ENVIRONMENTAL SCIENCE AND GEOLOGY

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https://clas.wayne.edu/esg (https://clas.wayne.edu/esg/)

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- Environmental Science (Online M.A.) (http://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/environmental-science-geology/environmental-science-ma/)
- Geology (M.A.) (http://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/environmental-science-geology/geology-ma/)
- Geology (M.S.) (http://bulletins.wayne.edu/graduate/college-liberal-arts-sciences/environmental-science-geology/geology-ms/)

ESG 5000 Geological Site Assessment Cr. 4
Geologic methods for Phase I Environmental Site Assessments. Application of geostatistics to site characterization. Offered Every Other Year.
Prerequisites: GEL 1010 with a minimum grade of D- or ESG 1010 with a minimum grade of D-

ESG 5120 Environmental Geochemistry Cr. 4
Survey of some of the geochemical interactions which take place in Earth environments (water, soils, atmosphere, etc.) brought about by natural and human-induced chemical processes. Offered Every Other Year.
Prerequisites: CHM 1000-6XXX with a minimum grade of D- and (GEL 1010 with a minimum grade of D- or ESG 1010 with a minimum grade of D-)
Course Material Fees: $20

ESG 5150 Soils and Soil Pollution Cr. 4
Physical, chemical and mineralogical properties and classification of soils. Behavior of pollutants in soils and methods for reclamation. Offered Spring/Summer.
Prerequisites: CHM 1220 with a minimum grade of D- and CHM 1230 with a minimum grade of D-
Course Material Fees: $40

ESG 5210 Environmental and Applied Geophysics Cr. 4
Introduction to geophysical methods used in characterizing the Earth's subsurface for environmental, engineering, and exploration applications. Students will learn the basics of near-surface seismic, gravity, magnetic, electrical resistivity, and electromagnetic methods and data analysis. Offered Every Other Year.
Prerequisites: (4 of (GEL 1010 with a minimum grade of D- or ESG 1010 with a minimum grade of D-), PHY 1230 with a minimum grade of D-, and PHY 1240 with a minimum grade of D- or 2 of PHY 2170 with a minimum grade of D- and PHY 2180 with a minimum grade of D-) and MAT 2010 with a minimum grade of D-
Course Material Fees: $40

ESG 5360 Hydrology of Natural and Urban Environments Cr. 4
Focuses on surface water processes including how water movement, storage and transformation on the Earth's surface is influenced by landscape characteristics, including human modifications of those characteristics, and weather. Offered Every Other Year.
Prerequisites: MAT 1800 with a minimum grade of D-
Course Material Fees: $55

ESG 5420 Mathematical Methods in Earth Science Cr. 4
An introduction to mathematical methods in Earth Science focusing on an introduction to programming in Matlab, using statistical methods, Monte Carlo, and building towards finite difference numerical methods. Offered Every Other Year.

ESG 5450 Hydrogeology Cr. 4
Characteristics and behavior of groundwater in earth materials. Principles of groundwater flow and solute transport. Introduction to numerical models and methods. Offered Every Other Year.
Prerequisites: GEL 1010 with a minimum grade of D- and MAT 2010-6XXX with a minimum grade of D-

ESG 5510 Environmental Fate and Transport of Pollutants Cr. 4
Basic principles of chemical behavior in the environment; sources, fate, and transport of contaminants. Offered Winter.
Prerequisites: (CHM 1220 with a minimum grade of D-, CHM 1240 with a minimum grade of D-, CHM 1230 with a minimum grade of D-, or CHM 1250 with a minimum grade of D-) and MAT 2010-6XXX with a minimum grade of D-

ESG 5600 Special Topics in Environmental Science and Geology Cr. 4
Subjects of general interest to Environmental Science and Geology majors. Topics may include: mapping, soil and groundwater pollution; petroleum geology; engineering geology; mathematical methods in Earth Science; Biogeochemical cycling in aquatic system; or others. Offered Intermittently.

