

LIKELIHOOD METHODS IN ECOLOGY

June 2nd – 13th, 2008
Dept of Ecology, Evolution & Environmental Biology
Columbia University, New York, NY

COURSE SCHEDULE

DAILY SCHEDULE

Room 1015/1016 Schermerhorn Extension

Mornings:

Lecture:	8:30 – 10:00 am
Break:	10:00 – 10:30 am
Lab:	10:30 – 12:30 am

Lunch: 12:30 – 2:00

Afternoons:

Discussion:	2:00 – 3:00 pm
Break:	3:00 – 3:30 pm
Lab/Individual Projects	3:30 – 5:30 pm

INSTRUCTORS

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Teaching assistant : Charles Yackulic, email : c_yackulic@yahoo.com

READINGS

There are copies (PDFs) of an extensive set of readings on likelihood methods on the course website. The readings are password protected – you should have received the username and password from one of the instructors.

There are two recommended textbooks:

- Hillborn, R. and M. Mangel. 1997. *The Ecological Detective*. Princeton University Press.
- Bolker, B. In press. *Ecological Models and Data in R*. Available for download at <http://www.zoo.ufl.edu/bolker/emdbook/> (Aug 2007 version).

SYLLABUS

DAY 0: MONDAY, JUNE 2ND [CC] **Note: Starts at 9:30 am (instead of 8:30)**
Optional 1-day tutorial as an introduction to R.

DAY 1: TUESDAY, JUNE 3RD

Lecture: [Introduction to likelihood and model comparison: A new framework for linking models, data and parameters.](#) [CC]

Lab: Regression using likelihood methods in R. [CC]

Discussion: Statistical philosophy and scientific inference [CC]

Recommended reading:

Scheiner, S. 2006. T & L Chapter 3.

Stephens, P.A., S.W. Buskirk, G.D. Hayward and C. Martinez del Rio. 2005. [Information theory and hypothesis testing: a call for pluralism.](#) Journal of Applied Ecology 42:4-12.

DAY 2: WEDNESDAY, JUNE 4TH

Lecture: Know your data: probability distributions and dataset properties. [MU]

Lab: Probability, probability density functions and dataset properties. [MU]

Discussion: Why should we care about distributional theory? [MU]

Recommended reading:

Ruel, J. J. and M. P. Ayres. 1999. [Jensen's inequality predicts effects of environmental variation.](#) Trends in Ecology & Evolution 14: 361-366.

Schmitt et al. 1999. Quantifying the effects of multiple processes on local abundance. Ecol Letters 2: 294-303.

DAY 3: THURSDAY, JUNE 5TH

Lecture: Probability and likelihood [MU]

Lab: Probability and likelihood [MU].

Discussion: Choosing the right likelihood function [MU]

Recommended reading:

Canham, C. D., M. J. Papaik, et al. 2001. Interspecific variation in susceptibility to windthrow as a function of tree size and storm severity for northern temperate tree species. *Canadian Journal of Forest Research* 31: 1-10.

DAY 4: FRIDAY, JUNE 6TH

Lecture: [Model formulation and choice of functional forms](#). [CC]

Lab: Choosing functional forms and programming functions in R. [CC]

Discussion: Building your own toolkit of favorite functions [CC]

Recommended reading:

Canham, C. D., M. Papaik, M. Uriarte, W. McWilliams, J.C. Jenkins, and M. Twery. 2006. [Neighborhood analyses of canopy tree competition along environmental gradients in New England forests](#). *Ecological Applications* 16:540-554.

Gómez-Aparicio, L. and C. D. Canham. 2008. A neighborhood analysis of the allelopathic effects of the invasive tree *Ailanthus altissima* in temperate forests. *Journal of Ecology* 96:447-458.

DAY 5: MONDAY, JUNE 9TH

Lecture: [Parameter estimation and evaluation of support](#). [MU]

Lab: Parameter estimation using local and global optimization in R; Evaluating support. [CC]

Discussion: Estimating the unmeasurable – inverse modeling [CC]

Recommended reading:

Canham, C. D., M. L. Pace, M. J. Papaik, A. G. B. Primack, K. M. Roy, R. J. Maranger, R. P. Curran, and D. M. Spada. 2004. [A spatially-explicit watershed-scale analysis of dissolved organic carbon in Adirondack lakes](#). *Ecological Applications* 14:839-854.

DAY 6: TUESDAY, JUNE 10TH

Lecture: Model comparison [CC]

Lab: Model comparison. [MU]

Discussion: Model comparison as a form of hypothesis testing [MU]

Recommended Reading:

Uriarte, M., R. Condit, C.D. Canham, and S.P. Hubbell. 2004. A spatially-explicit model of sapling growth in a tropical forest: Does the identity of neighbours matter? *Journal of Ecology* 92: 348-360.

DAY 7: WEDNESDAY, JUNE 11TH

Lecture: Model evaluation [CC]

Lab: Methods for model evaluation [CC]

Discussion: Prediction vs. explanation: the tyranny of R^2 [CC]

Recommended Readings:

Oreskes et al. 1994. Verification, validation, and conformation of numerical models in the earth sciences. *Science* 263: 641-646.

Moller, A. P. and M. D. Jennions. 2002. How much variance can be explained by ecologists and evolutionary biologists? *Oecologia* 132: 492-500.

Peek, M. S., A. J. Leffler, et al. 2003. How much variance is explained by ecologists? Additional perspectives. *Oecologia* 137: 161-170.

DAY 8: THURSDAY, JUNE 12TH

Lecture: Statistics revisited: Traditional statistics and analysis of experiments from a likelihood framework [MU]

Lab: Traditional stats in a likelihood framework and built-in R tools [MU]

Discussion: Why bother with likelihood? [MU]

Recommended Reading:

Strong, D. R., Whipple, A. V, Child, A. L., and Dennis, B. 1999. [Model selection for a subterranean trophic cascade: root-feeding caterpillars and entomopathogenic nematodes.](#) *Ecology* 80(8): 2750-2761

DAY 9: FRIDAY, JUNE 13TH

Symposium 9:00 – 12:00, 1:30 – 3:00: Presentation of individual projects