NEON Operations at Toolik: 2015 – 2024

Toolik All Scientists Meeting, January 16-18, 2025

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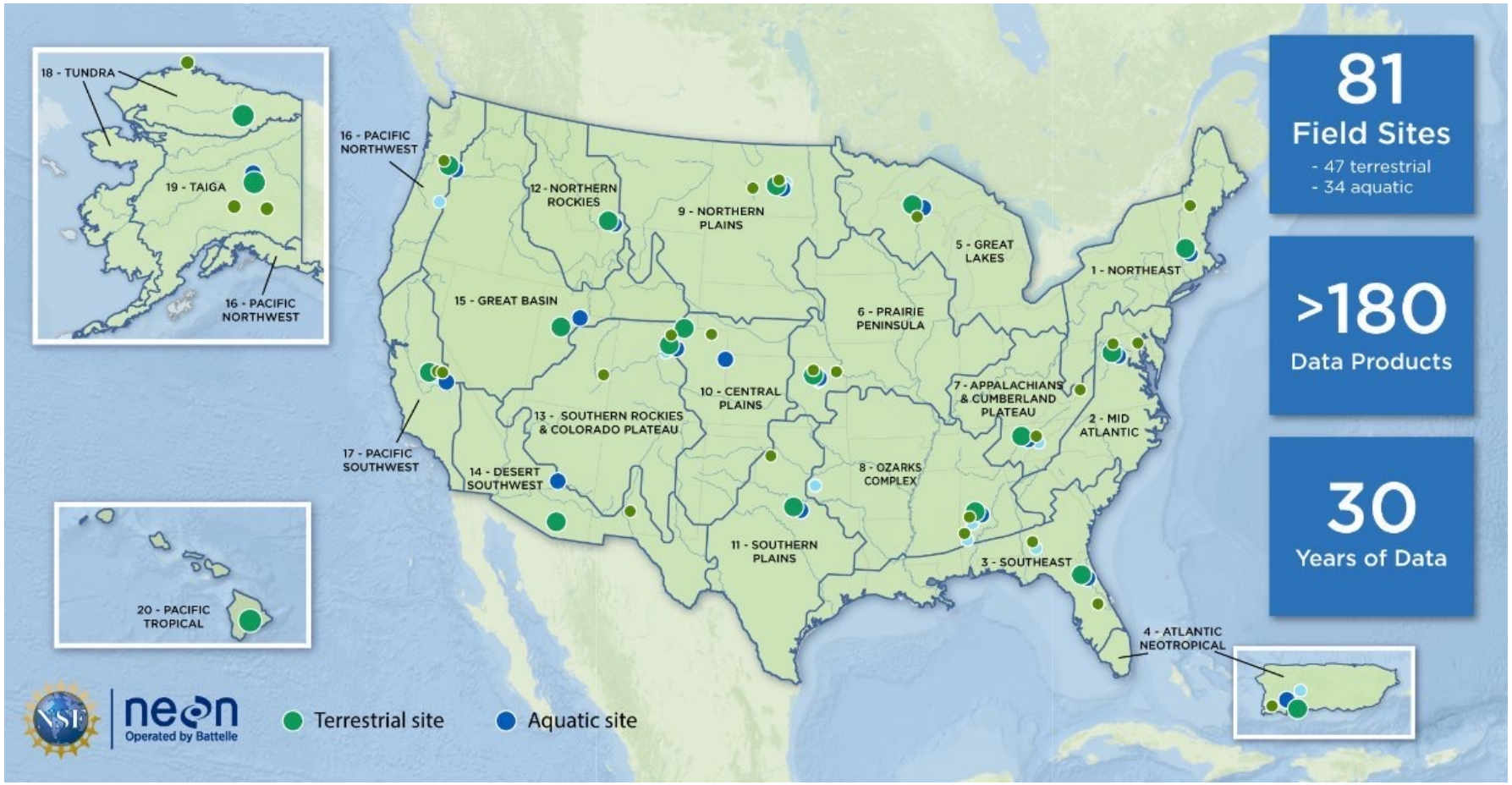
Operations Manager, D18/19

What is the National Ecological Observatory Network (NEON)?

