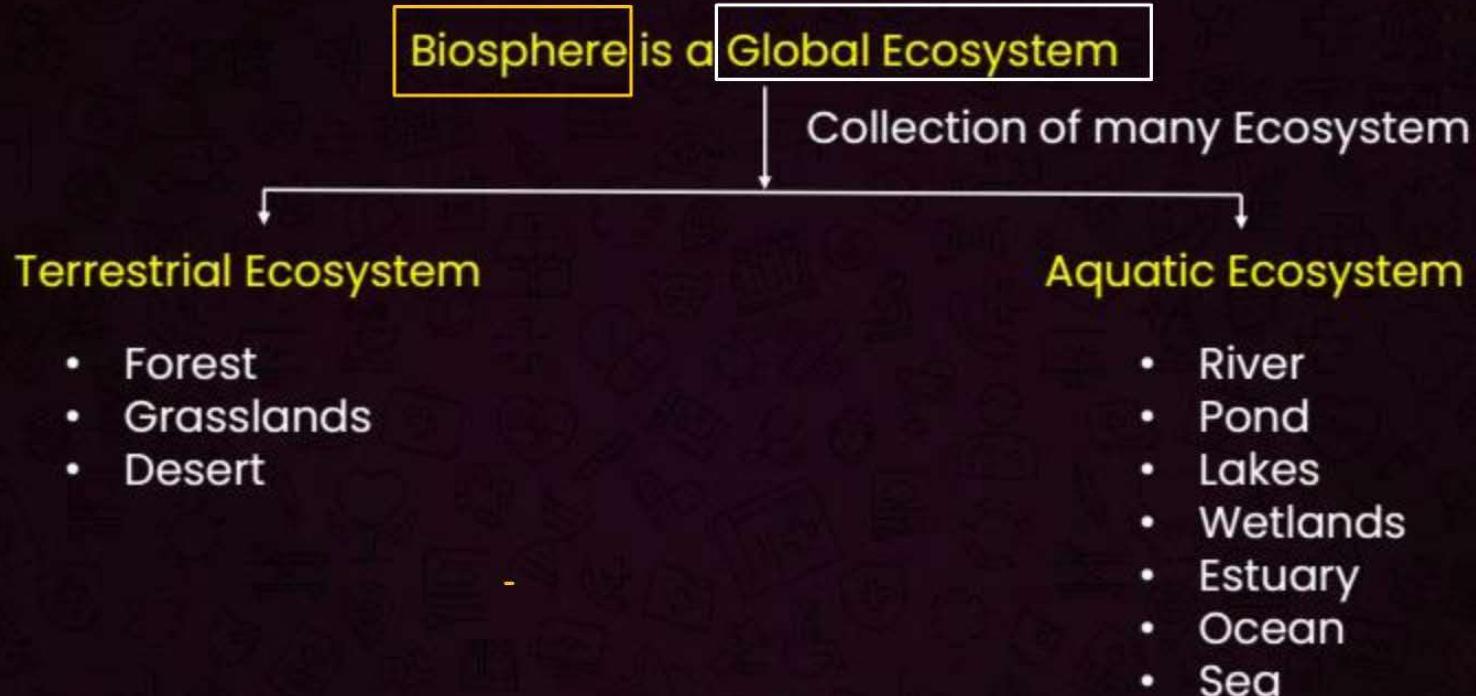




Ecosystem



- Functional unit of Ecology. (Biotic)
- Ecosystem is a unit where living organisms interact with their non-living environment. (Abiotic)
- Many Communities forms Ecosystem.





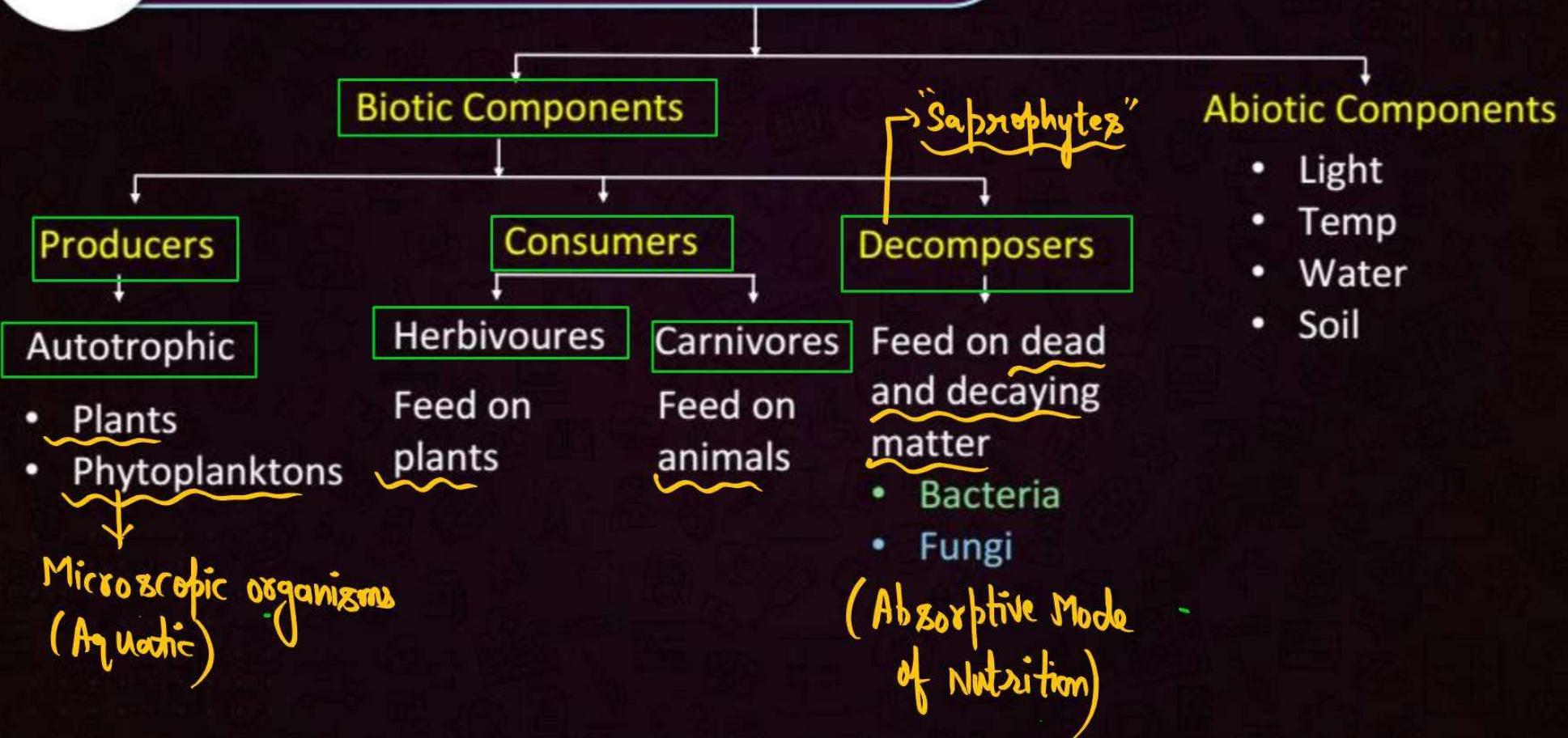
Artificial/Man-made/ Anthropogenic Ecosystem



