

Streamlining Water Quality Field Data Collection with GIS



WATER QUALITY PROGRAM

Ecology's Role

The Washington State Department of Ecology (Ecology) is Washington's environmental protection agency.

Our mission is to protect, preserve and enhance Washington's land, air and water for current and future generations.

We support environmental work throughout Washington.

Nearly 70 percent of our budget is passed through to local communities to pay for projects that benefit the environment.



Water Quality - Nonpoint Role

I work in Ecology's Water Quality Program, focusing on nonpoint pollution issues.

Scope of work includes:

- Complaint response
- Watershed assessments (looking for potential sources of nonpoint pollution)
- Project management / grants and loans management
- Technical papers and plans for solving problems in various watersheds in eastern Washington

Better management of this work can be achieved by using GIS.





Needs

Take Agency GIS data into the field.

Collect georeferenced field data (more than just points).

Geotag photos and associate with GIS features.

Map all data collected.

- Problem sites
- Inspections
- Remediative measures installed

If possible, do all of this with one device that requires minimal configuration and GIS skills.



Goals

Reduce Workload –

- Less equipment configuration
- Fewer steps to collect data
- Less work managing data

Reduce time to follow up on issues identified.

Improve data quality and ability to share and access data.

Reasonable cost/increased use of GIS – All staff can collect GIS data.



Old Process

FIELD

OFFICE

Standard operating procedures and field data sheet

ERO Watershed Evaluation Data Sheet				Agency Staff	Date
(Ver. 2.4/5/2013)					
Site ID	Watershed	Feature Category	Response Code	Description	Point Score(s)
	Watershed Gravel	Gravel	0	Base gravel/bedrock not	
		Gravel	1	Continental gravel (active or potential)	
		Gravel	2	Transportation materials and erosion	
		Gravel	3	Removal of readily eroded vegetation	
		Gravel	4	Manure accumulation	
		Gravel	5	Overlooked paths and trails in riparian area	
		Gravel	6	Other	
		Gravel	7	Base gravel/bedrock not	
		Gravel	8	Transportation materials and erosion	
		Gravel	9	Overgrowth of grass	
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Report Codes: 3 = Functional Buffer; 2 = 100-0.99 Buffer; 1 = 0.99-0.5 Buffer; 0 = 0.5-0.1 Buffer; 4 = No Buffer

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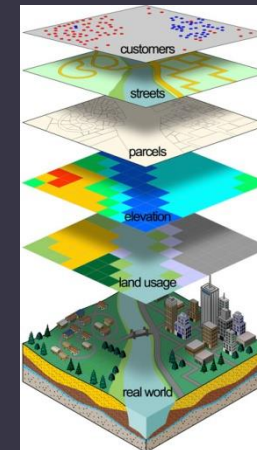
Sync Date & Time



Geotag Photos



GIS



Site Folders:

