



COLUMBUS STATE

UNIVERSITY

**ENVIRONMENTAL SCIENCE
GRADUATE PROGRAM**

COMPREHENSIVE PROGRAM REVIEW

SELF STUDY

2010 – 2011

ENVIRONMENTAL SCIENCE GRADUATE PROGRAM COMPREHENSIVE PROGRAM REVIEW

EXECUTIVE SUMMARY

Major Findings of the Program's Quality and Productivity

Program Quality

The quality of the Graduate Program in Environmental Science (ENVS) is very high. Columbus State University's ENVS curriculum is unique in Georgia, encompassing courses in biology, chemistry, geology, environmental law, and environmentally important societal issues, thereby allowing graduates to gain employment in a wide range of careers. Of program graduates who responded to a recent on-line survey, 82% are either employed in an environmentally-related job or are in doctoral programs at other universities. The recent addition of a non-thesis option to the Master of Science degree track has increased program enrollment, retention and graduation. The program provides opportunity for its students to pursue a thesis based or a non-thesis based Master of Science degree so that we can appeal to a wider student audience. Our graduate classes are rigorous and often involve overnight field trips with hands-on activities that nurture valuable connections among the faculty and the students. ENVS students have received research grants, conducted important research projects, and presented their findings in regional and national scientific meetings.

The quality of the ENVS faculty is a major factor in the program's success. They are highly qualified (93% with terminal degrees) and have expertise in the primary fields of modern environmental science. Many pursue significant, grant-supported research programs. They have received more than 500K in external grants and published 53 refereed articles in the last 5 years alone. ENVS faculty members have amassed an outstanding record of service to the community, university and their professions. Many have significant university and professional awards, including three "Educator of Year" awards, three "Faculty Research and Scholarship" awards, and one "Faculty Service" award.

The principle weakness of the program is the limited amount of ENVS-dedicated laboratory space and equipment. Many of the labs are under the aegis of individual academic department and consequently are often completely booked. This problem will become more acute as the student population continues to grow. Important laboratory facilities, such as fume hoods, dangerous chemical storage, and chemical spill containment kits are needed in ENVS faculty and student labs in LeNoir Hall Annex. Although the need for graduate teaching assistants in departments of Biology, Chemistry and Earth and Space Sciences is great, the number of assistantships available is unacceptably low. Existing graduate assistantships provide inadequate compensation for the students (3K/semester). Lastly, heavy course and committee loads of ENVS faculty limit their ability to effectively mentor graduate students and to pursue their own research agendas. There will be even heavier course and student-mentoring responsibilities with the addition of a new undergraduate degree track in the Department of Earth and Space Sciences (Fall 2011).

Recommendations for Improving Program Quality

- Obtain additional ENS lab space with appropriate facilities for student and faculty research
- Obtain funding for more graduate assistantships with adequate levels of compensation

- Implement a faculty work-load regimen to facilitate critical acquisition of external grants that support student and faculty research
- Hire a new faculty member in Environmental Science
- Gain Admission to the Gulf Coast section of the Cooperative Ecosystem Studies Units (GC-CESU)
- Strengthening of Ties with Fort Benning

Program Productivity

The productivity of the ENVS program is very good. The number of students enrolled in the program has increased 167 % since 2005 when a new program director was appointed, following a two-year interval with no director at the helm. With the implementation of the non-thesis track (2008) the number of students graduating has increased 233 %. Credit hour production for Fall and Spring semesters has risen 476 % from 2005-2010. During the same period, the cost per credit-hour has dropped from \$1,436 to \$410. We believe that enrollment in the program will grow even faster with the adoption of the following improvements.

Recommendations for Improving Program Productivity

- Implement new ENVS undergraduate track to feed the graduate program
- Create a 4 – 1 undergraduate – graduate degree program.
- Offer a new professional science masters degree track
- Develop articulation agreements with Georgia Perimeter College and Other 2-Year Colleges in Georgia to provide students a fast-track to the proposed ENVS undergraduate degree
- Increase recruiting efforts through:
 - development of powerful internet marketing tools
 - development of an attractive ENVS program brochure
 - travel to other campuses in our region to promote our program
 - promotional activities at professional meetings
- Creation of Agreements with Georgia Perimeter College and Other 2-Year Colleges in Georgia
- Creation of a 4 – 1 Undergraduate – Graduate Degree Program
- Offer a New Professional Science Masters Degree Track

Conclusions about Program's Viability at CSU

Columbus State University's Environmental Science (ENVS) Graduate Program boasts a group of accomplished, professional instructors with an outstanding record of scholarship and service. The program features a curriculum based broadly in all major areas of environmental science today, and is designed to produce successful graduates with the skills and knowledge to pursue a wide range of careers or to further their graduate education. Our ENVS program is unique in Georgia in its focused mission, and its multi-disciplinary breadth of instruction. The U.S. Bureau of Labor Statistics Occupational Outlook Handbook for 2010- 2011 forecasts that jobs in environmental science related fields will grow at a rate of 29% in the future. Our graduates are ideally situated to gain employment in this important and expanding job market. As the program grows in numbers of students and numbers of graduates, it draws from an expanding geographic area from which those students are drawn. For all of the reasons cited in these paragraphs , we rate our program's viability as very strong.

Program Improvement Plan

[This section is to be completed by the Dean of the College of Letters and Sciences in consultation with the VPAA at the conclusion of the self-study conducted by the program.]

Summary Recommendation and Supporting Rationale

Enhance and Expand the Program. The field of Environmental Science is growing at all levels in our nation. As understanding of the importance of a clean environment, sustainable growth and renewable energy grows, job opportunities are growing proportionally. The history of CSU's ENVS program over the past five years demonstrates that further growth is highly likely. Especially with the advent of a new undergraduate track in Environmental Science and with implementation of promotional activities enumerated above, our enrollment numbers will increase even more than they have over the past five years. External funding opportunities for environmental research are increasing nation-wide, as are employment opportunities for Environmental Science program graduates. Consequently, the expansion of CSU's ENVS program has great potential to serve as a promotional tool to appeal to young and environmentally-conscious students graduating from high schools. A thriving ENVS program will also benefit CSU as it seeks to enhance its stature as a regional leader in education and scientific expertise. In our estimation, the Environmental Science graduate program holds great promise for generating a significant return on investments that will benefit CSU students surrounding communities, and our university well into the future.

ENVIRONMENTAL SCIENCE GRADUATE PROGRAM

COMPREHENSIVE PROGRAM REVIEW

APPENDIX I: SELF STUDY

SECTION I – PROGRAM BACKGROUND AND OVERVIEW

I. Brief Program Overview

Description of Program

Columbus State University's Master of Science in Environmental Science (ENVS) program provides a rigorous and diverse two-year curriculum that prepares graduates for successful careers in the rapidly growing industry of environmental management and protection. Still unique in the state of Georgia, the ENVS program offers advanced training, education and research opportunities to post-baccalaureate science students through evening and weekend classes in Biology, Chemistry, Ecology, Geology and Anthropology, and both thesis and non-thesis degree tracks. Graduates serve as environmental professionals in local, state, and federal environmental resource agencies; in the private sector as environmental consultants; or enter doctoral programs in environmental science or related fields at other universities.

The ENVS program's singular diversity of course offerings and flexible curriculum encourage each student to design a unique program suited to his or her individual goals. Student by student, we emphasize the building of a firm foundation in the underpinning concepts of environmental science, proficiency in designing and conducting original research, and effectiveness in communicating the results in both written and oral forms. Our curriculum includes advanced courses in toxicology, environmental chemistry, environmental geology, paleontology, geomorphology, hydrology, and geography. Because many environmental problems are inherently societal issues, we also offer courses in Environmental Law and Regulation; Culture and the Environment; Human Ecology; Land-Use and Waste Management; and Water Resources Management.

