Regional partnerships fostering stewardship of San Francisco Bay tidal marsh & mudflats

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Cal-IPC Symposium
CSU Chico

Invasive *Spartina* Project began in 2000 as a partnership between USFWS & California Coastal Conservancy

U.S. FISH & WILDLIFE SERVICE

"Working with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people."

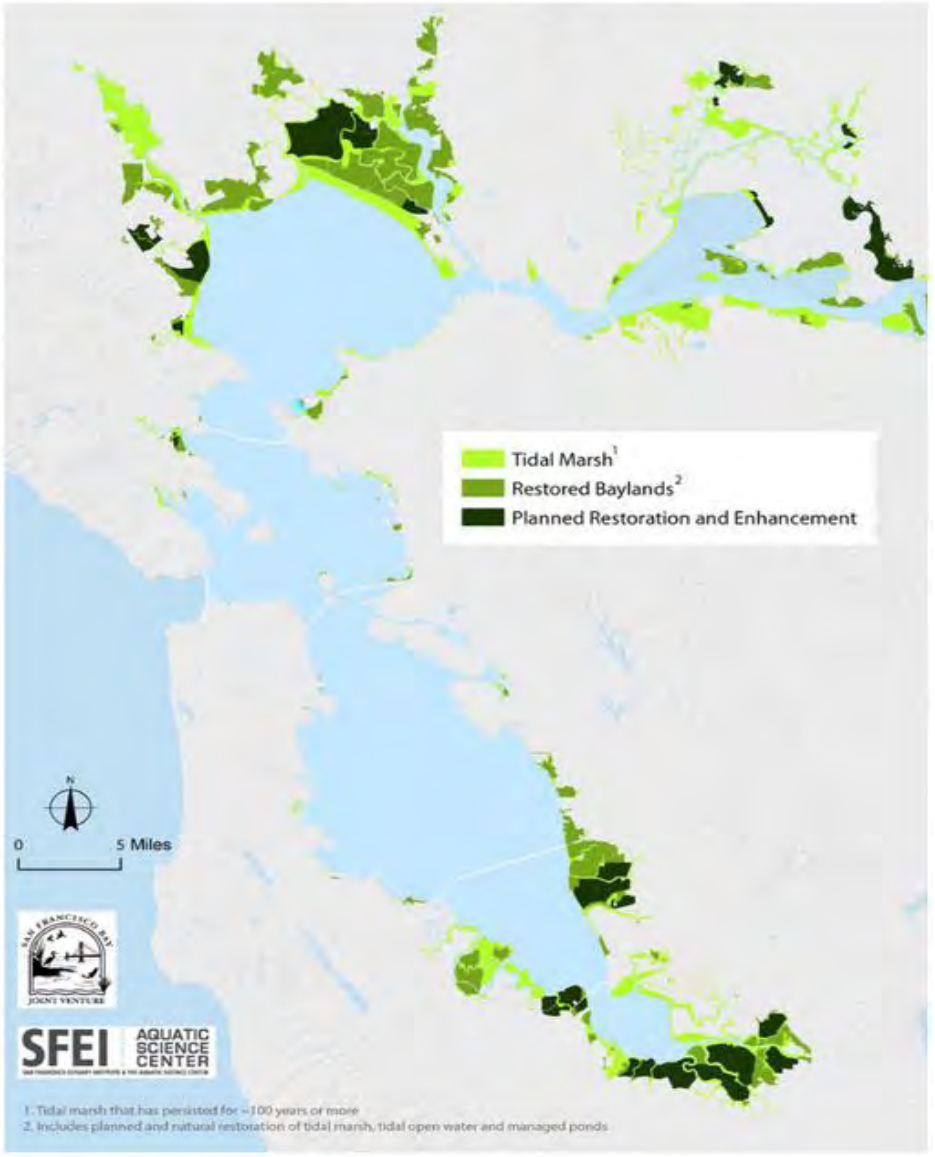
SAN FRANCISCO ESTUARY INVASIVE SPARTINA PROJECT

Preserving native wetlands

Coastal Conservancy

Established "to protect and improve natural lands and waterways, to help people get to and enjoy the outdoors, and to sustain local economies along **California's coast**."

Tidal Marsh Extent: Then and Now



These maps from the San Francisco Estuary Institute show what was tidal marshland back around 1800 (left) and what today is still marsh, what's been restored to tida
bay lands and what is in the works (right). *(San Francisco Bay Joint Venture)*

Tidal Marsh Habitat + Ecosystem Services

- Protect urban areas from flooding & storm surge
- Reduce erosion
- Filter pollutants from water
- Sequester carbon
- Open space for recreation

salt marsh harvest mouse

CA Ridgway's rail

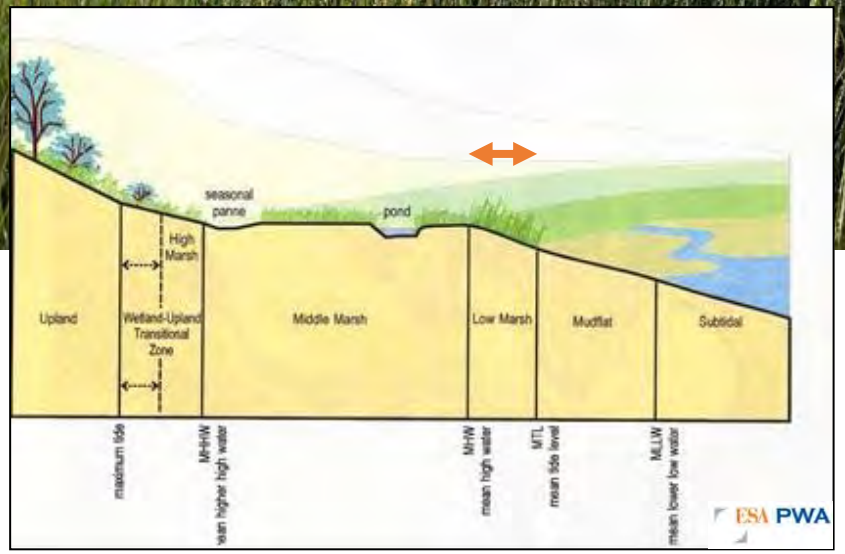
CA black rail

Suaeda californica
(CA 1B.1;
Federal Endangered)

Chloropyron molle
ssp. *molle*
(CA 1B.2;
Federal Endangered)

San Mateo County Mosquito and Vector Control District

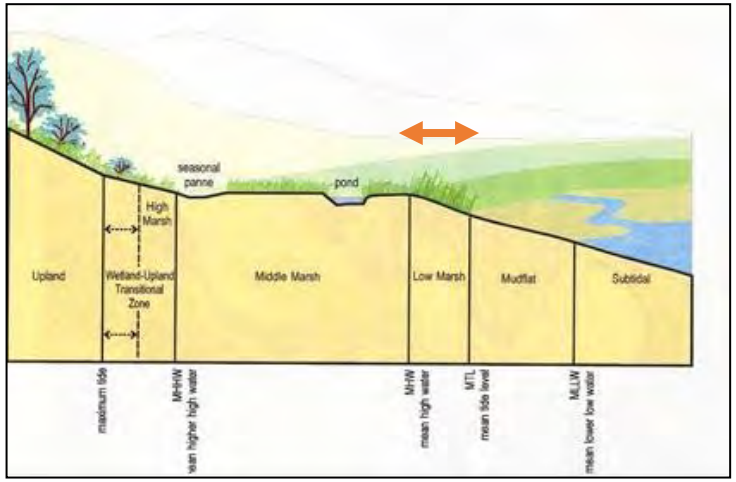
Native Pacific Cordgrass *Spartina foliosa*



