

Introduction to GIS

NRC 585 & GEOGRAPH 585 & SPP 585 & DACSS 585 (4 credits)

Instructor/Syllabus Author**Forrest J. Bowlick**

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Schedule at will:

Meetme.so/UMassGIS (Zoom)

** If no time in the scheduler works for you,
please email for other availability! **

Teaching Assistants**Ollie Murphy**

Sections: All

Email: olimurphy@umass.eduOffice Hours: In person and Zoom: Mondays,
1100a to 100p, Holdsworth 302Zoom: Sundays, 600p – 700p (use lab Zoom
link)**Deni Ranguelova**

Sections: All

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Office Hours: In person and Zoom:

Wednesdays, 1230p to 330p, Morrill IV
South 271 (use Lab Zoom link)

Course Description and Pedagogy

This class serves as an introduction to Geographic Information Science (GIS). GIS is the science of spatial relationships, linking data to locations to explore relations between objects. Based on principles of geography, spatial thinking, and computational thinking, GIS has evolved to be a universally applicable way of thinking, means of analysis, and set of tools.

GIS is also a broadly accessible way to deepen your understanding of interactions, relationships, and connections within and between items, ideas, or information. GIS is for everyone, and no matter your background knowledge or skills with geography, computers, or spatial thinking, GIS is a valuable way to think and do work in your domain and aligned with your interests.

Because of the broad utility of GIS, learners come from many different backgrounds to this course. Everyone has different expertise and comfort with the many parts of GIS. Yet the unifying nature of geospatial and geographic work allows us all to learn along these different axes at our own pace. I treat this course as a flexible environment where you can find time to engage with topics with the time and attention you need to learn them, while also learning

and seeing how others build and understand their GIS practice. In all cases, this serves to broaden our abilities to enjoy doing GIS, and to continue doing GIS after this course.

Through lab work and foundational discussions, this course covers the guiding principles behind various facets of GIS including the nature of spatial data, map projections, spatial analysis, and cartographic production. The goals of this course are to teach you foundational GIS concepts through practice and theory to enable you to make useful and meaningful contributions to various disciplines through spatial analysis. Throughout this course, you will be challenged to not only think spatially, but apply spatial analysis techniques within GIS.

Meeting Time and Locations

Lecture

Thursday 11:30a to 12:45p
ILC S140

Lecture Zoom: <https://umass-amherst.zoom.us/j/97493446063>

All sections meet physically in the same lecture section. You enrolled for a specific lab section when registering.

Labs

Thursday 2:30p to 5:30p
Friday 9:05a to 12:05p
Friday 1:25p to 4:25p
All labs meet in Morrill III 212

Lab Zoom: <https://umass-amherst.zoom.us/j/95363692408>

All Labs use the same Zoom link.

Learning Objectives

This GIS course is built to explore the foundations of GIS knowledge, skill, and practice. While organized similarly to professional practice standards from the Geospatial Technology Competency Model and the UCGIS Body of Knowledge, these objectives are also designed to foster significant learning in this course.

In general, it is my expectation that at the end of the class you will be able to:

- 1) Describe the structure, composition, and function of basic GIS data formats (raster and vector).
- 2) Identify the interactions between the geographic, computational, and domain factors which construct GIS data, and how these components operate within GIS practice.
- 3) Create cartographic and non-cartographic geospatial products answering questions or contributing to solution of problems.
- 4) Critically reflect on the nature of GIS data collection, analysis, and utility to conceptualize GIS work beyond 'buttonology'.
- 5) Begin practicing geospatial inquiry: seek external resources to help with troubleshooting; recall, practice and learn debugging techniques; build spatial and computational thinking; work towards self-directed learning.

- 6) Explore utilities, applications, and functions of GIS beyond topics introduced in class.

Class Moodle in the Cloud (Moonami)

There are extensive web-based materials associated with this class. Updates to the syllabus as well as other course materials will be made available on our Moodle. These materials will include lectures, participation components, resources, and other data necessary for you to succeed in this class. All assignments will be turned in via Moodle, as will all grades and assignment feedback.

