

# Identifying invasive weeds with high spatial resolution multispectral imagery

Chris Moller



## Project Goals

The overall goals of this project is to research and develop means of applying GIS and remote sensing technologies to aid decision makers in managing invasive plants species and rangeland health

## Project Purpose

Our research addresses four of the eight critical issues identified in Idaho Department of Agriculture's Strategic Plan for Managing Noxious Weeds (ISDA, 1999).

- awareness and education
- inventory, mapping, and monitoring
- assessments and adaptive planning
  - integrating weed management into resource management
  - develop an early detection system
- research and technology

## Study Plants



### Leafy Spurge (*Euphorbia esula*)

- fast growing perennial forb
- >10% cover → grazing loss
- >80% cover → cannot graze
- \$150M loss annually



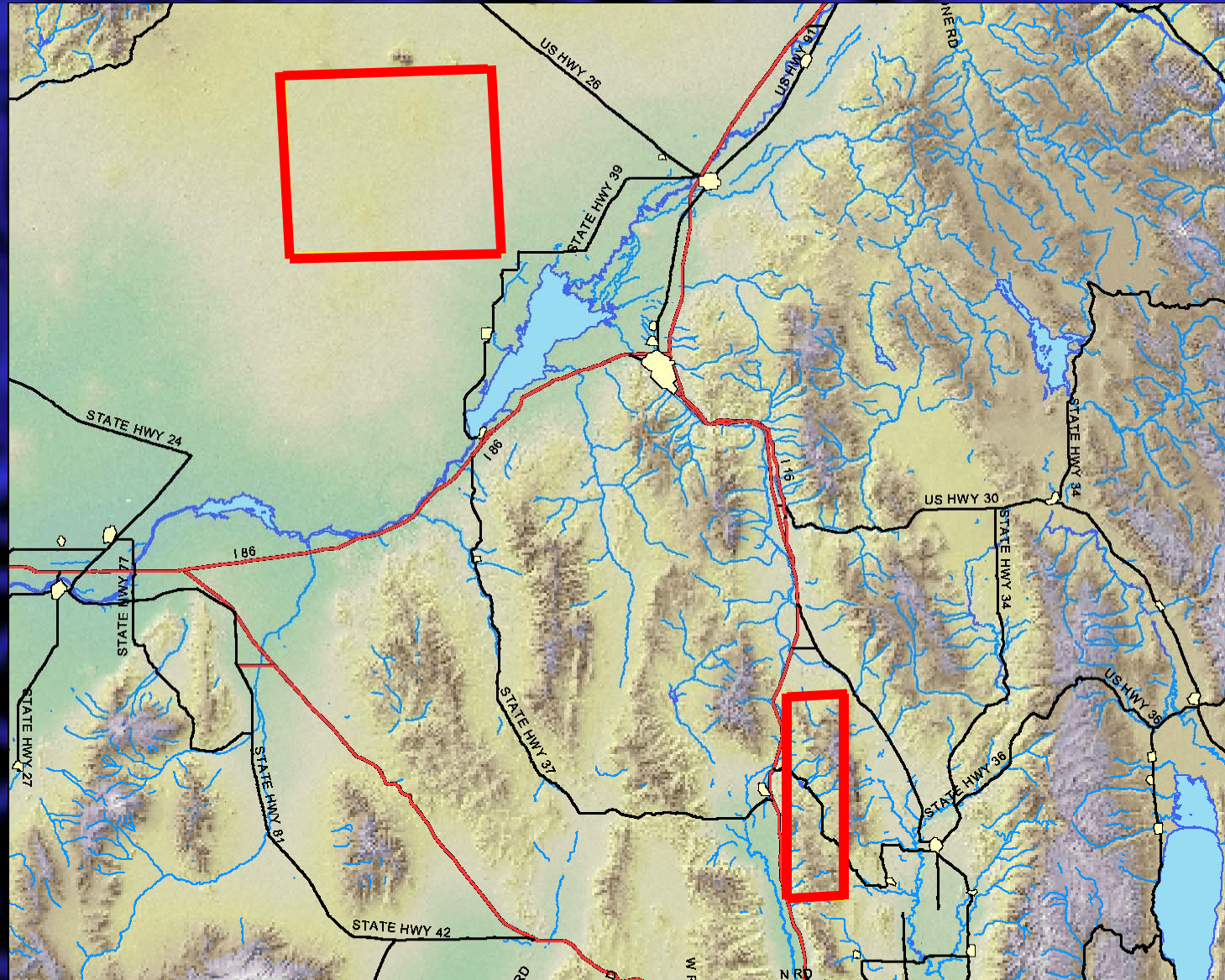
# Study Plants



## Cheatgrass (*Bromus tectorum*)

- weedy annual grass
- forage early for limited time—then harmful
- highly invasive—fire tolerant/propagating

