Twin Cities Campus

Geography B.S.

Geography, Environment, Society

College of Liberal Arts

- Program Type: Baccalaureate
- Requirements for this program are current for Spring 2021
- Required credits to graduate with this degree: 120
- Required credits within the major: 44 to 59
- Degree: Bachelor of Science

From climate to culture, urban settings to rural land uses, human society to environment, the B.S. in Geography provides students with the tools to understand our world, its processes, and all of its inhabitants. The Geography B.S., with its emphasis on the application of scientific knowledge and critical thinking to a wide variety of contemporary geographic problems, is an exceedingly relevant degree. Students specialize in one of two areas, Environmental Geography or Geographic Information Science (GIS). In Environmental Geography students study natural environments and systems, both in themselves and as they relate to human beings, including weather and climate patterns, climate change, plant and animal distributions, forest fires, and natural resources such as water, wind, and forestland. GIS collects geographic information, creates spatial analytical methods, and uses cutting-edge technologies to advance our knowledge of natural and societal phenomena and processes across space and time. Environmental Geography and GIS are highly employable fields that offer opportunities to study some of the most urgent problems facing society today: How do humans affect the climate? Why are climate-change impacts not the same everywhere? What places are most prone to fire, flooding and other hazards, and why? In a city with many different people and many different needs, where is the best place to locate a new hospital or school? How should electoral boundaries be drawn to ensure fair representation? How can we ensure that everyone has access to the goods and services they need or reduce spatial disparities? A B.S. in Geography provides the fundamental knowledge and analytical skills to tackle these and many other fundamentally geographic questions.

The B.S. in Geography directly benefits from being a science field located in a liberal arts department. As noted by the U.S. National Academies, the liberal arts are of increasing importance in scientific and technical fields because they train students to think broadly and in an integrative way. Geography majors at the University of Minnesota report high rates of satisfaction with the major. The B.S. in Geography supports students in connecting the sciences and the liberal arts by including a broad palette of coursework in Geography such as urban geography, economic geography, and social-cultural geographies. The capstone experience, taken near the end of the student's studies, readies students to move forward by encouraging them to synthesize what they have learned.

A wide variety of career options are open to students with a B.S. in Geography. Local, regional, and federal agencies seek geographers for city and regional planning, natural resource management, transportation, and community development positions. Private industry consulting, environmental and marketing firms, the non-profit sector, and local, national, and transnational non-governmental organizations seek the geographic skills taught in the Geography B.S. Many Geography undergraduate majors obtain careers in education and many go on to graduate school.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Admission Requirements

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

Program Requirements

Some GEOG 5xxx-level courses are graduate-level courses and will require departmental consent.

A given course may only count towards one major requirement.

See major advisor for final approval of individual program.

At least 14 upper-division credits in the major must be taken at the University of Minnesota Twin Cities campus.

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Students may earn up to one undergraduate degree in the geography program: a BA, a BS, or a minor. Students in the Geography BS may also seek a major or minor in urban studies, or the minor in public health. Students who declare the Geographic Information Science sub-plan in the BS may not minor in Geographic Information Science.

All incoming CLA freshmen must complete the First-Year Experience course sequence.

All students must complete a capstone in at least one CLA major. The requirements for double majors completing the capstone in a different CLA major will be clearly stated. Students must also complete all major requirements in both majors to allow the additional capstone to be waived. Student completing an addition degree must complete the capstone in each degree area.

Ways of Knowing

The Ways of Knowing requirement provides a theory-intensive overview of the discipline. Students are encouraged to take 3-5 of their breadth courses and electives before taking their Ways of Knowing course.

Take exactly 1 course(s) totaling 3 - 4 credit(s) from the following:

- GEOG 4001 - Modes of Geographic Inquiry (3.0 cr)
- GEOG 4002W - Environmental Thought and Practice [WI] (3.0 cr)

Capstone

The Capstone may include data collection, reading, reflection, collaboration, and interpretation, and ends with writing a document. As the culmination of undergraduate training, each project develops from an interest or specialization deriving from previous courses. Students who double major and choose to complete the capstone requirement in their other major may waive the geography BS capstone, and they do not need to replace the 2 credits.

Take exactly 1 course(s) totaling 2 - 4 credit(s) from the following:

Option 1: Seminar

Note: this option is not available every semester.

