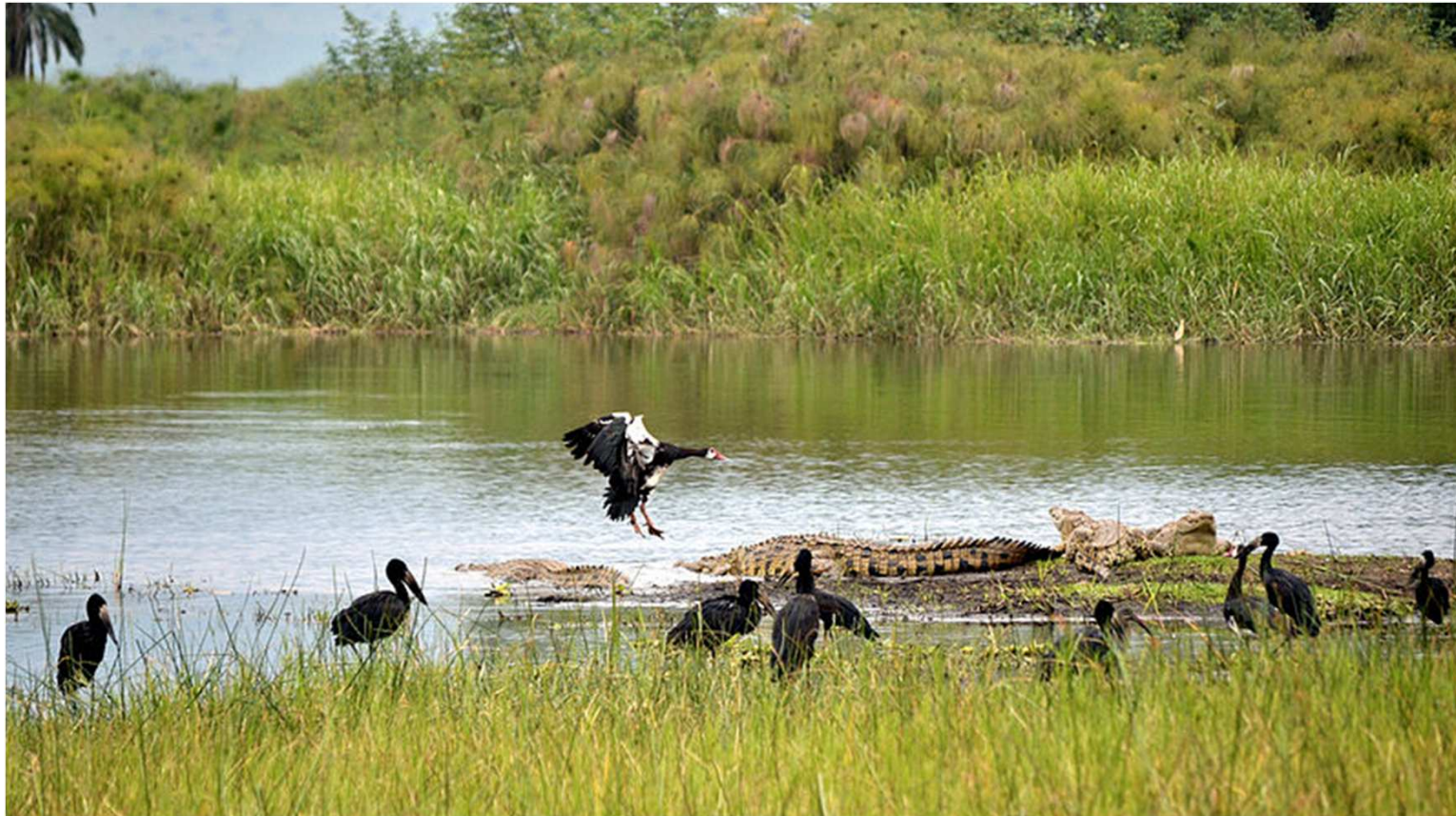
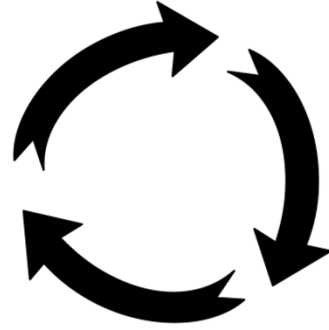




