The National Institute *of* Invasive Species Science

Global Organism Detection & Monitoring

Integrating Invasive Species Data:

Solutions for Data Collection, Management, and Dissemination

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www.niiss.org

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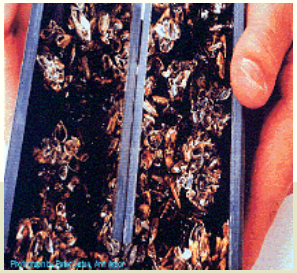
Global Organism Detection & Monitoring

The Problem

- Invasive species
  - Impact biodiversity, ecosystem function, human health, and the economy
  - $120 billion spent annually in the US
  - 46% of species on threatened and endangered list are listed because of invasive species

- Issues of Data Synergy
  - Large data gaps (spatial and temporal)
  - Crosier and Stohlgren 2004 (Weed Technology)
  - Crall et al. 2006 (Frontiers in Ecology and the Environment)
    - 319 databases
    - 43% not online



Why not share data?

- Sensitive Data
  - Threatened and endangered species
  - Private property
  - Biological control agents
  - Species of cultural significance
  - Data not yet published
- Inability to Share
  - Data on paper, not digital
  - No website to provide data online
  - No database management system in place

Partners

- Major partners
  - Colorado State University-NREL
  - United States Geological Survey-USGS
  - National Aeronautics and Space Administration-NASA

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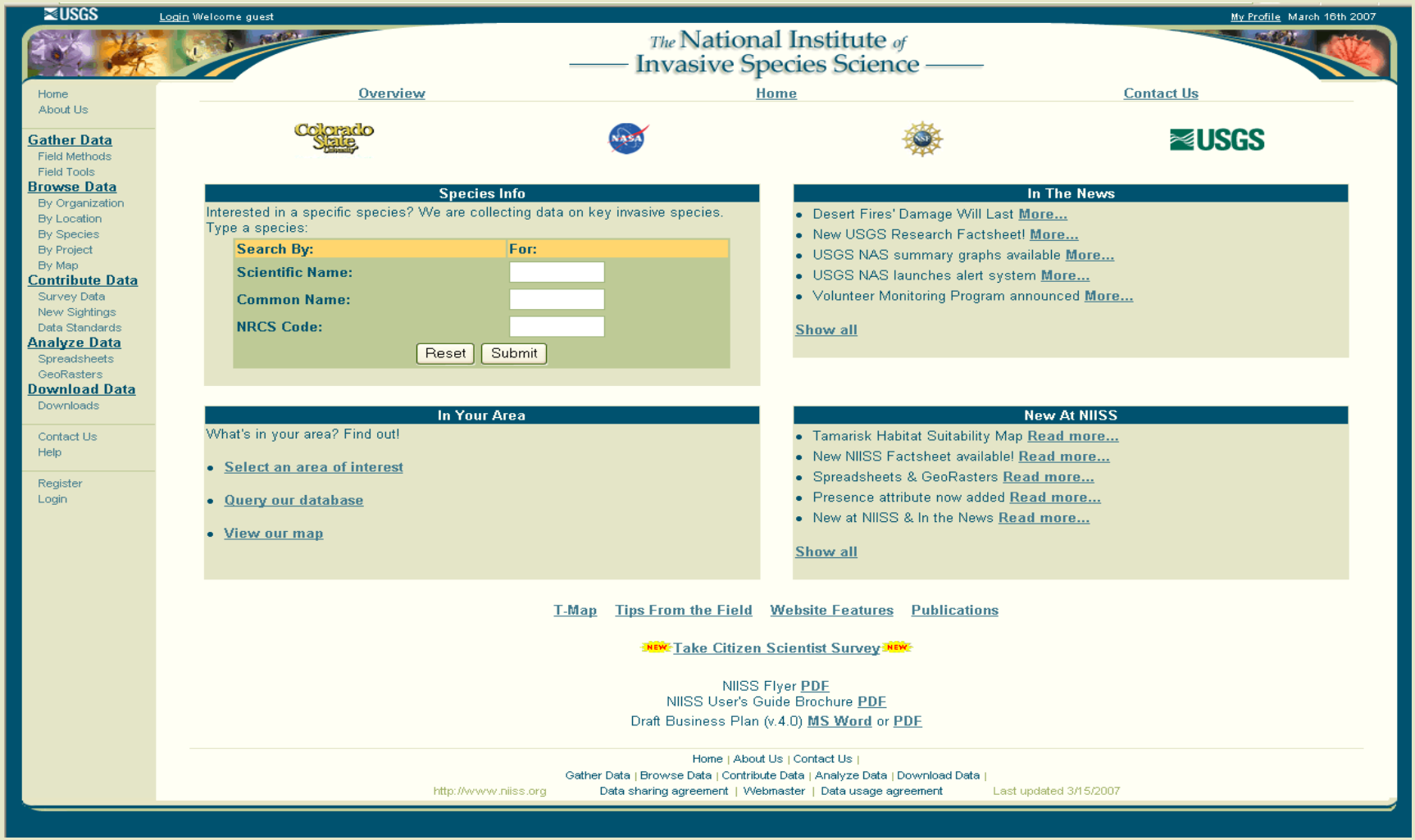


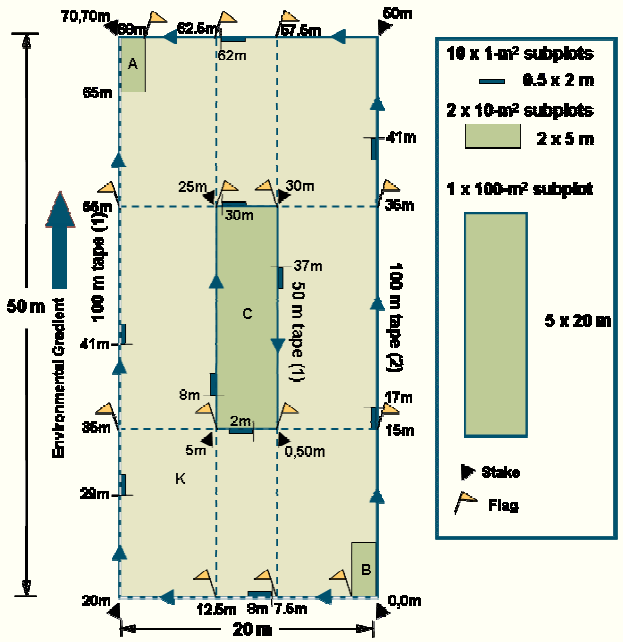
Implementation of sensitive data security

- Different levels of access to website pages and functionality based on user's login
  - User Levels: Guest, User, Tester, Instigator, Expert
- Data sharing agreement required
- Uploaded data assigned to project
  - Project Roles: Contributor, Reviewer, Authority, Manager
  - Can assign data sensitivity during upload
  - Given four "data fuzzing" choices: 7.5 min, 30 min, ½°, 1°
  - Exact locations can be used in general analyses

Jarnevich, C. et al. 2007. Balancing data sharing requirements for analyses with data sensitivity. Biological Invasions 9:597-599.

