Senate Bill No. 0102-12

UNIVERSITY SENATE

UNIVERSITY AT ALBANY
STATE UNIVERSITY OF NEW YORK

Introduced by: UAC

Date: April 12, 2002

FACULTY-INITIATED INTERDISCIPLINARY PROPOSAL FOR A BACHELOR OF SCIENCE DEGREE IN ENVIRONMENTAL SCIENCE

IT IS HEREBY PROPOSED THAT THE FOLLOWING BE ADOPTED:

1. Approve the Faculty-Initiated Interdisciplinary Proposal for a Bachelor of Science (BS) degree in Environmental Science.

2. That this becomes effective Fall 2002.

3. That the bill be referred to the President for approval and implementation.

FACULTY-INITIATED INTERDISCIPLINARY PROPOSAL

for a

BACHELOR OF SCIENCE DEGREE (B.S.)

in

ENVIRONMENTAL SCIENCE

Submitted
by

The Department of Earth and Atmospheric Sciences
University at Albany
State University of New York

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December 20, 2001

Introduction

The members of the faculty of the Department of Earth and Atmospheric Sciences (DEAS) propose a new Bachelor of Science (B.S.) degree in Environmental Science to begin in the Fall semester of 2002. This degree would be a multi- and trans-disciplinary major that would utilize strengths from several departments at this University. The degree is designed to meet the oft expressed student desire for such a formal degree program here, as well as the clear need of potential employers (within private industry and the government) to have graduates trained within the interdisciplinary fields that are collectively known as Environmental Science.

The proposed degree requirements are outlined below and are presented in more detail in *Appendix I.* Classes required for the degree would consist of a core curriculum of 46 credits in environmental and foundation courses spanning six departments. In addition, one of four specialty tracks would be selected by the student, each track entailing19-20 credits: Earth Science, Atmospheric Science, Biology, or Geography. The degree is a combined major/minor totaling 65-66 credits. The program as proposed has been built around existing faculty strengths, and where possible, existing classes to facilitate its initiation. In its initial implementation, no additional faculty resources or significant physical infrastructure would be required.

Significant collective environmental science expertise presently exists on campus as represented within the Department of Earth and Atmospheric Sciences, the related but distinct institution, the Atmospheric Sciences Research Center (ASRC, which is housed in the Center for Environmental Science and Technology Management), the Department of Biological Sciences, the Department of Geography and Planning, the Institute for Health and the Environment, and the Department of Environmental Health and Toxicology (School of Public Health) as well as the Rockefeller College of Public Affairs and Policy. The Albany area has yet additional trenchant environmental expertise represented in external (but potentially participatory) entities such as the NYS Department of Environmental Conservation (DEC), the Wadsworth Center (NYS Department of Health) and the U.S. Geological Survey (USGS). Once the program is established, we intend to utilize these exceptional resources for further development of the Evironmental Science major, particularly with respect to student research and internship opportunities. The presence of nearby EPA Super Fund sites (e.g., Upper Hudson River and the Patroon Creek) offers potentially even more opportunities for field-related activities and interactions with State and Federal experts. There can be no doubt that our institution and region offer a truly substantive environmental education opportunity. This potential begs to be realized.

It should be noted that the Department of Geography and Planning (GP) also intends to submit a new degree for consideration (either simultaneous with or shortly after submission of this proposal) that will complement the degree described herein. GP will propose a new Bachelor of Arts (B.A.) in Environmental Studies; the B.A. would be more focused on planning and policy issues related to the environment. In contrast to the B.A., the B.S. must necessarily concentrate on providing the student with training of sufficient breadth and rigor within the sciences appropriate to this inherently inter-disciplinary field. These two degrees (Environmental Science B.S. and Environmental Studies B.A.) would provide students interested in environmental careers with a new set

of degree paths hitherto unavailable formally on this campus. Obviously, the net effect should be that additional students would be attracted to this campus that might not have come otherwise. This is consistent with the stated goals and aspirations of this institution as presently outlined within the Strategic Plan for the University at Albany (1998), as well as the recently agreed upon Mission Review (Memorandum of Understanding Between U-Albany and SUNY, 2001). (These documents are available on the University's web site: *http://www.albany.edu/news_information_events/index.html.*)

