

The “other” invasive *Spartina* in San Francisco Bay: Progress towards eradication for the lesser-known species



Drew Kerr, ISP Treatment Program Manager
Cal-IPC Symposium
Chico, CA
October 9, 2014





Alternate title:

***Eradication is really hard...especially
around T&E species***

Presentation Map

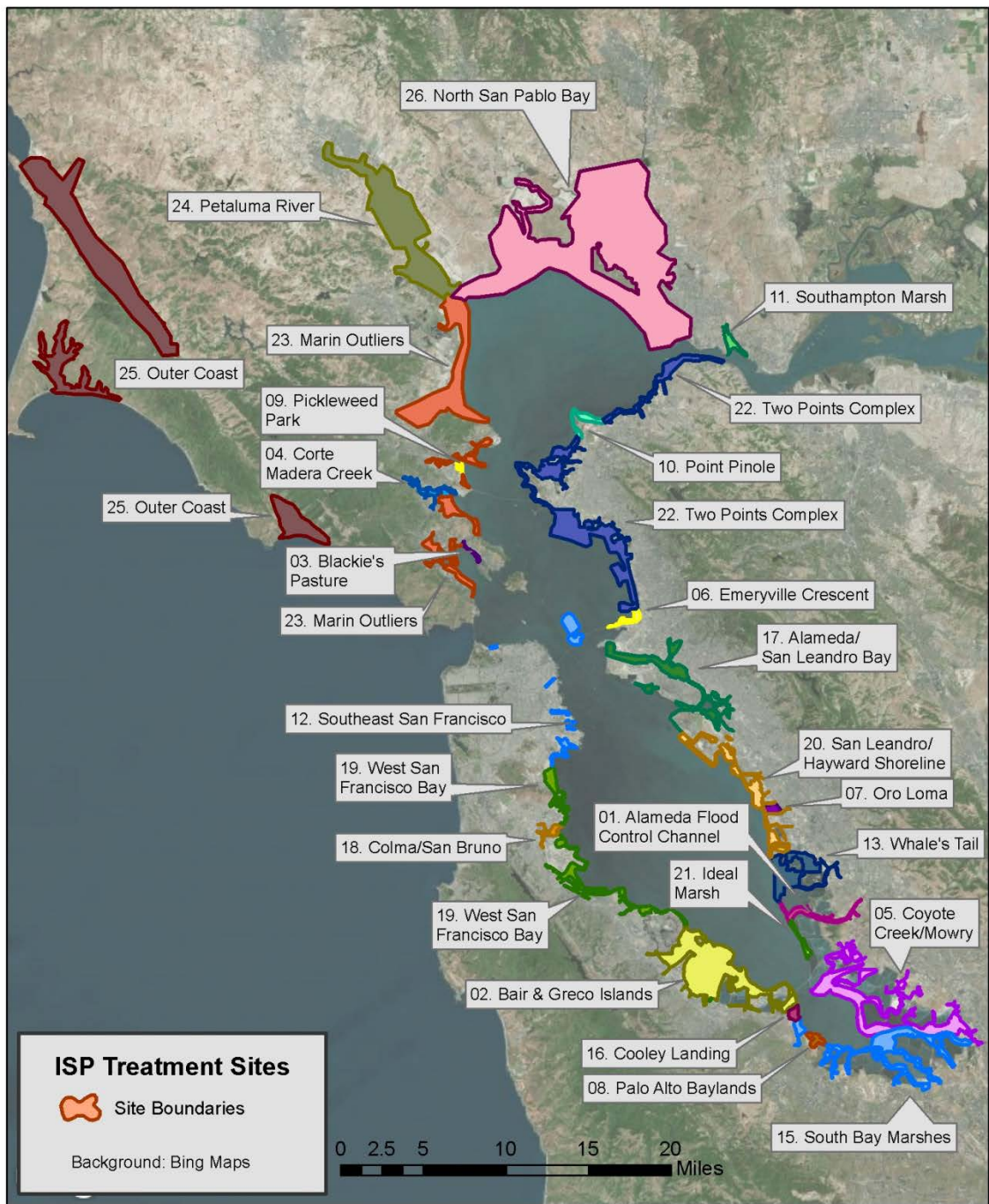
- Overview of the California Coastal Conservancy's Invasive *Spartina* Project (ISP)
- *Spartina densiflora* Treatment Program
- *Spartina patens* Treatment Plan

