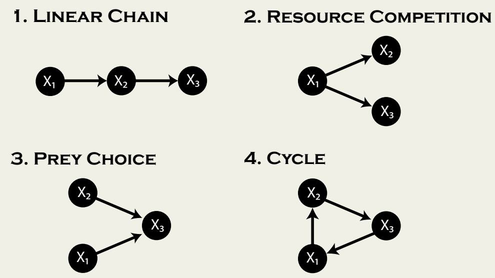
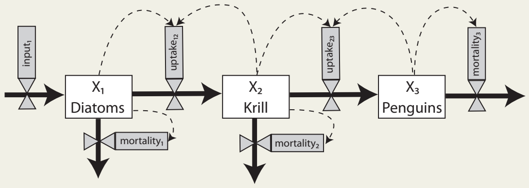
Three State Variables

Bio534
Borrett

Three Compartment Motifs



Linear Chain



Forms of the Logistic

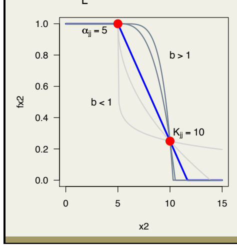
Interference

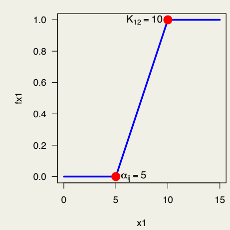
$$w = \left(1 - \frac{\delta_j}{\tau_{ij}} \cdot (1 - \epsilon_{ij})\right)$$

$$f(X_j) = \left[1 - w \cdot \left(\frac{X_j - \alpha_{jj}}{K_{jj} - \alpha_{jj}}\right)^b\right]_+\Big]_+$$

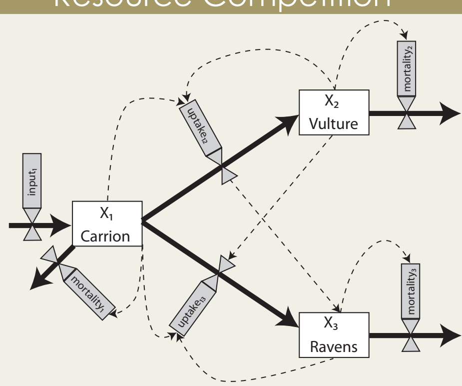
Exploitative

$$f(X_i) = \left[1 - \left(\frac{K_{ij} - X_i}{K_{ij} - \alpha_{ij}}\right)_+\right]_+$$





Resource Competition



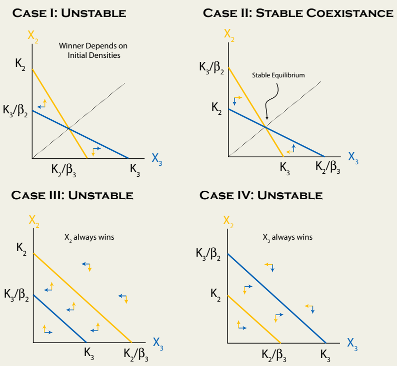
Limits to Growth: 3 Cases

- Optimally enriched
  - $X_1 >> K_{12}$ and K_{13}
- Basal resource is only limiting factor
  - X_2 and X_3 never exceed α_{22} or α_{33}
- X_1, X_2, and X_3 are all at steady state at values between the defining thresholds

Graphical Analysis of Equilibriums
(isocline analysis)

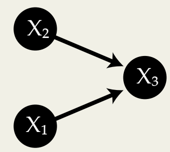
Assume "Plenty" of Carrion

Same as Interspecific Competition



Prey Choice

3. Prey Choice



Mechaelis–Menton – 1 Resource

$$f(R) = \tau_{12}\left(\frac{R}{R+k_R}\right)$$

Weighted addition of Resources

Linear combination

$$R = \sum_{i=1}^{n} w_{ij} R_i$$

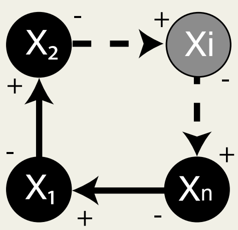
w_{ij} is the relative weight of each resource

Combined Form "substitutable"

$$f(R) = \tau_{12}\left(\frac{\sum_{i=1}^{n} w_{ij}R_i}{\sum_{i=1}^{n} w_{ij}R_i + k_R}\right)$$

Only 1 half saturation constant

Cycles



Autocatalytic Cycle

Hypercycle

Positive feedback