13.1 Ecologists Study Relationships

KEY CONCEPT

Ecology is the study of the relationships among organisms and their environment.

13.1 Ecologists Study Relationships

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

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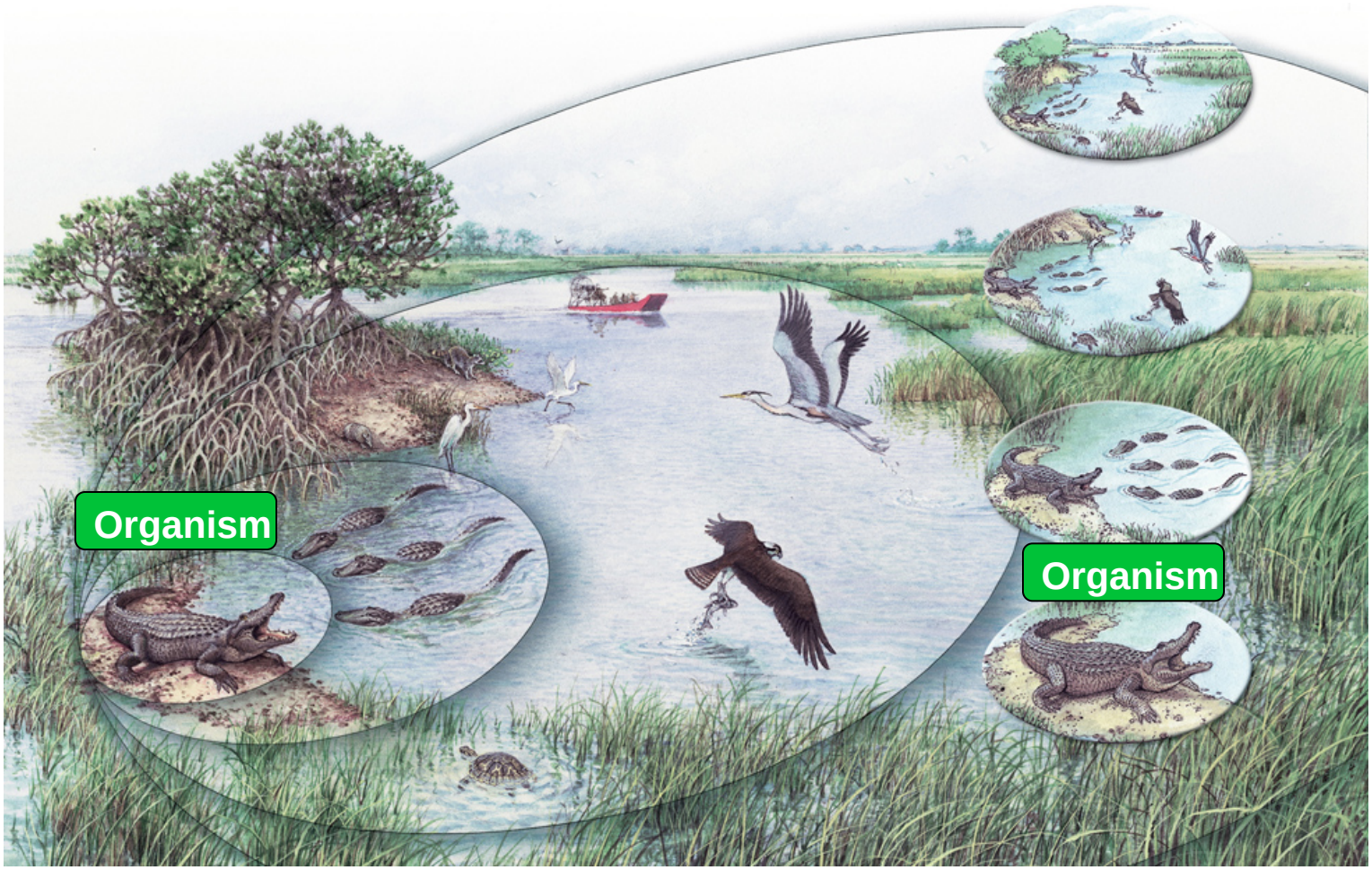
- An **organism** is an individual living thing, such as an alligator.



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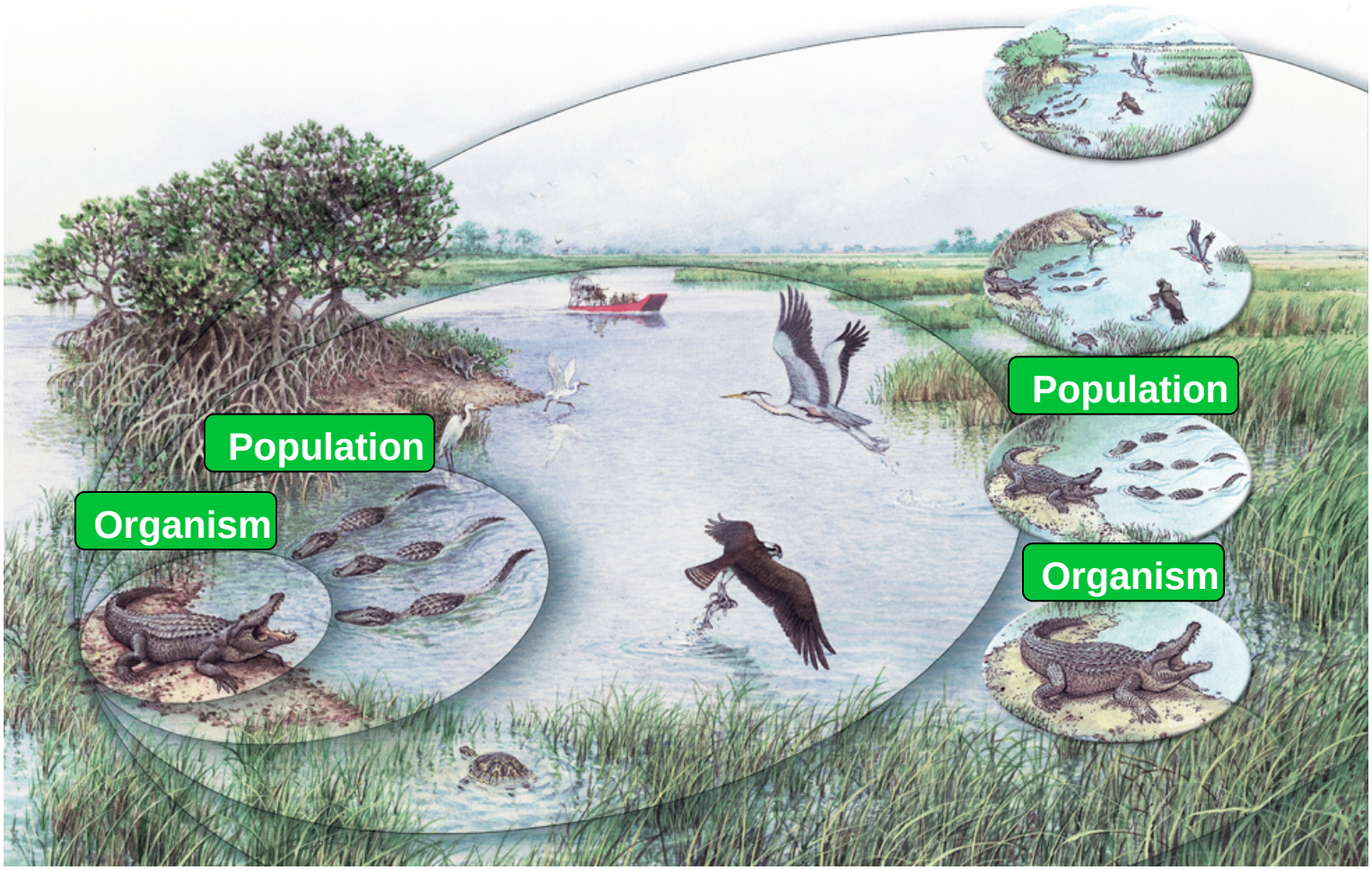
- A **population** is a group of the same species that lives in one area.



