

# ENVIRONMENTAL SCIENCE: NATURAL SCIENCE CONCENTRATION

## Degree: B.S., Environmental Science and Geology

Department of Earth and Environmental Sciences (<https://cas.umw.edu/ees/>)

The Environmental Science and Geology degree (Bachelor of Science) promotes the study of our environment and the impact that human activities have on natural systems. Environmental Science majors choose either a natural science or a social science perspective according to their interests. Both tracks provide a strong background for advanced study or allow placement directly in a variety of career areas.

The Natural Science track provides a background in biology, chemistry, and geology. Analytical skills acquired in this program, coupled with an appreciation of socioeconomic considerations, will prepare the student to evaluate environmental problems and work on solutions with the limits of societal resources in mind.

The interdisciplinary nature of the Environmental Science program permits students to select classes from a wide range of course offerings in multiple departments in order to best prepare for personal career goals.

The Department has modern laboratories in the Jepson Science Center equipped with advanced analytical instruments to support classroom instruction and to provide opportunities for research. Equipment for ecological studies in terrestrial, fresh water, and marine environments includes live animal traps, plankton and insect nets, seines, dissolved oxygen, conductivity, and pH meters, and fresh and salt water aquaria. Major laboratory equipment includes petrographic microscopes, a magnetic susceptibility instrument, and dedicated lab facilities for paleontology, sedimentology, and geochemistry. The Jepson Science Center has a variable pressure scanning electron microscope with chemical capabilities that is shared by the science disciplines. For environmental and geological fieldwork, the department has GPS equipment, a small fleet of research boats (including one equipped for trawling, coring, and dredging), coring and surveying equipment, and for classroom study, an extensive collection of rocks, minerals, and fossils. The department also maintains a computer lab/classroom equipped with the latest Geographic Information Systems (GIS) software.

Majors in all of our programs are encouraged to do independent study and/or research during their senior year. Financial support for student research is available. Qualified students may also choose to do an internship with a professional organization during either their junior or senior year. Students with a 3.00 overall grade-point average and a 3.25 grade-point average in the major may pursue Honors in Environmental Science, Geology, or Environmental Geology by completing an independent research project and writing and defending a thesis.

All of our majors are encouraged to fulfill the general education experiential learning requirement by completing URES 197 Undergraduate Research, EESC 481 Readings, EESC 491 Individual Study, EESC 493 Honors Research, or EESC 499 Internship. Alternatively, majors may meet this requirement by participating in an approved supervised on-campus or off-campus summer research experience developed in consultation with the department (such as the UMW Summer Science Research Program or a similar program at another college or university). **To complete**

the Beyond The Classroom requirement through a summer research experience, contact the department chair for more details.

## Student Learning Outcomes

1. Students will demonstrate how different components of the Earth System interact.
2. Students will demonstrate the ability to examine a problem and develop a solution.
3. Students will demonstrate the ability to collect field and lab data.
4. Students will demonstrate the ability to process and interpret data sets.
5. Students will demonstrate the ability to effectively communicate in both oral and written formats.

## Major Requirements

Code	Title	Credits
EESC 110	Environmental and Ecological Systems	3
EESC 111	Our Dynamic Earth	4
EESC 120	Principles of Environmental Sustainability	4
EESC 315	Hydrogeology	4
EESC 460	Senior Seminar	2
Select one of the following:		4
EESC 205	GIS Applications in Environmental Science and Geology with Lab	
GISC 200	Introduction to GIS	
GISC 250	Introduction to Geographic Information Systems and Cartography	
Select one of the following:		4
BIOL 311	Plant Ecology	
BIOL 322	Animal Ecology	
BIOL 426	Biology of Fishes	
BIOL 427	Ornithology	
BIOL 428	Conservation Biology	
EESC 418	Applied Ecotoxicology	
Select one of the following:		4
CHEM 211	Organic Chemistry I	
CHEM 253	Chemical Analysis I	
CHEM 254	Chemical Analysis II	
EESC 325	Environmental Geochemistry	
Select 12 credits from courses in the Natural Sciences Elective Track list		12
<b>Total Credits</b>		<b>41</b>

