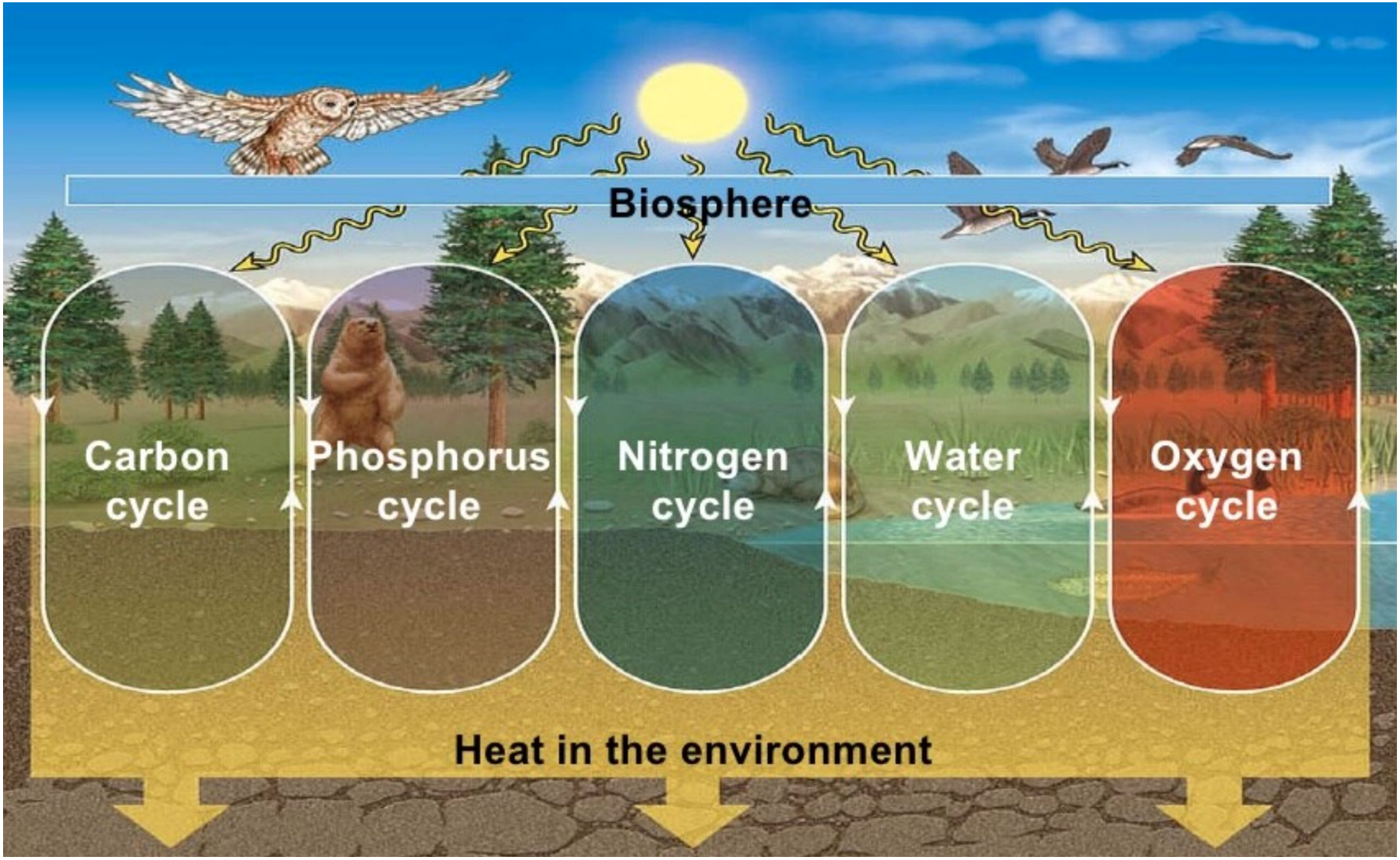
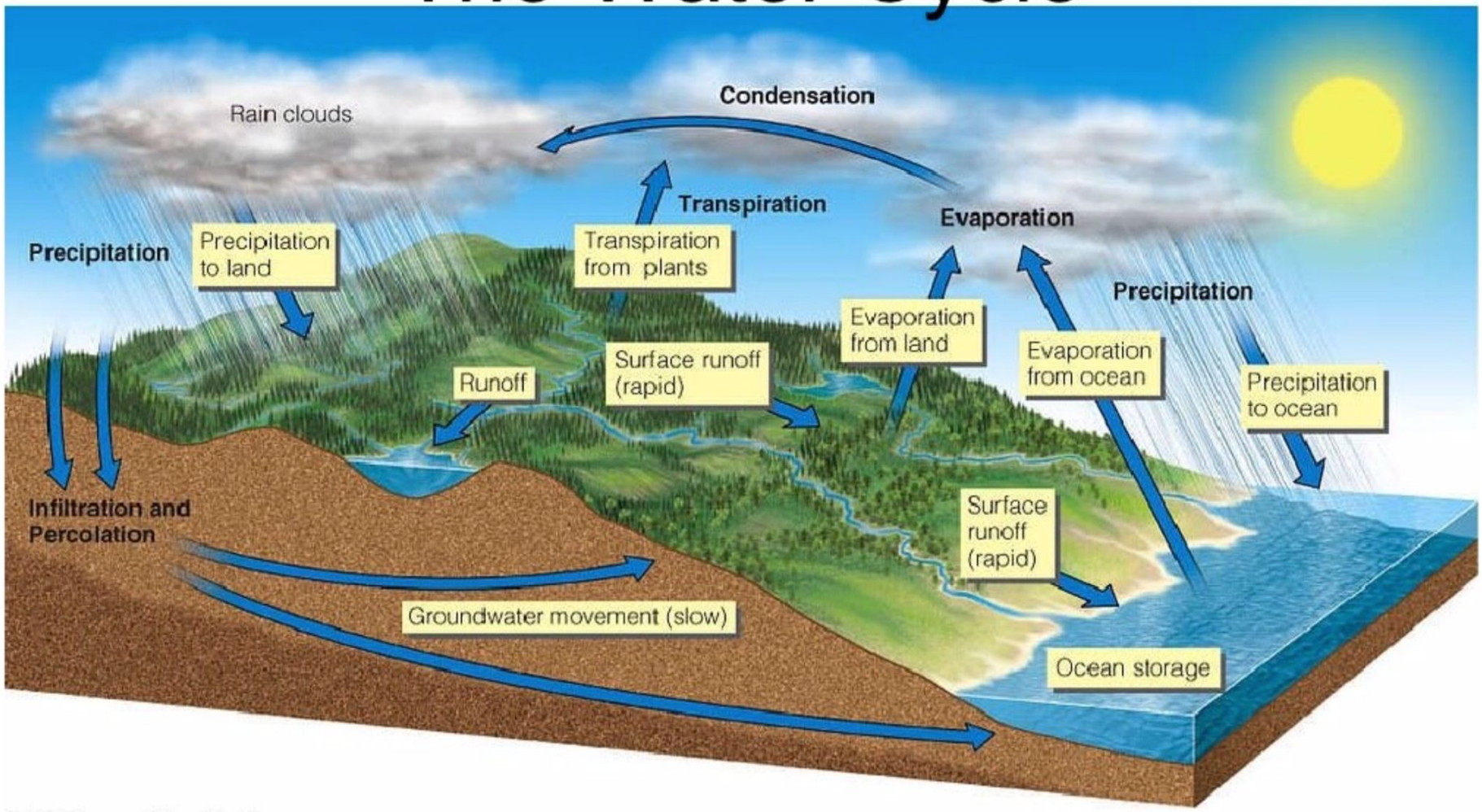
