



Nitrogen in the Environment: Nitrogen's Most Common Forms

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Nitrogen is important for all plants to live, and it comes in many forms. Although the atmosphere is mostly made up of nitrogen, it is in the form of a gas known as **dinitrogen** N_2 . Plants cannot use this form. Dinitrogen, or atmospheric nitrogen, can also be found in the soil. In addition to dinitrogen, other inorganic and organic forms exist in the soil as well. Organic forms of nitrogen make up a very high percentage of the total nitrogen found in the soil. However, plants are able to use only very specific inorganic forms of nitrogen. The table shows the most common forms found in the soil and the most common forms used by plants.

Nitrogen form	Symbol	Use in soils and plants
Dinitrogen (Atmospheric Nitrogen)	N_2	Dinitrogen is the most common form. It makes up 78 percent of the atmosphere but cannot be used by plants. It is taken into the soil by bacteria, some algae, lightning, and other means.
Nitrate	NO_3	Nitrate is the form of nitrogen most used by plants for growth and development. Nitrate is the form that can most easily be lost to groundwater.
Ammonium Nitrogen	NH_4	Ammonium taken in by plants is used directly in proteins. This form is not lost as easily from the soil.
Organic Nitrogen	$C-NH_2$ (where C is a complex organic group)	Organic nitrogen exists in many different forms. It is changed into ammonium, then into nitrates, by microorganisms. Both of these inorganic forms can be used by the plant.

Impact on water quality

Nitrogen becomes a concern to water quality when nitrogen in the soil is converted to the nitrate (NO_3^-) form. This is because nitrate is very mobile and easily moves with water. The concern of nitrates and water quality is generally directed at groundwater. However, nitrates can also enter surface waters such as ponds, streams and rivers. Nitrates in the soil result from natural biological processes associated with the decomposition of plant residues and organic matter. Nitrates can also come from animal manure and nitrogen fertilizers.

Whether nitrates actually enter groundwater depends on underlying soil and/or bedrock conditions, as well as depth to groundwater. If depth to groundwater is shallow and the underlying soil is sandy, the potential for nitrates to enter groundwater is relatively high. However, if depth to groundwater is deep and the underlying soil is heavy clay, groundwater contamination from nitrates is not likely.

Once nitrates get into the groundwater, the greatest concerns are for infants less than one year old and for young or pregnant animals. High levels of nitrates can be toxic to newborns, causing **anoxia**, or internal suffocation. Seek alternative water sources if nitrate levels exceed the health standard of 10 ppm nitrate-N. Do **not** boil water to eliminate nitrates. It **increases** nitrate levels rather than decreasing them. The most common symptom of nitrate poisoning in babies is a bluish color to the skin, particularly around the baby's eyes and mouth. These symptoms of nitrate toxicity are commonly referred to as the "blue-baby" syndrome.

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