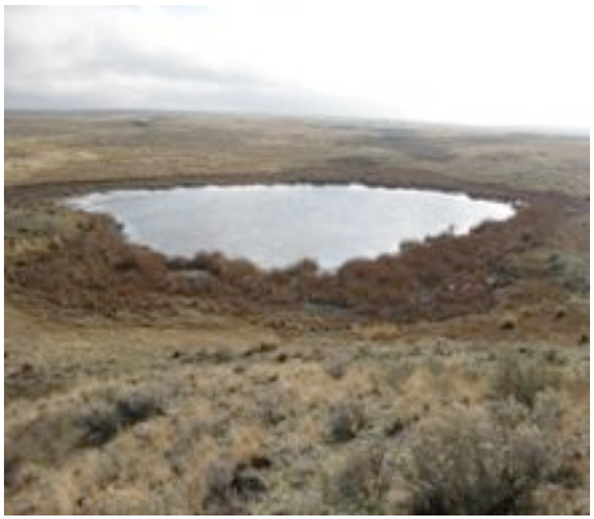
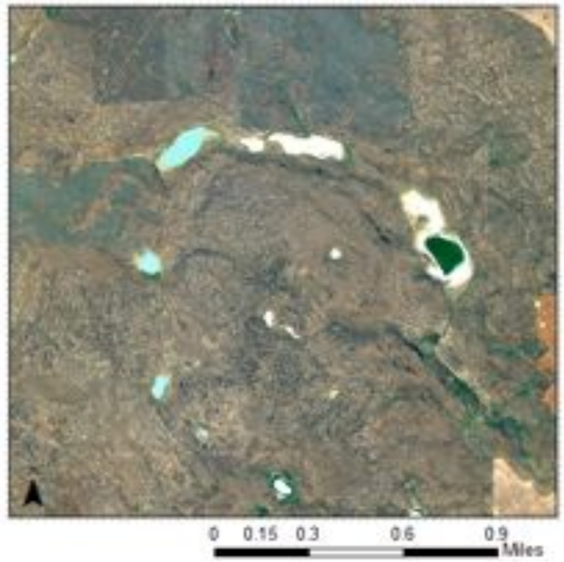
Remote Sensing of Wetlands





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University of Washington

UW | Remote Sensing & Geospatial Analysis Laboratory

Research Objectives

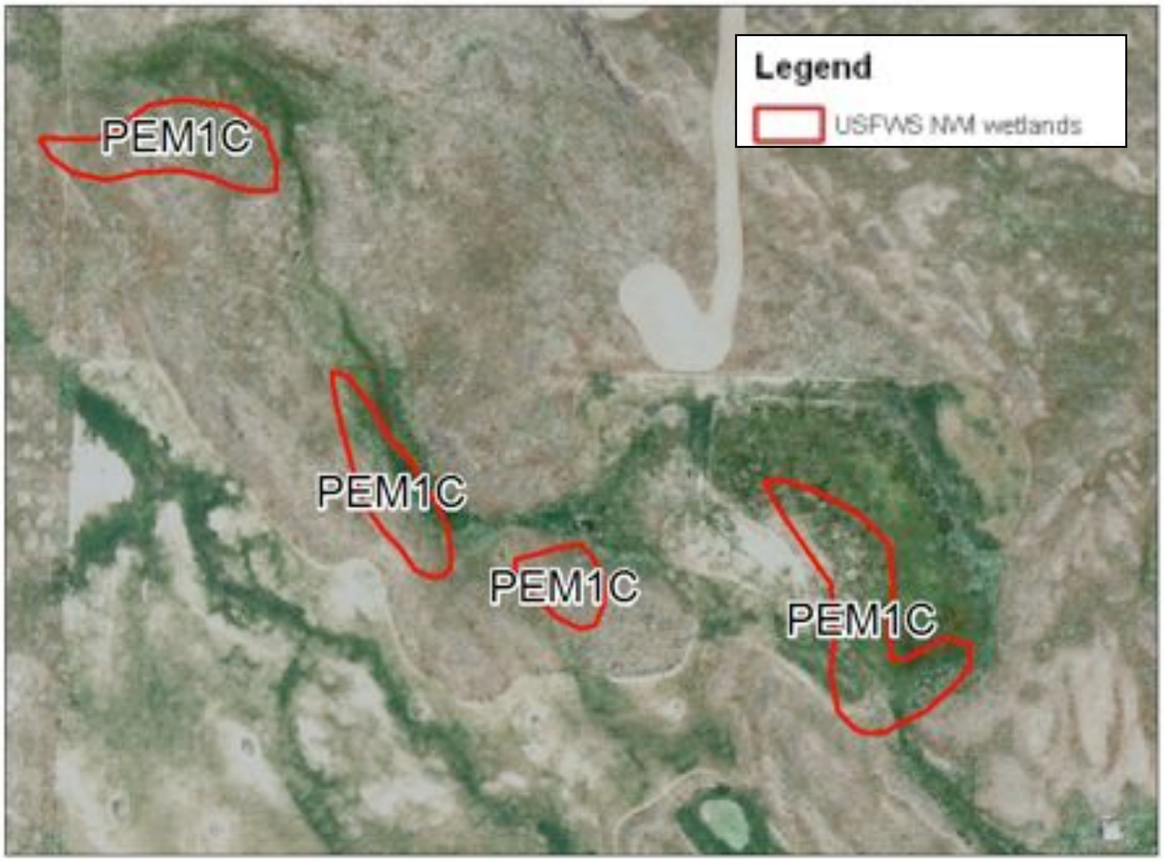
- *Develop* a repeatable cost-effective approach to map wetlands over large spatial extents.

  Where are the wetlands? What types?

- *Reconstruct the wetland hydrology* over the last thirty years.

  What are the wetland dynamics?

- *Wetlands maps are outdated or inadequate in many areas.*

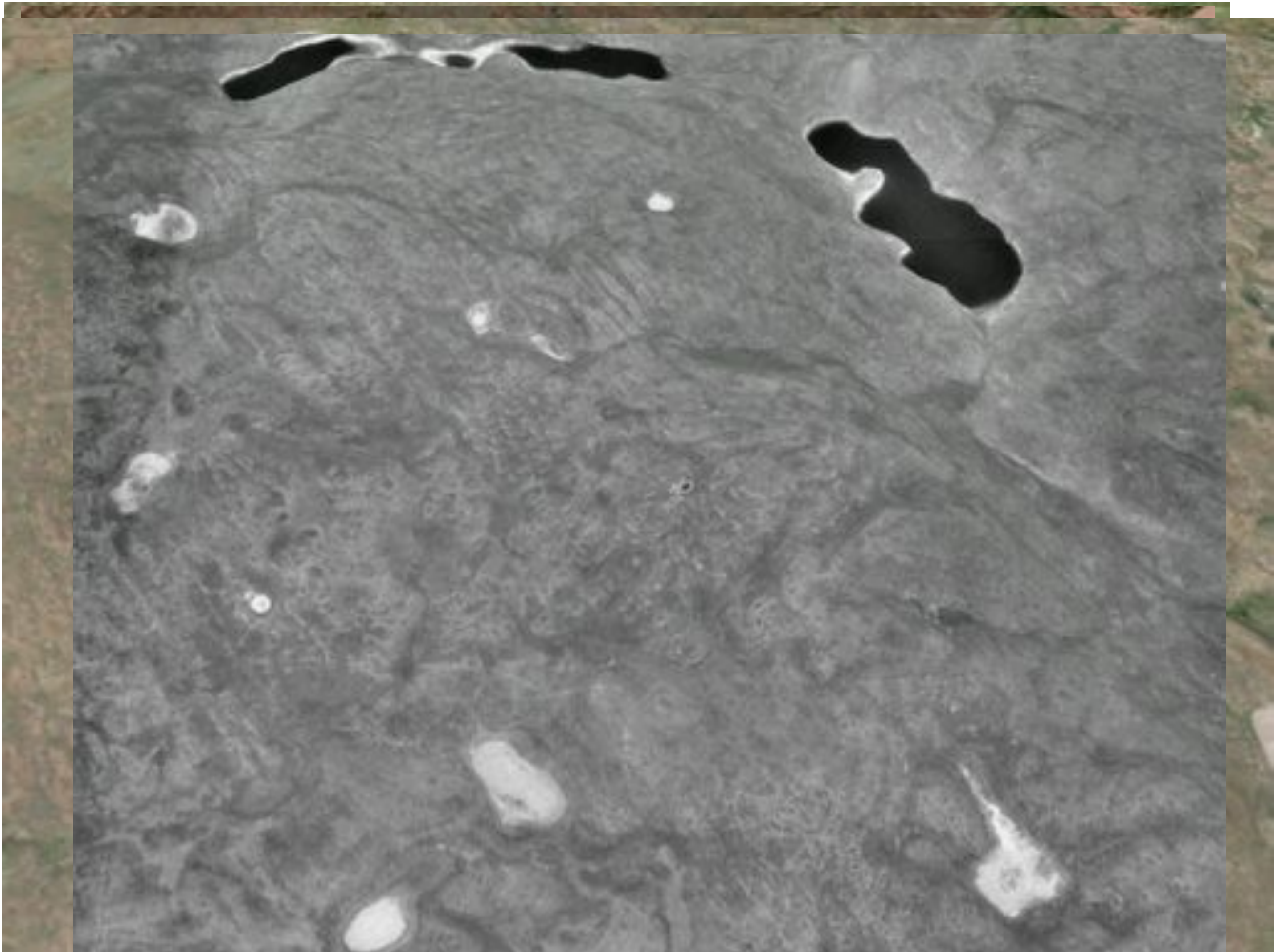


Example of NWI dataset

Importance of Wetland Inventories

- Research
- Conservation Management
- Wetland Restoration
- Regulation
- Monitoring of Wetland Policies

- *Wetlands are one of the most dynamic ecosystems, yet we know little of their dynamic nature.*

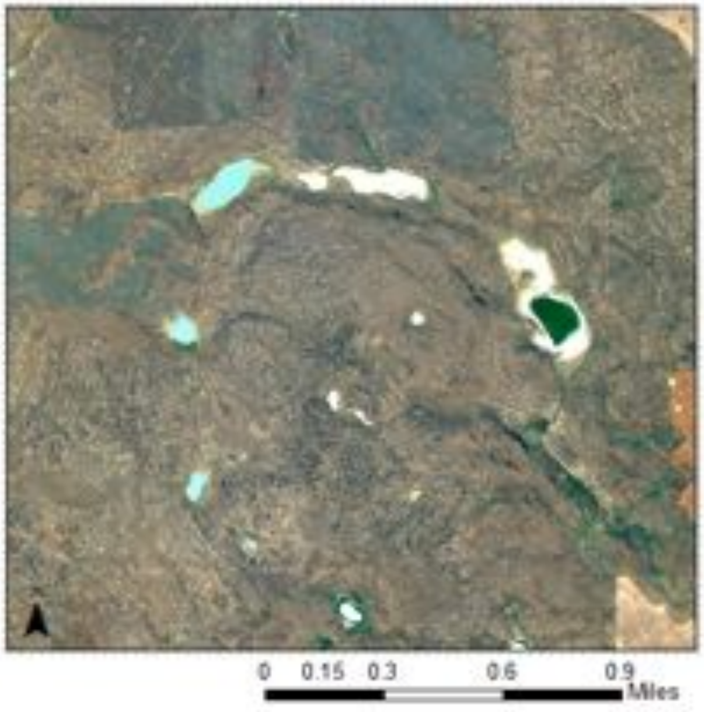


Challenging to survey the wetlands through time. Would require visiting each wetland every 2- 4 weeks throughout the year.