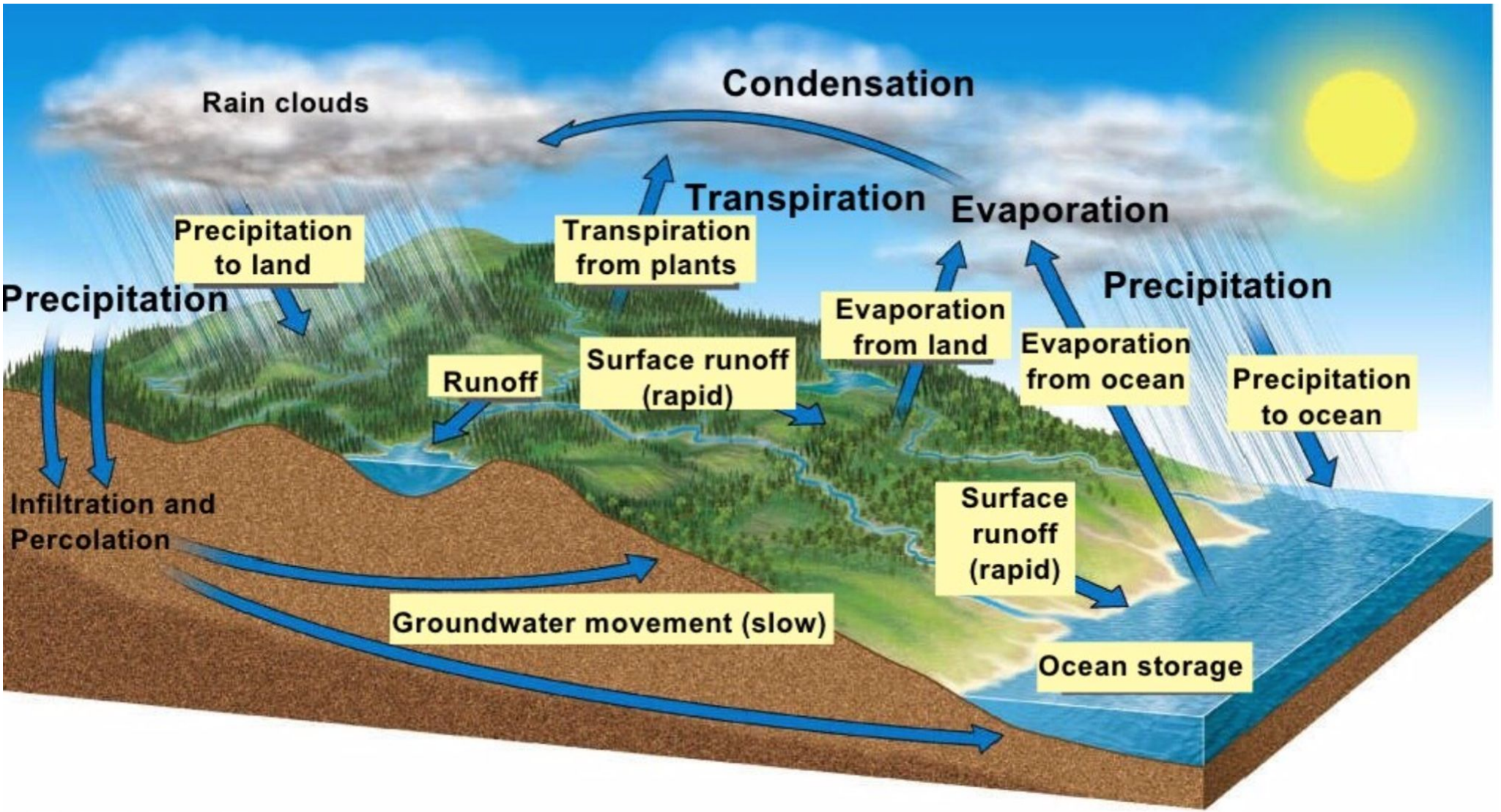

