

National Ecological Observatory Network:



neon
Operated by Battelle

Linking Arctic and Continental Observations



Christopher Baird
cbaird@battelleecology.org

NARL 75th Anniversary
August 3, 2022

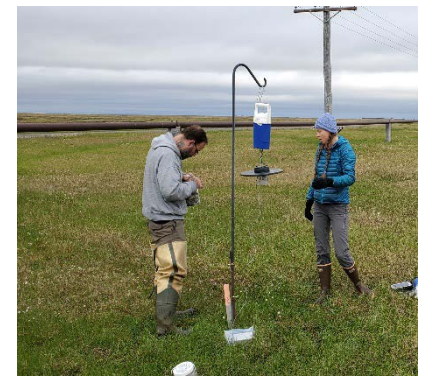
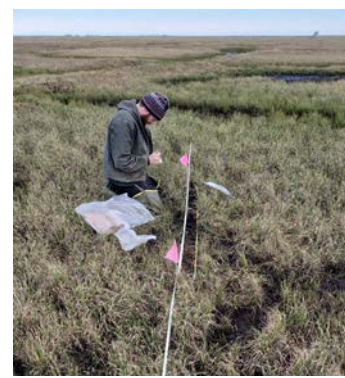
National Ecological Observatory Network (NEON)

...a continental-scale, long-term (30 year) Observatory, funded by NSF and operated by Battelle

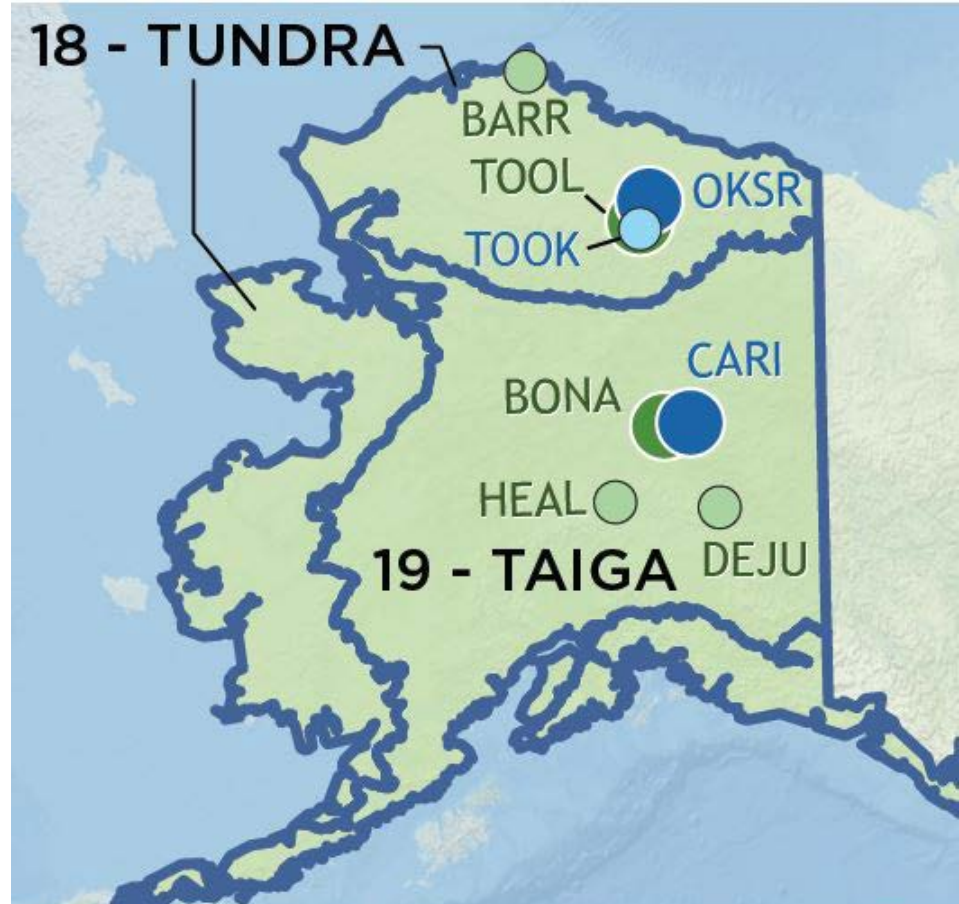
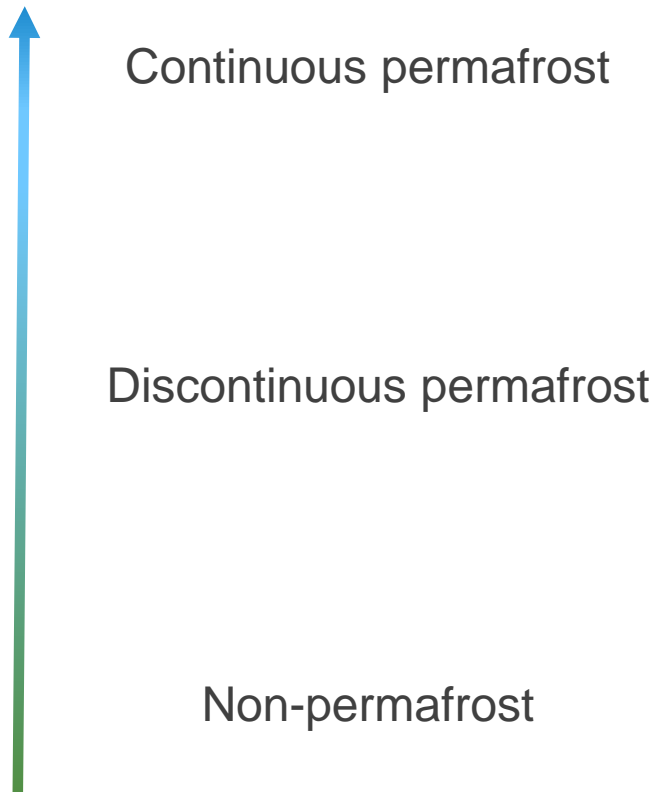
Enables:

- Analysis: Free and open data and samples on the drivers of and responses to environmental change
- Comparison: Standardized and reliable framework for research and experiments
- Interoperability: Integration with other national and international network science projects

BATTELLE



Alaska Core and Gradient sites



NEON is a distributed Observatory across the U.S.



CONCEPT & DESIGN

2004-2011

SITES BUILT OUT

2012 - ~2017

DATA COLLECTION

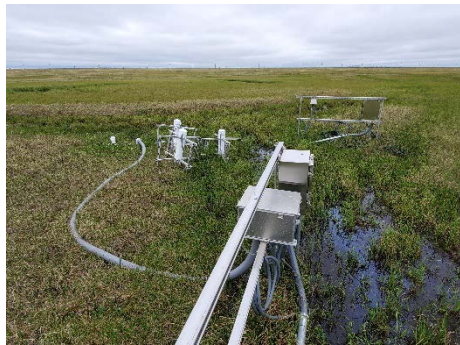
~2017 - 2046

NEON's Data Collection Systems

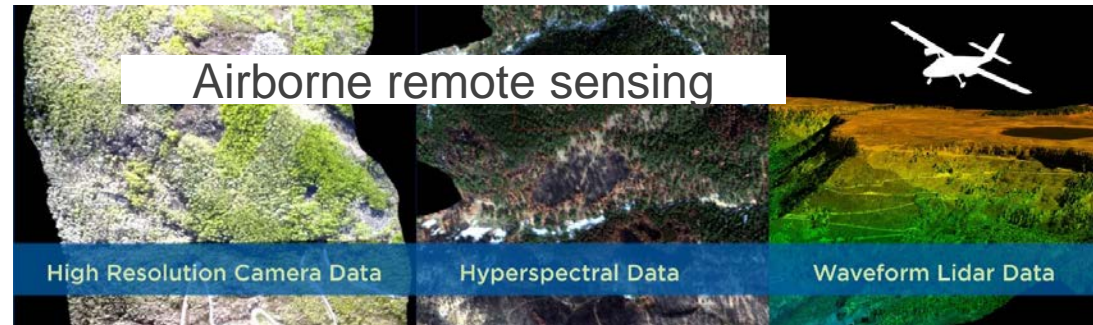
Standardized, co-located methods across sites



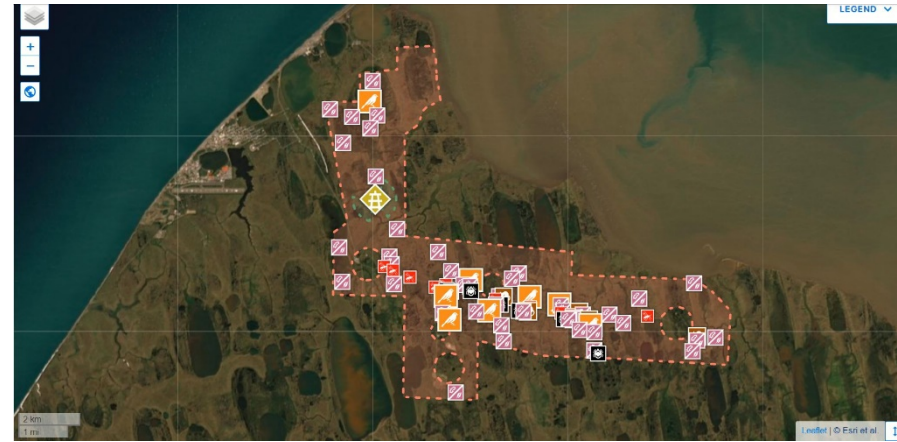
Observational
sampling



Automated
instruments



Terrestrial Sampling Design



	Plants	Soil microbes	Small mammals	Mosquitoes	Birds	Ground beetles	Ticks	Soil
Diversity	✓	✓	✓	✓	✓	✓	✓	
Abundance	✓	✓	✓	✓	✓	✓	✓	
Pathogens			✓	✓			✓	
Phenology	✓			✓			✓	
Pools/fluxes: biogeochemistry	✓							✓
Metabolism		✓						
Productivity & biomass	✓	✓						

182 Data Products

Atmospheric



H₂O, CO₂
Heat
Micromet
Isotopes
Turbulence
Storage
Fluxes

Organismal



Abundance
Composition
Biomass
Productivity
Pathogens
Phenology
Marker Genes
Metagenomics