Can’t go back in time.

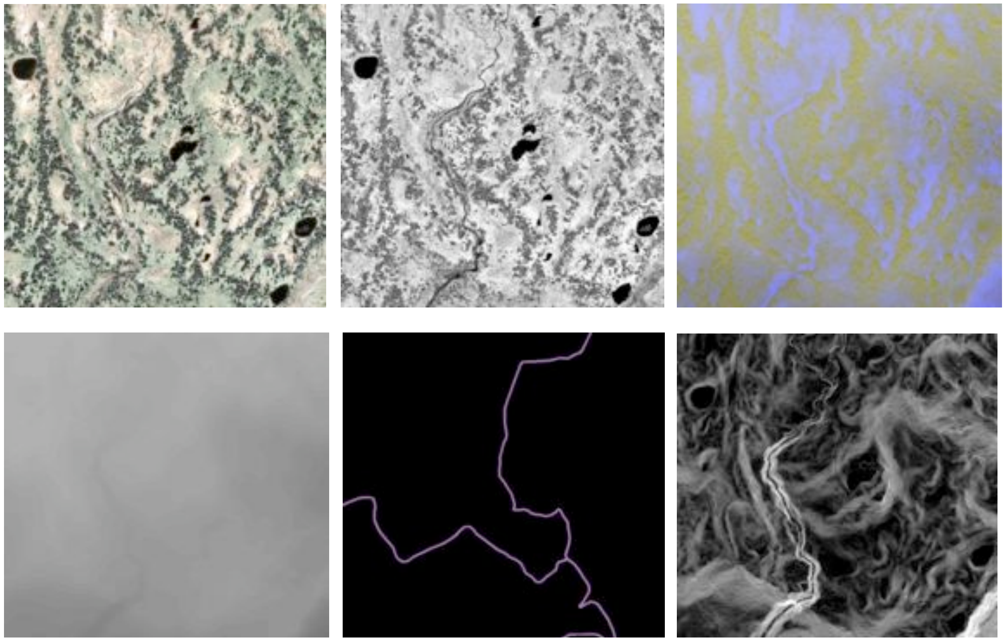
Remote Sensing Methods

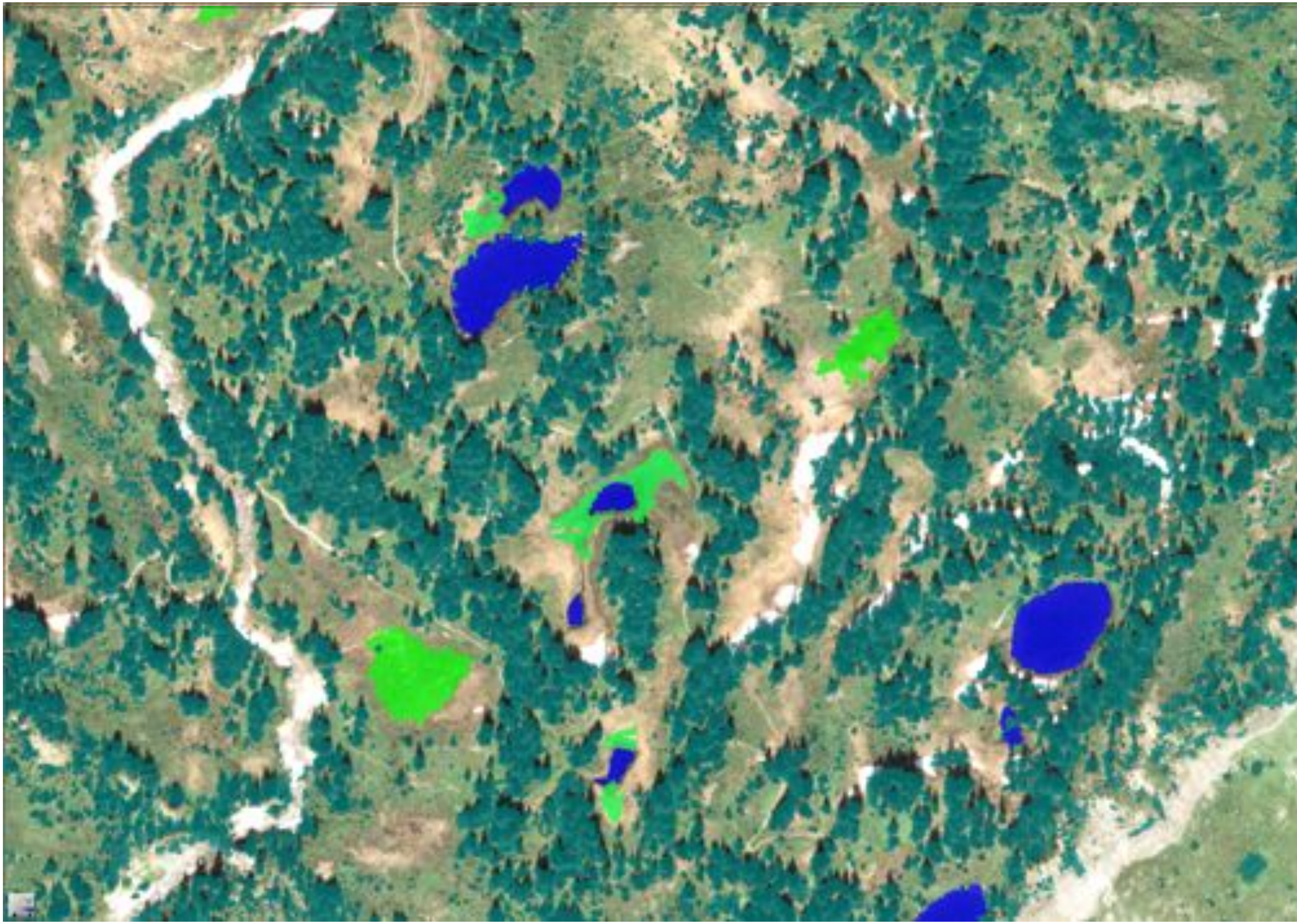
- ***Improved wetland maps*** - Object based image analysis (OBIA) using high resolution aerial images.

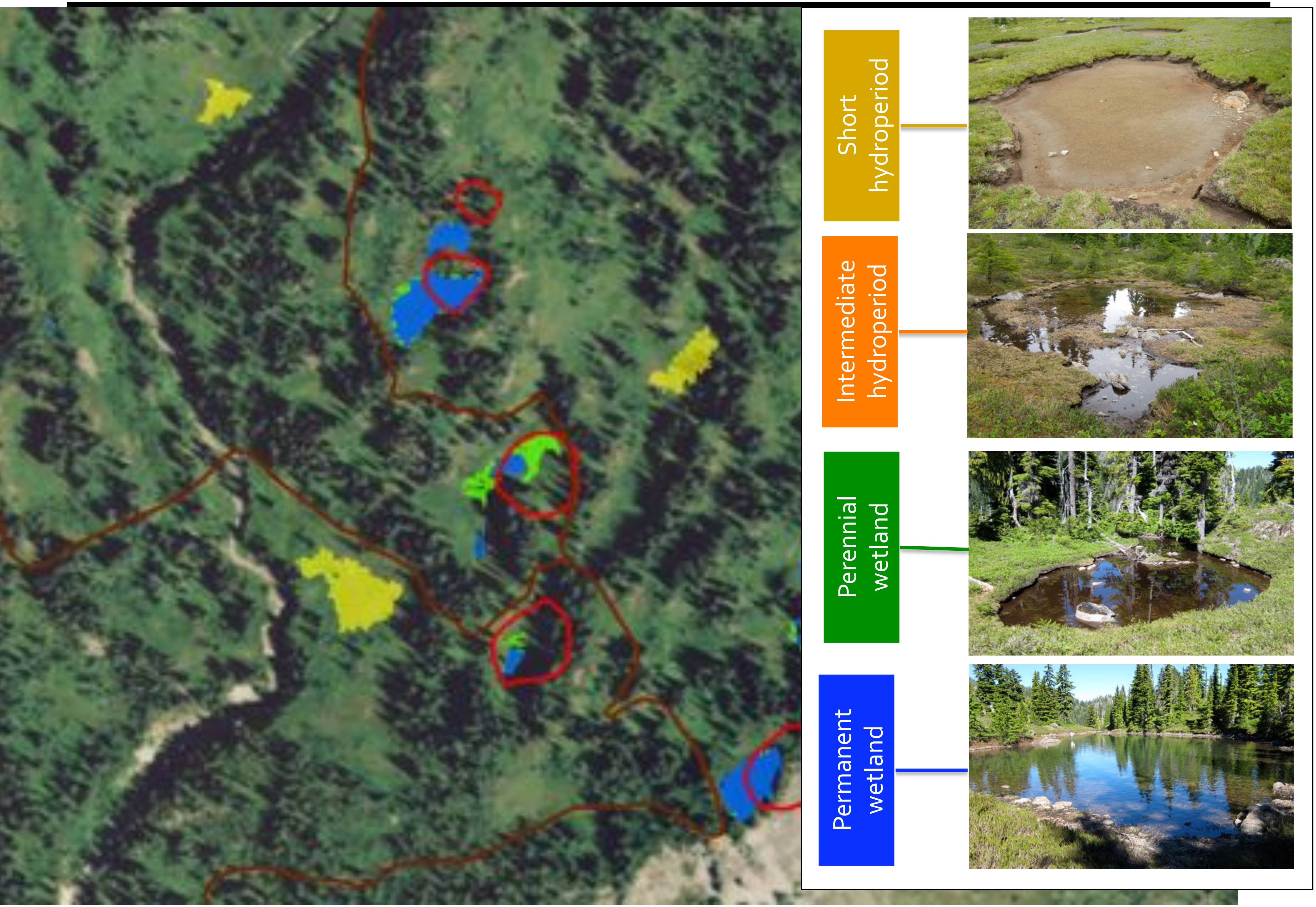


Object Based Image Analysis (OBIA)

- OBIA automates human pattern recognition
- Approach is flexible and allows the use of any available datasets.



