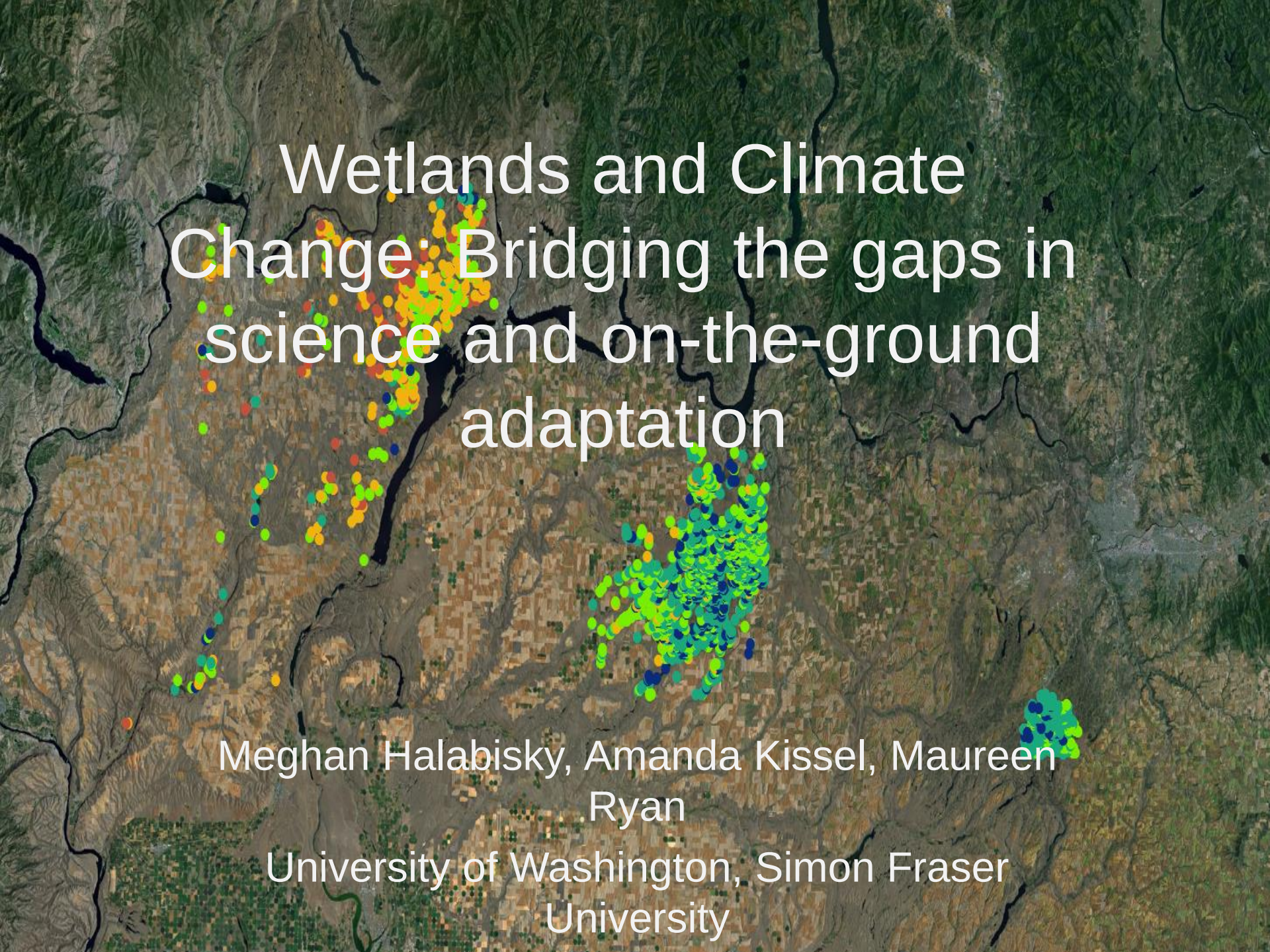


Wetlands and Climate Change: Bridging the gaps in science and on-the-ground adaptation

Meghan Halabisky, Amanda Kissel, Maureen Ryan

University of Washington, Simon Fraser University

Amanda
Kissel

Se-Yeun Lee

Maureen Ryan

Meghan Halabisky

Alan Hamlet

Noll Steinweg, Reed McIntyre,
Rae Parks, Mara Healy

Josh Lawler

Monika Moskal

Lara Hansen

Wendy Palen

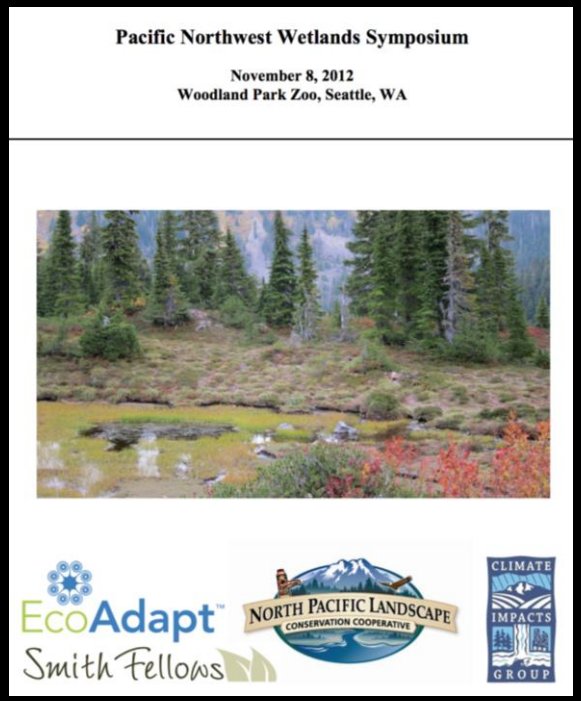
Mike Adams

Gina Rochefort

IPCC 2001: “regional inventories & management plans for wetlands at greatest risk from climate change”

IPCC 2007: “integrated large spatial-scale remote sensing with long-term field studies” of wetlands

Wetlands Adaptation Group



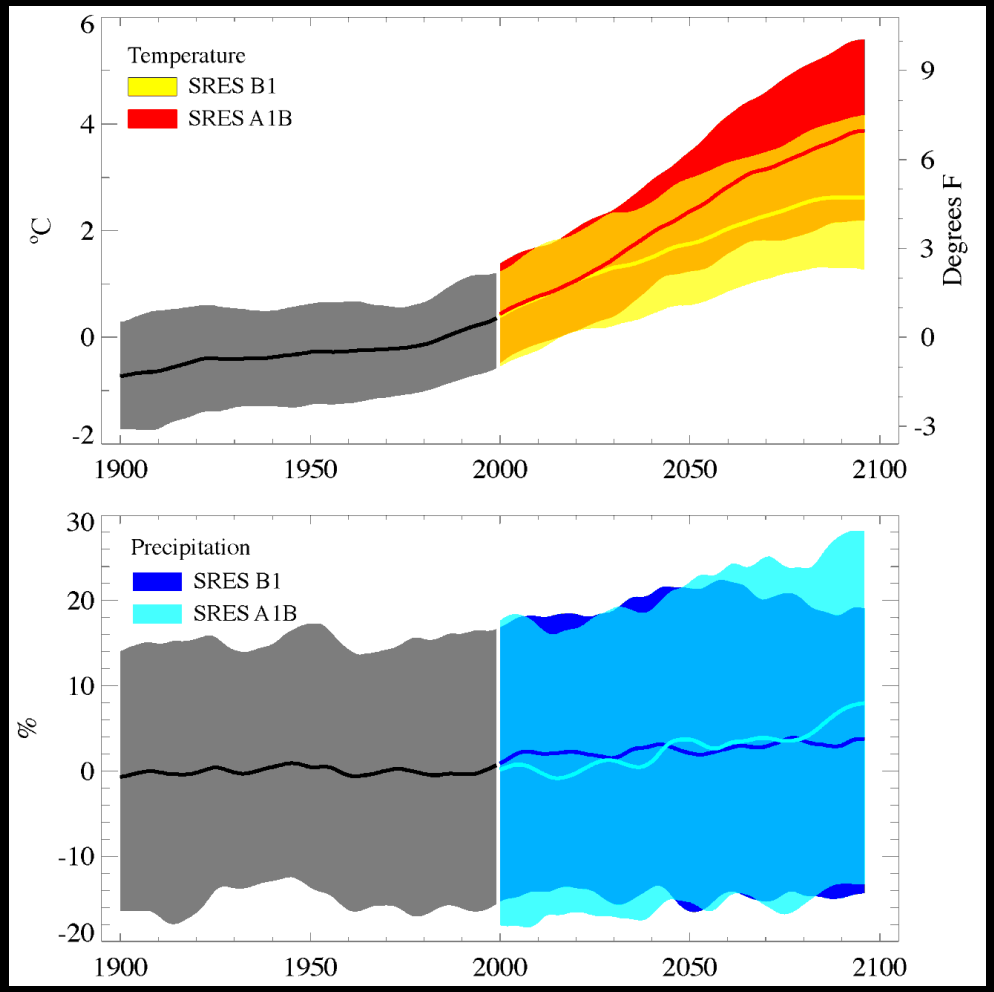
2 years →

Today's session:
What we've learned so far
Current applications
Your input on next steps