Programmatic Distinctiveness

The Evironmental Science B.S. program we propose would be distinctive within at least the following aspects:

- Quantitative, field- and/or laboratory-intensive;
- Inherent flexibility via the specialty track options (see *Appendix I*);
- Enhanced linkages between Earth and Atmospheric Sciences, Biological Sciences, and Geography and Planning programs;
- Utilization of resident DEAS expertise in climate/surface processes studies (on both regional and global scales);
- Utilization of existing environmental expertise and/or facilities within the region (e.g., DEC; USGS; National Weather Service [NWS]; School of Public Health; Rockefeller College; Atmospheric Science Research Center [ASRC]; Wadsworth Laboratory; Mohawk Tower Observatory; Institute For Health and The Environment-SUNY);
- Access to field sites such as Whiteface Mountain Research Station (which is operated by ASRC); USGS Catskill region; the Huyck Preserve, Dippikill, the Albany Pine Bush, and Superfund Sites (Upper Hudson River, the Patroon Creek, Mereco, and National Lead Industries sites, all of which are local to U-Albany).

Program Overview

Environmental Science core curriculum:

Atm 100N	3 credits:	The Atmosphere
Geo 100N	3 credits:	Planet Earth
Geo/Gog 201	3 credits:	Environmental Analysis
Geo 210	3 credits:	Earth Materials *(revised course)*
Geo 250	3 credits:	Energy and Resources *(revised course)*
Geo 350	4 credits:	Environmental Geochemistry *(revised course)*
Gog 330	3 credits:	Principles of Environmental Management
Mat 111 or 112	4 credits:	Algebra and Calculus II or Calculus I
Mat 113	4 credits:	Calculus II
Mat 108	3 credits:	Statistics
Bio 110N/F	4 credits:	General Biology I
Chm 120N	3 credits:	General Chemistry I
Phy 105N+108N	6 credits:	General Physics I and II

Total credits in Environmental Science B.S. core curriculum: 46

Elective credits in one specialty track (see Appendix I): 19-20

(1) Earth Science;
(2) Atmospheric Science;
(3) Biology;
(4) Geography

Total credits in Environmental Science B.S.: 65-66

Comparison with Other Environmental Science Programs at Comparable Institutions

We have compared the curriculum for this proposed major to existing "Environmental" programs at other Universities and we find that this program, as proposed, is distinctive in its academic breadth and rigor, and in its flexibility of specialty track choice. Specifically, the Atmospheric Science and Geography tracks would be unique among academic institutions in the northeastern U.S.

Most other "Environmental" B.S. degrees are modifications of Geoscience programs and therefore focus primarily on the geosciences. Programs of that type are similar in content to B.S. degrees in Geology with other coursework in environmental geology and surface/groundwater hydrology. An exception is the Rutgers University B.S. program in Environmental Science, which is offered within their Department of Environmental Science (see *Appendix II*). This program requires study in a more diverse array of environmental disciplines that is, in fact, similar to the program proposed here. The University at Albany program would be similar in structure to the Rutgers program, but would remain distinct in reflecting specific faculty research specializations and long-standing programmatic strengths that exist here (i.e.; paleoclimatology, geochemistry, soil science, atmospheric chemistry/air pollution, aerosol physics and meteorological instrumentation).

It should also be appreciated that our program will be complementary to other programs within the SUNY system. The proposed program will emphasize our local recognized strengths in atmospheric science, geology, and paleoclimatology. As such, the programs at Syracuse and Stony Brook are not subjected to undue competition, as their emphases are forestry and marine science, respectively. Hence, within the SUNY system, our proposed program will fill an entirely appropriate niche.

