ENVIRONMENTAL STUDIES, BACHELOR OF SCIENCE (B.S.)

The Bachelor of Science in Environmental Studies requires a minimum of 120 credits.

Along with the general education requirements of VCU Life Sciences, this curriculum requires 32-33 credits in core science and mathematics courses and 37-38 credits in environmental studies core courses.

Learning outcomes
Upon completing this program, students will have mastered and be able to demonstrate the following:

- Comprehension of the foundational scientific concepts that underpin understanding of the environment
- Comprehension of basic environmental policies that govern society's interactions with the environment
- Comprehension of quantitative skills required in environmental research, policy development and education
- The ability to communicate about environmental issues in a variety of contexts

Special requirements
The Bachelor of Science in Environmental Studies requires a minimum 2.0 cumulative average in all major course work and a minimum of 34 credits of upper-level (e.g., 3XX, 4XX, or 5XX) approved courses. To meet the University Core capstone (Tier III) requirement, students are required to complete ENVS 499 and an additional course as approved by the unit. This additional course credit will count toward the electives for this major.

Degree requirements for Environmental Studies, Bachelor of Science (B.S.)

General Education requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIV 111</td>
<td>Play course video for</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Focused Inquiry I</td>
<td></td>
</tr>
<tr>
<td>UNIV 112</td>
<td>Play course video for</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Focused Inquiry II</td>
<td></td>
</tr>
<tr>
<td>UNIV 200</td>
<td>Inquiry and the Craft of Argument</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Approved humanities/fine arts</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Approved natural/physical sciences</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Approved quantitative literacy</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Approved social.behavioral sciences</td>
<td>3-4</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>21-24</td>
</tr>
</tbody>
</table>

Course Title Hours
University Core Education Curriculum (minimum 21 credits)

Major requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 151 &amp; BIOZ 151</td>
<td>Introduction to Biological Sciences I and Introduction to Biological Science Laboratory I</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 152 &amp; BIOZ 152</td>
<td>Introduction to Biological Sciences II and Introduction to Biological Science Laboratory II</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 317</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 101 &amp; CHEZ 101</td>
<td>General Chemistry I and General Chemistry Laboratory I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 102 &amp; CHEZ 102</td>
<td>General Chemistry II and General Chemistry Laboratory II</td>
<td>4</td>
</tr>
<tr>
<td>ECON 325</td>
<td>Environmental Economics</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 101</td>
<td>Introduction to Environmental Studies I</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 102</td>
<td>Introduction to Environmental Studies II</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 105</td>
<td>Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>ENVS/POLI 311</td>
<td>Politics of the Environment</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 330/BIOZ 332</td>
<td>Environmental Pollution</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 335 &amp; ENVZ 335</td>
<td>Environmental Geology and Environmental Geology Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>ENVS 401</td>
<td>Meteorology and Climatology</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 411</td>
<td>Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 499</td>
<td>Environmental Studies Capstone Experience (Tier III Capstone)</td>
<td>0</td>
</tr>
<tr>
<td>MATH 151</td>
<td>Precalculus Mathematics (by course or placement)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 201 or PHYS 207</td>
<td>General Physics I</td>
<td>4-5</td>
</tr>
<tr>
<td>STAT 314</td>
<td>Applications of Statistics</td>
<td>4</td>
</tr>
<tr>
<td>Major electives</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>71-72</td>
</tr>
</tbody>
</table>

Open electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open elective credits (up to a total of 120 credits)</td>
<td>13-25</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>13-25</td>
</tr>
</tbody>
</table>

The minimum total of credit hours required for this degree is 120.