Key findings

- Promising new approaches & products
  - Mapping wetlands
  - Reconstructing historical hydrologic data
  - Modeling historical variability & climate impacts
- Continuing challenges
  - Data limitations & methodological hurdles
  - Wetland diversity! (awesome, and a challenge)
  - The “loading dock problem”

PNW Climate Model Consensus



Strong Warming in all Seasons, Especially Summer

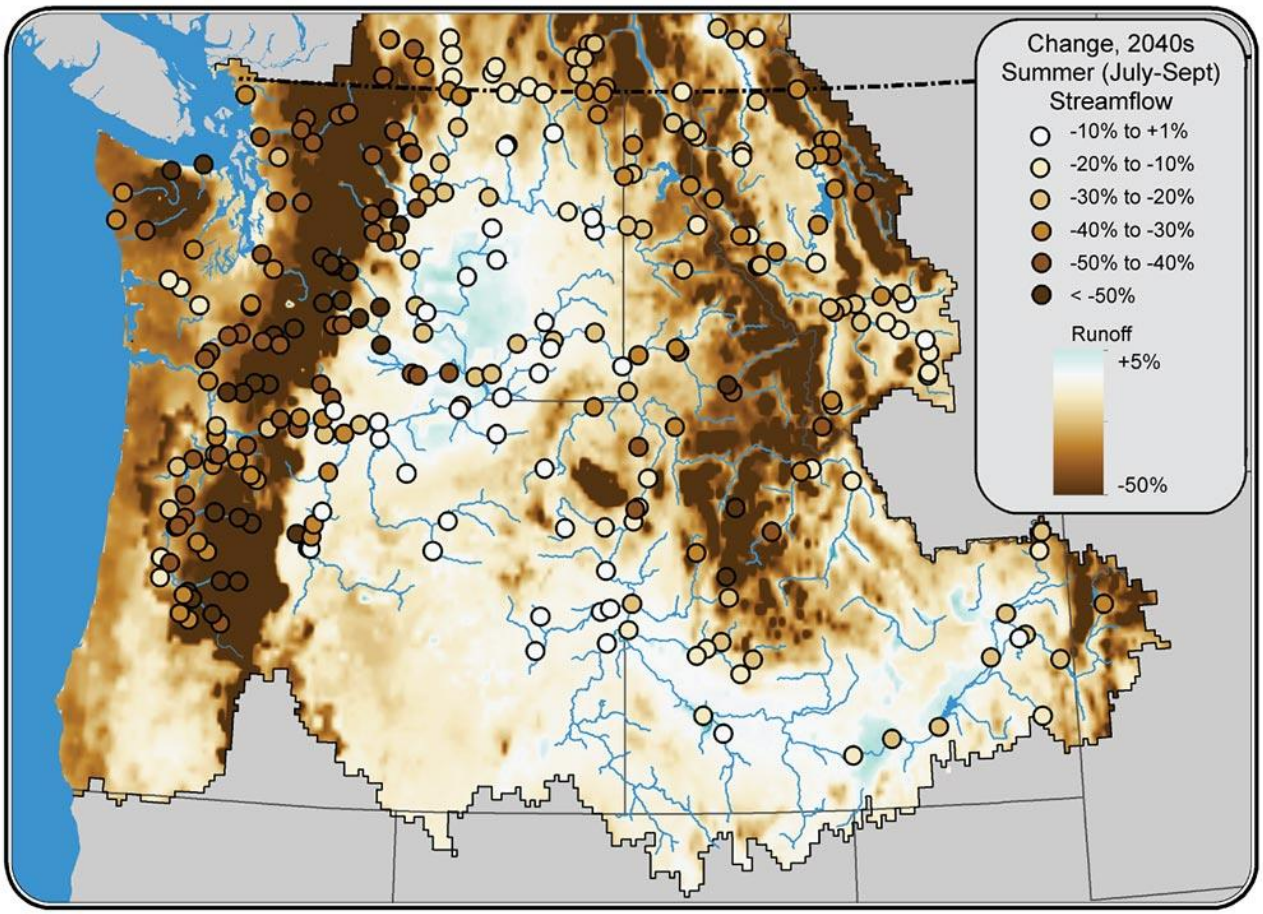
Relatively Small Changes in Annual Precipitation

Wetter Falls, Winters, & Springs

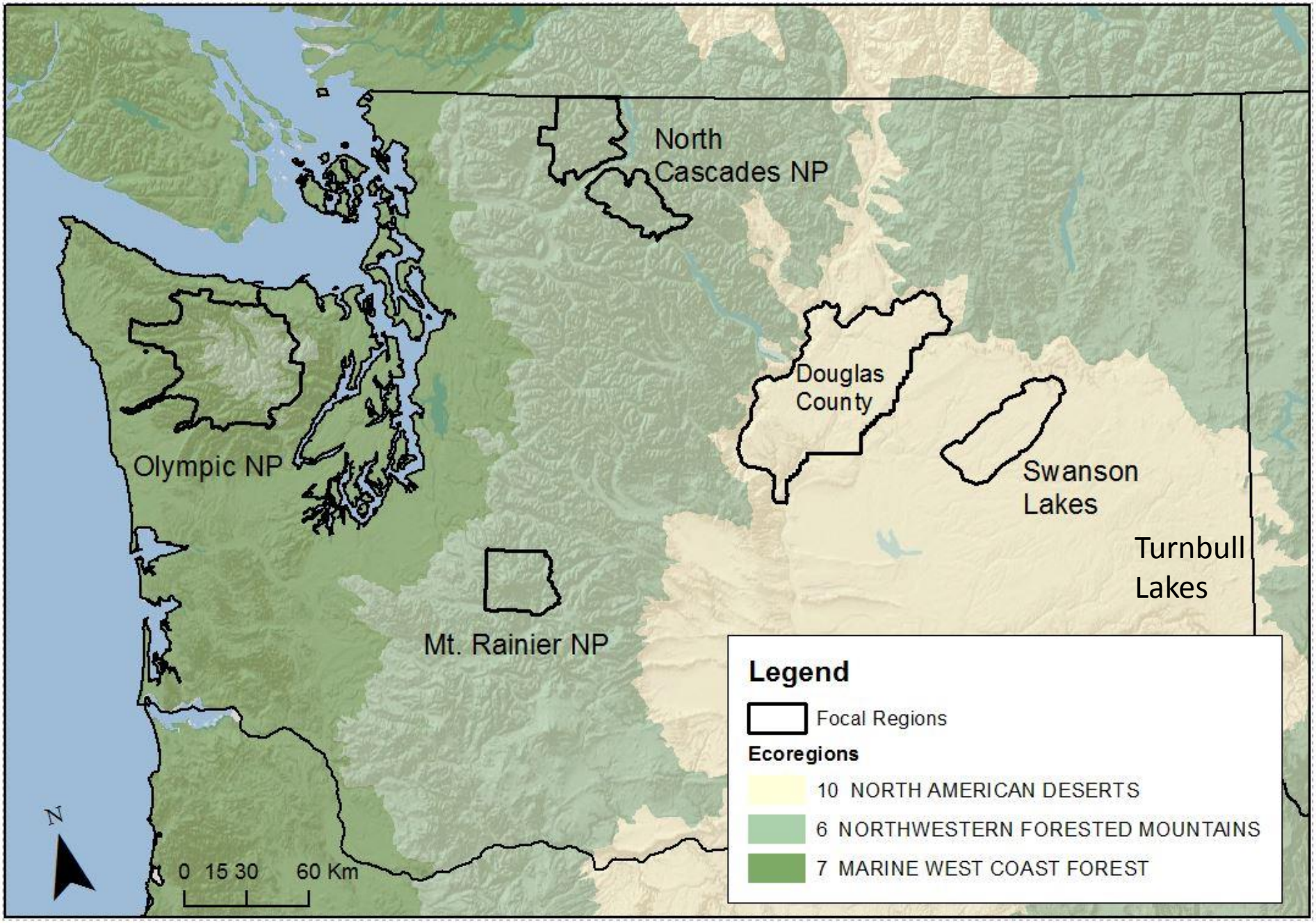
Drier Summers

Mote, P.W., and E.P. Salathé. 2010. Future climate in the Pacific Northwest. Climatic Change 102(1-2): 29-50, doi: 10.1007/s10584-010-9848-z

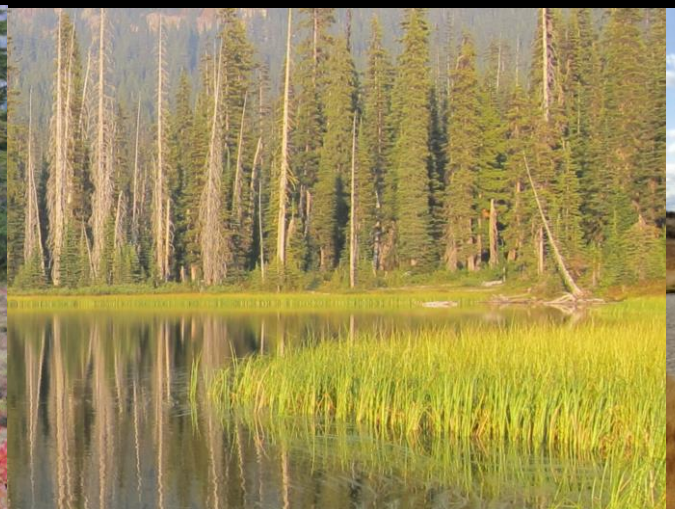
Reduced Summer Flows



Mote, P., A. K. Snover, S. Capalbo, S. D. Eigenbrode, P. Glick, J. Littell, R. Raymondi, and S. Reeder, 2014: Ch. 21: Northwest. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 487-513. doi:10.7930/J04Q7RWX.