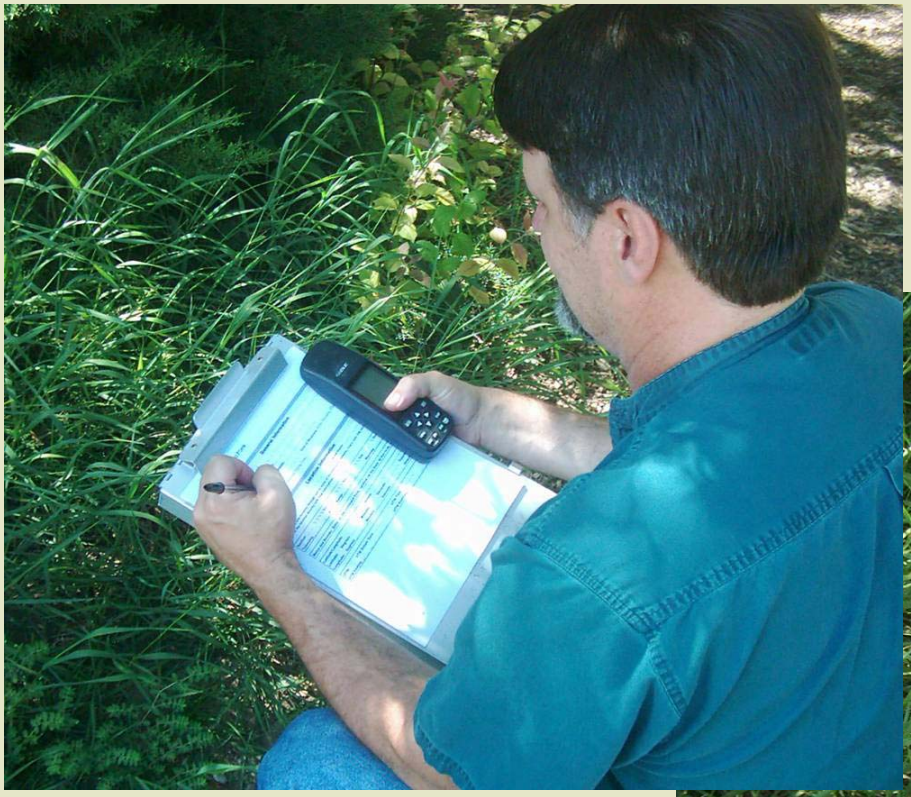
Gather Data

- Field Methods
  - Description
  - Equipment needed
  - How to setup
  - References
- Field Tools
  - Project Envelope
    - use with ArcGIS
    - survey full environmental range of species
  - EcoNab
    - field data collection program that runs on a PDA with Palm OS
  - GODMSurveyor



Field Tools

The Past



+ Manual entry

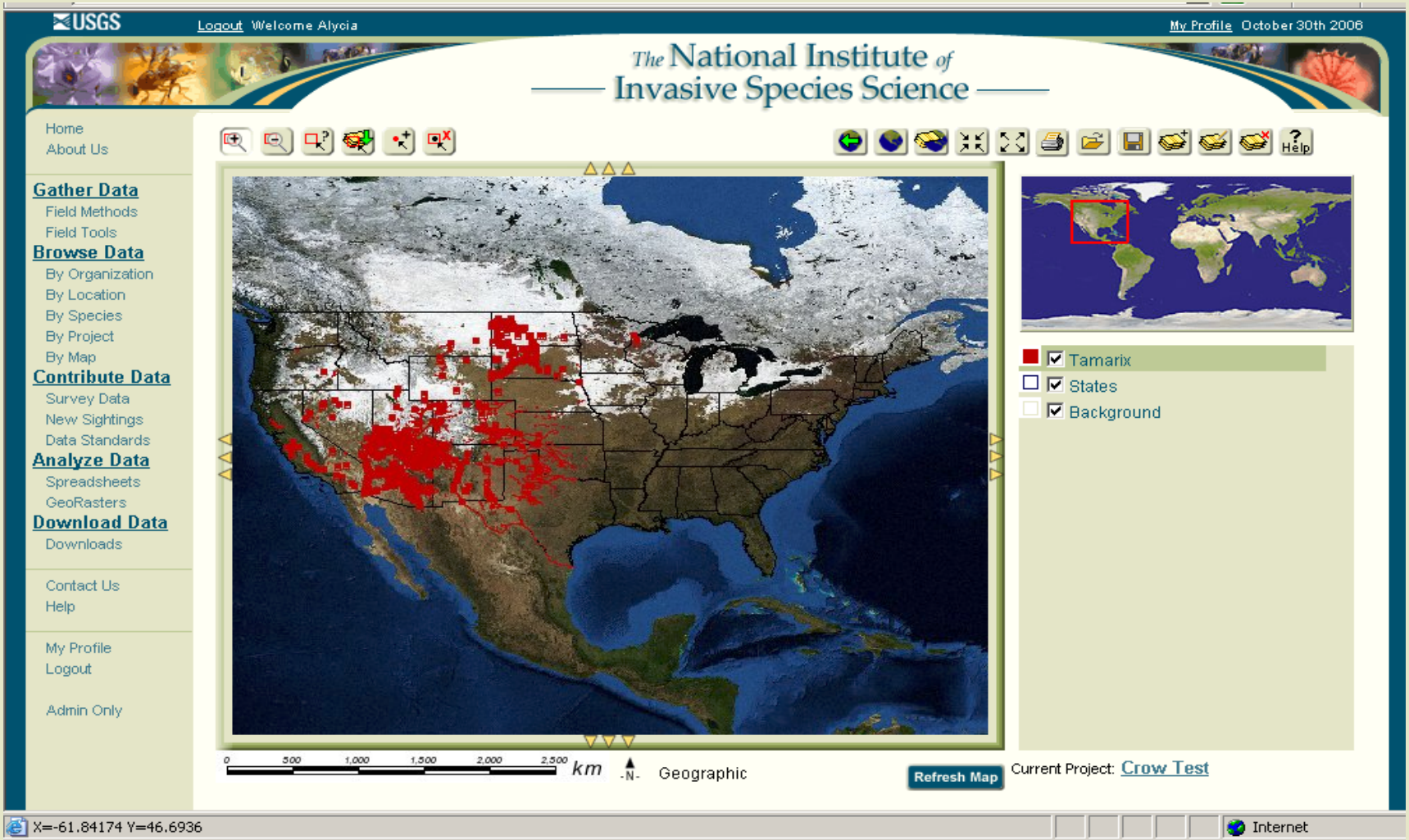
The Future

+ Automatic upload

Browse Data

- By Organization
  - university, non-profit, etc.
- By Location
  - politically defined locales such as states, counties, national parks, wildlife refuges
- By Species
  - scientific name, common name, NRCS code
- By Project
  - data contributed by project members and managed by project managers
- By Map

