University of Rhode Island

Computer Science and Statistics Department
STA 550, Ecological Statistics, Section 0001, Fall 2014

Instructor:	Gavino Puggioni, PhD
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Office Hours:	Th 11:00 am – 1:00 pm
Class Days/Time:	W 4:00 pm – 6:45 pm
Classroom:	CBLS 010
Prerequisites:	Introductory Statistics and Calculus. Ecology encouraged.

Course Description

STA 550 is designed as a graduate level course in Ecological Statistics. Through this course, students are expected to learn to analyze ecological problems using modern statistical methods in the Frequentist, Likelihood, and Bayesian frameworks: Optimization, Design of Experiments, Generalized Linear Models, Zero-inflated models, introduction to time series and spatial models, multilevel models, dynamic models. Implementation is explained using the freeware statistical language R .

Course Goals

- To develop statistical thinking
- To learn modern ecological modeling through statistical methods
- To understand advantages and limitations of the proposed methods
- To acquire computational skills (using R)

Student Learning Outcomes

Upon successful completion of this course, each student will be able to:

- Perform an accurate statistical data analysis
- Identify the correct methodology to use for a given ecological application
- Write working computer code in R to perform the estimation
- Use R additional packages if needed
- Perform parameter estimation
- Quantify estimates uncertainty
- Interpret the results in relation to the original scientific goal
- Compare different approaches to solve the same problem

Required Texts/Readings

Textbook

Benjamin M. Bolker: "Ecological Models and Data in R", Princeton University Press, 2008. Available at the URI bookstore, the Princeton University Press website or Amazon.com We will use material from the book website:
http://people.biology.ufl.edu/bolker/emdbook/index.html

Other Readings

- N. Gotelli and A. Ellison: "A primer of Ecological Statistics", Sinauer Associates, 2nd edition, 2013. Available at the URI bookstore and www.Amazon.com.

- M. Lavine: "Introduction to Statistical Thought", 2006. Free publication in electronic format available at:
  www.math.umass.edu/~lavine/Book/book.pdf

Other equipment / material requirements

R statistical software will be used in class. Students are required to install R in their personal computers. R is available at: www.r-project.org
Sakai will be used extensively

Classroom Protocol

Participation is strongly encouraged. Students are expected to arrive on time, keep a respectful behavior, and avoid cellphone use.

Assignments and Grading Policy

The final grade will be a combination of the following:

- Lab homework 20%
- Additional questions homework 25%
- Final project/take home final 55%
- Participation (Extra credit) 5%

Grading policy:

- Labs: There will be weekly labs. Students are expected to replicate the labs from the textbook and encouraged to experiment and work with their own data.
- Additional Questions. Roughly every two weeks students will have to work on a problem set. Students can collaborate but required to write and submit an individual document.
- The final will include a problem set and a data set analysis using the methods acquired in the course. Those students who have data on their own can use it as a substitute for the assigned dataset.
- Participation is evaluated by attendance, participating to class discussions with comments or questions.

Grading Scale:

- A 94-100
- A- 90-93
- B+ 87-89
- B 83-86
- B- 80-82
- C+ 77-79
- C 73-77
- C- 70-72
- D+ 67-69
- D 60-66
- F <60)

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Here is a timetable and schedule for the course. Contents and assignment are subject to change.

Week	Date	Topics, Readings, Assignments, Due Dates, Deadlines
1	09/03/2014	Introduction to Statistical Ecology, statement of course objectives. Installation and introduction to R. Lab 1 out. Read Chapter 1.
2	09/10/2014	Exploratory Data Analysis and Graphics. Lab 1 due. Lab 2 out. Read Chapter 2 and Chapter 9. Review of Classical Statistics
3	09/17/2014	Deterministic functions typically used in an Ecological Context. Lab 2 due. Lab 3 out. Read Chapter 3.
4	09/24/2014	Probability and Distributions. Lab 3 due. Lab 4 out. Read Chapter 4.
5	10/01/2014	Introduction to Simulation methods. Lab 4 due. Lab 5 out. Read Chapter 5.
6	10/08/2014	Power analysis and Design of Experiments. Read additional material provided by the instructor.
7	10/15/2014	Likelihood methods and parameter estimation. Lab 5 due. Lab 6 out. Read Chapter 6.
8	10/22/2014	Optimization. Lab 6 due. Lab 7 out. Read Chapter 7.
9	10/29/2014	Linear models and nonlinear least squares. Lab 7 due. Lab 8 out. Read Chapter 8.
10	11/05/2014	Generalized linear models: Poisson, Logit, Negative Binomial. Lab 8 due. Lab 9 out. Read Chapter 9.
11	11/19/2014	Generalized linear models: Zero inflated distributions. Read additional material provided by the instructor.
12	11/26/2014	Modeling Variance: Time series and Spatial data. Lab 9 due. Lab 10 out. Read Chapter 10.
13	12/03/2014	Modeling Variance: General Multilevel models. Read additional material provided by the instructor.
14	Make up class?	Introduction to Dynamic Models. Lab 10 due. Read Chapter 11.
Final Exam		Take Home Project