- File Notes
- Photos

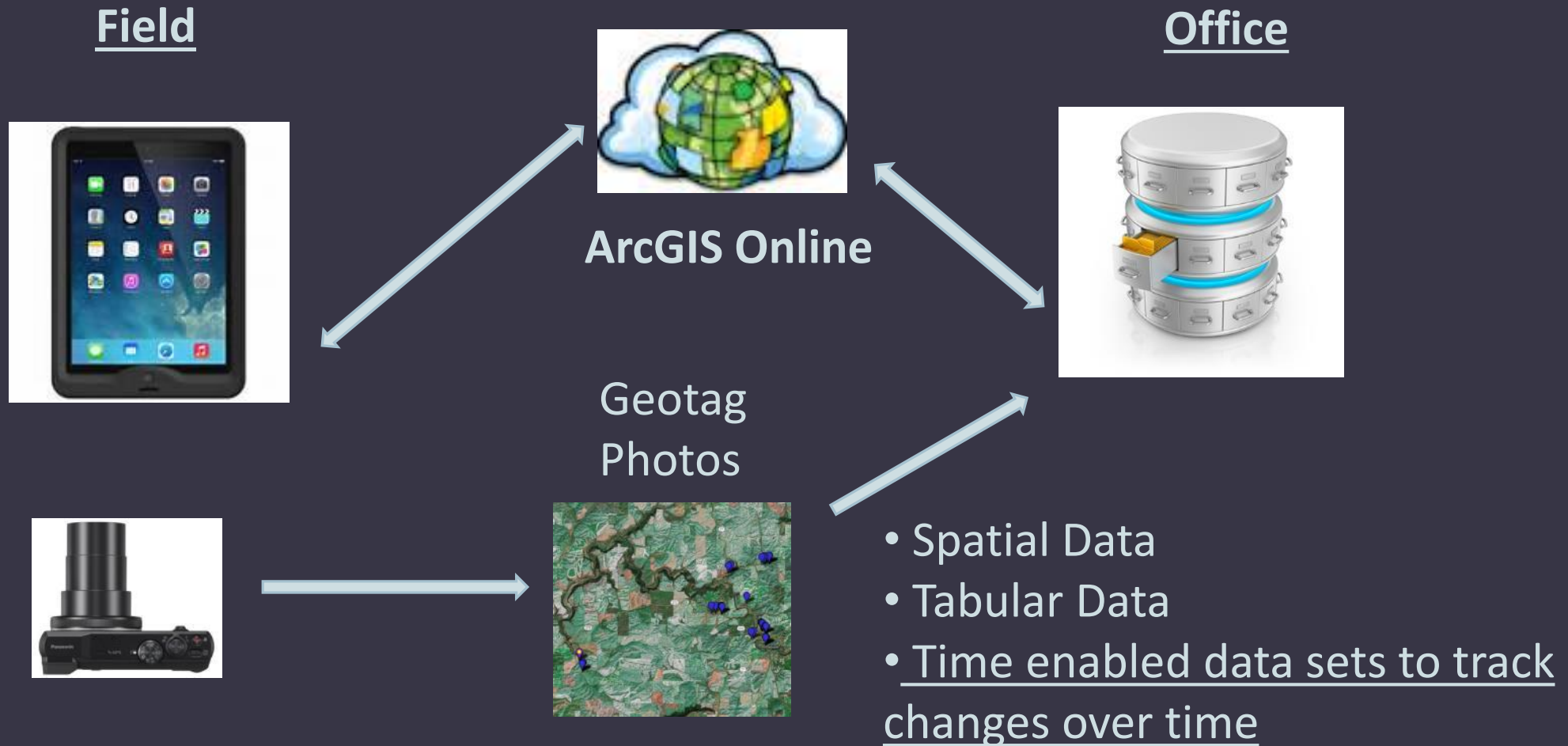
Database



How We Streamlined

- Replaced paper field data sheet – all data collected in collector app.
- Replaced handheld GPS – use built in GPS with tablet device
- Data from collector app uploaded directly to ArcGIS Online

New Process



Workflow

1. ArcMap - Create data collection feature class

- Create coded value or range domains for attribute fields
- Publish feature class to ArcGIS Online

2. ArcGIS Online - Create web map for data collection

- Add the data collection feature class to the map
- Add a basemap layer/other layers as needed

