



SAN FRANCISCO
ESTUARY INVASIVE
SPARTINA PROJECT

Preserving native wetlands



Coastal
Conservancy

Monitoring a Declining, Hybridizing Weed

Ingrid Hogle

Monitoring Program Manager

Outline

- Invasive Spartina Project (ISP)
- GPS for Monitoring
- GIS for Monitoring
- GIS for Mapping
- GIS for Decision Support
- Q & A

What is invasive *Spartina*?

Spartina is a cordgrass that grows in salt marshes, mudflats and brackish channels

Four introduced species of *Spartina* invading San Francisco Bay



***Spartina alterniflora*
and hybrids**



Spartina densiflora



Spartina anglica



Spartina patens



One native species (*Spartina foliosa*) occurs in San Francisco Bay marshes

Occupies specific niches in the marsh, balanced with the other important parts of the ecosystem (unvegetated mudflats, healthy channels, pickleweed mid-marsh, etc.)



Why is non-native Cordgrass a Problem ?

Degrades endangered species habitat

Hybridizes with native Pacific cordgrass

Fills in restoration sites

Degrades flood control capacity



The Invasive *Spartina* Project

- Created in 2000 by the Coastal Conservancy and the USFWS
- Coordinate Estuary-wide *Spartina* monitoring and control efforts
- Long term goals: eradicate (eliminate) invasive *Spartina* from the San Francisco Estuary.



Control Program



Monitoring Program

- Genetic testing
- Inventory and mapping
- Treatment efficacy monitoring



Annual Challenges

1. Monitoring Design
2. Spatial Data Preparation/Collection
3. Identification of Hybrids
4. Data Processing, Viewing, Editing
5. Map Production
6. Decision Support

Monitoring Design

- Annual Inventory
 - *New Features Every Year*
 - Points, Lines & Polygons
 - Spatial Grids
- Annual Sampling
 - *Permanent Plots*

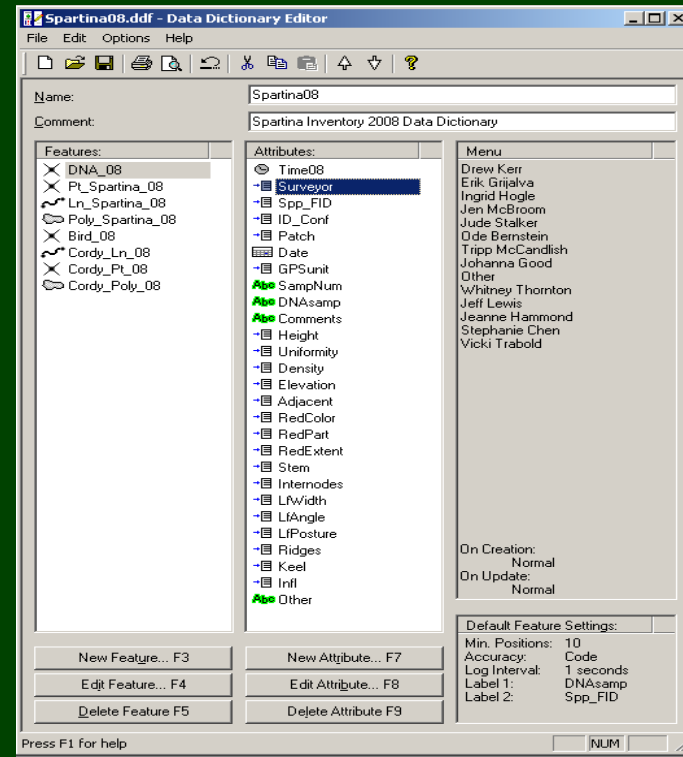
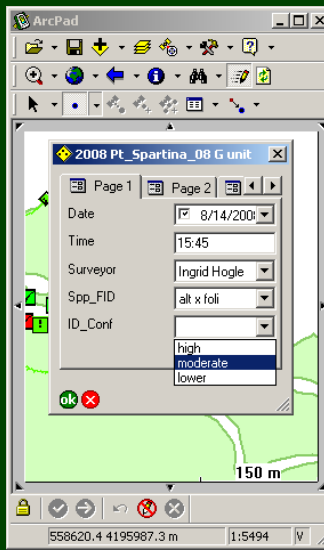


Genetic Testing



Spatial Data Collection Methods

- Handheld GPS units or Tablet PC
- ArcPad or TerraSync Software
- Map of past years' data
- Customized data dictionary
- Points, lines & polygons
- Grid cells



ArcPad Data CheckOut

The screenshot displays the ArcMap interface with the following components:

- Title Bar:** ArcPad_for_Inv.mxd - ArcMap - ArcView
- Menu Bar:** File Edit View Insert Selection Tools Window Help
- Toolbars:** Standard toolbar with icons for file operations, navigation, and editing. The scale is 1:64,171.
- Editor Panel:** Task: Create New Feature, Target: [empty]
- Data for Checkout Panel:**
 - 2008 Inventory
 - Ode Y-unit 2008 Inventory
 - Jeanne P-unit 2008 Inventory
 - Whitney B-unit 2008 Inventory
 - Stephanie G-unit 2008 Inventory
 - Jen W-unit 2008 Inventory
 - Vicki J-unit 2008 Inventory
 - Ingrid/Jude A-unit 2008 Inventory
 - Tripp T-unit 2008 Inventory
 - X misc. 2008 Inventory
 - Copy Out Data
 - Trt_Plot_08
 - To Do 2008
 - To Do Point 08
 - To Do Line 08
 - To Do Poly 08
 - ArcPad Past Years DNA results
 - ArcPad Past Years Inventory data
 - Channels
 - 2008 Scheduled Inv Boundary (unselect f
 - CLRA sites
 - 2008 Inventory Boundary
 - Control Program subareas
 - Prep for Inventory Boundary
 - TeleAtlas
 - NAIP_2005
- Optional data layers
 - Trt_Plot_08
 - Trt Mon 07 Live NN Spartina

