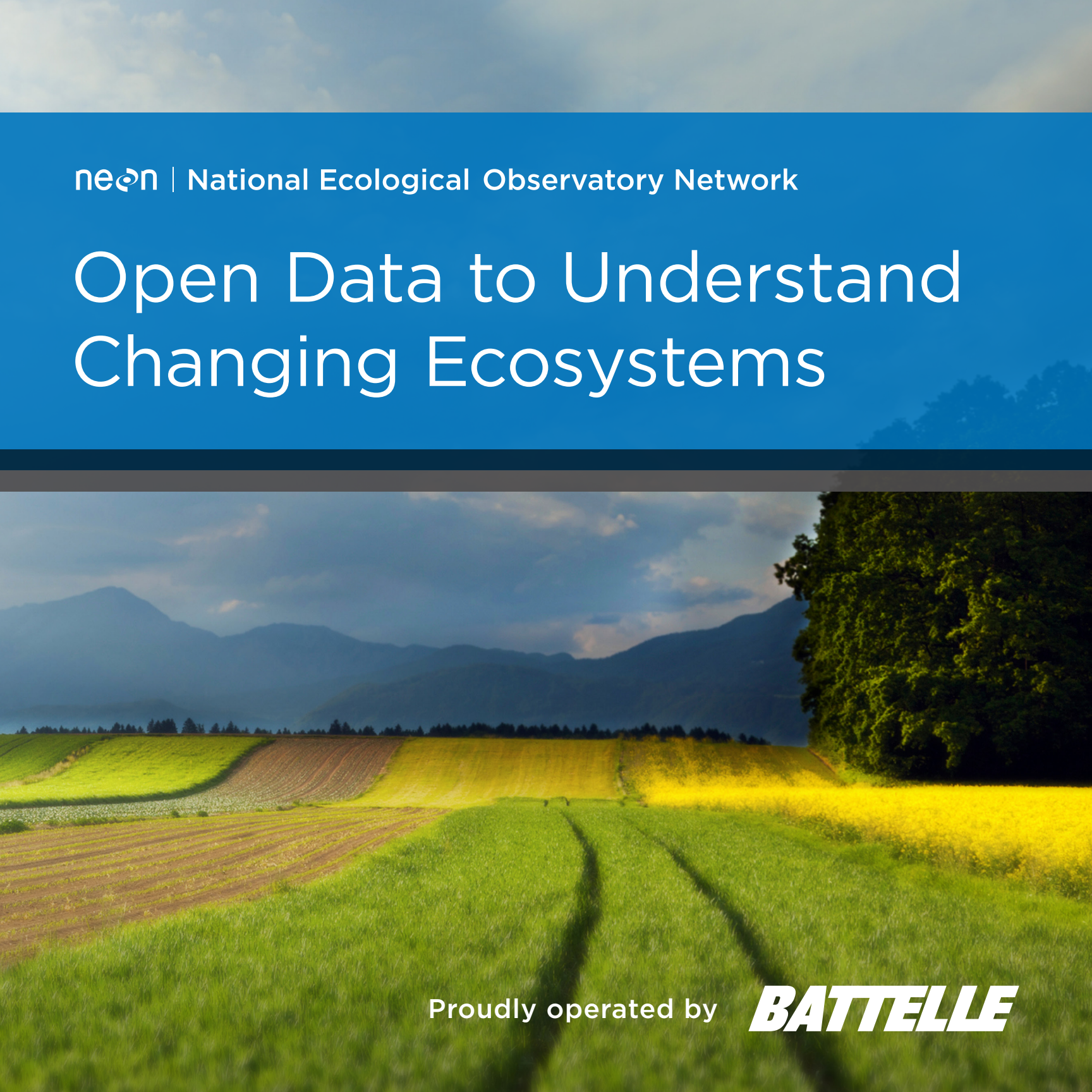
neon | National Ecological Observatory Network

Open Data to Understand Changing Ecosystems



Standardized data collection methods and infrastructure

The **National Ecological Observatory Network (NEON)**, funded by the National Science Foundation and operated by Battelle, provides open data that characterize plants, animals, soil, nutrients, fresh water and the atmosphere in ecosystems across the United States over a 30-year timeframe. Researchers can also arrange to use the Observatory's infrastructure (field sites, instrumentation, etc.) for their own studies to advance understanding of ecological processes.

