

Raster Geo-Information Science

Instructor

Professor Grant McKenzie
613A Burnside Hall
grant.mckenzie@mcgill.ca
Office Hour: Fridays 2:30p-3:30p
or by appointment (email)

Teaching Assistants

Hongyu Zhang
Heloisa Ehalt Macedo
Office Hours TBA

GENERAL INFORMATION

The proliferation of information in the digital age has led to the widespread availability and use of raster data sets in GIS. These types of data are well suited for documenting changes occurring on the Earth's surface at a variety of spatial scales. They also allow for the simulation of the distribution and flow of mass, energy, goods, services, animals, and people in a spatially explicit manner.

Note that this is NOT an introductory course to GIS. It is expected that you are familiar with the basic concepts of GIS. If your general proficiency in GIS is limited, it is expected that you keep yourself up-to-date with the basics, and you may require a significantly higher work load than other students to succeed in this course. It is extremely important that you stay on top of the work (including the tutorials) assigned throughout the course. Learning the software and concepts is a cumulative process. If you let things slide you will be snowed under come March!

LEARNING OUTCOMES FOR THE COURSE

Upon successful completion of the course students will have:

- A solid foundation in the core concepts and tools used for displaying, formatting, manipulating, and analyzing raster data sets
- A foundation for studying and understanding a wide variety of mainly terrestrial biophysical phenomena in a spatially explicit framework
- Gained practical knowledge in the application of raster data for environmental decision making and planning
- The knowledge to construct meaningful spatial models that can address a problem, test a hypothesis, and enhance scientific understanding
- Gained experience producing scientific and technical reports

COURSE SCHEDULE

- Fridays (10:05 – 11:25) – Lecture
- Fridays (12:05 – 14:25) – Lab Section

READINGS & COURSE MATERIALS

There is no required text book. Readings will be distributed in class, or made available electronically (via myCourses). Material may be put on reserve in the map library from time to time. Much of the material will be drawn from:

- ArcGIS Guides and Tutorials (PDF files on *myCourses* and on computers in GIC lab).
- Burrough, Peter A. and McDonnell, Rachel A. 1998. *Principles of Geographical Information Systems*. Oxford University Press, 333 pp.
- DeMers, Michael N. 2002. *GIS Modeling in Raster*. John Wiley & Sons, 203 pp.
- In lieu of a required text, students are **strongly** encouraged to purchase a (paper) notebook that will serve as a work log for all lab tutorials, assignments, and projects.
- Data will be provided in class or will be downloaded from online sources. Students are expected to have (or purchase) a memory stick or external hard-drive (min. 4 GB) in order to backup, archive and/or transfer data as required.

COURSE COMMUNICATION

The main course communication will be carried out through the course portal within the McGill University course management system (myCourses). All students enrolled in the course have access to the system. In addition to communications, this portal will be used by the instructor and the TA to post assignments and grades, and by the students to submit their assignments.

FORMAT

Geographic Information Science is a largely a practical field of study. This course will entail a significant 'hands-on' component including laboratory sessions, practical examination, and an independent project. It is envisioned that the morning lecture on Fridays will entail theory and/or concepts, while the afternoon session will involve in-lab demonstrations and tutorials.

SOFTWARE

The software used for most tutorials and lab exercises will be ArcGIS 10.x. ArcGIS is the core product of ESRI, the industry leader in GIS software. We will mostly rely on the Spatial Analyst extension of ArcGIS, which provides special functionalities for handling raster data. Typical application areas of this software include environmental monitoring, simulation modeling, decision support, uncertainty analysis, and surface interpolation/ geostatistics. Its level of sophistication is tempered by a user-friendly interface. Other software may be introduced on an 'as need' basis or will be referred to for special applications. Note that a free 1-year student ESRI ArcGIS license is available from the GIC. ESRI's ArcGIS Desktop currently only work on Windows OS and unfortunately neither the TAs nor the instructor are able to help you install the software on your own computer.

