College Speaking Tour Report

NSF Grant No. 0934200
Cultivating Participation of Underrepresented Institutions and Students in NEON Science and Education

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Executive Summary

Between 2009 and 2010, the Science and Engineering Alliance Inc., (SEA) in collaboration with National Ecological Observatory Network Inc. (NEON) and Ecological Society of America (ESA), with a financial support from National Science Foundation (NSF), sponsored College Speaking Tours (CSTs) at 16 Minority Serving Institutions (MSIs) across the U.S. The major objective of the tour was to measure institutional capabilities and to enhance understanding of NEON science focus areas among members in the participating institutions.

The National Ecological Observatory Network (NEON) Inc. is a continental-scale research platform for discovering and understanding the impacts of climate change, land-use change, and invasive species on ecology (http://www.neoninc.org). Using standardized protocols and an open data policy, NEON will enable better understanding of the management and impacts of biofuels, watersheds, grazing lands, and other vital systems of terrestrial ecosystems. As part of its mission, NEON has institutionalized education and outreach wing to enable society and the scientific community to use ecological information in the development of models to forecast the impact of climate change and land use on the biosphere. An important part of this outreach includes enabling and building the framework for free and open access and utilization of NEON data and resources by all higher education institutions including minority serving institutions (MSIs). To prepare the foundation for engagement of the minority serving institutions in NEON science research and education, the Science and Engineering Alliance (SEA) in partnership with the NEON and the Ecological Society of America (ESA) implemented a project, "Cultivating Participation of Underrepresented Institutions and Students in NEON Science and Education", during 2008-2010. One component of this project was the "College Speaking Tours".

The CSTs are aimed to present the concept and operation of the NEON project that includes NEON resources and opportunities for collaboration to the research and education community at a sample of Minority Serving Institutions (MSIs). Along with this speaking tour, an online survey research tool was launched to collect data on the existing NEON related research that is being conducted at these institutions. The purpose of the survey was to evaluate and assess existing research, field, laboratories and skilled professional capabilities in six NEON science areas, namely: biodiversity, biogeochemistry, climate changes, ecohydrology, infectious diseases and land use and changes.

Out of the original 16 institutions selected based on representation in four of the 20 NEON geographic domains, two institutions declined participation in the project due to time limitations and conflicts. The participating 14 institutions represented the geographic domains of NEON and covered an estimated student body of 98,000 and faculty of 5,500 members. However, they did not reflect Hispanic Serving Institutions.

The NEON presentation was delivered as a one-day long workshop format at 14 participating institutions to a total of 317 faculty, postdoctoral and graduate students. The dissemination impact of the presentations has gone beyond those participating in the workshop, as the participants have been sharing their experience with peers, colleagues and particularly undergraduate students. The site observations showed strong interest and enthusiasm for learning about NEON opportunities by the faculty and other member of the research and educational community on the participating campus. The participants on each campus became engaged beyond the formal presentation and a lasting and extensive discourse among members from multiple science disciplines about NEON's role in a possible resource allocation (funding)

to research dominated discussion among participants. It is expected that such discourse will create motivation and action toward collaborative initiatives by members of the educational and research community on these campuses.

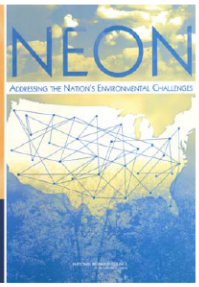
As a secondary outcome of the CST, SEA developed the SEA NEON Science Capabilities Checklist (the Survey) that is part of the invitation package sent to the 16 schools. The purpose of the Survey is to collect institution demographic information and assess their capabilities to conduct research that somewhat parallels the National Research Council's Grand Challenges formulated in 2001 to evaluate the following six major ecological, environmental and national concerns. The science that is being conducted in the NEON project is directly related to the grand challenge areas envisioned in the NEON design found in the document "Integrated Science and Education Plan." (ISEP, 2006). Another outcome of the CST is that the potential engagement of the MSIs in large science projects such as NEON not only will serve to improve its performances but will heighten its image and exposure as they strive to become successful researchers in big science.

1) Biodiversity,
2) Biogeochemical cycles
3) Climate change
4) Hydroecology
5) Infectious diseases
6) Invasive species
7) Land Use.

Box 1.2 Grand Challenges in the Environmental Sciences from the National Research Council (NRC 2001, 2003)

- Biodiversity: "… to improve understanding of the factors affecting biological diversity and ecosystem structure and functioning, including the role of human activity."
- Biogeochemical cycles: "… to further our understanding of the Earth's major biogeochemical cycles, evaluate how they are being perturbed by human activities, and determine how they might better be stabilized."
- Climate change: "… to increase our ability to predict climate variations, from extreme events to decadal time scales; to understand how this variability may change in the future; and to realistically assess the resulting impacts."

NRC (National Research Council). 2001. Grand Challenges in Environmental Sciences. Washington DC: National Academies Press.



NRC (National Research Council). 2003. NEON: Addressing the Nation's Environmental Challenges. Washington DC: National Academies Press.

- Hydroecology: "… to develop an improved understanding of and ability to predict changes in freshwater resources and the environment caused by floods, droughts, sedimentation, and contamination."
- Infectious disease: "… to understand ecological and evolutionary aspects of infectious diseases; develop an understanding of the interactions among pathogens, hosts/receptors, and the environment; and thus make it possible to prevent changes in the infectivity and virulence of organisms that threaten plant, animal, and human health at the population level."
- Invasive species: … to understand species invasion "as an ecological process sufficiently to allow forecasting of the invasiveness of species and prediction of which potential biological agents would both be effective in controlling an exotic species and have the fewest detrimental effects on natural and managed ecosystems."
- Land use: "… to develop a systematic understanding of changes in land uses and land covers that are critical to ecosystem functioning and services and human welfare."

Figure 1. NEON Seven Grand challenges

The information from this Survey will allow SEA, ESA, and NEON, Inc. to:

- Identify potential partners for NEON-enabled research and educational projects; and
- Serve as a mechanism that allows SEA to identify opportunities and to inform MSIs of relevant NEON-like research, education and funding opportunities.

Data was collected from 55 faculty members and other researchers at the participating institutions. The Survey participants reported on the demographics of their institutions and provided detailed contact information. The 100 percent contact information data suggested the interest of the participants in follow up for collaboration in the future. The respondents were also asked to identify and provide a detailed list of measurements from previously funded or ongoing experiment likely to be similar in nature to that employed in areas of the six NEON science research.

From a methodological perspective, the results from the Survey indicated the importance and the need for the successful development of an effective and efficient survey instrument that can be used in similar studies of undergraduate institutions and Hispanic serving institutions that were not represented in the current Survey.

The ongoing research data from the Survey participants showed that the least frequent NEON research measurement class was "bioclimatic" with 6 percent average reporting. Other NEON areas in increasing order are disease (7%), biogeochemistry (14%), biodiversity (16%), and land use (27%). The most frequent measurements NEON group was reported to be ecohydrology with 30 percent reporting.

These data not only suggested that some of the more research oriented institutions and those with agricultural schools have potential for NEON research, but some smaller schools with less research intensive capital are engaged in NEON related research. Hence, we should not miss the opportunity of expanding some low cost NEON related research collaborations. At the lowest level the faculty and students on these campuses can collaborate on using the data generated by NEON.

It is recommended

- To develop a comprehensive webinar which can emulate the CST for faculty and students from more remote areas and with less funding for travel.
- To expand the CST and the accompanying data collection about NEON science research to a larger number of undergraduate institutions and particularly TCUs and small HSIs. This will allow for the generation of a richer more diverse database of capabilities and ongoing research which can be used in development of future initiatives for collaboration in NEON-like research.
- To expand the SEA NEON Capabilities Checklist during an expanded CST to collect information not just on the institution's NEON-like research but cross-walk that information to a specific research program at that institution. This will specify and enhance the identified capabilities because the capabilities are now tied to a formal program. This will also enhance any future collaborative efforts between the CST institutions and other schools and organizations.
- To engage a few of the more research oriented institutions among the 14 institutions, in a pilot collaborative initiatives where they can contribute to the data collection in the field as part of the larger activities of the NEON data collection enterprise.
- To engage a few of the smaller institutions among the 14 institutions, in a pilot collaborative initiative where they receive and analyze data through NEON cyberinfrastructure.