- Man-made Lakes
- Aquarium
- Crop-fields



Components of Ecosystem





Ecosystem

Structural
Components

Functional
Components





Structural Components of Ecosystem

Species Composition

"Different kinds of Species" present in Ecosystem

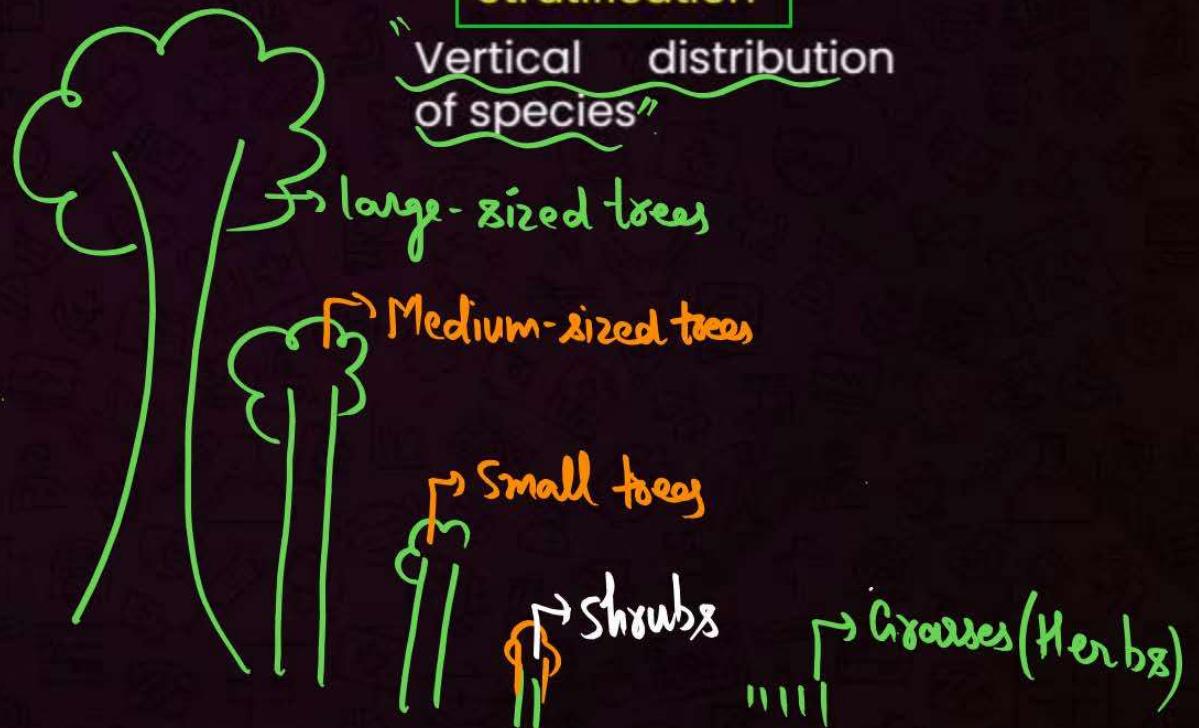
- ✓ Producers
- ✓ Consumers
- ✓ Decomposers

Top layer of soil

Bottom of waterbody

Stratification

"Vertical distribution of species"





Ques : Maximum stratification is found in

Ans : Tropical Rain Forest

↳ "Amazon Forest"



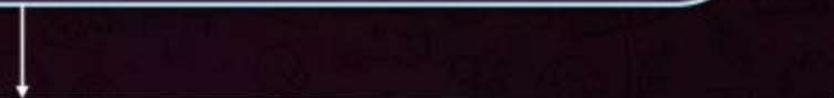
Functional Components of Ecosystem

Productivity

Decomposition

Energy Flow

Nutrient Cycling





Productivity



The rate of formation of **organic material or Biomass** is called as Productivity

Unit of Productivity

In terms of **weight**

(g/m²/year)
or
 $(\text{gm}^{-2}\text{yr}^{-1})$

In terms of **Energy**

Kilocalorie/m²/year
or
 $(\text{Kcal m}^{-2}\text{yr}^{-1})$



Types of Productivity



Primary Productivity
(at Producer Level)

Rate of biomass
production in plants by
photosynthesis

Secondary Productivity
(at Consumer Level) ✓

(Herbivores, Carnivores)

Rate of Biomass production
in Consumers by feeding
on other organisms.



Primary Productivity

Gross Primary Productivity (GPP)

Total amount of organic material produced in plants by photosynthesis

Net Primary Productivity (NPP)

