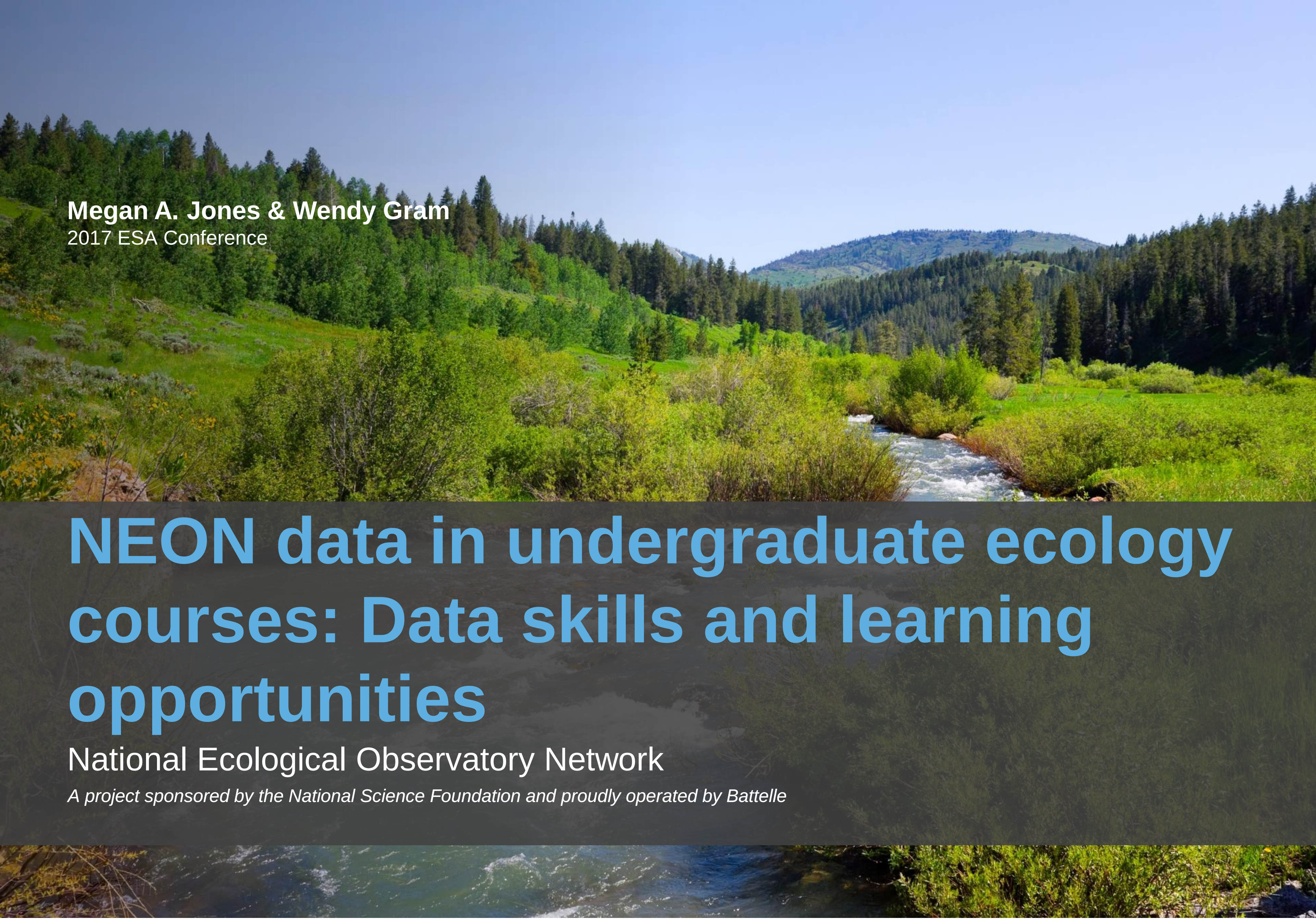


Megan A. Jones & Wendy Gram
2017 ESA Conference

NEON data in undergraduate ecology courses: Data skills and learning opportunities

National Ecological Observatory Network

A project sponsored by the National Science Foundation and proudly operated by Battelle

What is the National Ecological Observatory Network (NEON)?