Possible major electives
Any ENVS or ENVZ course at the 300, 400 or 500 level or courses listed below.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 103</td>
<td>Environmental Science</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 307</td>
<td>Aquatic Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 312</td>
<td>Invertebrate Zoology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 313</td>
<td>Vertebrate Natural History</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 314</td>
<td>Animal Reproduction</td>
<td>3</td>
</tr>
</tbody>
</table>
BIOL 320  Biology of the Seed Plant  4
BIOL 321  Plant Development  3
BIOL 322  Economic Botany  3
BIOL 332  Environmental Pollution  3
BIOL 333  Evolution of the Angiosperms  3
BIOL 335  Global Change Biology  3
BIOL 402  Comparative Vertebrate Anatomy  5
BIOL 403  Primatology  4
BIOL 411  Physiology  3
BIOL 415  Mangrove Avian Field Ecology  4
BIOL 416  Ornithology  3
BIOL 422  Forest Ecology  4
BIOL 423  Plant Physiology  3
BIOL 425  Play course Field Botany  3
BIOL 459  Infectious Disease Ecology  3
BIOL 480  Animal-Plant Interactions  3
BIOL 491  Topics in Biology  1-4
BIOL 497  Ecological Service Learning  1
BIOL 498  Insects and Plants Service-learning  2
BIOL 507  Aquatic Microbiology  4
BIOL 508  Barrier Island Ecology  3
BIOL 510  Conservation Biology  3
BIOL 512  Plant Diversity and Evolution  4
BIOL 514  Stream Ecology  4
BIOL 516  Population Genetics  3
BIOL 518  Plant Ecology  4
BIOL 519  Forest Ecology  4
BIOL 520  Population Ecology  3
BIOL 521  Community Ecology  3
BIOL 522  Evolution and Speciation  3
BIOL 532  Water Pollution Biology  3
BIOL 535  Wetlands Ecology  4
BIOL 545  Biological Complexity  3
BIOL 550  Ecological Genetics  3
BIOL 591  Special Topics in Biology  1-4
BIOZ 307  Aquatic Ecology Laboratory  1
BIOZ 312  Invertebrate Zoology Laboratory  1
BIOZ 313  Vertebrate Natural History Laboratory  1
BIOZ 317  Ecology Laboratory  2
BIOZ 416  Ornithology Laboratory  2
ENGL 368  Nature Writing  3
ENVZ 105  Physical Geology Laboratory  1
URSP 332  Environmental Management  3
URSP 545  Sustainable Energy Policy and Planning  3

Freshman year
Fall semester
ENVS 101  Introduction to Environmental Studies I  3
MATH 141  Algebra with Applications  3
UNIV 101  Introduction to the University  1
UNIV 111  Play course video for Focused Inquiry I  3
University Core course (natural/physical sciences)  3
University Core course (social/behavioral sciences)  3
Term Hours:  16

Spring semester
CHEM 101  General Chemistry I & CHEZ 101 and General Chemistry Laboratory I  4
ENVS 102  Introduction to Environmental Studies II  3
MATH 151  Precalculus Mathematics (satisfies University Core quantitative literacy)  4
UNIV 112  Play course video for Focused Inquiry II  3
Term Hours:  14

Sophomore year
Fall semester
BIOL 151  Introduction to Biological Sciences I & BIOZ 151 and Introduction to Biological Science Laboratory I  4
CHEM 102  General Chemistry II & CHEZ 102  4
UNIV 200  Inquiry and the Craft of Argument  3
Foreign language (101-level)  4
Term Hours:  15

Spring semester
BIOL 152  Introduction to Biological Sciences II & BIOZ 152 and Introduction to Biological Science Laboratory II  4
ENVS 105 or URSP 204  Physical Geology or Physical Geography  3
STAT 210  Basic Practice of Statistics  3
Foreign language (102-level)  4
Term Hours:  14

Junior year
Fall semester
BIOL 317  Ecology  3
ENVS/POLI 311  Politics of the Environment  3
ENVS 330/BIOL 332  Environmental Pollution  3
PHYS 201  General Physics I  4
Open elective  3
Term Hours:  16
### Environmental Studies, Bachelor of Science (B.S.)

