

Can We Conserve Wetlands Under a Changing Climate?

Mapping Wetland Hydrology Across an Ecoregion and Developing Climate Adaptation Recommendations

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Wetlands provide important ecosystem services.



Challenges of modeling wetland ecosystems.

- Wetlands are dynamic.
- Wetlands are diverse. = Lack of adequate baseline data
- Wetlands vary in size.

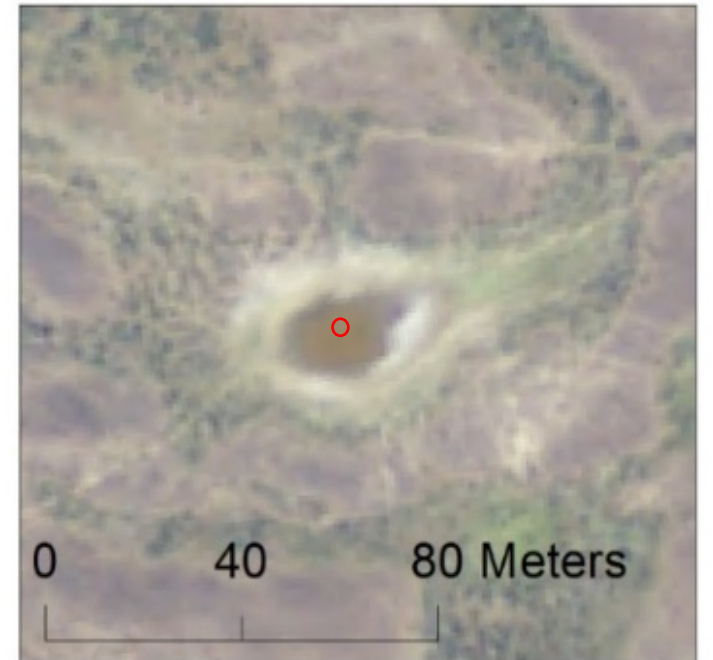
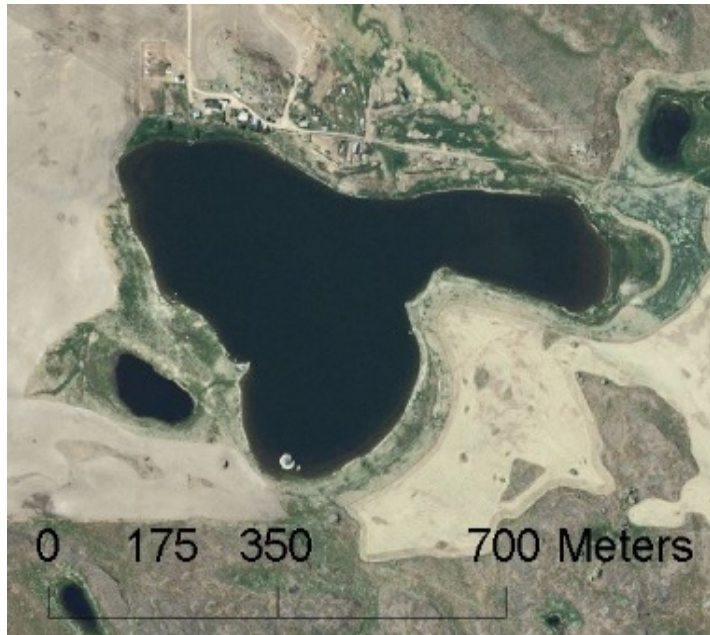


The Wetland Continuum

- Euliss et al (2004)

Ground Water

Surface Water

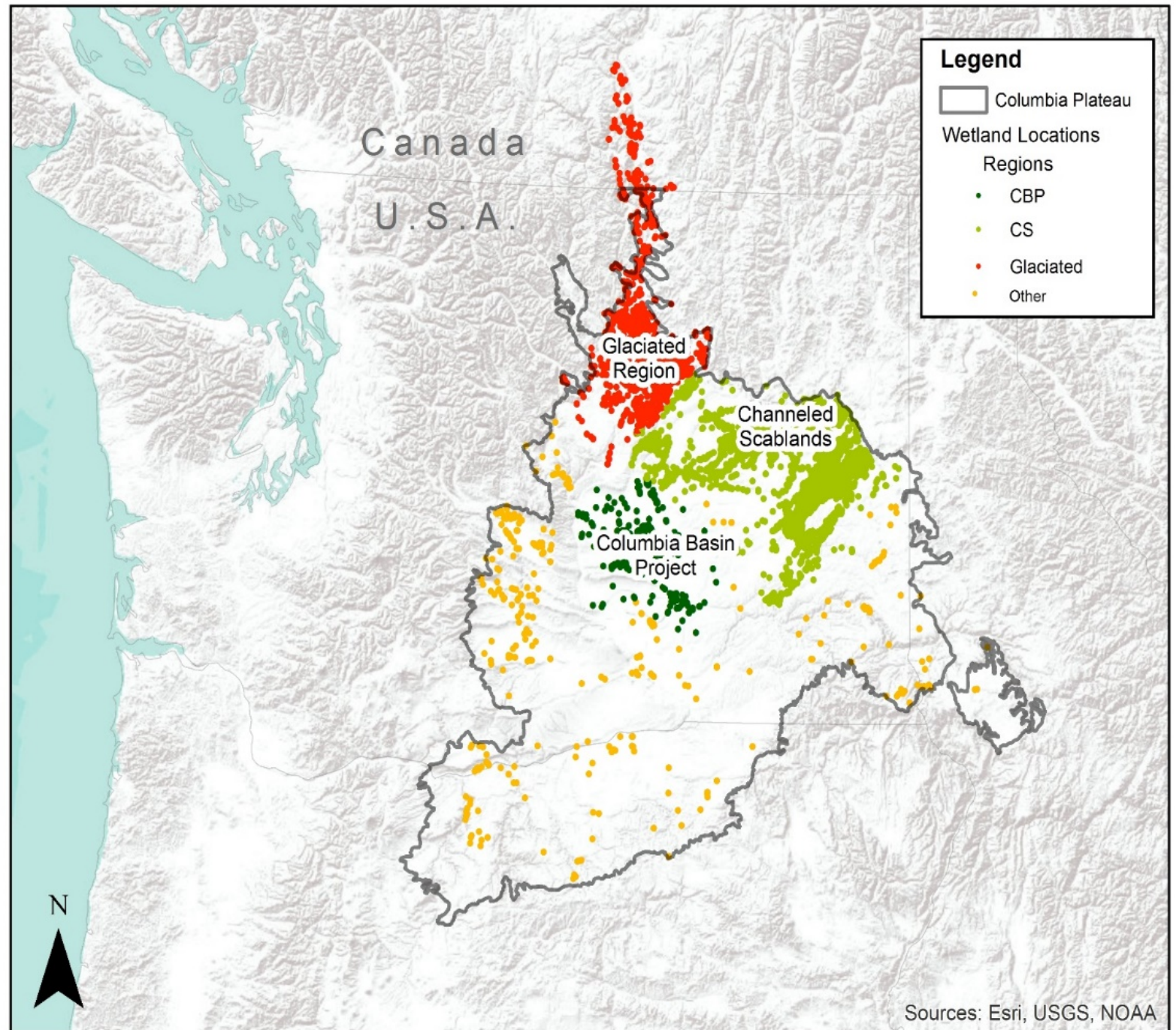


How will wetland hydrology change in the future?

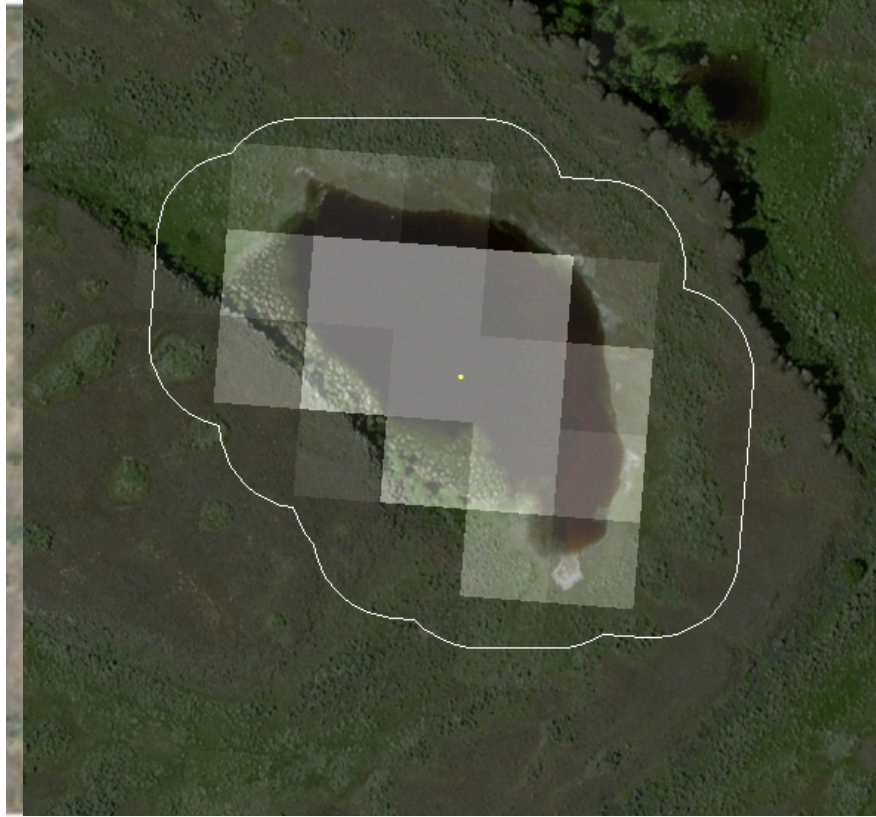
- 1.)** Develop a large baseline dataset using new remote sensing methods to reconstruct the flooding and drying patterns for individual wetlands.
- 2.)** Relate this dataset to historical climate and make future climate change projections.
- 3.)** Work with wetland practitioners from start to finish.

