

Community Ecology

- A community is defined as an assemblage of species living close enough together for potential interaction.
- Communities differ in their **species richness**, the number of species they contain, and the **relative abundance** of different species.
- There are different **interspecific interactions**, relationships between the species of a community.

Populations may be linked by competition, predation, mutualism and commensalism

• *Competition*

- **Interspecific competition** for resources can occur when resources are in short supply.
 - There is potential for competition between any two species that need the same limited resource.
 - The **competitive exclusion principle**: two species with similar needs for same limiting resources cannot coexist in the same place.
- The **ecological niche** is the sum total of an organism's use of abiotic/biotic resources in the environment.
 - An organism's niche is its role in the environment.
 - The **competitive exclusion principle** can be restated to say that two species cannot coexist in a community if their niches are identical.

• *Predation*

- A **predator** eats prey.
- **Herbivory**, in which animals eat plants.
- In **parasitism**, predators live on/in a host and depend on the host for nutrition.
- Predator adaptations: many important feeding adaptations of predators are both obvious and familiar.
 - Claws, teeth, fangs, poison, heat-sensing organs, speed, and agility.
 - Plant defenses against herbivores include chemical compounds that are toxic.
 - Animal defenses against predators.
 - Behavioral defenses include fleeing, hiding, and self-defense.
 - Camouflage includes **cryptic coloration**, deceptive markings.
 - Mechanical defenses include spines.
 - Chemical defenses include odors and toxins
 - **Aposematic coloration** is indicated by warning colors, and is sometimes associated with other defenses (toxins).
 - Mimicry is when organisms resemble other species.
 - **Batesian mimicry** is where a harmless species mimics a harmful one.
- Parasites and pathogens as predators.
 - A **parasite** derives nourishment from a host, which is harmed in the process.
 - **Endoparasites** live inside the host and **ectoparasites** live on the surface of the host.
 - **Parasitoidism** is a special type of parasitism where the parasite eventually kills the host.
 - Pathogens are disease-causing organisms that can be considered predators.

- **Mutualism** is where two species benefit from their interaction.
- **Commensalism** is where one species benefits from the interaction, but other is not affected.
 - An example would be barnacles that attach to a whale.
- Coevolution and interspecific interactions.
 - **Coevolution** refers to reciprocal evolutionary adaptations of two interacting species.
 - When one species evolves, it exerts selective pressure on the other to evolve to continue the interaction.

Trophic structure is a key factor in community dynamics

- The **trophic structure** of a community is determined by the feeding relationships between organisms.
- The transfer of food energy from its source in photosynthetic organisms through herbivores and carnivores is called the **food chain**.
- Charles Elton first pointed out that the length of a food chain is usually four or five links, called **trophic levels**.
- He also recognized that food chains are not isolated units but are hooked together into **food webs**.
- Food webs.
 - **Who eats whom in a community?**
 - Trophic relationships can be diagrammed in a community.
 - **What transforms food chains into food webs?**
 - A given species may weave into the web at more than one trophic level.

Dominant species and keystone species exert strong controls on community structure

- **Dominant species** are those in a community that have the highest abundance or highest **biomass** (the sum weight of all individuals in a population).
 - If we remove a dominant species from a community, it can change the entire community structure.
- **Keystone species** exert an important regulating effect on other species in a community.
 - If they are removed, community structure is greatly affected.

Community Disturbances

- Disturbances affect community structure and stability.
 - **Stability** is the ability of a community to persist in the face of disturbance.
- **Disturbances** are events like fire, weather, or human activities that can alter communities.
- We usually think that disturbances have a negative impact on communities, but in many cases they are necessary for community development and survival.
- Human activities cause more disturbance than natural events and usually reduce species diversity in communities.

Ecological succession is the sequence of community changes after a disturbance

- **Ecological succession** is the transition in species composition over ecological time.
- **Primary succession** begins in a lifeless area where soil has not yet formed.
 - Mosses and lichens colonize first and cause the development of soil.
 - An example would be after a glacier has retreated.
- **Secondary succession** occurs where an existing community has been cleared by some event, but the soil is left intact.
 - Grasses grow first, then trees and other organisms.

Community biodiversity measures the number of species and their relative abundance

- Two key factors correlated with a community's **biodiversity** (species diversity) are its size and biogeography.
- The variety of different kinds of organisms that make up a community has two components.
 - **Species richness**, the total number of species in the community.
 - **Relative abundance** of the different species.
 - Imagine two small forest communities with 100 individuals distributed among four different tree species.
 - Species richness may be equal, but relative abundance may be different.

Species richness generally declines along an equatorial-polar gradient

- Tropical habitats support much larger numbers of species of organisms than do temperate and polar regions.
- What causes these gradients?
 - The two key factors are probably evolutionary history and climate.
 - Organisms have a history in an area where they are adapted to the climate.
 - Energy and water may factor into this phenomenon.

Species richness is related to a community's geographic size

- The **species-area curve** quantifies what may seem obvious: the larger the geographic area, the greater the number of species.
- What about islands?
- Species richness on islands depends on the size of the island and its distance from the mainland.
- Because of their size and isolation, islands provide great opportunities for studying some of the biogeographic factors that affect the species diversity of communities.
 - Two factors will determine the number of species that eventually inhabit the island.
 - The rate at which new species immigrate to the island.
 - The rate at which species become extinct.