North
Cascades NP
Douglas
County
Swanson
Lakes
Turnbull
Lakes
Olympic NP
Mt. Rainier NP
Legend
Focal Regions
Ecoregions
10 NORTH AMERICAN DESERTS
6 NORTHWESTERN FORESTED MOUNTAINS
7 MARINE WEST COAST FOREST
N
0 15 30 60 Km

Wetlands & Climate Change: Research & Conservation Challenges we seek to address



Challenge #1:
We often don’t know where wetlands are, and many old maps are wrong or incomplete.

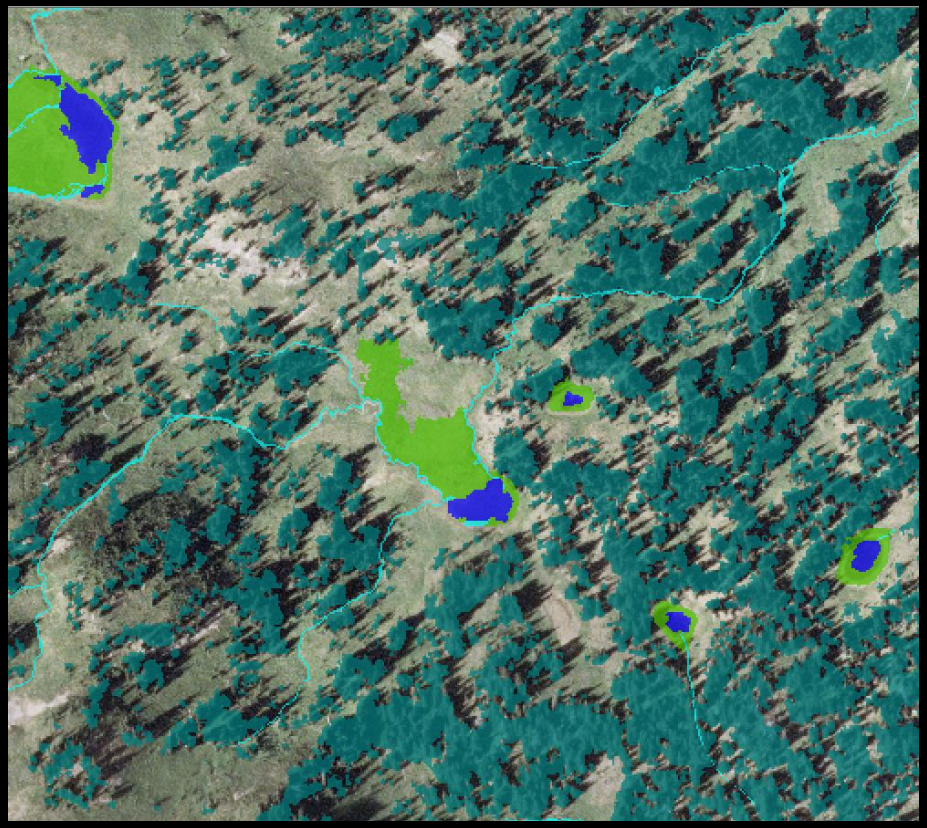
Challenge #2:
Wetlands are naturally very dynamic
& sensitive to climate change.

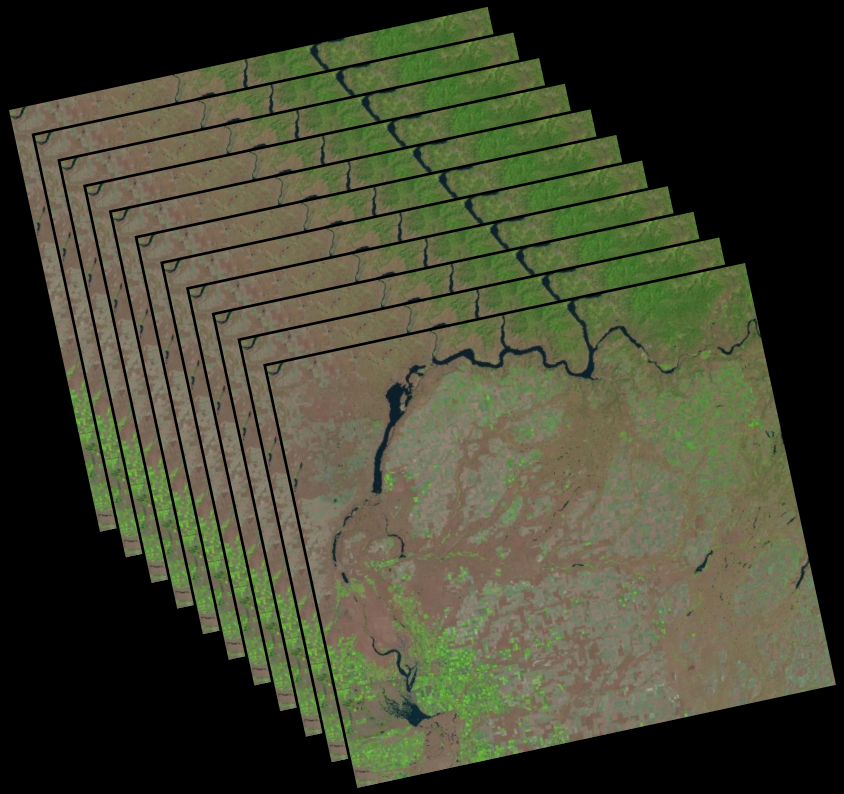
Challenge #3:
Diverse, understudied, limited baseline data.

Challenge #4:
Limited ability manage in general, and especially in the face of climate change.

