JSR IAS ACADEMY

GENERAL SCIENCE

BIOLOGY

Environment

Environment

The surroundings or space in which a person, animal, or plant lives, is known as on environment.

The Ecosystem

Ecosystem is a community of living and non-living things that work together

Food Chain

Producers

Producers are organisms that are able to produce their own organic food.

They do not need to eat other organisms to do this. Producers are also called autotrophs.

Consumers

Consumers Organisms which cannot produce their own **food**

All animals are consumers as they cannot produce their own food. Consumers are also called heterotrophs.

Herbivores

Animals which eat plants or plant products e.g: cattle, deer, goat and rat.

Carnivores

Animals that eat other animals e.g: Lion, tiger, frog and owl.

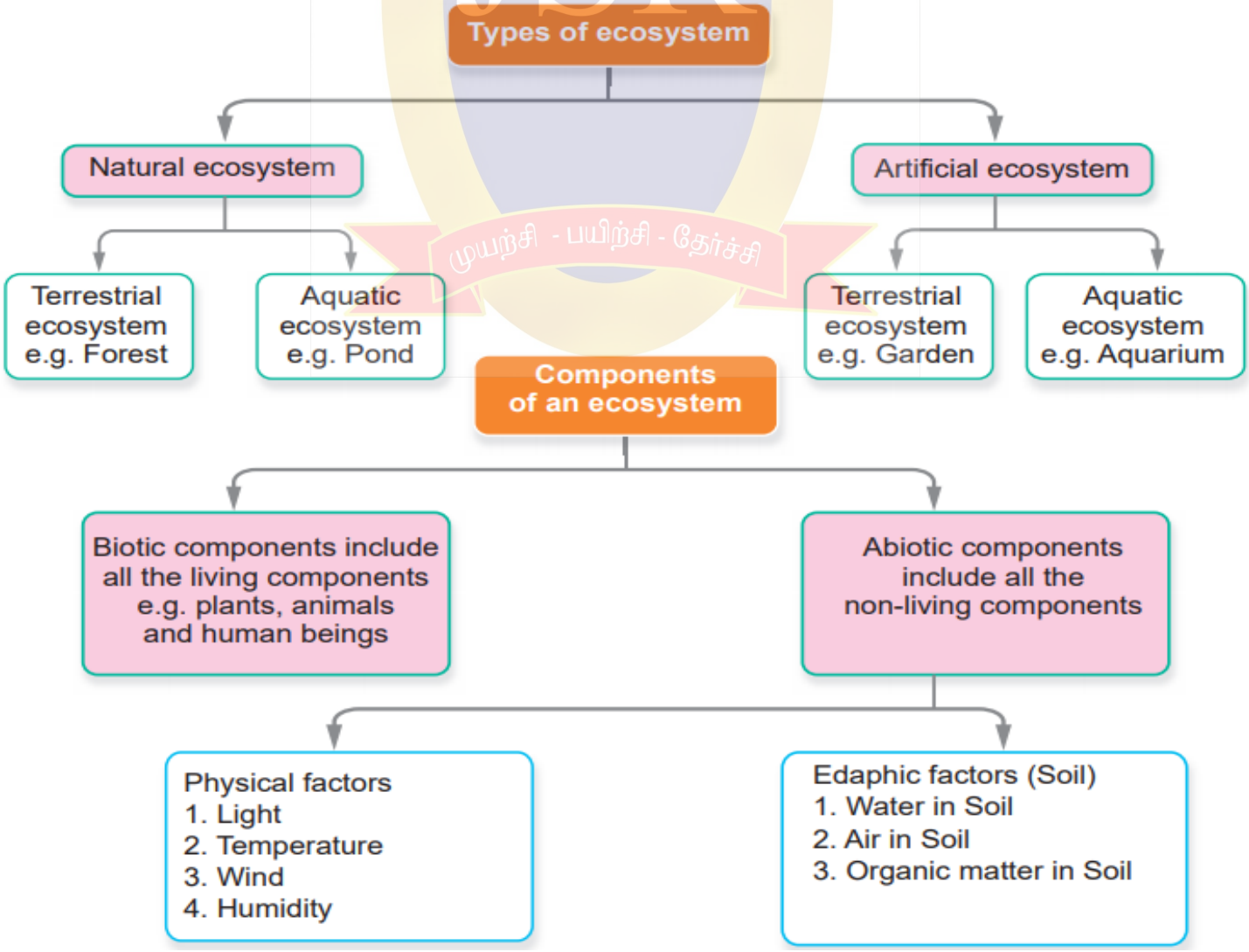
Omnivores

Animals that eat both plants and animals e.g: Humans, dog and crow

decomposers

Micro-organisms that obtain energy from the chemical breakdown of dead organisms (both plants and animals).