Ecohydrology



Water quality
Precipitation
Discharge
Radiation
Geomorphology
Riparian Structure

Biogeochemistry



Soil conditions
Chemistry
Particulates
Foliar characteristics

Remote Sensing



Spectrometry
Hi-Res Imagery
LiDAR

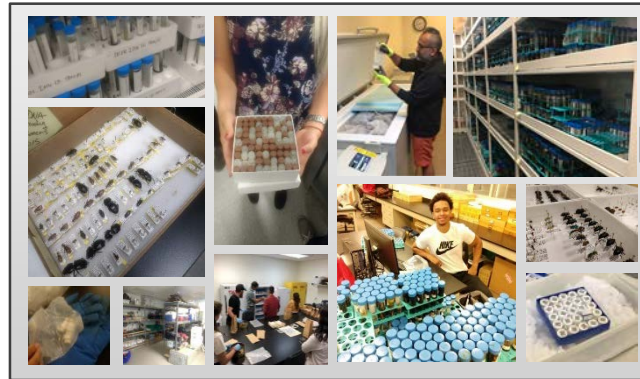
<https://www.neonscience.org/data>

NEON specimens & samples: NEON Biorepository

65 sample types

- Small mammals
- Fishes
- Ground beetles
- Mosquitos
- Ticks
- Zooplankton
- Benthic macroinvertebrates
- Vascular plants, algae, bryophytes and lichens
- Soil microbes
- Soil
- Dust
- Wet deposition

100,000 specimens & samples/year



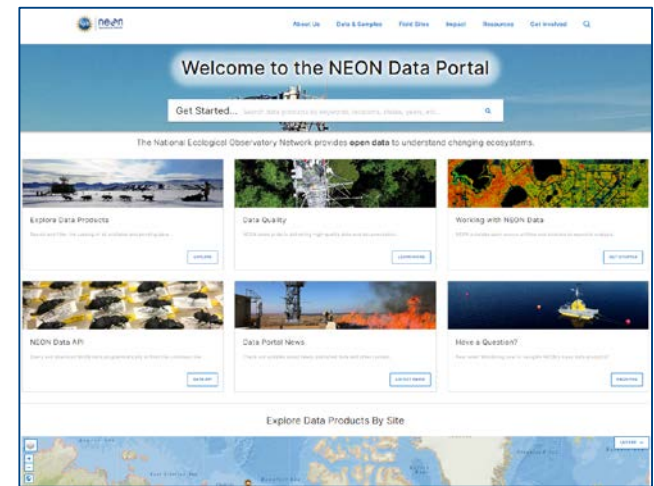
ASU Arizona State University

biorepo.neonscience.org



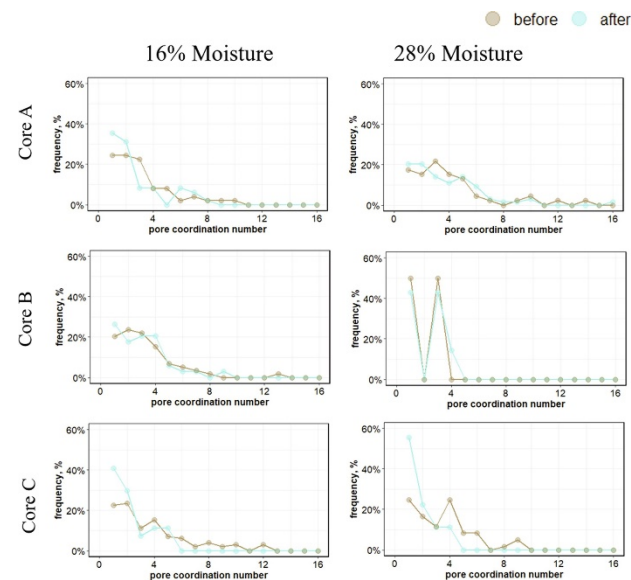
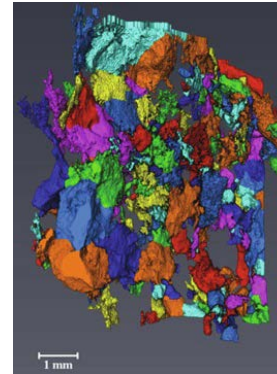
Data portal: data.neonscience.org

- Explore and download FREE data
- Information on programmatic access to NEON data
 - API
 - Code packages
- Access data product user guides, detailed protocols, and other important documents



Case Study: Soil pore network response to freeze-thaw cycles in Alaskan permafrost aggregates

- How do freeze-thaw cycles impact the pore network of newly thawed permafrost soil layers?
- Specifically, how do freeze-thaw cycles impact pore morphology, pore connectivity, and pore throat diameter?
- **Freeze-thaw alters the microenvironment of permafrost soil aggregates during the first stage of deformation following permafrost thaw**

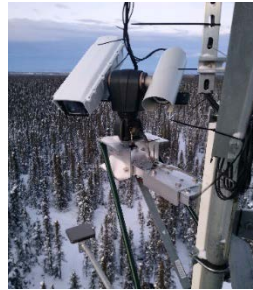


Rooney, E. C., Bailey, V. L., Patel, K. F., Dragila, M., Battu, A. K., Buchko, A. C., ... & Lybrand, R. A. (2022). Soil pore network response to freeze-thaw cycles in permafrost aggregates. *Geoderma*, 411, 115674.

