

COMMUNITY ECOLOGY

This presentation contains copyrighted material under the educational fair use exemption to the U.S. copyright law.

Community ecology: overview

- *Community*
 - ▣ All the populations of all the species in a given area
- *Community ecology*
 - ▣ The study between species in a given area

Species interactions

□ *Competition*

- ▣ Occurs when organisms use same resource
- ▣ Lower fitness for both (-/-)

□ *Consumption*

- ▣ one organism eats another
- ▣ Increasing consumer's fitness/decreasing victim's (+/-)

□ *Mutualism*

- ▣ Two species benefit from interaction (+/+)

□ *Commensalism*

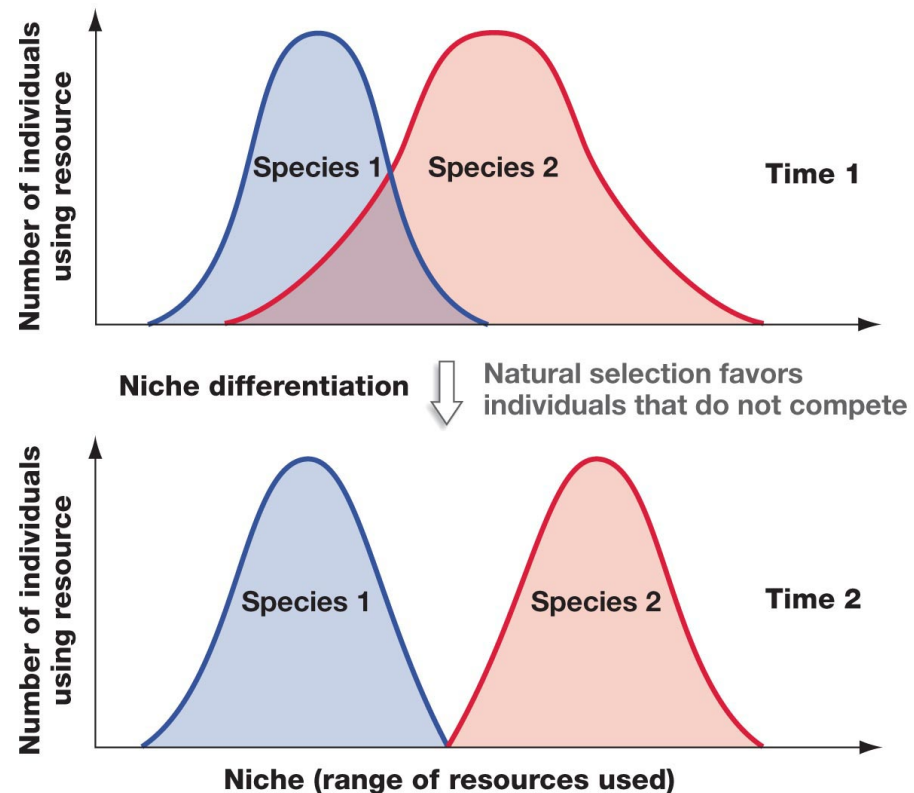
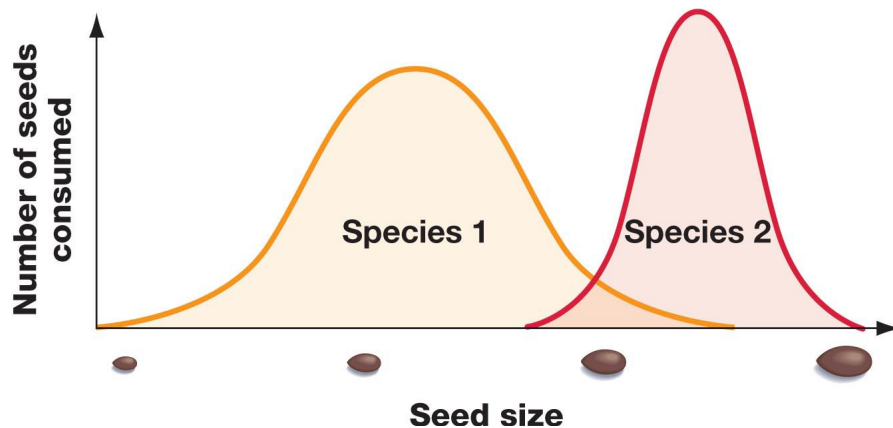
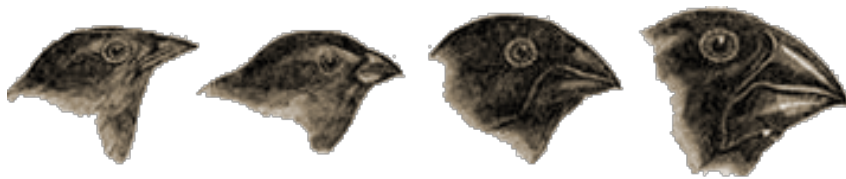
- ▣ One species benefits, the other is unaffected (+/0)

