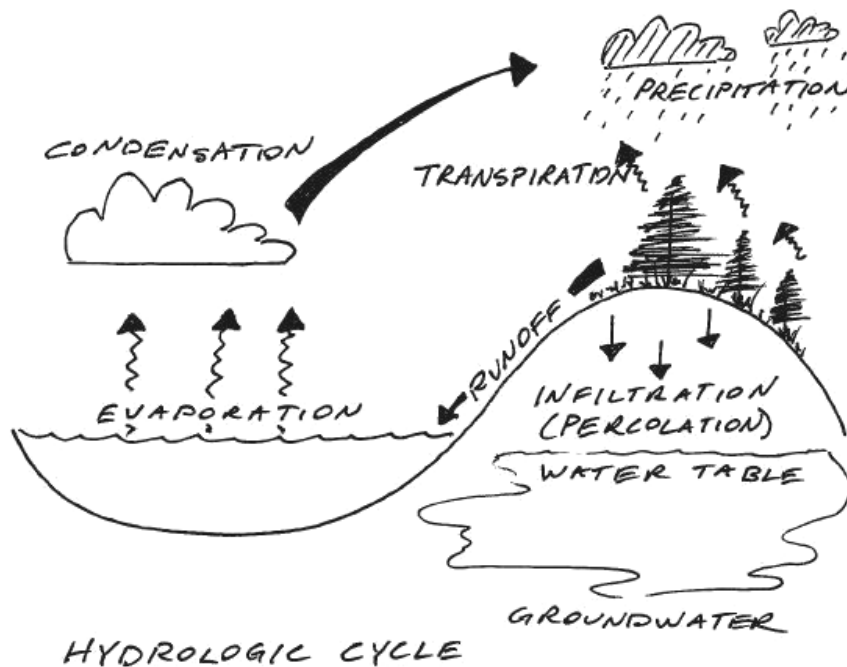




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BioGeoChemical Cycles

Water is constantly moving through the biosphere through **evaporation, condensation, transpiration** and **precipitation**. These processes are collectively known as the **hydrologic** or **water cycle**. When disturbance is kept to a minimum, the water cycle provides man with a constant renewable resource. However, it has been stretched to its limits with the explosion of the human population, urban and agricultural development in arid environments, and pollution.



