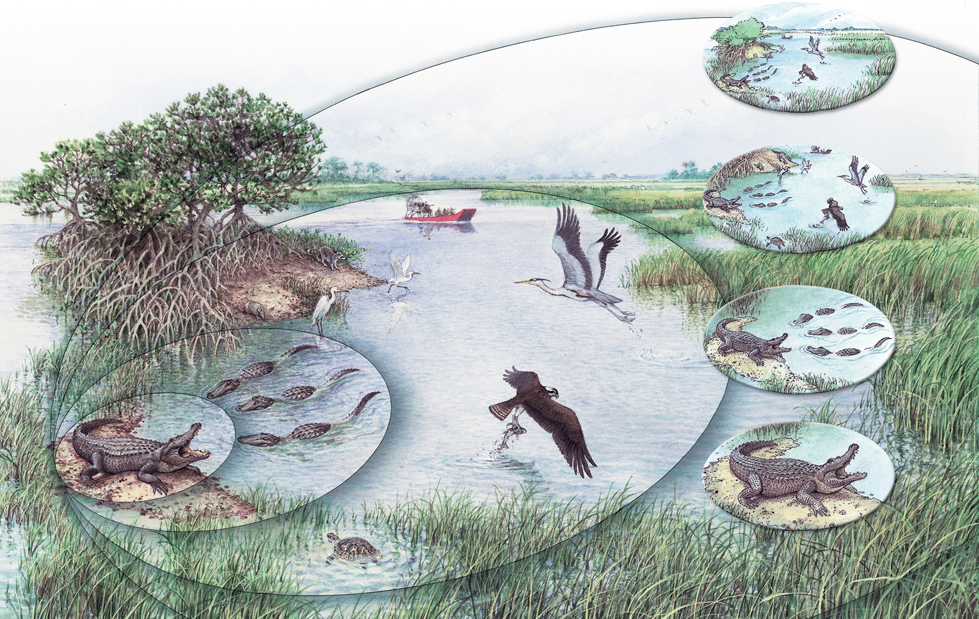
**KEY CONCEPT: Ecology is the study of the relationships among organisms and their environment.**

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| Objectives | CH3.1 Vocab | CH 3.2 Vocab |
| * Summarize the levels of organization that an ecologist studies * Identify biotic and abiotic factors in an ecosystem * Describe how a change in 1 factor in an ecosystem can affect others * Describe the roles of producers and consumers in ecosystems * Compare photosynthesis to chemosynthesis | * Biosphere * Species * Population * Community * Ecology * Ecosystem * Biome * Biotic factor * Abiotic factor * Keystone species | * Autotroph * Primary producer * Photosynthesis * Chemosynthesis * Heterotroph * Consumer * Carnivore * Herbivore * Omnivore * Decomposer * Detritivore |

* Ecology is the study of the interactions among living things, and between living things and their surroundings.
* Ecologists study environments at different levels of organization.

Biome:



Ecosystem:

Community”

Population:

Organism:

An ecosystem includes both biotic and abiotic factors.

|  |  |
| --- | --- |
| **Biotic Factors** | **Abiotic factors** |
|  |  |

* Changing one factor in an ecosystem can affect many other factors. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the assortment, or variety, of living things in an ecosystem. Rain forests have more biodiversity than other locations in the world, but are threatened by human activities.
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a species that has an unusually large effect on its ecosystem. Keystone species form and maintain a complex web of life.

1. What are the 5 different levels of organization studied by ecologists?
2. How do the principles of Ecology relate to understanding how adaptations occur?
3. Describe the biotic and abiotic factors that exist in the Lake Michigan ecosystem.
4. How would the removal of a keystone species affect biodiversity?
5. Explain how a change in an abiotic factor such as sunlight would affect biodiversity?
6. Humans are sometimes described as being a keystone species. Does this label fit? Why or why not?
7. What role might an abiotic factor such as temperature play in the evolution of a species?

**KEY CONCEPT: Life in an ecosystem requires a source of energy.**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ provide energy for other organisms in an ecosystem. Producers get their energy from non-living resources. Producers are also called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because they make their own food. Almost all producers obtain energy from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the process by which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy is captured and used to power chemical reactions that convert carbon dioxide and water into carbohydrates and oxygen

Life without Light: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in prokaryote producers uses \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as an energy source to produce carbohydrates. Chemosynthetic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ live in harsh environments like near deep sea volcanic vents and hot springs.

Producers provide energy for other organisms in an ecosystem. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are organisms that get their energy by eating other living or once-living resources. Consumers are also called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because they feed off of different things.

