

EARTH AND ENVIRONMENTAL SCIENCES

Program Overview

The Earth and Environmental Sciences minor, offered by the Department of Earth and Chemical Sciences, introduces students to basic geological and environmental principles, as well as advanced topics that unite the two disciplines. This minor not only helps students analyze and learn more about the multitude of the earth's functions, but also what the ever-changing face of environmentalism says about society and how students can help promote positive environmental change.

Degree Offered

- Minor in Earth and Environmental Sciences

Contact

Alexander Grushow, Ph.D.

Professor

Department of Earth and Chemical Sciences

School of Science, Technology and Mathematics

Hennessy Science and Technology Center, #324A

609-896-5095

grushow@rider.edu

Program Website: Earth & Environmental Sciences (<https://www.rider.edu/academics/colleges-schools/college-arts-sciences/science-technology-math/undergraduate/earth-environmental-sciences-minor/>)

Associated Department: Earth & Chemical Sciences (<https://www.rider.edu/academics/colleges-schools/college-arts-sciences/science-technology-math/faculty-departments/earth-chemical-sciences/>)

Related Programs

- Earth Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/earth-sciences/>) (for Secondary Education majors)
- Environmental Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/environmental-sciences/>)
- Environmental Studies (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/environmental-studies/>)
- Geology (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/geology/>)
- Marine Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/marine-sciences/>)

Requirements for the Minor

(21-22 credits)

Note: *Geology and Environmental Science majors may not select this minor.*

Code	Title	Credits
Fundamental Courses		14
ENV 100 & 100L	Introduction to Environmental Sciences and Introduction to Environmental Sciences Lab	
ENV 205	Introduction to Geographic Information Systems	

ENV 220	Weather and Climate Change	
GEO 100	Earth Systems Science	
or GEO 113	Environmental Geology	
GEO 102	Earth Materials and Processes Lab	
Electives		7-8
Select two of the following; at least one must be a 300 or 400 level course:		
ENV 320 & 320L	Global Biogeochemistry and Global Biogeochemistry Lab	
ENV 340	Environmental Field Methods and Data Analysis	
GEO 306 & 306L	Sedimentology and Stratigraphy and Sedimentology and Stratigraphy Lab	
GEO 308 & 308L	Mineralogy and Petrology and Mineralogy and Petrology Lab	
GEO 310 & 310L	Structural Geology and Structural Geology Lab	
GEO 350 & 350L	Soil and Surficial Processes and Soil and Surficial Processes Lab	
GEO 407 & 407L	Hydrology and Water Resources and Hydrology and Water Resources Lab ¹	
MAR 210 & 210L	Marine Life through Time and Marine Life through Time Lab	
Total Credits		21-22

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This course has one or more prerequisites that must be completed in addition to the course required for this minor.

ENV 100 Introduction to Environmental Sciences 4 Credits

Examines how ecosystems function, with emphasis on the interactions between biological organisms and their physical environment, and the chemical processes that govern these interactions. The impact of human populations on natural ecosystems is investigated in detail using case studies from history and current events. The laboratory provides for hands-on experiences and/or short field trips to local sites for a better understanding of many of the concepts discussed. Weekday and weekend field trips may be required. Three hours of lecture and one three-hour lab per week. CLAS general education areas addressed: DP, SP, GP.

Corequisite(s): ENV 100L.

ENV 100L Introduction to Environmental Sciences Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): ENV 100.

ENV 205 Introduction to Geographic Information Systems 3 Credits

This course introduces the computer-based concepts and skills of Geographic Information Systems (GIS). It covers the basic GIS concepts, such as map characteristics and projections, spatial data models and analysis, and relational databases. It explores data sources, data quality, and metadata, as well as implementation and management of specific GIS projects. Hands-on experience with ArcGIS software is provided through a series of student exercises completed throughout the semester. Students will also be taught how to process both vector and raster data using ArcGIS software. The course is relevant for students from numerous disciplines in the natural sciences, social sciences, and business, which require the analysis and graphical representation of spatial data. Three hours of lecture per week.