- An NSF large facility
- A continental-scale observatory
- Designed to enable understanding and forecasting of the effects of climate and environmental change

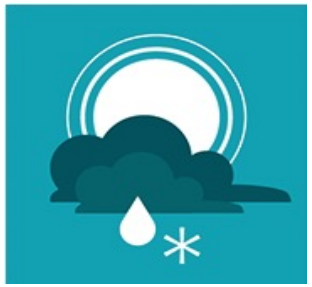


CONCEPT & DESIGN	SITES BUILT OUT	DATA COLLECTION
2004-2011	2012 - ~2017	~2017 - 2046

FAIR and Open

182 Data Products

Atmospheric



H_2O, CO_2
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

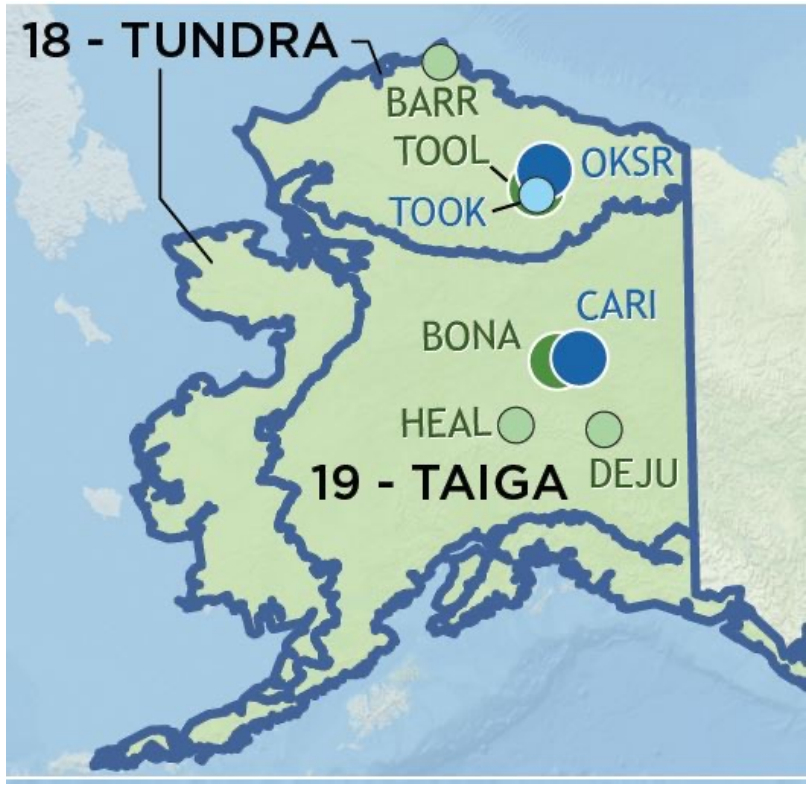
https://www.neonscience.org/data

Alaska site gradient: Permafrost

Continuous permafrost

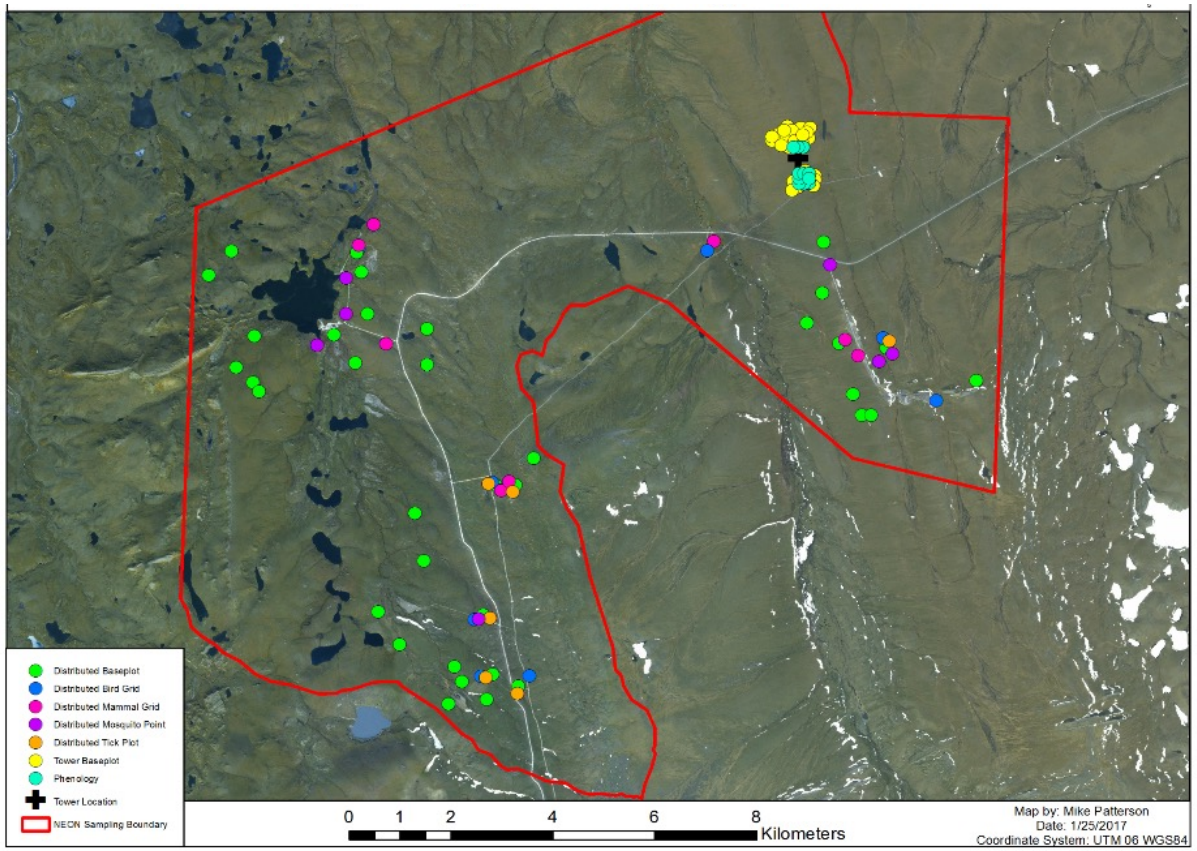
Discontinuous permafrost

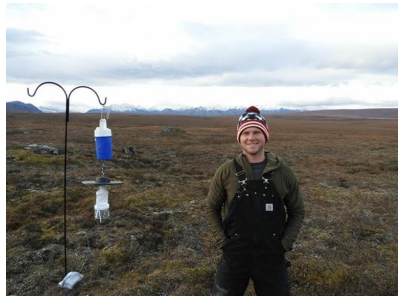
Non-permafrost

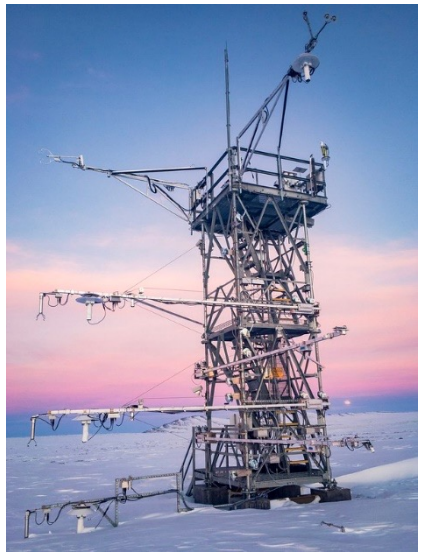


TOOL – Terrestrial Sampling

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







TOOK – Aquatic Sampling (lake)

