ESM 566/CE 566/666 Environmental Data Analysis
Remote via Zoom @ https://pdx.zoom.us/j/91731640857
M & W: 10:15am-12:15pm
Instructor: Kelly E. Gleason (SRTC B1-04D, Phone: 5-2334, email: k.gleason@pdx.edu)
Gleason office hour: Tuesday 10-11am and Thursday 2-3 pm or by arrangement
Teaching assistant: Lara Jansen (email: ljansen@pdx.edu)
Jansen office hour: Monday 1-2 pm or by arrangement

Portland State University Land Acknowledgement:
Portland State University is located near the heart of downtown Portland, Oregon in Multnomah County. We honor the Indigenous people whose traditional and ancestral homelands we stand on, the Multnomah, Kathlamet, Clackamas, Tumwater, Watlala bands of the Chinook, the Tualatin Kalapuya and many other Indigenous nations of the Columbia River. In remembering these communities, we honor their legacy, their lives, and their descendants.It is important to acknowledge the ancestors of this place and to recognize that we are here because of the sacrifices forced upon them.

Zoom expectations: Zoom classes will be recorded and made available on D2L within 24 hours. You are expected to come to class and have your video on during class, unless there is a reason for you not to show your video. Also, please mute yourself during the class except when it is your turn to speak. Show up to Zoom as though you would show up to class (dressed and ready to engage). Be respectful of others always.

Course learning goals and objectives:
The main purpose of this course is to help students ***think statistically*** and use statistics effectively in ***framing, conducting, and reporting*** their research. At the end of the term, students are expected to understand and be able to use statistical analyses within an overall environmental research framework (i.e., conceptual model, problem formulation, sampling/study design, model parameter estimates, hypothesis testing, statistical inference, and environmental conclusions). Specifically, students are expected to

- Design statistically sound field studies and lab experiments
- Graphically and numerically summarize the data
- Select appropriate statistical methods, and be able to assess the assumptions and find possible remedies if the assumptions are violated
- Draw statistical conclusions and understand the uncertainty associated with each statistical decision (e.g., Type I and II error)
- Communicate scientific results effectively
- Critically interpret statistical analyses in the environmental research literature
- Use statistical computing programs, specifically, R, effectively to analyze environmental data

Textbook:

Gotelli, N. J. and A. M. Ellison. 2013. *A Primer of Ecological Statistics*. Sinauer Associates, Inc. Publishers, Sunderland, MA. (2nd edition) (required)

If you choose to purchase the 1st edition of the textbook, it is up to you to coordinate the page numbers of the equivalent readings from the 2nd edition.

Software:

- *R* (free downloadable from <http://cran.stat.ucla.edu/>. For the basic R tutorial to get a start with R, please go to <http://www.cyclismo.org/tutorial/R/> or you can go to YouTube <http://www.youtube.com/> and search for "R tutorial"
- *RStudio*: a text editor for R and others (free downloadable from <http://rstudio.org/download/desktop>). For more helpful documents on using RStudio, please go to <http://rstudio.org/docs/> and you can also watch a 2-minute Screencast on the RStudio website <http://rstudio.org/>.
- *D2L*: an on-line learning system (https://d2l.pdx.edu/). You need to use your ODIN user name and password to log in. Class materials such as syllabus, homework assignments, lecture PowerPoint presentations, grades, and extra readings will be posted in "D2L". Students are encouraged to use "D2L" to post questions, comments, and suggestions. **D2L's email system works in a mysterious way and I strongly recommend that you don't use D2L to email me.**

Useful R Resources:

- The Comprehensive R Archive Network <http://cran.us.r-project.org/> for free R reference manuals/books and other information
- UCLA's IDRE Institute for Digital Research and Education: Rich resources for helping you learn and use R <http://www.ats.ucla.edu/stat/r/>
- Stack overflow <https://stackoverflow.com/>: many R-related questions and answers.
- R-Bloggers: R news and tutorials contributed by >500 R bloggers <http://www.r-bloggers.com/>
- The R Journal <http://journal.r-project.org/>
- R for Data Science by Wickham and Grolemund: A wonderful online and print book with tips for manipulating and evaluating data in R <https://r4ds.had.co.nz/>

Approach:

This class emphasizes tremendously on team-work and student-based learning. Each class period will start with a brief introduction, an in-class group exercise with worksheets, and class discussion. The class will be divided into groups each with 2-3 members. Each group will work together on the assignments during the class, and present/critique the results and interpretation among the group members.

Peer-evaluation:

Since the class emphasizes tremendously on team-work and student-based learning, each member will have a chance to evaluate their peers' performance at the end of the term. The outcome of the peer evaluation will affect a student's final grade.

