

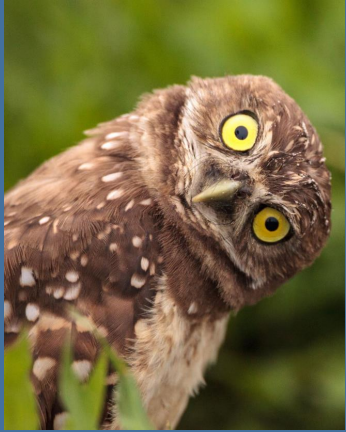


# **Enabling real time data collection, quality control, reporting, and visualization to enhance field data collection across the west**

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Jacqueline B. Cupples, Wildlife Biologist, USFWS**

**PNAMP  
Emerging Technologies Information Session  
January 22<sup>nd</sup>, 2025**



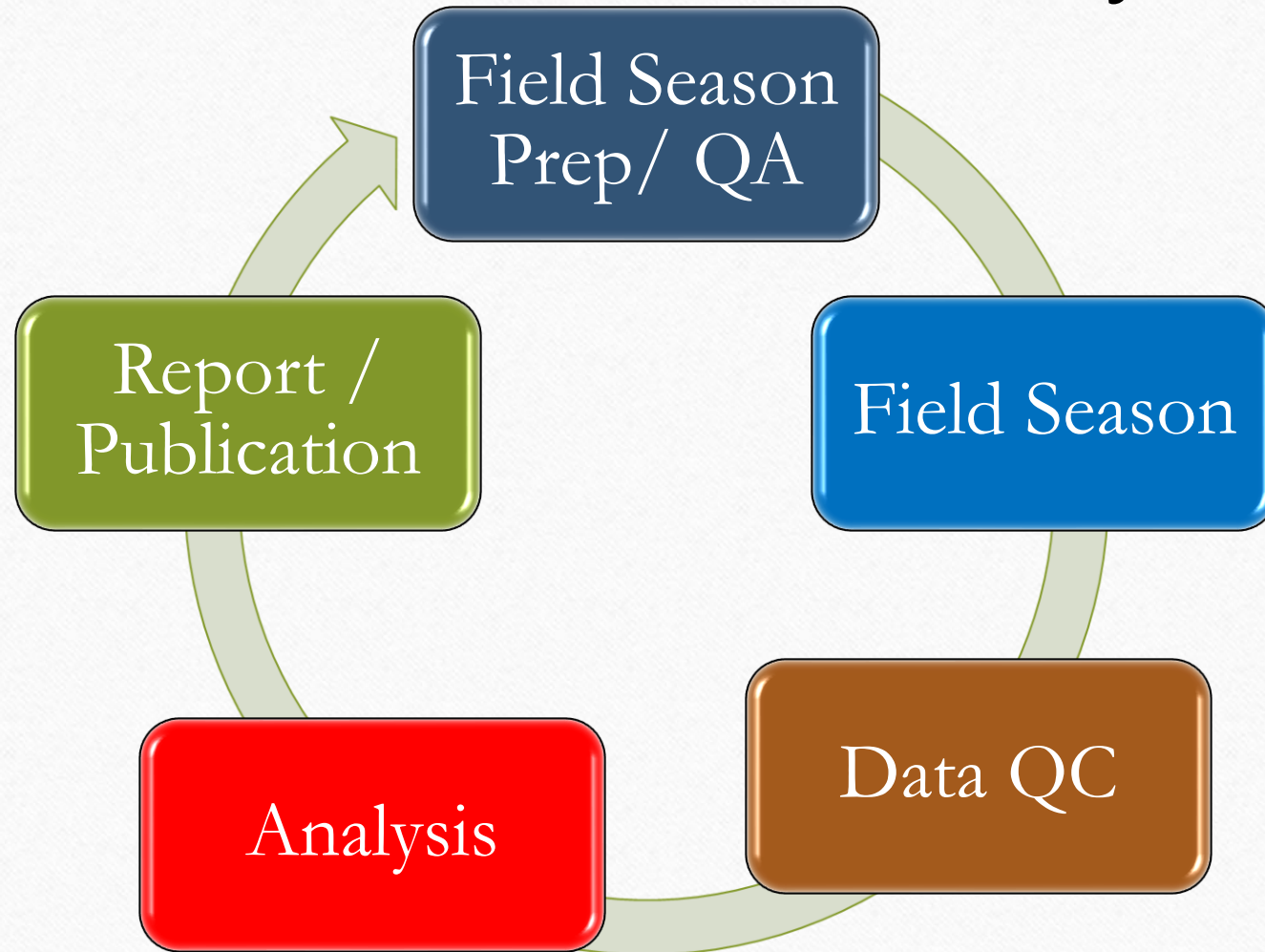
# How Do I Interact With My Data?

# Data Life Cycle

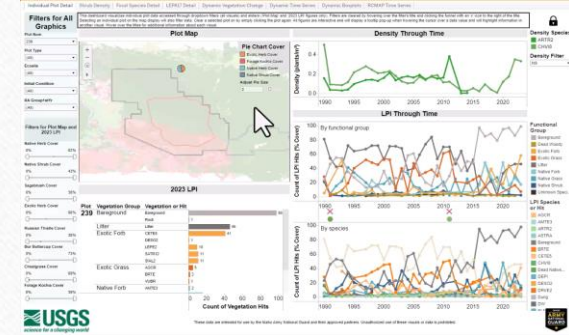
\*Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

\*These data are preliminary or provisional and are subject to revision. They are being provided to meet the need for timely best science. The data have not received final approval by the U.S. Geological Survey (USGS) and are provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the data.

