



NOAA | OFFICE OF EDUCATION | NOVEMBER 2012

## REPORT ON THE EDUCATIONAL PARTNERSHIP PROGRAM 2001 - 2011

“DEMONSTRATING NOAA’S COMMITMENT TO EDUCATION THROUGH PARTNERSHIPS”





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## Executive Summary

Since its inception in 2001, the Educational Partnership Program (EPP) has supported over 2,500 students in NOAA mission-critical areas of study at the Cooperative Science Centers or through scholarship programs. Eighty three percent of those students were from underrepresented groups. The program has invested in critical infrastructure, adding 6 new degree programs and 75 additional faculty members. Partnerships between NOAA and the Cooperative Science Centers resulted in 777 collaborative research projects and 887 peer-reviewed research papers.

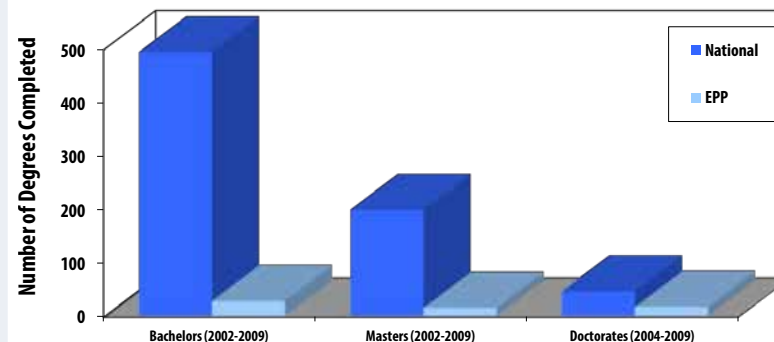
The five Cooperative Science Centers, each led by a Minority Serving Institution (as defined by the U.S. Department of Education), include 37 university campuses. These Centers play a vital role increasing the number of students from underrepresented groups who graduate with degrees in NOAA mission critical fields and strengthen NOAA's research capacity. To date, the Centers and their partner institutions have graduated 950 students with these degrees, with 805 students in the pipeline. The Centers are able to leverage NOAA's investment by attracting research funding from other federal agencies including the National Science Foundation and the Office of Naval Research.

EPP also manages two competitive scholarship programs. One provides graduate level training plus entry level employment and the other provides paid summer internships and stipends for undergraduates. With heavy emphasis on a substantive guidance role for mentors who work with these students, as well as robust oversight of the students by the EPP, most students successfully complete the program.

Among the accomplishments of the EPP Scholarships and Cooperative Science Centers:

- The NOAA Center for Atmospheric Sciences at Howard University leads the nation in production of minority PhDs in atmospheric sciences.
- The EPP program recently graduated our 100<sup>th</sup> PhD.
- In the Graduate Sciences Program (GSP), 53 students received science, technology, engineering or mathematics (STEM) degrees in fields relevant to NOAA mission science.

### Environmental Science African American Graduates National and EPP Comparison



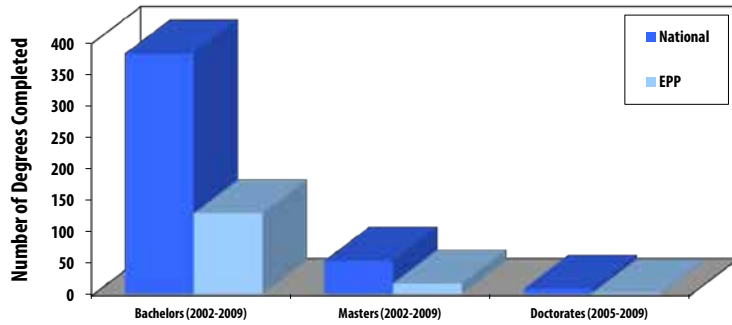
This chart compares the number of Environmental Science African American graduates (Bachelor, Master, and Doctorate) from the EPP with all graduates in the United States. Based on those graduates reporting, EPP supported 5.7% of Bachelors, 7.6% of Masters, and 37.0% of Doctorates.

GSP students account for 19% of all underrepresented minorities hired into NOAA professional science positions.

A strong research program that benefits NOAA is fundamental to the success of EPP. Research highlights from the Cooperative Science Centers include:

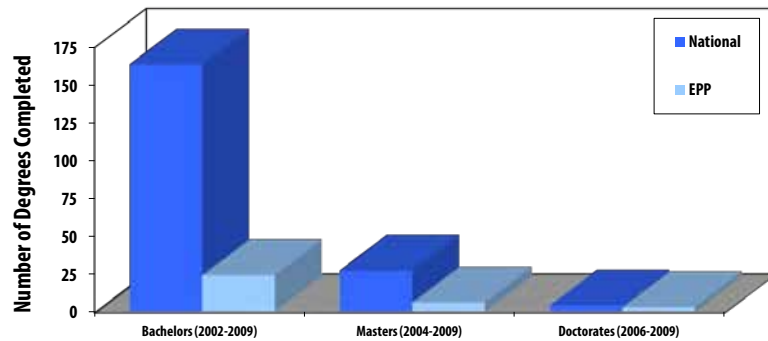
- Improving flash-flood forecasting and satellite-based rainfall estimates.
- Improving “nowcasting” for rapidly developing thunderstorms.
- Providing fisheries managers with scientifically sound information and data to support ecosystem-based fishery conservation and management.
- Developing risk prioritization models as planning tools used by several National Estuarine Research Reserves.
- Becoming one of only two Global Climate Observing System Upper-Air Network sites in the U.S.
- Conducting Radiosonde Replacement Program Experiments and Lidar Planetary Boundary Layer Height measurements in support of the National Weather Service.

### Marine Science African American Graduates National and EPP Comparison



This chart compares the number of Atmospheric Science Hispanic or Latino graduates (Bachelor, Master, and Doctorate) from the EPP with all graduates in the United States. Based on those graduates reporting, EPP supported 14.7% of Bachelors, 22.2% of Masters, and 75.0% of Doctorates.

### Atmospheric Science Hispanic or Latino Graduates National and EPP Comparison



This chart compares the number of Marine Science African American graduates (Bachelor, Master, and Doctorate) from the EPP with all graduates in the United States. Based on those graduates reporting, EPP supported 33.5% of Bachelors, 32.1% of Masters, and 25.0% of Doctorates.

Chart Sources: Educational Partnership Program Administrative Data (EPP) / Department of Education's National Center for Education Statistics (NCES)



# Program Overview

In an increasingly dynamic and global marketplace, STEM workers are critical to American innovation and competitiveness. Accomplishing NOAA's challenging vision for the future, i.e., resilient ecosystems, communities and economies, requires an inclusive, diverse, highly skilled, motivated and effective workforce that reflects the communities it serves. Through partnerships with formal education institutions and direct engagement and support of faculty and students, NOAA's Educational Partnership Program (EPP) strives to increase the underrepresented population that is trained in science, technology, engineering, and mathematics (STEM), reducing the educational gap between minority and non-minority population groups. This effort is essential to meeting the future workforce needs of the agency and the nation.



NOAA's education mission is to advance environmental literacy and promote a diverse workforce in ocean, coastal and Great Lakes weather and climate sciences, thereby encouraging stewardship and informed decision making for the nation. The agency's role in science education is defined in the America COMPETES Act, P.L. 110-691, which provides broad statutory authority for educational activities. EPP is a proven NOAA education program with demonstrated results that include:

- Support for more than 2,500 students--of whom 83% are drawn from underrepresented populations--as they obtain their undergraduate and graduate degrees in NOAA-relevant fields.
- More than 1,100 of these students have graduated with degrees in marine and atmospheric sciences, while an additional 1,200 are in the pipeline.
- Since the inception of the program, 19% of science professionals from underrepresented communities who have been hired by NOAA were supported by EPP.

At the heart of NOAA operations is the creative work of scientists, engineers, technicians, managers, NOAA Corps Officers and administrative staff. Only by investing in this stock of intellectual capital can NOAA achieve its strategic goals to provide the public with scientific knowledge, information services, incident response and environmental stewardship capabilities. An analysis of data by NOAA's Workforce Management Office has determined that by 2014, approximately 37% of NOAA's workforce will be eligible to retire. The need to ensure that a pool of well-educated and skilled candidates exists to replace this aging workforce cannot be overstated.

