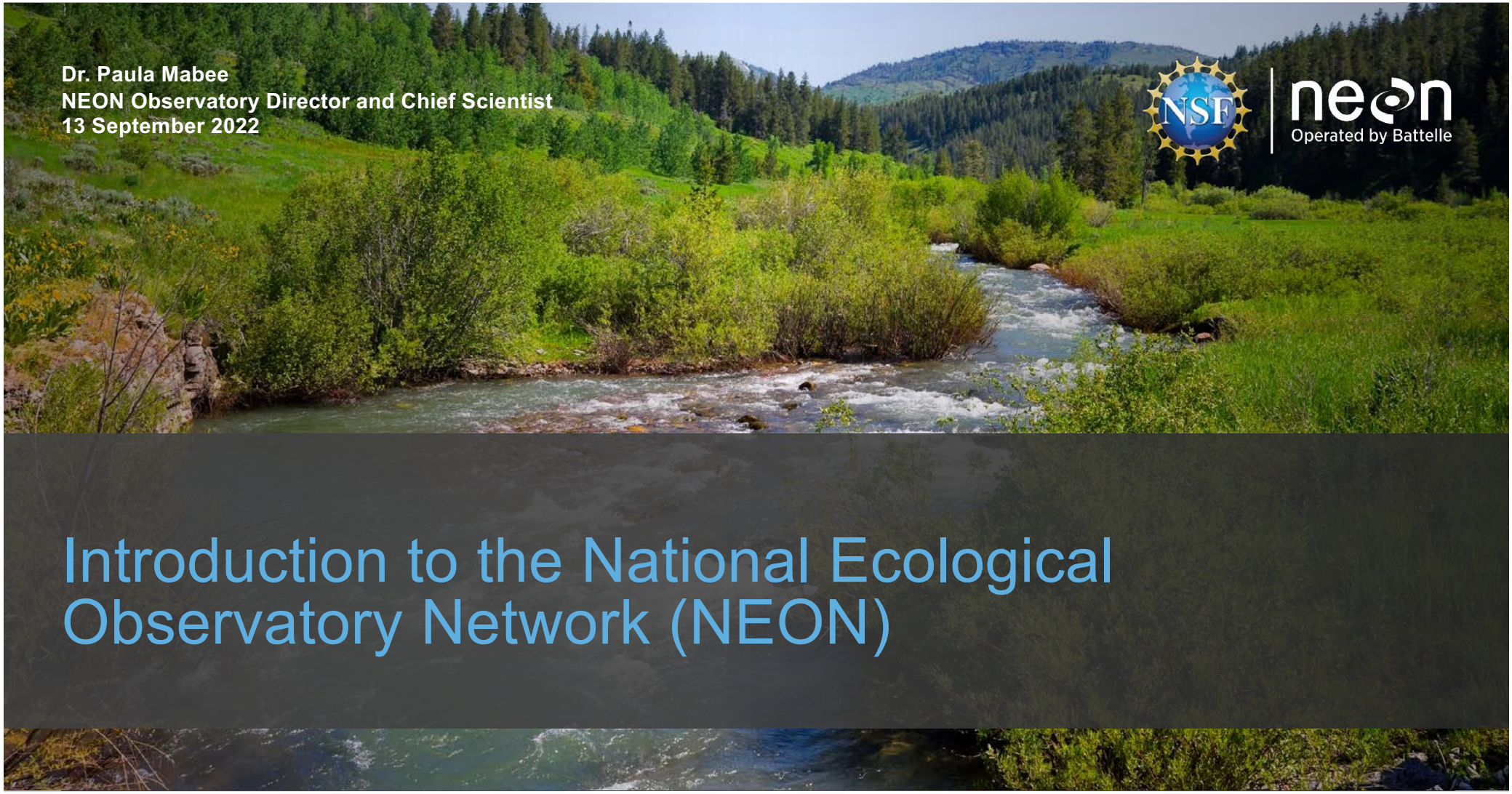


Dr. Paula Mabee
NEON Observatory Director and Chief Scientist
13 September 2022

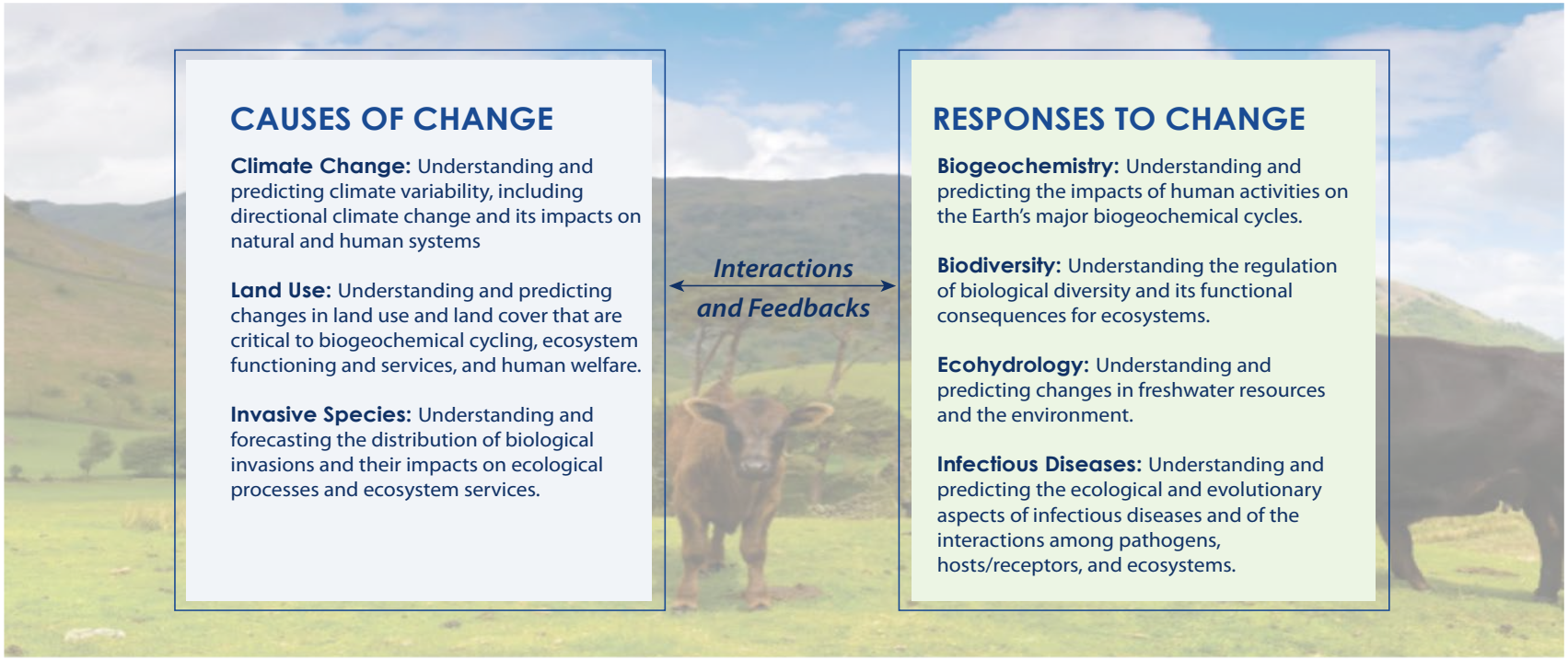
Introduction to the National Ecological Observatory Network (NEON)

