

# CARTOGRAPHY AND GEOGRAPHIC INFORMATION SYSTEMS, BS

People often ask, “So you’re a cartographer? Hasn’t everything already been mapped?” No, cartographers are not explorers charting frontiers in an ancient time; we are artists, community organizers, data scientists, visual storytellers, and full-stack web developers. In an era of massive data sets and location-based apps, maps and geospatial data have never been more important, and the UW–Madison Cartography and GIS major covers the conceptual foundations and technical skills needed to harness maps and geospatial data to solve society’s most pressing problems. Courses range from graphic design and web mapping to big data analytics and mobile app development, with all courses having an important laboratory component to work with industry-standard cartography and GIS technology. So, yes, everywhere has been mapped in some form, but in a dynamic world driven by information and technology, cartographers and GIS scientists are needed more now than ever to help us understand our changing planet.

## HOW TO GET IN

### HOW TO GET IN

Exploring the field of geographic information science at UW–Madison is easy. Interested students are strongly encouraged to take introductory courses in the field. The Department of Geography offers four intro courses in geographic information science:

- GEOG 170 Our Digital Globe: An Overview of GIScience and its Technology;
- GEOG 370 Introduction to Cartography;
- GEOG/ENVR ST/F&W ECOL/G L E/GEOSCI/LAND ARC 371 Introduction to Environmental Remote Sensing; and
- GEOG/CIV ENGR/ENVR ST 377 An Introduction to Geographic Information Systems

Students who intend to declare their major as Cartography and Geographic Information Systems need to schedule an appointment with the geography undergraduate advisor.

## REQUIREMENTS

### UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as

needed. For additional information, see the university Undergraduate General Education Requirements (<http://guide.wisc.edu/undergraduate/#requirementsforundergraduatetext>) section of the *Guide*.

|                   |  |
|-------------------|--|
| General Education | <ul style="list-style-type: none"> <li>• Breadth–Humanities/Literature/Arts: 6 credits</li> <li>• Breadth–Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits</li> <li>• Breadth–Social Studies: 3 credits</li> <li>• Communication Part A &amp; Part B *</li> <li>• Ethnic Studies *</li> <li>• Quantitative Reasoning Part A &amp; Part B *</li> </ul> |
|-------------------|--|

\* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

### COLLEGE OF LETTERS & SCIENCE DEGREE REQUIREMENTS: BACHELOR OF SCIENCE (BS)

Students pursuing a Bachelor of Science degree in the College of Letters & Science must complete all of the requirements below. The College of Letters & Science allows this major to be paired with either the Bachelor of Arts or the Bachelor of Science degree requirements.

### BACHELOR OF SCIENCE DEGREE REQUIREMENTS

|   |   |
|---|---|
| Mathematics                               | Complete two courses of 3+ credits at the Intermediate or Advanced level in MATH, COMP SCI, or STAT subjects. A maximum of one course in each of COMP SCI and STAT subjects counts toward this requirement.   |
| Language                                  | Complete the third unit of a language other than English.   |
| L&S Breadth                               | Complete: <ul style="list-style-type: none"> <li>• 12 credits of Humanities, which must include at least 6 credits of Literature; and</li> <li>• 12 credits of Social Science; and</li> <li>• 12 credits of Natural Science, which must include 6 credits of Biological Science and 6 credits of Physical Science.</li> </ul> |
| Liberal Arts and Science Coursework       | Complete at least 108 credits.  |
| Depth of Intermediate/Advanced Coursework | Complete at least 60 credits at the Intermediate or Advanced level.   |
| Major                                     | Declare and complete at least one major.  |
| Total Credits                             | Complete at least 120 credits.  |
| UW–Madison Experience                     | Complete both: <ul style="list-style-type: none"> <li>• 30 credits in residence, overall, and</li> <li>• 30 credits in residence after the 86th credit.</li> </ul>  |

Quality of Work • 2.000 in all coursework at UW–Madison  
 • 2.000 in Intermediate/Advanced level coursework at UW–Madison

## NON-L&S STUDENTS PURSUING AN L&S MAJOR

Non-L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements. They do not need to complete the L&S Degree Requirements above.

