

Adaptive Integrated Vegetation Management of Invasive *Spartina densiflora* in the San Francisco Estuary



Drew Kerr, Co-Manager Field Operations, Coastal Conservancy's Invasive *Spartina* Project

Spartina densiflora (Chilean cordgrass) was introduced to Creekside Park along Corte Madera Creek, Marin County in the 1970's as part of a restoration effort. It had been misidentified as a form of native *Spartina foliosa* (Pacific cordgrass) and was subsequently imported from Humboldt Bay where it now infests more than 2000 acres after dry ballast was deposited there during the timber trade with South America in the 19th Century. By 2004, *S. densiflora* dominated the marsh at Creekside Park and had spread to 12 other marshes in Marin as well as Point Pinole and Mare Island across the North Bay. The Invasive *Spartina* Project and Friends of Corte Madera Creek Watershed began treatment on these infestations in 2004-2006, relying predominantly on imazapyr application in the initial years to gain control of the problem while also digging isolated plants and outliers with the Conservation Corps. Until receiving an amendment to the Biological Opinion in 2008, entry into many infested marshes was restricted until the end of endangered California clapper rail breeding season on September 1. Since *S. densiflora* sets seed by early July, that initial timing made it impossible to stay ahead of the infestation. In addition, imazapyr produced extremely variable results, especially on established meadow areas and on small plants with less leaf surface area. Mowing the persistent dead biomass remaining at meadows of previously-sprayed *S. densiflora* allowed for fresh green growth that could identify targets for retreatment with imazapyr or digging. Despite these considerable challenges, the annual imazapyr treatment significantly reduced the infestation, allowing the IVM strategy to shift by 2010 to purely manual removal by ISP biologists at 93% of the sites.


Constraints on *Spartina densiflora* Control in the San Francisco Estuary




- Until a Biological Opinion amendment in 2008, ISP was not permitted entry to known California clapper rail breeding sites before Sept 1 (either to inventory sites or to treat them on the ground).
- Full comprehensive treatment of all 168 *Spartina* sites around the Estuary was **AN IMPOSSIBLE TASK** for the first 3 years.
- *S. densiflora* had already set seed by July, AND was less likely to take in the herbicide in September because of senescence
- No mowing initially to preserve refugia for rails (even the standing dead mass)

Mowing of previously herbicide-treated *Spartina densiflora* in mid-elevation marsh

- Removes dead (or partially-dead) above-ground biomass allowing for best assessments of current plant status and development of an adaptive IPM (Integrated Pest Management) treatment strategy
- Weakens the reserves of the plants by interrupting the transfer of nutrients back down to perennial roots (November 2008)



Hummocks accreted by mature *Spartina densiflora* plants




Mowed *Spartina densiflora* biomass raked into piles for disposal

Post-Mowing Herbicide Application to *Spartina densiflora*

Limits amount of herbicide required due to reduction in above-ground biomass

If herbicide is effective, the marsh plain does not need to be destroyed by digging all of these remaining plants from this meadow



6/28/10: Lush pickleweed & native *Spartina foliosa* colonizing Creekside Park marsh that was a *Spartina densiflora* meadow less than 2 years ago (adjacent photos).

Methods: imazapyr herbicide treatment and mowing to the ground supported by digging

