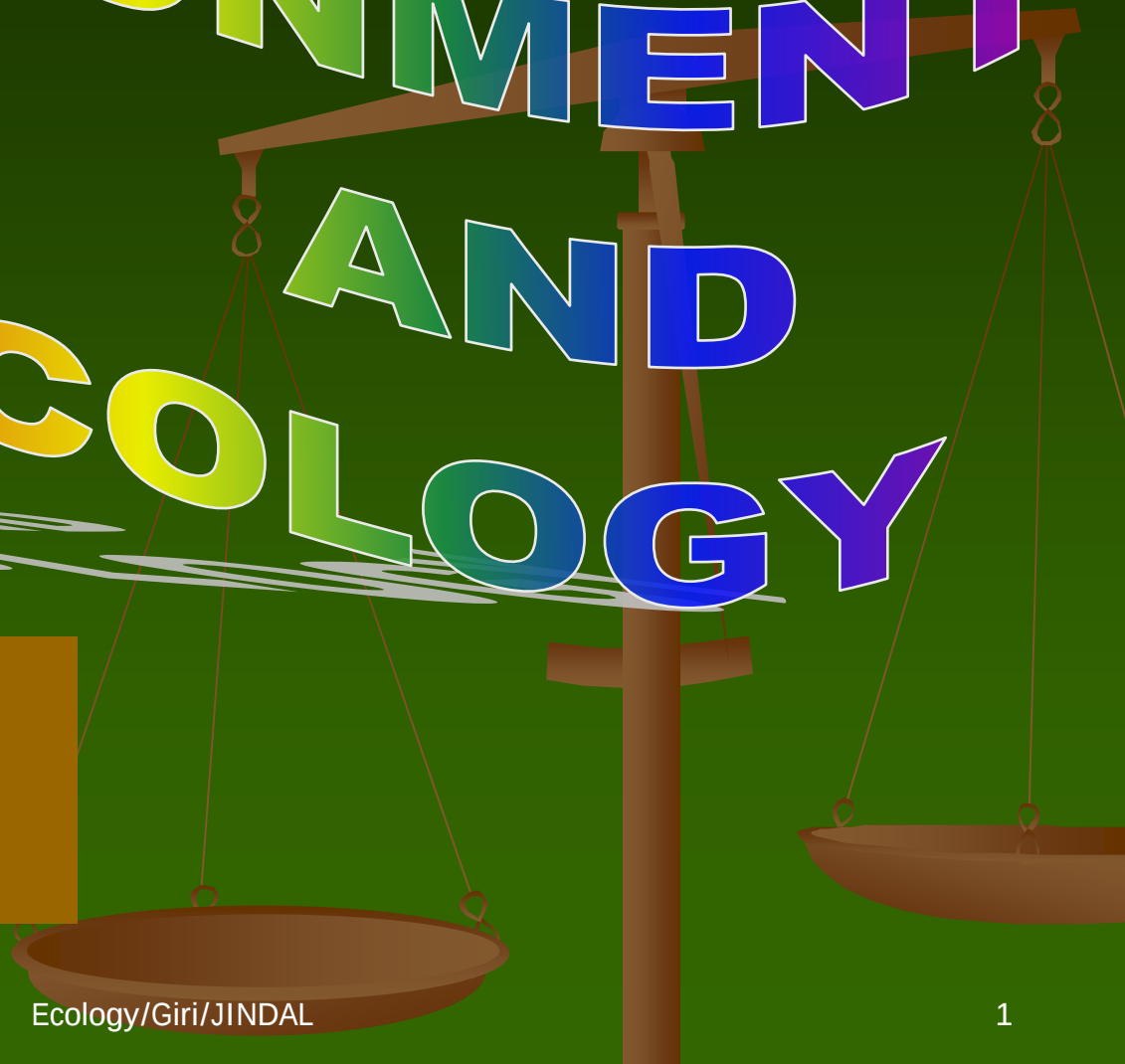
ENVIRONMENT AND ECOLOGY



DR. S. Anand Giri
H.O.D. Chemistry
OPJIT, Raigarh.C.G.


Absolute

SYLLABUS

- UNIT -1 Environment &ecology
- UNIT -2 Air pollution
- UNIT -3 Water pollution
- UNIT -4 Land & Noise pollution
- UNIT -5 Bio technology

BOOK PLAN

1) Environment & Ecology by P.K. Pandey

2) Environmental Chemistry
&
Pollution control
By
S. S. Dara

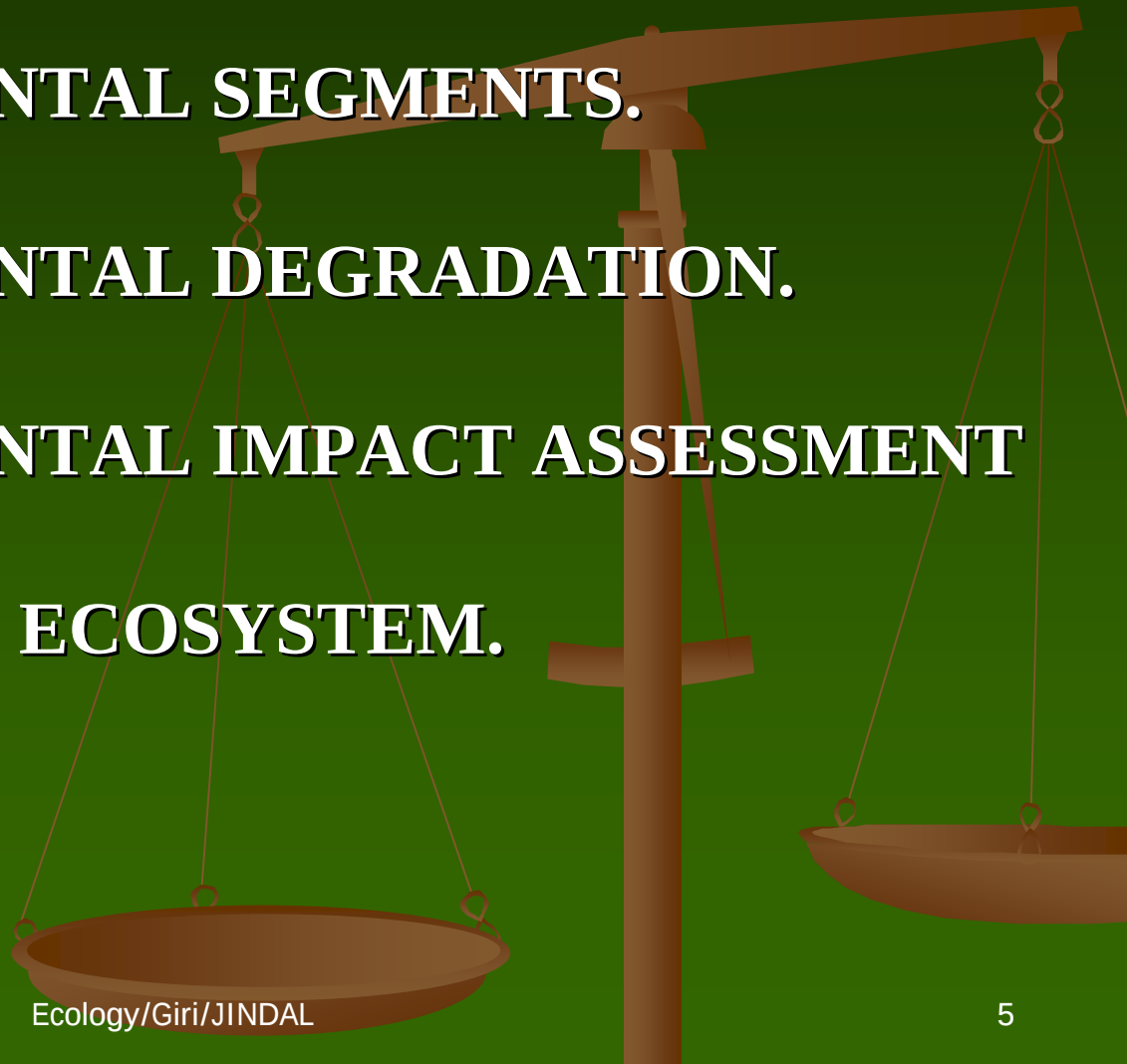
3) Energy Ecology Environment
& Society
By S. Deshwal

4) Engineering Chemistry
By
M.M. Uppal

X

L-1/1 UNIT -1

- INTRODUCTION.
- ENVIRONMENTAL SEGMENTS.
- ENVIRONMENTAL DEGRADATION.
- ENVIRONMENTAL IMPACT ASSESSMENT
- CONCEPT OF ECOSYSTEM.

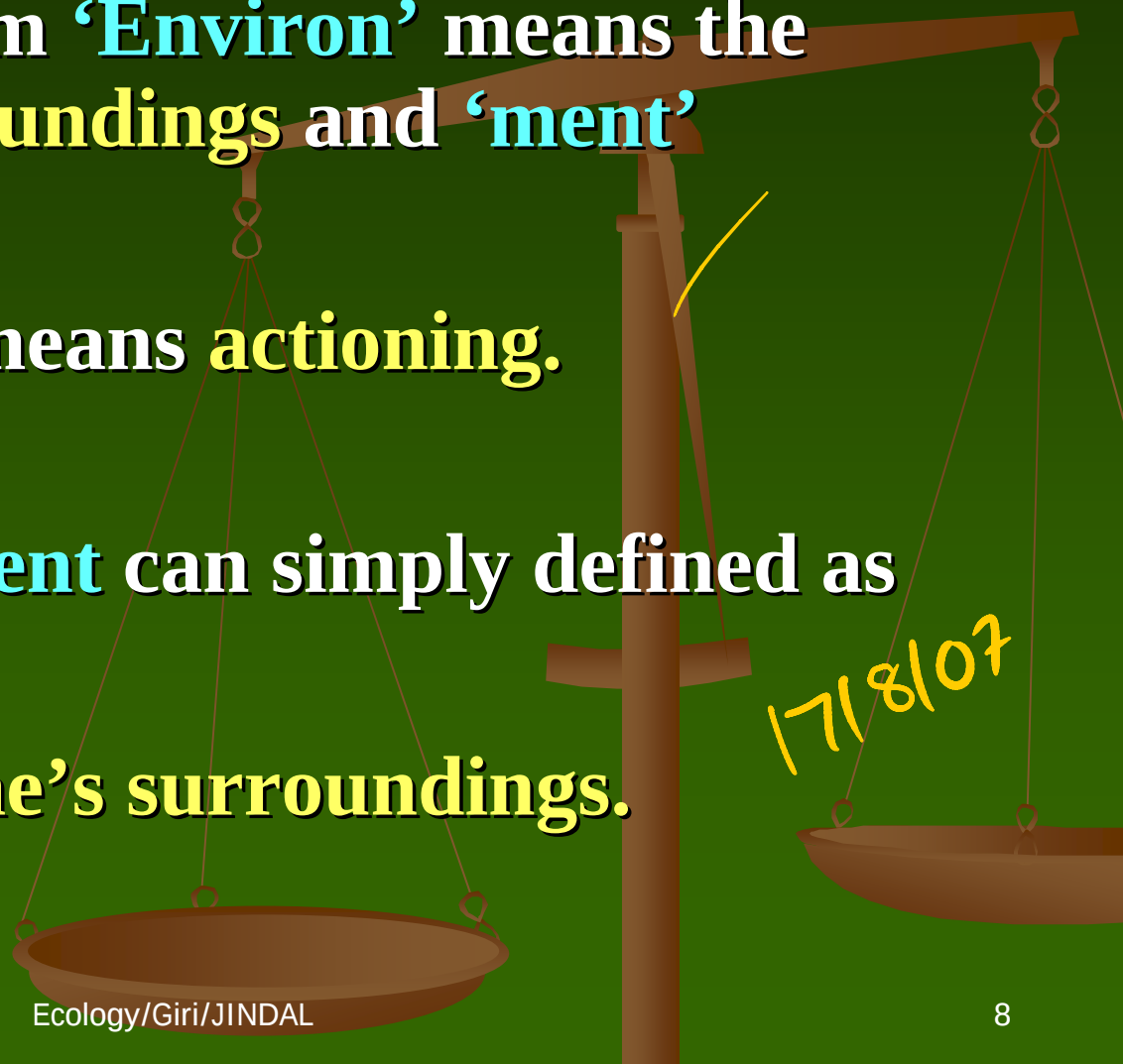


L-1/1a UNIT -1

- FUNDAMENTALS OF ECOLOGY AND ECOSYSTEM.
- COMPONENTS OF ECOSYSTEMS
- FOOD-CHAIN, FOOD WEB,TROPHIC LEVELS.
- ENERGY FLOW CYCLING OF NUTRIENTS
- MAJOR ECOSYSTEM TYPES.

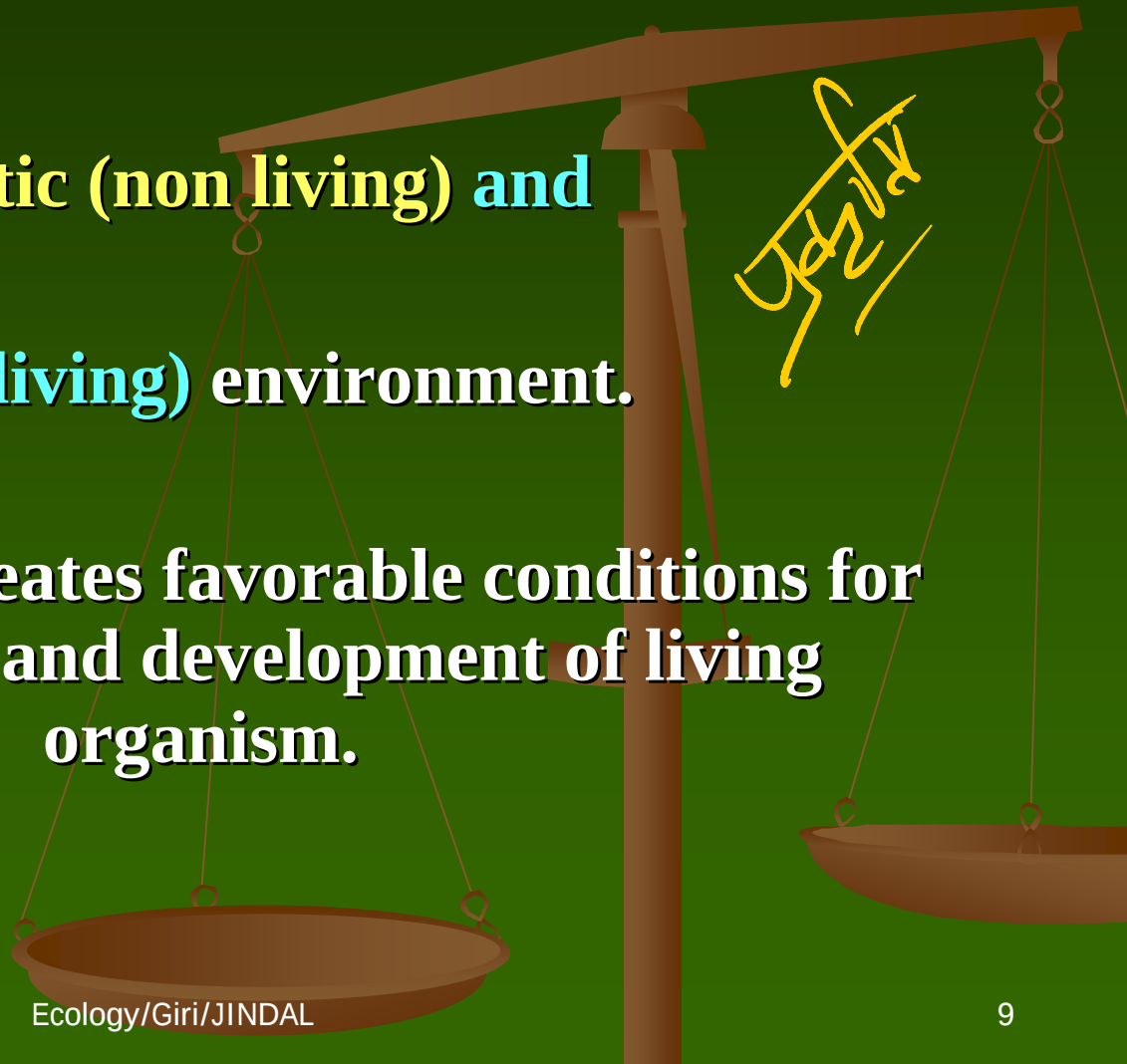
L-1/1a Introduction of Environment

- The term 'Environ' means the surroundings and 'ment'
  - means actioning.
- Environment can simply defined as
  - 'One's surroundings.



L-1/1a Introduction of Environment

- Which includes everything around the organism like:
  - a-biotic (non living) and
  - biotic (living) environment.
- Environment creates favorable conditions for the existence and development of living organism.



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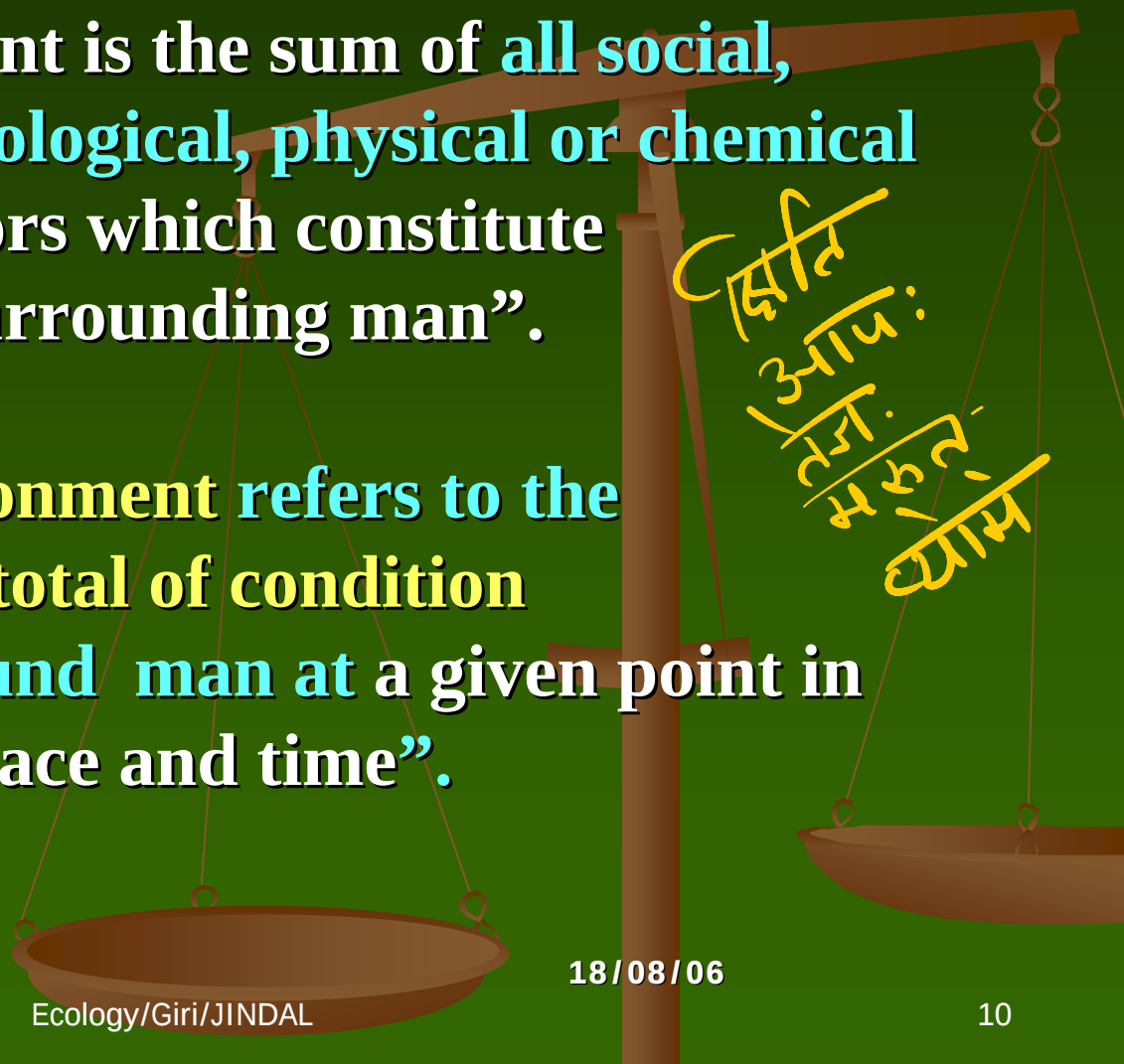
L-1/1b Introduction to Environment

DEFINITIONS :

"Environment is the sum of all social, economical, biological, physical or chemical factors which constitute the surrounding man".

"Environment refers to the sum total of condition which surround man at a given point in space and time".



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L-1/1b Introduction to Environment

DEFINITIONS :

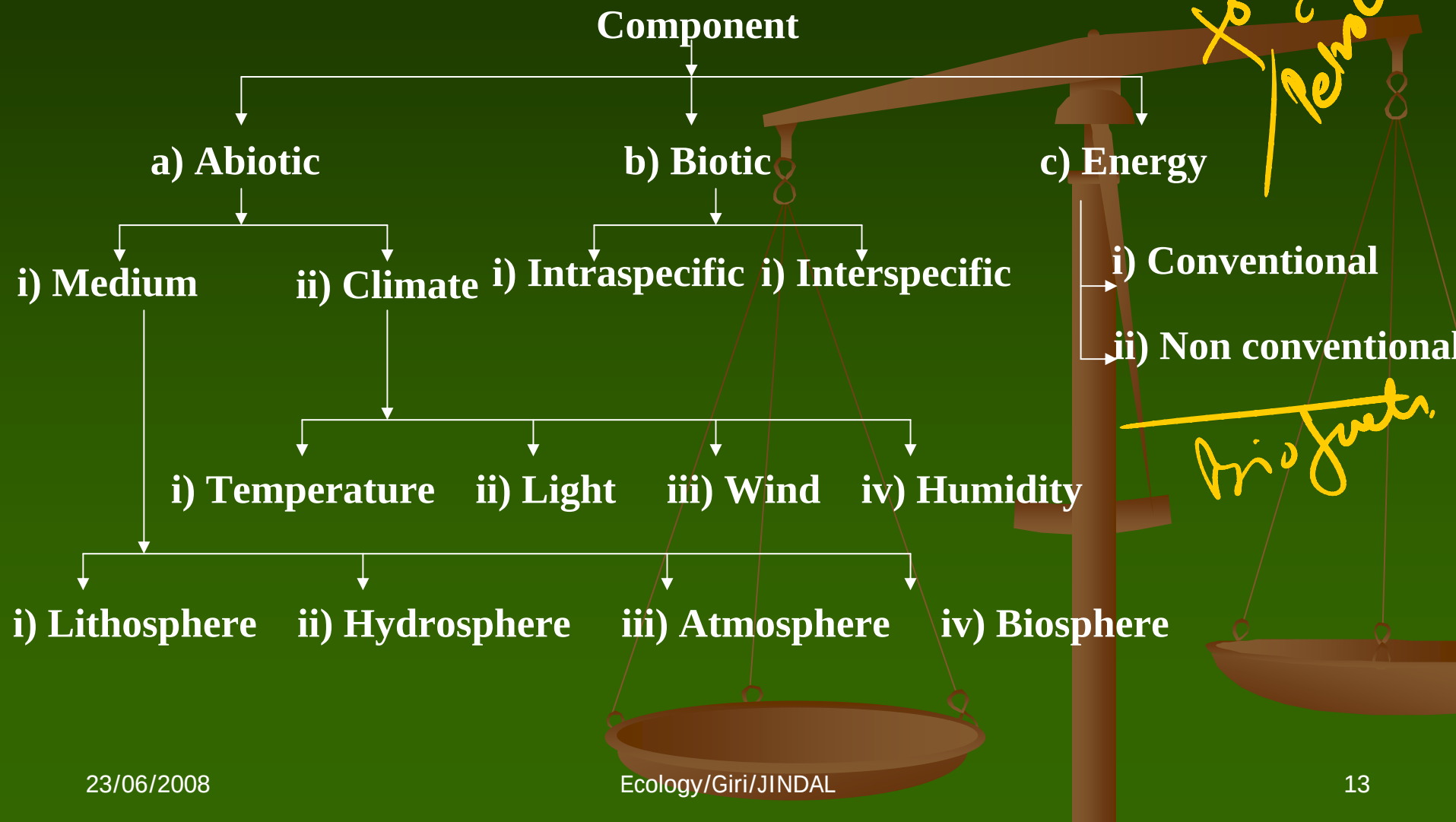
"Environment is the representative of physical components

of the earth

where man is the important factor influencing his environment."

L-2/7 Environmental Segments

Environment consists of the following three components:-

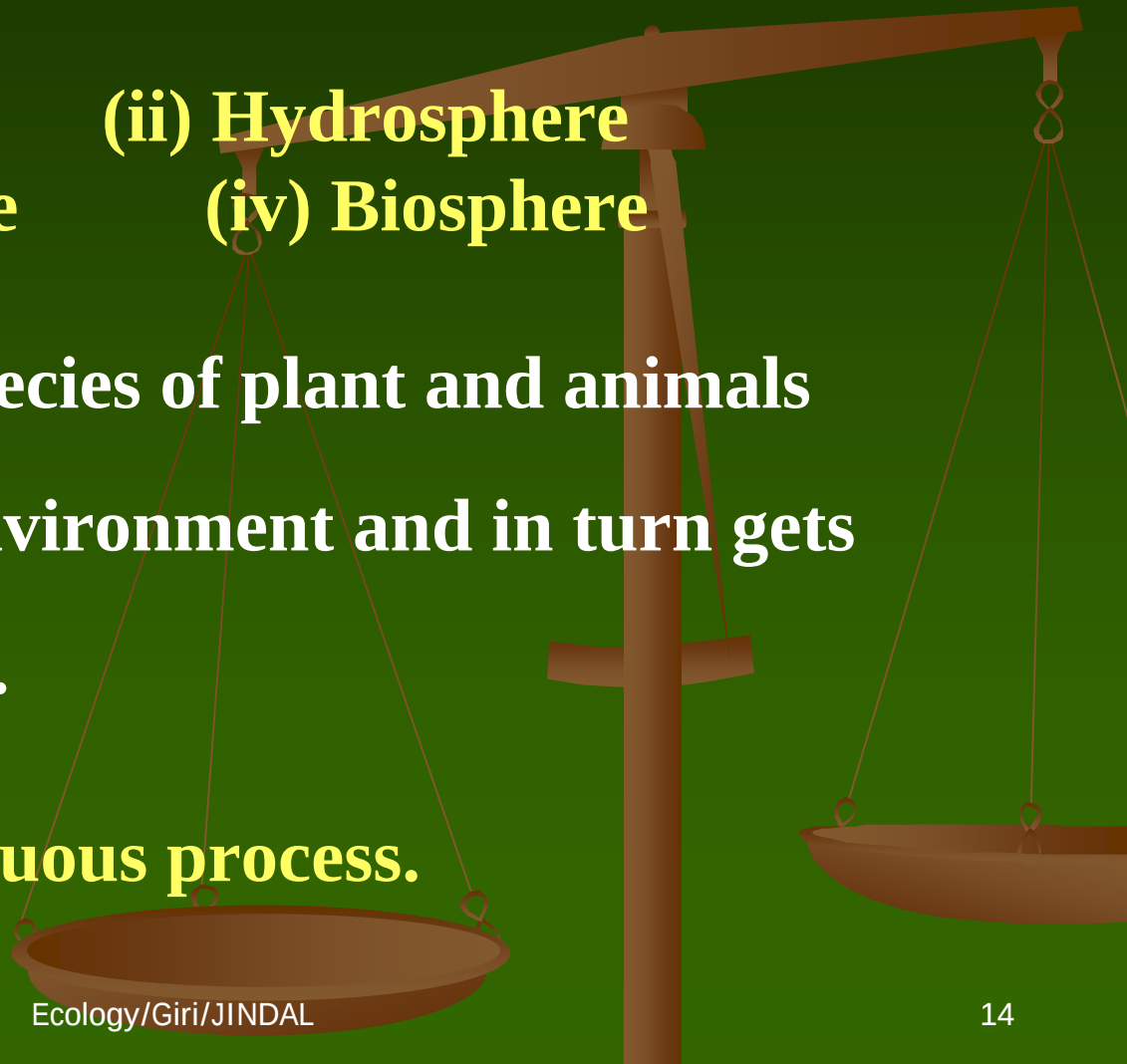


L-2/1 Environmental Segments

The global environment consist of 4 segments

(i) Atmosphere (ii) Hydrosphere
(iii) Lithosphere (iv) Biosphere

- Every living species of plant and animals influences its environment and in turn gets influenced by it.
- This is a continuous process.

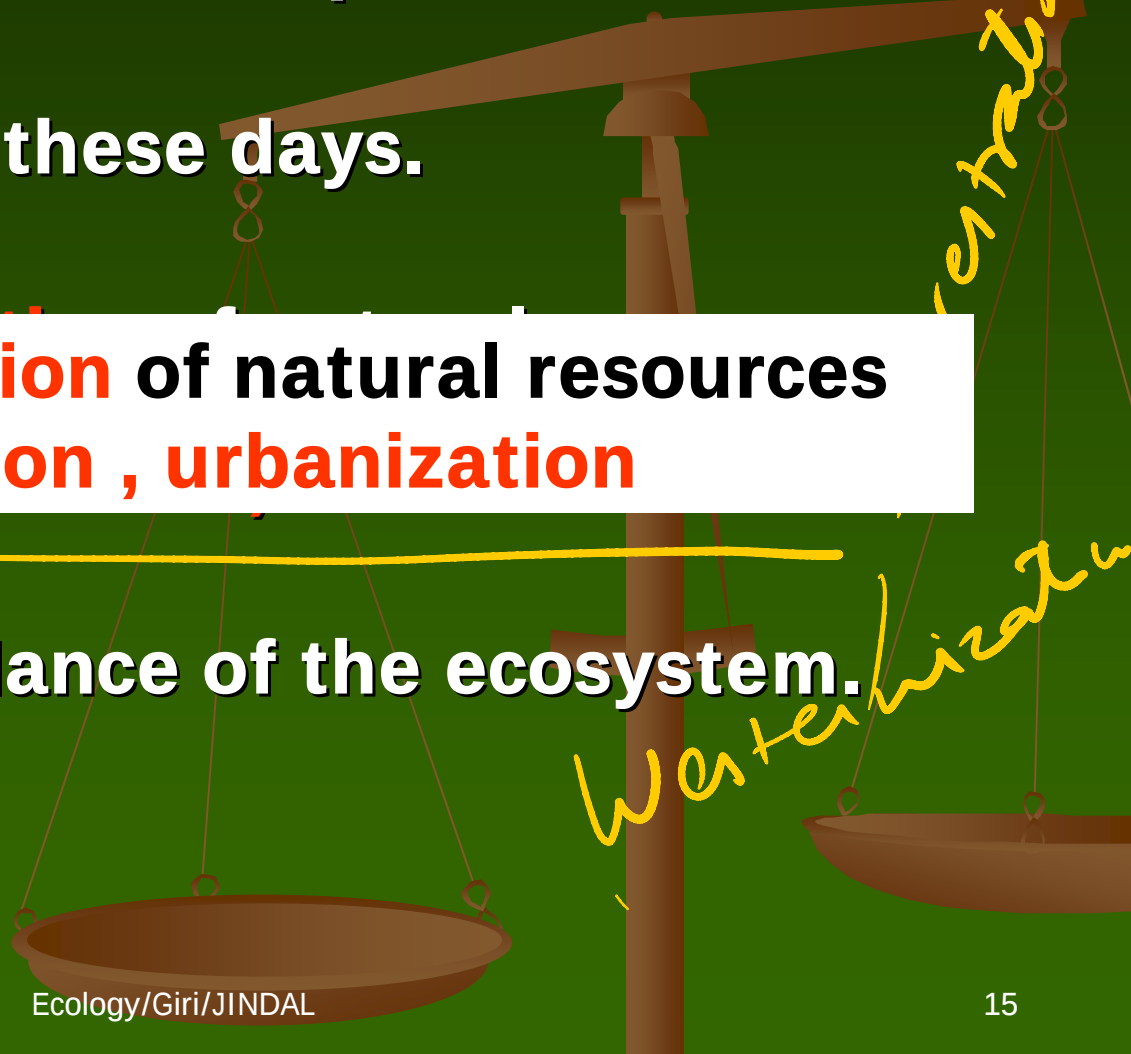


L-2/1a Environmental Segments

Environment is an important issue of these days.