Example Map: *Tamarix sp.* locations



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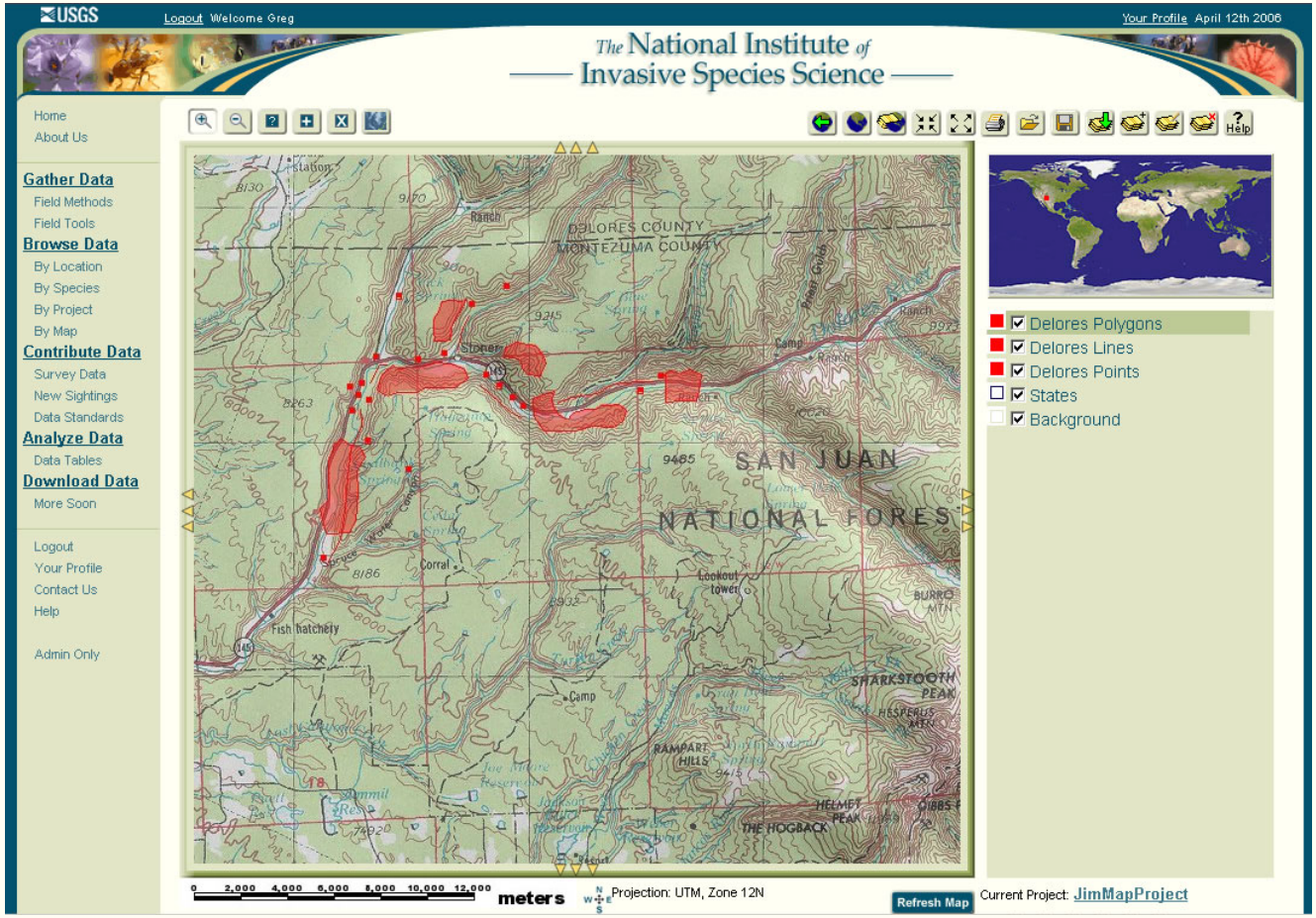
Example Map – Points, lines, polygons



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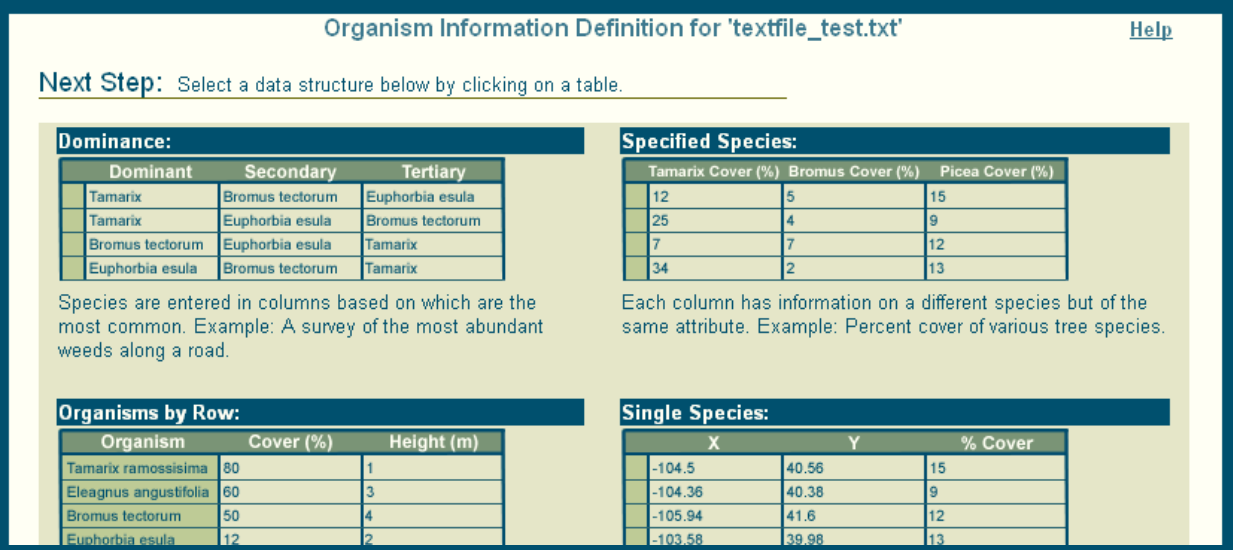
Contribute Data

- Survey Data
  - tab-delimited text file or shapefiles
  - single species or many species
  - many locations or single political boundary
  - captures organism location, date, attributes, auxiliary data, treatment data
- New Sightings
  - enter single point sighting
- Data Standards
  - set of standards users can follow to upload disparate data in a standard format

Contribute Data: Survey Data



USGS

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GeoRasters

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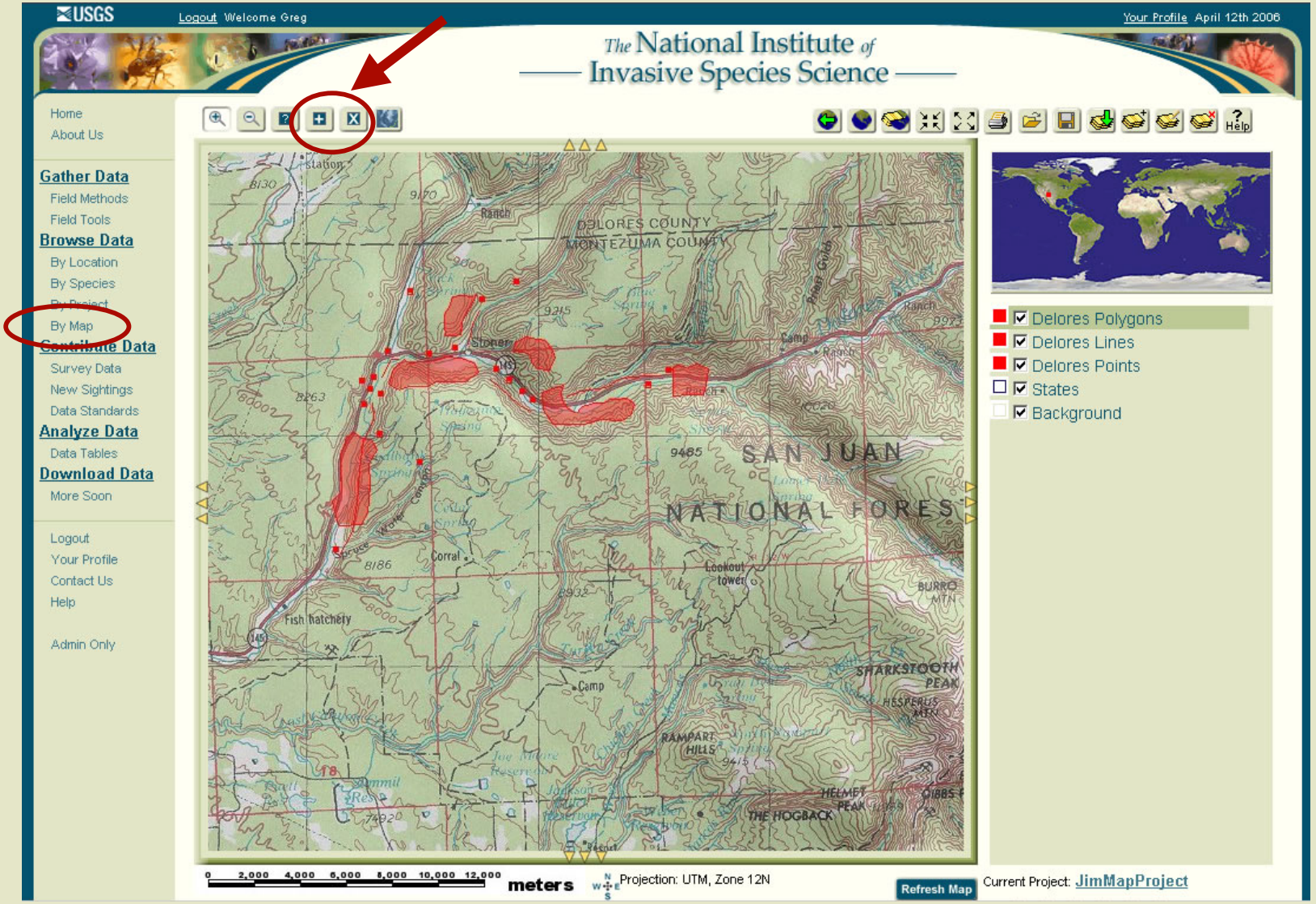
Describe the columns in your file

