

# *Mesembryanthemum crystallinum* reduces ecosystem functions on San Nicolas Island

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# Invader Impact Information helps us prioritize conservation efforts and design solutions

**Nutrient cycling**



**Seed dispersal**



**Parasitism**



**Pollination**



**Predation**

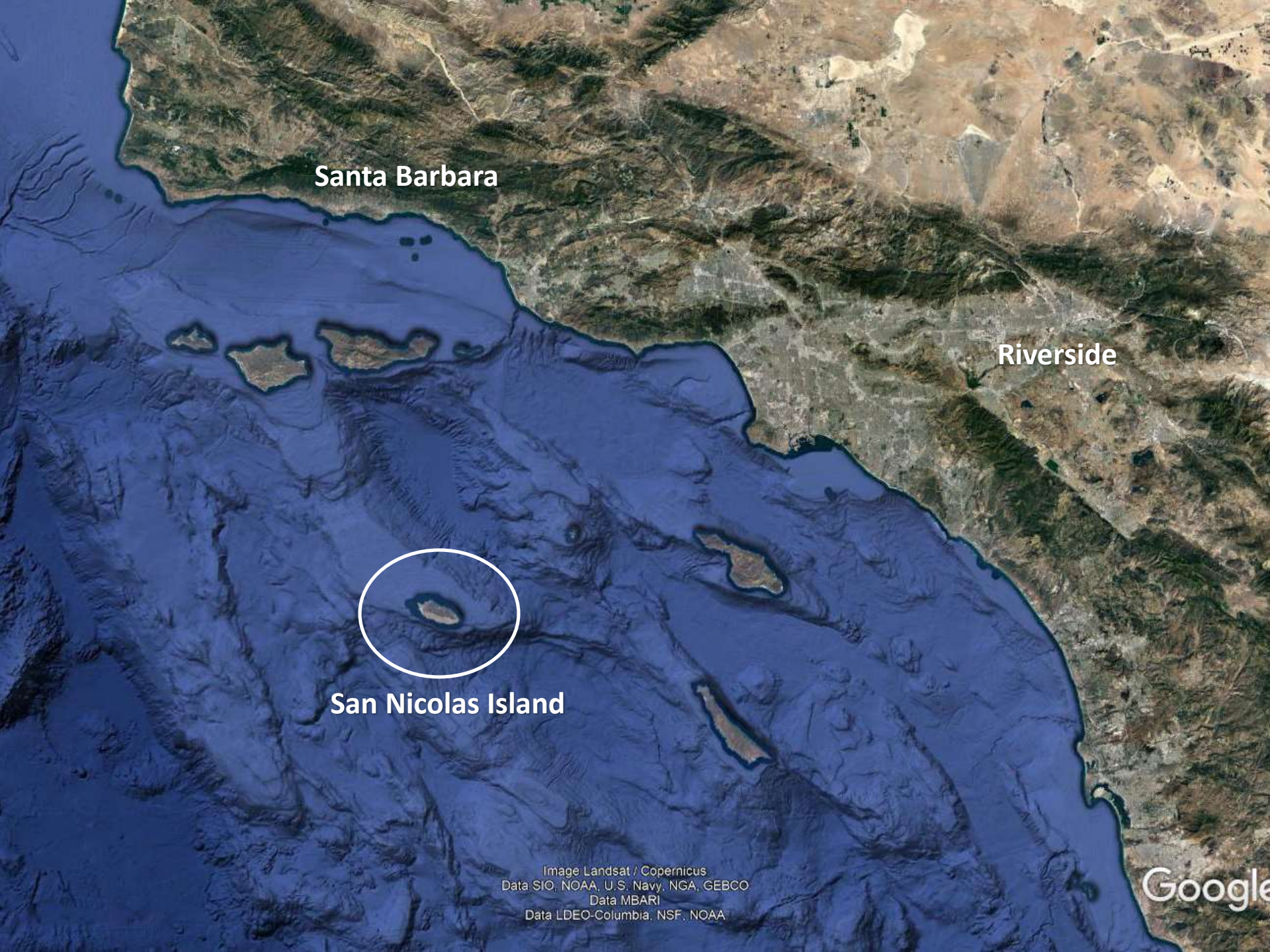


**Herbivory**

**Invertebrates are *Excellent* indicators**

Invasive plant impacts follow the food chain.  
On San Nicolas Island, this ends at Island Foxes.