Over exploitation of natural resources **industrialization , urbanization**

upsets the balance of the ecosystem.



L-2/1a Environmental Segments :

The environment can be divided into four segments:

(i) Lithosphere **(ii) Hydrosphere**

(iii) Atmosphere **(iv) Biosphere**

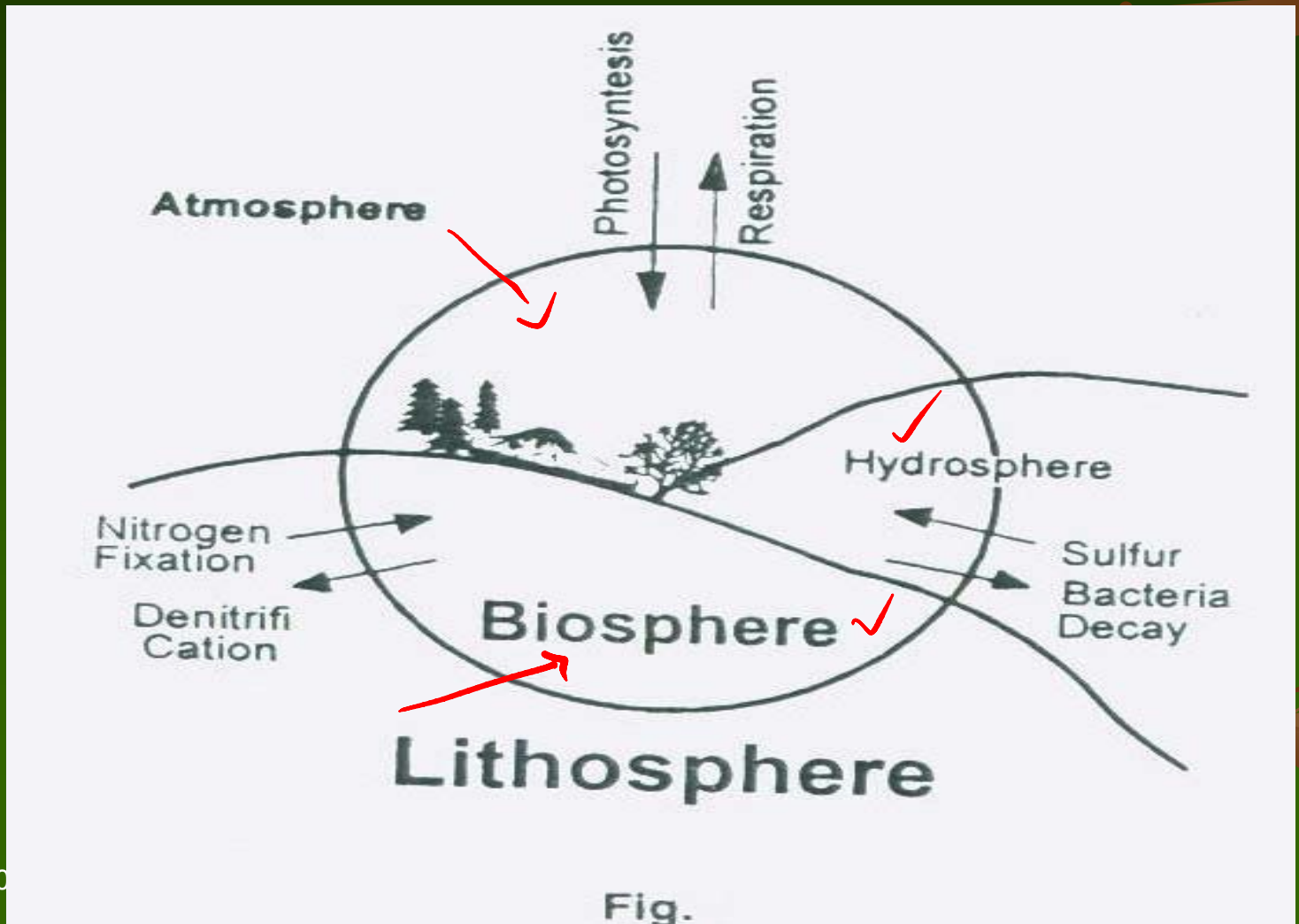


Fig.

Lithosphere

- The solid component of the earth is known as lithosphere.
- It is the thickest in all the continents.
- The lithosphere is very important.
- It produces food for humans &animals and……..
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Lithosphere

- ….and the decomposition of organic wastes is carried out by
- host of micro organisms in the soil.
- A proportion that commonly found is 40%sand , 40%silt & 20%clay.

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L-2/2b Lithosphere:-

- **Lithosphere means the mantle of rocks constituting the earth's crust. This contains three layers –**

Crust, Mantle and Core.

- **The CORE is the central fluid having diameter of about 2900 Km. from the crust.**

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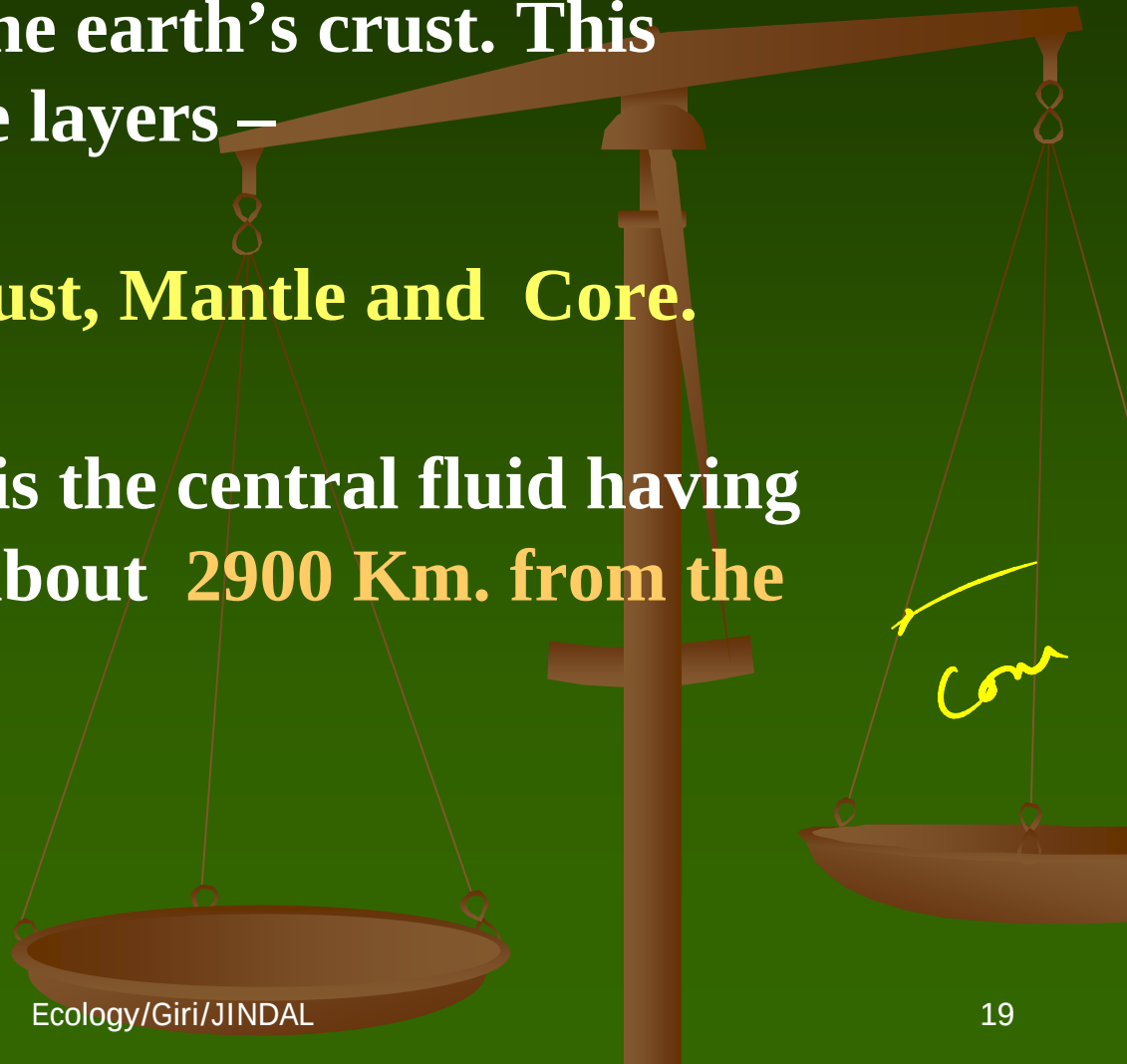

L-2/2b Lithosphere:-

The CORE
is the central fluid having diameter of about

2900 Km. from the crust.
It is mainly composed of

nickel and iron. [NIFE]

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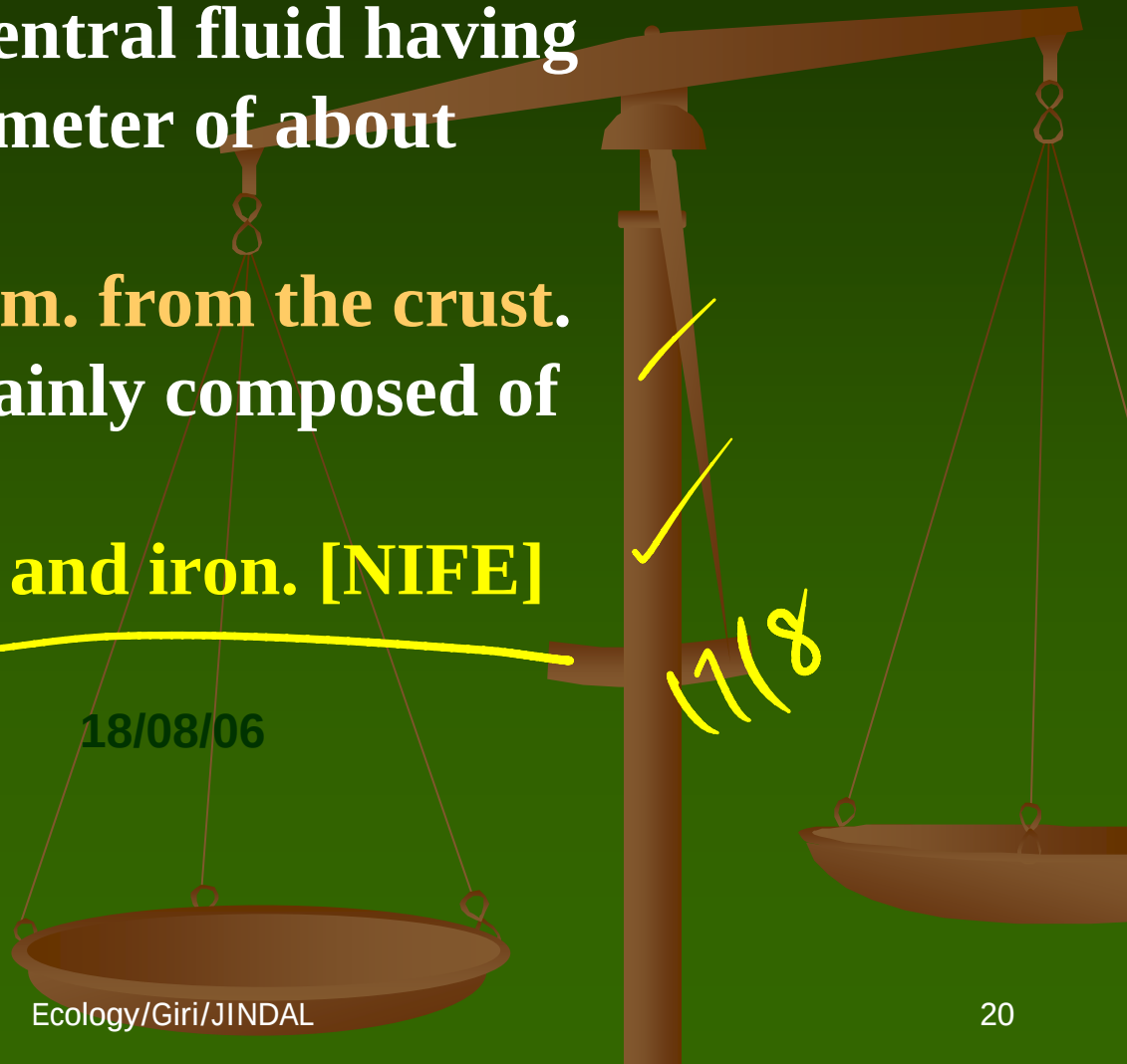

L-2/2b Lithosphere:-

The MANTLE
extends about 2900-3000 Km.
above the core.
The surface of crust

is covered with Soil..
Soil
is the most significant part of the
Lithosphere.

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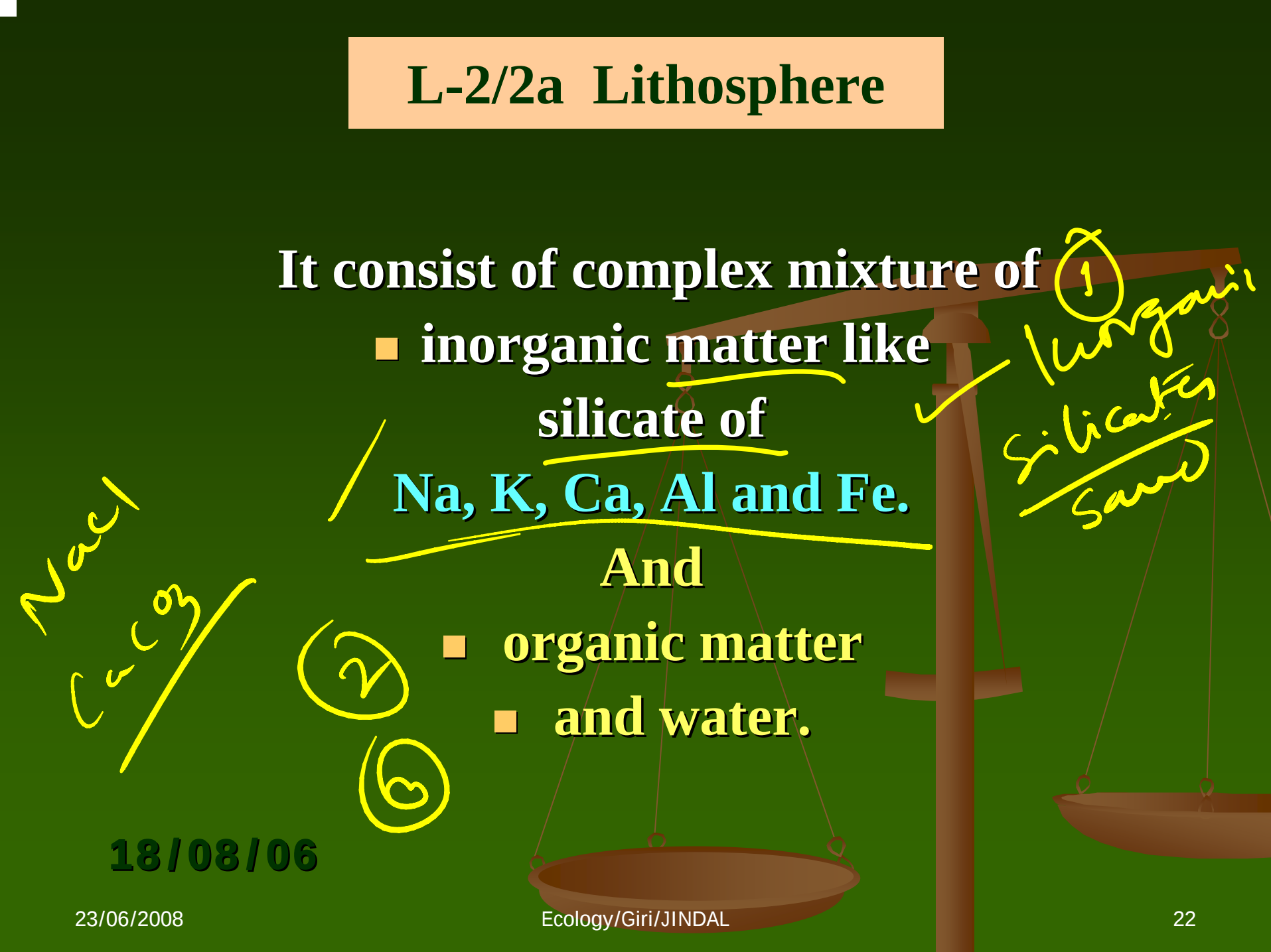
L-2/2a Lithosphere

It consist of complex mixture of

- inorganic matter like silicate of Na, K, Ca, Al and Fe.

And

- organic matter
- and water.



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L-2/2a Lithosphere

The organic matter consist not more than about 5% of the soil.

- **It consist of bio-logically active component such as**
- **polysaccharides, nucleotide, sugar**
- **and organo - sulphur compounds.**

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L-2/2b 18/08/06

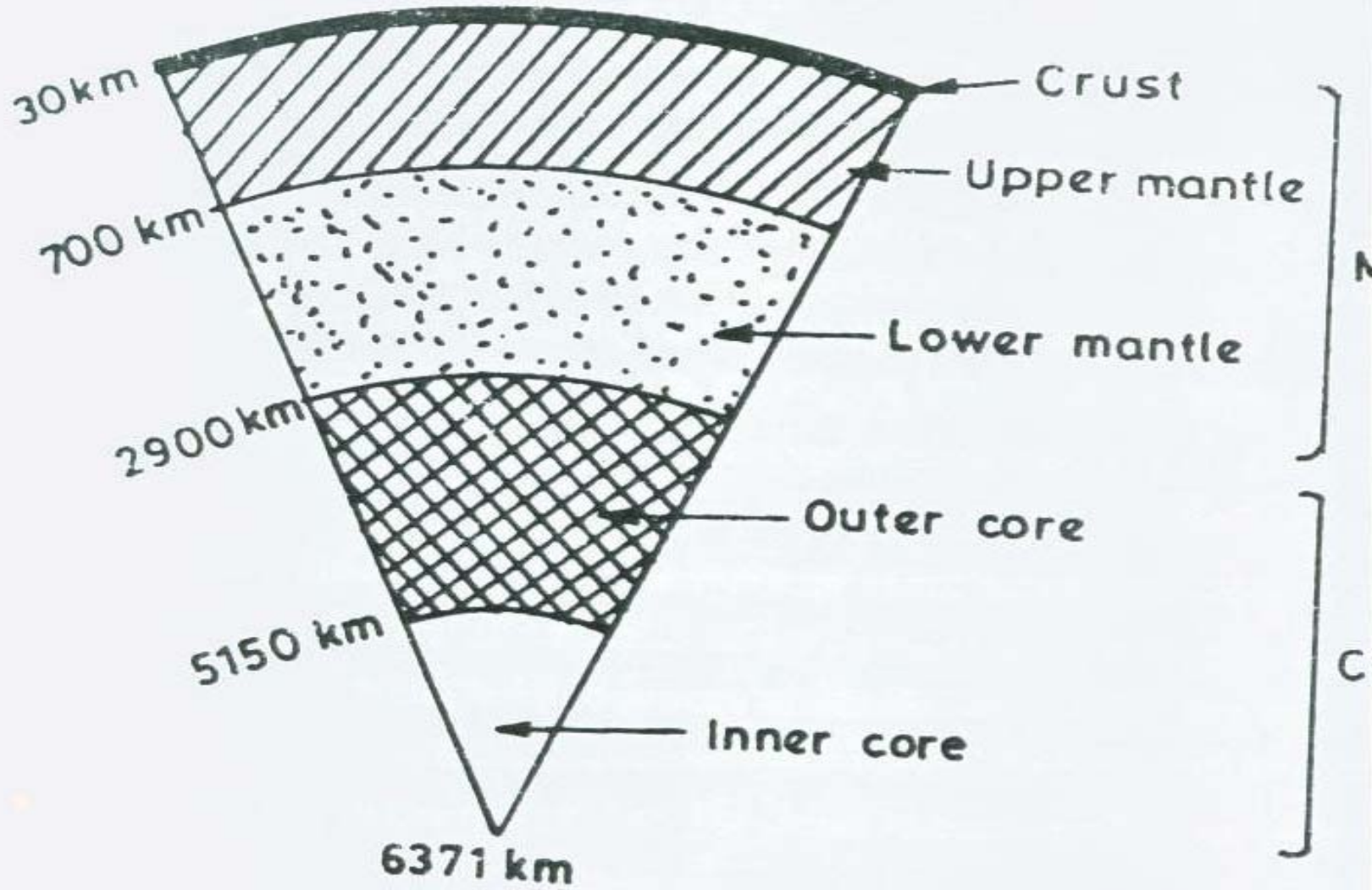


Fig. The Major Components of Earth.


Winner of the "Not My Job"
Award - ADOT
Litchfield Park, AZ 85

L-2/3 Hydrosphere:-

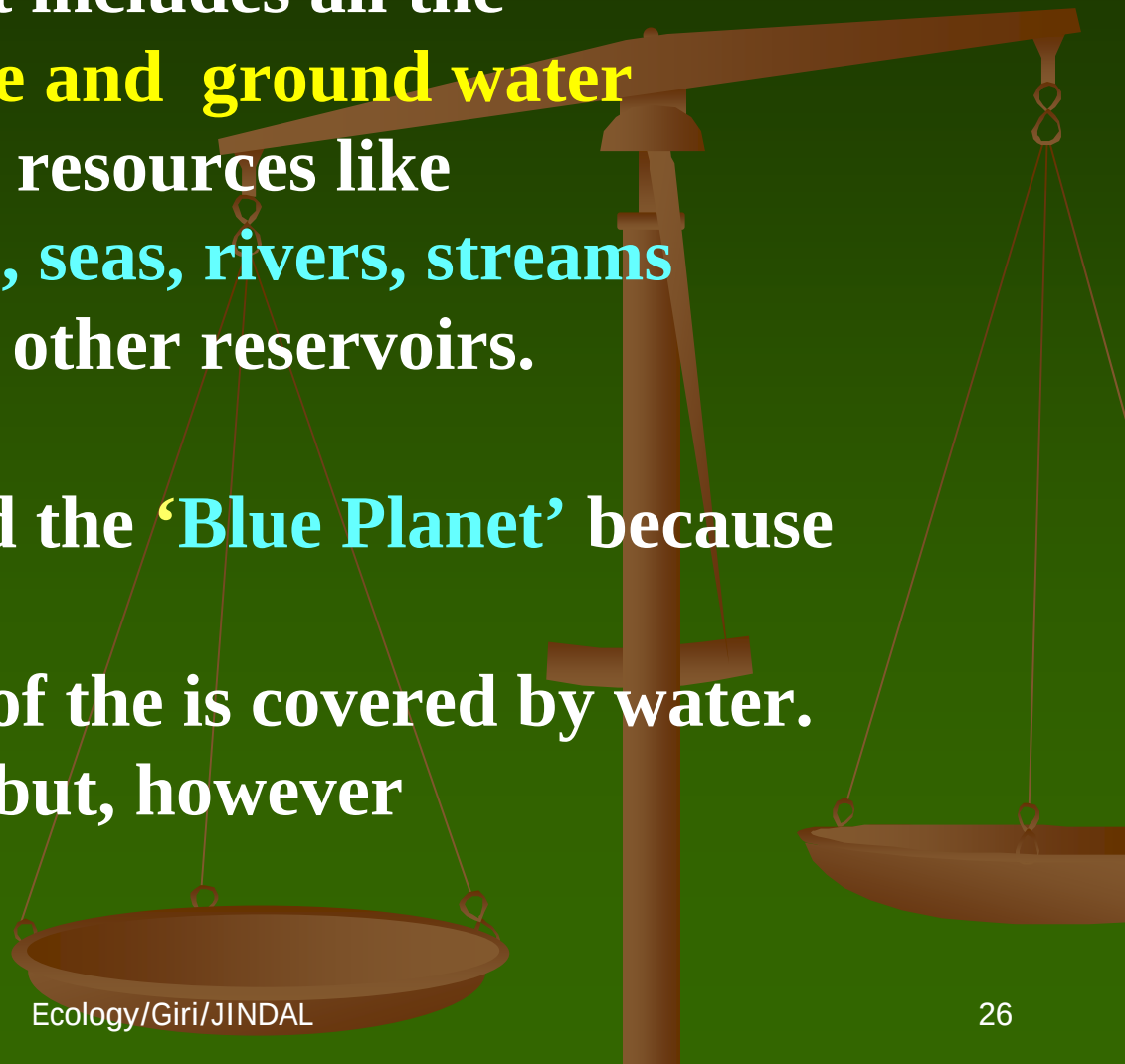
- It includes all the
- surface and ground water resources like
- oceans, seas, rivers, streams

And other reservoirs.

Earth is called the ‘Blue Planet’ because

about 80% of the is covered by water.

but, however



L-2/3 Hydrosphere:-

- but, about 97%
- of water resources is locked-up
- in the
oceans and seas,

- which is too saline to drink and
- Cannot be used for
- agriculture and industrial purposes.

L-2/3a Hydrosphere

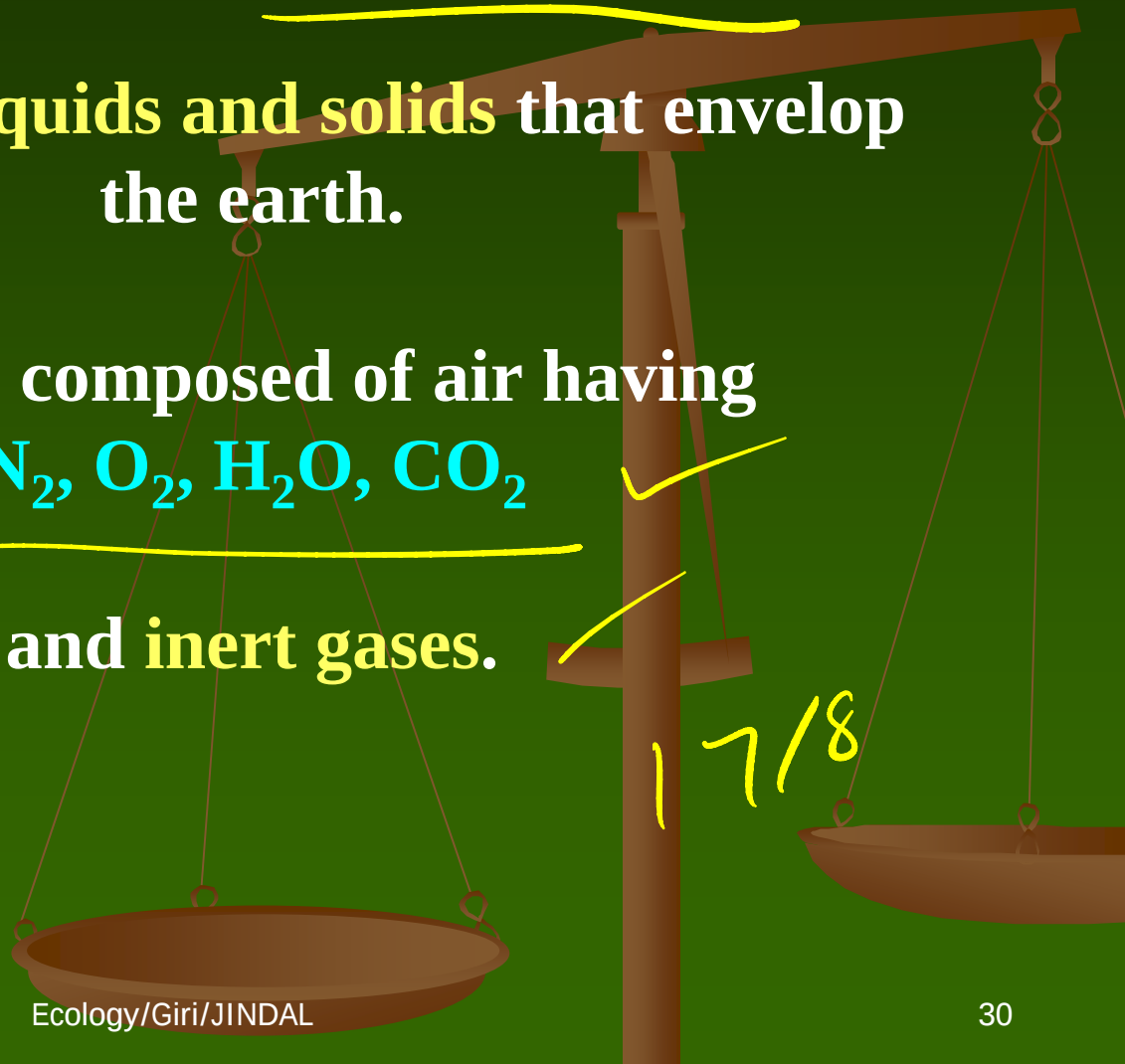
- About 2% of the water resources is locked in glaciers And ice caps and
- only 1% is available as fresh water.
- Water is said to be ‘universal solvent’.

L-2/3a Hydrosphere

- It is able to dissolve most of the
- natural elements and organic matters.
- It (water) also regulates the body temperature of all the living beings in biosphere.

L-2/4 Atmosphere:-

- The atmosphere is a blanket of gases and
- suspended liquids and solids that envelop the earth.
- Earth is composed of air having
  - N_2, O_2, H_2O, CO_2
- and inert gases.



