Managing California rangelands:
implications of weather patterns on plant composition

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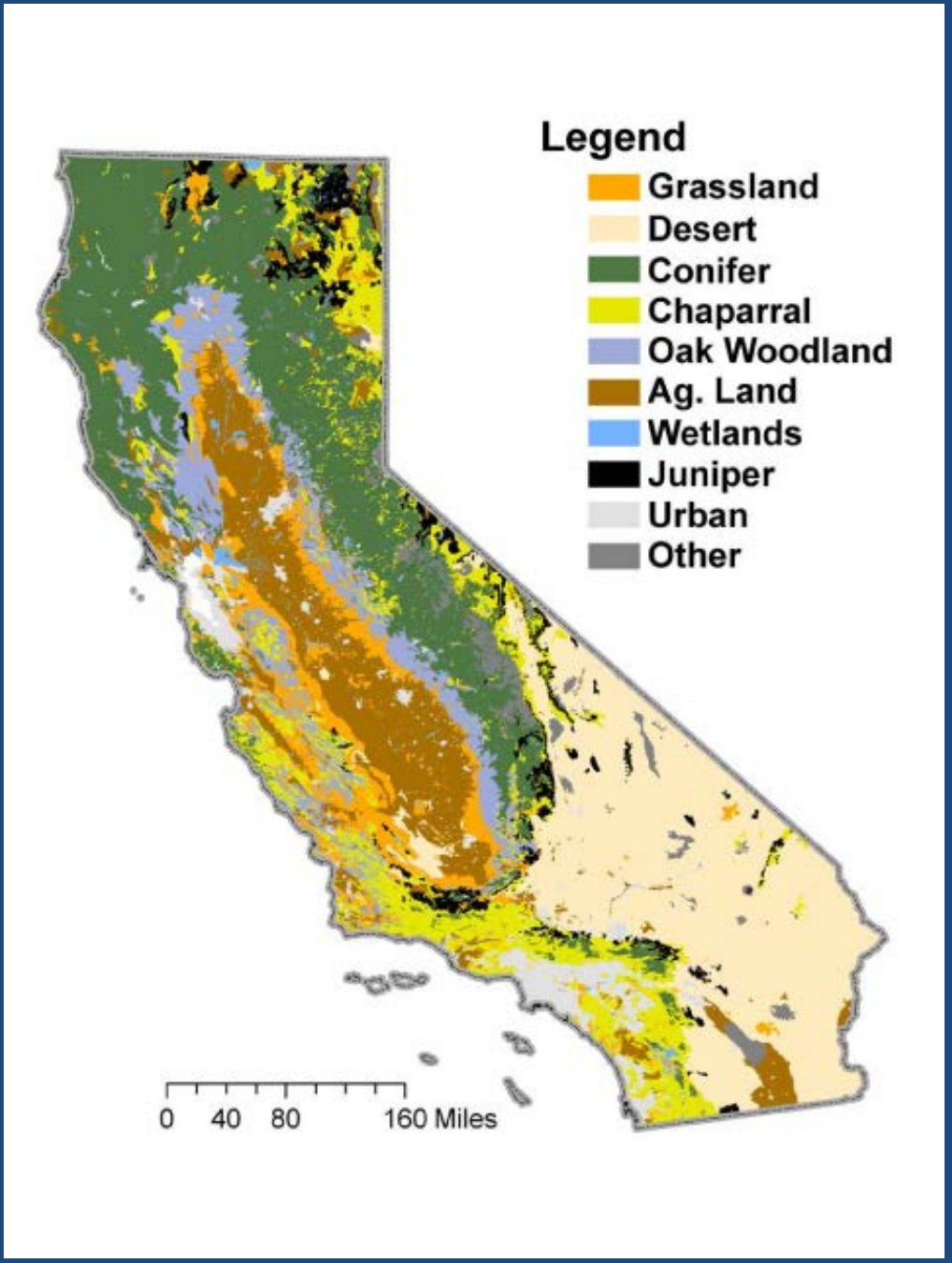
Overview

