

## Proposed revision in catalog description of program

### **INTEGRATED ENVIRONMENTAL SCIENCES PROGRAM**

#### **Faculty**

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Wade A. Znosko, PhD, *Assistant Professor of Biology*

The integrated environmental sciences major at Longwood provides an interdisciplinary perspective to develop citizen leaders who are equipped to understand complex environmental issues. The major provides strong foundational knowledge in natural and social sciences and heavily emphasizes practical skills and integrated critical thinking throughout the curriculum. Students will receive training that is appropriate preparation for graduate studies or careers in research, teaching, industry, government, or nonprofit organizations.

The major requires core competency courses in life sciences, physical sciences, earth sciences, and social sciences. Additional coursework emphasizes the development of quantitative and communication skills. The hallmark of the curriculum is the integrative courses that are required throughout each year of coursework, bringing together the core competency knowledge and skills to engage in critical thinking about environmental issues from an interdisciplinary perspective. In addition, students must choose a specialization in one of the core competency areas to complete advanced elective courses. Alternatively, a student may design an individualized concentration to best meet the student's objectives for professional preparation.

Students may take a maximum of 4 credits total in internship (ENSC 492, 494) and research (ENSC 496, 497) courses for quality points (A, B, and C grades). Beyond 4 credits, such courses must be taken on a pass/fail basis. A minimum grade of C- must be earned in every prerequisite to ENSC courses and all courses listed under the integrated environmental sciences major requirements.

### **INTEGRATED ENVIRONMENTAL SCIENCES MAJOR, BS DEGREE**

#### **A. General Education Core Requirement/38 credits**

MATH 171 is recommended for General Education Goal 5.  
PHYS 103 is recommended for General Education Goal 6.  
PHIL 316 is required for General Education Goal 12.  
ENSC 492 or 496 is required for General Education Goal 14.

#### **B. Additional BS Degree Requirements/7 credits**

MATH 301/3 credits (MATH 171 prerequisite)  
CHEM 111/4 credits

**C. Major Requirements/49 credits** (Courses noted with \* are satisfied under either General Education Requirements or Additional BS Degree Requirements and are not double-counted here.)

1. CORE CONTENT KNOWLEDGE/26 credits

Life Sciences

BIOL 122 The Diversity of Life/4 credits

BIOL 341 General Ecology/4 credits

Physical Sciences

\*CHEM 111 Fundamentals of Chemistry I/4 credits (satisfied by Additional Degree Requirements)

CHEM 112 Fundamentals of Chemistry II/4 credits

\*PHYS 103 Conceptual Physics/4 credits (satisfied if taken as General Education Goal 6)

Earth Sciences

EASC 211 Environmental Geology/4 credits

EASC 212 Atmospheric Science/4 credits

Social Sciences

*Choose two courses from the following:*

ECON 314 Environmental and Resource Economics/3 credits

ENSC 380 Introduction to Environmental Law and Policy/3 credits

GEOG 241 Cultural Geography/3 credits

SOCL 260 Environment and Society/3 credits

2. PROFESSIONAL SKILLS/7 credits

COMM 101 Public Speaking/3 credits

GEOG 275 Introduction to Geographic Information Systems/4 credits

\*MATH 171 Statistical Decision Making/3 credits (satisfied if taken as General Education Goal 5)

\*MATH 301 Applied Statistics/3 credits (satisfied by Additional Degree Requirements)

3. INTEGRATIVE ABILITIES/16 credits

ENSC 101 Introduction to Integrated Environmental Sciences/2 credits

ENSC 201 Integrated Environmental Investigations/4 credits

ENSC 340 Global Environmental Issues/3 credits

ENSC 401 Environmental Planning and Management/4 credits

ENSC 402 Environmental Decision Making/3 credits

ENSC 492 Internship in Environmental Science/1 credit (satisfies General Education Goal 14)

OR

ENSC 496 Research in Environmental Science/1 credit (satisfies General Education Goal 14)

OR

ENSC 490 Directed or Independent Study/1 credit (satisfies General Education Goal 14)

OR

ENSC 498 Honors Research in Environmental Science/1 credit (satisfies General Education Goal 14)

**D. Environmental Science Concentrations (A minimum of 12-16 credits)**

A student must choose four courses in one of the approved concentrations listed below (Life Sciences, Physical Sciences, Earth Sciences, or Social Sciences). Alternatively, a student may design an individualized concentration to best meet the student's objectives for professional preparation. An individualized concentration must be developed in consultation with the student's advisor and approved by the Departmental Curriculum Committee.

**Life Sciences Concentration (A minimum of 16 credits)**

Students selecting the Life Sciences concentration will learn about key ecosystems and gain specialized knowledge and skills pertaining to biology. They will be employable as environmental scientists and technicians, conservation biologists, environmental microbiology analysts, wildlife biologists, foresters, park naturalists and managers, and natural resources managers. Students also will be prepared to continue their education in graduate school.

