ENV1005: Ecological Statistics (WINTER 2023)

Instructor: Dr. Vianey Leos Barajas

Lectures: Tuesday 13:10 - 15:00 (in person)
University College, Rm 248

Tutorials: Thursday 13:10 - 14:00 (in person – starting week 2)
Bahen Centre for Information Technology, Rm B026

Online Office Hours: Friday 14:00 - 15:00 (starting week 2)
https://utoronto.zoom.us/j/4704586849
Meeting ID: 470 458 6849
Passcode: 777189
Other times by appointment only

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Course description:

This course will cover popular statistical models for the analysis of ecological data, including topics in movement ecology, capture-recapture, and ecological time series. There will be a particular focus on the statistical properties and assumptions underlying the methods in a Bayesian framework. We will cover topics like identifiability, estimability, how to interpret results in both a statistical and ecological context, and cover simulation-based model assessment.

Learning objectives:

The general learning objectives of the course are:
- Understand how to identify the mechanisms underlying statistical models and why they are useful in the analysis of ecological data.
- Learn statistical theory for the associated methods.
- Learn how to do inference in a Bayesian framework for the associated methods and understand the role that estimability/identifiability plays.
- Construct Bayesian workflows for analysis of ecological data.
- Understand how to do model checking and check for ecological realism of the associated methods

Course outline:

Week 1: Introduction to Bayesian statistics + computing in Stan

Week 2-4: Generalized linear models (GLMs) + penalized regression
Week 5-6: Including random effects in GLMs
Week 7: Step-selection functions (SSFs)
Week 8-11: Hidden Markov models (HMMs) & their application in ecology, e.g. movement modeling, capture-recapture, occupancy modeling
Week 12: Either continuing with HMMs or special topic, such as survival modeling, point processes

Textbook and slides:
This course has no specific textbook. Information will be contained in slides, handouts, and specific references that will be available on Quercus before classes.

Assessment:

	WEIGHT	DATE	TIME
HOMEWORK 1	25%	26 January	Beginning of tutorial
HOMEWORK 2	25%	16 February	Beginning of tutorial
HOMEWORK 3	25%	16 March	Beginning of tutorial
HOMEWORK 4	25%	6 April	Beginning of tutorial

The assignments will each be a data analysis project for which you will use R and, for some, the Stan (in R) as well. Any requests to have marked work re-evaluated must be made in writing within two weeks of the date the work was returned to the class. The request must contain a justification for consideration.

Grade calculation: Each homework assignment is worth 25% of your overall grade.

Late homework policy:
> Late homework will generally not be accepted, unless a prior arrangement has been made.

Re-grading policy:
> Regrading requests should only be made for genuine grading errors, and should be initiated by writing or typing a complete explanation of your concern (together with your full name, student number, and e-mail address) on a separate piece of paper, and giving this together with your original unaltered homework/test paper to the instructor within two weeks of when the graded item was first available. Warning: your mark may end up going down rather than up.

Computing:
- The course will be run using the R computing environment.
- This course will use the software Stan.
- You are strongly encouraged to use RStudio (https://www.rstudio.com), which is a free IDE for R.

- All instructions in the course will assume that you have the latest version of both RStudio and R installed. We will not answer any R related questions unless both of these things are true.

Questions about the course content/homework and sending an email:

Questions about the homework or course content should be posted on Quercus. In general, I am not able to answer questions about the course material by e-mail. Before you send an e-mail, make sure that you are not asking for information that is already on the course web site, syllabus or questions about the course material or assignments that are more appropriately discussed in tutorial or during office hours. If you do not get a response, this may be why.

E-mail is appropriate for private communication. Use your utoronto.ca account to ensure that your message does not automatically go to my junk folder. When sending an e-mail, please follow professional e-mail etiquette, use ENV1005 as the subject line, and be specific about what it is you need from me – this will help me respond in a timely manner. An example below:

Subject line: ENV1005

Content:

Dr. Leos Barajas,

I would like to know more about capture-recapture models. Do you have any books you would recommend on the topic?

Best/Thank you/Other appropriate way to close an email

(Insert your name here)

Announcements will be posted on Quercus. Please check there regularly. If an urgent matter arises, I may contact the entire class by e-mail. In order to receive these messages, please make sure that your ROSI account has your utoronto.ca e-mail.

Accessibility:
Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or Accessibility Services as soon as possible.
https://studentlife.utoronto.ca/wp-content/uploads/Accessibility-Services-Undergraduate-Handbook-2021-2022.pdf

Additional Resources:
- Big book of R: https://www.bigbookofr.com/index.html
- Stan: https://mc-stan.org