



Invasive *Spartina* Project: Treatment Program

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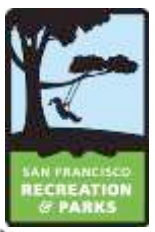
Bolinas, CA
May 16, 2012



Conservancy Grant Recipients

- **Alameda County Public Works**
- **California Department of Parks and Recreation**
- **California Wildlife Foundation**
- **City of Alameda**
- **City of Palo Alto**
- **City of San Leandro**
- **East Bay Regional Parks District**
- **Friends of Corte Madera Creek Watershed**
- **San Mateo County Mosquito & Vector Control District**
- **USFWS, Don Edwards National Wildlife Refuge**

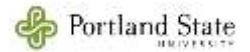
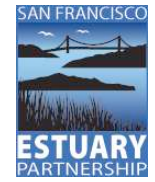
These entities use the grant funds to either hire contractors or use their agency staff to implement the site-specific *Spartina* control plans in their area



ISP Partnerships



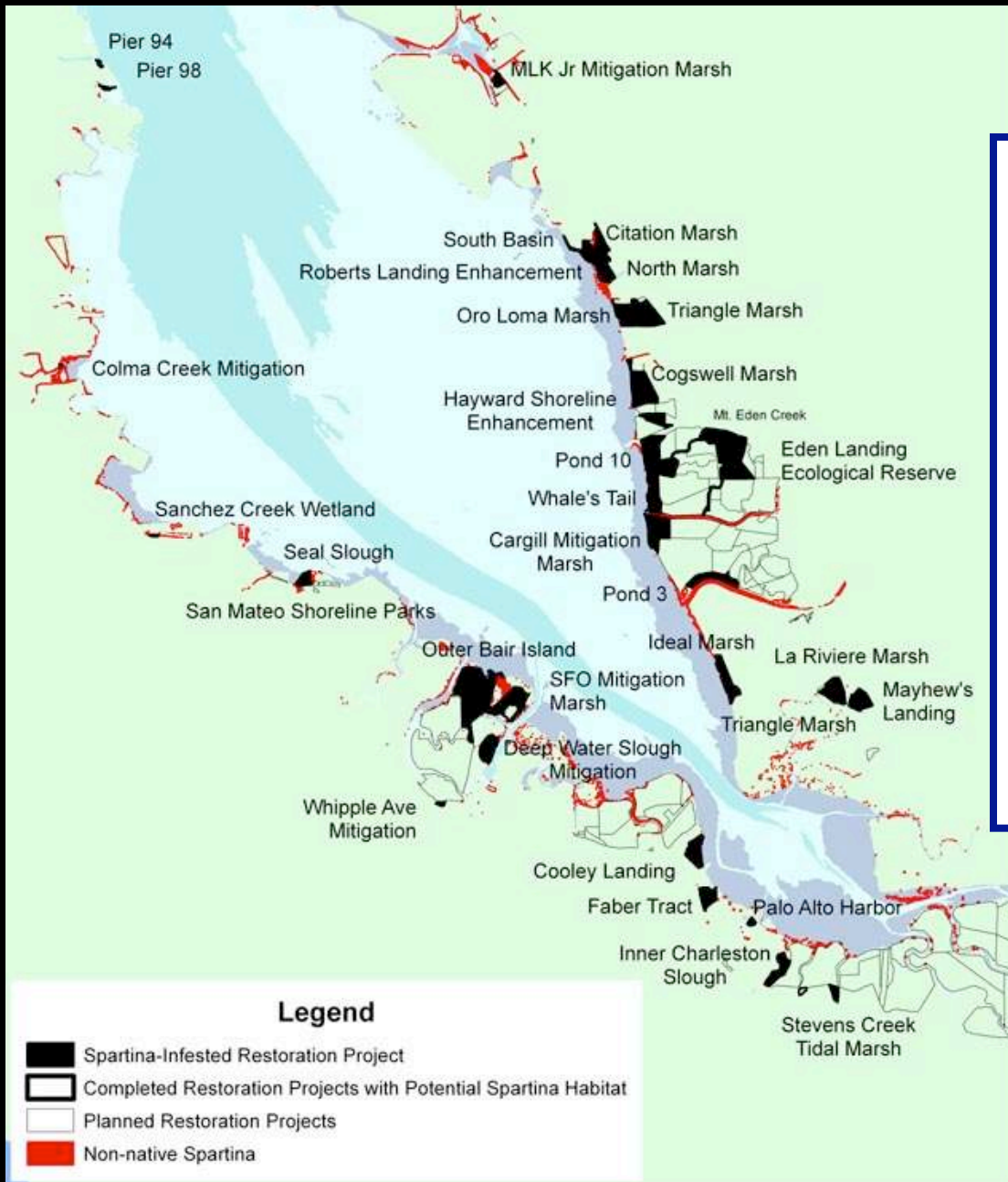
science for a changing world