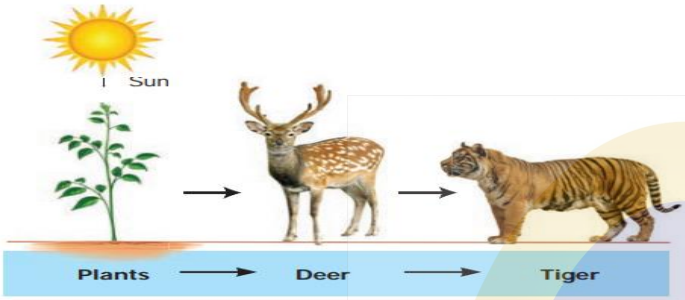
They break complex organic substances into simple organic substances that goes into the soil and are used by plants. (e.g) Bacterium, Fungi



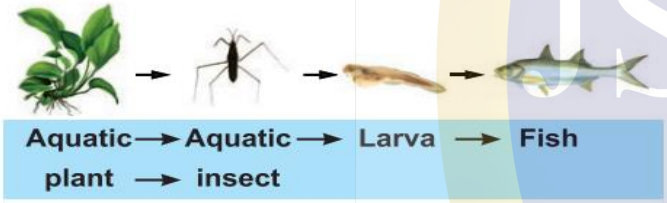
Food chain

This sequence of who eats whom in an ecosystem is called as food chain.

E.g. Food chain in a terrestrial (grassland) ecosystem

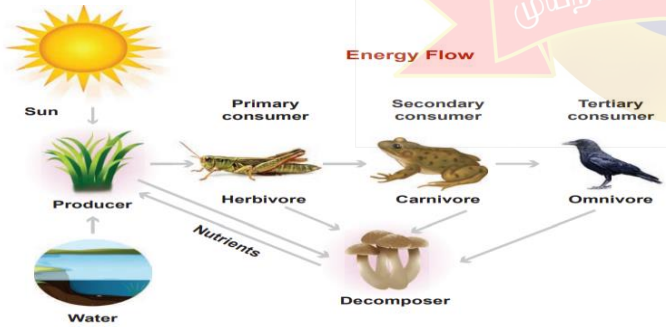


E.g. Food chain in an aquatic (lake) ecosystem

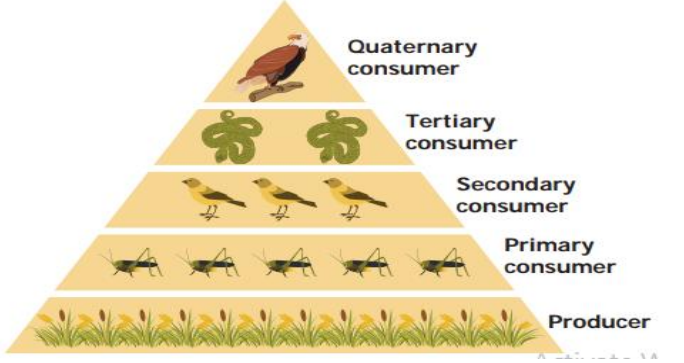


Energy flow

The food chain begins with the energy given by the Sun.



