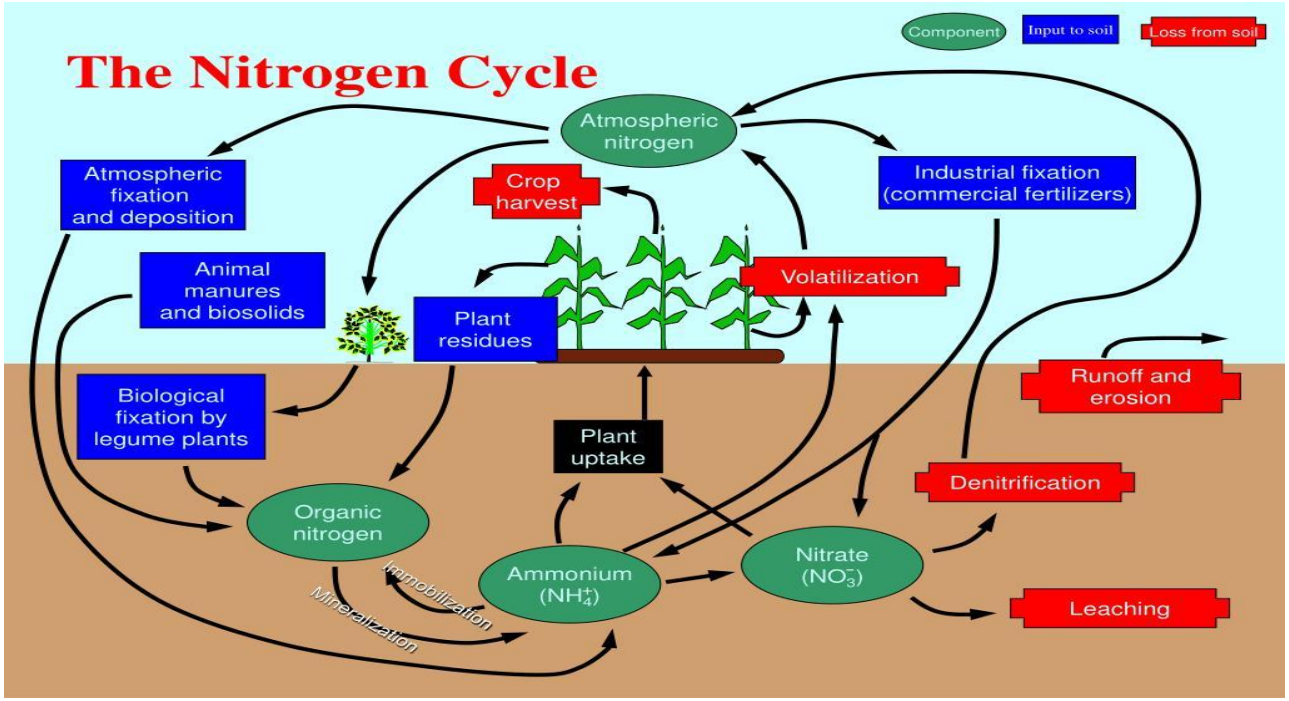
Bhagalpur National College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University, Bhagalpur)

PPT Presentation for B.Sc. III- Environmental Pollution



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Nitrogen Cycle

The **nitrogen cycle** is the process by which **nitrogen** is converted between its various chemical forms. This transformation can be carried out through both biological and physical processes.

Nitrogen Cycle

Forms of Nitrogen :

a) organic nitrogen as-

- ammonium (NH_4^+),
- nitrite (NO_2^-),
- nitrate (NO_3^-),
- nitrous oxide (N_2O),
- nitric oxide (NO) or

b) inorganic nitrogen as nitrogen gas (N_2).

Nitrogen Cycle

Nitrogen cycle consists of the following steps-

1. Nitrogen Fixation
2. Nitrogen assimilation
3. Ammonification
4. Nitrification and
5. Denitrification
6. Sedimentation

Nitrogen Cycle

1. **Nitrogen fixation :**

The conversion of free nitrogen of atmosphere into the biologically acceptable form or nitrogenous compounds.