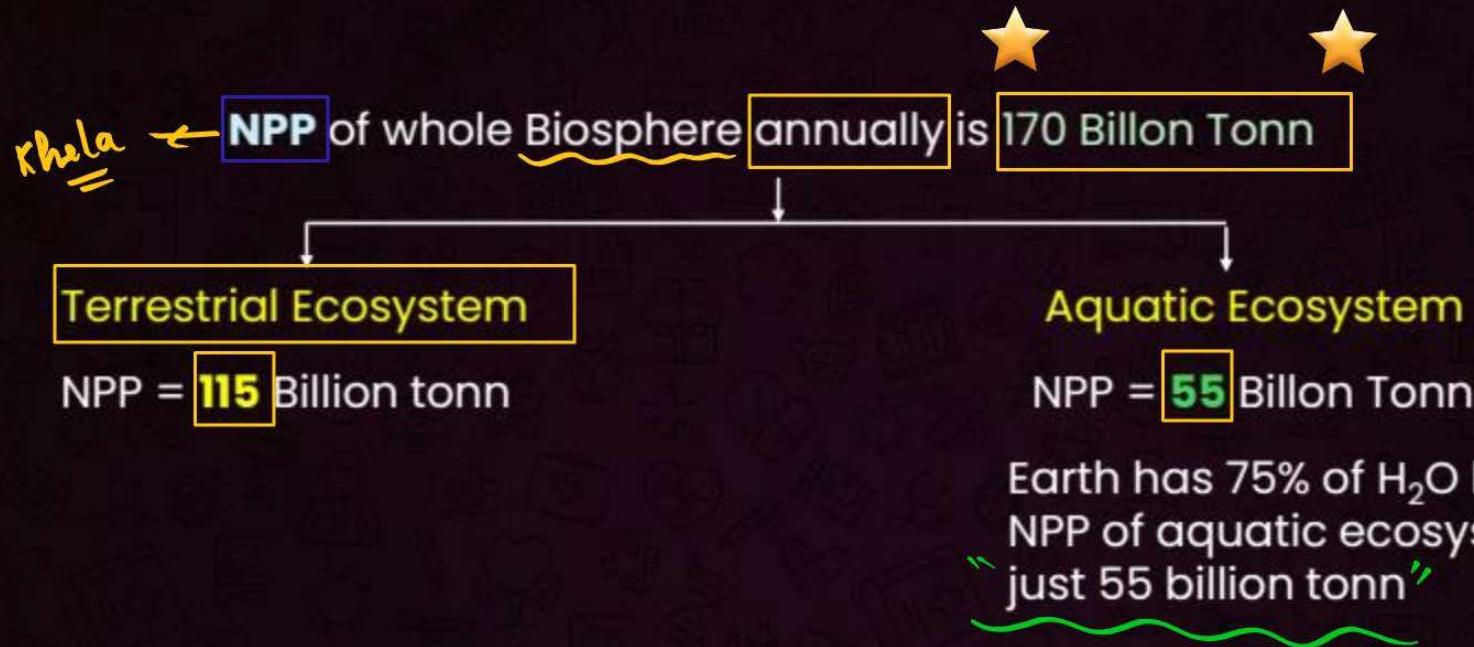
$$NPP = GPP - R$$

R = Respiratory losses

- NPP is the remaining biomass after respiratory losses.

Imp

- NPP is available to next trophic level i.e. Herbivores



Reason of low productivity of Oceans (Aquatic Ecosystem)

1. Availability of Light
2. "Nutrients" (Dissolved nutrients are less or compared to soil.)
 - No. of decomposers are less which add nutrients
 - Nitrogen is the most limiting nutrients.



Factors affecting Primary Productivity



- Light
- Temperature (optimum temp.)
 → 20-25°C
- Soil: pH, moisture
- Available H₂O
- Nutrients



Decomposition



- Break down of Complex organic material into simpler inorganic materials.
- Decomposition occurs on dead and decaying matter.

Detritus

Dead remains of both plants and animals

Litter

Dead remains of plants only





Decomposition



Fragmentation

Catabolism

Leaching

Humification

Mineralisation





Fragmentation → Physical process

Breaking down of Detritus into smaller fragments.

Done by : "DETRITIVORES" (small invertebrate animals)

Earthworms, Termites

Detritivores

Detritus comes out as faecal matter.

- a) It pulverizes
- b) Surface area increases

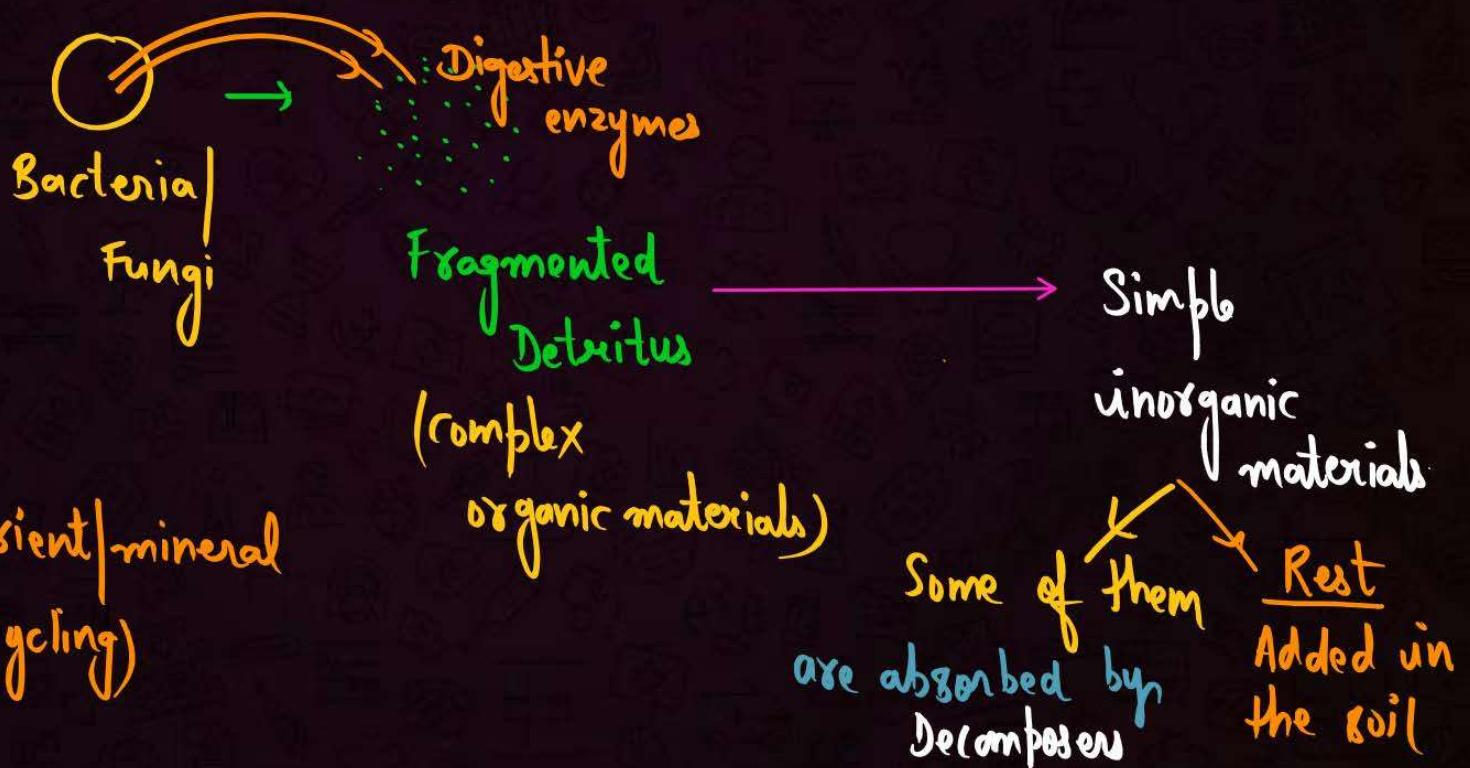
Catabolism → Chemical/Enzymatic process

Fragmented detritus (Complex organic materials) is converted to Simpler inorganic materials.

Done by:

- Bacteria
- Fungi

↓
(Help in nutrient/mineral cycling)



Catabolism → "Rate of catabolism" is different and depends on chemical composition of detritus.

Humification

Formation of "HUMUS" in top layer of soil

HUMUS - Properties

- a) Dark coloured
- b) Amorphous
- c) Colloidal
- d) "Slightly acidic"
- e) Rich in organic materials
- f) Reservoir of Nutrients
- g) "Resistant to microbial activity"
(Rate of decomposition is slow) (Kheda)

Mineralization

"Rate of decomposition fast" ↓
"Simple inorganic material"

i.e. minerals are added to soil called as Mineralisation.