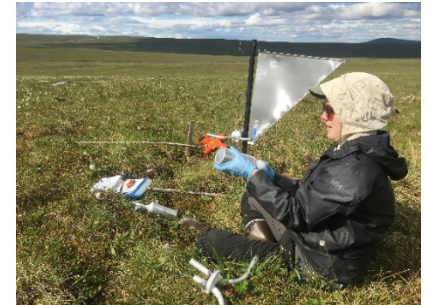
Leveraging NEON: Assignable Assets



Site Access & coordination



Access to Sensor Infrastructure



Sample Collection



- Access to **Observational Sampling Infrastructure** (staff and resources)
- Access to **Sensor Infrastructure**

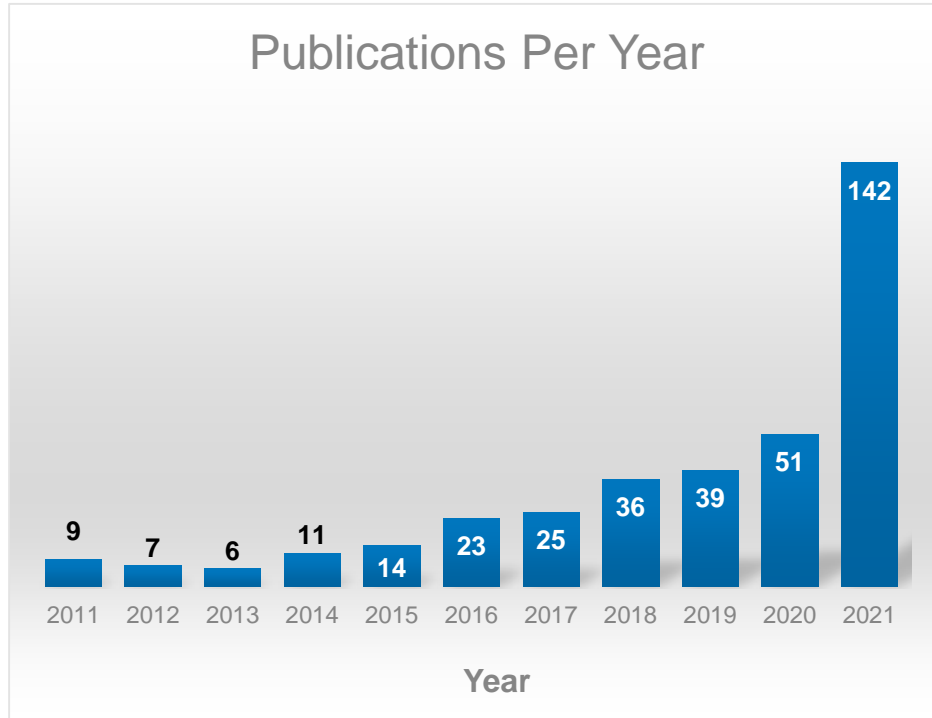
- **Airborne Observation Platform**
- **Mobile Deployment Platforms**

Leveraging Local Capacity

- Partnership with UIC to provide technical training instrumentation, sensor, and tower maintenance
 - UIC technical staff have taken a leading role in maintaining data streams
- Program expanded to incorporate terrestrial science sampling side-by-side with NEON staff
- **Goal** is to promote scientific capabilities of UIC staff and leverage their position in the advancement of arctic research



Research enabled by NEON data & specimens



NEON publications, visit:

<https://www.neonscience.org/impact/papers-publications>



New NSF center will advance, broaden and catalyze environmental data science

July 11, 2022

Understanding the impacts of climate change and the loss of biodiversity, and predicting and preparing for extreme environmental disturbances such as wildfires, floods and drought, require combining and synthesizing data sets that provide information at varying scales.

To support the analysis and integration of these data and advance the use of data-intensive approaches and training in environmental science, the U.S. National Science Foundation has announced the creation of the [Environmental Data Science Innovation and Inclusion Lab](#), or ESILL (pronounced "easel"), through a \$20 million, five-year award to the University of Colorado Boulder. Scientist Jennifer Balch is the principal investigator. The new synthesis center is funded jointly by NSF's Directorate for Biological Sciences and Office of Advanced Cyberinfrastructure.



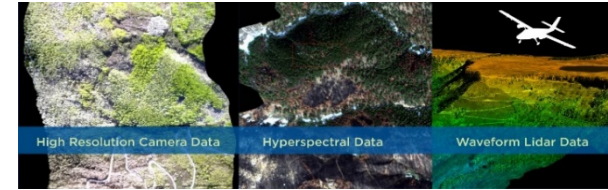
neon
Operated by Battelle

720.746.4844 | neonscience@battelleecology.org | neonscience.org



Airborne remote sensing

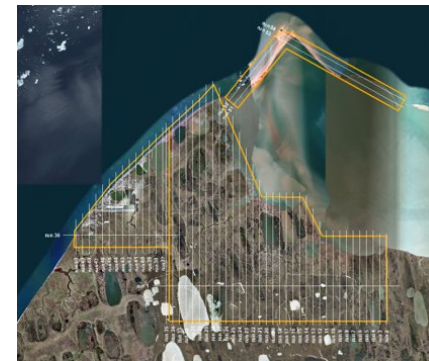
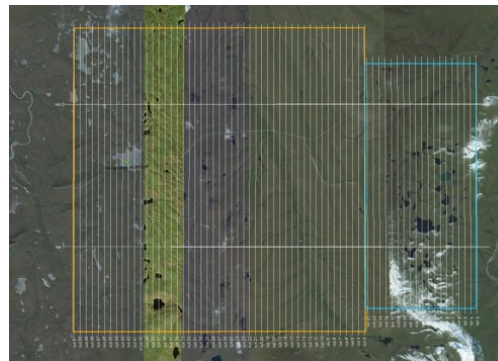
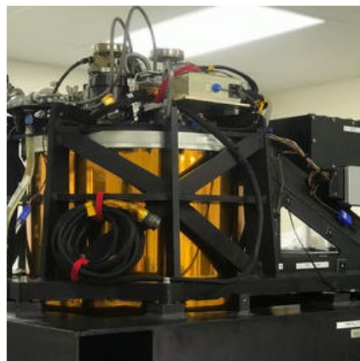
2022 AOP Campaign Schedule



