

Monitoring, Mapping, and Remote Sensing for Adaptive Management

Wildfires and Invasive Plants in American Deserts
W-III. Effective Invasive Plants Management

December 10, 2008



Contributors



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Outline

- Knowledge transfer
 - Geospatial Extension Program
- Answering the “Where?” question
 - Ground-up: The Geospatial Tool Kit (GTK)
 - Space-down: Some remote sensing examples
- Collaborative mapping
 - Google tools
- Decision support
 - RangeView
 - Invasive Species Forecasting System (ISFS)
 - Multi-criteria Decision Making

I. Knowledge transfer

A Convergence of User Needs and Agency Missions



Cooperative State
Research, Education, and Extension Service





The mission of NGTEN is...

...to facilitate the practical use of Earth systems science and geospatial technology, and help meet the growing demand for a spatially literate workforce.

This is made possible through seeds sown by NASA, USDA and NOAA, and the networks provided by Land Grant (Cooperative Extension), Space Grant, Sea Grant and other local partners.





National Geospatial Technology Extension Network

Our mission is to facilitate the practical use of Earth systems science and technology, and help meet the growing demand for a spatially literate workforce. This is made possible through seeds sown by NASA, USDA and NOAA, and the science and education networks provided by Land Grant (Cooperative Extension), Space Grant, Sea Grant and other local partners.



- Alabama
- Arizona
- Connecticut
- Mississippi
- Missouri
- Nebraska
- New Hampshire
- North Dakota
- Ohio
- Oklahoma
- Rhode Island
- Texas
- Utah
- Virginia

Mission



About Geospatial Extension



Outcomes and Impacts



Resources



Geospatial Technology



Applications



From Our Archives



Courtesy of Barron Orr
University of Arizona

Upcoming Events

Wildfire and Invasive Plants in American Deserts
December 10-11, 2008
Reno, Nevada
[Website](#) • [More Info](#)

ASPRS 2009 Annual Conference
March 8-13, 2009
Baltimore, MD
[Website](#) • [More Info](#)

[Full Calendar](#)



In each participating state, a Geospatial Extension Specialist (GES) acts as a knowledge broker, or the two-way conduit between research, applications development and practice. We build on existing Earth science capabilities, which include Earth observations from space, modeling and systems engineering, geographic information systems (GIS), the global positioning system (GPS) and spatial decision support systems (SDSS).

Factoid

NASA Learning Technologies: World Wind lets you zoom in from satellite altitude into any place on Earth.

Geospatial Data Site for Natural Resource Managers and Producers

The screenshot shows a Mozilla Firefox browser window displaying the USDA Geospatial Data Gateway website. The browser's address bar shows the URL <http://datagateway.nrcs.usda.gov/>. The website header includes the USDA logo, the text "United States Department of Agriculture", and "Service Center Initiative". A navigation menu contains links for "Get Data", "Login", "Check Order", "Status Maps", "News", "FAQ", "About", "Contact", and "Administration". The main content area features a large graphic of a globe with a satellite and a stack of data layers, with the text "the one stop source of natural resources data" and "Data Gateway". To the right, there is a "SYSTEM STATUS" box indicating that all products and services are running normally. Below the main content, there are sections for "Minimum Requirements" (Microsoft Internet Explorer 5.5 or Netscape Communicator 4.76 with Java enabled) and a "WARNING" about the site's use for official government business. The footer contains links for "USA.gov", "FOIA", "Non-Discrimination Statement", "Privacy Policy", "Disclaimer", and "Data Distribution Policy".

Internet Explorer users must check java options and use JRE 1.5 (or higher) before proceeding. (see FAQ item 2)

USDA + United States Department of Agriculture + Service Center Initiative +

Get Data Login Check Order Status Maps News FAQ About Contact Administration

+ Natural Resources Conservation Service +
+ Farm Service Agency +
+ Rural Development +

the one stop source of
natural resources data

The Geospatial Data Gateway provides One Stop Shopping for natural resources or environmental data at anytime, from anywhere, to anyone. **The Gateway** allows you to choose your area of interest, browse and select data from our catalog, customize the format, and have it downloaded or shipped on CD or DVD.

SYSTEM STATUS

All products and services are running normally.

Geospatial Data Gateway

Minimum Requirements: Microsoft Internet Explorer 5.5 or Netscape Communicator 4.76 with Java enabled.

WARNING: This is a United States Department of Agriculture computer system, which may be accessed and used only for official Government business (or as otherwise permitted by regulation) by authorized personnel. Unauthorized access or use of this computer system may subject violators to criminal, civil, and/or administrative action. All information on this computer system may be intercepted, recorded, read, copied, and disclosed by and to authorized personnel for official purposes, including criminal investigations. Access or use of this computer system by any person, whether authorized or unauthorized, constitutes consent to these terms.

USA.gov FOIA Non-Discrimination Statement Privacy Policy Disclaimer Data Distribution Policy

<http://datagateway.nrcs.usda.gov/>

Answering Technical Questions: eXtension: Map@Syst

The screenshot shows a Mozilla Firefox browser window displaying the eXtension website. The browser's address bar shows the URL <http://www.extension.org/>. The website's header includes the eXtension logo with the tagline "more mind reach" and a navigation menu with links for Home, About, Resource Areas, News, Answers, Calendar, Self Learning, and Feeds. A search bar is located in the top right corner of the page.

The main content area features a "did you know?" section with the text: "Cooperative Extension offices are found in almost all of the more than 3,000 counties throughout the nation. [Read more...](#)". Below this is a navigation bar with a search box and a "Search" button.

The main content area is divided into two columns. The left column contains a blue box with the text: "Objective. Research-based. Credible. Information and tools you can use every day to improve your life." followed by "This is the most reliable information you'll find on the Internet brought to you by the nation's largest and oldest network of universities. [More...](#)" and "Here are some of our featured articles and activities...". Below this is a featured article titled "Understanding A Forage Analysis" with a small image of hay. The article text reads: "Learn about balanced rations and how to interpret the results from your forage analysis." and includes a "More..." link.

The right column contains a green box titled "Find An Extension Office" with the text: "Enter your zipcode to find your local Extension office:" followed by a text input field and a "submit" button. Below this is another green box titled "Resource Areas" with a list of categories: "Community", "Diversity Across Higher Education", "Entrepreneurs & Their Communities", "Gardens, Lawns & Landscapes" (circled in black), "Geospatial Technology", and "Imported Fire Ants".

At the bottom of the featured article box, the URL <http://www.extension.org/> is displayed in large, bold, black text.

eXtension - Geospatial Technologies - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.extension.org/geospatial+technology

Google


extension
more mind reach

did you know?
Approximately 7 million young people across America are members of Cooperative Extension's 4-H program. [Read more...](#)

Home About Resource Areas News Answers Calendar Self Learning Feeds Search

Geospatial Technologies

Here are some of our featured articles and activities:



Geocaching - Getting Started
Geocaching - Putting GPS to Work
[More...](#)

1 2 3 4 5 6 Next

In This Resource Area

Geospatial Technologies

- Geographic Information Systems(GIS)
- Global Positioning Systems(GPS)
- Remote Sensing
- Web Mapping
- Geospatial Data
- Hardware and Software

Application Areas

- Land Use and Community Planning
- Precision Agriculture
- Natural Resource Management

Additional Information

- Glossary
- User Groups

Answers from our Experts


February 12, 2006
What can remote sensing produce?

February 06, 2006
What is a "user needs" analysis?

February 07, 2006
If the GPS gives a position only at the antenna, how does a spray nozzle thirty feet away on the...

[More ...](#)

This resource area was created by the [Map@SysT community](#)



Find An Extension Office

Enter your zipcode to find your local Extension office:

In The News...

March 17, 2006
Applications for National 4-H GIS/GPS Leadership Team due March 31

March 14, 2006
Apply Now for Nevada Range Camp, Held June 15-21

March 05, 2006
Iowa 4-H'ers Use GPS/GIS to Map Barn Quits

[More ...](#)

Resource Area Feeds

- Track all new content

Resource Area Tags

aerial imagery ArcGIS beef cattle coin
cotton industry diversity engineering
entrepreneurship GIS field crops
geographic information systems geospatial
data geospatial technology ocala global

Answering Your Technical Questions?
MAP@SYST

<http://www.extension.org/geospatial+technology>

Geographic Coordinate System - eXtensionCommunities - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://cop.extension.org/wiki/Geographic_Coordinate_Syst

Events Frequently Asked Questions People About Wiki About Blog

Barronrr my talk my preferences my watchlist my contributions log out

eXtension Communities of Practice
more mind reach

navigation article discussion edit history move watch meta publish

- ▶ Main Page
- ▶ Community portal
- ▶ Categories
- ▶ Current events
- ▶ Recent changes
- ▶ Random page
- ▶ Help
- ▶ New Page

search

toolbox

- ▶ What links here
- ▶ Related changes
- ▶ Upload file
- ▶ Special pages
- ▶ Printable version
- ▶ Permanent link

▶ Status: **Unpublished**

▶ Preview page

▶ - Preview site updates every 5 minutes

Geographic Coordinate System

Jump to: navigation, search

Main Page < Map@Syst < Map@Syst Content < ADD Map@Syst Wiki Pages Here < **Geographic Coordinate System**

The geographic coordinate system (also known commonly as "latitude and longitude") is a non-planer (spherical) coordinate system.

such as the geographic coordinate system (based on angles) of latitude and longitude. Latitude is a north/south angular measurement of position perpendicular to the Earth's polar axis ranging from 0° at the equator to 90° at the poles (the major lines are called parallels of latitude). Longitude is an east/west angular measurement of position relative to the Prime Meridian (0°), an imaginary circle passing through the poles (the major lines are called meridians of longitude, ranging from 0° to plus or minus 180°). To precisely locate points on the Earth's surface, degrees (°) longitude and latitude have been subdivided into minutes (') and seconds ("). There are 60 minutes in each degree (60' = 1°) and 60 seconds in each minute (60" = 1'). Latitude and longitude measurements are indicated by black tick marks in the margins of a topographic map using degrees, minutes, seconds nomenclature, or DDD° MM' SS.S" (e.g. latitude 32° 7' 11.3" N longitude 110° 55' 48.5" W).

Category: map@syst incomp

map@syst incomp

This page was last modified 21:26, 11 December 2007. This page has been accessed 3 times. Privacy policy About eXtensionCommunities Disclaimers Send Us Feedback

MAP@SYST

Answering Your Technical Questions?

Learning Modules

- Introduction to Mapping
- Image Types and Sources
- GPS Basics
- Handheld Computers
- Handheld GIS Software
- Desktop GIS Software
- Collaborative Mapping with Google Tools



Moodle is a course management system (CMS) - a free, Open Source software package designed using sound pedagogical principles, to help educators create effective online learning communities.

Increasing access

GELL – GELL - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://gell.arid.arizona.edu/

Geospatial Equipment Lending Library

Home About GELL Browse Lenders Search for Equipment Log in Register Help

you are here: home

Borrowers

- Borrow equipment from County Extension offices and other lenders in your area
- Equipment available includes handheld GPS, handheld computers, etc.
- Register to create a borrower account
- Learn more about the Geospatial Equipment Lending Library

Lenders

- Manage equipment rental scheduling and transactions online
- Create your own rental policies
- Link to something extremely important
- Learn more about the Geospatial Equipment Lending Library

cart

Your cart is empty

August 2008

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

log in

Login Name

Password

log in

Forgot your password?

Search

Register

http://gell.arid.arizona.edu/

ARSC – GELL - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://gell.arid.arizona.edu/

Geospatial Equipment Lending Library

Home About GELL Browse Lenders Search for Equipment Log in Register Help

you are here: home → lenders → arsc

ARSC

- iPAAQ Handheld PC
- more ...
- iPAAQ Handheld PC
- more ...
- iPAAQ Handheld PC
- more ...
- iPAAQ Handheld PC
- more ...
- iPAAQ Handheld PC
- more ...
- iPAAQ Handheld PC
- more ...
- Garmin GPS Handheld GPS
- more ...
- Garmin GPS Handheld GPS
- more ...
- Garmin GPS Handheld GPS
- more ...

Coming soon !!!!

II. Answering the “Where?” Question -- Ground-up

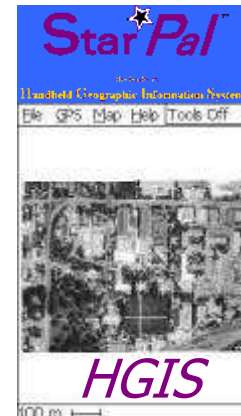
Converging technologies

- Windows Mobile, Pocket PCs, GPS innovations
- Smartphones, GPS Enabled Smartphones
 - GPS & GIS & Navigation enabled Smartphones?
- Mashups & KML
 - Google Earth, Google Maps, Flickr, etc.
- User Created Content
- Google My Maps, Google Groups, Web Picasa
- Remote Sensing
- Decision Support



The Geospatial Tool Kit (GTK)

- Aerial photos/topos in background
 - TerraServer-USA.com
- GPS Receiver
 - Garmin GPSmap 60
- Handheld Computer
 - Hp iPAQ series PocketPC
- GIS on the handheld
 - StarPal HGIS, ESRI ArcPad
- GIS on the desktop or laptop
 - HGIS and ESRI ArcView



Original concept for the GTK was developed by USU's Phil Rasmussen

Using the “Geospatial Tool Kit”



Diné College student Nora Jeli trains NPS staff on the GTK

Equipment Options



Recent GPS/GIS integrated solutions



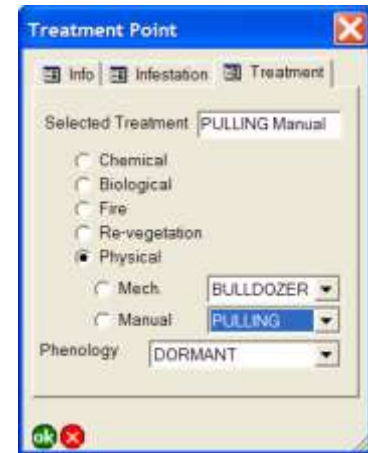
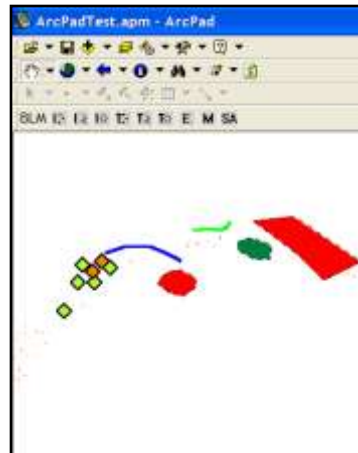
Trimble Juno ST



**HP iPAQ rx5915
Travel Companion**

Both these units combine a Handheld Computer and a Integrated SiRFstarIII GPS receiver – the best integrated options we are aware of. You can add HGIS or ArcPad to each of these. The Juno ST sells for \$650 and the iPAQ for \$600 (\$410 even!).

Software/Database Options



- What is the best system? The one you use!
 - For invasive species, is it WIMS? GeoWEED? The new BLM system? The new Forest Service system?
 - The one most commonly used by you/those you are working with...
 - The one that gets the job done

Selected screen shots from the BLM Invasive Species Management Information System (courtesy of Kathie Jewell)

GPS-enabled mobile phones

Boost Mobile - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.boostmobile.com/index.html

Google

“Where you At?” **boost mobile**

STORE LOCATOR Zip Code GO MY ACCOUNT Search SUBMIT

Block

HOME SHOP ACTIVATE RE-BOOST COMMUNITY SUPPORT

i425t OVERVIEW SPECS ACCESSORIES

- NATIONWIDE BOOST WALKIE-TALKIE
- MULTI-MEDIA & TEXT MESSAGING
- MESSAGING (AOL, YAHOO! & MSN)
- WIRELESS WEB
- RINGTONES (MUSIC & VOICE)
- GPS ENABLED**
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FREE SHIPPING
\$5 FREE CALL CREDITS

Only **\$39.99**

ADD TO CART

GPS ENABLED

Get real time turn-by-turn directions with details more accessible than ever before thanks to GPS technology. This GPS feature now comes standard on all new Boost phones.

Vine St.
130 ft
Hollywood Blvd

i425t

Boost Mobile: <http://www.boostmobile.com/>

GPS-enabled mobile phones

loopt - Live In It - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://loopt.com/loopt/sess/index.aspx

loopt

HOME PROFILE FRIENDS JOURNAL PLACES EVENTS MESSAGING SETTINGS HELP REGISTER

LOGIN REGISTER WHAT'S LOOPT? PHONES BE SAFE ABOUT US

Drag the map & click the dots.

Sammy Wu
What's up? I see you're in chinatown [4.1 mi away]

what is loopt?

- find friends on the map
- know what friends are up to
- get alerts when friends are nearby
- share events and favorite places
- tag photos with location

register! take a tour

now available on Sprint and boost mobile try it free for 30 days other carriers coming soon!

take the loopt tour!

already on loopt? login!

MOBILE #:

PASSWORD:

Not registered yet? login

Forgot your password?

Loopt: <https://loopt.com/>



G3 Project - provides tracking, archiving and geotagging features, with the help of Google Maps and Google Earth, of any Java-capable mobile phone connected to a GPS receiver.

The Future Is Now

amAze BETA
GET OUT OF THE MAZE
GPS navigation for your mobile phone!

Free download
For Java Phones

Enter to learn more about amAze

115 m
To Via Cassar
Via del Cardello
Via di San Seregnone

amAze - is for the Java-enabled mobile phone, which can provide and voice guidance to any destination; search or define any location by its address; search and navigate to businesses listed in yellow pages directories.

<http://www.maps-gps-info.com/fgpfw.html>



II. Answering the “Where?” Question -- Space-down

High Resolution Imagery (QuickBird) to Monitor Conifer Encroachment

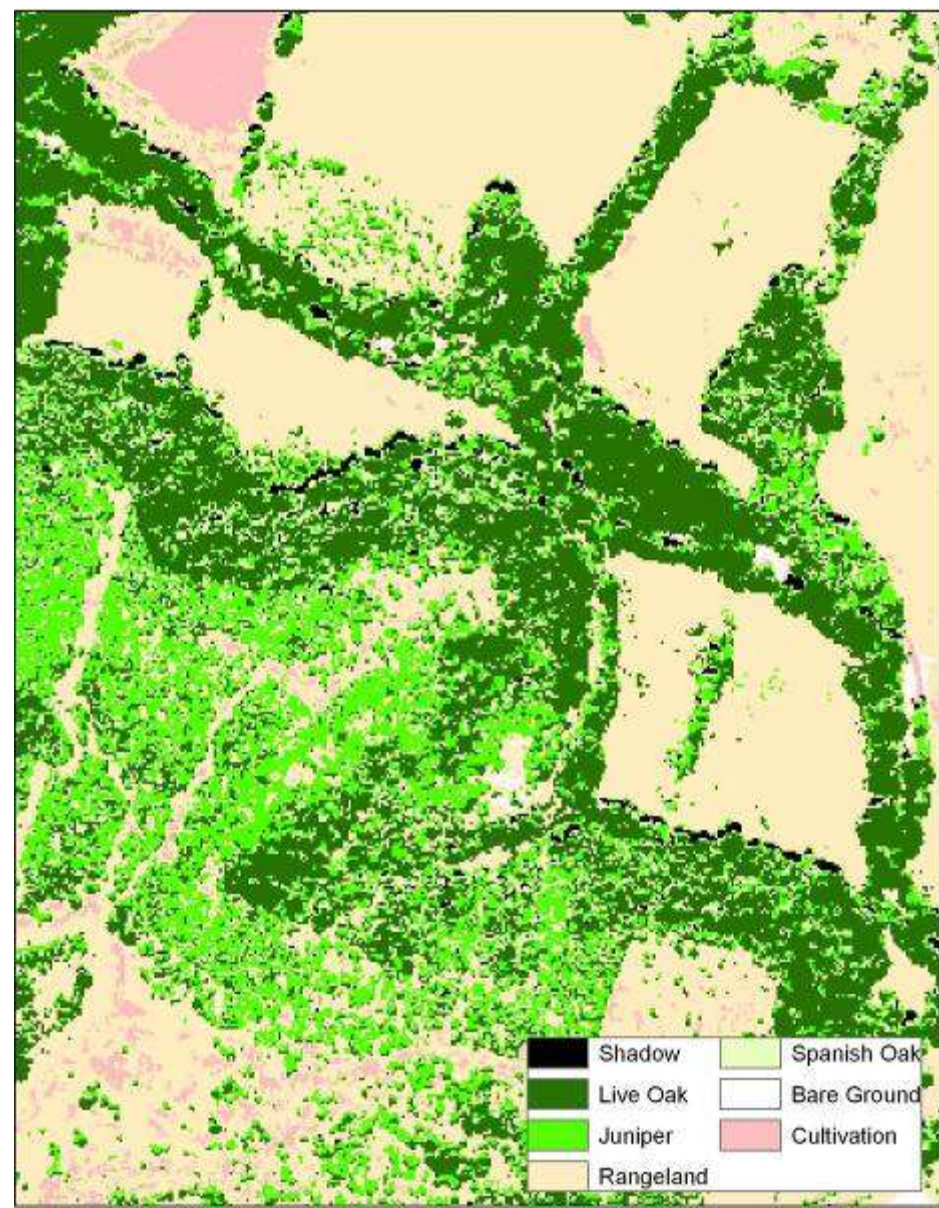
- Neal Wilkins, TCE, Texas A&M
- Amy Hays, Land Information Systems, Texas Cooperative Extension (TCE)
- Jeff Mosely, Montana State University
- John Boren, New Mexico State University
- Red Baker, New Mexico State University