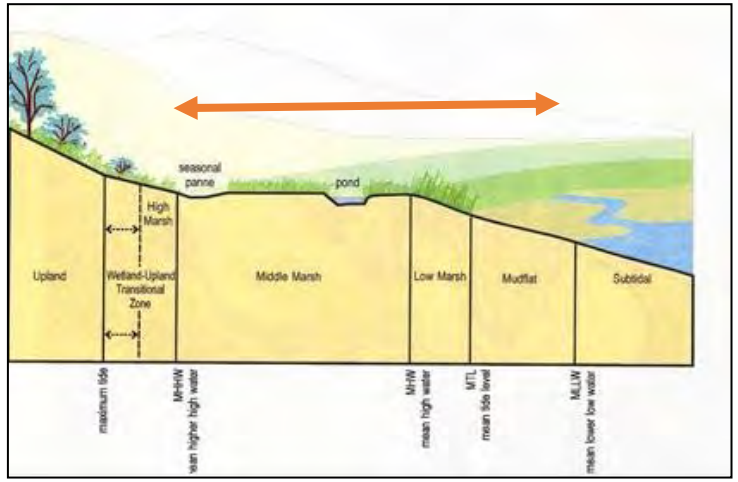
Foundational species in the low marsh & pickleweed plain

Important early colonizer and lowest elevation plant in intertidal zone

Ecosystem engineer that has evolved in this region, growing in narrow elevational range; **plays well with others**



East Coast *Spartina alterniflora* introduced 1970's hybridized with native Pacific cordgrass, *Spartina foliosa*



Spartina foliosa

Spartina alterniflora × *foliosa*

Why is hybrid *Spartina* a problem?

Mudflat converted to hybrid *Spartina* monoculture in <20 years by sediment accretion after hybrid *Spartina* colonization

Ecosystem engineer throws native system out of balance

- Dominates mudflats, impacting shorebirds
- Changes mudflat invertebrate community (extensive UC Davis body of literature)
- Displaces native tidal marsh plant community & alters hydrology

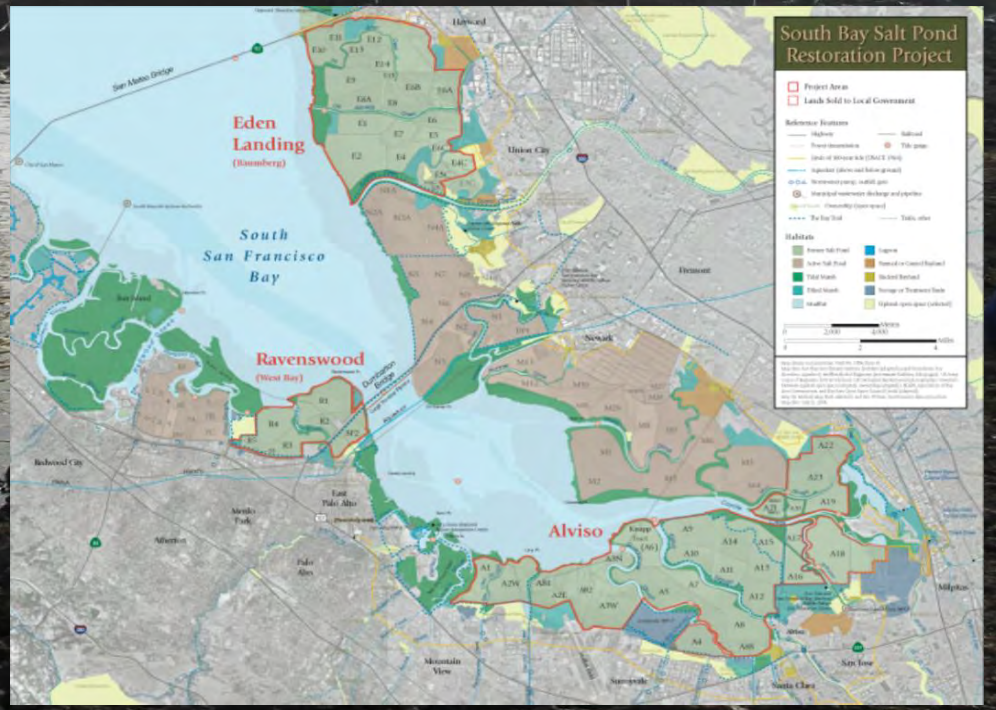
Why is hybrid *Spartina* a problem?

- **Causes failure of native tidal marsh restoration**
- Threatens rare plants
- Reduces flood control capacity
- Creates mosquito breeding areas

South Bay Salt Pond Restoration Project

Over 15,000 acres of decommissioned salt production ponds

Conversion to various types of marsh and pond habitat over several decades



Mt Eden Creek Marsh breach 2008 in Eden Landing Ecological Reserve

Invasive *Spartina* Project Programs

- **Inventory**: OEI biologists survey tidal marshes & map invasive *Spartina*
- **Treatment**: Contractors & ISP staff treat mapped invasive *Spartina* accompanied by biologists
- **Restoration**: Habitat enhancements to benefit Ridgway's rail & other tidal wetland species
- **Ridgway's rail monitoring**: Breeding season call-count surveys that inform other programs

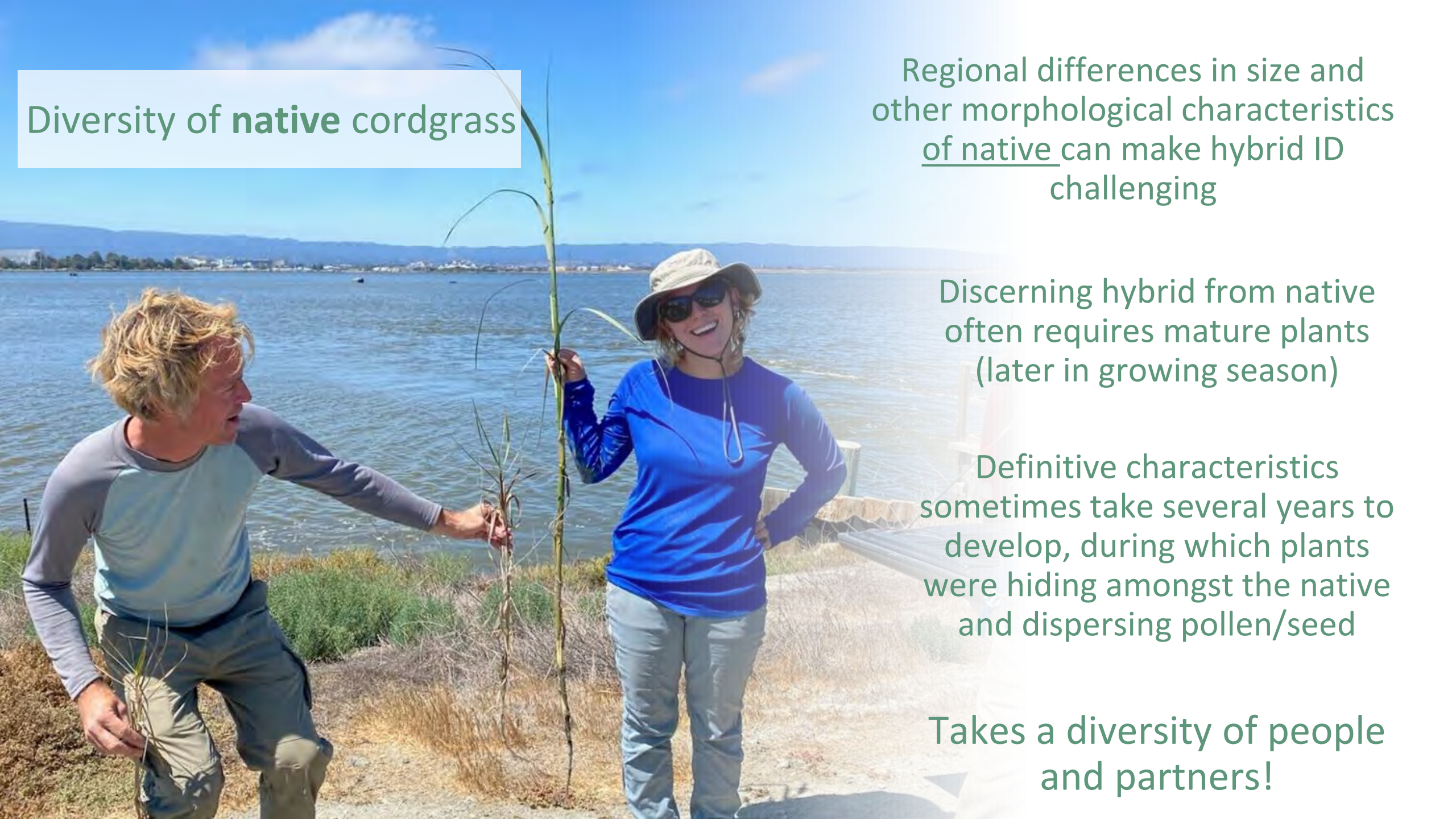
Ridgway's rail
Rallus obsoletus obsoletus
Federal & State endangered