Biological

- Three bouts – Spring, Summer, Fall

Physical

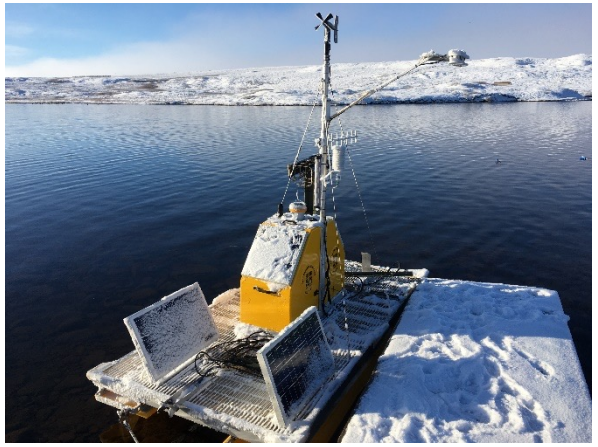
- Discharge (inlet/outlet)
- Bathymetry

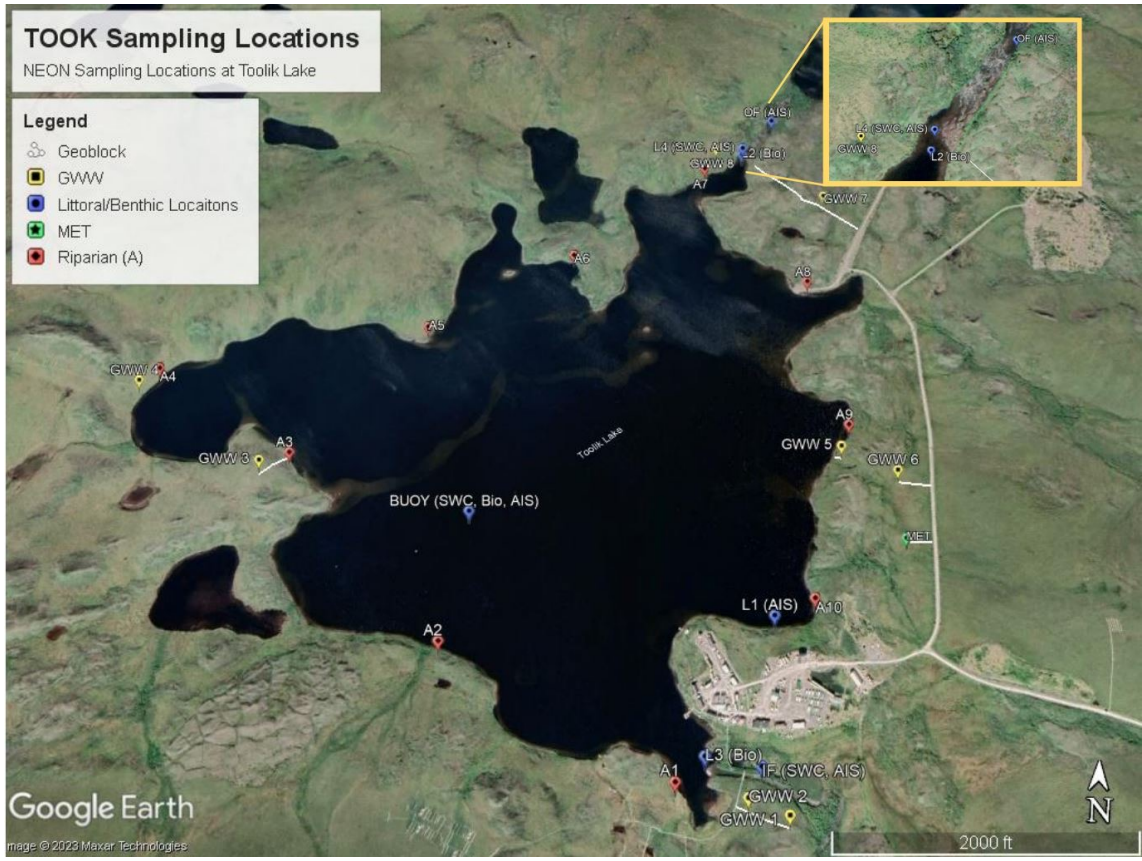
Chemical

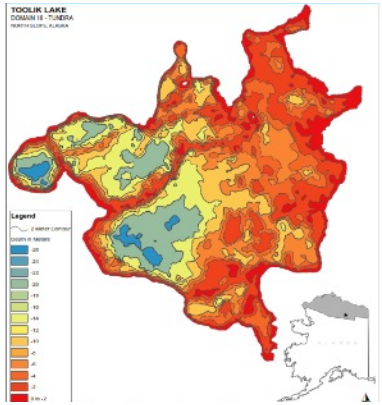
- Water and sediment chemistry

Automated sensors

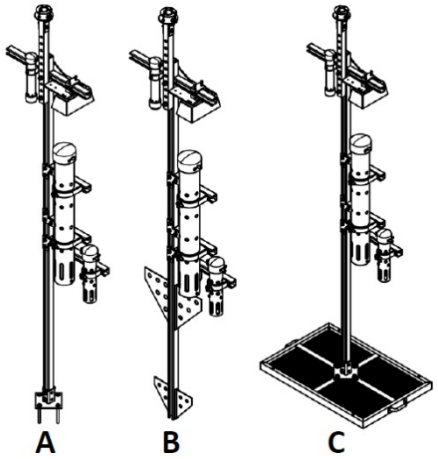
- Inlet, outlet, littoral zones, lake center







Ah ha moment!



OKSR – Aquatic Sampling (Stream)

Biological

- Three bouts – Spring, Summer, Fall

Physical

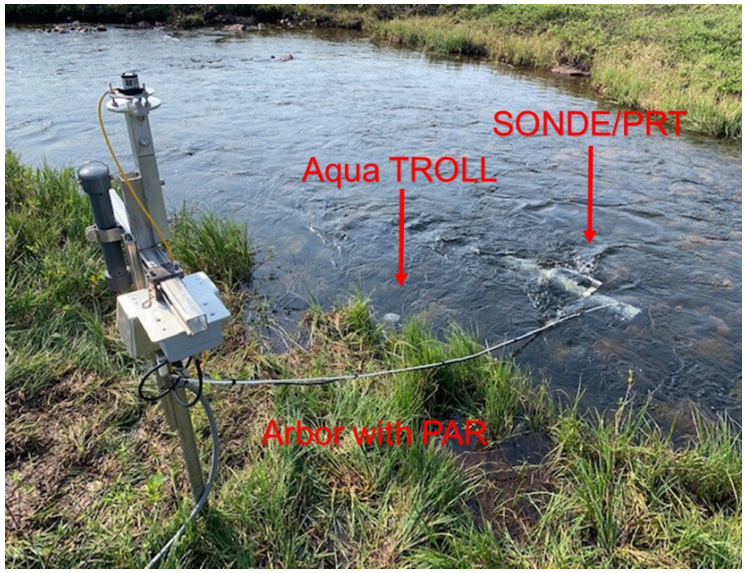
- Discharge (S2), and reaeration
- Geomorphology

