

CSS 645 / GGS 631

Spatial Agent-based Models of Human-Environment Interactions

1. General Information

Instructor:	Dr. Hamdi Kavak (hkavak@gmu.edu)
Backup Instructor:	Dr. William G Kennedy (wkennedy@gmu.edu)
Where:	Exploratory Hall 2310
When:	Monday from 4:30 PM - 7:10 pm
Course website:	The GMU Blackboard Website (https://blackboard.gmu.edu/)
Credits:	3
Prerequisites:	CSS 600 or GGS 531 or permission of instructor.
Office Hours:	Wednesday from 1:30 PM - 5:00 PM (email the instructor at hkavak@gmu.edu with your preferred meeting time).

2. Course Description

This course will introduce graduate students in the spatial, environmental, and computational social sciences to the use of agent-based techniques as a means of modeling human-environment interactions. Major topics include spatial processes, the use of spatial identifiers to link socioeconomic and biophysical models, and, where possible, links to geographic information and associated technologies. We will cover applications in agriculture, epidemiology, forestry, biodiversity, habitat degradation, interactions between human populations and nonhuman species, and urban modeling.

The course will combine literature review with some hands-on modeling. When demo versions are available, we will compile and run models and review articles based on those models. In addition, students will complete a class project where they develop their models in their areas of interest. Students with no programming background can develop simple models using NetLogo or AnyLogic. Students with advanced programming abilities are encouraged to create more sophisticated models using packages such as GAMA, Repast, MASON, Mesa, etc., or may develop their spatial agent-based model using the programming language of their choice.

3. Who Should Take This Class?

Students should be familiar with spatial structures and concepts, have some background in social science, and have a high level of computing competence. Students should have some familiarity with agent-based modeling and complexity theory, such as would be provided by Introduction to Computational Social Science (CSS 600), Agent-Based Modeling and Simulation (CSS 610), or Land-Use Modeling Techniques and Applications (CSS 643/GGS 531). Knowledge of a programming language is helpful but not required. Additional readings will be suggested for students lacking a background in any of these areas. Generally, no one student has a background in all of these areas. Students are encouraged to make more substantial contributions in their areas of expertise and to learn from the expertise of others in their weaker areas.

4. Learning Outcomes

By the end of the course, students will

- have a fundamental understanding of agent-based modeling to research human-environment interactions
- gain state-of-the-art methodological knowledge to conceptually spatial design agent-based models involving human-environment interactions,

- gain hands-on experience to develop spatial agent-based computational models involving human-environment interactions and geographical information systems (GIS),
- expand their literature knowledge in the application of spatial agent-based models in various topics.

5. Lecture Format

The course will be taught as face-to-face lectures supported by instructional material dissemination through Blackboard. Per university guidelines, the instructor cannot change the modality of the class from face-to-face to online or hybrid.

6. Inclement Weather Policy

If the university is closed due to inclement weather like heavy snow, we will not meet that week, and students should **not** expect an online meeting (unless told otherwise).

7. Student Privacy

All course materials posted to Blackboard or other course sites are private; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class.

8. Textbooks and Other Instructional Material

We have no required textbooks for the class. Articles and chapters are available online or are made available on BlackBoard. For students with no experience with Agent-based modeling or NetLogo you might consider the following book:

- **Crooks, A.T., Malleon, N., Manley, E. and Heppenstall, A.J. (2019)**, Agent-based Modelling and Geographical Information Systems: A Practical Primer, Sage, London, UK.

9. Technology Requirements

Activities and assignments in this course will regularly use the Blackboard learning system, available at <https://mymason.gmu.edu>. Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OSX 10.13 or higher) and a stable Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher. You can check your speed settings using speed check software such as [fast.com](#))

10. Face-to-face Classes

All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (<https://www.gmu.edu/safe-return-campus>). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check prior to coming to campus. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, Red, or Blue email response. **Only students who receive a "green" notification are permitted to attend courses with a face-to-face component.** If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2021, **all community members are required to wear a facemask in all indoor settings**, including classrooms. An [appropriate facemask](#) must cover your nose and mouth at all times in our classroom. If this policy

changes, you will be informed; however, students who prefer to wear masks either temporarily or consistently will always be welcome in the classroom.