## REQUIREMENTS FOR THE MAJOR BREADTH

3 courses, 1 each from these areas:

| Code  | Title   | Credits  |
|---|---|----------|
| <b>Human Geography (1 course)</b>                       |   | <b>3</b> |
| GEOG 101  | Introduction to Human Geography                               |          |
| GEOG 104  | Introduction to Human Geography                               |          |
| GEOG/ART HIST/<br>ENVIR ST/<br>HISTORY/<br>LAND ARC 239 | Making the American Landscape                                 |          |
| GEOG 300  | Weird Geographies   |          |
| GEOG 301  | Revolutions and Social Change                                 |          |
| GEOG 302  | Economic Geography: Locational Behavior                       |          |
| GEOG/<br>URB R PL 305                                   | Introduction to the City                                      |          |
| GEOG 307  | International Migration, Health, and Human Rights             |          |
| GEOG/CHICLA/<br>GEN&WS 308                              | Latinx Feminisms: Women's Lives, Work, and Activism           |          |
| GEOG/<br>INTL ST 311                                    | The Global Game: Soccer, Politics, and Identity               |          |
| GEOG/<br>INTL ST 315                                    | Universal Basic Income: The Politics Behind a Global Movement |          |
| GEOG 318  | Introduction to Geopolitics                                   |          |
| GEOG 340  | World Regions in Global Context                               |          |
| GEOG 342  | Geography of Wisconsin  |          |
| GEOG 355  | Africa, South of the Sahara                                   |          |
| GEOG 358  | Human Geography of Southeast Asia                             |          |
| GEOG/<br>AMER IND 410                                   | Critical Indigenous Ecological Knowledges                     |          |
| GEOG 501  | Space and Place: A Geography of Experience                    |          |
| GEOG/<br>URB R PL 503                                   | Researching the City: Qualitative Strategies                  |          |
| GEOG/<br>GEN&WS 504                                     | Feminist Geography: Theoretical Approaches                    |          |
| GEOG/<br>URB R PL 505                                   | Urban Spatial Patterns and Theories                           |          |
| GEOG 507  | Waste Geographies: Politics, People, and Infrastructures      |          |
| GEOG 510  | Economic Geography  |          |

|   |   |          |
|---|---|----------|
| GEOG 511  | Critical Social Theory  |          |
| GEOG/<br>GEN&WS 514                                     | Feminist Geography: Methodological Approaches                   |          |
| GEOG 518  | Power, Place, Identity  |          |
| GEOG 566  | History of Geographic Thought                                   |          |
| <b>People-Environment (1 course)</b>                    |   | <b>3</b> |
| GEOG/<br>ENVIR ST 139                                   | Global Environmental Issues                                     |          |
| GEOG/ART HIST/<br>ENVIR ST/<br>HISTORY/<br>LAND ARC 239 | Making the American Landscape                                   |          |
| GEOG/<br>ENVIR ST 309                                   | People, Land and Food: Comparative Study of Agriculture Systems |          |
| GEOG/<br>ATM OCN/<br>ENVIR ST 332                       | Global Warming: Science and Impacts                             |          |
| GEOG/<br>ENVIR ST 333                                   | Green Urbanism  |          |
| GEOG/<br>ENVIR ST 337                                   | Nature, Power and Society                                       |          |
| GEOG/<br>BOTANY 338                                     | Environmental Biogeography                                      |          |
| GEOG/<br>ENVIR ST 339                                   | Environmental Conservation                                      |          |
| GEOG 340  | World Regions in Global Context                                 |          |
| GEOG 344  | Changing Landscapes of the American West                        |          |
| GEOG/<br>AMER IND/<br>ENVIR ST 345                      | Caring for Nature in Native North America                       |          |
| GEOG 359  | Australia: Environment and Society                              |          |
| GEOG/<br>AMER IND 410                                   | Critical Indigenous Ecological Knowledges                       |          |
| GEOG/C&E SOC/<br>ENVIR ST 434                           | People, Wildlife and Landscapes                                 |          |
| GEOG/<br>ENVIR ST 439                                   | US Environmental Policy and Regulation                          |          |
| GEOG/ENVIR ST/<br>HISTORY 460                           | American Environmental History                                  |          |
| GEOG/<br>SOIL SCI 526                                   | Human Transformations of Earth Surface Processes                |          |
| GEOG/<br>ENVIR ST 534                                   | Environmental Governance: Markets, States and Nature            |          |
| GEOG/<br>ENVIR ST 537                                   | Culture and Environment   |          |
| GEOG 538  | The Humid Tropics: Ecology, Subsistence, and Development        |          |
| GEOG/<br>ENVIR ST 557                                   | Development and Environment in Southeast Asia                   |          |
| <b>Physical Geography (1 course)</b>                    |   | <b>3</b> |
| GEOG/<br>ENVIR ST 120                                   | Introduction to the Earth System                                |          |
| GEOG/<br>ENVIR ST 127                                   | Physical Systems of the Environment                             |          |