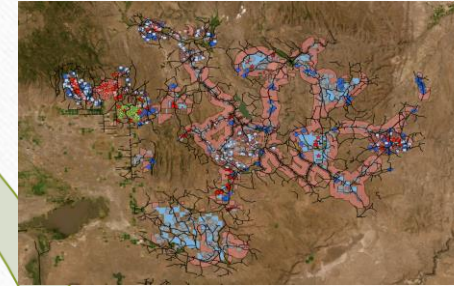
# Traditional Data Life Cycle



# Proposed Data Lifecycle



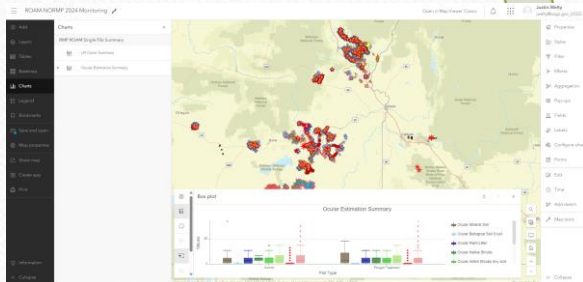
Field Season  
Prep



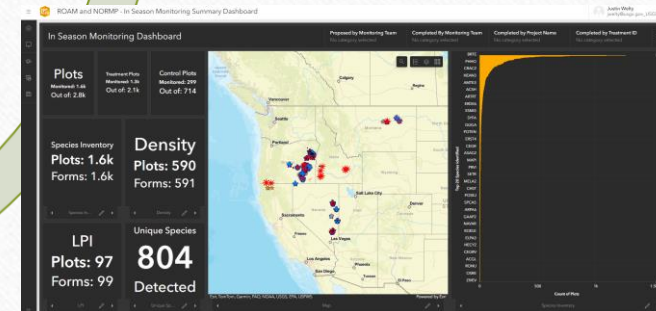
Field Season

Data  
QA/QC and  
Visualization

Report / Pub

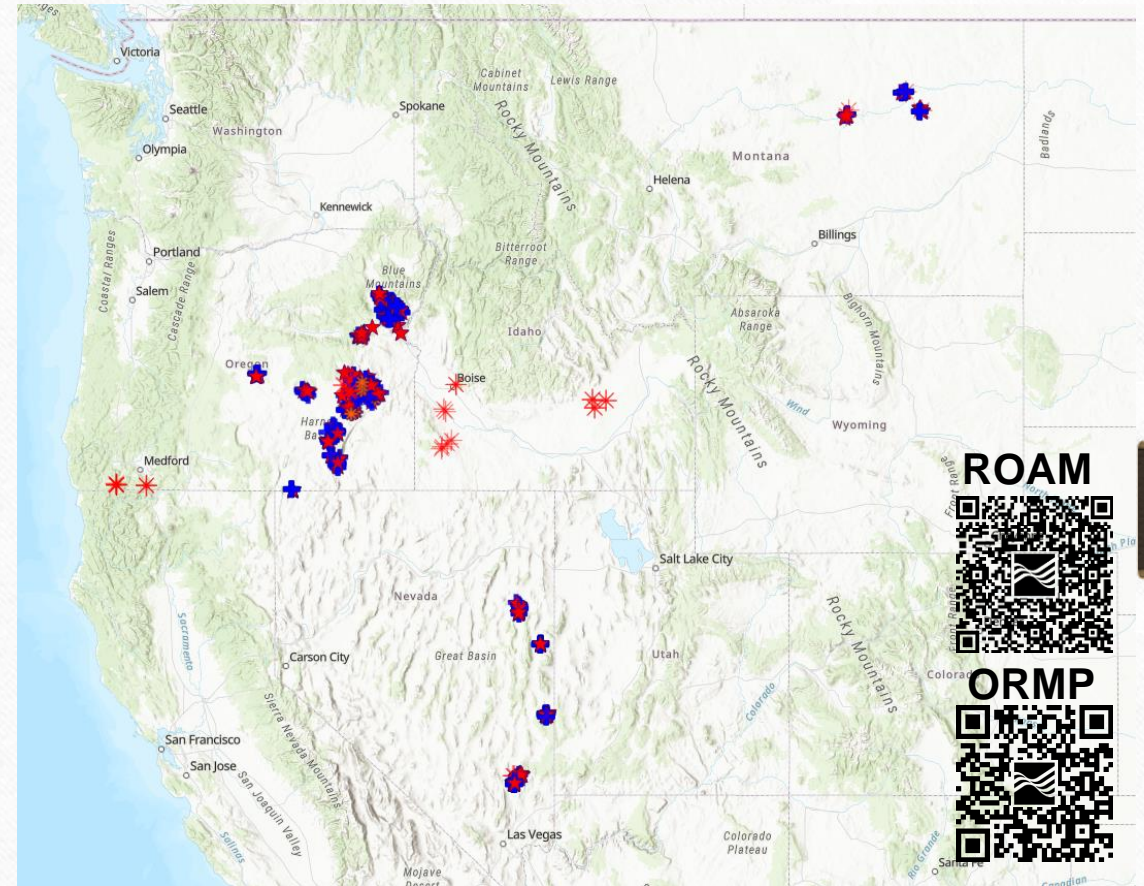


Analysis

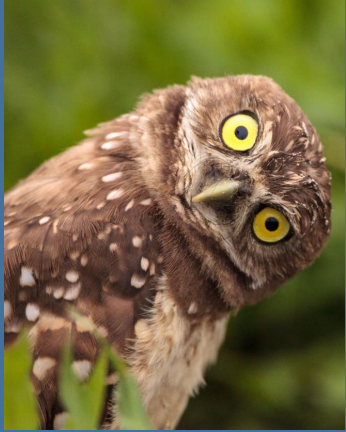


# Rangeland Monitoring Program & Rapid and Other methods for Assessment and Monitoring

- 15 different protocols (ROAM)
  - Cover
  - Density
  - Observations
- RMPs group utilize their own set of these protocols
- National, state, and local group participation
  - USGS, USFWS, BLM, NDOW, OR INR, OR DSL, OR HDP, and OR LIT
- 1600 plots monitored in 2024
- Each group has its own set of defaults within a protocol
- All data submitted to a single, centralized location



[Project ROAM](#) & the  
[Oregon Rangeland Monitoring Program](#)



How can I protect data integrity while collecting the data?

# Data Quality Assurance

## Field Season Apps

# Field Maps & Survey123

## Field Maps

- Used for navigation and basic data entry
- Take advantage of map symbology and layer visibility



# Field Maps & Survey123

## Field Maps

- Used for navigation and basic data entry
- Take advantage of map symbology and layer visibility
- Require users to complete fields in Field Maps by using settings and Arcade expressions



The screenshot shows a mobile application interface for editing a feature. The title bar at the top says "Edit feature" with a back arrow on the left. Below the title bar is a "Settings" section with a gear icon and a dropdown arrow. The main content area contains several fields:

- Sampling Locations 2024: Harney\_Pvt\_Trtr\_54**
- Plot Information** (with an expand/collapse arrow)
- Monitoring Status**: A dropdown menu with "No value" selected.
- Initial Monitored Date**: A date picker showing "MM/DD/YYYY" and a clock icon.
- Monitoring Team**: A dropdown menu with "HDP" selected.
- Monitoring Protocol**: A dropdown menu with "Oregon Rangeland Rapid Monitoring" selected.
- Plot ID**: A text input field containing "Harney\_Pvt\_Trtr\_54".
- Treatment ID**: A text input field containing "Private Harney Polygon Treatments".

# Field Maps & Survey123

## Field Maps

- Used for navigation and basic data entry
- Take advantage of map symbology and layer visibility
- Require users to complete fields in Field Maps by using settings and Arcade expressions
- Use links to open individual Survey123 forms and pre-populate fields
  - Links are created on the fly via Arcade so updates to the Field Map fields create updated links



The screenshot shows a mobile application interface for 'Field Maps'. A popup window titled 'Sampling Locations 2024: Private Harney Polygon Treatments' is overlaid on a satellite map. The popup contains a table of plot-specific data and links to Survey123 forms.

**Plot Specifics**  
Instructions: Edit Monitoring Team and Protocol only if needed. Edit Monitoring status to indicate current monitoring status. Links to open the survey will only appear after monitoring status has been updated.

|                        |                                   |
|------------------------|-----------------------------------|
| Monitoring Team        | HDP                               |
| Monitoring Protocol    | Oregon Rangeland Rapid Monitoring |
| Plot ID                | Harney_Pvt_Trt_54                 |
| Monitoring Status      | Monitored                         |
| Initial Monitored Date | 1/14/2025, 7:32 AM                |

**Survey123 Links**

Android/iOS Link: [Open OR Rapid Survey](#)  
iOS/Windows Link: [Open OR Rapid Survey](#)

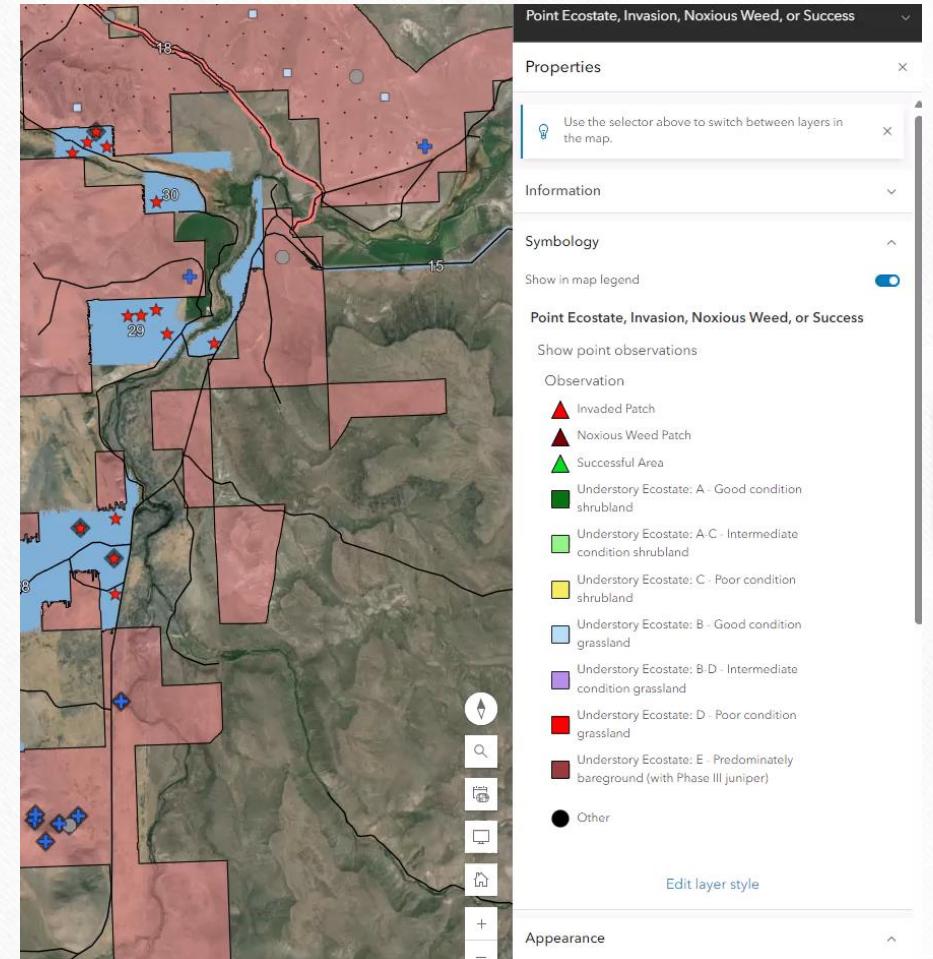
**Plot Details**

|                           |                                   |
|---------------------------|-----------------------------------|
| Treatment ID              | Private Harney Polygon Treatments |
| Project Name              | Private Harney Treatments OR      |
| Sampling Type             | Focal Area                        |
| Stratification_Zone_Combo |                                   |
| Preferred Point           | 1                                 |
| Land Ownership            | Private                           |