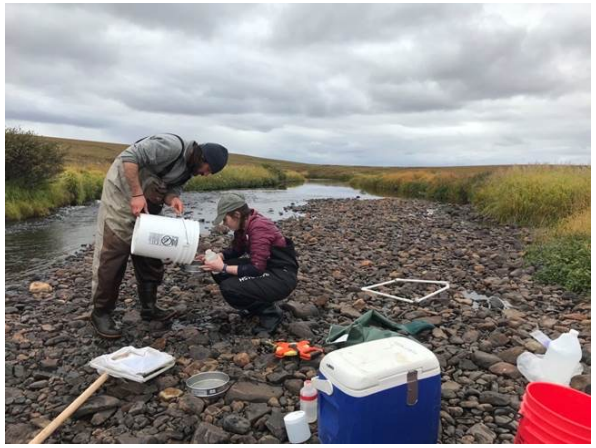
Chemical

- Water and sediment chemistry

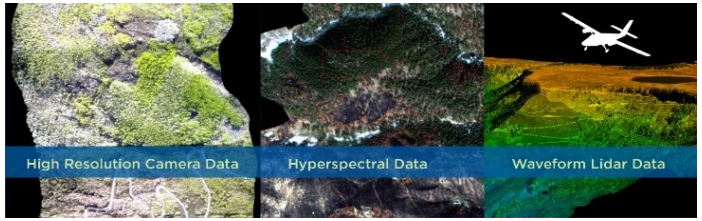
Automated sensors

- Upstream (S1), Downstream (S2), Met.

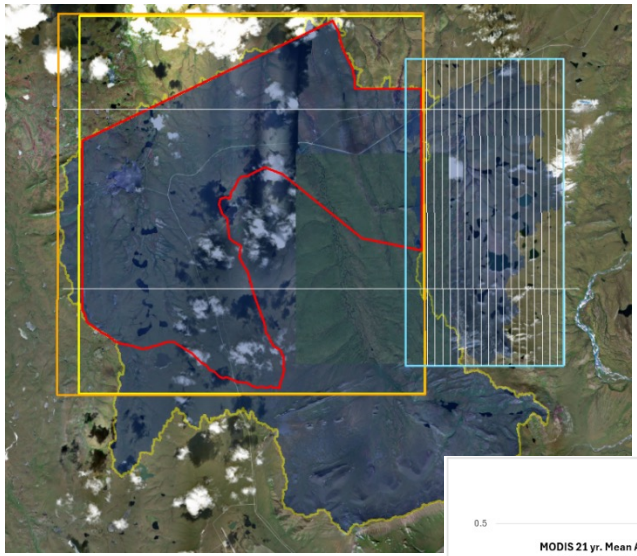


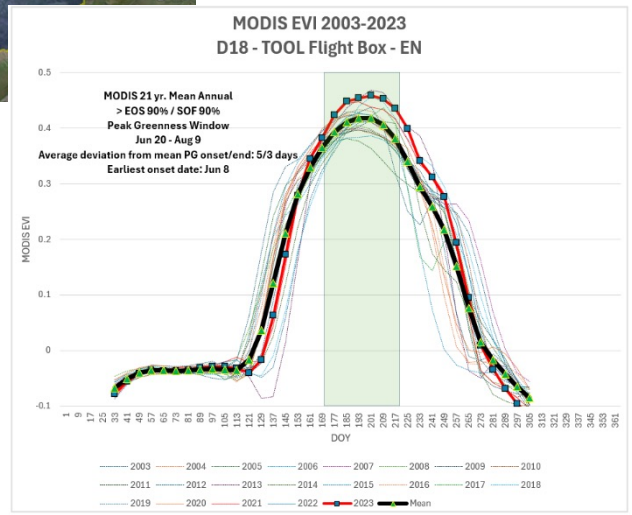


Aerial Observation Platform (AOP)



AOP now in Google Earth Engine



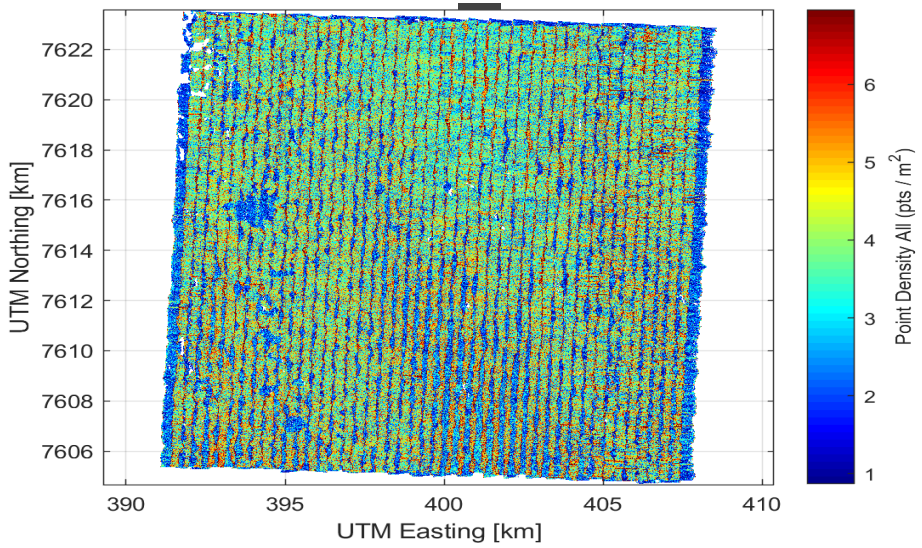


Desktop: https://neon-prod-earthengine.projects.earthengine.app/view/neon-aop-gee-data-viewer---desktop