Payload 1

Payload 3

Domain	Start Date	End Date	Domain	Start Date	End Date
11 - Southern Plains	4-May	10-May	13 - Southern Rockies & Colorado Plateau	27-Apr	11-May
2 - Mid-Atlantic	13-May	2-Jun	15 - Great Basin	27-Apr	11-May
6 - Prairie Peninsula	5-Jun	16-Jun	7 - Appalachians & Cumberland Plateau	16-May	4-Jun
12 - Northern Rockies	18-Jun	30-Jun	5 - Great Lakes	6-Jun	4-Jul
16 - Pacific Northwest	4-Jul	15-Jul	10 - Great Plains	6-Jul	27-Jul
18 - Tundra	20-Jul	22-Aug	1 - Northeast	1-Aug	26-Aug
14 - Desert Southwest	28-Aug	11-Sep			
7 - Appalachians & Cumberland Plateau	18-Sep	11-Oct			
4 - Atlantic Neotropical	17-Oct	12-Nov			





Field Operations: Aquatic team

Biological

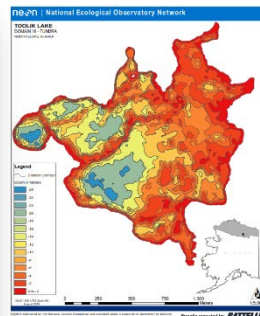
- 3 sites; 3 bio bouts annually
 - Spring
 - Summer
 - Fall

Physical

- Routine measurements of:
 - Discharge
 - Reaeration
 - sediment
- Geomorphology/bathymetry
- Bathymetry

Automated Collections

- Water Quality
- Met station
- Winter & summer data streaming capabilities





Field Operations: Terrestrial team (TOS)

Annual

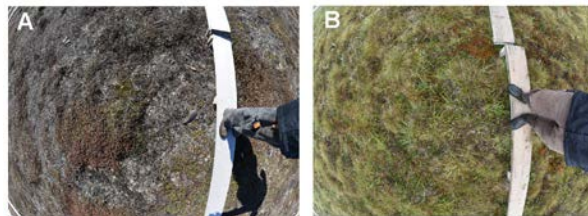
- Plant Diversity
- Phenology
 - Plants, mosquitoes, ticks
- LAI (tower)
- Soil microbes
- Litterfall collections
- Herb. biomass (tower)
- Carabids and bycatch
- Breeding birds
- Small Mammals

Every 5yrs

- Vegetation Structure
- CDW and bulk density
- LAI & herb biomass (site level)
- Below ground biomass
- Canopy foliage Chemistry
- Soils (nitrogen (N) pools and net N transformation rates)



*AOP ground-truthing
with canopy chemistry*



Toolik Field Station, AK. Photo A: June 7, 2018, Photo B: August 1st, 2018

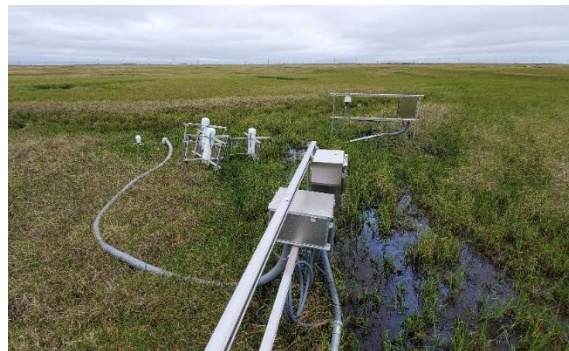
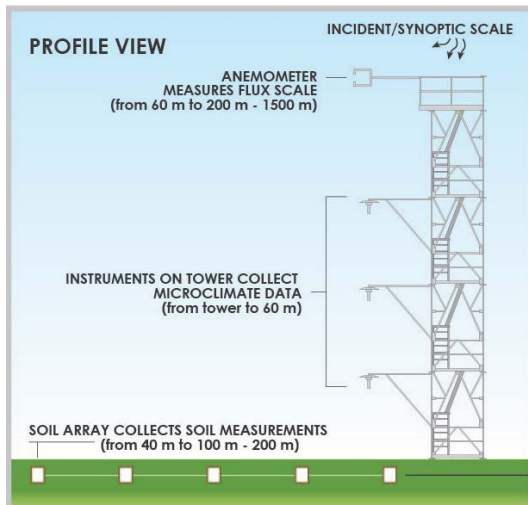


Field operations: Instrumentation Tower Team

- Five tower sites
- Climate controlled hut w/ remote monitoring capabilities
- Routine Preventative maintenance on all towers and soil arrays bi-weekly, year-round
- Researchers can request to add their own instruments to towers and infrastructure



