EARTH AND ENVIRONMENTAL SCIENCES

Mission Statement

In Earth and Environmental Sciences, we investigate the *Earth* and the *Environment*, understood in the broadest terms, from a *natural science perspective*. We seek to understand how they have evolved and continue to evolve, how Earth systems—including human agents—interact to produce the environment in which we live, and how present and future changes may impact the habitability of Earth. The central goal of the department is to educate students about the nature and history of the Earth, the processes that shape the Earth, and the impacts those processes have on humans, other organisms, and the environment.

An understanding of the Earth is an essential component of global citizenship. Humanity faces many critical environmental issues, including global climate change, water shortages, loss of arable land, natural hazards such as earthquakes and flooding, and the dwindling access to energy resources; furthermore, vulnerability to these issues is disproportionate across humanity. Citizens and professionals with training in the Earth and Environmental Sciences will contribute to addressing these and other problems, while increasing opportunities for humans to live sustainably and equitably on the Earth.

The Department of Earth and Environmental Sciences strives to foster an environment of inclusion and equity. Innovative, effective, and equitable stewardship of Earth's resources requires a diversity of perspectives and influences; we strive to empower a future generation of socially responsible scientific leaders who represent a cross-section of human society. We are committed to excellence in teaching and learning and affirm the value of our community members regardless of race, ethnicity, gender, social class, or sexual identity.

Broadly speaking, the Department of Earth and Environmental Sciences provides the tools to be suc-cessful in any field. Whether their goal is employment in the field or graduate school, EESC majors and minors develop a strong background in the Earth and Environmental Sciences. The department provides non-majors with a broad and deep knowledge of the Earth and its environment that will serve their needs as citizens and future community leaders.

Learning Goals

The Department of Earth and Environmental Sciences is committed to helping students become productive, informed, and influential citizens. To that end, we have developed a clear set of learning goals that reside within three broad categories:

Content Knowledge.—Mastery of modern disciplinary content is paramount in the EESC pro-gram. EESC faculty are committed to staying apprised of the most recent developments and best practices within our individual specialties. Therefore, EESC students will encounter up-to-date concepts and methods. EESC Faculty are also keenly aware of the importance of the allied foundational sciences (i.e., Biology, Chemistry, Mathematics, Computer Science, Data Analytics, and Physics). Accordingly, students are encouraged to learn deeply in the allied disciplines. Ultimately, we recognize that modern earth and environmental science is rooted in a broad un-derstanding of foundational skills and core disciplinary knowledge. By the end of their EESC major, students will master the disciplinary knowledge needed to comprehend, apply, analyze, synthesize, evaluate, and integrate new information into their ever-developing understanding of the earth and its environment.

Quantitative Literacy.—The ability to reason using numbers is an essential skill for any informed member of the citizenry. We believe students should be empowered, not intimidated, by data. That said, we recognize that interpreting data is not always a straightforward exercise. Accordingly, quantitative exercises are integrated into all levels of the EESC curriculum. These learning opportunities in EESC are designed to promote operational proficiency with data beyond college, even when confronted with incomplete and/or contradictory information. EESC graduates should be able to evaluate, analyze, and interpret quantitative information, not simply to find an answer but rather, to help interpret the earth and environment around them.

Communication.—The ability to communicate effectively is a core learning outcome of any undergraduate education. The Department of Earth and Environmental Sciences recognizes the importance of both oral communication skills (public speaking) and written communication (expository writing). Both skill sets are emphasized at all levels of the EESC curriculum. Upon the completion of an EESC major, students should be able to construct, apply, and evaluate effective oral and written communication strategies for both specialized and general audiences.

The Department of Earth and Environmental Science employs a comprehensive exam to evaluate student learning. This multi-day exam uses oral and written components to evaluate individual student mastery of core EESC knowledge. Special emphasis is placed on student performance with novel data sets. The comprehensive exam serves two important functions. First, it provides valuable feedback to the EESC faculty on teaching effectiveness across multiple dimensions of the curriculum. Second, in providing students with an experience similar to what they might expect on the job, or in graduate school, it provides a unique opportunity for self-evaluation. The comprehensive exam is administered early in the spring semester of a student's senior year. Successful completion of the EESC Comprehensive Exam is required from all EESC majors.