Study Area: Columbia Plateau

- Depressional wetlands

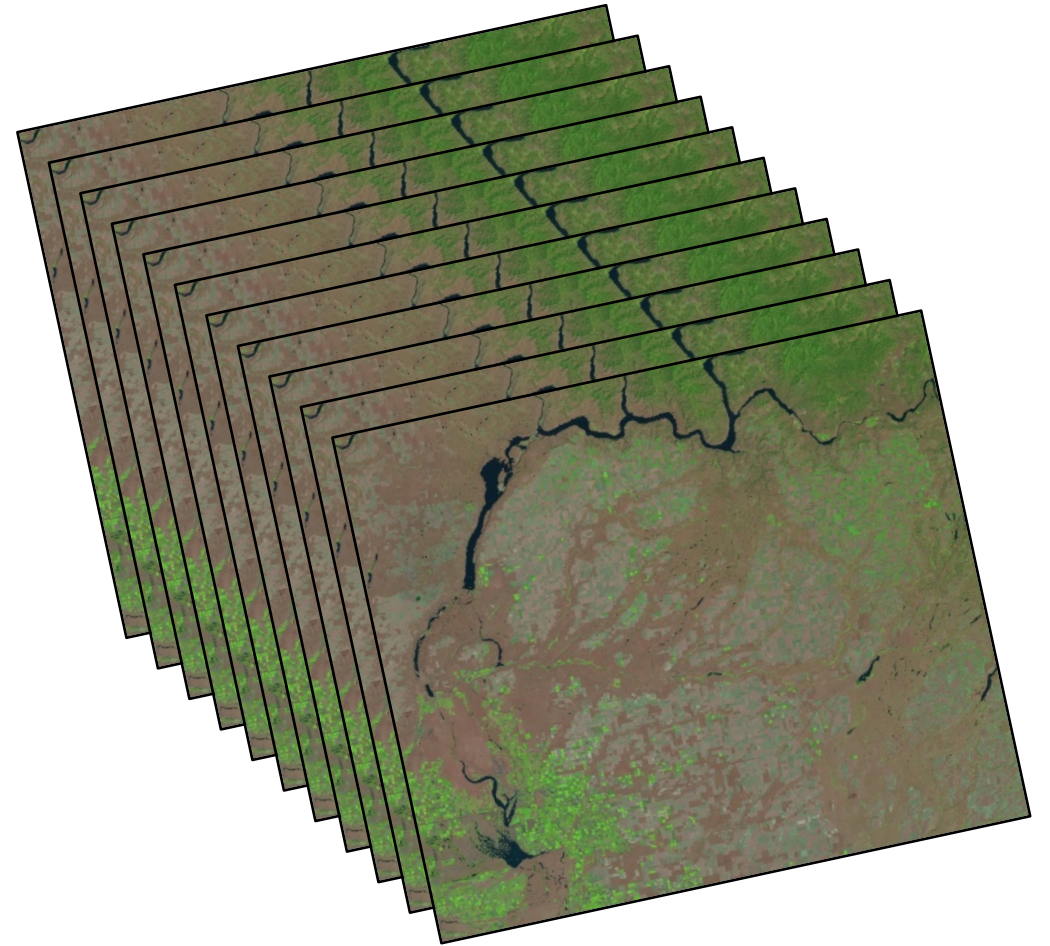


Remote Sensing Methods



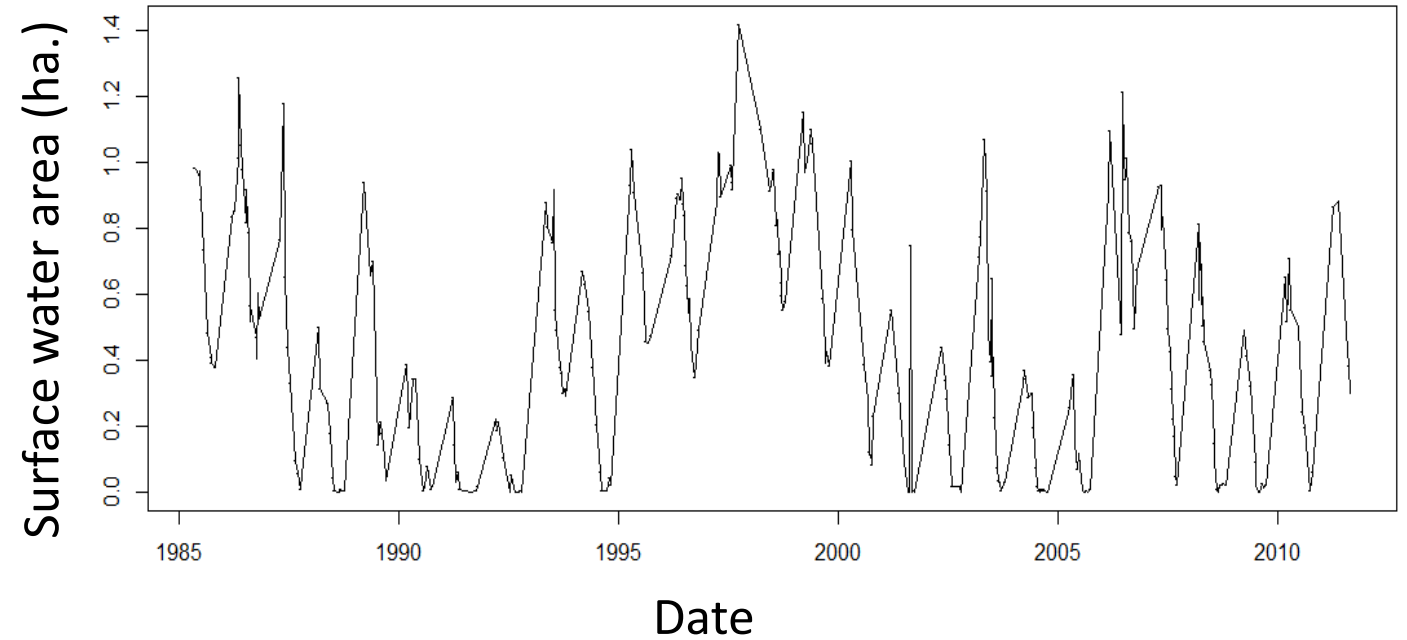
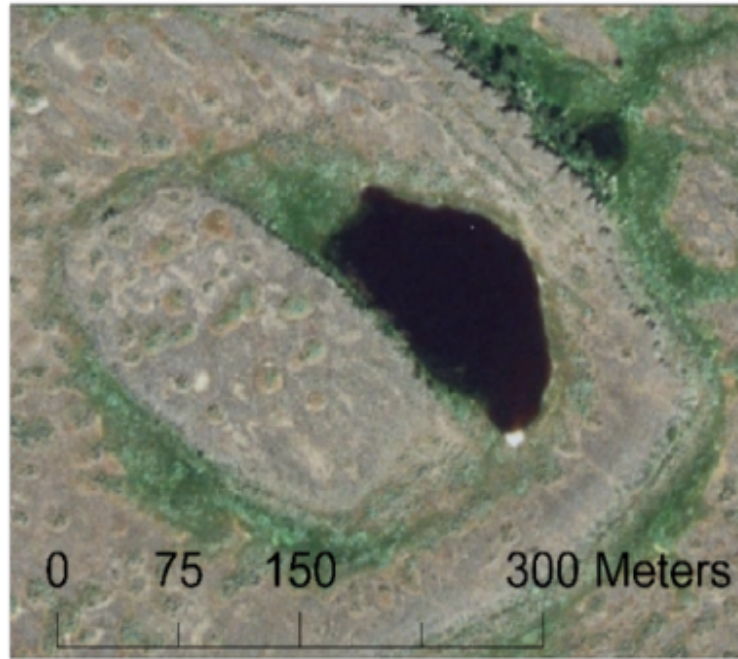
Computer aided pattern recognition

