**13.1 Ecologists Study Relationships**

**Objectives**

* **Summarize the levels of organization that an ecologist studies**
* **Describe research methods ecologists use to study the environment**

Ecologists study environments at different levels of organization.

Ecology is the study of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and between living things and their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

* An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an individual living thing, such as an alligator.
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a group of the same species that lives in one area.
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a group of different species that live together in one area
* An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_includes all of the organisms as well as the climate, soil, water, rocks and other nonliving things in a given area
* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is a major regional or global community of organisms characterized by the climate conditions and plant communities that thrive there.

Ecological research methods include observation, experimentation, and modeling.

* Observation is the act of carefully watching something over time. Observations of populations can be done by visual surveys.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are performed in the lab or in the field.
* Computer and mathematical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be used to describe and model nature.

13.1 Assessment: What are the 5 different levels of organization studied by ecologists?

13.1 Assessment: Describe the 3 general methods used by ecologists to study organisms

13.1 Assessment: How might an ecologist use modeling to study a forest fire in an ecosystem? What might be some of the key variables used to create the model

Answer: Ecologists could use models to determine the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the fire, locations where prescribed burns should take place, and areas with the potential for outbreaks.

Key variables might include:

13.1 Assessment:How do the principles of Ecology relate to understanding how adaptations occur?

**13.2 Every ecosystem includes both living and nonliving factors**

* **Objectives**
* **Identify biotic and abiotic factors in an ecosystem**
* **Describe how a change in 1 factor in an ecosystem can affect others**

An ecosystem includes both biotic and abiotic factors.

* Biotic factors are living things.
* Abiotic factors are nonliving things.
* Changing one factor in an ecosystem can affect many other factors.
* Biodiversity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_have more biodiversity than other locations in the world, but are threatened by human activities.

* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_species is a species that has an unusually large effect on its ecosystem. Keystone species form and maintain a complex web of life.

13.2 Assessment: Select an ecosystem that is familiar to you and describe the biotic and abiotic factors that exist there.

13.2 Assessment: How would the removal of a keystone species affect biodiversity?

13.2 Assessment: explain how a change in an abiotic factor such as sunlight would affect biodiversity

13.2 Assessment: Humans are sometimes described as being a keystone species. Does this label fit? Why or why not?

13.2 Assessment: What role might an abiotic factor such as temperature play in the evolution of a species?

**13.3 Life in an ecosystem requires a source of energy.**

* **Objectives**
* **Describe the roles of producers and consumers in ecosystems**
* **Compare photosynthesis to chemosynthesis**

Producers provide energy for other organisms in an ecosystem.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_get their energy from non-living resources. Producers are also called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because they make their own food. Almost all producers obtain energy from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in most producers uses sunlight as an energy source.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in prokaryote producers uses chemicals as an energy source.

13.3 Assessment: How does the stability of an ecosystem depend on its producers?

13.3 Assessment: What are the 2 processes used by producers to obtain energy?

13.3 Assessment: Few producers live deep below a lakes surface. Suggest an explanation for this pattern

13.3 Assessment: could producers survive without consumers? Explain why or why not.

13.3 Assessment: How might chemosynthetic organisms help scientists to understand how life evolved?

* **Objectives**
* **Describe the structure of a food chain**
* **Explain how food chains and trophic levels are related**
* **Analyze feeding relationships in a food web**

A food chain is a model that shows a sequence of feeding relationships.

* A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_links species by their feeding relationships. A food chain follows the connection between\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and a single chain of consumers within an ecosystem.

Consumers are not all alike.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_are consumers that primarily eat one specific organism or a very small number of organisms.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_are the nourishment levels in a food chain.

A food web shows a complex network of feeding relationships.

* An organism may have multiple feeding relationships in an ecosystem. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_emphasizes complicated feeding relationships and energy flow in an ecosystem.
* 13.4 Assessment: Why are food chains especially useful for describing the relationships of specialists?
* 13.4 Assessment: what happens to energy as it flows through an ecosystem?
* 13.4 Assessment: Only a small percentage of all consumers are specialists. What danger does a specialist face that a gerneralist does not?
* 13.4 Assessment: how might the stability of an ecosystem be affected if all its decomposers were suddenly removed?
* 13.4 Assessment: 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 ther oil spill?
Explain.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_would be affected by an oil spill. Oily water may kill off the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The loss of smaller fish would affect the larger fish, which would, in turn, affect tertiary consumers. Plants and animals that live along the coast would also be affected as oil seeped onto the shore. The overall affect would be a decline in the availability of food sources both within and outside the ocean, and so a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**13.5 Life in an ecosystem requires a source of energy.**

* **Objectives**
* **Summarize Earths hydrologic and biogeochemical cycles**
* **Relate cycling of matter to an ecosystem**

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.

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.
* The main processes involved in the oxygen cycle are

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Oxygen cycles indirectly through an ecosystem by the cycling of other nutrients.

* Carbon is the building block of life.
* Draw the Carbon & Oxygen Cycle
* The nitrogen cycle mostly takes place \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Some \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ convert gaseous nitrogen into ammonia through a process called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Some nitrogen-fixing bacteria live in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on the roots of plants; others live freely in the soil. 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 below \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Phosphate is released by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Phosphorus moves through the food web and returns to the soil during \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13.5 Assessment: How does the hydrologic cycle move water through the environment?

13.5 Assessment: What are 4 elements that cycle through ecosystems, and why are they important?

13.5 Assessment: Why might farmers plant legumes such as peas to improve the nitrogen levels in the soil?

13.5 Assessment: Explain the importance of decomposers to the overall biogeochemical cycle

13.5 Assessment: how might Earths biogeochemical cycles help scientists to understand the early history of life on Earth?

Studies of the biogeochemical cycles and how they interact may help scientists \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**13.6 Pyramids model the distribution of energy and matter in an ecosystem.**

* **Objectives**
* **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**

An energy pyramid shows the distribution of energy among trophic levels.

* Energy pyramids compare energy used by producers and other organisms on trophic levels.
* Other pyramid models illustrate an ecosystem’s biomass and distribution of organisms.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is a measure of the total dry mass of organisms in a given area.
* A pyramid of numbers shows the numbers of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at each trophic level in an ecosystem.



13.6 Assessment: how does an energy pyramid help to describe energy flow in a food web?

13.6 Assessment: What is the difference between a biomass pyramid and a pyramid of numbers?

13.6 Assessment: Draw a pyramid of numbers for a dog with fleas.

13.6 Assessment: 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 enetrgy is left after the 3rd trophic level?

13.6 Assessment: Why is a herbivorous diet more energy efficient than a carnivorous one? Explain.