- GEOG 3985W *{Inactive}*[WI] (4.0 cr)

or GEOG 3985V *{Inactive}*[WI] (4.0 cr)

- **Option 2: Directed Research**

Note: this option requires instructor consent prior to the first day of classes.

- GEOG 3996 *{Inactive}*(3.0 - 4.0 cr)

- **Option 3: Supplemental Project**

Note: this option requires instructor consent prior to the first day of classes and concurrent registration in a breadth or elective course.

- GEOG 3997 *{Inactive}*(2.0 cr)

Upper Division Writing Intensive within the major

Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.

Take 0 - 1 course(s) from the following:

- GEOG 3371W - Cities, Citizens, and Communities [DSJ, WI] (3.0 cr)
- GEOG 3374W - The City in Film [AH, WI] (4.0 cr)
- GEOG 3381W - Population in an Interacting World [SOCS, GP, WI] (3.0 cr)
- GEOG 3411W - Geography of Health and Health Care [WI] (3.0 cr)
- GEOG 4002W - Environmental Thought and Practice [WI] (3.0 cr)
- URBS 3955W - Senior Paper Seminar [WI] (2.0 cr)
- GEOG 3361W *{Inactive}*[WI] (3.0 cr)

or BSE 3361W *{Inactive}*[WI] (3.0 cr)

- GEOG 3985W *{Inactive}*[WI] (4.0 cr)

or GEOG 3985V *{Inactive}*[WI] (4.0 cr)

Program Sub-plans

Students are required to complete one of the following sub-plans.

Environmental Geography

Breadth Requirement

Students may count two 1xxx courses toward the breadth requirement.

Take 4 or more course(s) totaling 12 or more credit(s) from the following:

Human Geography

Take exactly 1 course(s) totaling 3 or more credit(s) from the following:

- GEOG 1301W - Our Globalizing World [SOCS, GP, WI] (3.0 cr)
- GEOG 3101 *{Inactive}*[SOCS, TS] (4.0 cr)
- GEOG 3371W - Cities, Citizens, and Communities [DSJ, WI] (3.0 cr)

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- GEOG 3373 - Changing Form of the City [HIS, GP] (3.0 cr)
- GEOG 3379 - Environment and Development in the Third World [SOCS, ENV] (3.0 cr)
- GEOG 3381W - Population in an Interacting World [SOCS, GP, WI] (3.0 cr)
- GEOG 1973 - Geography of the Twin Cities [SOCS] (3.0 cr)
  or GEOG 3973 - Geography of the Twin Cities [SOCS] (3.0 cr)
- GEOG 3331 - Geography of the World Economy [SOCS, GP] (3.0 cr)
  or GLOS 3231 - Geography of the World Economy [SOCS, GP] (3.0 cr)
- GEOG 3361W *{Inactive}*[WI] (3.0 cr)
  or BSE 3361W *{Inactive}*[WI] (3.0 cr)

•Environmental Geography

Take exactly 1 course(s) totaling 3 or more credit(s) from the following:

- GEOG 3401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
- GEOG 3423 - Urban Climatology (3.0 cr)
- GEOG 1403 - Biogeography of the Global Garden [BIOL, ENV] (4.0 cr)
  or GEOG 1403H - Honors: Biogeography of the Global Garden [BIOL, ENV] (4.0 cr)
- GEOG 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
  or ESPM 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
- GEOG 3431 - Plant and Animal Geography (3.0 cr)
  or GEOG 5431 *{Inactive}*(3.0 cr)
- GEOG 3839 - Introduction to Dendrochronology (4.0 cr)
  or GEOG 5839 - Introduction to Dendrochronology (4.0 cr)

•Geographic Information Science

Take exactly 2 course(s) totaling 6 or more credit(s) from the following:

- GEOG 1502 - Mapping Our World [TS, SOCS] (3.0 cr)
- GEOG 3511 - Principles of Cartography (4.0 cr)
- GEOG 5563 - Advanced Geographic Information Science (3.0 cr)
- GEOG 5564 - Urban Geographic Information Science and Analysis (3.0 cr)
- GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
  or GEOG 5531 - Numerical Spatial Analysis (4.0 cr)
- GEOG 3541 - Principles of Geocomputing (3.0 cr)
  or GEOG 5541 - Principles of Geocomputing (3.0 cr)
- GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
  or GEOG 5561 - Principles of Geographic Information Science (4.0 cr)

