NEON Technical Working Groups

2025 Biannual Report Quarter 1 & Quarter 2

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The National Ecological Observatory Network (NEON) is a major facility fully funded by the U.S. National Science Foundation and operated by Battelle.

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Introduction

Since its inception, NEON has relied on expertise within the science, education, and engineering communities to advise on key areas impacting the design, construction, and maintenance of the Observatory with the goal of optimizing its operation. Currently, two types of external advisory bodies support staff and leadership in making key decisions that guide all of NEON's activities: The Science, Technology and Education Advisory Committee (STEAC) and Technical Working Groups (TWG). Both bodies are comprised of experts nominated to serve in these roles who are selected by NEON staff following a rigorous selection process.

NEON currently relies upon input from 22 TWGs. These groups play an important role by providing input to NEON's data collection and processing methods and ensuring that NEON infrastructure, data, and programs are a valuable community resource. Working groups are participatory and advisory; they are often tasked with providing input on issues that have scientific, educational, engineering, or operational implications. This document includes a summary of activities, recommendations, and NEON's response to those recommendations for each TWG during the first half of the 2025 funding year (October 2024-March 2025).

Airborne Remote Sensing Data Quality TWG

The Airborne Remote Sensing Data Quality Technical Working Group provides expert input and advice regarding NEON's airborne sampling design, data collection requirements and constraints, campaign scheduling, data products and algorithms, and reported quality metrics.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Aquatic Biogeochemistry TWG

The Aquatic Biogeochemistry Technical Working Group (ABTWG) provides experience and expert knowledge across the fields of Aquatic Biogeochemistry, including water chemistry, solute and sediment transport, nutrient cycling and metabolism. The scope of the NEON ABTWG includes both the Aquatic Observation System (AOS) and the Aquatic Instrument System (AIS). The expertise of this group is intentionally broad and is intended to represent the diverse set of data users interested in utilizing NEON data to address research questions within the various subfields of aquatic biogeochemistry.

Summary of Activities

Q1: Requested additional feedback and TWG's previous recommendation to change continuous discharge frequency to 15-minute average.
Q2: Requested feedback on whether to used chilled acetone for chlorophyll extraction.

TWG Recommendations

Q1: TWG agreed with plans for 15-min discharge.
Q2: TWG did not have any recommendations other than chilling might be for safety purposes since acetone is flammable and volatile.

NEON Response

Q1: N/A
Q2: N/A

Aquatic Biology TWG

The Aquatic Biology Technical Working Group provides expert knowledge across the fields of organismal sampling in aquatic systems. The scope of the NEON Aquatic Biology Technical Working Group includes data products generated by the Aquatic Observation System (AOS). The expertise on this group is intentionally broad within the field of aquatic biology and ecology. The group is intended to represent a broad set of NEON data users and experts in various subfields of aquatic biology and ecology, who can 1) take a broad and complete view of the aquatic program, and 2) provide scientific guidance on design, prioritization, and value of the components of the Project.

Summary of Activities

Q1: Contacted TWG to review zooplankton dilution calculations and new lab SOP. Contacted TWG regarding the reduction of the reach lengths with barriers for fishing.
Q2: 2025 kickoff meeting on 1/8/2025 requested feedback on whether to used chilled acetone for chlorophyll extraction.

TWG Recommendations

Q1: For zooplankton questions, TWG members referred NEON to other experts, the TWG was not able to answer NEON's questions directly. Outside experts agreed that NEON's Statement of Work (SOW) and the lab SOP made sense in terms of what the user community would want to see, and they confirmed that LimnoPro's (new lab) dilution calculations were correct. For the fish question, TWG exhibited no concerns with removing sections of reaches above or below barriers because it would improve data interoperability and streamline operations.
Q2: No feedback provided to chlorophyll extraction inquiry.

NEON Response

Q1: No recommendations were made by the TWG.
Q2: N/A

Atmospheric Deposition TWG

The NEON Atmospheric Deposition Technical Working Group TWG will focus on the project that performs sampling of precipitation for chemical analysis and isotope concentrations as well as particulate size distribution. Potential scenarios where input from the TWG would be requested include refinement of current procedures, algorithms, sensor obsolescence and replacement or the elimination, modification, or addition of data products, and infrastructure issues related to deposition.