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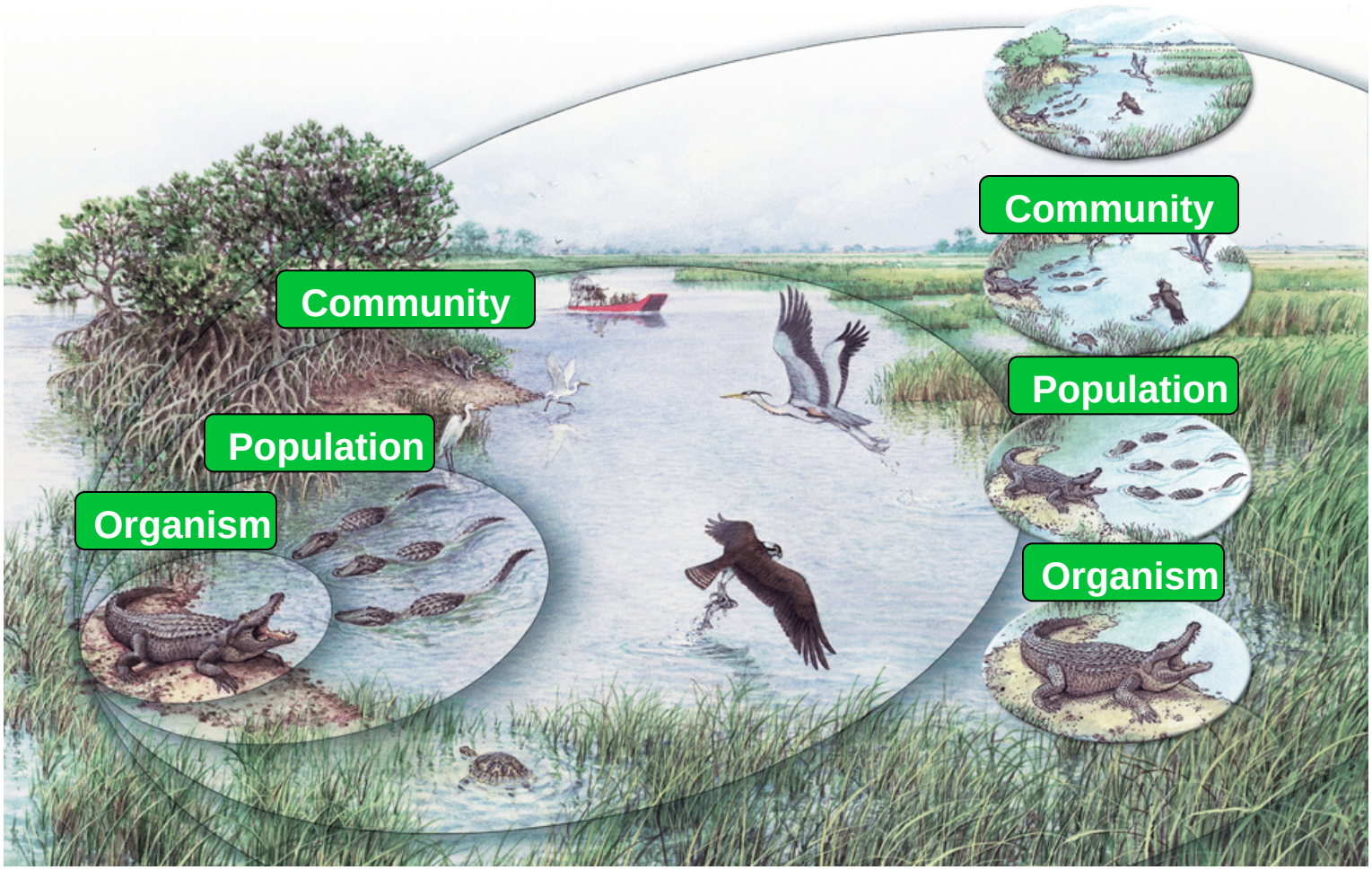
- A **community** is a group of different species that live together in one area.