# Field Maps & Survey123

## Field Maps

- Used for navigation and basic data entry
- Take advantage of map symbology and layer visibility
- Require users to complete fields in Field Maps by using settings and Arcade expressions
- Use links to open individual Survey123 forms and pre-populate fields
  - Links are created on the fly via Arcade so updates to the Field Map fields create updated links
- Create quick capture point, line, and polygon features for rapid, opportunistic data collection



# Field Maps & Survey123

## Survey123

- Multiple different “surveys” collected across multiple forms all being submitted to the same source
- Each group gets its own customized form, but all are part of something larger



ROAM Density, PQ, Ocular, Er... :



ROAM SI and Pls :



ORMP 2024 :



NRMP 2024 :



USGS RMP Montana :



# Field Maps & Survey123

## Survey123

- Multiple different “surveys” collected across multiple forms all being submitted to the same source
- Each group gets its own customized form, but all are part of something larger
- Auto-populate as many fields as possible
- Ability to accept data from existing, preset, random points or new, non-random points



ArcGIS Survey123

ORMP - 2024

Starting date and time \*

Tuesday, January 14, 2025 7:40 AM

Plot Location Type \*

*These should be filled in automatically from Field Maps, change the value if you need to edit the plot ID or are collecting a plot not loaded via Field Maps or you need to edit the plot ID*

Preset Point (random location)

Plot ID \*

Harney\_Pvt\_Trtrt\_54

Treatment ID \*

Private Harney Polygon Treatments

Project Name \*

Private Harney Treatments

Monitoring Group \*

*Autofilled from Field Maps. Which monitoring group are you working with?*

Oregon Rangeland Monitoring - Rapid

Monitoring Team \*

*Autofilled from Field Maps. Which monitoring team is conducting the survey?*

HDP

What monitoring methods are you conducting on this plot? \*

*For existing groups, these have been pre-selected based on the group you are with and the plot you are monitoring.*

Plot Information,Species Inventory,Gridpoint (Overhead Photo) - Monitoring,Landscape Photos,Ocular Estimation (Point or Roadside) - Assessment,Ecostate and Trend - Plot

1 of 5

# Field Maps & Survey123

## Survey123

- Multiple different “surveys” collected across multiple forms all being submitted to the same source
- Each group gets its own customized form, but all are part of something larger
- Auto-populate as many fields as possible
- Ability to accept data from existing, preset, random points or new, non-random points
- Walk field users through data collection
- Defaults are specific to each group’s needs



ORMP - 2024

Plot Info, Photos, and Species Inventory for Plot ID: Harney\_Pvt\_Tr\_54

- ▶ Plot Information
- ▶ Gridpoint (Overhead Photo) Monitoring Data
- ▶ Landscape Site Photos
- ▶ Species Inventory
- ▶ Expand to View Instructions to Save Battery Life

2 of 5

The screenshot shows a mobile application interface for data collection. At the top, there is a green header bar with a close button (X), the text "ORMP - 2024", and a menu icon (three horizontal lines). Below the header, the title "Plot Info, Photos, and Species Inventory for Plot ID: Harney\_Pvt\_Tr\_54" is displayed. A list of five menu items follows, each with a right-pointing chevron and a colored background: "Plot Information" (green), "Gridpoint (Overhead Photo) Monitoring Data" (blue), "Landscape Site Photos" (light green), "Species Inventory" (orange), and "Expand to View Instructions to Save Battery Life" (pink). A mouse cursor is hovering over the "Species Inventory" item. At the bottom of the screen, there is a navigation bar with a left arrow, the text "2 of 5", and a right arrow.

# Field Maps & Survey123

## Survey123

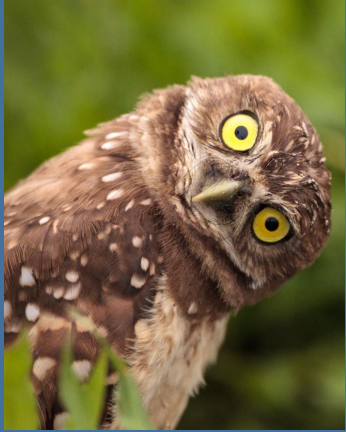
- Multiple different “surveys” collected across multiple forms all being submitted to the same source
- Each group gets its own customized form, but all are part of something larger
- Auto-populate as many fields as possible
- Ability to accept data from existing, preset, random points or new, non-random points
- Walk field users through data collection
- Defaults are specific to each group’s needs
- Each protocol has a summary section for instant user review



▼ *Expand to See Ocular Summary*

**Ocular Calculation**

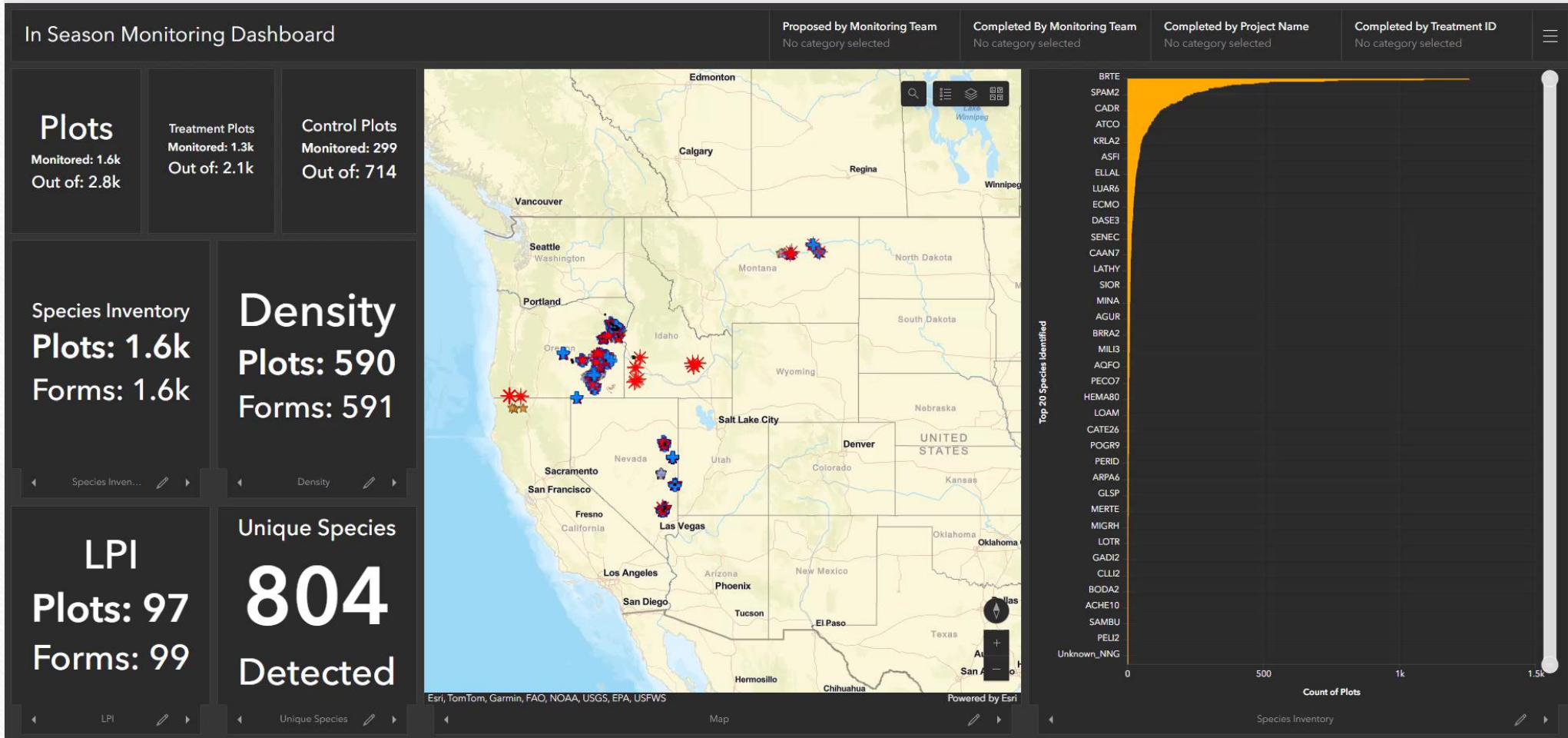
|   |         |
|---|---------|
| Mineral Soil  | - 7.5%  |
| Gravel  | - 0%    |
| Rock (Larger than Gravel)                                   | - 2.5%  |
| Biological Soil Crust                                       | - 7.5%  |
| Plant Litter  | - 17.5% |
| All Treatment Seeded Species                                | - 0%    |
| Invasive Annual Grasses                                     | - 7.5%  |
| B RTE - Bromus tectorum L. (cheatgrass)                     | - 2.5%  |
| TACA8 - Taeniatherum caput-medusae (L.) Nevski (medusahead) | - 0%    |
| VEDU - Ventenata dubia (Leers) Coss. (North Africa grass)   | - 2.5%  |
| Non-Native Perennial Grasses                                | - 12.5% |
| POBU - Poa bulbosa L. (bulbous bluegrass)                   | - 7.5%  |
| Native Perennial Grasses                                    | - 27.5% |
| POSE - Poa secunda J. Presl (Sandberg bluegrass)            | - 2.5%  |
| Native Perennial - Deep Rooted - Large Stature Grasses      | - 12.5% |
| Invasive Annual Forbs                                       | - 2.5%  |
| Invasive Perennial Forbs                                    | - 0%    |
| CADR - Cardaria draba (L.) Desv. (whitetop)                 | - 0%    |
| CESO3 - Centaurea solstitialis L. (yellow star-thistle)     | - 0%    |
| CHJU - Chondrilla juncea L. (rush skeletonweed)             | - 0%    |
| ONAC - Onopordum acanthium L. (Scotch cottonthistle)        | - 0%    |
| Native Annual Forbs   | - 12.5% |
| Native Perennial Forbs                                      | - 2.5%  |
| Native Shrubs   | - 12.5% |
| Artem Shrubs - Any size                                     | - 7.5%  |
| BAPR5 - Bassia prostrata (L.) A.J. Scott (forage kochia)    | - 0%    |
| Pinyon or Juniper Trees                                     | - 2.5%  |



