

# ENVR 4872/GEOG 4872 /GEOG 7872 Course Outline

## Advanced Methods in Geomatics

### 1. General Information

Lecturer: David Walker  
(David.Walker@umanitoba.ca)  
Office Location: 253 Wallace Bldg.

Lecture Location: WALLACE 218  
Lecture Time: 8:30 am - 9:45 am TR  
Lab Location: 321 Wallace  
Lab Time: 2:30 pm - 5:25 pm T

**Objectives:** This course focuses on the theory and application of geomatics in spatial problem solving in geography and the environment. The use of geomatics' technologies including GIS, Earth observation and spatial numerical methods will be covered. Students will learn the theoretical underpinning of spatial statistical concepts and will experiment with data exploration, inference and hypothesis testing. Lab assignments will provide practical experience with GIS and other geomatics software as well as CRAN-R.

### 2. Materials

**Required Readings:** Papers from leading journals may be assigned as required during the course. Students will need to read the following prior to the first lab:

Dale, M., P. Dixon, M-J. Fortin, P. Legendre, D. Myers and M. Rosenberg. 2002. Conceptual and mathematical relationships among methods for spatial analysis. *Ecography* 25: 558-577.

Hurlbert, S. H. (1990). Spatial distribution of the Montane Unicorn. *Oikos*, 58(3), 257-271.

Perry, J. N., Liebhold, a M., Rosenberg, M. S., Dungan, J., Miriti, M., Jakomulska, a, & Citron-Pousty, S. (2002). Illustrations and guidelines for selecting statistical methods for quantifying spatial pattern in ecological data. *Ecography*, 25(5), 578-600.

**Required Software:** It is expected that all students will have a general knowledge of spreadsheets, word processors, and presentation software. Background in databases and programming, while not required skills, would be advantageous. We will be using ESRI ArcGIS 10.4, Multispec and CRAN-R software in this course. All software is provided in the lab, however, a tutorial on installation and use of CRAN-R (libraries: sp, maptools, spdep) for use on personal laptops will also be delivered. It is the responsibility of each student to learn these packages.

**Using Copyrighted Material:** Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact [um\\_copyright@umanitoba.ca](mailto:um_copyright@umanitoba.ca). Citation of copyrighted or any source materials in written assignments for this course should use the APA reference style as outlined in the text:

American Psychological Association. (2009). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC.

**Recording Class Lectures:** Dr. David Walker holds copyright over the course materials, presentations and lectures that form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission of Dr. David Walker. Course

materials (both paper and digital) are for the participant's private study and research.

### 3. Evaluation

Final Paper	40%
Lab Assignment 1	15%
Lab Assignment 2	15%
Lab Assignment 3	15%
Lab Assignment 4	15%

\* Assignment due dates will be discussed in class and a mutually agreeable time frame will be established.

### 4. Grade Distribution Scale

Grade	Range
A+	$\geq 90\%$
A	80 – 89%
B+	75 - 79%
B	70 - 74%
C+	65 – 69%
C	60 – 64 %
D	50 - 59%
F	$\leq 49\%$

### 5. Computer Lab

**Lab Attendance:** All materials including specifics of each assignment and instructions for their completion (written and supplemental), and data and software, are provided in 321 Wallace. All assignments **MUST** be completed on the lab computers in 321 Wallace and handed in using the lab server. Because the computer software landscape is constantly changing, it may be necessary to provide oral instructions during lab time for unforeseen and unforeseeable events (e.g. new computer virus or system patch) necessary to complete an assignment. These instructions will be provided in a clear and concise manner, to lab attendee's. It is the responsibility of students to ask for clarification or obtain these instructions for a missed lab by contacting the course instructor. Attendance of all labs is required for a passing grade in this course.

**Policy on Technology and Lab Use:** It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in classroom setting only for educational purposes approved by instructor and/or the University of Manitoba Disability Services. Student should not participate in personal direct electronic messaging/posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline "gaming" during scheduled class time. If a student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it.