San Mateo County Mosquito and Vector Control District



Invaded Restoration Projects circa 2006



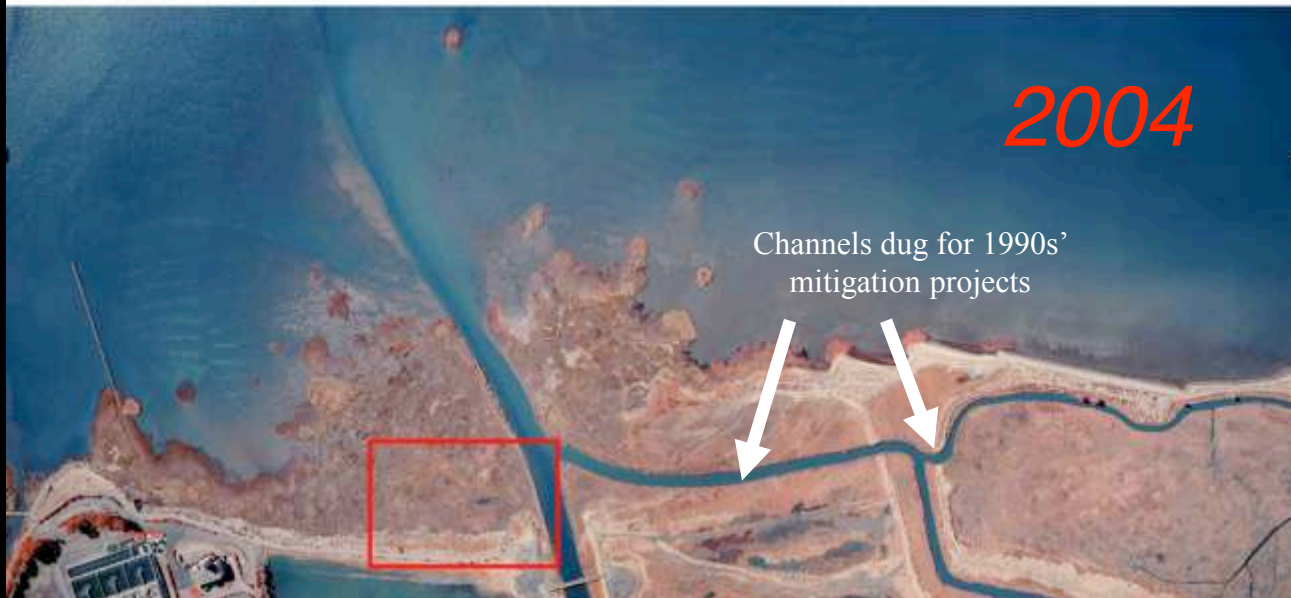
- Recent Additions:**
- 2007 Nordstrom/Shorebird Marsh, Marin
 - 2008 Richmond Parkway Marsh, Contra Costa
KGO Towers Marsh, Alameda
Triangle Marsh, Marin
 - 2009 Baumberg Marshes, Alameda
Plummer Creek Mitigation Marsh, Alameda
Color Spot Marsh, Contra Costa
Outer Bair Island, San Mateo
 - **2011 SF-2**

- WATCH LIST:**
- ISLAND PONDS
 - ~~SF-2~~
 - KNAPP TRACT

Legend

- Spartina-Infested Restoration Project
- Completed Restoration Projects with Potential Spartina Habitat
- Planned Restoration Projects
- Non-native Spartina

**Ecosystem Engineer: *Spartina* marsh built
in < 20 years by sediment accretion due to
hybrid *Spartina* colonization of mudflats**



Robert's Landing, San Leandro Shoreline



MLK Mitigation Marsh, constructed in 1998 (photo 2005)

