APPLIED ENVIRONMENTAL SCIENCE

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 students choose either the Applied Environmental Science major or the Environmental Sustainability and Policy major according to their interests. Both majors provide a strong background for graduate programs or employment in a variety of career areas after graduating from UMW.

The Applied Environmental Science major provides a diverse foundation in biology, chemistry, and geology with a focus on applying environmental science to real world issues. This interdisciplinary nature permits students to select from a wide range of course offerings in multiple departments to customize their learning experience based on career goals. Analytical skills acquired in this program, coupled with an appreciation of sustainability principles, will prepare majors to evaluate environmental problems and work on solutions within a real-world context.

The Department has recently-constructed laboratories in the Jepson Science Center equipped with sophisticated analytical instruments and the latest Geographic Information Systems (GIS) software to support both classroom instruction and research opportunities. Major laboratory equipment includes petrographic microscopes, a magnetic susceptibility instrument, inductively coupled plasma optical emission spectroscopy (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), high-performance liquid chromatography (HPLC), fluorescent microplate readers, a variable pressure scanning electron microscope with chemical capabilities, a flow-through ecotoxicology exposure system, and dedicated wet and dry lab facilities for paleontology, sedimentology, and environmental geochemistry. For environmental and geological fieldwork, the department maintains a variety of high accuracy GPS devices, research vessels (including one equipped for trawling, coring, and dredging), and coring, surveying, and sampling equipment. An extensive collection of rocks, minerals, and fossils for classroom and comparative study is also available. To promote active learning, majors are encouraged to conduct independent studies, research, or internships which are often financially supported by undergraduate research grants provided by the University.

These experiences may also be used to fulfill the general education experiential learning requirement (Beyond the Classroom) through the completion of URES 197 Undergraduate Research, EESC 481 Readings, EESC 491 Individual Study, EESC 493 Honors Research, or EESC 499 Internship. Our faculty also offer short-course study abroad opportunities for students to explore environments in other countries. 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.

For more information on this program, please 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
Foundation Courses		28
EESC 110	Environmental and Ecological Systems	
EESC 120	Principles of Environmental Sustainability	
EESC 111	Our Dynamic Earth	
BIOL 210	Introduction to Ecology and Evolution	
CHEM 112	General Chemistry II	
EESC 205	GIS Applications in Environmental Science and Geology with Lab	
or GISC 200	Introduction to GIS	
or GISC 250	Introduction to Geographic Information Systems and Cartography	
EESC 315	Hydrogeology	
EESC 460	Senior Seminar	
Choose one (1) Applied Chemistry course:		4
EESC 325	Environmental Geochemistry	
CHEM 253	Chemical Analysis I	
CHEM 254	Chemical Analysis II	
Choose one (1) Ecological Processes course:		4
EESC 418	Applied Ecotoxicology	
BIOL 311	Plant Ecology	
BIOL 322	Animal Ecology	
Choose two (2) Applied Environmental courses:		6-8
EESC 240	Field Methods in Environmental Science and Geology	
EESC 307	Environmental Soil Science	
EESC 311	Sedimentation and Stratigraphy	
EESC 330	Environmental Regulations	
EESC 340	Energy Resources and Technology	
EESC 355	Icehouse-Greenhouse Earth	
EESC 357	Sustainable Aquaculture	
BIOL 428	Conservation Biology	
GISC 340	Remote Sensing and Air Photo Interpretation	
Choose two (2) courses with EESC designation at the 200-level or above		4
Total Credits		**46-48**

Up to 3 credits in applicable Special Topics courses with departmental approval.

Prerequisite Courses

Code	Title	Credits
Select one of the following:		8
BIOL 121 & BIOL 132	Biological Concepts and Organism Function and Diversity	
BIOL 125 & BIOL 126	Phage Hunters I and Phage Hunters II	
CHEM 111	General Chemistry I	4

Plan of Study

This suggested plan of study should serve as a guide to assist students when planning their course selections. The schedule outlined below assumes a student enters UMW planning to major in Applied Environmental Science. All entering students considering a major in Applied 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 Fall of their freshman year. CHEM 111 General Chemistry I can then be taken during the spring of a student's freshman year and CHEM 112 General Chemistry II during fall of the sophomore year. Alternatively, a student may take the CHEM 111-112 sequence during their sophomore year.