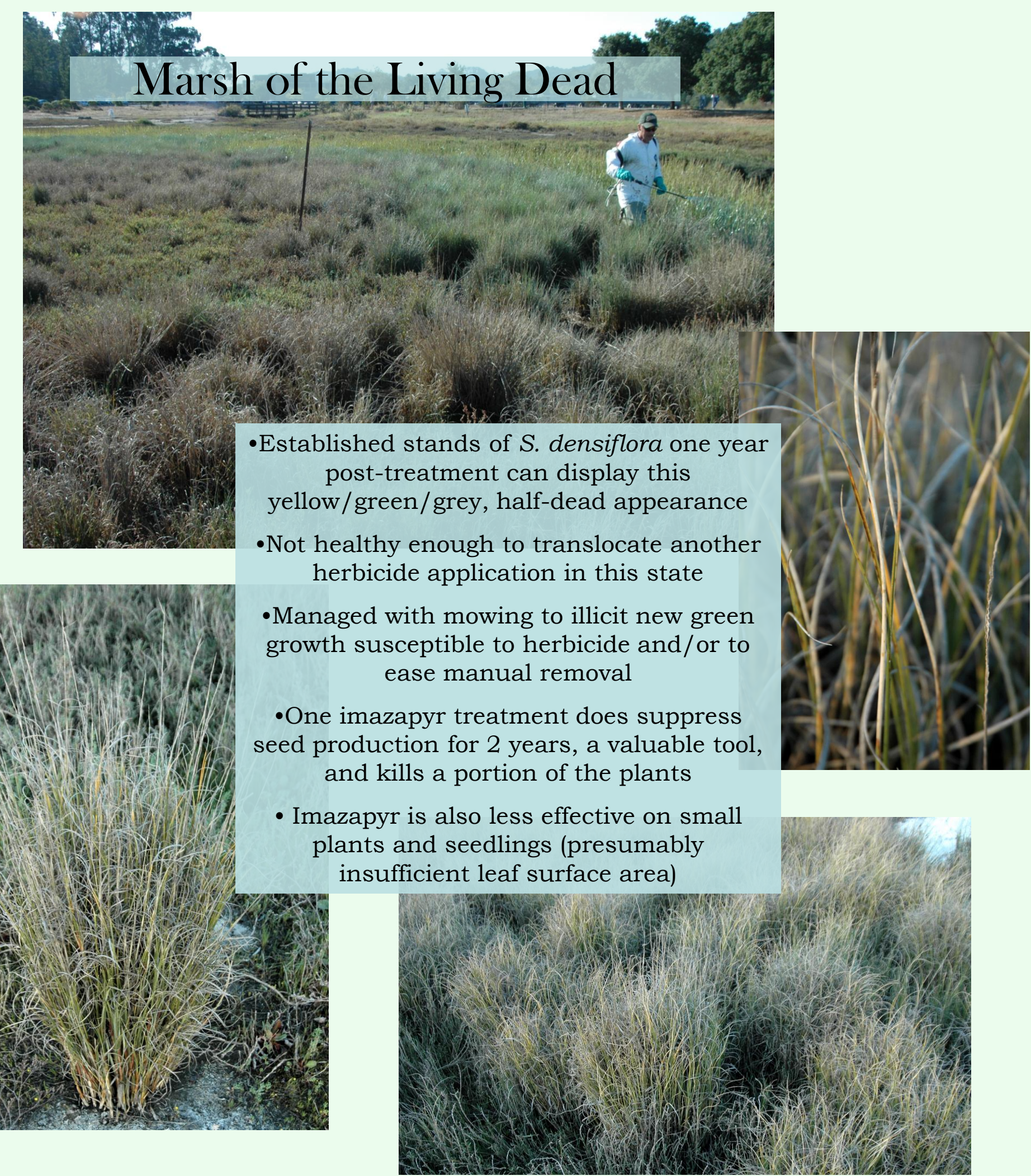
Conservation Corps North Bay (CCNB) digging isolated *Spartina densiflora* under the direction of Sandy Guldman, President of Friends of Corte Madera Creek Watershed



Photo courtesy of Sandy Guldman, Friends of Corte Madera Creek

Marsh of the Living Dead

- Established stands of *S. densiflora* one year post-treatment can display this yellow/green/grey, half-dead appearance
- Not healthy enough to translocate another herbicide application in this state
- Managed with mowing to illicit new green growth susceptible to herbicide and/or to ease manual removal
- One imazapyr treatment does suppress seed production for 2 years, a valuable tool, and kills a portion of the plants
- Imazapyr is also less effective on small plants and seedlings (presumably insufficient leaf surface area)



In 2008, the Conservation Corps dug out and hauled 13 TONS of *Spartina densiflora* from the Corte Madera Creek watershed (Marin County)



Photo courtesy of Sandy Guldman, Friends of Corte Madera Creek

Pickleweed Park/Tiscornia Marsh Before treatment in 2003



One example of a successfully implemented ISP Site-Specific Control Plan with an adaptive IPM strategy that developed over several years and was applied to similar sites around the estuary

2004 - Digging with Conservation Corps on large, mature plants

2005-2008 - Imazapyr application once a year

From 2005-2007, the herbicide treatment was conducted in September because of clapper rail restrictions. This late treatment was much less effective on the senescent plants & viable seed was produced in quantities.

2009 & 2010 - Several hours of manual removal 2X in 2009 (spring/autumn). In 2010, just a single small area with a cluster of 15 seedlings left at this site.

Pickleweed Park/Tiscornia Marsh June 6, 2010



Successful control with imazapyr has resulted in 93% of all San Francisco Estuary *Spartina densiflora* sites shifting to purely manual treatment conducted by a team of ISP biologists in 2010



Spartina densiflora has also hybridized with the native *S. foliosa* to create a novel form that ISP began to find in 2007 at most marshes where both parent species are present

