VOCABULARY

Biodiversity = the total of the variety of organisms in the biosphere

Ecosystem Diversity: variety of habitats, communities and ecological processes in the biosphere

Species Diversity = number of different species that makes up a particular area

Genetic Diversity = sum total of all the different forms of genetic information carried by a particular species or by all organisms on Earth

Speciation: formation of a new species as a result of geographic, physiological, anatomical or behavioral factors that prevent previously interbreeding populations from breeding with each other

Extinction: Permanent loss of a species

Habitat Fragmentation: splitting of ecosystems into pieces

Ecological hot spot = small geographic area where significant numbers of habitats and species are in an immediate danger of extinction

Biosphere = part of Earth in which life exists including land, water, and air/atmosphere

Species: a group of similar organisms that can breed and produce fertile offspring

Population = group of individuals of the same species that live in the same area

Community: assemblage of different populations that live together in a defined area

Ecology = scientific study of interactions among organisms and between organisms and their environment

Ecosystem: all the organisms that live in a place, together with their nonliving environment

Biome: a group of ecosystems that share similar climates and typical organisms

Biotic: any living part of the environment with which an organism might interact

Abiotic factor = physical, or nonliving, factor that shapes an ecosystem

Autotroph: organism that is able to capture energy from sunlight or chemicals and use it to produce its own food from inorganic compounds; AKA producer

Primary Producer = first producer of energy-rich compounds that are later used by other organisms

Photosynthesis = process used by plants and other autotrophs to capture light energy and use it to power chemical reactions that convert CO_2 and H_2O into O_2 and energy rich carbohydrates such as sugars and starches

Chemosynthesis = process in which chemical energy is used to produce carbohydrates

Heterotroph = organism that obtains food by consuming other living things; AKA consumer

Consumer = organism that relies on other organisms for its energy and food supply; AKA heterotroph

Carnivore = organism that obtains energy by eating animals

Herbivore = organism that obtains energy by eating only plants

Scavenger = animal that consumes the carcasses (dead body) of other animals

Omnivore = organism that obtains energy by eating both plants and animals

Decomposer = organism that breaks down and obtains energy from dead organic matter

Detritivore = organism that feeds on decaying plant and animal remains and other dead matter

Food chain = a series of steps in an ecosystem in which organisms transfer energy by eating and being eaten

Food web = network of complex interactions formed by the feeding relationships among the various organisms in an ecosystem

Trophic Level = each step in a food chain or food web

Ecological Pyramid = illustration of the relative amounts of energy or matter contained within each trophic level in a given food chain or food web

Biomass = total amount of living tissue within a given trophic level

Population density = number of individuals per unit area

Age-structure = the number of males and females of each age in a population

Immigration = movement of individuals into an area occupied by an existing population

Emmigration = movement of individuals out of an area

Exponential Growth = growth pattern in which the individuals in a population reproduce at a constant rate

Logistic growth = growth pattern in which a population's growth slows and stops following a period of exponential growth

Carrying Capacity = largest number of individuals of a particular species that a particular environment can support

Tolerance = Ability of an organism to survive and reproduce under circumstances that differ from their optimal conditions

Habitat = area where an organism lives including the biotic/abiotic factors that affect it

Niche = full range of physical and biological conditions in which an organism lives and the way in which the organism uses those conditions

Resource = any necessity of life, such as water, nutrients, light, food, or space

Competitive Exclusion Principle = principle that states that no two species can occupy the same niche in the same habitat at the same time

Predation = interaction in which one organism (predator) captures and feeds on another organism (prey)

Herbivory = interaction in which one animal (herbivore) feeds on producers (plants)

Keystone species = single species that is not usually abundant in a community yet exerts strong control on the structure of a community

Symbiosis = relationship in which two species live close together

Mutualism = symbiotic relationship in which both species benefit from the relationship

Parasitism = symbiotic relationship in which one organism lives on or inside another organisms and harms it

Commensalism = symbiotic relationship in which one organism benefits and the other is neither helped nor harmed

Limiting factor = factor that causes population growth to decrease

Density-independent limiting factor = limiting factor that affects all populations in similar ways regardless of the population density

Density-dependent limiting factor = limiting factor that operates strongly only when population density reaches a certain level

BIODIVERSITY

Biodiversity, or biological diversity, is the total of all the genetically based variation in all organisms in the biosphere

Biodiversity exists on 3 levels : ecosystem diversity, species diversity, and genetic diversity

Ecosystem Diversity: variety of habitats communities and ecological processes in the biosphere

Species Diversity = number of different species that makes up a particular area
- biologists have identified and named more than 1.8 million species
  - ↳ estimate at least 30 million more are yet to be discovered
- much of this diversity exists among single-celled organisms