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L-2/4 Atmosphere:-

- **Atmosphere can be divided in to following layers. These are :**

(i) Troposphere **(ii) Stratosphere**

(iii) Mesosphere **(iv) thermosphere**

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Atmosphere

Name of region	Height above the earth surface (Km)	Temperature In (^{0}C)	Major Chemical species present
Troposphere	0-11	15 to -56^{0}C	O_2, N_2, CO_2, H_2O
Stratosphere	11-50	-56 to -2 ^{0}C	O_3
Mesophere	50-85	-2 to -92 ^{0}C	O_2^+, NO^+
Thermosphere	85-500	-92 to 1200	O_2^+ , O^+, NO^+

L-2/4a Atmosphere

Troposphere :

- The lower part of the atmosphere.
  - It extends up to 11 Km.
  - from the earth's surface.

- The temp. of air decreases with increasing altitude from the ground temperature.
  - (15^0C to -56^0C)

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Troposphere (add)

The change of temperature with height is called the "LAPSE RATE".

- **End of Troposphere is known as "Tropopause".**
- **It has a positive Lapse Rate.**

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L-2/5.1 Stratosphere

- Above Troposphere, Stratosphere starts.
- It extends to 11 – 50 KM.
- The temperatures increases with Altitude
- due to absorption of UV radiation from Sun by Ozone.

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L-2/5.1 Stratosphere

- The presence of **Ozone** in the stratosphere
- serve as a shield to protect life on the earth
- from the harmful effects of the
- solar U.V. radiation.

At the top of Stratosphere a narrow zone is called "Stratopause".

The Lapse Rate is negative.

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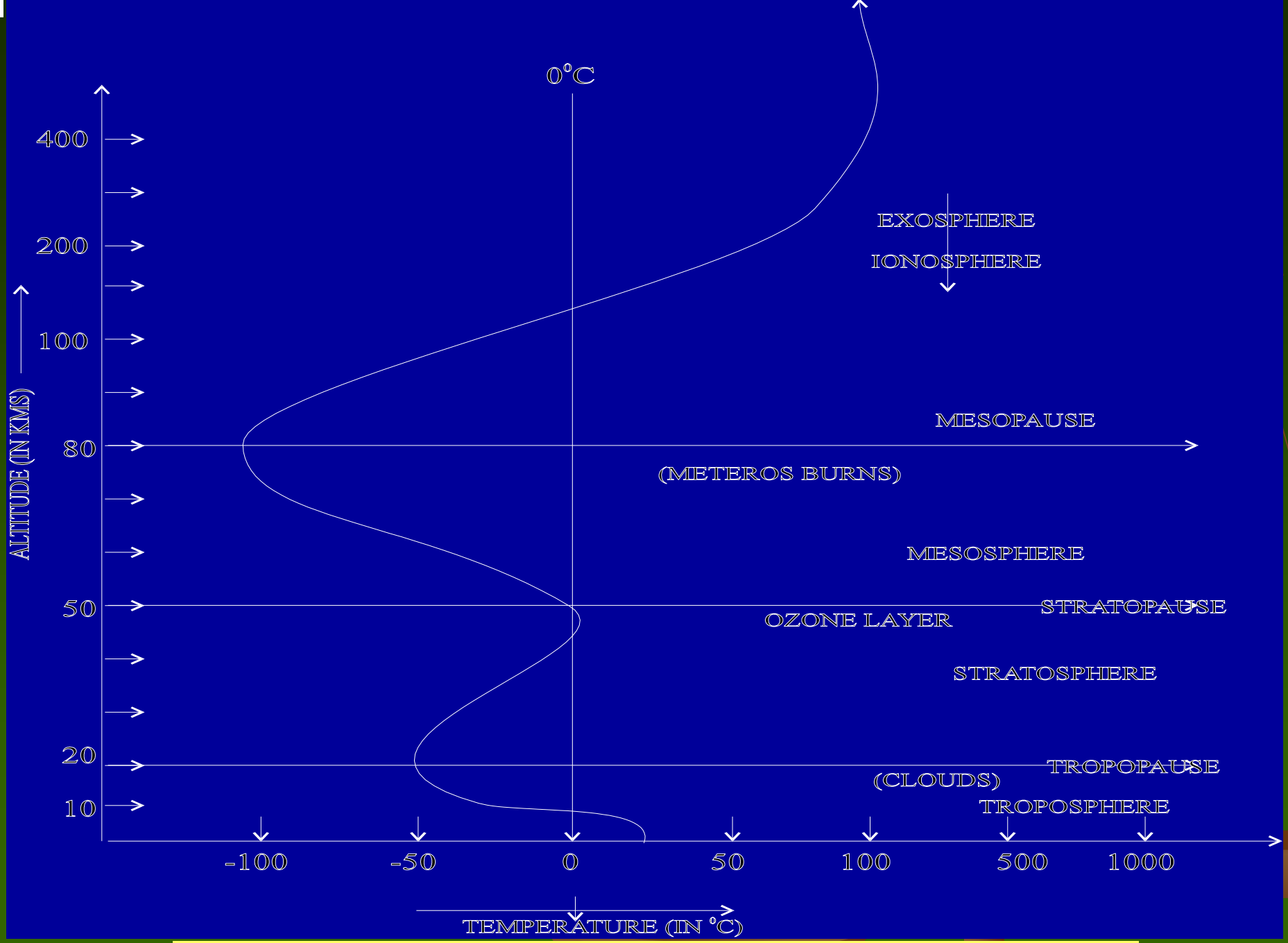

Structure of Atmosphere along with temperature

Atmosphere

Name of region	Height above the earth surface (Km)	Temperature In (^{0}C)	Major Chemical species present
Troposphere	0-11	15 to -56	O_2, N_2, CO_2, H_2O
Stratosphere	11-50	-56 to +2	O_3
Mesophere	50-85	+2 to -92	O_2^+, NO^+
Thermosphere	85-500	-92 to 1200	O_2^+ , O^+, NO^+

L-2/5.2 Mesosphere

- Above Stratopause, Mesosphere Starts.
  - It extends up to 50 – 85 KM.
- The temperature decrease with Altitudes
  - because the
  - concentration of ozone decrease.
- The Altitudes where this layer ends is called "Mesopause".
  - The Lapse Rate is positive.

L-2/5.3 THERMOSPHERE

THERMOSPHERE

- It is the region above the Mesopause.
- In this region, the Temperature – Altitudes cure exhibits a negative Lapse Rate.
- In this region temperature increase very rapidly with Altitude.

L-2/5.3 THERMOSPHERE

- This region is characterized by low pressure and high temperature.
- Oxygen and nitric oxides absorbs the solar radiations in the UV region and undergo "Ionization"
- So this region is also called 'IONOSPHERE".

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L-2/6.1 Biosphere:-

This is the region of the earth where life exist .

- **Biosphere is biological envelop that surround the globe.**
- **It is made up of the lithosphere, hydrosphere and atmosphere.**
- **The biosphere is that it supports life.**

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L-2/6.2 Biosphere:-

- The biosphere contains
  - > 3.5 lacks species of plants and
  - eleven million species of animals.

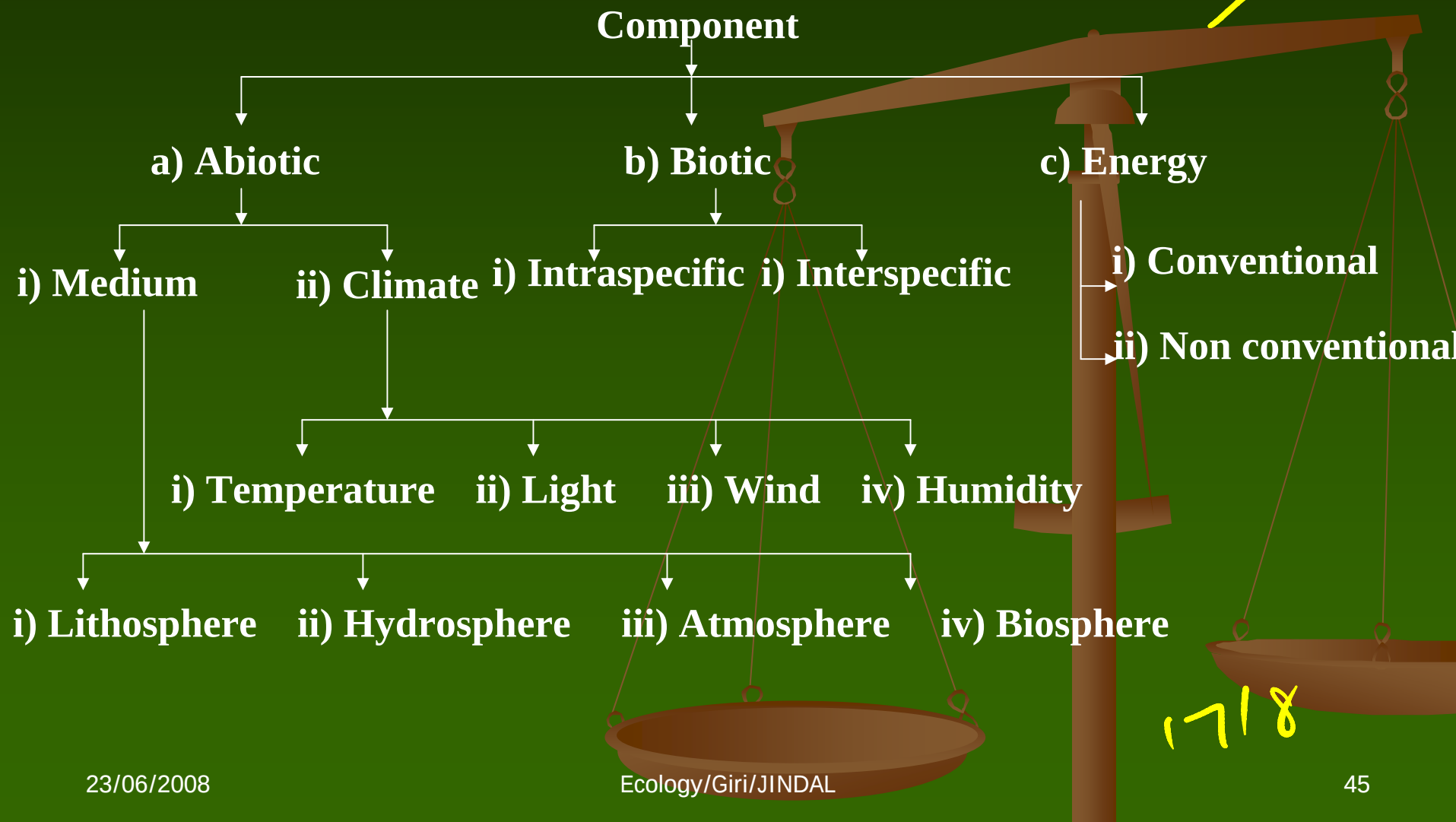
- The biosphere supplies all the essential namely light, heat, air, water, food, and living space.

- The biosphere is divided in to smaller units called :

"ECO-SYSTEM"

L-2/7 Environmental Segments

Environment consists of the following three components:-



L-3/1.1 Environmental Degradation

- Man started his life by simply
- utilizing a small portion of
God gifted natural resources.

- With increase in number and with
- advanced Culture and technologies

He modified the natural system into
an artificial and highly productive system

to get more energy and more nutrients sources.

L-3/1.2 Environmental Degradation

- It resulted in the production of more byproducts and wastes which
- naturally mixed up in the nature gradually.
- Today the problem of conservation of environment is one of the
- greatest challenges to us.

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Environmental Pollution/Degradation

Over consumption ‘Un-sustainability’

L-3/1.3 Environmental Degradation

Major causes of environmental degradation

i) Pollution

ii) Deforestation, loss of bio- diversity

iii) Garbage

and

iv) Energy crisis.

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L-3/2.1 Environmental Degradation

Minor causes of environmental degradation

i) Population explosion.

ii) Poverty

iii) Urbanization and

iv) industrialization.

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L-3/2.1a Environmental Degradation

Minor causes…contd.

iv) Illiteracy and ignorance.

v) Inequality in income and wealth between different classes of society.

vi) Automobiles and heavy transport.

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Schooling?
They never
have had
a full diet.
These must be
infected by
HIV or Aids!!

L-3/2.2 Environmental. Degradation

- Pollution of the environment is one of the most horrible ecological crisis.
- Today the environment has become foul, contaminated and harmful for the health of living beings.
- The unlimited exploitation of nature by man has disturbed the ecological balance.

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L-3/3.1 Environmental. Degradation

‘ Definition of Pollution’

- “The addition of the constituent
- to water, air, soil, which adversely alter

the natural quality of the environment.”

The word pollution is derived from Latin word “Pollutions” means to make dirty, i.e. the act of polluting the environment.

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L-3/3.1 Environmental. Degradation

Definitions…Contd.

- Pollution comes from getting rid of wastes at the least possible cost. (Darling)

- Pollution is an undesirable change in the physical, chemical or biological characteristics of air, land and water causing

harmful effect on our life or other desirable species and cultural assets.

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L-3/3.1 Environmental. Degradation

Definitions…Contd.

- **Pollution is the introduction of**
  - **surplus energy or**
- **waste matter into the environment by**

- **man's activities which directly or indirectly cause**
- **hazards to man and his environment.**

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Environmental Pollution/Degradation





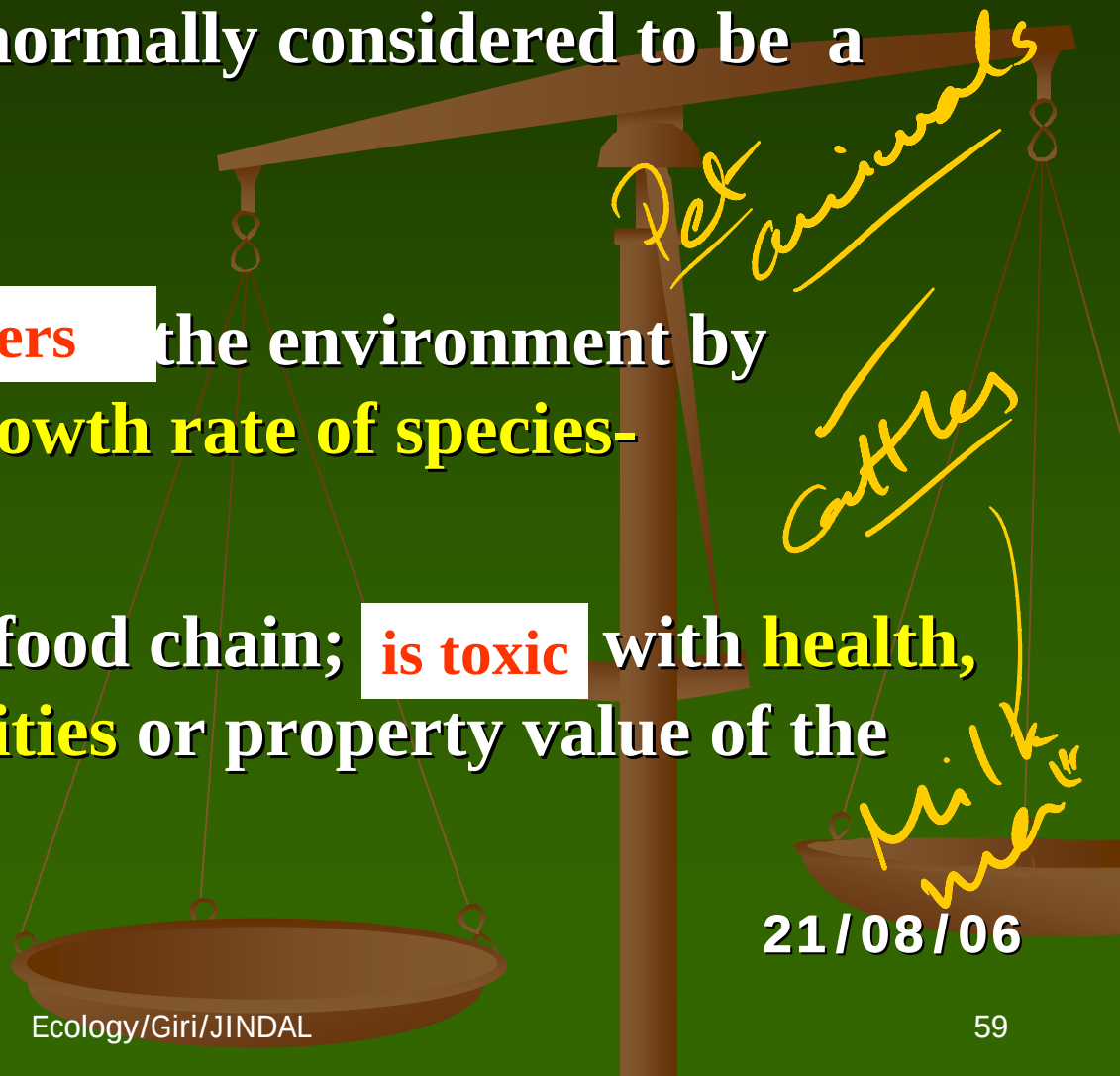

Effluents of the affluent

L-3/3.1 Environmental. Degradation

Pollutants:-

A **substance** is normally considered to be a **pollutant :**

- If it **adversely alters** the environment by changing the **growth rate of species-**
- **Interferes** with food chain; **is toxic** with **health, comforts, amenities** or property value of the people.



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L3/4.1 Environmental. Degradation

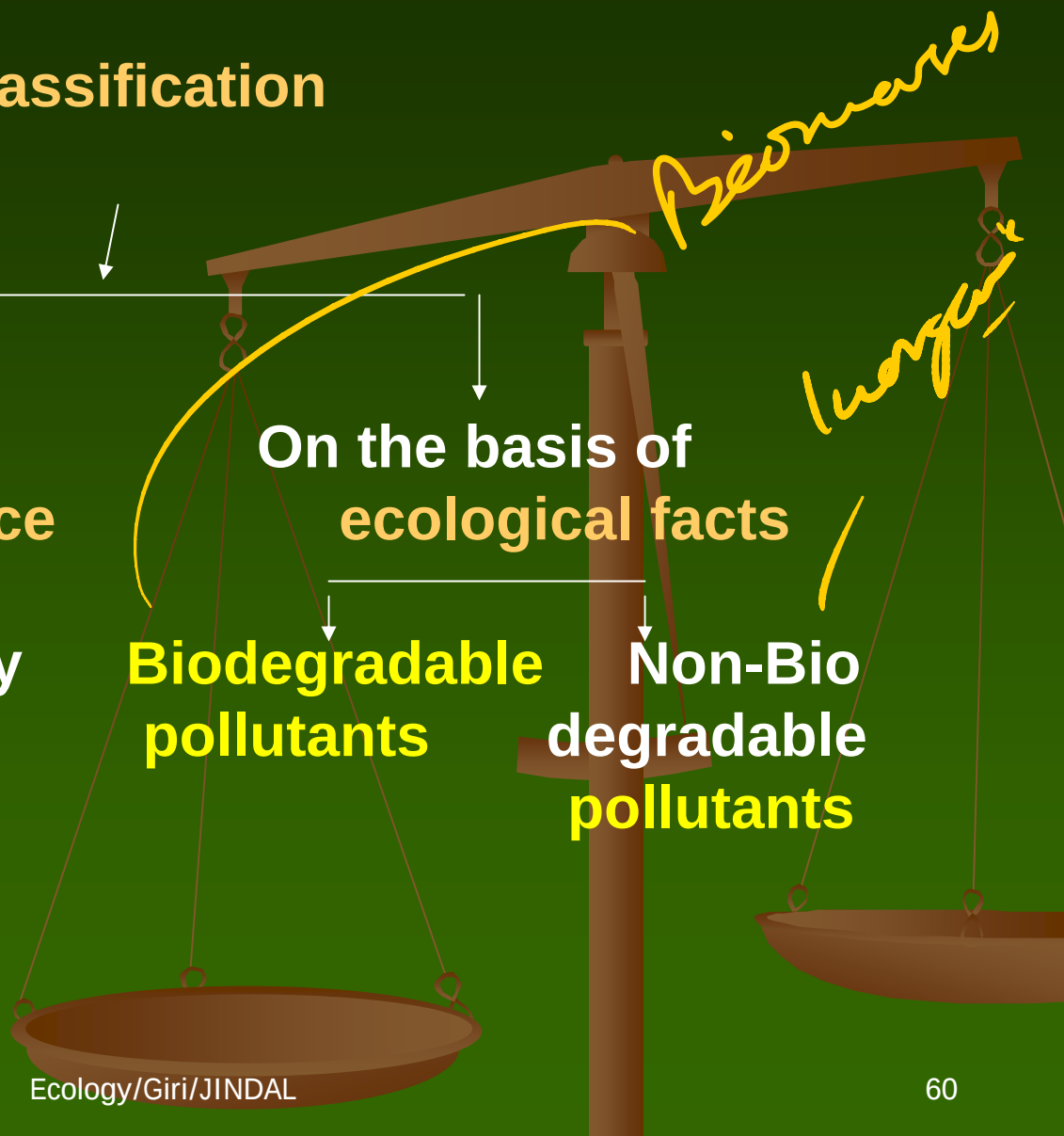
Classification

On the basis of environmental existence

- **Primary pollutants**
- **Secondary pollutants**

On the basis of ecological facts

- **Biodegradable pollutants**
- **Non-Bio degradable pollutants**



L-3/4.2 Social causes-

environmental Degradation:

- Poverty & population
- Industrialists & politicians
- Prosperity, consumption & pollution
- Lack of environment friendly technology
- Unsustainable living

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L-3/4.2 Social causes-

environmental Degradation:

- Unsustainable living
- Development of man made ecosystem
- Population growth
- Modern sciences, power policies.

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A man made Paradise Treeless,
Oxygen less, polluted….

L3/4.3 Environmental. Degradation

Some other social causes:

- **Poverty and population :**
- **This is one of factors for environmental degradation in developing countries.**
- **“Poverty is not an independent entity but a part of equity”.**
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L3/4.3 Environmental. Degradation

Some other social causes :

- **Lack of environmental friendly Technology :**

- **technological advancement is also contributing to environmental degradation.**

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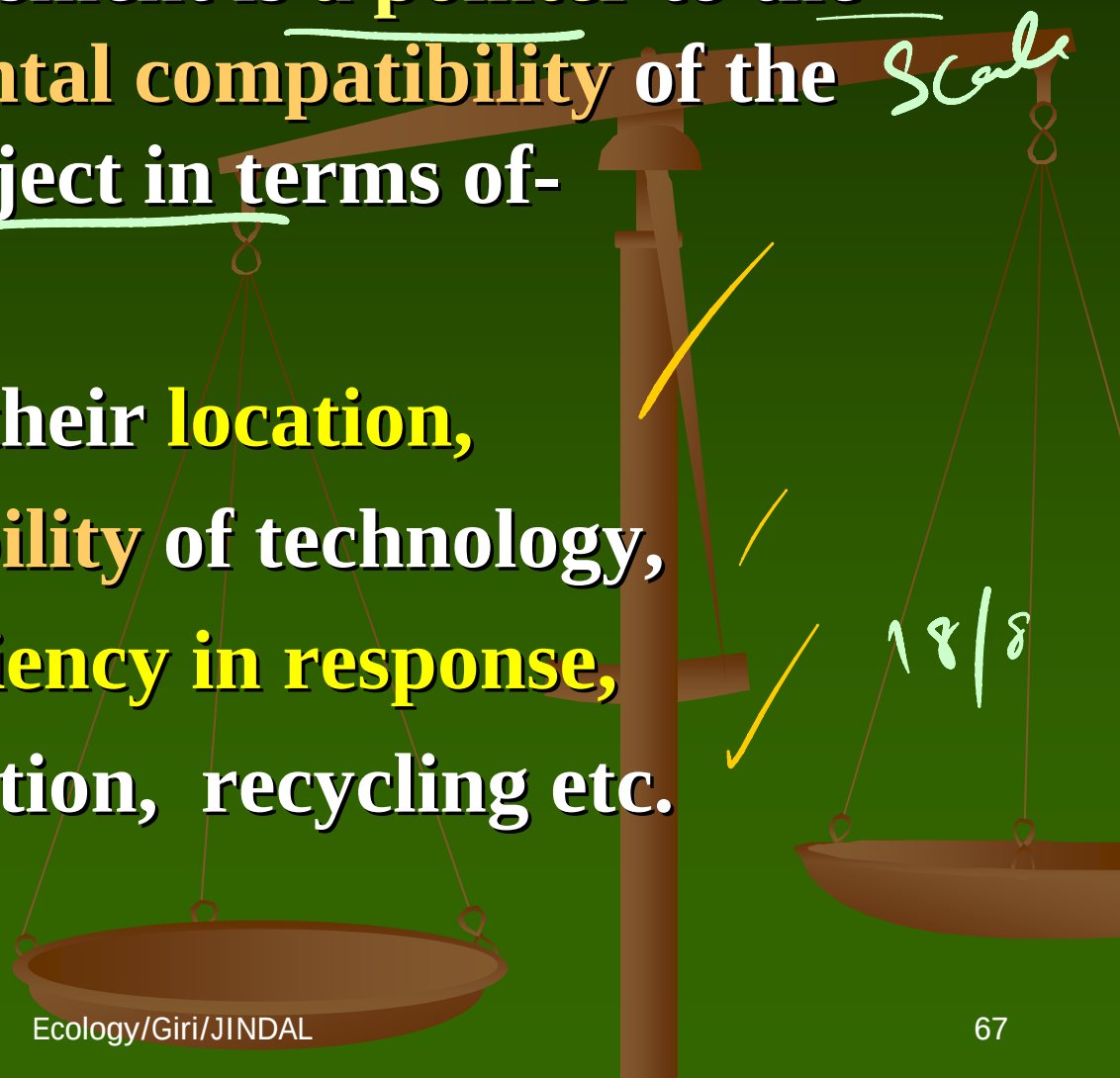
L-3/5.1 Environment Impact Assessment:-

Impact assessment is a pointer to the environmental compatibility of the project in terms of-

- their location,
- suitability of technology,
- efficiency in response,
- utilization, recycling etc.



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L-3/5.2 E. I. A.

Nature **balances** the environment in different ways.

- **Ecological ethics limit** social as well as **individual freedom** of action,

- for other individuals and society as well as to the **larger community** ….

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L-3/5.2 E. I. A.

- consisting of plants, animals, soils, air, water etc.

- The belief in laws-Role of man in nature can create final order, harmony and balance in the following ways:

- Man can engineer nature and modify it to his benefits.

Genetic Engineering

GMM

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L-3/5.3 E. I. A.

- Man has a **moral obligation** to
- protect and preserve the environment.
  - Environment is beautiful,
  - magnificent and powerful.
- Development is **fundamental character**
  - of a society
- But if we want to make it **sustainable development,**
- possible **positive or negative impacts**
  - are to be studied.

L-3/5.3 E. I. A.

Environmental impact can be observed on the following parameters-

1. Impact on soil, water or air quality.
2. Impact on natural resources like agriculture, forests, wild life etc.
3. Socio-economic impacts on affected human population.
4. Impact on health.
5. Impact on economy and security.

L-3/5.3 E. I. A.

Example:-

A high dam at Aswan and lake Nasser is the biggest and most expensive dam of the world.

There are five major environmental projects-

1. **The dam lacks sluices to transport sediment through the reservoir and trayer**

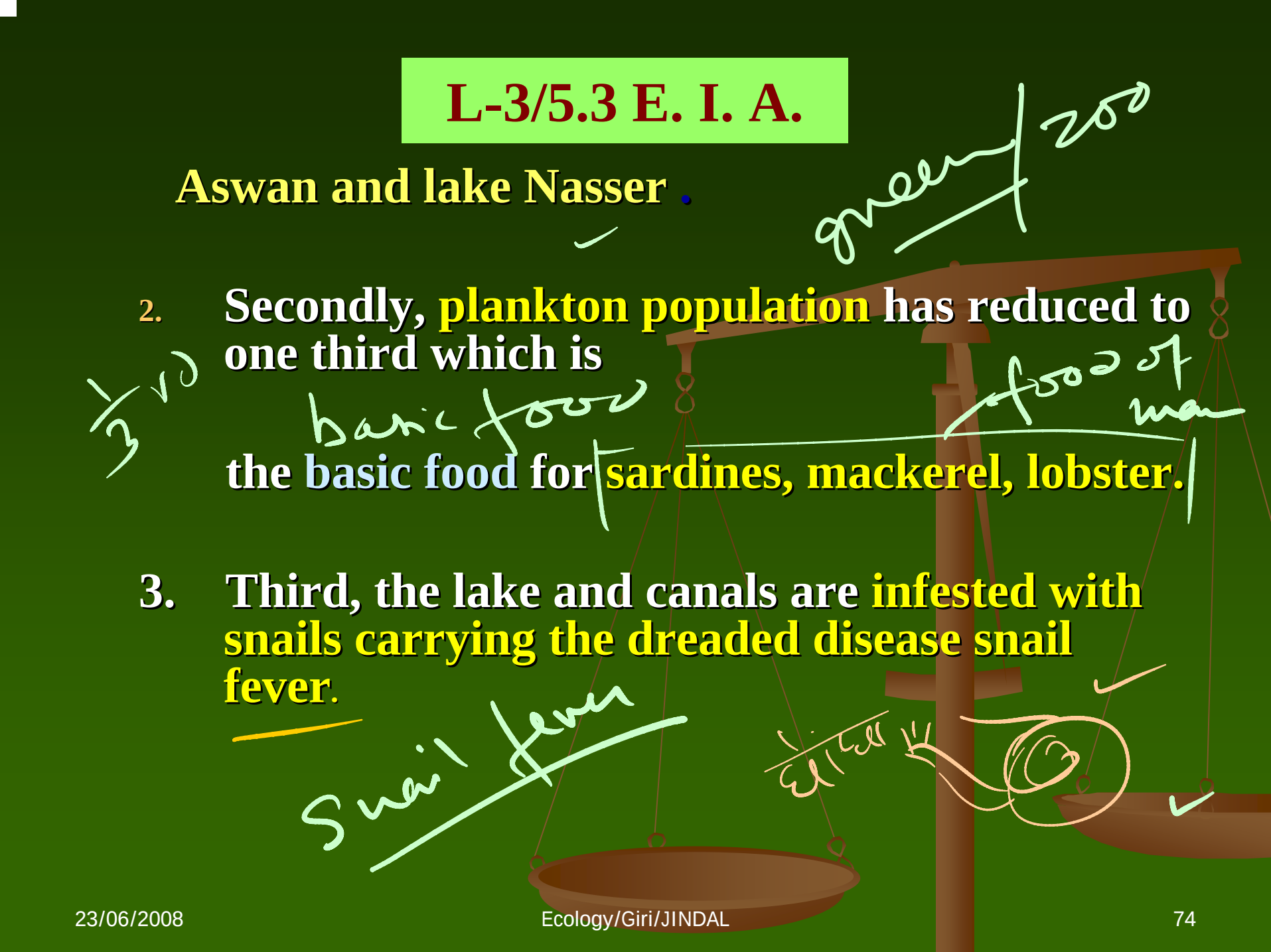
134 million tons of Niles sediment per year.