Contents

List of Tables

List of Figures

SEA ESA NEON Inc., College Speaking Tour (CST) Project

If climate science is going to impact humanity, then society must invest intensively in how to effectively communicate the science-based evidence climate research to the greater community in manner intuitive to the average citizen.

For far too long, efforts aimed at broadening participation of the general public in the ever-increasing dialogue of climate change has been absent and for most part remained ineffective. And that may well be the number one reason for the public hesitance and lack of active engagement in many public discourses. Clarity in public understanding or recognition of the climate change will shore up society's' willingness to bear the costs and risk associated with mitigation strategies and implement changes required to mitigate impacts of climate change.

The issue of citizen engagement is more so relevant to students and educators at higher educational systems than at any other segment of society. And this could not have been better illustrated by current state of climate research capabilities at Historically Black Colleges and Universities (HBCU) and Minority serving Institutions (MSI).

With that in mind, SEA Inc. has instituted a cross-national College Speaking Tour (CST) with partners in NEON and ESA. The tour was aimed at finding HBCUs institutional infrastructure and human power capabilities in understanding NEON science and gather data support for and opposition to policies that may be required in order to lessen emissions.

This document reports on the implementation and outcome of the College Speaking Tour (CST) conducted as part of the larger project of "Cultivating Participation of Underrepresented Institutions and Students in NEON Science and Education," funded by National Science Foundation (NSF) under the NSF Grant agreement number 0934200.

The National Ecological Observatory Network (NEON) Inc. is a continental-scale research platform for discovering and understanding the impacts of climate change, land-use change, and invasive species on ecology. NEON will gather long-term data on ecological responses of the biosphere to changes in land use and climate, and on feedbacks with the geosphere, hydrosphere, and atmosphere. NEON is a national observatory consisting of distributed sensor networks and experiments, linked by advanced cyber infrastructure to record and projected to archive ecological data for at least 30 years. Using standardized protocols and an open data policy, NEON will enable better understanding of the management and impacts of biofuels, watersheds, grazing lands, and other vital systems of the terrestrial ecosystem. NEON will provide data streams for next-generation ecological forecasting capability, and will catalyze the use of ecological forecasts for resource and policy decisions and adaptive management in a range of societal undertakings and in science based policy decision-making processes. NEON will support an early warning system for the impacts of climate change, invasive species, and emerging diseases.

HBCUs and Minority-Serving Institutions

Minority serving institutions (MSIs) have a long standing tradition of providing higher education for minorities. The MSIs include Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), and institutions with large Hispanic enrollments (Hispanic Serving Institutions (HSIs). HBCUs are a source of accomplishment and great pride for the African American community as well as the entire nation. The Higher Education Act of 1965, as amended, defines an HBCU as: "...any historically black college or university that was established prior to 1964, whose principal mission was, and is, the education of black Americans, and that is accredited by a nationally recognized accrediting agency or association determined by the Secretary [of Education] to be a reliable authority as to the

quality of training offered or is, according to such an agency or association, making reasonable progress toward accreditation." HBCUs offer all students, regardless of race, an opportunity to develop their skills and talents. These institutions train young people who go on to serve domestically and internationally in the public and private sectors as professionals and entrepreneurs.

The majority of the HBCUs are located in the southern states (see Figure 1 for State Map of Historically Black Colleges and Universities). About 80 percent of these institutions are a four-year colleges and universities that offer Bachelor's degrees in a number of fields including wildlife science, fishery and conservation biology (WFCB) fields. In addition, some of these institutions contribute to the training of higher-level scientists by offering Master's and Doctoral degrees in various fields of science and education. Private institutions (totaling 53) make up the bulk of these institutions. However, these institutions have a smaller share of the enrollment. State supported HBCUs have most of the enrollment in all states. In addition, some two-year HBCUs continue to serve as a bridge between high school and four-year-college for some African-Americans with less access to educational resources.

Figure 2. State Map of Historically Black Colleges and Universities

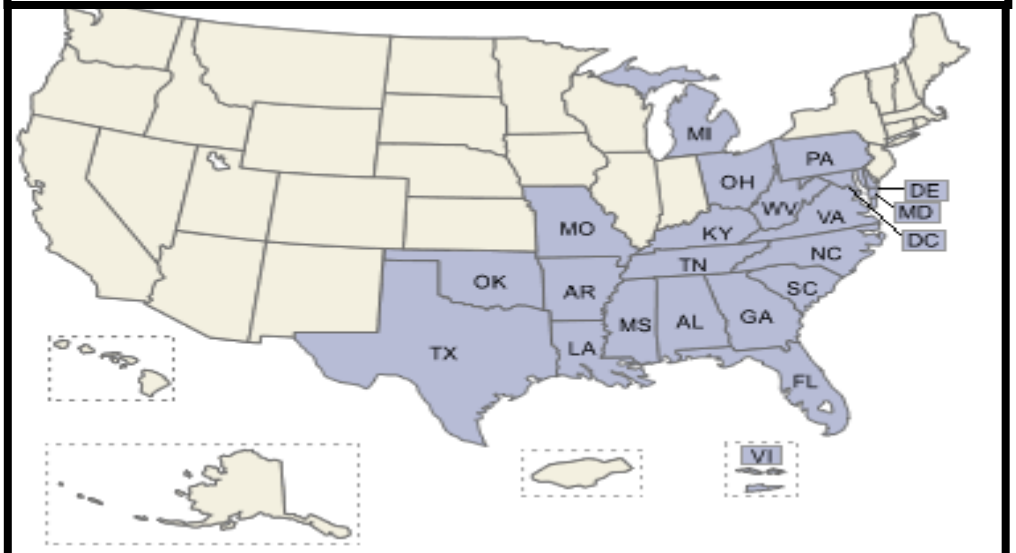


Table 1. Distribution of Historically Black Colleges and Universities by State

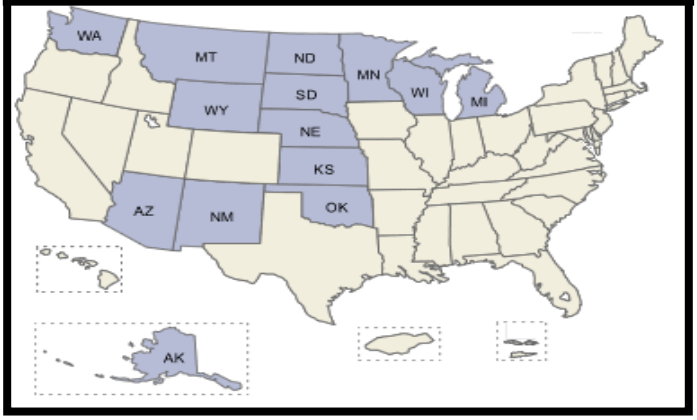
State	4-year Public	4-year Private	2-Year Public	2-Year Private
Alabama	2	7	6	0
Arkansas	1	2	0	0
Delaware	1	0	0	0
District of Columbia	1	0	0	0
Florida	1	1	0	0
Georgia	3	7	0	0
Kentucky	1	0	0	0
Louisiana	3	2	2	0

Table 1. Distribution of Historically Black Colleges and Universities by State				
State	**4-year Public**	**4-year Private**	**2-Year Public**	**2-Year Private**
Maryland	4	0	0	0
Michigan	0	0	0	1
Mississippi	3	2	2	2
Missouri	2	0	0	1
North Carolina	4	6	0	0
Ohio	1	1	0	0
Oklahoma	1	0	0	0
Pennsylvania	2	0	0	0
South Carolina	1	5	1	1
Tennessee	1	5	0	0
Texas	2	6	1	0
Virginia	2	4	0	0
West Virginia	2	0	0	0
US Virgin Island	1	0	0	0
Total	39	48	13	5

Tribal colleges and universities are a category of higher education, minority-serving institutions in the United States. Most are located on or near Indian reservations and provide access to post-secondary education, accredited degrees, and vocational training for both Indian and non-Indian students. Indian culture and tradition are a part of the curricula. These institutions of higher education face problems similar with other rural educational institutions: recruitment, retention, and curriculum issues. Lack of funding, along with minimal resources of the tribes are additional obstacles.[1] From Wikipedia, the free encyclopedia

Tribal colleges and Universities are located in the north mid-west states and southwest where the majority of the American-Indian population resides. In fact, Montana has 7 out of the 30 tribal colleges and Universities and North Dakota has 5 of these institutions. The majority of these institutions are two- year colleges that serve as a bridge to higher education to the American-Indian population. The total enrollment in TCUs in 2005 was 16,889 ("Tribal Colleges and Universities: Education as the Engine for Economic Development in Indian Country." A Report to the President. 2005.)

Figure 3. State Map of Tribal Colleges and Universities



The Department of Education defines the Hispanic Serving Institutions as those non-profit higher educational organizations with enrollment of 25 percent or more Hispanics. According to the Association of Hispanic Colleges and Universities (www.hacu.org, 2009) there were 217 institutions with 25 percent Hispanic enrollment (see Table 2 for number of these institutions by state). As the enrollment of Hispanic population changes year by year, there is variation in this number annually. Some of these institutions are large and serve as regional or national universities such as Texas A&M University, Colorado State University, California State University at Fresno, California State University at Fullerton. Overall there is a wide-range of institutions among those defined with 25 percent Hispanic enrollment. One group of these institutions with 25 percent of Hispanic enrollment and with 50 percent and more low-income students are referred to as Hispanic Serving Institutes (HSIs) by the Department of Education and they are eligible for Title V support. There is no official list of these institutions available as they vary year by year. According to the data presented by Hispanic Association of Colleges and Universities, 77 of these institutions are located in the State of California. Another 41 are in Texas. New Mexico and Florida have the next highest frequency of these institutions. Note that many of these institutions not only serve a large number of first generation white students but they include a significant number of African-Americans, especially in California. El Camino College in California is a good example. In 2008, El Camino had 47.9 percent African-American enrollment and 36.6 percent Hispanic/Latino enrollment

In 2001, the Department of Education estimated a total enrollment of 295,000 for HBCUs and over 1.3 million for HSIs. At the tribal colleges and Universities enrollment was above 16,000 in 2005. The enrollment trend has been increasing in HBCUs and HSIs. Tribal Colleges and Universities have not experienced a significant increase (www.ed.gov, 2010). Table 3 shows the number of Hispanic Serving Institutions by State in the U.S.

Table 2. Number of Hispanic Serving Institutions by State

State	Number
Arizona	9
California	77
Colorado	6
Connecticut	1
Florida	10
Illinois	4
Kansas	1
Massachusetts	1
New Jersey	4
New Mexico	15
New York	13
Pennsylvania	1
Puerto Rico	32
Texas	41
Washington	2

Source: www.hacu.org, 2010

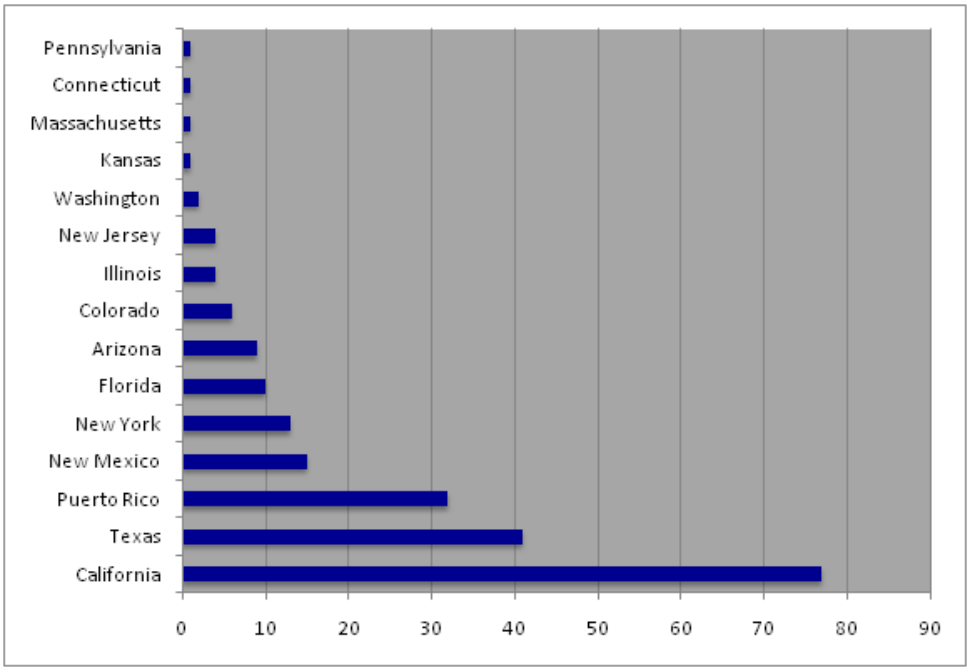


Table 2a. Number of Hispanic Serving Institutions by State

College Speaking Tour Activity Goals

The mission of NEON includes education and outreach to enable society and the scientific community to use ecological information and forecasts to understand and effectively address critical ecological questions and issues. In continued effort toward this mission, the ESA in partnership with and SEA and NEON, Inc, implemented a two-year project entitled, "Cultivating Participation of Underrepresented Institutions and Students in NEON Science and Education." The major thrust of the tour is to build the foundations for the participation of underrepresented minority institutions and students in NEON science and education. A major component of this project was to organize a College Speaking Tour (CST) at MSIs and collect baseline data on relevant research related to the science being conducted in the NEON project.

The goals of CST are to:

- Build the foundations for broadening the participation of underrepresented minority institutions and their community of researchers and students in NEON science and education,
- Identify the research and development capacity of the MSIs to conduct and participate in future NEON ecological, engineering, cyber-infrastructural, and social science research and education opportunities, and
- Reduce the risks for future NEON education initiatives through targeted needs assessment of educational and research activities.

The specific objectives of CST are to:

- Increase the knowledge and awareness of faculty, researcher, postdoctoral students, graduate and undergraduate students at MSIs about the resources and research opportunities being developed and currently available through NEON.
- Collect data on the existing research at the MSIs within the domain of the NEON research agenda.

Significance

The introduction of NEON to the higher educational community across the continent contributes to the use of unique research data resources for teaching theoretical and community-based ecology covering a wide spatial spectrum of local, regional, continental scales and temporal scales spanning from milliseconds to decades and beyond. This large-scale data based ecological research approach to the science of ecology will enormously expand the potential for collaborative continental scale research. The NEON cyberinfrastructure provides the tools that make such large-scale working partnerships and educational activity not only possible, but practical. Hence a broad spectrum of society can be engaged with NEON science and the use of NEON data, information and forecasts to address the critical environmental challenges of our time.

The students at the minority serving institutions are a large source of potential ecological researchers of the future. But they have to be informed, mentored and trained. The continuous data streams available through the NEON cyberinfrastructure will provide an unprecedented opportunity for students at these institutions to work with data streams on the interactions between ecosystems, climate and land use. However, currently the participation of the students from MSIs, particularly HBCUs in science in general and ecological science in particular, is limited (Congressional Commission 2000; NSTC 2000; NSF 2007). The minority enrollment in graduate programs in earth, atmospheric and ocean sciences is less than 6 percent (Chee-Wah, 2005). To reduce this gap there is need for special attention to ensure that MSIs are ready to benefit from engagement in NEON opportunities. The College Speaking Tour is a first step toward reducing the information gap as an impediment to the use NEON resources for the science of ecology and ecology education at MSIs.

Implementation: Approach and Methodology

A team of experienced personnel from Science and Minority Alliance (SEA) and Demographic and Institutional Research (DIRS) collaborated on the delivery of the NEON campus presentation and collection of data from the participating institutions. Dr. Robert Shepherd, Executive Director of SEA led the team in collaboration with Mr. Don Bowie, an experienced scientist and Dr. Akbar Aghajanian-Saba, the evaluator and research methodologist, and the SEA support staff.

The CST team members traveled to 14 MSI schools and presented a one-day workshop and a question and answers period with the faculty and students at all levels in science related fields particularly among those areas where there was some connection with NEON sciences. At each institution, the team first established a liaison faculty or administrator in a science field who could support the local arrangements for the presentation and the one-day discourse. This person then would select a proper day, which would be possible for the members of the science community, particularly the research faculty, at the institution to attend the meeting. The presenter from the CST team then would arrive on the campus on the day and set time. A formal presentation of NEON project was the first on the agenda. The presentation included the following:

- What is NEON?
- Why NEON?
- How NEON Works (NEON design and operation plans)
- NEON Chronology
- SEA Involvement – The SEAPON Institutions
- Current Status of the NEON project
- Solicitations and Other Opportunities to Engage in the NEON project

- Discussion of the MSI's response to the SEA NEON Capabilities Checklist
- Future Considerations

Then time was allowed for questions and answers and individual meetings. The crux of this approach was that each attendee will at least inform about three to five other community members in his/her circle regarding the opportunities that will be afforded them and how their capabilities can support the NEON mission. Hence, the dissemination impact of the activity would be exponential.

The typical CST day had the following agenda

- 10:00-10:15 AM Introductions
- 10:15-11:15 NEON Presentation
- 11:15-12:00 PM Questions and Answers
- 12:00-1:00 Lunch
- 01:00-2:00 Tour of Research Facilities at the MSI
- 02:00-available time: individual visits

CST at Jackson State University: SEA NEON PM, Don Bowie making NEON presentation

CST NEON Presentation at Howard University

The participants at the presentation were encouraged to follow up any questions and inquiries with the CST team members. At the end of the morning presentation, the members of the science community (faculty and students at all levels) were encouraged to support the development of a data base of current NEON related research activity on their campus by responding to an online questionnaire. The main benefit of the data base is the availability of a data source for needs assessment of their school and other similar schools in utilization of NEON resources.

A data collection tool named the SEA NEON Capabilities Checklist was developed and piloted by the CST team member prior to start of the campus visits. The online survey tool consisted of demographic and contact information about the respondents and their institution. In addition, a series of focused questions related to the NEON Grand Challenges (e.g. biodiversity) were developed from a matrix of about 140 high-level science questions. [NEON Higher Level 4 Science Questions] Each high-level science question was cross-matched to one or more of the Grand Challenges, which is considered as a high-level data product. The high-level data products (Grand Challenges) are then cross-walked to a series of measurements. The measurement is the question the CST respondents check in the Checklist. This is an indication that that measurement is included in the research at that institution. Below is an example of the question, the high-level product, and the measurements associated with that high-level data product:

Question	High-level Data Product (Grand Challenge)	Measurements
How do changes in biodiversity affect infectious disease dynamics?	Disease	• West Nile Virus (WNV) prevalence in mosquitoes • Dengue prevalence in mosquitoes • Mosquito-borne West Nile Virus and Dengue

		distribution maps • Hantavirus prevalence in deer mice • Hantavirus distribution map • Lyme disease prevalence in Peromyscus • Lyme disease distribution map

There was eighth area left open-ended to capture all research areas not included in structured questions. Appendix 1 includes the seven-page SEA NEON Capabilities Checklist. The Checklist can be viewed on the Internet at:
http://www.surveymonkey.com/s.aspx?PREVIEW_MODE=DO_NOT_USE_THIS_LINK_FOR_COLLECTION&sm=LYrB%2fTIFIeRCS9IPZibMz7EgJBC9783gME9%2fleWZPuo%3d

Sixteen institutions were selected. The list of these institutions is presented in Table 3. The table shows the institutions in four groups based on the NEON domain. The list includes one Hispanic-Serving Institution and one American-Indian institution. The combination of schools represented an estimated population of 98,000 undergraduate students, 15,000 postdoctoral and graduate students and about 5,500 faculty members in 2009. About 14,800 students and 1,200 of the faculty members in the participating institutions were in science related areas. These four group institutions present a strong representation of the institutions serving African-Americans and small undergraduate institution serving the Hispanic and American-Indian population.

Table 3. Participating Institutions by NEON Domain and the Minority Serving Population

Institution	Domain	Group	Population
University of Maryland Eastern Shore	2	1	African-Americans
Virginia State University	2		African-Americans
Howard University	2		African-Americans
NC A&T University	2		African-Americans
Alabama A & M University	3	2	African-Americans
Florida A and M University	3		African-Americans
Spelman College	3		African-Americans
Southern University of Baton Rouge	3		African-Americans
Alcorn State University	8	3	African-Americans
Jackson State University	8		African-Americans
Tennessee State University	8		African-Americans
University of Arkansas at Pine Bluff	8		African-Americans
Prairie View A&M University	11	4	African-Americans

Texas Southern University	11		African-Americans
National Hispanic University	11		Hispanic
Dine College	11		Native American

Results: CST Implementation

Of the 16 institutions who had agreed to participate in the CST activity, one HBCU and one Hispanic Serving Institution did not respond to the invitation to participate in the project as the implementation continued. As a result, the implementation did not involve Hispanic Serving Institutions. However, the institutions serving African-Americans and American-Indians are well presented (Table 4).

Table 4. Participating Institutions by NEON Domain and the Minority Serving Population

Institution	Domain	Group	Participation Status
University of Maryland Eastern Shore	2	1	X
Virginia State University	2		X
Howard University	2		X
NC A&T University	2		X
Alabama A & M University	3	2	X
Florida A and M University	3		X
Spelman College	3		X
Southern University of Baton Rouge	3		X
Alcorn State University	8	3	Declined
Jackson State University	8		X
Tennessee State University	8		X
University of Arkansas at Pine Bluff	8		X
Prairie View A&M University	11	4	X
Texas Southern University	11		X
National Hispanic University	11		Declined
Dine College	11		X

Overall 14 College Tour Presentations were completed with participation of 317 faculty, postdoctoral, graduate, and undergraduate students. The dissemination impact of the project should be viewed with the assumption that each participant will on the average share the learning from the presentation with at least three member of the science community in each institution. In addition, some faculty members have shared their learning and knowledge from the presentation with large science classes in many of the institutions.

Fifty five (55) members of the community of researchers in the 14 participating institutions provided information about themselves and the on-going NEON related research activities on their campuses. This information was collected through an online survey tool described before. The interest and commitment of the survey participants is apparent and reflected in the complete contact data provided by each of them. Table 5 shows the availability of contact information for the 55 survey participants.

Table 5. Availability of Information about the Participating Researchers

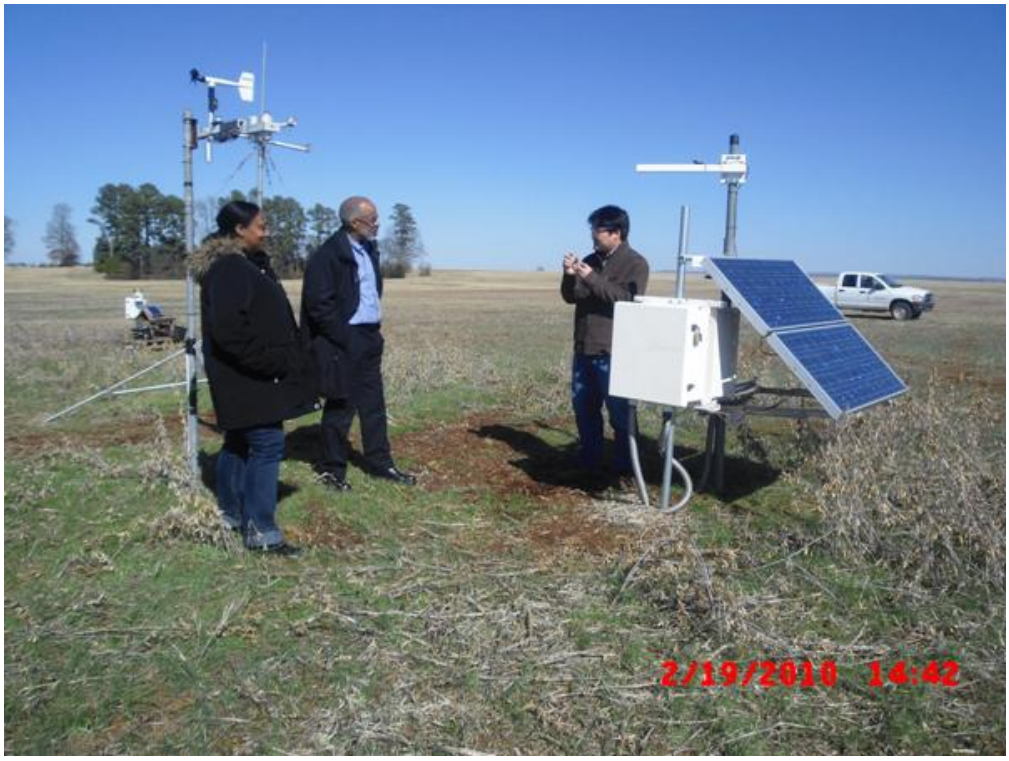
Information Items	Response Percent
Name	100.0%
Institution	100.0%
Department/Office/Center	100.0%
Address	96.4%
City	100.0%
State	100.0%
ZIP/Postal Code	100.0%
Email Address	98.2%
Cell Phone Number	60.0%
Office Phone Number	96.4%
Total number of respondents	**55**

Among the 14 participating institutions, 6 reported at least one research center which was directly related to the NEON science and research (Table 6). Except for Jackson State University and Dine College, the other four institutions were land grant universities where agriculture is a main part of curriculum and research on the campus. This finding signifies the role these institutions can play as the first line of partners and potential collaborators in NEON related research and resource utilization. The future NEON collaboration can be easily started and built upon existing research infrastructure and experienced personnel.

Table 6. The Availability of NEON-like Research Facilities at the CST Participating Institution

Institution	Institution Research Program
Alabama A & M University	School of Agricultural and Environmental Sciences
Alabama A & M University	Center for Forestry and Ecology (CFE)
Alabama A&M University	Winfred Thomas Agriculture Research Station
Alabama A&M University	Forestry, Ecology and Wildlife Program, Agricultural Research Center
Alabama A&M University	Natural Resources and Environmental Sciences
Dine College	Dine Environmental Institute
Florida A&M University	Center for Water & Air Quality

Florida A&M University	Environmental Science Institute
Florida A&M University	Forestry & Natural Resources Conservation
Jackson State University	Trent Lott Geospatial and Visualization Center (TLGVRC)
Jackson State University	GIS
Jackson State University	Technology, Hazardous Materials Management
Jackson State University	College of Science Engineering and Technology (CSET)
NC A&T State University	Center for Environmental Design
Virginia State University	Agricultural Research Station
University of Arkansas at Pine Bluff	Forestry, Ecology and Wildlife Program, Agricultural Research
University of Maryland Eastern Shore	Living Marine Resources Cooperative Science Center
University of Maryland Eastern Shore	Center for Research Excellence in Science and Technology (CREST)



CST Visit at Alabama A&M University (AAMU), Winfred Thomas Agriculture Research Station: SEA NEON Program manager, Don Bowie (center), ESA SEEDs Coordinator, Charlee Glenn (left) and AAMU Graduate Student, Huan Hee (right). Hee explaining measurement and data collection protocols at carbon dioxide flux measurement site.

Results: Ongoing Research at the CST Participating Institutions

The survey instrument developed for this project turned out to be very efficient and effective. Complete contact information was collected from the 55 survey participants and each respondent reported on the

existence of research in each detailed measurement of NEON on their campus. Results from the CST survey indicate that the institutions have current research priorities (in descending order) in the following NEON grand challenge areas: biodiversity, land use, biogeochemistry, ecohydrology, bioclimate, and disease.

Summary of Individual Responses (√) to the SEA NEON Capabilities Checklist		Yes	No	Response Count
Q2. NEON Science Area: Biodiversity		253	553	806
Q3. NEON Science Area: Disease		24	143	167
Q4. NEON Science Area: Ecohydrology		101	86	187
Q5. NEON Science Area: Biogeochemistry		193	467	660
Q6. NEON Science Area: Bioclimate		61	341	402
Q7. NEON Science Area: Land-Use		288	289	577
Total Responses for Survey		**920**	**1879**	**2799**

Biodiversity Research

Table 7 shows the tabulation of results from the biodiversity measurements of research. Ongoing research about mosquito diversity and abundance was reported by 9 percent of the respondents. On the average, 16 percent of the respondents reported some measurements of biodiversity research. The top four frequently mentioned ongoing biodiversity research measurements were

- Plant richness, diversity, and abundance,
- Soil microbial diversity, and
- Ecosystem structure.

The least frequent measurement reported was peromyscus species demographic traits.

Table 7. Report of Ongoing Research in Biodiversity

Research Measurements	% Reporting existence of research
Mosquito diversity and abundance	9.1
Mosquito species distribution	9.1
Ground dwelling beetle diversity and abundance	16.4
Ground dwelling beetle distribution	18.2
Small mammal density, diversity, and abundance	14.5
Small mammal distribution	12.7
Peromyscus species demographic traits	1.8
Ectoparasite diversity and abundance	5.5
Bird diversity	12.7
Bird species distribution maps	11.0
Mosquito phenology	9.1
Peromyscus breeding activity period	7.3
Plant richness, diversity, and abundance	29.1
Plant phenological patterns (3 focal plant species)	16.4

Table 7. Report of Ongoing Research in Biodiversity	
Research Measurements	**% Reporting existence of research**
Plant demography (3 focal plant species)	14.5
Vegetation species distribution map	21.8
Invasive species and disease risk maps	21.8
Ecosystem structure	**36.4**
Soil microbial diversity	**40.0**
Soil relative microbial abundance	**34.5**
Soil microbial functional diversity	**32.7**
Soil microbial metagenomes	23.6
Algae and associated microbial biofilm diversity and abundance	9.1
Algae distribution maps	11.0
Macrophyte and Bryophyte diversity and abundance	5.5
Macrophyte and Brypohyte distribution maps	7.3
Benthic macro-invertebrate diversity and abundance	14.5
Benthic macroinvertebrate distribution map	12.7
Zooplankton diversity and abundance	5.5
Fish species richness, diversity, and abundance	12.7
Fish distribution map	18.2
Average	**16.0**
Total respondents	**55**

Disease Research

Table 8 shows the responses related to the disease related research measurements. On the average 7 percent of all respondents reported ongoing research about one of the measurements of disease. The top three most frequent research fields in disease research were:

- West Nile Virus (WNV) prevalence in mosquitoes,
- Mosquito-borne West Nile Virus and Dengue distribution, and
- Lyme disease distribution map.

Table 8. Report of Ongoing Research in Disease	
Research Measurements	**% Reporting existence of research**
West Nile Virus (WNV) prevalence in mosquitoes	**11.0**
Dengue prevalence in mosquitoes	3.6
Mosquito-borne West Nile Virus and Dengue distribution maps	**11.0**
Hantavirus prevalence in deer mice	1.8
Hantavirus distribution map	7.3
Lyme disease prevalence in Peromyscus	5.4

Table 8. Report of Ongoing Research in Disease	
Research Measurements	**% Reporting existence of research**
Lyme disease distribution map	**9.0**
Average	**7.1**
Number participating in the study	**55**

Echohydrology Research

Ecohydrology related ongoing research was reported by 29 percent of the participants, on the average (Table 9). The three most frequently cited ongoing research measurements were:

- Soil Moisture,
- Soil Moisture (sub-region map), and
- Water balance.

Table 9. Report of Ongoing Research in Echohydrology	
Research Measurements	**% Reporting existence of research**
Soil Moisture	**40.0**
Soil Moisture (sub-region map)	**31.0**
Water balance	**32.7**
Water balance (sub-region map)	27.3
Potential evapotranspiration	23.6
Stream discharge regime	21.8
Stream and pond morphology dynamics	23.6
Average	**29.0**
Number participating in the study	**55**

Biogeochemistry Research

Table 10 shows that 18 percent of the respondents reported some fields of biogeochemistry research. The three most frequent ongoing research measurements in biogeochemistry area were:

- Particulate concentration and deposition,
- Biomass, and
- Soil carbon and nitrogen stocks.

Table 10. Report of Ongoing Research in Biogeochemistry	
Research Measurements	**% Reporting existence of research**
Ozone deposition	18.1
Ozone over threshold	14.5

Table 10. Report of Ongoing Research in Biogeochemistry	
Research Measurements	**% Reporting existence of research**
Chemical deposition - e.g., reactive nitrogen gases (NO-NOy and NOAA National Atmospheric Deposition Program)	21.8
Particulate concentration and deposition	**27.3**
Biomass	**23.6**
Biomass map	18.2
Necromass	3.6
Canopy nitrogen	7.2
Canopy water content	9.0
Canopy xanthophyll cycle	3.6
Canopy chlorophyll	5.4
Canopy lignin	7.3
Soil carbon and nitrogen stocks	**23.6**
Soil CO2 flux, chambers and soil profile	21.8
Fine root production	9.1
Ecosystem exchange, tower	9.1
Ecosystem exchange map, aerial observatory platform (AOP)	11.0
Ecosystem exchange of carbon	14.5
Net primary productivity (NPP) at plot level	12.7
Ecosystem water use efficiency	20.0
Ecosystem light use efficiency	5.4
Litterfall - C, N, K, P, Ca, Mg flux	16.3
Litter C, N, K, P, Ca, Mg turnover	16.3
Stream carbon flux	16.3
Stream nitrogen flux	18.2
Stream phosphorus flux	20.0
Stream metabolism	12.7
Average	**14.3**
Number participating in the study	**55**

Bioclimatic Research

Bioclimatic research was reported by 6.5 percent of the participants on the average (Table 11). We found the three most frequent ongoing research measurements to be in the areas of:

- Summary Weather Statistics,
- Albedo map, and
- fPAR, from satellite.

Table 11. Report of Ongoing Research in Bioclimatic	
Research Measurements	**% Reporting existence of research**
Summary Weather Statistics	**12.7**

Table 11. Report of Ongoing Research in Bioclimatic	
Research Measurements	**% Reporting existence of research**
Energy fluxes (tower scale)	7.2
Vapor pressure deficit (VPD)	7.2
Leaf Area Index (LAI) map from AOP	7.2
Leaf Area Index map	**7.**2
Aerodynamics, Bulk Canopy, and Canopy Conductances	5.5
Atmospheric stability: Monin-Obukhov Length (L)	5.5
Atmospheric stability: Richardson number (Ri)	7.2
Albedo	5.5
Albedo map from AOP	7.2
Albedo map	**11.0**
Aerosol optical depth from AOP	7.2
Total column water vapor	7.2
Static potential photo synthetically active radiation (PAR)	1.8
Fraction of photo synthetically active radiation (fPAR), (towers)	1.8
fPAR, from AOP	1.8
fPAR, from satellite	**9.1**
Fire risk probability	5.4
Average	**6.5**
Number participating in the study	**55**

Land-Use Research

Land-use ongoing research measurements were reported by an average of 26.5 percent of respondents. Table 12 shows the following three research areas were the most frequently cited:

- Land cover classification, Flood plains and wetlands (both at 34.5%)
- Streams and rivers, Agricultural Management (both at 40%), and
- Flood plains and wetlands.

Table 12. Report of Ongoing Research in Land-Use	
Research Measurements	**% Reporting existence of research**
Elevation	23.6
Elevation (10m resolution)	18.1
Slope and Aspect (30m resolution)	18.1
Slope and Aspect (from AOP at 10m resolution)	16.3
Soil properties (1km resolution)	31.0
Soil properties (100m resolution)	29.1
Land cover classification	**34.5**
Land cover classification from AOP	21.8
Streams and rivers	**40.0**

Table 12. Report of Ongoing Research in Land-Use	
Research Measurements	**% Reporting existence of research**
Streams and rivers from AOP	20.0
Flood plains and wetlands	**34.5**
Dams and control structures	21.8
Watershed boundaries to level 6 stream	21.8
Watershed boundaries to level 1 stream order from AOP	20.0
Protected areas boundaries	23.6
Human population statistics	32.7
Transportation Infrastructure	25.4
Agricultural Management	**40.0**
Industrial Infrastructure	18.1
Potential vegetation	29.0
Historical land cover classification	31.0
Historical climate data	32.7
Average	**26.5**
Number participating in the study	**55**

Table 13. Distribution of Other Areas of Research Reported By the CST Participants		
Research area	**Number this measurement was reported**	**% of the total responses**
Biodiversity	18	17.1
Informatics/computer	15	14.3
Soil Studies	13	12.4
Climate	13	12.4
Water Studies	11	10.5
Urban Studies	7	6.7
Plant Studies	6	5.7
Human Health	5	4.8
Environmental Studies	5	4.8
Ecology	5	4.8
Fish Studies	4	3.9
GIS	2	1.9
Oceanography	1	1
Total responses	**105**	**100.0**

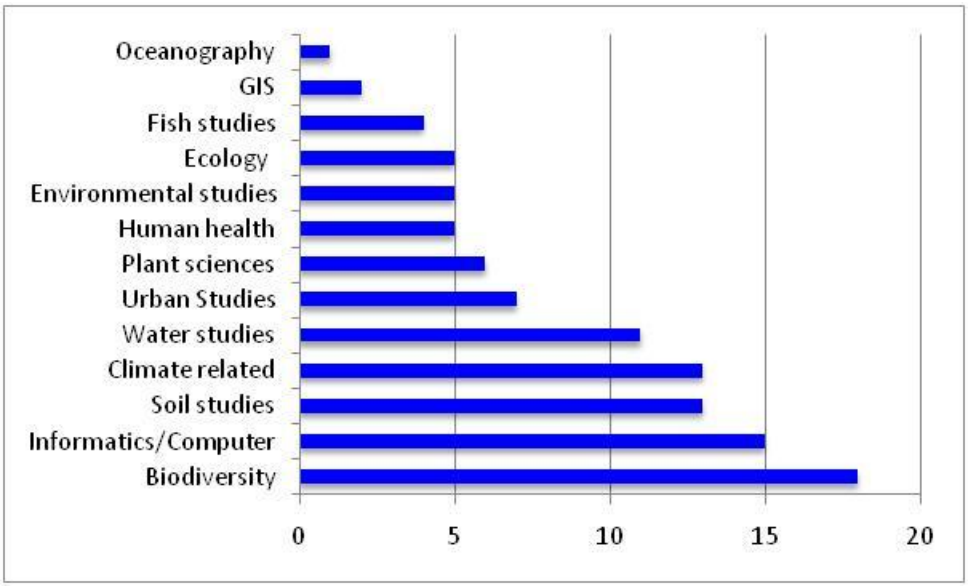


Figure 4. Distribution of other area of research as reported (in absolute numbers) by CST participants (source Table 13)

