Community Interactions

LECTURE 3

TYPES OF INTERSPECIFIC INTERACTIONS

	Effect on species 1	Effect on species 2
Competition	-	-
Commensalism	+	0
Mutualism	+	+
Predation,	-	+
Parasitism, Herbivory		

Organisms Interact in Different Ways

- How one organism interacts with other organisms is an important part of defining its **niche.**

- Organisms may **cooperate**, **compete**, or **depend on each other** for survival.

Competition

- How one organism interacts with other organisms is an important part of defining its niche.
- Competition occurs when organisms attempt to use the same limited ecological resource in the same place at the same time.

- If you look at any community, you will probably find more than one kind of organism attempting to use various essential resources.
- When organisms attempt to use the same limited ecological resource in the same place at the same time, competition occurs. In a forest, for example, plant roots compete for water and nutrients in the soil.

- Animals, such as the beetles in compete for resources such as food, mates, and places to live and raise their young.

- Competition can occur both among members of the same species (known as intraspecific competition) and among members of the different species (known as interspecific competition).

Intraspecific Competition

Interspecific Competition

Outcomes of Competition

- Exploitation competition may cause the **exclusion** of one species. Or they may **coexist**, with a decrease in their potential for growth. For this to occur, they must **partition the resource**.

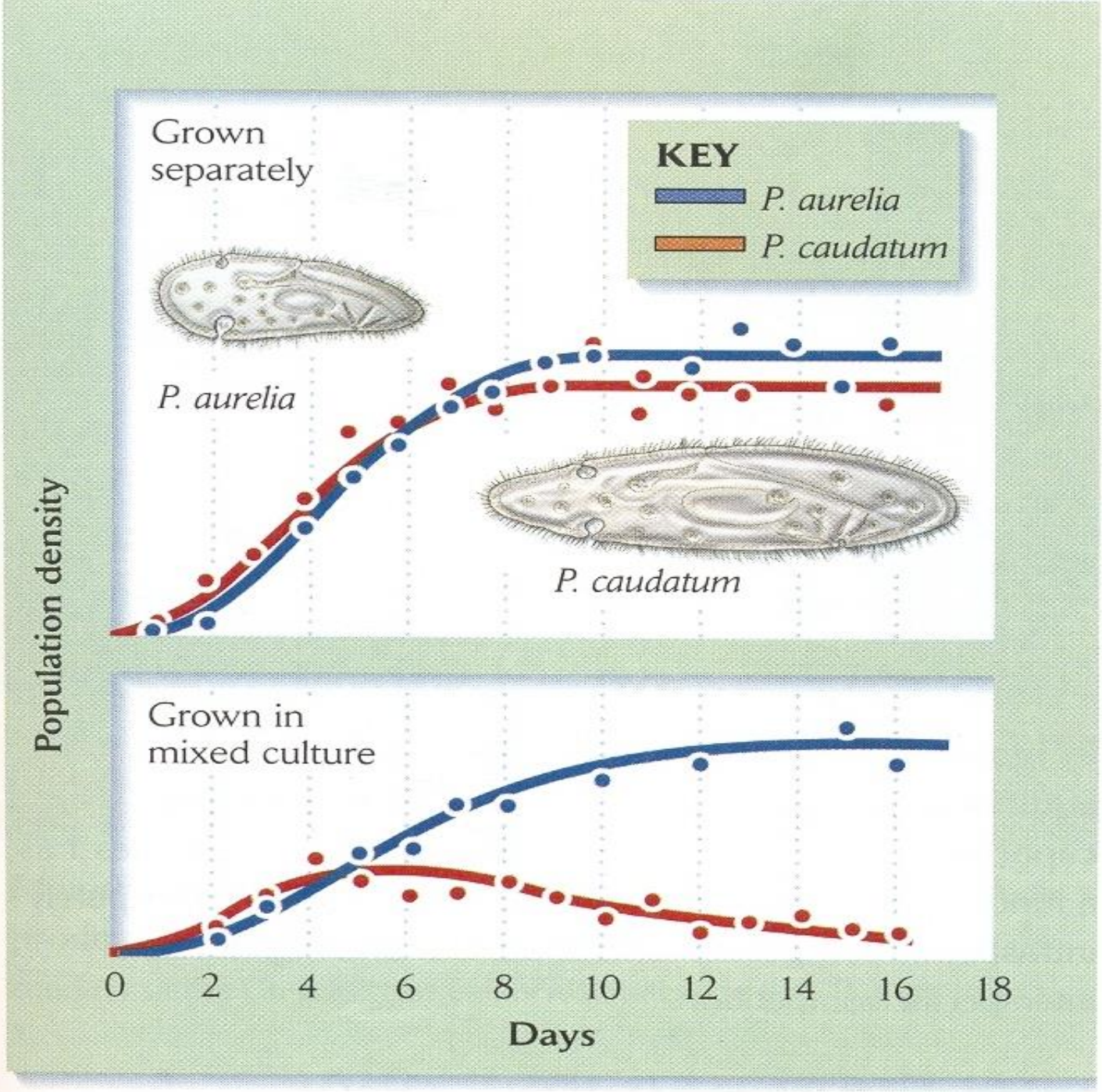
The Competitive Exclusion Principle

- Early in the twentieth century, two mathematical biologists, A.J. Lotka and V. Volterra developed a model of population growth to predict the outcome of competition.