ECOLOGY





BIOGEOCHEMICAL CYCLES

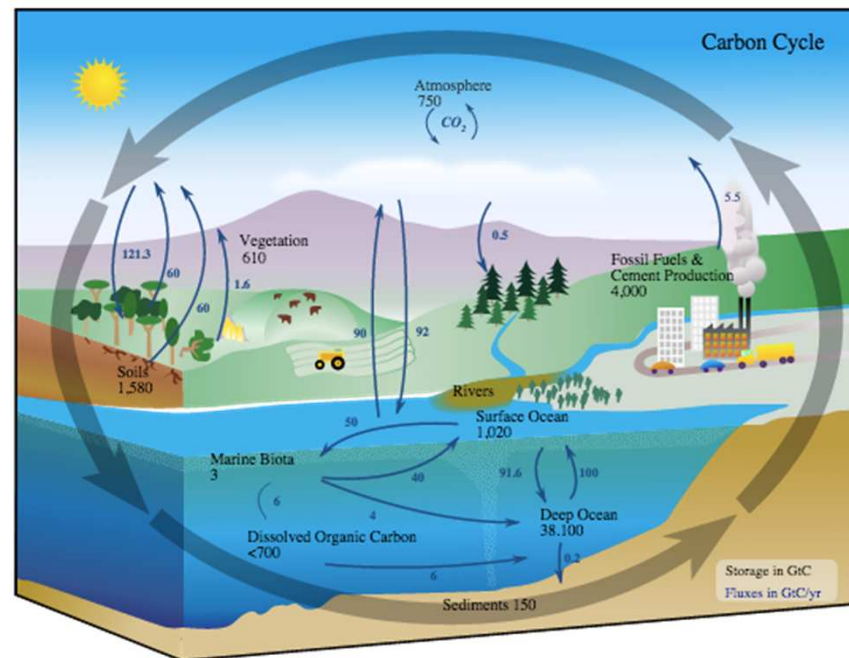


**EQ: How are nutrients recycled
throughout the environment?**

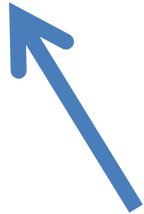
Biogeochemical Cycles

Recall that **matter is neither created nor destroyed;**
but it can transform and be passed on.

Biogeochemical cycles: how water, carbon, nitrogen and phosphorus pass from the physical environment to living organisms.



BIO



Life

GEO



Earth

CHEMICAL



**Elements and
molecules**

There are 3 essential biogeochemical cycles- **the water cycle, the carbon cycle, and the nitrogen cycle.**

In order for these materials to be recycled, they must **change states and transform!**

Death and decay also contribute to the biogeochemical cycles. As animals and plants die, bacteria and other decomposers break them down into raw elements, which can be absorbed by plants and then passed on to animals.



The Water Cycle

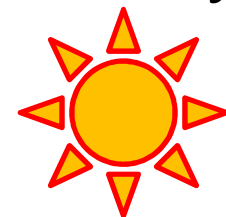
All living things require water to survive. Water moves between the ocean, atmosphere and the land, cycling from water vapor to liquid water.

Evaporation- liquid water returns to the atmosphere (vaporizes)

Transpiration- evaporation of water from plants

} Water transforming from liquid to vapor

Evaporation and transpiration occur during the daytime when the sun heats up the atmosphere.

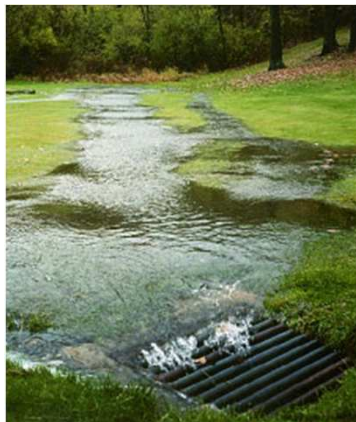


As the atmosphere cools, the water vapor in the air condenses to form clouds, in a process called **condensation**.

Precipitation- when the water droplets that form clouds become large enough, the water droplets fall to the earth (rain, sleet, snow).

