

Dept. of Biological Sciences, University of Toronto Scarborough
BIOD59 / EEB1420 Syllabus, Fall 2018
Models in Ecology, Epidemiology, and Conservation
Prof. Péter Molnár

Prerequisites

BIOB50

MATA29 or MATA30 or MATA31 (or equivalent). These are non-negotiable.

Course description

Modelling is a critical tool used to address urgent resource management questions in ecology, epidemiology and conservation. This practical introduction includes approaches for modelling individuals, populations, species interactions, and communities.

Applications include population viability assessments, disease eradication and climate change mitigation.

Learning goals

At the end of the course, students will have obtained a broad overview of the many situations in which models can be helpful in ecology, epidemiology, and conservation. They will have learned how to formulate ecological models, parameterize and test them against data, and analyze them both analytically and using simulations. Students will be able to determine in which situations models can be useful and what their limitations are, and will be able to apply these skills to different biological systems / conservation management questions.

The course puts particular emphasis on sensitizing students to the philosophy and rationale behind ecological models, the links to classical hypothesis testing approaches, as well as communicating the strengths and limitations of models to both technical and non-technical audiences. These skills are critical, as most ecologists work in interdisciplinary teams and also need to communicate their results to the broader public, i.e. people that may not understand or value models.

Course information

Instructor:

Dr. Péter Molnár

Office: SY548

Office hours: Thursdays 3-4pm

Email: peter.molnar@utoronto.ca (please put BIOD59 or EEB1420 in the subject line)

Teaching Assistant:

Juan Sebastian Vargas Soto, juan.vargassoto@mail.utoronto.ca

Lecture times & location:

Tuesdays, 12-2pm, BV 363.

See below for tentative lecture schedule.

Tutorials:

Thursdays, 1-3pm, BV 471.

Note that this course is running as BIOD59 for undergraduate students and as EEB1420 for graduate students. Some tutorial times are only for EEB1420 students, see below for schedule and attendance.

Course Website and Online Lectures: All lecture slides will be posted on Quercus (q.utoronto.ca) before the lecture begins. Materials discussed in tutorials (e.g. computer codes) will also be posted on Quercus, either before or after the tutorial. Additional announcements may also be made on the course website, so please check regularly.

Communication policy

Students are required to regularly check their UTOR email to receive announcements relating to the course. To inquire about course-related issues, students should solely use their UTOR email, as hotmail and other email providers are spam-filtered on a regular basis. **When emailing the instructor, please begin the subject line with “BIOD59: <subject>” (or “EEB1420: <subject>” for grad students) to make sure emails are not overlooked.** It is the responsibility of the student to make sure his or her email reaches the instructor.

Tentative lecture schedule

Date	Day	Lecture	Topic	Recommended Readings
Sep 3	TU	1	Course introduction	
Sep 10	TU	2	How to construct a model	Otto Ch. 2
Sep 17	TU	3	Discrete-time population models, density dependence, fisheries management and the butterfly effect	Case, Ch. 1, 5
Sep 24	TU	4	Age- and stage-structured models; population viability analysis	Case Ch. 3
Oct 1	TU	5	Continuous-time population models, ordinary differential equations, the stability of systems, fisheries revisited	Case, Ch. 1, 5
Oct 8	TU	6	An introduction to epidemiology: interactions, disease dynamics, SIR models; Time-permitting: other multispecies interactions (e.g. predator-prey, competition, parasitism, metapopulations, food webs)	Keeling Ch. 2 Hastings Ch. 6-9
Oct. 12-20	Reading week			
Oct 22	TU	7	A brief introduction to the philosophy of science; modelling & the scientific approach; linking models to data	Hilborn Ch. 2, Haefner Ch.7
Oct 29	TU	8	Linking models to data (cont.); model discrimination & model validation	Haefner Ch. 8
Nov 5	TU	9	Thermal performance curves, the Metabolic Theory of Ecology, & understanding climate change impacts	TBA
Nov 12	TU	10	Case studies: e.g. harvest management; invasive species control; climate change impacts on parasitism	TBA
Nov 19	TU	11	TBA	TBA
Nov 26	TU	12	Student presentations (mandatory attendance)	