© Thomas Colby Wright



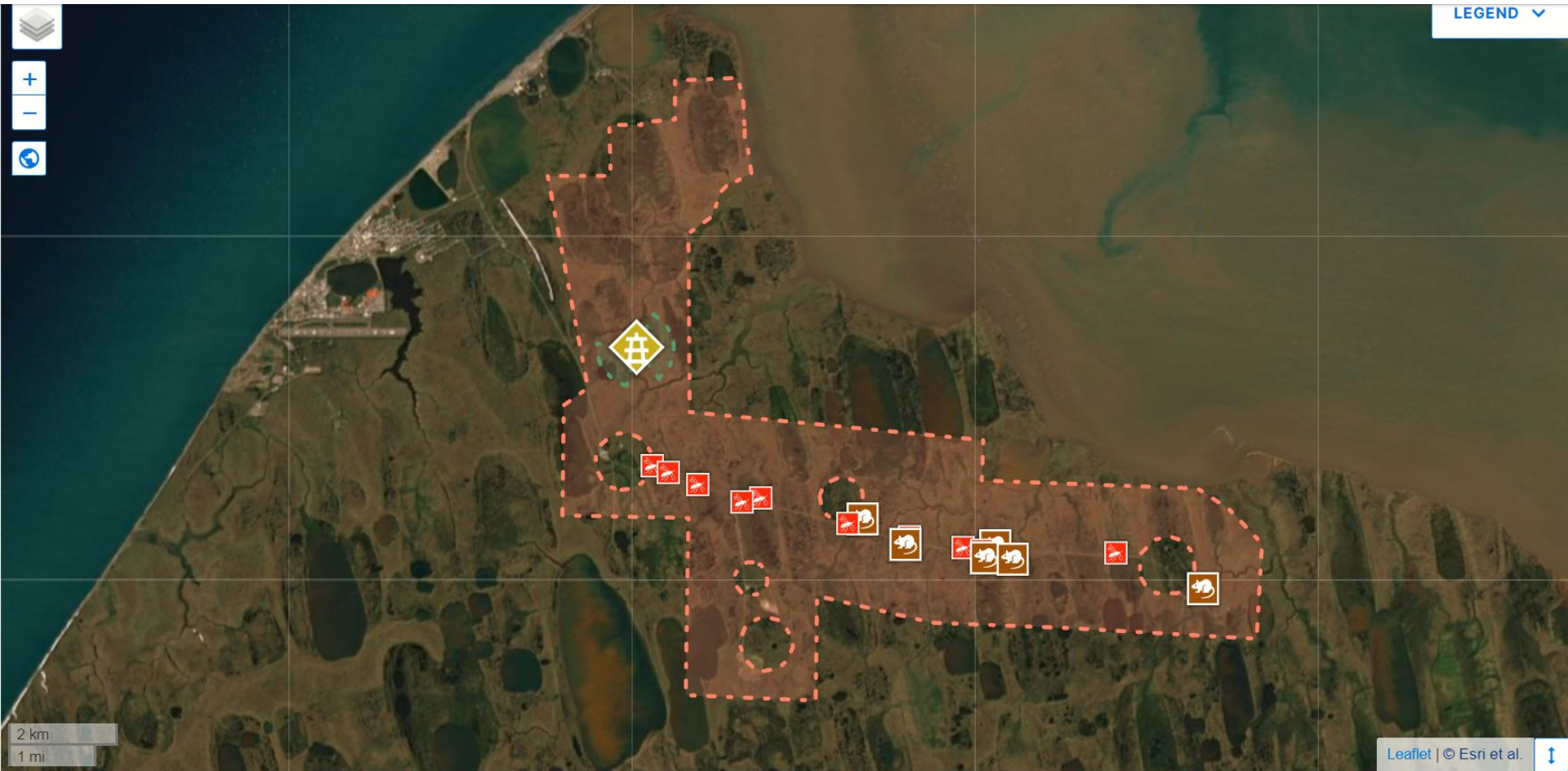
Spatial Sampling Design (BARR)



