Montserrat
Natural World Cluster
Fall, 2011

Cluster Description

Humans have always sought to understand the world we inhabit and our place in it. Our sciences, arts and literature, philosophy and religion are all aspects of this search for understanding. Humans have the ability to describe and shape their environment, and therefore the environments of all other inhabitants of our planet. But what have been the consequences and what are our responsibilities? Our seminars this year will address questions such as: How do organisms and the environment interact in their intertwined paths of development? How are humans affecting the natural environment? How can mathematics be used to study both nature and aspects of human culture such as music? How has the idea of the frontier and the history of westward expansion shaped Americans' ideas about nature and our place in it? What do our choices of what and how we eat tell us about ourselves and our relation to the rest of the natural world? Finally, how do we deal with illnesses and other challenges to our well-being? Can we reconcile a belief in the goodness of the natural world with the presence of elements of that world that cause suffering?

Common Text

Jared Diamond, *Collapse. How Societies Choose to Fail or Succeed.* New York: Penguin Books, 2005.

Common Events

1. Trip to Harvard Forest (Fisher Museum and Ecological Research Station in Petersham, MA) Saturday, September 17 or Saturday, October 22, both days approximately 9:30am – 4:00pm, including travel time.
2. Presentation on Holy Cross Presidential Taskforce on the Environment, date and time: Weds. September 21, 7:00pm, Rehm Library (location still tentative)

Natural World Cluster Faculty, Fall Seminar Titles, and Class Hours

1. Andrea Borghini – I Eat, Therefore I Mean, TR 12:30pm and TR 2:00pm
2. Jodi Rymer – Development and the Environment, TR 9:30am
3. John Little – Modeling the Environment, MWF 9:00am
4. Stephanie Reents – Go West, Young Man and Woman, TR 9:30am
5. Gareth Roberts – Math/Music: Structure and Form, MWF 9:00am
6. Kelly Wolfe-Bellin – Environmental Understanding, WF12:30pm

Montserrat 102N – Modeling the Environment
Syllabus – Fall 2011

Professor: John Little
Office: Swords Hall 331
Office Phone: (508) 793-2274
Office Hours: MF 10 - 12noon, W 3 - 5pm, TR 1 - 2pm, and by appointment
Course Homepage: `http://mathcs.holycross.edu/~little/Montserrat1112/Fall.html`

General Description

This course is a part of the Natural World Cluster of the Montserrat program. This means that at various times we will be addressing one or several of the following:

- The general aims of Montserrat – continued development of your thinking, writing, and communication skills, and the connection of living, learning and doing in college education,
- The theme of the Natural World Cluster (see cover page for this syllabus), and
- The specific subject matter of this seminar – mathematical techniques used for modeling and understanding our natural environment.

Some groundrules

Many class meetings will be devoted to discussions, oral presentations, or work in smaller groups, so your active participation will be important for the success of what we do.

- Unless specifically directed otherwise, please *turn off* all cell phones, pagers, I-phones, I-pads, computers and other similar electronic devices for the duration of each class meeting – your full attention will be required.
- No distracting or "provocative" clothing, headgear, or other personal items in class, please.
- In on-campus events, off-campus trips, etc. you are representing this seminar, the Montserrat program, and by extension, Holy Cross in a wider community. Take responsibility and regulate your behavior accordingly.
- In discussions, there may be times that you disagree with Prof. Little or with a classmate. Please feel free to express that and be prepared to say why and back up your ideas. But please keep the conversation civil and respectful.

This seminar

At the start of the second decade of the 21st century, humans are grappling with a number of tough decisions concerning our place in the natural world and the consequences of how we have

used various resources and impacted our environment. For instance, if we continue to use fossil fuels to generate energy for our industry and transportation, what effects can we expect to see from the pollution they generate? In particular, is human activity causing long-term changes in the Earth's climate? Are there realistic alternatives to those fuels that would sustainably provide for human society's energy needs and have fewer harmful effects? How do we decide what alternatives make more sense?

Our ability to develop answers to such questions and to understand the political, economic and social issues involved depends on being able to deal with *quantitative information*. Mathematical models–equations of various sorts capturing relationships between variables involved in a complex situation–are fundamental for understanding the potential consequences of choices we make. In the mathematical component of this course we will introduce a number of basic techniques for constructing models and see ways they can be applied to study environmental issues.

