GEOGRAPHY AND EARTH SCIENCES

Department of Earth, Environment, and Physics

Geography is a science that examines physical and social processes and their interrelationships through the integrative concept of space. Earth systems science analyzes the systems and processes that shape the earth’s surface including weather, climate, landforms, and hydrology. Human geography analyzes social processes such as globalization, demographics, urbanization, and construction of cultural identities. Environmental geography examines the interactions between social and physical systems. Geographers explore these processes using such tools as maps, geographic information systems, and remote sensing techniques.

Membership in Gamma Theta Upsilon, the international geography honor society, is available to distinguished students. Prospective members must have completed a minimum of 3 geography or earth science courses, have a GPA of at least 3.3 overall in those courses, and have completed at least 3 semesters of college course work. A prospective member is not required to be a geography major or minor. Undergraduate Geography majors who have demonstrated academic excellence and an interest in Geographic research may participate in the Honors in Geography program.

Requirements for a Major

Minimum requirement for the major is completion of a six-course (18 credit) core curriculum and one of five concentrations. Students will declare a concentration in either General Geography, Environmental Studies, Geographic Information Systems, Earth System Science, or Earth Science Education. Study Away/Study Abroad is strongly encouraged for geography majors.

- Geography Honors Program
- Geography Major: Earth Science Education Concentration
- Geography Major: Earth System Science Concentration
- Geography Major: Environmental Studies Concentration
- Geography Major: General Geography Concentration
- Geography Major: Geographic Information Systems Concentration
- Geography Minor
- Geospatial Information Science Minor

Faculty

Allison Dunn, Department Chair, Professor (2007), B.A., Oberlin College; M.A., Ph.D., Harvard University

William Hansen, Professor (2005), B.A., State University of New York Albany; M.A., Hunter College; Ph.D., City University of New York Graduate Center

Laura C. Reynolds, Assistant Professor (2020), B.A., Dartmouth College; Ph.D., University of California

Alexander R. Tarr, Associate Professor (2016), B.A., University of Southern California; Ph.D., University of California Berkley

Courses

GE-102 Human Geography
LASC Categories: GP, HBS
Introduction to human geography, emphasizing globalization, humanevironmental relations, and spatial patterns of population, development, economics, politics, urbanization and culture.
Fall and Spring and every year. 3 Credits

GE-130 Introduction to Energy Studies
Foundation concepts in energy studies. Overview of environmental and societal implications of energy systems - past, present and future.
3 Credits

GE-193 Special Topics in Geography for First-Year Students
LASC Categories: FYS
Introductory level course covering topics of special interest to first-year students. Offered only as a First-Year Seminar.
3 Credits

GE-195 Special Topics
Introductory course to be offered on a trial basis. Topic to be announced in advance.
1-6 Credits

GE-200 Geography Literature Seminar
Prerequisites: GE-102 and GS-101 and GS-140 and GS-165
Geography majors will attend research seminars, conduct literature searches; identify relevant primary literature; read and take notes on primary literature; compile annotated bibliographies; create written syntheses.
Fall only and every year. 1 Credit

GE-214 Critical Cartographies: Digital Mapping and Spatial Data Visualization
Prerequisites: one course from the following: GE-102, GS-165, CM-100, CM-106, PO-130, SO-100, SO-193, SO-200, UR-101, UR-193, UR-201 GS-165.
This course introduces the fundamental theories, art and science of map making using web-based platforms. It provides an interdisciplinary approach for students to learn both practical and conceptual skills to collect, interpret and present data in the form of online, interactive maps and data visualizations.
Every 2-3 years. 3 Credits

GE-250 Urban Geography
LASC Categories: HBS
Prerequisites: GE-102 or GL/GE-102 or UR-101
World urbanization, location, and central place concepts, economy of cities, land use patterns, urban, physical, and societal environmental problems.
Every 2-3 years. 3 Credits

GE-255 Geography of Africa
LASC Categories: DAC, GP
Prerequisites: GE-102 or GE-111 or GL/GE-102 or GL/GE-111 or GL-150 or SO-100 or SO-110 or UR-101
Analysis of the physical and human geography of Africa.
3 Credits