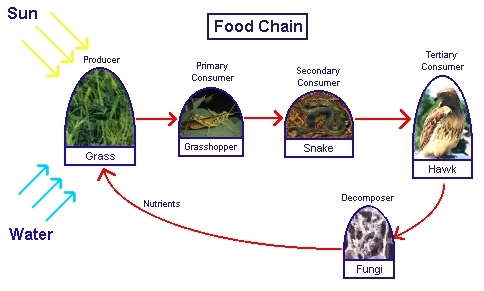
* + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: animals that consume the carcass of other animals that have been killed by predators or died of other causes
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: kill and eat other animals
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: animals whose diets naturally include a variety of different foods including both plants and animals
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ : eat only plants
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: feed on pieces of dead plants or animals, chewing on them and grinding them into smaller pieces
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: bacteria and fungi “feed” by chemically breaking down organic matter

1. How does the stability of an ecosystem depend on its producers?
2. What are the 2 processes used by producers to obtain energy?
3. Few producers live deep below a lakes surface. Suggest an explanation for this pattern
4. Could producers survive without consumers? Explain why or why not.
5. How might chemosynthetic organisms help scientists to understand how life evolved?

**KEY CONCEPT: Food chains and food webs model the flow of energy in an ecosystem. Pyramids model the distribution of energy and matter in an ecosystem.**

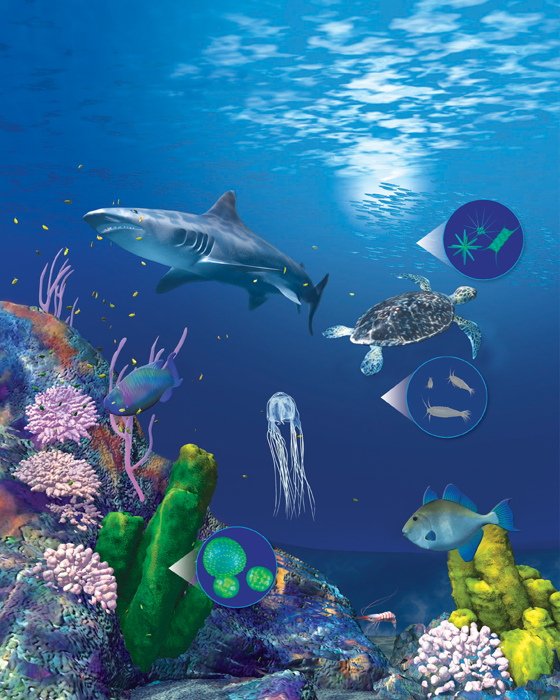
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| Objectives | Section 3.3 Vocabulary | |
| * Describe the structure of a food chain * Explain how food chains and trophic levels are related * Analyze feeding relationships in a food web | * Food chain * Food web * Zooplankton * Phytoplankton * Biomass * Pyramid of energy | * Trophic level * Ecological pyramid * Biomass * Specialist * Pyramid of numbers * Pyramid of biomass |

* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a model that shows a sequence of feeding relationships. A food chain links species by their feeding relationships. It follows the connection between one producer and a single chain of consumers within an ecosystem.



* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are consumers that primarily eat one specific organism or a very small number of organisms.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are consumers that have a varying diet.

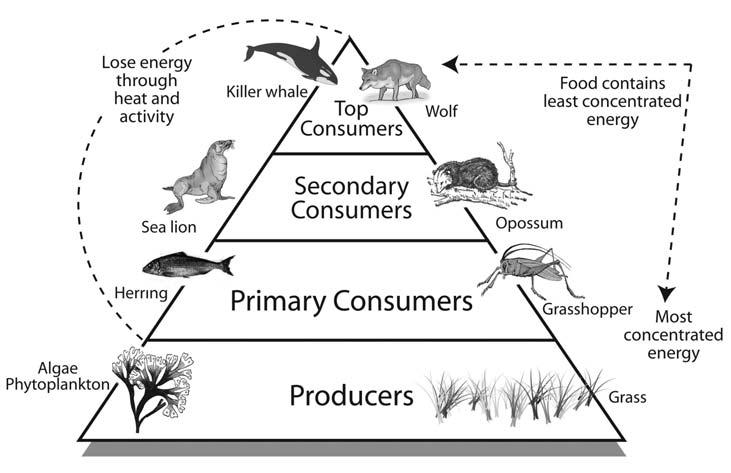
Trophic levels are the nourishment levels in a food chain.

* Primary consumers are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that eat producers.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are carnivores that eat herbivores.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are carnivores that eat secondary consumers. Omnivores, such as humans that eat both plants and animals, may be listed at different trophic levels in different food chains.
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shows a complex network of feeding relationships. An organism may have multiple feeding relationships in an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A food web emphasizes complicated feeding relationships and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in an ecosystem.