- Background
- Study description
- Results
- Broader applications

Rangelands & climate change



Source: http://casoilresource.lawr.ucdavis.edu/drupal/node/804

What We Know

- Precipitation = grass year
- Temperature and timing matter

Photo: Nomadic Lass

Questions

1. Functional groups: how do functional groups respond to annual weather and seasonal weather?

2. Lagged effects: how does previous year's weather affect current year abundance?

Exotic Grasses

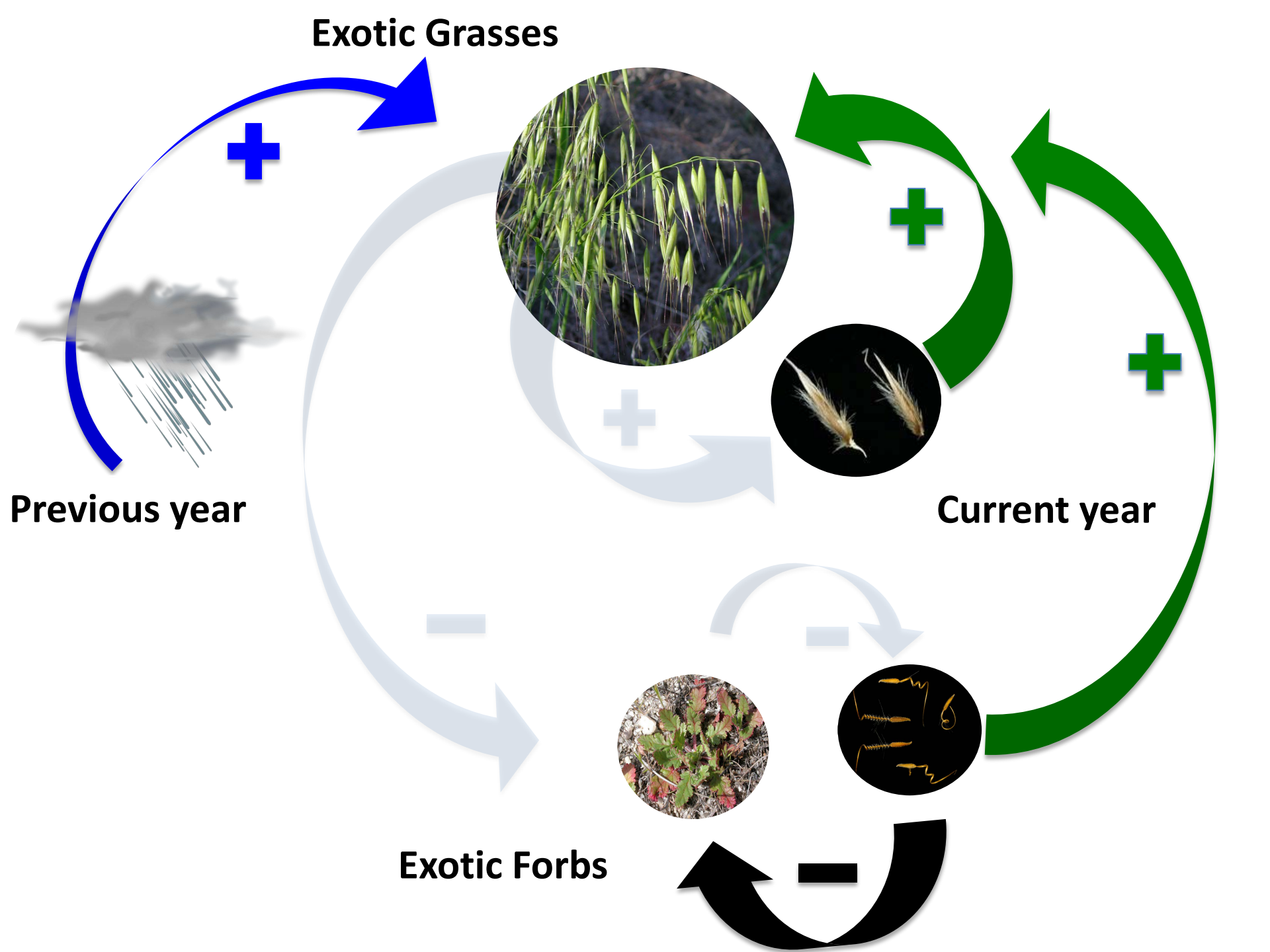
Previous year:
High Rainfall

Exotic Forbs

Exotic Grasses

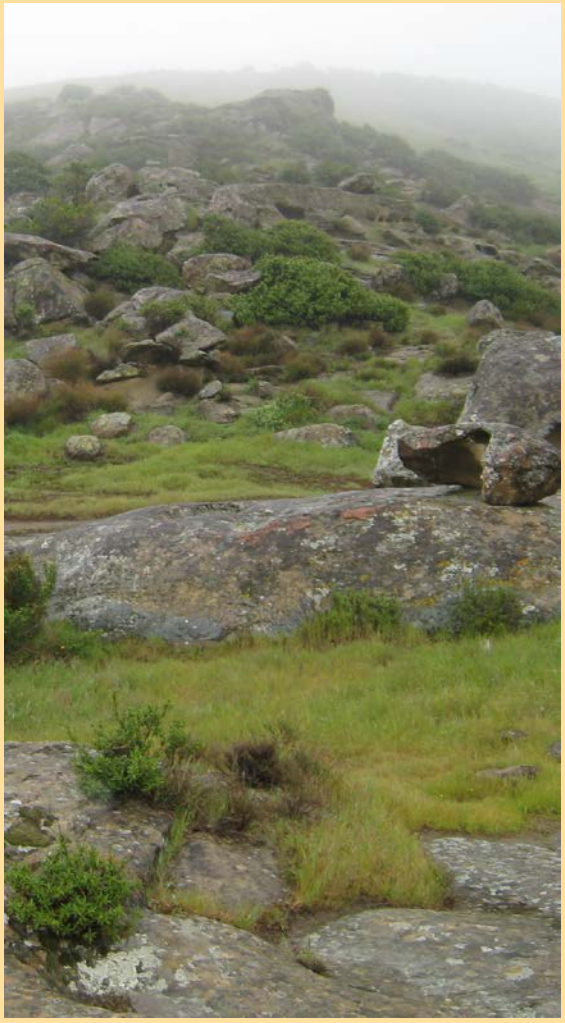
Previous year

Exotic Forbs

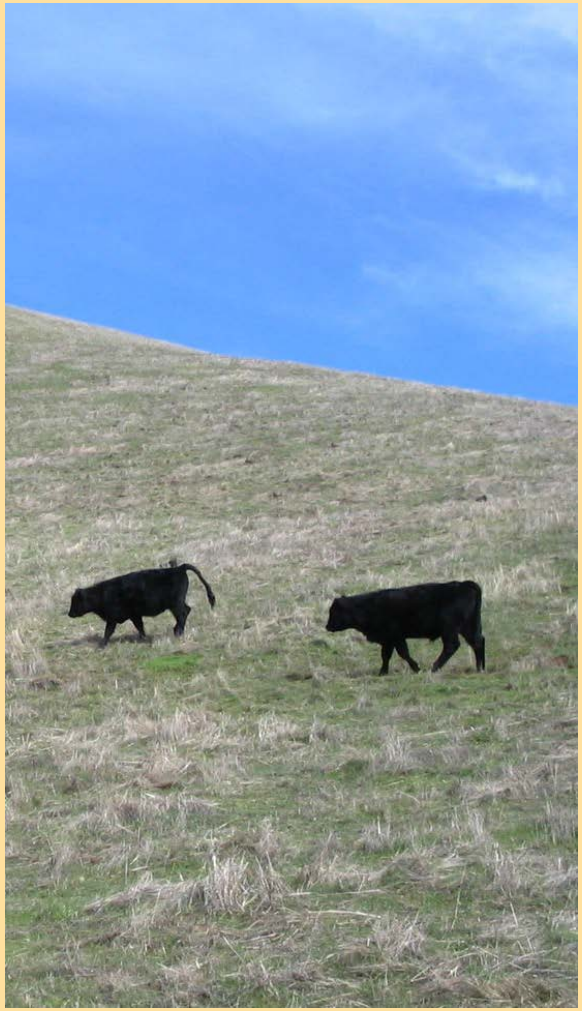

Exotic Grasses
Previous year
Current year
Exotic Forbs

Methods

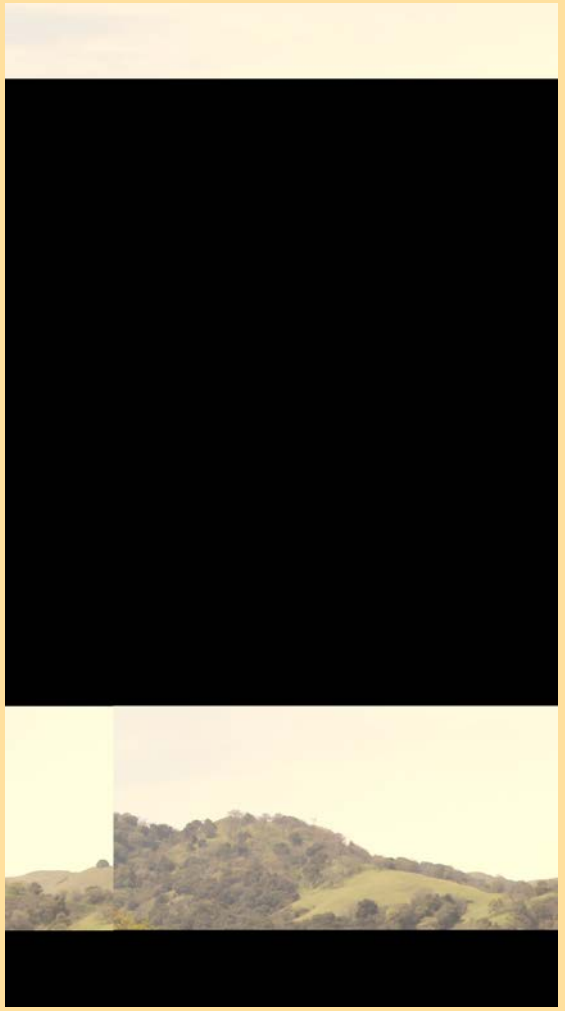
Vasco Caves



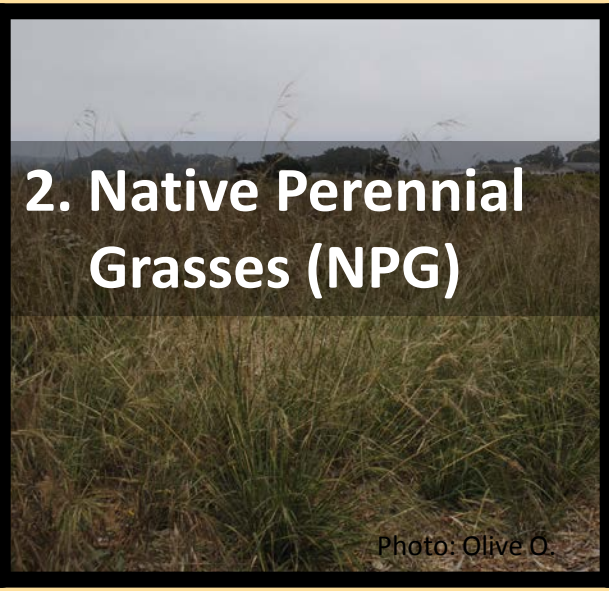
Pleasant Ridge



Sunol Regional



Five Functional Groups

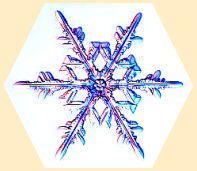


Multiple regression models

4 models per functional group with current and lagged weather:

- Model 1: Annual weather

Model 2: Fall weather



Model 3: Winter weather

Model 4: Spring weather

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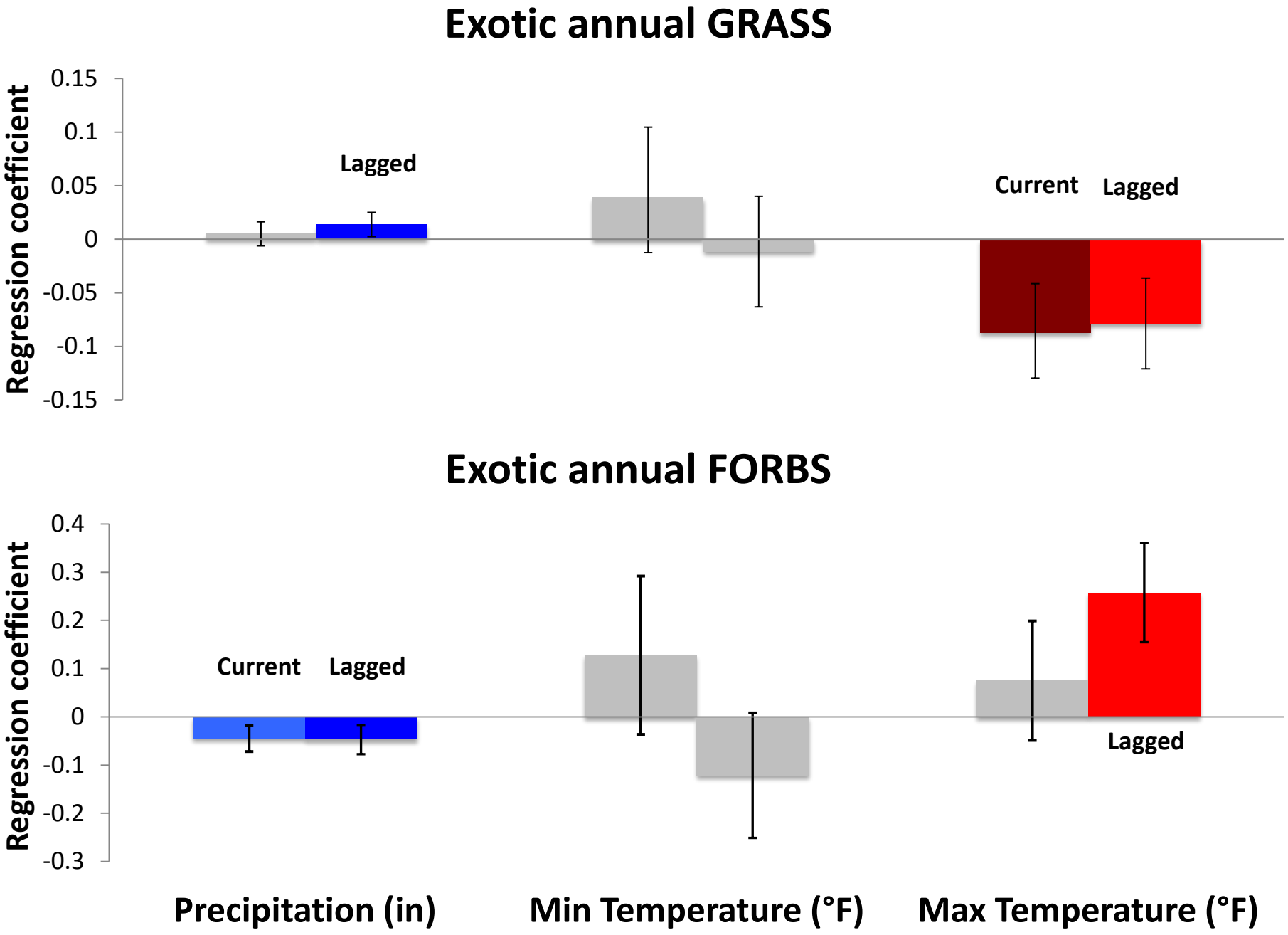
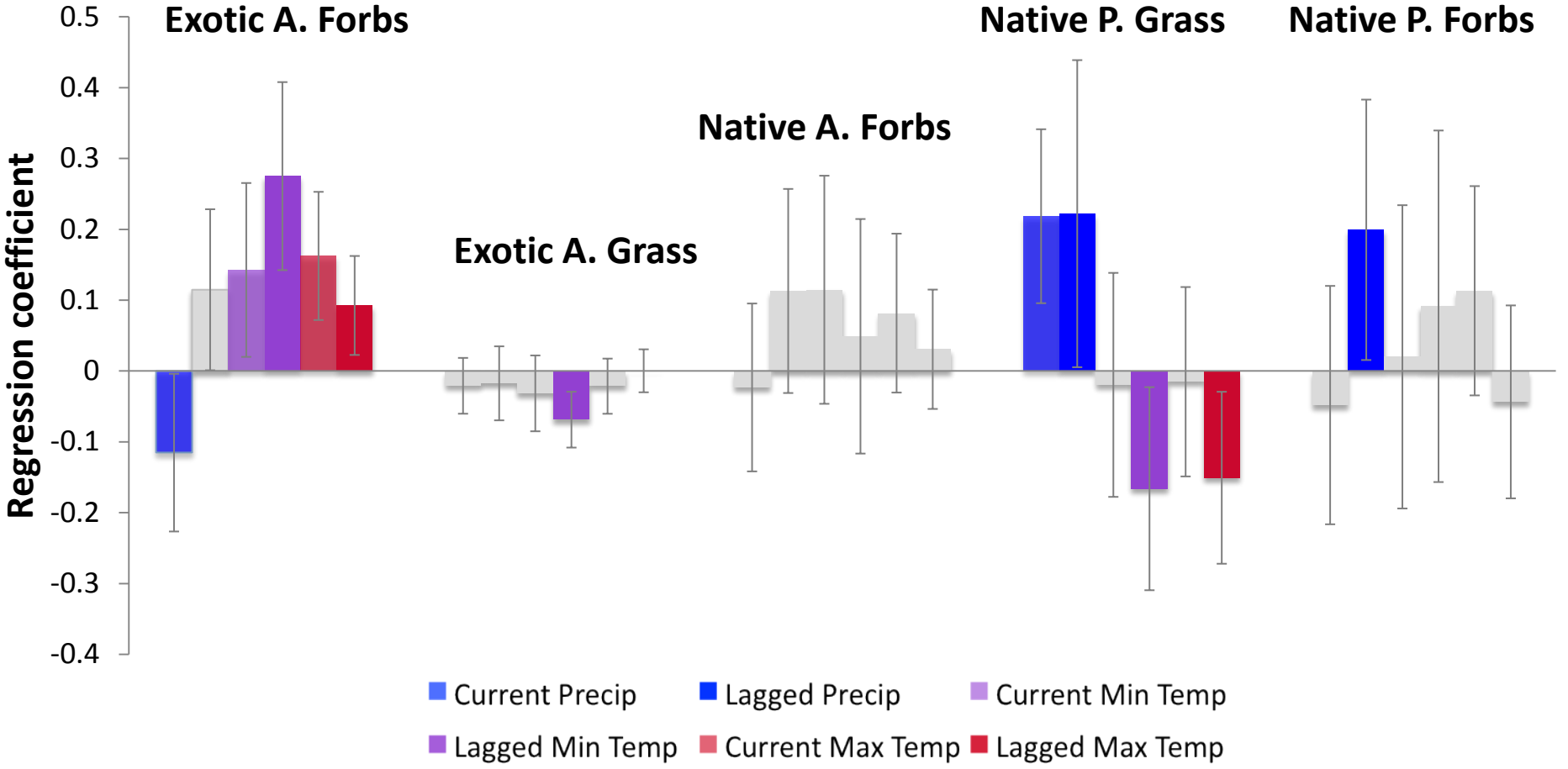
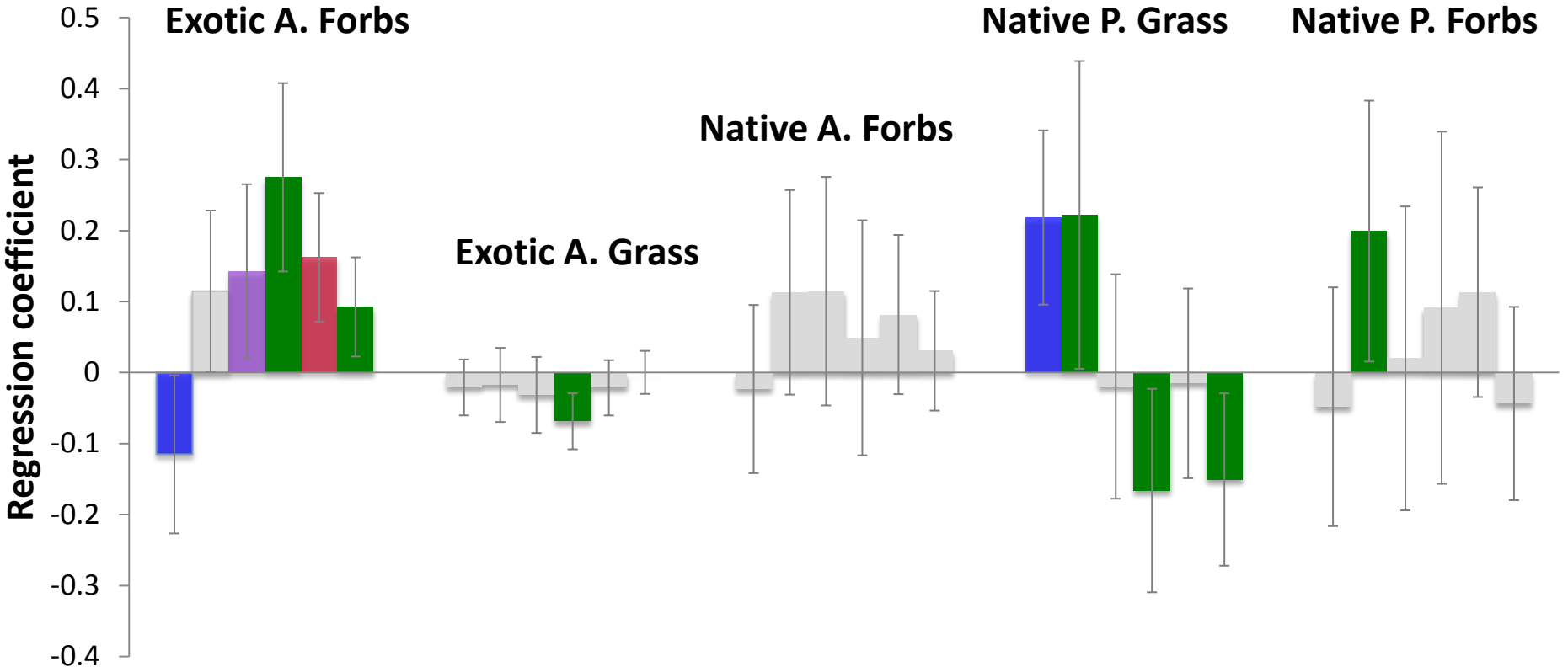

Exotic annual GRASS
Regression coefficient
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
Lagged
Current
Lagged
Exotic annual FORBS
Regression coefficient
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
Current
Lagged
Lagged
Precipitation (in)
Min Temperature (°F)
Max Temperature (°F)