- Their models suggest that two species cannot compete for the same limiting resource for long. Even a minute reproductive advantage leads to the replacement of one species by the other.
- This is called the **competitive exclusion principal**.

One series of experiments demonstrated this using two species of single-celled organisms, *Paramecium* (*Paramecium aurellia* outcompetes and displaces *Paramecium caudatum*). When the species were grown in separate cultures under the same conditions, each survived, as shown in Figure .

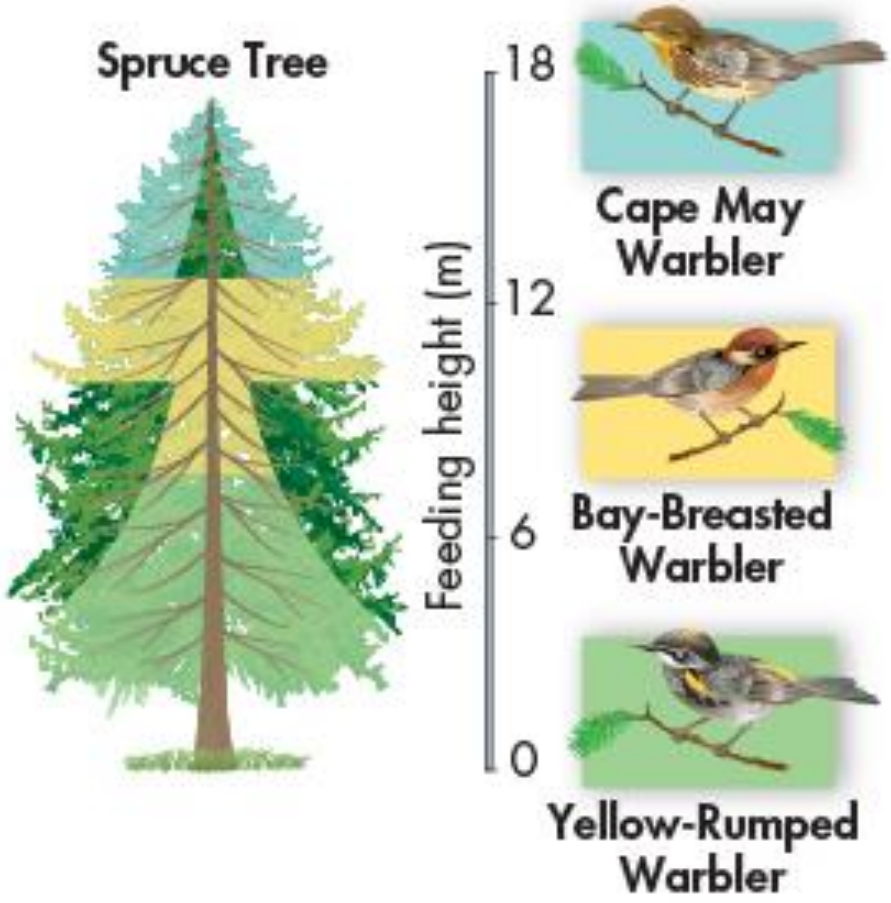
But when both species were grown together in the same culture, one species outcompeted the other. The less competitive species did not survive.
Experiments like this one, along with observations in nature, led to the discovery of an important ecological rule.

The competitive exclusion principle states :
that no two species can occupy exactly the same niche in exactly the same habitat at exactly the same time.
If two species attempt to occupy the same niche, one species will be better at competing for limited resources and will eventually exclude the other species. As a result, if we look at natural communities, we rarely find species whose niches overlap significantly.


Grown separately
KEY
P. aurelia
P. caudatum
P. aurelia
P. caudatum
Grown in mixed culture
Population density
0
2
4
6
8
10
12
14
16
18
Days

Dividing Resources

- Instead of competing for similar resources, species usually divide them. For instance, the three species of North American warblers shown in thev Figure.
- All live in the same trees and feed on insects.
- But one species feeds on high branches, another feeds
- on low branches, and another feeds in the middle. The
- resources utilized by these species are similar yet different.
- Therefore, each species has its own niche and competition is minimized.


