

GE 2211 Environmental Science and Engineering

Unit – II

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Eco System

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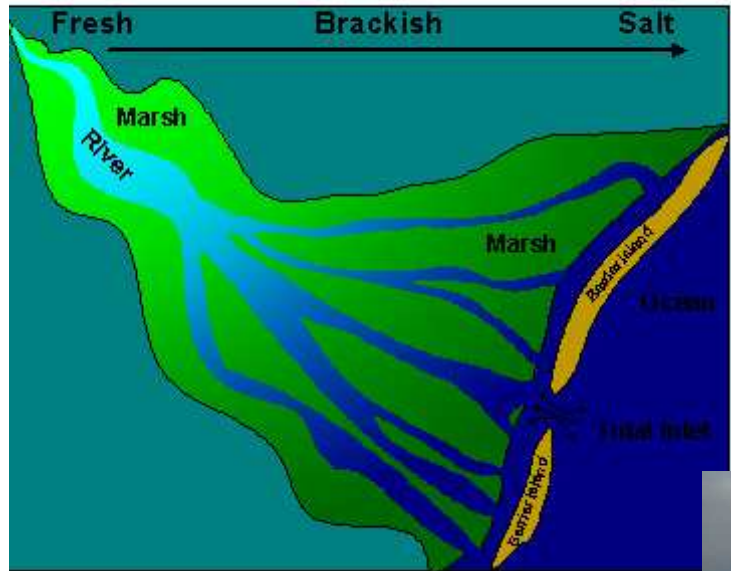
Contents

- Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids

Introduction

- An ecosystem can be defined as the basic functional unit of nature, including both biotic (living) and abiotic (nonliving) constituents.
 - a pond, a forest, an estuary, a grassland
- Abiotic components: air, rock, and water are the basic components
- Biotic components: classified according to the function of the particular organism. There are three groups:
 - producers, consumers, and decomposers.

The Estuary

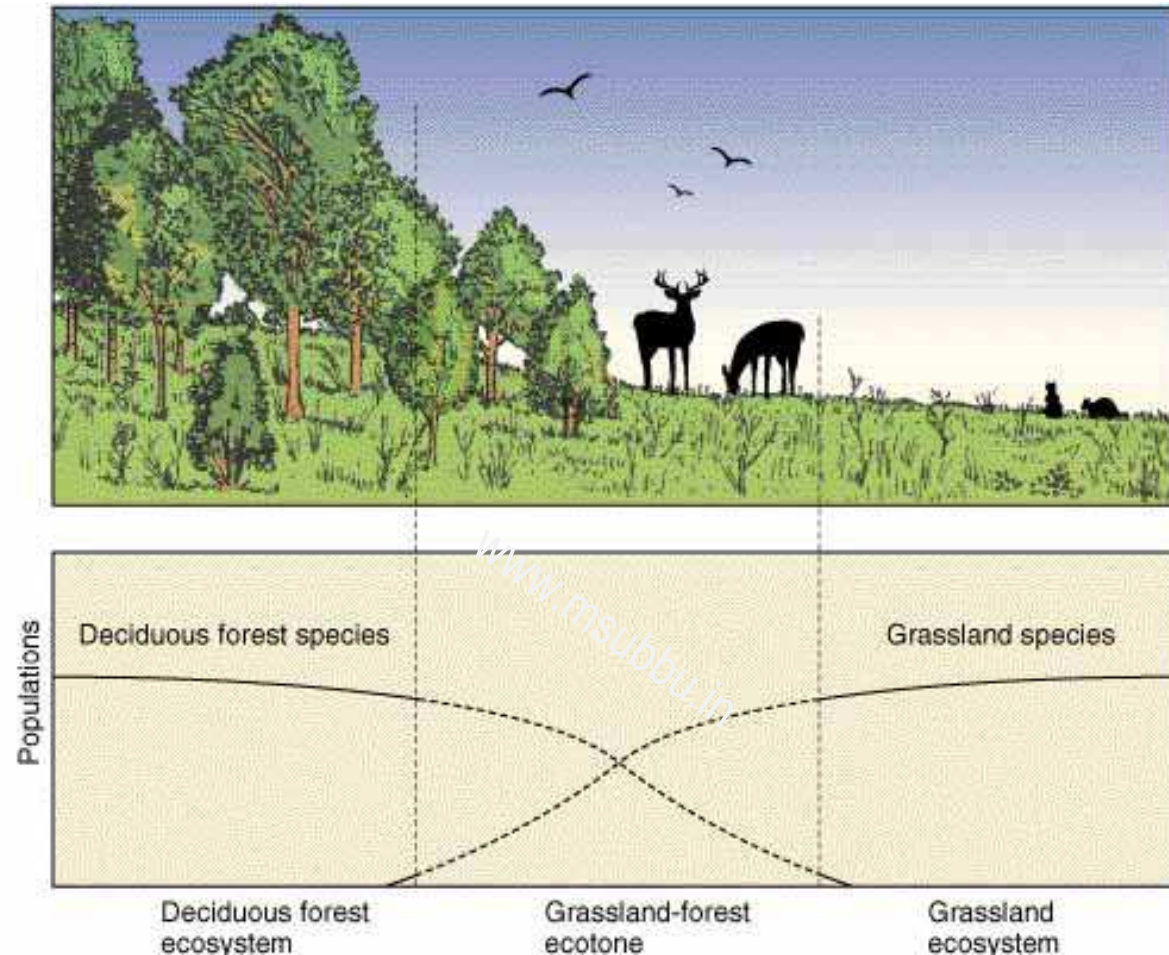


Estuary

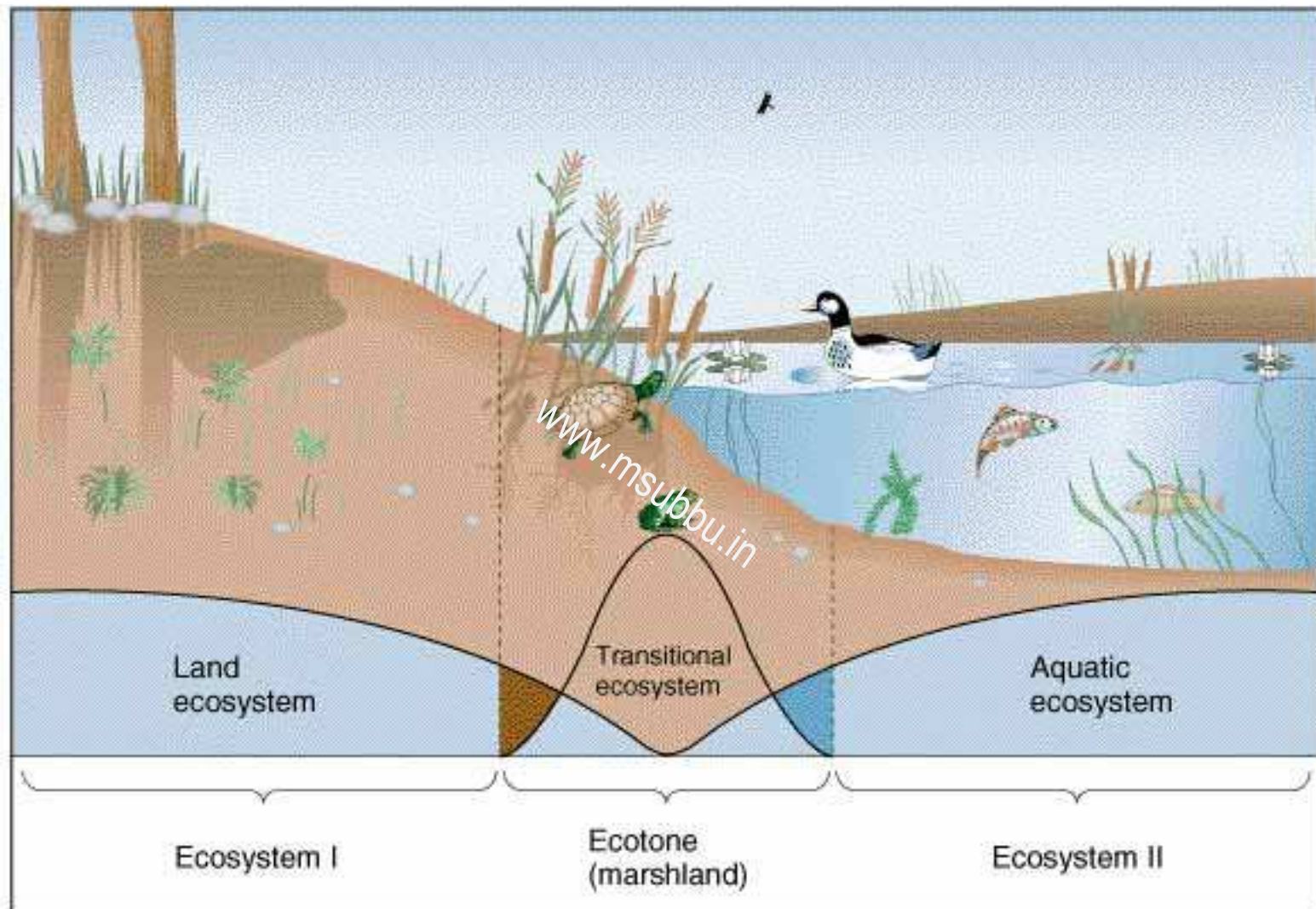




Grassland

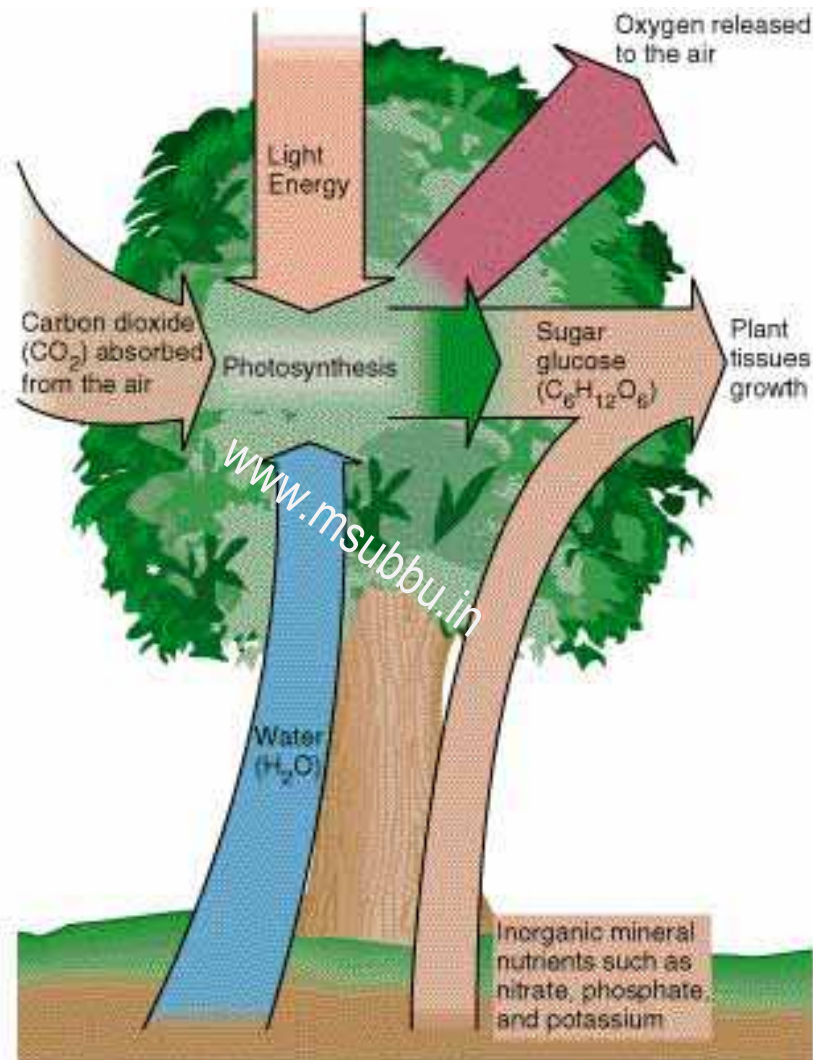


Ecosystems are not isolated from one another. One ecosystem blends into the next through a transitional region, an ecotone, which contains many species common to the two adjacent systems.