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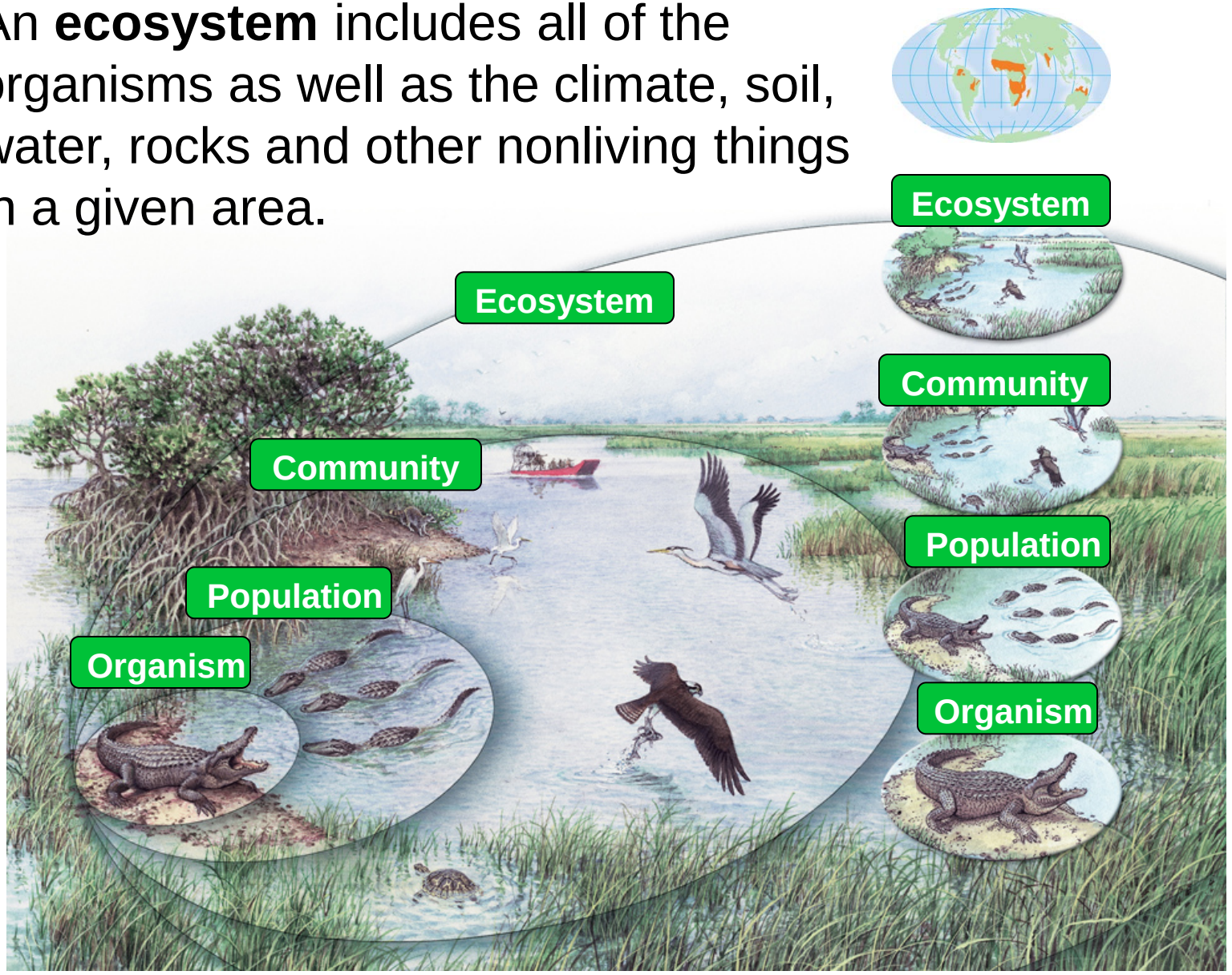
- An **ecosystem** includes all of the organisms as well as the climate, soil, water, rocks and other nonliving things in a given area.



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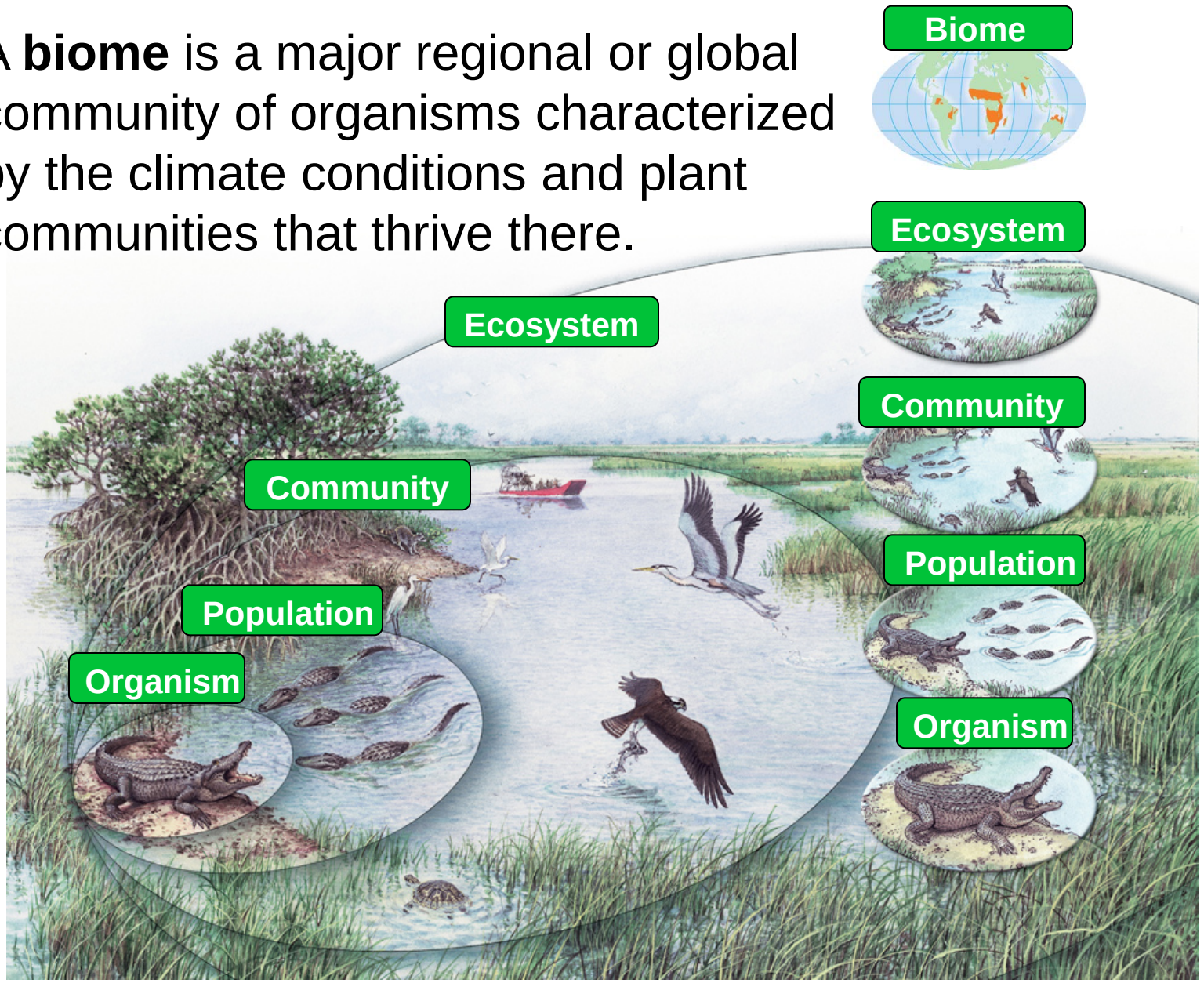
- A **biome** is a major regional or global community of organisms characterized by the climate conditions and plant communities that thrive there.