- Map View:** Aerial view of a coastal area with several marsh units highlighted in red and purple. Labels include "22b: San Pablo Marsh", "22a: Wildcat Marsh", "22d: Stege Marsh", and "22t: Albany/South Richmond shoreline 22e: Hoffman Marsh". Symbols include red squares with exclamation marks, green squares with checkmarks, and yellow stars.
- Status Bar:** 550533.884 4196940.297 Meters

Zoom to Today's Boundary

The screenshot displays the ArcMap interface with the following components:

- Title Bar:** ArcPad_for_Inv.mxd - ArcMap - ArcView
- Menu Bar:** File Edit View Insert Selection Tools Window Help
- Toolbars:** Standard toolbar with icons for file operations, navigation, and editing. The scale is set to 1:13,269.
- Editor Toolbar:** Task: Create New Feature Target:
- Data for Checkout Panel:**
 - 2008 Inventory
 - Ode Y-unit 2008 Inventory
 - Jeanne P-unit 2008 Inventory
 - Whitney B-unit 2008 Inventory
 - Stephanie G-unit 2008 Inventory
 - Jen W-unit 2008 Inventory
 - Vicki J-unit 2008 Inventory
 - Ingrid/Jude A-unit 2008 Inventory
 - Tripp T-unit 2008 Inventory
 - X misc. 2008 Inventory
 - Copy Out Data
 - Trt_Plot_08
 - To Do 2008
 - To Do Point 08
 - To Do Line 08
 - To Do Poly 08
 - ArcPad Past Years DNA results
 - ArcPad Past Years Inventory data
 - Channels
 - 2008 Scheduled Inv Boundary (unselect f)
 - Optional data layers
 - Trt_Plot_08
 - Trt Mon 07 Live NN Spartina
- Map View:** Aerial imagery showing a coastal area with a cyan boundary line. Various data points are plotted, including green squares with checkmarks, red squares with exclamation marks, and red squares with question marks.
- Status Bar:** 559436.943 4195498.02 Meters

Copy Out Data to ArcPad

The screenshot shows the ArcMap interface with the 'Get Data For ArcPad' wizard dialog box open. The wizard is titled 'Get Data For ArcPad' and contains the following text:

This wizard gets data and puts it into a folder so you can transfer it to ArcPad.

Choose the layers you want to get from the map.

Layer	Folder or Database
<input checked="" type="checkbox"/> X Cordy_Poly_08	G:\Y 2008\2008 Edits\X_edits_2008
<input checked="" type="checkbox"/> Trt_Plot_08	G:\Y 2008\2008 Edits\Blank Data\b
<input checked="" type="checkbox"/> To Do Point 08	G:\Y 2008\2008 To Do List
<input checked="" type="checkbox"/> To Do Line 08	G:\Y 2008\2008 To Do List
<input checked="" type="checkbox"/> To Do Poly 08	G:\Y 2008\2008 To Do List
<input checked="" type="checkbox"/> DNA 2007: SpplID v FID	G:\N Monitoring Program\NSP-Veg M
<input checked="" type="checkbox"/> DNA 2007: Hybrid based on a singl...	G:\N Monitoring Program\NSP-Veg M
<input checked="" type="checkbox"/> DNA 2006: Spp_LID/Spp_FID	G:\N Monitoring Program\NSP-Veg M
<input checked="" type="checkbox"/> DNA 2006: Hybrid based on a singl...	G:\N Monitoring Program\NSP-Veg M
<input checked="" type="checkbox"/> DNA 2005	G:\N Monitoring Program\NSP-Veg M
<input checked="" type="checkbox"/> DNA 2004	G:\N Monitoring Program\NSP-Veg M

Buttons: Select All, Clear All, < Back, Next >, Cancel

If you choose any database layers, you'll get the option of checking these layers out for editing in ArcPad when you click Next.

The background map shows a satellite view of a wetland area with a cyan boundary and several red markers. The 'Data for Checkout' pane on the left lists various layers, including '2008 Inventory' and 'Copy Out Data'. The status bar at the bottom indicates 'Copies data for use in ArcPad. Also checks out database layers for editing.' and shows coordinates '558650.538 4196993.594 Meters'.

Check Out Data for ArcPad

Data for Checkout

- 2008 Inventory
 - Ingrid/Jude A-unit 2008 Inventory
 - Ode Y-unit 2008 Inventory
 - Jeanne P-unit 2008 Inventory
 - Whitney B-unit 2008 Inventory
 - Stephanie G-unit 2008 Inventory
 - Jen W-unit 2008 Inventory
 - Vicki J-unit 2008 Inventory
 - Tripp T-unit 2008 Inventory
 - X misc. 2008 Inventory
- Copy Out Data
 - Trt_Plot_08
 - To Do 2008
 - To Do Point 08
 - To Do Line 08
 - To Do Poly 08
 - ArcPad Past Years DNA results
 - ArcPad Past Years Inventory data
 - Channels
 - 2008 Scheduled Inv Boundary (unse
 - CLRA sites
 - 2008 Inventory Boundary
 - Control Program subareas
 - Prep for Inventory Boundary
 - TeleAtlas
 - NAIP_2005
- Optional data layers
 - Trt_Plot_08
 - Trt Mon 07 Live NN Spartina

Get Data For ArcPad

If you want to check out any of the database layers you selected on the previous panel, choose the database and the layers below.

Note: you can only include data from one database in a check out.