Inventory Monitoring

OEI biologists survey 40,000 to 70,000 acres of San Francisco Bay marsh & shoreline June – November each year to inform invasive *Spartina* treatment

ISP does extensive genetic testing each year (≅500 samples) to identify hybrids before treatment and preserve native *S. foliosa*

Can you spot the more robust, bright green hybrid growing amongst the native *Spartina*? She can!



Diversity of **native** cordgrass

Regional differences in size and other morphological characteristics of native can make hybrid ID challenging

Discerning hybrid from native often requires mature plants (later in growing season)

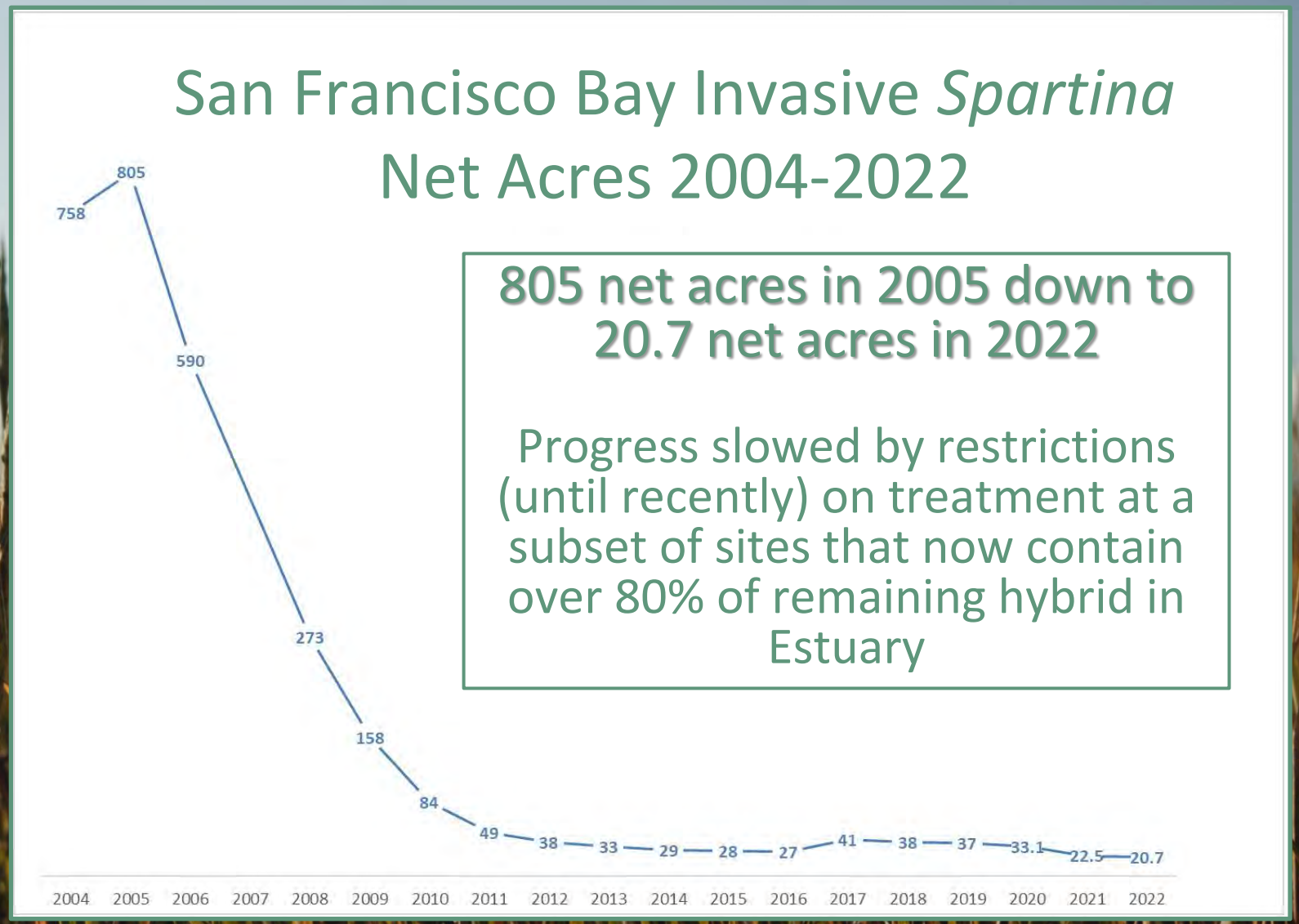
Definitive characteristics sometimes take several years to develop, during which plants were hiding amongst the native and dispersing pollen/seed

Takes a diversity of people and partners!

