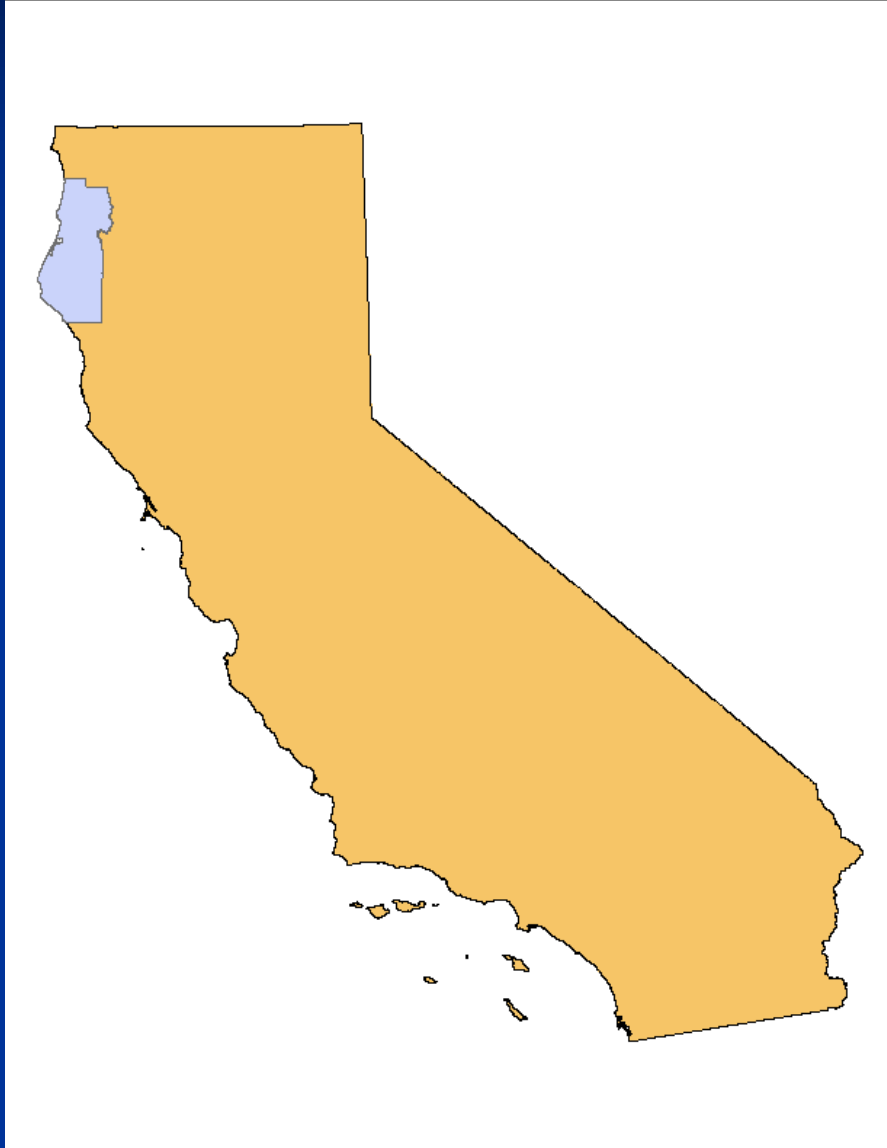


Refining Mechanical Removal Methods for the Eradication of *Spartina densiflora* at Humboldt Bay National Wildlife Refuge, Arcata, CA

Trevor Goodman and Andrea Pickart,
U.S. Fish and Wildlife Service

Where is Humboldt Bay?