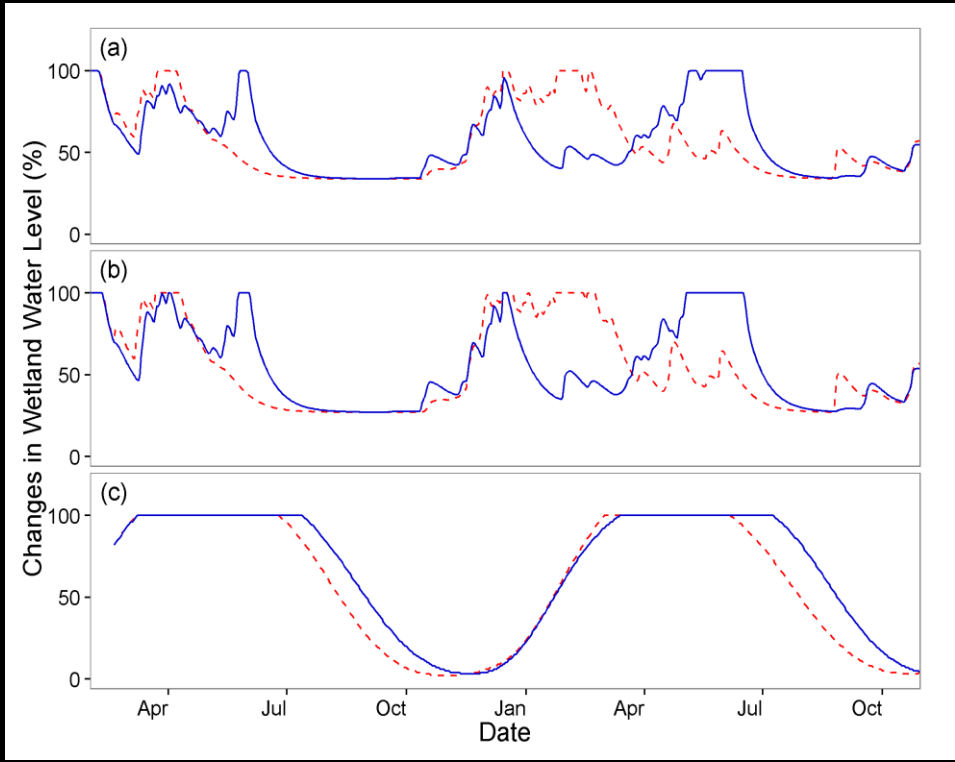
Maureen Ryan & Amanda Kissel

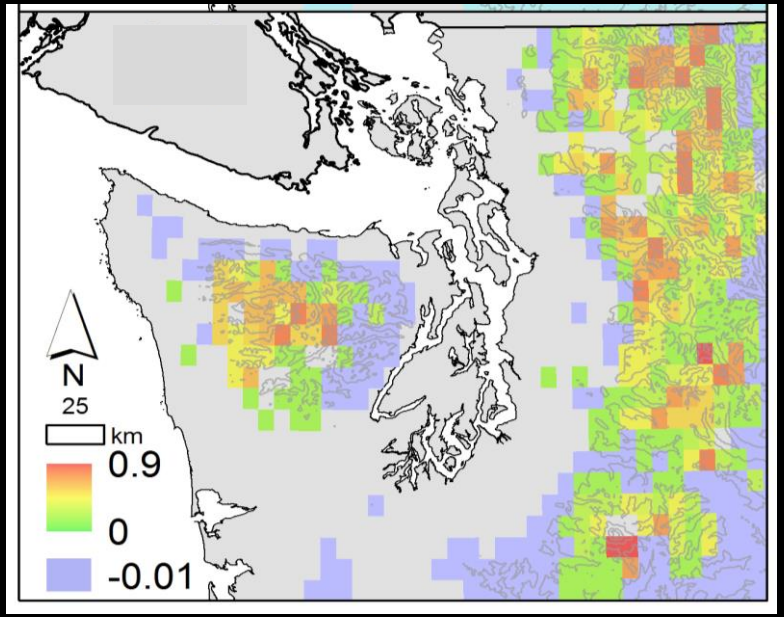
Meghan Halabisky

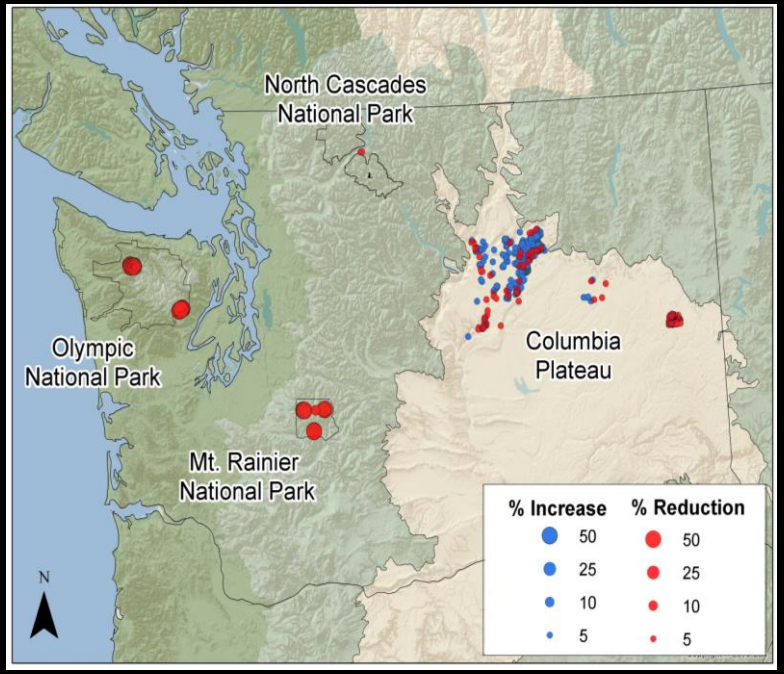




Se-Yeun Lee


(a)
(b)
(c)
100
50
0
Changes in Wetland Water Level (%)
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Date


N
25
km
0.9
0
-0.01


North Cascades
National Park
Olympic
National Park
Columbia
Plateau
Mt. Rainier
National Park
% Increase
% Reduction
50
25
10
5
50
25
10
5
N

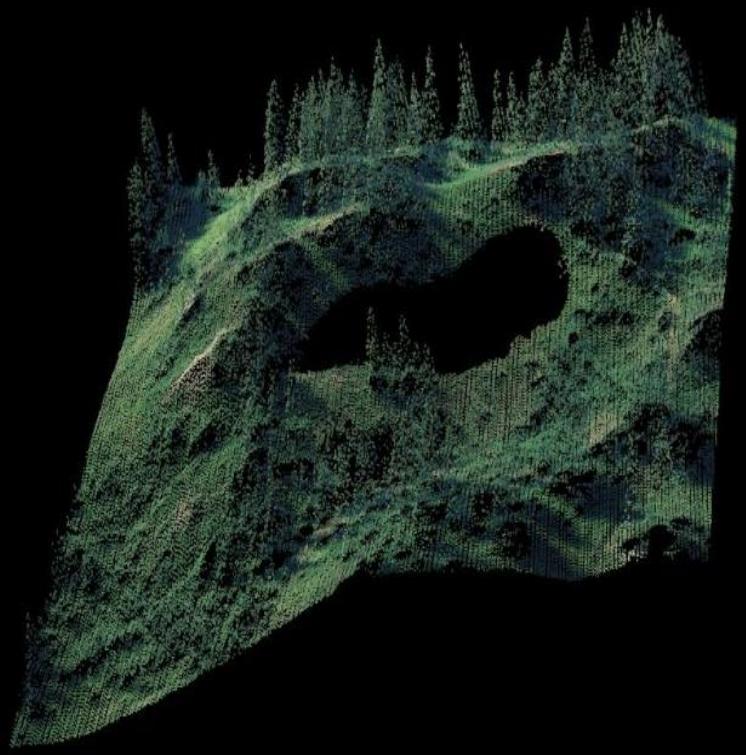
Regina Rochefort, Barbara Samora (Natl Park Service)
Mike Rule

U.S. Fish & Wildlife Service

Turnbull

National Wildlife Refuge | Washington

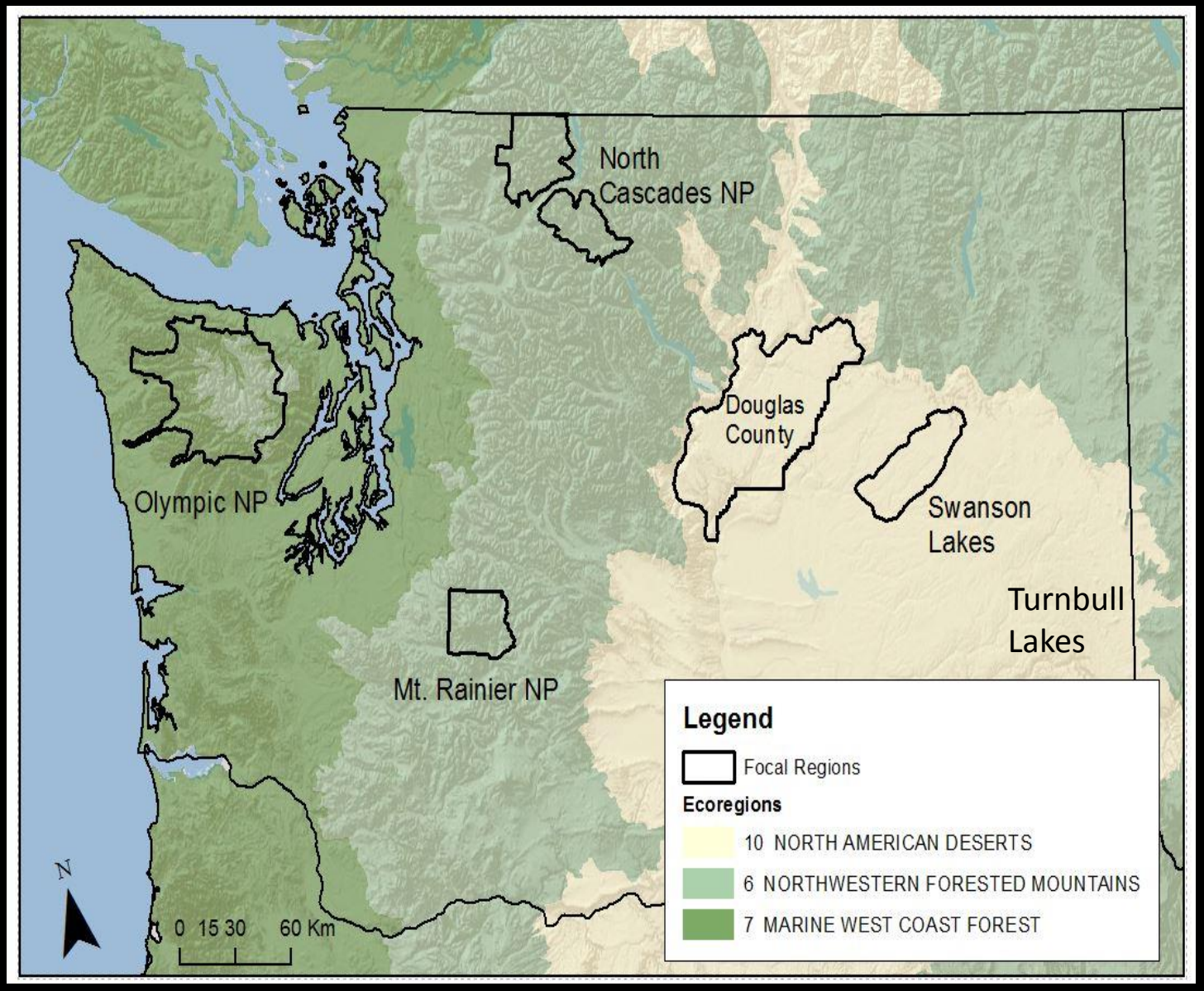
Remote Sensing Tools to Map Wetland Hydrology



Issues:

- Existing datasets are insufficient:
  - National Wetland Inventory
  - field data

- Existing remote sensing techniques for wetlands are inadequate
  - Temporal resolution is limited
  - Spatial resolution is too coarse


