

CH2356 Energy Engineering

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Bio-geo-chemical Cycles

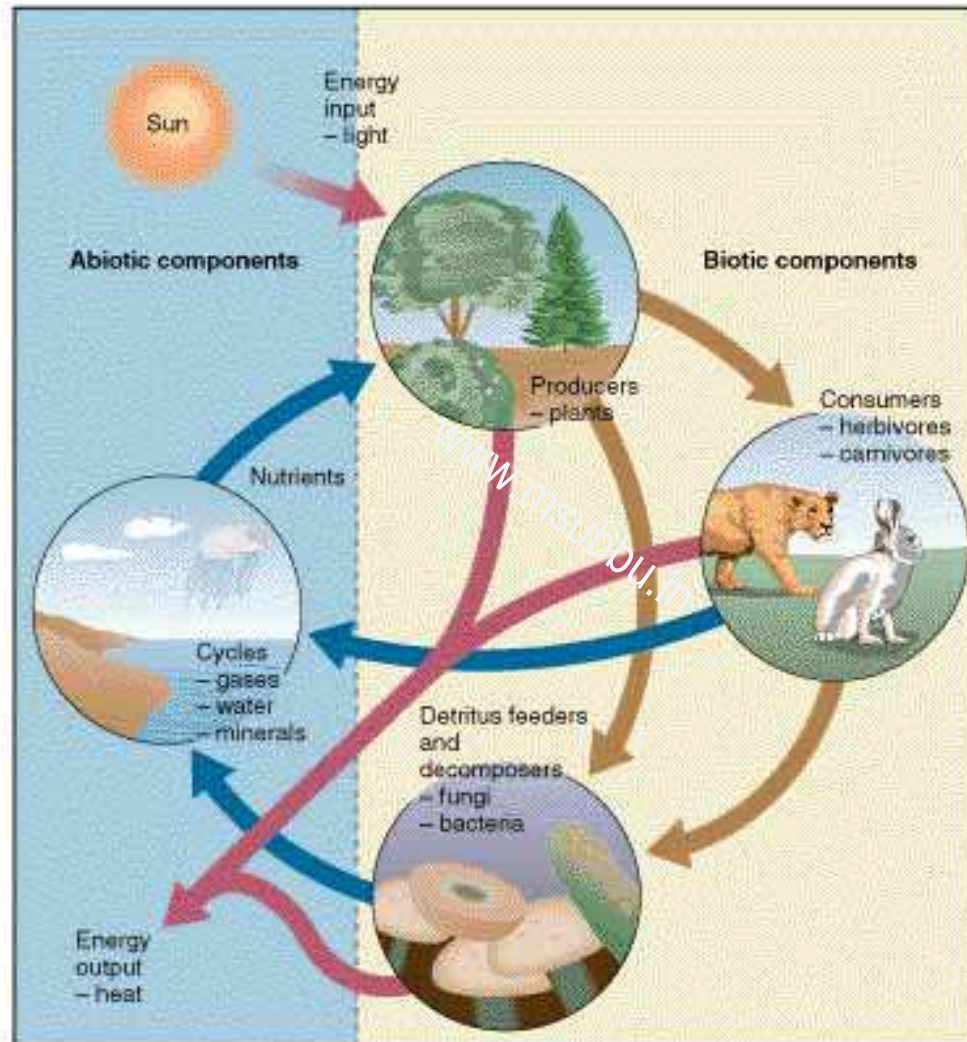
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Introduction