Summary of Activities

Q1: Email to finalize wording for recommendation to relocate wet deposition sensors at core sites from tower tops to the ground, collocating with the weighing gauge for precipitation.
Q2: Kickoff meeting summarizing updates from last year and seeking additional feedback on wet and dry deposition sampling.

TWG Recommendations

Q1: TWG recommended relocating sensors to ground level.
Q2: The TWG recommended that NEON should discontinue the practice of discarding samples that had been in the collector for extensive periods. These samples should still be analyzed but the data flagged. They also recommended that the Dust Particulate and Size Distribution data was not of sufficient quality for the scientific community and thus supported discontinuation of data collection.

NEON Response

Q1: NSF approved recommendation, and NEON is working to identify the requisite funds to implement.
Q2: New guidance provided to field staff to stop discarding wet deposition samples regardless of holding times and drafted recommendation to NSF regarding discontinuation of remaining dust deposition product.

Atmospheric Stable Isotope TWG

This group provides guidance regarding sensor designs and assemblies, data products, and field and lab procedures and protocols to measure atmospheric stable isotopes of ^{13}C in CO^2 and ^{18}O and 2H in water vapor and precipitation water.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Biorepository TWG

The Biorepository Technical Working Group is comprised of curation, archival and museum collections experts as well as ecologists and others who would make use of the NEON Biorepository. The group advises NEON on curation best practices, and discoverability of and ready access to biological samples and specimens for future scientific research. A particular focus is to broaden the availability and use of museum assets for regional to continental-scale ecological research.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Breeding Landbird TWG

The Breeding Landbird Technical Working Group provides expert input and advice regarding the science design and protocols related to NEON breeding landbirds sampling.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Data Standards TWG

The Data Standards Technical Working Group is tasked with making recommendations about effective ways to provide NEON's data products to the broader scientific, educational, and policy communities. Topics may include 1) principles, standards, and policies for open data and software; 2) data discovery, exploration, and delivery mechanisms; 3) improvement of data products to increase utility; and 4) monitoring impact of NEON data use on research.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Ecological Forecasting TWG

The Ecological Forecasting TWG provides recommendations to NEON on how to best support ecological forecasting. This may include facilitating community discussions around forecasting needs, providing guidance for data product development, and identifying opportunities for NEON to engage with the forecasting community though workshops, educational materials, and code/data product development.

Summary of Activities

Q1: The EF TWG had email communication to schedule a kickoff meeting which could not be scheduled until Jan (Q2). NEON staff solicited feedback from the TWG about priorities for the NEON presence at the Ecological Forecasting Initiative (EFI) 2025 meeting. NEON staff also solicited input via email about a NEON collaboration with Imageomics for an NSF HDR AI/ML challenge with a "forecasting" theme involving NEON beetle images and metadata.
Q2: The EF TWG held the kickoff meeting for AY2025 on 9 Jan 2025. The TWG discussed opportunities and priorities for NEON at the Ecological Forecasting Initiative (EFI) 2025 meeting that will be held at Virginia Tech in May 2025. The TWG also discussed the use of NEON beetle specimen images as a benchmark dataset to be used in an NSF Harnessing the Data Revolution (HDR) AI/ML challenge focusing on a forecasting theme.

TWG Recommendations

Q1: The EF TWG encouraged NEON-led workshops at the EFI 2025 meeting and encouraged the development of a NEON benchmark dataset to use in the HDR AI/ML forecasting challenge.
Q2: The TWG recommended several NEON outreach activities for the EFI 2025 meeting, including NEON-led poster presentations, workshops, a table for outreach, and coordinating a data help desk.

NEON Response

Q1: NEON personnel (Eric Sokol) submitted proposals for several workshops and NEON-led activities at the EFI 2025 meeting and is working with NEON Biorepository and Imageomics personnel to develop an HDR AI/ML challenge centered around images of NEON beetle specimens and their metadata.
Q2: NEON personnel have been working with the EFI 2025 steering committee to coordinate the recommended activities.

Foliar Sampling TWG

The Foliar Sampling Technical Working Group provides expert input and advice related to sampling sunlit plant foliage, with a key goal of linking field measurements to remotely-sensed observations of vegetation chemical and physical properties.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Ground Beetle TWG

NEON collects ground beetle observations and archival samples at all terrestrial field sites to capture how ground beetles (*Carabidae*) communities change in different habitats and ecosystems over time. This TWG determines targets for sampling that generate data that can reveal significant changes in beetle abundance, diversity, and community composition.