Supporting Courses

Take exactly 4 course(s) totaling 12 or more credit(s) from the following:

Mathematics

Take 0 - 3 course(s) from the following:

- MATH 1151 - Precalculus II [MATH] (3.0 cr)
  or MATH 1155 *{Inactive}*[MATH] (5.0 cr)
- MATH 1142 - Short Calculus [MATH] (4.0 cr)
  or MATH 1271 - Calculus I [MATH] (4.0 cr)
  or MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
  or MATH 1571H - Honors Calculus I [MATH] (4.0 cr)
- MATH 1272 - Calculus II (4.0 cr)
  or MATH 1372 - CSE Calculus II (4.0 cr)
  or MATH 1572H - Honors Calculus II (4.0 cr)
- MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
  or MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
  or MATH 2574H - Honors Calculus IV (4.0 cr)

•Basic Statistics

Take 0 - 1 course(s) from the following:

- EPSY 3264 - Basic and Applied Statistics [MATH] (3.0 cr)
- ESPM 3012 - Statistical Methods for Environmental Scientists and Managers [MATH] (4.0 cr)
- STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
- STAT 3021 - Introduction to Probability and Statistics (3.0 cr)
- BIOL 3272 - Applied Biostatistics (4.0 cr)
  or BIOL 3272H - Applied Biostatistics (4.0 cr)
- GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
  or GEOG 5531 - Numerical Spatial Analysis (4.0 cr)
- SOC 3811 - Social Statistics [MATH] (4.0 cr)
  or SOC 5811 - Social Statistics for Graduate Students (4.0 cr)

•Intermediate & Advanced Statistics

Take 0 - 3 course(s) from the following:

- STAT 3022 - Data Analysis (4.0 cr)
- STAT 4101 - Theory of Statistics I (4.0 cr)
- STAT 4102 - Theory of Statistics II (4.0 cr)

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•STAT 5201 - Sampling Methodology in Finite Populations (3.0 cr)
•STAT 5302 - Applied Regression Analysis (4.0 cr)
•STAT 5421 - Analysis of Categorical Data (3.0 cr)

•Programming & Logic

Take 0 - 3 course(s) from the following:
•PHIL 1001 - Introduction to Logic [MATH] (4.0 cr)
•CSCI 1103 - Introduction to Computer Programming in Java (4.0 cr)
or CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
or CSCI 1133 - Introduction to Computing and Programming Concepts (4.0 cr)
or CSCI 1133H - Honors Introduction to Computing and Programming Concepts (4.0 cr)
•CSCI 1913 - Introduction to Algorithms, Data Structures, and Program Development (4.0 cr)
or CSCI 1933 - Introduction to Algorithms and Data Structures (4.0 cr)
or CSCI 1933H - Honors Introduction to Algorithms and Data Structures (4.0 cr)
•GEOG 3541 - Principles of Geocomputing (3.0 cr)
or GEOG 5541 - Principles of Geocomputing (3.0 cr)

•Remote Sensing, GPS, and GIS Applications

Take 0 - 3 course(s) from the following:
•CSCI 5715 - From GPS, Google Maps, and Uber to Spatial Data Science (3.0 cr)
•ESPM 3031 - Applied Global Positioning Systems for Geographic Information Systems (3.0 cr)
•ESPM 4295W - GIS in Environmental Science and Management [WI] (4.0 cr)
•FNRM 3262 - Remote Sensing and Geospatial Analysis of Natural Resources and Environment (3.0 cr)
•FNRM 3362 - Drones: Data, Analysis, and Operations (3.0 cr)
•FNRM 3462 - Advanced Remote Sensing and Geospatial Analysis (3.0 cr)

•Physical Sciences

Take 0 - 3 course(s) from the following:
•CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
•CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr)
CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
•CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
•CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr)
CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)
•PHYS 1221 - Introductory Physics for Life Science Majors I [PHYS] (4.0 cr)
or PHYS 1101W - Introductory College Physics I [PHYS, WI] (4.0 cr)
or PHYS 1201W *{Inactive}*[PHYS, WI] (5.0 cr)
or PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
or PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
•PHYS 1222 - Introductory Physics for Life Science Majors II [PHYS] (4.0 cr)
or PHYS 1202W *{Inactive}*[PHYS, WI] (5.0 cr)
or PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
or PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)

