Course Syllabus

University of Maryland Center for Environmental Science	Environmental Statistics I 3 credits	MEES 698B Fall 2020

Course Objectives / Overview

This course will extend the quantitative training for students in the environmental sciences. It will explore the basic practices of statistics to inter-disciplinary environmental data. The goal is to train students with the statistical knowledge and tools needed to conduct statistical analysis in their own research. The statistical programming language R is used in class, to complete homework sets, and to analyze online data.

Expected Learning Outcomes

1. Gain basic skills in data analysis using R

2. Apply fundamental concepts of applied statistics to environmental data

3. Enhance professional development through integrated data presentation

INSTRUCTOR DETAILS:
Dong Liang
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CLASS MEETING DETAILS:
Dates: Monday Wednesday
Times: 10:00-11:30 am,
Originating Site: CBL
IVN bridge number: (830415)
Phone call in number: (301-779-2901)
Room phone number: (410-326-7381)

CURRICULUM FULLFILMENT:
MEES 698B fulfills Professional Development or elective MEES requirements.

Prerequisites
N/A

Teaching Assistant
N/A

4. Produce a draft manuscript written for a peer-reviewed journal

Course Assessment / Grading

Grades will be based on the performance of two take-home exams, and an individual project and homework problem sets. The exams and individual project will represent 30% of the grade. The homework problem sets will make up the remaining 10%. In cases where students are between lower and higher grades, a high level of participation in the class discussions and class, in general, will win the day for the higher grade.

Homework problems are essential to the understanding of the materials. Although the homework comprises only 10% of the final grade, performance on the exams is usually correlated with effort on the homework problems. Homework will usually be assigned on Tuesday, due the next Tuesday, with discussion during lecture and optional recitation session.

Whereas plagiarism will not be tolerated, students ARE encouraged to work together to learn from one another (especially those from the same IVN site) and solve problems in a collaborative and collegial way (aside from the take-home exam).

Tentative Weekly Course Schedule

Date	Topic	Reading
31-Aug	Picture data with graphs	Crawley Ch 2
2-Sep	Describe data with numbers	Crawley Ch 2
9-Sep	Estimation & R intro	Crawley Ch 5
14-Sep	Normal distribution	Crawley Ch 7.2
16-Sep	Sampling 1	Thompson Ch 1
21-Sep	Sampling 2	Ch 2-6
23-Sep	Confidence intervals, testing	Crawley Ch 8
28-Sep	Student's t-test	Crawley Ch 8
30-Sep	Correlation & Regression	Chatterjee Ch 2

5-Oct	Simple linear regression	Chatterjee Ch 3
7-Oct	Multiple linear regression	Chatterjee Ch 3
12-Oct	Regression model diagnostics	Chatterjee Ch 4
14-Oct	Model selection	Chatterjee Ch 11
19-Oct	Transformation of variables	Chatterjee Ch 6
21-Oct	Qualitative variables as predictor	Chatterjee Ch 5
26-Oct	1-way ANOVA	Oehlert Ch 3
28-Oct	ANOVA – Assumptions and heterogeneous variances	Oehlert Ch 6
2-Nov	ANOVA sample size and power	
4-Nov	ANOVA – Multiple comparisons tests	Oehlert Ch 5
9-Nov	ANOVA – 2 way & factorial	Oehlert Ch 8
11-Nov	ANOVA – blocking designs and random effects	Oehlert Ch 13
16-Nov	ANOVA – nested effects and subsamples	Oehlert Ch 12
18-Nov	ANOVA – split plots, etc.	Oehlert Ch 16
23-Nov	ANOVA – repeated measures	Oehlert Ch 16
30-Nov	Introduction to time series analysis	Brockwell & Davis Ch 1; Shumway Ch 2
2-Dec	Introduction to geostatistics	Webster Ch 1
7-Dec	Class presentations	
9-Dec	Class presentations	

Required textbooks, reading and/or software or computer needs

Crawley, M.J. 2007. The R Book. John Wiley and Sons. ISBN 9780470510247

Reference Textbooks:

Oehlert, G.W. 2000. First Course in Design and Analysis of Experiments Chatterjee, S., Hadi, A.S. and Price, B. 2000. Regression Analysis by Example Wood, S. 2006, Generalized Additive Models, An Introduction with R, Chapman & Hall Thompson, S.K. 2012, Sampling, Wiley Brockwell P.J., and Davis R.A. 2002. Introduction to time series and forecasting. 2nd ed. Springer: New York. Shumway, R.H., and Stoffer D.S. 2014. Time series analysis and its applications. 3rd ed. Webster, R., Oliver, M.A. 2007, Geostatistics for Environmental Scientists. 2nd ed. Wiley

Course Communication

We will be using the distance learning tool, Edge (and Moodle) for storing and disseminating class information – class notes, R code and output, assigned readings, and even discussion threads if you wish. Each student will be given a personal login and password to access the site. Materials for the next class will be posted no later than 12 hours before the beginning of the class. You are strongly encouraged to download and bring the R code and output to each class as these are critical components of the lectures and may be hard to follow without having these in front of you.

