**Quantitative Analysis of Ecological Data**

June 26 – 30, 2017

**Course Syllabus**

**Course Description:**

Effective management and conservation of the products and ecosystem services that forests provide requires natural resource professionals to be adept at assessing questions related to “how many, how much, where, and when”. This 5 day course will train graduate and undergraduate students in forestry, biology and environmental sciences in quantitative methods relevant for the analysis of ecological data to answer these questions. At the end of the course, participants will be able to analyze real datasets and communicate those results in a format that conforms to scientific standards.

**Course Instructors:**

Mr. Anand Roopsind ([aroopsind@gmail.com](mailto:aroopsind@gmail.com))

*PhD Candidate, Department of Biology, University of Florida*

Dr. Trevor Caughlin ([trevor.caughlin@gmail.com](mailto:trevor.caughlin@gmail.com))

*Postdoctoral Fellow, School of Forest Resources and Conservation, University of Florida*

**Student Learning Outcomes:**

At the end of the course participants should have an improved understanding of data processing standards and an improved ability to analyze ecological data. Specifically, students will have a working knowledge of the following:

1. Basic programming skills in the R statistical software;
2. Sample size determination, data simulation, parameter estimation and effect size;
3. Regression models (including normal, binomial and poisson distributions) for scientific inference and;
4. Data visualization.

**Course Format:**

Using a combination of readings, lectures, discussions, and exercises, course participants will refine their data analytical skills. Students will work on datasets (provided by participants and instructors) using the free open statistical software, R. Morning sessions (8:30am-12:00pm) will be used to introduce students to new analytical methods, and implement those methods in R. The afternoon sessions (1:00-4.30pm) will be focused on the analysis of actual datasets, and reporting on those results. The in-class sessions will emphasis data analysis in CRAN-R, presentation skills and scientific writing. Prior to the commencement of the course, students will be asked to follow a basic online training for code in R.

**Recommended Readings:**

Ecologicals Models and Data in R. Ben Bolker (for a free pdf copy please visit: http://ms.mcmaster.ca/~bolker/emdbook/)

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Topic** | **Readings** | **Activities** |
| 26/06/2017  (Day 1) | Course introduction (8.30-9.30 am)   * participant introduction * course structure |  | Feedback from course participants on personal learning goals |
| Introduction to modelling (9.30-10 am)   * types of models * goals of modeling * parameter estimation | Examples of modeling | Lecture (Dr. Caughlin) |
| Examples of modeling (10-10.15 am)   * effect size * prediction |  | Lecture (Dr. Caughlin) |
| Examples of modeling (10.15-10.30 am)   * hypothesis testing |  | Lecture (Anand) - Camera trap study |
| Inference – p-values (10.30-11 am) |  | Ant activity (Dr. Caughlin) & coffee break |
| Introduction to R (11 am-12 pm)   * plotting data * mean, variance, standard deviation |  | R practical: catfish data (Dr. Caughlin) |
| ***Lunch (12-1 pm)*** | | |
| Framing and testing hypothesis (1 -2.45 pm) | Chapter 4: A primer to ecological statistics | Paper discussion & coffee break |
| Types of data (2.45-3 pm) |  | Lecture (Anand) |
| Data analysis |  | Students work on actual datasets |
| 27/06/2017  (Day 2) | Allometry study (8.30-10.30 am) |  |  |
| Graphing data in R (10.30 am – 12 pm) |  | R practical |
| Parameter interactions |  | Lecture |
| Poisson distribution |  | Lecture |
| Example of Poisson distribution | Jansen et al. 2008. Spatial contagiousness of canopy disturbance in tropical forest - an individual tree-based model test. Ecology 89 (12) | Paper discussion |
| ***Lunch (12-1 pm)*** | | |
| Reading scientific papers (1-1.30pm) |  | Lecture (Anand) |
| Formulating hypothesis and experimental design for ecological studies (1.30-3 pm) |  | Design studies that focus on testing hypothesis, prediction & parameter estimation |
| Data analysis (3-4.30 pm) |  | Students work on final year project data analysis |
| 28/06/2017  (Day 3) | Binomial, count and categorical data (8.30 am-12 pm) |  | Students conduct small projects (covers all types of data, hypothesis testing, parameter estimation and effect size) |
| ***Lunch (12-1 pm)*** | | |
| Data visualization and preliminary analysis of data (1-3.30 pm) |  | R practical |
| 29/07/2017  (Day 4) | Parametric tests: P-values and F-ratios (8.30-10 am) |  | Lecture (Dr. Caughlin) & practice examples |
| Linear regression (10-11.30 am) |  | R practical using allometry data collected (Dr. Caughlin) |
| Allometric equations (11.30 am – 12 pm) | King 1996. Allometry and Life History of Tropical Trees. | Paper discussion (Dr. Caughlin) |
| Power analysis |  | Lecture (Anand) |
| Dynamic models |  | Lecture (Dr. Caughlin) |
| Data analysis |  | Students work on projects and presentations |
| ***Lunch (12-1 pm)*** | | |
| Using R2 for prediction (1-1.30 pm) |  | Lecture (Dr. Caughlin) |
| Confidence intervals (1.30-2 pm) |  | Lecture (Anand) |
| Data analysis (1.30-4 pm) |  | R practical: students analyze data collected in field & discuss results |
| 30/06/2017  (Day 5) | Categorical variables  Multiple regression |  | Lecture (Dr. Caughlin) |
| Count data | Jung et al. 2014. Female hurricanes are deadlier than male hurricanes. PNAS. | Paper discussion |
| **Lunch (12-1 pm)** | | |
| Binomial distribution |  | Lecture |
| Data analysis: binomial data |  | R practical: students analyze data collected in field & discuss results |
| Maximum likelihood |  | Lecture (Dr. Caughlin) |
| Data analysis |  | Students work on project data analysis |
|  | Presentations of results |  |  |