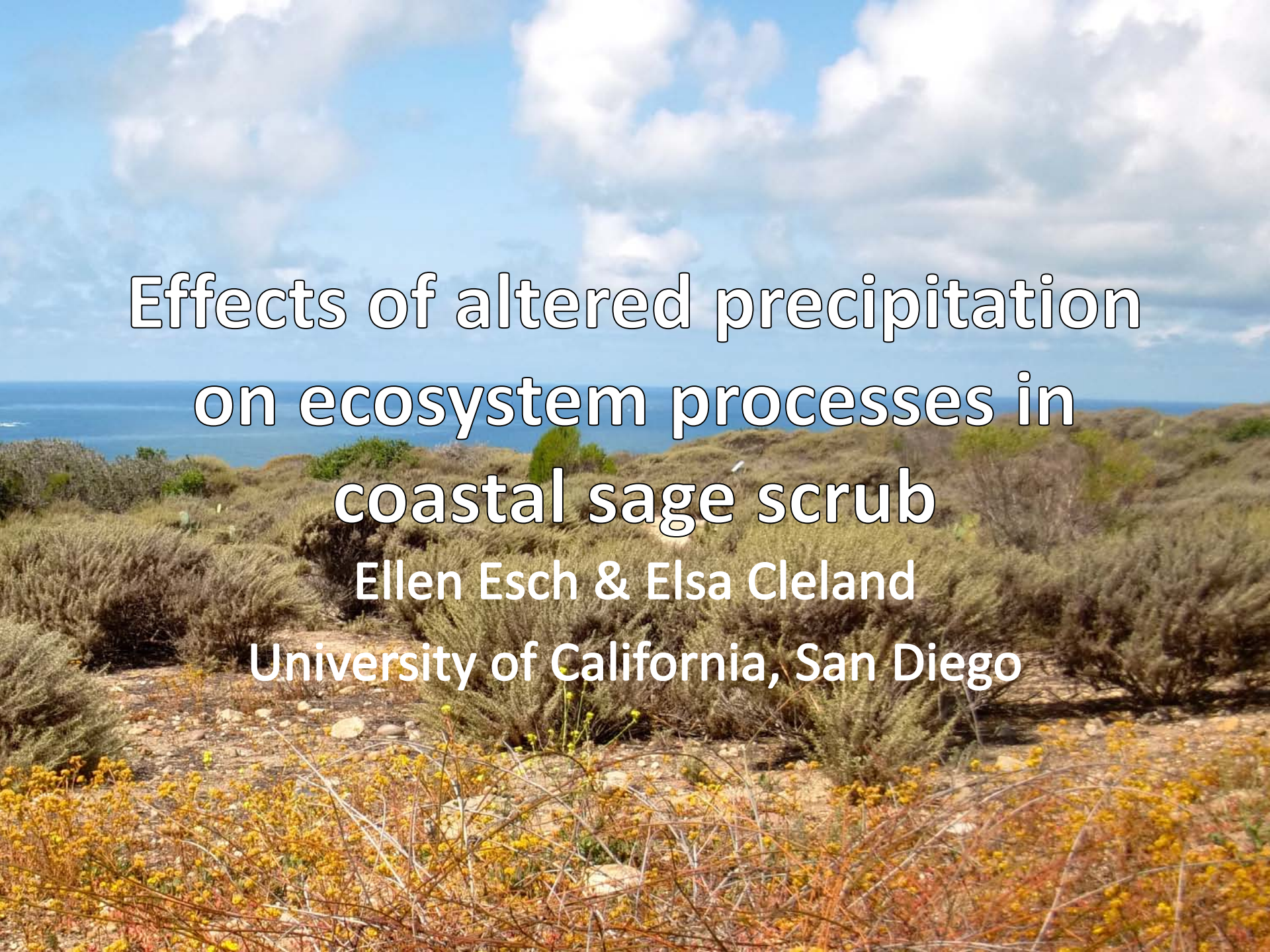


Effects of altered precipitation on ecosystem processes in coastal sage scrub

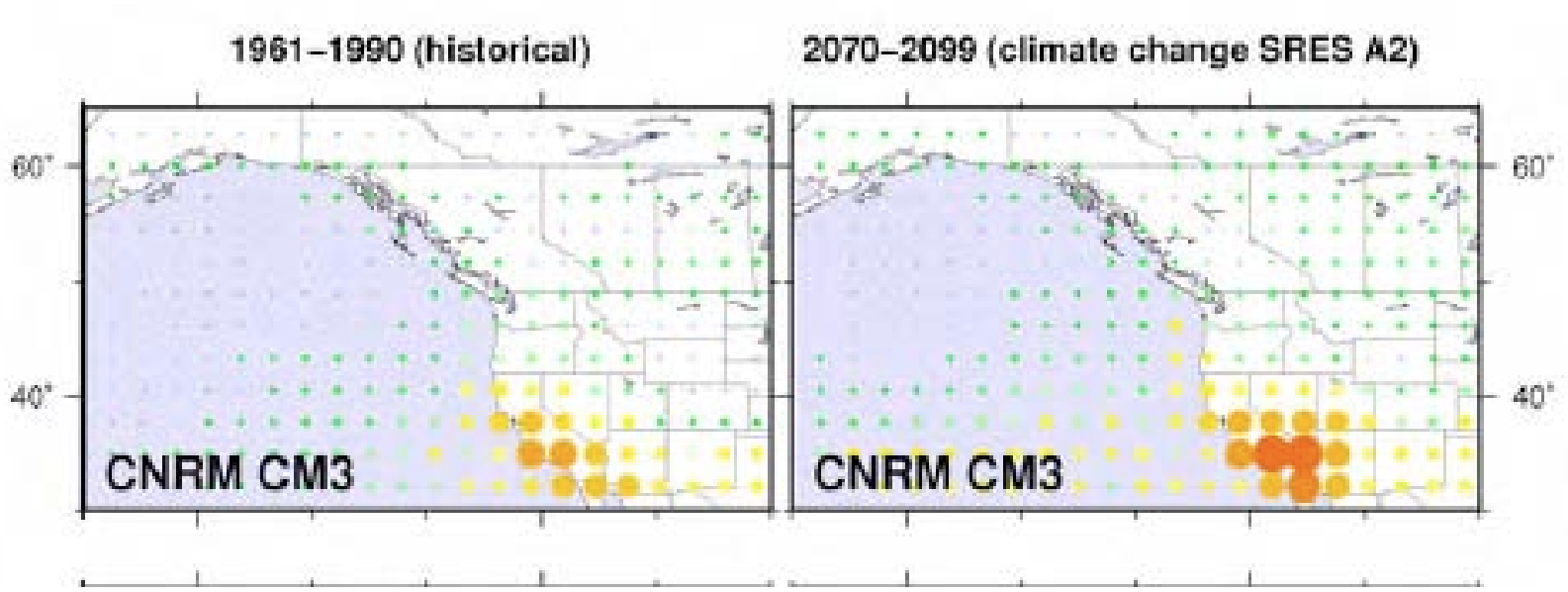
Ellen Esch & Elsa Cleland

University of California, San Diego

Carbon cycling

Coastal Sage Scrub

Rainfall variability to increase



Cayan et al. 2009

Problematic invasion by exotic grasses

Hypotheses

- Altered precipitation will affect **productivity**, with exotic dominated communities being more dynamic in their response. Native community productivity expected to be more stable across precipitation scenarios.

- Decreased precipitation will slow **decomposition** overall. Exotic litter will be more readily degraded than native litter thanks to differences in litter quality.