Competition

- -/-
 - ▣ Competitors use up resources
 - ▣ Lowering both of their fitness
- *Intraspecific competition*
 - ▣ b/n members of same sp.
 - ▣ Intensifies as population density increases
- *Interspecific competition*
 - ▣ Members of different spp.

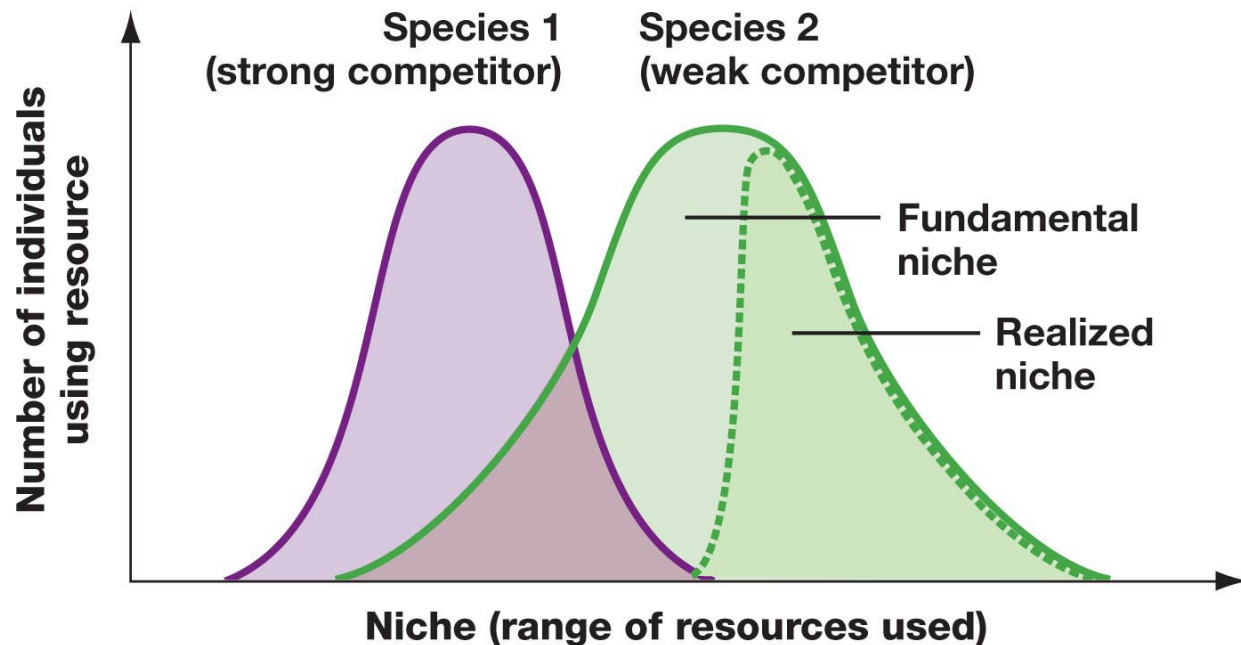
Niche model

- Interspecific competition is minimized
 - via limiting competition for resources
 - e.g. Darwin's Finches