Humboldt Bay

Historic salt marsh about
9,000 acres



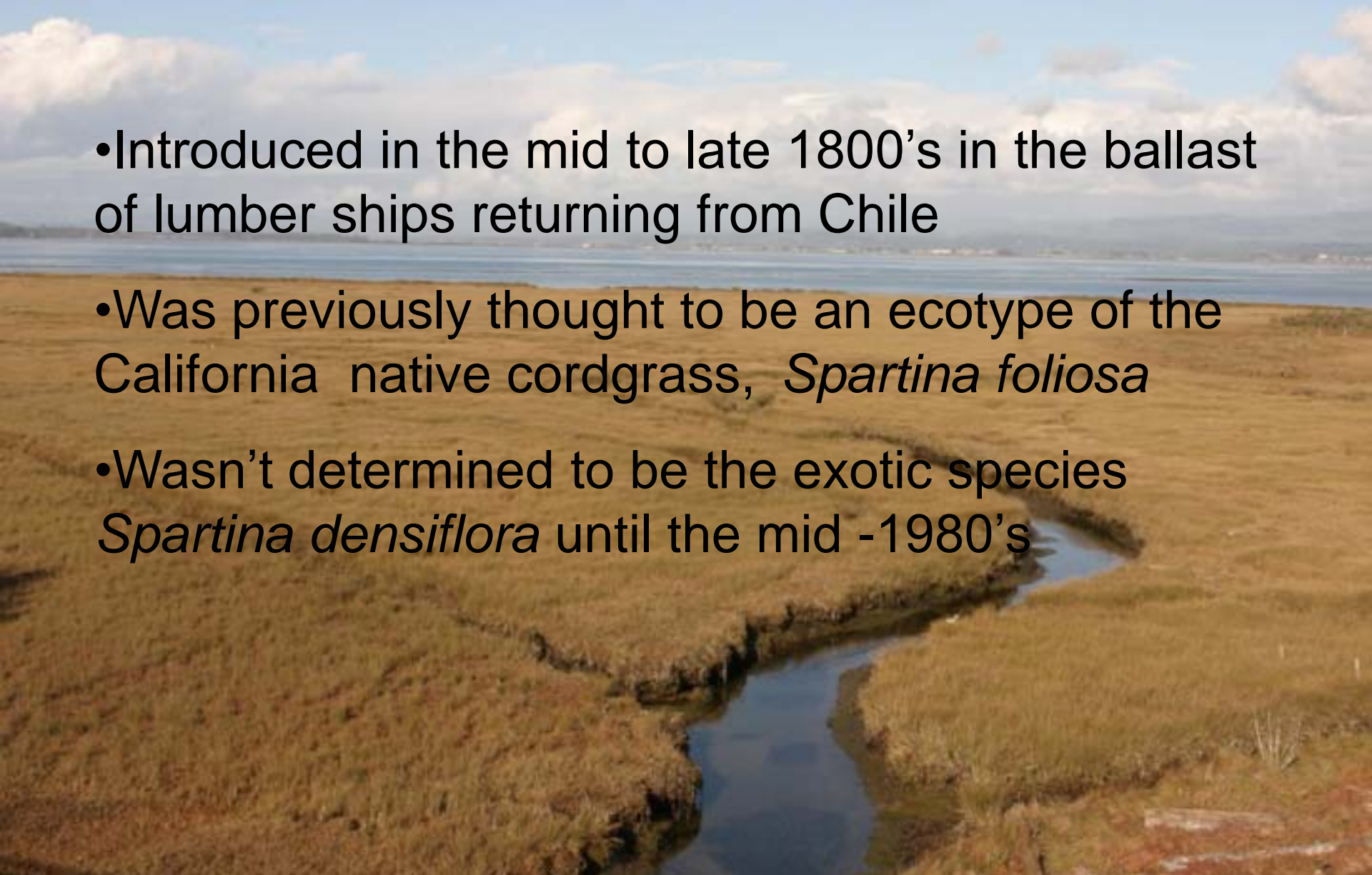
Humboldt Bay

Current salt marsh about
900 acres



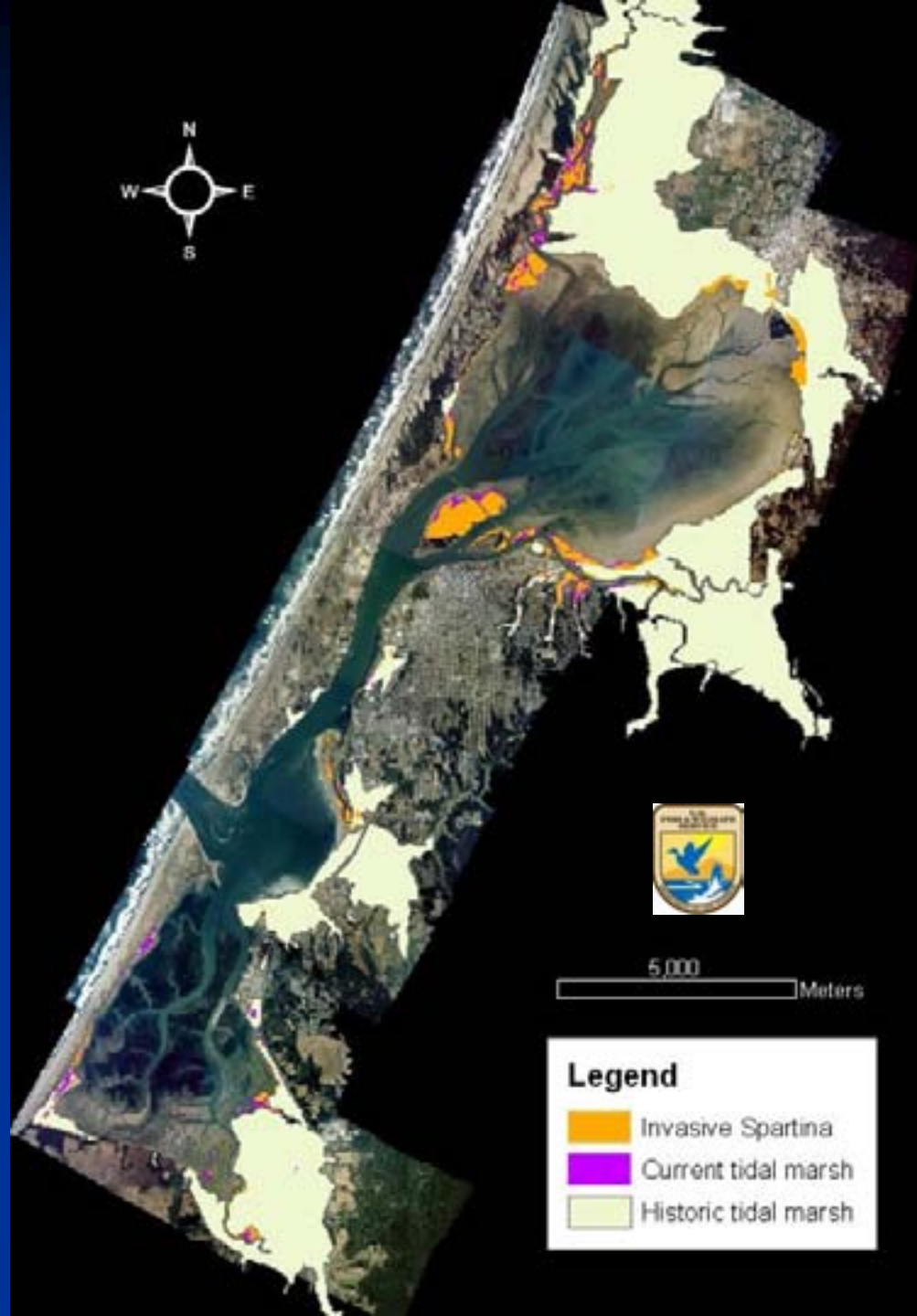
Spartina in Humboldt Bay


- Introduced in the mid to late 1800's in the ballast of lumber ships returning from Chile
- Was previously thought to be an ecotype of the California native cordgrass, *Spartina foliosa*
- Wasn't determined to be the exotic species *Spartina densiflora* until the mid -1980's



