



Ecological Monitoring Strategies for Freshwater Systems in Alaska's National Parks

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Talk Outline



- Brief background on National Park Service Inventory and Monitoring Program and Alaska Parks.
- Aquatic resources in Alaska Parks
- Designing a long-term ecological monitoring program
- Examples and challenges of data acquisition

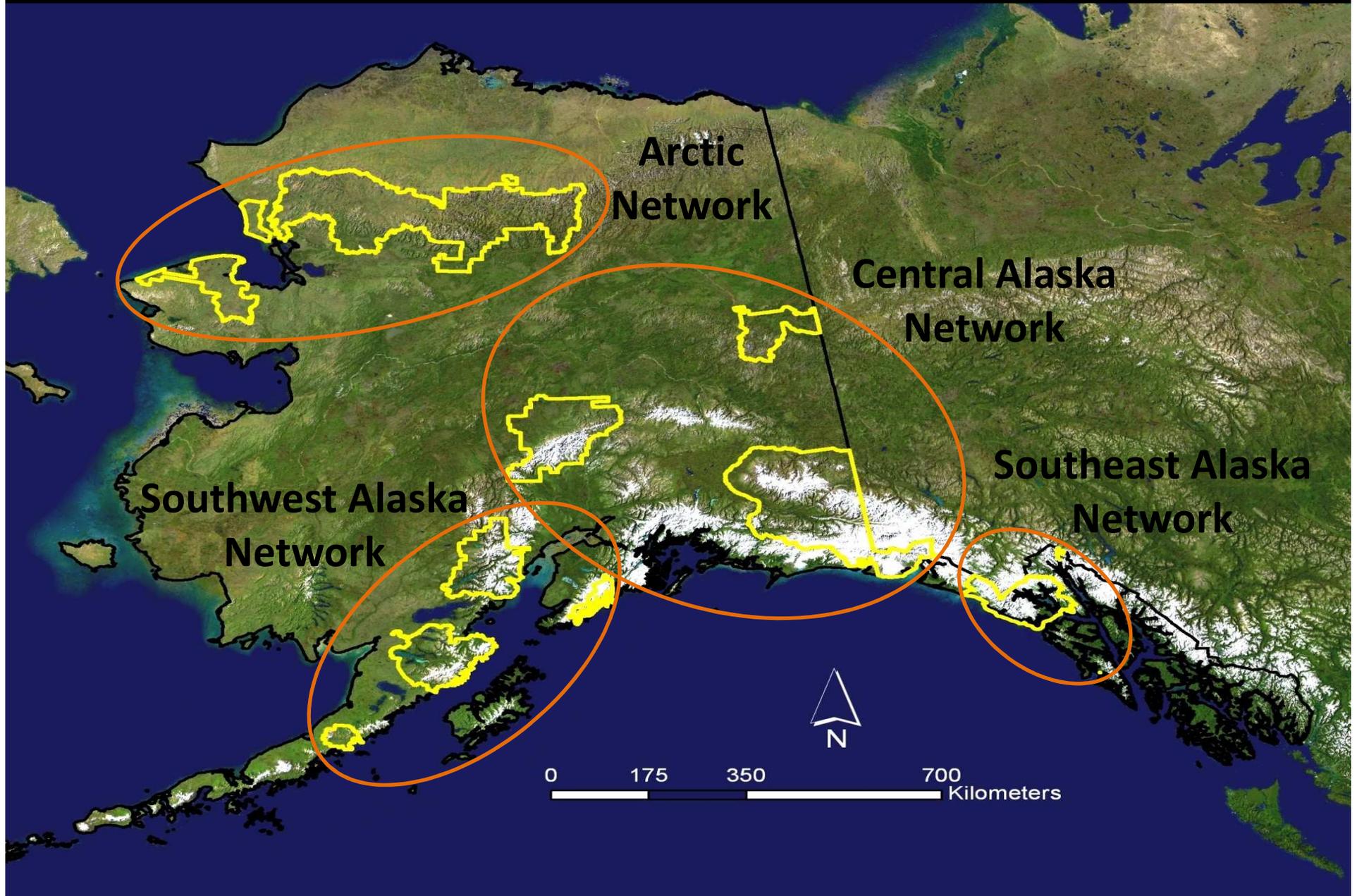
National Goals for I&M Program



1. **Determine the status and trends in selected indicators** of the condition of park ecosystems to allow managers to make better-informed decisions regarding park resources.
2. **Provide early warning of abnormal conditions of selected resources** to help develop effective mitigation measures and reduce costs of management.
3. **Provide data to better understand the dynamic nature and condition of park ecosystems** and to provide reference points for comparisons with other, altered environments.
4. **Provide data to meet certain legal and Congressional mandates** related to natural resource protection and visitor enjoyment (e.g. the Clean Water Act).



Alaska I&M Networks



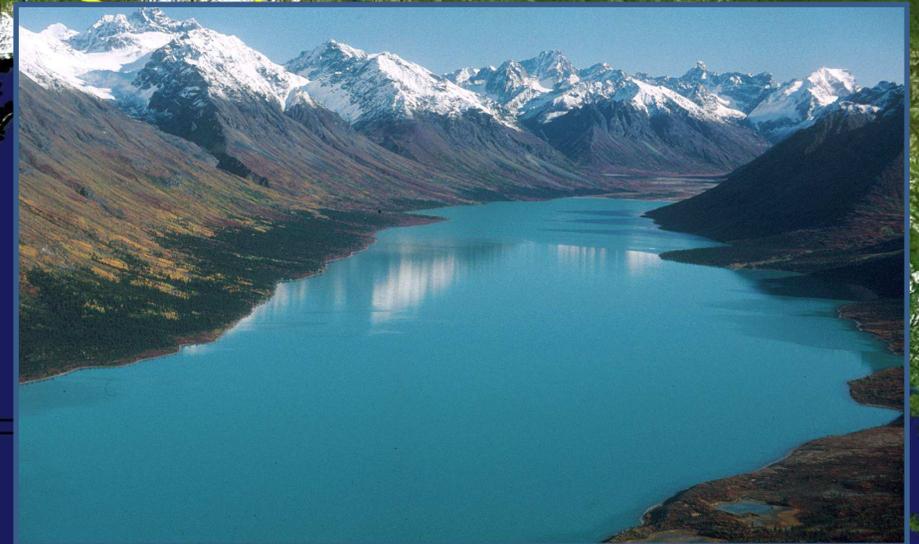
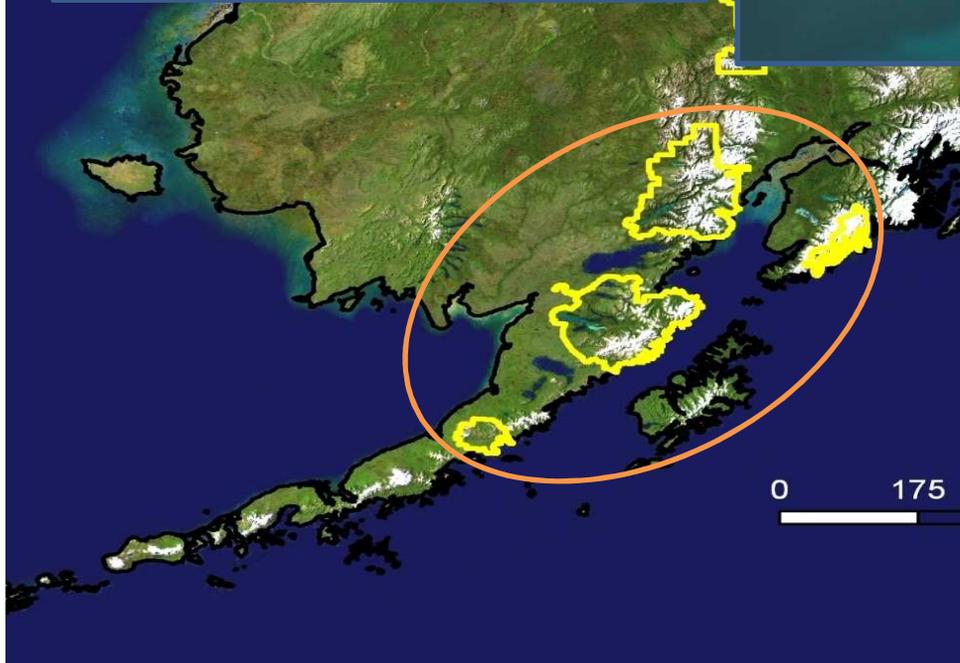
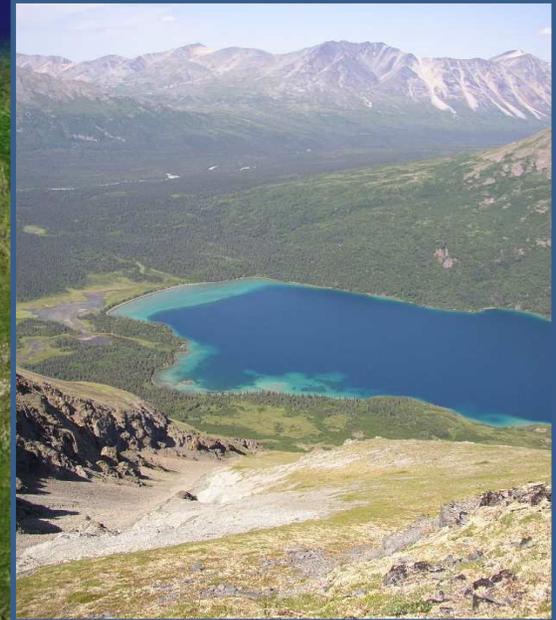
NPS Alaska Region