Database: G:\Y 2008\2008 Edits\A_edits_2008.mdb

Layer	Feature Class
<input checked="" type="checkbox"/> A DNA_08	A_DNA_08
<input checked="" type="checkbox"/> A Pt_Spartina_08	A_Pt_Spartina_08
<input checked="" type="checkbox"/> A Ln_Spartina_08	A_Ln_Spartina_08
<input checked="" type="checkbox"/> A Poly_Spartina_08	A_Poly_Spartina_08
<input checked="" type="checkbox"/> A dens 10x10 centroids	A_dens_10x10_centroids
<input checked="" type="checkbox"/> A Birds_08	A_Bird_08
<input checked="" type="checkbox"/> 2008 Generic Pt 08 A unit	A_Generic_Pt_08

Only check out schema of layers (no data will be checked out)

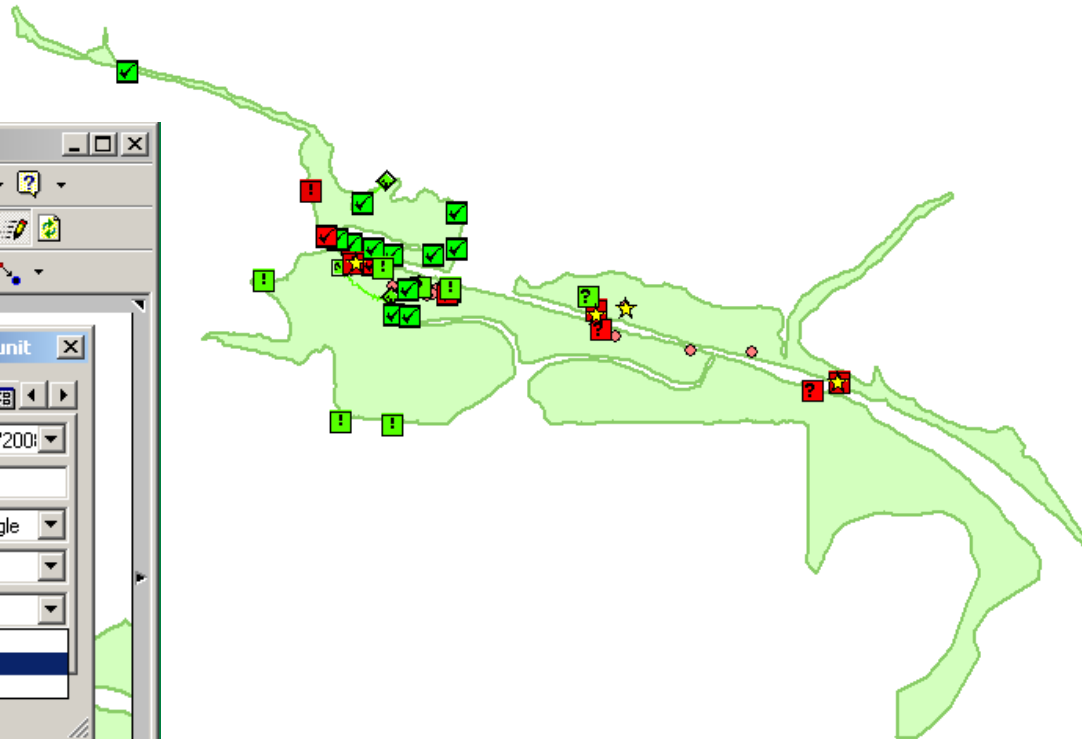
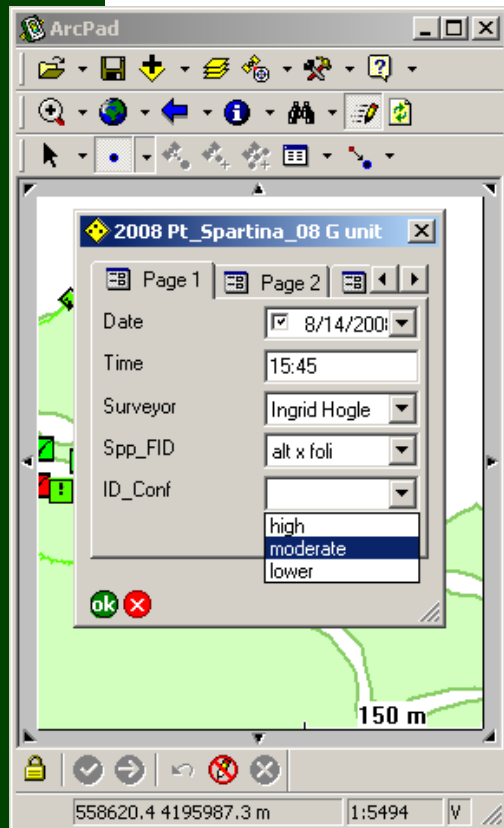
Size of editing form that will be generated: 130x80

< Back Next > Cancel

Copies data for use in ArcPad. Also checks out database layers for editing.

557428.802 4196087.824 Meters

ArcPad Project on GPS Unit



Stege Marsh Inventory Map



Spatial Data Collection Methods

- Land
 - Foot, Bicycle
- Water
 - Kayak, Airboat, Power boat
- Air
 - Airplane, Helicopter
- Office
 - Digitizing Tablet & GIS



The image is a composite of three vertical panels showing an aerial view of a river system. The top panel is a semi-transparent white box containing the title 'Aerial Photo Interpretation' in black text. Below this, the left panel shows a close-up of a river channel with a light-colored, sandy or silty bed and a dark, narrow channel of water. The middle panel shows a wider view of the river with a complex, braided pattern of channels and islands, indicating a high sediment load. The right panel shows a large, meandering river channel with a wide, flat floodplain, characteristic of a mature river in a lowland area. The overall color palette is dominated by earthy tones: browns, greys, and blues, with some reddish-brown patches scattered throughout the landscape.