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- **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.
    - Direct surveys for easy to spot species employ binoculars or scopes.
    - Indirect surveys are used for species that are difficult to track and include looking for other signs of their presence.

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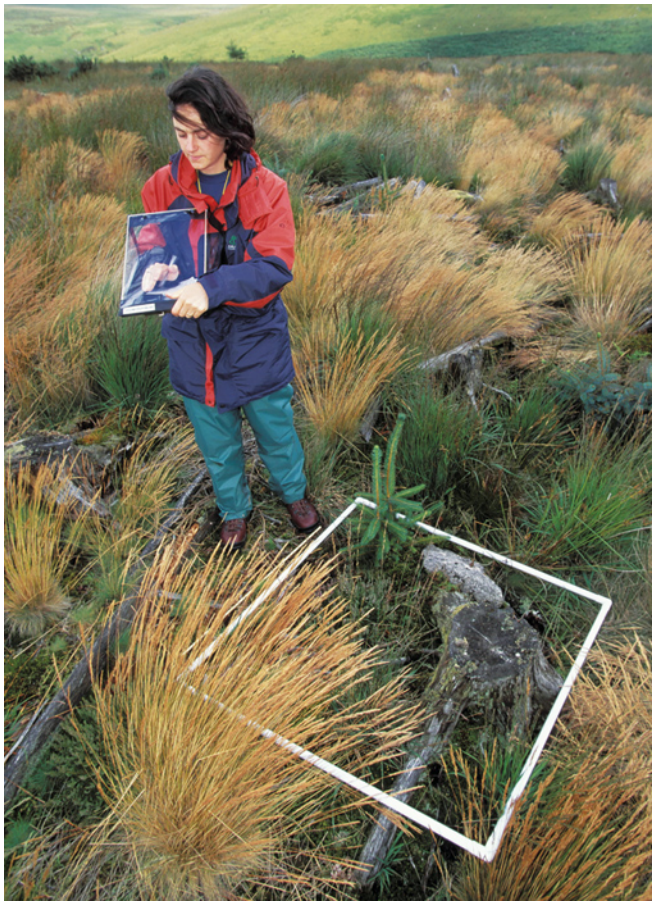
- Experiments are performed in the lab or in the field.
  - Lab experiments give researchers more control.
  - Lab experiments are not reflective of the complex interactions in nature.
  - Field experiments give a more accurate picture of natural interactions.
  - Field experiments may not help determine actual cause and effect.



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- Computer and mathematical models can be used to describe and model nature.
- Modeling allows scientists to learn about organisms or ecosystems in ways that would not be possible in a natural or lab setting.

Ecologists use data transmitted by GPS receivers worn by elephants to develop computer models of the animal's movements.

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KEY CONCEPT

Every ecosystem includes both living and nonliving factors.

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- **An ecosystem includes both biotic and abiotic factors.**
  - Biotic factors are living things.
    - plants
    - animals
    - fungi
    - bacteria

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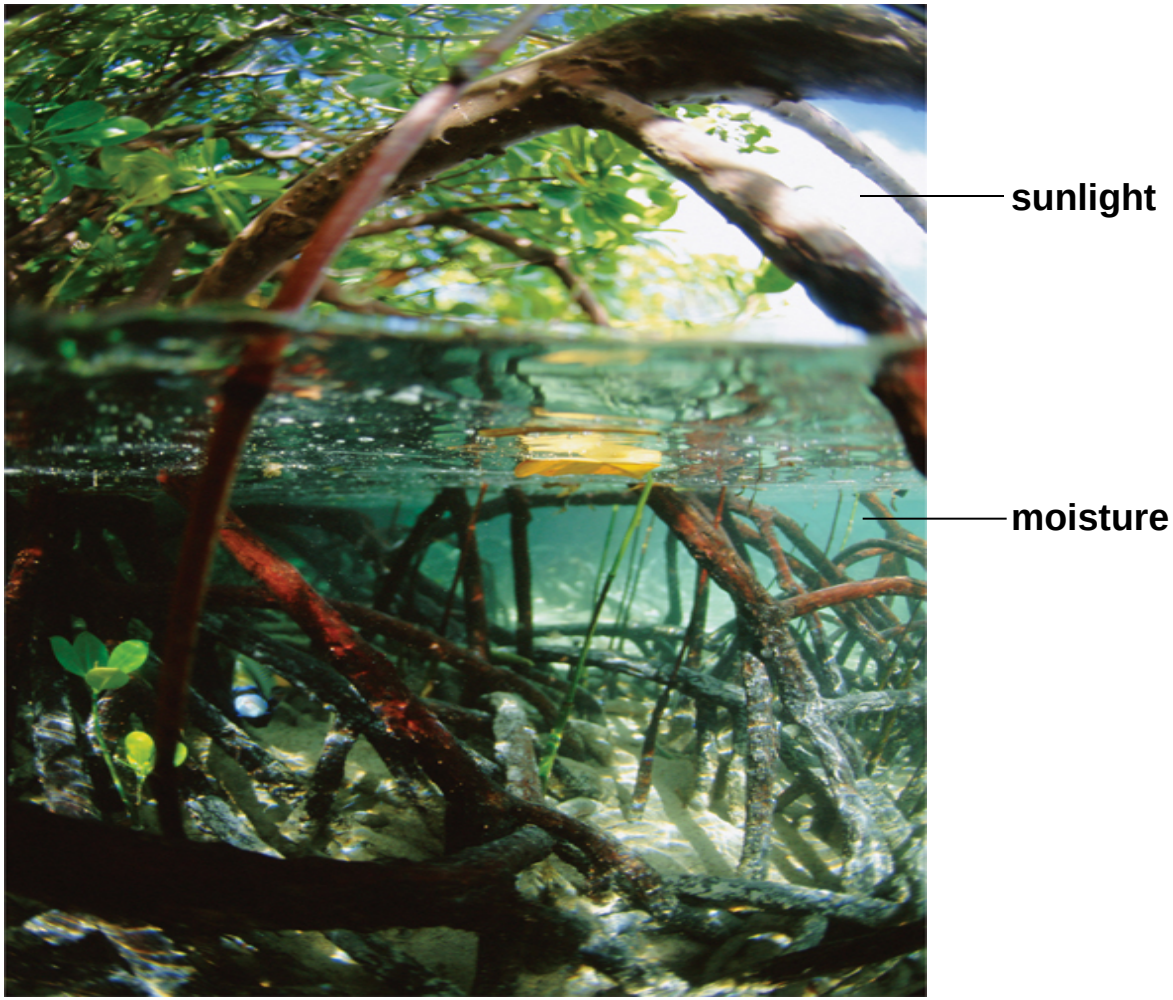
- Abiotic factors are nonliving things.
  - moisture
  - temperature
  - wind
  - sunlight
  - soil



