Earth and Environmental Sciences

Chair
- David W. Peate

Undergraduate major: geoscience (B.A., B.S.)
Undergraduate minor: geoscience
Graduate degrees: M.S. in geoscience; Ph.D. in geoscience
Faculty: https://clas.uiowa.edu/ees/people
Website: https://clas.uiowa.edu/ees/

Courses

Earth and Environmental Sciences Courses

Not all courses are offered every year.

EES:1000 First-Year Seminar 1-2 s.h.
Small discussion class taught by a faculty member; topics chosen by instructor; may include outside activities (e.g., films, lectures, performances, readings, visits to research facilities). Requirements: first- or second-semester standing.

EES:1021 Spring Break Service Learning Trip 1 s.h.
Special topics, directed research.

EES:1030 Introduction to Earth Science 3-4 s.h.
Relationships between plate tectonics, geologic time, and the rock cycle with volcanoes and igneous, sedimentary, metamorphic rocks; fossils; radioactive isotopes; landscape evolution; mountain building; natural resources; their impacts on civilization. GE: Natural Sciences with Lab; Natural Sciences without Lab. Same as CEE:1030.

EES:1031 Introduction to Earth Science Laboratory 1 s.h.
Laboratory component of EES:1030. Requirements: completion of 3 s.h. in EES:1030 or CEE:1030. GE: Natural Sciences Lab only. Same as CEE:1031.

EES:1040 Evolution and the History of Life 3-4 s.h.
Fossils over the past 3.5 billion years, origin and evolution of life, evolutionary radiations and mass extinctions, the invasion of land, dinosaurs, the age of mammals, relationship between biological systems and environmental change in earth history. GE: Natural Sciences with Lab; Natural Sciences without Lab.

EES:1050 Introduction to Geology 4 s.h.
Minerals, rocks, and rock-forming processes (including volcanoes and sedimentary environments); surface processes (rivers, groundwater, glaciers, deserts, ocean shorelines), major earth processes (continental drift, plate tectonics, earthquakes, mountain building); impact on civilization. Offered fall semesters. GE: Natural Sciences with Lab.

EES:1060 Big Ideas: Origins of the Universe, Earth, and Life 3 s.h.
Origin of the universe, the biochemistry of life, and the origin of life on Earth; for non-science majors. Recommendations: first-year or sophomore standing. GE: Natural Sciences without Lab. Same as ASTR:1060, BIOL:1060.

EES:1070 Age of Dinosaurs 4 s.h.
Origin and evolutionary history of dinosaurs; diversity of dinosaurian groups, their geographic distributions and paleoecology; origins of flight among dinosaurs; environmental context, including other animals and plants that lived alongside dinosaurs; the so-called extinction of dinosaurs and radiation of modern forms; the role dinosaurs play in the interaction between science and the popular media. Offered fall semesters. GE: Natural Sciences with Lab.

EES:1080 Introduction to Environmental Science 3-4 s.h.
Biological and physical character of the Earth; interaction of humans with the environment, including impacts on ecosystems, climate, natural processes, resources; alternative options, including sustainability, waste management, energy, land reform. GE: Sustainability. GE: Natural Sciences with Lab; Natural Sciences without Lab. Same as ENVS:1080.

EES:1081 Introduction to Environmental Sciences Laboratory 1 s.h.
Laboratory component of EES:1080. Requirements: completion of 3 s.h. in EES:1080 or ENVS:1080; or 3 s.h. of transfer equivalent. GE: Natural Sciences Lab only. Same as ENVS:1081.

EES:1085 Fundamentals of Environmental Science 4 s.h.
Interdisciplinary study of how Earth's natural systems interact, how these systems affect society, and how they respond to human activity; how environmental problems can be solved and avoided by drawing upon knowledge in disciplines as diverse as ecology, anthropology, economics, chemistry, and political science; blended instructional environment, including traditional lectures, discussions in TILE classrooms, laboratory, online learning, peer-reviewed writing exercises, and service learning. Offered fall semesters. GE: Sustainability. GE: Natural Sciences with Lab. Same as ENVS:1085.

EES:1086 Fundamentals of Environmental Science Laboratory 1 s.h.
Laboratory component of EES:1085. Prerequisites: EES:1085 or ENVS:1085.

EES:1115 The History and Science of Oil 3 s.h.
Historical perspective on business, science, geology, technology, politics, environment, and culture of the global oil industry; the rise of oil as the most influential international business of the last 150 years, the material foundation of economies, a major force in world politics, a shaper of daily life, and a guide to understanding Earth's deep history. Offered fall semesters. GE: Sustainability. GE: Historical Perspectives. Same as ENVS:1115, GEOG:1115, HIST:1115.