California Coastal Conservancy & U.S. Fish & Wildlife Service created ISP in 2000

Coordinated, Estuary-wide Treatment Program

207 sites
within 24 complexes

Began with 805 net
acres within 50,000
acres of estuary



Hybrid Cordgrass
Spartina alterniflora × *foliosa*

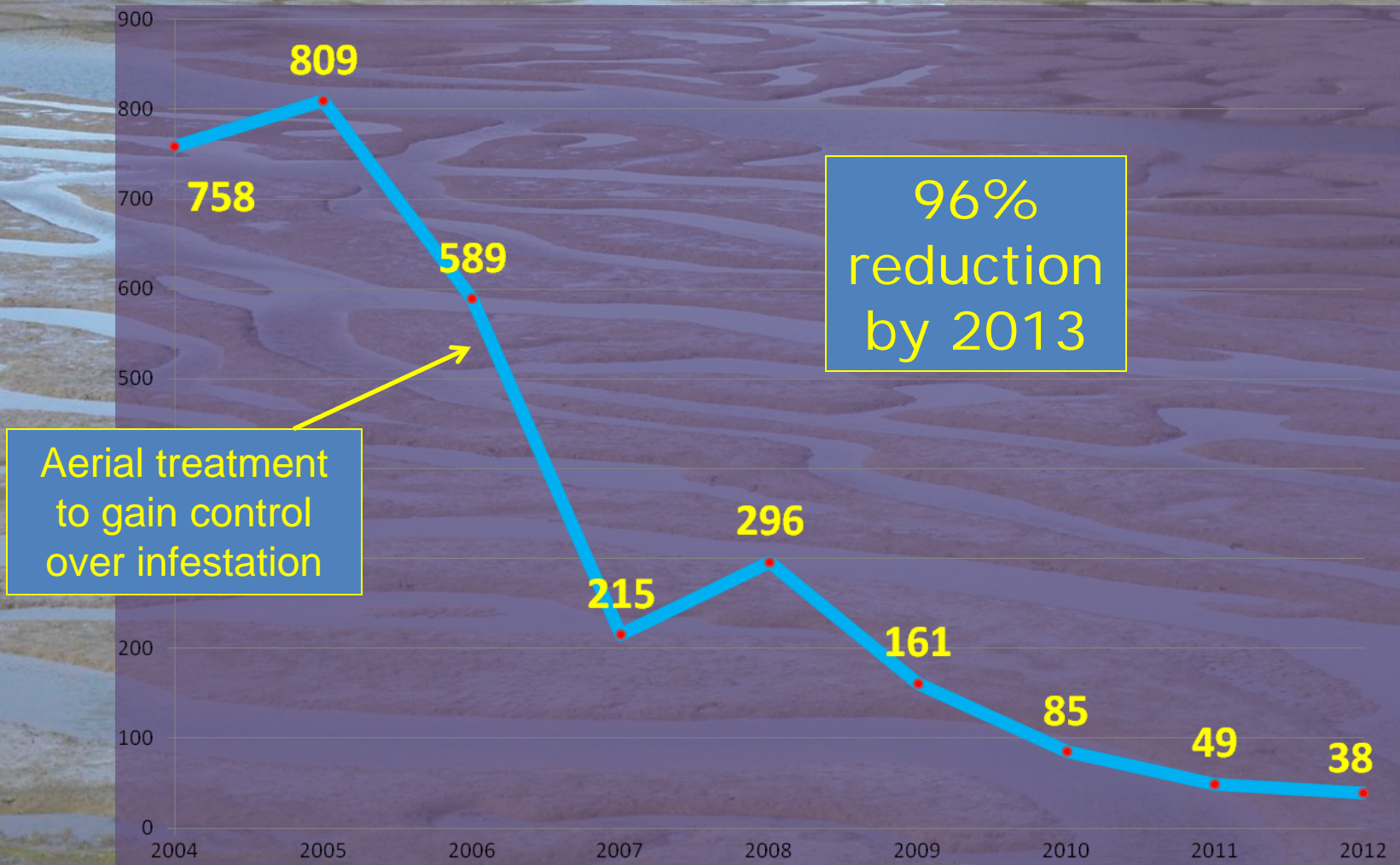