This plan is not a substitute for a student's Degree Evaluation, or the Program Requirements listed for this major in the Academic Catalog. Academic planning is the student's responsibility, and course selections should be finalized only after speaking with an advisor in Earth and Environmental Sciences. 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
Freshman		
Fall		
EESC 110	Environmental and Ecological Systems	3
BIOL 121	Biological Concepts	4
FSEM 100	First-Year Seminar	3
General Education Courses		5
	Credits	**15**
Spring		
EESC 120	Principles of Environmental Sustainability	4
BIOL 132	Organism Function and Diversity	4
General Education Courses		7
	Credits	**15**
Sophomore		
Fall		
CHEM 111	General Chemistry I	4
EESC 111	Our Dynamic Earth	4
EESC 205 or GISC 200 or GISC 250	GIS Applications in Environmental Science and Geology with Lab or Introduction to GIS or Introduction to Geographic Information Systems and Cartography	4
General Education Courses		3
	Credits	**15**
Spring		
CHEM 112	General Chemistry II	4
BIOL 210	Introduction to Ecology and Evolution	3
EESC elective or Applied Environmental course		4
General Education Courses		4
	Credits	**15**
Junior		
Fall		
EESC 418 or BIOL 311 or BIOL 322	Applied Ecotoxicology (Ecological Processes Course) or Plant Ecology or Animal Ecology	4
General Electives		11
	Credits	**15**
Spring		
EESC 325 or CHEM 253 or CHEM 254	Environmental Geochemistry [1] or Chemical Analysis I or Chemical Analysis II	4
EESC elective or Applied Environmental course		4
General Electives		7
	Credits	**15**
Senior		
Fall		
EESC 315	Hydrogeology	4
EESC 465	Senior Portfolio and Career Preparation (After Mary Washington Option)	1
EESC elective or Applied Environmental course		4
General Electives		6
	Credits	**15**
Spring		
EESC 460	Senior Seminar	2
EESC elective or Applied Environmental course		4
General Electives		9
	Credits	**15**
	Total Credits	**120**

[1] CHEM 253 traditionally only offered in the fall.

Notes: BIOL 121-132 and CHEM 111 are prerequisites to courses in the major. The Applied Environmental Science major also requires a 4-credit GIS course; all three options satisfy the Digital Intensive general education requirement (EESC 205 or GISC 200 or GISC 250). EESC 205 is only offered in the fall; GISC 200 and GISC 250 are typically offered in both fall and spring. Students may take the honors BIOL 125-126 in place of BIOL 121-132. All Ecological Processes options (one course required) are offered in the fall semester only. See Catalog for the complete list of courses and options.

Fall courses required in the AES major:

Code	Title	Credits
EESC 110	Environmental and Ecological Systems	3
EESC 111	Our Dynamic Earth	4
EESC 120	Principles of Environmental Sustainability	4
EESC 205	GIS Applications in Environmental Science and Geology with Lab (GIS Option)	4

EESC 240	Field Methods in Environmental Science and Geology (Applied Environmental Option)	4
EESC 311	Sedimentation and Stratigraphy (Applied Environmental Option)	4
EESC 315	Hydrogeology	4
EESC 340	Energy Resources and Technology (Applied Environmental Option)	3
EESC 418	Applied Ecotoxicology (Ecological Processes Option)	4

Spring courses required in the AES major:

Code	Title	Credits
EESC 111	Our Dynamic Earth	4
EESC 120	Principles of Environmental Sustainability	4
EESC 307	Environmental Soil Science (Applied Environmental Option)	3
EESC 325	Environmental Geochemistry (Applied Chemistry Option)	4
EESC 330	Environmental Regulations (Applied Environmental Option)	3
EESC 355	Icehouse-Greenhouse Earth (Applied Environmental Option)	3
EESC 357	Sustainable Aquaculture (Applied Environmental Option)	3
EESC 460	Senior Seminar	2

See Catalog for the complete list of options.

Earth and Environmental Sciences Faculty

Jodie L. Hayob, Chair
Jodie L. Hayob, Career Advisor (Geology)
Melanie D. Szulczewski, Career Advisor (Environmental Science)/ Program Director, (Environmental Sustainability Minor)

Professors

Jodie L. Hayob
Ben O. Kisila
Melanie D. Szulczewski
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Associate Professors

Tyler E. Frankel
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