Producers

- Producers
 - the green plants such as grasses and trees
 - are so called because they are capable of producing their own food from the abiotic environment
- Producers create organic molecules proteins, lipids and carbohydrates- by capturing light energy and combining the captured energy with inorganic molecules



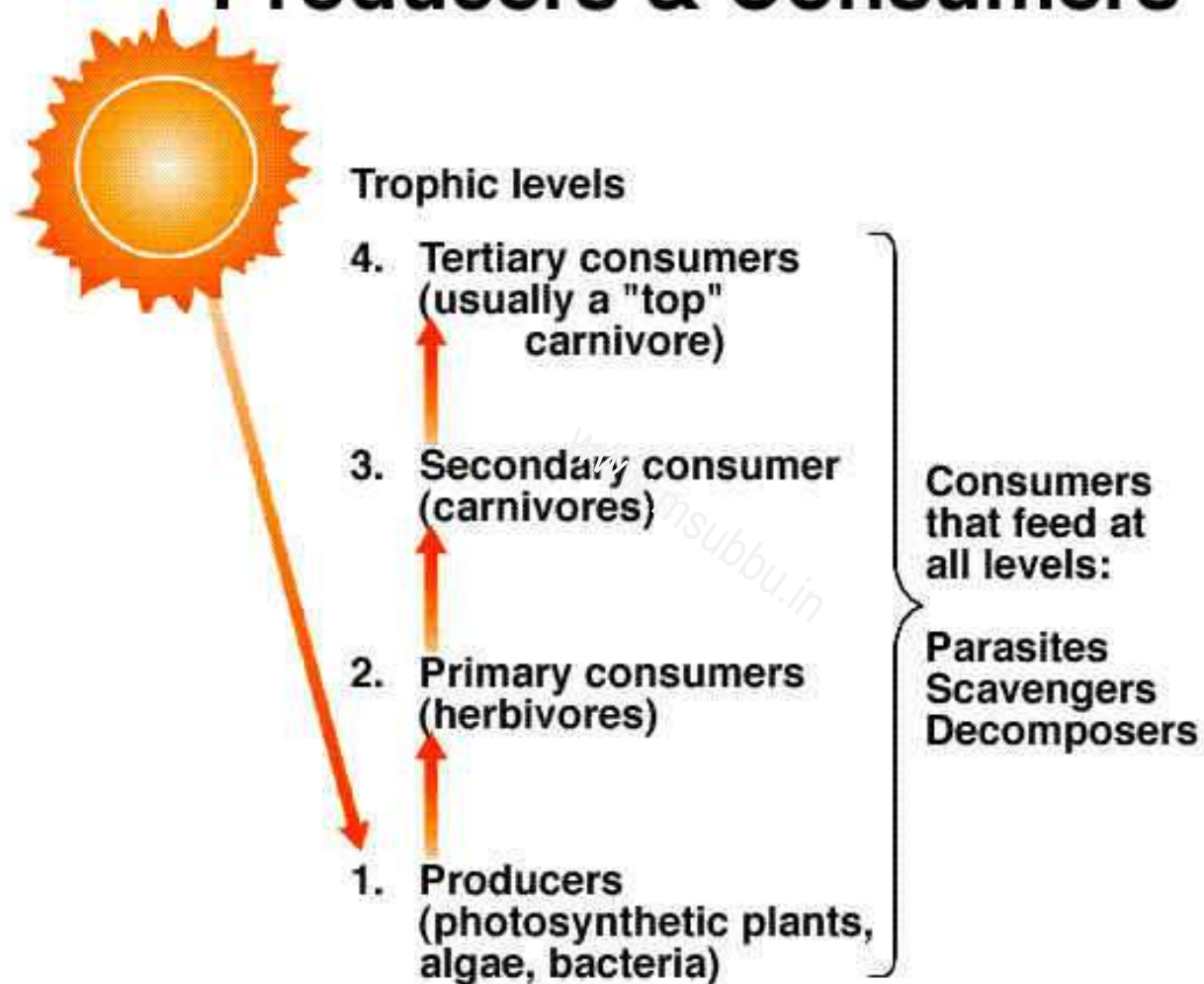
Consumers

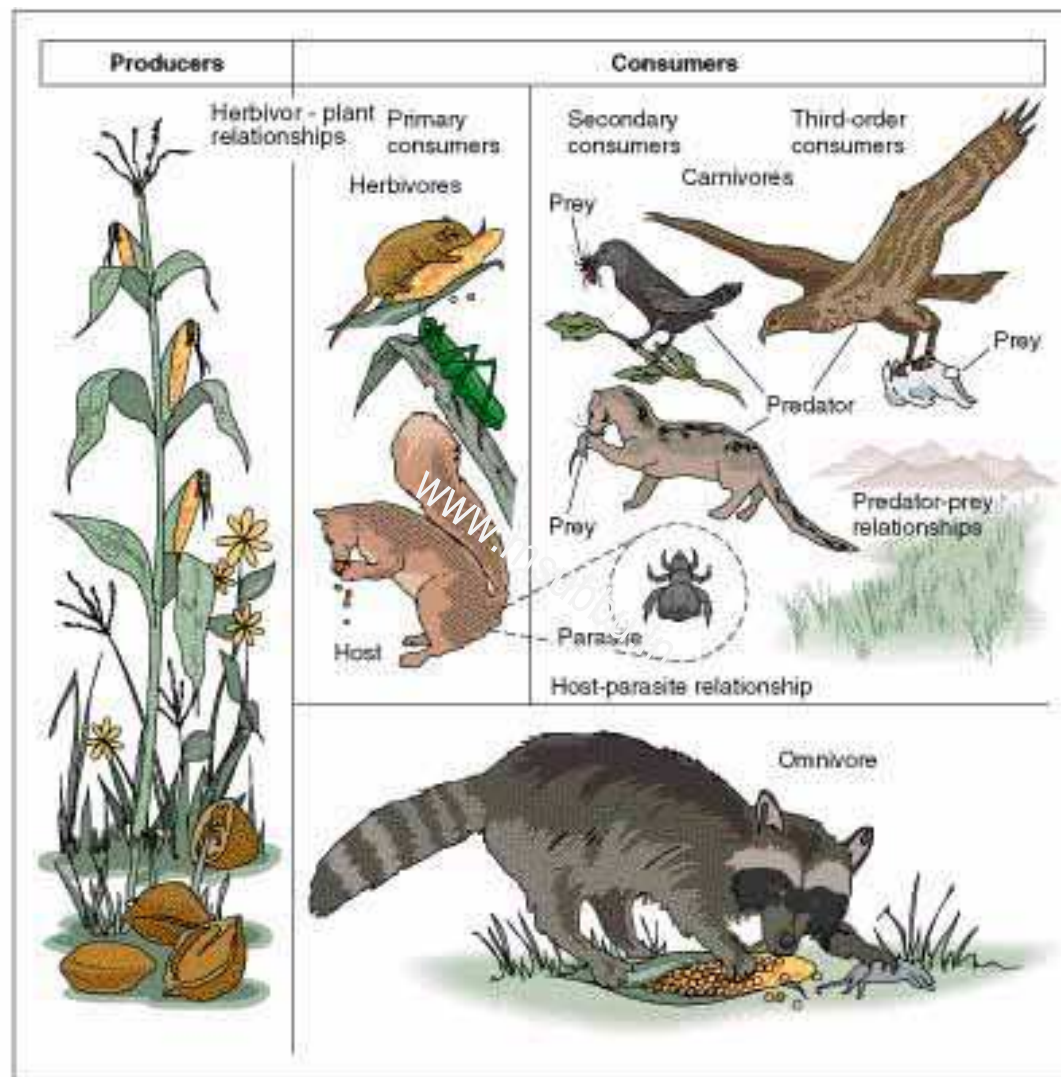
- **Consumers**
 - organisms that are incapable of producing their own food and that must use (consume) other organisms for their food
 - all animals fall into this category.
 - consumers feed on producers and would not exist without producers.
- Three types of consumers:
 - **herbivores**, which eat plants (producers);
 - **carnivores**, which eat animals – either herbivores or other carnivores;
 - **omnivores**, which are both herbivorous and carnivorous.

Decomposers

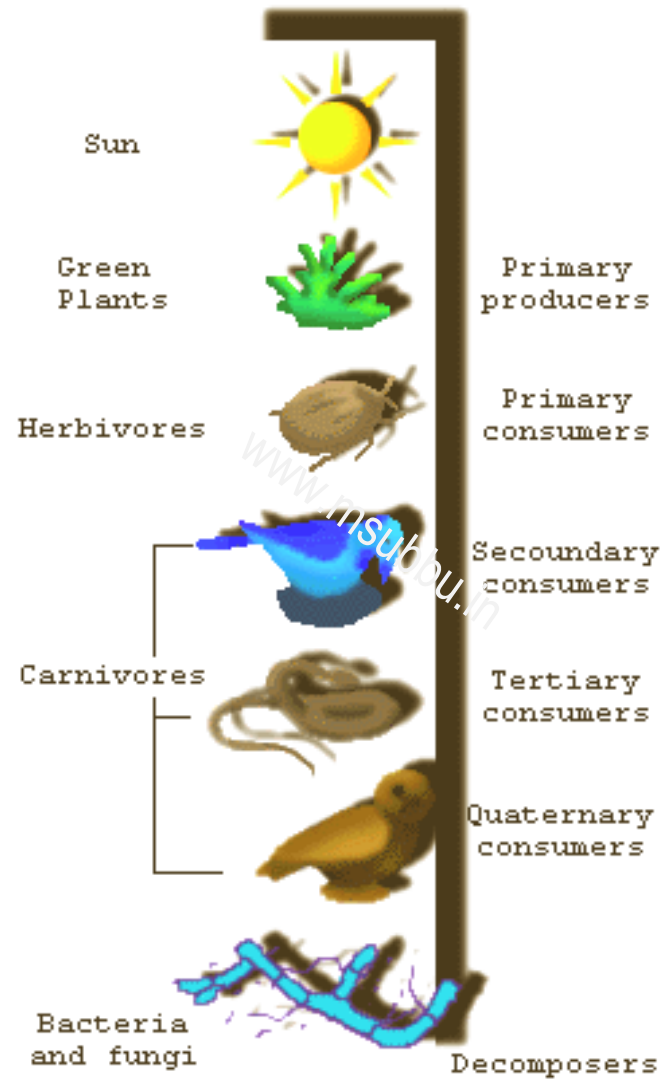
- **Decomposers** – also called microconsumers, include bacteria, fungi, and some of the small invertebrates (animals without backbones , eg: worms).
- Like consumers, these organisms cannot produce their own food; but unlike consumers, they obtain their food energy by breaking down dead plants and animals to their basic components, thereby releasing these substances back into the abiotic portions of the environment.

