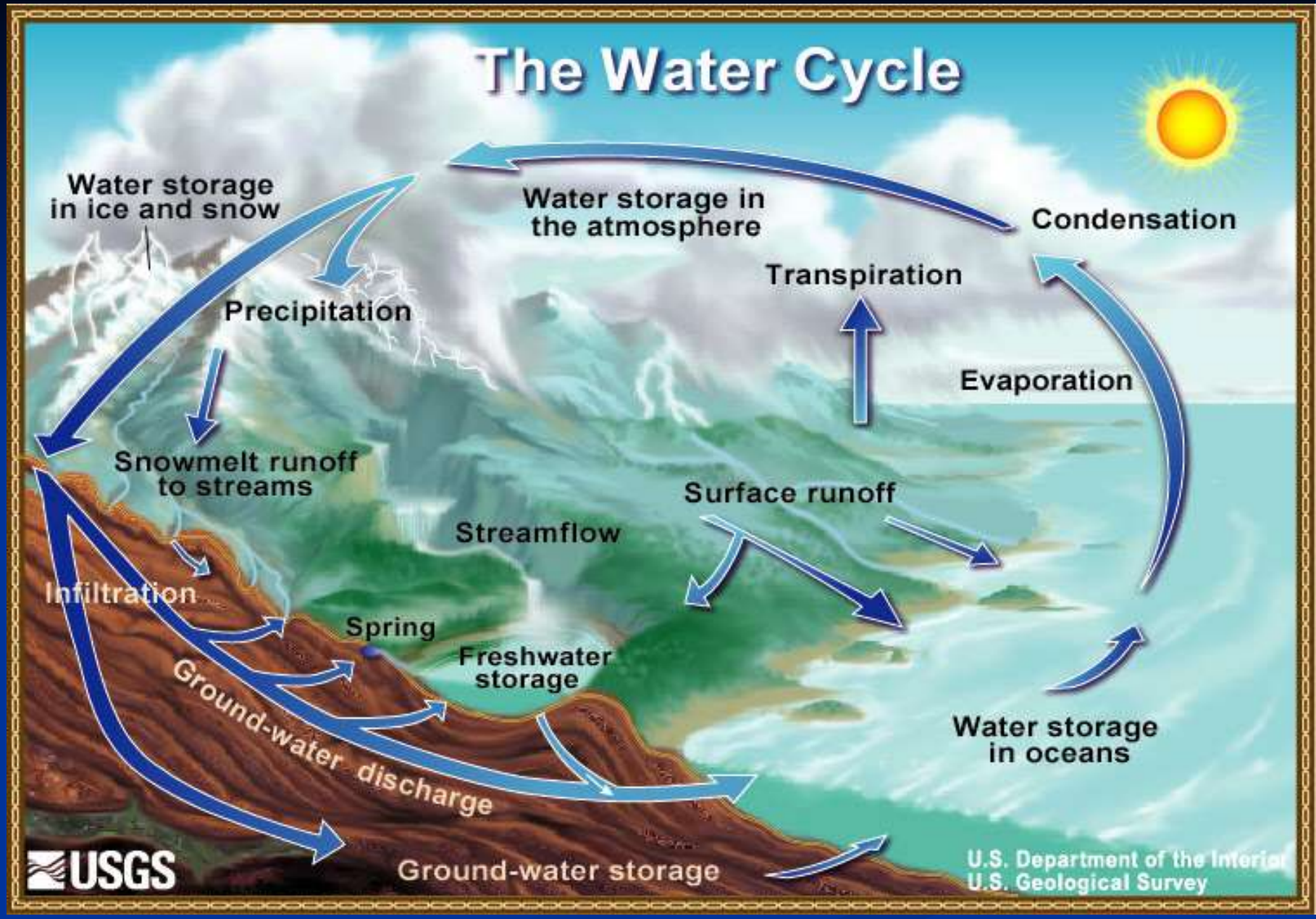
The Chemical Cycles

- Unlike energy, matter can be recycled. The Water, Carbon, and Nitrogen Cycles are the three main ways matter is recycled in the environment.

