

AP Biology
Ecosystems Ecology – Part 2

(Associated Learning Objectives: 2.8, 2.9, 2.22, 2.23, 2.24, 2.28, 4.16,)

Most of this information is important review material.

I. **Biogeochemical Cycles** (“Bio” means “life”; “geo” means “earth”) These refer to the *cycling* of matter.

- A. **Water cycle** – Water vapor is created by the sun causing evaporation of the bodies of water such as oceans and lakes. This water vapor is carried by the winds to almost the whole world. It condenses in the air to make rain or snow (referred to as precipitation) and is returned to the land or ocean. Eventually the water that lands on land, makes its way to plants or rivers and streams that lead back to the oceans. Plants take in the water and use it for photosynthesis but also can lose it in the form of transpiration to the air.
- A. **Carbon Cycle** - Carbon Dioxide is *removed* from the air by photosynthesizing organisms such as plants, phytoplankton and bacteria. They use the Carbon Dioxide to aid in the development of sugars during photosynthesis. These sugars, which contain the carbon (C₆H₁₂O₆) are then passed from organism to organism through the food chain. All organisms then release the carbon, in the form of Carbon Dioxide, by performing the process of cellular respiration in their cells. The burning of plant materials, natural gas and fossil fuels, which are the remains of dead life forms such as dinosaurs and pre-historic forests, puts Carbon Dioxide back into the air as well.
- B. **Nitrogen Cycle** - The majority of nitrogen is *removed* from the air by water. Remember, water is the universal solvent, so the gas is dissolved in the rain or snow. The nitrogen in the water mainly is consumed by **Nitrogen Fixing bacteria**, in the soil, that convert it into ammonium (NH₄). This process is referred to as **Nitrogen Fixation**. The ammonium can then be *absorbed* by plants to help make proteins and DNA or RNA. Some ammonium (NH₄) in the soil is also consumed by **Nitrifying Bacteria**, and converted to Nitrite (NO₂) first and then ultimately into Nitrate (NO₃). This process is called **Nitrification**. The nitrates are also *absorbed* by the plants, just as was the ammonium. (The plants *ate* the nitrates and ammonium, but not the nitrites.) Some other bacteria in the soil can also eat the nitrates. These are called **Denitrifying Bacteria**. They consume the nitrates and break it down into Oxygen gas (O₂) and Nitrogen gas (N₂) and both are returned to the air to be used again. This process is called **Denitrification**. As plants are eaten by animals, the nitrogen travels through the food chain. When all life forms die, the bodies decompose and create ammonia (NH₃), which is why they stink. The ammonia is converted by bacteria into ammonium to be used again by plants and bacteria. This conversion is called **Ammonification**. Some nitrogen is also released by animals in their urine. It too undergoes ammonification.
- C. **Phosphorus Cycle**- The phosphorus is initially a component of rock. As the rock breaks down over time, called **weathering**, the phosphorus is released into the soil. Some dissolves into the water as the rains pass through the soil. This phosphorus makes its way into bodies of water, such as lakes and oceans, and is available for producers (phytoplankton) to use to help make organic compounds such as phospholipids and DNA or RNA. Plants (also producers) can also retrieve the phosphorus from the soil and use it to make organic compounds too. When organisms die, decomposers break down the bodies and return the phosphorus back to the soil to be reused.

E. Temperature affects the cycling rates

1. High Temperature cause *faster* recycling of the chemicals. (Such as in the Tropical Rain Forest.)

2. Low Temperature causes *slower* recycling of the chemicals. (Such as in the Tundra.)

F. Harvesting and deforestation on Nutrient retention? These processes *remove* the nutrients from that area and cause disruption of the cycles to occur. So areas become nutrient poor, thus creating the need for fertilizers to *be added* to replenish the nutrients. (Remember, cultural eutrophication.)