**BIOD59 / EEB1420 Syllabus, Fall 2018**
**Models in Ecology 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 validate 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:* To be announced
*Office hours:* Weeks 1 and 2, by appointment. Starting week 3: Thursdays 3-4pm. If this time does not work with your schedule, please send me an email to schedule a meeting at a different time.
*Email:* peter.molnar@utoronto.ca (**please put BIOD59/EEB1420 in the subject line**)
*Phone:* 416-208-2247
*Teaching Assistant:*
Juan Sebastian Vargas Soto, juan.vargassoto@mail.utoronto.ca

*Lecture times & location:*

Tuesdays, 12-2pm, BV 355.
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 and tutorials will be posted on Quercus (q.utoronto.ca) the evening before. Additional announcements may also be made on the course website, so please check regularly.

## Communication policy

Students are required to regularly and often 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 | Required Readings |
|---|---|---|---|---|
| Sep 4 | TU | 1 | Introduction | |
| Sep 11 | TU | 2 | How to construct a model | Otto Ch. 2 |
| Sep 18 | TU | 3 | Discrete-time population models, density dependence, fisheries management and the butterfly effect | Case, Ch. 1, 5 |
| Sep 25 | TU | 4 | Age- and stage-structured models; population viability analysis | Case Ch. 3 |
| Oct 2 | TU | 5 | Continuous-time population models, ordinary differential equations, the stability of systems, fisheries revisited | Case, Ch. 1, 5 |
| **Oct. 8-12** | **Reading week** | | | |
| Oct 16 | TU | 6 | An introduction to epidemiology: interactions, disease dynamics, SIR models | Keeling Ch. 2 |
| Oct 23 | TU | 7 | Multi-species interactions: predator-prey dynamics, competition, parasitism | Hastings Ch. 6-9 |
| Oct 30 | TU | 8 | A brief introduction to the philosophy of science; modelling & the scientific approach; linking models to data | Hilborn Ch. 2, Haefner Ch.7 |
| Nov 6 | TU | 9 | Linking models to data (cont.); model discrimination & model validation | Haefner Ch. 8 |
| Nov 13 | TU | 10 | Case studies: e.g. harvest management; invasive species control | TBA |
| Nov 20 | TU | 11 | TBA | TBA |
| Nov 27 | TU | 12 | **Student presentations (mandatory attendance)** | |

## Tentative tutorial schedule

| Date | Time | Tut. | Topic | Due dates | Attendance |
|---|---|---|---|---|---|
| Sep 6 | 1-3pm | 1 | Introduction to MATLAB, part 1 | | |
| Sep 13 | 1-3pm | 2 | Introduction to MATLAB, part 2 | | |
| Sep 20 | 1-2pm | 3a | Discrete-time models (Homework 1) | | |
| | 2-3pm | 3b | **Readings:** TBA | | EEB1420 only |
| Sep 27 | 1-3pm | 4 | Population viability analysis (Homework 2), Research projects | Homework 1 | |
| Oct 4 | 1-2pm | 5a | Continuous-time models (Homework 3), Research projects | Homework 2 | |
| | 2-3pm | 7b | **Readings:** TBA | | EEB1420 only |
| **Oct. 8-12** | **Reading week** | | | | |
| Oct 18 | 1-2pm | 6a | Epidemiological models (Homework 4); Research projects | Homework 3 | |
| | 2-3pm | 6b | Translating and communicating models to scientists from other fields and/or the general public | | |
| Oct 25 | 1-2pm | 7a | Epidemiological models (Homework 4); Research projects | | |

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|---|---|---|---|---|---|
| | 2-3pm | 7b | **Readings:** TBA | | EEB1420 only |
| Nov 1 | 1-3pm | 8 | Parameter estimation & model selection (Homework 5) | Homework 4 | |
| Nov 8 | 1-2pm | 9a | Research projects | | |
| | 2-3pm | 9b | **Readings:** TBA | | EEB1420 only |
| Nov 15 | 1-3pm | 10 | Research projects | Homework 5 | |
| Nov 22 | 1-2pm | 11a | Research projects | | |
| | 2-3pm | 11b | **Readings:** TBA | | EEB1420 only |
| Nov 29 | 1-3pm | 12 | **Student presentations (mandatory attendance)** | Research paper & News summary | |

## 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. Required book chapters are noted in the schedule above, with additional readings assigned throughout the course. Scanned copies of all required book chapters will be available for your convenience on eReserve to the degree that copyright permits, and copies of each book will also be on hold in the library. 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; includes 'Primers' for reviewing calculus concepts**

Case T. 1999. An Illustrated Guide to Theoretical Ecology. Oxford University Press.

Hastings A. 1997. Population Biology: Concepts and Models. Springer

Keeling M. J. & Rohani P. 2008. Modeling Infectious Diseases in Humans and Animals.

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:**

| | |
|---|---|
| 5 homework assignments (HW 1-4: 10% each; HW 5: 7.5%) | 47.5% |
| Research Paper | 30% |
| Presentation of Research Paper | 10% |
| Research Paper – News Summary | 7.5% |
| Attendance | 5% |

**EEB1420 – marks breakdown:**

| | |
|---|---|
| 5 homework assignments, 8% each | 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, 1% each meeting | 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 Quercus following each tutorial. All homework is due at the end of the tutorials indicated in the schedule. **Penalty for late submission:** 2% 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. All students in the group will receive the same mark for the research paper (up to 30%). All students will also receive the same mark for the powerpoint presentation (up to 5% for BIOD59, up to 3.75% for EEB1420). Students may, however, receive different marks from their group members for their ability to answer questions and engage in subsequent discussions (up to 5% for BIOD59, up to 3.75% for EEB1420). Students will receive individual marks for their *News Summary*. **Penalties for late submission:** Research paper, 2% per day that the assignment is received late. News Summary, 2% 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, groups of 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 (10% of your mark). In addition, students will receive 1% for each discussion they attend.

## Attendance policy: lectures and tutorials

Attendance at lectures **is required, and worth 5% of your mark**. Starting week 2, you may miss up to two lectures without excuse and without penalty; subsequently your maximum attendance mark (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 five 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).

## 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, 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
http://sites.utoronto.ca/ic/software/detail/matlabStudent.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 it will detect plagiarism to 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* (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm) 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 of substantial evidence that the University of Toronto's Code of Behaviour on Academic Matters (Section B; http://www.governingcouncil.utoronto.ca/policies/behaveac.htm) 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. Otherwise, or if you fail to respond to two emails inviting you to discuss the matter, a formal investigation will be initiated, and a penalty according to the U of T's guidelines on sanctions may 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.utsc.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 SW302 and can be reached at: (416) 287-7560 or ability@utsc.utoronto.ca.

## Audio/video recordings

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