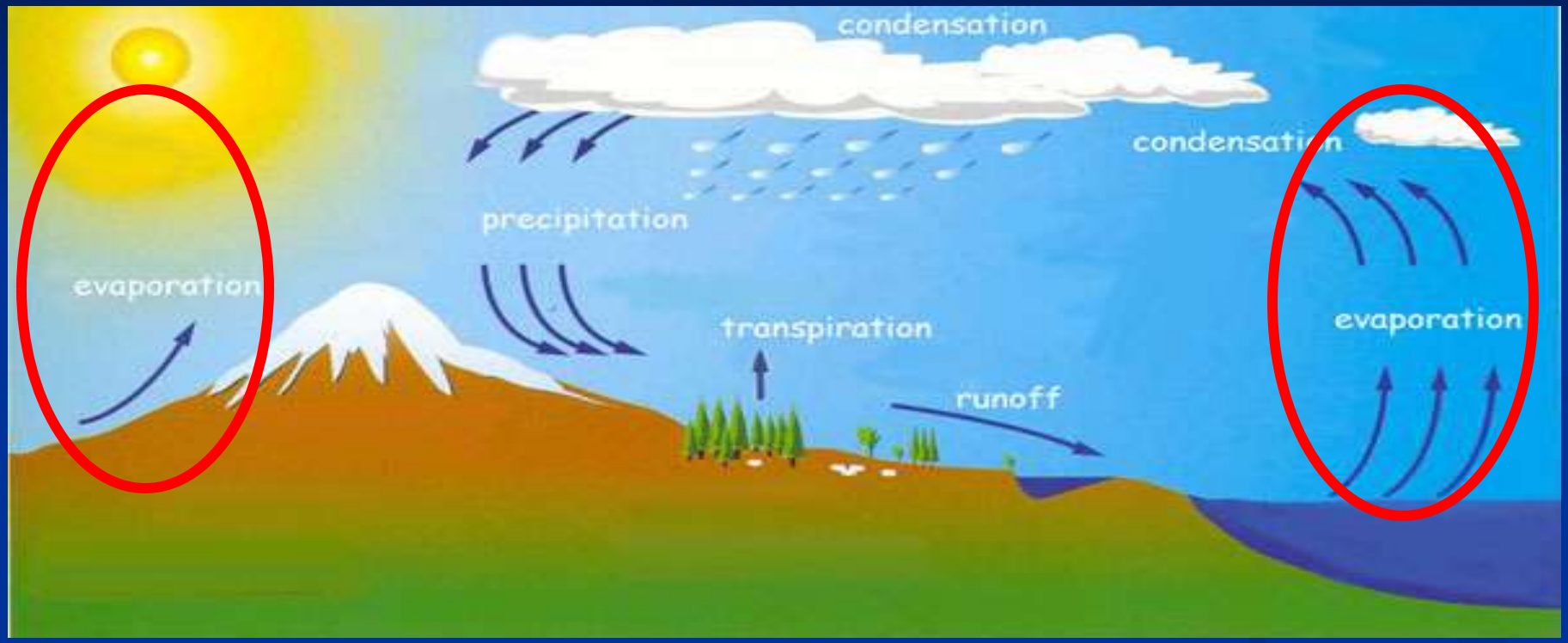
The Water Cycle

By Christine Ward

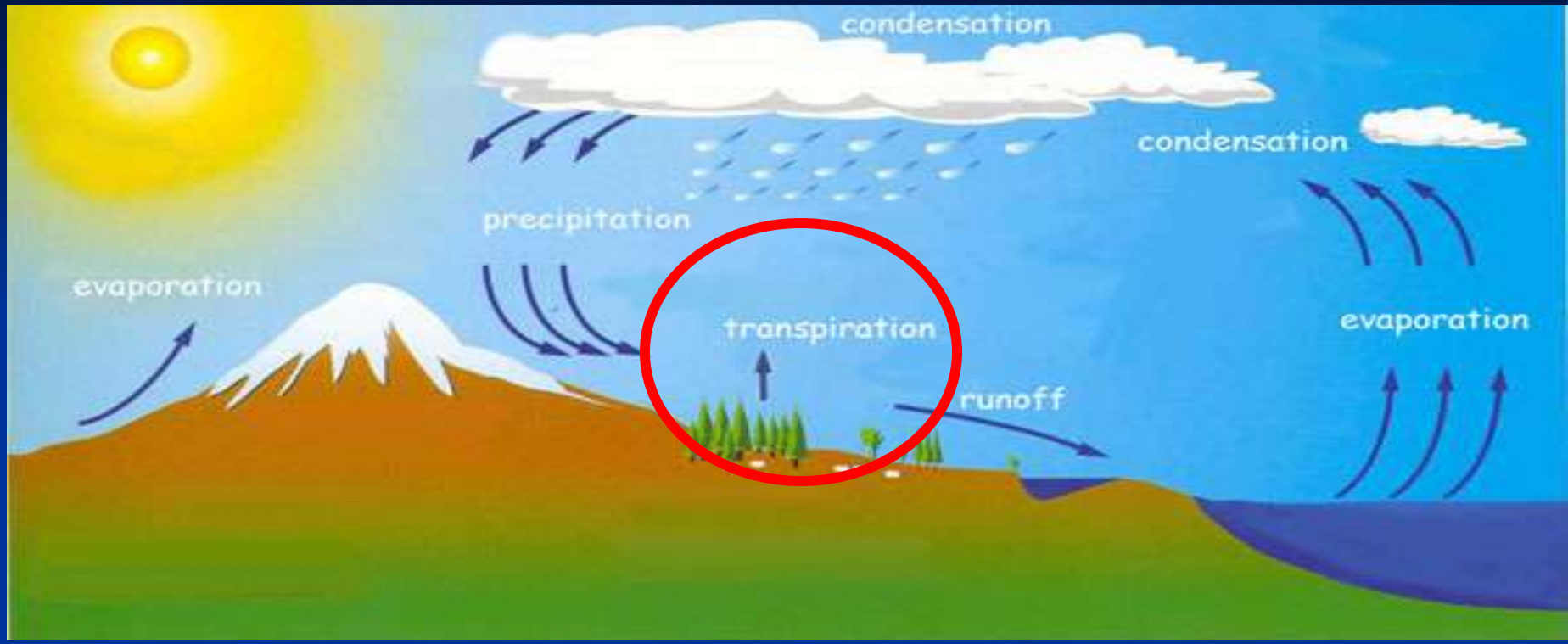
Water never leaves the Earth. It is constantly being cycled through the atmosphere, ocean, and land. This process, known as the **water cycle**, is driven by energy from the sun. The water cycle is crucial to the existence of life on our planet.


The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Transpiration
Precipitation
Evaporation
Snowmelt runoff to streams
Surface runoff
Streamflow
Infiltration
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
USGS
U.S. Department of the Interior
U.S. Geological Survey