Spatiotemporal design

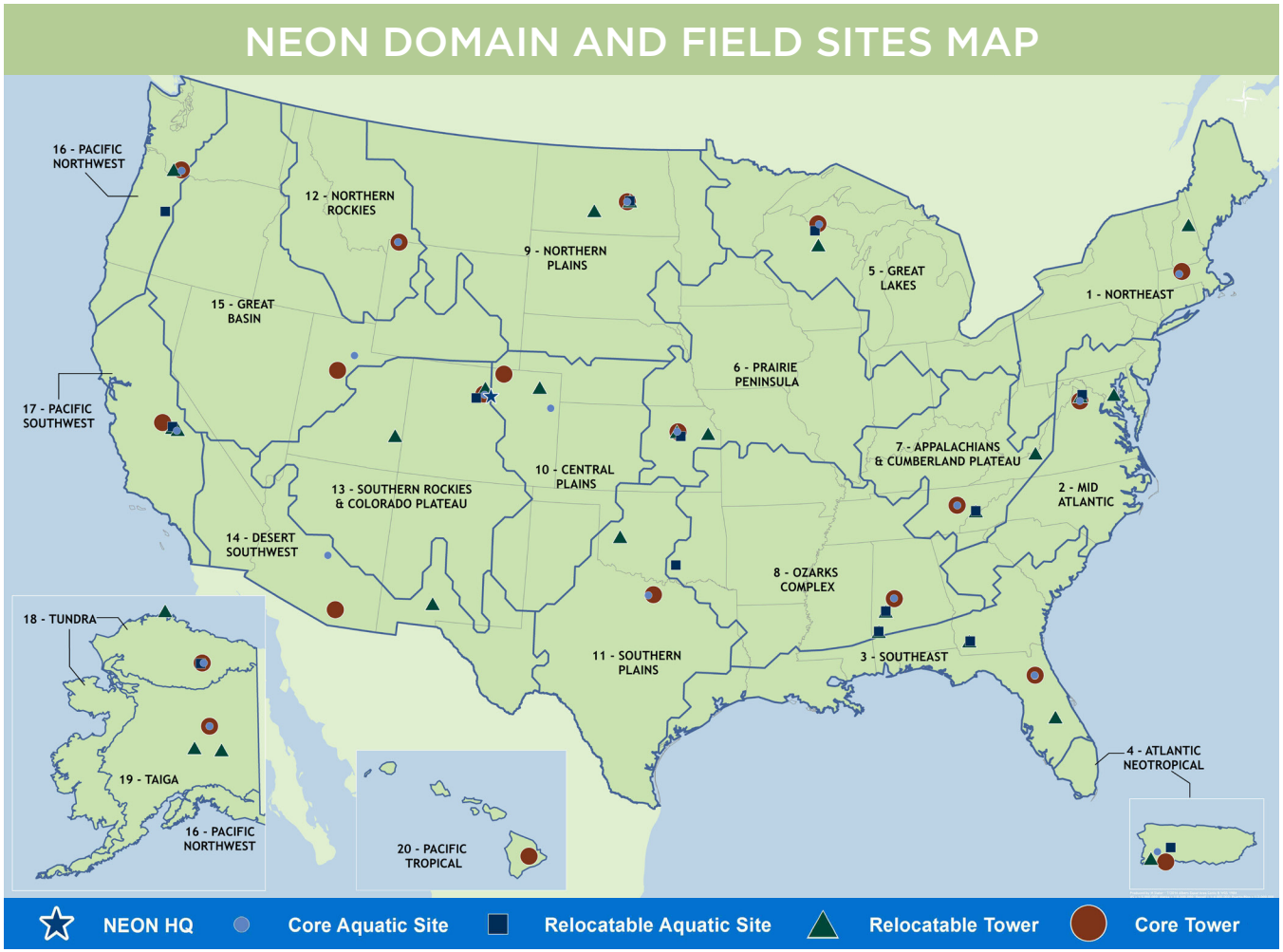
Scientists working on the NEON program collect data at terrestrial sites and freshwater aquatic sites at various spatial and temporal scales. Sites are strategically placed within 20 ecoclimatic domains to ensure statistically robust representation of ecological, physical and biological variability. Where logistically possible, terrestrial and aquatic sites are co-located to capture connections across atmospheric, terrestrial and aquatic ecosystems.