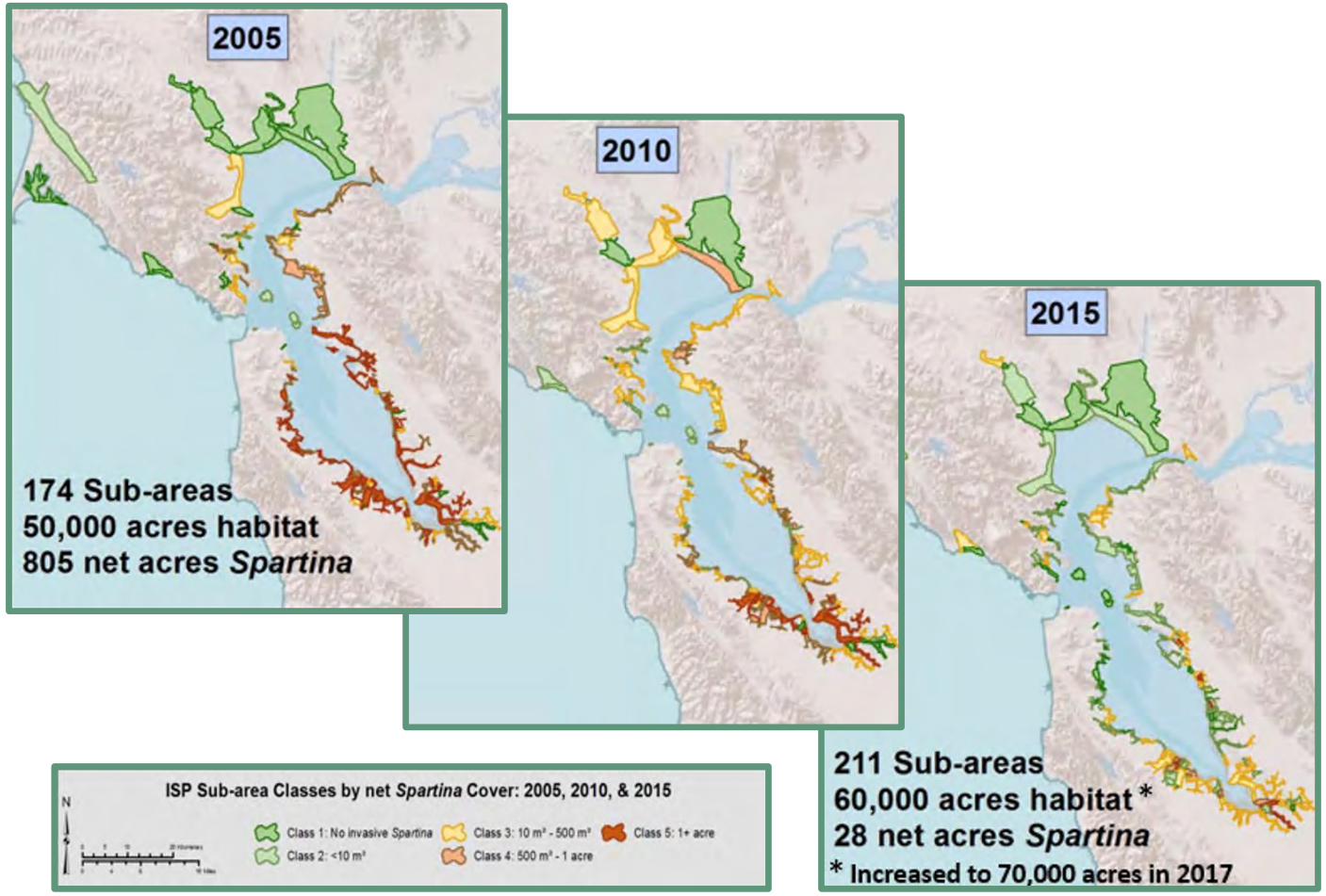
Our AI Buddy System

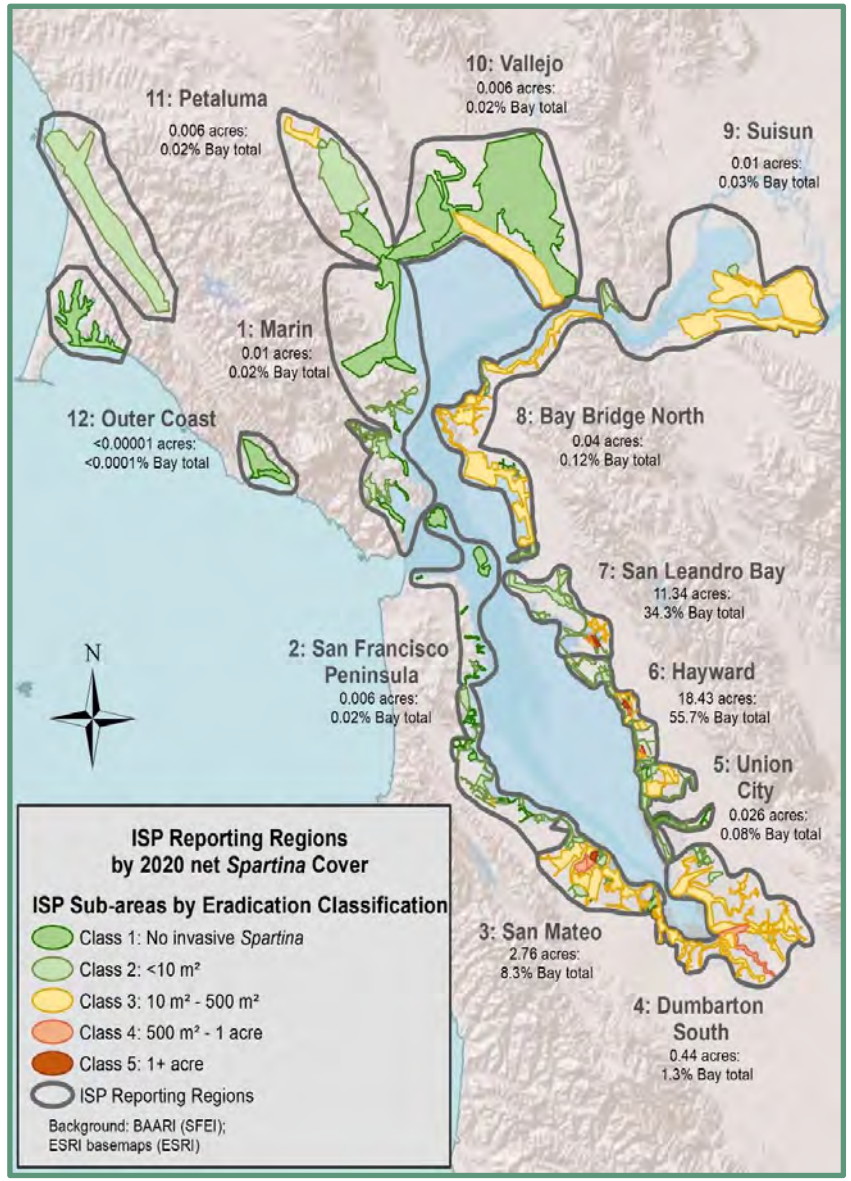
- Linear Discriminant Analysis (LinDA) computer program developed by Simon Gunner (OEI)
- Memorized measurements of over 500 DNA-verified plants
- Correct over 80% of the time on plants backcrossed with native morphologies
- But doesn't have eyes…or hands!

Hybrid *Spartina* reduced by 97.4% Estuary-wide



Invasive *Spartina* Cover Reduction 2005-2020





2022 Invasive *Spartina* Status

- As of 2022, 167 of 221 ISP sites **now contain under 10m² of invasive *Spartina*** with a total of less than 200m² net cover

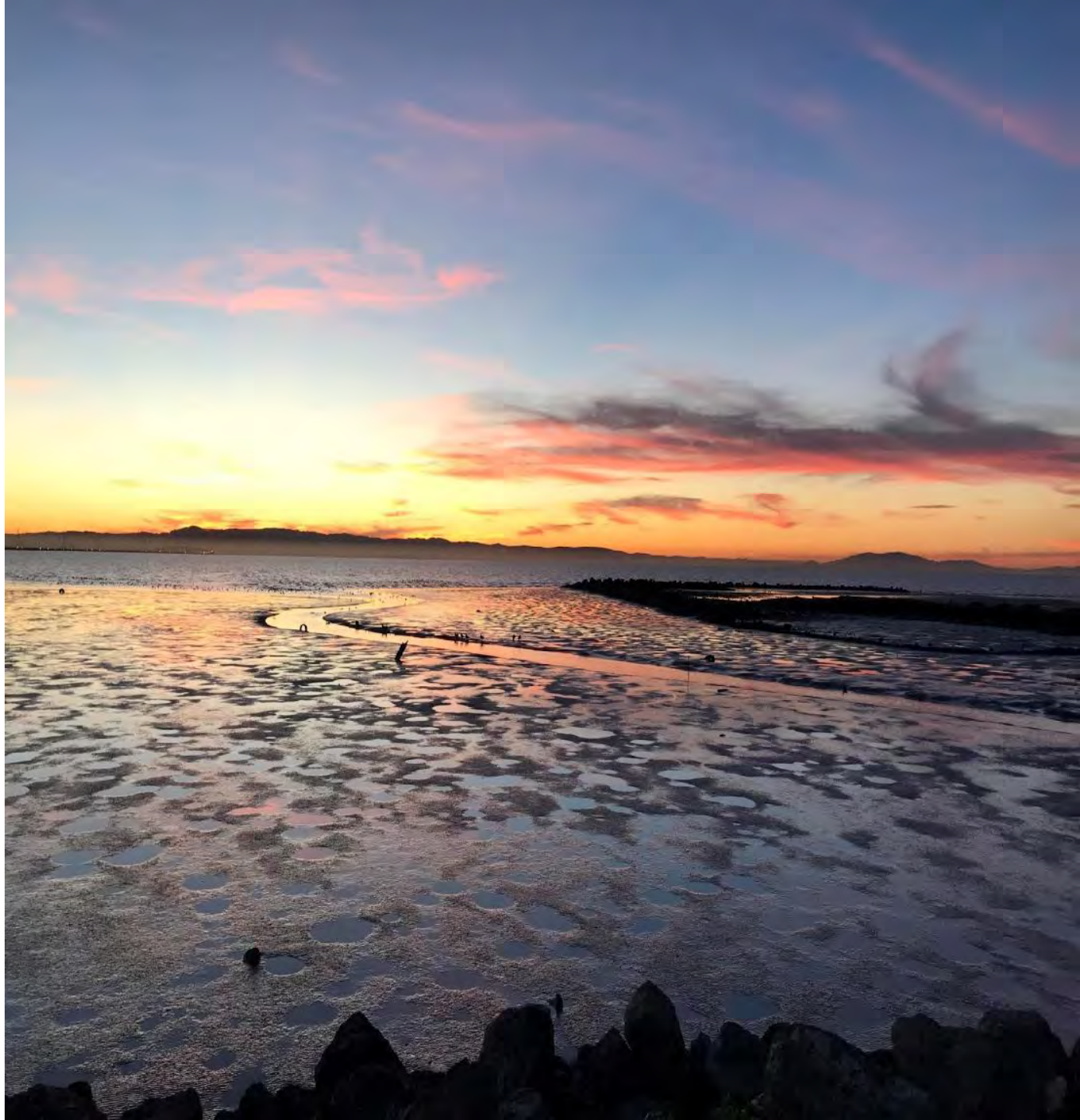
- **53 of these sites contain under 1m²** of invasive *Spartina*

