

The Cycling of Materials



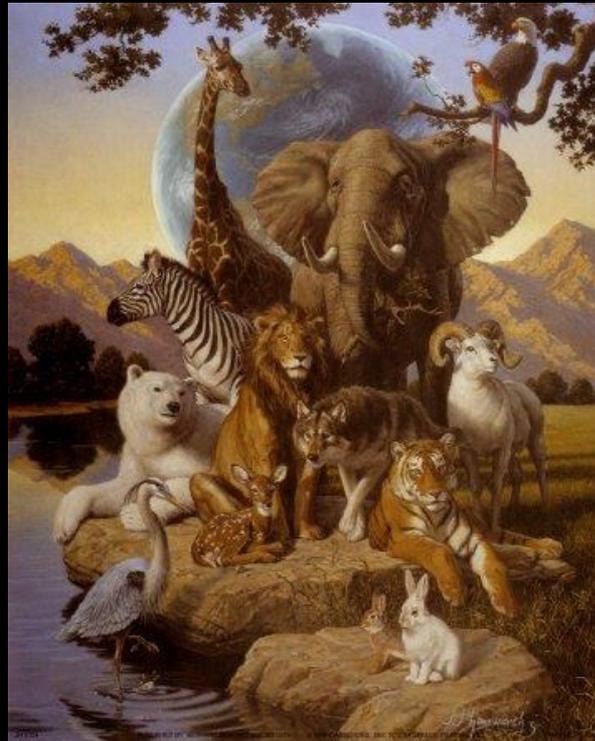
The Water Cycle

Water (H_2O)
can be a
liquid, solid
(ice) or gas
(water
vapor).



- Animals drink water or get it in the food they eat.

Animals lose water through *respiration* and *excretion*.