Data collection

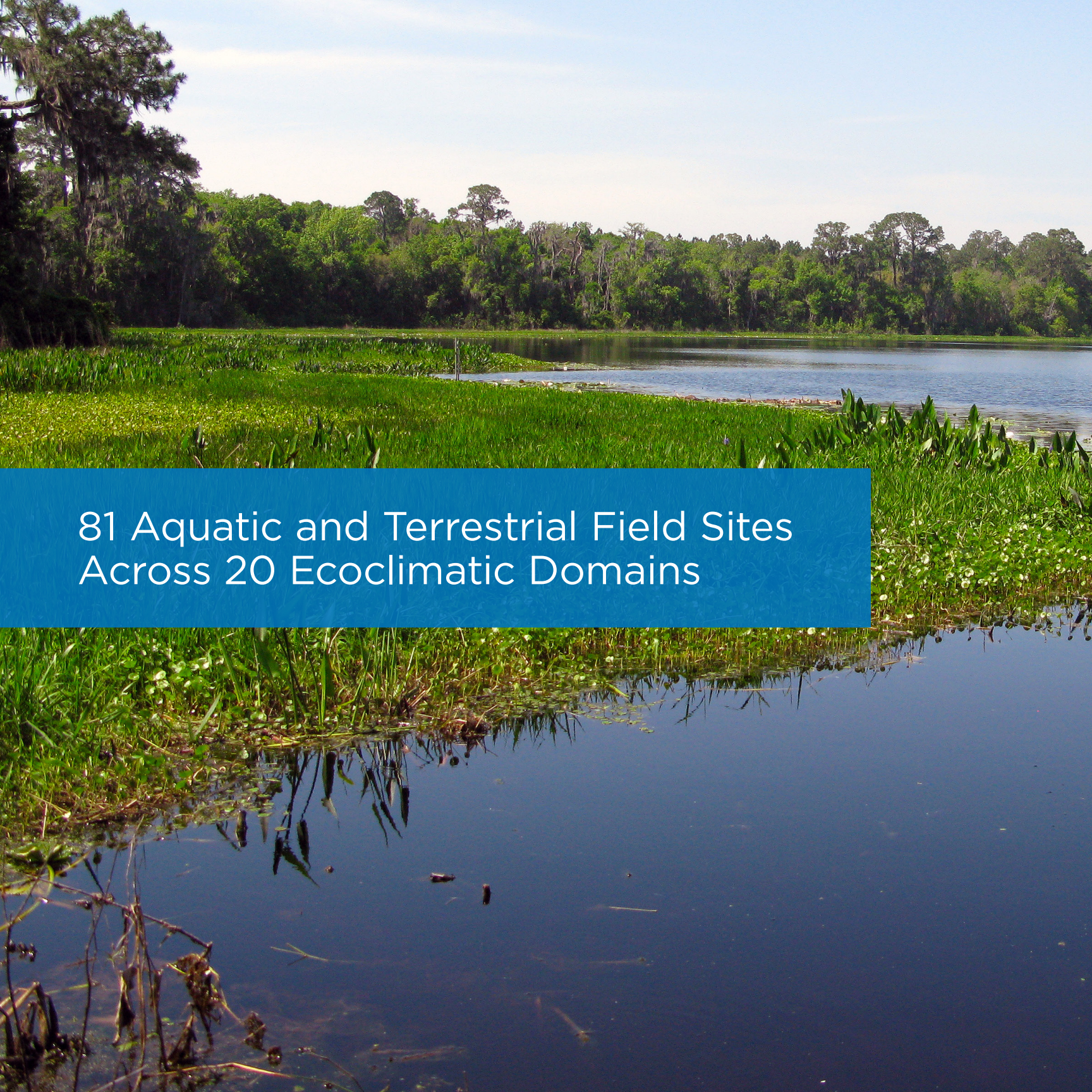
Automated instruments, observational sampling and airborne remote sensing methods are used to gather data. The collection methods are standardized and integrated to ensure comparability of ecological patterns and processes between NEON sites and through time.

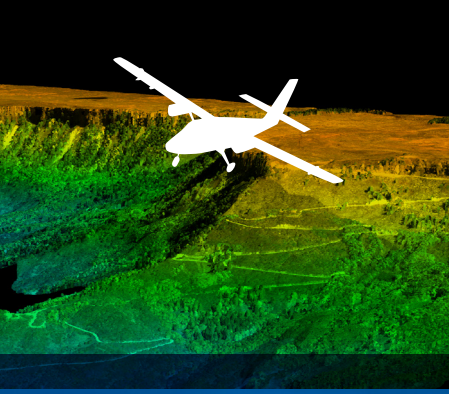
Accessing data, samples and resources

Anyone can access the Observatory's open data, archived samples, supporting protocols and documentation at neonscience.org. Training is available to help scientists learn how to work with these data, including free online tutorials and in-person workshops.



