Instructor and Course Information

Advanced Academic Programs Zanvyl Kreiger School of Arts and Sciences
Johns Hopkins University

Syllabus
Analysis of Environmental and Ecological Data
AS.420.667

Instructor Information
Instructor: Dr. Jerry L. Burgess
Email Address: jerry.burgess@jhu.edu
Office Hours: Email me to schedule a ‘chat’ session. Otherwise you can contact me directly by email.

Course Description
This course will teach participants how to develop work flows going from raw data to graphics and statistical analysis, using the programming language and statistical environment R. Topics will focus exclusively on the biological sciences and will cover foundational concepts in statistical modeling (ANOVA, Regression, ANCOVA, PCR, etc); emphasis is on conceptual underpinnings of statistics not methodology, with a focus on defining statistical models and the major inference paradigms in use today.

Course Objectives
Following the completion of this course, students should be able to:
• Analyze data from experiments and draw sound conclusions about the underlying processes using their understanding of mathematics and statistics
• Manage and visualize datasets while conducting exploratory and formal statistical analyses, and presenting results.
• Apply their knowledge of statistical methods and use their skills with R to conduct an analysis of their own dataset, they will develop a documented, reproducible analysis, and present results to class.
• Utilize a particular workflow process for quantitative problem solving
Course Prerequisites

Prior to taking this course, students need to have completed their quantitative requirements for this program, specifically Quantitative Methods for Environmental Sciences or at a minimum one semester of undergraduate Calculus. Though not a prerequisite, Principles of Ecology will be very helpful in understanding course datasets as most of our material will be based on ecological or environmental data.
Course Materials

Textbook
There will be no required text for this course. That is, we will not be following any particular text, however there are two textbooks that might serve you well as a resource and I will be using material from them on occasion.

Ecological Statistics: Contemporary theory and application
ISBN: 9780199672554

Statistics for Ecologists Using R and Excel: Data Collection, Exploration, Analysis and Presentation (Data in the Wild) 2nd Edition
ISBN-10: 178427139X

➢ These textbooks can be purchased on iTunes, Amazon, Barnes and Noble, the JHU bookstore and most internet textbook stores.

Other readings
Other readings will be posted in the weekly content and eReserves for the course when relevant.

Other software
It is necessary for this course that you are somewhat familiar with Microsoft Excel or some other graphing program such as Google Sheets. However, nearly all of our work will be done in R or rather RStudio.
Assessments and Grading Policy

Course Basics
Each unit will open on a Monday at 12:00 am and will close Sunday of that week at 11:59 pm. Apart from the student presentation and final project, students are expected to participate in threaded discussions and complete a problem set each week.

Assignments

Data Analysis:
Weekly problem sets: Each week, students will analyze data (provided by the instructor) to illustrate statistical methods discussed that week.

Debate and discussion leadership and participation:
The goal of the discussions is to provide you with the opportunity to develop your skills to critically read and evaluate primary scientific literature, interpret and synthesize data and fundamental concepts in community ecology, and understand how these research papers fit within the broader context of the course.

Quizzes:
Short quizzes (approximately 20 mins) will be administered periodically throughout the term. The purpose of the quizzes is to encourage students to review course materials outside of class. Quizzes will generally target concepts whereas homeworks will focus on model implementation and inference (primarily through programming in R). Quizzes will generally be limited to concepts that were covered in recent class periods although quizzes may also draw from content that was covered earlier in the semester.

Group Lecture:
Each group (2-3 students) will identify a topic (in consultation with the instructors) and prepare a 15-20 minute lecture to be delivered to the class during the last couple of weeks of the semester as well as a summary handout. A list of topics will be provided for students to choose from. Each group will also develop two quiz questions on the topic (with answers provided to instructor), which will be administered to the class during the last week of the course.

Critical Review of a Scientific Paper:
Select a scientific paper (i.e., journal publication) of interest. Make sure the paper is a scientific study involving the use of statistics. Read, discuss and critically evaluate the scientific paper with respect to the foundational concepts discussed in the course.

Midterm:
The "midterm" will take the form of a recorded online presentation using our Work Flow model to discuss the analysis of a publically available dataset of your choosing.

Final Project:
The final data analysis paper (due during Finals week) will be a 5 page (single spaced) short-communication (Research Note) paper strictly following guidelines in Conservation Biology (http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1523-
This will be a group publication that can involve data collected personally, obtained from your professional work or from an online source.

Please refer to the table below for due dates.