3. Collector App on iPad- Collect data

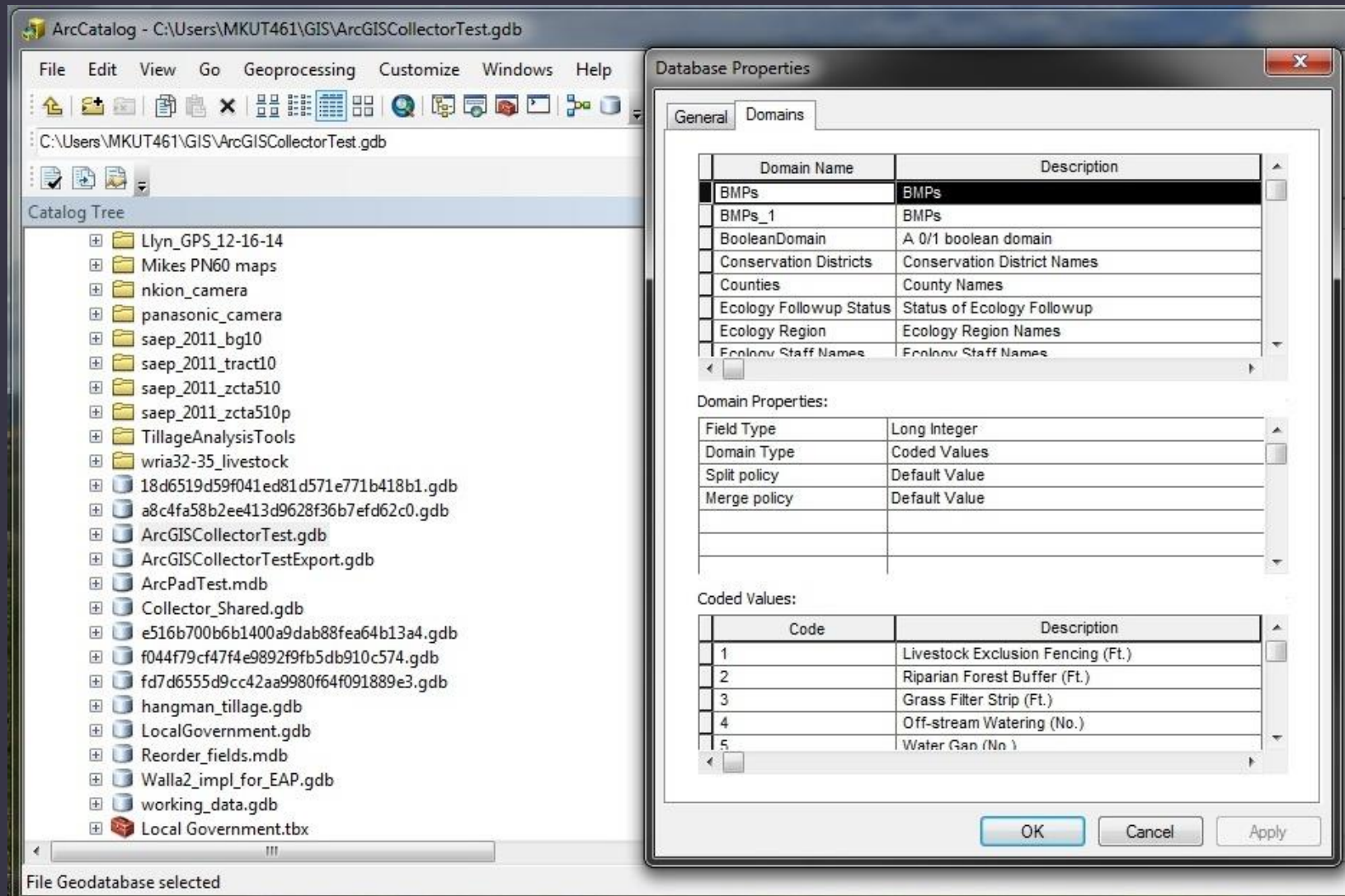
- Collect data
- Sync the data with ArcGIS Online

4. ArcMap – Verify data

- Open the data collection feature class in ArcMap
- Use the Identify tool on each feature and use the Attachment Manager to download the photos



Create Domains to Populate Dropdown Lists in Collector



Screenshot collecting data for 2015 ERO watershed evaluations in the Collector app on an iPad



Collector Tasks

Turn layers on/off

Change basemap

Measure (change units)

Search (by layer and place)

