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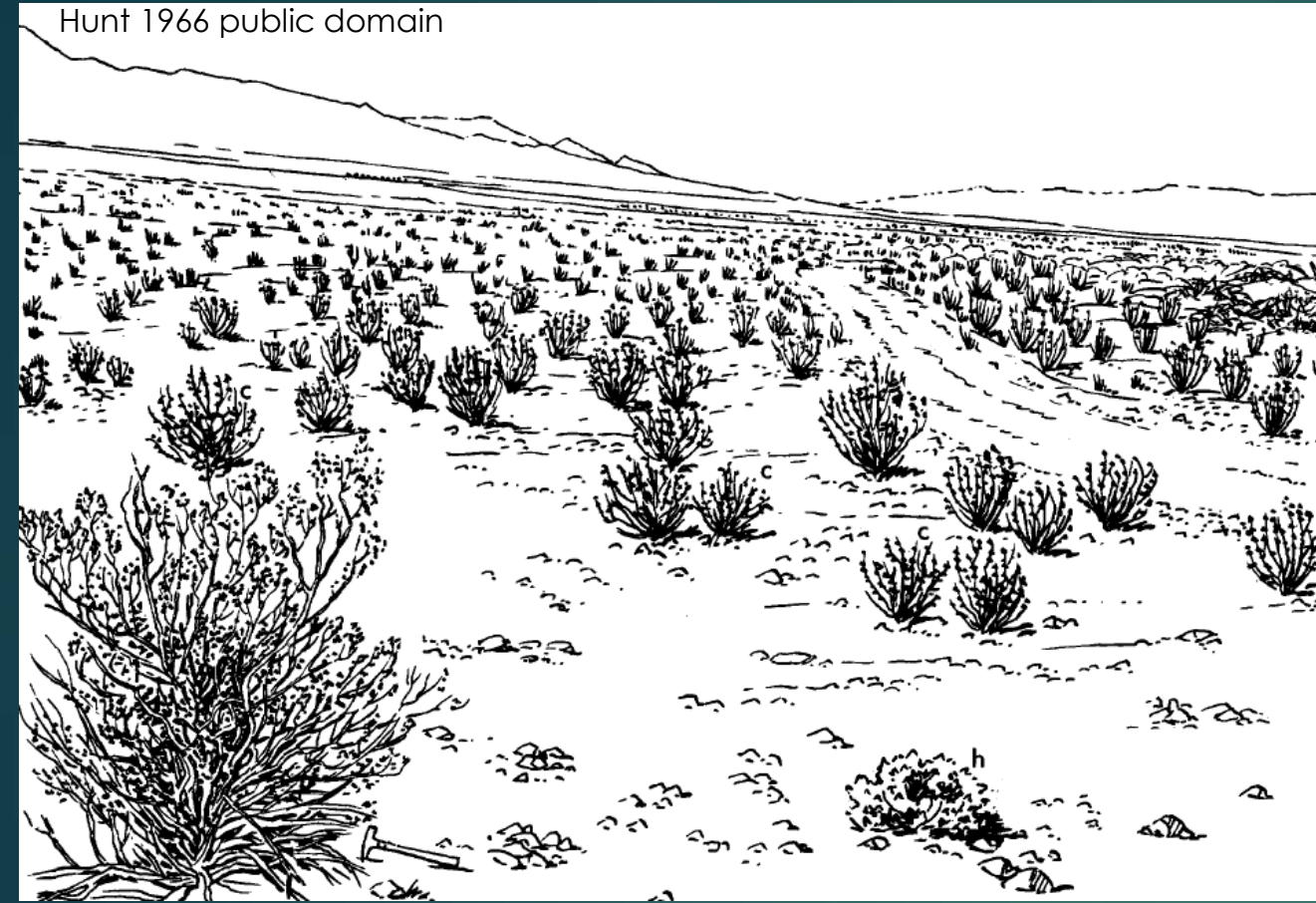
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# The Good with the Bad: when Ecological Restoration Facilitates Non-Native Plants



# Fertile Islands Underpin Desert Restoration

Hunt 1966 public domain



- Microsites below many perennials (often shrubs)
- Enriched nutrients, shaded, seed deposition
- Restore for structure and function

