Optimizing restoration strategies in iceplant-dominated landscapes of coastal California

Cal-IPC Symposium 2025

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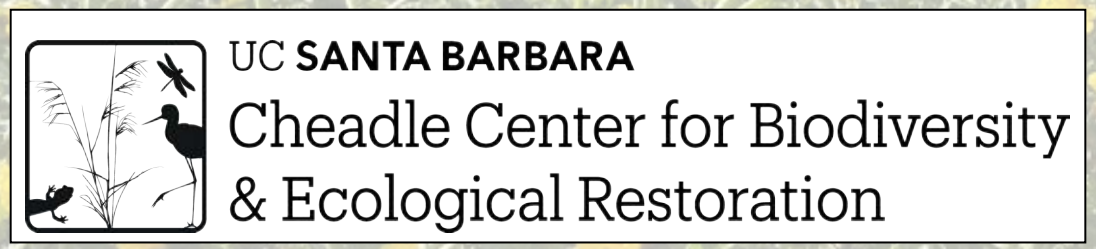
1. Department of Ecology, Evolution, and Marine Biology, University of California, Santa Barbara
2. Cheadle Center for Biodiversity and Ecological Restoration, University of California, Santa Barbara



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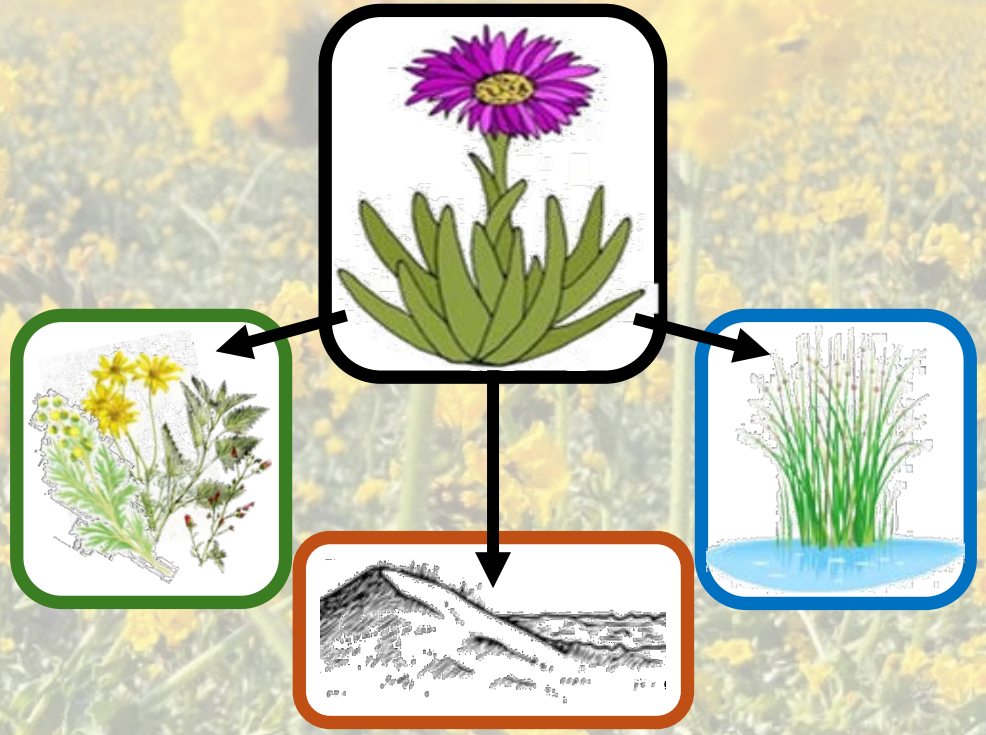
- Lillian Ferreira
- James Mills
- Elyse Hartmann
- Eva Boas
- Gigi Mitchell
- Amalia Narofsky
- Schuyler Capita
- Amy Rowe
- Haley Weinstein
- And more!

Key Messages

Moving beyond a **single species** mindset reveals **multi-species** and **multi-ecosystem** challenges for restoration practitioners.

Enhancing **ecological resistance** can lead to **larger-scale** and **longer-term** success.



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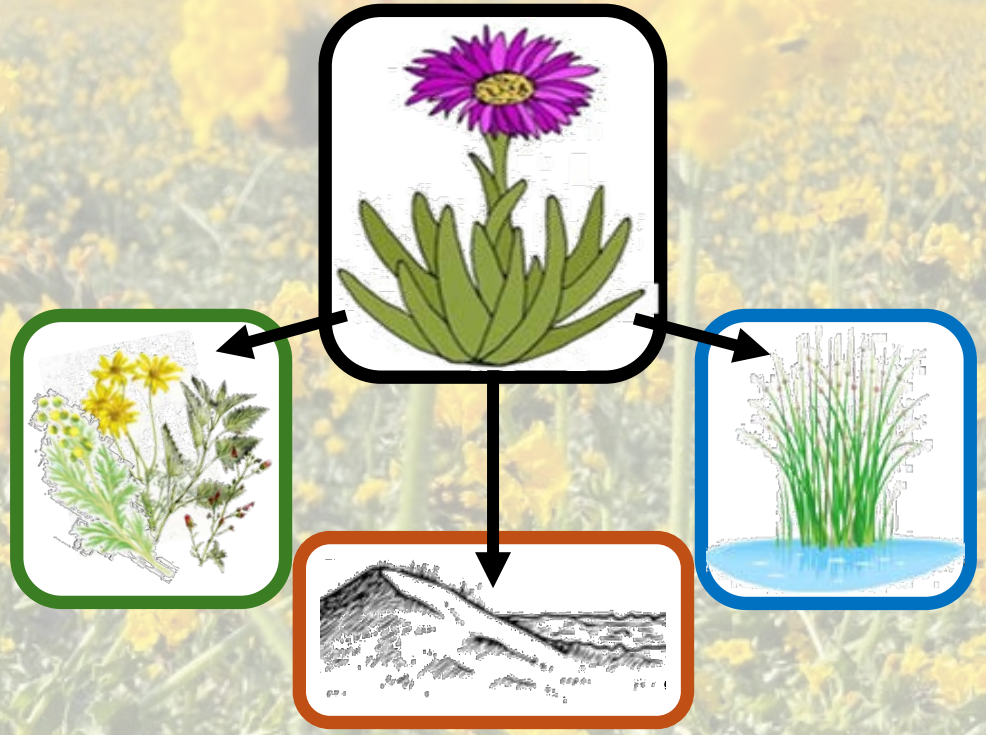

Iceplant (*Carpobrotus edulis*)

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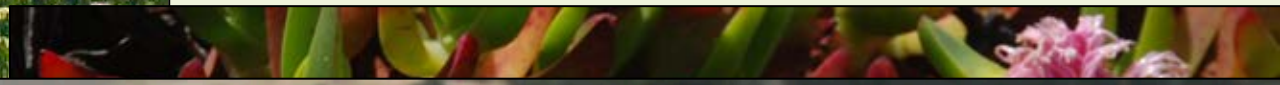

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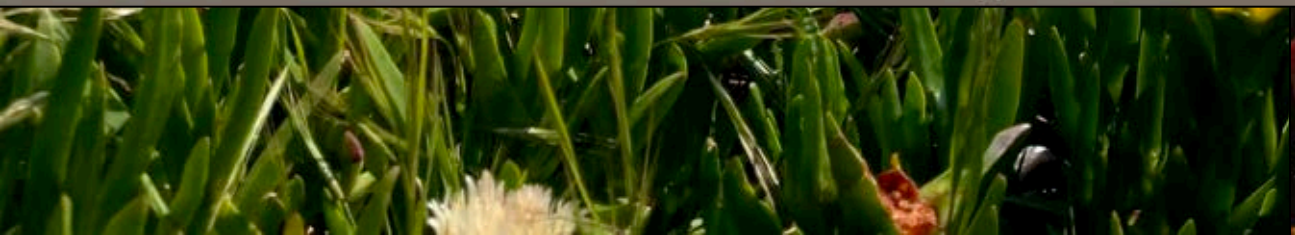

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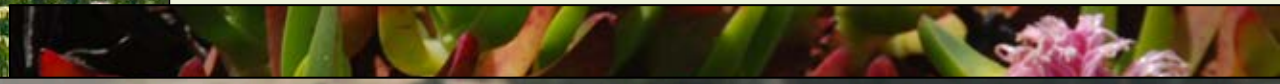

ICEPLANT!!

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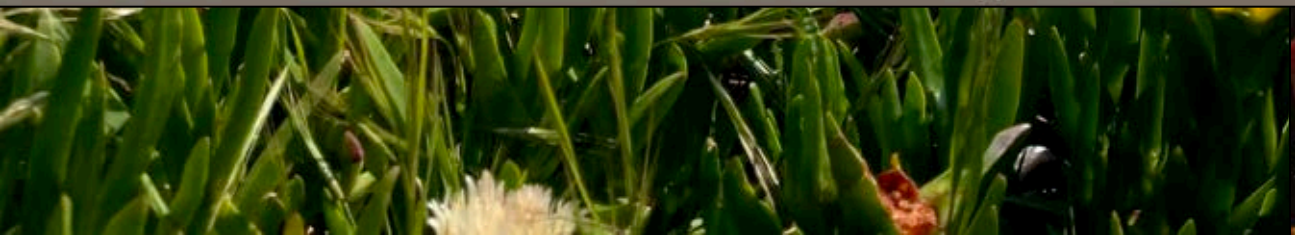

Biological Conservation 164 (2013) 1–9

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Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

Constraints to native plant species establishment in coastal
communities invaded by *Carpobrotus edulis*: Implica

Ana Novoa [a,b,c,*], Luís González [a], Lenka Moravcová [b]

[a] Departamento de Bioloxía Vexetal e Ciencia do Solo, Facultade de
[b] Institute of Botany, Department of Invasion Ecology,
[c] Centre for Invasion Biology, Department of Bo
[d] Department of Ecology, Faculty of Sc

Biol Invasions (2009) 11:349–358
DOI 10.1007/s10530-008-9252-z

ORIGINAL PAPER

**Assessing the residual effects of *Carpobrotus ed*
plications for restoration**

l E. Connor

American Journal of Botany 78(

ROOT PROFILES A
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NATIVE SHRUB SPECIES IN CALIFORNIA

CARLA M. D'ANTO
Department of Biological

PLANT SPECIES BIOLOGY

Plant Species Biology (2017) 32, 460–465 doi: 10.1111/1442-1984.12157

NOTES AND COMMENTS

The effect of stolon fragmentation on the colonization of clonal invasive *Carpobrotus edulis* in a coastal dune system: a field test

SERGIO R. ROILOA,* SANDRA ABALDE,* CHENG-YUAN XU† and LÚA LÓPEZ*

*BioCost Group, Faculty of Sciences, Department of Animal Biology, Plant Biology and Ecology, Universidade da Coruña, 15071 A Coruña, Spain; and †School of Medical and Applied Sciences, Central Queensland University, Bundaberg, Queensland 4760, Australia

ITION BETWEEN THE INVASIVE,
CARPOBROTUS EDULIS AND TWO
AL SCRUB[1]

nia 93106

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Effects of Soil Characteristics, Allelopathy and Frugivory on Establishment of the Invasive Plant *Carpobrotus edulis* and a Co-Occuring Native, *Malcolmia littorea*

Ana Novoa[1,2*], Luís González[1], Lenka Moravcová[2],

1 Departamento de Bioloxia Vexetal e Ciencia do Solo, Universidade de Vigo, Vigo,
Průhonice, Czech Republic, 3 Department of Ecology, Charles University in Pragu

Ecology, 74(1), 1993, pp. 83–95

MECHANISMS CONTROLLING INVASION OF COASTAL PLANT COMMUNITIES BY THE ALIEN Ssucculent *CARPOBROTUS EDULIS*[1]

CARLA M. D'ANTONIO
Department of Integrative Biology, University of California, Berkeley, California 94720 USA

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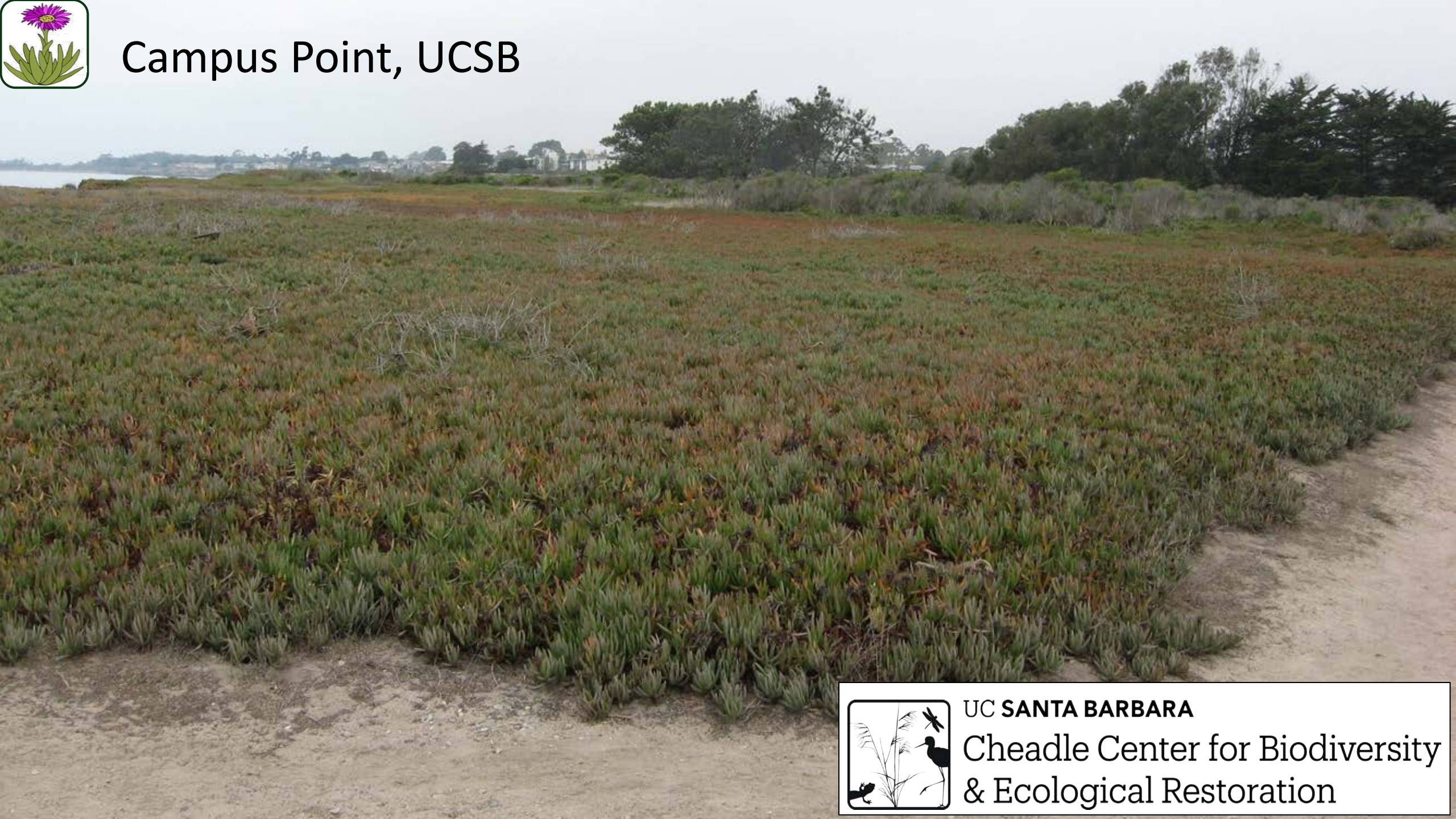
Impacts of *Carpobrotus edulis* (L.) N.E.Br. on the Germination, Establishment and Survival of Native Plants: A Clue for Assessing Its Competitive Strength

Ana Novoa*, Luís González

Departamento de Bioloxía Vexetal e Ciencias do Solo, Facultade de Bioloxía, Universidade de Vigo, Vigo, Spain

We don’t have to reinvent the wheel!

