GEOGRAPHICAL SCIENCES MAJOR

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Geographical Sciences concerns the relationships between people and the natural world, the effects of ecosystems on human beings and vice versa, the choices people make, the effects of past actions on people today, and the effects of today's choices on future generations. Students and faculty in the Geographical Sciences Department study the human dimensions of global change in order to address the most pressing global issues of our time, including climate change, food security, loss of forests and biodiversity, the spread of diseases, poverty, inequality, and much more.

Students earning a Bachelor of Science degree in Geographical Sciences will investigate the human dimensions of global change through synthesizing knowledge from geography sub-disciplines such as physical, human, and technical. Upon graduation students will understand physical geographic processes, the global distribution of landforms and ecosystems, and the role of the physical environment on human populations, as well as be able to explain how social and cultural systems develop in response to varying geographical, environmental, and historical circumstances. Program graduates will also be familiar with applications of geographic information science techniques and spatial analytics.

The Geographical Sciences Department offers two technical specializations in addition to the general Bachelor of Science in Geographical Sciences degree. These specializations are "Geospatial Data Science" and "Computational Earth Observation Science."

Students specializing in Geospatial Data Science gain the technical skills needed to acquire, manage, and analyze large amounts of geospatial data. Students will get computer training in digital processing of remote sensing observations and cartographic vector data, spatial analysis, and the display of information in Geospatial Information Science (GIS) software. The curriculum will provide students with the necessary background to use GIS in various fields such as environmental monitoring, disaster assessments, military analysis and intelligence, social justice, cartography, and other related fields. This specialization goes beyond the techniques for gathering and analyzing data and requires an understanding of the environmental and social processes represented by the data. These tools are essential to the education and future of global citizens.

Students specializing in Computational Earth Observation Science will explore the analytical capabilities offered by current Earth-observing satellite missions, including the different types of information collected by various satellites and how this information is analyzed to solve important environmental and societal problems. Students will learn the methods that are used to extract meaningful information from satellite images including mapping different land covers such as forests, cropland, or water, and monitoring environmental change over time. They will learn to apply statistical techniques, machine and deep learning algorithms to spatial data and will develop the necessary computer programming skills to handle big data analytics to support satellite image analysis. These technical skills will be developed alongside the fundamental understanding of environmental processes and human society to tackle a variety of pressing global, regional, and local issues including sea and continental ice loss and ocean warming, forest management and loss, wildfire impacts and prevention, urban growth and its consequences, crop monitoring and food security, and environmental degradation and health outcomes, among others. These students will be the next generation of professionals that will support the integration of satellite monitoring into private and public operational and research agencies to support building a better and more sustainable world.

Courses offered by this department may be found under the acronym GEOG.

Program Objectives

Mission

To make fundamental contributions to the advancement of geographic science by:

- Conducting disciplinary and integrative research in the physical and social sciences that spans local to global scales, with an emphasis on a geospatial perspective of our changing planet and its sustainability.
- Equipping undergraduate and graduate students to meet the challenges associated with the continuing evolution of geographic science while providing them with vibrant and fulfilling educational experiences.
- Applying geographic science to societal and environmental issues in our state, the nation and the global community.

Vision

To lead the development of academic, educational, and research directions of human and natural systems, land cover/and land use change and geospatial information science, harnessing the integrative nature of geographic science to answer fundamental questions of global importance.

Program Learning Outcomes

Having completed the degree program, students should have acquired the following knowledge and skills:

1. Geographic Theory: Demonstrate and apply knowledge of general geographic theory.
2. Integrative Thinking: Synthesize material within and between sub-disciplines of geography for application to an array of global issues.
3. Research Skills: Design and implement a research project.
4. Communication: Communicate effectively orally, in writing, and through geovisualization.