L-3/5.3 E. I. A.

Aswan and lake Nasser .

2. **Secondly, plankton population has reduced to one third which is the basic food for sardines, mackerel, lobster.**

3. **Third, the lake and canals are infested with snails carrying the dreaded disease snail fever.**



L-3/5.3 E. I. A.

Aswan and lake Nasser

4. Salinity of the soil is increasing at an alarming rate.

5.There is an increased threat of Malaria

On the positive side….

- The Nile dam and lake have converted
  - 2800 Kms from natural flood water irrigation to
  - canal irrigation and allowed double cropping.

L-3/5.3 E. I. A.

- **Environmental Planning:-**
- **Environment can be protected by the planning methods at local, regional and global levels.**
- **Local Land Use Planning:- Selection, construction and determination of environmental impact .**
- **Simple activities like transportation, drinking water supply, clear air etc. need planning.**

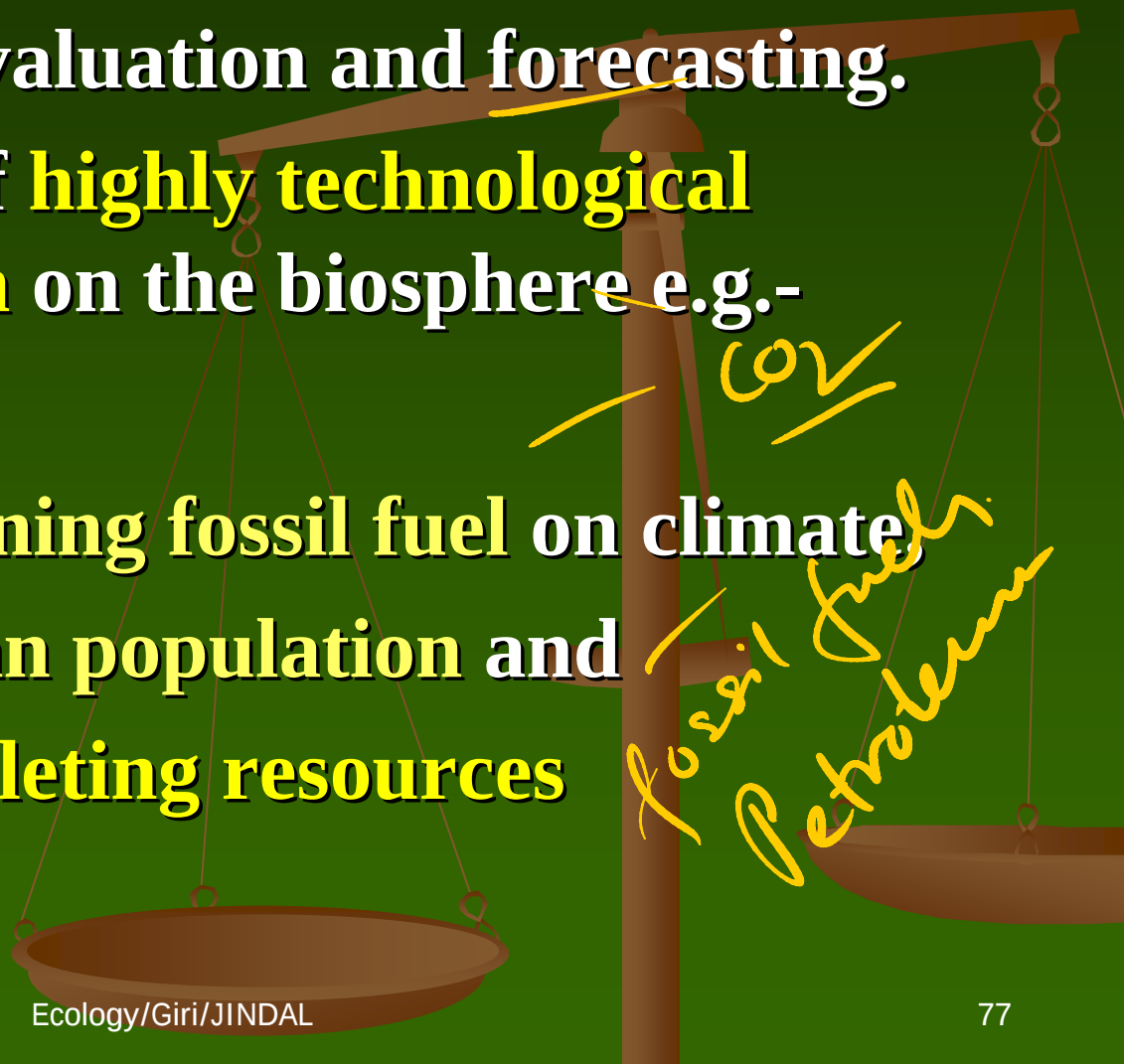
L-3/5.3 E. I. A.

Global Planning:-

It consists of evaluation and forecasting.

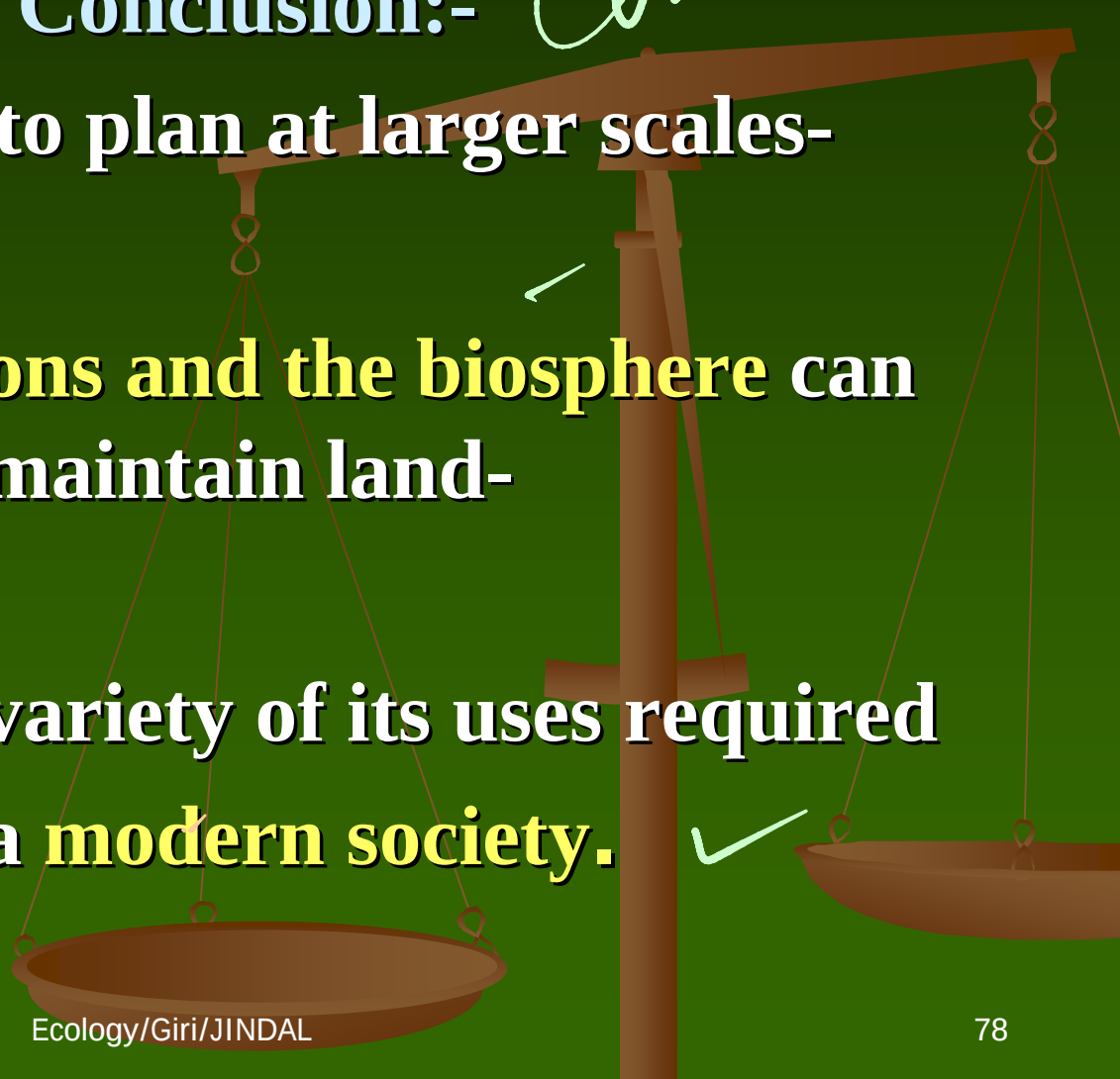
- Effects of highly technological civilization on the biosphere e.g.-

- Effects of burning fossil fuel on climate,
  - human population and
    - Depleting resources



L-3/5.3 E. I. A.

- **Conclusion:-**
- **We need to plan at larger scales-**
- **so that nations and the biosphere can maintain land-**
- **with all the variety of its uses required by a modern society.**



L-4/1 Fundamentals of Ecology & Ecosystem

- **The term Ecology was given by 'Ernst Haeckal in 1869'. It is derived from the Greek words "Oikology" –**

Oikos and Logy.

↓ ↓

home study

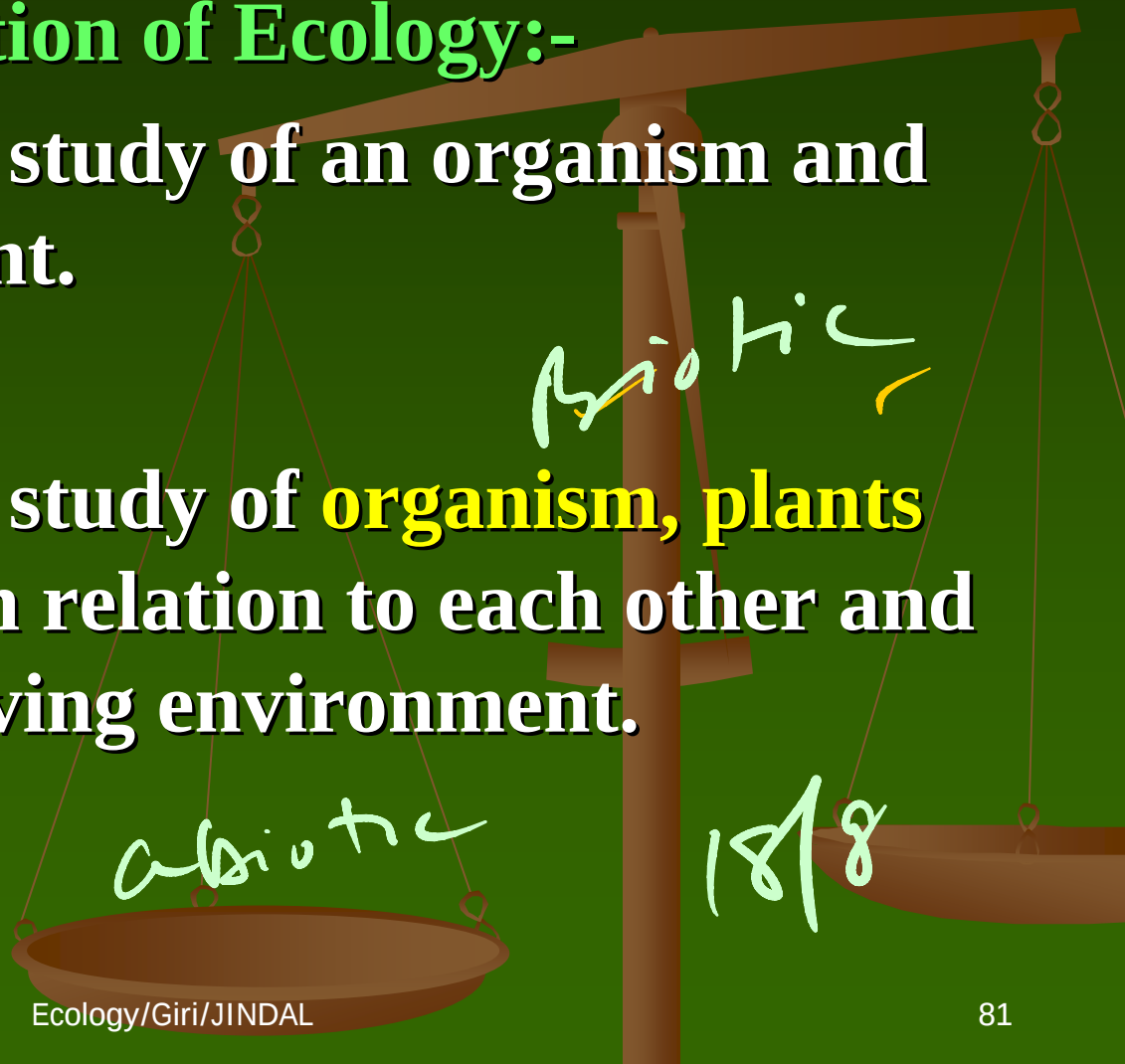
- **So ecology deals with the study of organisms in their natural home interacting with there surroundings.**

L-4/1a .. Ecology & Ecosystem

Definition of Ecology:-

- Ecology is the study of an organism and its environment.

- Ecology is the study of **organism, plants and animals** in relation to each other and to their non living environment.



L-4/2 … Ecology & Ecosystem

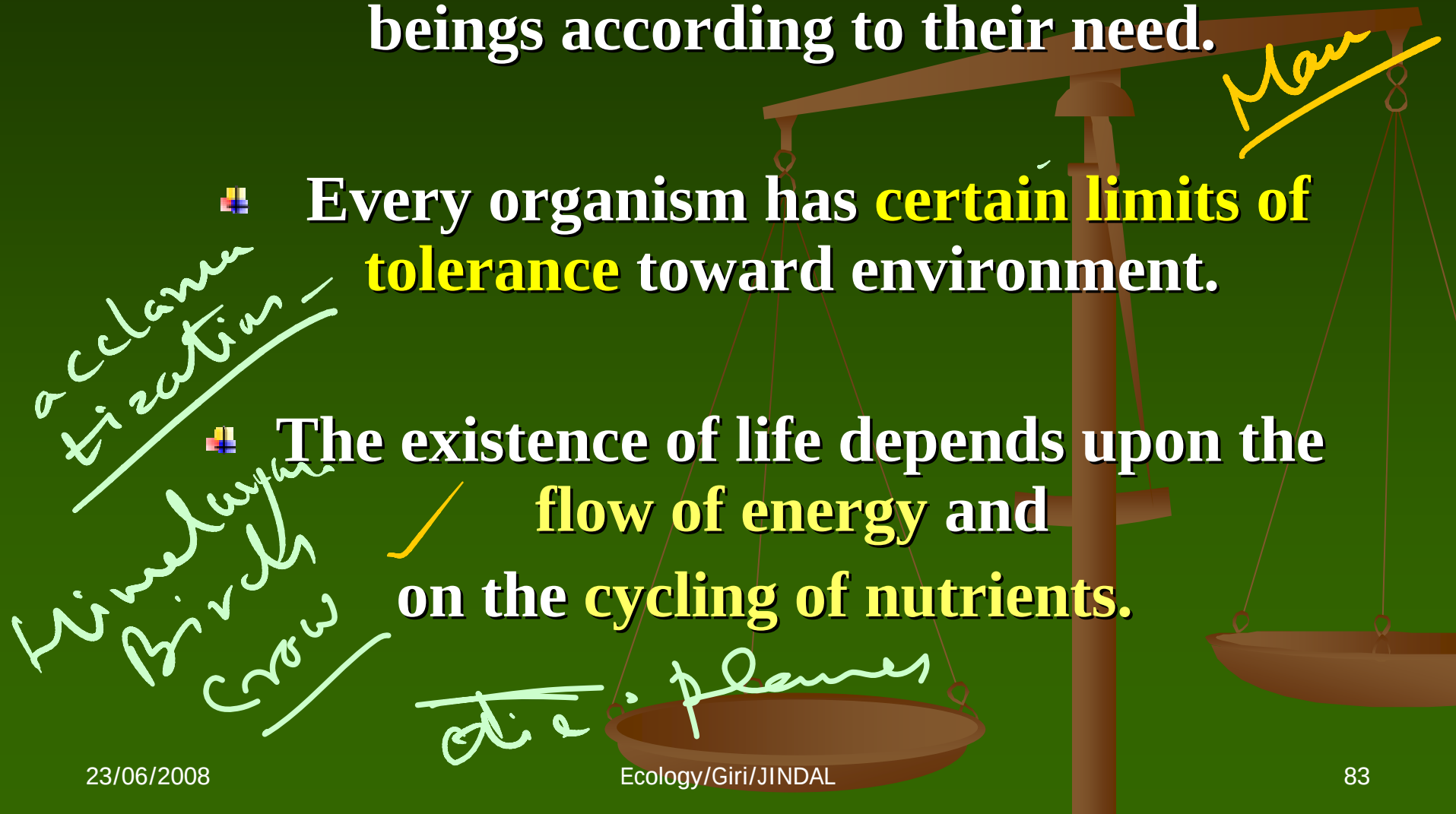
- **Ecological Principles:-**

- **All living beings and their environment are interdependent and affect each other.**

- **An alteration of any one component affects all other components.**

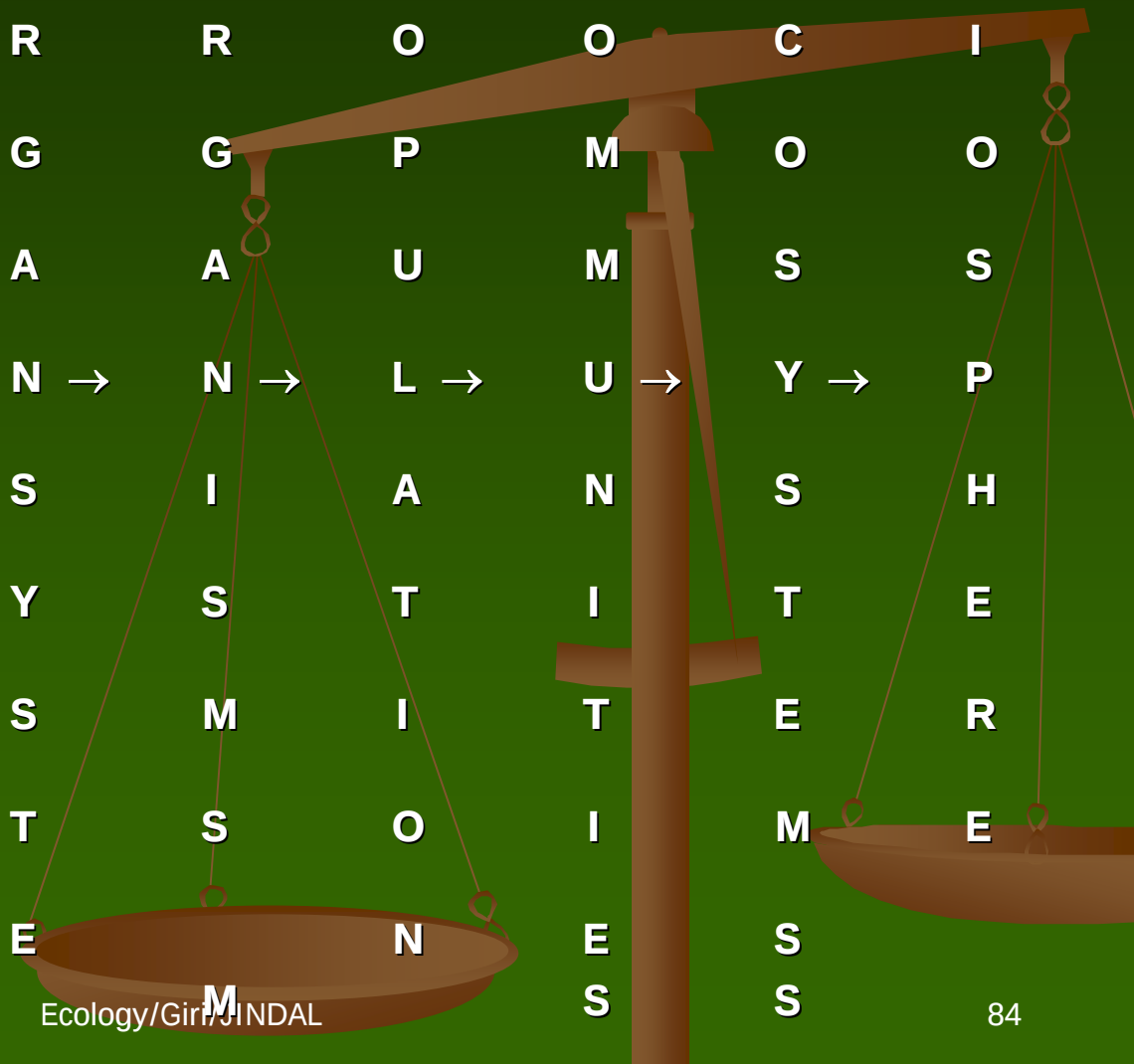
L-4/2a … Ecology & Ecosystem

- The environment is modified by living beings according to their need.
- Every organism has certain limits of tolerance toward environment.
- The existence of life depends upon the flow of energy and on the cycling of nutrients.



Level of Organisation:- Ecology is a basic division of ‘biology’ and also forms on integral part of organism of their environment. It is divided into ten levels.

P	C	T	O	O	O	P	C	E	B
R	E	I	R	R	R	O	O	C	I
O	L	S	G	G	G	P	M	O	O
T	L	S	A	A	A	U	M	S	S
O →	S →	U →	N →	N →	N →	L →	U →	Y →	P
P		E	S	S	I	A	N	S	H
L		S		Y	S	T	I	T	E
A				S	M	I	T	E	R
S				T	S	O	I	M	E
M				E	N	E	S	S	
					M		S		



L-4/3 …. Ecology and Ecosystem

Sub Division of Ecology:-

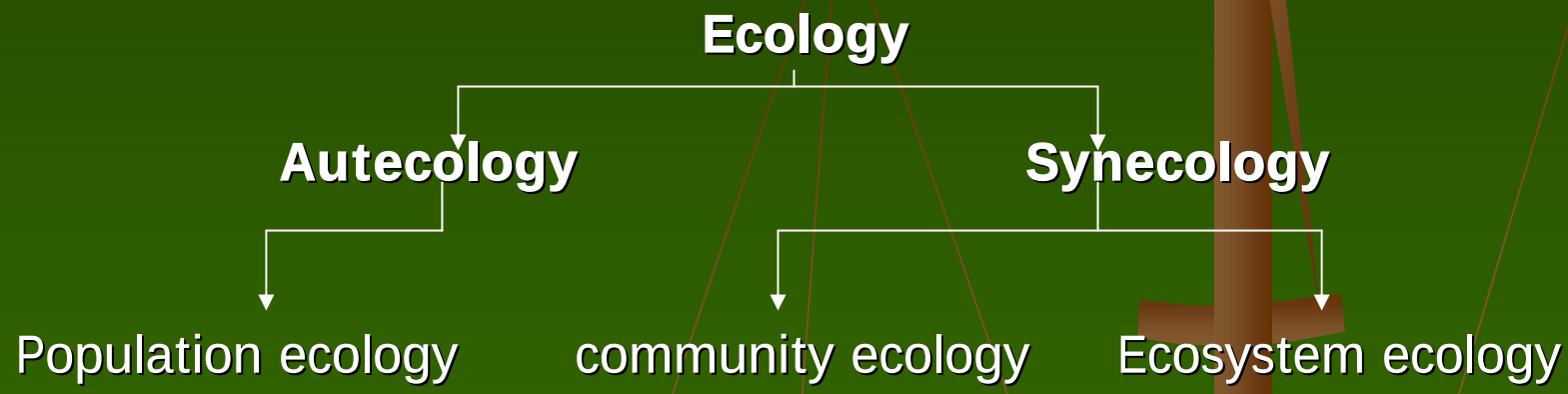
It is divided into two main groups-

- **(i) Autecology:-** It is the study of the individual organism.
- **(ii) Synecology:-** It is study of communities, their composition, their behavior and relation to the environment.

L-4/3 …. Ecology and Ecosystem

Sub Division of Ecology:- It is divided into two main groups-

- **(i) Autecology:- It is** the study of the individual organism.
- **(ii) Synecology:-** It is study of communities, their composition, their behavior and relation to the environment.



L-5/1 Components of Ecosystem

Ecosystem:-

According to

A. G. Tansley in 1935.

" Ecosystem is the basic fundamental unit of ecology which consist of the

- **biotic and abiotic community".**

L-5/1 Components of Ecosystem

Ecosystem:- **Definition:-**

'Ecosystem is a functional ecological unit comprising of living organisms (biotic) and their non living (abiotic) environment that interact to form a ~~stable~~ supporting system.

L-5/1 Components of Ecosystem

- **Example- A pond, lake, desert, grassland, forest ecosystem.**

Components or Structure of Ecosystem:-

Ecosystem has two main components

(a) Abiotic (b) Biotic.

L-5/3 Components of Ecosystem

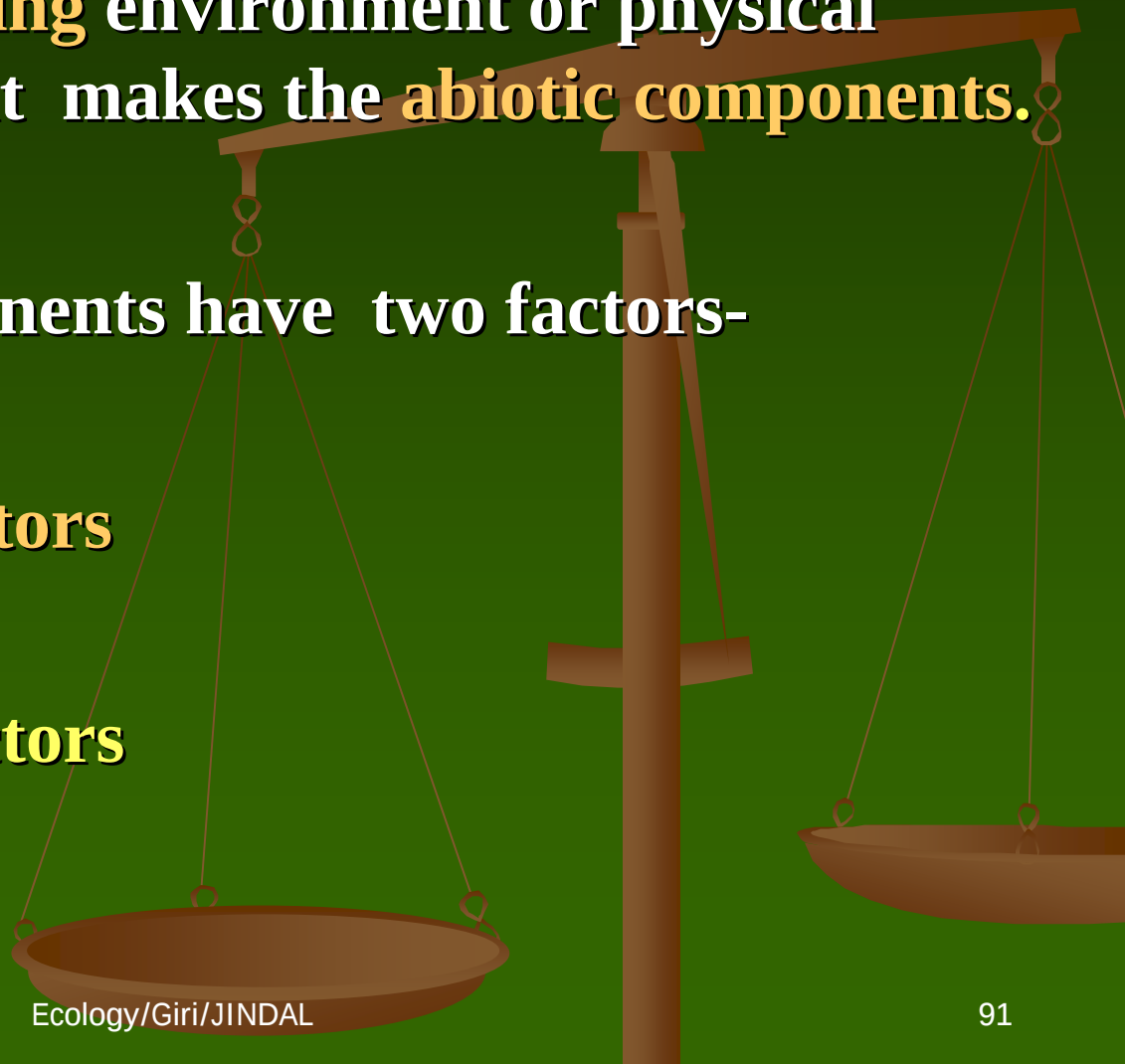
Abiotic Components:-

- The non- living environment or physical Environment makes the abiotic components.