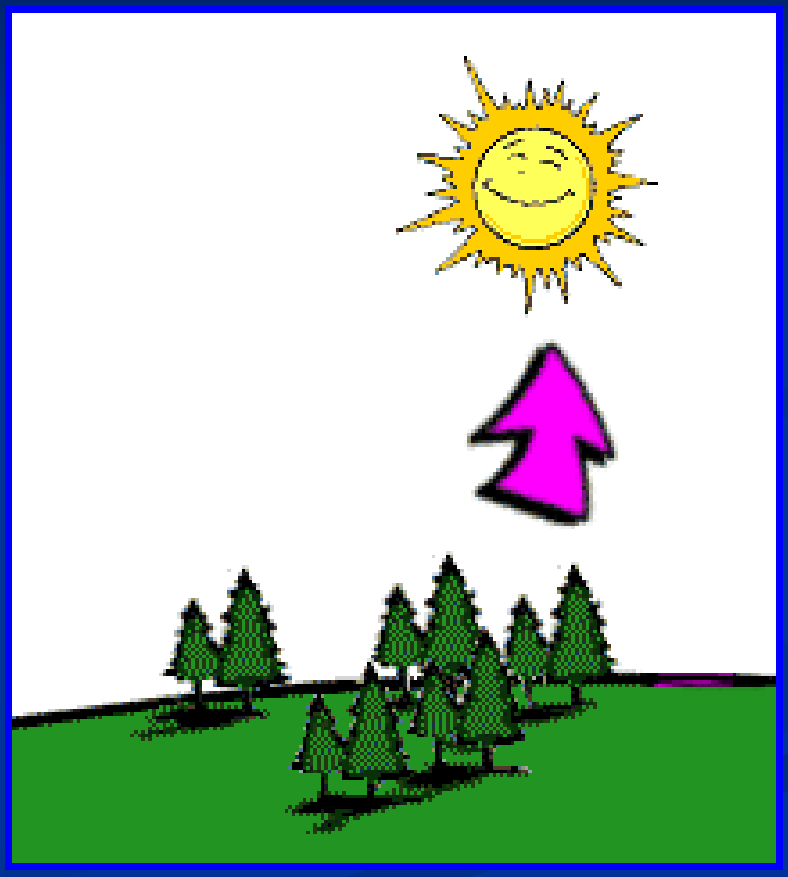
The Water Cycle

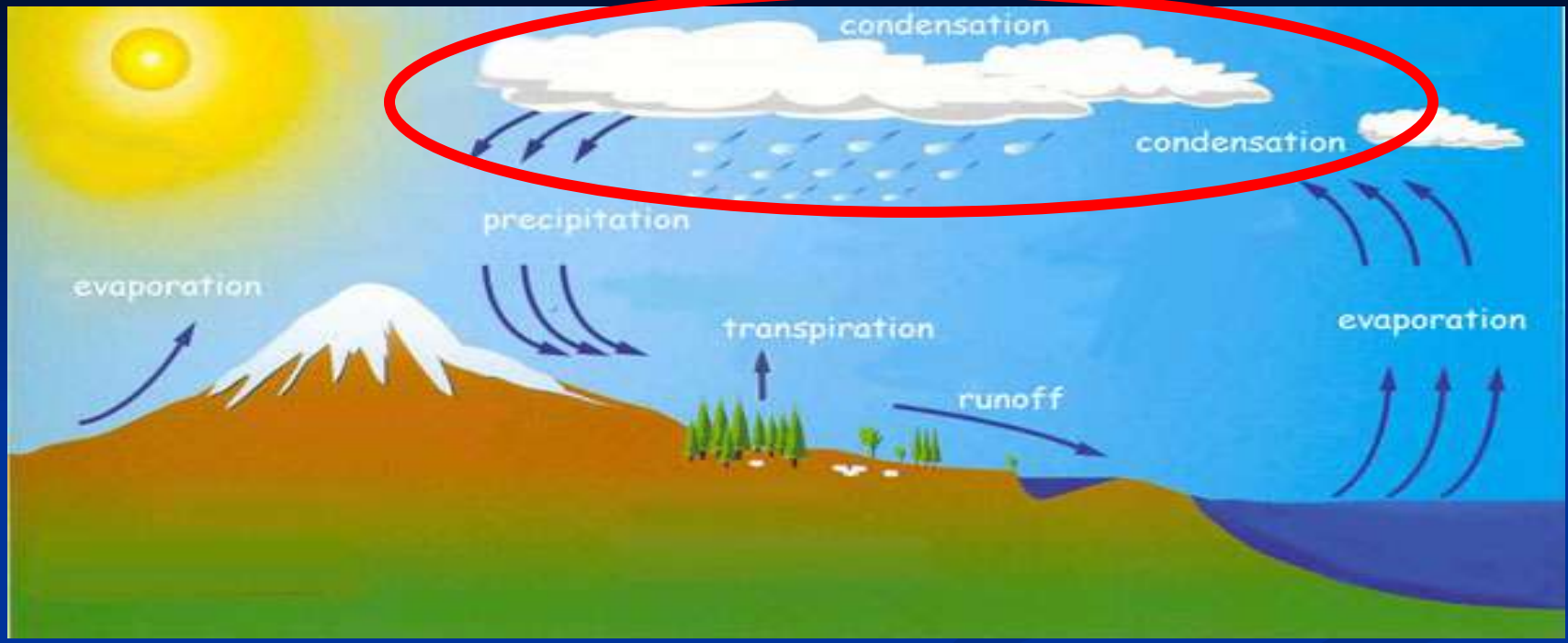


During part of the water cycle, the sun heats up liquid water and changes it to a gas by the process of evaporation. Water that evaporates from Earth's oceans, lakes, rivers, and moist soil rises up into the atmosphere.