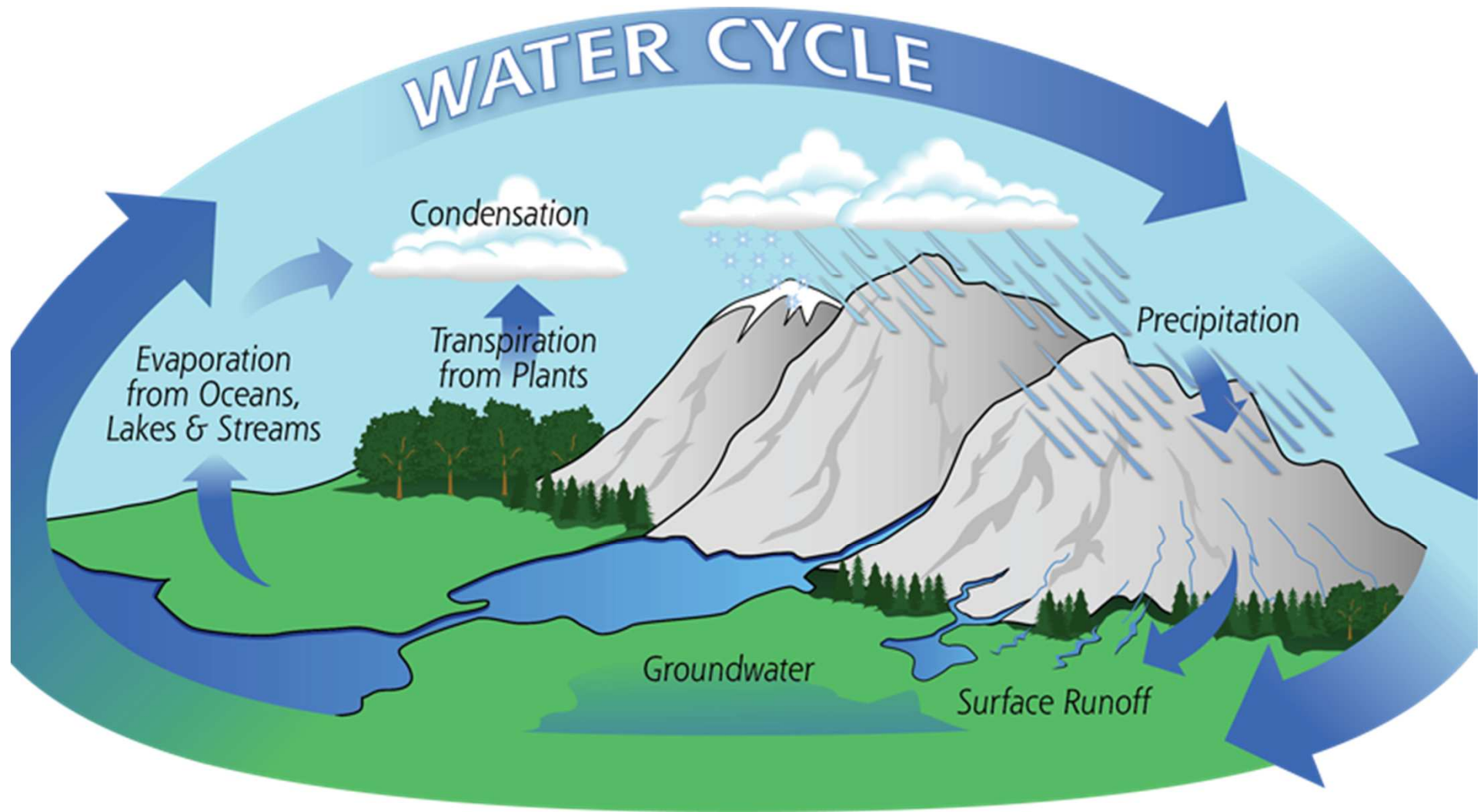
Once the water is returned to the earth, some of it is absorbed by plants through their roots. Other water continues to seep into the soil to become **ground water** in a process known as **percolation**.

Water
transforming
from vapor to
liquid



Runoff is surface water found on land that is eventually carried back to an ocean or lake.





How is water returned to the earth?
How is water returned to the atmosphere?

The Carbon Cycle

Carbon is an essential element for all living things. Carbon is found in living tissues, rocks, the atmosphere, and the ocean. Less than 1% of the carbon found on earth participates in the carbon cycle.