Tentative tutorial schedule

Date	Time	Tut	Topic	Tentative homework due dates	Attendance
Sep 5	1-3pm	1	Introduction to MATLAB, part 1		
Sep 12	1-3pm	2	Introduction to MATLAB, part 2		
Sep 19	1-3pm	3	Discrete-time models (Homework 1)		
Sep 26	1-2pm	4a	Population viability analysis (Homework 2)	HW 1	
	2-3pm	4b	Readings: TBA		EEB1420 only
Oct 3	1-3pm	5a	Research Projects		
Oct 10	1-2pm	6a	Continuous-time models (Homework 3); Research projects	HW 2	
	2-3pm	6b	Readings: TBA		EEB1420 only
Oct 12-20	Reading week				
Oct 24	1-2pm	7a	Epidemiological models (Homework 4); Research projects	HW 3	
	2-3pm	7b	Readings: TBA		EEB1420 only
Oct 31	1-3pm	8	Research projects		
Nov 7	1-2pm	9a	Translating and communicating models to scientists from other fields and/or the general public	HW 4	
	2-3pm	9b	Readings: TBA		EEB1420 only
Nov 14	1-3pm	10	Research projects		
Nov 21	1-2pm	11	Research projects		
	2-3pm	11	Readings: TBA		EEB1420 only
Nov 28	1-3pm	12	Student presentations (mandatory attendance)	Research paper & News summary	Mandatory for everyone

Course readings

No single textbook covers the breadth of topics we will discuss in this class. As such, we will use a combination of chapters from different books as well as readings from the primary literature. The readings outlined above are not required, but highly encouraged to provide additional foundations on the lecture topics discussed. Additional readings may be assigned throughout the course. Scanned copies of all required book chapters are available for your convenience on eReserve on the course website to the degree that copyright permits. Copies of each book are also on hold in the library and/or are available online. We will work with the following:

Otto S. & Day T. 2007. A Biologist's Guide to Mathematical Modeling in Ecology and Evolution. Princeton University Press. **Also available in bookstore and online at UofT library; includes 'Primers' for reviewing calculus concepts**

Case T. 1999. An Illustrated Guide to Theoretical Ecology. Oxford University Press. **Available on course website**

Hastings A. 1997. Population Biology: Concepts and Models. Springer. **Available online at UofT library**

Keeling M. J. & Rohani P. 2008. Modeling Infectious Diseases in Humans and Animals. **Available online at UofT library**

Haefner J. W. 2005. Modeling Biological Systems: Principles and Applications. Springer. **Available online at UofT library**

Hilborn R. & Mangel M. 1997. The Ecological Detective: Confronting Models with Data. Springer. **Available online at UofT library.**

Evaluation

BIOD59 – marks breakdown:

Homework assignments	50%
Research Paper	27.5%
Presentation of Research Paper	12.5%
Research Paper – News Summary	7.5%
Attendance	2.5%

EEB1420 – marks breakdown:

Homework assignments	40%
Research Paper	30%
Presentation of Research Paper	7.5%
Research Paper – News Summary	7.5%
Discussion group - Moderation	10%
Discussion group – Attendance and participation	5%

Homework assignments:

Homework assignments will be introduced during the tutorials, so it is to your benefit to attend each tutorial. Homework assignments and relevant computer code will be posted on the course website following each tutorial. All homework is due at the beginning of the tutorials indicated in the schedule. **Penalty for late submission:** 20% of the maximum homework mark per day that the assignment is received late. Weekend days count as individual days. Unless there are extenuating circumstances (e.g. medical reasons), a mark of zero will be applied to all assignments submitted 5 days late or more. If you know ahead of time that you have a legitimate reason why you cannot

hand in the assignment at the due date, let the course instructor know **before** the due date.

