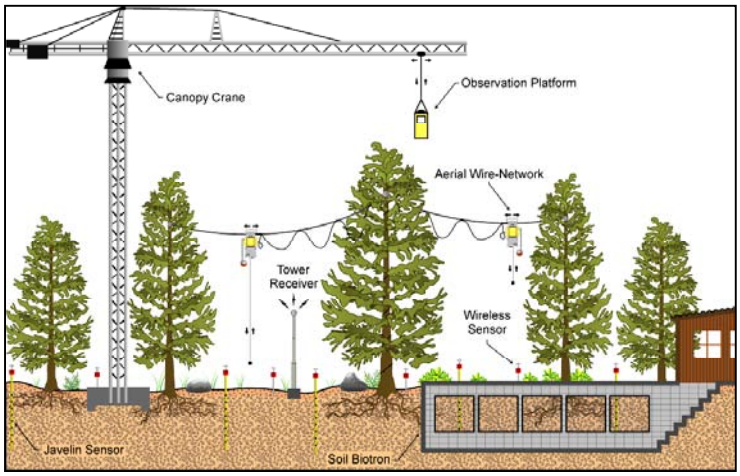
National Ecological Observatory Network (NEON)

Project Description: NEON will be a continental scale research platform consisting of geographically distributed infrastructure for ecological research that is networked via state-of-the-art communications technology. Cutting-edge sensor networks, instrumentation, experimental infrastructure, natural history archive facilities, remote sensing, will be linked via the internet to computational, analytical and modeling capabilities to comprise NEON.

Principal Scientific Goals: NEON will transform ecological research by enabling studies of the biosphere at regional to continental scales, quantifying the strong and weak forces regulating these systems, and predicting the consequences of climate and land use change on the biosphere. Through remote sensing, in-situ observation, experimentation, synthesis, and modeling, the National Ecological Observatory Network will enable new scientific approaches needed to quantify and understand the complex biosphere processes and interactions that operate across local to continental scales.

As a "shared-use" research platform to advance fundamental understanding of the biosphere NEON will facilitate interdisciplinary research on the complex interactions between the biological, physical and human drivers of ecological change. NEON will be used to conduct comprehensive, regional to continental-scale experiments on ecological systems and thus will represent a virtual laboratory for research to obtain a predictive understanding of the biosphere.

Principal Education Goals: The knowledge base NEON will create, its real time and continuous integrated data, simulation and observation capabilities, and its networked communication will be an asset for formal and informal education and training. NEON will foster the NSF goal of integrating research and education by creating a research-intensive and collaborative learning environment. A NEON gateway will provide cutting-edge resources to support informal public education and provide opportunities for citizens to actively participate in scientific investigations. Data from standard measurements made using NEON will be publicly available.



Planning for the National Ecological Observatory Network includes visual rough drafts of sensors and research infrastructure deployed across a forest ecosystem, from the forest canopy to the soil community.

Partnerships and Connections to Industry: Federal agencies such as USGS, EPA and DOE are on the NEON Advisory Board and planning committees. A NEON Federal Agency Coordinating Committee meets on a regular basis[6]. Discussions are underway with the U.S. Department of Agriculture (USDA), USGS and DOE on formal agreements. NEON will be the only observation network that will be able to provide the insitu biospheric component called for in the US Group on Earth Observations Ten-year Strategic Plan. International perspectives are provided through the NEON Advisory Board, which is comprised of Environment Canada and CONABIO, Mexico, and the NEON planning committees, one of

[6] A full list of the members of these committees can be provided on request.

which includes a member of Argentine National Research Council. Private foundations, e.g., the Heinz Center, Nature Serve, and US Landtrust, participate on the NEON design consortium. NEON-generated information will be useful to natural resource industries, such as forestry and fisheries. Resource managers and decision makers will participate in NEON through partnerships; use of its facilities, data, and forecasts; and education, training, and outreach opportunities. NEON's scientific and networking demands will require technological innovations that will foster partnerships with industry for infrastructure development, deployment, and operation.

