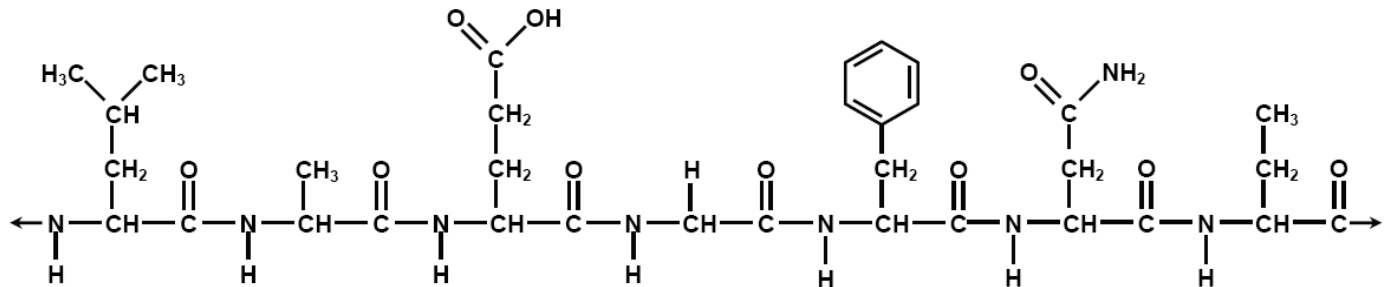
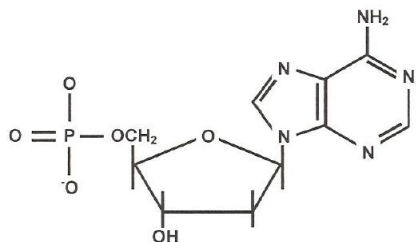
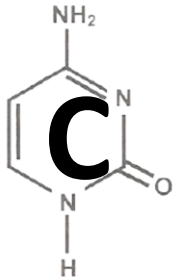
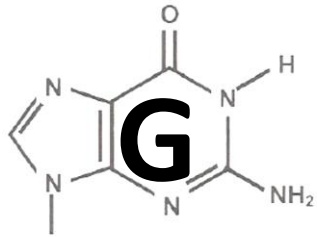
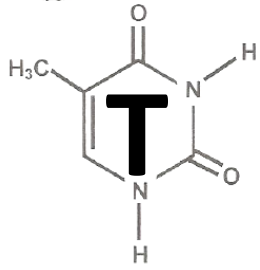
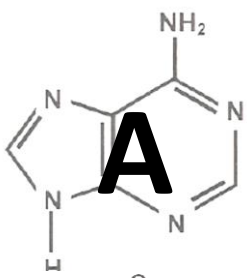