Carbon dioxide that is in the air or dissolved in water is used by photosynthesizing plants, algae and bacteria as a raw material to build organic molecules such as glucose.

Carbon may return to the air or water in 3 ways:

Respiration- all living organisms undergo cellular respiration.

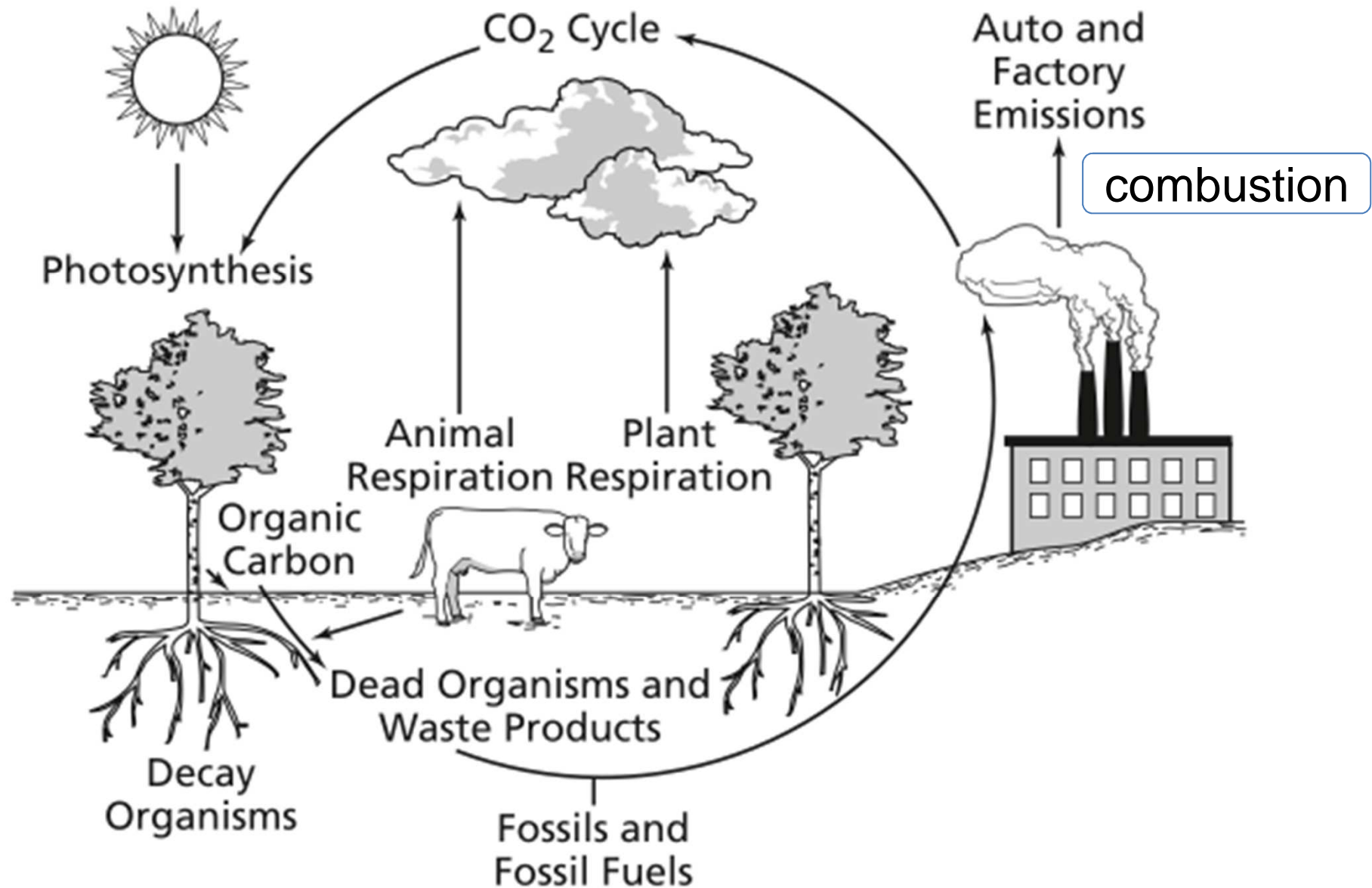
They use oxygen to break down food; CO_2 is a byproduct of the reaction (exhaled).