- **60 sites at Zero Detection (ZDs)**, many for 3 or more consecutive years

 # ZDs has increased annually 9 of past 10 years

- These sites encompass tens of thousands of acres of marsh and mudflat

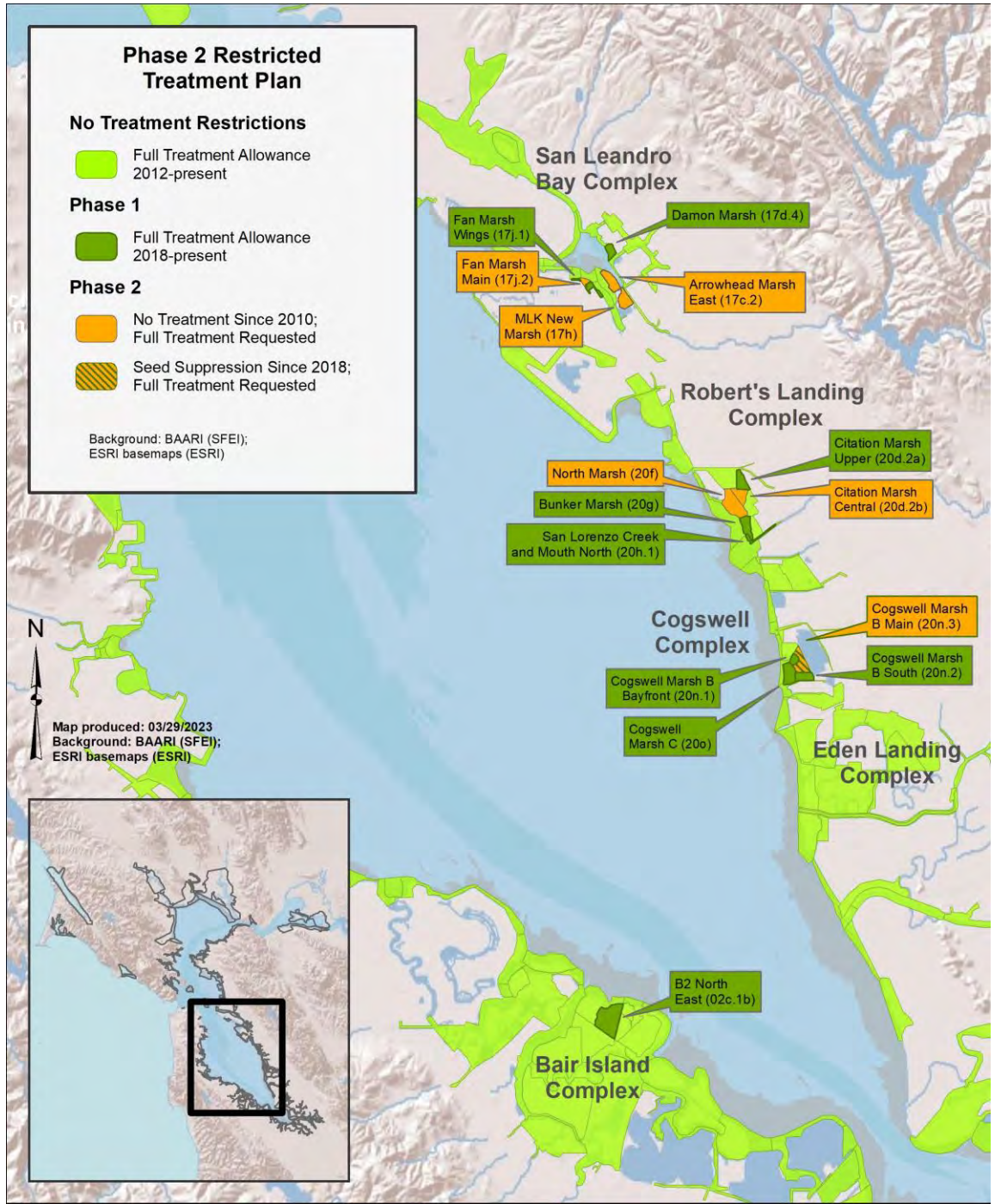
- Removing or reducing the threat from hybrid *Spartina* protects extant marshes & mudflats & supports regional native marsh restoration



Phased Treatment to protect Ridgway's Rail in San Francisco Bay

- As predicted in ISP's EIR/S, removing hybrid *Spartina* monocultures in this urbanized system reduced the artificially dense cover for rails; more problematic in fragmented marshes & those with low biodiversity
- Treatment restricted at subset of sites in 2011-2012 Biological Opinions to proceed with caution & not risk jeopardy for rails
- Unfortunately, in the absence of management, infestations sprang back to pre-treatment levels (or MUCH worse, up to 350% increases)

- Resumed treatment at 7 sites in 2018 Biological Opinion (Phase 1, dark green on map);
  By 2022, **7 of 10 sites already >94% reductions**
- Phasing in treatment initiation at final 6 sites 2023-2027 (Phase 2, orange on map);
  Resumed treatment of 3 marshes in 2023



ISP Treatment Program

- Narrow treatment timing window after Ridgway's rail breeding season for their protection
- Tough to fit in mapping & treatment of the entire Bay into such tight window before *Spartina* senesces
- Targeted spot treatment, minimizes impacts to habitat
- Airboat essential at new restoration marshes and other DENWR sites

ISP Treatment Program

Larger infestations are treated by hauling hose out from an airboat or truck

Approach from mudflat to reduce disturbance to wildlife associated with marshplain

Majority of sites are simply treated by backpack sprayer

San Mateo County Mosquito and Vector Control District

Partnerships are Key to Landscape Scale Management
San Mateo County Mosquito & Vector Control District (SMCMVCD)

- SMCMVCD has been an active partner since treatment began in 2005
- Partnership with the ISP helped them clear the way to breach large Bair Island ponds to alleviate some of their worst mosquito breeding areas
- Originally responsible for treatment along the entire San Mateo County shoreline, and **dozens of those sites are now Zero Detection for hybrid *Spartina***

Partnerships are Key to Landscape Scale Management
East Bay Regional Park District (EBRPD)

- EBRPD is on the ISP Project Management Team (PMT) and has been an active partner since the inception of the project
- Tasked with protecting biodiversity in their marshes from Point Pinole to MLK Shoreline & Hayward Shoreline
- Began assisting with airboat services again in 2023 after hiatus during Covid and recent management transitions

Partnerships are Key to Landscape Scale Management
SOLitude Lake Management (formerly Aquatic Environments)

- SOLitude is the primary vegetation management contractor for the ISP
- ISP began a pilot project with an airboat in 2008, expanded to DENWR in 2009
- Pioneered the airboat access program that the project now utilizes all around the Estuary
- Also involved in native planting

Accessing the hybrid *Spartina* infestation by airboat at low tide for treatment:

You want me to drive the airboat in there??!!

