



Babacomari Ranch (Santa Cruz & Cochise Counties)

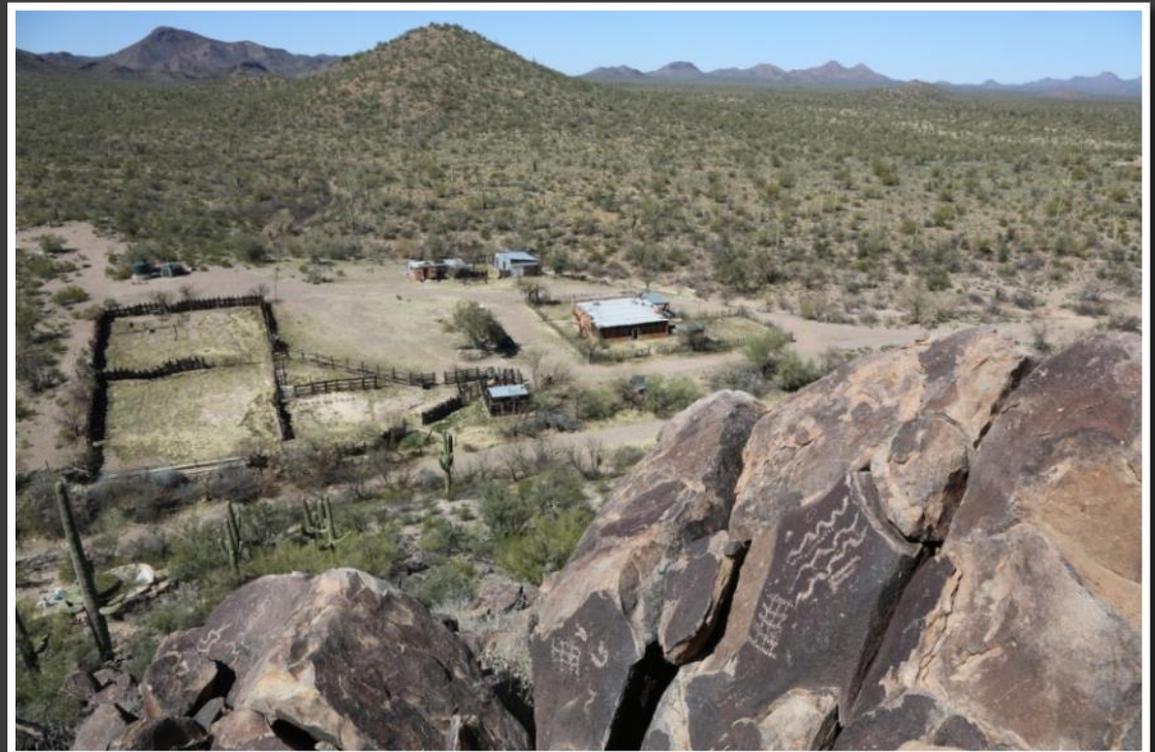
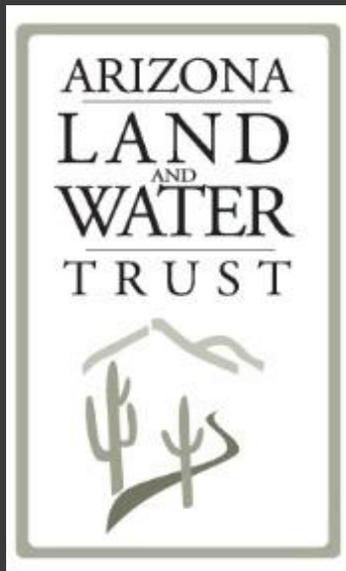
# UTILIZING ARCGIS DESKTOP AND ONLINE TOOLS TO DYNAMICALLY EVALUATE AND SHARE CONSERVATION PROJECTS



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University of Arizona  
MSGIST 2014 Final Project  
Tucson Area GIS Cooperative  
March 13, 2015

# GOAL

Create a GIS-based Project Evaluation System for a local land trust that addresses the need for flexibility in identifying potential conservation values of projects that meet the diverse priorities of funding opportunities for conservation in SE Arizona



Ranch in Ironwood Forest National Monument (Pima County)

# AGENDA

1. Study Area
2. Problems
3. Solution
4. Conclusion
5. Review
6. Questions



Putnam Spring, Triangle Bar Ranch (Pinal County)



ly Area  
y Focus Area  
led Focus Area

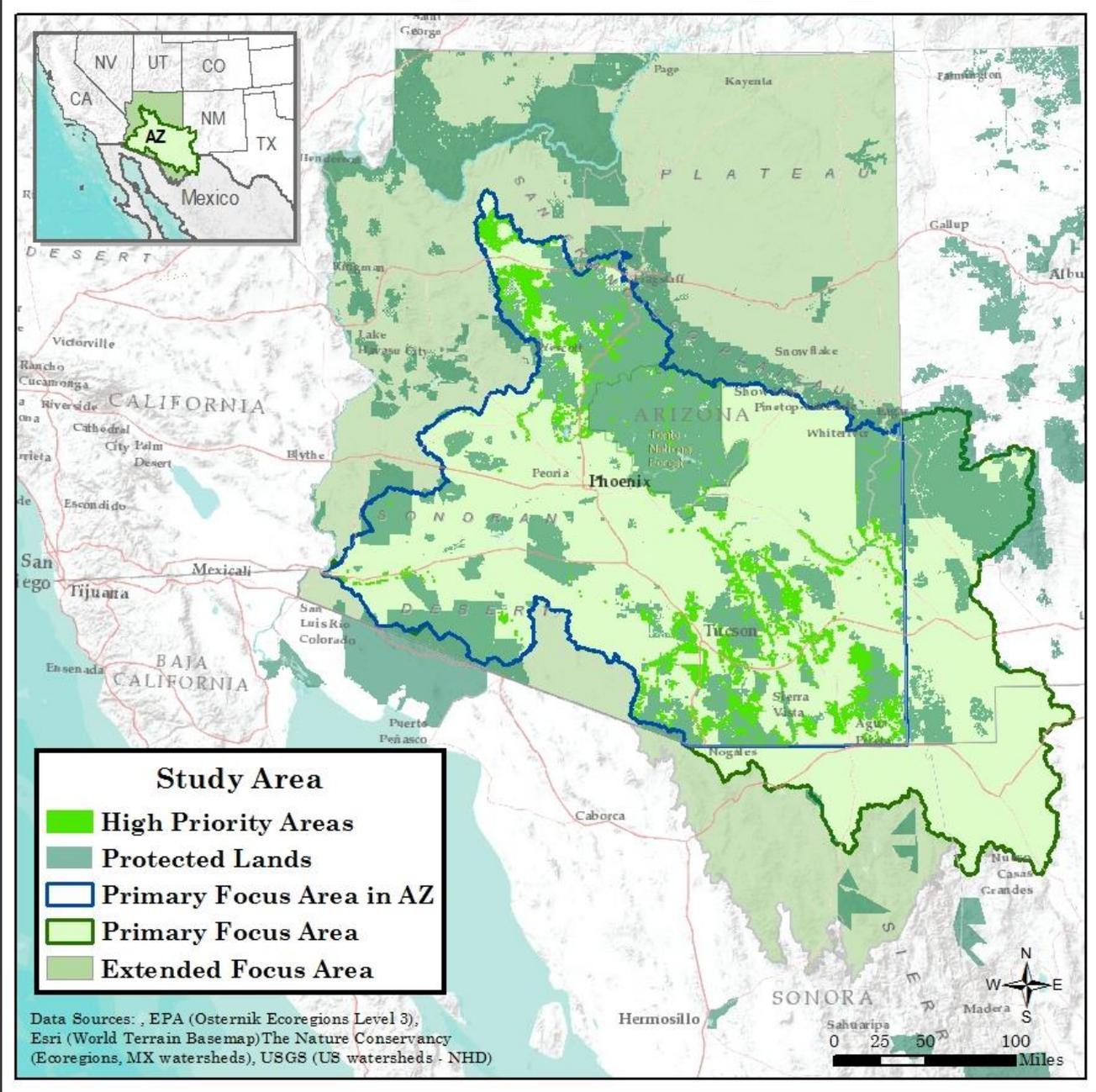


**Major Biotic Influences in the Sky Island Region**  
©2010 Sky Jacobs

Data Sources: EPA (Osprey), Esri (World Terrain Basemap), EPA (Ecoregions, MX watersheds)

