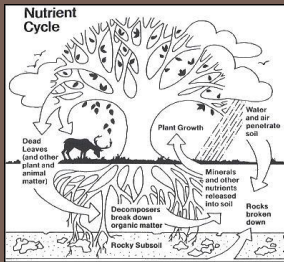


INTRODUCTION TO NUTRIENT CYCLES



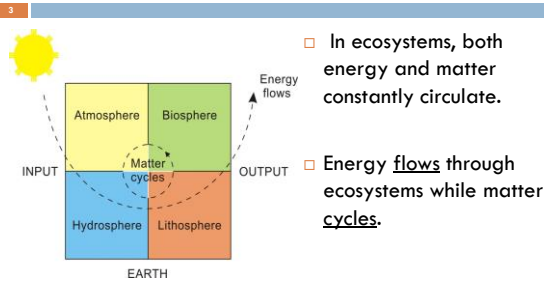
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Introduction

- The Earth is a closed system.
- Energy enters and leaves via radiation but matter does not enter or leave earth.



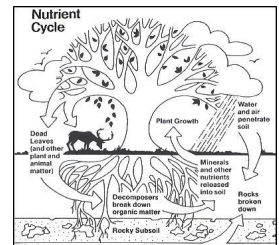
Introduction



- In ecosystems, both energy and matter constantly circulate.
- Energy flows through ecosystems while matter cycles.

Nutrient Cycles

- A nutrient cycle is the movement and exchange of matter throughout an ecosystem.
- A nutrient is any substance needed by an organism for proper growth, repair, and function (i.e. C, N, P, O).



Carbon Cycle

- Carbon is found in all living matter.
- Places that carbon is found are called stores or sinks.

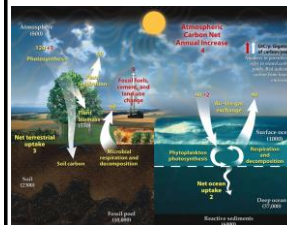
Short-term Stores

- living things in water & on land
- rotting tissue of plants/animals
- atmosphere (air)
- ocean (dissolved in the water)

Long-term Stores

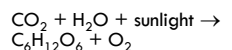
- underground (oil, gas, natural gas and coal)
- sedimentary rock (limestone)
- ocean floor (old shells)

Carbon Cycle



1. Carbon moves from the atmosphere to plants and oceans.

- In the atmosphere, carbon is in CO₂. Through photosynthesis, CO₂ is pulled from the air to make plant food.



- The oceans soak up carbon from the atmosphere.

Carbon Cycle

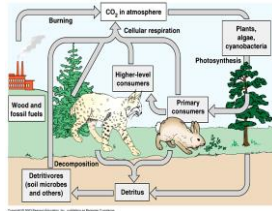
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2. Carbon moves from plants to animals.

- Through food chains, the carbon in plants moves to higher level consumers.

3. Carbon moves from plants and animals to the ground.

- When living things die, their bodies, wood and leaves decompose bringing carbon into the ground.

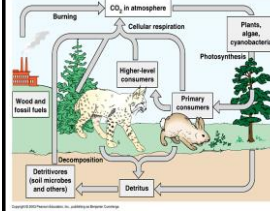
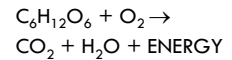


Carbon Cycle

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4. Carbon moves from living things to the atmosphere.

- Through cellular respiration (in cells of all living things), CO₂ is released to the atmosphere.

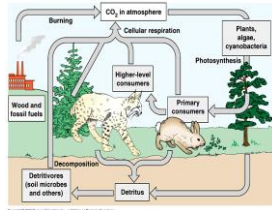
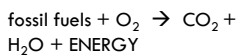


Carbon Cycle

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5. Carbon moves from fossil fuels to the atmosphere.

- During combustion (e.g. in factories, vehicles, homes, forest fires, volcanoes), carbon quickly enters the atmosphere as CO₂.



Human Activities & the C Cycle

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1. Burning Fossil Fuels

- CO₂ in atmosphere has increased 30% in past 160 years. In the 160,000 years before that, it only increased 1-3%.
- Carbon is removed from long-term stores by combustion of coal, oil, & gas.

2. Deforestation

- Trees absorb CO₂, so when they are cut down, CO₂ is released into the air.
- Other crops don't remove as much CO₂

Nitrogen Cycle

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- Makes up DNA & proteins (muscle function).
- Help plants grow.

Where Nitrogen is Found:

- Atmosphere (78% is N₂)
- Oceans
- Organic matter in soil
- Lakes, marshes, organisms



Nitrogen Cycle

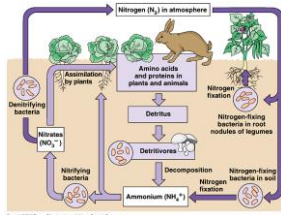
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- Earth's atmosphere is 78% N₂ (nitrogen gas) but most organisms cannot use this nitrogen directly.
- Plants can use NO₃⁻ (nitrate) and NH₄⁺ (ammonium).
- Nitrogen becomes usable when it is "fixed" – pulled from the air and bonded with other elements to make new compounds. This process is called nitrogen fixation.

Nitrogen Cycle

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 1. Nitrogen moves from the atmosphere to the soil or water through nitrogen fixation.

- Lightning changes $N_2 \rightarrow NO_3^-$.
- Rain washes nitrate into soil.
- Bacteria in soil (*rhizobium*) & cyanobacteria in water change $N_2 \rightarrow NH_4^+$.



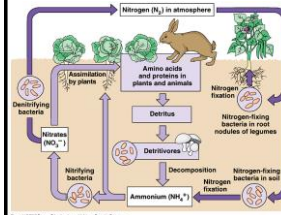
Nitrogen Cycle

14
 2. Nitrogen moves from the soil and water to plants and animals.

- Animals get the nitrogen they need by eating plants or other animals that contain nitrogen.

3. Nitrogen moves from plants and animals back to the soil and water.

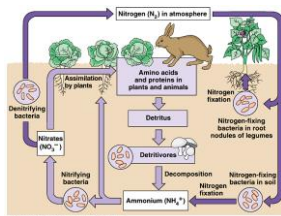
- When organisms die, their bodies decompose bringing the nitrogen into soil or water.



Nitrogen Cycle

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 4. Nitrogen moves from the soil and water to the atmosphere.

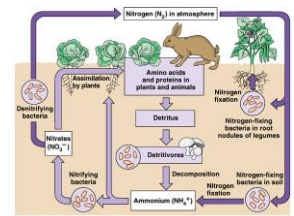
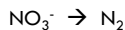
- Certain bacteria can convert nitrogen from the soil (NH_4^+) to nitrates. This process is called nitrification.



Nitrogen Cycle

- 16
 ➤ Following nitrification, bacteria and volcanic eruptions change the soil nitrates into N_2 through a process called denitrification.

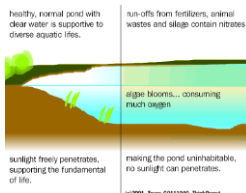
- Nitrogen gas is then released to the atmosphere.



Human Activities & the N Cycle

1. Overfertilization

- The use of nitrogen-rich fertilizers and manure can add nitrogen to nearby water systems.
- The build up of nitrogen and other nutrients in water is called eutrophication.
- The result is that algae and weeds grow rapidly. These can pollute the water.



Human Activities & the N Cycle

2. Burning Fossil Fuels

- Burning fossil fuels releases nitrogen into the air. This nitrogen eventually falls back to Earth and adds more nitrogen to ecosystems.
- NO & NO_2 are byproducts