Hybrid *S. alterniflora*
treatment methods

San Francisco Estuary

Net Non-Native *Spartina* Acres 2004-2012



Progress Towards Eradication at Selected ISP Site Complexes

Alameda Flood Control Channel

2005 infestation = 135 net acres

**2012 infestation = 0.06 net acre
(228 m²)**

Eden Landing/Whales Tail Complex

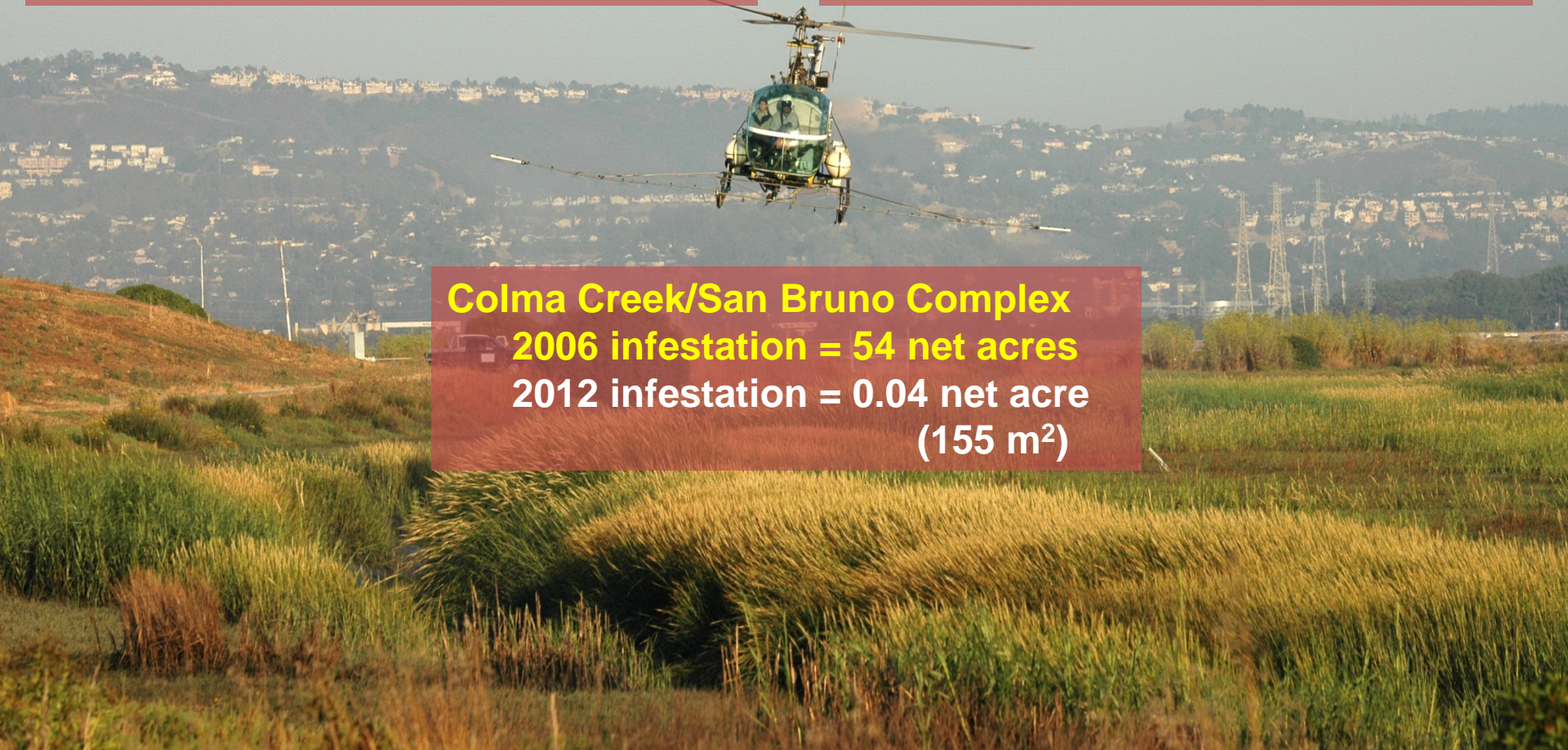
2005 infestation = 81 net acres

**2012 infestation = 0.12 net acre
(500 m²)**

Colma Creek/San Bruno Complex

2006 infestation = 54 net acres

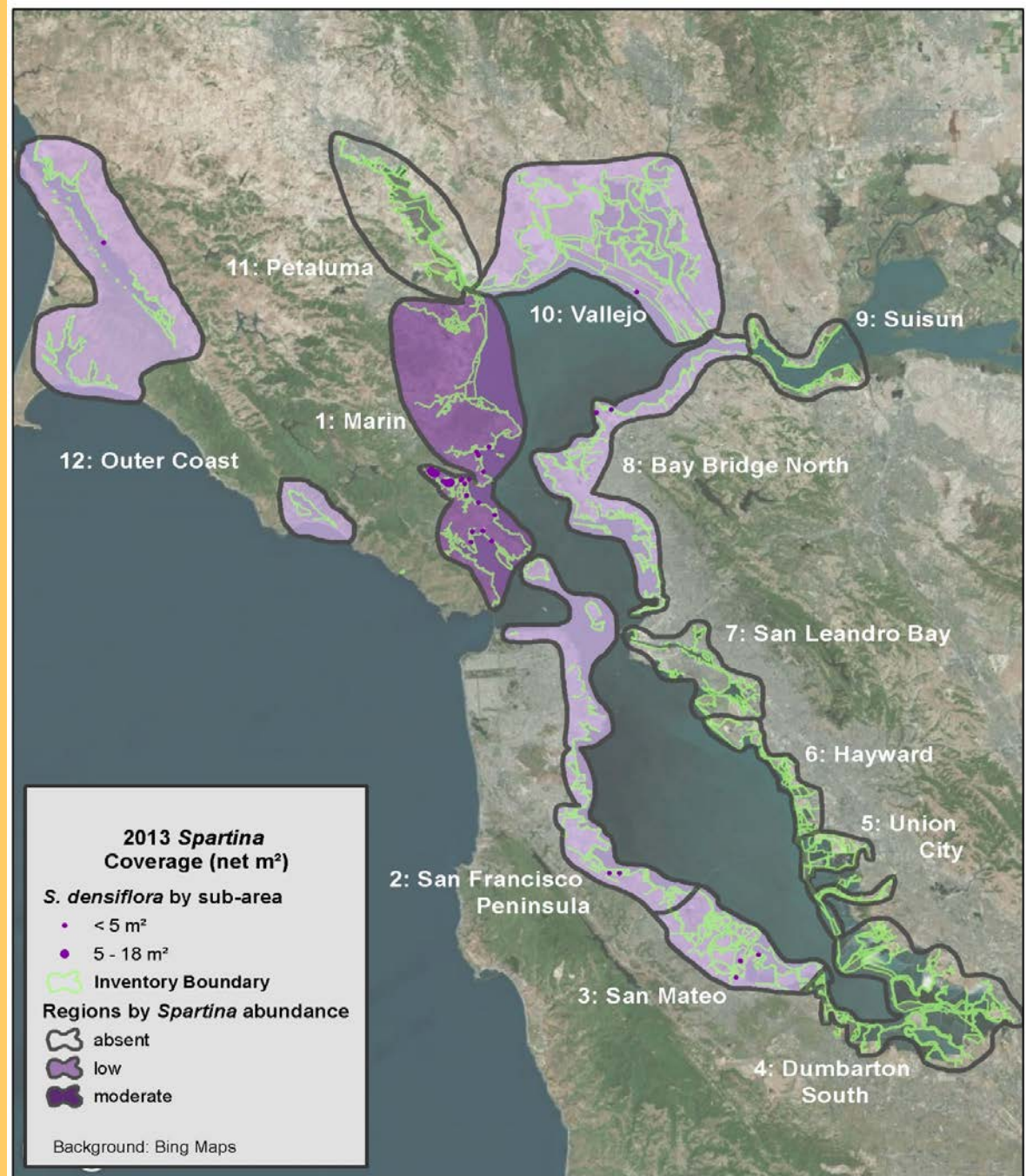
**2012 infestation = 0.04 net acre
(155 m²)**



