

Chapter Reading

Chapter #27:
“Community Interactions”

Pg. 538 - 553.

Yellowstone, Wyoming

Ecological “Lines of Dependency”

Individual to Individual
Territory, Home Range, Density
Abundance, Distribution

Species to Species
Predator-Prey
Compete (?) for access to essential resources

Species to Abiotic (non-living) Components
Soil, Topography, Weather

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graph TD; A[Species A] <--> B[Species B]; A --> C[Species C]; B --> D[Species D]; C <--> D;
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What is a Community?



What is a Community?

- An **ecological community** consists of all the interacting populations in an ecosystem.
- The interactions among populations in a community limits their abundance, distribution, and density.
 - Populations are associated with resource availability.

Community Interactions

- **Coevolution** occurs when two species act as agents of natural selection on each other.
- Interactions shape the evolution of the species in that community.
 - ▲ **Competition:** harms both species
 - ▲ **Predation:** benefits predator but harms prey
 - ▲ **Parasitism:** benefits parasite but harms host
 - ▲ **Commensalism:** benefits one species but has no effect on the other
 - ▲ **Mutualism:** benefits both species

Community Interactions



Table 27-1 Interactions Among Organisms

Type of Interaction	Effect on Organism A	Effect on Organism B
Competition between A and B	Harms	Harms
Predation by A on B	Benefits	Harms
Symbiosis		
Parasitism by A on B	Benefits	Harms
Commensalism of A with B	Benefits	No effect
Mutualism between A and B	Benefits	Benefits

Community Competition



- **Competition** is an interaction that may occur between individuals or species vying for the same, limited resources
 - Energy
 - Nutrients
 - Space



Species Competition



- Interspecific competition: 2 \geq species rely on the same or similar limiting resources.
 - **interference competition** (actual physical contact)
 - **exploitative competition (indirect contact via consumption or use of resources).** As the population density of one species increases, it may limit the density of the competing species as well as its own.
 - Each species is harmed as access to resources is reduced.
 - The greater the overlap of **ecological niches**, the more intense the interspecific competition.

Ecological Niche

Niche – a collective set of roles and characteristics that an organism(s) plays in the environment.



Ecological Niche

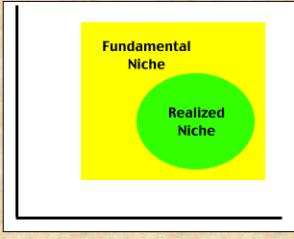
- The Ecological Niche Defines the Place and Role of Each Species in Its Ecosystem
- Adaptations Reduce the Overlap of Ecological Niches Among Coexisting Species
- Helps Control Population Size and Distribution



Ecological Niche

Ecological Niche (fundamental **and** realized)

The total requirements of a species for all resources and physical conditions determine where it can live and how abundant it can be at any one place within its range.

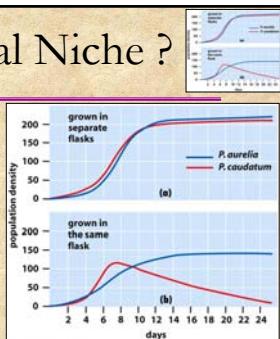


Ecological Niche



- Encompasses all aspects of a species' way of life, including
 - Physical home or **habitat**.
 - Physical and chemical environmental factors necessary for survival.
 - How the species acquires its energy and materials.
 - All the other species with which it interacts.

An Identical Niche?

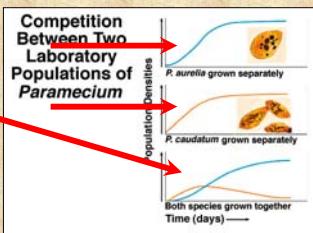


- The competitive exclusion principle was formulated by biologist G. F. Gause...
- Lab experiments - protists
 - Paramecium aurelia* and *P. caudatum* have same niches - one excludes the other.
 - However, *P. aurelia* and *P. bursaria* can coexist as they feed in different places—have different niches

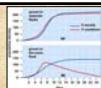
Ecological Niche

Competitive Exclusion Principle

No two species can occupy the same niche at the same time.