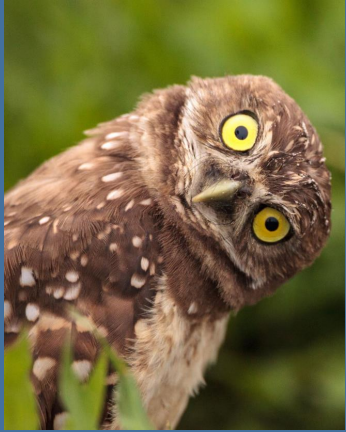
How can I ensure errors are caught quickly and easily identified?

# Data Quality Control

## In-Season Dashboard



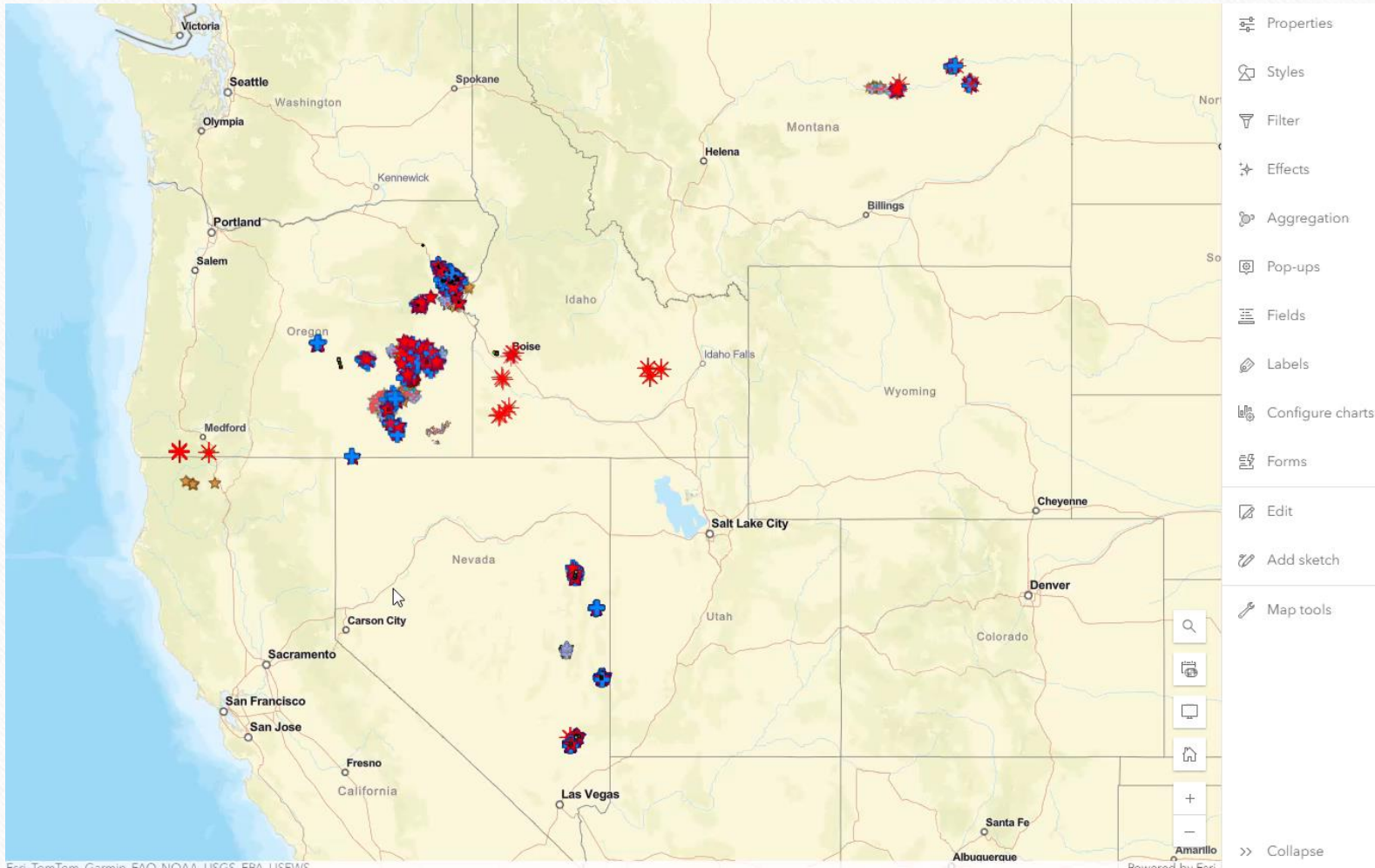
# In-Season Dashboard



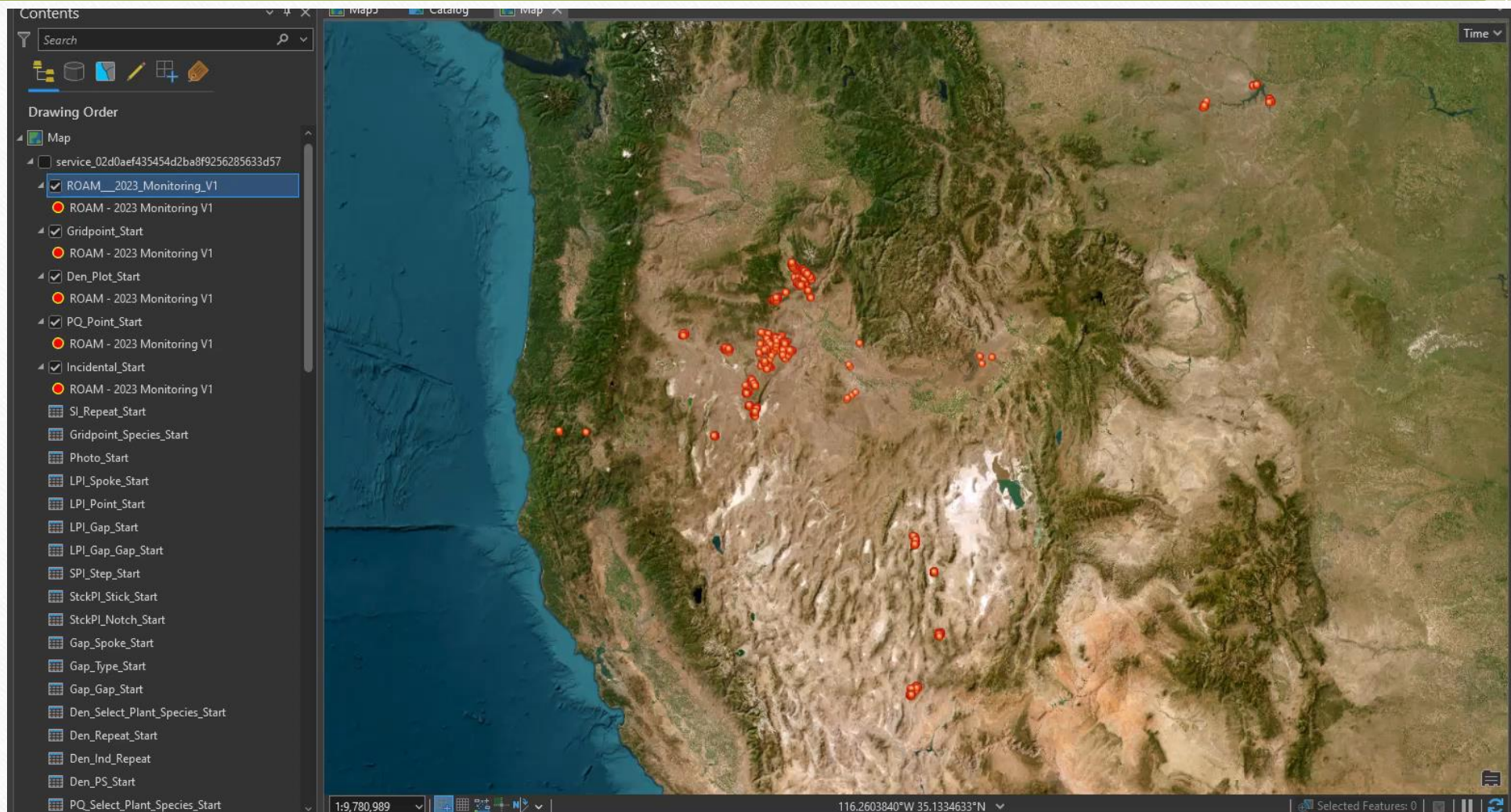
How do allow users easily edit data and how do we track these edits?