For the first several class periods, we will email reminders to get the info for class and where the info will be located. Please bookmark the Moodle site (https://moodle.cbl.umces.edu/login/index.php) in your web browser so that you can rapidly get there.

Resources

cran.r-project.org/doc/manuals/R-intro.pdf

www.statmethods.net/index.html

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved of various academic and research-related policies by which all students and faculty must abide.

Please visit http://www.umces.edu/consolidated-usm-and-umces-policies-and-procedures for a full list of campus-wide academic policies.

Course-Specific Policies and Expectations

[Individual project*]

1. Decide on a series of questions of interest and the associated hypotheses and predictions that you will attempt to test and answer with inferential statistics covered in class.

2. Design an experiment/study or analysis (if using an existing dataset) to answer these questions.

3. Identify and obtain or generate a dataset to analyze.

4. Analyze the data and prepare a report as you would for the scientific journal 'Ecology'. Include in the Discussion a section on how you might better design the study/experiment if you had the opportunity to do things over again. Report limited to 10 double spaced pages of text (including literature cited) with 1" margins and 12 pt font. The title page, tables, and figures are in addition to a 10-page limit. Be concise yet informative, organized, and well written. Everyone will have a chance to present their project findings in the standard 15-minute talk format (12-minute talk, 3 minutes for questions) on the last day of class. This should be a good exposure to giving talks at scientific meetings, but you'll be among friends in our case. The 15-minute limit will be rigidly enforced.

Project presentations are due no later than the day of the first-class presentation. Project reports are due no later than the first day of the final week denoted above in the class schedule. Electronic submissions via email are encouraged. Failure to meet the deadline will result in 10% deducted for every additional day late.

* Well done projects are sometimes good enough to publish or may become a chapter in your thesis, so keep this in mind during your project.

ACADEMIC INTEGRITY

> The University of Maryland Center for Environmental Science (UMCES) is an academic community and its fundamental purpose is the pursuit of knowledge. Like all other communities, UMCES can function properly ONLY if its members adhere to clearly established goals and values. Essential to this fundamental purpose is the commitment to the principles of truth and academic honesty. UMCES' Code of Academic Integrity is designed to ensure that the principle of academic honesty is upheld. While all members of the community share this responsibility, the Code of Academic Integrity is designed so that special responsibility for upholding the principle of academic honesty lies with the students.
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> Academic integrity refers to a set of shared values, principles, behaviors, and skills that lie at the heart of learning and scholarship. Students are expected to maintain the highest level of integrity throughout their academic pursuits.

Intellectually honest academic work represents independent analysis and acknowledges all sources of information that contribute to the ideas being explored. The failure to uphold academic integrity includes: falsification of data; improper assignment of credit; and any representation of the ideas, words, or work of others as one's own. When students misrepresent their work, faculty cannot accurately assess their performance or provide the feedback students need to learn. Students who plagiarize or cheat harm themselves and ultimately damage the value and reputation of education for everyone.

All students are expected to adhere to this Code. UMCES does not tolerate academic dishonesty. All acts of academic dishonesty will be dealt with in accordance with the provisions of this code.

Participation in this course using the edX learning management system through the USMx partnership means that you agree to the following:

- Complete all tests and assignments on my own, unless collaboration on an assignment is explicitly permitted.
- Maintain only one user account and not let anyone else use my username and/or password.
- Not engage in any activity that would dishonestly improve my results, or improve or hurt the results of others.
- Not post answers to problems that are being used to assess student performance.

Academic integrity violations in this course would include but are not limited to:

- Sharing of answers to the knowledge checks and final exam in any electronic form
- Violations of Copyright and Intellectual Property
- Copying on exams
- Plagiarizing material from published sources or from current or UMCES students
- Submitting someone else's work as your own

- Helping other students to cheat.

If you have any questions regarding what is permissible, please contact your instructor for guidance.

COPYRIGHT & INTELLECTUAL PROPERTY

Class materials are the property of the instructor – please do not sell them or post them on a website. Please also be reminded that course materials may not be reproduced for anything other than personal use without the permission of the course instructor. As a student, you own the work that you create as part of your University academic and research activities.

ACCESSIBILITY

UMCES is proactive in our efforts to make this course accessible to all learners.
We are committed to meeting the following goals:

- Captions and transcripts are offered for all video and audio content.
- Text content is formatted
  - With appropriate color contrast; and
  - To be compatible with screen readers.
- Graphics and charts include meaningful alternative text and long descriptions.
- Documents and other files are formatted to be compatible with screen readers.
- Interactive components, such as drag and drop activities and the final exam, can be navigated using a keyboard.
- Content is offered in multiple formats wherever possible to meet the needs of diverse learners.