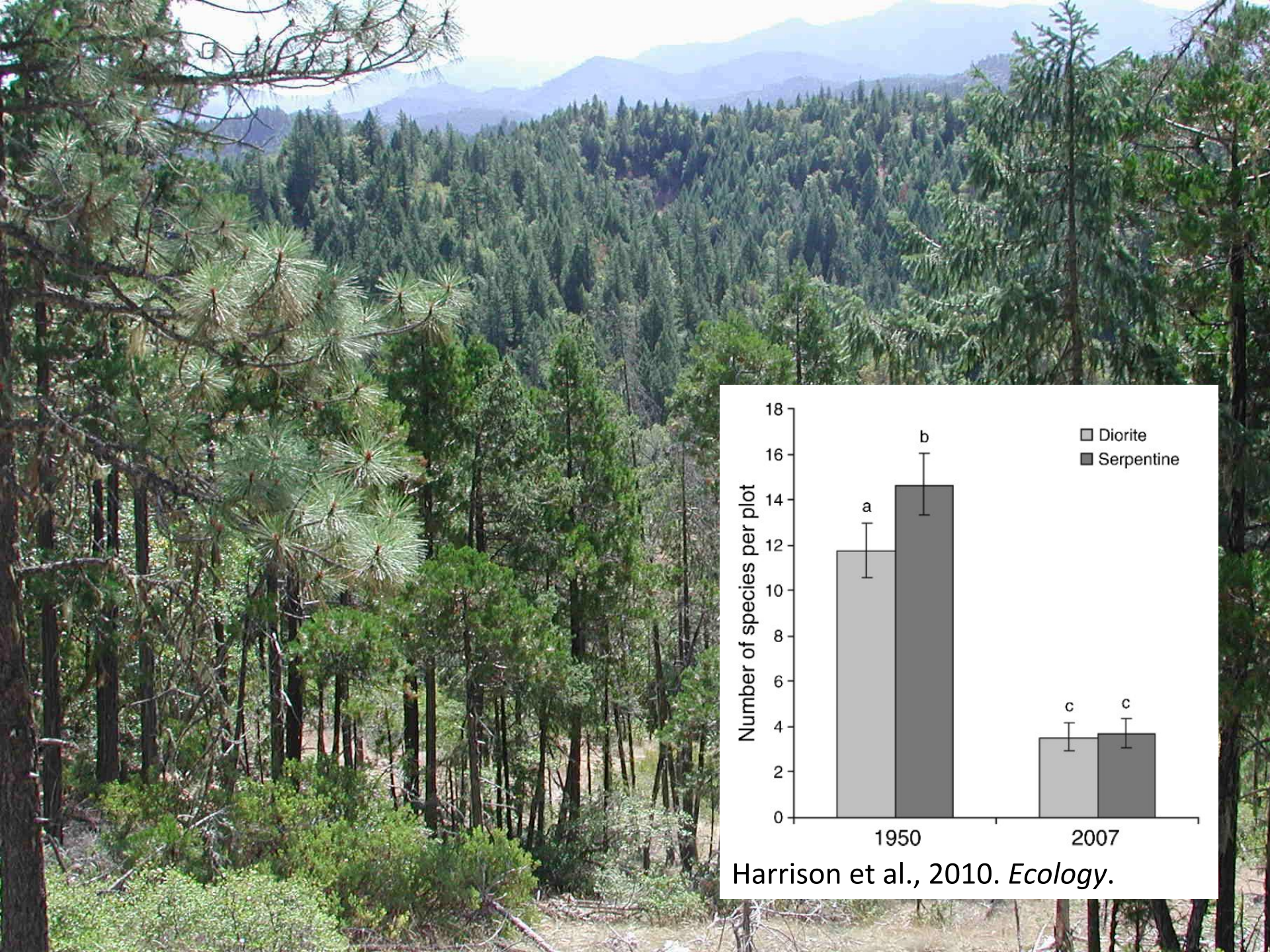




Stanley et al., 2011. Northwest Science.