Fall weather

Lagged weather seems particularly important

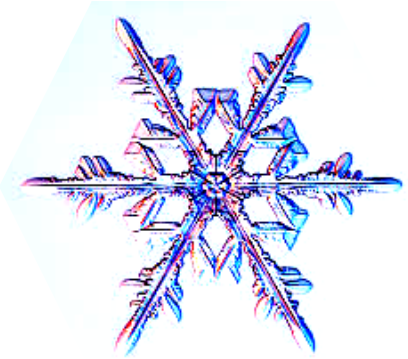


Lagged weather patterns drive abundance patterns

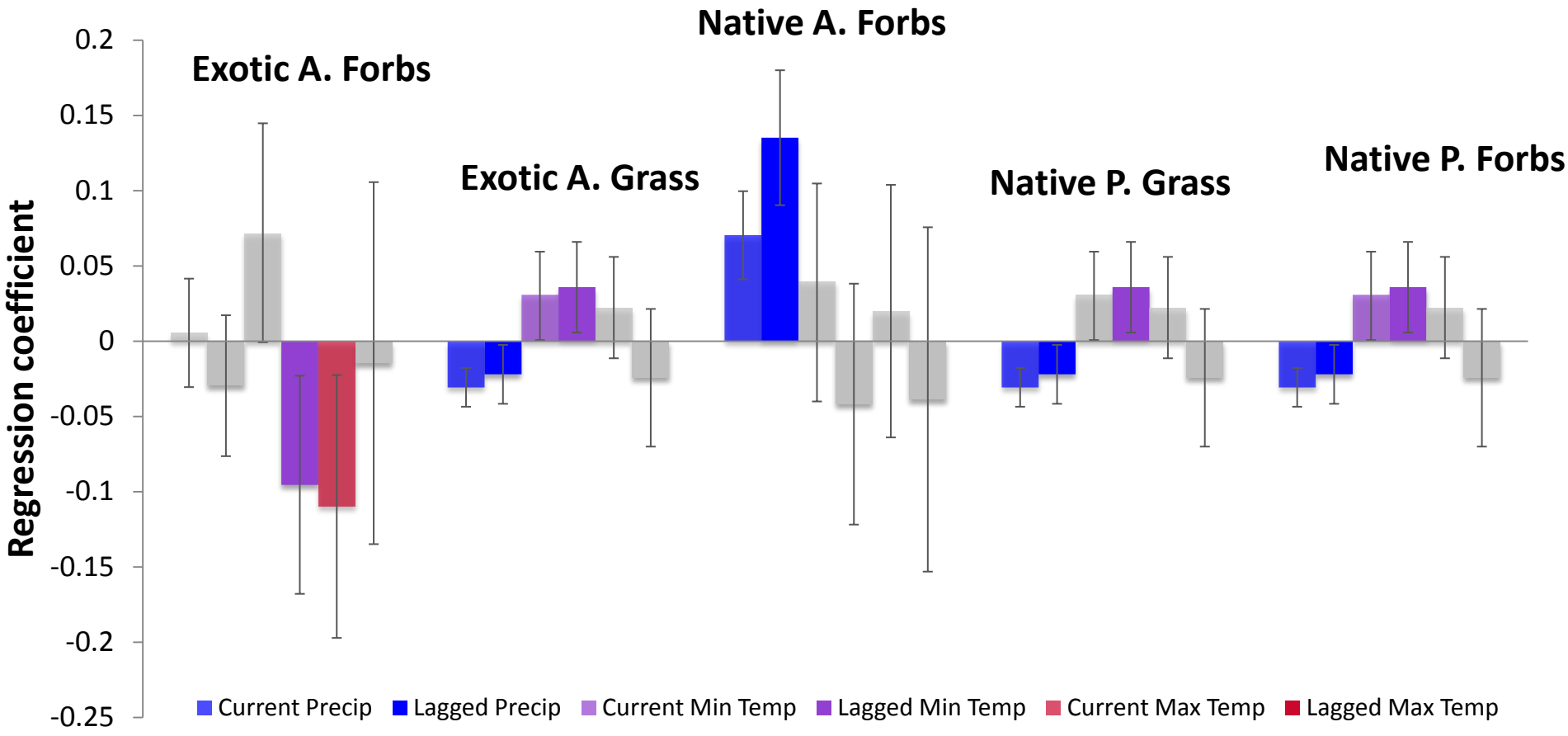


Green bars = lagged weather