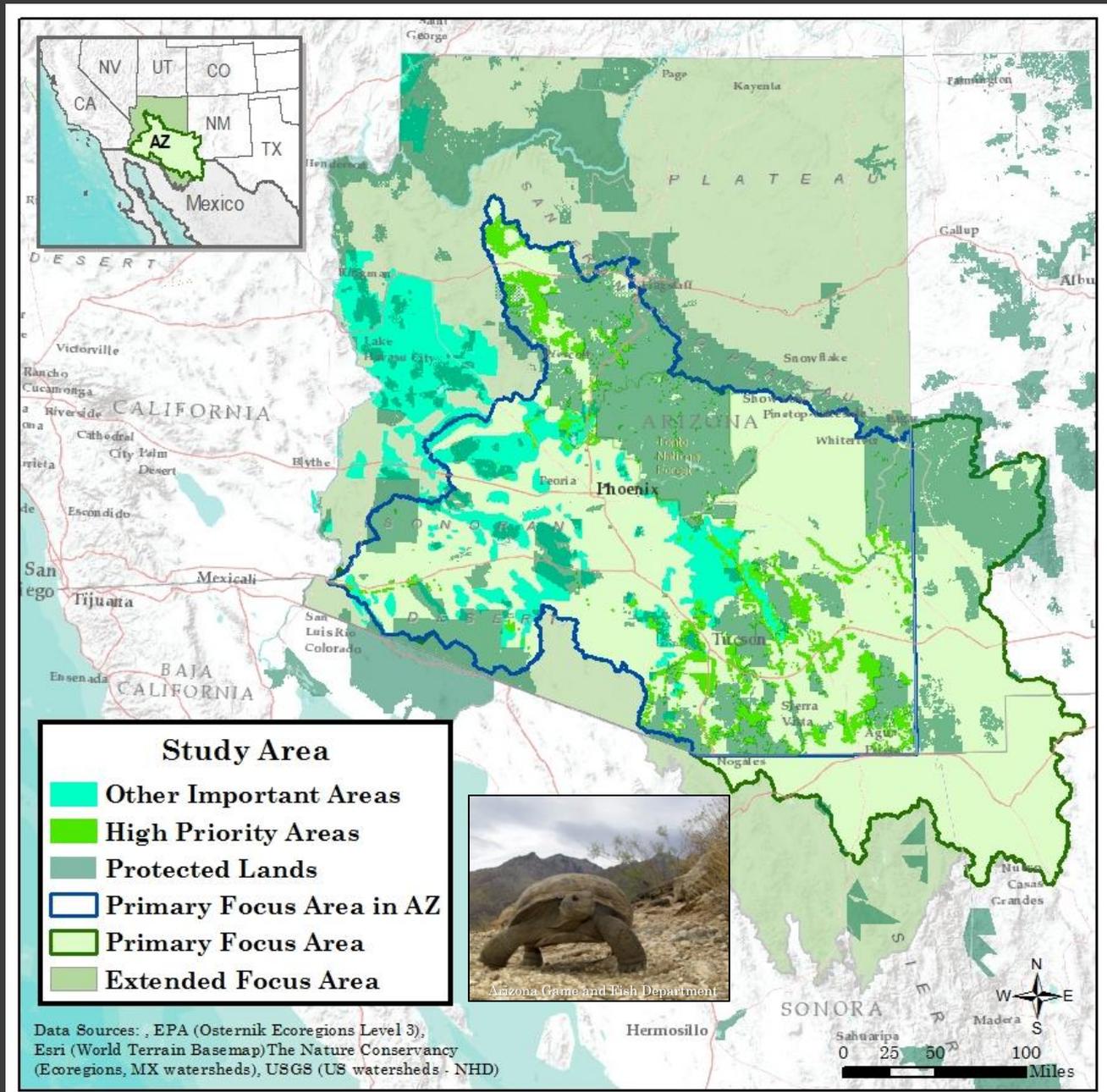
**PROBLEM:**  
The need for  
land and water  
conservation  
dollars  
outweighs  
available funds

**TYPICAL  
SOLUTION:**  
Narrow your  
larger focus  
area down to  
high priority  
areas



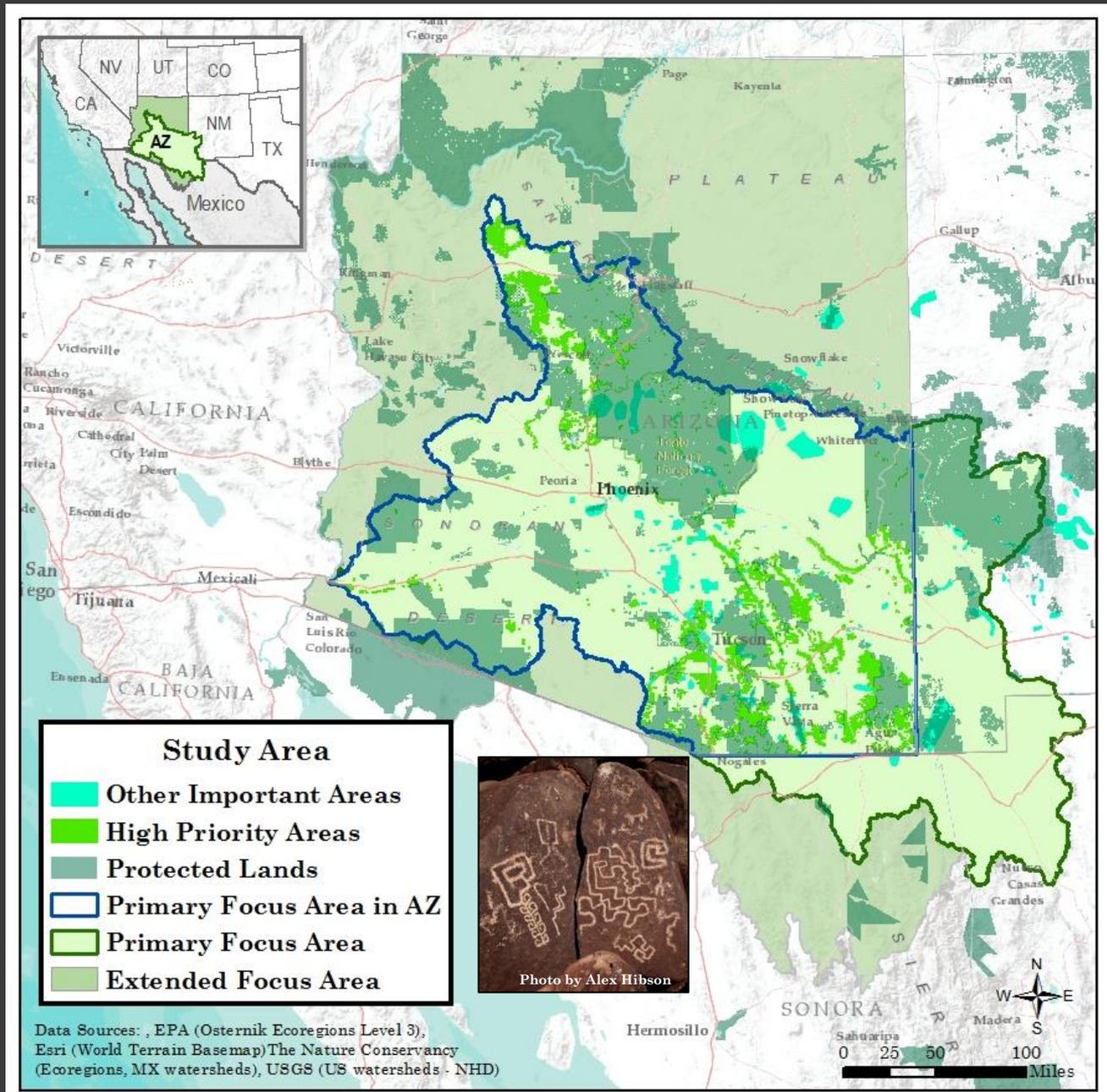
# NEW PROBLEM: Limited information to assist with project implementation

- What if a project does not fall within these high priority areas?
- What if it does?
- Other important areas?



