



# Tracking weed population dynamics using geodatabase technology

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*University of California, Davis*

*Information Center for the Environment*



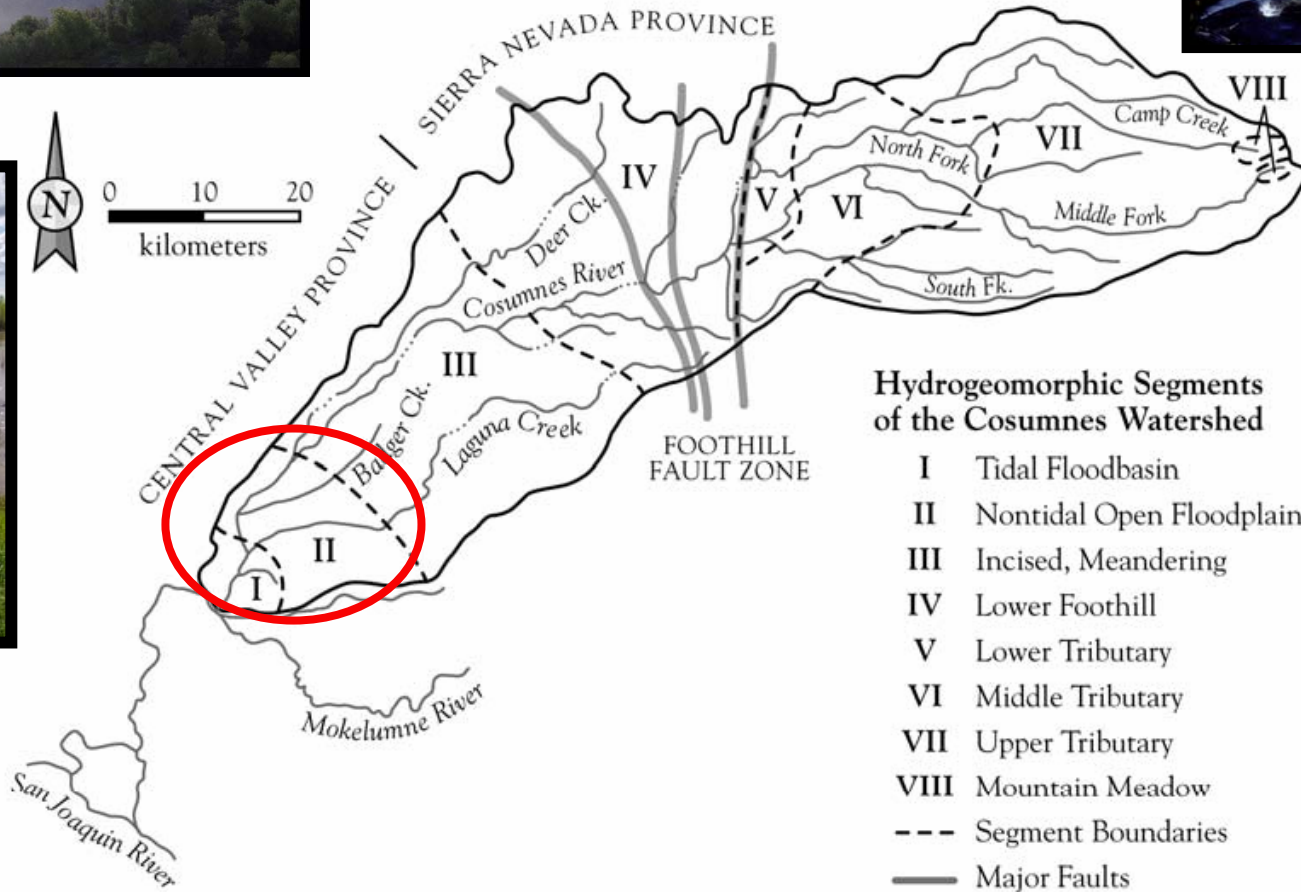
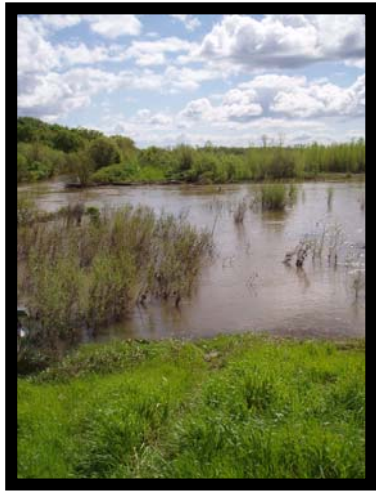


Figure 1. Map of the Cosumnes River watershed, California, showing the major geologic regions, fault zones, and stream reaches.



## Bay Delta River Hydromodification

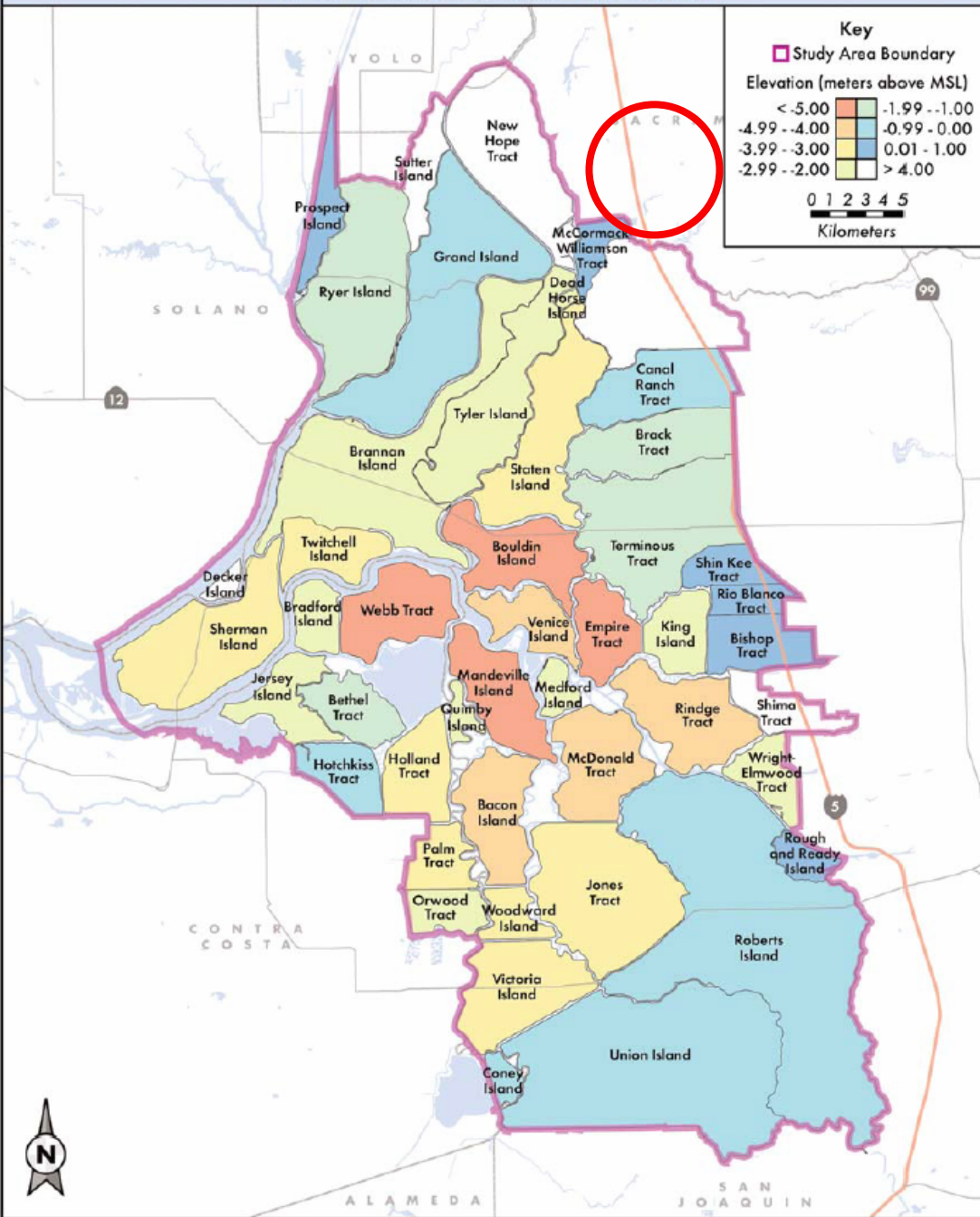
- Levees
- Channelization
- Dams
- Water diversion

## Changes in Floodwater

- Magnitude
- Timing
- Duration
- Frequency
- Connectivity



# Mean Island Elevation - Year 2000



# Levee Impact



Photo: DWR

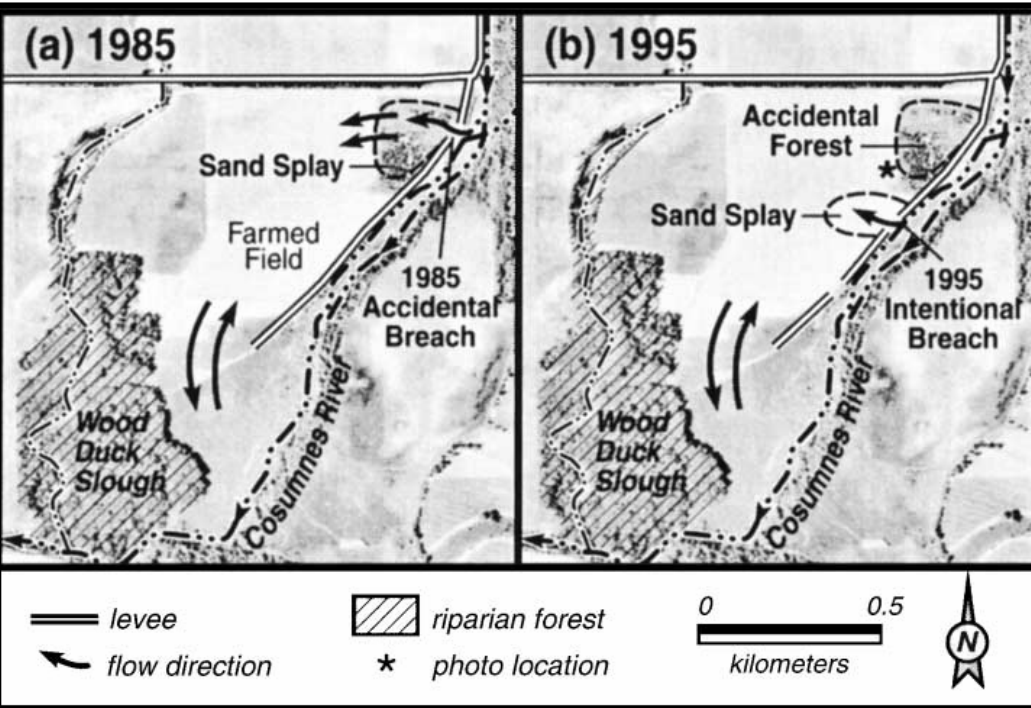
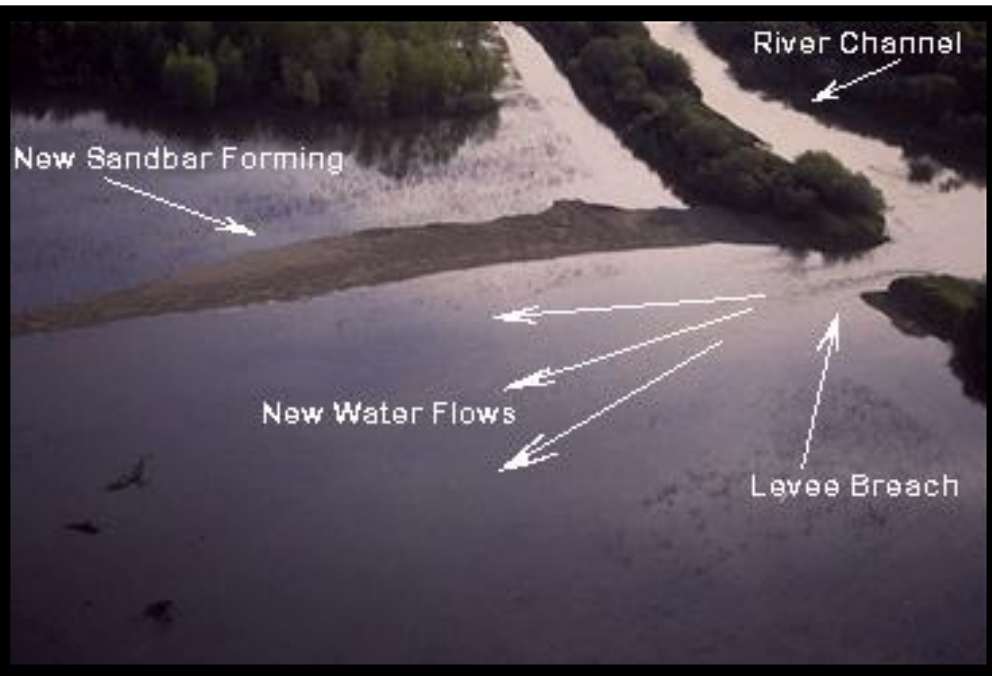
Unplanned Levee Break 6/3/2004 Upper & Lower Jones Tract

Mount and Twiss. *San Francisco Estuary and Watershed Science* (March 2005 Vol. 3, Issue 1, Article 5)

Figure 4A. Calculated average island elevations for 2000. Methods described in text.