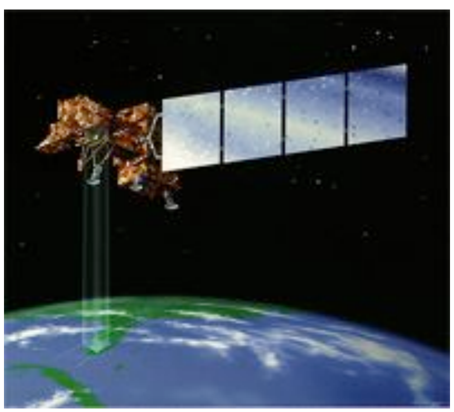




Short hydroperiod
Intermediate hydroperiod
Perennial wetland
Permanent wetland

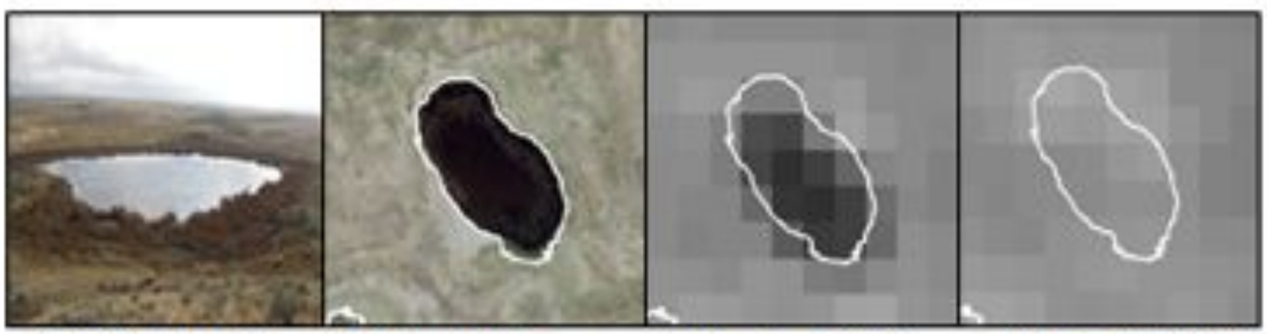
Remote Sensing Methods

- ***Reconstruction of wetland dynamics*** - Spectral Mixture Analysis (SMA) using Landsat satellite images



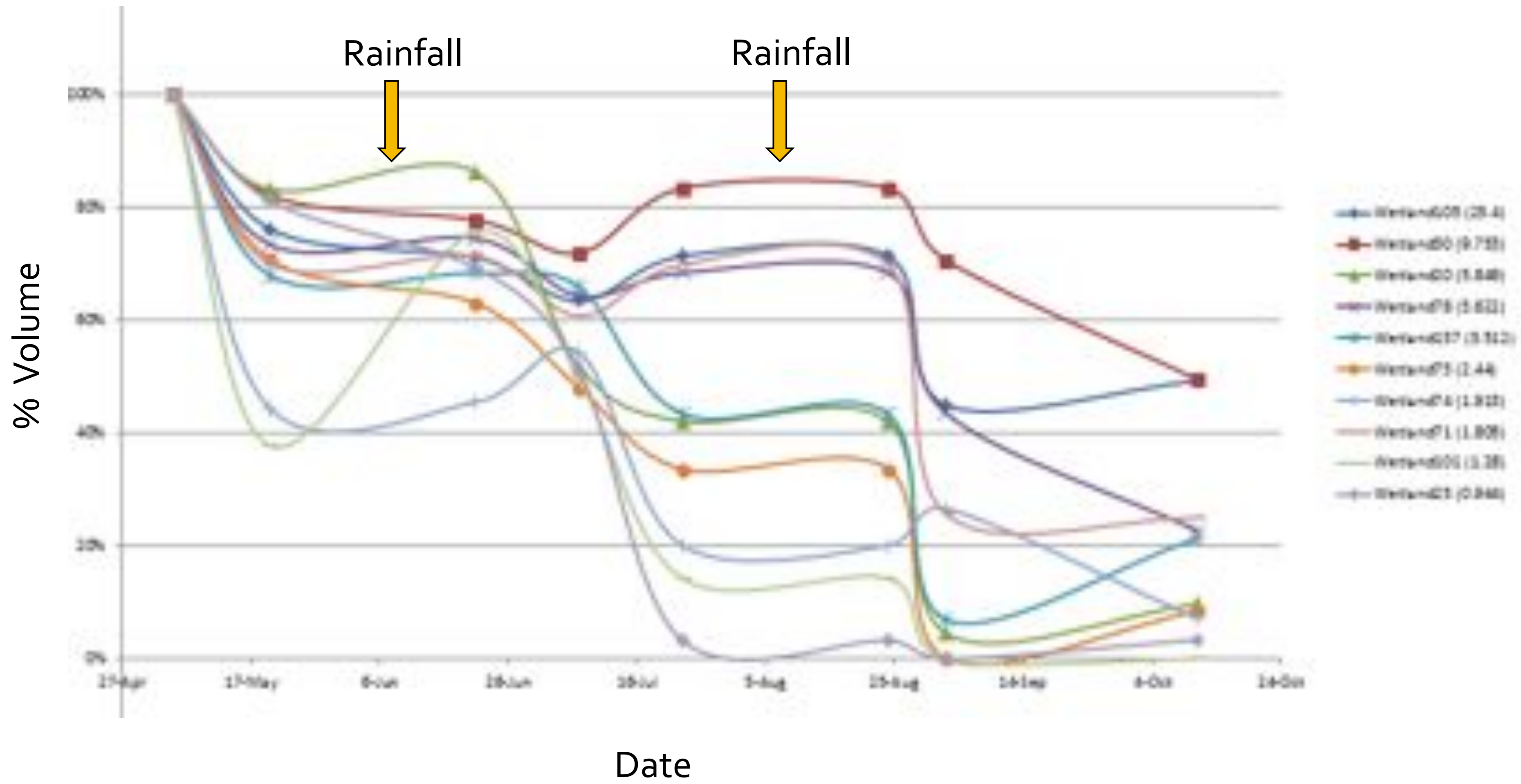
Example: Douglas County

Analyze 200 + dates of satellite imagery.