Campus Point, UCSB



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Solarize iceplant…

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Plant native shrubs…

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Success!

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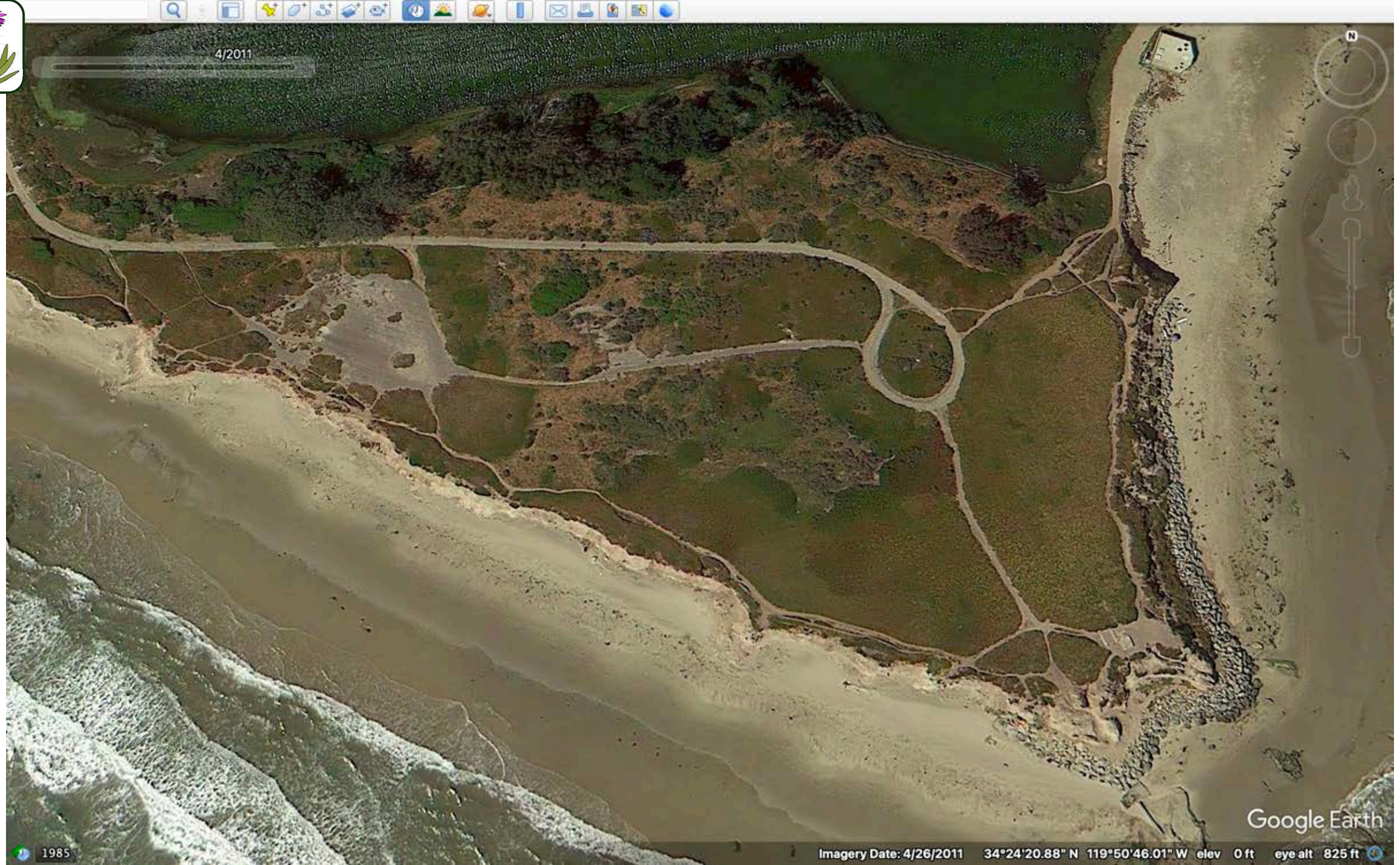
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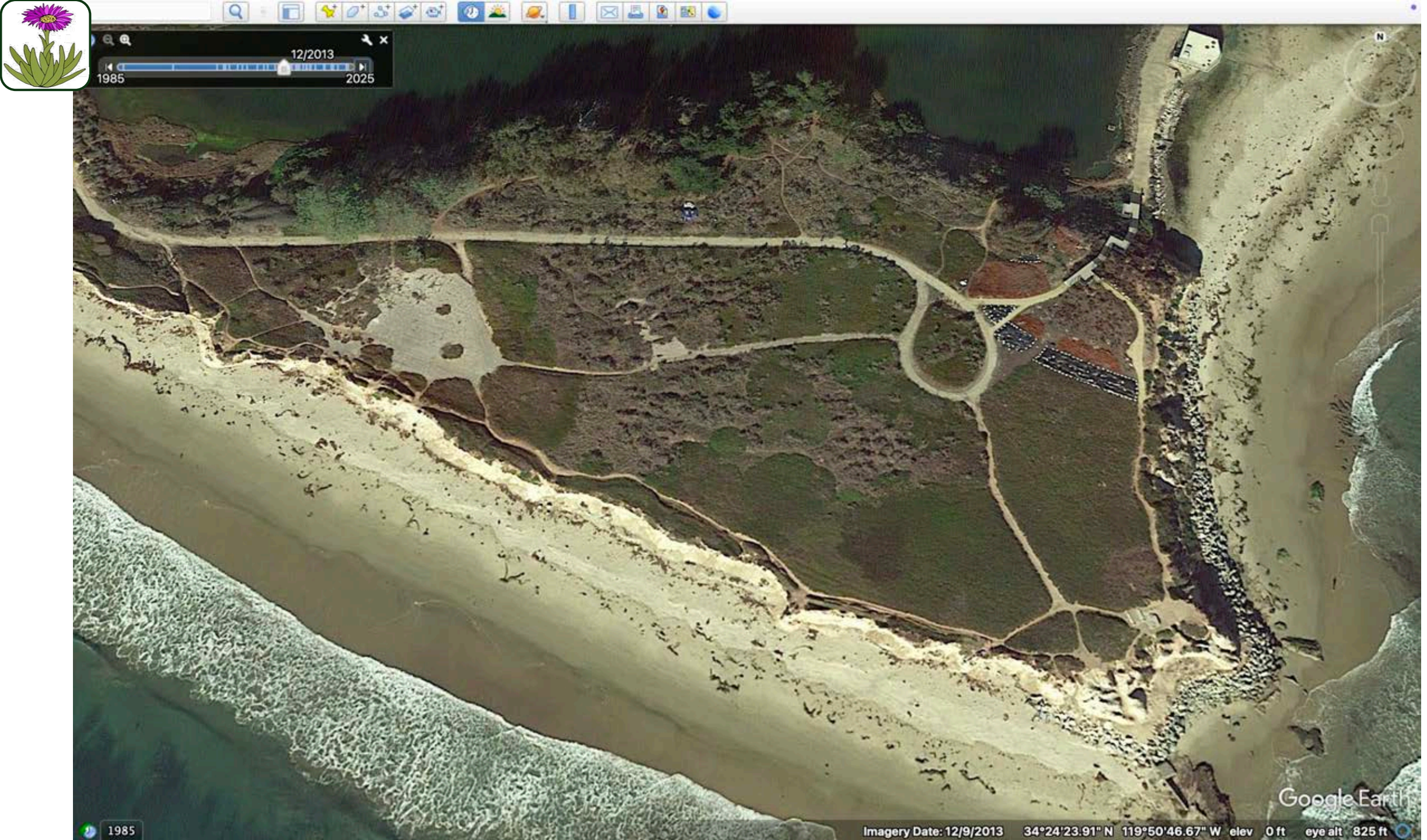
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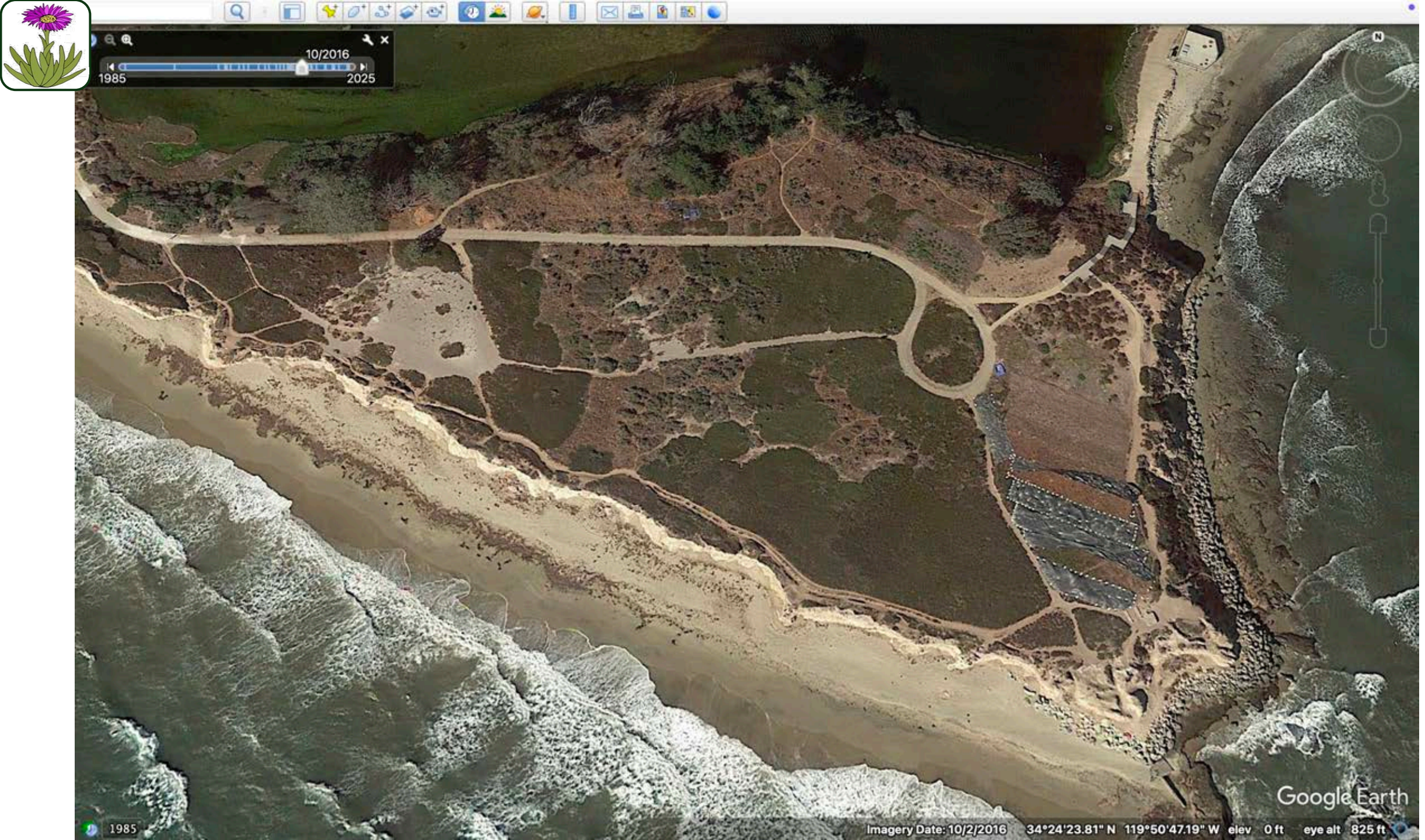
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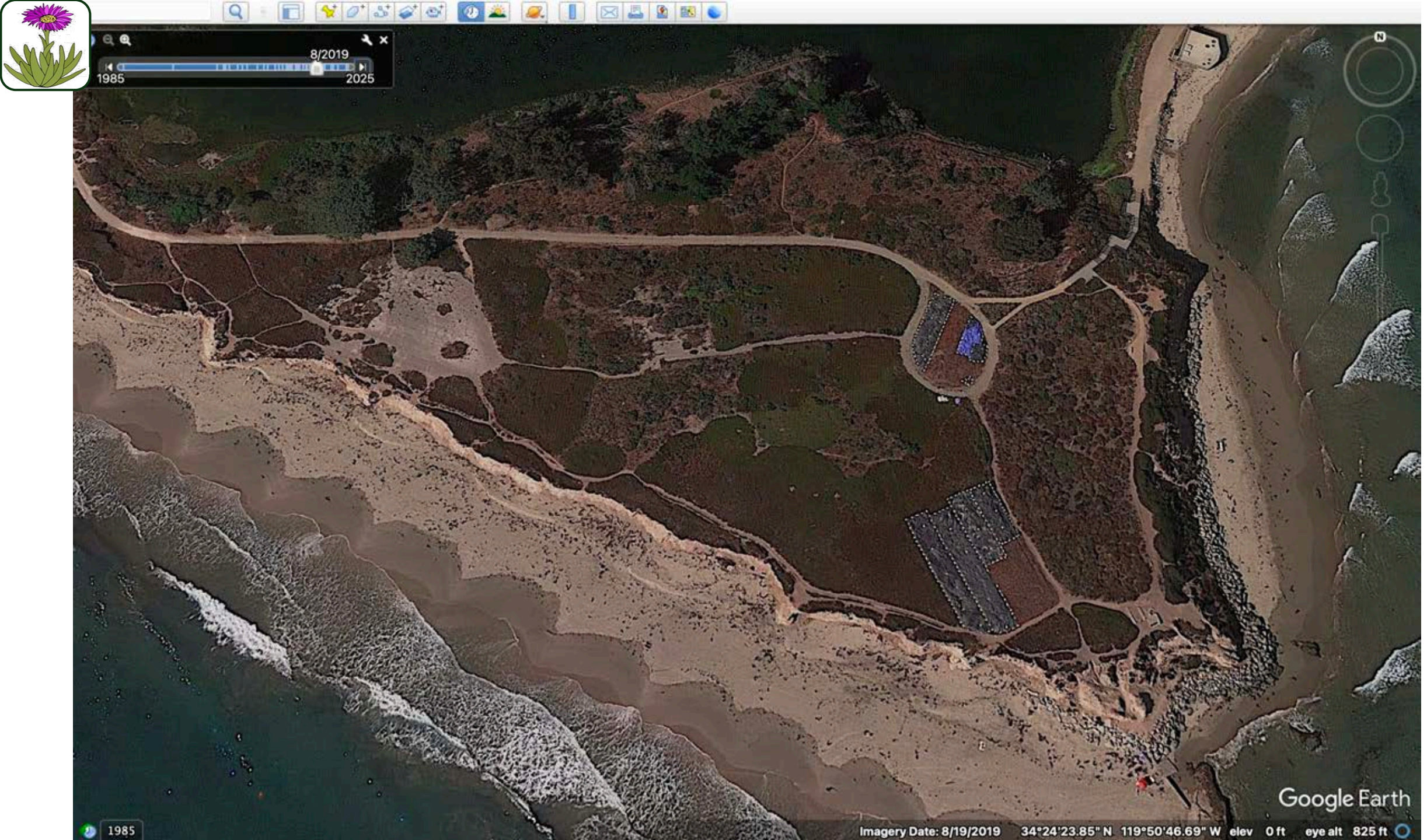