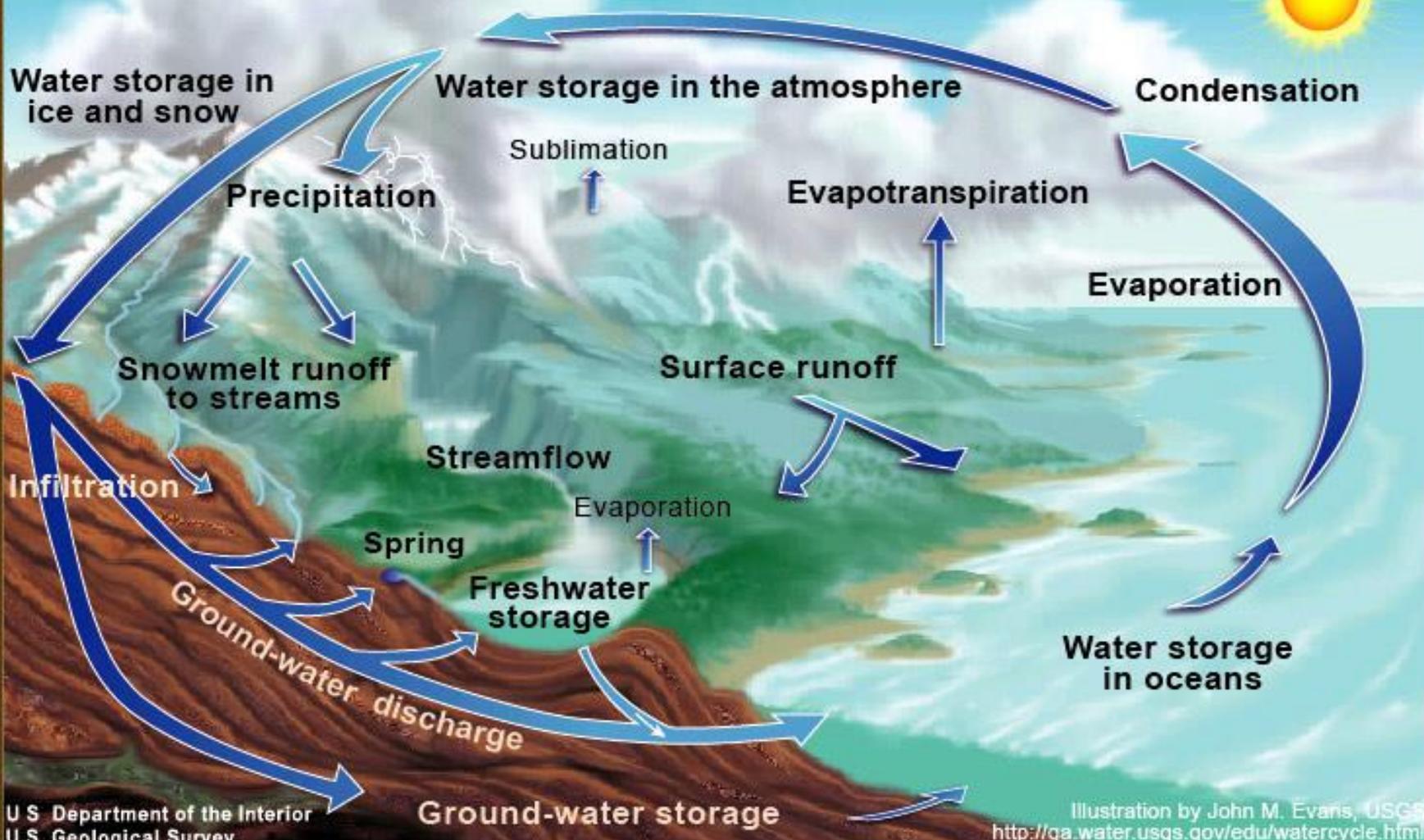


Decomposition of dead organisms
also releases water.

Plants absorb water through their roots and then lose it through their leaves during *transpiration*.