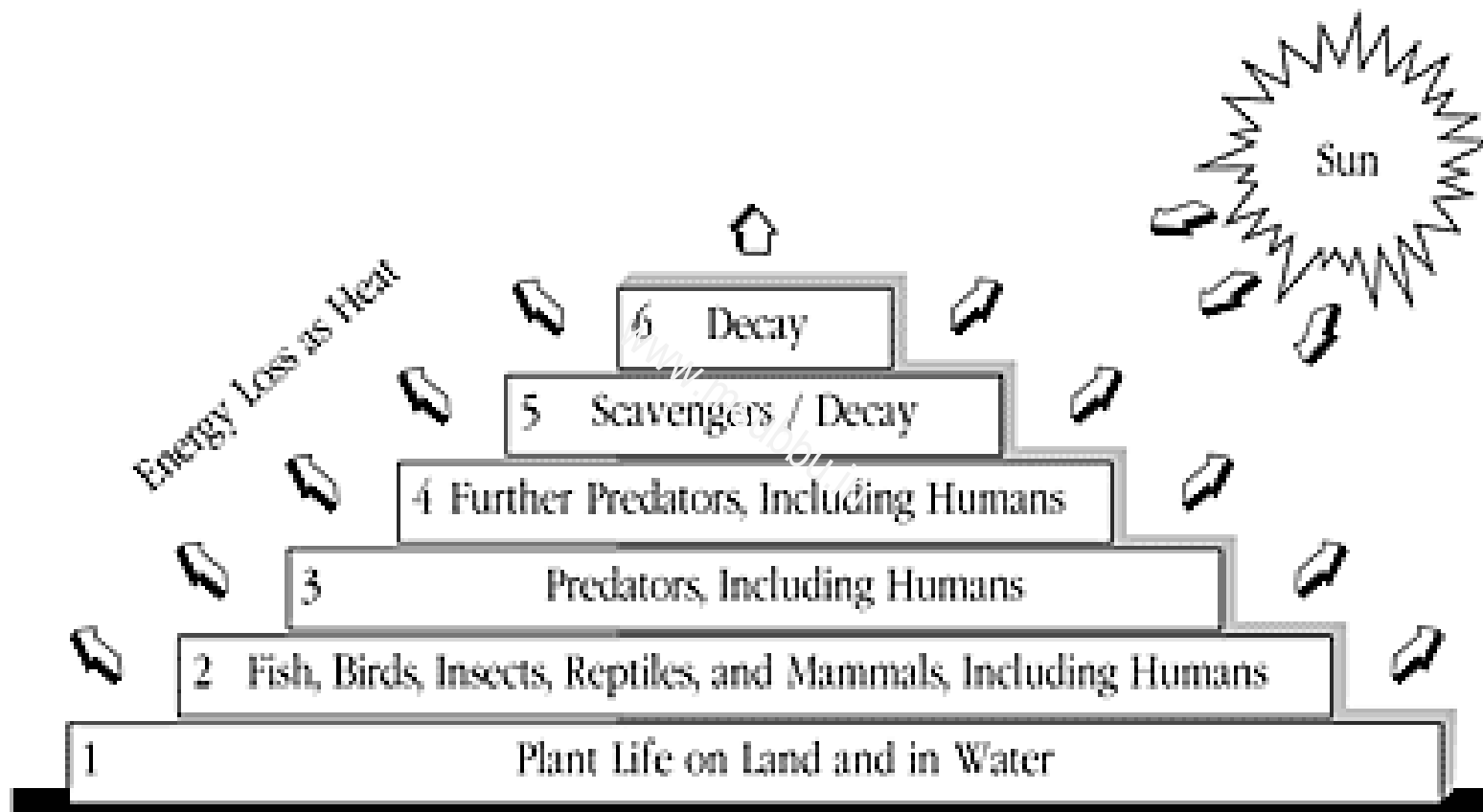
- A **biogeochemical cycle** or **nutrient cycle** is a pathway by which a chemical element or molecule moves through both biotic (biosphere) and abiotic (lithosphere, atmosphere, and hydrosphere) compartments of Earth.
- In effect, the element is recycled, although in some cycles there may be places (called *reservoirs*) where the element is accumulated or held for a long period of time (such as an ocean or lake for water).
- Elements, chemical compounds, and other forms of matter are passed from one organism to another and from one part of the biosphere to another through the biogeochemical cycles

Energy Flow and Materials Cycling



The movement of nutrients (blue arrows) and energy (red arrows) and both (brown arrows) through the ecosystem.

