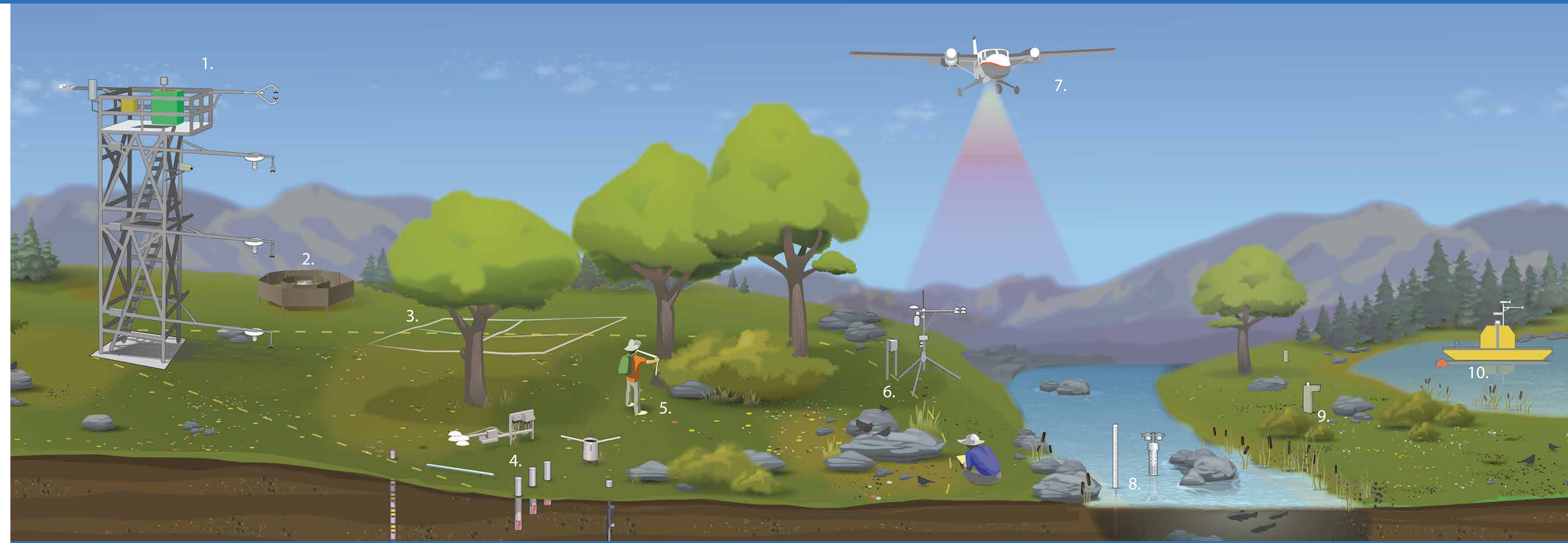


# Open Access Observational and Airborne Remote Sensing



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 in 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.

## 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 greenness 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.

## AOP Data Products

### Lidar

- Discrete return lidar point cloud
- Lidar slant range waveform
- Slope and Aspect - Lidar
- Elevation - Lidar
- Ecosystem structure

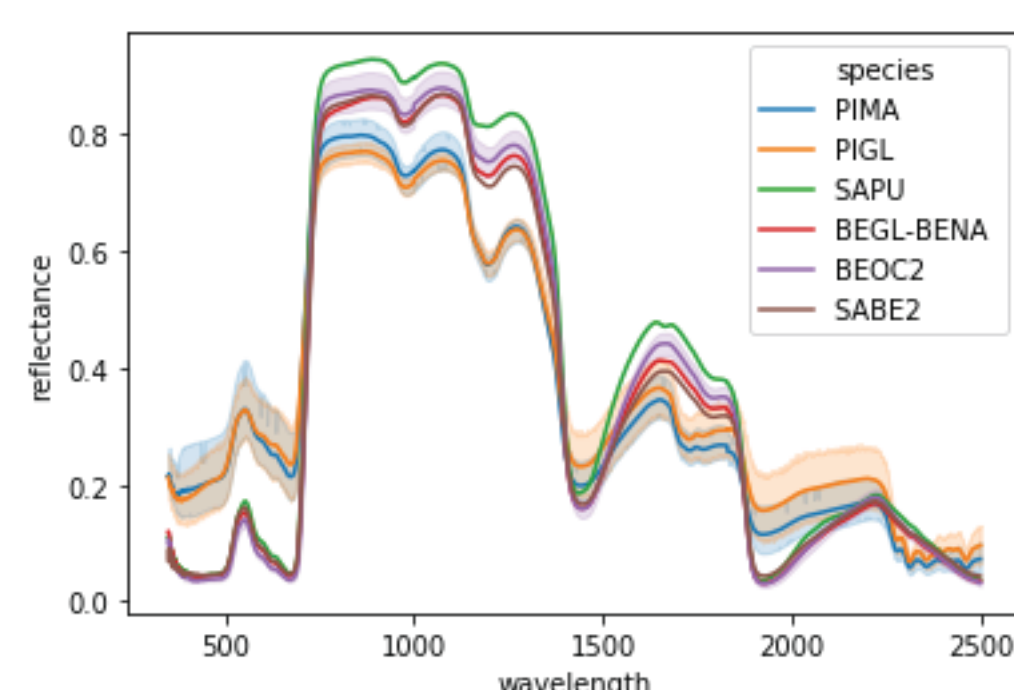
### Digital Camera

- High-resolution orthorectified camera imagery and mosaics

### Hyperspectral Flightlines and Mosaics

- Spectrometer orthorectified surface directional reflectance
- Spectrometer orthorectified at-sensor radiance (flightline only)
- fPAR
- LAI
- Total biomass map
- Vegetation indices
- Albedo
- Canopy water content
- Canopy lignin
- Canopy nitrogen
- Canopy xanthophyll cycle

