

Research Project Assignment

Bio 534, Fall 2008

Description

The final project for *Bio534: Fundamentals of Ecological Modeling* is to construct and analyze a process-based simulation model to address an ecological research question of your choice. Through this project you will have the opportunity to:

- Critically read ecological literature that uses dynamic models;
- Delve deeper into an ecological topic of your choice;
- Design and implement research based on dynamic models;
- Construct and analyze process-based simulation model;
- Communicate model based research to a scientific audience; and
- Become more effective, self-assessing, and self-directed learners.

For this project, you will choose a published research paper that uses a dynamic model and (1) re-implement the original model (using the software/language of your choice like R), and (2) then push the research and model further. Specifically, you should formulate a new research question and hypothesis that you can address by modifying the model in some non-trivial way.

We will break this project into four tasks.

Task 1: Topic Selection (5%)

The first task of the project is to select a topic, paper(s), and dynamic model to replicate and modify. You will present your selection to the class on Oct. 14th. In this short presentation (5-10 minutes depending on course enrollment), you should introduce the class to the model and describe how it was originally used. Conclude your presentation by discussing the new research question or hypothesis you plan to address by modifying the model.

Task 2: Project Proposal (15%)

The second task is a written project proposal. In this short report (3–6 pages, double spaced, not including figures, tables, and references) you will first describe the original model that you plan to modify. Please include a diagram of the original model. You should include any preliminary evidence you have that you can replicate the original model. Next, you should briefly describe your new research objectives, question(s), and hypotheses, the model modifications you intend to make (include a revised diagram), and outline your work plan. Include a description of the motivation and significance of this research.

While I do not wish to unduly limit your research possibilities, I strongly suggest that you limit the size of your model to between 4 and 8 state variables. This will provide a rich enough modeling activity to challenge your developing skills, but still be manageable in the time-span of the semester.

This task serves two purposes. First, it provides encouragement for you to start working on this project early in the semester. Second, it offers me an opportunity to provide feedback and guidance on the project and your writing before it is complete. I expect this document to serve as a draft for part of your final report.

Task 3: Project Report (40%)

The third task is the final project report that should take the form of a manuscript you might submit to the journal *Ecological Modelling* (see instructions to authors on the Elsevier website and [Jørgensen et al. \(2006\)](#)). In this report, you should include evidence that you were able to re-implement the original model as well as address your new question. You should also critically evaluate the model and its ability to address the research questions, and compare your results with existing results from the literature. I expect that this report will incorporate revised text and ideas from the project proposal, including the system description, conceptual model, and motivation and significance.

This report should be between 10 and 15 double spaced pages not including the abstract, figures, tables, and references. Please number the lines and place the figures and tables on separate pages at the end of the report. I suggest *The Chicago Manual of Style* (2003) for grammar advice and [Tufte \(1983, 2003\)](#) for suggestions on the display of quantitative information.

In addition to the report, please submit a working copy of your source code. While this is not a programming class, neat and well documented code will be appreciated. Please zip (Stuff) these files together and submit them electronically with your report.

Task 4: Project Presentation (15 % of Lab.)

The final task for the final project is to present a 15–20 minute summary of your work to the class. As with your written report, you should (1) introduce your ecological topic and research objectives, (2) tell the audience the significance of the work, (3) describe the model and any revisions you made, (4) communicate the results of your work, and (5) discuss their broader impacts. Again, you must provide evidence that you were able to replicate the

previous model OR provide a compelling argument for why you were unable to achieve this objective.

Due Dates & Evaluation

Task 1 is due in class on October 9th. Tasks 2 and 3 are due on October 28th and December 2nd, respectively. Both of these assignments are due by 5 pm, and will be evaluated with the rubric presented at the end of this assignment. They should be submitted in MS Word or PDF format and emailed to borretts@uncw.edu.

Task 4 will be due during our Final Exam periods Dec. 11th from 11:30 am - 5 pm. I will emphasize organization, clarity, timing, and evidence display in my evaluation. As always with presentations, the trick here is to provide enough information that the audience can understand what you have done and why without overwhelming them with details.

Recommended Journals

Dynamic, process-based models are common in the ecological literature, but I recommend the following journals as good starting points for your research.

American Naturalist	Environmental Modelling & Software
Ecological Applications	Evolutionary Ecology
Ecological Modelling	Journal of Ecology
Ecological Monographs	Limnology & Oceanography
Ecology	Oikos
Ecology Letters	Proceedings of the National Academy of Sciences

References

2003. The Chicago Manual of Style. 15th edition. University of Chicago Press, Chicago.

Jørgensen, B. D., S. E. and Fath, W. Grant, and S. N. Nielsen. 2006. The editorial policy of Ecological Modelling. *Ecological Modelling* **199**:1–3.

Tufte, E. R. 1983. The visual display of quantitative information. Graphics Press.

Tufte, E. R. 2003. The cognitive style of PowerPoint. Graphics Press.

Scoring Rubric for Research Paper

Achievement Level	General Presentation (33%)	Model Construction & Evaluation (33%)	Reasoning & Argumentation (33%)
Exemplary (100%)	<ul style="list-style-type: none"> Provides a clear introduction and rational for research. States a specific, testable research question. Clearly explains the proposed research methods. Compelling title and abstract. Citations are relevant and used appropriately. Figures and Tables are clear, self-explanatory, and described in the text. Uses acceptable style and grammar errors (0). 	<ul style="list-style-type: none"> Model replicates previously published behavior or clear and logical rational as to why not. Initial and modified conceptual model are diagramed and explained. Primary modeling assumptions are stated. Modifications of original model are clear and logical. Model components and equations are presented and well explained. Careful and critical model assessment reported (e.g., sensitivity analysis). 	<ul style="list-style-type: none"> Provides relevant evidence to support conclusions. Demonstrates a solid understanding of the research implications. Provides reasons for the legitimacy of the evidence that enables conclusions. Discussion focuses on the scientific progress in ecology and ecological modeling modeling.
Adequate (80%)	<ul style="list-style-type: none"> Introduction and research rational are presented, but could be done more logically, clearly, or concisely. Research question is vague. Proposed methods are unclear. Figures and Tables are unnecessary or unclear. No more than 4 grammar and style errors. 	<ul style="list-style-type: none"> Initial and modified conceptual models are diagramed, but not explained. Model presentation adequate for understanding, but not for replication. Variables and parameters are not well explained and units are unclear. Minimal model evaluation is reported. 	<ul style="list-style-type: none"> Research implications stated, but weak evidence is provided. Legitimacy of evidence used for conclusions is unclear. Demonstrates minimal understanding of ecological modeling.
Needs Improvement (65%)	<ul style="list-style-type: none"> Research question is not testable with dynamic modeling. Report is not clearly or logically organized. Citation use is inappropriate, inadequate, or formatting is inconsistent. Report exceeds required length. Fails to use acceptable style and grammar (> 4 errors). 	<ul style="list-style-type: none"> Original model is unable to replicate published behavior with no valid rational. No conceptual model diagrams and/or inadequate description. Equations, variables, parameters, and forcing functions not identified or explained. No model evaluation is reported. 	<ul style="list-style-type: none"> Does not demonstrate understanding of research implications. Proposed methods cannot address research question. Supporting evidence is lacking or inaccurate. Fails to demonstrate understanding of ecological modeling concepts and techniques. Conclusions are inaccurate.

Adapted from D. Ebert-May (<http://www.flaguide.org/cat/rubrics/rubrics2.htm>)