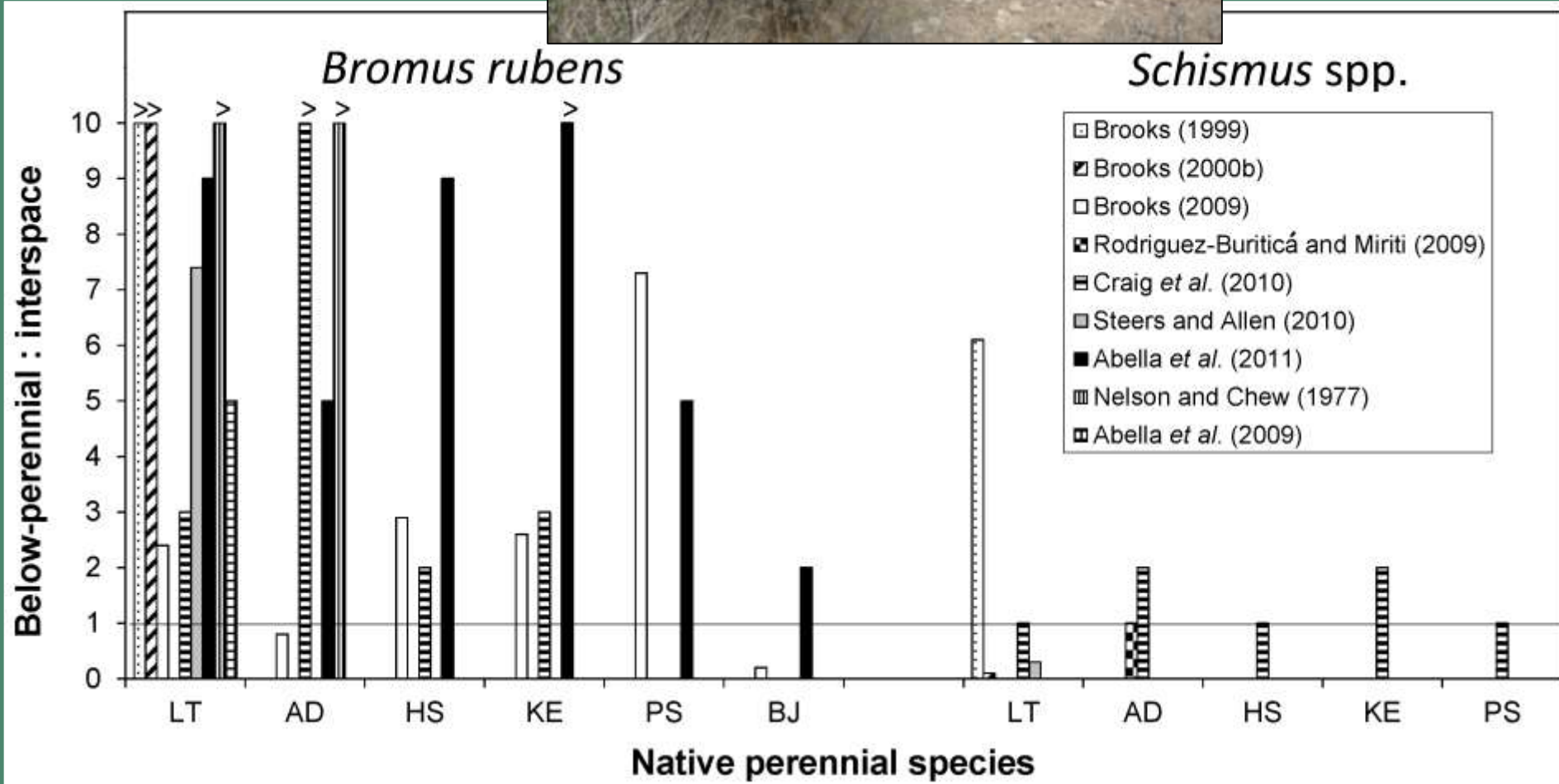
## Annual-perennial plant relationships and species selection for desert restoration

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**Abstract:** Exotic plant invasion is a growing concern in desert ecosystems. By creating areas of ameliorated microclimate, restoration might influence exotic annual plant invasions. We compared exotic annual plant abundance among native perennial species in North America's Mojave Desert, where exotic plant invasion has led to and broad-scale ecosystem transformation. Ten studies



Are these patterns similar during restoration?

