GGS 653: GIS ANALYSIS AND APPLICATION
COURSE SYLLABUS, SPRING 2026, 3 CREDITS

INSTRUCTOR		COURSE STRUCTURE
Name: Dr. Timothy Leslie	Meeting time(s) and Modality	M 4:30-7:10pm, 100% in-person
Email: tleslie@gmu.edu	Location:	Exploratory Hall 2103

COURSE OVERVIEW & OBJECTIVES

GIS Analysis and Application is a course that examines how distance and spatial relationships shape patterns, processes, and evidence in geographic data. The course develops the conceptual and technical foundations needed to design, implement, and critically evaluate research-grade spatial analyses, rather than only producing maps or operational products. Over the semester, you will formulate and refine a geographic research question, construct a defensible spatial data and model architecture, and produce a manuscript-style report and poster that could form the basis of future scholarly work.

LEARNING OBJECTIVES

By the end of the course, you should be able to:

- **Formulate and refine spatial research questions** - Develop a theoretically informed geographic research question that explicitly states how distance and neighborhood relationships enter the problem, and scope it appropriately for a semester-long project.
- **Design and manage a spatial data architecture** - Identify, acquire, and prepare spatial and non-spatial data; define units of analysis and joins; and assess how choices about boundaries and aggregation affect possible inferences and applications.
- **Select and apply appropriate spatial methods** - Choose among pattern measures, regression and spatial regression, interpolation, kernel density, and geographically weighted or other local models, and implement them so that assumptions, diagnostics, and uncertainty are explicit.
- **Evaluate uncertainty, robustness, and limitations** - Diagnose spatial dependence and non-stationarity, design and interpret robustness and sensitivity checks (e.g., alternative spatial weights, bandwidths, or units), and articulate the resulting limits on both scholarly and applied claims.
- **Communicate spatial analyses for research and practice** - Produce a manuscript-style report and a poster that clearly link question, data, distance/neighborhood choices, methods, results, and uncertainty, using appropriate cartographic and analytic conventions for technical and informed non-specialist audiences.

ASSESSMENTS AND GRADE WEIGHTS

Pre-Class Exercises

Students will participate have brief check-ins to complete prior to class each week to reinforce learning and prepare for future material. These check-ins are not meant to be tricky; they flag what you should focus on so that class time can be spent on projects and questions, not on cold starts. Grades are based on completion. | 5%

Exam

The exam will be a mix of multiple choice, true/false, fill in the blank, and free response. I do not provide review sheets for exams. | 20%

Project		
Each student will participate in a course project that serves as a semester-long investigation. Evaluation of the project will be distributed throughout several updates and milestone submissions that come together to make a cohesive product. Each milestone submission is accompanied by a conversation and discussion with the course instructor.	Project Step 1 – Concept & Data Audit	15%
	Project Step 2 – Methods & Analysis Plan	15%
	Project Step 3 – Preliminary Results & Diagnostics	15%
	Project Step 4 – Robustness & Refinement Memo	5%
	Project Step 5 – Written Report	15%
	Project Step 6 – Poster and Submission	10%

TENTATIVE SCHEDULE
(SUBJECT TO CHANGE)

Week	Topic	Date
1	Framing, projects, and distance	Jan 26
2	Quantifying spatial patterns and philosophy of analysis	Feb 2
3	Data architecture, units, and MAUP	9
4	Stats reboot: correlation and regression in space	16
5	Spatial autocorrelation and neighborhoods	23
6	Spatial regression and model choice	Mar 2
	No Class - Spring Break	9
7	Geographically weighted regression (GWR) and local models	16
8	Interpolation, kernel density, and "continuous fields"	23
9	Categorical, counts, and time	30
10	Inputs and Possibilities	Apr 6
11	Automation and the Spatial Analyst	13
12	*Exam* (conceptual spatial methods)	20
13	Visual communication for scholars and practitioners	27
14	Polishing, limitations, Next Steps	May 4
Final	Posters, Presentations	11

GRADING

The expected grade breaks are the following:

A	A-	B	B-	C	D
100 - 92	91.9 - 87	86.9 - 82	81.9 - 77	76.9 - 71	70.9 - 65

Submission Policies:
- Unless noted otherwise, submissions will be conducted through Canvas. Students should familiarize themselves with its features, including file submission, to ensure smooth participation. Assignments should only be emailed to the instructor if explicitly requested.
- For assignments allowing multiple submissions, only the most recent submission will be assessed, so ensure the final version is correct and complete, as earlier versions will not be reviewed.
- Unless otherwise specified, assignments should be submitted as PDFs with in-line text and tables, not screenshots of tables. Links to documents stored on external services such as Google Docs or Drive will be treated as non-submissions.
- Files must be readable and, if applicable, formatted according to the guidelines. Corrupted or improperly formatted files, such as those with missing visual elements or unclear tables, may result in deductions or be treated as non-submissions.

Late Submission Policy:
- Late submissions will incur a deduction, which increases every 24 hours after the deadline. These deductions are based on the total points possible for the assignment.
- Extensions require valid documentation and timely communication. If extraordinary challenges arise, please reach out promptly to discuss options.
- All submissions must meet the posted end-of-semester cutoffs to be graded.