|  |  |          |
|--|--|----------|
| GEOG/<br>GEOSCI 320                          | Geomorphology  |          |
| GEOG/<br>ATM OCN/<br>ENVIR ST 322            | Polar Regions and Their Importance<br>in the Global Environment            |          |
| GEOG 329                                     |  |          |
| GEOG/<br>ATM OCN/<br>ENVIR ST 332            | Global Warming: Science and<br>Impacts                                     |          |
| GEOG/<br>ATM OCN/<br>ENVIR ST/<br>GEOSCI 335 | Climatic Environments of the Past  |          |
| GEOG/<br>BOTANY 338                          | Environmental Biogeography   |          |
| GEOG 342                                     | Geography of Wisconsin   |          |
| GEOG 344                                     | Changing Landscapes of the<br>American West                                |          |
| GEOG/<br>GEOSCI 420                          | Glacial and Pleistocene Geology  |          |
| GEOG 523                                     | Advanced Paleocology: Species<br>Responses to Past Environmental<br>Change |          |
| GEOG/<br>SOIL SCI 525                        | Soil Geomorphology   |          |
| GEOG/<br>SOIL SCI 526                        | Human Transformations of Earth<br>Surface Processes                        |          |
| <b>Total Credits</b>                         |  | <b>9</b> |

## SKILLS, TECHNIQUES & METHODOLOGY

| Code  | Title   | Credits    |
|---|---|------------|
| <b>Core Cartography/GIS</b>   |   |            |
| GEOG 370  | Introduction to Cartography                                   | 4          |
| GEOG/ENVIR ST/<br>F&W ECOL/<br>G L E/GEOSCI/<br>LAND ARC 371                      | Introduction to Environmental<br>Remote Sensing               | 3          |
| or GEOG 379   | Geospatial Technologies: Drones, Sensors, and<br>Applications |            |
| GEOG/CIV ENGR/<br>ENVIR ST 377  | An Introduction to Geographic<br>Information Systems          | 4          |
| GEOG 378  | Introduction to Geocomputing                                  | 4          |
| <b>Quantitative Methods (1 course)</b>  |   | <b>3-4</b> |
| GEOG 560  | Advanced Quantitative Methods                                 |            |
| STAT 301  | Introduction to Statistical Methods                           |            |
| STAT 324  | Introductory Applied Statistics for<br>Engineers              |            |
| STAT 371  | Introductory Applied Statistics for<br>the Life Sciences      |            |
| <b>Mathematics Proficiency</b>  |   | <b>6</b>   |
| <i>Complete one of the following by Placement or by<br/>completing the course</i> |   |            |
| MATH 112<br>& MATH 113  | Algebra<br>and Trigonometry                                   |            |

|                      |                          |              |
|----------------------|--------------------------|--------------|
| MATH 114             | Algebra and Trigonometry |              |
| <b>Total Credits</b> |                          | <b>24-25</b> |

