# COMPETITION & MUTUALISM

## 1. SYMBIOSES

symbiosis - any relationship between 2 species
+ beneficial, – harmful, 0 no effect

| | | |
|---|---|---|
| neutralism | 0 | 0 |
| competition | – | – |
| predation | + | – |
| mutualism | + | + |
| commensalism | + | 0 |
| ( amensalism ) | 0 | – |

## 2. COMPETITION

interspecific competition - between 2 diff spp.
- limited resources (food, water, space)
- major force behind speciation

exploitation - no direct interaction
- deplete resource so not available

interference
- direct behavior or chem interaction
- incl. allelopathy in plants

$$\frac{dN}{dt} = r N \left( \frac{K - N - \alpha N_2}{K} \right)$$

$N_2$ - population size of other species

$\alpha$ - inhibitory effect
- degree carrying capacity is lowered

## 3. COMPETITIVE EXCLUSION PRINCIPLE

Gause - 2 competing spp. cannot coexist
- evolve diff species to avoid compete
- adapt diff resource, emigrate, extinct

resource partitioning
- evolutionary strategy to avoid comp.
- divide resources in ecosystem
- diff prey/size, time, microhabitat, etc.

niche - specific role in ecosystem esp. food
- fundamental - if no competition
- realized - after competition

niche overlap - when share resources

niche breadth - range of resources used
- narrow if specialist (esp. stable envi.)
- wide if generalist (esp. unstable envi.)

## 4. MUTUALISM

mutualism - positive reciprocal relationship
- obligatory or facultative

$$\frac{dN}{dt} = r N \left( \frac{K - N + \alpha N_2}{K} \right)$$

$N_2$ - population size of other species

$\alpha$ - coefficient of mutualism (benefits)

nitrogen-fixing bact.
- absorbs nitrogen in plant roots

luminescent bact.
- produces light in fish & fireflies

intestinal bact. & protozoans
- digests cellulose in termites, grazers

lichens - fungi + algae, obligatory

symbiotic green algae
- photosynthesis in marine inverts

herbivory - disperse seeds in feces
- frugivory - fruit enhances dispersal
- nectivory - sugar + pollen attracts
  insects, bats, hummingbirds

cleaners - cleaner & anemone fishes

followers - birds warn & remove parasites

chloroplasts & mitochondria
- cell structures for energy reactions
- own DNA differ from chromosomes
- evolved from parasites/commensals?