# The Nitrogen Cycle

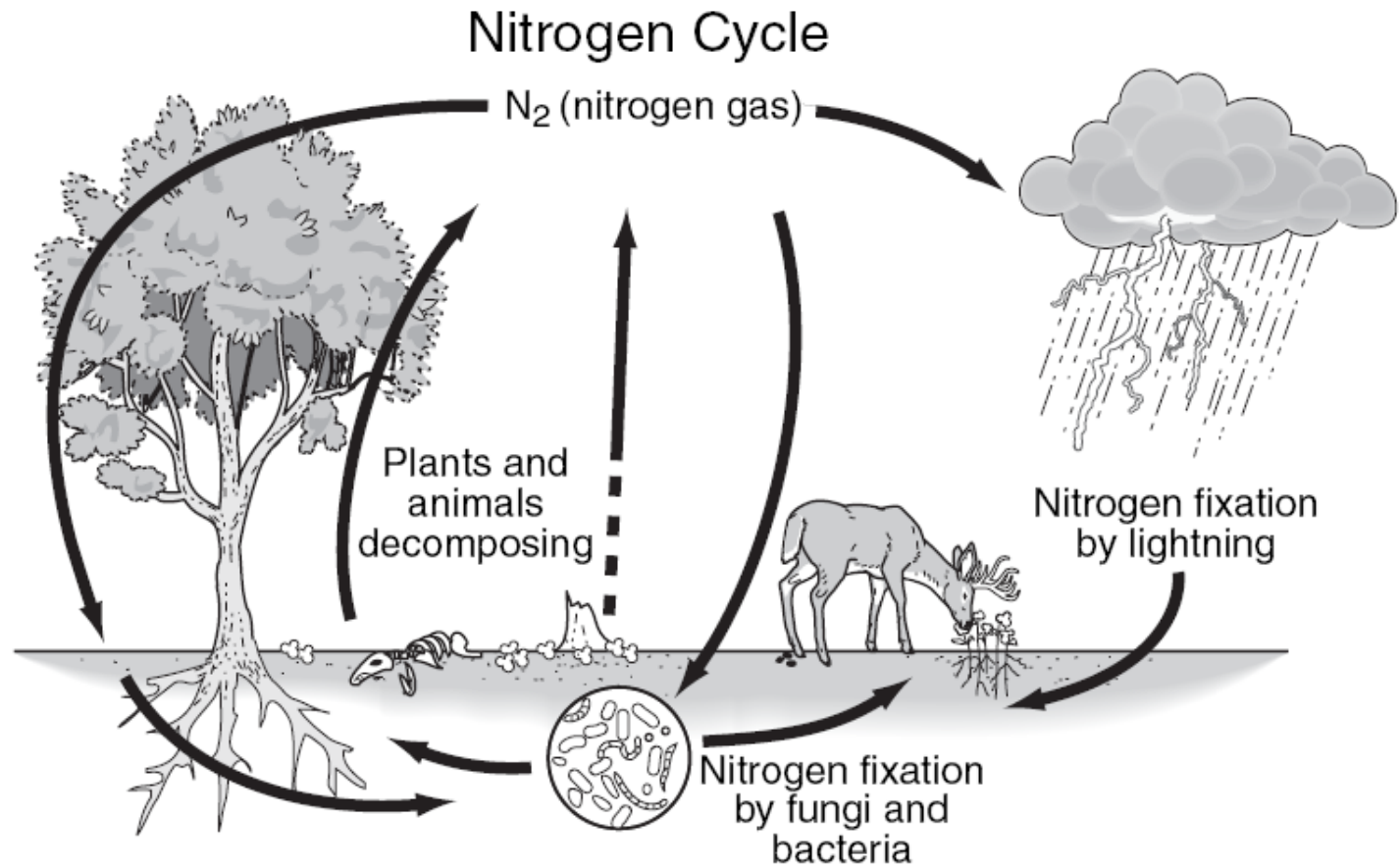
# Nitrogen

**Nitrogen** is an essential nutrient for plants that must be absorbed from the environment. Nitrogen is found in every **amino acid** and **nucleotide**, which are used to make all of the plant's **proteins** and **nucleic acids**.