Fundamental vs. realized niche

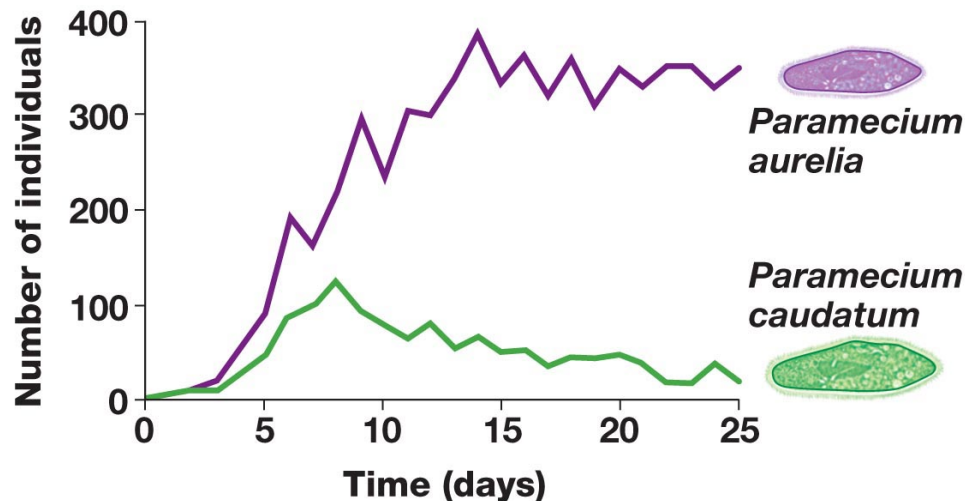
- *Fundamental niche*
 - ▣ Resources a sp. can tolerate in absence of competition
- *Realized niche*
 - ▣ Resources a sp. can tolerate in presence of competition



Competitive exclusion principle

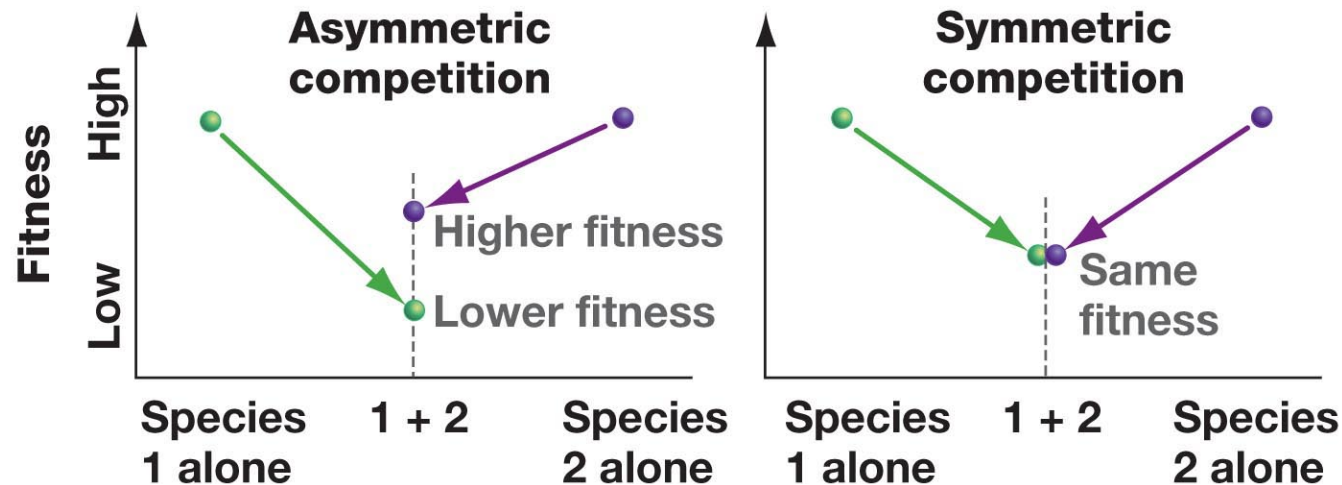
□ GF Gause's hypothesis

- ▣ It is not possible for spp. within same niche to coexist
- ▣ Experiment with paramecium
 - Grown separately: each sp. grew logistically
 - Grown together: one grew logistically, one went extinct