GIS Software

This course will utilize the ArcGIS™ suite of software developed by ESRI, primarily ArcGIS Pro. This software is available to you free of charge, and our license allows you to install it on any Windows computer which meets the [minimum specifications](#). You can obtain access to download and install ArcGIS Pro by filling out the form at this link:

<https://www.geo.umass.edu/arcgis>.

ArcGIS Pro is also available on most computers on campus.

You may explore other technologies or systems for using GIS in class, but you are not responsible for purchasing any of them.

Required Materials

There is no required textbook.

You will need a means of data storage for this course. This could be a cloud storage system, like Google Drive or One Drive, both of which are provided with your student account. You may also use a USB storage drive for this class, provided it has at least 16 GB of storage and meets the writing/rewriting speeds necessary for GIS work. Such devices are readily found online or in most retailers for approximately \$15.00. In either case, you will practice good data management practices.

We will have the opportunity to present our final projects as a poster, or in a recorded form, at the end of this course. Poster presentations require printing – we can print on campus through various partners at the approximate cost of \$20.00, though other printers are acceptable. Recorded presentations require no cost.

If any of these costs are prohibitive for you completing this course in your preferred method, scholarship opportunities are available to defray these costs.

Additional Readings and Data Sources

The *UMass Libraries GIS Hub*, created by our wonderful GIS Librarian, Rebecca Seifried:

<https://gis.library.umass.edu/>

The *National Center for Geographic Information & Analysis (NCGIA) Core Curriculum in*

GIScience, a guide to key GIS topics: <http://www.ncgia.ucsb.edu/giscc/>

The *ESRI Virtual Campus*, a guide to all things ArcGIS: <http://campus.esri.com/>

The Geographers Craft web site developed by Peter Dana and Ken Foote:

<https://foote.geography.uconn.edu/gcraft/contents.html>

The *UCGIS Body of Knowledge*, a standardized guide to GIS knowledge areas:

<https://gistbok.ucgis.org/>

An excellent introductory GPS website is provided by *Trimble Navigation*:

<http://www.trimble.com/gps/>

Class Attendance

This course is a 'Flex' course as defined by university administration. The ongoing COVID-19 pandemic has created a teaching and learning dynamic mired in uncertainty. There are still major instabilities present that will continue to disrupt our learning environment. Further, the assumption that all students (or instructors) will always be available to travel to campus with a physical presence is not supported by the reality of life. Therefore, synchronous opportunities for connecting during lecture and lab will always be offered, and attendance asynchronously is also appropriate. This means that during our scheduled lecture and lab times we will have activities, lessons, support, and 'class' both in person, recorded, and with synchronous online connection. In person (or virtual) live attendance will not be mandatory, and all activities, assignments, and so forth will have asynchronous options for completion and participation. Lab support will be similarly distributed throughout the week in different modes and ways of support.

Platforms and Policies

We will use Zoom and Echo360 for livestreaming and recording this semester. All class activities will be recorded for posting, review and future editing. In all digital platforms, inappropriate behavior, which could consist of text, audio, or video content, will not be tolerated, and will result in the closure of the course for the day, as well as referral to appropriate student services.

Electronic Devices

This class will use interactive methods to answer questions, complete participation assignments, and deliver course materials. Labs take place in a computer lab, though you are welcome to bring your own provided it can run our software. You may be asked to leave if you use computing resources inappropriately or in a way that distracts other learners.

Email Communications

The only means I can use to contact the entire course at once is through the course email list. This list connects to your @umass.edu email account – it is where you should expect to receive course message.

Students should likewise use their university-associated email accounts when emailing the instructor and teaching assistants. Emails from personal accounts (like @yahoo or @hotmail)

without proper forwarding information will be ignored. You will receive regular emails from the course listserv detailing course scheduling and important events.

It is your responsibility to check your email account regularly. **The only assumption I make about your course performance is that you read your email before coming to class.** Please remember that federal privacy law (FERPA) prohibits discussion of grades via email.

Grading

Your grade in this class will be based on performance from lab exercises, a practical exam, your final projects, and course participation.

Dates and times of examinations are listed on the class schedule at the end of the syllabus.