This material is based upon work supported by NSF's National Ecological Observatory Network which is a major facility fully funded by the National Science Foundation

NEON: Designed to understand and forecast the effects of environmental change

NEON Mission:

To enable fundamental understanding and forecasting of the impacts of global change on continental-scale ecology by providing infrastructure to support research and education

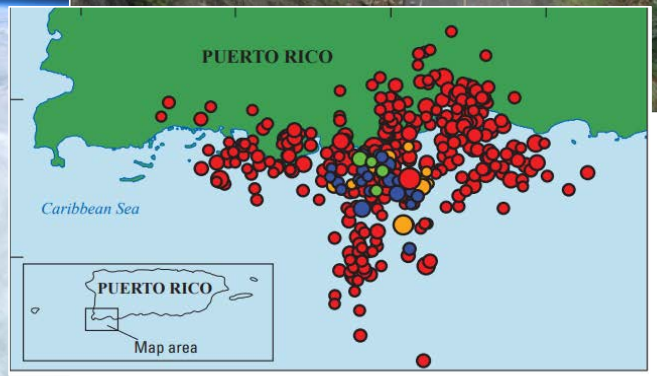


NEON is a distributed Observatory

NEON is an ecological Observatory

Requires long-term data; continuity in data stream

Natural hazards



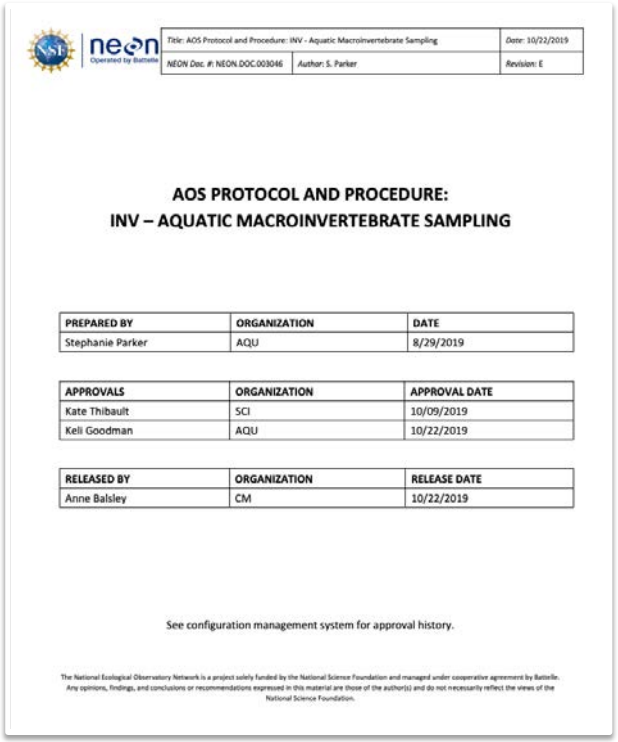
NEON data are standardized

“I think they often don’t appreciate how hard it is to actually make that standardization happen throughout the network.”

Stephanie M. Parker, Ph.D.

One protocol,
many habitats…

Standard protocols



Title: AOS Protocol and Procedure: INV - Aquatic Macroinvertebrate Sampling		Date: 10/22/2019
NEON Doc. #: NEON.DOC.003046	Author: S. Parker	Revision: E

AOS PROTOCOL AND PROCEDURE:
INV – AQUATIC MACROINVERTEBRATE SAMPLING

PREPARED BY	ORGANIZATION	DATE
Stephanie Parker	AQU	8/29/2019

APPROVALS	ORGANIZATION	APPROVAL DATE
Kate Thibault	SCI	10/09/2019
Keli Goodman	AQU	10/22/2019

RELEASED BY	ORGANIZATION	RELEASE DATE
Anne Balsley	CM	10/22/2019

See configuration management system for approval history.