A satellite-style topographic map of the Santa Barbara Channel region. The land is shown in shades of brown and tan, indicating a dry, hilly terrain. The ocean is a deep blue. Several islands are visible in the channel. One island, San Nicolas Island, is circled in white. Labels for 'Santa Barbara' and 'Riverside' are placed on the land. A white circle highlights San Nicolas Island, with its name labeled below it. The Google logo is in the bottom right corner, and a list of data sources is at the bottom center.

**Santa Barbara**

**Riverside**

**San Nicolas Island**

Image Landsat / Copernicus  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Data MBARI  
Data LDEO-Columbia, NSF, NOAA

**Google**

*Mesembryanthemum crystallinum* (MECR) invades  
the California coast and islands



Aizoaceae (few native species = Taxonomic Isolation)



On San Nicolas: MECR, MECR, everywhere





Highly adaptable  
+  
Long-lived seeds  
=  
Difficult to manage

# MECR can accumulate salts on the soil surface



Vivrette & Muller 1977, *Ecological Monographs*

*What does this mean for the invertebrates?*



# METHODS

3 Study Sites:



“Buckwheat Badlands”



“Caliche Plateau”



“Stilted Dunes”

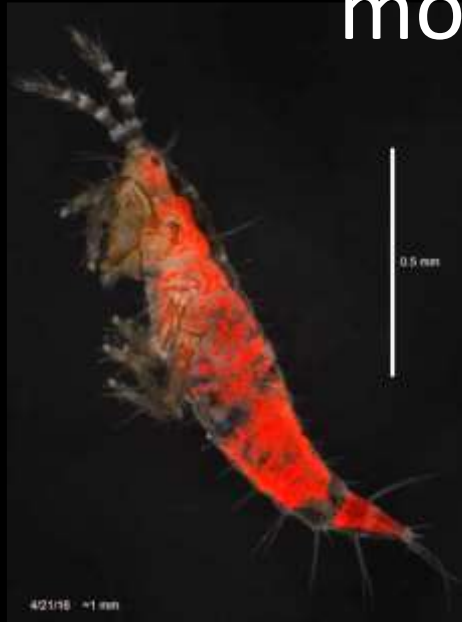
42 plots at each site: 36 MECR, 6 adjacent native



# We Used Pitfall Trapping to Capture Ground-Active Arthropods



# We ID'ed arthropods to family and “morphospecies”



We get our ecological question answered across an array of taxa, then entomologists get the specimens