# Study Areas



# Study Methods

## Supervised Classification:

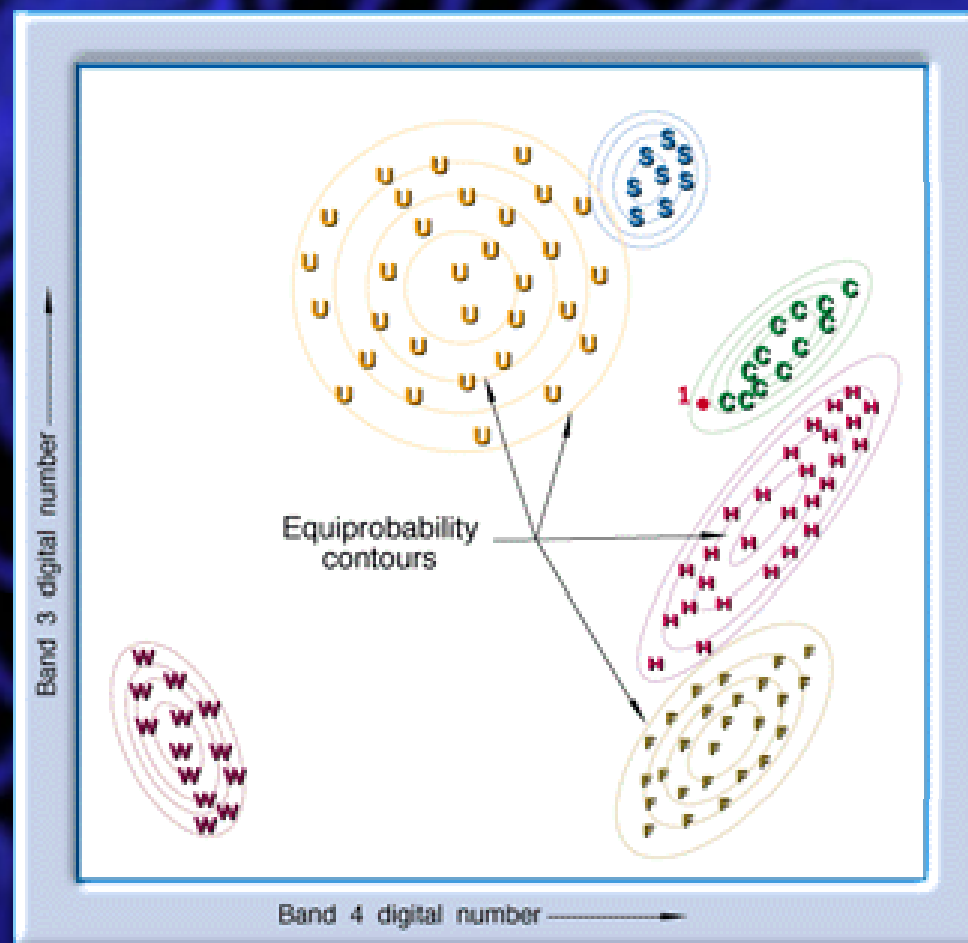
- The identity and location of weed types are known beforehand through a combination of:
  - existing maps
  - field work
- These become our training sites

# Study Methods

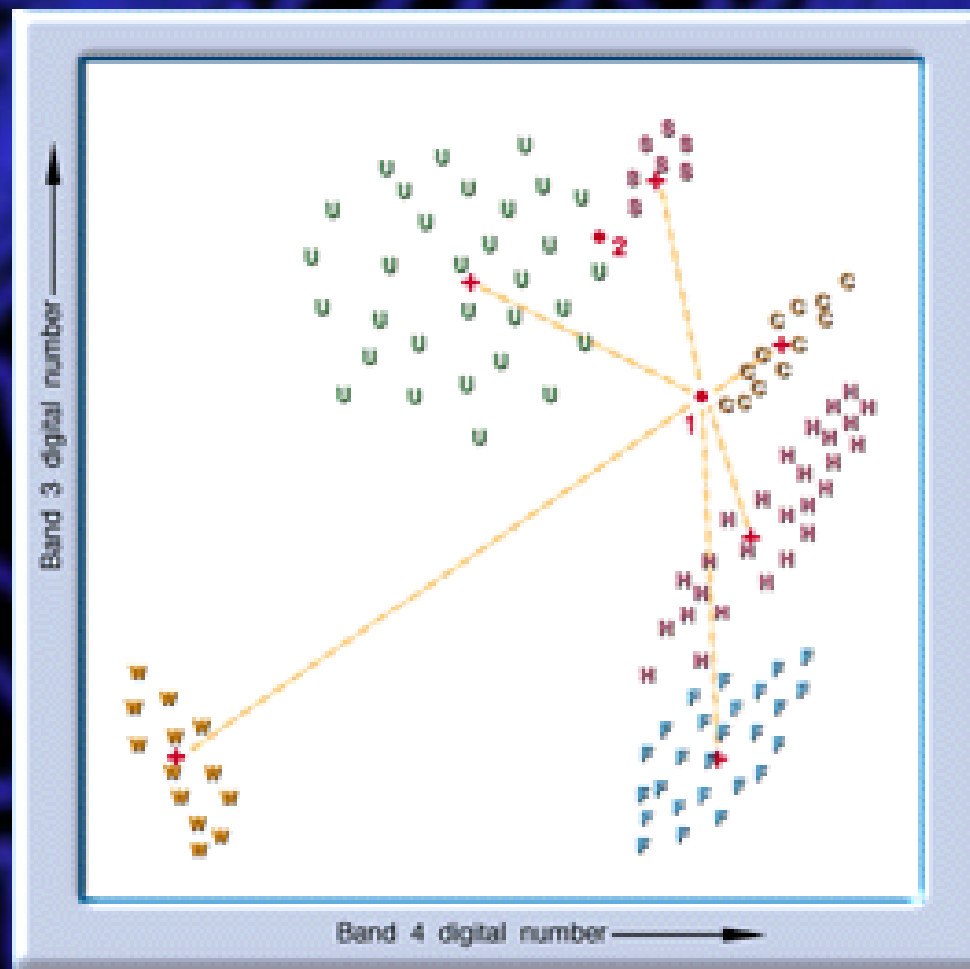
## Supervised Classification:

- Spectral Angle Mapping
- Minimum distance to means
- Maximum likelihood

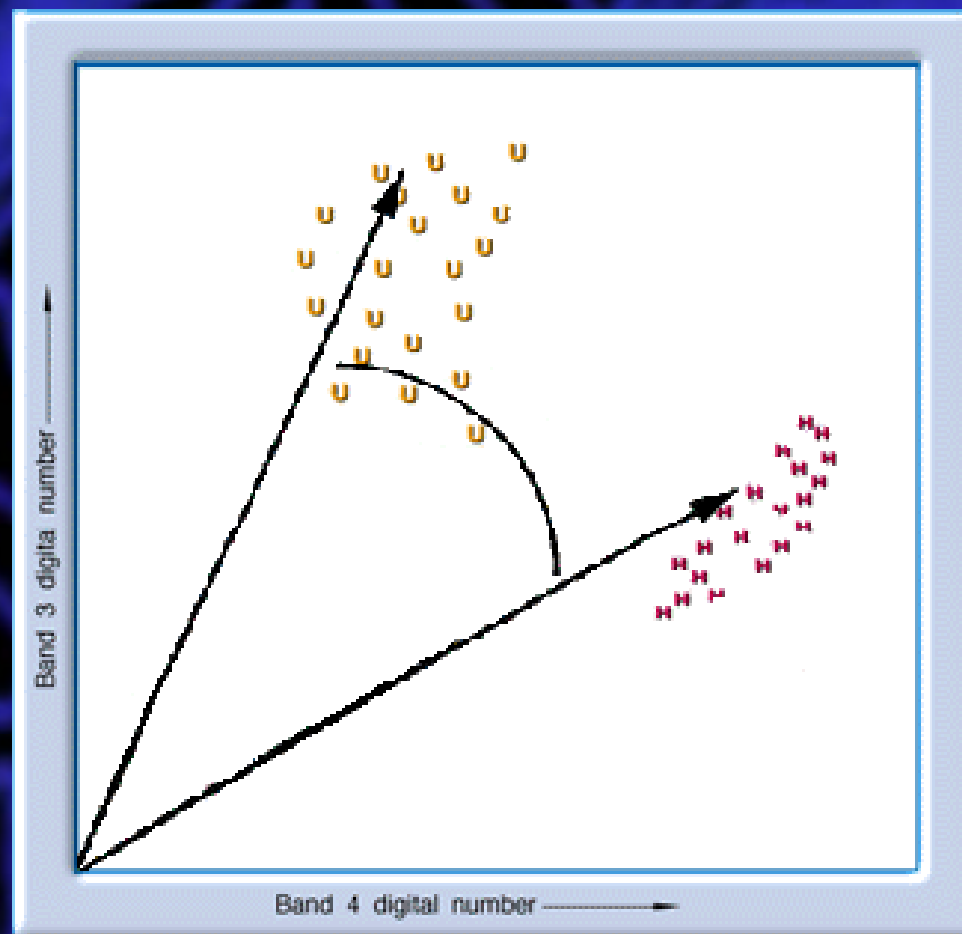
# Study Methods



# Study Methods



# Study Methods



# Study Methods

## Training Sites Collected with GPS

- Percent Grass Cover
- Percent Weed Cover
- Percent Dominant Shrub
- Percent Litter & Duff
- Collect Photographs
- AUM Clipping
- Sage diameter



# Study Methods

## Soft (Fuzzy) Classifiers

- Allows one pixel to be a member of several classes
- Opposed to hard (crisp)—largest single representative group ‘wins’
- Utilizing combinations of techniques

# Study Methods

## Relational Database

- Organize data
- Relate points to other spatial information
  - Grazing
  - Fire
  - Soil data
  - Control info

The screenshot displays the ArcMap interface with the following data tables:

FID	Shape	POINT_ID	DATE	DOMINANT_W	PCT_DOMINA	PCT_SHRUB	DOMINANT_S	MEAN_S
4	Point	3	7/16/02	Lealy Spurge	51.75%	1-5%	Serviceberry	low (1-50cm)
5	Point	4	7/16/02	Lealy Spurge	76.95%	1-5%	Serviceberry	medium (51-100)
6	Point	5	7/16/02	Lealy Spurge	76.95%	6-15%	Serviceberry	medium (51-100)
7	Point	6	7/16/02	Lealy Spurge	51.75%	16-25%	Serviceberry	medium (51-100)
8	Point	7	7/16/02	Lealy Spurge	76.95%	0%	none	none
9	Point	8	7/16/02	Lealy Spurge	36.50%	0%	none	none

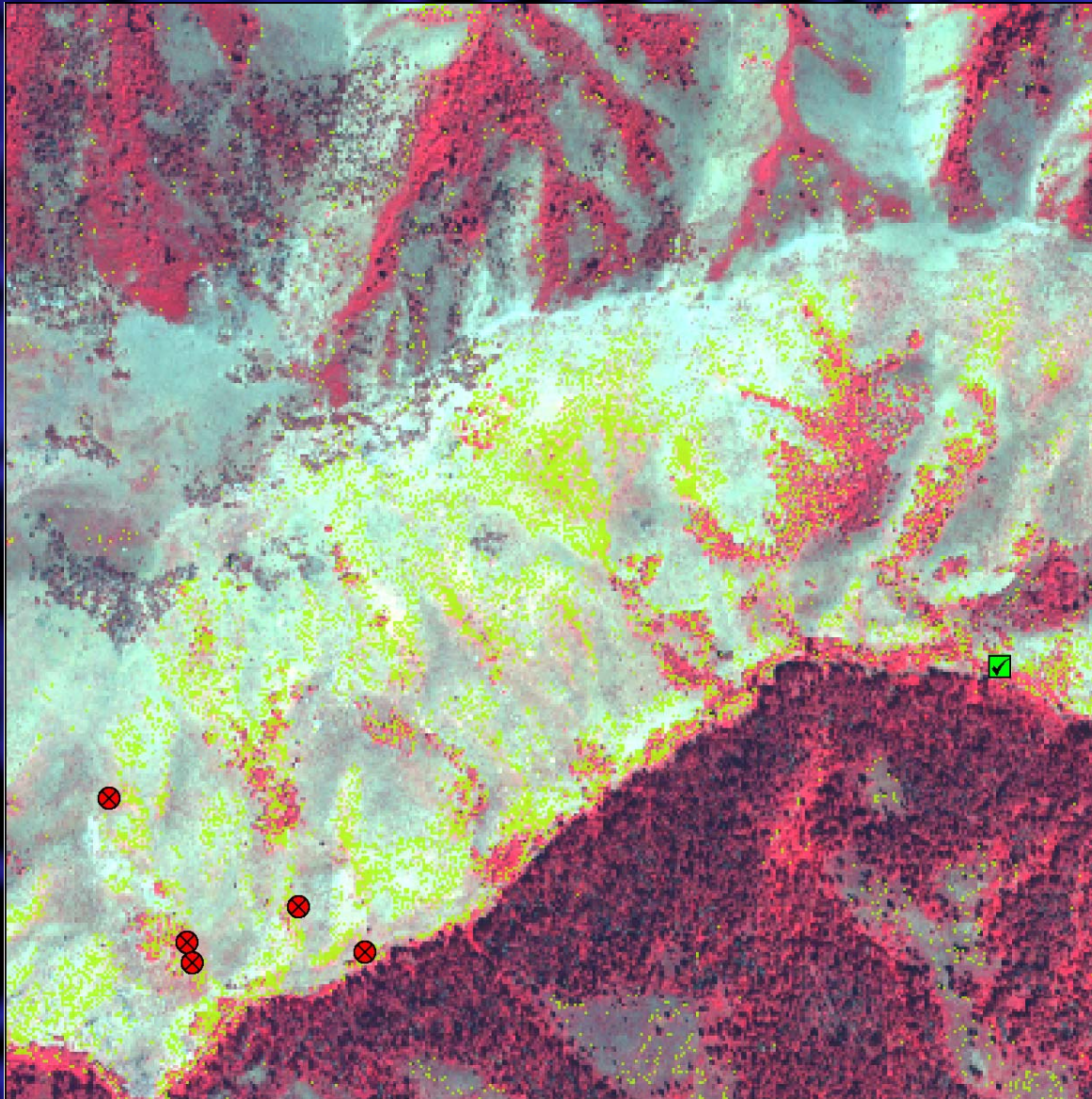
OID	POINT_ID	LAST_GRAZE	GRAZE_ANIM
0	102B	1995 -999	
1	102C	1995 -999	
2	104B	1995 CATTLE	
3	108A	1995 -999	
4	108C	1995 -999	
5	109A	1995 -999	
6	109B	1995 -999	
7	109C	1995 -999	
8	110B	1995 -999	
9	110C	1995 -999	
10	111A	1995 -999	

