

Montserrat 100N – Modeling the Environment
Syllabus – Fall 2017

Professor: John Little
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Office Hours: M, 2-4pm, T 9-11am, W 10-11am, R 1-3pm, F 10-11am, and by appointment
Course Homepage: <http://mathcs.holycross.edu/~little/MONT201718/Fall.html>

The Natural World Cluster

Seminars in this year’s Natural World Cluster will explore humans’ relationship to the natural world. Through different perspectives and fields of study, we will investigate quantitative and philosophical approaches to identifying environmental crises and proposing solutions, interrogate our assumptions about what constitutes “wilderness” and what makes something “wild” or “natural” in the context of literature, medicine, religion, history, and art, and trace the rise of environmental movements here and abroad. In particular, this year we will compare and contrast two different approaches to investigating the natural world: one rooted in sensory data and subjective encounters with the natural world (such as walking a path or canoeing a river); and another that relies on quantitative data (such as statistical inference and scientific inquiry). We will examine the sometimes complementary and sometimes conflicting relationship between these approaches asking: *If experiential and quantitative investigations do not always align, how then shall we proceed?* Faculty teaching in the Natural World Cluster are drawn from a variety of departments, including the Center for Interdisciplinary Studies, English, History, Mathematics, and Modern Languages and literatures.

Natural World Cluster Events

- (1) Saturday, October 21, 10:00am - 1:30pm, Field trip to Purgatory Chasm, Sutton, MA
- (2) Monday, November 13, 7:00pm, Showing of film “Containment,” location TBD
- (3) Monday, December 11, 7:00pm, Study Break get-together

2017-18 Natural World Cluster Faculty and Seminars

ENVIRONMENTAL MATHEMATICS

Prof. John Little
MWF 9 - 9:50am
(fall) MONT 100N-01 “Modeling the Environment”
(spring) MONT 101N-01 “Analyzing Environmental Data”

HABITAT EXPLORATIONS

Prof. Sylvia Schmitz-Burgard

WF 2 - 3:15pm

(fall) MONT 102N-01 “Germany’s Greening”

(spring) MONT 103N-01 “Celebrating Geometry Bauhaus”

SCIENCE, NATURE, AND RELIGION

Prof. Catherine Thompson

TR 9:30-10:45am

(fall) MONT 104N-01 “Science and Religion”

(spring) MONT 105N-01 “Health and Sickness”

WILDERNESS AND ENVIRONMENTALISM

Prof. Bruce Bunke

MWF 11 - 11:50am, 12 - 12:50pm, and 2 - 2:50pm

(fall) MONT 106N-01,02,03 “The Idea of Wilderness”

(spring) MONT 107N-01,02,03 “The Last Wilderness”

WRITING/READING PLACE

Prof. Stephanie Reents

WF 12:30 - 1:45pm

(fall) MONT 108-01 “Go West, Young Man and Woman”

(spring) MONT 109-01, “Lost in the City”

Natural World Cluster Librarian

Barbara Merolli

O’Callahan Science Library

508-793-2643

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General Information

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, and
- The specific subject matter of this seminar – mathematical techniques used for modeling and understanding our natural environment.

Some Additional Information and Groundrules

It is my intent that students from all backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a *resource, strength, and benefit*. It is my intent to present materials and activities that are respectful of diversity in all forms: diversity in socioeconomic status, ethnicity, nationality, religion, culture, political opinions, gender identity, sexuality, disability, age, etc. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally, or for other students or student groups.

The College policy on excused absences from class is available at

www.holycross.edu/sites/default/files/files/registrar/excused_absence_policy.pdf

Any student who feels the need for accommodation based on the impact of a disability should contact the Office of Disability Services to discuss support services available. Once the office receives documentation supporting the request for accommodation, the student would meet privately with Disability Services to discuss reasonable and appropriate accommodations (which might include extra time and/or distraction-free environments on examinations, services of a note-taker or sign language interpreter, etc.) The office can be reached by calling 508-793-3693 or by visiting Hogan Campus Center, room 215A.

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

- *Unless specifically directed otherwise, please turn off and stow* all cell 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 a classmate or Prof. Little. Please feel free to express that and be prepared to say why and back up your ideas with evidence and as much eloquence as you can muster. 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.

Texts

The text books for the course (this is for both semesters) are:

- 1) J. Little, *Modeling the World* – download from course homepage. We will do almost everything in Chapters 1 - 8 this semester – additional chapters will follow. We'll cover those remaining chapters containing topics in statistics next semester.
- 2) J. Diamond, *Collapse; How Societies Choose to Fail or Succeed*, Penguin Books; Revised 2011 edition.
- 3) G. Graff and C. Birkenstein, *They say/I say*, 3rd ed. Norton.
- 4) D. Meadows and D. Wright (ed.), *Thinking in Systems*, Chelsea Green Publishing.