Biosphere
Carbon cycle
Phosphorus cycle
Nitrogen cycle
Water cycle
Oxygen cycle
Heat in the environment

MATTER CYCLING IN ECOSYSTEMS

- Nutrient Cycles: Global Recycling
  - Global Cycles recycle nutrients through the earth's air, land, water, and living organisms.
  - Nutrients are the elements and compounds that organisms need to live, grow, and reproduce.
  - Biogeochemical cycles move these substances through air, water, soil, rock and living organisms.

The Water Cycle




Rain clouds
Condensation
Transpiration
Evaporation
Precipitation to land
Transpiration from plants
Precipitation
Evaporation from land
Precipitation
Evaporation from ocean
Runoff
Surface runoff (rapid)
Precipitation to ocean
Infiltration and Percolation
Surface runoff (rapid)
Groundwater movement (slow)
Ocean storage

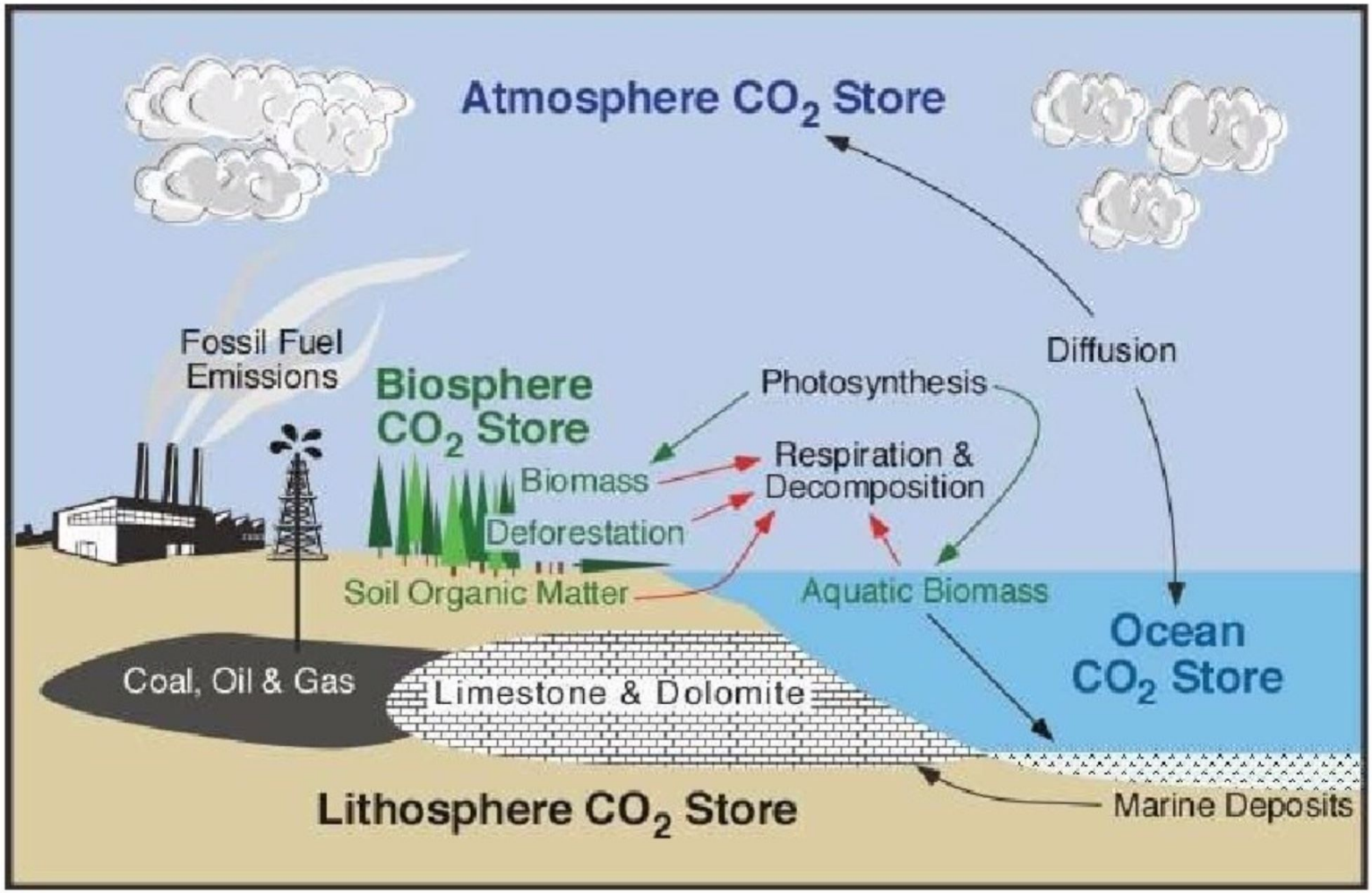
Water's Unique Properties

- There are strong forces of attraction between molecules of water.
- Water exists as a liquid over a wide temperature range.
- Liquid water changes temperature slowly.
- It takes a large amount of energy for water to evaporate.
- Liquid water can dissolve a variety of compounds.
- Water expands when it freezes.