Column Has:	Contains:	Format: / Value Format:	Dominance: / Target species column: / Species column:	Control agents are: / Attribute types are:	Column: / Type is	Units are:	Units:
Organism	Organism Name	Scientific Name	Primary (1st)				
Organism	Organism Name	Scientific Name	Secondary(2nd)				
Treatment	Control Agent	Custom Code					
Treatment	Number	DOMINANT		In another column	BIOCONTROL	In next pull down menu	Count per hectare
Attribute	Number	DOMINANT		In next pull down menu	Infested Area	In next pull down menu	Meters Squared

DOMINANT	SECONDARY	BIOCONTROL	NUMBER	INFESTEDAR
tamarix	Elaeagnus angustifolia	Diorhabda elongata	100	100
Euphorbia esula	Descuraina sophia	Apthona lacertosa	500	1000
Euphorbia esula	Agropyron smithii	Apthona nigriscutis	500	500

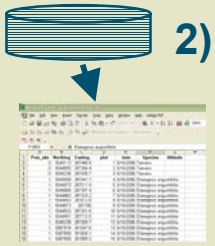
Contribute Data: New Sightings

Contribute Data: Add Point Via Map



Multiple Ways to Contribute Data

1) GISIN exchange protocol



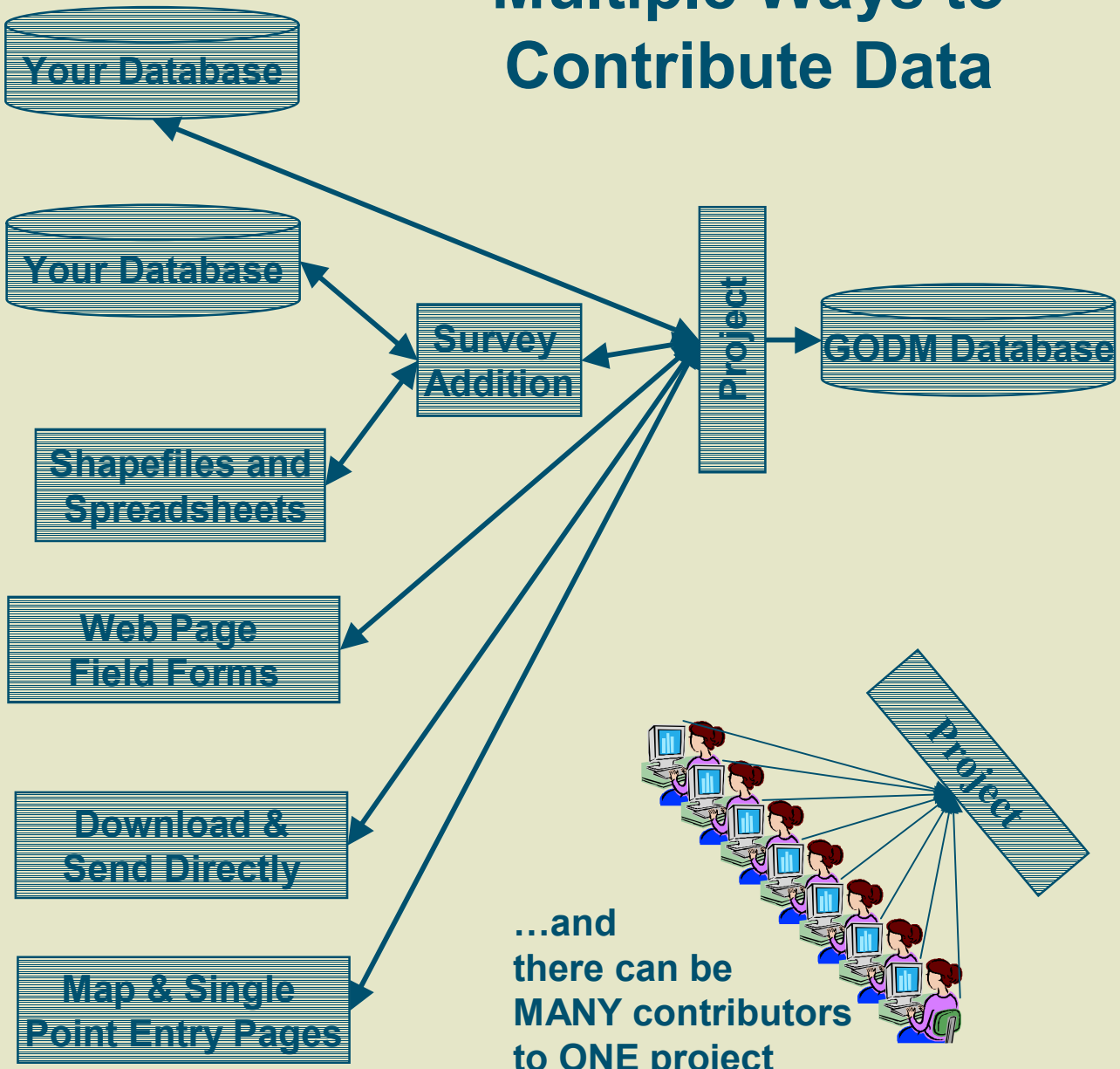
2) Your database export to spreadsheet, survey addition

