Zoology 955
LIMNOLOGY SEMINAR: A limnologist's introduction to spatial analysis and GIS in R
Official Course Name Explr and Wrk with LTER data

Spring Semester 2018
1 credit

Course Designations and Attributes
Graduate 50%

Seminars: Tuesdays 1:30p-2:30p in Hasler Laboratory of Limnology, Room 210

Instructional Mode
All face-to-face.
This seminar will be tutorial-based and focused on developing a skill set that can be applied in graduate student research.

Credit Hours
This class meets one 50-minute class period each week over the spring semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc) for about 2 hours out of the classroom for every class period. The syllabus includes additional information about meeting times and expectations for student work.

Instructor
Dr. Hilary Dugan, Assistant Professor, Center for Limnology
Department of Integrative Biology
Office hours by appointment.
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Course Description and Overview
If you have never used GIS in your research, you may think of it as a great way of creating maps (and it is!). But more importantly, GIS is a good foundation for applying spatial analyses. As ecologists, much of our research has an inherent spatial component (sampling locations, species distributions, site heterogeneity). The objective of this course is to provide an introduction to handling and manipulation spatial data so that students can have the skillset and resources to apply spatial analyses in their own research.

This course will cover topics such as: handling spatial data, coordinates and projections, raster datasets (like climate or land cover data), data interrogation, modifying spatial data, maps, and the basics of satellite imagery. Even if you do not currently use spatial data in your research, it is advantageous to know how to complete simple GIS tasks, both for your own research and for your future career.

Requisites
Graduate or professional standing.

Additional Recommendations:
Students should bring laptops to class, with the latest version of R and RStudio installed.
Students should be familiar (beginner level) with the R programming language.

If you have never used R and would like to take this course, it does not take long to get acquainted. There are plenty of online courses (*e.g.* https://www.coursera.org/learn/r-programming), and meaty text documents, (*e.g.* https://cran.r-project.org/doc/manuals/R-intro.pdf).
I highly recommend using RStudio as a code editor. RStudio provides a wealth of learning resources, and handy desk cheatsheets.

Course Aim
After completion of this seminar, students will be able to develop the knowledge and skills to use and analyze spatial data in graduate student research.

Course Learning Outcomes
- Identify the differences between different types of spatial objects
- Understand and manipulate coordinate reference systems
- Discover, organize, and work with a range of spatial data objects
- Apply statistical techniques to spatial data
- Create useable outputs, such as maps and summary statistics

GRADING
Grades will be based on short assignments (25%), participating in class discussion (50%), and a final project based on individual research topics that will be presented during the final two weeks of the semester (25%). Numerical grades are assigned as follows: 93-100 (A), 88-92 (AB), 82-87 (B), 78-81 (BC).

FINAL PROJECT
- 10 minutes presentation
- You can use your own computer, but a thumb drive on the conference room computer would enable better ZOOM connectivity
- Presentation should mainly be in R/R Markdown, but other sources are ok (thinking figures, showing data sources, etc...)
- Presentation should cover how you have applied/are applying/will apply spatial data and data analysis in your own research and future goals
- Not necessary, but incredibly useful if you point out awesome R packages, hurdles, unexpected frustrations/successes

TIMETABLE (as of 1/8/2018)

Date	Topic	Useful R Packages
Jan 23	Introduction to Spatial Data	
Jan 30	Coordinate Reference Systems Projections	Packages: - rgdal
Feb 6	Vector Data - Types	Packages: - sp

	- Reading/Writing	- sf - raster - rgeos
Feb 13	Guest Lecture	
Feb 20	Raster Data - Types Reading/Writing	
Feb 27	Vector Data Manipulation - Aggregating - Overlays - Spatial Queries - Ex) National Hydrography Dataset	
Mar 6	Raster Data Manipulation - Raster Stacks/Bricks - Ex) Global Climate Model Data	
Mar 13	Spatial Data Analysis - Autocorrelation	
Mar 20	Spatial Data Analysis - Interpolation	
Mar 27	SPRING BREAK	
Apr 3	Case Study – FLAME with Luke Loken	
Apr 10	Satellite Imagery - Thresholding - Classification	Remote sensing R packages: - RStoolbox - landsat - MODISTools - hsdar Visualization: rasterVis
Apr 17	QGIS introduction	
Apr 24	Final Reports	
May 1	Final Reports	

OTHER COURSE INFORMATION

Resources:
Applied Spatial Data Analysis with R
(http://gis.humboldt.edu/OLM/r/Spatial%20Analysis%20With%20R.pdf)

RULES, RIGHTS & RESPONSIBILITIES

Refer to the Guide's Rules, Rights and Responsibilities

ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be

forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus statement: "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA." http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

DIVERSITY & INCLUSION

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world." https://diversity.wisc.edu/