Leaching



"Simple water-soluble inorganic compounds", percolates deep down into the soil
converts in the form of Unavailable salts.

QUESTION

Primary productivity is expressed in terms of

- A $(\text{Kcal m}^{-2})\text{yr}^{-1}$
- B $\text{Kcal} \times \text{yr} / \text{m}^2$
- C yr/gm^2
- D Kcal / m^2

QUESTION



Rate of organic matter stored by producers in their bodies per unit time and area is called as

- A GPP
- B NPP
- C Secondary productivity
- D Ecological efficiency

QUESTION

Mark the incorrect match.

- A Primary productivity – Varies in different types of ecosystems ✓
- B GPP – Available biomass for the consumption to herbivores ✗
- C 55 billion tons – Annual NPP of oceans ✓
- D Secondary productivity – Rate of formation of new organic of new organic matter by consumers ✗

QUESTION

Mark the **odd one** w.r.t. humus.

- A Slightly acidic
- B Colloidal in nature
- C Undergoes decomposition of very fast rate
- D Serves as a reservoir of nutrients

V. imp

Factors affecting Rate of decomposition

1. **Chemical composition** of Detritus

Fast

- “Nitrogenous compounds”
(DNA, RNA, Protein)
- “Water soluble sugars”
and carbohydrates

Slow

- Chitin ✓
- Lignin ✓
- Tannin ✓
- Resin ✓
- Cellulose ✓
- Phenolic ✓
compounds

2. **Temperature**

Controls

"Enzymatic activity"



Optimum temp.

25°C – 35°C

Temp less than 10°C

slows down

decomposition

3. **Humidity/
Moisture**



Humid conditions
accelerates
decomposition

4. Aeration



Supply of O₂



Decomposition

Fast

- Warm
- Humid (*Moisture*)
- Aerobic conditions
(O_2)

Slow

- Cold
- Dry
- Anaerobic Condition
(O_2 absence)



Energy Flow

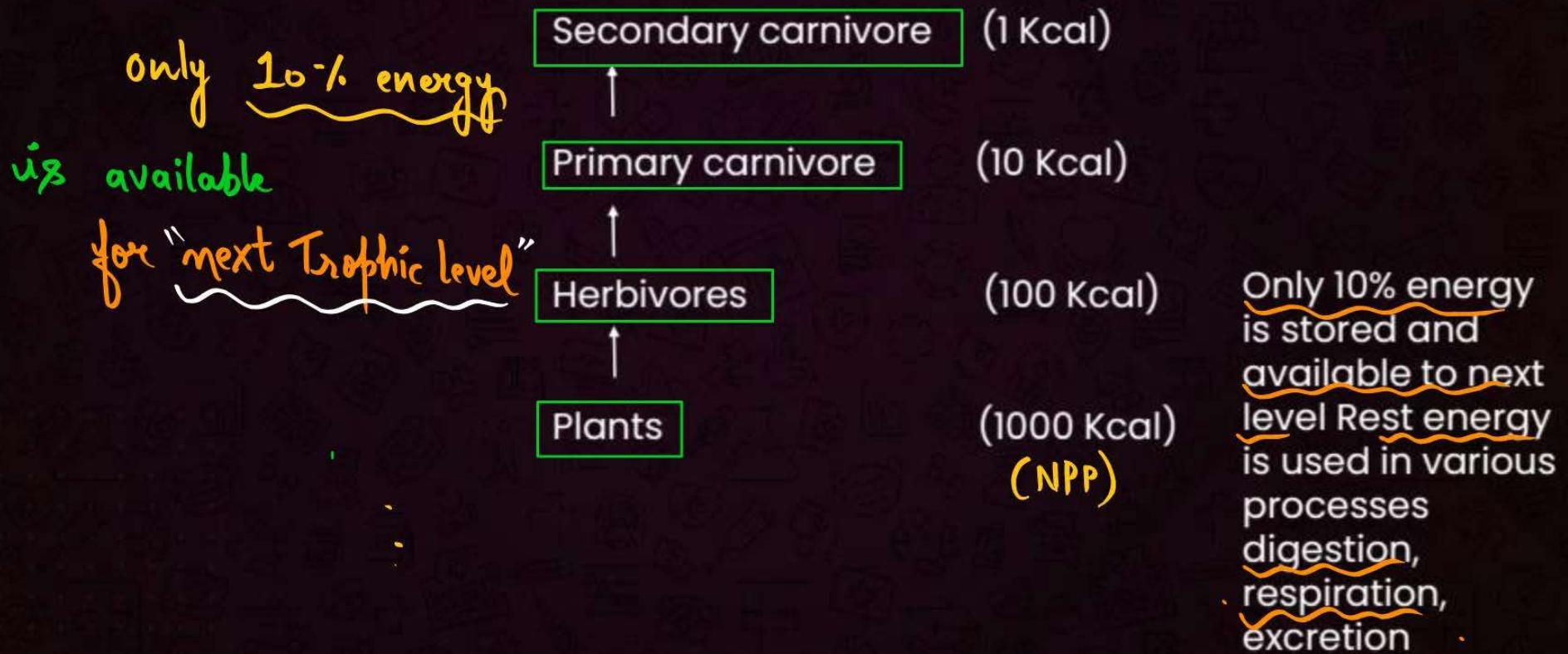


Transfer of Energy from one organism to another and from one form to another.

Energy flow is always unidirectional



Ten Percent Law





Energy Flow



Solar energy is the Prime source of Energy in all Ecosystem.