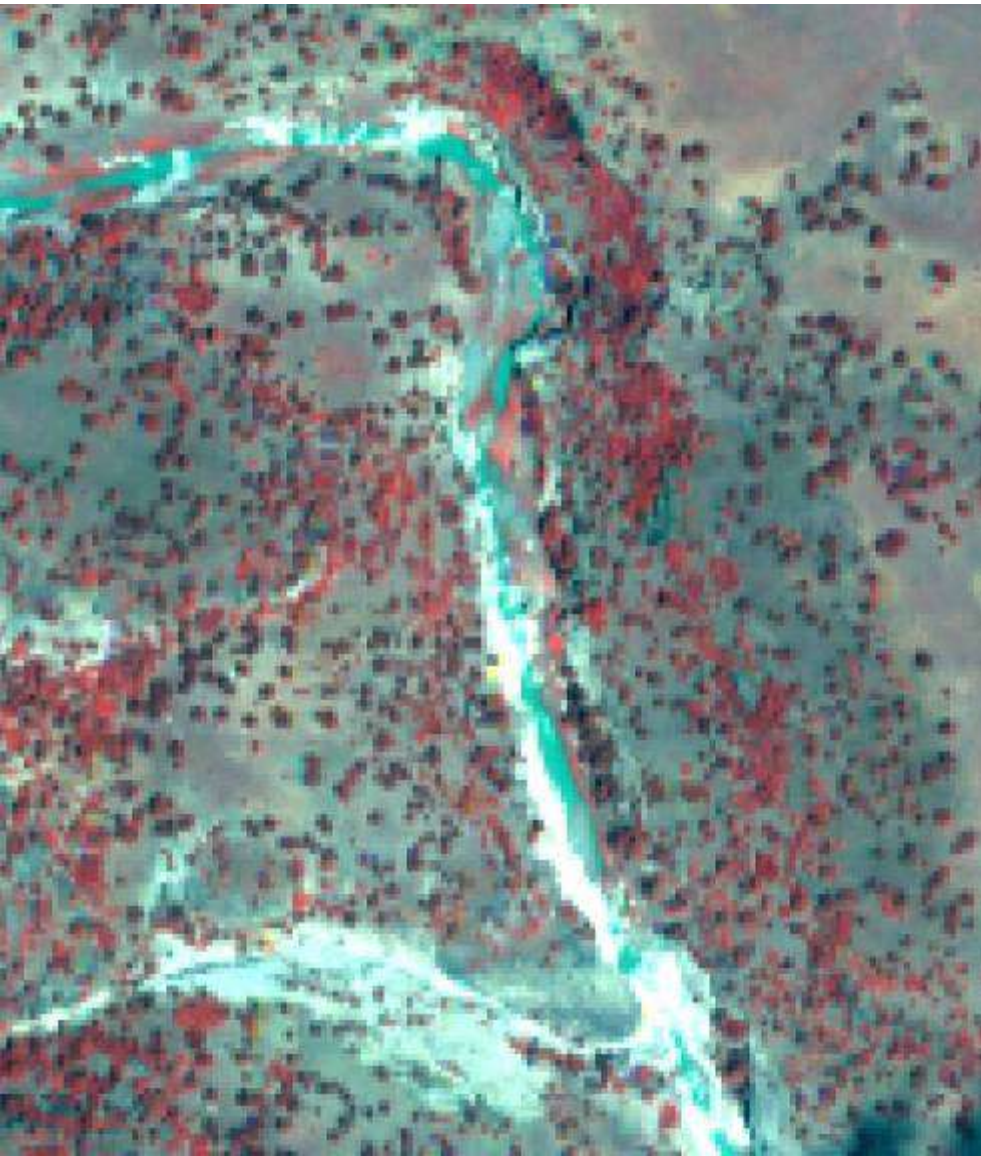
Examples of Conifer Encroachment



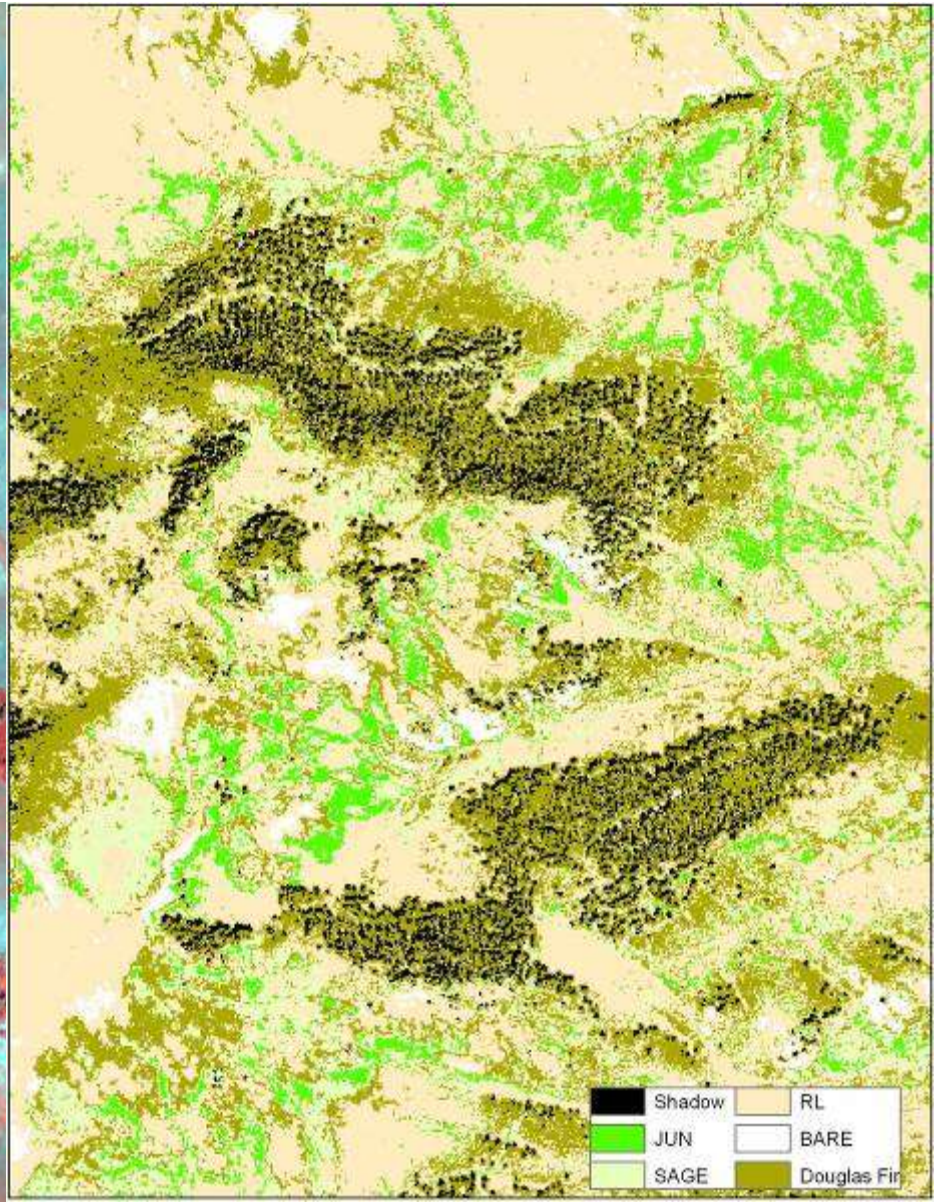
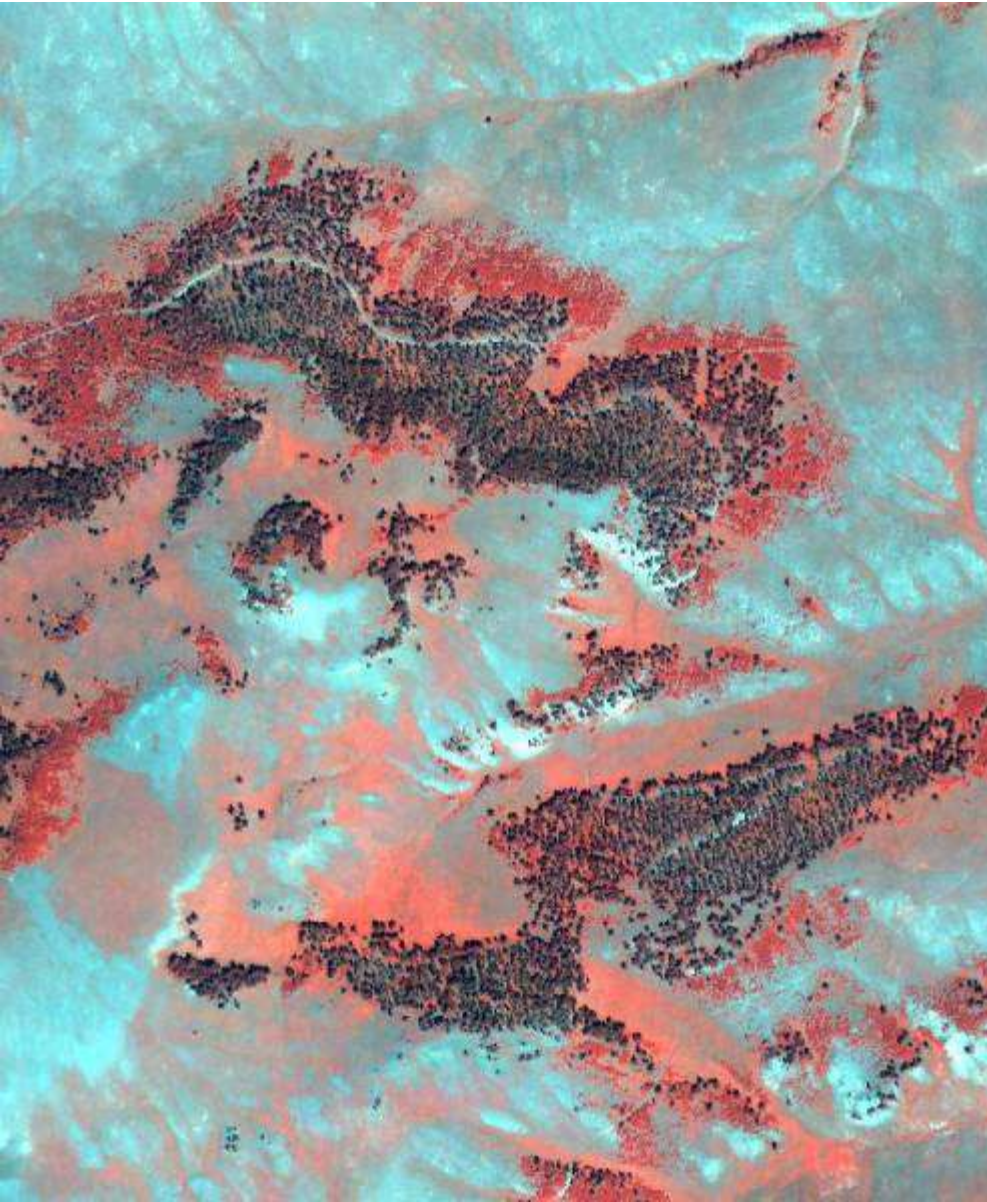
Texas – Classification from QB



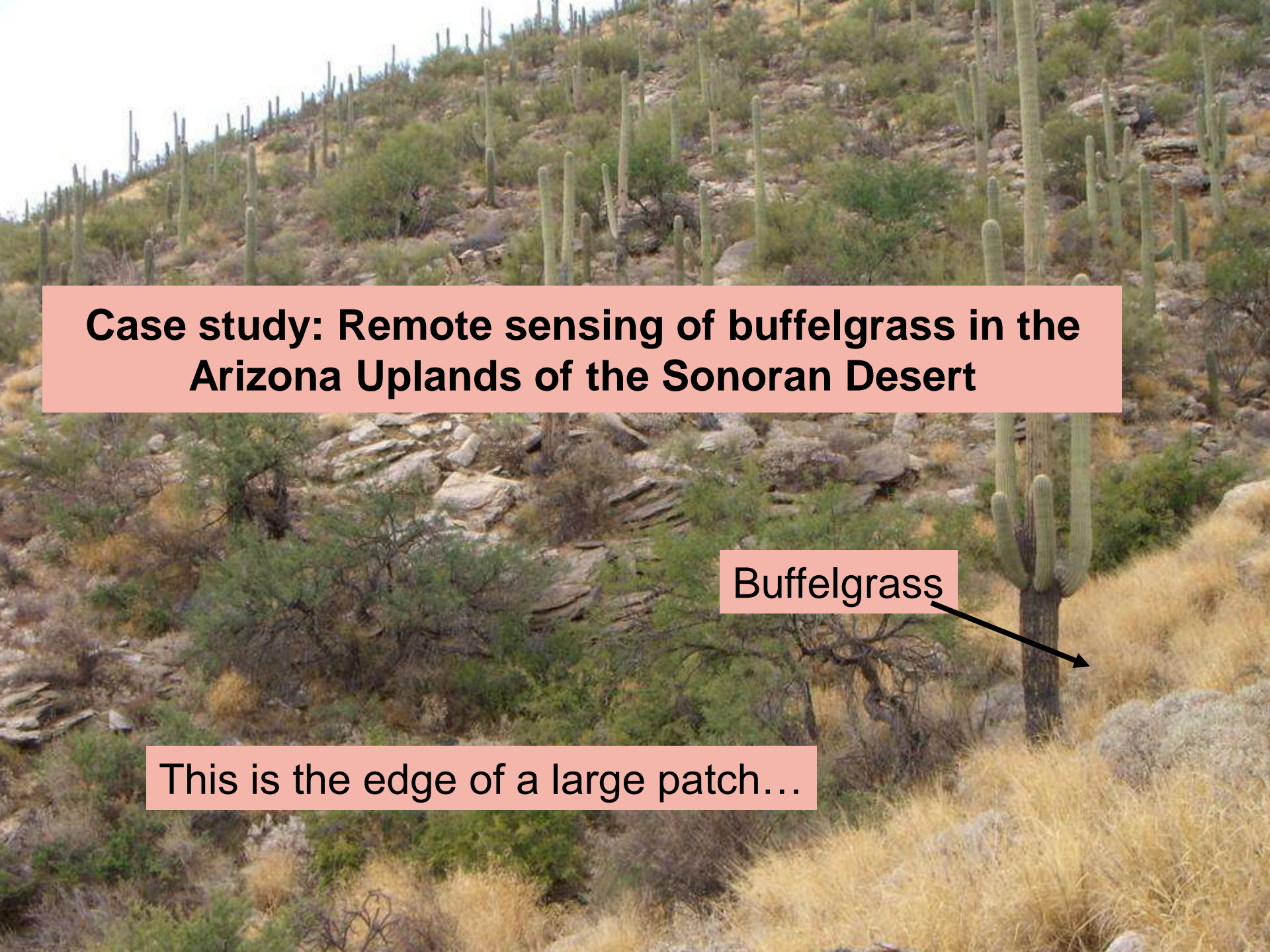
New Mexico – Classification from QB



Montana – Classification from QB



Shadow	RL
JUN	BARE
SAGE	Douglas Fir



**Case study: Remote sensing of buffelgrass in the
Arizona Uplands of the Sonoran Desert**

Buffelgrass



This is the edge of a large patch...

This is the center of the same patch



Evaluating importance of spatial, spectral, and temporal resolution to determine an **operational** method for detecting and monitoring buffelgrass

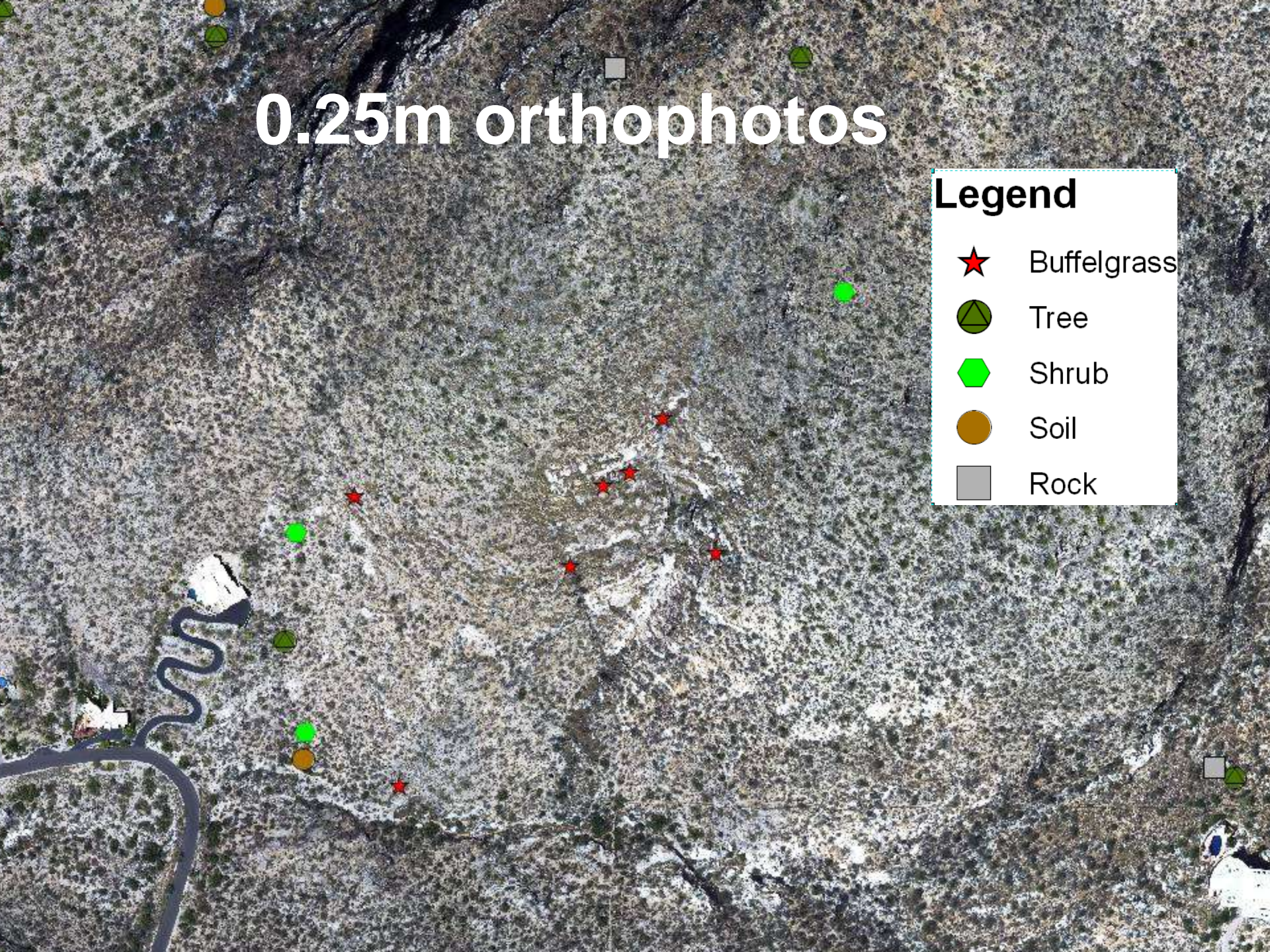
Aaryn Olsson, Stuart Marsh, Corrie Hannah, Kyle Hartfield, Univ. of Arizona

- Case Study: foothills of Santa Catalina Mountains
 - High spatial imagery
 - 0.25m true-color aerial photography
 - 1m true-color plus NIR digital orthophoto quarter quads (DOQQ)
 - Multispectral imagery (Landsat)
 - Landsat: 3 visible, 1 NIR, 2 SWIR
 - ASTER: 2 visible, 2 NIR, 6 SWIR
 - Multitemporal imagery:
 - Summer dry ASTER + summer wet ASTER
 - Summer dry ASTER + summer wet Landsat
 - Summer wet ASTER + fall dry ASTER
 - Summer wet Landsat + fall dry ASTER
- To improve classification accuracy, we incorporated ancillary data:
 - Digital elevation model (DEM) – climate constraints on buffelgrass growth
 - Aspect, slope, elevation
 - Texture – buffelgrass expected to be more homogeneous
 - Neighborhood variance (3x3, 5x5, 7x7)

0.25m orthophotos

Legend

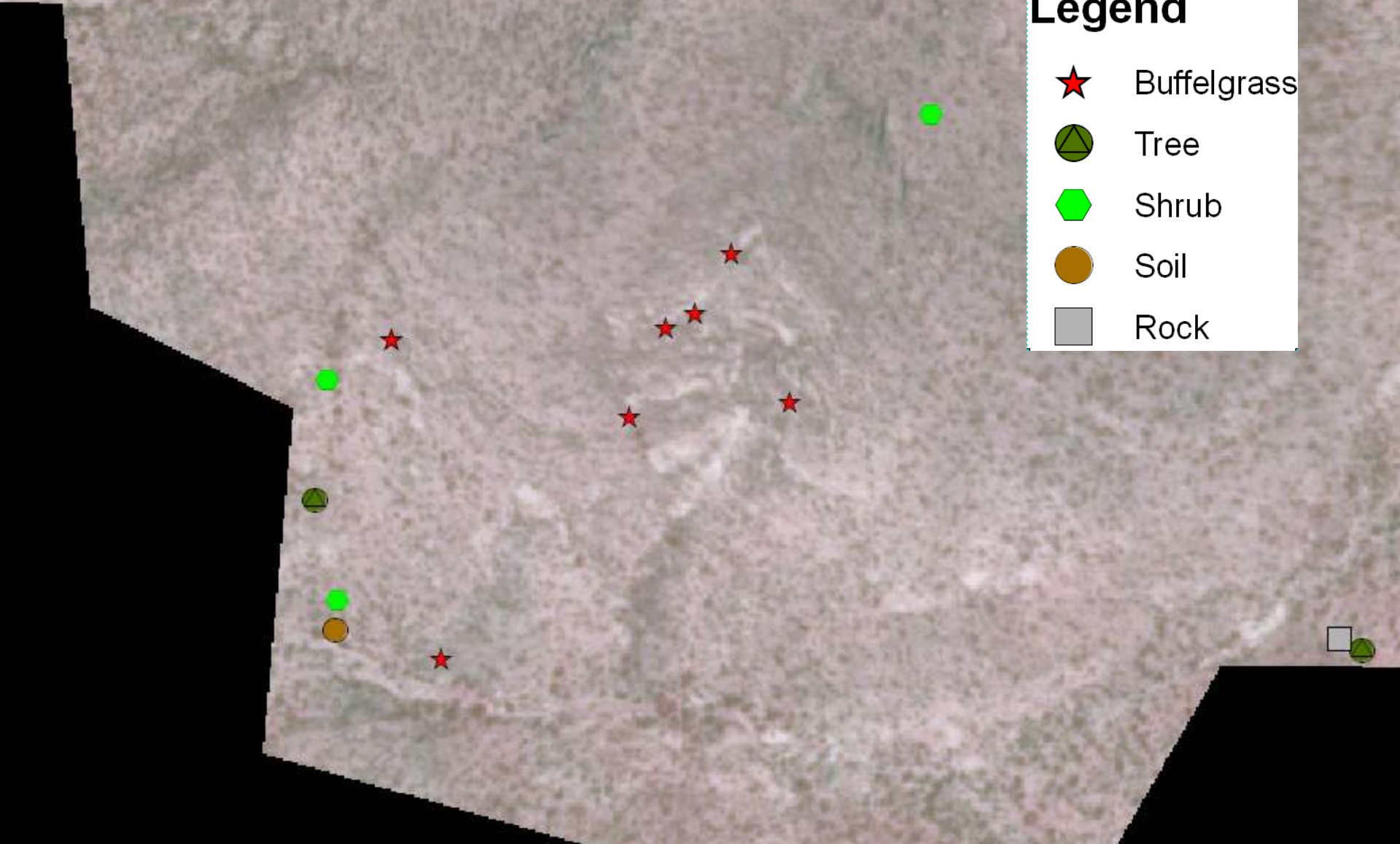
- ★ Buffelgrass
- ⊙ Tree
- ⬡ Shrub
- Soil
- Rock



DOQQ (blue, green, red, NIR)

Legend

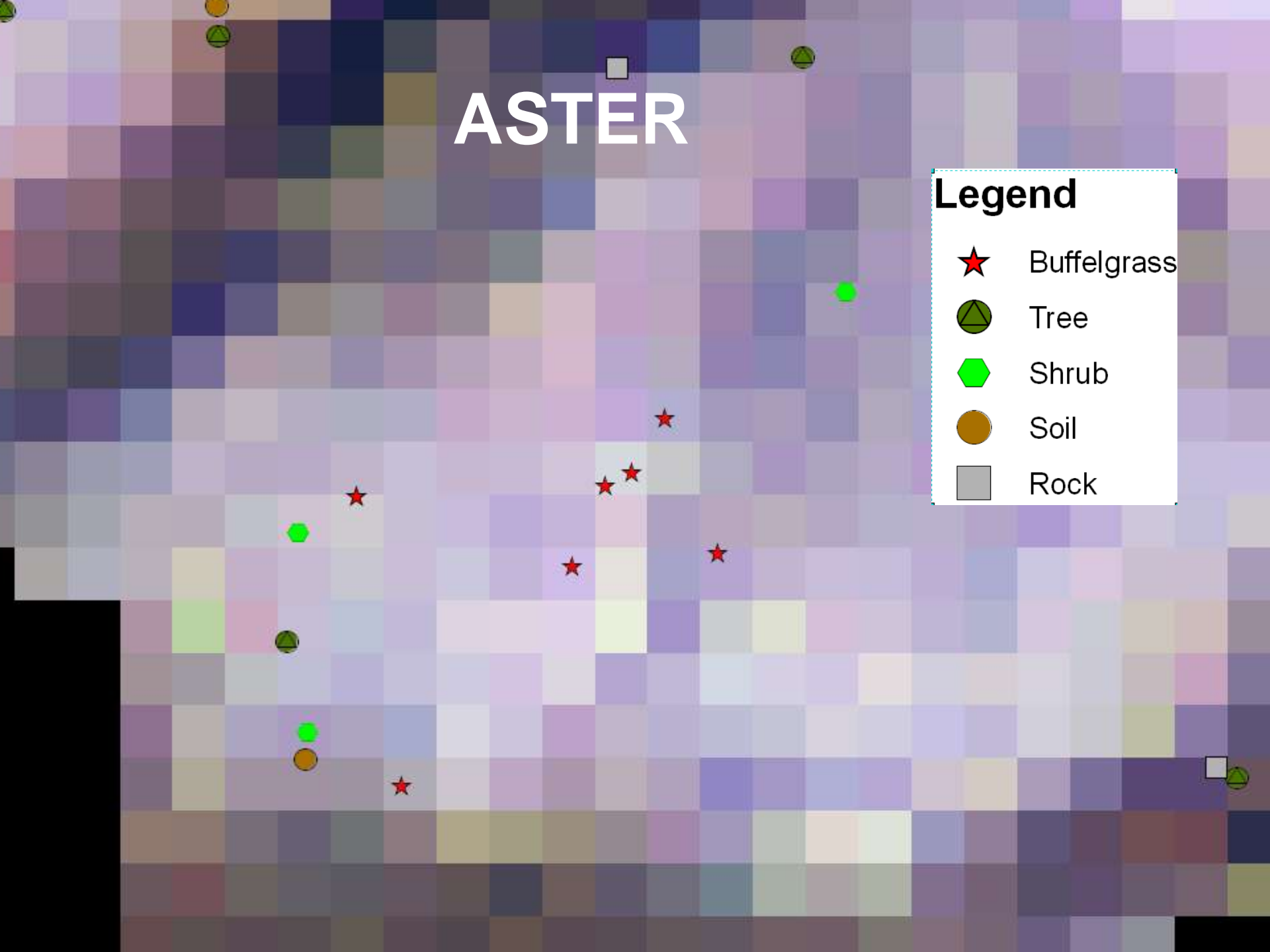
- ★ Buffelgrass
- ⊙ Tree
- ⬡ Shrub
- Soil
- Rock



ASTER

Legend

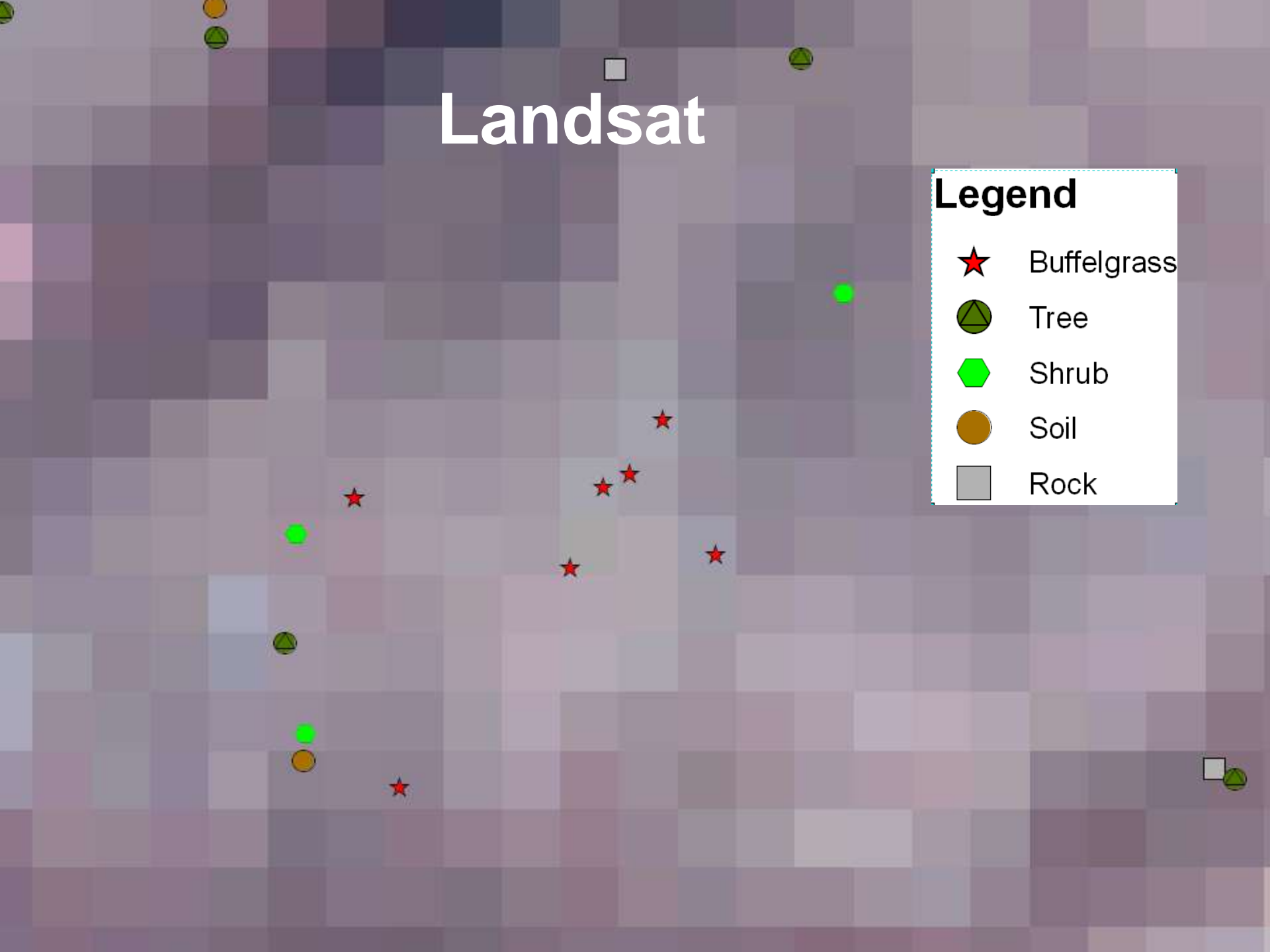
- ★ Buffelgrass
- Tree
- ◆ Shrub
- Soil
- Rock



Landsat

Legend

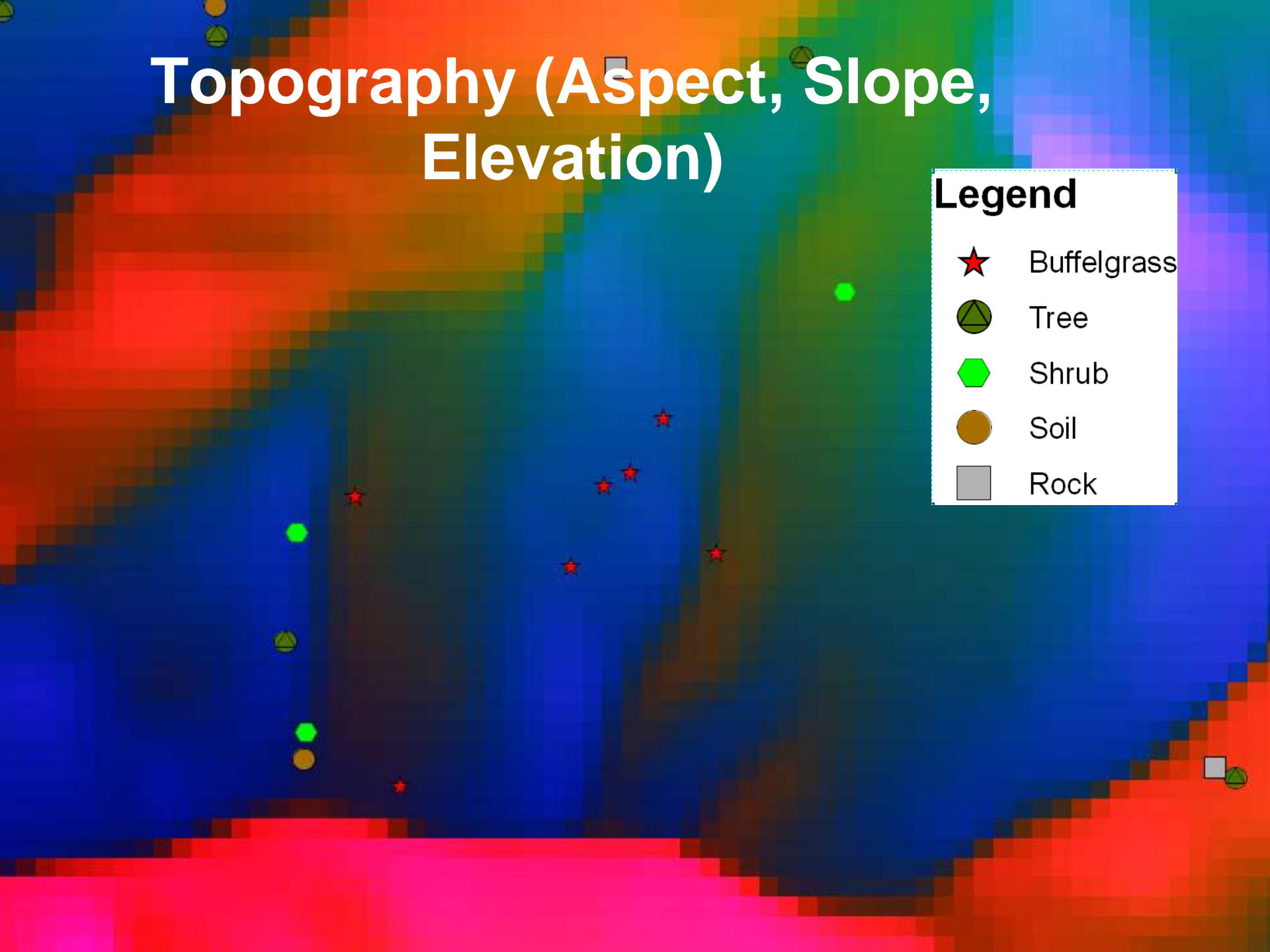
- ★ Buffelgrass
- Tree
- ◆ Shrub
- Soil
- Rock