3) Survey addition from shapefiles or spreadsheets

4) Field form data entry on the web

5) Direct from GPS or PDA

6) Enter single coordinates or click on map



…and there can be MANY contributors to ONE project

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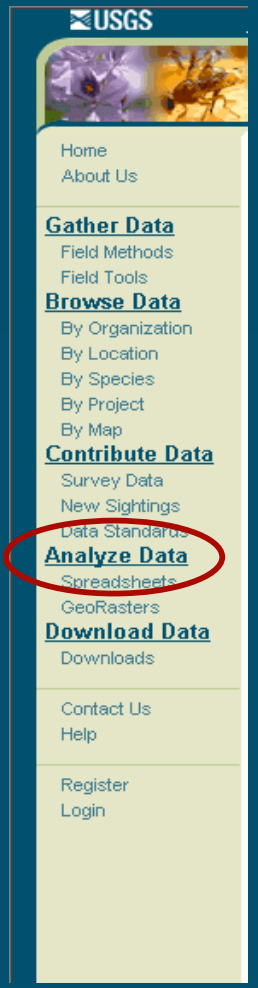
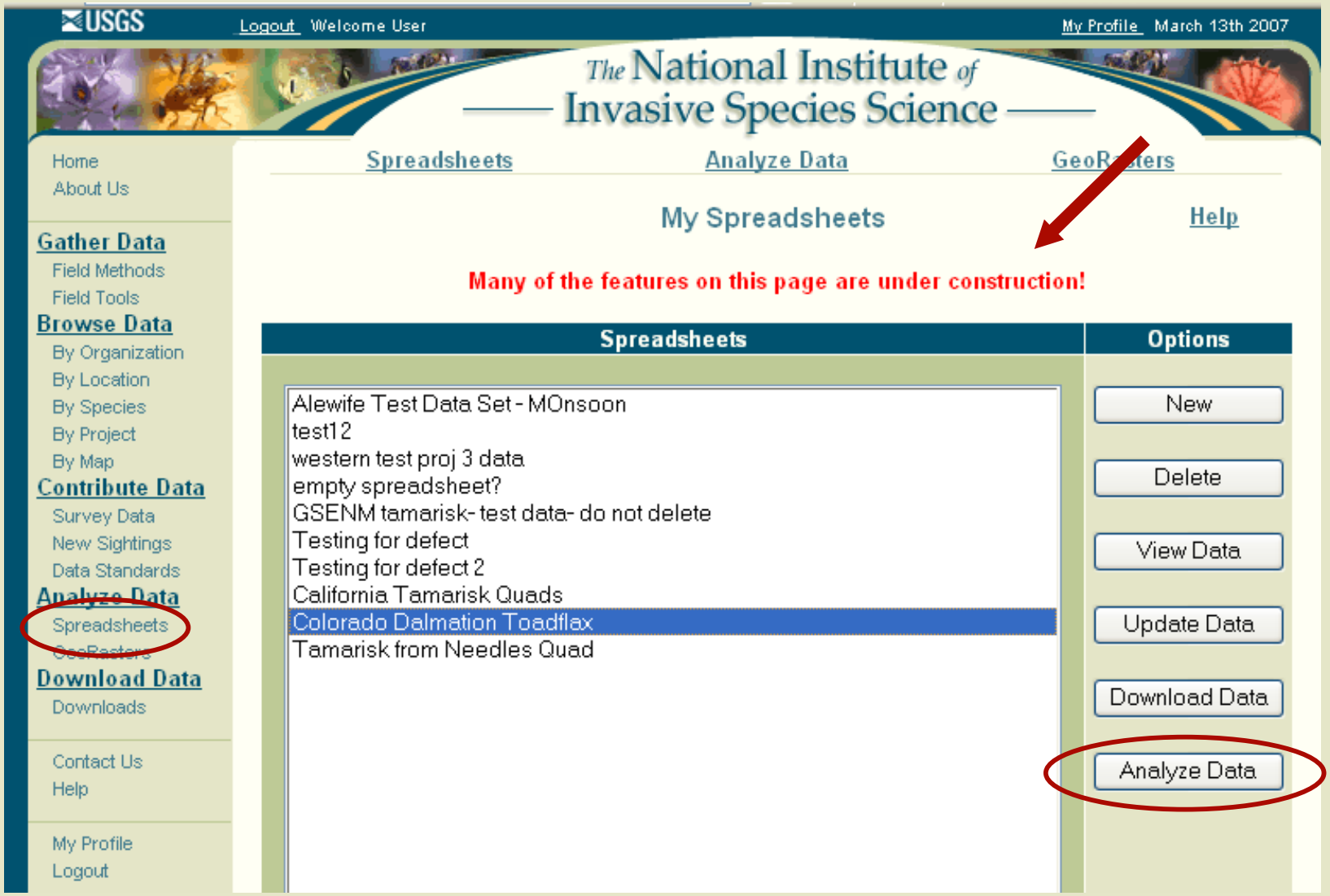
Analyze Data