The Program's curriculum outcomes were created to ensure our students graduate with:

- an understanding of basic fluid mechanics and how water flows on and beneath the surface of the planet
- knowledge concerning how human interact (e.g., mining) with the geologic environment with an emphasis on the potential hazards associated with geologic phenomena (e.g., volcanoes, earthquakes, and tsunamis)
- an understanding of the fundamentals of aquatic and atmospheric chemistry and the methods used to analyze their chemical constituents

- an understanding of ecology and how to design ecological experiments, analyze data, and report their findings
- an understanding of environmental policy and statutes and how the resulting regulations influence human actions
- the ability to find and analyze the scientific literature and prepare both written and oral critiques of environmental research

Program Mission and Its Relation to the Mission of Columbus State University

In keeping with the mission of Columbus State University, the ENVS program's mission is to:

- To achieve academic excellence through teaching and research
- To achieve excellence in the preparation of environmental professionals
- To achieve recognition as a scientific leader in environmental analysis and management
- To foster environmental awareness in the local community and to develop public-private partnerships to enhance the quality of life in our region

Stakeholder's Satisfaction with the Program

A survey of graduates from the ENVS program was conducted in connection with this Self Study. The results of this survey show that graduates feel strongly that CSU's ENVS program was highly beneficial to their careers. On a scale of "Strongly Disagree" to "Strongly Agree," responses to survey questions were as follows:

- *CSU's Environmental Science graduate program prepared me well for my job or for graduate school:* 64% "Strongly Agree;" 36% "Agree"
- *The skills I learned in the ENVS graduate program are important in my job or in graduate school:* 72% "Strongly Agree;" 28% "Agree"
- *CSU's Environmental Science graduate program is comprehensive:* 82% "Strongly Agree;" 18% "Agree"
- *CSU's Environmental Science graduate program is rigorous:* 45% "Strongly Agree;" 45% "Agree;" 9% "Neutral"
- *CSU's Environmental Science graduate program provided me with an adequate number of course options:* 54% "Strongly Agree;" 27% "Agree;" 9% "Neutral;" 0% "Disagree"

Relationship of the Program to Needs of Students and Societal Demands

In society today, issues affecting the physical environment present increasingly greater demands and concerns. These range from local problems such as stream, air and groundwater pollution, to national problems such as energy use and sustainability, to global problems such as anthropogenic climate change. Columbus State University's Environmental Science program is designed to train professional scientists who can critically assess a wide range of environmental issues, create plans

for sound environmental management, and deal effectively with environmental problems arising from population and industrial growth.

The job market for broadly trained environmental scientists is growing rapidly. The United States Bureau of Labor Statistics Occupational Outlook Handbook (2010-11 Edition) states “Employment of environmental science and protection technicians is expected to grow much faster than average, at a rate of 29 percent; these workers will be needed to help regulate waste products; to collect air, water, and soil samples for measuring levels of pollutants; to monitor compliance with environmental regulations; and to clean up contaminated sites. Most of this growth is expected to be in firms that assist other companies in environmental monitoring, management, and regulatory compliance” (see: <http://www.bls.gov/oco/ocos115.htm>). Our graduates are ideally situated to compete for jobs in this expanding industry.

SECTION II – INDICATORS OF PROGRAM QUALITY

II. A. Quality of Faculty: Above Average

The Environmental Science program integrates the expertise of faculty from multiple CSU academic units who specialize in Anthropology, Biology, Botany, Chemistry, Geography, Geology, Paleoecology, Paleontology, and Public Policy. Three ENVS faculty have won the distinction of Educator of the Year (Ballenger, Birkhead, Frazier); three received the annual Faculty Research and Scholarship Award (Burgess, Birkhead, Schwimmer [twice]); and one earned the Faculty Service Award (Ballenger). **Some faculty members are actively engaged in pioneering research and are widely recognized experts in their fields of expertise. The following are among responses of program graduates asked to identify program strengths and weaknesses:**

“The professors. Each is extremely knowledgeable and all do research in their field of expertise. I loved every class I took and wish I had the money to just take a class whenever I wanted.”

“Knowledge and skills of professors and their willingness to share information.”

“The professors are really passionate about teaching. Field trips and hands-on experience really helped.”

Appropriateness of Faculty Credentials

The credentials of ENVS faculty show them to be highly-skilled instructors with an understanding of social, economic and political contexts in which environmental science is conducted. All except one ENVS faculty member holds a doctorate from a highly-regarded university. Program faculty members, their highest degrees, and their thesis titles are listed:

- William J. Frazier, Director Environmental Science Graduate Program, Professor of Geology
Ph.D., University of North Carolina at Chapel Hill in Sedimentary Petrology (1974)
Dissertation: *Carbonate Petrology of the Pennington Formation in Central Tennessee*
- Samuel M. Abegaz, Assistant Professor of Chemistry
Ph.D., Ghent University, Belgium in Chemistry (2005)
Dissertation: *Investigation of input and distribution of polluting elements in Tinishu Akaki River, Ethiopia, based on the determination by ICP-MS*
- Julie A. Ballenger, Chair of Department of Biology, Professor of Biology
Ph.D., Miami University, Ohio in Botany (1992)
Dissertation: *A biosystematic revision of genus Cercis L. (Leguminosae) in North America*
- John A. Barone, Associate Professor of Biology
Ph.D., University of Utah in Biology (1996)
Dissertation: *Herbivory and Tropical Forest Tree Diversity*
- William S. Birkhead, Professor of Biology
Ph.D., University of Texas, Austin in Zoology (1968)
Dissertation: *The Comparative Toxicity of Ariid and Ictalurid Catfish Stings and a Quantitative Assessment of Their Protective Function*
- Roger W. Brown, Associate Professor of Environmental Science
Ph.D., University of Tennessee, Knoxville in Geography (2002)
Dissertation: *Paleoecological Evidence of Pre-Contact Human Impacts on Fire and Vegetation in Northern New York State, U.S.A.*
- Kevin S. Burgess, Assistant Professor of Biology
Ph.D., University of Guelph, Ontario in Botany (2004)
Dissertation: *The genetic and demographic consequences of hybridization in small plant populations*
- Warren B. Church, Professor of Anthropology and Archaeology
Ph.D., Yale University in Anthropology (1996)
Dissertation: *Prehistoric Cultural Development and Interregional Interaction in the Tropical Montane Forests of Peru*
- John Kevin Davis, Associate Professor of Biology
Ph.D., Indiana University, Bloomington (1993)
Dissertation: *Cloning of a Gene Involved in Benzoate Catabolism under Denitrifying Conditions from Alcaligenes xylosoxidans subspecies denitrificans, strain PN-1.*
- Zewdu Gebeyehu, Professor of Chemistry
Ph.D., Philipps University, Marburg, West Germany (1991)
Dissertation topic: Inorganic/Analytical Chemistry
- Frederick Gordon, Assistant Professor of Political Science
Ph.D., University of Southern California in Political Science and Public Policy (2005)

Troy Allen Keller, Assistant Professor of Environmental Science

Ph.D., University of Michigan, Ann Arbor, in Biology (1997)

Dissertation: *Influence of an Omnivore, Nutrients, and Site Heterogeneity on Stream Algal and Invertebrate Communities*

David R. Schwimmer, Professor of Vertebrate Paleontology

Ph.D., Stony Brook University, in Paleontology/Earth and Space Sciences (1973)

Dissertation: *The Middle Cambrian biostratigraphy of Montana and Wyoming.*

George Stanton

PhD (zoology), University of Maine, in Zoology (1969)

Dissertation: *Behavioral responses of adult apple maggots (Rhagoletis pomonella) to visual and olfactory stimuli*

Carson Stringfellow, Assistant Professor of Biology

M.Sci., Columbus State University in Environmental Science (1997)

Thesis: *A Descriptive Survey of Freshwater Unionidae Bivalves in Five Creeks Located in West Central Georgia.*

Use of Part-time Faculty

The ENVS Program has not utilized Part-time Faculty since Fall, 2009. A Part-time instructor was utilized from 2005 to 2010 to support teaching of ENVS 6106: Environmental Law and Regulations prior to 2006. The Environmental Law course is now taught by a Full-time Faculty (Gordon).

Diversity of Faculty

Thirteen of the fourteen ENVS faculty are male, while two are African. These faculty members conducted their thesis research at a wide variety of universities across the nation, as well as in Germany, Belgium and Canada. Although primarily focused on the southeastern US, faculty geographic experience also extends to Africa, Latin America, and the Caribbean Islands.