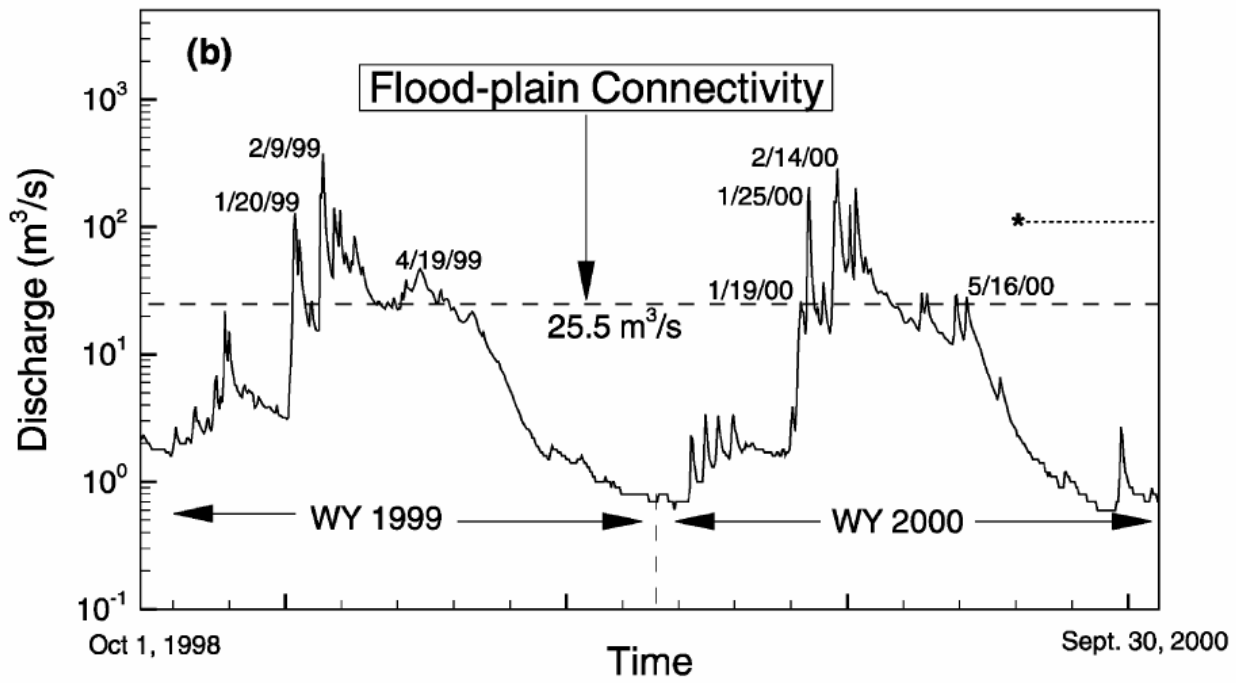
# Restored Floodplain Cosumnes River Preserve

Sacramento County, California



Florsheim and Mount

*Geomorphology* (2002; 44: 67-94)



Florsheim and Mount  
*Geomorphology* (2002; 44: 67-94)



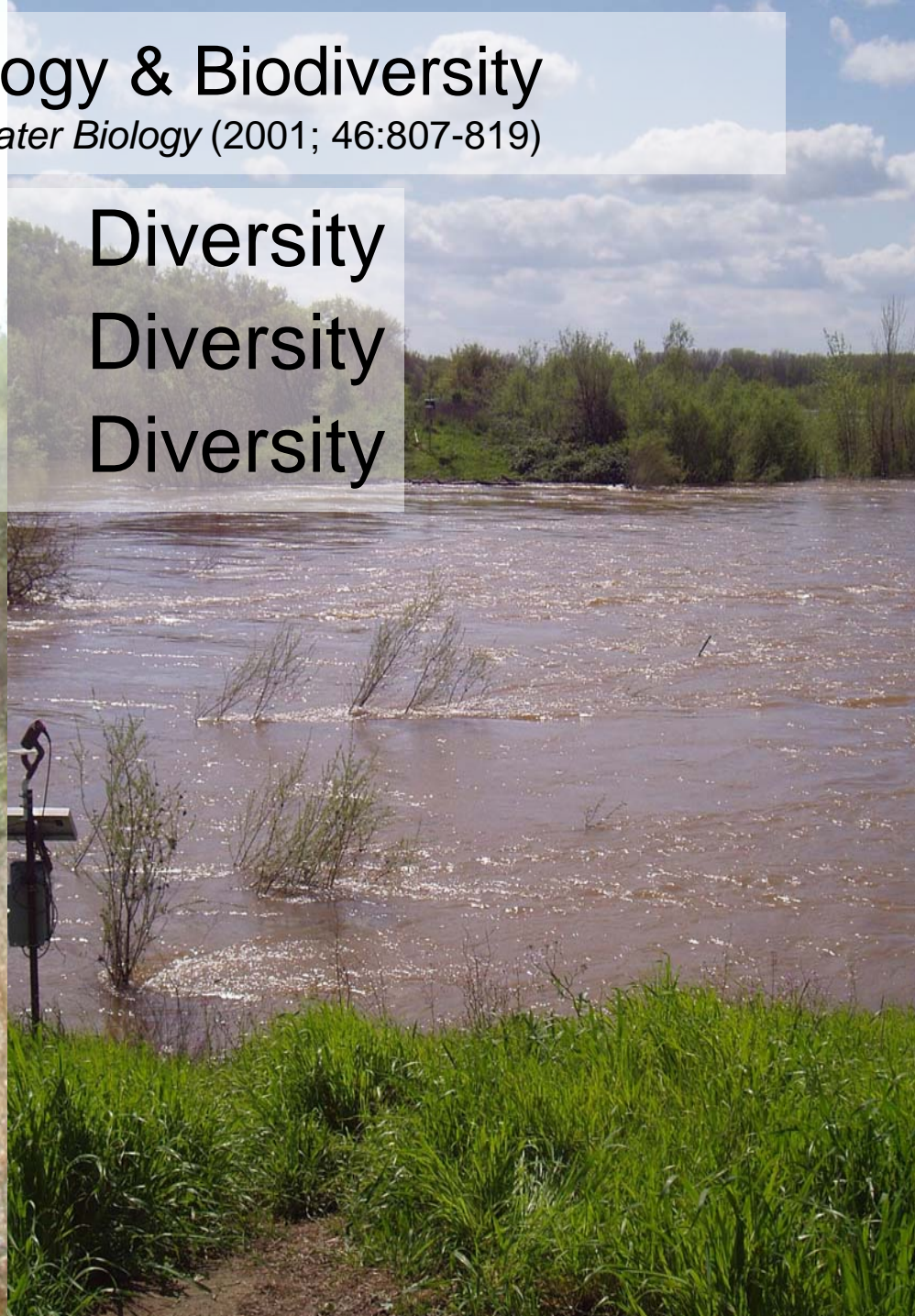
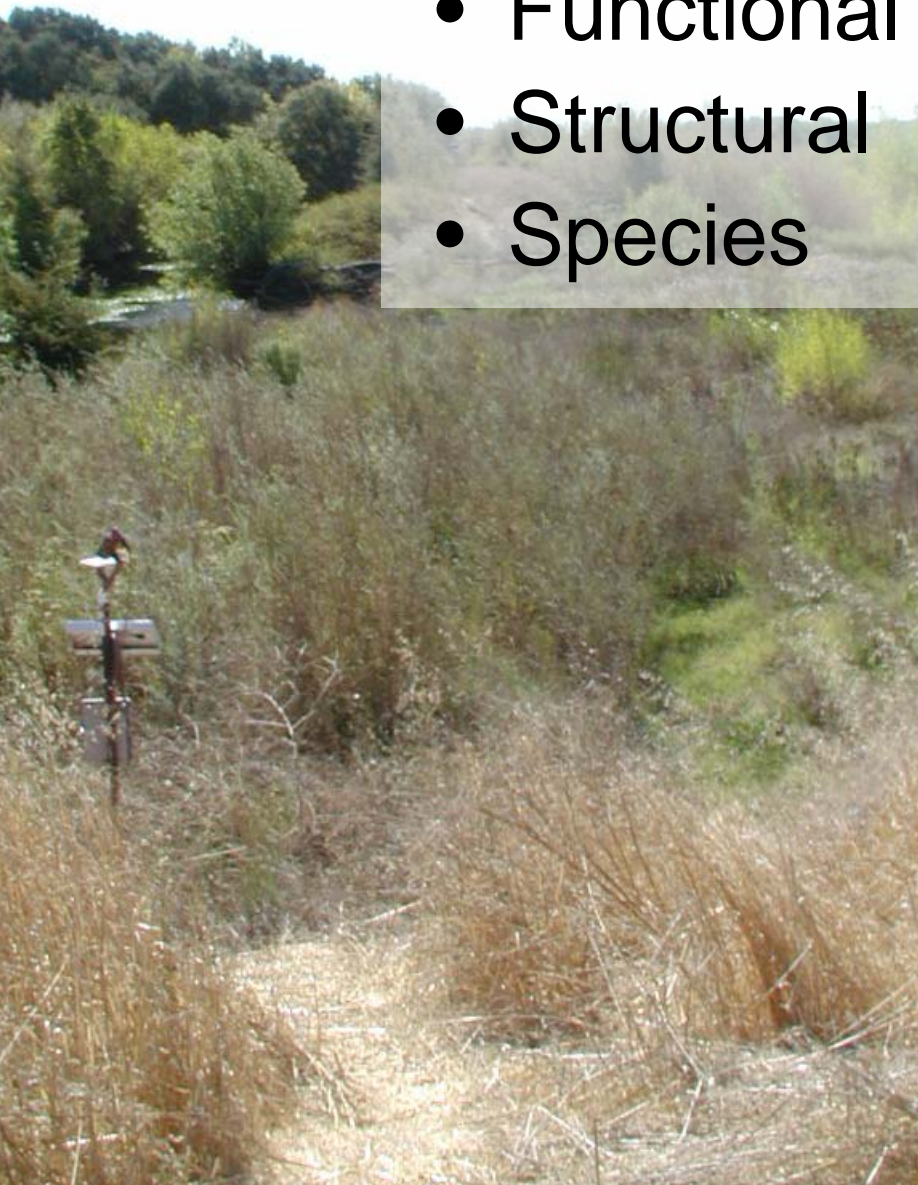


# Floodplain Ecology & Biodiversity

Ward and Tockner *Freshwater Biology* (2001; 46:807-819)

- Functional
- Structural
- Species

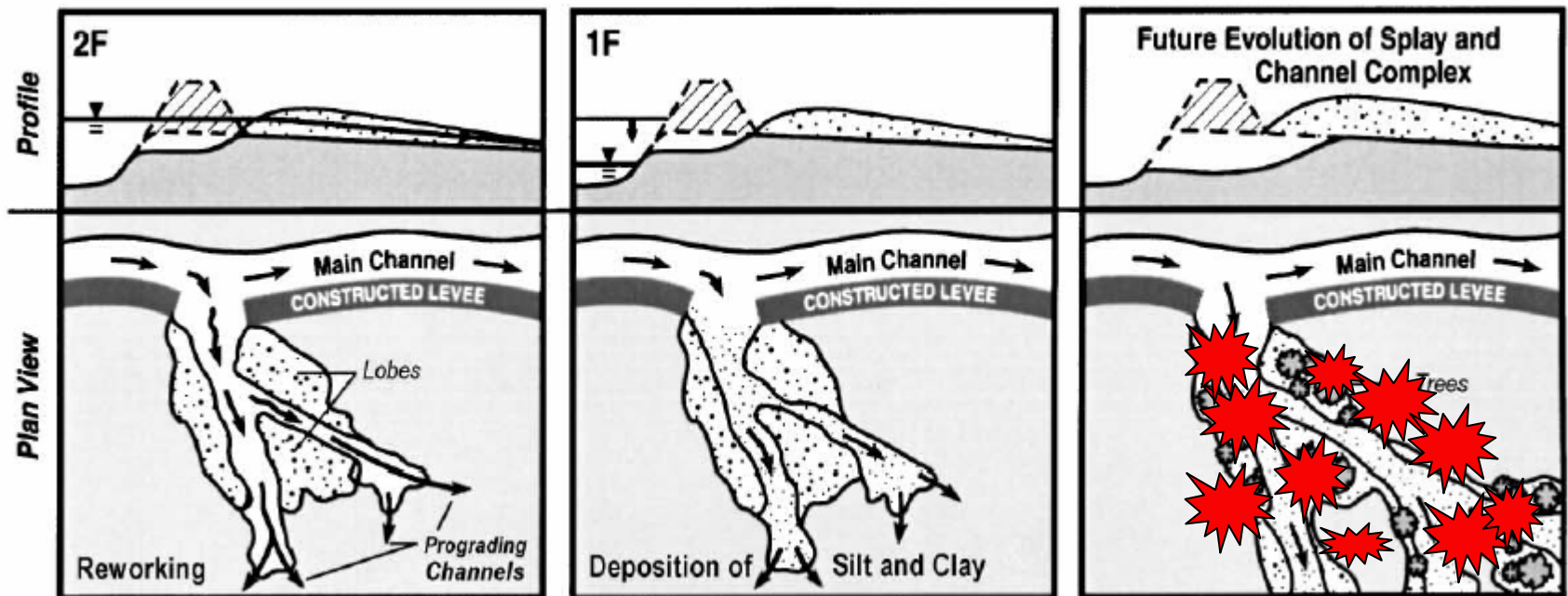
Diversity  
Diversity  
Diversity





# Breached Levees

- Improve Floodplain Connectivity
- Establish Heterogeneous Geomorphology & Habitat
- Provide Invasion Opportunity





# Species Diversity





# Benign Invasion...



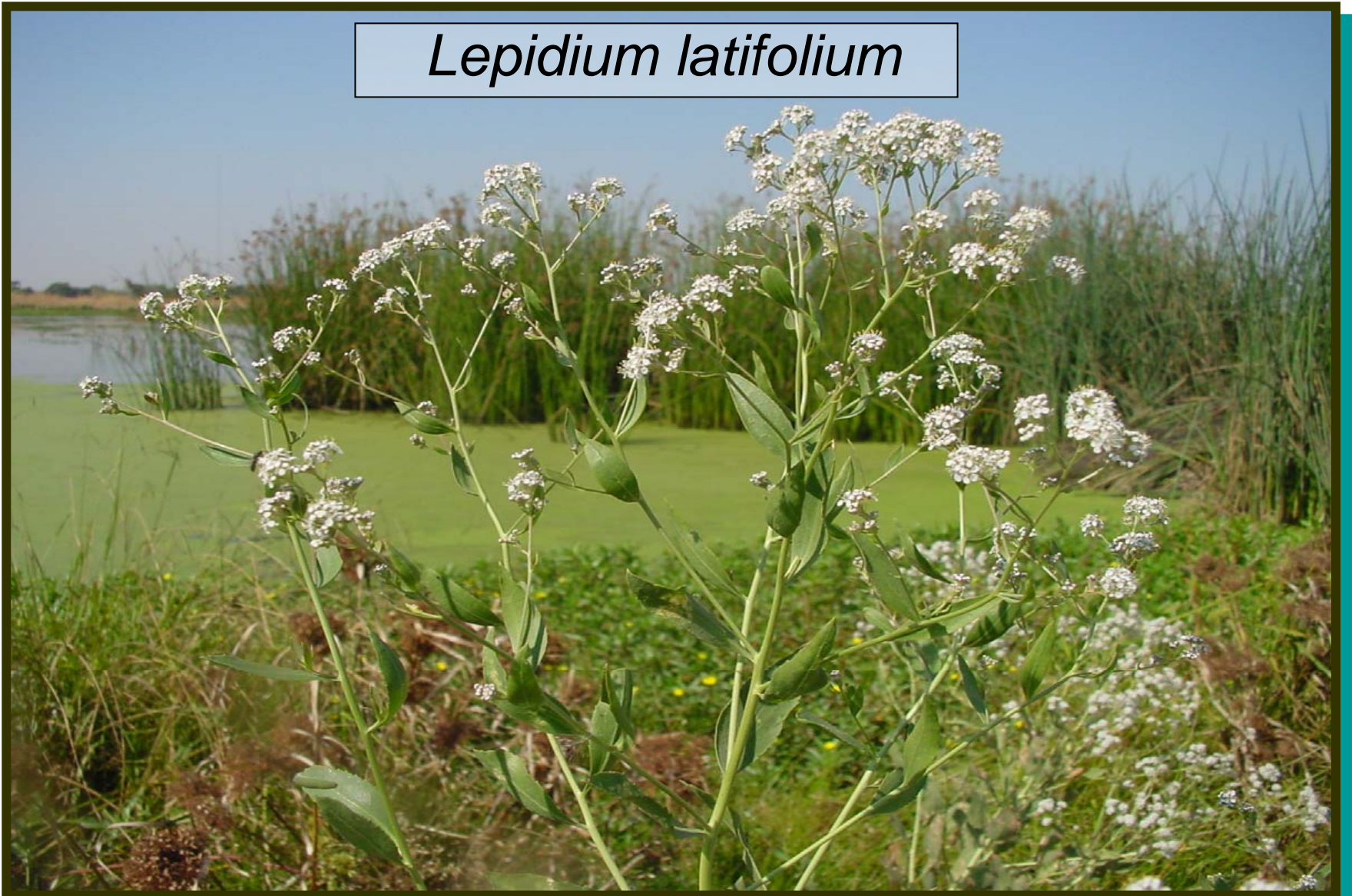
D.S. Ahearn, J.H. Viers, J.F. Mount, R.A. Dahlgren (Freshwater Biology *in review*)

