#### **Qualitative and Quantitative Methods**

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Syllabus

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### **Course Description**

A critical, probing approach to environmental research requires a secure foundation in the qualitative and quantitative methods used in professional work. This doesn't mean, however, that the technique comes first and the critical element is postponed until some later date. All methods employed in research depend on assumptions that may or may not apply to a given situation, and all of them are limited in some way. Our approach to QQM is based on this philosophy: we will study the nuts and bolts of research method, acquire some hands-on experience in their use *and* continue to develop the critical framework building on PEEP and ESS.

The main challenge we face is one of diversity: environmental studies as we understand it in MES functions across a wide range of academic disciplines in the social and natural sciences, and these in turn have many parallel methodological traditions. Ethnographers, toxicologists, economists, chemists and natural historians all take methodology seriously, but the techniques they use and the debates they have about them are strikingly different. We have one quarter to explore issues of methodology, and we will make an honest effort to represent the diversity of approaches you are likely to find in professional-level research in the years ahead. At the same time, we cannot shortchange the technical side of the subject, and this means we have to be committed to depth as well as breadth.

So QQM is built on three legs: a broad overview of diverse research methods, a detail, handson mastery of technique, and a critical approach to the ever-imperfect strategies devised to separate knowledge from speculation. We know in advance that there won't be enough time to do everything as thoroughly as we'd like, but we will try to do as much as we can. In this context, we ask you to be fully engaged with the program: to do all the readings before the due date, to work through periods of uncertainty and confusion, and to seek help earlier rather than later if you feel the material is running away from you. As a rule of thumb, if the material we are covering has not been clarified for you by the next class day, be sure to contact either Alison, Peter, or Andy. Don't fall more than a week behind.

The specific topics listed in the syllabus correspond to what we see as the most important set of methods employed in environmental studies. On the qualitative side this includes the case study approach to hypothesis testing, the technique of interviewing, ethnographic observation and interpretation and qualitative description in natural history and field ecology. On the quantitative side we will focus on standard metrics for hypothesis testing, analysis of variance (ANOVA), and multivariate regression. We will pay attention to the importance of knowing what sort of distribution the data are drawn from—normal, logistic or otherwise. Statistical work will be performed using R, a free, open-source software package that is gaining widespread acceptance among researchers in many fields.

Student work consists of keeping current with the readings, completing the workshops and other

assignments that provide practice with qualitative and quantitative methods, attending class and participating in discussions and seminars, taking and passing midterm and final exams, and, above all, developing a critical understanding of the main topics and concepts we will be exploring.

## **Class meetings**

Lectures:Sem II A1105 (Tuesdays), Sem II A1107 (Thursdays)Seminars:Sem II A2105, Sem II A3105CAL labs:Lab II 1223A (first floor Computer Applications Lab, CAL)

**Required Course Readings:** see the bibliography at the end of this syllabus. **Bookstore Note:** The campus bookstore is returning unpurchased books during week 4, so if you intend to obtain a book via the bookstore, please do so by that time.

## **Useful Websites**

Stats tutorials website (free): http://cast.massey.ac.nz/ Stats online courses (registration fee): http://www.statistics.com/ourcourses/ MD Anderson Statistical Software downloads (free): http://biostatistics.mdanderson.org/SoftwareDownload/ Wolfram Mathworld (free): http://mathworld.wolfram.com/topics/ProbabilityandStatistics.html

## Weekly Schedule

### Week 1

March 31 § Introductions, Overview of Descriptive Statistics, Probability, Quantitative Natural History (Alison)

*Read*: Moore and McCabe Ch. 1-4 + Crawley Ch. 1, 3, 4 + Short + Styring & Zakaria § Seminar: Descriptive and Quantitative Ecology (Short + Styring)

April 2 § Environmental Economics (Peter), Journal workshop (Alison) § CAL - R tutorial and comparing Excel and R with normal distribution graphs and descriptive stats

Read: Crawley Ch. 1, 2, appendix 1 + Indrawan + Dorman

Assignment: Moore and McCabe Ch. 1-4 homework Assignment: qualitative homework - red list research