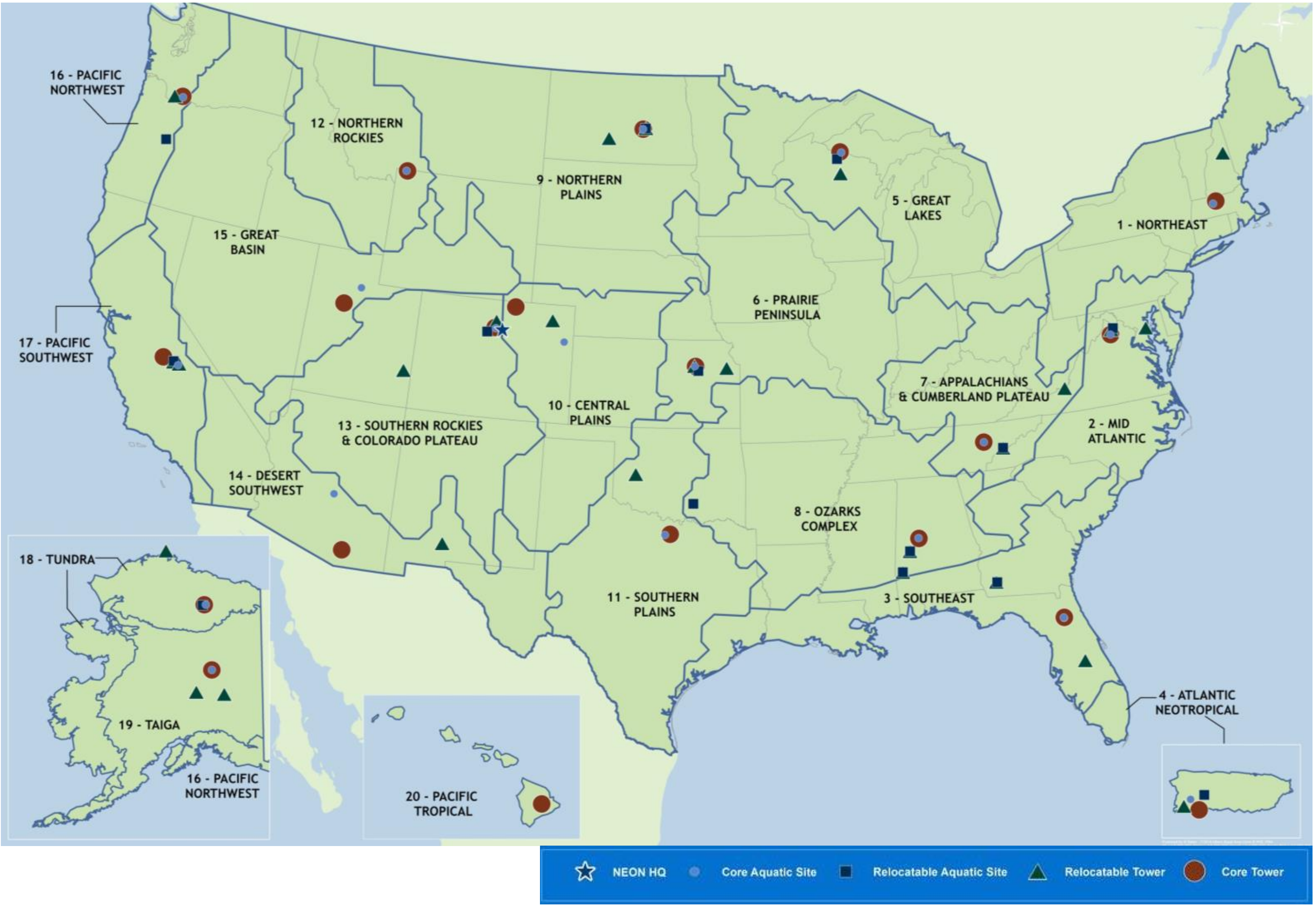
NEON is a continental-scale ecological observatory funded by the National Science Foundation as a large science facility. NEON provides:

- Free and open data on the drivers of and responses to ecological change
- A standardized and reliable framework for research and experiments
- Data interoperability for integration with other national and international network science projects

Why is NEON important?

NEON provides a highly coordinated national system for monitoring a number of critical ecological and environmental properties at multiple spatial and temporal scales.

NEON's field sites and data products



81

FIELD SITES

- 47 terrestrial
- 34 aquatic

Approximately

180

DATA PRODUCTS

NEON’s data collection methods

Automated instruments

Observational sampling

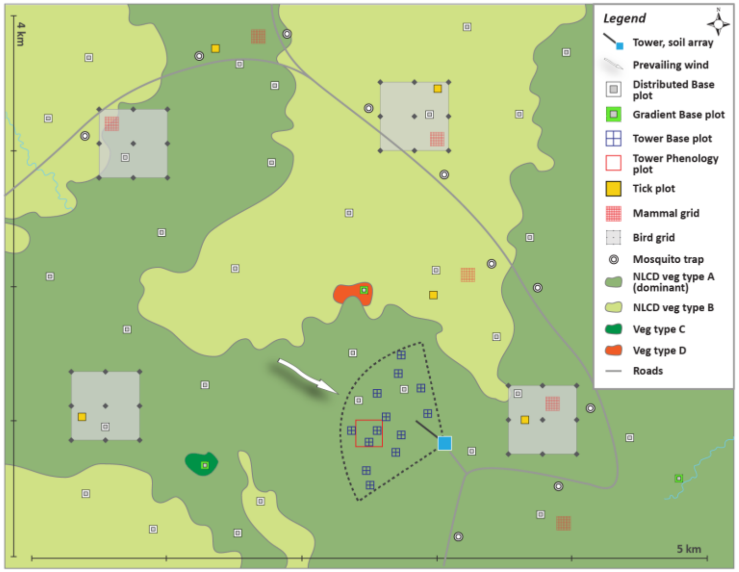
Airborne remote sensing

- ✓ These three systems collect data within close proximity of each other at each site
- ✓ Standardized methods are used across all sites