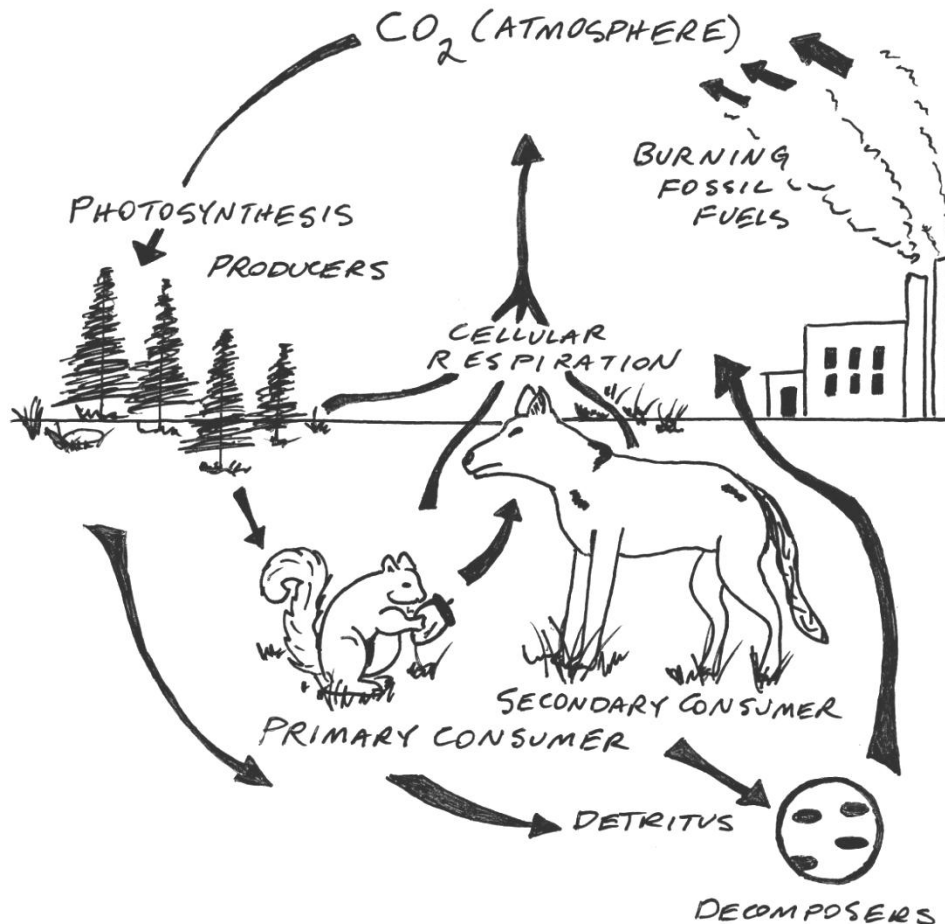
The Carbon Cycle

Photosynthesis and cellular respiration are key activities in the biogeochemical cycle of carbon. During photosynthesis, plants take inorganic carbon dioxide and convert it into glucose, a high-energy sugar molecule. Consumers and producers use glucose in respiration and return carbon back in the environment as carbon dioxide. Decomposition of detritus also releases carbon dioxide into the atmosphere. Fossil fuels were formed when incomplete decomposition was accompanied by heat, pressure, and burial. Fossil fuels include oil, coal, and



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natural gas. When man burns these fossil fuels, carbon dioxide is rapidly released back into the atmosphere. Since carbon dioxide is a greenhouse gas, this practice has led many scientists to believe drastic climate change is imminent. Removal of large tracts of forests also adds to the release of carbon dioxide. The ocean also acts as a sink or reservoir for carbon dioxide.



Nitrogen Cycle

Nitrogen makes up seventy-eight percent of the atmosphere. In order for it to be used by organisms it first has to be converted into a useable form. The following are the major steps in the nitrogen cycle:

Nitrogen fixation is the conversion of atmospheric nitrogen gas (N_2) in the atmosphere into ammonia (NH_3) or ammonium (NH_4). Lightening and specialized bacteria found in the soil accomplishes this step. **Rhizobium** bacteria, which form a mutualistic relationship with legumes, are examples of nitrogen-fixing bacteria.

Nitrification occurs when ammonium (NH_4) is converted into nitrates.



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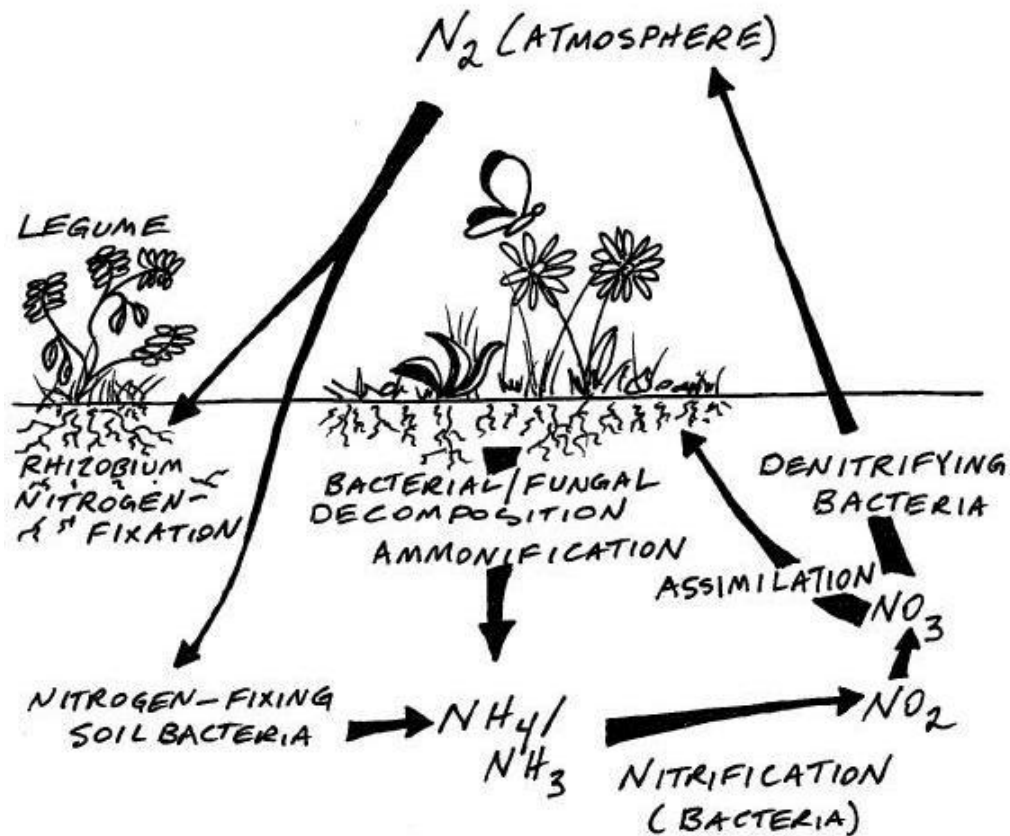
When detritus is decomposed, ammonia is released in the process of **ammonification**.