GE-258 Global Environmental Change
Prerequisites: GE-102 or GL/GE-102 or GS-101 or GL-150 or EV-150 or UR-101 or CH-106
An introduction to the science, political economy and ethics of global environmental change.
Every year. 3 Credits
GE-285 Sustainable Communities
LASC Categories: HBS, USW
Prerequisites: GE-102 or GL/GE-102 or GL-150 or EC-110 or EC-120.
Exploration of changes in U.S. and global economic landscape, 1970 to present. Approaches to sustainable economic development.
Every 2-3 years. 3 Credits

GE-299 Special Topics
Intermediate level course to be offered on a trial basis. Topic to be announced in advance.
1-6 Credits

GE-307 American Public Lands: Environmental Issues
Prerequisites: GE-258 or permission of instructor.
Exploration of the environmental management issues on U.S. public lands such as national parks, national forests BLM lands.
3 Credits

GE-312 Sustainable Food Systems
Prerequisites: GE-102 or a 200 level GE, GS, SO or UR course.
Overview of the structure, evolution, costs and benefits of the global food system. Exploration of local and global alternatives.
Every 2-3 years. 3 Credits

GE-342 Sustainable Housing And Techniques
Prerequisites: GE-130 or GE-240
Principles of green design with an emphasis on building construction. Material and energy flows, choice of materials, designing for sustainability.
3 Credits

GE-360 Middle East: Changing Environ
The Middle East: geography, society, economics and political structure.
3 Credits

GE-400 Geography Seminar
LASC Categories: CAP
Prerequisites: GE-102, GS-101, GS-140, GS-216, and GE-212 or GE-315
Capstone course for geography majors. Students prepare a comprehensive term paper and present on the topic. Course includes portfolio and career development.
Fall and Spring and every year. 3 Credits

GE-408 Directed Study: Geography
Directed study offers students the opportunity to complete an existing course with an established syllabus under the direction and with the agreement of a faculty member.
3 Credits

GE-410 Independent Study: Geography
Opportunity for advanced students to pursue a topic of special interest involving extensive reading, experimentation, and research.
Every year. 1-6 Credits

GE-420 Advanced Geoscience Research and Fieldwork
Lab and or field-based research on a specific geoscience topic under supervision of a faculty member. [Permission of instructor.]
1-6 Credits

GE-450 Readings and Directed Research
Directed study on selected topics; open to senior majors.
3 Credits

GE-460 Internship: Geography
Students assigned to various government and private agencies under joint supervision of agency and faculty. Major GPA of 3.0 or above required.
1-6 Credits

GE-470 Selected Topics: Geography
Prerequisites: GE-102 or GL/GE-102
Topic or subject to be announced in advance; topic to be relevant to student needs and interests and availability of professor.
1-6 Credits

GS-101 Physical Geography
LASC Categories: NSP
Geographic principles of location; characteristics of landforms, soil, climate, minerals, water, flora, and fauna. [Formerly GE101.]
Fall and Spring and every year. 3 Credits

GS-110 Meteorology
LASC Categories: NSP, QAC
Understanding the atmosphere and worldwide weather, Earth-Sun relationships, atmospheric humidity and precipitation, air pressure and winds, circulation of the atmosphere, climate change, air pollution, stratospheric ozone depletion, and extreme weather.
Fall and Spring and every year. 3 Credits

GS-140 Physical Geology
LASC Categories: LAB, NSP, QAC
Introduction to geological science: rocks and minerals, internal and external geologic processes, topographic map and air photo analysis, local field study. Three hours lecture and two hours laboratory per week.
Fall and Spring and every year. 4 Credits

GS-150 Humans and the Cold Regions
LASC Categories: NSP
Winter intersession. Examines earth's cold regions, including physical geography, cryosphere's role in earth systems, human adaptations. Includes outdoor activity.
3 Credits

GS-165 Geographic Information Systems I
LASC Categories: NSP, NLL
Introduction to the use of geospatial technologies including geographic information systems and GPS.
Fall and Spring and every year. 4 Credits

