

Relationships and Interactions in Ecosystems

A community is the biotic part of an ecosystem. It consists of all the populations of all the species in the same area. It also includes their biological interactions, the interactions between different organisms in an environment. Species interactions in communities are important factors in natural selection. They help shape the evolution of the interacting species.

All living things depend on their environment to supply them with what they need, including food, water, and shelter. Their environment consists of physical factors—such as soil, air, and temperature- and also of other organisms. An organism is an individual living thing. Many living things interact with other organisms in their environment. In fact, they may need other organisms in order to survive. This is known as interdependence. For example, living things that cannot make their own food must eat other organisms for food. Other interactions between living things include predation, competition, and symbiosis.

1. Competition (-/-)

Competition is a relationship between organisms that strive for the same resources in the same place. The resources might be food, water, or space. The two organisms are likely to come into conflict, and the organism with better adaptations may win out over the other organism. There are two different types of competition:

Intraspecific competition occurs between members of the same species. For example, two male birds of the same species might compete for mates in the same area. This type of competition is a basic factor in natural selection. It leads to the evolution of better adaptations within a species.

Interspecific competition occurs between members of different species. For example, predators of different species might compete for the same prey.

Interspecific Competition and Extinction

Interspecific competition, in ecology, is a form of competition in which individuals of different species compete for the same resource in an ecosystem (e.g. food or living space). If a tree species in a dense forest grows taller than surrounding tree species, it is able to absorb more of the incoming sunlight. However, less sunlight is then available for the trees that are shaded by the taller tree, thus interspecific competition. Cheetahs and lions can also be in interspecific competition, since both species feed on the same prey, and can be negatively impacted by the presence of the other because they will have less food. Interspecific competition often leads to extinction. The species that is less well adapted may get

fewer of the resources that both species need. As a result, members of that species are less likely to survive, and the species may go extinct.

Intraspecific Competition and Specialization

Intraspecific competition is an interaction in population ecology, whereby members of the same species compete for limited resources. Instead of extinction, interspecific competition may lead to greater specialization. Specialization occurs when competing species evolve different adaptations. For example, they may evolve adaptations that allow them to use different food sources. Members of the same species have very similar resource requirements whereas different species have a smaller contested resource overlap, resulting in intraspecific competition generally being a stronger force than interspecific competition. Individuals can compete for food, water, space, light, mates or any other resource which is required for survival. The resource must be limited for competition to occur; if every member of the species can obtain a sufficient amount of every resource then individuals do not compete and the population grows exponentially. Exponential growth is very rare in nature because resources are finite and so not every individual in a population can survive, leading to intraspecific competition for the scarce resources.

2. Predation (+/-)

Predation is a relationship in which members of one species (the predator) consume members of another species (the prey). The lions and buffalo, buffalo and grasses are classic examples of predators and prey. Like the lion, it consumes prey species, in this case species of grass. However, unlike the lions, the buffalo does not kill its prey. Predator-prey relationships such as these account for most energy transfers in food chains and food webs.

Predation and Population

A predator-prey relationship tends to keep the populations of both species in balance. As the prey population increases, there is more food for predators. So, after a slight lag, the predator population increases as well. As the number of predators increases, more prey are captured. As a result, the prey population starts to decrease.

Keystone Species

Some predator species are known as keystone species. A keystone species is one that plays an especially important role in its community. Major changes in the numbers of a keystone species affect the populations of many other species in the community. For example, some sea star species are keystone species in coral reef communities. The sea stars prey on mussels and sea urchins, which have no other natural predators. If sea stars were removed from a coral reef

community, mussel and sea urchin populations would have explosive growth. This, in turn, would drive out most other species. In the end, the coral reef community would be destroyed.

Adaptations to Predation

Both predators and prey have adaptations to predation that evolve through natural selection. Predator adaptations help them capture prey. Prey adaptations help them avoid predators. A common adaptation in both predator and prey is camouflage. Camouflage in prey helps them hide from predators. Camouflage in predators helps them sneak up on prey.

3. Symbiosis

The term symbiosis comes from a Greek word that means “living together”. Symbiosis can be used to describe various types of close relationships between organisms of different species, such as mutualism and commensalism, which are relationships in which neither organism is harmed. Symbiosis can also be used to describe relationships where one organism lives on or in another, called parasitism.

i) Mutualism (+/+)

Mutualism is a symbiotic relationship in which both species benefit. An example of mutualism involves goby fish and shrimp. The nearly blind shrimp and the fish spend most of their time together. The shrimp maintains a burrow in the sand in which both the fish and shrimp live. When a predator comes near, the fish touches the shrimp with its tail as a warning. Then, both fish and shrimp retreat to the burrow until the predator is gone. From their relationship, the shrimp gets a warning of approaching danger. The fish gets a safe retreat and a place to lay its eggs.

ii) Commensalism (+/0)

Commensalism is a symbiotic relationship in which one species benefits while the other species is not affected. One species typically uses the other for a purpose other than food. Example: clownfish, and it's swimming near the tentacles of an animal called a sea anemone. The sea anemone kills prey by injecting poison with its tentacles. For some reason, the anemone doesn't harm the clownfish.. But why does the clownfish “hang out” with the sea anemone? One reason is for the food. The clownfish eats the remains of the anemone's prey after it finishes feeding. Another reason is safety. The clownfish is safe from predators when it's near the anemone. Predators are scared away by the anemone's poison tentacles.

iii) Parasitism (+/-)

Parasitism is a symbiotic relationship in which one species (the parasite) benefits while the other species (the host) is harmed. Many species of animals are parasites, at least during some stage of their life. Most species are also hosts to one or more parasites. Some parasites live on

the surface of their host. Others live inside their host. They may enter the host through a break in the skin or in food or water. For example, roundworms are parasites of mammals, including humans, cats, and dogs. The worms produce huge numbers of eggs, which are passed in the host's feces to the environment. Other individuals may be infected by swallowing the eggs in contaminated food or water. Some parasites kill their host, but most do not. It's easy to see why. If a parasite kills its host, the parasite is also likely to die. Instead, parasites usually cause relatively minor damage to their host.

iv) **Amensalism (- / 0)**

Where one organism is harmed while the other is unaffected. Often seen as trampling or allelopathy (one species releases chemicals that inhibit another). As for example i) Black walnut root exudates inhibiting some grasses. ii) The fungus *Penicillium* secretes penicillin an antibiotic that kills or inhibits the growth of nearby bacteria. The fungus remains unaffected.