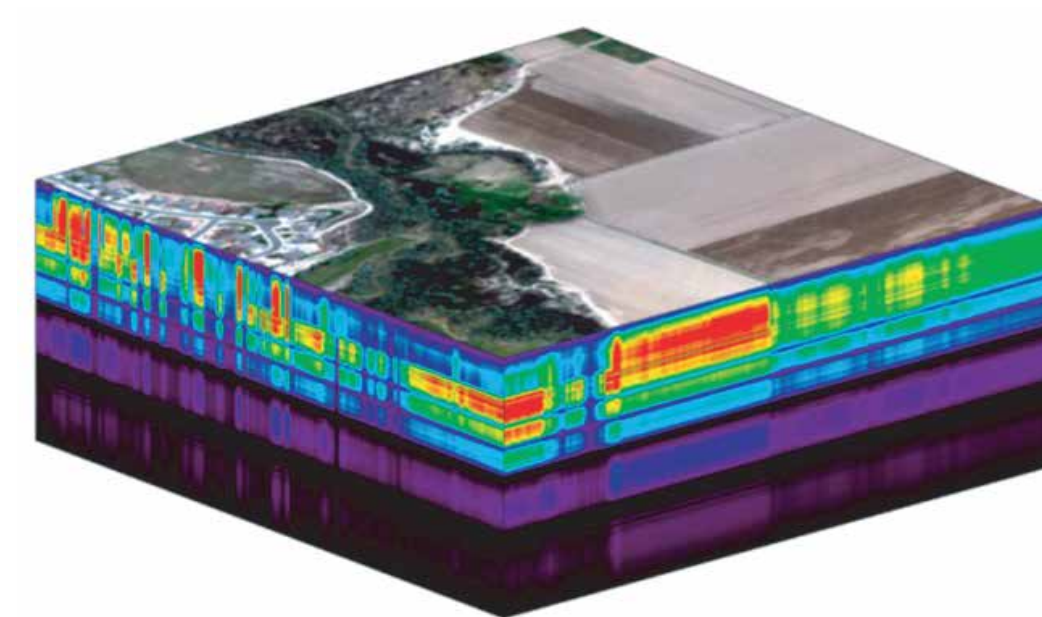
### Field Spectral Data



- Leaf spectra collected with hand-held Analytical Spectral Device, linked to OS Plant foliar physical and chemical properties samples



Above: a point cloud from the lidar system.



Above: a hyperspectral cube from the spectrometer.



Left: an ortho-rectified and mosaicked aerial photo.

## TERRESTRIAL OBSERVATIONAL SAMPLING

Sampling plots are established within the flux tower airshed, as well as throughout the dominant land cover/vegetation types identified at each field site. All data and archival samples collected are open access.



### Soils & Soil Microbes

- Soil microbe biomass
- Soil microbe community composition
- Soil microbe group abundances

### Terrestrial Plants

- Plant phenology observations
- Plant presence and percent cover
- Digital hemispheric photos of plot vegetation
- Herbaceous clip harvest
- Litterfall and fine woody debris sampling
- Non-herbaceous perennial vegetation structure
- Root sampling (Megapit)
- Root sampling tower plots
- Woody plant vegetation structure
- Coarse downed wood bulk density sampling
- Coarse downed wood log survey
- Bryophyte clip harvest

### Birds & Small Mammals

- Breeding landbird point counts
- Small mammal box trapping

### Ticks, Mosquitoes and Ground Beetles

- Ticks sampled using drag cloths
- Mosquitoes sampled from CO<sub>2</sub> traps
- Ground beetles sampled from pitfall traps

### Pathogens

- Rodent-borne pathogen status
- Tick-borne pathogen status
- Mosquito-borne pathogen status

### DNA & Meta-Barcode Sequences

- Small mammal DNA barcodes
- Mosquito DNA barcodes
- Ground beetle DNA barcodes
- Soil microbe marker genes
- Soil microbe metagenomes

### Biogeochemical

- Soil chemical properties (Distributed initial characterization)
- Soil chemical properties (Distributed periodic)
- Soil inorganic nitrogen pools and transformations
- Soil stable isotopes (Distributed periodic)
- Plant foliar physical and chemical properties
- Plant foliar stable isotopes
- Litter chemical properties
- Litter stable isotopes
- Root chemical properties
- Root stable isotopes

### Terrestrial Physical

- Soil physical properties (Distributed initial characterization)
- Soil physical properties (Distributed periodic)

## AQUATIC OBSERVATIONAL SAMPLING

Some data collection vary by aquatic site type. All data and archival samples are open access.



### 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

- Fish DNA barcodes
- Macroinvertebrate DNA metabarcodes
- Zooplankton DNA metabarcodes
- Benthic microbe marker genes
- Benthic microbe metagenomes

- Surface water microbe marker genes
- Surface water microbe metagenomes

### 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