Aerial Photo Interpretation



Oro Loma Marsh, Hayward Regional Shoreline

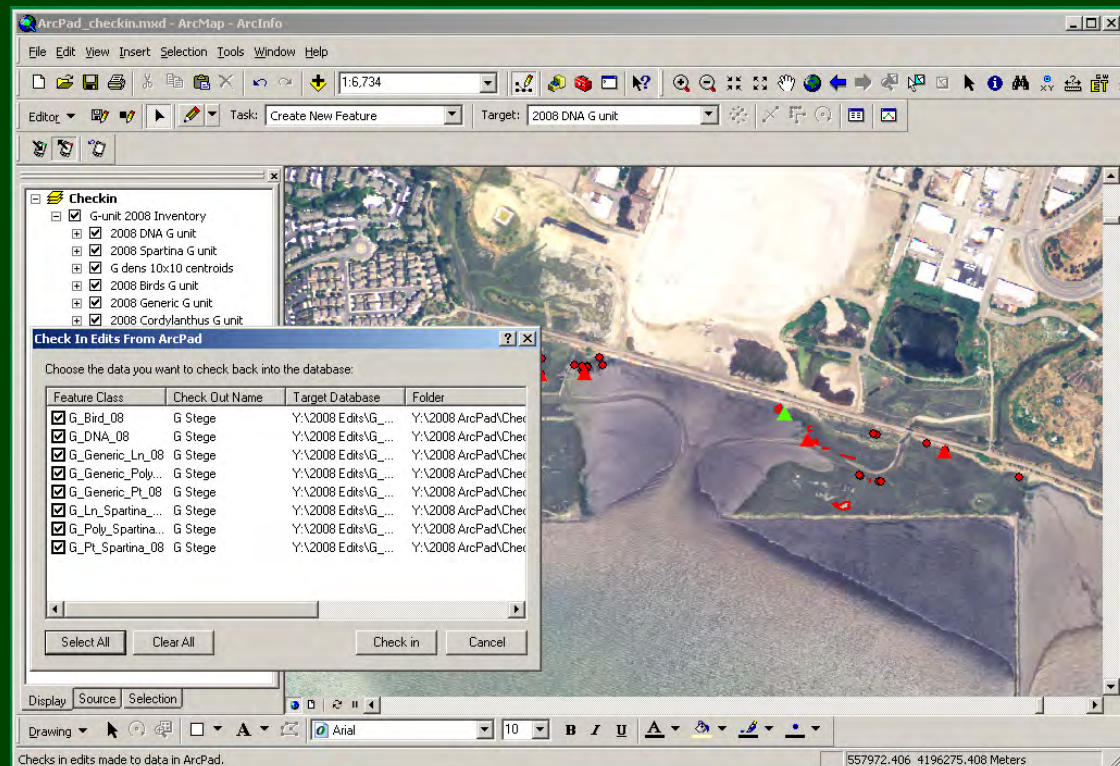
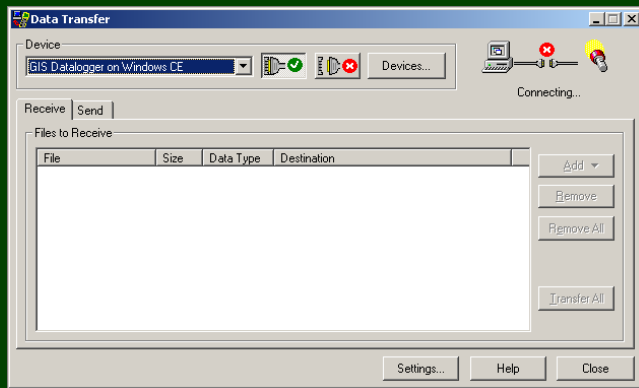
Helicopter Monitoring



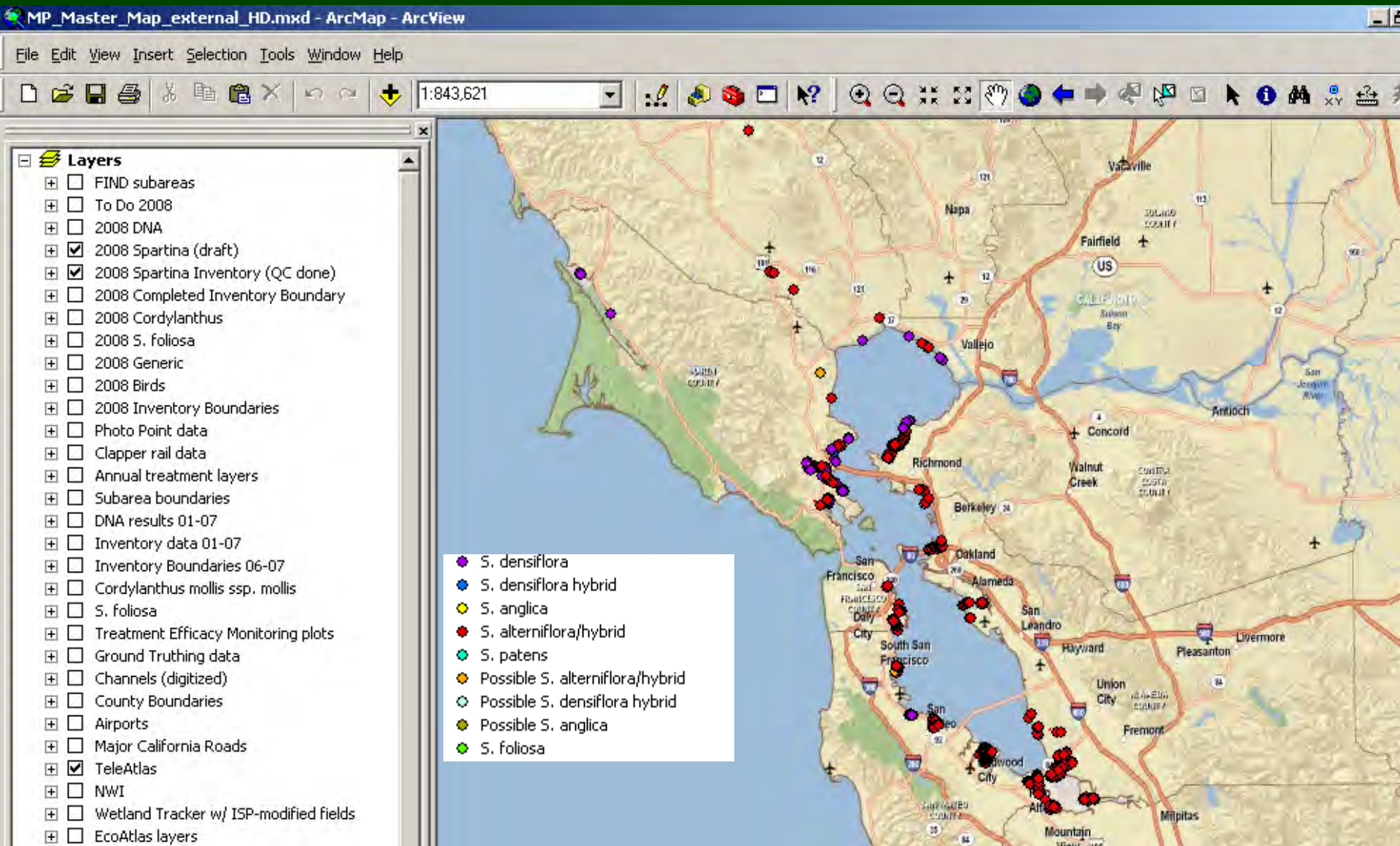


Data Processing

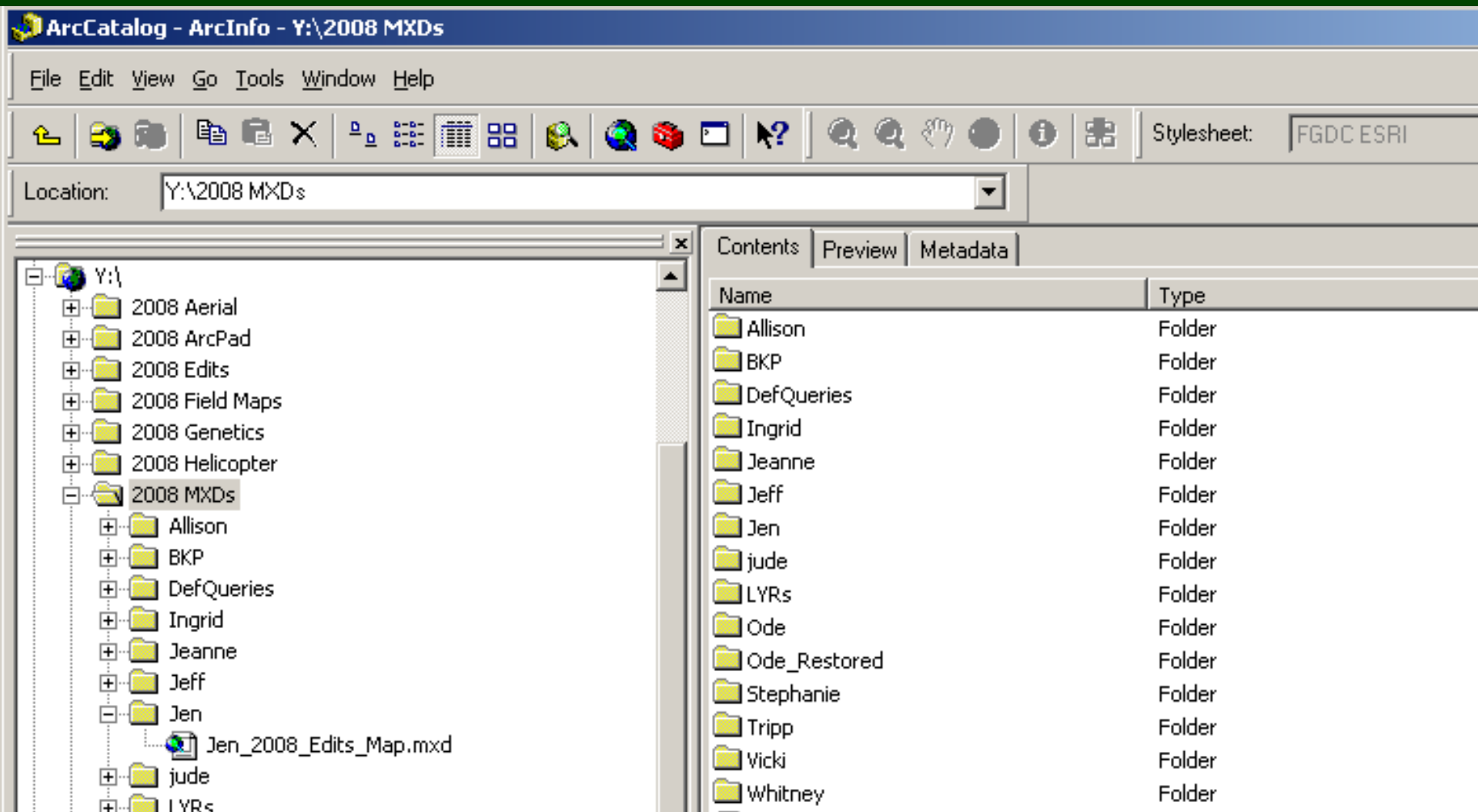
- Transfer from GPS to Desktop
- Differential Correction (or not)
- Load or Checkin to Geodatabase(s)



View Data in ArcMap



Data Editing: Individual edit maps for each field biologist



Map Production

- Interactive map (used in house...a LOT)
- Field maps (to inform monitoring)
- Reporting maps (to share with partners, others)

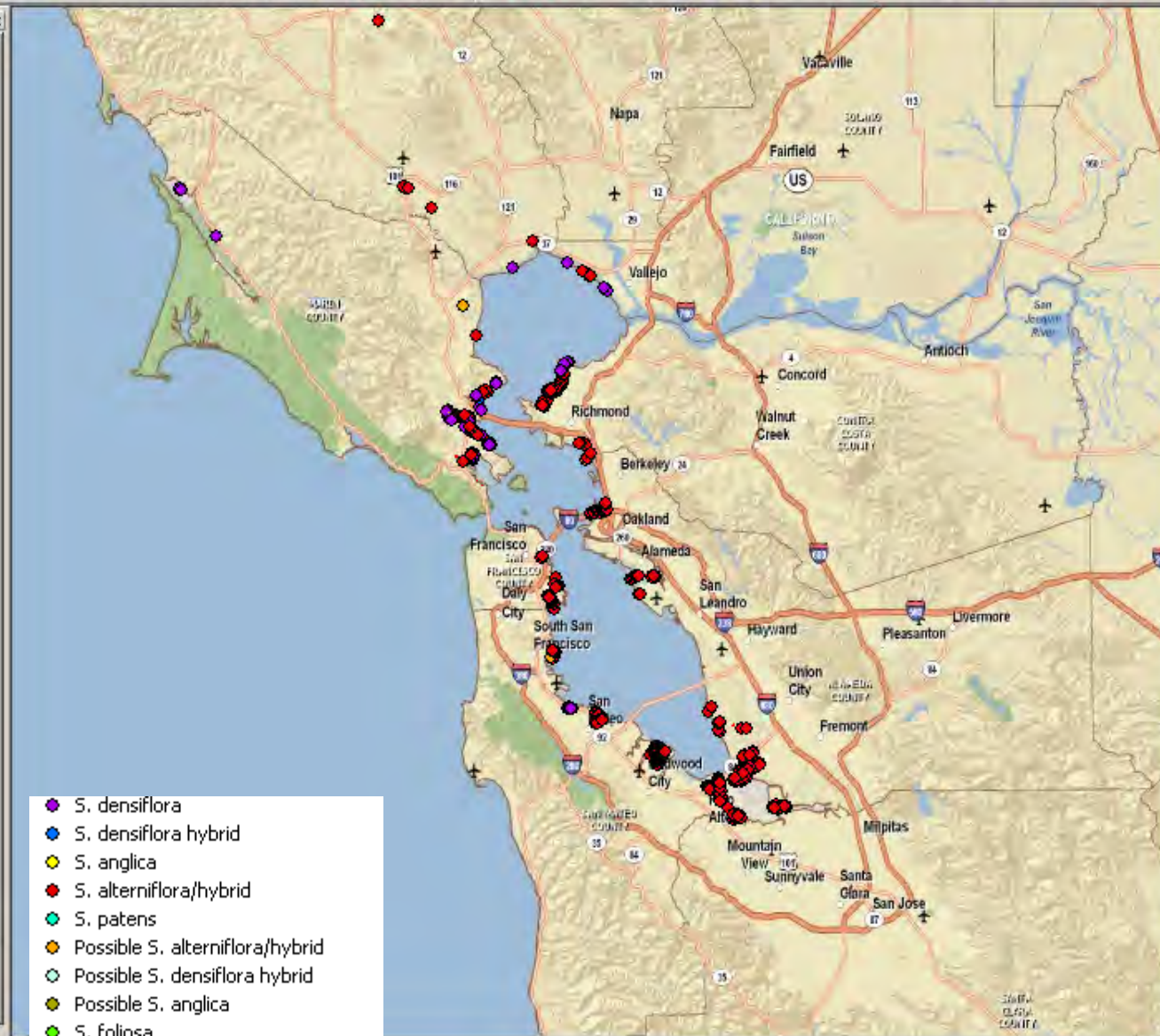
Layers

- FIND subareas
- To Do 2008
- 2008 DNA
- 2008 Spartina (draft)
- 2008 Spartina Inventory (QC done)
- 2008 Completed Inventory Boundary
- 2008 Cordylanthus
- 2008 S. foliosa
- 2008 Generic
- 2008 Birds
- 2008 Inventory Boundaries
- Photo Point data
- Clapper rail data
- Annual treatment layers
- Subarea boundaries
- DNA results 01-07
- Inventory data 01-07
- Inventory Boundaries 06-07
- Cordylanthus mollis ssp. mollis
- S. foliosa
- Treatment Efficacy Monitoring plots
- Ground Truthing data
- Channels (digitized)
- County Boundaries
- Airports
- Major California Roads
- TeleAtlas
- NWI
- Wetland Tracker w/ ISP-modified fields
- EcoAtlas layers
- Green Info Net
- Symbologies: Sample Data**
- Imagery
- LEGEND

