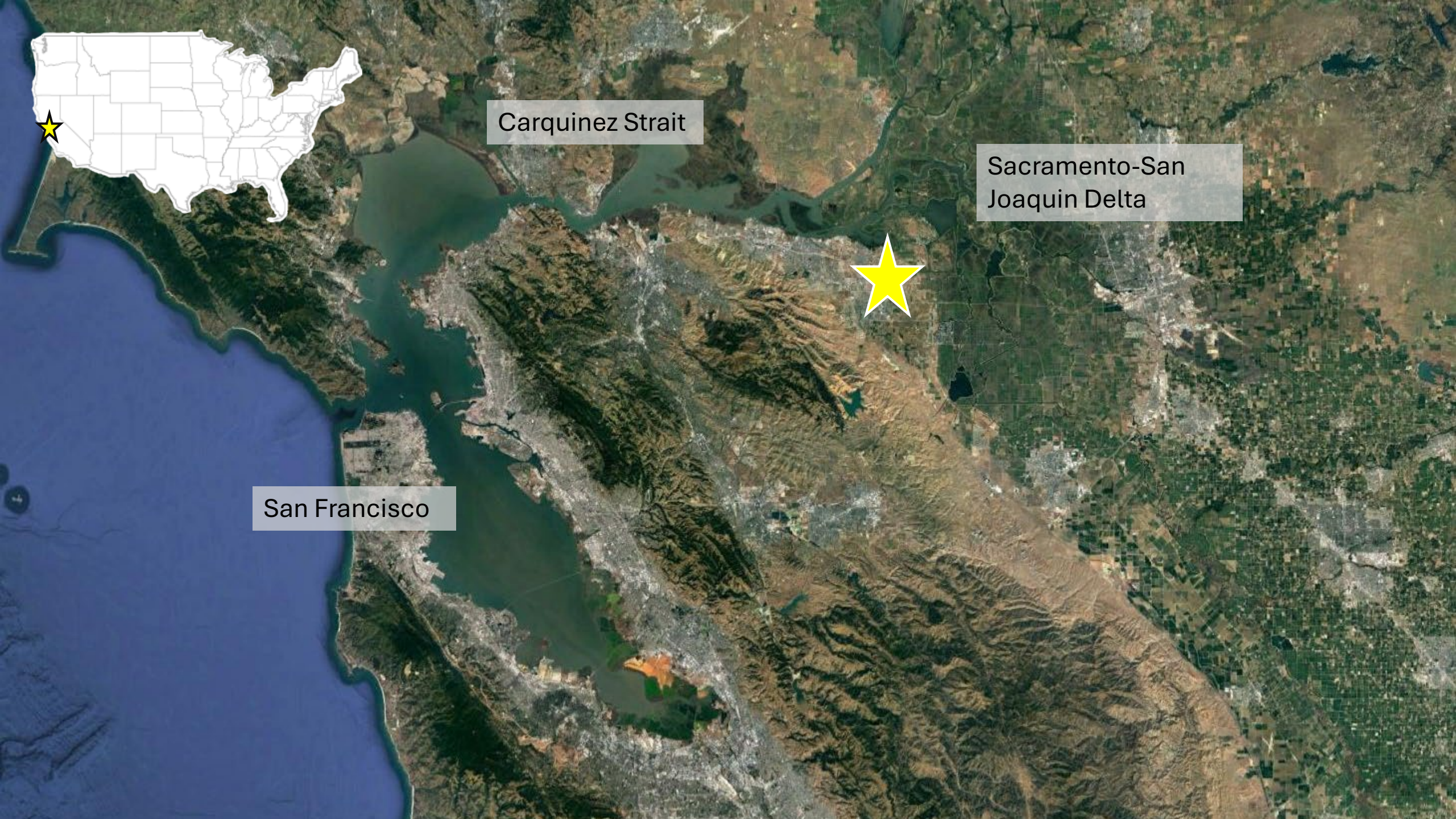
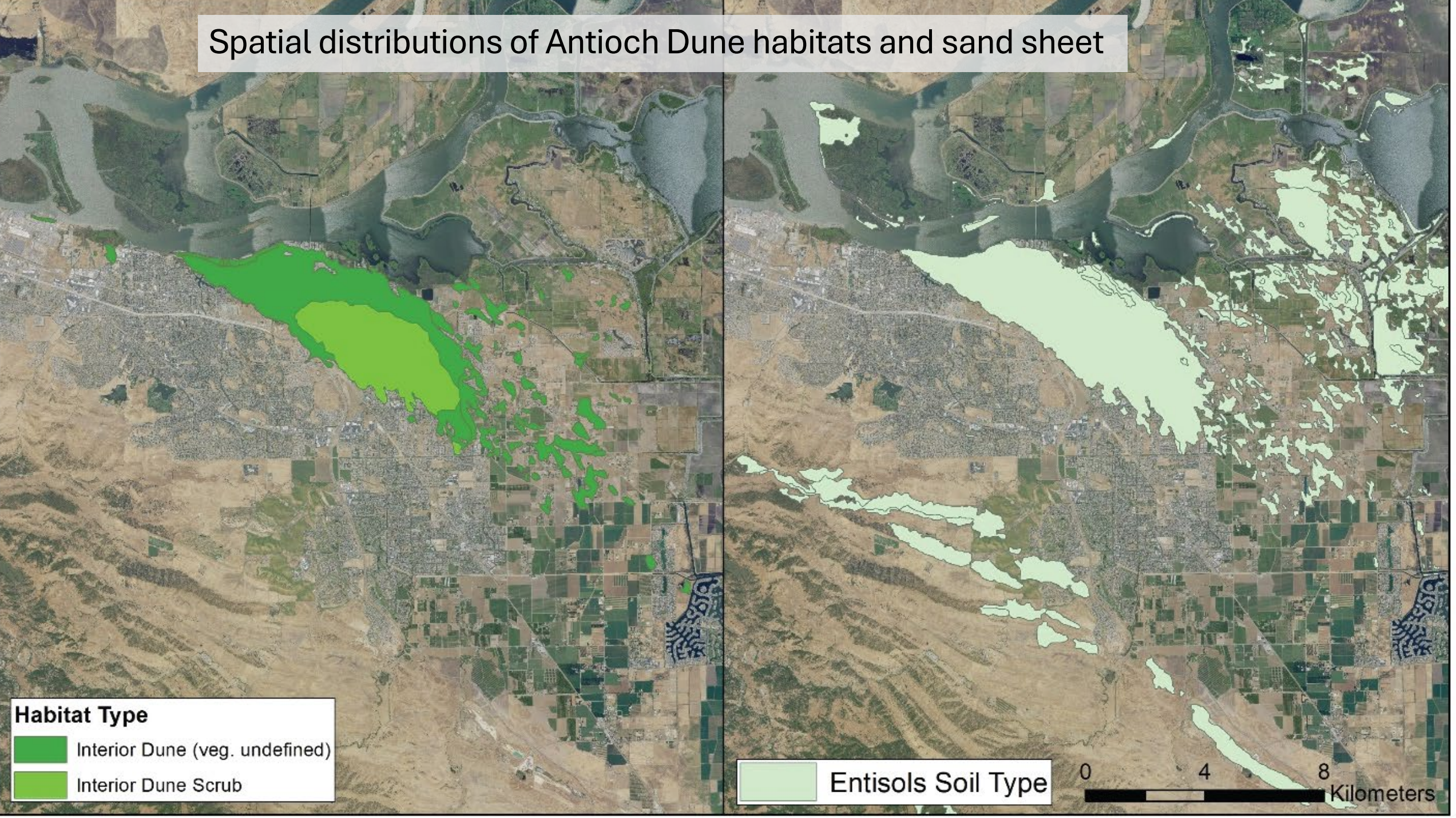
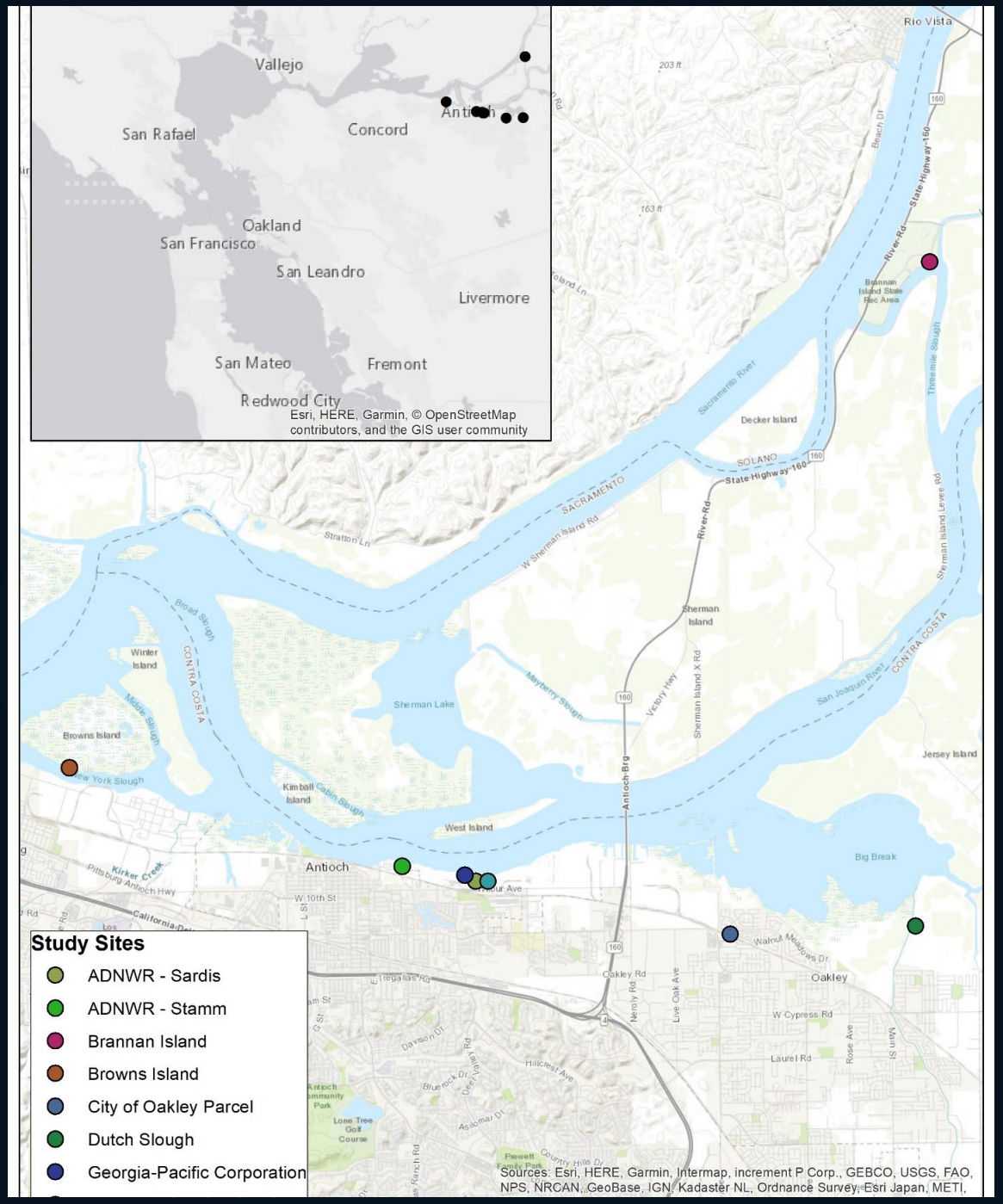
Oenothera deltoides subsp. *Julpunensis*: A new subspecies of the eastern Antioch Dunes sand sheet in the San Francisco Bay-Delta region