Opportunities for Faculty Development

Columbus State University has a competitive program for Faculty Development grants. Faculty must apply for these grants on a semi-annual basis. These grants can be used to support scholarly activities such as research, travel, and supplies. These grants are generally small amounts of money (< \$5,000). Faculty can also apply for larger equipment grants from the Student Activity Funds. These funds are reserved for equipment that will be used by many students and thus is not available for research-focused equipment needs.

Program Improvement Plans

- Develop a policy for giving teaching credit or reduced teaching loads for graduate thesis mentoring, grant writing, or related activities
- Acquire funds for faculty participation in workshops or training sessions in the use of advanced technologies and instrumentation and leading to professional certification or licensure
- Hire part time faculty to present specialized courses for our students leading to professional certification or licensure
- Increase funding for faculty travel to attend conferences or other professional activities

II. B. Quality of Teaching: Above Average

Indicators of Good Teaching

The quality of faculty teaching and mentoring is a critical factor in graduate programs because students' hiring opportunities and potential for further graduate education are both based significantly on the strength of their educational background and the quality of the faculty. The Environmental Science (ENVS) Graduate Program's ability to use faculty drawn from Departments of Biology, Chemistry and Earth and Space Sciences allows for a higher degree of advanced scientific specialization than programs based solely in Biology or Ecology programs. The number of faculty from Biology, Chemistry and Earth and Space Sciences also gives the ENVS Program a very small faculty/student ratio.

A major strength of the ENVS program is the ability of students to interact with faculty members outside of the classroom. These interactions are ensured by the Program's small faculty/student ratio and are provided by:

- *Course-related field trips*: One of the principal focuses of Environmental Science education involves collection, analysis, and interpretation of field data. For this reason, course-related field trips are important parts of the ENVS program. A related virtue, however, is the opportunity these trips provide for student-faculty interaction. A great deal of professional education takes place in such settings.
- *Research and thesis mentoring*: One of the closer student-faculty relationships involves mentoring of research methodologies, data interpretations, literature search, and thesis writing.
- *ENVS Colloquia Series*: Each semester, the ENVS holds a series of lectures on a wide variety of Environmental Science topics. These lectures are delivered by faculty members of the constituent departments of the ENVS program, graduate students presenting their thesis research, and outside environmental experts. These colloquia provide opportunities for students to interact with faculty in a professional venue.
- *Social occasions*: The ENVS program and its constituent departments hold a number of cook-outs and pot-luck dinners during which students can socialize with faculty members.

Quality of teaching in modern sciences requires use of up-to-date technology and the ENVS program stresses technology utilization. One of the most important courses in the program is

instruction in Geographic Information Systems and Global Positioning technology. Use of Internet resources is stressed in all ENVS courses and most courses' materials are now available on the University's web resources. Advanced instrumentation is available in Biology, Chemistry, and Earth and Space Sciences laboratories.

Teaching is formally evaluated by: 1) student evaluations of courses; 2) annual performance evaluations by the Program Director and by the Department Chair; 3) evaluation for promotion, tenure and post-tenure review; and 4) survey of Program graduates. In addition, faculty and the Program Director have good relations with students and make an effort to converse informally with students to seek their input on course and program matters. These inputs are also use in teaching evaluations.

One indication of good teaching in the ENVS Program is given by surveys of graduates of the program. The following are some survey responses to the question, "What do you believe are CSU's Environmental Science program's strengths?"

"The professors. Each is extremely knowledgeable and all do research in their field of expertise. I loved every class I took and wish I had the money to just take a class whenever I wanted."

"Knowledge and skills of professors and their willingness to share information."

"The professors are really passionate about teaching. Field trips and hands-on experience really helped."

"Students are able to target a specific branch of environmental science (ie. geology, chemistry, or biology)"

"Coursework offered/required that encompasses the spectrum of scientific fields - biology, botany, chemistry, geology, microbiology, etc."

"rigor (thesis, comprehensive exam), breadth (ecology, geology, biology perspectives), hands on field experience"

Indicators of Good Advising

When students are admitted into the ENVS Program, the Program Director is their first advisor. The Director continues to act as advisor until the student decides upon a specialization direction, at which time he or she chooses a faculty member in that area. Evaluation of advising is a factor in annual performance reviews and in evaluation for promotion, tenure, and post-tenure review.

Department and Program Rewards System

Good teaching is rewarded by annual merit pay raises; promotion, tenure and post-tenure review decisions; and by campus-wide nomination and consideration for the University's Instructor of the Year award. Budget considerations over the past two years have not allowed annual merit pay raises except for salary adjustments to reward promotion and the awarding of tenure.

Program Improvement Plan

In order to continue to improve education quality in the ENVS Program, we propose to:

- Instigate a formal program of classroom visitation by the ENVS program director and other members of the faculty
- Incorporate technology use as a factor in annual performance evaluation
- Institute annual survey of students
- Institute an ENVS *Teacher of the Year* award
- Add new faculty in order to broaden the areas of specialization in environmental science available to students

II. C. Quality of Research and Scholarship: Above Average

Opportunity for Student Research Projects

The ENVS Graduate Program provides for both a thesis and non-thesis degree track. The thesis track requires a research project commensurate with the award of a Master of Science degree. The project requires: preparation of a research proposal reviewed by a three-person graduate committee; conducting of research under the supervision of a thesis advisor; writing of a Master's thesis of publishable quality; oral delivery of the research to the faculty and students of the ENVS program; and defense of the work before the graduate committee.

Many of the courses in the ENVS program require student research projects as part of the grading structure.

Faculty Publications, Presentations, and Grants

Publications (including contracted reports), presentations and external grants by ENVS program faculty from 2004 to 2010 are tabulated below. Details of each are given in Curriculum Vitae presented in an Appendix at the end of this report.

Samuel M. Abegaz: 7 publications; 9 presentations ; 1 grant

Julie M. Ballenger: 6 presentations ; 1 grant

John A. Barone: 8 publications; 12 presentations; 4 grants

William S. Birkhead: 7 contracted reports; many grants

Roger W. Brown: 1 publication; 5 contracted reports; 9 presentations; 1 grant

Kevin S. Burgess: 8 refereed publications; 2 non-refereed publications; 14 presentations; 4 grants

Warren B. Church: 2 publications; 4 presentations; 1 grant

John K. Davis: 2 presentations; 1 grant

William J. Frazier: 2 publications; 1 contracted report; 2 presentations

Zewdu Gebeyehu: 1 publication; 3 presentations; 1 grant

Frederick D. Gordon: 2 publications; 2 non-refereed publications; 9 presentations
 Troy Keller: 4 publications; 1 non-referred publication; 17 presentations; 1 grant;
 David R. Schwimmer: 1 book; 4 publications; 2 published book reviews; 17 presentations
 George Stanton: 1 non-refereed publication; 5 presentations; 1 grant
 Rufus Stringfellow: 3 grants

Program Improvement Plans

In order to continue to foster faculty scholarly productivity, we recommend that the ENVS program:

- Enter into association with the Gulf Coast section of the Cooperative Ecosystem Studies Units (CESU). This organization promotes cooperation among academic, governmental and military organizations throughout the Gulf Coast region. Association with the CG CESU will allow cooperative research opportunities with other universities and allow access to a number of granting agencies. It will also allow us to gain formal partnership with Fort Benning
- Strengthen ties with the Fort Benning Military Reservation. There are many possible interactions between Columbus State University and Fort Benning, including research activities of benefit to the military and educational and research opportunities for our students
- Develop new research and educational opportunities at the Oxbow Meadows Environmental Learning Center. The Oxbow Meadows center is currently upgrading significantly its operation and facilities. We believe that there are many potential research opportunities that might be realized by greater cooperation between our program and the Oxbow operation
- Locate additional funding to provide for graduate research assistantships. The University currently provides some funds for graduate teaching assistantships, although these funds are not competitive with other graduate institutions. There are no University funds designated for research assistantships. Such funding will enhance our students' ability to conduct research as well as to increase faculty productivity
- Expand funding for paid faculty sabbaticals
- Expand funding for travel to professional conferences and meetings
- Expand available laboratory space

II. D. Quality of Service: Very Strong

Activities to Enhance Program, Department, College, Institution, Community and Region

Faculty members of the Environmental Science Graduate Program are campus, community and professional leaders. Membership of most major College and University committee includes individuals from ENVS faculty, often as committee chairs. Individual ENVS faculty members have chaired or been members of search committees involved in the hiring of the majority of the members of the faculties of Departments of Biology, Chemistry, and Earth and Space Sciences. ENVS faculty

members are past and present department chairs, a former dean of the College of Sciences, a former acting dean of the College of Letters and Sciences, a former vice president of academic affairs, and an interim president of the institution. It would not be an exaggeration to say that a large part of Columbus State University's history and governance has involved individuals now members of the ENVS faculty.