Faculty

Professor Erik W. Klemetti, Chair

Professor David H. Goodwin; Associate Professor Anjali M. Fernandes, Matthew C. Jungers; Assistant Professor Tyler Grambling; Visiting Assistant Professor Stacy Porter

Program Coordinator
Mary Lucas-Miller

View faculty profiles and contact information (https://denison.edu/academics/geosciences/contacts/)

Earth & Environmental Sciences Program

There are ***three*** **possible paths** to the bachelor's degree in Earth & Environmental Sciences: a Bachelor of Science in anticipation of advanced study in Earth Science or a Bachelor of Science in anticipation of advanced study in Environmental Science, or a Bachelor of Arts in Earth Science for those who seek a less specialized course of study. Earning a B.A. degree does not preclude a professional career in Earth Science, although admission to some graduate programs may require completion of additional science and mathematics courses.

DEGREE REQUIREMENTS BELOW:

Bachelor of Arts in Earth Science

Students are required to take 10 four-credit courses and 1 one-credit course.

Code	Title
(a) Students must take one (1) Introductory Course:	
100-Level EESC Course	
(b) Students must take the following three (3) EESC Foundation Courses:	
EESC 200	Environmental Geology
EESC 210	Historical Geology
EESC 211	Rocks, Minerals & Soils
(c) Students must take at least three (3) of the following Earth Science Core Electives:	
EESC 300	Geomorphology
EESC 308	Biodiversity Through Time
EESC 311	Structural Geology
EESC 312	Petrology and Volcanology
EESC 314	Sedimentology & Stratigraphy
(d) Students must take three (3) additional Earth Science Electives (200-level or above). One Earth Science elective can be replaced by a natural science cognate course (see section 2e).	
(e) Students must take EESC 380: Senior Seminar (1 credit) in their senior year. This course is open to all sophomore, junior and senior EESC students.	
EESC 380	Earth & Environmental Sciences Senior Seminar

Bachelor of Science in Earth Science

Students are required to take 14 four-credit courses, 1 one-credit course and a Field Course.

Code	Title
(a) Students must take one (1) Introductory Course:	
100-Level EESC Course	
(b) Students must take the following three (3) EESC Foundation Courses:	
EESC 200	Environmental Geology
EESC 210	Historical Geology
EESC 211	Rocks, Minerals & Soils
(c) Students must take at least three (3) of the following Earth Science Core Electives:	
EESC 300	Geomorphology
EESC 308	Biodiversity Through Time
EESC 311	Structural Geology
EESC 312	Petrology and Volcanology
EESC 314	Sedimentology & Stratigraphy
(d) Students must take three (3) additional Earth Science Electives (200-level or above).	
(e) Students must take four (4) Natural Science Cognate Courses:	
BIOL 210	Molecular Biology and Unicellular Life
BIOL 220	Multicellular Life
BIOL 230	Ecology and Evolution
CHEM 131	Atoms and Molecules: Structure and Dynamics
CHEM 132	Organic Structure and Reactivity
CS 111	Discovering Computer Science: Scientific Data and Dynamics
or DA 101	Introduction to Data Analytics
MATH 135	Single Variable Calculus
MATH 145	Multivariable Calculus
MATH 220	Applied Statistics
PHYS 121	General Physics I
PHYS 122	General Physics II
(f) Students must take EESC 380: Senior Seminar (1 credit) in their senior year. This course is open to all sophomore, junior and senior EESC students.	
EESC 380	Earth & Environmental Sciences Senior Seminar
(g) Students must take a Field Course also known as "Field Camp". This is a four to six credit course taught at other institutions, generally during the summer.	
EESC 400	Field Course

Bachelor of Science in Environmental Science

Students are required to take 14 four-credit courses and 1 one-credit course.

Code	Title
(a) Students must take one (1) Introductory Course:	
100-Level EESC Course	
(b) Students must take the following three (3) EESC Foundation Courses:	
EESC 200	Environmental Geology
EESC 210	Historical Geology
EESC 211	Rocks, Minerals & Soils
(c) Students must take the two (2) Environmental Science Core Courses:	
BIOL 230	Ecology and Evolution
CHEM 131	Atoms and Molecules: Structure and Dynamics
(d) Students must take three (3) of the following Environmental Science Core Electives:	
EESC 234	Applied GIS for Earth and Environmental Sciences
or SES 222 & SES 223	Geographic Information Systems I and Geographic Information Systems II
EESC 240	Earth Resources
EESC 270	Oceanography
EESC 300	Geomorphology
EESC 310	Global Biogeochemical Cycles
EESC 313	Environmental Hydrology
EESC 314	Sedimentology & Stratigraphy
EESC 333	Stable Isotopes in the Environment

(e) Students must complete a five (5) course Environmental Science Concentration (ESC). Developed in consultation with a member of the EESC faculty or a departmentally approved affiliate, the ESC must include four (4) Environmental Science Electives and one (1) Human Environment Elective selected from the approved list (see below). One semester of Senior Research may be substituted for a single science elective. The ESC must be approved by the EESC faculty no later than the end of the sophomore year.