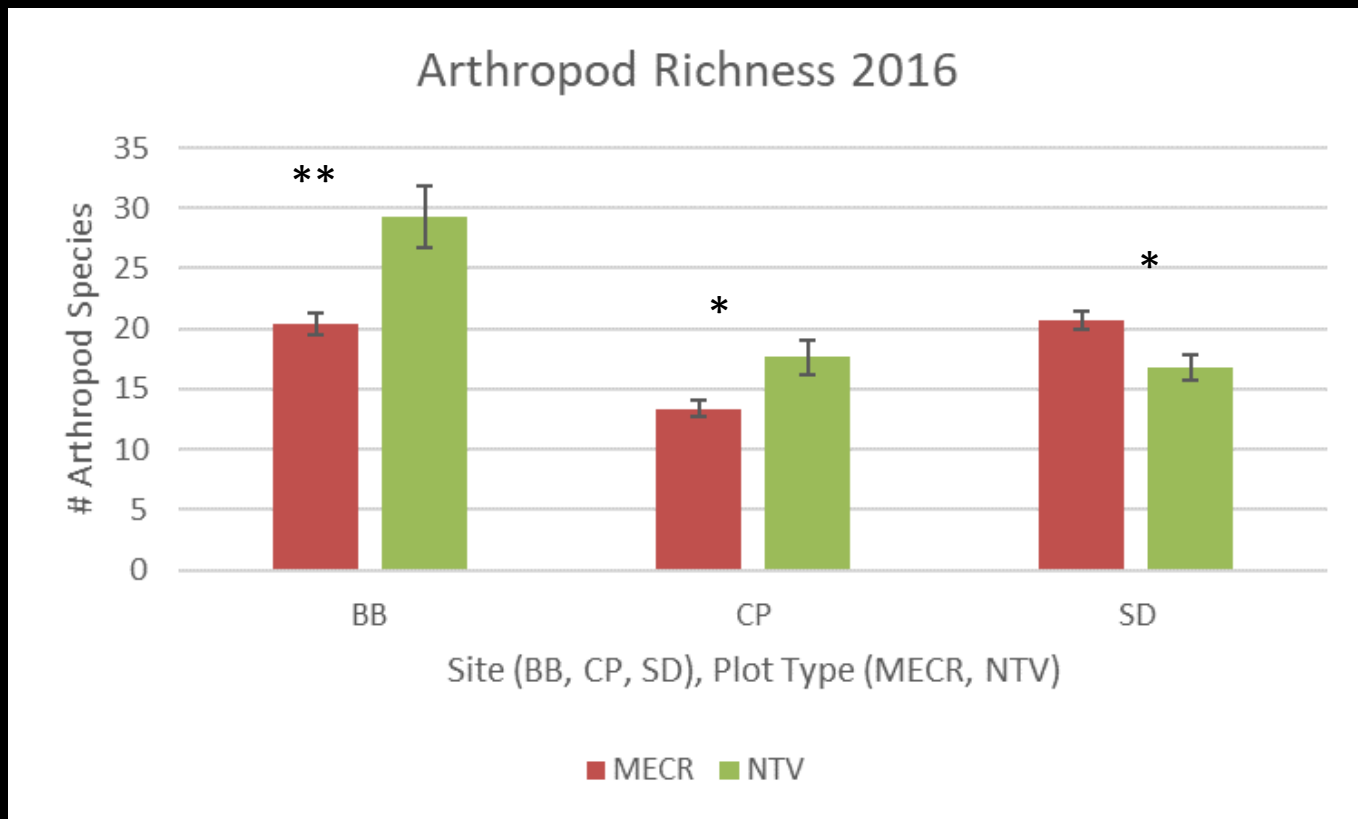


Encyrtidae 7:  
***A new wasp  
genus discovered  
through this  
project***

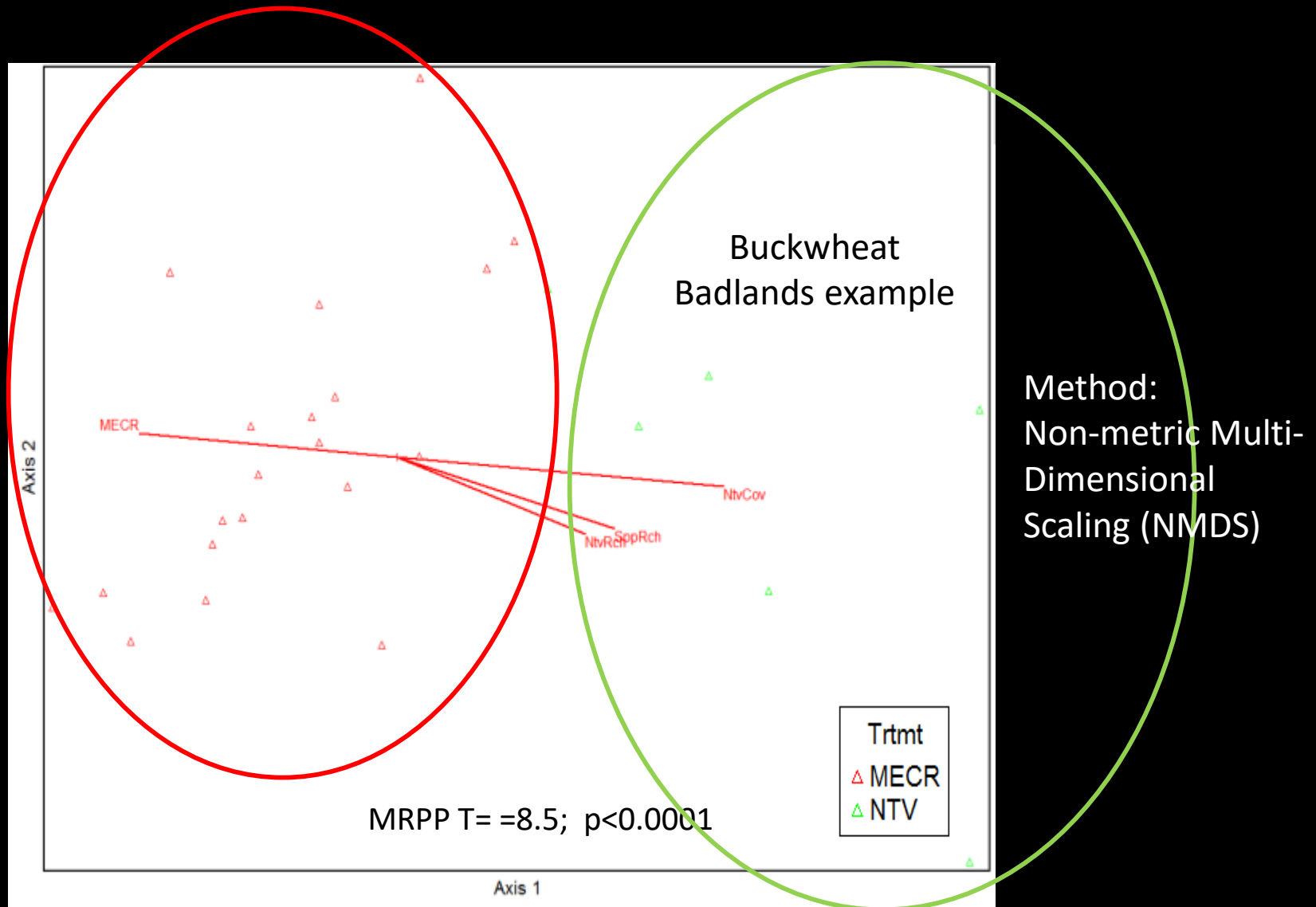
# RESULTS

11,048 arthropod individuals (192 morphs) were assessed.

Arthropod richness was lower in MECR at two sites, higher at one.



# All three sites had different arthropod composition in native vs. MECR plots



# Which arthropods used Mesembryanthemum?

Barklice, Bristletails, Mealybugs, & Springtails were Indicator Species.



Trogiidae1



Liposcelididae1



Trogiidae2



Meintertellidae1



Pseudococcidae3



Etmobryidae1



# *Which arthropods used native vegetation? (part 1)*

Leafhoppers, Moths, Gall Midges, Aphids, Wasps and Beetles



Cicadellidae9



Gelechiidae1



Cecidomyiidae1



Aphididae3



Platygastriididae1



Encyrtidae6



Sphecidae3



Melyridae1

# Which arthropods used native vegetation? (part 2)

Ants, Ants, Flies, Flies...