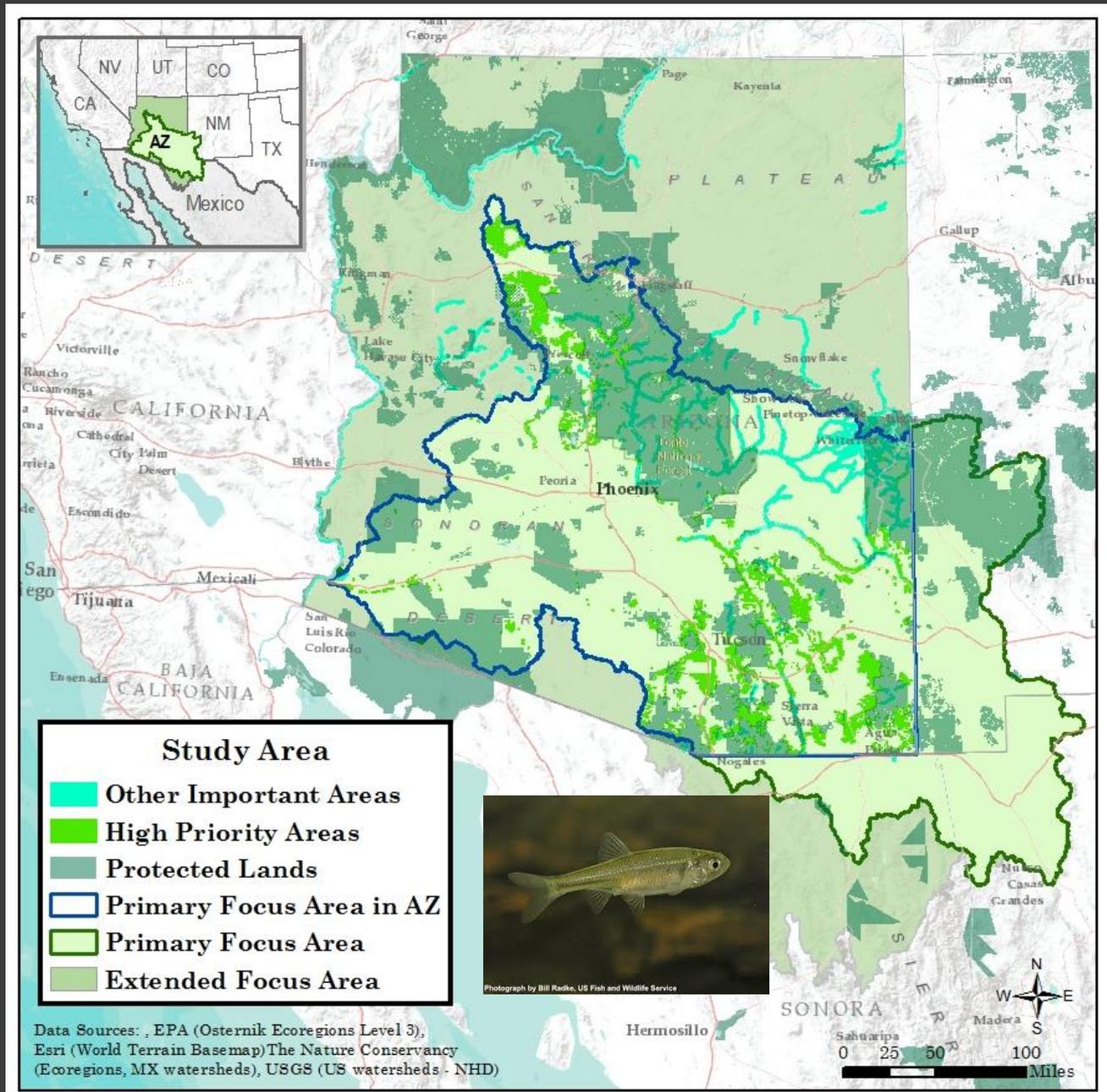
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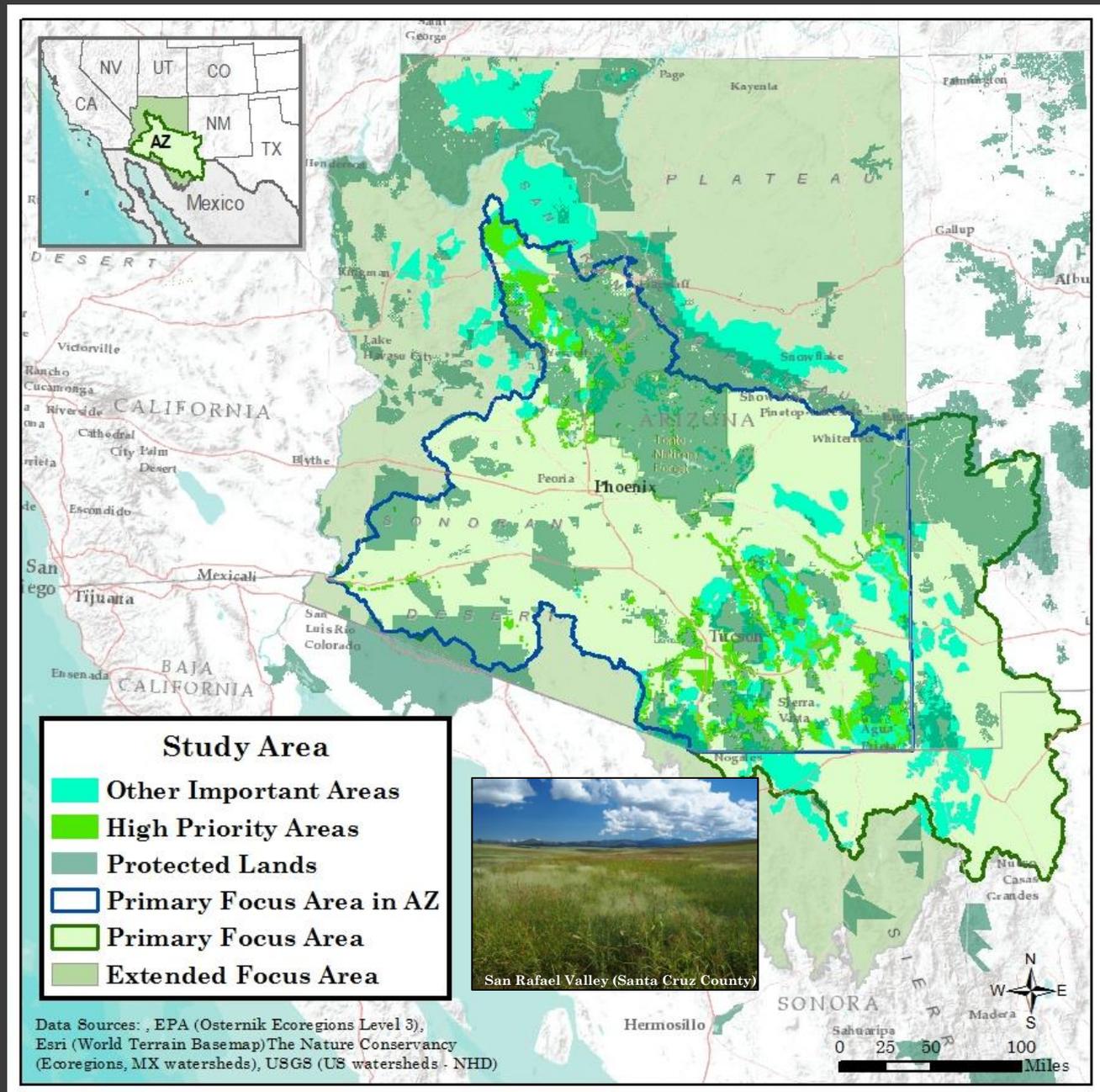
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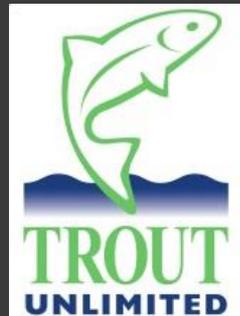
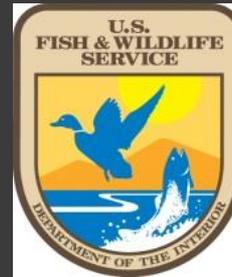
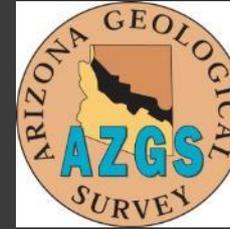
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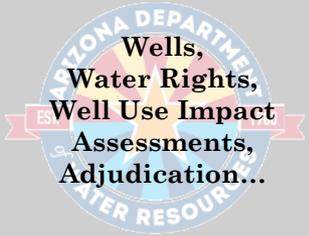


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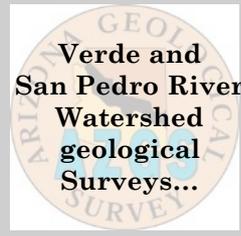
- What if a project does not fall within these high priority areas?
- What if it does?
- Other important areas?



Riparian Areas, Watchable Wildlife, Habitat Fragmentation, Wildlife Linkages, Biodiversity...  
\$\$\$



Wells, Water Rights, Well Use Impact Assessments, Adjudication...



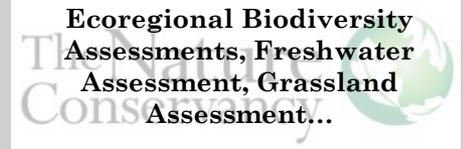
Verde and San Pedro River Watershed geological Surveys...