ENVS faculty members are also intimately engaged in community activities, serving on a variety of service organizations, advisory panels, and planning commissions. Many have acted as organizers or judges in local and regional science fairs and in the Science Olympiad, held annually at CSU. Most have given public lectures for local clubs, youth organizations, and civic groups, participated in public panel discussions, and presented educational activities in public and private schools. Many have given interviews for television productions or news programs, written articles for newspapers and magazines, and served as expert advisers for local school systems, and corporations.

Members of the ENVS faculty are also leaders in their professions, acting as peer reviewers for technical journals and textbooks. Many have vetted grant proposals, notably for the National Science Foundation. Many also have organized professional meetings, chaired technical sessions at conventions, and organized and led scientific field trips.

Service activities of ENVS faculty members for the period 2003 - 2010 are tabulated below. Details of each are given in Curriculum Vitae presented in an Appendix at the end of this report.

- *Service to the Institution*

Membership on department committees: 37; 12 as chair

Membership on College of Sciences or College of Letters and Sciences committees: 20; 3 as chair

Membership on University committees (includes Faculty Senate committees): 80; 10 as chair

Advisor to student organizations: 5

Service in an administrative capacity: 1 Department Chair; 2 Deans of the College of Sciences; 1

Director of Ox-bow Meadows Environmental Learning Center; 1 Director of ENVS graduate program; 1 Vice President for Academic Affairs; 1 interim President of the Institution; 1 associate director of CSU's International Program.

- *Service to the Community*

Delivery of public lectures: approximately 72

Delivery of university lectures: 31

Volunteer to Columbus Medical Center Emergency Room: 1

Judging of scholastic competitions: (science fairs; Science Olympiad) 20

Advisor to public/private schools: 21

Advisor to businesses: 3

Membership in or advisor to civic organizations: 20

Advisor to governmental organizations (including Fort Benning): 10

Subject of television programs or interviews: 10

Subject of on-line news interview: 1

Subject of radio interviews: 3

Subject or author of magazine articles or interviews: 7

Subject or author of newspaper articles, interviews, invited columns: 8

- *Service to the Profession*

Service to profession: 6

Author of textbook reviews: 10

Peer reviewer for technical journals: 7 faculty members for 28 journals

Reviewer for National Science Foundation grant proposals: 5

Reviewer for American Chemical Society grant proposal: 1

Program Improvement Plan

The ENVS program will continue to encourage participation of its faculty in campus governance, community activities, and professional engagement. Strengthening the ENVS program's ties with the Fort Benning Military Reservation will open a number of service opportunities for groups and organizations on post.

Services activities will continue to be rewarded as factors in annual performance reviews, salary considerations, and promotion and tenure recommendations.

II. E. Quality of Faculty and Student Achievement: Above Average

Faculty Honors (2003 – 2010)

Julie M. Ballenger

2009: Fort Hays State University Alumni Achievement Award

2008: CSU Outstanding Service Award, Columbus State University

2008: Beta Beta Beta: Outstanding Advisor Award

2007/08: Beta Beta Beta: Lloyd M. Bertholf Award – Awarded First Place (April 2008)_(CSU, Mu Omicron Chapter selected as first in the nation)

2007: Beta Beta Beta: Outstanding Advisor Award

2006: Beta Beta Beta: Second Honorable Mention Lloyd M. Bertholf Award (CSU, Mu Omicron Chapter selected as third in the nation)

2005: Beta Beta Beta: Outstanding Advisor Award

2005: CSU Outstanding Service Award Nominee, Columbus State University

2004: Most Internationalized Department: Best Practices Award

2004: Beta Beta Beta: Outstanding Chapter Award (Departmental award)

2004: Faculty Development Award: Natural Environments of Queensland, Australia

2003: Educator of the year, Columbus State University

John A. Barone

Spring 2009: Sabbatical, Awarded by Columbus State University
 2008: Outstanding Teacher of Writing Award, Columbus State University
 2007-2008: Faculty Writing Fellow, Columbus State University
 2008: Nominee Educator of the Year Award, Columbus State University

William S. Birkhead

Columbus State University Service Award: finalist, 2003

Kevin S. Burgess

2010: Columbus State University Researcher of the Year Award
 2008: Columbus State University Educator of the Year” Nomination
 2004: University of Guelph Teaching Award” Nomination

Warren Church

Phi Kappa Phi Honorary Society
 Research Associate, *Asociación Pesuana para la Conservación de la Naturaleza*
 Member, Phi Beta Delta International Honor Society

William J. Frazier

Golden Apple Award, 2007
 Award for 35 years of service to Columbus State University, 2009
 Phi Kappa Phi Honorary Society

Zewdu Gebeyehu

Received Certificate of Appreciation from CSU Honors Program, 2004 and 2005

Frederick D. Gordon

Tyler Environmental Fellowship – University of Southern California, 2004-2005
Haynes Intermediate Dissertation Fellowship – University of Southern California, 2002-2003

Troy Keller

Educator of the Year - Columbus State University 2008 (Nominee)
 Phi Beta Kappa and Phi Kappa Phi Honorary Society
 Research Associate, University of Michigan Biological Station (2005 – 2010)

David R. Schwimmer

2008: Appointed Research Associate at American Museum of Natural History
 2003: Faculty Research and Scholarship Award, Columbus State University
 CSU’s Outstanding Research Award (twice)

George Stanton

Columbus State University *Honorary Alumnus* (2009)
 Phi Kappa Phi Honorary Society

Rufus Stringfellow

U.S. Fish and Wildlife Service Regional Director’s Award, July 19, 2004
 U.S. Fish and Wildlife Service Georgia Ecological Services Volunteer Award, April 29, 2004
 Phi Kappa Phi Honorary Society

Student Honors

ENVS program awards one outstanding student the award for Best Environmental Science student.

Graduate Achievements

Graduates of the ENVS program answering our on-line survey have received the following certifications, accredited coursework, or awards:

CFM-Certified Floodplain Manager

CPESC-Certified Professional in Erosion & Sedimentation Control

CPSWQ-Certified Professional in Storm Water Quality

Georgia Certified Water and Wastewater Analyst

2006 & 2008 Storm Water Program of the Year by the Georgia Association of Water Professional

2010 2nd Quarter PEER Award by the Columbus Consolidated Government

Level IA, 1B, II-Plan Review, II-Design Professional, Level 1 & II

Certificate for Phase I Environmental Site Assessment

Completed Levels 1B and 2B Certifications for the Georgia Soil and Water Conservation

Commission (GSWCC) Storm Water Pollution Prevention

Received the Fort Benning Cross Functional Team of Excellence Certificate for work on the

Environmental Impact Statement related to BRAC (U.S. Army's program called "Base Realignment and Closure")

Completed coursework for the Implementation of the National Environmental Policy Act, at Duke University in the Environmental Leadership Program.

II. F. The Quality of the Curriculum Supporting the Program: Above Average

Relationship Between Program's Curriculum and Its Outcomes and key required courses addressing those outcomes

Learning Outcome	Key Required Course
An environmental scientist has an understanding of basic fluid mechanics and how water flows on and beneath the surface of the planet	Primary: ENVS 5165: Introduction to Hydrology Secondary: ENVS 6206: Water Resources Management
An environmental scientist has knowledge concerning how human interact (e.g., mining) with the geologic environment with an emphasis on the potential hazards	Primary: ENVS 5255: Environmental Geology (including lab)

associated with geologic phenomena (e.g., volcanoes, earth quakes, and tsunamis)	Secondary: ENVS 7145: Land Use and Waste Management, other upper level GEOL courses
An environmental scientist has an understanding of the fundamentals of aquatic and atmospheric chemistry and the methods used to analyze their chemical constituents	Primary: ENVS 7115: Environmental Chemistry Secondary: Upper Level CHEM courses
An environmental scientist has an understanding of ecology and how to design ecological experiments, analyze data, and report their findings	Primary: ENVS 6207: Ecological Methodology (including lab) Secondary: Upper level BIOL Courses
An environmental scientist has an understanding of environmental policy and statutes and how the resulting regulations influence human actions	Primary: ENVS 6106: Environmental Law and Regulations
An environmental scientist has the ability to find and analyze the scientific literature and prepare both written and oral critiques of environmental research	Primary: ENVS 6105: Environmental Issues Secondary: All core courses and electives

Our curriculum is intended to be broad-based and comprehensive, providing students with a background in topics from all of the key physical and natural sciences and their societal contexts that comprise the broader field of Environmental Science. In addition, students are exposed to social, political, and anthropological perspectives related to the environment in courses such as Environmental Issues, Environmental Law and Regulations, and electives in Anthropology.