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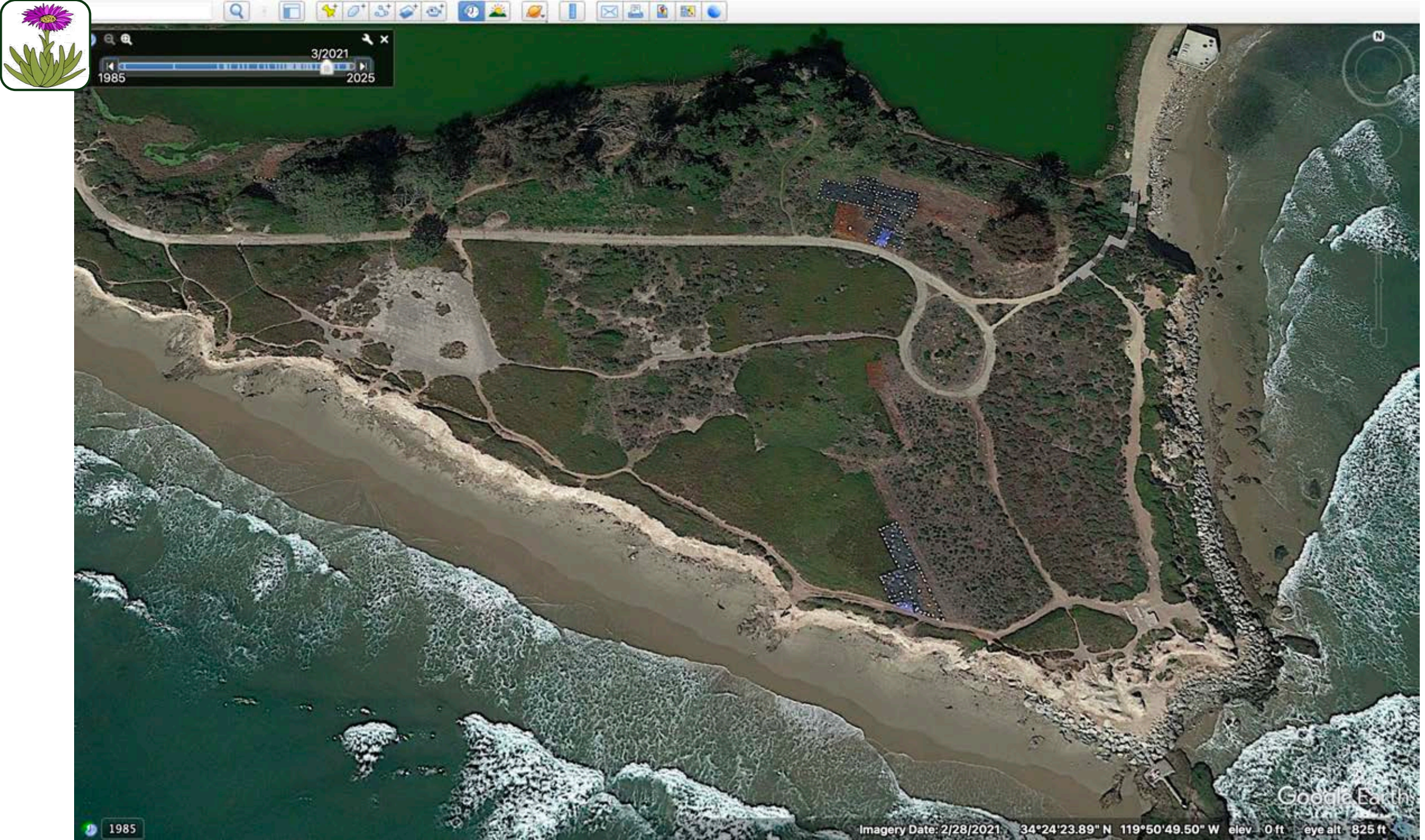
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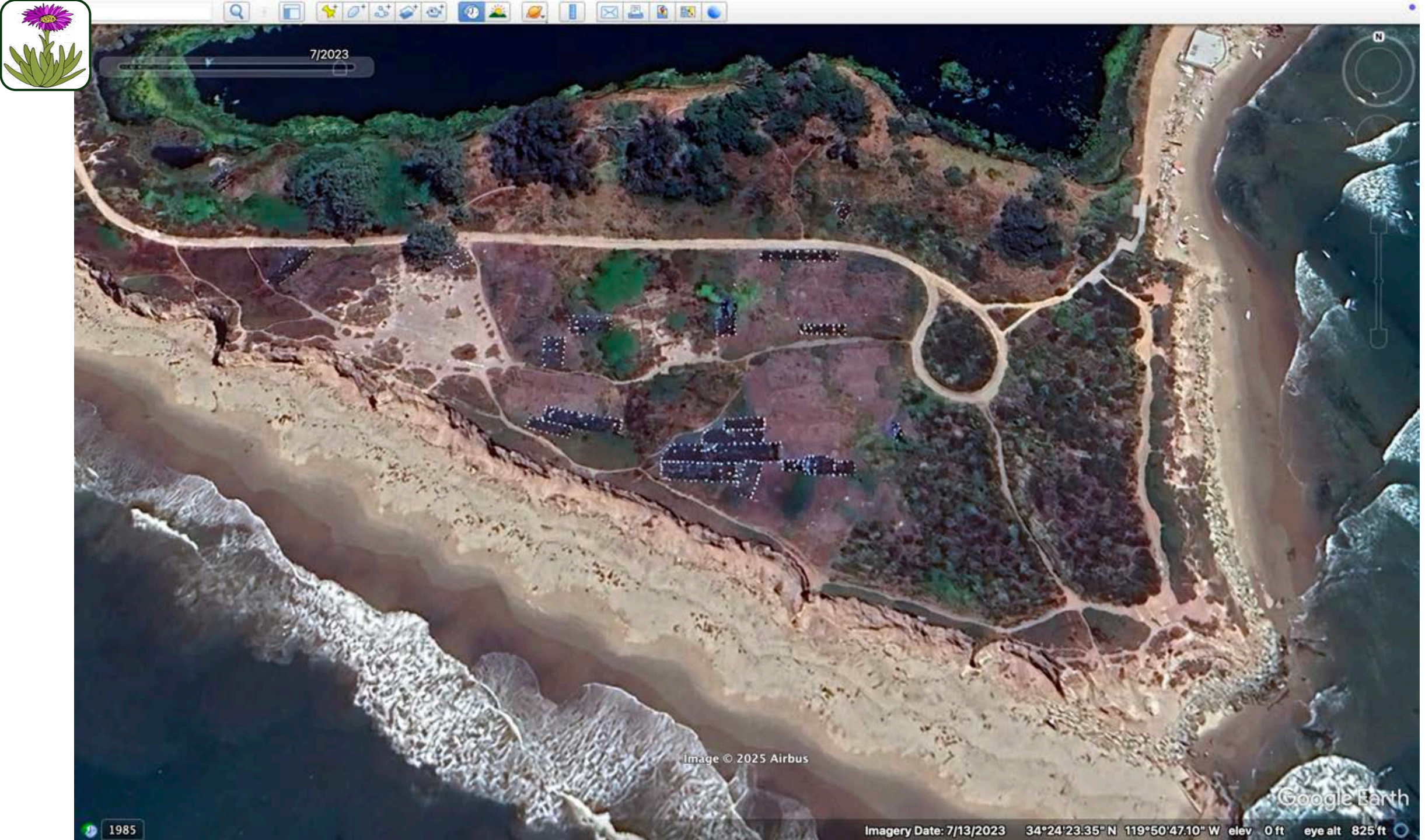
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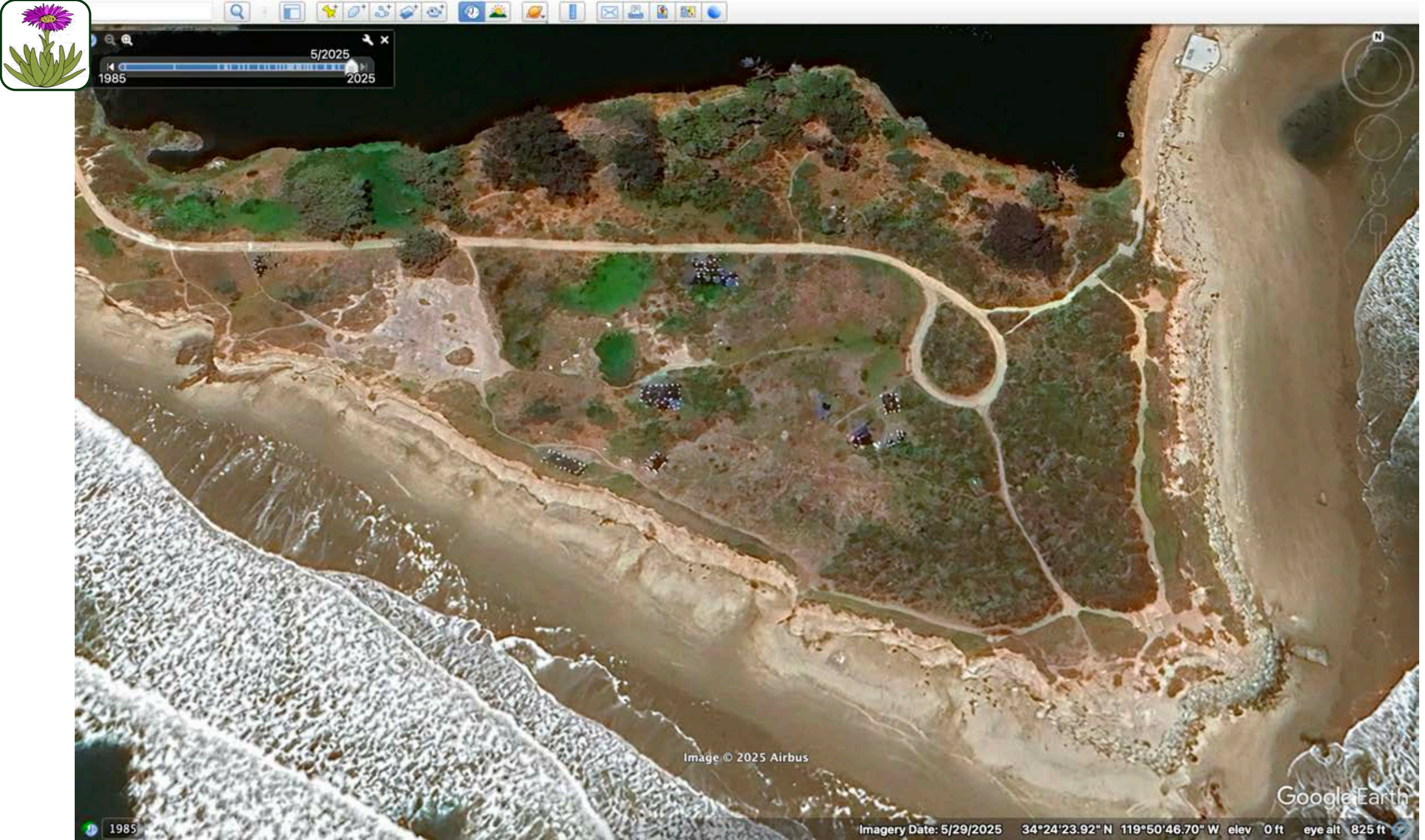
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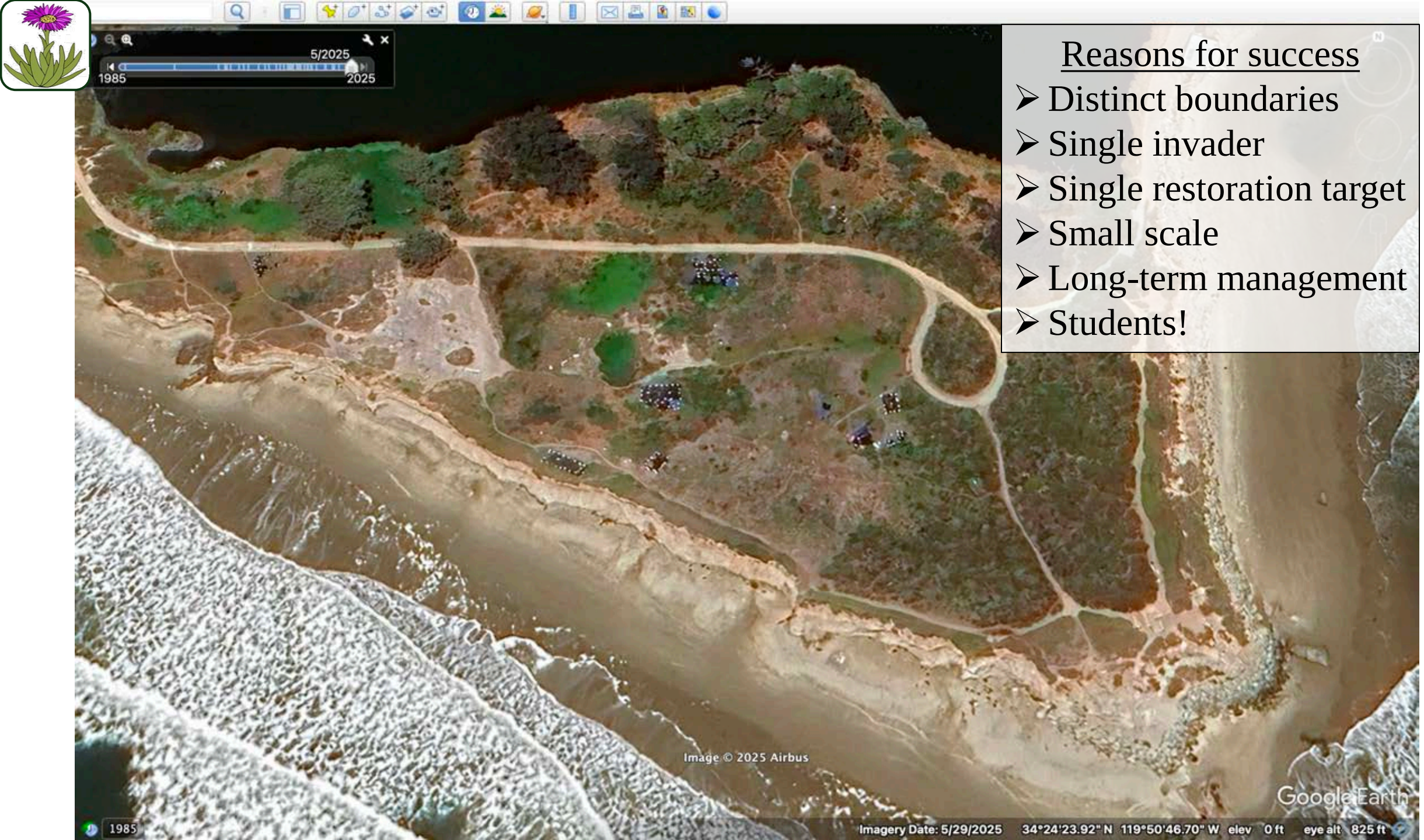
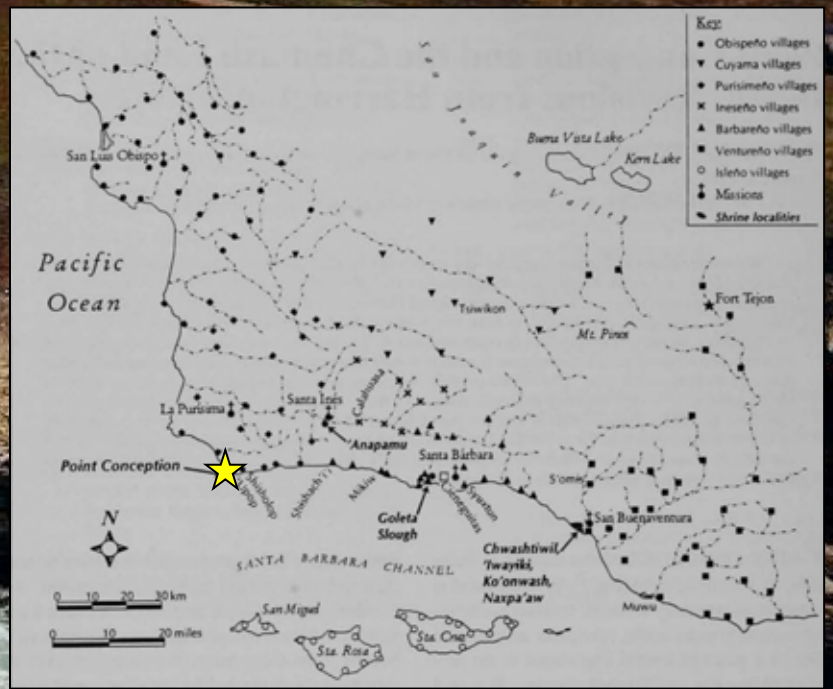


Reasons for success

- Distinct boundaries
- Single invader
- Single restoration target
- Small scale
- Long-term management
- Students!