Environmental Science Electives	
BIOL 210	Molecular Biology and Unicellular Life
BIOL 220	Multicellular Life
BIOL 321	Plant Ecology
CHEM 132	Organic Structure and Reactivity
CHEM 331	Intermediate Analytical Chemistry
CS 111	Discovering Computer Science: Scientific Data and Dynamics
or DA 101	Introduction to Data Analytics
SES 215	Renewable Energy Systems
SES 310	Wetland Ecology
SES 274	Ecosystem Management
SES 310	Wetland Ecology
MATH 220	Applied Statistics
Human Environment Electives	
ECON 202	Microecon Analysis Lec
PHIL 210	Philosophy of Science
PHIL 260	Environmental Philosophy
SES 240	Environmental Politics and Decision-Making
SES 334	Sustainable Agriculture and Food Systems
SES 264	Environmental Planning and Design
SES 274	Ecosystem Management
(f) Students must take a Senior Seminar (1 credit) in their senior year. This course is open to all sophomore, junior and senior EESC students.	
EESC 380	Earth & Environmental Sciences Senior Seminar
(g) Environmental Field Camp is recommended but not required.	

Students who want to pursue graduate study in the Earth & Environmental Sciences are strongly encouraged to take additional math and science courses beyond this minimum requirement.

Both B.S. and B.A. students are required to pass a comprehensive exam, administered early in the second semester of the senior year.

Note that most upper level EESC courses are offered in alternate years. Therefore careful schedule planning is important, especially if one pursues a semester of off-campus study.

Minor in Earth & Environmental Sciences

(6 four-credit courses)

Code	Title
(a) Students must take one (1) Introductory Course:	
100-Level EESC Course	
(b) Students must take the following three (3) EESC Foundation Courses:	
EESC 200	Environmental Geology
EESC 210	Historical Geology
EESC 211	Rocks, Minerals & Soils
(c) Students must take two (2) Additional EESC courses at the 200-level or above.	

Additional Points of Interest

Earth & Environmental Sciences has a long tradition of field trips during the fall and spring semester. Recent trips include Hawaii, coastal Maine, Arizona & Utah, the Bahamas, Death Valley, the Great Smoky Mountains and the Adirondacks.

Abundant student research opportunities are available, including working with faculty in the field or laboratory. Student employment opportunities within the department include working as teaching and laboratory assistants, and assisting in developing and maintaining departmental collections.

The C.L. Herrick Geological Society is an active, student-run organization, which coordinates guest lectures and social events throughout the academic year.

Courses

EESC 111 - Planet Earth (4 Credit Hours)
An introduction to the study of the Earth and its environment. This includes how it formed, how it evolved, how Earth systems interact to produce the environment in which we live, how Earth scientists interpret the materials of the planet and how humans use Earth resources. Laboratory exercises include learning to identify and interpret minerals and rocks, using maps and imagery to understand landscape processes, quantifying water resources to understand future use and examining natural hazards and mitigation. This course is designed as an introductory course in Earth & Environmental Sciences for both science and non-science majors. Fulfills the Q (Quantitative Reasoning) GE requirement.

EESC 112 - Special Topics in Earth & Environmental Science (4 Credit Hours)
What does it take to build a planet that harbors intelligent life? Are habitable planets common in the Universe, or is Earth the only one? In this course we will examine the development of planet Earth in light of the hypothesis that conditions necessary for a habitable planet are extremely rare in the universe. While emphasizing geology, this examination will involve us in aspects of biology and paleontology, astronomy and astrogeology, philosophy and even theology. Laboratory exercises will allow hands-on investigation of rocks, fossils, geologic maps, and other data important to our understanding of the development of planet Earth. This course is designed as an introductory course in the Earth & Environmental Sciences for both science and non-science major. Fulfills the R (Oral Communication) GE requirement.