*Flood pulse driven trends in suspended algal biomass distribution across a restored floodplain: Priming the productivity pump*



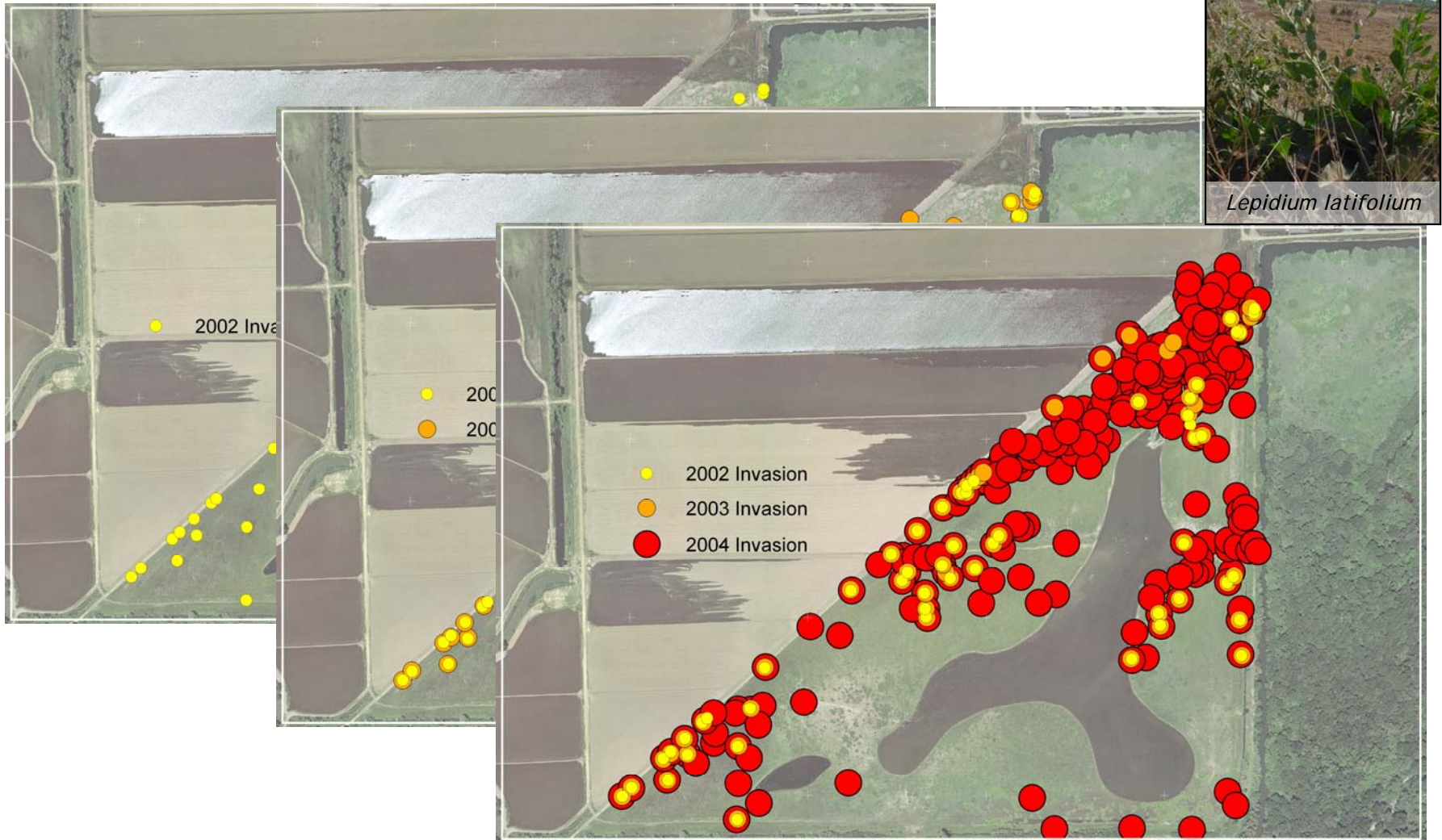
# Not so benign invasion...

*Lepidium latifolium*





# Spatial temporal dynamics of ecosystem processing: deleterious effects (invasion) are perhaps more rapid than desired ones (restoration)



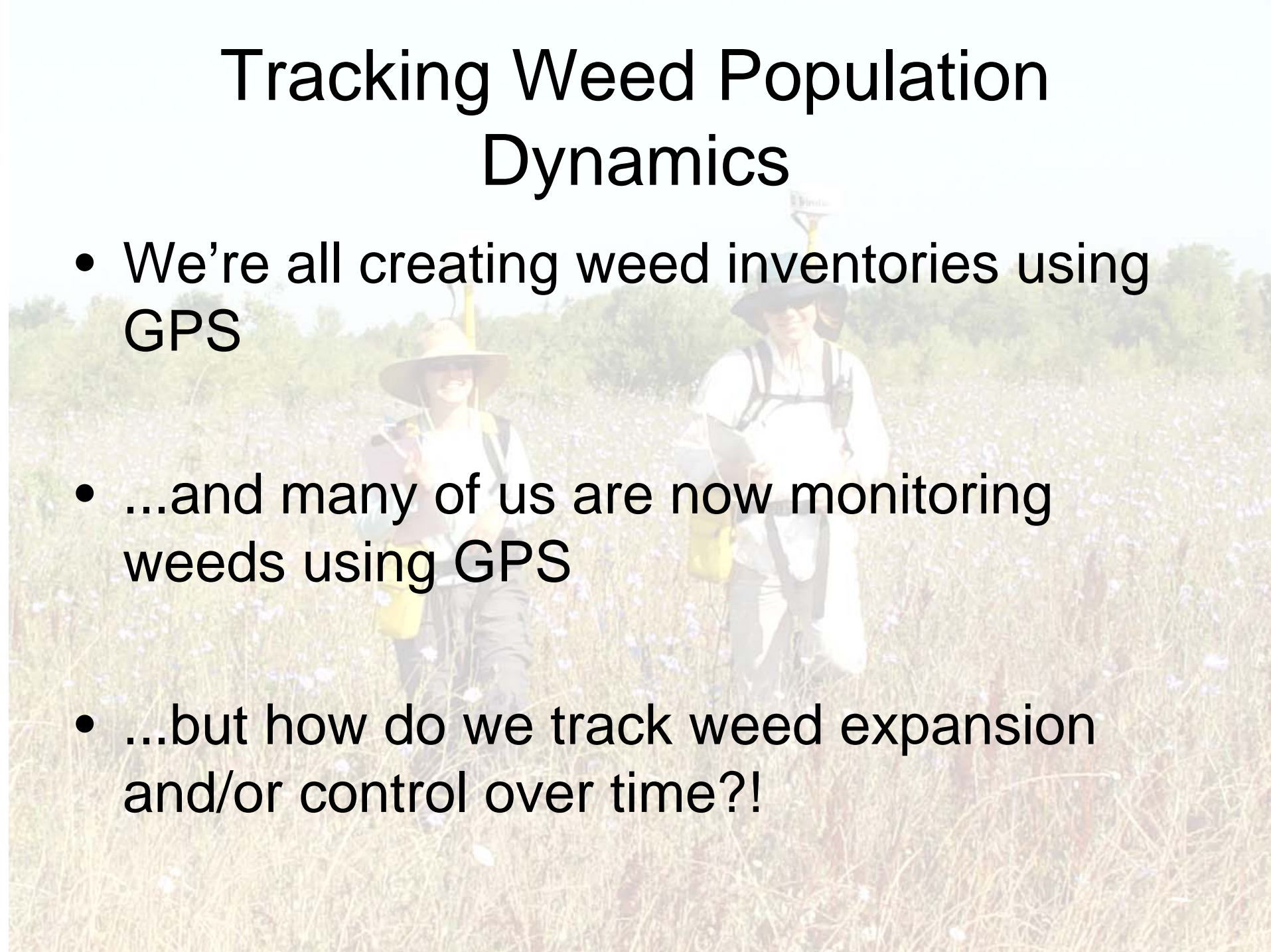


# Ecosystem Restoration & Invasive Species Monitoring



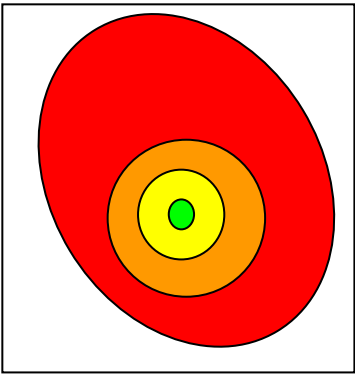
# Tracking Weed Population Dynamics

- We're all creating weed inventories using GPS
- ...and many of us are now monitoring weeds using GPS
- ...but how do we track weed expansion and/or control over time?!



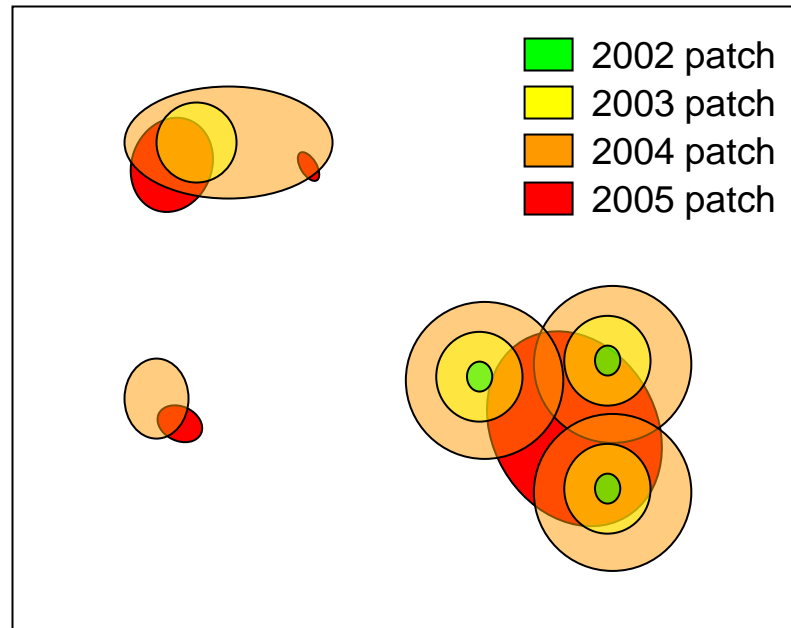
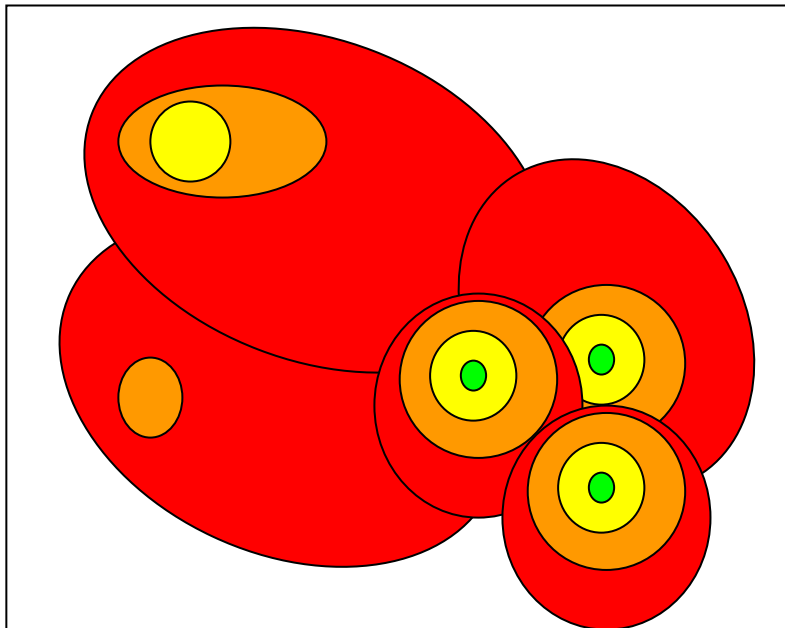


# Problem 1: Merging & Dissolving

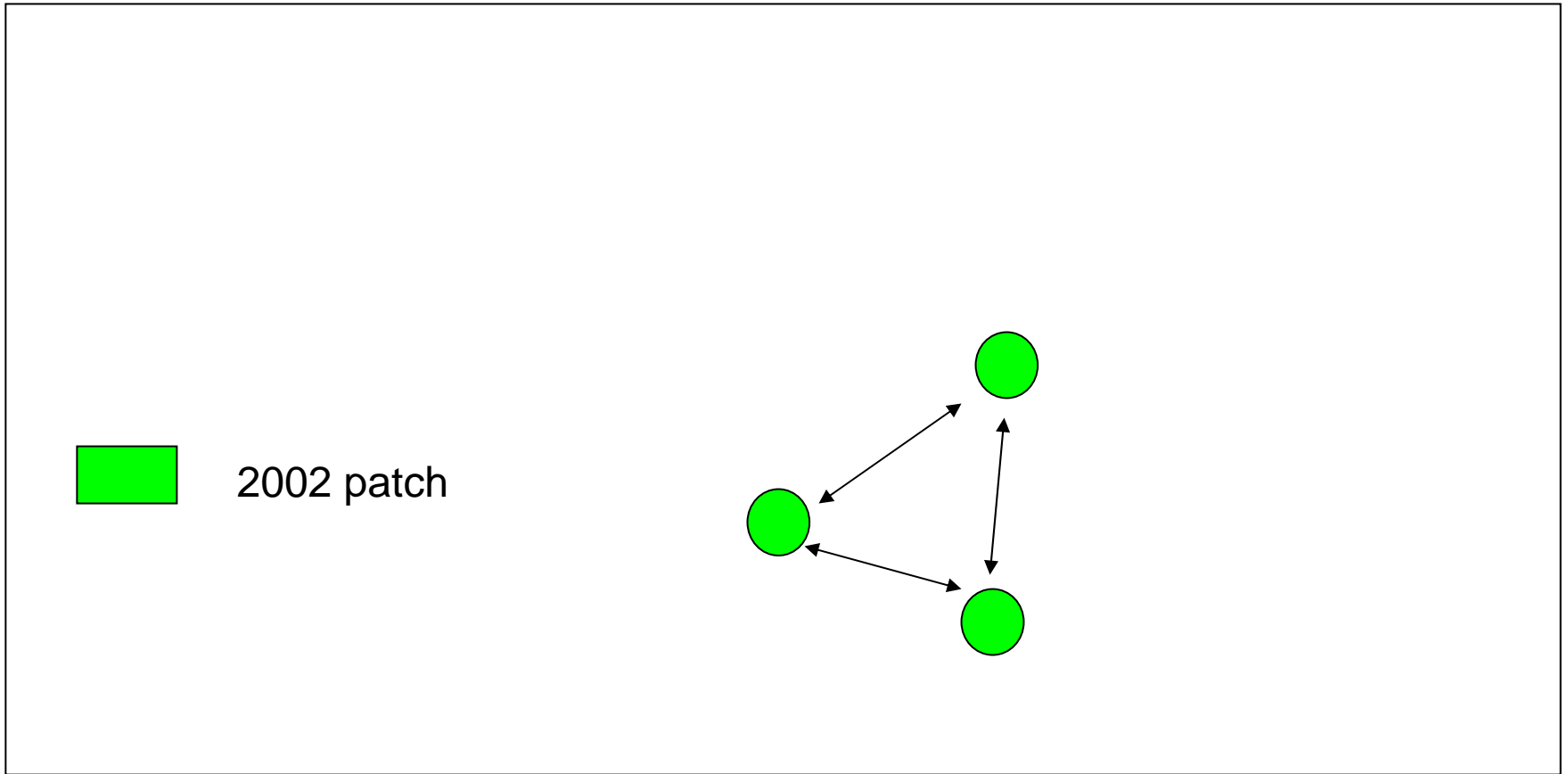


Patch A

How do we track patch-associated data over time if patches merge and dissolve?