The National Ecological Observatory Network is a project solely funded by the National Science Foundation and managed under cooperative agreement by Battelle. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

NEON Aquatic macroinvertebrate sampling protocol

https://data.neonscience.org/data-products/DP1.20120.001

Winter tree fall covering Upper Big Creek, CA (2019)

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

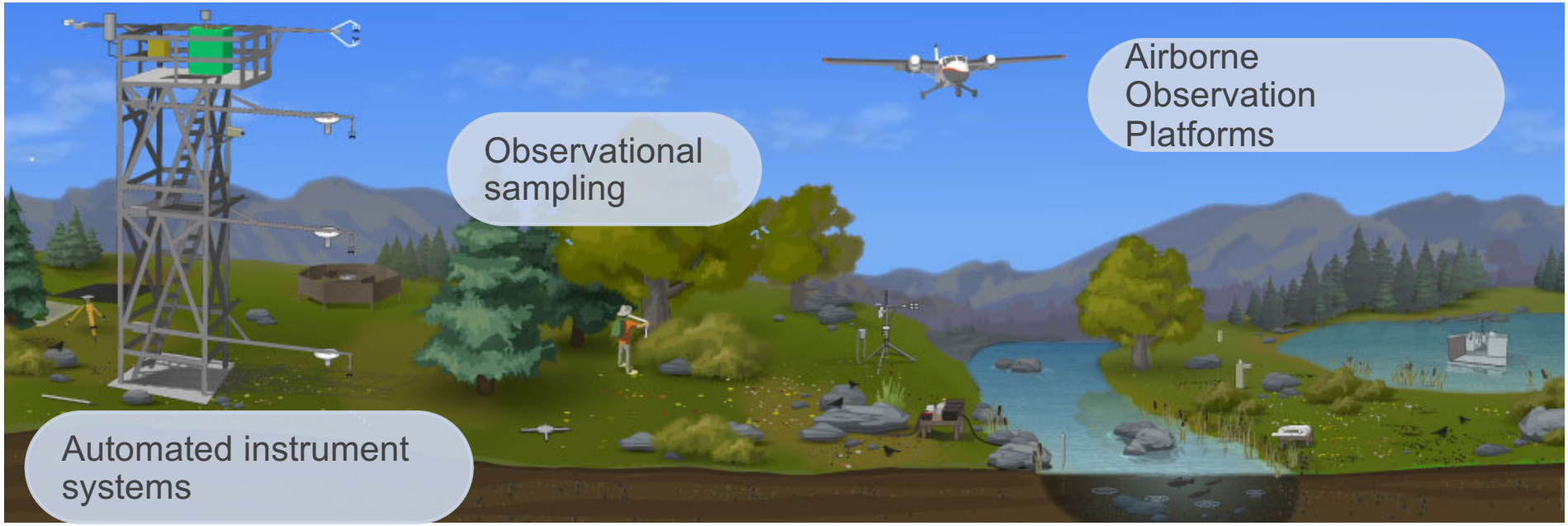
BATTELLE





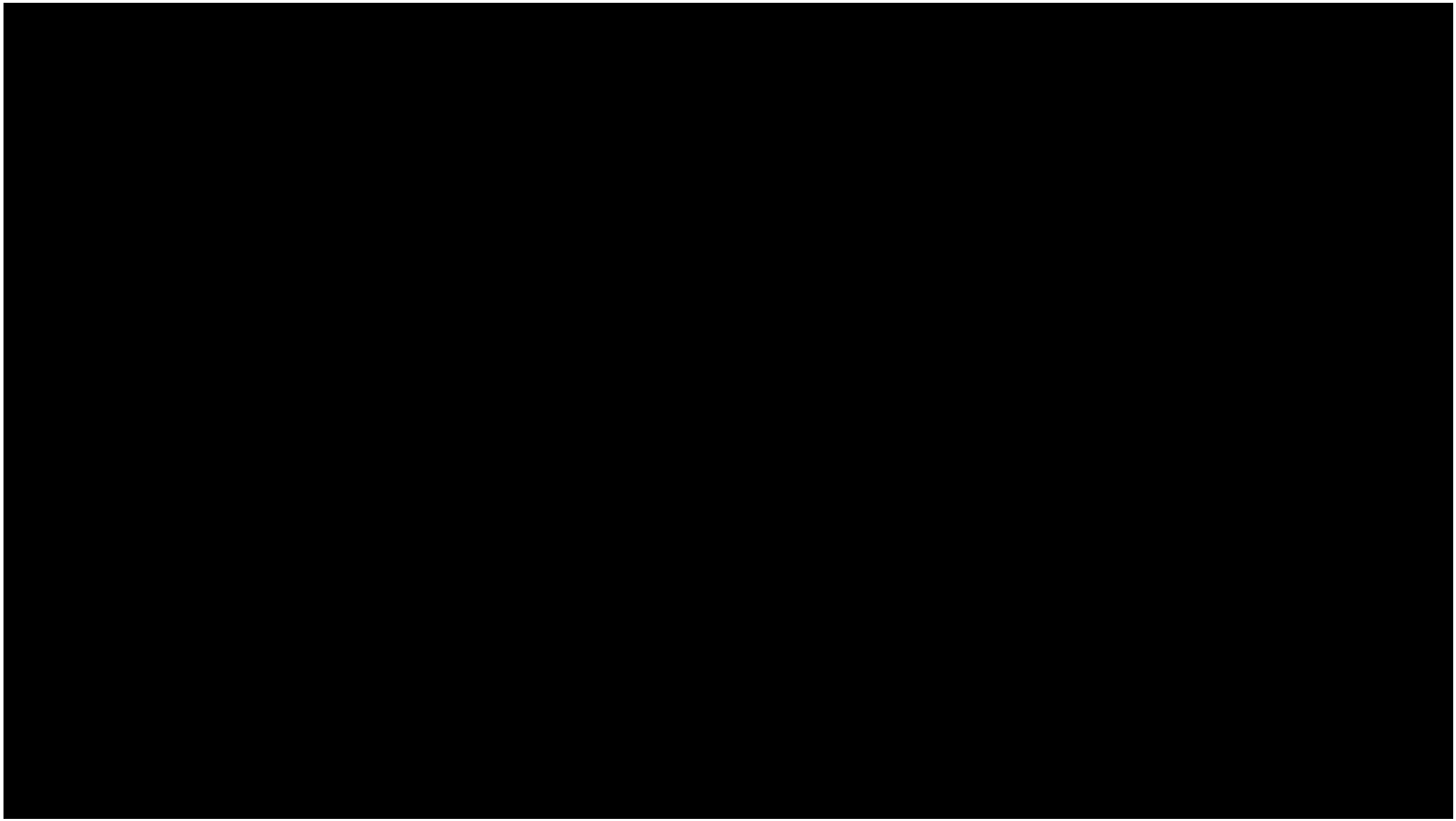

NSF | neon Operated by Battelle

NEON's three data collection systems



Standardized, colocated methods across sites