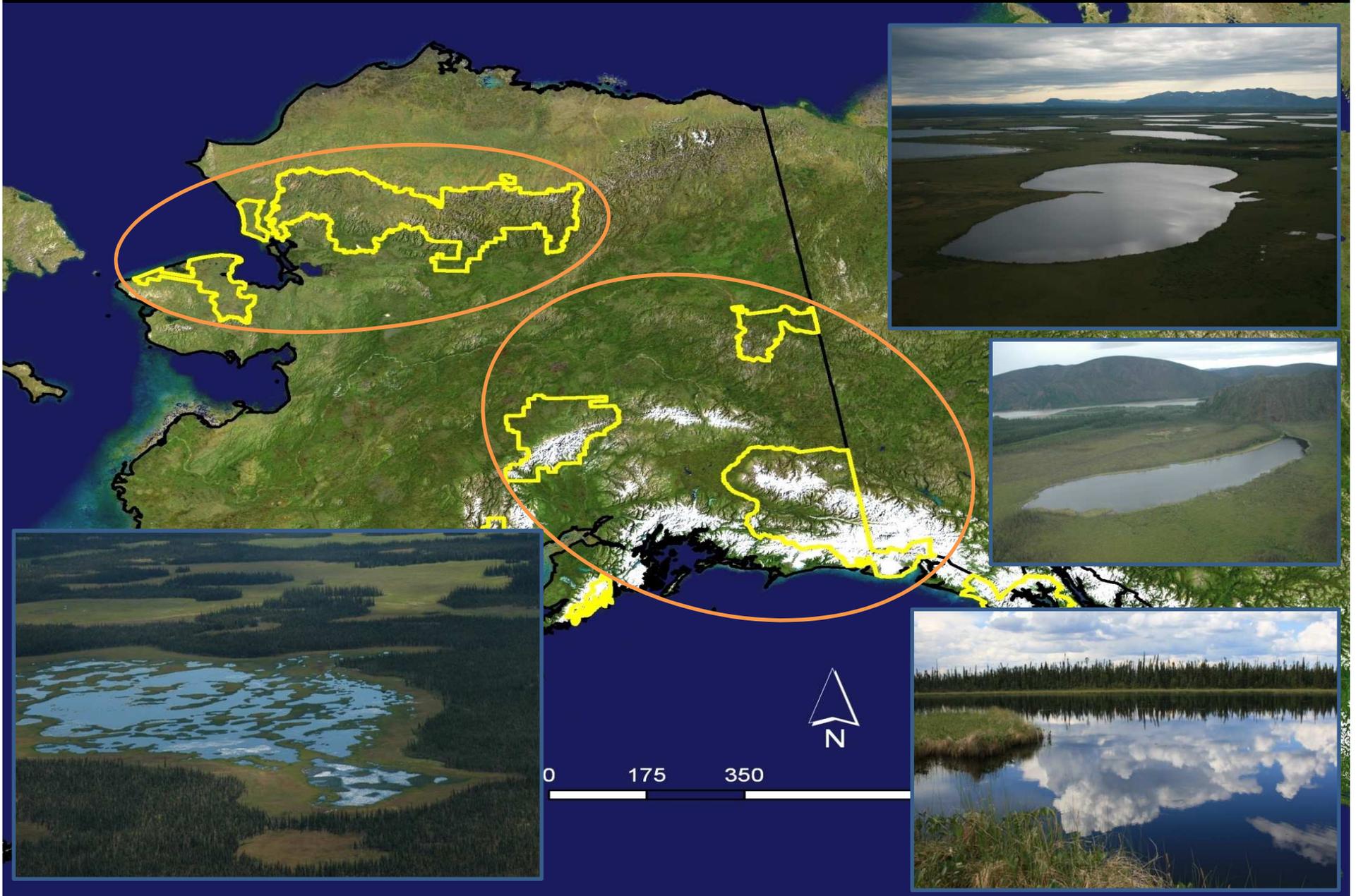
- 16 National Park units
- 217,300 square kilometers (~ 53.7 million acres)
- Ecosystems ranging from arctic to coastal rainforest environments
- Elevation: 20,320' to below sea level
- Extensive glacial and permafrost coverage
- Staggering array of aquatic systems!