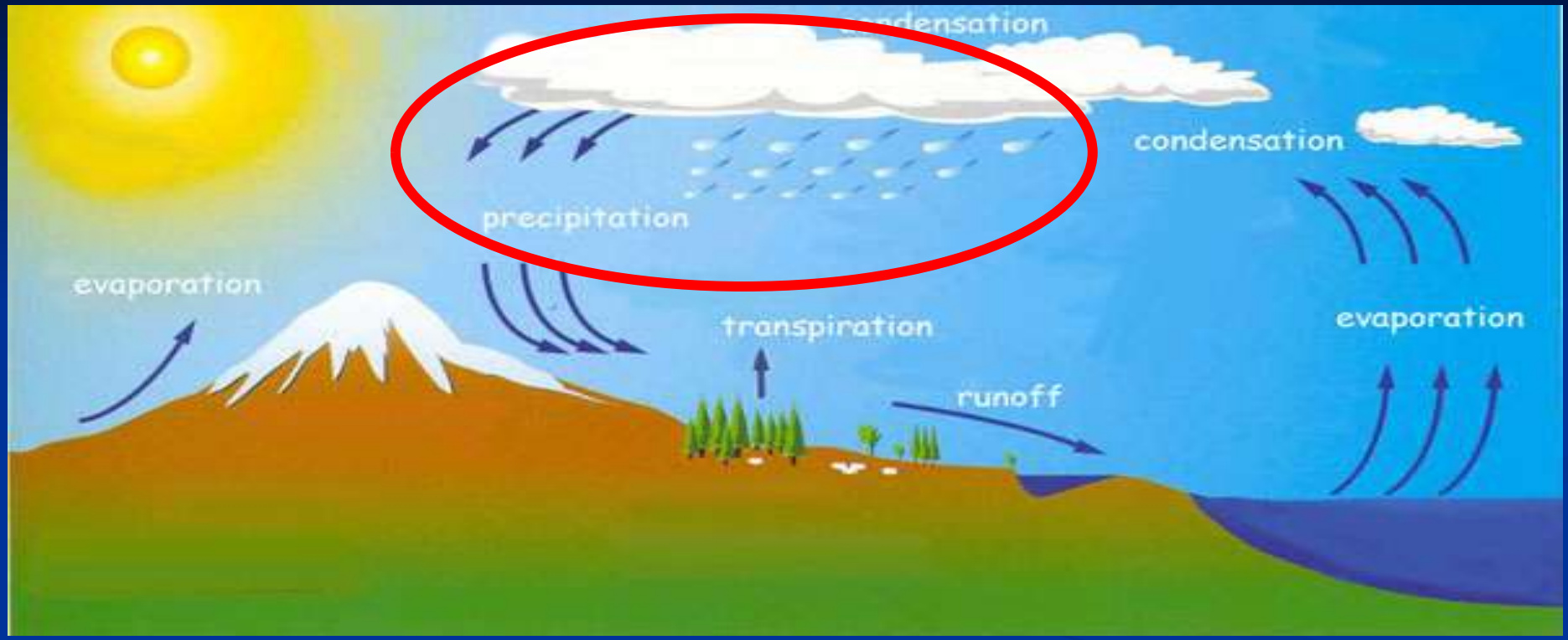

condensation
condensation
precipitation
evaporation
transpiration
runoff
evaporation

The process of evaporation from plants is called transpiration. (In other words, it's like plants sweating.)