Summary of Activities

Q1: No activities to report, as no beetle sampling issues arose.
Q2: Email request for volunteers to help identify a strong science question that uses NEON ground beetle specimen images to design an AI/ML challenge in partnership with the Imageomics Institute (at Ohio State University).

TWG Recommendations

Q1: N/A
Q2: No recommendations offered. One TWG member volunteered to join the AI/ML challenge brainstorming effort.

NEON Response

Q1: N/A
Q2: TWG member was invited to join the challenge brainstorming.

Microbial TWG

The Microbial Ecology Sampling Program encompasses measurements of soil and aquatic microbial diversity, composition, and abundances that are deemed critical for understanding long-term changes in biodiversity and ecosystem function. The tools used for measuring microbial diversity in the environment develop and change rapidly. NEON relies on input and guidance from the Microbial Technical Working Group to advise on questions related to methods and analyses, as well as best practices for ensuring data quality, accessibility, and usability.

Summary of Activities

Q1: No meetings were held.
Q2: The group was updated on developments in microbial data products, including the revised microbial community taxonomy data product and the soil reference community control development.

TWG Recommendations

Q1: N/A
Q2: The TWG was satisfied with the progress of the revised data processing algorithm for the community taxonomy product and provided suggestions for incorporating the soil reference into the marker gene (amplicon sequence data) and metagenome (shotgun metagenome sequencing) data products data products.

NEON Response

Q1: N/A
Q2: N/A

Mosquito TWG

The Mosquito Technical Working Group is comprised of researchers focused on topics including mosquito surveillance, public health, disease ecology, and phenology. The group advises NEON on sampling approaches that will generate data that reveal significant changes in mosquito abundance, diversity, and community composition. A focus of this group is to ensure compatibility of the mosquito dataset with other surveillance infrastructure used to monitor arboviruses in mosquito populations.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Reaeration TWG

The Reaeration Technical Working Group provides feedback on NEON re-aeration sampling protocols. The TWG is helping to evaluate previously collected data and develop plans to reduce the frequency of re-aeration experiments by strategically targeting certain discharge ranges to complete k-Q rating curves which can be used by data users to estimate re-aeration. The goal is to phase out the use of sulfur-hexafluoride as tracer gas.

Summary of Activities

Q1: Requested TWG approval to stop performing SF6 release at remaining sites and move to salt slugs at all sites based on data analysis designed and reviewed by TWG.
Q2: No meetings held.

TWG Recommendations

Q1: TWG concurred.
Q2: N/A

NEON Response

Q1: Approvals received for change through NEON's change process and implemented change on 2025-02-26.
Q2: N/A

Site Management and Disturbance TWG

The Site Management and Disturbance Technical Working Group (SIM TWG) provides experience and expert knowledge related to Disturbance Ecology, particularly in reporting disturbance events and metadata. The scope of the NEON SIM TWG includes capturing disturbance events for all NEON Science subsystems (AIS, AOP, AOS, TOS, TIS). The group advises NEON on SIM data accessibility, quality, and usability as well as identifying areas of improvement within our budget. This group is also tasked with providing guidance on disturbance monitoring methods and best practices for reporting impacts to other ongoing data collection at our sites.

Summary of Activities

Q1: Welcomed two new members and reviewed the NEON change board's comments and approvals associated with the TWG's protocol and sampling disturbance recommendations. Overall, the TWG was happy to see some items moving forward, especially using the point locations to create a polygon shapefile and appreciated the discussion and thought behind the decisions.
Q2: March meeting postponed due to low attendance due to travel and illness.

TWG Recommendations

Q1: The TWG supports adding photos to help end users better understand events and for potential use with AI/computer vision. The TWG also likes the idea of looking into AOP imagery/data products to help determine sampling disturbance (e.g., trampling).
Q2: N/A

NEON Response

Q1: We will continue to pursue the possibility of adding photos to the sampling protocol with the NEON change board, given their value relative to the text currently captured. We requested an intern for this summer to focus on R coding for the SIM package and are considering pursuing the AOP angle next year.
Q2: N/A

Small Mammals TWG

The Small Mammal Technical Working Group provides expert input and advice regarding the science design and protocols related to NEON small mammal abundance, diversity, and pathogen sampling.

