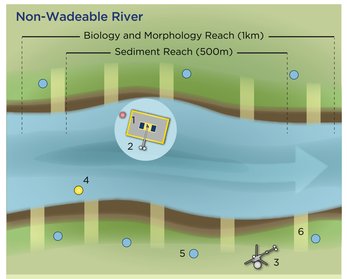
Open Data to Understand our Changing Aquatic Ecosystems

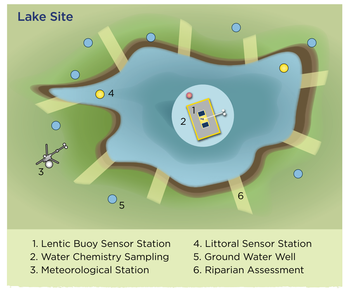
Data Collection Systems at Aquatic Sites

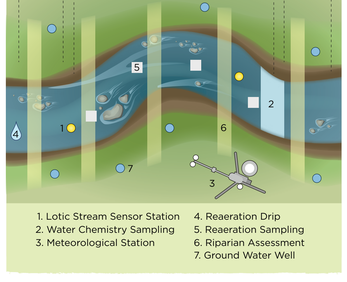
Automated instruments • Observational Sampling • Airborne Remote Sensing

The NSF's National Ecological Observatory Network has 34 freshwater aquatic field sites, including 24 wadeable streams, seven lakes, and three non-wadeable rivers. Locations are representative of aquatic features and habitats typical of regions across the United States within each NEON Domain (excluding D20: Pacific Tropical) and near to NEON's 47 terrestrial field sites whenever feasible.

SENSOR STATION LOCATIONS BY AQUATIC SITE TYPE







Aquatic Sensors

Manufacturer	Model	Parameters Measured
YSI/XYLEM	EXO2 Sonde	Conductivity, dissolved oxygen, pH, chlorophyll-a, turbidity, fluorescent dissolved organic matter
SeaBird	Suna V2	Nitrate
YSI/XYLEM	201043	Water temperature at specific depths (lakes)
Thermometrics	PRT	Water temperature
In-situ	AquaTroll 200	Groundwater depth, temperature and
In-situ	LevelTroll 500	Water depth
Kipp Zonen	PQS1	Photosynthetically active radiation
Li-COR	LI192SA	Underwater photosynthetically active radiation
Hukseflux	NRO1	Long- and short-wave radiation
NovaLynx	WindObserver II	2-D Wind speed and direction
Vaisala	PTB330	Barometric pressure
Thermometrics	PRT	Single point aspirated air temperature

Note: Fish, sediments, macroinvertebrates, zooplankton, plants, macroalgae, periphyton, and phytoplankton are sampled based on site-specific habitats and are not identified in the figures.

AUTOMATED INSTRUMENT MEASUREMENTS BY AQUATIC SITE TYPE

		Streams		Rivers		Lakes	
	Automated Instrument Measurements	Upstream (U)	Downstream (D)	Buoy (B)	Near Bank (NS)	Buoy (B)	Littoral (L)
●	PAR at water surface	√	√	√	⊘	√	⊘
●	PAR below water surface	⊘	⊘	√	√	√	√
●	Elevation of surface water (pressure transducer based)	√	√	⊘	√	⊘	√
●	Temperature in surface water	√	√	⊘	√	⊘	√
●	Temperature at specific depth in surface water (depths vary by site)	⊘	⊘	√	⊘	√	⊘
●	Water quality: specific conductivity, chlorophyll a, dissolved oxygen content, pH, turbidity, and fluorescent dissolved organic matter (fDOM)	√ (no fDOM)	√	√	⊘	√	⊘
●	Nitrate in surface water	⊘	√	√	⊘	√	⊘
◍	Groundwater wells: specific conductivity, water temperature, elevation of groundwater	√ Up to 8 per field site					
M	Meteorological measurements: wind speed and direction, air temperature, barometric pressure, relative humidity, shortwave radiation, and photosynthetically active radiation (PAR)	√ One on bank		√ One on bank, One on buoy		√ One on bank, One on buoy	