### Week 2

April 7 § Qualitative natural history wrap up – rapid assessment, red-listing, and prioritization (Alison)

§ Sampling and Estimation; characteristics of sample (Peter)

§ Seminar – examples of research with sampling problems (Lammertink)

Read: Moore and McCabe Ch. 3.2, 3.3, 5, 6.1 + Crawley Ch. 1, 5 + Lammertink

Assignment: Sampling and Estimation homework Due: Red list homework

April 9 § Rapid assessment and Qualitative Natural History

§ Seminar: Interviewing

§ CAL – R workshop Sampling and Estimation *Read:* Weiss first half (through Chapter 4).

Assignment: Sampling and Estimation exercise in R Due: Moore and McCabe Ch. 1-4 homework (and R tutorial if not finished during class on 4/2)

# Week 3

April 14 § Hypothesis testing, Inference: one population (Alison) § Seminar: Interviewing *Read:* Moore and McCabe Ch. 6, 7.1, 8.1 + Crawley Ch. 5 + Weiss (2<sup>nd</sup> half; Ch. 5-end)

Assignment: Moore and McCabe (MMC) Homework Due: Sampling and Estimation homework

April 16 § CAL Lab: Hypothesis Testing / Inference one pop - with R

Assignment: Inference one population exercise in R Due: Sampling and Estimation exercise in R

## Week 4

April 21 § Inference: Two or more populations (including ANOVA) (Alison) *Read:* Moore and McCabe Ch. 7, 8.2, 12 + Crawley Ch. 6, 9, 10, 12

Assignment: MMC homework – NOTE extended due date! Due: Week 3 MMC homework

April 23 § Ethnography panel – Karen Gaul and Linda Moon-Stumpff § CAL Lab : Inference: Two or more populations (including ANOVA) (Alison) *Read:* What is Ethnography?

Assignment: Take-Home Mid-term exam (quantitative + qualitative) Assignment: Inference: Two or more populations in R (including ANOVA) Due: Inference one population exercise in R

## Week 5

April 28 § Regression – Transformations (Peter) Read: Moore and McCabe Ch. 10 (if you need the review), 11 + Crawley Ch.6, 7, 8,11,12

Assignment: MMC Homework Due: Take-home exam

April 30 § More Regression (Peter) § CAL Lab: Regression

Assignment: Regression in R Due: Week 4 MMC homework (deadline extended to accommodate for the midterm) Due: Inference: Two or more populations in R (including ANOVA)

## Week 6

# May 5 § Rachel Carson Forum: Film Showing – Fuel (starts at 6:30 in Lecture Hall 3. Be there at 6:15 to get a good seat!)

FUEL is an insightful portrait of America's addiction to oil and an uplifting testament to the immediacy of new energy solutions. Director, Josh Tickell, a young activist, shuttles us on a whirlwind journey to track the rising domination of the petrochemical industry — from Rockefeller's strategy to halt Ford's first ethanol cars to Vice President Cheney's petrochemical company sponsored energy legislation — and reveals a gamut of available solutions to "repower America" — from vertical farms that occupy skyscrapers to algae facilities that turn wastewater into fuel. Tickell and a surprising array of environmentalists, policy makers, and entertainment notables take us through America's complicated, often ignominious energy past and illuminate a hopeful, achievable future, where decentralized, sustainable living is not only possible, it's imperative.

#### http://thefuelfilm.com/

### Assignment: nothing!

May 7 § Survey Methods speaker Martha Henderson § CAL Lab: More regression in R *Read:* Morehouse

Assignment: pick a paper that serves as a good example of a method you are interested in and prepare a brief presentation of that work for class time on **6/2 and 6/4** Assignment: more regression in R Due: Week 5 MMC homework Due: Regression in R

### Week 7

May 12 § Principle Components Analysis (PCA) (Alison) *Read*: Benkman + James + Losos

Assignment: PCA homework

May 14 § CAL - PCA in R (Alison)

Assignment: PCA in R Due: More regression in R

### Week 8

May 19 § Logistic regression (odds ratio) (Peter) § Seminar Case Studies *Read*: Moore and McCabe Ch. 14 (On Disc) + Gerring Part I