Energy Flow in Ecosystem

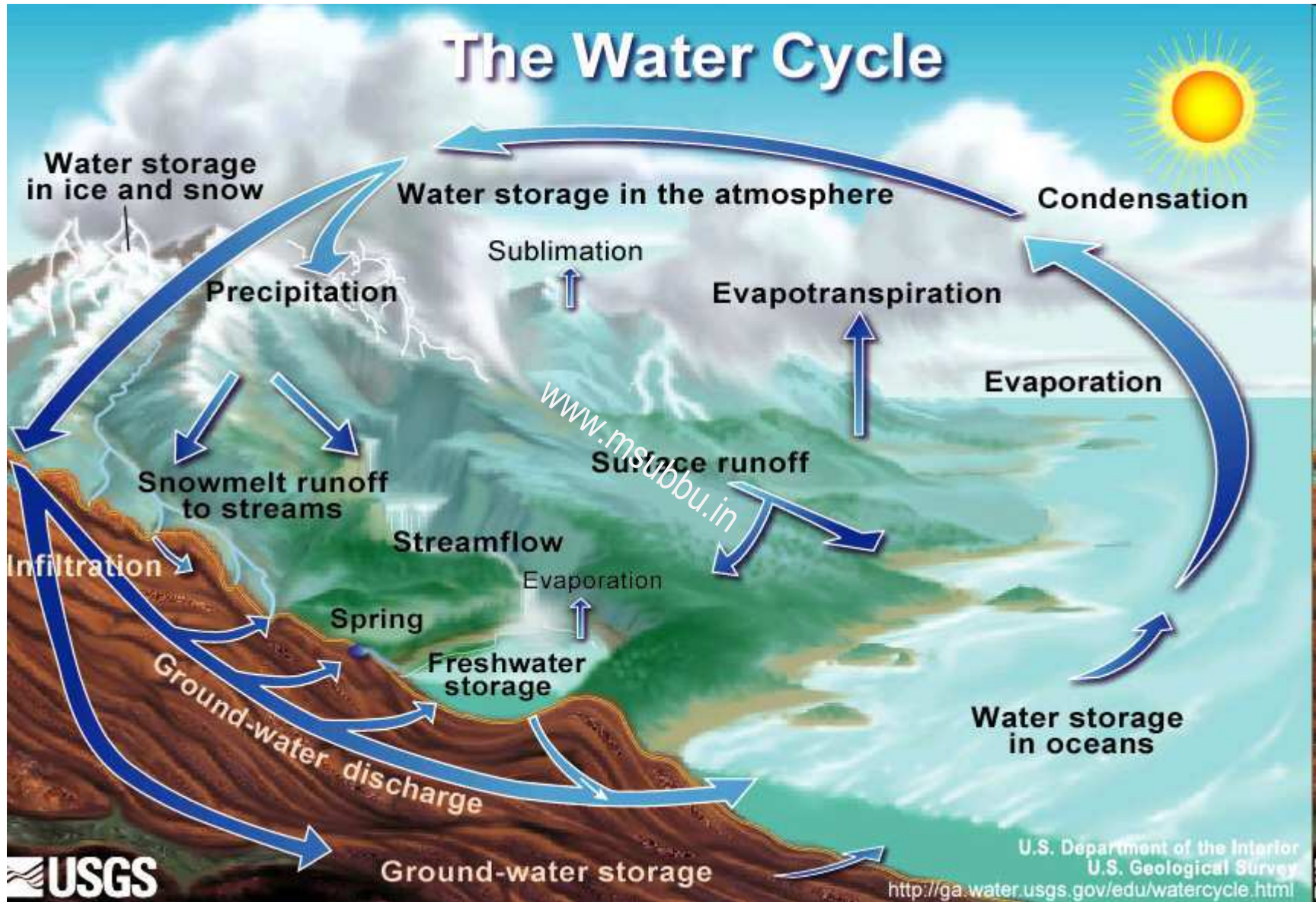


Energy Flow in Ecosystem

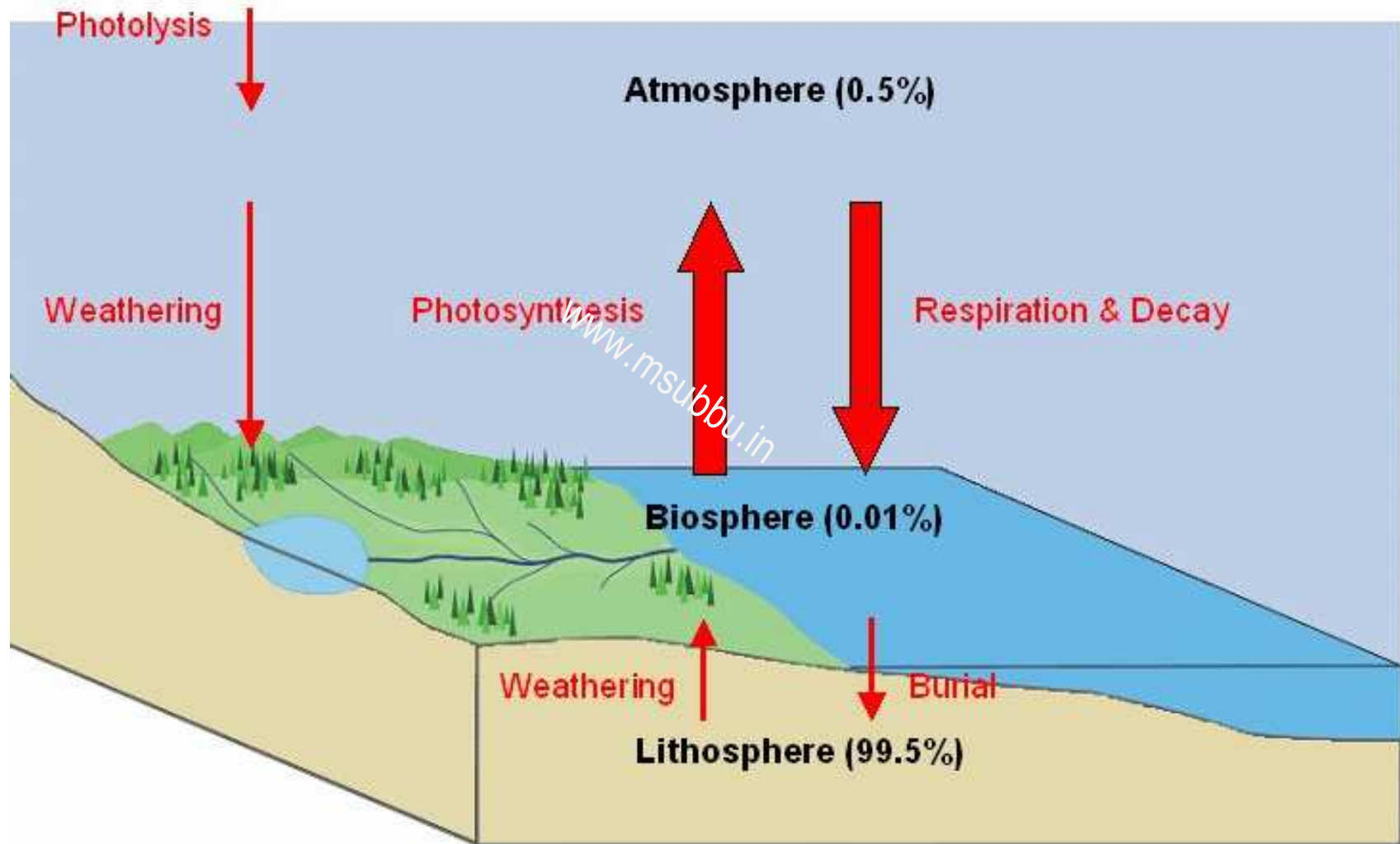
- Almost all life requires the energy that flows daily from the sun.
- The basic conversion of this solar energy to usable form takes place through plant material on land and in water.
- As the energy passes from plants to whatever eats them, and in turn eats the eaters of the plants, some is lost as heat, and eventually it all is.
- Thus, energy doesn't cycle; it flows through the ecosystem until it's used up.

