

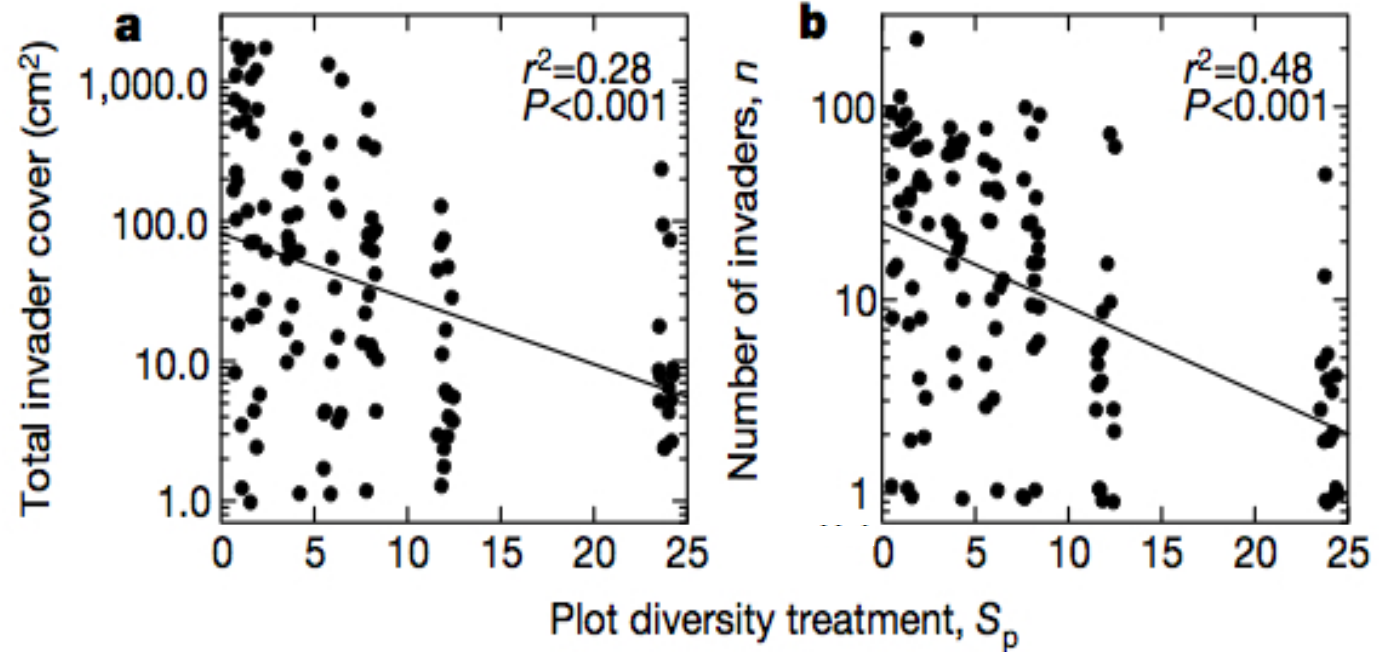
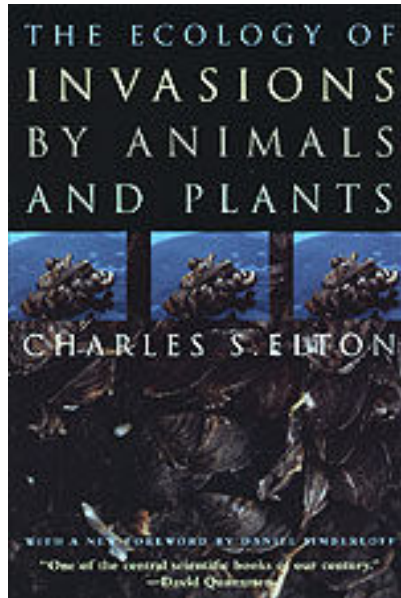
Resident community species diversity decreases the fitness of an invasive annual grass