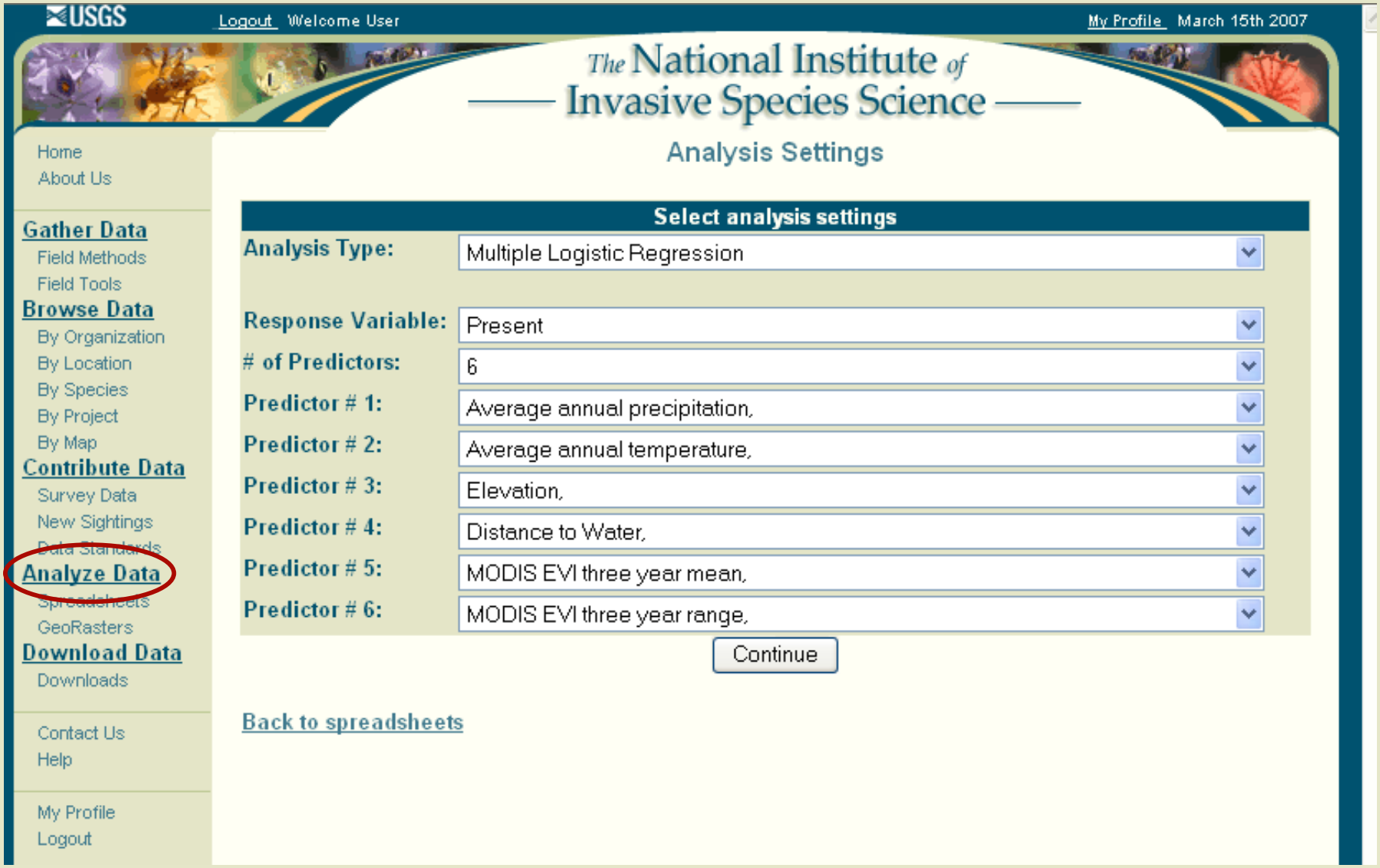


- Spreadsheets
  - manage and create spreadsheets of data from the database
  - columns include project name, visit date, scientific name, common name, present, percent cover, height, location data, raster layers
  - can filter by species, area, start and end date, project
- Georasters
  - Upload georasters
  - Download georasters
- Statistics
  - Descriptive statistics (mean, min, max, etc.)
  - Simple and multiple linear regression
  - Regression tree
  - Simple and multiple logistic regression

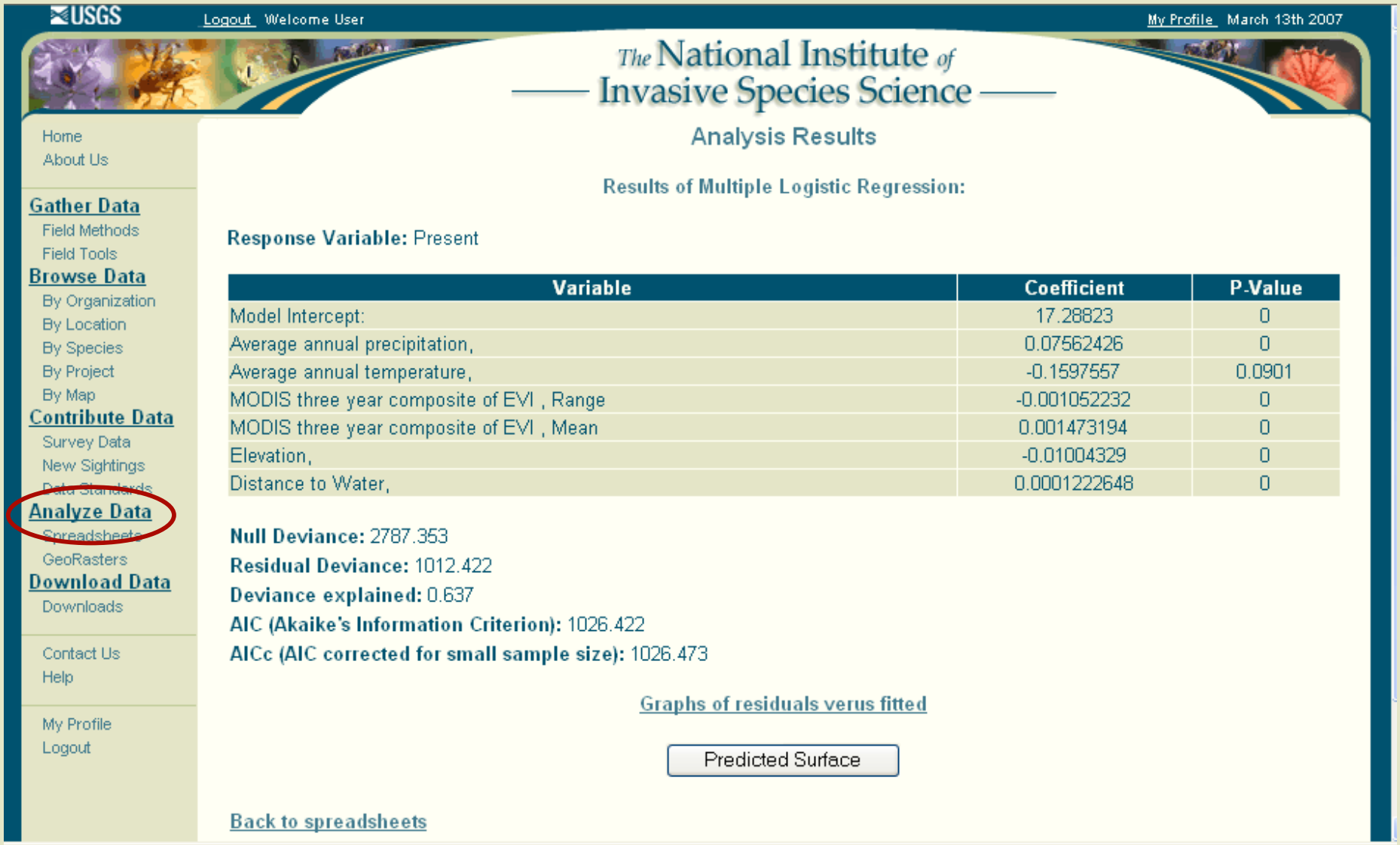
Analyze Data: Spreadsheets



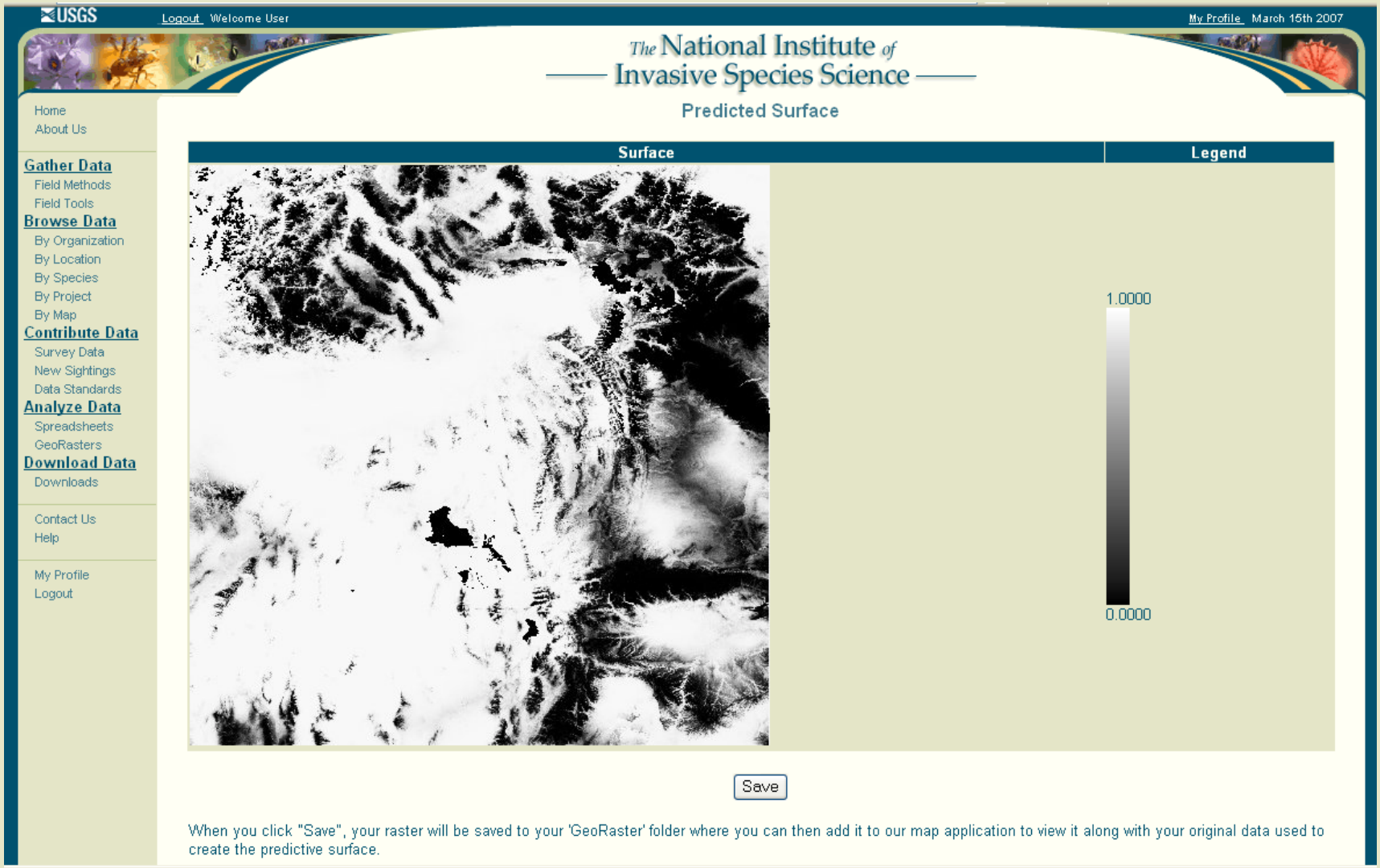
Analyze Data: Multiple Logistic Regression