Spruce Tree
Feeding height (m)
18
12
6
0
Cape May Warbler
Bay-Breasted Warbler
Yellow-Rumped Warbler

Therefore, each species has its own niche. This division of resources was likely brought about by past competition among the birds.

By causing species to divide resources, competition helps determine the number and kinds of species in a community and the niche each species occupies.

What are the three primary ways that organisms depend on each other?

Any relationship in which two species live closely together is called symbiosis.

Symbiosis which means “living together.”

Biologists recognize three main classes of symbiotic relationships in nature: **mutualism, parasitism, and commensalism.**

A. Mutualism

The sea anemone’s sting has two functions: to capture prey and to protect the anemone from predators. Even so, certain fish manage to snack on anemone tentacles. The clownfish, however, is immune to anemone stings.
When threatened by a predator, clownfish seek shelter by snuggling deep into tentacles that would be deadly to most other fish, as seen in the Figure.

But if an anemone-eating species tries to attack their living home, the spunky clownfish dart out and fiercely chase away fi sh many times their size. This kind of relationship between species in which both benefit.

B. Parasitism

Tapeworms live in the intestines of mammals, where they absorb large amounts of their hosts' food.

Fleas, ticks, lice, and leeches live on the bodies of mammals, feeding on their blood and skin, as seen in the Figure.

Relationships in which one organism lives inside or on another organism and harms it. The parasite obtains all or part of its nutritional needs from the host organism.

Generally, parasites weaken but do not kill their host, which is usually larger than the parasite.

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Leech

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Flea

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Tick

www.bogglesworldesl.com

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Louse

C. Commensalism

Small marine animals called barnacles often attach themselves to a whale's skin, as seen in the Figure .

The barnacles perform no known service to the whale, nor do they harm it. Yet the barnacles benefit from the constant movement of water—that is full of food particles—past the swimming whale. This is an example of Commensalism is a relationship in which one organism benefits and the other is neither helped or harmed.

Commensalism

- Example:barnacles on whale

Predation, Herbivory, and Keystone Species

How do predation and herbivory shape communities?

Virtually all animals, because they are not primary producers, must eat other organisms to obtain energy and nutrients. Yet if a group of animals devours all available food in the area, they will no longer have anything to eat! That's why predator-prey and herbivore-plant interactions are very important in shaping communities.

Predator-Prey Relationships

- An interaction in which one animal (the predator) captures and feeds on another animal (the prey) is called **predation.**