Experimental design

50% rainfall

100% rainfall

150% rainfall

Native Dominated

Exotic Dominated

calphotos.berkeley.edu

Carbon calculations

50% rainfall

100% rainfall

150% rainfall

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Productivity

- NDVI
  - Integrative ecosystem measure of carbon gain

Productivity

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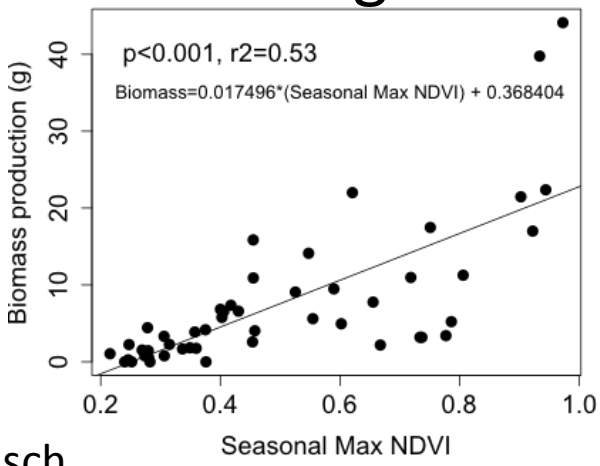
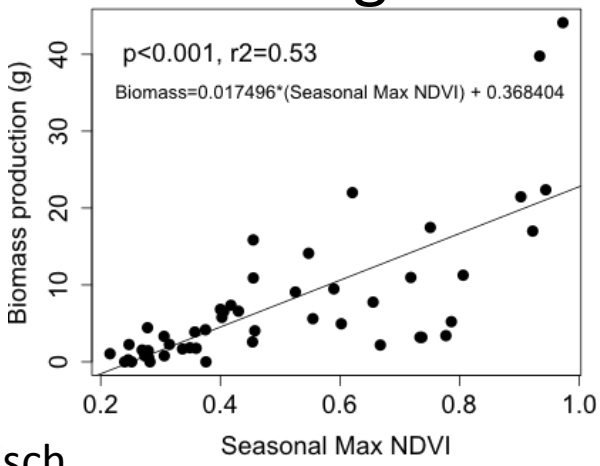


Esch unpublished data

Productivity

- NDVI
  - Integrative ecosystem measure of carbon gain



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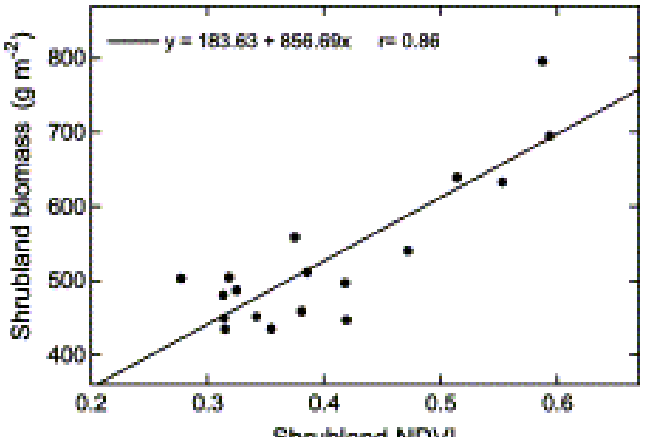
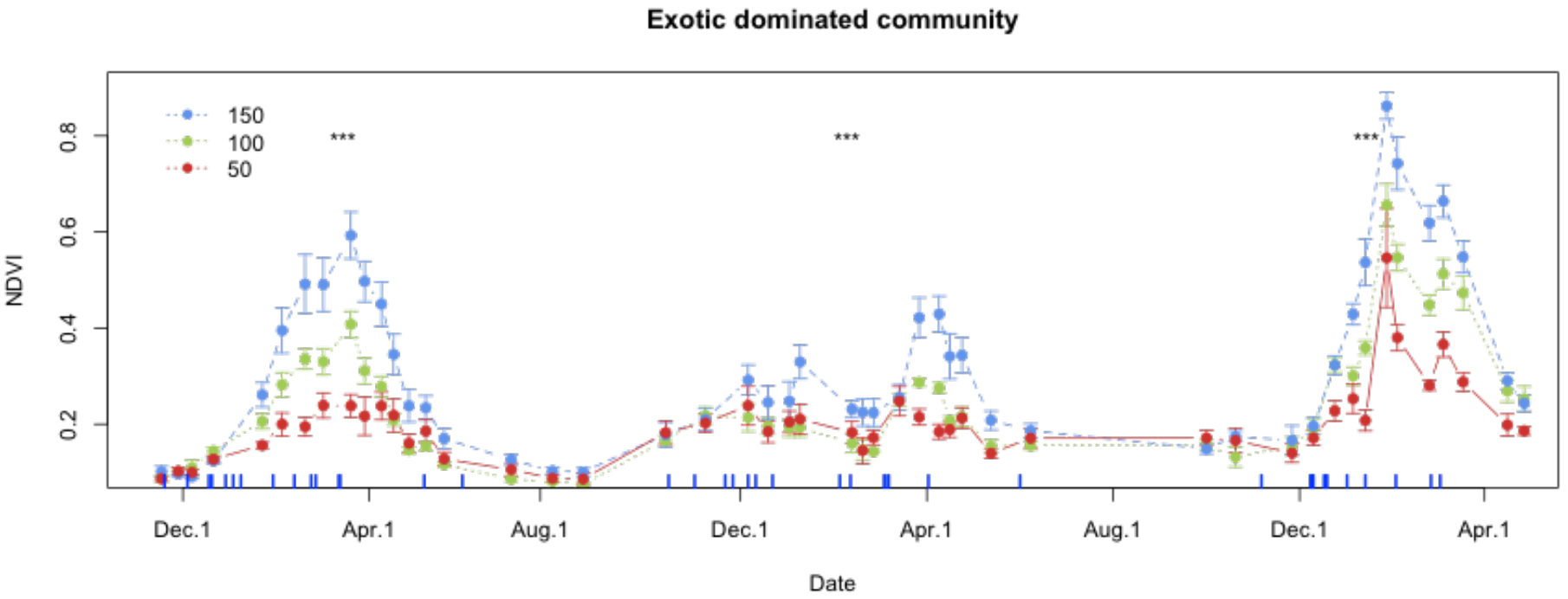