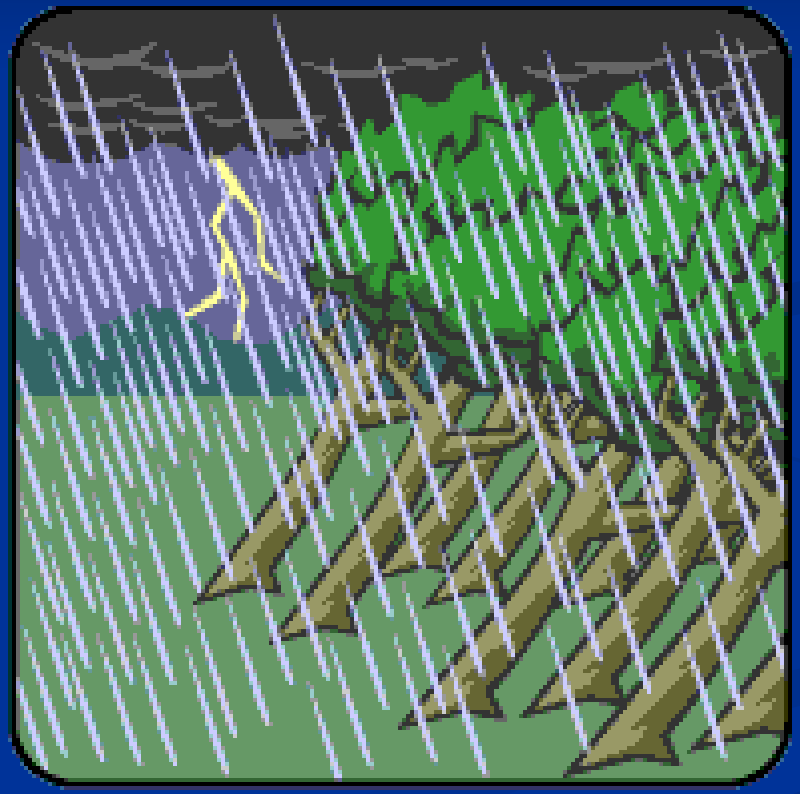


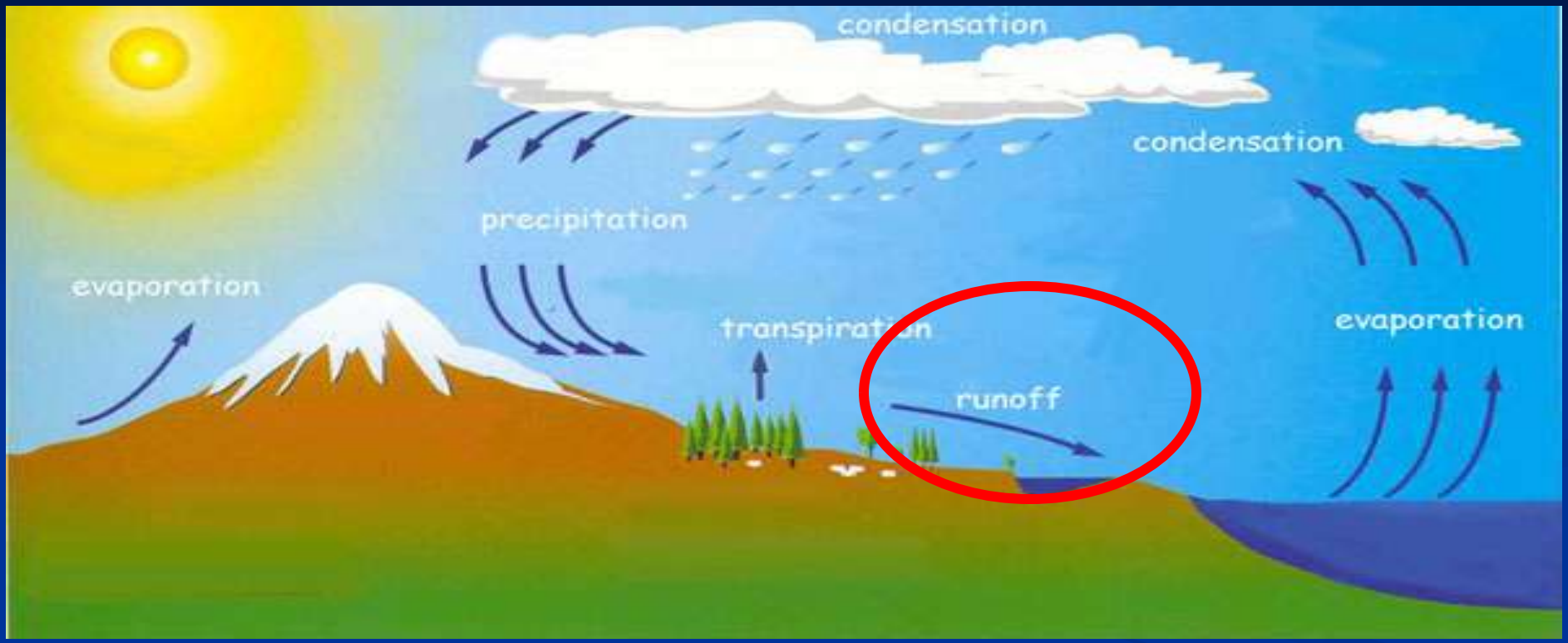

condensation
condensation
precipitation
evaporation
transpiration
runoff
evaporation

As water (in the form of gas) rises higher in the atmosphere, it starts to cool and become a liquid again. This process is called condensation. When a large amount of water vapor condenses, it results in the formation of clouds.

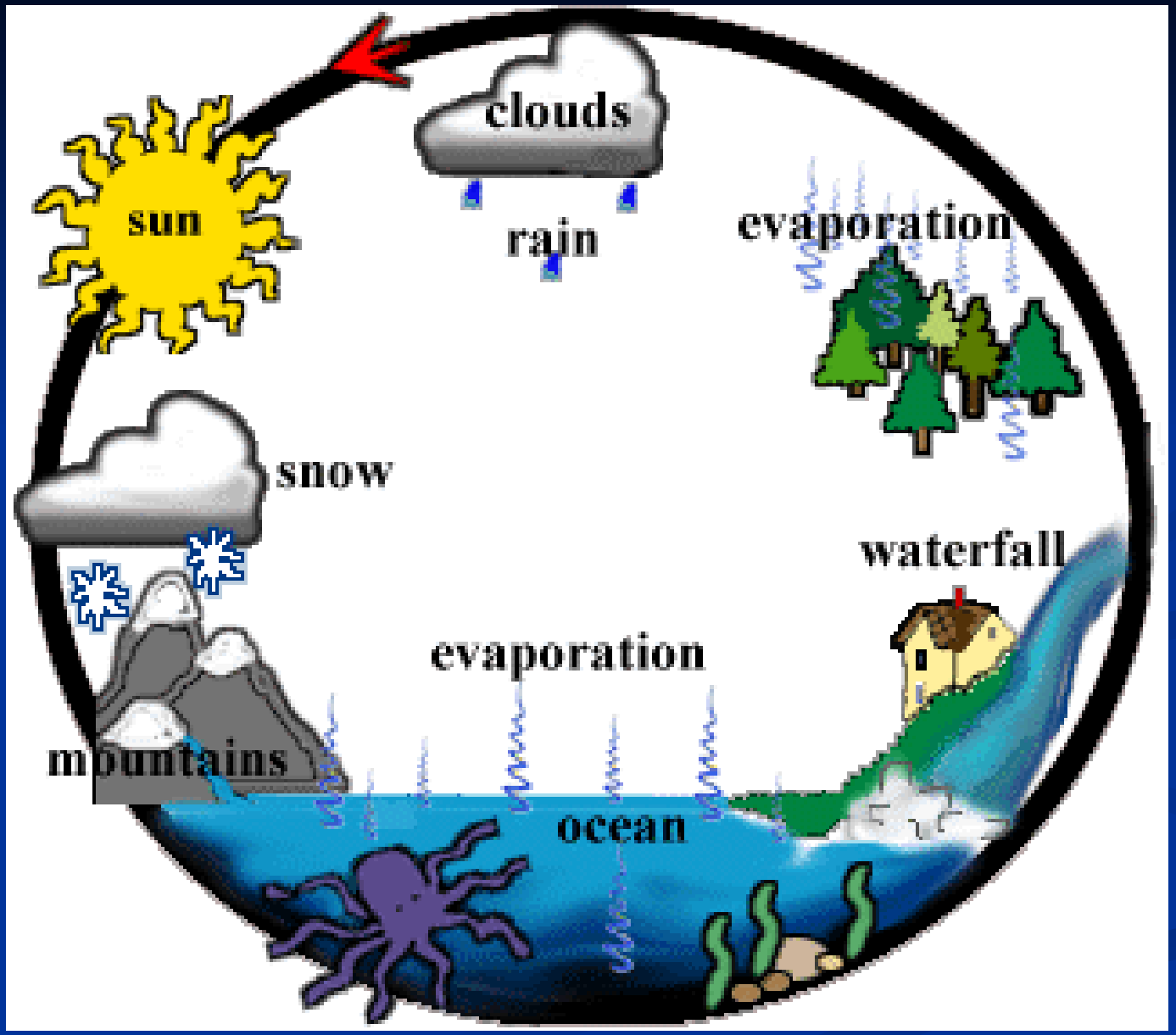

condensation
precipitation
condensation
evaporation
transpiration
runoff
evaporation

When the water in the clouds gets too heavy, the water falls back to the earth. This is called precipitation.




condensation
condensation
precipitation
evaporation
transpiration
runoff
evaporation

When rain falls on the land, some of the water is absorbed into the ground forming pockets of water called groundwater. Most groundwater eventually returns to the ocean. Other precipitation runs directly into streams or rivers. Water that collects in rivers, streams, and oceans is called runoff.