A. Lab Reports (Eight Total)	6% each, 48% total
B. Practical Exam	10%
C. Final Project	35%
1. Project Outline and Analytical Proposal	10%
2. Final Poster	15%
3. Final Exam	10%
D. Course Participation	7%

This course is out of 333 points, and course percentages represent the (rounded) point values each section corresponds to of that total. (One lab, 6%, is worth 20 points, for example).

Grading Schema	C: 76.9% to 73.0%
A: Above 93.0%	C-: 72.9% to 70.0%
A-: 92.9% to 90.0%	D+: 69.9% to 67.0%
B+: 89.9% to 87.0%	D: 66.9% to 60.0%
B: 86.9% to 83.0%	F: Below 60.0%
B-: 82.9% to 80.0%	
C+: 79.9% to 77.0%	

Late policy: This course is structured sequentially, not temporally. A recommended calendar of completion exists to provide you structure and planning support for course completion.

If you structure your life/semester better with hard deadlines, consider the calendar below as a hard deadline and ignore the next paragraph.

However, there are no late penalties in this course. The course will progress synchronously per the calendar at the end of the syllabus – if you need deadlines to keep you motivated, use those as a guide. It is my expectation that you will complete coursework in sequence, at a regular pace and rhythm, and not try to do it all in the last week of the semester. That will not turn out well for you.

Course incompletes will be handled on a case-by-case basis and will only be accepted with a clearly communicated plan for course completion.

Labs

Labs are an important and integral portion of the course. GIS requires both technical work and conceptual knowledge to function. Many of these labs will take longer than the three-hour session for which we are scheduled.

Expect to work on labs and your project outside of scheduled class time!

Please use and schedule your time for the labs accordingly. While TAs have office hours as well to assist you, these are not meant as personal, one on one tutoring time. Please use your time to your advantage.

In past years, failure to complete labs in a structured manner has been the primary cause for poor performance in this class. Please share any issues with lab completion with instructor before questions, issues, and struggles become problems.

Academic Dishonesty

The UMass Amherst Academic Regulations (p. 7) and Code of Student Conduct (p. 28) define plagiarism as: "Knowingly representing the words or ideas of another as one's own work in any academic exercise. This includes submitting without citation, in whole or in part, pre-written term papers of another or the research of another, including but not limited to commercial vendors who sell or distribute such materials."

The Writing Program has prepared a more-detailed explanation of plagiarism:

<http://www.umass.edu/writingprogram/geninfo/plagiarism.html>

The Code of Student Conduct (http://www.umass.edu/dean_students/codeofconduct/) states: "The integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research. Academic honesty is therefore required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Sanctions may be imposed on any student who has committed an act of academic dishonesty" (p. 28)."

The Code also outlines the process by which student rights are protected in academic honesty cases, which are handled through the Ombuds Office.

UMass' Academic Honesty Statement:

(<http://www.umass.edu/registrar/media/academicregs.pdf>):

"Intellectual honesty requires that students demonstrate their own learning during examinations and other academic exercises, and that other sources of information or knowledge be appropriately credited. Scholarship depends upon the reliability of information and reference in the work of others. Student work at the University may be analyzed for originality of content. Such analysis may be done electronically or by other means. Student work may also be included in a database for the purpose of checking for possible plagiarized content in future student submissions. No form of cheating, plagiarism, fabrication, or facilitating dishonesty will be condoned in the University community."

In short, I expect that in this course you will not lie, cheat or steal, or tolerate those that do.

Student Support

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities.

Disability Services • 161 Whitmore • 413-545-0892 • www.umass.edu/disability

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), Learning Disabilities Support Services (LDSS), or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me as soon as you are able so we can plan the best learning environment. For more information, consult the Disability Services website at <http://www.umass.edu/disability/>.

There are numerous other student support organizations on campus including:

Learning Resource Center • Library 10th floor • 413-545-5334 •
www.umass.edu/lrc

Offering peer-tutors trained to assist you in meeting academic challenges and achieving academic success.

Writing Center • Library Lower Level • 413-577-1293 •
www.umass.edu/writingcenter

Knowledgeable tutors are available to work with you on your writing. Tutors offer 45-minute consultations where they ask questions about the assignment, offer tips and advice.

Resource Librarians • Library Main Level • 413-545-0150 •
www.library.umass.edu/liaison

Subject-specialist librarians are available to help find the right sources, databases and strategies for your research needs.