Producers & Consumers

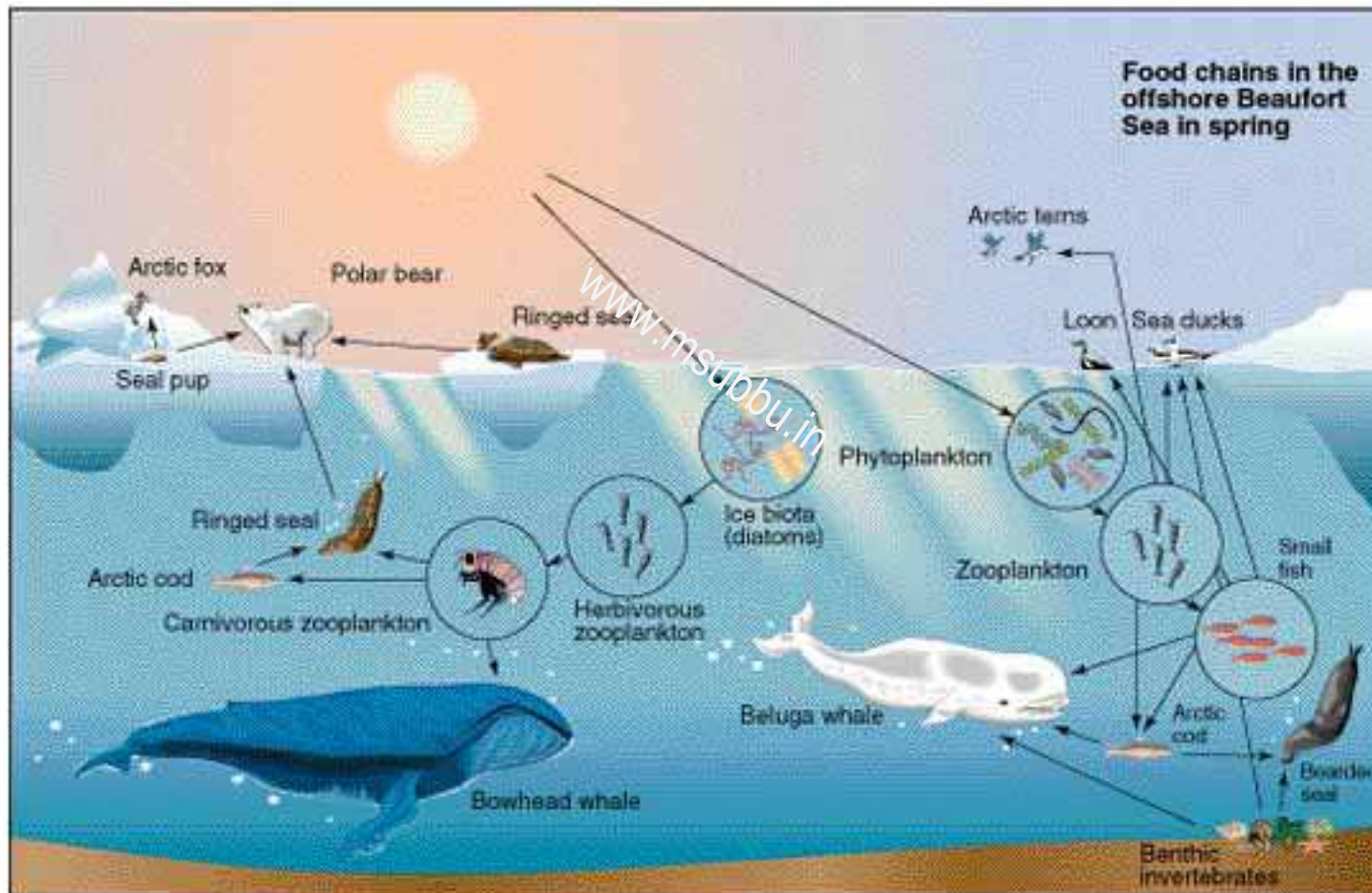




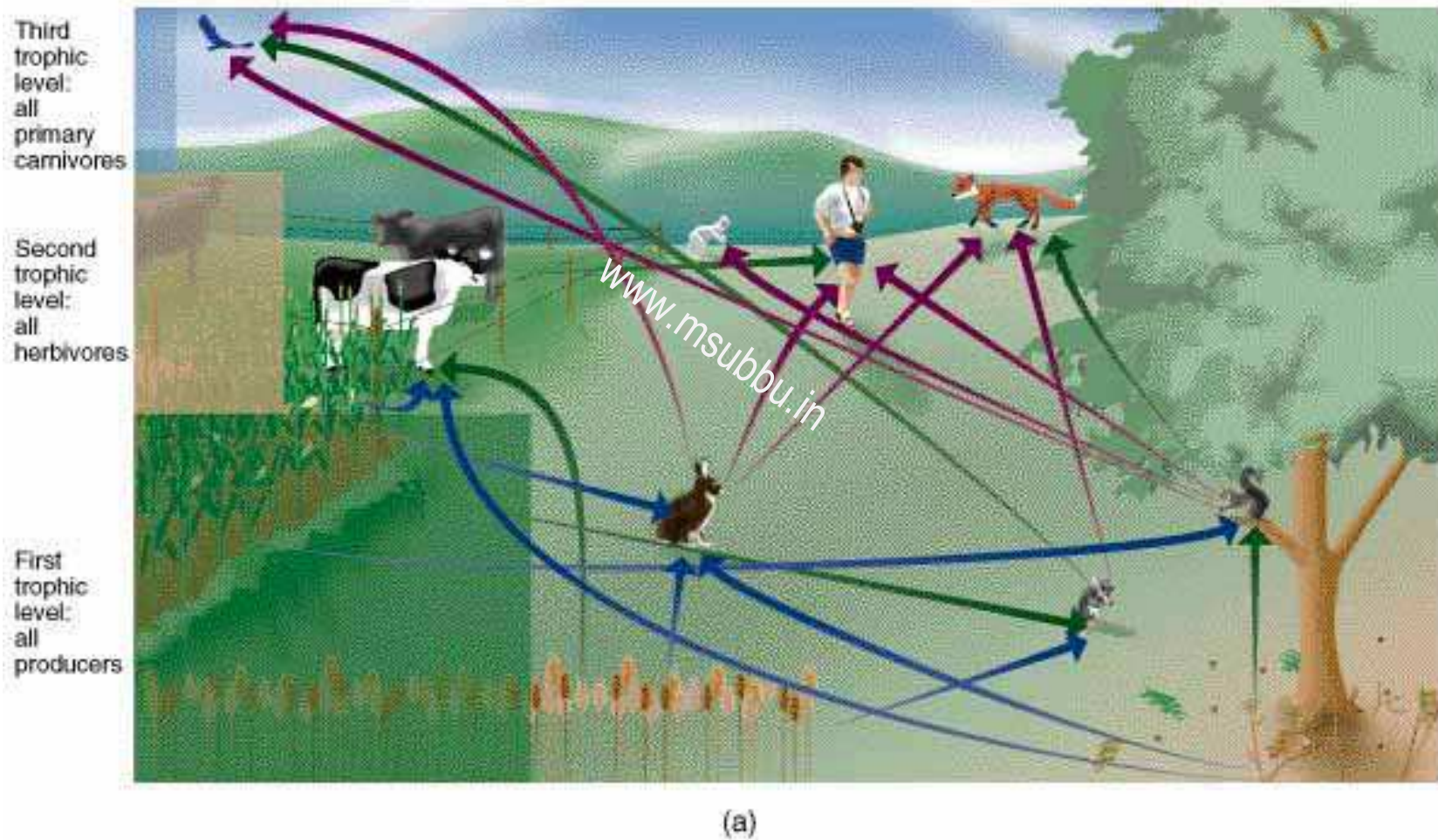
Food Chain



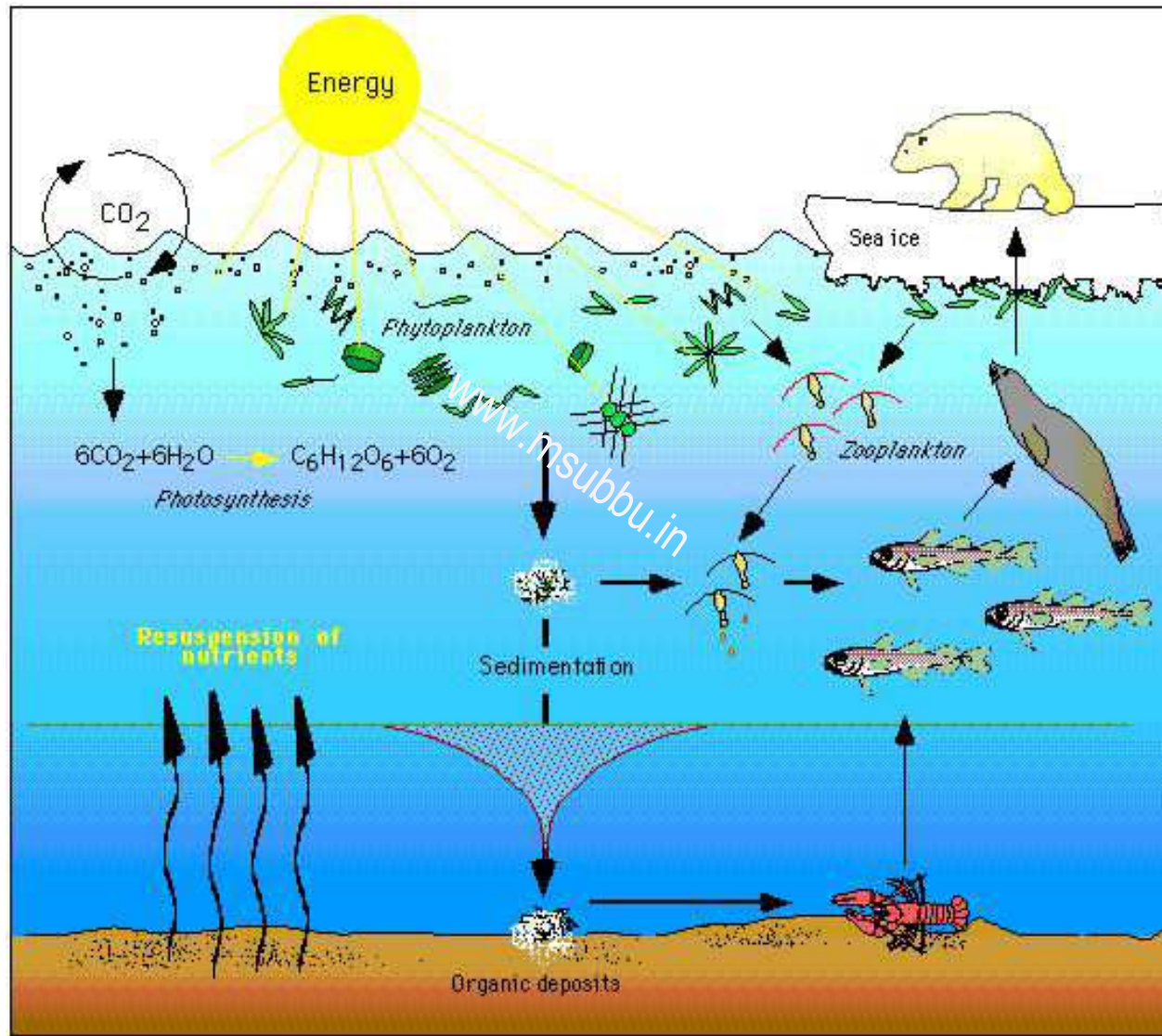
Food Chain in a Marine Ecosystem



Food Webs

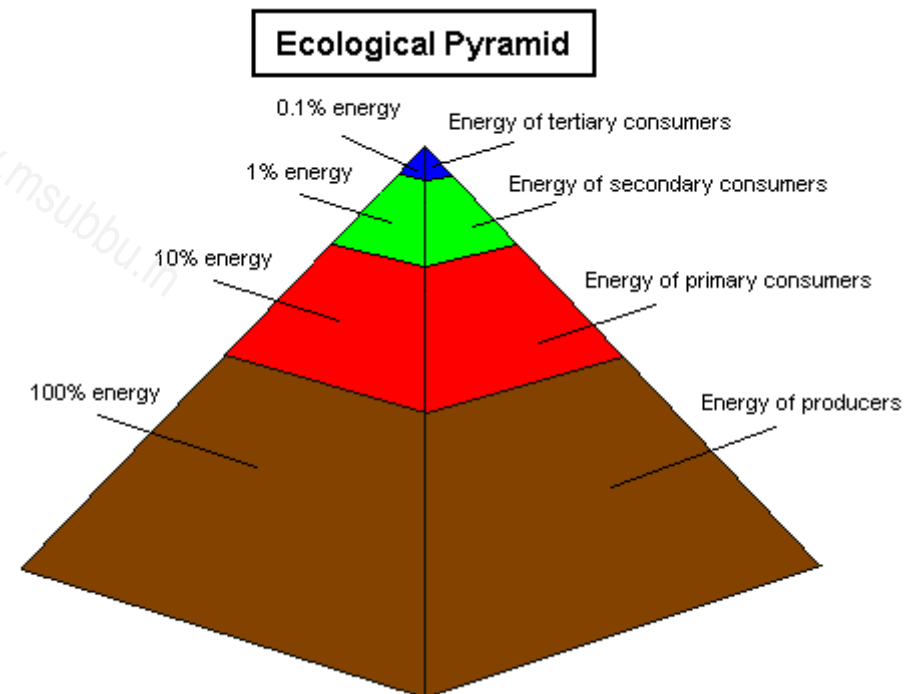
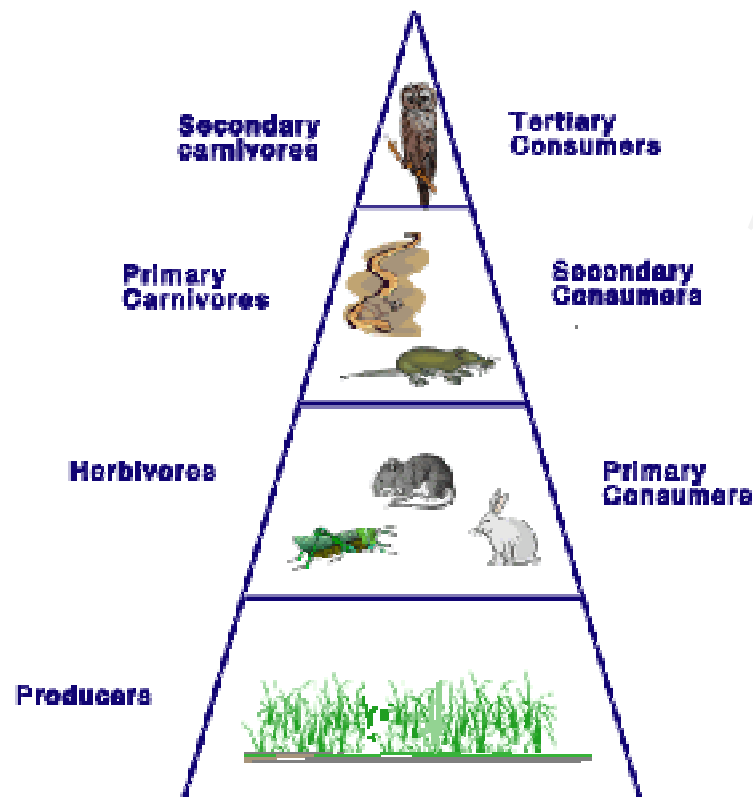


Marine Food Web



Drawn by Christopher Krembs

Ecological Pyramid

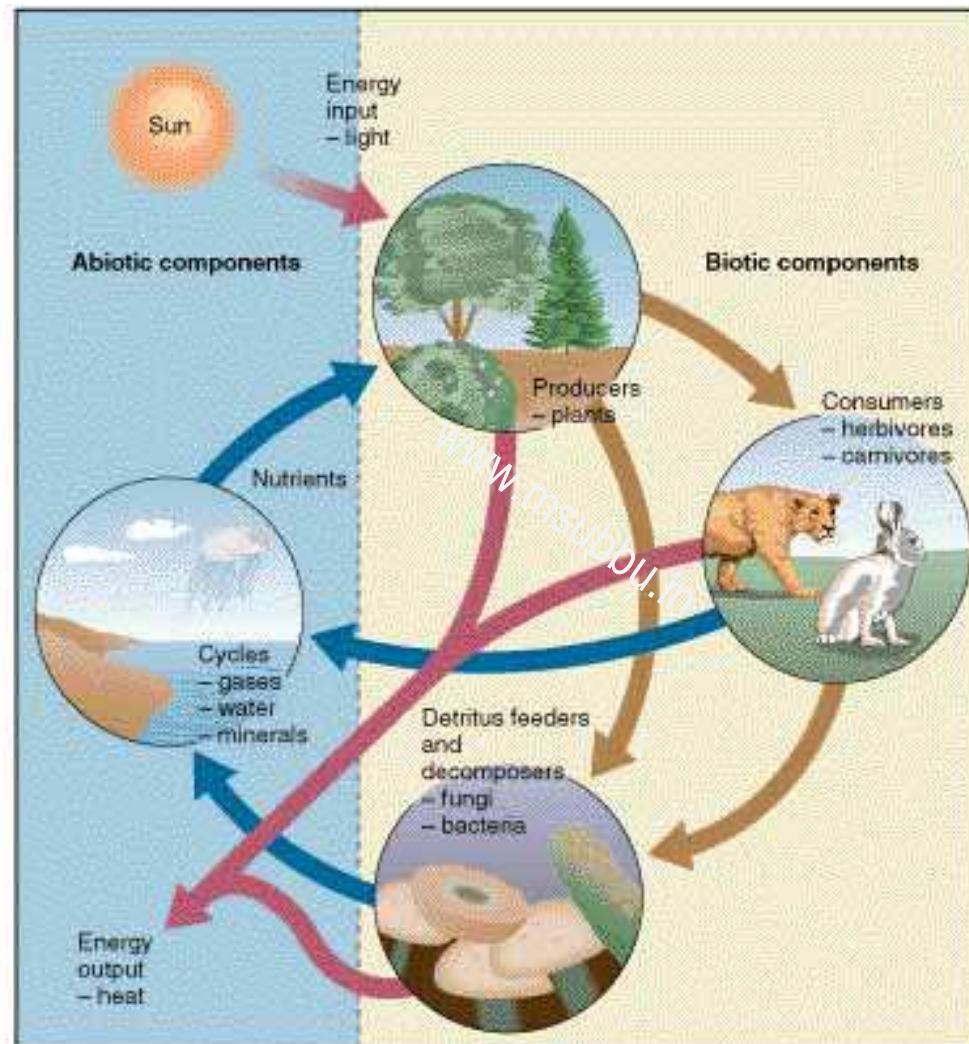


Ecological Succession

- Ecological succession is the gradual process by which ecosystems change and develop over time. Nothing remains the same and habitats are constantly changing.
- Succession takes place because the environmental conditions in a particular place change over time.
- Each species is adapted to thrive and compete best against other species under a very specific set of environmental conditions. If these conditions change, then the existing species will be replaced by a new set of species which are better adapted to the new conditions.