clouds
sun
rain
evaporation
snow
waterfall
evaporation
mountains
ocean

The Nitrogen Cycle

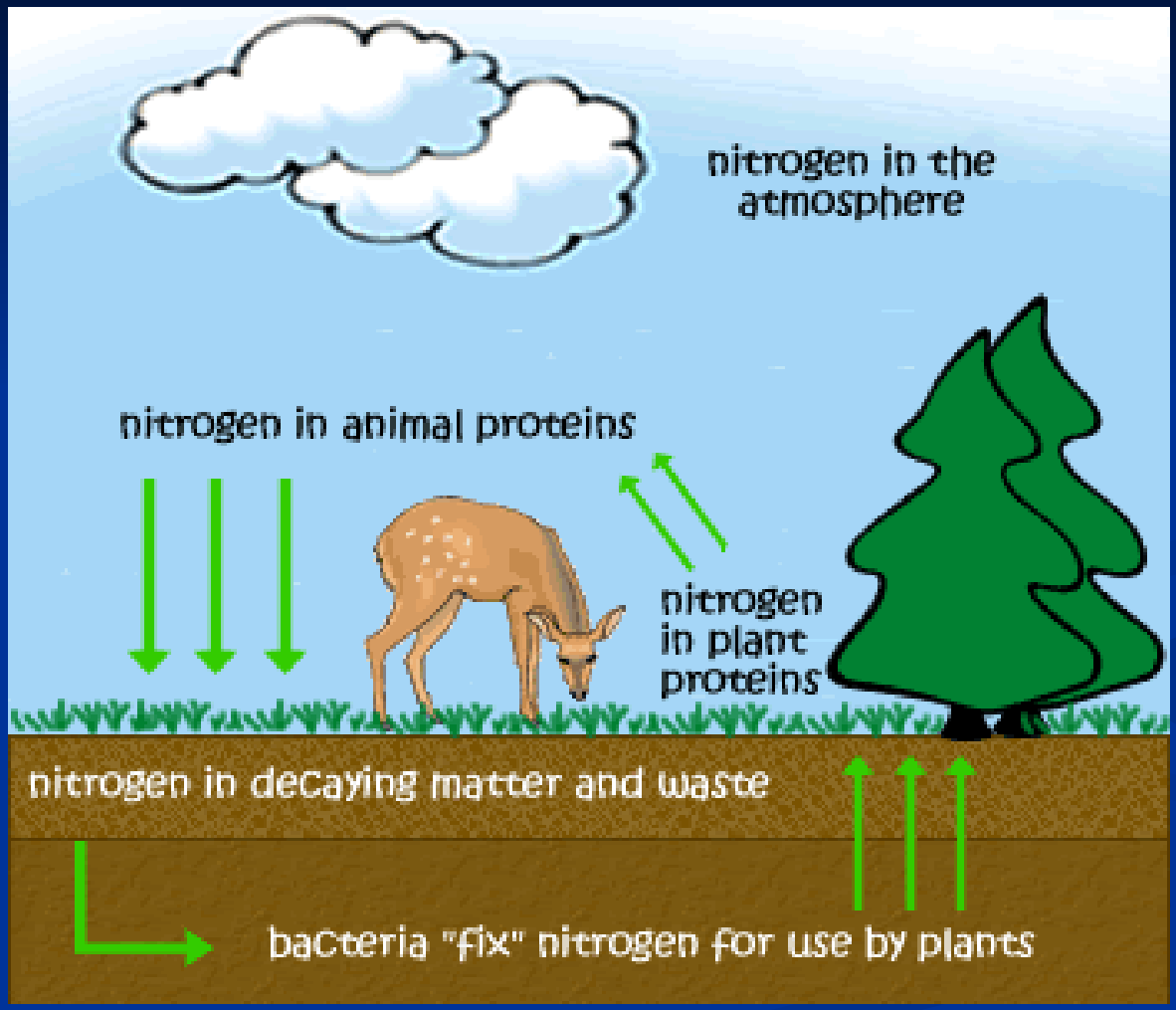
- Organisms require nitrogen to produce amino acids.