UC Irvine

Heather McGray & Katharine Suding

Species Diversity-Invasibility



Kennedy *et al.* *Nature* 2002

Species Diversity-Invasibility



Species Diversity-Invasibility



Increased resource use



Species Diversity-Invasibility

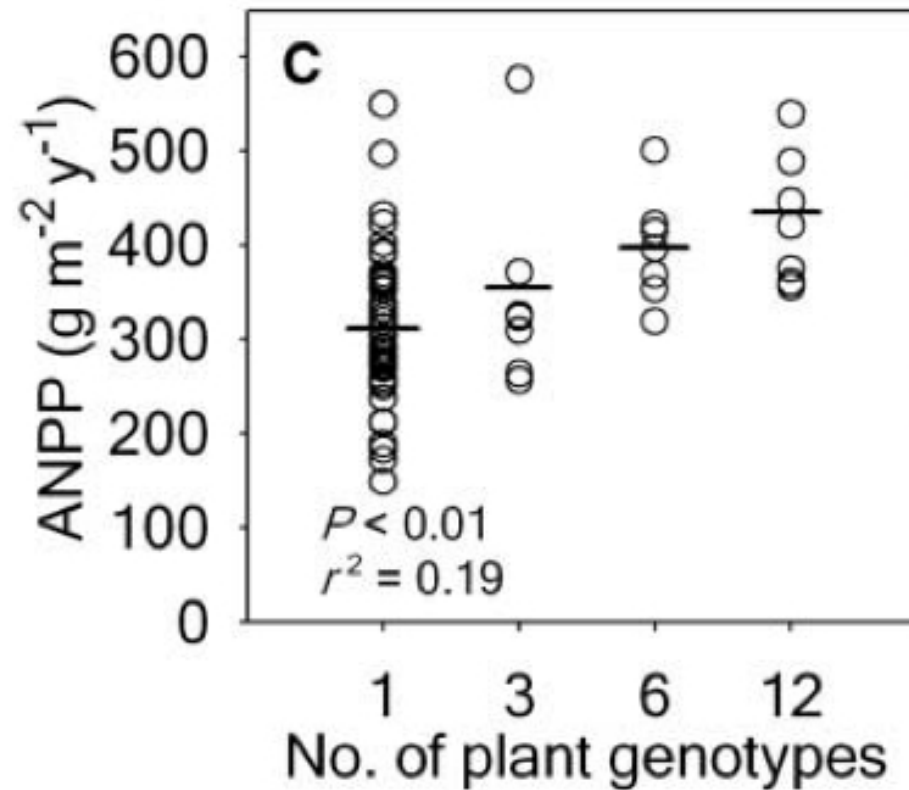


Increased resource use

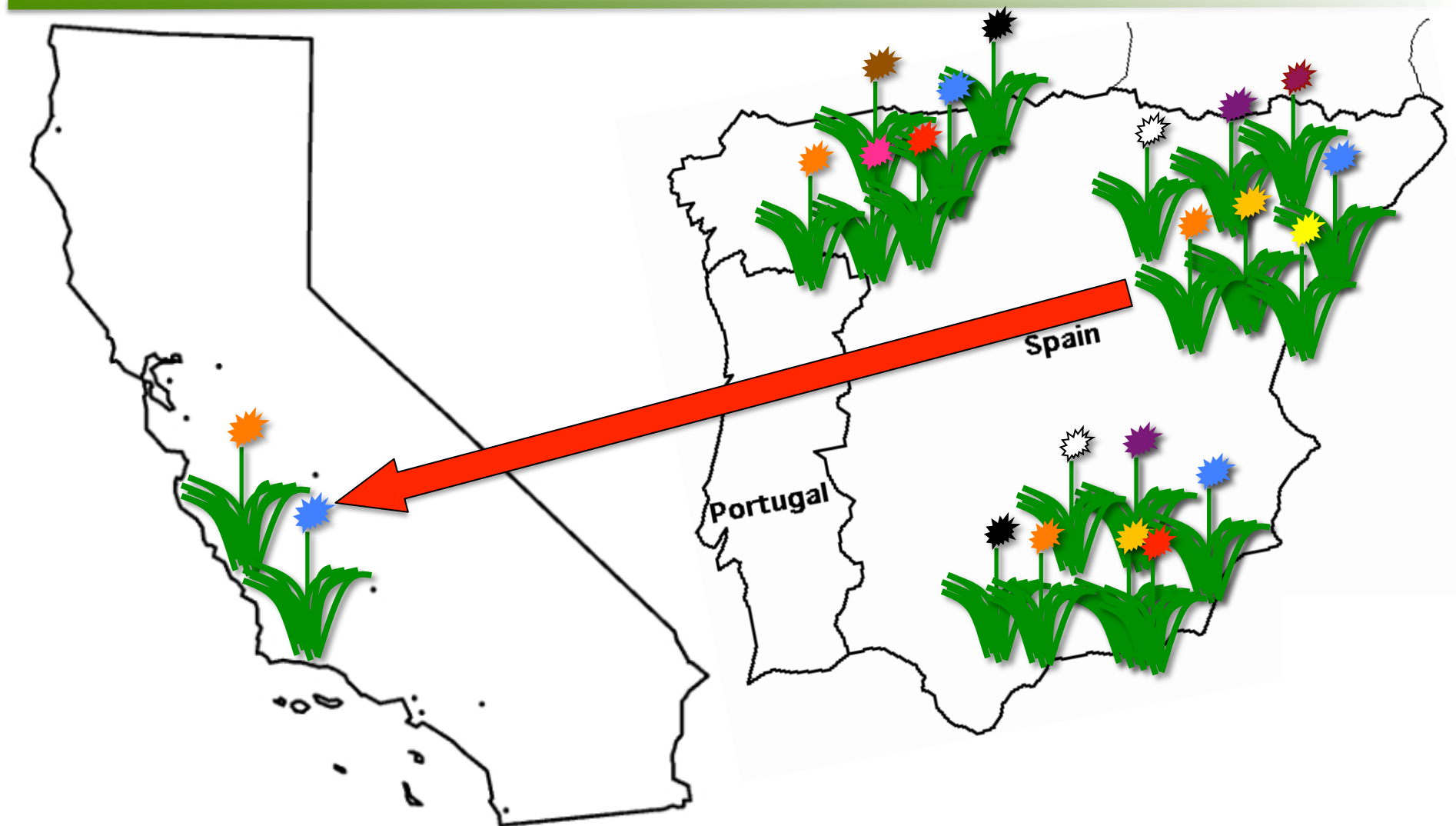


Presence of a good competitor

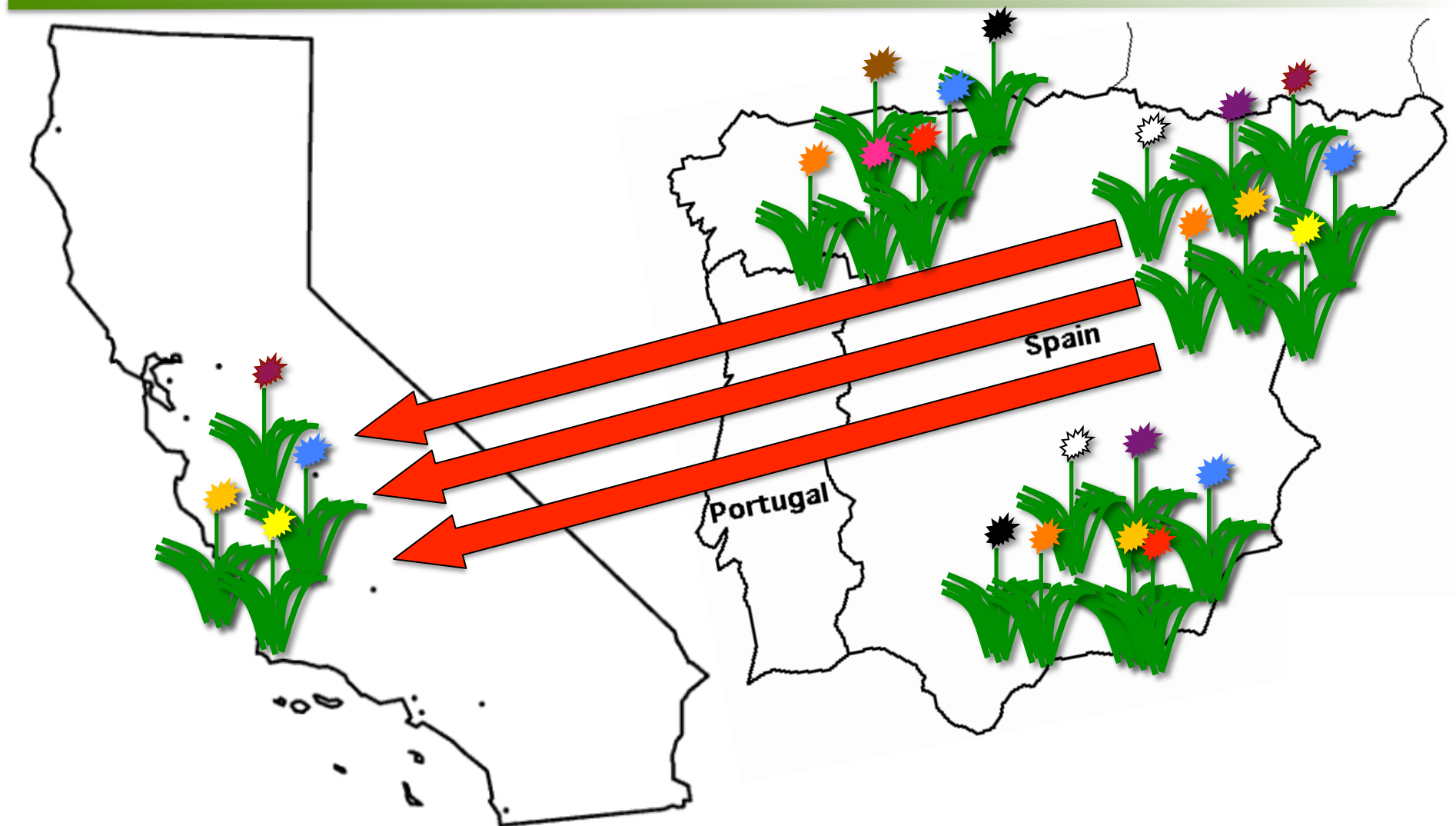
Genetic Diversity-Invasibility



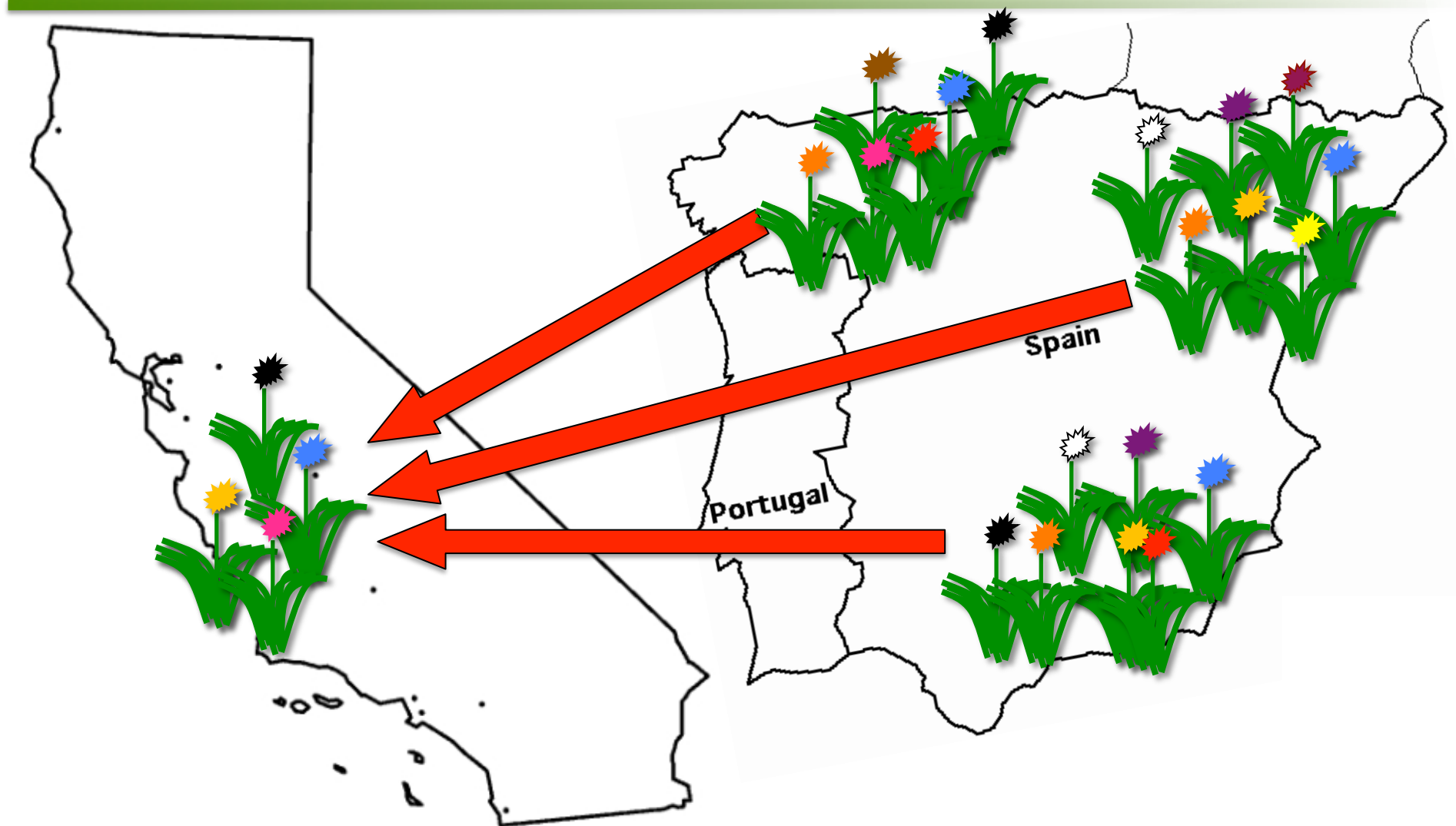
Genetic Diversity-Invasibility



Genetic Diversity-Invasibility



