NEON Technical Working Groups

2022 Third Quarter Report

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Table of Contents

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 & Education Advisory Committee (STEAC) and Technical Working Groups (TWGs). 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 23 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 third quarter of the 2022 funding year (May 2022-July 2022).

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

No meetings were held.

TWG Recommendations

N/A

NEON Response

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

Requested the TWG review the discharge protocol.

TWG Recommendations

N/A

NEON Response

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 are able to 1) take a broad and complete view of the aquatic program as a whole, and 2) provide scientific guidance on design, prioritization, and value of the components of the Project.

Summary of Activities

1) We requested TWG reviews for 3 AOS protocols

2) Contacted microbe-specialist members for questions about filters used to filter formaldehyde for surface water cell count samples.

3) We requested further feedback on Algal Taxonomy voucher collection and analysis issues to help determine how the data product can be improved.

TWG Recommendations

1) TWG reviews recited for 3 protocols, 1 reviewer per protocol.

2) The 0.2 um filters used to filter formaldehyde for cell count analysis do not appear to have caused any data quality issues, but to cover all the bases in the future NEON should switch to sterile filters as a best practice.

3) Voucher flora is an important piece of the algal analysis, but there were different views on the field design and lab analysis that would product different results favored by different members of the TWG.

NEON Response

1) Review comments will be incorporated in the next protocol revision, none were a high priority.

2) S. Parker surveyed NEON field science and determined that switching to sterile filters would not cause orphaned consumables because non-sterile 0.2 um filters are used for other protocols. Will present this change to the OS-IPT and add to the Aquatic Microbes protocol.

3) Because this is a large decision to make, we have expanded the feedback pool by creating a Lime survey with NEON Engagement. Discussions are still in progress for this issue.

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

We held our mid-year TWG meeting and provided NEON updates on previous TWG recommendations. TWG chair Dr. Rich Fiorella presented an analysis examining memory at the beginning of the sampling interval and optimum sampling time at each tower level. The goal of this analysis is to inform how much data should be excluded at the beginning of sampling each measurement level and to determine if the sampling interval at each tower level can be reduced.

TWG Recommendations

There are a series of trade-offs to decide on as a TWG/community: What do we think is most important to optimize? (minimize measurement uncertainty, minimize bias, maximize temporal frequency?) If we want to decrease peak time and measurement return intervals is there a maximum measurement uncertainty we are willing to accept? How much would temporal frequency need to increase to justify changing 10 minute sampling window? Suggest developing a survey for feedback on these issues, fuller characterization of uncertainty in L0p data, and work toward decision at next meeting.

NEON Response

Develop survey for feedback on these recommendations, more fully characterize uncertainty in L0p data, discuss in the next TWG meeting and decide on a preferred strategy.

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

No meetings were held.

TWG Recommendations

N/A

NEON Response

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

Met with Jen Timmer and Chris White from Bird Conservancy of the Rockies to discuss plans for the TWG and the Bird protocol overall. The following actions were planned/implemented:

1) The sub-contractor survey is being distributed currently and feedback will be incorporated into protocol updates.

2) Update the technician protocol quiz for the 2023 Field Season and host it online.

3) Create a KBA for minor updates to the protocol for the 2023 Field Season.

4) Schedule a TWG meeting for Sept. 2022 to discuss above actions.

5) Revise the protocol for the 2024 Field Season.

TWG Recommendations

N/A

NEON Response

N/A

Community Engagement TWG

The Community Engagement Technical Working Group (TWG) provides guidance on the ways in which NEON engages with its existing and potential user community. This includes scientists, educators, and students as well as organizations, agencies, institutions, and companies whose activities align with the mission and goals of the NEON program. Members serve as liaisons to the NEON user community while providing input on the program's strategic engagement plan and the activities and outcomes identified in that plan.

