



2014 HAWAII UNIVERSITY INTERNATIONAL CONFERENCES  
SCIENCE, TECHNOLOGY, ENGINEERING, MATH & EDUCATION  
JUNE 16, 17, & 18 2014  
ALA MOANA HOTEL, HONOLULU, HAWAII

# A NATIONAL MODEL FOR INCREASING THE NUMBER OF MINORITY GRADUATES IN ENVIRONMENTAL SUSTAINABILITY

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## **A National Model for Increasing the Number of Minority Graduates in Environmental Sustainability**

### Synopsis:

The City College of New York in collaboration with the US Department of Education developed and implemented a graduate program to support and train graduate students in Earth Sciences and Environmental Sustainability (ESES) fields. The ESES Graduate Initiative aims to increase the quality of the graduate experience through updated curriculums and exposure to cutting edge research projects in ESES fields.

## A. Background

There is a Global need for trained professionals with interdisciplinary skills to face the current and upcoming environmental challenges. The environment and its surroundings are rapidly changing as the Earth evolves and with it the population growth. The current population is numbering over 6.5 billion and continues growing placing high demands on basic resources. The Nation's most pressing current environmental concerns are linked to climate change, energy, water resources, waste and food and according to the President's Council of Advisors on Science and Technology report (February 2012), there will be one million fewer STEM graduates over the next decade than U.S. industries will need.

Data provided by the US National Science Foundation (NSF) indicates that about 520,000 bachelor degrees were awarded in 2010 and only approximately 20% of students who get a bachelor degree in the science and engineering fields pursue higher education. In addition, the data clearly shows that minority groups and women are substantially underrepresented in STEM fields (Figure 1).

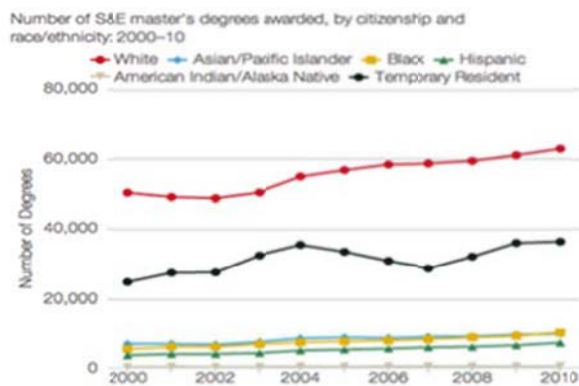


Figure 1 Number of Master's Degrees in Science and Engineering

Studies have identified important factors that prevent students from having a good academic performance and succeeding in the professional life. Some of the factors are: a) lack of preparation for graduate studies, b) minimum professional experience, c) lack of scientific publications, and d) poor communication skills, among others.

## B. Program Overview

The City College of New York (CCNY) in collaboration with the US Department of Education developed and implemented a holistic and rigorous graduate program to support and train graduate students in Earth Sciences and Environmental Sustainability (ESES) fields. The ESES Graduate Initiative aims to increase the quality of the graduate experience through updated curriculums and exposure to cutting edge research projects in ESES fields and to increase the number of Hispanics and other underrepresented minorities in the field.

The mission of the ESES Graduate Initiative is to create a welcoming and intellectually inspiring environment that engenders underrepresented graduate students from engineering, science and architecture to become scholars in the emerging fields of Earth Sciences and Environmental Sustainability.

## C. ESES Graduate Educational Model

The ESES graduate model consists of several elements that together provide students with a high degree of knowledge in ESES topics, a distinguish level of work in the field and the skills required to succeed in the professional life.



Figure 2  
The elements of the graduate model include:

- Summer Bridge Program
- Mentorship and Advising
- Professional training
- Research
- Summer and Academic Internships

#### a. Summer Bridge Program

The Summer Bridge Program helps students to have a seamless transition into graduate studies by providing the academic environment and tools needed to excel in the master or doctoral program. The summer program consists of four phases to help the student embark on graduate level studies.

