Comparison of Removal Methods for *Spartina densiflora* in Humboldt Bay

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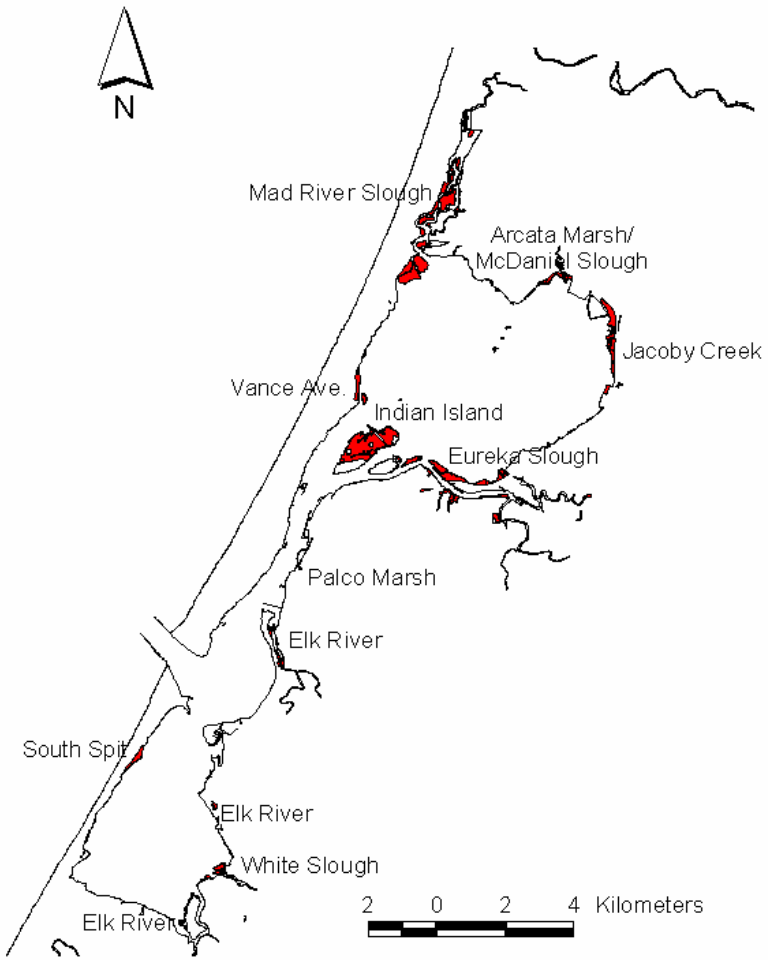
Spartina densiflora

- Native to coastal South America
- Perennial
- Reproduction by seed and tillers
- Germination/seedling establishment limited by salinity
- Invasive in Humboldt Bay, San Francisco Bay, Washington and Spain

History in Humboldt Bay

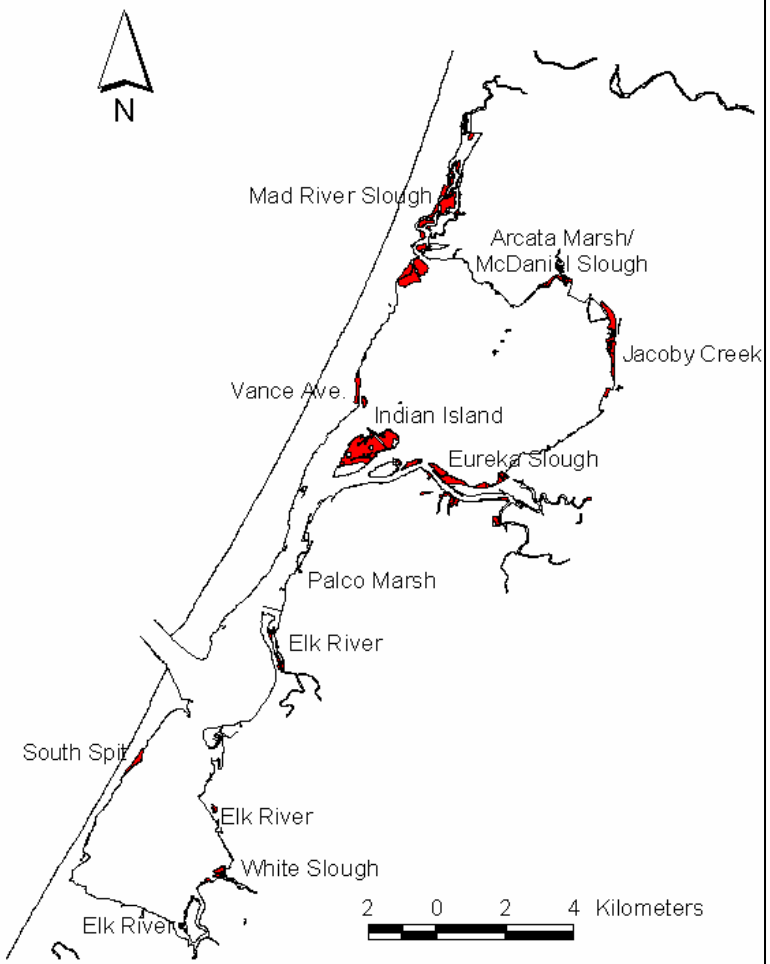
- Introduced from Chile in 1850s
- Thought to be ecotype of California native *S. foliosa* until the 1980s
- Originally described as mid-elevation species
- Dominant plant in Humboldt Bay salt marsh
- Estimated invaded acreage in 1999: 814 acres

Current salt marsh in Humboldt Bay, 2002

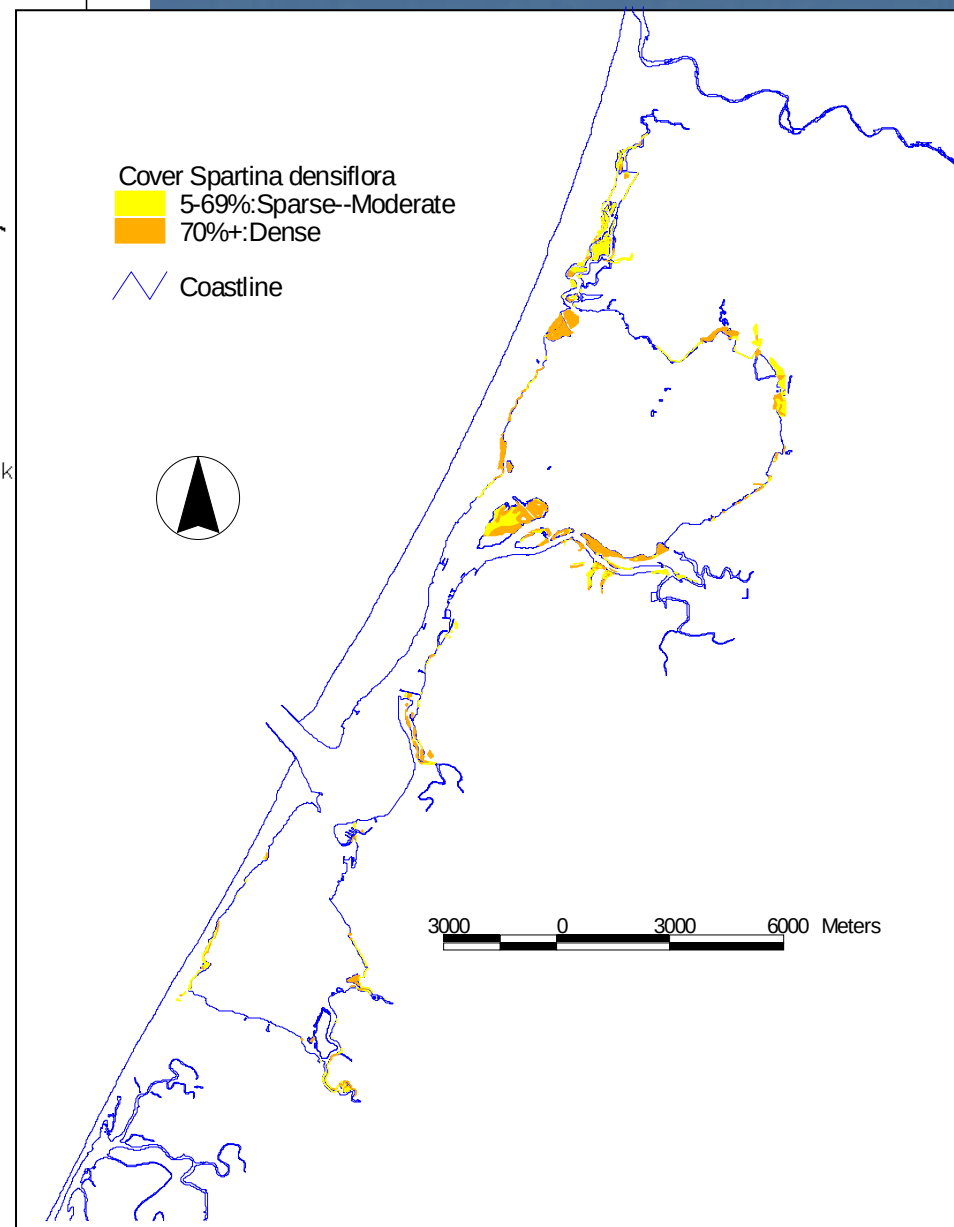


Source: U.S. Fish and Wildlife Service National Wetland Inventory.

