

AN INTRODUCTION TO THEORETICAL POPULATION AND COMMUNITY ECOLOGY
PLB 809: Section 431 (1 credit)

Instructor: Thomas Koffel, Research Associate WK Kellogg Biological Station, Michigan State University koffelth@msu.edu

When: Monday July 8 to Friday July 12

Where: WK Kellogg Biological Station, Hickory Corners MI

Course description:

This course will present an overview of the mathematical theory of populations and communities. We will organize the empirical and theoretical knowledge around a few core ecological principles, providing a unified framework for theoretical ecology. Core topics covered will be models of exponential growth, structured populations, population regulation, predator-prey, competition, competitive exclusion, and species coexistence.

The course will be taught in a lecture and discussion format coupled with laboratories involving both pen-and-paper and computer-based modeling exercises. Mathematically, the students will learn how to read, build and analyze an ecological model, with an emphasis on solving for the model equilibria and analyzing their stability. We will focus on continuous-time models, but discrete-time and matrix models will also be addressed.

The models will be implemented using the programming language *Mathematica*. No previous knowledge of *Mathematica* is necessary, as simple build-in examples will be provided during laboratories on which we will expand on.

Materials:

We will use *Mathematica* as it can both perform some basic calculus and simulate dynamical systems numerically.

MSU students can download and install Mathematica for free:

<https://techstore.msu.edu/mathematica-installation-and-use-information>

If you are not a MSU student, your home institution may have an equivalent site license of students. Alternatively, anyone can download and install a 15-day trial version:

<https://www.wolfram.com/mathematica/trial/>

Daily Schedule

9:00 am – 10:30 am	Lecture and discussion
10:45 am – 12:00	Lab
1:15 pm – 3:00 pm	Lecture and discussion
3:15 pm – 4:30 pm	Lab

Prospective Schedule for the week

Monday:

AM: Population models and exponential growth

PM: Structured populations

Tuesday:

AM: Population regulation

PM: Consumer-resource models

Wednesday:

AM: Predator-prey

PM: Host-parasite models

Thursday:

AM & PM: Lotka-Volterra competition

Friday:

AM: Resource competition

PM: Advanced topic (Evolution, metacommunity, student choice?)