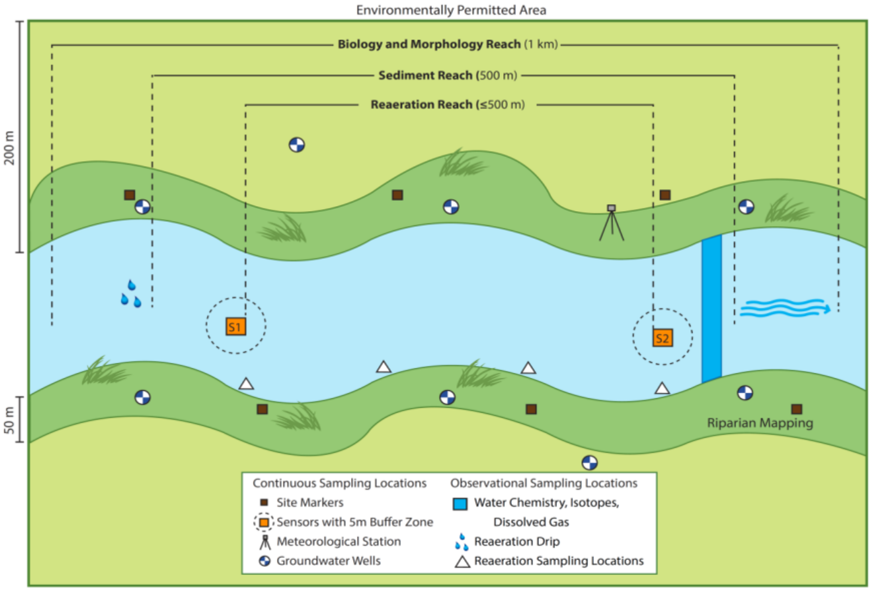
Collection systems at a site

Both aquatic and terrestrial field sites have all three collection systems

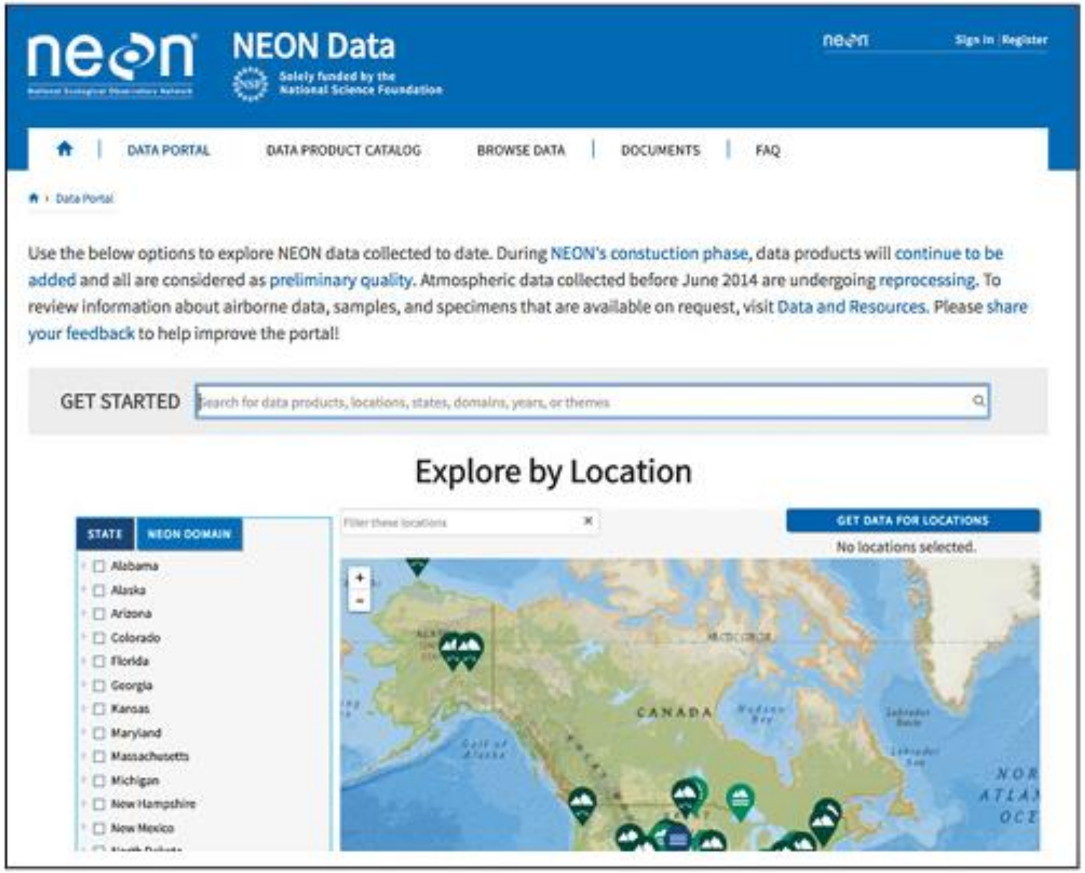
Terrestrial site



Aquatic wadeable site


Environmentally Permitted Area
Biology and Morphology Reach (1 km)
Sediment Reach (500 m)
Reaeration Reach (≤500 m)
200 m
50 m
S1
S2
Riparian Mapping
Continuous Sampling Locations
Site Markers
Sensors with 5m Buffer Zone
Meteorological Station
Groundwater Wells
Observational Sampling Locations
Water Chemistry, Isotopes, Dissolved Gas
Reaeration Drip
Reaeration Sampling Locations