Resource Partitioning



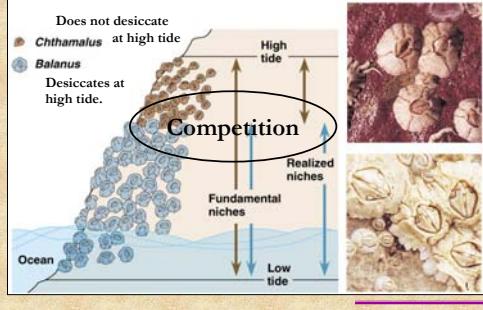
Resource Partitioning – Coexistence

Gause's Principle: no two species can coexist on the same limiting resource.

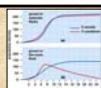
Species avoid competition by partitioning resources and habitats among themselves.



Resource Partitioning



Reducing Niche Overlap



- When species with largely overlapping niches are allowed to compete, their niches may focus on a different part of the resource spectrum.

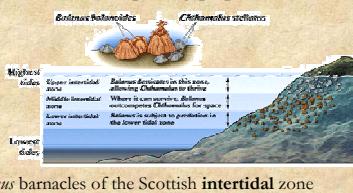
– Example: North American warblers.



Interspecific Competition

- Natural selection can reduce niche overlap, interspecific competition may still restrict the size and distribution of competing populations.

– Example:



Cthlamalus & Balanus barnacles of the Scottish **intertidal** zone

Intraspecific Competition

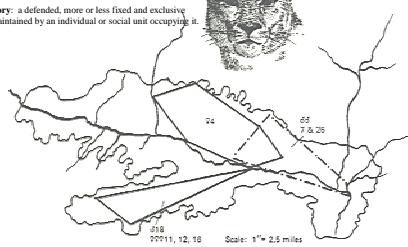
- Intraspecific competition** is usually intense since individuals of the same species have nearly identical niches.
 - If resources are limited, this is a major factor controlling population abundance, distribution, and density.



Social Behavior Limits Access to Resources

Home Range: an area in which an animal normally lives and is not necessarily associated with any type of aggressive behavior. Dominance hierarchy may exist among individuals with overlapping home ranges.

Territory: a defended, more or less fixed and exclusive area maintained by an individual or social unit occupying it.



Predator-Prey Interactions

- Predators kill and eat other organisms
 - Broadly defined, **predators** include **herbivorous** as well as **carnivorous** organisms, including cows, pika, and bats hunting moths
- Predators tend to be larger and less numerous than their prey.



Evolutionary Adaptations

- Predators have evolved characteristics that increase their chances of catching prey
 - Examples: tearing claws of mountain lions and keen eyesight of hawks

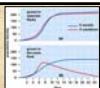


Evolutionary Adaptations

- Prey have evolved characteristics that decrease the chances of being eaten
 - Examples: dappling spots and motionless behavior of deer fawns



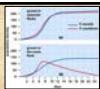
Counteracting Behaviors



- **Example:** Night-hunting bats and their moth prey
 - Bats evolved high-intensity, high-frequency sound pulses to “image” surroundings and locate moths
 - Some moths evolved simple ears to detect bat pulses and take evasive maneuvers.



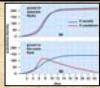
Counteracting Behaviors



- **Example:** Night-hunting bats and their moth prey
 - Bats can switch frequencies outside of moths’ sensitive range to avoid detection.
 - Moths can emit pulses to confuse bats.
 - Bats can turn off their pulses to listen for moths’ pulses.



Camouflage



- **Camouflage** renders animals inconspicuous even when in plain sight
 - May include evolved colors, patterns, and shapes that resemble one’s surroundings.



Camouflage



- To avoid detection by predators, some animals have evolved to resemble objects such as bird droppings, leaves, or thorns.



Camouflage



- Some plants have evolved to resemble rocks to avoid detection by herbivores.