



**The role of resource heterogeneity on native  
plant response to invasive plant removal**



**“Fertile Island Effect”**

**Increased SOM, Soil Moisture, and Soil Nutrients**

**Moderated Temps, Decreased PAR**

**Invasive plant abundance is positively correlated with resource availability** (Davis et al 2000, Bashkin et al. 2003, Deahler 2003, Foster and Dickson 2004, Colautti et al. 2006)

**Competition intensity is positively correlated with resource availability** (Grime 1979, Belcher et al. 1995, Aerts 1999)

**Species richness is negatively correlated with resource availability** within the range of resource availability between shrub and interspace microhabitats (Huston 1979)

# Objectives

**Determine which microhabitat will have the greatest:**

-invasive species abundance

-competition intensity

-native annual plant richness

-relative increase in native plant richness once all invasive plants are removed



*Bromus madritensis* spp. *rubens*  
(Red Brome)





# *Schismus arabicus* & *S. barbatus* (Schismus)



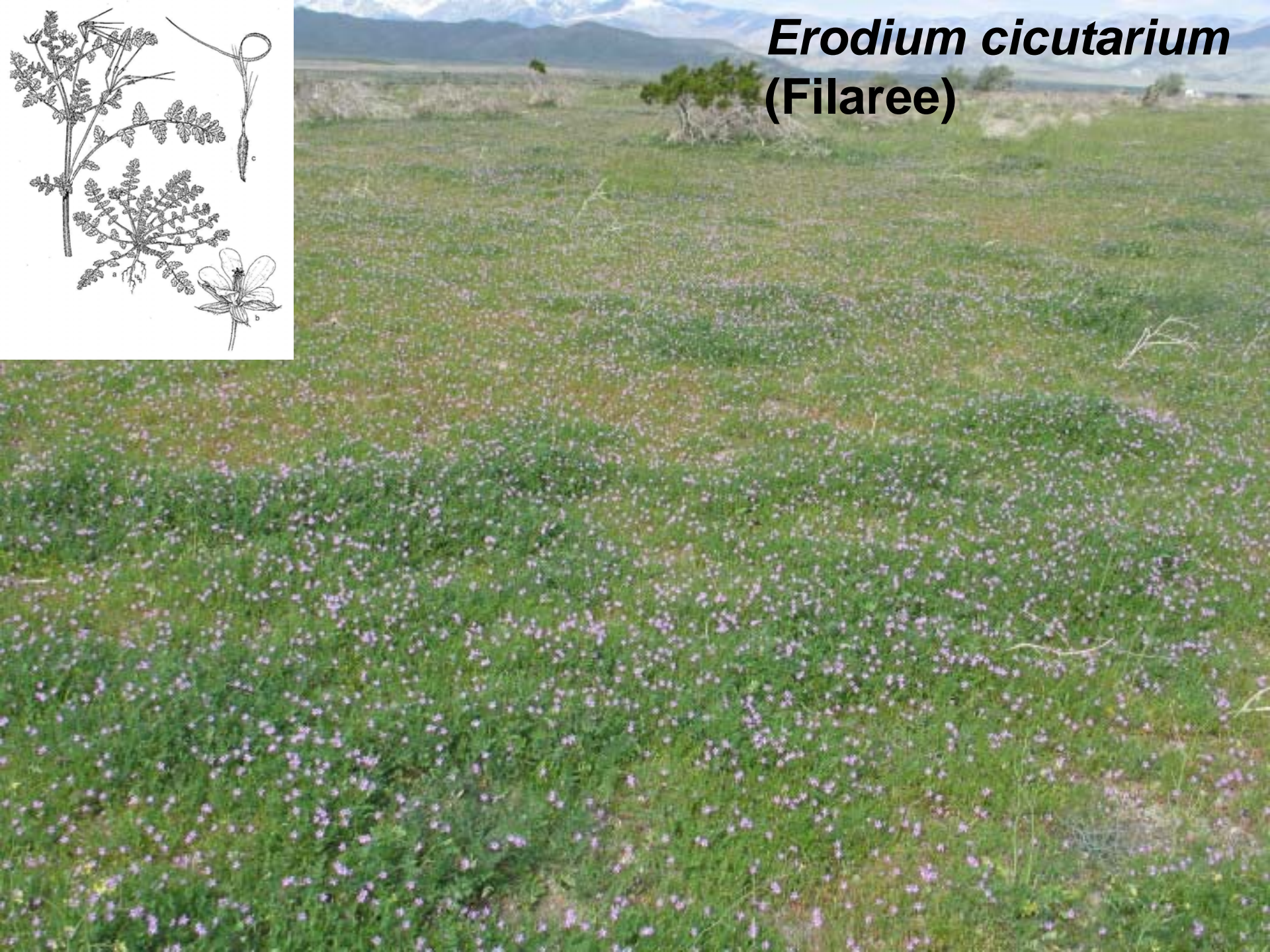


***Brassica tournefortii***  
**(Sahara Mustard)**

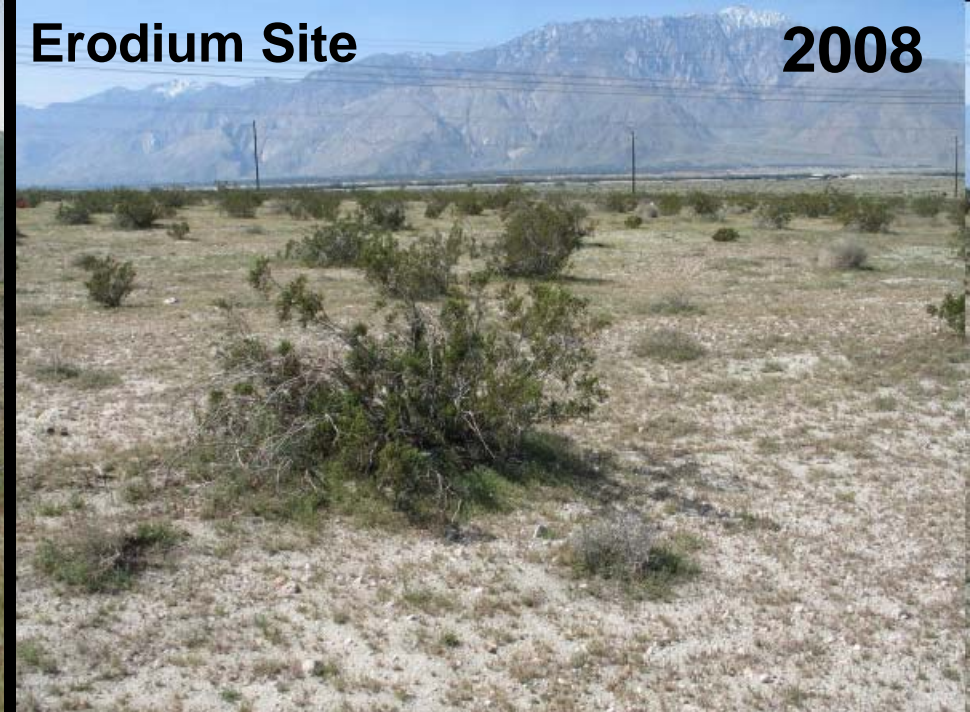




***Erodium cicutarium***  
**(Filaree)**



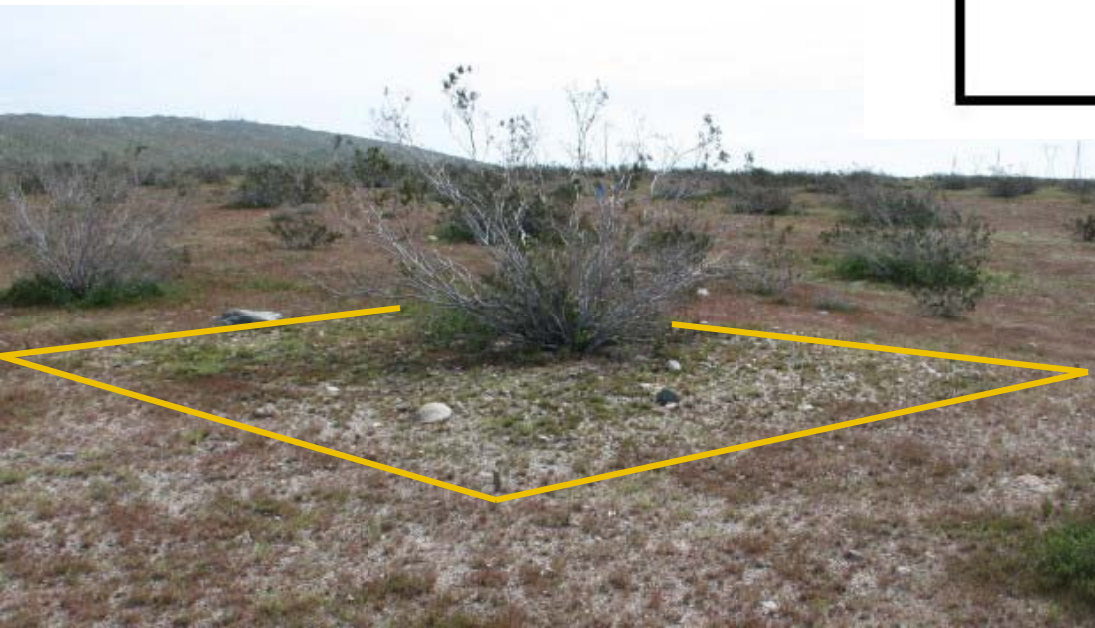
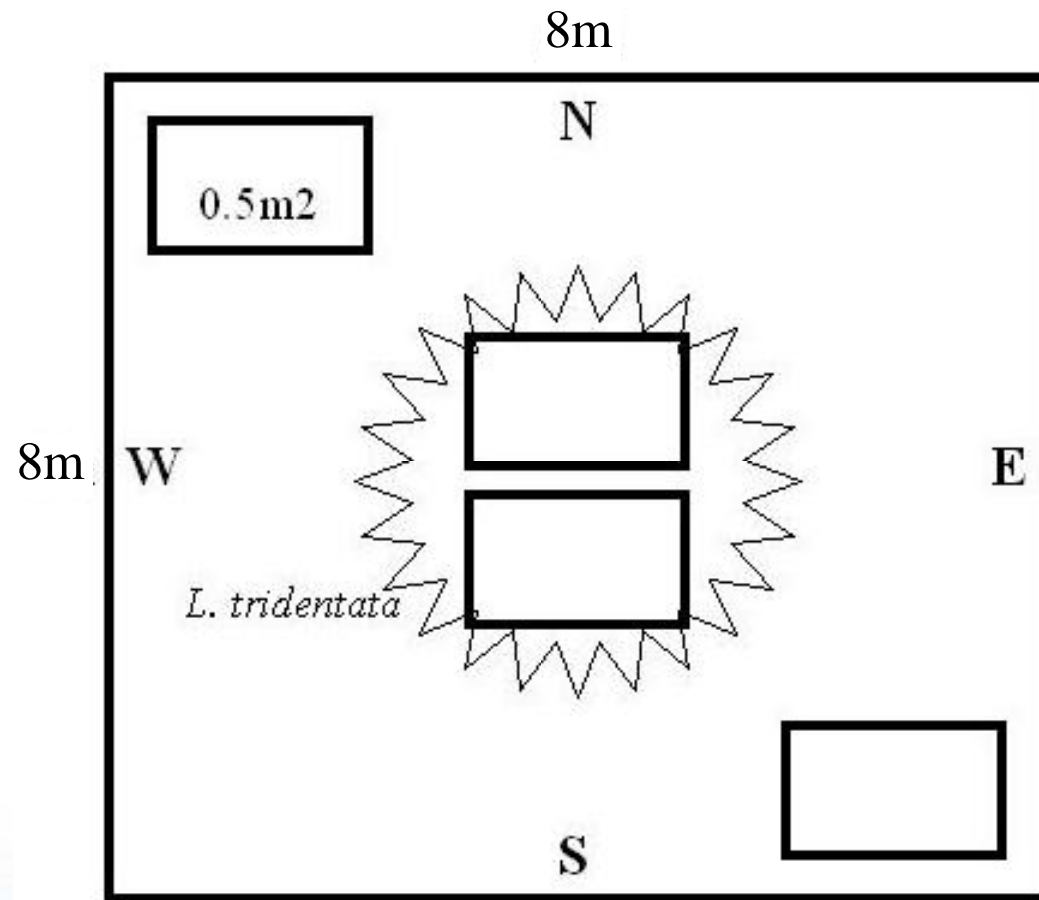






