The Nitrogen Cycle

Nitrogen is an essential element for life. Many of the types of molecules that make up living things are nitrogen containing.

Major Classes of Molecules Needed for Life

Types of Molecules	Elemental Composition			
	C	H	O	N
Sugars ($C_6H_{12}O_6$)	✔	✔	✔	
Starches	✔	✔	✔	
Fats	✔	✔	✔	
Proteins	✔	✔	✔	✔
DNA & RNA (genetic code)	✔	✔	✔	✔

The proteins DNA and RNA that must include nitrogen and are more complex than sugars, starches and fats.

For plants at the bottom of the food chain, carbon hydrogen and oxygen are easy to obtain from CO_2 (carbon dioxide) and H_2O

(water). Nitrogen on the other hand is often hard to get.

Our atmosphere is composed mostly of nitrogen:

N_2 – Nitrogen	~	78.08 %
O_2 – Oxygen	~	20.95 %
Ar – Argon	~	0.93 %
CO_2 – Carbon Dioxide	~	0.05 %
Other Gases	~	0.01 %
Total:		100.00%

The problem is that the it is nearly impossible to get nitrogen directly from the atmosphere. The nitrogen in the atmosphere is in the form of N_2 which is non-reactive and remains in the atmosphere. This nitrogen needs to be converted to nitrates (NO_3^{1-}) which easily becomes part of the soil and can be absorbed by plants. Once in the plant tissues, nitrogen can be

passed up the food chain.

		Plant		Animal
N_2(air) ⇨	NO_3^{1-}(soil) ⇨	Tissue	⇨	Tissue
		Nitrogen		Nitrogen

This process is called **nitrogen fixation** and it can happen three different ways:

1. Nitrogen Fixation by Lightning. The energy in lightning can convert N_2 and O_2 directly to NO_3^{1-} which fall to the ground in rain.

2. Nitrogen Fixation by Bacteria. Specialized bacteria that often live within special structures in the roots of some plants can convert N_2 to NO_3^{1-}. In return the plants provide glucose to the bacteria. Both plants and bacteria benefit. This is called a **symbiotic** relationship.

3. Man Made Fertilizers such as ammonium nitrate (NH_4NO_3).

The other main sources of nitrogen is nitrogen found in animal wastes and nitrogen that has been recycled from previously living material.