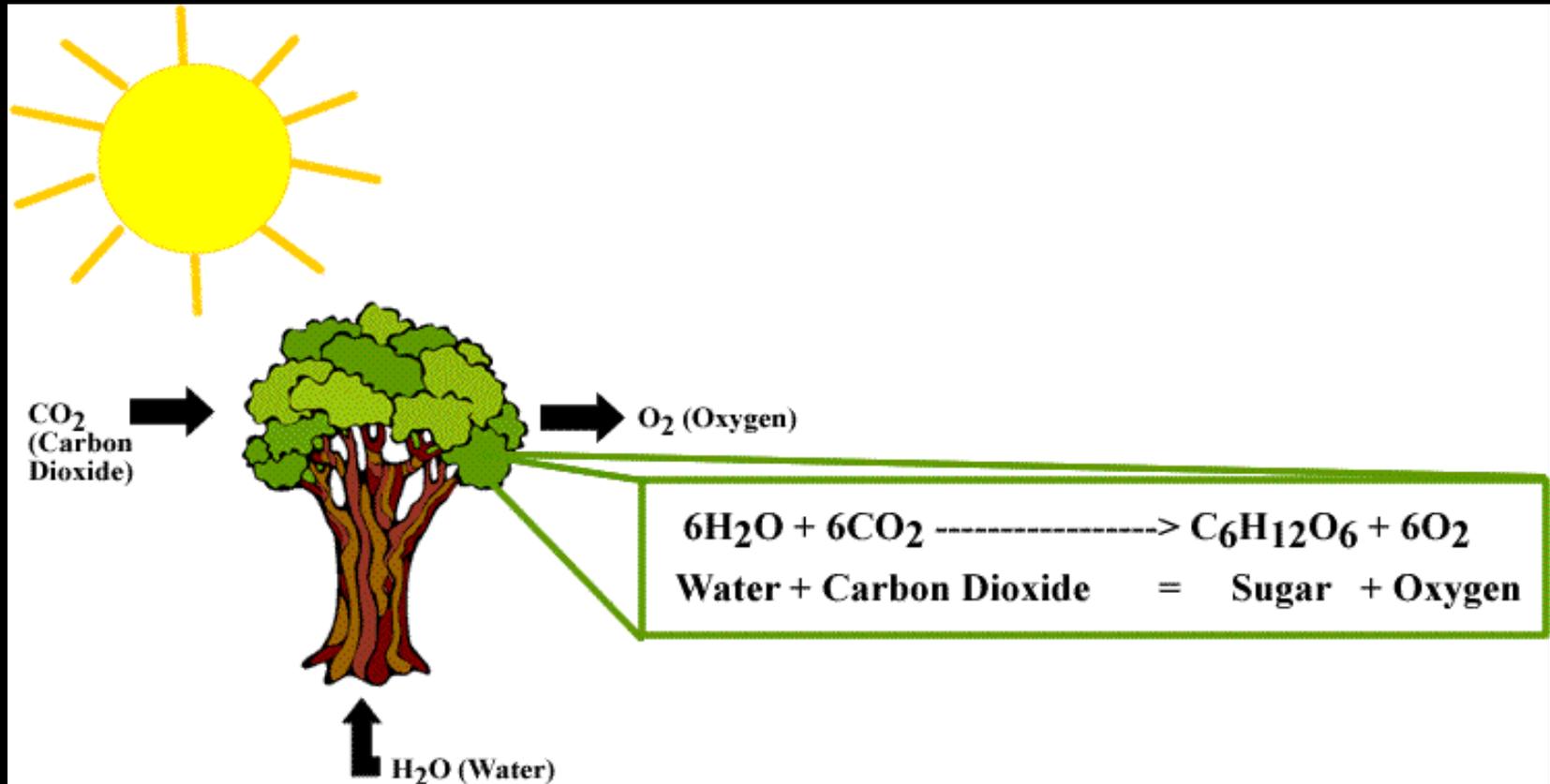


The Water Cycle

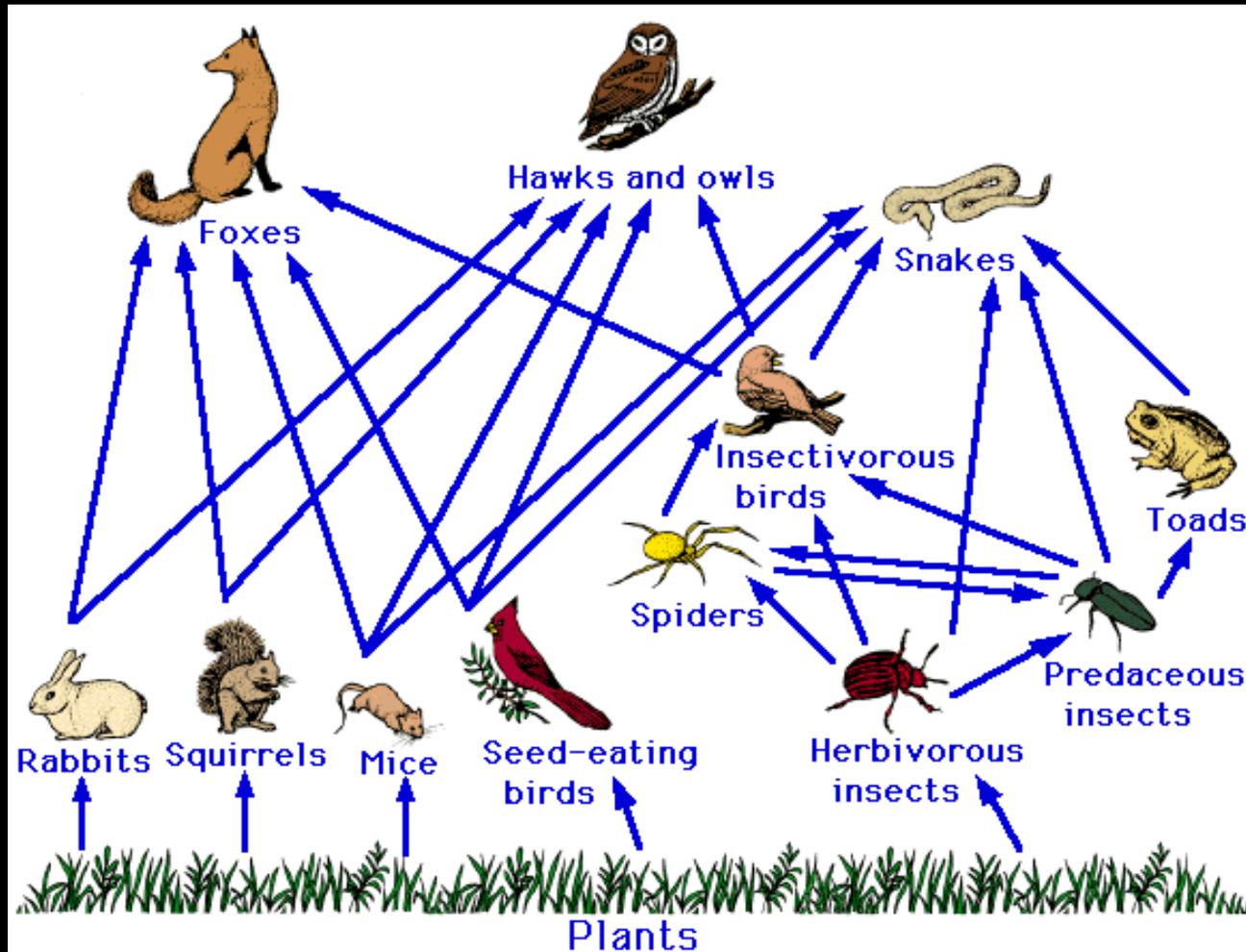


The Carbon Cycle

- Carbon is in the atmosphere as CO₂ gas.