The Nitrogen Cycle

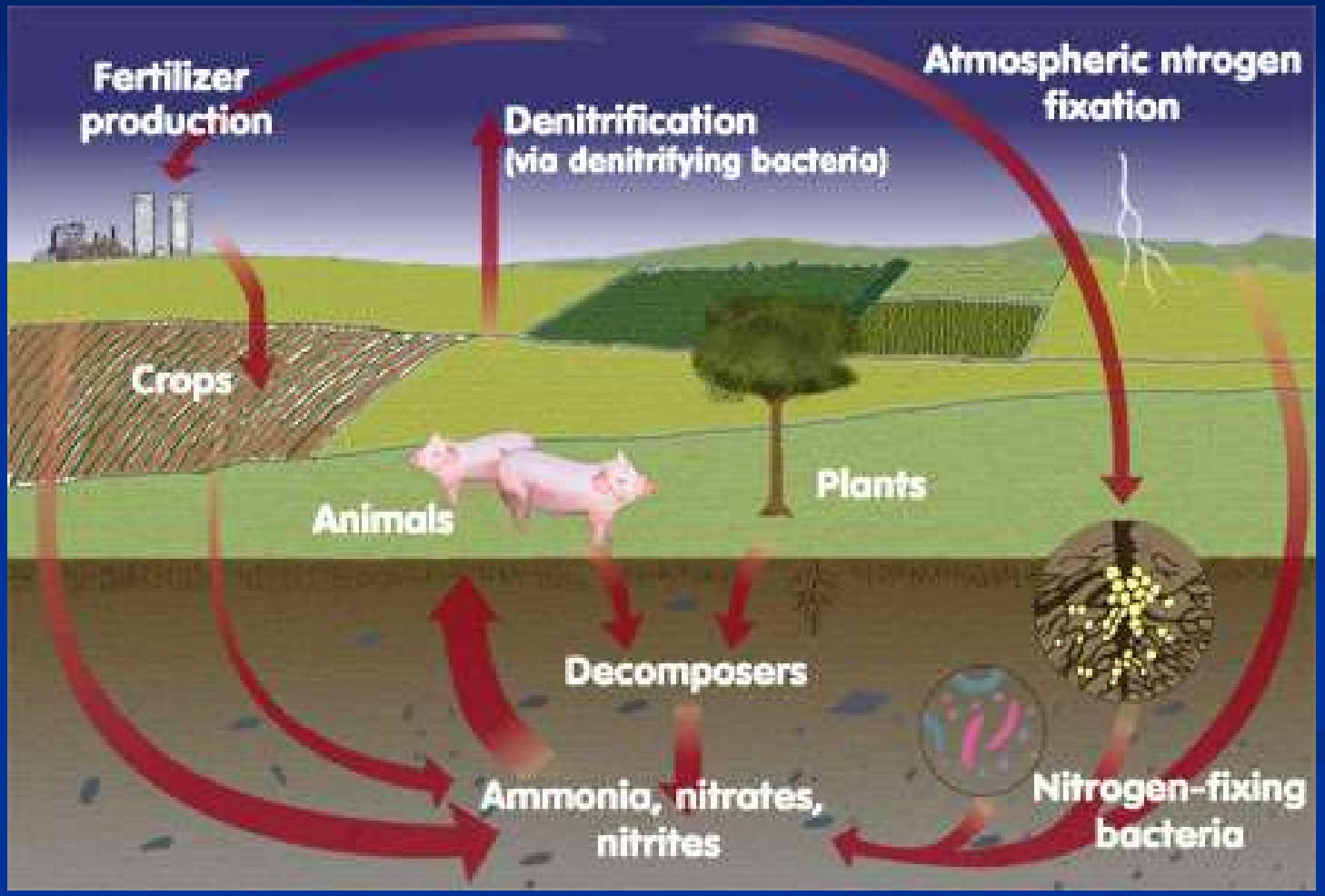
- Nitrogen makes up seventy-eight percent of the atmosphere, but most organisms can not use this form of nitrogen, and must have the fixed form.

The Nitrogen Cycle

- The nitrogen cycle produces the fixed form of nitrogen these organisms need.


nitrogen in the atmosphere
nitrogen in animal proteins
nitrogen in plant proteins
nitrogen in decaying matter and waste
bacteria "fix" nitrogen for use by plants

The Nitrogen Cycle



The Nitrogen Cycle
Steps

- Step 1: **Nitrogen Fixation.** A special type of bacteria called nitrogen fixing bacteria take in atmospheric nitrogen and produce ammonia (NH_3).

The Nitrogen Cycle
Steps

- Step 2: **Nitrification**. Other bacteria use this ammonia to produce nitrates and nitrites, which are nitrogen and oxygen containing compounds.

- Step 3: **Assimilation.** The nitrates and nitrites are used by plants to make amino acids which are then used to make plant proteins.

- Step 4: **Ammonification.** Plants are consumed by other organisms which use the plant amino acids to make their own.

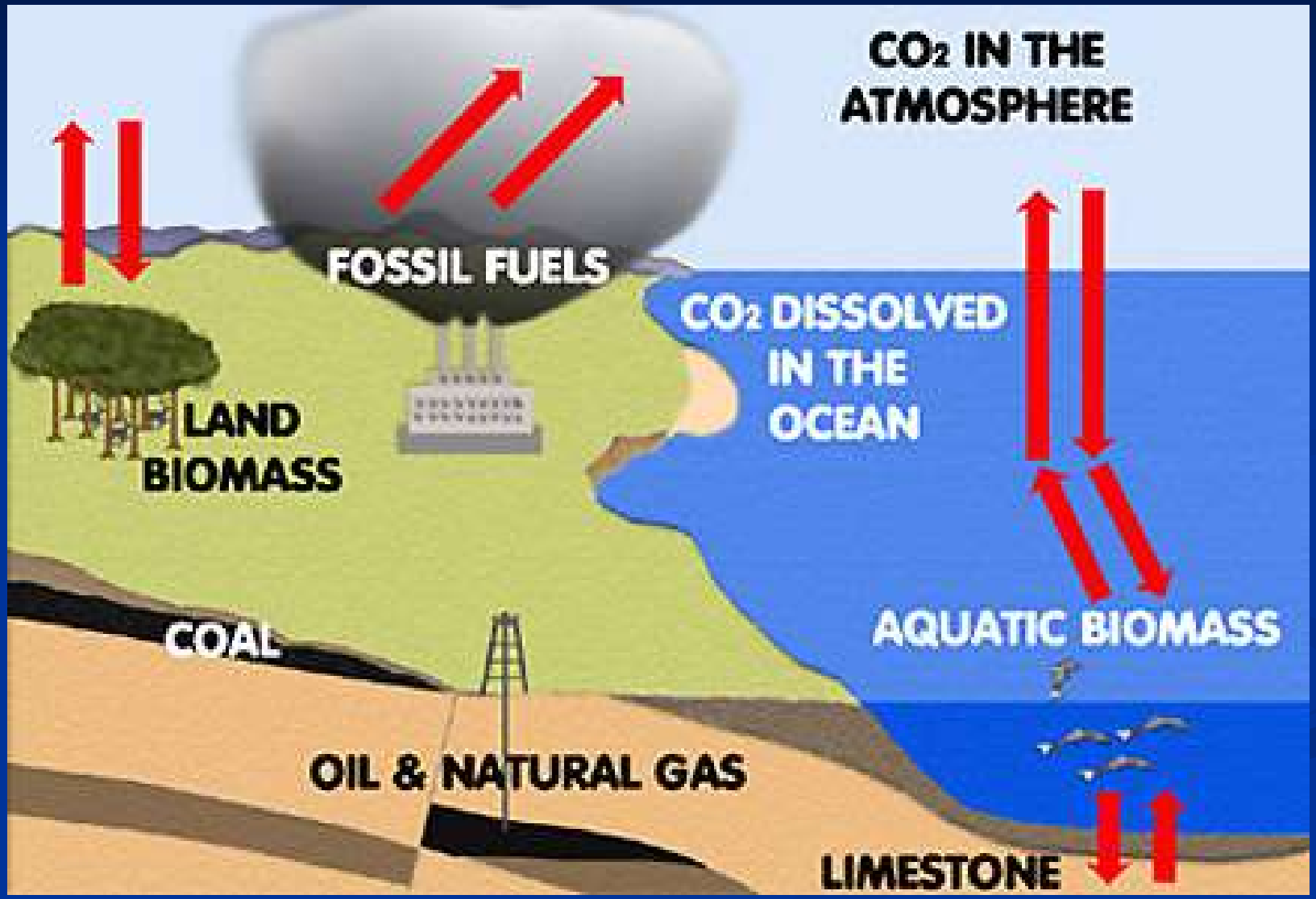
- Step 5: **Denitrification.** Decomposers convert the nitrogen found in other organisms into ammonia and return it to the soil.