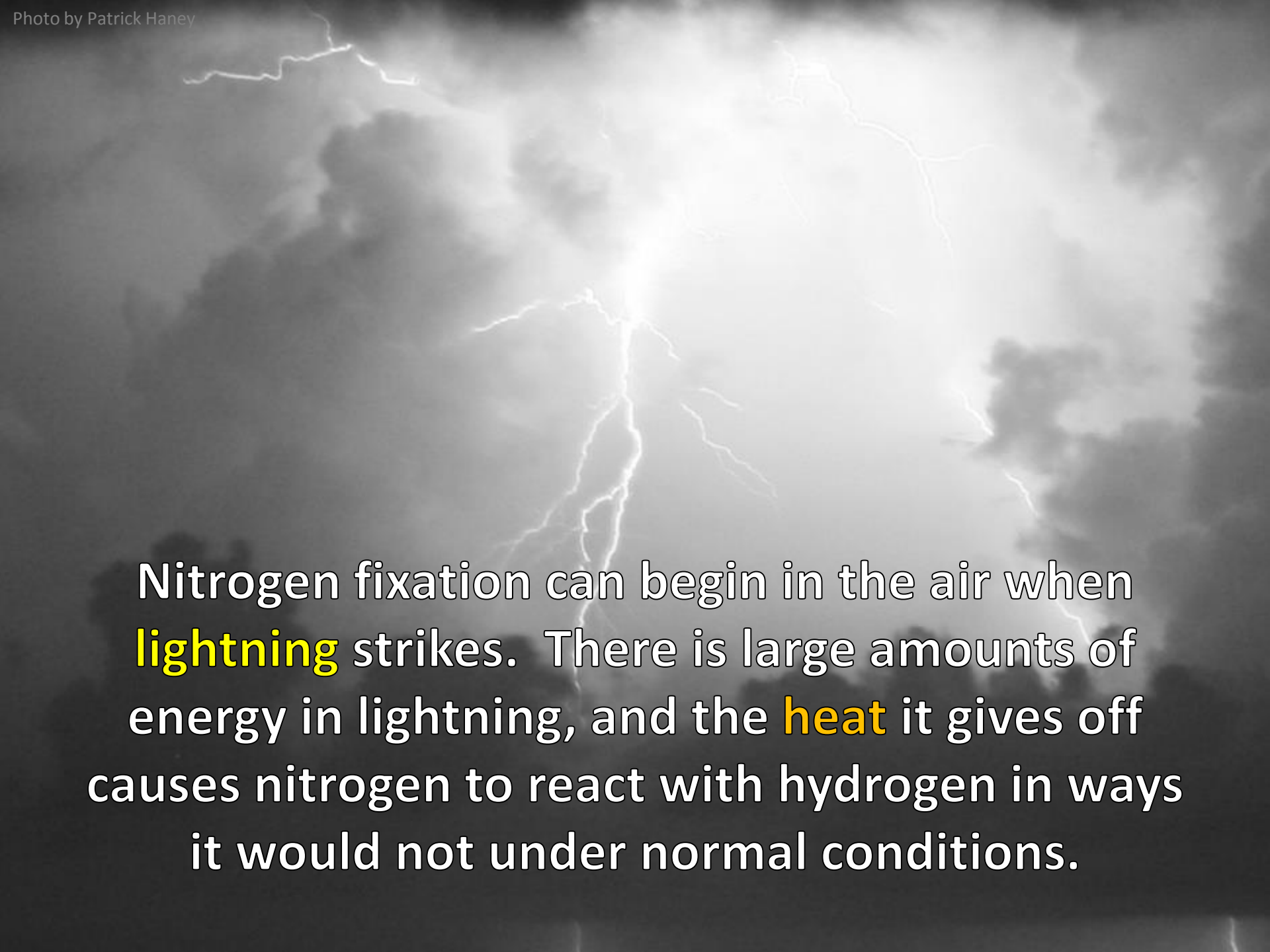




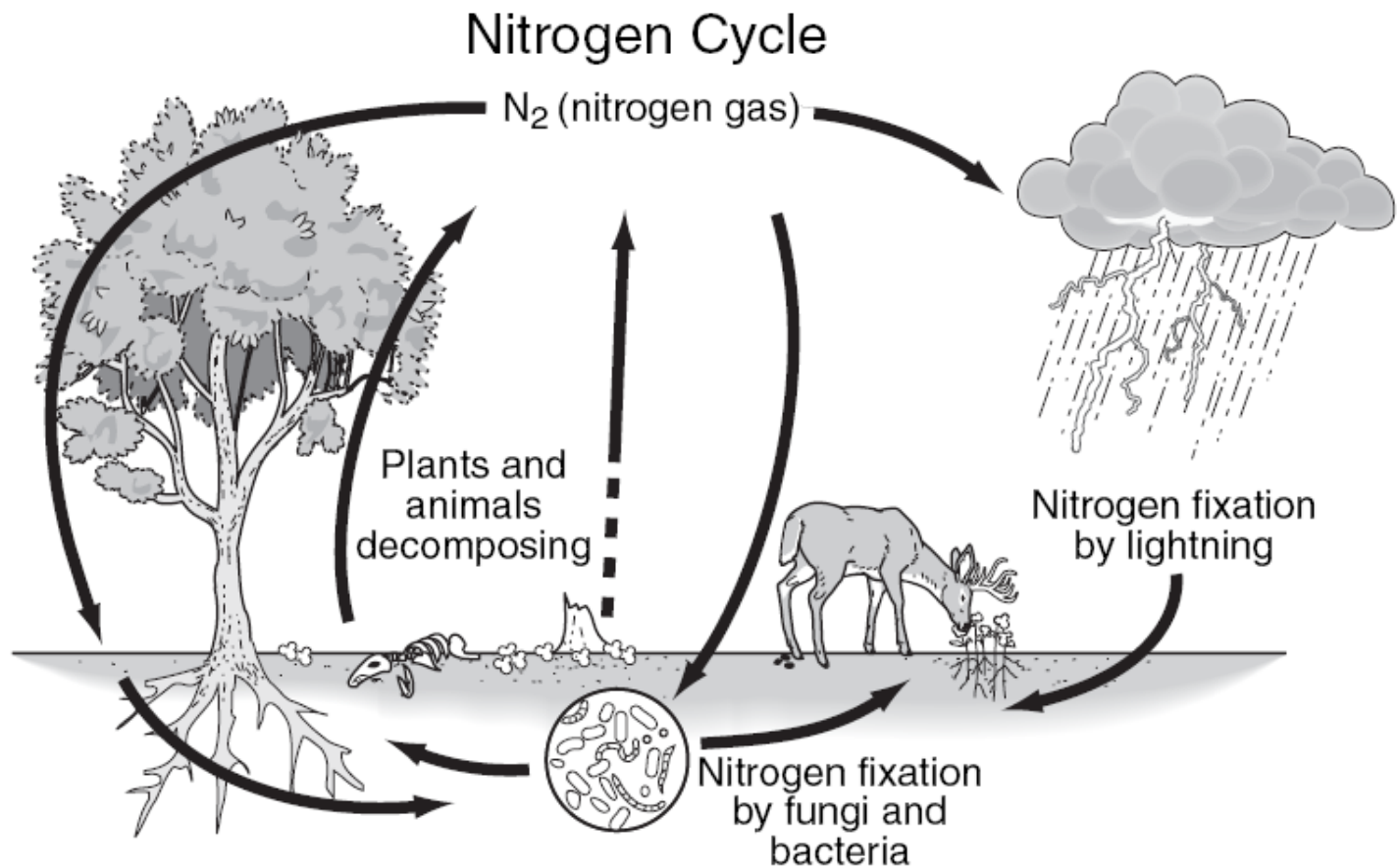
**Nitrogen gas ( $N_2$ )** is actually the most common gas in the atmosphere, but plants *cannot* absorb and use this form of nitrogen. In order for plants to absorb nitrogen, it must first be converted into a different form.



The process of converting nitrogen gas ( $N_2$ ) into ammonia ( $NH_3$ ) is known as **nitrogen fixation**. This is the first step of the nitrogen cycle, and it can happen in a couple of different ways.