## Major Electives for the Natural Sciences Concentration

Code	Title	Credits
<b>Biology Courses</b>		
BIOL 231	Plant Biology	4
BIOL 260	Biostatistics and Research Design	4
BIOL 311	Plant Ecology	4
BIOL 321	Invertebrate Zoology	4
BIOL 322	Animal Ecology	4
BIOL 323	Entomology	4

BIOL 340	Cellular Biology	4
BIOL 341	General Genetics	4
BIOL 371	Microbiology	4
BIOL 372	Parasitology	4
BIOL 401	Animal Behavior	3
BIOL 424	Tropical Ecology	4
BIOL 425	Vertebrate Zoology	4
BIOL 426	Biology of Fishes	4
BIOL 427	Ornithology	4
BIOL 428	Conservation Biology	4
BIOL 435	Plant Physiology	4

**Chemistry Courses**

CHEM 211	Organic Chemistry I	4
CHEM 212	Organic Chemistry II	4
CHEM 253	Chemical Analysis I	4
CHEM 254	Chemical Analysis II	4
CHEM 317	Biochemistry I	3
CHEM 318	Biochemistry II	3
CHEM 319	Biochemistry Laboratory I	1
CHEM 320	Biochemistry Laboratory II	1
CHEM 343	Inorganic Chemistry	3
CHEM 345	Inorganic Chemistry Laboratory	1
CHEM 423	Experimental Methods in Chemistry	4

**Economics Courses**

ECON 331A	Environmental and Resource Economics	3
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**Earth and Environmental Science Courses**

EESC 121	Oceanography	4
EESC 230	Global Environmental Problems	3
EESC 240	Field Methods in Environmental Science and Geology	4
EESC 301	Mineralogy	4
EESC 307	Environmental Soil Science	3
EESC 311	Sedimentation and Stratigraphy	4
EESC 313	Watershed Management	4
EESC 325	Environmental Geochemistry	4
EESC 326	Pollution Prevention Planning	3
EESC 330	Environmental Regulations	3
EESC 340	Energy Resources and Technology	3
EESC 355	Icehouse-Greenhouse Earth	3
EESC 360	Environmental Exploration	2-4
EESC 421	Special Topics	2-4
EESC 465	Senior Portfolio and Career Preparation	1
EESC 481	Readings	1-2
EESC 491	Individual Study	1-4
EESC 493	Honors Research	4
EESC 499	Internship <sup>1</sup>	1-12

**Geography Courses**

GEOG 110	Introduction to Weather and Climate	4
GEOG 231	Introduction to Planning	3
GEOG 325	Dynamic Climatology	3
GEOG 351A	Spatial Analysis	4

**Geographic Information Science Courses**

GISC 340	Remote Sensing and Air Photo Interpretation	4
GISC 351	Spatial Analysis	4
GISC 355	Mobile Geographic Information Systems and Global Positioning Systems	4

<sup>1</sup> A maximum of 3 credits may count toward the major requirements.

**Prerequisite Courses****Natural Science Concentration**

Code	Title	Credits
Select one of the following:		
BIOL 121	Biological Concepts	
& BIOL 132	and Organism Function and Diversity	
BIOL 125	Phage Hunters I	
& BIOL 126	and Phage Hunters II	
BIOL 210	Introduction to Ecology and Evolution	3
CHEM 111	General Chemistry I	4
CHEM 112	General Chemistry II	4

**General Education Requirements**

The general education requirements for Bachelor of Arts/Bachelor of Science degrees (<https://catalog.umw.edu/undergraduate/general-education/requirements-bachelor-arts-bachelor-science-degrees/>) apply to all students who are seeking to earn an undergraduate B.A., B.S. or B.S.Ed. degree.

Students seeking a Bachelor of Liberal Studies degree have a separate set of BLS general education requirements (<https://catalog.umw.edu/undergraduate/general-education/requirements-bachelor-liberal-studies-degrees/>).

**Electives**

Elective courses are those that are not needed to fulfill a general education requirement or major program requirement but are chosen by the student to complete the 120 credits required for graduation with a B.A./B.S./B.S.Ed. degree or the BLS degree. These courses may be taken graded or pass/fail (or S/U in the case of physical education and 100-level dance). No student in a regular B.A./B.S./B.S.Ed. program may count more than 60 credits in a single discipline toward the 120 credits required for graduation.