Jack and Laura Dangermond Preserve



Chumash Village Sites - Haley (1999)

The Nature Conservancy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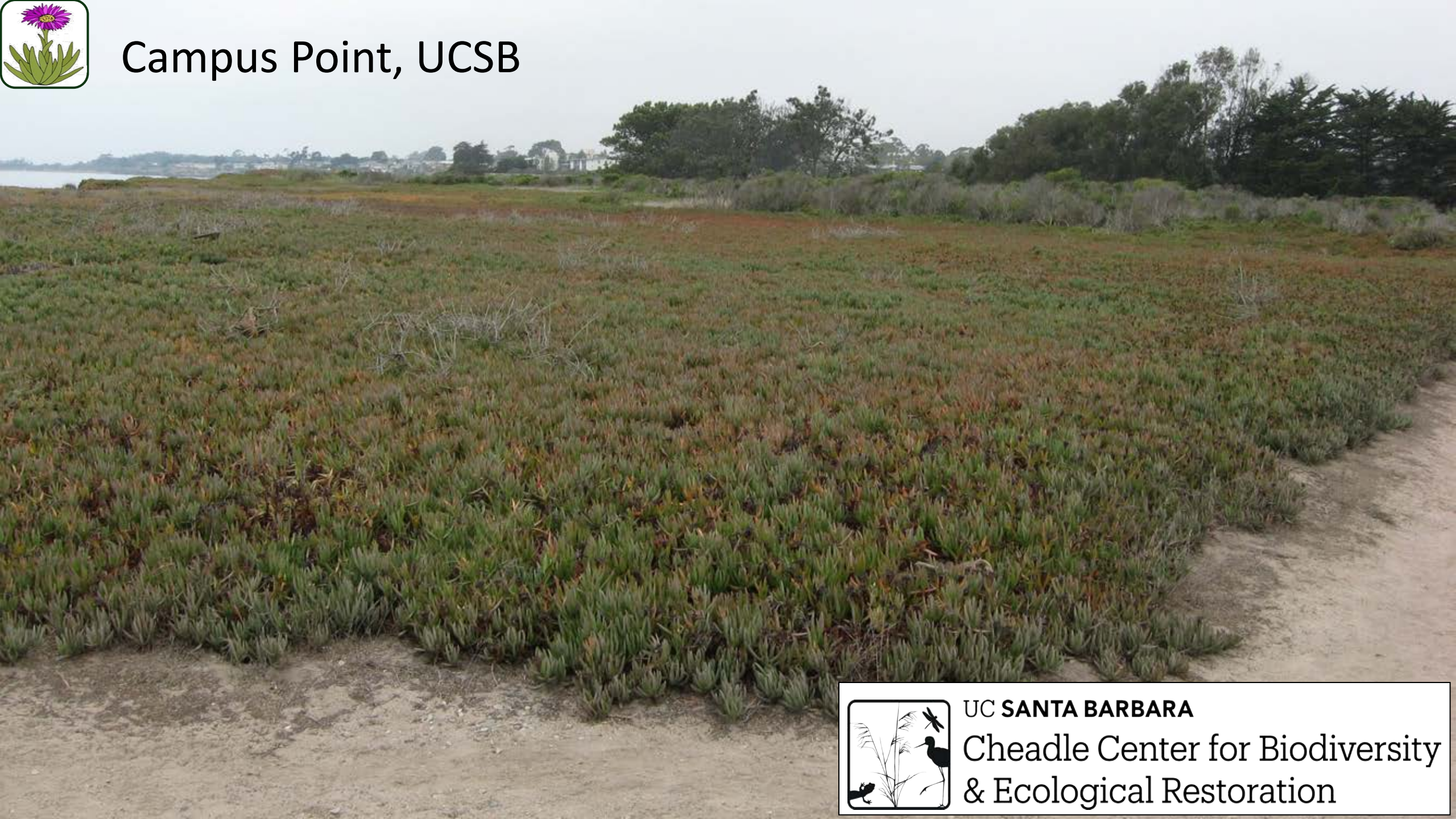

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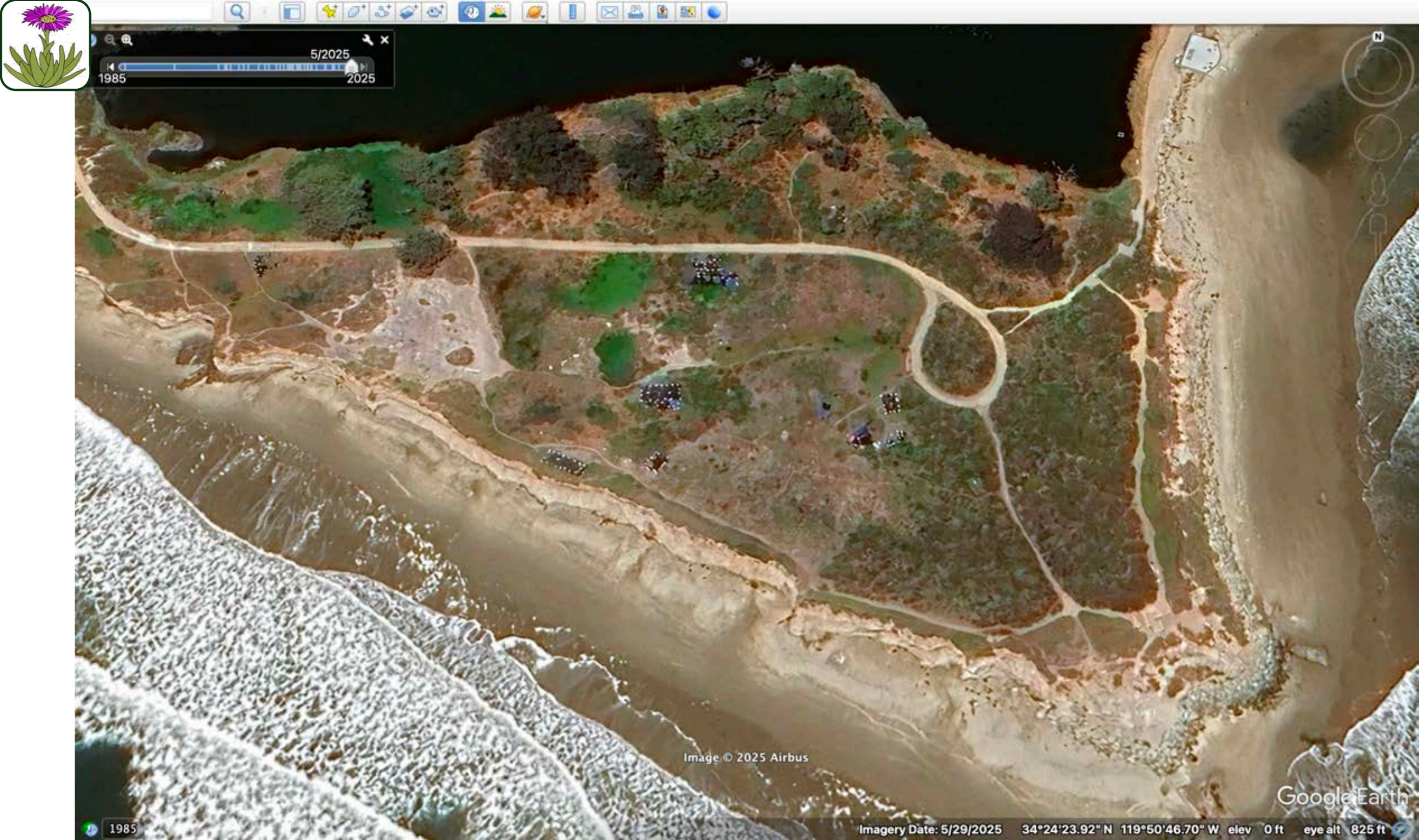
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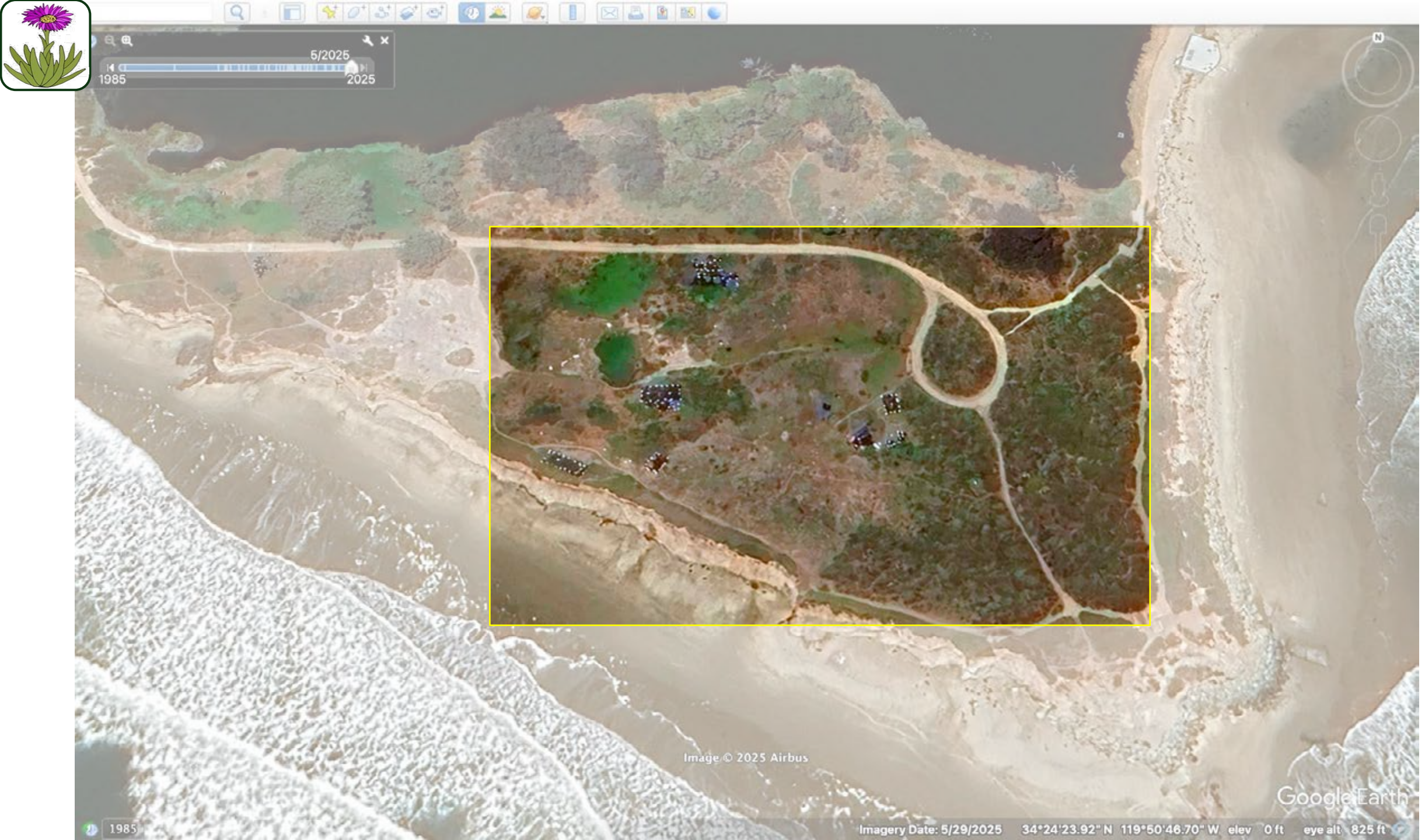
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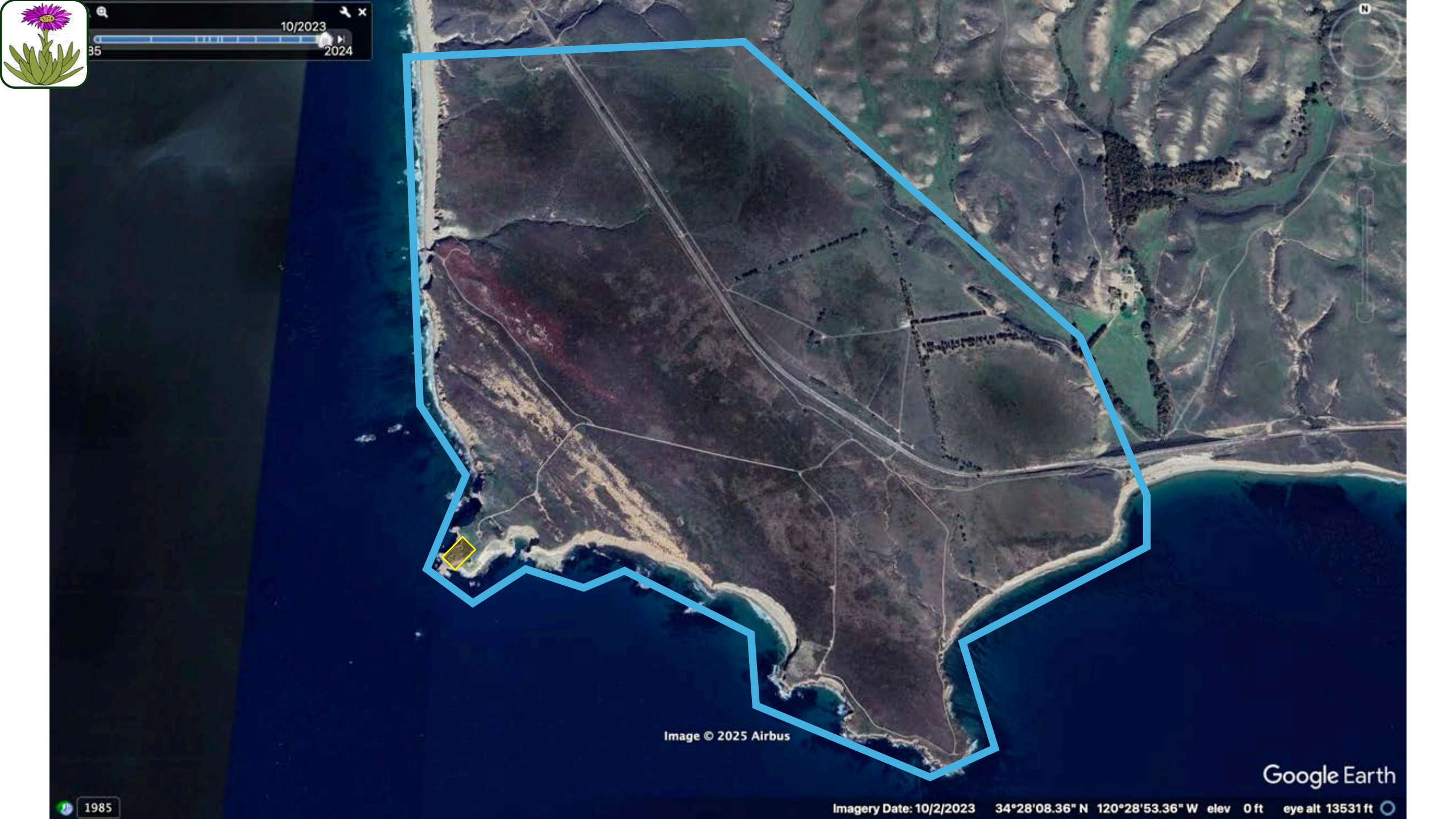
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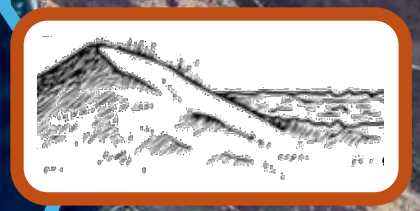