# METHODS

- Four Sites
- Randomized block design
- 12 blocks
- Plots centered on creosote shrubs



- Plots treated once, early in growing season
- Vegetation sampled at end of growing season



# TREATMENTS

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1. Control **C**

2. Total invasive plant removal: Fusilade II (grass-specific herbicide) plus invasive forb removal by hand **R**

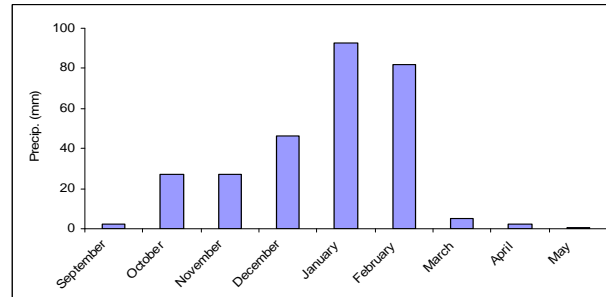
There is evidence that Fusilade II is lethal to *Erodium* spp. so we also implemented:

3. Fusilade II alone **F**

# PRECIPITATION

Average = **126.2 mm** (5 in)

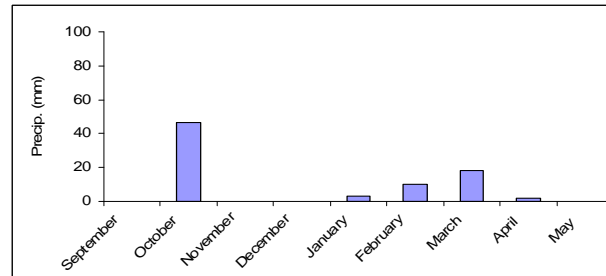
2005 (Sep. '04 - May '05)  
**285.2 mm**



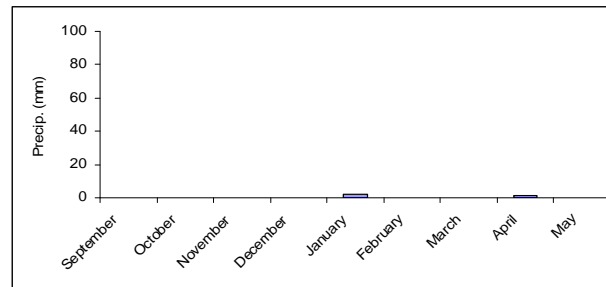
**Grass Site:  
Treatments  
Applied 2005**

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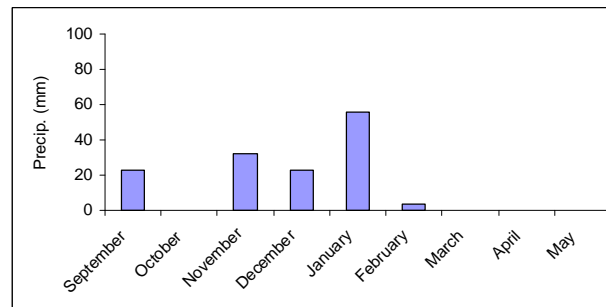
2006 (Sep. '05 - May '06)  
**79.8 mm**



2007 (Sep. '06 - May '07)  
**3.8 mm**



2008 (Sep. '07 - May '08)  
**138.1 mm**



**Other Sites:  
Treatments  
Applied '08**

**\* \* \***



	2005		Grass Site 2006		2008		Filaree Site 2008		Mustard Site 2008		Native Site 2008	
	Inter	Under	Inter	Under	Inter	Under	Inter	Under	Inter	Under	Inter	Under
Total Annual Cover	65.6	<b>83.7↓</b>	15.1	22.8	46.1	53	35.5	<b>53.1↓</b>	68.7	69.7	47.7	57.3