GRADE DETERMINATION

- Lab quizzes: 10% 7 quizzes @ 2% each; only the best 5 will count
- Take-home assignments: 30% 3 assignments @ 10% each
- Written Mid-term: 15% 1.5 hour written examination
- Practical Mid-term: 15% 2.5 hour practical examination
- Research Proposal: 5%
- Research Paper: 25%

LAB QUIZZES

There will be 7 short lab quizzes on Friday afternoons between Jan. 17 and February 28. Each will be worth 2 points. But note: Only the best 5 will count, i.e. you can get max. 10 points in total (or another way to see it: you can miss or fail two quizzes without consequences!). The quizzes must be submitted electronically during the lab section.

TAKE-HOME ASSIGNMENTS

For take-home assignments, students will work individually and in small groups to practice skills developed in class. All deliverables, as described in each take-home assignment, should be submitted online before posted deadlines. **Late assignments will be given a 0.42% penalty per hour (roughly 10% per day) up to a maximum of 5 days (including weekends).** Assignment submitted more than 5 days late will be given a grade of 0. Please note that lab presence is not mandatory, though highly recommended. A teaching assistant will be available during the lab session to provide help students with the current assignment.

MID-TERM EXAMS (WRITTEN AND PRACTICAL)

There will be a written and a practical midterm. Both mid-terms will be explained in more detail in a separate document, provided ahead of time.

RESEARCH PAPER

There will be an independent research project. The purpose of this project is to allow students to explore and apply raster GIS on a topic of their interest using the skills acquired from the course. The project will include a proposal outline, data collection and processing, analysis, and a final report. More information will be provided ahead of time.

PROVISIONAL SCHEDULE

Please, note that modifications may be introduced to the schedule as the semester progresses.
Updated schedules will be made available to all students via the course website as soon as possible.

WK	DATES	LECTURE	LAB	ASSIGNMENT
1	Jan 10	Intro to Geog 306	Introduction to ArcGIS and Spatial Analyst	
2	Jan 17	The Raster Data Model	The Raster Data Model	
3	Jan 24	Map Algebra	Map Algebra & Raster Cartography	Ass. 1 Assigned
4	Jan 31	Spatial Analysis (Neighborhoods & Filters)	Spatial Analysis	
5	Feb 7	Terrain Analysis 1 (Slope, Aspect, Visibility)	Terrain Analysis 1	Ass. 1 Due Ass. 2 Assigned
6	Feb 14	Terrain Analysis 2 (Flow paths)	Terrain Analysis 2	
7	Feb 21	Cost Surfaces	Cost Surfaces	Ass. 2 Due Ass. 3 Assigned
8	Feb 28	Spatial Interpolation	Spatial Interpolation	
9	March 6	<i>Reading Week</i>		
10	March 13	Midterm Exam (Written)	Project Discussion	Ass. 3 Due
11	March 20	Project Discussion	Midterm Exam (Practical)	
12	March 27	Project Proposal Due	Project Work	
13	April 3	Project Work		
14	April 10			
	April 17	Project Paper Due		

EXPECTATIONS OF STUDENTS IN THE CLASS

- Students should be aware that most of the material covered in the class is not available in the course eBook and will be presented in lectures only. Students are strongly encouraged to take careful notes during the lectures as not all material will be presented in the slides.
- Students are expected to complete their lab assignments and attend lab sessions. All lab assignments are to be submitted via McGill's myCourses by the specified due date and time.
- Students are expected to treat each other with respect. Disruptive behavior of any kind will not be tolerated. Students who are unable to demonstrate civility with one another, the teaching assistants, or the instructor will be subject to referral to the Office of Student Conduct or to the McGill Campus Security. You are expected to adhere to the [Code of Student Conduct](#).
- In this class, students will be allowed and encouraged to use their personal computers or other means of technology to take class notes and problem sets. Use of technology for tasks other than those related to the course is not permitted.