

THE NATIONAL ECOLOGICAL OBSERVATORY NETWORK (NEON)	\$62,600,000
	-\$5,300,000 / -7.8%

The National Ecological Observatory Network Funding

(Dollars in Millions)

FY 2018 Actual ¹	FY 2019 (TBD)	FY 2020 Request	Change over FY 2018 Actual	
			Amount	Percent
\$67.90	-	\$62.60	-\$5.30	-7.8%

¹ FY 2018 Actual includes \$3.0 million in additional FY 2018 one-time funding above the requested amount.

The most persistent challenges facing the ecological sciences today are a result of our limited understanding of the complex interactions between living and non-living systems operating over large spatial and temporal scales. Critical global challenges such as ecological effects of increasing atmospheric carbon dioxide land-use change, emerging infectious diseases, and invasive species highlight the complexity of key processes that are connected across large spatial scales and play out over decades. As these and other threats arise more frequently and spread rapidly across continents, it is critical to scientific progress that the short- and long-term effects of these phenomena be systematically monitored and assessed, as well as become more predictable through mathematical and statistical modeling.

Assessment of ecological processes at a continental scale has been hindered by a lack of infrastructure to enable the research required to address complex ecological issues at the necessary spatial and temporal scales. NEON was designed to address this lack of infrastructure and enable vital research. NEON consists of 81 strategically located field sites, across 20 eco-climatic domains, with instruments, sensors, cameras, and manual biological sampling networked into an integrated research platform for regional- to continental-scale ecological research. The sensor networks, instrumentation, experimental infrastructure, natural history archive facilities, and remote sensing are linked via the internet to computational and analytical capabilities to create NEON's integrated infrastructure.

NEON was constructed to revolutionize ecological research and engage the research and education communities in the use of open data. In doing so, it provides over 170 standardized data products including meteorological, soil, organismal, biogeochemical, freshwater and remote sensing data for ecosystems at various temporal and spatial scales across the United States over a 30-year timeframe.

Using NEON data, scientists across the U.S. are now able to conduct regional- to continental-scale research projects on the fundamental biological processes underlying invasive species, emerging diseases, changing biogeochemical cycles, land-use changes, climatic variation, and biodiversity, as well as other grand challenges in ecological science. Researchers can also arrange to use the Observatory's infrastructure (field sites, instrumentation, airborne remote sensing, etc.) for their own studies to advance understanding of ecological processes.

Current Status

Battelle Memorial Institute (Battelle) is the current awardee for management of NEON. Battelle is a non-profit professional management organization that operates a number of scientific and technical facilities. Construction of NEON is 99 percent complete and expected to be concluded in mid-FY 2019. NEON is collecting and analyzing biological and chemical samples, measuring physical properties, transmitting sensor data to headquarters, and delivering processed datasets and data products via the NEON data portal. Cyberinfrastructure enhancements are underway including some for the data center connectivity and site sensor data processing. Battelle is implementing community engagement plans that will support overall utilization of the data and resources that are now available to the community. The research community is

Major Multi-User Research Facilities

beginning to use NEON data and infrastructure in its research as evidenced by the increase in the number of awards in FY 2018, and the number of presentations at recent Ecological Society of America (31 NEON-related events) and American Geophysical Union (52 NEON-related events) meetings.

Total Obligations for NEON (Dollars in Millions)									
	Prior Years ²	FY 2018 Actual	FY 2019 (TBD)	FY 2020 Request	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
<i>R&RA:</i>									
Development & Design	\$104.85	-	-	-	-	-	-	-	-
Operations & Maintenance ^{3,4}		64.90	-	62.60	62.60	62.60	62.60	62.60	62.60
Cyberinfrastructure Enhancements	-	3.00	-	-	-	-	-	-	-
Subtotal, R&RA Obligations	\$104.85	\$67.90	-	\$62.60	\$62.60	\$62.60	\$62.60	\$62.60	\$62.60
<i>MREFC:</i>									
Implementation	447.48	12.79	-	-	-	-	-	-	-
Subtotal, MREFC Obligations ^{4,5}	\$447.48	\$12.79	-	-	-	-	-	-	-
Total Obligations	\$552.33	\$80.69	-	\$62.60	\$62.60	\$62.60	\$62.60	\$62.60	\$62.60

¹ Outyear funding estimates are for planning purposes only. The current cooperative agreement ends in FY 2020.

² Development and design funding and implementation funding are cumulative of all prior years.

³ Future O&M requests will be based on a more thorough analysis of science capabilities and affordability.

⁴ In FY 2016, consistent with the revised total project cost, \$20.0 million of FY 2016 R&RA appropriated funding was transferred to the MREFC account. In FY 2017, \$5.86 million of FY 2017 R&RA appropriated funding was transferred into the MREFC account.

