NEON Technical Working Groups

2020 Second Quarter Report

1685 38th St., Suite 100 | Boulder, CO 80301 | 720.746.4844 | www.neonscience.org

National Ecological Observatory Network (NEON) is a project sponsored by the National Science Foundation and proudly operated by Battelle.

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

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 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 quarter of the 2020 funding year (November 2019-January 2020).

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

Meeting held on 3/29/20 to introduce new members, review revised TWG name and charter, provide status update on Airborne Observation Platform (AOP) flight season, review letter to NSF on AOP data products, and to discuss and solicit feedback from TWG on sampling and data product optimizations.

TWG Recommendations

The Airborne Remote Sensing Data Quality TWG agreed with new TWG name and charter, focusing on AOP data quality issues more broadly in addition to flight sampling design. The TWG recommended that NEON announce as soon as possible if collections are halted for the remainder of the year due to COVID-19 to reduce uncertainty to external science community. Regarding new data products, recommended potential adoption of the Committee on Earth Observation Satellites (CEOS) standards and evaluation processes (i.e., products might be published while in provisional stages so that they can be tested and improved by community). In response to proposal on scaling of NEON Imaging Spectrometer H5 radiances, the TWG agreed that this should be implemented to save storage space and cost. Due to time constraints, the TWG did not achieve consensus on proposal to relax solar angles, or whether recent flight schedule optimizations should be adopted on an annual basis, so group will further discuss these optimizations and their implications in the next meeting.

NEON Response

Will present recommendations on external communications and CEOS standards to NEON's Science Working Group. Scaling of H5 radiances will proceed as part of production data processing. The next TWG meeting will be scheduled within two months to address optimization questions.

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

The Aquatic TWG did not meet during Q2 but is scheduling an update meeting to occur in mid-May. All communication during this quarter was via email. The TWG was asked to review draft examples of the newly designed data product quick start guides. There was also communication from AIS regarding a SUNA correction algorithm in response to recommendations made in Q1.

TWG Recommendations

Updated Data Products Quick Start guide templates based feedback.

NEON Response

Updated QS guide templates. AIS also responded to SUNA correction discussion from Q1. Scheduling TWG meeting for May 18.

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

The TWG held email discussions to fully prioritize future work related to the stable isotope data products. This prioritization was achieved by each TWG member ranking our proposed items, then the list was sorted to identify what items were most important to the science community. The TWG chair then summarized the information. Later in the quarter, we provided the TWG with a progress update on previously discussed topics, incorporated TWG recommendations into team quarterly planning, and distributed this plan to the group.

TWG Recommendations

The top items identified in TWG prioritization were to 1) improve data quality, 2) make LHD test data and plots available to community, and 3) implement strategies to increase data availability. The group suggested elevating priority of things that can only be done by NEON staff, such as working to improve data quality, compared with what can also be done through community code development (such as data calibration, which is already under active development at the University of Utah).

NEON Response

We investigated data quality issues and resolved the TWG-identified problem with reported reference gas uncertainty values. This required calibration files to be reprocessed from CVAL, however values won't be updated in the bundled EC HDF5 files until data product reprocessing. Additionally, our future work prioritization plan was adjusted based on feedback from the TWG.

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 meeting held during Q2.

TWG Recommendations

N/A

NEON Response

N/A

Additional Notes:

Next TWG meeting scheduled for early in Q3 (May 18); TWG will provide additional input into the design of the NEON Biorepository. Planned activities include a discussion of the current construction status, numbers of specimens planned, and a more formalized sample use request workflow.

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

The Bird TWG met on April 2, 2020. We started off by discussing the current impact on field data collection due to COVID-19. 2020 sampling will be determined on a site by site basis as deemed feasible by Bird Conservancy of the Rockies and their subcontractors in accordance with federal, state, local, and landowner rules and regulations. A TWG member offered to loan bio-acoustic autonomous recording units (ARUs) that could be deployed by local people without bird ID expertise.