Military Installations, Special Use Airspaces, Training Routes...  
\$\$\$



EnviroAtlas - Ecosystem Services = biological functions with economic value  
Landcover Diversity, Natural Hazard Mitigation....



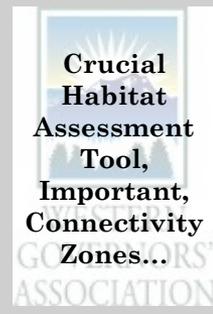
Ecoregional Biodiversity Assessments, Freshwater Assessment, Grassland Assessment...



Funder of applied science projects, Arizona streams (finally an AZ NHD data steward?)



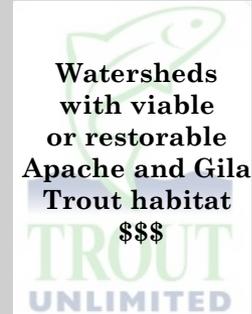
Designated and Proposed Critical Habitats of T&E Species, Species Recovery Areas...



Crucial Habitat Assessment Tool, Important, Connectivity Zones...



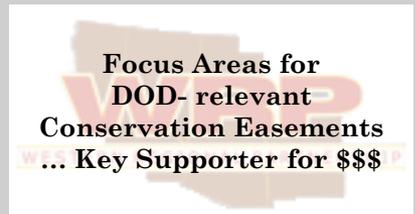
Wildlife Corridors, High Biological Areas Springs Assessments, Targets for Restoration...



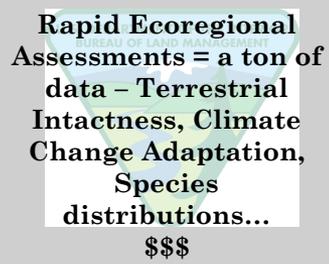
Watersheds with viable or restorable Apache and Gila Trout habitat  
\$\$\$



Distributions of and Threats to Grassland, Riparian, Desert, etc Bird Communities ...



Focus Areas for DOD- relevant Conservation Easements  
... Key Supporter for \$\$\$



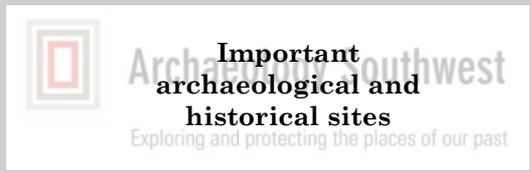
Rapid Ecoregional Assessments = a ton of data - Terrestrial Intactness, Climate Change Adaptation, Species distributions...  
\$\$\$



State & Intl Important Bird Areas



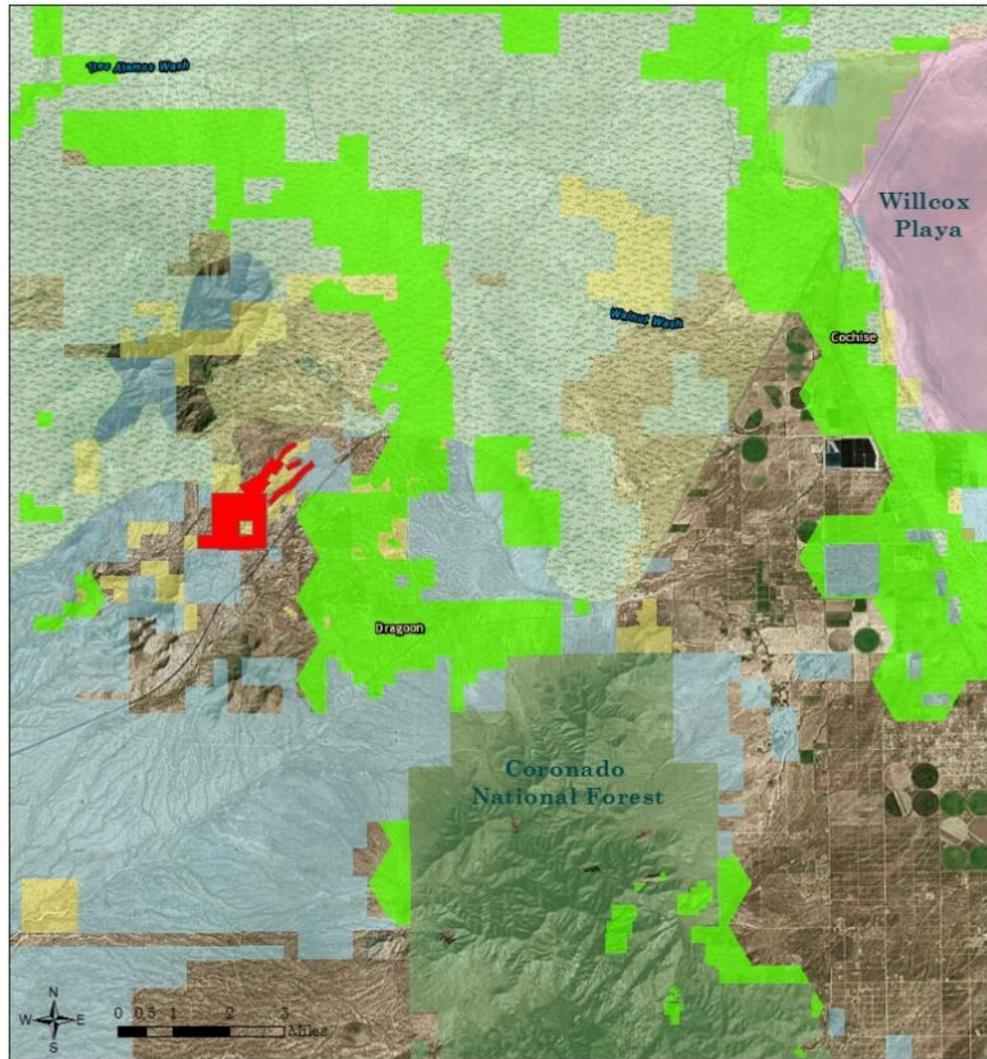
Conservation Lands System - Biocore, Important Riparian Areas  
\$\$\$



Important archaeological and historical sites  
Exploring and protecting the places of our past

# NEW PROBLEM: Limited information to assist with project implementation

- What if a project does not fall within these high priority areas?
- What if it does?
- Other important areas?



## XYX Ranch



Data Sources: ALWT, Esri, TNC.....

Disclaimer: Arizona Land and Water Trust is not responsible....

 Project (1234 acres)

 ALWT High Priority Areas

 Existing Protected Lands

 Important Grasslands

 Critical Habitat

**Land Ownership**

 BLM

 Military

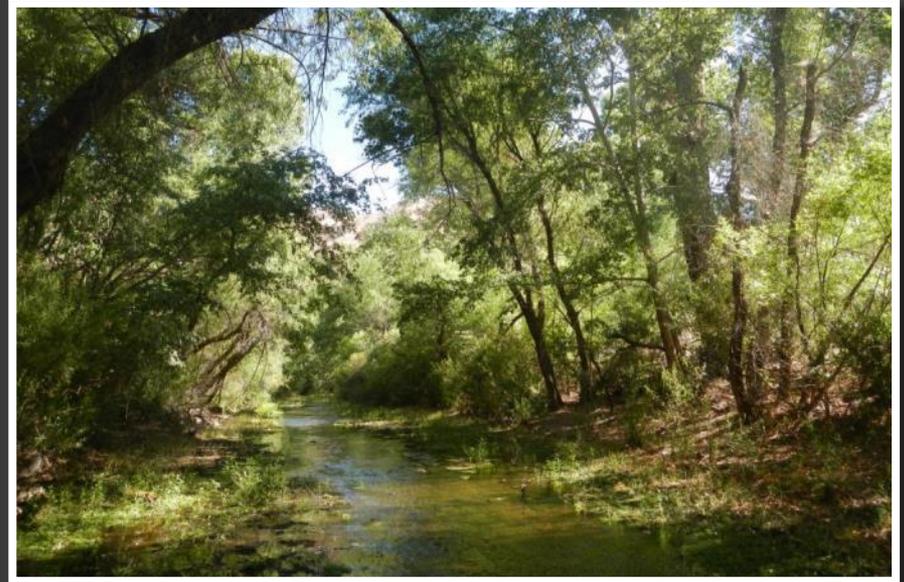
 Other

 State Trust



Photo taken by R. Dawson

Sands Ranch (Pima County)



Ranch along Sonoita Creek (Santa Cruz County)

**NEW SOLUTION:** Use an updatable suite of GIS data and technologies to help identify conservation value and funding opportunity attributes of projects