Erosion- marine organisms use carbon to make shells, (calcium carbonate), when they die the calcium carbonate is broken down, CO_2 forms and is returned to the atmosphere.

Combustion- when carbon returns to the atmosphere through combustion or burning of fossil fuels. *(Carbon is locked beneath the earth, dead organisms in sediment may gradually transform by heat and pressure into fossil fuels).*

Combustion of fossil fuels releases CO_2 , which is a greenhouse gas.





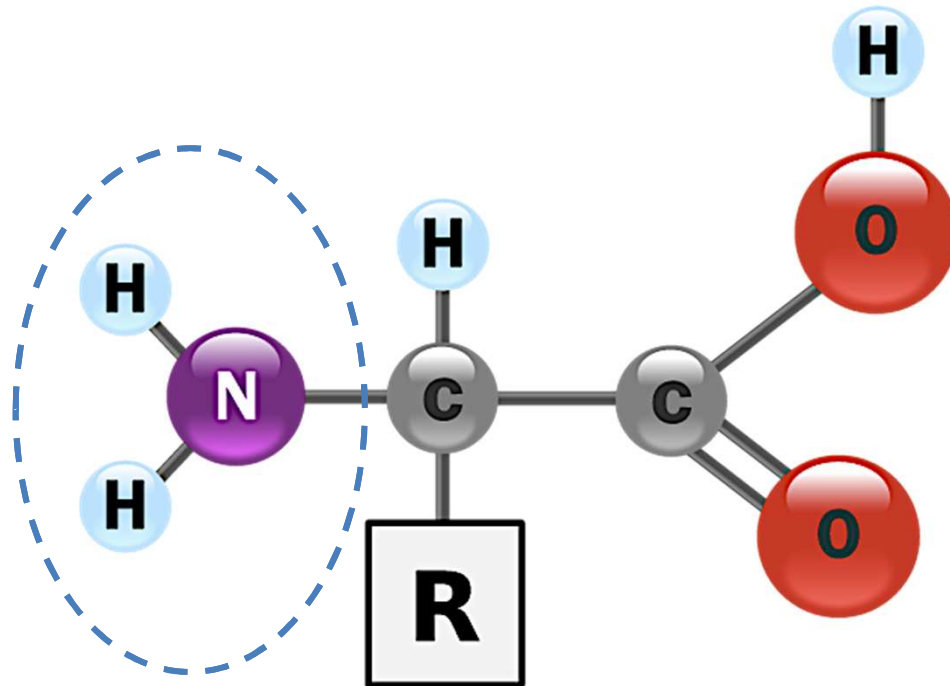
- Why do only plants have CO₂ going both into and out of them in this diagram?
- Where do fossil fuels come from?

The Nitrogen Cycle

Nitrogen makes up 78% of the atmosphere, however most organisms are unable to use it in this form. **Bacteria in the soil** are very important because they can use atmospheric nitrogen, and fix it into compounds usable by other living things.

Organisms need nitrogen to build proteins and nucleic acids.

Nitrogen compounds are found in amino acids (units of protein)



Nitrogen fixation- bacteria combine nitrogen from the atmosphere with hydrogen to make ammonia (NH_3) in the soil.

Ammonification- production of ammonia by bacteria during the decay of organic matter.

Nitrification- production of nitrates and nitrites from ammonia. Bacteria are responsible for nitrification. Plants can use nitrates and nitrites to make proteins.