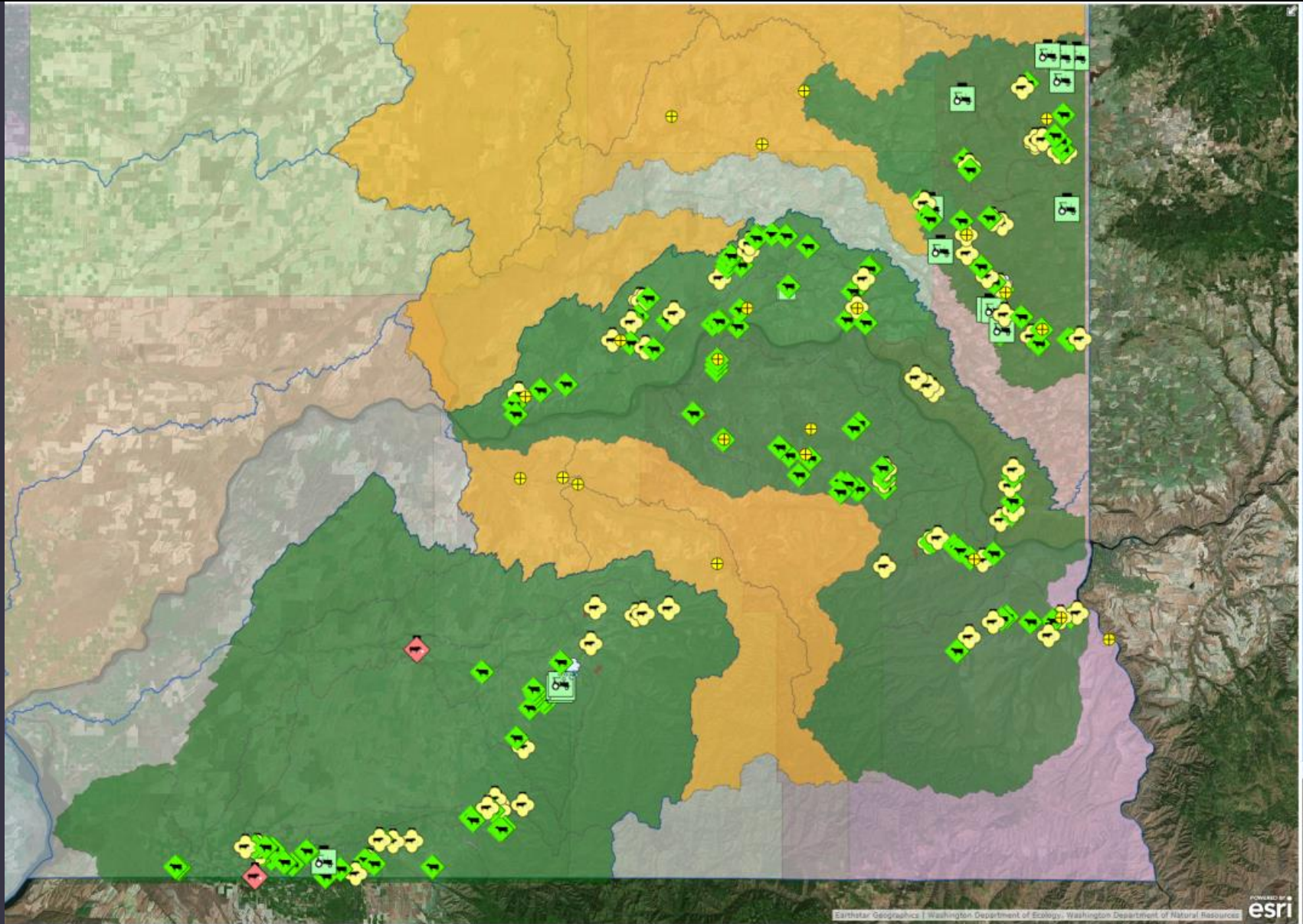
Turn by turn directions

Query data

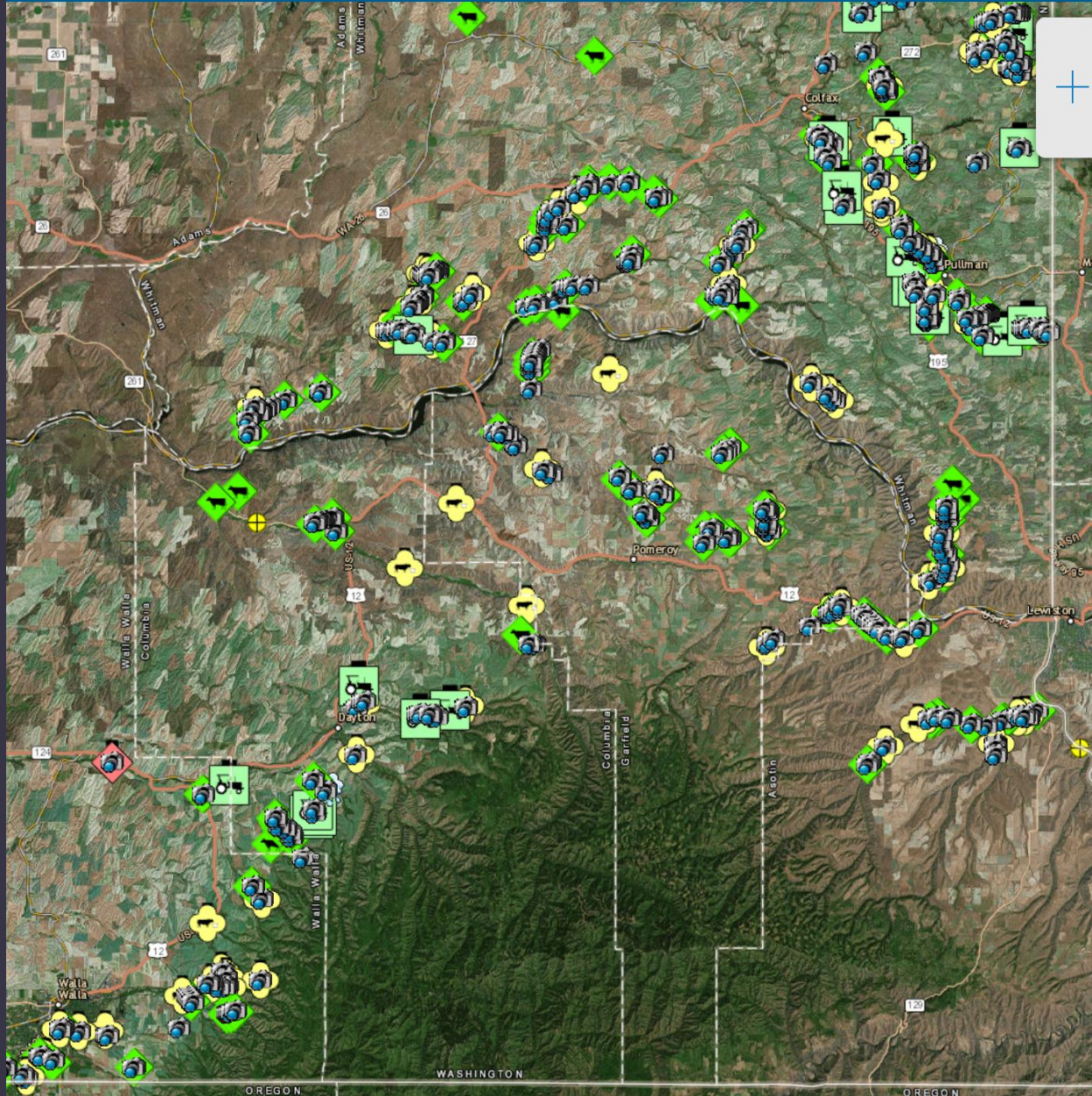
Collect data

- Points/lines/polygons
- Attach photos/videos
- Sync data to server

Screenshot of 2015 ERO watershed evaluation data collected with Collector app on iPad and uploaded to ArcGIS Online.



Maps



Collect a new feature



Filter



Livestock Grazing

ERO Nonpoint WQ Sites of Concern



Livestock Feeding

ERO Nonpoint WQ Sites of Concern



Feedlot

ERO Nonpoint WQ Sites of Concern



Tillage

ERO Nonpoint WQ Sites of Concern



Stormwater

ERO Nonpoint WQ Sites of Concern



Other

ERO Nonpoint WQ Sites of Concern

Challenges

- Convincing a risk-averse management team that potential benefits/uses outweigh potential drawbacks
- Taking a pilot program in one region to a statewide project (requiring all regions to agree on an identical protocol)
- Future improvements to enhance field data collection without making overly complex/cumbersome
- Training less technically adept staff to utilize the platform



Limitations

Hardware

- Device camera lacks zoom capabilities, need separate camera
- iPad GPS fairly reliable for most part, but still carry backup GPS

Software

- Issues with legacy data maintained in other database systems
- App doesn't automatically geotag photographs
- ArcGIS & app don't currently support multi-value selection fields
- Would be nice to attach audio files, PDF records etc.



Water Quality Program Suggested Uses

Nonpoint water quality

- Watershed evaluations
- Site inspections to document problems and best management practices
- Track water quality samples collected for enforcement

Permit Unit and stormwater inspections

Forest Practices permit review site visits

Grant manager site visits to document best management practices

Future possibilities: Connect ArcGIS Online to other Ecology apps





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