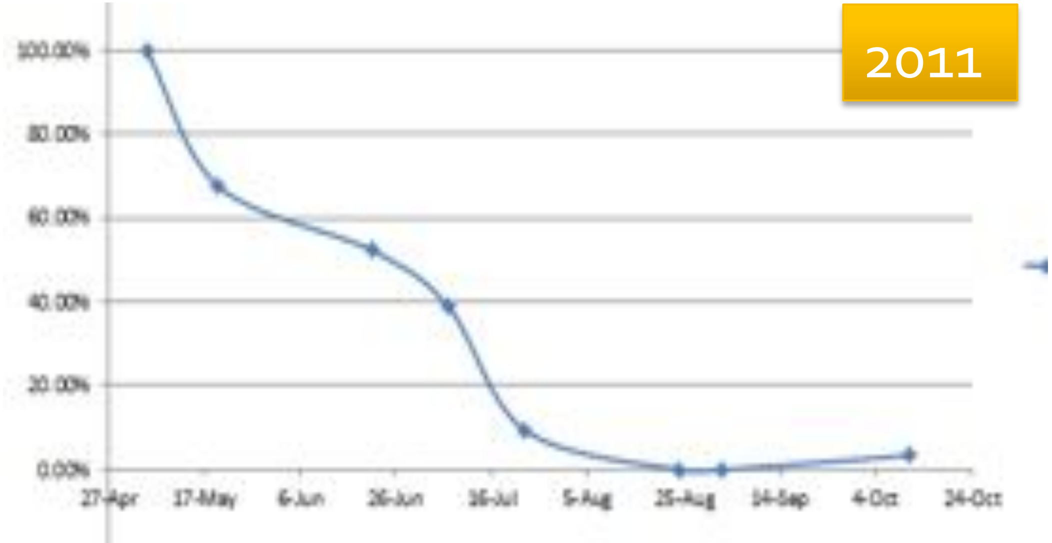


(a.) Oblique photo (b.) Classified image (c.) Landsat 05/95 (d.) Landsat 09/95

Reconstructing a hydrograph

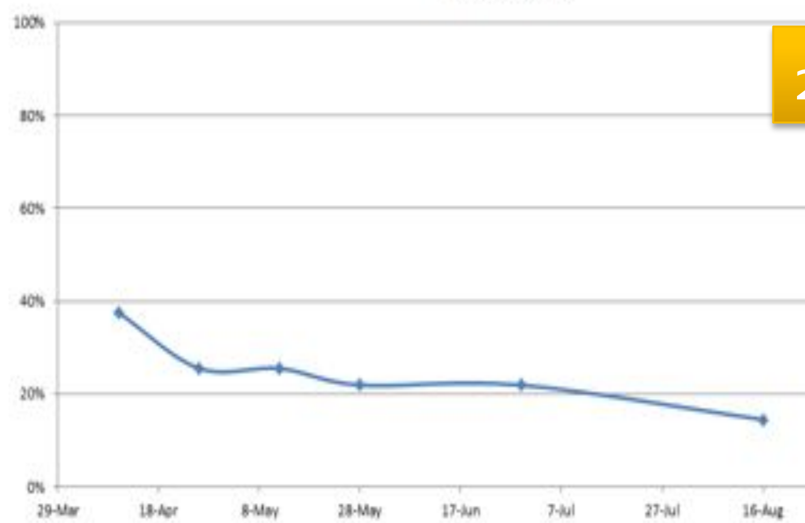


Comparison between wetlands

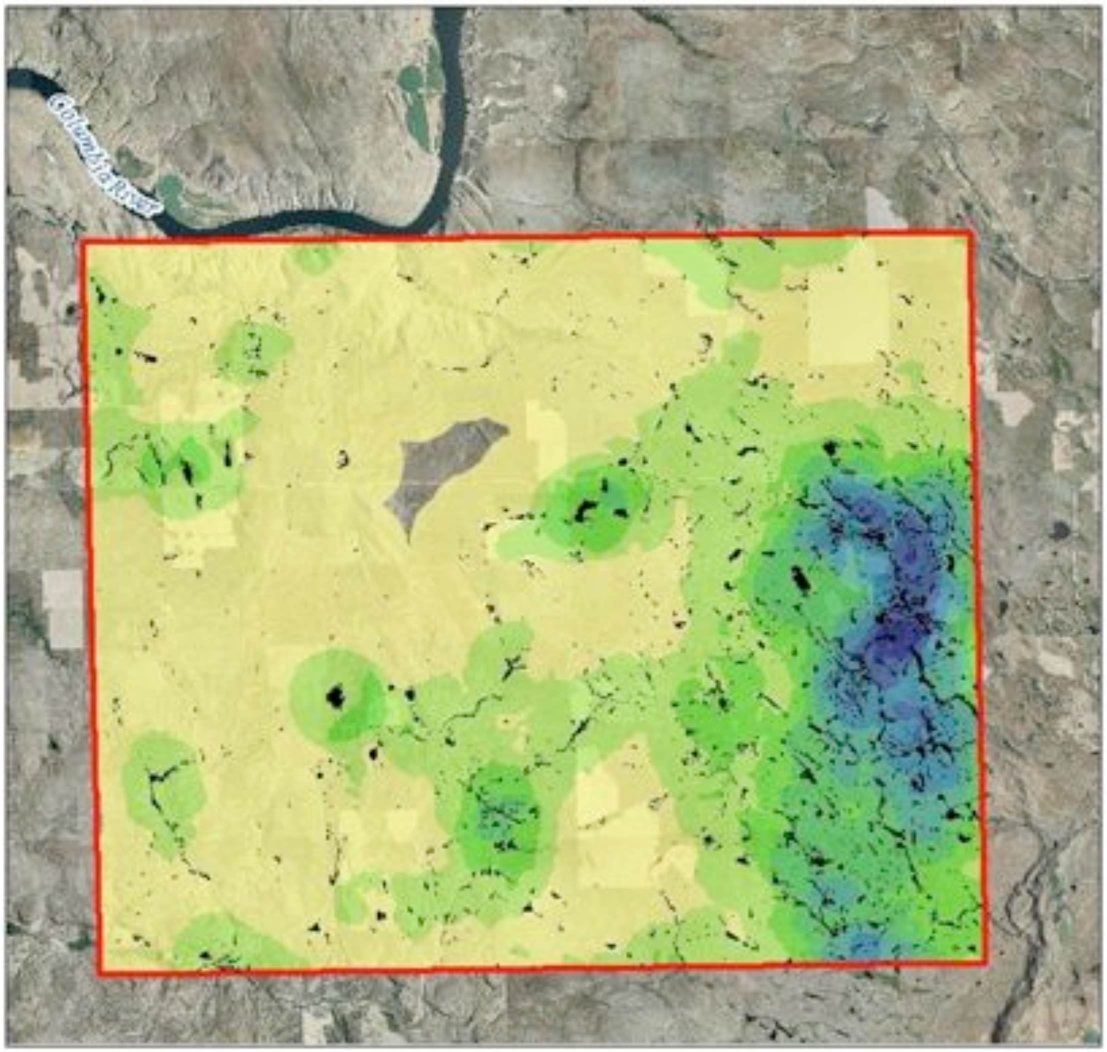


Comparison between years

Wetland 20
(1.28 acres)

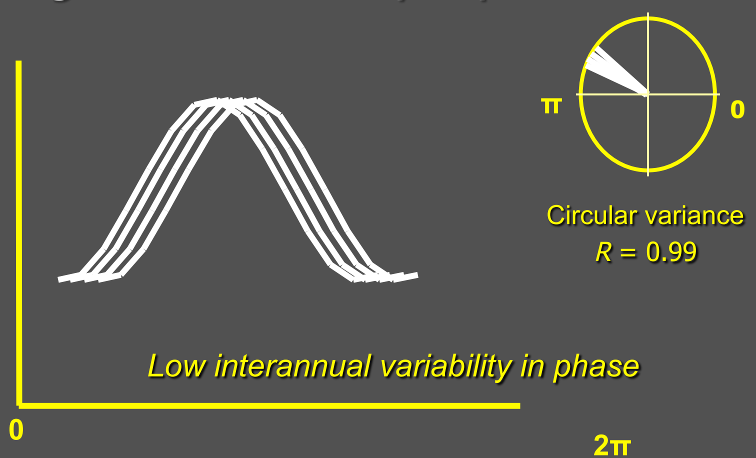


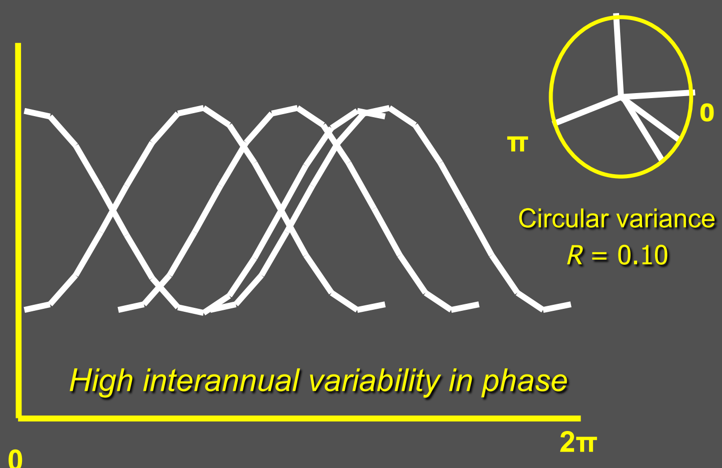
Landscape Analysis



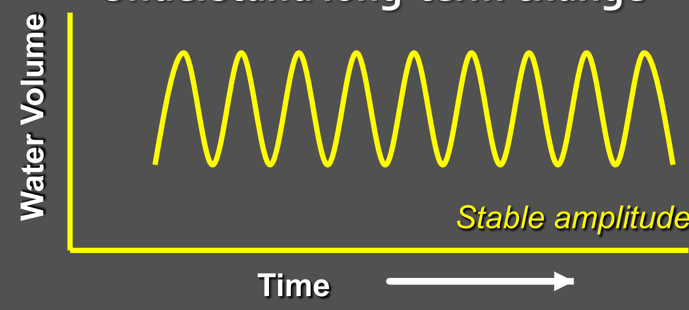
Dynamic Change Analysis

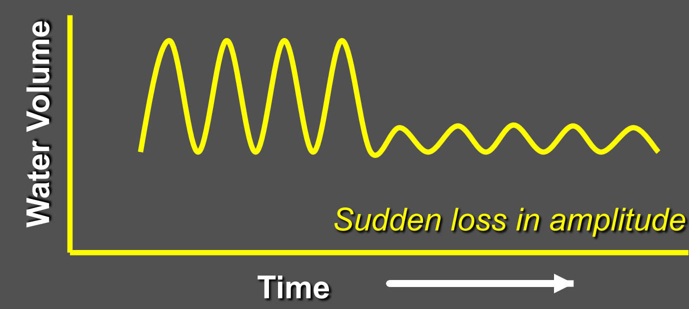
Variance of phase =
Timing and duration of hydroperiod