Genetic Diversity-Invasibility



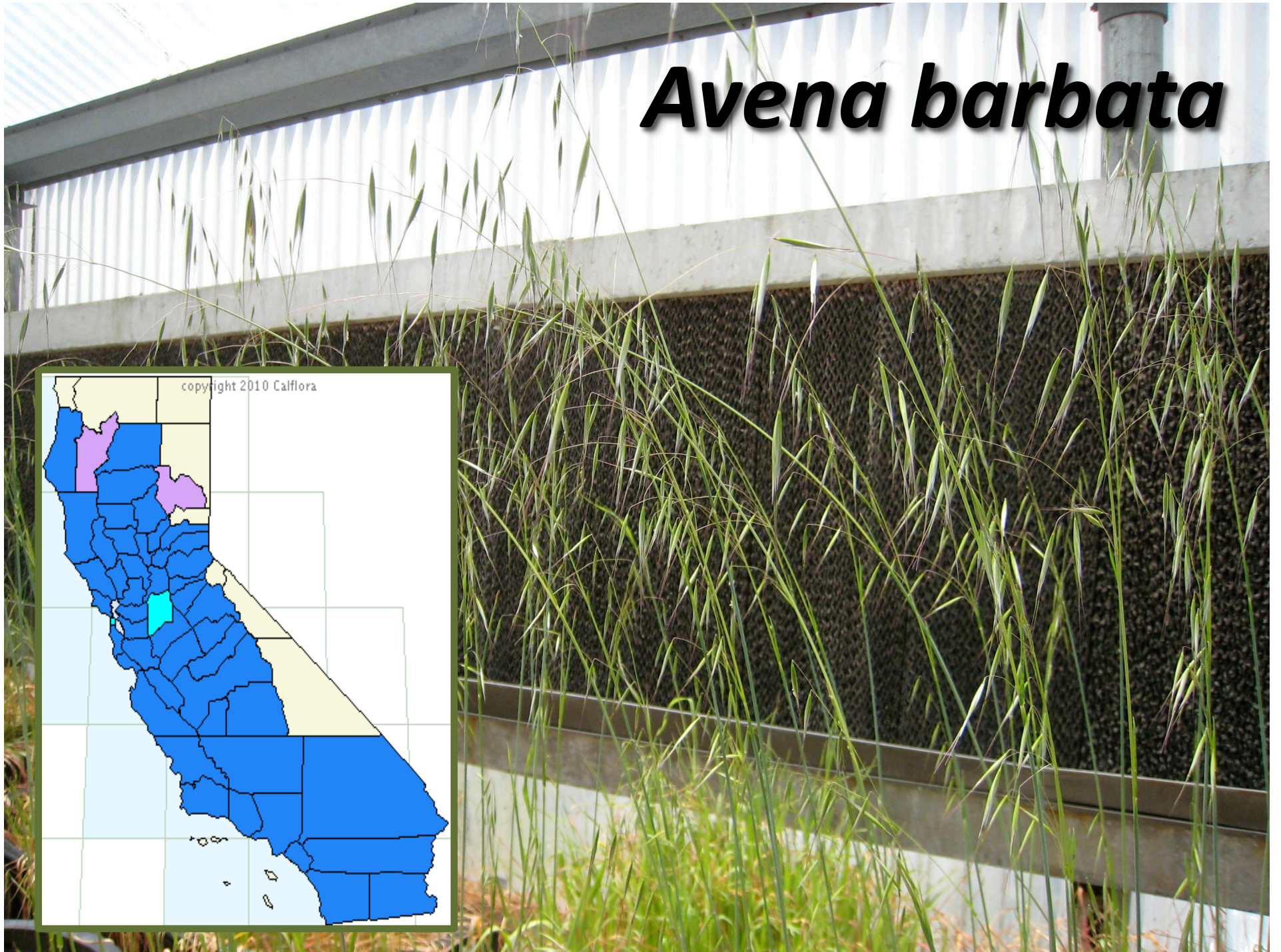
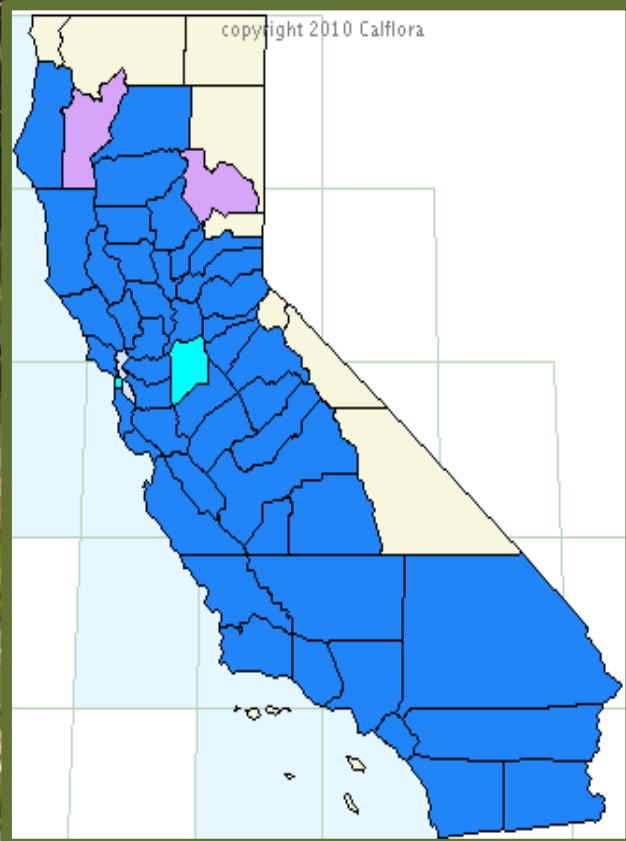
Hypotheses

1. Increasing the species diversity of a resident plant community will decrease invasive population success.
2. Increasing the genetic diversity of an invasive plant population will increase invasive population success.

Study System



Avena barbata

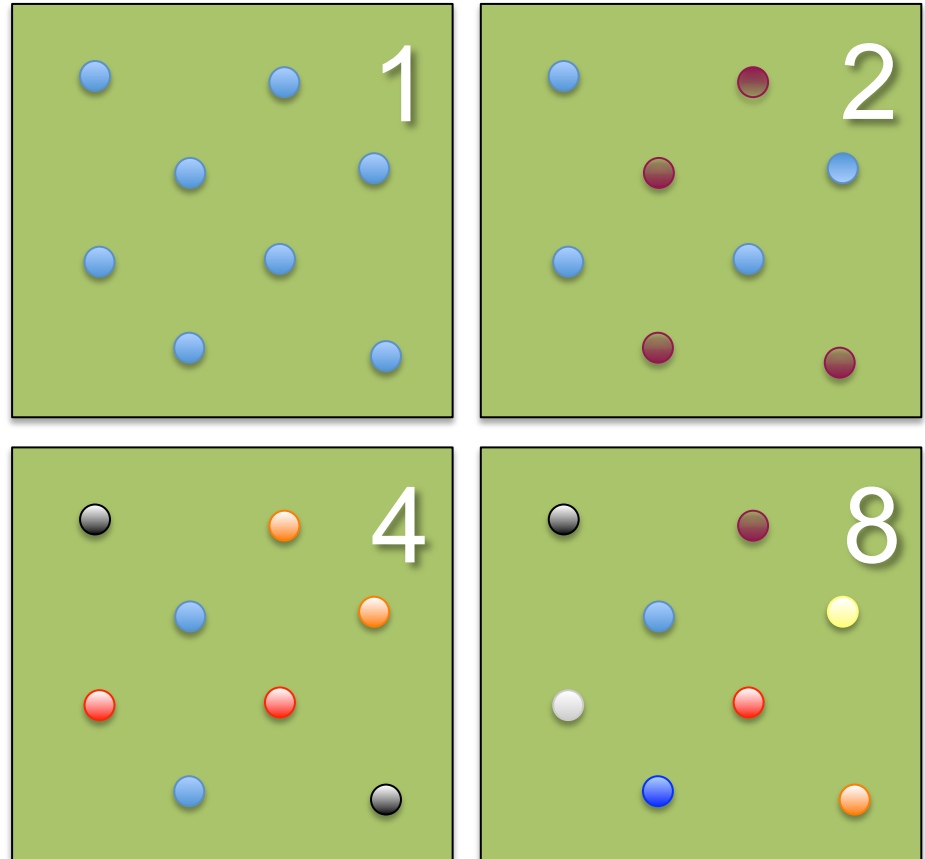


Experimental Design



Assembled Communities that differed in Species Diversity (1-16)

Experimental Design



Invaded communities with *Avena barbata* populations that differed in genetic diversity (1, 2, 4, 8)

Germination



Peak Biomass



Avena Survival



Avena Seed Production



Community Productivity



Community Productivity

A photograph of a diverse plant community. The foreground is dominated by a dense cluster of small, bright yellow flowers. Interspersed among them are several purple flowers and a tall, slender stem with a cluster of blue flowers. The plants are growing in a sandy, light-colored soil. The background shows more green foliage and a few scattered yellow flowers.