Formicidae 3:  
*Tapinoma  
sessile*



Formicidae5:  
*Monomorium ergatogyna*



Formicidae 1:  
*Dorymyrmex insanus*



Heleomyzidae5

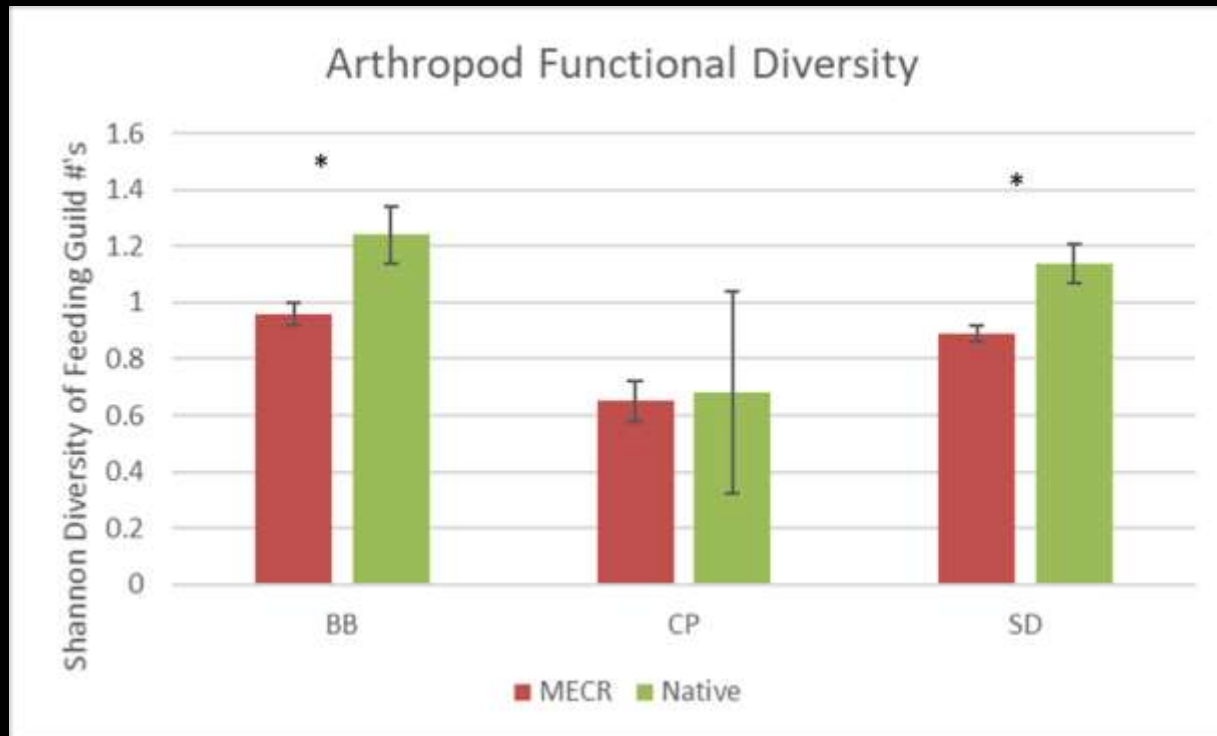


Heleomyzidae2



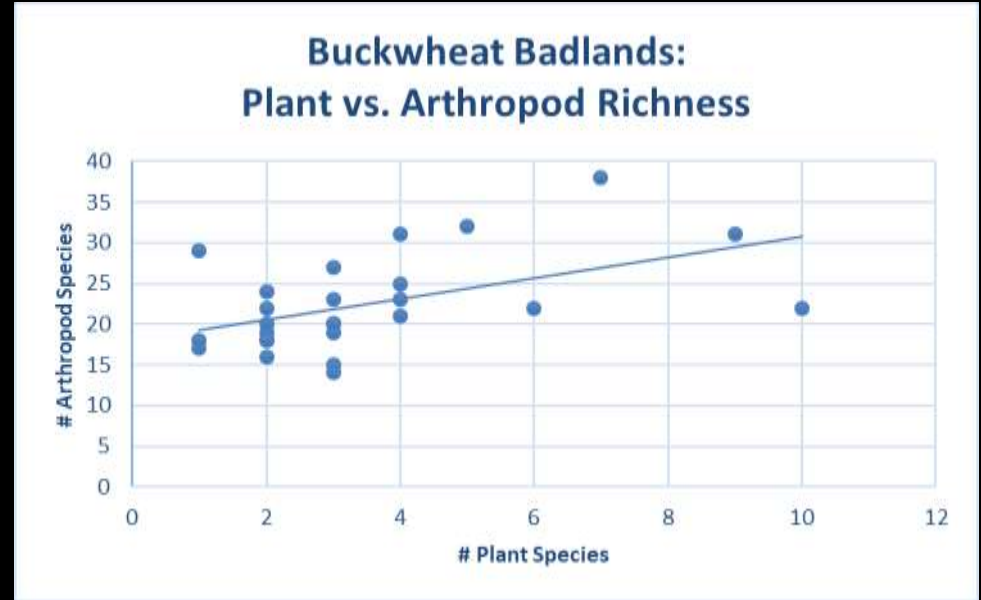
Sarcophagidae2

The diversity of arthropod functional groups was lower in MECR plots at two sites.



# DISCUSSION

At heavily invaded BB,  
plant richness begets  
arthropod richness.



Kendall's Tau correlation: 0.49



At the drier CP site, soil  
moisture was most important.



At the more open backdune site of SD, arthropod richness benefitted from ↑ plant litter.

Those lost arthropods were important to the struggling island fox.