EES:1170 Geology of the U.S. National Parks 2 s.h.
Geologic features, geologic history, important biological and archaeological characteristics, with emphasis on features that caused certain areas to be included in national park system.

EES:1180 Geology Field Trip: Selected National Parks 2 s.h.
Observation, interpretation of prominent geologic, geomorphic, biological features; semester-break or semester-end visits to different parks or groups of parks each year. Offered spring semesters.

EES:1290 Energy and the Environment 3 s.h.
Scientific concepts related to potentially significant energy sources of the 21st century; environmental impacts, positive and negative, of each energy source as well as geologic and geographical distributions and applications. GE: Natural Sciences without Lab.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES:1400</td>
<td>Natural Disasters</td>
<td>3</td>
</tr>
<tr>
<td>EES:2200</td>
<td>Historical Geology</td>
<td>4</td>
</tr>
<tr>
<td>EES:2310</td>
<td>Introduction to Climatology</td>
<td>3</td>
</tr>
<tr>
<td>EES:2410</td>
<td>Mineralogy</td>
<td>4</td>
</tr>
<tr>
<td>EES:2831</td>
<td>Geologic Field Methods</td>
<td>3</td>
</tr>
<tr>
<td>EES:3000</td>
<td>Geologic Training Assignment</td>
<td>1-3</td>
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<tr>
<td>EES:3001</td>
<td>Third-Year Field Trip for Earth and Environmental Sciences</td>
<td>1</td>
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<tr>
<td>EES:3030</td>
<td>Conservation Paleobiology</td>
<td>4</td>
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<tr>
<td>EES:3050</td>
<td>Geology of Iowa</td>
<td>2</td>
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<tr>
<td>EES:3051</td>
<td>Geology of Iowa Field Trip</td>
<td>1</td>
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<tr>
<td>EES:3060</td>
<td>Ecology and Natural History of Iowa</td>
<td>3</td>
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</tbody>
</table>

**EES:1400 Natural Disasters**  
How earth-atmosphere-hydrosphere-space systems produce events catastrophic to humans on the scale of individual lives to civilizations; root causes of earthquakes, landslides, volcanic eruptions, floods, hurricanes, tsunami, tornadoes, and asteroid impact, and their local, national, and global impact; spatial and temporal occurrences of these hazards; methods and processes for hazard preparedness, response, and recovery; social, economic, and policy aspects that affect and compound the magnitude of disasters associated with natural phenomena; case studies drawn from contemporary and ancient societies. GE: Natural Sciences without Lab.

**EES:2001 Second-Year Field Trip for Earth and Environmental Sciences**  
Opportunity for students to begin developing an appreciation of earth system and earth history scales; application of classroom learning to field-based inquiry; real-world examples of introductory course material in an outdoor classroom setting. Prerequisites: EES:1030 or EES:1050 or EES:1080 or ENVS:1080. Requirements: geoscience or environmental sciences major. Same as ENVS:2001.

**EES:2010 Interdisciplinary Environmental Seminar**  

**EES:2190 Directed Study**  
Special topics, independent research.

**EES:2200 Historical Geology**  
Framework of earth history that is essential to understand how the earth system works; investigation of physical, biological, atmospheric, oceanographic, and chemical history of the earth to prepare for further earth and environmental science courses. Prerequisites: EES:1030 or EES:1050 or EES:1080 or ENVS:1080 or EES:1085 or ENVS:1085. Same as ENVS:2200.

**EES:2310 Introduction to Climatology**  
Introduction to atmospheric processes that determine weather and climate; flow of energy through the atmosphere, distribution and movement of moisture and air, and atmospheric disturbances such as cyclones, hurricanes and tornadoes, and climate change. Recommendations: GEOG:1020 or similar earth systems science course. Same as GEOG:2310.

**EES:2410 Mineralogy**  
Physical, chemical, and optical properties of minerals; phase relations; structures; associations; diagnostic features for identification. Offered fall semesters. Prerequisites: (CHEM:1110 or CHEM:1070) and (EES:1050 or EES:1030).

**EES:2831 Geologic Field Methods**  
Basic methods of geologic fieldwork in southwest Montana using topographic maps and GPS to locate oneself, identifying geologic map units (including superficial deposits), recognizing geologic contacts, constructing stratigraphic sections, measuring planar structures, and making geologic maps complete with a legend and cross-section. Offered summer sessions. Prerequisites: EES:1400 or EES:1080 or EES:1030 or EES:1050.