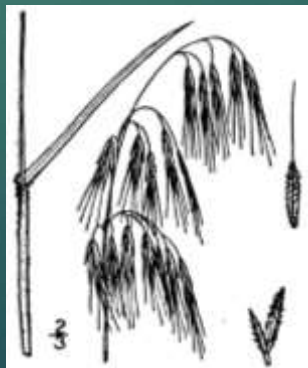
# Joshua Tree National Park



Red  
brome



Cheatgrass

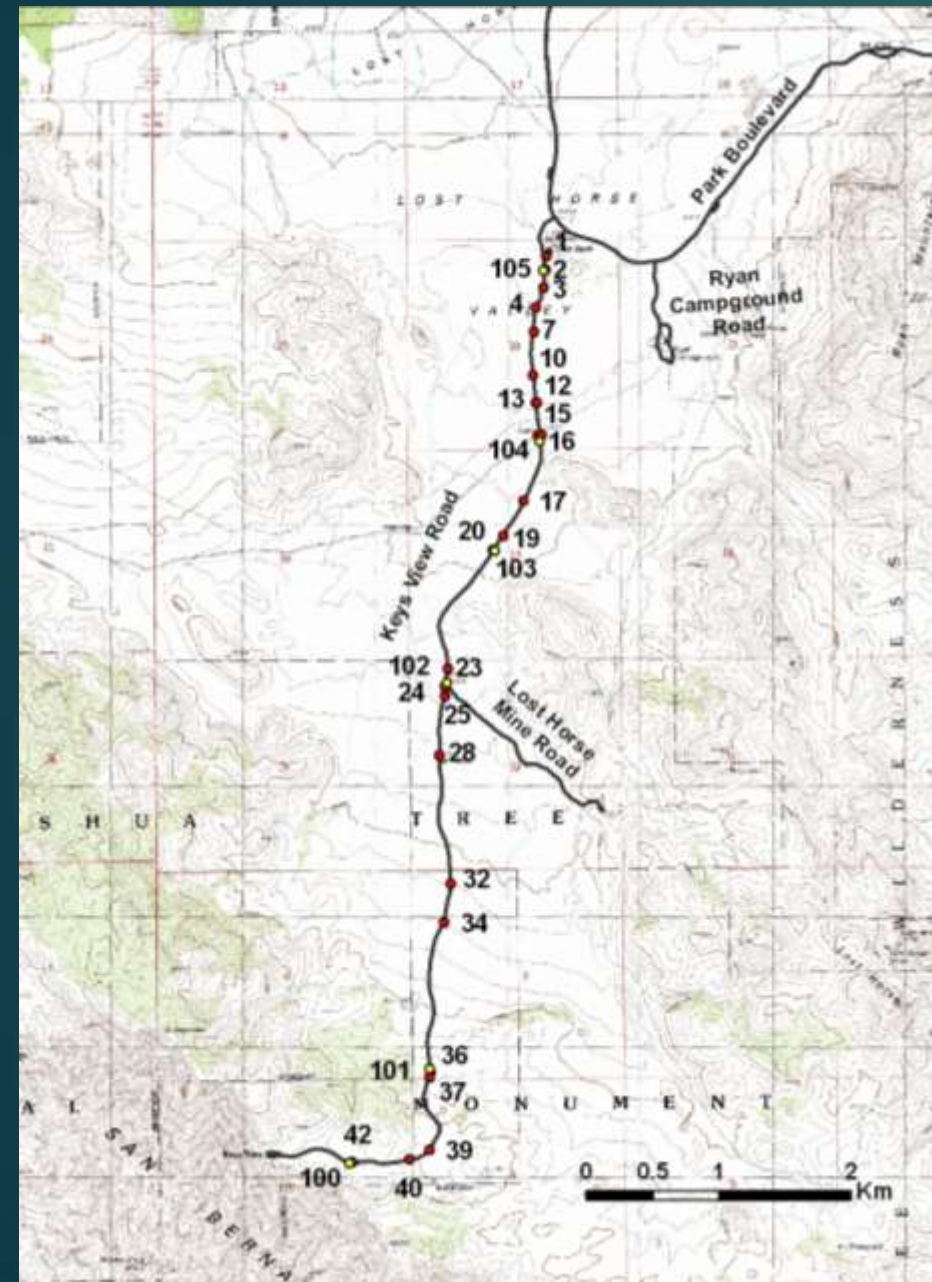


*Schismus*  
spp.



# Keys View Road Study Area

- 6-mile disturbance corridor, Federal Highways
- Outplanting, vertical mulch in March 2008
- Outplants caged, hand watered
- 5 whole-plot treatments
- Nested outplant, vertical mulch, interspace