Presented by Molly Ferrell, CA
Department of Water Resources


Carquinez Strait
Sacramento-San Joaquin Delta
San Francisco

Spatial distributions of Antioch Dune habitats and sand sheet



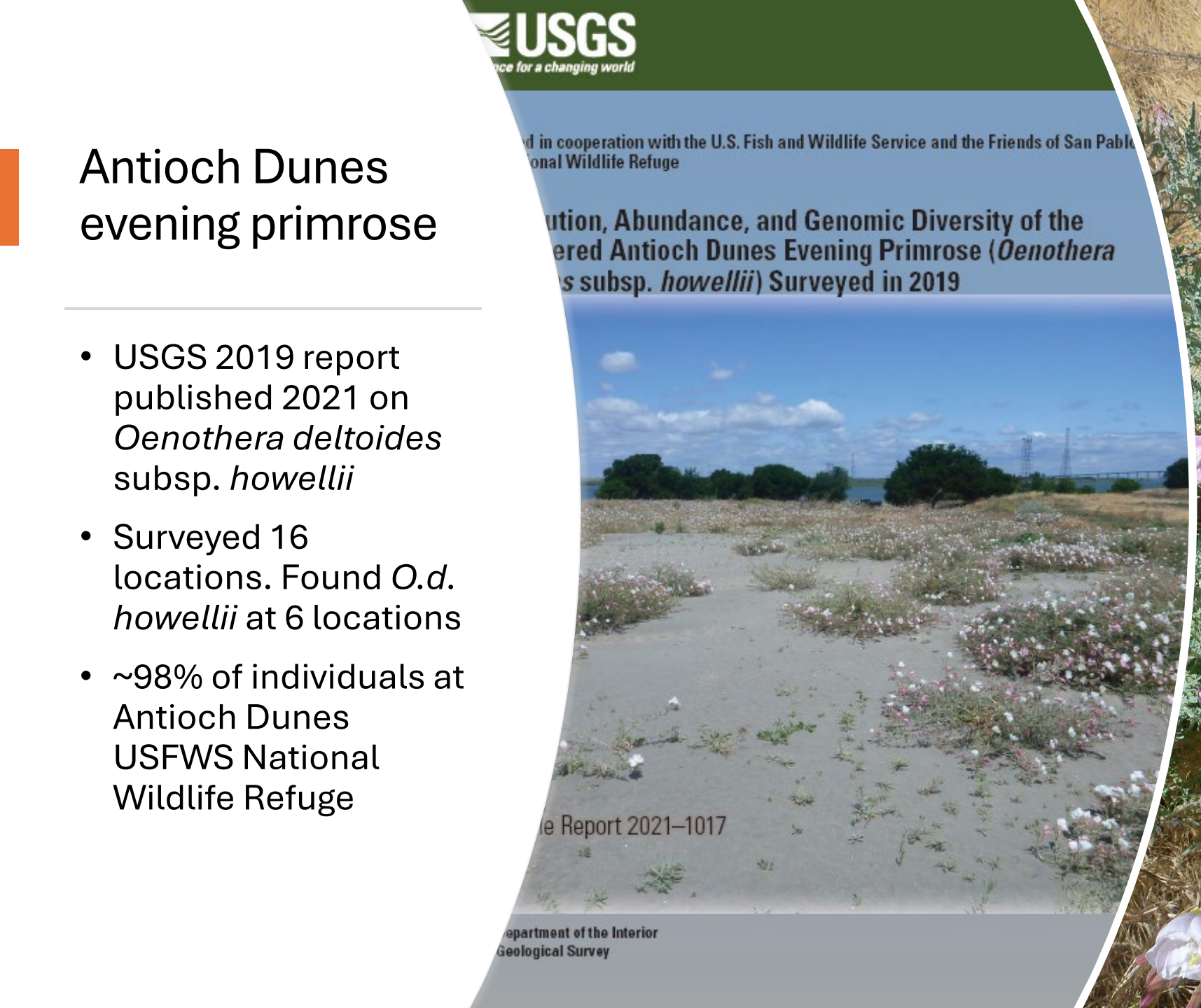


USFWS Antioch Dunes National Wildlife Refuge

- Est. 1980 for Federal- and state-listed endangered species endemic to Antioch Dunes sand sheet—2 plants and a butterfly.
- To assist In recovery of evening primrose, hired USGS to survey all populations in 2019.

Antioch Dunes evening primrose

- USGS 2019 report published 2021 on *Oenothera deltoides* subsp. *howellii*
- Surveyed 16 locations. Found *O.d. howellii* at 6 locations
- ~98% of individuals at Antioch Dunes USFWS National Wildlife Refuge

