

# Biodiversity, Species Interactions, and Population Control

## Chapter Five

### Living Systems

- living systems have six key features
  - \_\_\_\_\_ Diversity
  - \_\_\_\_\_ Adaptability
  - Unpredictability Limits
- learning about these six features help to understand the impact of humans on natural systems

### Ecosystem Structure

- There are four major characteristics to consider when examining the structure of ecosystems:
  - physical appearance includes the size and stratification of species
  - niche \_\_\_\_\_ is the number of diversity of ecological niches
  - species diversity or richness is the number of species
  - species abundance is the number of \_\_\_\_\_ of each species

### Convergence

- A species functional role in an ecosystem is its niche.
  - A fundamental niche is the full range of conditions and resources a species could use with no direct competition.
  - A \_\_\_\_\_ niche is the part of the fundamental niche actually used by a species.
  - Species that have similar niches tend to evolve a similar set of traits. This resemblance between species is called convergence.
  - \_\_\_\_\_ is the change in the gene pool of one species leading to the change of the gene pool of another species (ex. hummingbird and flower)

### Species Interactions

- Some species develop adaptations that allow them to reduce or avoid \_\_\_\_\_ with other species for resources. One way to do this is resource \_\_\_\_\_, which is dividing up resources so they are used at different times, in different ways or in different places.

### Interspecific Competition

- In predation, members of one species (predator) feed directly on another species (prey)
- A symbiosis is an intimate relationship between members of two or more species. There are three types:
  - parasitism occurs when one species (parasite) feeds on another species (\_\_\_\_\_) by living on or in the host
  - mutualism is a relationship in which both species benefit
  - \_\_\_\_\_ is a relationship in which one species benefits while the other is unaffected

### Population Characteristics

- Population dynamics are described by:
  - Population size is the number of individuals in a population at a given time
  - population density is the number of individuals of a population in a certain space at a given time
  - population \_\_\_\_\_ is the spatial pattern in which the members of a population are found in their habitat
    - clumping pattern appears when small groups of individuals are distributed throughout the habitat
    - uniform pattern appears when individuals are distributed evenly throughout the habitat
    - random pattern appears when individuals are distributed throughout the habitat without an identifiable order
  - \_\_\_\_\_ is the proportion of individuals in each age group (prereproductive, reproductive, and postreproductive) in a population

### Population Growth

- The \_\_\_\_\_ potential of a population is its capacity for growth
- The intrinsic rate of increase ( $r$ ) is the rate at which a population could grow if it had \_\_\_\_\_ resources
  - a species with a high intrinsic rate of increase typically reproduce early in life, have short generation times, can reproduce many times, and produce many offspring each time they reproduce

### Carrying Capacity

- There are always limits to population growth in nature. All the factors acting jointly to limit the growth of a population are collectively called the environmental \_\_\_\_\_.
- Together biotic potential and environmental resistance determine the carrying capacity (\_\_\_\_\_), the number of individuals of a given species that can be sustained indefinitely in a given space.

### J and S

- A population that does not have resource limitations grows \_\_\_\_\_. Exponential growth starts out slowly and then proceeds faster and faster as the population increases. If number of individuals is plotted against time, this sequence yields a J-shaped exponential growth curve.
- \_\_\_\_\_ growth involves exponential population growth when the population is small and a steady decrease in population growth with time as the population approaches the carrying capacity. A plot of number of individuals against time yields a sigmoid or S-shaped logistic growth curve.

### Carrying Capacity (continued)

- Populations tend to temporarily exceed  $K$ . This occurs because of reproductive \_\_\_\_\_, which is the period required for the birth rate to fall and the death rate to rise in response to resource overconsumption.
  - Species with J-shaped exponential growth curves tend to overshoot  $K$  and suffer a population crash
  - species with S-shaped logistic growth curves tend to overshoot  $K$  only to drop and hover around  $K$

### Population Cycles

- In nature there are three general types of population cycles:
  - stable cycles occur in a species whose population size fluctuates slightly above and below  $K$
  - \_\_\_\_\_ cycles occur in a species whose population is normally stable and occasionally explodes to a high peak and then crashes
  - \_\_\_\_\_ cycles occur in a species whose population undergoes a pattern of sharp increases followed by crashes

### Reproductive Strategies

- Species with a high intrinsic rate of increase are called \_\_\_\_\_, have many small and unprotected young in which mortality is high, reach sexual maturity quicker, have shorter life spans and show a J-shaped exponential growth curve (ex. algae, bacteria, rodents)
- Species with a low intrinsic rate of increase are called \_\_\_\_\_, have few but large young, reach sexual maturity slower, have longer life spans and show an S-shaped logistic growth curve. (ex. elephants, whales, redwood trees)

### Survivorship Curves

- One way to represent the age structure of a population is with a survivorship curve, which shows the number of survivors of each age group for a particular species. There are three general types:
  - late loss curves are typical for  $K$ -strategists
  - \_\_\_\_\_ loss curves are typical for  $r$ -strategists
  - \_\_\_\_\_ loss curves are typical in species with intermediate reproductive strategies with a fairly constant rate of mortality in all age classes

### Ecological Succession

- Ecological succession is the gradual and predictable change in species composition of a given area.
  - \_\_\_\_\_ succession involves the gradual establishment of biotic communities in an area that has not been occupied by life before (ex. volcanic island, abandoned parking lot, newly created pond)
  - \_\_\_\_\_ succession involves the reestablishment of a biotic community in an area where a biotic community was previously present (ex. burned forest, abandoned farmland, polluted stream)

### **Primary Succession**

- Primary succession begins with an essentially lifeless area and establishment is generally slow (up to hundreds of years).
  - \_\_\_\_\_ species are the first species to colonize a site as the first stage of primary succession
  - pioneer species and other early successional plant species typically grow quickly under harsh conditions and have short lives, during which they are responsible for the breakdown of rock and buildup of soil
  - midsuccessional plant species are less hardy and more specialized, including larger shrubs and herbs
  - late successional plant species, mostly trees, can tolerate shade and represent an established, stable community sometimes called a \_\_\_\_\_ community (controversial concept because communities never reach terminal growth)

### **Ecological Succession (continued)**

- There are three factors that affect how and at what rate succession occurs
  - Facilitation occurs when one species creates a more suitable area for other species that occur later in succession
  - \_\_\_\_\_ occurs when a species hinders the establishment of other species, typically through the release of toxic chemicals
  - \_\_\_\_\_ is the range of conditions that an organism can endure before injury or death. This can apply to an individual or a species.
- Succession does not occur in a linear fashion. A disturbance is a discrete event in time that disrupts an ecosystem or community.
  - Natural disturbances include \_\_\_\_\_, hurricanes, and floods and are frequently necessary for maintaining the health of an ecosystem. For example, fire releases nutrients into the soil, removes excess ground vegetation, and stimulates reproduction
  - Human-caused disturbances include deforestation and \_\_\_\_\_
- Wildlife can migrate short-term or long-term to survive disturbances.

### **Ecological Stability**

- There are three aspects of stability in living systems:
  - \_\_\_\_\_, or persistence, is the ability of a living system to resist being disturbed or altered
  - constancy is the ability of a living system (population) to maintain a size within the limits imposed by available resources
  - \_\_\_\_\_ is the ability of a living system to recuperate after an external disturbance