MES SPRING 2015 *Working Draft*

Research Design and Quantitative Methods (RDQM) - 11452

Syllabus

**Faculty:** Peter Dorman, Lab I 3015, 360-867-8699, dormanp@evergreen.edu

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**Faculty Office Hours:** Dina: Thursday 3-6 pm or by appointment.

**Class times and locations:** Tues. & Thurs., 6 – 10 PM; Sem II E1107; Seminar (E2105, E2107); CAL West for all computer labs.

**Course objectives:** To understand: (1) the role of statistics across fields of science, with emphasis on the ecological, environmental and social sciences, (2) the two-way relationship between data collection and analysis, (3) the use of statistical methods to help us answer questions about the world we observe, (4) how to develop a study and articulate methodology and statistical analyses, and (5) what makes a good grant proposal and how to collaborate with a peer(s) to complete a competitive grant proposal.

**Approach:** The above components of a scientific study need to be considered together rather than separately; design and analysis aspects will be taught together in this course. Emphasis will be on application, and will include data analyses on personal or lab computers. Important points will be reinforced by readings from the scientific literature, statistics blogs and through seminar discussions. Data assignments/labs are intended to reinforce each student’s understanding of design, analysis and reporting of statistical methods and results.

**Required Textbook**: Nicholas J. Gotelli and Aaron M. Ellison, ***A Primer Of Ecological Statistics***

**ADVISORY**: We advise students to consider using a personal computer and to have **JMP** installed – Technicians in TESC CAL have the software and necessary license, see them to get install and year license.

**Software:** We will primarily use Microsoft Excel and SAS JMP to perform data management and data analysis. These programs are available for both the Windows and Mac operating systems; Excel is a commonly used spreadsheet program, and JMP is a popular statistical program with an excellent user interface. Some labs will use the MS Excel Resampling Stats plug-in which only works on Windows and we explore the use of PC-ORD which is also only available for Windows. All the software required for labs is available on campus in both the CAL and ACC, and a one year license of JMP (Windows and Mac). You should plan to spend considerable time outside class working in the CAL or on your laptop to complete your lab assignments and your grant proposal project.

**Program Expectations and Assessment:** Faculty expect students to attend lectures, seminar, and labs, complete assigned readings, work in groups on research proposal project. We also expect students to satisfactorily complete lab assignments, midterm and final exams, and the grant proposal research project with student team member(s). **Late work will not be accepted.**

**Help Sessions:** Besides Faculty, students will have access to a teaching/lab assistant; Chelsea Waddell will be assisting students on Tuesday afternoons in the CAL from 3-6 pm. Email: waddellc@evergreen.edu

**Final project: A Second-Round Grant Proposal** (A Project Handout will be provided during the second class when we will discuss assignment in detail).

A common activity for professionals in environmental and other fields is pursuing grants from donors like the National Science Foundation, the National Institutes of Health and the many private foundations that fund research. This is normally a two-step process. In the first stage you submit a relatively short (3-5 page) proposal that sketches the research you want to conduct and makes a case for why it’s important. If this idea catches the eye of the funder, you will be invited to submit a much more detailed second-round proposal, typically, depending on the conventions of your field, about 15-30 pages in length. Our final project in RDQM this quarter will be preparing a *hypothetical second-round proposal* for research of interest to you.

Weekly Schedule:

| **Week** | **Date** | **Activity** | **Reading** |
| --- | --- | --- | --- |
| 1 | Tuesday March 31 | Syllabus, Introduction/Role of Statistics/Why Everyone Needs to Understand Quantitative Methods  **Seminar**: Ioannidis Reading | Ioannidis (2005) on Moodle; and Gotelli and Ellison, Chapter 1 |
| Thursday April 2 | Connection between Theory, Data and Methodology  **Guest MES Student Panel:**Using Statistics/Modelling  **Computer Lab:** Look at Grant Proposals online (Dorman, Roberts) | Morrison et al. 2008 (pp 1-24) on Moodle, Philosophy and Statistics |
| 2 | Tuesday April 7 | Summary Statistics, Descriptive and Inferential Statistics  **Computer Lab:** Spreadsheet Exercise, Generating Summary Statistics, Finding the Denominator | Gotelli and Ellison Chapter 3;  Waddell Workshop for LAB |
| Thursday April 9  Thursday April 9 cont. | Distributions (normal, z, t, non-normal), p-values; Understanding the meaning of p-values and confidence intervals.  **Seminar**: Morey paper and Hoekstra | Gotelli/Ellison, Chapter 2 and 4, Morey et al. (2014), Hoekstra et al. (2014) |
| 3 | Tuesday April 14 | Hypothesis testing: t-test, z-test, one-sample vs. two sample testing; Critique of *Ho*;  **Computer Lab:** Hypothesis Testing | Fanelli (2010) |
| Thursday April 16 | Type I and Type II error--impacts on science vs. policy; Experimental Design.  **Seminar:** Hurlbert | Gotelli/Ellison, Chapters 6 and 7; Hurlbert on Moodle |
| 4 | Tuesday April 21 | Linear relationships--Correlation and Regression  **Computer Lab:** Correlation and Regression | Gotelli/Ellison, Chapter 9 |
| Thursday April 23 | **Rachel Carson Forum – Attendance Required** |  |
| 5 | Tuesday April 28 | Data Coding with Shangrila Wynn; Chi Square, Contingency Tables  **Computer Lab:** Chi-square, Contingency Tables | Gotelli/Ellison, Chapter 11 |
| Thursday April 30 | ANOVA;  Parametric vs. nonparametric tests.  **Computer Lab:** ANOVA/Hand out Take Home Mid-term Exam: Due Thursday, May 7 by 5:00 pm – Email your Seminar Leader. | Gotelli/Ellison Chapter 10 |
| 6 | Tuesday May 5 | Roxanne Dunbar-Ortiz, Author of An Indigenous People’s History of the United States, TESC Longhouse 7-9 pm |  |
| Thursday May 7 | Principle Components Analysis (Guest Speaker – Alison Styring) | Readings on Moodle |
| 7 | Tuesday May 12 | Reporting results, presenting data;  Strategic ambiguity: the clearer you are the more you open yourself up to questions and critique.  **Computer Lab:** Data presentation; Data visualization | Tufte Reading on Moodle |
| Thursday May 14 | Logistic Regression (and Dummy Variables) and Lab |  |
| 8 | Tuesday May 19 | Natural experiments;  Using existing data, data repositories; Administrative Data: from agencies, organizations, etc.; Real world vs. perfect world issues in data gathering and analysis; Big Data--your sample is your population. | Seminar Readings:  Soranno et al. (2014)  Donovan et al. (2013) |
| Thursday May 21 | Bayesian Methods – Guest lecture by Ilai Keren, WDFW Statistician  Computer Lab: Overfitting |  |
| 9 | Tuesday May 26 | Model selection: Robustness, strategic selection/ Power Calculation/Interpretation of Results  Sensitivity Analysis; External validity of results/interpretive Power vs Credibility of Results | Gelman and Loken (2013) |
| Thursday May 28 | Project Work  Hand out Final Exam |  |
| 10 | Tuesday June 2 | Student presentations – Research Grant Proposal |  |
| Thursday June 4 | Student presentations – Research Grant Proposal |  |
|  | June 8-12 | Evaluation Week – |  |