The expansion of the Environmental Policy Tract within the MPAA program in Political Science will provide additional opportunities for our students outside of our current course offerings and in addition promote synergy and connections between students and faculty in both programs.

The recent hiring of Fred Gordon within the MPAA program has also allowed us to continue to offer ENV5 6106: Environmental Law and Regulations, without hiring part-time faculty.

Currently, we offer both thesis and non-thesis options. The addition of the non-thesis option in 2008 has provided the opportunity for management and consulting professionals not interested in pursuing traditional research to complete our program. This change has increased the appeal of our program to a broader audience; for this reason, both the number of students enrolling and those completing the program has increased significantly.

Currently, the thesis track requires six core courses across the spectrum of the sciences; the non-thesis track those six courses and also ENV5 6235: Introduction to Geographic Information Systems (GIS) and Global Positioning Systems (GPS). Program electives include various topics in Geology, Chemistry, and Biology, many of which are cross-listed as upper-level undergraduate courses. Traditionally, our program was designed in part for professionals seeking further study, with the majority of required courses and electives offered in late afternoon and evening, education majors seeking MEd degrees also frequently take our courses as electives. With increases in enrollment in both the Masters program and the undergraduate programs in Earth and Space Sciences, we are offering more courses during traditional hours, in particular courses with a significant lab/field component.

Incorporation of Technology

As graduate students, most of our students are well versed in common software applications including various word-processing, spreadsheet, and presentation programs.

Many faculty members routinely use VISTA or CougarVIEW to post assignments, readings, or exercises, communicate with students by email and often require students to assignments electronically.

Most courses require students to search the web and library for data, information, and journal articles for papers, projects, and theses. Other courses often require annotated bibliographies, or brief presentations or critiques of relevant scientific papers for specific topics or in-class discussions. Many courses also require presentations of topics or research results using PowerPoint. Students in our program and others on campus must develop search skills using GoogleScholar or other options because library holdings and available databases are frequently inadequate to obtain many journal articles.

Many graduate courses (*e.g.*, Environmental Geology, Ecological Methods, Hydrology) require the recording, input, analysis, and presentation of complex datasets via graphs, charts or maps; Ecological Methods requires analysis of data using SPSS. Students conducting Masters theses are routinely required to perform statistical analyses of data. Students conducting a thesis are also required to conduct a public presentation for their defense.

In the non-thesis track, students are required to take ENV5 6235: Introduction to Geographic Information Systems (GIS) and Global Positioning Systems (GPS), which are expanding technologies increasingly used in environmental monitoring, analysis, and outreach. Part of the coursework required for this course includes developing a research topic where students acquire and

analyze relevant geospatial data available from the internet or other sources as well as analyze data collected with hand-held GPS units. Many of our former students are employed with environmental consulting firms, contractors, or public agencies or municipalities where they continue to use, collect or analyze geospatial data and GIS for environmental analysis and decision making.

Utilization of Multidisciplinary Approaches

Environmental Science is interdisciplinary by nature, as the multidisciplinary nature of our contributing faculty and courses demonstrate. In addition to a broad-based scientific background, our program includes courses which include current and historical foundations of human attitudes towards the environment and environmental issues, including multi-cultural perspectives, and also introduce students to views that may be counter to established views in environmental activist groups or public agencies. Our goal is produce scientists with a strong grounding in science complemented by exposure to legal, social, and economic perspectives on human-environment interactions. In addition, our students develop critical thinking and analysis skills to be effective researchers, managers, or decision makers. Understanding of the interrelationships between the natural and human world, including historic and prehistoric interactions, is integral to a developing a theoretical perspective capable of resolving environmental issues and problems today and in the future.

Students in our program are provided a broad background in all disciplines contributing to Environmental Science and can choose to select electives in variety of contributing areas. This facet of our program allows students from diverse undergraduate backgrounds (including biology, geology, chemistry, anthropology or geography) to enter our program and either broaden their background, move in a new direction, or further develop their primary interests through selection of electives and/or a thesis topic. The breadth of our program is unique in Georgia and one of our strengths.

Utilization of Multicultural Perspectives

Courses such ENVS 6105: Environmental Issues address regional, national, and international issues that include different cultural, social, economic and political perspectives on environmental issues, problems and solutions. The integration of Dr. Warren Church (whose research focuses on South American Archeology) within our department introduces concepts from anthropology and archaeology as available electives including ENVS 5125: Human Ecology and ENVS 5226: Culture and Environment. Longer-term perspectives on human evolution and human-environment interaction are considered in Dr. Schwimmer's GEOL 5175: Physical Anthropology and Archaeology.

Dr. Church also periodically offers a study abroad course to the Peruvian Andes that graduate students can participate in; several study abroad courses to areas such as the Bahamas, Africa, and Australia are also available to graduate students through the Biology Department. In spring semester

2010, Dr. Abegaz is leading a study abroad trip focusing on environmental and social issues in his native Ethiopia.

Our department also benefits from both an ethnically diverse faculty across multiple disciplines and the enrollment of international students in our program.

Program Improvement Plans

- Development of a 4-1 Masters program to allow qualified students to obtain both an undergraduate and Master's degree in a shorter time frame, improve RPG rates, and improve the overall efficiency of the program.
- Be more proactive in scheduling within our core group as well as with the other disciplines contributing to the program to minimize time conflicts and maximize offerings of electives with appropriate enrollments, recognizing that the majority of upper level elective / graduate courses (especially lab or field-based) are not effectively taught at enrollments higher than 15-20.
- Add additional faculty that can contribute to the Master's Program in Environmental Science as well as undergraduate programs in Earth and Space Sciences in the future.

II G. Quality of Facilities and Equipment: Satisfactory

Availability of Classroom and Laboratory Space

Faculty members have full or part-time appointments in Environmental Science are housed in offices in the LeNoir Annex. Offices are large enough to accommodate student and faculty mentoring sessions and advisory meetings. The building was recently constructed and has modern amenities. Faculty members have lab space adjoining their offices. These personal research labs are modest but provide faculty space, electricity, running water, and storage. LeNoir Annex currently does not have auxiliary ventilation in the labs, nor are there are functioning fume-hoods, proper chemical storage facilities, chemical spill containment kits or eyewash stations. Many of our students are funded by graduate teaching assistantships. Currently these students do not have office space to meet with their students outside of the classroom. This lack of office space for graduate student instructors will continue to have a negative effect on the undergraduate experience of students taught by these student instructors.

LeNoir Annex provides the program with a versatile and adequate lecture room for courses limited to 25 students or less. Because the program is interdepartmental, many courses in the program are taught in classrooms in LeNoir Hall, Stanley Hall, and Clearview II. These courses are modern classrooms with appropriate projectors and computers. The program has not dedicated program specific lab space. All lab based courses are currently taught in laboratories in other departments such as Biology or Chemistry. This fact has created some scheduling problems and has constrained the options available for lab exercises available to our graduate students. The program's recent growth and the fact that it is initiating a new undergraduate track will necessitate the creation of a dedicated environmental learning lab space. Failure to create such a lab space will hamper future growth of both the graduate and undergraduate degrees. While there are no dedicated computer labs, courses focused on GIS can access computer labs in LeNoir Hall however, a

computer lab in Tucker Hall with GIS capabilities is being created. Successful creation and staffing of a GIS Center would greatly benefit students and enable faculty to more effectively compete for external grants and contracts.