Current salt marsh in Humboldt Bay, 2002



Source: U.S. Fish and Wildlife Service National Wetland Inventory.




Hutton Marsh, 1985 (high marsh)


Hutton Marsh, 2002, general increase over marsh

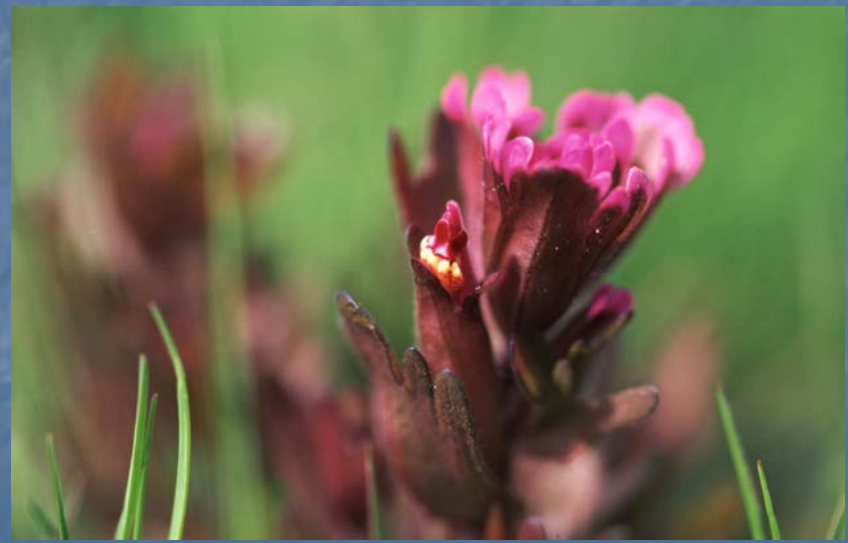
Impacts of expansion into high-elevation salt marsh

High-elevation marsh most diverse vegetation type

- 22 species, none with >25% cover
- 2 rare species (CNPS List 1B):