Grades:

- "Homework" (3 homework exercises: 60%): Late homework will be accepted but will suffer a 10% per day grade reduction.
- Class and group participation: 5%
- Final project (35%): You are required to formulate a conceptual model, study question, collect/"borrow" data, analyze the data and interpret the results with relation to the study question, and write a professional research paper.

Note: This syllabus is tentative and may be changed slightly throughout the quarter to accommodate scheduling and learning objectives.

Tentative Course Outline

Week	Topics	Reading
1	Research framework; Population vs. sample Parameter estimates;	Chapter 3 (p.58)
2	Exploratory data analysis: Display data graphically using ggplot and lattice Summarize data numerically using dplyr	Ch. 8 (p.212-236)
3	Hypothesis testing Analysis of Variance (ANOVA) Experimental design, Statistical power; **(Due: Homework 1 due October 13, 2020 12:59pm)**	Ch. 4 (p.79) Ch. 10 (p.288-300) Ch. 10 (p.300-308)
4	Simple ordinary least-square linear models: Estimation and inference Residual analysis and diagnostic checks **(Due: "Conceptual model/Study question")**	Chapter 9 (p239-264)
5	Multiple linear models: Variance inflation factor and multicollinearity Step-wise regression hypothesis-testing **(Due: Dataset descriptions)** **(Due: Homework 2 due October 27, 2020 12:59pm)**	Chapter 9 (p275) Chapter 9 (p282)
6	Generalized Least Squares (GLS) models for Dependent data Heterogeneity	Zuur et al. (2009)
7	Generalized linear models (GLM): Logistic regression models **(Due: Homework 3 due November 10, 2020 12:59pm)**	Guisan et al. (2002) *Ecol. Modeling 157*
8	Multi-level regression models for nested data Random intercept models Random slope models Random intercept and slope models **(Due: Draft of Final Paper due November 17, 2020 12:59 pm)**	Zuur et al. (2009)
9	Tree-based models: Regress tree models;	De'ath & Fabricius (2000) *Ecology 81*

	Classification tree models; Random Forests and Boosted models **(Due: Peer review due November 24, 2020 12:59 pm)**
10	Time-series: Autoregression (AR) Moving-averaging (MA) ARIMA models **(Work on Revision of Final Paper)**
11	**Final paper due (Wednesday December 9, 2020 by 5:00 pm)**

General student information:

All students are expected to embrace a culture of respect, inclusion, and academic integrity. Plagiarism will not be tolerated. Students must abide by the University's conduct policies here: https://www.pdx.edu/dos/psu-student-code-conduct/

Don't forget to check out the ESM department and School of Environment webpages:
http://www.pdx.edu/esm/
http://www.pdx.edu/environment/

Advising & Career Services: https://www.pdx.edu/careers/ and https://www.pdx.edu/careers/what-can-i-do-degree-environmental-studiesenvironmental-sciences

Library Research Tutorials: http://guides.library.pdx.edu/home/howto and http://guides.library.pdx.edu/biology

Safe Campus: If you have not done so already, please complete the Safe Campus Module in D2L. The module should take approximately 30 to 40 minutes to complete and contains important information and resources. If you are uncomfortable completing the module, please send an email to saveact@pdx.edu to request an exemption. If you or someone you know has been harassed or assaulted, you can find the appropriate resources at Sexual Misconduct Prevention & Response: www.pdx.edu/sexual-assault/. PSU's Student Code of Conduct makes it clear that violence and harassment based on sex and gender are strictly prohibited and offenses are subject to the full realm of sanctions, up to and including suspension and expulsion. http://www.pdx.edu/sexual-assault/safe-campus-module

Learning Center/Free Tutoring: http://www.pdx.edu/tutoring/ PSU library rm 245

Writing Center: for class assignments, resumes... http://www.writingcenter.pdx.edu/ Cramer rm 188
Please consult the Purdue OWL regarding ***plagiarism*** and other writing issues: https://owl.english.purdue.edu/owl/resource/589/01/

Math: https://www.pdx.edu/math/math-resource-lab; Department of Mathematics and Statistics provides free tutors for lower division algebra, calculus and statistics: https://www.pdx.edu/math/resources

Disability Resource Center: If you are a student with a documented disability and are registered with the Disability Resource Center, please contact me so that we can arrange whatever academic accommodations you need.

Veterans: If you are a Veteran and have questions about University services or need assistance with your transition from military to campus life, please contact Chris Goodrich, Coordinator of Veterans Services at the Office of Veterans' Services, SMSU room 425.

Multicultural Centers: https://www.pdx.edu/dmss/multicultural-student-center ; https://www.pdx.edu/dmss/native-american-student-community-center ; https://www.pdx.edu/dmss/la-casa-latina-student-center

Queer Resource Center: www.pdx.edu/queer

SAFE office: