Math/EEB589 Mathematical Biology Seminar: Integral Projection Modeling, Spring 2022

University of Tennessee, Knoxville

Meeting Time and Place: In-person, Fridays 2:15-3:05PM in Ayres 114, with occasional virtual, synchronous meetings
Course Credit Hours: 1.0
Course Instructor: Louis J. Gross, Chancellor's Professor and Alvin and Sally Beaman Distinguished Professor of Ecology and Evolutionary Biology and Mathematics
Course website: Available linked through the Teaching section of the instructors webpage at http://lgross.utk.edu/math589_spring2022.html - please see the website for details on the course structure, participant expectations, links to references, etc. Note that materials that are not openly shareable will be shared with participants through the Basecamp site that has been used by this course regularly for several years. All registered students will be added to the list for this site.

Course Objectives and Expectations:

Major questions in population ecology consider the impacts of population structure such as size, age and physiological status of individuals on population growth. A classic mathematical approach to analyze the impacts of such structure is to break down a population into discrete age classes and consider, using matrices that include survivorship between age classes and fertilities associated with each age class, how the life history parameters giving survival and fertility affect overall population growth. Such Leslie matrix models and the many extensions of these have been critical means to develop life history theory, investigate harvesting and population control methods and they serve as the basis for much of human demographical analysis. These matrix population projection methods, and similar ones which consider size or physiological status, make strong assumptions about the characteristics of individuals within each class. To expand the realism and applicability of these models to situations in which the classes are too crude an approximation because the trait characteristics of individuals within a class vary, Integral Projection Models (IPM) have been developed.

The objective of this one-credit course is to provide an overview of IPM. We will initially focus on reading the text: *Data-driven Modelling of Structured Populations: A Practical Guide to the Integral Projection Model* by Stephen Ellner, Dylan Childs, and Mark Rees. Springer (2016). This text is available as an e-book through the UTK Library. Participants will be expected to participate in class discussions based on the readings and registered students will be expected, in addition to actively participating in class discussions, to lead a class discussion based on a selected chapter from the text and associated additional reference papers. Participants are assumed to have some of the appropriate underlying undergraduate-level background in mathematics but are not expected to have taken courses such as Math/EEB581-2 or 681-2. Note that one of the textbook's authors will be leading discussion in a few meetings of the course.

Course Modality: This class is scheduled to be in-person. My overall objective is to ensure that the class is as safe as possible for all attendees under the constraints set by the University. There may be temporary circumstances therefore in which we will hold class meetings virtually. In this case, I may make a class-by-class instructional decision to hold class online so that ALL students can learn together. If I am ill or if I know that I have been exposed to an individual with Covid infection, class will be held virtually. If I am notified that a significant fraction of class participants are unable to attend in-person due to illness, class will be held virtually and I will so inform all class participants by email. I will be wearing a mask in class and encourage others to do so as well to help reduce the likelihood of infection spread, at least for the first few weeks of the semester. If you are ill, please do not attend in-person, and if appropriate complete the Covid form at https://covidform.utk.edu/index.php. As Volunteers, we commit to caring for one another and for the members of the communities in which we live, work, and learn. Please remember that Vols help Vols so please endeavor to support the campus efforts to limit the spread and negative impacts of Covid on our community. If you have any concerns about your safety in this class please contact me. Information on campus response to Covid is at https://www.utk.edu/coronavirus/

Information on the student counseling center is at https://counselingcenter.utk.edu/

Information on help available from the Dean of Students is at https://dos.utk.edu/974-help/

Faculty Contact Information

The instructor is available for consultation with participants through email (lgross@utk.edu). Due to the pandemic, the instructor will not be holding in-person office hours at least at the start of the semester but will be happy to meet virtually with participants at times set up through email.

University Policies:

The honor statement is included on the Campus Syllabus available on the Provost website at https://utk.instructure.com/courses/55015/pages/ut-knoxville-campus-syllabus-%7C-2021-2022 . This includes sections on Academic Integrity, Your Role in Course Assessment, Students with Disabilities, Accessibility Policies, Wellness, Emergency Alert System, and COVID-19 Guidelines.

Key Campus Resources for Students:

- Center for Career Development (Career counseling and resources; HIRE-A-VOL job search system)
- Course Catalogs (Listing of academic programs, courses, and policies)
- Hilltopics (Campus and academic policies, procedures and standards of conduct)
- OIT HelpDesk (865) 974-9900
- Schedule of Classes/Timetable
- Student Health Center (visit the site for a list of services)
- Student Success Center (Academic support resources)
- University Libraries (Access to library resources, databases, course reserves, and services)