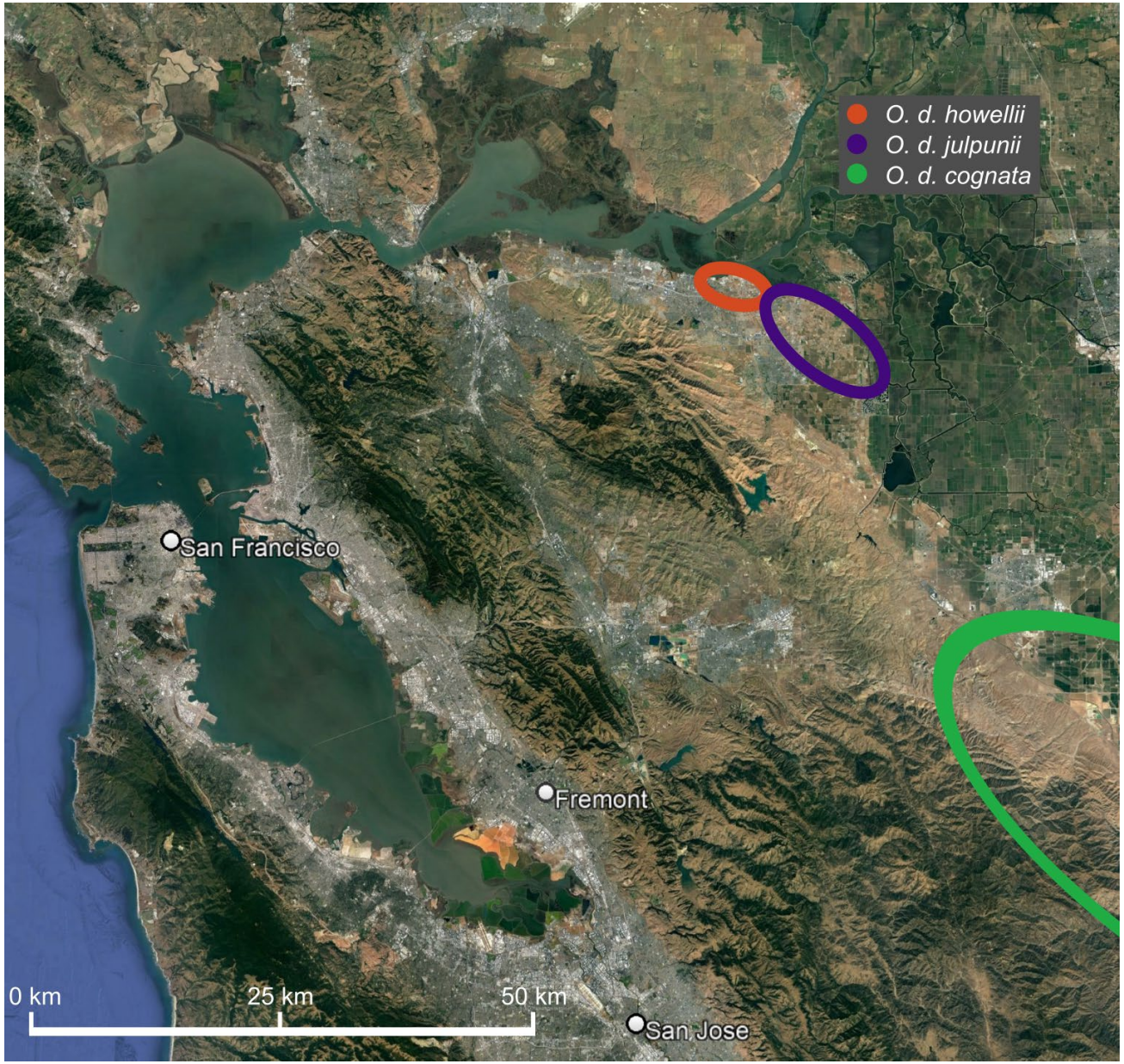


Range of three subspecies of *Oenothera deltoides* (Onagraceae):

O. d. howellii (orange; excludes out-planted sites beyond historical range),

O. d. julpunensis (purple), and

O. d. cognata (green; note distribution continues to the southeast).



Cryptic species

- 2 of 8 populations were the unknown taxon of eastern Antioch Dunes