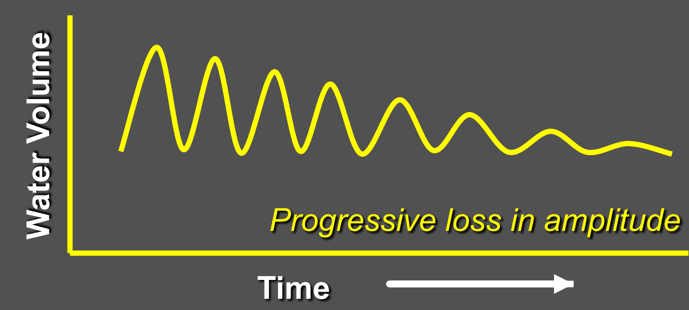


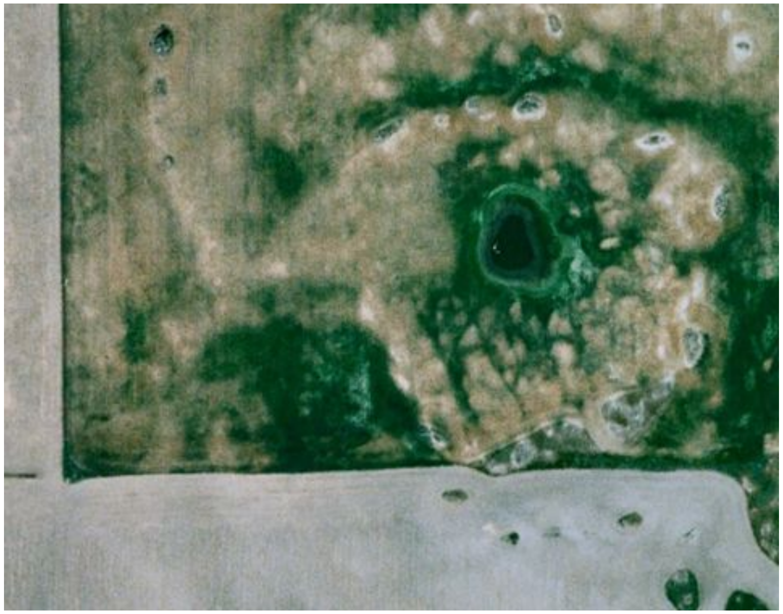


Variance of amplitude =
Understand long-term change



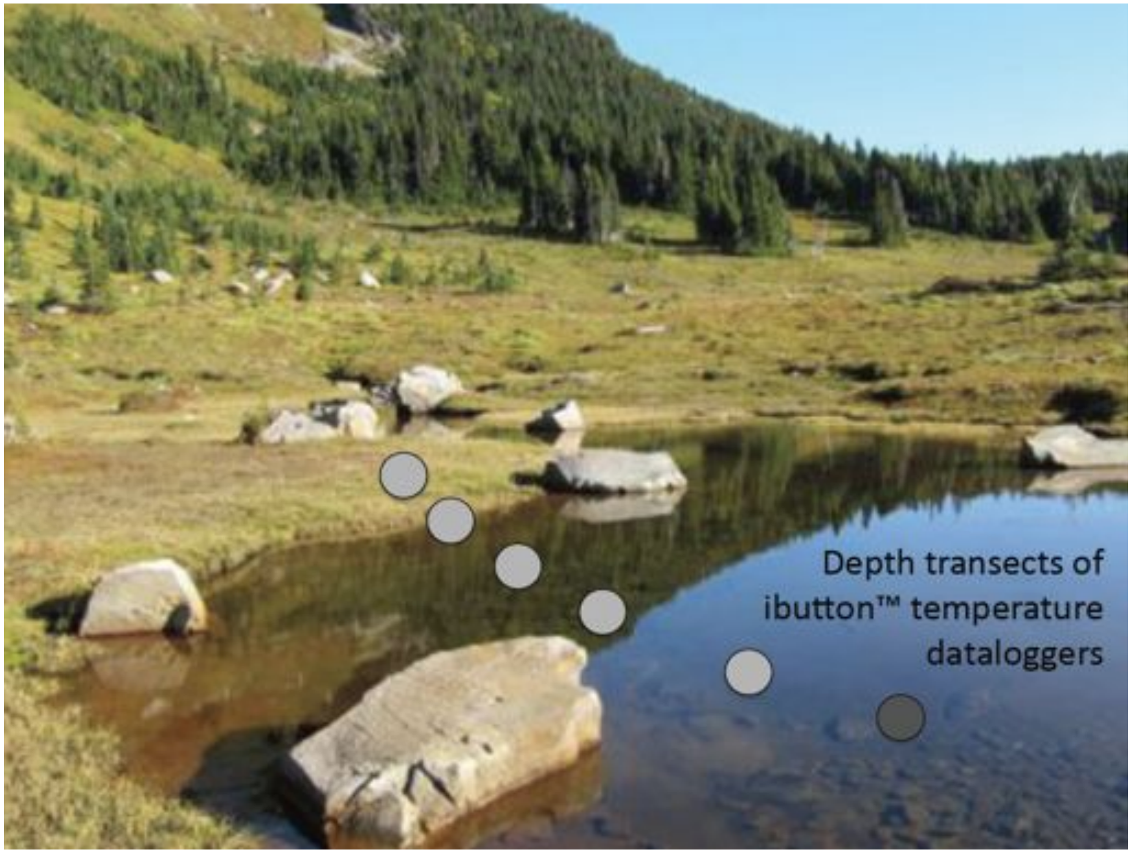






Validation

- Ibuttons



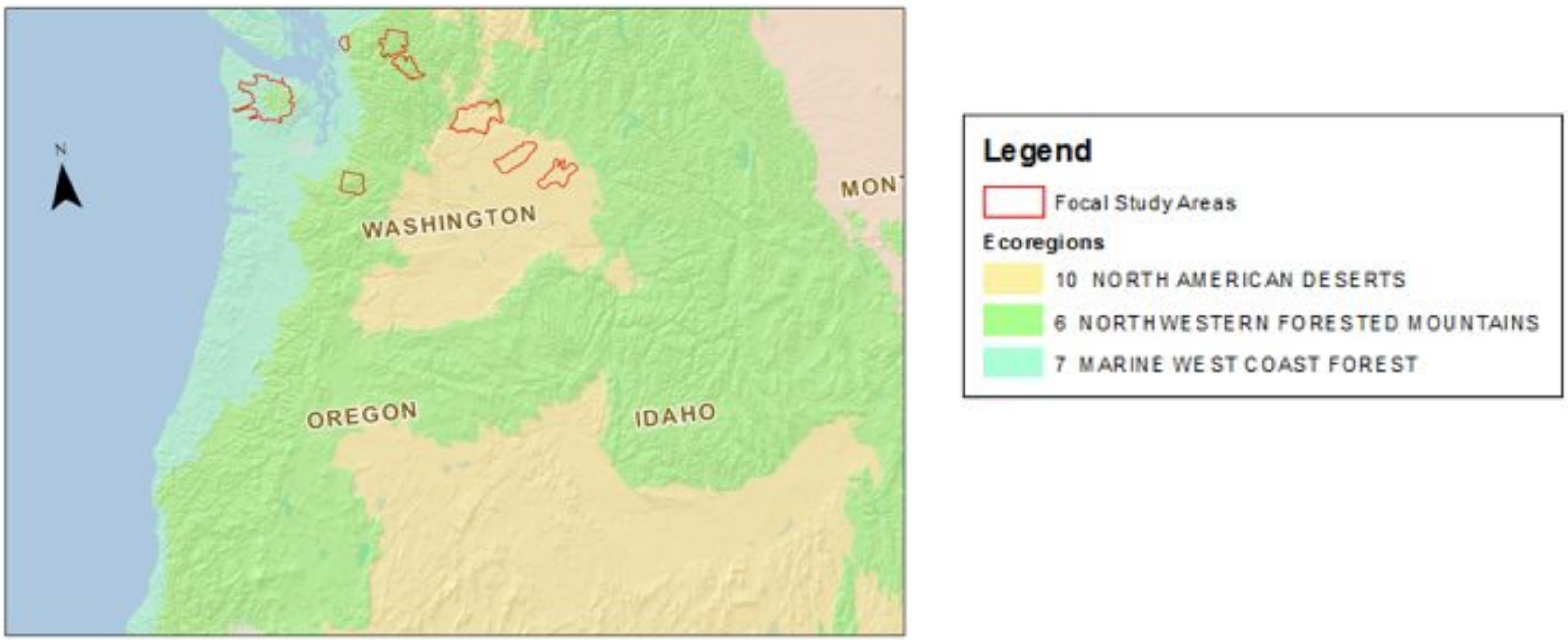
Products

1. Updated Wetland Maps

- *Mt. Rainier National Park*
- *North Cascades National Park*
- *Olympics National Park*
- *Douglas County*

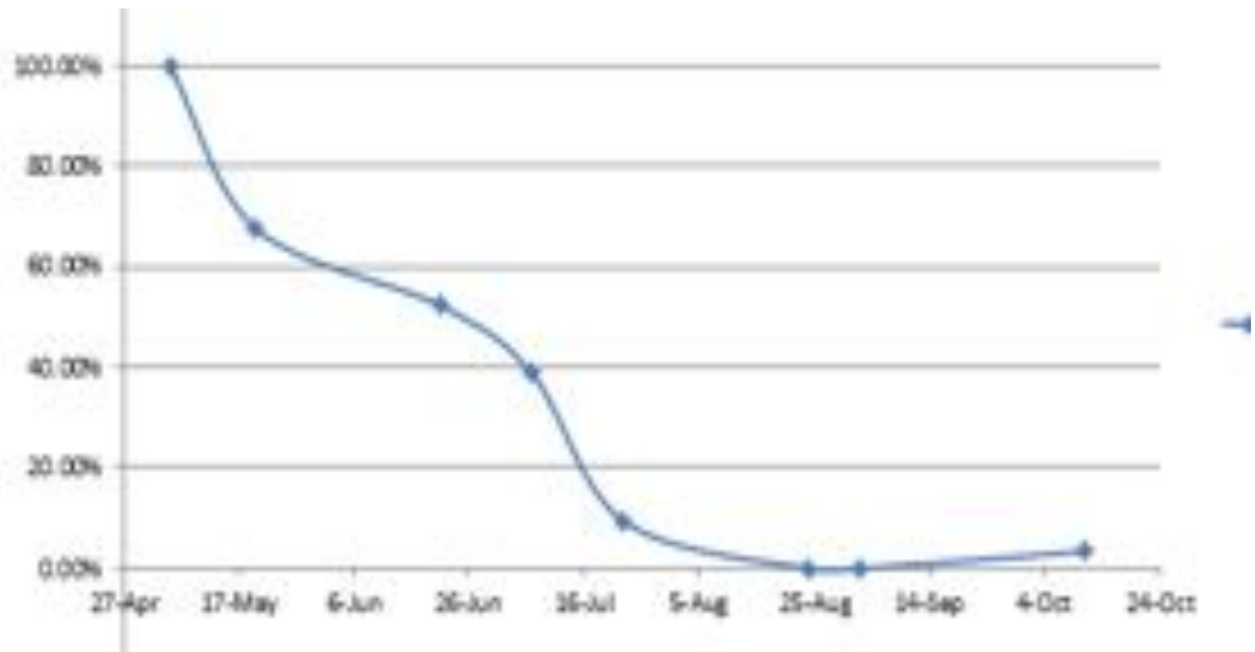
Products

2. *Remote sensing algorithms that can be extended to other areas throughout each ecoregion.*



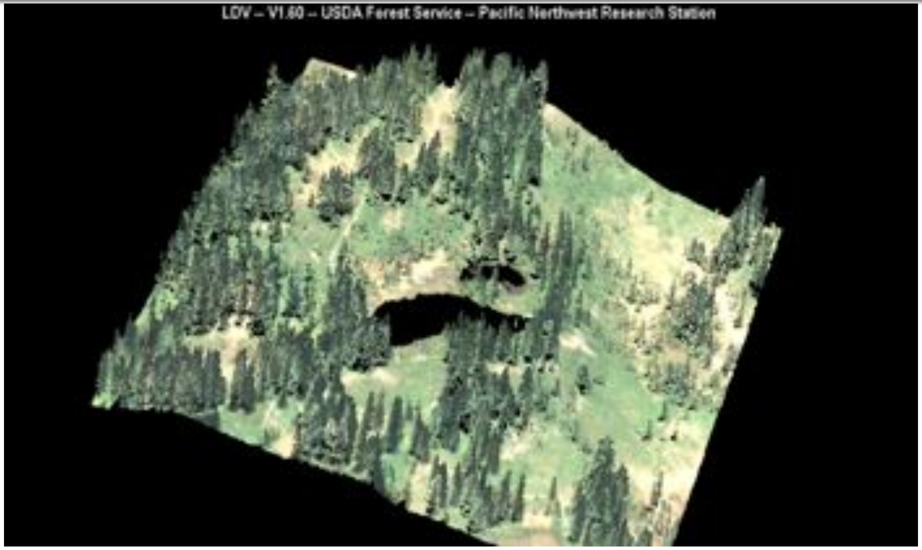
Products

3. Historic reconstruction of wetland hydrographs for focal regions in the Columbia Plateau



Thank you!