Expected Student Demand and Faculty/Facility Resource Implications

Based upon a review of the current number of Geology and Atmospheric Science majors at the University at Albany, and review of other programs, we estimate that this new major will initially attract 30 to 40 majors over a two to three year period. Some of these could be current Geology or Atmospheric Science majors that would change to the new major, though we expect that at least half would be newly declared majors. As the major became established and the uniqueness of the program was realized, we anticipate that students enrolling here with this intended major would be primarily those that otherwise would not have come to this campus. We have, in fact, consulted with Mr.

Harry Wood, the Director of Admissions, regarding a realistic expectation of overall student demand for this major presently and for the next several years at least. He was gracious enough to provide a letter of support along with relevant statistics (see *Appendix III*). We believe, as he does, that these statistics confirm that there is ample student demand for this major. Further, our informal ties to private industry indicate there is a good demand for such a major, and this demand is expected to remain strong for the foreseeable future.

Also presented in *Appendix III* are letters of support from the chairs of the five other departments on campus that would provide required courses for this new degree. All assert that this would be a positive addition to this campus, and indicate that their respective department's course contribution would not be problematic as based upon our estimated enrollment over the initial years of offering this major.

An additional benefit of the Earth Sciences specialty track is the creation of new shared-resource (undergraduate/graduate) classes that will be developed. These classes will strengthen and re-focus the graduate level Geological Sciences program toward areas of environmental science and environmental change, further strengthening the interdisciplinary "bridge" between the Geological Sciences and Atmospheric Science programs. We also anticipate increased interaction with faculty in the biodiversity program of the Department of Biological Sciences. Indeed, Professors T. Caraco and G. Robinson have actively and supportively contributed to consideration of this proposal. Professor Gary Kleppel, Director of the Biodiversity, Conservation and Policy Program, also has offered a strong letter of support for the proposed degree (see *Appendix III*).

The program, as proposed here, has been built around existing faculty and facilities. Because of this design, initially no additional faculty resources would be required to get the program up-and-running. In addition, no new laboratories or other infrastructure facilities would be needed. Depending on program popularity and faculty changes in the future, additional faculty resources may be required as the program develops, but this criterion applies to all programs on campus. Because we have focused on utilizing a mixture of existing classes and development of only critically relevant new coursework, we also anticipate that a minimal increase of just one or two teaching assistants would be sufficient to initiate the program. Certainly, to mount this Environmental Science program with existing faculty resources, modifications to the current Geological Sciences B.S. program will be required. The proposed revisions are described in the next section. Note, however, that the Geological Sciences B.S. degree will remain as an available and viable program within the department.

Revisions to the Existing Geological Sciences B.S. Degree

To implement the Environmental Sciences B.S. as proposed here (without additional faculty) does necessitate certain revisions to the present Geological Sciences B.S. degree. Several required classes would be modified and the major would acquire somewhat of an environmental-geology slant similar to programs that exist at Lehigh University, Boston University, and SUNY-Buffalo (among others). The revised Geological Sciences B.S. degree would now entail coursework as detailed in *Appendix V*.

New and Revised Courses

Four new courses have been created to provide additional underpinning for the new environmental science major. These include *Earth Surface Processes and Hazards* (Geo 260), *Instrumental Analysis in Environmental Science* (Geo 420/520), *Paleoclimatology* (Geo 450/550), and *Marine/Estuary Systems* (Geo 466/566). Details concerning each of these courses are provided in *Appendix IV* (see associated Course Action Forms and course syllabi). Five other courses would undergo major revision and be renamed: *Earth Materials* (Geo 210), *Earth Materials Laboratory* (Geo 212), *Stratigraphy, Sedimentology and the Fossil Record* (Geo 230), *Energy and Resources* (Geo 250), and *Environmental Geochemistry* (Geo 350). We anticipate no problems in offering these courses frequently enough to allow potential majors to complete their degrees in a timely manner.