## PROJECT EVALUATION SYSTEM

Data → Python Script (Arcpy) → ArcGIS Online

# NEW SOLUTION: The Project Evaluation System ArcGIS Online

- More information in an interactive mapping environment
- Learn about data, the existing/potential partners that created the data and possible funding opportunities – DOD example

The screenshot displays the ArcGIS Online interface for the 'ALWT Active Projects & Inquiries' system. The browser address bar shows the URL: [alwt.maps.arcgis.com/home/webmap/viewer.html?webmap=66160db90ece47749c70d362710a0a3a](http://alwt.maps.arcgis.com/home/webmap/viewer.html?webmap=66160db90ece47749c70d362710a0a3a). The page title is 'ALWT Active Projects & Inquiries'. The interface includes a navigation menu with 'HOME', 'NEW MAP', 'CREATE PRESENTATION', and 'ALWT'. A toolbar at the top provides options for 'Details', 'Add', 'Edit', 'Basemap', 'Save', 'Share', 'Print', 'Directions', 'Measure', and 'Bookmarks'. A search bar labeled 'Search Project' is also present. The main content area features a map of the Colorado River Basin with various data layers overlaid. A legend on the left side lists several layers, including 'Colorado River Basin Rivers', 'Projects - Category', 'Projects - Overall CV Score', 'Projects - Overall FO Score', 'BLM Protected Lands Boundaries', 'ALWT Protected Lands', 'Other Protected Lands', 'Public Land Ownership', 'Arizona Springs Public Information', and 'Imagery'. A detailed view window is open over a specific project area, showing a pie chart titled 'Conservation Values Variables' and a table of 'CV Variables that intersect with the Project'. The pie chart shows a distribution of variables, and the table lists 'PP-Fort Huachuca EPG: 3'.

ALWT Active Projects & Inquiries

NEW MAP CREATE PRESENTATION ALWT

Details Add Edit Basemap Save Share Print Directions Measure Bookmarks Search Project

About Content Legend

Contents

- Colorado River Basin Rivers
- Projects - Category
- Projects - Overall CV Score
- Projects - Overall FO Score
- BLM Protected Lands Boundaries
- ALWT Protected Lands
- Other Protected Lands
- Public Land Ownership
- Arizona Springs Public Information
- Imagery

Streams - TNC

W-Non-Exempt 0

Wells in FHA/HA

Conservation Values Variables

CV Variables that intersect with the Project

PP-Fort Huachuca EPG: 3

Zoom to Get Directions Edit

Esri.com ArcGIS Marketplace Help Terms of Use Privacy Contact Esri Report Abuse

Earthstar Geographics, CNES/Airbus DS | Pima County Information Technology Dep. POWERED BY esri

# NEW SOLUTION: The Project Evaluation System ArcGIS Online

- Now in 3D!

The screenshot displays the ArcGIS Online 3D viewer interface. The browser address bar shows the URL: `alwt.maps.arcgis.com/home/webscene/viewer.html?webscene=8723a41ed01749e4a0bb7680f44fb32f#`. The page title is "ALWT Projects - 3D".

**Contents Panel (Left):**

- Buttons: + ADD LAYERS, - (minus), Home, Refresh, Home.
- Layer list: Three entries for "ALWT\_Projects - ALL PROJECTS CONT...".
- Buttons: Create Layer Group...
- Slides: A right-pointing arrow button.
- SAVE SCENE (Green button)

**Main View:** A 3D aerial view of a desert landscape with a red-outlined project area. The terrain is rugged and rocky, with some green vegetation on the hills. A road or path is visible in the foreground.

**Right Panel:** A vertical toolbar with icons for layer management, sun (lighting), search, and globe (3D/2D toggle).

**Inset Image (Bottom Right):** A photograph of a yellow billboard with the text "THE THING?" in large blue letters, with "EXIT 322-MYSTERY OF THE DESERT" below it. The billboard is set against a blue sky and desert background.

# PROJECT EVALUATION SYSTEM (PES)

## DATA

Four updatable inputs to the PES

### Project Parcels

- 1 Feature Class
- All Parcels of All Projects

### Contextual Information

- 1 Excel File
- Updated weekly by all staff
- 15 attributes
- Landowner correspondence
- Staff, partner and Board meeting outcomes
- Project category, type priority, source information
- Completed Due diligence, next steps, etc.

### Conservation Values (CV) Variables

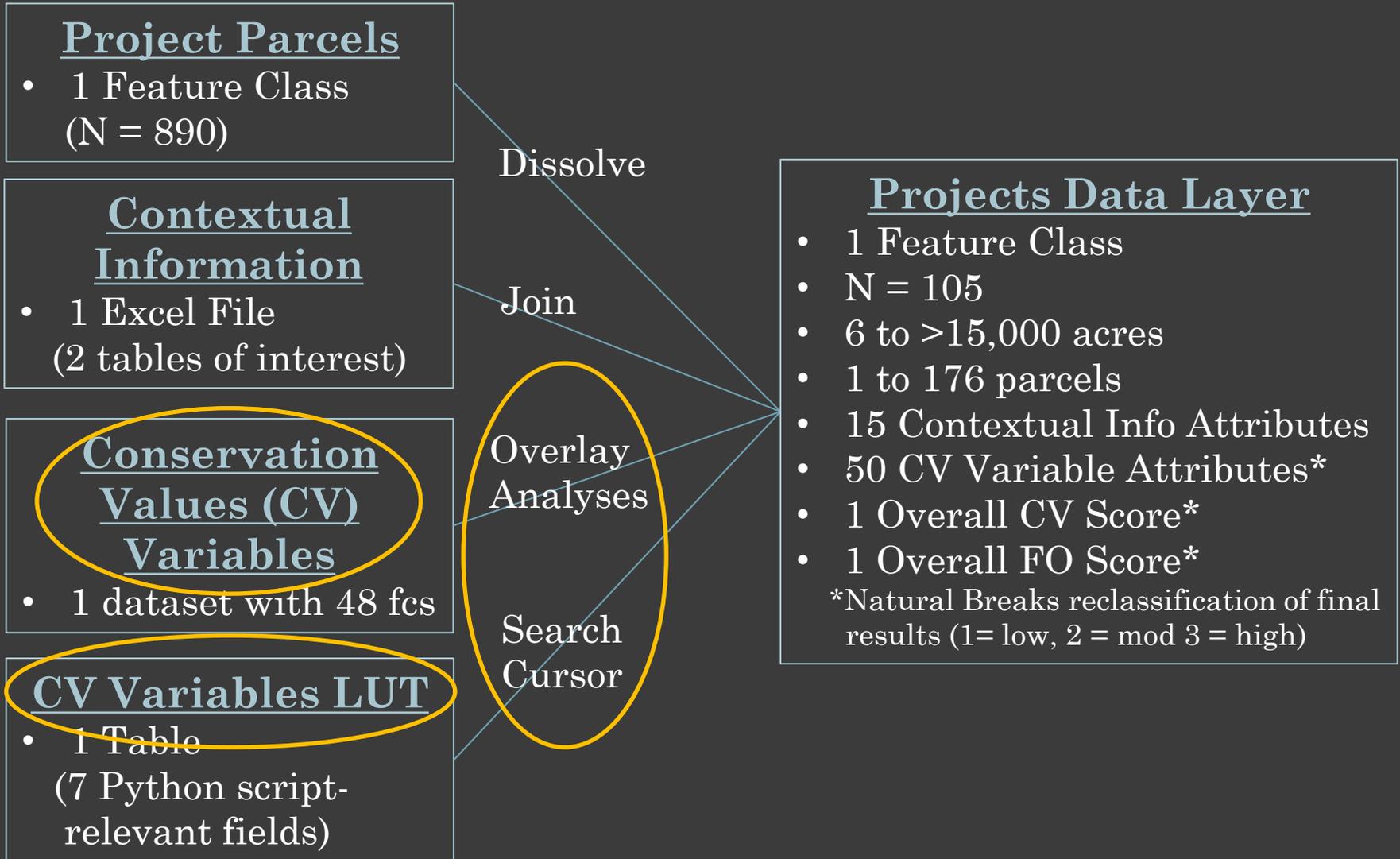
- 1 dataset with 48 feature classes
- Represent 50 conservation values and funding opportunities

### CV Variables Look-Up Table

- 1 Table
- 50 rows describing each CV Variable
- 7 Python script-relevant fields