A Walk Around the Observatory: https://youtu.be/2ITbdjPprN4



Summary: NEON Collection of Data & Samples

Automated Instrument Systems

Fixed sensors; data transferred autonomously and continuously, processed in batches

Terrestrial & Aquatic

Observational Sampling

Terrestrial & Aquatic

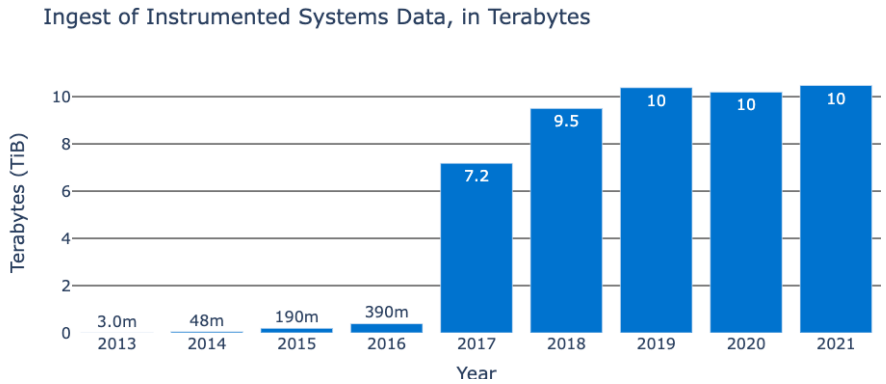
Data are collected manually; samples sent to external facilities for analysis and/or archive

Remote Sensing

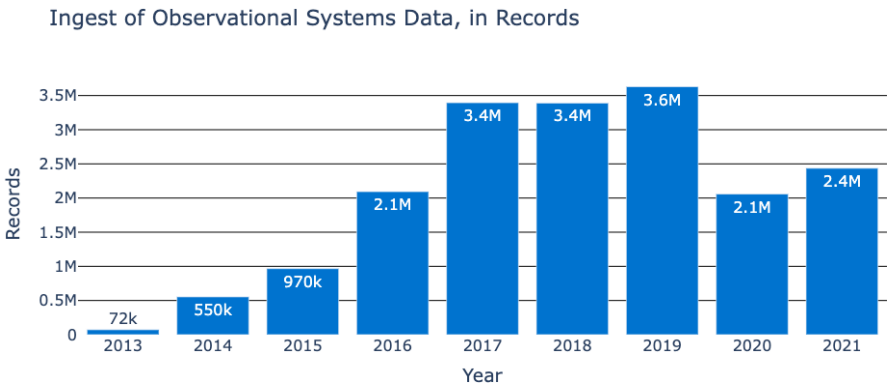
Airborne Platform

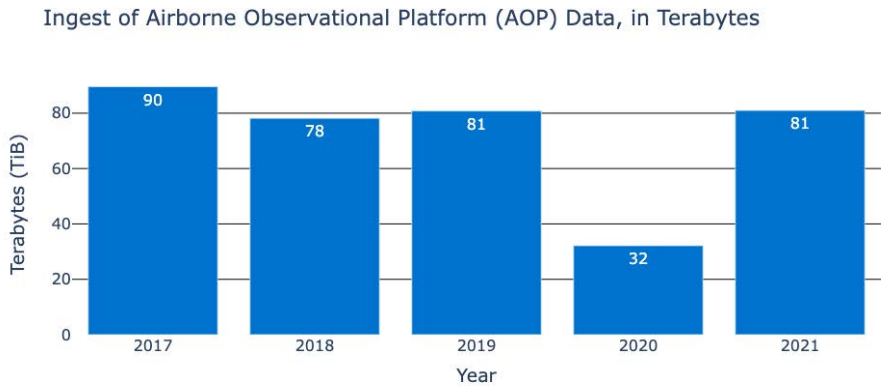
Mobile, airborne system; data are recorded electronically and downloaded later