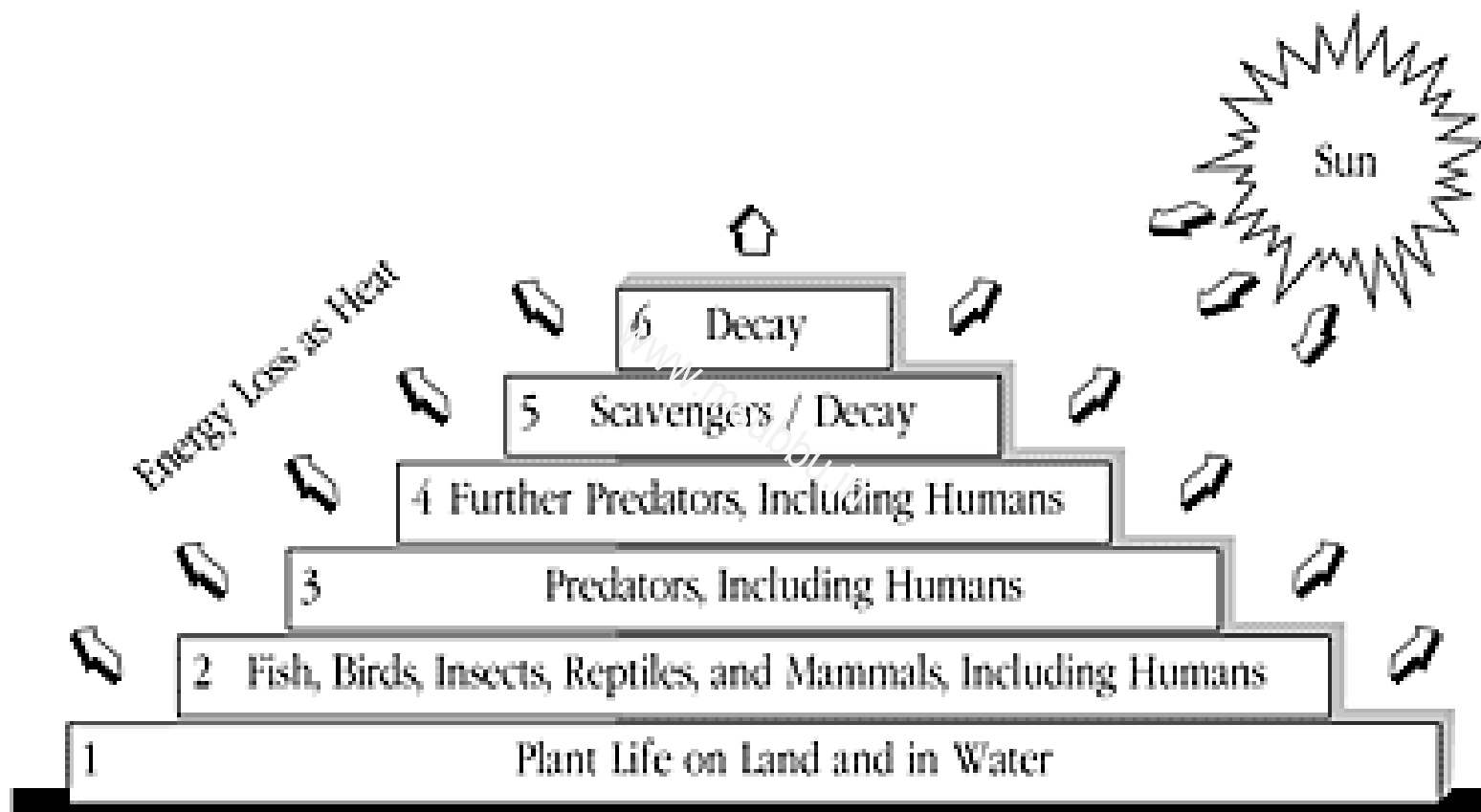


Energy Flow and Materials Cycling



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

Energy Flow in Ecosystem

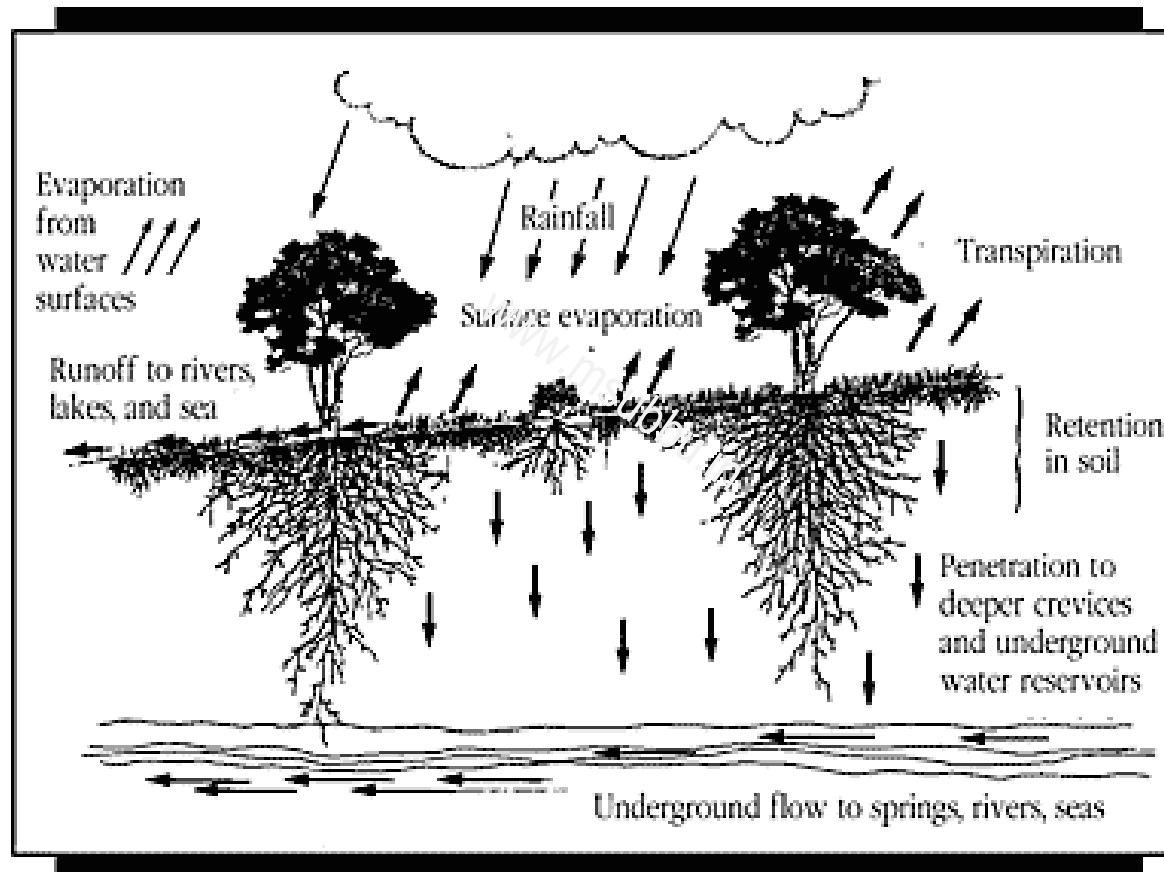


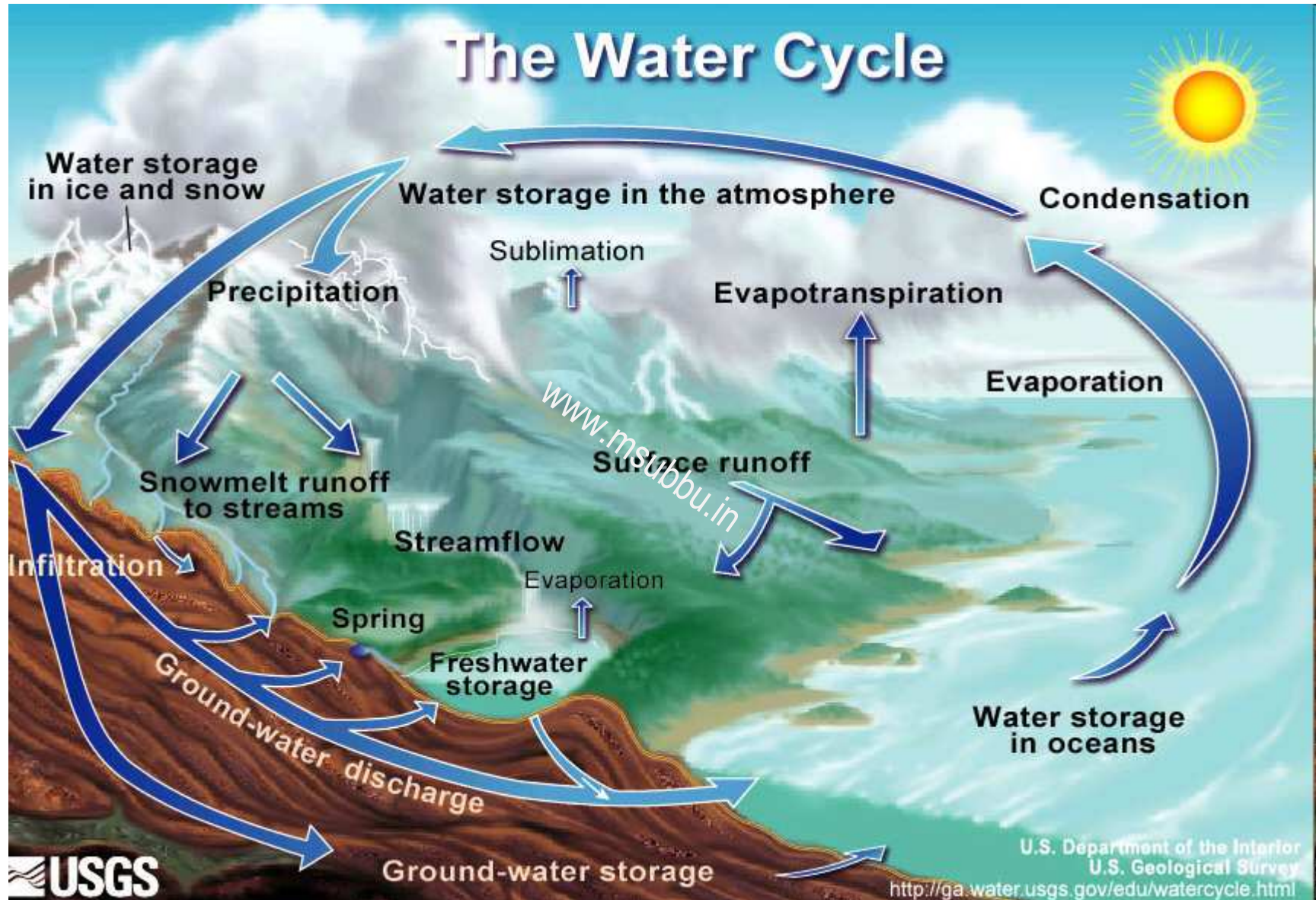
Energy Flow in Ecosystem

- 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.

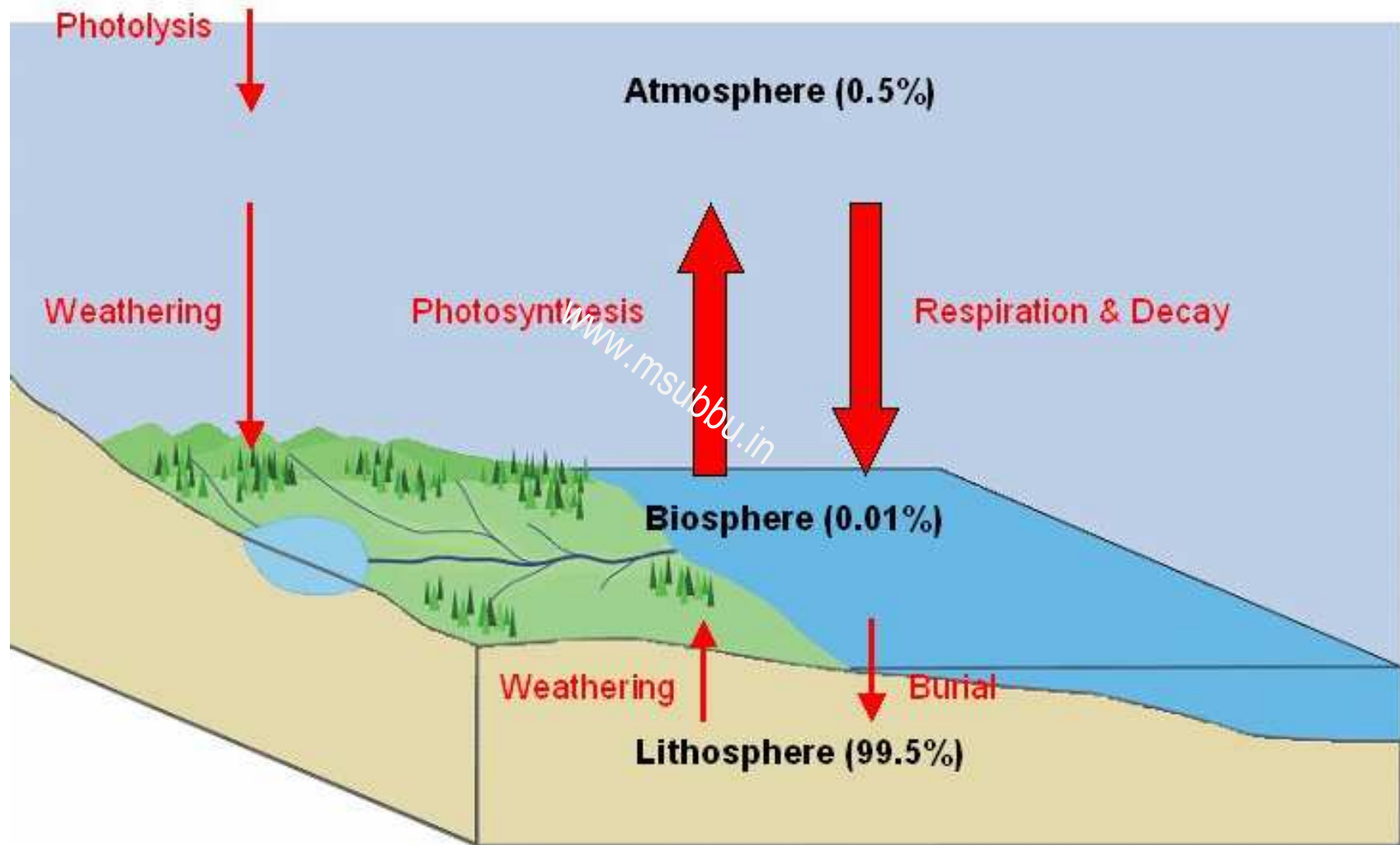
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Water Cycle