Plankton make up the foundation of aquatic food chains

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: plankton like algae that do photosynthesis

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**: very small swimming animals like krill or fish eggs

* An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shows the distribution of energy among trophic levels. 

Energy pyramids compare energy used by producers and other organisms on trophic levels. Between each tier of an energy pyramid, up to \_\_\_\_\_\_\_percent of the energy is lost into the atmosphere as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Only \_\_\_\_\_\_\_ percent of the energy at each tier is transferred from one trophic level to the next.

* Other pyramid models illustrate an ecosystem’s biomass and distribution of organisms. Biomass is a measure of the total dry mass of organisms in a given area.
* A pyramid of numbers shows the numbers of individual organisms at each trophic level in an ecosystem. A vast number of producers are required to support even a few top level consumers.

1. Why are food chains especially useful for describing the relationships of specialists
2. what happens to energy as it flows through an ecosystem
3. Only a small percentage of all consumers are specialists. What danger does a specialist face that a generalist does not?
4. How might the stability of an ecosystem be affected if all its decomposers were suddenly removed?
5. Why is a herbivorous diet more energy efficient than a carnivorous one? Explain.
6. How might an oil spill in the ocean affect an aquatic food web? What might happen to the food web on the land located near the oil spill?  
   Explain.
7. How does an energy pyramid help to describe energy flow in a food web?
8. What is the difference between a biomass pyramid and a pyramid of numbers
9. Draw a pyramid of numbers for a dog with fleas.
10. If each level in a food chain typically loses 90% of the energy it takes in, and the producer level uses 1000kcal of energy, how much of that energy is left after the 3rd trophic level?

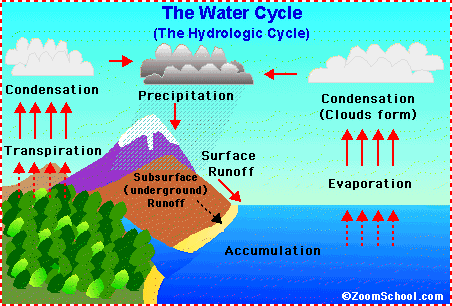
**KEY CONCEPT : Matter cycles in and out of an ecosystem.**

|  |  |
| --- | --- |
| Objectives | Vocabulary |
| * Summarize Earths hydrologic and biogeochemical cycles * Relate cycling of matter to an ecosystem * Trace the flow of energy through an ecosystem, using an energy pyramid * Relate energy pyramids to food chains and trophic levels * Compare and contrast a biomass pyramid and pyramid of numbers | * Biogeochemical cycle * Nutrient * Nitrogen fixation * Denitrification * Limiting nutrient * Transpiration * Precipitation * Evaporation |

Elements essential for life also cycle through ecosystems.

* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cycle is the movement of a particular chemical through the biological and geological parts of an ecosystem. Unlike the one way flow of energy, matter is recycled within and between ecosystems. The main processes involved in the oxygen cycle are photosynthesis and respiration.

Water cycles through the environment. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or water, cycle is the circular pathway of water on Earth. Organisms all have bodies made mostly of water.



Nutrient Cycles

* Every organism needs nutrients to build tissues and carry out life functions like metabolism.
* Like water. Nutrients pass through the organisms and the environment through biogeochemical cycles.
* The 3 cycles that move carbon, nitrogen, and phosphorous through the biosphere are especially critical for life.

Carbon Cycle

* Life is Carbon-based. Carbon is a major component of all organic compounds, including \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The main processes that move carbon through an ecosystem include
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The carbon cycle moves carbon from the atmosphere, through the food web, and returns to the atmosphere. Carbon is emitted by the burning of fossil fuels. Some carbon is stored for long periods of time in areas called carbon sinks. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cycles indirectly through an ecosystem by the cycling of other nutrients.

Nitrogen Cycle

* All organisms require nitrogen to make amino acids for proteins and nucleotides for nucleic acids like DNA, RNA, and ATP. The nitrogen cycle mostly takes place \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Nitrogen gas makes up \_\_\_\_\_\_\_\_\_\_\_\_\_\_% of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Only certain types of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can directly use nitrogen gas through a process of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Ammonia released into the soil is transformed into ammonium. Nitrifying bacteria change the ammonium into nitrate. Nitrogen moves through the food web and returns to the soil during \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The phosphorus cycle takes place at and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ level.

* + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is released by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Phosphorus moves through the food web and returns to the soil during decomposition. Phosphorus leaches into groundwater from the soil and is locked in sediments. Both mining and agriculture add phosphorus into the environment.

1. How does the hydrologic cycle move water through the environment?
2. What are 4 elements that cycle through ecosystems, and why are they important?
3. Why might farmers plant legumes such as peas to improve the nitrogen levels in the soil?
4. Explain the importance of decomposers to the overall biogeochemical cycle