Disturbed

Undisturbed  
Unrestored

Unrestored

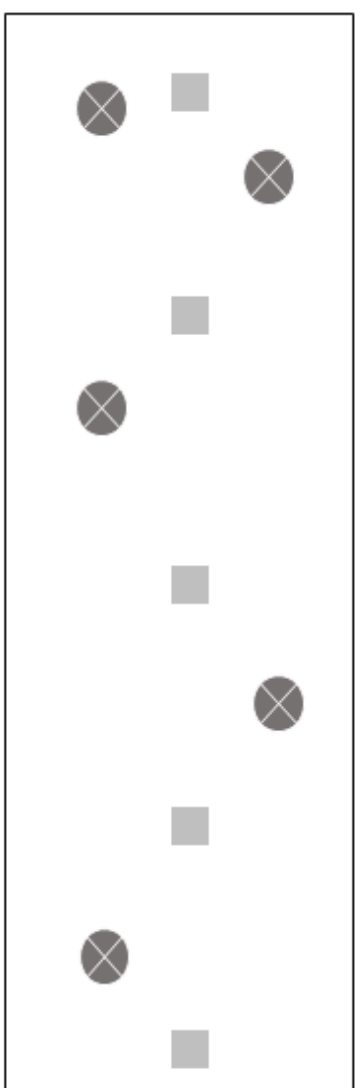
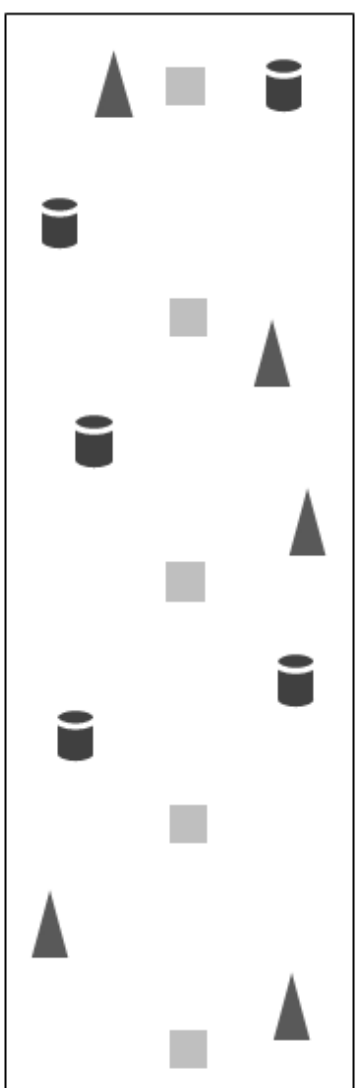
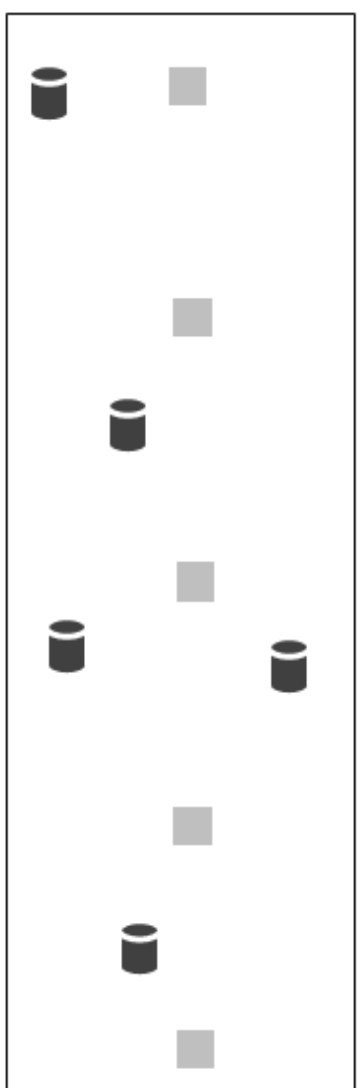
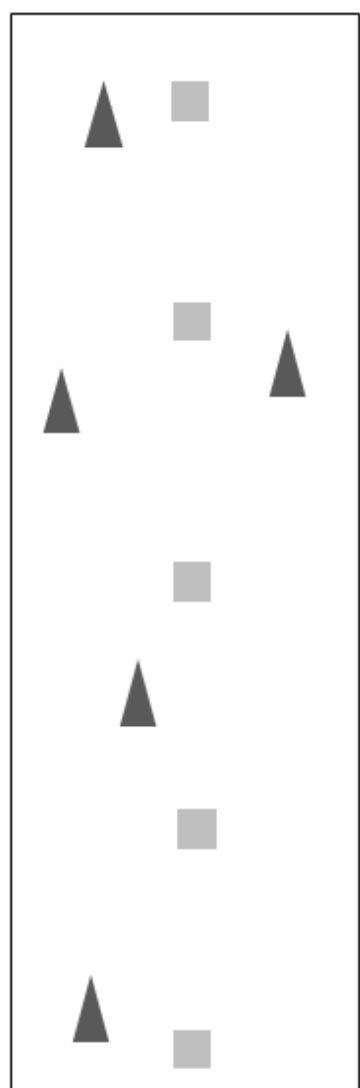
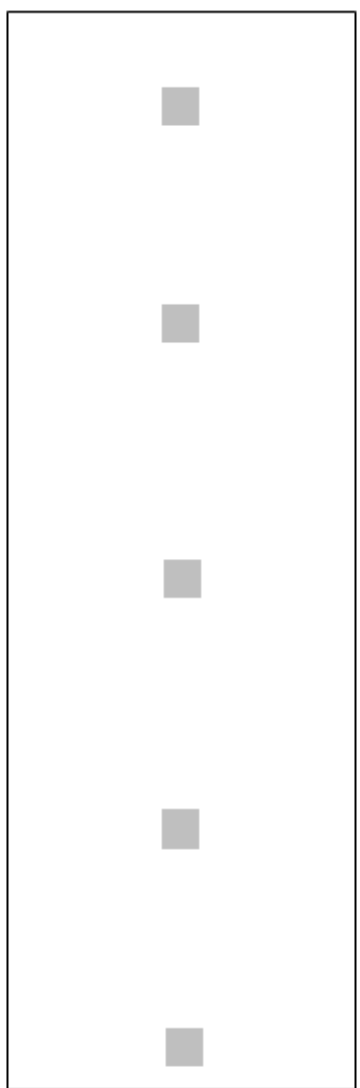
Vertical Mulch

Outplant

VM + OP

Unrestored

20 m



2 m

■ Interspace

▲ Vertical mulch

● Outplant

⊗ Natural plant

6 each  
2009  
2010  
2011  
2017



2008



2010



2011



2017



2017



2010



2017



2010



2011



Ambient "undisturbed"