Proposed Degree Curriculum Relative to the New General Education Program

The Environmental Science B.S. degree curriculum proposed here will naturally overlap with courses required in the new General Education program. For example, any student selecting this major must necessarily satisfy *both* Natural Science course requirements, as well as the Mathematics and Statistics requirement via the core curriculum. The lower level writing requirement is satisfied if the student selects *General Biology I* (Bio 110F) as writing intensive. *Environmental Chemistry* (Geo 350), another required core course, will also satisfy an Oral Discourse requirement (see Course Action Form and syllabus for this revised course in *Appendix IV*). Courses within the four specialty tracks offer a good opportunity to satisfy the upper level writing requirement as well. Hence, the overlap of requisite coursework between the new General Education program and the proposed Environmental Science major is, in our opinion, quite typical and reasonable.

Student Advisement Load

The members of the faculty of the Department of Earth and Atmospheric Sciences recognize that any increase in department majors necessarily entails a correspondingly greater student advisement responsibility. To date, DEAS has an exemplary record of undergraduate student advisement; this is a facet of our department that we are particularly proud of. In this respect, the members of the faculty of DEAS are committed to handling any additional student advisement load with the same level of dedication and care as at present. Any major within our department will receive not merely adequate advisement, but truly *superior* advisement. This attention to advisement is a fundamental tenet applied to all programs offered in the department. If the reader believes these assertions amount to exaggeration, the reader is invited to contact Mr. John Downey, Director, Advisement Services Center/Undergraduate Studies.

Summary

A formal program in Environmental Science is long overdue for this campus. The available faculty and infrastructure for such a program is undeniably present but latent, needing only a point of coalescence. Admittedly, other programs exist within the SUNY system, as well as within the local and regional academic venue. Nonetheless, the proposed program would have clear *distinctiveness,* as described above, within the context of our established strengths in teaching and research. With these strengths integrated into a coherent curriculum for the new major, we are confident that DEAS and U-Albany will provide yet another high-quality undergraduate experience for our students - to their ultimate benefit. We look forward to having the opportunity to bring this new major in Environmental Science to maturity.

APPENDIX I

Proposed Bachelor of Science Degree (B.S.) in Environmental Science

Department of Earth and Atmospheric Sciences
University at Albany, State University of New York

A *combined* major/minor totaling 65-66 credits.

Programmatic Distinctiveness

- Quantitative, field- and/or laboratory-intensive;
- Inherent flexibility via the specialty track options;
- Enhanced linkages between Earth and Atmospheric Sciences, Biological Sciences, and Geography and Planning programs;
- Utilization of resident DEAS expertise in climate/surface processes studies (on both regional and global scales);
- Utilization of existing environmental expertise and/or facilities within the region (e.g., DEC; USGS; National Weather Service [NWS]; School of Public Health; Rockefeller College; Atmospheric Science Research Center [ASRC]; Wadsworth Laboratory; Mohawk Tower Observatory; Institute For Health and The Environment-SUNY);
- Access to field sites such as Whiteface Mountain Research Station (which is operated by ASRC); USGS Catskill region; the Huyck Preserve, Dippikill, the Albany Pine Bush, and Superfund Sites (Upper Hudson River, the Patroon Creek, Mereco, and National Lead Industries sites, all of which are local to U-Albany).

The Environmental Science B.S. curriculum consists of a ***core*** of ***46 credits*** plus selection of one ***specialty track*** of ***19-20 credits*** (see below).