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- **Changing one factor in an ecosystem can affect many other factors.**
  - Biodiversity 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.

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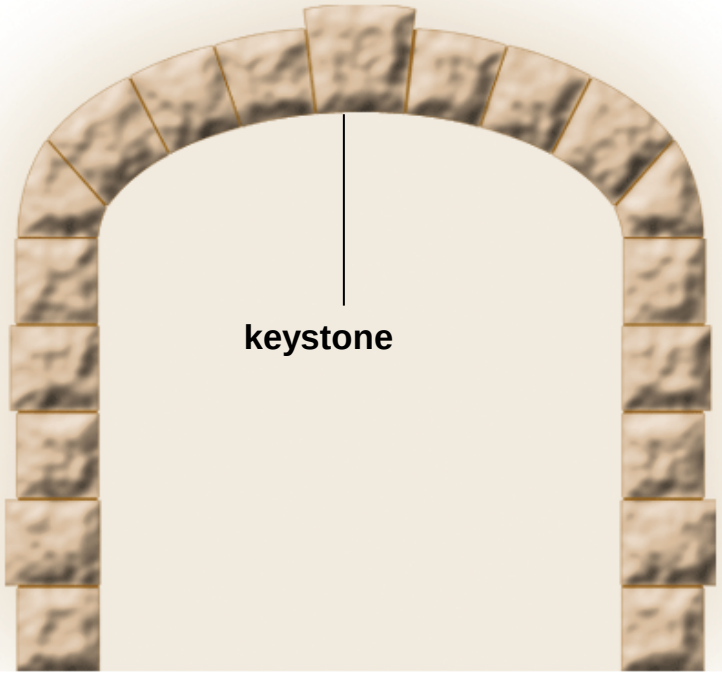
- A keystone species is a species that has an unusually large effect on its ecosystem.



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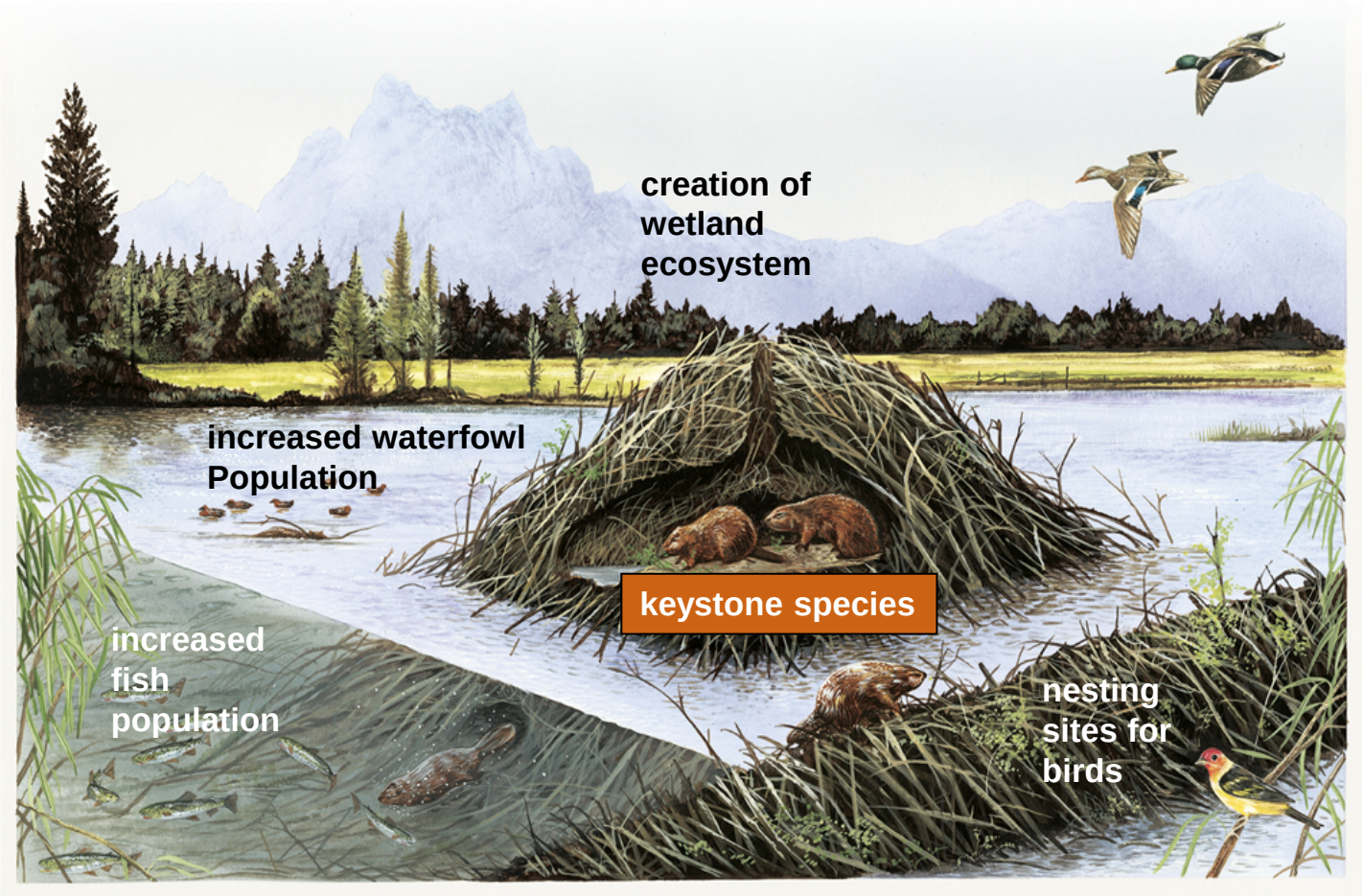
- Keystone species form and maintain a complex web of life.