REQUIREMENTS

Within any of the specializations available in the geographical sciences program it is possible for students to adjust their programs to fit their individual interests. The Geographical Sciences major totals 35 semester hours. In addition to the 35 semester hours, the Geographical Sciences major requires an additional 15 semester hours of supporting course work outside of the department. Supporting coursework is approved by the department advisor. Visit or call the GEOG Advising Office, Lefrak 2181, 301-405-4073, e-mail geog-advise@umd.edu, or see the web page at www.geog.umd.edu (http://www.geog.umd.edu). Supporting courses generally are related to the area of specialty in geographical sciences. The pass-fail option is not applicable to major or supporting courses. A minimum grade of "C-" in each course is required for major

and supporting courses. Students must have a minimum 2.0 cumulative grade point average across all courses, including the supporting sequence, used to satisfy the major degree requirements.

The required courses for Geographical Sciences majors are as follows:

Course	Title	Credits
College Requirements (https://academiccatalog.umd.edu/undergraduate/colleges-schools/behavioral-social-sciences/#collegerequirementstext)		
Required Courses		
GEOG201 & GEOG211	Geography of Environmental Systems and Geography of Environmental Systems Laboratory	4
GEOG202	Introduction to Human Geography	3
GEOG212	Career Planning for Geographical Sciences, GIS, and ENSP Majors	1
Select one upper-level physical geography course		3
Select one upper-level human geography course		3
Select one upper-level geographic techniques course		3
ELECT300/400	Upper-level geography electives [1]	15
GEOG306	Introduction to Quantitative Methods for the Geographical Environmental Sciences	3
Supporting Courses		
MATH120	Elementary Calculus I	3
Supporting courses approved by GEOG advisor		12
Total Credits		**50**

[1] At least one upper-level course in physical geography, human geography and geographic technique is required regardless of the specialty of the individual student's program. These courses build on the initial base provided by the Primary Courses, and also serve as the basis for selection of upper-level geography courses.

Related Programs

Geospatial Data Science Specialization

The Geographical Sciences Department offers an important area of specialization: Geospatial Data Science (formerly: GIS and Computer Cartography). The Bachelor of Science degree program in Geographical Sciences: Geospatial Data Science is designed to give students the technical skills needed to acquire, manage, and analyze large amounts of geographic data. Students will get computer training in digital processing of remote sensing observations and cartographic vector data, spatial analysis, and the display of information in Geospatial Information Science (GIS) software. The curriculum will provide students with the necessary background to use remote sensing and GIS in various fields such as environmental monitoring, disaster assessments, military analysis and intelligence, social justice, cartography, and other related fields. This track goes beyond the techniques for gathering and analyzing data and requires an understanding of the environmental and social processes represented by the data. These tools are essential to the education and future of global citizens.

The required courses for Geospatial Data Science Specialization are as follows:

Course	Title	Credits
College Requirements (https://academiccatalog.umd.edu/undergraduate/colleges-schools/behavioral-social-sciences/#collegerequirementstext)		
Required Courses		
GEOG201 & GEOG211	Geography of Environmental Systems and Geography of Environmental Systems Laboratory	4
GEOG202	Introduction to Human Geography	3
GEOG212	Career Planning for Geographical Sciences, GIS, and ENSP Majors	1
Select one upper-level physical geography course		3
Select one upper-level human geography course		3
Select three credits of upper-level geography electives		3
GEOG306	Introduction to Quantitative Methods for the Geographical Environmental Sciences	3
GEOG272	Introduction to Earth Observation Science	3
GEOG276	Principles of Python Programming and Geocomputing	3
GEOG373	Geographic Information Systems	3
Six credits from the following list:		6
GEOG416	Conceptualizing and Modeling Human-Environmental Interactions	
GEOG470	Algorithms for Geospatial Computing	
GEOG472	Remote Sensing: Digital Processing and Analysis	
GEOG473	Geographic Information Systems and Spatial Analysis	
GEOG475	Geographic Visualization and Digital Mapping	
GEOG476		
GEOG477		
Supporting Courses		
MATH120	Elementary Calculus I	3
Supporting courses approved by GEOG advisor [1]		12
Total Credits		**50**

[1] Supporting area courses must be taken from a list provided by the department. All math programs should be approved by a departmental advisor.