- A few of these type of bacteria return a small amount of this nitrogen to the atmosphere during **denitrification**.

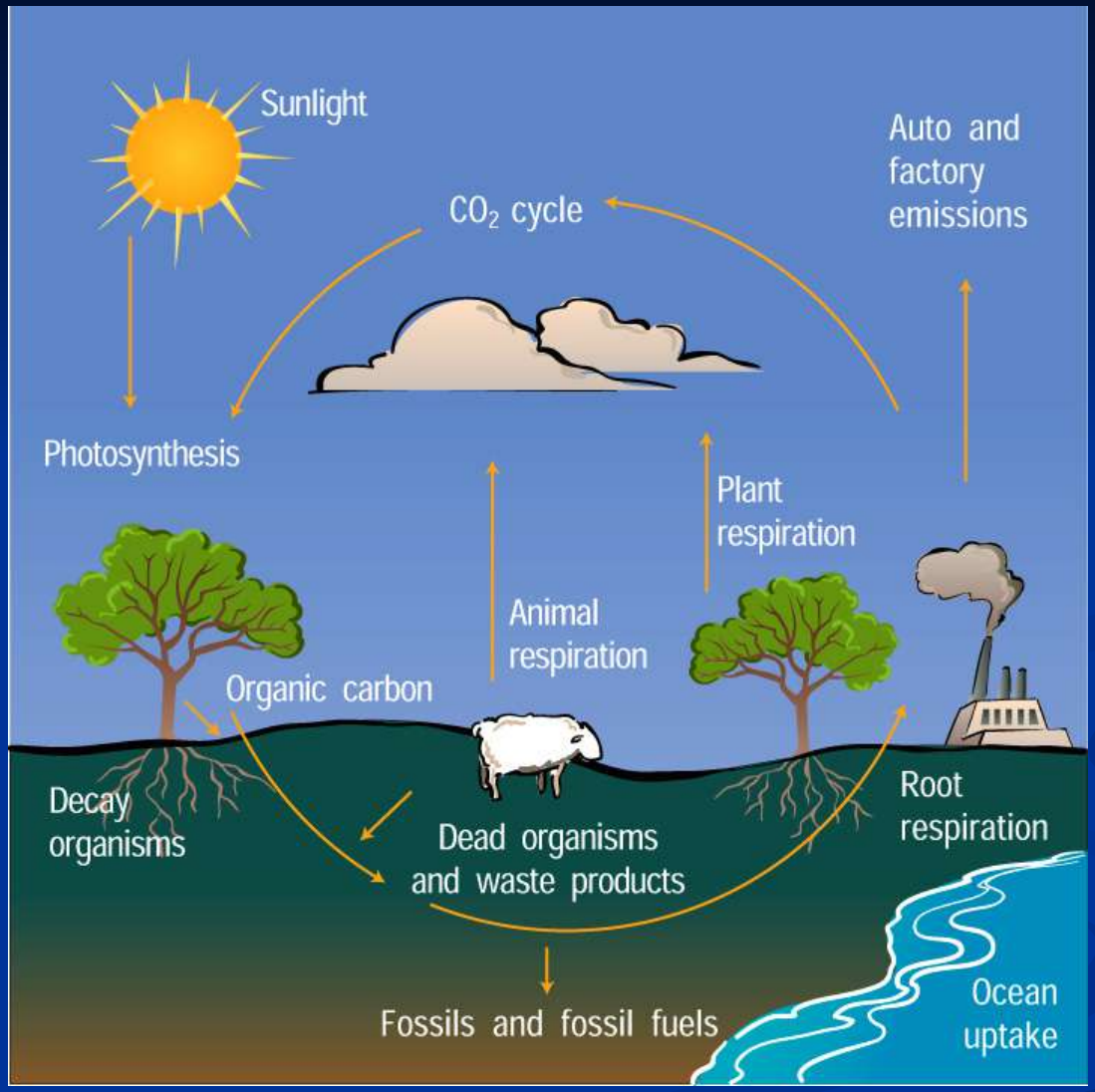
The Carbon Cycle

- The Carbon Cycle describes the flow of carbon between living organisms and the non-living environment.
- Carbon cycles through the environment in the form of a gas, carbon dioxide (CO_2). The atmosphere of Earth contains .04 percent CO_2.

The Carbon Cycle



- Living organisms provide two important steps in the carbon cycle:
- Plants absorb CO_2 from the atmosphere to use during photosynthesis.
- Other organisms release CO_2 into the air during respiration.


Sunlight
CO_2 cycle
Auto and factory emissions
Photosynthesis
Plant respiration
Animal respiration
Organic carbon
Decay organisms
Dead organisms and waste products
Root respiration
Fossils and fossil fuels
Ocean uptake

- In addition, there are several important non-organic storage areas of carbon in the environment:
- A large portion of the Carbon on the Earth is stored in rocks.
- The Earth's oceans hold a large amount of CO_2 because it easily dissolves in water.
- Coal, oil, and limestone store carbon that once formed ancient organisms. Burning fossil fuels, like coal and oil, will release CO_2 into the atmosphere.