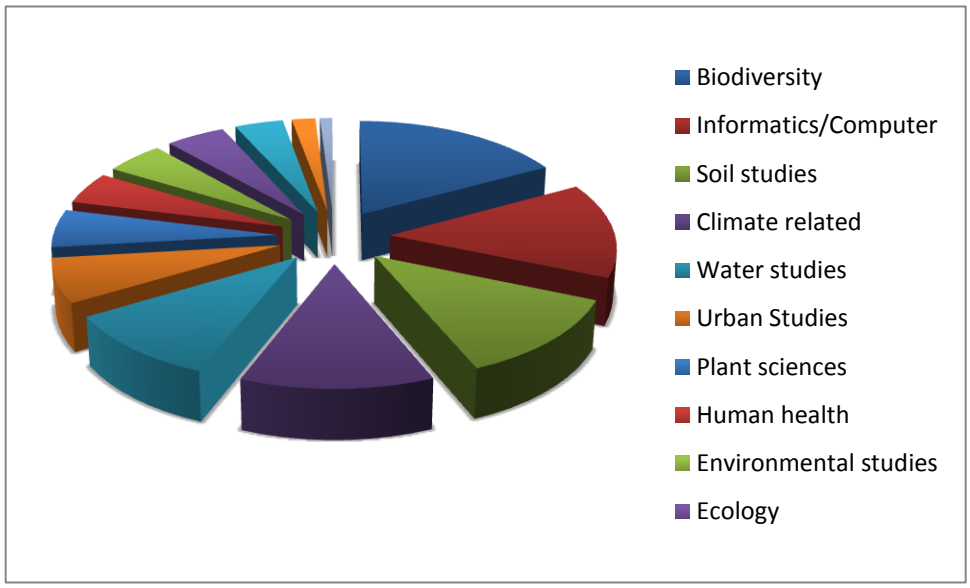


Figure 5. Distribution of other area of research as reported (in percent) by CST participants (source Table 13)

Other Research

The respondents were asked an open ended question about other research going on their campus. This question helped the project to capture any research which is missed due to the technical language of NEON research list. Among the 55 respondents 33 reported 105 research areas. These research areas were

coded and grouped based on the nature of research. The summary of these research reporting is presented in Table 13. Seventeen percent of these responses were categorized in biodiversity research. After biodiversity, the soil, climate, and water related studies were the most frequent research areas mentioned, that are part of NEON science areas.

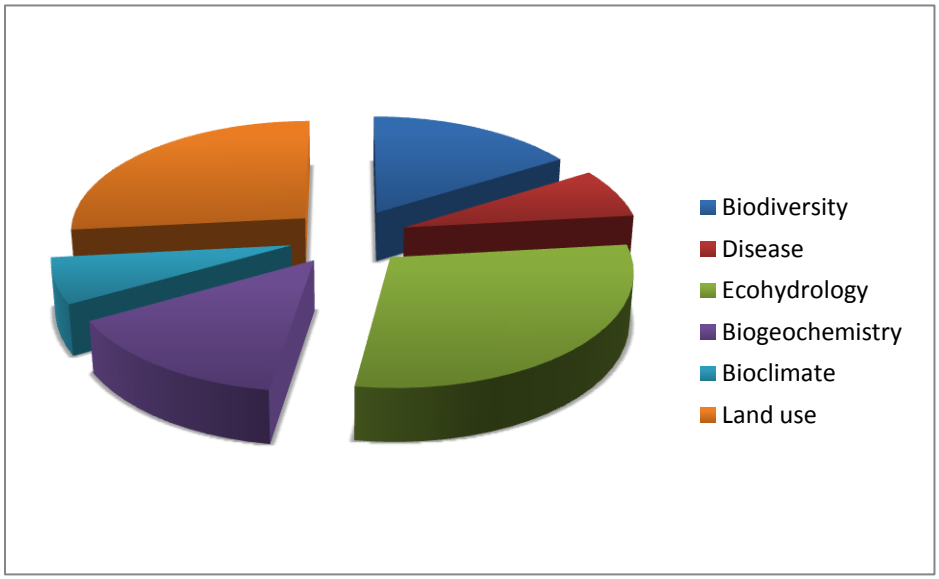


Figure 6. Focus Research Area as Reported by Participant Institutions

Conclusion and Recommendations

The College Speaking Tour (CST) implemented in this project was able to reach the faculty and graduate students in 14 minority serving institutions across four of the 20 NEON domain areas. The main dissemination impact of this activity should be seen in relation to the role of faculty and high level graduate students in sharing the results of the NEON presentations and discussion with undergraduate students in classes, group meetings, and individual mentoring sessions. These students majoring in science areas will be the potential researchers in a variety of NEON science areas. The knowledge shared due to the CST presentations is expected to motivate these students to pursue further information about NEON project and how to get involve in NEON related research.

The CST exposed a significant number of faculty and graduate students at MSIs to the potential research areas and resources of NEON. Through this interaction, the participants were able to link their current research activities to NEON diverse research areas. This exposure has the potential for refining and redirecting research priorities toward NEON-like research and the utilization of NEON data and large datasets. The community can take advantage of guidance NEON is making available to the community on how to make use of its physical and information cyberinfrastructures and accompanying education resources. In addition, participants may increase the identification of innovative research ideas and implementation as the researchers learn about the cyber infrastructure and data sharing capabilities at NEON.

The survey of faculty and researchers in the participating institution provided an extensive insight to the on-going NEON science related research at the MSIs. Figure 1 summarizes this information. The level of ongoing research related to NEON sciences is varies by the type of research. Land-use studies and Echo-hydrology research projects are reported by 30 percent of the survey's faculty members. On the other

hand Biodiversity and Biogeochemistry research areas were reported by about 15 percent of the total participating faculty members.

These data indicate that the basic foundation of NEON research exists at least in 30 percent of the survey institutions. However, we need further information about the depth and breadth of the on-going research and level of funding. There are a good number of faculty members who seem to be familiar with some aspect of NEON science research. However, we need further information about the extent of their knowledge and their skill in each specific field.

The results from the survey provided strong indication that the survey tool will be useful in generating the necessary fundamental data in expanding this research to a more representative group of MSI institutions and their faculty members. In the present study, the institutions that were eventually covered in the CST were, all but one, among the HBCUs. The HSIs were not represented because the selected institution declined to participate in the CST. While our results are representative of several of the geographic domains of the NEON, future research needs to expand to HSIs and TCUs especially smaller undergraduate institutions in this category. The latter group of institutions may represent more of the characteristics of underfunded institutions than the large more research oriented institutions with more than 25 percent Hispanic enrollment.

The ongoing research data from the institutions suggested that not only the more research oriented institutions have potential for NEON research, but some smaller schools with less research intensive capital are engaged in NEON related research. Hence, we should not miss the opportunity of expanding some low cost NEON related research that will basically use the data managed by NEON that is available through the NEON cyberinfrastructure.

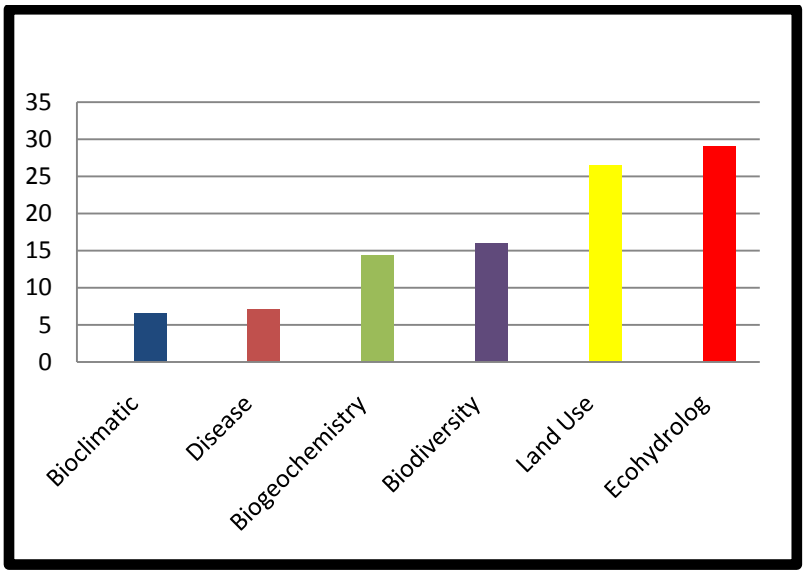


Figure 7. Percent of Faculty reporting Ongoing NEON Research on Their Campuses

The data from this study leads to the following recommendations:

- Develop a comprehensive webinar which can emulate the CST for faculty and students from more remote areas and with less funding for travel.