+



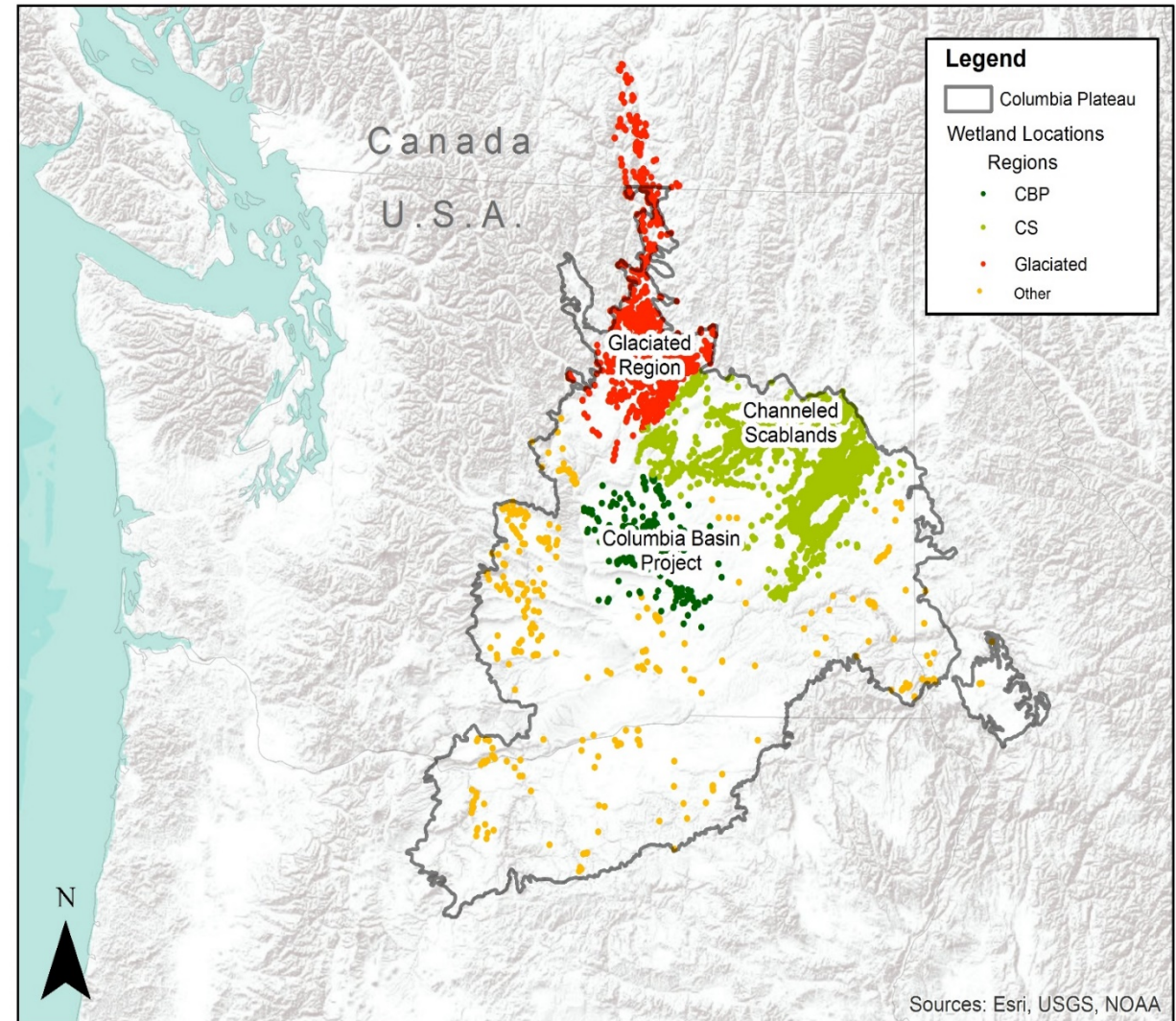
Landsat satellite archive (1984 – 2011) to measure changes in surface water for each wetland.

Surface water area hydrograph of a wetland



Wetland dataset

- sample size (> 5,000)
- temporal extent (27 years)
- frequency (~ 16 days)
- spatial scale (<30m)



Variable Infiltration Capacity (VIC) model

Hydrologic projections at **multiple scales**

simulates **back** 90 years

simulates **forward** to 2080s

*

Estimates soil moisture layers

*

Developed a variable that served as a groundwater
proxy

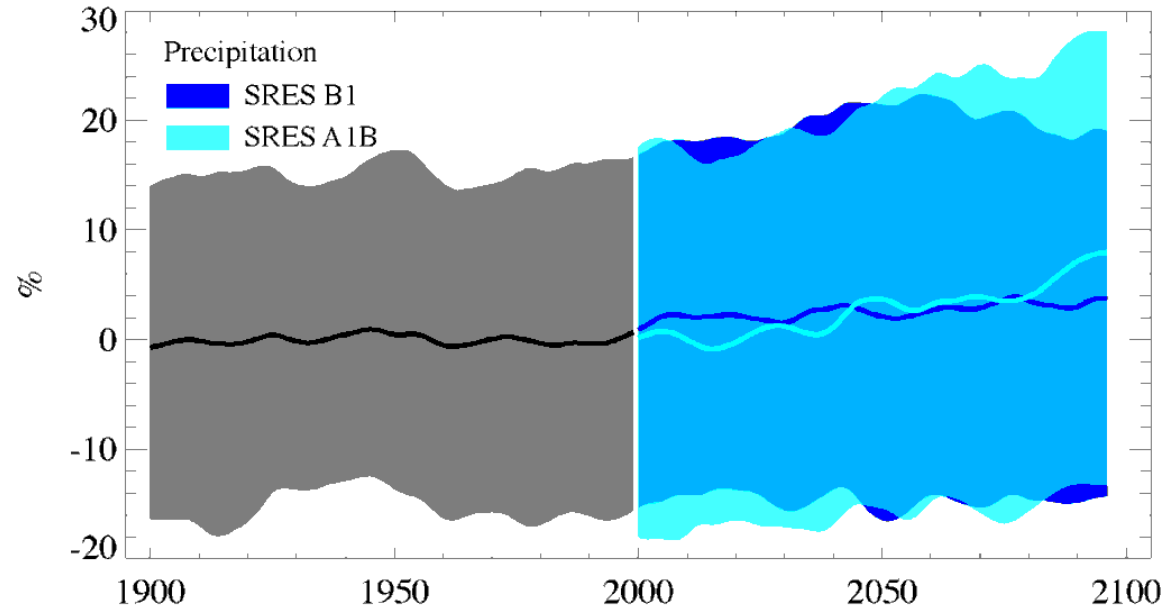
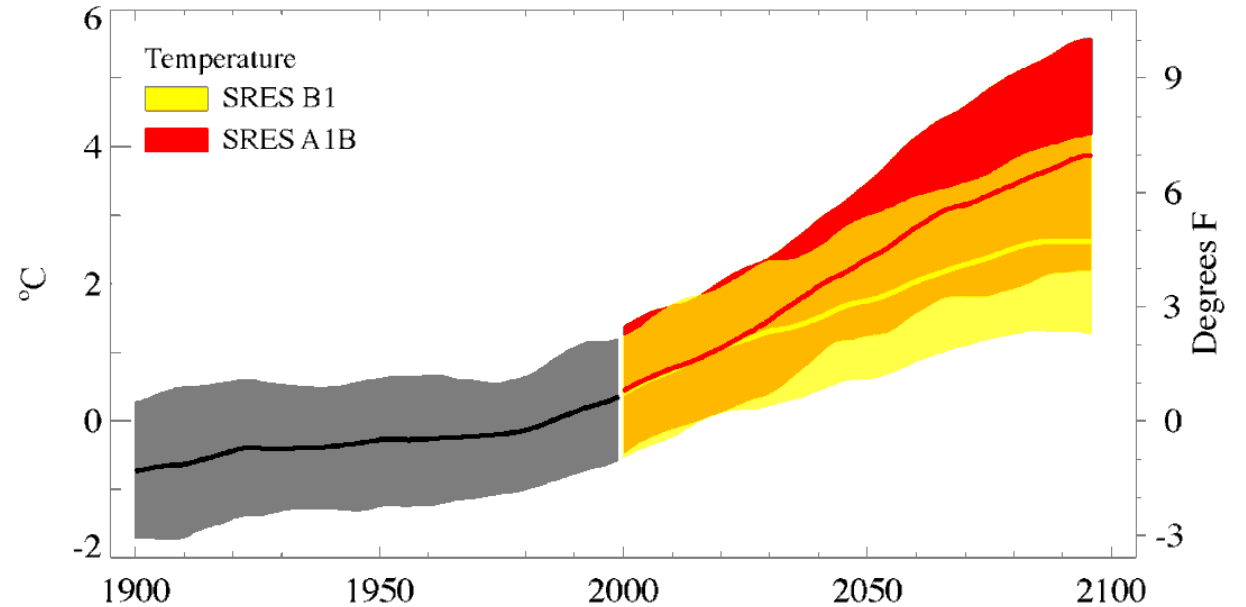
Climate modeling

A1B scenario 2080s:

- air temperature increase by 5.3°F (2.8-9.7°F)
- annual precipitation increase by 4%.

Wetter warmer winters

Hotter drier summers



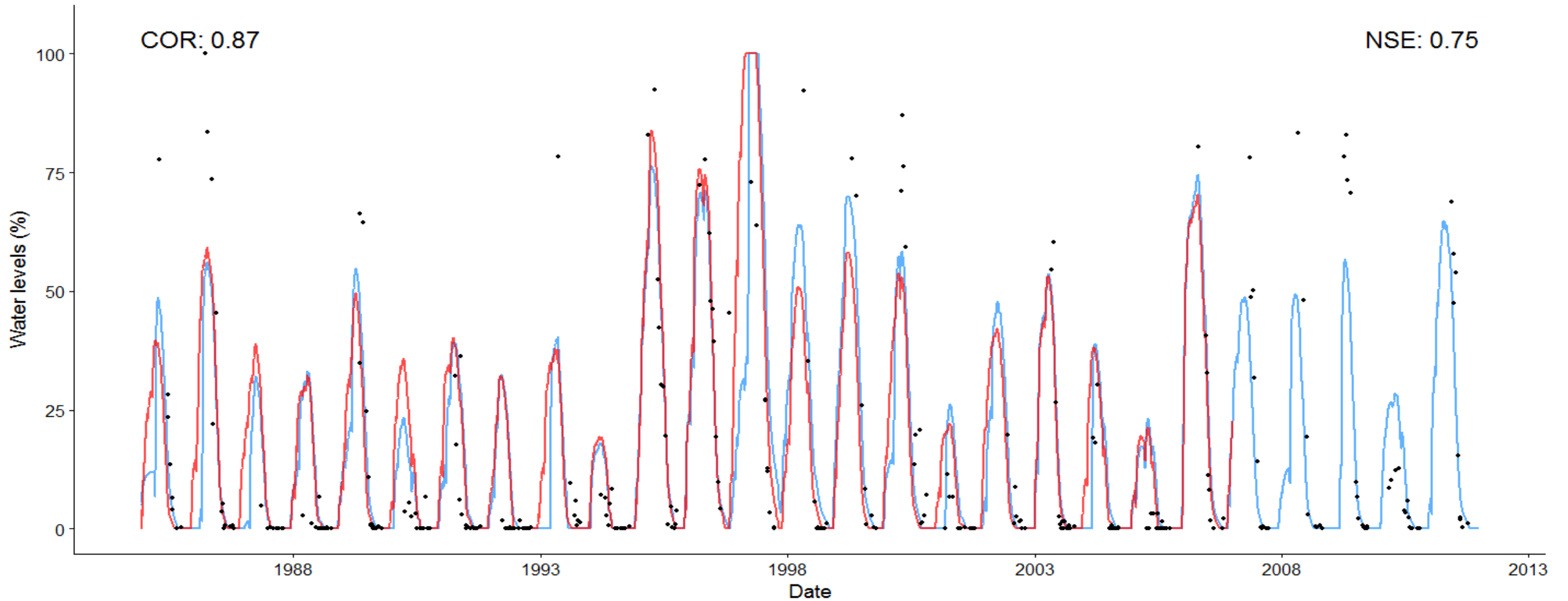
How will wetlands change in the future?