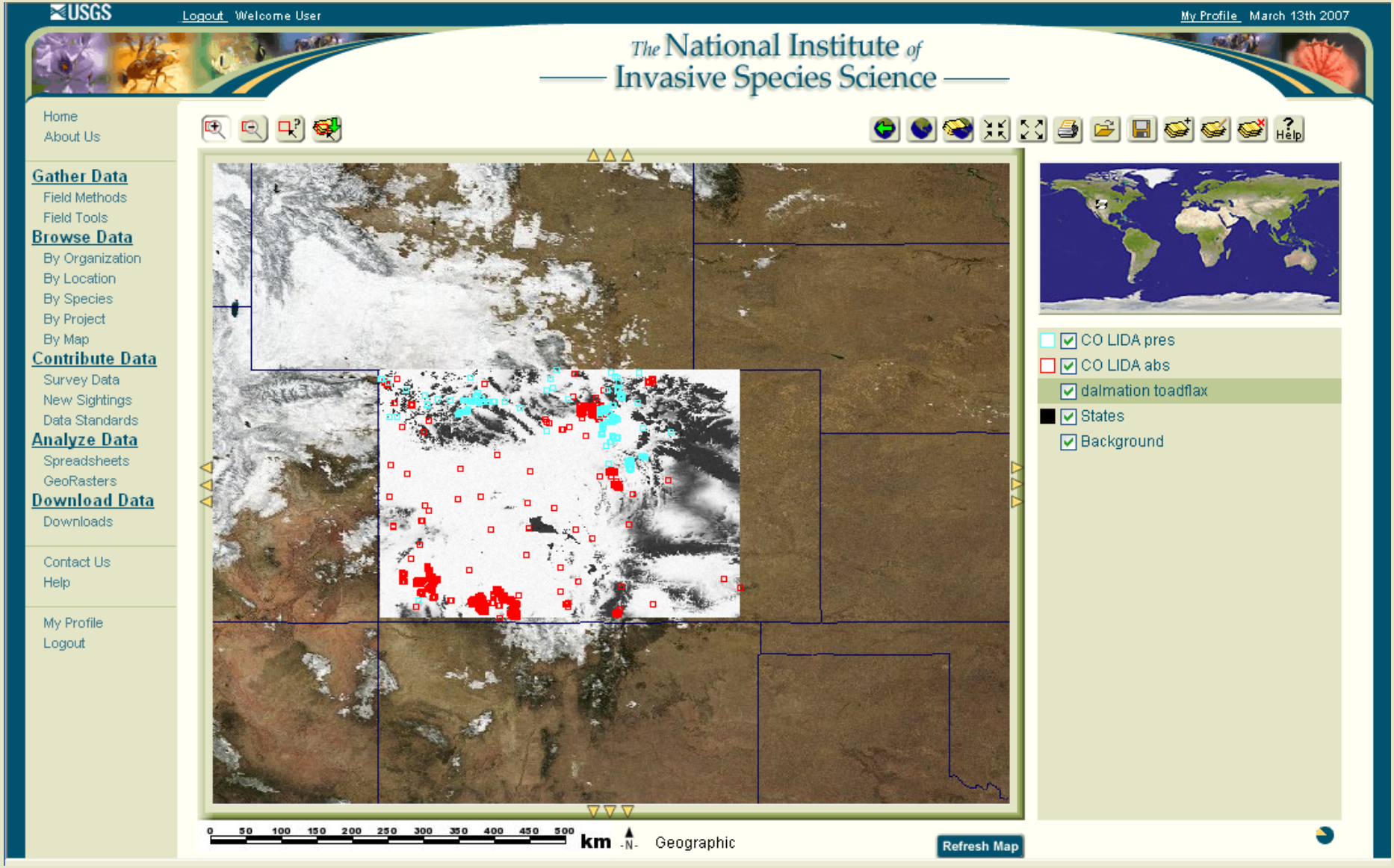
Analyze Data: Multiple Logistic Regression



Analyze Data: Predictive Surface

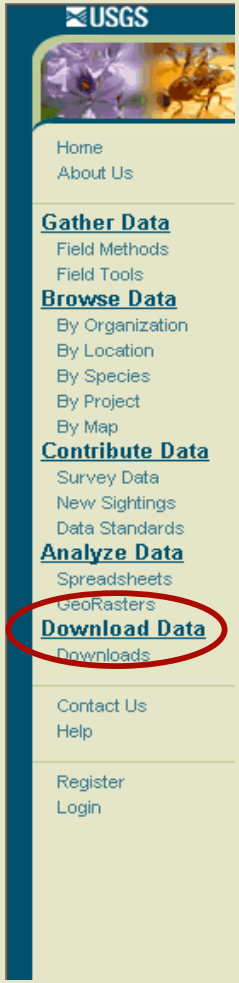


Analyze Data: Map Display



Download Data

- allows you to download organism locations as a textfile, csv file, or shapefile

