

## THE NATIONAL ECOLOGICAL OBSERVATORY NETWORK (NEON)

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### National Ecological Observatory Network Funding

(Dollars in Millions)

| FY 2022<br>Actual | FY 2023          |                    | Change over                     |         |
|-------------------|------------------|--------------------|---------------------------------|---------|
|                   | Estimate<br>Base | FY 2024<br>Request | FY 2023 Estimate Base<br>Amount | Percent |
| \$69.01           | \$71.71          | \$78.04            | \$6.33                          | 8.8%    |

### Brief Description

Funded and overseen by the Directorate for Biological Sciences, NEON is the first observatory of its kind, designed to foster and enable advances in the basic understanding of the complexities of life on Earth at a continental scale, building from organisms and populations to the biosphere, and over timescales from seconds to decades. Construction of the observatory was completed in 2019, and it is designed to operate for 30 years. The NEON infrastructure is distributed across the United States (including Alaska, Hawaii, and Puerto Rico) and includes 20 regional eco-climatic domains. NEON collects standardized observations of plants, animals, and biogeochemistry in the air, land, and water at 81 sites across these domains using three types of approaches: on-the-ground organismal sampling by trained professionals, measurements by automated instruments in the environment, and airborne remote sensing surveys. After the collection and processing of data from instrument and observational systems, NEON makes 182 data products available on a centralized data portal that is free for all to access and use. It also makes openly available data tutorials, code packages, and other resources that enable use of NEON data by scientists and the community at large.

### Meeting Scientific Community Needs

Use of NEON data and assets is increasing as more data become available, and as the research community continues to diversify and grow. Use of site data, soil and other samples, and remote sensing data continues to expand. Research is supported through awards made by the Macrosystems Biology and NEON Enabled Science Programs, as well as other research programs across the Agency. The NEON Airborne Observation Platform (AOP) has been used to assess major fires and, in partnership with the National Aeronautics and Space Administration (NASA), has participated in the science development of the Hyperspectral Infrared Imager (HypSIIRI) mission. Multiple NEON science presentations by funded researchers formed the corpus of continental-scale sessions at the 2022 Ecological Society of America meetings in addition to presentations at several other venues, such as the 2022 American Geophysical Union Fall Meeting. The number of presentations using Remote Sensing data continues to increase compared to previous years, spurred in large part by data from the three AOPs. To date, there are over 530 articles (125 in 2022) with publishing authors from 54 countries, and 14,000 associated citations using NEON data or infrastructure in a substantial manner. In 2022 a new synthesis center, the Environmental Data Science Innovation & Inclusion Lab (ESIIL), was launched that will rely extensively on NEON and other data resources. A key component of NEON's ability to empower STEM talent in the ecological research community is through strategic leveraging of NEON's vast geographical footprint to foster numerous high impact outreach and education activities. Moreover, NEON democratizes data access and enables research capability throughout the U.S., including in almost 40 percent of the EPSCoR States and at many minority serving

institutions.

### **Status of the Facility**

Prior to the COVID-19 pandemic in 2020, data were being collected as planned at all 81 terrestrial and aquatic sites across the 20 eco-climatic domains. In the year prior to the onset of COVID-19, NEON staff supported 304 engagement events reaching over 8,400 individuals. Events included presentations, site tours, conferences, trainings and outreach through social media, and in-person and virtual workshops targeting a wide range of public and STEM audiences. The groups engaged during these events were from different educational and/or career stages (e.g., high school, undergraduate, graduate student, postdoctoral fellows, scientists in academia, agencies), diverse geographic areas within the U.S., and multiple demographic groups, including underrepresented groups and Minority Serving Institutions. Data collection in the ensuing year was compromised by restrictions imposed during the pandemic. Despite these adverse impacts, the overall trend shows an increase in the use of NEON data. To date, more than 500 publications (126 in 2022) have been produced that rely significantly on NEON data or NEON infrastructure. Furthermore, engagement activities, many of which transitioned to a virtual format during the pandemic, have also continued to increase. Currently, all 18 Domain Support Facilities and the NEON Headquarters in Boulder, Colorado, are fully open, with COVID-19 policies implemented when required. The changing status around COVID-19 is continuously monitored for potential impacts on regular maintenance and data continuity, especially in the gathering of biological samples, an important component of the Observational Systems data.