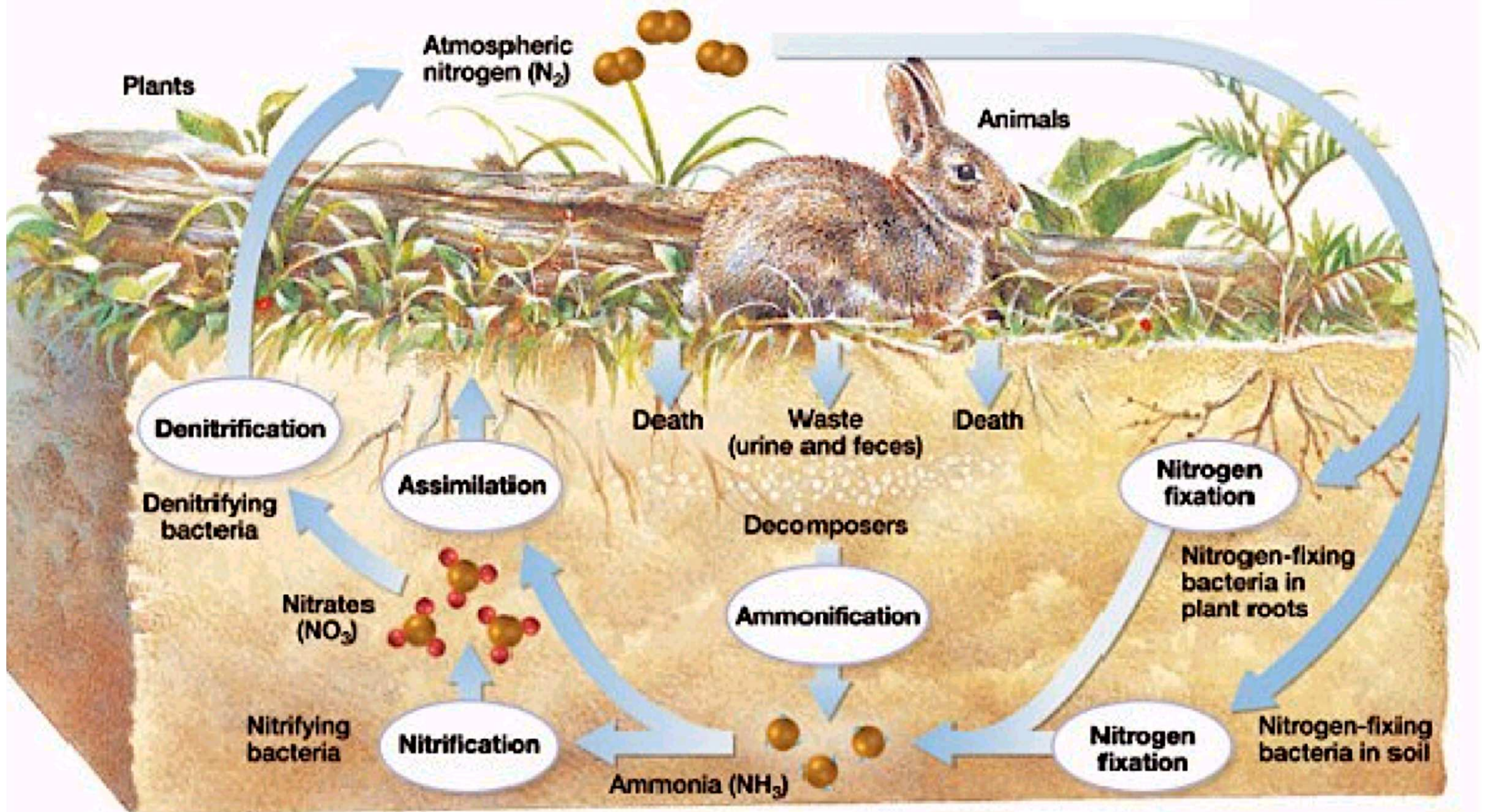
Assimilation- absorption of nitrogen into organic compounds by plants (absorbed through roots).

Denitrification- conversion of nitrate to nitrogen gas, which is released back into the atmosphere.



Rhizobia are a species of bacteria that have a symbiotic with certain types of plants. They live in their roots and fix nitrogen into ammonia.





The Nitrogen Cycle

The Phosphorus Cycle

Phosphorus is necessary to build DNA molecules, as well as RNA.