# Problem 2: Patch Threshold

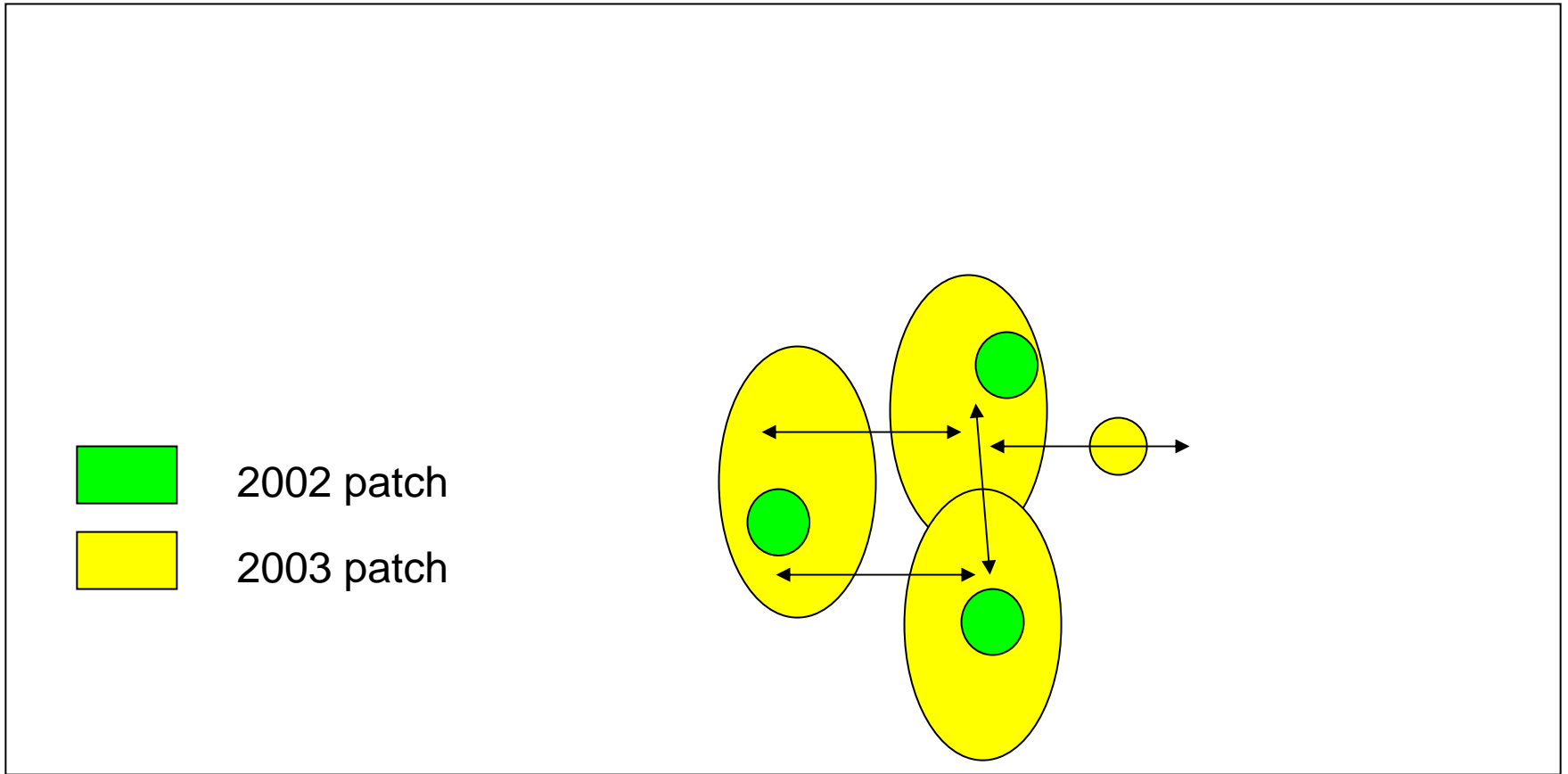


←→  
3 meters

**patch threshold**



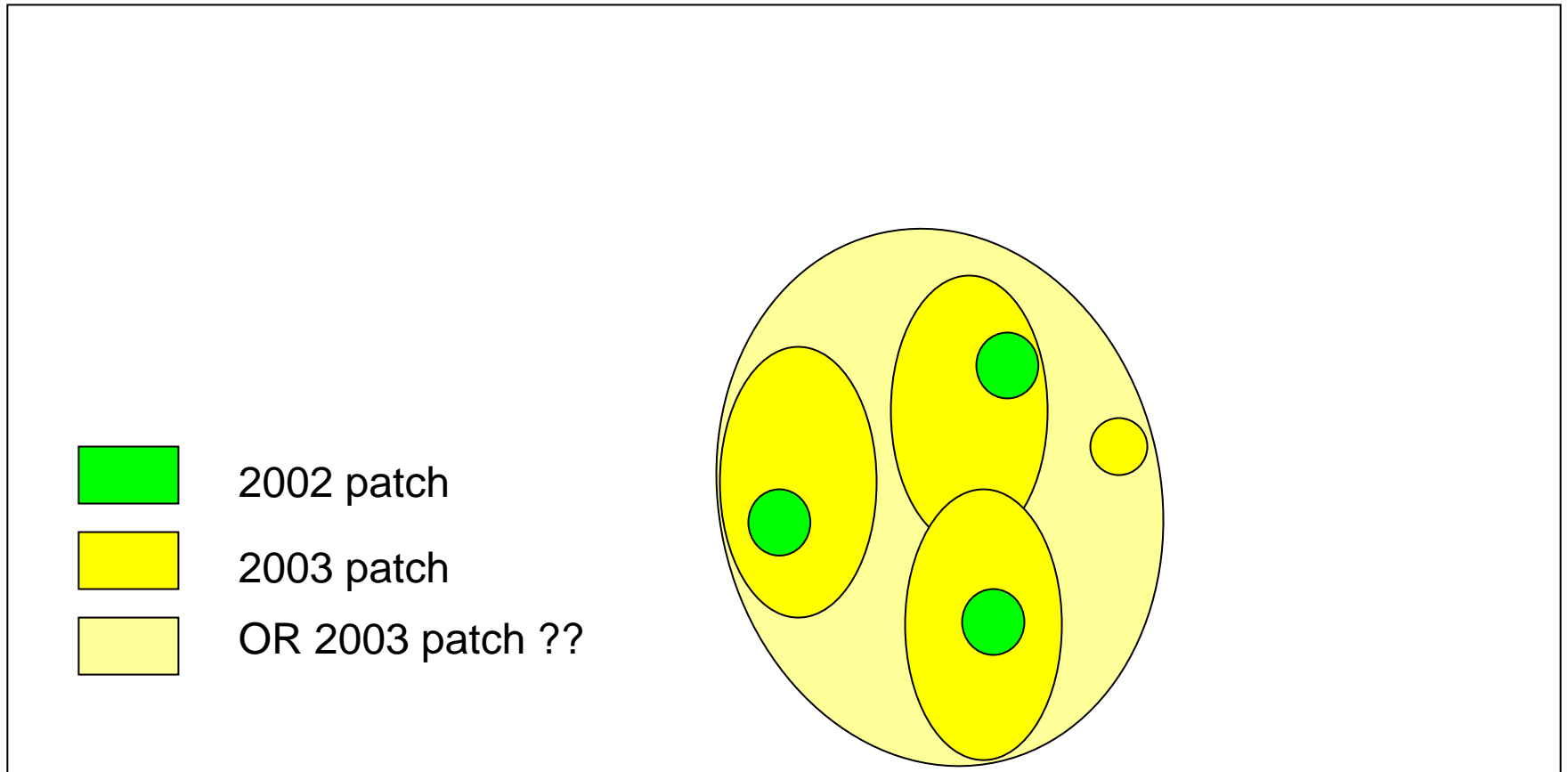
# Problem 2: Patch Threshold



←→  
3 meters

**patch threshold**

# Problem 2: Patch Threshold

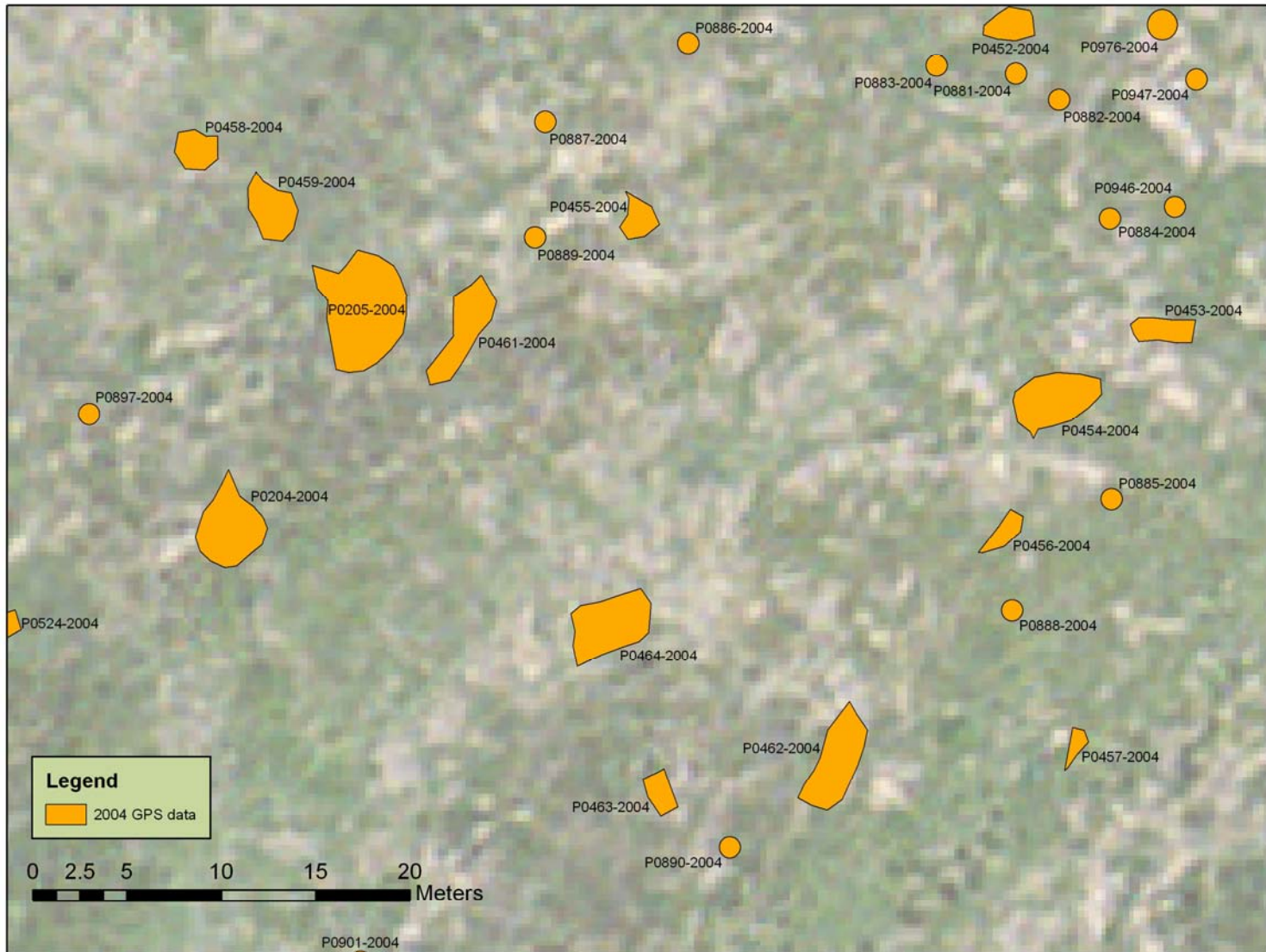


←→  
3 meters

**patch threshold**



# Field-collected GPS Data

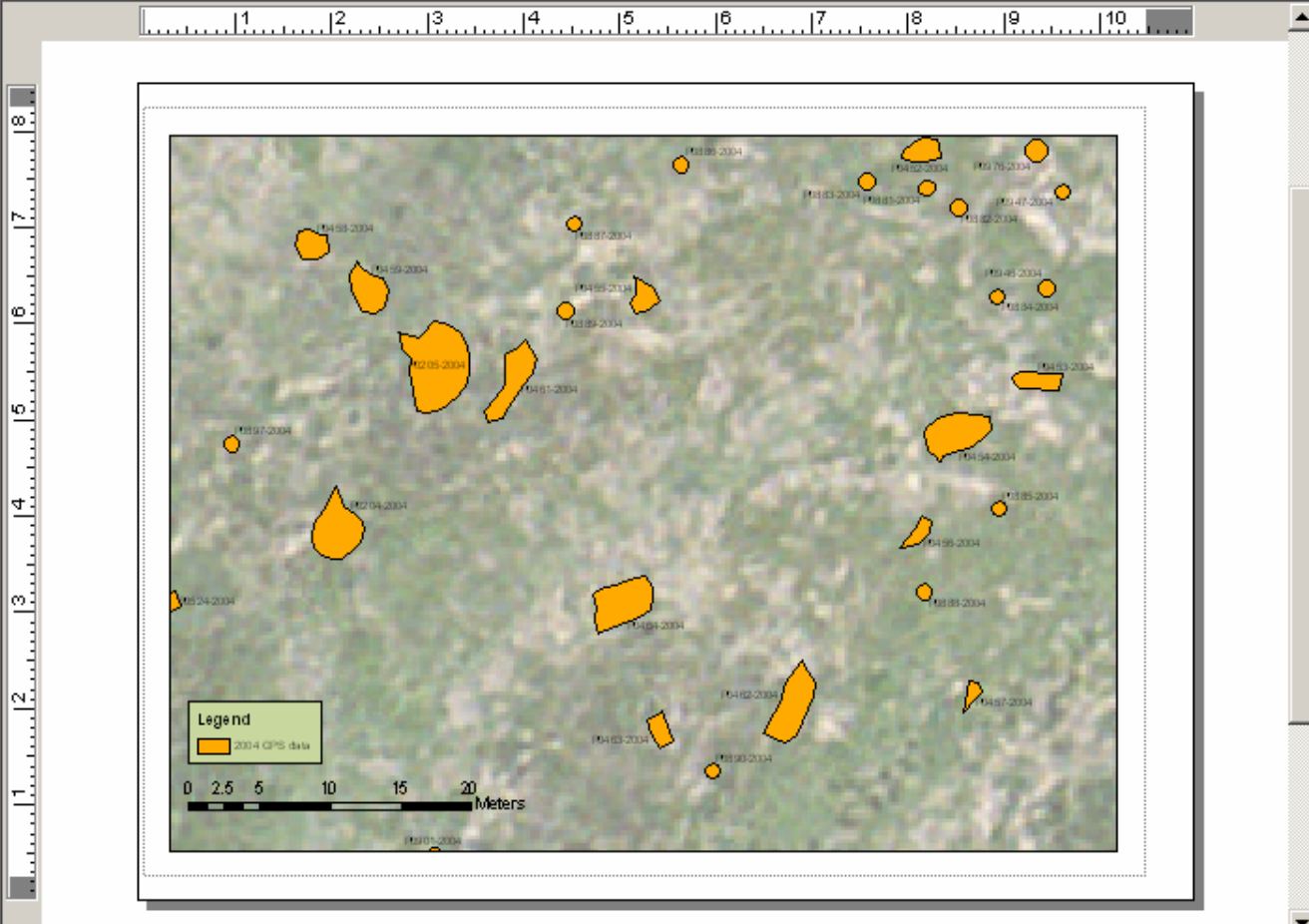


1:267

Analysis Tools

Editor Merge... Task: Create New Feature Target:

- Preserve
  - LCEcornerposts2005
  - LCEplots-CS-M-CO
  - 2005 No Stems Found
  - 2002
  - 2003
  - 2004
    - 2004 GPS data
    - trilow2004 mgmt
    - 2004 LELA patch
      - 2004 LELA patch
    - trilow2004 patches
    - 2004 Lepidium patch
    - all2004\_dispoly
    - 2004 LELA patch
  - 2005
  - Corner Posts
  - 2005 Tracks
  - Buffer\_of\_prbo\_cosumnespc
  - Roads
  - LCEsites
  - WIMS\_areas
  - LCEsites
  - PRBO
  - preserve\_bound
  - water



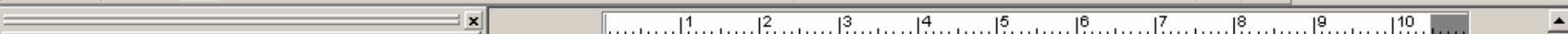
Display Source Selection

Construction: Horizontal Text: Text Symbol:

Drawing

Arial 10 B I U

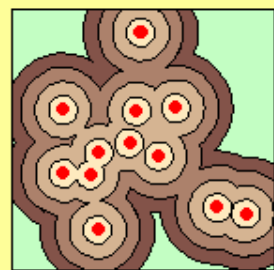




- Preserve**
- LCEcornerposts2005
  - LCEplots-CS-M-CO
  - 2005 No Stems Found
  - 2002
  - 2003
  - 2004
    - 2004 GPS data
    - trilow2004 mgmt
    - 2004 LELA patch
      - 2004 LELA patch
    - trilow2004 patches
    - 2004 Lepidium patch
    - all2004\_dispoly
    - 2004 LELA patch
  - 2005
  - Corner Posts
  - 2005 Tracks
  - Buffer\_of\_prbo\_cosumnespc
  - Roads
  - LCEsites
  - WIMS\_areas
  - LCEsites
  - PRBO
  - preserve\_bound
  - water

**Buffer Wizard****About buffers**

Buffers are rings drawn around features at a specified distance from the features.



What do you want to buffer?

The graphics in the data frame (Default Annotation Target)

The features of a layer

2004 GPS data

Number of features: All Features

