



NEON Technical Working Groups

2021 Third Quarter Report



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National Ecological Observatory Network (NEON) is a project sponsored by the National Science Foundation and proudly 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 to optimize 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 24 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 2021 funding year (May 2021-July 2021).

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 TWG meeting was held this quarter, currently scheduled for Q4.

TWG Recommendations

N/A

NEON Response

N/A

Algal Taxonomy TWG

Taxonomic identification of algae is difficult. Organisms are typically microscopic, and nomenclature has been changing in recent years. Taxonomic consistency between individual taxonomists, as well as taxonomy labs, is crucial to data quality over the time span of the NEON program. The Algal Taxonomy Technical Working Group seeks to assemble a group of algal taxonomists with broad spatial representation both for soft algae and diatoms.

The Group will be called upon to plan the best way to 1) develop a method for consistent taxonomic identification for NEON contractors, across labs and over time, 2) develop taxonomic comparison or harmonization across NEON Domains, and 3) facilitate and support data quality. The Group may also be called upon to evaluate how best to allocate limited resources while maintaining the best possible science and data product delivery.

Summary of Activities

Met on July 1, 2021 to report optimization findings and solicit feedback on changes to field sampling.

TWG Recommendations

- 1) Group recommended NEON use EPA National Rivers and Streams Assessment (NRSA) field sampling approach which collects samples along 11 transects and composites them into 1 final sample that is used for taxonomic analysis.
- 2) After response from NEON about losing spatial replication with this approach, the group seemed uncomfortable answering further questions about field work.
- 3) The consensus is that NEON is under sampling and should increase surface area sampled in streams.
- 4) Soft algae: some members of group suggested adopting California SWAMP (Surface Water Ambient Monitoring Program) protocols, some did not - no consensus.

NEON Response

- 1) Presented suggestions to Aquatic TWG, Optimization WG, and OS-IPT. All groups agreed that we should not move to the 10 transect = 1 composite method but should preserve spatial replication for field sampling.
- 2) We will instead continue a similar approach to the current field sampling but de-emphasize sampling in different habitats and emphasize sampling on different substrata, which is not much different from current NEON sampling.
- 3) NEON will also pursue a pilot study for expert taxonomic analysis to improve data quality and efficiency, without increasing workload at the lab.

4) Because there was no consensus on soft algae, we will continue with the existing analysis approach.

The Algal Taxonomy TWG was prepared to talk about details of lab analysis and taxonomy, not field analysis or optimization. The Aquatic TWG may be better suited for these questions and has been consulted.

Aquatic TWG

The Aquatic Technical Working Group provides expert knowledge across the fields of Aquatic Ecology, Biogeochemistry, and Ecohydrology. This group is broadly geared toward aquatic observational sampling and instrumentation along with associated data products, design and maintenance documents, protocols, and algorithms.

Summary of Activities

No meetings. Solicited TWG feedback on:

- 1) Leveraging USGS continuous discharge data for TOMB,
- 2) Eliminating particulate carbon and nitrogen (PCN) sampling from groundwater,
- 3) reporting Total suspended solids (TSS) only in units of mg/L and stopping Dry Mass,
- 4) Review of AOS protocols and Statements of Work (SOWs), and
- 5) Feedback on algal optimization and field sampling from Algal Taxonomy TWG. We also invited TWG members to apply for the NEON Ambassador program.

TWG Recommendations

TWG supported NEON recommendations and provided feedback on protocols.

NEON Response

USGS data will be used for TOMB. PCN will be eliminated from groundwater sampling and reporting of TSS Dry Mass.

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

No meetings, currently scheduling for Q4.

TWG Recommendations

N/A

NEON Response

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

No meetings were held; TWG needs a new NEON lead, given K. LeVan's resignation.

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

No meetings were held.

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

No meetings were held; TWG needs a new NEON lead, given A. Crall's resignation. Marie Faust will be leading and setting up a meeting for 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

Met July 22; discussed the existing data release file structure and documentation as well as the new data publishing guidelines.