Effects of Human Activities on Water Cycle

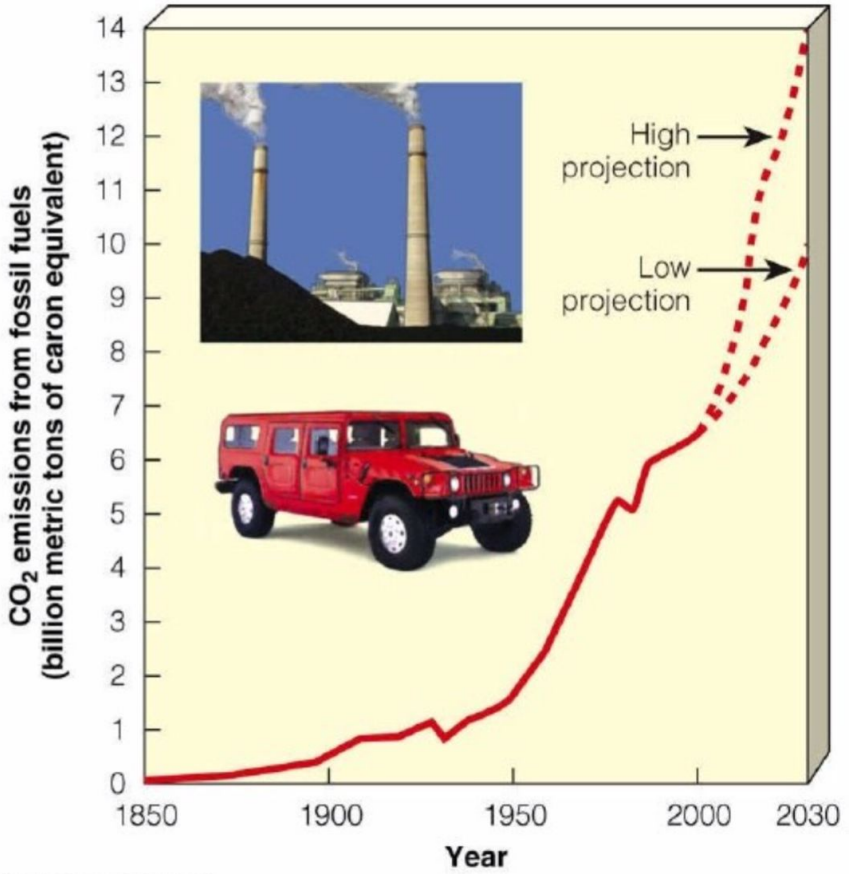
- We alter the water cycle by:
  - Withdrawing large amounts of freshwater.
  - Clearing vegetation and eroding soils.
  - Polluting surface and underground water.
  - Contributing to climate change.

