

# Relationships Within Ecosystems

## 1: *Biotic Relationships*

- Biotic Relationships: all relationships among organisms

### Competition

- Competition: the use or defense of a resource by one individual that reduces the availability of that resource to other individuals
  - Intraspecific competition: occurs between organisms of the same species
    - Intraspecific competition is very keen because members of the same species require the same food, space, and mates.
    - In a population the individuals best adapted to survive will pass their genetic material on to offspring at a greater than less fit competitors.
      - ◆ Due to this fact, intraspecific competition is one of the driving forces of evolution.
  - Interspecific competition: occurs between organisms of different species
    - Interspecific competition is often less intense than intraspecific competition because individuals of different species do not compete for exactly the same kinds of food, space, or mates.
  - Competitive Exclusion Principle: exclusion that occurs when two or more species compete for the very same resource, and all but one eventually fails as a competitor
    - Two competitors cannot coexist on the same limiting resource.

### Predation

- Predation: biotic relationship in which one organism feeds upon another
  - In any ecosystem, the relative numbers of predators and prey vary from year to year. Over time, however, a biological balance is established.
    - Predators and prey are part of a food web of an ecosystem, and a change in their number affects the entire ecosystem.

### Symbiosis

- Symbiosis: a biological relationship in which two dissimilar organisms live together in a close association.
- Parasitism (+/-): a close, long-term symbiotic relationship in which one organism (parasite) obtains its nutrition from another organism (host).
  - Example: parasitic worms in the digestive tract of a white-tailed deer
- Commensalism (+/0): a form of symbiosis in which one organism benefits and the other neither benefits nor suffers harm.
  - Example: Epiphytes (plants that grow on other plants)
- Mutualism (+/+): a form of symbiosis in which both organisms benefit from living together.
  - Example: bacteria that live the digestive tract of cattle

## 2: *Rhythmic Patterns*

- Biological Rhythms: the periodic responses of organisms to periodic changes in their physical environment
- Example: daily alteration between periods of activity and inactivity
  - Diurnal: referring to an organism that is active mainly during the day
  - Nocturnal: referring to an organism that is active mainly at night

- Rhythmic patterns are adaptations that often limit competition, facilitate food gathering, or help organisms respond to changes in climate. Rhythmic patterns also allow different species to occupy the same habitat but to utilize its resources at different times.

### **Circadian Rhythms**

- Circadian Rhythm: physiological or behavioral pattern of an organism that occurs in cycles of about 24 hours
  - Circadian rhythms are affected by social needs and cycles of day light, but the main control is an organism's biological clock
    - Biological Clock: an internal timing mechanism that controls circadian rhythms
      - ◆ The exact nature of this internal control is unknown, but it may involve fluctuating levels of hormones.

### **Annual Rhythms**

- Annual Rhythm: a physiological or behavioral pattern that recurs in yearly cycles
  - Example: reproductive cycles of plants and animals
- Hibernation: a state of severely reduced physiological activity occurring during the winter
  - This adaptation allows an otherwise active creature to survive during the months when temperatures are extremely cold and food is scarce. This sleeplike state can be maintained with the use of very little energy.
- Estivation: an annual rhythm characterized by severely reduced physiological activity during the summer

### **Migratory Rhythms**

- Migration: the movement of animals from one community or biome to another with the change of seasons
- Migration is a behavioral adaptation that allows animals to exploit the nutrients, climatic conditions, and habitats that are available only seasonally.

### **Tidal Rhythms**

- The position of the moon and sun causes tides.
- Tidal Rhythms: occurs when cyclical changes in the physiology or behavior of an organism correspond to the rise and fall of the sea

### ***3: Succession***

- Succession: the gradual, sequential replacement of populations in an area
- Process of Succession:
  - Pioneer Species: the first species to colonize a new habitat
  - Seral Community: an intermediate community that arises after the pioneer species and before the climax community
  - Climax Community: a community that will remain stable as long as the area is undisturbed
    - The soil, climate, and other abiotic factors in a region determine the organisms that will make up a climax community.
- Each set of species in the community changes the environment in ways that ultimately make it unfavorable for the survival and reproduction of those species. Yet these changes allow other species to survive and reproduce resulting in a new community.

### **Primary Succession**

- Primary Succession: the sequential replacement of populations in an area that has not previously supported life (such as bare rock or a sand dune)
- The transformation of a barren environment into a climax community may require a thousand years or more.
- Volcanic eruptions that create new islands and retreating glaciers can produce barren environments where primary succession will take place.

### **Secondary Succession**

- Secondary Succession: the sequential replacement of populations in disrupted habitats that have not been totally stripped of soil and vegetation
  - This disruption may stem from a natural disaster (forest fire, volcanic eruption, etc.) or from human activity (farming, logging, mining, etc.).
- Old Field Succession: the replacement of populations in abandoned farm fields
  - It commonly takes about 100 years to produce a stable community of trees in an old field.

### **Succession in Lakes**

- Lakes undergo succession that slowly transforms them from crystal clear bodies of water into dry land.
- Eutrophication: the increase of nutrients (nitrogen, phosphorous, etc.) in an environment
  - Oligotrophic Lake: a lake that is very low in nutrients
  - Eutrophic Lake: a lake rich in organic matter