- Plants use carbon dioxide in **photosynthesis** to form sugars (like *glucose*)



Organisms get carbon when they eat *producers (autotrophs)* or other *consumers (heterotrophs)*.



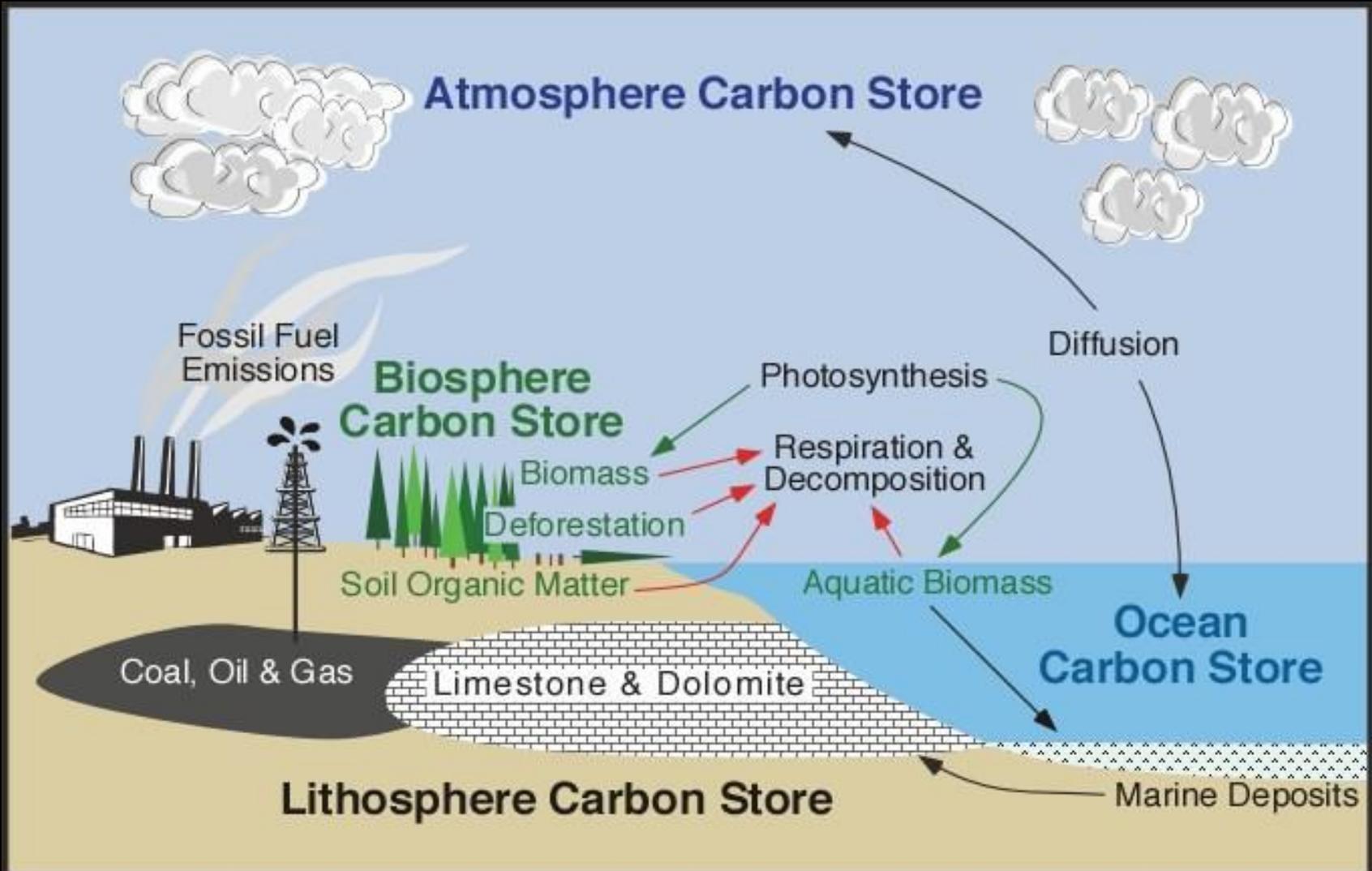
Carbon dioxide is released back into the atmosphere in several ways, like:

- When organisms decay
- Or when wood or fossil fuels are burned

Carbon is also returned to the atmosphere from organisms through *cellular respiration*.



The Carbon Cycle

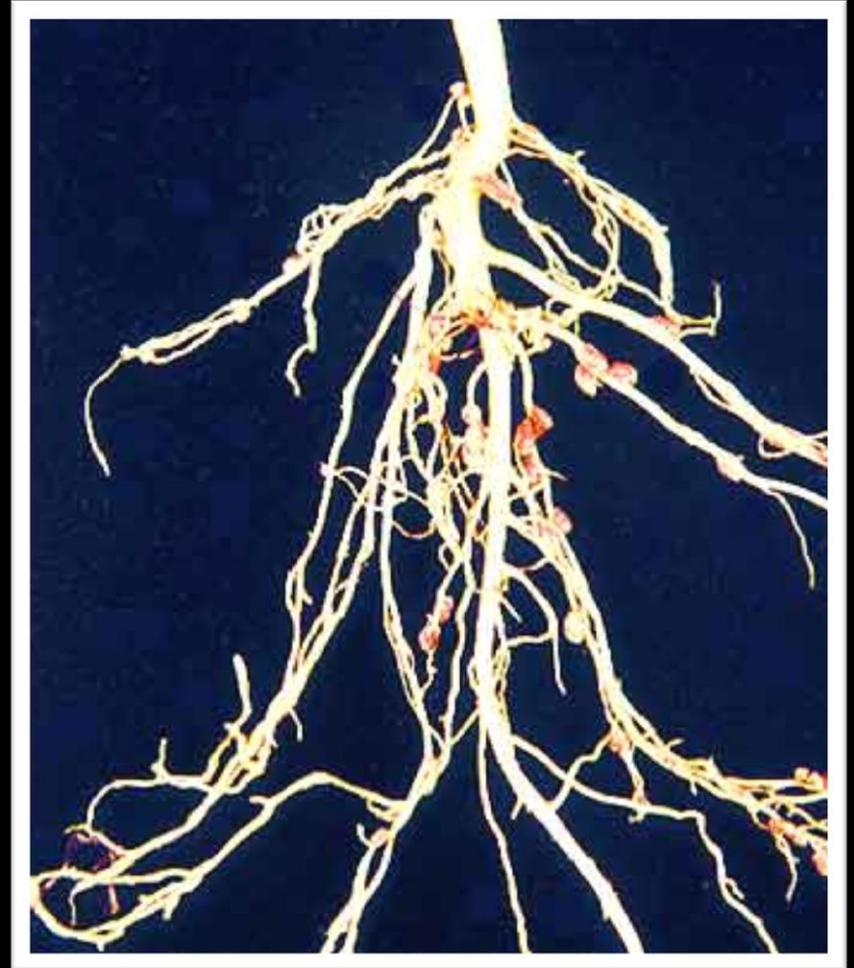


The Nitrogen Cycle

- Nitrogen is the main component of the air.
 - 78% of our atmosphere is Nitrogen!
- BUT living things can't use that nitrogen from the air.

Nitrogen Fixation

- Must happen before living things can use nitrogen
- Happens in two ways:
 1. Bacteria (in the soil and roots of plants)
 2. Lightning



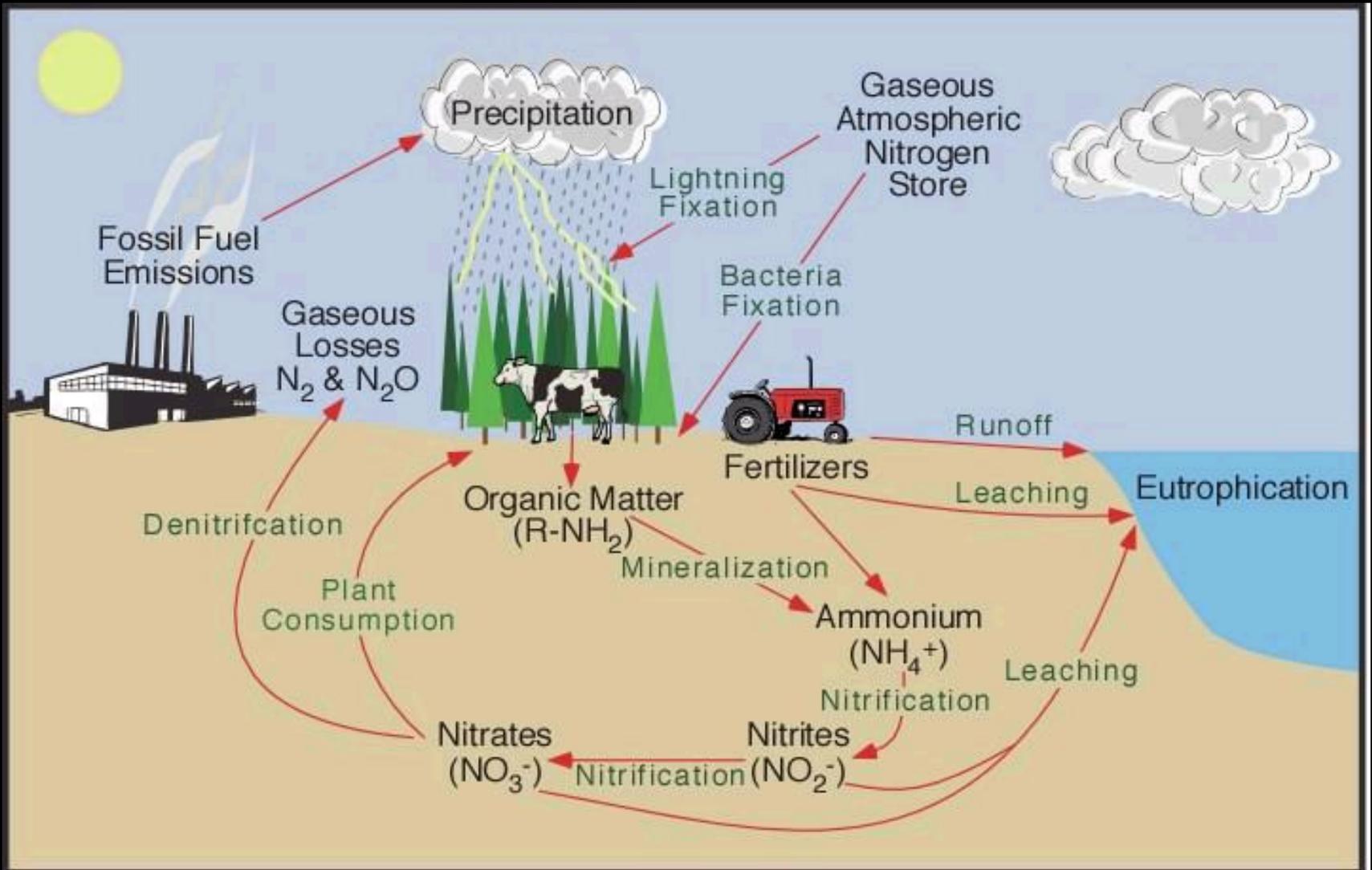
Nitrogen Cycle

- Once nitrogen is fixed, it moves through the **food chain**
 1. Plants use it to make proteins
 2. Herbivores eat the plants
 3. Carnivores eat the herbivores
 4. Organisms decompose when they die and the nitrogen is returned to the soil

There are some different bacteria in the soil that “unfix” nitrogen and return some of it back to the atmosphere.



The Nitrogen Cycle



Humans have affected the nitrogen cycle!

- Fertilizers and animal waste cause leaching of nitrates into groundwater.



Nitrogen entering the groundwater system flows into streams, rivers, lakes, and estuaries.



The added nitrogen can lead to eutrophication.



Not to mention sewage waste and septic tank leaks. (Yuck!)

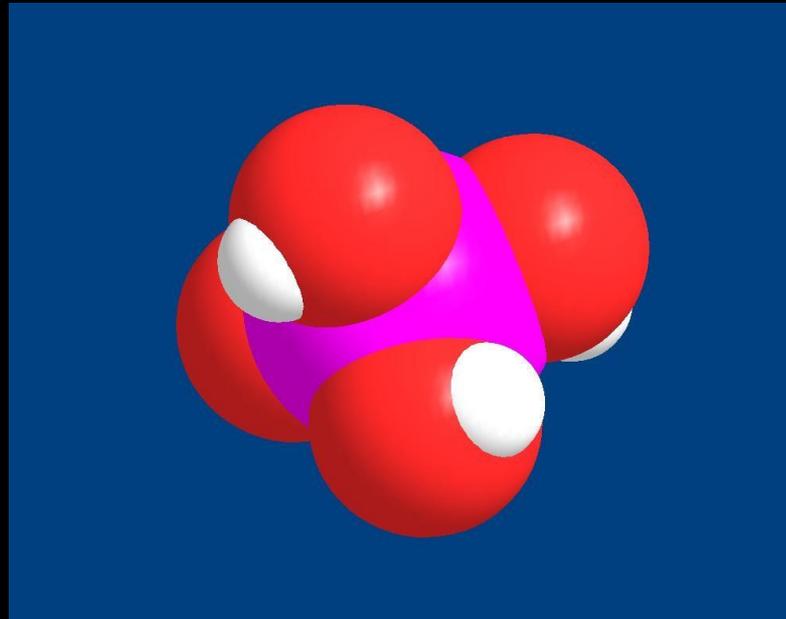


The Phosphorus Cycle

- Phosphate (PO_4^{3-}) dissolved in runoff and groundwater ends up in the oceans.
- PO_4^{3-} is returned to land by animals that feed on phosphorus containing sea creatures and then deposit their feces on land.