Assimilation occurs when plants incorporate the usable forms of nitrogen into organic molecules, which ultimately are incorporated into consumers.

Denitrifying bacteria converts nitrates into atmospheric nitrogen in the **denitrification process**.

Fertilizers from agricultural runoff disrupt the nitrogen cycle. This can also lead to **cultural eutrophication** of water sources.

The Nitrogen Cycle

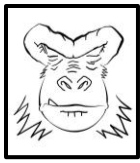




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Phosphorus Cycle

The phosphorus cycle is a **sedimentary** cycle. Unlike the other major biogeochemical cycles it does not have an atmospheric component. Therefore, the phosphorus cycle is a slow process which often causes it to be a **limiting factor** in ecosystems. A limiting factor determines the growth of a population. Phosphorus is released from rocks by weathering. **Immobilization** occurs when phosphorus is converted into an organic form and not available for assimilation by plants. In **mineralization**, phosphorus is in an inorganic form, readily absorbed by plants. Much like the nitrogen cycle, bacteria play an important role in the phosphorus cycle. Phosphorus is often a key component of fertilizer.



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Biogeochemical Cycle Review Questions

1. Which of the following best describes why phosphorus is often a limiting nutrient in ecosystems?

- A) There is very little phosphorus on the planet.
- B) Phosphorus is not normally found in the air, so it cycles much more slowly through the biosphere than something like Oxygen.
- C) Phosphorus is not found in nature, and is only available as a commercial fertilizer.
- D) Plants cannot use phosphorus.
- E) B and C

Use the following answer choices for questions 2-6

- A) Primary succession
- B) Nitrogen fixation
- C) Assimilation
- D) Nitrification
- E) Cultural Eutrophication

2. Process in which animal waste and fertilizers runoff into bodies of water and disrupt the nitrogen cycle.

3. The establishment of an ecological community in an area where no soil previously existed.

4. Process by which bacteria convert atmospheric nitrogen into ammonia.

5. Occurs when ammonium is converted into nitrates by bacteria.

6. Process by which plants incorporate nitrates in the soil into organic molecules.



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Use the following answer choices for questions 7-10

- A) Transpiration
- B) Evaporation
- C) Precipitation
- D) Infiltration
- E) Condensation

- 7. Refers to the evaporation of water through the stomata on the leaves of plants.
- 8. Refers to water soaking into the ground.
- 9. Water falling from the sky as rain, snow, sleet, or hail.
- 10. Refers to water molecules clumping together to form droplets.



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Multiple Choice Scoring Guidelines

1. B	3. A	5. B	7. A	9. C
2. E	4. D	6. C	8. D	10. E

Multiple choice points earned/10 * 100 = Quiz average

(_____)/ 10 * 100 = _____ Quiz Grade