# Data Quality Control

## Editing Data



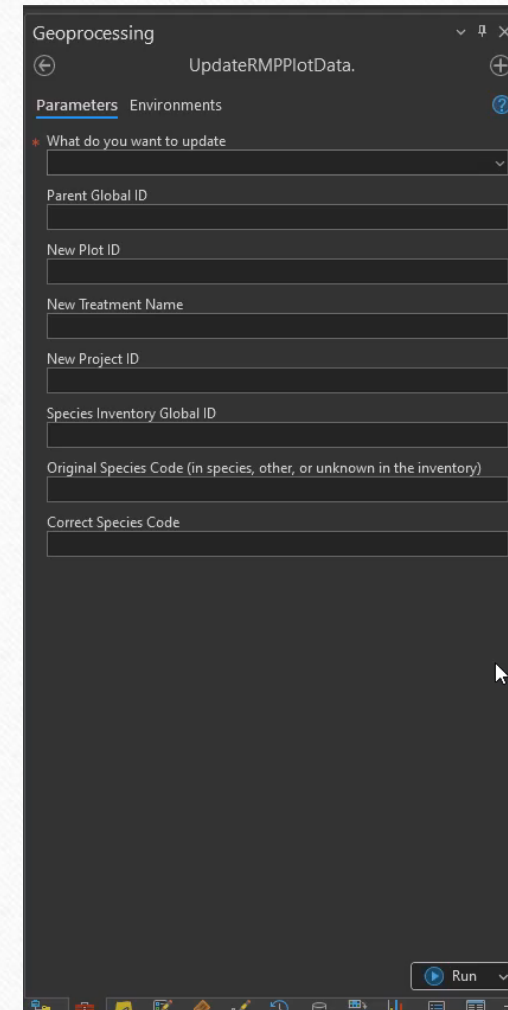
# Editable AGOL Web Map

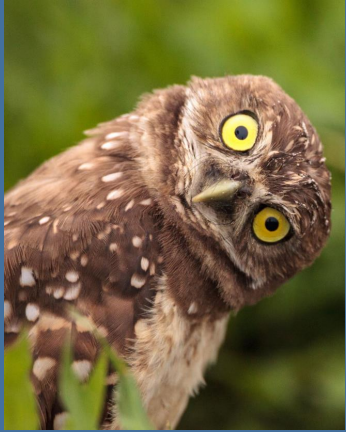


# Batch Edits in ArcGIS Pro

## Custom Scripts:

- Cons
  - Upfront time to design and test
- Pros
  - Fully customizable QC tools
  - Tailored exactly to your needs
  - Update multiple tables/records at once
  - Long-term time/cost savings





How can we quickly  
get preliminary data  
to collaborators?

# In-Season Rapid Reporting

## Quick Summary & Map

## Single File Summary

- One row per plot
- Plot information
- Species Inventory
- Ocular Estimates
- Ecostate
- Erosion
- Functional Group LPI
- Functional Group Density

RMP ROAM Single File Summary x

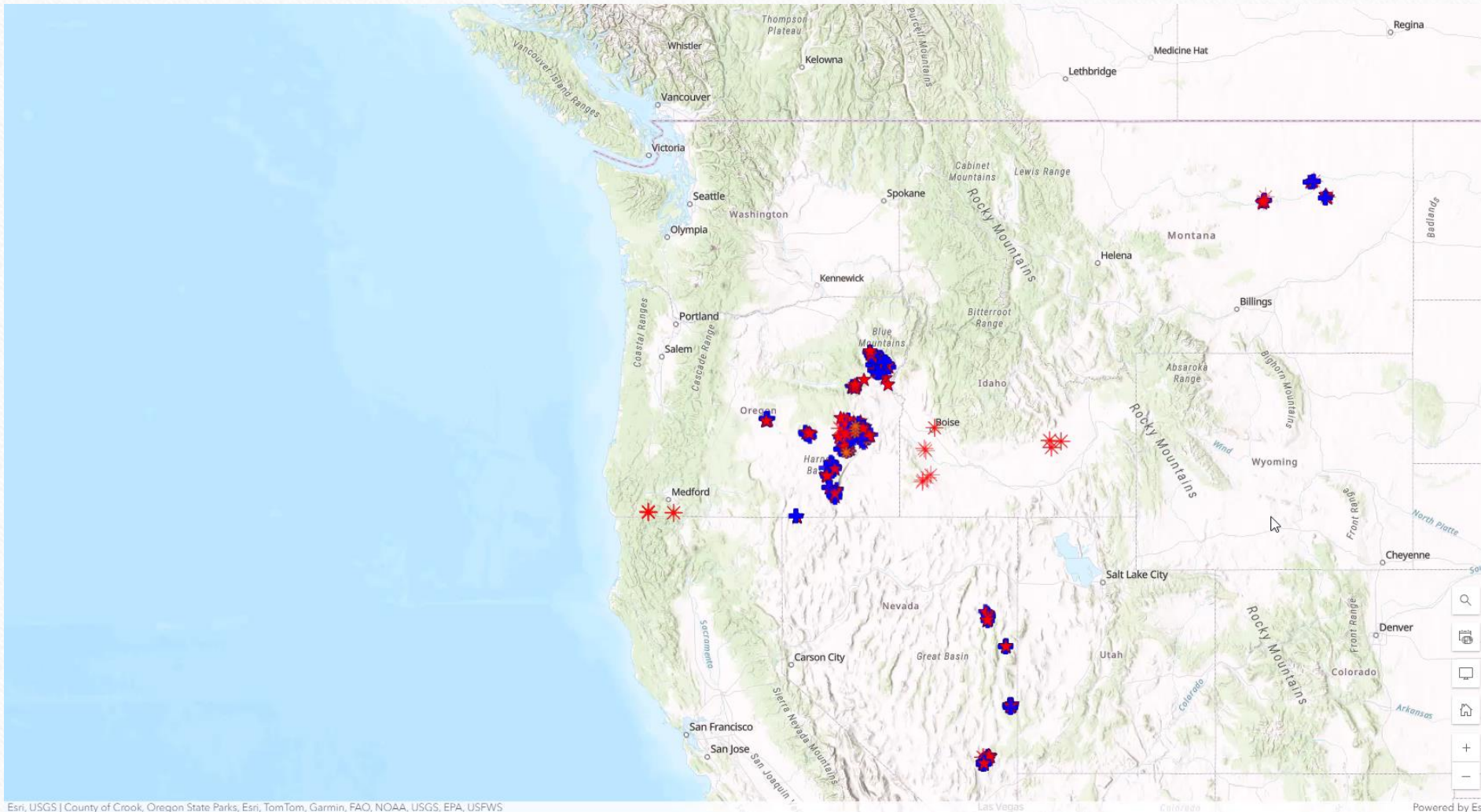
1,617 records, 0 selected

|   | Density Native Forb (per sq meter) ▾ ... | Density Native Grass (per sq meter) ▾ ... | Density Native Shrub (per sq meter) ▾ ... | Density Non-Native Forb (per sq meter) ▾ ... | Density Non-Native |
|---|--|---|---|--|--------------------|
| ■ |  |   |   |  |                    |
| ■ |  |   |   |  |                    |
| ■ |  |   |   |  |                    |
| ■ |  |   |   |  |                    |
| ■ | 0.39                                     | 0.01                                      | 0.14                                      | 4.41   | 1.15               |
| ■ | 13.30                                    | 1.64                                      | 1.38                                      | 0.03   | 0.00               |
| ■ |  |   |   |  |                    |
| ■ |  |   |   |  |                    |
| ■ |  |   |   |  |                    |