OID	POINT_ID	SAGE_DIAM	SAGE_AGE
0	102B	17	16
1	102B	17	16
2	102B	30	23
3	102B	32	25
4	102C	17	16
5	102C	41	30
6	102C	43	31
7	102C	61	41
8	109A	44	31
9	21C	32	25
10	21C	36	27
11	22C	44	31

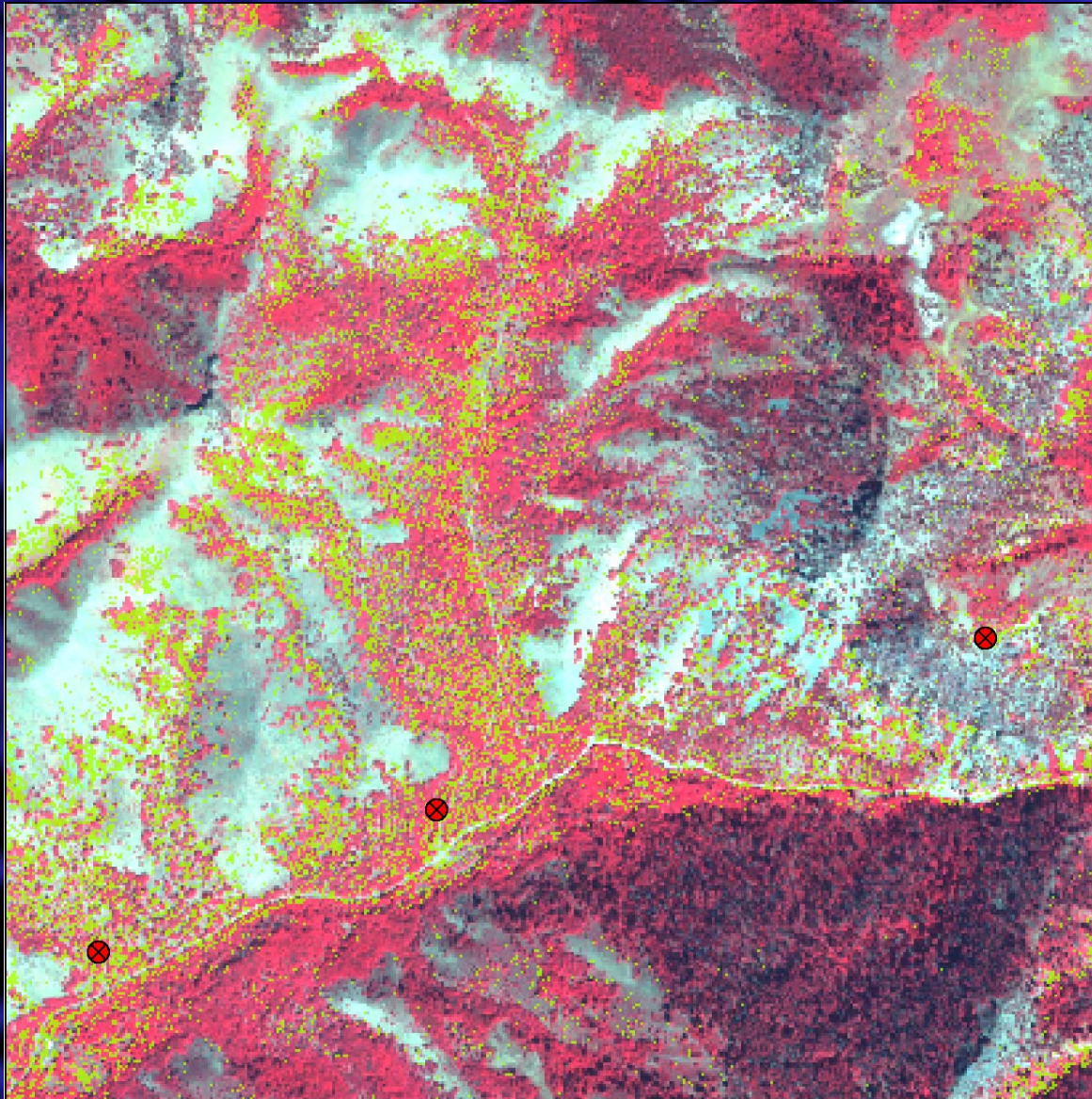
# Challenges

- Georectification
- Control measures
  - Chemical
  - Biological
- Lack of original samples (16)
- Late season imagery