E-mail: Halabisk@uw.edu



- USDA Forest Service MacIntire Stennis Grant.
- Foster Creek Conservation District
- Washington State Conservation Commission
- Mt. Rainier National Park Service & Maureen Ryan for providing data for this research.
- Chris Vondrasek, Lopamudra Dasgupta, Stephanie Kong

Potential Uses

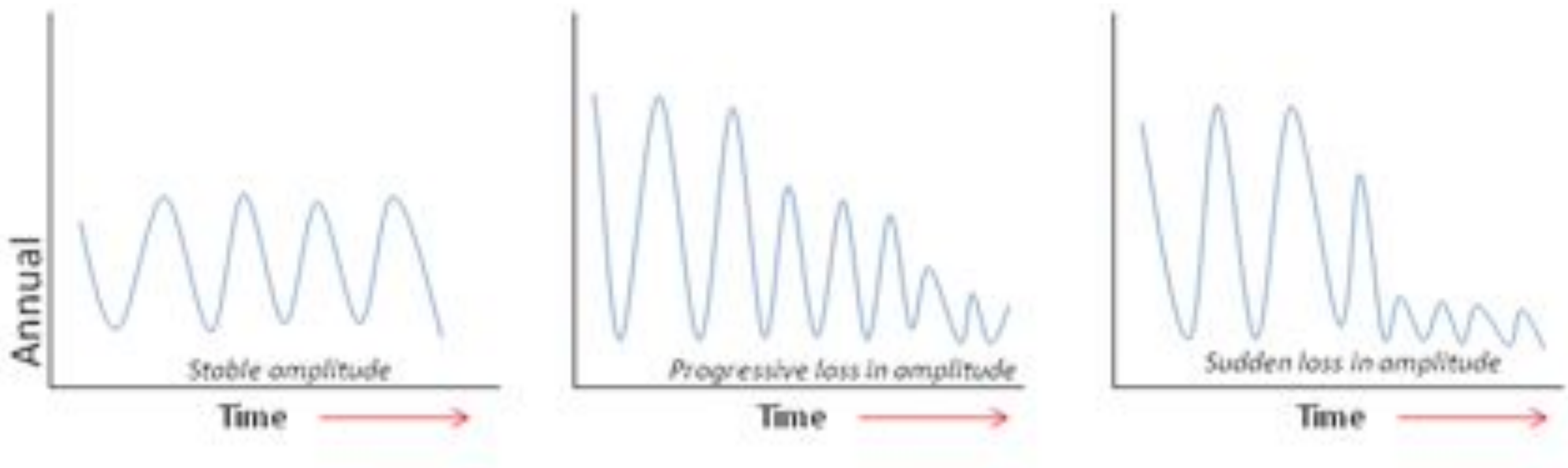
- Habitat mapping for specific species & plant communities. Also useful for conservation planning.
- Monitoring of wetland change –beyond “no net loss”
- Identifying groundwater fed systems
- Understand what the historic variability at the landscape level.
- Used to calibrate the climate hydrologic models for climate change predictions

Potential Uses

- Result will provide a unique dataset cataloguing changes to the hydroperiod for thousands of wetlands over 30-40 years across a broad spatial extent.
- The dataset will be used to calibrate the climate hydrologic models for climate change predictions
- Conduct dynamic change analysis.
- Other ideas?

Monitoring Changes to the Wetland Hydroperiod

- Increase the temporal resolution to conduct dynamic change analysis.



Monitoring Changes to the Wetland Hydroperiod

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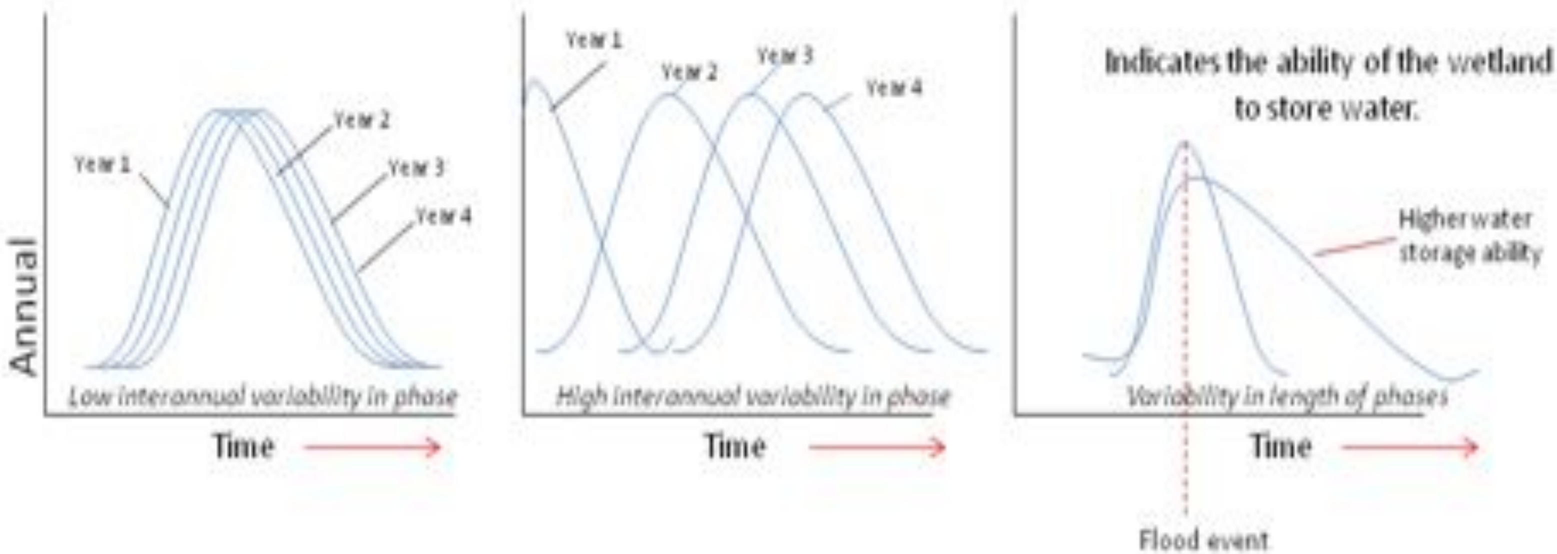
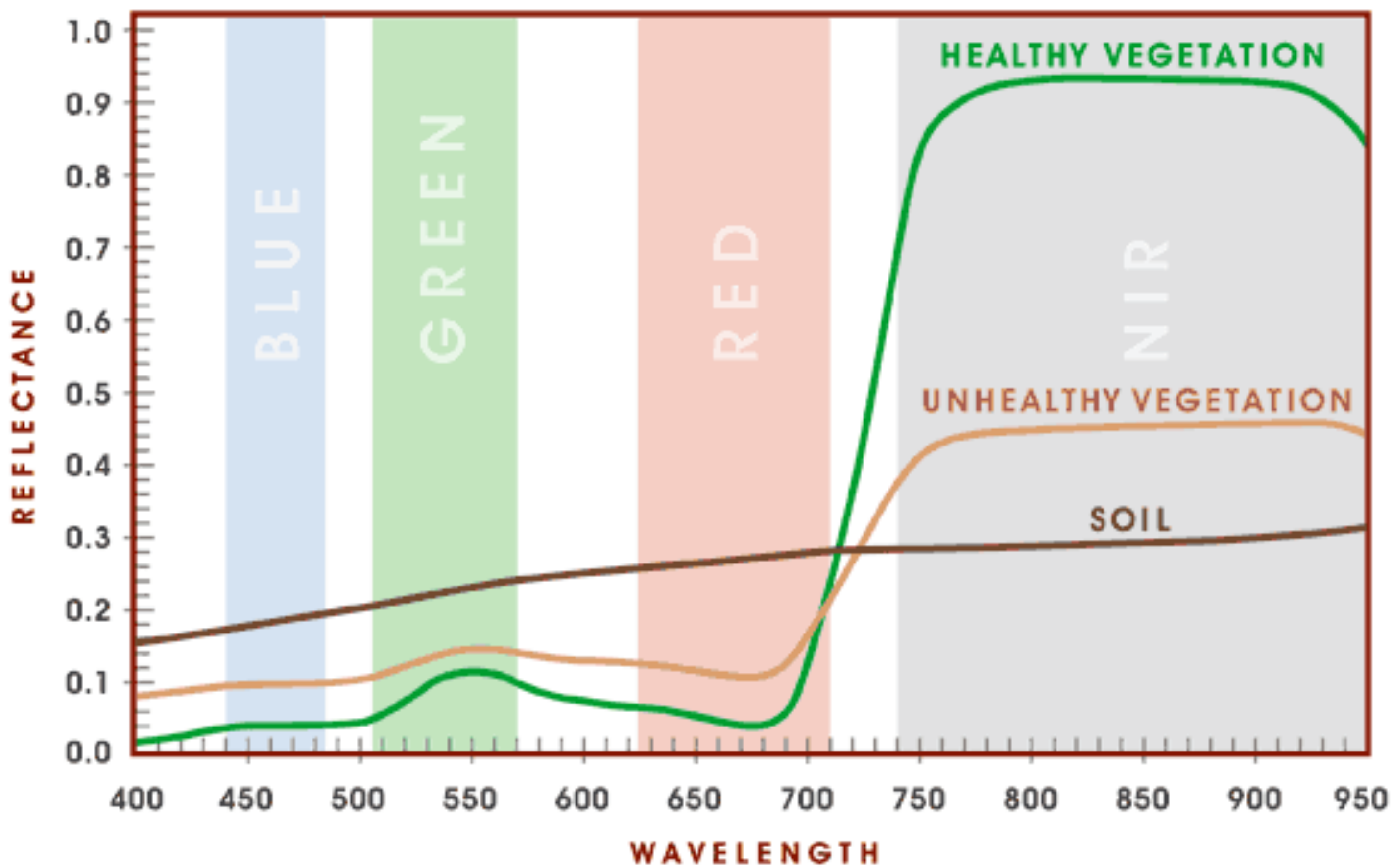
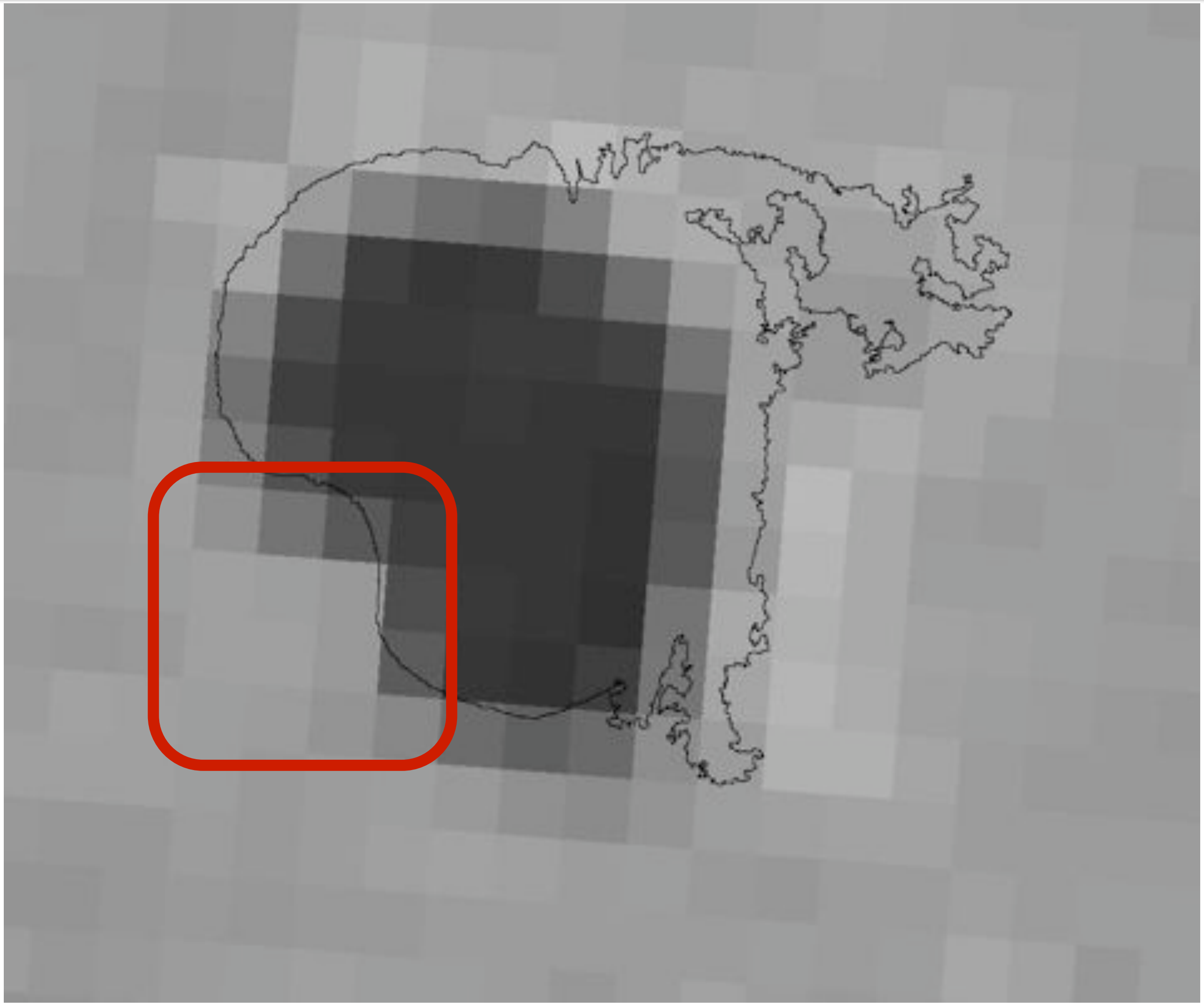