+ Create feature



# Single File Summary



- Properties
- Styles
- Filter
- Effects
- Aggregation
- Pop-ups
- Fields
- Labels
- Configure charts
- Forms
- Edit
- Add sketch
- Map tools
- >> Collapse

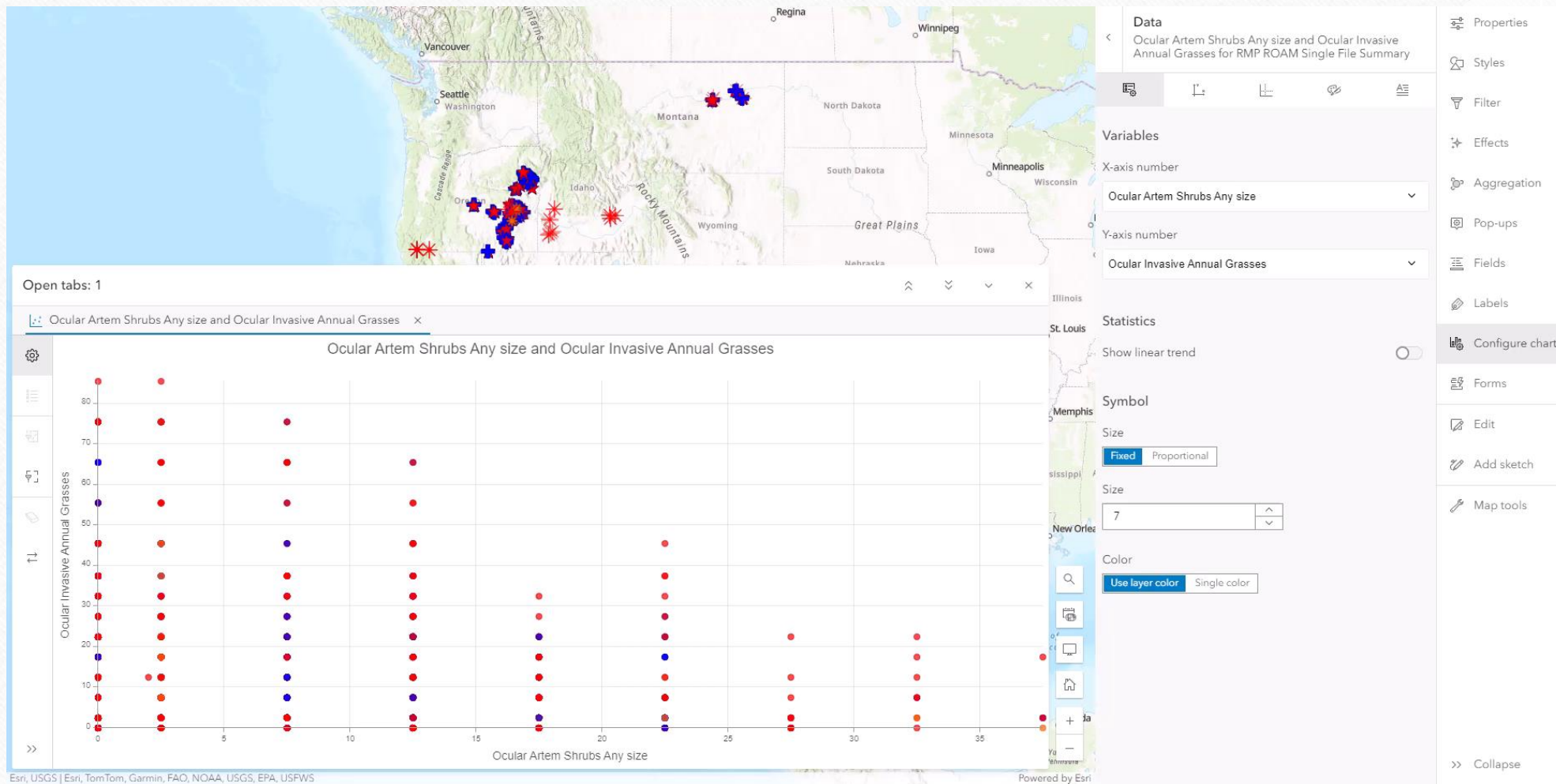
Esri, USGS | County of Crook, Oregon State Parks, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS

Powered by Esri



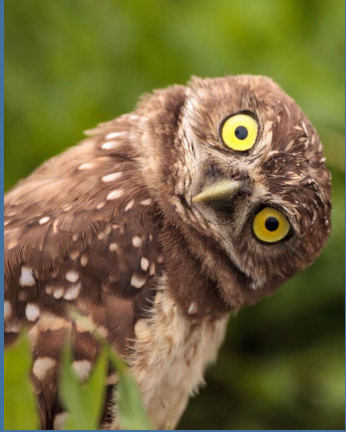
# Custom Figures

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# Custom Figures

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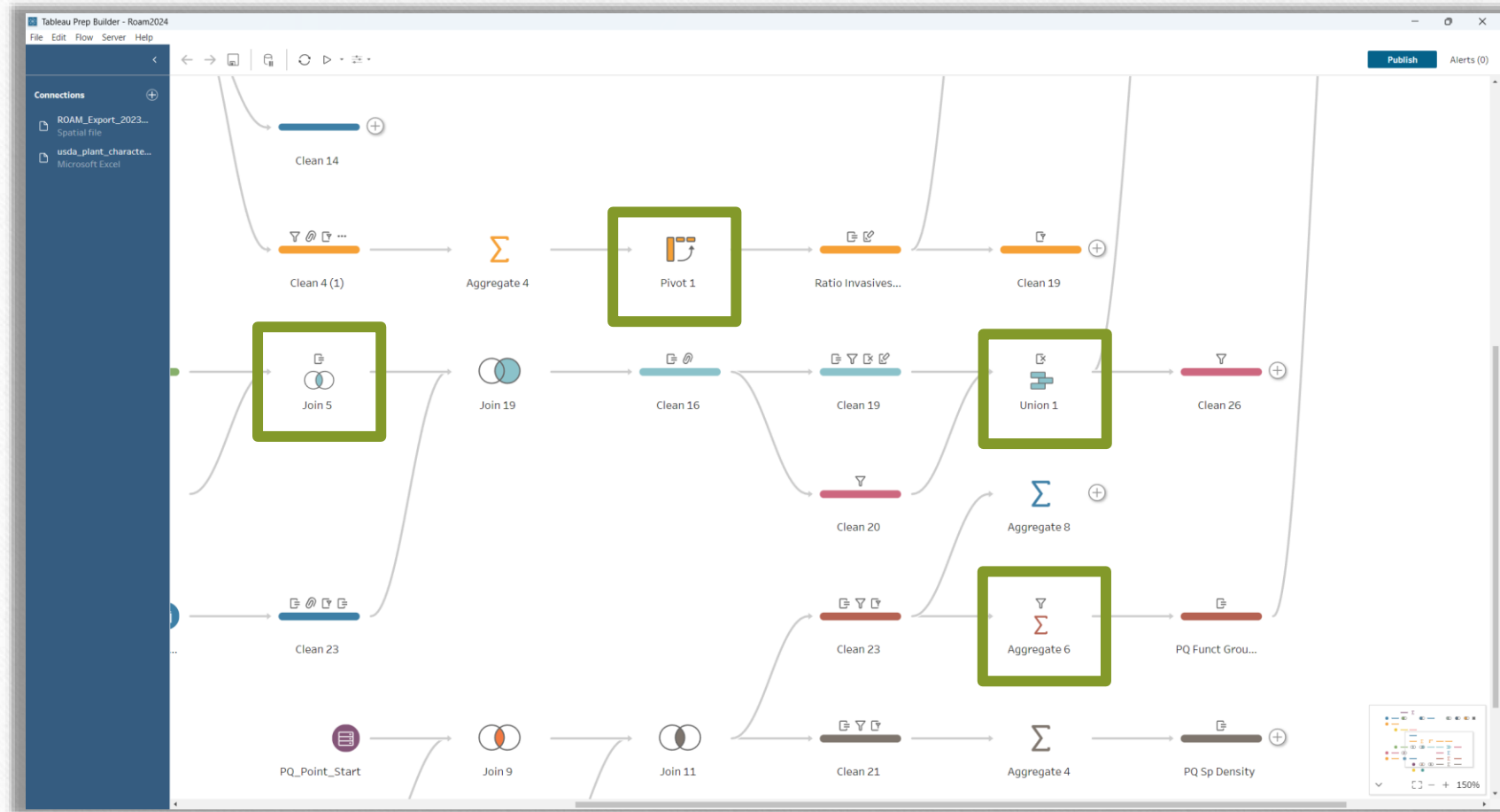
How can we conduct  
a thorough QC of all  
data?