**Relative abundance of all 16
native species in each plot**

Resource Availability



Analysis – ANCOVA model



Measured Response variables:

Avena Survival

Avena Seed Production

Community Productivity

Resource Availability

Were predicted by manipulated variables:

Realized species richness (1-16)

Avena genotypic richness (1, 2, 4, 8)

Relative abundance of all 16 native species

Analysis – ANCOVA model



Measured Response variables:

Avena Survival

Avena Seed Production

Community Productivity

Resource Availability

Were predicted by manipulated variables:

Realized species richness

Avena genotypic richness (1, 2, 4, 8)

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Relative abundance of all 16 native species

Analysis – ANCOVA model



Measured Response variables:

Avena Survival

Avena Seed Production

Community Productivity

Resource Availability

Were predicted by manipulated variables:

Realized species richness

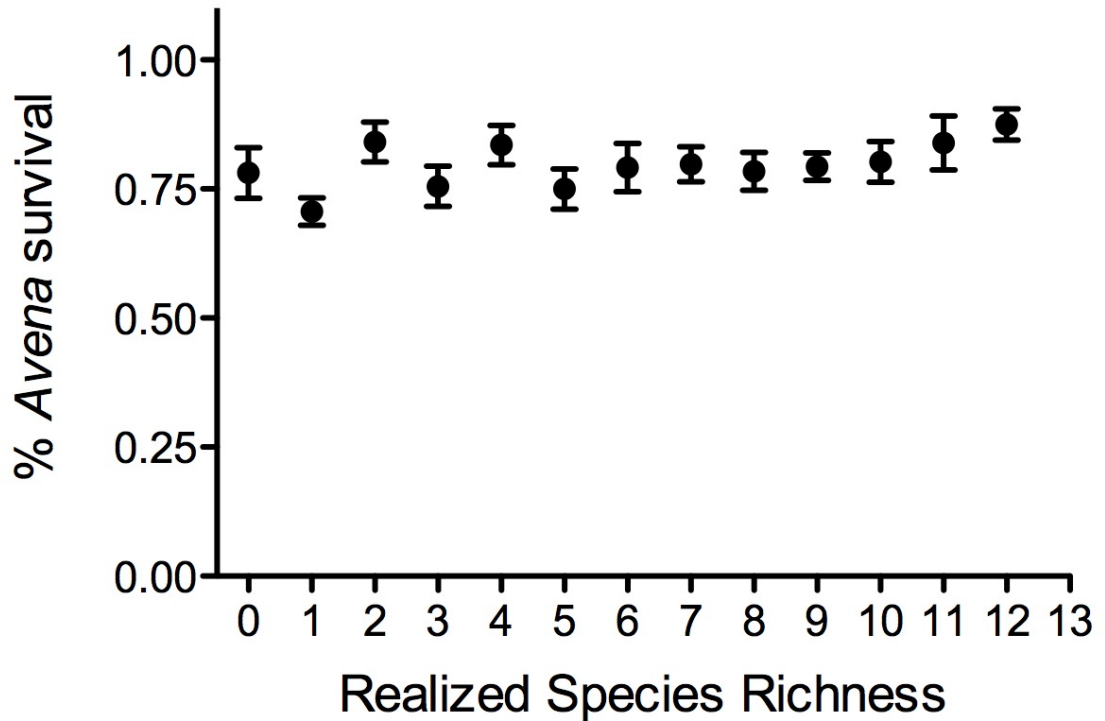
Avena genotypic richness (1, 2, 4, 8)