We talked about constraints and logistics such as site access and how to store and process a new type of data, and about how it would be optimal if ARU deployment was in parallel with human observations to allow for cross-comparisons. On the main topic of Optimal Sampling Windows for bird data collection, there was general agreement that the windows should be narrowed and that in some cases they should be shifted later in the season.

TWG Recommendations

1. To prevent data loss in 2020, NEON should work to deploy ARUs at select field sites to capture bird audio recordings otherwise lost in 2019. ARUs can be deployed by untrained individuals so site hosts or others already at sites can deploy them to avoid COVID-19 related restrictions on social distancing or travel restrictions on subcontractors. These same sites should have ARUs deployed in 2021 to allow for comparing the ARU “point counts” to human point count data.
2. The optimal sampling windows should be narrower. Determination of these windows should use expert knowledge and quantitative analysis of data.
3. NEON should deploy ARUs for ~2-month periods to help identify the peak (and any shifts) in breeding timing.

NEON Response

1. Permits would need to be obtained before deploying ARUs and the timeline would likely be too short to accomplish this before the 2020 field season. In addition, most sites don’t have on-site staff that could deploy ARUs in accordance with various state directives and site closures. Consequently, there are too many obstacles to allow for deployment of ARUs for the 2020 field season. NEON plans to further explore whether to deploy ARUs in 2021 for reasons unrelated to COVID-19.
2. Sampling windows based on expert knowledge: The contracting organization (Bird Conservancy of the Rockies) will draft revised sampling windows to be brought back to the TWG.

   Sampling windows based on data analysis: The data analysis will take considerable time to

complete. Therefore, the TWG leads will bring this recommendation to the internal feedback approval process to determine budget and personnel availability to fulfill this recommendation.

3. This change will require several changes to the existing protocol, including the purchasing of ARUs, the use of NEON Field Scientists to deploy and recover ARUs, new permits and site host permissions to deploy ARUs, and new cyberinfrastructure to host the ARU data. The TWG is working with NEON to submit a proposal to the NSF.

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

The Community Engagement TWG held three meetings in Q2. One was held in February and two in April. A meeting was not scheduled in March due to numerous challenges surrounding COVID-19. During the February meeting, the group was given an overview of NEON international engagement activities. A request was brought to the group about whether NEON should host and support an online community forum which was discussed at length. During this meeting, the TWG decided to break into two subgroups with one subgroup focused on broadening awareness and participation and the other focused on supporting data skills training. Each subgroup met independently in April. Both subgroups discussed the adoption of a public comment period for all recommendations made by NEON's technical working groups. The broadening awareness subgroup reviewed the findings from a survey that was sent out to members of all NEON TWGs to get input on groups that NEON should engage, and conference and meetings NEON staff should attend. The group also discussed ideas for future social media campaigns following the success of the one launched by NEON during women's history month. The data science subgroup discussed opportunities for building open data skills for ecologists and linking NEON to other environmental data repositories.

TWG Recommendations

The group recommended not hosting an online community forum until identifying a specific purpose/need for it. Once that purpose is established, the existing forum should be restructured to support it. The group recommended adoption of a public comment period for recommendations coming from all technical working groups. There was a lot of discussion around the issue but a process for NEON to adopt was not identified. The TWG requested additional information from leadership to determine if there is interest in having the group define the process and/or making a formal recommendation on what should be included in the process.

NEON Response

NEON staff sitting on the TWG took the recommendation of the community engagement forum to NEON's engagement, education, and outreach team. It was decided that an online forum should not be hosted at this time due to a lack of interest and staff's limited ability to fully engage (i.e., answer all incoming questions) with community members. NEON staff will continue to assess the need for such a forum as the user community grows. A summary of feedback from the TWG on NEON having a public comment period was provided to leadership, and it is currently being discussed internally and with the external Science, Technology, and Education Advisory Committee.