### **Governance Structure and Partnerships**

#### NSF Governance Structure

Oversight of the NEON program resides within the Division of Biological Infrastructure (DBI) in BIO, which works cooperatively with BFA, the Office of the General Counsel, and the Office of Legislative and Public Affairs. Within BFA, the Large Facilities Office provides advice to program staff and assists with agency oversight and assurance. The BIO Office of the Assistant Director and the Chief Officer for Research Facilities also provide high-level guidance, support, and programmatic oversight.

#### External Governance Structure

Within the current managing entity, Battelle, the NEON Chief Scientist provides overall scientific leadership and serves as the Principal Investigator for the award. A Science, Technology, and Education Advisory Committee (STEAC), composed of members of the NEON user community, provides strategic guidance and advice to Battelle, and helps ensure that NEON will enable frontier research and education. The work of the STEAC is complemented by several Technical Working Groups, comprising over 170 science, education, and engineering experts, that advise Battelle on technical aspects of the project and other issues that have scientific, educational, engineering, or operational implications.

#### Partnerships and Other Funding Sources

Several federal agencies (NASA, the National Oceanic and Atmospheric Administration, the Department of Energy, the United States Forest Service, the Environmental Protection Agency, the United States Department of Agriculture, the National Park Service, the Bureau of Land Management, and the United States Geological Survey) provide significant in-kind services, including sites for

## Major Facilities

deployment of NEON infrastructure. Formal agreements have been signed with the European Union, including with the Integrated Carbon Observing System Ecosystem Thematic Center, Infrastructure for Analysis and Experimentation on Ecosystems, and the Czech Climate Change Research Center, and Australia's Terrestrial Ecosystem Research Network. Coordination with the above entities spans planning, design, construction, deployment, environmental assessment, data management, geospatial data exchange, cyberinfrastructure, research, and modeling. Nongovernment Organizations, including the Ecological Society of America, the American Geophysical Union, and the American Indian Higher Education Consortium are assisting to broaden the impact of NEON science and education to the next generation of scientists and educators.

## Funding

| Total Obligations for NEON |                |                |                |                        |                |                |                |                |
|----------------------------|----------------|----------------|----------------|------------------------|----------------|----------------|----------------|----------------|
| (Dollars in Millions)      |                |                |                |                        |                |                |                |                |
|                            | FY 2023        |                | FY 2024        | ESTIMATES <sup>1</sup> |                |                |                |                |
|                            | FY 2022        | Estimate       |                | FY 2025                | FY 2026        | FY 2027        | FY 2028        | FY 2029        |
|                            | Actual         | Base           | Request        |                        |                |                |                |                |
| Operations & Maintenance   | \$69.01        | \$71.71        | \$73.04        | \$73.04                | \$73.04        | \$73.04        | \$73.04        | \$73.04        |
| Deferred Maintenance       | -              | -              | 5.00           | -                      | -              | -              | -              | -              |
| <b>TOTAL</b>               | <b>\$69.01</b> | <b>\$71.71</b> | <b>\$78.04</b> | <b>\$73.04</b>         | <b>\$73.04</b> | <b>\$73.04</b> | <b>\$73.04</b> | <b>\$73.04</b> |

<sup>1</sup> Outyear estimates are for planning purposes only. The current cooperative agreement ends October 2023.

The NEON program in BIO provides all support for operations, which are estimated at approximately \$73.04 million in FY 2024. Operations and maintenance support began in FY 2014. In August of 2017, a supplemental operations award was authorized.

## Reviews and Reports

The planned 2021 annual review of O&M was replaced by the review of a supplemental proposal to extend Battelle's period of performance through October 31, 2023. This review was completed by an external panel of experts and focused on science outcomes enabled by the facility, responses to the pandemic, Battelle's cost performance, and the facility's cyberinfrastructure, resulting in an NSB-approved two-year extension to the active O&M award and facilitating the ongoing competition for the next O&M award that was delayed by the pandemic (see below). The 2022 annual review of O&M was conducted by a panel of external expert reviewers that focused primarily on migration of NEON data to the Google Cloud, sensor and instrumentation life-cycle management, and overall approaches to risk management across the facility. Progress against the annual program plan and towards implementation of review recommendations is also monitored by BIO via bi-weekly teleconferences, triannual interim operations reports, an annual report, and site visits as needed.

## Renewal/Recompetition/Disposition

The current O&M award, extended with NSB authorization due to the COVID-19 pandemic, ends in October 2023. BIO is completing review of proposals submitted in response to solicitation NSF 21-603, with the expectation of issuing a new award for O&M of NEON in late FY 2023. There are currently no plans for disposition of the facility.