Assignment: Logistic regression homework (MMC or other) Due: PCA homework

May 21 § CAL - logistic regression in R (Peter) § Seminar Case Studies *Read*: Gerring Part II

Assignment: Logistic regression in R Due: PCA in R

## Week 9

May 26 § Non-parametric/survival (Peter) § Seminar on Silent Scourge *Read*: Moore and McCabe Ch. 15 (on Disc) + Moore (Silent Scourge)

Due: Logistic regression homework

May 28 § CAL - Non-parametric/survival in R (Peter) § Seminar on Silent Scourge *Read:* Moore

Assignment: Final take-home exam Assignment: non-parametrics in R Due: Logistic regression in R

Week 10 June 2 § Presentations

Due: Final take-home exam

June 4 § Presentations, Wrap Up, Potluck

### Week 11

June 11-15 Evaluation conferences – bring your self evaluation to the conference. Faculty evaluations can also be turned in to your seminar leader at the conference or to the the Lab 1 Program Secretary, Pam Udovich.

**Bibliography** (be sure to find all three sections of this—books & monographs, articles, and chapters)

(**Books & Monographs**) These books can be obtained via the bookstore (with one exception – see below) and several copies are available through SUMMIT and ILIAD.

Crawley, Michael J. 2005. Statistics: An Introduction using R. John Wiley & Sons. ISBN: 0470022981

Gerring, John. 2006. Case Study Research: Principles and Practices. Cambridge University Press. ISBN:0521676564.

- Moore, Colleen F. 2003. *Silent Scourge: Children, Pollution, and Why Scientists Disagree.* Oxford University Press. ISBN: 019515391X (not at the bookstore, but lots of copies online).
- Moore, David S. and George P. McCabe. 1998. *Introduction to the Practice of Statistics.* W.H. Freeman and Company (3rd edition or later). ISBN: 0-7167-3502-4
- Weiss, Robert S. 1994. *Learning from Strangers: the Art and Practice of Qualitative Interview Studies.* Free Press. ISBN: 9780029346259

What is Ethnography? (Remainder of citation is on it's way!).

(*Articles*: we will make every effort to make these available on Moodle; all should also be available through the Evergreen Library)

Dorman, Peter. 2003. Debt and Deforestation. Rethinking Macroeconomics: Social

*Institutional and Environmental Perspectives* (J. Harris and N. Goodwin, eds.). Edward Elgar, Northhampton.

- Benkman, Craig W., Julie W. Smith, Patrick C. Keenan, Thomas L. Parchman, and Leonard Stantisteban. 2009. A new species of the Red Crossbill (Fringillidae: *Loxia*) from Idaho. *The Condor* 111(1):160-176.
- James, Frances C. and Charles E. McCulloch. 1990. Multivariate analysis in ecology and systematics: panacea or Pandora's Box? Annual Review of Ecology and Systematics 21:129-166.
- Losos, Jonathon B. 1990. Ecomorphology, performance capability, and scaling of West Indian *Anolis* lizards: an evolutionary analysis. Ecological Monographs 60:369-388.
- Morehouse, Barbara, J., Martha Henderson, Kostas Kalabokidis, and Theodoros Iosifides. In review. Managing environmental risk in the context of institutional complexity: the case of wildfire in Greece. Journal of Environmental Management.
- Indrawan, M., P. C. Rasmussen, and Sunarto. 2008. A new white-eye (Zosterops) from the Togian Islands, Sulawesi, Indonesia. *The Wilson Journal of Ornithology* 120(1):1-9.
- Lammertink, M. 2004. A multiple site comparison of woodpecker communities in Bornean lowland and hill forests. *Conservation Biology* 18(3):746-757.
- Short, Lester. L. 1978. Sympatry in woodpeckers of lowland Malayan forest. *Biotropica* 10(2): 122-133.
- Styring, Alison. R. and Mohamed Zakaria. 2004. Foraging ecology of woodpeckers in lowland Malaysian rainforests. *Journal of Tropical Ecology* 20(5):487-494.

What is Ethnography? (Remainder of citation is on it's way!).