Topography (Aspect, Slope, Elevation)

Legend

- ★ Buffelgrass
- ⊙ Tree
- ⬡ Shrub
- Soil
- Rock



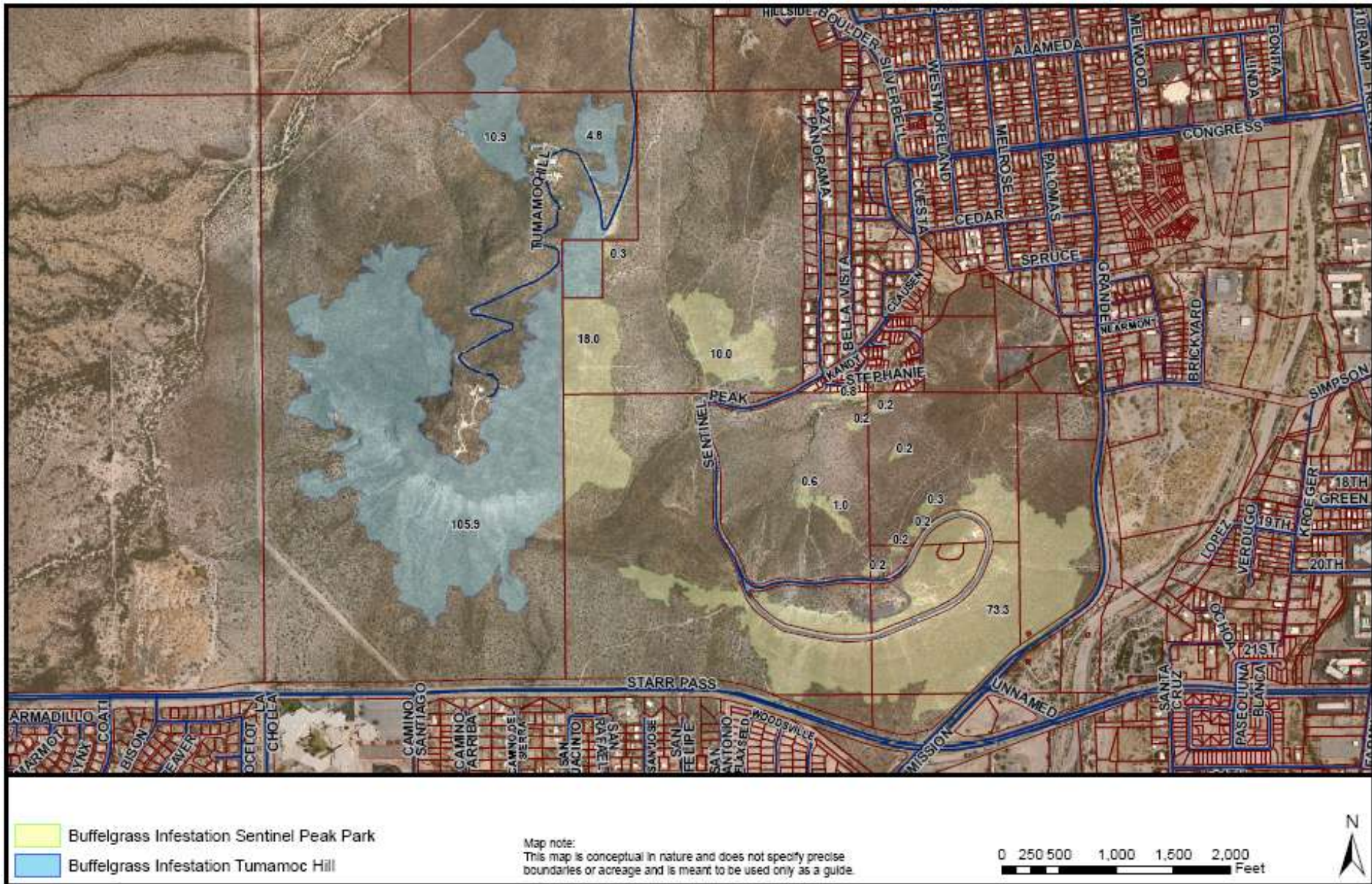
Results

(in progress)

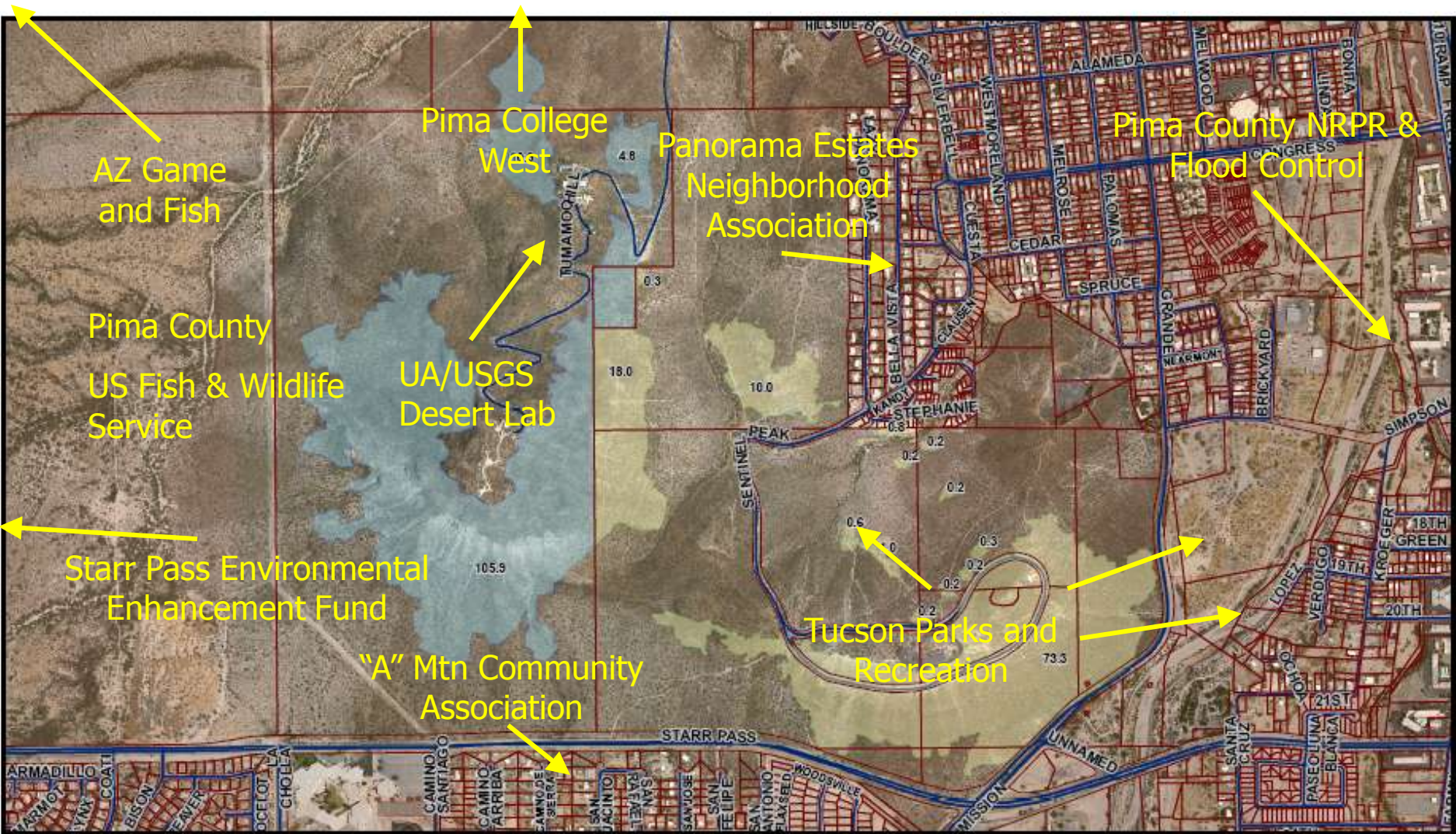
- Multi-date classification is more accurate than single date classification
- High spatial resolution is more important than high spectral resolution
- Texture does not help – landscape is too heterogeneous
- 0.25m true color is better than 1m color-IR
 - Commission errors
- **So far, it looks like heads up digitizing of high-resolution imagery is better than automatic classification**

III. Collaborative mapping

Buffelgrass "Mega-Eradication" Effort-August 2006

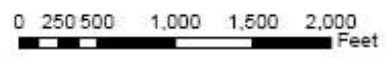


A Cooperative Effort With:



- Buffelgrass Infestation Sentinel Peak Park
- Buffelgrass Infestation Tumamoc Hill

Map note:
 This map is conceptual in nature and does not specify precise boundaries or acreage and is meant to be used only as a guide.





Find business and places of interest. Search the map and places of interest. Learn more.

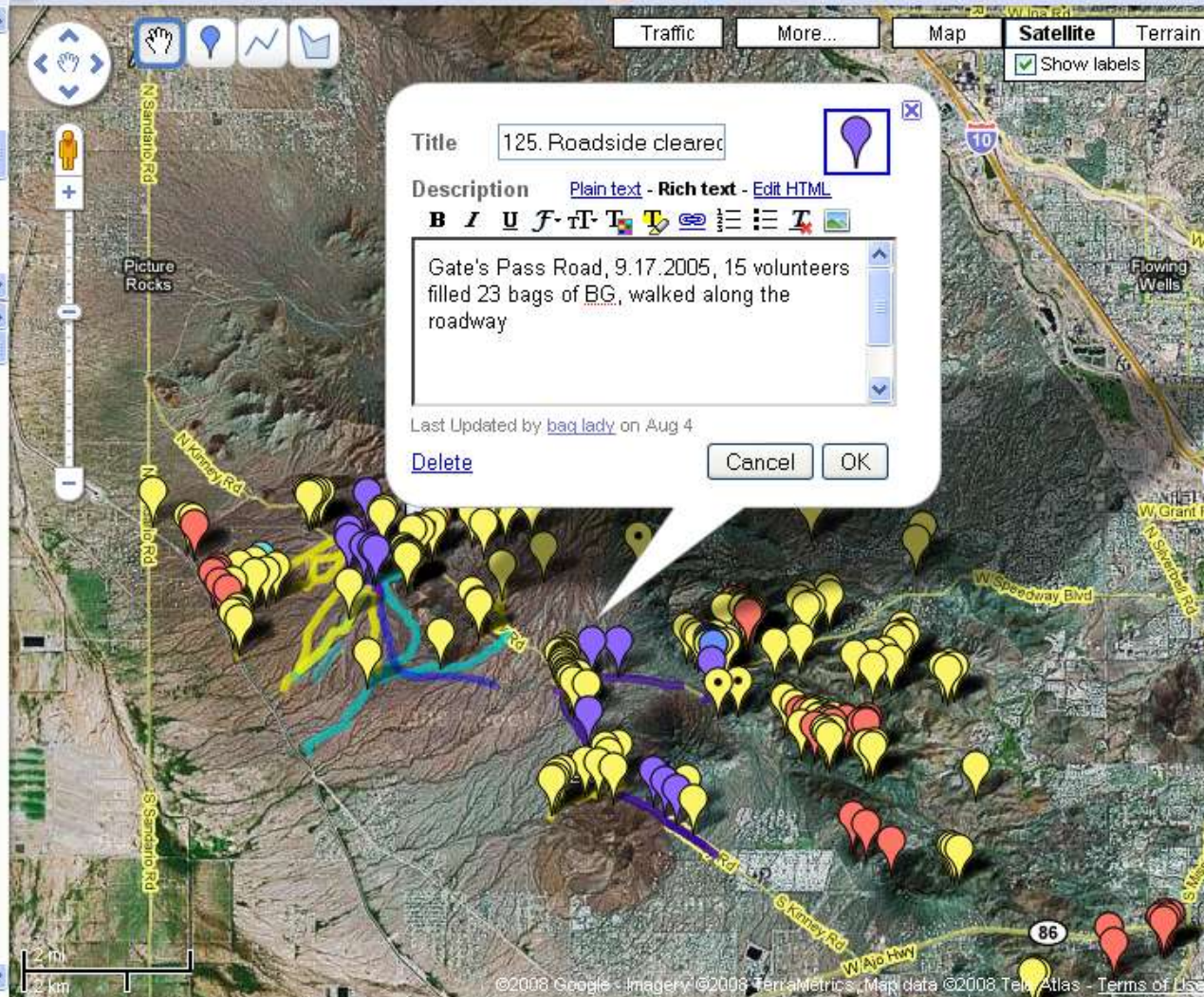
Get Directions My Maps

- jon's property Unlisted
 - Created by others**
 - Mapplet Scratch Pad
 - Developer Mapplet
 - La Jolla Trip
 - SD Weedwackers-2000-2002
 - SD Weedwackers-2008
 - SD Weedwackers-2003-2007
- Collaborate Import Done Saved

Title
SD Weedwackers-2003-2007

Description
Since 2000, the Weedwackers have removed 75 tons of buffelgrass and fountain grass from hillsides and washes.

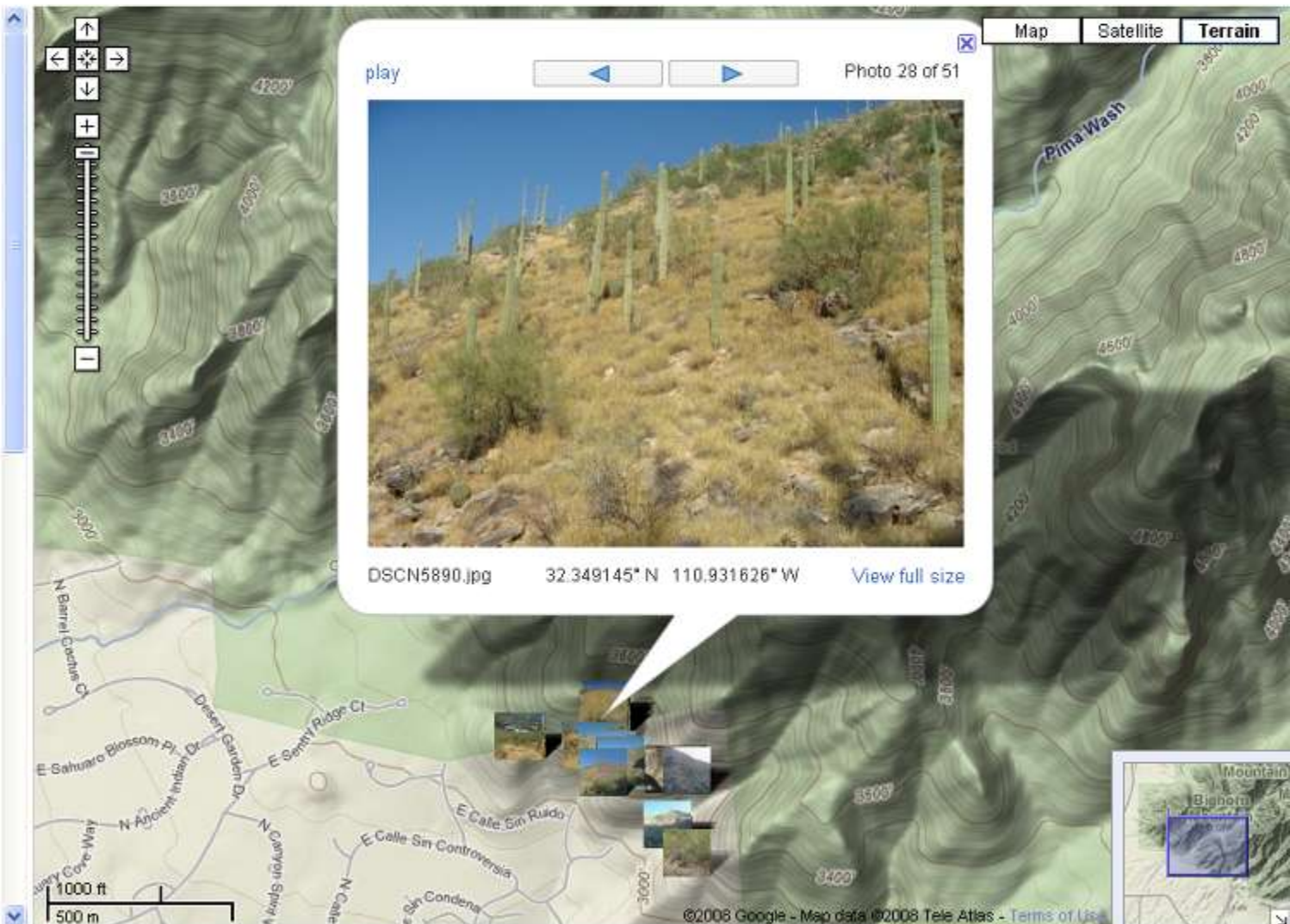
- 1. BG pulled-2007.12.18/8 bags
Starr Pass Trailhead S, 2007-12-18, 25-50 plants
- 2. BP pulled-2007.12.12/90 bags
Gate's Pass Road spill down patch of BG,
- 3. BG pulled-2007.11.28/rocked
Bren Mountain-11.28.2007-Wednesday SDWW
- 4. BG pulled-2007.11.28/rocked
South of Gate's Pass Road, 11.28.2007- BG pulled
- 5. BG pulled-2007.11.28/rocked
South of Gate's Pass Road, 11.28.2007-BG pulled
- 6. BG pulled/rocked-2007.11.14
David Yetman Trail, 11.14.2007, 9 volunteers (Sierra



BufTelgrass > BufTelgrass between Campbell and Pima Canyon > View map

Back to album view

View in Google Earth



play

Photo 28 of 51

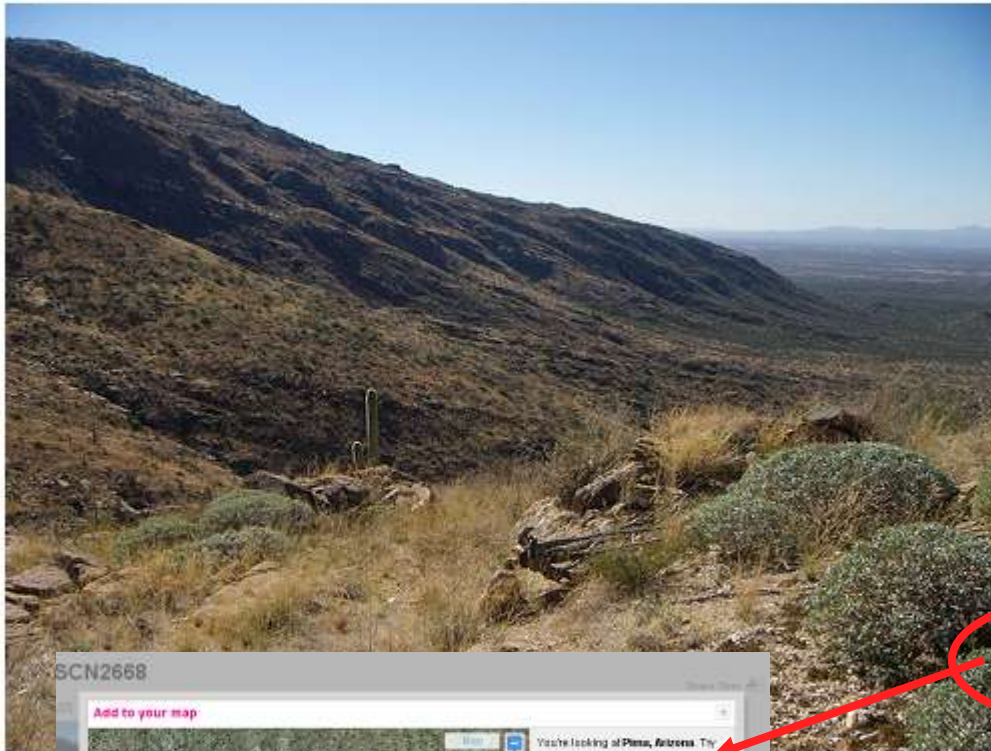
DSCN5890.jpg 32.349145° N 110.931626° W View full size

Map Satellite Terrain

DSCN2668

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SCN2668

Add to your map

Go to the Organizer | Go to the Map

Add

if your comment

Citizen science-based mapping

Invaders Survey Tracking Sheet - Mozilla Firefox

http://www.desertmuseum.org/invaders/invaders_track.php

Invaders Citizen Scientists Combat Invasive Species

Invaders of the Sonoran Desert Region a project of the Arizona-Sonora Desert Museum

Home About Us Planning a Visit Members & Partners Education Programs & Research Kids Art Institute ASDM Press Books Español

Survey Tracking Sheet

General Information

Surveyor: **arid lands**

Date: *Use MM/DD/YYYY format*

Survey Shape: **Linear**

Survey Distance: m *Enter Search Distance*

Survey Site/Route Name & Description:

County Park? **Check this box if location is a Pima County Park**

Species Searched For

Simply choose each species searched for from the list. They will be added to the list as you select them. Multiple selections will create a list of multiple species. Be sure to check which species were actually found.

- SELECT A SPECIES -

Selected Species

Survey Points

Add survey tracking coordinates below. Add as many points as necessary by filling in the coordinates and clicking the "Add Coord" button to add the coordinate to the list.

Order	Latitude (N)	Longitude (W)	
1	32° 15' 10"	110° 15' 10"	<input type="button" value="Add Coord"/>

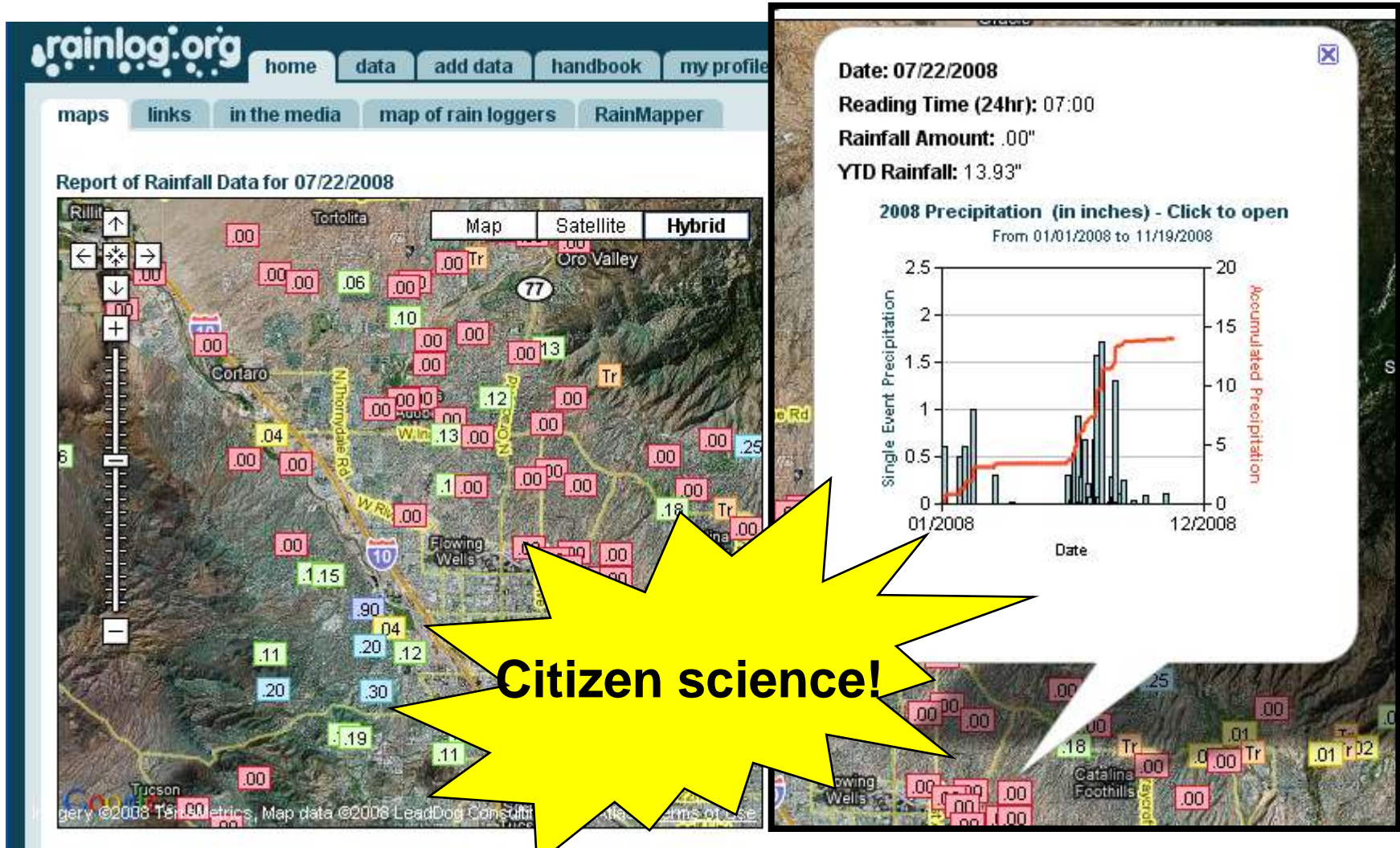
Entered Coordinates

Done

Open Notebook 3 Zotero

Can we use other C.S. data?

Precipitation data to answer:
“Where is buffelgrass green today & tomorrow?”