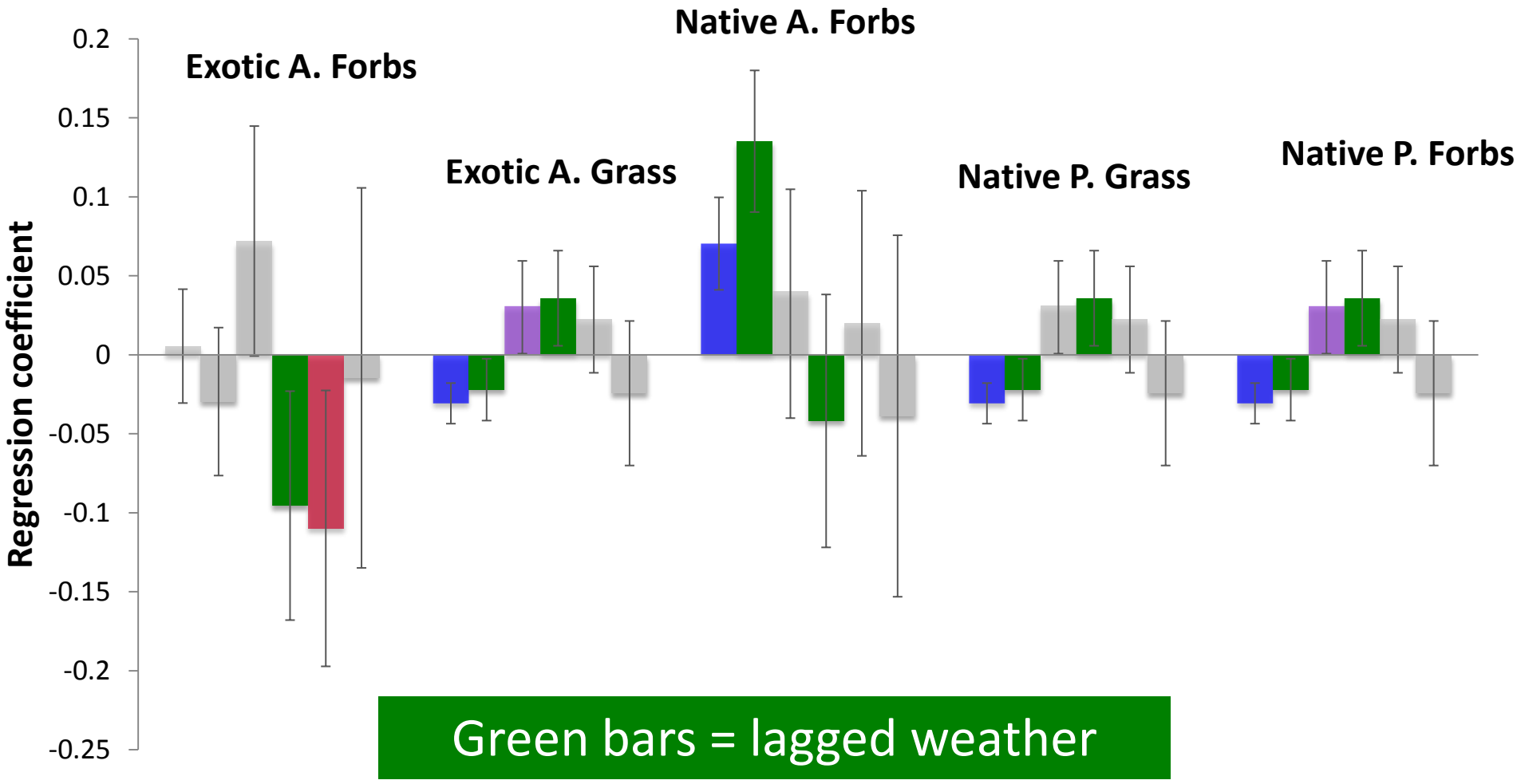
Winter weather



Precipitation and minimum temperatures drive winter responses

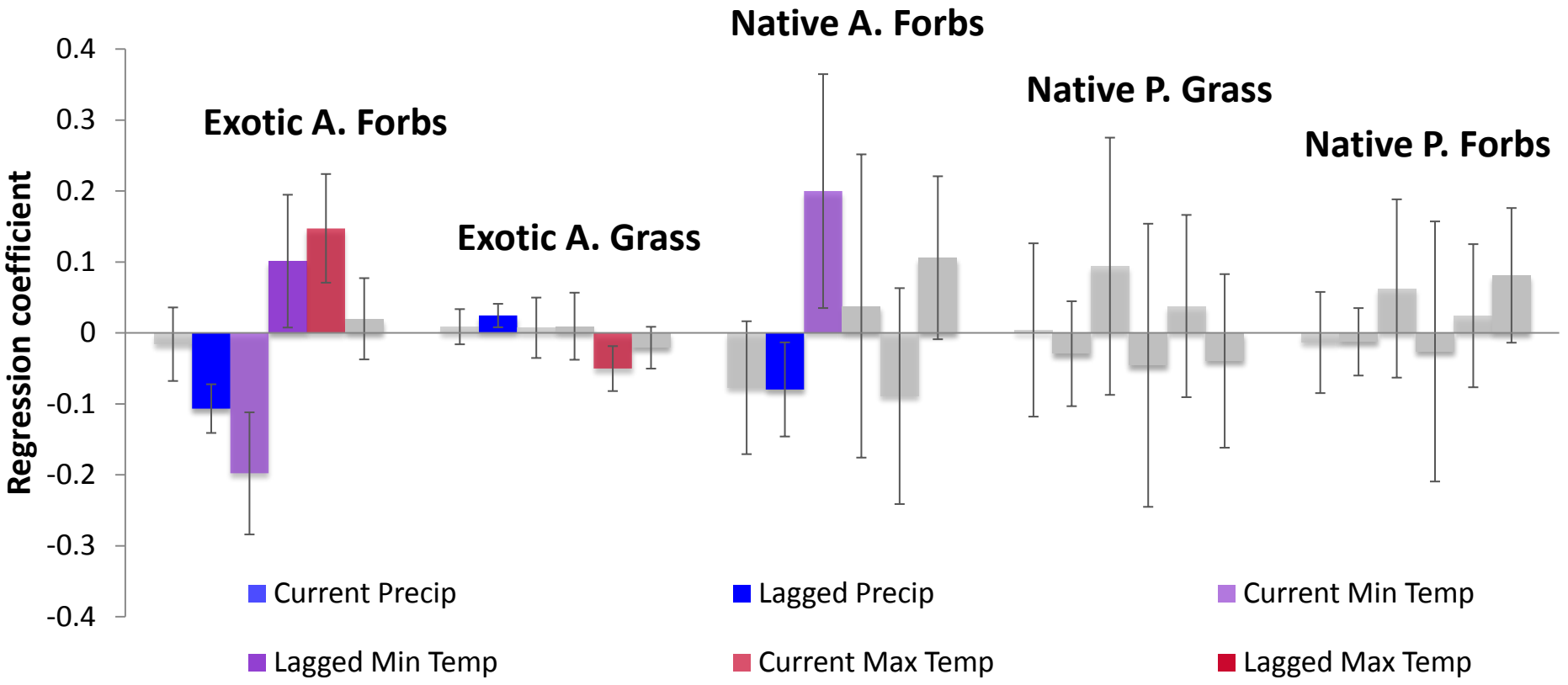


Lagged effects & current weather equally important