Furthermore, STEM workers earn significantly more than comparable workers in non-STEM occupations, regardless of race. Hispanics and African Americans receive a significantly larger STEM wage premium than do non-Hispanic Whites. However, only half as many African Americans or Hispanic workers have STEM jobs, relative to their overall representation in the U.S. workforce.<sup>2</sup> Increasing the numbers of STEM workers among currently underrepresented groups through education and access to jobs is one more way NOAA contributes to

America's economic growth, and to the nation's future as an innovator and global leader.

The Educational Partnership Program has four components:

**1. Graduate Sciences Program**

This scholarship program trains outstanding candidates seeking advanced degrees in NOAA-related disciplines. Each year, for each scholar, the Graduate Sciences Program pays tuition, books, lab fees, and provides a housing allowance at the selected university, travel expenses, and salary during 16 weeks of NOAA work experience at a NOAA research facility.

**2. Undergraduate Scholarship Program**

This scholarship program provides NOAA internships and one-on-one mentoring to increase the number of students from underrepresented communities graduating with degrees in fields integral to NOAA's mission. Each scholar receives approximately \$28,000 for two academic years, to cover the costs of tuition and fees, two summer internships, travel and conference fees.

**3. Five Cooperative Science Centers**

These Centers—selected via a competitive grants program-- advance collaborative research, educate and graduate students and build capacity in NOAA-mission sciences at Minority Serving Institutions. Each center is led by a Minority Serving Institution (MSI), and each collaborates with 6 or more colleges or universities.

**4. Environmental Entrepreneurship Program**

While the Environmental Entrepreneurship Program is no longer funded, it promoted student training in the application of NOAA sciences to create business opportunities and enhance STEM programs at MSIs.

These program components support education, research internships and employment opportunities in NOAA-related sciences. Collaboration

with Minority Serving Institutions to build capacity, strengthen curricula and improve research infrastructure provides professional options to students who have not traditionally chosen careers in earth and environmental sciences. Financial support, internships and work opportunities provided by EPP scholarship programs also help support outstanding scholars who might otherwise find it difficult to pursue their education in NOAA mission-critical fields.



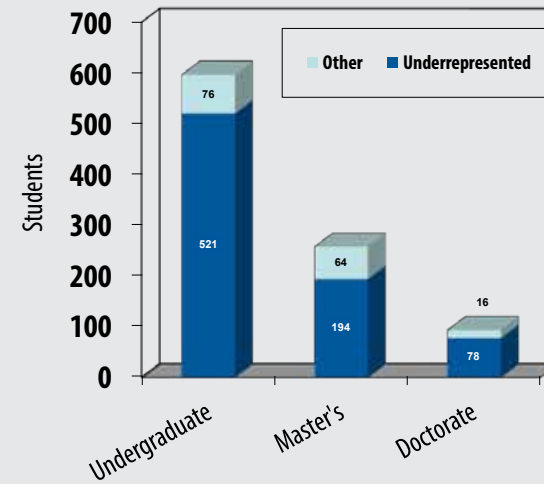
# Cooperative Science Centers

NOAA's December 2010 Next Generation Strategic Plan acknowledges that both education and engaged stakeholders are vital to the agency's mission of science, service and stewardship. NOAA's Educational Partnership Program (EPP) with Minority Serving Institutions (MSIs) provides financial assistance through competitive processes to support students and build capacity in NOAA mission-critical sciences to train the next generation of scientists and managers to carry NOAA and our nation into the future—a future that includes healthy, resilient ecosystems, communities and economies.

The Educational Partnership Program established five Cooperative Science Centers (CSCs) at MSIs. These Centers are each comprised of a consortium of academic institutions with the principal goal of providing formal education to students in coursework directly related to NOAA's mission. Each Center strengthens and builds sustainable capacity in education and research experience in NOAA mission scientific and technology areas, including atmospheric science, coastal resources management, fisheries sciences and management, environmental sciences, meteorology, environmental technology and remote sensing. The Centers support NOAA's essential goal to increase the number of students, particularly from underrepresented groups, who graduate with academic degrees that support NOAA and the Nation's science, technology, engineering and mathematics (STEM) priorities. Moreover, these Centers increase diversity in NOAA and beyond, enlarging the national pool of individuals from underrepresented groups who receive post-secondary degrees and enter the workforce in fields directly relevant to NOAA.

In addition to supporting education and research, the CSCs build STEM capacity at their institutions with new and enhanced curricula and degree programs, the hiring of new faculty, and focused academic and professional mentoring of students, thereby ensuring an expanded

Cooperative Science Center Degrees Completed



Cooperative Science Center Pipeline Students

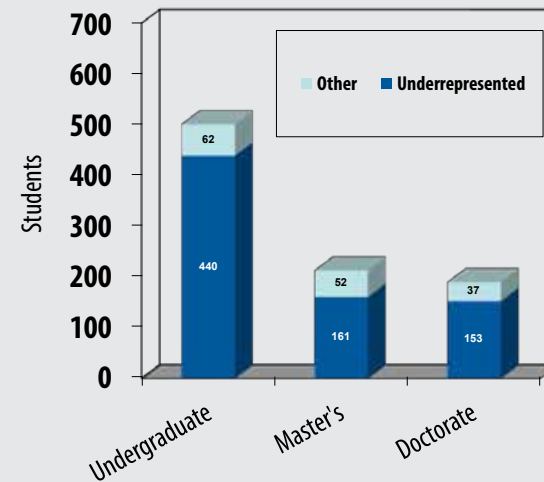


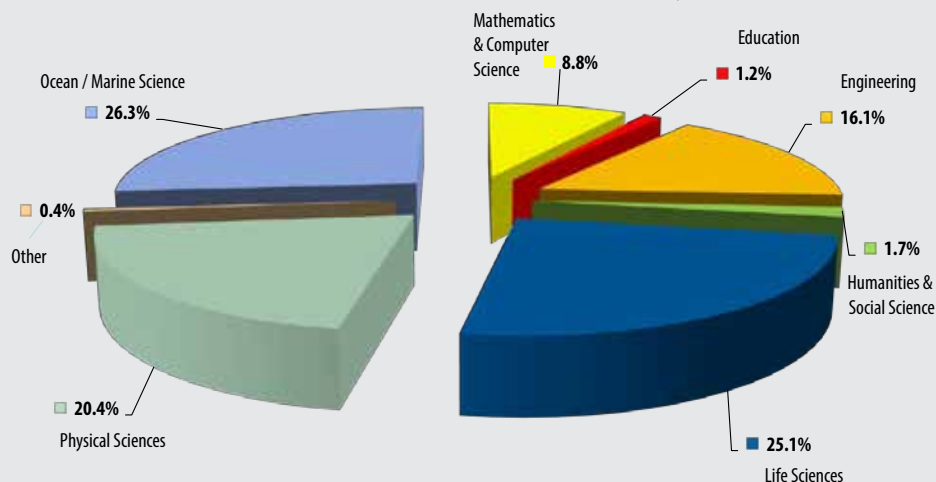
Chart sources: Educational Partnership Program Administrative Data



pipeline of scholars trained in science, engineering and natural resources management to meet the nation's needs. Since the creation of the Centers, they have trained 1,880 (1,821 uniquely supported) students in NOAA mission sciences. EPP places an emphasis on student preparation in understanding and improving environmental observations and predictions, particularly through the development and application of next-generation instrumentation and modeling technologies. Recognizing that managing the Nation's resources also requires excellence in social sciences, training in social sciences--including environmental policy and resource economics, which impact environmental outcomes on the larger society--has been integrated into many CSC programs.

Since their establishment, the five NOAA Cooperative Science Centers have hired 75 new faculty members. Over 770 research projects have been jointly undertaken by Center and NOAA scientists, and approximately 880 peer-reviewed publications have been produced by scientists (faculty and students) who are sponsored by NOAA's Educational Partnership Program.

**Cooperative Science Centers  
Graduated Students Fields of Study**



## Cooperative Remote Sensing Science and Technology Center (CREST)

CREST research into cutting edge remote sensing applications for air quality, coastal waters, precipitation and water resource issues enhances critical understanding of climate variability and change as well as providing needed weather information. The Center's work strongly supports NOAA climate, weather and water and ecosystem goals. While CREST's partner at NOAA is the National Environmental Satellite, Data, and Information Service (NESDIS), their research is also well aligned with efforts by NOAA's National Weather Service (NWS) and Office of Oceanic and Atmospheric Research (OAR).

