**FALL 2016: R Workshop for Ecologists & Evolutionary Biologists**

**EEB590, section HR (1 credit)**

**Instructor: Dr. Haldre Rogers**

**9:00-10:30 am Tuesdays, 334 Bessey**

**Course description:**

In this course, students will practice manipulating, analyzing, and graphing the types of data commonly collected in ecology and experimental evolutionary biology. We will use the open-source software, R. Each class will start off with a short presentation to introduce the topic, followed by a group exercise in R. Students will then apply this method to a real, messy dataset and work through the problems that inevitably arise when analyzing datasets plagued by missing values, small sample sizes, overdispersion etc. The goal will be to produce a final analysis, complete with tables and figures that could be used in a manuscript. For the final project, each student will be expected to analyze their own dataset, and turn in the script, methods & results sections, and manuscript-quality figures and tables. We will finish the semester with a symposium where each student will give a short presentation about his or her research with a focus on the statistical analysis.

**Course Objectives:**

By the end of the semester, students will:

1. Be comfortable using R to import, explore, analyze, and graph data.
2. Know how to follow best practices for sharing data and code.
3. Be comfortable discussing statistical analyses and sharing code.
4. Have analyzed their own dataset, written the analysis section and the results section of a paper, and have produced manuscript-quality graphics.
5. Become part of an active community of R-users in Ecology & Evolutionary Biology at Iowa State.

**Requirements:** Students are expected to have some experience with R, and some background in statistics (e.g. STAT401/402, EEOB 590 - Advanced Biostatistics). Students must bring their own dataset, ready for analysis. If you are not sure whether you are ready for this course, email the instructor (haldre@iastate.edu).

**Topics we will cover include:**

* Intro to R, R Studio, and GitHub
* Data exploration
* Data visualization (base graphics and ggplot)
* Linear models
* General linear models (GLM's)
* Linear mixed effects models (LMER's)
* Generalized linear mixed effects models (GLMM's)
* Other topics to be determined by the course participants & instructor

**Resources:**

* ***Iowa State Statistics Consulting*** is a fantastic resource. They can help with (from their website) "research design, sample size calculations, choosing statistical methods, use of statistical computing packages (R, SAS, and some JMP) to analyze data, and interpretation of results. Just make an appointment here: http://stat.iastate.edu/statistical-consulting
* **EEOB 590: Spring, Odd Years: Advanced Biostatistics with Dean Adams**

Review of the basic univariate and multivariate statistics commonly used in evolutionary and ecological research. The goal of the course is to give students a general idea of what statistical methods are commonly used in evolutionary ecology, which methods are appropriate for which types of data, and to provide a general knowledge of how the methods work.

* **Various Statistics courses**

**Reference books**

* Bolker, B. M. 2008. Ecological models and data in R. Princeton University Press, Princeton, N.J.
* Clark, J. S. 2007. Models for ecological data : an introduction. Princeton University Press, Princeton, N.J.
* Crawley- The R Book. Available online at: http://www.kharms.biology.lsu.edu/CrawleyMJ\_TheRBook.pdf
* Kery, M. 2010. Introduction to WinBUGS for Ecologists: Bayesian approach to regression, ANOVA, mixed models and related analyses. Academic Press.
* Zuur, A. F., E. N. Ieno, and G. M. Smith. 2007. Analysing ecological data. Springer, New York ; London. http://link.springer.com/book/10.1007%2F978-0-387-45972-1 (free download)
* Zuur, Ieno, Walker, Savelieve, and Smith. 2009. Mixed Effects Models and Extensions in Ecology with R. http://link.springer.com/book/10.1007%2F978-0-387-87458-6 (free download)

**Online learning resources**

https://www.coursera.org/learn/r-programming

http://ecology.msu.montana.edu/labdsv/R/labs/R\_ecology.html

http://swirlstats.com/students.html

GLMM wiki: http://glmm.wikidot.com/faq

**Class Schedule**

Note that this is subject to change, depending on the pace of the class and what is working/not working.

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| **Date** | **Topic** |
| 23-Aug-16 | Introduction |
| *27-Aug-16* | *3-4:30 pm. Optional - crash course in R* |
| 30-Aug-16 | Best practices in data management, data manipulation |
| 6-Sep-16 | Introduction to data exploration & visualization |
| 13-Sep-16 | Introduction to linear models, gaussian data |
| 20-Sep-16 | Introduction to generalized linear models - count data |
| 27-Sep-16 | Introduction to generalized linear models - proportion or survival data |
| 4-Oct-16 | Introduction to linear mixed effects models (random effects) |
| 11-Oct-16 | Introduction to generalized linear mixed effects models - poisson |
| 18-Oct-16 | Generalized linear mixed effects models continued - binomial |
| 25-Oct-16 | Writing analysis sections, work on own datasets |
| 1-Nov-16 | Writing results section, work on analysis of own dataset |
| 8-Nov-16 | Presentation of figures, work on figures for own dataset |
| 15-Nov-16 | In-class work on own datasets |
| 22-Nov-16 | No class- Thanksgiving |
| 29-Nov-16 | Final presentations & peer review, part 1 |
| 6-Dec-16 | Final presentations & peer review, part 2 |