Filella et al. 2004 Remote Sensing of Environment

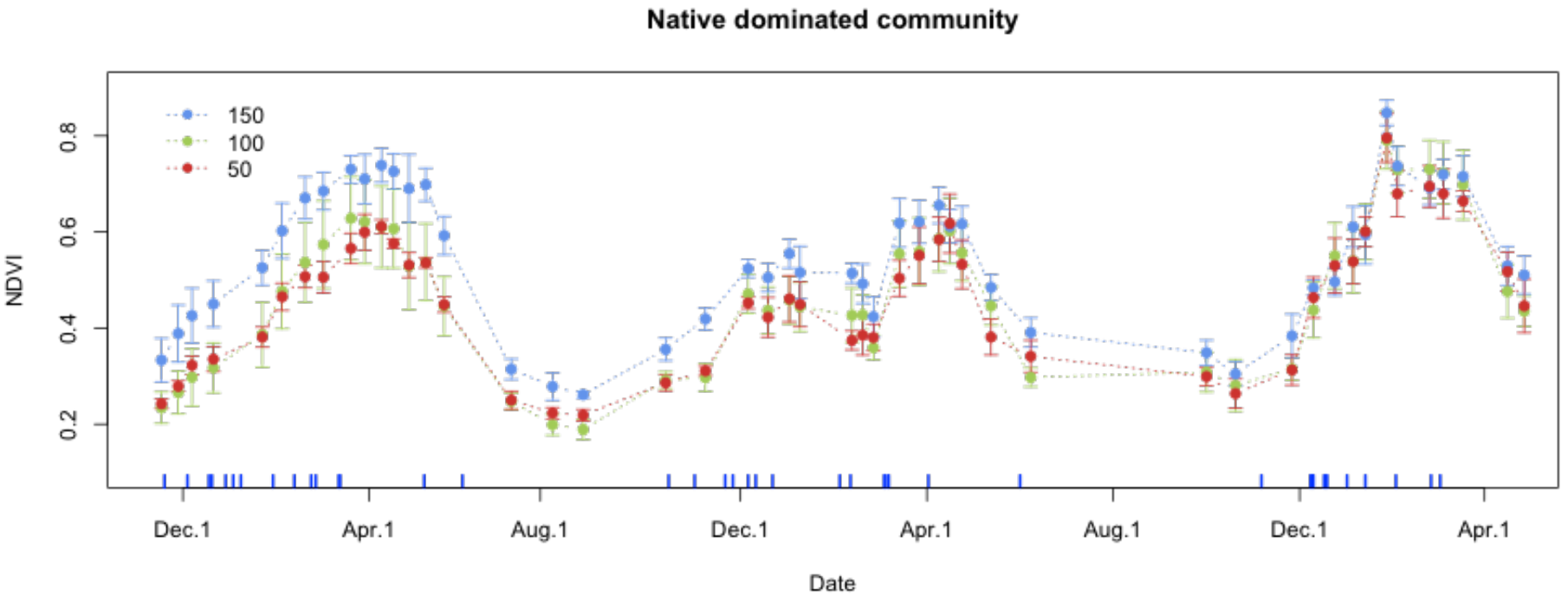
Phenology tracks rainfall



- Productivity is highly sensitive to rainfall

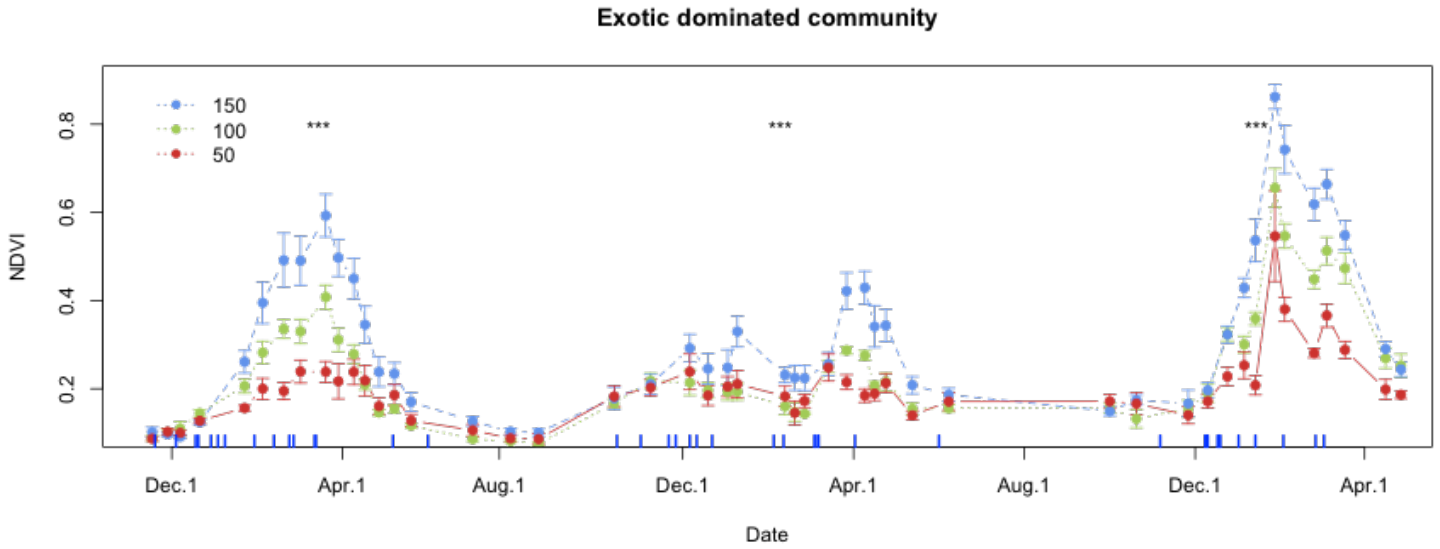
* Indicates significant treatment differences in repeated measures ANOVA