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

The Data Standards TWG held three meetings in Q2. The Science Data Quality Integrated Product Team (SDQ IPT) had some questions about the costs and benefits of CCO licensing over CC-BY and requested that we continue the conversation and draft a memo. We held thorough discussions over the February and March meetings which led to a re-affirmation of the CCO model. A memo was produced for the SDQ IPT; this memo was discussed and approved by the SDQ IPT and sent forward to leadership for further review. In April, the TWG discussed the COVID-19 impacts on NEON, particularly the impacts of disrupted sampling and shipping to the bio-archive, as well as a potentially heightened interest in NEON data as academic sampling has also been disrupted. Members pointed out that this could support justification for more automated sampling (e.g., acoustic). We also discussed NEON's discussions with the Environmental Data Initiative (EDI) about hosting data derived from NEON data; it was noted that we could consider 1) pulling information about NEON derived data hosted on EDI via API hooks, 2) talk to Figshare about a NEON landing page such as what NIH has (https://nih.figshare.com/), and 3) think about other aggregators or data repositories.

TWG Recommendations

The Data Standards TWG made the following recommendations in Q2:

1. Use CCO licensing where possible for data.
2. Consider metrics and use cases for our upcoming API tokens.
3. Consider how to pull information about datasets derived from NEON data that may be hosted in repositories such as EDI, DataDryad, Figshare, Zenodo, and Mendeley.
4. Create better citation exposure/generation within neonUtilities and during download on the Data Portal.

NEON Response

1. We will continue working on approval of CCO licensing for NEON data.

2-3. We will research both of these ideas.

4. We are prototyping a function that creates a bibtex citation file during data downloading in a future release of neonUtilities.6. Our team has been working on a draft citation document, which has been preliminarily reviewed by the SDQ IPT. The need for better citations as previously been noted by Annual Operations Review (AOR) panel 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 though workshops, educational materials, and code/data product development.

Summary of Activities

The Ecological Forecasting TWG held three meetings in Q2, one each in February, March, and April. Over the course of these meetings, NEON staff stood up an instance of a TWG member's Global Ensemble Forecast System (GEFS) code on a NEON server, ran it, and produced some introductory outputs. The group also created a spreadsheet to try to figure out which L0' data products would be the most useful to the group as streaming data products (future). The difficulties of archiving forecasts were discussed; even at the Environmental Data Initiative (EDI) it is a challenge, as a DOI is placed on each forecast and is expensive to generate and maintain. In April, we discussed the impacts of COVID-19 on both NEON and academic field operations, with the note that NEON could provide graduate students/postdocs with data needed to complete their work while they can't access the field.

TWG Recommendations

The Ecological Forecasting TWG made the following recommendations:

1. Try out the existing GEFS code and run for at least a subset of NEON sites, in time for the Research Coordination Network (RCN).
2. Discuss with EDI the potential for better storage of forecasts built on NEON data.

NEON Response

1. This has been done for a single slice of time for all 81 NEON sites. The resulting data is several hundred MB for a 16-day window. Storage is an issue for NEON, despite the clear advantages of hosting such data. Computation bandwidth is also an issue, and we recommend running this code on Cyverse.
2. We have had a preliminary conversation about hosting NEON-based forecasts at EDI, who also acknowledge this is very difficult to do properly and is costly.

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

Over email, the TWG was asked to give feedback on where to release fish caught behind potential barriers.

TWG Recommendations

The majority of the TWG suggested holding fish in extra buckets and returning them to the same location they were caught. They also suggested that if NEON does implement this method to make sure, buckets kept in shade, adequately aerated and that predators be kept in separate buckets. This will be a change to the current method.

NEON Response

Working on implementing this change, for the current protocol update.

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 to give feedback on a revised version of the Plant Foliar Traits data product user guide. There have been several recent protocol updates and the guide is out of date.