#### Major Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVS 101</td>
<td>Introduction to Environmental Studies I</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 102</td>
<td>Introduction to Environmental Studies II</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 103</td>
<td>Environmental Science</td>
<td>4</td>
</tr>
<tr>
<td>ENVS 300</td>
<td>Sustainable Societies: James River Basin</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 291</td>
<td>Special Topics in Environmental Studies</td>
<td>1-4</td>
</tr>
<tr>
<td>ENVS 301</td>
<td>Introduction to Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 305</td>
<td>Introduction to Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 311</td>
<td>Politics of the Environment</td>
<td>3</td>
</tr>
<tr>
<td>ENVS 335</td>
<td>Environmental Geology</td>
<td>4</td>
</tr>
<tr>
<td>&amp; ENVS 335</td>
<td>Environmental Geology Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>Major elective</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Open electives</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

#### Term Hours: 15

#### Total Hours: 120

The minimum total of credit hours required for this degree is 120.

- Environmental Studies (ENVS) (p. 3)
- Life Sciences (LFSC) (p. 5)

### Environmental Studies

**ENVS 101. Introduction to Environmental Studies I. 3 Hours.**
Semester course; 3 lecture hours. 3 credits. An introductory course designed to provide the student with an overview of the structures and processes that cause weather. These include atmospheric circulations and the weather patterns that we observe. Emphasis will be placed upon the tracking and display of weather phenomena, as well as their forecast movement and impact.

**ENVS 102. Introduction to Environmental Studies II. 3 Hours.**
Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 101 or permission of instructor. An introduction to the structures and processes of the world's oceans. These include the systems that impact the oceans: the hydrosphere, the atmosphere, the geosphere, the biosphere and the sociosphere. Emphasis will be placed upon hands-on techniques for understanding these systems, including online simulations and in-class activities.

**ENVS 103. Environmental Science. 4 Hours.**
Semester course; 3 lecture and 2 laboratory hours (delivered mostly online). 4 credits. Online presentations, assignments, debates and exams require students to understand situations and ideas that involve scientific, social and economic concepts associated with Earth’s environment. Laboratory exercises reinforce major course concepts. Integrates aspects of biology, chemistry, geology, physics and sociology. Topics include ecology, evolution, natural resources, air and water resources, energy and recycling, population biology, and sustainable global societies. Not applicable as a prerequisite for any biology course at the 200 level or above, nor for credit toward the B.S. in Biology. Crosslisted as: BIOL 103.
ENVS 314. Man and Environment. 3 Hours.
Semester course; 3 lecture hours. 3 credits. A comparative study of the ecology and natural history of human populations, including the environments as determining factors in the evolution of human institutions and technology, resources management, and population crises; cultural traditions as mechanisms of population control; basic theory of population biology. Crosslisted as: INTL 314.

ENVS 315. Energy and the Environment. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Enrollment restricted to non-physics majors with junior or senior standing; not applicable to the physics major. A study of society's demands for energy, how it is currently being met, the environmental consequences thereof and some discussion of alternatives. Crosslisted as: PHYS 315.

ENVS 330. Environmental Pollution. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: eight credits in biology. The study of pollution in the environment with emphasis on the procedures for detection and abatement. Crosslisted as: BIOL 332.

ENVS 332. Environmental Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: URSP 204. An interdisciplinary review of domestic and international environmental problems and their underlying causes, current management frameworks, alternative management approaches and strategies, and barriers to their implementation. Other topics include: environmental history and economics, population growth, natural resources use, biodiversity, pollution. Crosslisted as: URSP 332.

ENVS 335. Environmental Geology. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 105 or URSP 204. The relationship between humankind and the physical environment, earth materials and processes, geological hazards, water, mineral and energy resources, land use, and environmental health and law.

ENVS 360. Outdoor Programming and Event Management. 3 Hours.
Semester course; 3 lecture hours. 3 credits. This course is designed to provide students with information and practical experience required to successfully design, promote, implement and evaluate outdoor experiential programming across a range of contexts.