**Lab Server Use and Policy:** The Geography Lab Server in 321 Wallace is on a network separate from UManNet and uses different user id and password credentials. Detailed instructions regarding access and use of the server will be provided during the first lab session. In brief, the lab server has three folders visible to each student: a **hand-out**, **hand-in** and **home** folder that contains your own **user** folder (named using the lab ID assigned to you in the first lab e.g. **ageo99**). Lab assignments are provided in the **hand-out** folder and **MUST** be copied to your **user** folder **BEFORE** you start working on them. Your **user** folder is the working directory where you keep copies of files in progress, backups and files to be handed in. Once an assignment is **completed** and **no later** than the designated due date, it must be submitted to the lab **hand-in** folder (for further details see **Lab Report Submissions** and **Lab Report Format** in the sections below). The **user** folder provided is for course materials **only**. Papers and documents related to other courses are strictly not allowed to be saved in this directory. Multimedia and other files downloaded from the Internet must relate to course materials. Saving inappropriate, copyright restricted or illegal materials on the lab server may result in academic punishment and or other penalties.

**Lab Report Submissions:** Lab reports can consist of **multiple** components including a written report and other digital deliverables (e.g.

maps, databases, posters, graphs etc.). When more than one document and deliverables are required, students should place all required files in a **new** folder in their **user** folder and then **zip the file into a compressed archive** (instructions will be provided in lab). Electronic project submissions (whether a single file or zip archive) must be **NAMED** using the following naming format:

LASTNAME\_STUDENT#\_LABID\_ASSIGNMENT#

e.g. SMITH\_9999999\_ageo01\_LAB1[.pdf/.docx/.zip]

All assignments **MUST** be **submitted to the lab server**, **named properly**, be **complete** and **MUST open** to be considered finished. In many instances we can accept screen captures of deliverables inserted into a single Word document or PDF of results. Specific instructions will be provided in the lab. The written report and deliverables must be organized and follow the instructions provided in the lab assignments.

## 6. Format of Lab Assignments

The general requirements and structure for lab assignments are as follows:

1. Laboratory assignments must be typed, using a 12-point font.
2. Assignments should be well-organized and well-written. Proper grammar and spelling will be considered in grading.
3. Assignments should be no more than 5 pages (single spaced) in length, excluding Figures, Tables and Maps.
4. Assignments will have the following basic structure:
  - (a) **Title Page**: include your Student ID #
  - (b) **Introduction**: a short paragraph or two, to give perspective to the report. Include a clear statement of objectives.
  - (c) **Materials and Methods**: a summary of the methods used to obtain the results presented, especially the **WORKFLOW** and additions or modifications to the steps outlined in the assignment.

- (d) **Results**: Include the results that will be discussed in the next section. You are expected to include all Tables and Figures necessary to summarize the trends and relationships discussed in the text. Tables and Figures should be captioned and appended to the written portion of the report. Note: table captions belong ABOVE the table content and figure captions belong BELOW the figure content. There is a distinct difference between the kind of content that goes into figures (i.e. graphics) and tables (i.e. columns of text). Questions are to be incorporated into your results and the trends of the results, reported in the discussion. However you are **ENCOURAGED** to answer questions in the lab numerically, this will save you time.
- (e) **Discussion**: the results must be interpreted based on the stated objective in a clear and concise fashion. Typically a topic of discussion will be suggested and you will incorporate your findings into that topic.
- (f) **References**: all primary sources must be identified using APA/CSE/CBE guidelines.
- (g) **Electronic Appendix**: All digital products that are requested should be listed in an appendix and handed-in as part of an electronic submission.

## 7. Final Paper

The topic and objective of the final paper will be determined in discussion between the instructor and student. In developing the final paper topic students are encouraged to use their own research data (if available) and/or research topics of interest to them. In choosing a topic, the application of geomatics theory and methodology must be tangibly demonstrated. Once a topic is defined and approved with the instructor, it will become the **assigned** final paper topic. The subject matter submitted for grading must be relevant to the **assigned** topic and objective. The requirements for final paper format and expected content differs for students

registered in the undergraduate and graduate sections of this course.

**Undergraduate Students:** The final paper must be formatted and structured according to the instructions for the lab assignments, especially if there are data to analyze as part of the final paper. No specific questions will be assigned as in the lab reports, methods, results and discussion will be relevant to the objective and topic of the final paper. If there are no specific datasets being analyzed, the instructor and student will discuss how the report will be structured. It will still follow a well structured format – most likely using scholarly literature review or monograph style.