Environmental Science B.S. core curriculum:

Atm 100N	3 credits:	The Atmosphere
Geo 100N	3 credits:	Planet Earth
Geo/Gog 201	3 credits:	Environmental Analysis
Geo 210	3 credits:	Earth Materials *(revised course)*
Geo 250	3 credits:	Energy and Resources *(revised course)*
Geo 350	4 credits:	Environ. Geochem. *(revised w/ Oral Disc. Req.)*
Gog 330	3 credits:	Principles of Environmental Management
Mat 111 or 112	4 credits:	Algebra and Calculus II *or* Calculus I
Mat 113	4 credits:	Calculus II
Mat 108	3 credits:	Statistics
Bio 110N/F	4 credits:	General Biology I

Chm 120N	3 credits:	General Chemistry I
Phy 105N+108N	6 credits:	General Physics I and II

Total credits in Environmental Science B.S. core curriculum: 46

Elective credits in one specialty track (see below): 19-20

(1) Earth Science
(2) Atmospheric Science
(3) Biology
(4) Geography

Total credits in Environmental Science B.S.: 65-66

Specialty Tracks

<u>Earth Science Specialty Track</u> (19-20 credits)

Required:

Geo 212	1 credit:	Earth Materials Laboratory *(revised course)*
Geo 260	3 credits:	Earth Surface Processes & Hazards *(new course)*
Geo 420/520	3 credits:	Instrum. Analysis in Environ. Sci. *(new course)*

Electives (any combination):

Bio 316	3 credits:	Biogeography
Geo 330	3 credits:	Structural Geology I
Geo 435/535	3 credits:	Geohydrology
Geo 450/550	3 credits:	Paleoclimatology *(new course)*
Geo 466/566	3 credits:	Marine/Estuary Systems *(new course)*
Geo 497	1-3 credits:	Independent Study (at USGS or other local organization)
Geo 498	3 credits:	Honors Research
Phy 202N	3 credits:	Environmental Physics

<u>Atmospheric Science Specialty Track</u> (19-20 credits)

Required:

Atm 210/Z	4 credits:	Atmospheric Structure
Geo 260	3 credits:	Earth Surface Processes and Hazards *(new course)*

Electives (any combination):

Atm 211	4 credits:	Weather Analysis and Forecasting
Atm 304/Z	3 credits:	Air Quality *(alternates with Atm 307)*
Atm 305	3 credits:	Global Physical Climatology *(alt. years)*

Atm 307/Z	3 credits:	Atmospheric Chemistry *(alternates with Atm 304)*
Atm 311	4 credits:	Severe and Unusual Weather Anal. & Forecasting
Atm 335	3 credits:	Meteorological Remote Sensing *(alt. years)*
Atm 422	2 credits:	Meteorol. Instrumentation & Meas. *(alt. years)*
Atm 408B	3 credits:	Hydrometeorology

Additional electives (maximum of two):

Geo 420/520	3 credits:	Instrum. Analysis in Environ. Sci. *(new course)*
Geo 450/550	3 credits:	Paleoclimatology *(new course)*
Gog 304	3 credits:	Climatology
Bio 316	3 credits:	Biogeography
Phy 202N	3 credits:	Environmental Physics

<u>Biology Specialty Track</u> (19-20 credits)

Required:

Bio 111N	4 credits:	General Biology II
Bio 320	3 credits:	Ecology

Electives (any combination):

Bio 212	4 credits:	Introductory Genetics
Bio 314	3 credits:	General Bacteriology
Bio 316	3 credits:	Biogeography
Bio 319/Z	3 credits:	Field Biology
Bio 325	4 credits:	Comparative Anatomy of Chordates
Bio 365	3 credits:	Biological Chemistry
Bio 366	3 credits:	Biological Chemistry II
Bio 402	3 credits:	Evolution
Bio 422	3 credits:	Biological Architecture
Bio 432	3 credits:	Animal Behavior
Bio 436	3 credits:	Sensory Worlds
Bio 442/443	3+1 credits:	Restoration Ecology and Laboratory
Bio 445	3 credits:	Experimental Ecology
Bio 450	3 credits:	Biodiversity *(possibly revised?)*
Bio 455	4 credits:	Plant Ecology
Bio 468	3 credits:	Behavioral Ecology

<u>Geography Specialty Track</u> (19-20 credits)

Required:

Geo 260	3 credits:	Earth Surface Processes and Hazards *(new course)*

Electives (at least four Gog courses):