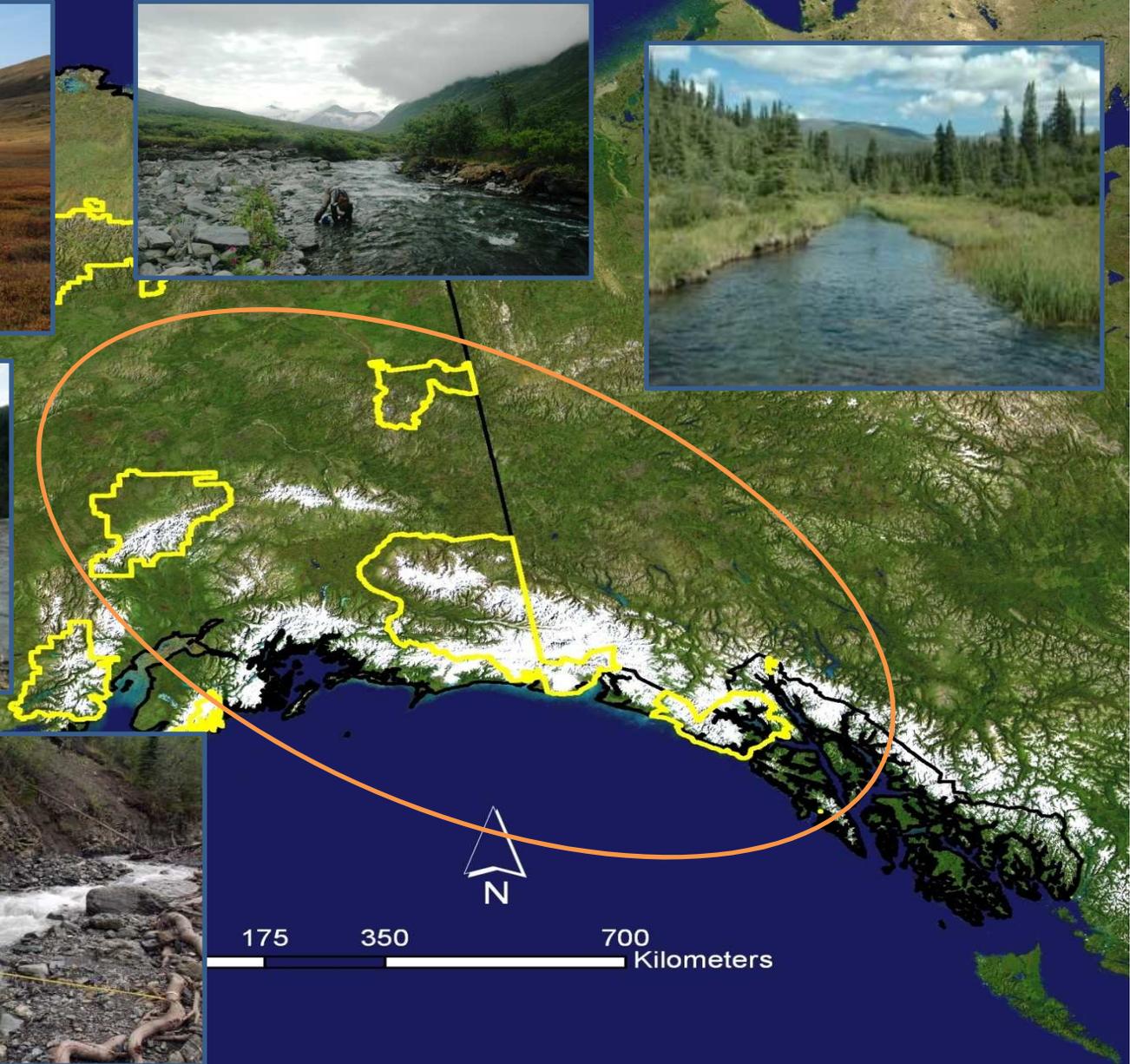
Large Lakes



Shallow Lakes / Ponds



Wadeable Streams



175 350 700 Kilometers

The Challenge



- To develop a long-term monitoring program for aquatic systems that describes current status and track trends and that is:
 - Ecologically based
 - Statistically sound
 - Relevant to park management
 - Repeatable and sustainable
- * No active USGS gauging stations, limited historical WQ data, some macroinvertebrate data, no diatom data, and very poor digital elevation models.

Sample Design



Multi-panel Survey Design

- Sites partitioned between Intensive, Sentinel, and Synoptic

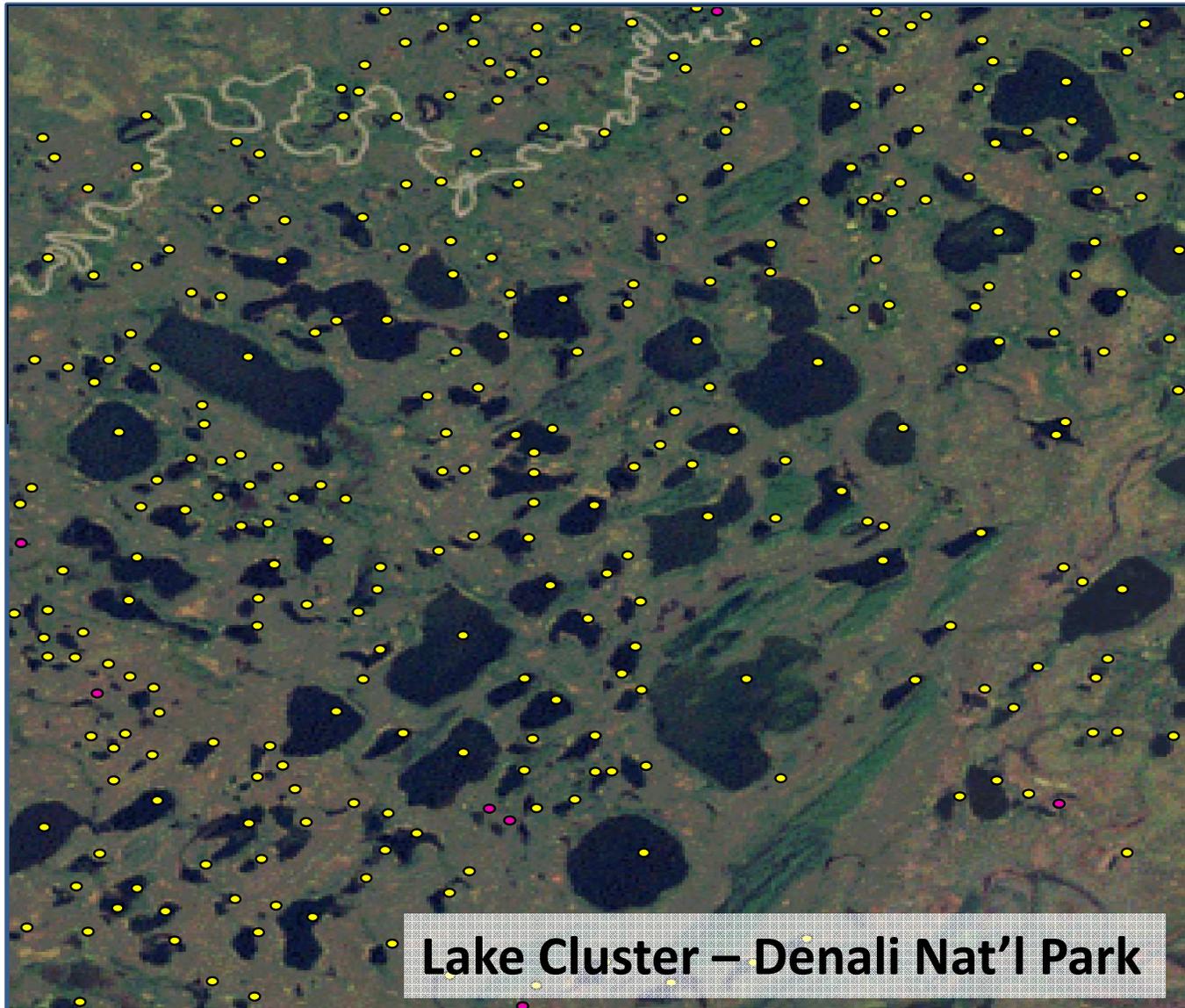
Targeted Sites

- Selected to address park-specific management concerns
- Primarily applies to large lake systems and some SE AK park streams