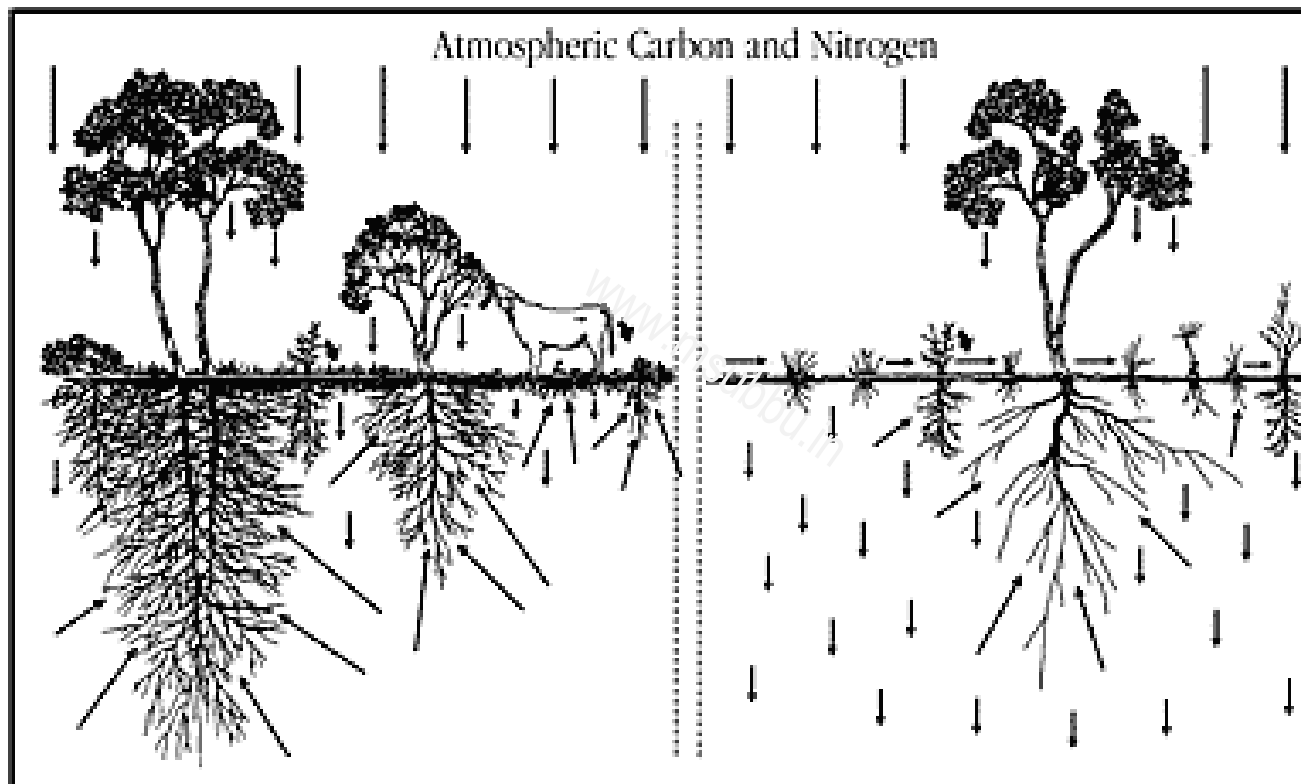




Oxygen Cycle Reservoirs & Flux



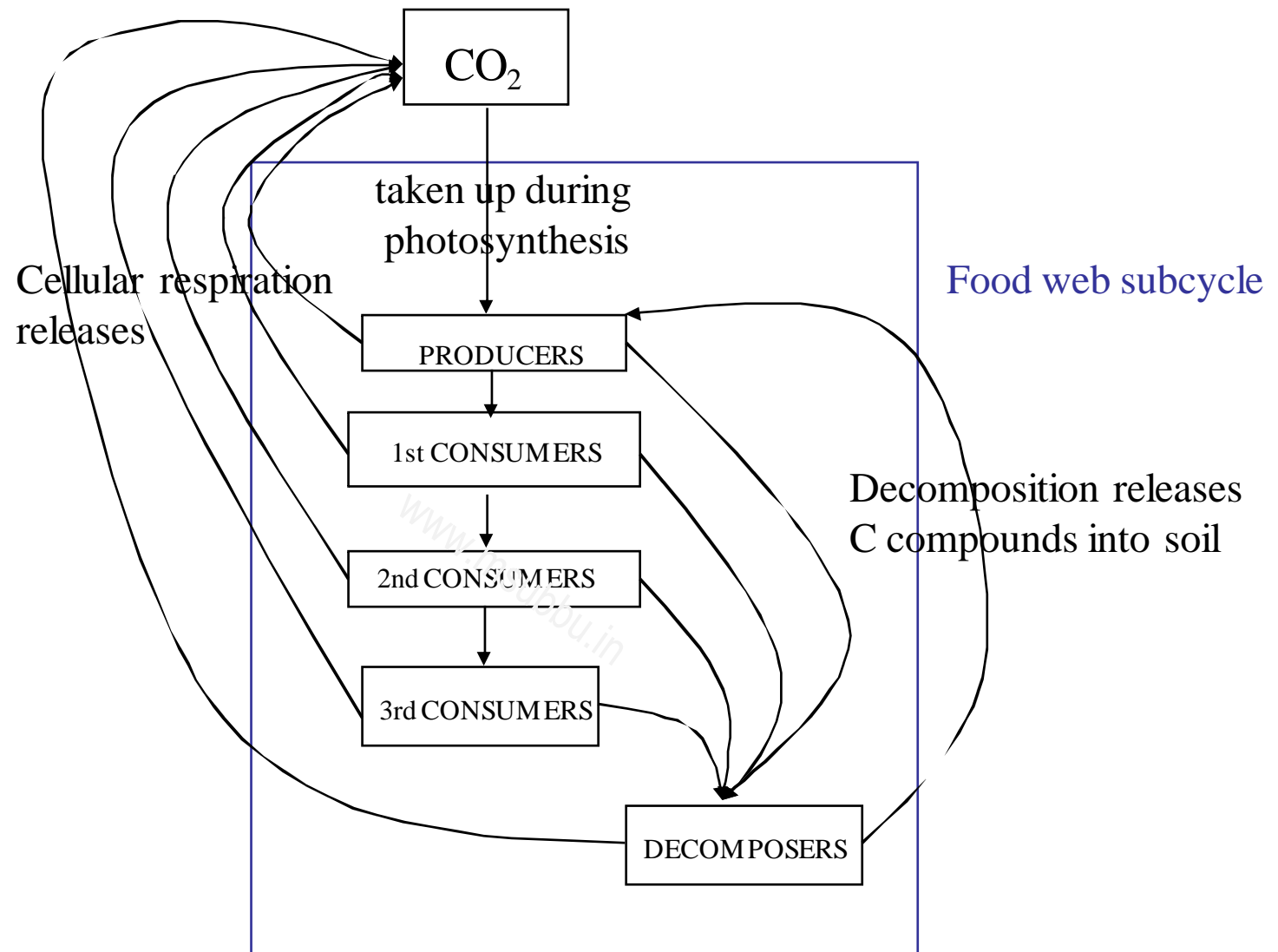
Mineral Cycle

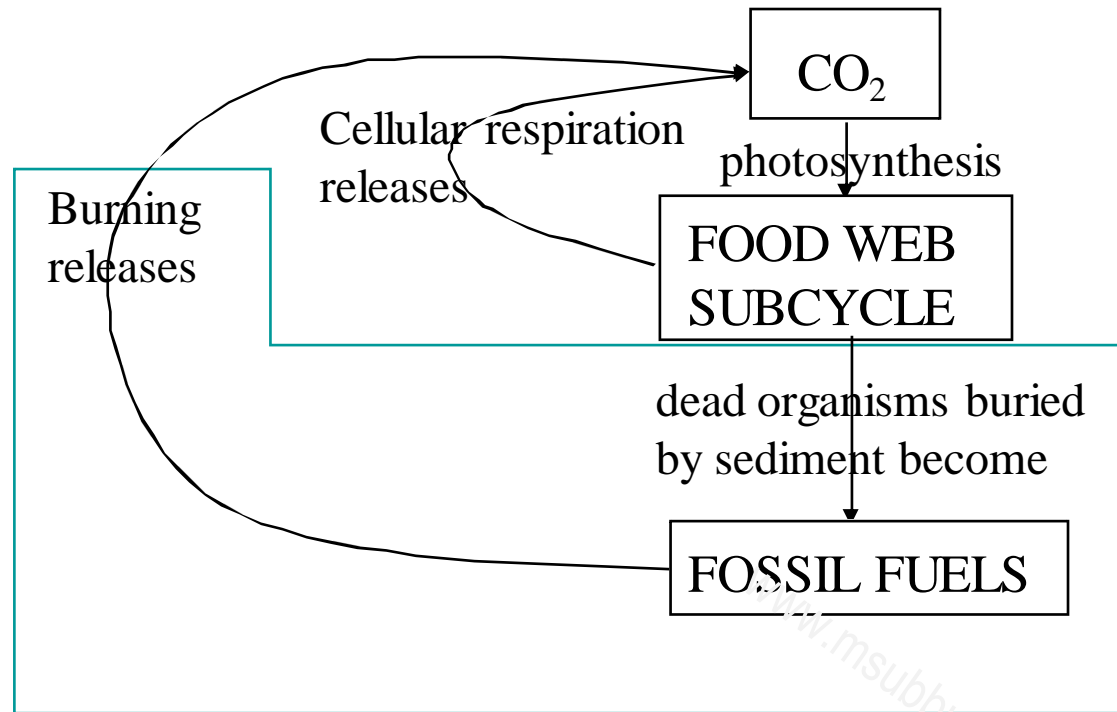


Carbon Cycle

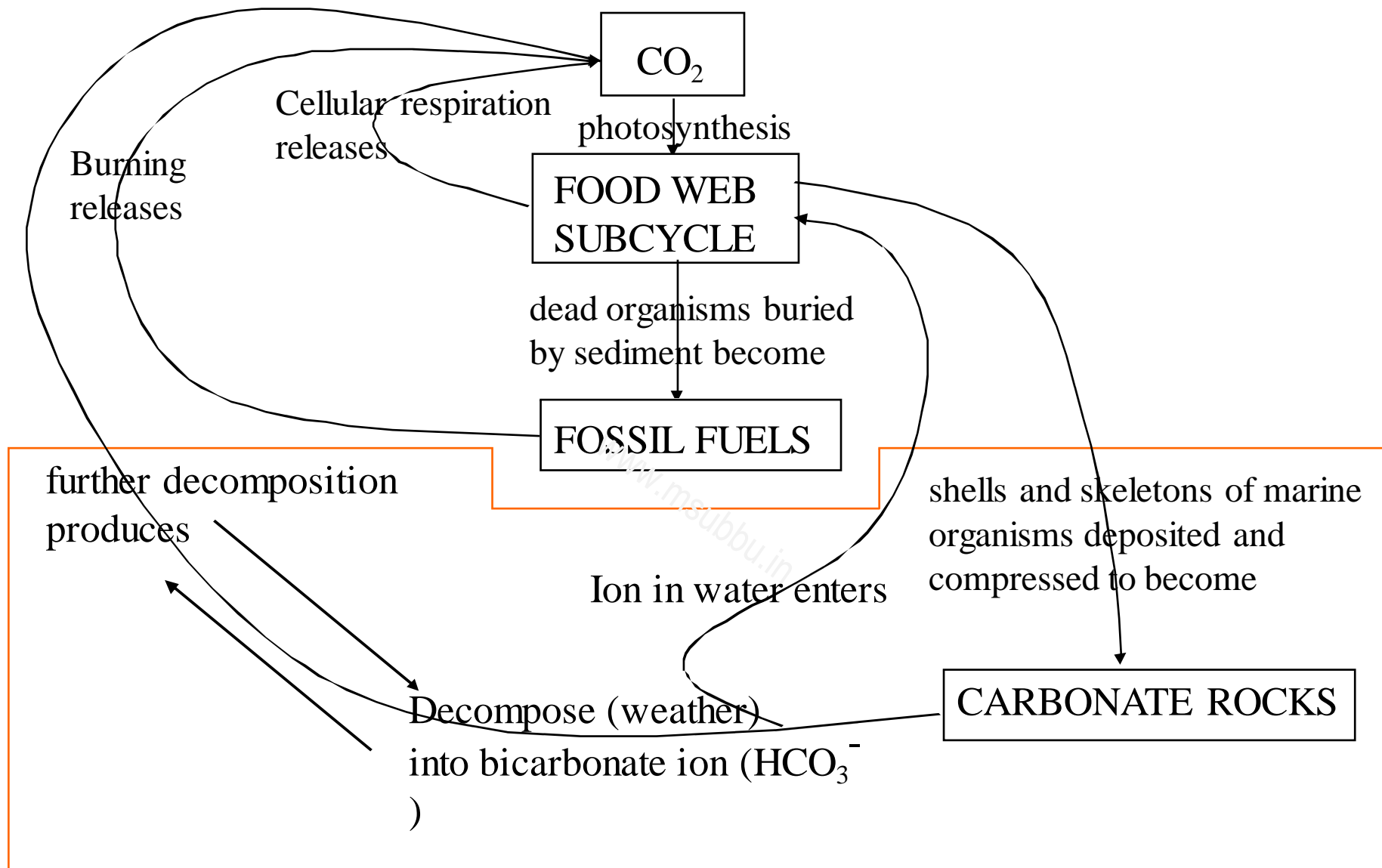