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KEY CONCEPT

Matter cycles in and out of an ecosystem.

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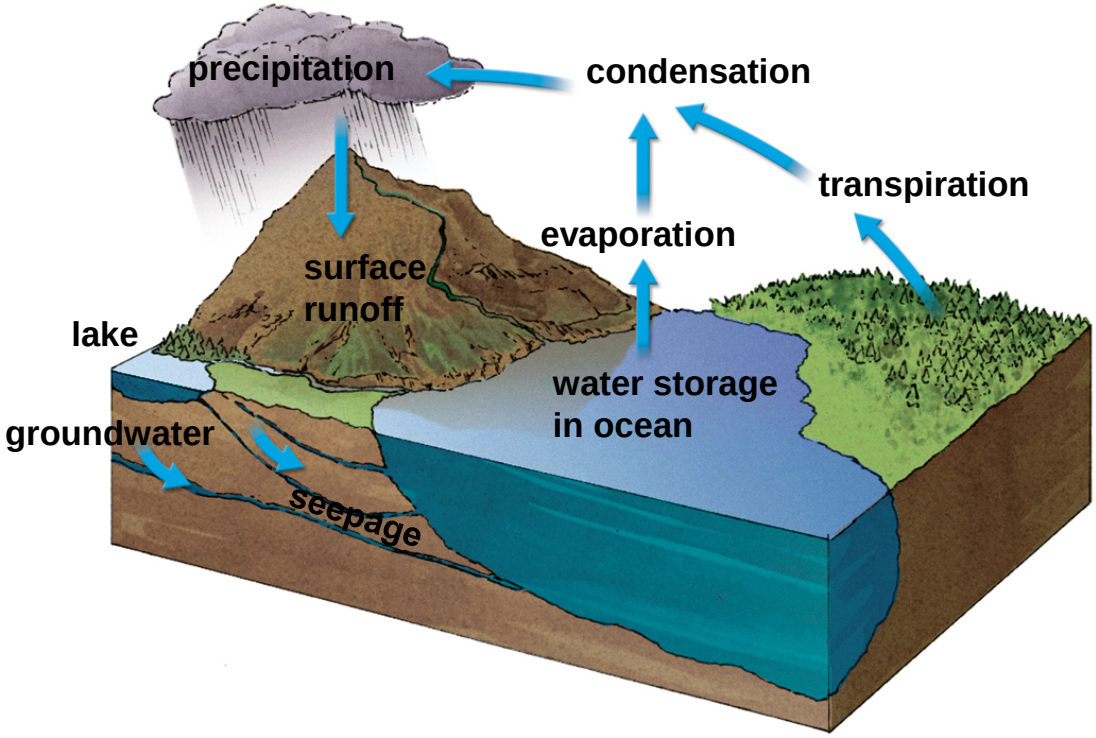
Water cycles through the environment.

- The hydrologic, or water, cycle is the circular pathway of water on Earth.
- Organisms all have bodies made mostly of water.



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- **Elements essential for life also cycle through ecosystems.**
  - A biogeochemical 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 photosynthesis and respiration.

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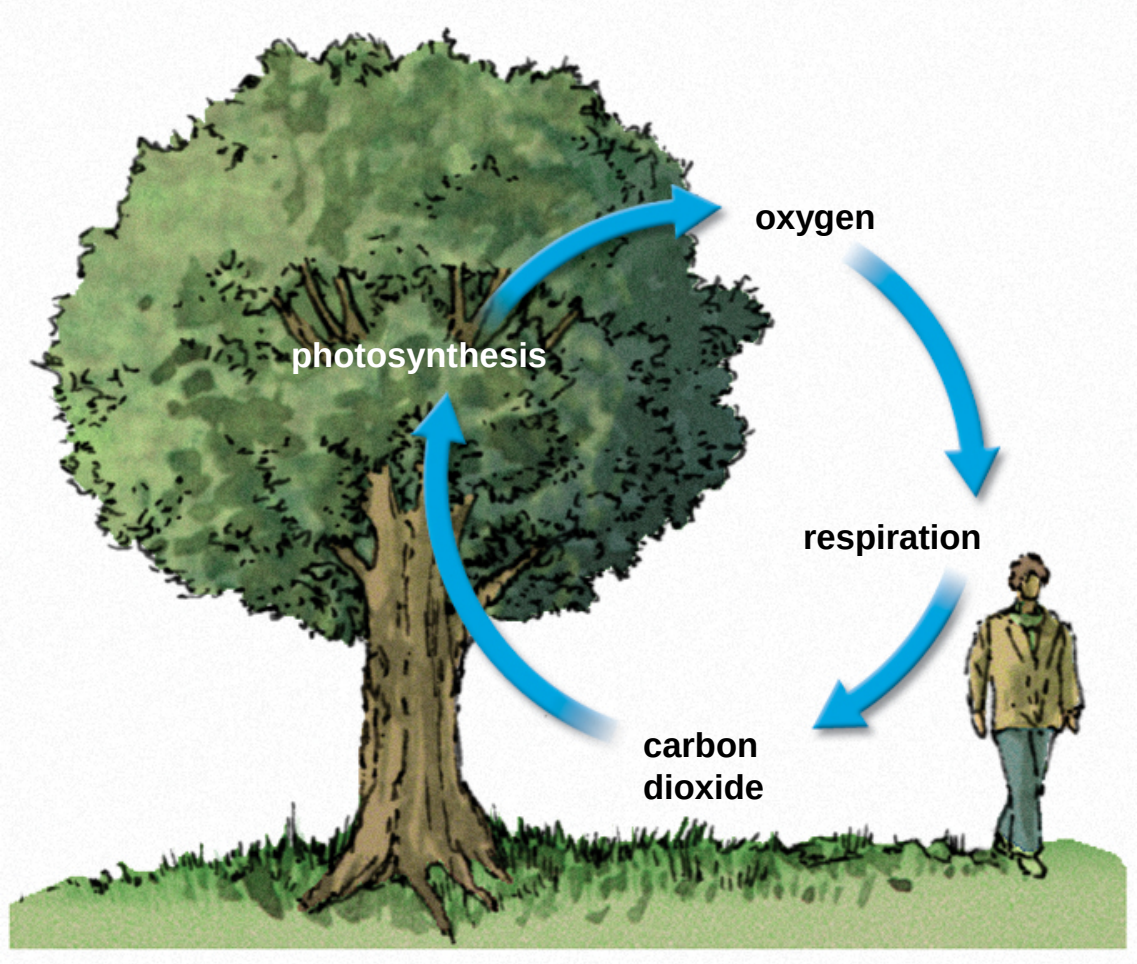
- Oxygen cycles indirectly through an ecosystem by the cycling of other nutrients.