**Hybrid *Spartina* invading the open mud of
Middle Bair Island Restoration opened autumn 2008**



Photo taken from airboat
during treatment (Sept. 2010)

Alameda Flood Control Channel Pre-treatment (2005)



REGIONAL CONTROL PROGRAM

170 sites
within 24 complexes

2006 Baywide infestation:
Over 800 net acres
within 24,000 acres of
tidal habitat

2010 Baywide infestation
85 acres

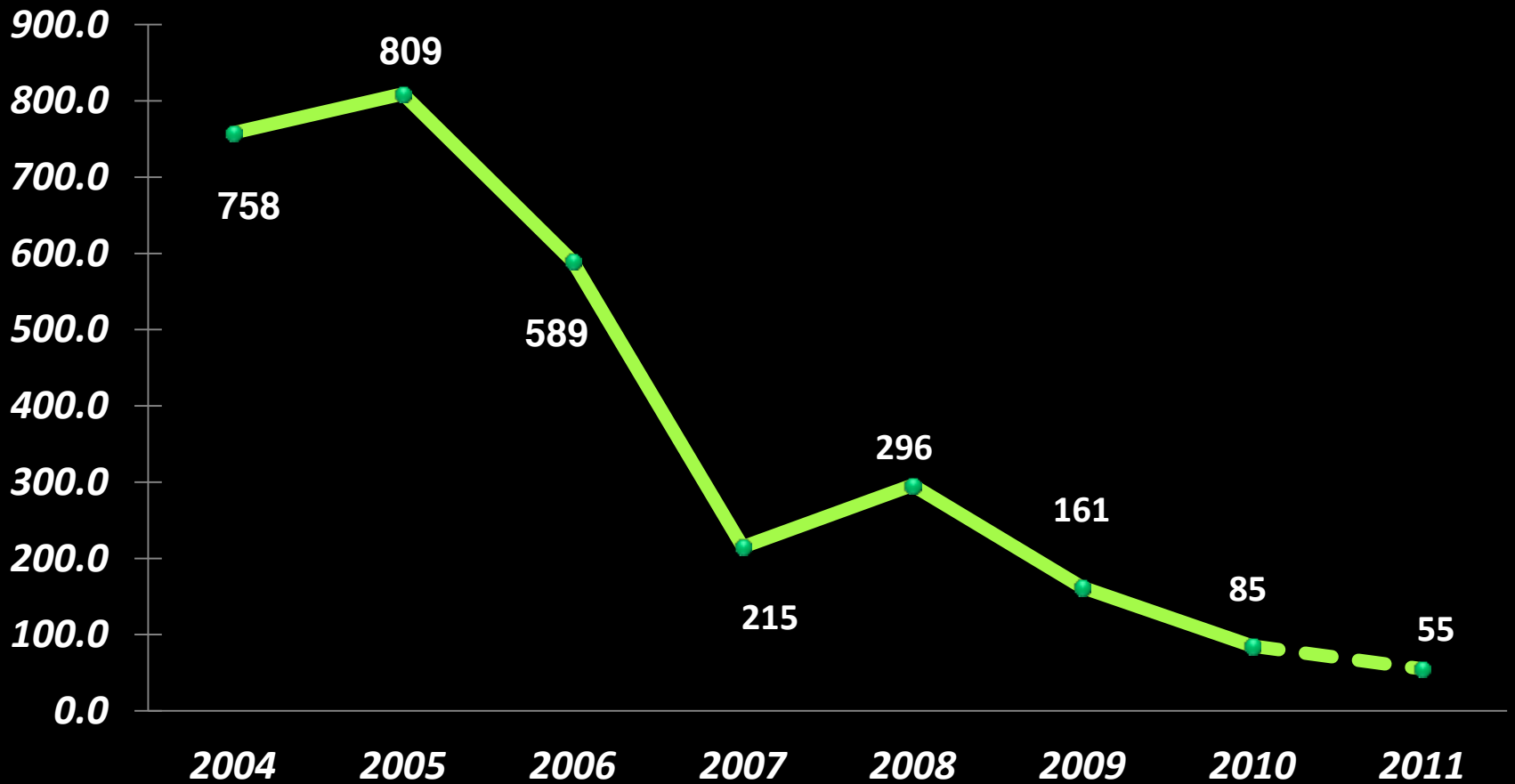
2011 Baywide infestation
55 acres

99% of remaining Baywide
infestation is composed of
hybrid *Spartina alterniflora*