11. Course Outline (tentative)

In this course, we will cover the following topics, which are subject to change at the discretion of the instructor, and changes will be announced during our lectures or via announcement emails.

Week (Date)	Topic	Short writing assignment	Paper presentation	Term project
Week 1 (Jan 24)	<ul style="list-style-type: none"> Course Introduction Agent-based Modeling 			
Week 2 (Jan 31)	<ul style="list-style-type: none"> Complexity in Human Environment Systems, Pattern Oriented Validation 			
Week 3 (Feb 7)	<ul style="list-style-type: none"> ABM/GIS Integration. Model Communication / Ontologies 			
Week 4 (Feb 14)	<ul style="list-style-type: none"> ABM/GIS Integration 			
Week 5 (Feb 21)	<ul style="list-style-type: none"> Applications: Agrarian societies 	•	•	Abstract due 11:59 pm.
Week 6 (Feb 28)	<ul style="list-style-type: none"> Applications: Overview of Urban Models, Gentrification 	•	•	
Week 7 (Mar 7)	<ul style="list-style-type: none"> Guest Lecture: Richard (Na) Jiang 	•		
Week 8 (Mar 14)	SPRING RECESS (No Lecture)	No Assignment		
Week 9 (Mar 21)	<ul style="list-style-type: none"> Guest Lecture: Dr. Taylor Anderson 	•		
Week 10 (Mar 28)	<ul style="list-style-type: none"> Applications: Slums and Urban Poverty 	•	•	
Week 11 (Apr 4)	<ul style="list-style-type: none"> Applications: Residential Land Markets 	•	•	
Week 12 (Apr 11)	<ul style="list-style-type: none"> Applications: Mobile Agent Models - Part 1 	•	•	
Week 13 (Apr 18)	<ul style="list-style-type: none"> Applications: Mobile Agent Models - Part 2 + project check up 	•		
Week 14 (Apr 25)	<ul style="list-style-type: none"> Applications: Disasters and Disease Models 	•		
Week 15 (May 2)	<ul style="list-style-type: none"> Term Project Presentations - 1 (5 presentations) 			Slides due at noon.
Week 16 (May 9)	<ul style="list-style-type: none"> Term Project Presentations - 2 (4 presentations) 			Slides due at noon.
May 13	<ul style="list-style-type: none"> Paper, Code, and Data submission 			Due at 11:59 pm.

12. Grades

Weekly, you will complete short writing assignments from week 5 to week 14 as indicated on BlackBoard.

You will present a paper selected from weeks 5, 6, 10, 11, and 12.

Finally, you will develop a spatial agent-based model as your final project involving an initial abstract/proposal, up to 12-page paper, and live presentation.

Short writing assignment	30%
Presentations	30%
Final project	40% (10% abstract, 20% presentation, 70% paper)

Final grades at the end of the course will be assigned based on the following table, independent of the relative standing in the class.

Final Mark	Corresponding Grade
97.0 or more	A+
93.0 – 96.99..	A
89.0 – 92.99..	A-
86.0 – 88.99..	B+
83.0 – 85.99..	B
80.0 – 82.99..	B-
70.0 – 79.99..	C
less than 60.0	F

13. Exams

There are no exams in this class.

14. General guidelines for assignment/presentation/term project preparation and submission

- **Weekly Show Writing Assignments (SWAs) (30%)**

- From week 5 to week 14, there will be at least one short writing assignment. Topics will be posted on BlackBoard for that week. Starting the 21th of February, each student will be required to complete a brief written review of one of the weekly readings, based on the SWA questions posted on Blackboard. Check the Assignments menu for guidance.
- Submissions are uploaded to Blackboard under the Assignments menu.

- **Paper Presentations (30%)**

- Students will be required to give an in-depth review of 1 article over the course of the semester, starting Week 5.
- The requirements for this assignment are provided under the Assignments menu on Blackboard.