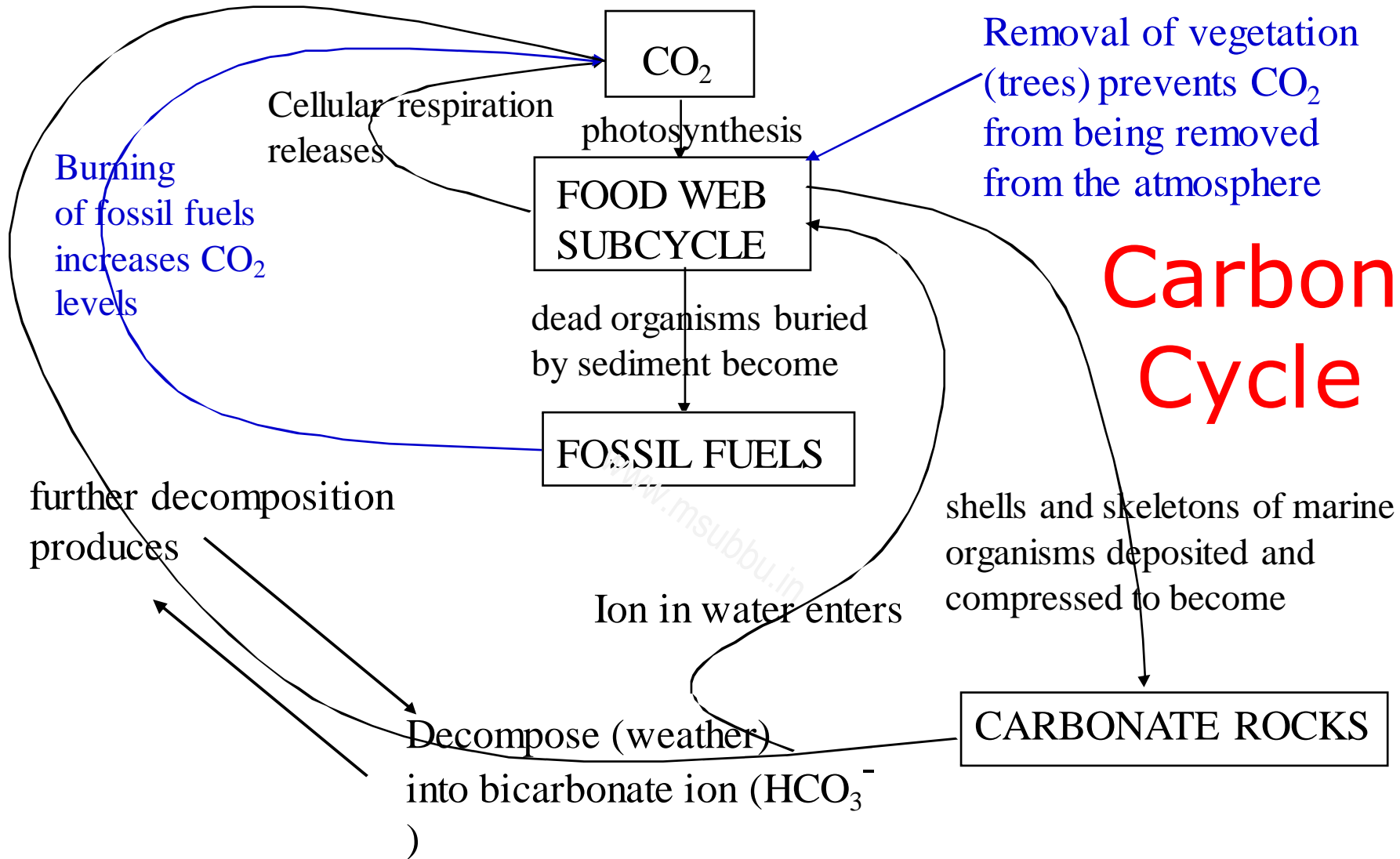
Important Cycles

- The most well-known and important biogeochemical cycles include the carbon cycle, the nitrogen cycle, the oxygen cycle, the phosphorus cycle, the sulfur cycle, and the water cycle.
- There are many biogeochemical cycles that are currently being studied for the first time as climate change and human impacts are drastically changing the speed, intensity, and balance of these relatively unknown cycles. (eg. Mercury cycle)



