

# CARTOGRAPHY AND GEOGRAPHIC INFORMATION SYSTEMS, B.S.

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

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 (online);
- GEOG 370 Introduction to Cartography;
- GEOG/ENVIR ST/F&W ECOL/G L E/GEOSCI/ LAND ARC 371 Introduction to Environmental Remote Sensing; and
- GEOG/CIV ENGR/ENVIR ST 377 An Introduction to Geographic Information Systems

Students who intend to declare their major as cartography and GIS 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/#requirementsforundergraduatestudyttext>) 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>
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\* 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 (B.S.)

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.

**Foreign Language** Complete the third unit of a foreign language.

**L&S Breadth** Complete:

- 12 credits of Humanities, which must include at least 6 credits of Literature; and
- 12 credits of Social Science; and
- 12 credits of Natural Science, which must include 6 credits of Biological Science and 6 credits of Physical Science.

**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:

- 30 credits in residence, overall, and
- 30 credits in residence after the 86th credit.

**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 301	Revolutions and Social Change	
GEOG 302	Economic Geography: Locational Behavior	
GEOG/ URB R PL 305	Introduction to the City	
GEOG 307	International Migration, Health, and Human Rights	
GEOG/CHICLA/ GEN&WS 308	Latinx Feminisms: Women's Lives, Work, and Activism	
GEOG/ INTL ST 311	The Global Game: Soccer, Politics, and Identity	
GEOG/ INTL ST 315	Universal Basic Income: The Politics Behind a Global Movement	
GEOG 318	Introduction to Geopolitics	
GEOG 300	Weird Geographies	
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/ AMER IND 410	Critical Indigenous Ecological Knowledges	
GEOG/ENVIR ST/ HISTORY 469	The Making of the American Landscape	
GEOG 501	Space and Place: A Geography of Experience	
GEOG/ URB R PL 503	Researching the City: Qualitative Strategies	
GEOG/ GEN&WS 504	Feminist Geography: Theoretical Approaches	
GEOG/ 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/ GEN&WS 514	Feminist Geography: Methodological Approaches	
GEOG 518	Power, Place, Identity	
GEOG 566	History of Geographic Thought	

## People-Environment (1 course)

3

GEOG/ ENVIR ST 139	Global Environmental Issues	
GEOG/ ENVIR ST 309	People, Land and Food: Comparative Study of Agriculture Systems	
GEOG/ ATM OCN/ ENVIR ST 332	Global Warming: Science and Impacts	
GEOG/ ENVIR ST 333	Green Urbanism	
GEOG/ ENVIR ST 337	Nature, Power and Society	
GEOG/ BOTANY 338	Environmental Biogeography	
GEOG/ ENVIR ST 339	Environmental Conservation	
GEOG 340	World Regions in Global Context	
GEOG 344	Changing Landscapes of the American West	
GEOG/ AMER IND/ ENVIR ST 345	Managing Nature in Native North America	
GEOG 359	Australia: Environment and Society	
GEOG/ AMER IND 410	Critical Indigenous Ecological Knowledges	
GEOG/C&E SOC/ ENVIR ST 434	People, Wildlife and Landscapes	
GEOG/ ENVIR ST 439	US Environmental Policy and Regulation	
GEOG/ENVIR ST/ HISTORY 460	American Environmental History	
GEOG/ENVIR ST/ HISTORY 469	The Making of the American Landscape	
GEOG/ SOIL SCI 526	Human Transformations of Earth Surface Processes	
GEOG/ ENVIR ST 534	Environmental Governance: Markets, States and Nature	
GEOG/ ENVIR ST 537	Culture and Environment	
GEOG 538	The Humid Tropics: Ecology, Subsistence, and Development	
GEOG/ ENVIR ST 557	Development and Environment in Southeast Asia	
<b>Physical Geography (1 course)</b>		<b>3</b>
GEOG/ ENVIR ST 120	Introduction to the Earth System	
GEOG/ ENVIR ST 127	Physical Systems of the Environment	
GEOG/ GEOSCI 320	Geomorphology	
GEOG/ ATM OCN/ ENVIR ST 322	Polar Regions and Their Importance in the Global Environment	
GEOG 329	Landforms and Landscapes of North America	