Probabilistic Sites

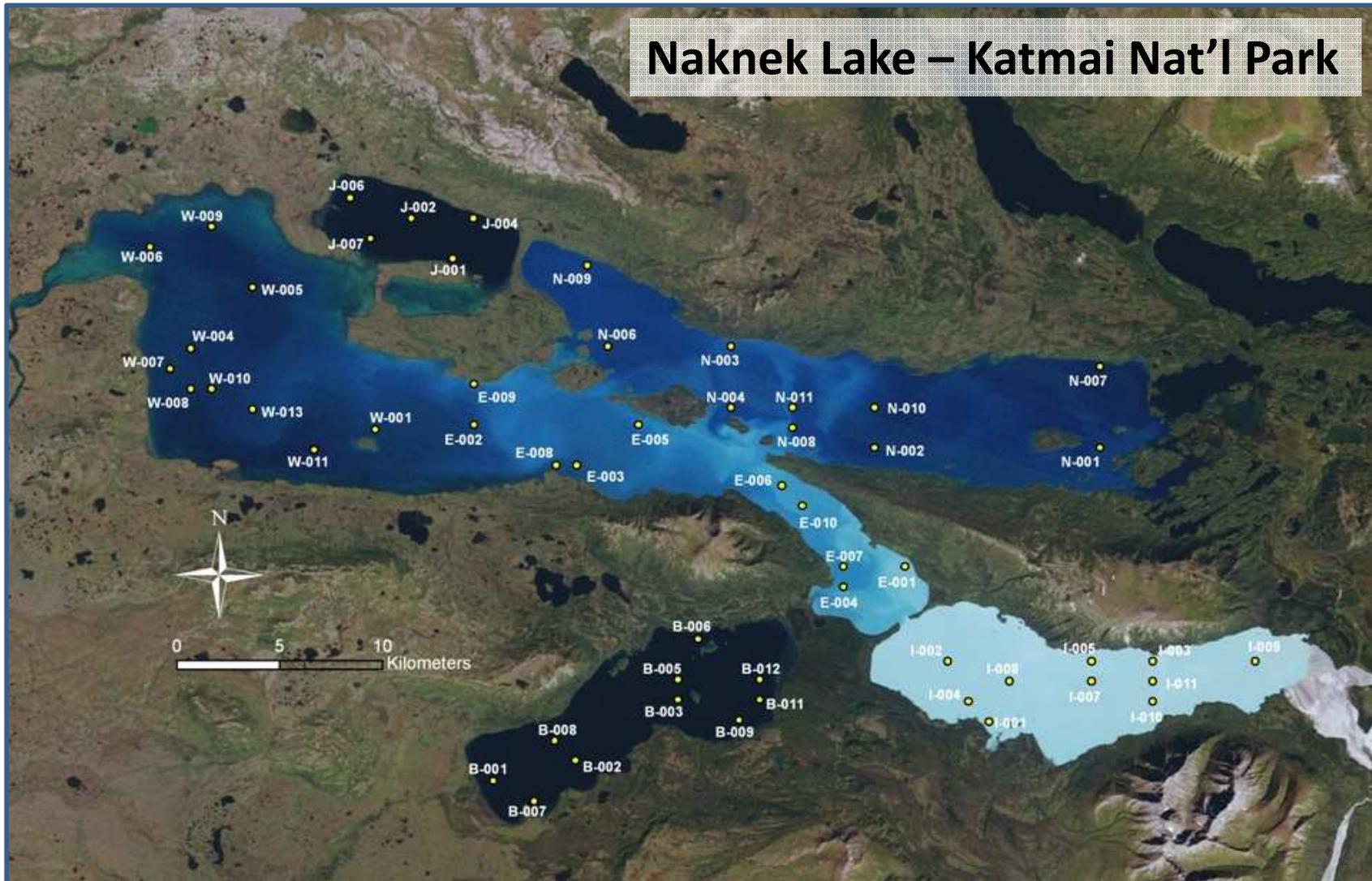
- Selected through a Generalized Random Tessellation Stratified (GRTS) process
- Generates a list of randomly selected, spatially balanced sites
- Allows for stratification and weighting across selection criteria, such as stream size, elevation, accessibility