2011-2015 ISP Site-Specific *Spartina* Control Plans



San Francisco Bay Net Non-native Spartina Acres 2004-2011



The labor and time-intensive work of treating scattered small infestations in these vast marsh and mudflat systems (above new breach of Mt. Eden Creek)





Greco Island South in 2006



Greco Island South in 2011



Old Alameda Creek in 2006



Old Alameda Creek in 2011



Ravenswood Slough in 2006

A photograph of Ravenswood Slough in 2011. The image shows a narrow, winding waterway with muddy, silty banks. The water is a light, turbid brown color. The surrounding area is covered in dense, low-lying vegetation, including various grasses and shrubs in shades of green and brown. The sky is overcast and grey. A semi-transparent teal banner is overlaid across the middle of the image, containing the text "Ravenswood Slough in 2011" in a black serif font.

Ravenswood Slough in 2011

Colma Creek – South San Francisco

2006



2008



20010

← Pickleweed
← *Grindelia*





Hose from truck with extra long wand attached for longer reach

Backpack application



Argo amphibious tracked vehicle has very low ground pressure. It can go where you can't even walk

Airboat has been invaluable for treatment on mudflats and to access sites on the proper tidal regime for successful control by maximizing dry time exposure



Backpack applications continue to be a big part of the eradication work, especially as infestations dwindle



Manual Treatment of *Spartina densiflora*

Spartina densiflora is a bunchgrass that doesn't spread by rhizomes, so individual plants can be dug without exacerbating the infestation.



Photos courtesy of Sandy Guldman,
Friends of Corte Madera Creek

Successful Implementation of IPM

By 2010, successful control with imazapyr resulted in 93% of *S. densiflora* sites shifting to purely manual treatment conducted by a team of ISP biologists



Examples of remaining infestations in 2011 at some of these sites (minimum 3 year seedbank):

- Blackie's Pasture = 4 plants
- Tiscornia Marsh = 5 plants
- Starkweather Park = 9 plants
- Martas Marsh = 10 plants
- Whittell Marsh = 5 plants
- Sanchez Marsh = 1 plant

State Listed Noxious Weed: ISP and Friends of Corte Madera Creek received invaluable assistance from the Marin Agricultural Commissioner with landowners who refused to allow the removal of *S. densiflora* on their shorelines

Integrated Pest Management (IPM) for Invasive Vegetation

- Develop treatment strategy based on the biology of the target plant
- Evaluate infestations on a site-specific basis
- Evaluate the full suite of appropriate methods in the IPM toolbox
- Design strategy to reduce dependence on a single method
- Strategy should include adaptive management feedback loops (incorporate lessons learned and adjust to the realities of a changing infestation)

Digging is not normally an effective treatment method for hybrid *Spartina*: the Crissy Field story

***2010 *Spartina* clone
before digging***



***Footprint of 2011 digging
required b/c of expansion***



What is Imazapyr?

A systemic herbicide that enters the leaf and is circulated (translocated) down to the roots

ISP partners use the aquatic formulation of imazapyr (Habitat® or Polaris™) approved for estuaries

Acetolactate synthase inhibitor (ALS inhibitor);
Inhibits key enzyme required for biosynthesis of 3 amino acids (the branched-chain aliphatic) needed for plant growth

Animals don't produce these amino acids but rather acquire them by consuming plants.

ISP uses two surfactants: one is lecithin [soy bean] based (Liberate), and second is a methylated vegetable oil (Competitor)