CARBON CYCLE

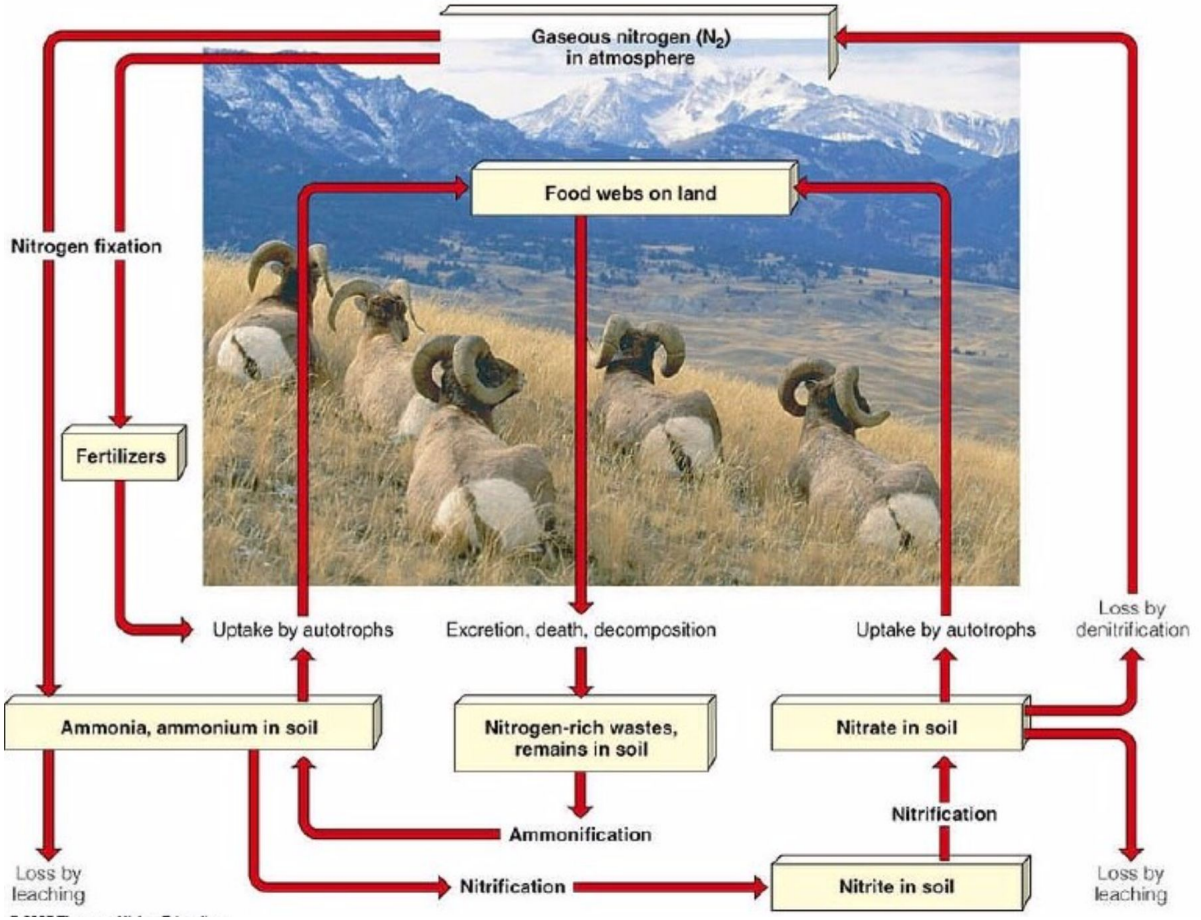


Effects of Human Activities on Carbon Cycle

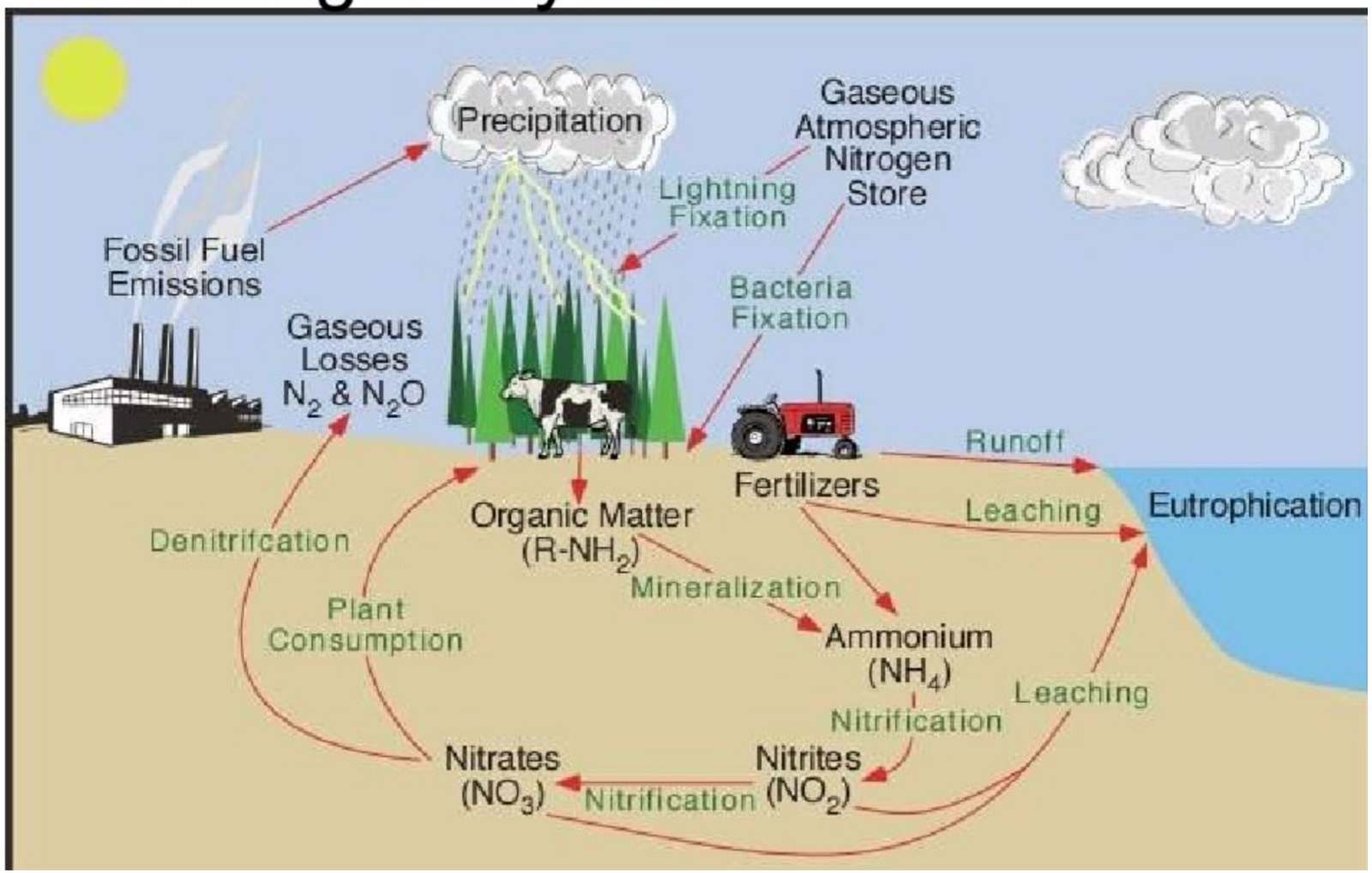
- We alter the carbon cycle by adding excess CO_2 to the atmosphere through:
  - Burning fossil fuels.
  - Clearing vegetation faster than it is replaced.