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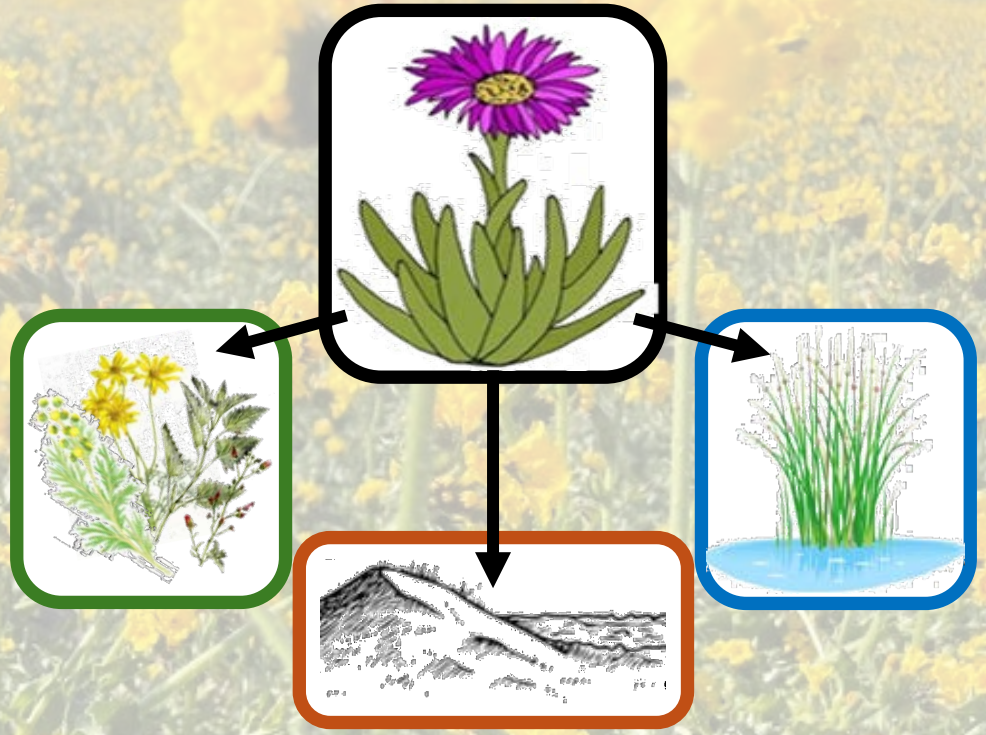
How can we effectively “scale up” restoration in iceplant dominated landscapes?

Key Messages

Moving beyond a **single species** mindset reveals **multi-species** and **multi-ecosystem** challenges for restoration practitioners.

Enhancing **ecological resistance** can lead to **larger-scale** and **longer-term** success.



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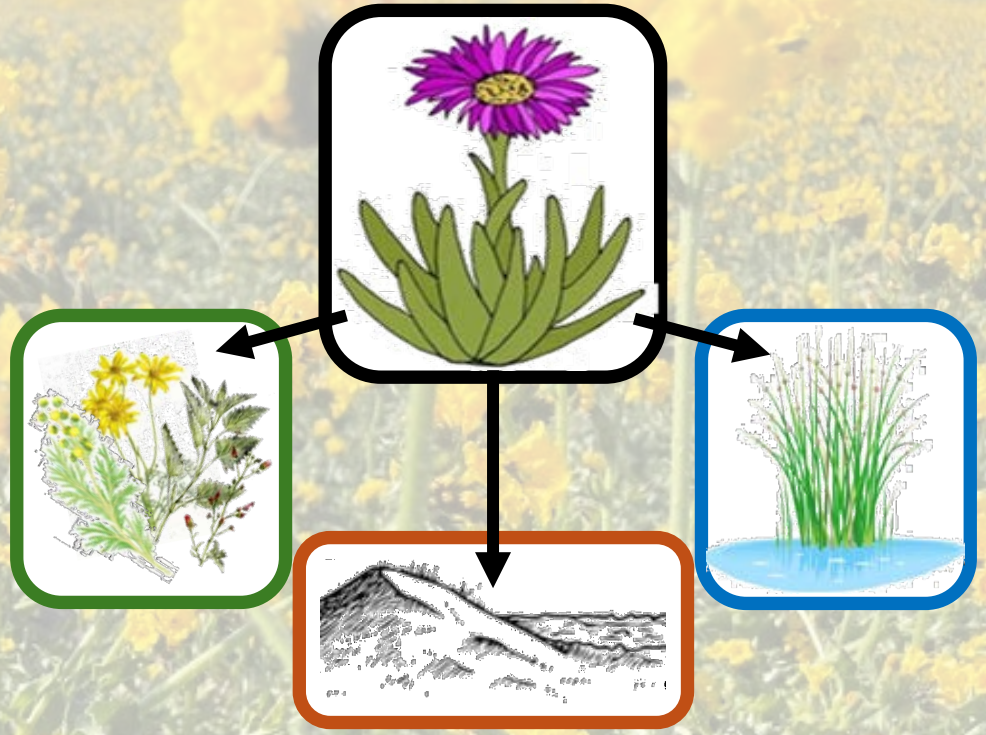
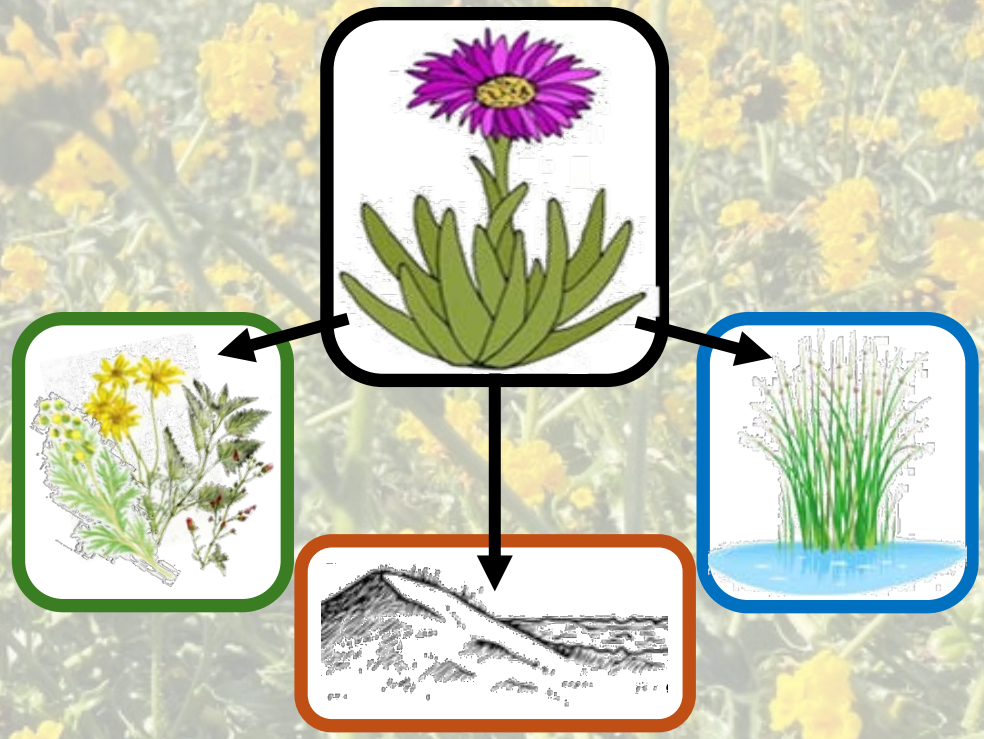


Restoration Objective:

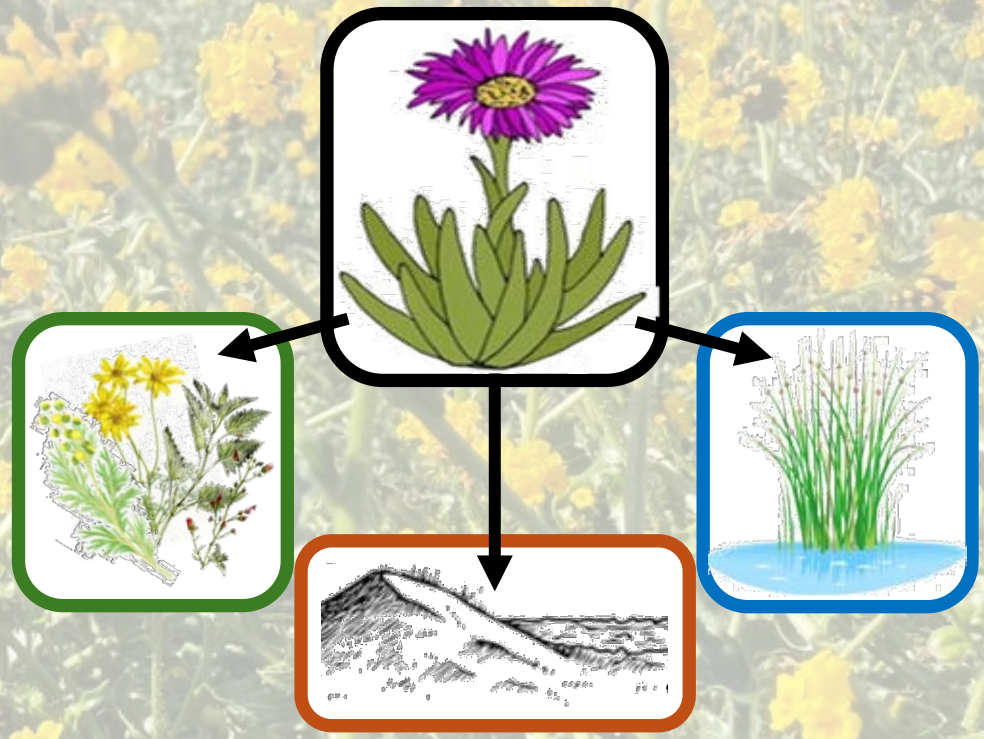
Restore coastal ecosystems currently dominated by iceplant



Restoration Objective:

Restore coastal ecosystems currently dominated by iceplant

1) Control iceplant and minimize reinvasion



Restoration Objective:

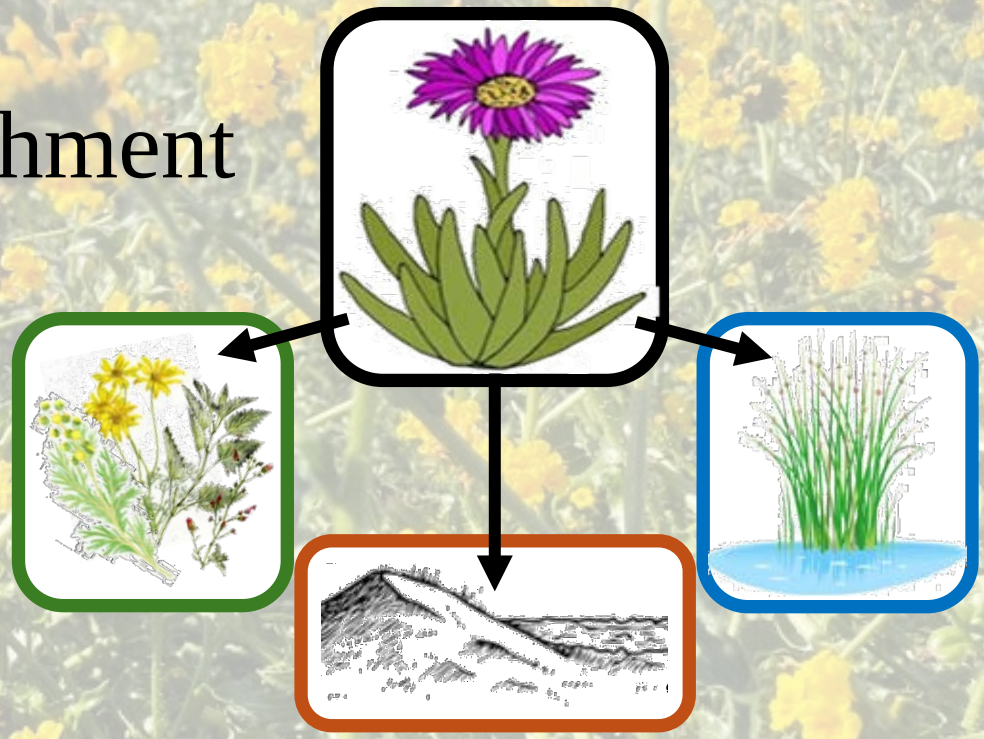
Restore coastal ecosystems currently dominated by iceplant

1) Control iceplant and minimize reinvasion

2) Active Restoration

   a) Maximize native plant establishment

   b) Improve ecosystem processes



Restoration Objective:

Restore coastal ecosystems currently dominated by iceplant

1) Control iceplant and minimize reinvasion

2) Active Restoration

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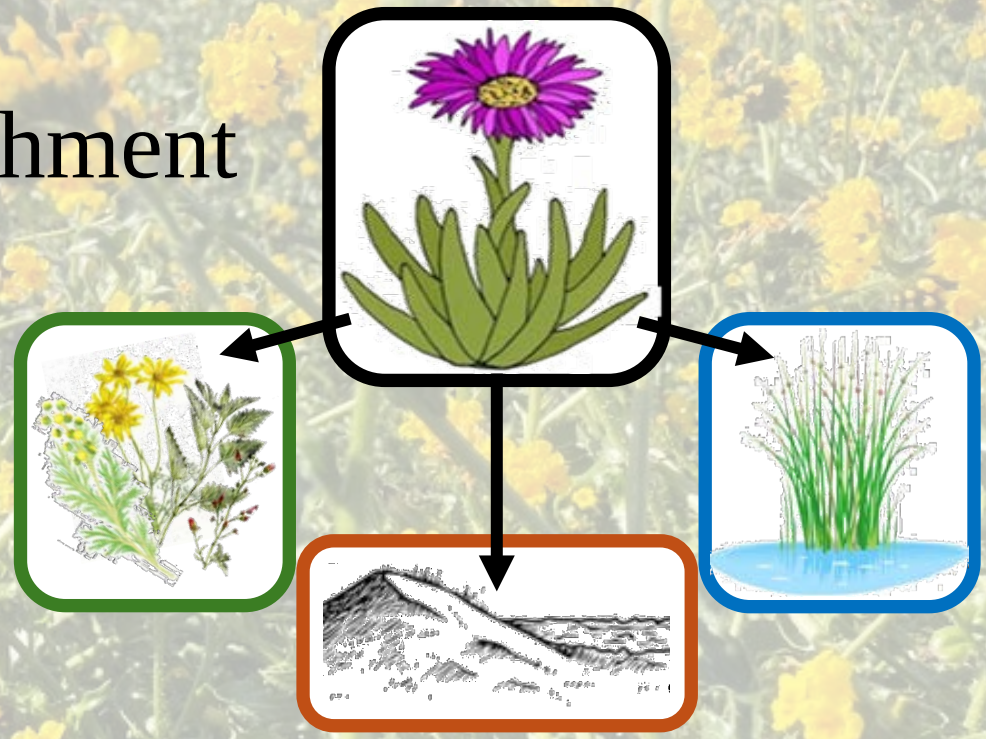
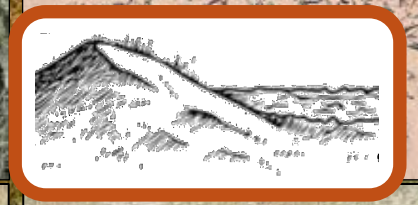
    b) Improve ecosystem processes

3) Minimize secondary invasions



Restoration Targets

Coastal Sage Scrub

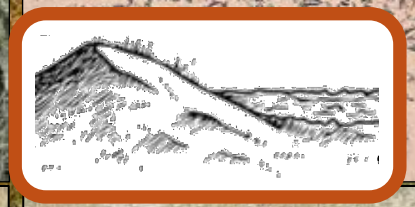


Coastal Dunes

Seasonal Wetlands

Resistance to Invasion?

