

SNC1P

1.5 The Nitrogen Cycle

Have you even noticed that some of the lawns in your neighbourhood are a dull, yellowish-green colour while others are a rich, dark-green colour? The colour of lawn grasses is determined mainly by how much nitrogen is present.

Even though nearly 79% of the atmosphere is nitrogen gas (N_2), plants and other organisms cannot use it directly to make chemicals that are essential to life. Instead, they must get their nitrogen from chemicals called nitrates. Like carbon, nitrogen is cycled through ecosystems in various forms. This is called the nitrogen cycle.

Nitrogen Fixation

The conversion of nitrogen into nitrates occurs in a process called **nitrogen fixation**. Nitrogen fixation occurs in two main ways.

1. Energy from lightning causes nitrogen gas to combine with the oxygen in the air, producing a small amount of nitrates. The nitrates dissolve in rain or surface water and enter the soil.
2. Bacteria, called **nitrogen-fixing bacteria**, are able to convert nitrogen into nitrates. They are found mostly in soil or in small lumps called nodules on the roots of some legumes like peas, clover, and alfalfa. These bacteria provide the majority of nitrates found in the soil.

The plants use nitrates to make proteins and DNA by absorbing the nitrates through their roots.

Nodules

The bacteria in the nodules of legumes depend on the plant for a supply of sugar, which the plant produces. In return, the bacteria supply the plant with a supply of nitrates and produce much more nitrates than are needed. The excess nitrates are available for other plants.

Denitrification

The opposite process of nitrogen fixation is **denitrification**. Denitrifying bacteria can break down nitrates into nitrites, and then nitrites into nitrogen gas. The nitrogen gas is released back into the atmosphere. This completes the nitrogen cycle. The denitrifying process also speeds up when the soil is very acidic or when the denitrifying bacteria grow out of control.

Ammonification and Assimilation

Some bacteria convert nitrogen compounds into ammonia. This is **ammonification**. The process by which plants uptake ammonia, ammonium ions, or nitrates and convert them into organic molecules containing nitrogen is called assimilation.

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Decomposers in the Nitrogen Cycle

Decomposers play a critical role in the nitrogen cycle. As organisms produce wastes and eventually die, the decomposers break down the nitrogen-containing chemicals into simpler chemicals. Farmers who use manure as fertilizer are taking advantage of the nitrogen cycle by putting a supply of nitrates back into the soil.

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Worksheet 1.5: The Nitrogen Cycle

1. If nearly 79% of the atmosphere is nitrogen, how could there be a shortage of nitrogen in some soils?
2. How do animals obtain usable nitrogen?
3. Nitrogen-fixing bacteria are found in the roots of bean plants. Explain how the bacteria benefit the plant and how the plant benefits the bacteria.
4. Why do you think clover would begin to grow in an older lawn? How would the presence of clover benefit the lawn?
5. Some farmers alternate crops that require rich supplies of nitrogen, such as corn, with alfalfa. Alfalfa is usually less valuable in the marketplace than corn. Why would farmers plant a crop that has less economic value?
6. Is the nitrogen cycle possible without decomposers? Explain.
7. Knowing what you know about the nitrogen cycle, what could you do, other than adding chemical fertilizer, to help keep your lawn green and healthy?