- Expand the CST and the accompanying data collection about NEON science research to a larger number of undergraduate institutions and particularly TCUs and small HSIs. This will allow for the generation of a richer more diverse database capabilities and ongoing research activities which can be used in designating future initiatives for collaboration in NEON-like research.
- Expand the SEA NEON Capabilities Checklist during an expanded CST to collect information not just on the institution's NEON-like research but cross-walk that information to a specific research program at that institution. This will specify and enhance the identified capabilities because the capabilities are now tied to a formal program. This will also enhance any future collaborative efforts between the CST institutions and other schools and organizations.
- Engage a few of the more research oriented institutions among the 14 institutions, in a pilot collaborative initiatives where they can contribute to the data collection in the field as part of the larger activities of the NEON data collection enterprise.
- Engage a few of the smaller institutions among the 14 institutions, in a pilot collaborative initiative where they receive and analyze data through NEON cyberinfrastructure.

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Appendix 1. SEA NEON Capabilities Checklist

The Checklist can be viewed in its original format on the Internet at:
http://www.surveymonkey.com/s.aspx?PREVIEW_MODE=DO_NOT_USE_THIS_LINK_FOR_COLLECTION&sm=LYrB%2fTIFIeRCS9IPZibMz7EgJBC9783gME9%2fleWZPuo%3d

Exit this survey

SEA NEON Science Capabilities Checklist

The purpose of this data collection instrument is to assess the SEAPON institutions current capability to conduct research in the following
six NEON Science Areas: (1) Biodiversity, (2) Disease, (3) Ecohydrology, (4) Biogeochemistry, (5) Bioclimate and (6) Land-Use.

PLEASE, DO NOT EMBELLISH YOUR RESPONSES AND ONLY CHECK THE AREAS THAT ACTUALLY APPY TO YOUR CURRENT CAPABILITY.
(Completing the instrument will take less than 45 minutes).

To get started, please provide us with your contact information:

Name:	
Institution:	
Department/Office/Center:	
Address:	
City:	
State:	-- select state --
ZIP/Postal Code:	
Email Address:	
Cell Phone Number:	
Office Phone Number:	

NEON Science Area: Biodiversity --
Does your institution have current research that will

produce results in any of the areas listed below? Please check yes in only those areas that apply.

	Yes	No
Mosquito diversity and abundance		
Mosquito species distribution		
Ground dwelling beetle diversity and abundance		
Ground dwelling beetle distribution		
Small mammal density, diversity, and abundance		
Small mammal distribution		
Peromyscus species demographic traits		
Ectoparasite diversity and abundance		
Bird diversity		
Bird species distribution maps		
Mosquito phenology		
Peromyscus breeding activity period		
Plant richness, diversity, and abundance		
Plant phenological patterns (3 focal plant species)		
Plant demography (3 focal plant species)		
Vegetation species distribution map		
Invasive species and disease risk maps		
Ecosystem structure		
Soil microbial diversity		
Soil relative microbial abundance		
Soil microbial functional diversity		
Soil microbial metagenomes		
Algae and associated microbial biofilm diversity and abundance		
Algae distribution maps		
Macrophyte and Bryophyte diversity and abundance		

Macrophyte and Brypohyte distribution maps	
Benthic macro-invertebrate diversity and abundance	
Benthic macroinvertebrate distribution map	
Zooplankton diversity and abundance	
Fish species richness, diversity, and abundance	
Fish distribution map	

NEON Science Area: Disease --
Does your institution have current research that will produce results in any of the areas listed below? Please check yes in only those areas that apply.

	Yes	No
West Nile Virus (WNV) prevalance in mosquitos		
Dengue prevalence in mosquitos		
Mosquito-borne West Nile Virus and Dengue distribution maps		
Hantavirus prevalance in deer mice		
Hantavirus distribution map		
Lyme disease prevalence in Peromyscus		
Lyme disease distribution map		

NEON Science Area: Ecohydrology --
Does your institution have current research that will produce results in any of the areas listed below? Please check yes in only those areas that apply.

	Yes	No
Soil Moisture		
Soil Moisture (sub-region map)		
Water balance		
Water balance (sub-region map)		
Potential evapotranspiration		
Stream discharge regime		
Stream and pond morphology dynamics		

NEON Science Area: Biogeochemistry --
Does your institution have current research that will produce results in any of the areas listed below? Please check yes in only those areas that apply.

	Yes	No
Ozone deposition		
Ozone over threshold		
Chemical deposition - e.g., reactive nitrogen gases (NO-NOy and NOAA National Atmospheric Deposition Program)		
Particulate concentration and deposition		
Biomass		
Biomass map		
Necromass		
Canopy nitrogen		
Canopy water content		
Canopy xanthophyll cycle		
Canopy chlorophyll		
Canopy lignin		
Soil carbon and nitrogen stocks		
Soil CO2 flux, chambers and soil profile		
Fine root production		
Ecosystem exchange, tower		
Ecosystem exchange map, aerial observatory platform (AOP)		
Ecosystem exchange of carbon		
Net primary productivity (NPP) at plot level		
Ecosystem water use efficiency		
Ecosystem light use efficiency		
Litterfall - C, N, K, P, Ca, Mg flux		
Litter C, N, K, P, Ca, Mg turnover		

Stream carbon flux	
Stream nitrogen flux	
Stream phosphorus flux	
Stream metabolism	

NEON Science Area: Bioclimate --
Does your institution have current research that will produce results in any of the areas listed below? Please check yes in only those areas that apply.

	Yes	No
Summary Weather Statistics		
Energy fluxes (tower scale)		
Vapor pressure deficit (VPD)		
Leaf Area Index (LAI) map from AOP		
Leaf Area Index map		
Aerodynamics, Bulk Canopy, and Canopy Conductances		
Atmospheric stability: Monin-Obukhov Length (L)		
Atmospheric stability: Richardson number (Ri)		
Albedo		
Albedo map from AOP		
Albedo map		
Aerosol optical depth from AOP		
Total column water vapor		
Static potential photosynthetically active radiation (PAR)		
Fraction of photosynthetically active radiation (fPAR), (towers)		
fPAR, from AOP		
fPAR, from satellite		
Fire risk probability		

NEON Science Area: Land-Use --

Does your institution have current research that will produce results in any of the areas listed below? Please check yes in only those areas that apply.

	Yes	No
Elevation		
Elevation (10m resolution)		
Slope and Aspect (30m resolution)		
Slope and Aspect (from AOP at 10m resolution)		
Soil properties (1km resolution)		
Soil properties (100m resolution)		
Land cover classification		
Land cover classification from AOP		
Streams and rivers		
Streams and rivers from AOP		
Flood plains and wetlands		
Dams and control structures		
Watershed boundaries to level 6 stream		
Watershed boundaries to level 1 stream order from AOP		
Protected areas boundries		
Human population statistics		
Transportation Infrastructure		
Agricultural Management		
Industrial Infrastructure		
Potential vegetation		
Historical land cover classification		
Historical climate data		

Other NEON-related Science Areas: Please provide other science capabilities at your institution that are not listed in this checklist. Limit your response to a phrase no more than 80 characters long.

1.
2.
3.
4.
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9.
10.

Done