Relative abundance of all 16 native species

***Avena* survival not influenced by resident species diversity**

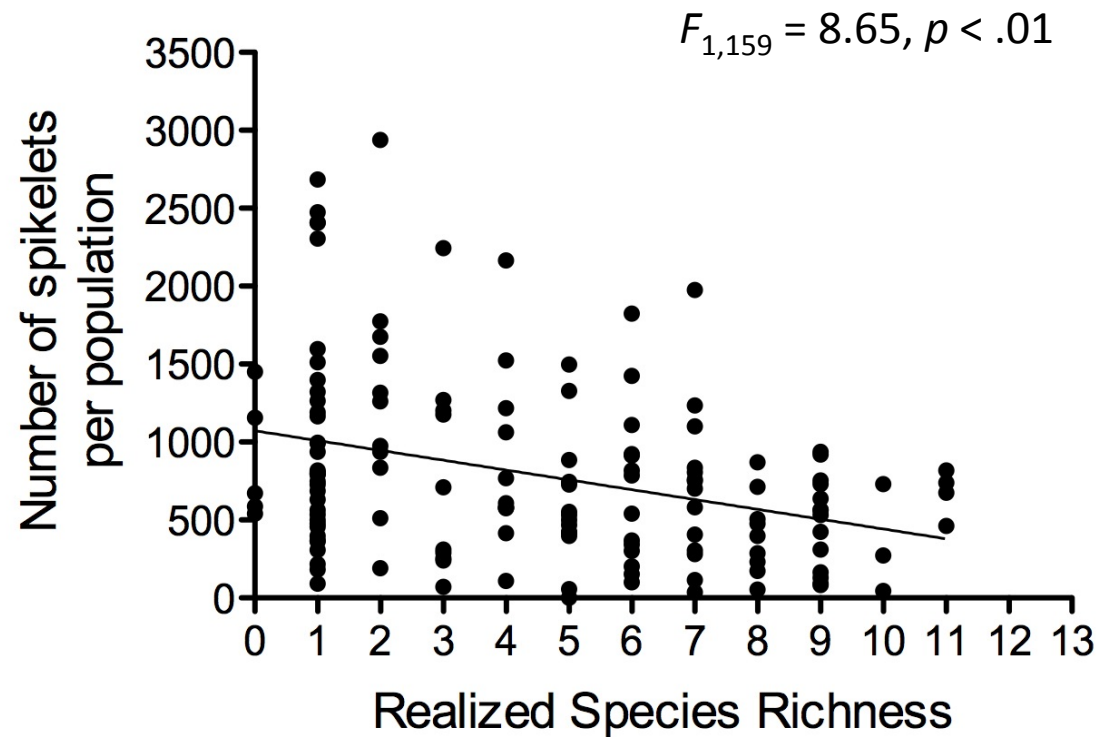


$F_{1,287} = 0.37, p > .05$



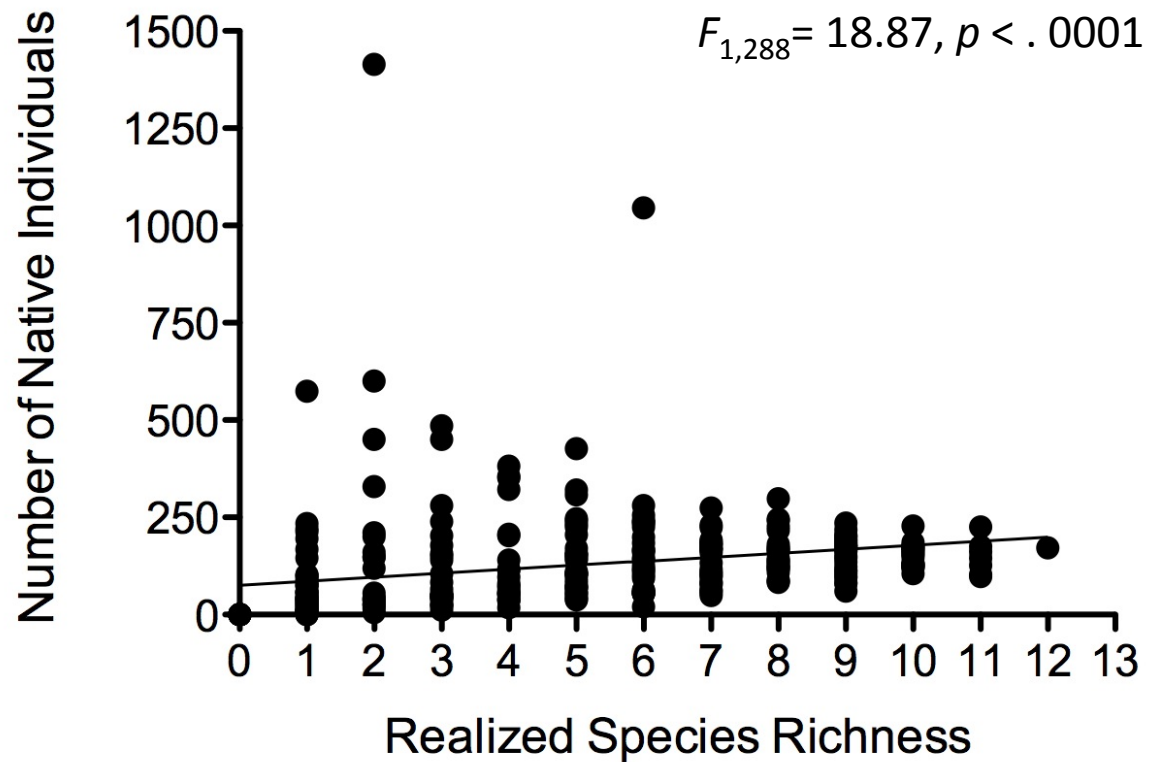


***Avena* seed production decreased with species diversity**



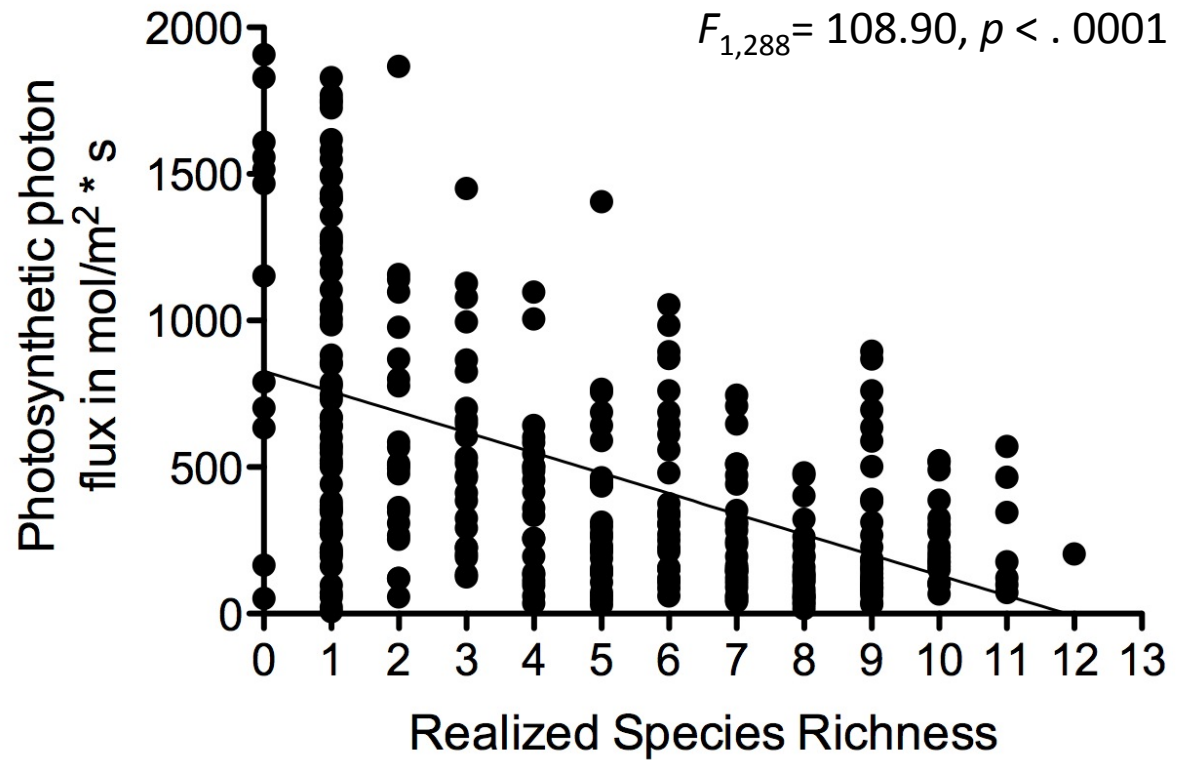


Community productivity increased with species diversity

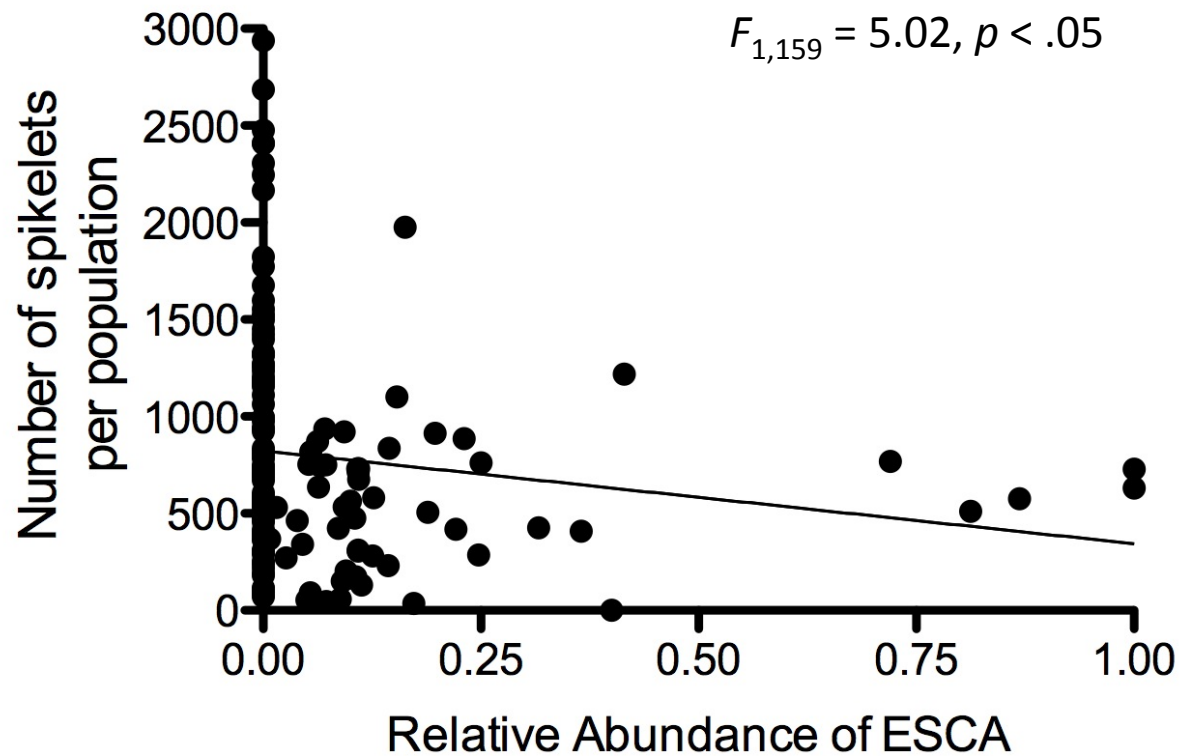