The Nitrogen Cycle: Bacteria in Action



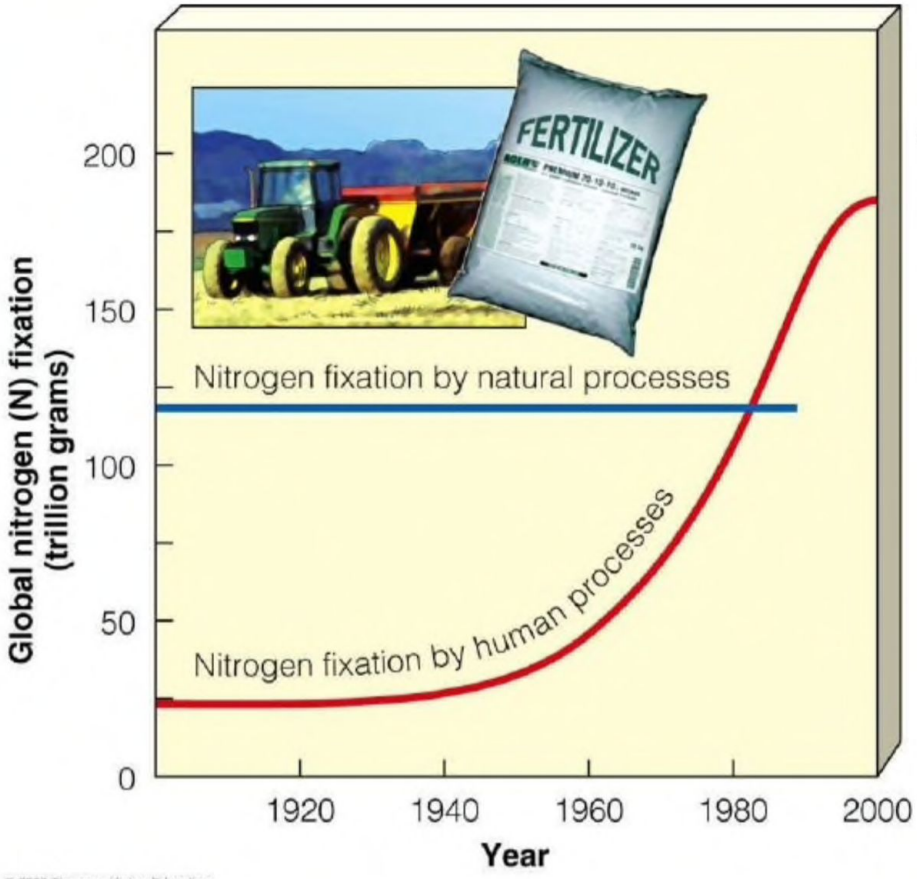
Nitrogen Cycle



Effects of Human Activities on the Nitrogen Cycle

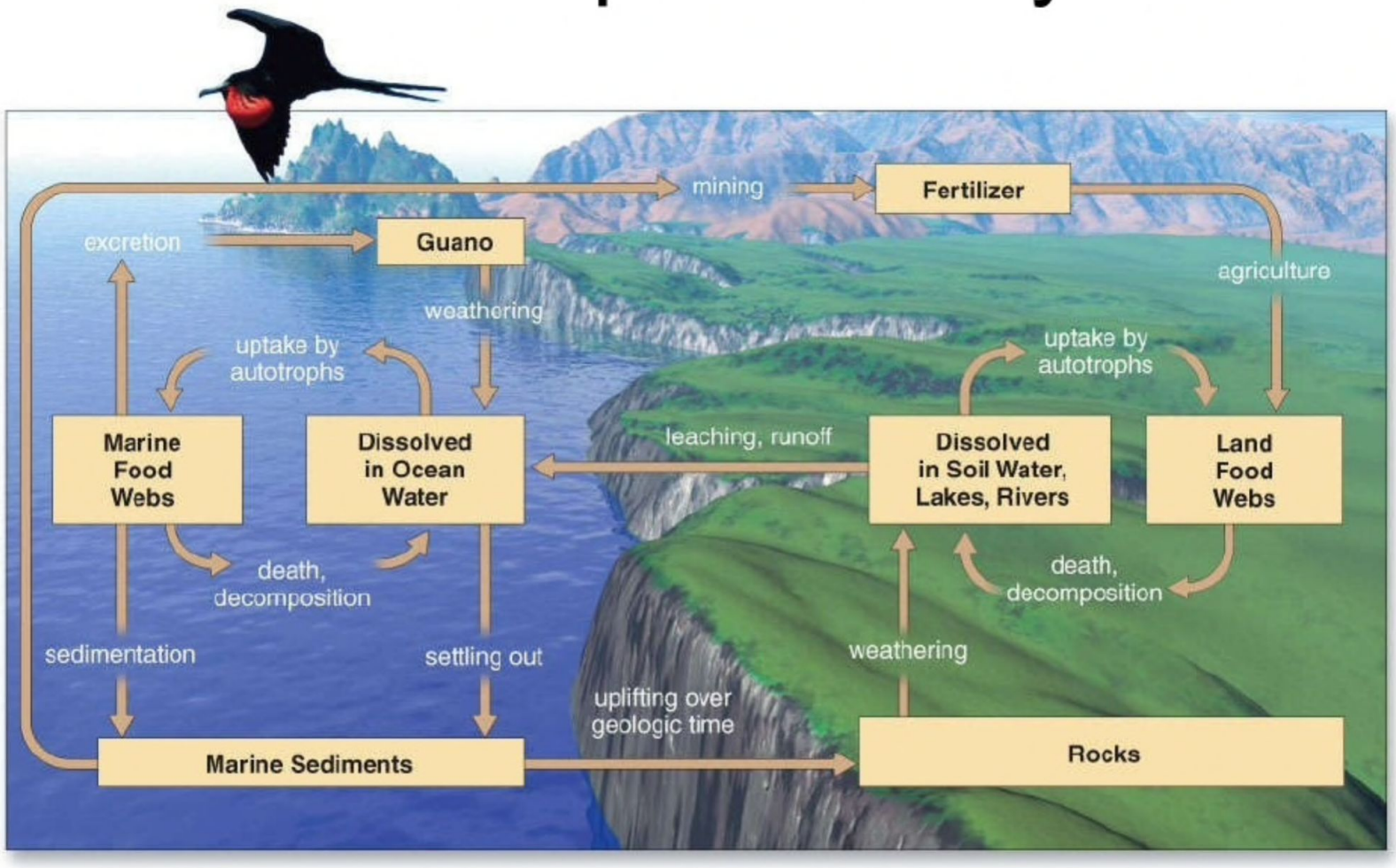
- We alter the nitrogen cycle by:
  - Adding gases that contribute to acid rain.
  - Adding nitrous oxide to the atmosphere through farming practices which can warm the atmosphere and deplete ozone.
  - Contaminating ground water from nitrate ions in inorganic fertilizers.
  - Releasing nitrogen into the troposphere through deforestation.