- Showed intermediate characteristics between *O.d. howellii* and *O.d. cognata* in San Joaquin Valley
- 2021 Report: Population genomic studies of h*owellii* and detection of a potential new taxon

Genomic data collection and differentiation

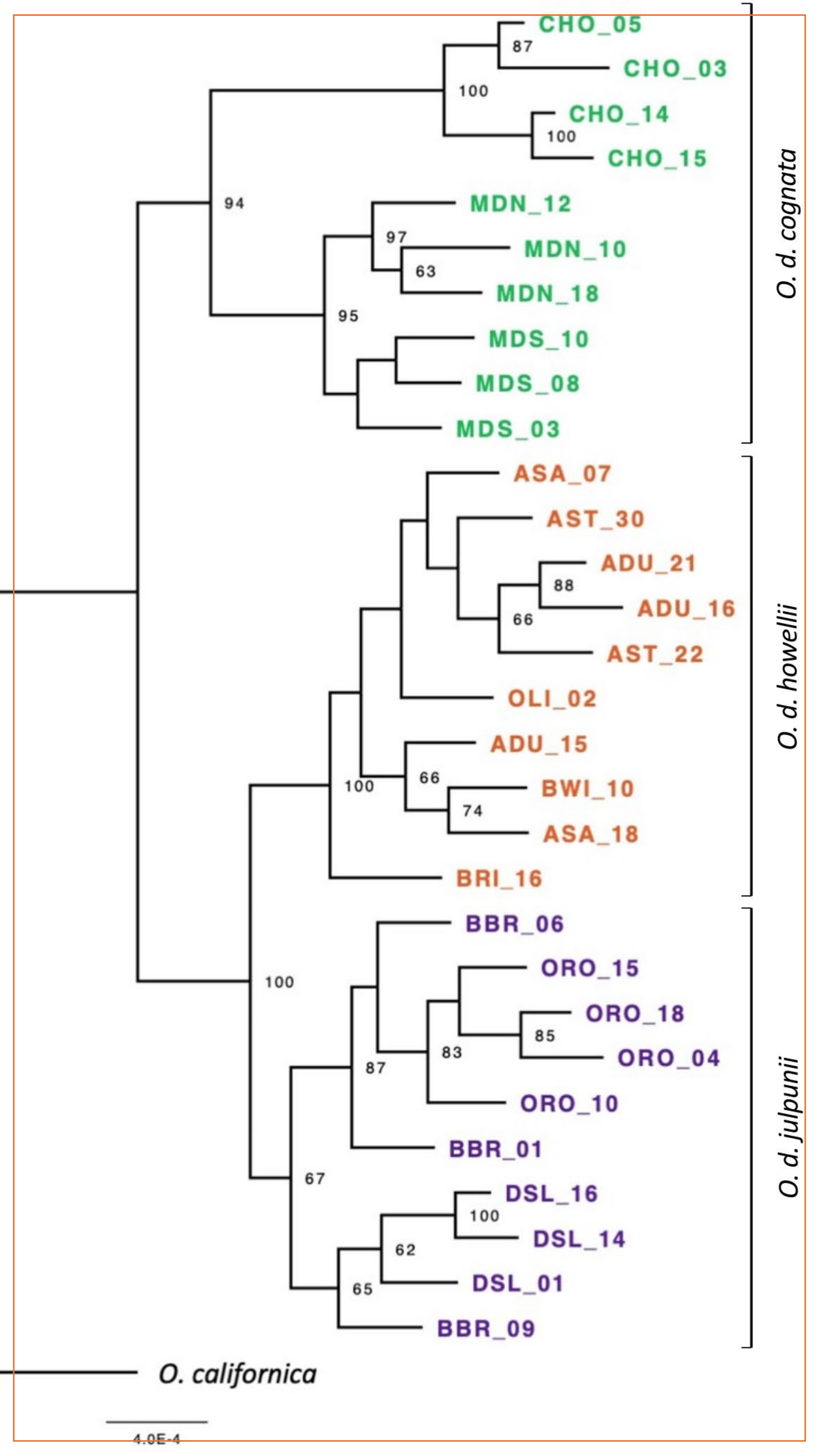
Leaf tissue collected from 212 specimens from 14 occurrences of the 3 subspp.