CREST research priorities include investigations into atmospheric trace gases and aerosols, optical properties of coastal waters, hydroclimates, precipitation and land hydrology. The Center's advances in data compression technology are an exciting enhancement of their research efforts.

### Education and Outreach

CREST strives to recruit, train, educate and graduate students from early grades through advanced degrees, in NOAA-related STEM fields of remote sensing sciences, engineering and technology. CREST institutions have modified a number of existing courses to incorporate NOAA mission sciences into the curriculum. They have implemented new recruiting and mentoring strategies that reach high school, undergraduate and graduate students in NOAA mission science, engineering and technology areas. They offer training activities that target students from middle school through college, introducing them to NOAA mission science, engineering and technology areas. CUNY provides activities geared toward inner city students, especially from Harlem, North

### CREST PARTNERSHIPS

Lead Institution: City College of the City University of New York (CUNY); Partners: Hampton University (HU); University of Maryland at Baltimore County (UMBC); University of Puerto Rico at Mayaguez (UPRM); California State University, Los Angeles (CSULA); Lehman College, Bronx Community College; New York City College of Technology; LaGuardia Community College; Hostos Community College; Hunter College; Bowie State University; Corporate Partners: Raytheon; Northrop Grumman; Earth Resources Technology Inc.; Boeing

Manhattan and the Bronx, serving a population that is more than 85% Hispanic/Latino and African American. HU coordinates with science centers and museums to provide speakers, workshops, seminars, K-12 field trips and summer science enrichment student camps. UPRM offers a two week program for fifty students and twenty teachers, exposing them to CREST and NOAA-related science and technology.

### Accomplishments

- Graduated 223 students in NOAA sciences; 111 Bachelor's, 78 Master's; 34 PhDs
- Trained 502 students in NOAA-related science curriculum; 73% of those students were African American or Hispanic/Latino
- Outreach/training to 66 middle and high school students
- 4 graduates (each of whom is a member of an underrepresented group) joined the Northrop Grumman workforce
- 7 graduates joined academia as faculty members, continuing their research projects in NOAA mission sciences and mentoring CREST students
- Collaborated on 176 research projects
- 298 peer reviewed articles published by scientists (faculty and students) sponsored by NOAA EPP
- 40 new faculty hired since the Center was established

### Highlighting CREST Achievements

- The City College of CUNY has established a multidisciplinary engineering and science curriculum, with a focus on remote sensing, leading to a Bachelor's degree in engineering or science; it was Accreditation Board for Engineering and Technology accredited in 2010.
- A new Master's Degree in Earth System Science and Environmental Engineering has been approved by the CUNY Board of Trustees and is expected to enroll the first class in Fall 2012.
- CREST's program received a big boost with the long awaited installation of a satellite receiving station on the campus in 2007.
- In 2010, the installation of the new Microwave Observation Unit with snow, soil and coastal water radiometric measurement in

Caribou, ME and Millbrook, NY greatly enhanced CREST's ability to function as a premier university partner to NOAA in satellite calibration and validation related activities and their remote sensing science and technology.

- Also in 2010, The City University of New York inaugurated the CUNY-CREST Institute (The Remote Sensing Earth System Science and Technology Institute), expanding remote sensing education, science and technology opportunities to all CUNY colleges, and increasing partnerships with other universities, industry, state and city agencies.
- At HU, a minor in Space, Earth and Atmospheric Sciences was introduced, which subsequently resulted in the formation of an Atmospheric and Planetary Sciences department.

### Research Goals and Successes

CREST research includes air quality investigations that focus on monitoring and studying regional and urban air quality in the eastern United States. Researchers are also exploring long-term impacts of air quality on regional and global climate. Potential correlations between air pollution and health impacts are being examined. This effort will contribute to an improved scientific basis for assessing air quality standards and management. Climate work focuses on quantification and characterization of "climatic forcing agents" in the atmosphere. Advancing techniques for predicting and estimating precipitation is another focus area.

Ongoing and completed research projects include:

- Released four 26.5 year-long datasets of cloud-type-defined weather states covering four different latitude zones at 3-hourly intervals. The code for producing these data products from International Satellite Cloud Climatology Project (ISCCP) is posted online. These data have been used for research reported in at least a dozen papers.
- Released a 66-year cyclone identification, tracking and attribution data product based on the NCEP2 reanalysis. The code for performing a similar analysis in any global atmospheric circulation model output is available online. The codes for accessing and analyzing this product are posted online as well.

- Produced climatology of penetrating tropical convection; identified convective “regime switching” behavior as the key to the Madden-Julian Oscillation and to initiation of African Easterly Waves. Demonstrated convective “regime dependence” of extremes of tropical precipitation.
- Evaluated an ISCCP-based global climatology of cloud vertical distribution using the CloudSat/Calipso product
- Developed the capability for remote sensing of land inundation; produced a 16 year global climatology. Demonstrated the capability for remote sensing-based estimates of large river discharge. Demonstrated the capability for linking flooding and discharge to precipitation in the Siberian and Amazon River systems.
- Improving a satellite-derived Aerosol Optical Depth (AOD) product and its applications to air quality monitoring, including exploring aerosols’ indirect effect on climate/precipitation
- Using Geographic Information Science, Geostatistics, and spatial analysis, developed innovative approaches and new methods for exploring and demonstrating the correlation between health and environmental factors, such as asthma; poverty/poor quality of life and air pollution
- Improved “nowcasting” for rapidly developing thunderstorms, improved snow cover mapping, snow depth estimates and predictions, snow grain size estimation, and rainfall amounts
- Validation of satellite-based precipitation estimates for severe storms
- Improving satellite-based rainfall estimations by using lightning
- Improving flash-flood forecasting
- Development of new merged algorithm for precipitation estimation in radar blockage areas
- Development of a system for ice detection in major rivers in the Northeast
- CREST contributed to NOAA on applications of remote sensing for marine ecological monitoring include:
  - Development of new algorithms for improved marine remote sensing products
  - Development of novel optical instruments for shipborne and in-water measurement
  - Development of a satellite algorithm for detection of harmful algal blooms
  - Developed the Long Island Sound Coastal Observatory (LISCO) for calibration and validation of NOAA satellite observations

**For additional CREST information:**

<http://icerd.engr.cuny.cuny.edu/noaa>

Dr. Reza Khanbilvardi, CREST Director | [khanbilvardi@cny.cuny.edu](mailto:khanbilvardi@cny.cuny.edu)

[rk@ce-mail.engr.cuny.cuny.edu](mailto:rk@ce-mail.engr.cuny.cuny.edu)

212-650-8009



## Environmental Cooperative Science Center (ECSC)

The ECSC mission is to educate a new generation of environmental scientists--particularly from underrepresented communities--in NOAA related sciences, and to develop natural and social science tools for integrated assessments of ecosystem health in support of coastal environmental decision making.

ECSC has established a regional approach to address coastal and marine environmental issues through collaborations with NOAA and its National Ocean Service (NOS), by partnering with strategically selected Reserves from the National Estuarine Research Reserve System (NERRS) that span coastal regions from the extreme western Gulf of Mexico to the Atlantic coast of Delaware. The ecological, economic, social, and cultural attributes of these coastal and marine ecosystems are vital

on local, regional, and national levels and as such provide excellent study areas upon which to focus the research, training, and outreach activities of the Center.

### Education and Outreach

The ECSC's educational objective is to enhance curriculum and educational capacities at partner institutions in NOAA-relevant disciplines by providing high quality education and research experiences to students. By interacting directly with kindergarten through 12th grade (K-12) students and enhancing the quality of teacher education programs, the Center has established a pipeline for the production of scientists and teachers from underrepresented communities.

### Accomplishments

- Graduated 147 students in NOAA sciences; 67 Bachelor's, 53 Master's and 27 PhDs

### ECSC PARTNERSHIPS

Lead Institution: Florida A&M University (FAMU); Partners: Bethune-Cookman University (BCU); Creighton University (CU); Delaware State University (DSU); Jackson State University (JSU); Morgan State University (MSU); University of Miami (UM); University of Nebraska at Lincoln (UNL); Texas A & M University-Corpus Christi (TAMUCC); University of Texas-Brownsville (UTB); Other Partners: National Estuarine Research Reserve System; Gulf of Mexico Alliance (GOMA); Gulf of Mexico coastal Ocean Observing System

- Trained 348 students in NOAA-related science curriculum; 84% of those students were African American or Hispanic/Latino
- Outreach/training to 205 elementary, middle and high school students
- 10 graduates joined NOAA workforce
- Collaborated on 77 research projects with NOAA and MSI partners in support of NOAA operations
- 170 peer reviewed articles published by scientists (faculty and students) sponsored by NOAA EPP
- 11 new faculty hired since the Center was established

### Highlighting ECSC Achievements

- FAMU added a university-wide freshman environmental science course for non-majors to satisfy their basic science requirement. In addition to enhancing environmental literacy for students, the new course helps to recruit new undergraduates into the University's School of the Environment and encourages students



to obtain their teaching certification. To date, over 150 students have taken the course.

- FAMU developed a post-secondary Ocean Science Concept-driven Interactive (OSCI) teaching model which is available online at <http://www.famu.edu/index.cfm?a=osci&p=OSCIHome>. ECSC students are required to demonstrate ocean science-based core competencies, much of which are based on this model. It was developed to assist ocean science instructors at post-secondary institutions to transition to a teaching approach that is more concept-driven, interactive and collaborative for student audiences and also one that is designed to highlight the relevance of ocean science issues to society. It is the model for ocean science courses at several of the LMRCSC partner schools.
- Teacher education programs were modified to increase awareness of environmental science.
- Jackson State University added a Remote Sensing Course.
- Bethune-Cookman University began operation of its new Master's of Science in Integrated Environmental Science degree program. The program currently has 8 students. The university has provided four full-tuition scholarships to help with the initiation of this new degree program on campus.
- A core competency partner training program was implemented for students. ECSC students receive classroom and field training in core competencies that have been identified as necessary for NOAA and NOAA-related careers, including basic ocean sciences, field methods, and safety practices.
- FAMU collaborated with the Leon County (FL) public school system to conduct in school Environmental Awareness Poster Competitions for elementary, middle and high school students. Over one hundred students participated.
- FAMU Environmental Science High School Summer Camp is held annually for 20-25 high school students. The camp introduces students to marine and estuarine sciences through lectures, hands-on laboratory experiments, field trips, and seminars given by professionals in the field, and serves as a recruitment tool for ECSC partner colleges.



- FAMU High School Science Bowl Team is coached by ECSC graduate students and meets weekly to discuss topics related to the oceans; the team competes in National Ocean Science Bowls.
- Morgan State University's Eco Clues Summer Camp encourages youth to embrace urban community design and community sustainability and raises their understanding of the Chesapeake Bay watershed.
- Texas A&M University-Corpus Christi's course, "Teaching Environmental Science" is a graduate-level course designed for K-12 teachers. The course provides instruction in teaching and communicating environmental sciences and environmental awareness, and promotes partnerships among teachers, government agencies, businesses, and community organizations, so that their K-12 students may become knowledgeable citizens of the future.



### Research Goals and Successes

ECSC's research goals focus on natural and social science tools and approaches for integrated assessments of ecosystem health that support coastal and environmental decision making. ECSC research is organized into four thematic areas: 1) Integrated assessment in support of environmental decision making, 2) Integrated social sciences, 3) Ecological processes and indicators of ecosystem health and 4) Geospatial analyses and data development.

Projects include:

- Risk prioritization for 5 Reserves; developed models that are currently in use as planning tools at 2 National Estuarine Research Reserves:
  - Conceptual models for decision making that incorporate multiple factors
  - Development of an adaptive management framework that provides for managers to move from models to decision making
  - Assessments of the new protocols

- Training students in the inclusion of social and economic concerns in public policy issues
- Development of a model of public policy that encourages the consideration of these issues and acknowledges the importance of public participation and the contributions of stakeholders and local communities
- Use of both quantitative and qualitative ecological risk assessment techniques
- Research in remote sensing of water resources and water quality to enhance forecasting of the impact of natural and anthropogenic stressors on the health and function of estuarine ecosystems
- Biogeochemical studies that look at food web relationships
- Bioindicator studies addressing harmful algal blooms, invasive species and habitat preference of key species
- Modeling studies that describe hydrodynamic process of a Reserve and associated river and watershed systems
- Exotoxicological studies of metal, bacterial and viral contamination of selected species, addressing issues of human and ecosystem health, and supporting NOAA's goal of "Healthy Oceans for the 21<sup>st</sup> Century"
- Studies of the long term impacts of the Deepwater Horizon oil spill in coastal waters; ECSC had existing baseline, pre-spill data for the Gulf, and has been able to take advantage of that data to perform several studies that are looking at the effects of the spill on Gulf coast ecosystems, with a particular emphasis on food web dynamics. The results of these studies will help scientific understanding of what's happening to Gulf ecosystems, so that NOAA can make better-informed decisions. Supported graduate students involved in the research are presenting papers on the studies at major scientific conferences.

#### For additional ECSC information

<http://www.ecsc.famu.edu/>  
 Dr. Michael Abazinge, ECSC Director  
[michael.abazinge@fam.u.edu](mailto:michael.abazinge@fam.u.edu)  
 850-599-3521

## Interdisciplinary Scientific Environmental Technology Cooperative Science Center (ISETCSC)–CLOSED

ISETCSC focuses its research on development of technologies that support the prediction and understanding of climate and environmental change. Global climate studies require a multi-platform (satellite, ground, airborne, shipborne, etc), multi-sensor supply of streams of mul-

timodal data with vast geographical coverage. These include data on aerosols, wind, ocean waves, seawater quality, temperature, ice coverage and depth at the North Pole, and hurricane intensity and trajectories. Chartered during the second competitive EPP grant cycle, ISETCSC is allied with NOAA's Earth System Research Laboratory (ESRL), whose strategic plan calls for observing and understanding the Earth system and for developing products that will advance NOAA's environmental information and service on the global-to-local scale.

### Education and Outreach

ISETCSC's education and outreach program is extensive and

thorough. The Center has established new degree programs aligned with NOAA's Office of Atmospheric Research (OAR) missions; provided scholarships to undergraduates at partner universities that are enrolled in OAR-aligned degree programs; provided graduate assistantships that support research aligned to OAR missions; developed new curriculum; hired outstanding faculty to mentor students as researchers; developed infrastructure to support interdisciplinary education focused on OAR mission-related science; hosted online courses; hosted frequent schol-

arly seminars and colloquium; developed and hosted summer camps that focus on NOAA sciences for grades 6–12 at several partner universities; developed and hosted a teacher workshop for grades 9–12 at several partner universities; implemented a flexible student recruitment plan that meets the needs of different underrepresented groups at different institutions; provided opportunities for students to intern at NOAA laboratories and provided a medium through which NOAA scientists mentor undergraduate and graduate students. ISETCSC also implements extensive outreach to foster NOAA goals, including visits to schools, content-mentoring with teachers, pedagogical support of instruction of NOAA sciences, hosting field trips to laboratories, hosting groups for ISETCSC Day, and providing summer internships for high school students in research laboratories.

### Accomplishments

- Graduated 101 students in NOAA sciences; 57 Bachelor's, 36 Master's, 8 PhDs
- Trained 302 students in NOAA-related science curriculum; 71% of those students were from underrepresented groups
- Outreach/training to 91 high school students
- 76 peer reviewed articles published by published by scientists (faculty and students) sponsored by NOAA EPP
- 436 faculty and student conference presentations
- Hosted 8 to 15 NOAA-relevant seminars and colloquia annually
- 7 new faculty members
- 187 collaborative research projects
- 44 students participated in NOAA research at NOAA laboratories

### Highlighting ISETCSC Achievements

- Establishment of a Bachelor of Science program in Atmospheric Sciences and Meteorology at NCA&T. This is the second BS program in meteorology at a Historically Black Colleges and Universities (HBCU) in the country.
- Established a PhD concentration in Atmospheric Sciences within the Department of Energy and Environmental Systems
- Developed NOAA-relevant interdisciplinary Master's thesis projects and undergraduate senior projects for ISETCSC-supported

### ISETCSC PARTNERSHIPS

Lead Institution: North Carolina Agricultural and Technical State University (NCA&T); Partners: California State University-Fresno (CSU-Fresno); City College of the City University of New York (CUNY); Fisk University (FU); North Carolina State University (NCSU); University of Alaska Southeast (UAS); University of Minnesota (UM) Corporate Partners: Simpson Weather Associates; Arete Associates; SAS Institute; Vexcel Corporation; USDA Natural Resources Conservation Service; East National Technology Support Center; Brookhaven National Laboratory Office of Educational Programs; North Carolina Dept. of Environment and Natural Resources; Center for Geographic Information and Analysis; Southeastern Universities Research Association (SURA)

- STEM students in physics, mathematics, chemistry, computer science, electrical and chemical engineering
- NCA&T developed strong collaborations that have led to faculty and student exchanges with major NOAA laboratories and research universities with major atmospheric sciences programs.
  - NCA&T developed 25 undergraduate and 14 graduate courses in NOAA mission sciences
  - Has been providing community service to North Carolina teachers and K-12 students through very popular summer workshops and camps. In the last four years over 150 North Carolina teachers have attended summer workshops in earth and atmospheric sciences and hundreds of K-12 students have been impacted
  - At CUNY, 60 students have been impacted by the ISETCSC support including 10 PhD (5 leveraged), 10 Master's (2 leveraged), 21 Bachelor's (7 leveraged), and 19 high school students.
  - ISETCSC has directly supported 9 CSC-Fresno students and indirectly supported an additional 29 over the last four years. A significant fraction of these 38 students are from populations that are underrepresented in NOAA-related sciences.
  - ISETCSC has also helped to facilitate a new degree program in Environmental Science at CSC-Fresno, and the establishment of the Institute of Climate Change, Oceans and Atmosphere. More information can be obtained from the Atmospheric Chemistry Research Group (Atmospheric Chemistry Home), the METRO Geosciences Center (NSF grant leveraged by NOAA-ISET, <http://www.csufresno.edu/geosciencesmetro/>), and the Institute for Climate Change, Oceans and Atmosphere (<http://www.csufresno.edu/icoa/>).
  - ISETCSC partner FU has established research capabilities in image processing, pattern recognition, earth information systems, environmental science and grid computing.
  - ISETCSC has provided direct research funding to 10 students at FU, which lead to 2 students receiving NOAA scholarships. This funding has also helped increase the enrollment of underrepresented students in STEM majors.
  - With support from ISETCSC, 28 undergraduate students, 36 secondary science teachers, and 80 high school students have



participated in NOAA-supported UAS Icefield to Ocean Watershed studies in southeast Alaska, as of 10-9-10.

- With support from the Center, a new Alaska statewide Geography Program Bachelor of Science in Environmental Resources Studies was co-offered at University of Alaska Fairbanks, (UAF) and UAS beginning in fall 2010. An upper division, online Atmospheric Science Class was offered for the first time in spring 2010.
- Thirty-five Alaska secondary science teachers received hands-on training in geosciences education and were mentored while they mentored their own students through field based science fair projects in glacier watersheds.
- For more on ISETCSC-funded projects, see <http://robfatland.net/seamonster/>. For information on the UAS-B.S. Environmental Science program, [http://www.uas.alaska.edu/infocus/programs/envs\\_glacier08.html](http://www.uas.alaska.edu/infocus/programs/envs_glacier08.html).

### Research Goals and Successes

ISETCSC is developing meteorological, oceanographic and chemical sensors; improved modeling tools and algorithms for analyzing data from global observing systems to help understand weather, climate, and



environmental change; and information technology tools for data assimilation, fusion, and mining. Weather and climate-related social science research is also conducted, and stakeholders benefit from technology transfer and the decision support tools developed. All these activities support NOAA's efforts to "understand and describe climate variability and change to enhance society's ability to plan and respond." They are aligned with ISETCSC's mission to produce a highly competent workforce trained in interdisciplinary research and comprised of interdisciplinary, underrepresented groups to meet NOAA's next generation strategic plan goal of diversifying its workforce. Specific research includes:

- Successful study of mechanical aspects of ocean spray effect on air-sea interaction and their effect on the intensity and structure of hurricanes
- Design and demonstration of the feasibility of a prototype hyperspectral Stokes Vector polarimeter for the measurements of underwater polarized light fields
- Development of a benchtop fiber optic eye-safe, infrared, heterodyne wind-speed Lidar for use in urban atmospheres. This work has received \$2.66 million in leveraged support from two grants from the Office of Naval Research
- Development of the Satellite Image Base Retrieval Application (SIBRA) in support of Structural Indexing of Satellite Images (SISI).
- Measurement of absorption cross sections, rates, and branching ratios of chemicals of atmospheric relevance and of climate forcing gases
- Development of chemical sensors: synthesis and characterization of several ligands for Volatile Organic Compound (VOC) detection
- A comprehensive study that encompasses all stages of hurricane development from the embryonic stage over the Ethiopian highlands to coastal storm surge and inland flooding in the US
- Use of Geographic Information System (GIS) in conjunction with the HEC-RAS model to study inland hurricane-related flooding over the Tar River basin in North Carolina

**For additional ISETCSC information**

<http://www.noaaiset.org>  
Dr. Solomon Bililign, Director  
bililign@ncat.edu  
336-285-2328 | 336-334-7424

## Living Marine Resources Cooperative Science Center (LMRCSC)

The mission of the LMRCSC is to develop exemplary academic and research collaborations that prepare a diverse student body for careers in marine and fisheries sciences. LMRCSC training and research activities directly support:

- NOAA's Ecosystem goal of "the protection, restoration and management of coastal and ocean resources, using an ecosystem approach to management"
- NOAA's Education goal of preparing students for "careers in environmental sciences to ensure a future workforce reflecting the nation's diversity"
- NOAA Fisheries goals of:
  - Providing "scientifically sound information and data sufficient to support ecosystem-based fishery conservation and management"
  - increasing "long term economic and social benefits to the nation from living marine resources," and
  - "development of a sustainable and environmentally sound aquaculture"

### LMRCSC PARTNERSHIPS

Lead Institution: University of Maryland Eastern Shore (UMES); Partners: Delaware State University (DSU); Hampton University (HU); Oregon State University (OSU); Savannah State University (SSU); University of Maryland Center for Environmental Science Institute of Marine and Environmental Technology (IMET); University of Miami Rosenstiel School of Marine and Atmospheric Science (RSMAS)

### Education and Outreach

To prepare a future workforce for marine and fisheries science, LMRCSC is strengthening collaborations across universities to enhance relevant academic programs. To enhance efficient use of resources, the Center has expanded its virtual campus. Courses and seminars are offered at multiple partner campuses via the Center's video network, developed and launched in 2002, and more recently through the use of web based technologies (Wimba, AdobeConnect and GoToMeeting). These systems also foster cooperation between Center partners and with NOAA, and facilitate participation of NOAA scientists in student committee meetings and thesis/dissertation defenses.

## Accomplishments

- Graduated 352 students in NOAA sciences; 268 Bachelor's, 73 Master's, 11 PhDs
- Trained 572 students in NOAA-related science curriculum; 75% of those were African American, Native American or Hispanic/Latino
- Outreach/training to 585 elementary, middle, and high school students
- Collaborated on 148 research projects
- Annual research cruises aboard NOAA vessels have exposed more than 58 LMRCSC students to open-ocean deep water research
- 188 peer reviewed articles published by scientists (faculty and students) sponsored by NOAA EPP
- 11 new faculty members have been hired since the Center was established.
- The Center has leveraged funding and established a new National Science Foundation (NSF) funded Center of Research Excellence in Science and Technology—Center for the Integrated Study of Coastal Ecosystem Processes and Dynamics.

## Highlighting LMRCSC Achievements

- Created a new Professional Science Masters degree program at UMES that focuses on two NOAA mission-critical areas: Quantitative Fisheries and Resource Economics. Both of these areas are projected employment growth areas that will otherwise lack sufficient trained professionals.
- Established Research Experiences for Undergraduates (REU) Sites in marine and estuarine sciences at UMES and SSU
- Established a pipeline program from high school through doctoral levels to recruit, mentor and train students in the study of living marine habitats and resources
- Created a summer Fish Stock Assessment program that includes internships at NOAA laboratories
- Provide support for high performing undergraduate students to pursue a dual five-year B.S./M.S. degree in marine science
- Developed numerous internship programs to provide students with hands-on experiences
- UMES collaborates with Maryland Coastal Bays Program and

the National Park Service to conduct the summer Upward Bound Marine and Estuarine Science Program for about 25 high school students each year.

- SSU's Coast Camp exposes more than 100 high school students to marine science each summer.
- A marine science essay and art contest is conducted at SSU for K-12 students.
- The Sci-Tech Program at UMCES IMET provides hands-on training to more than 200 middle and high school students, and science training in environmental and marine science to about 150 middle school students
- IMET provides research internships to high school students and teachers through its Summer Microbiology and Research Training (SMaRT) Program.
- DSU helps fund the Environmental Justice Camp, which educates 30-40 underprivileged youth in Kent County, Delaware. During the week-long camp, students learn experientially about aquatic sciences, the environment, recycling and volunteerism.
- RSMAS mentors more than 150 high school students through the South Florida Student Shark Program, as they engage in shark research



## Research Goals and Successes

LMRCSC's research goal is to develop an exemplary capacity for scientific collaborations among partner institutions in the fields of marine and fisheries sciences. The Center's research focuses on coastal/estuarine waters. The Center seeks to improve understanding of the relative importance of the complex factors influencing fish populations, fish habitats and fisheries and marine ecosystems as a whole. Research activities fall into four thematic areas: 1) Fisheries socioeconomics, 2) Quantitative fisheries, 3) Essential fish habitat, and 4) Aquaculture.

Examples of research projects conducted at LMRCSC include:

- Use of mitochondrial DNA markers to evaluate US fishery management areas and effective population size of monkfish
- Temperature preferences of Atlantic croaker under hypoxic and normoxic conditions
- Examining where taurine may be the missing ingredient for development of fish-free diets for aquaculture
- Sensory ecology of tautog
- Tracking pathogens of blue crabs along a climatological and latitudinal gradient
- Development of in-situ assessment and observation methods for black sea bass
- Effects of temperature change on the distribution and behavior in *Lophius americanus*
- Polyunsaturated fatty acids and resistance to mycobacteriosis in striped bass
- Analysis of records of sightings for invasive lionfish
- Congener-specific analysis of Polychlorinated Biphenyls (PCB) accumulation in Chesapeake Bay Striped Bass (*Morone saxatilis*)
- Impact of ocean acidification on larval fish otolith growth

### For additional LMRCSC information

<http://www.umes.edu/lmrcsc>

Dr. Paulinus Chigbu, LMRCSC Director  
pchigbu@umes.edu

410-621-3034

## NOAA Center for Atmospheric Sciences (NCAS)

NCAS leads the nation in both the production of African American PhDs in Atmospheric Sciences as well as the overall production of minority PhDs in Atmospheric Sciences. The NCAS mission is to conduct research and develop applications in support of NOAA's long term goals for "Climate Adaptation and Mitigation" and preparing a "Weather-Ready Nation." In particular, NCAS addresses the NOAA National Weather Service (NWS) strategic goals of "advancing the scientific understanding and improving the prediction of air quality, climate, and weather." NCAS investigates air quality-climate-health interactions in order to provide a basis for improved scientifically-driven policy decisions. NCAS has expanded into new areas of research that focus on the social and behavioral implications of communicating weather and climate risks, in particular, culturally-based responses. NCAS employs a combination of integrated measurements, model applications, and data analyses to train students who will become the next generation of innovators, scientists, and technical specialists. NCAS collaborates with NOAA to improve weather and climate predictions, to enhance understanding of regional air quality, and to assess their impact on climate and health. This includes development of novel technologies for weather, climate, and air quality research and applications for NOAA.

### NCAS PARTNERSHIPS

Lead Institution: Howard University (HU)  
Partners: Jackson State University (JSU);  
State University of New York at Albany (SUNYA);  
University of Maryland, College Park (UMD);  
University of Puerto Rico at Mayaguez (UPRM);  
University of Texas at El Paso (UTEP); University  
of Illinois Urbana-Champaign (UIUC)

### Education and Outreach

NCAS' goal is to increase the number of US students from underrepresented communities who are educated and trained for research and operational careers in weather, climate, and air quality monitoring and prediction. NCAS graduates will have the necessary skills to contribute to the accuracy of weather and climate forecast modeling. Energetic efforts continue to enhance enrollment at partner institutions at both the graduate and undergraduate levels.

## Accomplishments

- Graduated 149 students in NOAA sciences; 93 Bachelor's, 36 Master's, and 20 PhDs
- Trained 295 students in NOAA-related science curriculum; 92% of those were African American or Hispanic/Latino
- Outreach/training to 147 high school students
- Collaborated on 189 research projects
- 155 peer reviewed articles published by scientists (faculty and students) sponsored by NOAA EPP
- 6 new faculty members hired in NCAS participating programs since NCAS was established
- NCAS has impacted the national technical workforce in atmospheric sciences
  - 5 NCAS graduates (4 PhDs and 1 MS - Master of Science) are presently NOAA employees
  - 4 current NCAS doctoral students are presently employed by NOAA.
  - 5 NCAS graduates (including 2 Bachelor's of Science) are



working as NOAA contractors.

- 6 NCAS graduates are working for other federal agencies (e.g. National Aeronautics and Space Administration (NASA), National Research Council (NRC), Department of Energy (DOE)) or academia

## Highlighting NCAS Achievements

- NCAS educates more minority PhDs in Atmospheric Sciences than any other US university
- NCAS enhances curriculum and academic infrastructure within the partner institutions through shared instruction and content, faculty and scientists exchanges, and training programs
- NCAS works with local public school systems within the jurisdictions of partner institutions to offer workshops and curriculums to K-12 teachers focusing on recent research and hands-on experiences in weather, climate and ocean topics
- NCAS faculty bring NOAA science to the community through informal learning activities that provide K-12 students with engaging hands-on experiences
- NCAS has developed a nationally recognized network of fifteen high school weather camps
- NCAS sponsors a highly visible professional development activity - Colour of Weather, Inc.™ at the annual American Meteorological Society (AMS) Meeting, with plans to expand to the Association for the Sciences of Limnology and Oceanography (ASLO) and American Geophysical Union (AGU) meetings

## Research Goals and Successes

- The NCAS Beltsville Campus was cited as an exemplar in a 2009 National Academy of Science (NAS) Report "Observing Weather and Climate from the Ground Up: A Nationwide Network of Networks," for its role in surface observations.
- NCAS has developed a unique facility for training students in the use of instruments for measurement and monitoring of surface fluxes, urban and coastal/marine boundary layer meteorological parameters, and profiles of water vapor, ozone and aerosols within the troposphere which are critical for

weather, climate and air quality research.

- The Howard University Beltsville Atmospheric Measurements Program (HUBC) is one of only two Global Climate Observing System (GCOS) Reference Upper-Air Network (GRUAN) sites in the US.
- NCAS provides Ozone sonde launches in support of regional air quality forecasts and ozone products (NCEP/Environmental Modeling Group (EMC)).
- NCAS conducts the National Weather Service (NWS) Radiosonde Replacement Program Experiments (NWS/Office of Operational Service (OOS)).
- NCAS conducts Lidar Planetary Boundary Layer (PBL) Height measurements in support of NWS Operations (NCEP).
- NCAS leads a unique international and interdisciplinary field project on Saharan Dust AERosols and Oceanographic Science Expedition (AEROSE) Expeditions (AEROSE).

Through AEROSE, NCAS provides NOAA with multi-year, in situ trace gas, aerosol, and meteorological measurement products in both near-real-time (full-resolution) and gridded data. It is one of the most extensive collections of in situ measurements of the Saharan air layer (SAL) and associated African dust and smoke outflows over the tropical Atlantic Ocean, and allows NOAA scientists and collaborators to explore and improve model prediction of aerosols and aerosol-influenced processes in the tropics.

- Collaborations across NOAA (NESDIS, OAR, NWS, OMAO), across federal agencies (NOAA, NASA), and across countries (8 nations represented)
- Atmospheric Infrared Sounder (AIRS) sea surface temperature validation/corrections to assist NESDIS satellite operational products (C-STAR)
- AEROSE measurements are used for boundary conditions in air quality forecasts with a Hybrid Single-Particle Lagrangian Integrated (HYSPLIT) dust model (ARL).
- NCAS has developed PBL parameterization schemes for weather and climate forecasts as an integral part of a team to assist NOAA and Department of Homeland Security.