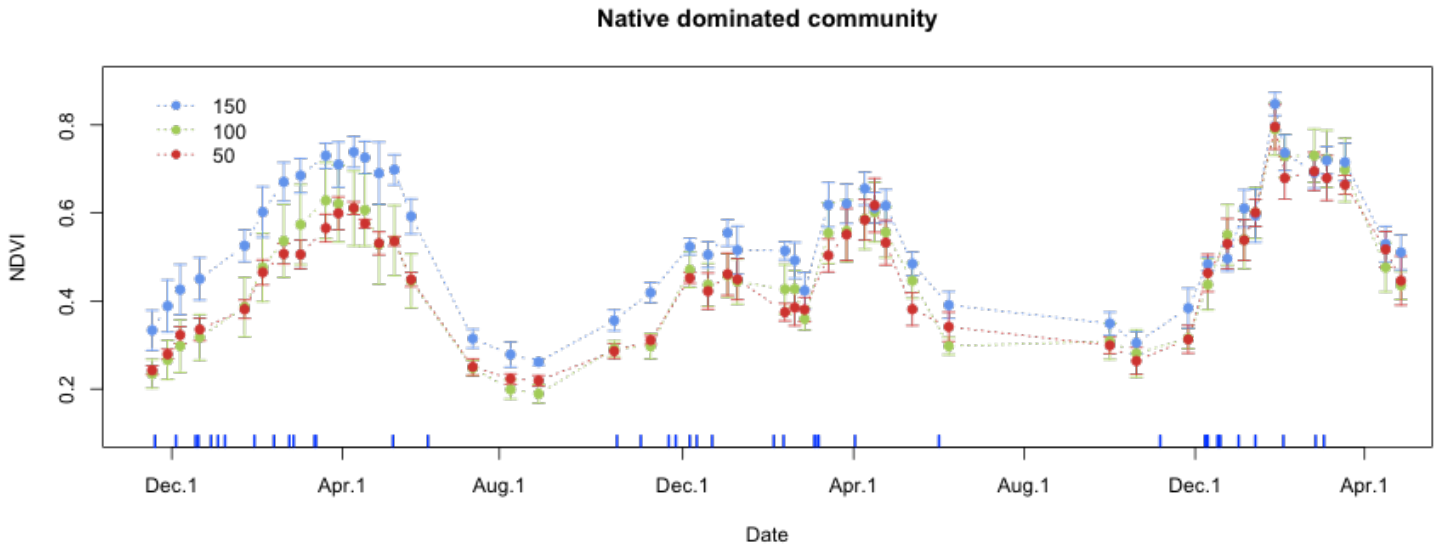
Phenology tracks rainfall



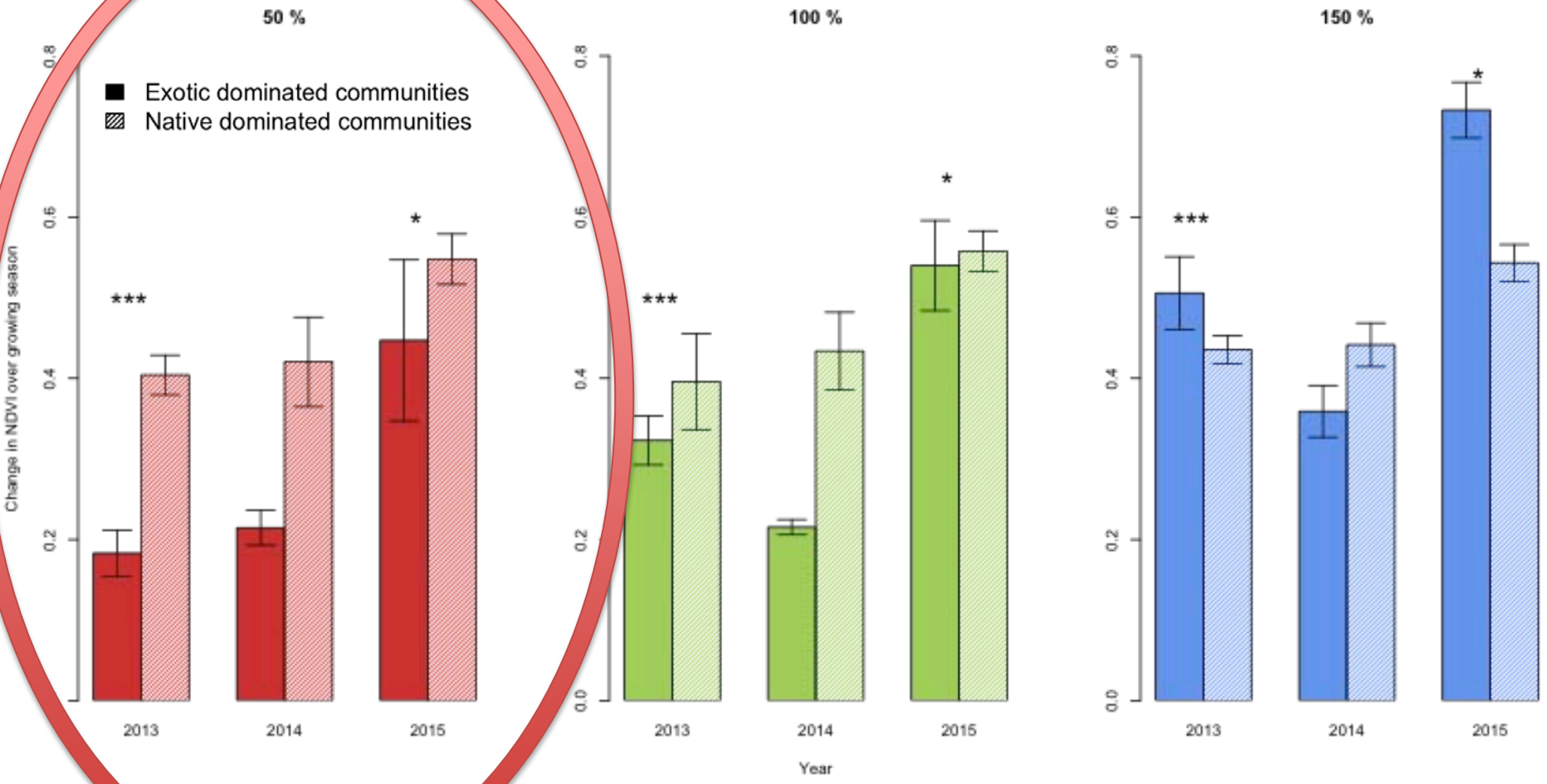
- More subtle differences across rainfall treatments.