2017



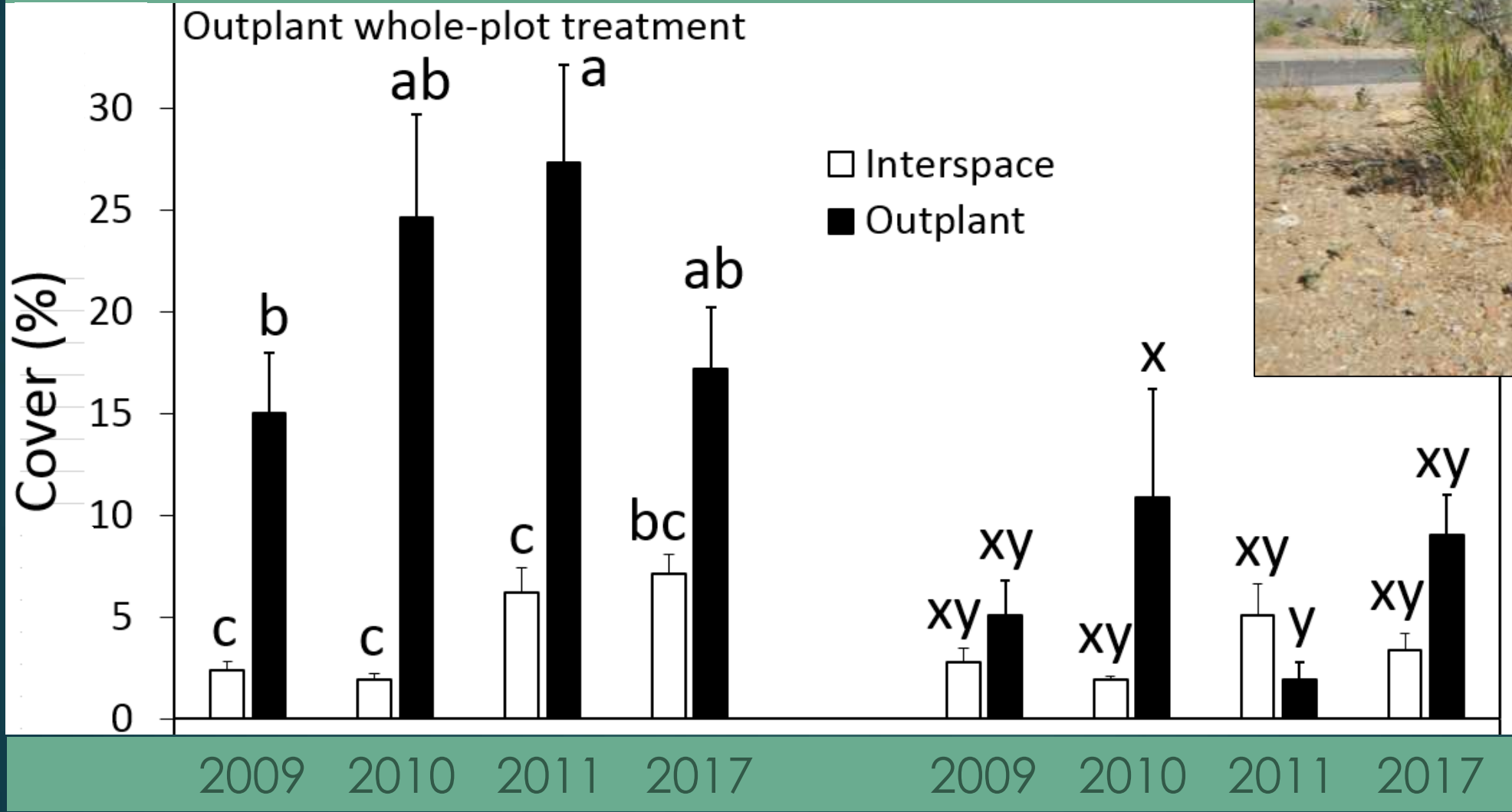
# Microsite Scale – annual-biennial species