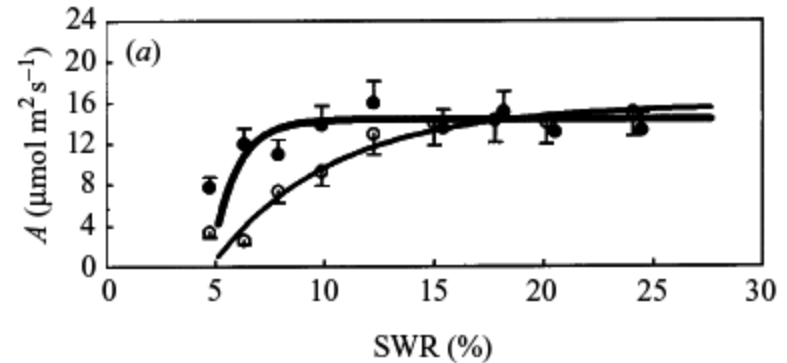


Model buffelgrass phenology

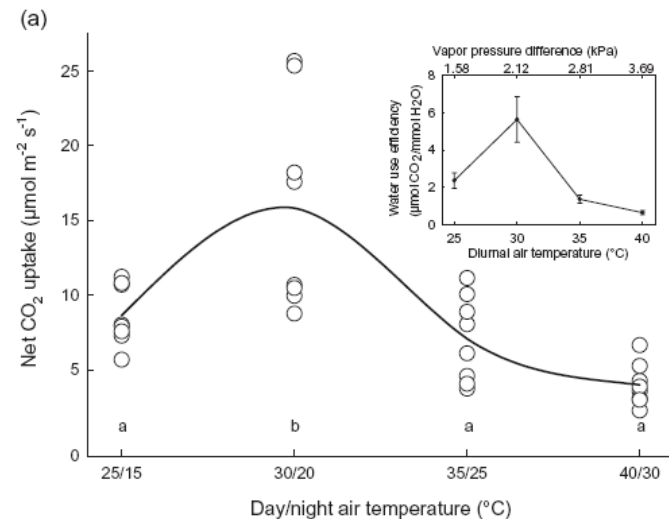
Use C.S. rainfall to estimate soil moisture, one of several factors driving a phenology model

- Productivity
 - A = f(soil moisture, temperature)
- Senesced dormancy is broken when soil moisture “sticks around”
 - 5 days minimum to greenup after onset of monsoon (Bean 2008, personal communication)
- Cold dormancy around 10 degrees C
- Mortality when temperatures held below 0 C for 8 hours (Duke 1983)

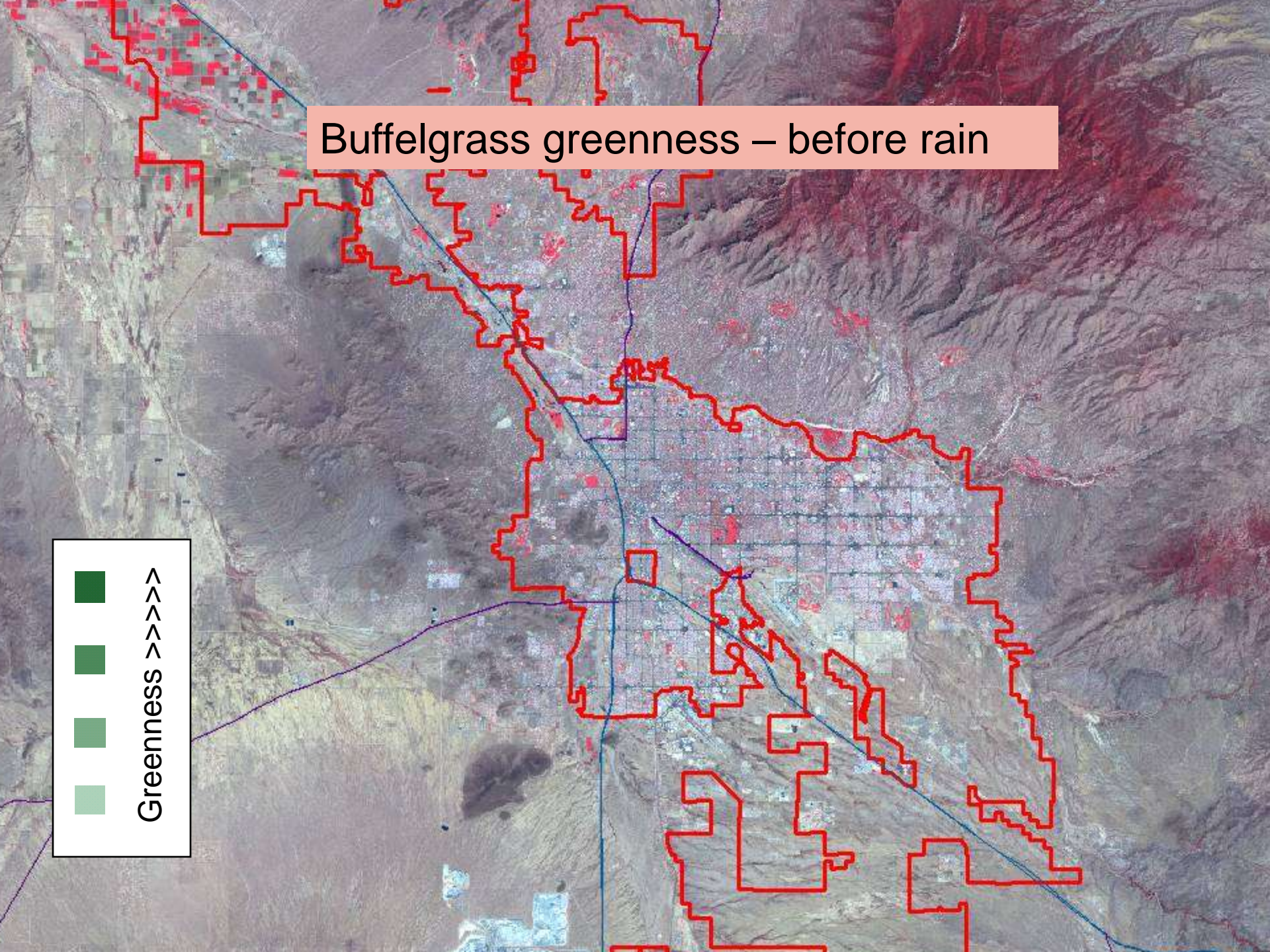
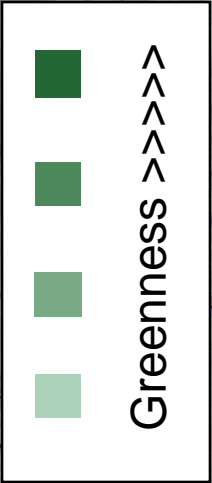
Productivity based on soil moisture



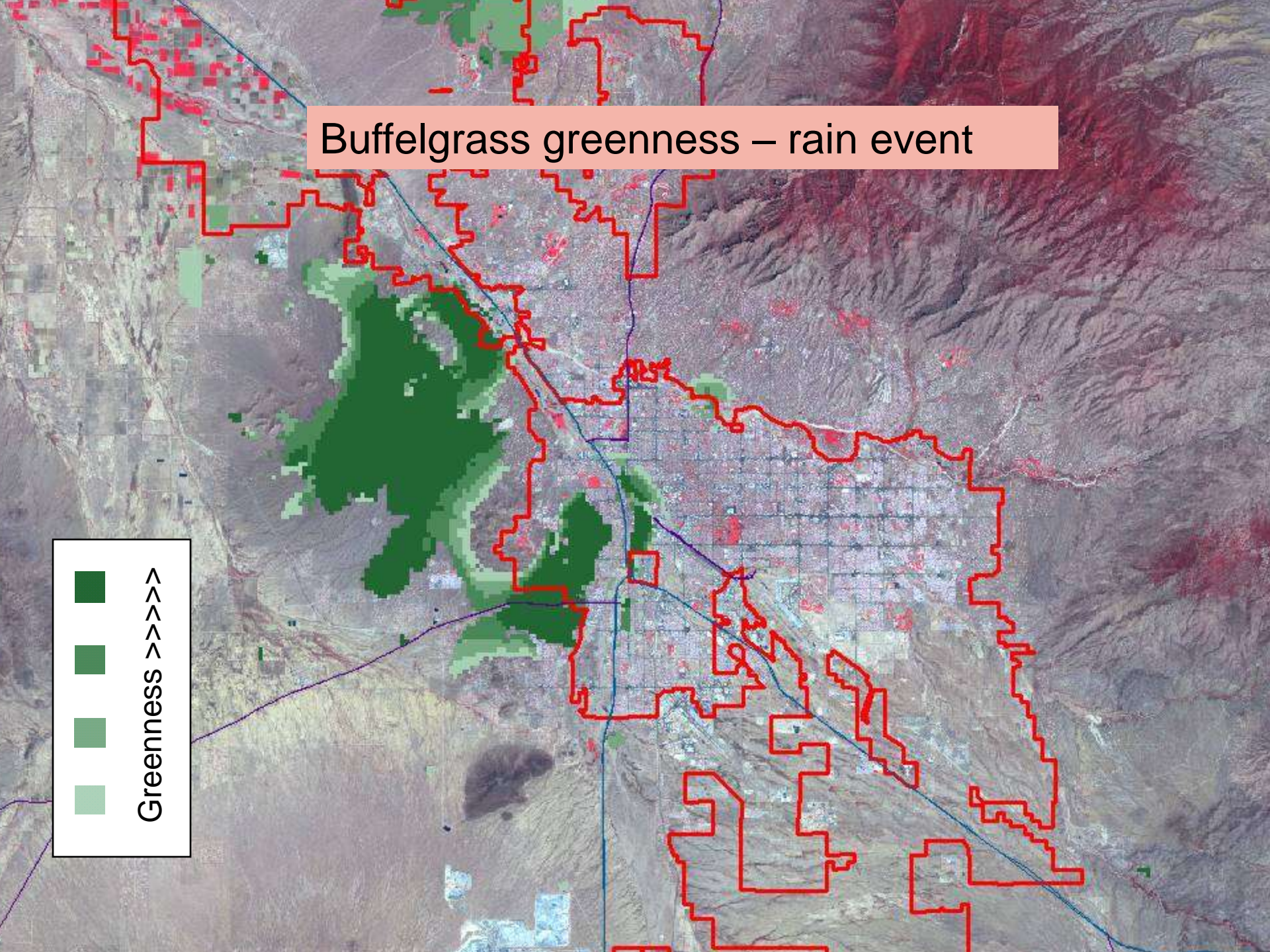
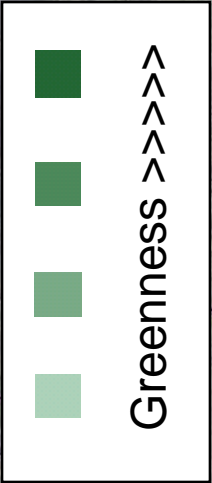
Productivity based on temperature



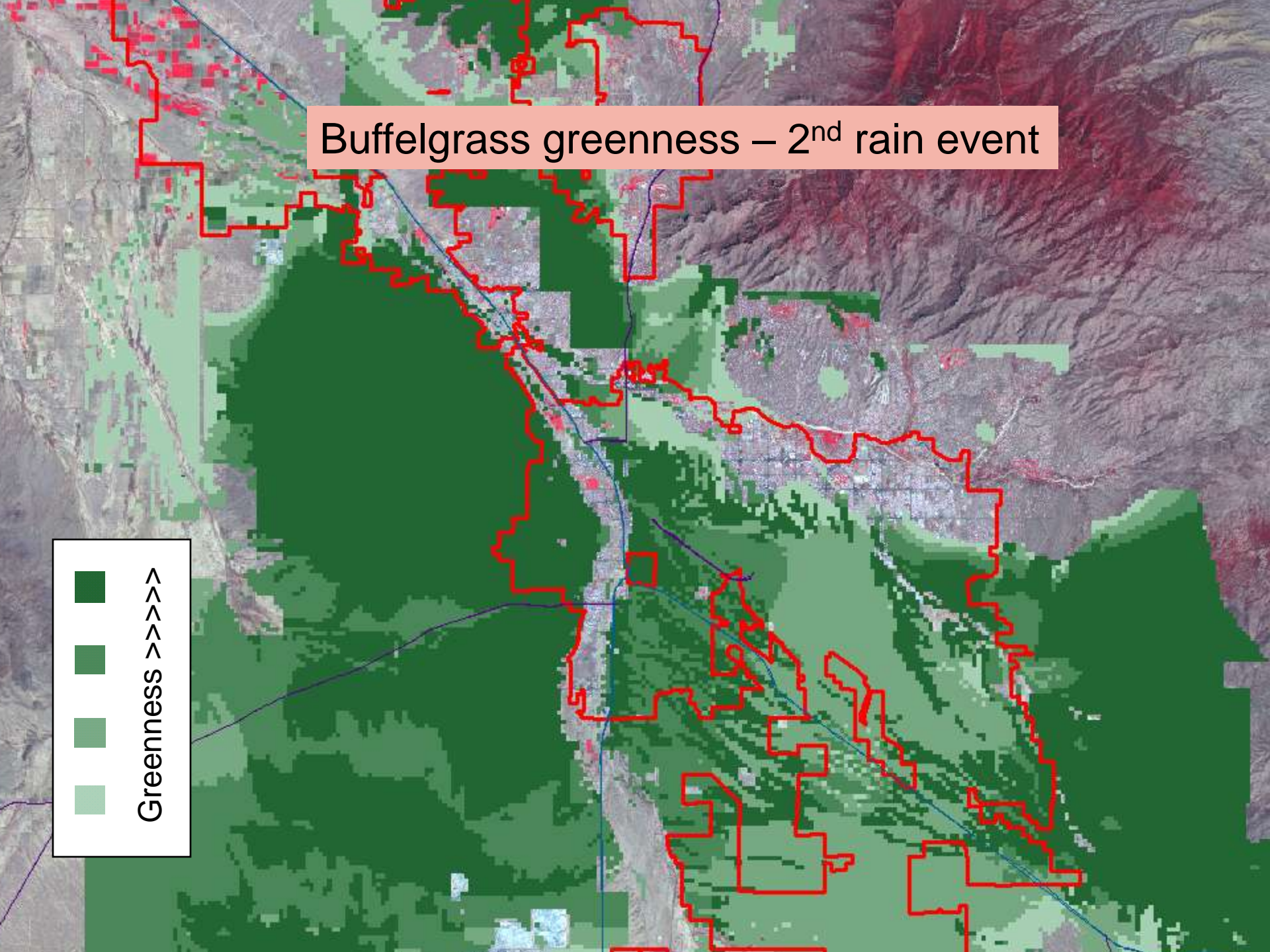
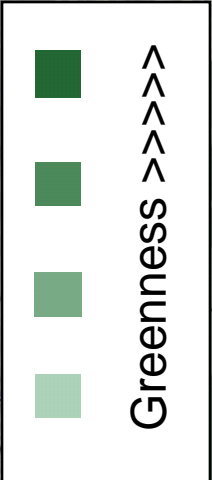
Buffelgrass greenness – before rain



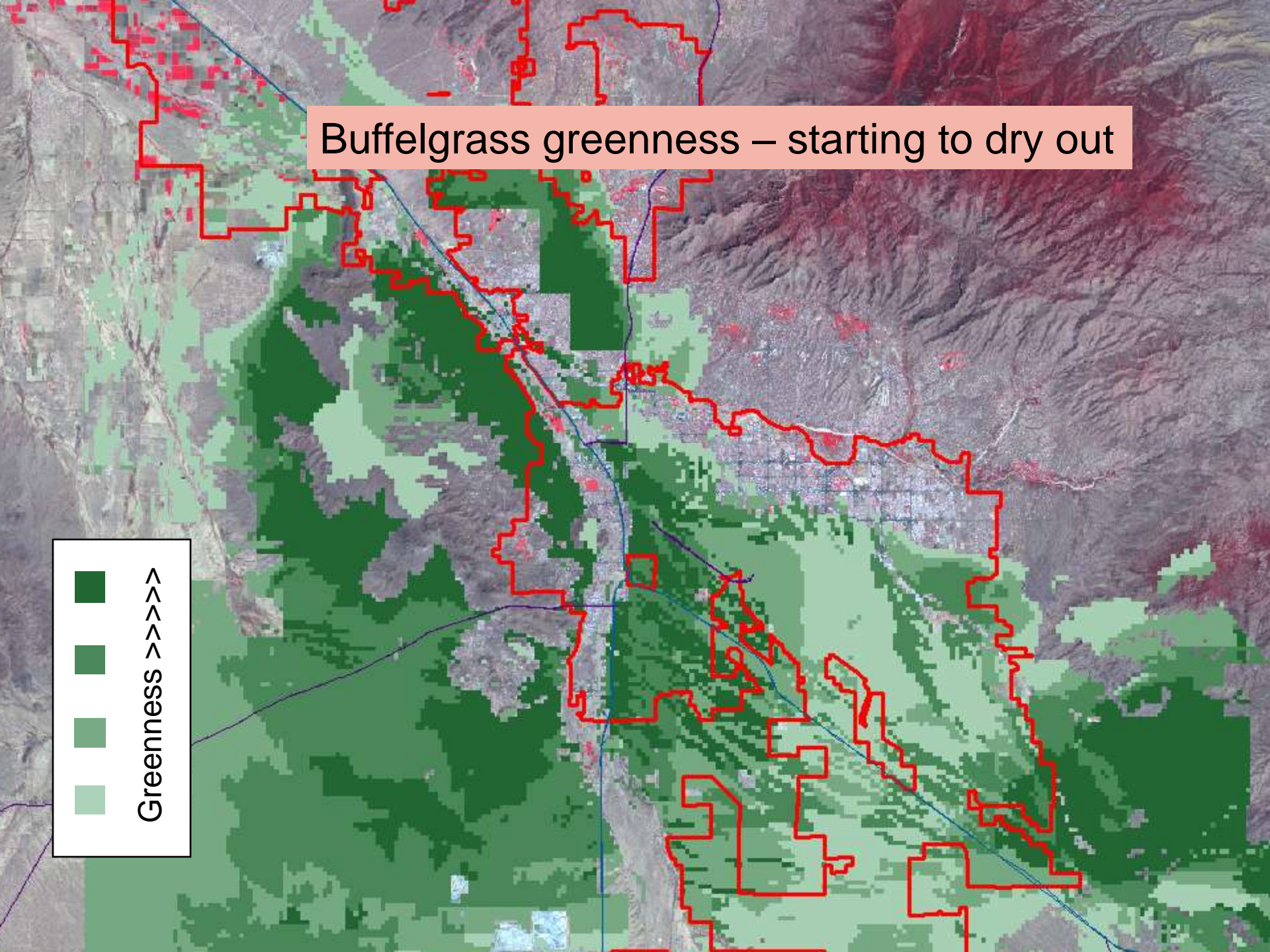
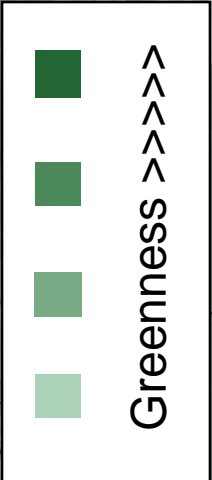
Buffelgrass greenness – rain event



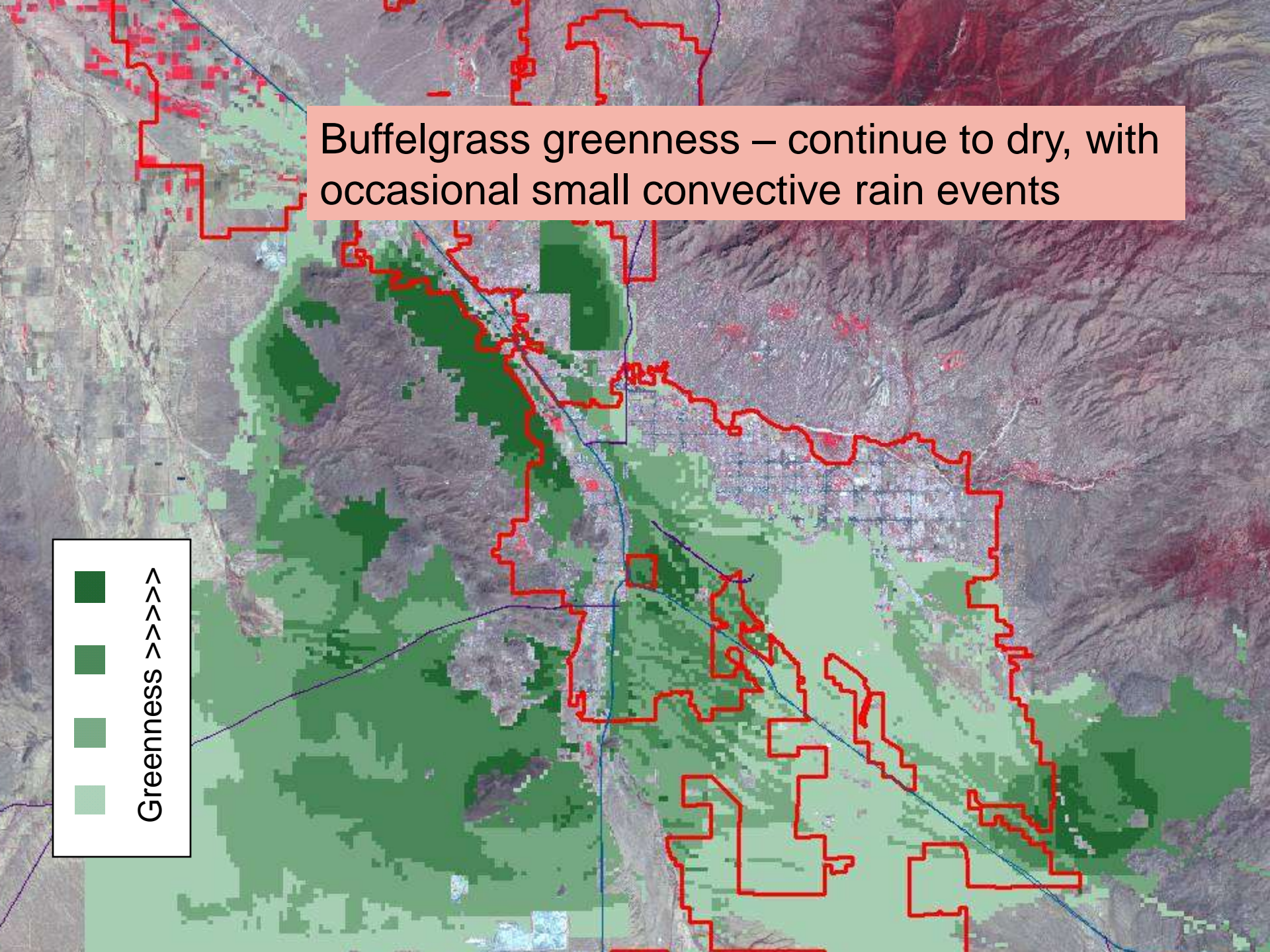
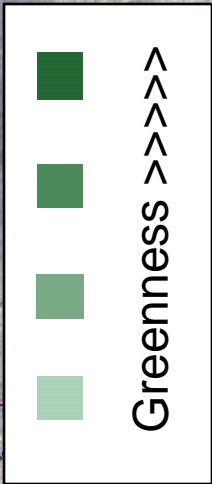
Buffelgrass greenness – 2nd rain event



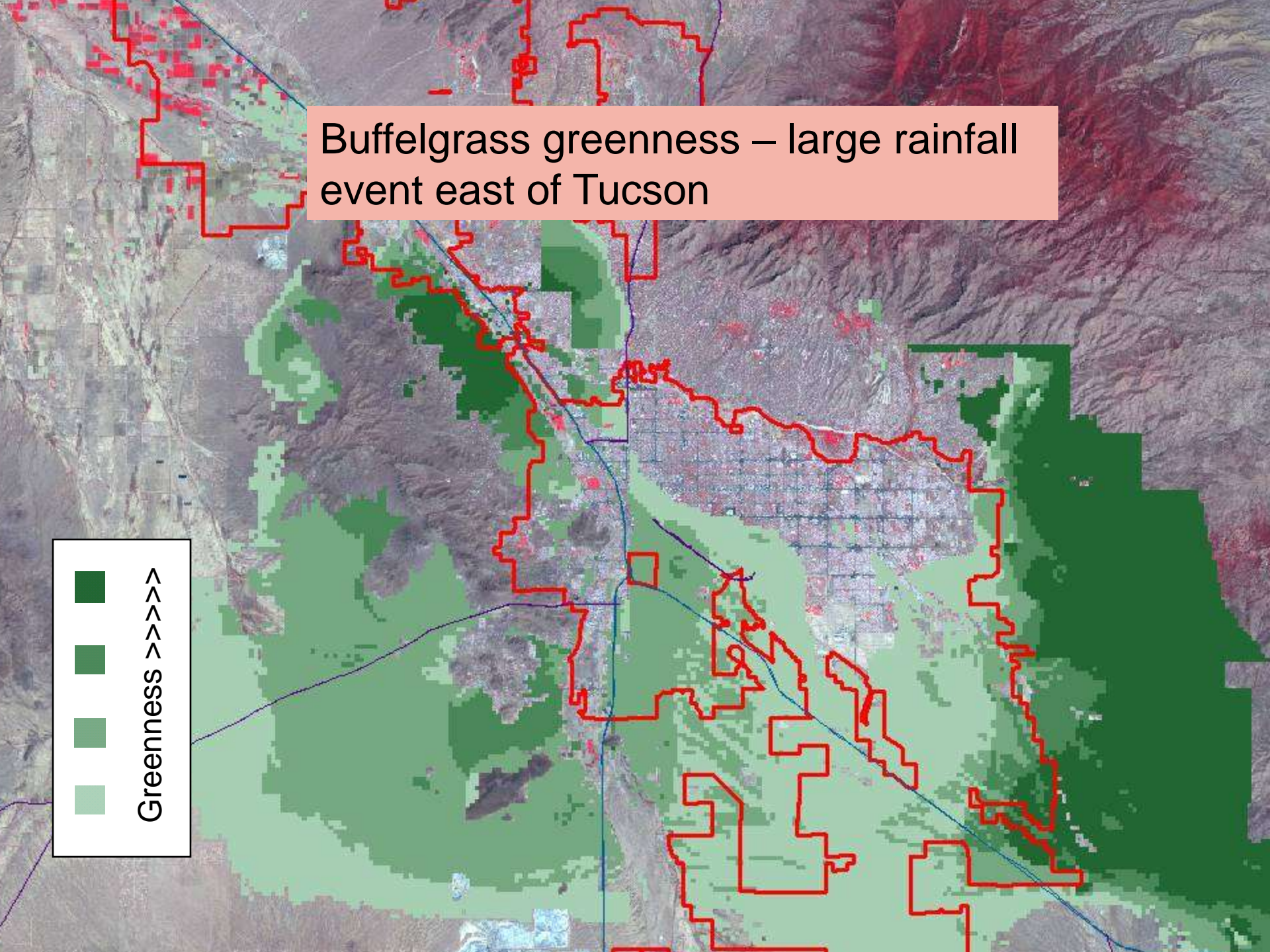
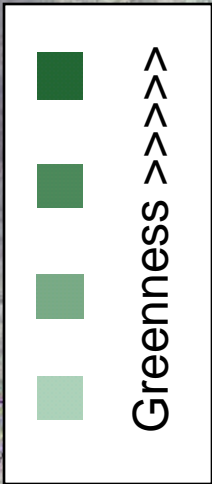
Buffelgrass greenness – starting to dry out



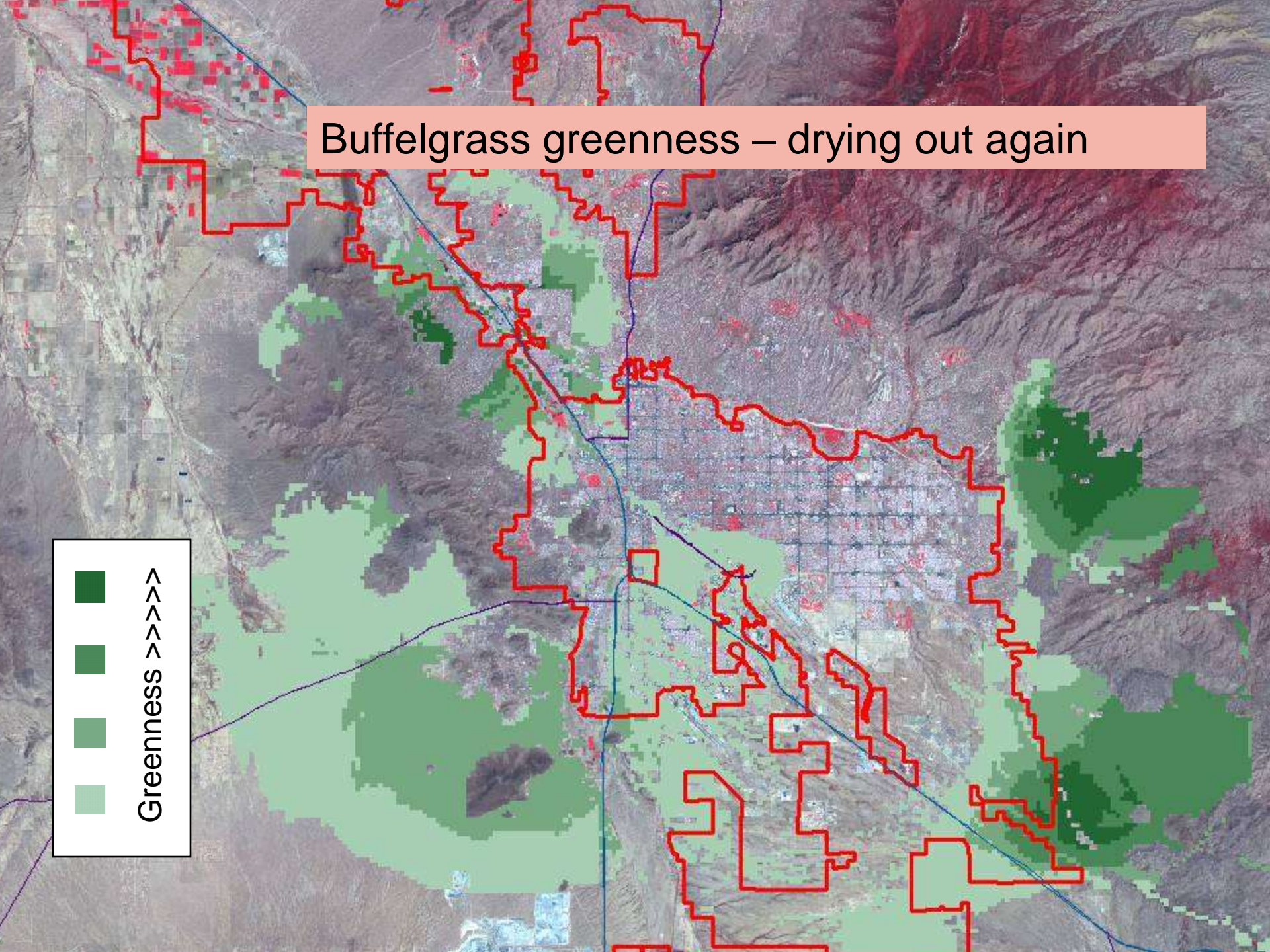
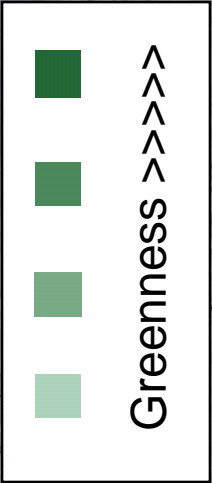
Buffelgrass greenness – continue to dry, with occasional small convective rain events



Buffelgrass greenness – large rainfall event east of Tucson



Buffelgrass greenness – drying out again



How about direct C.S. measures?

