

Using computers to explore this model

- Does r affect the outcome?
 - A) yes
 - B) no
 - C) it depends

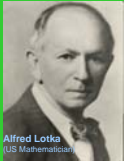

Coexistence Criteria

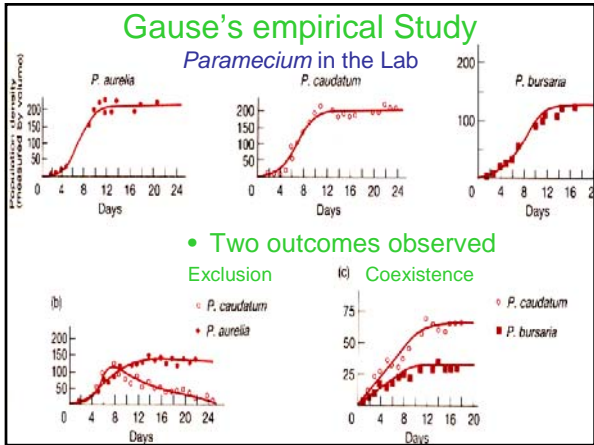
- The Lotka-Volterra Equations predict that coexistence will depend on:
 - K
 - A_{ij}

$$\hat{N}_1 = \frac{K_1 - a_{12}K_2}{1 - a_{12}a_{21}}$$

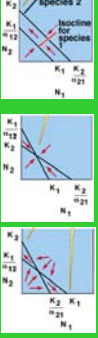
- It will NOT depend on!

$$a_{12}a_{21} < 1$$



Outcomes of L-V Competition



- Exclusion** of one or the other species
 - Isoclines don't cross
 - Species with highest isocline wins
- Stable equilibrium**: both species coexist
 - Isoclines cross
 - Intraspecific competition is stronger than interspecific competition
 - $K_2/a_{21} > K_1$ & $K_1/a_{12} > K_2$
- Unstable equilibrium**: coexist briefly, then one goes extinct.
 - Isoclines cross
 - Competition within species is WEAKER than between
 - Loser depends on initial conditions (N_1, N_2)

Assumptions of the Lotka-Volterra Model of Competition

- Shared Resources are Limiting
 - Requires identification of appropriate resource
- Competition coefficients are constant
- Carrying capacity is constant
- Density dependence is linear
 - Violating these assumptions strongly affects model behavior

Exercise on Competition

- The savannas of Africa have several large herbivores coexisting (Zebra, Giraffe, Wildebeast, Eland)
- ALONE: generate TWO possible reasons that these potential competitors can coexist
- SMALL GROUPS:
 - Explain and compare your answers.
 - How could you test one of your explanations?

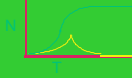


$$a_{12}a_{21} < 1$$

Coexistence in Nature



- Generally possible if:
 - Weak competition
 - Within species > between
 - Not at equilibrium
 - Exclusion will happen eventually
 - Niche partitioning or Character Displacement
 - Use different subsets of the shared resource
 - Limited by something other than the shared resources
 - Differences in use of or requirements for another niche axis



Conclusions



- Studies of Intraspecific competition provide evidence for resource limitation
- Competition is usually asymmetric, with one species "winning"
- Competitors can coexist if competition within species > competition between species ($a_{ij}a_{ji} < 1$)
- More likely when there is little niche overlap
- Long-term resource partitioning can lead to character displacement
- Best evidence for competition comes from experiments