GS-180 Field Geoscience
LASC Categories: NSP, LAB
Field Geoscience course for EEP majors as well as non-majors. Course explores the intersection of human activities and the Earth's landscape and processes, with a basic introduction to topics in geology, mapping and landscape analysis. Includes lecture, labs and field activities. Introductory lectures lab and field work on or near the Worcester State campus and then an overnight trip of 7-10 days. Other or on demand and every 2-3 years. 4 Credits

GS-193 First Year Seminar in Geography
LASC Categories: FYS
Introductory level course covering topics of special interest to first-year students. Offered only as a First-Year Seminar.
3 Credits

GS-195 Special Topics
Introductory course to be offered on a trial basis. Topic to be announced in advance.
1-6 Credits
GS-210 Geomorphology  
LASC Categories: NLL, QAC  
Prerequisites: GS-101 or GS-140 and an accuplacer score of 3 or one college level Math course.  
The study of landforms and the processes that form them. Labs focus on interpretation of maps and aerial photographs. Three hour lecture and two hour laboratory.  
Every 2-3 years. 4 Credits

GS-217 Spatial Data Methods  
LASC Categories: QR  
Prerequisites: GS-165  
Introduction to the methods used in GIS programming and quantitative geospatial analysis.  
Every 2-3 years. 3 Credits

GS-218 Introduction to Remote Sensing  
LASC Categories: NSP  
Prerequisites: GS-101 or GS-140 or EV-150 or BI-101 or BI-140  
Introduction to the use and analysis of remotely sensed images such as aerial photographs and satellite imagery.  
Every 2-3 years. 3 Credits

GS-225 Oceanography  
LASC Categories: QAC  
Prerequisites: GS-101 or GS-140 or GS-110 or EV-150  
The principles of physical, chemical, biological, and geological oceanography.  
Spring only and every year. 3 Credits

GS-230 Biogeography  
Prerequisites: GS-101 or GS-110 or BI-101 or BI-140  
The distribution patterns of plants and animals, processes affecting this distribution, and how these patterns change in space and time.  
Every 2-3 years. 3 Credits

GS-235 Contemporary Climate Change  
Prerequisites: GS-101 or GS-110 or EV-150 or CH-106.  
The global climate system, factors influencing climate, recent climate change and the role of human activity.  
Every 2-3 years. 3 Credits

GS-240 Coastal Environments  
Prerequisites: GS-101 or GS-140  
Summer session course examining the physical geography of coastal environments including human impacts. Includes field trips.  
3 Credits

GS-245 Planetary Geology  
Prerequisites: GS-140 or PY-101  
Solar system formation and evolution with emphasis on planetary interiors and surface features.  
Every 2-3 years. 3 Credits

GS-250 Hydrology  
Prerequisites: GS-101 or GS-140 or GS-110 or EV-150  
Hydrologic processes, their estimation and measurement. Includes precipitation, evaporation, runoff, groundwater and water resources management.  
Fall only and every year. 3 Credits

GS-260 Introduction to Soil Science  
Prerequisites: GS-101 or GS-140  
The study of the formation, processes, classification and composition of soils with emphasis on environmental applications, including watershed delineation.  
Every 2-3 years. 3 Credits

GS-270 The Sedimentary Record  
LASC Categories: NLL  
Prerequisites: GS-140 and GS-101 or GS-110  
Theoretical, laboratory, and field investigations of modern sedimentary processes, depositional environments, the sedimentary record of earth history, principals of stratigraphy. 3 hours lecture and 3 hours lab.  
Every 2-3 years. 4 Credits

GS-299 Special Topics  
Intermediate level course to be offered on a trial basis. Topic to be announced in advance.  
1-6 Credits

GS-318 Geographic Information Systems II  
Prerequisites: GS-165  
Advanced production of digital choropleth maps on PCs using a GIS vector oriented software.  
Every 2-3 years. 3 Credits

GS-328 Digital Landscape Analysis  
Prerequisites: GS 165 and one 200 level GS course.  
Computer based methods of representing, storing and analyzing landscape features. Explores technologies such as LiDAR and Unmanned Aerial Vehicles for gathering landscape data and the use of geospatial tools to analyze and represent landscape features. 3 hours of lecture and 2 hours of lab.  
Every 2-3 years. 4 Credits