Magnitude between treatments is greater for exotic communities



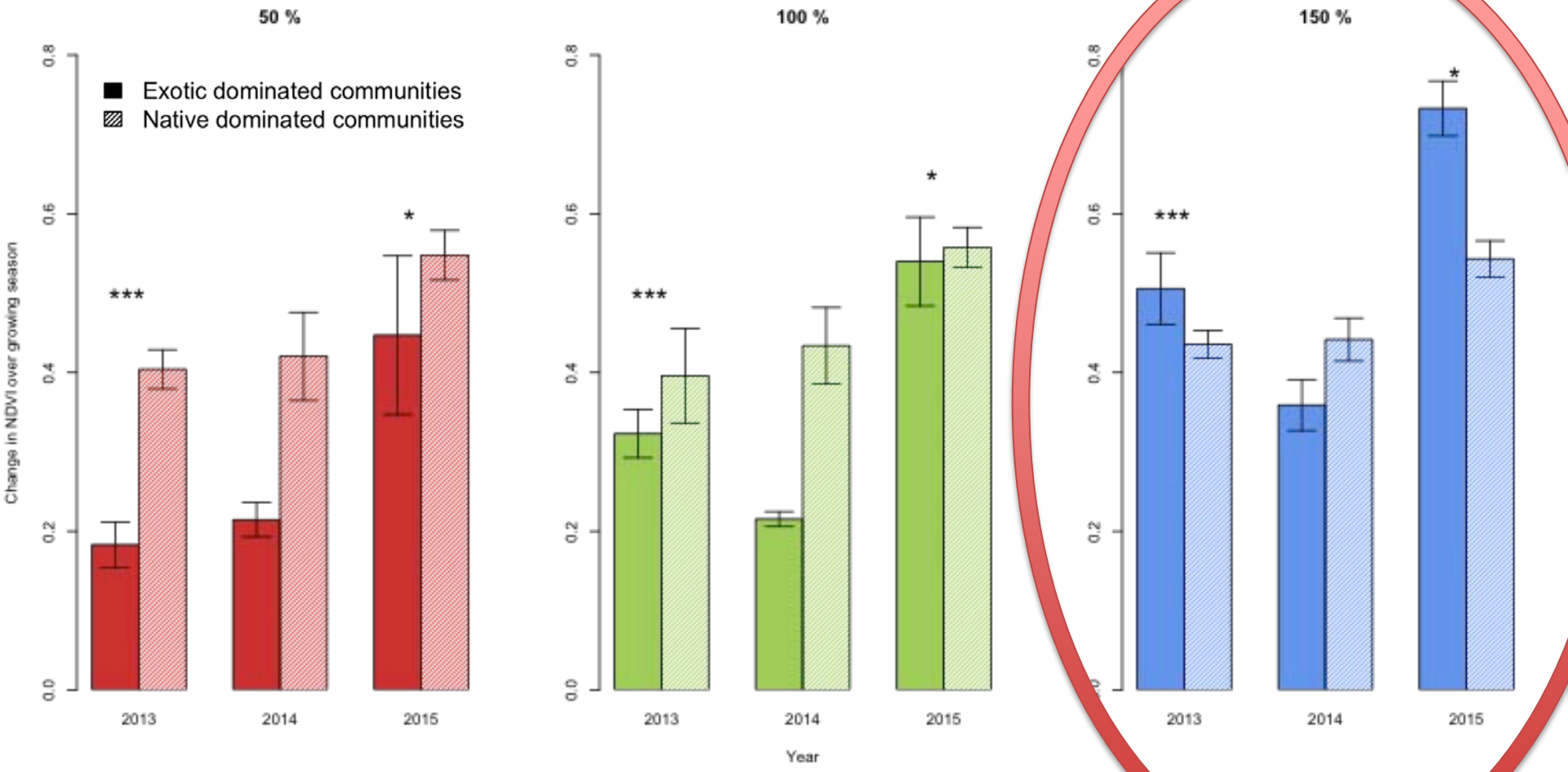


Native communities are more productive in drought scenarios



* = significant rainfall x community composition interaction for that year

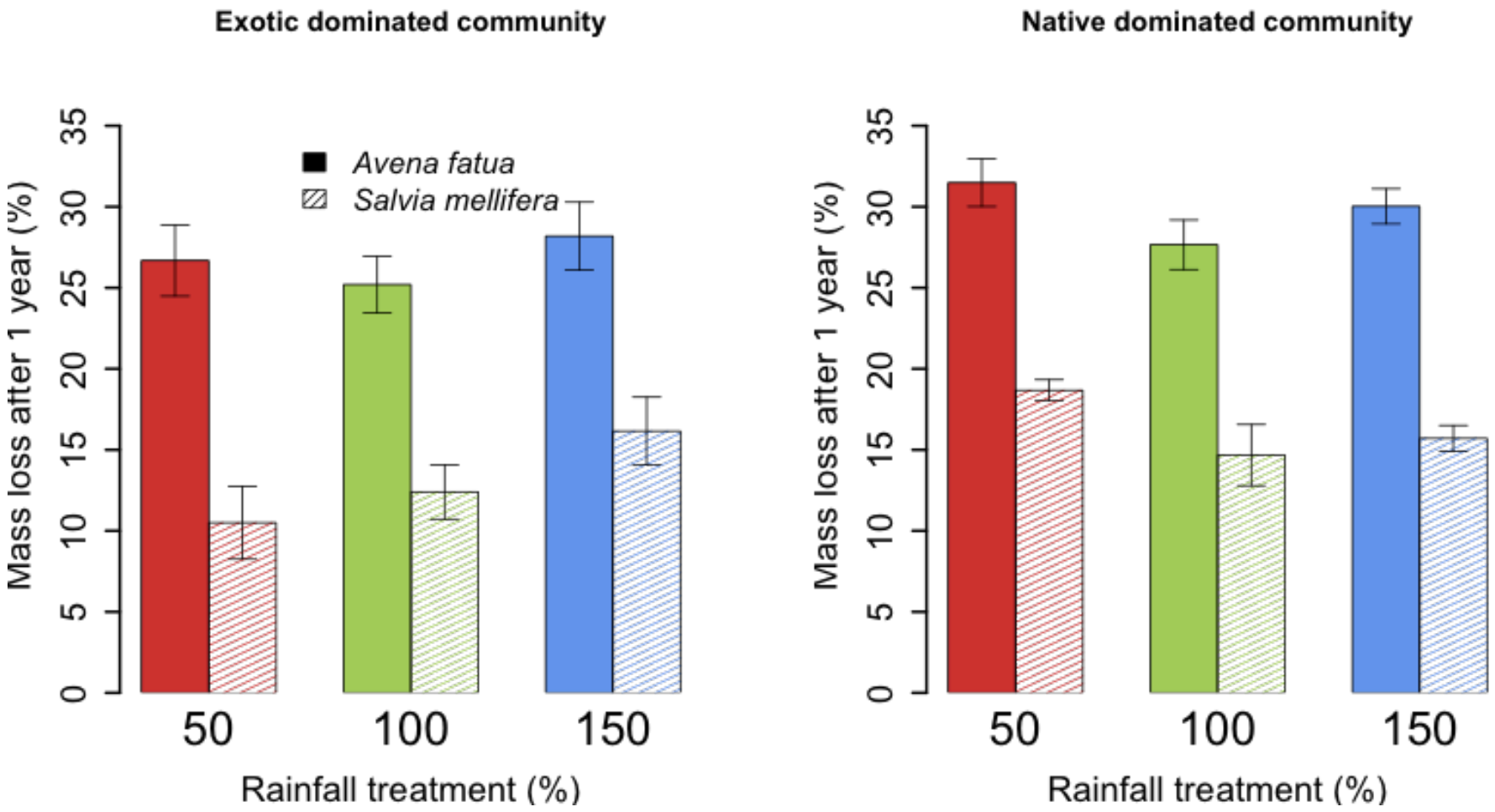
Exotic communities are more productive in high rainfall years