Nitrogen fixation can begin in the air when **lightning** strikes. There is large amounts of energy in lightning, and the **heat** it gives off causes nitrogen to react with hydrogen in ways it would not under normal conditions.



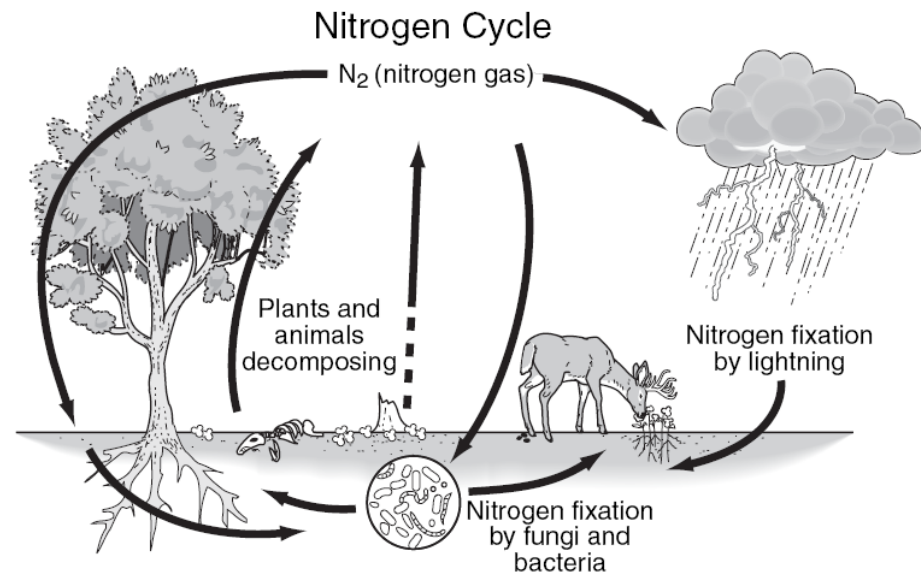
Most nitrogen fixation is performed by *microorganisms* in the soil. **Nitrogen-fixing bacteria** convert  $N_2$  gas into other nitrogen compounds that can be absorbed by plants.

