Chapter 54: Community Ecology

Community-Group of Populations of different species living close enough to interact

54.1 COMMUNITY INTERACTIONS ARE CLASSIFIED BY WHETHER THEY HELP, HARM, OR HAVE NO EFFECT ON THE SPECIES INVOLVED

Some key relationships in the life of an organism are its interactions with individuals of other species in the community. These relationships are called INTERSPECIFIC INTERACTIONS and include: Herbivory, Symbiosis (Parasitism, Mutualism, Commensalism) and facilitation.

COMPETITION

INTERSPECIFIC COMPETION is a negative/negative interaction that occurs when individuals compete for a resource that limits their growth and survival. An example would be weeds competing with garden plants for soil nutrients and water.

Competitive Exclusion

2 species competing for the same limiting resource cannot coexist permanently in the same place. In the absence of disturbance, one species will use the resources more efficiently and reproduce more rapidly. This will lead to the elimination of the inferior competitor.

Ecological Niches and Natural Selection

An ECOLOGICAL NICHE is the sum of a species use of biotic and abiotic resources. An ecological niche is an ecological role and how an organism fits into an ecosystem. 2 species cannot coexist permanently in a community if they have identical niches; they need a difference to arise overtime to coexist. Evolution by natural selection can alter niches by having populations use different resources. RESOURCE PARTIONING (differentiation of niches allows for similar species to coexist in a community). Competition results in a species FUNDAMENTAL NICHE (potential niche occupied by that species) to be different from the REALIZED NICHE (portion of the fundamental niche that it actually occupies). To identify a fundamental niche, ecologists will remove a competing species to see if it expands into the newly available space. Species can partition their niches in time as well.

Character Displacement

CHARACTER DISPLACEMENT occurs when allopatric populations of closely related species tend to look more similar and behave more similar to each other than the sympatric populations. The sympatric populations look more different and compete for different resources.

PREDATION

Is a positive/negative interaction between the predator and the prey. Adaptions to both predatory and prey tend to be refined through natural selection since these adaptations are a matter of life or death. Many predators have evolved acute senses (heat sensing organs) to catch prey. Owls have large eyes to help see prey at night. Owls that pursue prey are fast and agile. Prey possess adaptations to avoid being eaten by developing behavioral and physical defenses. These defenses include….

- Hiding, Fleeing, Forming Herds or Schools
- Aposematic Coloration (bright coloration) that serves as a warning
- Cryptic Coloration-Camouflage
- Batesian Mimicry-Harmless Species mimics a harmful one
- Mullerian Mimicry-2 harmless species resemble each other
    - Convergent evolution

Predators can use mimicry to sneak up on Predators. The mimic octopus imitates various marine animals to catch its prey.

HERBIVORY

Positive/Negative interaction in which an organism eats parts of a plant or alga. Herbivores have specialized adaptations such as insects having chemical sensors on their feet to determine the toxicity of various plants, specialized digestive systems and teeth. Because plants are not motile, they have to develop chemical toxins, or structures such as spines and thorns to protect itself. Nicotine in tobacco is toxic to herbivores.

SYMBIOSIS

2 or more species live in direct and intimate contact with one another. Can be harmful, helpful or neutral.

Parasitism

Is a positive/negative interaction. The parasite benefits by obtaining nourishment from the host. ENDOPARASITES live within the host while ECTOPARASITES such as ticks or lice live one outside. A unique form of Parasitism is found in PARASATOID INSECTS which lay their eggs inside the host and the larvae then feed on it. Some parasites have complex life cycles involving multiple hosts and this can occur by altering the behavior of one host to reach the other necessary host.

Mutualism

Interspecific interaction that benefits both species. Nitrogen fixation in bacteria, cellulose digestion in microorganism are good examples. Usually involves Coevolution in both species to keep up with changes. For example, some flowers adapt (develop fruit and nectar) to attract pollinators.

Commensalism

Is a relationship in which one benefits but the other does not benefit or get harmed. An example is organisms that hitchhike (barnacles on whales).

FACILITATION

Species can have positive effects on the survival and reproduction of other species without living in direct or intimate contact of the symbiosis. The black rush *Juncus Geradii* makes the soil more hospitable for other plant species in New England marshes.

54.2 DIVERSITY AND TROPIC STRUCUTRE CHARACTERIZE BIOLGICAL COMMUNITES

SPECIES DIVERSITY

Is the variety of different kinds of organism that make up the community. It has 2 components: SPECIES RICHNESS (number of different species in community) and RELATIVE ABUNDANCE (proportion of each species). The Shannon Diversity is an index used to see the diversity of communities. Main difficulties in tracing species diversity is that it is easy to be deceived by different looks of members within the same species (overcome by DNA analysis), that some species are extremely rare, and that some organisms are highly mobile or nocturnal.

DIVERSITY AND COMMUNITY STABILITY

More diverse communities are more stable and productive long term. The most diverse plots produced the most BIOMASS (total mass of all organisms in a habitat) that the single species plots each year according to a study.

TROPHIC STRUCTRE

The structure and dynamics of a community depend not only on diversity but also on the TROPHIC STRUCRE (feeding relationships). Energy flows from primary producers to consumers and then to decomposers. This energy flow is called a FOOD CHAIN.

Food Webs

Food Chains are not isolated units but actually are linked together. Food Chains link together to form a FOOD WEB. Complicated food webs van be simplified by grouping species with similar trophic relationships into a functional group and isolating a portion of the web that interacts very little with the rest of the community.

Limits on Food Chain Length

Each food chain within a food web is usually a few links long. The chains are usually short because of the ENERGETIC HYPOTHESIS which suggest that about 10% of the energy that stored in organic matter gets transferred to the next trophic level. 100 kg of plant material can support about 10 kg of herbivore biomass and 1 kg of carnivore biomass. This hypothesis predicts that food chins with higher photosynthetic production are going to be much longer. Another limit to food chain length could be the size of a carnivore and its feeding mechanism put an upper limit on the size of food an organism can take into its mouth.

SPECIES WITH A LARGE IMPACT

DOMINANT SPECIES in a community are the species that are most abundant or has the highest collective biomass. One hypothesis suggests that the dominant species are superior in obtaining limited resources. Another is avoiding predation or impact of disease. To discover the impact of the Dominant Species, one can remove it and see what happens to the community. In contrast KEYSTONE SPECIES are not usually abundant in a community but exert a strong control on the community by having pivotal ecological niches. Sea Stars maintain diversity in intertidal communities. ECOSYSTEM ENGINEERS alter the environment by altering the environment physically.

BOTTOM- UP AND TOP-DOWN CONTROLS