Trowbridge et al., 2016. Restoration Ecology.





Harrison et al., 2010. *Ecology*.

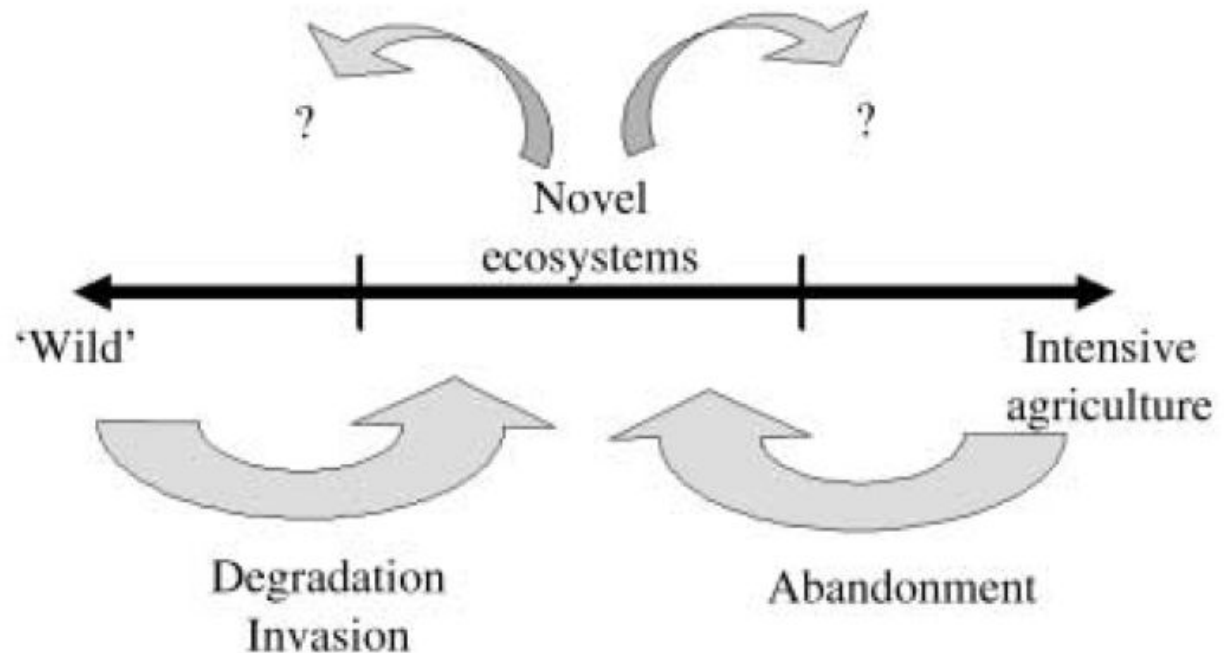


# Novel Ecosystems

- “Novel ecosystems ... result when species occur in combinations and relative abundances that have not occurred previously within a given biome.”