**Graduate Students:** The final paper must be formatted following the author instructions for a *submitted paper* to a **peer-reviewed journal**. The journal selected should be appropriate for the topic of your final paper but should conform to an experimental science (or social science)-style **full** article. A full article is one that is reporting new findings from a completed study and not a note or brief. For this reason the journal Science, and the journal Nature are not appropriate. Some suggested journals with high impact factors and appropriate article formatting include, Photogrammetric Engineering and Remote Sensing, Remote Sensing of Environment, and Journal of Geographical Sciences, but you are free to choose. Following author instructions means the figures, tables, line numbering, abbreviation and SI Unit converts, and citations should match the journal instructions. YOU must hand-in a copy of the author instructions with your paper. If there are no specific datasets being analyzed, the instructor and student will discuss how the report will be structured. It will still follow a peer-reviewed format – most likely a scholarly literature review or monograph.

## 8. Academic Regulations

Last VW date: 03/31/2017 for withdrawal without academic penalty. At least two assignments will be graded and returned prior to

this date to provide feedback prior to the VW date.

**Attendance:** Regular attendance is expected of all students enrolled in this course. Please note the following penalty: a student may be debarred from class, laboratories, and examinations by action of the dean/director for persistent non-attendance, or failure to produce assignments to the satisfaction of the instructor. Attendance of all laboratories and completion of **all** laboratory assignments is required to achieve a passing grade. Note that a grade of “F” will be automatically awarded if all assignments are not completed.

**Plagiarism:** Plagiarism, cheating or impersonation in the completion of assignments, and at examinations, are very serious offences. Students caught plagiarizing on tests and laboratories may be debarred from class with further risk of academic penalty and possible expulsion. All graded work must be independent.

## 9. Outline of Topics Covered

Please note that this outline is subject to change without notice.

Topic	Description
1	Introduction to Geomatics
2	Geomatics Technologies
3	Multivariate Data and Statistics in Geomatics
4	Spatial Statistical Methods
5	Spatial Autocorrelation and Geostatistics
6	Modeling Point Patterns
7	Spatial Process Modeling in Human and Physical Geography
8	Advanced Modeling and Decision Support in Geomatics
9	Artificial Intelligence and the Future of Geomatics

## Schedule “A”

### **Section (a) Academic Supports**

**Writing and Learning Support:** The Academic Learning Centre (ALC) offers services that may be helpful to you throughout your academic program. Through the ALC, you can meet with a learning specialist to discuss concerns such as time management, learning strategies, and test-taking strategies. The ALC also offers peer supported study groups called Supplemental Instruction (SI) for certain courses that students have typically found difficult. In these study groups, students have opportunities to ask questions, compare notes, discuss content, solve practice problems, and develop new study strategies in a group-learning format.

You can also meet one-to-one with a writing tutor who can give you feedback at any stage of the writing process, whether you are just beginning to work on a written assignment or already have a draft. If you are interested in meeting with a writing tutor, reserve your appointment two to three days in advance of the time you would like to meet. Also, plan to meet with a writing tutor a few days before your paper is due so that you have time to work with the tutor’s feedback.

These Academic Learning Centre services are free for U of M students. For more information, please visit the Academic Learning Centre website at:

<http://umanitoba.ca/student/academiclearning/>

You can also contact the Academic Learning Centre by calling 204-480-1481 or by visiting 201 Tier Building.

### **University of Manitoba Libraries (UML)**

As the primary contact for all research needs, your liaison librarian (if they weren’t recently fired by Central Administration) can play a vital role when completing academic

papers and assignments. Liaisons can answer questions about managing citations, or locating appropriate resources, and will address any other concerns you may have, regarding the research process. Liaisons can be contacted by email or phone, and are also available to meet with you in-person. A complete list of liaison librarians can be found by subject:

<http://bit.ly/WcEbA1> or name:  
<http://bit.ly/1tJ0bB4>.

In addition, general library assistance is provided in person at 19 University Libraries, located on both the Fort Garry and Bannatyne campuses, as well as in many Winnipeg hospitals. For a listing of all libraries, please consult the following: <http://bit.ly/1sXe6RA>. When working remotely, students can also receive help online, via the Ask-a-Librarian chat found on the Libraries’ homepage:

[www.umanitoba.ca/libraries](http://www.umanitoba.ca/libraries).

