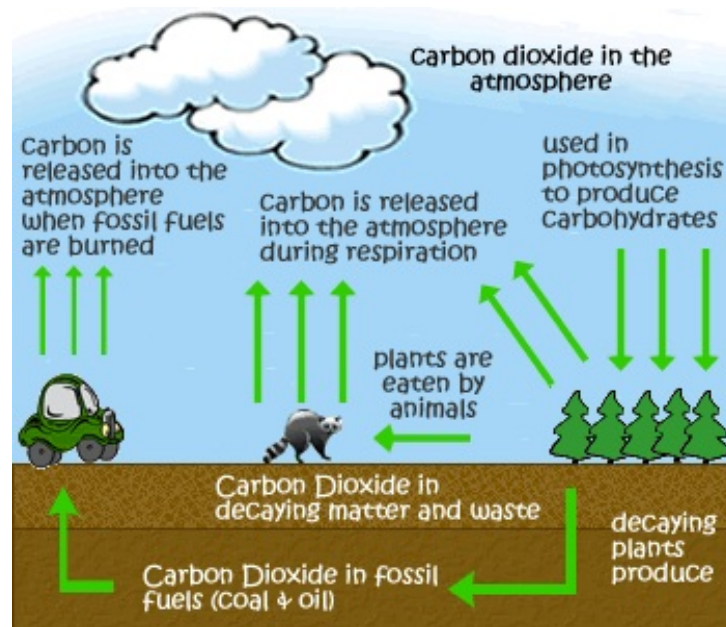


Recycling Within Ecosystems :

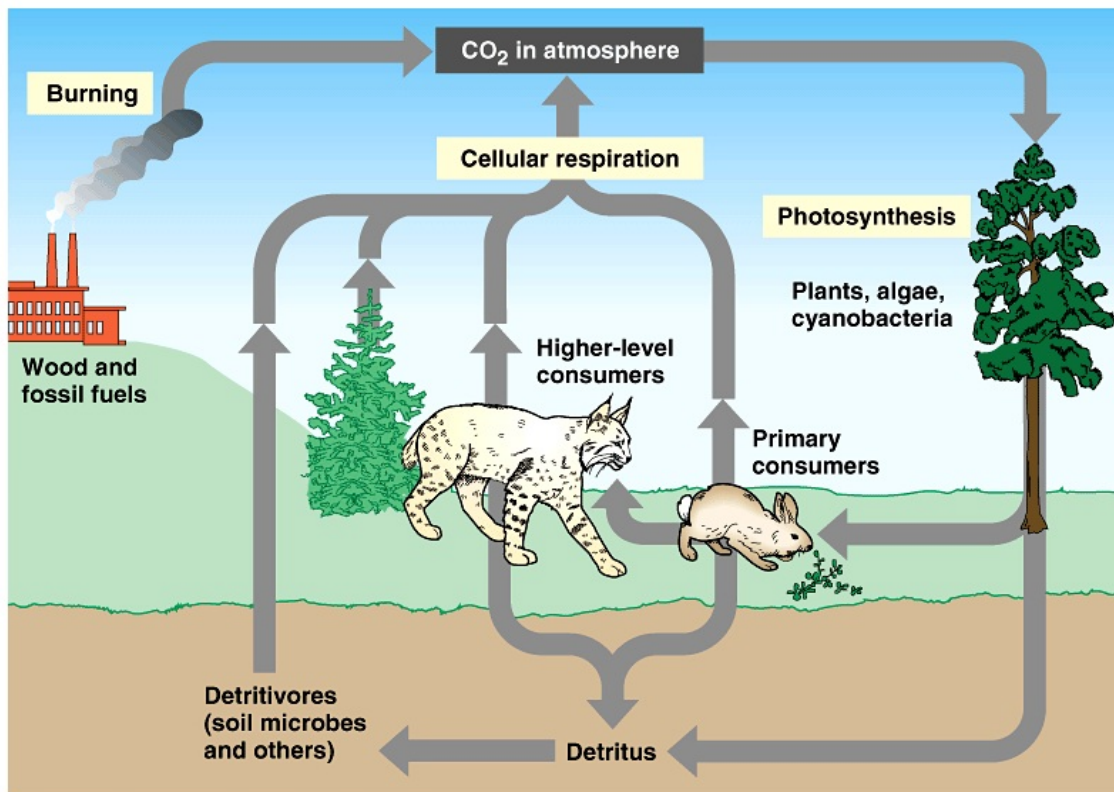
- Ecosystems recycle ALL materials, with the exception of **energy (cannot be created or destroyed, only changed - the “first Law of Thermodynamics”** and **each time it changes, some is lost - the “second Law of Thermodynamics”**)
- Most matter **contains carbon and hydrogen**, often oxygen and nitrogen (referred to as **“organic matter”**)
Any **matter not containing carbon and hydrogen** is **“inorganic matter”**.
- All of these chemical atoms must be used over and over to build the bodies of living things. Photosynthesis, digestion of food, and decay of tissues are examples of this recycling.