North
Cascades NP
Douglas
County
Swanson
Lakes
Turnbull
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Olympic NP
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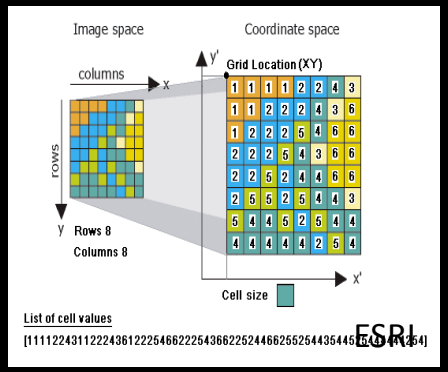
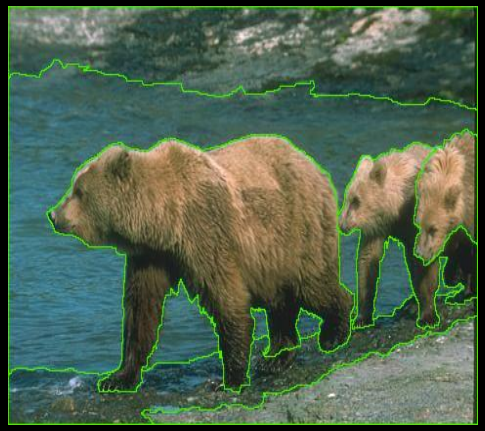
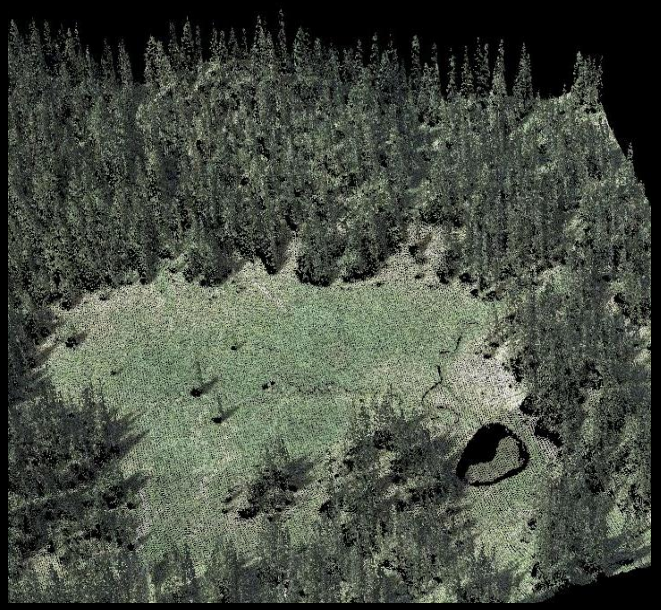
Legend
Focal Regions
Ecoregions
10 NORTH AMERICAN DESERTS
6 NORTHWESTERN FORESTED MOUNTAINS
7 MARINE WEST COAST FOREST
N
0 15 30 60 Km

Pattern recognition tools & 3D mapping (LiDAR)

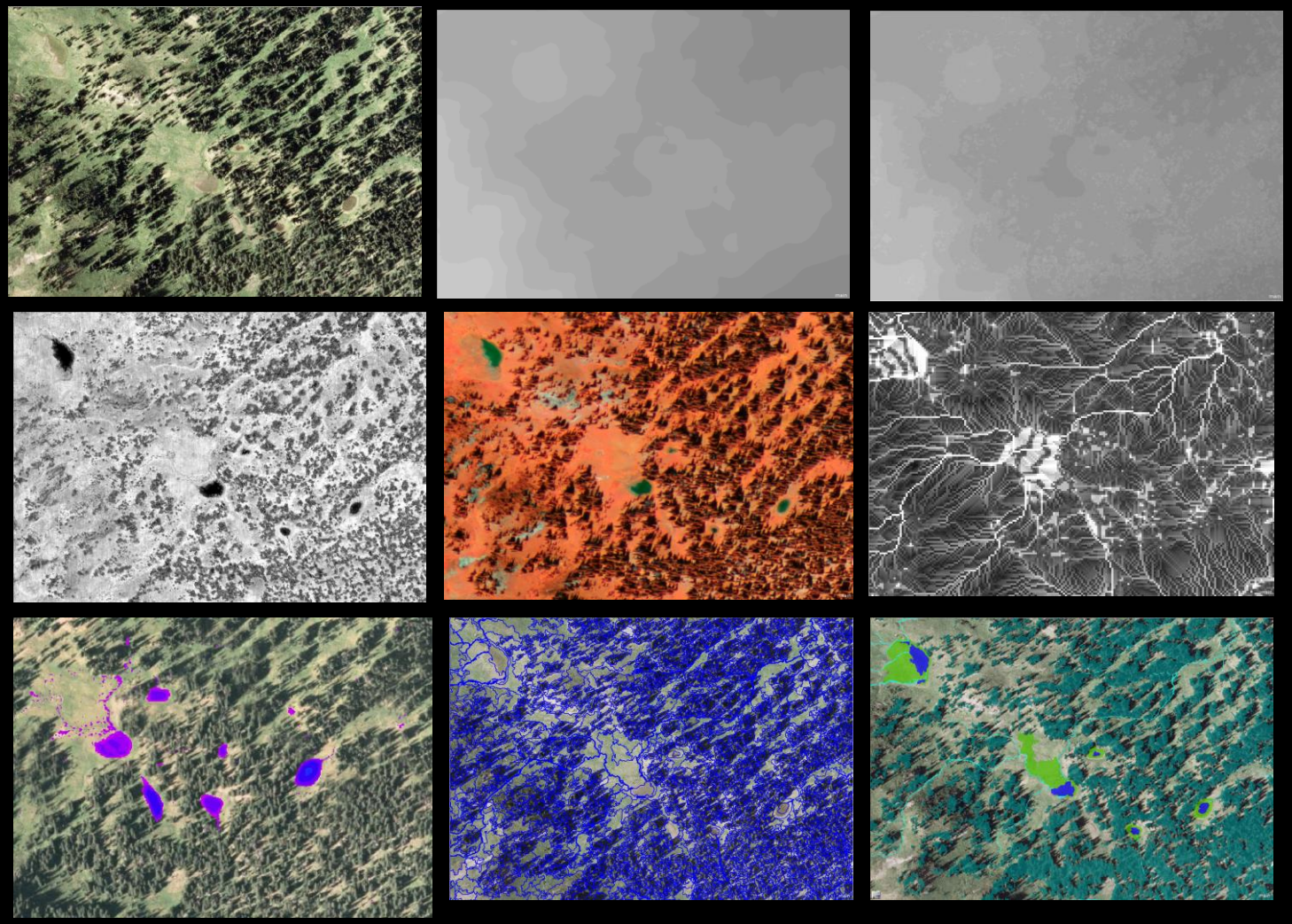




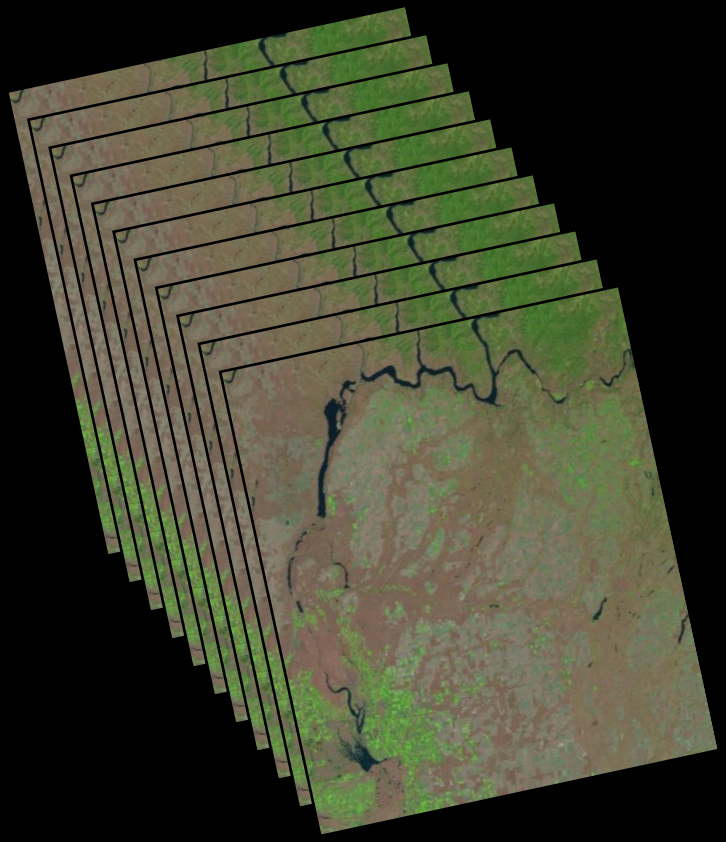
Courtesy of UC Berkeley Remote Sensing Lab