Light availability decreased with species diversity



***Avena* seed production decreased with abundance of poppies**



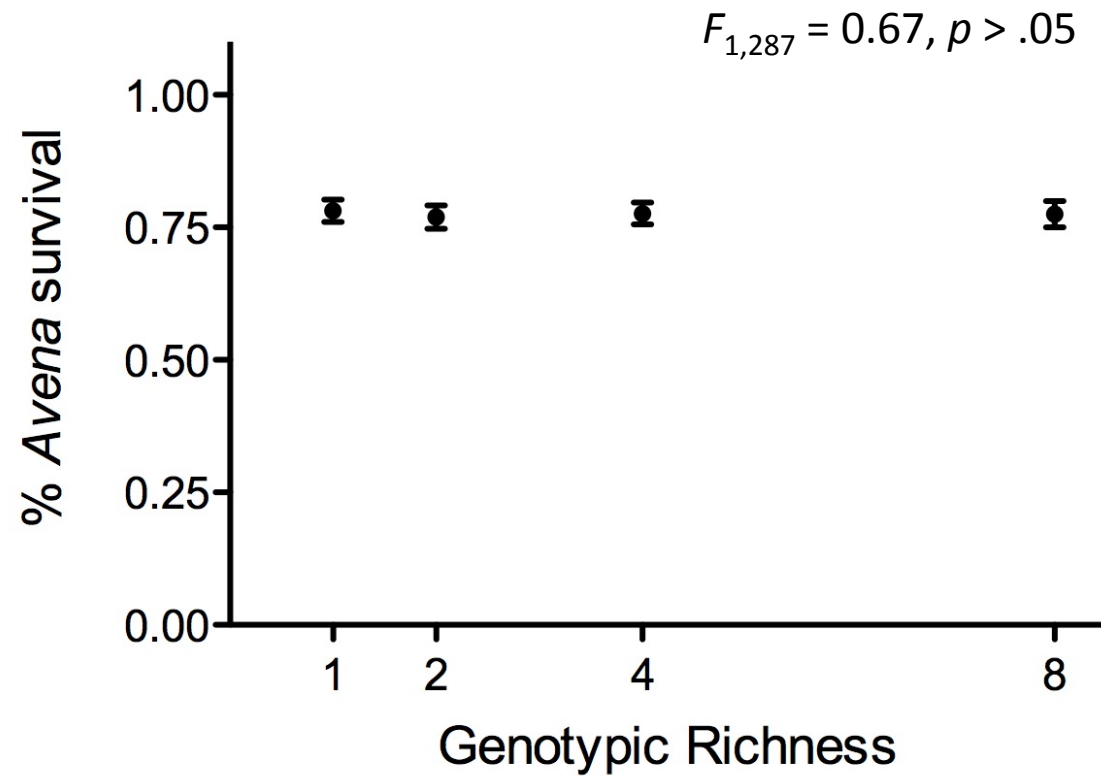


Summary – Hypothesis 1

Increasing species diversity of a resident plant community did not affect *Avena* survival but did decrease seed production.

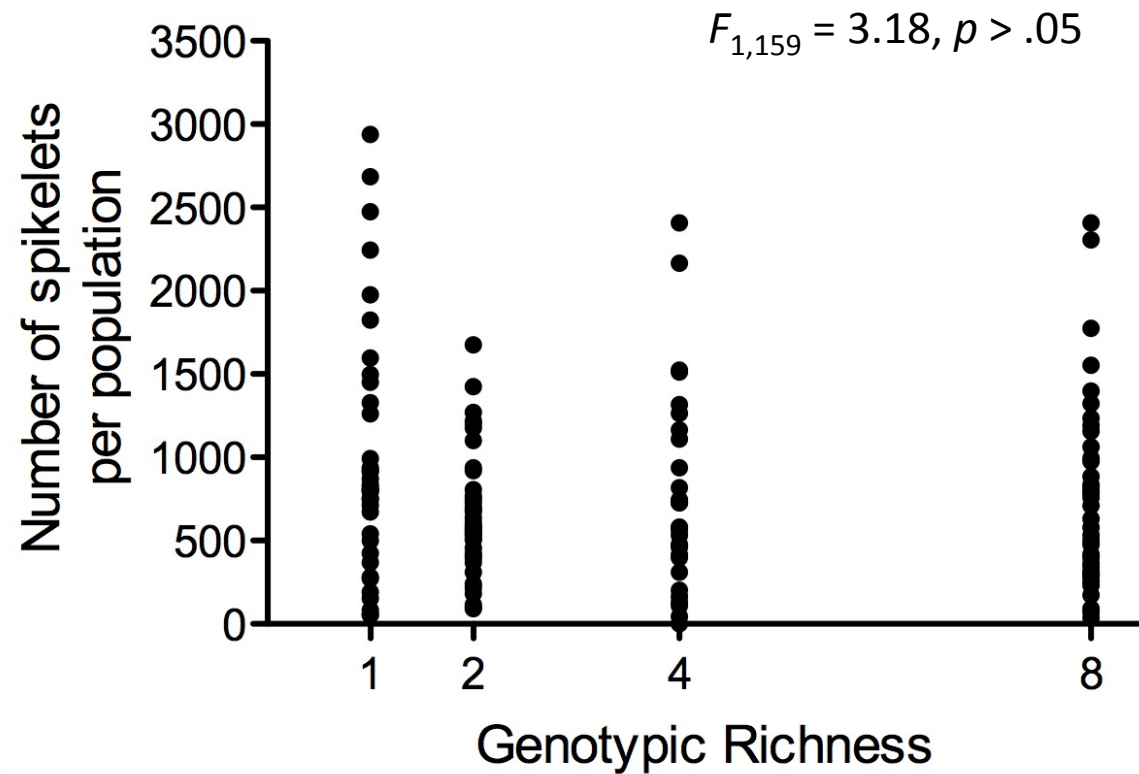
- **Increasing community productivity**
- **Decreasing light availability**
- **Presence of *Eschscholizia californica***