# PROJECT EVALUATION SYSTEM (PES)

## Python Script



# PROJECT EVALUATION SYSTEM (PES)

## CV Variables

### General Conservation Values (CV)

1. Connectivity (6)
  - Wildlife linkages (modeled & stakeholder)
  - Landscape fragmentation
  - Adjacent to existing protected lands
2. Climate Change - Ecosystem Services (4)
  - Topographic features (e.g., roughness, landscape diversity)
  - Long-term climate change potential
  - Flood hazard areas
3. Cultural & Public Value (4)
  - High priority archaeological sites
  - Arizona Trail or designated scenic highway
4. Partner Priorities (7)
  - Other high priority areas, habitats, etc. designated by partner organizations and agencies (e.g., Audubon Important Bird Areas, Pima County Conservation Lands System)
5. Species (7)
  - Specific species of concern
6. Water (10)
  - Stream flow and riparian habitat
  - Wells and water rights

### Funding Opportunities (FO)

1. Land (10)
  - Priority military
  - Priority BLM
  - % Forest Cover (USFS)
  - Specific acquisition priorities for conservation (e.g., Pima County Open Space, AGFD)
2. Water (2)
  - Streams with native fish

#### 50 CV Variables

- Created from 48 feature classes
- Organized into 6 General CV and 2 FO categories
- CV Variables and Categories are easily removed and added
- CV Variables can move between categories
- All variables and categories are queryable based on the output attribute/field name

# PROJECT EVALUATION SYSTEM (PES)

## CV Variables Look-Up Table (LUT)

CV ID	CV Category Code	CV Variable Name	Variable Description	CV Data Layer Name	Input Field	Output Field	Incl_in_Overlay	Model Type	Incl_in_CV_Total	Incl_in_F_Total
1	C	Modeled Linkage Corridors - NAU/AGFD	Compiled Northern Arizona University & AGFD Missing Linkages Corridor Designs for AZ	C_AGFD_NAU_ModeledLinkages	MODEL	C_MODEL	Yes	Area	No	No
2	C	Within/Adjacent to Existing Protected Lands	Compilation of all federal, state, local and other protected lands from nine datasets - 0.5 mi buffer	C_ALWT_ProtectedLandsALL_2014	PL	C_PL	Yes	Area	Yes	No
3	F	Near ALWT Conservation Easements	5 mile buffer around all existing ALWT conservation easements - reduces monitoring costs	FL_ALWT_CEs_5miBuff	ALWT	FL_ALWT	Yes	Area	No	Yes
4	F	BLM Priority Areas	Compiled protected and special management areas of the BLM with 30m buffer	FL_BLM_AllProtected	BLM	FL_BLM	Yes	Area	No	Yes
5	F	High Forest Cover	2006 NLCD product - % cover of all forest classes combined - selected cells with values >= 50	FL_ForestCover	FOREST	FL_FOREST	Yes	Area	No	Yes
6	F	Perennial Flow Streams with native fish	The Nature Conservancy's AZ Freshwater Assessment - Native Fish Species Richness > 0	FW_TNC_NativeFish	TNC_Nfish	FW_TNC_Nfish	Yes	Line	No	Yes
7	SP	Jaguar Critical Habitat	Designated Critical Habitat for Panthera onca	SP_Jaguar_CH	JAG	SP_JAG	Yes	Area	Yes	No
8	SP	Desert Tortoise - BLM	BLM categorized tortoise habitat (1-3); 1 = essential habitat, 2 = may be essential to viable pop, 3 = not essential (Switch Values, 1=3, 2=3, 3 = 1)	SP_SDTortoise_BLM	TORT	SP_TORT	Yes	Area	Yes	No
9	W	Non-Exempt Wells in flood zones	All non-exempt Registry 55 wells (buffered 1/4 mi based on QQ PLSS reporting of location) that intersect with FEMA-Subflow zones	W_ADWR_NEWells_FEMASubflow	WELLS	W_WELLS	Yes	Count	Yes	No
10	W	Formerly Perennial Streams - TNC	The Nature Conservancy's AZ Freshwater Assessment - updated flow status = Formerly Perennial	W_TNC_Flow	TNC_F_PER	W_TNC_F_PER	Yes	Line	Yes	No
11	W	Perennial Streams - TNC	The Nature Conservancy's AZ Freshwater Assessment - updated flow status = Perennial	W_TNC_Flow	TNC_PER	W_TNC_PER	Yes	Line	Yes	No

# PROJECT EVALUATION SYSTEM (PES)

## LUT in PYTHON



Project



Conservation  
Value (CV)  
Variable

1. Include in Overlay?

YES

NO

2. What type of Overlay?

3 Models

Count

Area

Line

3. Include in Overall CV Score?

YES

NO

Add Field Name to a List of Field Names with values that will be summed to calculate an Overall Conservation Value Score (Low = 1, Mod = 2, High = 3)

4. Include in Overall FO Score?

YES

NO

Add Field Name to a List of Field Names with values that will be summed to calculate an Overall Funding Opportunity Score (Low = 1, Mod = 2, High = 3)

# PROJECT EVALUATION SYSTEM (PES)

## Overlay Models



Project



Conservation Value (CV) Variable

1. Include in Overlay?

YES

NO

2. What type of Overlay?



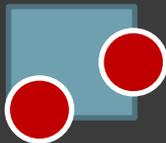
**3 Models**

**Count**

**Area**

**Line**

Non-exempt wells in flood zone



2

# of CV Variable features that intersect with the Project

3. Include in Overall CV Score

YES

NO

4. Include in Overall FO Score

YES

NO

# PROJECT EVALUATION SYSTEM (PES)

## Overlay Models



1. Include in Overlay?

YES

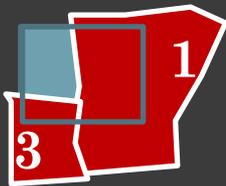
NO

2. What type of Overlay?

**3 Models**



Desert  
Tortoise  
Habitat  
(BLM)



$$1 * 60\% = .60$$

$$3 * 15\% = .45$$


---


$$1.05$$

**Proportion of total project acres that overlaps with the CV variable \* CV feature value**

3. Include in Overall CV Score

YES

NO

4. Include in Overall FO Score

YES

NO

# PROJECT EVALUATION SYSTEM (PES)

## Overlay Models



Project



Conservation Value (CV) Variable

1. Include in Overlay?

YES

NO

2. What type of Overlay?



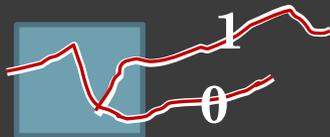
Count

Area

Line

**3 Models**

Native Fish Streams (TNC)