Volume and variety of NEON data are enormous

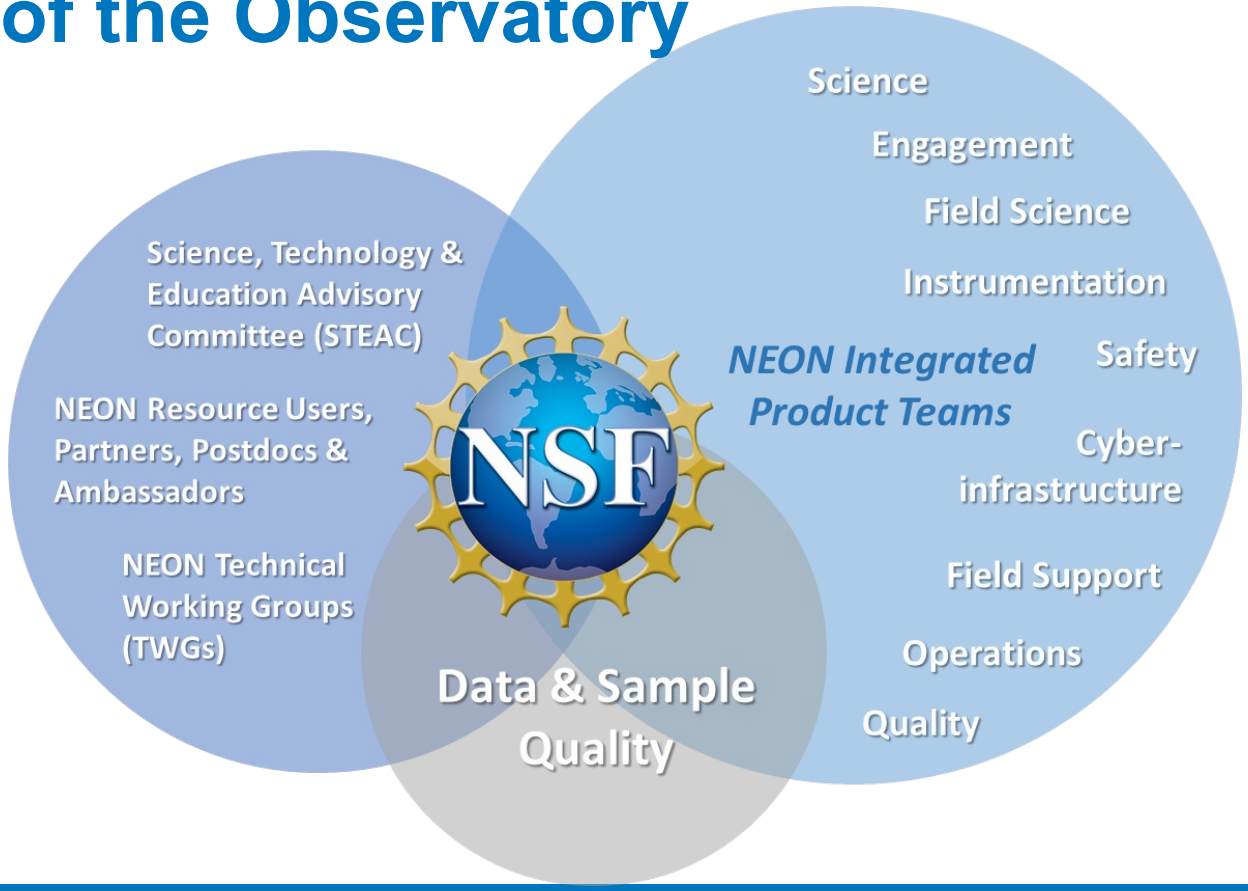


- Total ingested data volumes (approx.) through 2021:
  - IS: 48 TiB
  - OS: 18.6 M records
  - AOP: 362 TiB





Quality Data are dependent on integration across all parts of the Observatory



NEON Data Portal

Explore and Download Data Products

All of NEON's data products are free and open. Explore all of our available and pending data products.

GET DATA

API and GraphQL

Work more efficiently - query and download NEON data programmatically or from the command line.

USE THE API

Data Availability

Learn more about our data collection schedules and expected latencies between when data or samples are collected and when they are available for use.

MORE ABOUT AVAILABILITY

Data Notifications

From time to time, we post important news about our data products, with topics ranging from availability to quality. If you are using our data, please check this important resource!

READ THE LATEST

https://www.neonscience.org/data

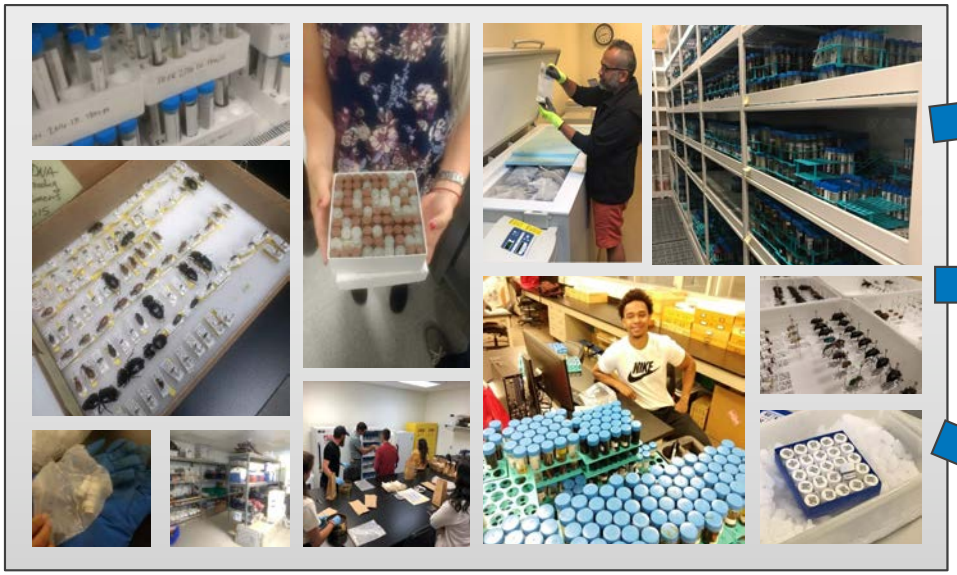
NEON Samples: NEON Biorepository

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

…many more

100,000 specimens & samples/year



GBIF
Global Biodiversity Information Facility

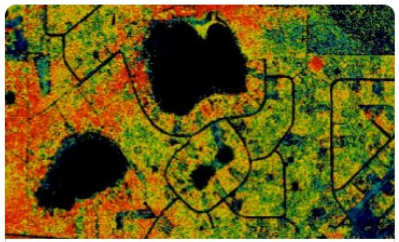
iDigBio
Integrated Digitized Biocollections

= includes associated genomic data

Arizona State University

biorepo.neonscience.org

NEON data are challenging for the ecological community



Working with NEON Data

Just getting started? NEON provides open source software and tutorials to expedite analyses.