Access data: data.neonscience.org



Use the below options to explore NEON data collected to date. During NEON's constuction phase, data products will continue to be added and all are considered as preliminary quality. Atmospheric data collected before June 2014 are undergoing reprocessing. To review information about airborne data, samples, and specimens that are available on request, visit Data and Resources. Please share your feedback to help improve the portal!

GET STARTED
Search for data products, locations, states, domains, years, or themes

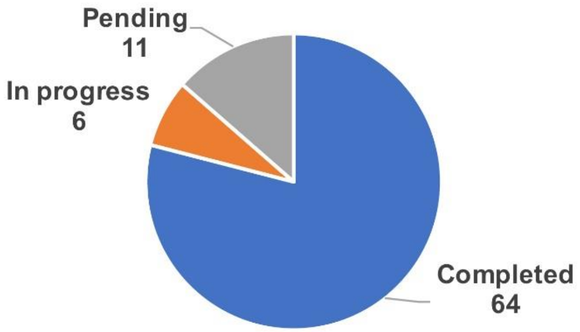
Explore by Location

- Download data
- View data product catalog
- API
- Read protocols
- Register a free account

June 2017: Construction Progress Stats

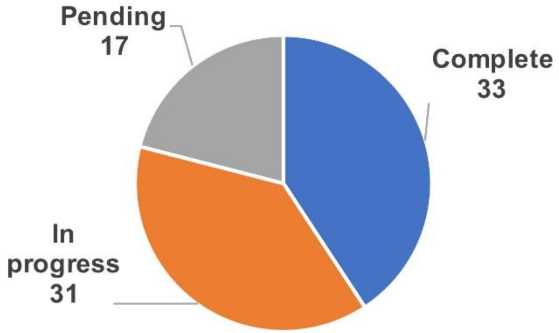
Civil Construction

(No. of sites with physical infrastructure completed)



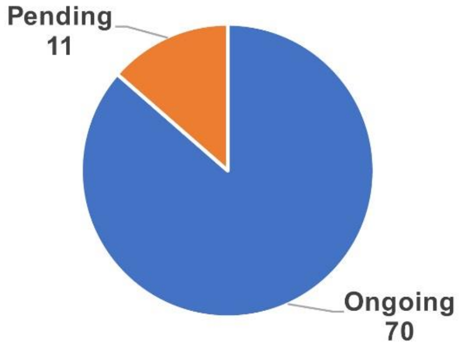
Sensors Installed

(No. of sites with automated instruments installed)



Field Sampling

(No. of sites with ongoing annual field sampling)



