

ECOLOGY, LECTURE 5: INTERSPECIFIC RELATIONSHIPS (1198–1214)

A **community** is a group of populations of different species living close enough to interact. Other definitions of a community are certainly possible. At one extreme, ecologists view a biotic community as a kind of **superorganism** (the **Clementsian** view) where the member species are functional parts of the larger whole. At the other extreme, the community is seen as an assemblage of individualistic species that co-occur as a result of similar abiotic requirements (the **Gleasonian** view).

One of the obvious problems with the superorganismal view is that communities usually do not have clear physical boundaries. The **boundaries** of a community are best identified with reference to the research question under investigation. The community might be the assemblage of species in a mountain lake, or it might be the set of species in the canopy of a tree. All the community concept is intended to refer to *all* the species in a local area, in practice, ecologists usually study only a subset of the whole community.

The **niche** of a species refers to its ecological role in the community. In lecture, we briefly discussed the early views of the niche in the work of Joseph Grinnell and Charles Elton, and we showed how G. Evelyn Hutchinson made the niche amenable to mathematical description in the concept of an *n*-dimensional hypervolume.

The **competitive exclusion principle**—based originally on the experiments of the Russian biologist, G. F. **Gause**—states that if two competing species co-exist in a stable environment then they do so as a result of niche differentiation. In the absence of such differentiation, one species will eliminate or exclude the other. As a result of competition, the observed niche of a species (its **realized niche**) is often a subset of its potential niche (its **fundamental niche**). **Character displacement** refers to the tendency of populations to diverge morphologically when living in sympatry.

Resource partitioning and **niche differentiation** refer to the dividing up of the resource spectrum by species within a community. Many ecologists see the “**ghost of competition past**” in these examples of **community structure**.

Competition is a broad category that includes interactions that have a negative influence on growth, survival, and/or reproduction of the interacting species. **Interference competition** refers to the direct, negative encounters between organisms that involve physical interaction (e.g., a hyena chasing a lion off a kill). **Exploitative competition** refers to indirect, negative interactions that result from depletion of a common resource (e.g., grasshoppers and caterpillars that eat the same leaves but do not actually encounter one another physically).

Predation generally refers to an interaction where one organism kills and eats another. Because of the dire consequences of predation for the fitness of the prey, it is not surprising that many organisms have evolved elaborate means of **predator defense**, including **crypticity** and **camouflage**, **aposematism**, **Batesian** and **Müllerian mimicry**, **eyespots**, spines, unwieldy body forms, etc.

Herbivory refers to the general process in which one organism consumes a plant or alga. Usually, the consumer *grazes* the food item, eating part of it without killing it. Plants have evolved many chemical and mechanical defenses against being eaten. Some types of herbivory, such as nectar-drinking and pollen-eating, have evolved into complex mutualisms.

We will follow your text in defining a **symbiosis** as an interaction that involves direct and intimate contact between species. **Parasitism** is a symbiotic interaction where one species benefits at the expense of another (in this way it is not unlike herbivory and predation). **Parasites** generally have one or a few hosts that they do not kill. **Parasitoids** generally have a single host that is killed after being consumed by newly hatched larvae.

Mutualism refers to a symbiotic relationship that benefits the participating species. In an **obligate mutualism**, one organism cannot survive without the other; in a **facultative mutualism**, both species can survive alone. There are many important examples of mutualism, including the relationship of certain ants to aphids and fungi; the prokaryotic “flora” in the guts of cows and termites; the algal cells in the tissues of corals (zooxanthellae); nitrogen fixing bacteria in plant root nodules; and the fusion of fungi and algae in lichen.

Commensalism refers to an interaction in which one species benefits and another species is unaffected (e.g., cattle egrets and large vertebrate herbivores). When closely examined, however, many of these apparent cases of commensalism appear to be examples of mutualism or parasitism (without a tight symbiosis).

The transfer of mass and energy along trophic pathways in a community creates a series of **food chains** that are connected into a larger **food web**. At the base of the food web are the **primary producers** or **autotrophs** (usually photosynthetic plants or phytoplankton), and there follow the **primary, secondary, and tertiary consumers**. The number of links in a local food chain is related to energy availability and environmental variability. Note that **decomposers** are ubiquitous in natural foodwebs, and they are critical in the recycling of **dead organic matter**.

The **species diversity** of a community has two major components—**species richness** and **relative abundance**. The **Shannon diversity index** is a widely used measure of community diversity.