GET STARTED

NEON leverages partnerships to expand research and build capacity

neon Partners

Strategic growth to foster convergence

Training	5	Organizations that provide instruction in specific skill sets needed to use NEON data, samples, or protocols.
FAIR Data	30	Organizations that host, harvest, use, or share NEON data; may also generate or provide derived data products.
Research	18	Organizations, networks, and projects that use NEON data for discovery and innovation.
Education	9	Organizations that develop or co-develop educational materials using NEON data.
Inclusion	7	Organizations that connect NEON to underserved and underrepresented communities & opportunities.
Relationship	11+	Organizations that help increase awareness of NEON within a community of interest.
Societal Impact	3	Organizations that facilitate relationships that benefit the broader public.
Site Partner	103	Site hosts or other networks that also have field sites in close conjunction with NEON sites.
International	3	Organizations whose mission is explicitly international and not funded by the US NSF.

NEON-43

Research use of NEON

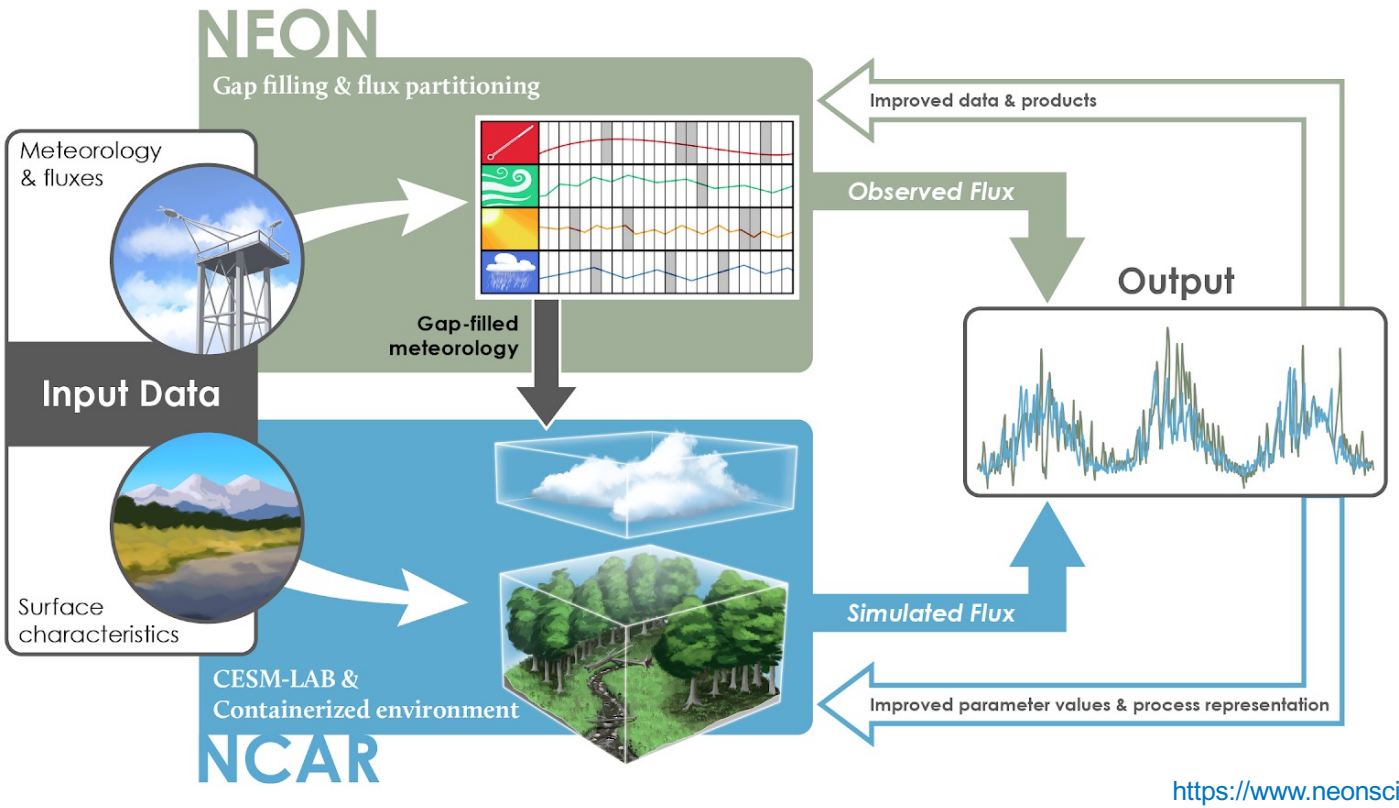
NEON Assignable Assets Program

- Enables PI-driven research using NEON infrastructure
  - Observational Sampling Infrastructure
  - Sensor Infrastructure
  - Airborne Observation Platform
  - Mobile Deployment Platform
  - Field Site Access/Coordination
- Cost recoverable basis

Mobile Deployment Platform (MDP) deployment at Konza Biological Station (Kansas). Assignable Asset request from Colorado State University supported by NSF RAPID 2137769