Oxygen Cycle Reservoirs & Flux

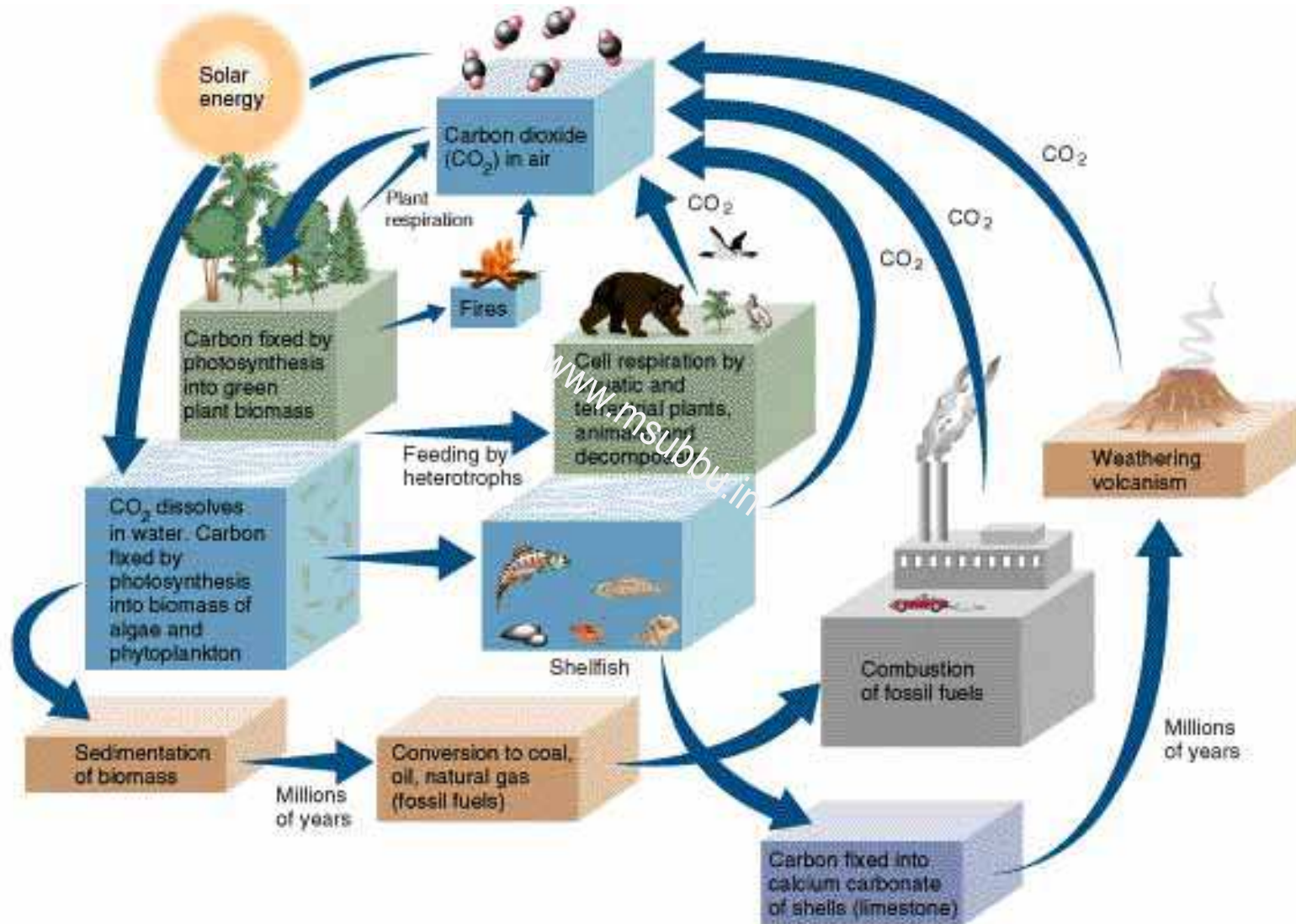




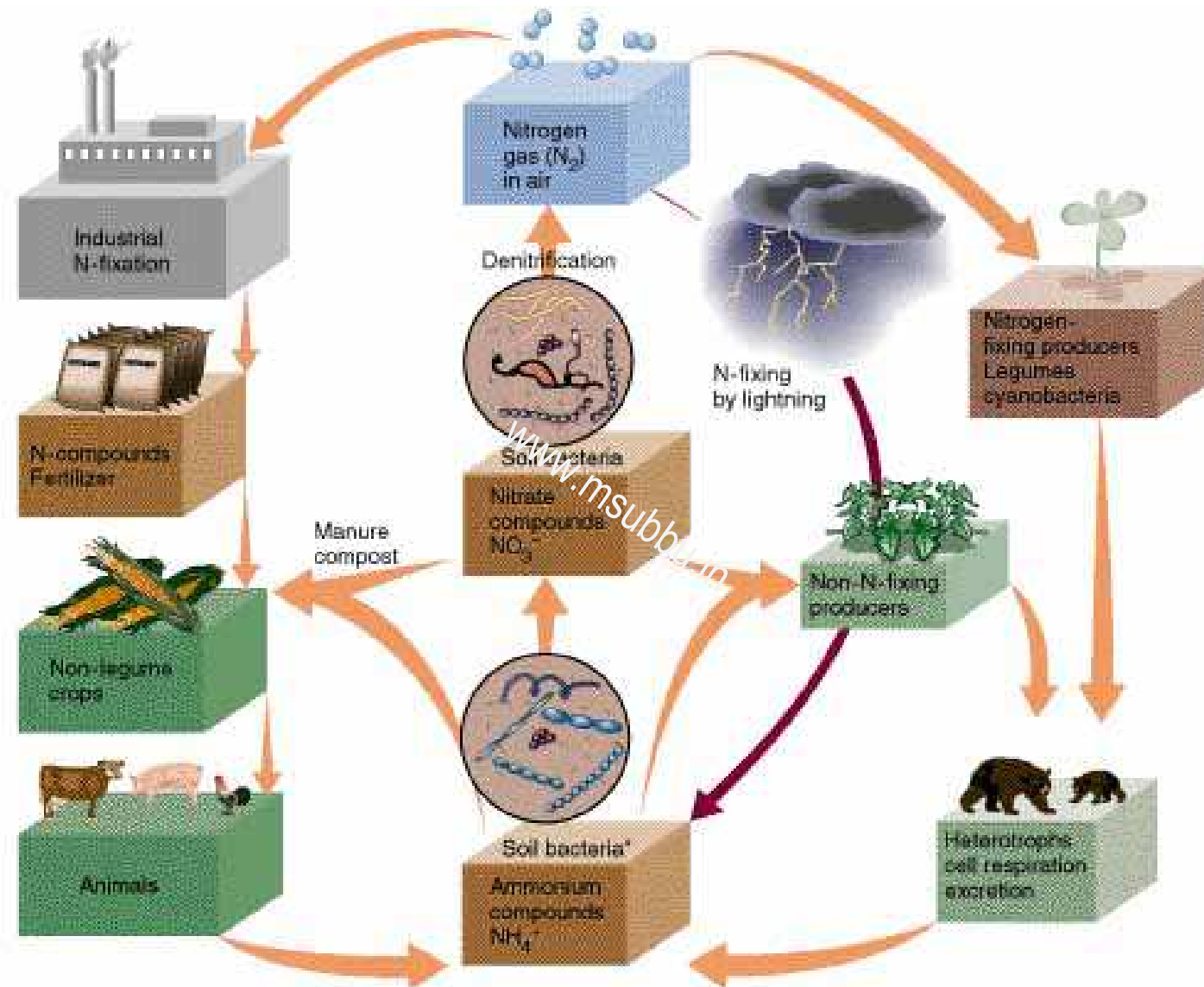
Carbon Cycle

Where human activities change the cycling rate of carbon among reservoirs.