# Annual Quality Control

## Tableau Prep



# Easy data wrangling and visualization



# Tableau Prep

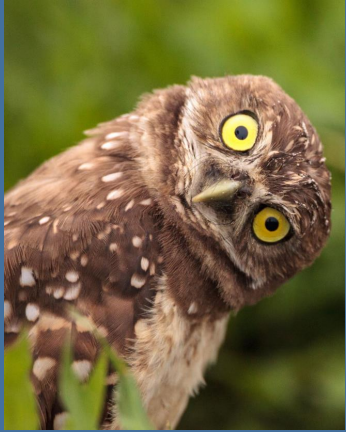
# Easy data wrangling and visualization

The screenshot displays the Tableau Prep interface. At the top, a workflow diagram shows the sequence: Clean 4 (1) → Aggregate 4 → Pivot 1 → Ratio Invasives... → Clean 19. Below this, the main workspace shows a data table with columns: Ocular\_Repeat\_Treatment\_ID, IF:PG Text Annotation, IF:NPDRG Text Annotation, IF:NPDRG Ratio Calculation, IF:NPDRG Ratio Text, IF:PG Ratio Calculation, IF:PG Ratio Text, and IF:POSE Text Annotation. A tooltip is visible over the 'IF greater than PG' cell in the 'IF:NPDRG Text Annotation' column, indicating that 213 (22%) rows are highlighted.

| Ocular_Repeat_Treatment_ID                     | IF:PG Text Annotation | IF:NPDRG Text Annotation | IF:NPDRG Ratio Calculation | IF:NPDRG Ratio Text | IF:PG Ratio Calculation | IF:PG Ratio Text | IF:POSE Text Annotation |
|--|-----------------------|--------------------------|----------------------------|---------------------|-------------------------|------------------|-------------------------|
| BLM Keating Broadleaf                          | IF greater than PG    | IF greater than NPDRG    | 11                         | 27.5:2.5            | 5.5                     | 27.5:5           | IF greater than POSE    |
| BLM Keating Broadleaf                          | IF greater than PG    | IF greater than NPDRG    | 2.66666666666667           | 20:7.5              | 2.66666666666667        | 20:7.5           | IF greater than POSE    |
| SE Oregon Wildfire Resilience Roadside- BLM    | IF greater than PG    | IF greater than NPDRG    | 2.33333333333333           | 17.5:7.5            | 1.4                     | 17.5:12.5        | IF greater than POSE    |
| Hatchery Fire Monitoring Combined Control      | IF greater than PG    | IF greater than NPDRG    | null                       | 2.5:0               | null                    | 2.5:0            | IF greater than POSE    |
| Hobson - Seeded                                | IF greater than PG    | IF greater than NPDRG    | 9                          | 22.5:2.5            | 9                       | 22.5:2.5         | IF greater than POSE    |
| Long Draw PostFire Monitoring Combined Control | IF greater than PG    | IF greater than NPDRG    | 7                          | 17.5:2.5            | 7                       | 17.5:2.5         | IF greater than POSE    |
| Miller Homestead 2012                          | IF greater than PG    | IF greater than NPDRG    | 1.8                        | 22.5:12.5           | 1.28571428571429        | 22.5:17.5        | IF greater than POSE    |
| Five Mile Herbicide - 2023                     | IF greater than PG    | IF greater than NPDRG    | 2                          | 5:2.5               | 2                       | 5:2.5            | IF greater than POSE    |
| Flat Baldy - Mix A and Spray                   | IF greater than PG    | IF greater than NPDRG    | 5                          | 12.5:2.5            | 5                       | 12.5:2.5         | IF greater than POSE    |
| Hatchery Fire Monitoring Combined Control      | IF greater than PG    | IF greater than NPDRG    | null                       | 22.5:0              | null                    | 22.5:0           | IF greater than POSE    |
| Hatchery - Seeding                             | IF greater than PG    | IF greater than NPDRG    | 9                          | 22.5:2.5            | 9                       | 22.5:2.5         | IF greater than POSE    |
| Sampson Creek - Burned Untreated               | IF greater than PG    | IF greater than NPDRG    | 3                          | 7.5:2.5             | 3                       | 7.5:2.5          | IF greater than POSE    |



# Tableau Prep



How should the  
public interact with  
the data?

# Final Reporting Tableau Dashboard & Data Release

**Treatment ID**  
(Multiple values)

**Highlight Treatment ID**  
Highlight Treatment...

Ocular Search Sp or FG PT

- (All)
- Null
- AGCR - Agropyr...
- AGFR - Agropyr...
- All Treatment Se...
- Artem Shrubs - A...
- BAPRS - Bassia ...
- Biological Soil Cr...
- BRARS - Bromus...

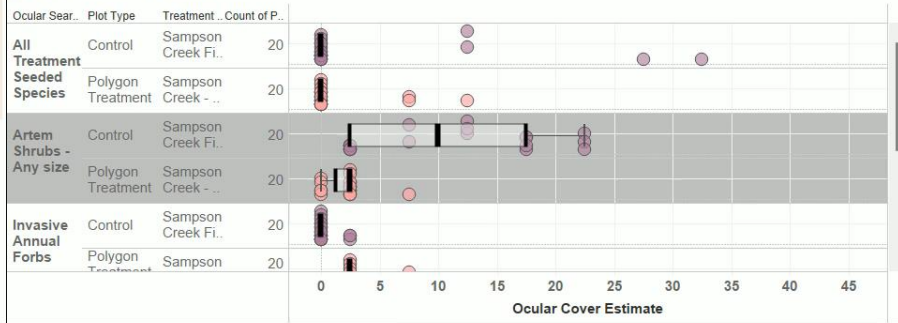
Density Functional Group C.

- (All)
- Null
- EAF
- EPF
- EPG
- EPS
- NAF
- NAS
- NPF
- NPG
- NPS
- NPT

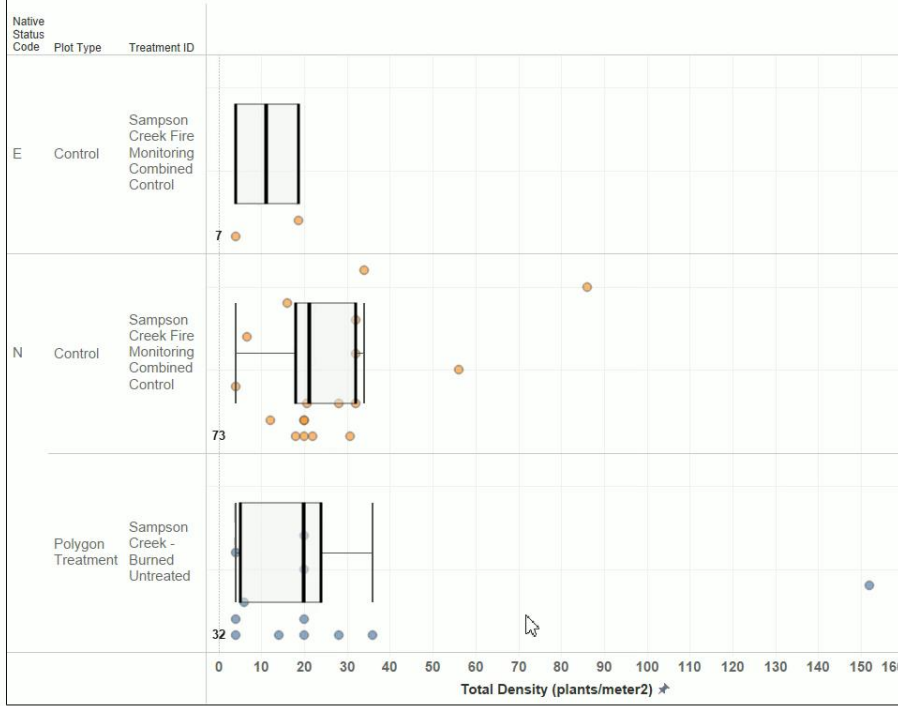
Density Species

- (All)
- Null
- Achillea millefolium
- Achnatherum hy...
- Achnatherum thu...
- Agoseris
- Agoseris glauca
- Agropyron cristat...
- Agropyron fragile
- Allium
- Allium acuminatum
- Allium anceps
- Alyssum deserto...
- Amelanchier
- Amsinckia
- Antennaria
- Antennaria dimor...
- Arabis