*Choose four of the following courses:*

BIOL 304 Microbiology/5 credits

BIOL 342 Terrestrial Biogeography/4 credits

BIOL 361 Aquatic Ecology/5 credits

BIOL 430 Conservation Biology/4 credits

BIOL 435 Advanced Ecology/4 credits

BIOL 443 Field Botany/6 credits  
BIOL 445 Tropical Ecology/4 credits  
BIOL 471 Ornithology/4 credits  
BIOL 474 Entomology/4 credits

### **Physical Sciences Concentration (A minimum of 14 credits)**

Students selecting the Physical Sciences concentration will gain specialized knowledge and skills pertaining to environmental chemistry and chemical analysis. They will be employable as environmental scientists, technicians, and chemists. Students also will be prepared to continue their education in graduate school.

*Choose four of the following courses (lecture and lab combination counts as one course):*

CHEM 305 and 307 Organic Chemistry I (lecture + lab)/4 credits  
CHEM 306 and 308 Organic Chemistry II (lecture + lab)/4 credits  
CHEM 350 Quantitative Analysis/4 credits  
CHEM 351 Instrumental Analysis/3 credits  
CHEM 372 Environmental Chemistry/3 credits

### **Earth Sciences Concentration (A minimum of 13 credits)**

Students selecting the Earth Sciences concentration will gain specialized knowledge and skills pertaining to Earth's water resources, climate, and processes that shape the physical landscapes. They will be employable as environmental scientists and technicians, soil and water conservationists, and natural hazards analysts. Students also will be prepared to continue their education in graduate school.

*Choose four of the following courses:*

EASC 261 Meteorology/4 credits  
EASC 354 Hydrology/3 credits  
EASC 355 Climatology/3 credits  
EASC 363 Physical Oceanography/4 credits  
EASC 410 Geomorphology/3 credits  
EASC 342 Terrestrial Biogeography/4 credits

### **Social Sciences Concentration (A minimum of 12 credits)**

Students selecting the Social Sciences concentration will gain specialized knowledge and skills pertaining to the intersection of human activities and conservation. They will be employable as environmental scientists and technicians, managers of environmental outreach and educational programs, land consultants, policy advisors, and eco-tourism guides. Students also will be prepared to continue their education in graduate school.

*Choose four of the following courses:*

ECON 314 Environmental and Resource Economics/3 credits\*  
SOCL 260 Environment and Society /3 credits\*  
ENSC 380 Introduction to Environmental Law and Policy/3 credits\*  
GEOG 241 Cultural Geography/3 credits\*  
ANTH/SOCL 322 Sustainability/3 credits  
GEOG 342 Terrestrial Biogeography/4 credits  
GEOG 358 Map Design and Analysis/4 credits  
GEOG 353 Geography of Virginia/3 credits  
HIST 427 Latin American Environmental History/3 credits  
HLTH 210 Global Health/3 credits  
HLTH 400 Environmental Health/3 credits  
RECR 420 Environmental Education Resources/3 credits

\*ECON 314, SOCL 260, ENSC 380, and GEOG 241 may be used to fulfill requirements in the Social Science Concentration only if they were not taken to fulfill core competencies

**E. General Electives/10-14 credits**

**F. Total Credits Required for BS in Integrated Environmental Sciences/120 credits**

**INTEGRATED ENVIRONMENTAL SCIENCES MINOR**

Students who are interested in pursuing the integrated environmental sciences minor should contact the chair of the Department of Biological and Environmental Sciences. Grades below C- will not apply toward the fulfillment of minor requirements. The minor must include:

ENSC 101 Introduction to Integrated Environmental Sciences/2 credits  
OR GNED 162 Introduction to Environmental Science/4 credits

ENSC 201 Integrated Environmental Investigations/4 credits  
BIOL 122 The Diversity of Life/4 credits

CHEM 111 Fundamentals of Chemistry I/4 credits  
OR PHYS 103 Conceptual Physics/4 credits

EASC 211 Environmental Geology/4 credits  
OR EASC 212 Atmospheric Science/4 credits

One of the following courses:

ECON 314 Environmental and Resource Economics/3 credits  
ENSC 380 Introduction to Environmental Law and Policy/3 credits  
GEOG 241 Cultural Geography/3 credits  
SOCL 260 Environment and Society/3 credits

**Total required hours:** 21-23 credits

**ENVIRONMENTAL SCIENCE COURSE DESCRIPTIONS (ENSC)**

*A special fee is charged for all courses with laboratories.*

General Education Course \*  
Writing Intensive Course WR  
Speaking Intensive Course SP

**ENSC 101.** *Introduction to Integrated Environmental Sciences.* This seminar-style course overviews contemporary global issues in environmental science, including species extinction, pollution, resource depletion, and waste. Students examine behavior leading to environmental degradation; consider the scientific, ethical, and economic aspects of the resulting problems; and study policies intended to provide solutions. Students learn to recognize the integration of multiple disciplines in environmental issues and the complexity involved in environmental problem solving. 2 lecture hours. 2 credits.