ENV 220 Weather and Climate Change 3 Credits

This course introduces students to the concepts of weather and climate change. These concepts frame a continuum from short-term or daily changes in the atmosphere (meteorology) to those changes averaged over much longer periods of time (climatology). Students will learn the fundamentals of weather forecasting, the causes of natural variation in the Earth's climate, and the impact of human actions on the Earth's climate. Connections will be drawn to other current issues in the Earth system, including land use change, biodiversity, and pollution. Three hours of lecture per week.

Prerequisite(s): GEO 100 or GEO 113 or permission of instructor.

ENV 320 Global Biogeochemistry 4 Credits

This course introduces students to global biogeochemical processes in the earth system and their influences on marine and terrestrial ecosystems. With a focus on systems thinking and interdisciplinary science, students will learn about the interactions of the biosphere, lithosphere, hydrosphere and atmosphere through elemental cycling and energy transfers. The course extends from the origin of our planet to the modern earth system and considers the anthropogenic impacts of climate change and pollution on humans and other species. Students will analyze scientific data with examples in regulatory and research settings. Students will also gain first-hand experience with field methods including sampling ocean and freshwater using various techniques and equipment and interpreting chemical data. Field trips may be required for this course. Course

Prerequisites: GEO 100 or GEO 113; GEO 102; CHE 120 & 121.

ENV 320L Global Biogeochemistry Lab 0 Credits

This course introduces students to global biogeochemical processes in the earth system and their influences on marine and terrestrial ecosystems. With a focus on systems thinking and interdisciplinary science, students will learn about the interactions of the biosphere, lithosphere, hydrosphere and atmosphere through elemental cycling and energy transfers. The course extends from the origin of our planet to the modern earth system and considers the anthropogenic impacts of climate change and pollution on humans and other species. Students will analyze scientific data with examples in regulatory and research settings. Students will also gain first-hand experience with field methods including sampling ocean and freshwater using various techniques and equipment and interpreting chemical data. Field trips may be required for this course. Course

Prerequisites: GEO 100 or GEO 113; GEO 102; CHE 120 & 121.

GEO 100 Earth Systems Science 3 Credits

Investigates the major global processes that occur on Earth. These processes can be grouped into four major systems: atmosphere, hydrosphere, lithosphere, and cosmosphere. Each system interacts with and affects the other systems creating, in a sense, a single Earth process. With this approach, the student will view the Earth as a whole, and understand that the many seemingly separate components that make up this planet are, in fact, a set of interacting processes, that operate in cycles through time, within a single global system. Three hours of lecture per week. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

GEO 102 Earth Materials and Processes Lab 1 Credits

This lab course introduces students to the origin, identification, and significance of geologic materials, processes, and landforms. Hands-on experiences with mineral and rock specimens, topographic and geologic maps, and GPS and other data collection techniques are emphasized, along with field trip and in-lab observations, measurements, and interpretations. One three-hour lab per week.

Prerequisite(s): concurrent enrollment in, or prior completion of, GEO 100 or GEO 113 is required.

GEO 306 Sedimentology and Stratigraphy 4 Credits

The principles of weathering, erosion, transportation, and deposition of sediment are the focus of this course. Sediment characteristics are examined to identify the processes involved in transporting grains and the specific environment in which the grains were deposited. Students will learn how to collect, analyze, and interpret sedimentary data and how to interpret surface and subsurface stratigraphic data using various techniques, such as lithostratigraphic, biostratigraphic, and geophysical, correlations. Field trips will expose students to different sedimentary environments and provide opportunities for students to learn how to conduct fieldwork. Three hours of lecture and one three-hour lab per week. Weekend field trips may be required. Prerequisite(s): GEO 100.

Corequisite(s): GEO 306L.

GEO 306L Sedimentology and Stratigraphy Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): GEO 306.

GEO 308 Mineralogy and Petrology 4 Credits

This course examines the origin, evolution, and distribution of igneous and metamorphic rocks based on mineralogy, chemistry, and tectonic relationships. Mineral content and rock texture are used to identify and classify igneous and metamorphic rocks. The physical and chemical properties of these rocks are used to understand their tectonic setting, process of formation, and pressure-temperature conditions.

Prerequisite(s): GEO 100 (or GEO 113) and GEO 102.