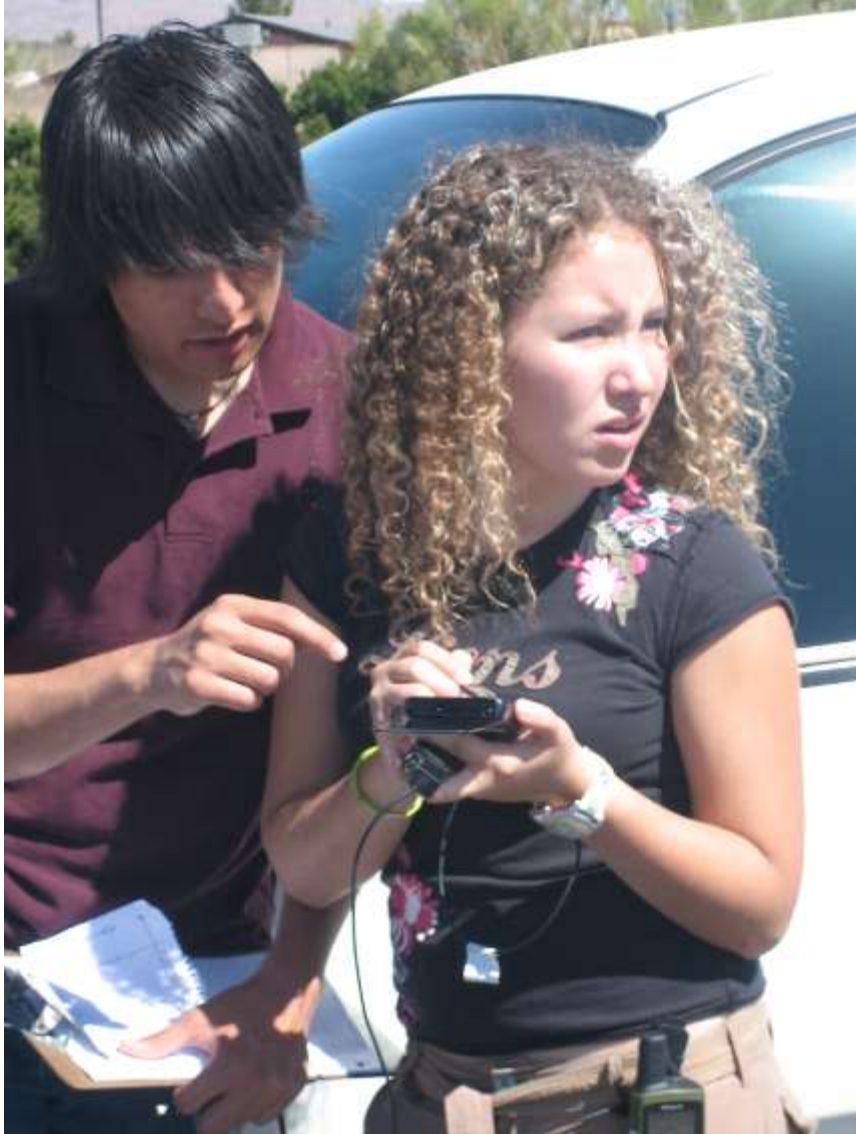
Project BudBurst, a National Phenology Network Initiative



The screenshot shows the Project BudBurst homepage in a Mozilla Firefox browser window. The address bar displays <http://budburst.org/>. The page features the Project BudBurst logo, a navigation menu with links for Phenology, Climate Change, Participate!, Downloads, Report, and Maps, and a grid of images showing various plants and flowers. Below the navigation menu, there is a text block that reads: "Thank you for making the pilot year of Project BudBurst a success! We are in the process of analyzing the 2007 data and will be posting maps and a summary by mid-July. Get ready for the 2008 Project BudBurst starting in January! Join us in 2008 collecting important climate change data on the timing of leafing and flowering of trees and flowers in your area through Project BudBurst. This national citizen science field campaign targets native tree and flower species across the country. By recording the timing of the leafing and flowering of native species each year, scientists can learn about the prevailing climatic characteristics in a region over time. With your help, we will be compiling valuable environmental information that can be compared to historical records to illustrate the effects of climate change." Below this text, there is a link to "Read about us in the news" and a "Subscribe" button for the Project BudBurst mailing list. At the bottom of the page, there is a row of logos for various partner organizations, including the National Phenology Network, the University of Wisconsin-Milwaukee, and the University of Montana.

<http://budburst.org>

Can we engage youth?



...if it is cool!



Search

Fly To Find Businesses Directions

Fly to e.g., 1600 Pennsylvania Ave., 20008

Places Add Content

- The Amazing Rez Race_20
- The Amazing Rez Race_20100223
- Las_Cienegas_20100216
 - Photos at Las Cienegas 0
 - Tracks at Las Cienegas 0
 - TRACKS at Las Cienegas
 - CARLY
 - DAIDA
 - CHANTEL
 - BERND
 - ALLY
 - WILE
 - MATE
 - PHILIP
 - WILE
- Points at Las Cienegas 0
- High-Tech Treasure Hunt created at [GPS Visualizer](#)
- ITE_Green_Lbs_Final.kmz
- WAA42 Please to Walk & Hike

Layers

View: Core

- Primary Database
 - Towns
 - Geographic Web
 - roads
 - Traffic
 - Weather
 - 3D Buildings
 - Borders and Labels
 - Gallery
 - Global Awareness
 - Places of Interest
 - More



Mesquite

and Carly Noto: Surrounded by brush 16-FEB-08 12:34:08PM
 New links: [To here](#) [From here](#)

Close Link Dates

Field Station
 Exploration Location
 Mesquite

Beyond the field...



MySpace.com - Barron - 99 - Male - TUCSON, US - www.myspace.com/barron_orr - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.myspace.com/barron_... my space

Barron

"Contigo es posible!"

Male
99 years old
TUCSON, Arizona
United States

Last Login:
9/6/2007

View My: [Pics](#) | [Videos](#)

Contacting Barron

Send Message	Forward to Friend
Add to Friends	Add to Favorites
Instant Message	Block User
Add to Group	Rank User

MySpace URL:
http://www.myspace.com/barron_orr

Barron's Interests

General

The world! Diversity. Maps. Languages, one and all. Maps. World Cup. Diversity. Reading. Science for society. GPS. GIS. Remote sensing. Web applications. Gardening. Philosophy. Slow food. Adaptation. Art. An end to intolerance. Theater. Music. Diversity. The future...yes, I am interested in the future.

Magnitude: 4.4 3.9 4.9 2.9 3.5 2.7 4.9 4.4

Location: [Map]

Date & Time: [Map]

Get Widget

Facebook | Barron Orr - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://arizona.facebook.com/profile.php?id=700086921&wstafy=900291

facebook

Profile edit Friends Networks Inbox

Search: Find friends

Applications edit

- Photos
- Groups
- Events
- Marketplace
- Visual Bookshelf
- Weather

more

Barron Orr
Update your status...

Network: Arizona Faculty
Tucson, AZ
Birthday: February 20, 1912

Mini-Feed

Cities I've Visited
I've traveled to 467 cities in 29 countries (updated hourly)

Where I've Traveled (467)

- View your Zomba
- View Your Ninja Army
- Fight with Barron
- Draw graffiti on your wall
- Reading The Wizard Sop...
- View My Trivia (1)
- Edit My Profile

You are online now!

Arizona Friends
40 friends at Arizona. See All

- Sarah Barber
- Rachel Miller
- Debra Casey
- Susan Anderson
- Selene Woodward
- Sharna Strunk

Photos
Album: Using the "Geospatial Tool Kit" Updated July 29

Videos
1 video. See All

Slippy's Documentary
11:42 Uploaded about a week ago

Information

Contact Info [edit]

Email: barron@u.arizona.edu
Current Address: Office of Arid Lands Studies
Tucson, AZ 85719
Website: <http://geospatialextension.org/>

Personal Info [edit]

Activities: Associate Professor and Geospatial Extension Specialist

Interests: The world! Diversity. Maps. Languages, one and all. Maps. World Cup. Diversity. Reading. Science for society. GPS. GIS. Remote sensing. Web applications. Gardening. Philosophy. Slow food. Adaptation. Art. An end to intolerance. Theater. Music. Diversity. The future...yes, I am interested in the future.

Favorite Music: Most, and quite varied. I particularly enjoy the piano, perhaps because my mother was a pianist.

Favorite TV Shows: The New Hour with Jim Lehrer; Star Trek

Favorite Movies: Dirty Harry; The Godfather; The Godfather Part II; The Godfather Part III; The Godfather Part IV: The Journey Home; The Godfather Part V: The Final Chapter

Favorite Books: Paranoia; Max Smilla's feeling for Snow; Zorba the Greek; Catch 22; Slaughterhouse 5; Lord of the Rings; Just about everything by Neal Stephenson; Linda La Gun, C. J. Cherryh, Clifford D. Simak, Many

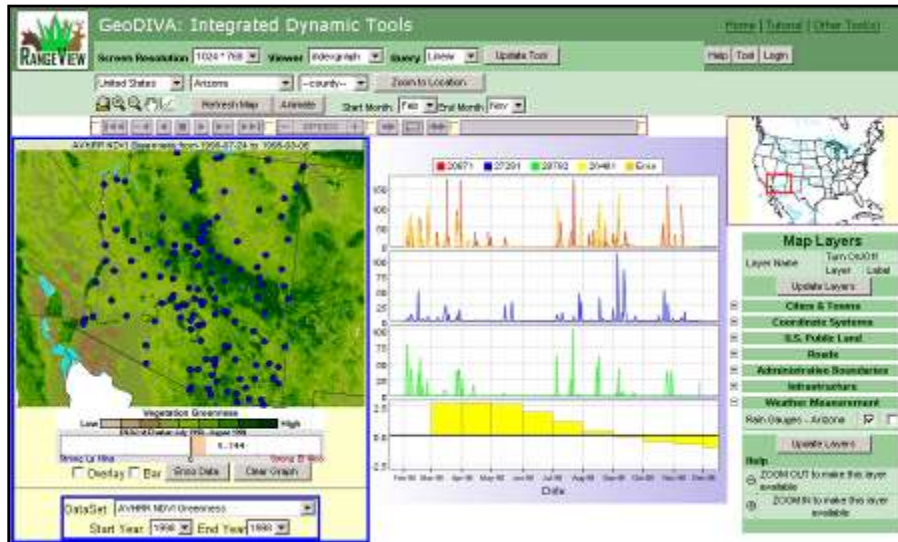
Widgets!!!

IV. Decision support



RANGEVIEW

Geospatial Tools for Natural Resource Management



<http://rangeview.arizona.edu>



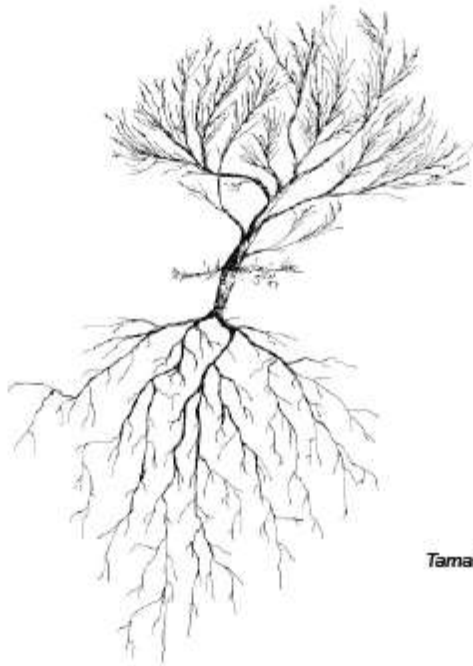
"RangeView's decision support tool opens the door to the information inside NASA satellite imagery that we believe is a vital part of the future of ranching in Arizona."
John A. Scammon, Executive Director, Arizona Cattle Growers' Association (12/15/03)





The Invasive Species Forecasting System

A NASA / USGS National Application Project



Tamarisk

John L. Schnase

*Office of Computational and Information
Science and Technology (CISTO / Code 606)*

NASA Goddard Space Flight Center

24 September 2008

Invasive Species Forecasting System

<http://invasivespecies.gsfc.nasa.gov>


ISFS: Invasive Species Forecasting System - Mozilla Firefox

File Edit View History Bookmarks Tools Help

<http://invasivespecies.gsfc.nasa.gov>

 Invasive Species **Forecasting System** 

Select a photo to learn about these Invasive Species >



Home The Invasive Species Forecasting System

Science The NASA Office of Earth Science and the US Geological Survey are working together to develop a National Invasive Species Forecasting System for the early detection, remediation, management, and control of invasive species on Department of Interior and adjacent lands.

Test Sites

Partners

People

News The forecasting system will provide a framework for using USGS's early detection and monitoring protocols and predictive models to process NASA and commercial data and create on-demand, regional-scale assessments of invasive species patterns and vulnerable habitats.

When fully implemented, the forecasting system will provide a dynamic and flexible mechanism for generating electronic and paper maps of hot spots for potential exotic species invasions.



+ go to ISFS



Landsat image of Amistad Reservoir located on the Rio Grande River near Del Rio, Texas (December 7, 2000).

General Information

The NBII Invasive Species Information Node is a central repository for information pertaining to the identification, description, management, and control of invasive species.

Invasivespecies.gov details the impacts of invasive species, provides profiles, and outlines the response of US Federal Government Agencies.

NASA Applications

NASA's Earth Science Enterprise Applications Program is partnering with public, private, and academic organizations to develop innovative decision support capabilities for invasive species management.

Cerro Grande Case Study

NASA and USGS scientists are using geostatistical models to predict the spread of invasive species at the site of the Cerro Grande wildfire, near Los Alamos, New Mexico.

+ read more

About the Project

A recent *Earth Observing Magazine* article describes the new NASA/USGS partnership to manage biological invasions.

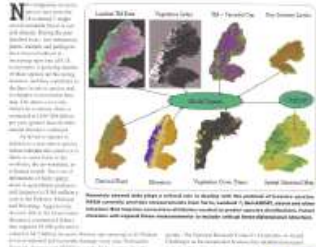
The ISFS Project ...

- Partnership between NASA and the US Geological Survey
- Goal to improve the invasive species management decision processes by improving efficiency, effectiveness, and access to tools tailored to the needs of the invasive species management communities.
- Based on USGS's early detection and monitoring protocols.
- Targets DOI operational agencies and DOI lands.

The National Invasive Species Forecasting System:

A Strategic NASA-USGS Partnership to Manage Biological Invasions

By David Robinson, Thomas L. Shalquist and James A. Smith



What do antibodies, bee stings and blueberries have in common? All are part of the "invasion" of our planet by non-native species. Invasives are species that are not native to an area and cause harm to the environment, economy, or human health. They can be plants, animals, or insects. Invasives are a major threat to biodiversity and ecosystem health. They can also cause significant economic damage. For example, the Asian longhorn beetle is a major pest of hardwood trees in the United States. The emerald ash borer is a major pest of ash trees in North America. The Asian tiger mosquito is a major pest of humans in many parts of the world. Invasives are a global problem that requires a coordinated international response.

Defending The Front

Preventing species invasions, genetic and located as they, scientists hope to stay one step ahead of them.

BY JENNIFER BIRD

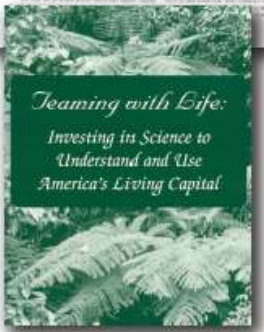


DEFENDING THE FRONT Scientists are working to prevent species invasions, genetic and located as they, scientists hope to stay one step ahead of them.

DEFENDING THE FRONT Scientists are working to prevent species invasions, genetic and located as they, scientists hope to stay one step ahead of them.

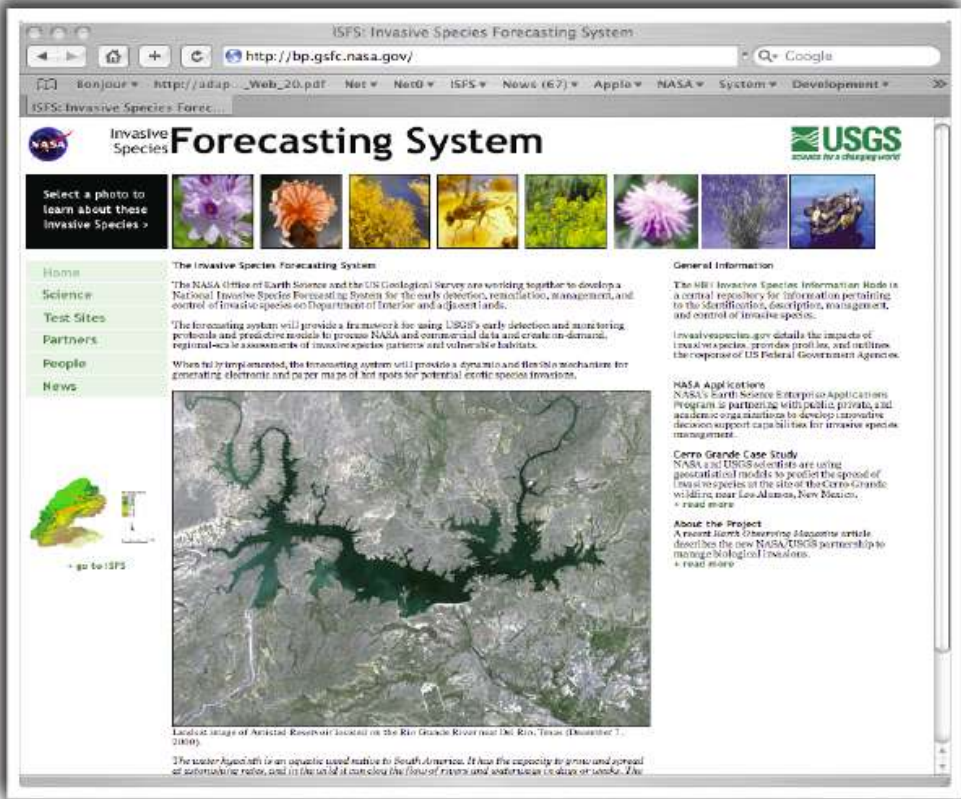
Teaming with Life:

Investing in Science to Understand and Use America's Living Capital



ECOLOGICAL FORECASTING

AGENDA FOR THE FUTURE

ISFS: Invasive Species Forecasting System

http://bp.gsfc.nasa.gov/

Invasive Species Forecasting System

Select a photo to learn about these Invasive Species >

Home
Science
Test Sites
Partners
People
News


The Invasive Species Forecasting System
 The NASA (Office of Earth Science and the US Geological Survey) are working together to develop a National Invasive Species Forecasting System for the early detection, notification, management, and control of invasive species on Department of Interior and adjacent lands.

General Information
 The 18th Invasive Species Information Made in a central repository for information pertaining to the identification, description, management, and control of invasive species.

NASA Applications
 NASA's Earth Science Enterprise Applications Program is partnering with public, private, and academic organizations to develop innovative decision support capabilities for invasive species management.

Cerro Grande Case Study
 NASA and USGS scientists are using geostatistical models to predict the spread of this invasive species at the site of the Cerro Grande wildfire near Los Alamos, New Mexico.

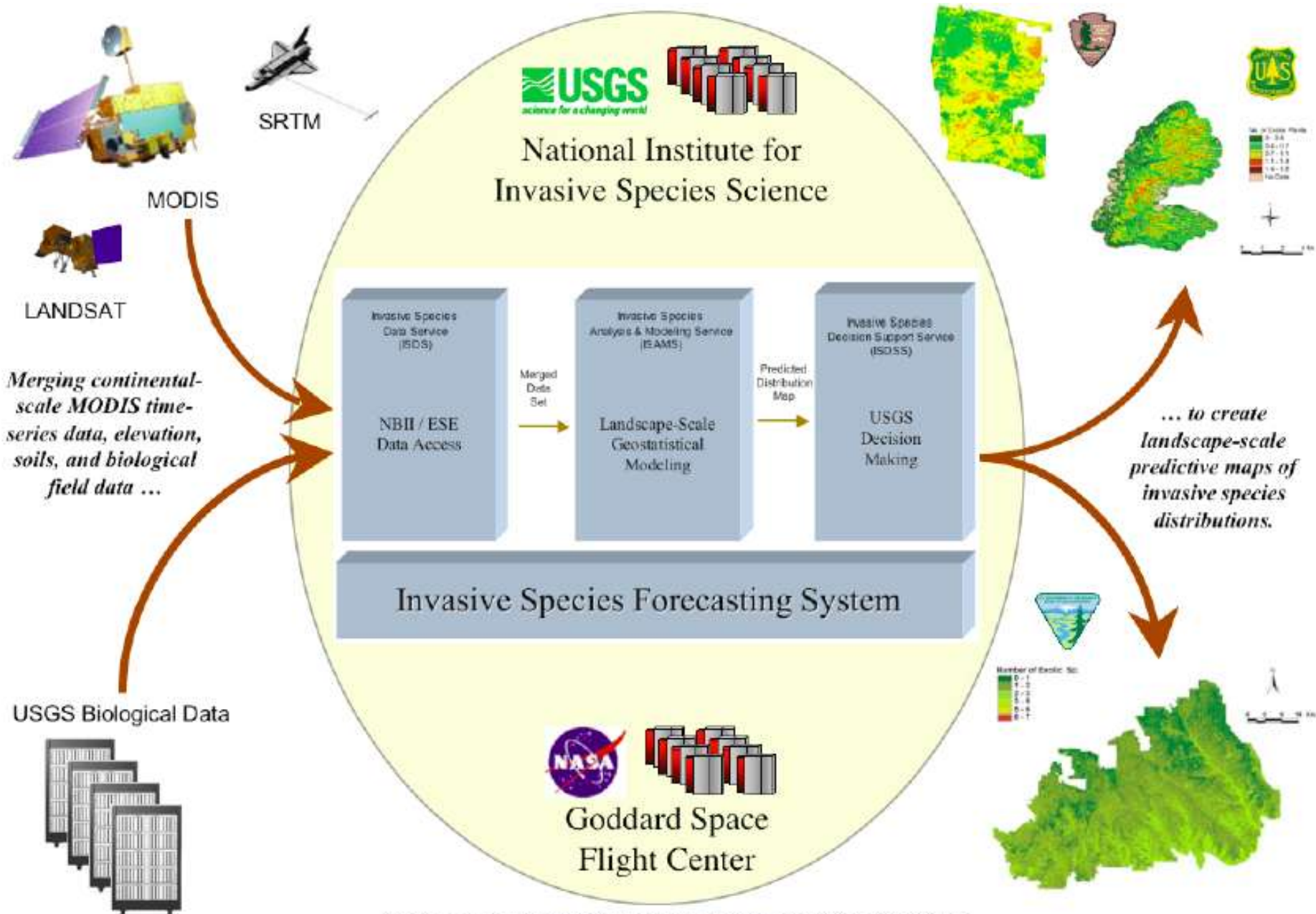
About the Project
 A recent issue of *Restoration Ecology* describes the new NASA-USGS partnership to manage biological invasions.



Latest image of Aristida Reservoir located on the Rio Grande River near Del Rio, Texas (December 7, 2008).

The water hyacinth is an aquatic weed native to South America. It has the capacity to grow and spread at astronomical rates, and in the US it clogs the flow of rivers and waterways in large swaths.





High-speed networking interconnects NASA/USGS cluster computer, modeling, & mass storage resources ...