Coastal Sage Scrub



Coastal Dunes

Seasonal Wetlands

Resistance to Invasion?

Coastal Sage Scrub

Coastal Dunes

Seasonal Wetlands

Biotic Resistance	
Abiotic Resistance	

Resistance to Invasion?

Coastal Sage Scrub

Coastal Dunes

Seasonal Wetlands

Biotic Resistance	**High:** strongly competitive native plants	**Low:** poorly competitive native plants	**Low:** poorly competitive native plants
Abiotic Resistance			

Resistance to Invasion?

Coastal Sage Scrub

Coastal Dunes

Seasonal Wetlands

Biotic Resistance	**High:** strongly competitive native plants	**Low:** poorly competitive native plants	**Low:** poorly competitive native plants
Abiotic Resistance	**Low:** productive environment	**Moderate-High:** harsh, dynamic environment	**Low-Moderate:** environment varies interannually

Restoration Priorities

Coastal Sage Scrub

Coastal Dunes

Seasonal Wetlands

Biotic Resistance	**High:** strongly competitive native plants	**Low:** poorly competitive native plants	**Low:** poorly competitive native plants
Abiotic Resistance	**Low:** productive environment	**Moderate-High:** harsh, dynamic environment	**Low-Moderate:** environment varies interannually
Restoration Priority			

Restoration Priorities

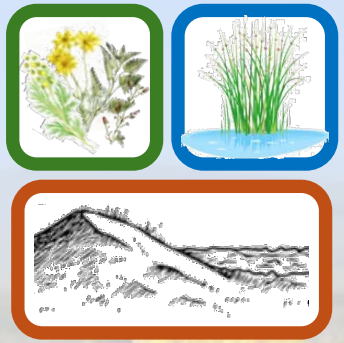
Coastal Sage Scrub

Coastal Dunes

Seasonal Wetlands

Biotic Resistance	**High:** strongly competitive native plants	**Low:** poorly competitive native plants	**Low:** poorly competitive native plants
Abiotic Resistance	**Low:** productive environment	**Moderate-High:** harsh, dynamic environment	**Low-Moderate:** environment varies interannually
Restoration Priority	Increase **native plant cover** to enhance biotic resistance	Restore **physical processes** to enhance abiotic resistance	**Strategic management** to limit invaders

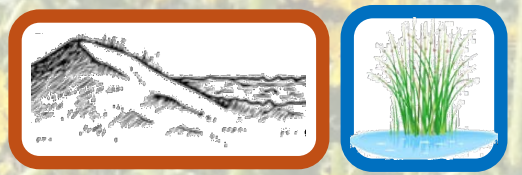
1) Control iceplant and minimize reinvasion



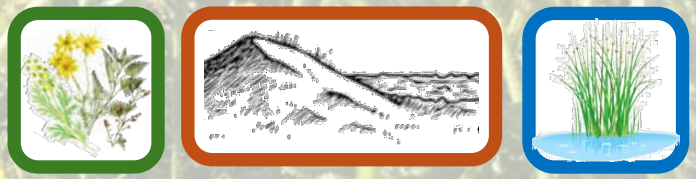
2) Active Restoration

a) Maximize native plant establishment

b) Improve ecosystem processes



3) Minimize secondary invasions



1) Control iceplant and minimize reinvasion

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a) Maximize native plant establishment

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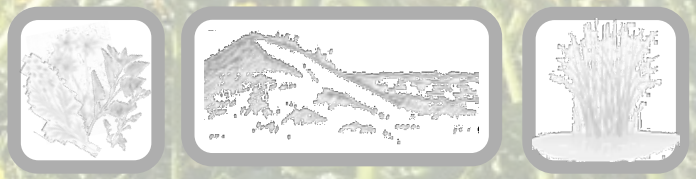
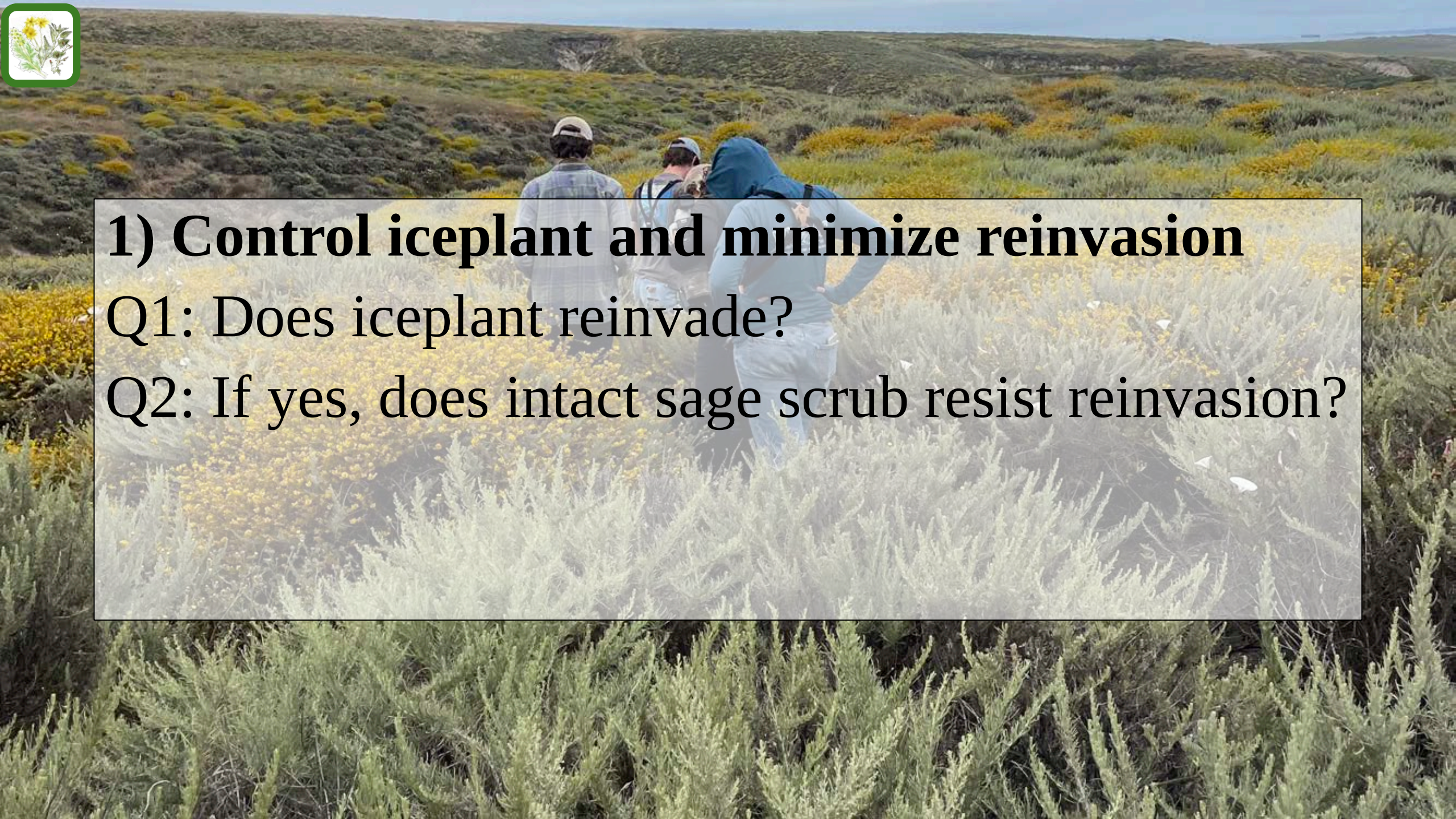


Coastal Sage Scrub

1) Control iceplant and minimize reinvasion

2a) Maximize native plant establishment



1) Control iceplant and minimize reinvasion

Q1: Does iceplant reinvade?

Q2: If yes, does intact sage scrub resist reinvasion?

Experimental Restoration Plots

High Native Cover

Low Native Cover

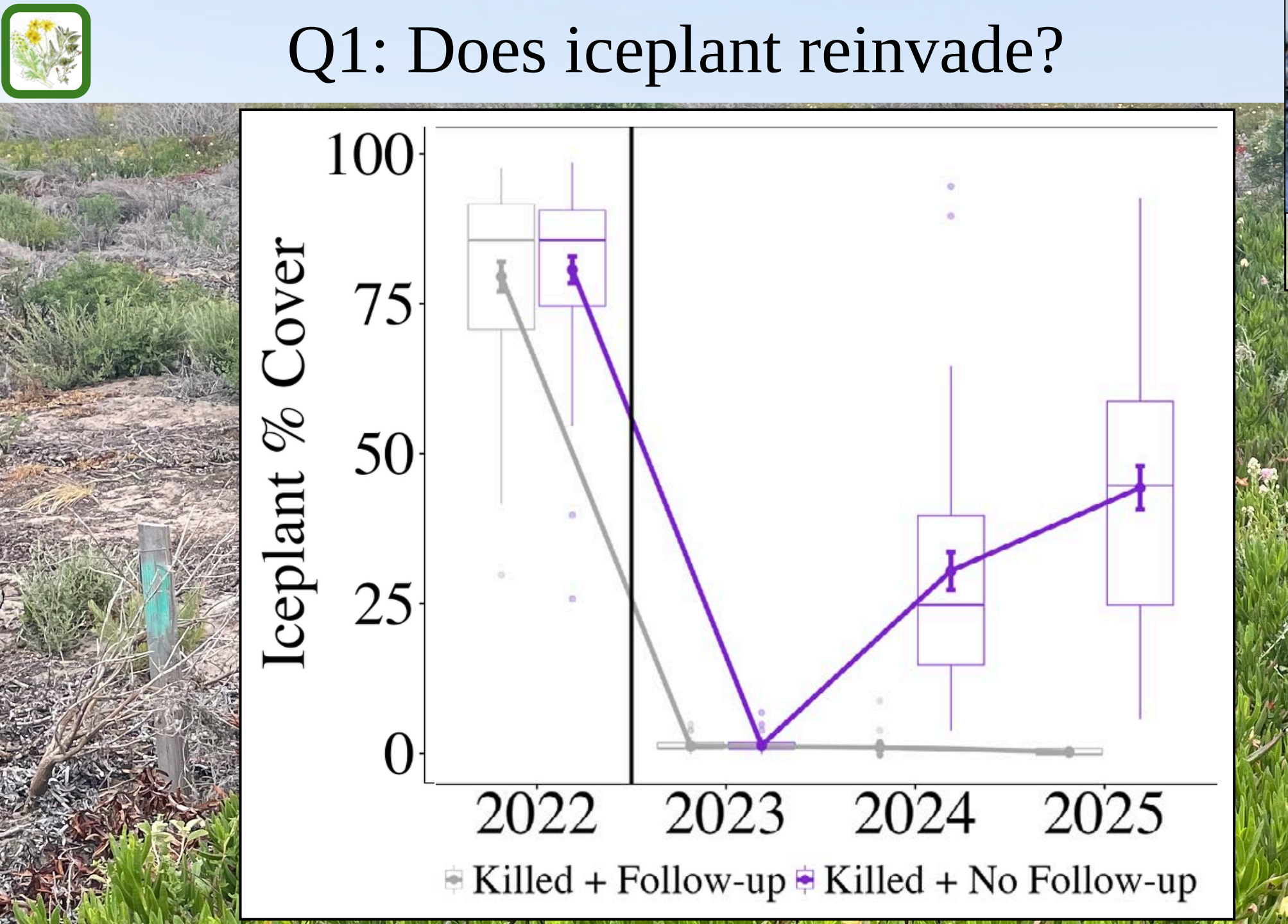
Q1: Does iceplant reinvade?

Low Native Cover

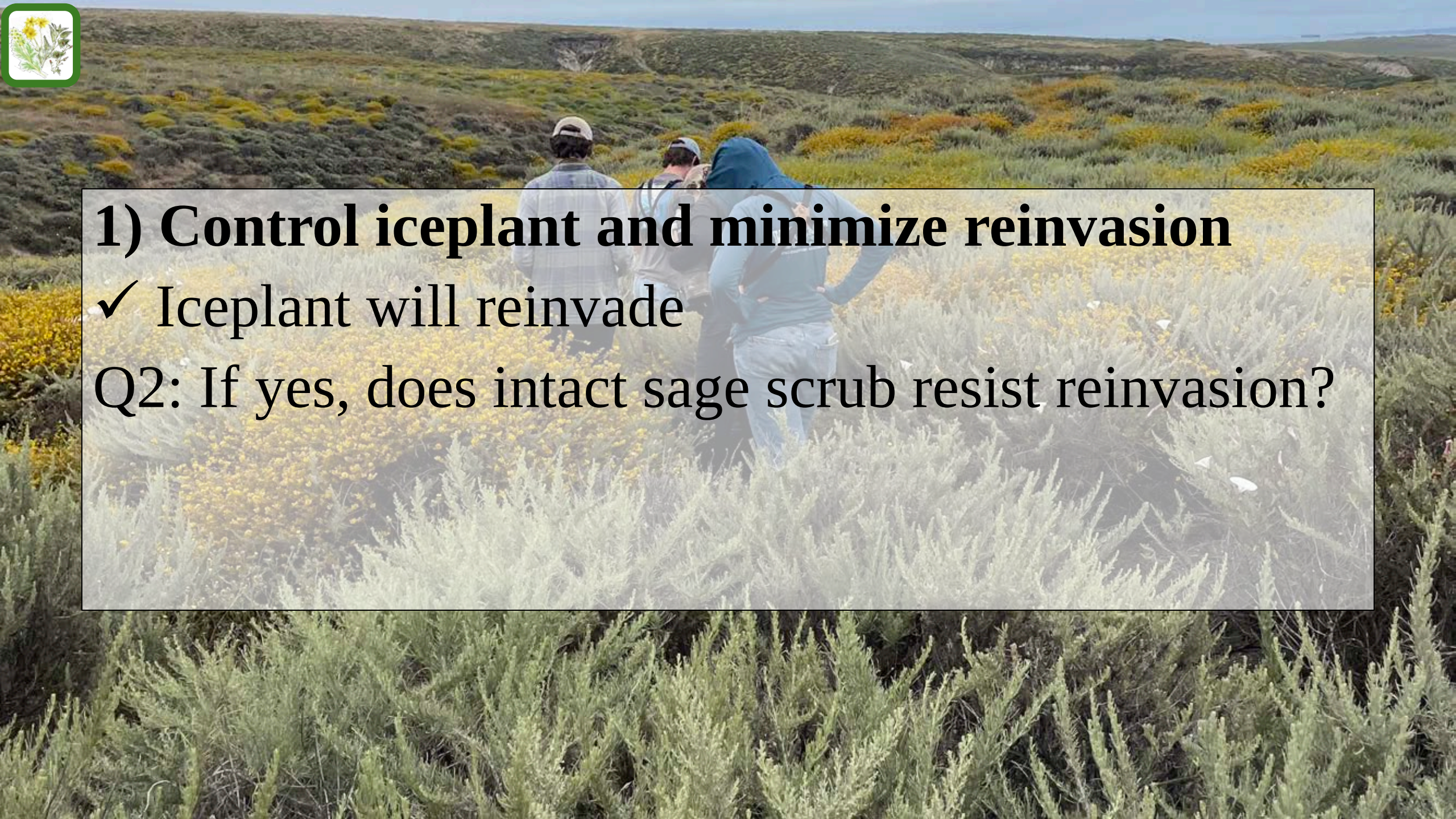
Killed + Follow-up

Killed + No Follow-up

Q1: Does iceplant reinvade?



Low Native Cover



1) Control iceplant and minimize reinvasion

✓ Iceplant will reinvade

Q2: If yes, does intact sage scrub resist reinvasion?