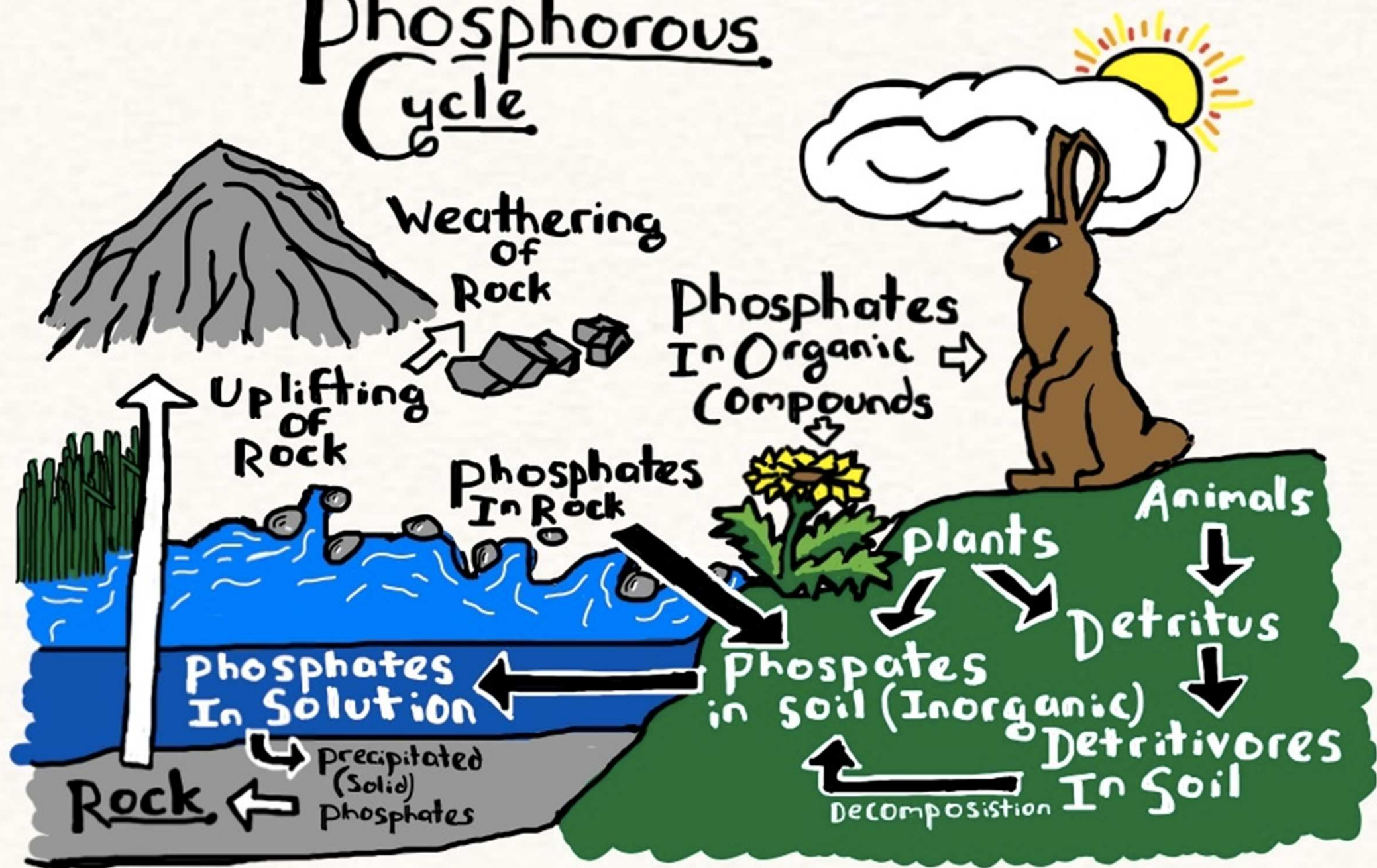
Though phosphorus is necessary, it is not very common in the biosphere and does not enter the atmosphere- it is locked into the land or water.

Phosphorous is found in rocks and minerals in the soil. As these rocks gradually wear down, the phosphorus is released into the soil or water.

When organisms die, decomposers in the soil or water break them down into raw elements, including phosphorus, which can then be reused.

When plants absorb phosphate from the soil, it can be passed along from the plants/producers to the other trophic levels.

Phosphorous Cycle



Nutrient Limitation

The amount of available nutrients directly affects the primary productivity of an ecosystem.

-(Primary productivity= rate at which producers produce energy).

Sometimes an ecosystem is limited by a single nutrient that is very scarce or cycles slowly. This is called the **limiting nutrient**.

Fertilizers are so popular because they contain 3 important nutrients: nitrogen, phosphorus and potassium.

By using fertilizers, farmers can ensure that there are enough nutrients and their crops grow to their fullest potential.



Left Side Activity

- Explain the importance of the following
 - Water Cycle
 - Nitrogen Cycle
 - Carbon Cycle
 - Phosphorus Cycle