WILFRID LAURIER UNIVERSITY

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Inspiring Lives.

Course Syllabus

GG501 Spatial Knowledge Mobilization
Geography and Environmental Studies, Faculty of Science, Waterloo Campus
Winter 2022

I acknowledge that in Kitchener, Waterloo, Cambridge and Brantford we are on the traditional territory of the Neutral, Anishnawbe, and Haudenosaunee peoples.

The course schedule, evaluation scheme, methodology, assessments, lab and tutorial attendance, testing and final exam policies have been planned based on current public health guidelines. Should these guidelines change, any adjustments will be communicated to students.

Instructor Information

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Email: crobertson@wlu.ca
Weekly Office Hours† (after class) or online By Appointment
Course Website**:** https://colinr23.github.io/gg501/

Course Information

This course covers quantitative aspects of knowldedge mobilization from a spatial perspective. Specifically we examine how the outputs generated from environmental data science workflows can be critiqued, deployed, and used by different stakeholder communities. The emphasis in the class is on visualization of data and models commonly used with spatial/environmental datasets.

Bricker Academic Building BA305, Tuesdays 2:30 – 5:20 pm

Course Overview and Approach

Translating data into actionable insights requires more than analytical tools; the ability to communicate, visualize, deconstruct and interrogate analytic results is an increasingly required set of skills for environmental professionals. This course will build the skills and knowledge needed to interpret, critique, and communicate outputs from data-analytic workflows and processes. Key issues discussed will include parameterization, sensitivity analysis, visualization, and summarizing results for a variety of audiences.

Course Goals and Learning Outcomes

This course will develop skills that allow students to ask critical questions of environmental data analytic tools. We will focus on visualization and model assessment techniques. Students will be expected to work with statistical programming language R in the course.

By the end of this course students should be able to:

- create and critique visualizations for disparate data types
- critically evaluate statistical and machine learning model output
- critically evaluate the data quality dimensions of environmental data workflows
- describe approaches for incorporating data science outputs into environmental decision making

Course Materials

Required Texts (freely available online)

- Wickham, Hadley, Danielle Navaro, and Thomas Lin Pedersen. 2021. Ggplot2: Elegant Graphics for Data Analysis. 3rd ed. Springer. https://ggplot2-book.org/index.html.
- Chang, Winston. 2021. R Graphics Cookbook, 2nd Edition. https://r-graphics.org.

Additional Readings

- Wilke CO. 2019. Fundamental of Data Visualization: A Primer on Making Informative and Compelling Figures. O'Reilly Media. Chicago, https://clauswilke.com/dataviz/

Course Software

- This course will use R, RStudio, and the tidyverse packages.
- Students need to have a computer with R and RStudio Desktop installed (both are free software).
- Windows users:
  - Download and install R from CRAN https://cran.r-project.org/bin/windows/base/release.htm
  - Download and install RStudio Desktop from RStudio https://www.rstudio.com/products/rstudio/download/
  - Open RStudio to check that there are no error messages
- Mac OS X users:
  - Go to CRAN https://cran.r-project.org/
  - Click "Download R for (Mac) OS X"
  - Download and install the appropriate pkg file for your version of OS X
  - Download and install RStudio Desktop from RStudio https://www.rstudio.com/products/rstudio/download/
  - Open RStudio to check that there are no error messages
- Linux users:
  - R is available through most Linux package managers. You can download the binary files for your distribution from CRAN https://cran.r-project.org/. Or you can use your package manager (e.g. for Debian/Ubuntu run sudo apt-get install r-base and for Fedora run sudo yum install R).
  - Download and install RStudio Desktop from RStudio for your distrobution https://www.rstudio.com/products/rstudio/download/
  - Open RStudio to check that there are no error messages
- The tidyverse packages https://www.tidyverse.org/packages/ can be installed from inside RStudio by running install.packages("tidyverse") in the R Console or from the Packages tab in the lower right quarter of RStudio.

Student Evaluation

Assessment	Weighting	Due Date
Assignments (3x15%)	45%	Jan 25; Mar 01; Mar 15
Term Project	40%	Apr 05
Participation	15%	N/A
Total	**100%**	

Learning Activities/Assignments

Assignments: Three assignments will require students to demonstrate data visualization and critique skills learned in the course. Students will be able to use their own datasets or any publicly available datasets of their choosing.

Term Project: Students will work on a major project which will require either an independent data analysis project, or a detailed critique/reproduction of an existing published analysis.

Participation: Students will be expected to attend and participate in designated course times. Participate includes contributing to discussions and working collaboratively with other students when needed.

Weekly Schedule(s) (subject to change)

Week # - Date	Topic	Tools	Delivery Mode
1-Jan 4	Spatial knowledge mobilization; key concepts	R, R-Studio	Remote
2-Jan 11	Tabular visualization	R (base, ggplot2)	Remote
3-Jan 18	Time series visualization	R (ggplot2)	Remote
4-Jan 25	Spatial visualization	R (ggplot2, tmap, mapsf)	Remote
5-Feb 01	Spatial visualization	R (ggplot2, tmap, mapsf)	Remote
6-Feb 08	Model visualization	R (ggplot2, broom, jtools)	Remote
Feb 15	Reading Week		No Class
7-Feb 22	Work Period/Catch Up		Remote Office Hours / Help Session
8-Mar 01	Model parameterization and validation I	R (stat, lme4)	TBD
9-Mar 08	Model parameterization and validation II	R (randomForest, kmeans, spgwr)	TBD
10-Mar 15	Modelling: Socio-Technical Critique	Readings	TBD
11-Mar 22	Project Work Period		TBD Office Hours / Help Session
12-Mar 29	Communication strategies for EDA	R markdown / Shiny	TBD
13-Apr 05	Term Project Presentations		TBD

University and Course Policies

1. **Academic Calendars:** Students are encouraged to review the Academic Calendar for information regarding all important dates, deadlines, and services available on campus.