Gog 290	4 credits:	Introduction to Cartography
Gog 293	3 credits:	Use and Interpretation of Aerial Photographs
Gog 304	3 credits:	Climatology
Gog 385	4 credits:	Introduction to Remote Sensing of the Environment
Gog 414	3 credits:	Computer Mapping

Gog 485	3 credits:	Advanced Remote Sensing of the Environment
Gog 496	3 credits:	Geographic Information Systems
Geo 420/520	3 credits:	Instrum. Analysis in Environ. Sci. (*new course*)
Geo 435/535	3 credits:	Geohydrology

APPENDIX II

Rutgers Program

Rutgers University:
Environmental Sciences B.S. within the Department of Environmental Sciences:

Degree: B.S. Students selecting the program in Environmental Sciences gain an understanding of the biological, chemical, and physical sciences and their application to environmental problems. Students will select an option emphasizing the chemical, physical, or biological aspects of the discipline. The program permits a reasonable degree of freedom in course of study. Selection of electives will allow students to specialize in study of air, water, or soils related problems as well as pollution and treatment sciences and environmental health, occupational, or radiological science studies. With consultation with the faculty advisor, students can design a program to meet the requirements for graduate study and to provide the basis for a professional career in government, education, consulting, or industry.

Rutgers Required Courses (52-57 CREDITS) for Environmental B.S.

Quantitative Methods (4 credits)

01:640: Calculus 1

Computer Competence (3 credits)

11:375:303 Numerical Methods (3) fulfills this requirement.
101:198:110 Introduction to Computers and Their Application (3)
or equivalent can be substituted.

Professional Ethics

Ethical problems in environmental and regulatory fields are addressed throughout the program in both introductory- and advanced-level courses.

Basic Science Requirements

01:119:101-102 General Biology (4,4)
01:160:161-162 General Chemistry (4,4)
01:160:171 Introduction to Experimentation (1)
01:750:193-194 Physics for the Sciences (3,3) or 01:750:203-204 General Physics (3,3)
or 01:750:201-202 Extended General Physics
11:704:351 Principles of Applied Ecology (4) or 01:119:330 General Ecology (3)
11:960:211 Introduction to Statistics (3) or equivalent

Environmental Sciences (375) Requirements (15 Credits)

11:375:101 Introduction to Environmental Science (3)
11:375:201 Biological Principles of Environmental Science (3)
11:375:202 Chemical Principles of Environmental Science (3)
11:375:203 Physical Principles of Environmental Science (3)
11:375:303 Numerical Methods in Environmental Science (3)

Each student will complete one of the following 4 options, including a concentration:

A: Environmental Biology
B: Environmental Chemistry
C: Environmental Physics
D: Applied Environmental Sciences

Rutgers University, Geology Department: Environmental Geology Track

The curriculum below stresses the interdisciplinary nature of both geological and environmental sciences. Students are encouraged to take additional courses in geology, mathematics, computer science, statistics, and the physical and biological sciences. A faculty adviser-assigned by the departmental office at the time the student declares the major-recommends elective courses that best suit the student's career options.

Foundation Courses

01:119:101-102 General Biology (4,4)
01:160:161-162 General Chemistry (4,4)
01:160:171 Introduction to Experimentation (1)
01:160:209 Elementary Organic Chemistry (3)
01:460:101 Introductory Geology (3)
01:460:103 Introductory Geology Laboratory (1)
01:640:CALC1-CALC2 Calculus (4,4)
01:750:203-204 General Physics (3,3)

Geological and Environmental Science Courses

01:460:307 Structural Geology (4)
01:460:330 Sedimentary Geology (4)
01:460:331 Fundamentals of Mineralogy and Petrology (4)
01:460:410 Field Geology (3) or equivalent (see Field Requirement)
01:460:412 Introduction to Geophysics (4)
11:375:201 Biological Principles of Environmental Science (3)
11:375:202 Chemical Principles of Environmental Science (3)
11:375:203 Physical Principles of Environmental Science (3)