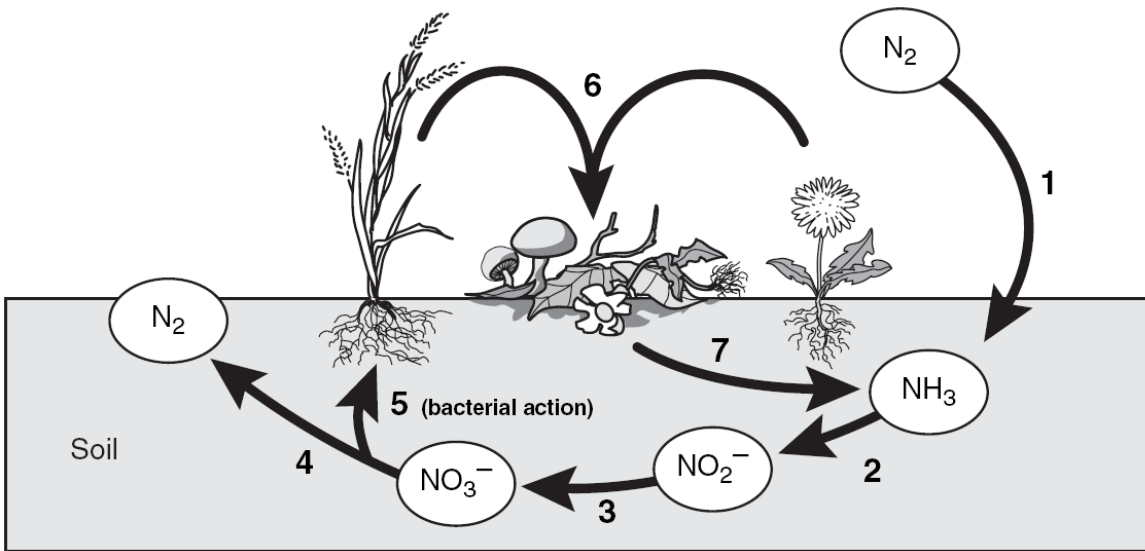


Many of these bacteria actually live inside of the **roots** of plants. Soybean plants and other *legumes* contain these bacteria inside of **root nodules**.