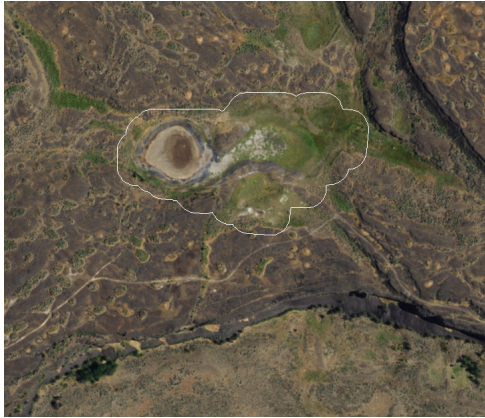
- Water quantity
- Drying frequency
- Distribution of wetland types



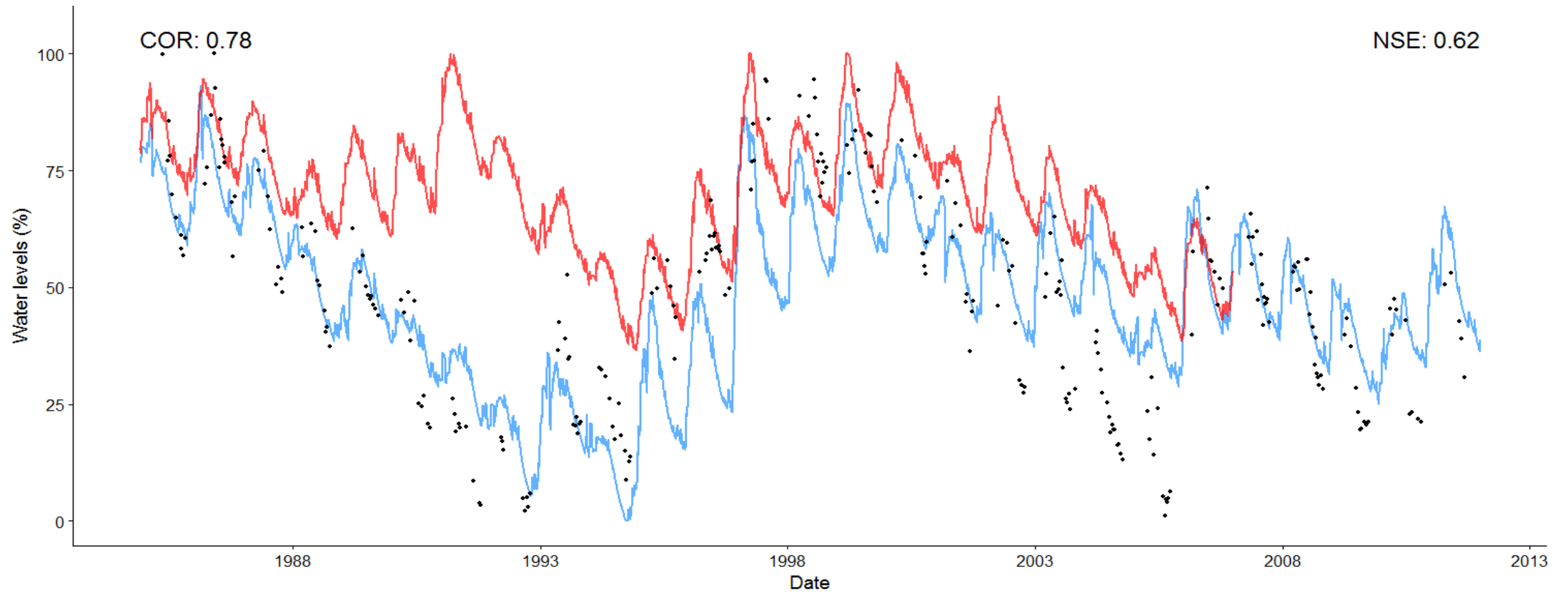


Example of a Seasonal Wetland



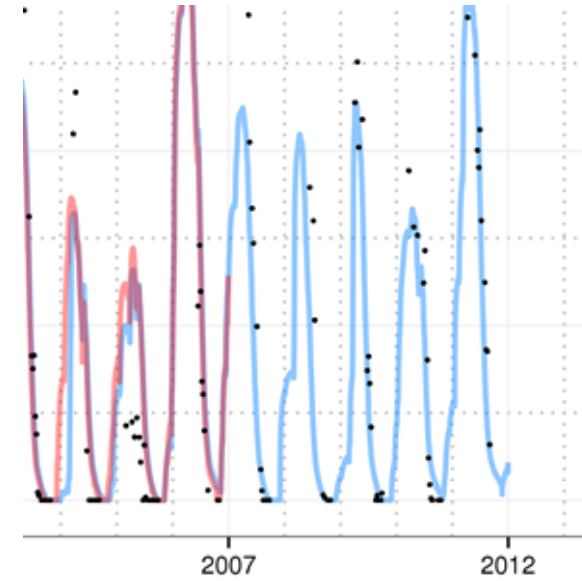
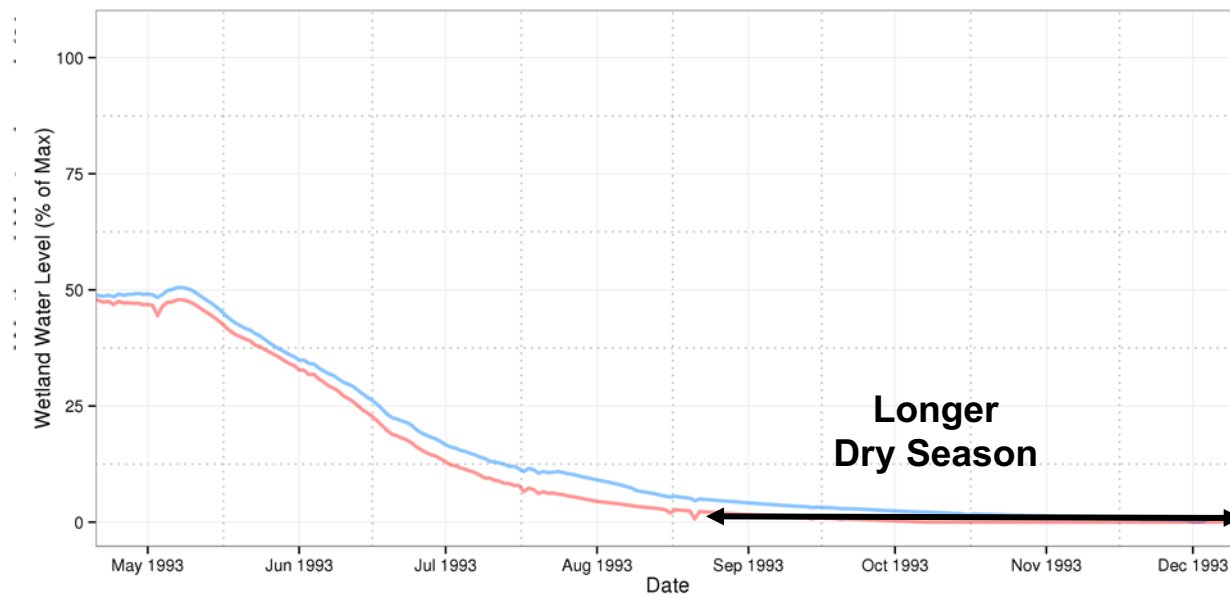
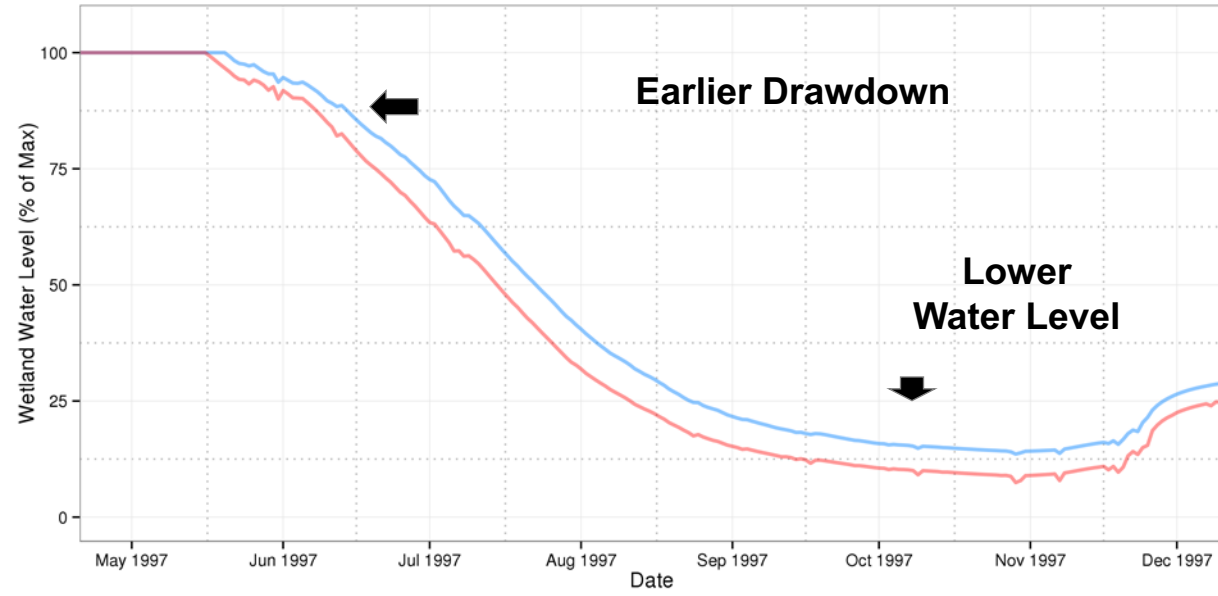