Point Reyes bird's beak

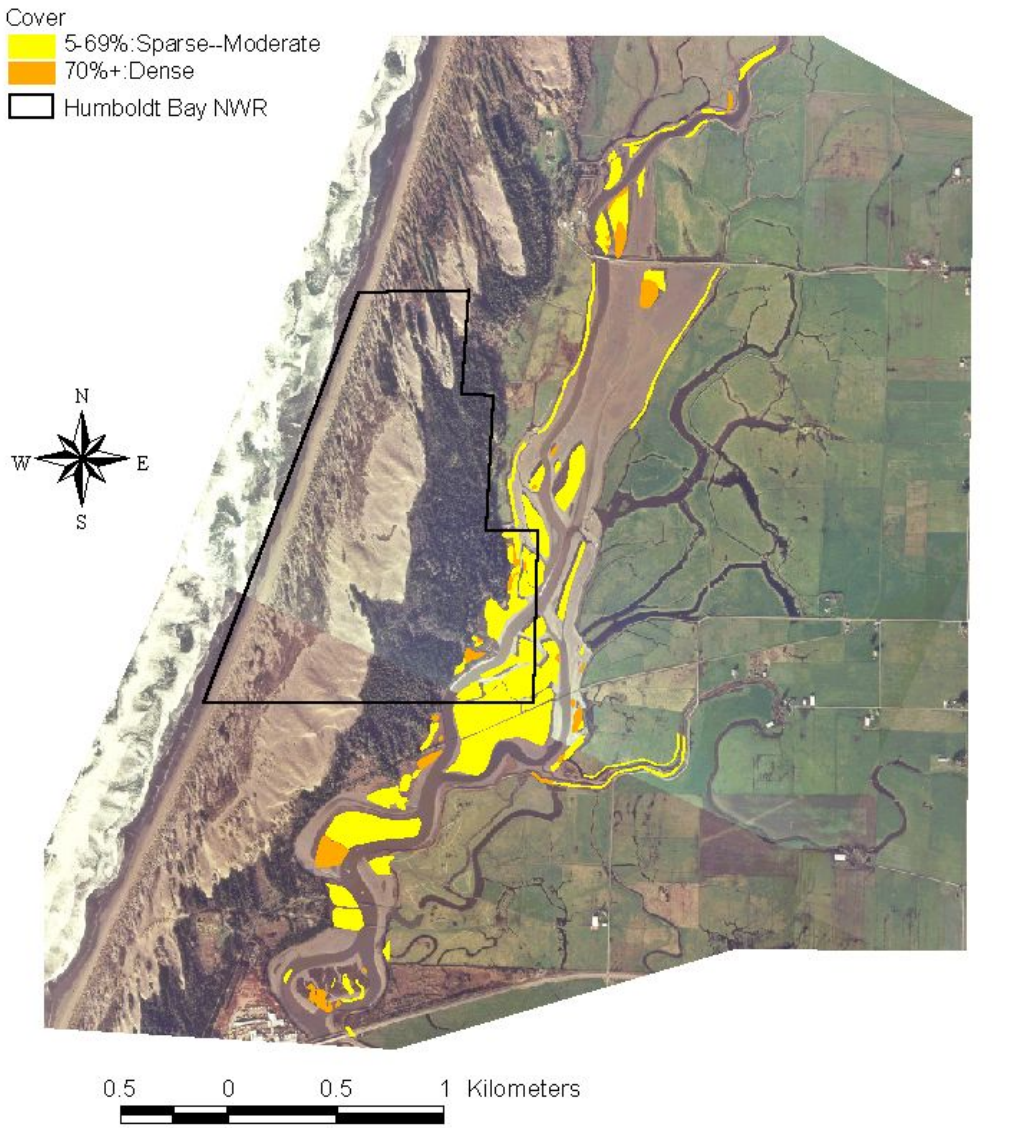
Cordylanthus maritimus ssp. *palustris*



Humboldt Bay owl's clover

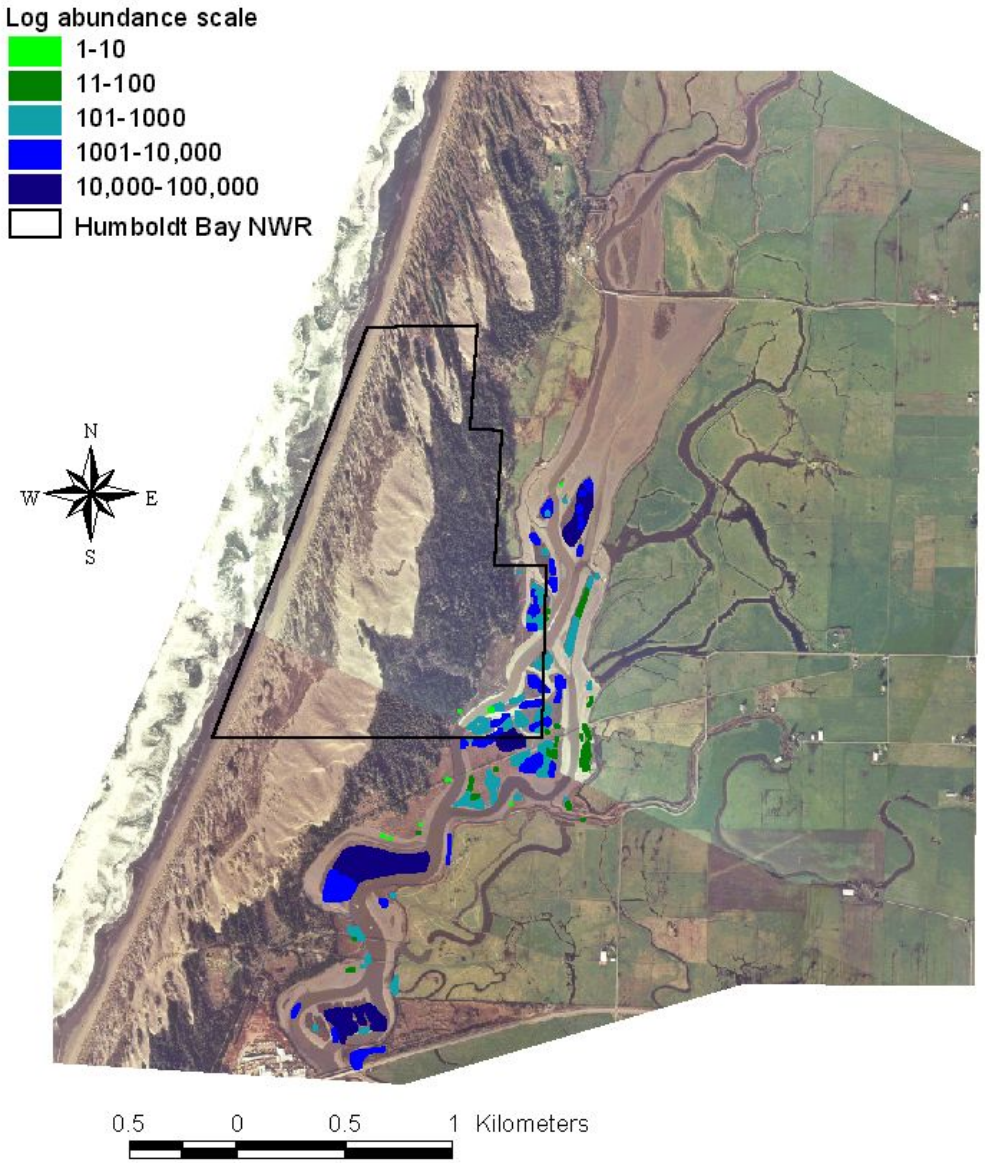
Castilleja ambigua ssp. *humboldtiensis*

Distribution and abundace of Spartina densiflora -- Mad River Slough



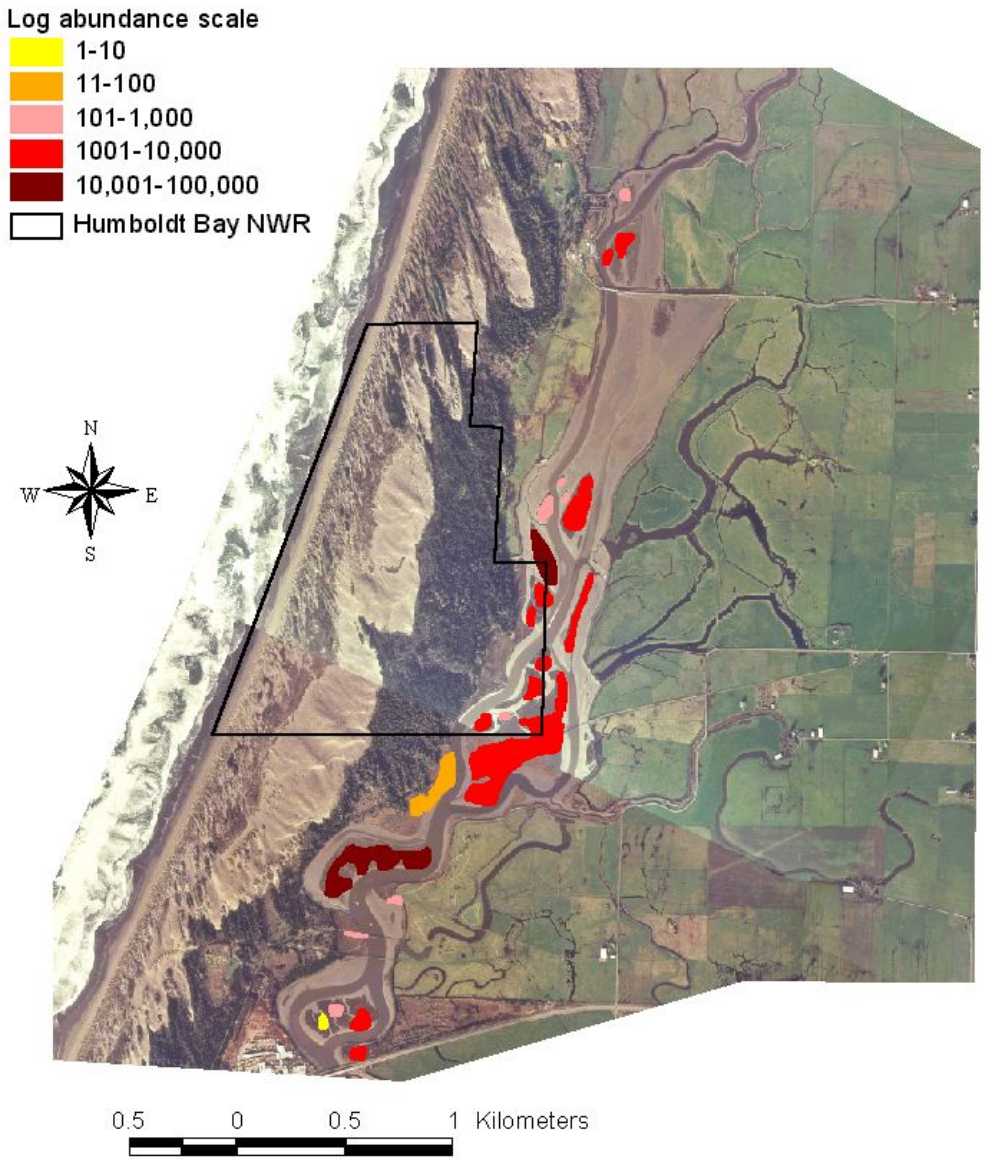
Mapped by USFWS, 1999

Distribution and abundace of Point Reyes birds-beak -- Mad River Slough



Mapped by USFWS, 1999

Distribution and abundace of Humboldt Bay owl's-clover -- Mad River Slough



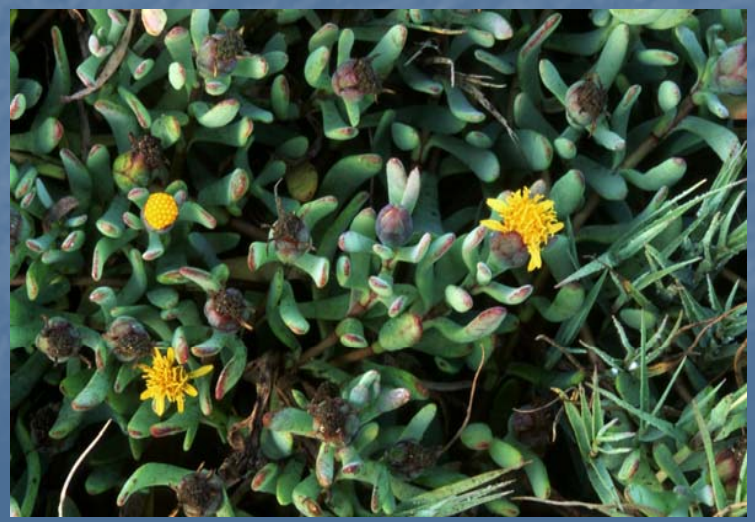
Mapped by USFWS, 1998

Native flora

Salicornia virginica

Distichlis spicata

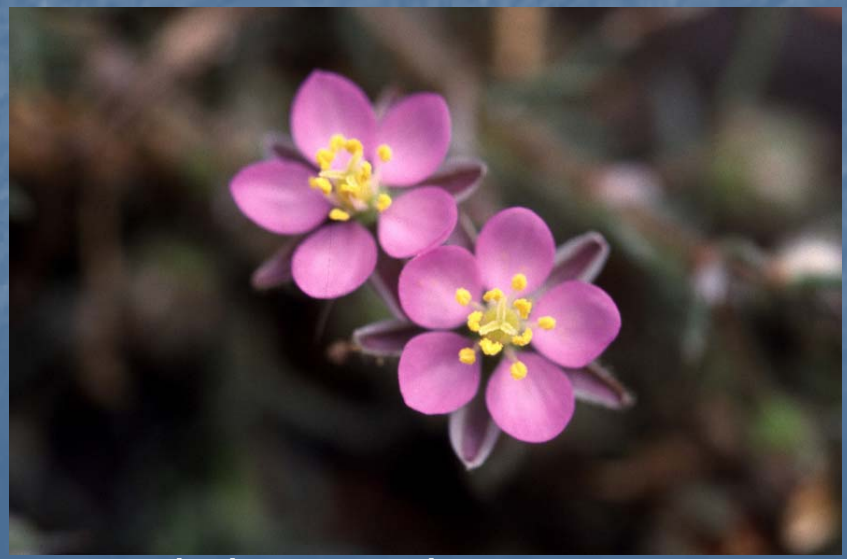
Grindelia stricta



Jaumea carnosa

Plantago maritima

Limonium californicum



Spergularia macrotheca

Triglochin maritimum

Photos: Andrea Pickart

S. densiflora outcompetes natives

- Lacks total dormancy period
- Quickly colonizes bare areas
- Large quantities of wrack smothers natives
- Accretes and retains sediment
- Seed and tiller dispersal

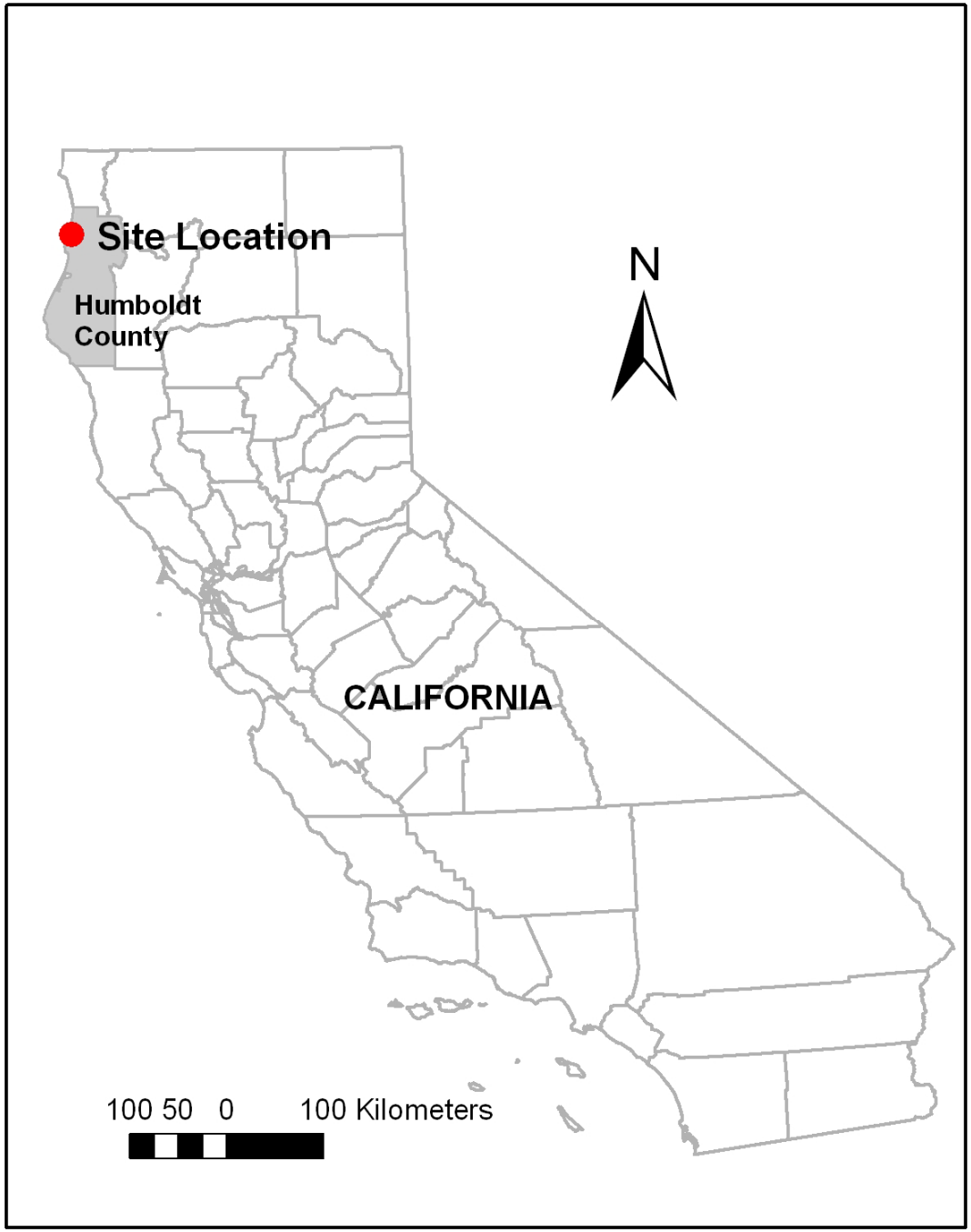
Wrack composed of dead *S. densiflora*

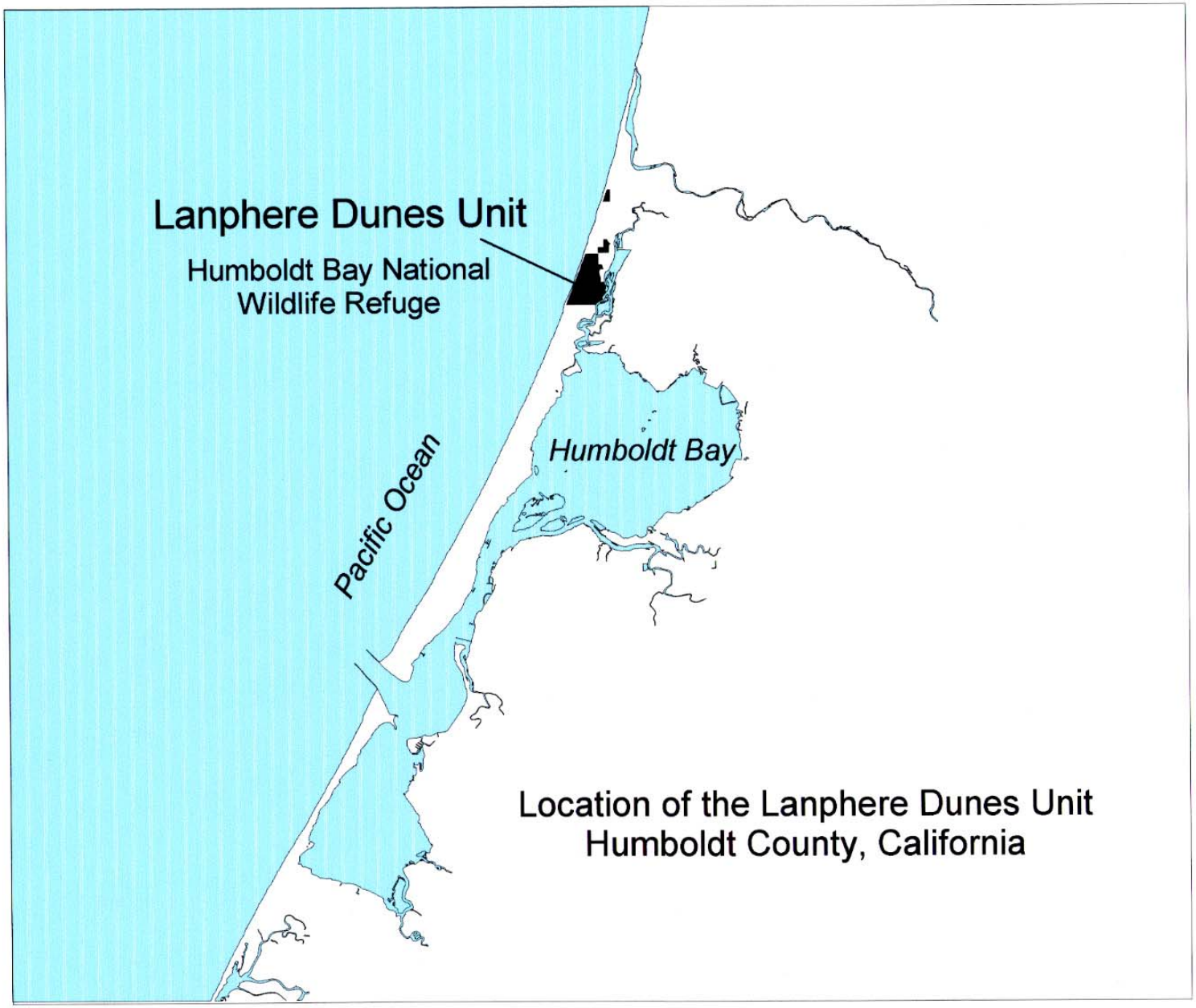
2004-2006 Removal Experiment

- Test methods of removal from high-elevation salt marsh
  - Mowing in high density plots
  - Hand-digging in low density plots
- Determine scale of feasibility
  - Apply treatments to entire island
  - Estimate applicability to larger areas

Why manual control?