TWG Recommendations

In general, reviews suggest document is written with sufficient detail and explanations are clear, but several ideas were suggested for improvement.

NEON Response

Will work to incorporate these changes into the user guide, then post a revised version to the NEON data portal in the next month or so.

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

No meeting held in Q2. First meeting scheduled for early Q3.

TWG Recommendations

N/A

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 in Q2, but feedback was requested in two separate emails for lidar instrument/collection parameters and also lidar data products (current products and suggestions for improvements or future additions).

TWG Recommendations

In terms of replacing the lidar instruments, one TWG member stressed buying an instrument that would give high quality waveforms. Another mentioned a recent data challenge that suggested that higher point density data would help with tree canopy segmentation. And a third offered a reminder of the challenges dealing with data consistency over the 30-year mission considering that new lidar instruments can detect vegetation features that previous generations cannot.

NEON Response

We took these recommendations into account during the evaluation of vendor proposals for a lidar replacement. We are still waiting on feedback about data products.

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

Email correspondence only occurred during this quarter. The TWG was asked to provide input on the following items: review the analytical laboratory's calculations for microbial biomass; aligning soil microbial measurements with other organismal sampling protocols; the technical soundness of employing different data processing methods for fungal ITS sequencing data.

TWG Recommendations

The TWG concurred that co-location of soil microbial sampling with plant measurements is more important than maintaining all tower plots within the tower airshed. The TWG also wondered how many soil plots would move as a result of NLCD rectification efforts, which spurred a flurry of internal discussion with the spatial team. Finally, the TWG did not have specific expertise regarding the use of two different methods for assigning fungal taxonomy; a member of the TWG reached out to a colleague who provided helpful insight into this topic. Internal discussions are ongoing.

NEON Response

The TWG perspectives were considered as part of the final internal review to spatially re-allocate plots for the NLCD rectification effort. Moving forward, the decision was made to not attempt to 'chase' NLCD classes if and when classifications change, in order to retain the important time series. Regarding ITS fungal taxonomic methods, internal discussions continue, and no final decision has been made, since testing of the processing pipeline is still underway.

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

No meeting held in Q2.

TWG Recommendations

The TWG recommendations remain the same as Q1:

The TWG recommended placement of additional traps that target disease vector species, especially gravid traps since they will attract species that have already fed and are thus more likely to be infected. BG sentinel traps were also discussed although the TWG felt that the location of NEON sites may not be well-placed to capture the species those traps target (Aedes aegypti and albopictus). The TWG was also quite positive about the potential for either identifying mosquito bloodmeals or isolating those mosquitoes for interested researchers.

NEON Response

Q1 Response:

NEON staff are drafting an OS IPT proposal to optimize the mosquito disease vector sampling, including potential additions of different trap types. A TWG member is drafting a proposal and budget that further considers the potential for identifying host bloodmeals from blood-fed mosquitoes.

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

Conducted an email discussion regarding resumption of small mammal sampling in light of COVID19.

TWG Recommendations

The majority of the TWG concurred that the likelihood of the virus jumping between species is low, with most currently known examples of viral spillback from humans to animals involving felines. Most also recommended the use of cloth masks to further reduce the risk of pathogen transfer to small mammal populations. Some also expressed concern about NEON setting a precedent of trapping cessation for the community without substantial evidence that it is warranted, especially considering the likelihood that this virus may pose a hazard on the scale of years rather than months. That being said, one TWG member recommended a short-term halt to small mammal sampling to prevent spread to North American small mammals.

NEON Response

NEON staff recommended that all small mammal technicians wear a cloth (or N95 as required per protocol) mask over the nose and mouth, gloves and eye protection during sampling. Sanitizer should be used before putting on gloves to reduce risk of pathogen transmission to outside of gloves. Staff also recommended that field staff should not conduct trapping activities if they have any symptoms of illness or have a known exposure to COVID-19 in the past 14 days. When possible, small mammal bouts should be scheduled later in the field season (July/August) to allow more time for the current epidemic to subside and additional research regarding small mammal transmissibility to emerge.

