Course Syllabus
Hierarchical Modeling in Ecology (FW/STAT 673)

Fall 2015
Tues/Thurs 12:30-1:45 PM
Room: 107 Wagar

Instructor: Mevin Hooten, Ph.D.
Office: 202A Wagar
Office Hours: Tues/Thurs 2:00-4:00 PM

Credits: 3

Prerequisites: STAT 420 or ESS 575

A working knowledge of the R statistical computing environment will be necessary to succeed in this course. Though not technically a prerequisite, students should have some familiarity with matrix notation and basic vector/matrix operations (i.e., linear algebra).

Course Description:

This course will focus on statistical ecological modeling using common forms of data collected in fish and wildlife ecology studies. After a short review of necessary probability, statistics, and computing we will focus primarily on Bayesian model building and implementation for specific studies. Examples include various forms of mark-recapture and occupancy studies and will emphasize the spatial, temporal, and community aspects of analysis. Royle and Dorazio (2008) have put together an excellent compilation of hierarchical methods in their text that we will augment with several scientific journal articles. The level of this course is aimed at the gap between Systems Ecology (ESS 575) and Bayesian Statistics (ST 675K), thus, in order to make progress in the course, we will need to assume a general understanding of probability and statistical computing but the content will be heavily focused on applications. Though the focus will be on fish and wildlife studies, many of the concepts and models are transferrable to other areas of biology and ecology. The review at the beginning is primarily meant to get everyone on the same page in terms of notation and to highlight the most important aspects of the prerequisites. Students should have access to their own computer and a familiar working installation of R.

Recommended Texts:


Academic Integrity:

This course will adhere to the Academic Integrity Policy of the General Catalog and the Student Conduct Code.
Anticipated Topics:

- Bayesian modeling basics.
- Bayesian computation.
- Regression models.
- Generalized linear models.
- Varying coefficient models.
- Bayesian multi-model inference.
- Common forms of dependence.
  - Spatial models
  - Temporal models.
- Models for animal movement.
  - Resource selection models.
  - Dynamic animal movement models.
- Mixture models.
- Models for occupancy.
  - Hierarchical occupancy models.
  - Reparameterized occupancy models.
  - Spatial occupancy models.
  - Occupancy dynamics.
  - Multispecies occupancy models.
- Models for abundance.
  - Closed population inference.
  - Models with individual effects.
  - Spatial capture-recapture models.
  - Population dynamics.
- Models with multiple sources of data.
  - Integrated population models.
  - Integrated disease models.
  - Integrated animal movement models.

Evaluation:

Student grades will be based on an occasional quiz as well as a sequence of approximately bi-weekly reports that may involve short-answer, essay, mathematical derivations, computer programming, data analysis, and paper summary/discussion.

- Reports must be prepared using some form of TeX language.
- Reports will be prepared by rotating pair groups.
- By the end of the day that reports are due, each group member must email me a brief description of their collaborator’s strengths (why this person is a good collaborator). These reports will be compiled and used to determine a collaborator-score that will account for 20% of the course grade. These emails will be kept anonymous.
- The R software will be used for all statistical analysis and code/functions should be attached to the report as an appendix.