- Phase I Orientation week: during this week senior and young faculty, postdoctoral researchers and graduate students give presentations and participate in panel discussions so that the students get familiar with our people and research groups at CCNY. They also get a sense of what kind of research they could conduct during their graduate studies.
- Phase II Training: during this two-week period students receive intensive training in Geographical Information Systems (GIS),

Remote Sensing and MATLAB. The short courses are taught by CCNY professors and/or postdoctoral researchers.

- Phase III Introduction to ESES Research Questions: this three-week session has a rotating theme on subjects related to ESES fields. Professionals with expertise in those subjects are invited to give lectures and present scientific research questions to the students.
- Phase IV Exploring ESES Research: in this phase students are given the freedom to research alongside a mentor within ESES topics and get the opportunity to apply all the tools and knowledge they have gained throughout the program

The last day of the summer program students have the opportunity to present their research findings at the annual symposium at CCNY.

#### b. Mentorship and Advising

Key to the success of any student in the professional life is effective mentoring. Studies have shown that mentoring has a great impact on students' professional lives. Each ESES fellow is assigned to a mentor. The ultimate goal of the mentor is to provide support to the student to become an independent researcher. Mentors' responsibilities include sharing knowledge and skills, overseeing the student's work, helping the students to make contact with other researchers and assisting with career counseling.

#### c. Professional Training

The main objective of this component is to expose students to the real professional life and broaden their knowledge on ESES fields. For this, the Graduate Initiative hosts professionals from different sectors, government, industry and academia, to come to CCNY and give seminars on their work. Guest speakers spent one to two days with the students providing mentoring and answering scientific questions. Students get the opportunity to network and develop a

connection that supports them through the academic journey and professional life.

#### **d. Research**

Aside from the summer research during the Summer Bridge Program, research is also conducted throughout the rest of the academic year. Students are paired with a mentor throughout their graduate career and based on the students' research interest and major. Faculty mentors meet the fellows at least once per week to discuss research progress.

The Graduate Initiative provides the environment, training, facilities and materials for students to conduct research. Student research topics include, but are not limited to: Sustainable Coastal Urban Systems, Climate, Energy Systems, Water Resources, and Ecosystem Services and Biodiversity.

#### **e. Academic and Summer Internships**

ESES requires students to participate at least in one internship during their graduate studies. Students often need to accommodate their academic schedules to find the best summer season to find internships. For instance, doctoral students are more likely to participate in an internship in the second year as they are required to take the qualification exams in the first year of the doctoral program. Appropriate selection of the time to participate in an internship is very important because the students must have the appropriate background to succeed and take advantage of the opportunities.

Internship placements vary based on student interests and future prospects. For instance, Master students interested in pursuing doctoral studies may want to join an internship at a research lab so they can build on their research skills. Others may have interest on working in the industry sector so they may want an internship there to build connections.

The Initiative facilitates the process of internship placements through its partners at the government, industry and academia sectors. Internship positions may also correlate with research being conducted in the CCNY campus. In the previous years, ESES fellows have gone to institutions and governmental agencies like the National Oceanic and Atmospheric Administration, NASA Jet Propulsion Laboratory, and the Environmental Protection Agency.

#### **f. Conferences and Publications**

ESES Fellows have the opportunity to travel across the Nation to showcase their research at technical conferences. Students are encouraged to publish at least one or two papers to showcase their research with ESES and CCNY faculty. Publishing will increase students' profiles and will make them a competitive candidate for jobs and careers in the variety of sectors in the field.

#### **D. Program Accomplishments**

In only three years the Graduate Initiative has provided training and academic support to 23 graduate students and seven of them have graduated with diverse degrees in engineering and sciences. In addition, nine ESES fellows have successfully participated in summer internships. ESES students have published about 7 technical papers and given more than 22 presentations at national technical conferences. The biggest accomplishment is the high overall students' retention which is about 80%.

#### **E. Program Challenges**

The main challenge the program faced in its first year was students' retention. The Graduate Initiative supports mostly students from underrepresented groups. The majority of them faces many personal issues and is clear they are not well-prepared for higher education. The Graduate Initiative implemented a strong mentoring program that not only provides the

appropriate support to students but also acts proactively to prevent students from dropping the program. In addition, senior students were engaged in providing training to junior students during the academic year.