## DEPTH

| Code  | Title   | Credits    |
|---|---|------------|
| <b>Two courses</b>                          |   |            |
| GEOG/ENVIR ST/<br>LAND ARC/<br>URB R PL 532 | Applications of Geographic<br>Information Systems in Planning |            |
| GEOG 572                                    | Graphic Design in Cartography                                 |            |
| GEOG 573                                    | Advanced Geocomputing and<br>Geospatial Big Data Analytics    |            |
| GEOG 574                                    | Geospatial Database Design and<br>Development                 |            |
| GEOG 575                                    | Interactive Cartography &<br>Geovisualization                 |            |
| GEOG 576                                    | Geospatial Web and Mobile<br>Programming                      |            |
| GEOG 578                                    | GIS Applications  |            |
| GEOG 579                                    | GIS and Spatial Analysis                                      |            |
| <b>Total Credits</b>                        |   | <b>7-8</b> |

## CAPSTONE

| Code                    | Title  | Credits    |
|-------------------------|--|------------|
| <b>Complete one of:</b> |  |            |
| GEOG 565                | Colloquium for Undergraduate<br>Majors           |            |
| GEOG 681<br>& GEOG 682  | Senior Honors Thesis<br>and Senior Honors Thesis |            |
| GEOG 691<br>& GEOG 692  | Senior Thesis<br>and Senior Thesis               |            |
| <b>Total Credits</b>    |  | <b>3-6</b> |

## RESIDENCE AND QUALITY OF WORK

- 2.000 GPA in GEOG and major courses
- 2.000 GPA on 15 upper-level credits, taken in residence<sup>2</sup>
- 15 credits in GEOG, taken on the UW–Madison campus

<sup>2</sup> GEOG courses designated Intermediate/Advanced are upper level in this major.

## HONORS IN THE MAJOR

Students may declare Honors in the Cartography and GIS Major in consultation with the Geography undergraduate advisor.

## HONORS IN THE CARTOGRAPHY AND GEOGRAPHIC INFORMATION SYSTEMS MAJOR REQUIREMENTS

To earn Honors in the Major in Cartography and Geographic Information Systems, students must satisfy both the requirements for the major (above) and the following additional requirements:

- Earn a 3.300 overall university GPA
- Earn a 3.300 GPA for all GEOG courses, and all courses accepted in the major
- Complete GEOG 578: GIS Applications with a grade of B or better
- Complete at least one advanced-level course OR 6 credits of honors credits in the major at the 300 level or above
- Complete a two-semester Senior Honors Thesis in GEOG 681 Senior Honors Thesis and GEOG 682 Senior Honors Thesis, a piece of original research composition, for a total of 6 credits.

## UNIVERSITY DEGREE REQUIREMENTS

**Total Degree** To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

**Residency** Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

**Quality of Work** Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.

## LEARNING OUTCOMES

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1. Apply cartographic design principles and visual storytelling to transform geospatial data into actionable insights.
2. Apply appropriate technologies and methods, including geographic information systems (GIS) and informed geodatabase design, to analyze qualitative and quantitative geospatial data.
3. Use appropriate geographic concepts, methods, and technologies to interpret the dynamic interactions among human and natural characteristics of place and space.
4. Combine geospatial theories, methodologies, and project management strategies to design and conduct ethical cartographic and geographic research and development.
5. Utilize appropriate GIS-based spatial decision tools to inform discussions of social, economic, and environmental issues that confront policymakers and citizens.
6. Discuss complex geospatial data, concepts, and technologies using written, oral, and visual forms of communication appropriate for technical, non-technical, and community-based audiences.

## FOUR-YEAR PLAN

### FOUR-YEAR PLAN

This Four-Year Plan is only one way a student may complete an L&S degree with this major. Many factors can affect student degree planning, including placement scores, credit for transferred courses, credits earned by examination, and individual scholarly interests. In addition, many students have commitments (e.g., athletics, honors, research, student organizations, study abroad, work and volunteer experiences) that necessitate they adjust their plans accordingly. Informed students engage in their own unique Wisconsin Experience by consulting their academic advisors, Guide, DARS, and Course Search & Enroll for assistance making and adjusting their plan.