Double-digest restriction-site DNA sequencing led to 2,694 independent loci

Bootstrap values over 60 were mapped onto a tree.

DAPC (discriminant analysis of principal components) to maximize differences between subspecies groups.

Genotype data are available as a U.S. Geological Survey data release (Milano and Vandergast 2021). Raw sequence data are available as an NCBI Sequence Read Archive


CHO_05
87
CHO_03
100
CHO_14
100
CHO_15
94
MDN_12
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MDN_10
63
MDN_18
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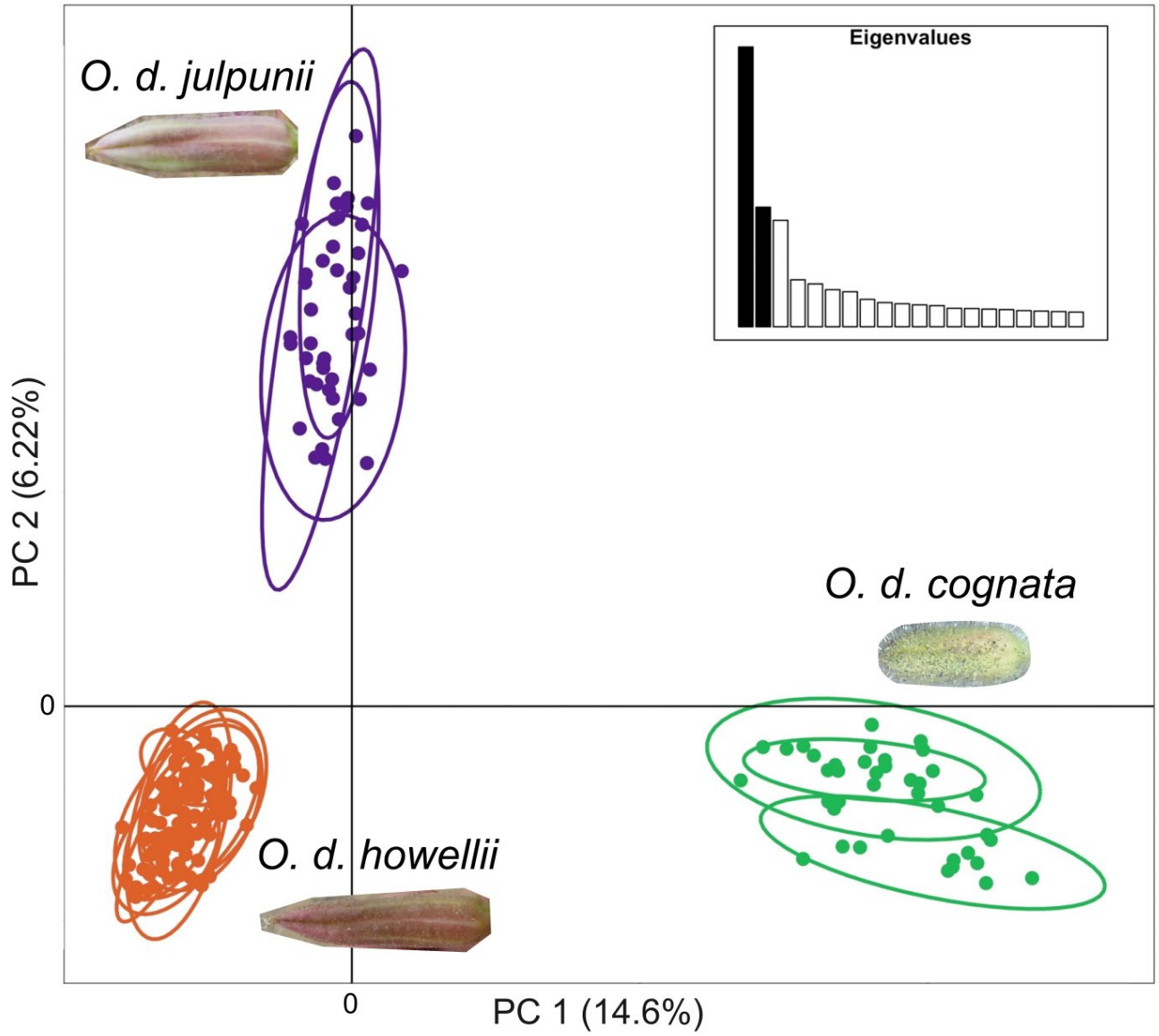
MDS_10
MDS_08
MDS_03
ASA_07
AST_30
ADU_21
88
ADU_16
66
AST_22
OLI_02
ADU_15
66
100
BWI_10
74
ASA_18
BRI_16
BBR_06
ORO_15
ORO_18
85
83
ORO_04
87
ORO_10
BBR_01
100
67
DSL_16
100
DSL_14
62
65
DSL_01
BBR_09
O. californica
4.0E-4
O. d. cognata
O. d. howellii
O. d. julpunii