Exception → **Deepsea hydrothermal vent**



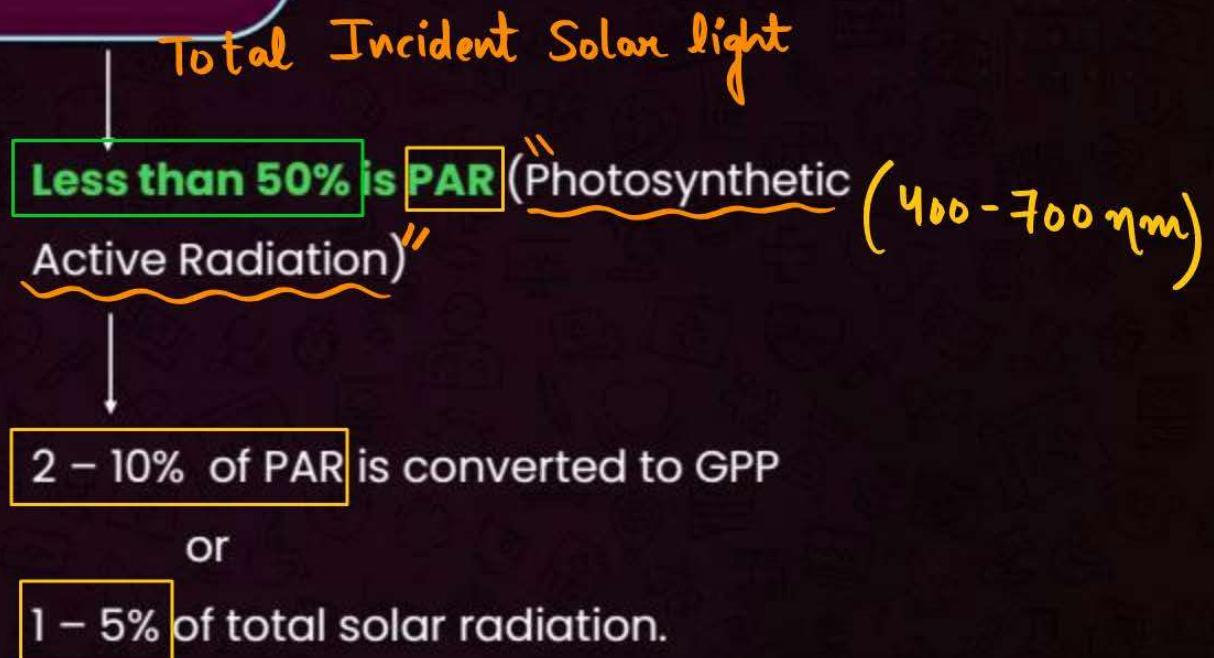
Decomposers / Heterotrophs (Depend on other organisms for energy)



Total Solar Radiation



- **Light saturation** points for plant in at "10% of total solar radiation."





Law of Thermodynamics



1st Law

Energy can neither be created nor be destroyed, only changed from one form to another.

Energy concentrated from (one form)

Exp: Food energy

2nd Law

"Dissipation of energy"

Dispersed from (other form)

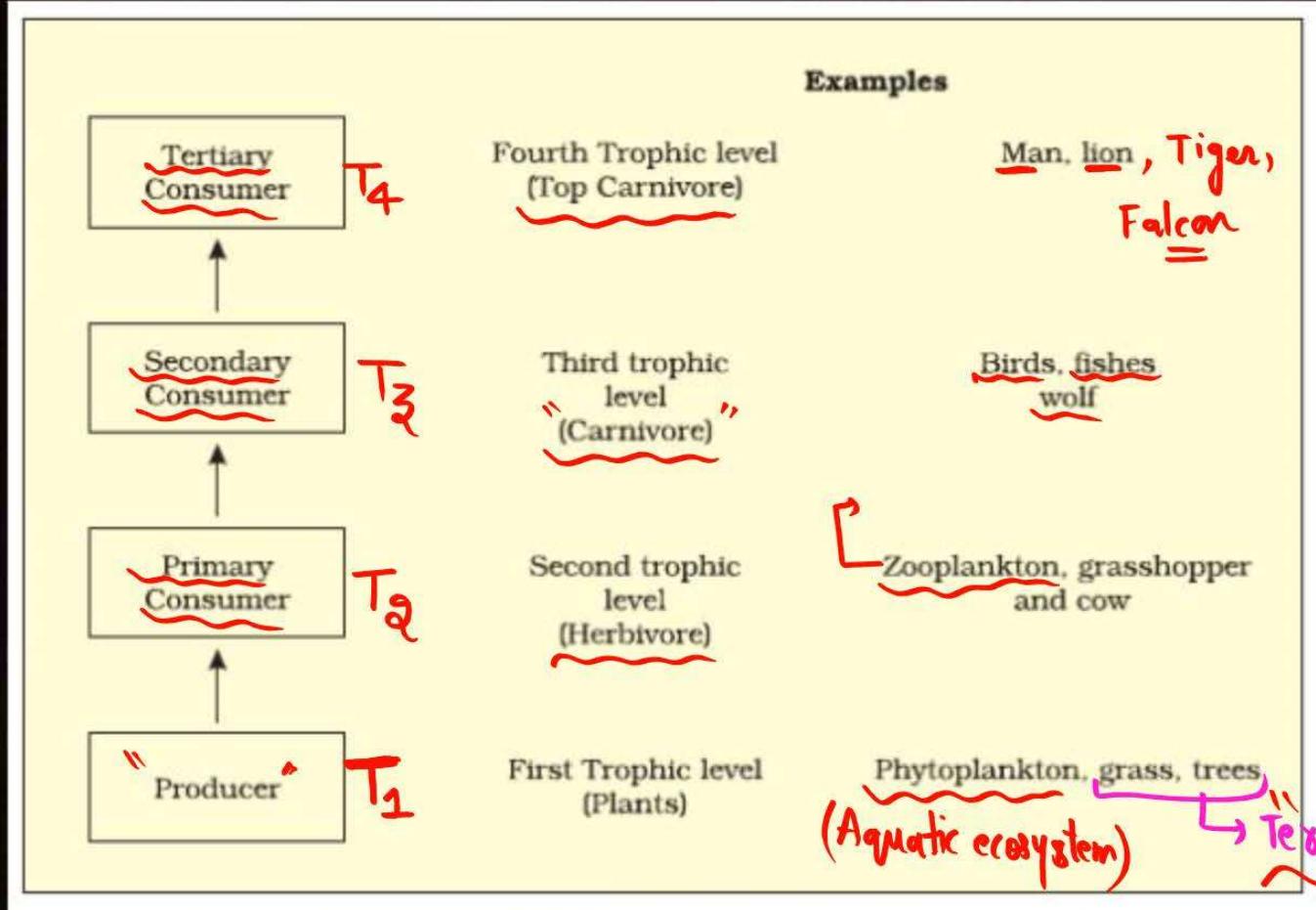
Exp: Heat energy



Food Chain



It is a sequence of organisms in which energy is transferred from one trophic level to another.



Aquatic Ecosystem

T₂-level → "Zooplanktons"
Herbivore → "Molluscs"

(Aquatic ecosystem) → "Terrestrial Ecosystem"



Types of Food Chain



Grazing Food Chain
(GFC)

Detritus Food Chain
(DFC)