There are following ways to convert N_2 into more chemically reactive forms:

a) Biological Nitrogen fixation
b) Physiocochemical nitrogen fixation
c) Industrial nitrogen fixation

Nitrogen Cycle

a) **Biological Nitrogen fixation :**

some symbiotic bacteria , blue-green algae and some free-living bacteria are able to fix nitrogen as organic nitrogen.

e.g-

symbiotic bacteria	:	*Rhizobium*
symbiotic blue-green algae	:	species of ***Nostoc***, ***Anabaena*** , etc
free-living bacteria	:	***Azotobacter***, *Clostridium*, ***Derxia***, ***Rhodospirillium***, *etc*

Nitrogen Cycle

b) **Physiocochemical *or Non-biological nitrogen fixation :***

In this process, atmospheric nitrogen combines with oxygen (as ozone) during lightning or electrical discharges in the clouds and produces different nitrogen oxides :

$$N_2 + 2(O) \xrightarrow{Electric} 2NO$$

$$2NO + 2(O) \xrightarrow{Discharge} 2NO_2$$

$$2NO_2 + (O) \rightarrow N_2O_5$$

Nitrogen Cycle

The nitrogen oxides get dissolved in rain water and on reaching earth surface they react with mineral compounds to form nitrates and other nitrogenous compounds :

$$N_2O_5 + H_2O \rightarrow 2HNO_3$$

$$2HNO_3 + CaCO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$$

Nitrogen Cycle

c) **Industrial nitrogen fixation :**

Under great pressure, at a temperature of $600^{\circ}C$ and with the use of an iron catalyst, hydrogen and atmospheric nitrogen can be combined to form ammonia **(NH_3)** in the **Haber-Bosch** process.

Nitrogen Cycle

2. Nitrogen assimilation :

In this process , Inorganic nitrogen in the form of nitrates , nitrites , and ammonia is absorbed by the green plants via their roots and then it is converted into nitrogenous organic compounds.

Nitrates are first converted into ammonia which combines with organic acids to form aminoacids . Aminoacids are used in the systhesis of proteins, enzymes, chlorophylls, nucleic acids, etc.

Nitrogen Cycle

3. **Ammonification :**

It is the process of releasing ammonia by certain microorganisms utilizing organic compounds derived from the dead organic remains of plants and animals and excreata of animals .

The microorganisms especially involved are-

actinomycetes, and
bacilli
(Bacillus ramosus , B. vulgaris, B. mesenterilus)

Nitrogen Cycle

4. **Nitrification :**

Nitrification is a process of enzymatic oxidation of ammonia to nitrate by certain microorganisms in soil and ocean.

Nitrosomonas ammonia to nitrites (NO_2^-

Nitrobacter oxidation of the nitrites into nitrates (NO_3^-).

Nitrogen Cycle

In soil,

$$2NH_4^+ + 2O_2 \xrightarrow{Nitrosomonas,\ Nitrococcus} NO_2^- + 2H_2O + Energy$$

$$NO_2^- + 2O_2 \longrightarrow NO_3^- + Energy$$

In ocean,

$$2NO_2^- + O_2 \xrightarrow{Nitrobacter,\ Nitrocystis} 2NO_3^- + Energy$$

Nitrogen Cycle

5. **Denitrification :**

Denitrification is the reduction of nitrates back into the largely inert nitrogen gas (N_2).