The only conference room that is currently available for the Environmental Science program is the Dean's conference room in LeNoir Hall. Most program and Departmental meetings are held in the LeNoir Annex classroom.

Availability of Equipment

The Environmental Science program is the only graduate option for students seeking a Masters degree in the natural sciences at Columbus State University. As such, there are faculty members from several departments (Biology, Chemistry, and Earth & Space Sciences) that participate as research mentors and course instructors. These faculty members have access to a broad array of the equipment and make these devices available to our graduate students. For instance our students have access to equipment for:

- *Chemical analyses* such spectrophotometers, HPLC, NMR, GC and Graphite Flame
- *Genetic analyses* such as a DNA sequencer, centrifuges, and a PCR machine
- *Environmental sampling* such as air quality samplers, sieve series and shaker, sediment corers, electro-fishing equipment, flow meters, and water chemistry multi-probes
- *Geospatial tools* such as high resolution DGPS units, a total station, handheld GPS units, and ArcGIS software. While students can access a broad range of equipment, the program will need purchase equipment (microscopes, spectrophotometers, gps units, etc) to provide courses with the tools needed to give students hands-on experience collecting and analyzing field data.

Transportation is available using the College-owned 10-passenger van or the 5-person-extended-cab pickup truck. Enrollments in field-based courses such as Ecological Methods, Stream Ecology, and Fluvial Geomorphology are limited by the number of seats available using these vehicles. Efforts to improve the capacity of our transportation pool, for example by purchasing another van, will enhance class sizes and improve retention and graduation rates. CSU also has no adequate boat for aquatic sampling or field trips. This hampers the ability of the faculty to deliver a large portion of the courses on the Environmental Science curriculum (e.g., Geology of Georgia, Fluvial Ecology, Limnology, and Water Resources Management).

Program Improvement Plan

The follow list highlights steps that can be taken to recruit more students, increase the graduation rates and improve the quality of our graduates.

Offices/labs:

- Install at least one preferably more functioning fume-hood for the proper handling and storage of chemicals in LeNoir Annex
- Install chemical spill containment kits or eyewash stations in LeNoir Annex
- Develop a room outfitted with shared office equipment for graduate student assistants in LeNoir Annex or other building

Classrooms and Teaching Laboratories:

- Renovate a space in LeNoir Annex (storage space) or other area (Clearview II) to create a safe and modern environmental science teaching lab with drains, sinks, utilities, storage, refrigeration, projector/computer, etc.
- Complete renovations to computer lab in Tucker Hall for teaching GIS on main campus
- Implement existing plans to develop a GIS Computer Center either on the RiverPark campus or on CSU's main campus

Conference Rooms:

- No changes requested at this time

Availability of Equipment:

- Purchase microscopes, spectrophotometers, glassware, flow meters, and other field equipment needed to outfit the proposed environmental science lab
- Acquire an additional 10-passenger van to improve the capacity of our field trips and field-based courses
- Purchase a boat for field trips to sample lakes and rivers

SECTION III – INDICATORS OF PROGRAM PRODUCTIVITY

III A. Enrollment in Program for the Past 5 years

The number of graduate students in the Environmental Science program has grown 167% in the past 5 years (Table 1). That achievement places it as the 5th highest growth rate among all graduate programs at CSU over the academic years 2005-2009. This growth was not just the result of increased CSU enrollment given that graduate enrollment among all programs rose 42% during that same period. It is important to note that enrollment nearly doubled starting in 2008 (Table 1); the year we began offering the non-thesis track option.

Table 1. Environmental Science graduate student fall enrollment over the past 5 years. Four other graduate programs of comparable size are shown for comparison purposes.

Graduate Program	2005	2006	2007	2008	2009	5-yr Change	5-yr % Change
Early Childhood Education	12	19	49	66	61	49	408.3%
Educational Leadership	17	14	12	13	49	32	188.2%
Environmental Science	9	10	11	23	24	15	166.7%
General Business	58	44	54	69	69	11	19.0%

Health & Physical Education	12	17	15	18	28	16	133.3%
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III B. Degrees Awarded Over the Past 5 Years

The rate of new degrees awarded outpaced growth measured in number of students enrolled over the past 5 years (Fig. 1). Degrees advanced by over 233% compared to the enrollment growth of 167%. The 3-yr running average for degrees awarded exceeds the BOR minimum of 5 for graduate programs and will continue to rise next year. Once again the implementation of the non-thesis option has greatly increased the number of graduates in 2008 and 2009.

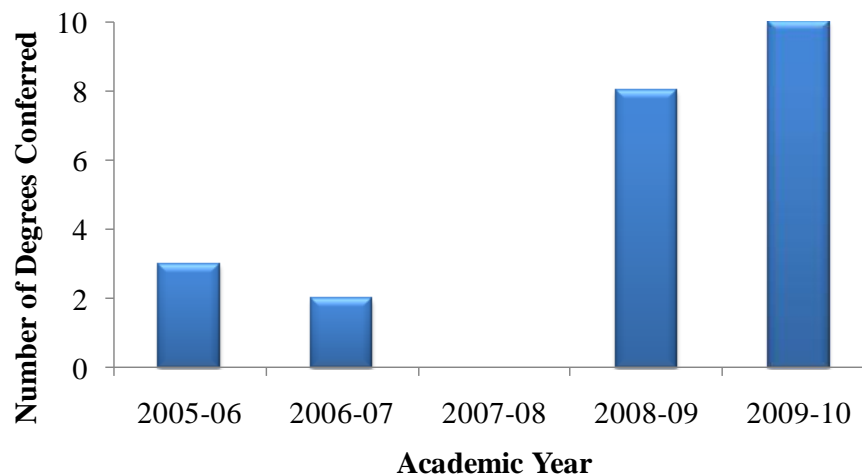


Figure 1. Number of Environmental Science masters degrees conferred by academic year.

III C. Comparisons With CSU & USG Programs

There are no other equivalent master's programs in the USG system, thus no comparisons can be made. CSU should capitalize on the unique nature of the Environmental Science program to recruit students graduating from other USG institutions (e.g., Valdostate State, Georgia State University, *etc*)

III D. Retention Rates

Environmental Science graduation retention rates have ranged from 60 – 75 % for the past several fall semesters (Table 2). These rates compare favorably with other programs however they are on average slightly lower end than other programs used for our comparison.

Efforts to improve these retention rates need to focus on the actual reasons individual students choose not to continue with the program. It would be advisable to conduct a comprehensive survey of non-retained student to assess their reasons for leaving the program. A plan to reduced these losses could then be created.

Table 2. One year retention rates of 5 graduate programs at Columbus State University. Values calculated as percentage of students entering in year listed that re-enroll in the fall term of the next year

Graduate Program	Fall of Year Entered				4-yr Mean
	2006	2007	2008	2009	
Early Childhood Education	100 %	63 %	70 %	77 %	78 %
Educational Leadership			100 %	89 %	95 %
<i>Environmental Science</i>	75 %	67 %	67 %	60 %	67 %
General Business	86 %	81 %	68 %	75 %	78 %
Health & Physical Education	80 %	57 %	71 %	100 %	77 %

III E. Student Learning Indicators

Upon completion of the six core courses, all students in the MS program in environmental science are required to take and pass a Comprehensive Examination covering the six core areas, environmental issues, environmental law and regulation, environmental geology, environmental chemistry, hydrology, and ecological methods. Each section of this examination is graded pass or fail by the instructor of record for that course. Depending upon the performance, graduate students who receive an unacceptable evaluation must complete additional work by the professor and re-take the comprehensive exam. Students are denied graduation if they fail to successfully complete all 6 sections of the comprehensive exam.

III F. Graduation Rate of the Program

Graduation rates for this program appear to be extremely low (<25%) compared to other programs. These graduation rates are calculated as the percentage of students entering in the fall of one year and graduating 4 years later. The data shown in Table 3 represent cohorts of students that entered the

program in the fall of 2003 -2005 and do not reflect the current graduation rates of the program. Since 2005 the program has changed dramatically. It has hired 2 professors, created a non-thesis track, and established a permanent director. These changes have resulted in a dramatic increase in the number of graduates (167 % since 2005) which will be reflected in higher graduation rates calculated in the 2013.