Trophic levels



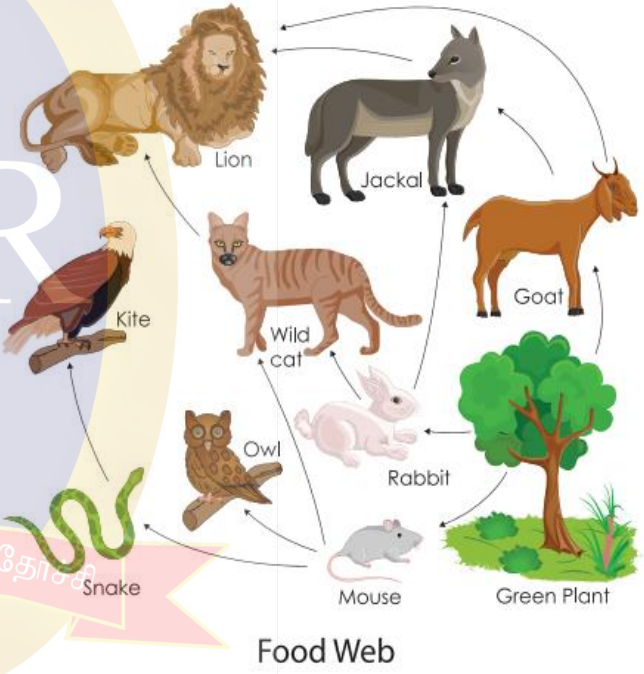
Organism uses up to 90% of its food energy for its life processes. Only about 10% of energy goes into new body cells and will be available to the next animal when it gets eaten.

This loss of energy at each trophic level can be shown by an energy pyramid.

Food web

Consumers have different sources of food in an ecosystem.

If we put all the food chains within an ecosystem together, then we end up with many interconnected food chains. This is called a food web.



Energy flow

- The transfer of energy in an ecosystem between trophic levels can be termed as energy flow.
- Part of the energy obtained from the sun by producer is transferred to consumers and decomposers through the each trophic level,
- while some amount of energy is dissipated in the form of heat.
- Energy flow is always unidirectional in an ecosystem

Laws of thermodynamics

i. First law of thermodynamics

Energy cannot be destroyed or created. But it can be transformed from one form to another.

. Example: In photosynthesis, the product of starch (chemical energy) is formed by the combination of reactants (chlorophyll, H2O, CO2).

The energy stored in starch is acquired from the external sources (light energy)

light energy is converted into chemical energy.

$$6\,CO_2 + 6\,H_2O \xrightarrow[\text{Chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6\,O_2$$

Light energy ⟶ chemical energy

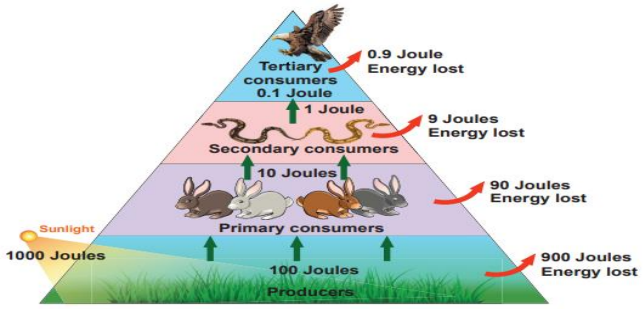
ii. Second law of thermodynamics

energy transformation cannot be 100% efficient.

Ten percent law

This law was proposed by **Lindeman (1942).**

It states that during transfer of food energy from one trophic level to other, only about 10% stored at every level and rest of them (90%) is lost in respiration, decomposition and in the form of heat. Hence, the law is called ten percent law.



Ecological pyramids

The concept of ecological pyramids was introduced by

There are three types:

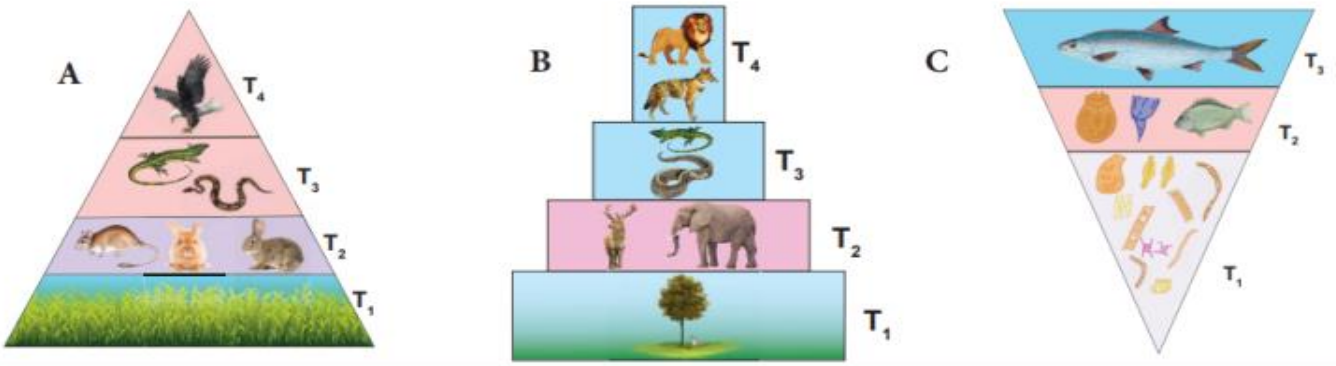
(1) pyramid of number

(2) pyramid of biomass

(3) pyramid of energy.

T_1 - Producers | T_2 - Herbivores | T_3 - Secondary consumers | T_4 - Tertiary consumers

Figure 7.8: Pyramids of numbers (individuals per unit area) in different types of ecosystems. **Upright**-A) Grassland ecosystem B) Pond ecosystem , **Spindle shaped** -C) Forest ecosystem, **Inverted**-D) Parasite ecosystem



T_1 - Producers | T_2 - Herbivores | T_3 - Secondary consumers | T_4 - Tertiary consumers

Figure 7.9: Pyramids of biomass (dry weight per unit area)in different types of ecosystems. **Upright**-A) Grassland ecosystem B) Forest ecosystem, **Inverted**- C)Pond ecosystem

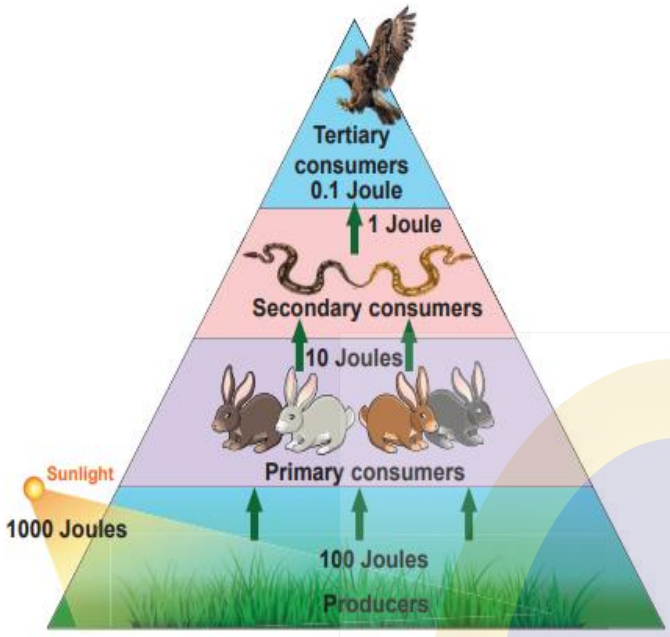


Figure 7.10: Pyramids of energy(Kcal/unit area/unit time) in any ecosystem

The Solid Waste Management (SWM) rules

The Solid Waste Management (SWM) rules, 2016 say that,

Every Household should segregate and store the waste generated by them in three separate streams – namely

1. bio-degradable,
2. non bio-degradable and
3. domestic hazardous waste

The average person in India produces 0.45kg of waste every day.

India produces 532 million kilos of solid waste every day.

3R's are important in protecting environment.

1. R is reduce
2. R is reuse
3. R is recycle.

Biogeochemical Cycles (bio – life; geo – earth)

Cyclic flow of nutrients between non-living and living factors of the environment are termed as bio-geo-chemical cycles.

continuity of nutrient cycles or biogeochemical cycles (N2, C, H2O, P, S cycles)

Some of the important biogeochemical cycles are:

- Water cycle
- Nitrogen cycle
- Carbon cycle

Water Cycle

water converts itself to various forms like

liquid,

solid and

vapour

Evaporation:

Evaporation is a type of vaporization, where liquid is converted to gas before reaching its boiling point.

