Lecture 6

Biogeochemical Cycles

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►**Lecture topics:**

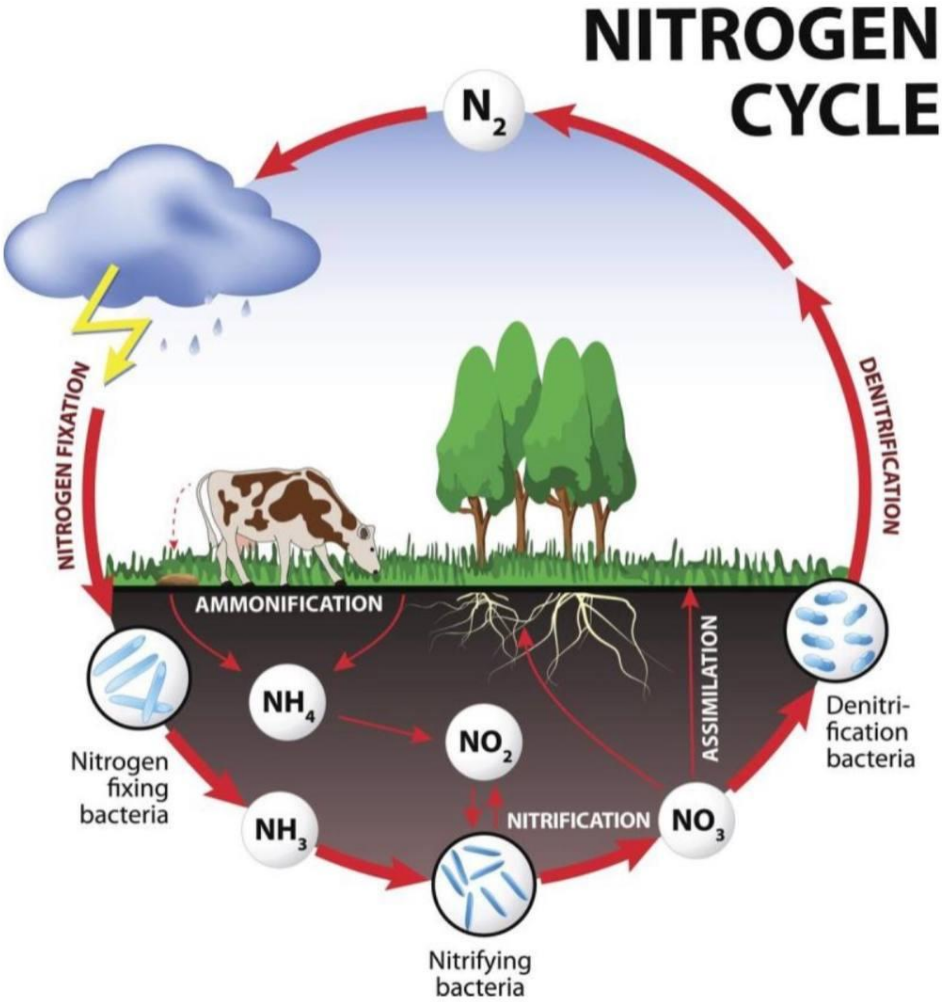
►**Nitrogen Cycle**

Nitrogen cycle:

circulation of nitrogen in various forms through nature. Nitrogen, a component of proteins and nucleic acids, is essential to life on Earth. Although 78 percent by volume of the atmosphere is nitrogen gas, this abundant reservoir exists in a form unusable by most organisms. Through a series of microbial transformations, however, nitrogen is made available to plants, which in turn ultimately sustain all animal life. Nitrogen fixation is a process by which molecular nitrogen in the air is converted into ammonia NH_3 or related nitrogenous compounds in soil. Atmospheric nitrogen is molecular dinitrogen, a relatively nonreactive molecule that is metabolically useless to all but a few microorganisms. Biological nitrogen fixation converts N_2 into ammonia, which is metabolized by most organisms. After the death of plants and animals, they are exposed to decomposition by certain bacteria and fungi. These microorganisms produce ammonia NH_3 from nitrogen compounds in the dead organic matter and in animal body waste. Then the plants absorb some ammonia and use it to make proteins and other substances necessary for life. The ammonia that is not absorbed by the plants turns into nitrate (NO_3 compounds) by nitrifying bacteria. There are two types of nitrifying bacteria: nitrite bacteria that convert ammonia into nitrites (NO_2 compounds) and nitrate bacteria, which convert nitrites into nitrates. Plants absorb most of the nitrates and use them in

the same way as ammonia. As for animals, they obtain nitrogen from eating plants or other animals that eat plants.

Although nitrogen fixation takes nitrogen from the air, a reverse process called nitrogen restoration returns almost the same amount of nitrogen to the air. Bacteria returning nitrogen turn some nitrates in the soil into gaseous nitrogen or N2O oxide, but the fixed nitrogen may circulate several times between living and soil before returning the nitrogen back to the atmosphere.



Some human activities impede the nitrogen cycle. For example, the industry takes large amounts of nitrogen to produce fertilizers. Fertilizers provide many benefits, but excess quantities are swept from farmland to waterways, contaminated with that water. In addition to this, the combustion of gasoline and some other fuels produces nitrogen compounds that contribute to plant pollution. The nitrogen cycle is considered one of the most important because the nitrogen is fed by the plant, which is considered the beginning of the food chain.