University of Alberta

Department of Renewable Resources

RENR 480 – Experimental design and data analysis in the environmental sciences

Course Syllabus for Fall 2012

Course Website – http://tinyurl.com/renr480

Lectures and labs:

Lectures: Tuesday & Thursday 8:00 to 9:20pm. General Services Building, 8th floor, Rm 866.
Labs: Monday 11-13:50. General Services Building, 8th floor, Rm 866.

Instructor:

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Teaching Assistant: Dave Roberts, Email: drr3@ualberta.ca

Calendar Description: Experimental design and data analysis in the environmental sciences *3 (fi 6) (first term, 3-0-3). Introduction to the scientific method; presentation of quantitative data in forestry, conservation and environmental sciences; common research approaches and experimental designs; fundamental concepts of statistics; classical hypothesis testing and Bayesian inference; parametric and non-parametric statistical tests; tests for binomial data; linear, non-linear, and multiple regression.

Prerequisites: A minimum of *60 of university-level course; *3 introductory statistics recommended.

Course Format: The course has two weekly lectures and a lab with an introductory lecture. Each lab has a set of exercises to put concepts from lectures into practice. During the Monday labs (3 hours) there will be time to work on assignments and a class project, where students analyze their own dataset using the methods covered in class.

Software: You have the choice to use either R or SAS (or both) software package throughout the course. R is free, open source, and has comprehensive and cutting-edge statistics packages. SAS has powerful data management tools and well documented statistics packages but does not cover many newly developed statistical methods relevant for ecology and biological science applications.

Evaluation:

Lab assignments (4 assignments @ 5% each)	20%
Participation	10%
Draft Project/Plan (5-7 minute presentation & website due **Nov 5th**)	10%
Final Project (5-7 minute presentation due **Dec 3rd** / website due on last day of classes **Dec 6th**)	30%
Final Exam on last RenR 480 class (**Dec 4th**)	30%

[Hand in your class notes at the end of the final exam if you want them contribute 50% to the final exam grade]

Policy for late submissions: some deduction depending on how good an excuse you have.

Hard deadline for late submissions of any kind: **Dec 13th**

Previous years' projects: http://tinyurl.com/renr480projects

No Classes: Mo, Oct 8 (Thanksgiving); Mo, Nov 12 (Remembrance Holiday); Tu, Nov 13 (Fall term break)

Learning Goals

Introductory section:

1. Become familiar with the fundamental concepts of statistics and empirical research. Understand how statistics can effectively be used in science.

2. By planning an independent student project, practice how to tell a scientific story from beginning to end, aided by statistical analysis and graphical presentation of quantitative data.

3. Learn the basics of experimental and sampling designs, and be aware of common design pitfalls and misinterpretations of results.

Data management and exploratory graphical analysis:

4. Learn how to collect and organize your data so that it is most useful for subsequent analysis.

5. Gain some hands-on experience with data organization, data checking, data preparation trough a set of exercises and a student project.

6. Be able to thoroughly understand the nature of your data through graphical display of raw data and summary statistics before applying any statistical tests.

7. Learn how to generate publication-quality scientific graphs, and how to use the correct type of graph for various objectives.

Inferential statistics:

8. *Get an o*verview of statistical methods, and learn under what conditions and for what objectives each method is applicable.

9. Explore how organizing your data determines what statistical analysis you can do.

10. Learn how the type of variables (continuous, discrete-ordinal, discrete-nominal, and binary) determines what statistical method you should use.

11. *Be aware of c*onditions that need to be met for particular methods, learn how to test assumptions, carry out data transformation, and deal with missing values.

12. Practice empirical research, application of statistical methods, and writing reports through the course project

Specific methods:

Learn how implement basic experimental and sampling designs (CRD, RCB) and analyze data with common statistical methods (T-test, F-test, single and multifactor ANOVA, multiple comparison methods, chi-square test, z-test for proportions, nonparametric methods, linear and non-linear regression and correlation analysis, mixed models) using a structured approach:

- Background
- When to use the method
- How the method works
- What to report
- Example analysis
- Example program code