Research paper

Over the course of the semester, students will engage in a modelling project that applies the skills learned throughout the course. Students will work in groups of 2-4, which will be assigned during Weeks 3-4 of the course. At the end of course, each group will present their research to the class using a PowerPoint presentation, and subsequently answer questions from the audience about their project, engaging in a scientific discussion. In addition, each student will write an individual, short *News Summary* of their paper intended for non-technical audiences.

By default, all students in the group will receive the same mark for the research paper; however, marks may be deducted from individuals at the discretion of the instructor if that individual is not contributing their fair share to the group's work (cf. separate document *Research Paper Instructions* for details). For their PowerPoint presentation, students will receive a mark that is a weighted average of two parts: (i) the PowerPoint slides themselves, for which all students in the group will receive the same mark, and (ii) the students' ability to present the information, answer questions, and engage in a scientific discussion, for which students will receive individual marks. Students will also receive individual marks for their *presentation News Summary*. **Penalties for late submission:** Research paper, 20% of the maximum mark per day that the assignment is received late. News Summary, 20% of the maximum mark per day that the assignment is received late. Weekend days count as individual days. Unless there are extenuating circumstances (e.g. medical reasons), a mark of zero will be applied to all assignments submitted 5 days late or more; in the case of the research paper, this applies to all students in the group. If you know ahead of time that you have a legitimate reason why you cannot hand in an assignment at the due date, let the course instructor know **before** the due date. **More details regarding the Research Paper will be announced in a separate document.**

EEB1420 – Additional Requirement: Discussion groups

EEB1420 students are required to attend the Discussion Groups indicated in the Tutorial schedule. These discussion groups are intended to provide a deeper understanding of the topics discussed in lecture, and place them within the context of current scientific advances. Each week, one or more students will lead the discussion on 2-3 assigned readings. At the beginning of the discussion, they will provide a brief summary of the papers and provide guidance for the discussion that follows. Attendance is required at all Discussion Groups.

Attendance policy: lectures and tutorials

Attendance at lectures **is required for BIOD59 students, and worth 2.5% of your mark.** Attendance at lecture is not required but strongly encouraged **for EEB1420 students.** Starting week 2, BIOD59 students may miss up to two lectures without excuse and

without penalty; subsequently the maximum attendance mark (2.5%) will be reduced by 0.5% per missed lecture. Attendance is not mandatory at the tutorials but strongly encouraged and to your own benefit, as homework exercises will be based on work begun in the tutorials. **Attendance is, however, mandatory, at the specific dates outlined in the schedule above for EEB1420 students.** Absences without a valid excuse during any of these dates will lead to a zero attendance mark for that date. Attendance is also mandatory for all students at the last lecture and tutorial where students will present their research projects. Absences without a valid excuse during either of these two presentation days will result in a penalty of up to 50% of your own presentation mark (assuming that other members of your group were able to give the presentation). If you miss any of these events due to illness or other causes beyond your control, submit as soon as possible, and no later than within three days of the missed date, a written request for special consideration to Jennifer Campbell, explaining the reason for missing the event and attaching appropriate documentation (see below). If you know you will miss the research project presentations (with a legitimate reason), let the course instructor and your group members know as soon as possible **before** the presentation day.