**Grading**

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Analysis (10 pts each)</td>
<td>110 pts</td>
</tr>
<tr>
<td>Participation</td>
<td>50 pts</td>
</tr>
<tr>
<td>Quizzes</td>
<td>50 pts</td>
</tr>
<tr>
<td>Group Lecture</td>
<td>25 pts</td>
</tr>
<tr>
<td>Critical Review</td>
<td>25 pts</td>
</tr>
<tr>
<td>Midterm</td>
<td>25 pts</td>
</tr>
<tr>
<td>Final</td>
<td>30 pts</td>
</tr>
</tbody>
</table>

**Reference manager suggestions for your Research:**

We encourage you to add references to your journal articles, book chapters, and books into a reference manager such as Endnote (http://endnote.com), Mendeley (http://www.mendeley.com), or Zotero (http://www.zotero.org). Benefits of using a reference manager include the ability to organize and search references by multiple keywords, create bibliographies and in-text citations for research papers, import journal-specific citation formats to quickly change the formatting style of citations and bibliographies, and collaborate and share literature with others online. Personally, I use Papers which is a like a personal library: [http://papersapp.com](http://papersapp.com)

**Online Data Sources:**

- [http://dryad2.lib.ncsu.edu](http://dryad2.lib.ncsu.edu): DryadLab is a collection of free, openly-licensed, high-quality, hands-on, educational modules for students to engage in scientific inquiry using real data.
- [https://www.esa.org/tiee/teach/teach_links.html#enviro_eco_data](https://www.esa.org/tiee/teach/teach_links.html#enviro_eco_data): Environmental and Ecological Data from ESA
- [https://ecologicaldata.org/find-data](https://ecologicaldata.org/find-data): Ecological Data WIKI
- [https://www.pangaea.de](https://www.pangaea.de): Data Publisher for Earth and Environmental Science
Contacting the Instructor

Please feel free to contact me, preferably by email with any questions that you may have. I will try my best to respond to you within 36-48 hours; however, it could be a little longer if I am travelling or busy with a work deadline. Also, I suggest that if you have a question relating to the course material, that you post the question under the thread group Syllabus so that classmates might be able to assist you.

It is important that you regularly check your JHU email address or forward your JHU email to a different email address that you frequently use. Also, please make sure that all of your communications for this course are sent through your JHU email address.

Getting Help

You have a variety of methods to get help on Blackboard. Please consult the help resources listed in the online classroom for additional information. Important Note: If you encounter technical difficulty in completing or submitting any online assessment, immediately contact the 24-hour Help Desk listed under the “Blackboard Help” tab. Also, contact your instructor at the email address listed atop this syllabus.
University Policies

General
This course adheres to all University policies described in the academic catalog. Please pay close attention to the following policies:

Students with Disabilities
Johns Hopkins University is committed to providing reasonable and appropriate accommodations to students with disabilities. Students with documented disabilities should contact the coordinator listed on the Disability Accommodations page. Further information and a link to the Student Request for Accommodation form can also be found on the Disability Accommodations page.

Ethics & Plagiarism
JHU Ethics Statement: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor.

Read and adhere to JHU’s Notice on Plagiarism.
During the first week of this course, you will have the option to complete a short course about plagiarism for extra credit. An announcement will be made during the first week.

Dropping the Course
You are responsible for understanding the university’s policies and procedures regarding withdrawing from courses found in the current catalog. You should be aware of the current deadlines according to the Academic Calendar.

Getting Help
You have a variety of methods to get help on Blackboard. Please consult the resource listed in the "Blackboard Help" link for important information. If you encounter technical difficulty in completing or submitting any online assessment, please immediately contact the designated help desk listed on the AAP online support page. Also, contact your instructor at the email address listed in the syllabus.
## Tentative Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 1    | 8 Jan - 14 Jan | How to Approach Statistical Inference  
Getting Started with R. Work Flow Processes |
<p>| 2    | 15 Jan – 21 Jan | Data Formatting and Input Packages                   |
| 3    | 22 Jan – 28 Jan | Exploring Data with dplyr                           |
| 4    | 29 Jan – 4 Feb | Data Visualization ggplot2                          |
| 5    | 5 Feb – 11 Feb | Basic Statistics: Comparing Groups ANOVA, t-Test   |
| 6    | 12 Feb – 18 Feb| Linear Regression, Chi-sq                           |
| 7    | 19 Feb – 25 Feb| Interactions and ANCOVA                             |
| 8    | 26 Feb – 4 Mar| Maximum Likelihood                                   |
| 9    | 5 Mar – 11 Mar| Beginning GLM                                       |
| 10 | 12 Mar – 18 Mar | GLM with non-normal distributions |</p>
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Activity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>18 Mar to 25 Mar</td>
<td>Spring Break</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>26 Mar – 1 Apr</td>
<td>Community Ecology Examples</td>
<td>Critical Review</td>
</tr>
<tr>
<td>13</td>
<td>2 Apr – 8 Apr</td>
<td>Mixed Effects</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>9 Apr – 15 Apr</td>
<td>Student Presentation and Discussions</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>16 Apr - 30 Apr</td>
<td>Semester Review</td>
<td>Final Project</td>
</tr>
</tbody>
</table>