RANGEVIEW

Geospatial Tools for Natural Resource Management



THE UNIVERSITY OF ARIZONA



GeoDIVA: Integrated Dynamic Tools

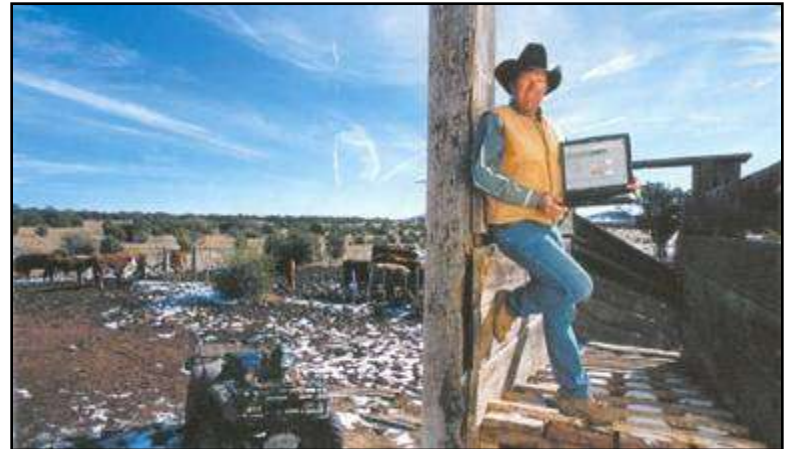
Screen Resolution: 1024*768 | View: Orthographic | Layer: | Update Tool

United States | Arizona | County: | Zoom to Location: | Refresh Map | Alerts | Start Month: Feb | End Month: Feb

Map Layers:

- Layer Name: Top CO201
- Layer: Label
- Update Layers
- Offices & Towns
- Coordinate Systems
- U.S. Public Land
- Roads
- Administrative Boundaries
- Infrastructure
- Weather Measurement
- Rain Gauges: Arizona
- Update Layers

Help: ZOOM OUT to make this layer available | ZOOM IN to make this layer available



<http://rangeview.arizona.edu>

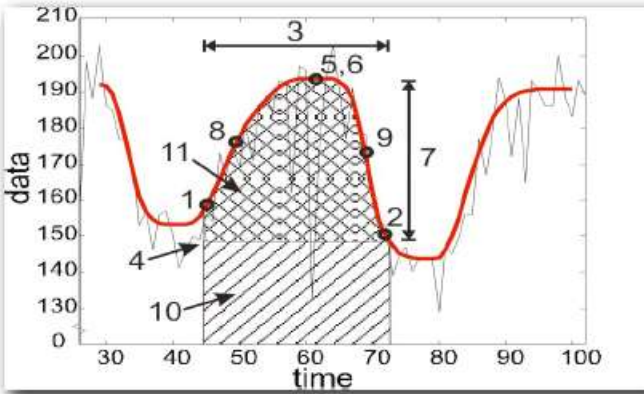
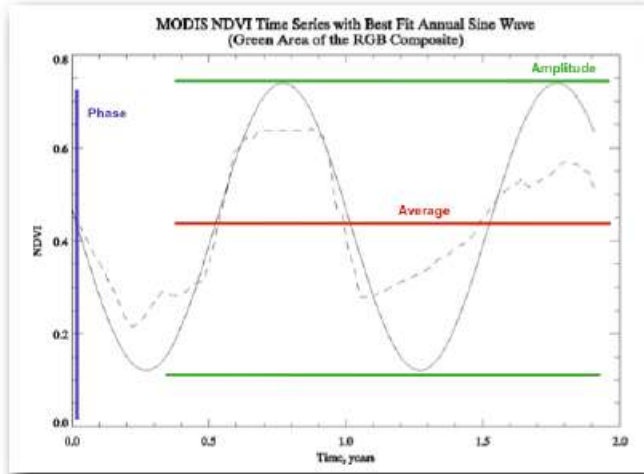


"RangeView's decision support tool opens the door to the information inside NASA satellite imagery that we believe is a vital part of the future of ranching in Arizona."
John A. Scammon, Executive Director, Arizona Cattle Growers' Association (12/15/03)



Science Accomplishments ...

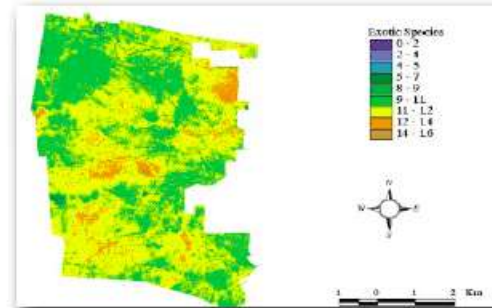
- Jeff Morisette's MODIS NDVI time series data studies ...



MODIS Time Series

...to map invasives

This block contains three satellite images of a landscape, likely a park area, showing seasonal changes in vegetation color from green to brown. The images are arranged in a collage, with the largest one at the bottom right and two smaller ones at the top left and top right. The text 'MODIS Time Series' is written in white on a black background at the top right, and '...to map invasives' is written in white on a black background at the bottom left.



Science Accomplishments ...

- National habitat suitability map for tamarisk ...
- A function of MODIS Land Cover and vegetation seasonality.
- Model based on over 30,000 field data points compiled by the USGS.

RESEARCH COMMUNICATIONS

A tamarisk habitat suitability map for the continental United States

Jillory T. Morissette*, Catherine S. Jernevic, and Ullah W. Cai*, Jeffrey A. Pedely, James E. Schnase, Thomas J. Stohlgren, and John L. Schnase*

This paper presents a national-scale map of habitat suitability for tamarisk (*Tamarix sp.*, salt cedar), a highly-invasive alien species. We successfully integrate satellite data and tens of thousands of field sampling points through logistic regression modeling to create a habitat suitability map that is 90% accurate. This integrative effort uses field data collected and coordinated through the US Geological Survey and nationwide environmental data layers derived from NASA's Moderate Resolution Imaging Spectroradiometer (MODIS). We demonstrate the use of the map by ranking the 48 continental US states (and the District of Columbia) based on their absolute, as well as proportional, areas of "highly suitable" and "moderately highly" habitat for tamarisk. This integrative effort and modeling approach presented here could be used to map other harmful species in the US and globally.

Front. Ecol. Environ. 2006, 4(2):11-17

Tamarisk (*Tamarix sp.*, salt cedar) is an Asian introduced species which is invading riparian zones in the United States (Chambers 1962, Robinson 1995). It alters stream hydrology, increases soil salinity, and displaces habitats for native species. There are substantial costs associated with the modification or removal of riparian, wetland, and riparian zones for water storage, wildlife, and riparian recreation (Barkert et al. 2003). Furthermore, many riparian zones, from inland riparian to grass roots riparian conditions, are associated with tamarisk invasion. For example, the Sacramento of the Interior and Delta Rivers have called for a cooperative initiative to control invasive tamarisk (Ullah et al. 2005). Highlighting a national riparian zone is a starting point for resource-related control and restoration efforts. These efforts, in turn, require geospatial information on tamarisk distribution, abundance, and suitability (as a natural scale).

Here we present a map of tamarisk habitat suitability throughout the continental US. This work builds on recent studies in the western US, showing the distribution of tamarisk in that region (Ullah et al. 2005). Our model, based on positive field locations and absence locations, shows that many low- and mid-elevation watersheds in western and central US are vulnerable to tamarisk invasion. The potential habitat for tamarisk spans well beyond areas where it already grows, allowing us to provide current distribution data, this habitat map can help guide conservation boundaries, identify priority areas for early detection and rapid response, and monitor

*NASA Goddard Space Flight Center, Mail Code 604 J, Greenbelt, MD 20771; *USGS Wetlands Division, 7000 Collier, Silver Spring, US Geological Survey, Fort Collins, CO, State Space Applications, Jr., Greenbelt, MD; *University of Maryland System, College Park, MD; *University of Maryland System, College Park, MD

© The Ecological Society of America

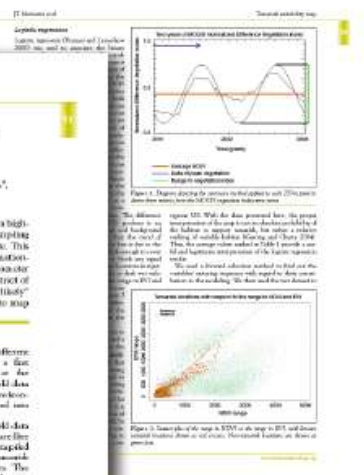
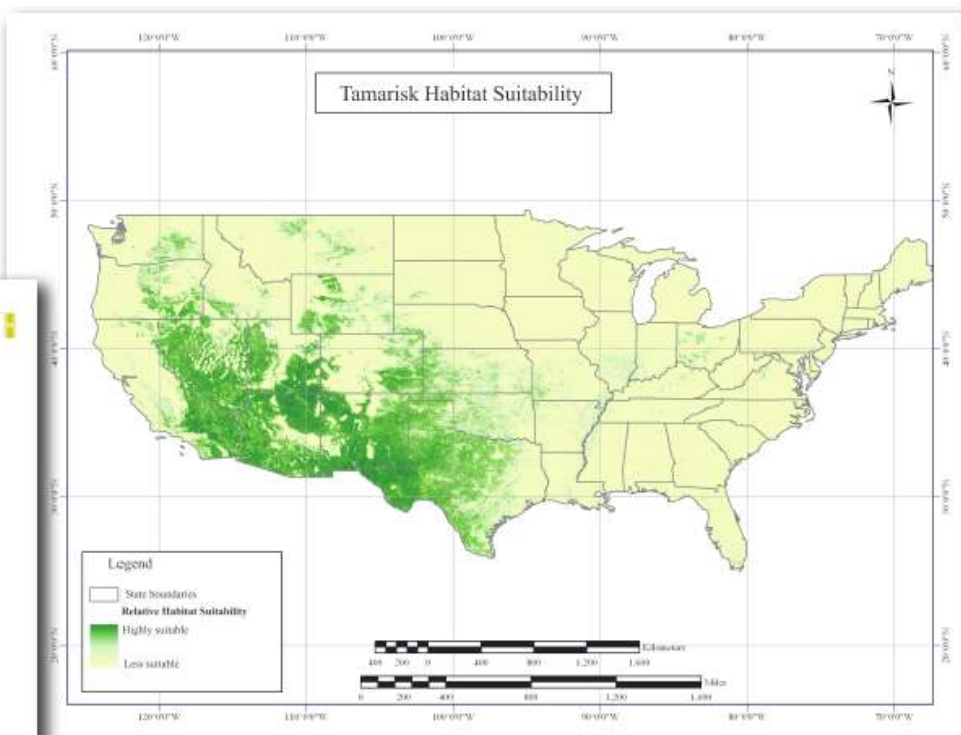
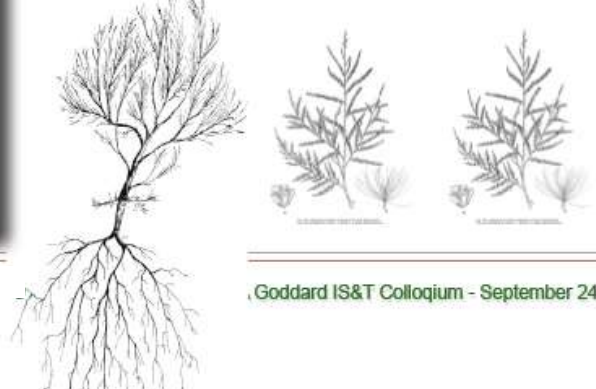


Figure 1. Diagram showing the process of habitat suitability modeling. The top graph shows the process of habitat suitability modeling. The bottom graph shows the process of habitat suitability modeling.

Figure 2. Scatter plot of the map at 300 m on the map at 300 m and 300 m on the map at 300 m.



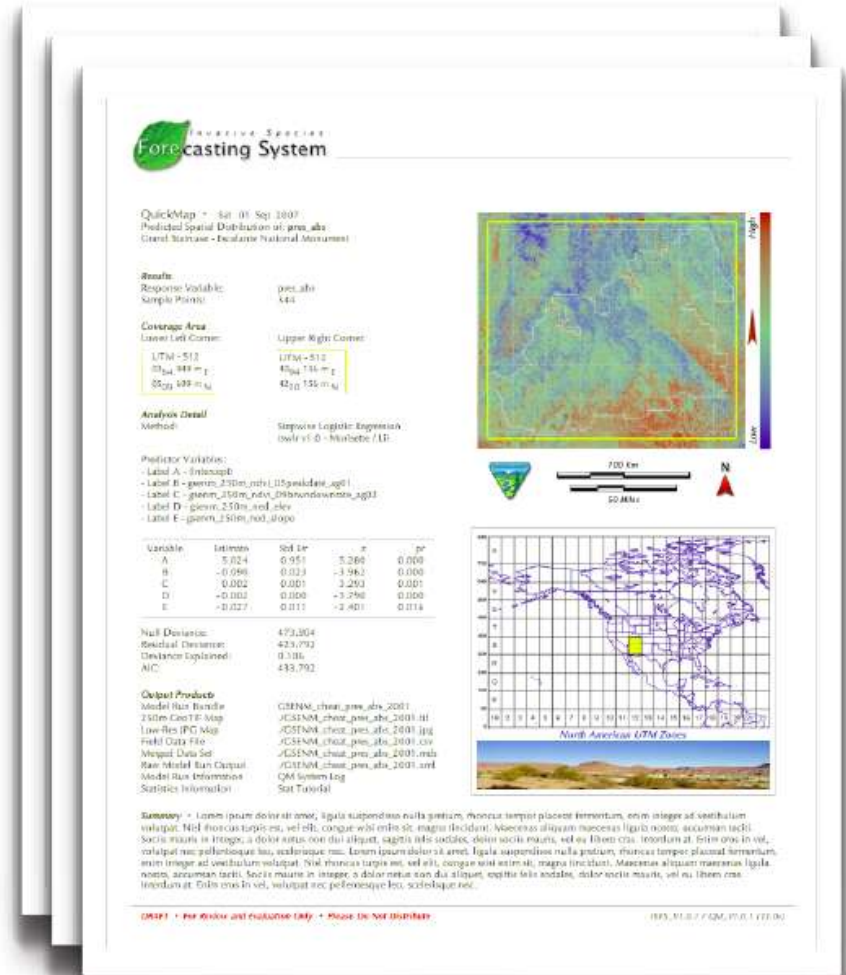
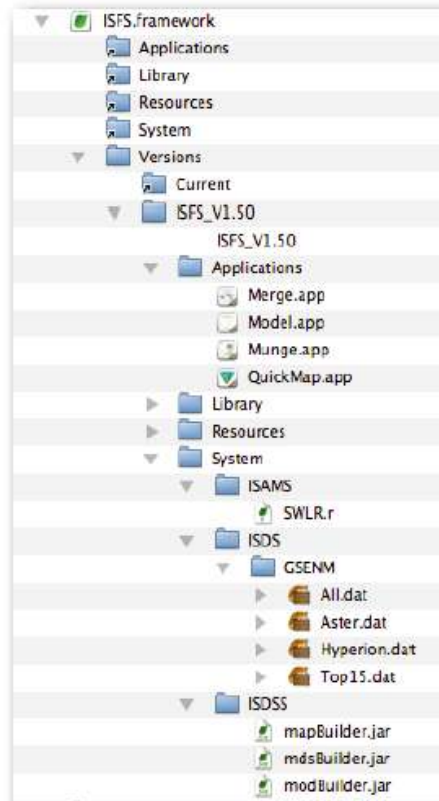
Morissette, J.T., C. S. Jernevic, A. Ullah, W. Cai, J.A. Pedely, J. Gentle, T.J. Stohlgren, J.L. Schnase, A. tamarisk habitat suitability map for the continental US, *Frontiers in Ecology*, February 2006.

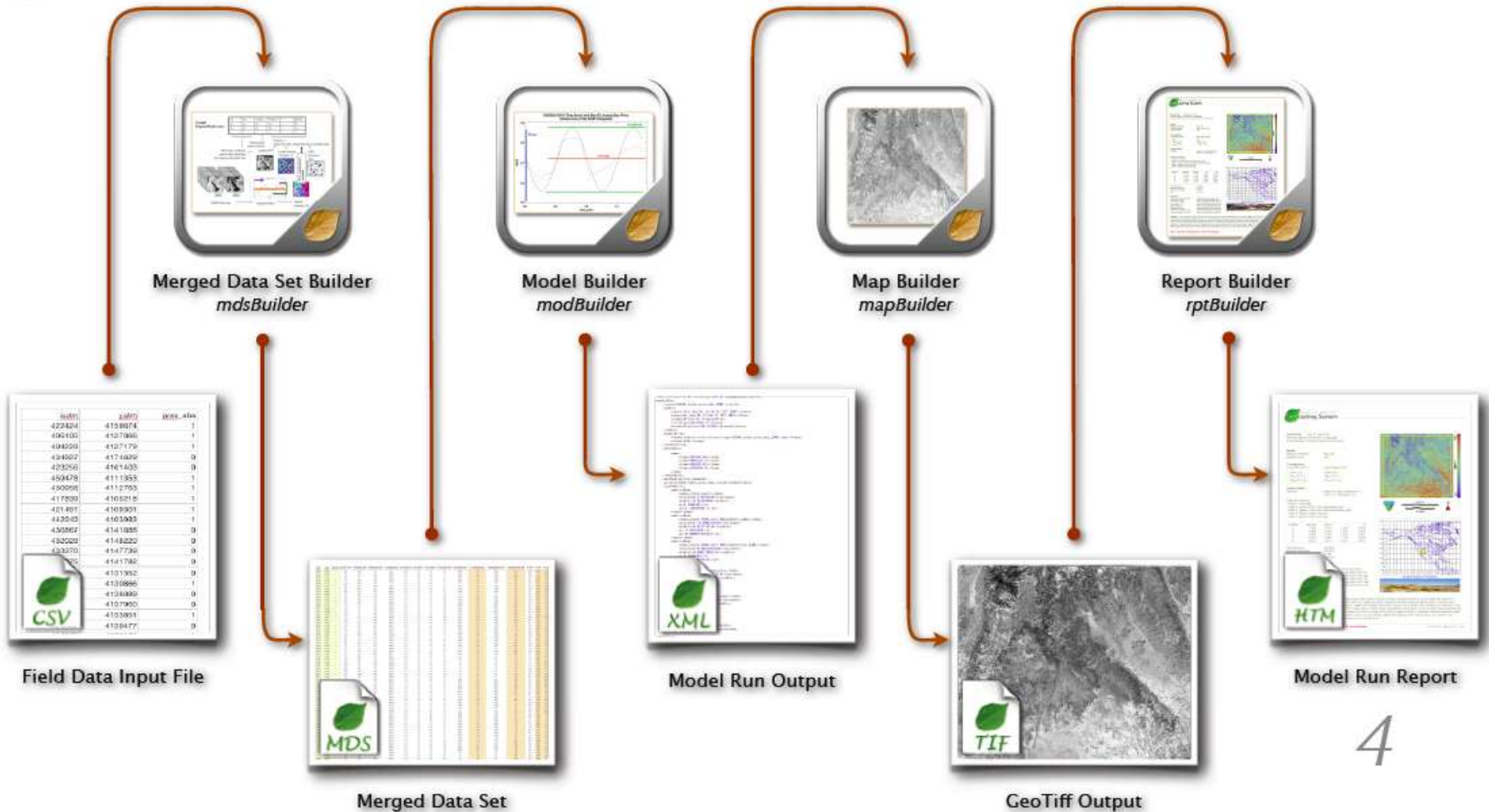


Operational deployment ...

1. Classic Web Services / USGS Fort Collins Science Center
2. WebDAV-enabled Runtime Service / BLM Grand Staircase - Escalante National Monument ...

Both based on a simple, adaptable, componentized "ISFS Framework" that implements our notion of a canonical modeling workflow ...





4

ISFS Workflow

See <http://www.isfs.us> on 01/01/2009

Operational deployment ...

1. Classic Web Services / USGS Fort Collins Science Center
2. WebDAV-enabled Runtime Service / BLM Grand Staircase - Escalante National Monument ...
 - Isolated ISFS Network
 - Each machine with Framework and Apple "MobileMe" account
 - Simple command Line / "Droplet" Apps
 - Asynchronous updates via from Linda Lea's Coffee Shop ...
 - Use of private-sector infrastructure accommodates BLM network security, technical support, and cost concerns ...








G S E N M

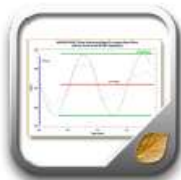
ISFS-G100-Console
 ISFS-G101-Moqui
 ISFS-G102-Coyote
 ISFS-G103-Peregrine
 ISFS-G104-Pareah
 ISFS-G105-Wolverine

Where we go from here ...

- **Extend use, broaden use**
National Interagency Fire Center is very interested (BAER Teams especially).
- **Broader implications for future NASA data and service delivery**
Lightweight (microkernel) architectures, regionalized delivery, appliance accommodative, data/model syndication, podcasting/catching, client-side tailorability, mashups, iconographic interfaces, etc.

Lessons learned ...

- **Regionalization**
Problems, solutions, responses, budgets, and management scopes are regional. Important implications for Applied Sciences in a globe-centric NASA ...
- **Capability Maturity**
Sustainable operational outcomes require a clear understanding of TRL expectations, programmatic means for capture work, agile development approaches, multi-faceted deployment strategies, etc.



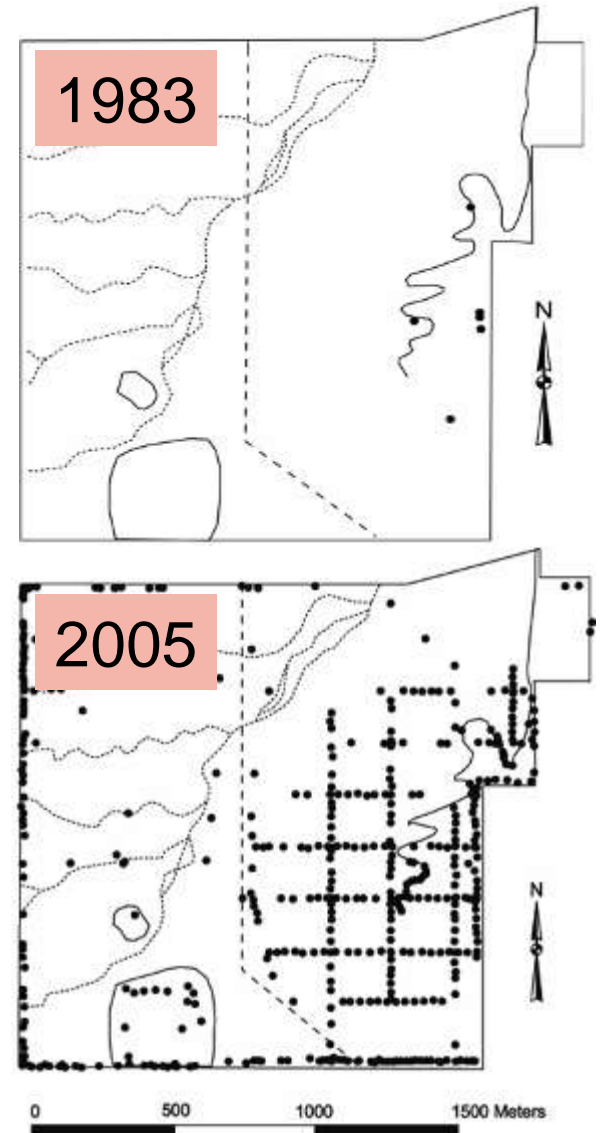
A Buffelgrass Decision Support System

*Aaryn Olsson, George Frisvold, Ferenc Szidarovszky, Travis Bean,
Julio Betancourt, Barron Orr, Stuart Marsh*

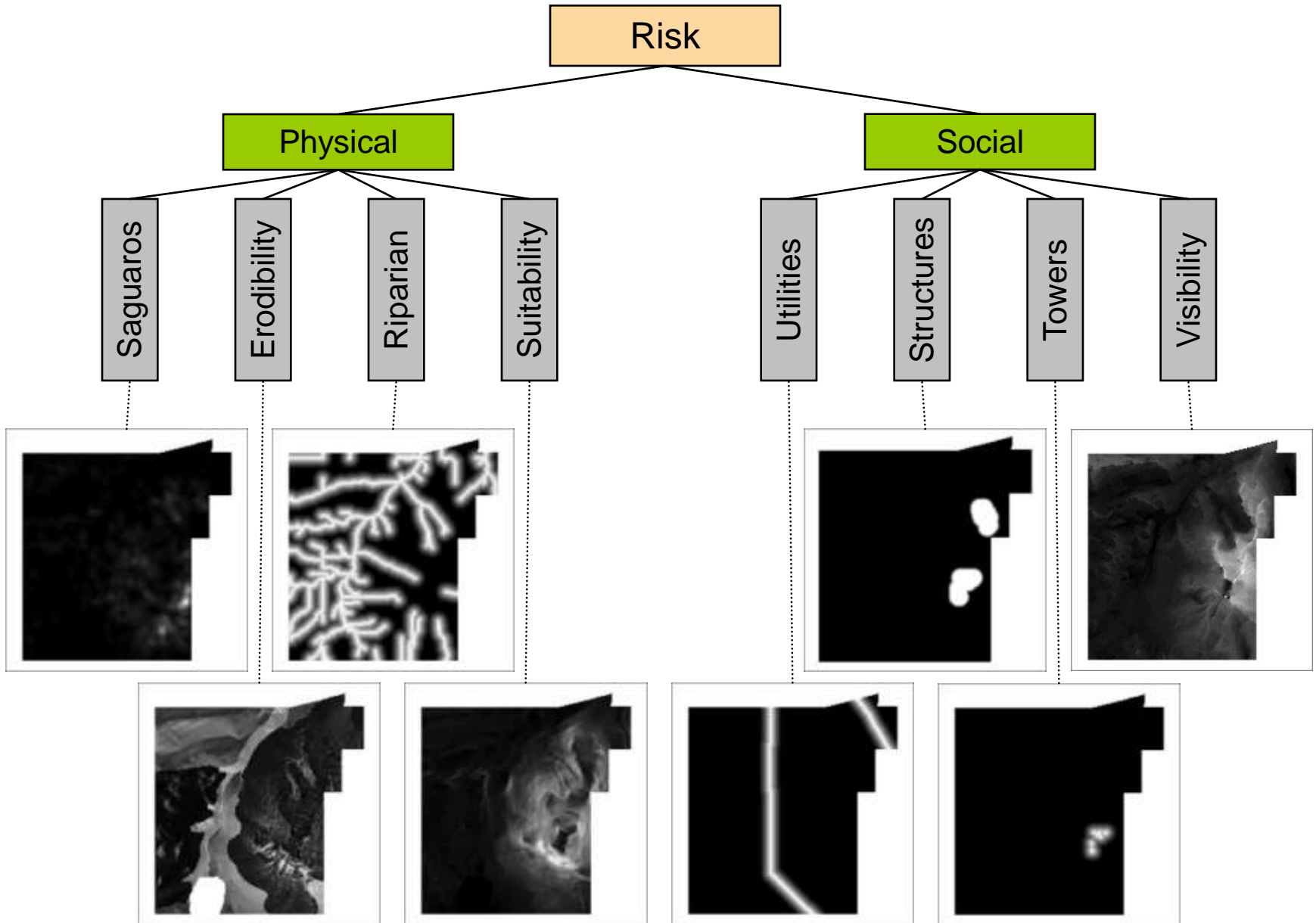


Designed with Data from Tumamoc Hill

- Tumamoc Hill is home to the University of Arizona's Desert Lab
 - Situated within Tucson
 - Buffelgrass expanded from a few plants in 1983 to saturation on this 1 sq. mi. property in 2005.
 - Highly visible from Tucson
- It has become very popular for research, recreation, and commerce
 - Early human settlement - archaeology
 - Long-term saguaro studies - ecology
 - Highly visible to most of Tucson - recreation
 - Convenient for communication towers - commercial