**EES:3000 Geologic Training Assignment**  
Practical experience.
EES:3070 Marine Ecosystems and Conservation 3 s.h.
Introduction to ocean ecosystems, including coral reefs, mangroves, estuaries and salt marshes, sandy and rocky shores, seagrass and kelp beds, the deep sea, plankton; biodiversity of each ecosystem; interrelationship of biota and physical/chemical environment; interactions among organisms, including food webs and symbiosis; local and global threats such as overfishing, pollution, ocean acidification, global warming, sea level change; ongoing biodiversity crisis, solutions for conservation problems.

EES:3080 Introduction to Oceanography 2 s.h.
Descriptive, chemical, physical, biological, geological aspects of oceans; impact on weather, climate, shorelines, food supply, other aspects of civilization. Offered spring semesters. Recommendations: knowledge of basic chemistry, biology, physics, earth science.

EES:3100 Earth and Planetary Remote Sensing 4 s.h.
Remote sensing of the earth's surface from aircraft, satellites; aerial photograph interpretation; remote sensing systems, methods, data analysis using electromagnetic spectrum and digital processing techniques, including visible, infrared, microwave radiation; remote sensing applied to geologic and environmental problems. Prerequisites: EES:1030 or EES:1050 or EES:1080 or EES:1085. Same as ENVS:3100.

EES:3110 Chemical Evolution of the Oceans 3 s.h.
Investigation of various physicochemical states oceans have assumed over the past four billion years of Earth history; use of isotopic geochemistry as a proxy for ancient ocean conditions; focus on integrated Earth system science, paleoceanographic and paleoclimatic modeling, role of chemical stratigraphy in deciphering past climate states of ocean-atmosphere system; relationship between chemical changes in ocean/atmosphere and biological systems of the Earth. Same as ENVS:3110.

EES:3130 Career Path Planning for Earth and Environmental Sciences 1 s.h.
Opportunity to cultivate a sense of what employers deem as important skills beyond the technical requirements, develop a set of polished application materials and practice interviewing skills, and investigate a wide variety of potential career paths through interaction with department alumni.

EES:3150 Sustainability Project arr.
Individual or collective project related to sustainability under the direction and supervision of a faculty member; involves regularly scheduled meetings, data collection and interpretation, and a final project report.

EES:3160 Field Trip 1-3 s.h.
Field trip to an area of geologic interest, such as localities in the Midwest, Hawaii, Grand Canyon (Arizona), Rio Grande Rift (New Mexico), Death Valley (California, Nevada), Appalachian Mountains (Virginia), as well as international destinations such as the Caribbean and China; preceded by weekly discussions of destination's geology.

EES:3190 Directed Study arr.
Special topics, independent research.

EES:3200 Collection Care and Management 3 s.h.
How a museum's management policy relates to its administrative, legal, and ethical obligations to its collections; acquisitions, deaccessions, collection use, data standards, storage environment, health, safety, documentation. Same as MUSM:3200.

EES:3210 Principles of Paleontology 3 s.h.
Patterns of evolution in fossil record; species and analysis of their evolutionary relationships; paleoecology, paleocommunity evolution; evolutionary radiation and mass extinctions; large-scale relationships between biodiversity and climatic change. Offered fall semesters.

EES:3220 Evolution of the Vertebrates 4 s.h.
Evolutionary history of vertebrates revealed by fossils and information from living animals; biogeographic, stratigraphic, paleoecological aspects of selected groups, especially mammals and dinosaurs; transitions from aquatic to terrestrial life, origins of flight, major events in vertebrate history (including mass extinctions and explosive radiations). Requirements: introductory course in geoscience, bioscience, or physical anthropology.

EES:3260 Wetlands: Function, Geography, and Management 3 s.h.
Hydrological, geomorphological, and ecological processes and their interaction in wetlands; geographic differences in wetlands based on climate and hydrology; wetlands, lakes, and rivers; role of wetlands in drainage basin hydrology and flooding; values and valuation of wetlands; wetland law and wetland delineation; wetlands and water resources. Prerequisites: GEOG:2310 or GEOG:2374. Same as GEOG:3320.

EES:3300 Sedimentary Geology 4 s.h.
Basic concepts of sedimentology, stratigraphy, depositional environments, sedimentary petrology; hands-on analyses of sediments and sedimentary rocks, including thin-section petrography; lecture/laboratory. Offered fall semesters.

EES:3350 Active Tectonics 3 s.h.
Exploration of current topics in active tectonics and earthquake research through applications of earthquake physics, earthquake seismology, geodesy, paleoseismology, tectonic geomorphology, and earthquake hazards assessment.

