

The Nitrogen Cycle (http://www.windows2universe.org/teacher_resources/nitrogen_main.html)

Nitrogen is an element. It is found in living things like plants and animals. It is also an important part of non-living things like the air above and the dirt below. Atoms of nitrogen don't just stay in one place. They move slowly between living things, dead things, the air, soil and water. These movements are called the nitrogen cycle.

Most of the nitrogen on Earth is in the atmosphere. Approximately 78% of the molecules in Earth's atmosphere are made of two nitrogen atoms bonded together (N₂). All plants and animals need nitrogen to make amino acids, (thus proteins), DNA, RNA, and enzymes, but the nitrogen in the atmosphere is not in a form that they can use. The molecules of nitrogen in the atmosphere can become usable for living things when they are broken apart during lightning strikes (**nitrification**) or fires, by certain types of bacteria, or by bacteria associated with bean plants.

Most plants get the nitrogen they need to grow from the soils or water in which they live. Animals get the nitrogen they need by eating plants or other animals that contain nitrogen. When organisms die, their bodies decompose bringing the nitrogen into the soil or into ocean water. Bacteria alter the nitrogen into a form that plants are able to use—this is called **fixation**. Other types of bacteria are able to change nitrogen into a form that allows it to return to the atmosphere—this is called **denitrification** (a form plants are unable to use).

Certain actions of humans are causing changes to the nitrogen cycle and the amount of nitrogen that is stored in the land, water, air, and organisms. The use of nitrogen-rich fertilizers can add too much nitrogen in nearby waterways as the fertilizer washes into streams and ponds. The waste associated with livestock farming also adds large amounts of nitrogen into soil and water. The increased nitrate levels cause plants to grow rapidly until they use up the supply and die. The number of plant-eating animals will increase when the plant supply increases and then the animals are left without any food when the plants die.

Nitrogen from fertilizers sinks into soils, often creating conditions that favor the growth of weeds rather than native plants. Nitrogen then washes into waterways causing a surplus of nutrients, a situation called **eutrophication**. In freshwater lakes, rivers, and streams eutrophication causes aquatic weeds to grow unchecked. They sometimes fill entire lakes, rivers, or streams. Algae cloud the water green and slimy algal scum coats shallow rocks.

When the nitrogen-rich waters make their way downstream to the ocean, they cause even more problems. Every summer for more than 30 years high nitrogen levels at the Mississippi River Delta have caused a dead zone where the water empties into the Gulf of Mexico. This dead zone, in which oxygen levels are too low for animals to survive, covered more than 8000 square miles (more than 20,000 km²) of ocean in 2001. It forms when nitrogen in the water causes algae to grow and reproduce very quickly. As the huge amounts of algae die, and decompose, oxygen in the water is used up. Animals cannot survive without oxygen. They flee to another part of the ocean if they can, or they die.

Although it is one of the larger dead zones, the one in the Gulf of Mexico is not the only one of its kind. There are about 550 dead zones throughout the world. There are even dead zones that form in Lake Erie (one of the Great Lakes). The dead zone in the Gulf is the world's second largest. Almost all dead zones are located at the mouths of rivers where fertilizers and other nutrient sources like sewage and livestock waste are added to the seawater.

Nitrogen Cycle Analysis Questions

1. Why do humans and other living things need nitrogen?
2. Why can't humans get their nitrogen by breathing in the atmosphere?
3. What is nitrification?
4. How do plants get their nitrogen?
5. How do humans get their nitrogen?
6. What is the name of the process where bacteria change nitrogen into a form that plants can use?
7. What is denitrification?
8. What happens when fertilizer that runs off crops heads down stream?
9. Is eutrophication a good or bad thing? Explain.
10. In a dead zone, what causes the oxygen to get all used up?
11. What does a lack of oxygen do in a dead zone?
12. Name at least 2 ways that the nitrogen cycle is different from the carbon cycle.

1

2