See video: https://www.youtube.com/watch?v=2FsdvPNw5sA

NCAR – NEON: Linking Ecology & Earth Science



NCAR, PI: Gordon Bonan
NEON, co-PIs: Mike SanClements, David Durden, Dawn Lenz

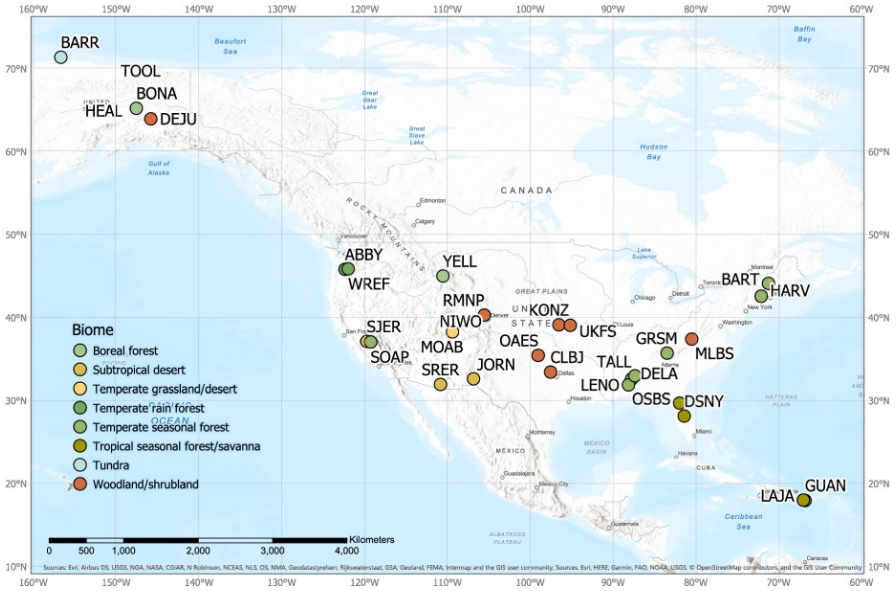
Data CI Pilot: NCAR and NEON cyberinfrastructure collaborations to enable convergence research linking the atmospheric and biological sciences

NSF 2039932

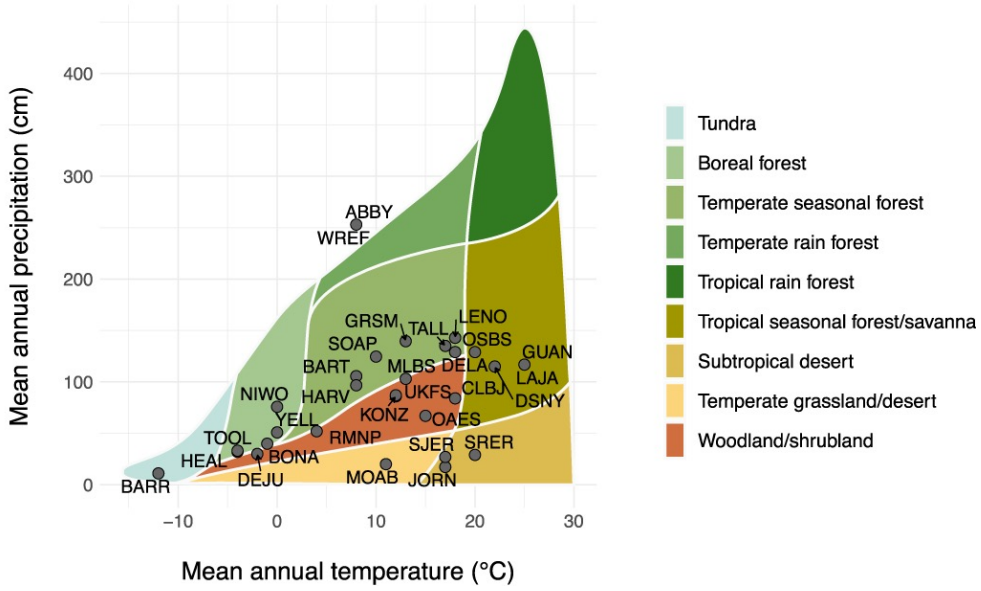
https://www.neonscience.org/ncar-neon-community-collaborations

Changes in plant species composition and diversity can calculated from spectral images (imaging spectroscopy)

a



b

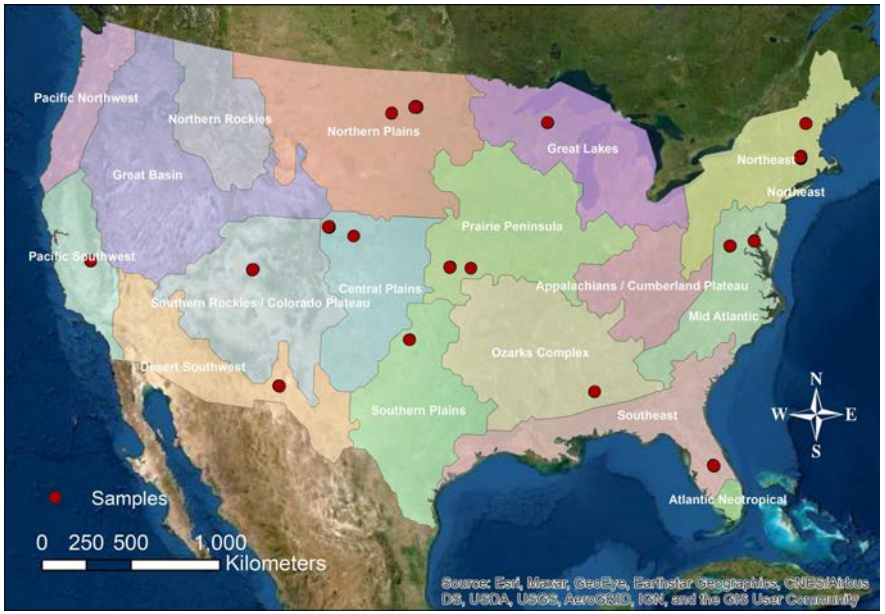


The NEON sites used in this study are located (**a**) across the entire United States and **b** cover all major biomes except for tropical rainforest.