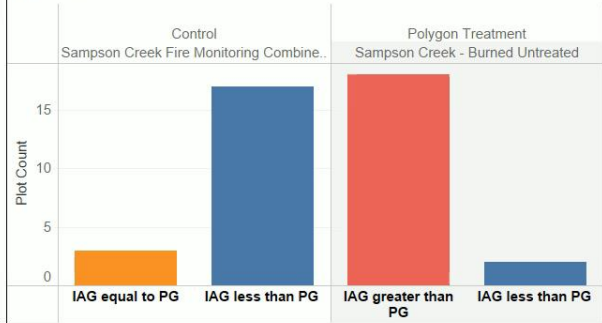
**Ocular Cover Estimates**



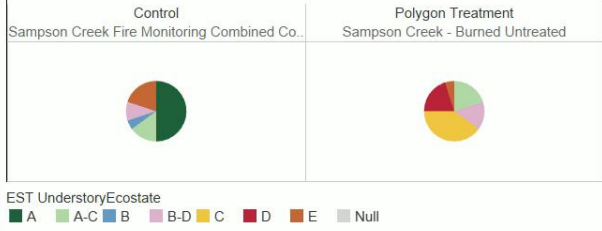
**Density Search**



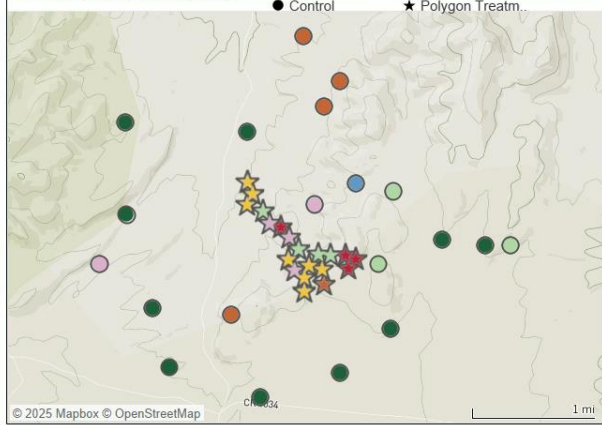
**IAG:PG Ratio**



**Ecostate Understory Designation**



**Ecostate Understory Map**



# Elegant interactive visualizations

Interactive Supplement for 'Clima' x +  
 https://geonarrative.usgs.gov/reptileclimateniche/

EHRI Electronic Offi... 7-Day Forecast 43.6... LTDL Favorites LTDL Forms Work Reptiles GCM data archive... 7-Day Forecast for L... HC\_39\_7thEd.pdf CNAH\_Common\_Na... https://tableau.chs... Watershed Restorati... Home - LTDL Planni...

**USGS**  
 science for a changing world

Welcome Single-species Model Results Single-species Range Change ... Multi-species Range Change a... Within-state Range Change Within-state Elevational Shifts

**CLOSE HELP** X <- Use the 'CLOSE HELP' button to view the dashboard.

### Single-species Range Change by State

This dashboard displays summary data between the recent and a selected time-by-climate scenario from the perspective of an individual species. States are listed for a species when it is lost, gained, or remains in the recent and selected time-by-climate scenarios. To the right, a map displays the range change within each state between the and selected time-by-climate scenario. Another map displays information on the elevation distribution of the species and if it is predicted to significantly increase or decrease from the recent scenario. To the left of this map, the median, 1st, and 3rd quantiles of elevation are shown for the species and state the mouse cursor was last hovered over on the map to the right.

**Table displaying predicted species occupancy changes in each state**

**Select a species and future scenario to filter the visuals.**

**Map displaying change in the proportion of each state occupied by a species.**

**The median, 1st, and 3rd quantiles of predicted elevation within a state. This figure changes when a state is hovered over in the map to the right.**

**Navigation buttons to other dashboards.**

**Pop up details with more information.**

**Symbology**

| Scientific Name          | Common Name        | Type of Change | States  |
|--------------------------|--------------------|----------------|---|
| Chilomeniscus stramineus | Variable Sandsnake | Species Gained | Nevada, New Mexico, Utah                      |
| Chilomeniscus stramineus | Variable Sandsnake | Species Lost   | Sierra Leone                                  |
| Chilomeniscus stramineus | Variable Sandsnake | Species Stable | Arizona, Baja California, Baja California Sur |

**Arizona Elevation Distribution:**

- Time 1 3rd qt: 1000
- Time 1 2nd qt: 800
- Time 1 1st qt: 600
- Time 1 median: 400
- Time 2 3rd qt: 1000
- Time 2 2nd qt: 800
- Time 2 1st qt: 600
- Time 2 median: 400

**Map Symbology:**

- Change in Proportion of State Occupied: 0.2571
- Change in Elevation:
  - Net Significantly Different
  - Significantly Decreasing
  - Significantly Increasing

**Pop up details for Chilomeniscus stramineus:**

- Species: Chilomeniscus stramineus
- Common Name: Variable Sandsnake
- State: Arizona, United States of America
- Scenario Comparison: recent and RCP85\_2085
- Type of Elevation Shift: Significantly Increasing
- Median Elevation Change: 627.0 m to 1,168 m

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**USGS**

## USGS Data Release Includes:

- Independent peer review
- Full metadata
- Ability to control what is released
  - Limit sensitive/private lands data
- Public access
  - Can download and work with the data
- Permanent Record
  - Accessible into the future

An official website of the United States government [Here's how you know](#)

**USGS**  
science for a changing world

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### ScienceBase

July 29, 2022

[ScienceBase Catalog](#)

[Learn more about the Science Data Management Branch](#) or [explore our other data management tools.](#)

#### What does this tool do?

ScienceBase is a Trusted Digital Repository (TDR) in the U.S. Geological Survey (USGS). The platform is developed and maintained by the USGS Science Analytics and Synthesis (SAS) Science Data Management (SDM) team to provide both permission-controlled and public access to scientific data products and bureau resources.

Items in ScienceBase adhere to a standardized data schema with consistent informational facets (e.g., title, abstract, keywords, etc.). This supports advanced query abilities and a mechanism to store and catalog different types of resources. Content in ScienceBase is accessible through both a web browser and an application programming interface (API), to enable users and tools to work with item content as machine-readable JSON (JavaScript Object Notation).

ScienceBase provides a number of features that scientists can use to build data collections, share data through web services, and ensure that these data are preserved for use by future researchers. The project supports open data, re-usable vocabularies, contact management, repository services, content security, and the handling of large datasets.

[Sources/Usage: Public Domain. View Media Details](#)

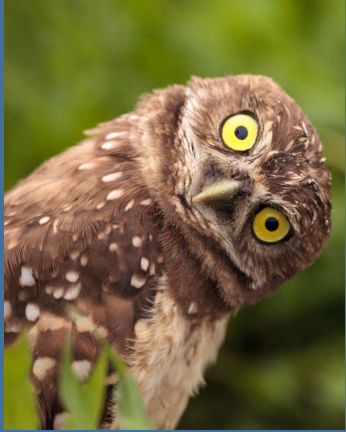
Screenshot of the ScienceBase homepage.

Explore Search  
Information Systems  
Methods and Analyses  
Science Technology  
Data Repository

<https://www.usgs.gov/tools/sciencebase>



# Official USGS Data Release



How often and when  
should I update my  
forms?

# Form v Adaptive Management

# Feedback & Updates

- Folks doing the actual work know more than the designers
- Annual feedback sessions
  - What worked
  - What didn't work
  - Ideas for improvement
- Annual training
  - Review and calibrate every year
  - Introduce new features
- Listening and adapting
  - Don't hide from criticism, embrace it
  - Give folks ownership in the product

## ORMP Training 2024



Photo by J. Welty, USGS

# Lessons Learned

- Newer technology should change how we interact with data
- Technology is often drag and drop
  - Minimal programming skills and low learning curve
- Software, form creators, field crews, and data analyzers are not perfect
  - Always anticipate everyone will make errors
- Working together we can centralize data from the beginning
- One size DOES NOT fit all
- Waiting until the end is no longer your best option
- Feed back from users has been incredible

# Questions?



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\*Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

\*These data are preliminary or provisional and are subject to revision. They are being provided to meet the need for timely best science. The data have not received final approval by the U.S. Geological Survey (USGS) and are provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the data.

ROAM



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