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 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

Communication was conducted via emails:

Requested feedback on a draft NEON Quick Start (QS) Guide for the soil temperature data product, which will serve as a template for all QS guides for sensor-based data products. The draft QS also acted as a catalyst for the TWG to develop a user/applications note for the soil temperature data product to demonstrate its utility to the potential user community, which is being led by a non-NEON member of the TWG.

Requested TWG recommendations for NEON's Community Engagement strategy including which conferences (besides AGU and ESA) NEON should have a presence at, which community groups NEON should engage with, and which online platforms NEON should consider for outreach.

Provided a notification of the suspension of all NEON in-person and on-site activities, including sensor maintenance and recalibration, due to the COVID-19 pandemic. Described the types of activities the field scientists would perform remotely and asked if there were additional suggestions that could be implemented while working remotely.

TWG Recommendations

Numerous QS suggestions were received, including adding hyperlinks to all documents, an explanation of file naming conventions, and different subsection headings.

Community Engagement feedback went directly to the NEON community engagement team.

No recommendations for remote work activities were received.

NEON Response

Most QS recommendations were incorporated into the template, but some could not be incorporated due to space constraints, maintaining consistency among the NEON Subsystems, and/or technical limitations given the short timeframe. The short timeframe was due to this activity being performed by field scientists that cannot perform their regular duties due to the COVID-19 pandemic and require alternative work immediately to remain productive.

Other TWG activities did not require a response.

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

We requested input regarding how to raise quality flags for storage flux values calculated with less than a full set of tower measurement levels. Currently, pump or valve failure frequently leads to 'gaps' in the sampling profile. During these times, we still calculate a flux value but flag it as invalid. We identified this as a significant source of data loss and our work with the TWG focused on a scientifically defensible quality flagging strategy that would relax the requirement of having data from all tower measurement levels.

TWG Recommendations

The key recommendation that seems unanimous among responding TWG members is that a storage calculated with missing profile values is better than being left with a gap to fill.

As for the best strategy and quality flagging:

- Consensus that a 'leave out' error analysis will be a good approach, and this has been demonstrated by Nicolini et al. (2018). This would be particularly useful during periods when the storage term is large (~10%). It will also be important to keep in mind that profile levels within the canopy will be most important, particularly levels very close to the ground.
- Ideally if a profile level is missing at one end of the half-hour but not the other, this level would not be used in the storage calculation.
- One alternate idea to consider as a quality indicator is to provide the number of profile levels used in each half hourly storage (or a fraction of total levels).

There was also a rich discussion around the storage flux approach in general.

There was some concern that intermittent or short-term advection essentially amounts to a storage term for the ecosystem that should be somehow accounted for in the profile sampling scheme. However, more of the group feels that doing so is not advisable or necessary, and potentially would even amount to double-counting a portion of the flux. A more detailed summary of this discussion may be useful but is outside the current scope of request.

NEON Response

We plan to conduct a “leave out” study similar to Nicolini et al. (2018) across a representative subset of NEON sites, relax our flagging criteria according to the feedback that ‘storage calculated with missing profile values is better than being left with a gap to fill’, add a quality indicator as recommended by the TWG, relating to the number of profile levels used in each half-hourly storage flux calculation, report results back to SAE TWG and schedule a meeting with the SAE TWG to discuss results as needed.

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

There were no direct interactions with the TWG, but lots of work implementing previous quarter's recommendations.

TWG Recommendations

Last quarter, the TWG recommended that we find a source of KCl powder low in nitrite. The previous suppliers had concentrations that were high enough to prohibit our ability to detect NO2/NO3 in low-concentration sites. They also recommended that we shift the design for litterfall biogeochemistry sampling to better capture annual fluxes.