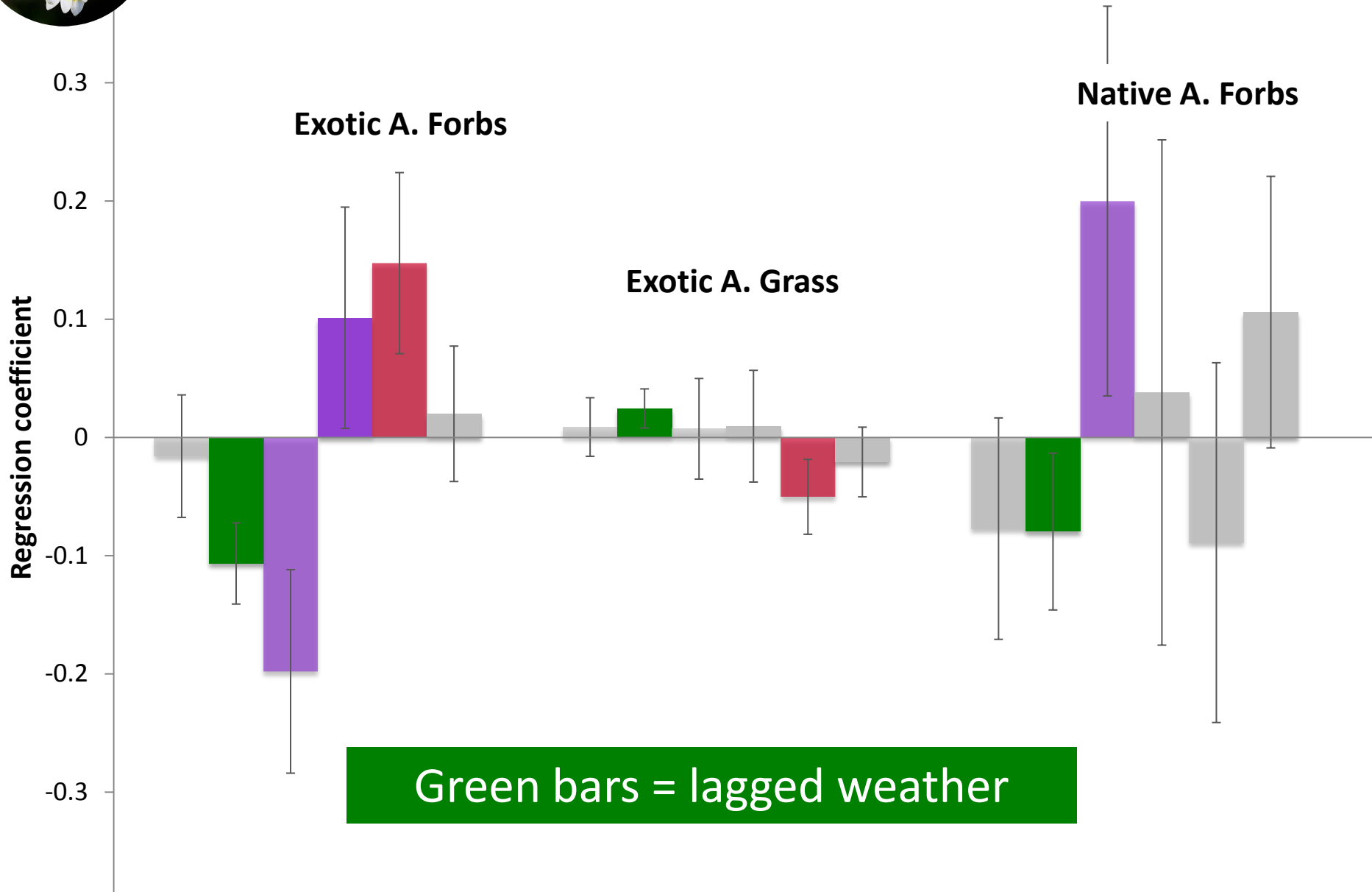


Spring weather

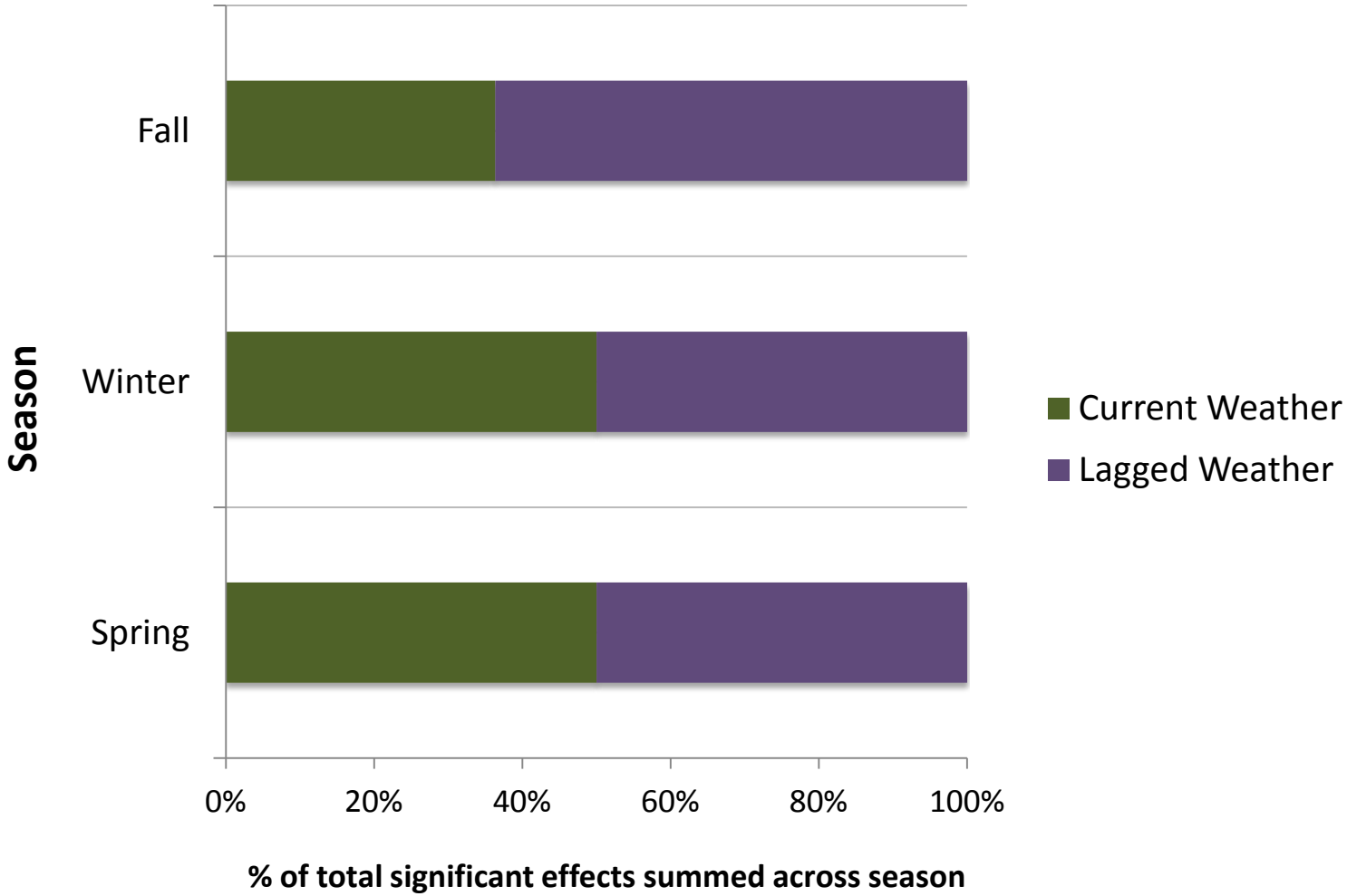
Lagged precipitation and current temperatures drive spring functional group response