University Ombuds Office • 823 Campus Center • 413-545-0867 •
www.umass.edu/ombuds

Resources and confidential advice related to the university's academic honesty policy and procedures.

Center for Counseling and Psychological Health • 127 Hills North • 413-545-2337 • <https://www.umass.edu/counseling/>

Provide short term individual, couple's and group psychotherapy; psychiatric medication consultation and treatment; psychological assessment (testing); behavioral medicine; and crisis intervention services.

Title IX Statement (Responsible Employee)

In accordance with Title IX of the Education Amendments of 1972 that prohibits gender-based discrimination in educational settings that receive federal funds, the University of Massachusetts Amherst is committed to providing a safe learning environment for all students, free from all forms of discrimination, including sexual assault, sexual harassment, domestic violence, dating violence, stalking, and retaliation. This includes interactions in person or online through digital platforms and social media. Title IX also protects against discrimination on the basis of pregnancy, childbirth, false pregnancy, miscarriage, abortion, or related conditions, including recovery. There are resources here on campus to support you. A summary of the available Title IX resources (confidential and non-confidential) can be found at the following link: <https://www.umass.edu/titleix/resources>. You do not need to make a formal report to access them. If you need immediate support, you are not alone. Free and confidential support is available 24/7/365 SASA Hotline 413-545-0800.

For purposes of Title IX reporting, I am considered a "responsible employee" at UMass (<https://www.umass.edu/titleix/about>). That means that if you tell me about a situation involving sexual assault, sexual harassment, domestic violence, dating violence, stalking, and retaliation, I must share that information with the Title IX Coordinator. Making a report to the Title IX Coordinator is my legal obligation, meets the University's goal of providing

members of our community with supportive resources they might need, and enables the University to obtain a more accurate picture of the extent of sexual violence in our community. It will be completely up to you to determine if and how you want to work with the Title IX Coordinator's office. You will not be in trouble for reporting to me that you have experienced any of these situations, and the law prohibits retaliation against anyone who participates in a Title IX process.

Sexual assault, abuse, and harassment survivor's bill of rights

<https://www.umass.edu/titleix/survivors-bill-of-rights>

Center for Women and Community <https://www.umass.edu/cwc/>

24/7 Sexual Assault Support and Advocacy Hotline (413) 545-0800

Please see the course schedule on the next page.

Course Schedule (subject to adjustment)

Date/Topic	Important Dates; Recommended Due Dates
Thursday 9/5 and Friday 9/6 LECTURE: Course overview, So, what is this GIS thing, anyway? LAB INTRO: GIS concepts LAB 1: Technical Foundations	N/A
Thursday 9/12 and Friday 9/13 LECTURE: Maps, mapping, mappers LAB INTRO: Cartographic design LAB 2: ArcGIS Foundations	
Thursday 9/19 and Friday 9/20 LECTURE: Data formats, querying, shapefile basics LAB INTRO: Thinking with data LAB 3: Joins, Relates, and Data Synthesis	Lab 1: Technical Foundations <u>due</u>. Upload assignment by the beginning of your lab period. Lab 2: ArcGIS Foundations <u>due</u>. Upload assignment by the beginning of your lab period.
Thursday 9/26 and Friday 9/27 LECTURE: Vector data analysis LAB INTRO: GIS data structures LAB 4: Vector Analysis	Lab 3: Joins, Relates, and Data Synthesis. Upload assignment by the beginning of your lab period.
Thursday 10/3 and Friday 10/4 LECTURE: Data creation and editing LAB INTRO: Finding yourself (spatially) Lab 5: GPS Scavenger Hunt	Lab 4: Vector Analysis <u>due</u>. Upload assignment by the beginning of your lab period.
Thursday 10/10 and Friday 10/11 LECTURE: Practical exam Q&A Lab Practical Exam	Time to complete your practical exam will be provided during lab this week. You will not be allowed to attempt the practical until you complete the first four labs of the semester.
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Date/Topic	Assignments Due