* = significant rainfall x community composition interaction for that year

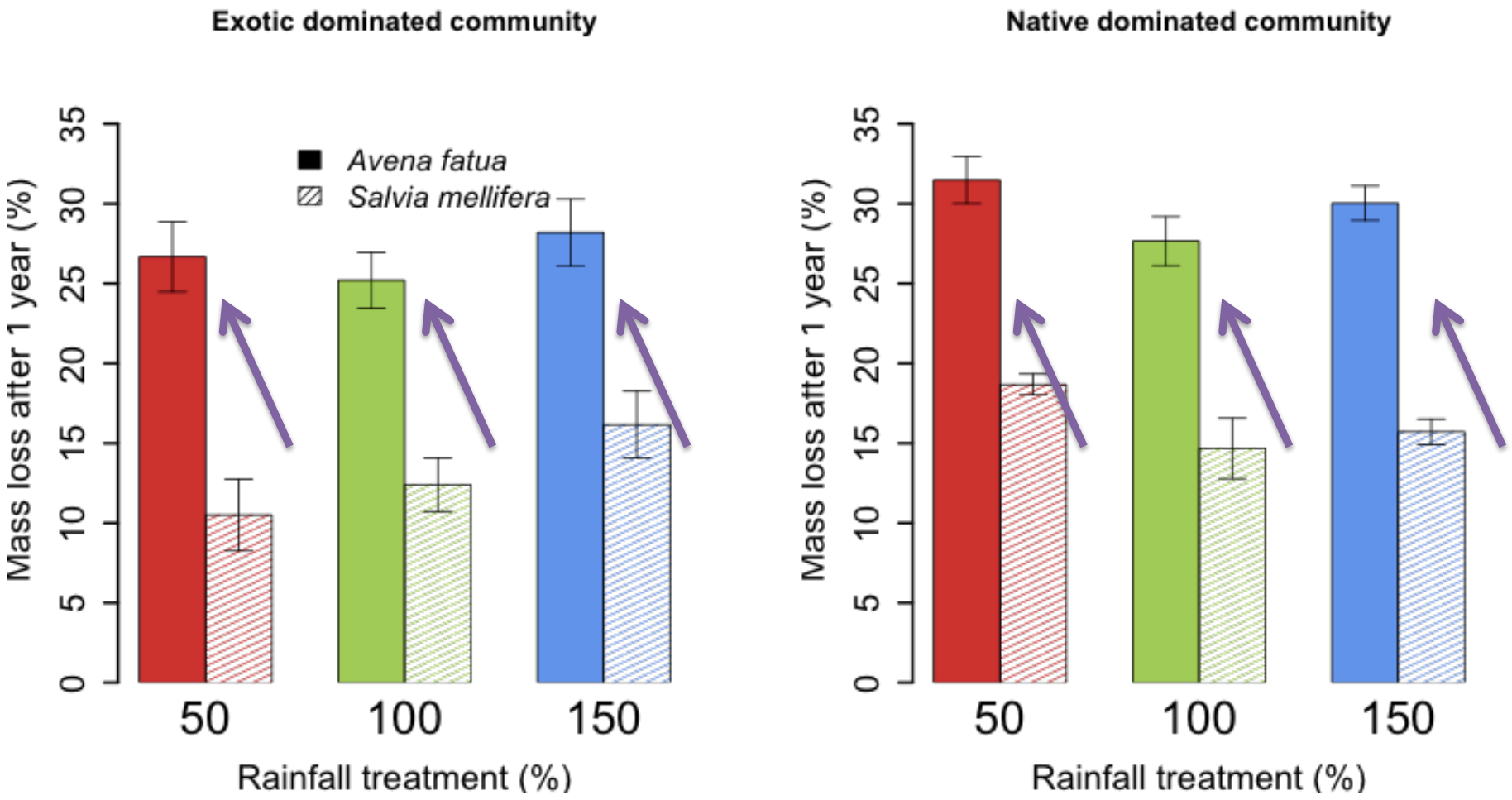
Decomposition

Exotic decomposes faster than native litter



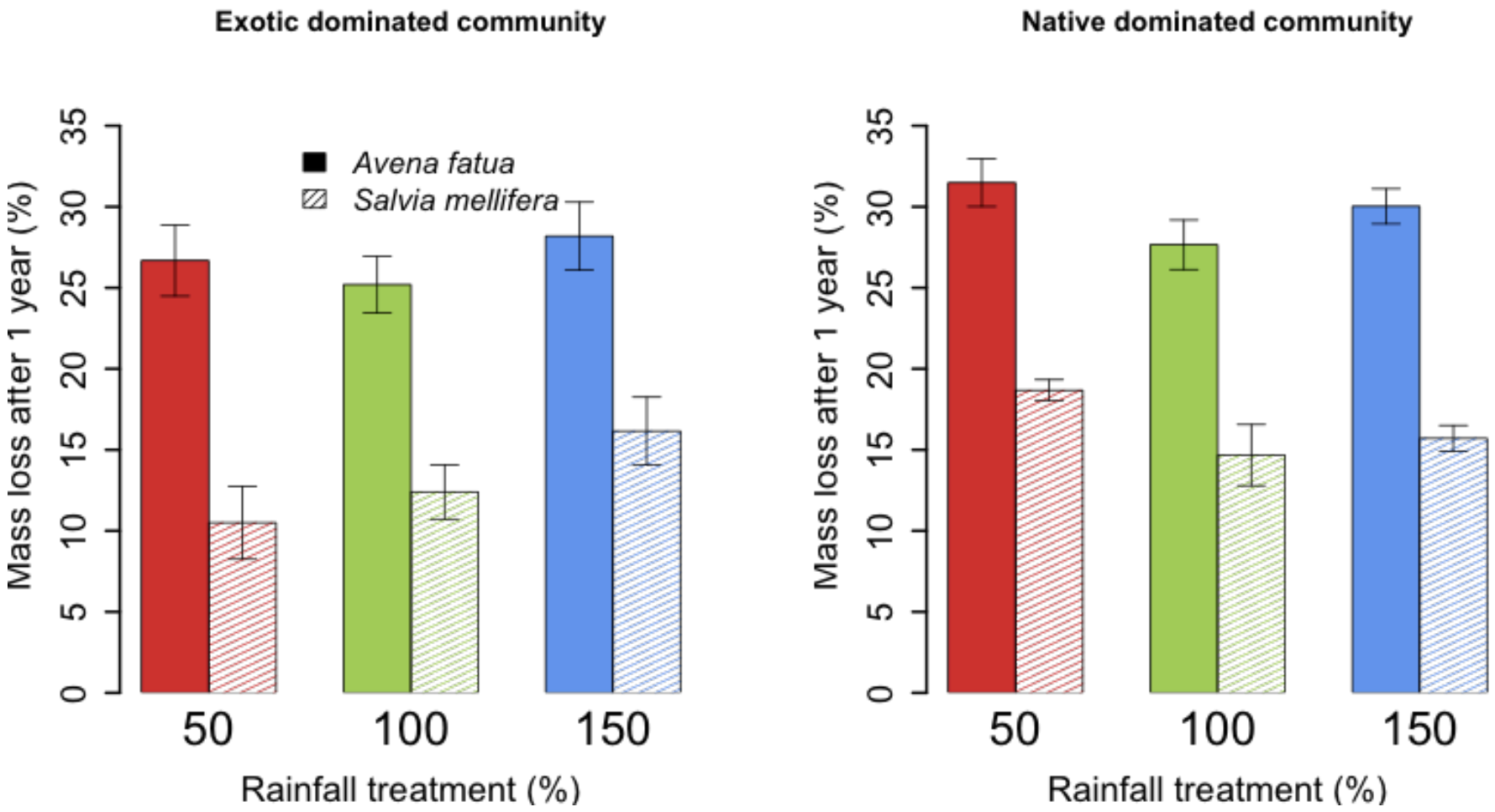
p<0.001 for species in both community types

Exotic decomposes faster than native litter



p<0.001 for species in both community types

Decomposition rates are insensitive to rainfall regime



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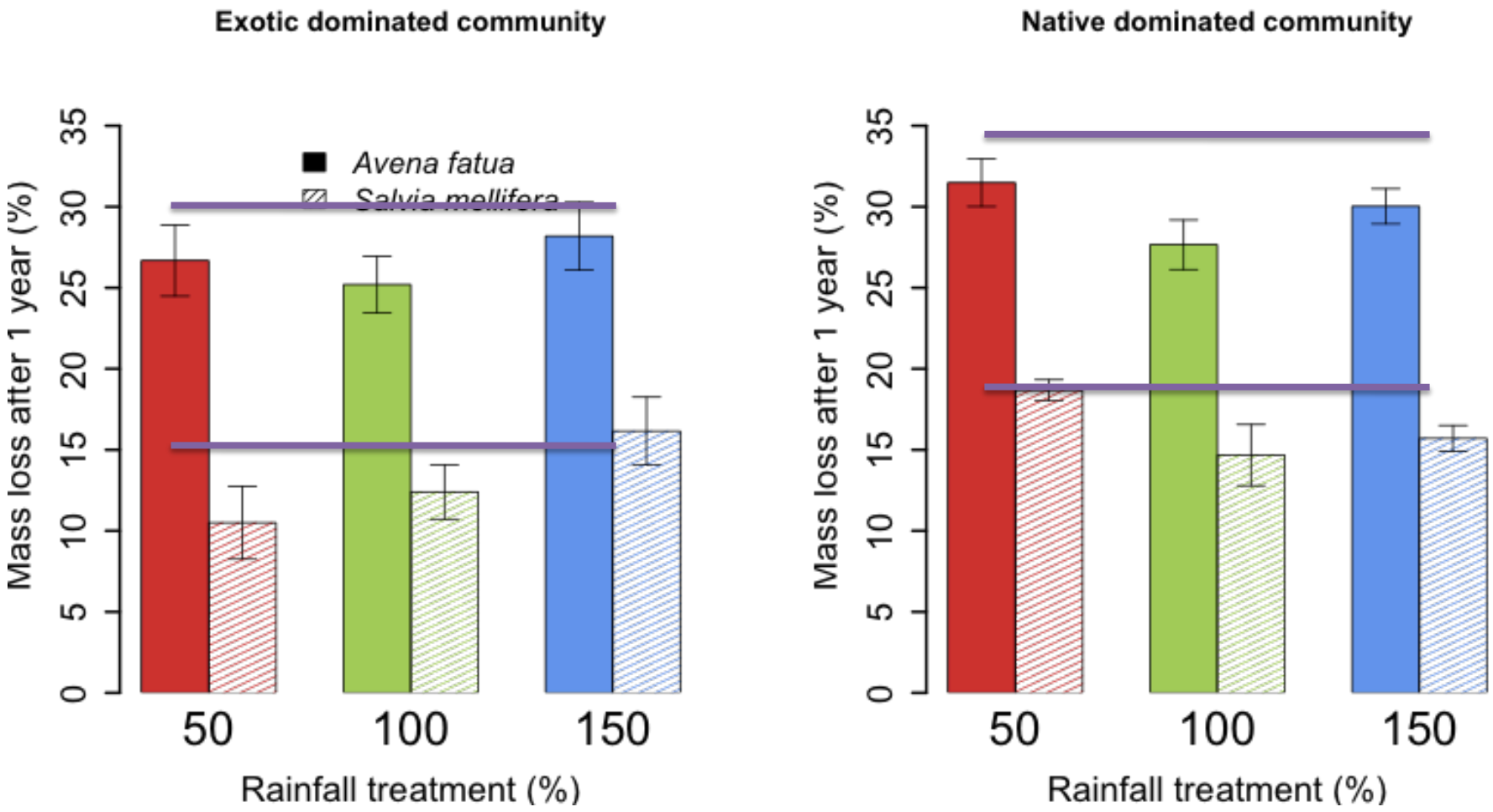