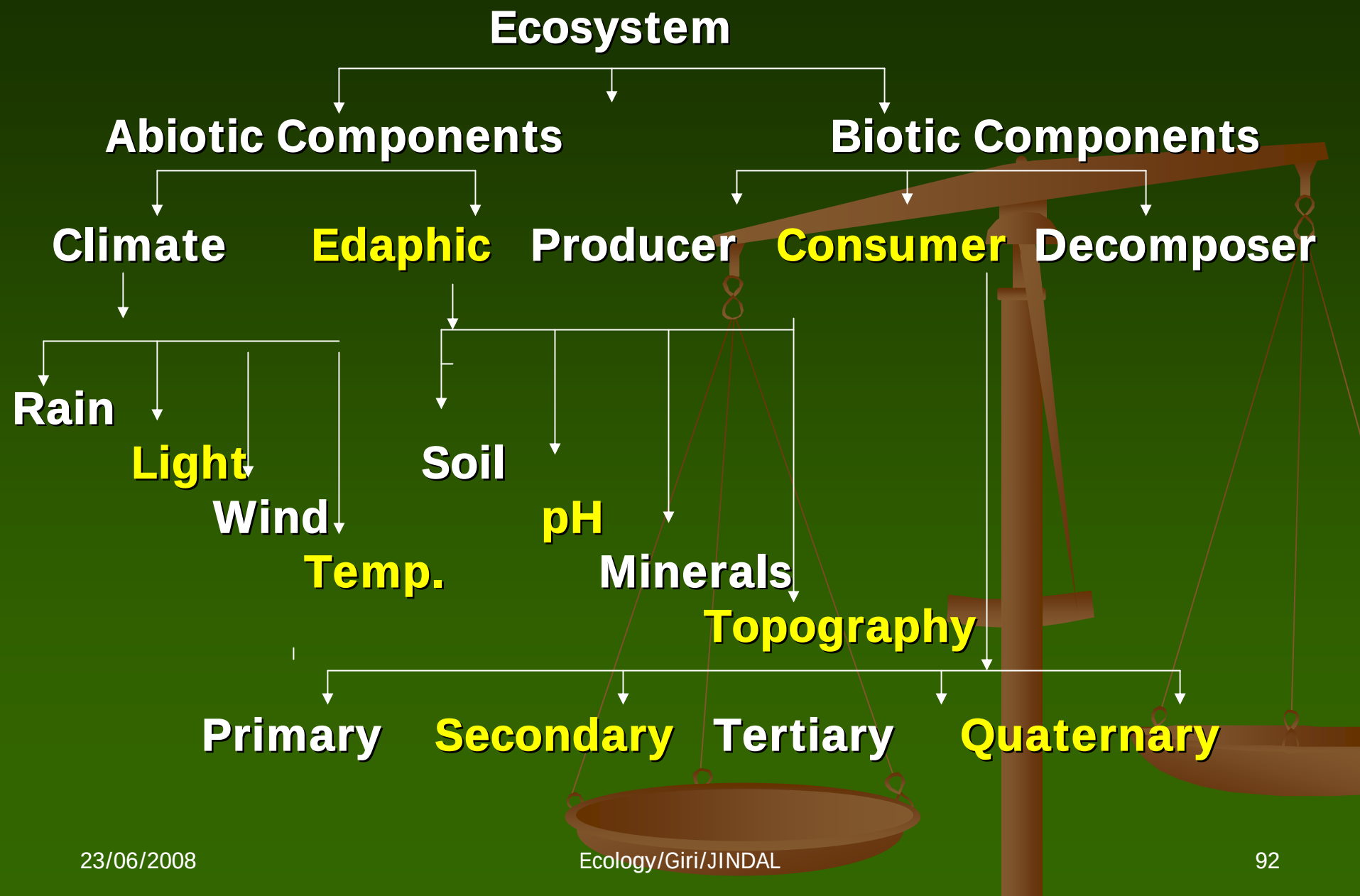
- Abiotic components have two factors-

- Climate Factors

- Edaphic Factors



L-5/2 Components of Ecosystem



L-5/3 Components of Ecosystem

1. **Climate Factors:-**

Which include rain, temperature. light, wind, etc.

2. **Edaphic Factors:-**

Which include soil, pH, topography, minerals etc.

It also include inorganic and organic factors.

L-5/3 Components of Ecosystem

2. Edaphic Factors:-

- **Inorganic factors –**

Ca, CO_2, H_2O, N_2 , etc.

- **Organic factors –**

Protein, Carbohydrate, lipids and amino acids.

L-5/4 Components of Ecosystem

Biotic Components:-

The living organism including **plants, animals and micro-organisms** that make the biotic components.

Biotic components are mainly of three types-

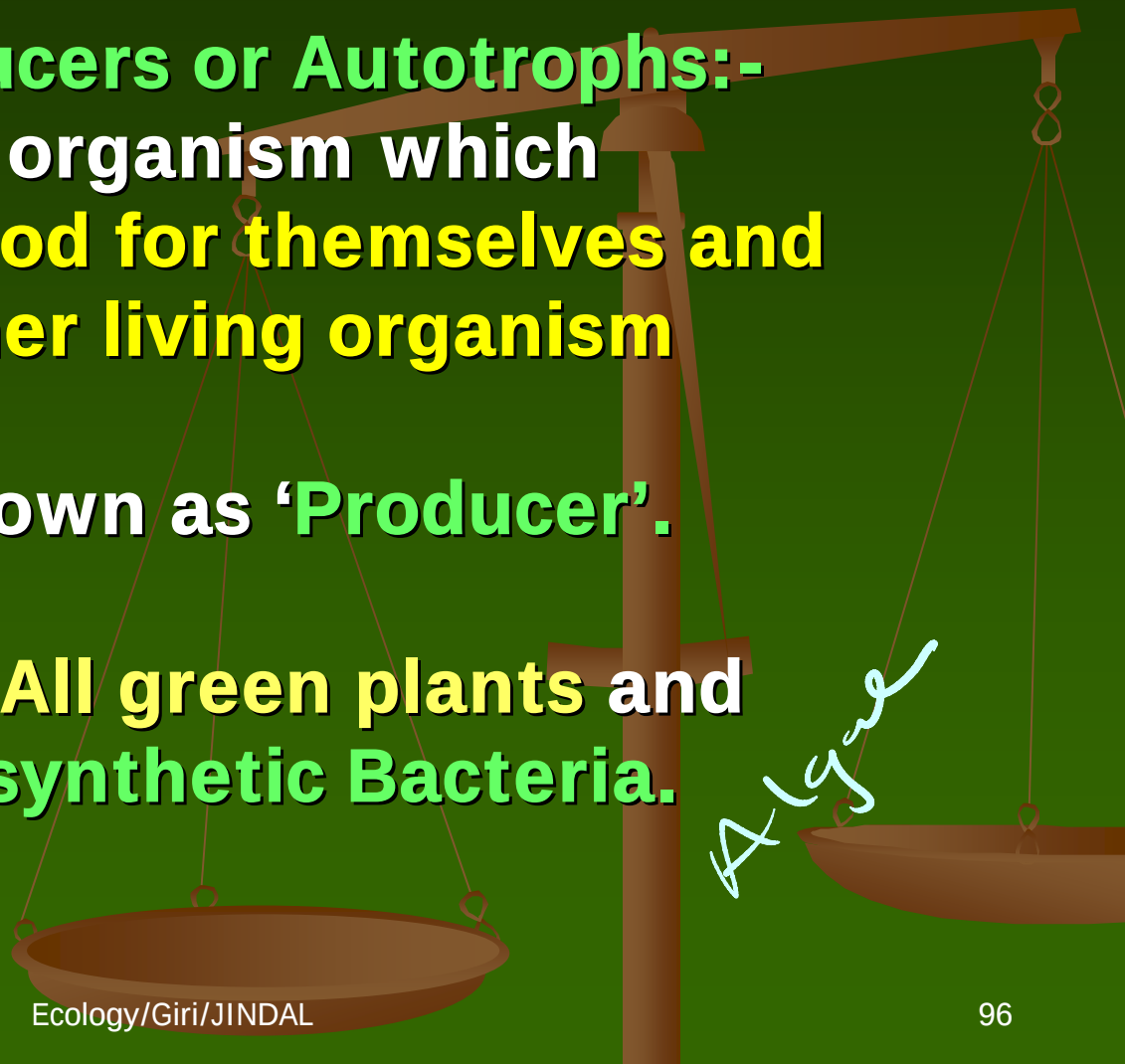
L-5/4 Components of Ecosystem

Biotic Components:-

1. Producers or Autotrophs:-
The organism which produce food for themselves and for other living organism

are known as 'Producer'.

Example: All green plants and Photosynthetic Bacteria.



Producers

- **Sunlight** is the main source of energy for **most** life on earth.
- **Producers contain chlorophyll** & can use energy directly from the sun

L-5/4a Components of Ecosystem

The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy this process is known as photosynthesis.

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

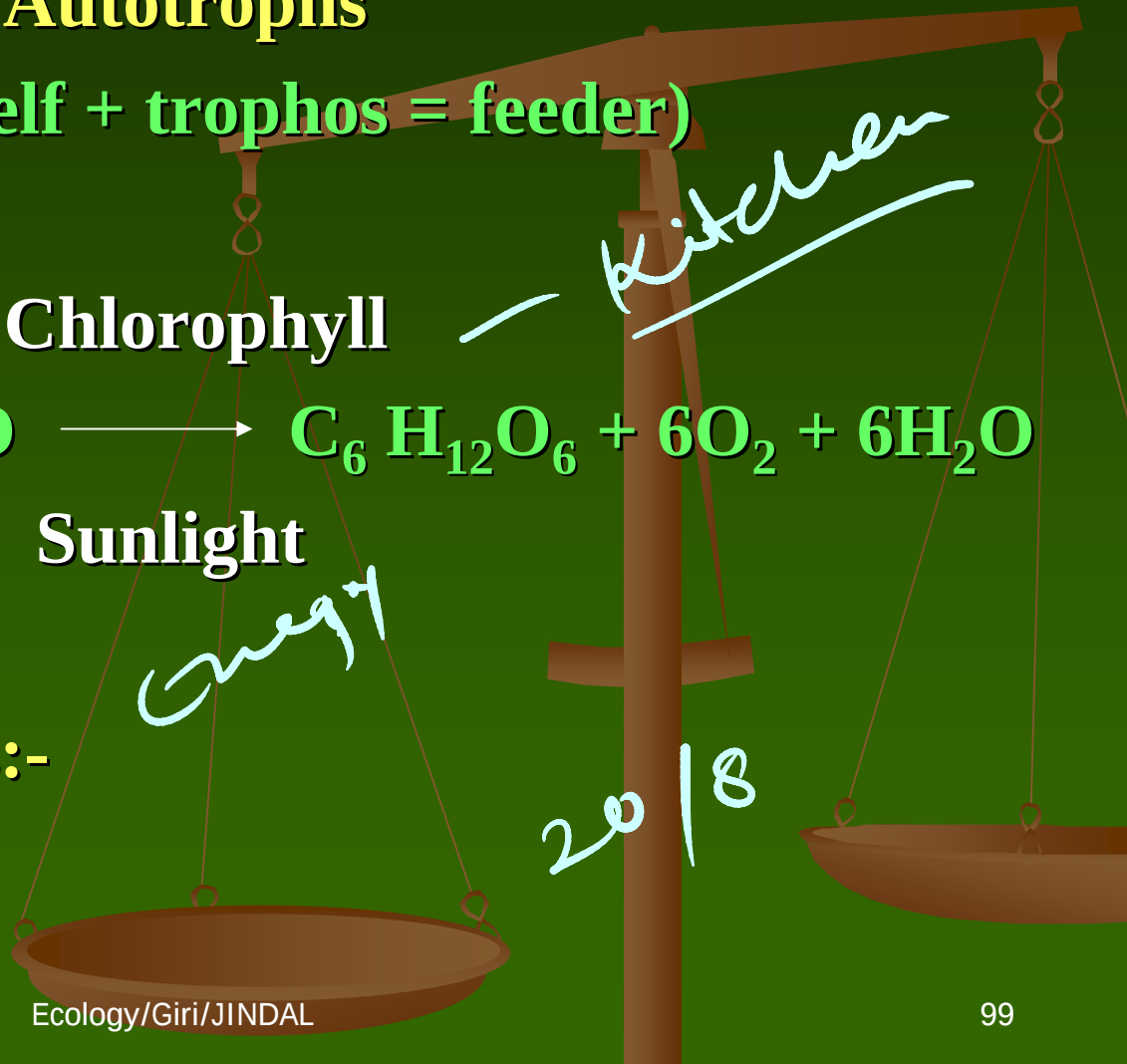
Solar energy → chemical

2018

L-5/4b Components of Ecosystem

- As the green plants made their own food they are known as **Autotrophs**

(Auto = self + trophos = feeder)



Chlorophyll

$$6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

Sunlight

2.Consumers:-

L-5/4c Components of Ecosystem

Consumers:-

- The animals lack chlorophyll and
- are unable to synthesize their own food.
- So they depend on the producers
- for their food.

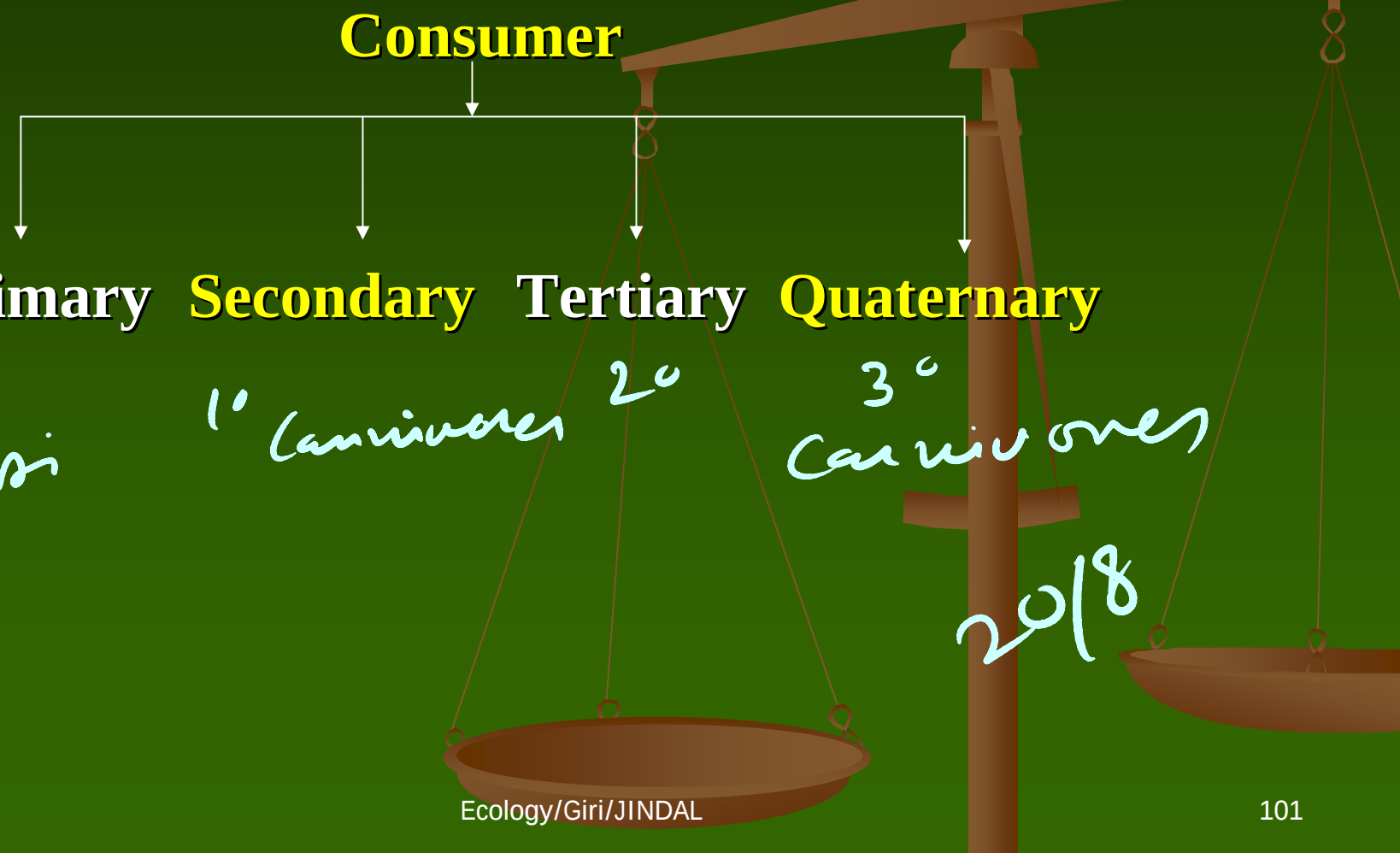
- These are also known as
- Heterotrophs

(Hereto = Other, trophos = feeder).

- These are known as
- consumers.

L-5/4c Components of Ecosystem

Consumers: Consumers are mainly of four types :



L-5/5 Components of Ecosystem

i) Primary Consumers or Herbivores:-

These are the animals which feed on plants or the producers.

They are called Herbivores.

Example: Rabbit, Deer, Goat, Cattle etc.

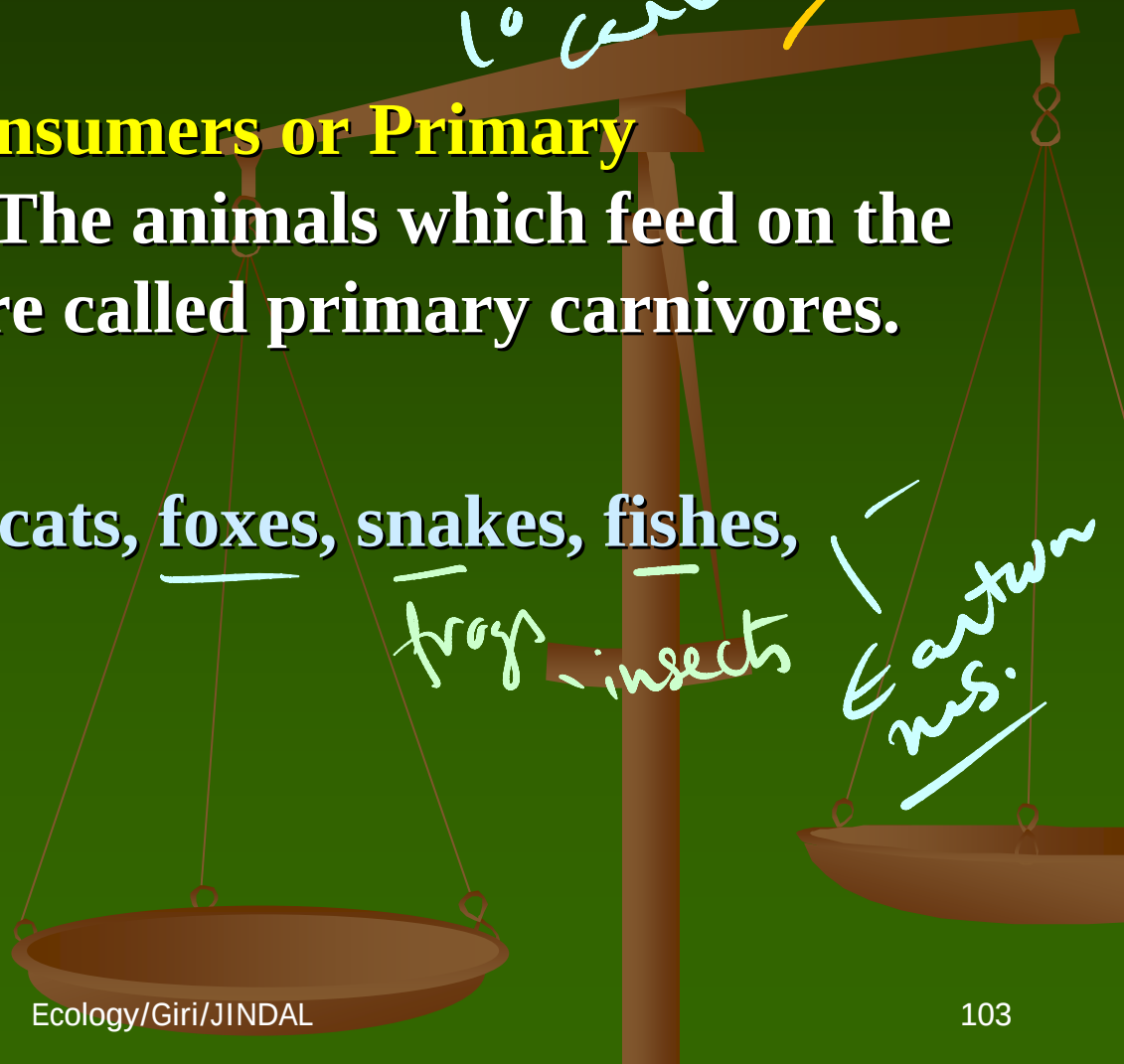
ii) Secondary Consumers or Primary Carnivores:-

L-5/5 Components of Ecosystem

i) Primary Consumers or Herbivores:-

ii) Secondary Consumers or Primary Carnivores:- The animals which feed on the herbivores are called primary carnivores.

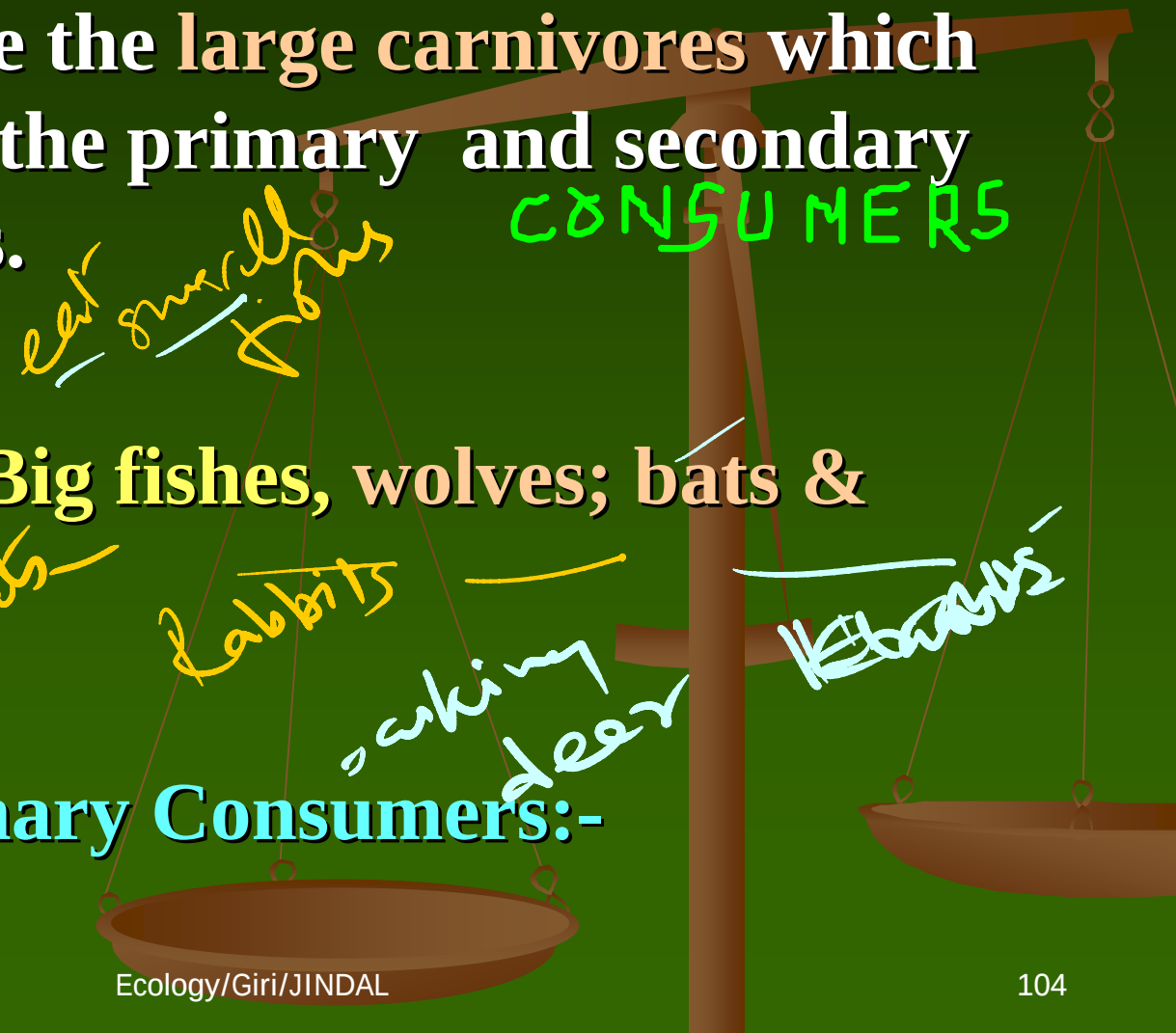
Examples: rats, cats, foxes, snakes, fishes, crows, etc.



L-5/5a Components of Ecosystem

iii) Tertiary Consumers:-

These are the large carnivores which feed upon the primary and secondary consumers.



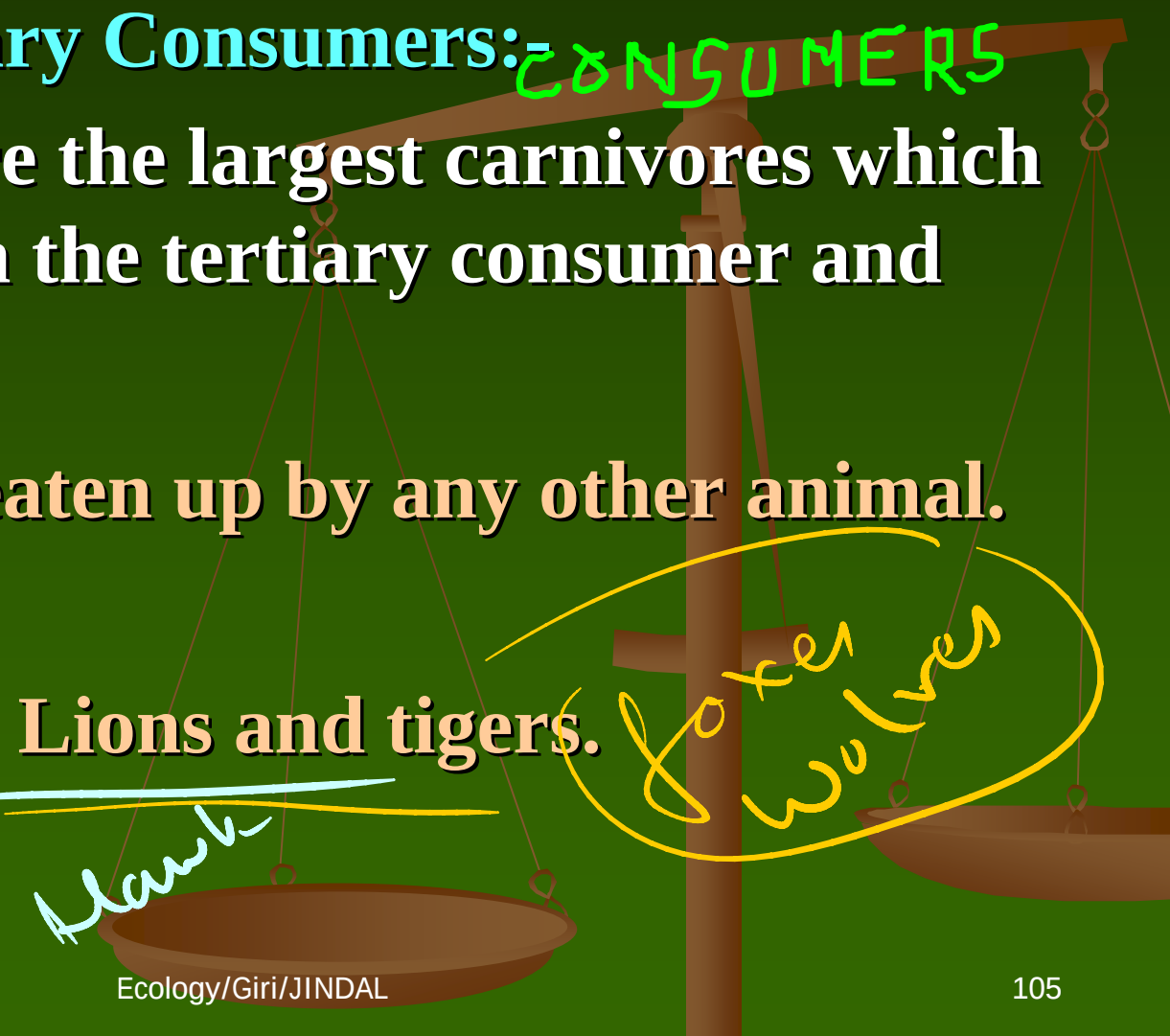
Example. Big fishes, wolves; bats & vultures.

iv) Quaternary Consumers:-

L-5/5a Components of Ecosystem

iv) **Quaternary Consumers:-** These are the largest carnivores which feed upon the tertiary consumer and are not eaten up by any other animal.

- **Example. Lions and tigers.**



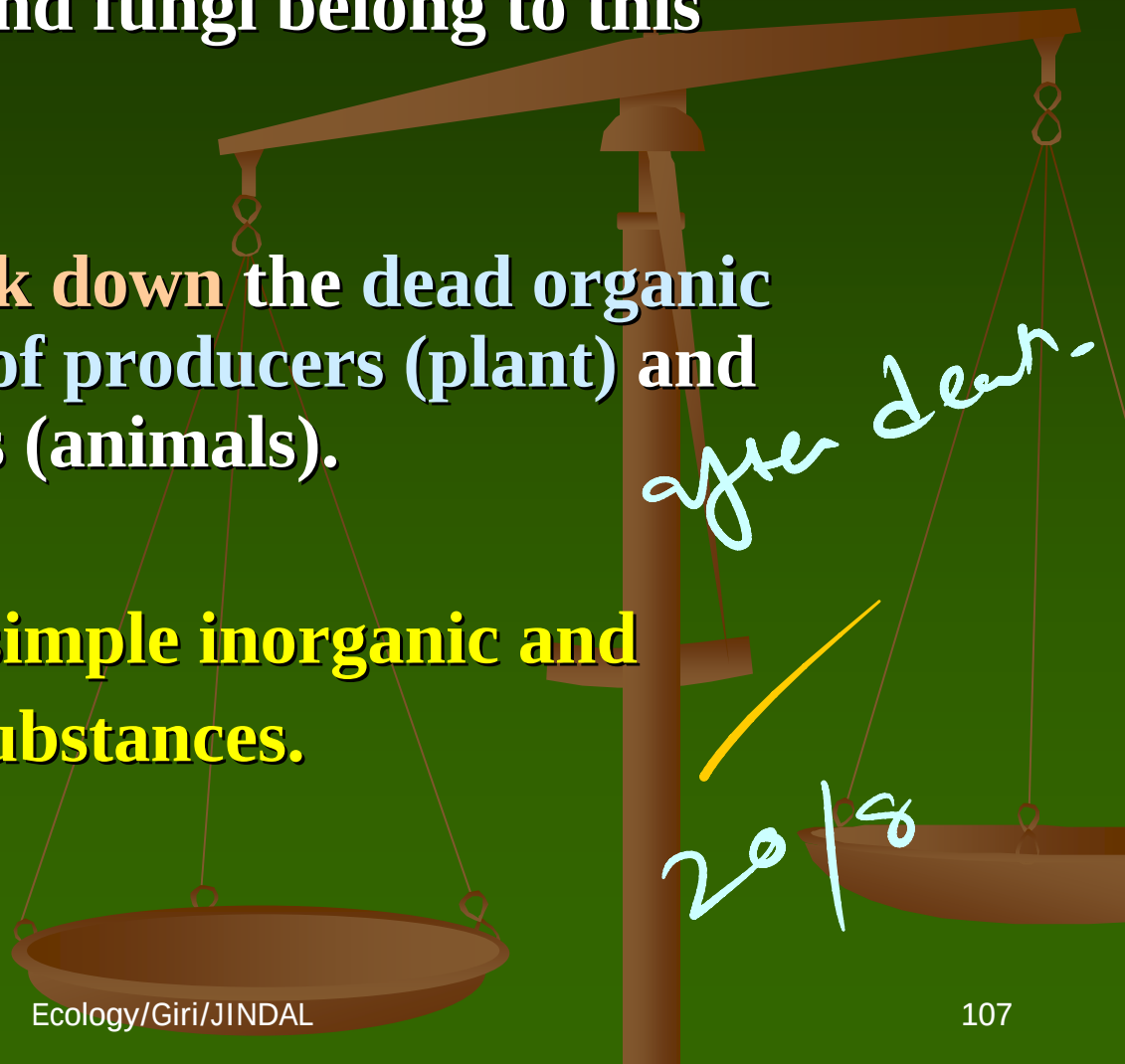
L-5/6 Components of Ecosystem

Decomposers or Reducers:

- Bacteria and fungi belong to this category.