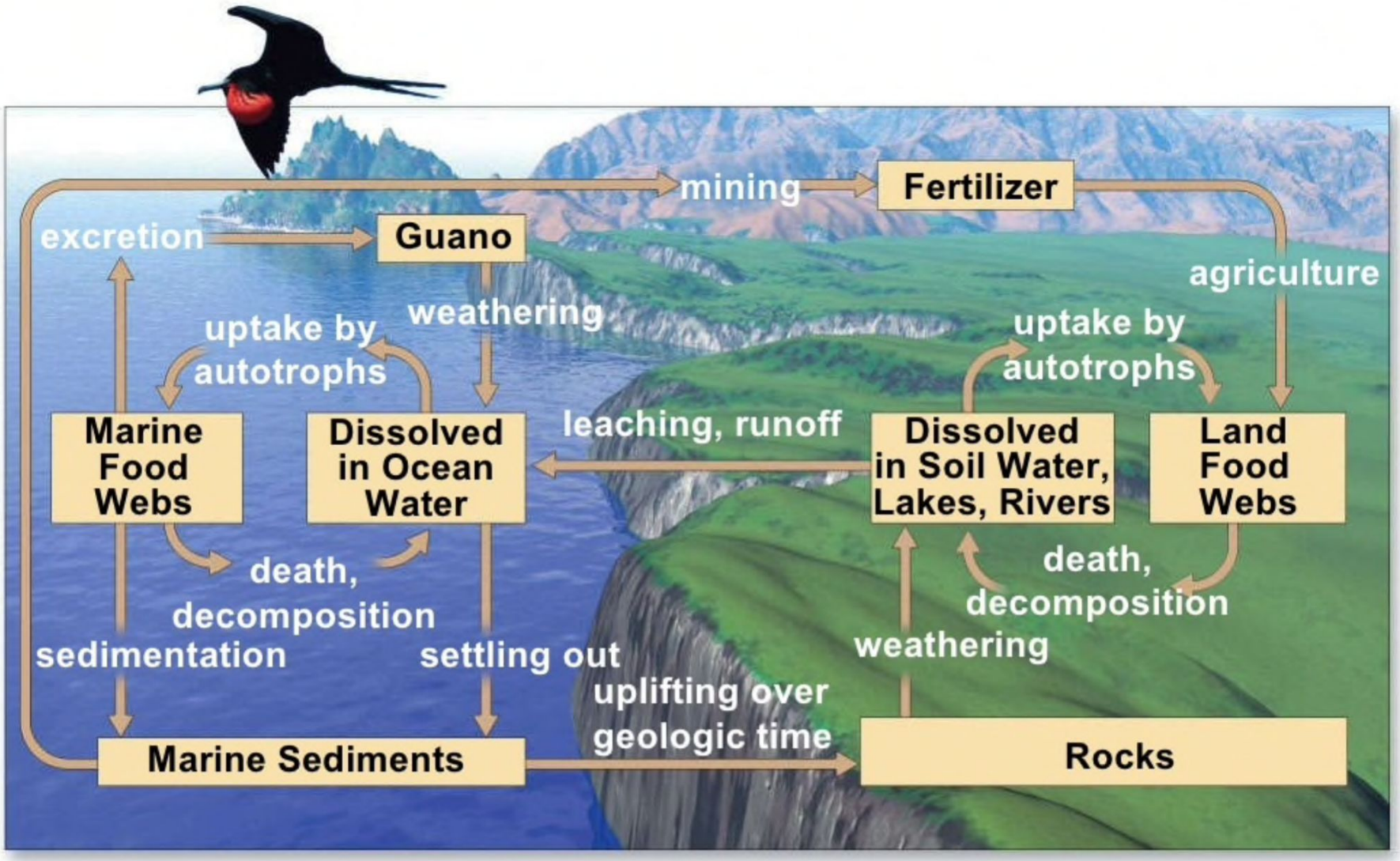
Effects of Human Activities on the Nitrogen Cycle



- Human activities such as production of fertilizers now fix more nitrogen than all natural sources combined.

