**Proseminar: Critical Analysis of Environmental Systems Fall 2017**

**ENVR E-210 19 November 2017 FINAL**

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*\*Note that TAs can be easily contacted individually or as a group via the Canvas inbox system.*

*Mondays and Thursdays, 7:40-9:40, lectures and sections. Students are encouraged to attend both Mon & Thurs sessions in room L01, 53 Church St., Cambridge.*

*Online and on-campus options. Limited enrollment, and only for graduate credit.*

*Qualifies for statistics course requirement in SEM Program.*

Understanding the dynamics of complex ecological and environmental systems and designing policies to promote their sustainability is a formidable challenge. Both the practitioner and policy maker must be able to evaluate scientific research, recognizing fundamental pitfalls in research design and data interpretation. Moreover, most important environmental problems involve interactions among variables as dynamic systems, so forecasting the impacts of potential environmental changes or policy interventions is critical. To develop these skills, students will conduct practical exercises illustrating a range of modeling techniques, including statistical analysis of ecological and environmental data, and system dynamics modeling. Computer simulation modeling will range across diverse issues in sustainability science, such as climate change, human population dynamics, population viability analysis of endangered species, and economic appraisal of projects that impact natural resources. The course also focuses on developing skills in scientific writing, critiquing primary research literature, and communicating about environmental science. Quantitative techniques are taught at an introductory level; some data analysis and simulation modeling is conducted using Excel spreadsheets.

Prerequisites: a satisfactory score on the mandatory test of critical reading and writing skills; experience manipulating data and algebraic equations in spreadsheets is helpful.

(4 credits)

Course Structure & Grading

The course will meet twice each week, on Thursdays usually for lectures and discussion, and on Mondays for lab sections, although there are a many exceptions. Note the special Saturday section to conduct stakeholder negotiation exercise, that will be followed by the fall term on-campus Sustainability mixer and panels. Other Sustainability program activities will be planned for the weekend, so students are urged to attend this session live if possible.

If you cannot attend lectures or sections in person, you are encouraged to participate via live video streaming and zoom-in-the-room on both Thursdays and Mondays from 7:40 to 9:40 pm. Videos will typically be posted the day after the session. Meetings listed as sections on the course schedule typically introduce and begin work on the weekly problem sets or modeling exercises, or discuss assigned articles. You may attend in person, watch and participate via zoom, or view the video online at your convenience on demand after each meeting.

Assignments will vary from problem sets and presentation of modeling results to short papers discussing assigned journal articles. There are no midterm or final exams; grades will be based on the weekly assignments.

Textbooks & other materials

Although this is not a statistics course, the main text and reference will be A Primer of Ecological Statistics, by N. J. Gotelli and A. M. Ellison. We will use selective chapters and sections from this book to discuss hypothesis testing, research design, analyzing data and using appropriate statistical tests. (*Note that for the chapters we use, the first edition is identical to those in the second edition, so you may purchase a used first edition if you wish.)* A second book, Thinking in Systems: A Primer, by Donella H. Meadows, provides an introduction to systems thinking and system dynamics modeling.

In addition, an interactive online SimUText Ecology lab (Isle Royale- interactions between wolves, moose & trees) will be assigned and will require online purchase of the $9 unit by students. Information on how to access this software will be made available closer to the assignment date.

Access to Excel software is required for manipulating data and running some computer simulations, and students are encouraged to learn basic Excel features before the second week of the class. For some weeks, journal articles illustrating different types of ecological or environmental research will be posted on the course website for students to download and evaluate.

Special Issues

The Extension School is committed to providing an accessible academic community. The Accessibility Office offers a variety of accommodations and services to students with documented disabilities. Please visit www.extension.harvard.edu/resources-policies/resources/disability-services-accessibility for more information.

You are responsible for understanding Harvard Extension School policies on academic integrity (www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity) and how to use sources responsibly. Not knowing the rules, misunderstanding the rules, running out of time, submitting the wrong draft, or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity. To support your learning about academic citation rules, please visit the Harvard Extension School Tips to Avoid Plagiarism (www.extension.harvard.edu/resources- policies/resources/tips-avoid-plagiarism), where you'll find links to the Harvard Guide to Using Sources and two free online 15-minute tutorials to test your knowledge of academic citation policy. The tutorials are anonymous open-learning tools.

Grading

Late assignments (unless approved in advance by TA) will have 0.5 pt deducted for each day late to a max. deduction of 2 pts; *assignment 11 must be completed by the due date without exception*.