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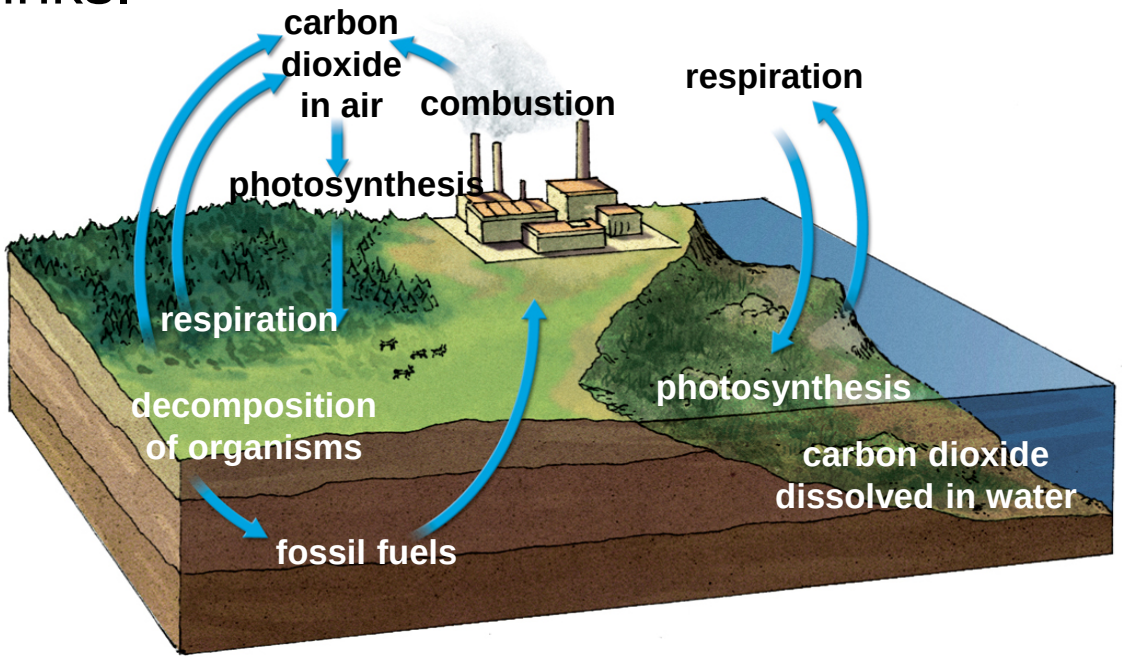
- Carbon is the building block of life.
  - The carbon cycle moves carbon from the atmosphere, through the food web, and returns to the atmosphere.
  - Carbon is emitted by the burning of fossil fuels.
  - Some carbon is stored for long periods of time in areas called carbon sinks.