More specifically, we will study the following topics:

1. Basic techniques of measurement, data analysis, and presentation of data in numerical and graphical forms

2. Functions and modeling – we will see how to use linear, exponential, and power functions to describe different situations and how to select an appropriate model for a given situation

3. Difference equations and modeling – we will see how to set up and solve difference equations that describe how systems evolve over time (treating time in discrete units).

We will not make use of any calculus or mathematics more advanced than ideas about functions, graphs, algebra, some geometry, etc. So everyone should have seen all the mathematical prerequisites and some of the basic ideas behind material we study may be familiar from mathematics courses you took in high school. What will probably be different, though, is the consistently applied and environmental focus of everything we do.

Course Objectives

The major objectives of the seminar will be:

1. To acquaint you with, and develop your skill in applying, various techniques of mathematical modeling (especially use of various functions and difference equations to construct models).
2. To study ways that the mathematics from point 1 can be used to address environmental questions.
3. To further your development as speakers and writers.
4. To create a group atmosphere where civil and constructive conversations can take place concerning difficult questions. Many of the topics we discuss will have controversial aspects and reasonable people can have very different viewpoints on them. Recognizing that, everyone (including Prof. Little, of course) should listen carefully and seek to understand where others are coming from, especially when your first inclination might be to disagree. (Good academic *writing* can also be seen as a conversation between the writer and others who have thought

about similar questions. So this way of doing things will carry over into the way we approach writing assignments as well.)

5. To participate in and contribute to the common activities of the Natural World Cluster of the Montserrat program. *Note:* See Cluster cover page for this syllabus.

Texts

The text books for the course are:

1) G. Langkamp and J. Hull, *Quantitative Reasoning and the Environment*, Pearson Prentice-Hall. (We will do almost everthing in Chapters 1 - 10 this semester; we'll cover the remaining chapters, and more topics in statistics, next semester.)
2) T. Easton, *Taking Sides, Clashing Views on Environmental Issues*, McGraw-Hill.
3) G. Graff and C. Birkenstein, *They say/I say*, Norton.

We will also read and discuss the Natural World Cluster common text:

4) J. Diamond, *Collapse*, Penguin.

Course Schedule

A detailed day-by-day course schedule and listing of required and suggested outside events will be maintained on the course homepage (and will be accessible through the Moodle course management system). That listing is a tentative, evolving schedule, so it may change and you will probably want to refer to it frequently. Any important changes will also be announced in class well in advance.

Assignments and Grading

1) *Midterm exam* (15 % of course grade) – tentative date: Friday, October 21.
2) *Final exam* (25 % of course grade) – the final will be given at the established time for MWF 9 am classes, when that is determined.
3) *Individual problem sets* (about 7 through the semester – 10 % of course grade)
4) *Writeups from group project days* (about 6 assignments – 10 % of course grade)
5) *Two roughly 5 page papers*, and other shorter writing assignments. (Information and guidelines to be distributed later) (25 % of course grade)
6) *Presentation*: Each student, working with a partner, will prepare and present one side of a "debate" based on one of the issues presented in the *Taking Sides* text. More details on this later. (10% of course grade)
7) *Class participation* (5 % of course grade)

I will be keeping your course average in numerical form throughout the semester, and only converting to a letter for the final course grade. The course grade will be assigned according to the following conversion table (also see Note below):

- A – 94 and above
- A- – 90 - 93
- B+ – 87 - 89
- B – 84 - 86
- B- – 80 - 83
- C+ – 77 - 79
- C – 74 - 76
- C- – 70 - 73
- D+ – 67 – 69
- D – 60 - 66
- F – 59 and below.

Note: Depending on how the class as a whole is doing, some downward adjustments of the above letter grade boundaries may be made. No upward adjustments will be made, however. (This means, for instance, that an 85 course average would never convert to a letter grade of B- or below, although it might be a B+ in some circumstances.) If you ever have a question about the grading policy or your standing in the course, don't hesitate to ask me.