$$1 * .25 \text{ mi} = 0.25$$

$$0 * 1.0 \text{ mi} = \underline{0.00}$$

$$0.25$$

Length (miles) of CV Variable that Overlaps with the Project \* CV feature value

3. Include in Overall CV Score

YES

NO

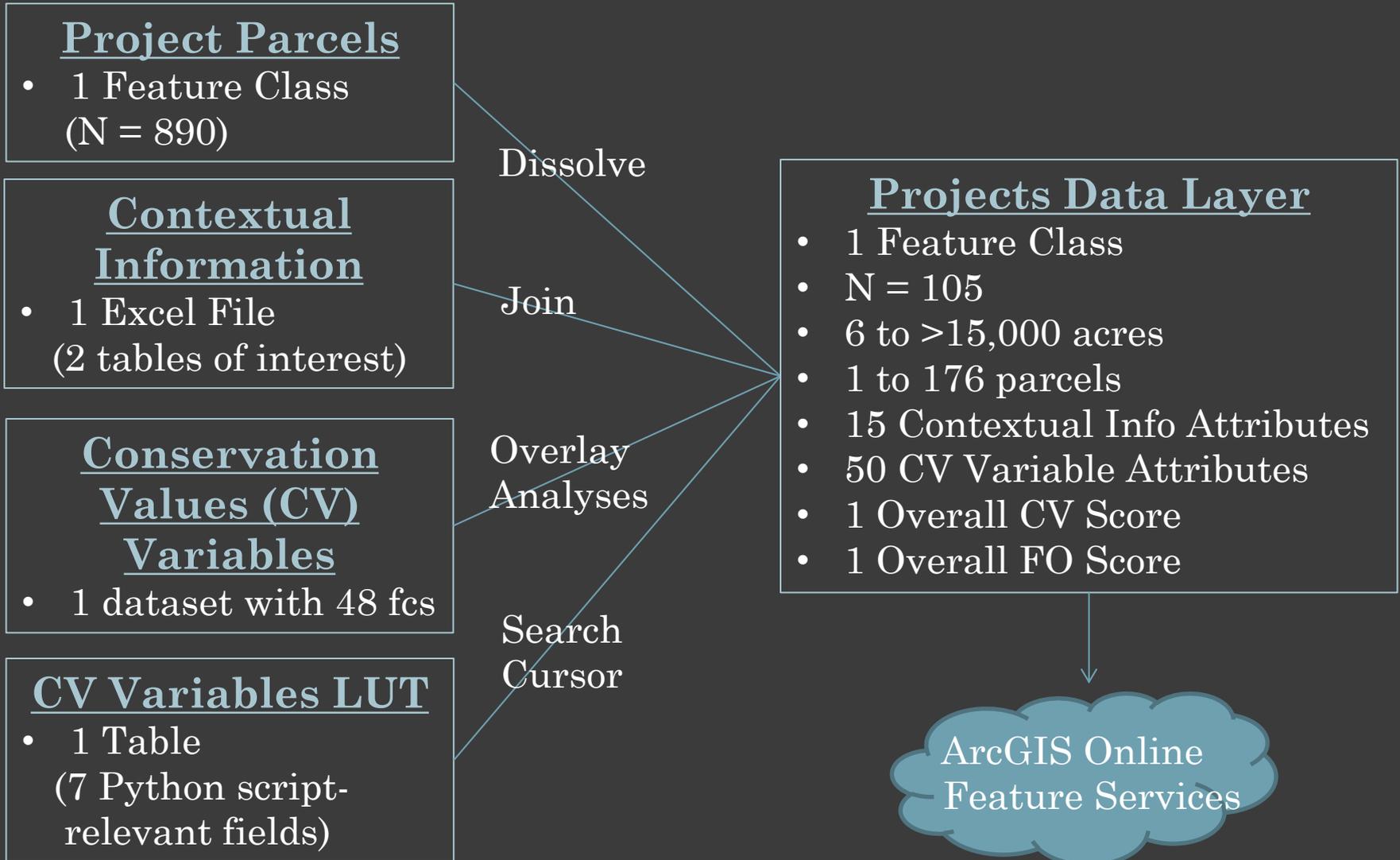
4. Include in Overall FO Score

YES

NO

# PROJECT EVALUATION SYSTEM (PES)

## Python Script



# PROJECT EVALUATION SYSTEM (PES)

## ArcGIS Online

- ArcGIS Online safely exposes the Trust to wide variety of project sharing options

The screenshot displays the ArcGIS Online web interface for the 'ALWT Active Projects & Inquiries' map. The browser address bar shows the URL: `alwt.maps.arcgis.com/home/webmap/viewer.html?webmap=66160db90e47749c70d362710a0a3a`. The map title is 'Rose Tree Ranch'. The interface includes a top navigation bar with 'HOME', 'NEW MAP', and 'CREATE PRESENTATION'. Below this is a toolbar with options like 'Details', 'Add', 'Edit', 'Basemap', 'Save', 'Share', 'Print', 'Directions', 'Measure', and 'Bookmarks'. A left sidebar contains a 'Contents' panel with a list of layers, including 'Colorado River Basin Rivers', 'Projects - Category' (with sub-categories like Active, Inquiry, Listed Ranch, ALWT Interest), 'Projects - Overall CV Score', 'Projects - Overall FO Score', 'BLM Protected Lands Boundaries', 'ALWT Protected Lands', 'Other Protected Lands', 'Public Land Ownership', 'Arizona Springs Public Information', and 'Imagery'. The main map area shows an aerial view of a landscape with a blue-outlined polygon representing a project area. A popup window titled 'Streams - TNC' is open over the map, displaying the following information:

Streams - TNC	
W-Non-Exempt	1
Wells in FHA/HA	

**Conservation Values Variables**  
CV Variables that intersect with the Project

PP-ALWT 2014 Priority Areas: 2

Zoom to Get Directions Edit

The popup also features a pie chart showing the distribution of variables. The Esri logo and 'POWERED BY esri' are visible in the bottom right corner. The footer contains links for 'Esri.com', 'ArcGIS Marketplace', 'Help', 'Terms of Use', 'Privacy', 'Contact Esri', and 'Report Abuse'. The bottom right footer also lists 'DigitalGlobe, GeoEye, Microsoft, CNES/Airbus DS | Pima County Information Techn...'

# PROJECT EVALUATION SYSTEM (PES)

## ArcGIS Online

- ArcGIS Online safely exposes the Trust to wide variety of project sharing options

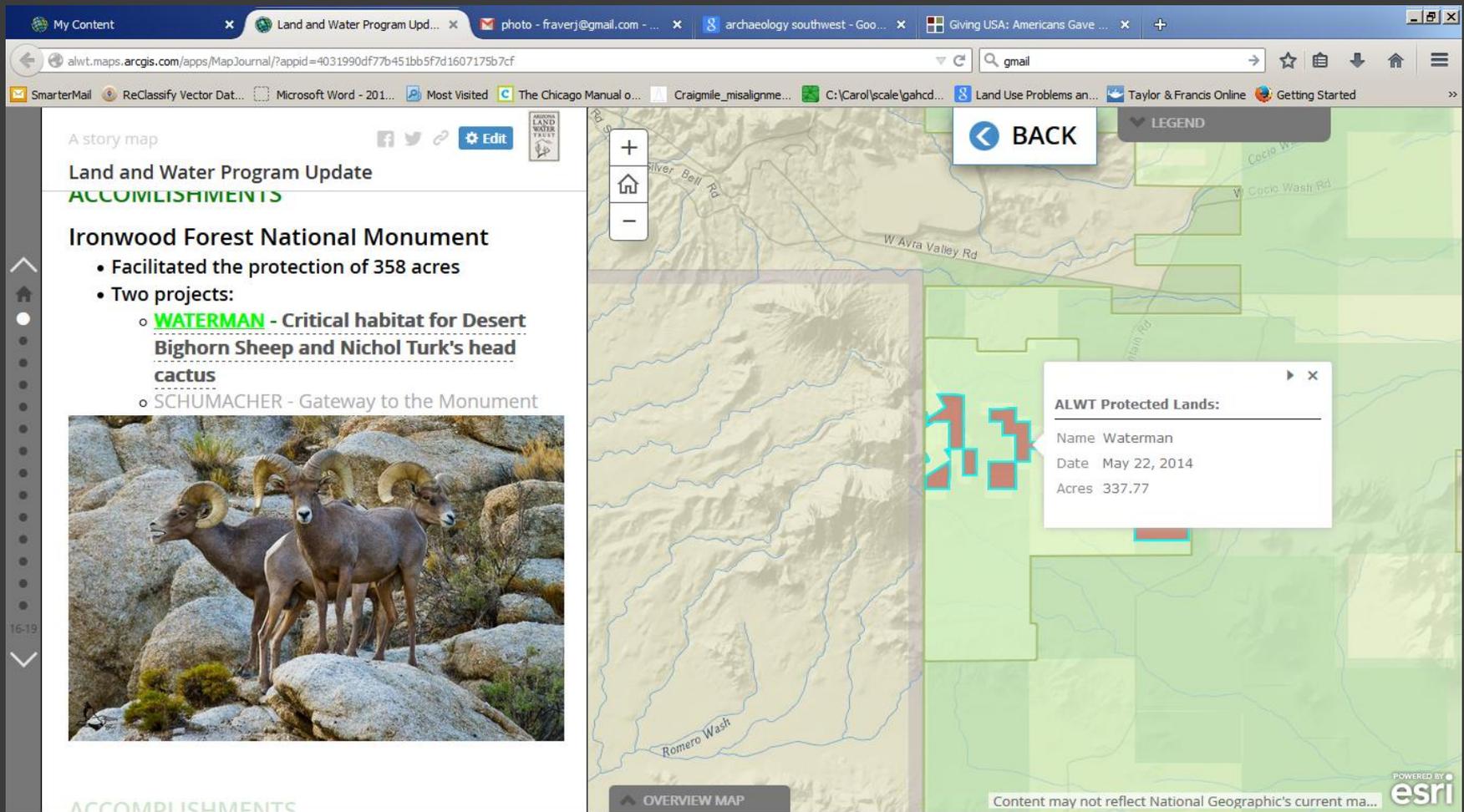
The screenshot displays the ArcGIS Online interface for 'ALWT Active Projects & Inquiries'. The map shows various project areas with different colors and outlines. A table below the map lists project details.