Summary of Activities

Q1: This meeting was a cross-TWG meeting involving TWG and community members with interests in ground beetles, mosquitoes, small mammals and fish. We discussed the current identification results of the barcoding data products as they relate to NEON taxonomic determinations and the future of sample selection, sequencing methodology and sample sizes.
Q2: No meetings were held.

TWG Recommendations

Q1: It was suggested that enlisting the help of the professional taxonomists to review voucher samples at ASU in relation to the existing BOLD results could help to modify identification keys and improve taxonomic accuracy. A similar effort by ASU to look for characteristics in *Peromyscus maniculatus* and *P. leucopus* and other cryptic species could be undertaken for mammals. Improvements to the reference libraries can also be made by using targeted submission of confirmed ASU archive samples. To determine the quantity of samples submitted by each taxon several of the taxonomists/attendees offered to look over existing BOLD data and recommend specific taxa to target for submission. Sara will send the data to Evan and Kip for beetles, to Laura and Jessica for mammals, and to Doc and Kelsey for mosquitoes. An additional step of bootstrapping to determine numbers of samples needed to achieve 90% accuracy may also help with sample size determinations. The question of which sequencing technologies to use centered around Sanger being reliable and requiring less bioinformatics expertise than PacBio and the other options. It was generally agreed that the focus for DNA barcoding should shift away from genetic diversity work and towards taxonomic confirmations. Most of these organisms have additional archived samples that can be used in an NRSS project if genetic diversity work is desired. Having stable extraction archives was deemed desirable since those samples do get requested and they can be used for additional genetic diversity work as needed.
Q2: N/A

NEON Response

Q1: Sara Paull has met with the 2 mosquito taxonomy labs to develop plans and lists of priority species for targeted barcoding as well as a general sample size. Sara has met with the beetle taxonomist, Kip at Essig to develop a similar plan for ground beetles and has been providing additional spreadsheets upon his request to finalize a species list and sample size for beetles. Laura has developed a small mammal priority list. Sara is working on developing sample sizes based on a goal of 90% taxonomic accuracy as well which will be considered in conjunction with the recommendations of the taxonomists for each group to finalize sample sizes as BOLD optimization work continues. An RFP will be

developed for either Sanger or PacBio sequencing and the choice will depend on which maximizes the number of samples given that the accuracy and data quality are comparable between the two methodologies.
Q2: N/A

Soil Sensor TWG

The Soil Sensor Technical Working Group, provides feedback on all aspects of sensor measurements made in the TIS soil plots, including soil temperature, soil moisture and salinity, soil CO_2 concentration, soil heat flux, throughfall, soil surface photosynthetically active radiation (PAR), net longwave radiation, and soil surface/litter/vegetation infrared temperature measurements. In addition, the Soil Sensor TWG provides recommendations on approving or disapproving requests for large amounts of soil from the NEON Megapit Soil Archive.

Summary of Activities

Q1: Scheduled annual kick-off meeting for 7 January 2025.
Q2: Soil Sensor TWG annual kick-off meeting was held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Surface Atmosphere Exchange TWG

NEON measures the surface-atmosphere exchange of momentum, heat, and several climate-relevant trace gases. This Technical Working Group advises on the operation of NEON's surface-atmosphere exchange assets, development of novel, scale-aware data products, adaptive algorithms, and usability tools, and active contribution to network science. The Technical Working Group accomplishes these tasks by working closely with NEON's Surface-Atmosphere Exchange Group. This includes prioritizing quarterly developments, pre-reviewing new resources, and bringing forward community input.

Summary of Activities

Q1: No meetings were held.
Q2: Requested approval to discontinue the use of archive gas in the SAE validations.

TWG Recommendations

Q1: N/A
Q2: The TWG supported discontinuing the archive gas and provided feedback that the NEON strategy to use a span of three known concentrations of CO2 measured daily is among the most comprehensive procedures implemented by the eddy covariance community. The archive gas is above and beyond what is needed from a data quality perspective.

NEON Response

Q1: N/A
Q2: NEON has discontinued sending archive gas cylinders to the field. We plan to remove the archive gas from file structures as part of future work.