Partnerships are Key to Landscape Scale Management
RECON Environmental

- RECON has two Intelli-Spray systems with very long hoses that have been invaluable for our Phase 1 & now Phase 2 treatment
- Truck can be staged on adjacent levee up to 850 feet away, allowing for more efficient treatment of large monocultures that would require 100’s of backpacks
- Also involved with native planting

Spartina densiflora: IPM Strategy & Eradication Progress

- *Spartina densiflora* was introduced from Chile to Humboldt Bay
- Used as dry ballast in 19th century timber trade ships
- Introduced to Marin County in 1970s for Creekside Park restoration
- Mistakenly identified as a form of the native *S. foliosa*

- Sandy Guldman, President of Friends of Corte Madera Creek, contacted hundreds of individual landowners to gain access permission for inventory and treatment
- Some final holdouts required contact from the Marin County Ag Commissioner, and education regarding the State noxious weed law
- All eventually partnered with us without need for enforcement actions

Current *Spartina densiflora* Eradication Methodology

All historical sites surveyed
2x annually

1st in early June
flower stalks can help detection

2nd in January/February
native pickleweed has senesced

- All plants are **manually removed** and disposed offsite

- Herbicide not used since 2012

Task remaining: Exhaust the *S. densiflora* Seed Bank

2.1 m^2 in 2021 in **entire Estuary**
(99.9% reduction)

ISP experience appears to indicate
5+ year seed viability

12 seedlings found throughout the Estuary in 2023
(27 seedlings 2021
65 seedlings in 2020)

Full eradication is a high bar; requires long term stewardship

Photo courtesy of W. Kitundu

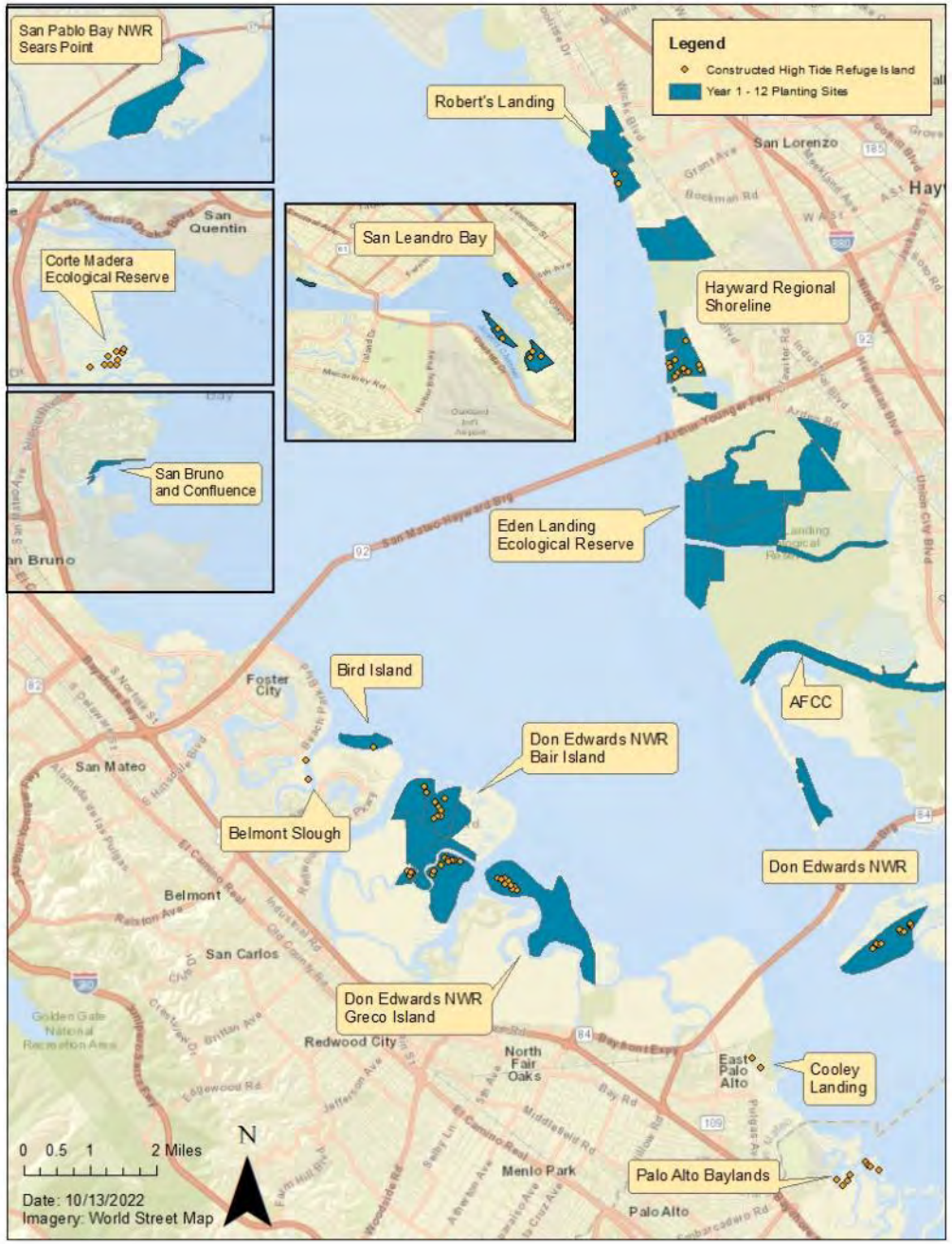
ISP Restoration Program:
Habitat Enhancements focused on California Ridgway's rail

ISP Restoration Program

Key at sites most impacted by hybrid *Spartina* invasion

Focus on key components rail habitat: cover from predators for foraging, nesting, high tide refuge

Accelerate enhancement through active planting



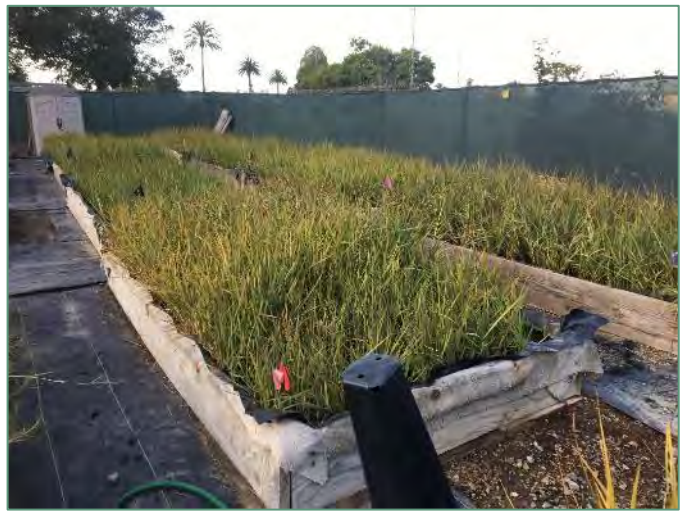
Habitat Enhancements

ISP and partners: 40+ Sites

Planted 550,000+ Pacific cordgrass, marsh gumplant, and transition zone species

Constructed 82 high tide refuge islands at 16 sites

What Do We Plant?