*Now, how do we recover these  
plants and “bugs”?*

# Navy seeking cost-effective restoration technique for a large scale

Our approach:

- Grow-kill MECR and hydroseed\*
- Grow-kill MECR, no hydroseed
- Herbicide MECR and hydroseed
- Herbicide MECR, no hydroseed
- No MECR treatment and hydroseed
- No MECR treatment, no hydroseed



Kodiakdevelopmentgroup.com

*\*ideal for an eroded island like San Nicolas*



# October-January 2016-2017: “Grow–Kill” to stimulate the seedbank, flush salts



# February 2017: Backcountry hydroseeding to secure the space



The "Turbo-Turf HS-50-M"



# Our diverse seed mix

- *Abronia umbellata*
- *Achillea millefolium*
- *Acmispon argophyllus*
- *Amblyopappus pusillus*
- *Astragalus traskiae*
- *Calystegia macrostegia*
- *Daucus pusillus*
- *Deinandra clementina*
- *Dudleya virens*
- ***Eriogonum grande* var. *timorum***
- *Isocoma menziesii*
- *Lepidium lasiocarpum* var. *lasiocarpum*
- *Leptosyne gigantea*
- *Lupinus albifrons* var. *douglasii*
- ***Lomatium insulare***
- *Malacothrix foliosa* var. *polycephala*
- *Oligomeris linearifolia*
- *Spergularia macrotheca* var. *macotheca*



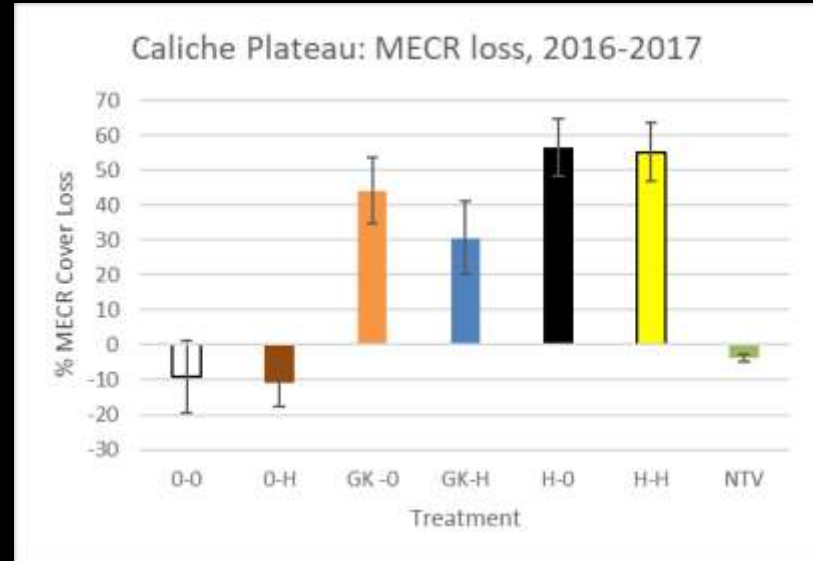
Results: Both methods killed MECR...



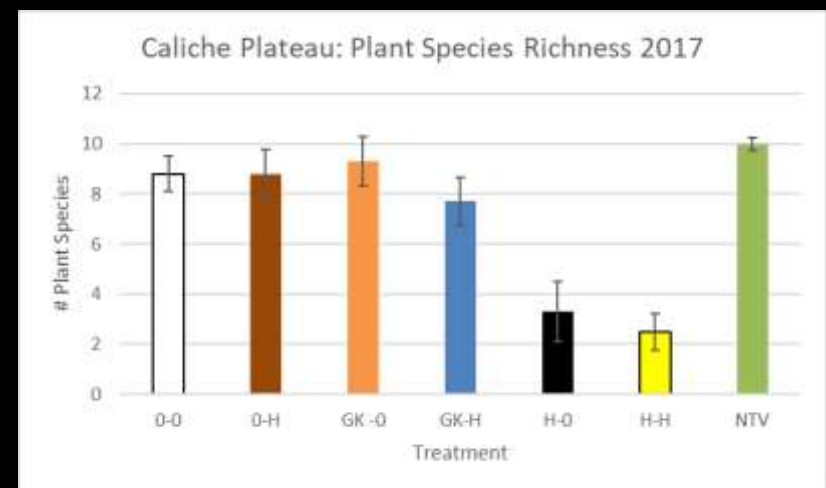
# Herbicide killed MECR slightly better

## Legend

- 0-0 No Action Control
- 0-H No Weeding Hydroseed
- GK -0 GrowKill NoSeed
- GK-H GrowKill Hydroseed
- H-0 Herbicide NoSeed
- H-H Herbicide Hydroseed
- NTV Native Control



But, Grow-Kill retained  
more plant species  
(higher native cover, too)



Seeds germinated, things were going great...  
and then the 2017-2018 drought happened.  
There's just no quick fix.



*An argument for biocontrol.*

Questions?