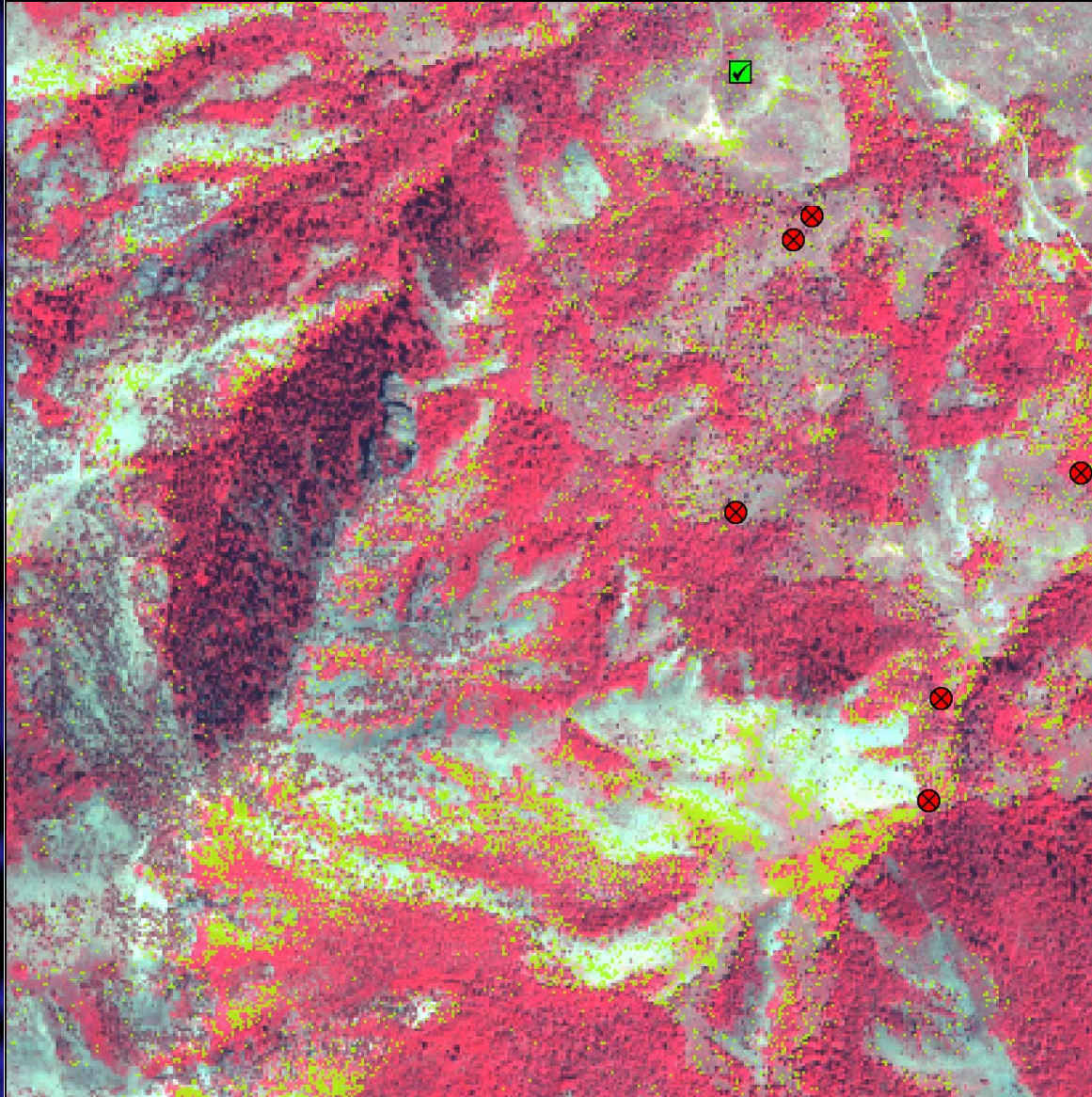
# Preliminary Results



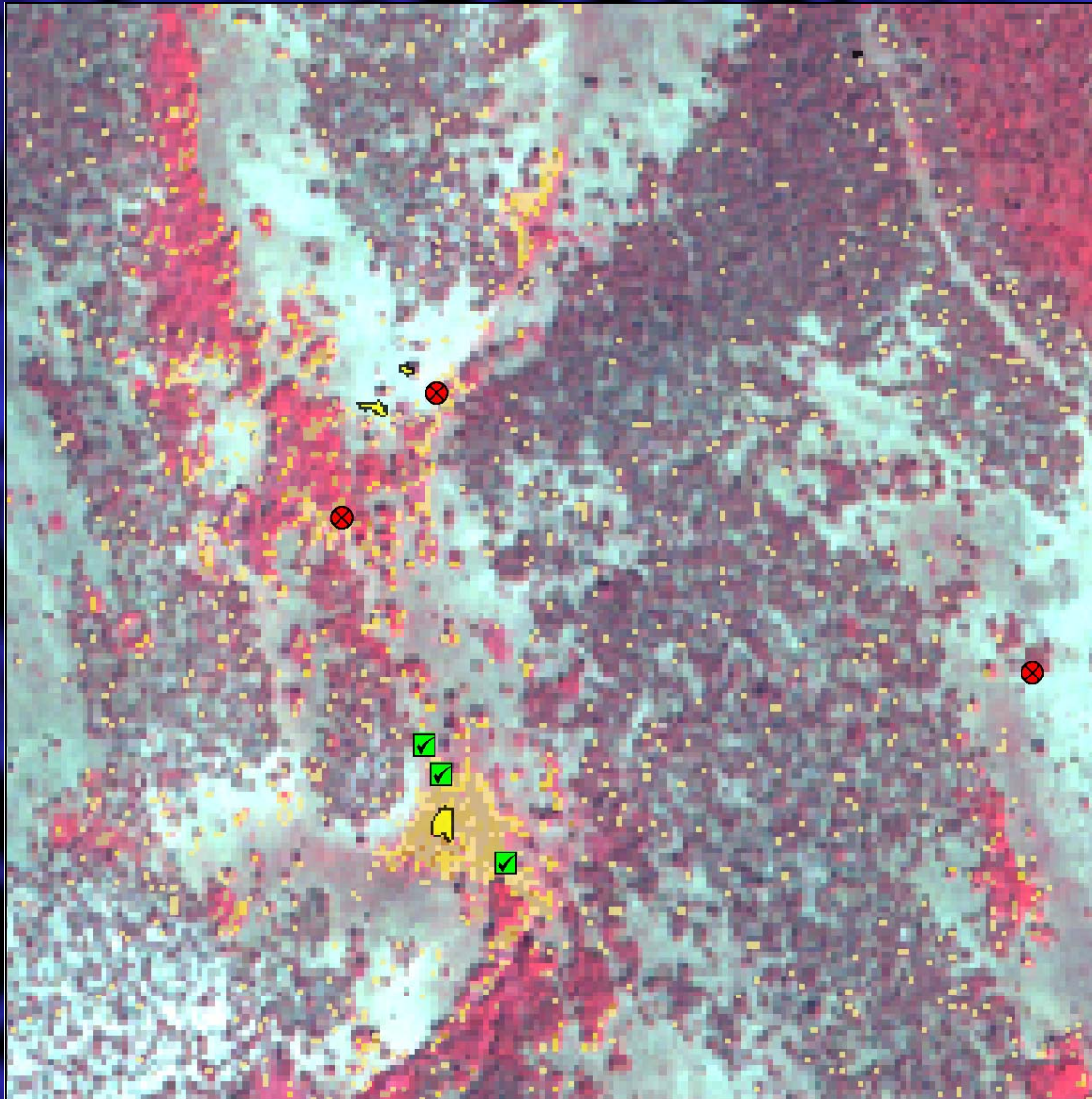