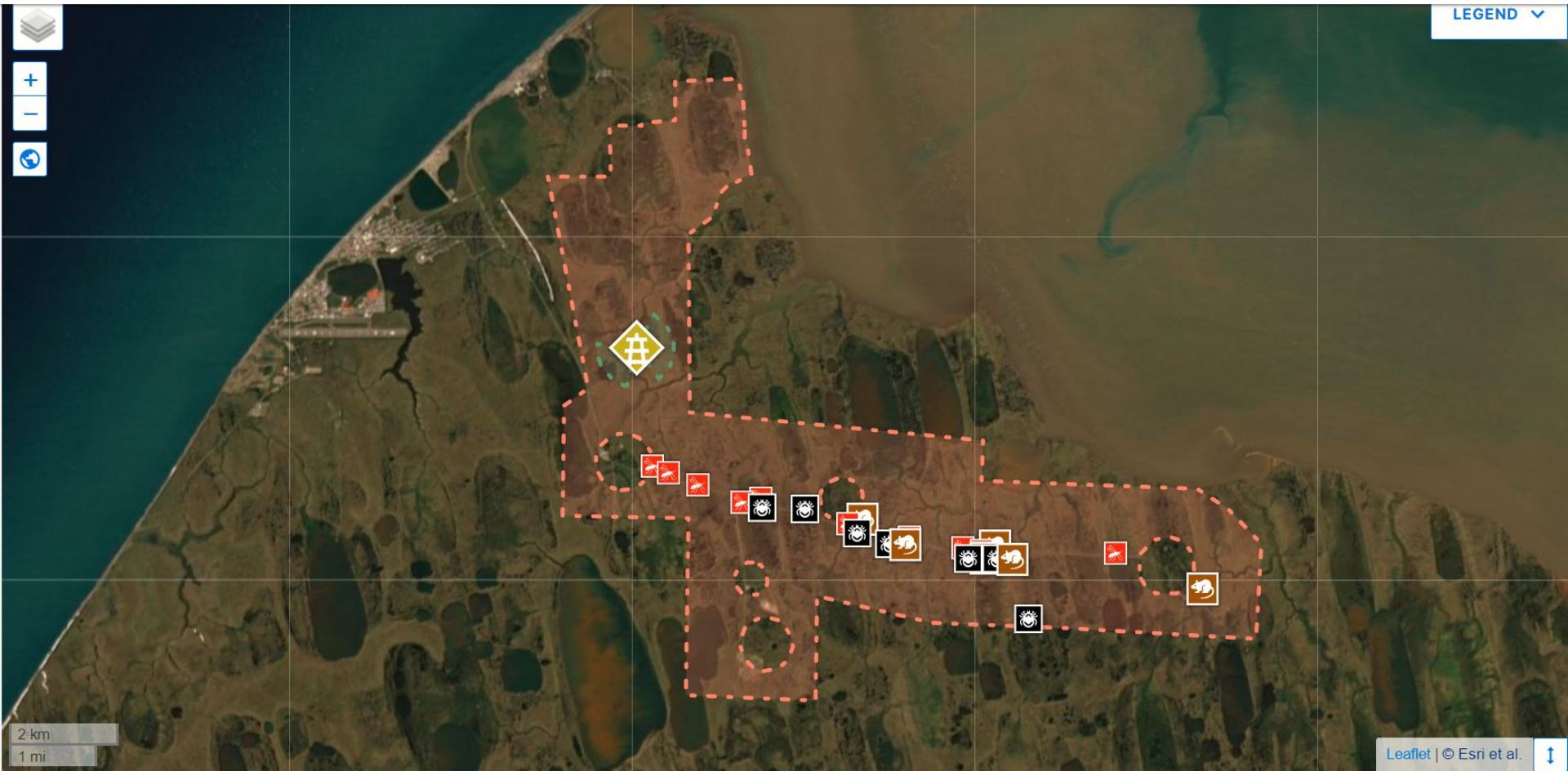
Spatial Sampling Design (BARR)



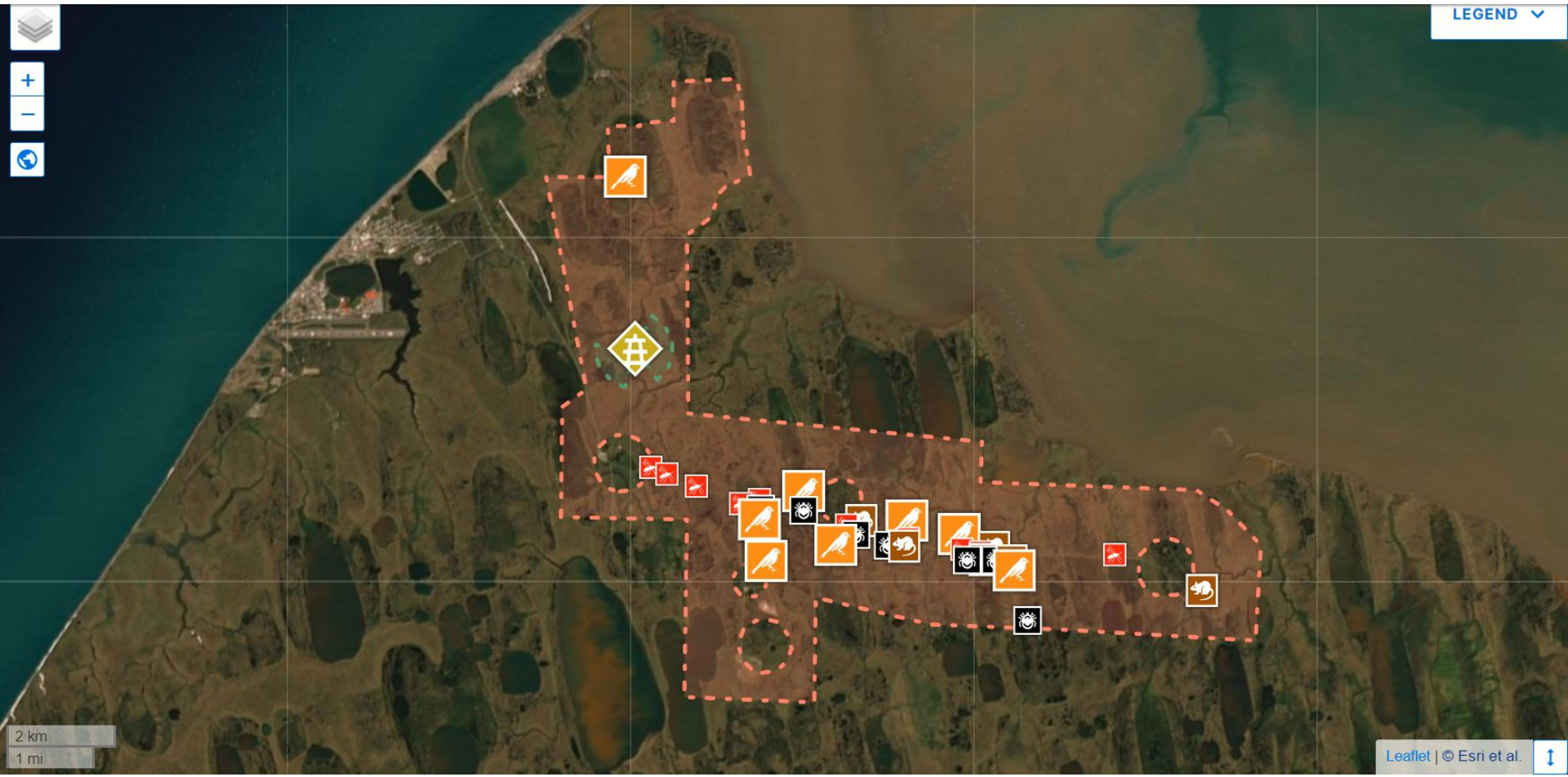
Spatial Sampling Design (BARR)