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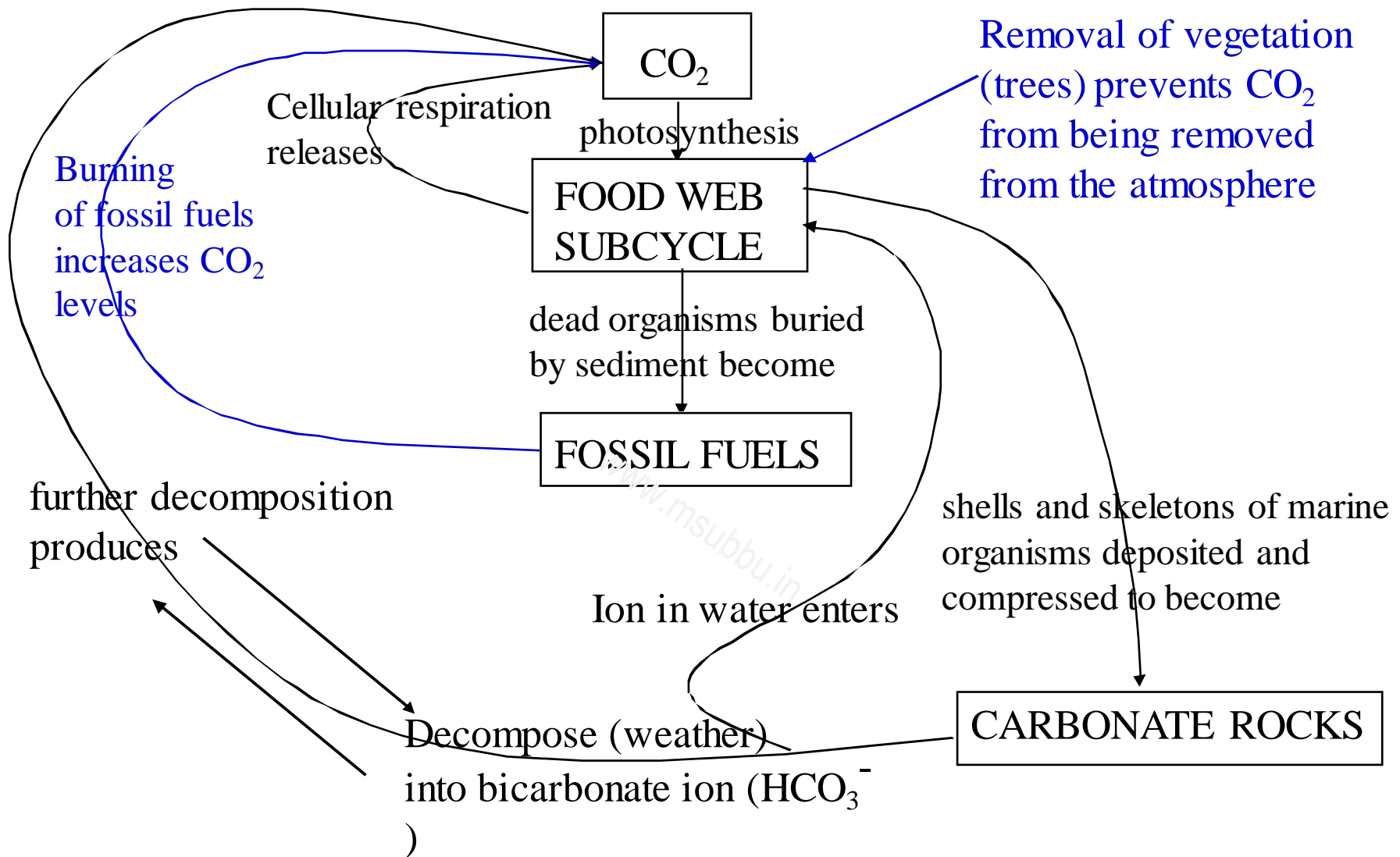




Fossil fuel
subcycle

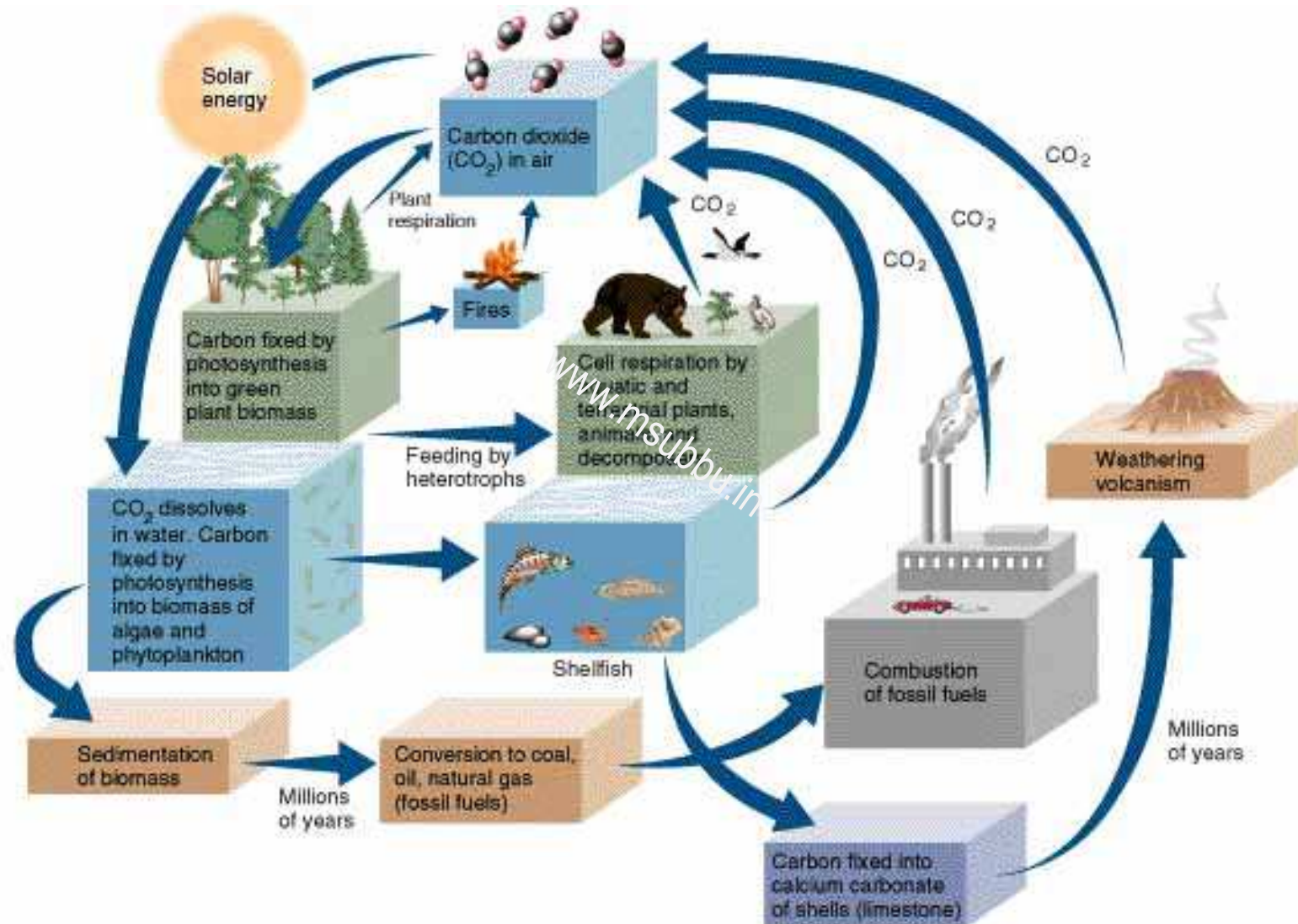


Carbonate rock subcycle

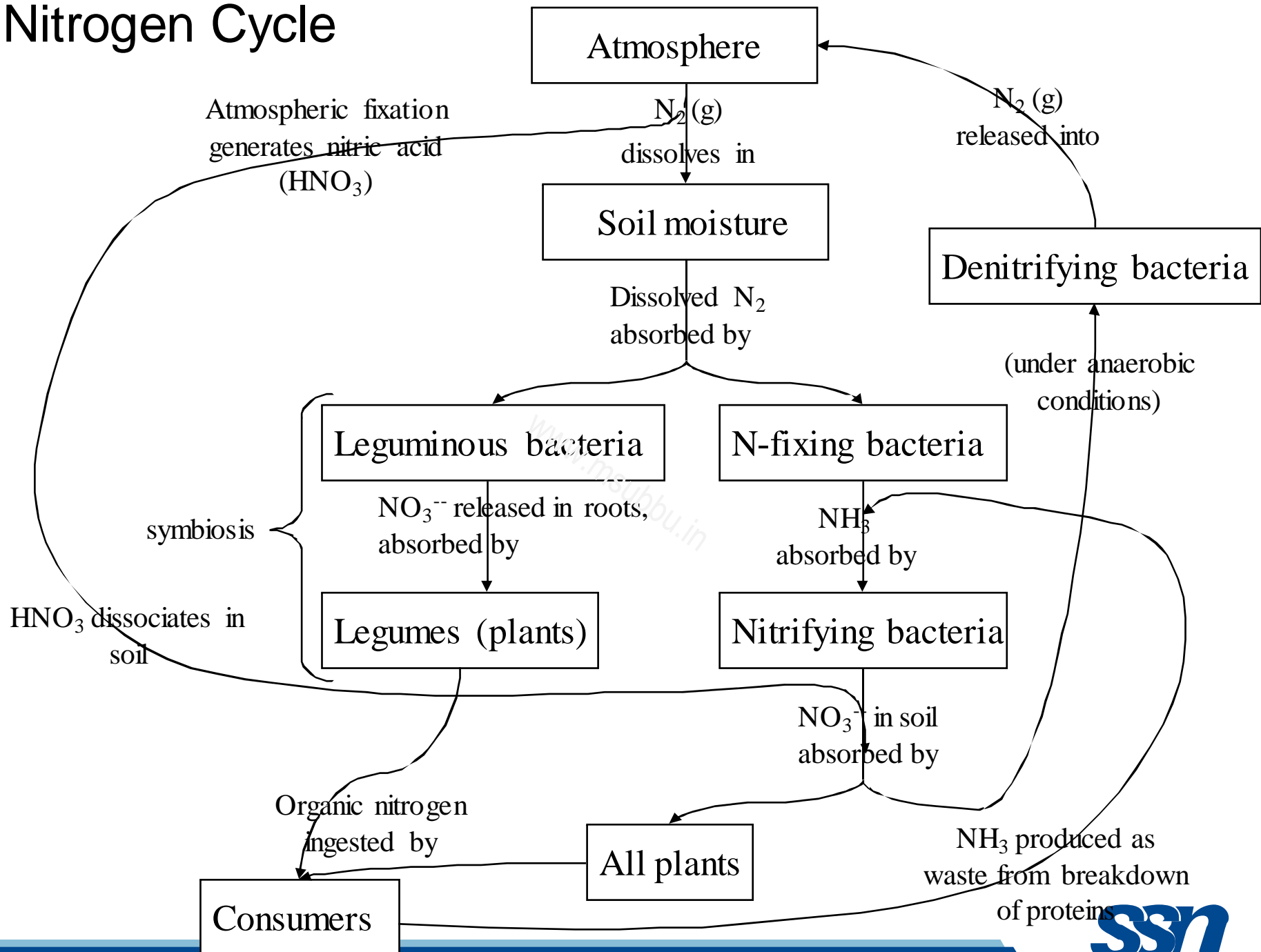


Where human activities change the cycling rate of carbon among reservoirs.