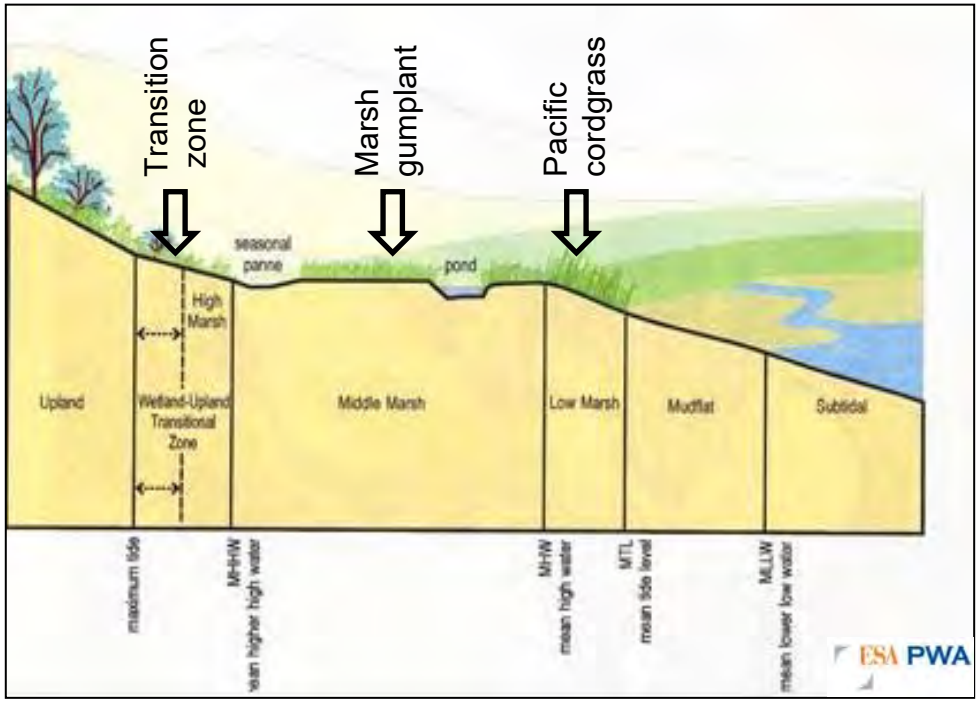
Partnered with The Watershed Nursery

Pacific cordgrass

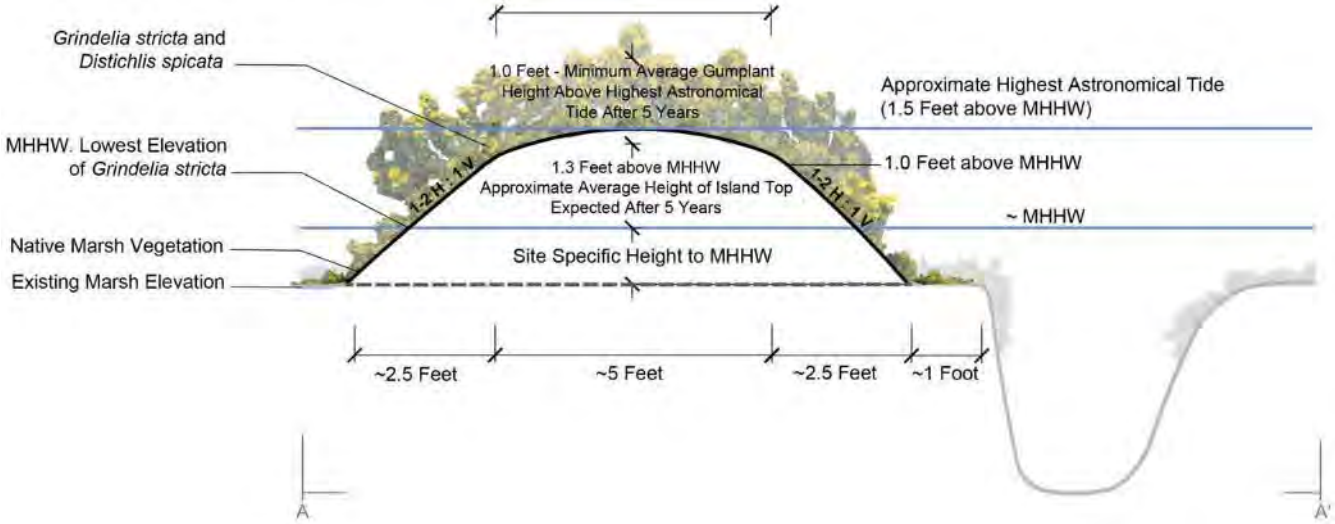
Marsh gumplant (*Grindelia*)

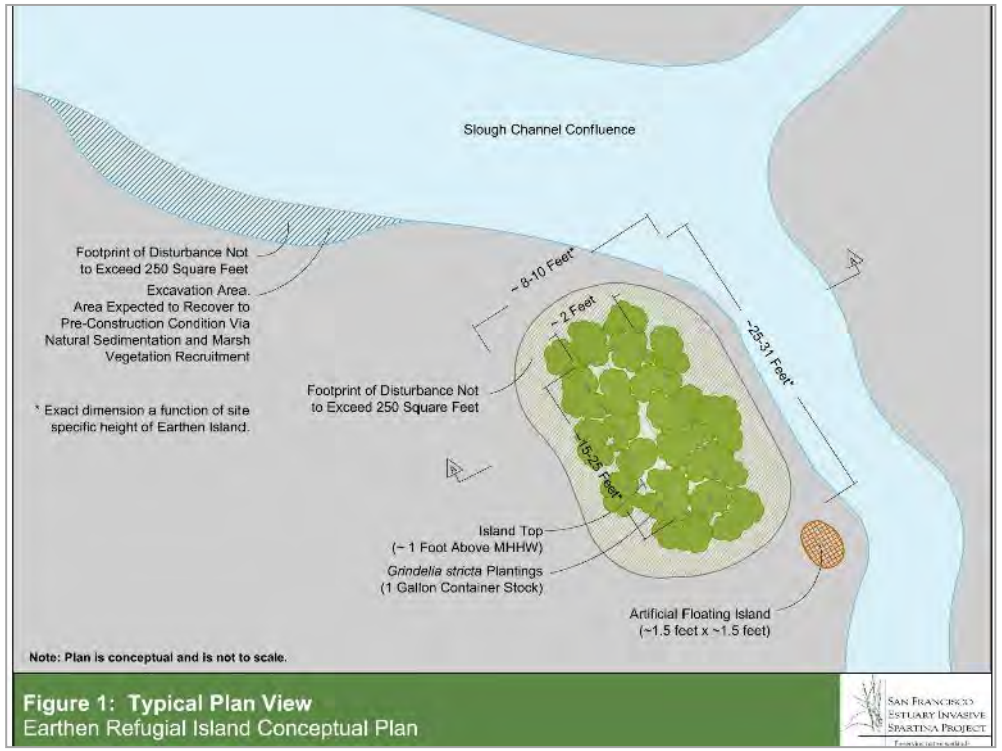
Upland transition zone spp.