p<0.001 for species in both community types

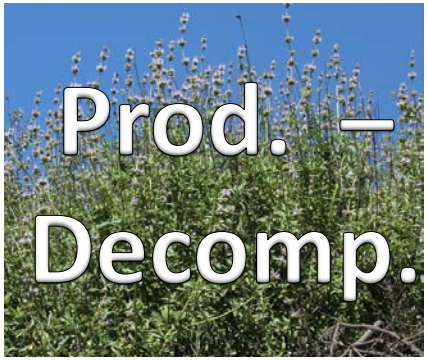
Carbon calculations

50% rainfall

100% rainfall

150% rainfall

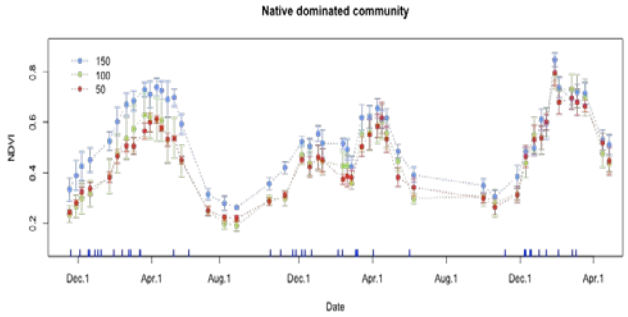
Native Dominated

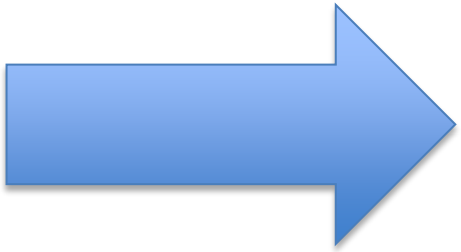


Exotic Dominated

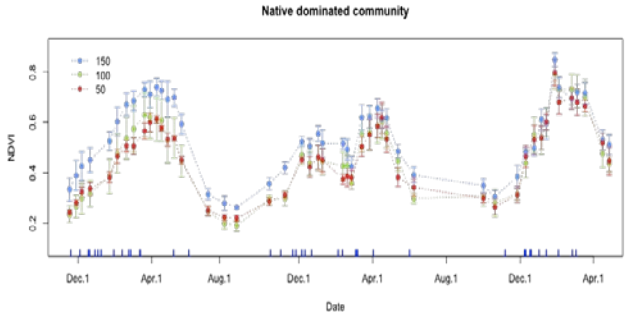
calphotos.berkeley.edu

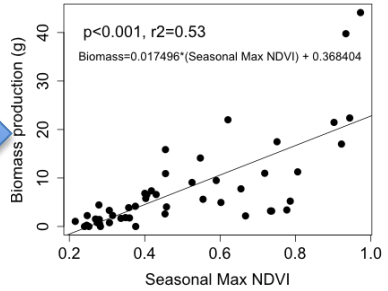
Carbon calculations

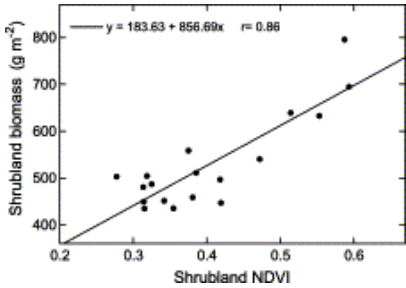




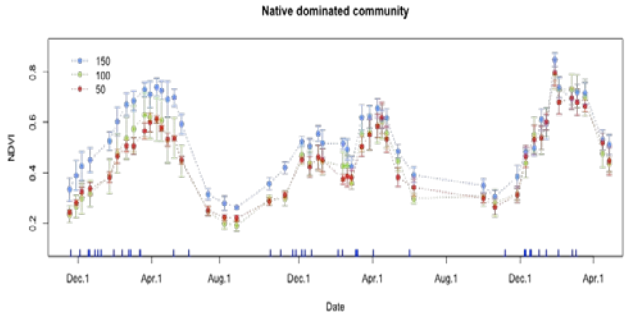
Carbon calculations

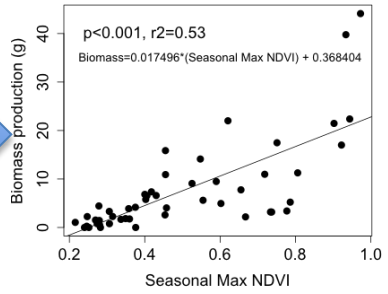


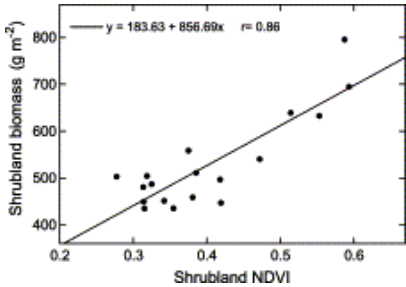




Carbon calculations

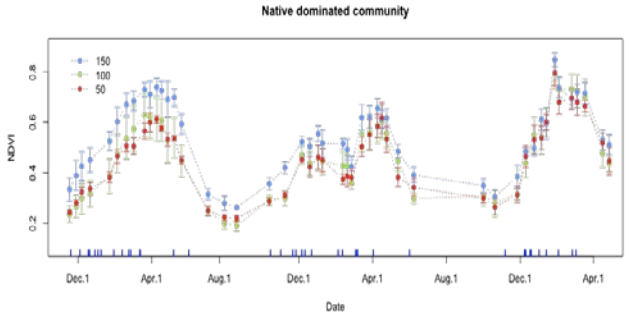


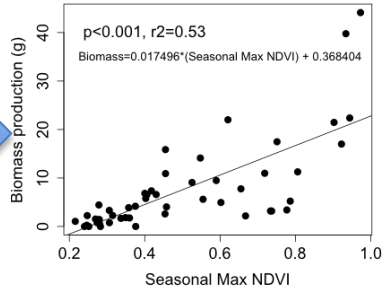


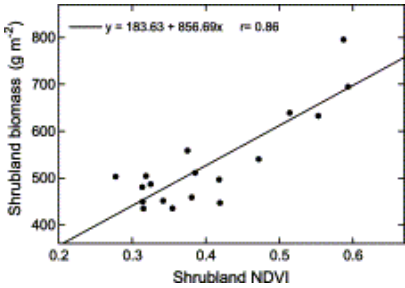


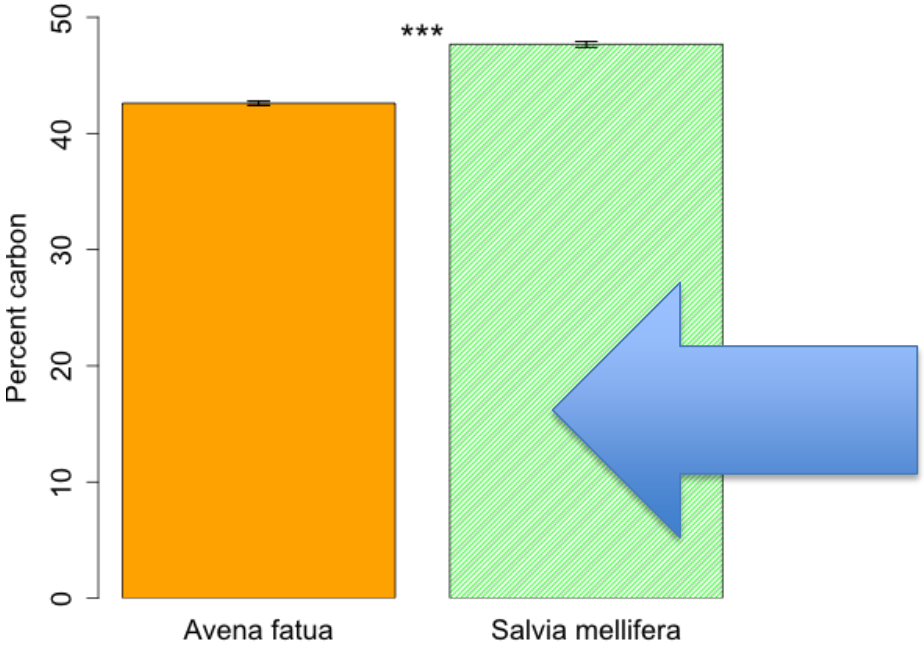
Carbon calculations

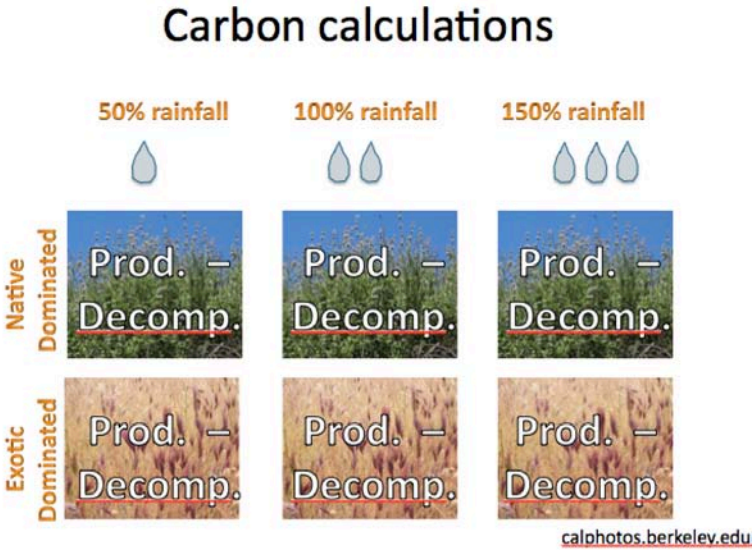