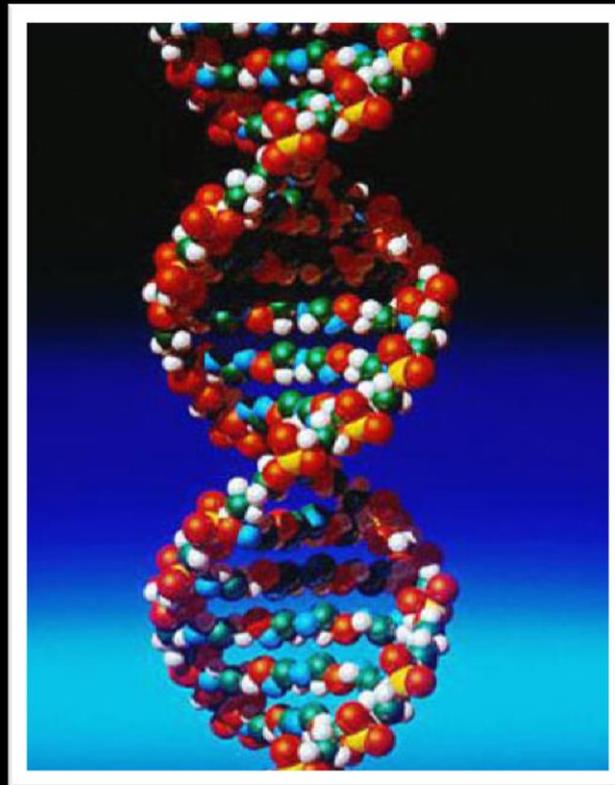
The Phosphorous Cycle

- Phosphorous is not usable alone – it has to be used in a Phosphate form
 - (Just remember Phosphorous = phosphate for our purposes)



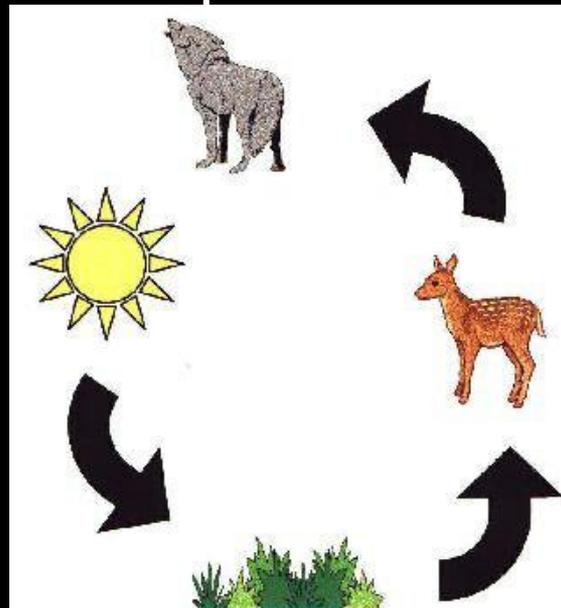
You need phosphorous because...

- It is used in DNA and RNA
- It is used in the energy-carrying molecules in your body



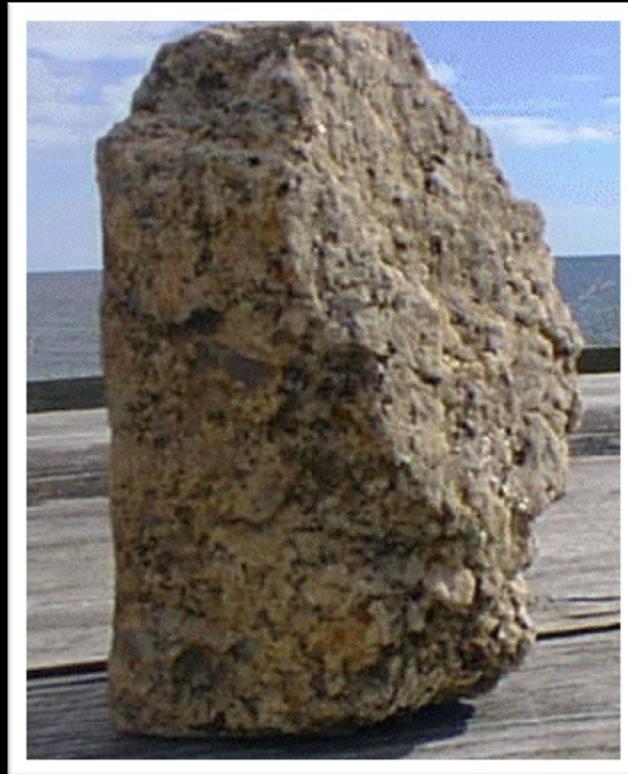
The Phosphorous Cycle

- Phosphorous basically follows the food chain:
 - Plants take it up from the soil
 - Animals eat the plants
 - Dead matter decomposes



The difference:

- Dead matter can also turn into rock, which stores phosphorous
- When rock erodes, the phosphorous is released.



The Phosphorus Cycle