ESG 5610 Special Topics in Environmental Science and Geology Cr. 1
Topics may be related themes such as current events, a specific area of geology or the Earth or Environmental Sciences, or the development of professional skills relevant to careers in the Earth and Environmental Sciences. Offered Every Other Year.
Repeatable for 3 Credits

ESG 5650 Applied Geologic Mapping Cr. 4
Geographic Information Systems (GIS) is a powerful tool for analyzing spatial datasets, and for this reason it can be applied to many geological problems. This course will provide students the necessary skills to use GIS with an emphasis on geological applications. It will focus on geologic aspects of GIS analysis such as spatial analysis, geologic mapping, topographic analysis, and the importation and interpolation of aerial photos/satellite images and field data. Offered Winter.
Prerequisites: GEL 1010 with a minimum grade of C or ESG 1010 with a minimum grade of C

ESG 6160 Applied Remote Sensing Cr. 3
This graduate level course focuses on remotely sensed data for geospatial applications. It is desirable for students to have prior knowledge in the basics of remote sensing, mapping, and GIS, and have experience with geospatial software, particularly ArcGIS, but it is not necessary. Students will develop a strong understanding of the tools and techniques used to display, process, and analyze remotely sensed data. Upon completion of this course, students will be able to develop analytical workflows to derive products and extract information from remotely sensed data for a broad range of applications. To assess the course learning, an independent final project for each student will be assigned in which students will demonstrate their ability to apply new skills to a real-world situation of personal or professional interest. Offered Yearly.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 6165 Biodiversity Changes in the Anthropocene Cr. 4
This course is a study of the Anthropocene—what scientists argue is our current epoch in geologic time—emphasizing changes in Earth's biodiversity as a result of human activities. Following an introduction to the Anthropocene, how it can be defined, and key ecological principles of biodiversity, we will explore the history and context for various types of human-influenced change. We will then survey seven human drivers of biodiversity change—from climate and chemical changes to habitat alteration and resource use and finally species transport (including modern pandemics) and invasion. We will wrap up the course examining past, present, and future tipping points, shifting baselines, goals and targets for management, and attitudes. Through this course, you will be challenged to consider both domestic and global (indigenous and western) perspectives of biodiversity change and issues concerning environmental justice. Emphasis will be placed on biodiversity shifts as influenced by humans. Offered Yearly.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 6170 Spatial Statistics and Analyses for Environmental Applications Cr. 3
Students will gain an understanding of spatial analysis methods and learning practical skills in using GIS and spatial analysis to discover features of spatial distribution. The class covers the methods of spatial analysis including measuring aspects of geometric features and identifying spatial patterns of geospatial objects that are represented as points, lines, networks, areal data, and 3-D surfaces. The material will be presented in readings, lectures, lab assignments, and a final project. Offered Yearly.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 6180 Environmental DNA for Ecosystem Monitoring and Conservation Cr. 4
This course is a study of environmental DNA principles, approaches, and applications to study anthropogenic change in the environment. Following an introduction to the field of eDNA, challenges and limitations, early landmark studies, and applications in a variety of ecosystems and types of research questions, we will shift our focus to the technical background for designing an eDNA study—including how eDNA samples are collected, processed, and analyzed— and wrap up with considerations of the future of DNA metabarcoding. Emphasis will be placed on eDNA as a tool for studying environmental changes caused by humans. Offered Yearly.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 6190 Environmental Microbiology Cr. 4
This course is a study of microbial diversity, approaches, and anthropogenic change in the environment. Following an introduction to the field of environmental microbiology, emerging global issues, and exploration of microorganisms in various habitats, we will focus on recent advances in characterization of microorganisms, pathogen transmission (including modern day pandemics), indicators of ecosystem health, and risk assessment. Through this course, you will also develop an understanding of how environmental microbiological samples are collected and processed, analyze how to track microbial sources and transport, and evaluate how microbiota interact with pollutants and ecosystems. Emphasis will be placed on microbiotic changes in the environment as influenced by humans. Offered Yearly.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 6250 Fluvial Geomorphology Cr. 3
This course is an introduction to the physical processes that shape rivers. The focus will be on wadable streams; however, many of the concepts will be applicable to larger rivers, such as the Missouri, Mississippi, Detroit and St. Clair Rivers. River restoration is a thriving industry, and professionals who understand the mechanics of rivers and sediment transport will be in great demand. Students will learn how the dimension, pattern and profile of a river will adjust to changes in hydrology and sediment supply. Students will apply equations to predict flow, velocity and sediment yield and transport, in addition to calculating stable channel dimensions and the extent of departure from stability. Students will learn the value of field measurements and how such observations can help reconstruct the historic disturbances to the fluvial system. Lastly, the role that humans and climate change play in river adjustment will be discussed. Offered Every Other Winter.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 6320 Coastal Geology and Processes in the Great Lakes Cr. 3
Waves and currents are the dominant forces shaping the shoreline. Students will learn how waves form and undergo transformation from deep water to the shoreline. Emphasis will be placed on a general understanding of these processes and their quantification with equations and numerical models. The geology and morphology of the shoreline will dictate its response, and student will spend a significant amount of time learning about the varying types of shorelines (till, dunes, bedrock, gravel/cobble, etc.), how they formed and their response to wave attack. Students will also learn how anthropogenic encroachment and climate change affect the coastal response, in addition to an introduction to coastal field methods. The material in this course will benefit students seeking employment as a coastal geologist, environmental engineer or environmental scientist. Offered Every Other Winter.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 6400 Isotopes: Applications in Geological and Environmental Sciences Cr. 4
Our current understanding of our Earth and its environment are revolutionized by the applications of radioactive and stable isotopes of a large number of the first 95 elements in the Periodic Table. These isotopes, because of their suitable geochemical and nuclear properties, serve as tracer and chronometers to investigate a variety of topics that include chronology of rocks and minerals, paleoclimate, and paleo-environment, erosion and weathering of rocks and minerals, material transport within and between various reservoirs of earth processes. The major objective of this course is to introduce fundamental principles behind dating of Earth material that includes sediment, carbonate, aerosols, glaciers, groundwater/water masses, etc. Further, the foundations of fractionation of stable isotopes in the environment will be laid. Using isotopes as a powerful tool, a large number of applications in solving environmental problems (during Anthropocene) will be presented. Offered Yearly.
Prerequisites: ((PHY 2130 with a minimum grade of D- and PHY 2140 with a minimum grade of D-) or (PHY 2170 with a minimum grade of D- and PHY 2180 with a minimum grade of D-)), (CHM 1220 with a minimum grade of D- and CHM 1230 with a minimum grade of D-), and (GEL 1010 with a minimum grade of D- or ESG 1010 with a minimum grade of D-)