Genetic Diversity = sum total of all the different forms of genetic information carried by a particular species or by all organisms on earth
- refers to the total of all different forms of genes present in that species
- most basic, yet hardest to see, kind of diversity
- important to the survival/evolution of species in a changing world

Biodiversitys benefits to society include contributions to medicine and agriculture, and the provision of ecosystem goods and services

When biodiversity is lost, significant value to the biosphere and to humanity may be lost along with it

THREATS TO BIODIVERSITY

Species diversity is related to genetic diversity
The more genetically diverse a species is, the greater its chance of surviving disturbances

Species diversity, in turn, is linked to ecosystem diversity
As ecosystems are damaged, the organisms that inhabit them become vulnerable to extinction

Humans reduce biodiversity by altering habitats, hunting introducing invasive species releasing pollution into food webs and contributing to climate change

Altered habitats: When natural habitats are eliminated for agriculture or urban development, the number of species in those habitats drops, and some species may become extinct
- Splitting ecosystems into pieces = habitat fragmentation, leaving habitats 'islands'
- Biological island can be a patch of habitat surrounded by a different habitat
- The smaller a habitat island, the fewer the species that can live there and smaller their populations
- Both changes make habitats and species more vulnerable to other disturbances

Hunting: humans can push species to extinction by hunting
animals can be hunted for their commercially valuable hides and skins or medicinal properties
hunted species are affected even more than other species by habitat fragmentation because fragmentation increases access for hunters and limits hiding spaces for prey

Invasive species: organisms introduced to new habitats can become invasive and threaten biodiversity
a nonnative species that significantly modifies/disrupts the ecosystems it colonizes
may arrive in new areas through natural migration
most likely through human activity

Pollution: pollutants can threaten biodiversity

Climate change: organisms are adapted to their environment and have specific tolerance ranges to temperature and other abiotic conditions
If conditions change beyond an organism's tolerance, the organism must move to a more suitable location or face extinction
Species in fragmented habitats are particulary vulnerable to climate change because if conditions change, they may not be able to move to a suitable habitat

To conserve biodiversity we must protect individual species preserve habitats and ecosystems, and make certain that human neighbors of protected areas benefit from conservation efforts

ECOSYSTEMS

The biosphere consists of all life on Earth and all parts of the Earth in which life exists
Organisms in the biosphere interact with each other and with their surroundings, or environment. The study of these interactions is called Ecology

Ecology: scientific study of interactions among organisms and between organisms and their environment

Interactions within the biosphere produce a web of interdependence between organisms and the environments in which they live
Organisms respond to their environments and can also change their environments, produce an ever-changing biosphere

Human economics and ecology are linked.
Economics is concerned with human interactions based on money and trade
Humans live within the biosphere and depend on ecological processes to provide such essentials as food and drinkable water that can be bought and sold/traded

Organization of life: cells → tissues → organs → organ systems → organisms
Environment refers to all conditions, or factors, surrounding an organism
Environmental conditions include biotic and abiotic factors

Biotic = any living part of the environment with which an organism might interact
the biological influences on organisms

Abiotic factor = physical, or nonliving, factor that shapes an ecosystem

Many physical factors can be strongly influenced by the activities of organisms

ENERGY AND CONSUMERS

for most life on earth, sunlight is the ultimate energy source
for some, chemical energy stored in inorganic chemical compounds serves as the ultimate energy source for life processes

Autotroph = organism that is able to capture energy from sunlight or chemicals and use it to produce its own food from inorganic compounds; AKA producer / primary producer
use solar or chemical energy to produce "food" by assembling inorganic compounds into complex organic molecules
Autotrophs store energy in forms that make it available to other organisms
Are the first producers of energy-rich compounds that are later used by other organisms And are essential to the flow of energy through the biosphere

Photosynthesis = process used by plants and other autotrophs to capture light energy and use it to power chemical reactions that convert CO_2 and H_2O into O_2 and energy rich carbohydrates such as sugars and starches

Chemosynthesis = process in which chemical energy is used to produce carbohydrates
deep sea ecosystems depend on primary producers that harness chemical energy from inorganic molecules such as hydrogen sulfide
Chemosynthetic organisms live in dark oceans and deep sea volcanic vents

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ENERGY TRANSFER

Sun = ultimate source of energy
Plants (primary producers) = make energy through photosynthesis
Animals (primary consumers) = ingest plants
Animals (secondary consumers) = ingest plant eating animals
Animals (tertiary consumer) = ingest carnivores
Animals (quaternary consumer) = eats tertiary consumes

Energy is lost as you move up the food web
Only 10% of the energy from one level is transfered to the next level on the food web
organisms expend much of the energy they acquire on life processes, such as respiration, movement, growth, and reproduction
most of the remaining energy is released into the environment as heat.