•Earth Sciences

Take 0 - 3 course(s) from the following:
•ESCI 2201 - Solid Earth Dynamics (4.0 cr)
•ESCI 2202 - Earth History (4.0 cr)
•ESCI 2203 - Earth Surface Dynamics (4.0 cr)
•ESCI 2301 - Mineralogy (3.0 cr)
•GEOG 3401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
•GEOG 3423 - Urban Climatology (3.0 cr)
•SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)
•ESCI 1001 - Earth and Its Environments [PHYS, ENV] (4.0 cr)
or ESCI 1101 - Introduction to Geology (lecture only) [ENV] (3.0 cr)
•ESCI 1006 - Oceanography [PHYS, ENV] (4.0 cr)
or ESCI 1106 - Oceanography [ENV] (3.0 cr)
•ESCI 3002 - Climate Change and Human History [ENV] (3.0 cr)
or ESCI 5102 - Climate Change and Human History (3.0 cr)
•ESCI 3402 - Science and Politics of Global Warming [ENV] (3.0 cr)
or ESCI 5402 - Science and Politics of Global Warming (3.0 cr)
•GEOG 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
or ESPM 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)

•Biological & Environmental Sciences

Take 0 - 3 course(s) from the following:
•ANTH 1001 - Human Evolution [BIOL] (4.0 cr)
•EEB 4068 - Plant Physiological Ecology (3.0 cr)
•EEB 4611 - Biogeochemical Processes (3.0 cr)

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•FNRM 3203 - Forest Fire and Disturbance Ecology (3.0 cr)
•GEOG 1403 - Biogeography of the Global Garden [BIOL, ENV] (4.0 cr)
•GEOG 3423 - Urban Climatology (3.0 cr)
•PMB 2022 - General Botany (3.0 cr)
•BIOL 1001 - Introductory Biology: Evolutionary and Ecological Perspectives [BIOL] (4.0 cr)
or BIOL 1001H - Introductory Biology I: Evolutionary and Ecological Perspectives [BIOL] (4.0 cr)
•BIOL 1009 - General Biology [BIOL] (4.0 cr)
or BIOL 1009H - Honors: General Biology [BIOL] (4.0 cr)
•EEB 3407 - Ecology (3.0 cr)
or EEB 3807 - Ecology (4.0 cr)
or EEB 5407 - Ecology (3.0 cr)

Electives

Students should work with the departmental advisor to develop a coherent set of electives that meet specific educational goals.
Take exactly 5 course(s) totaling 15 or more credit(s) from the following:

Environmental Geography & Geographic Information Sciences Electives

Students may petition to take additional courses under the GIS designator for major credit when prerequisites have been met.
Take 3 - 5 course(s) totaling 9 or more credit(s) from the following:

Environmental Geography Electives

Take 0 - 5 course(s) from the following:
•GEOG 3401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
•GEOG 3423 - Urban Climatology (3.0 cr)
•GEOG 5426 - Climatic Variations (3.0 cr)
•URBS 3751 - Understanding the Urban Environment [ENV] (3.0 cr)
•GEOG 3431 - Plant and Animal Geography (3.0 cr)
or GEOG 5431 *{Inactive}*(3.0 cr)
•GEOG 3839 - Introduction to Dendrochronology (4.0 cr)
or GEOG 5839 - Introduction to Dendrochronology (4.0 cr)

•**Geographic Information Sciences Electives**

Take 0 - 5 course(s) from the following:
•GEOG 3511 - Principles of Cartography (4.0 cr)
•GEOG 5563 - Advanced Geographic Information Science (3.0 cr)
•GEOG 5564 - Urban Geographic Information Science and Analysis (3.0 cr)
•GIS 5555 - Basic Spatial Analysis (3.0 cr)
•GIS 5571 - ArcGIS I (3.0 cr)
•GIS 5574 - Web GIS and Services (3.0 cr)
•GIS 5578 - GIS Programming (3.0 cr)
•GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
or GEOG 5531 - Numerical Spatial Analysis (4.0 cr)
•GEOG 3541 - Principles of Geocomputing (3.0 cr)
or GEOG 5541 - Principles of Geocomputing (3.0 cr)
•GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
or GEOG 5561 - Principles of Geographic Information Science (4.0 cr)