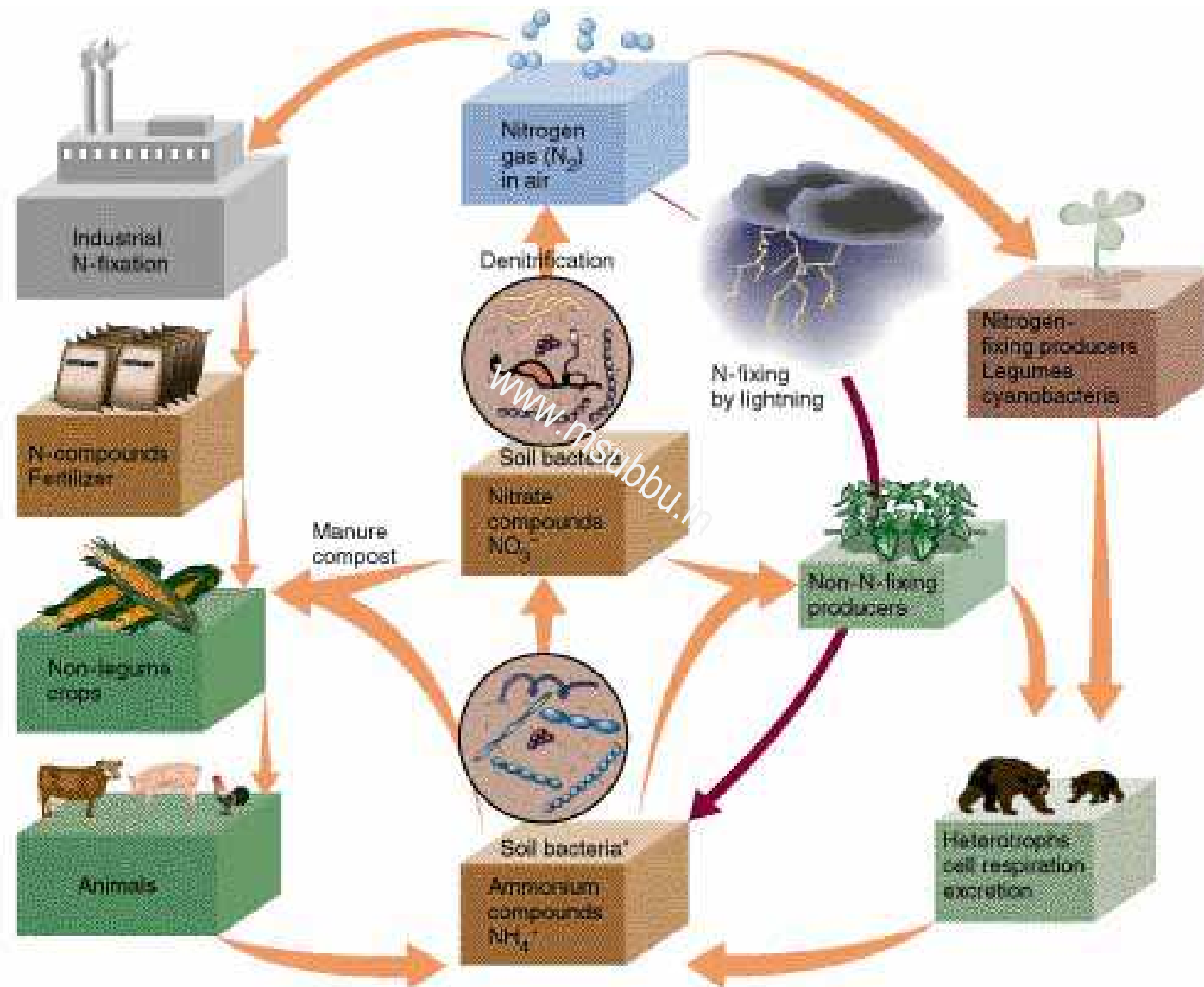
Carbon Cycle



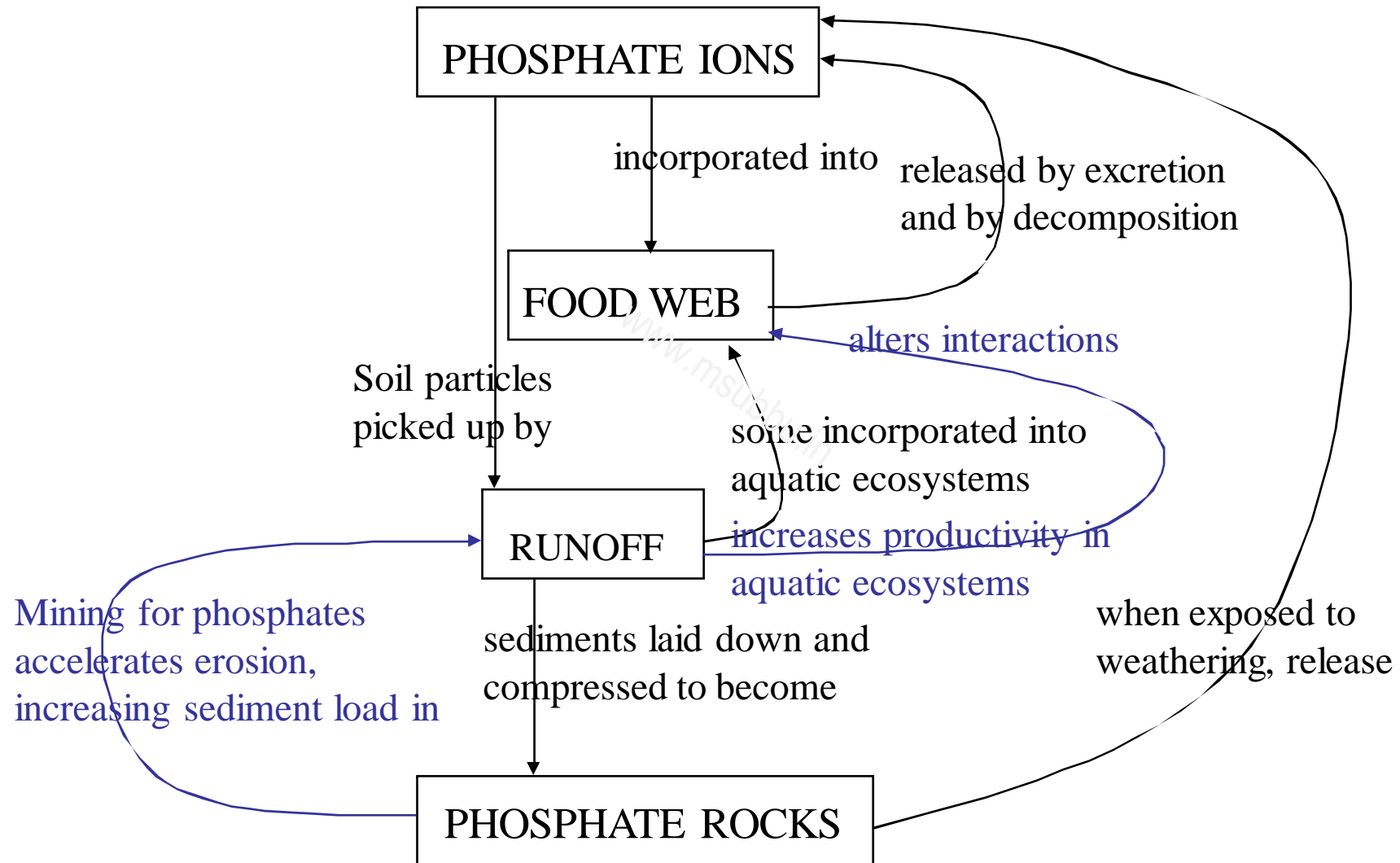
Nitrogen Cycle



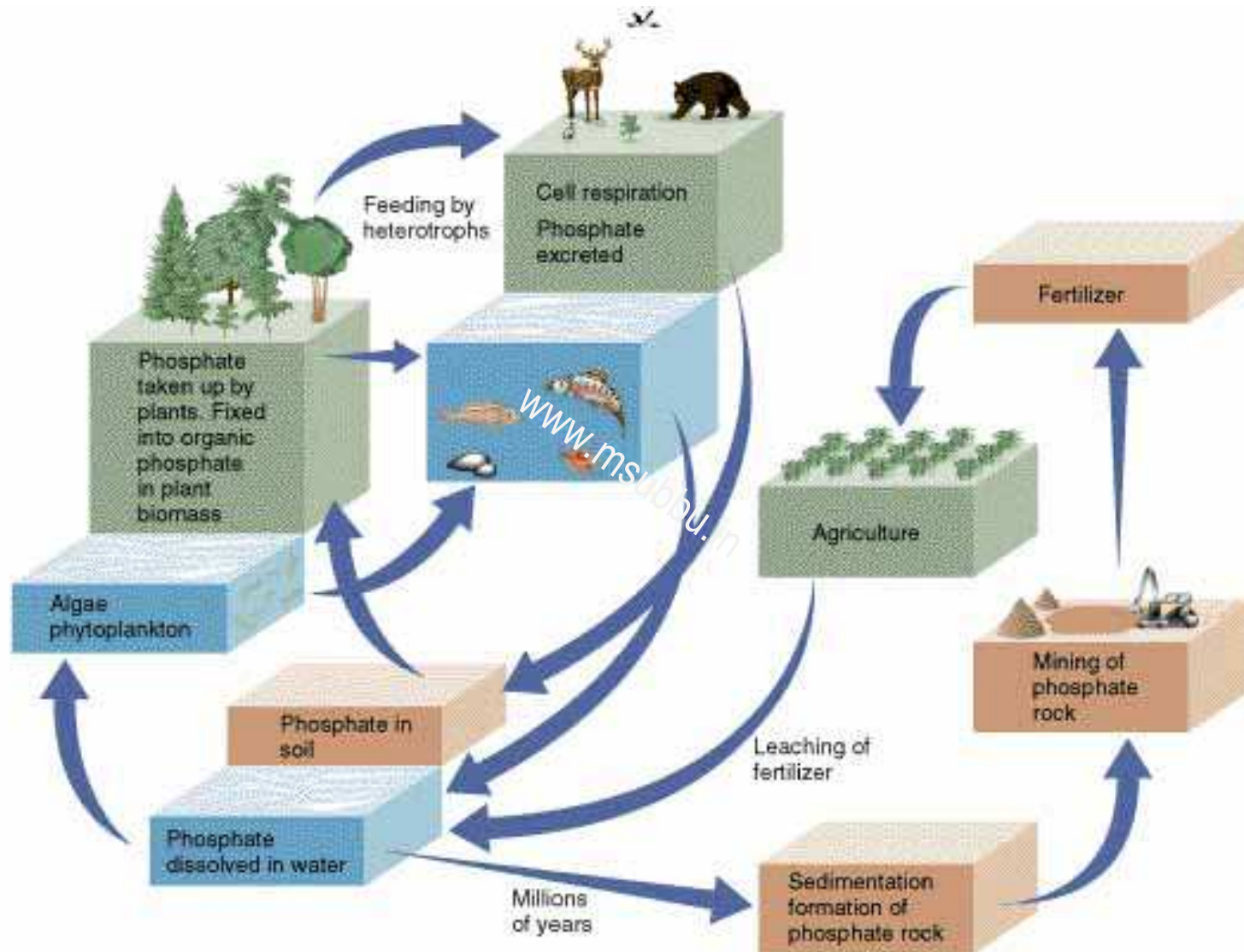
Nitrogen Cycle



Phosphorus Cycle



Phosphorus Cycle



THE HUMAN SYSTEM

How can we make it into a sustainable cycle?