#### First Year

| Fall               | Credits Spring       | Credits   |
|--------------------|----------------------|-----------|
| MATH 112           | 3 MATH 113           | 3         |
| Communication A    | 3 Ethnic Studies     | 4         |
| Foreign Language   | 4 Foreign Language   | 4         |
| Humanities Breadth | 3 Literature Breadth | 3         |
| Elective           | 2                    |           |
|                    | <b>15</b>            | <b>14</b> |

#### Second Year

| Fall               | Credits Spring                  | Credits   |
|--------------------|---------------------------------|-----------|
| STAT 301           | 3 GEOG/CIV ENGR/<br>ENVR ST 377 | 4         |
| GEOG 370           | 4 Communication B               | 4         |
| INTER-LS 210       | 1 Biological Science<br>Breadth | 3         |
| Literature Breadth | 3 Elective                      | 4         |
| Elective           | 4                               |           |
|                    | <b>15</b>                       | <b>15</b> |

#### Third Year

| Fall                             | Credits Spring                                 | Credits   |
|----------------------------------|--|-----------|
| GEOG 378                         | 4 500-level Cartography/<br>GIS Elective       | 4         |
| Major course: Human<br>Geography | 3-4 Biological Science<br>Breadth              | 3         |
| Electives                        | 9 Humanities Breadth                           | 3         |
|                                  | Major course: People-<br>Environment Geography | 3-4       |
|                                  | <b>16</b>                                      | <b>14</b> |

#### Fourth Year

| Fall  | Credits Spring                           | Credits   |
|---|--|-----------|
| GEOG/ENVR ST/<br>F&W ECOL/G L E/<br>GEOSCI/LAND ARC 371 | 3 500-level Cartography/<br>GIS Elective | 4         |
| Major course: Physical<br>Geography                     | 4 Electives                              | 12        |
| GEOG 565  | 3  |           |
| Electives   | 5  |           |
|   | <b>15</b>                                | <b>16</b> |

**Total Credits 120**

## ADVISING AND CAREERS

### ADVISING AND CAREERS

#### ADVISING

Students with questions about the major, courses, and careers are encouraged to contact the geography undergraduate advisor, Joel Gruley, at [jgruley@wisc.edu](mailto:jgruley@wisc.edu).

#### CAREERS

Cartography and GIS is a booming profession, but remains one of the biggest secrets on campus because of the limited treatment of geography in K-12 education. The Department of Labor reported that there were 425,000 U.S. residents working in the geospatial industry (<http://www.esri.com/news/arcnews/summer12articles/strengthening-the-gis-profession.html>) in 2010, and the National Research Council estimates this could exceed 2 million by 2020. Cartography and GIS recently was rated the #1 profession in engineering, in part due to its extremely low unemployment rate (less than 1% of students with degrees!), strong future growth of the job market, and relatively low stress rating. Our alumni work in local, national, and international government positions, as well as in private industry, including firms such as Apple, Google, Facebook, and Uber, and media outlets such as *National Geographic*, *The New York Times*, and *The Wall Street Journal*.

#### L&S CAREER RESOURCES

Every L&S major opens a world of possibilities. SuccessWorks (<https://successworks.wisc.edu/>) at the College of Letters & Science helps students turn the academic skills learned in their major, certificates, and other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.

Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (<https://careers.ls.wisc.edu/>)
- Set up a career advising appointment (<https://successworks.wisc.edu/make-an-appointment/>)
- Enroll in a Career Course (<https://successworks.wisc.edu/career-courses/>) - a great idea for first- and second-year students:
  - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
  - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (<https://successworks.wisc.edu/finding-a-job-or-internship/>)
  - INTER-LS 260 Internship in the Liberal Arts and Sciences
- Activate your Handshake account (<https://successworks.wisc.edu/handshake/>) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students' lives (<https://successworks.wisc.edu/about/mission/>)

## PEOPLE

### PEOPLE

#### GEOGRAPHY FACULTY AND STAFF

Faculty (<https://geography.wisc.edu/people/faculty/>)

Staff (<https://geography.wisc.edu/people/staff/#staff>)