# Preliminary Results



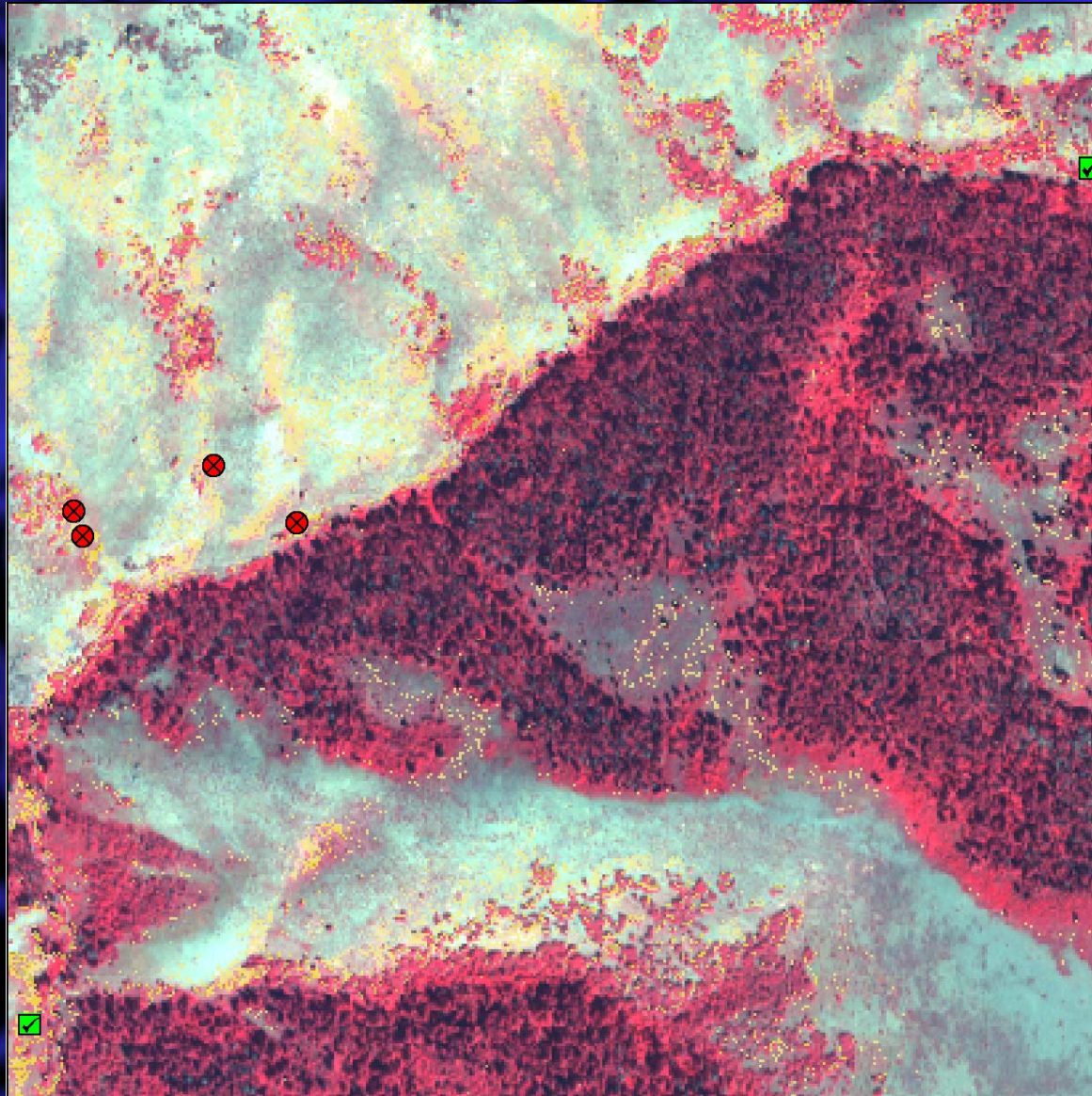
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