Advice On How To Succeed In This Class

A good "work ethic" is key. As you should be able to tell from the course description above, you do not need to be a "math genius" to do well in this course. But you will need to put in a consistent effort and keep up with the reading and assignments.

Come to class. Unless you are deathly ill, have a genuine family emergency, are away at a game or meet of a college athletic team, etc. plan on showing up here at 9:00 am every Monday, Wednesday, and Friday this semester. Many of the class meetings will be structured around discussions or student presentations. Your participation is expected and needed for the success of the course!

Take notes and use them. This may seem obvious, but it is worth saying! Used intelligently, your notes can be a valuable resource as you work on problem sets and prepare for exams.

Use the texts and class notes actively. Reading about mathematics is not like reading a novel. You will probably need to read and think over things more than once. You may want to work through examples to understand some of the topics that we do.

Set up a regular study schedule and work at a steady pace. It's not easy to play catch-up in a mathematics course (even when the course is part of a first-year program with additional goals beyond the mathematics). You should expect to budget at least 6 hours in a typical week for work outside of class. The best way to use your time is to do a few problems, some reading from the books, and reviewing of class notes every day.

Most importantly, if you are having difficulty learning something, get help as soon as

possible. You can do this by asking questions during class (any time something isn't clear), or seeing me during office hours.

Statement on Academic Integrity

All education is a cooperative enterprise between teachers and students. This cooperation works well only when there is trust and mutual respect between everyone involved. To be become an engaged and advanced learner, you must be able to think and work both independently and in concert with your peers. The College academic honesty policy states: "As an institution devoted to teaching, learning, and intellectual inquiry, Holy Cross expects all members of the College community to abide by the highest standards of academic integrity. Any violation of academic honesty undermines the student-teacher relationship, thereby wounding the whole community. The principal violations of academic honesty are plagiarism, cheating, and collusion.

Plagiarism is the act of taking the words, ideas, data, illustrative material, or statements of someone else, without full and proper acknowledgment, and presenting them as one's own.

Cheating is the use of improper means or subterfuge to gain credit or advantage. Forms of cheating include the use, attempted use, or improper possession of unauthorized aids in any examination or other academic exercise submitted for evaluation; the fabrication or falsification of data; misrepresentation of academic or extracurricular credentials; and deceitful performance on placement examinations. It is also cheating to submit the same work for credit in more than one course, except as authorized in advance by the course instructors.

Collusion is assisting or attempting to assist another student in an act of academic dishonesty.

The full statement on Academic Honesty in the College Catalog will be posted on the Natural World/Montserrat Moodle site and is available at

`http://www.holycross.edu/catalog/academic-honesty-policy.pdf`

The temptation to engage in an act of academic dishonesty will almost certainly arise, but the chance to possibly enhance a single grade is not worth the loss of your personal integrity. If you do not know how to correctly cite reference materials, consult with your professor, the campus Writers Workshop, or visit one of the links below (also posted on the Natural World/Montserrat Moodle site).

Department of History:

`http://www.holycross.edu/departments/history/website/academichonesty.htm`

Department of English (link to Houghton Mifflin booklet, "Understanding Plagiarism: A Student Guide to Writing Your Own Work"):

`http://college.cengage.com/english/plagiarism_prevention.html`

Houghton Mifflin, "The Plagiarism Zone"

`http://college.hmco.com/english/plagiarism_prevention.html`

NOTE: If in doubt about what you plan to do or write violates academic honesty, PLEASE ASK!

Specific Guidelines for this Course

In this course, all examinations will be closed-book. No sharing of information with other students in any form will be permitted during exams. On group discussion write-ups, close collaboration with the other members of your group is expected. On the individual problem sets, discussion of the questions with other students in the class and with me during office hours is allowed, *even encouraged*. However, your final problem solutions should be prepared individually and the wording and organization of your final problem solutions should be entirely your own work. Moreover, if you do take advantage of any of the above options for discussion of problems with others, you will be required to state that fact in a footnote accompanying the problem solution. Failure to follow this rule will be treated as a violation of the College's Academic Integrity policy. For the papers, if you do consult a source other than the course texts, include a full reference in a bibliography section at the end of your paper, and identify any direct quotations. Information about the acceptable formats for doing this will be distributed with the paper assignments.