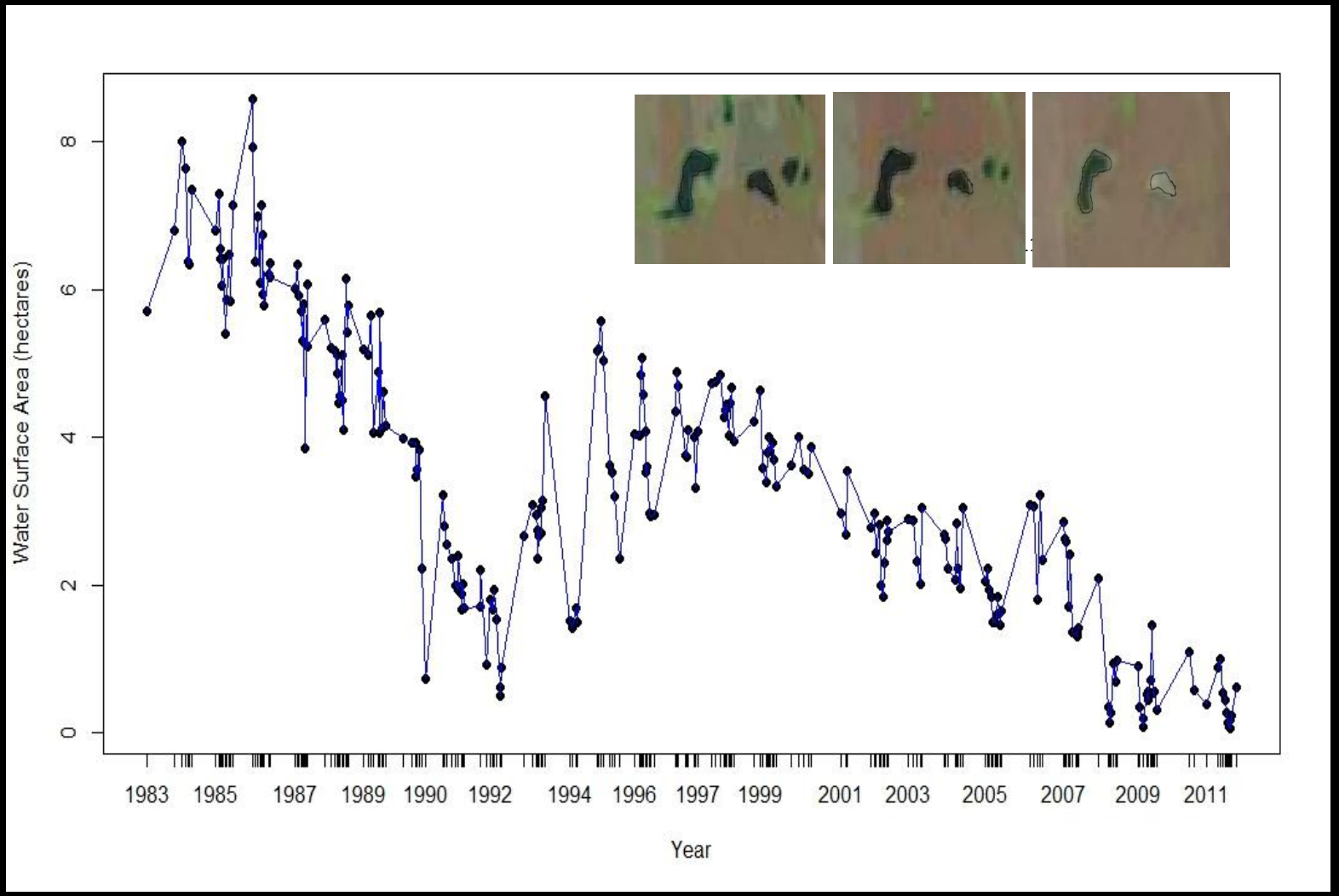


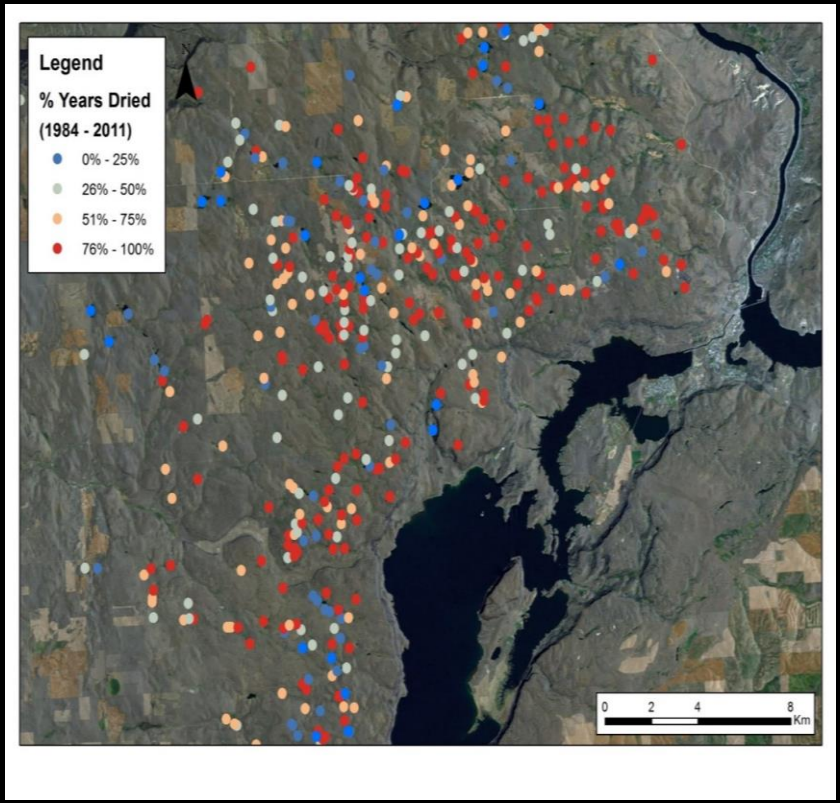
UW Remote Sensing & Geospatial Analysis Laboratory

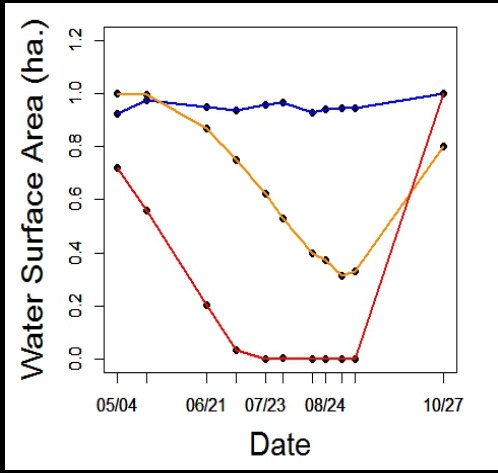


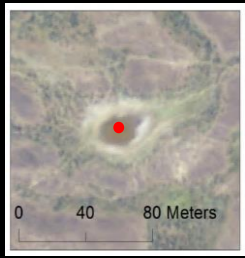
Combining datasets together to increase spatial and temporal data

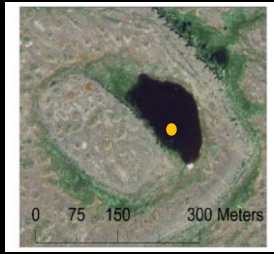



Water Surface Area (hectares)
0
2
4
6
8
1983
1985
1987
1989
1990
1992
1994
1996
1997
1999
2001
2003
2005
2007
2009
2011
Year

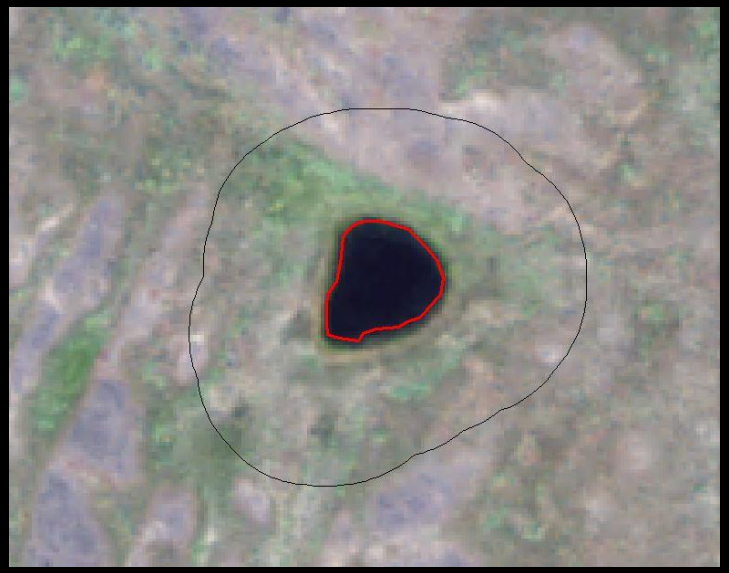

Legend
% Years Dried
(1984 - 2011)
0% - 25%
26% - 50%
51% - 75%
76% - 100%
0 2 4 8
Km

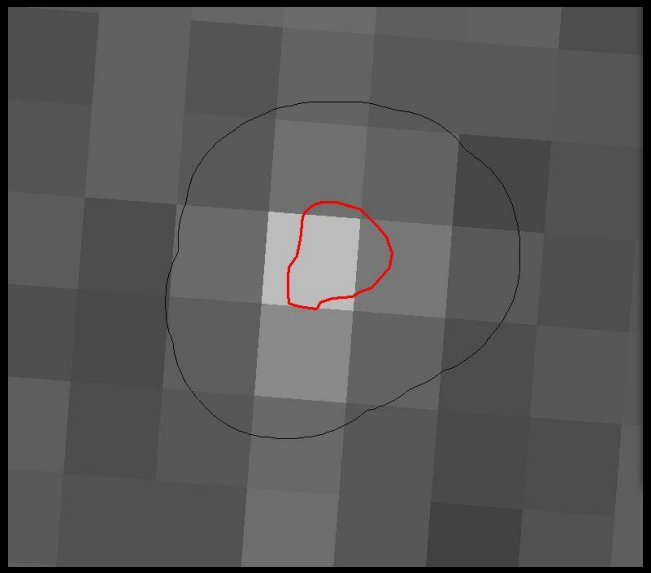

Water Surface Area (ha.)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
05/04
06/21
07/23
08/24
10/27
Date