•**Additional Geography Electives**

Take 0 - 2 course(s) totaling at most 8 credit(s) from the following:
•GEOG 3101 *{Inactive}*[SOCS, TS] (4.0 cr)
•GEOG 3111 - Geography of Minnesota (3.0 cr)
•GEOG 3161 - Europe: A Geographic Perspective [GP] (3.0 cr)
•GEOG 3211 *{Inactive}*(3.0 cr)
•GEOG 3371W - Cities, Citizens, and Communities [DSJ, WI] (3.0 cr)
•GEOG 3373 - Changing Form of the City [HIS, GP] (3.0 cr)
•GEOG 3376 - Political Ecology [ENV] (3.0 cr)
•GEOG 3377 - Music in the City [DSJ, AH] (3.0 cr)
•GEOG 3379 - Environment and Development in the Third World [SOCS, ENV] (3.0 cr)
•GEOG 3381W - Population in an Interacting World [SOCS, GP, WI] (3.0 cr)
•GEOG 3388 - Going Places: Geographies of Travel and Tourism [CIV] (3.0 cr)
•GEOG 3411W - Geography of Health and Health Care [WI] (3.0 cr)
•GEOG 3605 - Geographic Perspectives on Planning (3.0 cr)
•GEOG 3896 *{Inactive}*(1.0 - 4.0 cr)
•GEOG 3900 - Topics in Geography (3.0 cr)
•GEOG 3973 - Geography of the Twin Cities [SOCS] (3.0 cr)
•GEOG 4001 - Modes of Geographic Inquiry (3.0 cr)
•GEOG 4002W - Environmental Thought and Practice [WI] (3.0 cr)
•GEOG 3362 *{Inactive}*(3.0 cr)
•GEOG 5393 *{Inactive}*(4.0 cr)
•URBS 3771 - Fundamentals of Transit (3.0 cr)
•URBS 3861 - Financing Cities (3.0 cr)

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•URBS 3871 - A Suburban World (3.0 cr)
•GEOG 3145 - The Islamic World [SOCS, GP] (3.0 cr)
or RELS 3711 - The Islamic World [SOCS, GP] (3.0 cr)
•GEOG 3331 - Geography of the World Economy [SOCS, GP] (3.0 cr)
or GLOS 3231 - Geography of the World Economy [SOCS, GP] (3.0 cr)
•GEOG 3361W *{Inactive}*[WI] (3.0 cr)
or BSE 3361W *{Inactive}*[WI] (3.0 cr)
•GEOG 3374W - The City in Film [AH, WI] (4.0 cr)
or GEOG 5374 *{Inactive}*(4.0 cr)

Geographic Information Science

Breadth Requirement

Students may count two 1xxx courses toward the breadth requirement.
Take 4 or more course(s) totaling 12 or more credit(s) from the following:

Human Geography

Take exactly 1 course(s) totaling 3 or more credit(s) from the following:
•GEOG 1301W - Our Globalizing World [SOCS, GP, WI] (3.0 cr)
•GEOG 3101 *{Inactive}*[SOCS, TS] (4.0 cr)
•GEOG 3371W - Cities, Citizens, and Communities [DSJ, WI] (3.0 cr)
•GEOG 3373 - Changing Form of the City [HIS, GP] (3.0 cr)
•GEOG 3379 - Environment and Development in the Third World [SOCS, ENV] (3.0 cr)
•GEOG 3381W - Population in an Interacting World [SOCS, GP, WI] (3.0 cr)
•GEOG 1973 - Geography of the Twin Cities [SOCS] (3.0 cr)
or GEOG 3973 - Geography of the Twin Cities [SOCS] (3.0 cr)
•GEOG 3331 - Geography of the World Economy [SOCS, GP] (3.0 cr)
or GLOS 3231 - Geography of the World Economy [SOCS, GP] (3.0 cr)
•GEOG 3361W *{Inactive}*[WI] (3.0 cr)
or BSE 3361W *{Inactive}*[WI] (3.0 cr)

