REM 412/612 Aaron Springford
Simulation Modeling in Natural Res. Mgmt Spring 2010
Simon Fraser University
School of Resource and Environmental Management

Simulation Modelling in Natural Resource Management

Instructor: Aaron Springford
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Office: TASC I 8413
Office Hours: Wednesdays 12:30-1:30pm and Thursdays 9:30-10:30am
Lectures: Fridays 12:30pm – 2:20pm WMC3535
Computer Labs: Tuesdays 8:30am - 10:20pm MCF PC Lab 1 (AQ3148.1)

Course Objectives: This course is designed to achieve three main objectives. First, it is intended as an introduction to both systems and statistical simulation modelling. Second, it serves as an introduction to the tools and techniques of quantitative analysis, which essentially involves computer programming and implementation. Third, the course is intended to provide a real "learn-by-doing" experience in which students break through the technical barriers of developing models, implementing them on a computer, and communicating results. After completing this course, students will be able to:

1. Determine when a simulation approach is required
2. Conceptualise simulation approaches to assess resource management strategies, survey designs, and statistical analysis issues
3. Determine adequate model complexity
4. Develop and implement computer simulation models for systems and statistical analyses
5. Evaluate simulation models for sensitivity to input variables and external drivers
6. Develop optimization procedures to estimate model parameters and evaluate management strategies and survey designs
7. Communicate the rationale, methods, and results from simulation approaches to resource assessment and management stakeholders

Course Content
The course involves lecture, discussion, and computer lab sessions that develop a simulation approach to resource assessment and management. It uses actual simulation examples to highlight key points and approaches along with weekly computer labs to gain hands-on experience in model implementation and testing. The main components of the course include:

1. Overview of systems theory and simulation
2. Introduction to analysis and programming in R
3. A general approach to model building
4. Simulating deterministic and stochastic models
5. Monte Carlo methods for sensitivity and statistical analysis
6. Optimisation

Recommended Textbook
The textbook for the course will be *Ecological Models and Data in R* by Ben Bolker (http://people.biology.ufl.edu/bolker/emdbook/). The textbook is available from several online stores (Amazon, Chapters, etc.) for a modest price – I highly recommend getting a copy. There will be one copy on 24 hr reserve in the library. Although this book has an ecological focus, the techniques are applicable to other disciplines in resource management.

Grading/Evaluation
Grading for this course is mainly based on a Simulation Research Project (**60%**). Students choose their own projects, develop the initial background and conceptual model, construct, implement, and test the model and finally, present results to the class. Phases of model development will be completed in 3 assignments. The remaining evaluation consists of Computer Lab Projects (**30%**) and contribution to Class Discussion (**10%**). Listed below are the three main assignments related to the term project:
Assignment 1 – background on simulation problem and conceptual model
Assignment 2 – model construction, testing, and sensitivity analysis
Assignment 3 – 15 minute presentation of the model, sensitivity, main findings, and limitations. Completed written report.

Simulation Research Project
Written assignments (#1-3) may be handed in to the TA at any time prior to the due date for feedback before final submission. Assignment #3 also includes the in-class presentation and final written report, which is due on the last day of class. Student assignments are graded according to 4 criteria: Technical, Communication, Critical Thinking, and Effort (related to difficulty of the project). I will use the following guidelines to evaluate assignments (similar guidelines apply to class participation and discussion of reading material):

Grade	Requirements
A+	Performs above expectation in all 4 areas. Independently and correctly provides analyses/results/discussion beyond requirements
A	Assignment complete. Performs above expectation in some areas. Able to interpret results critically and accurately
B	Assignment complete. Performs at expected level in most areas. Some inconsistency/inaccuracy interpreting results
C	Assignment incomplete. Performs below expected level in most areas
D	Assignment incomplete. Performs well below expected level in all areas
F	Assignment not turned in earlier than 7 days after due date.