Soybean root nodules, containing Rhizobium bacteria



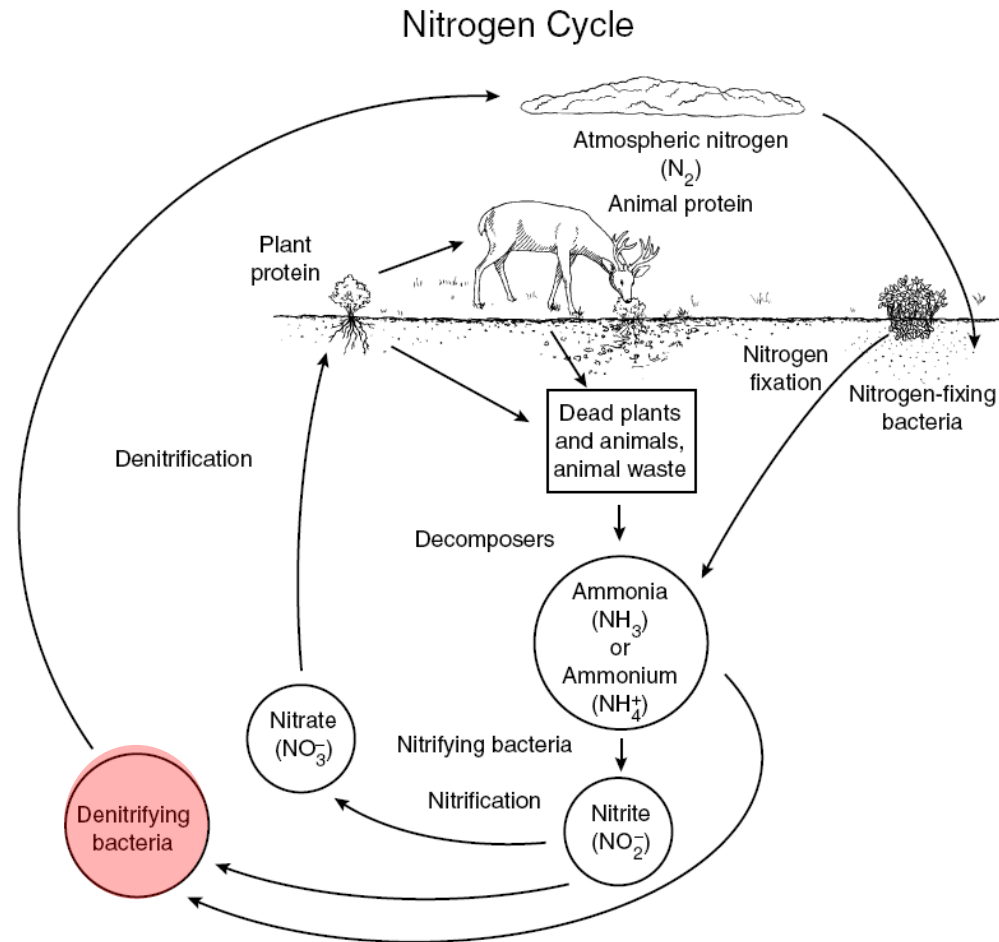


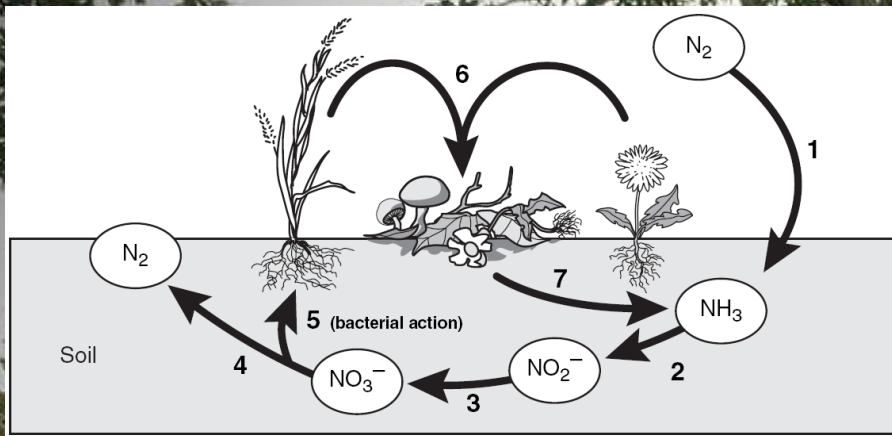
© Getty Images (6211 .JPG)

When plants and animals die, the nitrogen contained in these organisms is digested by **decomposers** and released into the soil as ammonia. Decomposers prevent the nitrogen from being trapped in the dead plant material and **recycle** vital nutrients in the ecosystem.



Some bacteria, known as **denitrifying bacteria**, use the *nitrites* and *ammonia* themselves and convert it back into atmospheric nitrogen ( $N_2$ ). These bacteria are an important part of the nitrogen cycle that help replenish the  $N_2$  found in the air.





Once the nitrogen fixation has occurred, the nitrogen can be absorbed through the roots of the plant. Without the proper amount of nitrogen, the plant would not be able to survive.



Wheat



Corn



Oats

Many plants are grown by **farmers** in large quantities and this can *deplete* the nitrogen in the soil. After a few years of growing these crops, they can start to have trouble growing because there isn't enough nitrogen left in the soil.