Computational Earth Observation Science Specialization

The Geographical Sciences Department offers an important area of specialization: Computational Earth Observation Science. The Bachelor of Science degree program Geographical Sciences: Computational Earth Observation Science allows students to explore the analytical capabilities offered by current Earth-observing satellite missions, including the different types of information collected by various satellites and how this information is analyzed to solve important environmental and societal problems. Students will learn the methods that are used to extract meaningful information from satellite images including mapping different land covers such as forests, cropland, or water, and monitoring environmental change over time. They will learn to apply statistical techniques, machine and deep learning algorithms to spatial data and will develop the necessary computer programming skills to handle big data analytics to support satellite image analysis. These technical skills will

be developed alongside the fundamental understanding of environmental processes and human society to tackle a variety of pressing global, regional, and local issues including sea and continental ice loss and ocean warming, forest management and loss, wildfire impacts and prevention, urban growth and its consequences, crop monitoring and food security, and environmental degradation and health outcomes, among others. These students will be the next generation of professionals that will support the integration of satellite monitoring into private and public operational and research agencies to support building a better and more sustainable world.

The required courses for Computational Earth Observation Science Concentration are as follows:

Course	Title	Credits
Required Courses		
GEOG201 & GEOG211	Geography of Environmental Systems and Geography of Environmental Systems Laboratory	4
GEOG202	Introduction to Human Geography	3
GEOG212	Career Planning for Geographical Sciences, GIS, and ENSP Majors	1
Select one upper-level physical geography course		
GEOG301	Advanced Geographical Environmental Systems	3
or GEOG340	Geomorphology	
or GEOG415	Land Use, Climate Change, and Sustainability	
or GEOG418	Field and Laboratory Techniques in Environmental Science	
or GEOG441	The Coastal Ocean	
or GEOG442	Biogeography and Environmental Change	
Select one upper-level human geography course		
GEOG330	As the World Turns: Society and Sustainability in a Time of Great Change [3]	3
or GEOG332	Economic Geography	
or GEOG333	The Social Geography of Metropolitan Areas in Global Perspective	
or GEOG335		
or GEOG413		
or GEOG431	Culture and Natural Resource Management	
or GEOG432	Spatial Econometrics	
Select three credits of upper-level geography electives		3
GEOG306	Introduction to Quantitative Methods for the Geographical Environmental Sciences	3
GEOG272	Introduction to Earth Observation Science	3
GEOG276	Principles of Python Programming and Geocomputing	3
Nine credits from the following list:		9
GEOG371	Programming for Image Analysis	
GEOG417	Land Cover Characterization Using Multi-Spectral Remotely Sensed Data Sets	
GEOG461	Machine Learning for Computational Earth Observation Science (CEOS)	
GEOG471	Technologies for Computational Earth Observations (Technologies for Computational Earth Obeservations)	
GEOG472	Remote Sensing: Digital Processing and Analysis	
Supporting Courses		
MATH120	Elementary Calculus I	3
Supporting courses approved by GEOG advisor [1]		12
Total Credits		**50**

[1] Supporting area courses must be taken from a list provided by the department. All math programs should be approved by a departmental advisor.

Geographical Science and Social Studies Education Double Major

In conjunction with the College of Education/Curriculum and Instruction, the Geographical Sciences Department offers a special 121 credit hour program for students wishing to double major in Geographical Sciences and Social Studies Education - Geography Concentration, allowing them to teach geography at the secondary level. Early examination of requirements is encouraged to reduce the number of additional hours required. In addition to the Geographical Sciences Department's required credits, the program requires 28 credit hours of course work in history and the social sciences. For a list of requirements, contact the Education Advising Office. Requirements are also listed under the Curriculum and Instruction Social Studies Education - Geography Concentration double major option.

Introduction to Geography

The 100-level geography courses are general education courses for persons who have had no previous contact with the discipline in high school or for persons planning to take only one course in geography. They provide general overviews of the field or in one of its major topics. Credit for these courses is not applied to the major.

GRADUATION PLANS

Click here (https://fellercenter.umd.edu/academic-advising/forms-policies/graduation-plans/) for roadmaps for graduation plans in the College of Behavioral and Social Sciences.

Additional information on developing a graduation plan can be found on the following pages:

- http://4yearplans.umd.edu
- the Student Academic Success-Degree Completion Policy (https://academiccatalog.umd.edu/undergraduate/registration-academic-requirements-regulations/academic-advising/#success) section of this catalog