

ECL298: Bayesian Models: A Statistical Primer

Time/location: Tuesday & Thursday 10:10-11:30am (2020 Fall Quarter on Zoom)

Overview. This course is to develop practical model-building and model-criticizing skills, to help students build intuition and raise their confidence in statistical modeling, and to make inferences from complicated ecological data. An essential part of the course is to learn how to construct accurate mathematical expressions for Bayesian models linking observation to specific hypothesis about how ecological systems work. We will cover logical foundations of Bayesian inference, causal inference, multilevel models, and model comparison. The course is meant to equip students with (1) the skills to engineer the model structure that is best for their research questions, conditioned on the status of data, and (2) the ability to evaluate, critique, and refine their models and use them responsibly. The principle audience is researchers in the natural and social sciences, who have had a basic course on regression but nevertheless remain uneasy about statistical thinking. We will use Richard McElreath's **Statistical Rethinking2** as the textbook (pdf of the book will be provided).

Things this course aims to help you do:

- 1) Develop statistical thinking and intuition.
- 2) Learn to build bespoke models, given status of data and research questions.
- 3) Practice model evaluation and comparison. Understand the limitation of statistical models and develop a healthy dose of skepticism for model results.
- 4) Develop the notion of learning statistics via simulation and get comfortable with that approach.
- 5) Build confidence for further self-learning of statistics.

Things the course won't do:

- 1) This course is not meant to develop a rigorous theoretical understanding of methods, as a course in the Statistics Department might. This is an applied statistics course: focusing on statistical intuition and coding.
- 2) This course is not meant to familiarize you with specific R packages. Instead, the course will focus on general model building and coding to convert specified model structure into R codes. We will primarily use the 'rethinking' library which was developed for teaching purpose. However, for your own research, you might want to explore other packages that provide more compact, prescribed functions.