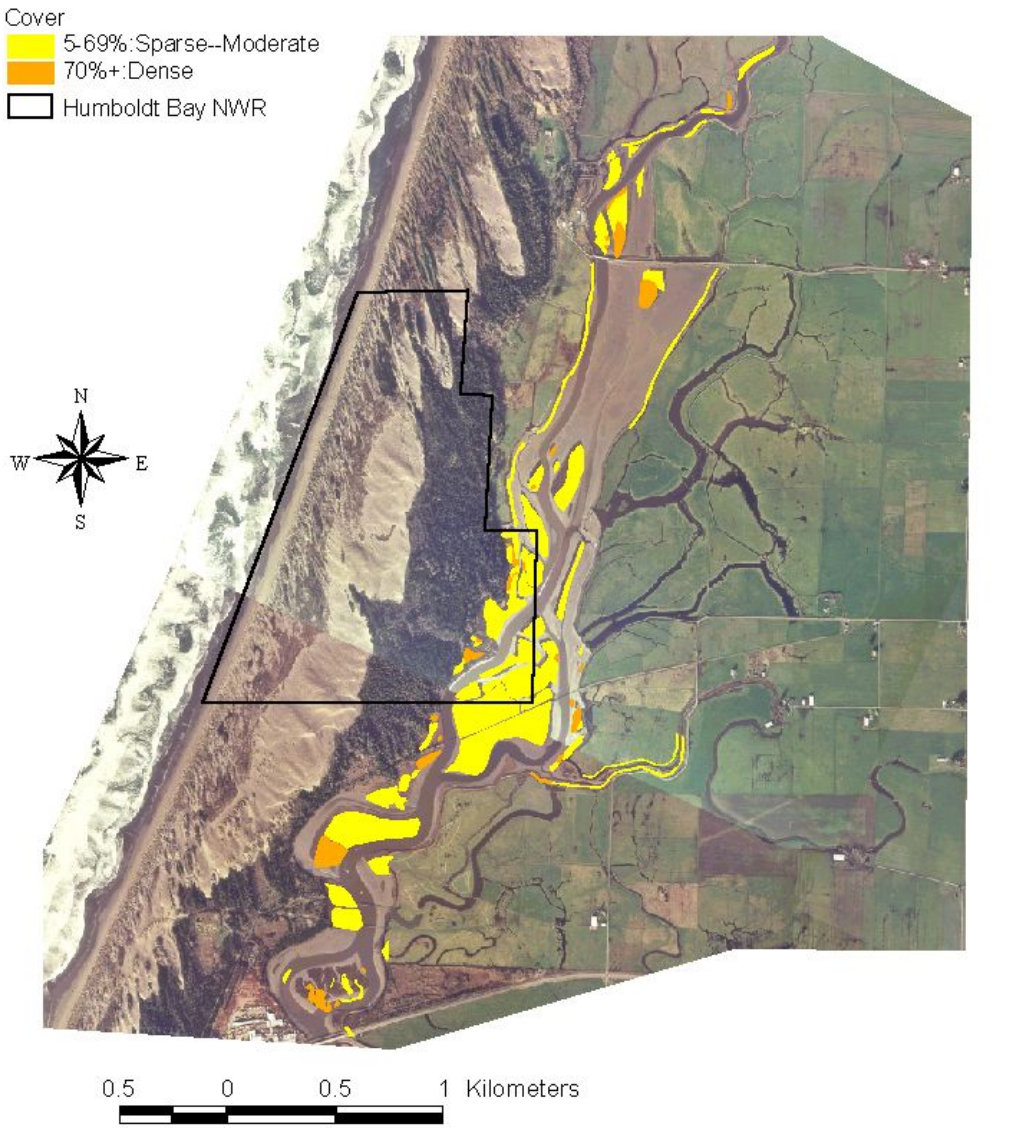
- Herbicide use not feasible
- First effort at control
- Priority to control spread into high-elevation salt marsh


Site Location
Humboldt
County
N
CALIFORNIA
100 50 0 100 Kilometers

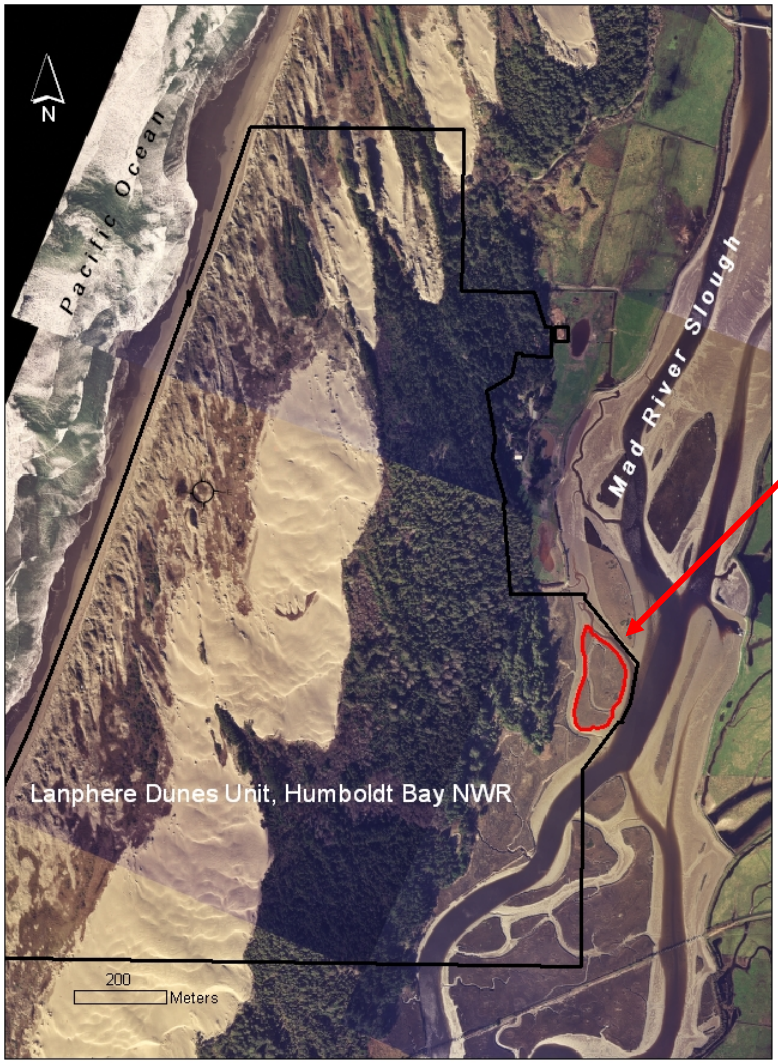

Lanphere Dunes Unit
Humboldt Bay National
Wildlife Refuge
Pacific Ocean
Humboldt Bay
Location of the Lanphere Dunes Unit
Humboldt County, California