Asymmetric vs. symmetric competition

- Asymmetric competition
 - ▣ One species suffers much greater fitness decline
 - ▣ Competitive exclusion
- Symmetric competition
 - ▣ Each species suffers equal decrease in fitness



Consumption

- +/-
- Types
 - ▣ Herbivory: plants
 - ▣ Parasitism: small amounts of tissue
 - ▣ Predation: animals



Coevolutionary arms race

- Consumers evolve traits
 - ▣ Increase efficiency of predation
- Prey evolve traits
 - ▣ Unpalatable
 - ▣ Elusive
 - ▣ Defense



Defenses

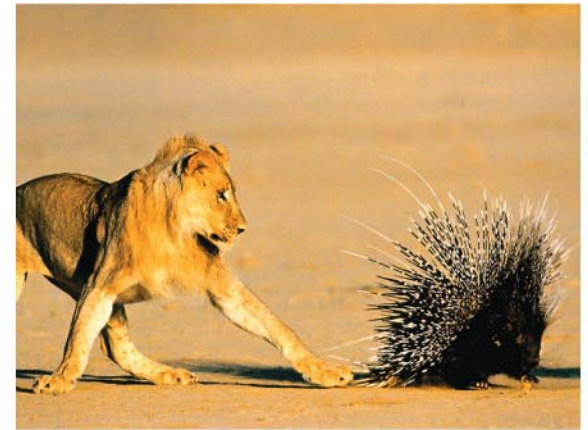
- Avoidance
- Poison
- Schooling behavior
- Fighting back



A leaf insect disappears among the leaves.



A school of fish confuses a shark.



Porcupines use their spines to fight back.

Mimicry

- Resemblance to a dangerous prey, but aren't



Hornet moth



Wasp beetle



Hoverfly

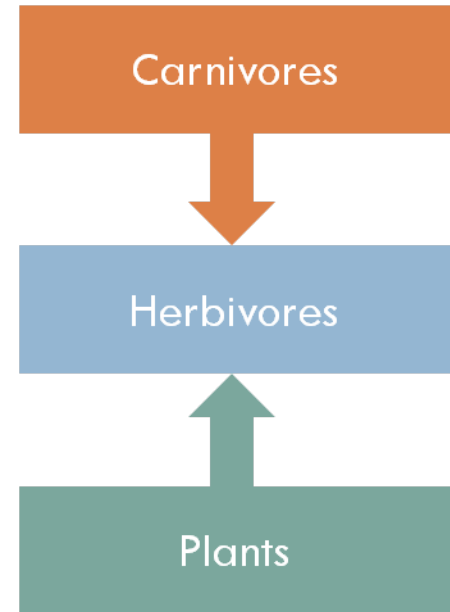
Mimicry

- Pseudocopulation mimicry



What controls herbivores?

- Top-down control
 - ▣ Predation (or disease) limit herbivores
- Bottom-up control
 - ▣ Plants nutrition determines herbivore abundance



Mutualisms

(a) Mutualism between ants and acacia trees



(b) Mutualism between cleaner shrimp and fish



□ $+/+$

□ Examples

- Flowers and pollinators
- Ants and acacia trees
- Mycorrhizal fungi & plants
- Cleaner shrimp and fish

Disturbance

□ *Disturbance*

- Event that removes biomass from a community
- Affects resource availability
 - Plants (resources increase)
 - Animals (resources decreases)

□ Factors affecting disturbance regime

- Type of disturbance
- Frequency of disturbance
- Severity of disturbance

Disturbance regime

- A characteristic type of disturbance common to an area
- Types
 - ▣ Fire
 - ▣ Avalanche
 - ▣ Hurricane
 - ▣ Drought
 - ▣ Flooding



