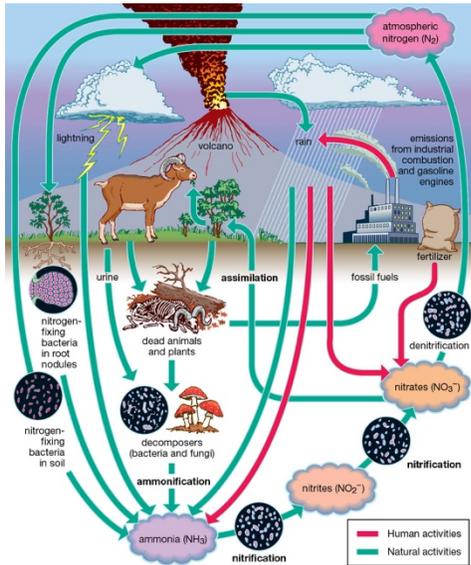


# Nitrogen Cycle



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Figure 1: The nitrogen cycle is the complex path that nitrogen follows as it circulates through nature in various forms.

## Introduction

The circulation of nitrogen in various forms through nature is called the nitrogen cycle. Nitrogen, a component of proteins and nucleic acids, is essential to life on Earth. Although about 78 percent of the atmosphere is nitrogen gas, this abundant reservoir exists in a form unusable by most organisms. Through a series of chemical transformations, however, nitrogen is made available to plants, which in turn ultimately sustain all animal life.

The nitrogen cycle includes five general steps: nitrogen fixation, nitrification, denitrification, nitrogen assimilation, and ammonification. However, these steps do not always occur in a particular order.

## Nitrogen Fixation

Nitrogen fixation is the process through which nitrogen gas is converted into inorganic nitrogen compounds. A small amount of nitrogen gas is fixed by abiotic means such as lightning or ultraviolet radiation, which reacts with nitrogen gas in the atmosphere to produce nitric oxide. However, most nitrogen fixation (about 90 percent) takes place in soil, where it is converted to ammonia by certain types of soil microorganisms: free-living (non-symbiotic) bacteria and cyanobacteria (or blue-green algae), and symbiotic bacteria that live in a mutualistic relationship with certain plants such as legumes and cereal grasses. The symbiotic nitrogen-fixing bacteria invade the root hairs of host plants, where they multiply and stimulate the formation of root nodules. These nodules are enlargements of the root hair composed of plant cells and bacteria living in intimate association. Within the nodules the bacteria convert free nitrogen from the soil to ammonia, which the host plant utilizes for its development.

## Nitrification and Denitrification

Nitrification, a process carried out by nitrifying soil bacteria, transforms soil ammonia into nitrates, another form of nitrogen that plants can incorporate into their tissues.

Nitrates also are metabolized by denitrifying bacteria, which are especially active in water-logged, anaerobic (oxygen-poor) soils. The action of these bacteria tends to deplete soil nitrates, forming free atmospheric nitrogen.

### ***Nitrogen Assimilation***

Ammonia and nitrates produced through the nitrogen cycle are taken in and assimilated into the tissues of algae and higher plant forms. Animals take in these compounds when they ingest the algae and plants, converting them into other materials and incorporating these into their tissues through various metabolic processes.

### ***Ammonification***

When living things die, their remains—and their waste products—undergo decomposition by bacteria and other microorganisms that can break down decaying tissues into simpler forms. Decomposition includes several processes, one of which is ammonification, which yields ammonia. Depending on soil conditions, this ammonia can be converted into other nitrogen compounds that are then reassimilated by plants and animals, or it can leave the soil as atmospheric nitrogen gas.

#### **Citation (MLA)**

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