

## **GEOG 318 / PLAN 353 – Spatial Analysis – Winter 2017**

Instructor: Derek T. Robinson, dtrobins@uwaterloo.ca  
Office hours: Thursdays 2:30–4:00pm, EV1-105A  
Lecture: Thursdays 11:30–2:20pm, EV3 1408  
Labs: Mondays 12:30 – 2:30pm EV2-1002A  
Thursdays 9:30 – 11:20am EV1-240  
Teaching Assistant: Bo Sun  
Office Hours: Tuesday 12:30-2:30pm  
Lab Hours: Thursday 9:30-11:20am  
Prerequisites: ENVS 278 Advanced Environmental Research Methods or  
Equivalent from another department  
Students with STATS 231 or BIO 361 may be signed in.  
Course Number: 7826

### **Course Description**

Spatial analysis techniques are developed and applied in diverse fields such as geography, spatial epidemiology, spatial econometrics, geocomputation, and spatial statistics to explain and predict spatial phenomena. Today, spatial analysis is mainly based on statistical techniques and geoprocessing using geographic information systems (GIS). The spatial character of data implies several methodological challenges in spatial data analysis especially related to the spatial dependence of the data, which often invalidates non-spatial modeling and evaluation approaches and leads to special techniques for spatial sampling and spatial regression modeling.

Geography 318 (cross listed with Planning 353) gives an overview of statistical and computational techniques for spatial regression modeling, spatial classification, spatial interpolation, and point pattern analysis. In addition, selected topics such as spatial data mining and spatial analysis software may be addressed, depending upon the progress of the course. Several real-world applications of spatial analysis techniques will be discussed and provide context for course assignments.

### **Learning Objectives**

At the end of this course, you should:

- Have gained an understanding and awareness of potential and pitfalls of spatial analysis;
- Have developed a general understanding of a variety of spatial modeling techniques;
- Be able to interpret and critically discuss spatial models and their results.

Statistical concepts and techniques known from ENVS 178/278 (or similar courses) will be reinforced (but not re-introduced), and typical misconceptions will be addressed.

### **Reference Books**

The following references are available on course reserve at the Porter Library. We will follow O’Sullivan and Unwin (2002) closely. You may purchase this book or find access to it (for free) online via the library. The other two books may also be used.

Burrough, P.A., McDonnell, R.A., and C.D. Lloyd, 2015. Principles of Geographical

Information Systems. Oxford University Press.

De Smith, M.J., Goodchild, M.F., and P.A. Longley, 2006. *Geospatial Analysis*, Troubador Publications. Available online at <http://www.spatialanalysisonline.com/output/>

Lloyd, C.D., 2010. *Spatial Data Analysis: an Introduction for GIS Users*. Oxford Univ. Press.

O'Sullivan, D. and D. Unwin, 2010. *Geographic Information Analysis*, 2<sup>nd</sup> Edition, Wiley. Available online through the library.

### Schedule

The course comprises a 3-hour lecture held on Thursdays from 11:30-2:20pm and dedicated lab time to work on assignments. The lecture will be used to introduce the theory and concepts behind spatial analysis methods as well as to demonstrate techniques that will aid the completion of lab assignments. Significant additional time will be required for independent study to complete assignments and develop necessary skills (see also section *Getting Help* below). The schedule of course content and due dates are subject to change. If a change is made an updated version of the schedule or due date will be posted on the course website and students will be notified via the course website and in class.

Class	Date	Contents	Chapters	Evaluation
1	Jan 5	Introduction to Spatial Analysis	1, 2	A1 Distributed
2	Jan 12	Maps as Outcomes of Processes	3, 4	
3	Jan 19	Point Pattern Analysis	5	A2 Distributed
4	Jan 26	Point Pattern Analysis, Area Objects, and Spatial Autocorrelation	6, 7	
5	Feb 2	Local Statistics	7, 8	A3 Distributed
6	Feb 9	Describing and Analyzing Fields	9	
7	Feb 16	Describing and Analyzing Fields	9, 10	A4 Distributed
-	Feb 23	<i>Family Day Holiday and Study Days</i>		
8	Mar 2	The Statistics of Fields	10	
9	Mar 9	Putting Maps Together	11	A5 Distributed
10	Mar 16	Landscape Metrics and Applications of Spatial Analysis		
11	Mar 23	New Approaches to Spatial Analysis	12	
12	Mar 30	Grad Presentations/Review Session		

Chapter references in the course schedule refer to the O'Sullivan and Unwin (2010) book. Other readings will be assigned/suggested throughout the term.