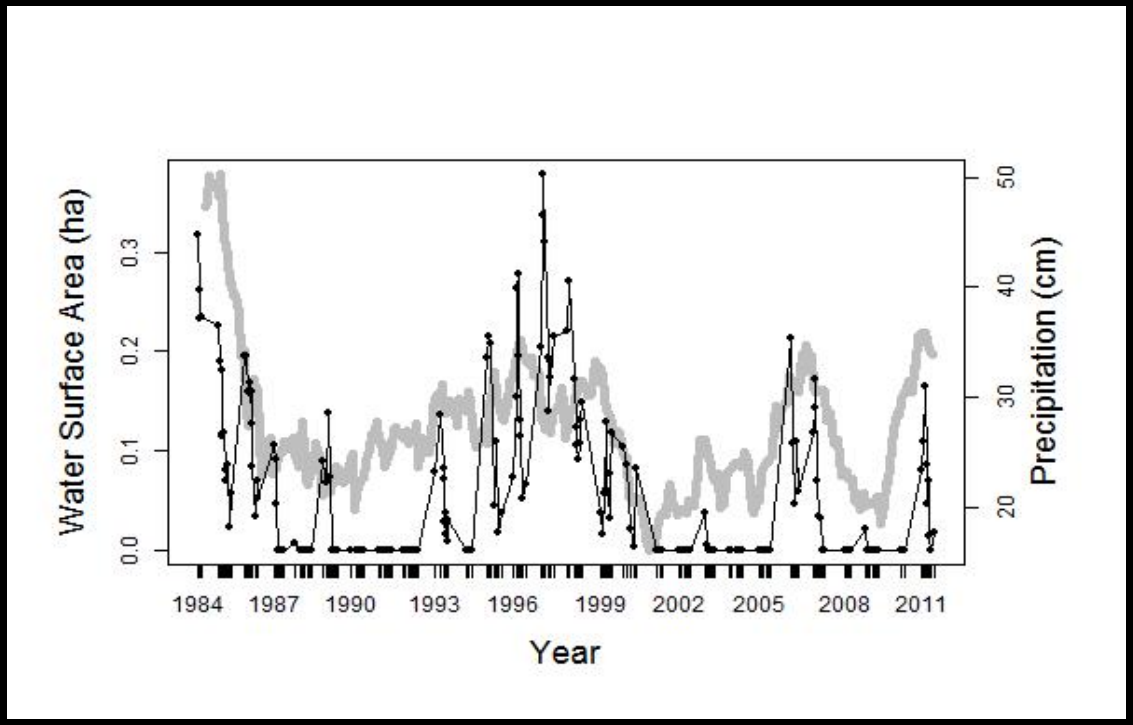

0 40 80 Meters

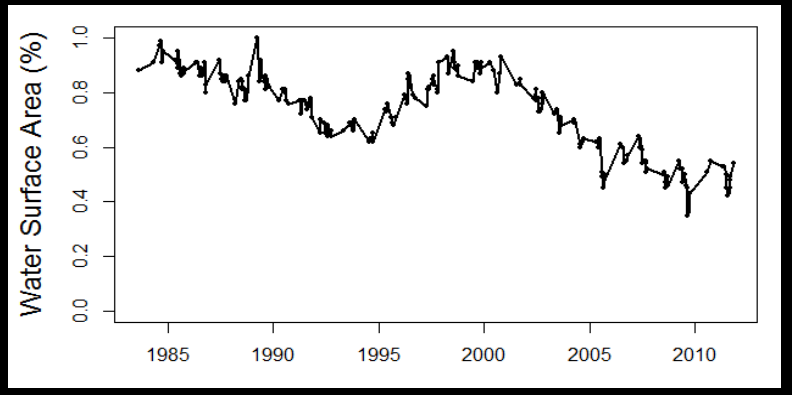

0 75 150 300 Meters

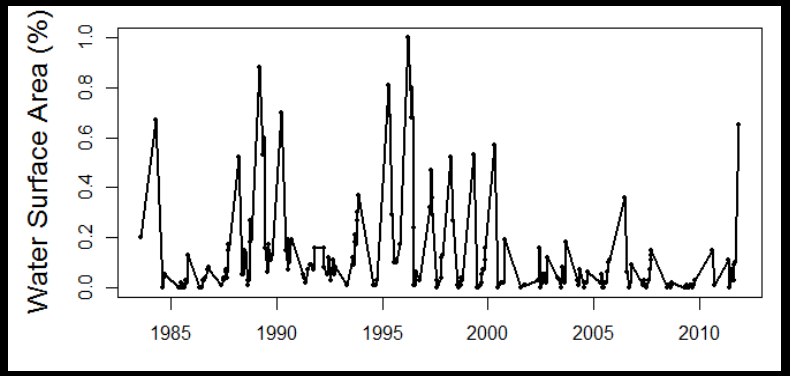
0 175 350 700 Meters

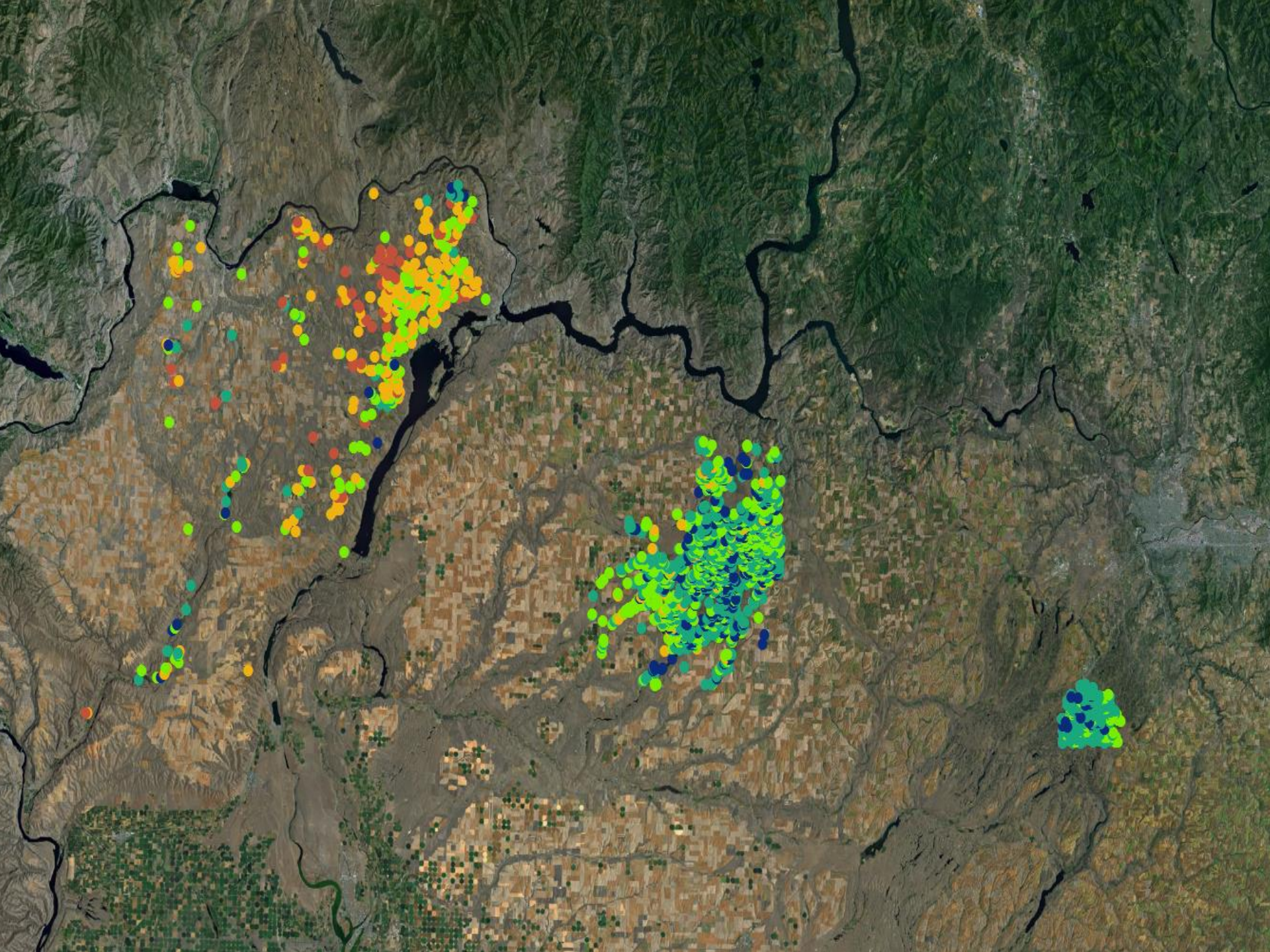


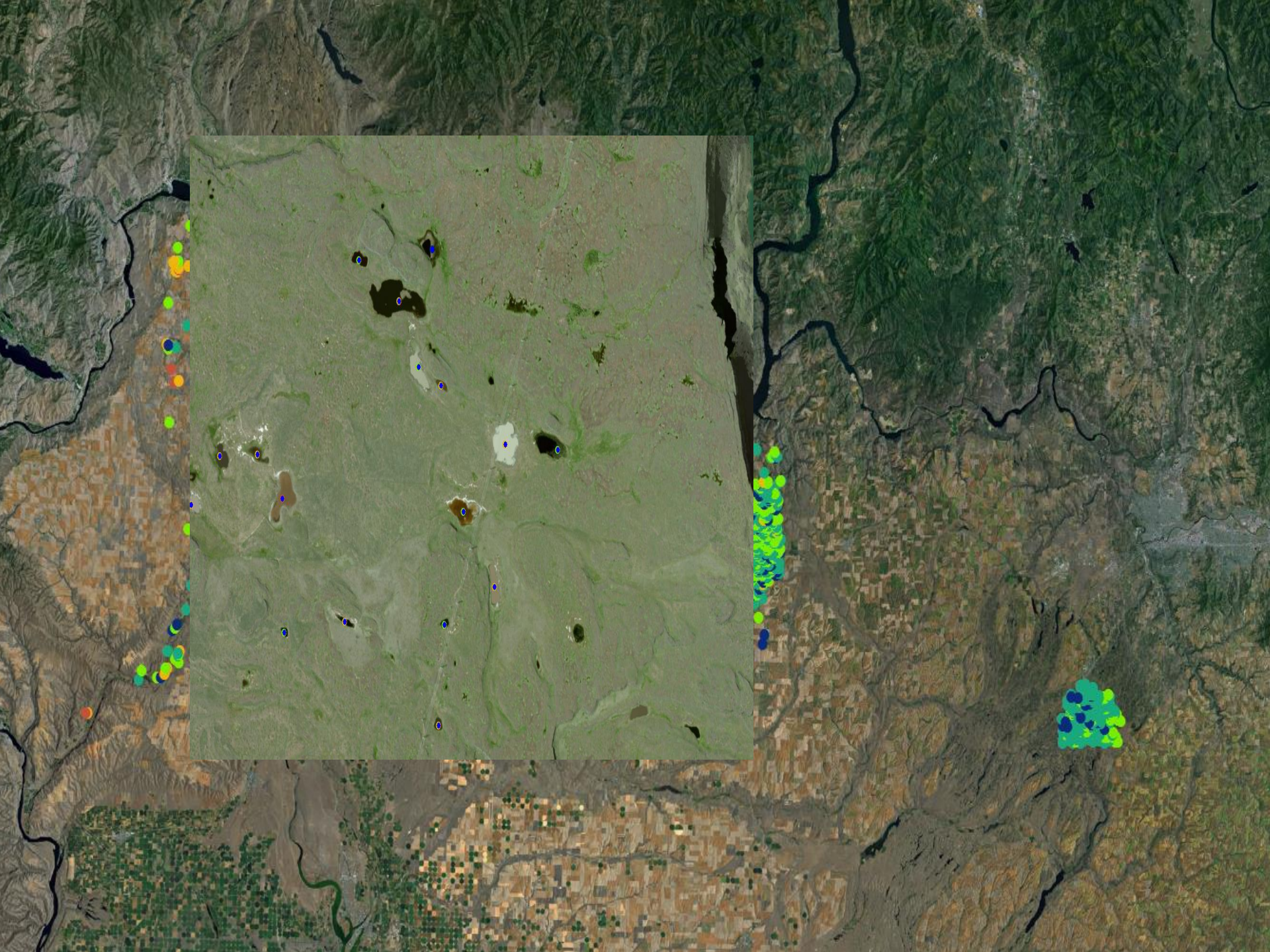


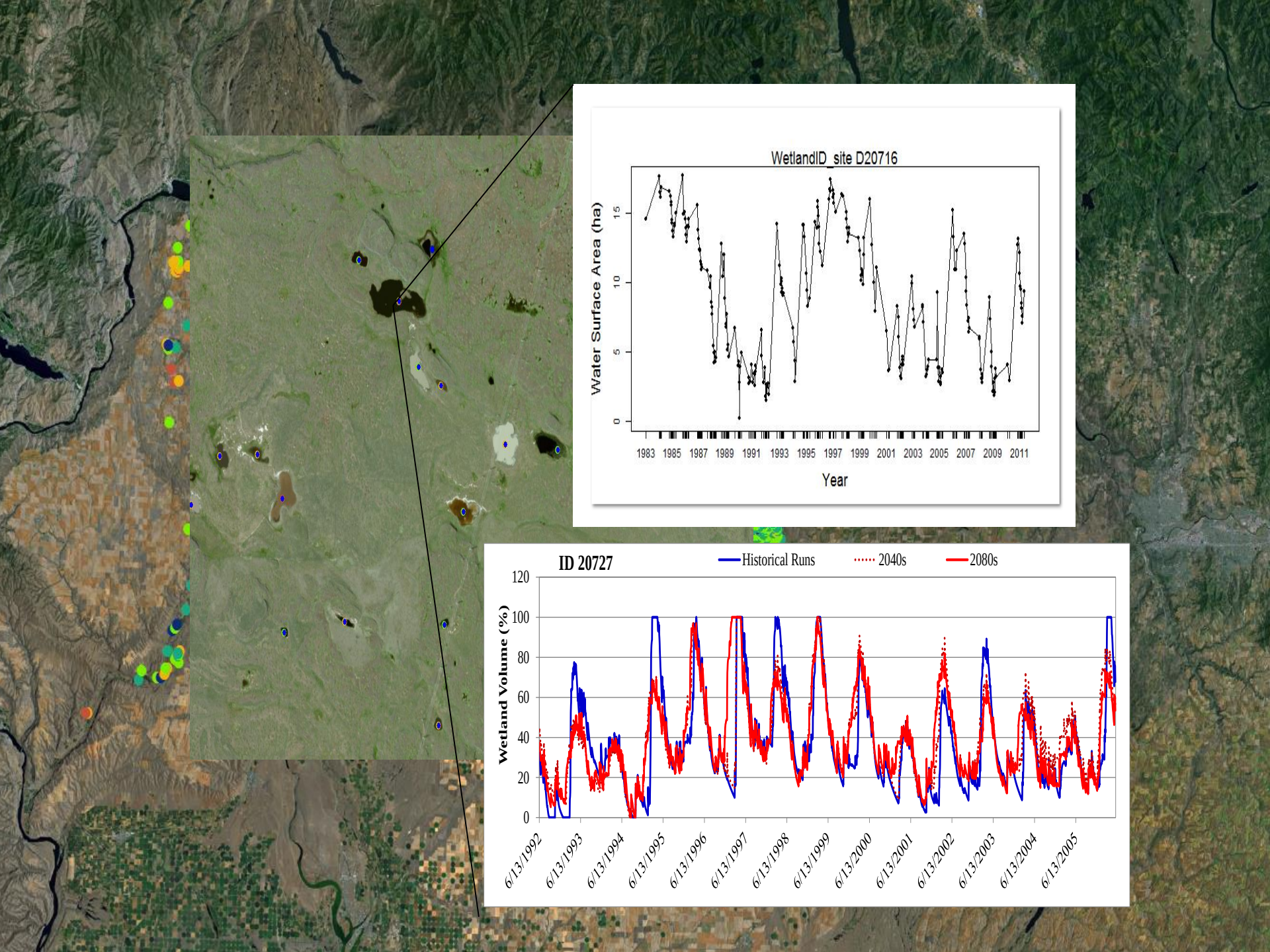

Water Surface Area (ha)
0.0
0.1
0.2
0.3
Precipitation (cm)
20
30
40
50
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
Year


Water Surface Area (%)
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010


Water Surface Area (%)
0.0
0.2
0.4
0.6
0.8
1.0
1985
1990
1995
2000
2005
2010

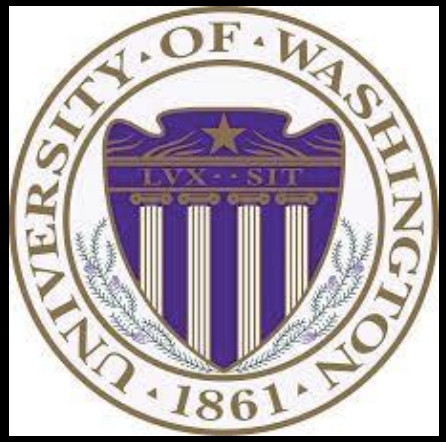





WetlandID_site D20716
Water Surface Area (ha)
0
5
10
15
1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011
Year
ID 20727
Historical Runs
2040s
2080s
Wetland Volume (%)
120
100
80
60
40
20
0
6/13/1992
6/13/1993
6/13/1994
6/13/1995
6/13/1996
6/13/1997
6/13/1998
6/13/1999
6/13/2000
6/13/2001
6/13/2002
6/13/2003
6/13/2004
6/13/2005

5th Annual Pacific Northwest Climate Science Conference

September 9-10, 2014



Smith Fellows

SFU

EcoAdapt™
Meeting the challenges of climate change

USGS
science for a changing world

General Challenge:
Linking solid & creative research with tangible applications on the ground.

(the “loading dock problem”)

What are our options for conservation action*?

- Would you use our products?
- What are your wetlands management priorities?
- Do you have data or the capacity to collect data on historical or current hydrology?
- We need your input.

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Meghan Halabisky: halabisk@u.washington.edu

Se-Yeun Lee: leesy@u.washington.edu

Amanda Kissel: akissel@sfu.ca