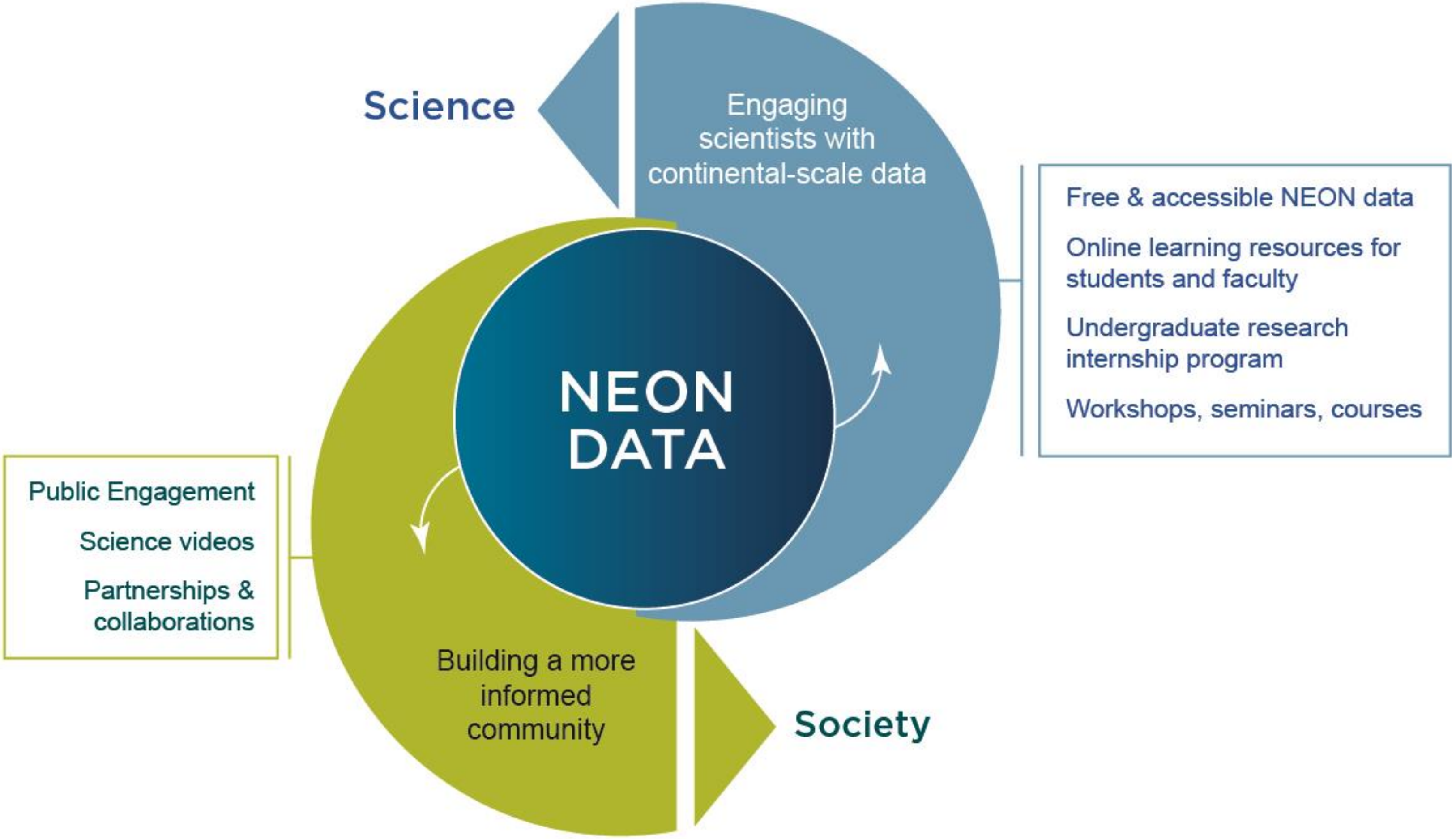
June 2017: Data Availability Stats

Data are partially available from **68** sites

No. of data products currently available **75** products

Education Strategy

Creating data-driven educational resources to support and build a more informed society



Science

Engaging scientists with continental-scale data

- Free & accessible NEON data
- Online learning resources for students and faculty
- Undergraduate research internship program
- Workshops, seminars, courses

NEON DATA

- Public Engagement
- Science videos
- Partnerships & collaborations

Building a more informed community

Society

Education Goals & Objectives

Facilitate understanding of NEON data and science by a diversity of users

- Provide **tools and resources** for scientists, students, and faculty to effectively use NEON data and infrastructure for research and teaching
- Provide **programs and training opportunities** for scientists, students, and faculty to effectively use NEON data and infrastructure for research and teaching

› Learn & Experience › Work with Data

Work with Data

NEON Data Skills Resources

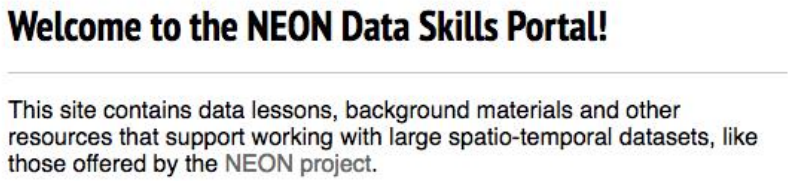
http://www.neonscience.org/resources

- Open educational resources
  - Web based
  - Hosted in GitHub
  - Shared on QUBES Hub

QUBES
The Power of Biology × Math × Community

- Improve data skills
  - Data manipulation
  - Data visualization
  - Data analysis

Source: National Ecological Observatory Network (NEON)

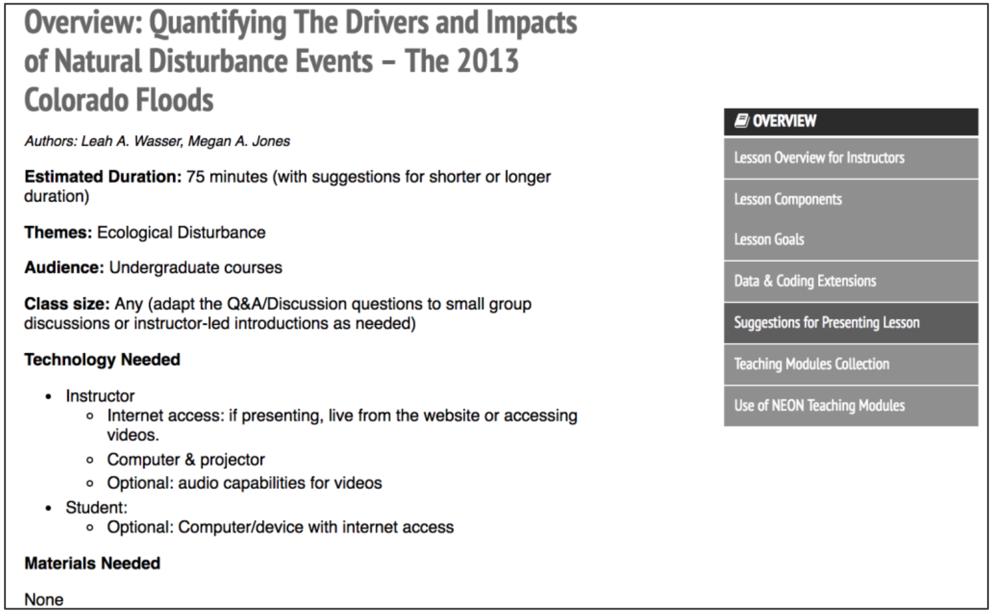


Welcome to the NEON Data Skills Portal!