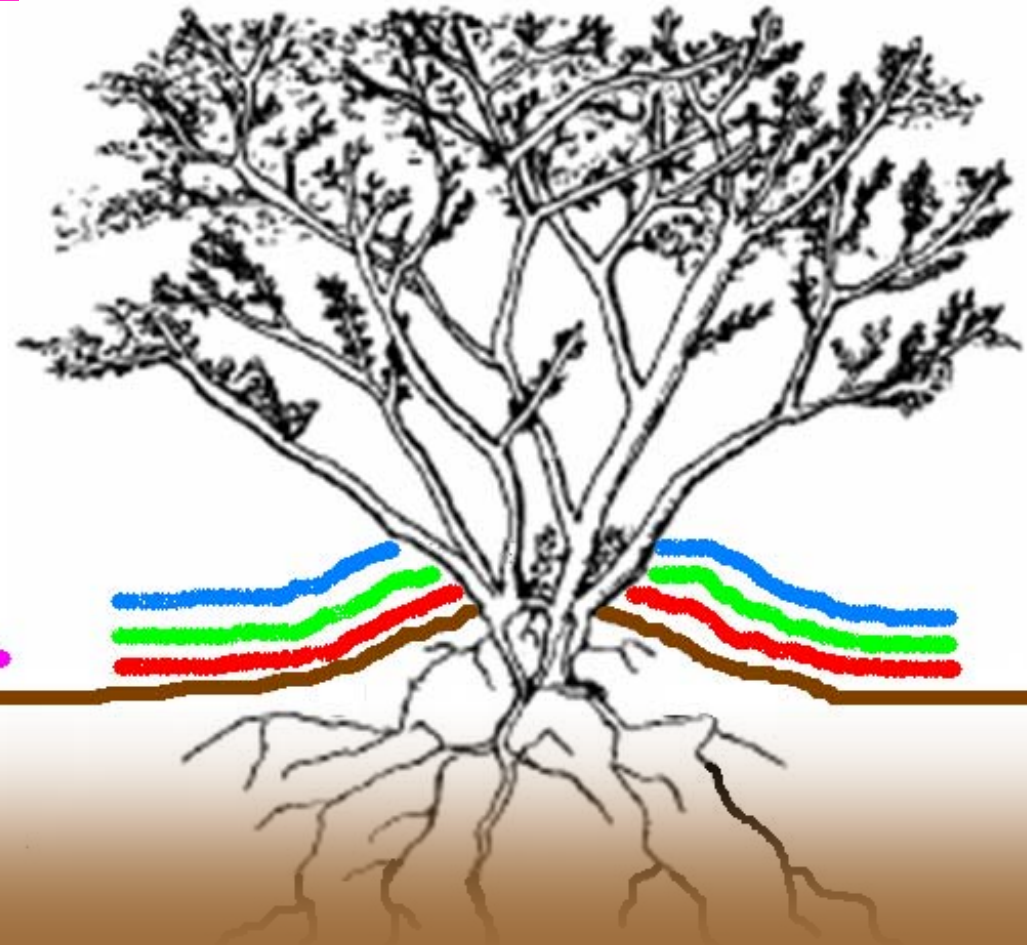


Invasive plant abundance

Competition intensity

Relative increase in native richness

Native annual plant richness

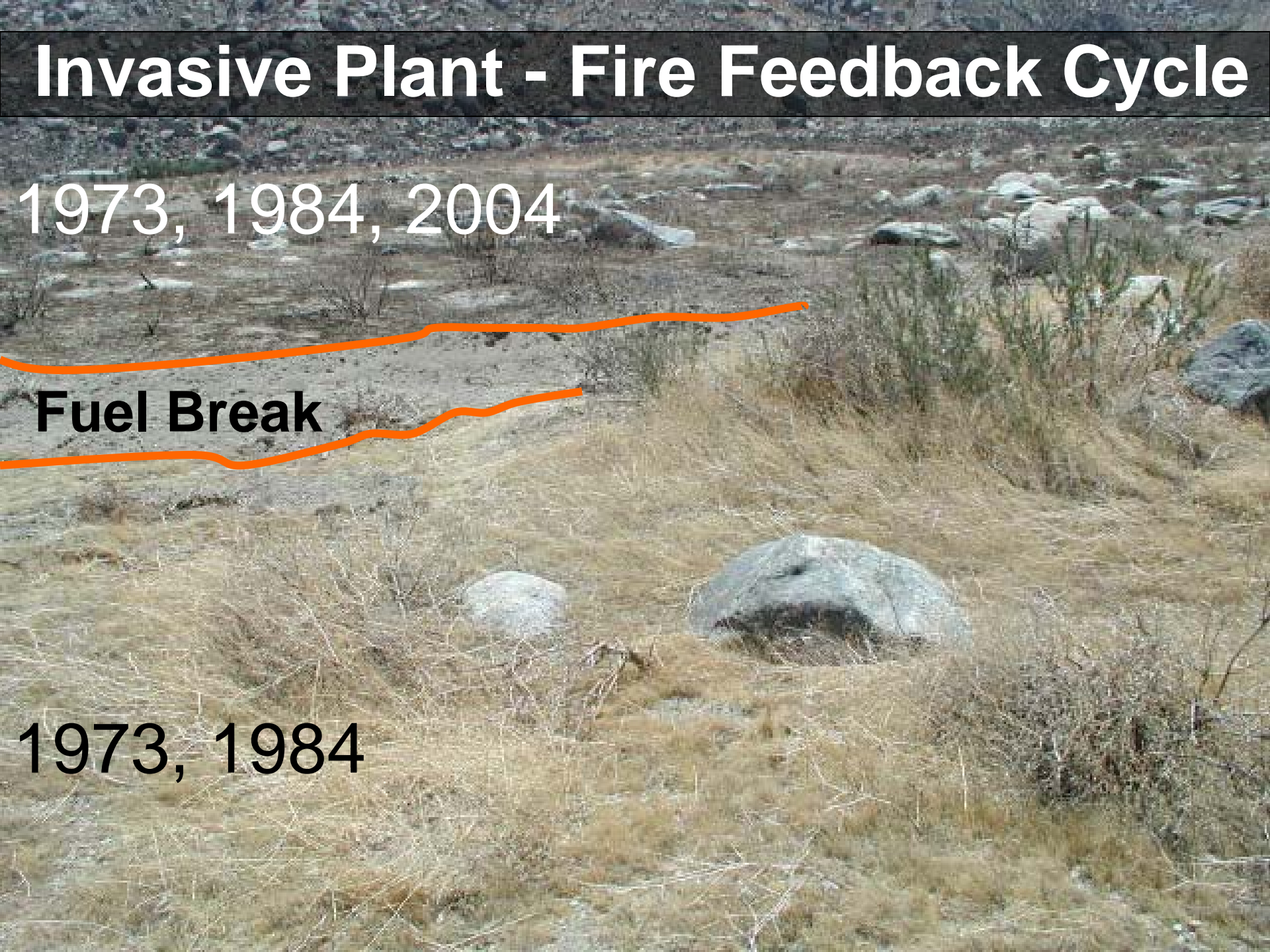


# Invasive Plant - Fire Feedback Cycle

1973, 1984, 2004

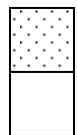
**Fuel Break**

1973, 1984



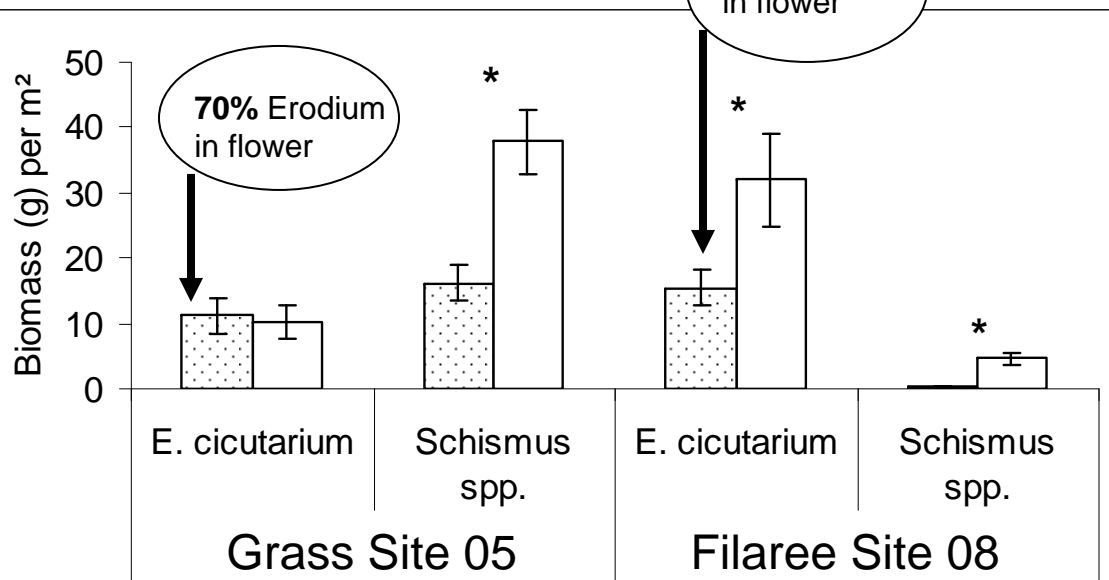


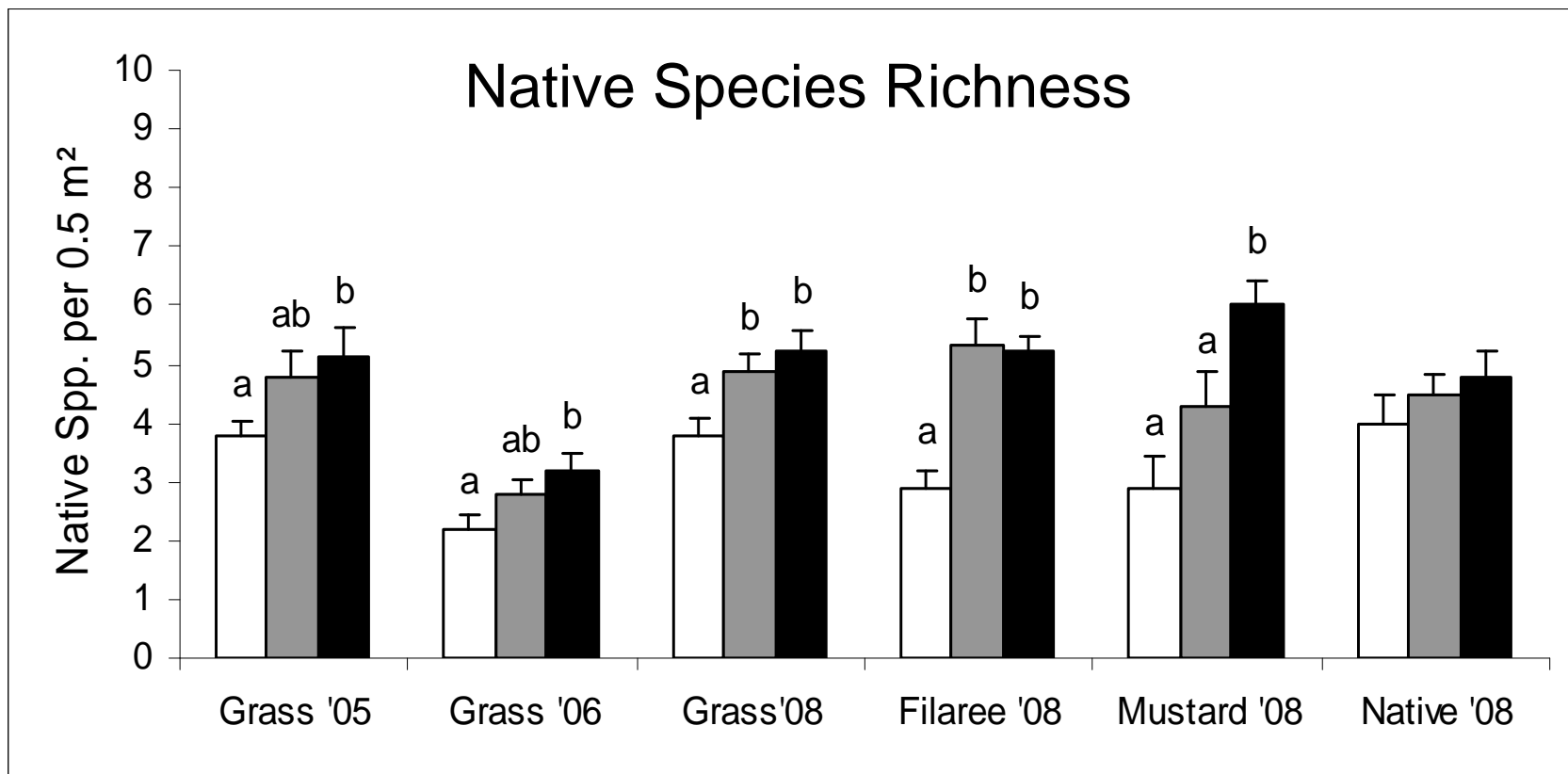