The Phosphorous Cycle

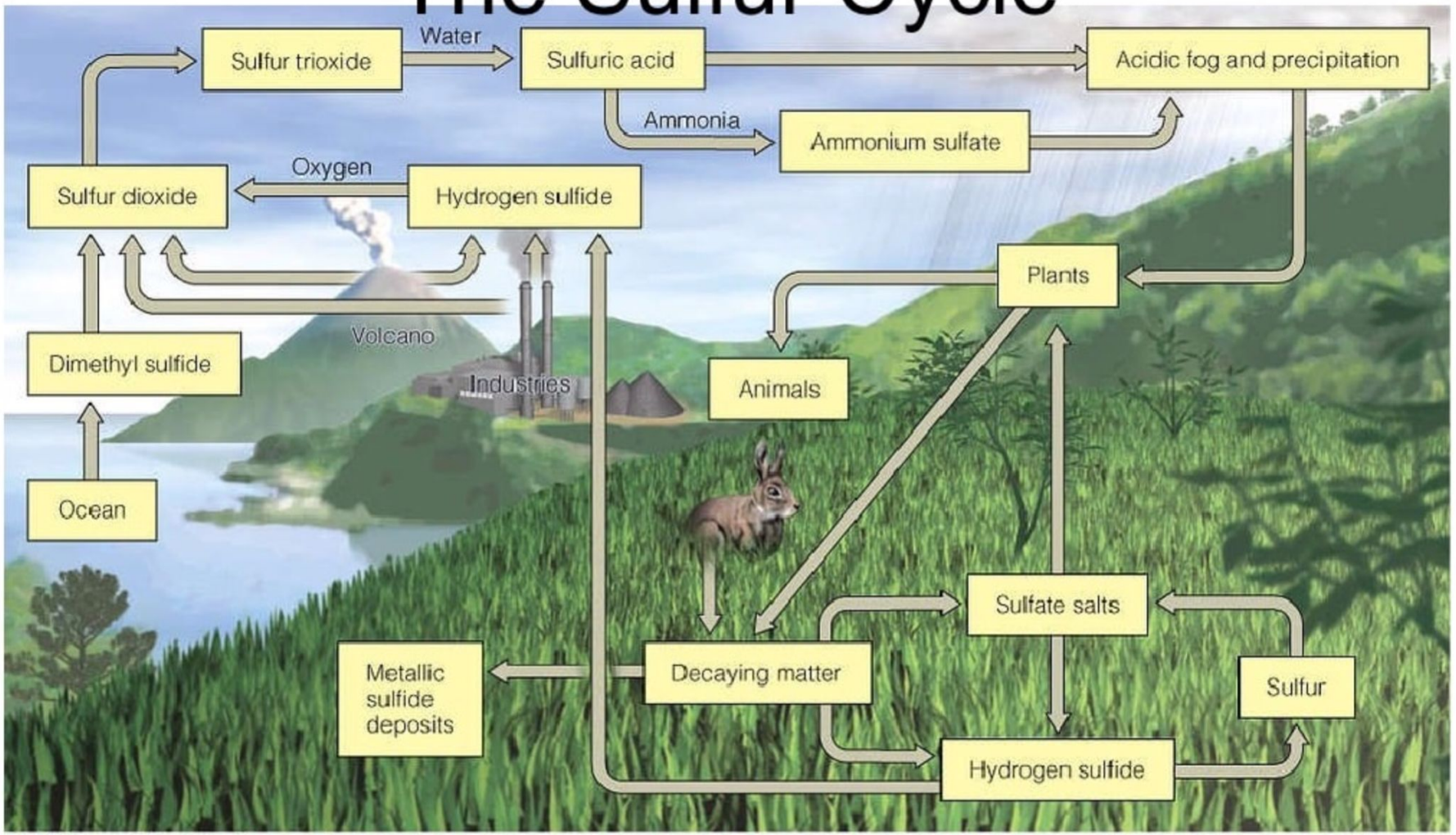



mining
Fertilizer
excretion
Guano
agriculture
weathering
uptake by autotrophs
uptake by autotrophs
Marine Food Webs
Dissolved in Ocean Water
leaching, runoff
Dissolved in Soil Water, Lakes, Rivers
Land Food Webs
death, decomposition
death, decomposition
sedimentation
settling out
weathering
uplifting over geologic time
Marine Sediments
Rocks

Effects of Human Activities on the Phosphorous Cycle

- We remove large amounts of phosphate from the earth to make fertilizer.
- We reduce phosphorous in tropical soils by clearing forests.
- We add excess phosphates to aquatic systems from runoff of animal wastes and fertilizers.

The Sulfur Cycle



Effects of Human Activities on the Sulfur Cycle

- We add sulfur dioxide to the atmosphere by:
  - Burning coal and oil
  - Refining sulfur containing petroleum.
  - Convert sulfur-containing metallic ores into free metals such as copper, lead, and zinc releasing sulfur dioxide into the environment.