•Environmental Geography

Take exactly 1 course(s) totaling 3 or more credit(s) from the following:
•GEOG 3401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
•GEOG 3423 - Urban Climatology (3.0 cr)
•GEOG 1403 - Biogeography of the Global Garden [BIOL, ENV] (4.0 cr)
or GEOG 1403H - Honors: Biogeography of the Global Garden [BIOL, ENV] (4.0 cr)
•GEOG 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
or ESPM 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
•GEOG 3431 - Plant and Animal Geography (3.0 cr)
or GEOG 5431 *{Inactive}*(3.0 cr)
•GEOG 3839 - Introduction to Dendrochronology (4.0 cr)
or GEOG 5839 - Introduction to Dendrochronology (4.0 cr)

•Geographic Information Science

Take exactly 2 course(s) totaling 7 - 8 credit(s) from the following:
•GEOG 3511 - Principles of Cartography (4.0 cr)
•GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
or GEOG 5531 - Numerical Spatial Analysis (4.0 cr)
•GEOG 3541 - Principles of Geocomputing (3.0 cr)
or GEOG 5541 - Principles of Geocomputing (3.0 cr)
•GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
or GEOG 5561 - Principles of Geographic Information Science (4.0 cr)

Supporting Courses

Take exactly 4 course(s) totaling 12 or more credit(s) from the following:

Mathematics

Take 0 - 3 course(s) from the following:
•MATH 1151 - Precalculus II [MATH] (3.0 cr)
or MATH 1155 *{Inactive}*[MATH] (5.0 cr)
•MATH 1142 - Short Calculus [MATH] (4.0 cr)
or MATH 1271 - Calculus I [MATH] (4.0 cr)
or MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
or MATH 1571H - Honors Calculus I [MATH] (4.0 cr)
•MATH 1272 - Calculus II (4.0 cr)
or MATH 1372 - CSE Calculus II (4.0 cr)
or MATH 1572H - Honors Calculus II (4.0 cr)
•MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
or MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
or MATH 2574H - Honors Calculus IV (4.0 cr)

•Basic Statistics

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Take 0 - 1 course(s) from the following:
- EPSY 3264 - Basic and Applied Statistics [MATH] (3.0 cr)
- ESPM 3012 - Statistical Methods for Environmental Scientists and Managers [MATH] (4.0 cr)
- STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
- STAT 3021 - Introduction to Probability and Statistics (3.0 cr)
- BIOL 3272 - Applied Biostatistics (4.0 cr)
  or BIOL 3272H - Applied Biostatistics (4.0 cr)
- GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
  or GEOG 5531 - Numerical Spatial Analysis (4.0 cr)
- SOC 3811 - Social Statistics [MATH] (4.0 cr)
  or SOC 5811 - Social Statistics for Graduate Students (4.0 cr)

•Intermediate & Advanced Statistics

Take 0 - 3 course(s) from the following:
- STAT 3022 - Data Analysis (4.0 cr)
- STAT 4101 - Theory of Statistics I (4.0 cr)
- STAT 4102 - Theory of Statistics II (4.0 cr)
- STAT 5201 - Sampling Methodology in Finite Populations (3.0 cr)
- STAT 5302 - Applied Regression Analysis (4.0 cr)
- STAT 5421 - Analysis of Categorical Data (3.0 cr)

•Programming & Logic

Take 0 - 3 course(s) from the following:
- PHIL 1001 - Introduction to Logic [MATH] (4.0 cr)
- CSCI 1103 - Introduction to Computer Programming in Java (4.0 cr)
  or CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
  or CSCI 1133 - Introduction to Computing and Programming Concepts (4.0 cr)
  or CSCI 1133H - Honors Introduction to Computing and Programming Concepts (4.0 cr)
- CSCI 1913 - Introduction to Algorithms, Data Structures, and Program Development (4.0 cr)
  or CSCI 1933 - Introduction to Algorithms and Data Structures (4.0 cr)
  or CSCI 1933H - Honors Introduction to Algorithms and Data Structures (4.0 cr)
- GEOG 3541 - Principles of Geocomputing (3.0 cr)
  or GEOG 5541 - Principles of Geocomputing (3.0 cr)