GS-335 Hydrogeology  
Prerequisites: GS-140 or GS-250 and a math placement test score of 3, or a college level math course.  
Underground water and its movement. Aquifer identification and test; wells, contamination and remediation, ground water as a geologic agent.  
Fall only and other on demand. 3 Credits

GS-338 Atmospheric Sciences  
Prerequisites: # GS-101 # Take CH-120 or CH-112;  
Atmospheric Science introduces students to the physics and chemistry of the atmosphere, and examines the science behind current issues such as global climate change, air pollution, and reductions in stratospheric ozone. Atmospheric physics includes both weather (clouds, rain, winds) and climate (weather averaged over longer timescales, as well as trends in climate over time). Atmospheric chemistry investigates processes controlling the chemical composition of the atmosphere, including related processes in the and biosphere, as well as anthropogenic pollution (smog, stratospheric ozone loss, etc.)  
Every 2-3 years. 3 Credits

GS-340 Special Topics: Advanced Earth Science  
Advanced course to be offered on a trial basis. Topic to be announced in advance.  
1-6 Credits

GS-348 Fundamentals of Earth Data Analytics  
LASC Categories: NSP, QR, QAC  
Prerequisites: GS-101 Take 1 course; From Subjects GS; From Levels 200;  
The theory and practice of data analytics using remote sensing and in-situ earth observations, and communicating the science.  
Fall only and every year. 4 Credits
GS-370 Lakes & Environmental Change  
**LASC Categories:** WAC, NLL  
**Prerequisites:** GS-140 Take one earth science course at the 200-level or above.  
Modern physical, biogeochemical, and sedimentary processes in lakes. Lake sediments as archives of past climate and environmental change. Includes fieldwork.  
Every 2-3 years. 4 Credits

GS-380 Advanced Field Geoscience  
**LASC Categories:** NLL  
**Prerequisites:** GS 140 and one other 200 level GS course.  
Field Geoscience course for EEP majors. Course explores the intersection of human activities and the Earth’s landscape and processes examining advanced topics in geology, mapping and landscape analysis. Includes lecture, labs and field activities. Introductory lectures lab and field work on or near the Worcester State campus and then an overnight trip to field sites, 1-10 days depending on the number of credits.  
Other or on demand and every 2-3 years. 1-4 Credits

GS-400 Senior Seminar  
**LASC Categories:** CAP  
**Prerequisites:** GE-102 GS-101 GS-140 GS-165 and GE-200 and senior standing  
Capstone course for geography majors. Students prepare a comprehensive term paper and present on the topic. Course includes portfolio and career development.  
Fall and Spring and every year. 3 Credits

GS-408 Directed Study: Earth Science Or Geoscience  
Directed study offers students, who because of unusual circumstances may be unable to register for a course when offered, the opportunity to complete an existing course with an established syllabus under the direction and with agreement from a faculty member.  
Other or on demand and every year. 1-4 Credits

GS-410 Independent Study: Earth Science- Geoscience  
Opportunity for advanced students to pursue an earth science or geoscience topic of special interest involving extensive reading, experimentation, and research.  
Fall and Spring and every year. 1-4 Credits

GS-420 Advanced Geoscience Research and Fieldwork  
Lab and or field-based research on a specific geoscience topic under supervision of a faculty member. [Permission of instructor.]  
1-6 Credits

GS-450 Readings and Directed Research  
Directed study on selected topics; open to senior majors.  
3 Credits

GS-460 Internship: Geography  
Students assigned to various government and private agencies under joint supervision of agency and faculty. Major GPA of 3.0 or above required.  
Other or on demand. 1-6 Credits

GS-470 Selected Topics: Geography  
**Prerequisites:** GS-101 and one course from GS-210, GS-225, GS-230, GS-235, GS-250, GS-260, GS-290 or GS-310  
Topic or subject to be announced in advance; topic to be relevant to student needs and interests and availability of professor.  
1-6 Credits

**Program Learning Outcomes**

- Demonstrate a command of geographic terminology and fundamental concepts
- Apply the scientific method to analyze and address geographic problems
- Communicate geographic data and concepts
- Locate, evaluate, and utilize various information sources and data
- Demonstrate an understanding of Earth and society as a set of interconnected, dynamic physical and human systems
- Obtain entry level employment and/or gain admission into graduate school