Number of features selected: 0

Use only the selected features

&lt; Back

Next &gt;

Cancel

0 2.5 5 10 15 20 Meters

- Preserve
  - LCEcornerposts2005
  - LCEplots-CS-M-CO
  - 2005 No Stems Found
  - 2002
  - 2003
  - 2004
    - 2004 GPS data
    - trilow2004 mgmt
    - 2004 LELA patch
      - 2004 LELA patch
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  - Buffer\_of\_prbo\_cosumnespc
  - Roads
  - LCEsites
  - WIMS\_areas
  - LCEsites
  - PRBO
  - preserve\_bound
  - water

### Buffer Wizard

How do you want to create buffers?

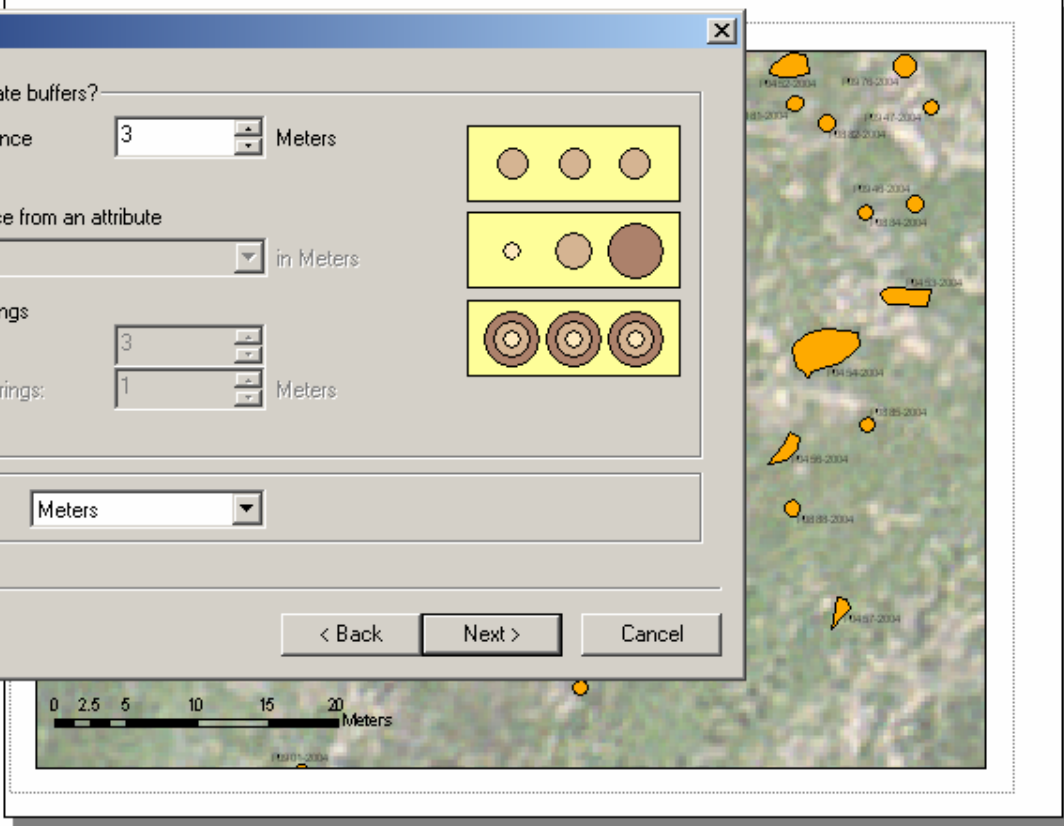
At a specified distance  Meters

Based on a distance from an attribute  
 in Meters

As multiple buffer rings  
Number of rings:   
Distance between rings:  Meters

Buffer distance  
Distance units are:

< Back Next > Cancel







Editor Merge... Task: Create New Feature Target:

- Preserve
  - LCEcornerposts2005
  - LCEplots-CS-M-CO
  - 2005 No Stems Found
  - 2002
  - 2003
  - 2004
    - 2004 GPS data
    - trilow2004 mgmt
    - 2004 LELA patch
      - 2004 LELA patch
    - trilow2004 patches
    - 2004 Lepidium patch
    - all2004\_dispoly
    - 2004 LELA patch
  - 2005
  - Corner Posts
  - 2005 Tracks
  - Buffer\_of\_prbo\_cosumnespc
  - Roads
  - LCEsites
  - WIMS\_areas
  - LCEsites
  - PRBO
  - preserve\_bound
  - water

### Buffer Wizard

Buffer output type

Dissolve barriers between  Yes  No

Create buffers so they are

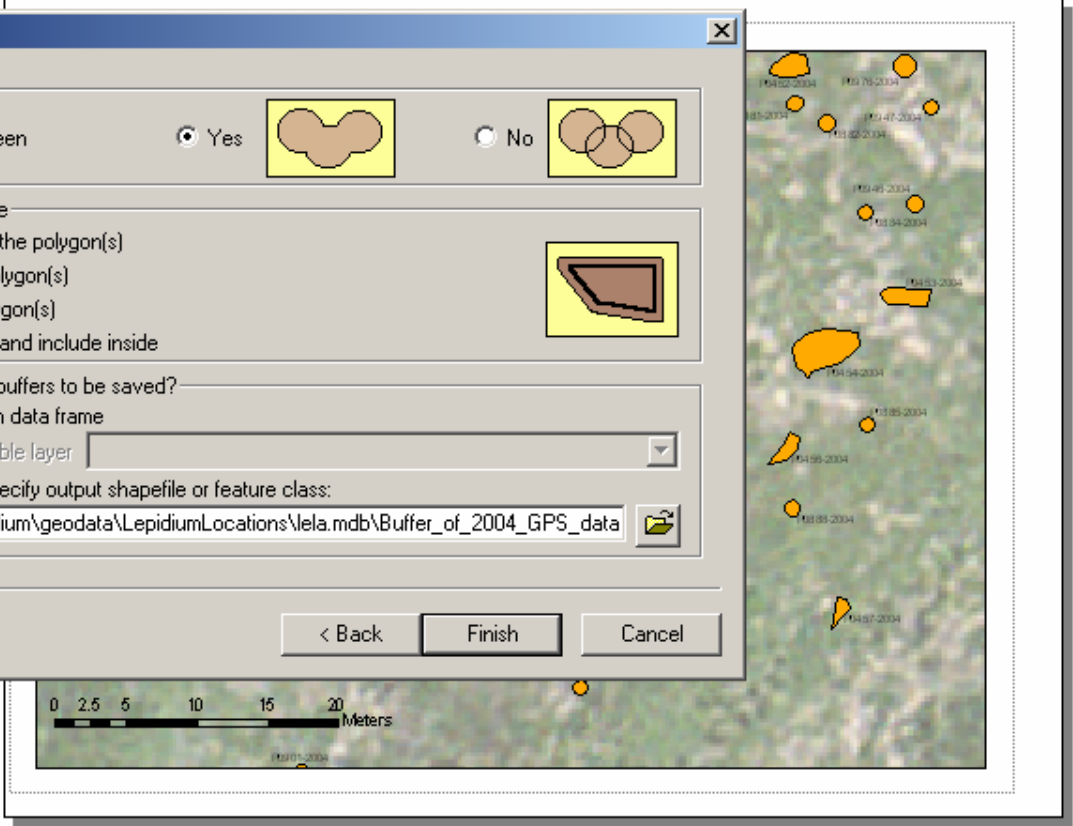
- inside and outside the polygon(s)
- only outside the polygon(s)
- only inside the polygon(s)
- outside polygon(s) and include inside

Where do you want the buffers to be saved?

- As graphics layer in data frame
- In an existing editable layer
- In a new layer. Specify output shapefile or feature class:

projects\crg\lepidium\geodata\LepidiumLocations\lela.mdb\Buffer\_of\_2004\_GPS\_data