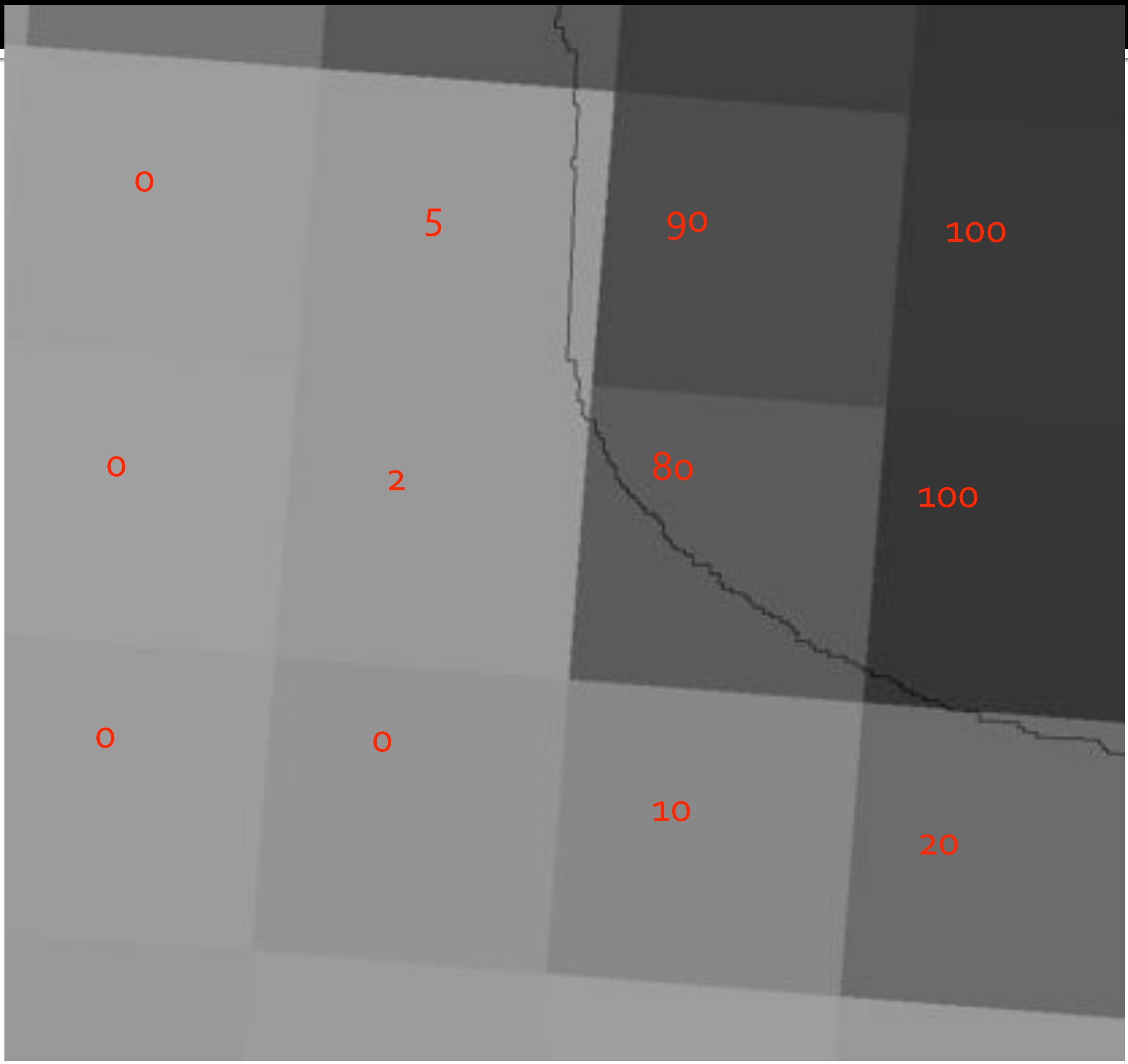
Spectral Mixture Analysis



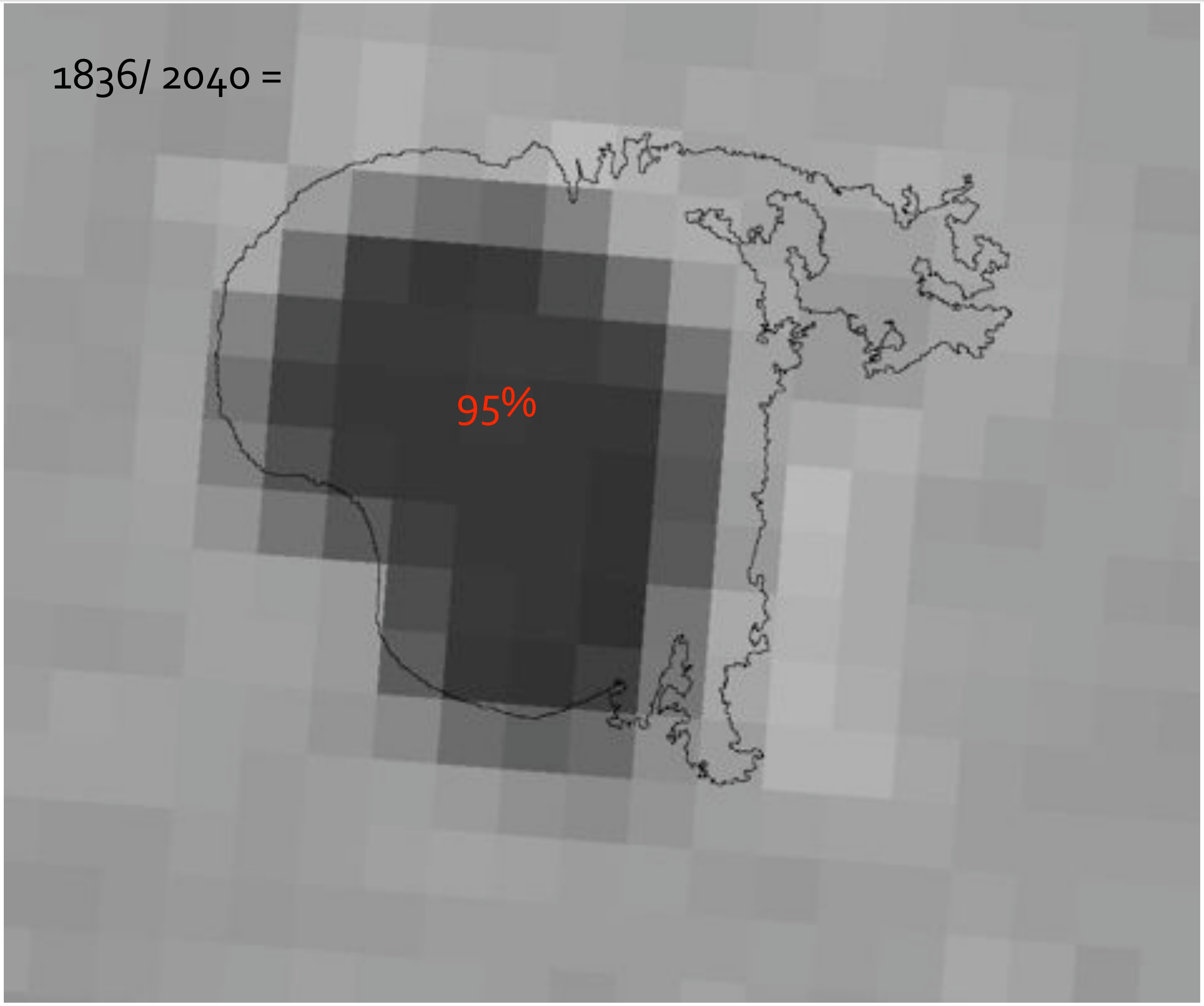
Spectral Mixture Analysis



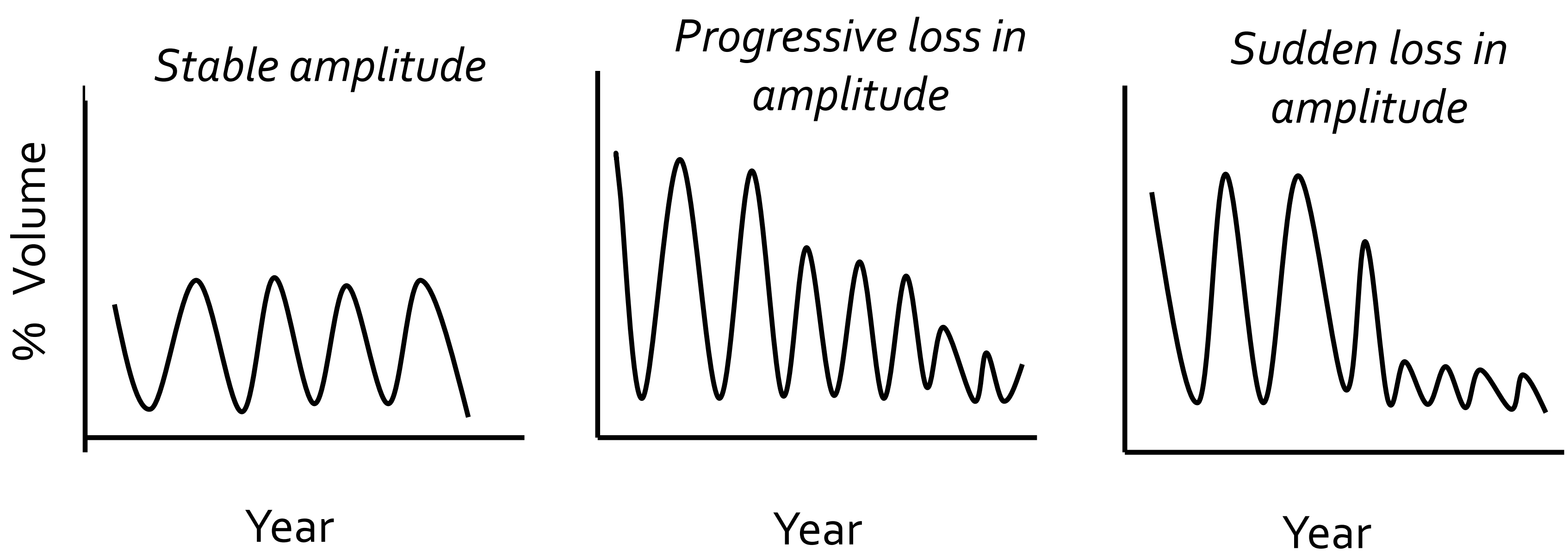
Spectral Mixture Analysis



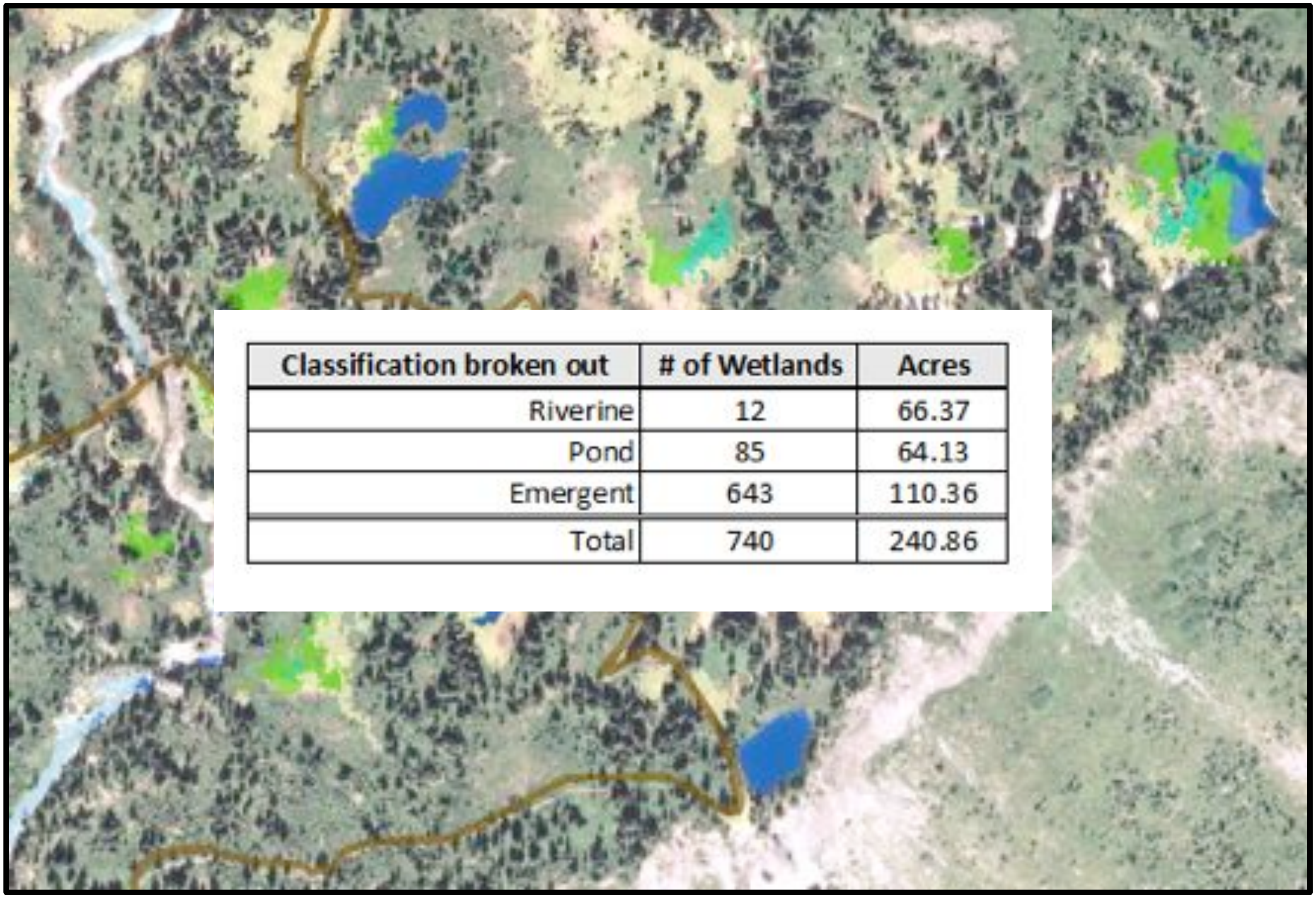
Percent Inundated for each date



Wetland hydrology



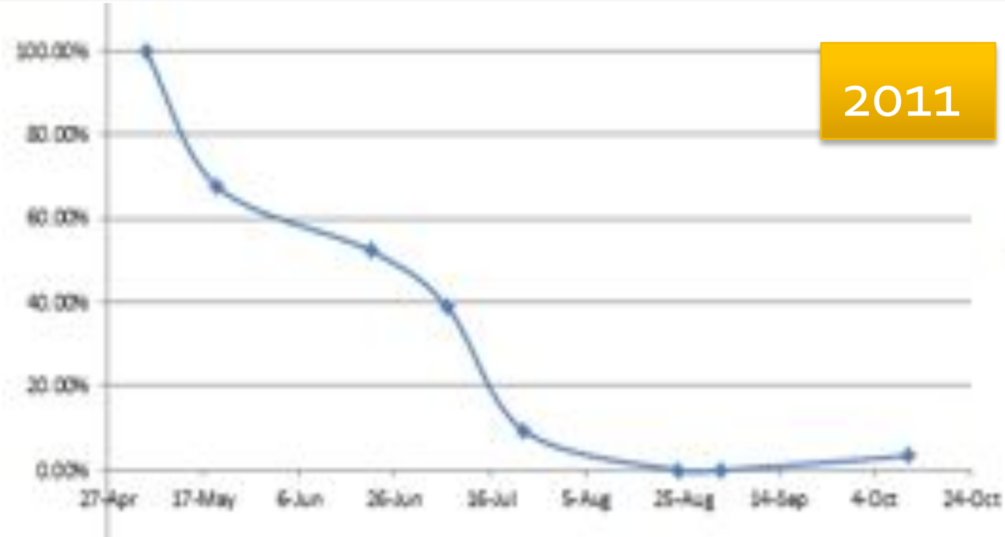
Preliminary Results