EESC 114 - Special Topics in Earth & Evironmental Science (4 Credit Hours)
Cool Science on a Hot Topic. Global warming constitutes one of the most controversial issues you, and society at large, will face in the future. At the center of this debate lies the question, "Are we responsible for the recent increase in global temperature, or is this trend part of the natural variability in the climate system?" To evaluate these possibilities, we will examine the geologic record of climate change and the processes responsible for these variations. While the majority of our discussions will focus on geology, we will also touch on elements of oceanography, meteorology, biology, paleontology, as well as policy and politics. By the end of this course you will be able to make informed decisions about the climate change issues we are certain to face in the future. This course is designed as an introductory course in the Earth & Environmental Sciences for both science and non-science majors and to fulfill the Q (Quantitative Reasoning) GE requirement.

EESC 115 - Special Topics in Earth & Environmental Science (4 Credit Hours)
This course provides a venue to explore different topics in Earth & Environmental Sciences at the introductory level.

EESC 119 - Rocks, People and Legends: The Story of Human History through Earth and Environmental Sciences (4 Credit Hours)
Geology, history and archeology: they all unravel that planet's past. We'll explore how the earth & environmental sciences can be used to understand events across human history, both in methods and process. Beyond empirical evidence found in geology and archeology, many cultures have mythologies based on real geologic events in the Earth's past. In this class, we will learn the skills of reading the Earth's record and apply them to archeologic, historic and geologic problems. Topics to be covered include human evolution, remote sensing and geophysics, mythology, stone tools, climate, dating techniques, taphonomy and more. Finally, we will explore some of the remarkable archeological sites of Ohio, potentially including the Newark Earthworks, Flint Ridge and Serpent Mound. This course is designed for majors, potential majors and non-majors. Fulfills the Y requirement. Field trips outside scheduled class hours may be required.
Prerequisite(s): None.

EESC 180 - Introduction to Environmental Science (4 Credit Hours)
An introduction to environmental science, including how the natural world works, how the environment affects people, and how people affect the environment. The course introduces the basic physical, chemical, and biological components of the environmental system. Topics include weather and climate, water, soils, vegetation, and wildlife. Examination of human and environment interactions focuses on population dynamics, natural resources, pollution, and climate change. Laboratory experiences introduce students to the tools and methods used by environmental scientists to study Earth's environmental system. This introductory course is designed for all Earth & Environmental Science tracts as well as non-science majors.

EESC 199 - Introductory Topics in Earth & Environmental Science (1-4 Credit Hours)
A general category used only in the evaluation of transfer credit.

EESC 200 - Environmental Geology (4 Credit Hours)
A broad survey of the geologic aspects of environmental issues, emphasizing human interactions with the geologic environment. Topics include geologic hazards, such as earthquakes, landslides, and flooding; global water supply and water quality issues, especially groundwater contamination and remediation; and global environmental change, emphasizing climate change and global warming. This course fulfills the W overlay requirement.
Prerequisite(s): A 100-level EESC course or consent of instructor.

EESC 210 - Historical Geology (4 Credit Hours)
A survey of the geologic history of planet Earth. Major topics include global climate history, paleogeography, history of life, and tectonic development and evolution of the North America continent. Lab exercises focus on description and interpretation of sedimentary rocks and environments, and the history of biological evolution.
Prerequisite(s): A 100-level EESC course or consent of instructor.

EESC 211 - Rocks, Minerals & Soils (4 Credit Hours)
An introduction to the minerals, rocks and soils that make up the Earth and how those materials influence and are influenced by the processes that operate within and on the surface of the planet. This course is part of the foundation in the Earth & Environmental Sciences for understanding our planet. The course provides a geological, chemical and physical basis for understanding the composition and physical properties of minerals, rocks and soils, and emphasizes the interplay between Earth materials, Earth systems, society and the environment.
Prerequisite(s): A 100-level course or ENVS 102 or consent of instructor.

EESC 215 - Special Topics in Earth & Environmental Sciences (4 Credit Hours)
This course provides a venue to explore different topics in Earth & Environmental Sciences at the intermediate level".

EESC 222 - Geographic Information Systems I (2 Credit Hours)
This course is an introduction to the concepts and uses of Geographic Information Systems (GIS) with particular application to environmental issues. The course consists of laboratory exercises on GIS data structures and sources of data, on the use of specific GIS tools, and on practical applications of GIS to real-world tasks. The student will gain skills in spatial data analysis, map generation, and data presentation using ArcGIS software. After successful completion of this course, students who wish to develop advanced GIS skills may enroll in EESC 223.
Crosslisting: SES 222.