Humboldt Bay

- *Spartina densiflora* currently has invaded over 90% of Humboldt Bay Salt Marshes



A person wearing a hard hat and safety gear is using a mechanical tool to clear tall grass in a field. The person is wearing a plaid shirt, khaki pants, and a red hard hat. They are holding a long-handled tool with a motorized head, likely a brush cutter or similar mechanical eradication tool. The field is filled with tall, dry grass, and there are some orange markers visible in the background. The background shows a line of trees and a clear sky.

- Mechanical eradication methods developed over past 4 years by Humboldt Bay National Wildlife Refuge.



Mow below surface with metal-blade brushcutter

Humboldt Bay National Wildlife Refuge





August 2006



April 2007



October 2008

Restored salt marsh, Lanphere Dunes

Triglochin

Sarcocornia

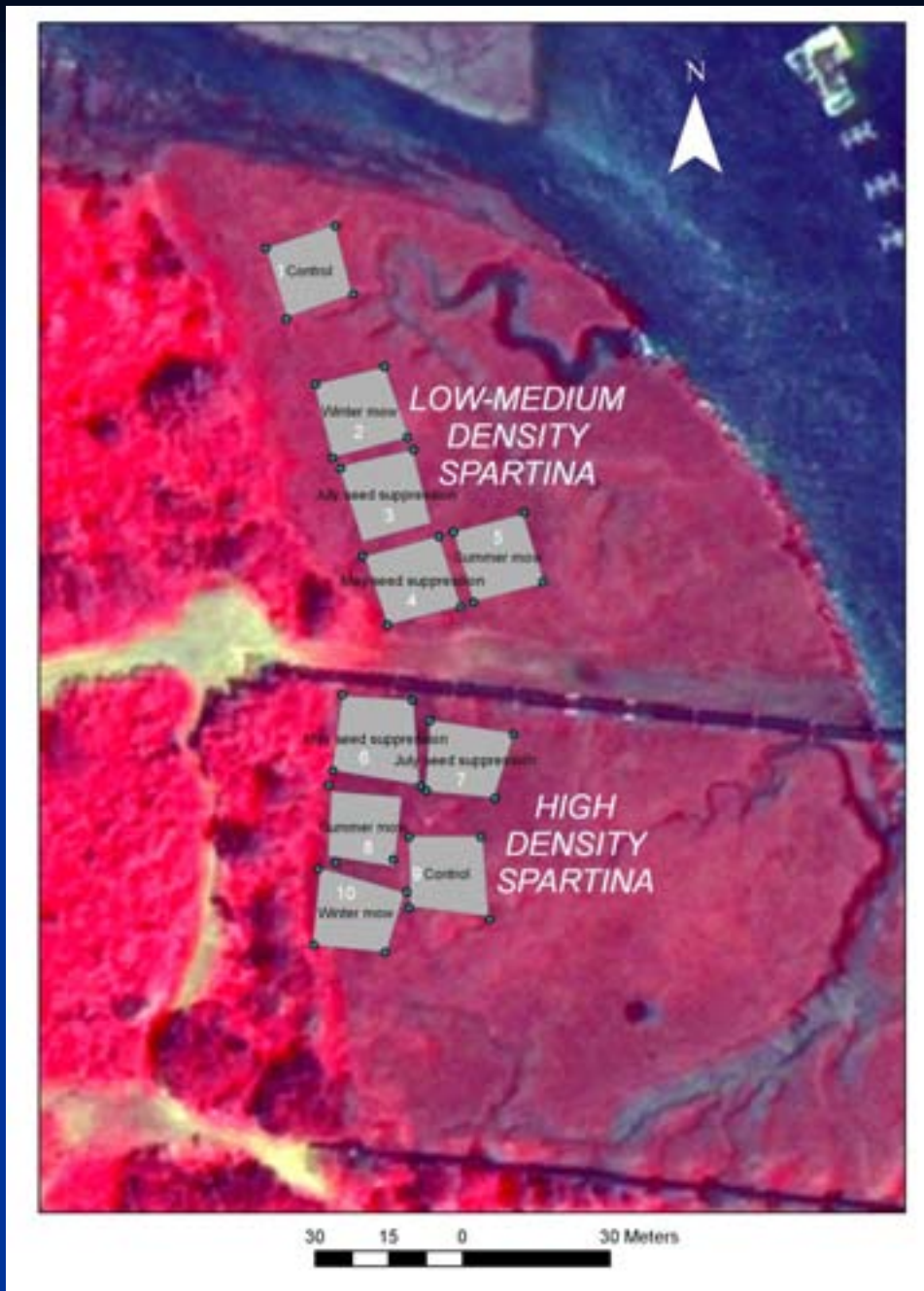
- Refuge property after eradication efforts
- Successfully removed from 25 acres
- However, seeds are tidally dispersed and new seedlings continually recruit
- Need for regional eradication