Schweiger, A.K., Laliberté, E.. *Nat Commun* **13**, 2767 (2022). https://doi.org/10.1038/s41467-022-30369-6

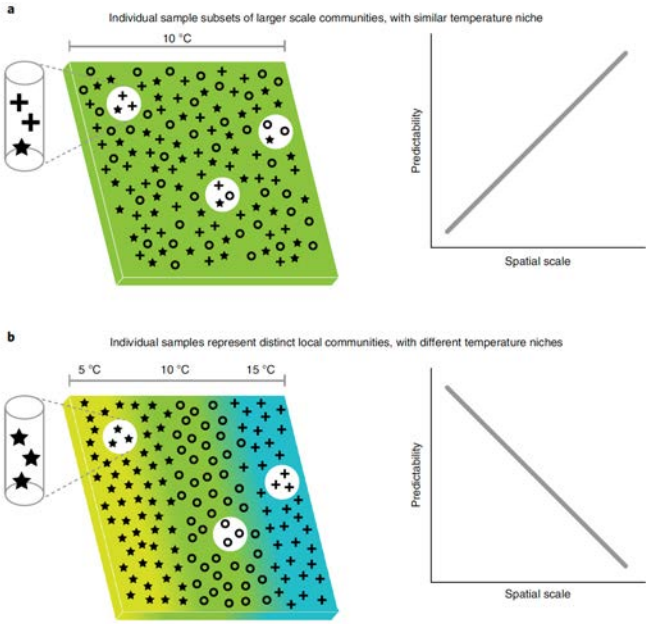
Biological and geophysical features predicted from NEON soil samples

Soil features predicted from NEON sample-based model



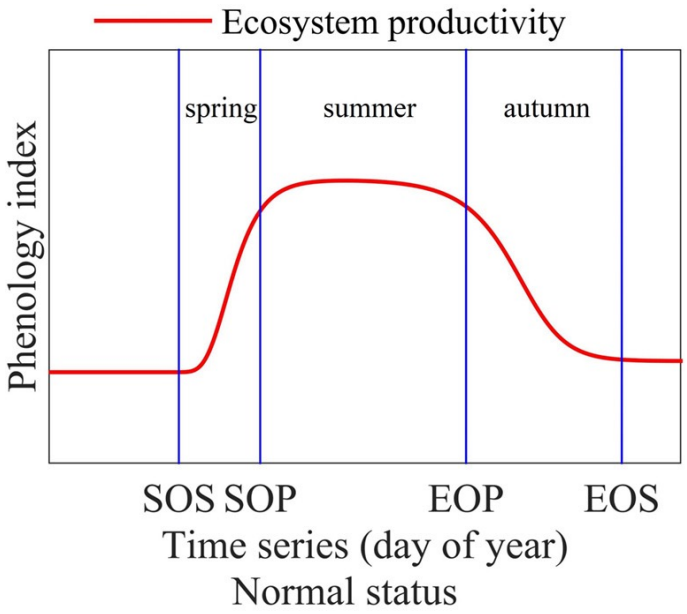
1167 NEON soil samples, 12 domains. Zhang et al., 2021

Soil microbiome predicted by the environment



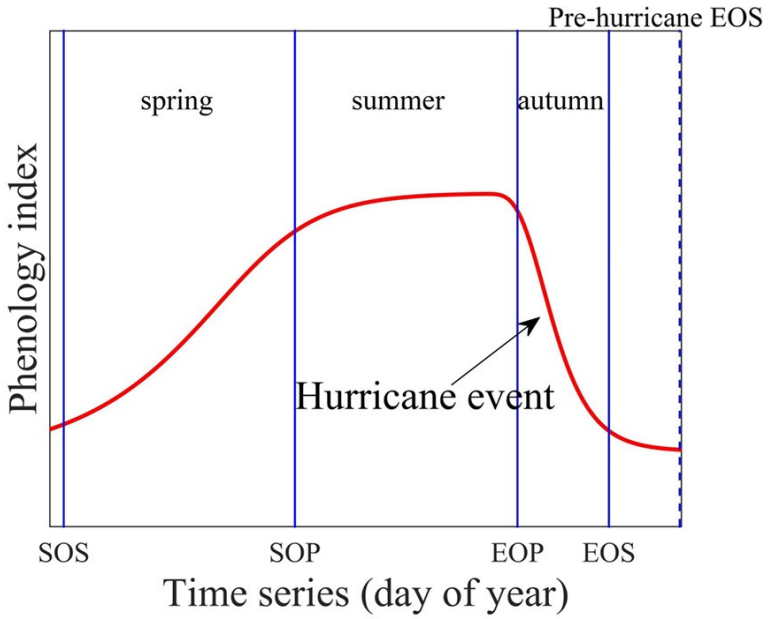
Soil microbe genomic data from 317 samples, 12 domains. Averill et al., 2021

Natural disasters are NEON research opportunities



Hurricane Michael

SOS: start of growing season
SOP: start of peak
EOP: end of peak
EOS: end of growing season



Gong et al., 2021; NSF 1241881, 1702029

NEON Community Impacts across Domains

NEON Community Fellow

Arlene Megill

Senior Field Ecologist; 6 years with NEON

https://thrivingearthexchange.org/project/adjuntas_puertorico/

Understanding contamination of the community well using NEON data

Future Impact on Society

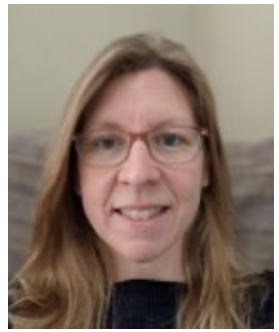
Thank you!

Kirsten Ruiz –
Field Science Lead

Kate Thibault –
Science Lead

Chris McKay –
Operations Manager

Kim Nitschke –
Instrumentation Lead



Bonnie Meinke – Science
Engagement Lead

Rommel Zulueta –
Assignable Assets Lead

Mike SanClements -
Terrestrial Instrument
Science Lead

Jeff Coleman – Field
Support Lead

Mike Kuhlman – Battelle
Chief Scientist

Mike Janus – Battelle
Vice President & General
Manager

Operated by Battelle

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