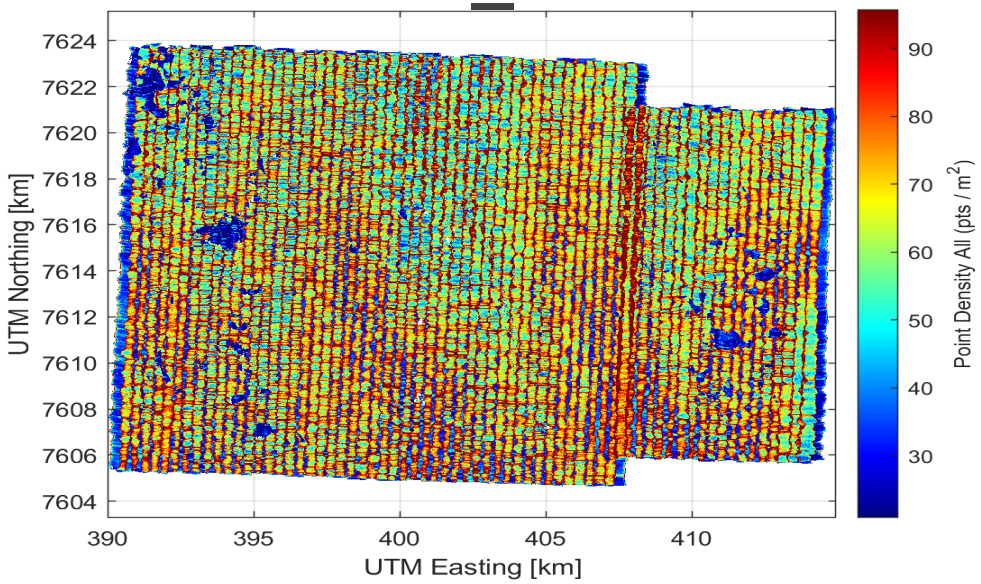
Mobile: https://neon-prod-earthengine.projects.earthengine.app/view/aop-gee-data-viewer---mobile

