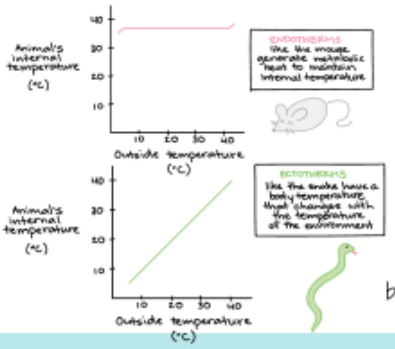
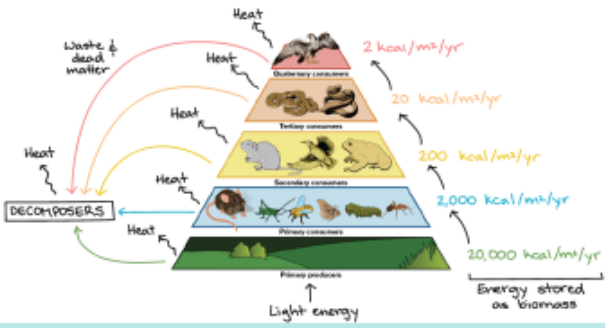
Unit 8: Ecology



Body Temperature

Endotherm
Maintains body temperature through metabolism

Ectotherm
Maintains body temperature through behaviors (bask in sunlight, aggregation)



Energy Flow

Organisms use energy to maintain, organize, grow and reproduce

Trophic Structure

Autotroph
Capture energy from physical or chemical source
- Photosynthetic - sunlight
- Chemosynthetic - small inorganic molecules in environment (sometimes without oxygen)

energy

Heterotroph
Capture energy present in carbon compounds produced by other organisms

Metabolize carbohydrates, lipids, and proteins (notice: not nucleic acids) for energy through hydrolysis

Changes in Availability

Change in Energy Resource
Affects number and size of trophic levels

Change in Producer Level
Affects number and size of trophic levels

Animal Behavior

Communication

Signaling allows for changes in behaviors of organisms to allow for differential reproductive success

Types of Communication:
- Visual
- Auditory
- Electrical
- Chemical

Function:
- Indicate Dominance
- Foraging (Finding Food)
- Establish Territory
- Ensure Reproductive Success

Altruistic Behaviors

Reduces individual fitness but increases inclusive fitness.

Intersexual Selection

Reproductive behaviors to attract a mate
Individuals of one sex choose members of the opposite sex

Examples
- Blue Footed Booby – mating dance (visual)
- Frogs – croaking (auditory)
- Pheromones – (chemical)

Intrasexual Selection

Reproductive behaviors to indicate dominance and compete for access to mates

Examples
- Deer: antler size
- Horned Beetles: strength and size of "horn"

Population Ecology

Exponential Growth

Unlimited growth of population

$r = b - d$

rate of increase = birth rate – death rate

$$\frac{dN}{dt} = rN$$

Example:

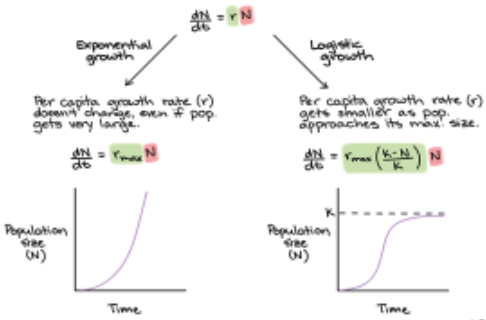
If a population has 400 individuals with a rate of increase of 0.5, how many individuals after 2 generations?

$$\frac{dN}{dt} = (0.5)(400) = 200$$

After generation 1: 600

$$\frac{dN}{dt} = (0.5)(600) = 300$$

After generation 2: 900



<u>Density Dependent Factors</u>

Factors that intensifies as population increases

Ex: competition, predation, disease

<u>Density Independent Factors</u>

Factors that affect all individuals regardless of size, population, density

Ex: natural disasters, human activity

Logistic Growth

Population size limited by carrying capacity

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right) = 200$$

Example:

If a population has 400 individuals with a rate of increase of 0.5 and a carrying capacity of 500, how many individuals after 2 generations?

$$\frac{dN}{dt} = (0.5)(400)\left(\frac{800-400}{800}\right) = 100$$

After generation 1: 500

$$\frac{dN}{dt} = (0.5)(500)\left(\frac{800-500}{800}\right) = 75$$

After generation 1: 575

Species Diversity

Simpson's Index: measures biodiversity (species composition and diversity)

$$Simpson\ Diversity = 1 - \sum\left(\frac{n}{N}\right)^2$$

n = total number of organisms of particular species

N = total of organisms of all species

Species	Number
Sloth	18
Penguin	13
Total	31

$$1 - \left(\left(\frac{18}{31}\right)^2 + \left(\frac{13}{31}\right)^2\right)$$

$$1 - ((0.58)^2 + (0.42)^2)$$

$$1 - (0.34 + 0.18)$$

$$1 - 0.52 = 0.48$$

Keystone Species

Organism with disproportionate to their abundance effect, and when they are removed from the ecosystem, the ecosystem often collapses.

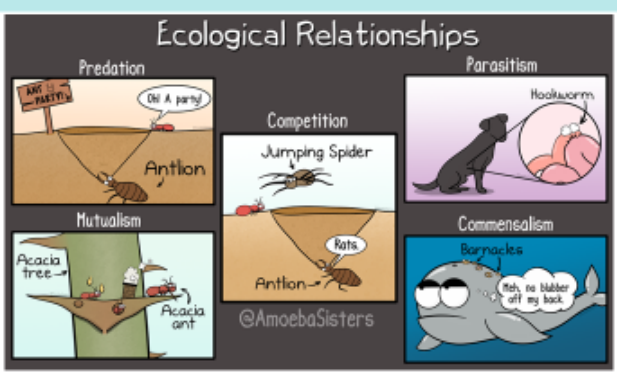
Examples: Sea Otter

Community Ecology

Interactions

Predator/Prey (+/-)
Herbivory (+/-)
Competition (-/-)

Symbiosis
Parasitism (+/-)
Mutualism (+/+)
Commensalism (+/0)



Invasive Species

Organism that is not indigenous, or native, to a particular area with no natural predators and unlimited resources

Examples:

- Zebra Mussel: clogging water way
- Lionfish: venomous species