Factors Affecting Ecosystems (Including Energy Flow)

Date: ______________

Energy Flow

- Energy flow through ecosystems can be described and illustrated in:
  - Food chains
  - Food webs
  - Energy pyramids
  - Number pyramids
  - Biomass pyramids

Food Chains

- Food chain: simplest path that energy takes through an ecosystem
- Energy enters an ecosystem from the SUN!
- Energy is transferred through *trophic levels*, in which each organism uses some of the energy for cellular respiration, lose the energy due to heat loss, and store the rest.

Food Chains – Trophic Levels

- 1st level: Primary Producers (Autotrophs)
  - Perform photosynthesis: sun \(\rightarrow\) sugar
  - Sugar is used for energy, structure, and function of plants
  - Examples: land plants and phytoplankton in aquatic environments
- 2nd level: Primary Consumers (Heterotrophs)
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A heterotroph that decomposes organic material and returns the nutrients to soil, water, and air is a detritivore. It makes nutrients available to other organisms.

Food Webs
- Represents many interconnected food chains describing various paths that energy takes through an ecosystem.

Ecological Pyramids
- Models that show how energy flows through ecosystems.
- Shows relative amounts of energy, biomass, or numbers of organisms at each trophic level.
- Base of the pyramid = producers
  - Each step up represents a different consumer level
- Trophic levels are based on the number of organisms in the food chain or web

Energy Pyramid
- Represents energy available for each trophic level in an ecosystem
  - Energy needs are greater from level to level
  - Total amount of energy available DECREASES
  - Each successive level in an ecosystem can support FEWER numbers of organisms than the one below
  - With each level of the pyramid, only 10% of the energy available is used while the other 90% is lost to the environment

Biomass Pyramid
- Represents the total mass of living organic matter (biomass) at each trophic level
  - The biomass at each trophic level is reduced
  - It does not necessarily represent the amount of energy available at each level
  - Skeleton and the beak of a bird will contribute to the total biomass, but are not available for energy

Number Pyramid
- Number of individual organisms available for energy at each trophic level
- Examines how the population of one species affects another
  - Autotrophic level is the base of the pyramid
    - Represents the total number of producers available to support the energy needs of the ecosystem
    - Total numbers of organisms decline as trophic level increases
Populations
- Population: group of organisms of the SAME SPECIES that live in a particular area
  - They can be described based on size, density, or distribution.
- Population density: number of individual organisms living in a defined space.
  - Regulation of population density is affected by density-dependent factors, density-independent factors, abiotic factors, and biotic factors.

Density-Dependent Factors
- Limiting factors that operate more strongly on LARGE populations.
- Triggered by increases in population density (crowding).
- Includes competition, predation, parasitism, and disease.

Density-Independent Factors
- Limiting factors that occur regardless of how large the population is.
- Reduce the size of ALL populations in the area by the same proportion.
- Mostly abiotic (weather changes), human activities (pollution), and natural disasters (fires).

Abiotic Factors
- Limiting factor that can change within an ecosystem and may affect a population.
- Chemical or physical
- Examples: water, nitrogen, oxygen, salinity, pH, soil nutrients and composition, temperature, amount of sunlight, and precipitation.

Biotic Factors
- Limiting factor that can change within an ecosystem and may affect a population.
- All living components of an ecosystem.
- Examples: bacteria, fungi, plants, animals.

Abiotic and Biotic Factors
- A change in one of these factors may DECREASE the size of a population if it cannot adapt or migrate.
- A change may INCREASE the size of a population if that change enhances its ability to survive, flourish, or reproduce.