Recycling Carbon :



Carbon is the key element found in living tissue. It is also found in the atmosphere (ex. CO_2) and dissolved in the oceans. This inorganic form of carbon makes its way into living tissue (and starts the Carbon Cycle) via photosynthesis - transformed into organic carbon sources like sugars and starches.

- Carbon can then be passed on to other organisms via food chains. Consumers eat organisms to get organic carbon and other building blocks for their own body's health, repair, and growth !



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- In changing and using these building blocks, we must lose some (as the second law of thermodynamics said), and this loss occurs as heat and CO₂. This process is called “Cell Respiration”.
- Fats / proteins / starches are changed into sugars, which is then chemically changed inside the mitochondria of our cells.



or...



(Cool...notice this is exactly the opposite of photosynthesis ? Animals and plants then, form a partnership, a “symbiosis” that aids each other’s survival !)

- This recycling between plants and consumers forms the basis of the carbon cycle, but there’s a little more to it than that !
- Carbon may also be placed in a material like rocks, magma, a living body, the ocean, fossil fuels, etc, and cannot be recycled for some time. These storage areas are called “carbon reservoirs”.

Inorganic Carbon Reservoirs...(page 63)

1. The atmosphere

- the **smallest** inorganic reservoir
- about 0.03 % is carbon dioxide
- supplies land plants with inorganic carbon
- carbon moves through this one the fastest

2. The oceans

- lots of dissolved carbon dioxide here
- supplies algae and phytoplankton with their carbon supply
- some reacts with salt water to become carbonate compounds, used to make shells for ocean dwellers

3. The earth's crust

- the **biggest** reservoir for inorganic carbon.
- Carbon in decaying flesh, in shells, and plant material can become sediment and “lithify” to form sedimentary rock layers. (Ex. limestone from carbonate containing compounds)
Carbon remains trapped here until geologic processes release it, or it may be released through contact with acidic water.
- Carbon moves through here the slowest

Organic Carbon Reservoirs...(page 63-64)

1. The bodies of living / once living things

- contain organic carbon, but all eventually are returned to the cycle after decomposition

2. Peatlands

- special low-oxygen, acidic conditions prevent decomposition.
- Carbon can be locked away as “peat” for long periods of time. Lithifies to make coal.

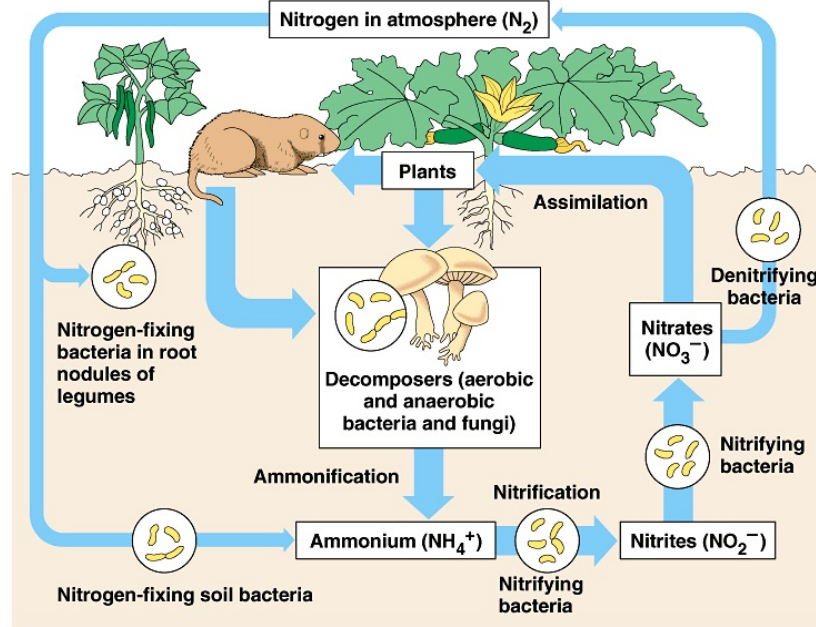
Human Impacts On The Cycle...(page 64)

