Chapter Introduction: Ecology of the Table Rocks

Ecology is the study of the interactions between organisms and their environment, including other organisms. Ecology is the most holistic branch of biology; it integrates knowledge from all fields of biological study and also draws heavily from other disciplines such as geology, meteorology, soil science, chemistry, and physics. Ecologists study interactions on a variety of different scales. For example, one might focus on the interactions among members of a single population of one species, while another might study the interactions among several species in an ecosystem. On the largest scale, ecology refers to the interconnectedness of all organisms in the entire biosphere.

Habitat and Ecosystems

One of the most fundamental concepts in ecology is that of habitat. Simply put, an organism's habitat is its home which includes all of the resources it needs to survive. Every habitat must offer food, water, air, space, and shelter. A habitat consists of both abiotic (nonliving) components and biotic (living) components. Abiotic components include water, soil nutrients, air, light, weather, and disturbances such as wildfire or floods. Biotic components of a habitat are simply all the living things that occur there. The Table Rocks are excellent sites for a discussion of habitats because several visibly distinct types of habitat (oak savannah, chaparral, woodland, mounded prairie/vernal pools) occur there. Some organisms, for example a fairy shrimp that spends its whole life in a single pool of water, have a very small habitat (though of course this small habitat is a component of, not separate from, larger habitats). Top predators such as eagles or mountain lions may have habitats that span hundreds of square miles.

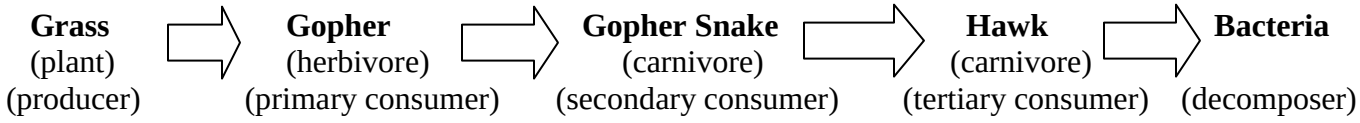
While the term "habitat" usually refers to the physical area within which an organism meets its needs, the related term "ecosystem" emphasizes the interactions among different species in an environment. An ecosystem is not a place, or an assemblage of organisms; an ecosystem consists of the interactions among its components. There are two key concepts of an ecosystem: one is the idea that all the components of an ecosystem are interrelated and function as one unit; the other is that the healthy functioning of an ecosystem ensures that fundamental natural processes, such as the flow of energy through the food web and the cycling of nutrients, continue to operate. Like habitats, ecosystems occur at various scales. One might speak of a single puddle as being an ecosystem. At the opposite extreme, the earth can be considered a single ecosystem.

Food Webs

The food web model is often used to demonstrate the interconnectivity of all species in an ecosystem. Most students are familiar with the concept of a food chain. However, since most animals have more than one food source and can serve as prey for more than one predator, a food web (in which each component is linked to several other components) is a more accurate model. Animals depend on plants and on each other not just for food, but also for shelter; the food web concept can be broadened to include these connections as well.

Producers or plants are the basis of any food web. Plants use energy from sunlight to manufacture carbohydrates out of carbon dioxide building blocks (via a process called

photosynthesis). Plants are the only organisms that, most of the time, do not depend on other organisms for food. Soil provides most plants with the nutrients that they need. However, they generate the biomass that all other organisms depend on. Plants become food for herbivores, which in turn are eaten by carnivores or omnivores. Herbivores, carnivores, and omnivores are all consumers rather than producers, because they consume other organisms for food. Herbivores are also known as primary consumers; a carnivore that eats an herbivore is a secondary consumer, while a carnivore that eats another carnivore is a tertiary consumer. When these organisms die, decomposers (organisms which get their nourishment from dead things) break down the carcasses and release any remaining nutrients back into the soil. Those nutrients are absorbed by plants and the cycle continues.



Types of Ecological Interactions

One basic type of ecological interaction which students will likely be familiar with is the relationship between predator and prey. The fauna of the Table Rocks offers many examples of predator-prey relationships: bobcat and jackrabbit, rattlesnake and rodents, mountain lion and black-tailed deer, and Violet-green Swallow and flying insects. Such relationships present a great opportunity to discuss the adaptations of predator and prey species to hunt and to escape.

A second fundamental type of ecological interaction is competition. Competition between two species occurs when both species depend on the same limited resource. Direct competition is actually surprisingly rare in nature; when two species compete, typically one will displace the other, or the two will adapt to exploit different resources and thus avoid competition. The three most common seed-eating birds in the grassland habitat at the Table Rocks, for example, differ in size so each is suited to exploit different-sized seeds. The same trend occurs across a wide variety of bird groups; when two or more ecologically similar species occur in the same habitat, they differ in size so they can avoid competing for exactly the same resources. This phenomenon is known as resource partitioning and it is one of the driving forces behind the trend toward diversification which characterizes evolutionary history.

Symbiosis is a third type of ecological interaction in which two species live in close conjunction with each other. Symbioses can be classified according to the effect (positive or negative) on the two species involved. In a mutualistic interaction, both species benefit. A great example of mutualism is the lichen that abounds at the Table Rocks. Lichen is not one organism, but two, an alga and a fungus living in unison, each providing something for the other. The fungus gives the lichen its structure and protects the algal cells from drying out, while the alga lives within the fungus, performing photosynthesis to provide food not just for itself but for the fungus as well. Another classic example of mutualism is the relationship between flowers and their pollinators; a pollinator benefits by feeding on a flower's pollen or nectar, while the flower benefits by having its pollen transferred to another flower of the same species, allowing it to

reproduce. Another common type of symbiosis is parasitism, an interaction in which one species benefits at the expense of another. A prominent example of a parasite at the Table Rocks is mistletoe, which students will notice growing among the upper branches of the oak trees. Mistletoe sinks its roots into an oak and steals water and nutrients from the tree.

Disturbance and Succession

Ecologists are interested in the response of ecosystems to disturbance. Ecosystems are subjected to human-caused disturbances such as development, resource extraction, off-highway vehicle use, and wildfire suppression from which they may or may not be able to recover. At the same time, some ecosystems depend on periodic natural disturbances, such as wildfire, floods, or windstorms, to remain healthy. Such disturbances facilitate nutrient recycling, create dead trees and snags (which are a crucial habitat component for many species), and help maintain biological diversity.

The concept of ecological succession dictates that following a landscape-clearing disturbance (such as a wildfire, landslide, or volcanic eruption), the disturbed area will pass through successional stages, each characterized by a different assemblage of plants. For example, after a severe forest fire in southwestern Oregon, the first plants to colonize the burned area will be grasses and wildflowers that disperse well, grow quickly, and thrive in open spaces. Gradually shrubs, which take longer to mature, will come to dominate the area and shade out the grasses. Eventually, trees will overtop the shrubs, shading them out. Ultimately a highly functioning and diverse plant assemblage, referred to as the "climax community," will become established. One of the benefits of wildfire is that it creates a "patchy" landscape, a mosaic containing some areas that have been burned recently and others that are at more mature successional stages. This diversity of successional stages across a landscape means a diversity of habitats for wildlife and other species.

Currently, many ecologists believe natural disturbances occur too frequently in most ecosystems for the theoretical "climax community" to ever be reached. The model of ecological succession can still be useful, however, in understanding the changes that an ecosystem undergoes in the wake of a disturbance.

For more detailed information on wildfire and its ecological effects, see the Fire Ecology chapter.

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