- Submission links will be provided under the Assignments menu.
- **Final Term Project (40%)**
 - Each student will complete a term modeling project in their area of interest and will present the results to the class.
 - An initial abstract/proposal will be submitted by week 5 while project presentation and paper are due in the last three weeks of the course. Check the Assignments menu on Blackboard for more details.
- All assignments should be submitted **through the Blackboard course website**. Every assignment should allow you to submit the work multiple times up until the deadline. The last version of the assignment will be graded.

Please note: Assignments should be submitted only through the Assignment submission section of the Blackboard system - DO NOT email assignments directly to the instructor.

15. Late submission

Weekly Show Writing Assignments (SWAs): The weekly short writing assignments are meant to give you some insights regarding the coming lecture. In that respect the noon deadline (of the class day) will be crucial and late papers will not be accepted. You can make up two SWAs by submitting extra papers in the following weeks. Exceptions to this policy may be given under serious circumstances at the discretion of the instructor. Please contact the instructor as soon as possible in such cases.

Please note: Deferral of a work is a privilege and not a right; there is no guarantee that a deferral will be granted. Please make sure you notify the instructor as soon as you know a deferral is required.

16. Attendance

Attendance is not part of the overall grade but highly recommended.

17. Military activation policy

If you are a military personnel and called on duty during the semester, check GMU's military activation policy at <https://military.gmu.edu/military-mason/military-activation-policy>.

18. Blackboard

The course has a Blackboard website. The Blackboard website will provide you with a portal through which you may obtain lecture notes, retrieve assignment data, review links to additional materials, and receive special announcements. You are required to visit the course website regularly and follow all announcements. Please notify ITS (and, if necessary, the instructor) if you encounter any problems accessing the Blackboard website.

19. Electronic communication, office hours and support

All course-related submission of assignments should be made through the course Blackboard website. Please **DO NOT** email your assignment submissions to the instructor unless the Blackboard website is down for an extended period.

Students are encouraged to contact the instructor via GMU email for questions regarding the course content and office hours (see General Information in the first page). Ideally, the instructor will respond to student emails within 2 business days, usually earlier. The instructor will notify the students via GMU email if there are any temporary or permanent changes in office hours.

20. Students with disabilities

Disability Services at George Mason University is committed to providing equitable access to learning opportunities for all students by upholding the laws that ensure equal treatment of people with disabilities. If you are seeking accommodations for this class, please first visit <http://ds.gmu.edu/> for detailed information about the Disability Services registration process. Then please discuss your approved accommodations with me. Disability Services is located in the Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474

21. Expectations from students

- *Academic Integrity:* Students must be responsible for their own work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture. [See <http://academicintegrity.gmu.edu/>].
- *Honor code:* Students must adhere to the guidelines of the George Mason University Honor Code. [See <https://oai.gmu.edu/mason-honor-code/>].
- *MasonLive/Email (GMU Email):* Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and the program will be sent to students solely through their Mason email account.
- *University Policies:* Students must follow the university policies (See <http://universitypolicy.gmu.edu>) including the Responsible Use of Computing [See <https://universitypolicy.gmu.edu/policies/responsible-use-of-computing/>].

22. Frequently asked questions

- *Have a question?*

Ask the instructor via email. If your question applies to all students, it will be shared here as well.

Last updated on 01/23/2022

Disclaimer: Any typographical errors in this Course Outline are subject to change and will be announced in class. The date of the final examination is set by the Registrar and takes precedence over the final examination date reported by the instructor.

Notes: (1) Recording is permitted only with the prior written consent of the professor or if recording is part of an approved accommodation plan. (2) The format and template of this syllabus is prepared based on the syllabus of Dr. Andreas Zufle's GGS 787 - Scientific Data Mining for Geo-informatics 2018 course. (3) A significant portion of the content of this syllabus is adopted from the syllabus of Dr. Andrew Crook's CSS 645 Spring 2021 course.