Mad River Slough

Distribution and abundace of Spartina densiflora -- Mad River Slough



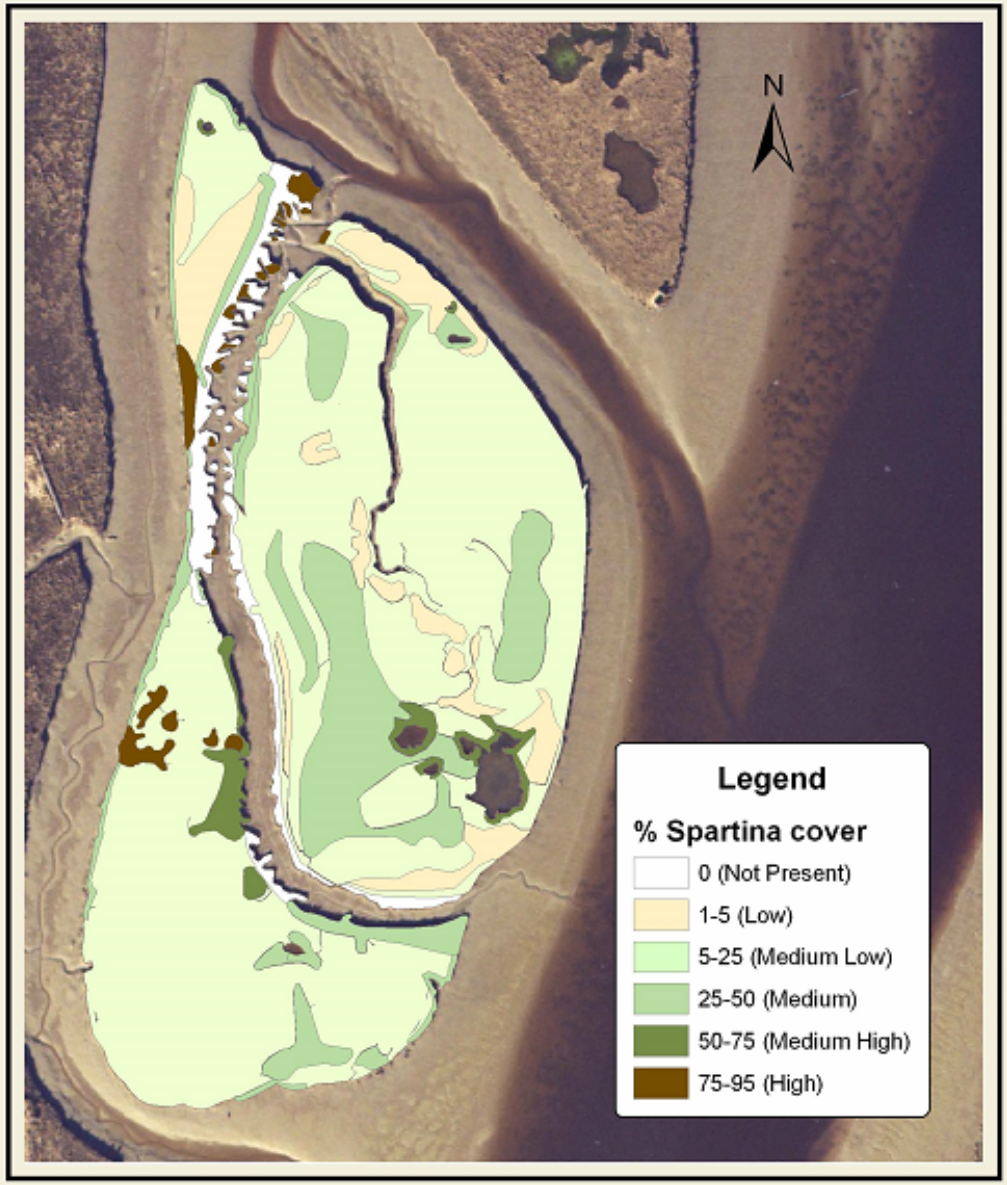
Mapped by USFWS, 1999


N
Pacific Ocean
Mad River Slough
Lanphere Dunes Unit, Humboldt Bay NWR
200
Meters

Study site


N
25
Meters

Cover of Spartina densiflora on islands of the Mad River Slough, Lanphere Dunes Unit, HBNWR 2004

