ESS 330 - Quantitative Reasoning for Ecosystem Science
Spring 2017

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Office Hours: CA: Wednesdays 11-12; ML: Wednesdays 11-12; SP: Wednesdays 11-12; KD: Wednesdays, 11-12
Or by appointment for any of the above.

Class Times:

Lectures: Mondays and Wednesdays from 10:00 – 10:50, Shepardson 212
Labs: Section 01: Thursdays, 8:00 – 9:50 in NR 232, West Lab
Section 02: Thursdays, 2:00 – 3:50 in NR 232, West Lab
Section 03: Thursdays, 4:00 – 5:50 in NR 232, West Lab
Section 04: Fridays, 10:00 – 11:50 in NR 232, GIS Lab

Prerequisite: MATH 155/160; STAT 301/307/315; ESS 211 or LIFE 320

Please familiarize yourself with Colorado State University Policies, such as student responsibilities, academic integrity - including cheating and plagiarism, and proper classroom conduct.

University Academic Policies:
http://catalog.colostate.edu/general-catalog/academic-standards/academic-policies/

University Disability Services: http://accessibility.colostate.edu/
If you have a disability or need assistance please see the instructors directly.

Course Description: This course provides an overview of ecosystem analysis using models and data, emphasizing critical thinking skills, and quantitative representation of interactive systems. The wisdom of decisions on sustainable management of ecosystems depends on using data to evaluate alternative policies and actions. Our understanding of how ecosystems work requires that we bring data together with models. This course is about how to use quantitative information to judge the validity of hypotheses concerning ecosystem structure, function, and sustainable management.

Course Objective: To challenge students to think critically using data to help inform answers to questions and develop a better understanding of how ecosystems work.

Textbook: None required

Course format and student Responsibilities
The course will consist of two 50-minute lectures per week, as well as one 2-hr laboratory period per week. Labs will be held in the computer laboratory, where students will critically work through problems, challenging questions with data (*see class schedule below*). Most of these labs will involve the use of a computer and software used to development models or plot, explore, graph and analyses data.

Educational Philosophy: Our role in the learning process is to present material to you in an interesting and understandable manner. We also think it is important to engage students in the learning and educations process, whenever possible. We will work hard to do this and to help you achieve the student expectations listed below. We expect you to attend all classes, to actively participate in class, to do all assignments on time, and to regularly check the course website. If you have problems with concepts, materials, or our teaching style, please come see us. Not everyone learns the same way. Maybe we can adjust teaching to help you learn better. We are very approachable, and always open for suggestions and constructive criticism.

Classroom Environment and Etiquette: It is very important that you be courteous and respectful to the instructor, the other students, and our guest lecturers. To do so, you must be prompt for class, turn off your cell phones, and not speak when others are speaking. Feel free to ask questions in and out of class. Also, feel free to provide feedback on class materials, assignments and readings throughout the semester.
Student must adhere to the CSU principles of academic integrity. Failure to do so may result in a zero for an assignment or a failure of the class.

Student Expectations - what you should expect to get out of this class:
Begin to think critically about scientific questions and use data to understand and challenge questions about how ecosystems function and how management of these systems works.

More specifically, your goals are to:

1) Understand data, from collection to interpretation.
2) Understand hypothesis testing, and multiple working hypotheses.

3) Be able to think critically, deductively and inductively.
4) Understand the fundamental principles of gaining insight from data.
5) Understand and embrace uncertainty.
6) Be able to use data to estimate parameters and make forecasts using simple models of ecosystem processes.
7) Understand integration of economics into data/models and decisions.
8) Be able to interpret and evaluate arguments based on quantitative analyses of data using mathematical models and commonly used statistical techniques.
9) Understand the space and time domains of data and models.

Class schedule and reading responsibilities

	Week	Lecture Topic	Reading	Lab Period	Lecturer
1	January 16, 2017	1) Introduction & What is QR		***No Lab this week***	Aldridge
2	January 23, 2017	1) Data and Evidence 2) Group Discussion MGF	Restif et al. 2012	**Exercise 1**: Graph interp. thought experiment	Aldridge
3	January 30, 2017	1) Scientific method 2) Hypothesis testing	Platt 1964	**Lab 1:** Intro to Data and Excel	Aldridge
4	February 6, 2017	1) Units 1 2) Units 2		**Exercise 2:** Units - Group Homework	Lefsky
5	February 13, 2017	1) T-tests, ANOVA 2) Regression		**Lab 2:** Basic Statistics in Excel	Aldridge
6	February 20, 2017	1) *MT Review* 2) ***Midterm I***	Clevenger & Waltho 2000	**Exercise 3:** Paper Application & Review	Aldridge/Lefsky Aldridge-Lab
7	February 27, 2017	1) Introduction to R 2) R continued		**Lab 3:** Introduction to R	Lefsky
8	March 6, 2017	1) Multivariate Models 2) Multiple Regression		**Lab 4:** Multiple Regression	1) Lefsky 2) Aldridge
	March 13, 2017	***Spring Break***			
9	March 20, 2017	1) PCA Analysis 2) Cluster Analyses		**Exercise 4:** PCA Homework	Lefsky
10	March 27, 2017	1) Introduction to Models 2) *MT Review*		**Lab 5**: PCA & Clustering	1) Lefsky 2) Lefsky/Aldridge
11	April 3, 2017	1) ***Midterm II*** 2) Systems Modeling I		**Lab 6**: Predator Prey	Lefsky
12	April 10, 2017	Systems Modeling II		**Lab 7:** Systems Modeling II	Lefsky
13	April 17, 2017	Risk Analysis		**Lab 8**: Risk Analysis	Lefsky
14	April 24, 2017	1) Economics 2) Uncertainty Lecture		**Exercise 5:** Economic games	Aldridge
15	May 1, 2017	1) Uncertainty Game 2) Lecture Review		***Lab Review***	1) Aldridge 2) Aldridge/Lefsky

Final Exam – Thursday May 11, 11:50-1:50 in Shepardson 212

Grading

Midterm Examinations (2) 10% each	20%
Lab Assignments (8) 5% each	40%
Homework or Exercises (5) 4% each	20%
Final Examination	20%

NOTE: For exercises and assignments, you are welcome to work together to problem solve, and figure things out, but you are expected to write up your own individual assignment, and hand in your own individual work.