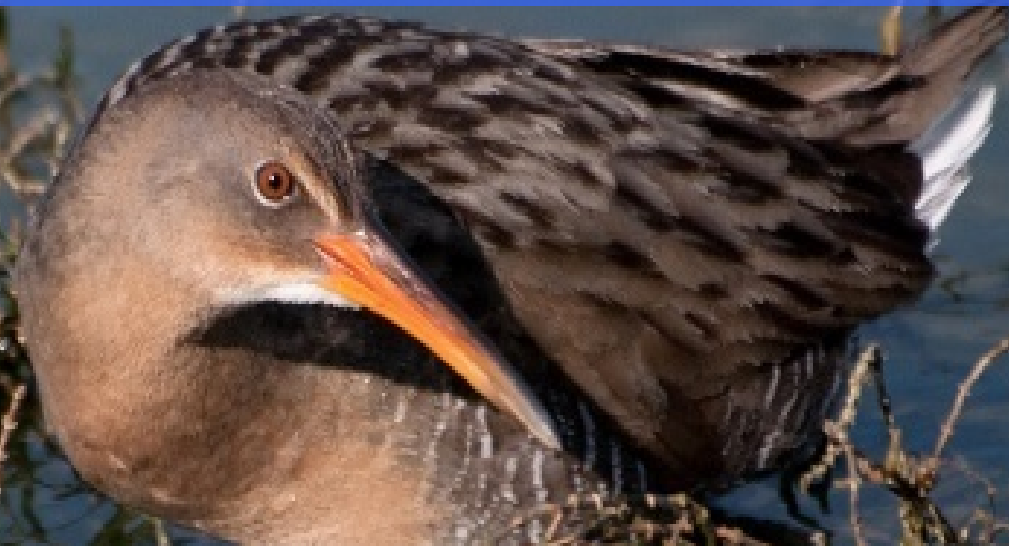
Spartina densiflora: Eradication Challenges and Progress



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



Endangered Species Constraints on *Spartina densiflora* Treatment: Ridgway's Rail



- For the 1st four seasons, treatment began Sept. 1 after breeding season
 - *S. densiflora* set seed by July, AND began senescence, reducing herbicide uptake/translocation
- Mowing not part of initial IVM plan, to allow rails to adjust as the invasive plant was removed

Manual Treatment of *Spartina densiflora*



Unlike *S. alterniflora* × *foliosa* individual *S. densiflora* can be dug without exacerbating the infestation.

However large scale removal is damaging to the marsh surface, so imazapyr herbicide has less impact.



Photos courtesy of Sandy Guldman,
Friends of Corte Madera Creek



Sandy Guldman, President of Friends of Corte Madera Creek contacted hundreds of individual landowners to gain access permission for inventory & treatment

Some final holdouts required threat of enforcement of the State noxious weed law from the County Agricultural Commissioner

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 & this
necromass is very persistent



THE LIVING DEAD – Up Close



And then there are...

THE TRULY DEAD



Efficacy from imazapyr treatment on *S. densiflora* has been highly variable, with many instances of full mortality as well as cases of low efficacy



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 adds further stress

Accreted mounds formed by mature *Spartina densiflora* plants



Photo courtesy of Sandy Guldman,
Friends of Corte Madera Creek

Post-Mow Imazapyr Application to *S. densiflora*

Primary purpose: Arrest development of plants and stop seed production/dispersal

Mowing reduced amount of herbicide needed due to decrease in above-ground biomass

Preserves integrity of marsh plain: only a fraction of these plants will now need to be dug

The higher disturbance activities (digging/mowing) are conducted outside of Ridgway's rail breeding season





2014: Dense *Distichlis spicata* covering mid-marsh
(where *S. densiflora* was most dominant);
Abundant *S. foliosa* expanding into lower elevation
portion of old meadow

*Methods: Annual imazapyr treatment (June) & mowing
to ground (Oct) + spot digging over several years*



Lush pickleweed and *S. foliosa* colonizing the main channel of Creekside Park that was a *S. densiflora* meadow

2009: before initiation of mowing within this meadow





2014: Tall, dense pickleweed and *Distichlis spicata* covering mid-marsh (where *S. densiflora* was most dominant)

Methods: Annual imazapyr treatment (June) & mowing to ground (Oct) + spot digging over several years

Current eradication methodology:

ISP biologists survey all historical sites 2X annually;

1st in early June when flower stalks help detection

2nd in January when pickleweed has senesced

All plants are manually removed and disposed offsite



Task remaining: Exhaust the seed bank

- Just 64m² found throughout the Estuary in 2013
 - 99.7% reduction
- ISP data appears to indicate 3-5 year viability



Tom's Point, Marin County, CA



Spartina densiflora × *foliosa*

- By 2008, ISP started finding this hybrid in virtually all sites where *S. densiflora* was growing adjacent to *S. foliosa*
 - By 2013, reduced by over 95% by ISP treatment
- ***Caught early but this likely could have been a very successful invader in the San Francisco Estuary and possibly far beyond***

Spartina densiflora × *foliosa*

- Fortunately, imazapyr has been much more effective on hybrid *S. densiflora*
- More closely resembles *S. foliosa* (absence of thick leaf cuticle, rhizomatous spread)
- But as with our other hybrid *Spartina*, there is variability in morphology, phenology, and herbicide effectiveness



A close-up photograph of a dense patch of Spartina anglica grass. The blades are long, narrow, and green, with some showing signs of wear or discoloration. The grass is growing in a wet, marshy area, with some water visible in the background.

Spartina anglica

- *Spartina anglica* introduced to same site as *S. densiflora* (Creekside Park) and treatment was complicated by similar factors
- Entry dates for Ridgway's rail protection meant treatment was conducted after seed set and as the cordgrass started to senesce



- Treatment has reduced *S. anglica* by 99% & kept it from dispersing outside the introduction site
- ISP & Friends of Corte Madera Creek had gotten *S. anglica* down to just 2m² in 2012, but it flared up to 4m² in 2013 (115% increase)
- Can grow as an understory to *S. foliosa*, and when it isn't flowering it can closely resemble the native, hampering detection

Spartina patens Eradication from Southampton Marsh



- ❖ Anonymous introduction to Benicia State Recreation Area (herbarium sample at Cal Academy of Sciences from early 1960's)
 - ❖ Never spread from this original introduction site
 - ❖ Less than one acre at peak of infestation 2005
- ❖ *S. patens* is known to out-compete *S. alterniflora* in the mid to high marsh in its native range (U.S. eastern seaboard)

Chloropyron molle molle (soft bird's beak)



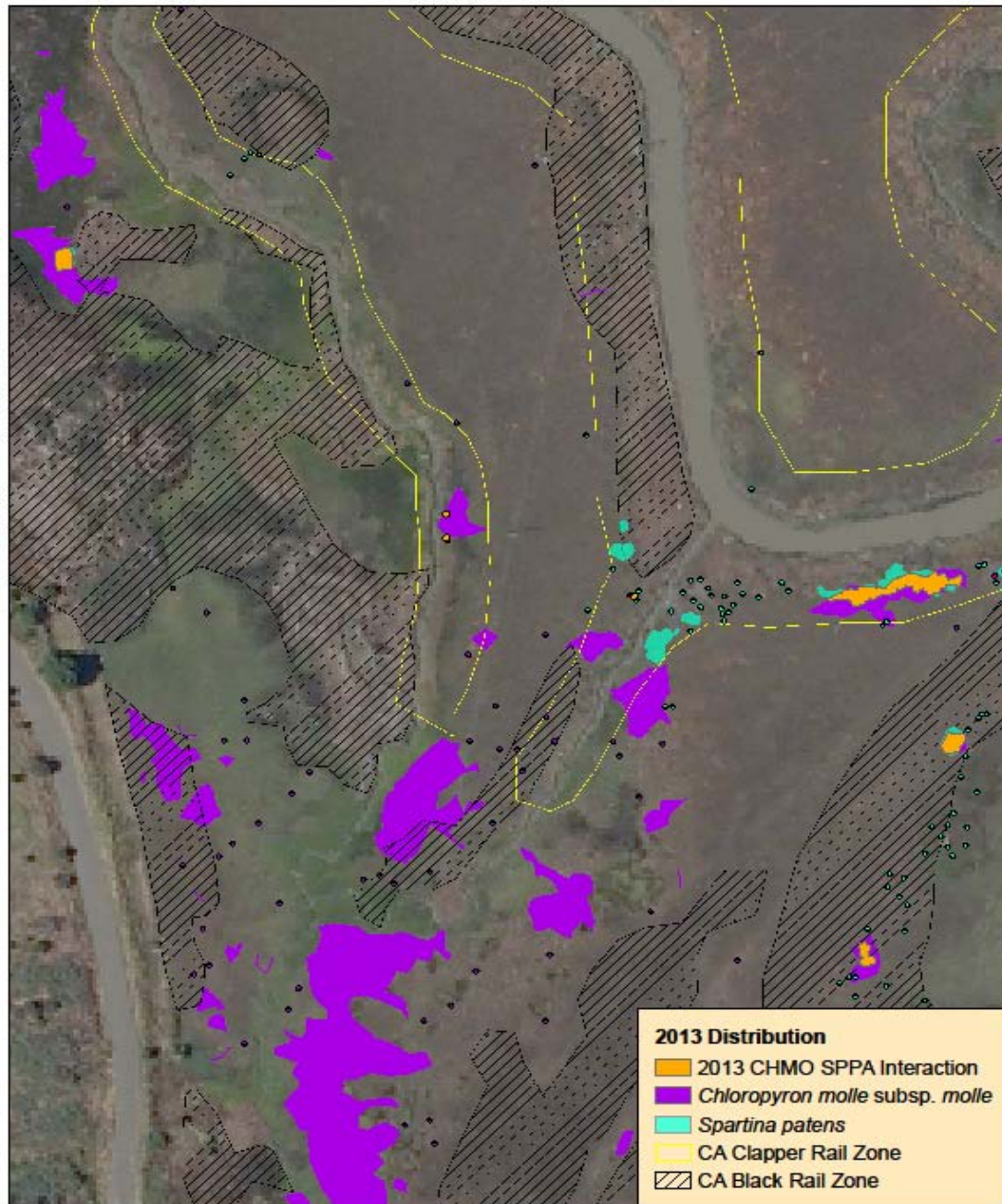
- ❖ Original treatment plan designed around *Chloropyron* (CHMO),
- ❖ Hemi-parasite that can form a haustorial connection to *S. patens*
- ❖ Treatment could only be conducted after CHMO had set seed (Oct/Nov) so as not to impact future populations
- ❖ But by autumn *S. patens* can be senescent, greatly reducing herbicide translocation and efficacy




- ❖ Although the *S. patens* had been reduced by 90%+, by 2010 it was clear that we were not on an eradication trajectory
- ❖ ISP was due for its USFWS Biological Opinion renewal in 2011, and a new plan was proposed that would involve temporary short-term impacts to *Chloropyron* to achieve eradication of *S. patens*

- ❖ As the plan was being developed, a Ridgway's rail (formerly clapper rail) was detected at Southampton Marsh for the 1st time in years
- ❖ Protective measure were instituted in 2011, including exclusion zones that put implementation of the *S. patens* plan on hold
- ❖ Black rail exclusion zones were also instituted to protect one of the Estuary's strongest populations of that species