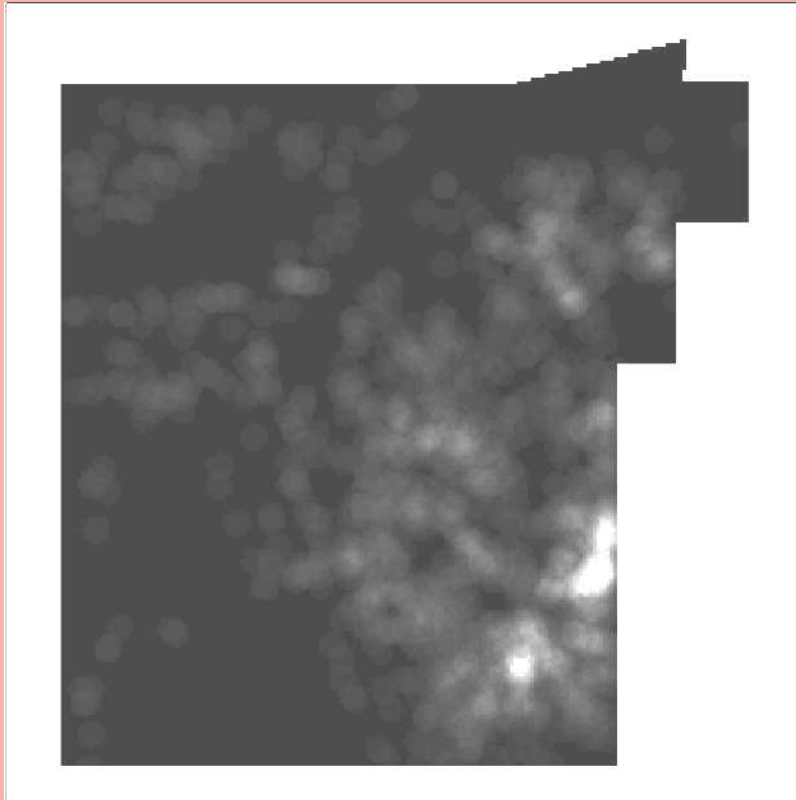


Buffelgrass Decision Hierarchy for Tumamoc Hill



Pairwise comparisons

Saguaro Density



Buffelgrass



9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9

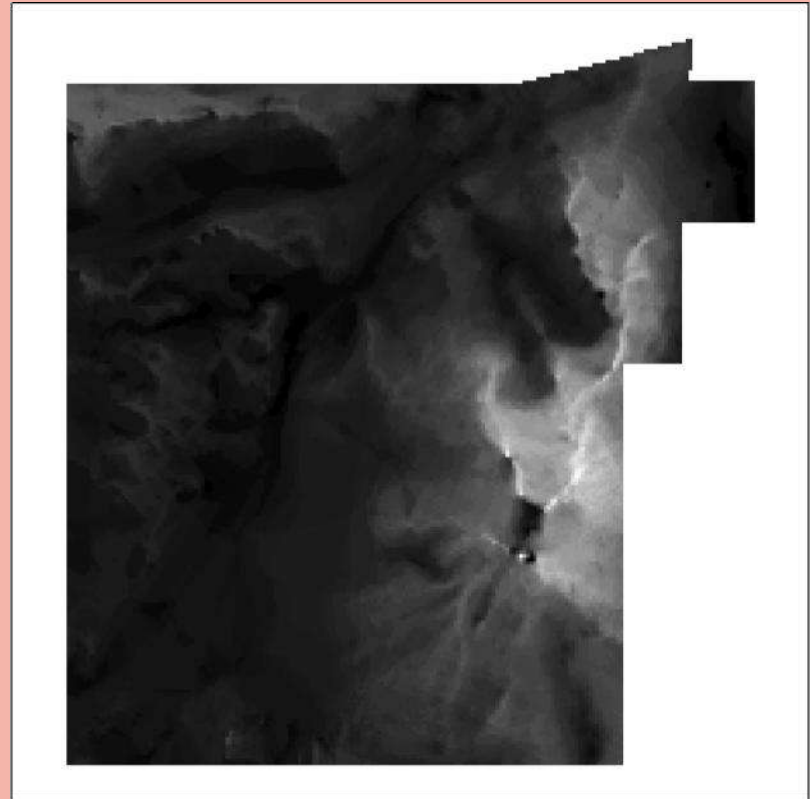
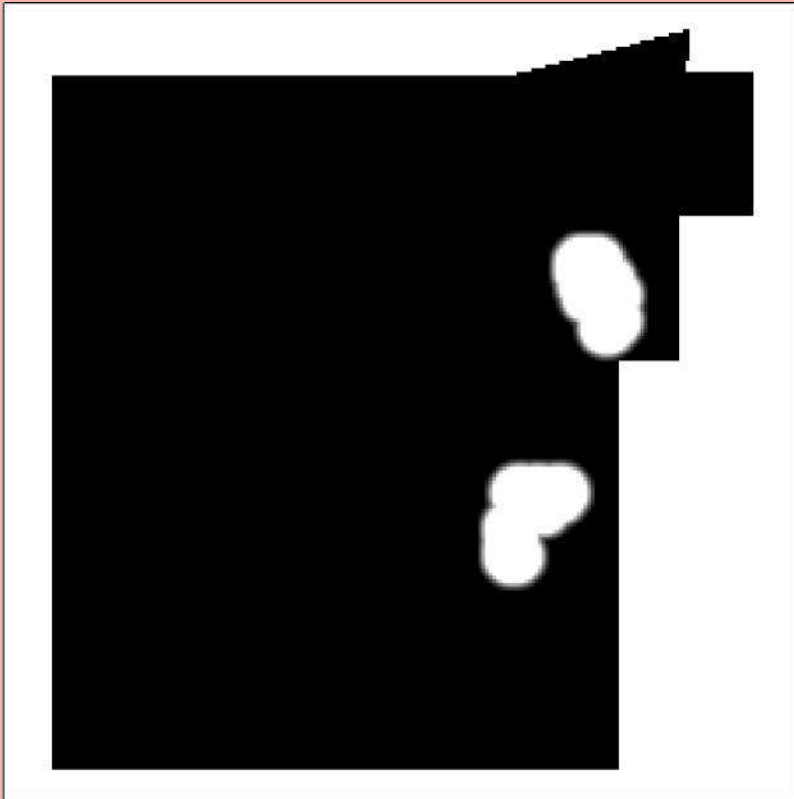


Submit

Pairwise comparisons

Structures

Visibility



9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9
○ ○ ○ ○ ○ ○ ○ ○ ● ○ ○ ○ ○ ○ ○ ○ ○ ○

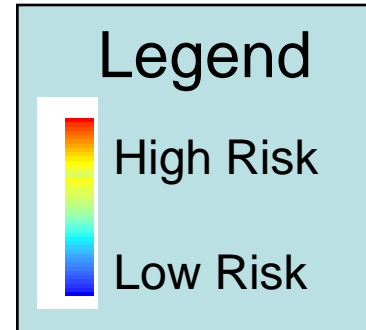
Submit

Use some mathematics to derive weights from the pairwise comparisons, then add them up

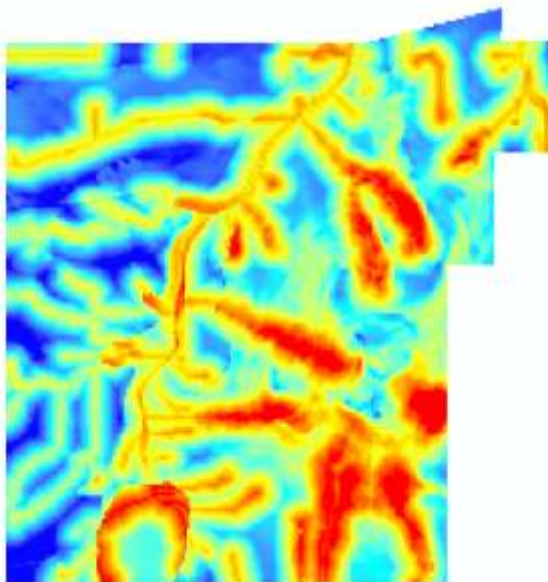
$$W_9^* \left(W_1^* \begin{img alt="Input image of a tree trunk" data-bbox="169 355 311 544"} + W_2^* \begin{img alt="Edge detection of the tree trunk" data-bbox="377 355 519 544"} + W_3^* \begin{img alt="Color image of the tree trunk" data-bbox="585 355 727 544"} + W_4^* \begin{img alt="Another color image of the tree trunk" data-bbox="801 355 943 544"} \right) \\ + W_{10}^* \left(W_5^* \begin{img alt="Edge detection of the tree trunk" data-bbox="169 610 311 799"} + W_6^* \begin{img alt="Binary mask of the tree trunk" data-bbox="377 610 519 799"} + W_7^* \begin{img alt="Another binary mask of the tree trunk" data-bbox="593 610 735 799"} + W_8^* \begin{img alt="Another color image of the tree trunk" data-bbox="793 610 935 799"} \right) \\ = ?$$

Three different risk layers

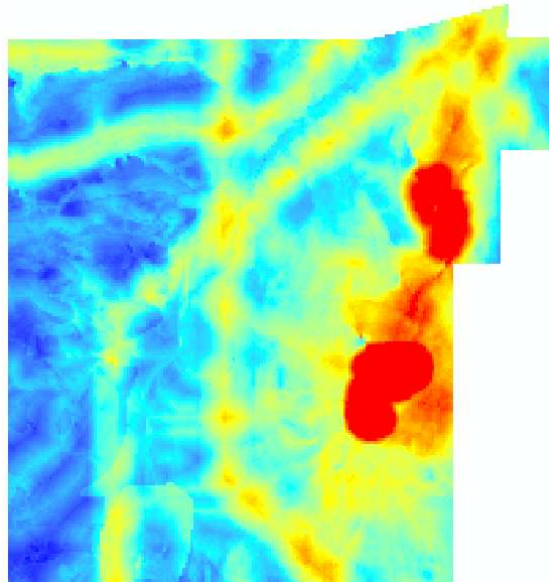
Here are three possible outcomes, depending on how we rated our comparisons



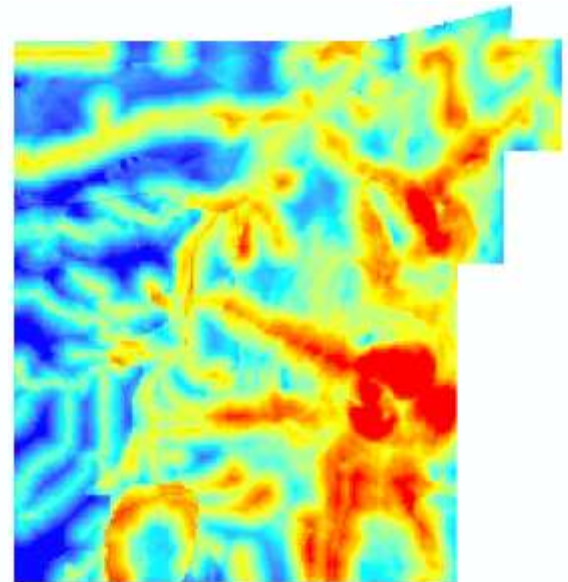
Ecology important



Infrastructure important



All equal



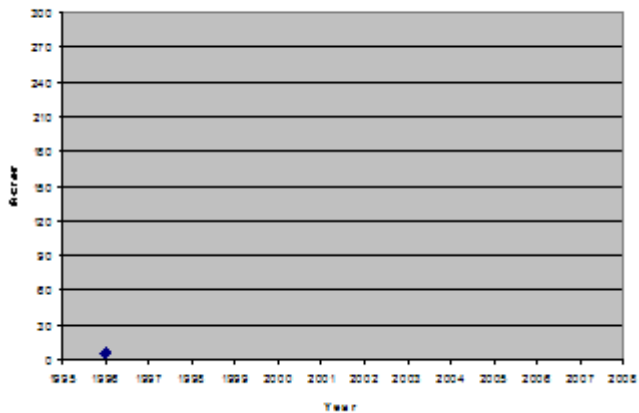
“Risk” vs. “Damage”

- We use risk to prioritize treatments
- **Risk** refers to the priority given to parts of the landscape *if* they are infested with buffelgrass
- So, from the previous slides, we have “risk” – now we need to know where the buffelgrass is and will be.
- **Damage** is the actualization of risk, given that buffelgrass is on the landscape.
- Thus, **Damage = Risk * Buffelgrass**

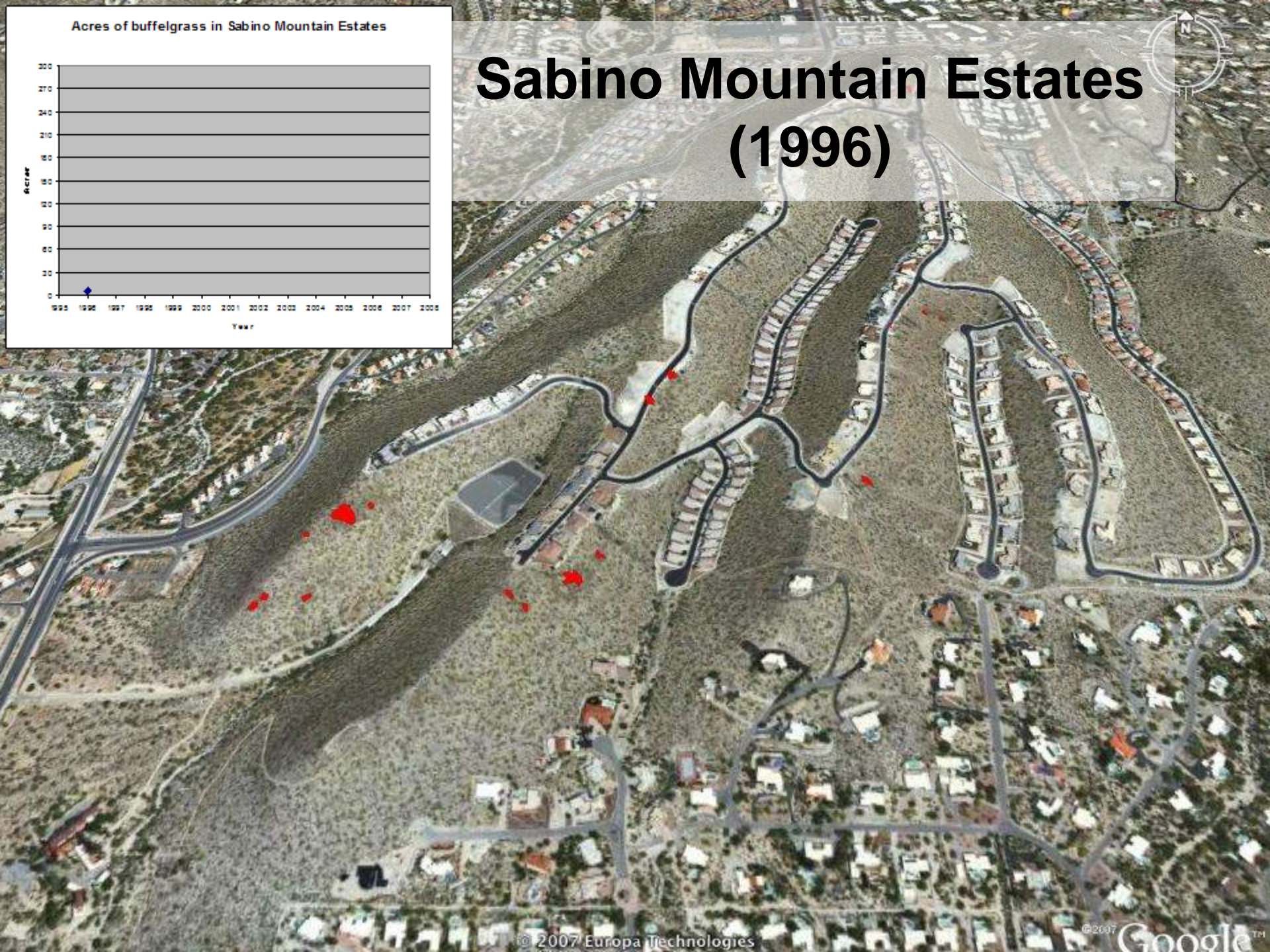
Objective: Minimize “Damage”

- Minimize damage over some planning horizon (e.g., 10 years)
- Given:
 - Initial distribution of buffelgrass
 - Resources (yearly budget, number of sprayers, laborers)
 - Constraints
 - Spatial constraints on types of treatments (e.g., roadside spraying is only applicable along roads)
 - Limited treatment window
 - Dynamic spread
 - What? You mean it’s spreading?

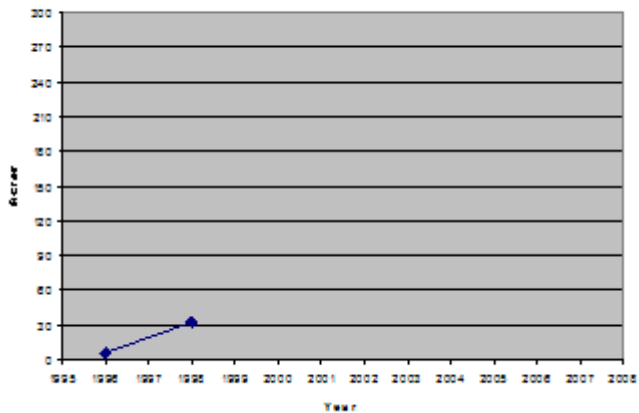
Acres of buffelgrass in Sabino Mountain Estates



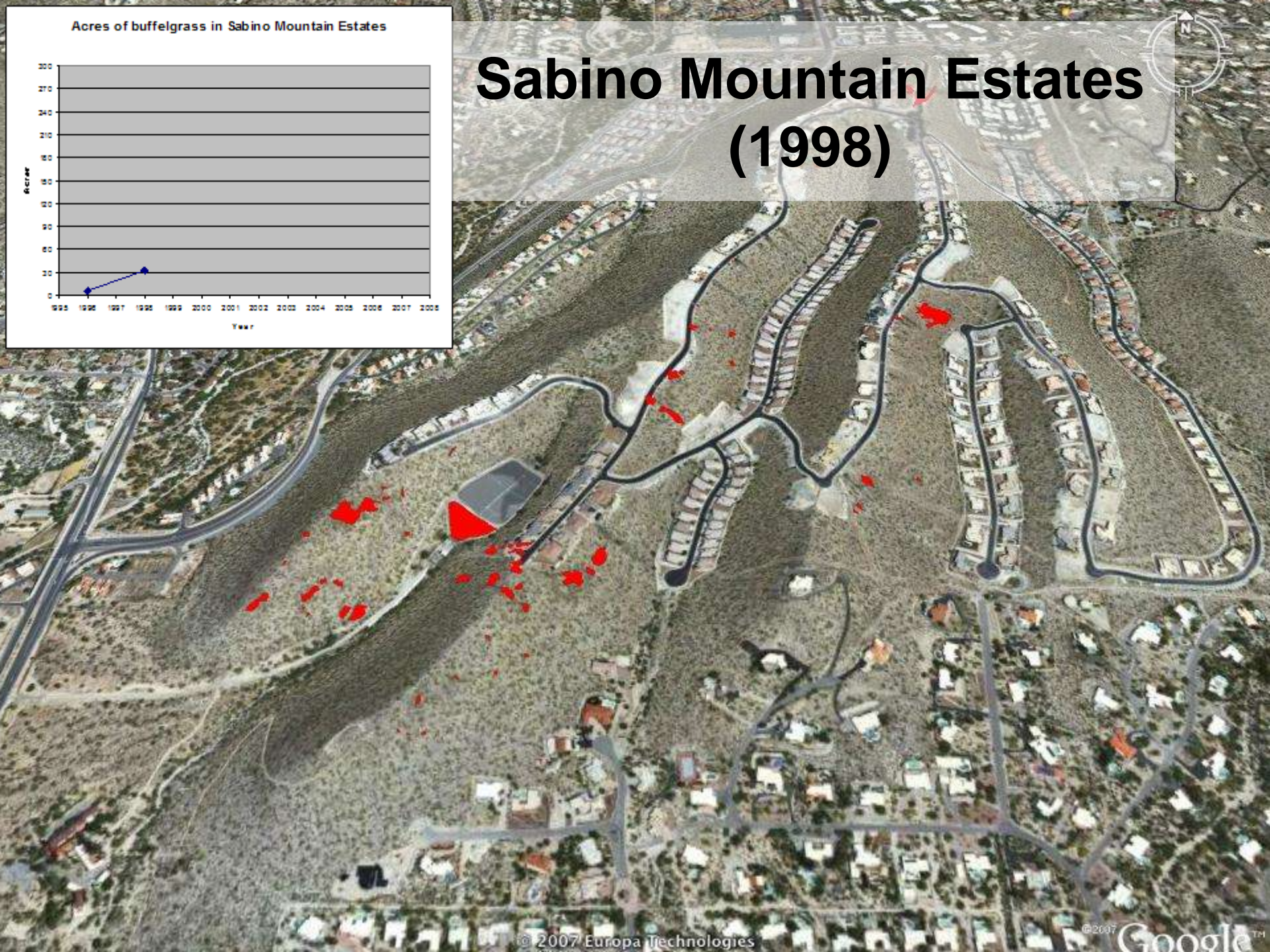
Sabino Mountain Estates (1996)



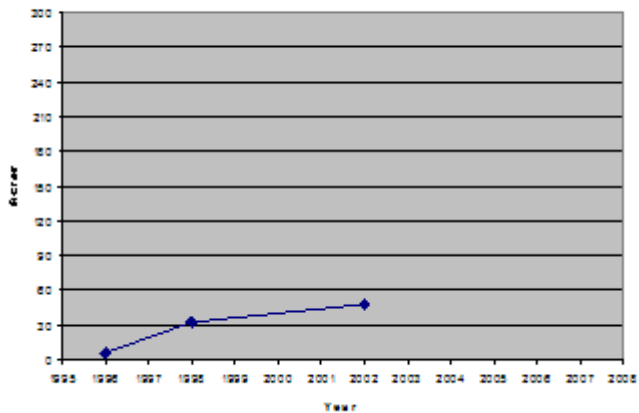
Acres of buffelgrass in Sabino Mountain Estates



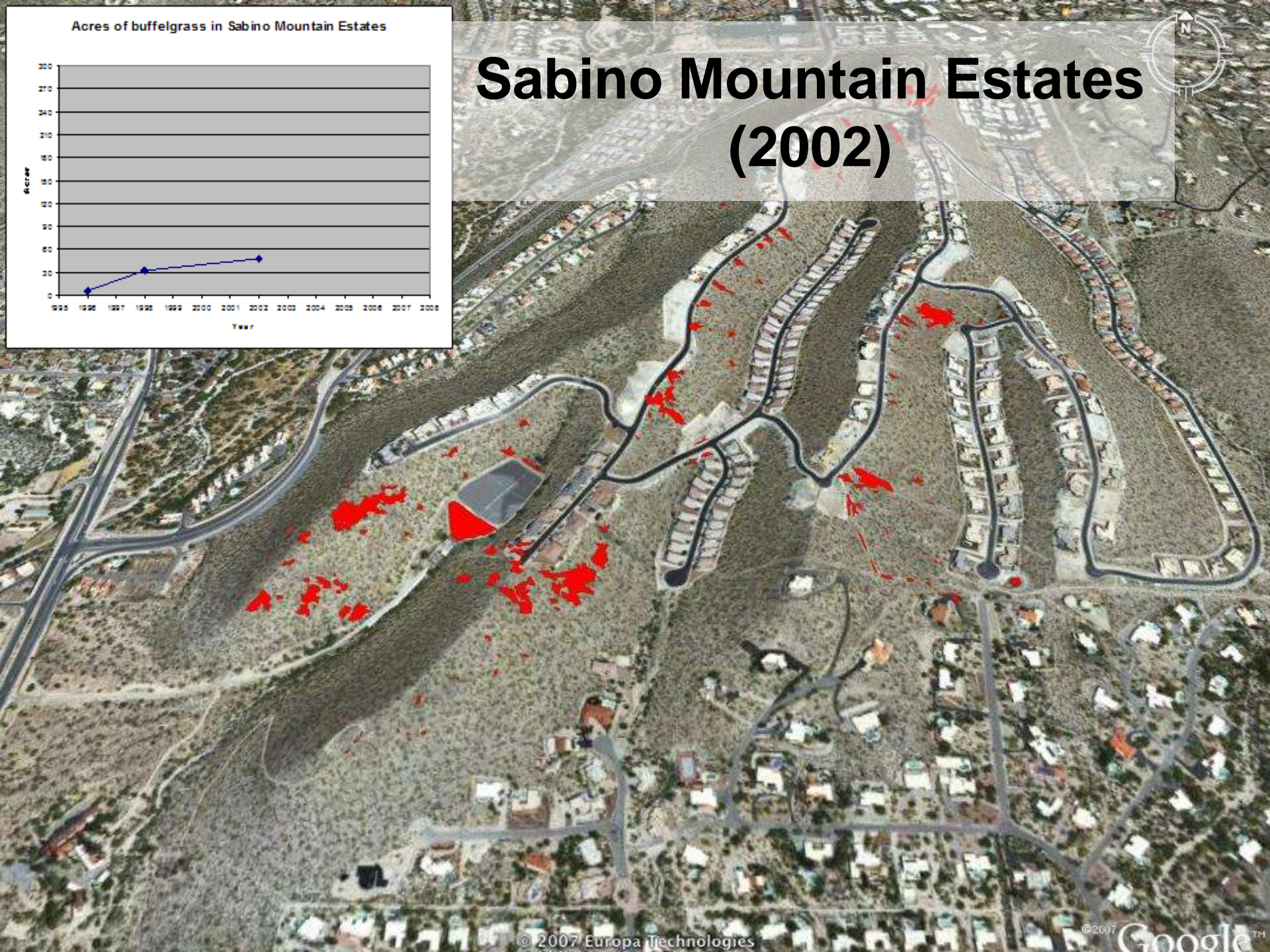
Sabino Mountain Estates (1998)



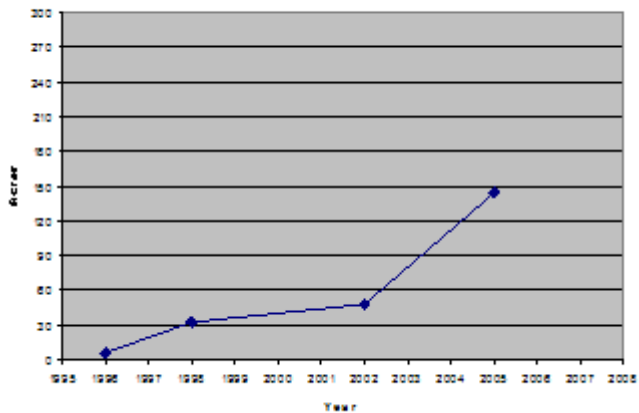
Acres of buffelgrass in Sabino Mountain Estates



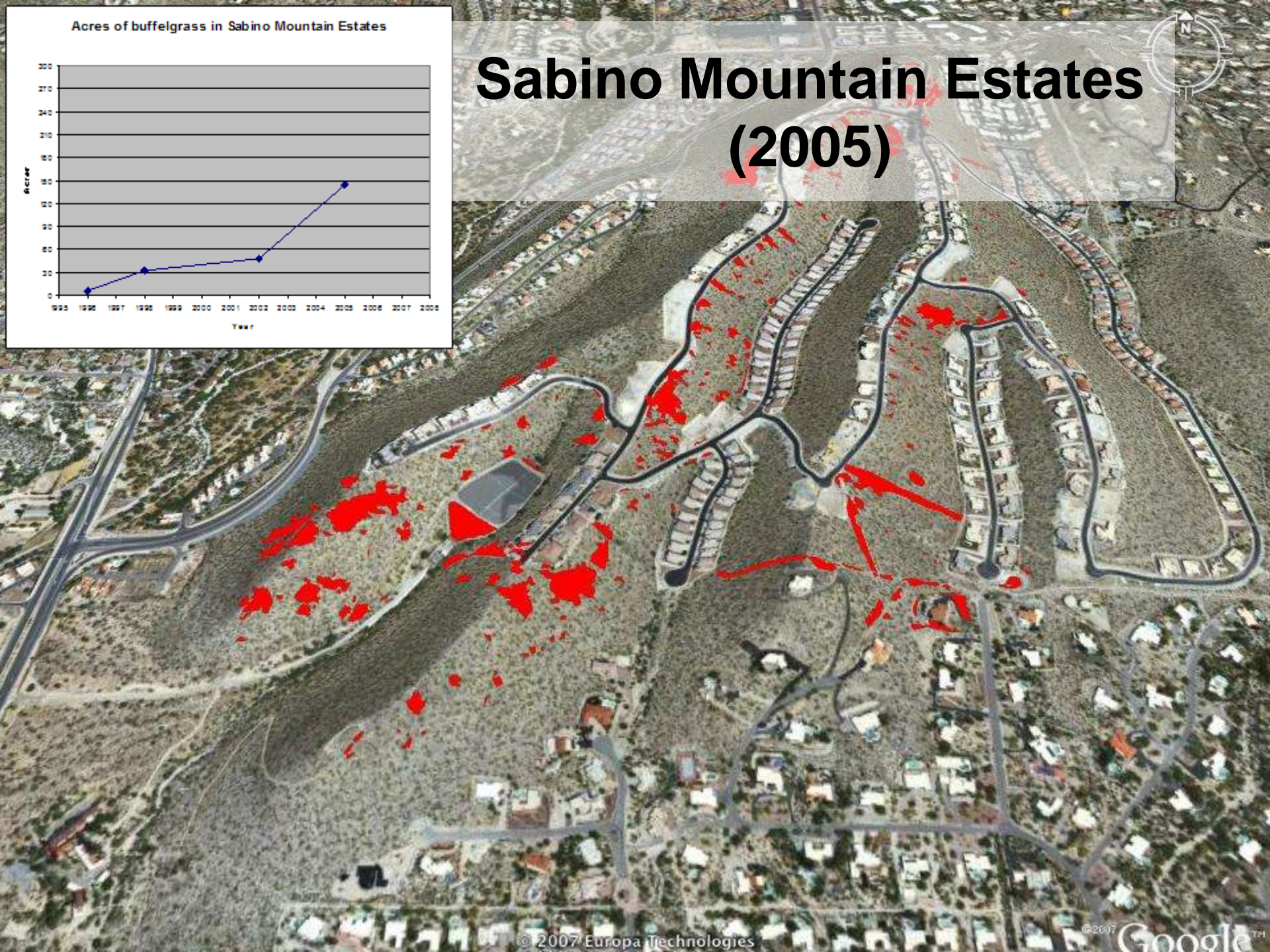
Sabino Mountain Estates (2002)