Example of a Semi-Permanent Wetland





Seasonal Wetland



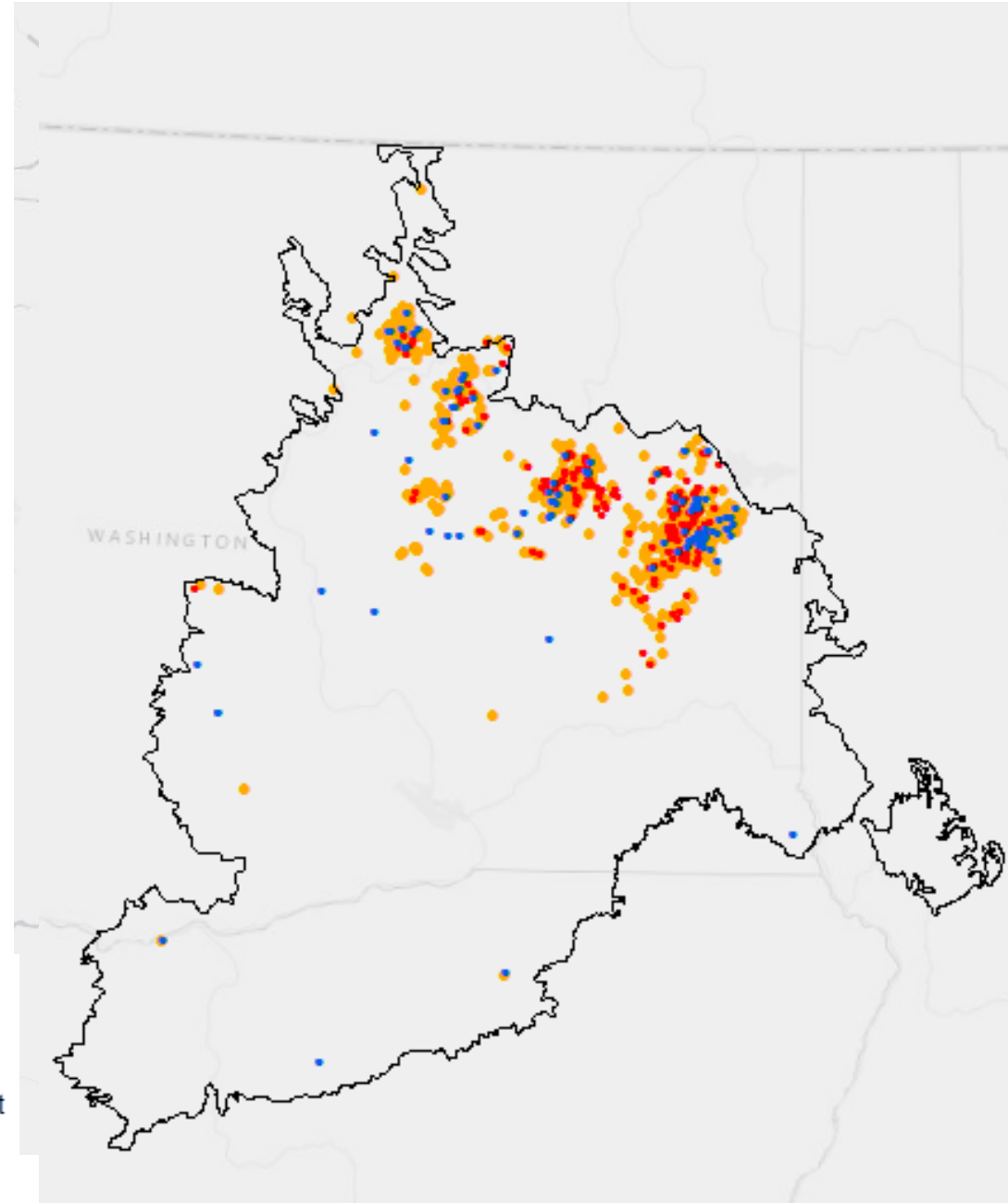
Climate modeling

Limitations:

- Can't model wetlands with large human impacts
- Can't perfectly model groundwater
- Reduces dataset to ~ 1,700 wetlands (1/3 of all wetlands).