**Total Credits Required for the Degree:** 120 credits

**Plan of Study**

This suggested plan of study should serve as a guide to assist students when planning their course selections. It is not a substitute for a student's Degree Evaluation or the Program Requirements listed for this major in the catalog. Academic planning is the student's responsibility, and course selections should be finalized only after speaking with an advisor. Students should familiarize themselves with the catalog in effect at the time they matriculated at the University of Mary Washington. Students should also familiarize themselves with general education requirements (<https://catalog.umw.edu/undergraduate/general-education/>) which can be fulfilled through general electives as well as major/minor course requirements. Course requirements and sequencing may vary with AP, IB, CLEP, Cambridge or previous coursework, transfer courses, or other conditions. To be considered full-time, an undergraduate student must be enrolled in 12 or more credits for the semester.

Course	Title	Credits
<b>Freshman</b>		
<b>Fall</b>		
BIOL 121	Biological Concepts	4
EESC 110	Environmental and Ecological Systems	3
FSEM 100	First-Year Seminar	3
General Education Courses		6
<b>Credits</b>		<b>16</b>
<b>Spring</b>		
BIOL 132	Organism Function and Diversity	4
EESC 120	Principles of Environmental Sustainability	4
General Education Courses		6
<b>Credits</b>		<b>14</b>
<b>Sophomore</b>		
<b>Fall</b>		
CHEM 111	General Chemistry I	4
EESC 205	GIS Applications in Environmental Science and	4
or GISC 200	Geology with Lab	
or GISC 250	or Introduction to GIS	
	or Introduction to Geographic Information Systems	
	and Cartography	
EESC 111	Our Dynamic Earth	4
General Education Course or Elective		3
<b>Credits</b>		<b>15</b>
<b>Spring</b>		
CHEM 112	General Chemistry II	4
BIOL 210	Introduction to Ecology and Evolution	3
Natural Science Concentration Elective		4
General Education Courses or Electives		6
<b>Credits</b>		<b>17</b>
<b>Junior</b>		
<b>Fall</b>		
EESC 315	Hydrogeology	4
300 or 400-Level Ecology Course		4
General Education Courses or Electives		6
<b>Credits</b>		<b>14</b>
<b>Spring</b>		
General Electives		12
Natural Sciences Concentration Elective		4
<b>Credits</b>		<b>16</b>
<b>Senior</b>		
<b>Fall</b>		
EESC 465	Senior Portfolio and Career Preparation	1
Natural Sciences Concentration Elective		4
General Electives		8
<b>Credits</b>		<b>13</b>
<b>Spring</b>		
EESC 325	Environmental Geochemistry	4
EESC 460	Senior Seminar	2
General Electives		9
<b>Credits</b>		<b>15</b>
<b>Total Credits</b>		<b>120</b>

Chemistry II during fall of the sophomore year. Alternatively, a student may take the CHEM 111-112 sequence during their sophomore year.

EESC 110, EESC 205 (GISC Option), EESC 315, and EESC 418 (Natural Sciences Concentration Elective Option) are traditionally offered every fall semester.

EESC 120, EESC 325 (Natural Sciences Concentration Elective Option), and EESC 460 are traditionally offered every spring semester.

## Earth and Environmental Sciences Department

Jodie L. Hayob, Chair

Jodie L. Hayob, Career Advisor (Geology)

Melanie D. Szulczewski, Career Advisor (Environmental Science)/  
Program Director, (Environmental Sustainability Minor)

### Faculty

#### Professors

Jodie L. Hayob

Ben O. Kisila

Grant R. Woodwell

#### Associate Professors

Tyler E. Frankel

Pamela R. Grothe

Melanie D. Szulczewski

#### Senior Lecturer

Sarah A. Morealli

**Note:** The schedule outlined above assumes a student enters UMW planning to major in Environmental Science. All entering students considering a major in Environmental Science should take the Chemistry Placement Test. Students who are recommended to take the preparatory CHEM 101 Foundations of Chemistry should do so during the fall semester of their freshman year. CHEM 111 can then be taken during the spring semester of a student's freshman year and CHEM 112 General