Thursday 10/17 and Friday 10/18 LECTURE: Projections Lab Intro: More projections	Lab 5: GPS Scavenger Hunt <u>due</u> . Upload assignment by the beginning of your lab period.
LAB 6: Projections	
Thursday 10/24 and Friday 10/25 LECTURE: Ways of thinking	N/A
Work Day	
Thursday 10/31 and Friday 11/1 LECTURE: Remote sensing and GIS	Lab 6: Projections <u>due</u> . Upload assignment by the beginning of your lab period.
LAB INTRO: More pixels LAB 7: Raster Analysis	
Thursday 11/7 and Tuesday 11/8 LECTURE: Data modeling, elections	N/A
Work Day	
Friday 11/14 and Tuesday 11/15 LECTURE: Geostatistics	Methods outline & study area map <u>due</u> . Upload methods outline by 11:59p, 11/15.
Lab 8: Geostatistics	
Thursday 11/21 and Friday 11/22 LECTURE: Computational thinking	Lab 7: Raster Analysis <u>due</u> . Upload lab assignment by the beginning of your lab period.
LAB INTRO: Poster layouts Work Day	
NO CLASS 11/28 and 11/29: Thanksgiving Recess	
Thursday 12/5 and Friday 12/6 LECTURE: GIS futures	N/A
Work Day	
Wednesday 12/11 (Reading Day) POSTER CONFERENCE TIME TBD LOCATION TBD	Lab 8: Geostatistics <u>due</u> . Upload assignment by 5pm on poster conference day. Don't forget to upload your final posters in PDF format to Canvas! Upload poster by Noon on poster conference day.

I reserve the right to make changes to the course schedule

Lab Reports

Lab data and tutorials will be available on our Canvas.

Each lab assignment is different. All labs require a map and/or answers to questions and/or description of methods. Please refer to the individual lab assignments for specific instructions.

Please upload labs to Canvas as PDF files. File formats other than pdfs can be corrupted or not contain necessary components for a grade.

You may work with others on the lab assignments; however, the product you hand in must be your own work. Duplicated/copied assignments will receive a 0. Chat GPT can't do GIS – think of it as future job security.

Practical Exam

The practical exams will test how well you can solve problems in GIS based on skills learned in the first four labs and in class, plus your general problem-solving capabilities.

Final Project

The final project is an independent research project visualizing and analyzing spatial data. With the support of ideas from faculty and community members across New England, you will be tasked with a GIS problem to solve or project to create, as well as finding GIS data needed to answer that question, and conducting a GIS analysis of those data. To formulate a research question, think back to other classes you've taken for inspiration, browse for ideas online, and talk to faculty and graduate students for ideas. If you wish, you may work with a partner on the final project provided there is a clear division of labor based on consultation with me. Everyone will be individually responsible for their own methodological outline and final poster.

You will have four lab periods to work on your final projects in the middle and end of the semester. Completing the project will also require substantial time outside of scheduled labs, so plan ahead!

One last page... next!

The final project will be graded in two parts:

1. Methodological outline and study area map

An outline of your project topic and the methods you plan to use to tackle your GIS research question. The outline must include:

- A 250-word description of your planned research project.
- A table of the datasets that you will use to complete your project, a short description of the data, and the data source(s).
- An outline of the mapping and/or analytical steps required to complete your research project.
- A map of your study area using appropriate cartographic techniques – invest the time making a professional map that you can reuse on your final poster.

2. Final poster presentation

You will be responsible for presenting your research to faculty, students and friends in the form of a research poster. This poster will be presented at a GIS poster conference in the 12/11 reading day. I will go over the poster layout during lab.

More details on all of these components will be available on Moodle as the semester progresses.

Final Exam

The final exam will be ‘take-home’ format, meaning we will not sit for a formal final during finals week. The final itself will consist of a small set of theoretical problems which will test your ability to deconstruct spatial problems and apply principles of spatial analysis as discussed in this course. You will have the entirety of finals week to complete this assignment, and it will be delivered via Canvas. It does not require access to GIS software.

Class Participation

Throughout the semester, we will have opportunities to participate in various fun and interesting quizzes, polls, and so forth as content knowledge checks. While you will receive a score on these for your own reference, simply completing them is all that is necessary for a grade. We will also have sporadic check-in surveys to see how you are feeling week to week. Your participation grade is a combination of your completion of these efforts.