Summary of Activities

Meetings were held May 24, 2022 and June 29, 2022. At the May meeting, activity leads discussed "Increasing awareness and access to NEON site tours" for which the group began drafting a prioritized list of networks to tap into for such events. The June meeting included follow up from the May meeting, M. Faust presenting a tour of NEON's digital outreach resources and discussion on new digital outreach resource idea. The TWG members then began developing recommendations for "Creating ways to incentivize staff to conduct outreach", which they hope to finalize in Q4,

TWG Recommendations

N/A

NEON Response

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

No meetings were held.

TWG Recommendations

N/A

NEON Response

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

1) The TWG coordinated a workshop at the 2022 EFI conference in May titled "NEON Data, the Forecasting Challenge, and an Opportunity to Provide Feedback" - see conference agenda at https://docs.google.com/document/d/1OJ8LniGIs57EvWlvPZilyuv0i40ZTEHVzgmMSYqqNIE/edit?usp=sharing.

2) The TWG has been coordinating outreach efforts, including two blog posts highlighting the NEON EFI forecast challenge: "Building a Forecasting Community: The EFI-RCN NEON Forecasting Challenge" was published on the NEON blog on 6/9/2022 and I (ERS) just reviewed another blog entry highlighting the use of the NEON EFI forecasting challenge that I assume will be published soon.

3) June 24, 2022 EF TWG meeting -- EFI folks inquired about NEON representatives at GLEON to help with forecasting challenge outreach; We discussed the timing for a PR push for the next iteration of the NEON EFI forecasting challenge (year 3 of 4 years); the group came up with the idea of "forecasting ambassadors" and recommended we discuss this further; the group suggest we highlight the success of the two-way communication between the EFI challenge organizers and NEON and how the lower latency data has is greatly appreciated by the EF community and how that has also benefited NEON (maybe another blog post?).

TWG Recommendations

1) Pursue a forecasting ambassadors' program as a joint effort with EFI to provide support for "champions" for the different themes of the NEON Eco forecasting challenge. EFI PIs mentioned they could fund a small workshop or something similar as one possibility for what such a program would include.

2) Highlight successes of the EFI-NEON collaboration in some PR material, such as the lower latency data and how it's benefited both EFI and NEON, in a blog post.

NEON Response

1) E. Sokol and B. Meinke plan to meet with the EFI RCN steering committee to discuss the forecasting ambassador idea in Aug 2022.

2) E. Sokol will reach out to the EEOC team about the possibility of another blog post.

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

Over email, the TWG was asked for input on communicating the 'percent green' status of leaves collected early in the season that had some non-green, emergent coloration. This information is recorded as part of the leaf mass per area trait measurement.

TWG Recommendations

TWG members suggested that 'percent green' should be used to communicate live, not senesced tissue. As such leaves with a pinkish hue that are not fully mature would still be 100% 'green' for the purposes of leaf mass per area measurements. However, they recommended that we stress the importance of recording 'leaves not fully expanded' for plant status in the field collection table for any leaves in this condition.

NEON Response

TWG recommendation was communicated to the field staff, and emphasis on properly recording plant status has been added to the foliar sampling protocol as it is currently under revision.

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

The TWG provided feedback via email on how to address the challenge of pitfall traps that get flooded with sediment during heavy rains.

TWG Recommendations

The contents of the traps should be salvaged, if at all possible, but with the caveat that sorting the contents should not take any longer than 25% of the time it would take to sort through an undisturbed trap. This would essentially mean that most of the visible insects could be retrieved and, as long as the trap data has been annotated to include disturbance information, it may be useful in the future.

NEON Response

NEON field staff are working through various sieve sizes and methodological approaches to test the cost-benefit in terms of time spent and number of arthropods collected.

LiDAR TWG

The LiDAR Technical Working Group assesses and recommends strategies for developing and implementing techniques for instrument calibration and data validation, operational instrument testing, and product data formatting for vegetation remote sensing.

Summary of Activities

No meetings were held.

TWG Recommendations

N/A

NEON Response

N/A

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

1) The past quarter H. Cross reconnected with the Microbial TWG to establish communication and gauge membership needs for the coming year. The responses from all members were very positive. Several emails were exchanged both as a group and individually.