This site contains data lessons, background materials and other resources that support working with large spatio-temporal datasets, like those offered by the NEON project.

Teaching Modules

- Designed to convey a scientific concept while teaching data skills
- Target audience: undergraduates
- Collaborative development encouraged



Overview: Quantifying The Drivers and Impacts of Natural Disturbance Events – The 2013 Colorado Floods

Authors: Leah A. Wasser, Megan A. Jones

Estimated Duration: 75 minutes (with suggestions for shorter or longer duration)

Themes: Ecological Disturbance

Audience: Undergraduate courses

Class size: Any (adapt the Q&A/Discussion questions to small group discussions or instructor-led introductions as needed)

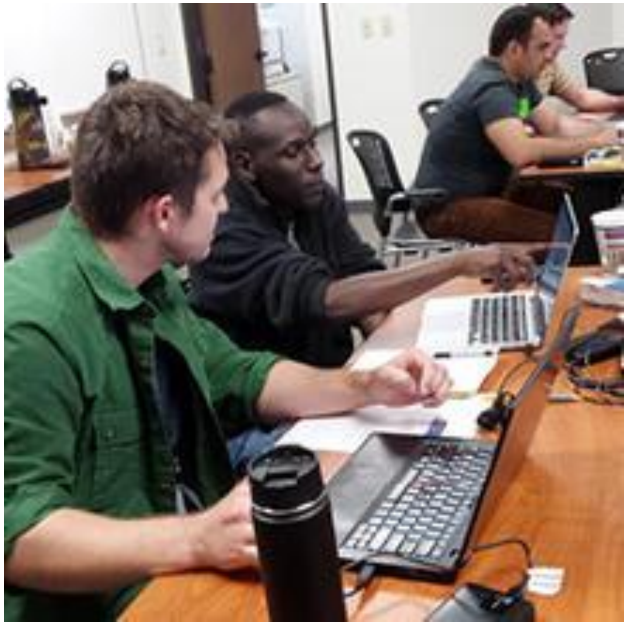
Technology Needed

- Instructor
  - Internet access: if presenting, live from the website or accessing videos.
  - Computer & projector
  - Optional: audio capabilities for videos
- Student:
  - Optional: Computer/device with internet access

Materials Needed

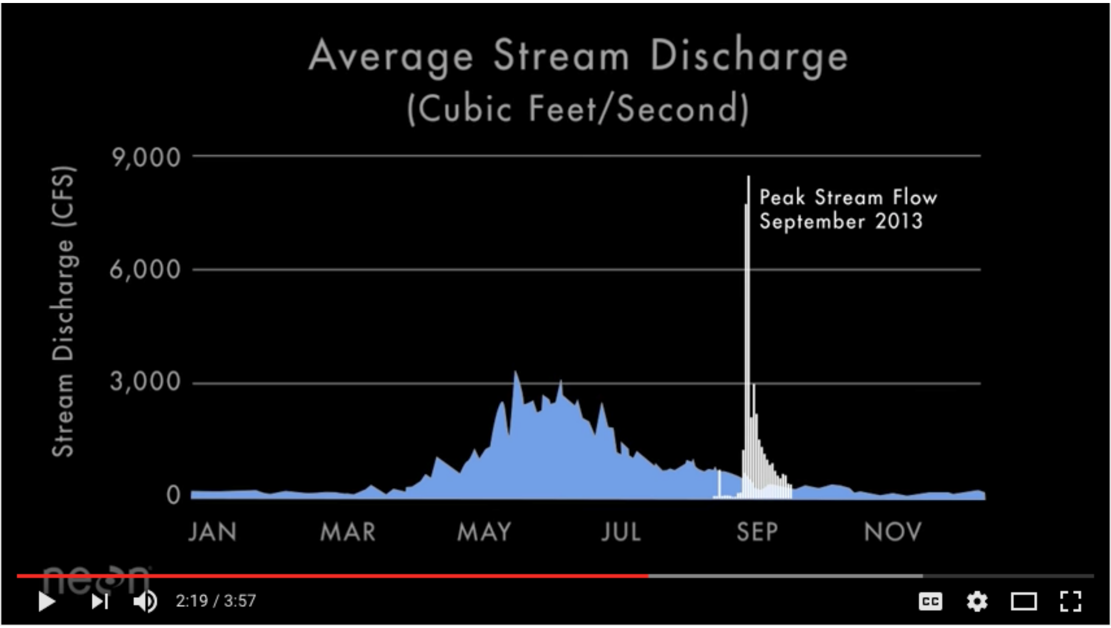
None

OVERVIEW
Lesson Overview for Instructors
Lesson Components
Lesson Goals
Data & Coding Extensions
Suggestions for Presenting Lesson
Teaching Modules Collection
Use of NEON Teaching Modules