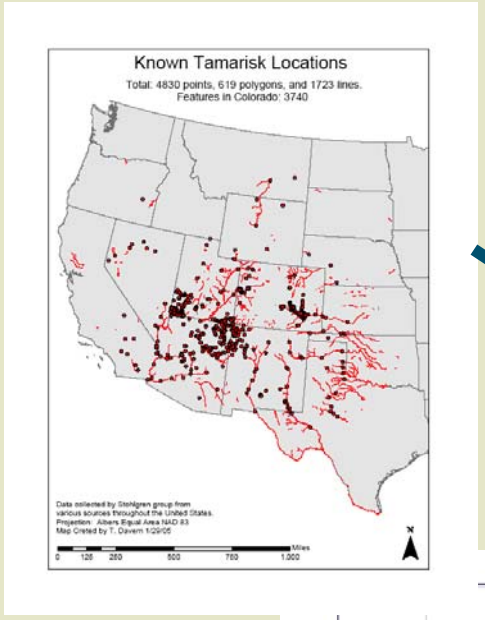


West (East-West Coordinate: Float)	North (North-South Coordinate: Float)	East (Unknown: Float)	South (Unknown: Float)	Height (Attribute: Float)	Average annual precipitation, Gray (GIS Layer: Float)	Average annual temperature, Gray (GIS Layer: Float)	Minimum average annual temperature, Gray (GIS Layer: Float)	MODIS three year average EVI , Range (GIS Layer: Float)	MODIS three year average EVI , Mean (GIS Layer: Float)	MODIS three year average EVI , Date of Peak (GIS Layer: Float)
-99.969	38.858	-99.969	38.858	1.692	56.266	11.888	4.2353	2090.8	610.69	172.73
-100.07	38.814	-100.07	38.814	2.1	56.238	11.905	4.2223	1917.7	805.95	184.39
-99.938	38.714	-99.938	38.714	1.597	56.405	11.986	4.3495	2162.1	1037.4	194.96
-99.915	38.811	-99.915	38.811	1.4	56.311	11.974	4.3188	2070.4	825.44	181.42
-99.849	38.942	-99.849	38.942	1.597	58.561	11.692	4.1783	2398.4	1027.6	191.25
-100.05	38.921	-100.05	38.921	0.4	59.294	11.597	4.0366	2044.1	974.59	188.92
-99.833	38.857	-99.833	38.857	2.1	57.733	11.844	4.2797	2140.7	670.49	176.06

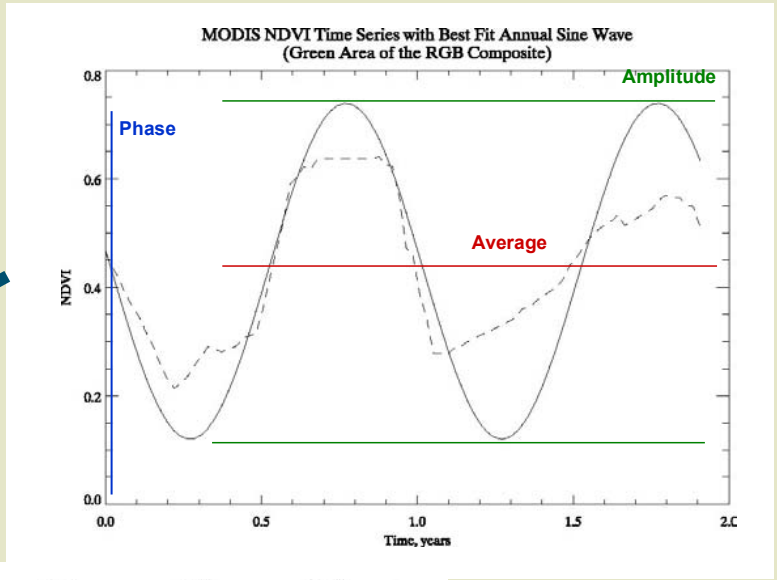
Input Field Data

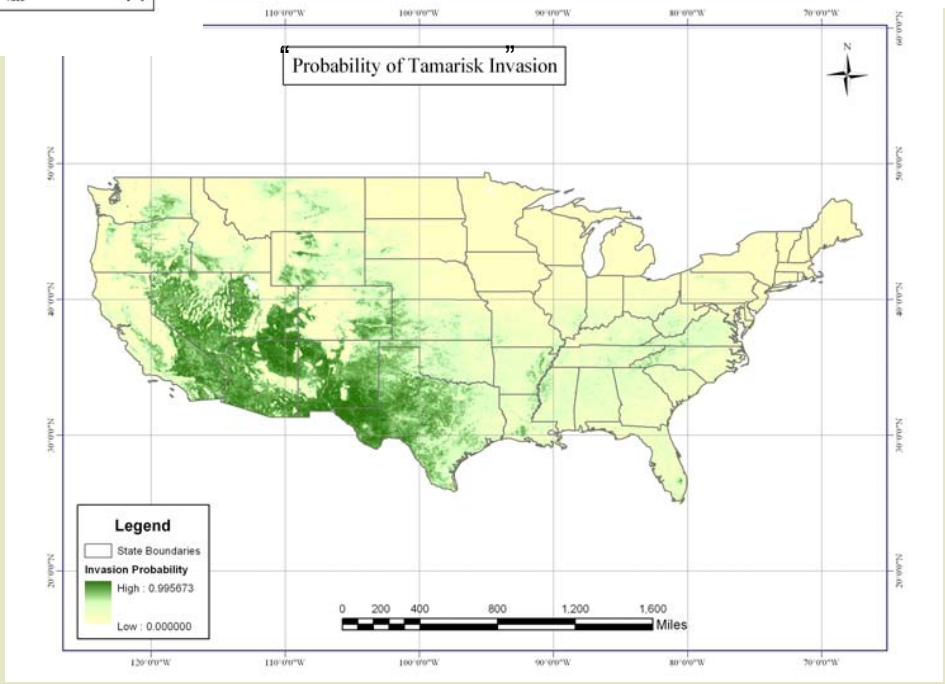
Automatically add satellite data

Field Observations



Satellite Data





Predictive Models

Morisette, J.T., C.S. Jarnevich, J.A. Pedelty, A. Ullah, W. Cai, T. Stohlgren, J. Gentle, J.L. Schnase. 2006. A tamarisk habitat niche map for the continental USA. *Frontiers in Ecology and the Environment* 11:14-17

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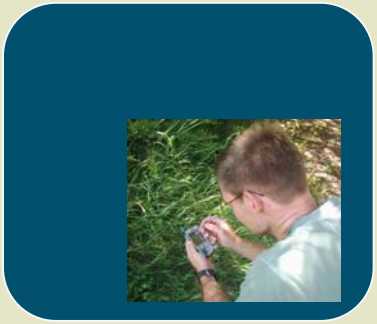
Global Organism Detection & Monitoring

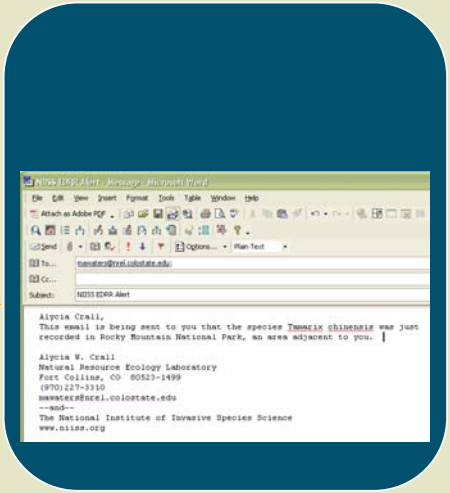
NSF Project 2006-2009

- Geared towards citizen scientist organizations in need of a data management system
- New Features
  - Online tutorials
  - Monitoring protocols
  - QA/QC protocols
  - Customizable data entry forms
  - Cheap, easy to use digital field tools

Additional New Feature

- Early Warning System
  - automatically sends emails out to users to warn them of a new non-native location on adjacent lands





Our Role in the Midwest

- Free Web-Based Data Management System
  - Caveats
    - Short term grants primarily focused on new features
    - Limited customer support staff
- Joint Grant Opportunities
  - More cost effective to pool existing resources rather than reinventing wheel across US
  - Provide support staff and hardware for larger user base

Acknowledgements:

Tom Stohlgren, Catherine Jarnevich, Tracy Davern, Geneva Chong (USGS), Jim Graham, Greg Newman, Paul Evangelista, Dave Barnett, Rick Shory, Suni Kumar, Sara Simonson, Nate Ament, and Mohammed Kalkhan (CSU), with help from . . .
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For more information contact:

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