Grade Concerns and Opportunities:
- All requests for grade reconsiderations must be made via email. When requesting reconsideration, refer to specific points of objection and provide specific examples or references, such as rubric criteria or feedback points. This ensures a focused discussion and equitable grading practices. Assignments will be evaluated uniformly, consistent with university accommodation policies. For further grade disputes beyond the instructor's review, students should refer to the university's grade appeal policy.
- Extra credit opportunities are rare and not provided upon individual request. If they arise, they will be announced to the entire class and made available equitably.
- If you are not satisfied with your progress during the semester, please see me as early as possible to discuss concerns.

Feedback and Grading Timeline:
- Grades for submitted material will typically be provided within 4 business days of submission, though the timeline may extend for larger assignments such as projects or labs.
- General feedback is intentionally concise and limited; for detailed discussions, please follow up in class or during office hours.
- Grades are calculated according to the syllabus criteria, and students are graded equitably based on their performance. Requests for rounding up grades cannot be accommodated to maintain fairness for all.

GENERATIVE AI AND ACADEMIC STANDARDS

The use of content-generating AI tools is prohibited unless explicitly allowed in an assignment. Unauthorized use of generative AI tools will be treated as academic misconduct. Where AI use is permitted, guidelines will clarify acceptable applications to ensure fairness and uphold integrity. If you are unsure about whether generative AI is permitted for an assignment, please ask for clarification before submission.

ATTENDANCE AND PARTICIPATION

- Your active presence in class is a key component of your success. Our sessions are designed for hands-on learning, collaborative problem-solving, and direct engagement with the material, which are difficult to replicate if missed. You are responsible for reviewing any missed material and staying up to date.
- In class, questions may sometimes be turned back to you or the group to diagnose your thinking. If you are still confused after that, say so explicitly and I will shift to a more direct explanation.
- ***Notify me only if your absence involves an exam or major assignment.*** For excused absences due to illness or valid reasons, provide a general doctor's note specifying the period covered. If you will miss classes due to a religious observance or participation in a university activity, you are obligated to notify me within the first two weeks of the semester (University Policy AP.1.6.1). In such cases, a reasonable alternative opportunity will be provided.
- Please make every effort to be punctual. Arriving on time shows respect for your classmates and helps maintain the flow of our class activities. Late arrivals will not receive additional time to complete timed assessments.
- In the rare event that class is cancelled, I will notify you via email or Canvas as soon as possible. Please check these platforms regularly for updates.

FOSTERING A COLLABORATIVE AND RESPECTFUL ENVIRONMENT

At George Mason University, we deeply value the diversity of backgrounds, experiences, and perspectives each student brings to the classroom. This breadth of viewpoint enriches our learning and strengthens our ability to analyze complex geographic challenges.

This course may involve discussions on sensitive or controversial topics, and all students are expected to approach these conversations with openness, empathy, and respect. We aim to create a collaborative and supportive atmosphere that values curiosity, constructive dialogue, and mutual respect. Thoughtful contributions, whether sharing ideas, asking questions, or offering insights, enhance learning for everyone.

- Please use professional and considerate language in all interactions, as tone and word choice significantly impact how messages are received.
- I am committed to ensuring that every student feels supported and can thrive in this course. If something said or done in the classroom, by myself or others, causes discomfort, offense, or concern, I encourage you to bring it to my attention.
- Students are encouraged to use their chosen first name and pronouns. I use male pronouns (he/him), and my last name is pronounced LESS-LEE. My preference is that you address me as 'Professor,' 'Professor Leslie,' or 'Dr. Leslie.' Please inform me of your preferences and update your Mason file for consistency.

TECHNICAL EXPECTATIONS

- Regular access to a computer with an updated operating system and a stable internet connection is required to participate in and complete course activities successfully. Test your setup early to avoid disruptions during assignments or exams.
- Materials on Canvas or other platforms are intended for students' use only. Sharing materials (e.g., lecture slides, recordings) with anyone not enrolled in the course is strictly prohibited.
- If students need to use ESRI proprietary software off-campus or on non-Windows machines, they can access it through the Patriot Virtual Computing & Labs (PVCL). Instructions are provided upon request. Students new to certain software packages are encouraged to review introductory tutorials before starting lab activities to build confidence and minimize delays.
- If students anticipate challenges in meeting technical requirements (e.g., lack of reliable internet access or appropriate hardware), they should inform me early in the semester so we can explore alternative solutions.
- Ensure your work is saved and backed up using reliable storage options such as OneDrive or Dropbox.
- Video or audio recordings are permitted only with prior written consent or as part of an approved accommodation plan. Recorded sessions are for personal, private use only and must not be shared with others without explicit permission.

CONTACTING ME

I am here to support your learning and help you with any challenges you may encounter during the course. You can reach me outside of class in the following ways:

1. Zoom Appointments: Schedule a meeting through my Calendly - Office Hours. If no available times fit your schedule, email me with at least three alternative meeting times, and I will do my best to accommodate you. Appointments are ideal for complex questions, such as in-depth assignment guidance or feedback on your work. A device with a functional microphone is required for participation. While using cameras during conversations is not mandatory, it is appreciated when speaking to facilitate communication.

2. Email: I respond to emails promptly Monday through Thursday. For weekend inquiries, expect a reply by noon on Monday. Before emailing, review the syllabus for common answers and include relevant details such as assignment names or due dates. For complex issues, consider scheduling a meeting through my Calendly link for in-depth discussion. Email is best for quick questions, while detailed discussions should be addressed in a scheduled meeting.

MODIFICATIONS

Occasionally, circumstances may require adjustments to the course schedule or policies. Any changes will be communicated promptly via email or Canvas. Students are responsible for regularly checking Canvas or email for updates, as all changes will take effect immediately upon notification.