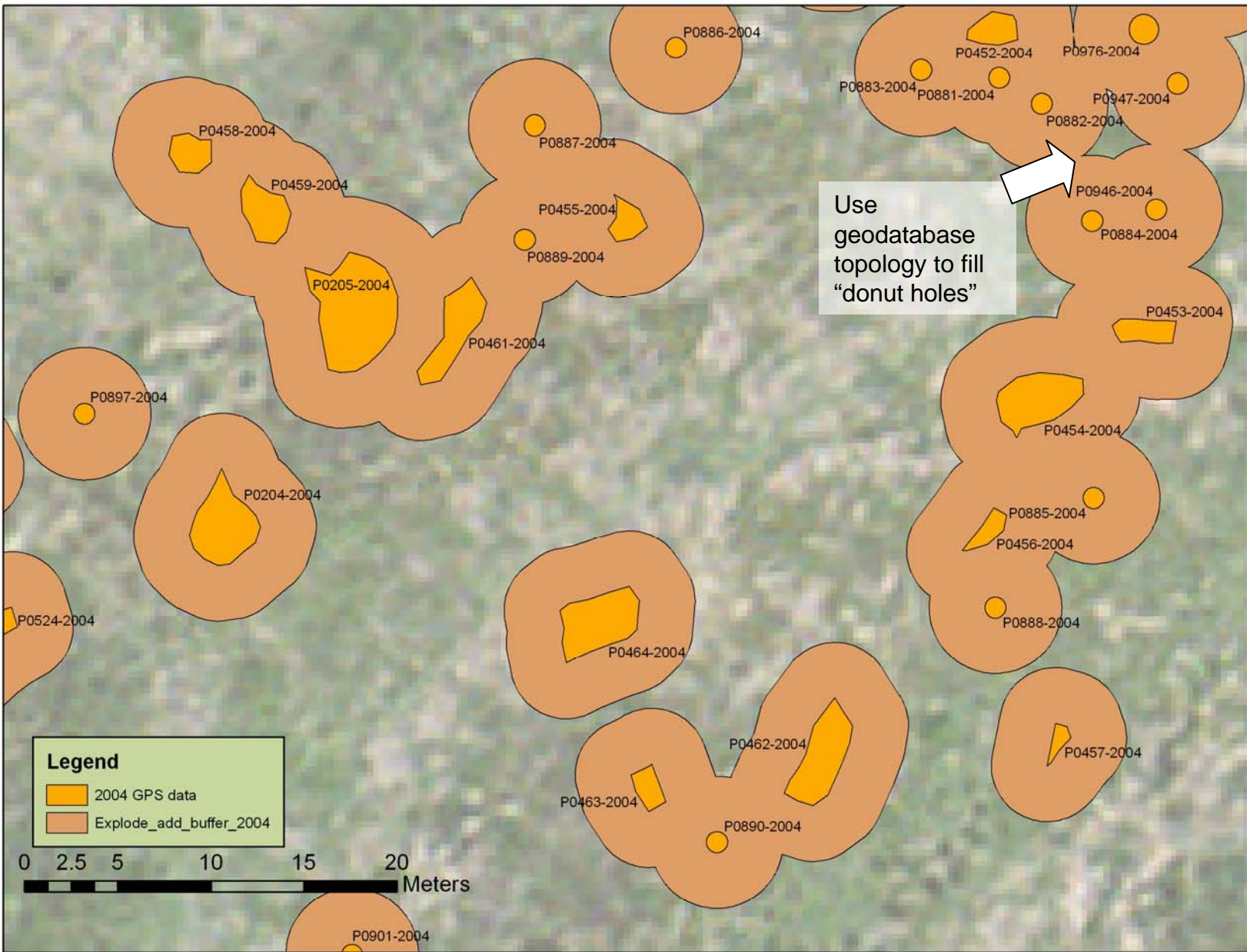
< Back Finish Cancel



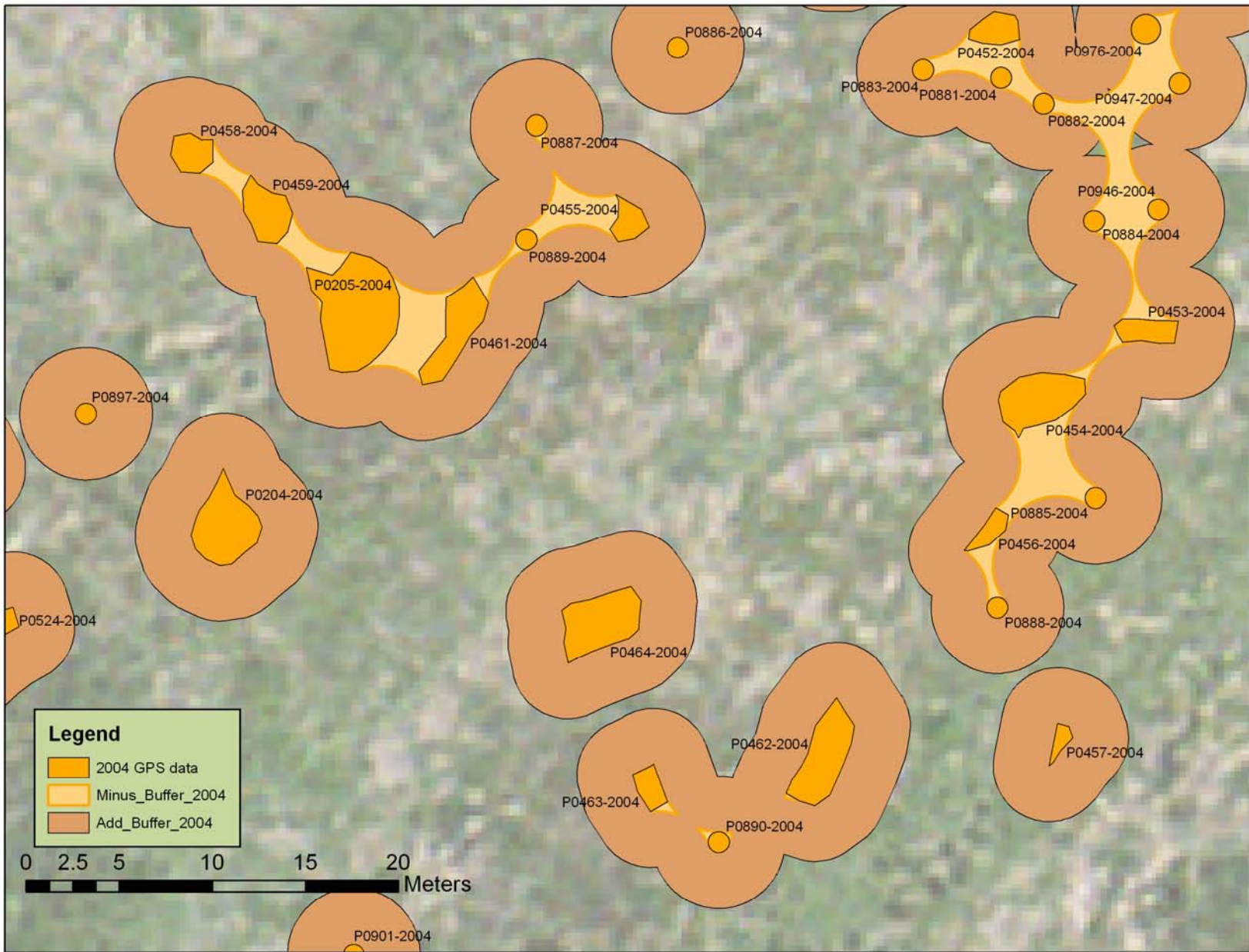
Display Source Selection

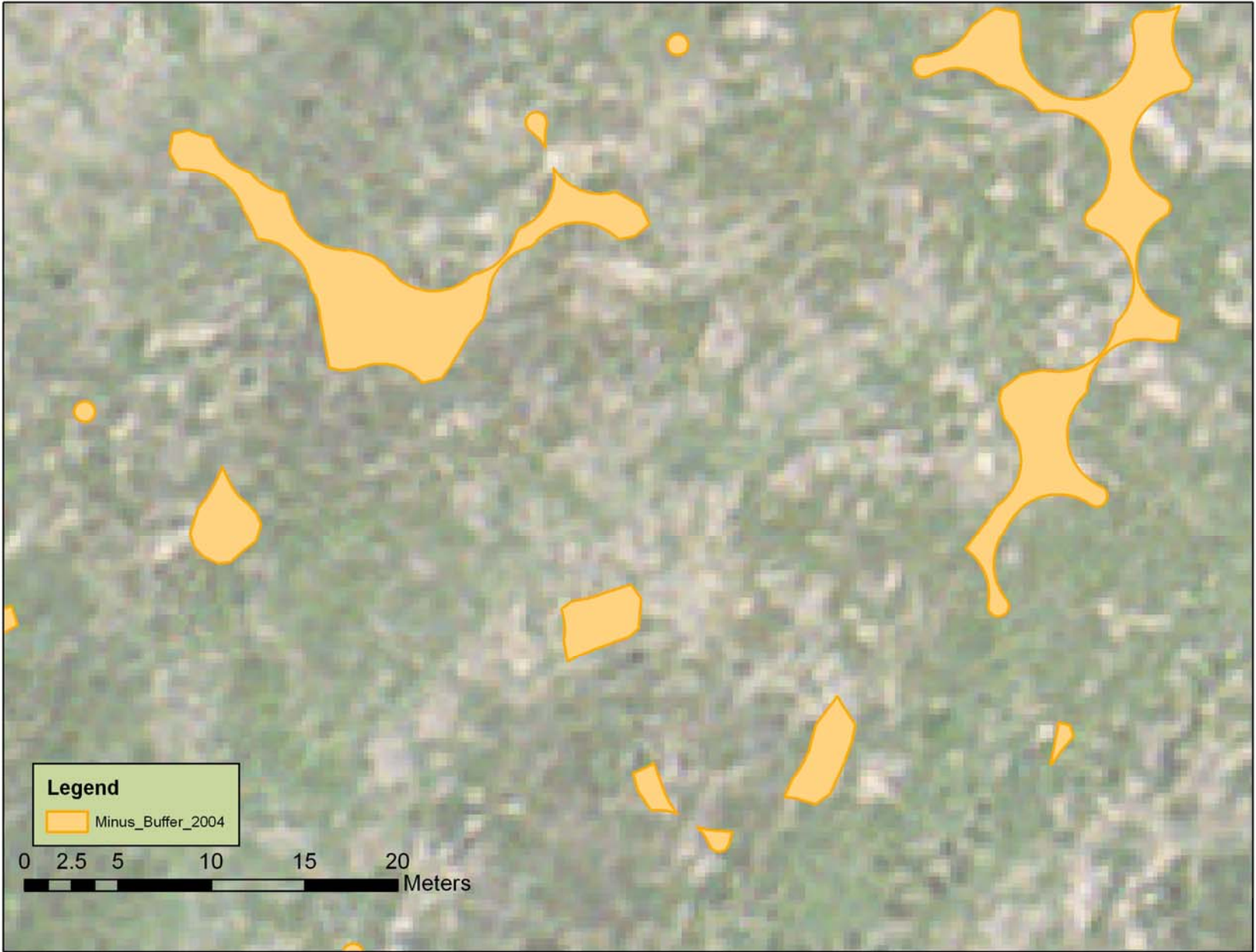
Construction: Horizontal Text: Text Symbol:

Drawing Arial 10 B I U











1:270 Analysis Tools 40%

Editor Merge... Task: Create New Feature Target:

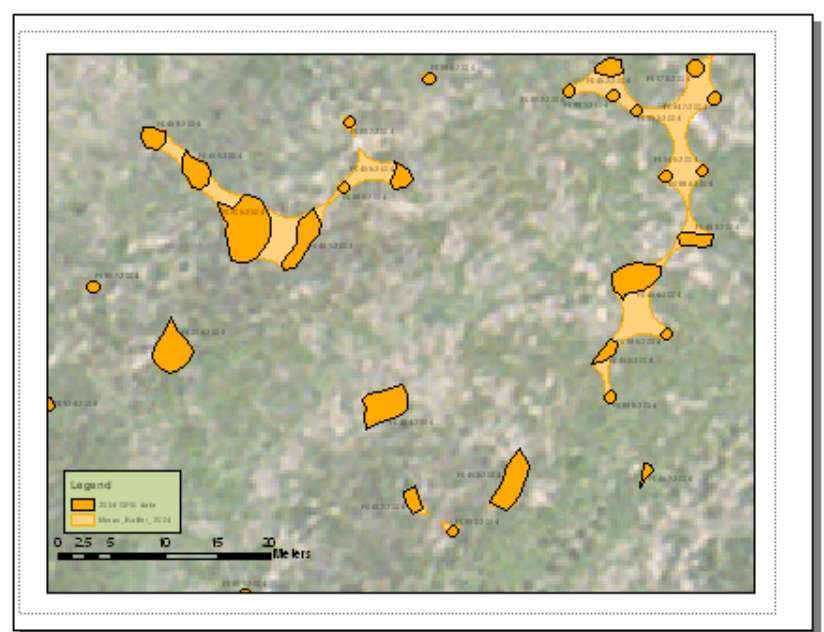
1 2 3 4 5 6 7 8 9 10

**Preserve**

- LCEcornerposts2005
- LCEplots-CS-M-CO
- 2005 No Stems Found
- 2002
- 2003
- 2004
  - 2004 GPC data
    - Minus\_Buffer
    - Add\_Buffer
  - trilow2005
  - 2004 LEI
  - trilow2004
  - all2004
- 2005
- Corner Posts
- 2005 Tracks
- Buffer\_of\_plots
- Roads
- LCEsites
- WIMS\_areas
- LCEsites
- PRBO
- preserve\_buffers
- water
- HiRes Photos

Display Source Selection Properties...

- Copy
- Remove
- Open Attribute Table
- Joins and Relates**
  - Join...**
  - Remove Join(s)
  - Relate...
  - Remove Relate(s)
- Zoom To Layer
- Visible Scale Range
- Use Symbol Levels
- Selection
  - Label Features
  - Convert Labels to Annotation...
  - Convert Features to Graphics...
- Data
  - Save As Layer File...
- Make Permanent
- Properties...



Construction: Horizontal Text: Text Symbol:

Drawing Arial 10 B I U

**Join Data** [X]

Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.

What do you want to join to this layer?

Join data from another layer based on spatial location

1. Choose the layer to join to this layer, or load spatial data from disk:
2. You are joining: Polygons to Polygons  
 Select a join feature class above. You will be given different options based on geometry types of the source feature class and the join feature class.
  - Each polygon will be given a summary of the numeric attributes of the polygons in the layer being joined that intersect it, and a count field showing how many polygons intersect it.

How do you want the attributes to be summarized?

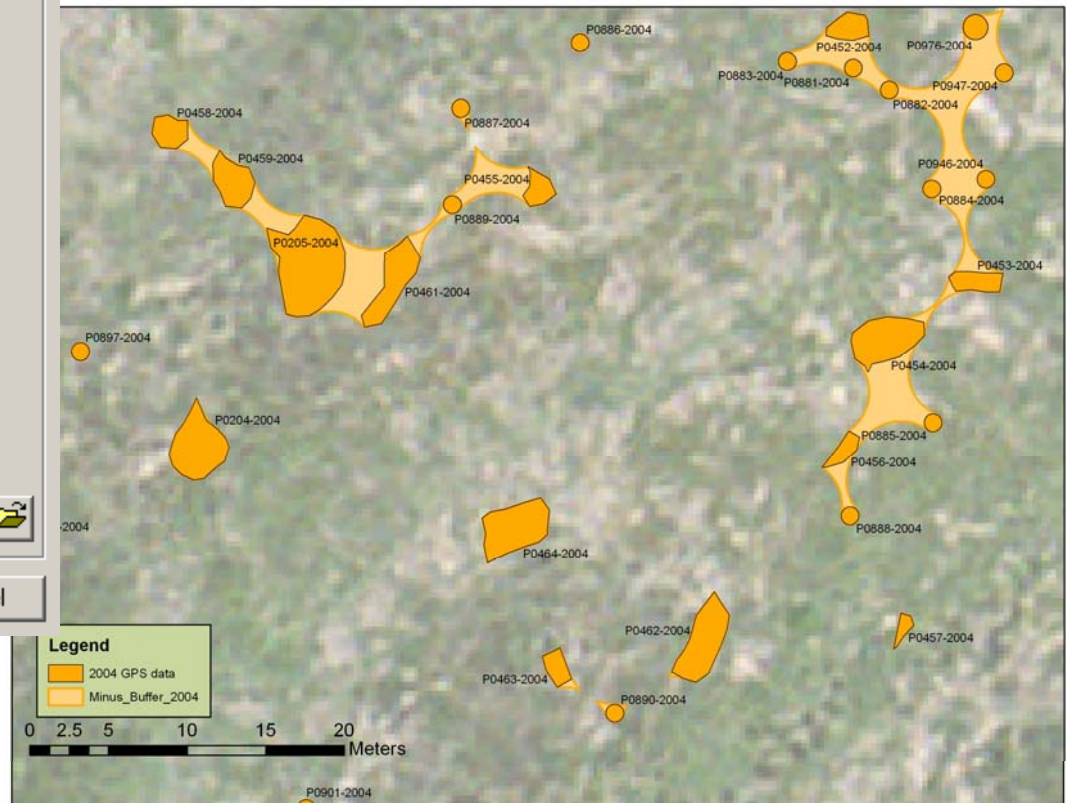
Average     Minimum     Standard Deviation  
 Sum     Maximum     Variance

- Each polygon will be given the attributes of the polygon it falls completely inside of in the layer being joined. If a polygon falls inside more than one polygon in the layer being joined, the first one found will be joined.