Is regional eradication feasible?....

Studies underway with partners: California Coastal Conservancy, Humboldt State University

1. Is there a persistent seed bank?
2. What are impacts of removal on invertebrates and birds?
3. What is aerial extent of *Spartina* in 3 estuaries.
4. Is revegetation needed?
5. What are impacts of removal on rare salt marsh plants?
6. What is most efficient timing of mowing?
7. Can seed set be reduced or prevented by top-mowing to allow phased treatments over a large area?



Experimental Design

- Two density strata
- Two replicates of each treatment (one per stratum)
- Each treatment area 15 m x 15 m, with 1-m buffer



Variables monitored quarterly:

- Density of culms
- Percent cover by species
- Seedlings recruited
- In seed suppression plots: inflorescence number and length



Summer Mow
July 2008 (before)



Mowing Treatment
Aug 2008



Summer Mow
Dec 2008



Summer Mow
August 2009



Winter Mow
Dec. 2008
(before)



Treatment Jan
2009



Winter Mow
March 2009



Winter Mow
August 2009



Seed Suppression
July 2008 (before)



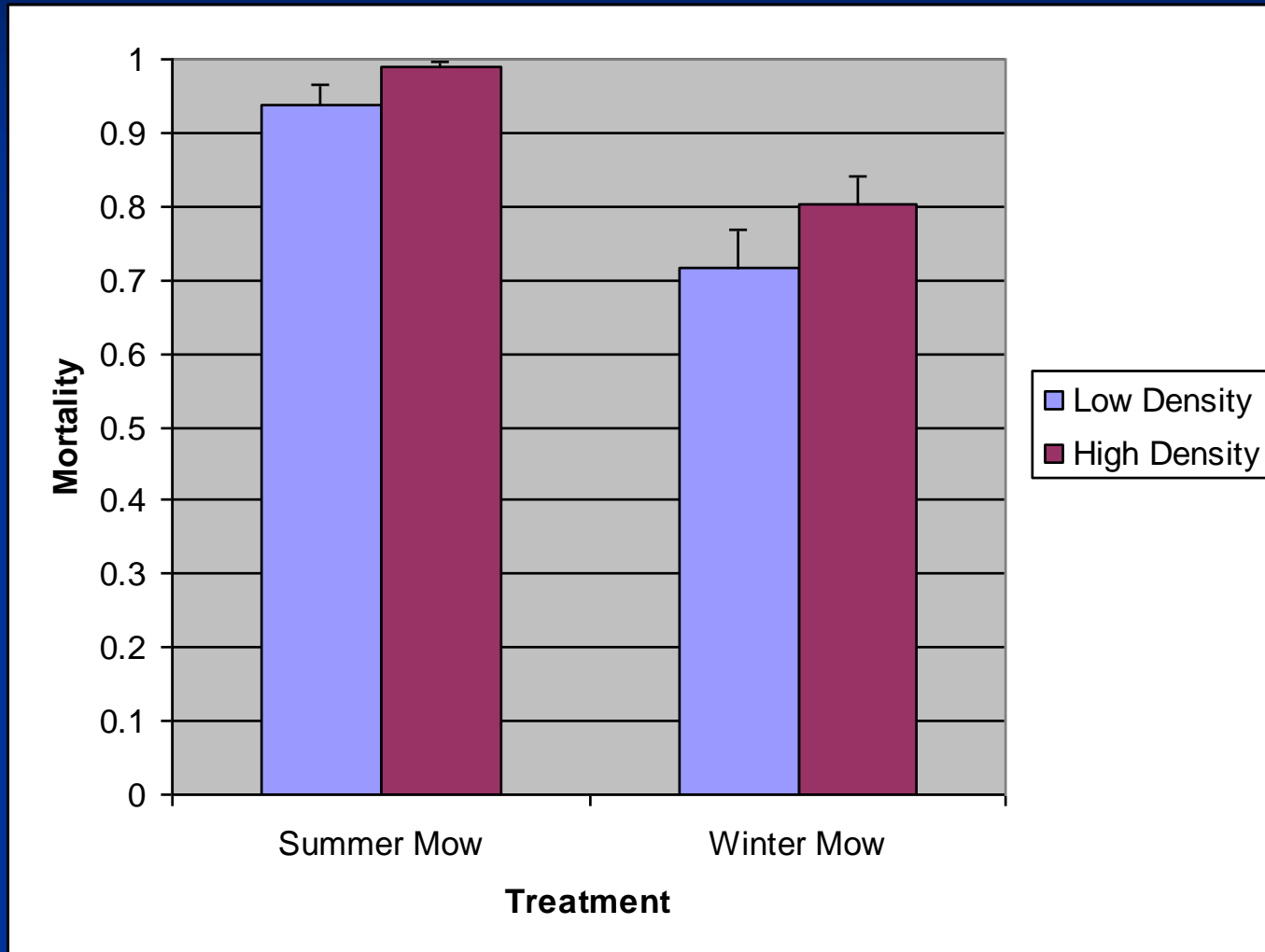
Seed Suppression
Treatment



Seed
Suppression
April 2009

Preliminary Results


Cumulative mortality by Sept. 2009




Preliminary Results

Seed suppression top mow

- 100% prevention (May) and mortality (July)
- Inflorescence height predicts number of seeds ($R^2=.62$)
- Seed set 49,367,712 seeds per acre

A photograph showing several developing seeds on a light brown, textured surface. The seeds are elongated and greenish-white, with some showing a darker green tip. They are arranged in a loose cluster.