PCA using SNP database



howellii

julpunensis

cognata

USGS

Bay Miwok Evening Primrose
Oenothera deltoides subsp. *julpunensis*

BAY MIWOK EVENING PRIMROSE: A NEW SUBSPECIES OF *OENOTHERA DELTOIDES* (ONAGRACEAE) ENDEMIC TO CALIFORNIA

MADROÑO, Vol. 71, No. 2, pp. 84–104, 2024

BAY MIWOK EVENING PRIMROSE: A NEW SUBSPECIES OF *OENOTHERA DELTOIDES* (ONAGRACEAE) ENDEMIC TO CALIFORNIA

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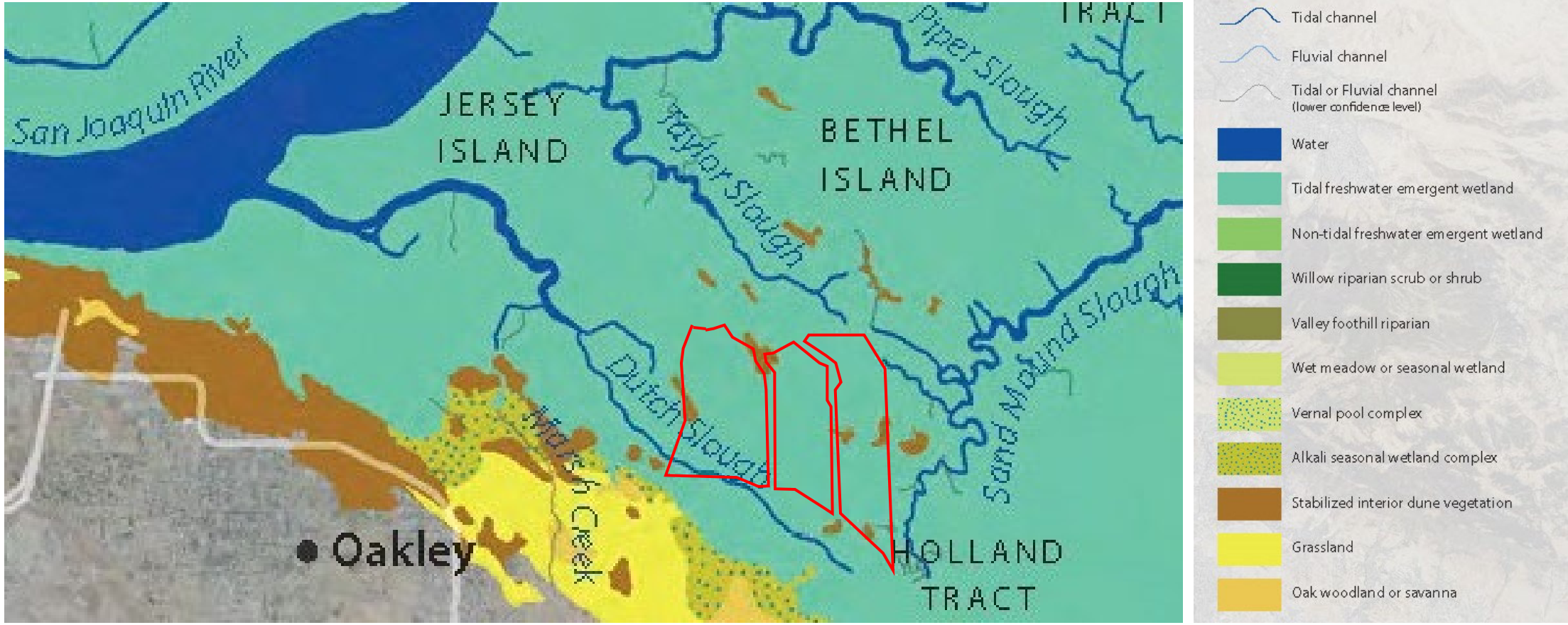
Delta Historic Ecology Study – SFEI, 2012