Name	Acres	Num of Parcels	Status	Category	Project Priority	Source	Source Date	Next Steps	Due Diligence	Last Cont
Austin - El Coronado Ranch - Turkey Creek	2,536	3	6 - Keep on Radar	ALWT Interest	Low	Michael Patrick (TPL)	June 23, 2014	MP scheduled a field trip on 12/16 and would like	None	

# PROJECT EVALUATION SYSTEM (PES)

## ArcGIS Online

- ArcGIS Online safely exposes the Trust to wide variety of project sharing options



The screenshot displays a web browser window with multiple tabs. The active tab is 'alwt.maps.arcgis.com/apps/MapJournal/?appid=4031990df77b451bb5f7d1607175b7cf'. The browser's address bar shows 'alwt.maps.arcgis.com/apps/MapJournal/?appid=4031990df77b451bb5f7d1607175b7cf'. The page content includes a story map titled 'Land and Water Program Update' with a sub-section 'ACCOMPLISHMENTS'. The main heading is 'Ironwood Forest National Monument'. Below this, there are two bullet points: 'Facilitated the protection of 358 acres' and 'Two projects:'. The first project is 'WATERMAN - Critical habitat for Desert Bighorn Sheep and Nichol Turk's head cactus'. The second project is 'SCHUMACHER - Gateway to the Monument'. A photograph of three bighorn sheep is shown below the text. A map on the right side of the page shows a topographic view of a landscape with roads and a river. A legend in the top right corner indicates 'ALWT Protected Lands:'. A pop-up window over the map displays the following information: 'Name Waterman', 'Date May 22, 2014', and 'Acres 337.77'. The bottom right corner of the page features the text 'Content may not reflect National Geographic's current ma...' and the 'esri' logo.

My Content

Land and Water Program Upd... photo - fraverj@gmail.com - ... archaeology southwest - Goo... Giving USA: Americans Gave ...

alwt.maps.arcgis.com/apps/MapJournal/?appid=4031990df77b451bb5f7d1607175b7cf

SmarterMail ReClassify Vector Dat... Microsoft Word - 201... Most Visited The Chicago Manual o... Craigmile\_misalignme... C:\Carol\scale\gahcd... Land Use Problems an... Taylor & Francis Online Getting Started

A story map

Land and Water Program Update

ACCOMPLISHMENTS

Ironwood Forest National Monument

- Facilitated the protection of 358 acres
- Two projects:
  - **WATERMAN** - Critical habitat for Desert Bighorn Sheep and Nichol Turk's head cactus
  - SCHUMACHER - Gateway to the Monument

16-19

OVERVIEW MAP

Content may not reflect National Geographic's current ma... esri

# IN CONCLUSION

The Project Evaluation System provides Trust staff with:

- An easily updatable framework for incorporating new data into project evaluation

## DATA

Four updatable inputs to the PES

### Project Parcels

- 1 Feature Class
- All Parcels of All Projects (N = 890)

### Contextual Information

- 1 Excel File

### Conservation Values (CV) Variables

- 1 dataset with 48 feature classes

### CV Variables Look-Up Table

- 1 Table
- 50 rows describing each CV Variable

# IN CONCLUSION

The Project Evaluation System provides Trust staff with:

- More preliminary project evaluation information to initiate more meetings and ultimately implement more projects
- Better tools to engage the Board, partners and other supporters
- The ability to take advantage of developing web mapping technologies and available online data

ALWT Active Projects & Inquiries

Contents

- Colorado River Basin Rivers
- Projects - Category
  - Active
  - Inquiry
  - Listed Ranch
  - ALWT Interest
- Projects - Overall CV Score
- Projects - Overall PD Score
- BLM Protected Lands Boundaries
- ALWT Protected Lands
- Other Protected Lands
- Public Land Ownership
- Arizona Springs Public Information
- Imagery

Last LO Contact	Project Type	Conservation Value	LO Acres	County	Project Area	Partner Interest	Overall CV Score	Overall PD Score	C-Stakeholder Defined Corridors - AGFD	C-Curren Terrestrial Intactness BLM
	Fee Title Acquisition	Ironwood Forest FM Inholding	9.00	Pima	Ironwood Forest National (7/11/14 mtg) Monument	BLM interested	1	2	0	3
	Fee Title Acquisition	Ironwood Forest FM Inholding	18.00	Pima	Ironwood Forest National (7/11/14 mtg) Monument	BLM interested	1	2	0	2
	Fee Title Acquisition	IPM inholding	600.00	Pima	Ironwood Forest National	Land and Water	1	2	0	3

Land and Water Program Update

OVERVIEW

1. ACCOMPLISHMENTS
  - Completed Projects
  - Outreach/Education
  - New Relationships
  - Funding Sources - Secured & Identified
2. 2015 PROJECTS
3. CHALLENGES

Colorado River Basin Rivers

ALWT Active Projects

- Conservation Assessments held by ALWT
- Other ALWT Protected Lands
- Grasslands
- Landmarks of ALWT
- Protected Lands

# FUTURE DIRECTIONS

- **Further implementation of the Project Evaluation System to explore more of its advantages and limitations**
- **Add report generation to the script for individual, selected and all projects**
- **Add the ability to create a new overlay output of selected CV Variables**
- **Explore other online app options for interactive display**
- **Survey land trust GIS use and explore interest from others in this type of system**



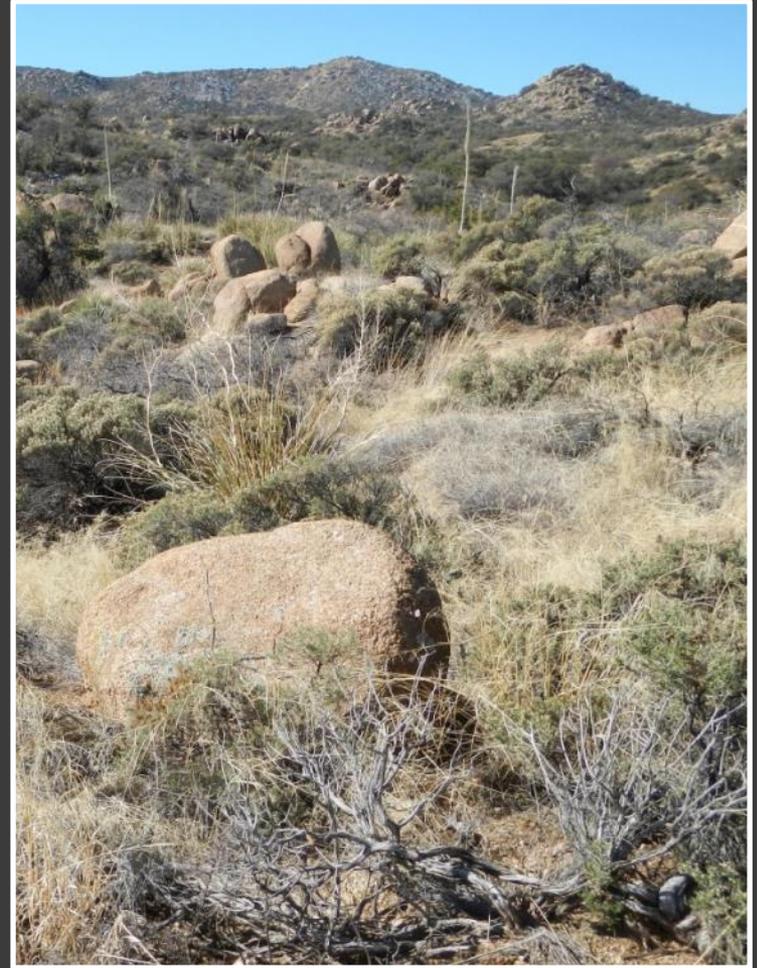
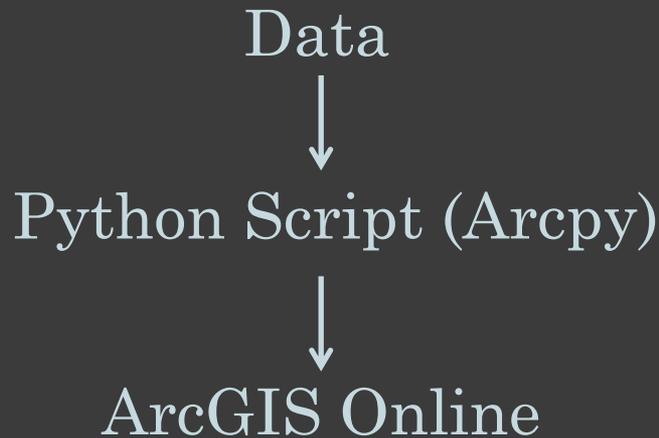
M Diamond Ranch (Pima County)



Ranch near Canelo Hills (Santa Cruz County)

# REVIEW

1. Not enough funding to meet conservation demand
2. Typical solution is limiting
3. New Solution:  
Project Evaluation System



Project near Oracle State Park (Pinal County)

# SPECIAL THANKS TO...

- **MSGIST Program Staff**
- **Fellow Students**
- **Arizona Land and Water Trust Staff and Board**



Ranch Seco (Pima County)

# THANK YOU



Diamond C Ranch (Santa Cruz and Cochise Counties)

## QUESTIONS?

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