BIOL 633: Fundamentals of Ecological Statistics

Dr. Samuel V.J. Robinson

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Outline and Marking

In this course, we will cover the basics of using the R programming language, along with simple plotting, data organization, and programming techniques. We will also cover the fundamentals of linear modeling before moving onto generalized linear modeling (non-normal distributions), mixed models (i.e. *random effects*), and spatio-temporal effects. Finally, we will discuss how to write about statistical analysis, and will end with short presentations on an analysis of your own datasets (or a simulated dataset, if you haven't collected data yet).

Proposed marking scheme:

- Class participation: 25%
- Final project "peer review": 25%
  - Create a draft write-up, and provide feedback on your colleagues' work
  - Write a review document to send to the editor (SR)
- Final project write-up: 25%
  - Respond to the feedback from your colleagues, and write a response letter
- Final project presentation: 25%
  - Mock committee/proposal meeting: "what are your main results so far?"

Draft Schedule

Date	Lecture	Learning Outcomes
Sep 8	Intro to R	• Learn R syntax, objects, and basic plotting • Custom functions • Write simple R programs
Sep 15	Tidyverse: `dplyr` & `ggplot2`	• Principles of graphic design • Introduction to the `tidyverse` • Data wrangling, filtering, and organization
Sep 22	Linear Models	• Basic structure and terminology of linear models • Effect sizes, model selection, partial effects plots • Checking model results and output
Sep 29	Generalized Linear Models (GLMs)	• Common non-normal distributions • GLM fitting and plotting • Model validation, model selection for GLMs • Preliminary models of your own data
Oct 6	Mixed effects models	• Random versus fixed effects • Random intercept and slope models • Slope/intercept covariance, hypothesis testing • Plotting of mixed models
Oct 13	Nonlinear & Additive models (GAMs)	• Fitting strategies • Generalized additive models (GAMs/"wiggly" models) • Distributional (non-stationary) models
Oct 20	Spatiotemporal & Dynamic models	• Spatial and temporal random effects • Dynamic models (e.g. logistic growth)
Oct 27	Other topics	• Multivariate models (e.g. community ordination) • R as a GIS (e.g. mapping) • Custom model coding (TMB or Stan)
Nov 3	Writing	• Structure of scientific papers (IMRaD) • Writing clearly about models • Reading about models critically
Nov 10	Open work time	• Time for open work on your own models and data • Can work together/ask for help or clarification
Nov 17	Reading break	Reading break
Nov 24	Peer review	• Draft write-up due • Show us some of your results!
Dec 1	Peer review	• Reviews due
Dec 8	Presentations	• Final presentations • Write-up due