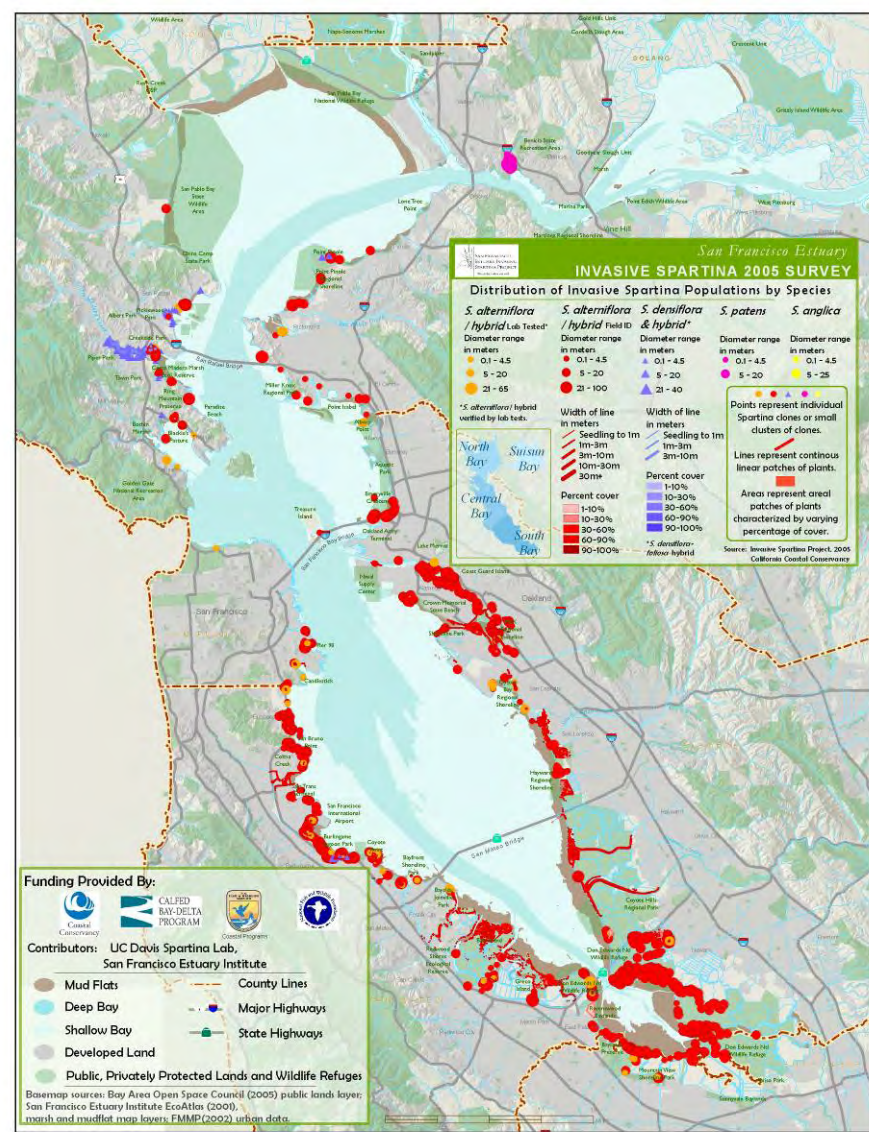
Bav Box

Display Source Selection

- S. densiflora
- S. densiflora hybrid
- S. anglica
- S. alterniflora/hybrid
- S. patens
- Possible S. alterniflora/hybrid
- Possible S. densiflora hybrid
- Possible S. anglica
- S. foliosa



Reporting Maps

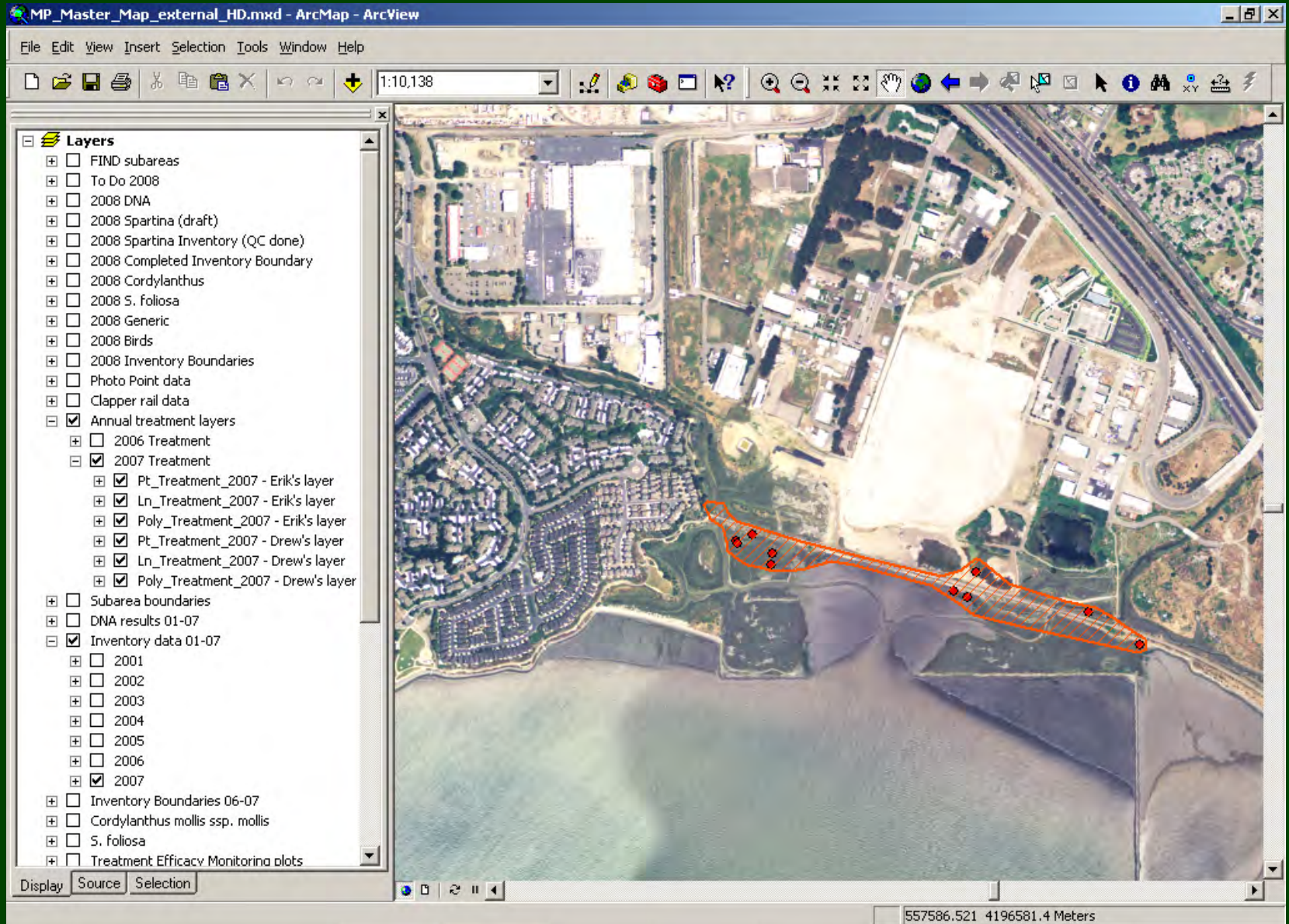


2007 Spartina Inventory	2007 DNA Results
● <i>S. alterniflora</i> /hybrid	■ Confirmed <i>S. alterniflora</i> /hybrid
■ <i>S. alterniflora</i> /hybrid	

Decision Support

- Maps
- Lab results
- Summary data

Where to Treat



What to Treat: Lab Results



Legend: Genetic Results

- h Confirmed *S. foliosa*
-)! *S. foliosa* lab ID, other spp field ID
- Ⓟ *S. foliosa* lab ID, unknown spp field ID
- h Confirmed *S. alterniflora*/hybrid
- Ⓟ *S. alterniflora*/hybrid lab ID, unknown spp field ID
-)! *S. alterniflora*/hybrid lab ID, other spp field ID
-)! *S. alterniflora*/hybrid lab ID based on lack of a single *S. foliosa* marker