- we cause more carbon to be released from reservoirs faster than ever
- mining activity, burning fossil fuels, burning forests (reducing photosynthesis - end result is Earth has a harder time replacing what we take out of the natural cycle)
- **END RESULT IS MORE CARBON DIOXIDE IN THE ATMOSPHERE, LEADING TO AN INCREASED “GREENHOUSE EFFECT”**

What are we doing about it ?

- Kyoto Accord
- legislation to reduce greenhouse gas emissions in vehicles, and by businesses
- changes in vehicle use
- better home construction (reduce need for heating fuel consumption)
- more sustainable mining, forestry practices
- public education (like Canada's “one tonne challenge”)

The Nitrogen Cycle : (page 66)



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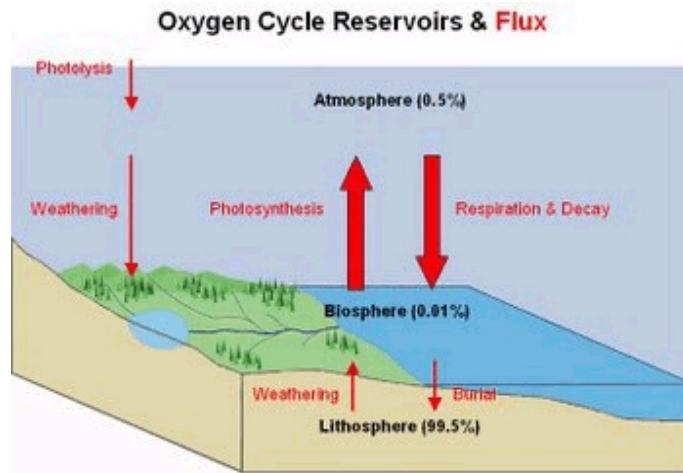
Nitrogen is needed by cells to make DNA, which is “read” by cells to make proteins (also contains nitrogen). Extremely important in living tissue. It too is cycled between biotic and abiotic factors.

- 79 % of atmosphere is nitrogen gas (N_2), unusable to organisms in that form, must be changed into “**nitrates**” (NO_3) (need by plants to be a rich green color - since it helps build chlorophyll)... (added artificially by applying chemical “fertilizers”)
- This chemical change (**NITRIFICATION**) is accomplished in three ways...
 1. **Lightning** changes a small amount of N_2 into NO_3 , which dissolves in water, enters soil, uptaken by plants.
 2. Some species of “**nitrogen fixing bacteria**”, found in soil and in “nodules” of legume plants like clover, alfalfa, soybeans, and peas, change nitrogen to nitrates.
 3. **Decomposers** change nitrogen compounds into ammonia (NH_3), changed by other bacteria to nitrites (NO_2), changed again by other bacteria to nitrates (NO_3) and uptaken by plants.

DENITRIFICATION is the reverse process : some bacteria break down nitrates into nitrogen gas and put it back in the atmosphere, completing the cycle.

prevented by ...aerating soil, treating with lime to lessen soil acidity, and rotating agricultural crops to include “legumes”.

Oxygen Cycle :
(not in the text)



- oxygen is made by plants as a byproduct of photosynthesis - it is part of their garbage. This is released into the atmosphere. Some of the plant oxygen is used to build sugar molecules, then passes through animal bodies in food chains. Returned to the air and soil during decomposition.
- some is taken in by animals during breathing (respiration), and we use it during the process of cell respiration, where we burn sugars to make energy and release carbon dioxide back into the air.
- some oxygen gets trapped during the rock forming processes, and released during weathering and erosion.
- humans affect this cycle by changing the speed of these processes, or the amount of any one part of the cycle : we burn things, we cut down plants, we change the amount and speed of rock weathering or erosion, we affect the numbers of animals and plants, we release huge amounts of carbon dioxide through use of fossil fuels.\

Water Cycle :