ESG 7210 Environmental and Applied Geophysics Cr. 4
Introduction to geophysical methods used in characterizing the Earth's subsurface for environmental, engineering, and exploration applications. Students will learn the basics of near-surface seismic, gravity, magnetic, electrical resistivity, and electromagnetic methods and data analysis. Offered Fall.
Restriction(s): Enrollment is limited to Graduate level students.

ESG 7620 Seminar in Environmental Science and Geology Cr. 1-4
This seminar seeks to explore topics relating to water, its infrastructure, availability, and human impacts to aquatic systems. Students will be introduced to drinking water management, and its availability in metropolitan areas from a multitude of experts ranging from academics (biology, anthropology, urban planning, engineering, pharmacology, and more) to community leaders. Potential solutions for issues relating to water equity, sustainable infrastructure and best management practices will be introduced and evaluated. This knowledge will allow students to engage in informed critical analysis of water issues from the perspective of availability, equity and evaluate the efficacy of sustainable infrastructure. Offered Intermittently.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 4 Credits

ESG 7650 Applied Geologic Mapping Cr. 4
Geographic Information Systems (GIS) is a powerful tool for analyzing spatial datasets, and for this reason it can be applied to many geological problems. This course will provide students the necessary skills to use GIS with an emphasis on geological applications. The course will focus on geologic aspects of GIS analysis such as spatial analysis, geologic mapping, topographic analysis, and the importation and interpolation of aerial photos/satellite images and field data. Offered Winter.
Prerequisites: GEL 1010 with a minimum grade of C or ESG 1010 with a minimum grade of C
Restriction(s): Enrollment is limited to Graduate level students.

ESG 7990 Directed Study in Environmental Science and Geology Cr. 2-8
Subjects of general interest to Environmental Science and Geology majors at the graduate level. Topics may include in any area where the department of Environmental Science and Geology faculty are interested. Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 8 Credits

ESG 7997 Research in Environmental Science and Geology Cr. 3-4
In-depth research on a particular topic producing an essay. Offered Every Term.
Restriction(s): Enrollment is limited to Graduate level students.
Repeatable for 8 Credits

ESG 7999 Master's Essay Direction Cr. 3-5
In-depth research on a particular topic producing an essay which will be comparable to a research publication. Offered Every Term.
Restriction(s): Enrollment is limited to students with a major in Geology; enrollment is limited to Graduate level students; enrollment limited to students in a Master of Arts degree.
Repeatable for 5 Credits

ESG 8999 Master's Thesis Research and Direction Cr. 1-8
Offered Every Term.
Restriction(s): Enrollment limited to students with a class of Candidate Masters; enrollment is limited to Graduate level students.
Repeatable for 8 Credits