Pacific cordgrass source populations



High Tide Refuge Islands





High Tide Refuge Islands

Corte Madera
Ecological Reserve

Additional refuge islands
visible in the distance

Bair Island B2NE

Eden Landing Ecological Reserve

Early restoration of former salt pond: Started unvegetated with no Ridgway's rail habitat

Photo Point A

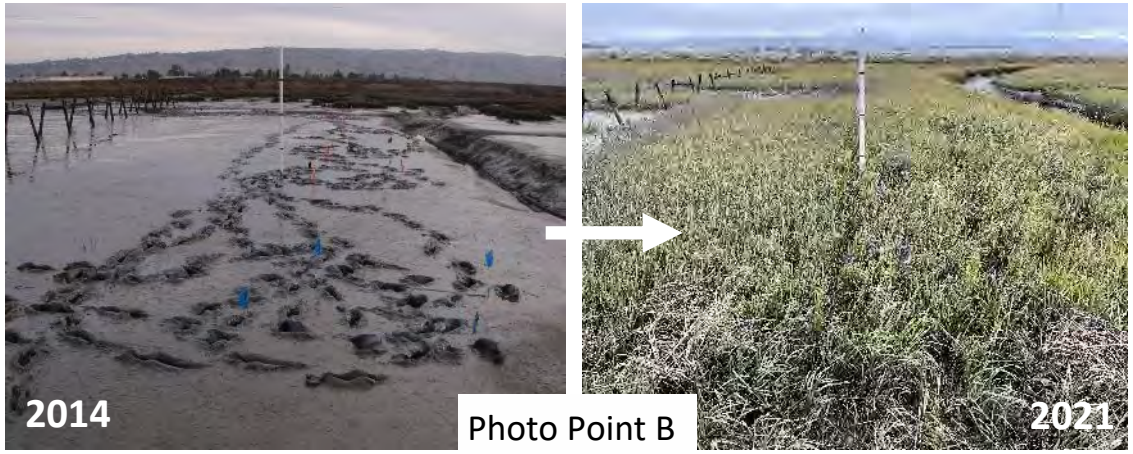


Photo Point B

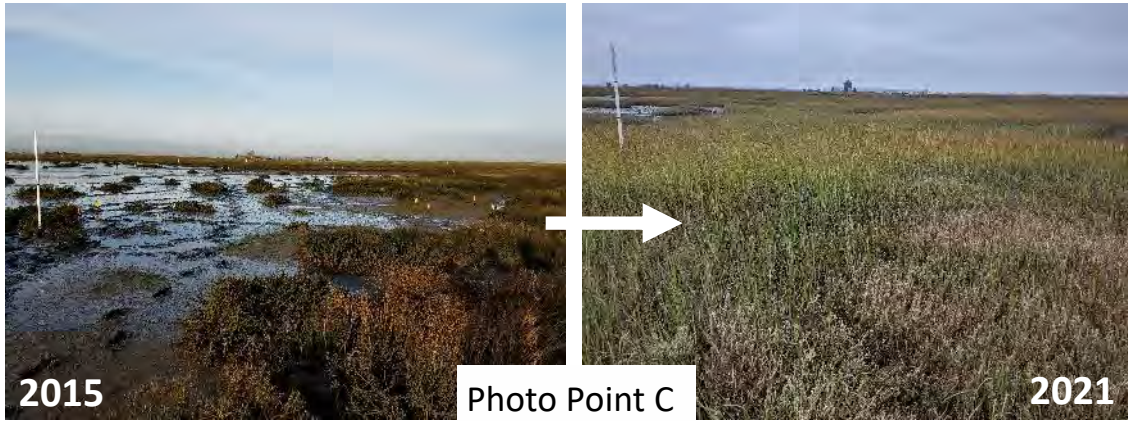
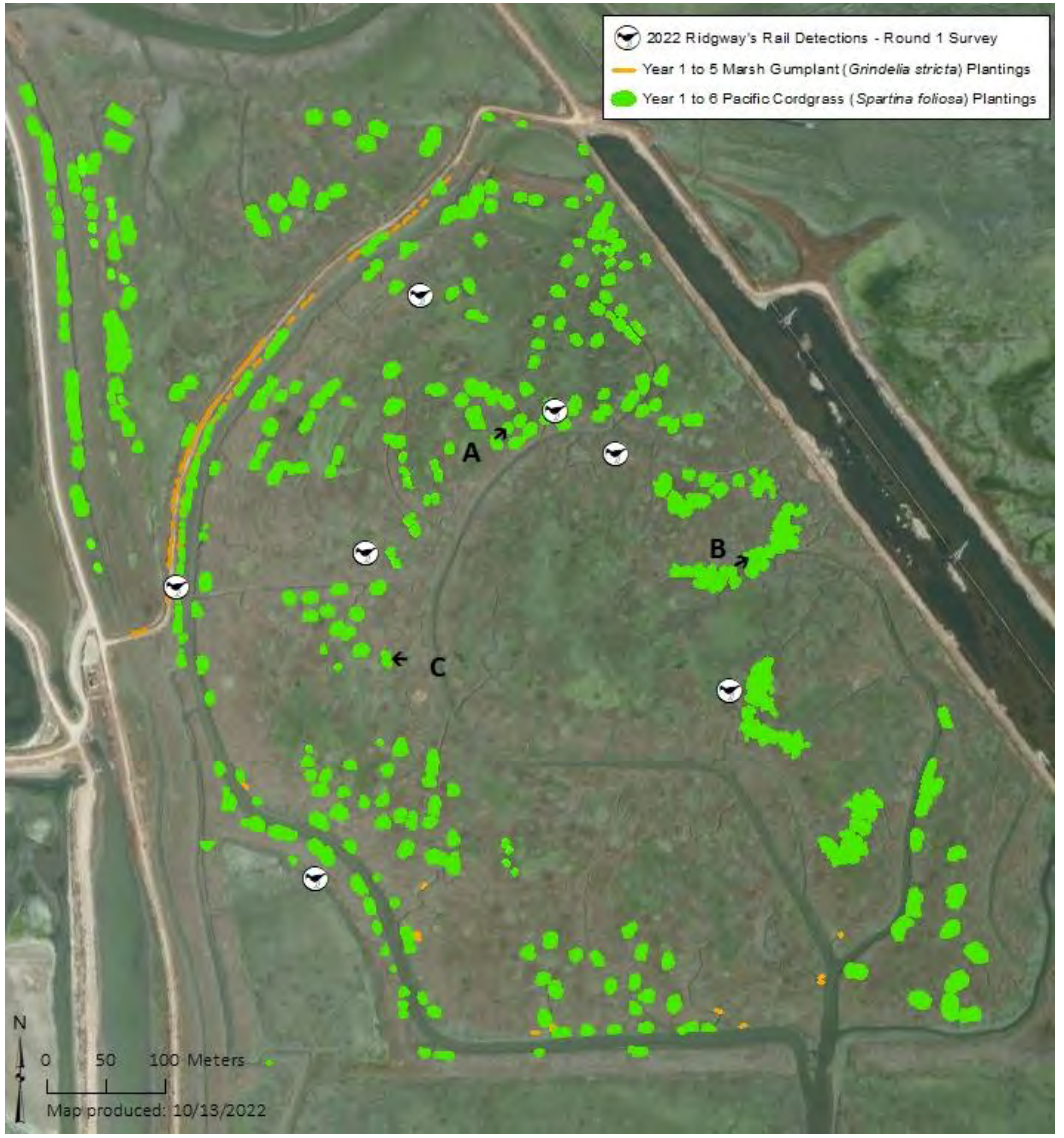


Photo Point C

Eden Landing Ecological Reserve



Successful rapid habitat enhancement at Eden Landing

Spartina foliosa plantings accelerated conversion of former salt pond into a marsh

13 Ridgway's Rail detected 2021 (first 1 in 2018)

North Creek Marsh 2019

Alameda Flood Control Channel

Original *Spartina alterniflora* introduction site in 1970's

Alameda Flood Control Channel in 2019

The original *Spartina alterniflora* introduction site…transformed!

Pond A6 (Knapp Tract) shown Sept. 2021 (breached 2010)

Passive native vegetation establishment under watchful protection of the ISP

Ongoing stewardship keeps a watchful eye for hybrid *Spartina* invasion so we can respond rapidly

Sites are most vulnerable to invasion at EARLY stages of development w/ less biotic resistance

Goal of healthy, resilient marshes
with thriving NATIVE biodiversity

Ongoing stewardship is essential

to maintain the health of our marshes & mudflats
& guard against future threats

THANK YOU!