2) We agreed to wait until Rush University had processed the fungal samples, and H. Cross has had a chance to analyze them before meeting.

3) An initial meeting was proposed for late-August/early September. One member, Linda Kinkel (UMN) will be unable to join due to personal and professional commitments.

4) H. Cross discussed with the Microbial TWG whether to recruit new members for the coming year.

TWG Recommendations

1) The first meeting will focus on discussing high priority items, including the assessment of Rush University's initial fungal sequencing, and proposed positive controls for microbial work.

2) The Microbial TWG recommended to recruit new members in the coming year and to check at LTER for potential recruits.

NEON Response

1) The main priority will be to analyze the Rush fungal samples and discuss these results with the TWG. The analysis of these and other data will also inform the discussion on positive controls.

2) H. Cross will recruit in the coming year.

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

1) We discussed the use of CO2 canisters instead of dry ice as bait for mosquito traps at sites struggling to obtain dry ice as well as the possibility of moving to CO2 canister use observatory-wide.

2) We talked about the use of alternative materials for storing sample collected in the field when dry ice is not available.

3) We discussed how to handle samples where 1-20% of the sample is encased in ice.

TWG Recommendations

1) Dry ice sublimation rates likely vary significantly over time and space. Using CO2 canisters with a .65 Lpm flow rate to allow CO2 canister use to be feasible with smaller tanks and to best match estimates of sublimation rates is a good path forward for the sites that cannot obtain dry ice. The TWG also felt that shifting to CO2 canisters across the observatory would not represent such a large shift from current collection methods given the current variability in flow rates from dry ice, and the other sources of variation in mosquito capture and would have the added benefit of standardizing flow rates moving forward.

2) The TWG was broadly supportive of using alternative methods to store samples when dry ice is not available at the time of collection but wanted these samples marked in some way so those using them for transcriptomics or viral culture would know not to use them.

3) The TWG felt the prioritizing mosquito identification was important and recommended thawing samples that have >1% of sample encased in ice rather than eliminating the frozen portion of the sample.

NEON Response

1) We approved the use of CO2 canisters as bait at sites in D07, D08 and D20 given dry ice shortages that they are facing. This will serve as a pilot period, and we will consider rolling CO2 canisters out across the observatory in future years.

2) We will mark all samples that are not stored on dry ice in the field.

3) We will thaw all samples that are >1% encased in ice.

Re-aeration TWG

The Re-aeration 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 ultimate goal is to phase out the use of sulfur-hexafluoride as tracer gas.

Summary of Activities

No meetings held.

TWG Recommendations

N/A

NEON Response

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

We had several email exchanges to discuss:
1) Whether to request the return of partially-used blood samples from large sample requests.

2). How far lethal sampling should be set back from existing NEON sampling grids to ensure that the integrity of our sampled population.

3) How to reduce the instances of spilled bait seeds sprouting.

TWG Recommendations

. We had several email exchanges to discuss:

1) Whether to request the return of partially-used blood samples from large sample requests

2) How far lethal sampling should be set back from existing NEON sampling grids to ensure that the integrity of our sampled population

3) How to reduce the instances of spilled bait seeds sprouting.

NEON Response

1) Blood samples with freeze thaw cycles have fractured cells and are difficult to separate components so they are likely of minimal current value for assays, but they may be of use in the future with technological advances.

2) Setting destructive sampling a distance of ~10-20 home range sizes from the typical rodents captured should be enough to prevent a population sink from impacting our sampled populations. Peromyscus home ranges are ~30m so 5-600 m should be sufficient.

3) One TWG member had used similar oven sterilization procedures, increasing the temperature at which the seeds bake could help.

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

No meetings were held.

TWG Recommendations

N/A

NEON Response

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

No meetings were held.

TWG Recommendations

N/A

NEON Response

N/A

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

Feedback was requested over email on a proposed process for rinsing specimen cups used for soil inorganic nitrogen extractions. NEON tested ultrpure water vs 5% HCl and determined that, while the acid rinse removed more N contaminant, it was also more complex and time consuming, and the ultrapure water rinse yielded nitrogen levels at or below the detection limit. The TWG was asked if the water rinse was sufficient or if HCl was required.