III G. Cost Effectiveness of Instructional Delivery

The cost per Environmental Science student is higher than the average cost per CSU student (\$4,000/student). Similarly the cost per credit hour is higher for our graduate students than that for CSU generally (\$187/credit hour). These cost differences are partly explained by the fact that calculations shown in Table 3 do not accurately reflect the teaching effort of the ENVS faculty that teach undergraduate courses and cross-listed sections in other Departments (Biology and Chemistry) that are not included in the credit hours reported in Table 3. This omission underestimates cost effectiveness and productivity of the program's faculty and artificially increases the apparent cost per credit hour.

In 2009 the Environmental Science program was moved into the new Department of Earth & Space Sciences. This administrative change is reflected in the dramatic decrease in the costs shown during that academic year. If one assumes that the instructional costs in 2009 were similar to 2008 then the estimated costs per credit hour dropped 25% relative to 2008 (Table 3). As the program's graduate student enrollments grow and course credit-hours increase these cost effectiveness of the faculty will continue to improve.

Table 3. Indicators of cost effectiveness of the instruction for the Environmental Science graduate program from 2005-2009 academic years.

Cost Indicator	2005	2006	2007	2008	2009	Average
Total \$/Major	\$13,559	\$10,888	\$15,978	\$9,010	\$8,373	\$11,562
State \$/Major	\$8,390	\$8,586	\$14,016	\$8,432	\$8,178	\$9,520
Credit-hr (Fall/Spring)	85	141	132	330	490	236
Cost/Credit Hour - Total	\$1,436	\$772	\$1,332	\$628	\$410	\$916
Cost/Credit Hour - State	\$888	\$609	\$1,168	\$588	\$401	\$731

SECTION IV – PROGRAM VIABILITY

IV A. Summary of Program's Viability: Very Strong

Columbus State University's Environmental Science (ENVS) Graduate Program boasts a group of accomplished, professional instructors with an outstanding record of scholarship and service. It has a

curriculum based broadly in all major areas of environmental science today, and is designed to produce successful graduates with the skills and knowledge to pursue a wide range of careers or to further their graduate education. Our ENVS program is unique in Georgia in its breadth of instruction. The U.S. Bureau of Labor Statistics Occupational Outlook Handbook (cited earlier in this report) forecasts that jobs in environmentally related fields will grow at a rate of 29% in the future. Our graduates will be ideally situated to gain employment in this important and expanding job market. Also as mentioned earlier, our program is growing in numbers of students, numbers of graduates, and the geographic area from which those students are drawn. For all of these reasons, we rate our program's viability as very strong.

Summarize Recommendations for the Future of the Program

In order to continue our growth, to enhance the breadth of our program, and to provide increased educational and research opportunities available to our students and our faculty, the following initiatives have been recommended in this report:

- **Creation of a New Environmental Science Undergraduate Degree Track in the Department of Earth and Space Sciences.** Although this is not specifically part of the graduate program, an undergraduate degree track would be a “feeder” program for the graduate school. This will be especially true with the creation of a 4 – 1 undergraduate – graduate degree program, as mentioned below.
- **Creation of a 4 – 1 Undergraduate – Graduate Degree Program.** Programs similar to the one we envision have been instituted at other universities. These programs allow undergraduates to take number of Environmental Science courses as part of their B.S. degree such that they can complete the Master of Environmental Science degree in one year. We believe that this will be an attractive option and will have the effect of increasing enrollment.
- **Creation of Agreements with Georgia Perimeter College and Other 2-Year Colleges in Georgia.** We seek agreements of students of Perimeter and other institutions whereby students taking a series of core and scientific preparatory courses in their first two years can matriculate into our Environmental Science B.S. degree track or into the 4 – 1 program. In addition to fostering the undergraduate ENVS program, it will increase our number of graduate students.
- **Gain Admission to the Gulf Coast section of the Cooperative Ecosystem Studies Units (CESU).** This organization promotes cooperation among academic, governmental and military organizations throughout the Gulf Coast region. Association with the CG CESU will allow cooperative research opportunities with other universities and allow access to a number of granting agencies. It will also allow us to gain formal partnership with Fort Benning.
- **Strengthening of Ties with Fort Benning.** We seek to enhance our relationship with Fort Benning, both in terms of educational opportunities for military personnel and in terms of research and educational opportunities for CSU's students.
- **Development of New Research and Educational Facilities at Oxbow Meadows.** The Oxbow Meadows operation is currently building new facilities and increasing its activities as a center

for environmental research. We believe that interrelationship of the ENVS and Oxbow Meadows programs is a natural symbiosis and will enhance both.

- **Offering of a New Professional Science Masters Degree Track.** Combination of Environmental Science and Business courses is becoming a popular option at other universities and will help CSU's program both to attract more students as well as helping to fill a widening niche for professional scientists interested in developing business opportunities. Environmental issues, from local concerns about water and air quality, to national ones such as development of sustainable energy resources, to global problems such as anthropogenic climate change, will create business opportunities for those graduates with grounding in both science and business. The Professional Science graduate degree will provide our students with such basic grounding and enhance their marketability and earning potential.
- **Increasing the Number of Graduate Assistantships.** As enrollment at Columbus State University increases, students taking introductory courses in Biology, Chemistry, Geology and proposed Environmental Science will also increase. This growth will require more Teaching Assistants. For this reason, more graduate assistantships will be needed. Further, for CSU to be competitive, the amount of assistantship stipends must be increased. Currently, graduate expenses for 9 hours of credit (various fees and mandatory student health insurance) amount to 25% of the stipend and waiver of tuition. This is the reason that we recommend greater institutional support for our assistantship program. Enhancement of research activities in the various areas of Environmental Science will be greatly aided by the availability of Research Assistants. For this purpose, we recommend increased effort to obtain outside support, from granting institutions, environmentally-concerned businesses and individuals. We also recommend inclusion of graduate research assistantships be included in research grants

Include Timetable for Program Initiatives.

Year 1 (2011 – 2012 Academic Year)

Implement Environmental Science undergraduate major
Complete application for membership in Gulf Coast section of the Cooperative Ecosystems Studies Unit

Year 2 (2012 – 2013 Academic Year)

Conclude negotiations with Fort Benning personnel
Conclude cooperative agreement with Oxbow Meadows
Conclude negotiations with Perimeter College

Year 3 (2013 – 2014 Academic Year)

Develop 4 - 1 undergraduate – graduate program
Develop Professional Science Masters degree program

IV B. Summary of Program Improvement: Very Strong

Reference recommendations previously made in this report.

- Develop a policy for giving teaching credit or reduced teaching loads for graduate thesis mentoring, grant writing, or related activities
- Acquire funds for faculty participation in workshops or training sessions in the use of advanced technologies and instrumentation and leading to professional certification or licensure
- Hire part time faculty to present specialized courses for our students leading to professional certification or licensure
- Increase funding for faculty travel to attend conferences or other professional activities
- Instigate a formal program of classroom visitation by the ENVS program director and other members of the faculty;
- Incorporate technology use as a factor in annual performance evaluation;
- Institute annual survey of students;
- Institute an ENVS *Teacher of the Year* award;
- Add new faculty in order to broaden the areas of specialization in Environmental Science available
- Join the Gulf Coast section of the Cooperative Ecosystem Studies Units (CESU).
- Strengthen ties with the Fort Benning Military Reservation.
- Develop new research and educational opportunities at the Oxbow Meadows Environmental Learning Center.
- Locate additional funding to provide for graduate research assistantships.
- Expand funding for paid faculty sabbaticals;
- Expand funding for travel to professional conferences and meetings;
- Expand available laboratory space
- Install at least one and preferably more functioning fume-hood for the handling and storage of chemicals in LeNoir Annex
- Install chemical spill containment kits or eyewash stations in LeNoir Annex
- Develop a room outfitted with shared office equipment for graduate student assistants in LeNoir Annex or other building
- Renovate a space in LeNoir Annex (storage space) or other area (Clearview II) to create a safe and modern environmental science teaching lab with drains, sinks, utilities, storage, refrigeration, projector/computer, etc.
- Complete renovations to computer lab in Tucker Hall for teaching GIS on main campus
- Implement existing plans to develop a GIS Computer Center either on the RiverPark campus or on CSU's main campus
- Purchase microscopes, spectrophotometers, glassware, flow meters, and other field equipment needed to outfit the proposed environmental science lab
- Acquire an additional 10-passenger van to improve the capacity of our field trips and field-based courses
- Purchase a boat for field trips to sample lakes and rivers studies.