Succession

- Recovery of communities following severe disturbance
- *Primary succession*
 - ▣ When disturbance removes soil and its organisms
 - ▣ e.g. avalanche, volcanism
- *Secondary succession*
 - ▣ When disturbance removes some or all organisms but leaves soil in tact
 - ▣ e.g. wildfire, windstorm

Successional communities

- Early successional communities
 - ▣ Dominated by r -selected species
 - Short lived and small size
 - Disperse seed long distance
 - aka pioneer species
 - ▣ Adaptations
 - Most E to reproduction
 - Little E to competitive ability
 - Tolerate severe abiotic conditions



Successional communities

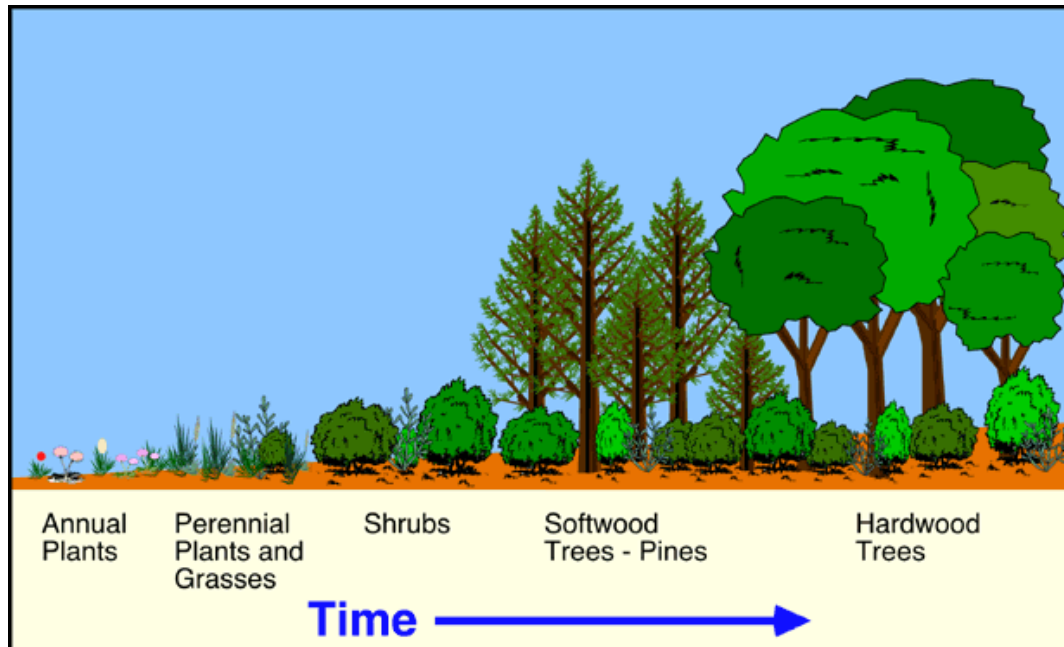
- Late successional communities
 - ▣ Dominated by *K*-selected species
 - Long lived and large size
 - aka climax species
 - ▣ Adaptations
 - Good competitors for resources
 - High E storage in seeds



Copyright © Robert O'Brien

Climax community

- Frederick Clements
 - ▣ Hypothesized biological communities progress
 - Through predictable stages
 - ▣ Final stage: climax community



Climax communities

Pioneering species



Early successional community ↓ Weedy species are replaced by longer-lived herbaceous species



Mid-successional community ↓ Shrubs and short-lived trees begin to invade



Climax community ↓ Long-lived tree species mature



Theory of Island Biogeography

□ Robert MacArthur & E.O. Wilson

□ Predicted *species richness* (# of spp.) is higher on:

- Larger islands than smaller ones
- Nearshore islands than remote islands

□ Predicted immigration more likely with fewer spp.

□ Predicted extinction more likely with more spp.