ENVS 361. Outdoor Team Building and Group Facilitation. 3 Hours.
Semester course; 3 lecture hours. 3 credits. This course is designed to provide students with the theory and practice of developing and deploying a successful outdoor recreational, educational, interpretive or adventure experience. In doing so, students will learn about group dynamics, team building, risk management and inquiry-based learning techniques.

ENVS 368. Nature Writing. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: ENGL 201, 202, 203, 204, 205, 206, 211, 215, 236, 291 or 295. A study of the literary genre of nature writing in English. Crosslisted as: ENGL 368.

ENVS 391. Special Topics in Environmental Studies. 1-4 Hours.
Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with different topics for a maximum of 12 credits. A detailed investigation into a selected topic salient to environmental studies. See the Schedule of Classes for specific topics being offered each semester.

ENVS 401. Meteorology and Climatology. 3 Hours.
Semester course; 3 lecture hours. Prerequisite: PHYS 201 or PHYS 207. A basic, semiquantitative course in the elements of weather and climate, their driving forces and their spatial and temporal distribution and variability. Atmospheric motions and circulation, weather forecasting, human impact on weather and climate.

ENVS 411. Oceanography. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 151, BIOL 152 and CHEM 102. A basic course in the physical, chemical and geological properties of oceans and ocean basins. Origin and character of ocean basins, properties of oceanic waters, oceanic circulation, land-sea interactions, marine environments and ecology.

ENVS 421. Environmental Data Visualization. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 314. This is an introductory course in using databases and geospatial technology. The course will introduce students to computer technology, project development and management skills, database management skills, and geospatial technology. Students will use in-class applied environmental analyses to guide skill-set development. The course will introduce the students to working with data in various formats and using the ArcGIS software suite to visualize the data. Students will be introduced to Microsoft Excel, Microsoft Access, ESRI ArcGIS software suite and ESRI ArcGIS Online.

ENVS 460. Wilderness First Responder. 3 Hours.
Semester course; 3 lecture hours. 3 credits. This course is intended for anyone working in a position of leadership in an outdoor setting or for individuals who want a high level of wilderness medical training for working in remote field settings, extended personal backcountry trips or expeditions. The course is a comprehensive and in-depth look at the standards and skills of dealing with response and assessment, musculoskeletal injuries, environmental emergencies and survival skills, soft tissue injuries, and medical emergencies. Additional topics, such as CPR, are also included. Wilderness First Responder training is the industry standard for those who work as government and nongovernment field technicians, backcountry trip leaders, camp counselors, mountain guides, river guides and ski patrollers.

ENVS 461. Wilderness Policy and Practice. 3 Hours.
Semester course; 2 lecture and 1 field experience hours. 3 credits. This course takes a multidisciplinary and experiential look at the concept of wilderness. Learning spans from the classroom to a first-hand wilderness experience, and materials include environmental law, natural resources management, environmental philosophy and ethics, regional and local history, and conservation science. Throughout students will focus on the intersection between society, biodiversity and the wilderness concept in principle and practice.

ENVS 490. Research Seminar in Environmental Studies. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisites: senior standing and at least 12 hours of approved environmental studies course work. An interdisciplinary examination of problems and issues central to environmental studies. Environmental research of VCU faculty will be reviewed, and selected local environmental problems will be studied. Each student will complete a research project focusing on a specific environmental question.

ENVS 491. Topics in Environmental Studies. 1-4 Hours.
Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with different topics for a maximum of 12 credits. An in-depth study of a selected environmental topic. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

ENVS 492. Independent Study. 1-3 Hours.
Semester course; variable hours. Variable credit. Maximum of 3 credits per semester; maximum total of 6 credits for all topics courses. Prerequisite: junior or senior standing, and permission of instructor.
ENVS 493. Environmental Studies Internship. 1-3 Hours.
Semester course; variable hours. 1-3 credits per semester. Maximum total of 6 credits. Prerequisite: junior or senior standing, and permission of instructor. Graded as pass/fail.