GRTS Sites - Shallow Lakes



Lake Cluster – Denali Nat'l Park

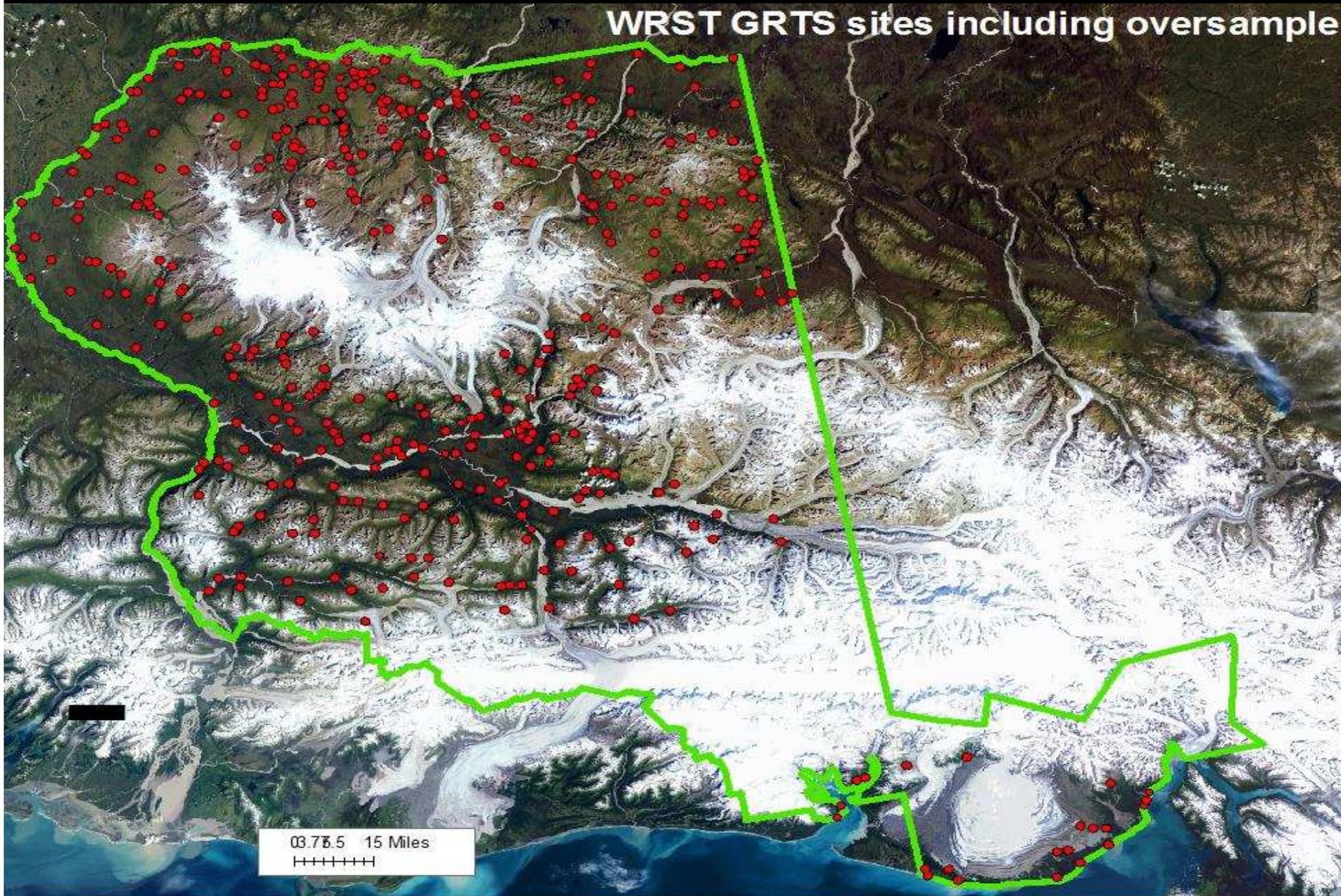
GRTS Sites - Large Lakes



GRTS Sites - Wadeable Streams



WRST GRTS sites including oversample



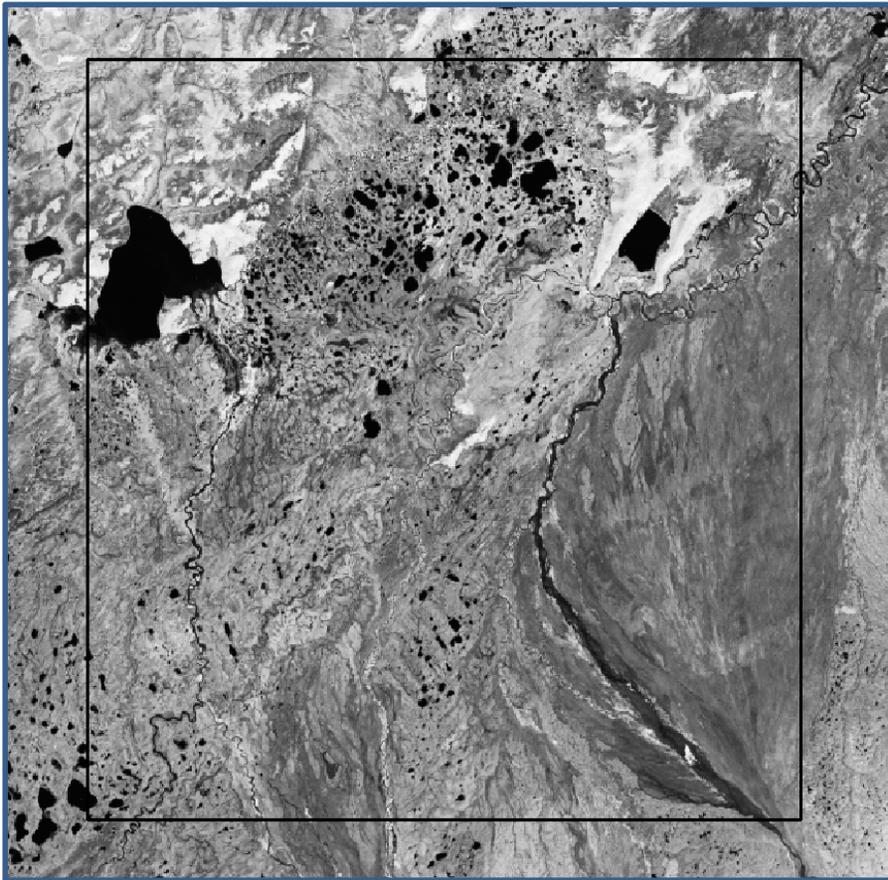
0.75 15 Miles
|-----|

Data Acquisition

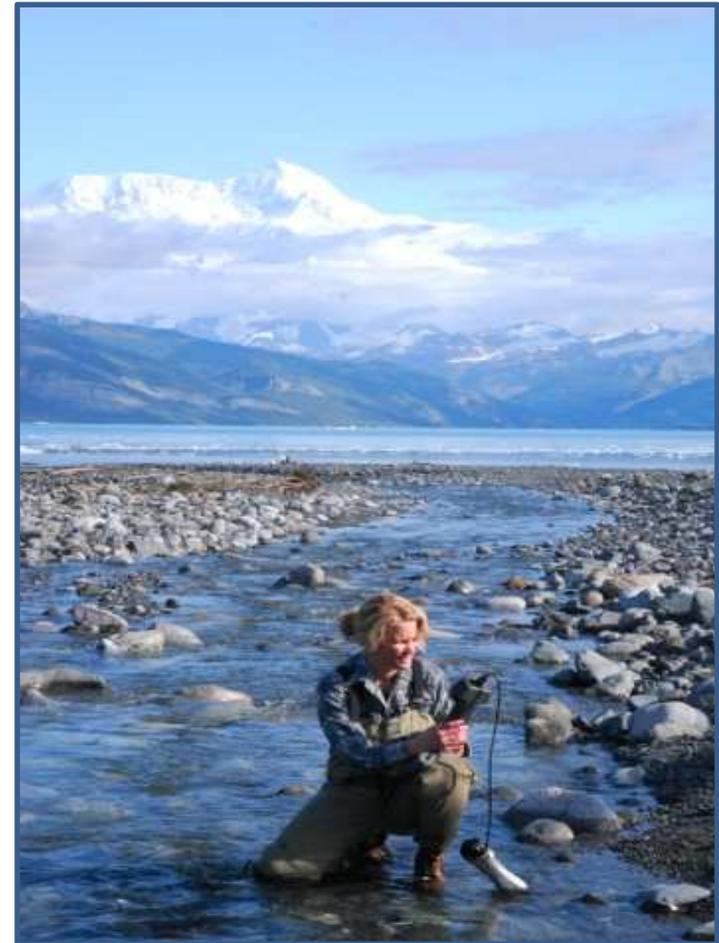


Two-pronged approach

Remote-sensing



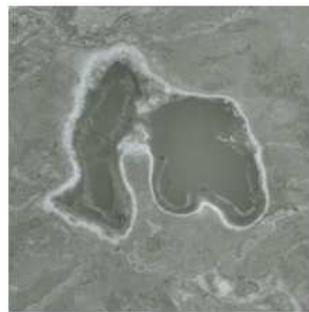
Field efforts



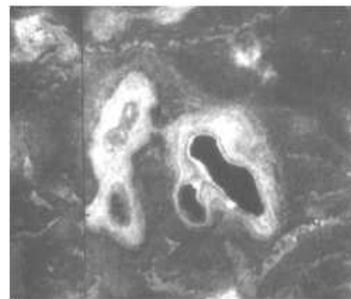
Remote-sensing: Shallow Lakes



Objective: track changes in landscape-scale features over time and corroborate on-the-ground observations



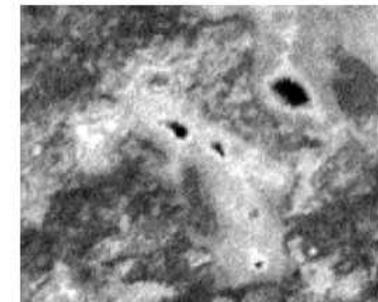
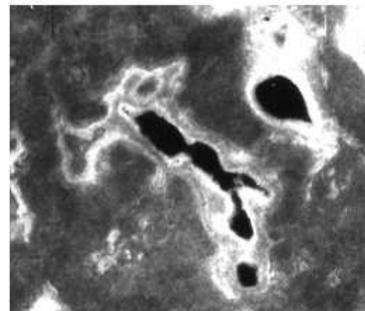
1950s