⁵ A total of \$14.21 million of FY 2017 MREFC funding was carried over into FY 2018. Of this amount, \$12.79 million was obligated in FY 2018 to complete project construction requirements. Approximately \$1.4 million is being held by NSF to mitigate remaining risks.

Cyberinfrastructure Enhancements: The cyberinfrastructure enhancements funding will support integration of up-to-date cyberinfrastructure components to strengthen NEON's ability to meet expected data delivery capabilities and user expectations. This will be accomplished through re-engineering and updating some aspects of NEON's data-gathering, processing, and storage infrastructure. Components of NEON's cyberinfrastructure, include the Grouped Remote Access Peripheral Equipment, the instrumented systems transition pipeline, the data portal and programming interface, and data center security, have been identified for improvement. Enhancements on these components will improve data volume handling, processing capacity and capability, data discoverability and accessibility, and data security.

Management and Oversight

NSF Structure:

The NEON program is managed in BIO, with the Office of the Assistant Director (BIO/OAD) providing policy and programmatic guidance. Oversight resides within the Division of Biological Infrastructure (DBI) and Division of Environmental Biology (DEB). The NEON Program team within BIO consists of DBI and DEB senior managers, program officers, and a project manager. The Integrated Project Team (IPT), chaired by the NEON cognizant program officer and which includes representatives from the BFA Large Facilities Office (LFO) and the BFA Division of Acquisition and Cooperative Support, with additional participation from the Office of Legislative and Public Affairs, BFA Division of Institution and Award Support-Cost Analysis and Pre-Award Branch, Office of General Counsel, Office of International Science & Engineering, and the Office of the Director, as necessary, provides guidance and advice in the review and oversight of the project.

External Structure

In the Spring of 2016, leadership and management of the NEON project was transferred to Battelle, which oversees all aspects of project implementation and coordinates observatory operations. Within Battelle, the observatory director/chief scientist (OD/CS) provides overall scientific leadership and interfaces with the

science community and other entities to support the scientific priorities and operations of NEON. A Science, Technology, and Education Advisory Committee (STEAC), composed of members of the NEON user community, provides oversight and guidance to the project and helps ensure that NEON will enable frontier research and education. The work of the STEAC is complemented by several Technical Working Groups that advise Battelle on the technical aspects of the project.

Reviews

A construction close-out review, scheduled for CY 2019, will document the completion of NEON construction scope and transition to operations. External evaluators will be tasked to review project documentation and confirm delivery of observatory capacity. Reviews of full operations and maintenance (O&M) are held annually. The first O&M review was held in July 2018, during which external reviewers were charged with the evaluation of details of NEON operations including: data collection, data delivery, community engagement, education and outreach, NEON's biorepository, cyberinfrastructure, cost performance, and risk management. The next review of O&M, emphasizing data availability and quality, is planned for summer of 2019. Progress against the annual program plan and towards implementation of review recommendations is also monitored by BIO via biweekly teleconferences, bimonthly operations reports, and site visits as needed. In addition to these scientific and technical reviews, there are periodic reviews by organizations within BFA.

Operations Costs

Operations and maintenance support began in FY 2014. In August of 2017, a supplemental operations award was authorized. For planning purposes, costs are held constant by BIO at the projected annual operations ceiling of \$65.0 million, pending further evaluation of the time phased cost-proposal submitted by Battelle and identification of further operating efficiencies.

Community Engagement

Battelle's community engagement efforts are led by the OD/CS. The community engagement programs facilitate increased awareness and understanding of ecological change and familiarize people with large, complex datasets. Staff are educating NEON users and the public through a YouTube channel,¹ presentations at local and national meetings, workshops and data institutes, and online learning modules. The data science team is facilitating access to and use of the data with open-source software packages and utilities. BIO and its Advisory Committee have assembled a subcommittee, composed of members of the research community, to evaluate engagement models that will inform a community-based strategy for mobilizing and sustaining NEON users. BIO also engages with other federal stakeholders, including Defense Advanced Research Projects Agency, Department of Energy, Department of Interior (DOI)/National Invasive Species Council (NISC), Department of Agriculture (USDA), DOI National Park Service, USDA Agricultural Research Service, United States Geological Survey, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and the Smithsonian Institution. Federal stakeholders are engaged through the NEON Interagency Working Group to help maximize the scientific impact of NEON through coordination when advantageous to the project.

Renewal/Recompetition/Termination

The current O&M award to Battelle began in November 2017 and ends in October 2020. An additional 12 months of funding to Battelle was also authorized but is to be awarded at the NSF Director's discretion for FY 2021. NSF is using established large facility processes to evaluate options for subsequent support to ensure continuity of operations beyond the current award.

¹ www.youtube.com/neonscience