***Avena* survival not influenced by genetic diversity**

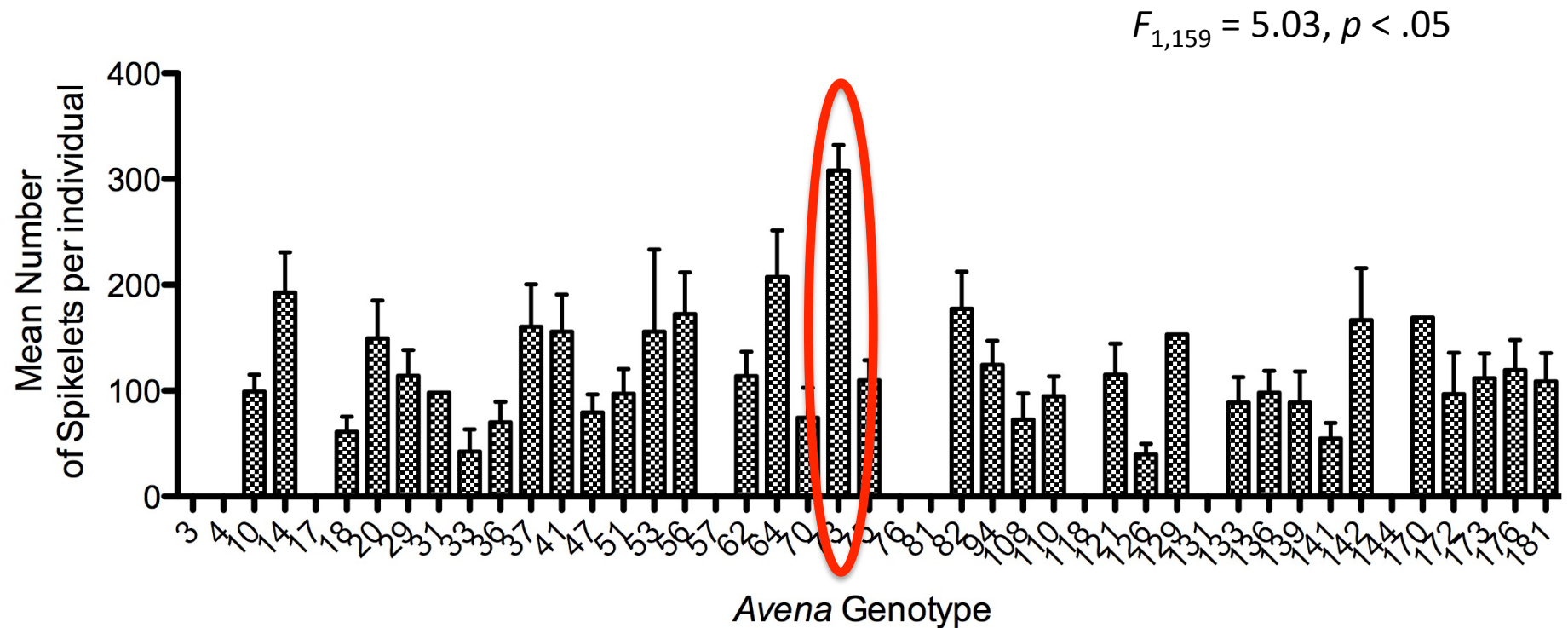




***Avena* seed production not influenced by genetic diversity**



Avena genotypes differed in seed production





Summary – Hypothesis 2

Increasing genetic diversity of invasive *Avena* populations did not affect *Avena* survival or seed production.

However, individual seed production differed between genotypes regardless of diversity.



Conclusions

- Abiotic factors may be more important for establishment and survival but biotic factors are important for fitness
- During a single generation species diversity is more important than genetic diversity for invasive success.
- Over time, selection may act to increase the number of highly productive invasive genotypes



Conclusions

- Conserve native species diversity
- Restore California grasslands with a diverse mix of species
- Focus eradication efforts on the most productive invasive individuals



Acknowledgements

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- **Dr. Kailen Mooney**
- **Dr. Art Weis**
- **Dr. Bob Latta**
- **Suding Lab**
- **Wonderful Bio 199 Students**





Photo Credits

Amsinkia: <http://www.vernalpools.org/Mather/tour/early/01amsint.htm>

Lasthenia: <http://www.coepark.org/wildflowers/yellow/lasthenia-californica.html>

Calandrinia: <http://www.fireflyforest.com/flowers/290/calandrinia-ciliata-fringed-redmaids/>

Hemizonia: <http://www.sdnhm.org/fieldguide/plants/dein-fas.html>

Heterotheca: <http://www.calflora.net/recentfieldtrips/whitewatercanyon09.html>

Eremocarpus: <http://www.flickr.com/photos/randomtruth/2672782212/sizes//in/photostream/>

Stephanomeria: <http://es.wikipedia.org/wiki/Stephanomeria>

Cryptantha: http://calphotos.berkeley.edu/cgi/img_query?enlarge=8253+3202+0179+0117

Eschscholzia: <http://www.laspilitas.com/nature-of-california/plants/eschscholzia-californica>

Lupinus suc.: <http://www.fireflyforest.com/flowers/1463/lupinus-succulentus-hollowleaf-annual-lupine/>

Lupinus bi.: <http://www.flickriver.com/photos/26446889@N04/popular-interesting/>

Lotus: <http://www.pbase.com/lethrus/wildflowers>

Bromus: <http://www.flickr.com/photos/36764294@N00/153066057/>

Vulpia: <http://www.flickr.com/photos/38213125@N00/2344925555/>

Melica: http://calphotos.berkeley.edu/cgi/img_query?query_src=&where-photographer=Tom+Annese&orderby=taxon

Nassella: http://www.larnerseeds.com/pages/native_grass_seed.html

Avena: <http://www.arizonacrop.org/weeds/wildoats.html>

Avena Distribution: http://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=1017

California map: <http://www.50states.com/maps/california.htm>

Spain Map: <http://www.enchantedlearning.com/europe/iberia/outlinemap/>