Lidar Point Density Improvements

2019_TOOL

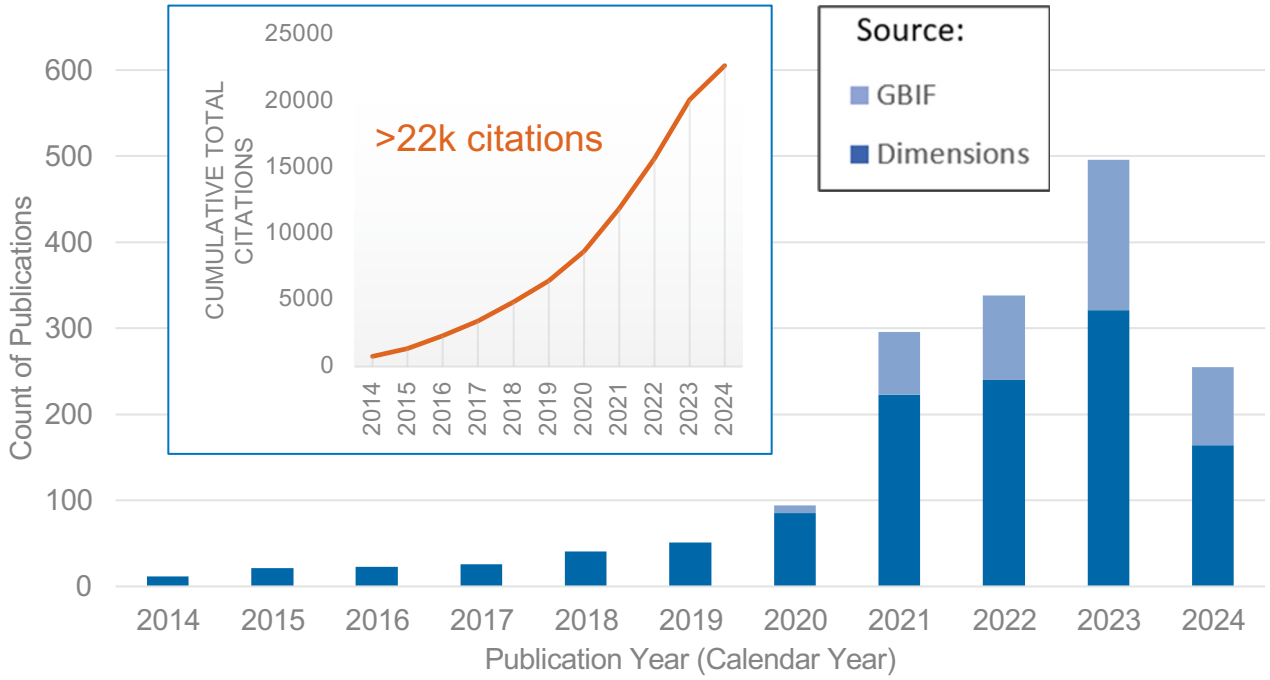


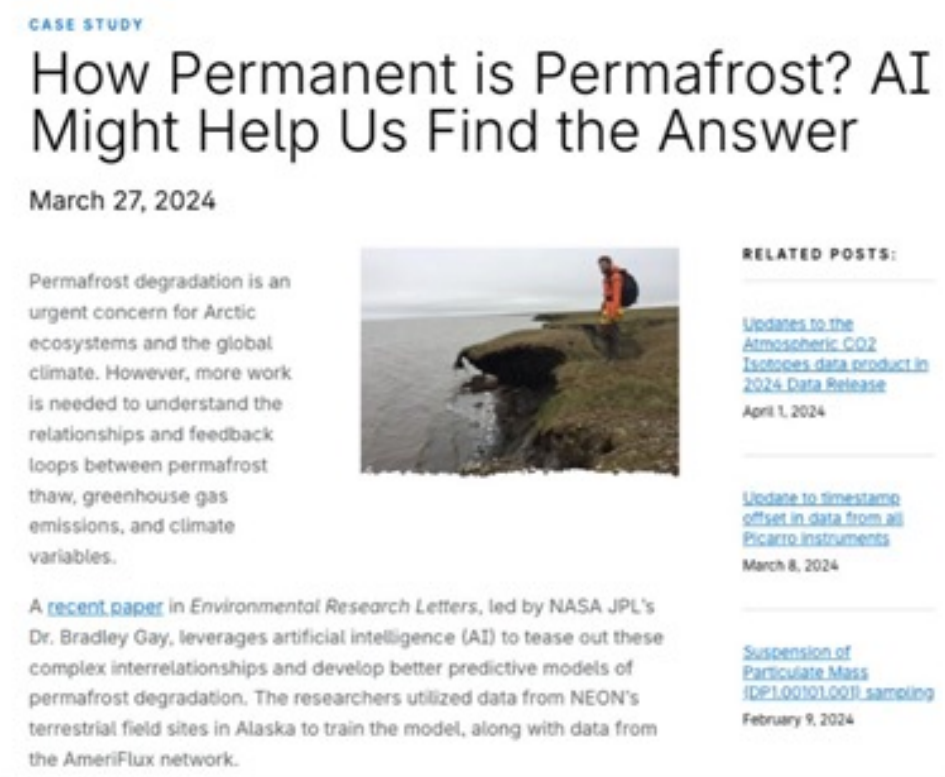
2022_TOOL



Year	Lidar Sensor	PRF (kHz)	Point Density (points per m^2)	Weather Conditions
2017	Optech Gemini	70	1-6	Mixed (Green, Yellow, Red)
2018	Optech Gemini	70	1-6	Red (>50% cloud cover)
2019	Optech Gemini	70	1-6	Mixed (Green, Yellow, Red)
2022	Optech Galaxy	750	30-90	Red (>50% cloud cover)

NEON research use: 1,200+ publications





CASE STUDY

How Permanent is Permafrost? AI Might Help Us Find the Answer

March 27, 2024

Permafrost degradation is an urgent concern for Arctic ecosystems and the global climate. However, more work is needed to understand the relationships and feedback loops between permafrost thaw, greenhouse gas emissions, and climate variables.

A recent paper in *Environmental Research Letters*, led by NASA JPL's Dr. Bradley Gay, leverages artificial intelligence (AI) to tease out these complex interrelationships and develop better predictive models of permafrost degradation. The researchers utilized data from NEON's terrestrial field sites in Alaska to train the model, along with data from the AmeriFlux network.