- *Novelty*

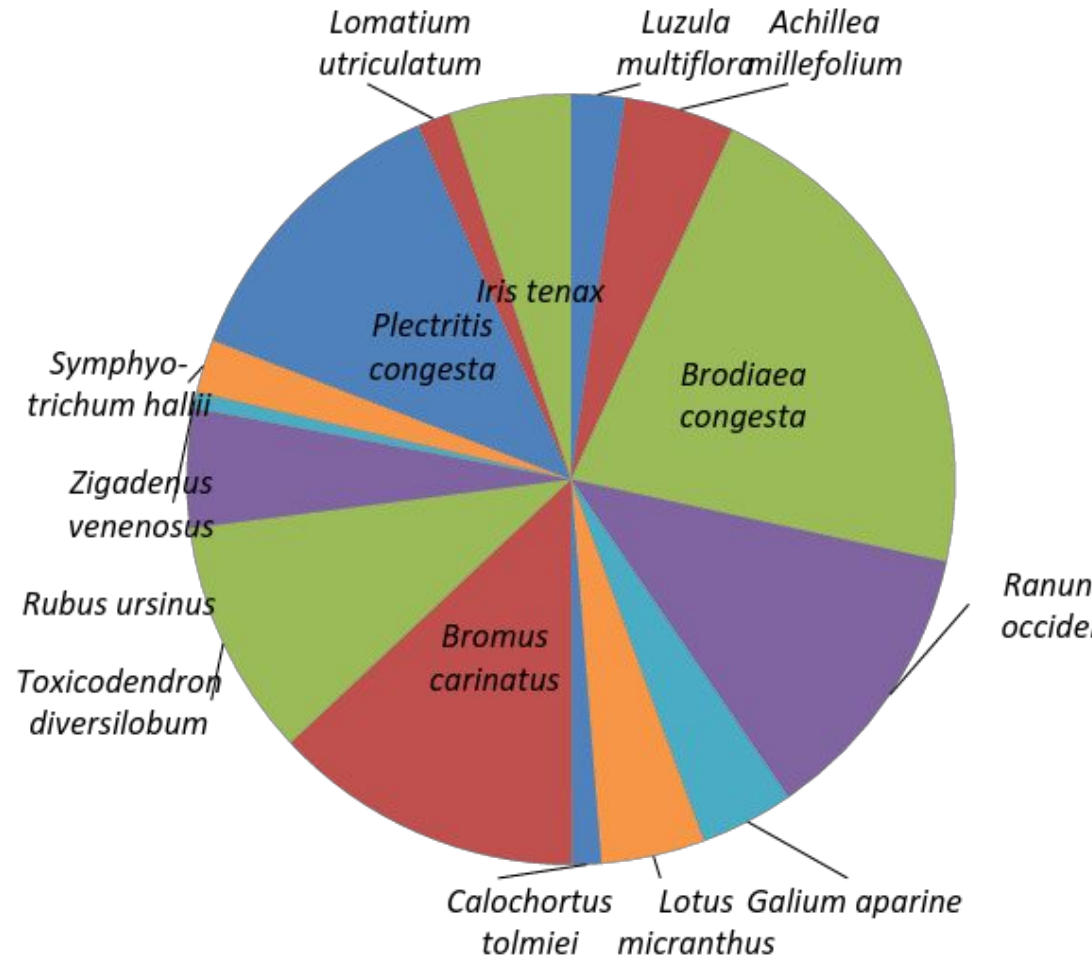
- *Human ager*





# Novel/Contemporary Ecosystem Designer communities: from robust species

Species	Frequency (%)
<i>Luzula multiflora</i>	45.1
<i>Achillea millefolium</i>	33.2
<i>Brodiaea congesta</i>	29.2
<i>Ranunculus occidentalis</i>	25.1
<i>Galium aparine</i>	24.7
<i>Lotus micranthus</i>	21.4
<i>Calochortus tolmiei</i>	20.0
<i>Bromus carinatus</i>	19.0
<i>Toxicodendron diversilobum</i>	18.3
<i>Rubus ursinus</i>	13.2
<i>Zigadenus venenosus</i>	12.9
<i>Symphyotrichum hallii</i>	12.5
<i>Plectritis congesta</i>	12.2
<i>Lomatium utriculatum</i>	11.9
<i>Iris tenax</i>	10.8





