Chapter 5
How Ecosystems Work
Section 2: Cycling of Materials

DAY 1
The Carbon Cycle

- The **carbon cycle** is the movement of carbon from the nonliving environment into living things and back.
- Carbon is the essential component of **proteins, fats, and carbohydrates**, which make up all organisms.
The Carbon Cycle

Diagram showing the carbon cycle with arrows indicating the movement of carbon dioxide (CO₂) between the atmosphere, plants, animals, and the Earth's crust.
The Carbon Cycle

- Carbon exists in **air, water, and living organisms**.
- Producers convert **carbon dioxide** in the atmosphere into carbohydrates during photosynthesis.
- Consumers obtain carbon from the carbohydrates in the producers they eat.
The Carbon Cycle

- During cellular respiration, some of the carbon is released back into the atmosphere as carbon dioxide.
- Some carbon is stored in limestone, forming one of the largest “carbon sinks” on Earth.
The Carbon Cycle

- Carbon stored in the bodies of organisms as fat, oils, or other molecules, may be released into the soil or air when the organisms dies.
- These molecules may form deposits of coal, oil, or natural gas, which are known as fossil fuels.
- Fossil fuels store carbon left over from bodies of organisms that dies millions of years ago.
How Humans Affect the Carbon Cycle

- Humans burn fossil fuels, releasing carbon into the atmosphere.
- The carbon returns to the atmosphere as **carbon dioxide**.
How Ecosystems Work

Section 2

How Humans Affect the Carbon Cycle

• Increased levels of carbon dioxide may contribute to global warming.

• Global warming is an increase in the temperature of the Earth.
The Carbon Cycle

Carbon Cycle Explained
The Nitrogen Cycle

- The **nitrogen cycle** is the process in which nitrogen circulates among the air, soil, water, plants, and animals in an ecosystem.
- All organisms need nitrogen to **build proteins**, which are used to build new cells.
- Nitrogen makes up **78** percent of the gases in the atmosphere.
The Nitrogen Cycle

- Nitrogen must be altered, or fixed, before organisms can use it.
- Only a few species of bacteria can fix atmospheric nitrogen into chemical compounds that can be used by other organisms.
- These bacteria are known as “nitrogen-fixing” bacteria.
The Nitrogen Cycle

- **Nitrogen-fixing bacteria** are bacteria that convert atmospheric nitrogen into ammonia.
- These bacteria live within the roots of plants called **legumes**, which include beans, peas, and clover.
- The bacteria use sugar provided by the legumes to produce nitrogen-containing compounds such as **nitrates**.
- Excess nitrogen fixed by the bacteria is released into the soil.
The Nitrogen Cycle

Atmospheric nitrogen, $N_2$

Lightning converts some atmospheric nitrogen into nitrates that organisms can use.

Nitrogen-fixing bacteria in soil and root nodules produce ammonia, $NH_3$.

Aquatic bacteria also process nitrogen.

Bacteria in soil and water add nitrogen to the atmosphere.

Other bacteria convert ammonia into nitrates, which plants can use.

Runoff

How Ecosystems Work

Section 2
Decomposers and the Nitrogen Cycle

- Nitrogen stored within the bodies of living things is returned to the nitrogen cycle once those organisms die.
- **Decomposers** break down decaying plants and animals, as well as plant and animal wastes.
- After decomposers return nitrogen to the soil, bacteria transform a small amount of the nitrogen into **nitrogen gas**, which then returns to the atmosphere to complete the nitrogen cycle.
**The Phosphorus Cycle**

- **Phosphorus** is an element that is part of many molecules that make up the cells of living organisms.

- Plants get the phosphorus they need from **soil and water**, while animals get their phosphorus by **eating plants or other animals** that have eaten plants.

- The **phosphorus cycle** is the cyclic movement of phosphorus in different chemical forms from the environment to organisms and then back to the environment.
The Phosphorus Cycle
The Phosphorus Cycle

- Phosphorus may enter soil and water when rocks erode.
- Small amounts of phosphorus dissolve as phosphate, which moves into the soil.
- Plants absorb phosphates in the soil through their roots.
- Some phosphorus washes off the land and ends up in the ocean.
- Because many phosphate salts are not soluble in water, they sink to the bottom and accumulate as sediment.
Fertilizers and the Nitrogen and Phosphorus Cycles

- **Fertilizers**, which people use to stimulate and maximize plant growth, contain both nitrogen and phosphorus.

- Excessive amounts of fertilizer can enter terrestrial and aquatic ecosystems through **runoff**.

- Excess nitrogen and phosphorus can cause **rapid growth of algae, algal bloom**.

- Excess algae can deplete an aquatic ecosystem of important nutrients such as **oxygen**, on which fish and other aquatic organisms depend.
Acid Precipitation

• When fuel is burned, large amounts of nitric oxide is release into the atmosphere.

• In the air, nitric oxide can combine with oxygen and water vapor to form nitric acid.

• Dissolved in rain or snow, the nitric acid falls as acid precipitation.
Acid Rain Explained via YouTube!

Acid Rain Explained