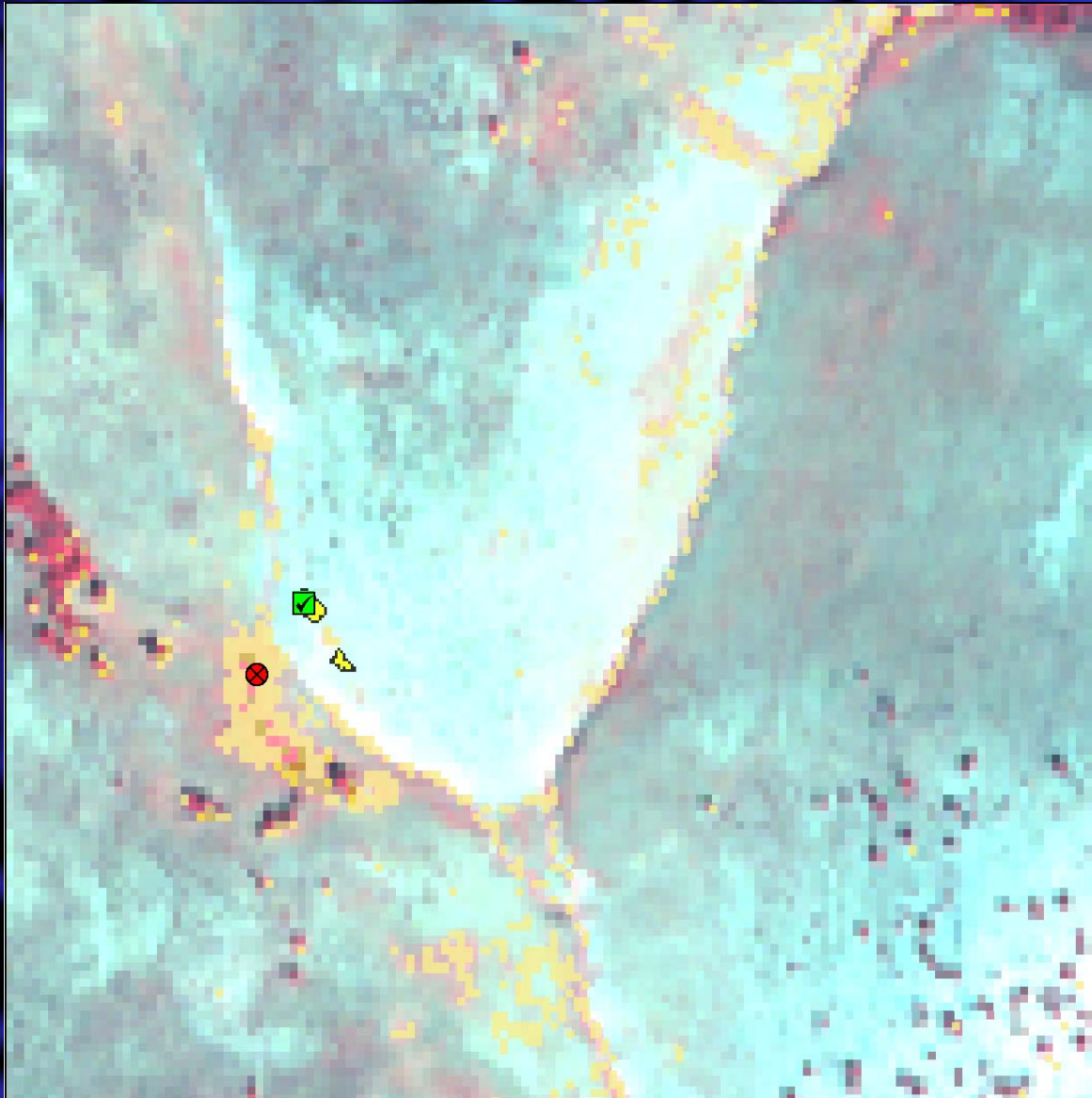
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# Preliminary Results