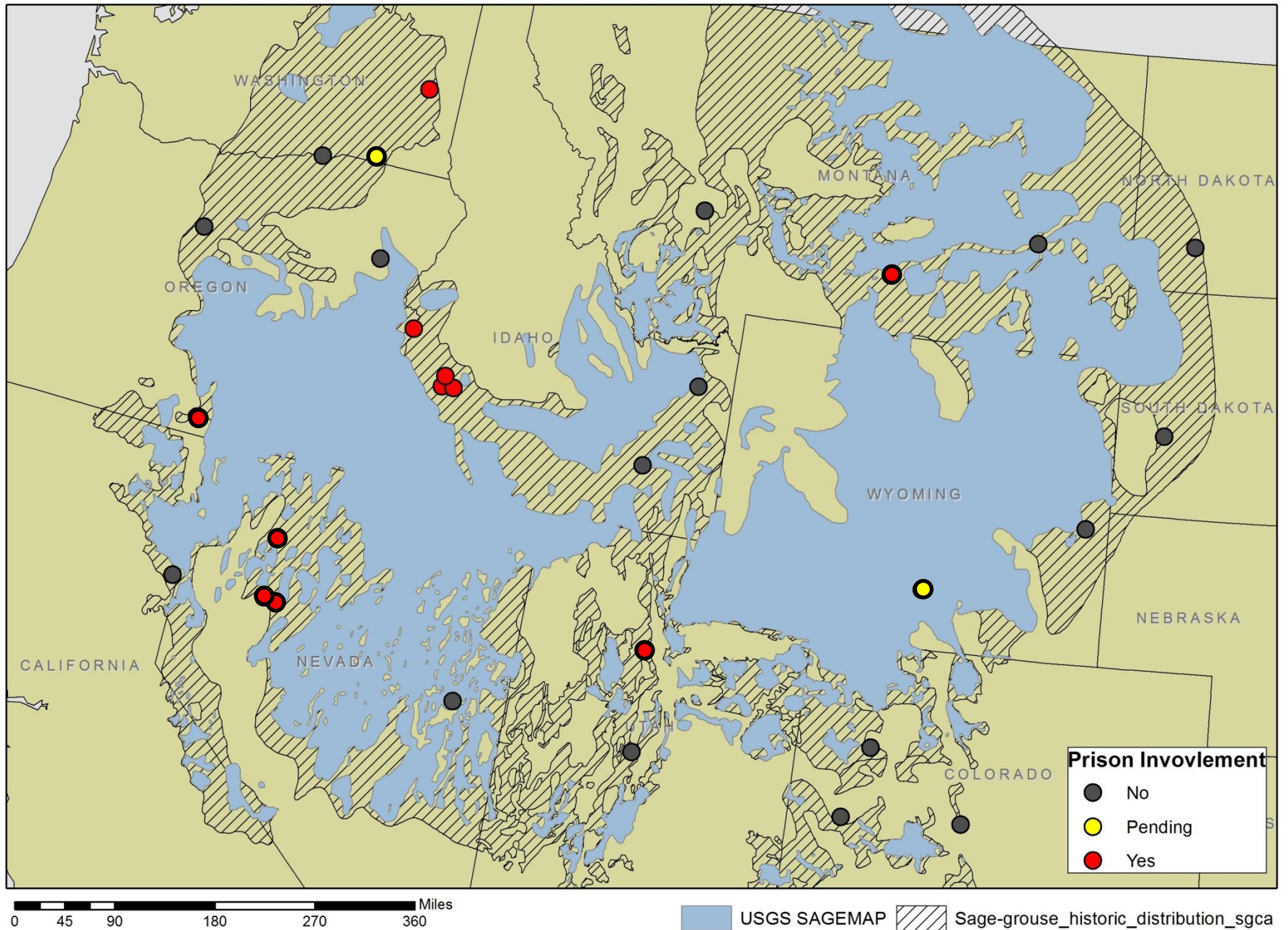
# Partnerships are crucial

- Seed production cooperatives
- Engaging tribes
- Engaging prison inmates





# Sustainability in Prisons Project: Overlay of Sagegrouse habitat and prison facilities







The preceding presentation was delivered at the

## **2017 National Native Seed Conference**

Washington, D.C. February 13-16, 2017

This and additional presentations available at <http://nativeseed.info>