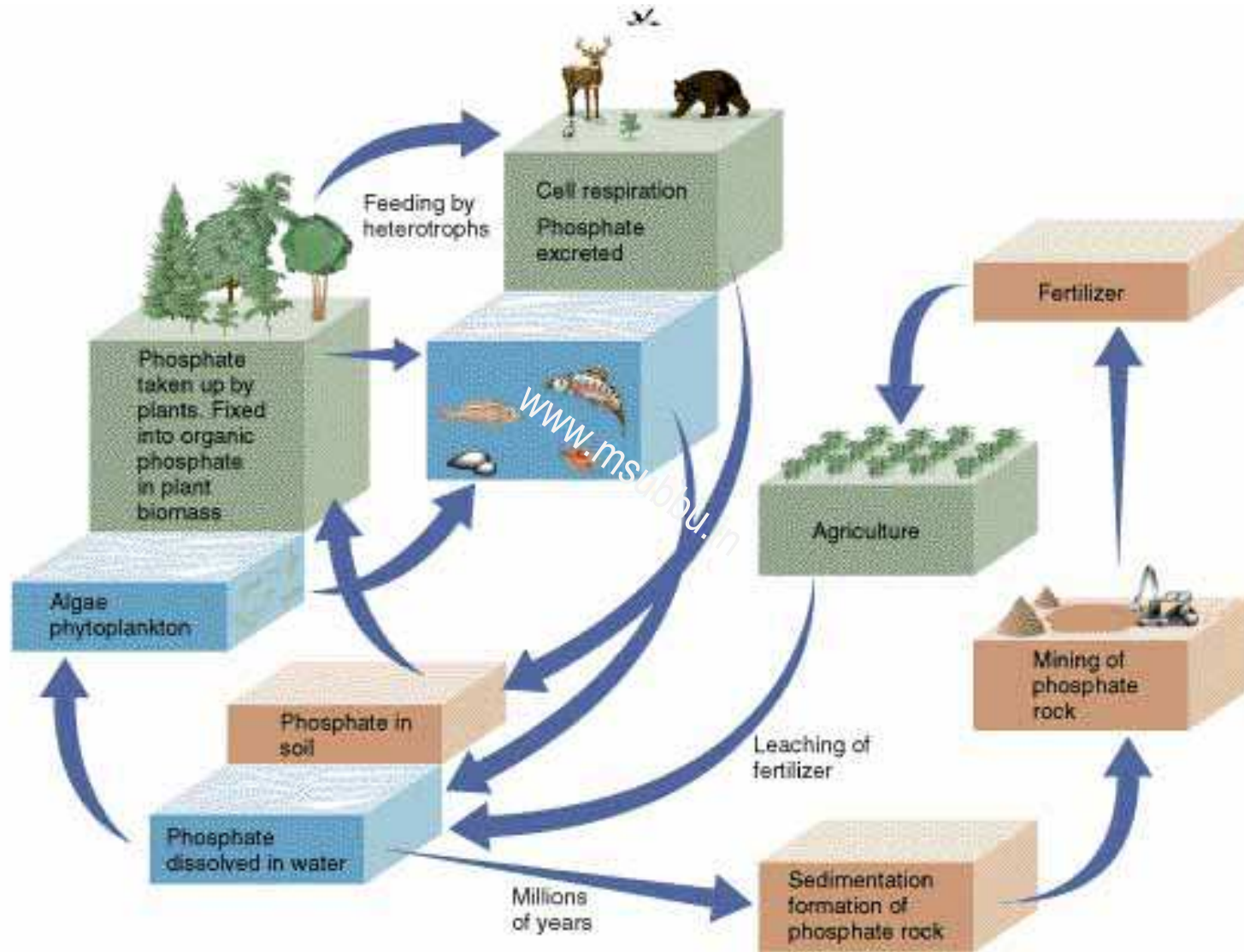
Carbon Cycle



Nitrogen Cycle



Phosphorus Cycle



THE HUMAN SYSTEM
How can we make it into a sustainable cycle?