TWG Recommendations

The group recommends that:

- 1) We provide a presentation/code example/video for creating a citation and published data package.
- 2) In the data availability page, make it clear that 2D wind speed is just a default selection of many data products,
- 3) create a widget that allows a user to view the download manifest in table format (and download as csv) prior to download.
- 4) Ask members of other TWGs what their experiences have been in using the data releases and documentation,
- 5) use the annual release as a promotional event - build excitement to use new clean data,
- 6) In a release-2022 page, make it clear what the major changes are between 2021 and 2022,
- 7) in the current release 2021 page, clarify what that table information is - e.g., "IS excluded data".

NEON Response

NEON agrees with all recommendations, and these tasks are being incorporated into the task planning for the data portal team and others.

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 through workshops, educational materials, and code/data product development.

Summary of Activities

We had one TWG meeting on May 13, finalized website design for NEON page with information for EFI RCN NEON forecasting challenge -- and published to neonscience.org. Dave Durden provided updates on access to shorter lag SAE data variables (5-day lag data available in ECS). NEON staff (Eric Sokol and Claire Lunch) participated in EFI RCN workshop on developing forecasting educational resources.

TWG Recommendations

N/A

NEON Response

N/A

Fish TWG

The Fish Technical Working Group provides expert knowledge and support for the development of field-based protocols and strategies for standardization of sampling across NEON aquatic sites.

Summary of Activities

No meetings were held.

TWG Recommendations

N/A

NEON Response

N/A

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

No meetings were held.

TWG Recommendations

N/A

NEON Response

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

The last meeting was 7/29/2021. Discussed were possible ways to reduce costs on the ground beetle protocol via:

- 1) changing the number of beetle sampling bouts conducted per site per year – via reducing the numbers of plots sampled and/or number of site visits.
- 2) Changing how long NEON technicians spend identifying beetles.
- 3) Altering the numbers of beetles pinned vs archived.
- 4) Performing DNA barcoding differently to save money.
- 5) Changing the sampling process, in the field, so technicians spend less time per sampling event.

TWG Recommendations

1) The TWG was NOT interested in reducing the sampling window. Discussed instead was trying to reduce redundancy (i.e., if consecutive bouts provide similar measurements, maybe both aren't needed; similarly, if adjacent plots provide similar estimates, maybe one can be dropped). Katie was going to do more analyses on the impacts of reducing redundancy using an abundance-weighted pairwise diversity approach. Other ideas were: reduce sampling in certain areas (e.g., desert areas) because the beetle communities are smaller/less diverse there anyway.

2) There is no great way to get techs to spend less time on identification. Ideas were presented regarding limiting the time technicians are allowed to spend trying to ID specimens, but it was thought this wouldn't be very effective and there is wide variation on how long it appears to actually take across sites. One TWG member suggested starting with the easy stuff (everything to genus, as many as are very easy to ID to species) and then spend up to some amount of additional time on the harder specimens. Another suggestion was site-specific identification time guidelines. It was also suggested that we “liberalize the use of morphospecies and slash species” so technicians do not have to fully identify taxa that are very similar or related (with expert review as a “backstop”).

3) The TWG suggested that NEON's reliance on expert identifications is in part because of the absence of a L2 data product that “repatriates” identifications”. I think the idea was that if we were to create another DP for updating taxonomic info well after the initial identification, it would allow us to slowly work through IDs instead of feeling like we have to ship them off for expert identification right away.

Another idea was to pin only 20 specimens per species per year, regardless of site, and then possibly some percentage of the remaining specimens.

4) All I have here is “Get a species list per site by metagenomic approach”. I’ll be honest that I don’t remember the recommendations from this discussion.

5) It was proposed that we stop doing an ethanol rinse in both the field and the lab and do it only in the lab. This would save field time, and generally the TWG was open to this idea. Field time savings would be countered, however, by the need to pre-rinse cups with etOH (before the field visit) and to top off samples at least once to account for specimens “bobbing to the top” after some time period

NEON Response

N/A

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, waiting on data from new lidar sensor.