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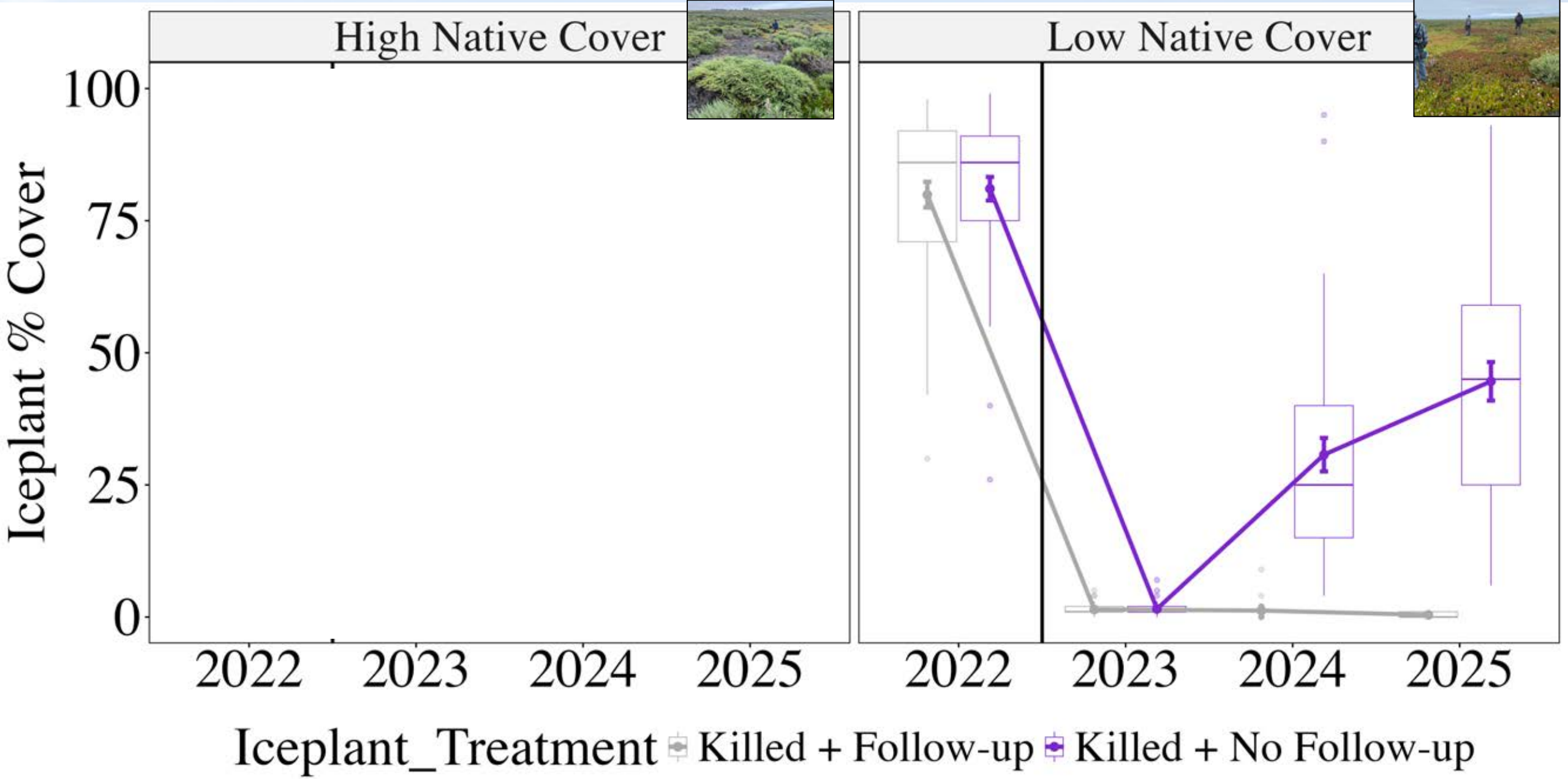
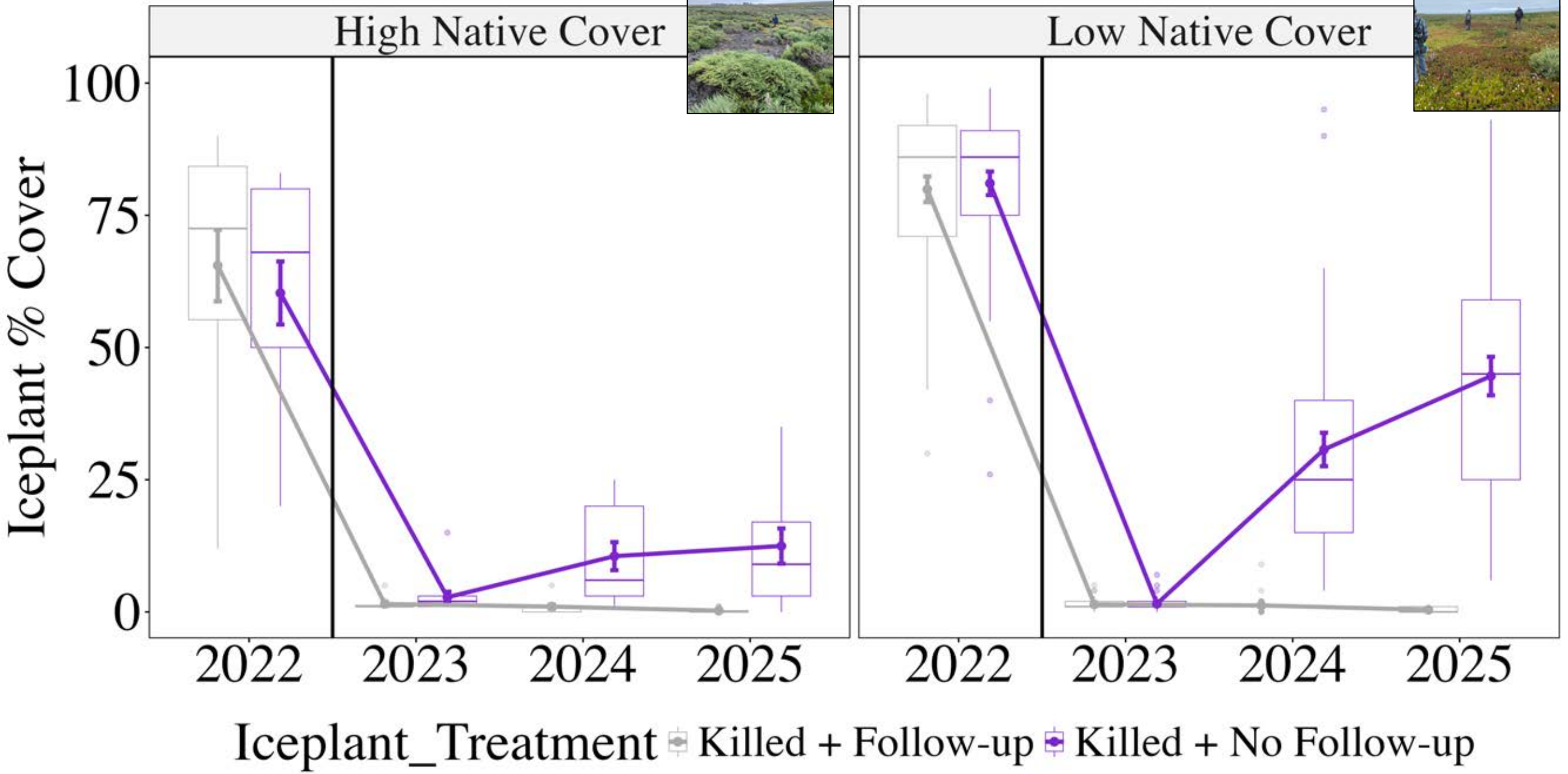
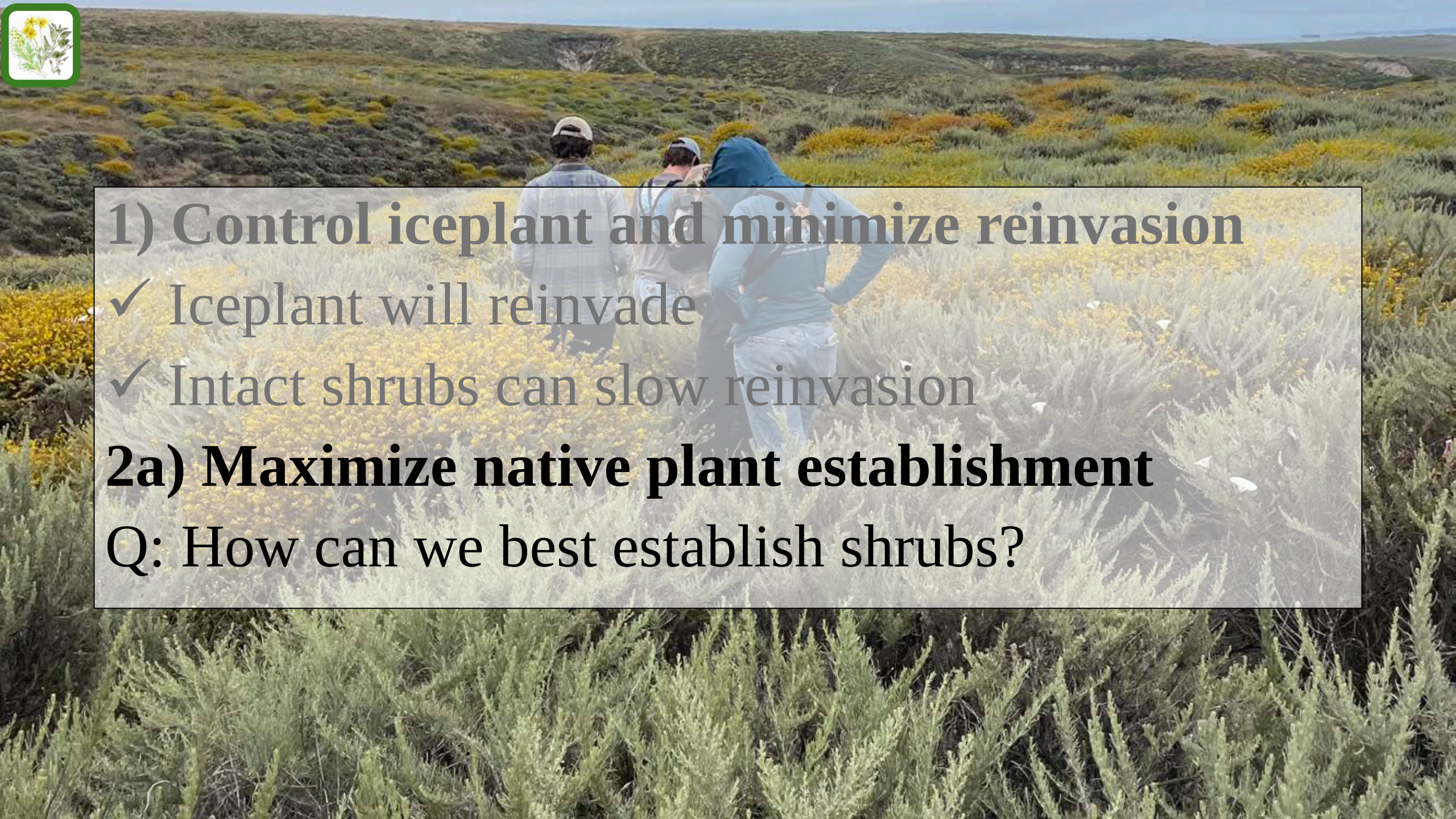


Q2: If yes, does intact sage scrub resist reinvasion?



1) Control iceplant and minimize reinvasion

- ✓ Iceplant will reinvade
- ✓ Intact shrubs can slow reinvasion



1) Control iceplant and minimize reinvasion

✓ Iceplant will reinvade

✓ Intact shrubs can slow reinvasion

2a) Maximize native plant establishment

Q: How can we best establish shrubs?

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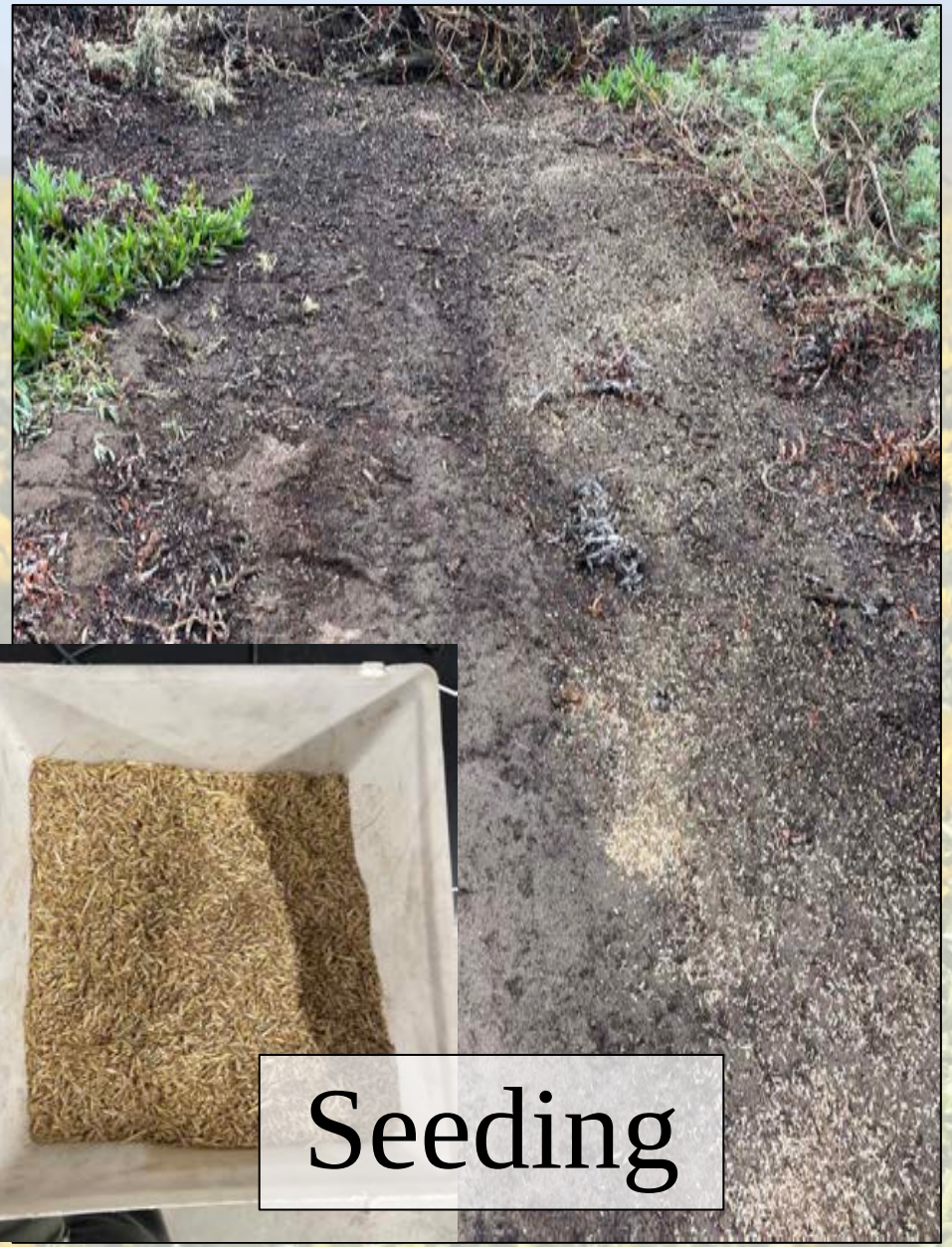
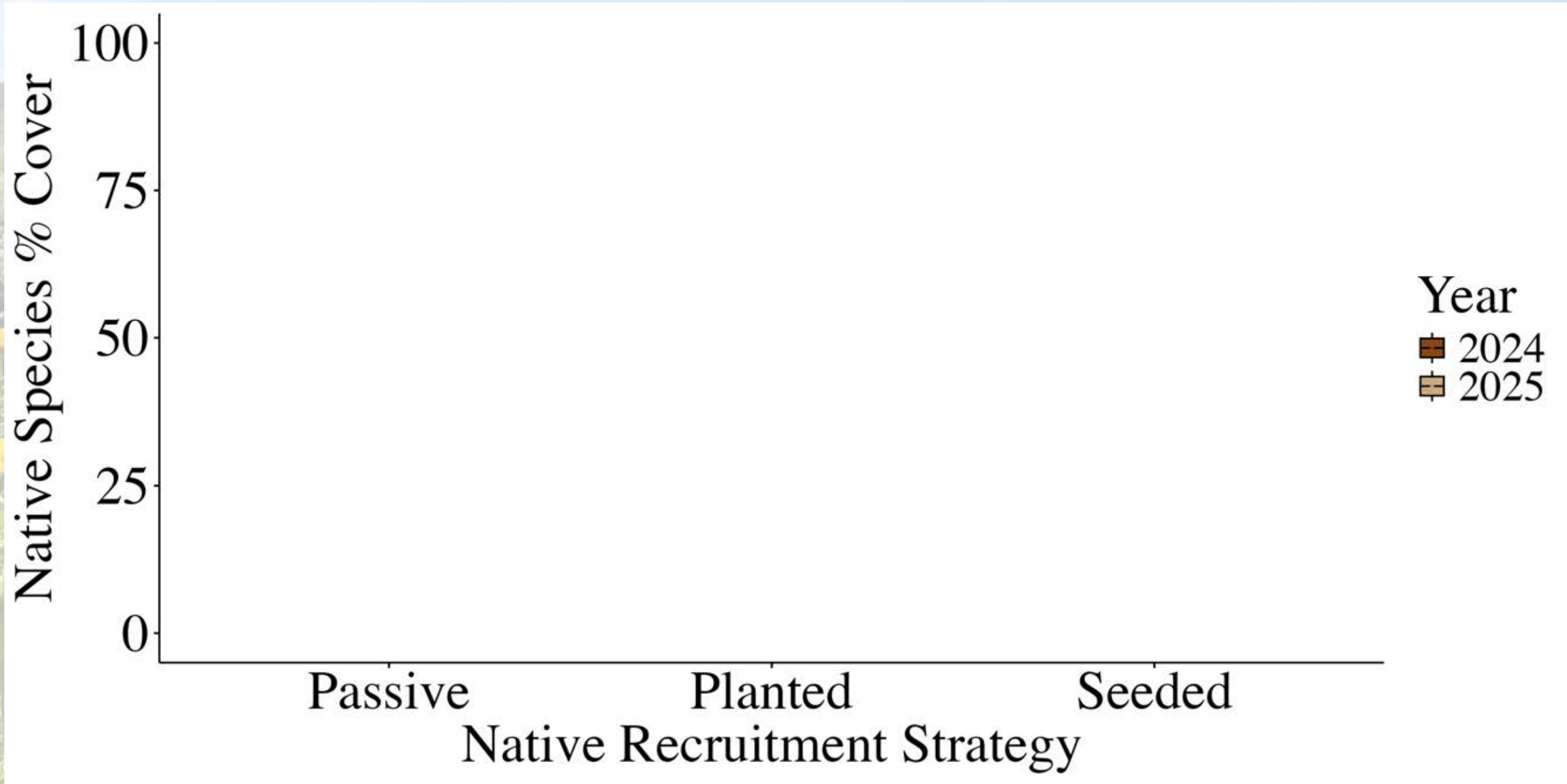
Planting