The NEON program has established “core” aquatic and terrestrial sites at locations selected to characterize wildland environments over the 30-year lifetime of the Observatory. Additional “relocatable” sites are designed to move multiple times during the lifetime of the Observatory and are selected to gather data that enable investigations of specific research areas such as climate gradients and dust transport.


81 Aquatic and Terrestrial Field Sites
Across 20 Ecoclimatic Domains



Airborne remote sensing observations

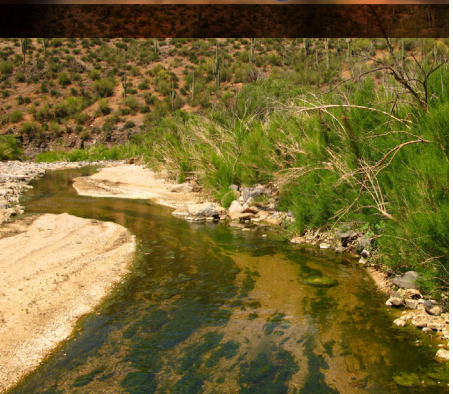
The Observatory's Airborne Observation Platform collects remote sensing data during peak greenness at each field site using sensors mounted on a Twin Otter aircraft. Sensors include a hyperspectral imaging spectrometer, a full waveform and discrete return LiDAR and a high-resolution digital camera. The resulting time series of landscape-scale data characterize changes in vegetation cover and density; canopy chemistry; and topography, including elevation, slope and aspect.

Automated instrument measurements

METEOROLOGICAL STATIONS

Flux towers rise above the plant canopy at terrestrial field sites and continuously collect atmospheric measurements above and throughout the canopy, including solar radiation, temperature and wind speed. Sensors at the tower top can also determine net ecosystem exchange. Smaller meteorological stations at NEON's aquatic sites gather a subset of atmospheric measurements.

Automated instruments, observational sampling and airborne remote sensing surveys



SOIL MEASUREMENT PLOTS

The Observatory's terrestrial sites include arrays of soil plots equipped with sensors to measure soil moisture, temperature and CO_2 concentration at multiple depths. Additional soil surface measurements are made, including throughfall and solar radiation.

SURFACE WATER AND GROUNDWATER SENSORS

At aquatic sites, sensor stations continuously collect data that characterize hydrologic conditions and surface water quality [including dissolved oxygen, pH, specific conductance, turbidity, nitrate and fluorescent dissolved organic matter (fDOM)]. Groundwater wells are installed in multiple locations at these aquatic sites to collect groundwater elevation, temperature and specific conductance.

Observational sampling of aquatic and terrestrial ecosystems

Observational sampling takes place throughout the growing season in a range of vegetation types across each field site. Morphology and bathymetry maps of aquatic sites are also created periodically. The spatial sampling design of each field site creates connectivity across field sites and between observational data, automated instrument measurements and remote sensing data.

AQUATIC OBSERVATIONS

	Diversity	Abundance	Productivity	Biomass	Pools/fluxes: Biogeochemistry
ALGAE	•	•	•	•	•
AQUATIC PLANTS	•	•	•	•	•
WATER		•			•
SEDIMENT					•
MICROBES	•	•	•	•	•
MACROINVERTEBRATES	•	•	•	•	•
FISH	•	•	•	•	

TERRESTRIAL OBSERVATIONS

	Diversity	Abundance	Pathogens	Phenology	Metabolism	Productivity & Biomass	Pools/fluxes: Biogeochemistry
SOIL MICROBES	•	•			•	•	
SOIL							•
PLANTS	•	•		•		•	•
MOSQUITOES	•	•	•	•			
GROUND BEETLES	•	•					
TICKS			•				
BIRDS	•	•					
SMALL MAMMALS	•	•	•				

How Do Ecosystems Adapt and Respond to Changes Over Time?

From droughts and wildfires to land use and invasive species, our ecosystems are constantly changing. The NEON program is a continental-scale, standardized network of field sites that captures key data to characterize the causes and impacts of environmental change in the United States. The program's open data and infrastructure allow scientists and policy makers to study changing ecosystems at large spatial and temporal scales and better forecast the impacts of these changes for future generations.

Learn more at **www.neonscience.org**