GEO 308L Mineralogy and Petrology Lab 0 Credits

This is the laboratory course that accompanies GEO 308. Laboratory work consists of the identification of mineral and rock hand specimens. Microscopic analyses include the identification and interpretation of optical properties of minerals and rock textures. Field trips provide opportunities for students to examine outcrops of igneous and metamorphic rocks.

Prerequisite(s): GEO 100 (or GEO 113) and GEO 102.

GEO 310 Structural Geology 4 Credits

The origin, distinguishing characteristics, and geographic distribution of deformational structures of the Earth's crust. In the laboratory, GPS, GIS, geologic maps, and three-dimensional problems are used in the study of typical surface and subsurface geologic problems. Three hours of lecture and one three-hour lab per week. Weekday and/or weekend field trips may be required. Prerequisite(s): GEO 100 or GEO 113, GEO 102.

Corequisite(s): GEO 310L.

GEO 310L Structural Geology Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): GEO 310.

GEO 113 Environmental Geology 3 Credits

Examines the fundamental premise that “society exists by geologic consent subject to change without notice” by studying a number of important global geologic processes and cycles, and the hazards and/or resources they present to individuals, societies, and the natural environment. Topics discussed include earthquakes, volcanism, stream flooding, coastal erosion, global climate change, and global water, soil, mineral, and energy resources. Cost/benefit considerations, hazard mitigation concepts, economic and political ramifications, and interactions among the lithosphere, hydrosphere, atmosphere, and biosphere also are presented. The course is designed to give non-science majors a deeper appreciation and understanding of the basic scientific concepts involved, as well as individual and societal connections to the global geologic environment, leading to better, more informed business, political, policy, and personal decisions. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

GEO 350 Soil and Surficial Processes 4 Credits

This course examines the physical, chemical, hydrological, and biological aspects of soil and their relation to geomorphologic development. Specific topics include descriptions of soil texture and structures, soil classification, soil colloids, soil redox and pH, and their effect on vadose zone water chemistry. Soil genesis and erosion controls, microbiology/ecology, nutrient cycles, and modern soil pollution from sludge and pesticide applications, as well as domestic and industrial chemical spills, also are discussed. The lab portion of the course introduces the basic techniques of soil analysis, both physical and chemical, and field survey methods. Three hours of lecture and one three-hour lab per week.

Prerequisite(s): GEO 100 or GEO 113, and GEO 102.

Corequisite(s): GEO 350L.

GEO 350L Soil and Surficial Processes Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): GEO 350.

GEO 407 Hydrology and Water Resources 4 Credits

This course introduces the principles that govern both surface water and groundwater flows that have applications to societal water needs. Surface water topics cover the basics of the hydrologic cycle, the processes of precipitation, evapotranspiration, runoff, and infiltration, and various factors affecting water supply and water quality issues in a modern watershed. Groundwater topics examine the principles that govern flow through a porous medium and the basics of well hydraulics under different pumping conditions that community development requires. Laboratory exercises will give students hands-on experience with the delineation of watersheds, analysis of precipitation data, and flow contaminant transport modeling. The field portion of the laboratory includes runoff and stream discharge measurements, as well as hydraulic conductivity estimations from both slug and pumping tests. Three hours of lecture and one three-hour lab per week. Prerequisite(s): GEO 100 or GEO 113, GEO 102, and MTH 105 or higher.

Corequisite(s): GEO 407L.

GEO 407L Hydrology and Water Resources Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): GEO 407.

MAR 210 Marine Life through Time 4 Credits

Survey of the important developments in marine life over the last three billion years from the Pre-Cambrian evolution of one-celled organisms, through the Cambrian explosion of complex marine invertebrate life and subsequent diversification of backboned organisms in the Ordovician time, to the colonization of marginal marine and freshwater habitats in the Silurian-Devonian geological periods, and ultimately to extinctions during global crises of the late Devonian, Permian, Triassic, Cretaceous, and Pleistocene time intervals. The emphasis is on evolutionary adaptive breakthroughs within each phylum, particularly the significant morphological and anatomical innovations, and the subsequent radiation of these higher taxa into new habitats and niches through geologic time. Three hours of lecture and one three-hour lab per week.

Prerequisite(s): GEO 100 & GEO 102; or GEO 113 & GEO 102 (can be signed in to take 102 with 113); or BIO 115; or BIO 116; or permission of instructor.