Grazing Food Chain(GFC) / Predator Food Chain

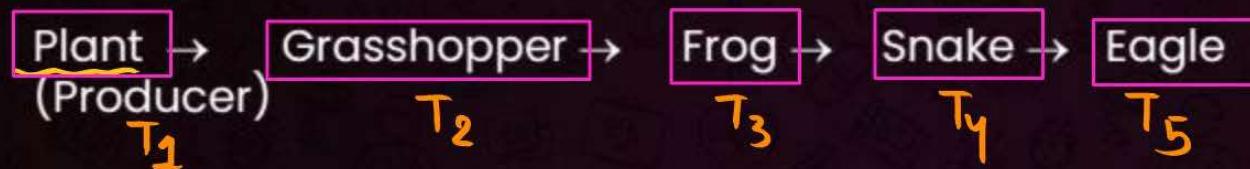
Starts with Producers

- GFC (i) Aquatic Ecosystem
 (ii) Terrestrial ecosystem

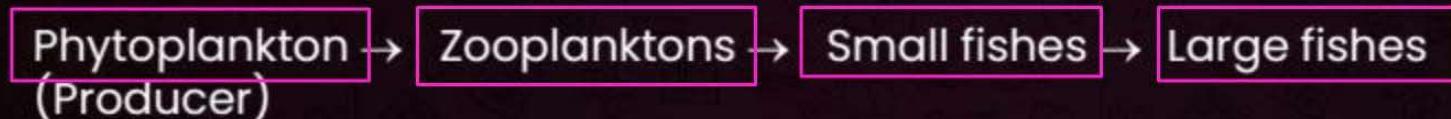
"Grazing Food Chain" is **major conduit of Energy flow** in **Aquatic ecosystem.**

Imp

GFC in **Terrestrial Ecosystem**



GFC is **Aquatic Ecosystem**



Detritus Food chain

(DFC)

Starts from "Detritus" (dead material)

Present in
both
Aquatic Terrestrial
Ecosystems



Imp:

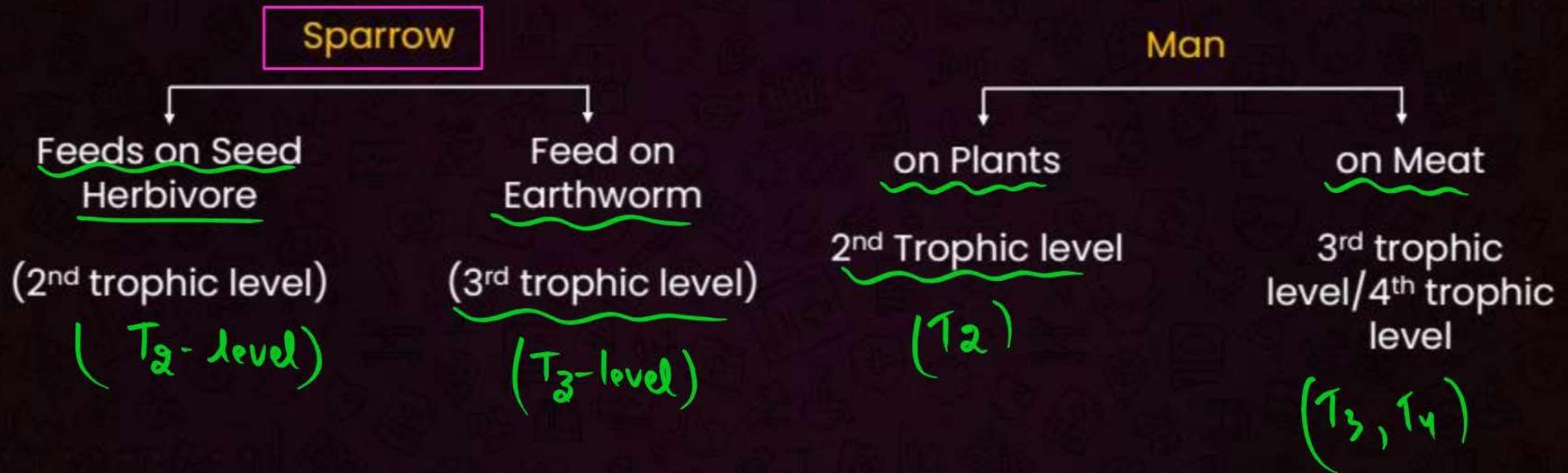
Major Food chain of
Terrestrial Ecosystem



FOOD - WEB



- No food chain exist as a single food chain.
- All food chains in an ecosystem are interconnected and forms a network called as FOOD-WEB.
- GFC is connected with DFC.



QUESTION

How Food web provides stability to Ecosystem?

- Ans : (a) Provides Alternate source of food, so that species are not starved
- (b) No species is over-exploited beyond it's recovery.





DFC

vs

GFC

→ Solar - energy
is not Prime - source
of energy.

→ Solar energy
(Prime - source of energy)

→ 10% law
"not applicable"

→ 10% law
(Applicable)

Break
(10 min)



QUESTION

Can 10% law be applied in DFC?

Ans : No,
Amount of energy present in Detritus is enormous.

QUESTION

A man having milk and milk products present on which trophic level?

- A 1st
- B 2nd
- C 3rd
- D 4th

QUESTION

Insectivores plants

- A 1st
- B 2nd
- C 3rd
- D both 1st and 3rd

QUESTION

Most important climatic factors that regulate the rate of decomposition are



- A Temperature and soil moisture
- B Soil pH and aeration
- C Aeration and temperature
- D Moisture and Soil pH

QUESTION

Mark the odd one (w.r.t. second trophic level)

- A Wolf (T_3)
- B Grasshopper (T_2)
- C Cow (T_2)
- D Zooplanktons (T_2)

QUESTION

Which of the following statement about GFC is incorrect?



- A Sun is the source of energy ✓
- B Begins with consumers ✗
- C Major conduit for energy flow in aquatic ecosystems ✓
- D Size of organisms commonly increase at higher trophic levels ✓

Standing state / Standing Quality

The total amount of "inorganic substances" in an ecosystem at a time.

Standing Crop

The total amount of 'living material' present in an ecosystem at a given time :

'living material'
(In term of)

Number of living organisms

In form of
Fresh weight
Biomass of organisms
Dry weight

(In form of dry weight)
(More dependable)





Ecological Pyramids

/ Eltonian Pyramids

It is graphical representation of 'various ecological parameter'
(Biomass, number, energy)

where producers at base and top-carnivores at Top and rest in the intermediate level.

Ecological Pyramids

Pyramid of Biomass

Pyramid of Number

Pyramid of Energy

Ecosystem

Pond, sea, Ocean etc.

1. Aquatic Ecosystem
2. Forest ecosystem (*Tree ecosystem*)
3. Grassland ecosystem

Pyramid of Number

Aquatic Ecosystem

"UPRIGHT"

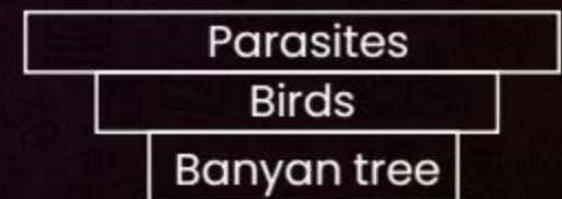
Grassland Ecosystem

UPRIGHT

Forest Ecosystem **(Tree)**

INVERTED

(Mostly)





Forest Ecosystem

Spindle shaped → Pyramid of number





Pyramid of Biomass

Aquatic Ecosystem

Inverted

Grassland Ecosystem

"Upright"

Forest Ecosystem (Tree)

UPRIGHT

Large fishes

Small fishes

Zooplanktons

Phytoplanktons

Falcon

Birds

Insects

Grasses

parasites

Birds

Banyan

(Biomass)



Pyramid of Energy

Always Upright for every ecosystem.