Carbon calculations



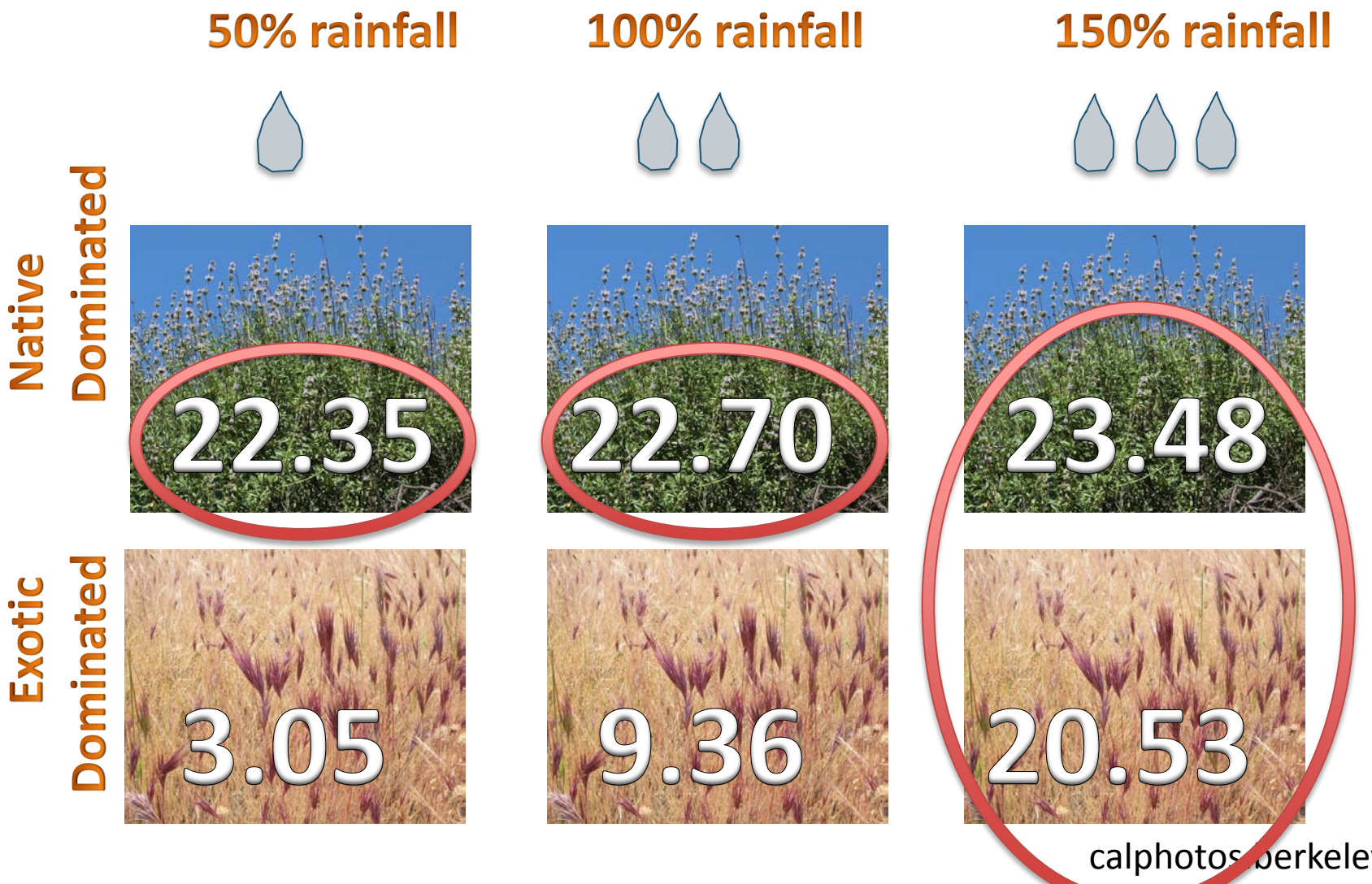








Estimate gC/m^2 gain



Conclusions

- Under drought conditions, greatest carbon sequestration will occur in native dominated communities
  - Coupled with low decomposition rates, this can be an important carbon sink
- High rainfall years will promote greater carbon sequestration by exotics, especially when associated with invasion into native dominated areas
  - High decomposition rates of exotic litter minimizes the actual carbon sink
- Invasion is likely to have a larger impact on ecosystem functioning than shifting rainfall regimes

Thank You!

Ralph Keeling
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Jen Shih

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NSF GRFP
CA Native Plants
Messier Fund
Mathias

Questions?