Legend

- Seasonal
- Semi-Permanent
- Permanent

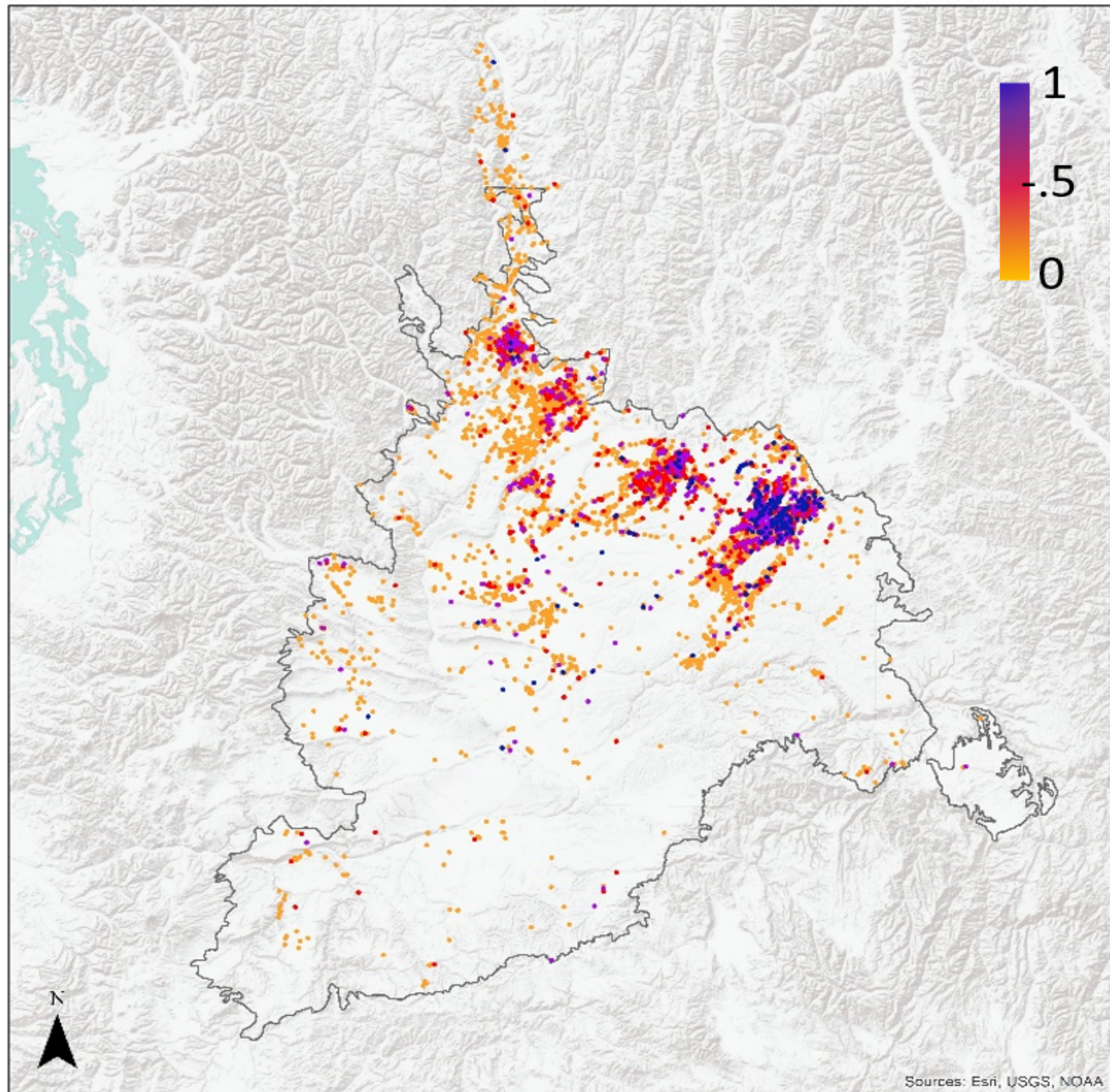


Results



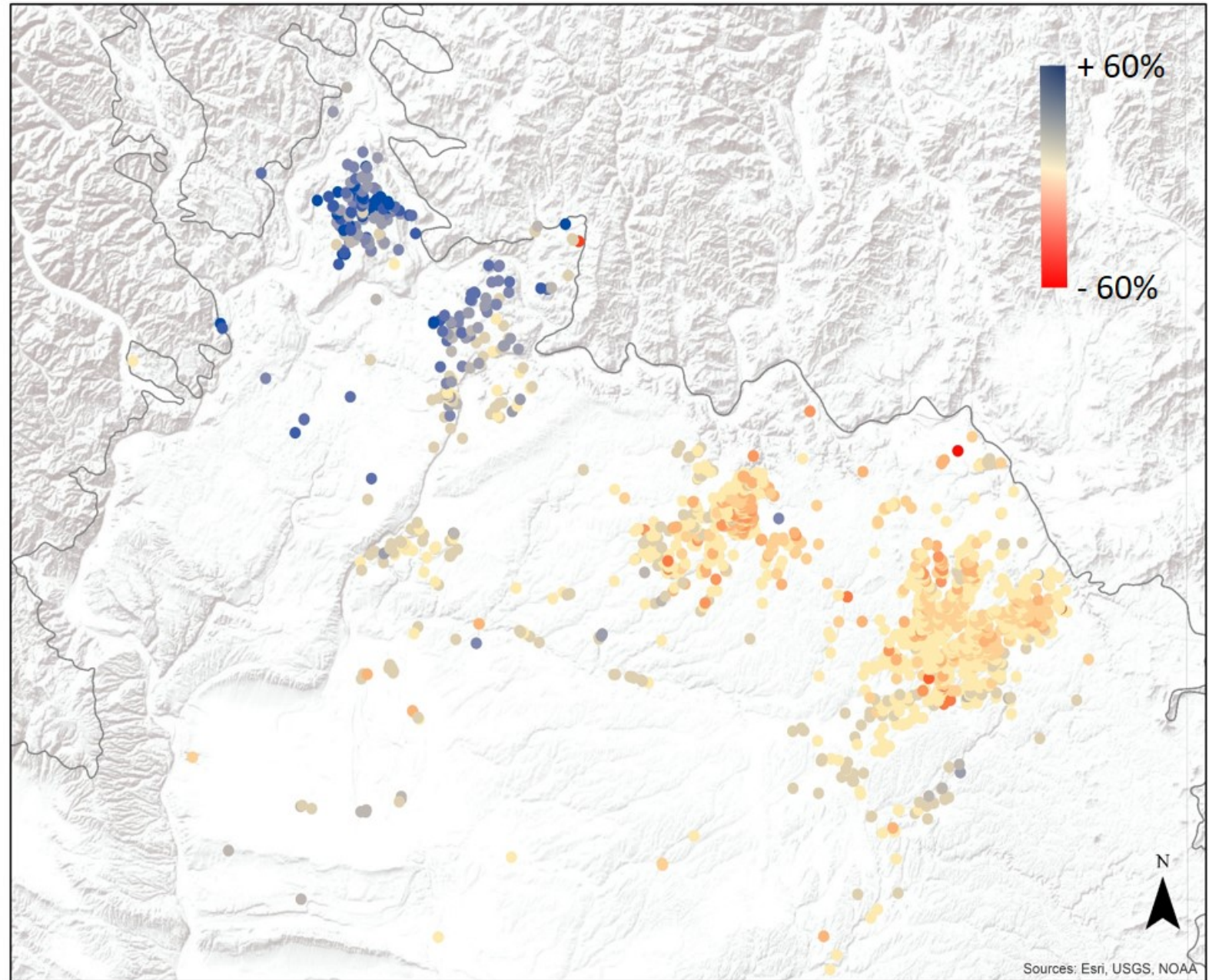
How well does
the model
work?

Site-specific
regression
model fit
(R^2)



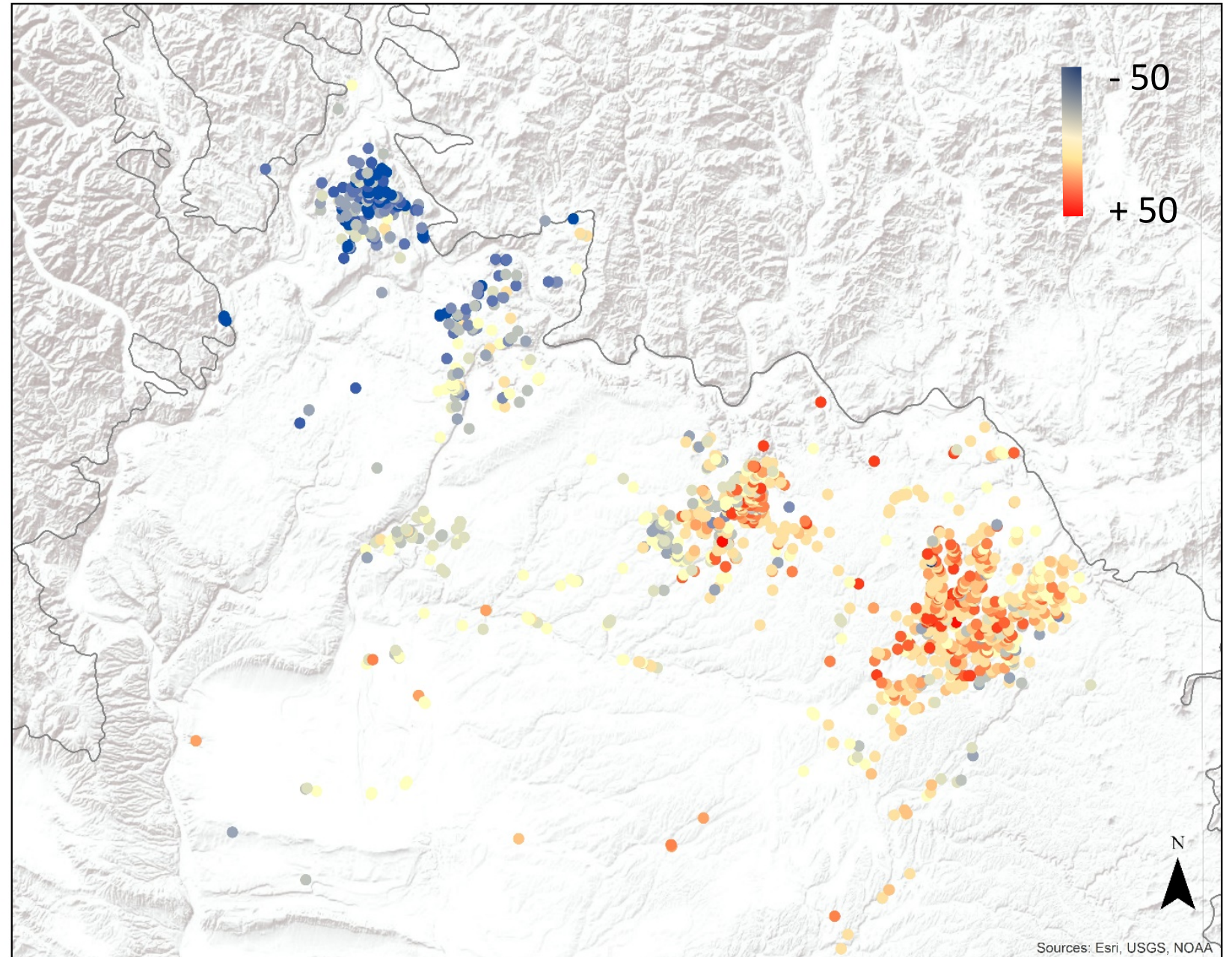
How will
wetland
hydrology
change?

Change in
max. annual
surface
water area
(%)