Quantifying The Drivers and Impacts of Natural Disturbance Events – The 2013 Colorado Floods

- Research Question: Why and how did flooding happen?
- Data from NOAA, USGS & NEON
- Two levels:
  - Data interpretation – interactive data figures available
  - Data analysis & coding – R code to produce all figures available
- Accompanying video: https://youtu.be/IHIckvWhwoo?t=1m26s

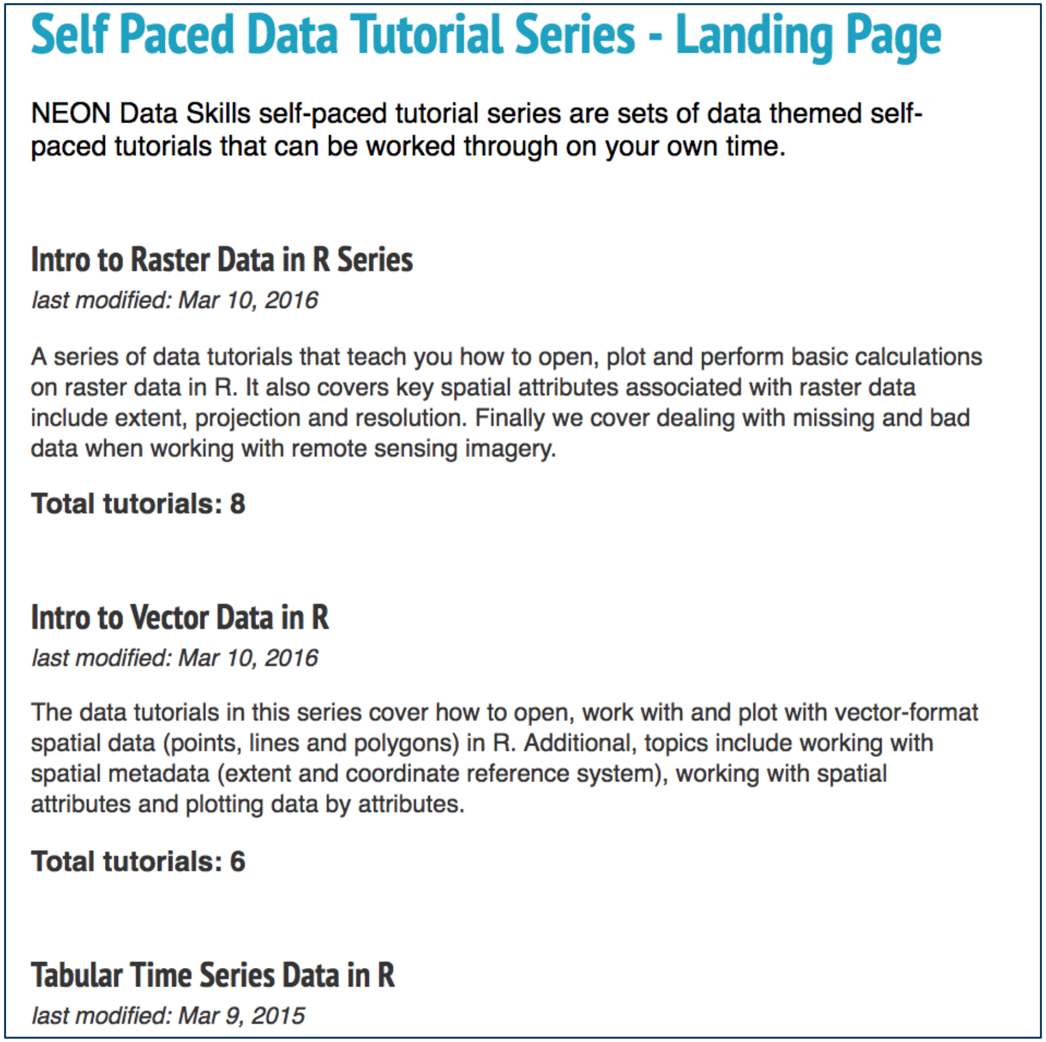


The Data Life Cycle: Small Mammals & Mark Recapture Analysis

- Data collection through to interpretation
- Small mammal data from NEON
  - Lesson built with data from two field sites but can easily be adapted for local data
- Step-by-step instructions culminating in a population size estimate
  - Using spreadsheets
- Field trip or videos for data collection component of lesson
  - If collections available, specimens of target species can be shown
- *Currently in review – release in Fall 2017*

Self-paced Tutorials

- Designed to help users with specific data skills
- Step-by-step instructions with teaching data subsets
- Focus on data skills, scientific concepts may be interwoven



Self Paced Data Tutorial Series - Landing Page

NEON Data Skills self-paced tutorial series are sets of data themed self-paced tutorials that can be worked through on your own time.

Intro to Raster Data in R Series

last modified: Mar 10, 2016

A series of data tutorials that teach you how to open, plot and perform basic calculations on raster data in R. It also covers key spatial attributes associated with raster data include extent, projection and resolution. Finally we cover dealing with missing and bad data when working with remote sensing imagery.