Management and Oversight: The Division of Biological Infrastructure within the Directorate for Biological Sciences manages NEON. The NEON program officer, in consultation with a BIO-NEON committee, which includes the Deputy Director for Large Facility Projects, formulates the programmatic development of NEON, i.e., drafting, release and review of program solicitations, etc. The BIO Advisory Committee provides external advice to BIO about specific programmatic elements.

The NEON program officer is a member of the NSF Environmental Observing Networks Task Force and serves on the PATs for other large facility projects, such as the Network for Earthquake Engineering Simulation (NEES) and the Ocean Observatories Initiative (OOI). Coordination with other federal agencies occurs through the NEON Federal Agency Coordinating Committee. In addition, NEON is represented on the Architecture and Data Management task force of the US Group on Earth Observations, the U.S. component of Global Earth Observation System of Systems (GEOSS), an activity of the National Science and Technology Council, Committee on Environment and Natural Resources.

Current Project Status:

In FY 2005, the NEON Design Consortium and Project Office refined the NEON science requirements, developed the scientific facilities and infrastructure reference design, completed the preliminary baseline definition for networking and informatics, formulated the infrastructure requirements for education, training, and outreach, and designed the governance and management structures for NEON as recommended in the 2004 NRC report, "NEON: Addressing the Nation's Environmental Challenges."

Three workshops were conducted to define the cross-cutting needs, challenges, and opportunities in sensors and cyberinfrastructure. The workshops addressed emerging issues of interoperability among evolving observing systems, leveraging emerging technologies and research frontiers, fostering collaboration, and stimulating robust technology development. R&RA supported R&D on environmental sensors, networks, and cyber tools that will advance the development of NEON as a network of nationally deployed infrastructure.

In FY 2006, a research community Consortium (NEON Inc.), which provides a link between NEON planning and construction, was established as a legal entity. The NEON Integrated Science and Education Plan and Networking and Informatics plans were completed. The preliminary project execution plan and design, cost, and management reviews will be conducted. R&RA funds continue to be provided to the Consortium of Regional Ecological Observatories to evaluate deployment criteria and locations across the continental US, Alaska, Hawaii, and Puerto Rico and to form the collaborations, partnerships, and organizations needed for NEON infrastructure deployment.

In FY 2006, NEON funding will be provided for the Cyberinfrastructure for Environmental Observatories: Prototype Systems to Address Cross-Cutting Needs competition to stimulate interdisciplinary collaborations that result in the development and deployment of viable prototype cyberinfrastructure for environmental observatories. The resulting awards will expand NEON research

and development to include a cyberinfrastructure research program to address interoperability with other networks and observing systems.

In FY 2007, an award will be made to complete the final Project Execution Plan for NEON, finalize deployment, and conduct (as appropriate) EIA/EIS. MREFC funds are requested for the construction and evaluation of the NEON fundamental technology unit. During FY 2007, the NEON research and development program will emphasize environmental sensors and networks to address interoperability and enabling technologies for ecological forecasting.

Major milestones for NEON are listed below.

FY 2005 Milestones:
- NEON Design Consortium and Project Office established
- NEON Advisory Board and Design Consortium subcommittees appointed
- NEON science requirements, facilities and infrastructure reference design refined, and the governance and management structures for NEON developed
- Research and development projects on environmental sensors, networks, and cyber tools that will advance the development of NEON as a network of nationally deployed infrastructure funded

FY 2006 Milestones:
- NEON Inc. established
- Review of NEON Science Plan and Requirements completed
- Baseline Networking and Informatics Plan and an external design review completed
- NEON Conceptual Design, Preliminary Project Execution Plan, and Project Development Plan completed
- NEON research infrastructure baseline design review and external cost review conducted
- Management review of the NEON Design Consortium and Project Office
- Research and development of cyberinfrastructure to address interoperability with other environmental networks and observing systems funded