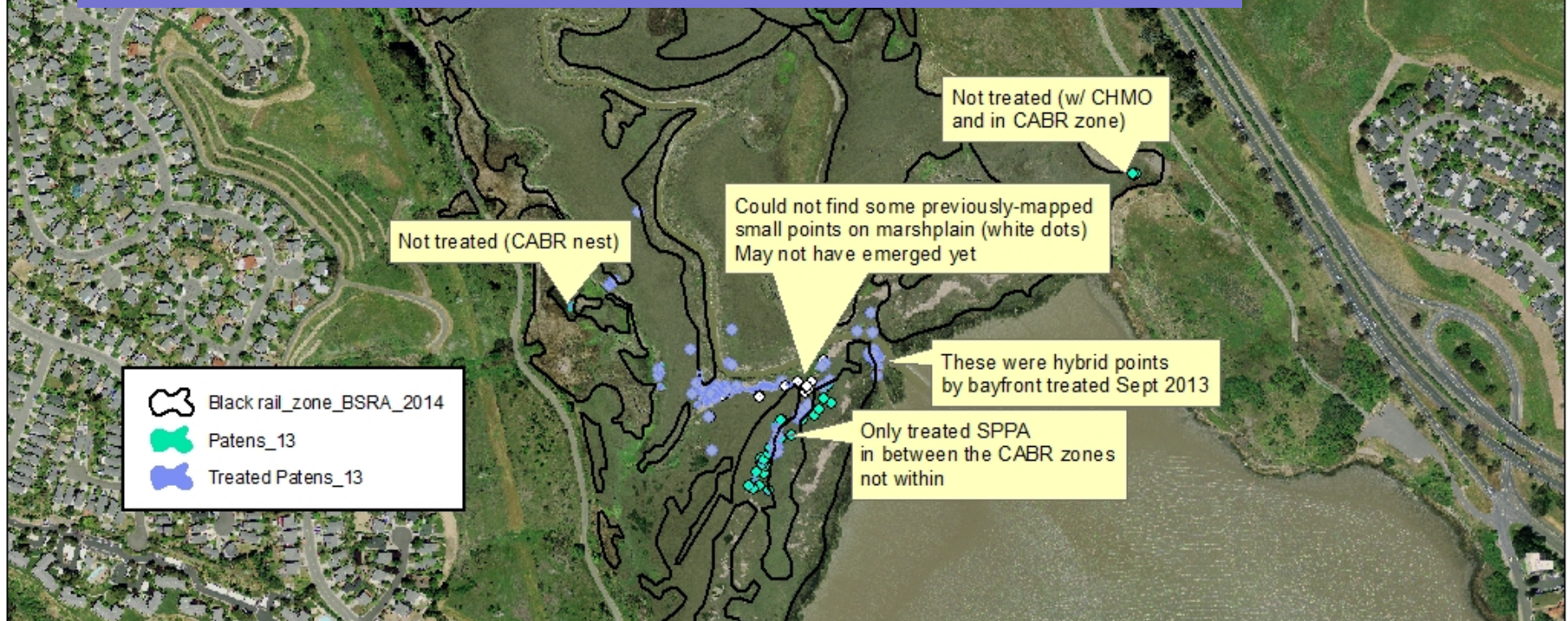




❖ There have been five consecutive years (2009-2013) of significant increases in the Southampton Marsh *Chloropyron* population and this population has higher survivorship and fecundity than other monitored populations in the Estuary (Grewell et. al. 2013)

- 
- ❖ By 2014, three Ridgway's rail breeding seasons had passed without a detection
 - ❖ ISP was permitted to enter the exclusion zones for treatment after they were “cleared” by a rail biologist
 - ❖ Piggybacked on a much more extensive *Lepidium* treatment effort at Southampton that coincided with the right timing for treating *S. patens* (late April)

- ❖ April 2014 ISP was able to treat *S. patens* with glyphosate in all areas except the black rail exclusion zones
- ❖ Represents approximately 80% of the infestation
- ❖ *S. patens* within black rail zones will be treated in the winter with alternative methods (herbicide not an option due to senescence)
- ❖ Methods: manual removal for individual plants/seedlings, tarping for larger patches.



San Francisco Estuary Invasive Spartina Project
Spartina patens treatment at BSRA (April 29, 2014)




Brenda Grewell (USDA-ARS) identifying *Chloropyron* seedlings for avoidance

Applicator: Mike Forbert, West Coast Wildlands


Implementation of the 2014 *Spartina patens* Eradication Plan



Seedling of *Chloropyron molle molle*
growing amongst a small patch of
Spartina patens



Applying glyphosate from a backpack sprayer to a sponge for wicking onto *S. patens* in areas within one meter of *Chloropyron*



Wicking glyphosate onto *S. patens* in
areas within one meter of *Chloropyron*

Standard backpack application
of glyphosate to larger stands of
S. patens that are greater than
one meter from *Chloropyron*





Glyphosate application in April should be much more effective than in autumn, and is also being conducted ahead of seed production for the 1st time

THANK YOU