NEONScience.org

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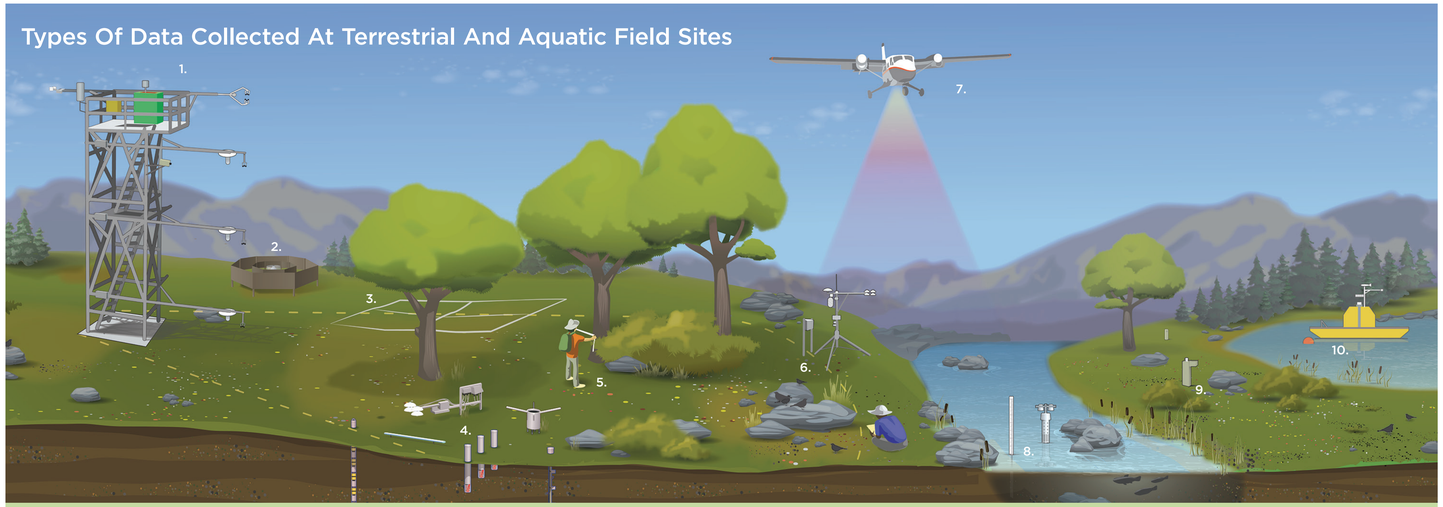
NEON data products are open access and can be used in conjunction with one another because they're gathered in close proximity to each other at a site. The data are also comparable among field sites so researchers can study connections and patterns across ecosystems, and then develop models to forecast environmental change locally, regionally and at a continental scale.

Types Of Data Collected At Terrestrial And Aquatic Field Sites



1. A flux tower collects atmospheric data at terrestrial sites.

2. Primary precipitation is measured using a Double Fence Intercomparison Reference.

3. Sampling plots are located within, and outside of the tower footprint.

4. Automated instruments collect soil data at terrestrial sites.

5. Field scientists collect organismal data from select plants, animals, pathogens, and microbes.

6. A meteorological station collects atmospheric data at aquatic sites.

7. The Airborne Observation Platform (AOP) flies over most sites annually to collect remote sensing data.

8. Surface water and depth profile data are collected at streams, rivers, and lakes.

9. Groundwater wells capture changes in groundwater elevation, temperature, and specific conductance.

10. Buoy stations at lake sites collect data about surface water quality.

OBSERVATIONAL SAMPLING AT AQUATIC FIELD SITES

Aquatic Plants & Microalgae
- Aquatic plant bryophyte macroalgae clip harvest
- Aquatic plant, bryophyte, lichen, and macroalgae point counts in wadeable streams
- Periphyton, seston, and phytoplankton collection

Aquatic Microbes
- Benthic microbe community composition
- Benthic microbe group abundances
- Surface water microbe cell count
- Surface water microbe community composition
- Surface water microbe group abundances

Macroinvertebrates & Zooplankton
- Macroinvertebrate collection
- Zooplankton collection

Fish
- Fish electrofishing, gill netting, and fyke netting counts

DNA & Meta-Barcode Sequences
- Benthic microbe marker genes
- Benthic microbe metagenomes
- Surface water microbe marker genes
- Surface water microbe metagenomes
- Fish DNA barcodes
- Macroinvertebrate DNA metabarcodes
- Zooplankton DNA metabarcodes

Biogeochemical
- Aquatic plant bryophyte chemical properties
- Periphyton, seston, and phytoplankton chemical properties
- Sediment chemical properties
- Chemical properties of groundwater
- Chemical properties of surface water
- Stable isotope concentrations in groundwater
- Stable isotope concentrations in surface waters
- Dissolved gases in surface water
- Reaeration field and lab collection

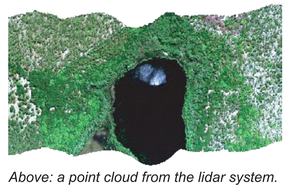
Aquatic Physical
- Riparian composition and structure
- Riparian vegetation % cover
- Morphology maps (streams)
- Bathymetric maps (lakes and rivers)
- Sediment physical properties
- Salt-based stream discharge
- Stream discharge field collection
- Depth profile at specific depths
- Secchi depth

AIRBORNE REMOTE SENSING SURVEYS

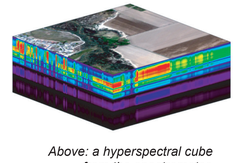
A NEON Airborne Observation Platform (AOP) is an array of instruments installed into a light aircraft to collect high resolution remote sensing data.

Collection of AOP data is synchronized with data collected on the ground at each site and takes place at peak greeness for each field site. Instruments include a discrete and waveform lidar, a hyperspectral imaging spectrometer, and a high resolution digital camera.

All data are open access. NEON has three AOPs that are used to capture data over NEON field sites and collect research-specific flight campaign data requested by the community.



Above: a point cloud from the lidar system.



Above: a hyperspectral cube from the spectrometer.

Left: an ortho-rectified and mosaicked aerial photo.

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BATTELLE