2. **Intellectual Property:** The educational materials developed for this course, including, but not limited to, lecture notes and slides, handout materials, examinations and assignments, and any materials posted to MyLearningSpace, are the intellectual property of the course instructors. These materials have been developed for student use only and they are not intended for wider dissemination and/or communication outside of a given course. Posting or providing unauthorized audio, video, or textual material of course content to third-party websites violates instructors' intellectual property rights, and the Canadian Copyright Act. Recording lectures in any way is prohibited in this course unless specific permission has been granted by instructors. Failure to follow these instructions may be in contravention of the university's Student Non-Academic Code of Conduct and/or Code of Academic Conduct, and will result in appropriate penalties. Participation in this course constitutes an agreement by all parties to abide by the relevant University Policies, and to respect the intellectual property of others during and after their association with Wilfrid Laurier University.

3. **Accessibility:** Students requiring accommodation are advised to contact Laurier's Accessible Learning Centre for information regarding its services and resources.

4. **Plagiarism:** Wilfrid Laurier University uses software that can check for plagiarism. If requested to do so by course instructors, students are required to submit their written work in electronic form and have it checked for plagiarism. (Approved by Senate May 14, 2002).

5. **Academic Integrity:** Laurier is committed to a culture of integrity within and beyond the classroom. This culture values trustworthiness (e.g., honesty, integrity, reliability), fairness, caring, respect, responsibility and citizenship. Together, we have a shared responsibility to uphold this culture in our academic and nonacademic behaviour. The University has a defined policy with respect to academic misconduct. As a Laurier student you are responsible for familiarizing yourself with this policy and the accompanying penalty guidelines, some of which may appear on your transcript if there is a finding of misconduct. The relevant policy can be found at Laurier's academic integrity website along with resources to educate and support you in upholding a culture of integrity. Ignorance is not a defense.

6. **Use of Zoom for Instructional Purposes**: Wilfrid Laurier University uses a range of technologies to facilitate in-person and remote instruction. Zoom is currently used for remote course delivery, including lectures, seminars, and group office hours, which may be recorded, stored and shared through MyLearningSpace for access by students in the course. For these course activities, students are permitted to turn off their cameras or use an alternative name to maintain their privacy after they have confirmed this with their course instructors. Student personal information is collected and used in the course in accordance with University policies and the Notice of Collection, Use or Disclosure of Personal Information. All exams and mid-terms in the course that are conducted online will be proctored using only technologies approved for assessment at Laurier as outlined on this page.

7. **Late Assignment Policy:** Late assignments will be penalized at 5% per day for a period up to 1 week.

8. **Foot Patrol, the Wellness Centre, and the Student Food Bank:** The University approved the inclusion of information about select wellness and safety services and supports on campus in the course information provided to students. (Approved by Senate November 28, 2011.) Specific language (by campus) is provided below.

Multi-campus Resource:

- Good2Talk is a postsecondary school helpline that provides free, professional and confidential counselling support for students in Ontario. Call 1-866-925-5454 or through 2-1-1. Available 24-7.

Kitchener/Waterloo Resources:

- Waterloo Student Food Bank: All students are eligible to use this service to ensure they're eating healthy when overwhelmed, stressed or financially strained. Anonymously request a package online 24-7. All dietary restrictions accommodated.

- Waterloo Foot Patrol: 519.886.FOOT (3668). A volunteer operated safe-walk program, available Fall and Winter daily from 6:30 pm to 3 am. Teams of two are assigned to escort students to and from campus by foot or by van.

- Waterloo Student Wellness Centre: 519-884-0710, x3146. The Centre supports the physical, emotional, and mental health needs of students. Located on the 2nd floor of the Student Services Building, booked and same-day appointments are available Mondays and Wednesdays from 8:30 am to 7:30 pm, and Tuesdays, Thursdays and Fridays from 8:30 am to 4:15 pm. Contact the Centre at x3146, wellness@wlu.ca or @LaurierWellness. After hours crisis support available 24/7. Call 1-844-437-3247 (HERE247).

Brantford Resources:

- Brantford Student Food Bank: All students are eligible to use this service to ensure they're eating healthy when overwhelmed, stressed or financially strained. Anonymously request a package online 24-7. All dietary restrictions accommodated.

- Brantford Foot Patrol: 519-751-PTRL (7875). A volunteer operated safe-walk program, available Fall and Winter, Monday through Thursday from 6:30 pm to 1 am; Friday through Sunday 6:30 pm to 11 pm. Teams of two are assigned to escort students to and from campus by foot or by van.

- Brantford Wellness Centre: 519-756-8228, x5803. Students have access to support for all their physical, emotional, and mental health needs at the Wellness Centre. Location: Student Centre, 2nd floor. Hours: 8:30 am to 4:15 pm Monday through Friday. After hours crisis support available 24/7. Call 1-884-437-3247 (HERE247).