NEON Response

Following a thorough search, a source of 'ultrapure' KCl that is very low in both nitrite and nitrate across all lots tested (n = 3) was identified. For bouts starting in spring 2020 and onward, this reagent will be used, and blank concentrations monitored to ensure this solves the issue. In regard to the litterfall work, a prototype SOP was developed including new equipment and workflows and was disseminated to the field staff in domains 1 and 5 in preparation for 2020 field season 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

The TWG did not meet in Q2, but the science team is currently implementing the recommendations the TWG provided in Q1 regarding data checks for early NEON data newly produced by reprocessing. Next meeting estimated for June/July 2020.

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

While there was no phone meeting, many emails were exchanged as the TWG - working as a group - generated guidance on three questions:

1. Should the plant diversity protocol be modified to include biocrusts?

2. Are plant phenology observations at remote sites at end of the season by camera acceptable?

3. Should local government or NGO lists of state and federal noxious weed species guide selection of new species for phenology monitoring as opposed to the sometime out of date USDA PLANTS lists?

TWG Recommendations

The TWG provided the following recommendations:

1. Biocrusts should be included in the plant diversity protocol.
2. Photographs are acceptable for documenting status of greenness at the NEON site near Barrow, AK, as long as frequent calibrations are made, equipment documented, and clear requirements on similar measurements moving forward to avoid degradation of data quality.
3. In cases where the USDA PLANTS database has yet to recognize newer invasive species, it is appropriate to rely on local and regional lists and track the citation and date lists were accessed.

NEON Response

1. Biocrusts will be documented in NEON data beginning during the 2021 field season.
2. Photographs with specific and rigorous guidelines will be used in late summer at the NEON site near Barrow, AK.
3. The selection of new, invasive species for phenology monitoring is being guided by local, regional, and the USDA PLANTS noxious species lists.

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

For the Plant Productivity TWG, the second quarter of AY2020 was dominated by discussing a proposal to create a higher-level NEON plant productivity data product. Following the initial meeting in February, the group focused on creating a NEON plant above-ground biomass higher-level data product. Subsequent meetings in March and April were devoted to determining how the NEON 'Herbaceous clip harvest' and 'Woody vegetation structure' data products could be combined to create this product. The TWG brought in additional expertise to craft a proposal for estimating uncertainty for woody biomass, and the group made significant progress drafting this proposal for ultimate delivery to the NSF.

TWG Recommendations

The TWG recommended drafting a proposal for submission to NSF to create a NEON above-ground biomass higher-level data product in order to optimize Observatory offerings and meet a significant scientific need within the ecological community. The group recommended that the lower-level 'Herbaceous clip harvest' and 'Woody vegetation structure' data products be combined at each site (dependent on presence/absence of qualifying vegetation), and that a major component of the work involves estimating biomass uncertainty in a robust manner.

NEON Response

The NEON TWG lead drafted an outline of a proposal for the putative higher-level NEON biomass data product. The NEON lead continues to work with a subset of TWG members to complete the proposal and outline which components of the proposed work require NEON staff to complete, which work TWG members will complete, and which resources already exist to support the proposed work.

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

Emailed a request for feedback on the tick sampling protocol ahead of protocol revisions. Also conducted optimization analyses to determine if shifting tick sampling seasons 4-6 weeks earlier would be likely to increase the catch of adult and nymph ticks.

TWG Recommendations

It was recommended that recording the distance over which dragging occurred separately from the distance over which flagging occurred will help improve density estimations. It was also recommended to add a winter sampling bout to southeastern sites to increase the capture of adult ticks since nymphal *Ixodes scapularis* are so difficult to catch on drag cloths in the area.

NEON Response

The addition of winter sampling bouts was not supported by the data we had from earlier years of data when sampling occurred over a wider range of months. Analyses suggested that fewer adult or nymph ticks would be caught by shifting the sampling 1-2 months earlier in the year. A request will be made to begin recording distances for dragging and flagging separately.