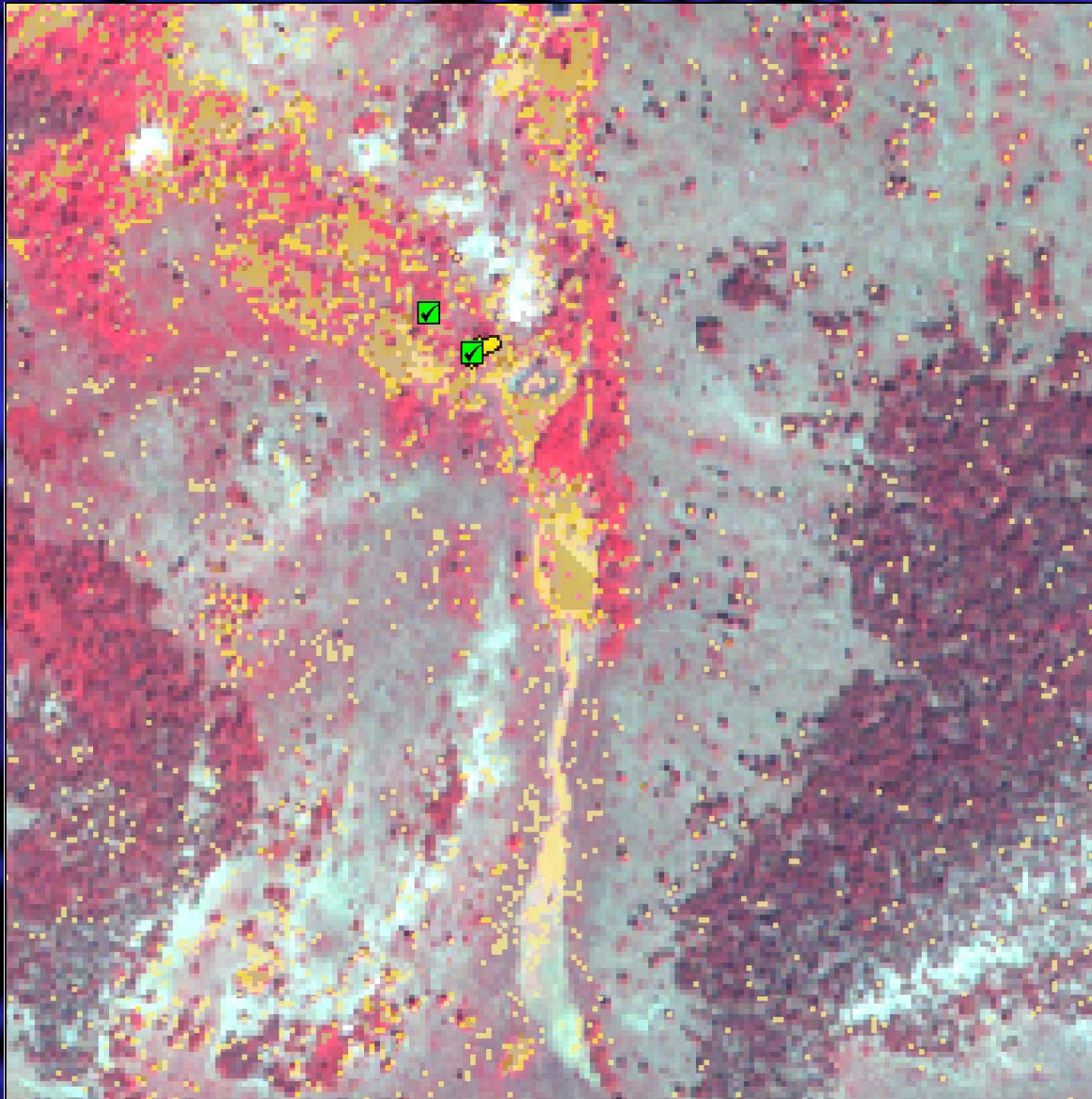
# Preliminary Results



# Preliminary Results



# Preliminary Results



# Preliminary Results



# Preliminary Results



# Preliminary Results



# Rangeland Health

## Indicators

“Adapt various indicators of rangeland health to evaluation through the application of geotechnologies”

We will evaluate the following indicators:

- Bare ground (erodible/exposed soils)
- Presence and proportion of various plant functional/structural groups
- Plant decadence (ratio of dead plants to young/mature plants)
- Litter amount
- Invasive plants (presence and density of non-native plants)

# Public

## Outreach Making our data available

- Delivered products to concerned parties
- ArcIMS for interested public
- Workshops, trainings, conference presentations and publications

The screenshot displays the ArcMap interface with several data tables open. The 'Selected Attributes of sum02\_weeds' table is the primary focus, showing weed data for 9 points. The 'Attributes of grazing\_info' table shows grazing records for 11 points. The 'Attributes of Sage\_prop' table shows sagebrush data for 12 points. The interface also includes a map view, a table of contents, and a status bar.

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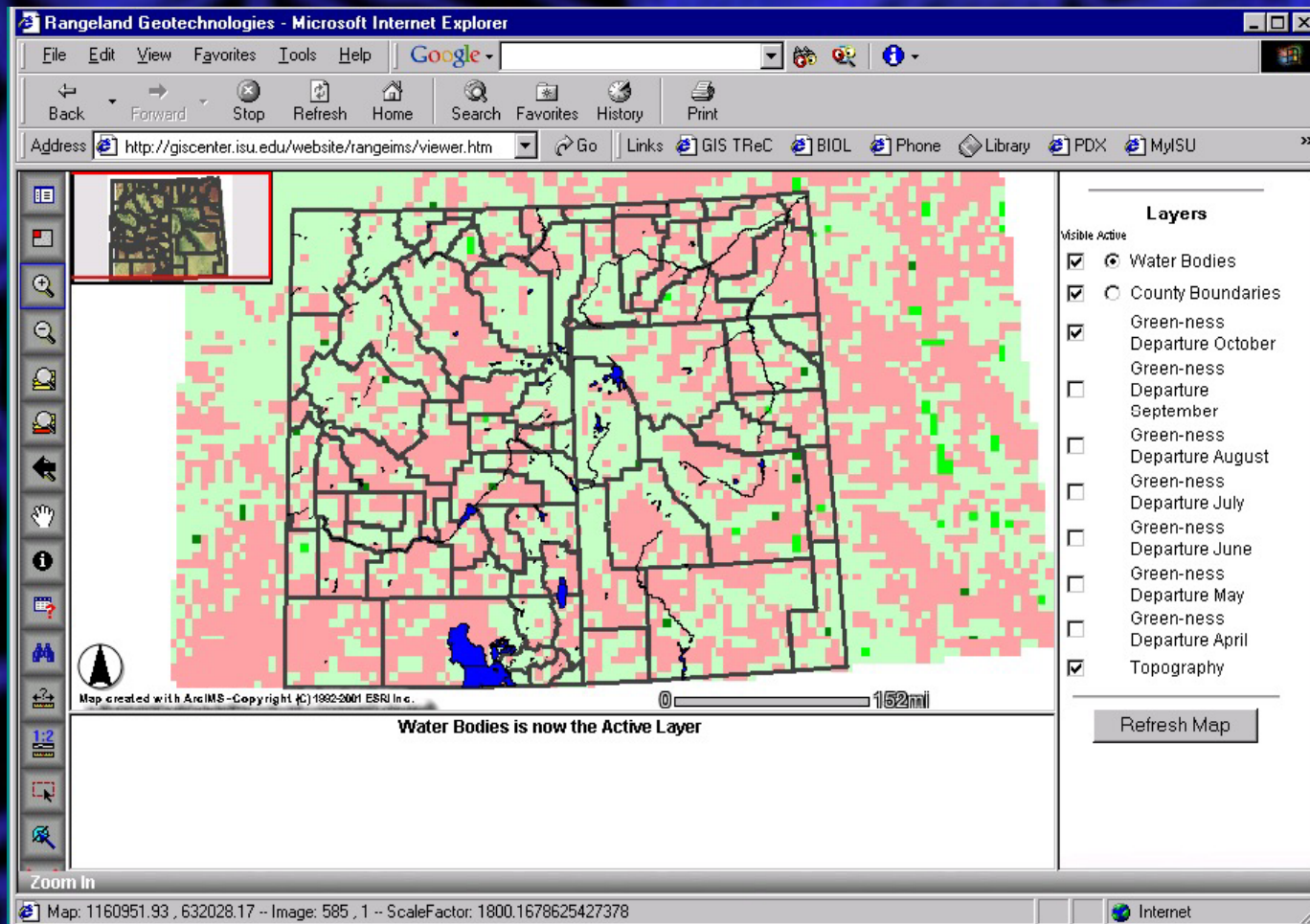
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# Public

## Outreach

- What are we doing to inform stakeholders



# Project Timeline

- Collection of additional and more detailed training data—Summer 2003
- Public Outreach—Fall 2003
- Refine model—2003-2004
- Public Outreach—Fall 2004
- Final models delivered 2005

# Questions

- Questions
- Comments
- Suggestions

Thanks to NASA, this research  
and public outreach are  
possible