- Mouth of Marsh Creek
  - Tidal Freshwater Wetlands
  - Interior Dunes – Culturally Significant
  - Alkali Seasonal Wetlands



Ex. O.d. julpunensis
leaf polymorphism

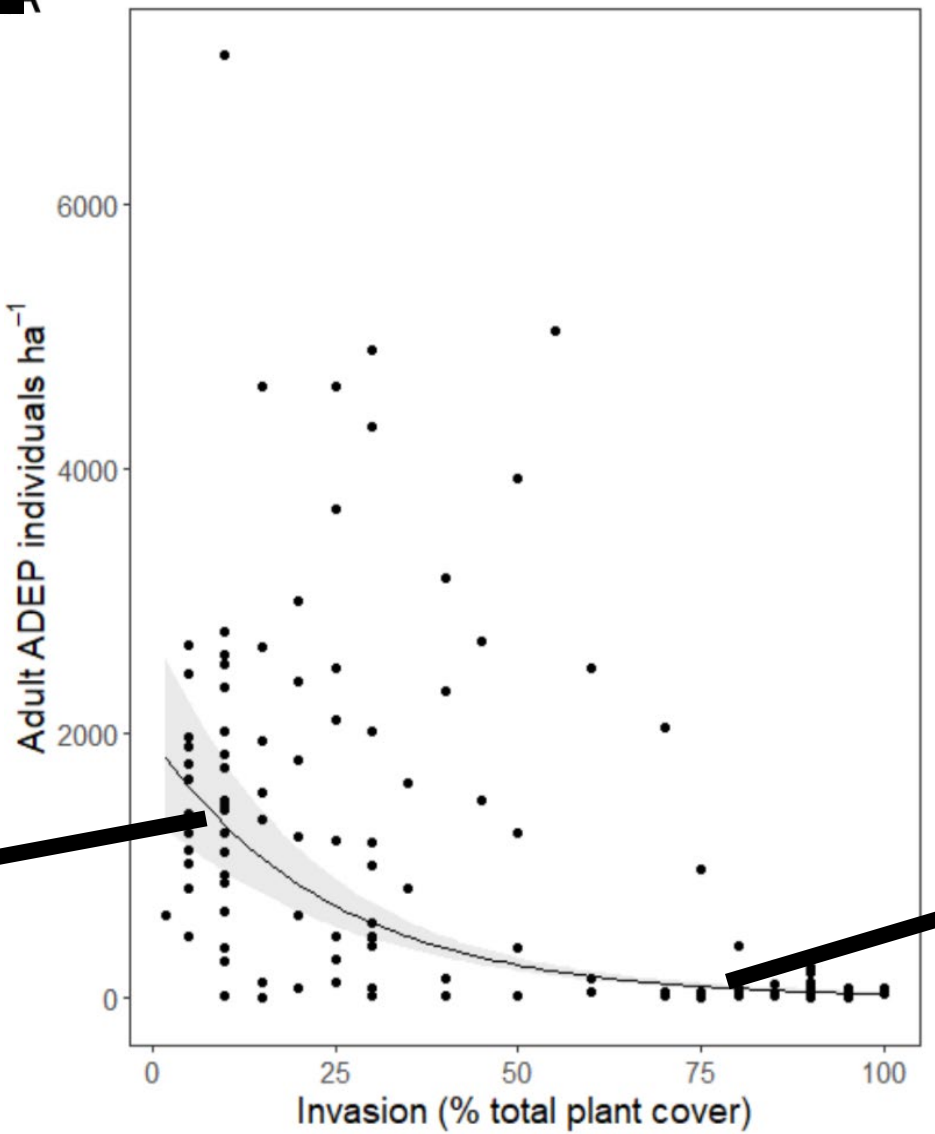
Habitat management: Aim for recruitment

- Total plant cover correlated with juveniles found. Reducing invasive weed competition to allow for the short-lived primrose perennial a better chance of survival.
- Promote juveniles to stabilize populations by maintaining areas of bare ground (sand).

Case study from 2021 USGS report

Open dune

1,306 individuals ha^{-1}



Invaded

75 individuals ha^{-1}

Dutch Slough Dune Restoration

March 2015

May 2016 weeds removed


Dutch Slough
April 2024

Thank you!

Please contact me at Molly.Ferrell@water.ca.gov