Imazapyr Toxicity

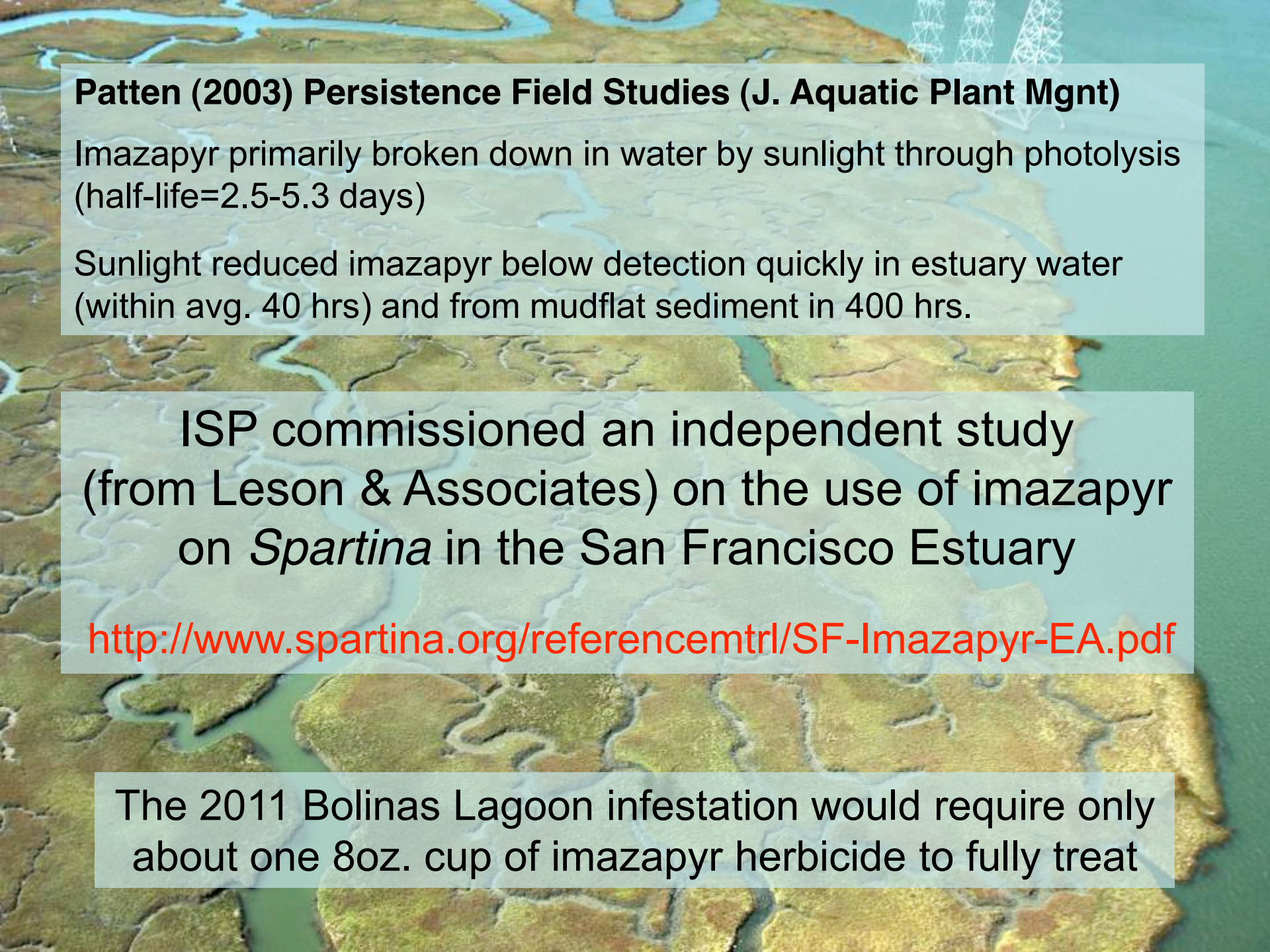
US EPA considers imazapyr “**practically non-toxic**” to wildlife, including mammals, birds, fish, and aquatic invertebrates
This is the lowest category of toxicity.

It is common for herbicides used in ecological restoration to be at this very low level of toxicity as compared with products used in production agriculture

Fish LC_{50} = 22,305 mg/L

ISP water quality monitoring – highest sample 1.3 mg/L immediately post-treatment; followed by 97-99% reduction in 1st week

Low potential for bioaccumulation



Patten (2003) Persistence Field Studies (J. Aquatic Plant Mgnt)

Imazapyr primarily broken down in water by sunlight through photolysis (half-life=2.5-5.3 days)

Sunlight reduced imazapyr below detection quickly in estuary water (within avg. 40 hrs) and from mudflat sediment in 400 hrs.

ISP commissioned an independent study (from Leson & Associates) on the use of imazapyr on *Spartina* in the San Francisco Estuary

<http://www.spartina.org/referencemtrl/SF-Imazapyr-EA.pdf>

The 2011 Bolinas Lagoon infestation would require only about one 8oz. cup of imazapyr herbicide to fully treat