3. The result of the join will be saved into a new layer.  
 Specify output shapefile or feature class for this new layer:

# Spatial Join

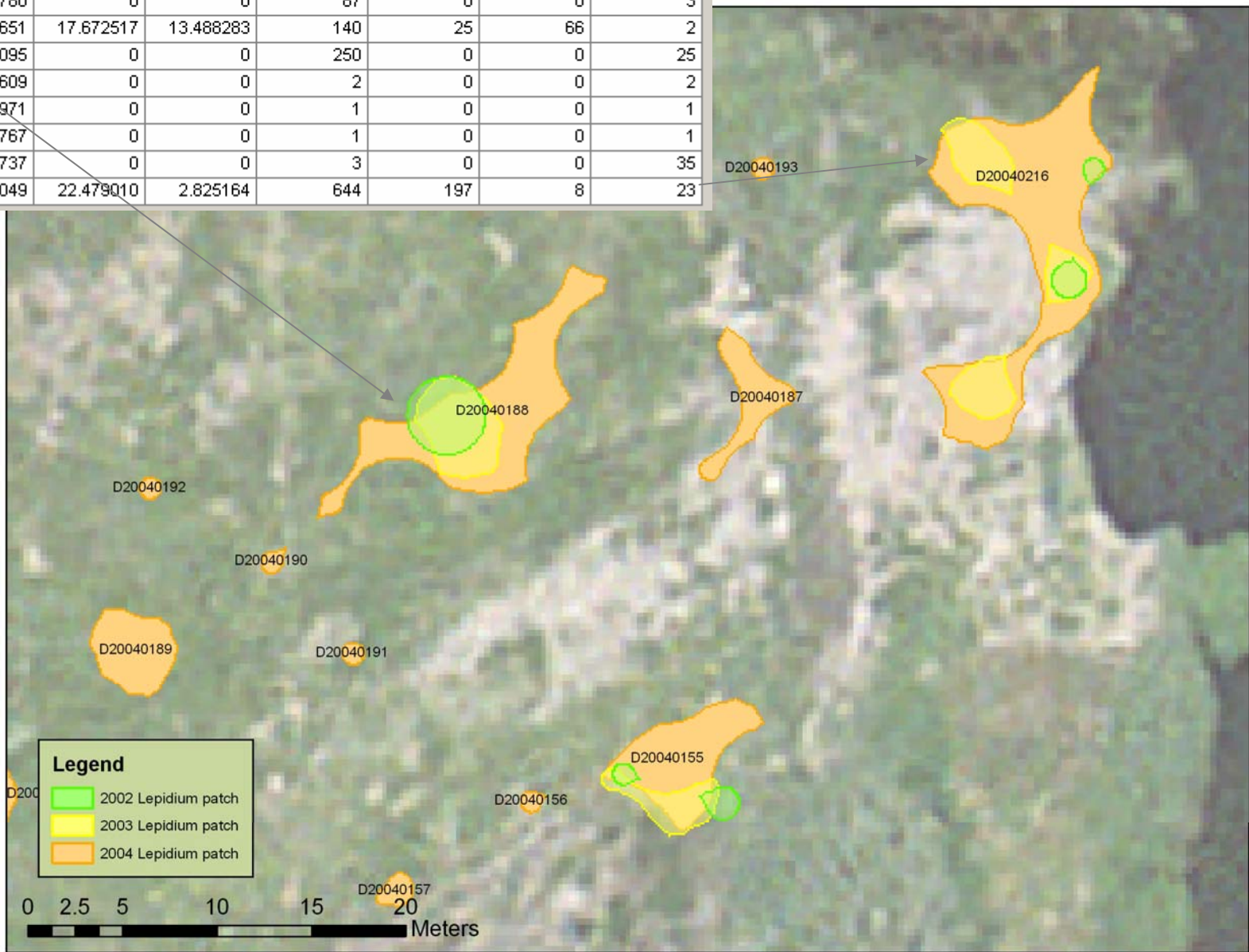
## Attribute GIS-modified patches with field data

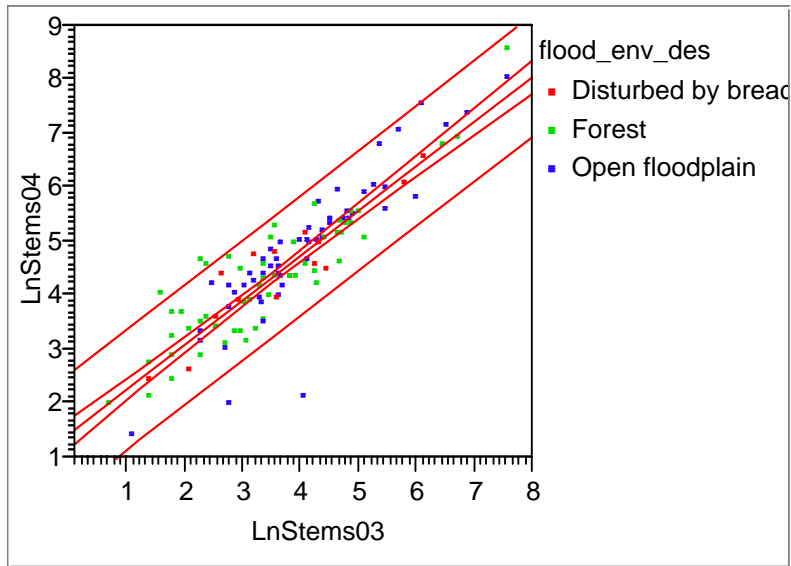




Selected Attributes of Data: 02-03-04

DisID	Area04	Area03	Area02	StemCt04	StemCt03	StemCt02	DCover04
D20040052	2.615477	0	0	15	0	0	3
D20040155	26.561242	9.580092	0	75	20	0	3
D20040156	1.099838	0	0	3	0	0	5
D20040157	2.383087	0	0	13	0	0	4
D20040187	11.965780	0	0	87	0	0	3
D20040188	54.647651	17.672517	13.488283	140	25	66	2
D20040189	15.356095	0	0	250	0	0	25
D20040190	1.177609	0	0	2	0	0	2
D20040191	1.006971	0	0	1	0	0	1
D20040192	0.993767	0	0	1	0	0	1
D20040193	0.993737	0	0	3	0	0	35
D20040216	79.874049	22.479010	2.825164	644	197	8	23





#### Linear Fit

$$\text{LnStems04} = 1.4130218 + 0.8310672 \text{ LnStems03}$$

#### Summary of Fit

RSquare 0.825405  
 RSquare Adj 0.823986  
 Root Mean Square Error 0.556839  
 Observations 125

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	180.30159	180.302	581.4874
Error	123	38.13857	0.310	Prob > F
C. Total	124	218.44016		<.0001

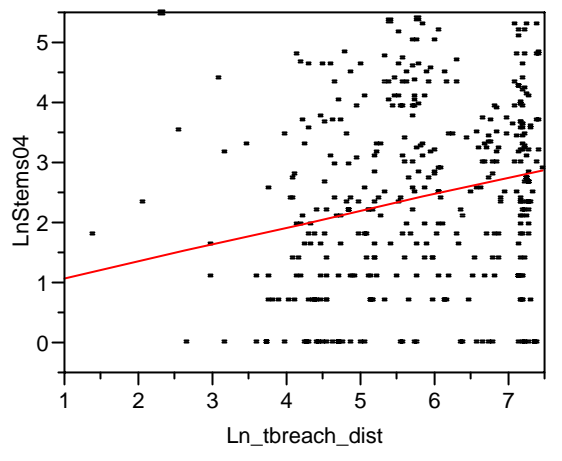
## Rate of Growth

Three years of monitoring data are being used to inform spatially explicit models to predict rates of spread, and areas of the landscape most likely to become infested.



## Fit Y by X Group

### Bivariate Fit of LnStems04 By Ln\_tbreach\_dist



— Linear Fit

### Linear Fit

$$\text{LnStems04} = 0.815539 + 0.2777539 \text{ Ln\_tbreach\_dist}$$

### Summary of Fit

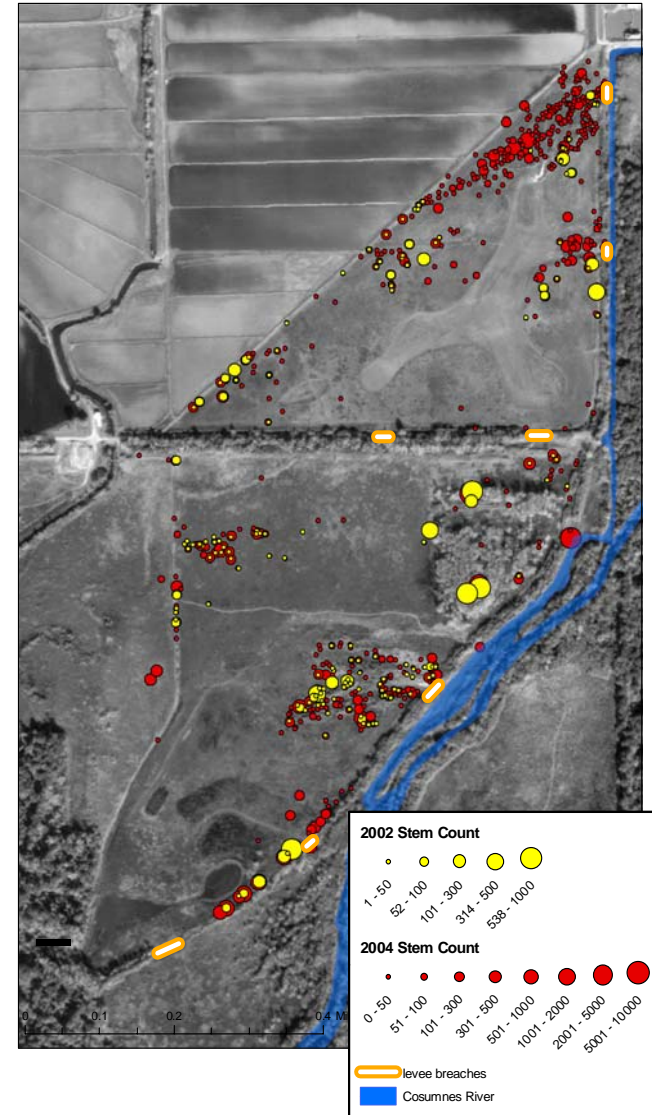
RSquare	0.053292
RSquare Adj	0.050794
Root Mean Square Error	1.419753
Mean of Response	2.437373
Observations (or Sum Wgts)	381

### Analysis of Variance

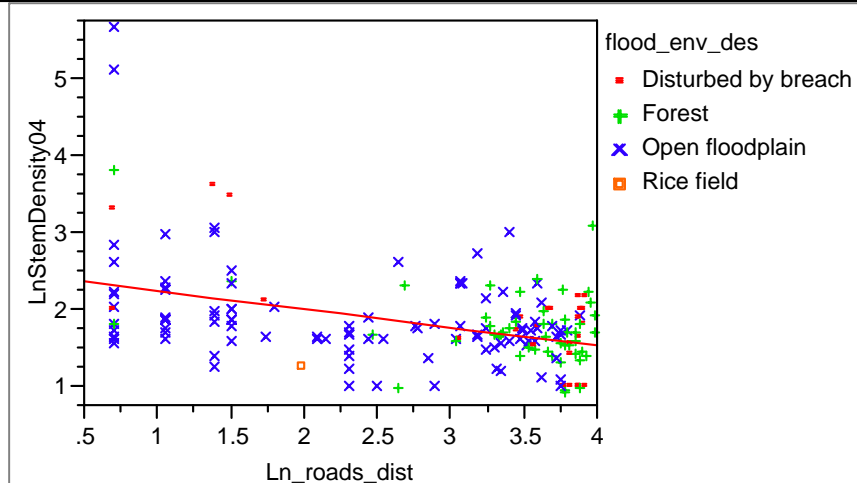
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	43.00385	43.0038	21.3345
Error	379	763.94936	2.0157	Prob > F
C. Total	380	806.95321		<.0001

### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	0.815539	0.358583	2.27	0.0235
Ln_tbreach_dist	0.2777539	0.060134	4.62	<.0001



## Bivariate Fit of LnStemDensity04 By Ln\_roads\_dist



— Linear Fit

### Linear Fit

$$\text{LnStemDensity04} = 2.4873119 - 0.2378733 \text{ Ln\_roads\_dist}$$

### Summary of Fit

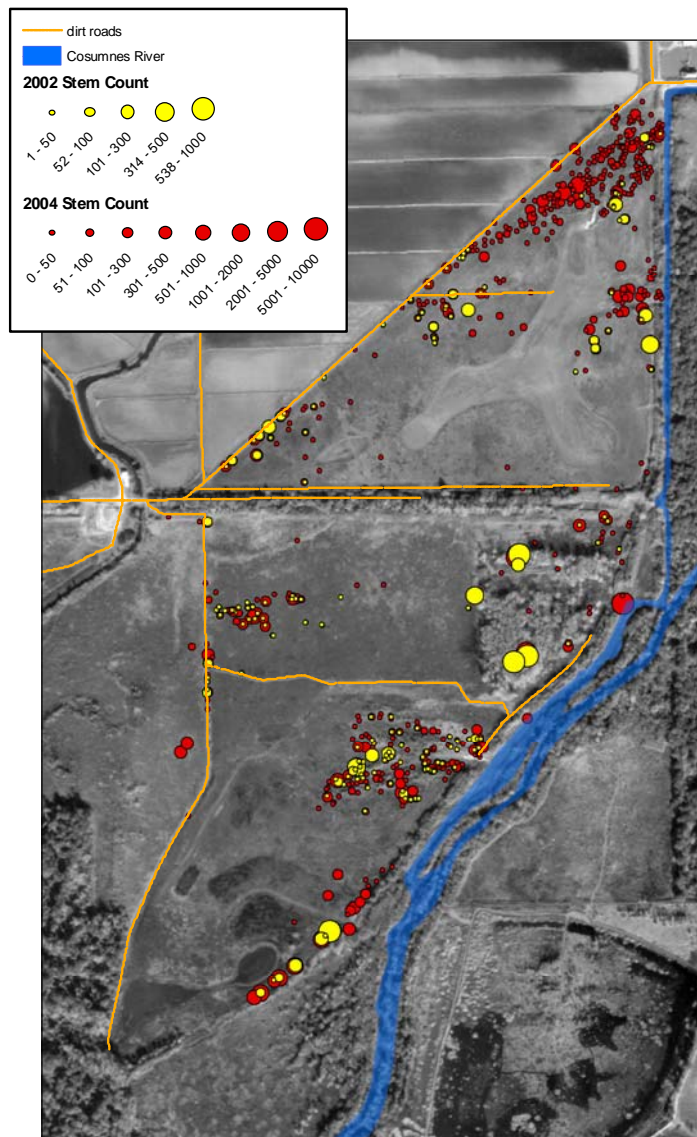
RSquare	0.175056
RSquare Adj	0.170203
Root Mean Square Error	0.570533
Mean of Response	1.84062
Observations (or Sum Wgts)	172

### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	11.742545	11.7425	36.0746
Error	170	55.336264	0.3255	Prob > F
C. Total	171	67.078809		<.0001

### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	2.4873119	0.116127	21.42	<.0001
Ln_roads_dist	-0.237873	0.039605	-6.01	<.0001



0 0.1 0.2 0.4 Miles



# Acknowledgments

## *ICE Interns:*

Rachel Hutchinson, Jorgina Cuixart, Joel Bonilla, Betsy Harbert, Lisa Kashiwase

## *The Nature Conservancy:*

Becky Waegell, Mandy Tu, Jamie Marty, Jennifer Buck

## *John Muir Institute of the Environment:*

Ellen Mantalica, Diana Cummings, Carson Jeffres, John Kochendorfer

## *UC Davis, Department of Environmental Science & Policy:*

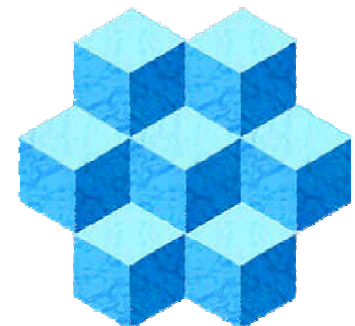
Jim Quinn, Mark Schwartz

## *California Bay-Delta Authority:*

Ecological Restoration Program (Award # ERP-01-NO1)



Cosumnes  
Research Group



Information Center  
for the Environment

Questions?