FY 2007 Milestones:
- Final Project Execution Plan
- Baseline NEON Infrastructure design, cost, and management reviews
- NEON fundamental technology unit (BioMesoNet, sensor micronets, and enabling cyberinfrastructure) assembled and field-tested
- NEON infrastructure deployment plan finalized
- Environmental Impact Assessment and/or Environmental Impact Statements (EIA/EIS), if appropriate, will be conducted
- Additional research and development on environmental sensors and sensor networks and enabling technologies for ecological forecasting

FY 2008 – FY 2011 Milestones:
- Construction of NEON research, networking, informatics, and education, training and outreach infrastructure begins
- Research and development activities on environmental sensors, networks, cyber tools for NEON, and interoperability with other networks and observing systems continues

Funding Profile: NSF expects to spend approximately $18 million in concept and development activities through FY 2006. The current construction costs for NEON are being revised based on deploying NEON simultaneously as a national research platform (NRC 2004). Total construction costs for NEON will be

determined from the project execution plan developed for research, networking, and education infrastructure due June 1, 2006. Management, operations, and maintenance will be funded through the R&RA Account. After a thorough cost review, a revised budget for NEON infrastructure and maintenance and operations will be provided.

Requested MREFC Funds for NEON
(Dollars in Millions)

FY 2007 Request	FY 2008	FY 2009	FY 2010	FY 2011	Total
$12.00	$12.00	$20.00	$30.00	$26.00	$100.00

NEON Funding Profile
(Obligated Dollars and Estimates in Millions)

	Concept/ Development		Implementation[1]		Operations & Maintenance		Totals		Grand
	R&RA	MREFC	R&RA	MREFC	R&RA	MREFC	R&RA	MREFC	**Total**
FY 2001 & Earlier	0.31						$0.31	-	**$0.31**
FY 2002	1.00						$1.00	-	**$1.00**
FY 2003	0.92						$0.92	-	**$0.92**
FY 2004	3.60						$3.60	-	**$3.60**
FY 2005	5.98						$5.98	-	**$5.98**
FY 2006 Current Plan	5.94						$5.94	-	**$5.94**
FY 2007 Request	11.94			12.00			$11.94	$12.00	**$23.94**
FY 2008 Estimate	10.00			12.00	4.80		$14.80	$12.00	**$26.80**
FY 2009 Estimate	8.00			20.00	8.80		$16.80	$20.00	**$36.80**
FY 2010 Estimate	6.00			30.00	14.80		$20.80	$30.00	**$50.80**
FY 2011 Estimate	4.00			26.00	28.00		$32.00	$26.00	**$58.00**
FY 2012 Estimate	2.00				28.70		$30.70	-	**$30.70**
Subtotal, R&RA	$59.69		-		$85.10		$144.79		
Subtotal, MREFC		-		$100.00		-		$100.00	
Total, Each Stage		**$59.69**		**$100.00**		**$85.10**			**$244.79**

NOTE: The expected operational lifespan of this project is 30 years after construction is complete. Implementation funding levels will be updated based on the cost review of the Project Execution Plans (PEP) for research infrastructure, networking and informatics, and education, outreach, and training. Annual operations and maintenance estimates for FY 2008 and beyond are presented strictly for planning purposes and are calculated as 28 percent of the pre-PEP, estimated MREFC costs summed to that year. They will be updated when the implementation costs are updated and reviewed.