ENVS 499. Environmental Studies Capstone Experience. 0 Hours.
Semester course; variable hours. 0 credits. Corequisite: ENVS 490, ENVS 491 (when topics implement core competencies required for a capstone experience and are approved by the director of the Center for Environmental Studies), ENVS 492 or ENVS 493. Enrollment restricted to students who have completed 90 hours of undergraduate course work. Any of the corequisite courses qualify as a capstone experience if taken with this course. Graded as pass/fail.

Life Sciences

LFSC 101. Academic and Career Options in Life Sciences. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Students interested in the life sciences at VCU are faced with an enormous variety of academic options from bioinformatics and biomedical engineering to exercise science and nursing. Students outside of these programs have post-graduate opportunities in the life sciences, such as health care administration and government policy. This course will introduce students to an overview of all of the academic programs in life sciences available at VCU and their associated potential career options. Graded as pass/fail.

LFSC 191. Special Topics in Integrative Life Sciences. 1-4 Hours.
Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for credit with different topics. A 100-level study of a selected topic in integrative life sciences. Students will find specific topics and prerequisites for each special topics course listed in the Schedule of Classes. If multiple topics are offered, students may elect to take more than one.

LFSC 251. Phage Discovery I. 2 Hours.
Semester course; 4 laboratory hours. 2 credits. Corequisite: BIOL 151 or 152. An exploratory laboratory where students will purify phage from soil, visualize phage using electron microscopy and isolate genomic material for nucleic acid sequencing. Registration by override only. Crosslisted as: BNFO 251.

LFSC 252. Phage Discovery II. 2 Hours.
Semester course; 4 laboratory hours. 2 credits. Corequisite: BIOL 151 or 152. An exploratory laboratory where students will learn about the genomes of viruses infecting bacteria. Students will be given the genome sequence of a novel virus, which will be the basis for a series of computer-based analyses to understand the biology of the virus and to compare it with other viruses that infect the same host. Registration by override only. Crosslisted as: BNFO 252.

LFSC 301. Integrative Life Sciences Research. 3 Hours.
Semester course; 2 lecture and 1 recitation hours. 3 credits. Pre- or corequisite: UNIV 200 or HONR 200. Students will leave this course knowing enough about science and the process of science to feel confident in critically evaluating scientific information and/or embarking on their own process of discovery with a faculty mentor. They will gain an appreciation of the interdisciplinary and complex nature of life sciences and will hone their critical thinking about how science interacts with and informs society.

LFSC 307. Community Solutions: Multiple Perspectives. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: PSYC 101. Explores possibilities for addressing social concerns of the Richmond community by understanding the complex nature of social issues as essential to their successful amelioration via perspectives of life and social sciences. Toward this end, expertise from the social sciences, the life sciences and the community are integrated. Includes a service-learning experience (a 20-hour volunteer requirement). Crosslisted as: PSYC 307.

LFSC 391. Special Topics in Integrative Life Sciences. 1-4 Hours.
Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for credit with different topics. A 300-level study of a selected topic in integrative life sciences. Students will find specific topics and prerequisites for each special topics course listed in the Schedule of Classes. If multiple topics are offered, students may elect to take more than one.

LFSC 401. Faith and Life Sciences. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: UNIV 200 or HONR 200. Open to students of any school or program. Explores the complex relationships between faith traditions and the life sciences. Topics include epistemology, impact of life sciences on ideas of fate and responsibility, limits of science and technology, and scientific and religious perspectives on human origins, consciousness, aggression, forgiveness, health, illness and death. Crosslisted as: RELS 401.

LFSC 491. Special Topics in Integrative Life Sciences. 1-4 Hours.
Semester course; 1-4 lecture hours. 1-4 credits. May be repeated for credit with different topics. A 400-level study of a selected topic in integrative life sciences. Students will find specific topics and prerequisites for each special topics course listed in the Schedule of Classes. If multiple topics are offered, students may elect to take more than one.