Natural World Cluster common reading:

- 5) Pope Francis, *Laudato Si'*, encyclical letter – download from course homepage

It is expected that all Holy Cross students will have textbooks and other required class materials in order to achieve academic success. If you are unable to purchase course materials, please go to the *Financial Aid* office where a staff member will be happy to provide you with information and assistance.

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 27.
- 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 – 15 % of course grade)
- 4) *Writeups from group project days* (about 7 assignments – 15 % of course grade)
- 5) *Two roughly 5 page papers*, and other shorter writing assignments. (Information and guidelines to be distributed later) (20 % of course grade)
- 6) *Presentation*: Each student, working with a group, will prepare and present one side of a “debate” based on an issue presented in one of the readings or the current news. More details on this later. (5% 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.

The College Academic Honesty Policy

All education is a cooperative enterprise between faculty and students. This cooperation requires trust and mutual respect, which are only possible in an environment governed by the principles of academic honesty. 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-faculty 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 ones 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.

At the beginning of each course, the faculty should address the students on academic integrity and how it applies to the assignments for the course. The faculty should also make every effort, through vigilance and through the nature of the assignments, to discourage and prevent dishonesty in any form.¹

It is the responsibility of students, independent of the faculty's responsibility, to understand the proper methods of using and quoting from source materials (as explained in standard handbooks such as *The Little Brown Handbook* and the *Harbrace College Handbook*), and to take credit only for work they have completed through their own individual efforts within the guidelines established by the faculty.

The faculty member who observes or suspects academic dishonesty should first discuss the incident with the student. The very nature of the faculty-student relationship requires both that the faculty member treat the student fairly and that the student responds honestly to the faculty's questions concerning the integrity of his or her work.

If the faculty is convinced that the student is guilty of academic dishonesty, he or she shall impose an appropriate sanction in the form of a grade reduction or failing grade on the assignment in question and/or shall assign compensatory course work. The sanction may reflect the seriousness of the dishonesty and the faculty's assessment of the student's intent. In all instances where a faculty member does impose a grade penalty because of academic dishonesty, he or she must submit a written report to the Chair or Director of the department and the Class Dean. This written report must be submitted within a week of the faculty member's determination that the policy on

¹NOTE: If in any doubt about what you plan to do or write violates academic honesty, PLEASE ASK!

academic honesty has been violated. This report shall include a description of the assignment (and any related materials, such as guidelines, syllabus entries, written instructions, and the like that are relevant to the assignment), the evidence used to support the complaint, and a summary of the conversation between the student and the faculty member regarding the complaint. The Class Dean will then inform the student in writing that a charge of dishonesty has been made and of his or her right to have the charge reviewed. A copy of this letter will be sent to the students parents or guardians. The student will also receive a copy of the complaint and all supporting materials submitted by the professor.

The students request for a formal review must be made in writing to the Class Dean within one week of the notification of the charge. The written statement must include a description of the students position concerning the charge by the faculty. A review panel consisting of a Class Dean, the Chair or Director of the department of the faculty member involved (or a senior member of the same department if the Chair or Director is the complainant), and an additional faculty member selected by the Chair or Director from the same department, shall convene within two weeks to investigate the charge and review the students statement, meeting separately with the student and the faculty member involved. The Chair or Director of the complainants department (or the alternate) shall chair the panel and communicate the panels decision to the students Class Dean. If the panel finds by majority vote that the charge of dishonesty is supported, the faculty members initial written report to the Class Dean shall be placed in the students file until graduation, at which time it shall be removed and destroyed unless a second offense occurs. If a majority of the panel finds that the charge of dishonesty is not supported, the faculty members initial complaint shall be destroyed, and the assignment in question shall be graded on its merits by the faculty member. The Class Dean shall inform the student promptly of the decision made. This information will be sent to the students parents or guardians.

The Class Dean may extend all notification deadlines above for compelling reasons. He or she will notify all parties in writing of any extensions. Each instance of academic dishonesty reported to the Class Dean (provided that the charge of dishonesty is upheld following a possible review, as described above) shall result in an administrative penalty in addition to the penalty imposed by the faculty member. For a first instance of academic dishonesty, the penalty shall be academic probation effective immediately and continuing for the next two consecutive semesters. For a second instance, the penalty shall be academic suspension for two consecutive semesters. For a third instance, the penalty shall be dismissal from the College. Dismissal from the College shall also be the penalty for any instance of academic dishonesty that occurs while a student is on probation because of a prior instance of dishonesty. Multiple charges of academic dishonesty filed at or about the same time shall result in a one-year suspension if the student is not and has not been on probation for a prior instance of dishonesty. Multiple charges of academic dishonesty filed at or about the same time shall result in a dismissal if the student has ever been on probation for a prior instance of dishonesty. Suspension and dismissal are effective at the conclusion of the semester in which the violation of the policy occurred. Students may appeal a suspension or dismissal for reasons of academic dishonesty to the Committee on Academic Standing, which may uphold the penalty, overturn it, or substitute a lesser penalty. A penalty of dismissal, if upheld by the Committee, may be appealed to the President of the College.

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.