•Remote Sensing, GPS, and GIS Applications

Take 0 - 3 course(s) from the following:
- CSCI 5715 - From GPS, Google Maps, and Uber to Spatial Data Science (3.0 cr)
- ESPM 3031 - Applied Global Positioning Systems for Geographic Information Systems (3.0 cr)
- ESPM 4295W - GIS in Environmental Science and Management [WI] (4.0 cr)
- FNRM 3262 - Remote Sensing and Geospatial Analysis of Natural Resources and Environment (3.0 cr)
- FNRM 3362 - Drones: Data, Analysis, and Operations (3.0 cr)
- FNRM 3462 - Advanced Remote Sensing and Geospatial Analysis (3.0 cr)

•Physical Sciences

Take 0 - 1 course(s) from the following:
- CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
  CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
- CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr)
  CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
- CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
  CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
- CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr)
  CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)
- PHYS 1221 - Introductory Physics for Life Science Majors I [PHYS] (4.0 cr)
  or PHYS 1101W - Introductory College Physics I [PHYS, WI] (4.0 cr)
  or PHYS 1201W *{Inactive}*[PHYS, WI] (5.0 cr)
  or PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
  or PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
- PHYS 1222 - Introductory Physics for Life Science Majors II [PHYS] (4.0 cr)
  or PHYS 1202W *{Inactive}*[PHYS, WI] (5.0 cr)
  or PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
  or PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)

•Earth Sciences

Take 0 - 1 course(s) from the following:
- ESCI 2201 - Solid Earth Dynamics (4.0 cr)
- ESCI 2202 - Earth History (4.0 cr)
- ESCI 2203 - Earth Surface Dynamics (4.0 cr)
- ESCI 2301 - Mineralogy (3.0 cr)
- GEOG 3401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
- GEOG 3423 - Urban Climatology (3.0 cr)

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- SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)
- ESCI 1001 - Earth and Its Environments [PHYS, ENV] (4.0 cr)
  or ESCI 1101 - Introduction to Geology (lecture only) [ENV] (3.0 cr)
- ESCI 1006 - Oceanography [PHYS, ENV] (4.0 cr)
  or ESCI 1106 - Oceanography [ENV] (3.0 cr)
- ESCI 3002 - Climate Change and Human History [ENV] (3.0 cr)
  or ESCI 5102 - Climate Change and Human History (3.0 cr)
- ESCI 3402 - Science and Politics of Global Warming [ENV] (3.0 cr)
  or ESCI 5402 - Science and Politics of Global Warming (3.0 cr)
- GEOG 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)
  or ESPM 1425 - Introduction to Weather and Climate [PHYS, ENV] (4.0 cr)

•Biological & Environmental Sciences

Take 0 - 1 course(s) from the following:

- ANTH 1001 - Human Evolution [BIOL] (4.0 cr)
- EEB 4068 - Plant Physiological Ecology (3.0 cr)
- EEB 4611 - Biogeochemical Processes (3.0 cr)
- FNRM 3203 - Forest Fire and Disturbance Ecology (3.0 cr)
- GEOG 1403 - Biogeography of the Global Garden [BIOL, ENV] (4.0 cr)
- GEOG 3423 - Urban Climatology (3.0 cr)
- PMB 2022 - General Botany (3.0 cr)
- BIOL 1001 - Introductory Biology: Evolutionary and Ecological Perspectives [BIOL] (4.0 cr)
  or BIOL 1001H - Introductory Biology I: Evolutionary and Ecological Perspectives [BIOL] (4.0 cr)
- BIOL 1009 - General Biology [BIOL] (4.0 cr)
  or BIOL 1009H - Honors: General Biology [BIOL] (4.0 cr)
- EEB 3407 - Ecology (3.0 cr)
  or EEB 3807 - Ecology (4.0 cr)
  or EEB 5407 - Ecology (3.0 cr)

Electives

Students should work with the departmental advisor to develop a coherent set of electives that meet specific educational goals.
Take exactly 5 course(s) totaling 15 or more credit(s) from the following:

Geographic Information Sciences Electives

Students may petition to take additional courses under the GIS designator for major credit when prerequisites have been met.
Take 3 or more course(s) totaling 9 or more credit(s) from the following:

- GEOG 3511 - Principles of Cartography (4.0 cr)
- GEOG 3531 - Numerical Spatial Analysis (4.0 cr)
- GEOG 3561 - Principles of Geographic Information Science (4.0 cr)
- GEOG 3541 - Principles of Geocomputing (3.0 cr)