### **Section (b) Mental Health**

**For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781.**

**Student Counselling Centre:** Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. *Student Counselling Centre:*

<http://umanitoba.ca/student/counselling/index.html>

474 University Centre or S207 Medical Services  
(204) 474-8592

**Student Support Case Management:** Contact the Student Support Case Management team if you are concerned about yourself or another student and don’t

know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.

*Student Support Intake Assistant*

<http://umanitoba.ca/student/case-manager/index.html>

520 University Centre  
(204) 474-7423

**University Health Service:** Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.

*University Health Service*

<http://umanitoba.ca/student/health/>

104 University Centre, Fort Garry Campus  
(204) 474-8411 (Business hours or after hours/urgent calls)

**Health and Wellness:** Contact our Health and Wellness Educator if you are interested in information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.

*Health and Wellness Educator*

<http://umanitoba.ca/student/health-wellness/welcome.html>

[Katie.Kutryk@umanitoba.ca](mailto:Katie.Kutryk@umanitoba.ca)

469 University Centre  
(204) 295-9032

**Live Well @ UofM:** For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site:

<http://umanitoba.ca/student/livewell/index.html>

### **Section (c) Copyright Information**

All students are required to respect copyright as per Canada's *Copyright Act*. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community. For more information:

<http://umanitoba.ca/copyright>

### **Section (d) Rights and Responsibilities**

**Your rights and responsibilities:** As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The [Academic Calendar](#)

<http://umanitoba.ca/student/records/academic-calendar.html> is one important source of

information. View the sections *University Policies and Procedures* and *General Academic Regulations*.

While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final **grade appeals**. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form:

<http://umanitoba.ca/registrar/>

- You are expected to view the General Academic Regulation section within the Academic Calendar and specifically read

the **Academic Integrity** regulation. Consult the course syllabus or ask your instructor for additional information about demonstrating academic integrity in your academic work. Visit the Academic Integrity Site for tools and support

<http://umanitoba.ca/academicintegrity/>

View the **Student Academic Misconduct** procedure for more information.

- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected to conduct yourself in an appropriate respectful manner. Policies governing behavior are included in the next section.

## **Section (e) Policies and Services Information**

### **Respectful Work and Learning Environment**

[http://umanitoba.ca/admin/governance/governing\\_documents/community/230.html](http://umanitoba.ca/admin/governance/governing_documents/community/230.html)

### **Student Discipline**

[http://umanitoba.ca/admin/governance/governing\\_documents/students/student\\_discipline.html](http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html) and,

### **Violent or Threatening Behaviour**

[http://umanitoba.ca/admin/governance/governing\\_documents/community/669.html](http://umanitoba.ca/admin/governance/governing_documents/community/669.html)

- If you experience **Sexual Assault** or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The **Sexual Assault** policy may be found at: [http://umanitoba.ca/admin/governance/governing\\_documents/community/230.html](http://umanitoba.ca/admin/governance/governing_documents/community/230.html) More information and resources can be found by reviewing the Sexual Assault

site <http://umanitoba.ca/student/sexual-assault/>

## **Intellectual Property**

- For information about rights and responsibilities regarding **Intellectual Property** view the policy:

[http://umanitoba.ca/admin/governance/media/Intellectual\\_Property\\_Policy\\_-\\_2013\\_10\\_01.pdf](http://umanitoba.ca/admin/governance/media/Intellectual_Property_Policy_-_2013_10_01.pdf)

## **Department Policies**

For information on regulations that are specific to Environment and Geography, read the section in the Academic Calendar for the Department and on:

<http://umanitoba.ca/faculties/environment/departments/geography/index.html>

Contact an **Academic Advisor** within our faculty/college or school for questions about your academic program and regulations <http://umanitoba.ca/academic-advisors/>

## **Student Advocacy**

Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.

<http://umanitoba.ca/student/advocacy/>  
520 University Centre  
204 474 7423  
[student\\_advocacy@umanitoba.ca](mailto:student_advocacy@umanitoba.ca)