Non-native

Native



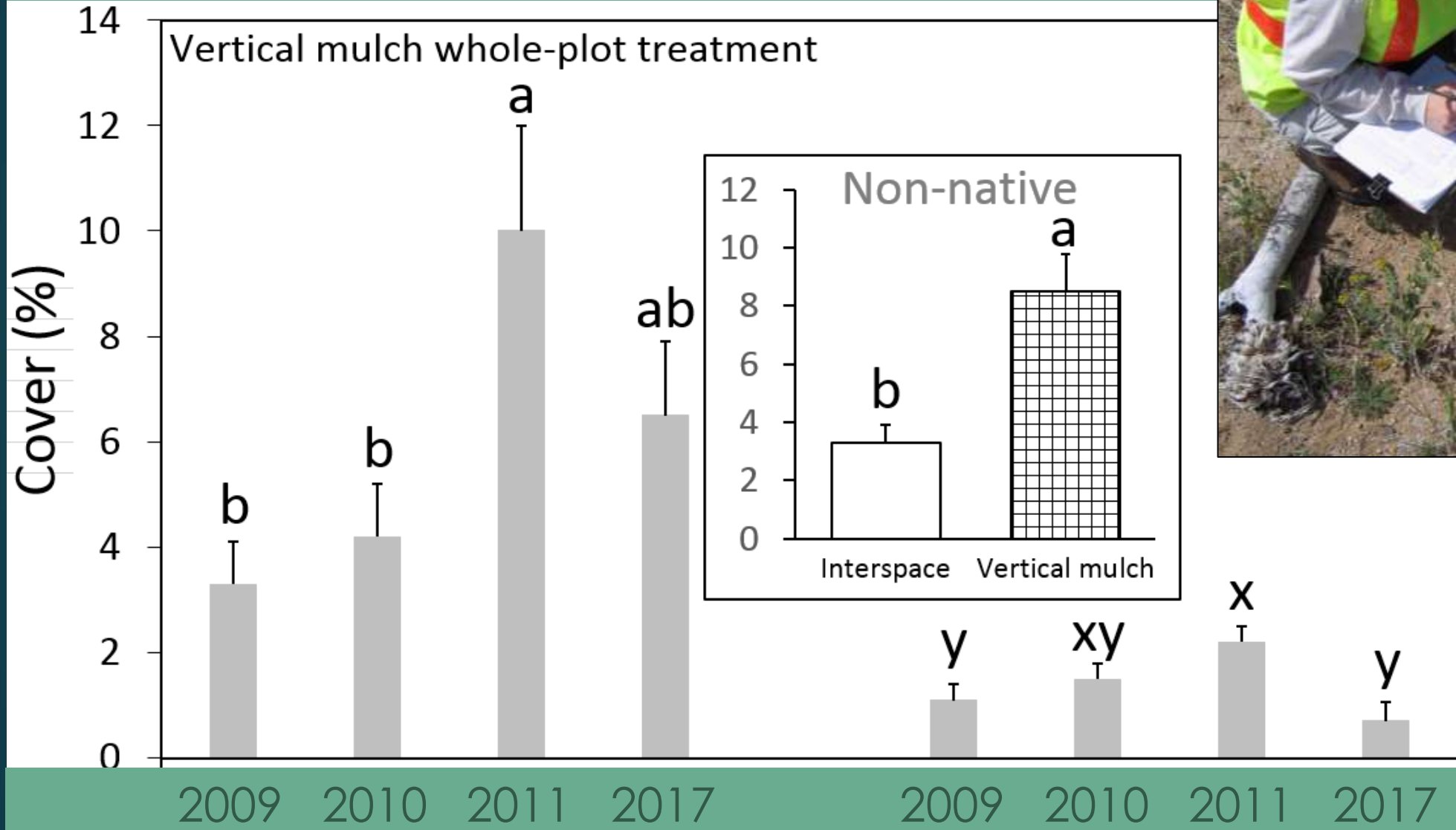
Outplant



# Microsite Scale – annual-biennial species

Non-native

Native

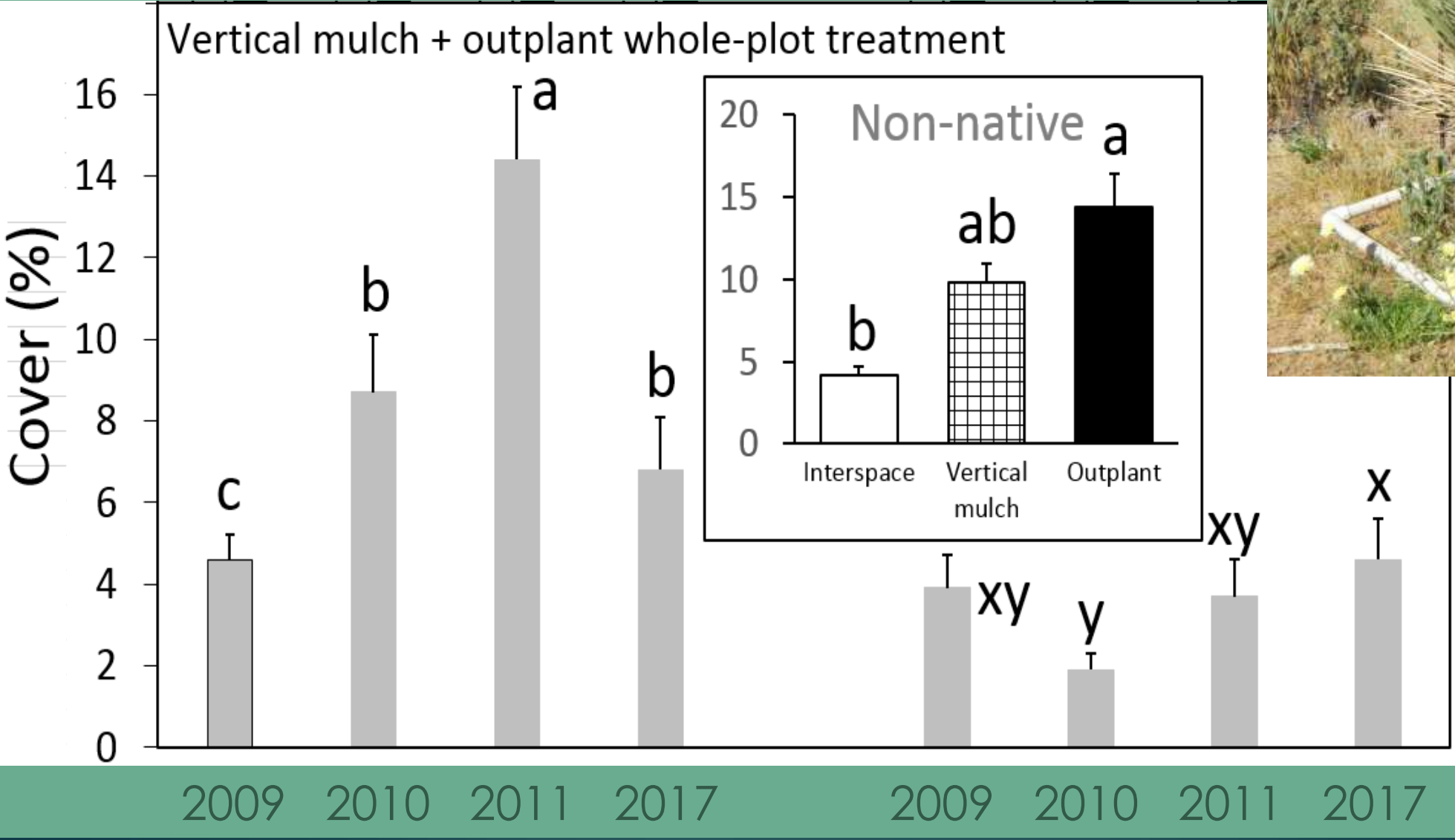


Vertical mulch

# Microsite Scale – annual-biennial species

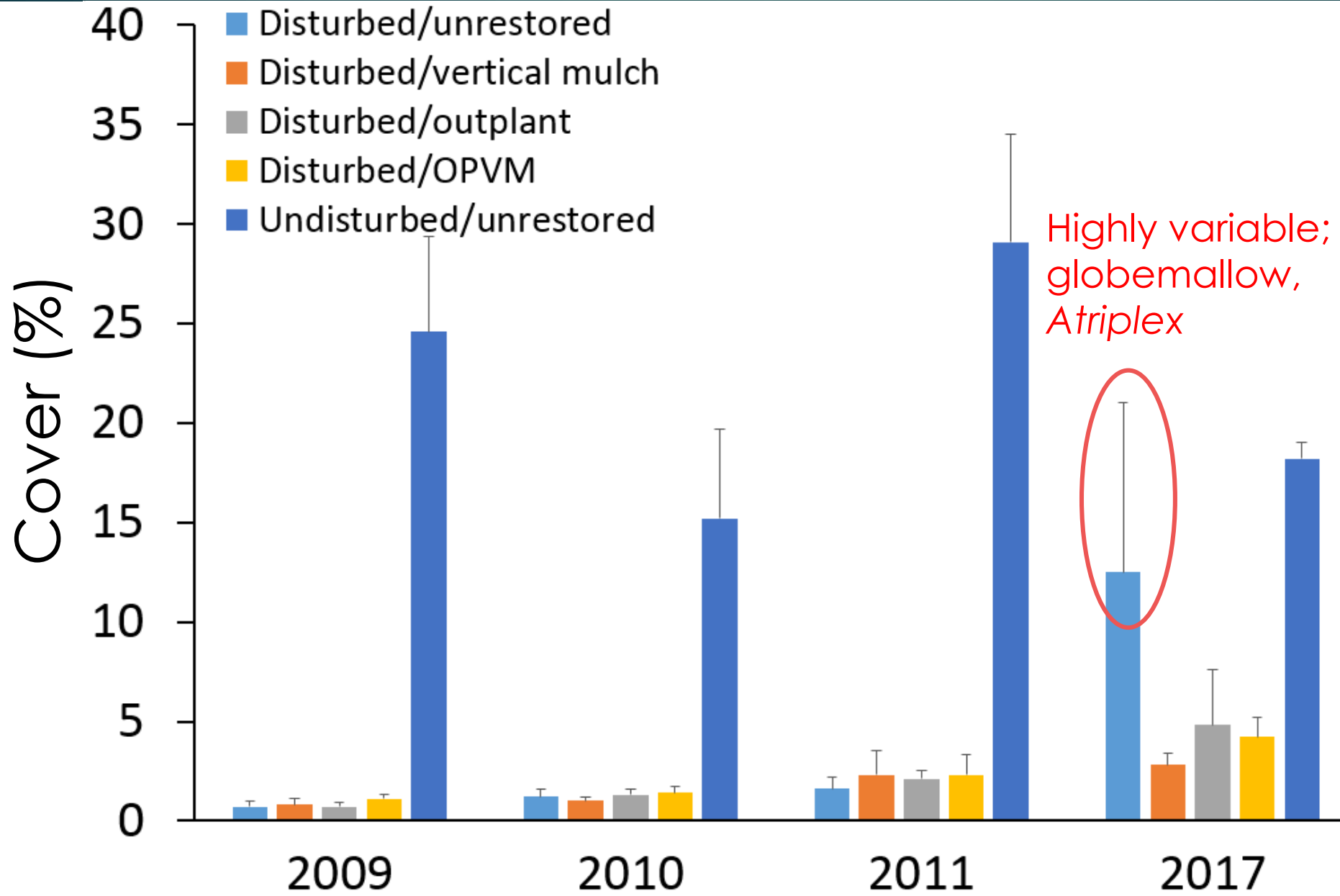
Non-native

Native

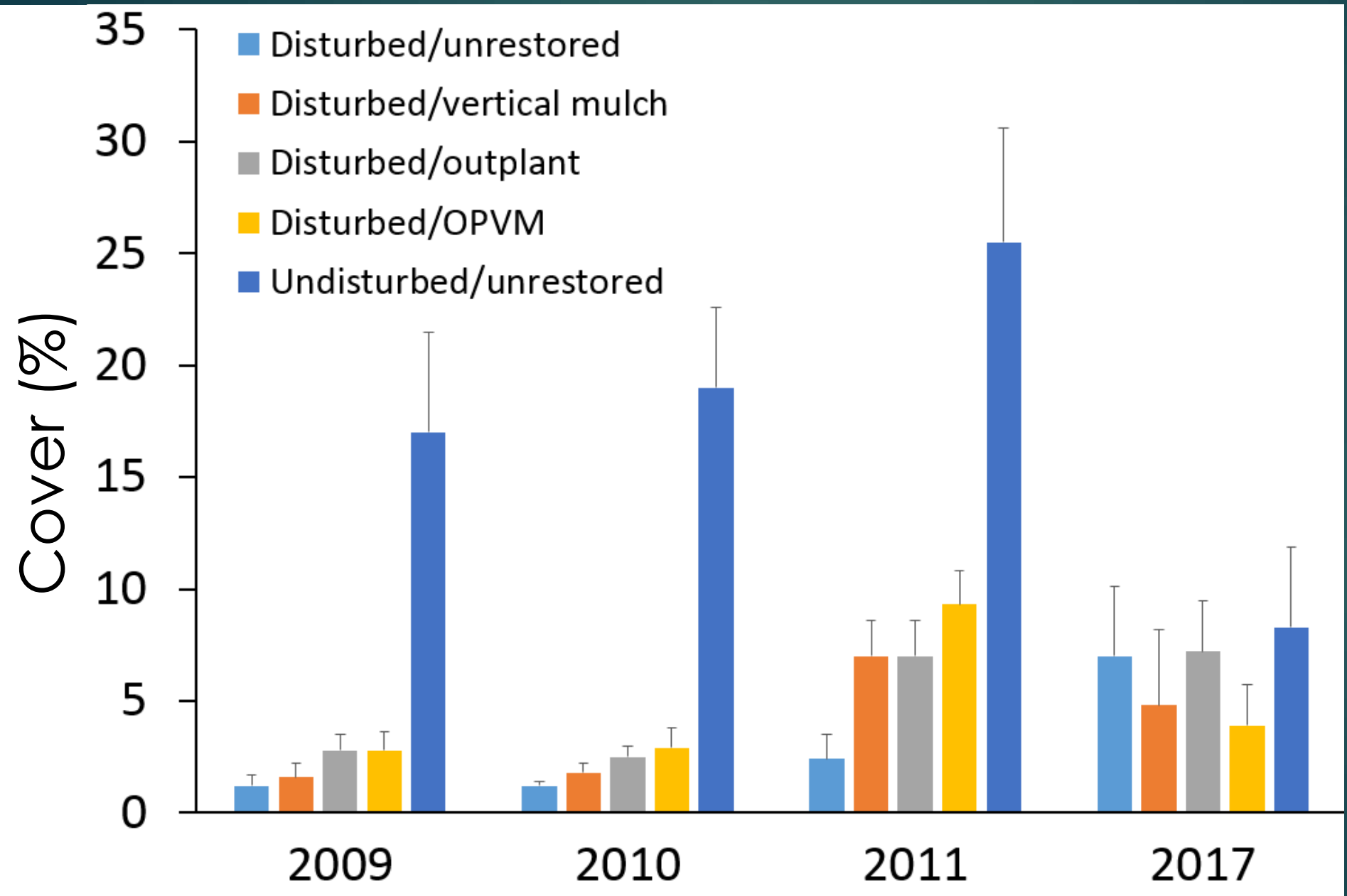


Outplant + vertical mulch

# Whole-Plot Treatment Scale – native perennials



# Whole-Plot Treatment Scale – non-native annuals-biennials



– Native annuals no significant patterns, not shown



# Discussion and Conclusions

- Lower-elevation Twentynine Palms, CA weather station reported 1936-2016 avg of 4.3 inches/yr rain
  - All 9 study years (incl 2017 trends) below average
  - Lacking winter rains or if have, shut off in late winter as in 2017
- 
- Difficult restoration setting – chronic disturbance, non-native plants coupled with the usual challenges of weather, herbivory, etc.
  - Outplanting treatment includes cage, watering, greenhouse soil
  - Native annuals were mercurial – run correlation analysis, species
  - Are fertile islands less important in wet years?
  - Weed control paired with native plant restoration?





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- Joshua Tree National Park employees, and E.C. Engel (UNLV)
- JFSP California Fire Science Consortium



UNLV Applied Ecology Lab

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**Las Vegas Wash Restoration January 2017**

Matthew Rader instructing volunteers how to plant. Photo credit: UNLV photographer Josh Hawkins

We are so proud of our undergraduate research team here at the Abella lab. Congratulations to Vivian Sam, Matthew Rader, and Aurdrey Rader for a great event. Together they developed and organized a field study design and all the logistics. The goals of the Las Vegas wash restoration project at Lake Mead NRA is to reintroduce native plant species along the watershed and provide wildlife habitat and protection along the now-exposed shoreline. Over the next



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Sierra Nevada Region

UC Berkeley

Central and Southern California Region

Desert Region

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