- NCAS partners with NCEP to develop the Georgia Tech/Goddard Global Ozone Chemistry Aerosol Radiation Transport Model (GOCART) as NCEP global aerosol model for new forecast products (NCEP/EMC).
- NCAS has developed a comprehensive mixed-layer ocean model for next-generation Climate Forecast System (NCEP/Climate Prediction Center (CPC)).
- NCAS has developed new chemical mechanisms and products to be incorporated into the new NOAA air quality forecasting system
  - Assessment tools for NOAA air quality forecasts
  - Improvement of model chemistry and physics
  - Development of the new chemical mechanisms (Regional Atmospheric Chemistry Mechanism, Version 2 (RACM2))

**For additional NCAS information**

<http://ncas.howard.edu>

Dr. Vernon Morris, NCAS Director

[vmorris@Howard.edu](mailto:vmorris@Howard.edu)

202-865-8678 or 202-806-6905

# Scholarship Programs

The Educational Partnership Program (EPP) Graduate Sciences and Undergraduate Scholarships provide financial support that allows students to pursue academic studies and research opportunities in science, technology, engineering, mathematics (STEM), and other fields (environmental economics, law, and planning) that directly support NOAA's mission. EPP scholarship programs provide specialized training opportunities and experiences for students at the Bachelor's, Master's and Doctoral levels. EPP scholarship recipients conduct scientific research, author papers in peer-reviewed journals, present their research at scientific meetings, and complete science degree programs at all academic levels (undergraduate through doctoral levels). A core component of the EPP scholarship programs are the mentoring relationships developed between NOAA employees, students and their academic advisors. EPP staff monitors each scholarship recipient through structured reporting requirements to ensure that students are on track in their studies and in their NOAA internships. Rigorous competition for these scholarships, along with careful tracking of the students ensures a high program completion rate.



NOAA's Educational Partnership Program administers and manages two competitive scholarship programs:

- a. The Graduate Sciences Program (GSP) provides graduate level training in NOAA mission critical sciences and entry-level employment with NOAA for outstanding candidates.
- b. The Undergraduate Scholarship Program (USP) provides stipends for two academic years to students attending Minority Serving Institutions (MSIs), plus paid summer internships to conduct research at NOAA facilities.

EPP scholarship programs have increased the number of students, particularly from underrepresented communities, who graduate with degrees in NOAA mission-critical STEM fields. Of the 146 undergraduates supported by the USP, 67 have obtained degrees in NOAA-related fields, and the remainder are on track to complete on time. Upon completion of GSP training programs, students, who are already NOAA employees, transition to full-time status—thoroughly familiar with the functioning of the agency, as well as the office or lab in which they work, reducing any “new employee learning curves.” To date, the GSP program has supported 57 students; 9 remain in the pipeline and are on target to complete their degrees within the next 18 months.

## Graduate Sciences Program (GSP)

The goal of the GSP is to recruit and train outstanding candidates in NOAA mission-related sciences. Its success is demonstrated by increased opportunities for students to pursue research and educational training in atmospheric, environmental and oceanic sciences at minority serving institutions, when possible. This multi-year program provides qualified graduate students with formal periods of work, study and structured classroom training in an array of NOAA-mission critical fields, including but not limited to: meteorology, hydrology, cartography, oceanography, ecology, environmental science, remote sensing technology, geography, environmental planning, marine science, fisheries biology, computer science, and environmental law. The Graduate Sciences Program pays for tuition, books, lab fees, and provides a housing allowance at the selected university, travel expenses, and salary during 16 weeks of NOAA work experience per year for each participant at a NOAA research facility.

## GSP Student Profiles

**Kate Abshire** received her Master's degree in Water Resources Engineering from Duke University in May 2012. Her Master's Thesis was entitled, "Impacts of Hydrologic and Hydraulic Model Connection Schemes on Flood Simulation and Inundation Mapping in the Tar River Basin." She had previously graduated with Distinction from The University of Virginia in 2010 with a Bachelor of Science in Environmental Sciences. She is now a full time physical scientist in NOAA's National Weather Service, working in the field of hydrology.



In May 2011, Graduate Sciences Program (GSP) student **Melanie Harrison** completed her PhD in Marine, Estuarine, and Environmental Sciences with a concentration in Environmental Science from the University of Maryland Baltimore County. Melanie is now a full-time employee of NOAA's National Marine Fisheries Service (NMFS) Southwest Region, Protected Resources Division in Santa Rosa, California. Her dissertation, entitled "Biogeochemical Hotspots of Nitrogen Removal in Urban Streams and Riparian Wetlands," focused on

restoration actions in urban watersheds as a strategy to reduce nitrogen loading in urban storm water runoff. In her new position as a Fish Biologist at NMFS, Dr. Harrison collaborates with the staff responsible for the Magnuson-Stevens Fishery Conservation Act Essential Fish Habitat recommendations. Her work includes providing recommendations for Endangered Species Act consultation documents and assisting in the development of recovery plans, strategic plans, and policy.

**Micheal Hicks** received a PhD from Howard University's Graduate Program of Atmospheric Science (HUPAS), the lead university for NCAS in the spring of 2012. His studies have focused primarily on surface-atmosphere energy and mass exchanges at Howard University's Beltsville, MD, Atmospheric Observatory. His research used Raman Lidar, radiosondes, and surface flux tower observations to analyze the impact of urbanization on planetary boundary layer processes. Micheal had previously received a Bachelor of Science



in Mathematics from Paine College of Augusta, GA, in 2006. As an undergraduate scholar, he worked at two NOAA summer internships, which developed his interest in the field of atmospheric sciences. He is now working full-time with the NWS Field System Operations Center Observing System Branch.

**Dominic Hondolero**, a Graduate Sciences Program (GSP) student, received his Master's Degree in Ecology in December 2011 from San Diego State University. His thesis was entitled, "Physical and Biological Characteristics of Kelp Forests in Kachemak Bay, Alaska." During his tenure as a GSP, he was primary author for a paper published in the journal *Polar Biology*, entitled, "Caloric Content of Dominant Benthic Species from the Northern Bering and Chukchi Seas: Historical Comparisons and the Effects of Preservation." Dominic is a full-time employee in NOAA's National Ocean Service. At NOS, Dominic is an Oceanographer at the NOAA Center for Coastal Fisheries and Habitat Research in Kasitsna Bay, AK.



**James Sims** is an alumna of both the USP and GSP programs and received her PhD in Atmospheric Science in 2009 from Howard University, lead partner for NCAS. She is a full-time employee of the NWS National Center for Environmental Prediction Environmental Modeling Center (NCEP EMC). Her dissertation, entitled "The Relationship Between Air-Sea Interactions and Tropical Cyclone Intensity," investigated the impact of air-sea interactions (latent and sensible heat

fluxes) on the forecasting of tropical cyclone activity in the Atlantic Ocean. James received a B.S. in Meteorology from Jackson State University (JSU) in 2004. During her matriculation at JSU, she was awarded an internship with the NOAA EPP Undergraduate Scholarship Program where she began working with NCEP EMC Marine Modeling and Analysis Branch (MMAB). After completing her degree at JSU, James simultaneously applied to the GSP program and Howard University. In her current position as a research meteorologist, James is continuing to work on projects utilizing HWRFTM to improve tropical cyclone forecasting as well as assisting with marine data base activities.

Beyond student education, each participant works with a NOAA mentor during the training period. The student, NOAA mentor, EPP GSP manager and university research/academic advisor all participate in quarterly meetings to discuss the thesis/dissertation research to ensure its alignment with NOAA's mission-critical sciences. The NOAA mentor is also a voting member of the student's research committee. Since the establishment of the program, 57 GSP students have been hired as NOAA professionals. GSP students work in all NOAA line offices and account for 19% of underrepresented minorities hired into NOAA professional science positions.