EES:3360 Soil Genesis and Geomorphology 3 s.h.
Introduction to soil genesis, soil geomorphology, and classification including the basics of soil profile description and soil-landscape, soil-vegetation, and soil-climate relationships; emphasis on study of soils as the interface between living and non-living Earth systems and the role of soils in sustaining ecosystems and human societies; short field excursions and a weekend field trip. Requirements: college earth science and chemistry. Same as GEOG:3360.

EES:3380 Fluvial Geomorphology 3 s.h.
Hydrologic principles, stream channel processes, and fluvial geomorphology within drainage basin systems; spatial and temporal variations in water distribution, analysis of hydrological data, flow mechanisms, sediment transport, forecasting procedures, hydrograph construction, modeling. Requirements: EES:3020 or another 3000-level geology or hydrology course. Same as CEE:3328.

EES:3390 Integrated Watershed Analysis 3 s.h.
Integration of existing knowledge of physical, hydrological, and environmental processes with management issues and challenges in water resources and environmental management; aspects of water quantity and quality, water use and treatment; basin management issues related to forestry, agriculture, urbanization, floods, droughts.
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<tr>
<td>EES:3500</td>
<td>Igneous and Metamorphic Petrology</td>
<td>4 s.h.</td>
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<tr>
<td>EES:3770</td>
<td>Global Stratigraphy</td>
<td>3 s.h.</td>
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<tr>
<td>EES:3840</td>
<td>Structural Geology</td>
<td>4 s.h.</td>
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<tr>
<td>EES:4001</td>
<td>Fourth-Year Field Trip for Earth and Environmental</td>
<td>2 s.h.</td>
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<tr>
<td>EES:4200</td>
<td>Museum Object Preservation</td>
<td>3 s.h.</td>
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<tr>
<td>EES:4230</td>
<td>Special Topics</td>
<td>1-3 s.h.</td>
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<tr>
<td>EES:4300</td>
<td>Quantitative Methods in the Geosciences</td>
<td>3 s.h.</td>
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<td>EES:4410</td>
<td>Analytical Methods Seminar</td>
<td>2 s.h.</td>
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<td>EES:4490</td>
<td>Elements of Geochemistry</td>
<td>3 s.h.</td>
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<td>EES:4520</td>
<td>Isotope Geochemistry</td>
<td>3 s.h.</td>
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<td>EES:4530</td>
<td>Volcanology</td>
<td>3 s.h.</td>
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<tr>
<td>EES:4530</td>
<td>Hydrogeology</td>
<td>4 s.h.</td>
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<td>EES:4640</td>
<td>Contaminant Hydrogeology</td>
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<td>EES:4660</td>
<td>Groundwater Modeling</td>
<td>3 s.h.</td>
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<tr>
<td>EES:4680</td>
<td>Field Methods in Hydrologic Science</td>
<td>3 s.h.</td>
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</table>
EES:4700 Evolution of Ecosystems 3 s.h.
Evolutionary history of terrestrial and marine ecosystems; ecological processes from population to ecosystem levels; community assembly, trophic levels, networks, biodiversity dynamics; practical aspects of paleoecological data collection, statistical analysis, modeling. Requirements: two courses in geoscience, biology, environmental sciences, anthropology, or geography. Same as ENVS:4700.

EES:4710 Evolution of Plants 3 s.h.
Evolutionary history of plants over geologic time: relationships, morphology, and fossil record of major plant lineages; patterns and processes in evolution of plant morphology and diversity; ecological innovations and evolution of terrestrial ecosystems; relationships between biotic and environmental change; paleobotanical tools in stratigraphy, paleoclimatology, sedimentology; practical aspects of paleobotanical data collection, statistical analysis, modeling; field trip. Requirements: two courses in geoscience, anthropology, biology, environmental science, or geography.

EES:4720 Paleoclimatology 3 s.h.
Introduction to glaciers and glacial and interglacial Earth systems; linkages among glacial, oceanic, and atmospheric systems and their effects on landscapes and biota over the past two million years; how oceans, atmosphere, and glaciers interact and landscape effects of past glacial and interglacial cycles. Requirements: physical geology or physical geography or anthropology.

EES:4750 Mineral and Petroleum Exploration Geology 3 s.h.
Fundamentals of resource exploration philosophy and methods, with project-based presentation of techniques and strategies for mineral exploration and petroleum exploration; integration and evaluation of geological, geochemical, and geophysical techniques for mineral exploration; hydrocarbon systems and seismic interpretation for petroleum exploration. Corequisites: EES:3500 and EES:3840.

