# **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
- Geoscience Minor
- · Geospatial Information Science Minor

# Faculty

Anne Armstrong, Assistant Professor (2022), B.A., Hamilton College; M.P.S., SUNY College of Environmental Science and Forestry; M.S., Ph.D., Cornell University

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

Nabin K. Malakar, Associate Professor (2017), M.S., Ph.D., University at Albany, State University of New York (SUNY)

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

# Courses

# GE-102 Human Geography

LASC Categories: GP, HBS

Introduction to human geography, emphasizing globalization, humanenvironment 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-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-290 Conservation & Natural Res Mgt

# LASC Categories: TLC

Through a multidisciplinary approach, students in this conservation management course will explore various theoretical frameworks and practical strategies for effective conservation management, including rational planning, adaptive management, stakeholder engagement, and structured decision making. Students will critically analyze past and present conservation management approaches and assess their applicability to current environmental issues in our local community and beyond. Through case studies, discussions, and project-based learning, students will apply their understanding of conservation management approaches to propose management plans that address real-world conservation challenges.

Other or on demand. 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-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-165 Geographic Information Systems I

#### LASC Categories: NSP, LAB

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 1-10 days.

Other or on demand and every 2-3 years. 1-4 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, NSP, LAB

Prerequisites: GS-101 or GS-140.

This class will introduce you to the geological, physical, and climatic aspects of oceanography and the many ways the world ocean affects our daily lives. Topics include ocean waves and currents, marine geology and sediments, tides, coastal processes and hazards, and sea level change. Course includes field trips.

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-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

# LASC Categories: LAB

Prerequisites: GS-101 or GS-140 or GS-110 or EV-150

This course examines Earth's freshwater and its processes as it moves between Earth's atmosphere, surface, and subsurface. Explores the interactions of precipitation, surface runoff, infiltration, streamflow, and groundwater flow. Topics include hydrograph analysis, runoff estimations, groundwater-surface water interactions, groundwater flow, water quality assessment, and water resources assessment. Course includes field trips.

Fall only and every year. 3 Credits

#### **GS-270 Sediments and Soils**

LASC Categories: NSP, LAB

#### Prerequisites: GS-140.

This laboratory class will introduce you to how sediments and soils form and transform over time. The class will include laboratory and field investigations of modern sedimentary environments and local soils, following standardized protocols used by government agencies and environmental companies.

Spring only and every 2-3 years. 3 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 or 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, LAB

**Prerequisites:** GS-101 Take 1 course; From Subjects GS; From Levels 200; The theory and practice of data analytics using remote sensing and insitu 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