EESC 223 - Geographic Information Systems II (2 Credit Hours)
A sequel to SES/EESC 222, this course is intended to give the student experience with advanced GIS applications. The focus will be on novel analyses of spatially explicit data pertaining to real-world issues. We will explore GIS as a tool for posing scientific applications involving spatial hypotheses. These will include questions of distribution, proximity, suitability, spatial pattern, and spatial and temporal change.
Prerequisite(s): EESC 222 or SES 222.
Crosslisting: SES 223.

EESC 234 - Applied GIS for Earth and Environmental Sciences (4 Credit Hours)
Geographic Information Systems (GIS) allow the organization, analysis, and display of large and varied collections of spatial information. Earth and environmental scientists are increasingly relying on the tools and methodologies of GIS to solve complex problems ranging from the intersection of rising sea level with coastal communities to the mapping and mitigation of landslide hazards in mountain communities. In this course, we will conduct a series of applied projects investigating Earth systems and environmental problems. Each project will include hands-on downloading of data, data processing, developing workflows in ArcGIS, mapmaking and data visualization, and communicating results in written reports. By the end of the term, students will apply the skills learned over the semester in an independent research project.

EESC 240 - Earth Resources (4 Credit Hours)
This course examines the Earth resources that humans exploit, including (but not limited to) energy, metals, and soil, from both geologic and societal perspectives. We will study: (1) the geologic processes that form these deposits and control their distribution; (2) the methods used to extract the resources and; (3) environmental impact of extraction and resource use. We will also scrutinize the effect on society of the resource, including conflict, labor, sustainability and class issues. The course will combine lab activities, scientific discussion and readings from academic literature, popular media, and activist propaganda. The end result will be the ability to bring together the science of Earth resources with the broader human context of resource exploitation. This course fulfills the P (Power & Justice) GE requirement.
Prerequisite(s): A 100 level or consent of instructor.

EESC 270 - Oceanography (4 Credit Hours)
This course will provide students with an introduction to the world's oceans. Topics will include: the sea floor and its sediments; the physical properties and chemistry of seawater; ocean circulation; waves and tides; life in the seas; and environmental issues and concerns facing the oceans today. By the end of this course students will have explored many of the basic concepts in modern oceanography, and should be able to integrate new concepts and data into their developing knowledge of the Earth.

EESC 275 - Geology of the Solar System (4 Credit Hours)
In this course, you will discover the wide variety of geologic processes at work across the planets, moons, asteroids and comets of our solar system. We will examine the missions and instruments used to observe extraterrestrial objects, the data collected and how to use it to unravel the geologic history of distant areas and what conditions are needed to support life outside Earth. In the end, you will design your own mission to investigate another piece of the solar system. This course will be a mix of class lecture and activities, labs and presentations/discussions with readings from academic publications, popular media and books. Fulfills the R (Oral Communication) GE requirement.
Prerequisite(s): A 100-level course or ENVS 102 or consent of instructor.

EESC 280 - Introduction to Meteorology (4 Credit Hours)
This course will introduce students to the science of weather and the atmosphere, focusing on understanding weather on a day-to-day basis through the collection and analysis of meteorological data. Students will explore various aspects of meteorology including solar radiation, global circulation, winds, cloud formation, stability, precipitation processes, weather systems, and severe weather. These basic physical principles and processes are important for understanding the world and have broad implications for students interested in global environmental change and other environmental-adjacent disciplines.
Prerequisite(s): EESC 111 or EESC 112 or EESC 114 or EESC 115 or EESC 119 or consent of instructor.

EESC 299 - Intermediate Topics in Earth & Environmental Sciences (1-4 Credit Hours)
A general category used only in the evaluation of transfer credit.

EESC 300 - Geomorphology (4 Credit Hours)
We will investigate how Earth's topography reflects the response of surface processes to shifts in tectonic, climatic, and human influences. Our study of landscape evolution will focus primarily on hillslopes (creeping soil to catastrophic landslides), rivers (gullies to bedrock gorges), and glaciers (alpine cirques to Midwest moraines) always with a focus on quantifying how the shapes of landforms reflect process. Labs and class activities will require a blend of fieldwork, introductory mapping and data analysis using ArcGIS, and simple numerical modeling. Frequent, short critical writing responses to primary literature will refine both writing skills and our engagement with the forefront of process geomorphology. This course fulfills the W overlay requirement.
Prerequisite(s): EESC 200 or EESC 210 or EESC 211 or consent of instructor.

EESC 308 - Biodiversity Through Time (4 Credit Hours)
An introduction to the study of fossil invertebrates with emphasis on preservation, taphonomy, diversity trajectories through geologic time, evolutionary mechanisms, extinction, paleobiology and paleoecology. Special emphasis will be placed on using fossils to interpret ancient depositional environments. Labs will introduce the student to the major invertebrate phyla commonly preserved in the geologic rock record.
Prerequisite(s): EESC 210 or BIOL 230.

EESC 310 - Global Biogeochemical Cycles (4 Credit Hours)
Global Biogeochemical Cycles explores the physical, chemical, biological, and geological processes that govern the composition of, and changes to, Earth's surface environment. This course will focus on the global cycles of carbon, nitrogen, phosphorous, and sulfur and their interactions with organisms and earth materials as they move through the atmosphere, hydrosphere, biosphere, and lithosphere. This multidisciplinary course is intended for students curious about life's influence on the planetary system. It will cover aspects of biology, geology, hydrology, meteorology, oceanography, and soil science. That said, no specific disciplinary background is required other than a fundamental understanding of elemental chemistry.
Prerequisite(s): EESC 200 or EESC 210 or EESC 211 or consent of instructor.

EESC 311 - Structural Geology (4 Credit Hours)
Study of the deformation of the Earth's crust. How and why rocks deform; geometry and interpretation of folds, faults, and rock fabrics; regional tectonics and mountain building. Labs emphasize interpretations of geologic structures in hand specimens, outcrops and geologic maps; and includes opportunities for geologic field mapping and a weekend field trip to the Appalachian fold and thrust belt.
Prerequisite(s): EESC 210 or EESC 211 or consent of instructor.

EESC 312 - Petrology and Volcanology (4 Credit Hours)
This course examines the processes that produce magma and metamorphic at high temperature. It also explores volcanism and the hazards produced by eruptions. We will employ the reasoning and approaches used to understand petrology including petrography, geochemistry, data analysis and modeling. Key topics include high-temperature isotopes and thermodynamics, formation of magmas in different tectonic settings, the physical processes of volcanism, hazards posed by volcanic activity and using metamorphic reactions to assess the tectonic history of rocks. We will explore petrology and volcanology through labs, primary literature, research projects and group assignments.
Prerequisite(s): EESC 211 or consent of instructor.

EESC 313 - Environmental Hydrology (4 Credit Hours)
This course explores the processes that transfer water between the various reservoirs of the hydrologic cycle. Working mostly at the watershed scale, we will study the balance between precipitation, evapotranspiration, and runoff by drawing on both field methods and the analysis of hydrologic datasets using Geographic Information Systems (GIS). We will study the flow of surface water through natural and engineered rivers, and the flow of groundwater through shallow soils and deep aquifers. Throughout the course, we will strive for an applied approach to Hydrology that explicitly links key concepts to the management of water resources.
Prerequisite(s): EESC 200 or EESC 210 or EESC 211 or consent of instructor.

EESC 314 - Sedimentology & Stratigraphy (4 Credit Hours)
This course is an introduction to sedimentary processes and sedimentary rocks. The course will cover three major areas: (1) physical sedimentology (how sedimentary rocks are formed); (2) depositional systems (where sedimentary rocks are formed and how they differ from place to place); and (3) stratigraphy (how sedimentary rocks are used to solve geological problems). Labs will expose students to sedimentary rocks under the microscope, in hand sample, and in the field.
Prerequisite(s): EESC 200 or EESC 210 or EESC 211 or consent of instructor.

EESC 333 - Stable Isotopes in the Environment (4 Credit Hours)
Light stable isotope analysis has become a nearly ubiquitous component of (paleo)environmental research. Stable isotopes of Hydrogen, Carbon, Nitrogen, Oxygen, and Sulfur have been used to integrate, indicate, record, and trace important physical and biological process operating at or near Earth's surface. This course will focus on how stable isotope systems can been used to study (paleo)climatology and (paleo)oceanography, hydrology, pollution, biogeochemical cycling, metabolism, photosynthesis, and (paleo)ecology.
Prerequisite(s): EESC 200 or EESC 210 or EESC 211 or consent of instructor.

EESC 361 - Directed Study (1-4 Credit Hours)
A student in good standing may work intensively in areas of special interest under the Directed Study plan. A Directed Study is appropriate when, under the guidance of a faculty member, a student wants to explore a subject more fully than is possible in a regular course or to study a subject not covered in the regular curriculum. A Directed Study should not normally duplicate a course that is regularly offered. Directed Studies are normally taken for 3 or 4 credits. A one-semester Directed Study is limited to a maximum of 4 credit hours. Note: Directed Studies may not be used to fulfill General Education requirements.

EESC 362 - Directed Study (1-4 Credit Hours)
A student in good standing may work intensively in areas of special interest under the Directed Study plan. A Directed Study is appropriate when, under the guidance of a faculty member, a student wants to explore a subject more fully than is possible in a regular course or to study a subject not covered in the regular curriculum. A Directed Study should not normally duplicate a course that is regularly offered. Directed Studies are normally taken for 3 or 4 credits. A one-semester Directed Study is limited to a maximum of 4 credit hours. Note: Directed Studies may not be used to fulfill General Education requirements.

EESC 363 - Independent Study (1-4 Credit Hours)
Independent Study engages a student in the pursuit of clearly defined goals. In this effort, a student may employ skills and information developed in previous course experiences or may develop some mastery of new knowledge or skills. A proposal for an Independent Study project must be approved in advance by the faculty member who agrees to serve as the project advisor. Note: Independent Studies may not be used to fulfill General Education requirements.

EESC 364 - Independent Study (1-4 Credit Hours)
Independent Study engages a student in the pursuit of clearly defined goals. In this effort, a student may employ skills and information developed in previous course experiences or may develop some mastery of new knowledge or skills. A proposal for an Independent Study project must be approved in advance by the faculty member who agrees to serve as the project advisor. Note: Independent Studies may not be used to fulfill General Education requirements.

EESC 370 - Global Tectonics (4 Credit Hours)
A study of geologic and tectonic processes at the global scale. Major topics include plate tectonic theory and development, topography and geology of the sea floor, plate geometries and processes at plate margins, volcanic arcs, collisional orogenies and mountain building, and the influence of tectonic processes on earth history.
Prerequisite(s): EESC 210 or EESC 211 or consent of instructor.

EESC 380 - Earth & Environmental Sciences Senior Seminar (1 Credit Hour)
This course is designed to help majors apply what they have learned throughout their undergraduate careers to a real-world issue or topic in the geosciences. The seminar will meet weekly with all members of the Geoscience faculty. The seminar topic will be selected by the entire geosciences faculty. Both students and faculty will be responsible for presenting summaries of weekly readings, although the majority will be presented by students. The course will be organized and administered by the department chair. Sophomore, Junior or Senior Earth & Environmental Science majors.

EESC 399 - Advanced Topics in Earth & Environmental Sciences (1-4 Credit Hours)
A general category used only in the evaluation of transfer credit.

EESC 400 - Field Course (4-8 Credit Hours)
A B.S. major in Earth and Environmental Sciences must register for an approved summer field course offered by any one of a number of universities. Upon the successful completion of the course, the student receives credit transferable to their record at Denison.

EESC 451 - Senior Research (4 Credit Hours)
Students may enroll in Senior Research in their final year at Denison. Normally, Senior Research requires a major thesis, report, or project in the student's field of concentration and carries eight semester-hours of credit for the year. Typically, a final grade for a year-long Senior Research will not be assigned until the completion of the year-long Senior Research at the end of the second semester. In which case, the first semester Senior Research grade will remain "in progress" (PR) until the completion of the second semester Senior Research. Each semester of Senior Research is limited to a maximum of 4 credit hours. Note: Senior Research may not be used to fulfill General Education requirements.

EESC 452 - Senior Research (4 Credit Hours)
Students may enroll in Senior Research in their final year at Denison. Normally, Senior Research requires a major thesis, report, or project in the student's field of concentration and carries eight semester-hours of credit for the year. Typically, a final grade for a year-long Senior Research will not be assigned until the completion of the year-long Senior Research at the end of the second semester. In which case, the first semester Senior Research grade will remain "in progress" (PR) until the completion of the second semester Senior Research. Each semester of Senior Research is limited to a maximum of 4 credit hours. Note: Senior Research may not be used to fulfill General Education requirements.