•Advanced Geographic Information Sciences Electives

Take 1 or more course(s) totaling 3 or more credit(s) from the following:

- GEOG 5531 - Numerical Spatial Analysis (4.0 cr)
- GEOG 5541 - Principles of Geocomputing (3.0 cr)
- GEOG 5561 - Principles of Geographic Information Science (4.0 cr)
- GEOG 5563 - Advanced Geographic Information Science (3.0 cr)
- GEOG 5564 - Urban Geographic Information Science and Analysis (3.0 cr)
- GIS 5555 - Basic Spatial Analysis (3.0 cr)
- GIS 5571 - ArcGIS I (3.0 cr)
- GIS 5574 - Web GIS and Services (3.0 cr)
- GIS 5578 - GIS Programming (3.0 cr)

•Environmental Geography Electives

Take 0 - 2 course(s) totaling at most 8 credit(s) from the following:

- GEOG 3401W - Geography of Environmental Systems and Global Change [ENV, WI] (3.0 cr)
- GEOG 3423 - Urban Climatology (3.0 cr)
- GEOG 5426 - Climatic Variations (3.0 cr)
- URBS 3751 - Understanding the Urban Environment [ENV] (3.0 cr)
- GEOG 3431 - Plant and Animal Geography (3.0 cr)
  or GEOG 5431 *{Inactive}*(3.0 cr)
- GEOG 3839 - Introduction to Dendrochronology (4.0 cr)
  or GEOG 5839 - Introduction to Dendrochronology (4.0 cr)

•Additional Geography Electives

Take 0 - 2 course(s) totaling at most 8 credit(s) from the following:

- GEOG 3101 *{Inactive}*[SOCS, TS] (4.0 cr)
- GEOG 3111 - Geography of Minnesota (3.0 cr)
- GEOG 3161 - Europe: A Geographic Perspective [GP] (3.0 cr)
- GEOG 3211 *{Inactive}*(3.0 cr)
- GEOG 3371W - Cities, Citizens, and Communities [DSJ, WI] (3.0 cr)
- GEOG 3373 - Changing Form of the City [HIS, GP] (3.0 cr)

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•GEOG 3376 - Political Ecology [ENV] (3.0 cr)
•GEOG 3377 - Music in the City [DSJ, AH] (3.0 cr)
•GEOG 3379 - Environment and Development in the Third World [SOCS, ENV] (3.0 cr)
•GEOG 3381W - Population in an Interacting World [SOCS, GP, WI] (3.0 cr)
•GEOG 3388 - Going Places: Geographies of Travel and Tourism [CIV] (3.0 cr)
•GEOG 3411W - Geography of Health and Health Care [WI] (3.0 cr)
•GEOG 3605 - Geographic Perspectives on Planning (3.0 cr)
•GEOG 3896 *{Inactive}*(1.0 - 4.0 cr)
•GEOG 3900 - Topics in Geography (3.0 cr)
•GEOG 3973 - Geography of the Twin Cities [SOCS] (3.0 cr)
•GEOG 4001 - Modes of Geographic Inquiry (3.0 cr)
•GEOG 4002W - Environmental Thought and Practice [WI] (3.0 cr)
•GEOG 3362 *{Inactive}*(3.0 cr)
•GEOG 5393 *{Inactive}*(4.0 cr)
•URBS 3771 - Fundamentals of Transit (3.0 cr)
•URBS 3861 - Financing Cities (3.0 cr)
•URBS 3871 - A Suburban World (3.0 cr)
•GEOG 3145 - The Islamic World [SOCS, GP] (3.0 cr)
or RELS 3711 - The Islamic World [SOCS, GP] (3.0 cr)
•GEOG 3331 - Geography of the World Economy [SOCS, GP] (3.0 cr)
or GLOS 3231 - Geography of the World Economy [SOCS, GP] (3.0 cr)
•GEOG 3361W *{Inactive}*[WI] (3.0 cr)
or BSE 3361W *{Inactive}*[WI] (3.0 cr)
•GEOG 3374W - The City in Film [AH, WI] (4.0 cr)
or GEOG 5374 *{Inactive}*(4.0 cr)

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