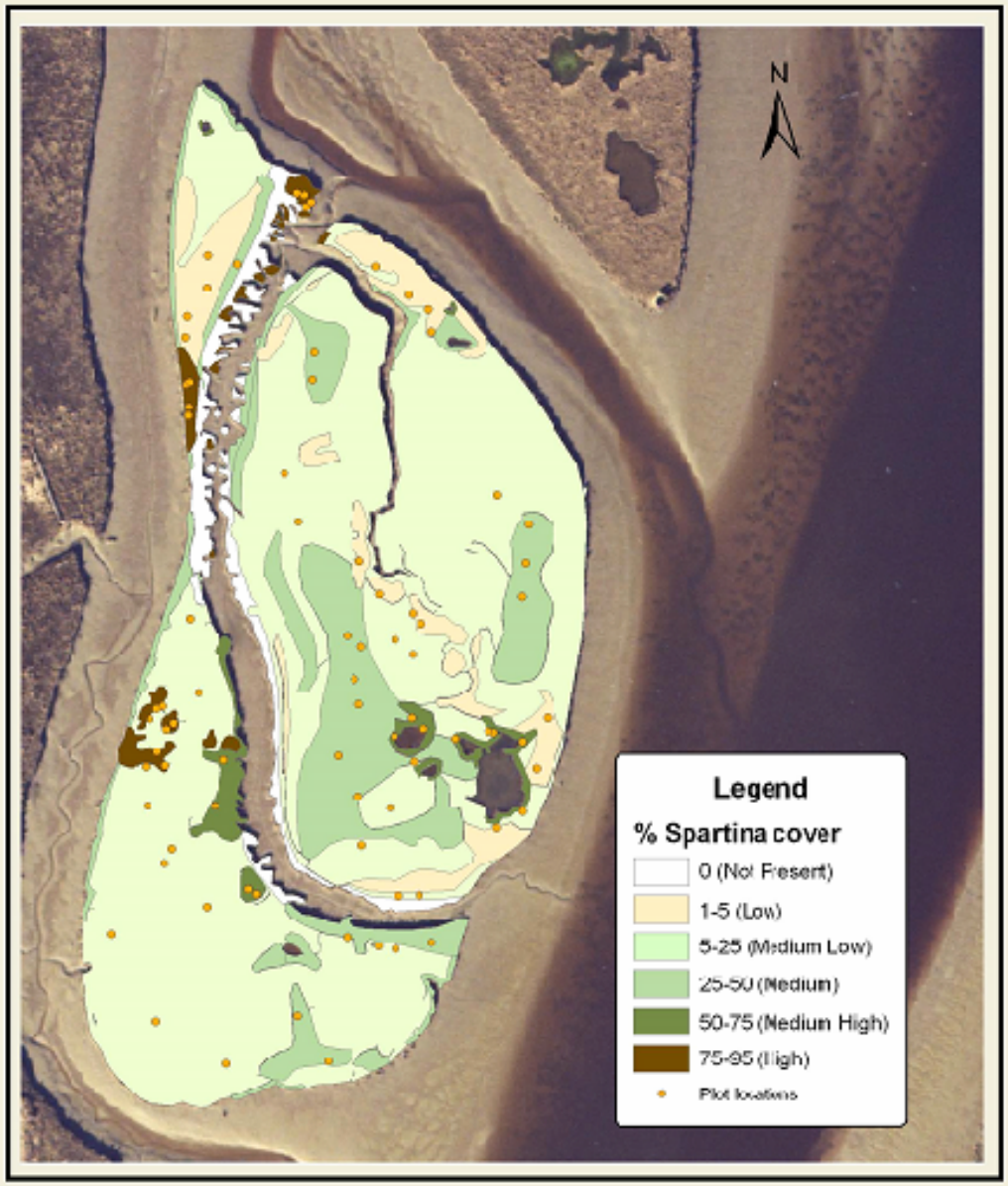


UTM Zone 10
NAD 27

0 5 10 20 30 40 Meters

Map compiled by: Andrea Craig
Sources: USFWS

Experimental Design



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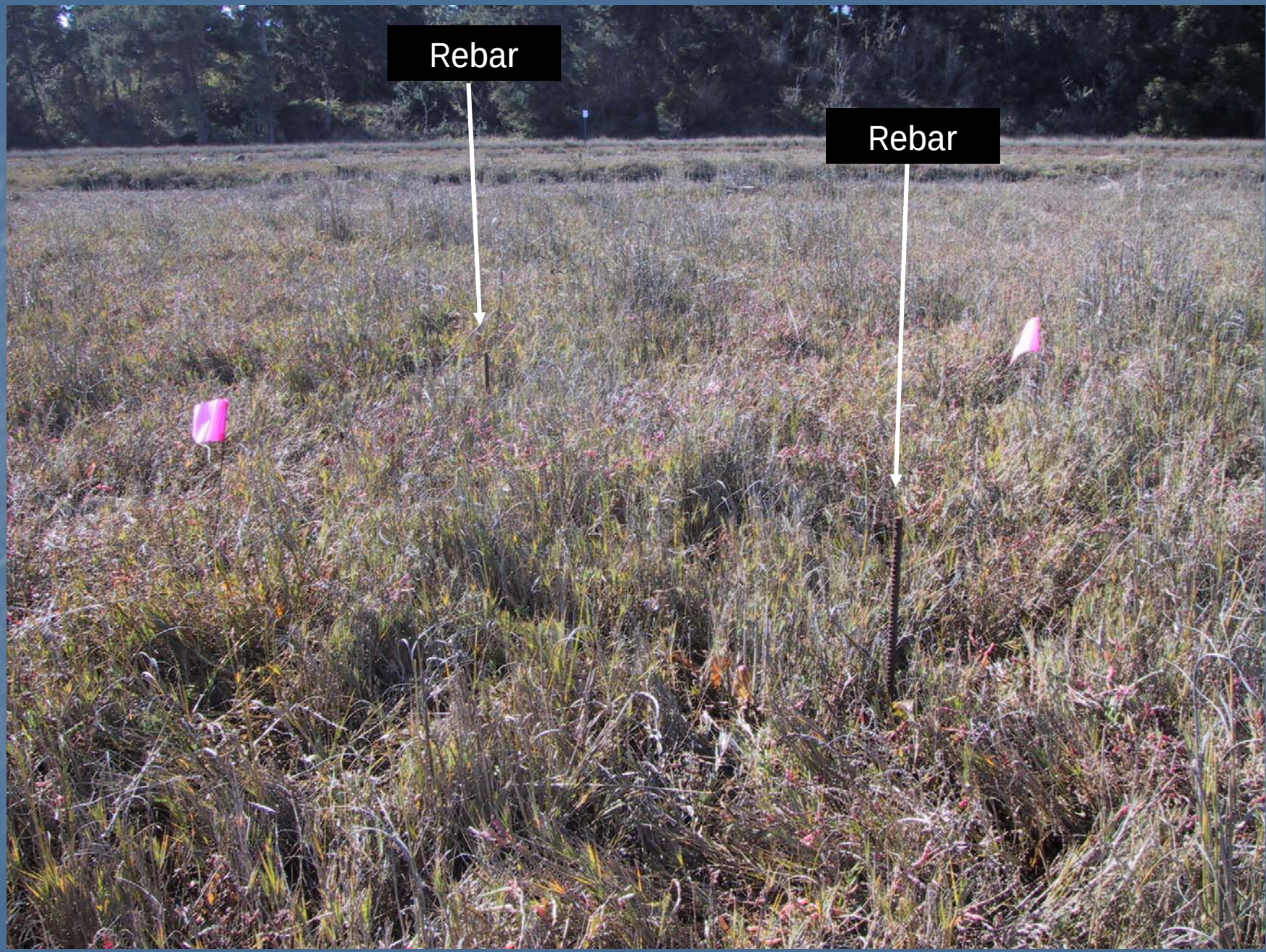
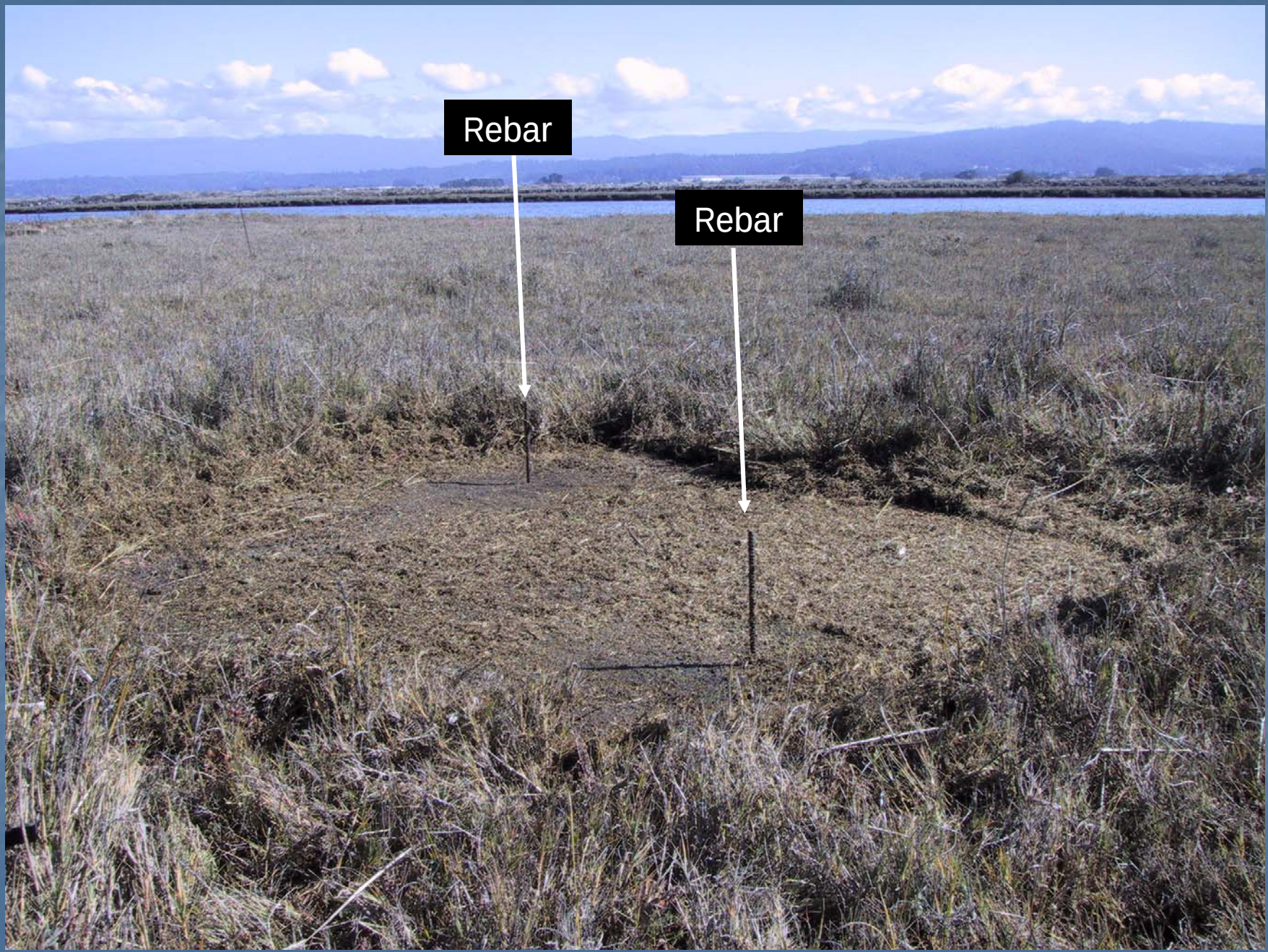