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Fall 2017 DRAFT Course Schedule Lectures or Sections:

 Mondays & Thursdays, 7:40-9:40

Readings: G&E = Gotelli & Ellison; M = Meadows ; pdf = journal article posted on course isite

TA assignment: JP= Jen Palacio; JM= Judith McMichael; SF= Steve Falivene;

 RyC= Ryan Cornell; KR= Kim Roseberry; RC= Romilly Cavanaugh

Lect. # Date Topic Assigned Reading

1 Aug 28 (this first meeting online only via zoom) Get started on Excel basics

Introduction: Analysis of Environmental Problems & stats background

 Assignment 1A: Handling sustainability data in excel

*2* Aug 31Probability, Summary Statistics & Statistical Hypotheses G&E: chap. (1-4, selective)

(pp. 1-12, 31-38, 46-49, 57-78, 90-93)

 Preparation for Water System Negotiations on Saturday, 9/9 pdfs: stakeholder roles

3 Multistakeholder Environmental Negotiations/Climate (video only)

Sep 4 no class- Labor Day holiday consult stakeholder team

*Sep 5 JP assignment 1A due: Handling sustainability data in Excel*

 *Sep 7 section: JP assignment 1B: Summary statistics and statistical tests*

Review: preparation for Water System Negotiations (Sat 9/9)

*Sat Sep 9 section (12-3pm): ML Water stakeholder negotiations*

 Note: you are invited to attend the Sustainability program mixer & panels (4-10pm)

 Sep 11 no class

*Sep 13 JM assignment 1B due: Summary stats & statistical tests*

4 Sep 14 Self-governing Institutions for Sustainability pdfs: Ostrom et al., Dietz

*Sep 18*  *section: Fisheries evaluation assignment # 3 pdfs: fisheries- Assign#3
(zoom session only, 7:40-8:30)*

*Sep 20 KR assignment 2 due: Water system negotiations*

5 Sep 21Economic and Financial Appraisal pdfs: Dixon, Schultze, etc.

6 Sep 25 Economic Appraisal of Environmental Projects

*Sep 27 SF/KR assignment 3 due:* *Fisheries evaluation*

 Sep 28 *section: JP Spreadsheet analysis of financial & economic appraisals*

7 *Oct 2* Linear Regression G&E: chap 8 (p218-233)

 Oct 5 *section:* *JP Linear regression analysis using R*

*Oct 8 JM assignment 4 due: Spreadsheet analysis of financial & economic appraisals*

 Oct 9no class: Columbus Day holiday

8 Oct 12Designing Experiments and Observations G&E: chap. 4, 6, 7

9 Oct 16 Multiple Regression G&E: chap 9 & 12

 Lyme Disease- assignment #7

 *Oct 19*  *section: JP Multiple regression using R*

*Oct 22 RyC assignment 5 due:* *Linear regression analysis using R*

10 Oct 23 Geographic Information Systems (GIS) Analysis (Guest Lecturer: Dr. Wendy Guan)

11 Oct 26 *S*ystems Thinking: Stocks & Flows M: chaps. 1-4

*Oct 29 JM assignment 6 due: Multiple regression using R*

12 Oct 30 System Dynamics (video only) M: chaps. 5-7

 *Nov 2 section: JP Systems diagrams & Life Cycle Analysis (LCA)*

 *Nov 5 KR/RoC assignment 7 due: Environmental brief on lyme disease*

 *Nov 6* no class

 Nov 9 *section: JP Sustainable food systems- cool farm tool*

*Nov 12 assignment 8 due: SF/RyC Systems diagrams & Life Cycle Analysis (LCA)*

 *KR Sustainable food systems- cool farm tool*

13Nov 13 ANOVA & Contingency Tables G&E: chap 10

 *Nov 16 section: JP ANOVA & Contingency Tables using R*

 Species population dynamics: SimuText Isle Royale Lab- Assignment #12

Nov 20 Assignment #13 review: Research Proposals

 Critiquing Research Paper- Assign#11 (online-zoom)

pdfs: Paoli & Curran, Kauffman, et al.

*Nov 21 RyC assignment 9 due: ANOVA & Contingency Tables using R*

Nov 23 No class: Thanksgiving Holiday

14Nov 27Conservation Biology

*Nov 29 JP assignment 10 due: Species population dynamics: Isle Royale SimuText lab*

15 Nov 30Human Population Growth *Science* pdfs

*Dec 4 JM/RoC assignment 11 due before class (7:30pm):* *Critique of research papers*

*Dec 4 section: ML Evaluating goals, research design, analysis and inferences*

 Discuss Assignment#13: Research proposal

16 Dec 7Conducting Research in Sustainability

*Dec 11 JM assignment 12 quiz due before section: Human population growth readings*

Dec 11 *section: JM Human population ecology discussion*

*Dec 14 JM/RoC assignment 12 due: Human population growth*

*Dec 18 JP assignment 13 due: Research proposal*