EES:4790 Applied Environmental Geology 3 s.h.
Application of geology, water, and earth processes to civil and environmental engineering practice; physical properties of rock and soil, geologic mapping and surveying, groundwater supplies and wells, stream engineering, watershed management, site investigations for environmental assessment, and geologic hazards. Prerequisites: EES:1030 or EES:1080 or EES:1050.

EES:4800 Global Geophysics 3 s.h.
Geophysics is the broad geoscience field interested in discovering the unseen characteristics of the Earth and other planets, including the internal structure of the Earth, the current motions of tectonic plates, the sources and causes of geological disasters, and the locations of economic resources; methods to accomplish these goals include seismology, gravity and magnetic studies, geodesy, and measurements of heat; course offers a broad introduction to these topics that is rooted in current and growing fields of active research. Requirements: introductory geology or physics.

EES:4820 Tectonics and Basin Analysis 3 s.h.
Dynamic processes responsible for crustal genesis, plate movements, mountain building; plate boundary zones; sedimentologic, structural, petrologic, geophysical characteristics of major tectonic settings; multidisciplinary approach; week-long field trip. Corequisites: EES:3840.

EES:4832 Geologic Field Analysis 3 s.h.
Structural, stratigraphic, and regional analysis of geology in the Rocky Mountains of Montana; emphasis on making reasonable geologic interpretations from field relationships; mapping projects in vicinity of Dillon, Montana that build on experience gained in EES:2831; capstone experience dedicated to synthesizing the geology of a fold-and-thrust belt near Glacier National Park. Offered summer session. Prerequisites: EES:2831 and EES:3840.

EES:4990 Senior Thesis in Geoscience arr.
Independent research resulting in a senior thesis. Requirements: senior standing.

EES:4999 Honors Thesis in Geoscience arr.
Independent research resulting in an honors thesis. Requirements: honors standing.

EES:5010 Geoscience Seminar Series 1 s.h.
Scholarly work and research in geoscience.

EES:5015 American Association of Petroleum Geologists Fall Field Trip 1 s.h.
Resource-related topics in mineral and hydrocarbon exploration; tectonic settings for resources. Requirements: AAPG student chapter member or graduate standing, and basic understanding of mineralogy, petrology, and structural geology.

EES:5380 Process Geomorphology Seminar 1-3 s.h.
Topics in process geomorphology ranging from fluvial dynamics to mass movement to sediment transport and related environmental processes.

EES:5530 Geochronology 3 s.h.
How to evaluate published ages, and assumptions/errors involved; how to select and sample suitable materials for dating, and choose a suitable dating method and analytical technique; opportunity to develop skills for research and professional careers. Prerequisites: EES:4490 or EES:4520.

EES:5550 Metamorphic Petrology 3 s.h.
Interpretation of metamorphic rocks using hand specimens, thin sections, field relationships, mineralogical composition, texture, geochronology, isotope geochemistry, thermodynamics, kinetics, and tectonic setting; phase equilibria in pelitic, mafic, and carbonate rocks; thermobarometry, petrogenetic grids, P-T-X relationships, and psuedosections; kinetic models of metamorphic textures, heat-flow modeling, P-T-T paths, and tectonic evolution of metamorphic rocks. Prerequisites: EES:3500.

EES:6190 Directed Study arr.
Independent research.

EES:6230 Special Topics 1-3 s.h.
Contemporary issues in earth sciences.

EES:6250 Paleontology Seminar 1-3 s.h.

EES:6390 Advanced Watershed Analysis Seminar 1-3 s.h.
Integration of existing knowledge of physical, hydrological, and environmental processes with management issues and challenges in water resources and environmental management; aspects of water quantity and quality, water use and treatment, and basin management issues related to forestry, agriculture, urbanization, floods, droughts.

EES:6570 Tectonics and Petrology Seminar 1-2 s.h.
Topics in tectonics, structural geology, petrology.
EES:7270 Geologic Orientation, Scholarly Integrity, and Responsible Conduct of Research  1 s.h.
Department degree requirements, programs; field survey of local geology; scholarly integrity; responsible conduct of research; tips for TAs; introduction to specialized facilities; for new graduate students.

EES:7604 Principles of Scholarly Integrity   0 s.h.
Training in responsible conduct of research and scholarly activities; student/mentor responsibilities, authorship, plagiarism/falsification/fabrication of data, intellectual property, conflict of interest; fiscal, institutional, and societal; data handling. Requirements: postdoctoral standing in geoscience.

EES:7990 Research: Geoscience       arr.
Independent research related to theses or dissertations in geoscience.