RELATED POSTS:

Updates to the Atmospheric CO2 Isotopes data product in 2024 Data Release
April 1, 2024

Update to timestamp offset in data from all Picarro instruments
March 8, 2024

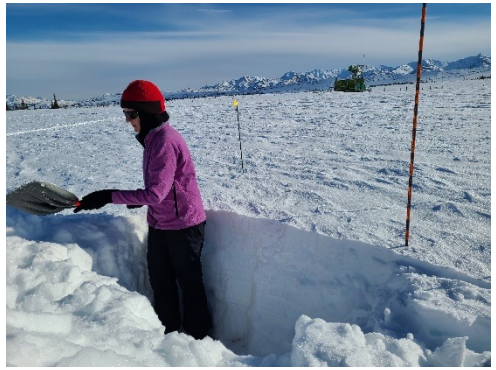
Suspension of Particulate Mass (DP1.00101.001) sampling
February 9, 2024

NEON Publications in Dimensions (data, assets)

NEON Publications in GBIF (specimens)

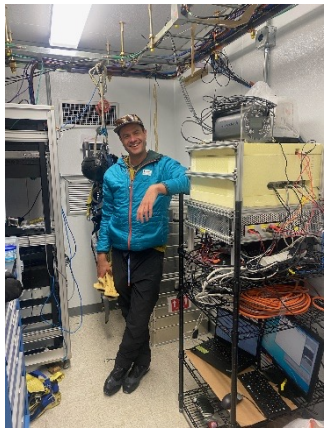
Data from 2 Jul 2024

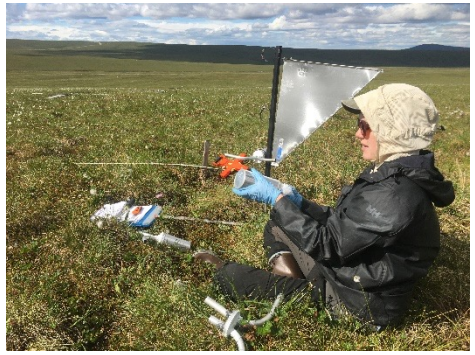
NEON Research Support Services (NRSS)



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**

Local partnerships and career development

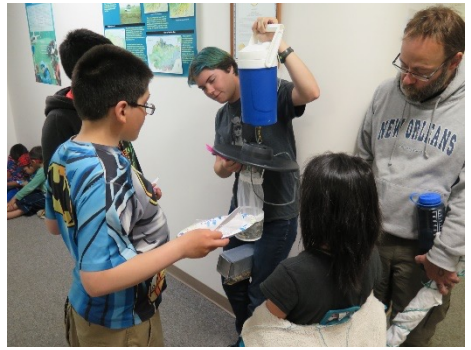
ANSEP ALASKA NATIVE SCIENCE & ENGINEERING PROGRAM

NATIONAL SCIENCE FOUNDATION LTER NETWORK LONG TERM ECOLOGICAL RESEARCH

UIC SCIENCE

ILISAĠVIK COLLEGE

UAF UNIVERSITY OF ALASKA FAIRBANKS



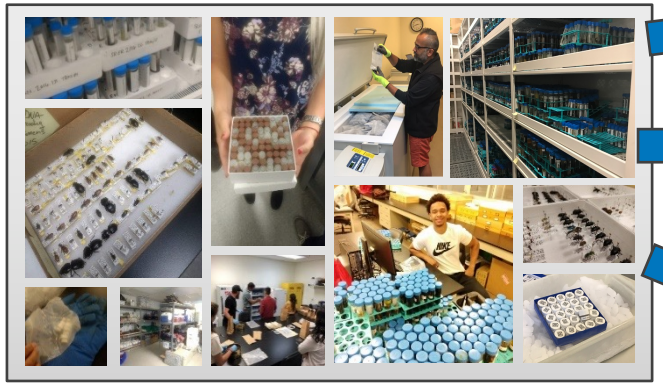
NSF neon Operated by Battelle

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



iDigBio Integrated Digitized Biocollections

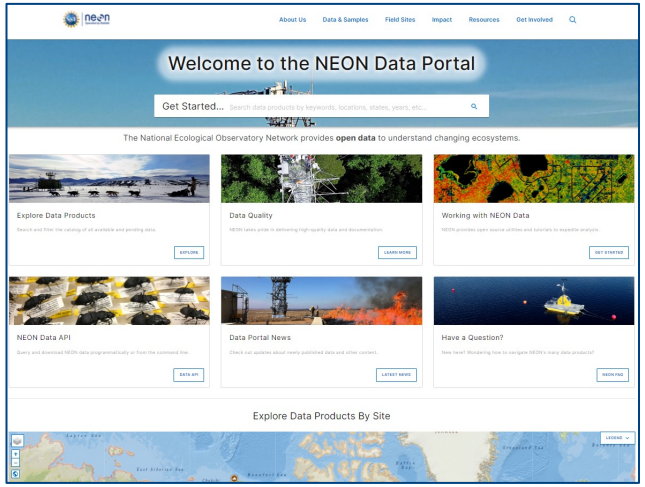
GBIF Global Biodiversity Information Facility

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



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