Some denitrifying bacteria are-

Thiobacillus denitrificants

Micrococcus denitrificants

Pseudomonas aeruginosa

$$2NO_3^- \rightarrow 2NO_2^- \rightarrow 2NO \rightarrow N_2O \rightarrow N_2$$

Nitrogen Cycle

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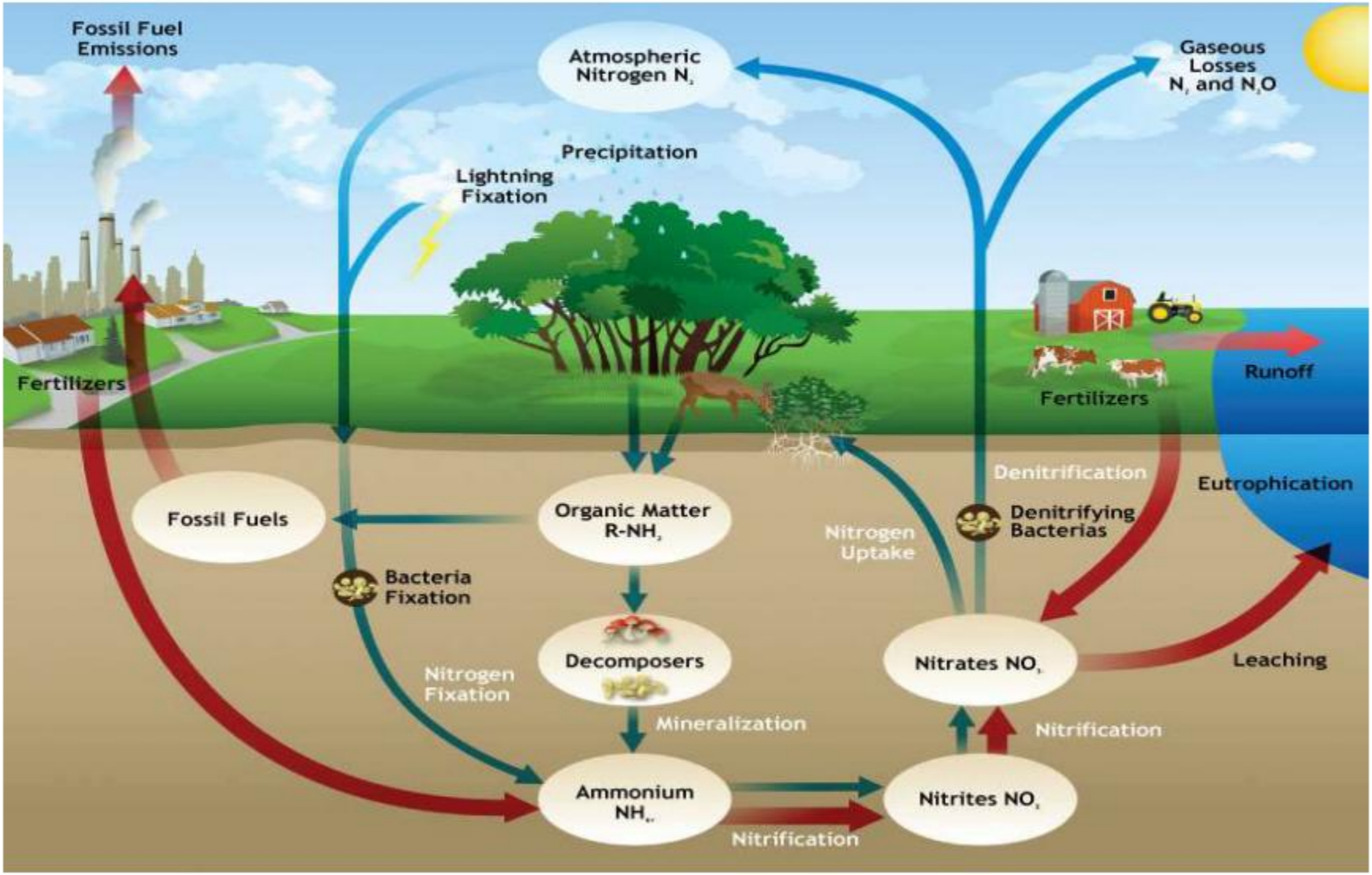
Nitrogen Cycle

6. **Sedimentation :**

Sometimes , nitrates of soil are locked up in the rocks while they are washed down to the sea or leached deeply into the earth along with percolating water.This phenomena is known as **sedimentation**.

Nitrogen Cycle



Thank

You

All