1970s



2000



Allows for relatively rapid analysis of broad spatial area

Ground Truthing of Satellite Imagery



Lake 2

Lake 8



2003

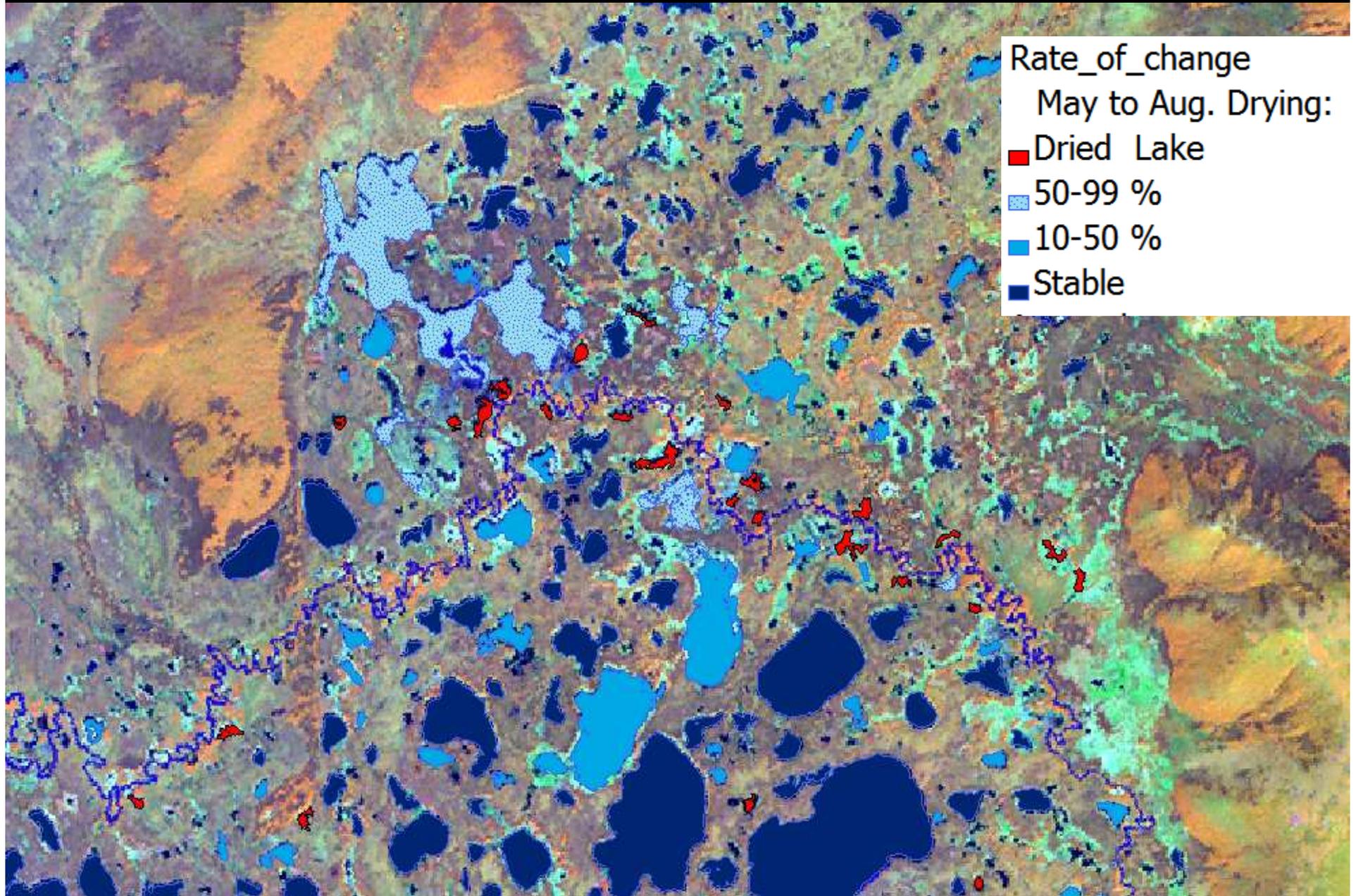


2004



2005

Seasonal Fluctuations



Aerial Oblique Photos



File Edit View Tools Add Help

Search

Fly To Find Businesses Directions

Fly to e.g., San Francisco

Places Add Content

- Drained Lake
- Polygons
- Reduced Lake
- Drained Lake
- Reduced Lake

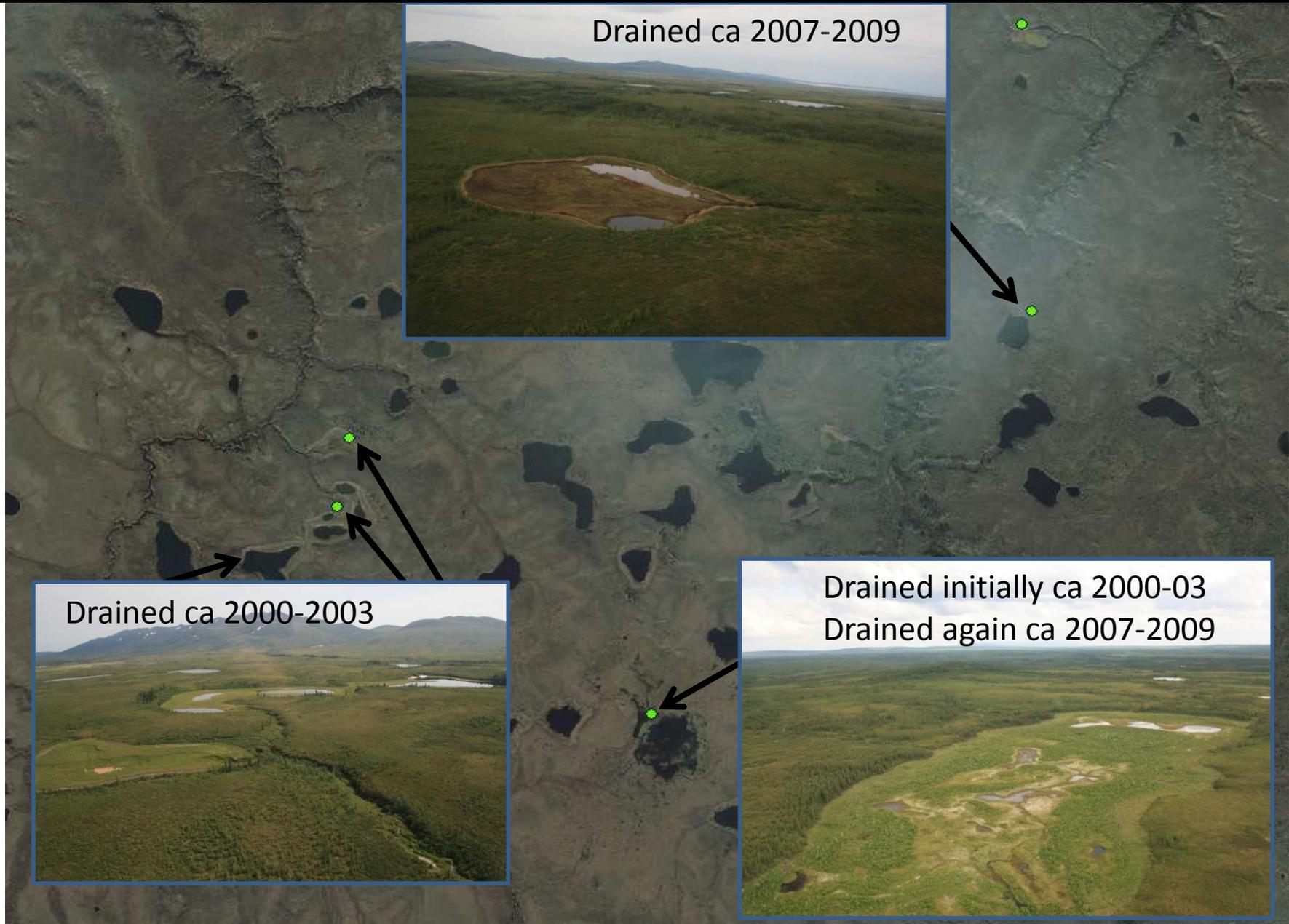
Layers

- Primary Database
- Geographic Web
 - Panoramio
 - Wikipedia
- Places
 - Places
 - Preview
- Businesses
- Roads
- 3D Buildings
- Street View
- Borders and Labels
- Traffic
- Weather
- Gallery
- Ocean
- Global Awareness
- Places of Interest
- More
- Terrain

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US Dept of State Geographer
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
67°20'49.07" N 158°41'32.06" W elev 1444 ft