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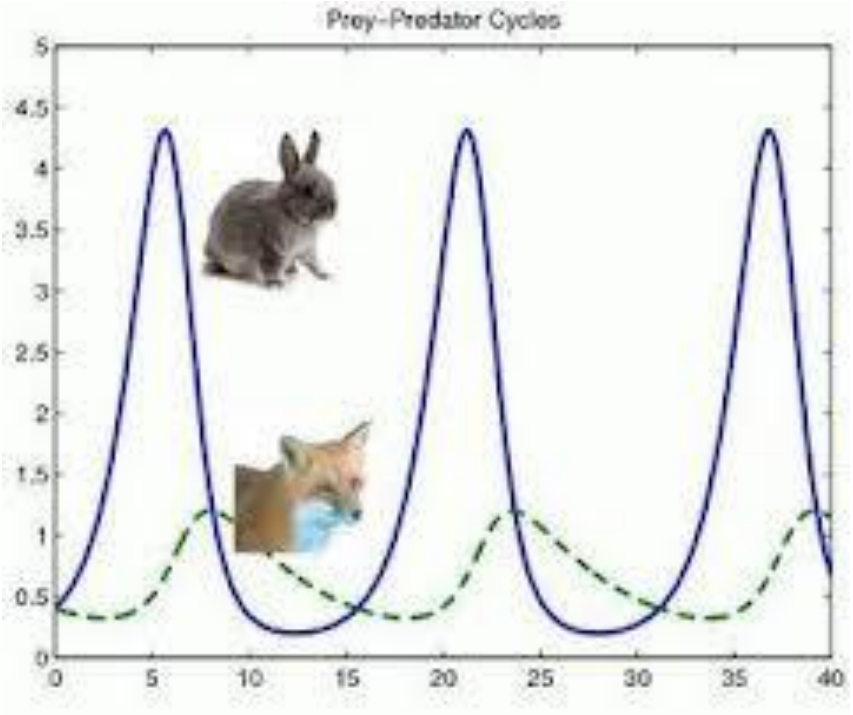
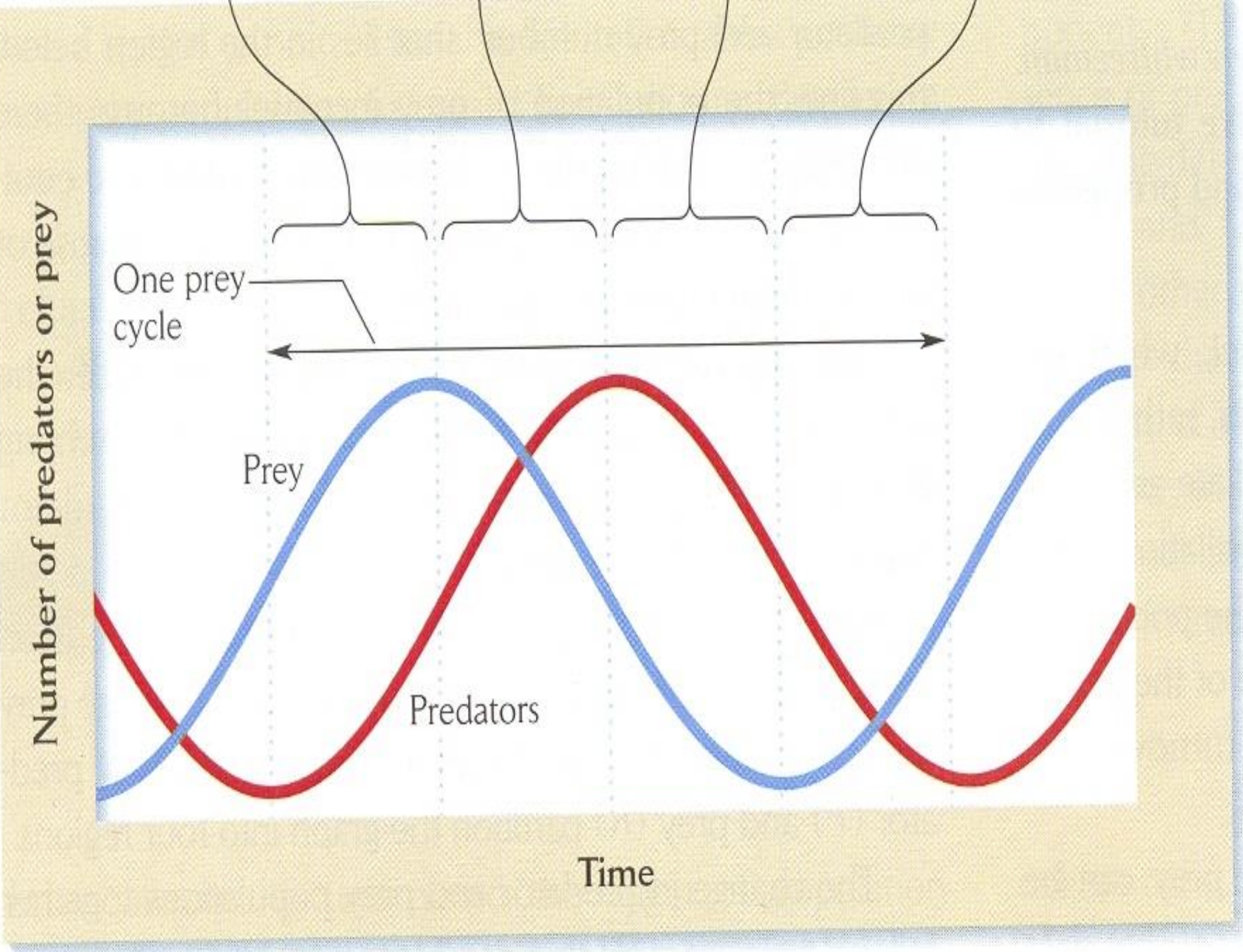
Predators can affect the size of prey populations in a community and determine the places prey can live and feed.

Birds of prey, for example, can play an important role in regulating the population sizes of mice, voles, and other small mammals.

Example : Fox and rabbit populations




One prey cycle
Prey
Predators
Number of predators or prey
Time

Herbivore-Plant Relationships

Interactions between herbivores and plants, are as important as interactions between predators and prey. An interaction in which one animal (the herbivore) feeds on producers (such as plants) is called herbivory.

Herbivores can affect both the size and distribution of plant populations in a community and determine the places that certain plants can survive and grow.

Herbivores ranging from caterpillars to elk can have major effects on plant survival. For example, very dense populations of white-tailed deer are eliminating their favorite food plants from many places.

White tailed deer and food plants

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.

- predator and prey
- parasite and host

Example of Parasite-Host Coevolution

- The common milkweed, ***Asclepias syriaca*** has leaves that contain cardiac glycosides: they are very poisonous to most herbivores. This renders them virtually immune to herbivory by most species.
- Monarch butterfly larvae have evolved the ability to tolerate these toxins, and sequester them within their bodies. They are important specialist hervivores of milkweeds.
- These sequestered compounds serve the additional purpose of making monarch larvae virtually inedible to vertebrate predators.