Programming language

The course will use MATLAB in all tutorials. If students wish, they are allowed to complete the exercises and research projects in R or another programming language, but should understand that programming help cannot be provided for languages other than MATLAB. All computers in the lab have MATLAB installed; if you wish to install it on your own computer, you can download it for free from <https://www.mathworks.com/academia/tah-portal/university-of-toronto-676468.html>

Submission of Reports to Turnitin

Each Research Paper will need to be submitted on or before the due dates indicated in the schedules above to Turnitin for a review of textual similarity and detection of possible plagiarism. In doing so, students allow their paper to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site. Turnitin.com is most effective when it is used by all students; however, if and when students object to its use on principle, the course will offer a reasonable offline alternative. The student will then be asked to meet with the course instructor to outline and discuss the report before its final submission to demonstrate the process of creating the report according to the academic integrity policy. **Note: Please submit only one copy of the group research project to Turnitin, as otherwise the program will think that you have plagiarized each other and becomes less effective comparing with other sources. Please also note that Turnitin is integrated into Quercus, so you will submit your assignment directly on the course website.**

Academic Integrity

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's *Code of Behaviour on Academic Matters* outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

- using someone else's ideas or words in their own work without appropriate acknowledgment.
- including false, misleading or concocted citations in your work.
- obtaining unauthorized assistance on any assignment.
- providing unauthorized assistance to another student. This includes showing another student completed work.
- submitting your own work for credit in more than one course without the permission of the instructor
- falsifying or altering any documentation required by the University. This includes, but is not limited to, doctor's notes.
- using or possessing an unauthorized aid in any test or exam.

The learning environment is built on mutual trust, and we will assume that all students operate with honesty and integrity. However, in the rare cases where there is evidence that the University of Toronto's Code of Behaviour on Academic Matters has been compromised, I will enact the procedures outlined in the Code of Behaviour on Academic Matters. First, I will invite you to discuss the possible offence through an email invitation. If our discussion leads me to believe that you have not compromised the code, then the matter will be dropped. If either you fail to respond to two requests for this discussion or new evidence comes to light, then a formal investigation will be initiated, and a penalty according to the U of T's guidelines on sanctions will be put into place.

Medical certificates:

This term, the department is trying a pilot program regarding the requirement of submitting the Verification of Student Illness form for missed term assignments. Specifically, if you are ill during the term, and this illness influences your ability to meet a deadline for submission of a term assignment, rather than submitting a Verification of Student Illness form in your request for accommodation you can submit a Self-Declaration of Student Illness form, indicating the days in which you were ill. This form is meant to take the place of the more typical medical form, and will be available on the department's website <https://www.utoronto.ca/biosci/missed-term-work-policy>.

Please note the following aspects related to this Self-Declaration of Student Illness form:

1. Similar to the submission of a medical form, YOU ARE RESPONSIBLE for contacting Jennifer Campbell (jacampbell@utsc.utoronto.ca) to make arrangements for an accommodation for this work.
2. You may use the Self-Declaration of Student Illness form ONLY for term assignments. Should you miss either of the two research project presentation days, you will still need to submit a Verification of Student Illness form.
3. You may use the Self-Declaration of Student Illness form up to three times in this course. If you require an additional accommodation for a term assignment you must then use the standard Verification of Student Illness form.
4. Submitting a false Self-Declaration of Student Illness form constitutes academic misconduct, and could be subject to sanctions under the Code of Behaviour on Academic Matters.

Please submit any Self-Declaration of Student Illness forms in the same fashion as you would have a previous Verification of Student Illness form. Accordingly, you will need to submit this form to Jennifer Campbell (SW421D) jacampbell@utsc.utoronto.ca departmental administrator, within three days of the missed term work.

AccessAbility

Everyone is a welcome member of this class, and we strive to provide an equal playing field for students with diverse learning styles and needs. In particular, if you have a disability/health consideration that may require accommodations, please contact the AccessAbility office as soon as possible. They will provide confidential services that include flexible, personalized solutions for test-taking, note-taking, and similar issues. The AccessAbility office is located in AA142 and can be reached at: (416) 287-7560 or ability@utsc.utoronto.ca. Please see their website at <https://www.utsc.utoronto.ca/~ability/> for more information.

Audio/video recordings

For reasons of privacy and protection of copyright, audio or video recordings of lectures and tutorials are not permitted.