### Method of Evaluation

Item	Format / Topic	Due Date	Contribution
Assignment 1	Spatial analysis case studies, and potential and pitfalls of spatial analysis	Jan. 18	5%
Assignment 2	Point pattern analysis	Feb. 1	15%
Assignment 3	Local Statistics, Autocorrelation, and Geographically Weighted Regression	Feb. 15	15%
Assignment 4	Exploring Field Data and Trend Analysis	March 8	15%
Assignment 5	Introduction to Interpolation	March 22	15%
Final Exam	True-false, multiple choice, and open questions, calculations, sketches.	TBD	35%

Assignment Submission and Late Penalty. Assignments are due at 9:00 pm on the due date listed in the Method of Evaluation Table directly prior to this text. Assignments will be subjected to a 10% reduction for each day that they are late up to 3 days and then a value of zero will be assigned for the entire assignment. An assignment submitted even one minute after the deadline will be considered late by one day.

Pocket calculators (with exponential function and logarithm) may be required for tests and class participation.

### Computer Labs

You can use the Galileo (EV1-240), Geddes (EV2-1002A) or Magellan (EV2-1014) labs for practical work in this course when they are not booked for other courses. Access codes are available at the Mapping Analysis and Design helpdesk in EV2.

*NOTE: No food or drink is allowed in the labs. Failure to abide by this rule may result in your computer accounts being suspended.*

### Course Website

A course website has been created on the new learning platform “Learn” (Desire2Learn). Information on access to the website will be provided in class. Students registered in the course can access the course website after the first class by going to the LEARN website (<http://learn.uwaterloo.ca>) and logging in using your WatIAM/Quest username and password. Once logged in, you will see the course listed under “My Courses and Communities”. Click on GEOG 318 to see the course content.

The course website provides access to lecture presentations, course notes, and other relevant information. Online material in LEARN can be opened or downloaded by clicking on the appropriate link. In addition, the course website supports announcements, discussion groups and e-mail. Assignments will be handed in via the LEARN course website and students should become familiar with the website and submission process early so as not to receive a late submission.

## Getting Help

Students are expected to get into the habit of using the on-line help files as the **first** source of help. The TA and instructor will be available during scheduled help sessions and office hours to answer questions related to the assignments. Additional help is available from the MAD help desk.

## Email

Please include the course shortcode and your family name in the subject of your email (e.g. Robinson GEOG/PLAN 318). The instructor or TA will try to respond to emails within 24hrs excluding weekends (i.e. Friday 5pm to Monday 8am). We will respond to emails regarding course content or logistics, while questions or concerns regarding evaluation will be reserved for discussion during office hours.

Email and online discussions are governed by the same rules of academic conduct as your behaviour in class. Please use common courtesy, be polite, and, of course, avoid sending or forwarding aggressive, sexist, racially discriminatory, obscene, offensive, libellous, or defamatory comments of any kind. If I do not respond to your email within 24 hours please send me another email or see me in person as it may have been deleted by a spam filter or a server may have been down when the email was sent. Email can be a benefit to both the student and instructor objectives; however, email is not a substitute for one-on-one discussion and therefore I prefer to meet with you during office hours.

**Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [www.uwaterloo.ca/academicintegrity/](http://www.uwaterloo.ca/academicintegrity/). Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at: <http://www.lib.uwaterloo.ca/ait/>

**Research Ethics:** Please also note that the 'University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office's Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent process, etc.).

If the development of your research proposal consists of research that involves humans as participants, the please contact the course instructor for guidance and see: [www.research.uwaterloo.ca/ethics/human/](http://www.research.uwaterloo.ca/ethics/human/)

**Note for students with disabilities:** The AccessAbility Services, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AccessAbility Services at the beginning of each academic term. It is imperative that you address all aspects of your situation with the instructor as close to the start date of the course as possible to ensure a fair outcome for yourself, your classmates, and for the instructor.

**Religious Observances:** Please inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

**Turnitin Software:** Plagiarism detection software (Turnitin) may be used to screen assignments in this course. This may be done to verify that use of all materials and sources in assignments is documented. Students will be given an option if they do not want to have their assignment screened by Turnitin. In the first week of the term, details will be provided about arrangements and alternatives for the use of Turnitin in this course.

**Grievance:** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, [www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm). When in doubt, please contact your Undergraduate Advisor for details.

**Discipline:** A student is expected to know what constitutes academic integrity, to avoid committing academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, [www.adm.uwaterloo.ca/infosec/Policies/policy71.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm). For typical penalties, check Guidelines for Assessment of Penalties, [www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm](http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm)

**Appeals:** A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 – (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals). See: [www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm)

**Consequences of Academic Offences:** ENV students are strongly encouraged to review the material provided by the university’s Academic Integrity office (see: <http://uwaterloo.ca/academicintegrity/Students/index.html>).