Specify initiatives to be implemented.

- Continue negotiations with Perimeter College
- Revise ENVS program policies to incorporate recommended changes in faculty evaluation
- Complete application materials for admission to the Gulf Coast section of the Cooperative Ecosystem Studies Units (CESU)
- Continue discussions with representatives of Fort Benning
- Investigate cooperative program with Oxbow Meadows
- Prepare specifications for facilities and equipment for a new lab space in Clearview II
- Prepare course requirements, policies, and protocols for the implementation of a Professional Science Masters degree program
- Enter into negotiations with administrators at the College and University level for expansion of support for ENVS graduate assistantships
- Search for grant funding of research assistantships
- Implement Environmental Science undergraduate major
- Prepare course requirements, policies, and protocols for implementation of a 4 – 1 undergraduate – graduate program
- Write grant proposals for major equipment and vehicle purchases (*e.g.*, 10-person van; boat; digital particle-size analyzer; vibracoring rig)
- Prepare request for hiring of new faculty members

Include timetable for program changes. (Note: includes items from the timetable in Section IV A)

Year 1 (2011 – 2012 Academic Year)

Implement Environmental Science undergraduate major
 Review and change review criteria for faculty
 Institute *ENVS Faculty of the Year* Award
 Revise policies for graduate courses, comprehensive written exams, admission policies, and evaluation of applications for graduate assistantships
 Complete application for membership in Gulf Coast Cooperative Ecosystems Studies Unit
 Complete renovations of Tucker Hall for GIS education on CSU's main campus
 Seek increase in number and financial amount of graduate assistantships

Year 2 (2012 – 2013 Academic Year)

Conclude negotiations with Fort Benning personnel
 Conclude cooperative agreement with Oxbow Meadows
 Occupy new ENVS lab space in Clearview II
 Seek increased funding for faculty sabbaticals and professional travel
 Seek funding for major equipment acquisitions

Year 3 (2013 – 2014 Academic Year)

- Develop 4 – 1 undergraduate – graduate program
- Develop Professional Science Masters degree program
- Hire new faculty member
- Occupy graduate student office space / computer work room
- Seek funding for major equipment acquisitions

Year 4 (2014 – 2015 Academic Year)

- Acquire 10-passenger van for the ENVS program
- Seek funding for major equipment acquisitions

Year 5 (2015 – 2016 Academic Year)

- Acquire boat for river and lake research and for student field trips
- Seek funding for major equipment acquisitions
- Hire new faculty member

APPENDIX II: QUANTITATIVE MEASURES**QUALITY DATA**

Average 1-year retention, GRE scores, and GPA of Environmental Science students entering in the fall of the academic years 2005/06 through 2009/10

Category	2005/06	2006/07	2007/08	2008/09	2009/10	Average
1-yr Retention Rates	-	75% (4)	67% (3)	67% (12)	-	70% (6)
Mean GRE Scores	1008	1003	960	939	974	977
Mean GPA	3.5	2.6	3.6	3.4	3.5	3.3

Eight indicators of the quality faculty associated with Environmental Science Program

Indicator of Faculty Performance 2005-2010

Total # of Publications	61
Refereed Articles	34
Other Publications	27
# Presentations at Conferences	70
University or College Presentations	31
Total \$ External Grants (#)	525K (19)
% Faculty with PhD (#)	93% (14)
% Faculty Tenured (#)	67% (10)

*Survey results of the performance of graduates (2000-Present)***Graduate Performance (Survey Results)**

% Licenses or certifications (#)	55%
% Graduates Employed	91%
% Graduates Accepted to Graduate School (#)	100%

PRODUCTIVITY DATA

Number of Environmental Science full-time, part-time students and degrees conferred from 2005/06 through 2009/10

Category	2005/06	2006/07	2007/08	2008/09	2009/10
Majors: Full-time	2	4	5	6	11
Majors: Part-time	7	6	6	17	13
Total	9	10	11	23	24
Degrees Conferred	3	2	0	8	10

Graduation rates of Environmental Science students enrolled in the fall

Year	4-yr Graduation Rate
2003-2007	0% (2)
2004-2008	0% (2)
2005-2009	0% (2)
2006-2009*	25% (4)

*3-yr graduation rate

Environmental Science faculty teaching productivity as measured by credit-hours and average enrollments for 5000-7000 level courses

Credit Hour	2005/06	2006/07	2007/08	2008/09	2009/10
5000-level	32	-	36	137	108
6000-level	11	54	48	75	118
7000-level	18	18	9	3	45
Total	61	72	93	215	271

Average Enrollment					
5000-level	8	-	9	19	12
6000-level	2	8	8	8	16
7000-level	1	4	1	32	10
Average	3	7	7	16	13

Full-time and part-time faculty and staff appointments in the Environmental Science program

Year	Faculty		Staff	
	Full-time	Part-time	Full-time	Part-time
2005/06	1.00	1.00	-	-
2006/07	0.75	1.00	-	-
2007/08	1.00	1.00	-	-
2008/09	1.33	1.00	0.50	-
2009/10	1.42	1.00	0.50	-
Average	1.10	1.00	0.50	

Budget summary for the Environmental Science program for 2005/06 through 2009/2010

Budget	2005/06	2006/07	2007/08	2008/09	2009/10
State	\$75,509	\$85,863	\$154,177	\$193,940	\$196,261
Grants	\$46,526	\$23,015	\$21,583	\$13,296	\$4,692
Subtotal	\$122,035	\$108,878	\$175,760	\$207,236	\$200,953

Environmental Science program costs per major and per credit-hour

Productivity	2005/06	2006/07	2007/08	2008/09	2009/10
Total Cost per Major	\$13,559	\$10,888	\$15,978	\$9,010	\$8,373
State Cost per Major	\$8,390	\$8,586	\$14,016	\$8,432	\$8,178
Credit-hr (F&Sp)	85	141	132	330	490
Total Cost/Credit-hr	\$1,436	\$772	\$1,332	\$628	\$410
State Cost/Credit-hr	\$888	\$609	\$1,168	\$588	\$401
Scholarships	-	-	-	-	-

Percent of unproductive grades (W, WF, U, and F) awarded in Environmental Science Courses

Year	Percent of Grades
2005/06	20.8%
2006/07	23.3%
2007/08	14.6%
2008/09	18.5%
2009/10	2.1%

Number and percent of Faculty by ethnic background and gender

Category	Percent
International	14% (2)
White	86% (12)
Female	7% (1)
Male	93% (13)

Total	100% (14)
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Employer Demand for Graduates

Bureau of Labor Statistics Occupational Outlook Handbook, 2010-2011 edition – “Employment of environmental science and protection technicians is expected to grow *much faster than average*, at a rate of **29 percent**; these workers will be needed to help regulate waste products; to collect air, water, and soil samples for measuring levels of pollutants; to monitor compliance with environmental regulations; and to clean up contaminated sites. Most of this growth is expected to be in firms that assist other companies in environmental monitoring, management, and regulatory compliance.”

Number and percent (#) of declared majors by ethnic background and gender

Race/Ethnicity	2005/06	2006/07	2007/08	2008/09	2009/10
Am. Indian or Native Alaskan	-	-	-	-	-
Asian	-	-	9%(1)	4%(1)	-
Black or African Am.	33% (3)	10%(1)	-	17%(4)	21%(5)
Hispanic or Latino	-	-	-	13%(3)	4%(1)
International	11%(1)	10%(1)	-	4%(1)	4%(1)
Native Hawaiian or Pacific Islander	-	-	-	-	4%(1)
Two or more	-	10%(1)	9%(1)	4%(1)	4%(1)
White	56%(5)	70%(7)	82%(9)	57%(13)	62%(15)
Unknown Race	-	-	-	-	-
Female	67%(6)	50%(5)	55%(6)	39%(9)	46%(11)
Male	33%(3)	50%(5)	45%(5)	61%(14)	54%(13)
Total	100%(9)	100%(10)	100%(11)	100%(23)	100%(24)