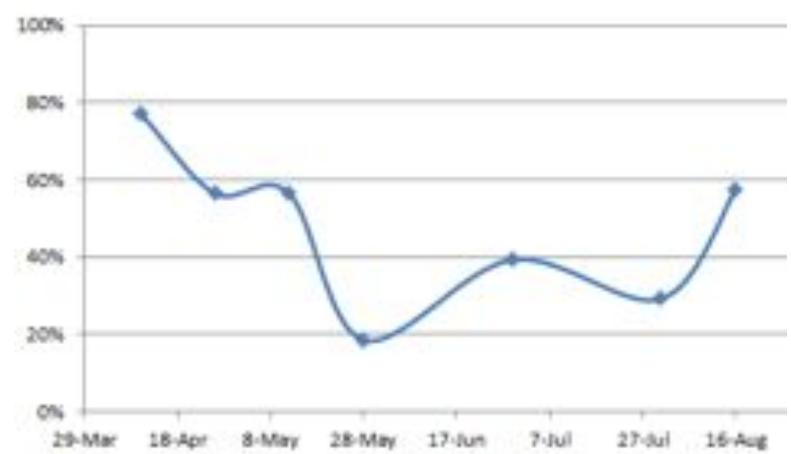
Classification broken out	# of Wetlands	Acres
Riverine	12	66.37
Pond	85	64.13
Emergent	643	110.36
Total	740	240.86

Comparison Between Years

Wetland 25
(0.94 acres)



2011



2005

Object-based image analysis (OBIA)

Mt. Rainier Inputs

- 2006 aerial imagery
- Lidar intensity
- Surface model
- Ground model
- Roads layer
- Trails layer
- Slope index