**Main Menu**

Exit Access

# Weeds Information Management System



6/15/05

Edit / Display Data

- Find/Create Occurrences
- Find/Create Areas/Surveys
- Find Treatments
- Reports

Inputs / Outputs

- Excel Export
- Excel Import

Misc. Functions

- Support Tables

**Start Menu**

## Weed Information Management System

### WIMS

version 3.15m (beta)

*Welcome to WIMS. You may choose from the following activities to manage your weed data.*

**Work with Data**

[Create New Org](#)

or Select an existing Organization

Set as default

**Handheld & GIS Operations**

[Handheld Setup](#)

[GIS Export](#) [GIS Import](#)

**View Data**

[Occurrences](#)

[Treatments](#)

**Support Lists**

Plants

**Reports**

Select Report

**Import & Export Data**

[Export](#)

[Import](#)

[Re-Link Tables](#) [Exit WIMS](#)

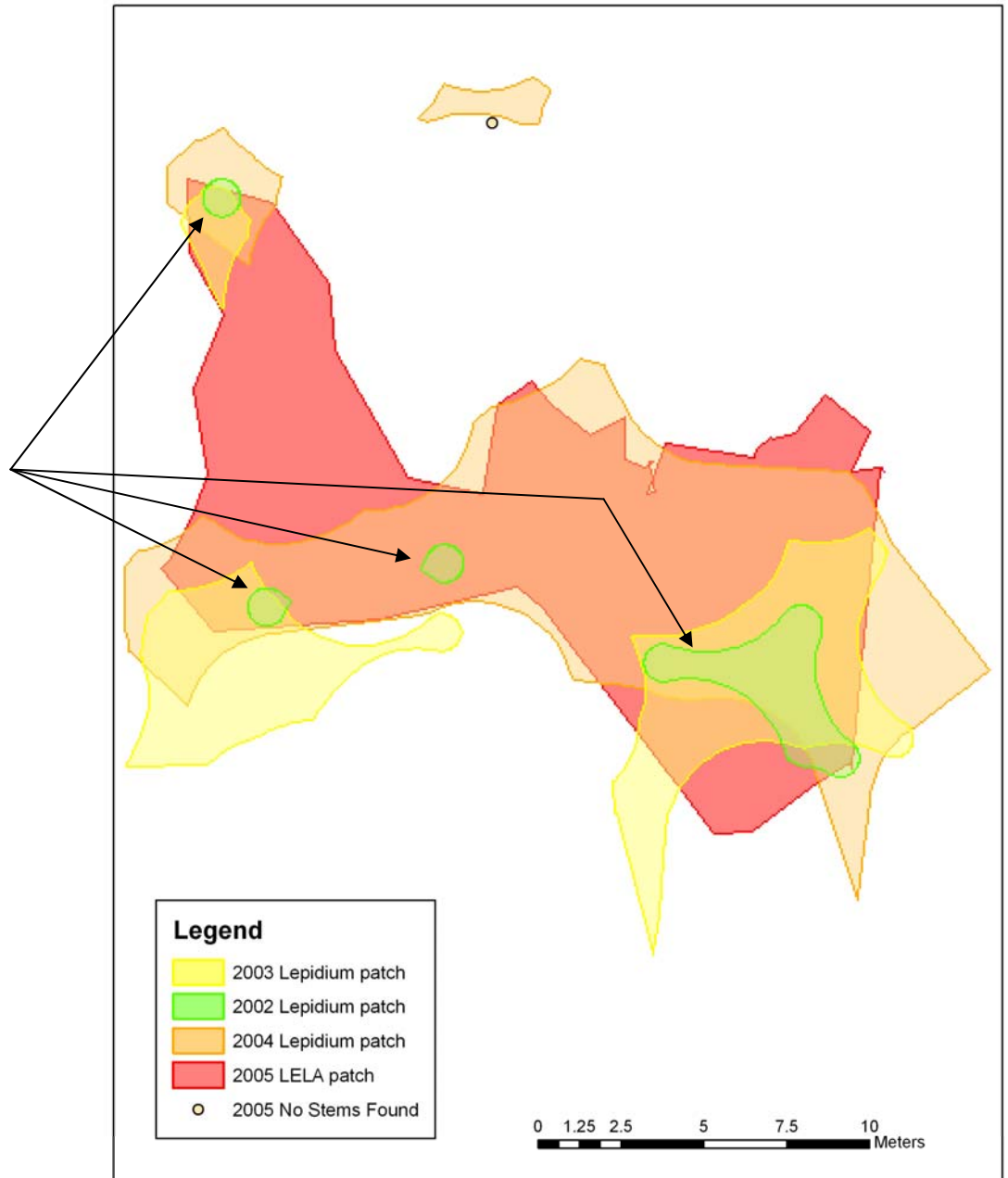




# Scenario One: Isolated patches

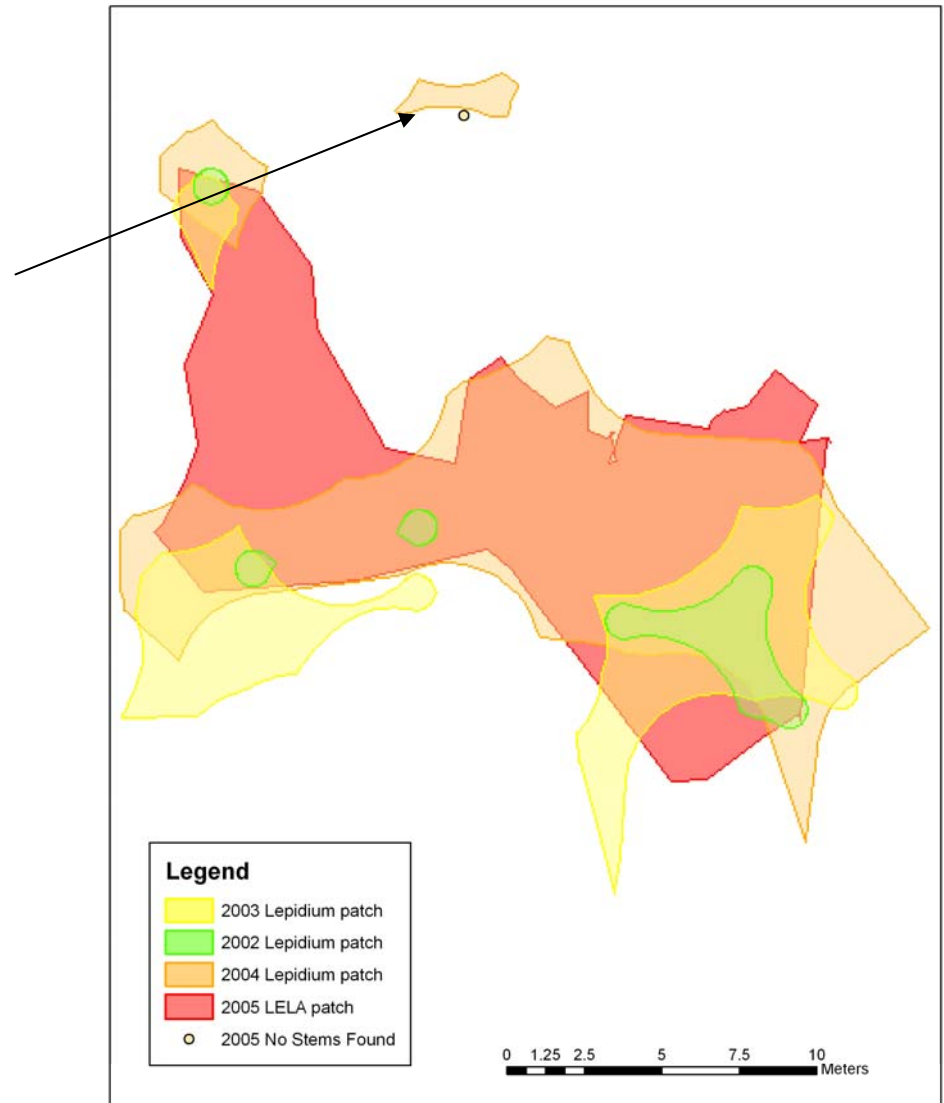


# Scenario Two: Patches merge

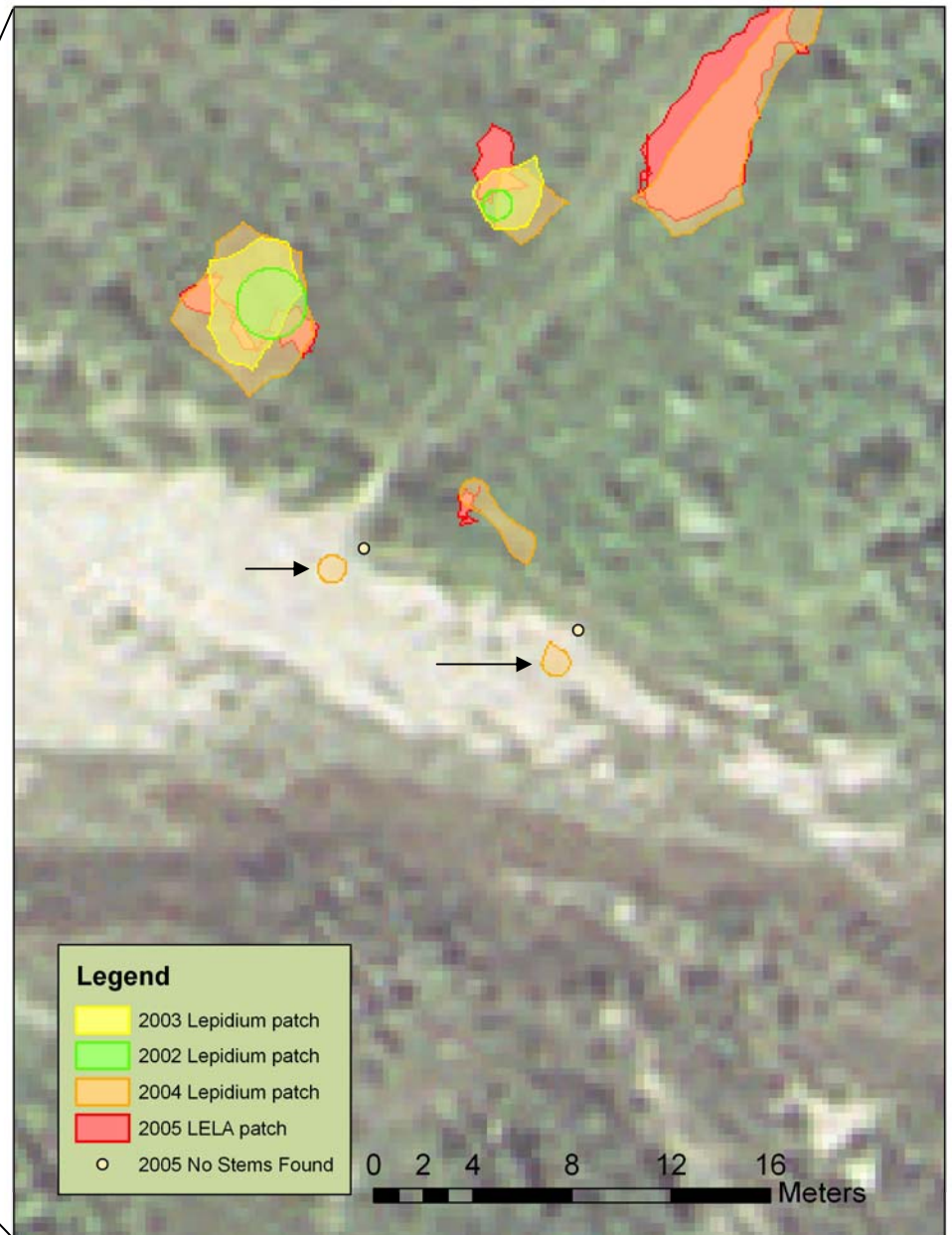
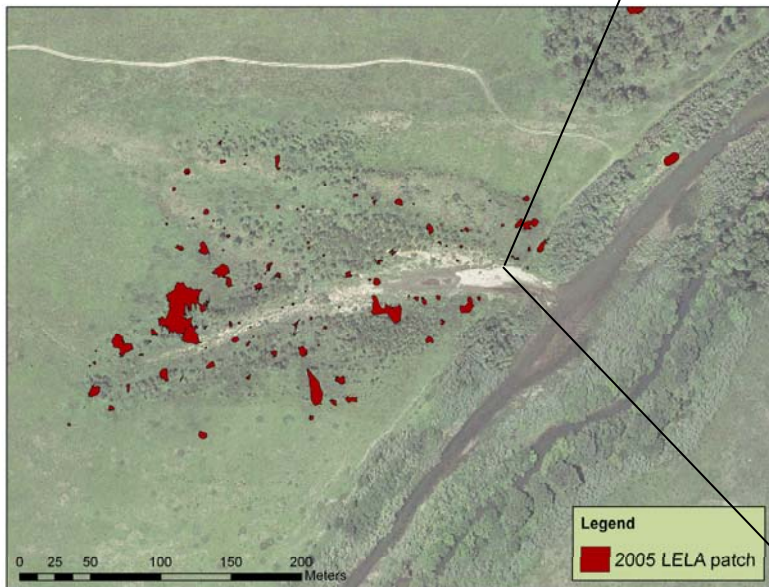




# Scenario Three: Patches disappear



# Scenario Three: Patches disappear





# Scenario Four: Patches shrink