GEOG/ ATM OCN/ ENVIR ST 332	Global Warming: Science and Impacts	
GEOG/ ATM OCN/ ENVIR ST/ GEOSCI 335	Climatic Environments of the Past	
GEOG/ BOTANY 338	Environmental Biogeography	
GEOG 342	Geography of Wisconsin	
GEOG 344	Changing Landscapes of the American West	
GEOG/ GEOSCI 420	Glacial and Pleistocene Geology	
GEOG 523	Advanced Paleocology: Species Responses to Past Environmental Change	
GEOG/ SOIL SCI 525	Soil Geomorphology	
GEOG/ SOIL SCI 526	Human Transformations of Earth Surface Processes	
GEOG/ ATM OCN/ ENVIR ST 528	Past Climates and Climatic Change	
<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/ F&W ECOL/ G L E/GEOSCI/ LAND ARC 371 or GEOG 379	Introduction to Environmental Remote Sensing	3
GEOG/CIV ENGR/ ENVIR ST 377	Geospatial Technologies: Drones, Sensors, and Applications	4
GEOG 378	An Introduction to Geographic Information Systems	4
<b>Quantitative Methods (1 course)</b>		<b>3-4</b>
GEOG 560	Introduction to Geocomputing	4
GEOG 560	Advanced Quantitative Methods	
STAT 301	Introduction to Statistical Methods	
STAT 324	Introductory Applied Statistics for Engineers	
STAT 371	Introductory Applied Statistics for the Life Sciences	
<b>Mathematics Proficiency</b>		<b>6</b>
<i>Complete one of the following by Placement or by completing the course</i>		
MATH 112 & MATH 113	Algebra and Trigonometry	
MATH 114	Algebra and Trigonometry	
<b>Total Credits</b>		<b>24-25</b>

## DEPTH

Code	Title	Credits
<b>Two courses</b>		
<b>7-8</b>		
GEOG/ENVIR ST/ LAND ARC/ URB R PL 532	Applications of Geographic Information Systems in Planning	
GEOG 572	Graphic Design in Cartography	
GEOG 573	Advanced Geocomputing and Geospatial Big Data Analytics	
GEOG 574	Geospatial Database Design and Development	
GEOG 575	Interactive Cartography & Geovisualization	
GEOG 576	Geospatial Web and Mobile 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>		
<b>3-6</b>		
GEOG 565	Colloquium for Undergraduate Majors	
GEOG 681 & GEOG 682	Senior Honors Thesis and Senior Honors Thesis	
GEOG 691 & GEOG 692	Senior Thesis 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

2

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 GIS, 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.

Elective	2		
	<b>15</b>		<b>14</b>

### Second Year

Fall	Credits	Spring	Credits
STAT 301		3 GEOG/CIV ENGR/ ENVR ST 377	4
GEOG 370		4 Communication B	4
INTER-LS 210		1 Biological Science 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/ GIS Elective	4
Major course: Human Geography		3-4 Biological Science Breadth	3
Electives		9 Humanities Breadth	3
		Major course: People- Environment Geography	3-4
	<b>16</b>		<b>14</b>

### Fourth Year

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

**Total Credits 120**

## LEARNING OUTCOMES

1. Broad spectrum of geographical knowledge and skills, as well as a degree of expertise in a specific sub-field of the discipline (Human, People-Environment, Physical, Cart/GIS).
2. Skills in developing and implementing research plans.
3. Critical reasoning and analytical skills.
4. Communication skills - both written and oral.

## FOUR-YEAR PLAN

### SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

#### 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

## 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 US residents working in the geospatial industry (<http://www.esri.com/news/arcnews/summer12/articles/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

Professors Burt, Cadwallader, Cronon, Downey, Kaiser, Knox, Mason, Naughton, Olds, Ostergren, Turner, Williams, Zhu

Associate Professors Alatout, Dennis

Assistant Professors Baird, Gibbs, Marin-Spiotta, Ozdogan, Robertson, Roth, Schneider, Woodward, Young