Acres of buffelgrass in Sabino Mountain Estates

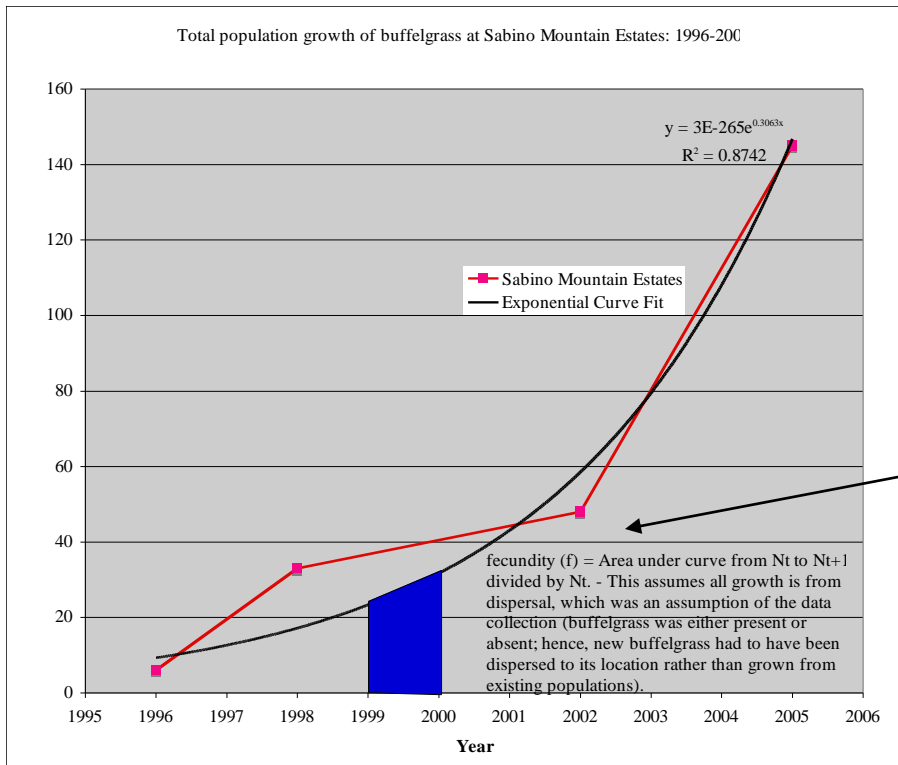
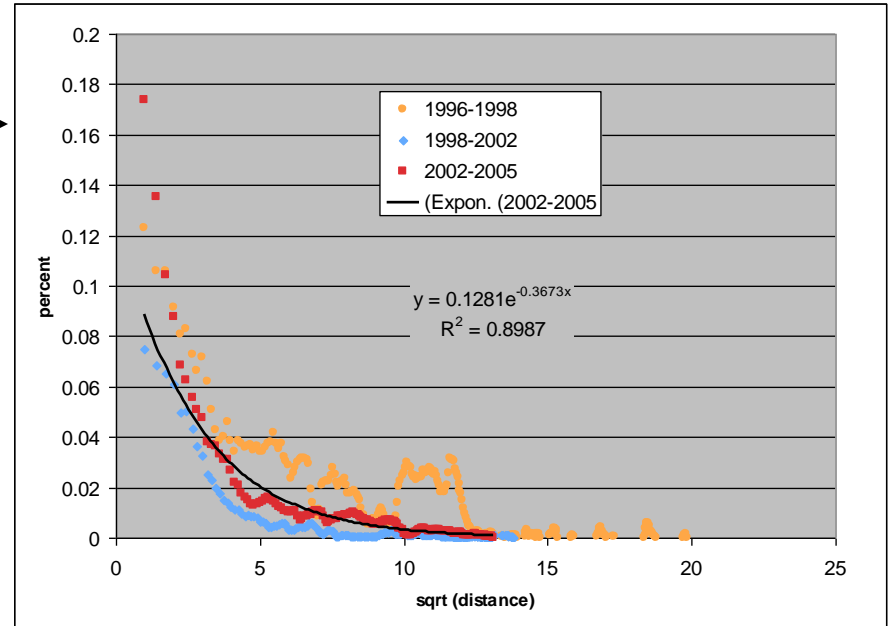


Sabino Mountain Estates (2005)



Next, run the spread model

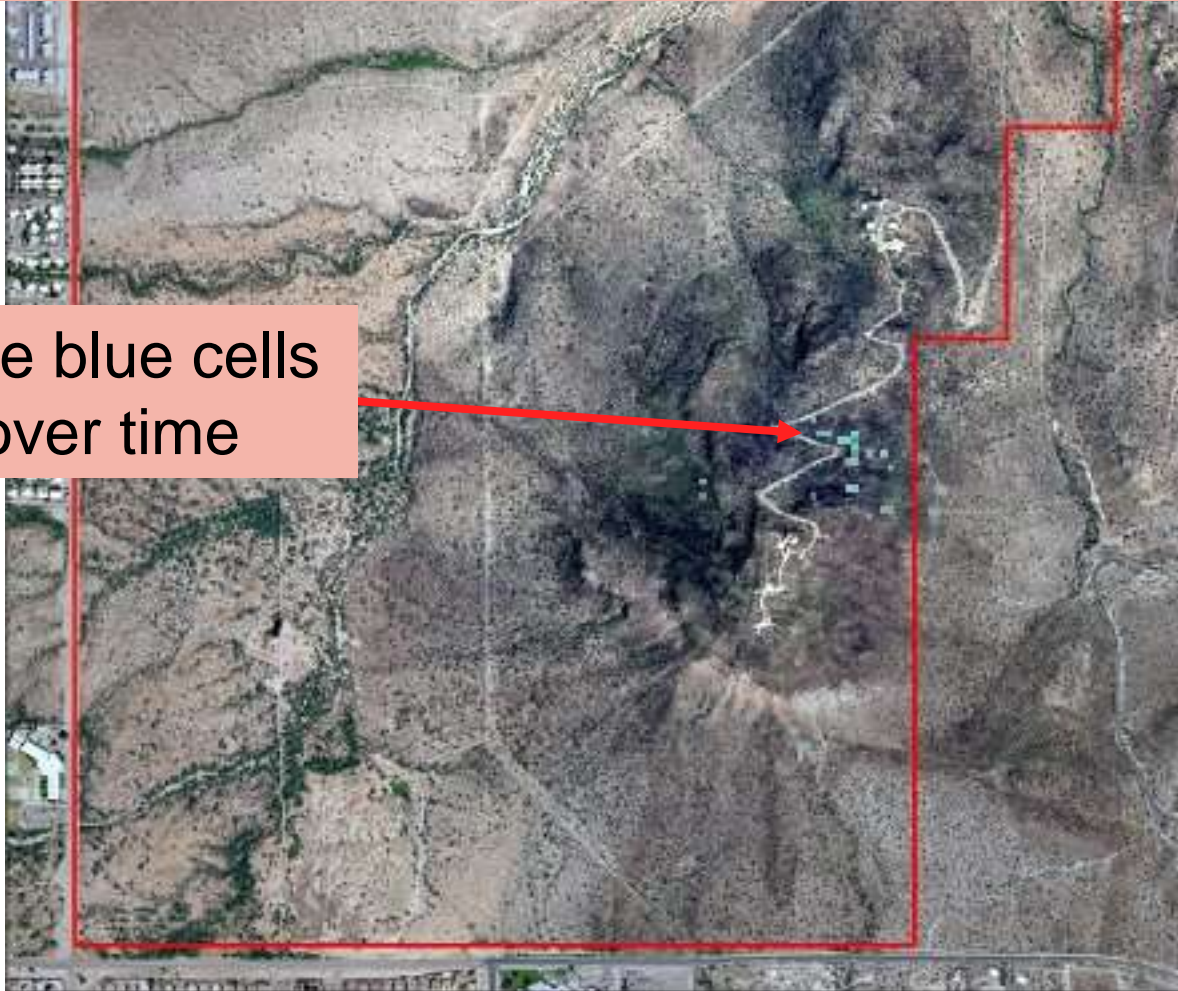
Fit curve to histogram of per capita propagule production as a function of distance



Fecundity is the number of propagules produced by a population

Simulations of Spread (T=1)

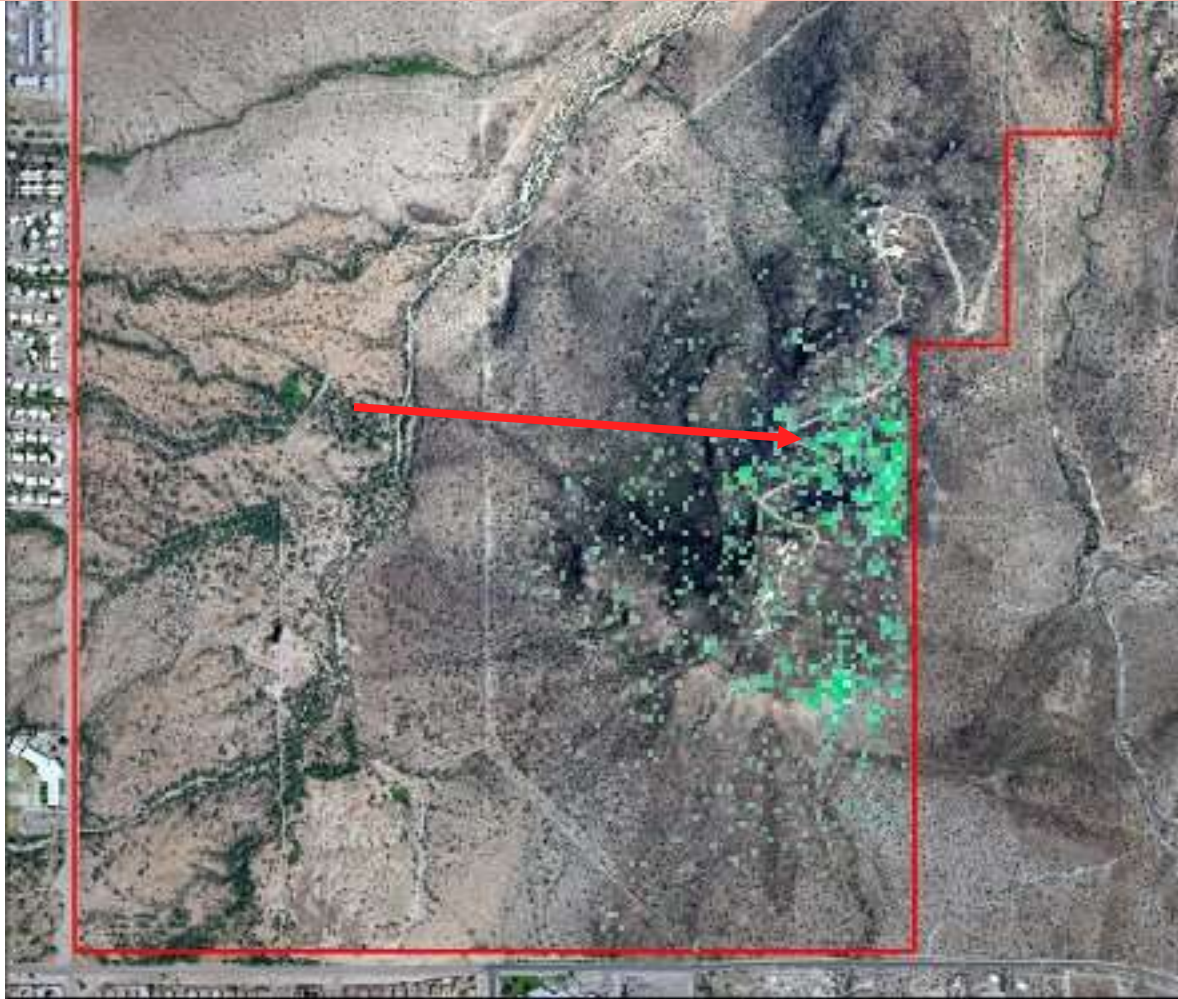
Watch the blue cells expand over time



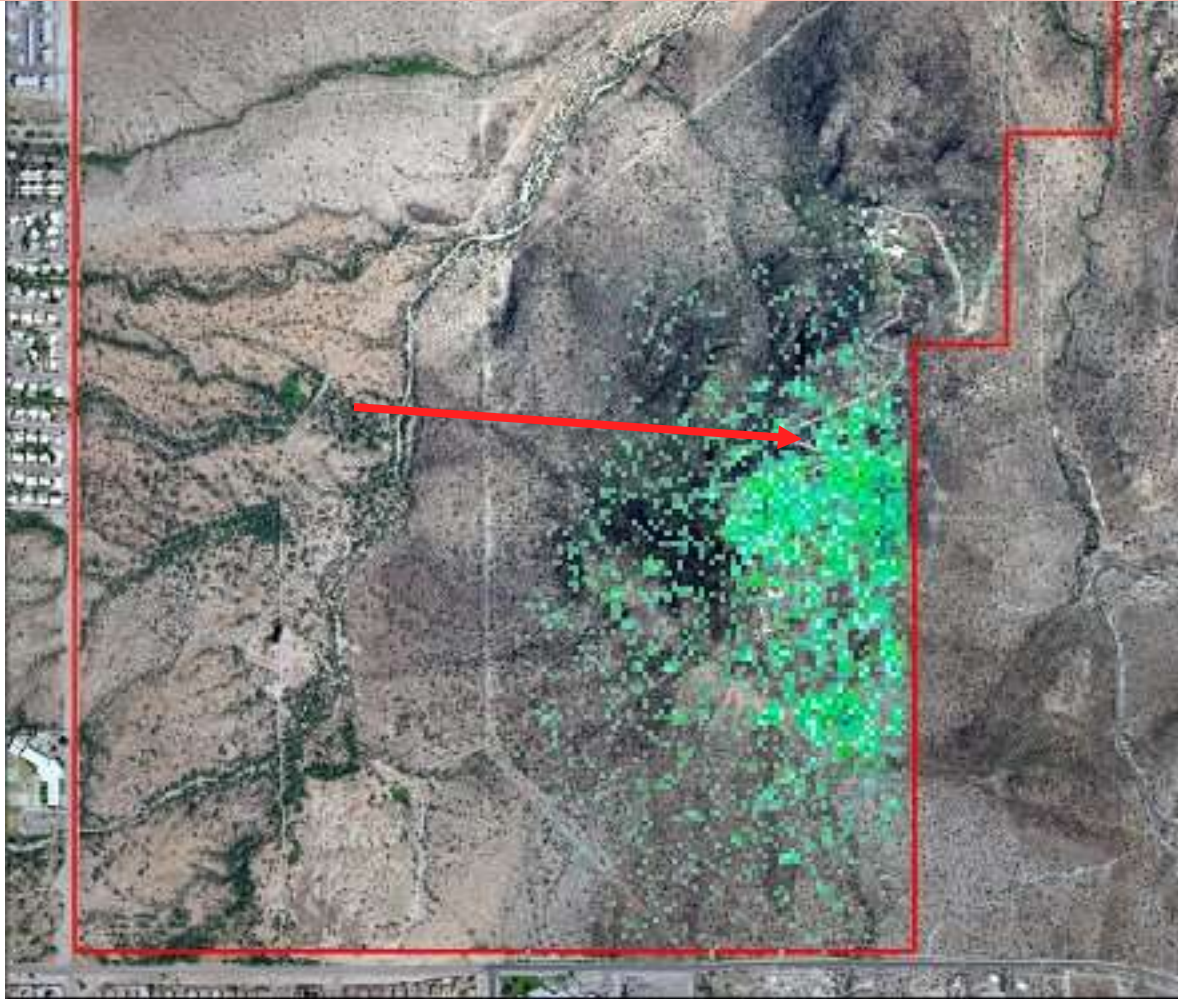
T=2



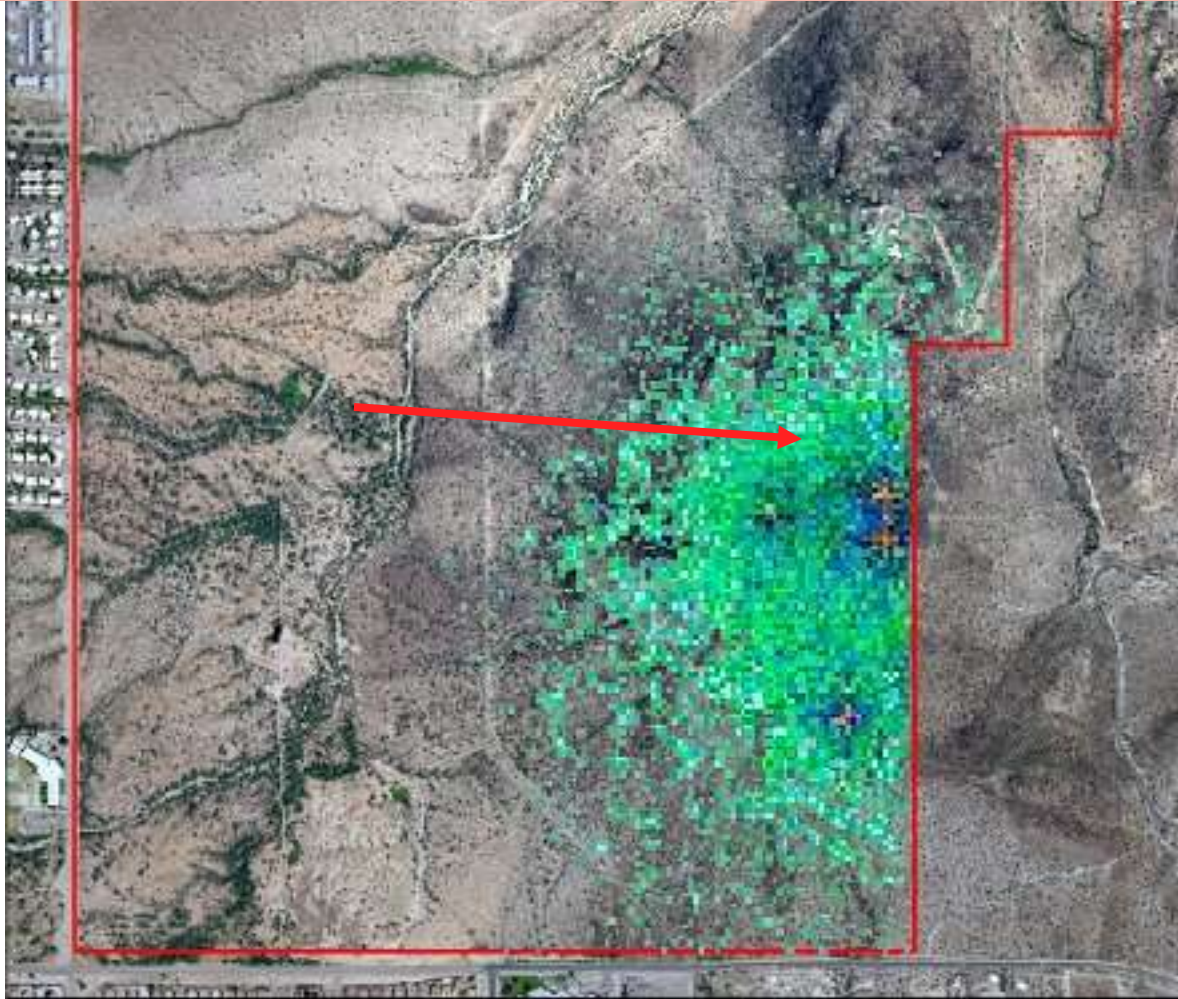
T=5



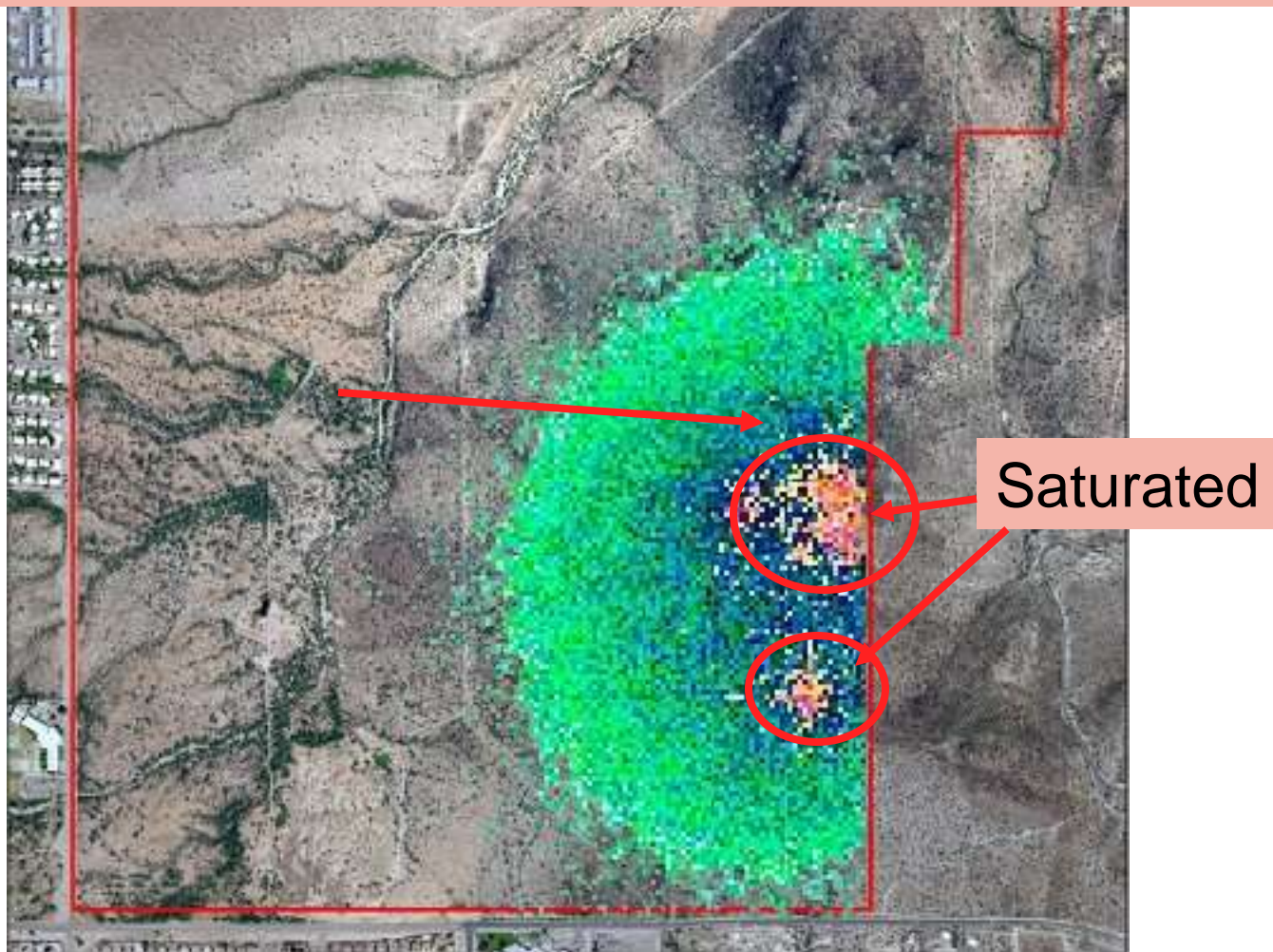
T=10



T=15

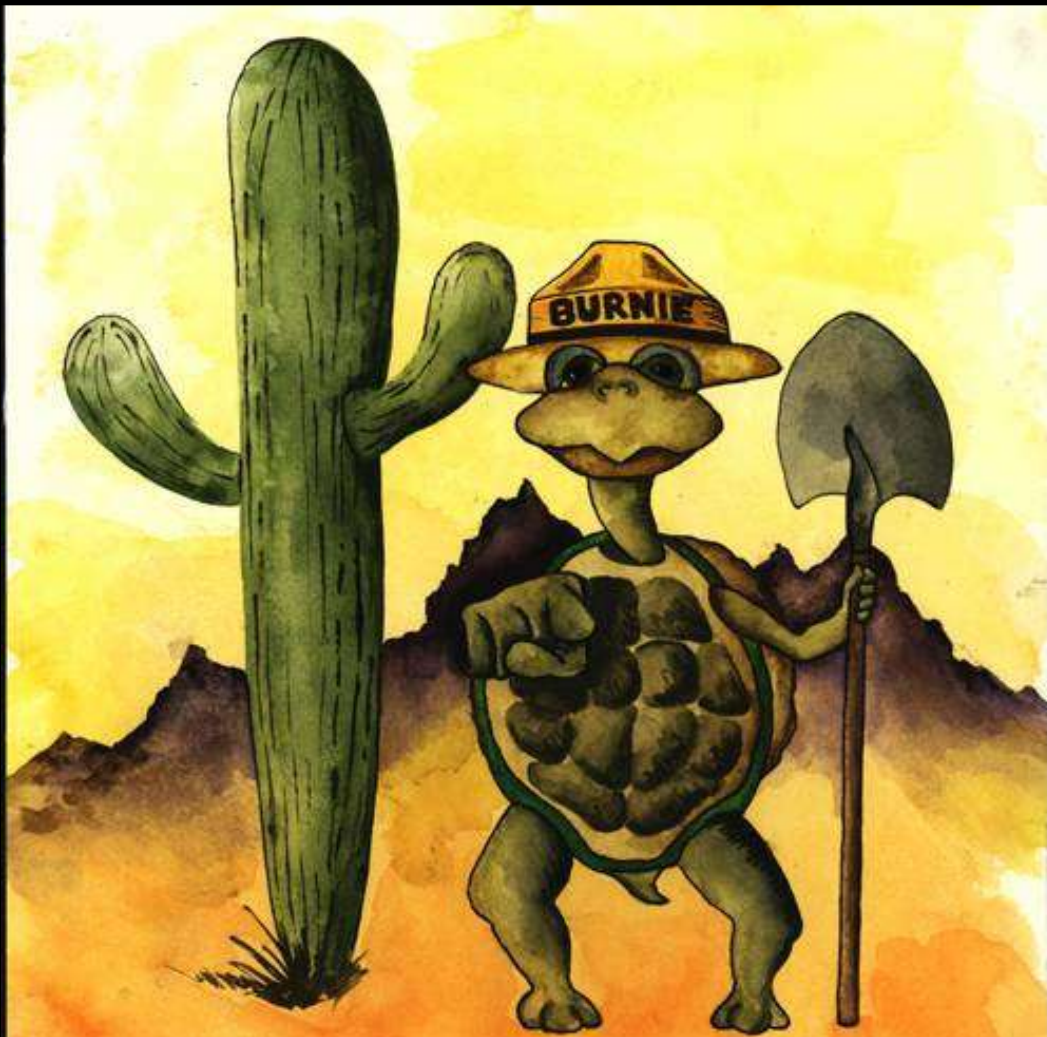


T=20



DSS Outputs = Recommendations

- Best use of existing resources
- Table of scenarios
 - Do nothing
 - Use of existing resources
 - Use of resources as a lump sum
 - Fewer resources (-33%, -50%)
 - More resources (+50%, +100%)
- Yearly maps of recommended treatment areas



REMEMBER:

ONLY YOU
Can Prevent Desert Fires!

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Betancourt