Predator-Prey Dynamics

Elton’s lynx-hare cycles

Single species
   Cycling related to time lags
      Increase when at low density causes crowding and “over compensation” next year

Predator-prey cycles are also related to lagged density dependence
   Prey increase
   Preds increase
   Preds begin to reduce prey density
   Preds begin to decline
   Prey begin to increase again…

Lotka-Volterra equations
   Neutrally stable cycles with period approx $2\pi*\sqrt{rd}$
   Exhibits “paradox of enrichment” or top down control
      Increase in prey production only increases predator density

Mathematical concept of stability
   Does small perturbation to a steady-state solution grow or die out?
   For continuous differential equations, stability related to slope of growth function in the vicinity of the steady state (negative slope stable, positive slope is unstable)
   Discrete time stability also determined by slope (derivative) of growth function at the steady-state (-slope > 1 is unstable)

Factors that can lead to stability in predator-prey cycles
   Change in predator functional response
   Prey switching by generalist predator
   Spatial variation in predator and prey density
   Reduction in the lag duration