Google
© 2009
Eye alt 2720.29 m

Aerial Oblique Photos



Drained ca 2007-2009

Drained ca 2000-2003

Drained initially ca 2000-03
Drained again ca 2007-2009

Phenology: Lake Ice Seasons



Jul 27, 2006

Nov 5, 2006

Jan 7, 2007

Mar 15, 2007

Field Efforts

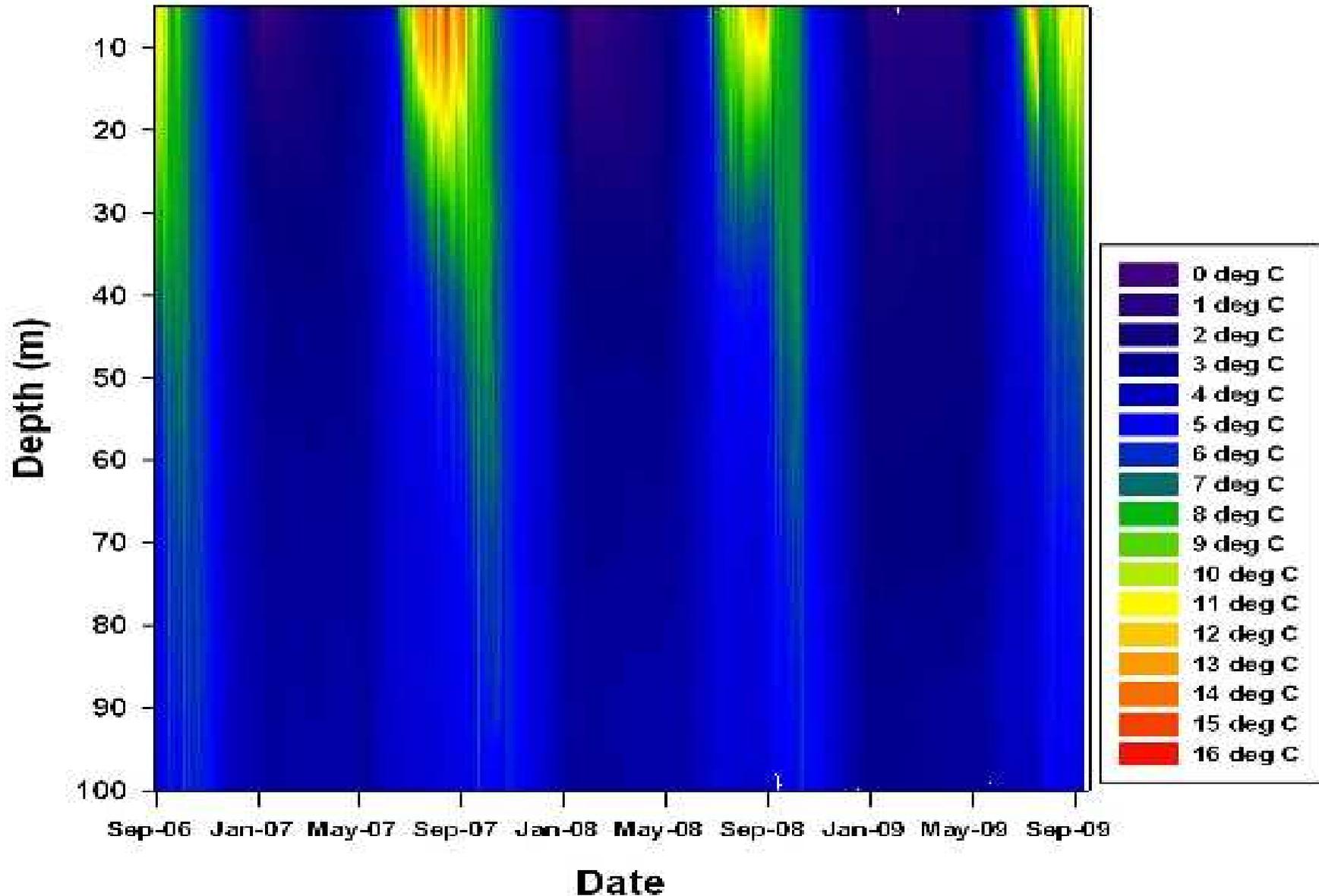


Focus on physical water quality and surface hydrology

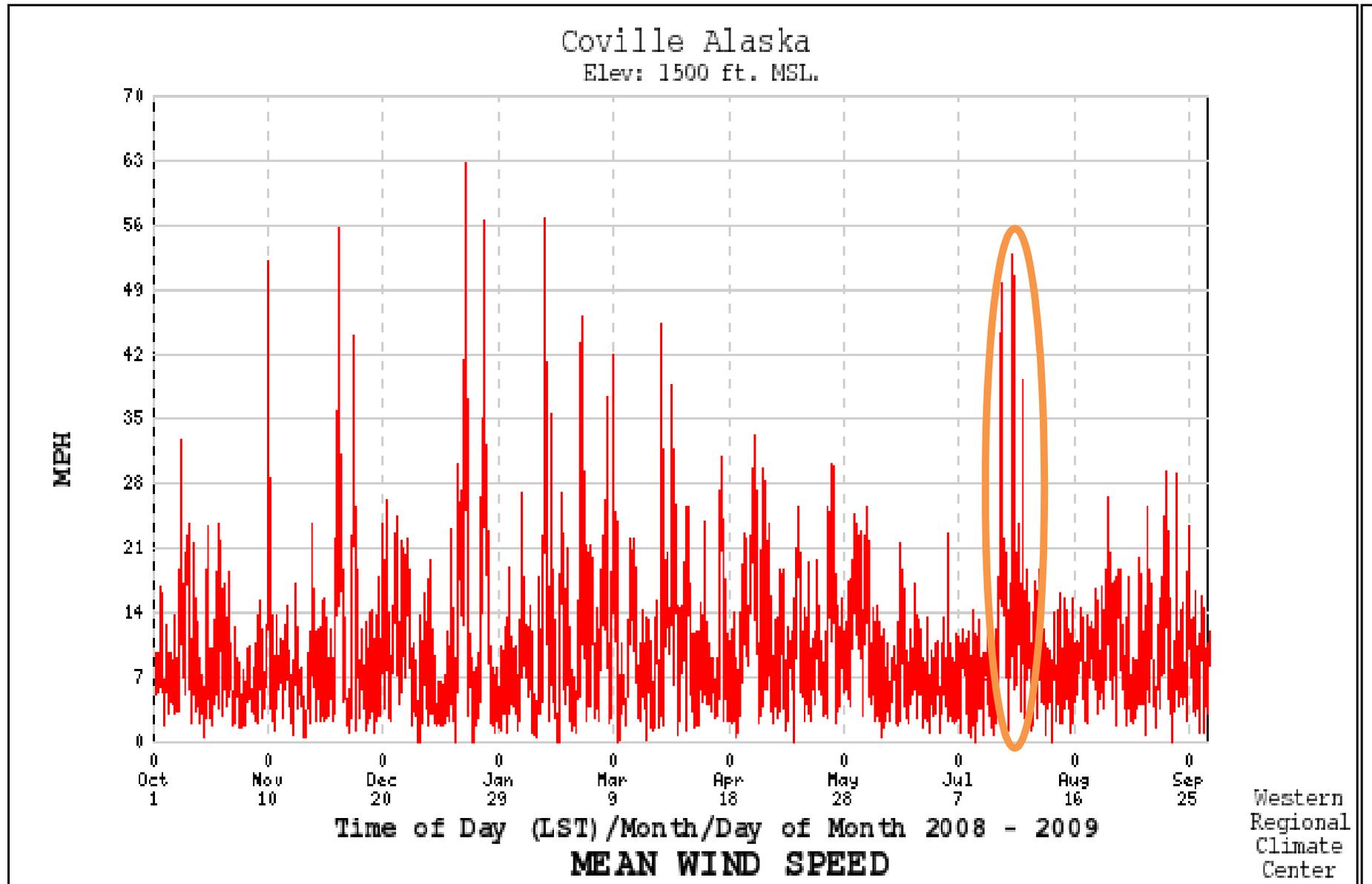