Seeding


Isocoma menziesii -
Menzie's goldenbush
Diplacus aurantiacus -
sticky monkeyflower
Artemisia californica –
California sagebrush
Scrophularia californica –
California bee-plant
Ericameria ericoides –
Mock heather
Leptosyne gigantea –
giant coreopsis
Eriogonum parvifolium
– seacliff buckwheat
Encelia californica –
California bush sunflower
Acmispon glaber –
deerweed

Q: How can we best establish shrubs?



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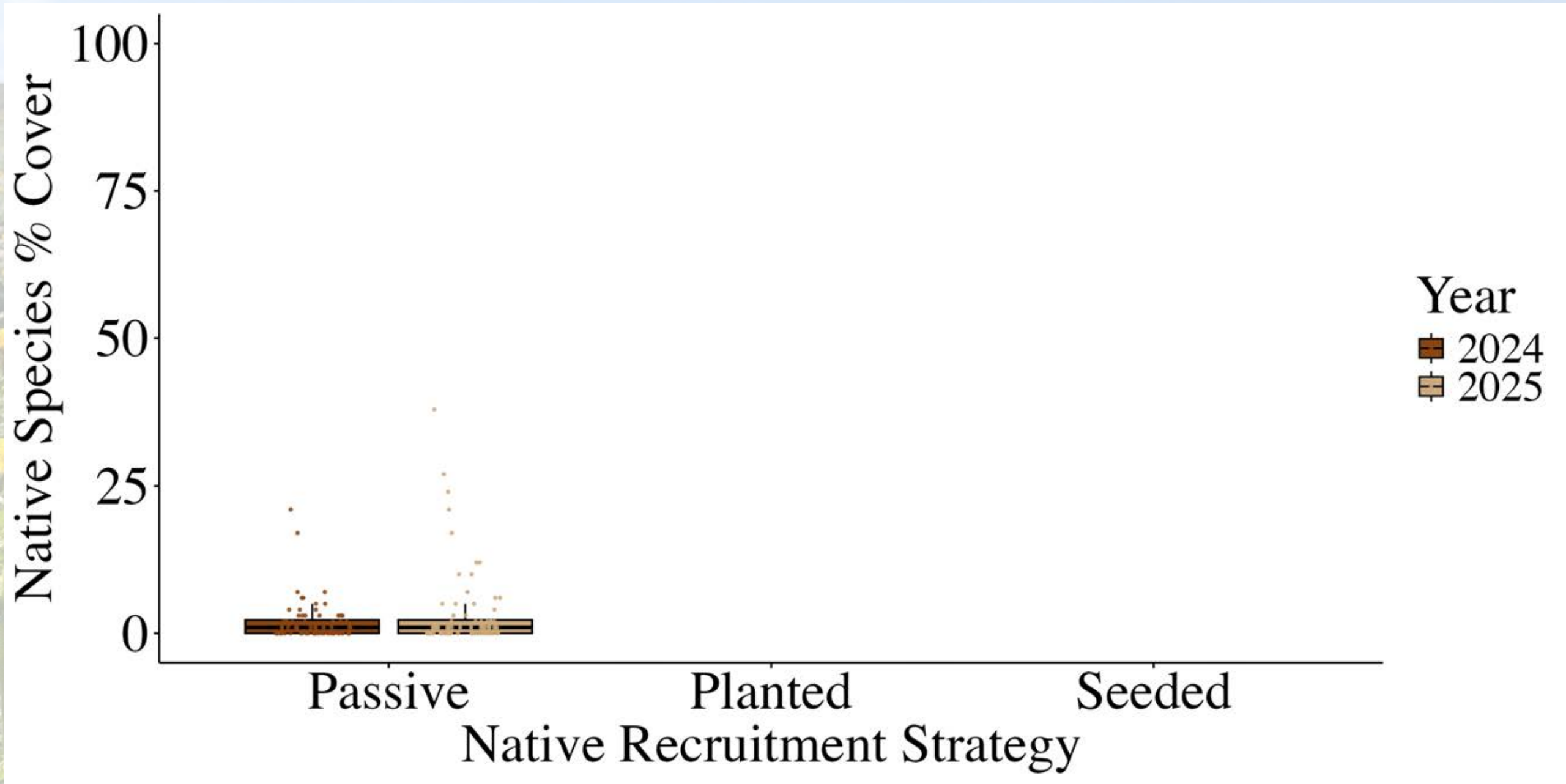

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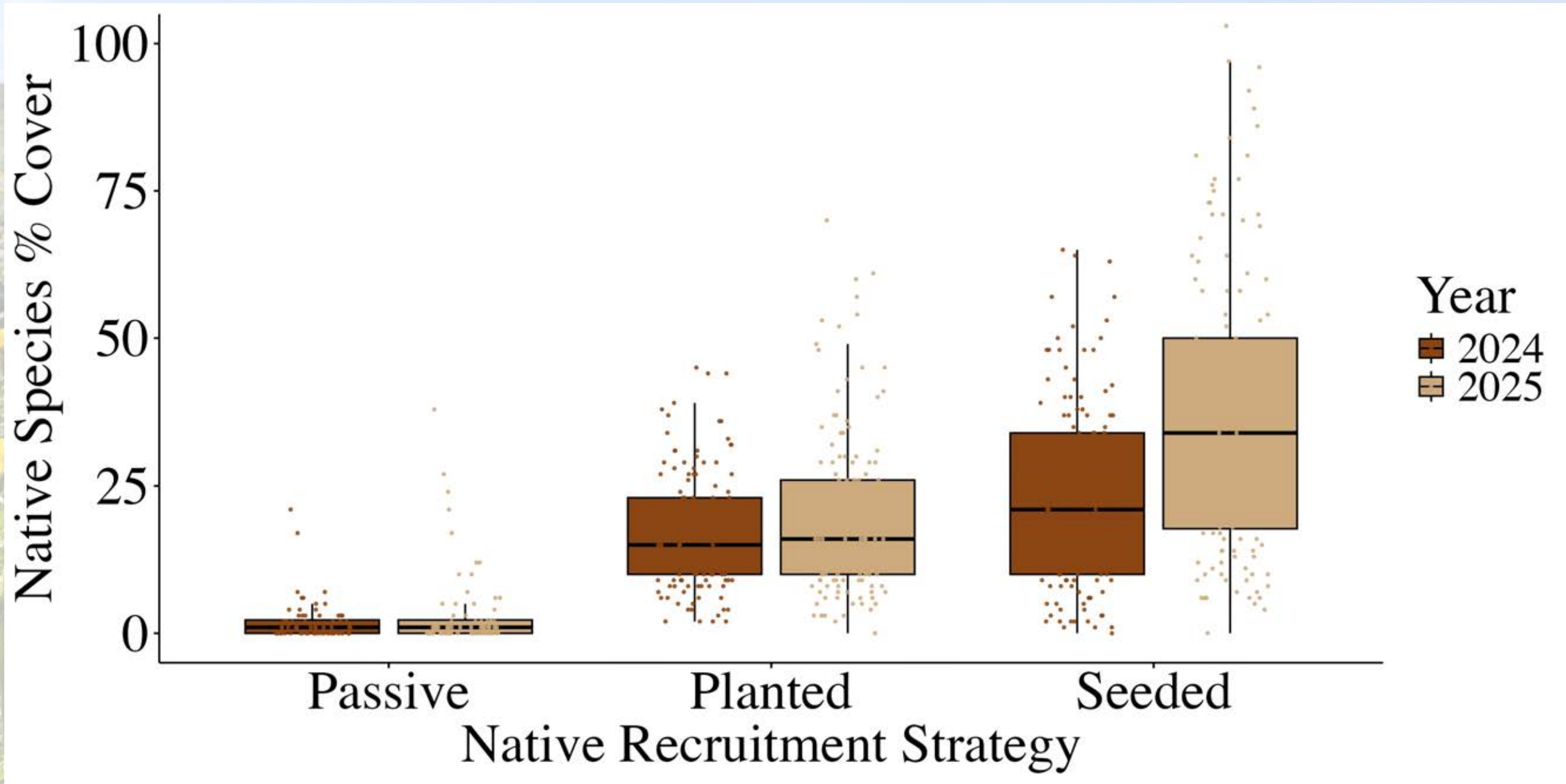

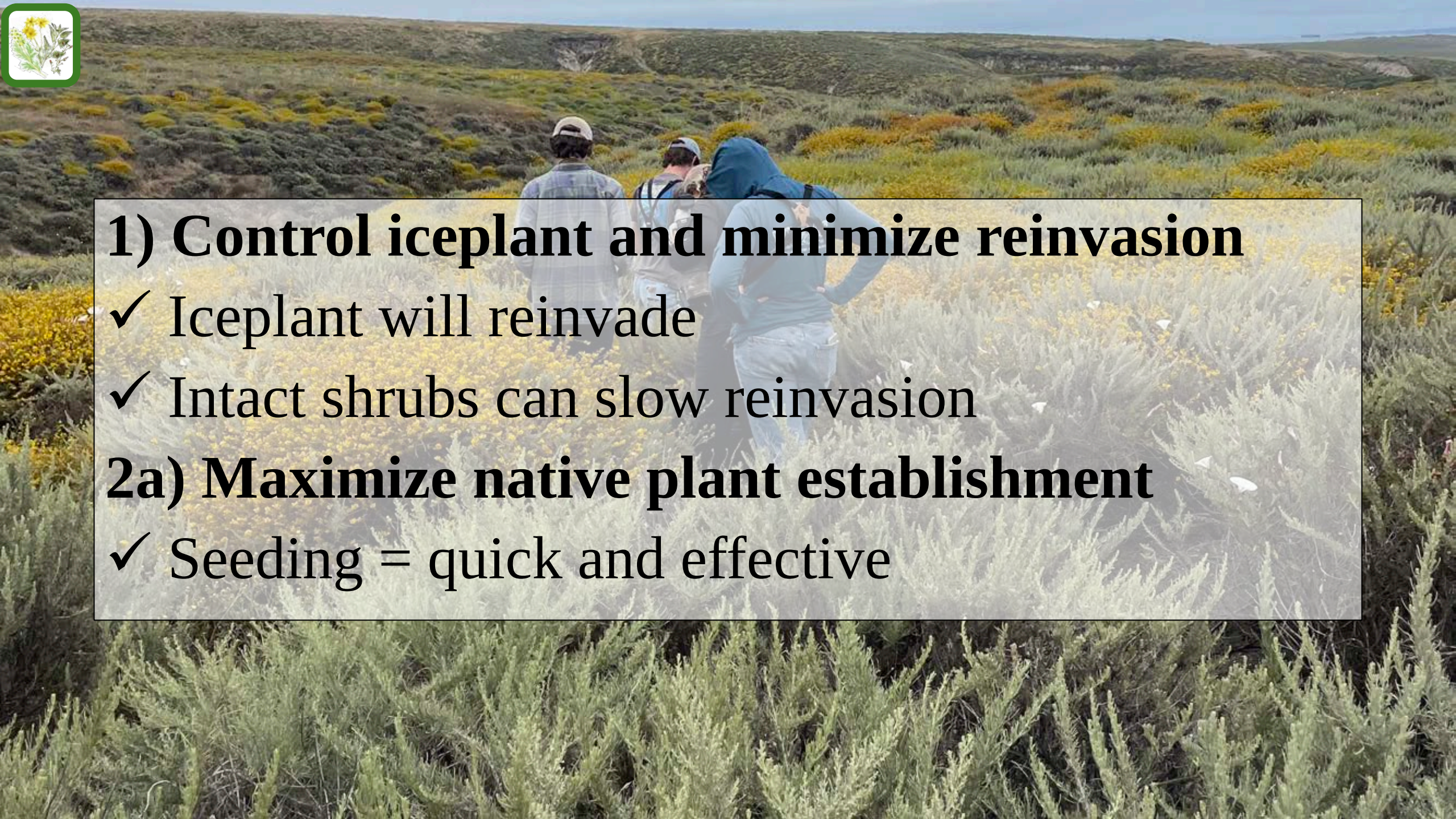

1) Control iceplant and minimize reinvasion

✓ Iceplant will reinvade

✓ Intact shrubs can slow reinvasion

2a) Maximize native plant establishment

✓ Seeding = quick and effective

Thank you! Email: nsaglimbeni@ucsb.edu

Moving beyond a **single species** mindset reveals **multi-species** and **multi-ecosystem** challenges for restoration practitioners.

Enhancing **ecological resistance** can lead to **larger-scale** and **longer-term** success.