TWG Recommendations

TWG members agreed that the ultrapure water rinse was sufficient, given that it brings nitrogen levels near or below the detection limit. They recommended we start rinsing our cups following this process.

NEON Response

A protocol change was drafted, and the rinse procedure communicated to the field teams for immediate implementation.

Terrestrial Instrument Data QA/QC TWG

The Terrestrial Instrument Data QA/QC Technical Working Group represents a diverse set of NEON data users and experts, in the relevant disciplines of biometeorology, soil science, ecology, and data science. The overarching goal of the TWG is to ensure that NEON delivers the highest quality data possible with the available resources and that quality information is adequately communicated to data users. The TWG broadly covers terrestrial instrument measurements, data processing, data monitoring, and data publication as they relate to quality.

Summary of Activities

1) The cause of widespread dark current in PAR readings was determined to be water ingress due to a failed seal. Sensor refresh will now include adding sealant.

2) Four cases of shading tower-top radiation sensors have been resolved.

3) Calibration cycles of four sensors were extended to 2 years following observatory-wide drift assessment.

TWG Recommendations

N/A

NEON Response

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

1) We requested feedback on sampling design and protocol implementation at SOAP following high intensity, stand replacement, wildfire on the primary phenology transect.

2) Submitted Phenology Optimization report for TWG review.

TWG Recommendations

1) Following email discussion, the TWG recommended no change to sampling at the site. Sampling location will not change, transition to phase II sampling will occur as originally scheduled (though most sampling will be suspending this season for safety reasons). The TWG acknowledged that during the re-generation phase species may not persist and there will be impacts to the phenology time series but that scientific value of post-fire phenology at the community level should be prioritized over maintaining year over year continuity of species or individual plants.

2) Received initial comments on report but have not yet convened a meeting to gather recommendations.

NEON Response

1) Passed TWG recommendation on to OS IPT and Field Science. Phenology sampling will continue as planned with awareness to successional shifts in community composition following disturbance.

2) Scheduling conference call in the Fall to discuss Optimization of phenology sampling.

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

1) Requested feedback on Herbaceous Biomass and Productivity protocol.

2) Requested feedback on Herbaceous Biomass/Vegetation Structure optimization analyses.

3) Requested guidance to determine whether shipping frozen root cores to D12 for processing poses risks to data quality.

4) Worked with TWG to determine value of Absence List data currently reported in Vegetation Structure vst_perplotperyear table.

5) Worked with TWG to assess how long Field Science staff should search for individuals that have not been found for at least one bout during Vegetation Structure sampling.

6) Continued discussions with TWG members Chris Gough and Lu Zhai to develop a proposal to create a derived NEON above-ground biomass data product.

TWG Recommendations

1) TWG review of Herbaceous Biomass and Productivity protocol is ongoing (due in August).

2) TWG review of HBP and VST optimization analysis is ongoing (due in August).

3) TWG recommended freezing root cores is a viable option before they are processed; temperature does not matter (e.g., -20 vs. -80) but cores should only be frozen once.

4) TWG recommended deleting Absence Lists from data product.

5) For VST sampling, TWG recommended giving up looking for individuals that are not found after 2 consecutive bouts for plots measured every 5 y and giving up after 3 consecutive bouts for plots measured annually.

6) TWG members working with C. Meier to develop and submit proposal by November.

NEON Response

3) Meier to draft KBA documenting root core freezing prior to processing; this is a very beneficial change that will allow much more efficient processing of collected root samples.

4) Absence Lists will be removed from publication in the VST product.

5) Updated guidance focused on the length of time people should look for lost individuals will be incorporated into ongoing VST protocol revision for 2022/23.

6) Meier to request AA proposal support and continue to work with TWG members Gough and Lu to develop and submit proposal.

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

No meetings held.

TWG Recommendations

N/A

NEON Response

N/A