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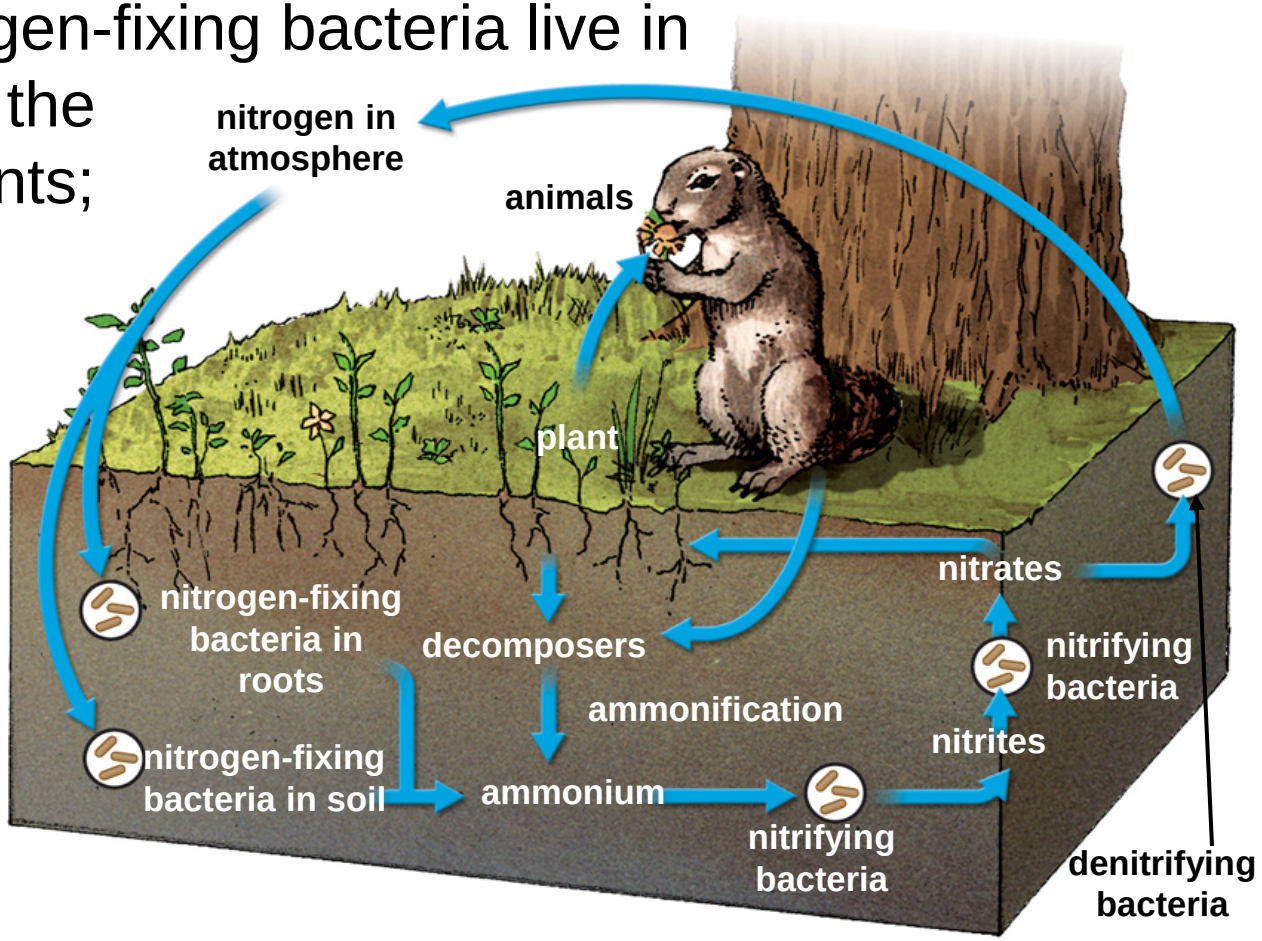
- The nitrogen cycle mostly takes place underground.
  - Some bacteria convert gaseous nitrogen into ammonia through a process called nitrogen fixation.
  - Some nitrogen-fixing bacteria live in nodules on the roots of plants; others live freely in the soil.



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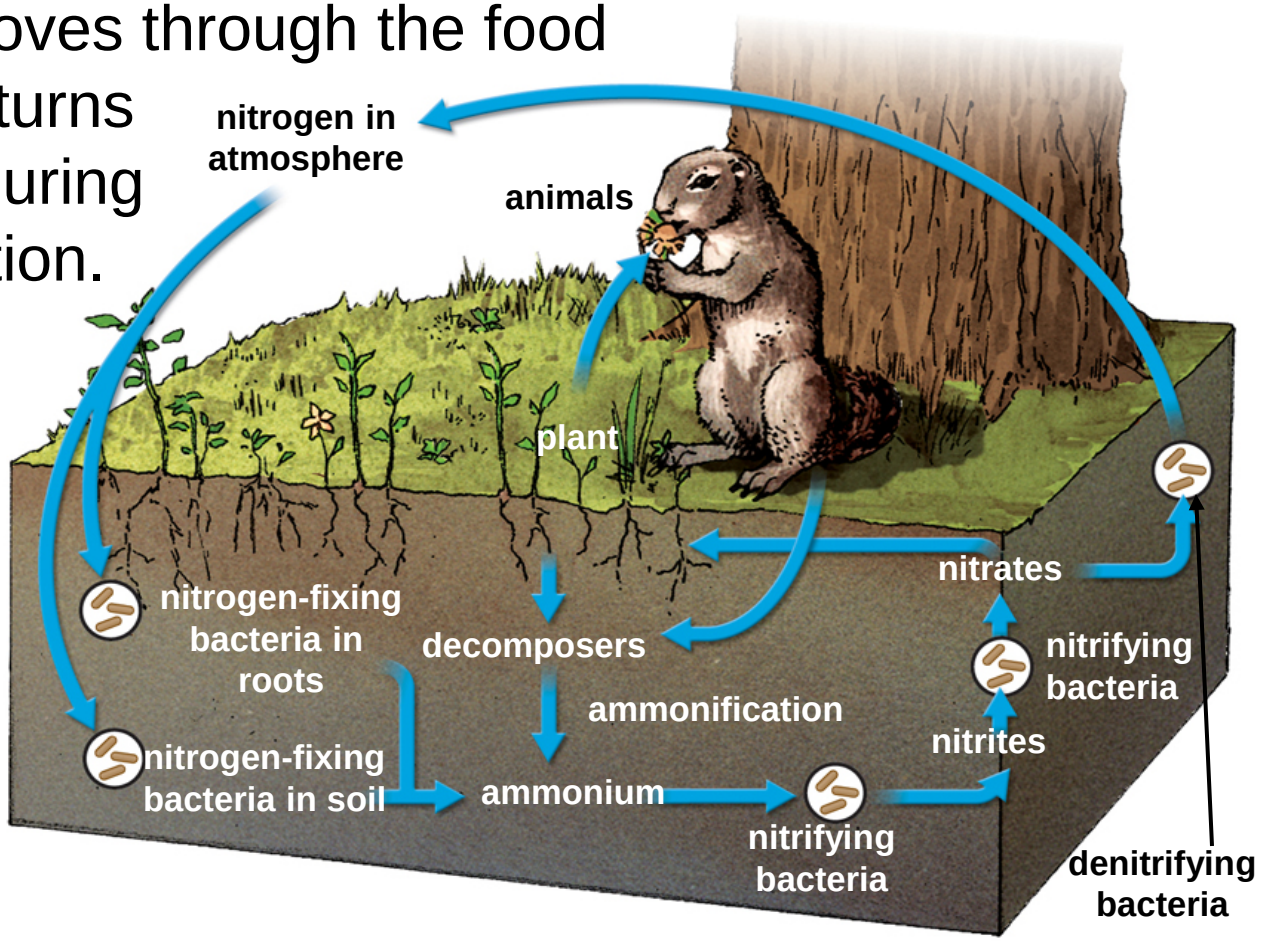
- Ammonia released into the soil is transformed into ammonium.
- Nitrifying bacteria change the ammonium into nitrate.
- Nitrogen moves through the food web and returns to the soil during decomposition.



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- The phosphorus cycle takes place at and below ground level.
  - Phosphate is released by the weathering of rocks.
  - 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.