

Introduction to Mathematical Population Biology

- (1) Deterministic single species population dynamics. Methods for the study of linear and nonlinear discrete and continuous dynamical systems. Cobwebbing with 1 dimensional difference equations; periodic points and their linearized stability. Global stability for some scalar difference models.
- (2) Population dynamics in structured populations. Deterministic matrix and partial differential equations formulation of birth and death processes. Perron-Frobenius Theorem and discussion of dynamics of $x_{n+1} = L x_n$ for low dimensional nonnegative Leslie matrix L .
- (3) Population dynamics of interacting species. Host parasitoid interactions, predator prey systems, competition. Nullclines/Direction Fields for planar systems of ODE.
- (4) Bendixson-Dulac criterion and the fact that a periodic orbit surrounds an equilibrium point. Liapunov-LaSalle theorem and its applications.
- (5) Standard models in epidemiology. Basic reproduction number. Discussion of questions associated with co-existence, co-evolution, control and eradication.

Prerequisite: MAT 272, 274/275, 342/343, or the approval of the instructor.

TEXTS

- (1) Leah Edelstein, *Mathematical Models in Biology*, SIAM Classics in Applied Mathematics **46**, 2004.
- (2) Brauer Fred and Carlos Castillo-Chavez, *Mathematical Models in Population Biology and Epidemiology*, Texts in Applied Mathematics, **40**, Springer Verlag 2001