# FUSILADE II



Biomass at treatment application time

Biomass at peak season



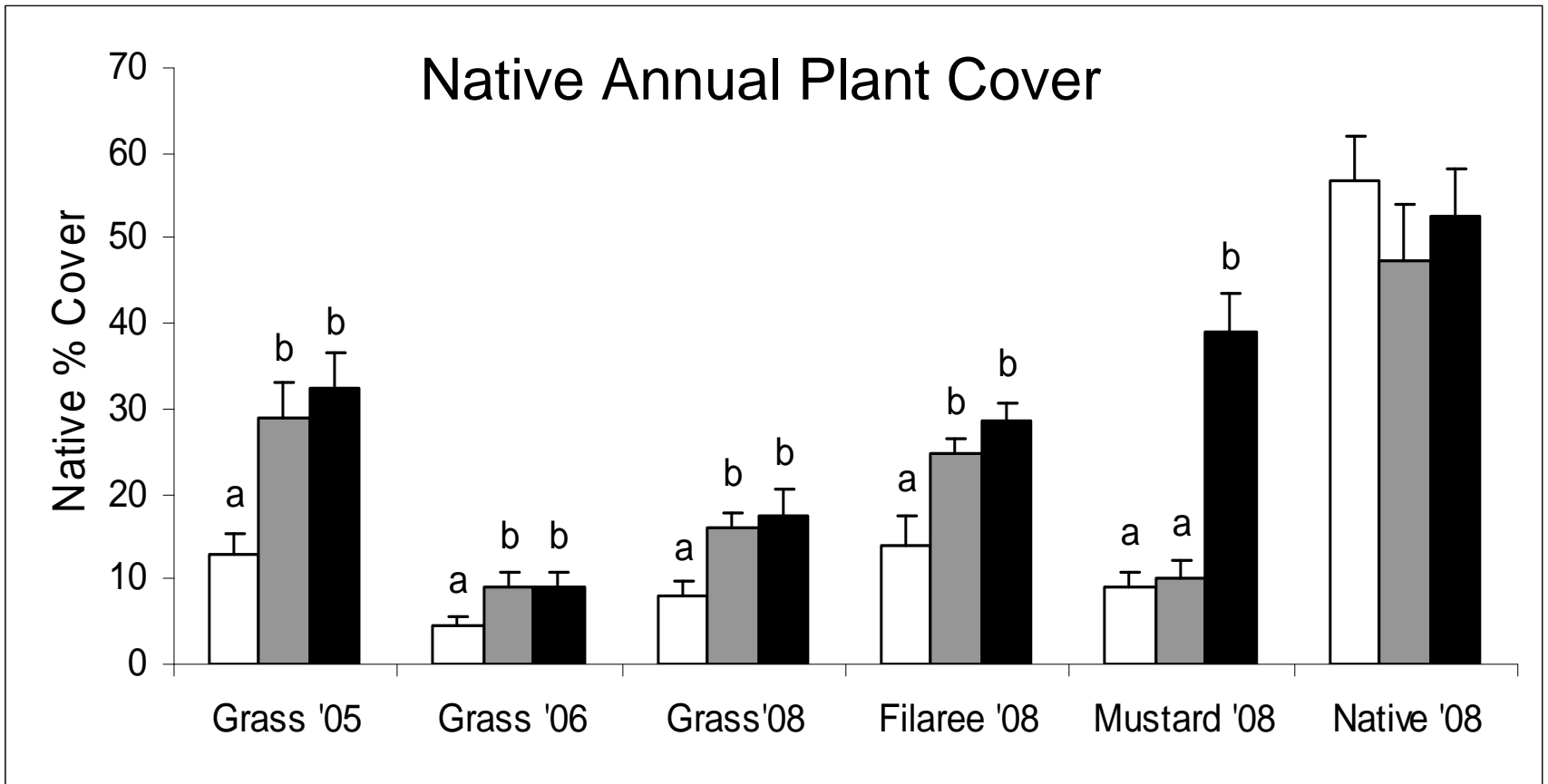


**C** Control

**F** Fusilade II

**R** Total Invasive Removal



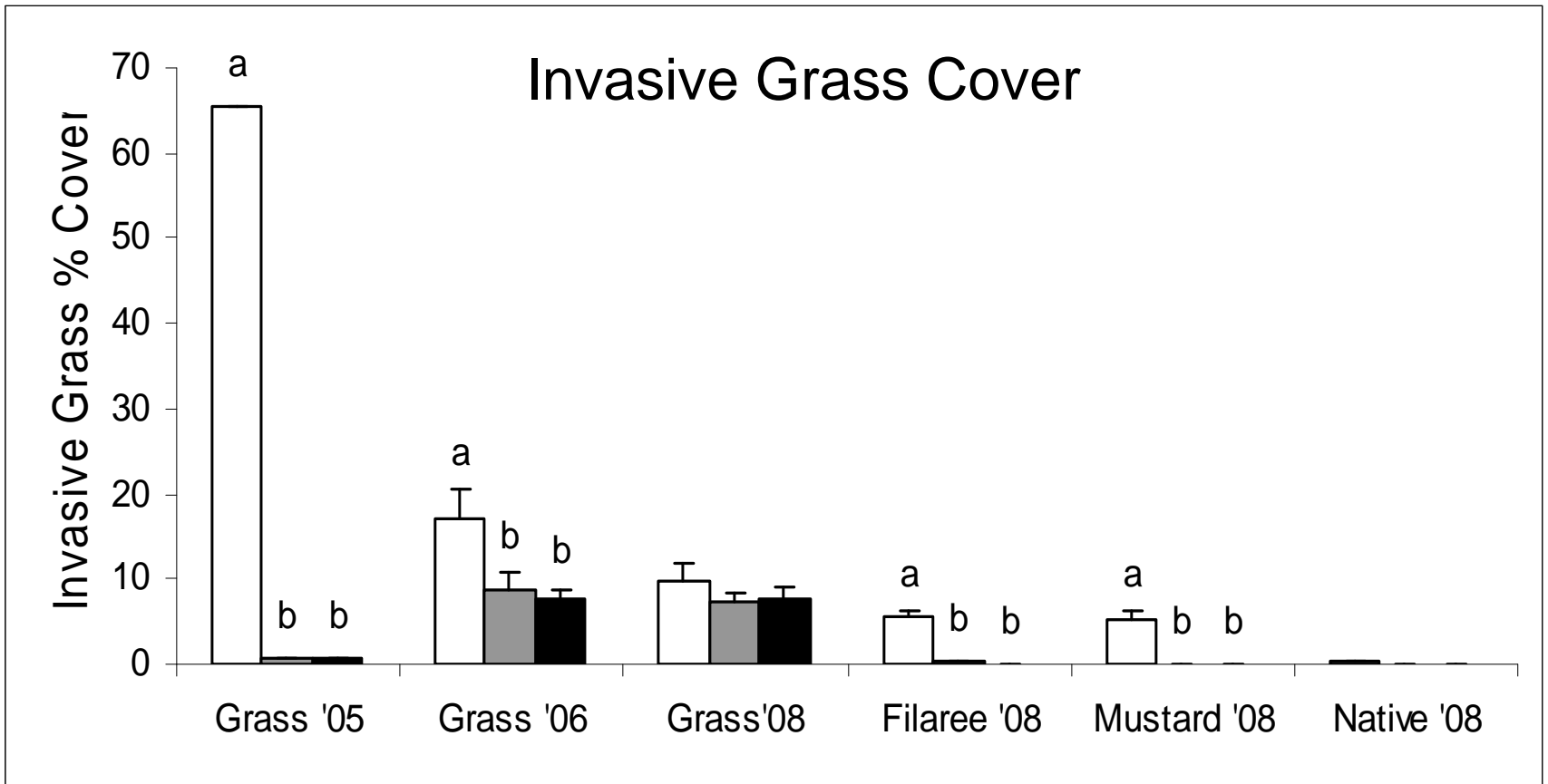


**C** Control

**F** Fusilade II

**R** Total Invasive Removal





**C** Control

**F** Fusilade II

**R** Total Invasive Removal

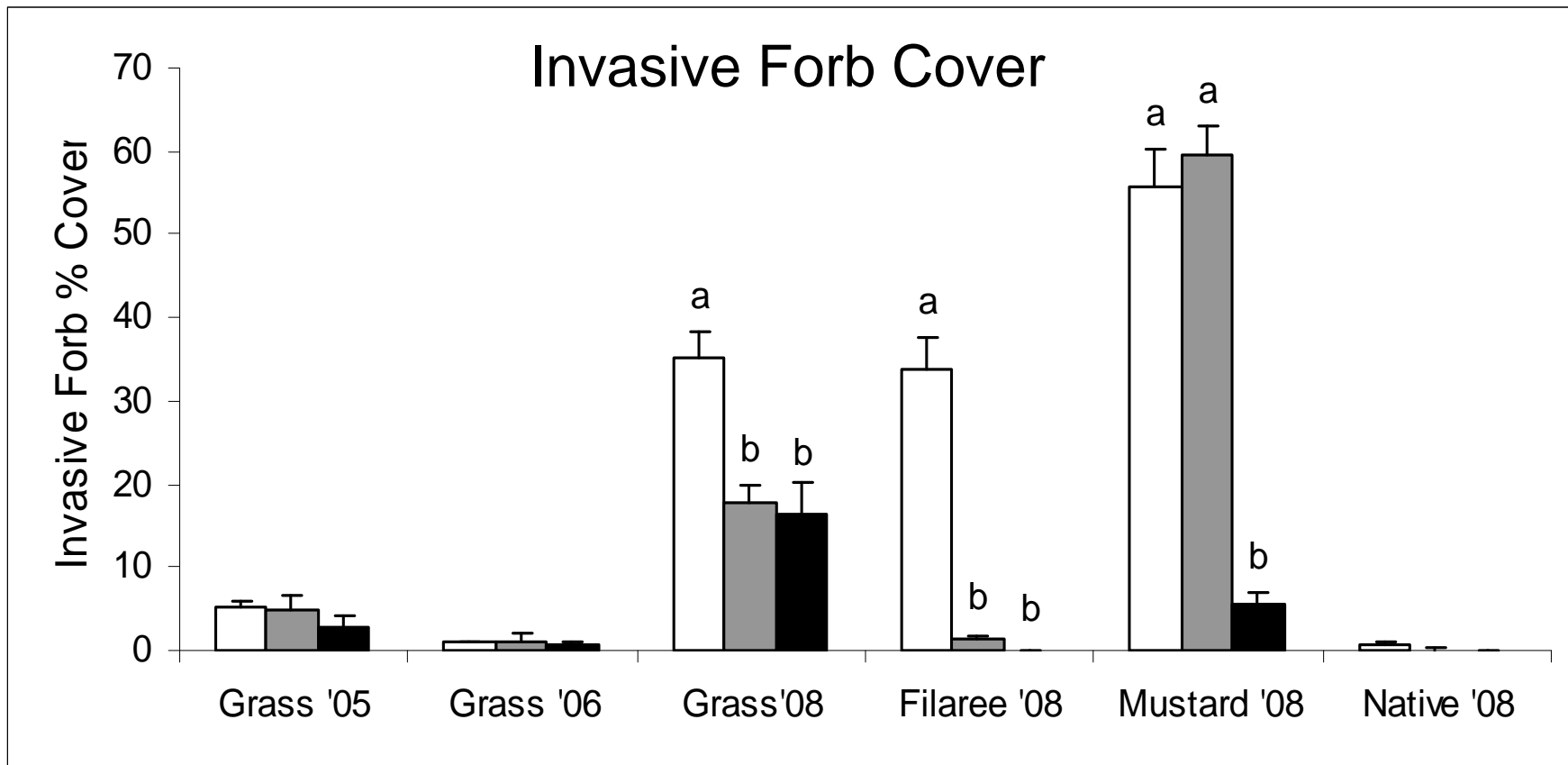




