CHAPTER 6

Population and Community Ecology

CASE STUDY When settlers first arrived, there were large amounts of temperate seasonal forests until deforestation occurred. Once the settlers moved the former farmland showed the resilience of the forest ecosystem as it naturally rebuilt itself. This example shows how populations can decrease and increase dramatically over time and that this can alter species abundance.

KEY IDEAS

- Levels of complexity- Individual→Population→Community→Ecosystem→Biosphere
- Density-Dependent influence an individual's probability of survival and reproduction that depends on the size of the population. Density-independent has the same effect on an individual's probability of survival and amount of reproduction at any population size.
- Growth models- explain how things work and predict how things might change in the future.
  Reproductive strategies- both k-selected species (low intrinsic rate, slow pop. Increase) and r-selected species (high intrinsic rate, large # of offspring) are the types of reproductive strategies.
  Survivorship curves-different patterns of species survival over time
  Metapopulation- a group of spatially distinct populations that are connected by occasional movements of individuals between them.
- Keystone species- plays a role in its community that is far more abundant than its relative abundance. The entire community is affected by the actions of this one species.
- Ecological Succession- primary=surfaces that are void of soils that eventually become communities. Secondary= surfaces that have been disturbed but haven't lost their soil.
- Latitude, time, area, and distance- the farther north or south from the equator the less species exist, older habitats have more colonization speciation and extinction occur, larger habitats contain more species, and habitats on Islands have fewer species.

SECTION 1- Individual is the simplest level. Scientists study individuals for natural selection, population for factors that cause increases and decreases, communities for how species interact with each other, ecosystems for flows of energy and matter, and biosphere for movements of air, water, and heat.

SECTION 2- **Population size**=total people in a defined area, **population density**=# of individuals per unit area, **population distribution**=how individuals are distributed based on one another. **Sex ratios** is males to females, **age structure** is how many individuals fir into various age categories. **Limiting resource** (resource a population can't live without), **carrying capacity** (limit to how many individuals the food supply can sustain).

SECTION 3- **Intrinsic growth rate** (maximum growth rate), **J-shaped curve** (pop. Not limited by resources so they have rapid growth), **logistic growth model** (initially exponential then slows as it reaches K=carrying capacity), **S-shaped curve** (growth slows at ½ K then stops at full K). **Overshoot** is too many for supply which leads to **die-off** which is population crash. **Survivorship curves** are in three types: **type 1** = K-selected species have high survival then suddenly die in large numbers due to age(whales, humans, elephants) **type 2**= constant decline in survivorship throughout lifespan(corals & squirrels) **type 3**= r-selected species have low survivorship in life, don't really reach adulthood(mosquitoes & dandelions).

SECTION 4- **Community ecology**

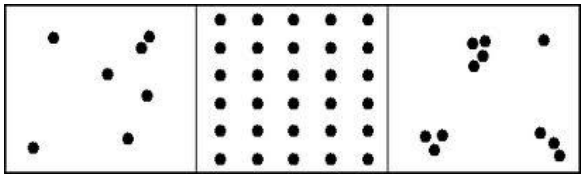
Type of interaction	Species 1	Species 2
Competition	-	-
Predation	+	-
Mutualism	+	+
Commensalism	+	0

Predation categories: Δ **True predators**-kill and consume most of it. Δ **Herbivores**-consume plants as prey. Δ **Parasites**- lives on host organism they consume. Δ **Parasitoids**- lay eggs inside other organisms. **Predator**-mediated competition example- sea stars prey on mussels so other species can attach to the rocks.

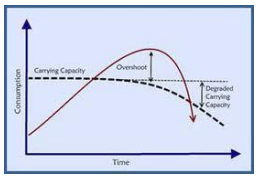
SECTION 5&6- **Pioneer species**-colonize new areas rapidly. **Theory of island biogeography**=importance of habitat size and distance in determining species richness.

MATH FORMULAS: Exponential Growth Model- Intrinsic growth rate of a population (r) and the # of reproducing individuals that are in the population (N_0), estimated future size (N_t) after some period of time (t).

$$N_t = N_0 e^{rt}$$



Random Distribution Uniform Distribution Clumped Distribution



Overshoot and Die-off

Keystone Species

NEGATIVE HUMAN IMPACTS: Deserting places instead of reusing or destroying them, making it more difficult for nature to restore back to its origins. Destroying the nature habitats of species.

POSITIVE HUMAN IMPACTS: Figuring the decreasing populations of various species and acting upon those findings. Protecting keystone species and ecosystem engineers. The best thing humans can do to help these topics is to simply let nature be nature and disrupt it as little as possible.

MISUNDERSTOOD VOCABULARY WORDS: K-selected species and r-selected species because it is difficult to remember what they mean in the first place and it is hard to tell which is which. Also density-dependent and density-independent factors because both are pretty similar as they deal with population size.

MULTIPLE CHOICE QUESTIONS:

1. Which predator lays its eggs inside the host, killing the host from inside out?
   A. True predators
   B. Herbivores
   C. Parasitoids
   D. Parasites

2. Which growth model grows rapidly because there isn't a limiting resource?
   A. J-Shaped Curve
   B. Exponential Curve
   C. Logistic Curve
   D. S-Shaped Curve

3. What happens in primary succession?
   A. A surface is left with only soil
   B. A surface contains shrubs
   C. A surface is devoid of soil
   D. A surface has only lichens and moss

FRQ: Keystone species are species which play a role in their communities that is far more important than its relative abundance might suggest. Explain what would happen to a community if (a) the keystone species became extinct and (b) how this extinction would affect the energy flow of the entire ecosystem. Then (c) give an example of a keystone species and (d) the reasons why this species plays such an important role in its community.