Primary producers and consumes are linked through feeding relationships.
Energy flows in similar ways in different ecosystems
Energy flows through an ecosystem in a one-way stream, from primary producers to various consumes

Food chain = a series of steps in an ecosystem in which organisms transfer energy by eating and being eaten
Food web = network of complex interactions formed by the feeding relationships among the various organisms in an ecosystem
Show more complicated feeding relationships as many animals eat more than one food

Decomposition process releases nutrients that can be used by primary producers
they recycle nutrients in food webs

Trophic Level = each step in a food chain or food web

Ecological Pyramid: illustration of the relative amounts of energy or matter contained within each trophic level in a given food chain or food web
Show the feeding relationship of groups and flow of energy through the trophic levels

Pyramids of energy show that relative amount of energy available at each trophic level of a food chain or food web

Biomass = total amount of living tissue within a given trophic level
organic matter, especially plant matter, that can be converted to fuel and is regarded as a potential energy source
usually measured in grams of organic matter per unit area
determined, in part, by the amount of energy available

A pyramid of biomass illustrates the relative amount of living organic matter available at each trophic level in an ecosystem

A pyramid of numbers shows the relative number of individual organisms at each trophic level in an ecosystem
The numbers of individuals on each level decrease from the level below it

POPULATION GROWTH

Researchers study populations's geographic range, density and distribution, growth rate, and age structure

Geographic Range: the area inhibited by a population
a populations range can vary enormously in size, depending on the species

Population density: number of individuals per unit area
populations of different species often have very different densities, even in the same environment
Distribution refers to how individuals in a population are spaced out across the range of the population (randomly, uniformly, or concentrated in clumps).

Growth Rate: A population's growth rate determines whether the size of the population increases, decreases, or stays the same

Age-structure: the number of males and females of each age in a population
To fully understand a plant or animal population, researchers need to know more than just the number of individuals it contains
most plants and animals cannot reproduce until they reach a certain age

The factors that can affect population size are birth rate, death rate, and the rate at which individuals enter or leave the population

Birth rate/ New individuals are added to a population (birth rate)
Death rate: Individuals leave the population by dying (death rate)
Populations can grow if more individuals are born than die in any period of time.
↳ populations can grow when birthrate > death rate
populations may stay the same when birthrate = death rate
populations may shrink when birthrate < death rate

Immigration: movement of individuals into an area occupied by an existing population
Emmigration: movement of individuals out of an area

If you provide a population with all the food and space it needs, protect it from predators and disease, and remove waste products, the population will grow
The population will increase because members of the population will be able to produce more offspring
The size of each generation of offspring will be larger than the generation before it (exponential)

Exponential Growth = growth pattern in which the individuals in a population reproduce at a constant rate
The larger a population gets, the faster it grows
Under ideal situations resources and a population will grow

If you plot the size of an exponential population on a graph over time, you get a J-shaped curve that rises slowly at first, and then rises faster and faster
If nothing interfered with this kind of growth, the population would become larger and faster until it approached an infinitely large size
Sometimes when an organism is moved to a new environment, its population grows exponentially for a time

Natural populations don't grow exponentially for long.
Soon, things stop exponential growth.

Growth Phase 1: Exponential Growth After a short time, the population begins to grow exponentially
resources are unlimited, so individuals grow/reproduce rapidly
few individuals die, and many offspring are produced

Growth Phase 2: Growth Slows down at some point, the rate of population growth begins to slow down.
The population still grows, but the rate of growth slows down, so the population size increases more slowly

Growth Phase 3: Growth Stops At some point, the rate of population growth drops to zero
the size of the population levels off.
Under some conditions, the population will remain at or near this size indefinetly

Logistic growth: growth pattern in which a population's growth slows and stops following a period of exponential growth (resources are less available)
the graph has an S-shape curve
when a population grows more organisms are born than die
Growth may slow down because the populations birth rate decreases/death rate increases
Growth may slow if immigration rate decreases/emmigration rate increases

Carrying Capacity: largest number of individuals of a particular species that a particular environment can support
Once a population reaches the carrying capacity of its environment, a variety of factors act to stabilize it at that size
a given ecosystem can only support the number of organisms that allow matter and energy to cycle efficiently through the ecosystem

COMMUNITY INTERACTIONS

Organisms occupy different places because each species has a range of conditions under which it can grow and reproduce
These conditions help define where and how an organism lives