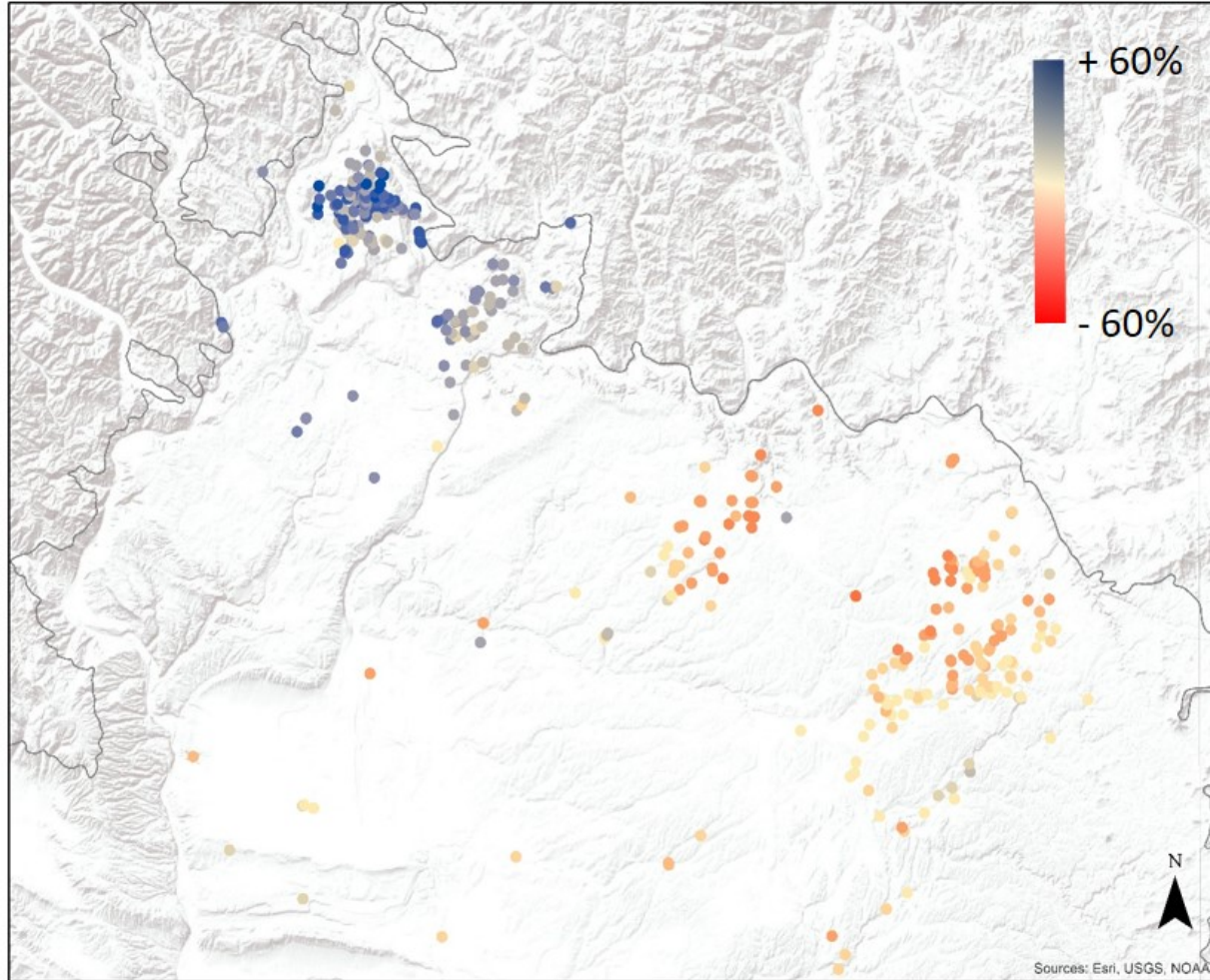


How will
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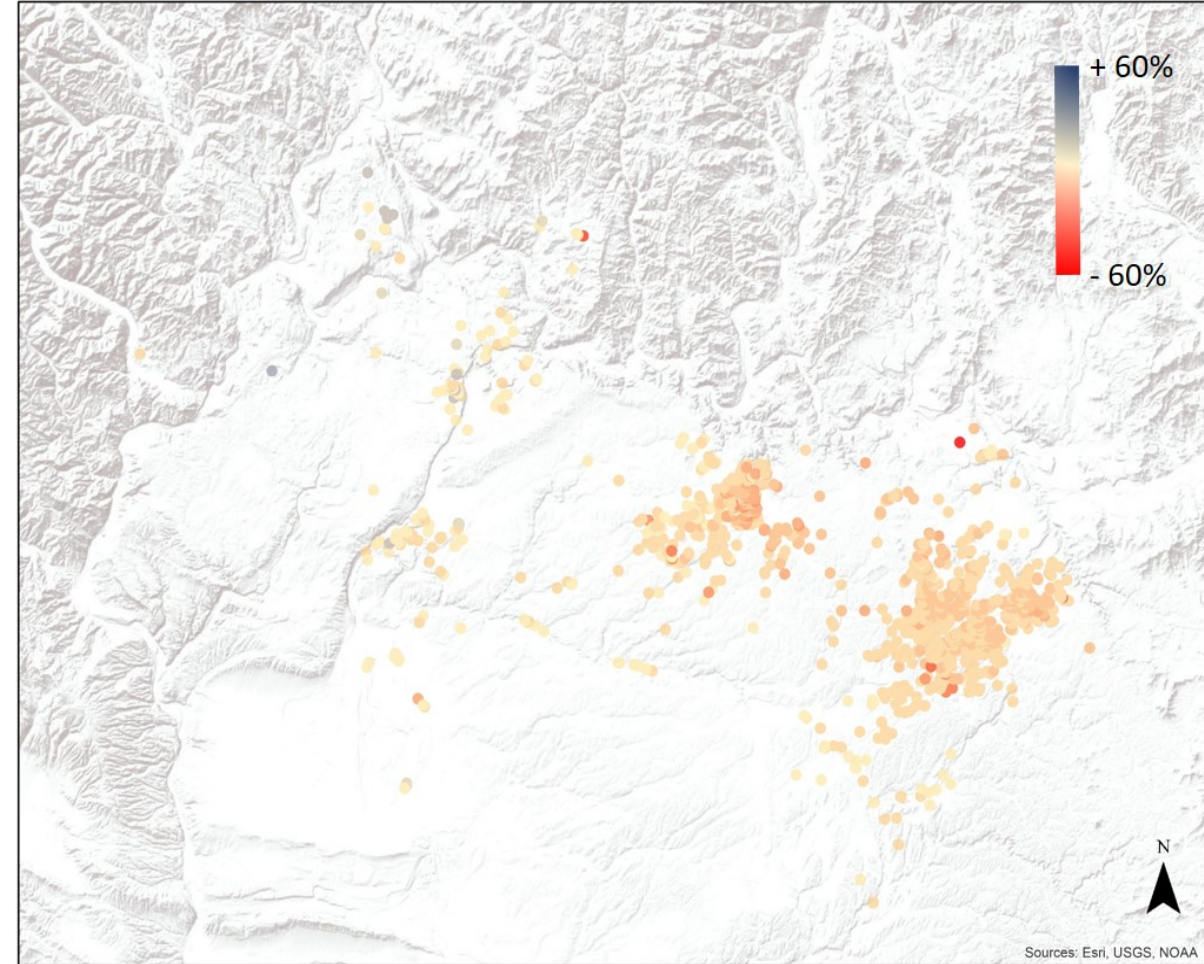
Change in
drying
frequency
(years out of
100)



Groundwater driven

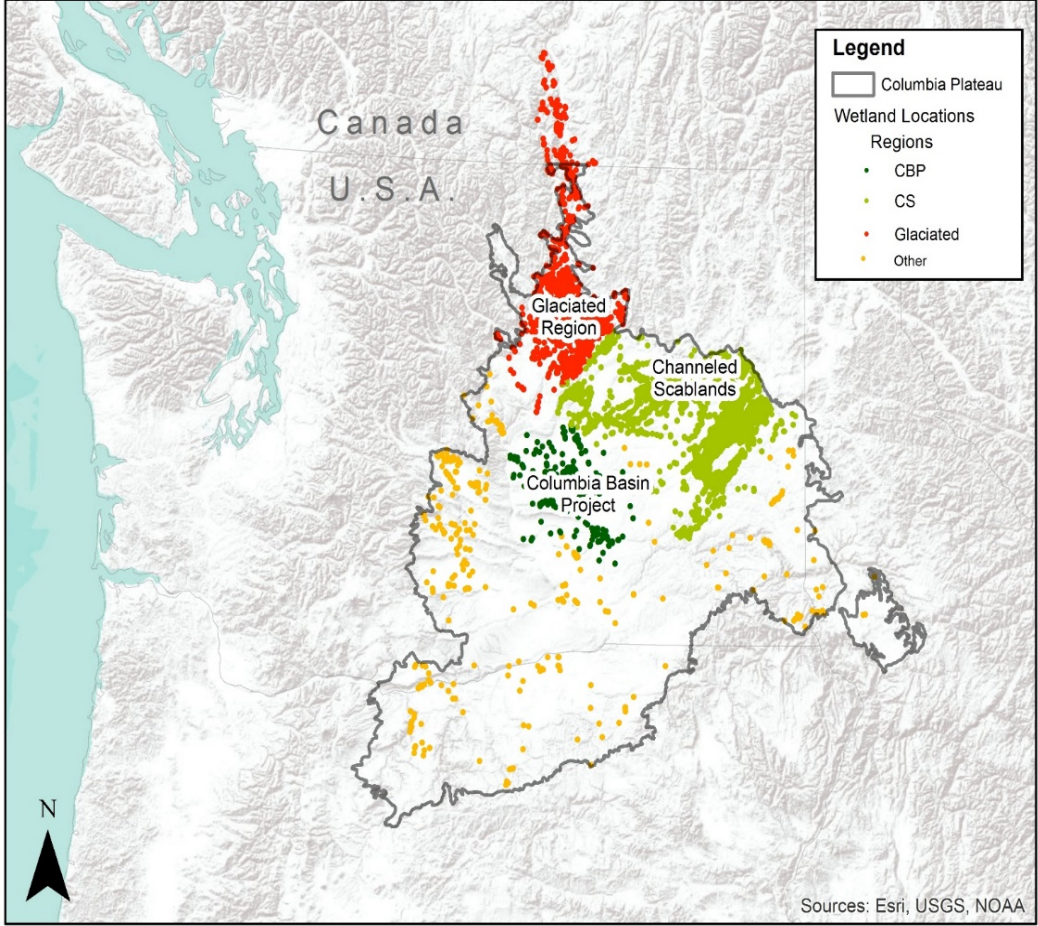
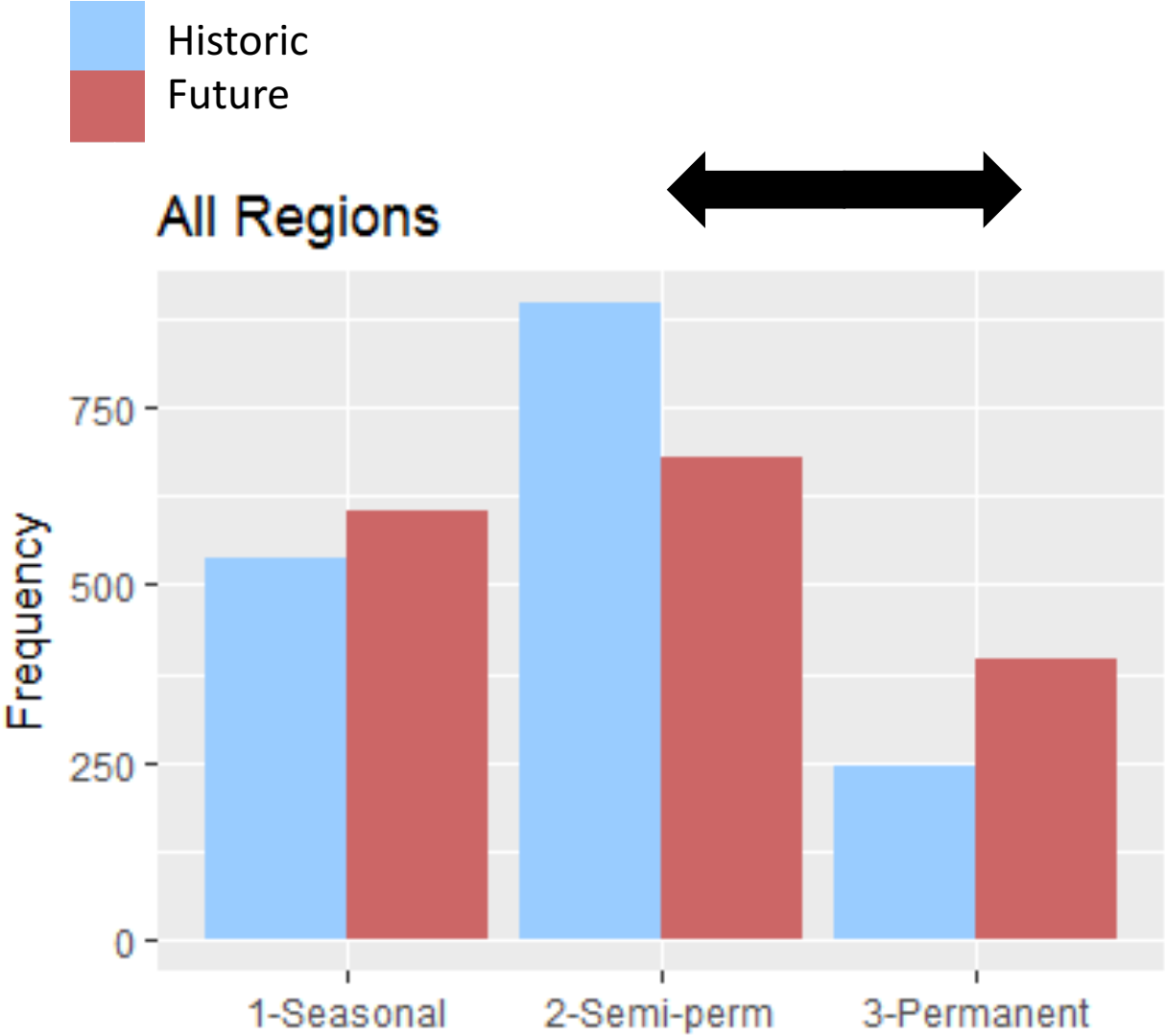