1. They break down the dead organic materials of producers (plant) and consumers (animals).

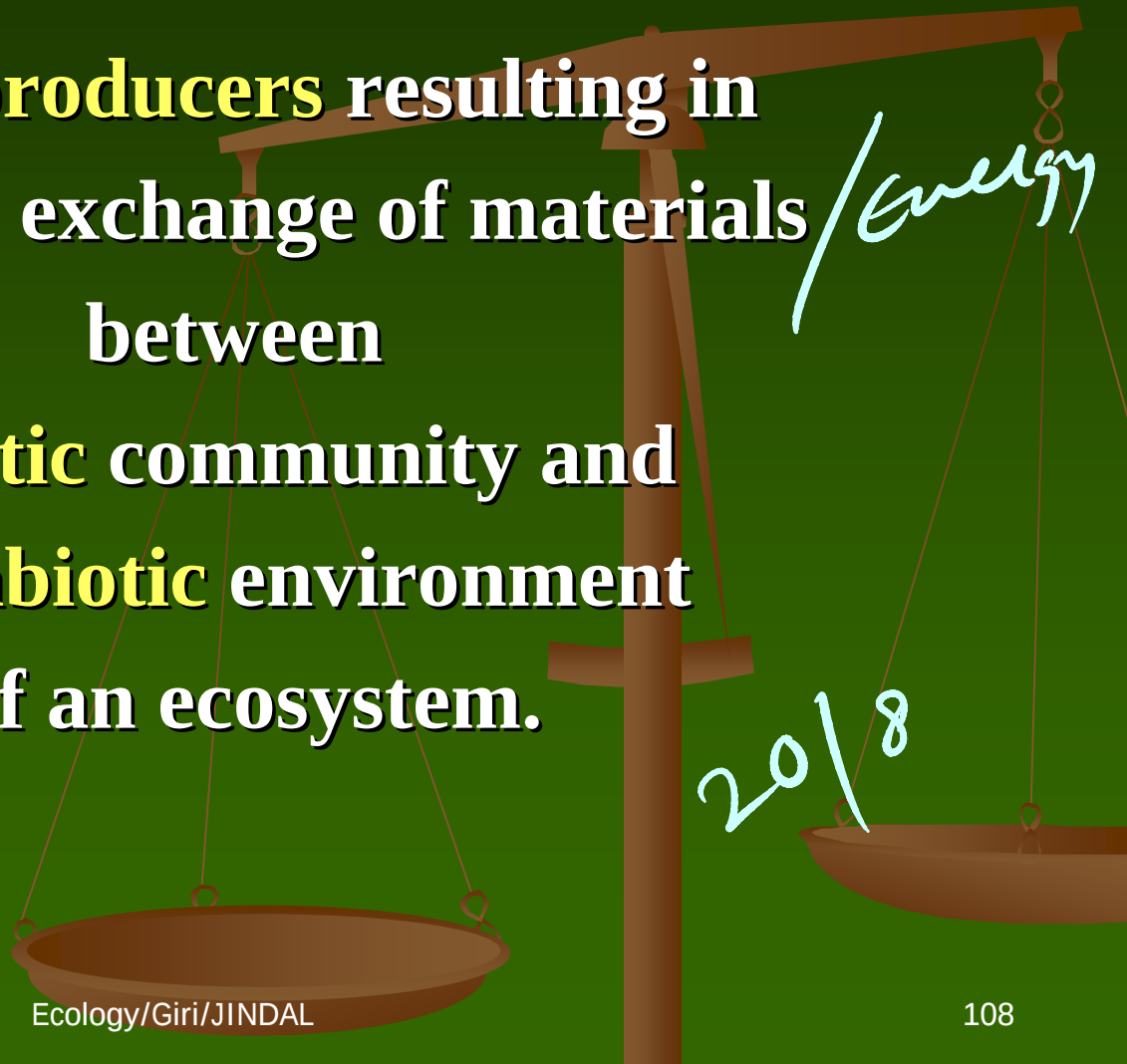
2. And give simple inorganic and organic substances.



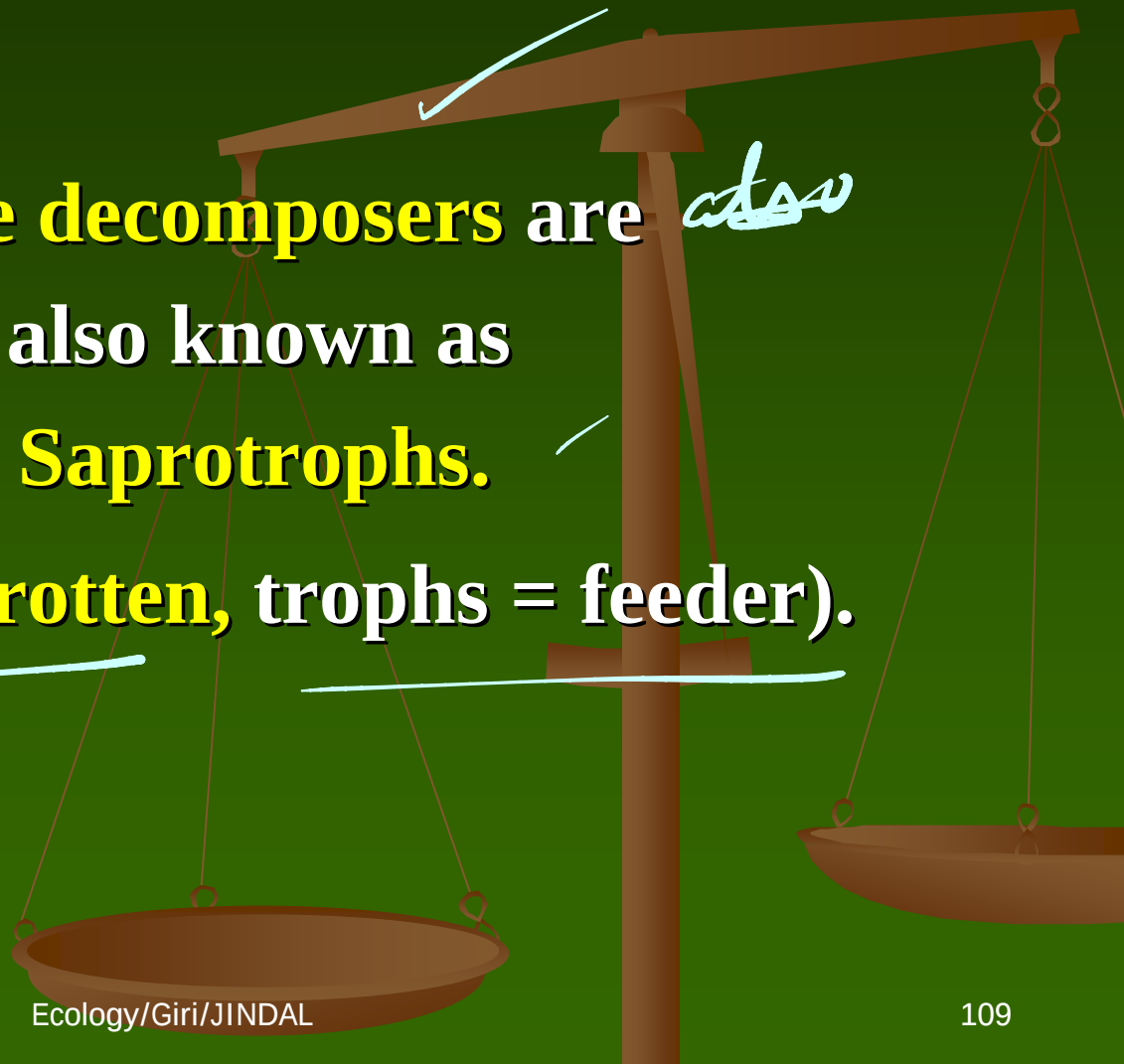
L-5/6a Components of Ecosystem

3. The simple substance are reduced by the producers resulting in

- a cyclic exchange of materials between
- the biotic community and
- the abiotic environment
- of an ecosystem.



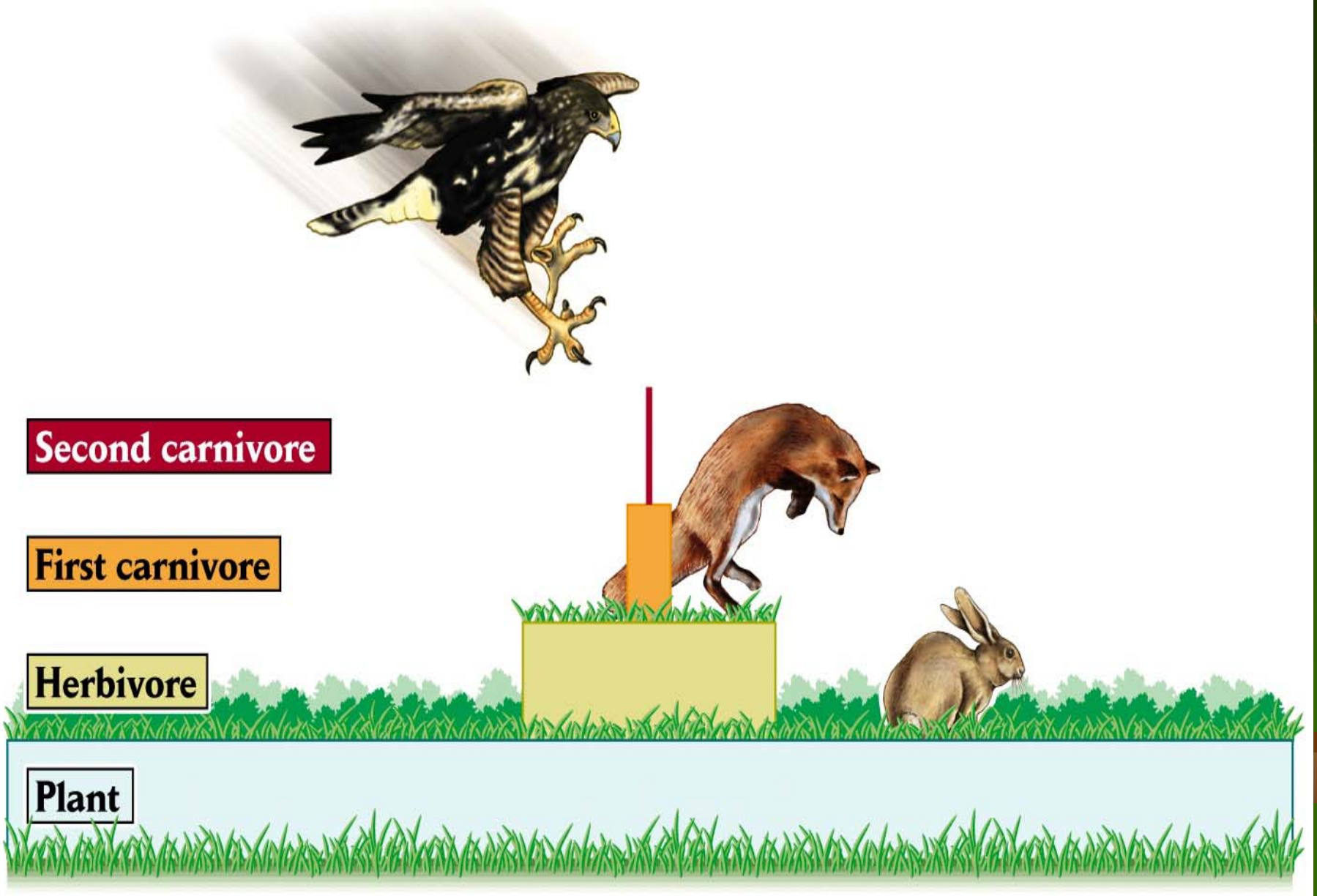
L-5/6a Components of Ecosystem



- **The decomposers are also known as Saprotrophs.**

(Sapro = rotten, trophs = feeder).

Food chains



L-6/1 Food chain, food web & trophic level

Food Chain:-

- The sequence
- Of eating and being eaten up

in an ecosystem is known as

- ‘Food Chain’.
- All those organisms which are interlinked

with each other through food make a food chain.

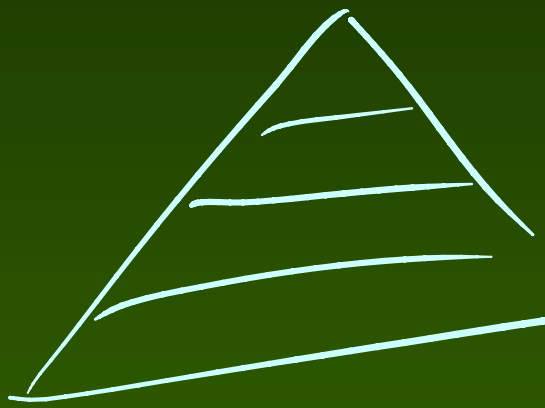
L-6/1a Food chain,....

- **Definition:-**
- **'Food chain is the**

sequence of organization in which energy flows in the form of food from one organism to another organism through a series of separated eating and being eaten up'.

L-6/1a Food chain,….

- **Definition:-**



TROPHIC LEVELS

The different species in a food chain are called trophic levels

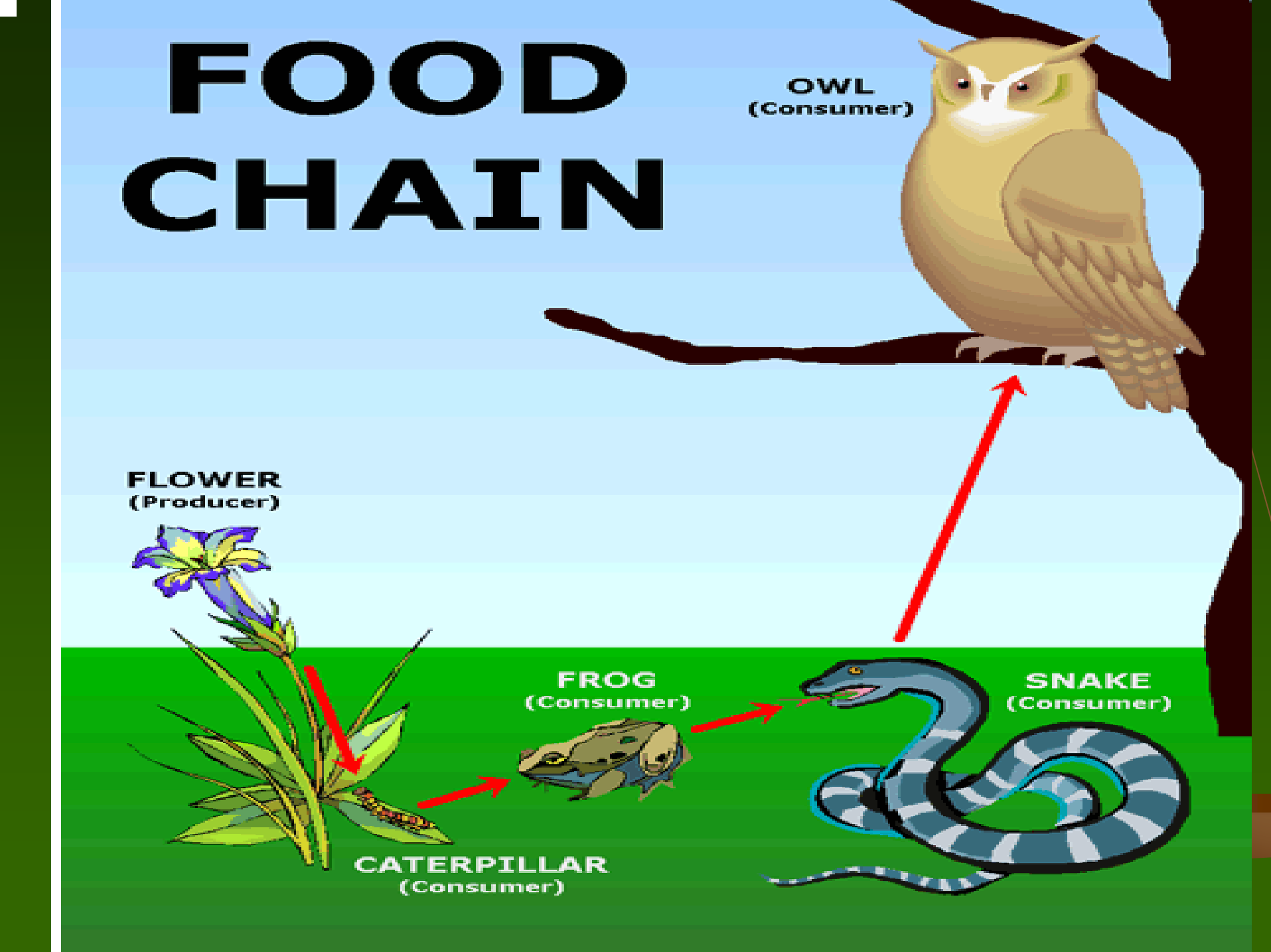
L-6/2 Food chain,…..

Example.

- A caterpillar eats plant leaves,
- a sparrow eats the caterpillar,
- a cat eats the sparrow-

and when they all die,

- they are all consumed by
- micro- organism (decomposers)-


FOOD CHAIN
OWL
(Consumer)
FLOWER
(Producer)
FROG
(Consumer)
SNAKE
(Consumer)
CATERPILLAR
(Consumer)

L-6/2 Food chain,…

Example. ….and when all die- all are consumed by micro-organism (decomposers)-

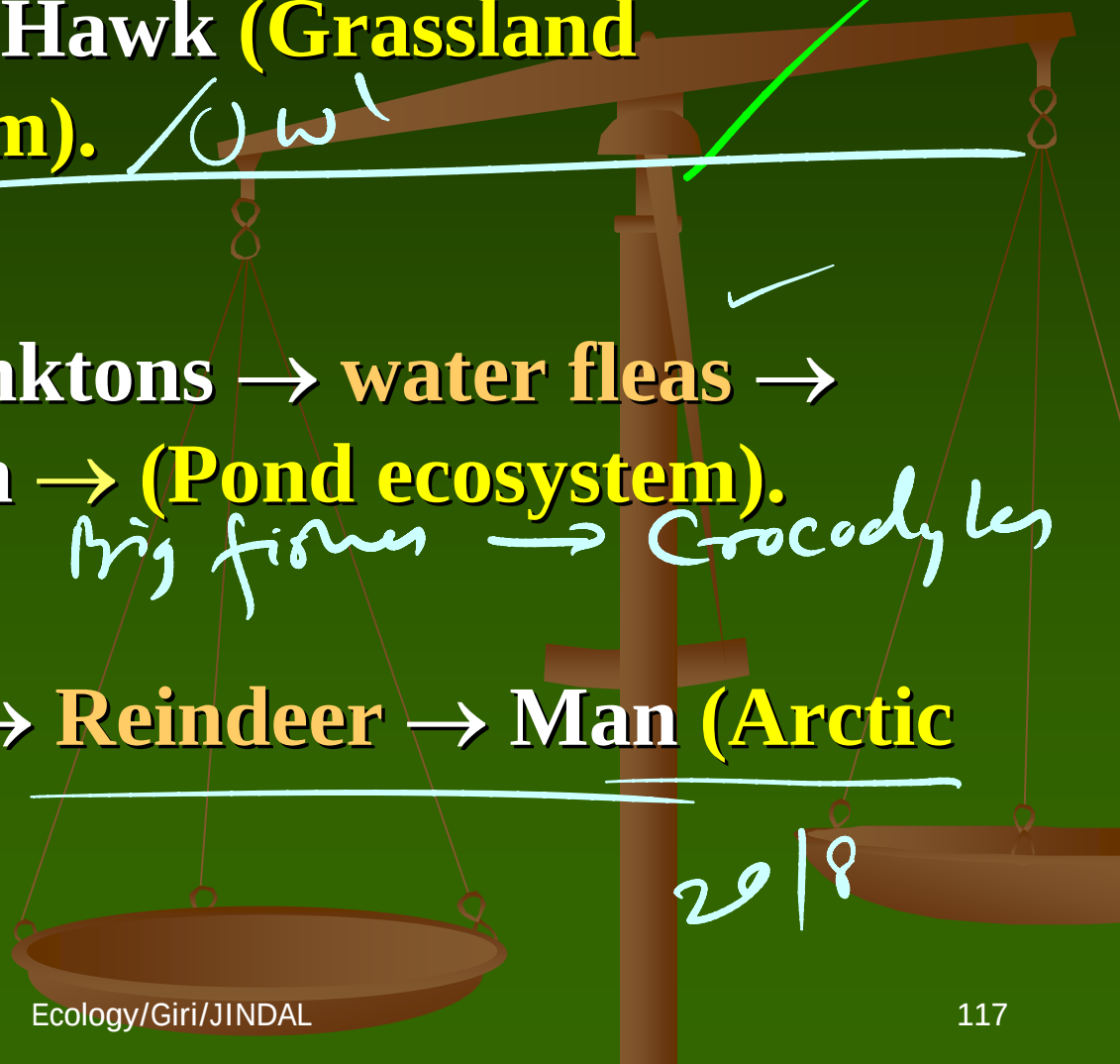
- which break down the organism matter and

convert it into simple inorganic matter that can again be used by the plants.

- Some common examples of simple food chain are-

L-6/2 Food chain,…..

1. Grass → grasshopper → frog → snake → Hawk (Grassland Ecosystem).
2. Phytoplanktons → water fleas → small fish → (Pond ecosystem).
3. Lichens → Reindeer → Man (Arctic tundra).



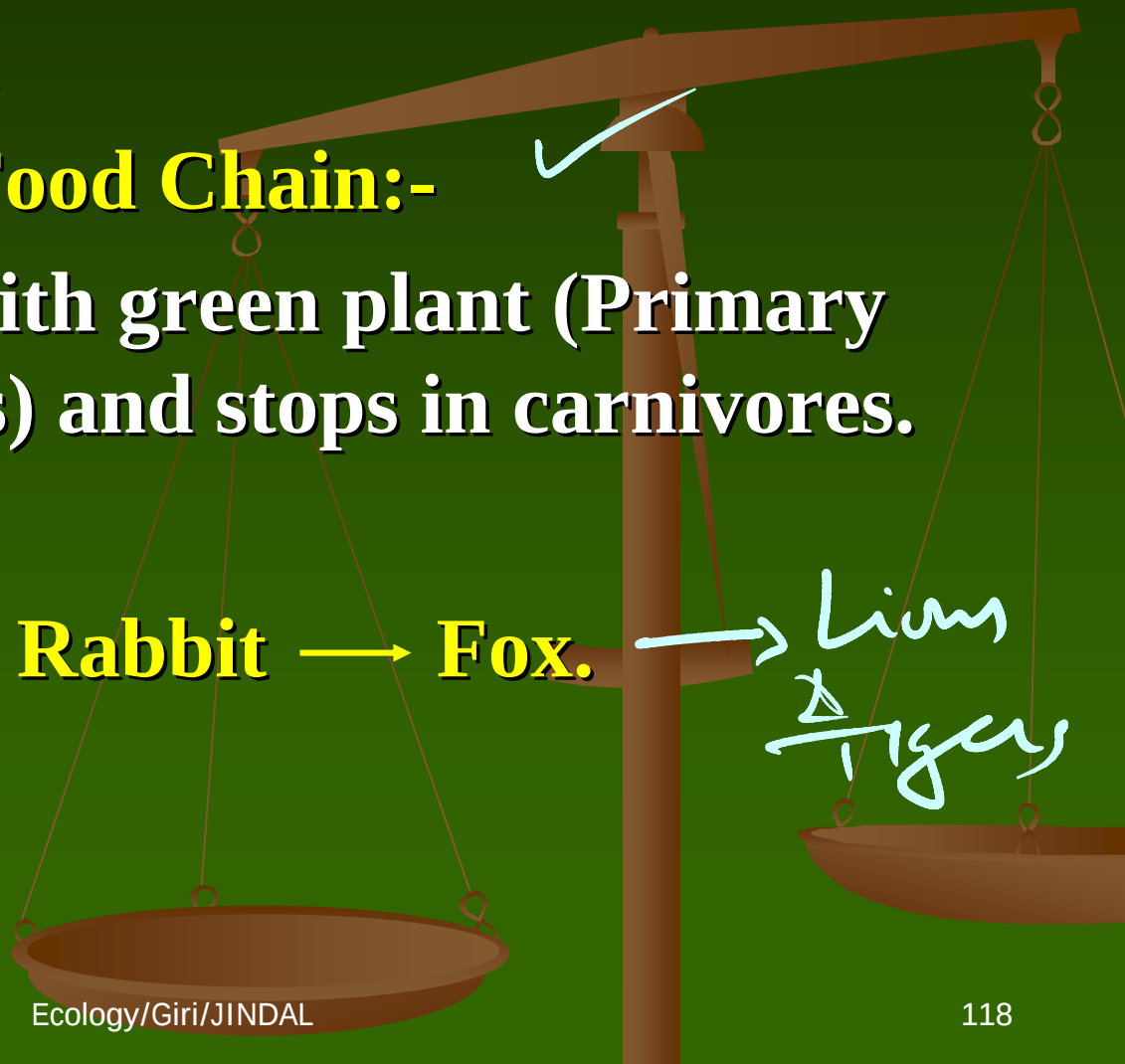
L-6/3 Food Chains…..

- **Types:- There are major two types of food chain**

1. **Grazing Food Chain:-**

   It starts with green plant (Primary Producers) and stops in carnivores.

- **Grass ⟶ Rabbit ⟶ Fox.**

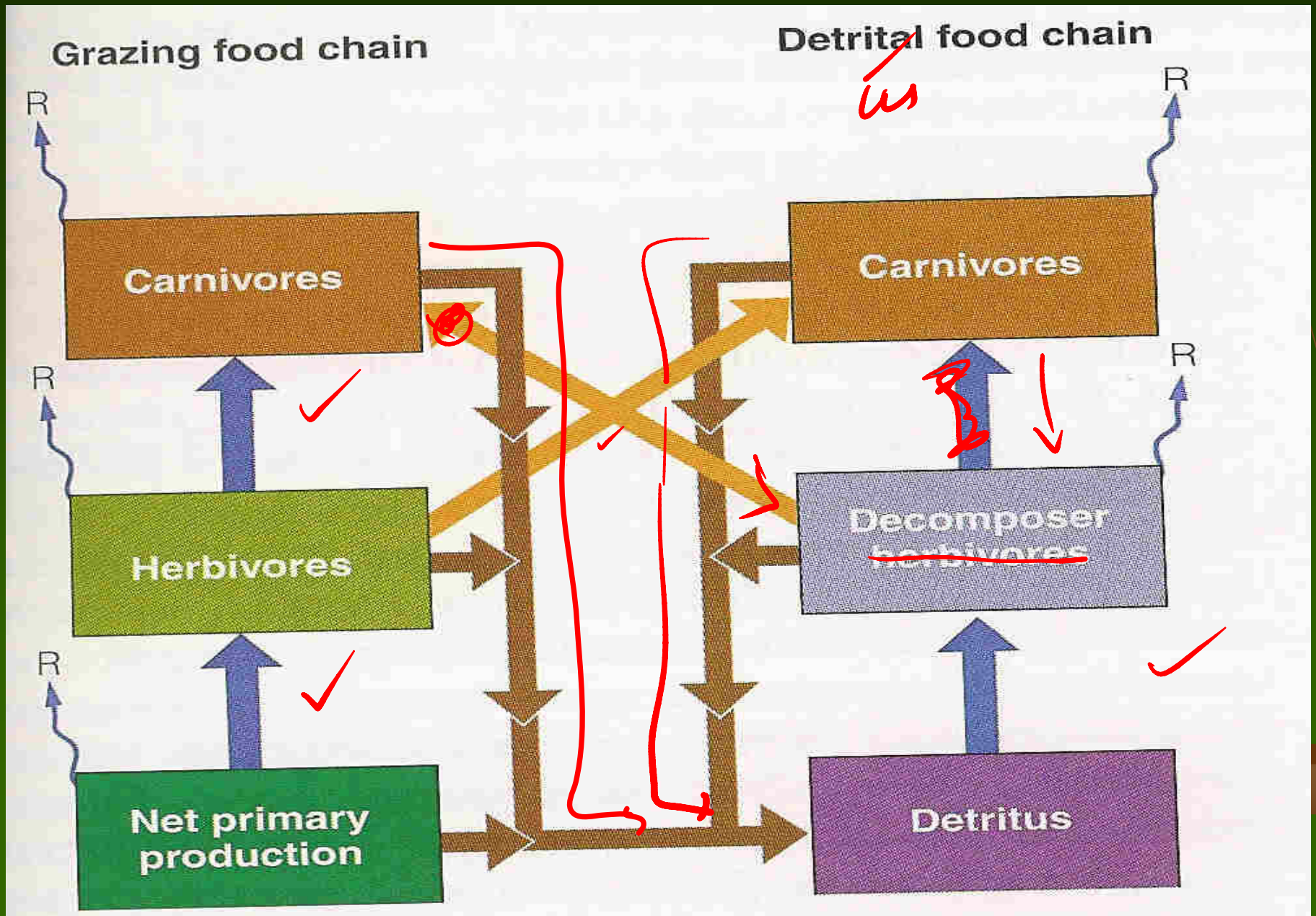


L-6/3 Food Chains….