How Much to Treat

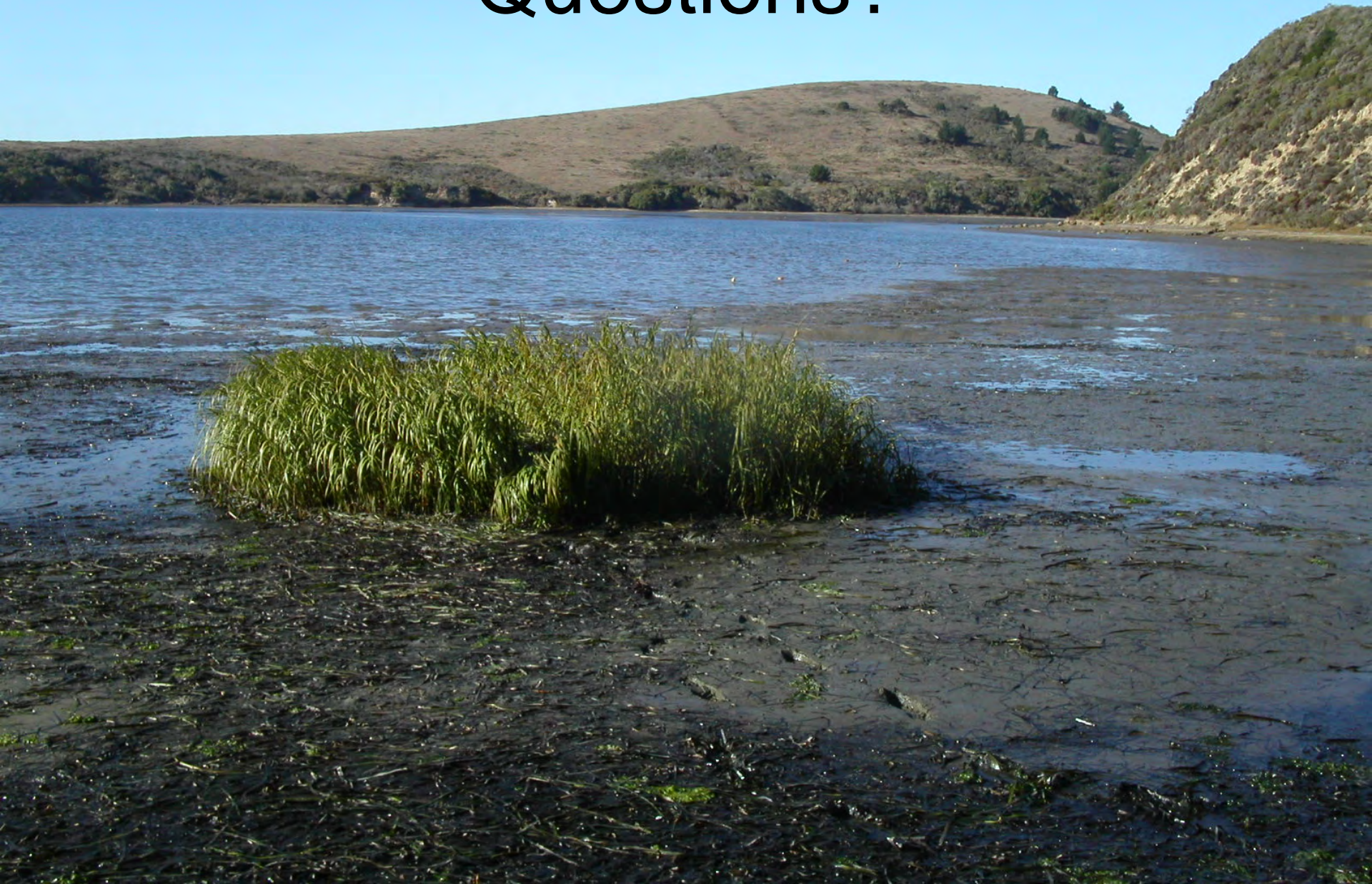
Selected Attributes of *Pt_Spartina_07 species centers

Comments	DNAcollect	LIDsample	Spp_LID	SppFinal	PctCov	Net_m2	Gross_m2
changed to <i>S. foliosa</i> based on lab ID	Yes	<Null>	<i>S. foliosa</i>	<i>S. foliosa</i>	0.55	<Null>	<Null>
DNA sample lost?	Yes	?	No Results	<i>S. alterniflora</i> /hybrid	0.25	4.90625	19.625
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.075	5.8875	78.5
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.075	0.529875	7.065
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.55	<Null>	<Null>
	yes	1116T1, 827B2	<i>S. foliosa</i>	<i>S. foliosa</i>	0.45	<Null>	<Null>
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.55	3.88575	7.065
green, long inf, red stem, upright	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.25	4.90625	19.625
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.15	0.471	3.14
	yes	827B2	<i>S. foliosa</i>	<i>S. foliosa</i>	0.25	<Null>	<Null>
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.45	8.83125	19.625
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.55	6.908	12.56
	No	<Null>	<Null>	<i>S. alterniflora</i> /hybrid	0.95	47.728	50.24

Record: 0 Show: All Selected Records (13 out of *2000 Selected) Options

- 2007
 - GPS-based Pt, Ln, Poly 07 species & diameters
 - Pt Spartina 07 species & diameter
 - *Pt_Spartina_07 species centers
 - Pt Spartina 07 diameters by species
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Pt_Spartina_07 diameter
 - Ln Spartina 07 species & widths
 - Poly Spartina 07 species border & fill
 - Dial Poly 2007 species borders & fill

Questions?



THANK YOU

ISP Project Director – *Peggy Olofson*

ISP Project Manager – *Maxene Spellman*

ISP Field Operations Managers – *Erik Grijalva & Drew Kerr*

ISP Clapper Rail Monitoring Program Manager – *Jen McBroom*

ISP Office Administrator – *Stephanie Erikson*

ISP Field Staff – *Tripp McCandlish, Ode Bernstein, Jude Stalker, Jeff Lewis, Jeanne Hammond, Whitney Thornton, Vicki Trabold, Stephanie Chen, Allison Nelson, Johanna Good*

Funders – *California State Coastal Conservancy, CALFED*