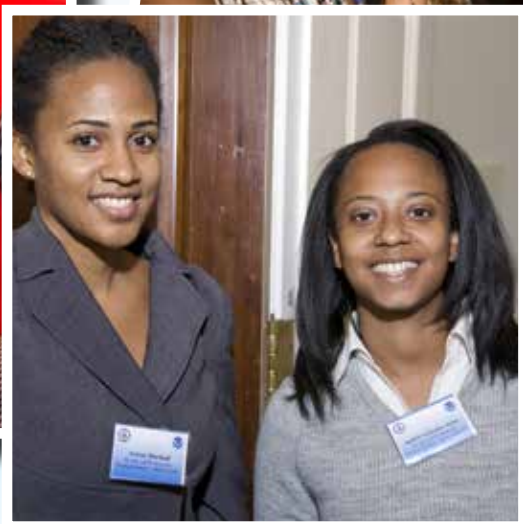
### **Undergraduate Scholarship Program (USP)**

Recognizing that hands-on research experience is integral to the development of scientists in environmental sciences, NOAA's Undergraduate Scholarship Program provides exceptional opportunities for students to build their research skills and resumes. Through this two year scholarship, each undergraduate intern has the opportunity to receive one-on-one mentoring from world-class scientists. Additionally, individualized research projects (based on the scholar's academic field of study) challenge students to expand their capability beyond formal academic training and to build research skills that focus on NOAA research or operational issues. Each scholar receives approximately \$28,000 for two academic years to cover the costs of tuition and fees, two summer internships, travel to conferences and housing allowance.

Targeting students in underrepresented communities, the USP recruits students attending MSIs. The USP selects recipients during their sophomore year, at a time when they have chosen (or are about to choose) their major field of study. Scholars are selected based on several objective criteria: academic record; interest in NOAA sciences; community activities; and communication skills. Students are given a two-week orientation to learn about the agency's mission, and are immediately immersed in research projects with NOAA mentors. Two paid 10-week summer internships provide USP recipients with opportunities to work with notable NOAA environmental scientists. Scholars complete a research project each summer, presenting their results to the NOAA community at a student symposium. Opportunities also exist to publish findings. At present, 125 undergraduate scholars have completed the two-year program and 25 students are in the pipeline.







# Environmental Entrepreneurship Program

The Environmental Entrepreneurship Program (EEP) was established to provide students with training in the application of NOAA sciences in order to foster economic development opportunities. EEP facilitated partnerships among MSIs; various NOAA offices; academic, research, government and business organizations that helped prepare students with appropriate knowledge and skills to exploit environmental tools and technological resources. Projects fell into one of two categories: *Environmental Demonstration* projects were geared towards engaging



MSI students and faculty in collaborative, field-based learning experiences. These endeavors trained students in a complement of entrepreneurial and technical skills that lead to business development opportunities in their local communities. *High School Pipeline* projects entrained a “pipeline” of high school (and even middle school) students to facilitate their understanding concepts of NOAA-mission sciences and social sciences. The aims of both categories were to encourage the pursuit of careers, advanced degrees or environmental entrepreneurship opportunities in fields directly related to NOAA’s mission.

Additionally, EEP strengthened the capacity of MSIs to promote student careers and advanced academic studies, as well as business opportunities. In a larger sense, the program had as a goal the fostering of economically viable and environmentally sustainable communities. Funds were provided on a strictly competitive basis.

EEP awarded \$15,142,674 to 51 different projects. 1844 students were part of the program, 54% of them from underrepresented communities. 959 of those participants were college students, while the remainder were high school and middle school students.

## Oxnard College’s Environmental Demonstration Project: White Abalone Restoration

Oxnard College’s (Oxnard, CA) project was a multi-part program of academic studies, hands-on experience in white abalone hatchery operations and research in the laboratory and at sea, and hands-on coastal dune restoration, providing a range of marine science career-related experiences. The Marine Studies Program at the college serves hundreds of students annually. Most are members of traditionally underrepresented populations, often from economically disadvantaged communities. Some of the EEP funds provided for paid internships, giving students the financial wherewithal to forego other jobs and focus on classes, lab work and field studies. Funds were also used to offer students opportunities for ocean research cruises. The proximity of the Channel Islands National Marine Sanctuary and Channel Islands National Park allowed for one-day cruises; students observed and participated in ocean research, familiarizing them with conditions in the marine environment.

Over the six-year grant period, objectives achieved included: providing environmental restoration education on campus, in the field and at professional conferences; promotion of environmental entrepreneurship in aquaculture and marine science and experiential education in laboratories. Curriculum development at Oxnard College included the Coastal Environmental Studies Associate of Arts and Associate of Science degrees, both of which were broad in scope and prepared students for transfer into such majors as Environmental Science and Resource management at California State University, Channel Islands and the Environmental Studies Program at University of California Santa Barbara.

The hands-on nature of the grant focused on entrepreneurial principles as well, taught to students in the Aquaculture course. The grant raised awareness among students and in the local community regarding the need for environmental stewardship and conservation of coastal resources. In sum, the activities associated with the grant added research interest and capability to the courses, facilitated the development of two degree programs, enhanced existing courses, and cemented lasting partnerships with various environmental agencies and four year universities.



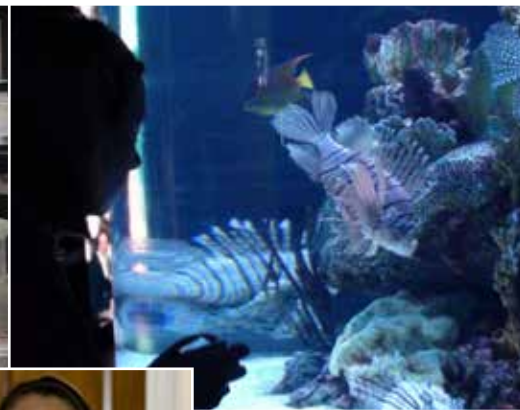
## Glossary of Acronyms

**ABET** - Accreditation Board for Engineering and Technology  
**AEROSE** - AERosol Ocean Science Expedition  
**AOD** - Aerosol Optical Depth  
**BAMS** - Bulletin of the American Society  
**CREST** - Cooperative Remote Sensing Science and Technology Center  
**CSC** - Cooperative Science Center  
**CUNY** - City College of the City University of New York  
**DOE** - Department of Energy  
**ECSC** - Environmental Cooperative Science Center  
**EEP** - Environmental Entrepreneurship Program  
**EPP** - Educational Partnership Program  
**ESRL** - Earth System Research Laboratory  
**FAMU** – Florida Agriculture and Mechanical University  
**GOCART** - Georgia Tech/Goddard Global Ozone Chemistry Aerosol Radiation Transport Model  
**GSP** - Graduate Sciences Program  
**HBCU** - Historically Black Colleges and Universities  
**HWRFTM** - Hurricane Weather Research and Forecasting Model  
**ISET** - NOAA Interdisciplinary Scientific Environmental Technology Cooperative Science Center  
**K-12** – Kindergarten through 12th grade  
**LISCO** - Long Island Sound Coastal Observatory  
**LMRCSC** - Living Marine Resources Cooperative Science Center  
**LO** - Line Office  
**MSI** - minority serving institution  
**NAS** - National Academy of Sciences  
**NASA** - National Aeronautics and Space Administration  
**NCA&T** – North Carolina Agriculture and Technology University  
**NCAS** - NOAA Center for Atmospheric Sciences  
**NCEP** - National Centers for Environmental Prediction  
**NERRS** - National Estuarine Research Reserve System  
**NESDIS** - National Environmental Satellite, Data and Information Service  
**NOAA** - National Oceanic and Atmospheric Administration  
**NRC** - National Research Council  
**NSB** – National Science Bowl  
**NSF** - National Science Foundation  
**NWS** - National Weather Service  
**OAR** - Office of Oceanic and Atmospheric Research  
**OMAO** – Office of Marine and Aviation Operations  
**OOS** - Office of Operational Service, NWS  
**PBL** - Lidar Planetary Boundary Layer  
**SMaRT** - Summer Microbiology and Research Training Program  
**STEM** – Science, Technology, Engineering and Mathematics  
**UMES** - University of Maryland Eastern Shore  
**UAF** - University of Alaska Fairbanks  
**USP** - Undergraduate Scholars Program

## Endnotes

1. America Competes Act, P.L. 110-69 <http://www.gpo.gov/fdsys/pkg/PLAW-110publ69/pdf/PLAW-110publ69.pdf>
2. U.S. Department of Commerce, Economics and Statistics Administration, “Education Supports Racial and Ethnic Equality in STEM,” <http://www.esa.doc.gov/Blog/2011/09/13/education-promotes-racial-and-ethnic-equality-science-tech-engineering-and-math-jobs>





Educational Partnership Program | Office of Education National Oceanic and Atmospheric Administration | U.S. Department of Commerce