Surface water driven

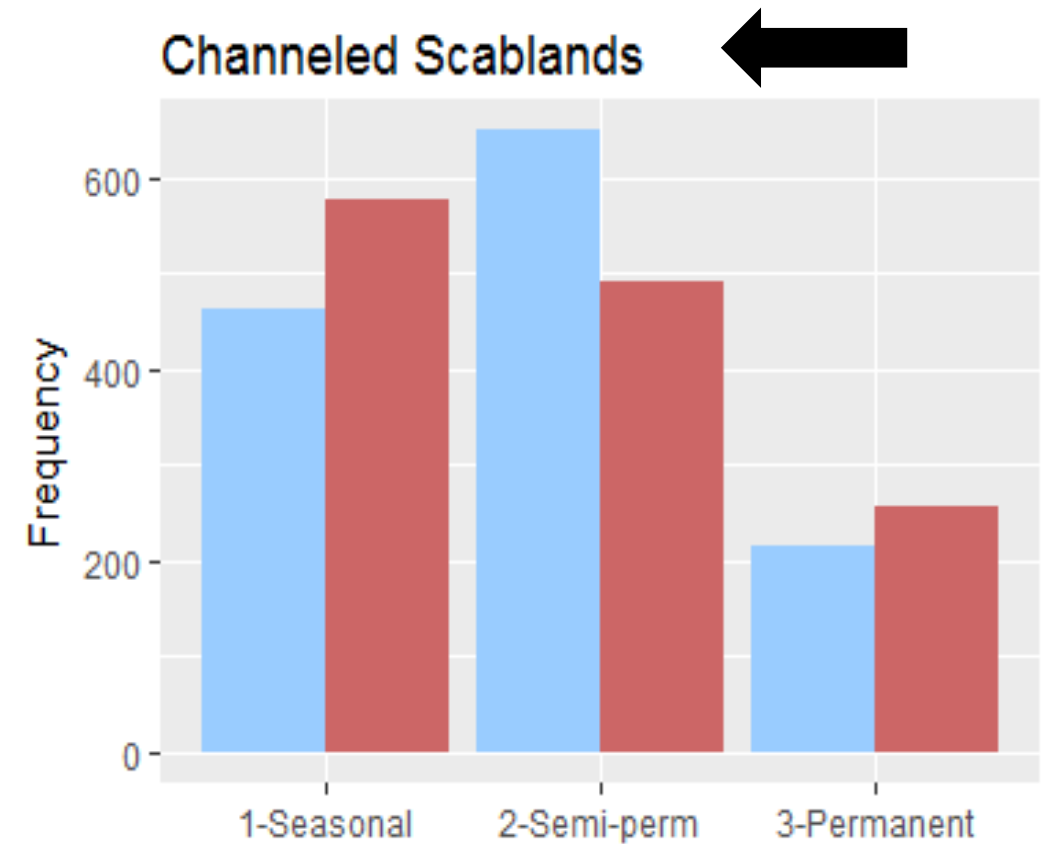
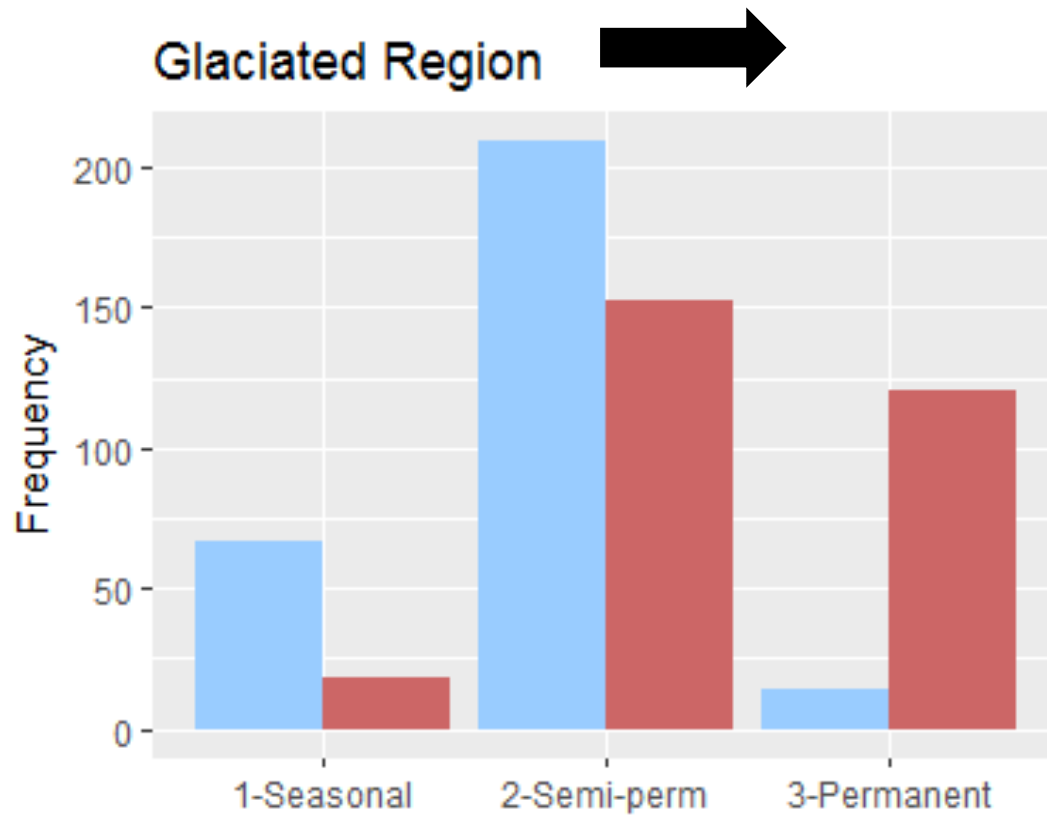
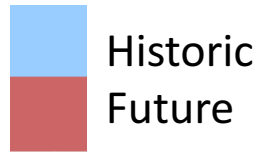


Change in max. annual surface water area (%)

Change in Distribution of Wetland Types



Change in Distribution of Wetland Types



What do we know now?

- Wetlands are dynamic and diverse, but we have tools to capture this variability and can use them to monitor hydrologic changes.
- Not all wetlands will get drier – instead there will be a more complex response to climate. Some wetlands will get wetter, some will get drier, and some will not change much.
- Climate change impacts will be different for wetlands than the surrounding upland.
- Groundwater driven wetlands can store increases in winter precipitation. But there is increasing pressures on groundwater.

Second wetland practitioner workshop

Every wetland practitioner had a different management/ policy goal:

- Cattle ranching
- Cultural resources
- Migratory birds
- Amphibians
- Hunting
- Policy goals
- Rare plants ...



How to access this data?

<https://lccnetwork.org/news/conserving-wetlands-under-changing-climate-columbia-plateau>

A story map

Can We Conserve Wetlands Under a Changing Climate?

Historical Changes in Hydrology (1984 - 2011)

Since 1984, wetlands in the Glaciated region and parts of the Channeled Scablands of the Columbia Plateau have decreased in annual mean surface water area, while wetlands in the Channeled Scablands either have not had a dramatic change in annual mean surface water area, or have increased slightly. This pattern is strongly related to the spatial distribution of groundwater driven and surface water driven wetlands. In general, groundwater driven wetlands have decreased in mean surface water area, while surface water driven wetlands have increased in mean surface water area or have had little change in mean surface water area.

Zoom in to the map to see historical changes to surface water area for individual wetlands in the Columbia Plateau.

LEGEND

CP_Wetlands_v1 - Hydrology historic change (1984 - 2011)

prctmax

- 0.24 - 1.03
- 0.04 - 0.23
- 0.14 - 0.03
- 0.36 - -0.15
- 1.06 - -0.37

46127_00125	
ha	20.30
error	0.03
wetland	0.97
POINT_X	-119.29
POINT_Y	48.00
wid	46,613
Field1	7,148
WetlandID	46,613
slopemax	-0.0125
slopemean	-0.01
slopemin	-0.0097

USDA FSA, DigitalGlobe, GeoEye, Microsoft, CNES/Airbus DS | Esri... **POWERED BY esri**

Questions



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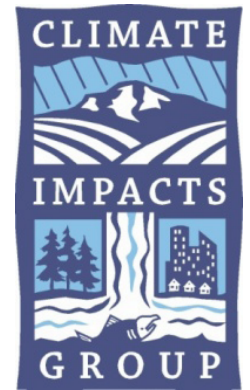
UW

Remote
Sensing &
Geospatial
Analysis
Laboratory

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- NW Climate Science Center
- UW Precision Forestry Cooperative

All data & the technical
report is available on
[Sciencebase.gov](https://sciencebase.gov)



How have wetlands changed?

Historical change in mean surface water area (%)