Tolerance = Ability of an organism to survive and reproduce under circumstances that differ from their optimal conditions
When an environmental condition extends in either direction beyond an organism's optimal tolerance range, the organism experiences stress
the organism must expend more energy to maintain homeostasis, and so has less energy left for growth and reproduction
organisms have an upper and lower limit of tolerance for every environmental factor, and cannot survive beyond those limits

Habitat = area where an organism lives including the biotic/abiotic factors that affect it
a species' tolerance helps determine its address/habitat

Niche = full range of physical and biological conditions in which an organism lives and the way in which the organism uses those conditions
describes not only what an organism does but also how it interacts with environmental factors
Resource: any necessity of life, such as water, nutrients, light, food, or space
Part of an organisms niche involves the abiotic factors it requires for survival
Biological aspects of an organism's niche involve the biotic factors it requires for survival (when/how it reproduces...)

When organisms attempt to use the same limited ecological resource in the same place at the same time, competition occurs
Competition can occur both among members of the same species (intraspecific competition) and between members of different species (interspecific competition)

Direct competition between different species almost produces a winner and a loser, and the loosing species dies out

Competitive Exclusion Principle= principle that states that no two species can occupy the same niche in the same habitat at the same time
If 2 species attempt to occupy the same niche, one species will be better at competing for limited resources and will eventually exclude the other

Instead of competing for similar resources, species usually divide them
By causing species to divide resources, competition helps determine the number and kinds of species in a community and the niche each species occupies

Predator - Prey Relationships: an interaction in which one animal (predator) captures and feeds on another animal (prey) is called predation
Predators can affect the size of prey populations in a community an determine the places prey can live and feed

Herbivory = interaction in which one animal (herbivore) feeds on producers (plants)
Herbivores can affect both the size and distribution of plant populations in a community and determine the places that certain plants can survive and grow

Keystone species = single species that is not usually abundant in a community yet exerts strong control on the structure of a community
Changes in the population of a single species can cause dramatic changes in the structure of a community

Symbiosis = relationship in which two species live close together

Mutualism = symbiotic relationship in which both species benefit from the relationship

Parasitism = symbiotic relationship in which one organism lives on or inside another organisms and harms it
The parasite obtains all or part of its nutritional needs from the host organism
parasites weaken, but do not kill their host, which is usually larger than the parasite

Commensalism = symbiotic relationship in which one organism benefits and the other is neither helped nor harmed

LIMITING FACTORS

Limiting factor = factor that causes population growth to decrease
A limiting nutrient can control the productivity of an ecosystem
↳ example of a limiting factor
Population size can be limited by competition, predation, parasitism and disease, unusual weather, and natural disaster
Acting together or separately, limiting factors determine the carrying capacity of an environment for a species
limiting factors keep most natural populations somewhere between extinction and overrunning the planet
These limiting factors produce the pressures of natural selection that make the evolutionary theory

Density-dependent limiting factor = limiting factor that operates strongly only when population density reaches a certain level
do not affect small, scattered populations as much
DD limiting factors include competition
include competition, predation, herbivory, parasitism, disease and stress

Competition (DD): when populations become crowded, individuals compete for essentials
competition can lower birthrates or increase death rates
the more individuals living in an area, the sooner they use up resources
competition can also occur among members of different species that are attempting to use similar or overlapping resources.
This type of competition is a major evolutionary change force

Predation / Herbivory (DD): In a predator-prey relationship, populations of predators and prey may cycle up and down over time
from a plant's perspective, herbivores are predators, so herbivore and plant cycle up and down just like predator and prey populations

Parasitism / Disease (DD): Parasits and disease-causing organisms feed at the expense of their hosts, weakening them and often causing disease or death
the denser the host population, the more easily parasites can spread from one host to another

Stress from Overcrowding (DD): some species fight amongst themselves if overcrowded
too much fighting can cause high levels of stress which can weaken the body's ability to resist disease
can lower birth rates, raise death rates and increase emmigration rate

Density-independent limiting factor: limiting factor that affects all populations in similar ways regardless of the population density
unusual weather / natural disasters can act as DI limiting factors
in response to such factors a population may "crash"
After the crash, the population may build up / stay low for some time

Sometimes the effects of so-called DI can vary with population density
Human activities can also place ecological communities under stress

OTHER INFO

Photic zone: the uppermost layer near the surface of water where photosynthesis can occur; AKA sunlight zone
Aphotic zone: portion of lake / ocean where there is little to no sunlight

Primary Succession: first steps of ecological succession after an extreme disturbance. Process of change in the species structure of an ecological community over time
Secondary Succession: restarts the entire ecosystem, but with nutrients from before

Biomagnification: concentration of toxins in an organism increase as a result of consuming other organisms with a higher concentration of that toxin