Total tutorials: 8

Intro to Vector Data in R

last modified: Mar 10, 2016

The data tutorials in this series cover how to open, work with and plot with vector-format spatial data (points, lines and polygons) in R. Additional, topics include working with spatial metadata (extent and coordinate reference system), working with spatial attributes and plotting data by attributes.

Total tutorials: 6

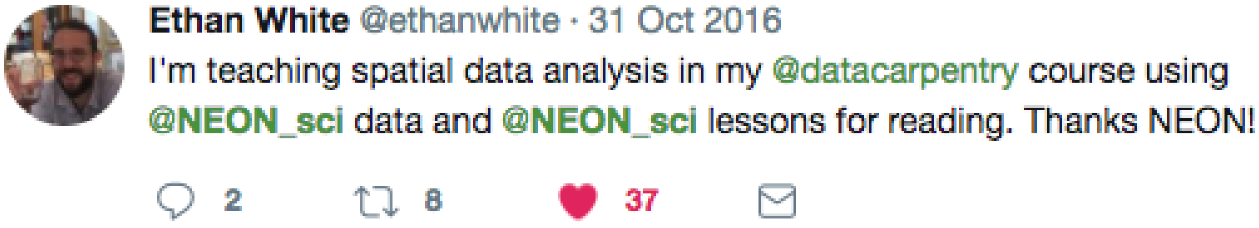
Tabular Time Series Data in R

last modified: Mar 9, 2015

Instructor adoption/adaptation of self-paced tutorials

Data Carpentry - for- Biologists

Teaching the tools to get computers to do cool science



Ethan White @ethanwhite · 31 Oct 2016

I'm teaching spatial data analysis in my @datacarpentry course using @NEON_sci data and @NEON_sci lessons for reading. Thanks NEON!

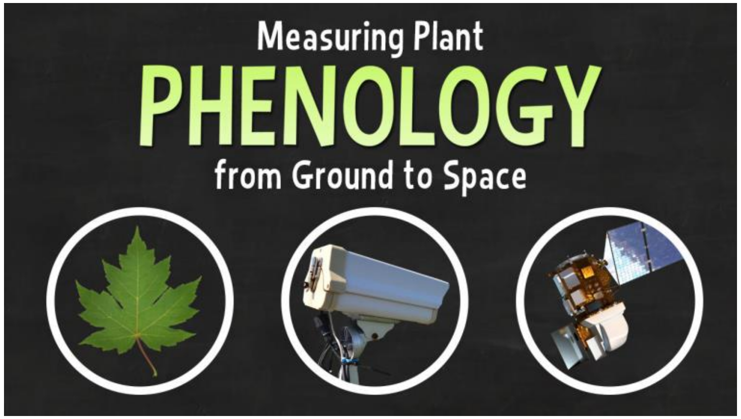
💬 2 🔁 8 ❤ 37 ✉

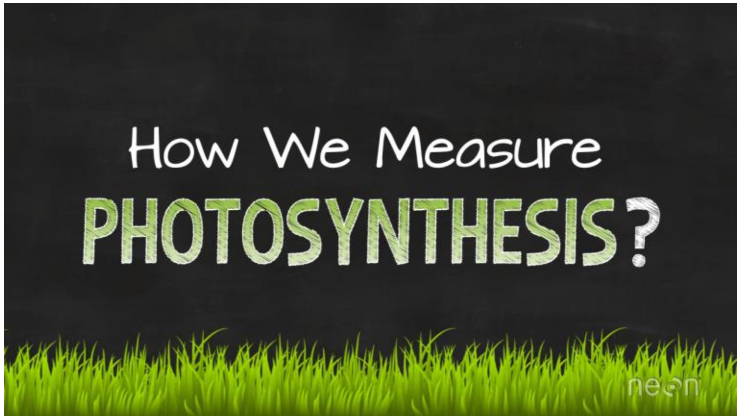
Dr. Ethan White, University of Florida

- Semester-long, mixed undergrad & grads
- Incorporating NEON materials into existing course

Science Videos

- Short (3-7 minute) animated, narrated explanations of a scientific concept or tool.
- Useful in lectures, flipped classrooms, individual learning
- Developed with content experts
- NEON Science YouTube Channel
  https://www.youtube.com/neonscience





Supporting faculty & instructors

- QUBES Faculty Mentoring Networks
  - DIG into Data: Spring 2017
  - NEON data focused FMN coming Spring 2018
- Direct Collaboration
  - Materials you want to adapt for use with NEON data?
  - Existing lessons you'd like to share?
- Workshops, seminars, presentations at meetings

Future Directions

- Expanding the topic focus of lessons
  - Match the increasing availability of NEON data products
  - Address needs in the community
- More materials for undergraduate classrooms
  - Collaborative development opportunities
  - Including focus on faculty professional development
- Further integration with NEON data via portal and API
- We’d love to hear your ideas: neondataskills@BattelleEcology.org

National Ecological Observatory Network

It can be done

720.746.4844 | neonscience@battelleecology.org | www.neonscience.org