Transpiration:

Transpiration is the process by which plants release water vapour into the atmosphere through stomata in leaves and stems.

Sublimation:

Sublimation is conversion of solid to gas, without passing through the intermediate liquid phase.

Ice sheets and ice caps from north and south poles, and icecaps on mountains, get converted into water vapour directly, without converting into liquid.

Condensation:

Condensation is the changing of gas phase into liquid phase and is the reverse of vaporisation.

Precipitation:

Due to change in wind or temperature, clouds combine to make bigger droplets, and pour down as precipitation(rain).

Precipitation includes drizzle, rain, snow and hail.

Nitrogen Cycle

It is an essential component of proteins, DNA and chlorophyll.

Atmosphere is a rich source of nitrogen and contains about 78% nitrogen.

They can use it only if it is in the form of ammonia, amino acids or nitrates.

Processes involved in nitrogen cycle are explained below.

Nitrogen fixation :

Nitrogen fixation is the conversion of atmospheric nitrogen, which is in inert form, to reactive compounds available to living organisms.

This conversion is done by a number of bacteria and blue green algae (Cyanobacteria).

Leguminous plants like pea and beans have a symbiotic relationship with nitrogen fixing bacteria Rhizobium.

Rhizobium occur in the root nodules of leguminous plants and fixes nitrogenous compounds.

Nitrogen assimilation:

Plants absorb nitrate ions and use them for making organic matter like proteins and nucleic acids. Herbivorous animals convert plant proteins into animal proteins. Carnivorous animals synthesize proteins from their food.

Ammonification:

The process of decomposition of nitrogenous waste by putrefying bacteria and fungi into ammonium compounds is called ammonification.

Animal proteins are excreted in the form of urea, uric acid or ammonia.

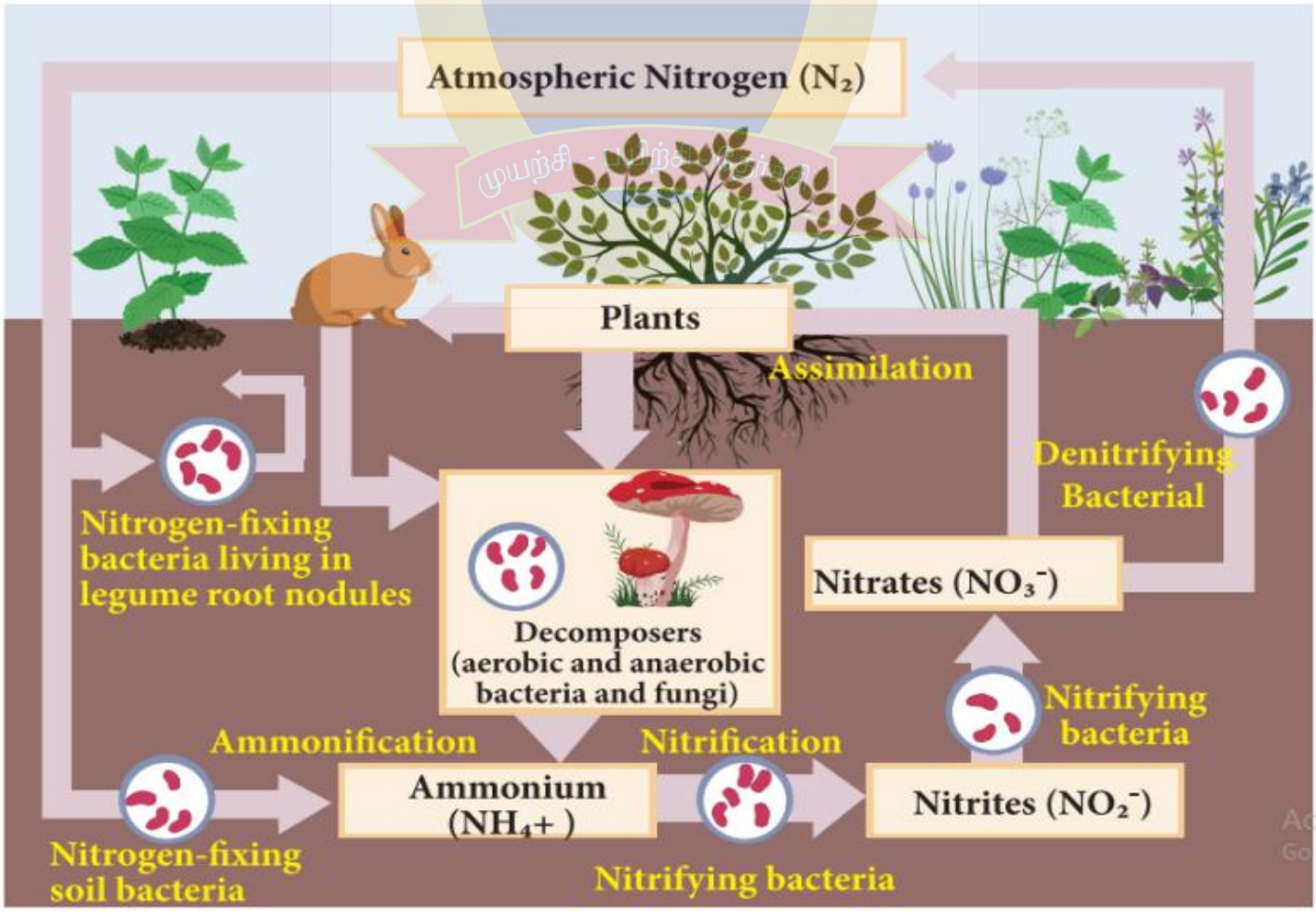
Nitrification:

The ammonium compounds formed by ammonification process are oxidised to soluble nitrates. This process of nitrate formation is known as nitrification. The bacteria responsible for nitrification are called as nitrifying bacteria.

Denitrification:

Free living soil bacteria such as Pseudomonas sp. reduce nitrate ions of soil into gaseous nitrogen which enters the atmosphere.

Role played in nitrogen cycle	Name of the microorganisms
Nitrogen fixation	*Azotobacter* (in soil) *Rhizobium* (in root nodules) Blue green algae- *Nostoc*
Ammonification	Putrefying bacteria, Fungi
Nitrification	Nitrifying bacteria *i. Nitrosomonas* *ii. Nitrobacter*
Denitrification	Denitrifying bacteria *Pseudomonas*



Sea grasses and mangroves of Estuarine and coastal ecosystems are the most efficient in carbon sequestration. Hence, these ecosystems are called as " **Blue carbon ecosystems**". They are not properly utilized and maintained all over the world although they have rich bioresources potential.

Types of Carbon

Green carbon – carbon stored in the biosphere (by the process of photosynthesis).

Grey carbon – carbon stored in fossil fuel (coal, oil and biogas deposits in the lithosphere).

Blue carbon – carbon stored in the atmosphere and oceans.

Brown carbon – carbon stored in industrialized forests (wood used in making commercial articles)

Black carbon – carbon emitted from gas, diesel engine and coal fired power plants.

Phosphorus cycle

- It is a type of sedimentary cycle.
- Already we know that phosphorus is found in the biomolecules like DNA, RNA, ATP, NADP and phospholipid molecules of living organisms.
- Phosphorus is not abundant in the biosphere, whereas a bulk quantity of phosphorus is present in rock deposits, marine sediments and guano. It is released from these deposits by weathering

Earthworms are referred as '*Farmer's friend*'. After digesting organic matter, earthworms excrete a nutrient-rich waste product called castings which is used as Vermicompost.

Wastewater Recycling Stages

Inlet - sewage water

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Primary treatment(physical)

- Sedimentation (heavy solids)
- Floatation (oil, grease, lighter solids)
- Filtration

↓

Secondary treatment(biological)

- Biological oxidation (biodegradable dissolved organic matter)
- Sedimentation (biological solids)
- Filtration

↓

Tertiary treatment (physio-chemical)

- (nitrogen, phosphorus, suspended solids, heavy metals)
- Disinfection (chlorination 5-15mg/l)

↓

Outlet- recycled water

World Water Day on 22nd March every year, is about focusing attention on the importance of water.