- Energy flow is unidirectional
- 10% law is applicable.



Ques : For which ecosystem all ecological pyramid are upright?

Ans : Grassland ecosystem.



Limitations of Pyramids



- (a) It does not take into account the same organism belonging to two or more trophic levels.



- (b) Takes into account simple food and not food web.

- (c) Saprophytes, Decomposers, microbes and detritivores are not given any place.

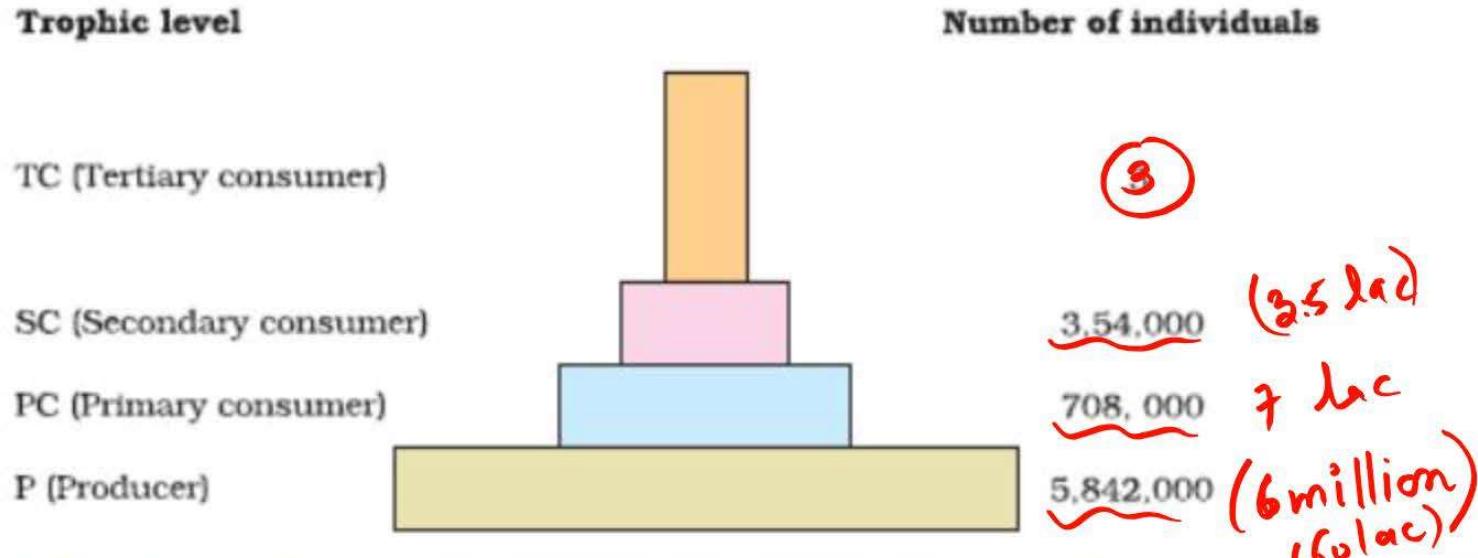


Figure 12.4 (a) Pyramid of numbers in a grassland ecosystem. Only three top-carnivores are supported in an ecosystem based on production of nearly 6 millions plants

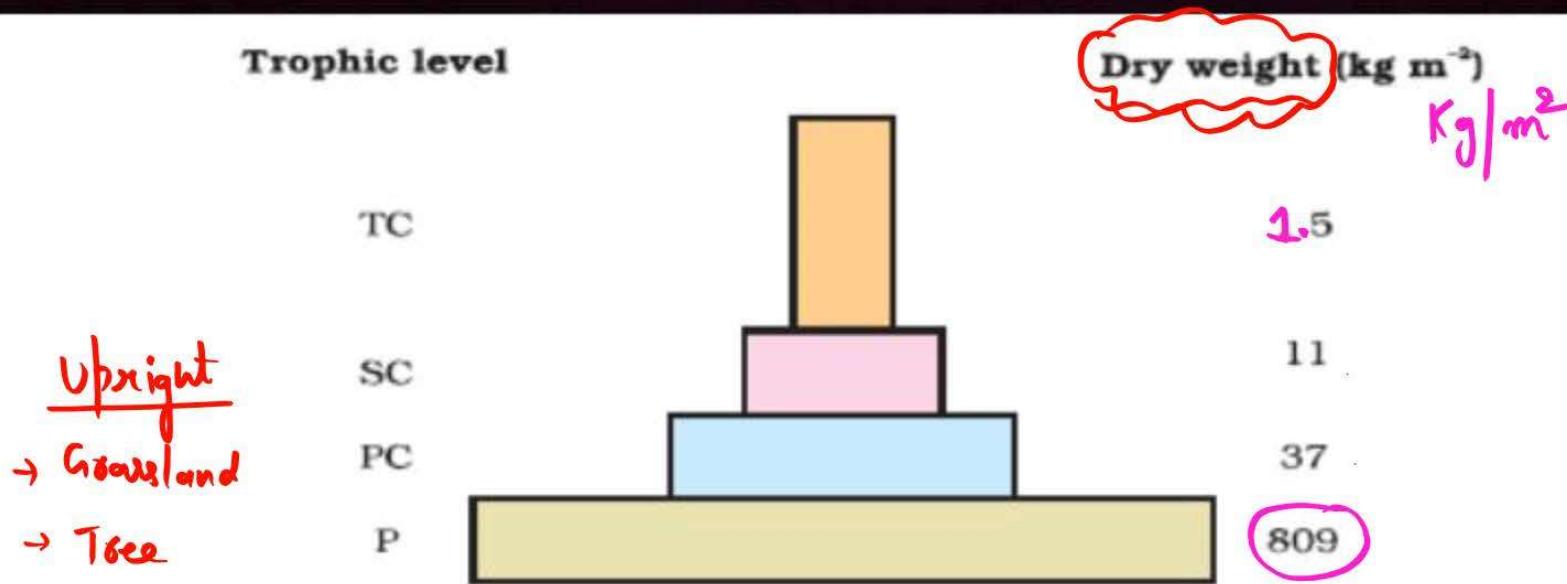


Figure 12.4 (b) Pyramid of biomass shows a sharp decrease in biomass at higher trophic levels



Figure 12.4 (c) Inverted pyramid of biomass-small standing crop of phytoplankton supports large standing crop of zooplankton