**ENSC 201.** *Integrated Environmental Investigations.* This course introduces an interdisciplinary and investigative approach to the science underlying environmental issues and the analysis of environmental problems. Students engage in the process of science through guided inquiry, experiments, and field work, and they will practice design of experiments, analysis and presentation of quantitative data, and written and oral communication. Prerequisites: ENSC 101 and MATH 171. 3 lecture and one 2-hour lab periods. 4 credits.

**ENSC 340 (GEOG 340).** *Global Environmental Issues.* This course requires students to apply the varied perspectives from the social sciences and natural sciences to gain a more integrated and multifaceted understanding of environmental issues at the global scale. It will examine the effects of globalization on the environment and economy in different parts of the world. Within the context of human population dynamics, the course will examine both physical and social sustainability issues associated with natural resource consumption and environment change. Prerequisite: ENSC 201. 3 credits. WR and SP.

**ENSC 380.** *Introduction to Environmental Law and Policy.* This course provides an introduction to concepts, issues, and statutes in national and international environmental law. In addition to reviewing background constitutional provisions, students examine a representative selection of federal statutes, including the National Environmental Policy Act, the Endangered Species Act, the Clean Water Act, the Clean Air Act, and the Resource Conservation and Recovery Act. The class explores the differences between “Dillon Rule” states (like Virginia) and “Home Rule” states. Students consider the expanding field of multi-nation treaties, laws, and politics governing the global environment as they relate to significant contemporary issues such as global climate change, sustainable development, biodiversity conservation, and transboundary air and water pollution. 3 lecture periods. 3 credits.

**ENSC 390.** *Directed or Independent Study.* Must be approved by the head of the department. 1-8 credits.

**ENSC 401.** *Environmental Planning and Management.* This course utilizes a comprehensive, interdisciplinary approach to examine issues related to natural resource management and their impacts on the environment. Principles of land use planning are considered within a broad framework that includes topics such as urban and rural development, natural hazard mitigation, ecosystem and watershed management, edaphic and hydrologic features, forest and wildlife management, and marine and coastal planning. The course integrates knowledge from previous coursework to consider the associated social, legal, economic, and scientific aspects, as well as the applications of skills involved in environmental impact assessment, such as GIS and analytical methods. Emphasis is placed on understanding the collaborative nature of approaches, methods, and techniques for sustainability. Prerequisites: GEOG 275, MATH 301, and at least 75 credit hours. 3 lecture and one 2-hour lab periods. 4 credits. WR.

**ENSC 402.** *Environmental Decision Making.* In this interdisciplinary capstone experience, students develop an understanding of and identify potential solutions to current environmental problems. Through a collaborative approach to encourage synthesis and analysis from multiple perspectives, students will develop research, communication (both oral and written), and collaborative work skills. Exploration of focal problems requires the integration of knowledge and skills from students' work in the natural and social sciences and the consideration of ethical, social justice, and economic perspectives. Further, a civic engagement component provides useful information to the community and provides students with real experience interacting with stakeholders. Prerequisites: GEOG/ENSC 340, ENSC 401, and COMM 101. 3 lecture periods. 3 credits. SP.

**ENSC 490.** *Directed or Independent Study.* Must be approved by the head of the department. 1-8 credits. \*Fulfills General Education Goal 14.

**ENSC 492.** *Internship in Environmental Science.* A semester-long, on-the-job learning experience designed to apply the principles of environmental science. May be repeated. 1-4 credits. Maximum of 4 hours total for ENSC 492 and/or ENSC 496. \*Fulfills General Education Goal 14.

**ENSC 494.** *Advanced Internship in Environmental Science.* A semester-long, on-the-job learning experience designed to apply the principles of environmental science. May be a continuation of ENSC 492 or a new internship experience that involves advanced responsibilities and application of knowledge. May be repeated. 1-4 credits.

**ENSC 496.** *Research in Environmental Science.* With the approval of a faculty member and the department chair, a student may carry out an individual research project. May be repeated. 1-4 credits. Maximum of 4 hours total for ENSC 492 and/or ENSC 496. \*Fulfills General Education Goal 14.

**ENSC 497.** *Advanced Research in Environmental Science.* With the approval of a faculty member and the department chair, a student may carry out an individual research project. May be a continuation of ENSC 496 or a new research project that involves advanced application of knowledge and skills. Students are encouraged to share the findings of their research through a poster or oral presentation. May be repeated. 1-4 credits.

**ENSC 498.** *Honors Research in Environmental Science.* Students conduct research in environmental science under the direction of a faculty member and the Senior Honors Research Committee. May be repeated as 499. 3 credits. WR. \*Fulfills General Education Goal 14.