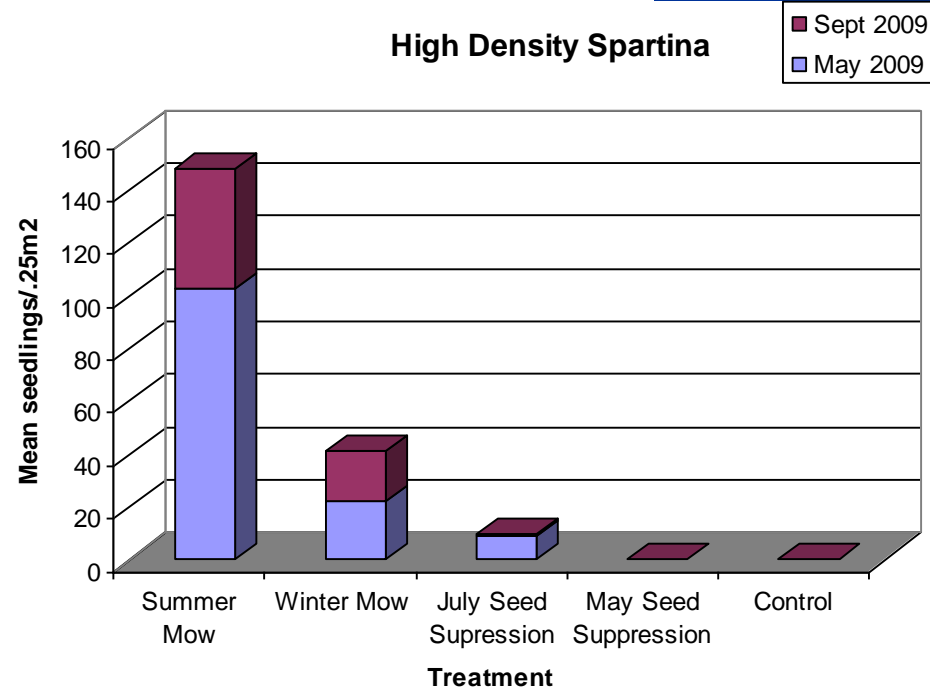
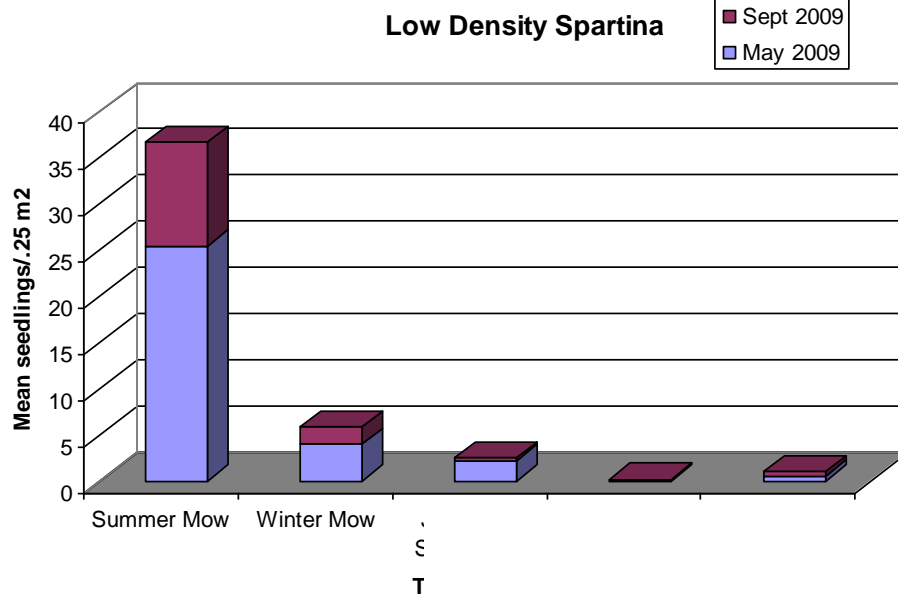
Developing seeds
on unmowed plant

A photograph showing several seeds from mowed inflorescences on a light brown, textured surface. The seeds are elongated and greenish-white, with some showing a darker green tip. They are arranged in a loose cluster.

Seeds from
mowed
inflorescences

Preliminary Results

Seedling emergence



Preliminary Conclusions

- Summer mow results in greater mortality, requires less labor, marshes are drier and more accessible, and wrack can be burned on site.
- Winter mow results in fewer seedlings
- In absence of persistent seedbank, and using top mow to suppress seeds in untreated areas, Summer mow would be more efficient.

Acknowledgements

- Mike Swank
- Jessi Graff
- Derek Weatherbee
- Heather Block
- Luc Lagarde
- Armando Aispuro
- Jason Zito
- State Coastal Conservancy
- Joel Gerwein

Thank you