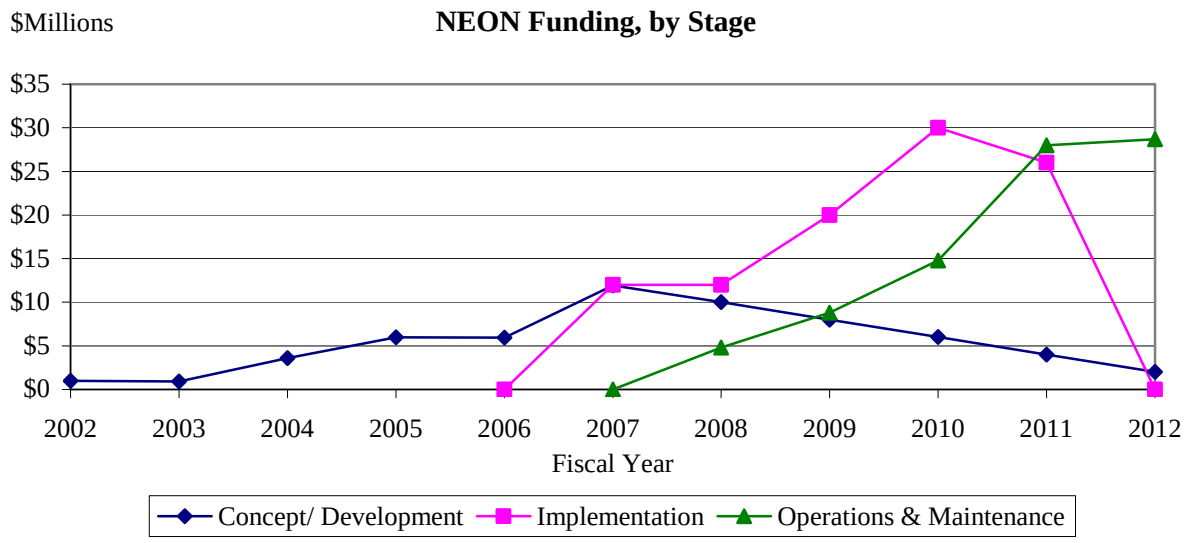
Information pertaining to the data in the table is provided below.

- Concept/Development: In FY 2003, the National Research Council's study on NEON recommended that the infrastructural elements needed to address the six greatest ecological research challenges be simultaneously deployed across the US and that a central NEON governance structure be established. A redefinition of an earlier scope, schedule, and cost for NEON was required in light of these recommendations. In FY 2004 and FY 2005, an award was made for a NEON Design Consortium and Project Office to redefine NEON (science and education plan and reference design) and to

develop the preliminary project execution plan for simultaneous national deployment. In FY 2006, support led to completion of the NEON Science Plan and Requirements and the Networking and Informatics Plan. Review of the preliminary Project Execution Plan is scheduled. Support will be continued for research and development of NEON enabling technologies from FY 2006 through the construction phase.

- Implementation: Total construction costs for NEON will be determined from the project execution plan developed for research, networking, and education infrastructure due June 1, 2006. After a thorough cost review, a revised budget for NEON infrastructure and maintenance and operations will be provided. NEON will include the standardized technology deployed across the U.S. and connected via cyberinfrastructure into a national research platform. In FY 2007, MREFC funds will be used to assemble and evaluate the NEON fundamental technology unit (BioMesoNet, sensor micronets, and enabling cyberinfrastructure) that will be deployed.

- Operations and Maintenance: Initial operations support will begin in FY 2008 as construction is commenced on NEON networking, and informatics infrastructure. Operations and maintenance support will increase as NEON is brought online.



Future Science Support: Since NSF supports 63 percent of the fundamental ecological research performed at U.S. academic institutions, advances in the field of ecology, and the infrastructure to enable those advances, depend largely on support from NSF. Current research infrastructure is inadequate to enable studies to address the complex phenomena driving ecological change in real time and at the appropriate scales. As a continent-wide research instrument, NEON could. Along with direct operations and maintenance support for NEON, NSF will support research performed using the NEON platform through ongoing research and education programs. The annual support for such activities once the research platform reaches full operations is estimated to be at least $12.0 million annually.

NEON will support a large and diverse group of organizations and individuals; foremost are the scientists, educators, and engineers who will utilize NEON infrastructure in their research and educational programs. NEON will provide enhanced research opportunities for existing field-based research networks, using natural history collections, and the cyberinfrastructure communities that are facilitating network-level ecological science. As a cyberinfrastructure enabled network, NEON will be accessible to

academic and research institutions, state and federal research and management organizations, minority serving institutions, community colleges, K-12 school systems, the general public, natural resource and conservation organizations, and other public and private organizations. Thousands of researchers will be able to use NEON, tens of thousands of children may participate in NEON activities through its educational programs, and hundreds of thousands of individuals will be able to access NEON data, information and research products via the Internet.