Because of this, farmers **rotate** their crops through their fields allowing legumes to grow in each field every few years. These legumes contain **nitrogen-fixing bacteria** in their roots that replenish the nitrogen available in the soil.



Alfalfa



Clover



Soybean Plants



Pea Plants



In some places, like swamps and bogs, the acidity of the soil keeps the level of nitrates very low. In these places you might find **carnivorous plants**. These plants get their energy from the sun, but they must trap and digest insects to get the **nitrogen** they need to survive.





Photo by [David M. Goehring](#)



**Raking leaves** actually reduces the nutrients in the soil in your yard. Since these leaves do *not decompose* and return nutrients to the soil, the amount of nitrogen in your yard can be reduced over time.

**Texas  
Bright** **Lawn Fertilizer**  
**10-4-6**

Guaranteed Analysis

Total Nitrogen (N) . . . . .	10.0%
Water-insoluble nitrogen . . . . .	1.6%
Nitrogen from ammonia . . . . .	3.1%
Nitrogen from urea . . . . .	5.5%
Available Phosphoric Acid (H <sub>3</sub> PO <sub>4</sub> ) . . . . .	4.0%
Soluble Potash (K <sub>2</sub> CO <sub>3</sub> ) . . . . .	6.0%
Iron (Fe) . . . . .	0.2%

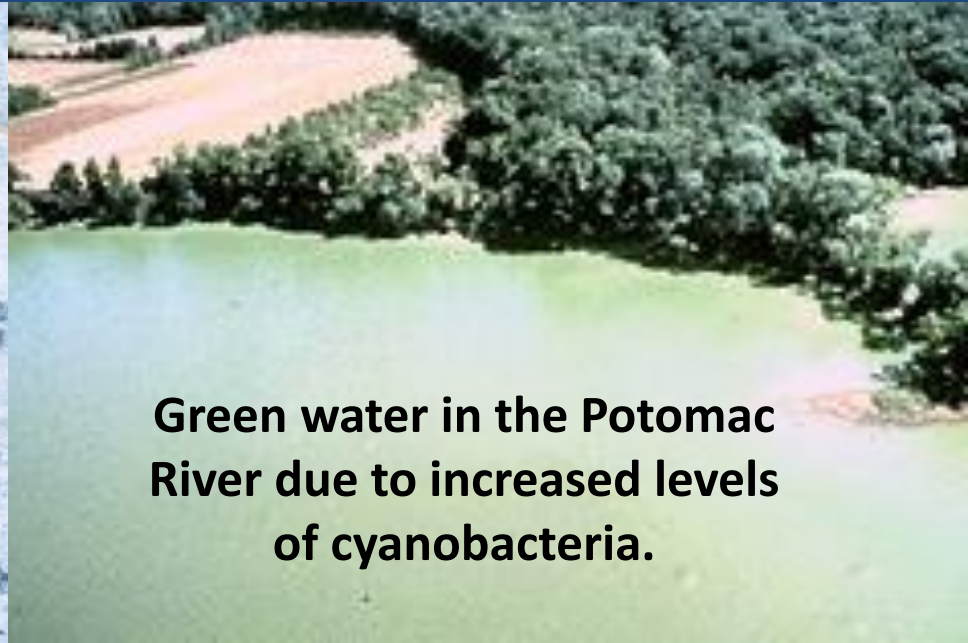


**Fertilizers** are often used by farmers and gardeners to add nitrogen to the soil. This can help plants to grow and produce fruits and vegetables, but fertilizers can also cause problems in the environment.

When fertilizers get into the water supply, they can make it too easy for *microorganisms* like bacteria and algae to grow. These organisms *deplete* the water of **oxygen** and can cause aquatic and marine life to die because they do not have the O<sub>2</sub> they need.



**Fish death due to depleted oxygen**



**Green water in the Potomac River due to increased levels of cyanobacteria.**



Algae and cyanobacteria also grow on the surface and block light from reaching *aquatic plants*. Without light, these plants cannot perform **photosynthesis** and die as a result of the *nitrogen pollution*.



Photo by Felix Andrews



Photo by Sasha Trubetskoy