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

No meetings were held; TWG needs a new NEON lead, given G. House's resignation.

TWG Recommendations

N/A

NEON Response

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

There were no agenda items for the mosquito TWG this quarter.

TWG Recommendations

N/A

NEON Response

N/A

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

Members of the TWG provided feedback on the re-aeration sampling protocols. We also held a virtual meeting to discuss updates to the reerate R package. This included alternative ways of calculating tracer travel times (e.g. peak vs. centroid) and using a pooled approach to reduce model uncertainty. We also discussed quantitative ways of evaluating potential shifts in k-Q rating curves.

TWG Recommendations

Overall, the TWG is quite pleased with the measurements that have already been collected. In most sites we should be able to reduce or eliminate re-aeration experiments. In the remainder of sites, we should target specific flows where we are currently missing measurements. The TWG also recommended that, since a cleaned and processed dataset is required in the evaluation process, this dataset should be made available to users either as a higher-level data product or in an alternative public repository.

NEON Response

We are working to incorporate the suggestions of the TWG into the current sampling protocol and the R model. Processing and evaluation of currently collected data remains ongoing.

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 reviewed the results from the pilot project testing for tick-borne pathogens in rodents. This TWG, in contrast to the tick TWG, felt the testing for rare viruses was interesting and worth of keeping in the budget. They agreed that surveying *Peromyscus* species for tick-borne pathogens will help ensure cross-Observatory comparisons, while surveying other rodent species will ensure novel results and potentially unidentified hosts. We discussed the best ways to collect blood to balance competing use needs (filter paper vs. anticoagulant vs. dry ice). We provided the update that the small mammal barcoding library will be completed in the next fiscal year - all samples have been requested. The TWG also suggested continuing to use mealworms to help reduce *Sorex* shrew mortality. Finally, we discussed dropping the number of sites sampled at WREF and there were no objections to the proposal.

TWG Recommendations

The TWG recommends testing both *Peromyscus* and non-*Peromyscus* species for the tick-borne pathogens data product. This TWG was more enthusiastic about testing for the rare viruses than the tick TWG; however, they recognize the budgetary constraints of surveillance for rare pathogens. The TWG did not all agree on the best method for collecting blood samples, some thought the filter paper was difficult to use, others do not like anticoagulant because it precludes serum collection and antibody testing. They did not object to achieving some progress towards optimization by dropping two plots at WREF.

NEON Response

We will follow the TWG recommendation to test both *Peromyscus* and non-*Peromyscus* species for tick-borne pathogens. We have decided not to test for the rare viruses despite TWG interest due to cost and contradictory recommendations of the tick TWG. We will continue to collect blood samples as we have in the past with no addition of anticoagulant since the laboratory is able to process these samples successfully as demonstrated by the pilot results. I will seek permission to reduce the number of plots at WREF from 8 to 6.

Soil Sensor TWG

The Soil Sensor Technical Working Group (TWG), provides feedback on all aspects of sensor measurements made in the TIS soil plots, including soil temperature, soil moisture and salinity, soil CO₂ 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. Shared *Eos* article on NEON's Assignable Assets program with TWG members.

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

The TWG discussed the maximum acceptable leak flow rate for maintaining high data quality in the eddy-covariance turbulent exchange and storage exchange systems. Additionally, NEON provided feedback on the TWG member request to provide information for a EU Copernicus Calibration and Validation Solution.

TWG Recommendations

The TWG discussed the impacts of where the leak is in the system, and in the case of the turbulent exchange system automatic leak detection less than 0.1 slpm is acceptable but all leaks above 0.1 slpm should be fixed. For the storage exchange system, leaks on the main sampling line less than 0.3 slpm are not a concern. The TWG indicated that looking at the cospectra from the turbulent exchange system is a good way to confirm that leaks are not causing an issue for the fluxes.