Rebar
Rebar


Rebar
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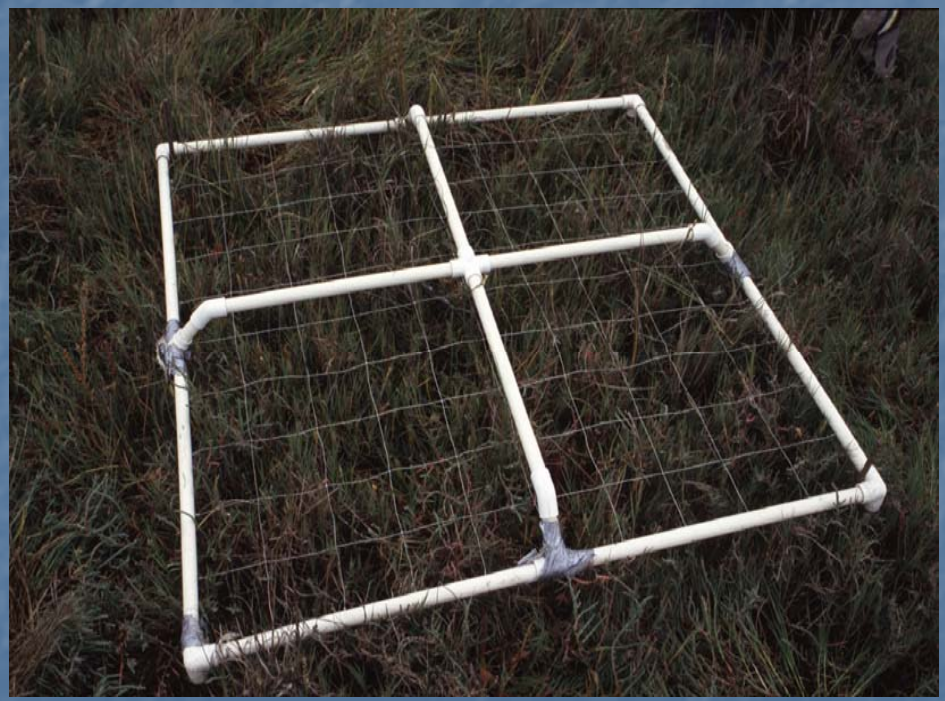
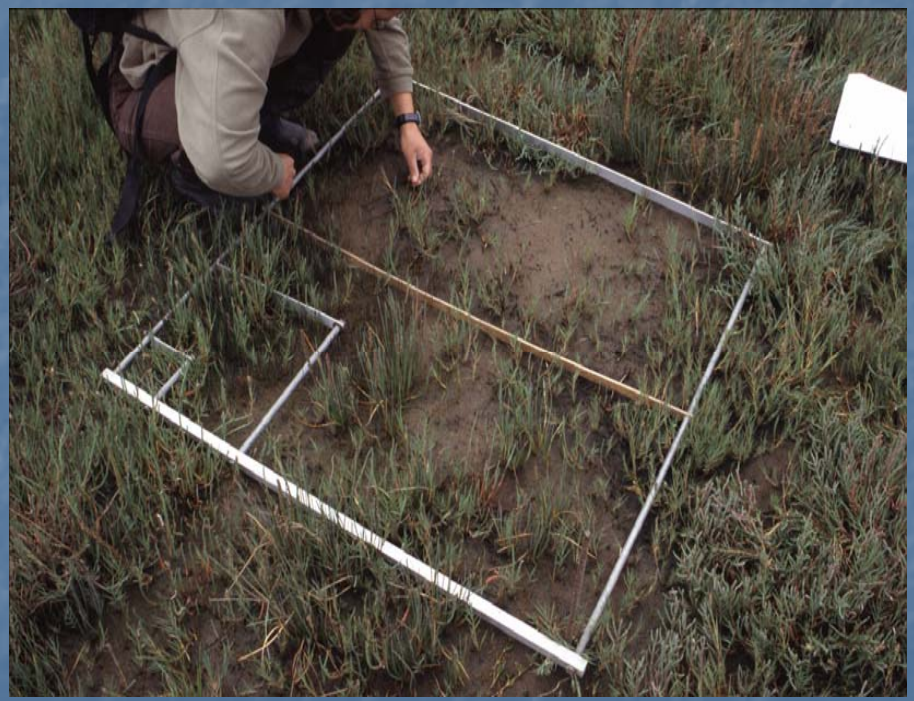
Monitoring

Density of *S. densiflora*



Cover of native species



Treatments

Mowing

- High stratum
- Medium-High stratum
- Medium stratum

Hand-digging

- Medium-Low stratum
- Low stratum

Mowing Treatment

- Initially treated in August 2004
- Treated monthly March-October, every other month in winter
- Plots and areas treated by staff

High stratum

Medium stratum

Mowing Treatment

High stratum after treatment

Medium-High stratum after treatment

Hand-digging treatment

- Initially treated in August 2004
- Plots treated monthly March-October, every other month in winter
- Plots treated by staff
- Areas treated by volunteers & Youth Conservation Corps

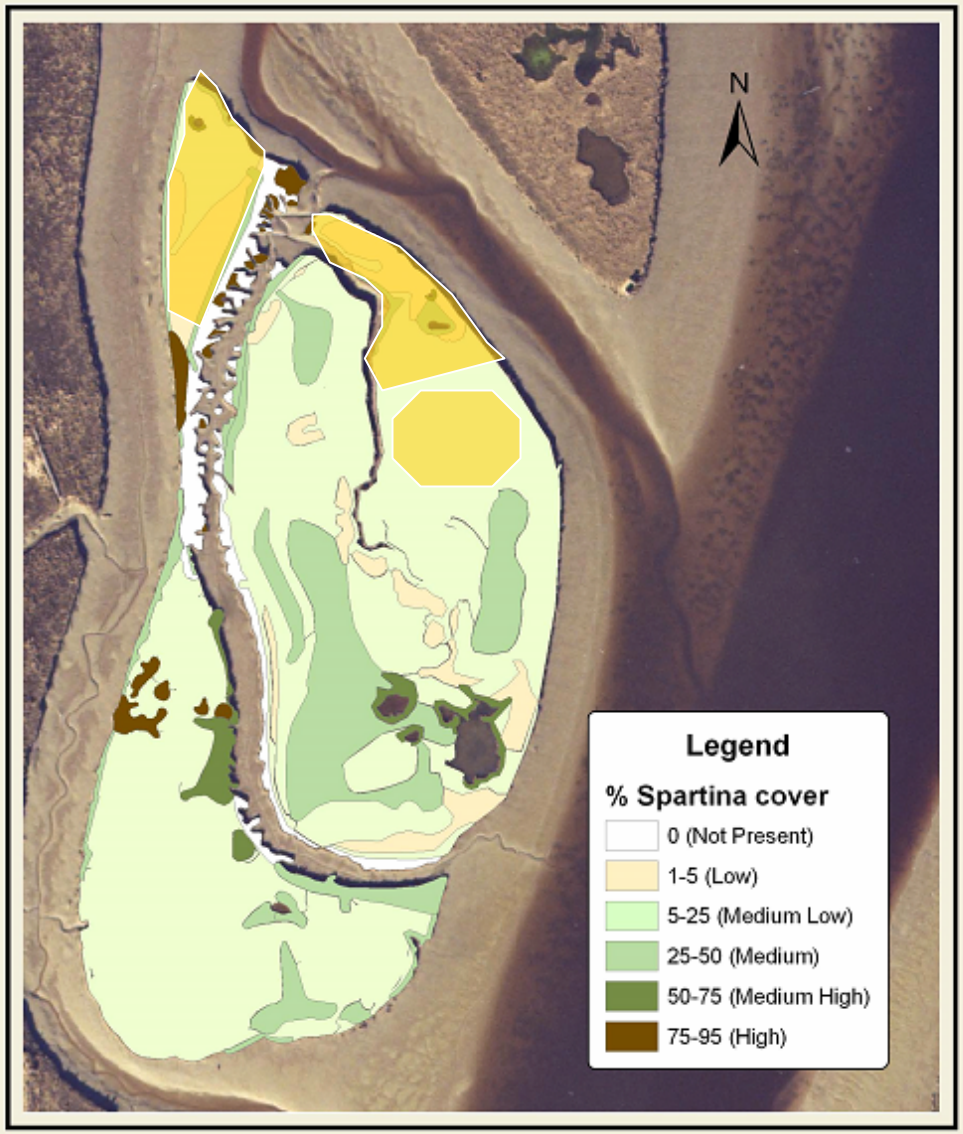
Low stratum

Digging treatment

Hand-digging treatment - Areas

- 156 person hours since August 2004
- Approximately 95 m^2 treated

Cover of Spartina densiflora on islands of the Mad River Slough, Lanphere Dunes Unit, HBNWR 2004



UTM Zone 10
NAD 27

0 5 10 20 30 40 Meters

Map compiled by: Andrea Craig
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Preliminary Results

- *S. densiflora* density much lower in treatment plots
- Almost no *S. densiflora* in dug plots (Low, Medium-Low)
- Natives recovering slowly, but more quickly than *S. densiflora*

Native regrowth

Natives recovering in mowed plots

Native regrowth

Rare plants recovering in mowed areas

Point Reyes bird’s beak

Humboldt Bay owl’s clover

Feasibility of maintenance at different scales

- Mowing treatment : mid- to large-scale
  - Effective after multiple hits
  - Time efficient (~6 m^2/ph)
  - Could be maintained by staff

- Hand-digging treatment : small scale
  - Effective after 1-2 hits
  - Time consuming (~0.6 m^2/ph)
  - Would need volunteer labor

Acknowledgements

Coastal Conservancy

Volunteers

Carrie Sendak