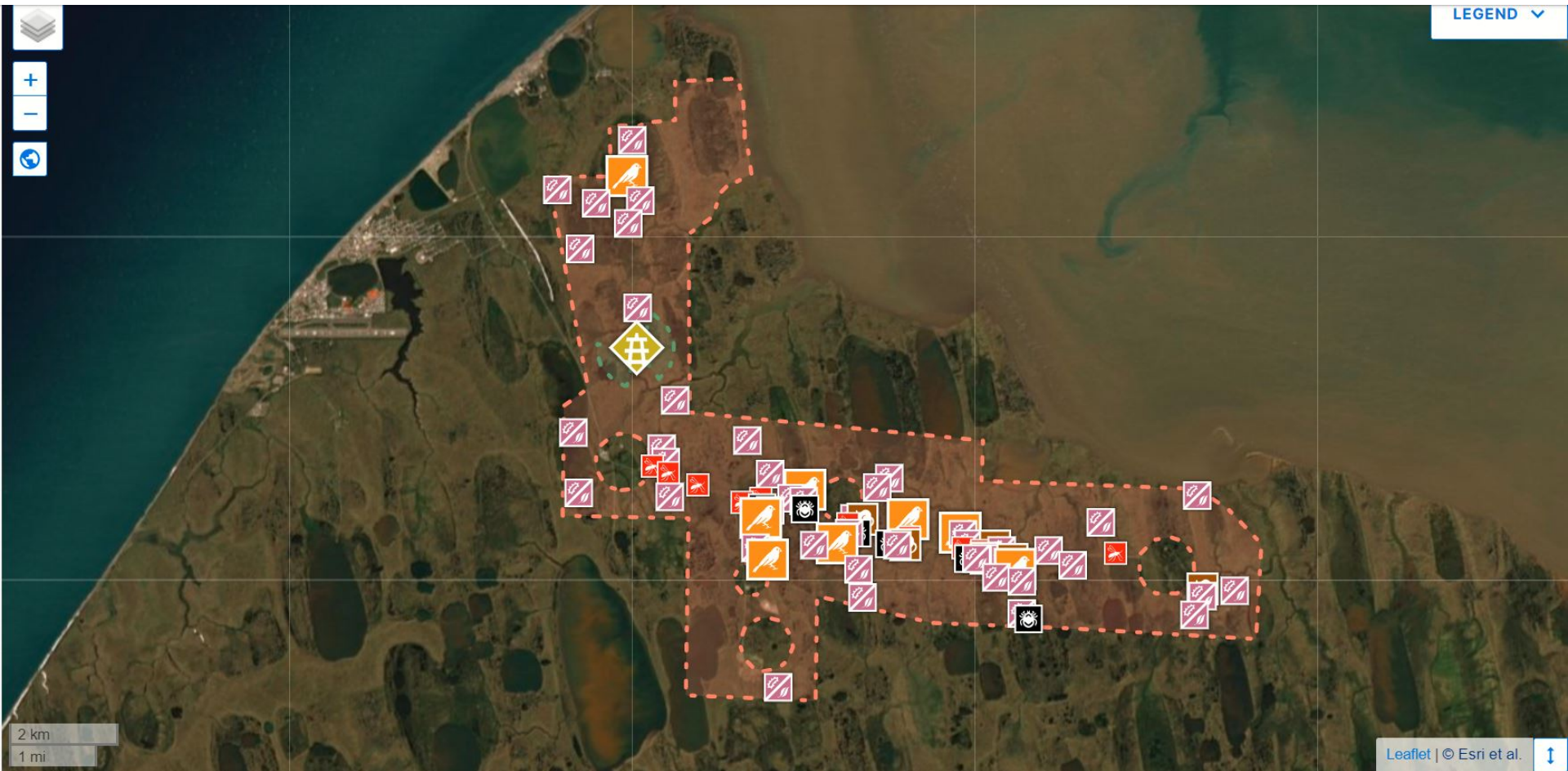
Spatial Sampling Design (BARR)



Spatial Sampling Design (BARR)



Spatial Sampling Design (BARR)



Spatial Sampling Design (BARR)