Terrestrial Biogeochemistry TWG

The Terrestrial Biogeochemistry Technical Working Group provides expert input and advice regarding the science design and protocols related to measurements of plant and soil biogeochemistry within the NEON Observational System (e.g., not sensors).

Summary of Activities

Q1: The TWG was asked for input regarding two soil sampling plots in Domain 9 Northern Plains with corners that have become frequently inundated. The question was whether to permanently 'reject' these flooded zones from the random sampling locations list, since the flooding is often too deep to sample and then the plot does not receive the usual 3 replicates. The other option was to keep them in consideration so that the wet zones, when sampleable, would be represented in the plot data.
Q2: No meetings were held.

TWG Recommendations

Q1: The majority of the TWG felt it was more appropriate to remove those flooded corners on the edge of prairie potholes from the random sampling list. This way, the plots could reliably be sampled with n = 3 within-plot replicates as designed, and plot-level averages would not be periodically skewed by introduction of soil data from flooded locations.
Q2: N/A

NEON Response

Q1: These corners have been removed from the random sampling lists in the two affected plots.
Q2: N/A

Terrestrial Plant Diversity and Phenology TWG

Membership of the Terrestrial Plant Diversity and Phenology Technical Working Group includes researchers and practitioners from universities, federal and regional government agencies, and coordinated research networks. This group represents the community of plant diversity and phenology data users that NEON aims to serve; members provide expert input and advice regarding the science design, protocols, and data quality issues related to NEON plant diversity and phenology sampling.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A

Terrestrial Plant Productivity and Biomass TWG

The Terrestrial Plant Productivity Technical Working Group advises which methods, protocols, and equipment are employed to create robust ground-based estimates of live and dead woody biomass, woody and herbaceous productivity, coarse downed wood volume and density, fine and coarse litterfall, belowground plant biomass, and leaf area index across a suite of different vegetation types. The TWG also considers optimal spatial and temporal integration of ground-based measurements with remote-sensing hyperspectral and LiDAR datasets (i.e., the NEON AOP system), and with data streams generated by the NEON Terrestrial Instrument System. Finally, the TWG is also deeply invested in determining how NEON Plant Biomass and Productivity data products can be optimized to enhance usability and value for the NEON end-user community.

Summary of Activities

Q1: Following TWG recommendations in Q4 2024, we re-ran power analyses for the belowground biomass optimization effort and other similar analyses with a pooled 0-2 mm diameter size category. Re-worked analyses were shared with the TWG in Q1 AY25, and a plan for data-driven reduction in sampling was applied to 8 sites following NEON change board approval. Separately, the TWG advised on how to handle Vegetation Structure (VST) height measurements in D16 when the tops of tall trees are not visible.
Q2: In January, the TWG discussed the fine root field sampling optimization results; in March, Vegetation Structure height measurement options were discussed for very tall trees with tops that are not visible.

TWG Recommendations

Q1: Belowground biomass (BBC) optimization: Reduce intra-plot replication to 1 core per cell at SCBI, SERC, JERC, UKFS, ORNL, WREF, BONA, and DEJU.
VST Height: Use height measurement from tree of similar diameter in same plot with top that is visible. Record nothing if no similar tree exists in the plot.
Q2: The TWG recommended reducing fine root core sampling effort at 8 sites in manner that retains the ability to detect a 20% change in fine root mass with 90% confidence using a pooled 0-2 mm sizeCategory; roots will continue to be sorted to all 3 existing sizeCategories. For the Veg Structure height question, it was recommended to remove the "height" requirement when treetops are not visible.

NEON Response

Q1: BBC Optimization: TWG recommendations approved by a NEON change board, guidance documented and shared with Field Science.
VST Height: Need further clarification from TWG regarding stemDiameter of nearby individual and what is "similar enough" for purposes of recording height data from a nearby individual.

Q2: The NEON change board reviewed the TWG fine root recommendation and implemented this recommendation for the 2025 field season. The board also reviewed the Veg Structure "height" recommendation and guidance was drafted for the 2025 field season.

Tick Sampling TWG

The Tick Technical Working Group provides expert input and advice regarding the science design and protocols related to NEON tick abundance, diversity, and pathogen sampling.

Summary of Activities

Q1: No meetings were held.
Q2: No meetings were held.

TWG Recommendations

Q1: N/A
Q2: N/A

NEON Response

Q1: N/A
Q2: N/A