NEON Response

We will continue our existing plan for fixing leaks above 0.1 slpm for the turbulent exchange system and above 0.3 slpm for the storage exchange system. A study of the cospectra will be scheduled in our future work to further examine the effects of leaks on data quality.

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

No meetings were held.

TWG Recommendations

N/A

NEON Response

N/A

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

No meetings, currently scheduling for Q4.

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

TWG members completed review of the phenology protocol and the herbarium techniques SOP.

TWG Recommendations

Phenology protocol - TWG reviewers suggested more clearly defining terms and clarifying alignment with National Phenology Network protocols. Suggested changing the threshold for triggering senescence frequency shift from one colored leaf to >5%. Typographical errors noted.

Herbarium SOP - Reviewer suggested that the current collection process is not ideal for preserving plant features and suggested collection teams use plant presses instead. The TWG generated recommendations for a subset of topics covered.

NEON Response

Suggestion to update the fall frequency trigger will be reviewed with field staff input and advanced through the internal review process, if supported by field staff. Other comments will be addressed in the next planned protocol revision.

Use of plant presses for collection bouts is already in practice for planned collection bouts and has steadily become the norm in practice. This will be further emphasized in future document revisions.

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) The TWG produced a 'Biomass Memo' for the NSF, detailing the TWG's proposal to create a derived Level-4 biomass product in partnership with NEON staff. The memo was shared with Dr. Paula Mabee, and it was recommended that the TWG spearhead an effort to seek external funding from the NSF to create the derived data product.
- 2) Sam Simkin shared a summary of Optimization Analyses completed to date, focused on determining whether HBP should continue to be implemented at forested sites based on Science Design criteria.
- 3) Discussed TWG review of Vegetation Structure data product and supporting documentation (i.e., DPUG) by end of September.

TWG Recommendations

- 1) Regarding the Biomass Memo, the TWG NEON lead (Meier) will work with the TWG Chair (Gough) to touch base with Matt Kane and determine NSF interest in such a proposal. Meier and Gough will then work with the rest of the TWG to turn the memo into a small-grant proposal, focused on funding a post-doc to work with the TWG and NEON to carry out the work.
- 2) Group recommended incorporating litterfall data into analysis when thinking about above-ground production and herbaceous biomass contribution to it.

NEON Response

- 1) Gough received positive feedback from Matt Kane, NSF needs to see a question-driven proposal that requires creation of the desired biomass product as one output. Aim is to identify potential candidates through TWG network at September meeting.
- 2) NEON POC noted that litterfall data will be helpful when analysis using only woody increment shows herbaceous biomass production is near threshold identified in Science Design.

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

We discussed the rules for switching from low intensity (every 6 weeks) to high intensity (every 3 weeks) sampling within sites. TWG agreed that a threshold of 5 ticks in a year matches the CDC definition of an established tick population. They recommended consistency in the data rather than switching back and forth. We also clarified the guidelines around when is too wet to sample. Most agreed that if it is not raining, and cloth isn't soaked, or muddy sampling is OK. We also discussed the results from the pilot study of tick-borne diseases in rodents. The TWG recommended continuing to sample both *Peromyscus* and other less common species. They also agreed that surveillance testing for rare viruses, while interesting, is a bit outside the primary scope of NEON.

TWG Recommendations

The TWG recommends less switching between high and low intensity both within and between sites. They also determined that sampling other species in addition to those in *Peromyscus* will yield interesting and novel results for the data on tick-borne diseases in rodents. They indicated that it would be a bit outside the primary scope of NEON and the data to continue surveillance for rare tick-borne pathogens in the rodent data.

NEON Response

NEON staff will be seeking approval through the internal review process to determine the sampling intensity at a site once every five years rather than switching back and forth at smaller time intervals. We have also used their recommendations for determining adequate sample size and species to create guidelines for the tick-borne pathogens in rodents data product. We also will not be conducting surveillance for the rare tick-borne viruses in concurrence with this TWG's suggestions.