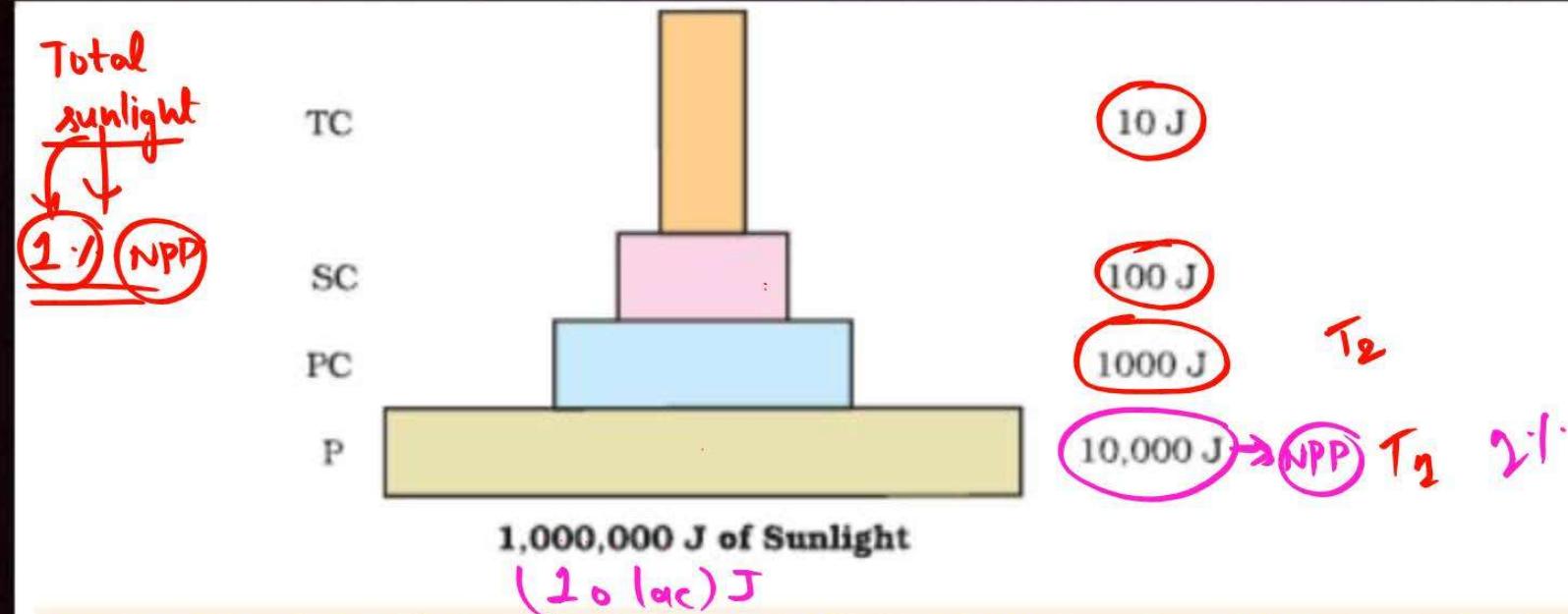


Figure 12.4 (d) An ideal pyramid of energy. Observe that primary producers convert only 1% of the energy in the sunlight available to them into NPP

QUESTION**Match List-I with List II:****Choose the correct answer from the options given below:****A**

A-I, B-II, C-III, D-IV

B

A-III, B-IV, C-II, D-I

C

A-III, B-II, C-IV, D-I

D

A-II, B-III, C-IV, D-I

	List-I		List-II
A.	Tertiary consumer II	(I)	Grass
B.	Secondary consumer III	(II)	Lion
C.	Primary consumer IV	(III)	Wolf
D.	Primary producer I	(IV)	Goat

QUESTION

Given below are two statements:

Statement I : The rate of decomposition is not related to chemical composition of detritus and climatic factors.

Statement II : In a particular climatic condition, decomposition rate is faster if detritus is rich in lignin and chitin.

In light of the above statements, choose the correct answer from the options given below:

A Both Statement I and Statement II are True.

B Both Statement I and Statement II are False.

C Statement I is True but Statement II is False.

D Statement I is False but Statement II is True.

QUESTION

What is incorrect about ecosystem?

- A It can vary from small sized pond to large sized sea.
- B It may be anthropogenic in origin.
- C It may be temporary or Permanent.
- D It involves the function of flow of energy but not recycling of nutrients.

QUESTION

In the equation

$$\text{GPP} - R = \text{NPP}$$

GPP is Gross Primary Productivity. NPP is net Primary Productivity. R here is _____

A Reproductive allocation

B Photosynthetically active radiation

C Respiratory quotient

D Respiratory loss

QUESTION

Identify the correct statements:

- A. Detrivores perform fragmentation. ✓
- B. The humus is further degraded by some microbes during mineralization. ✓
- C. Water soluble inorganic nutrients go down into the soil and get precipitated by a process called leaching. ✓
- D. The detritus food chain begins with living organism ✗
- E. Earthworms break down detritus into smaller particle by a process called catabolism. ✗

Choose the correct answer from the options given below:

A D, E, A only

C B, C, D only

B A, B, C only

D C, D, E only

QUESTION

The amount of nutrients as carbon, nitrogen, potassium and calcium present in the soil at any given time is referred to as:

- A Standing state
- B Standing crop
- C Humus
- D Detritus

QUESTION

Which of the following is not correct regarding the decomposition of wastes?

- (a) Low temperature inhibits decomposition.
- (b) Warm and moist environment favors the process
- (c) The process is anaerobic ✗
- (d) It is slower if detritus is rich in proteins and carbohydrates ✗
- (e) Detritus is degraded into simpler inorganic substance by fungal and bacterial enzymes. ✓

Choose the correct answer from the options given below:

A b, and c only

C ✓ c, and d only

B c, a, and d only

D c, d, and e only

QUESTION



Amount of living material present in different trophic levels at a given time is called

- A Standing quality
- B Standing state
- C GPP
- D Standing Crop

QUESTION

For ~~tree~~^{Tree} and grassland ecosystem, pyramid of biomass is

- A Upright
- B Inverted
- C Spindle-shaped
- D Urn-shaped

QUESTION

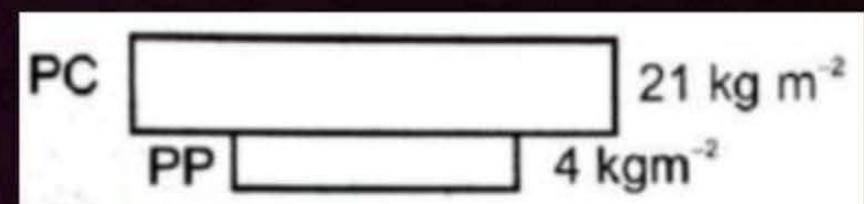
What does the given ecological pyramid represent?

- A Inverted pyramid of number in pond

- B Role of decomposers

- C Inverted pyramid of biomass in pond

- D Pyramid of biomass in a forest ecosystem.





Homework from Prachand Module



Solve Practice sheet