Control

Fusilade II



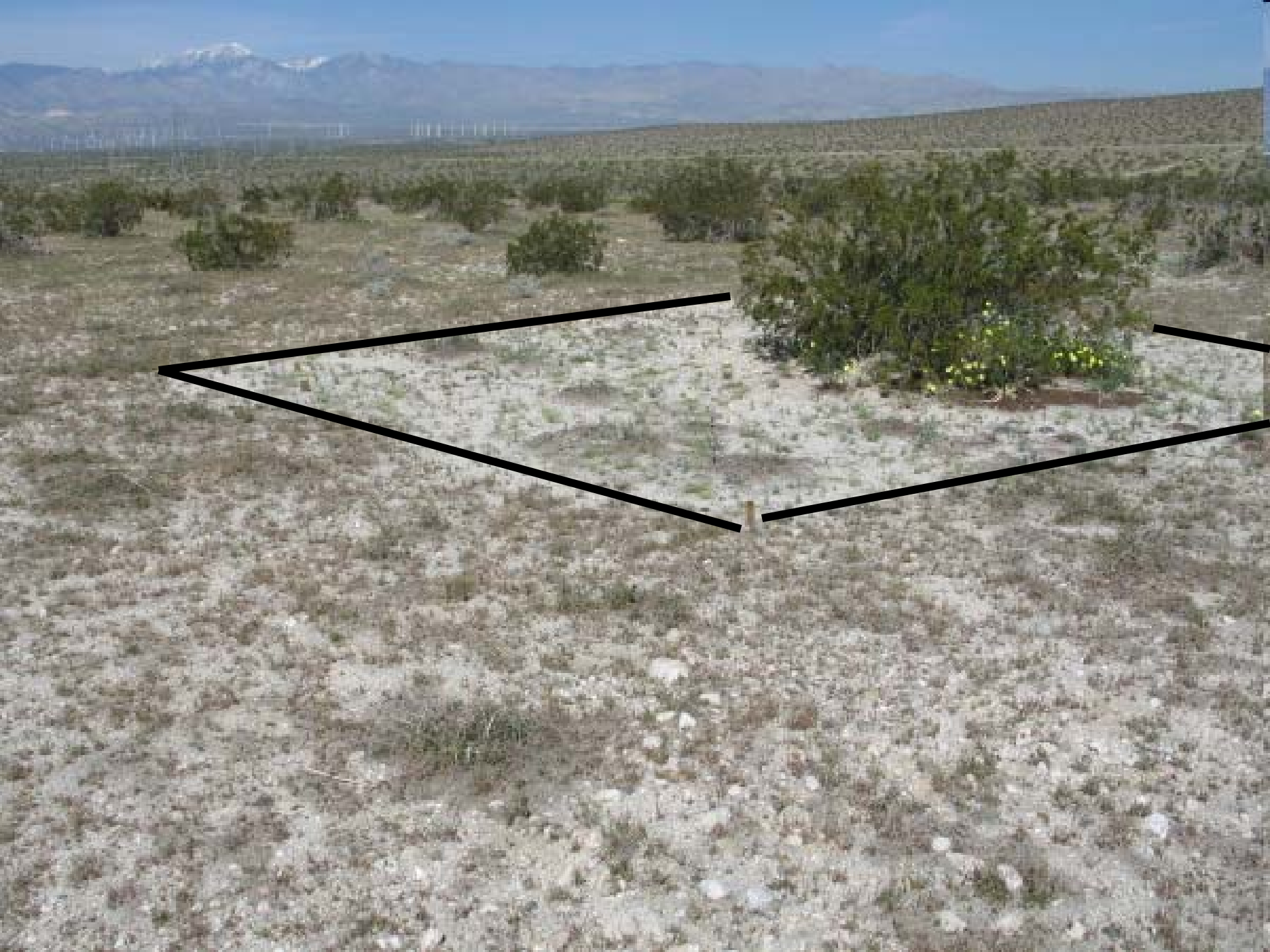


**C** Control

**F** Fusilade II

**R** Total Invasive Removal









# Conclusions

## 1. Understories:

- are more invaded
- can experience greater competition intensity, but not always
- are less speciose
- generally exhibit a greater relative increase in native annual plant richness when invasives are removed

These findings suggests that more productive microhabitats might gain the most from invasive plant control and restoration efforts.

# Conclusions

2. In sites with low invasive abundance, natives don't respond to the invasive plant removal. Although, it is generally more efficient to control invasives at the earliest stage of their spread.
3. Fusilade II is lethal to *Erodium* spp, especially when applied before inflorescence initiation.
4. Where *Erodium* spp. and grasses are the most abundant invasive plants, Fusilade II shows great potential as a restoration tool.
5. If treatments are applied in a very wet year, treatment effects can last for at least 4 yrs.



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WHERE DISCOVERIES BEGIN

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