Spring lagged precipitation is very important



Current and lagged weather equally important



What We Know Now

lagged effects = weather + indirect effects

community composition= current effects + lagged effects

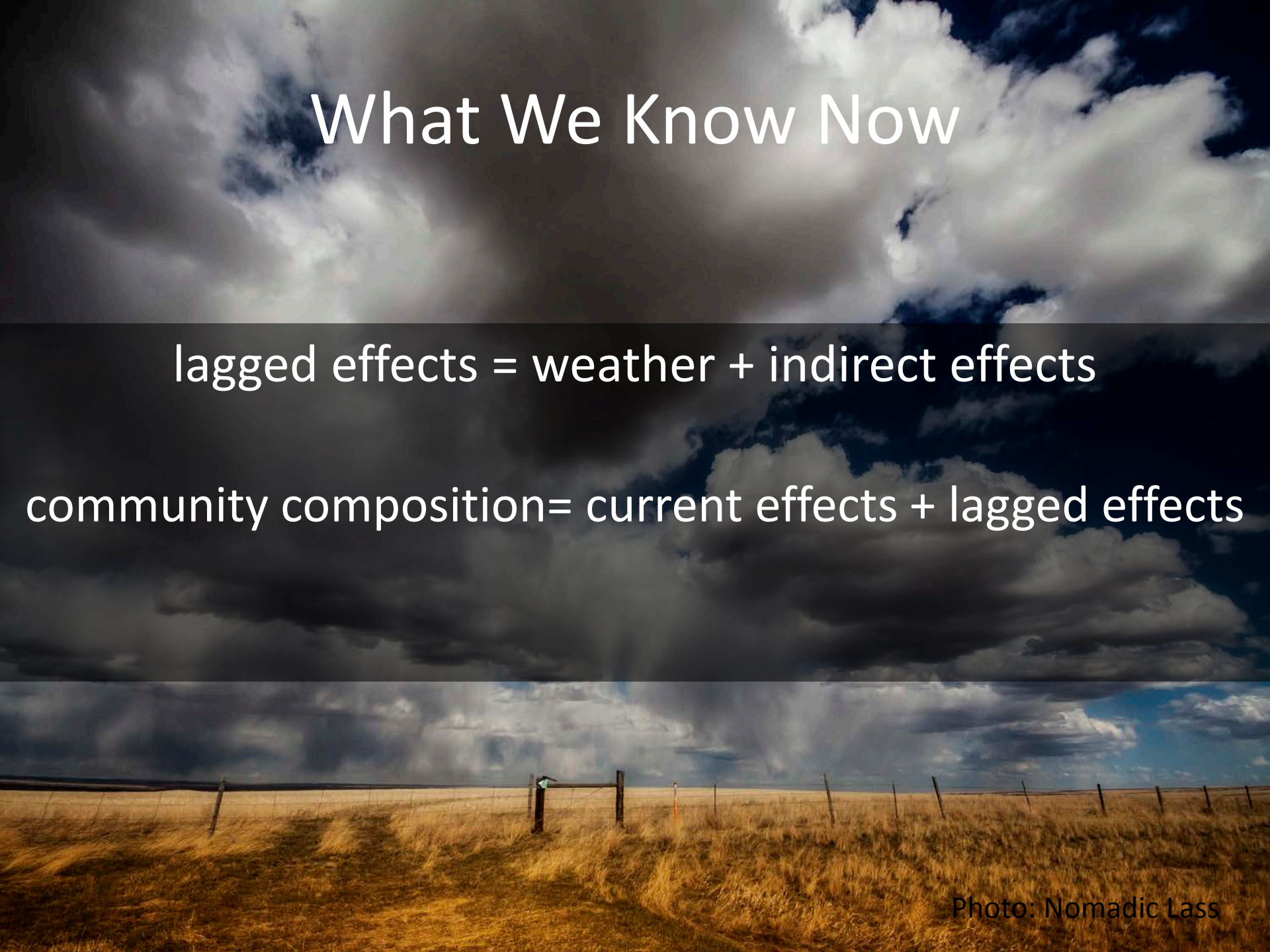


Photo: Nomadic Lass

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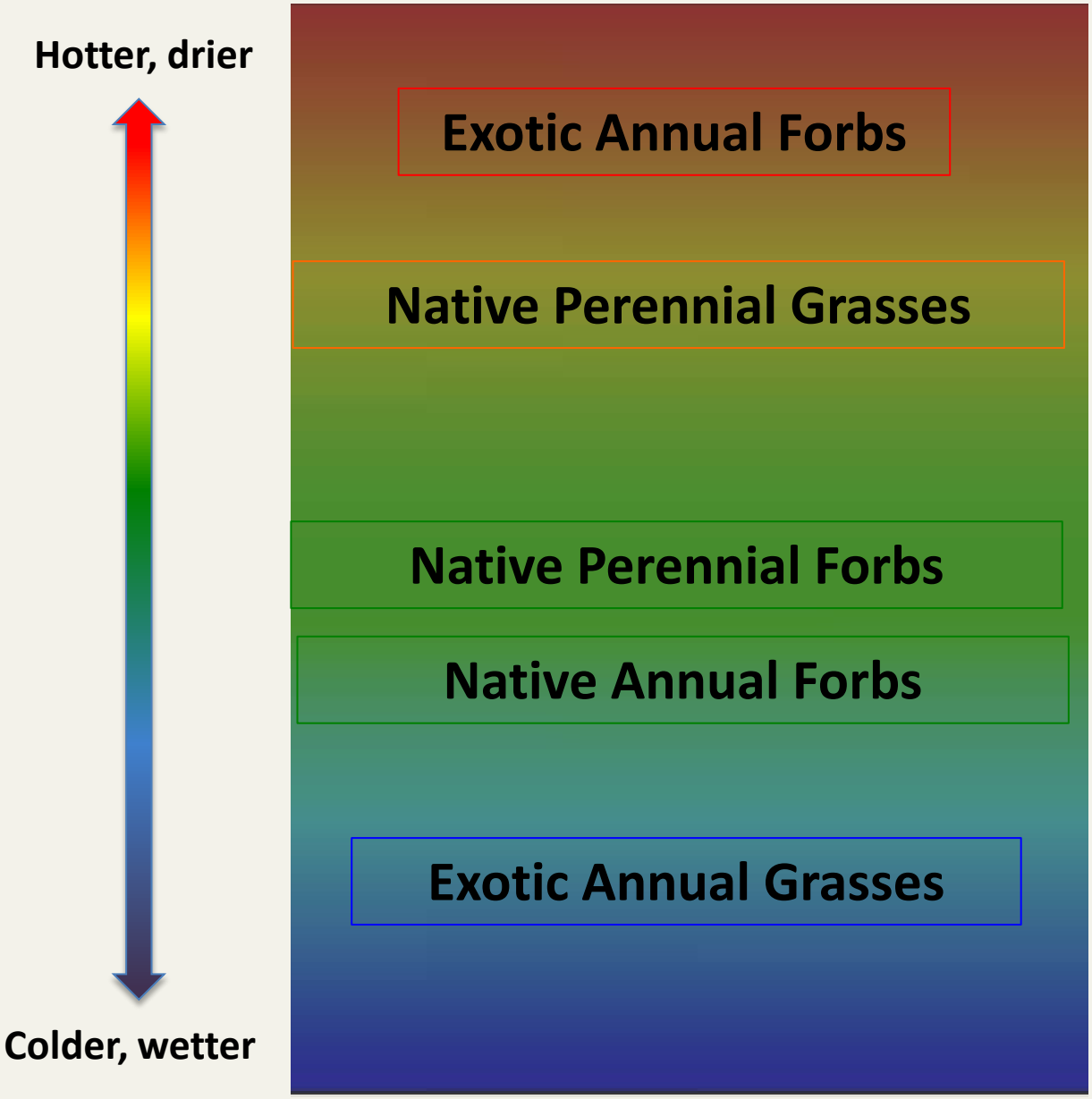
Environmental niche



Climate change and functional groups?

Managing for production

Functional Group	Fall	Winter	Spring
Exotic A. Grass	**Warm Lagged Temp**	**Low Precip, Low Temp**	**High Precip, Mild Temp**
Exotic A. Forb	Low Precip, Extreme Temps	Mild Temp	Low Precip, High Temp

Managing for diversity

Functional Group	Fall	Winter	Spring
Native A. Forbs	-	High Precip	Low Rainfall, Low Temp
Native P. Forbs	Lagged High Precip	Low Precip + Low temp	-
Native P. Grasses	High Precip and more Extreme Weather	Low Precip & Low temp	-

Thank you!!

Dr. Emily Farrer, Dr. James Bartolome, Bartolome's lab, Dr. Suding's lab, URAP students, and East Bay Parks