- Collection of system-specific measures (e.g., vegetation for shallow lakes, macroinvertebrates / diatoms for streams, etc.)
- Rely heavily on automated data loggers to collect physical water quality and hydrology parameters.
- Accessibility is greatest logistical challenge.



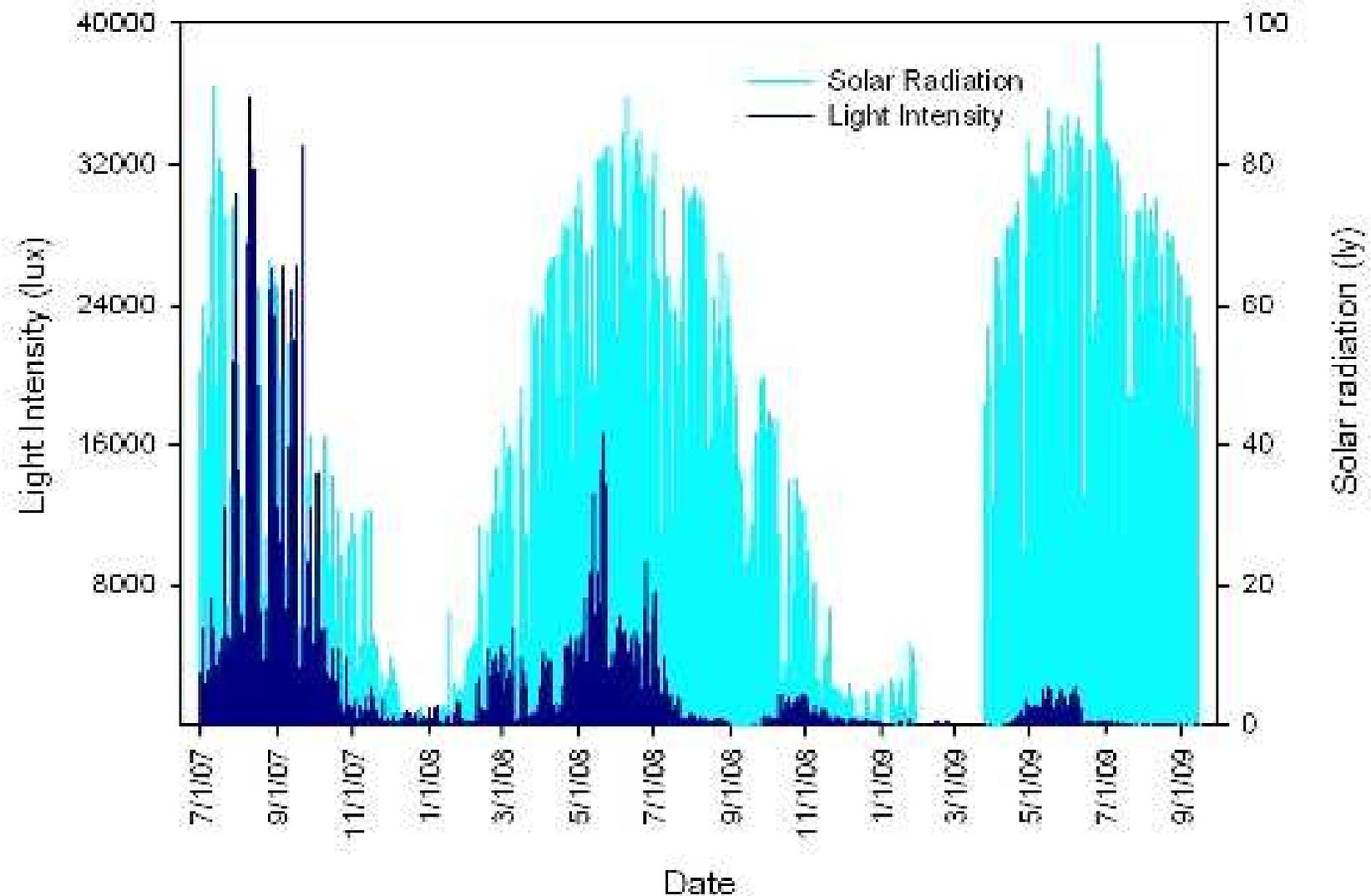
Tracking Intra-annual Patterns



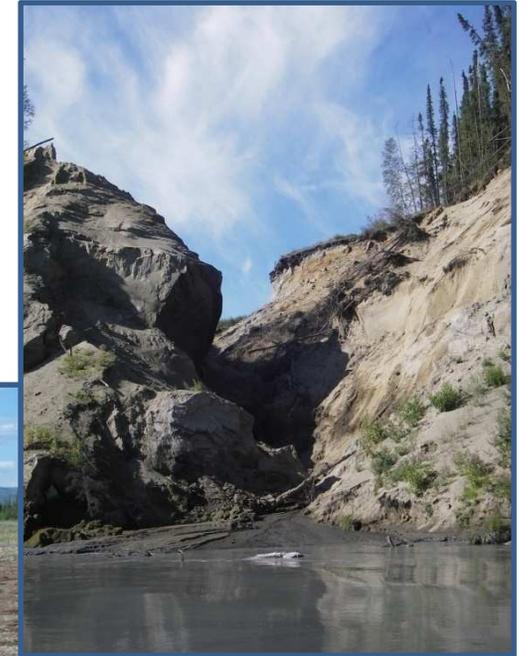
Documenting Stochastic Events



Documenting Stochastic Events



Anecdotal Observations



Questions?