- **Types:-**
  1. **Grazing Food Chain:-.**
  2. **Detritus Food Chain:-**

- **Detritus – Dead organic matter.**
- **Detrivore – Organism that consume organic matter, debris and dung.**

Detritus food chains



A Grazing food chain in a pond ecosystem

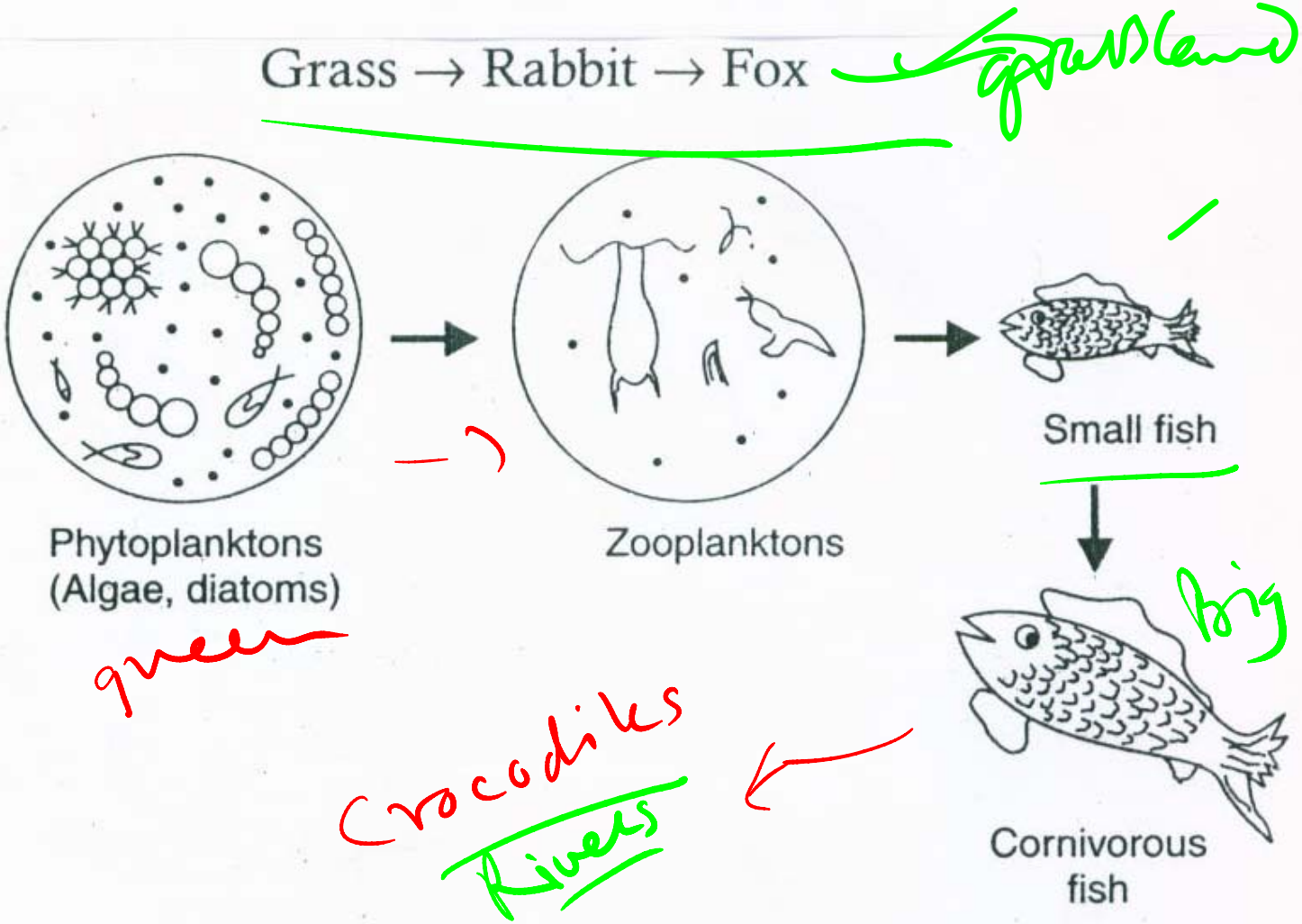


Fig. 3.2. A grazing food chain in a pond ecosystem.

L-6/4 Food chain,…

2. Detritus Food Chain:- It starts with dead organic matter which the detrivores and decomposers consume-

- **partially decomposed dead organic matter and**

even the decomposers are consumed

By

- **detrivores and their predators.**

L-6/4 Food chain,.....

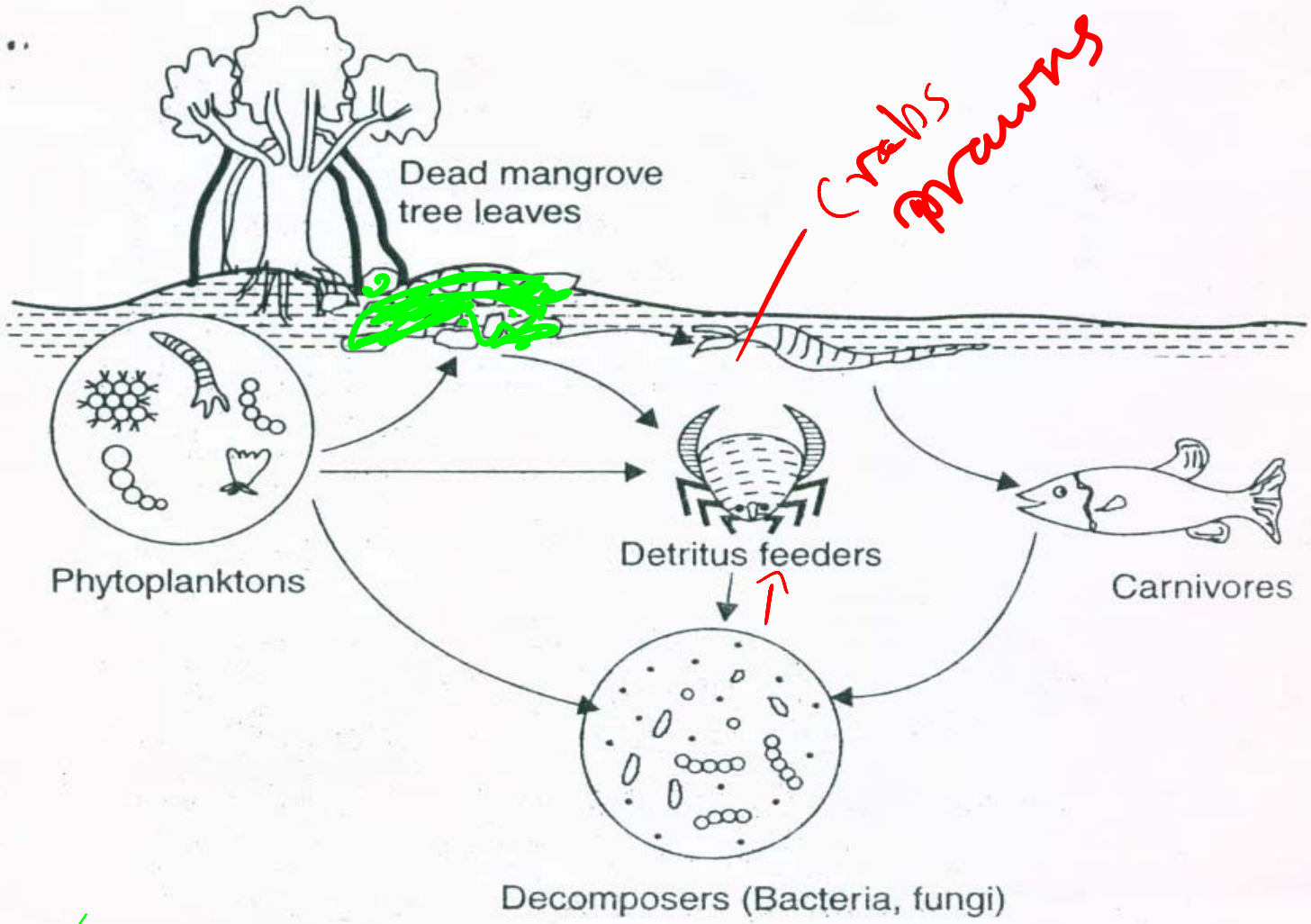


Fig. 3.3. A detritus food chain in an estuary based on dead leaves of mangrove trees.

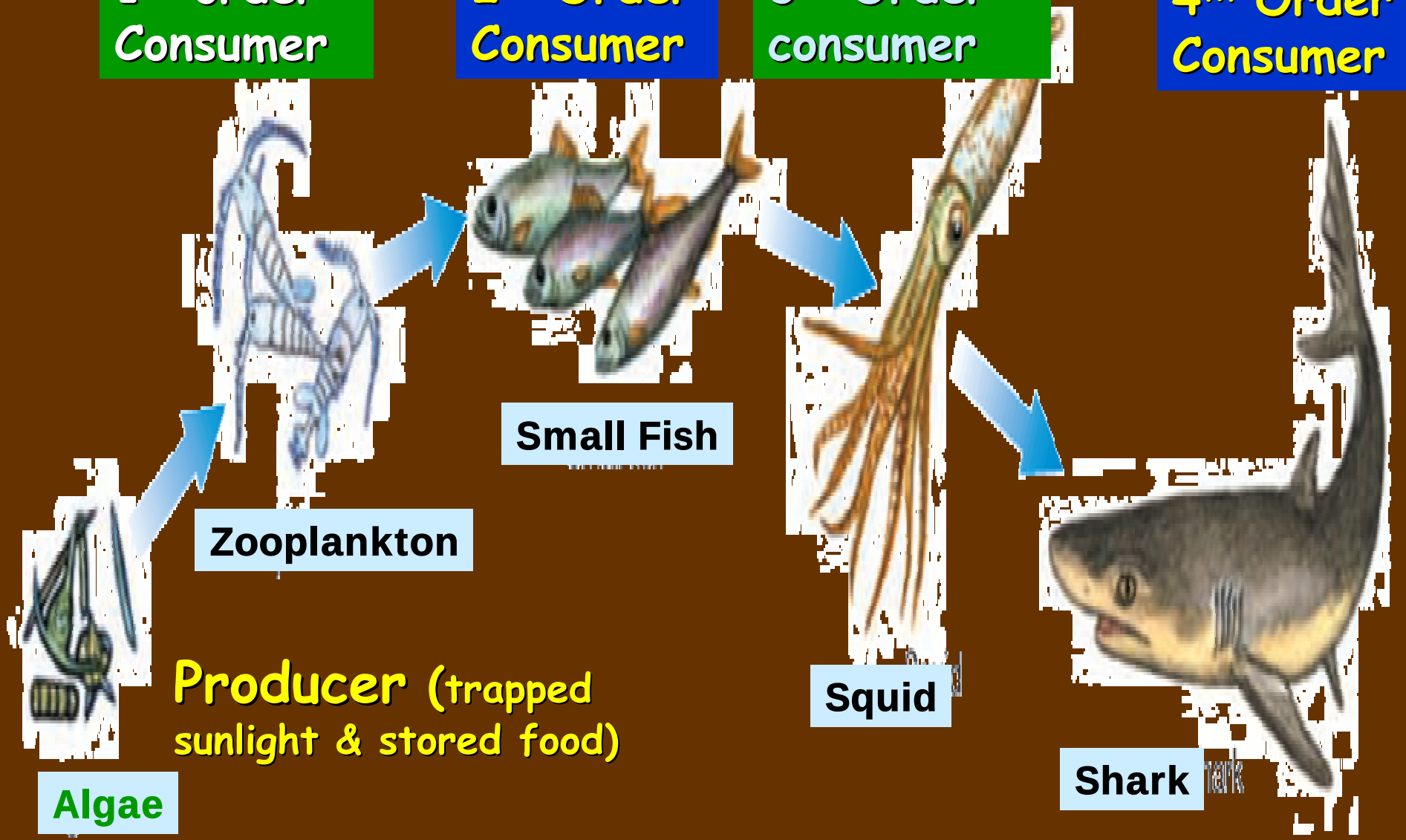
Food Chain

1st order Consumer

2nd Order Consumer

3rd Order consumer

4th Order Consumer



Zooplankton

Small Fish

Squid

Shark

Producer (trapped sunlight & stored food)

Algae

L-6/5 Food chain,….

Here fallen leaves are eaten by small algae

which are also eaten by

saprophytes or detrivores

consisting of

crabs, nematodes and very small fishes.

The detrivores are eaten up by

small carnivore fishes

which are again eaten up

by large fishes.

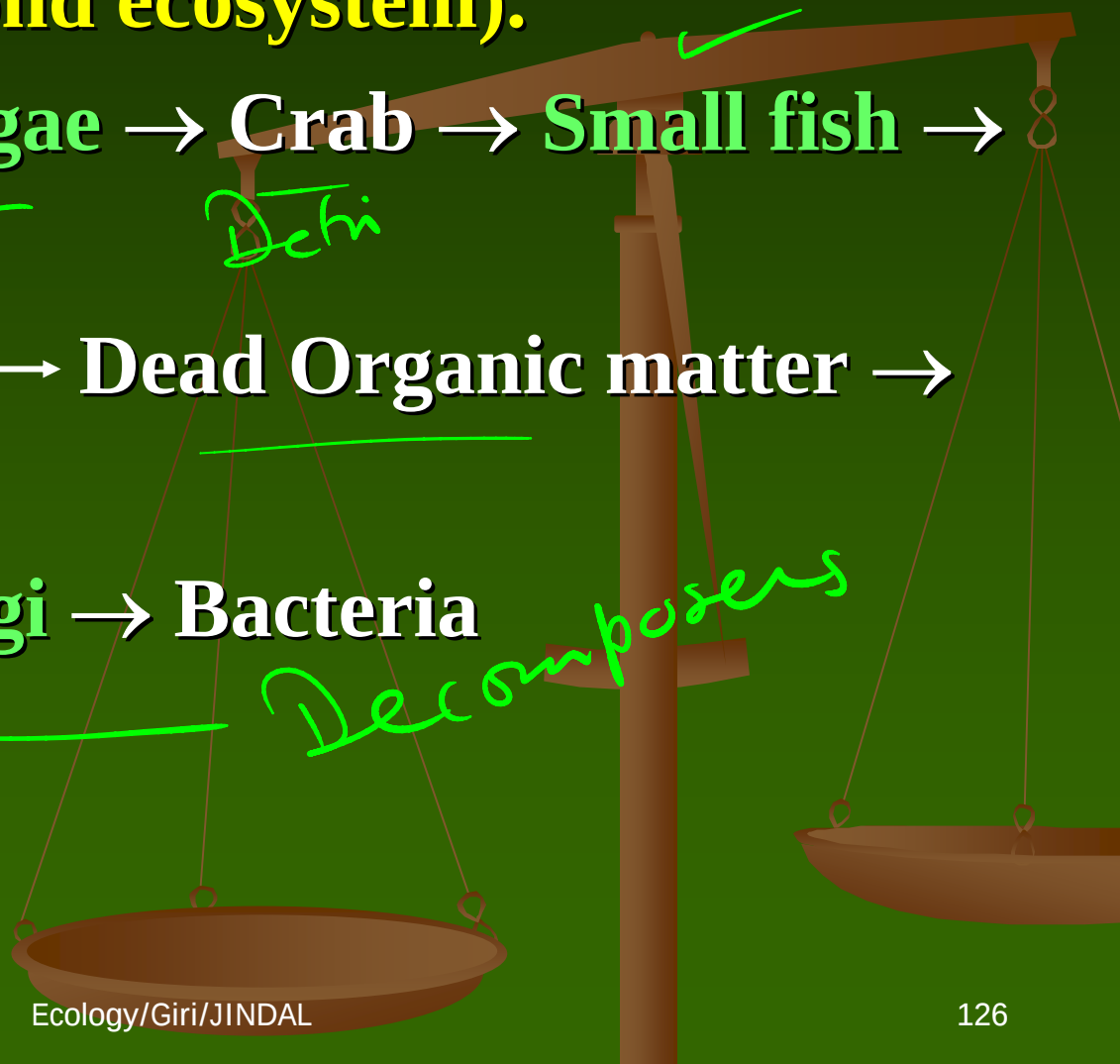
L-6/5 Food chain,….

(Pond ecosystem).

- **Leaf → Algae → Crab → Small fish →**

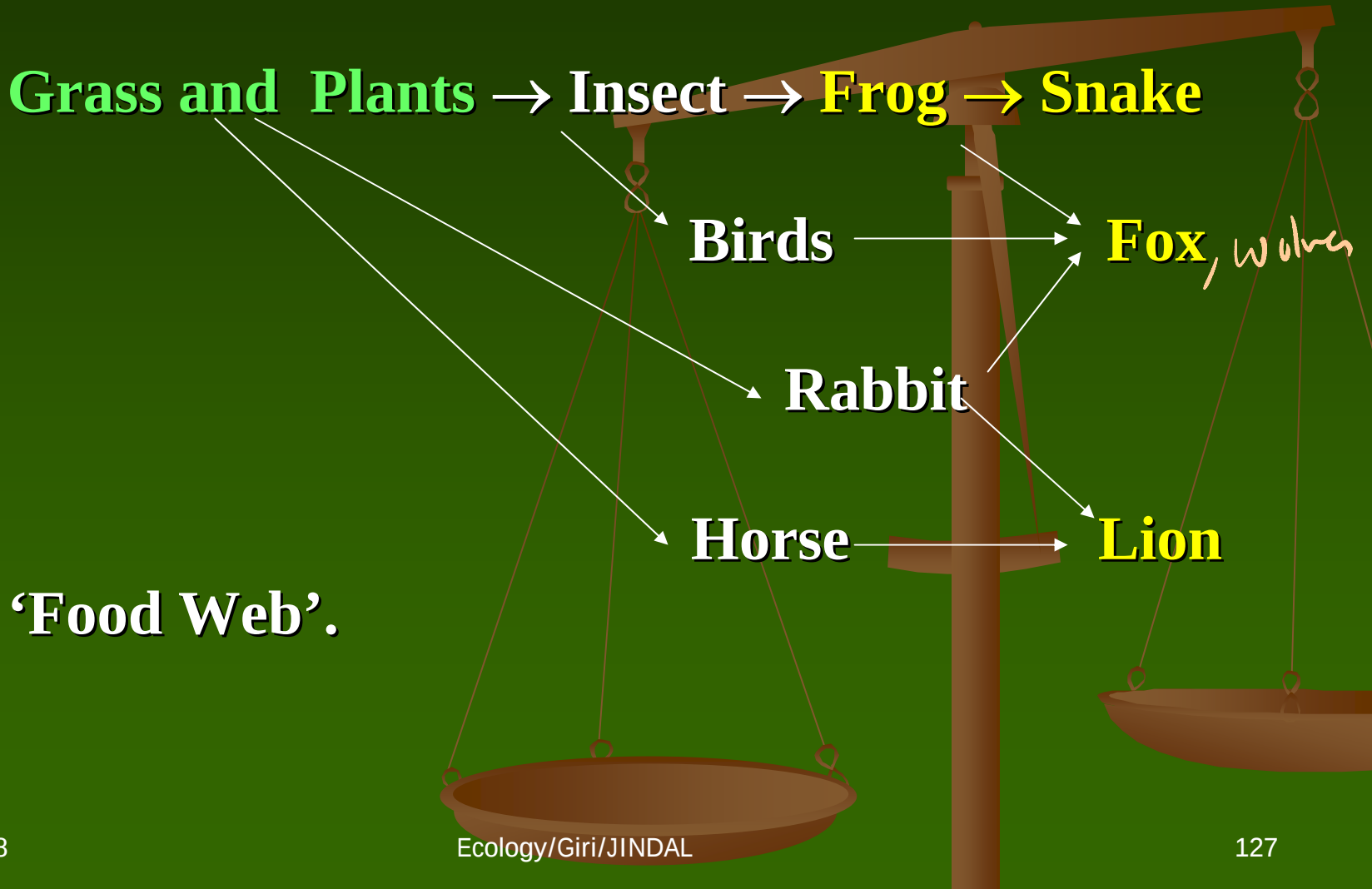
Large fish → Dead Organic matter →

Fungi → Bacteria

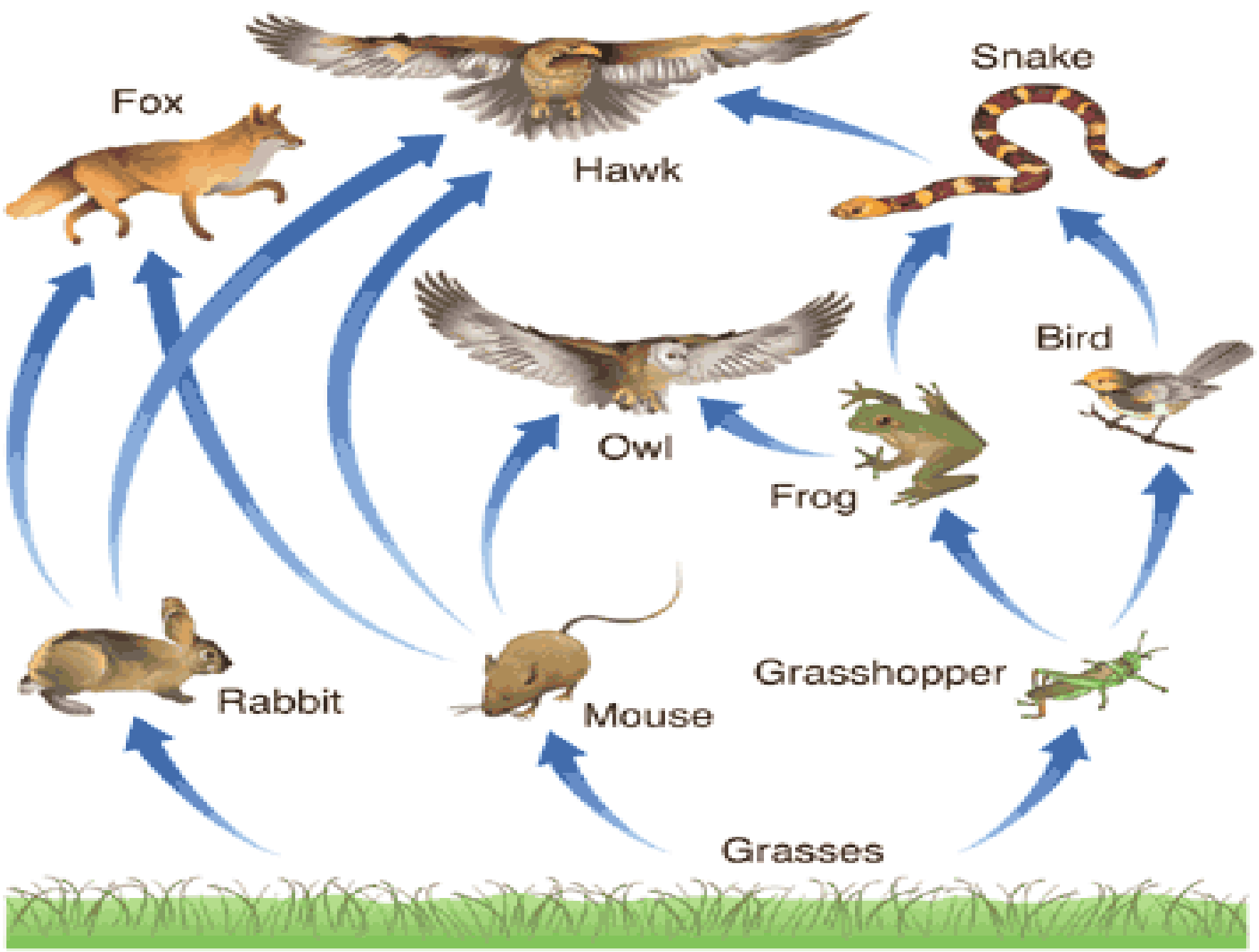


L-6/7 ….Food Web…

Simple food chains rarely occur in nature



'Food Web'.

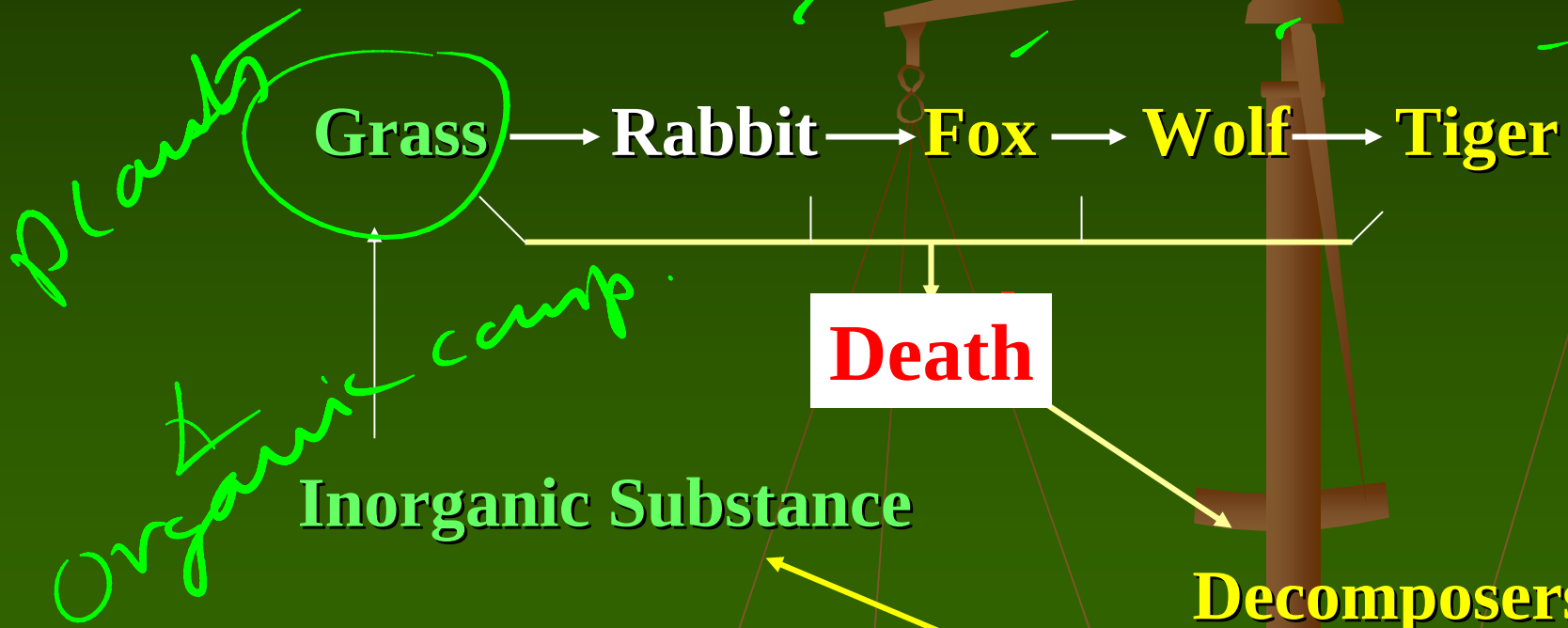

Fox
Hawk
Snake
Owl
Bird
Frog
Rabbit
Mouse
Grasshopper
Grasses

Food Web

L-6/7a …. Food Web..

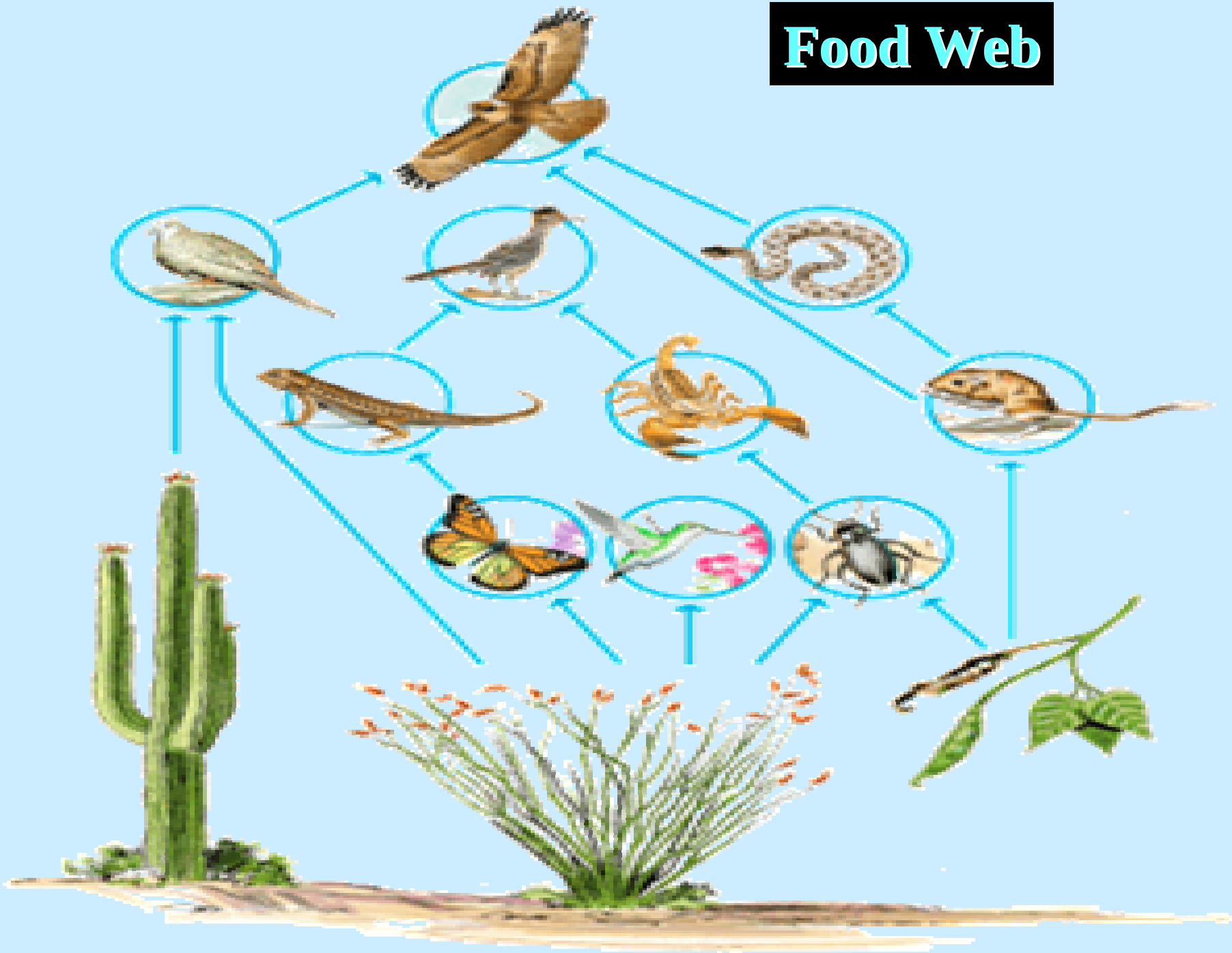
‘Food Web’.

The basic nutritional links in an ecosystem are shown-



‘Links in Ecosystem’

Food Web



L-6/8a ….Trophic Levels.

- The **same organism** may operate at **more than one trophic level.**
- It may be eaten up by several organisms of **a higher trophic level** or
  - several organisms may feed upon it.
- **So the various food chains** are **linked** and interact each other forming ‘food web’.

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L-6/8a … Trophic Levels.

Trophic Levels or Ecological Pyramids:-

Trophic structure and functions of a community when

- studied graphically make
- ecological pyramids
- or trophic levels.

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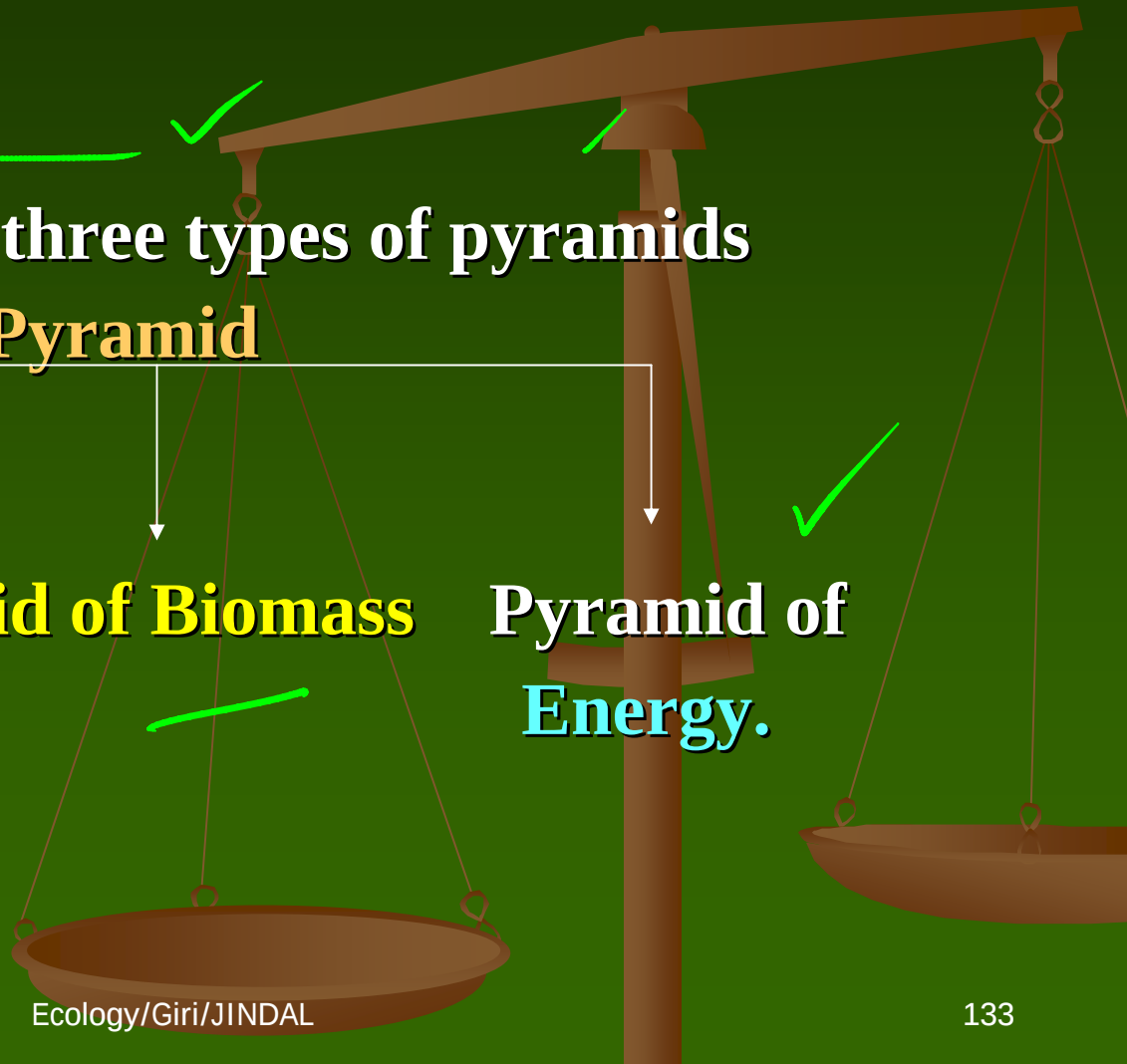
L-6/8 … Trophic Levels

Trophic Levels or Ecological Pyramids:-

Types – There are three types of pyramids

Pyramid

- **Pyramid of Numbers**
- **Pyramid of Biomass**
- **Pyramid of Energy.**



L-6/9 … Trophic Levels.

1. Pyramid of Numbers:-

- It represents the number of individual organisms at each trophic level.
- The smaller animals are eaten up by larger animals and
- smaller animals increase faster in number.

➢ 28/08/06

L-6/9 … Trophic Levels.

1. Pyramid of Numbers:-

……

- If The relative decrease in number at each stage of Food chain
- when put in a graph with size makes
- a triangular figure that is known as pyramid of number.

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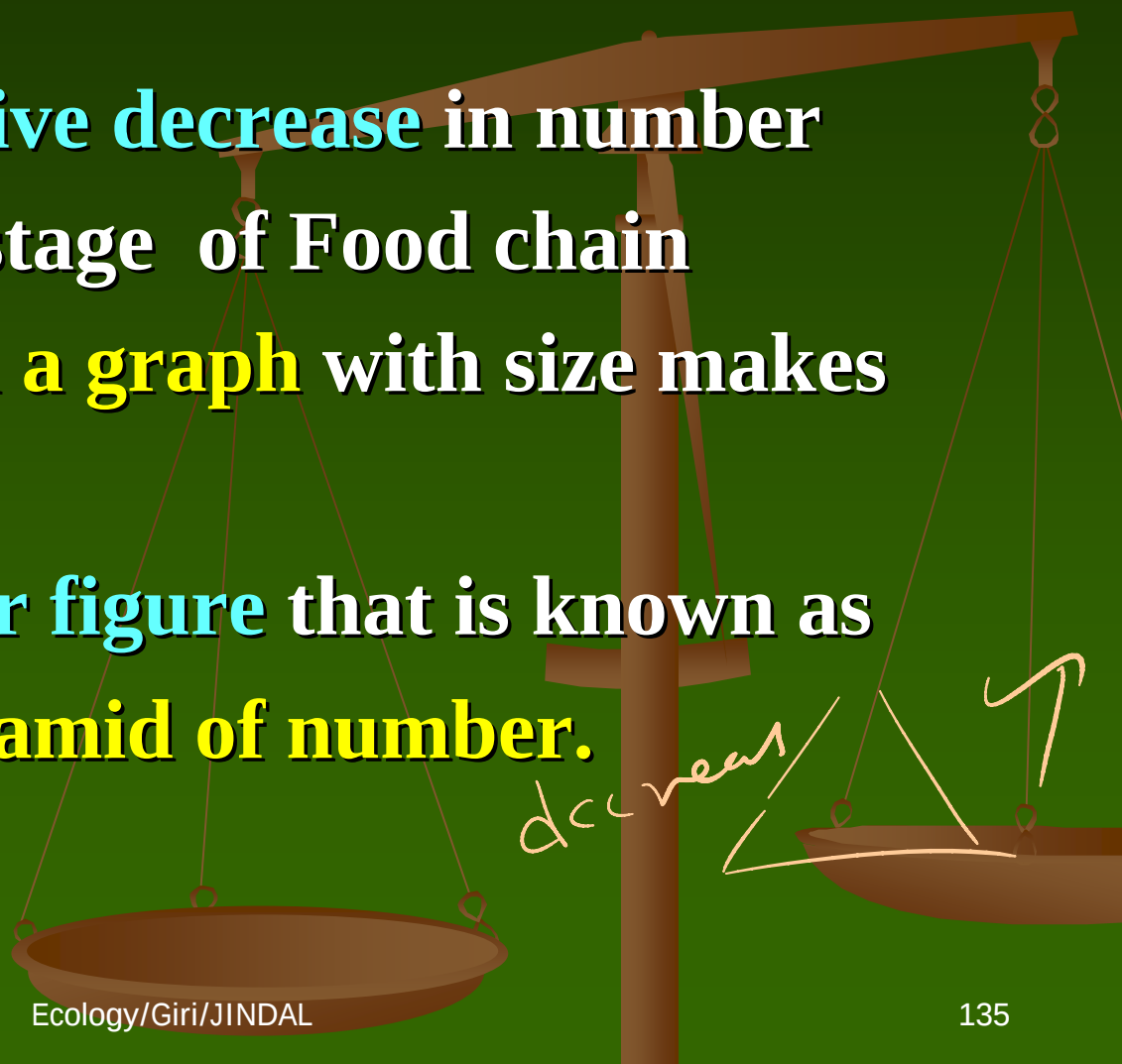


L-6/9a …. Trophic Levels.

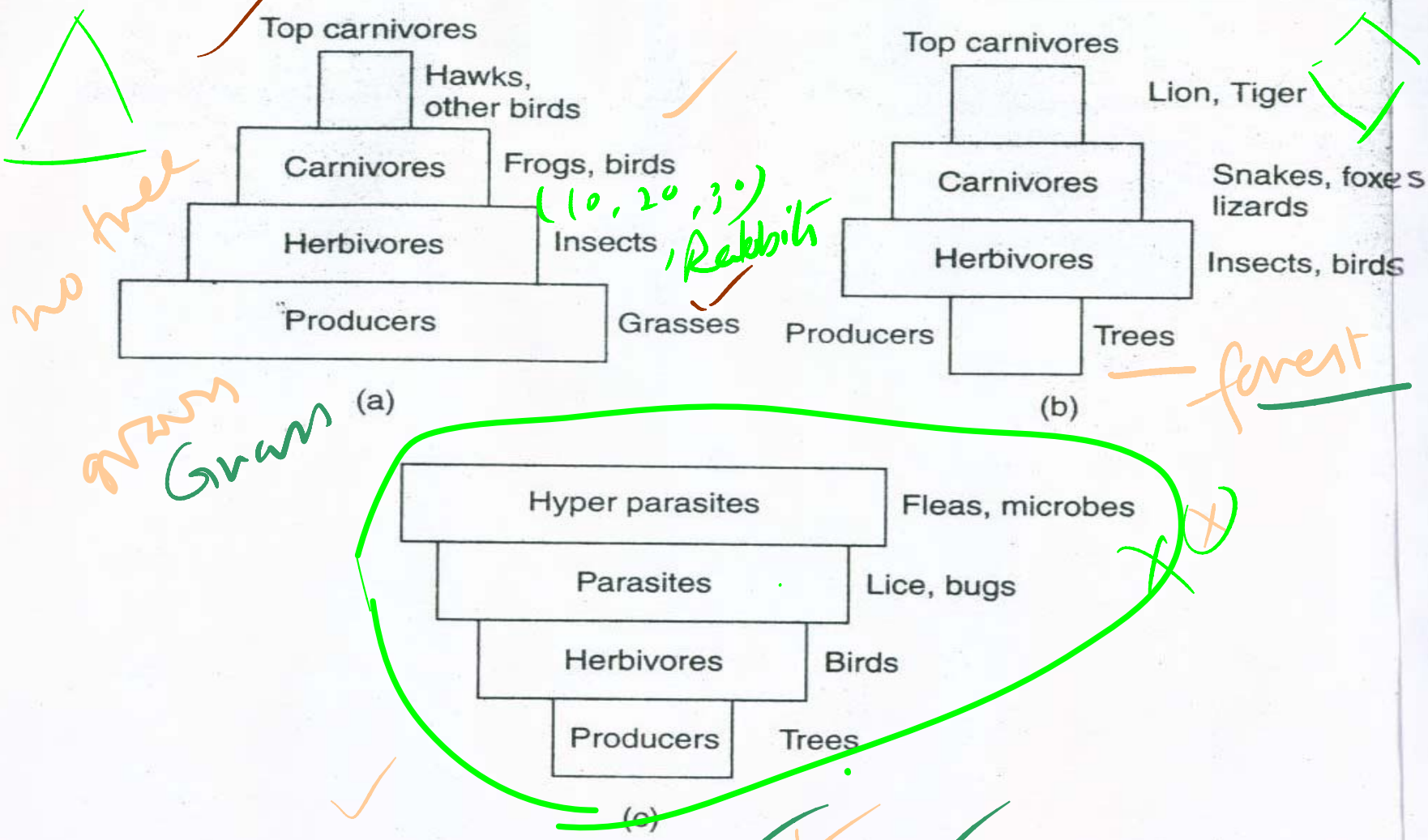


Fig. . Pyramid of numbers (*a*) grassland (*b*) forest (*c*) Parasitic food chain

Pyramid of Numbers

L-6/9b ….Trophic levels.

2. Pyramid of Biomass:-

- This can also be upright or inverted.

- The pond ecosystem shows inverted pyramid of biomass.

- It is based upon the total biomass
  - at each trophic level.

L-6/9b ….Trophic levels.

2. Pyramid of Biomass:-

- The total biomass of producers (phytoplanktons) is less as compared to herbivores (Zooplanktons, insects) carnivores (small fish) and tertiary carnivores (big fish).
- Thus the pyramid takes an inverted shape with narrow base and broad apex.

L-6/9c Food chain, web & trophic levels……

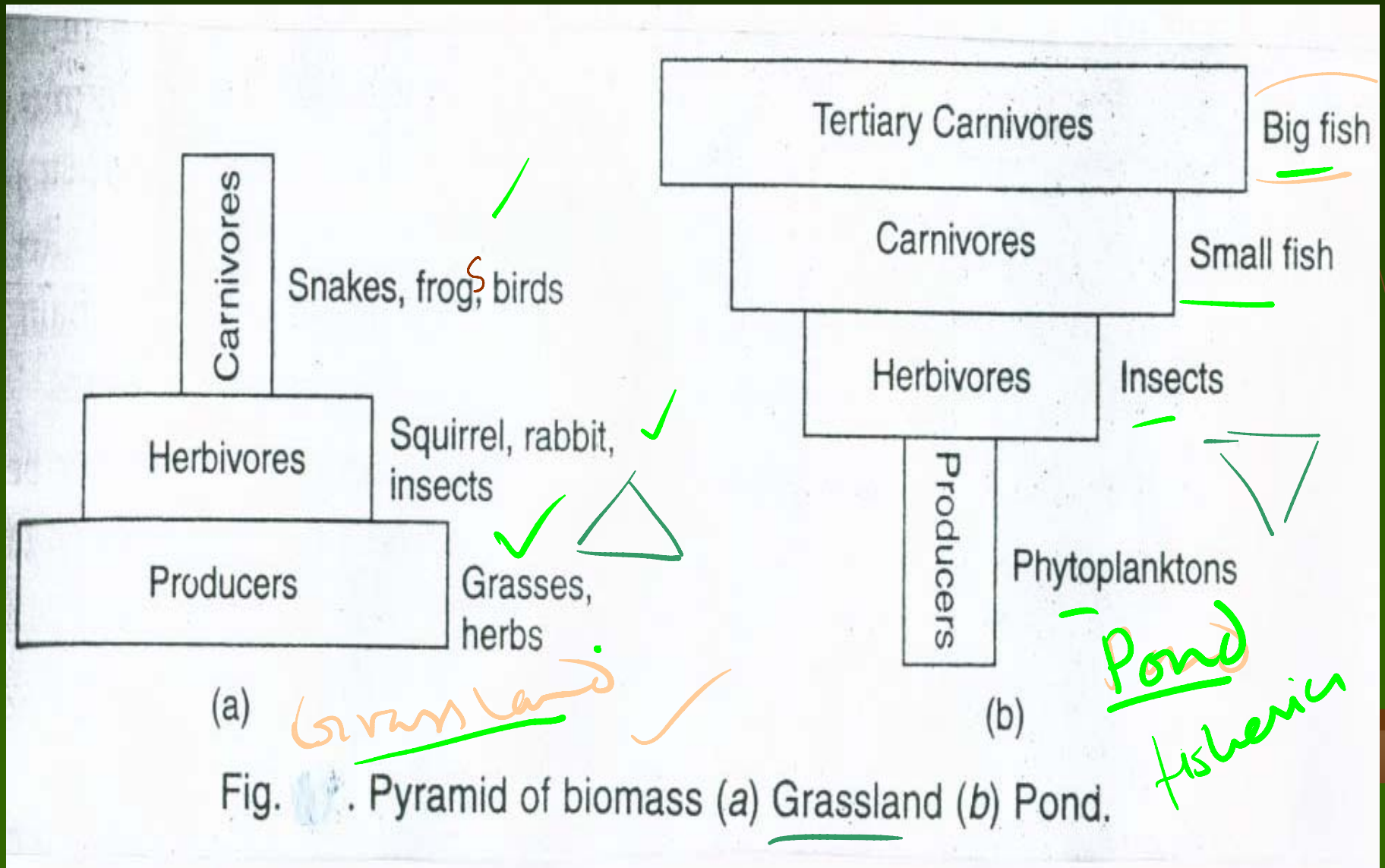
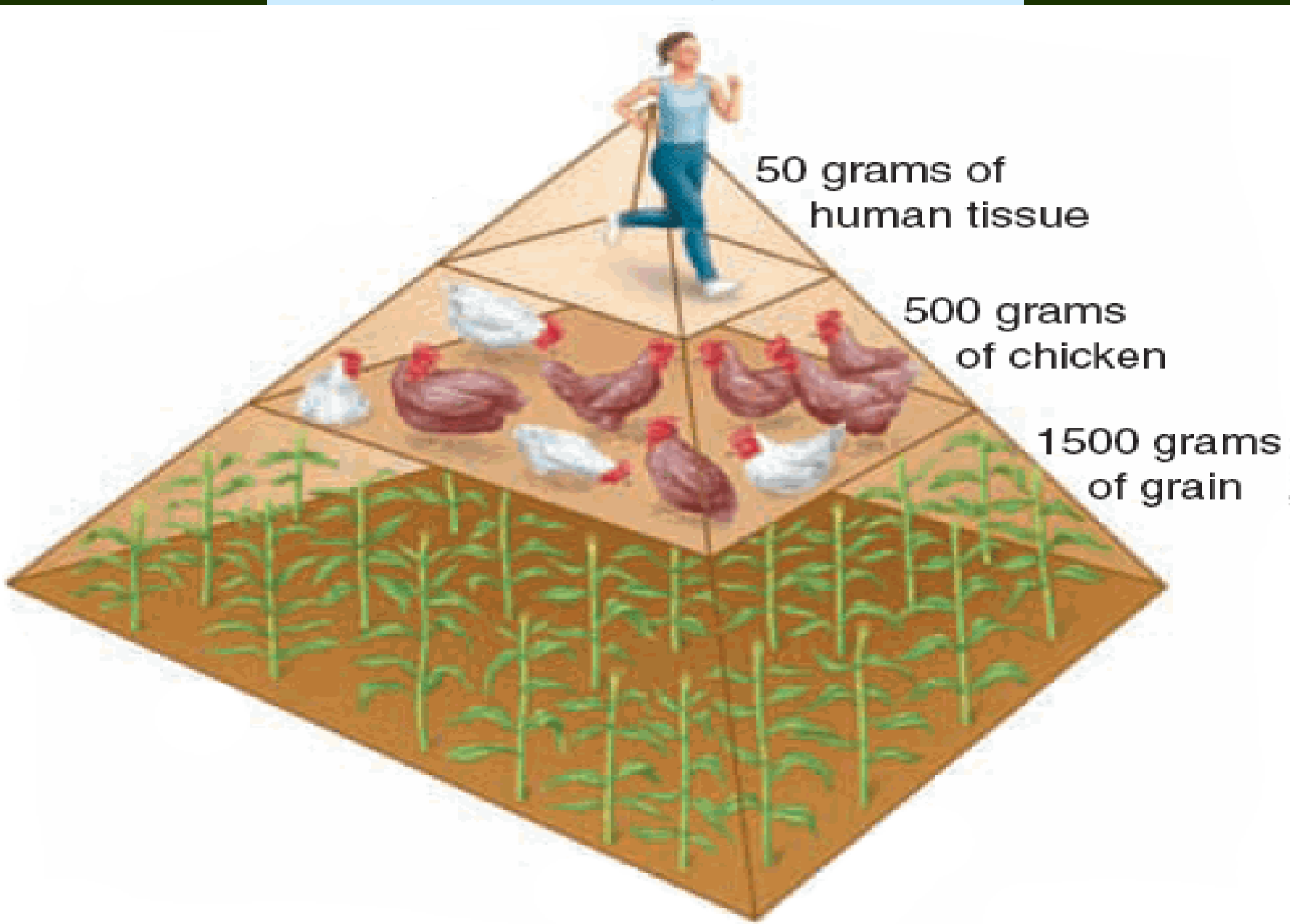


Fig. . Pyramid of biomass (*a*) Grassland (*b*) Pond.

Biomass Pyramid



L-6/10a … trophic levels.

Pyramid of Energy:-

- The amount of energy at each trophic level is considered for this type of pyramid.
- This shows the best representation of the trophic relationships.
- It is always 'Upright'.

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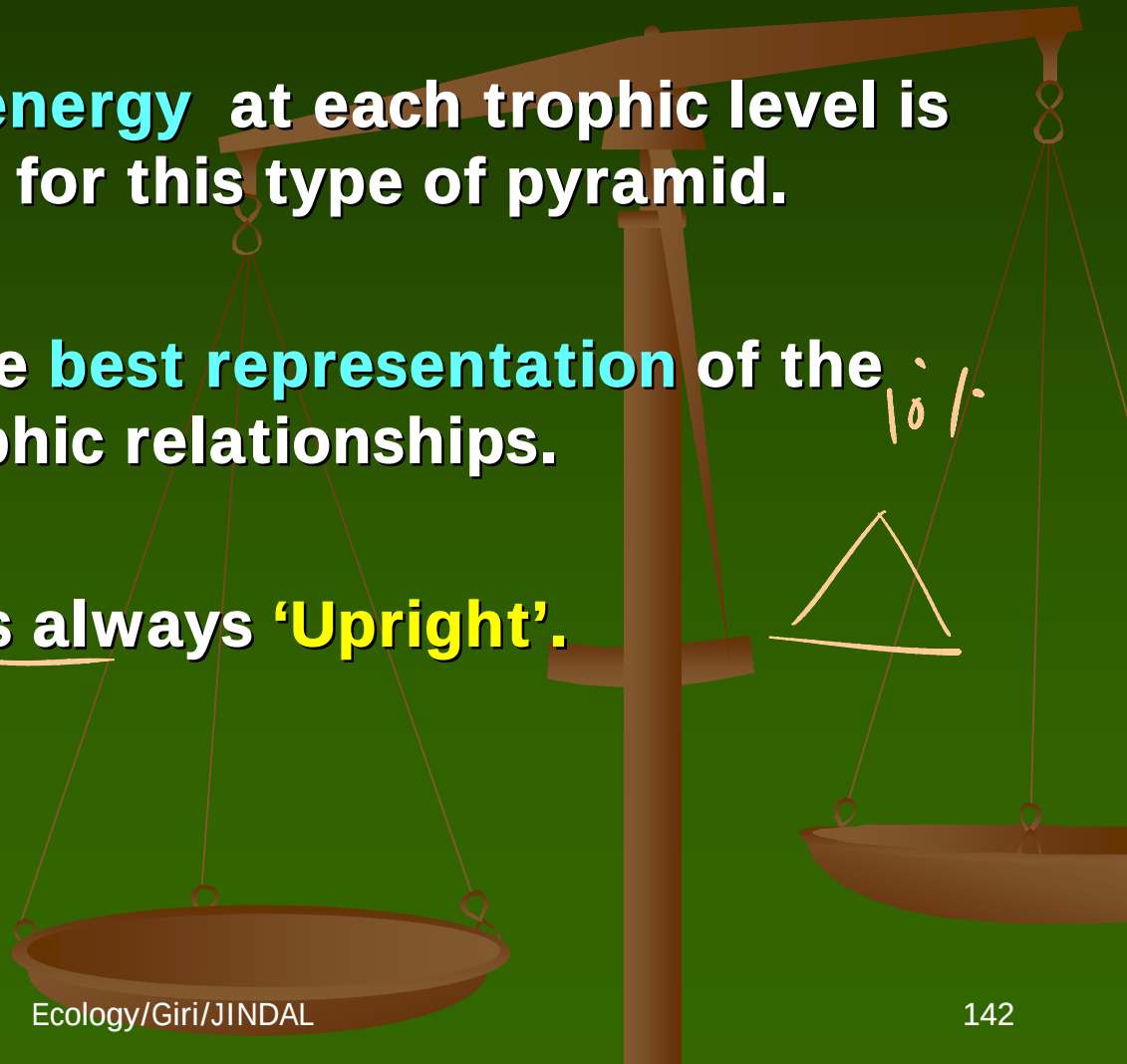


L-6/10b …..& Trophic Levels

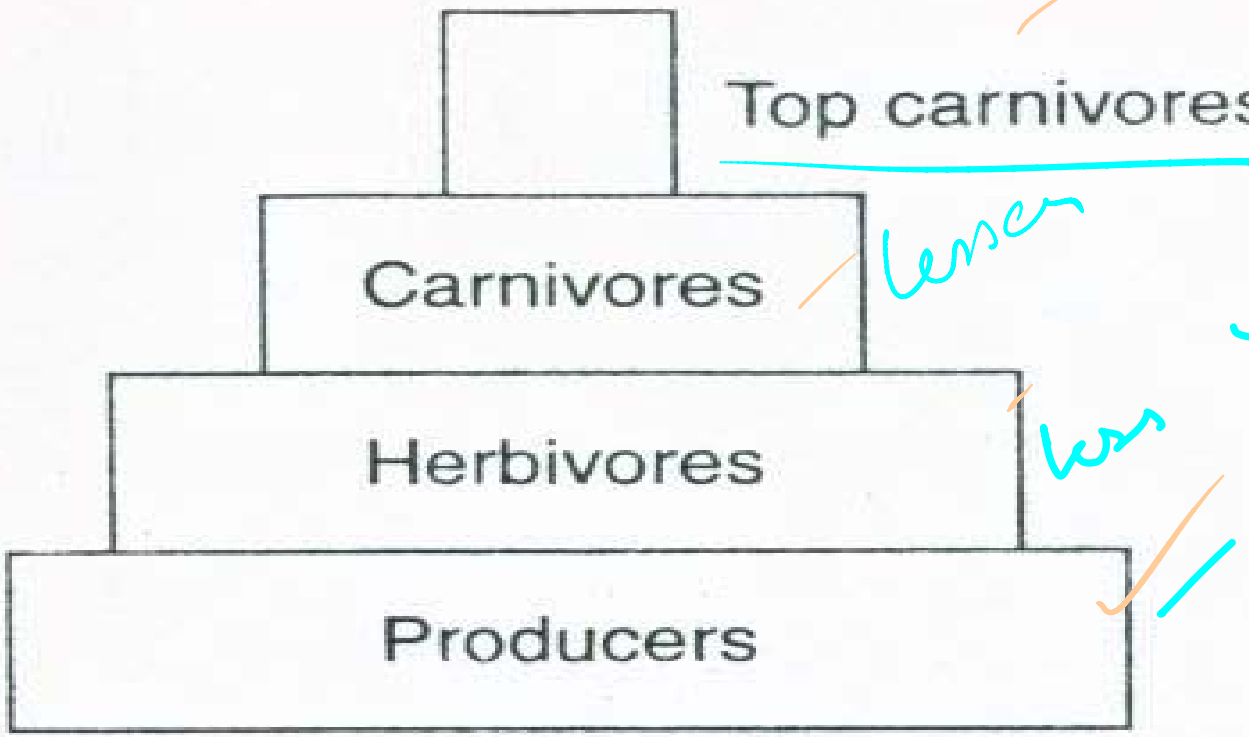
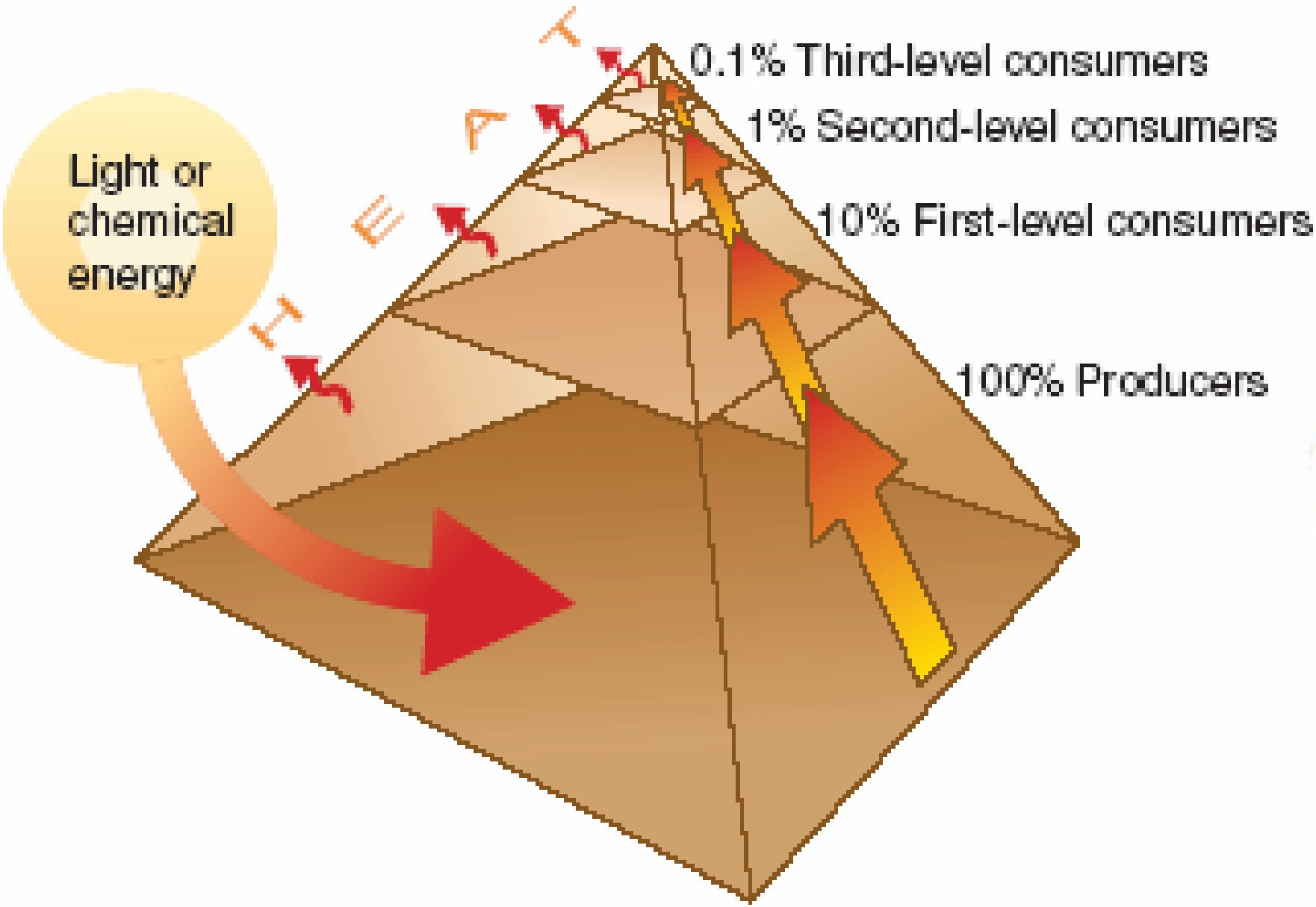


Fig. . Pyramid of energy.

Energy Pyramid



L-6/10 …& Trophic Levels.

Trophic Level:-

- This is the feeding status of an organism in an ecosystem.

- All organism which obtain food from plants
- in same number of steps are
- said to be in the same trophic level.

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L-6/10a … trophic levels.

Pyramid of Energy:-

it is always 'Upright'.

- **At every successive trophic level, there is a large loss of energy in the form of heat, respiration.**
- **Therefore the pyramid of energy is always upright.**

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L-6/10 ….& Trophic Levels.

Trophic Level:-

- ……
- Thus green plants belong to the first trophic level which is the producer level.

- Green Plants →Producer Level : First Trophic Level.

L-6/10 ….& Trophic Levels.

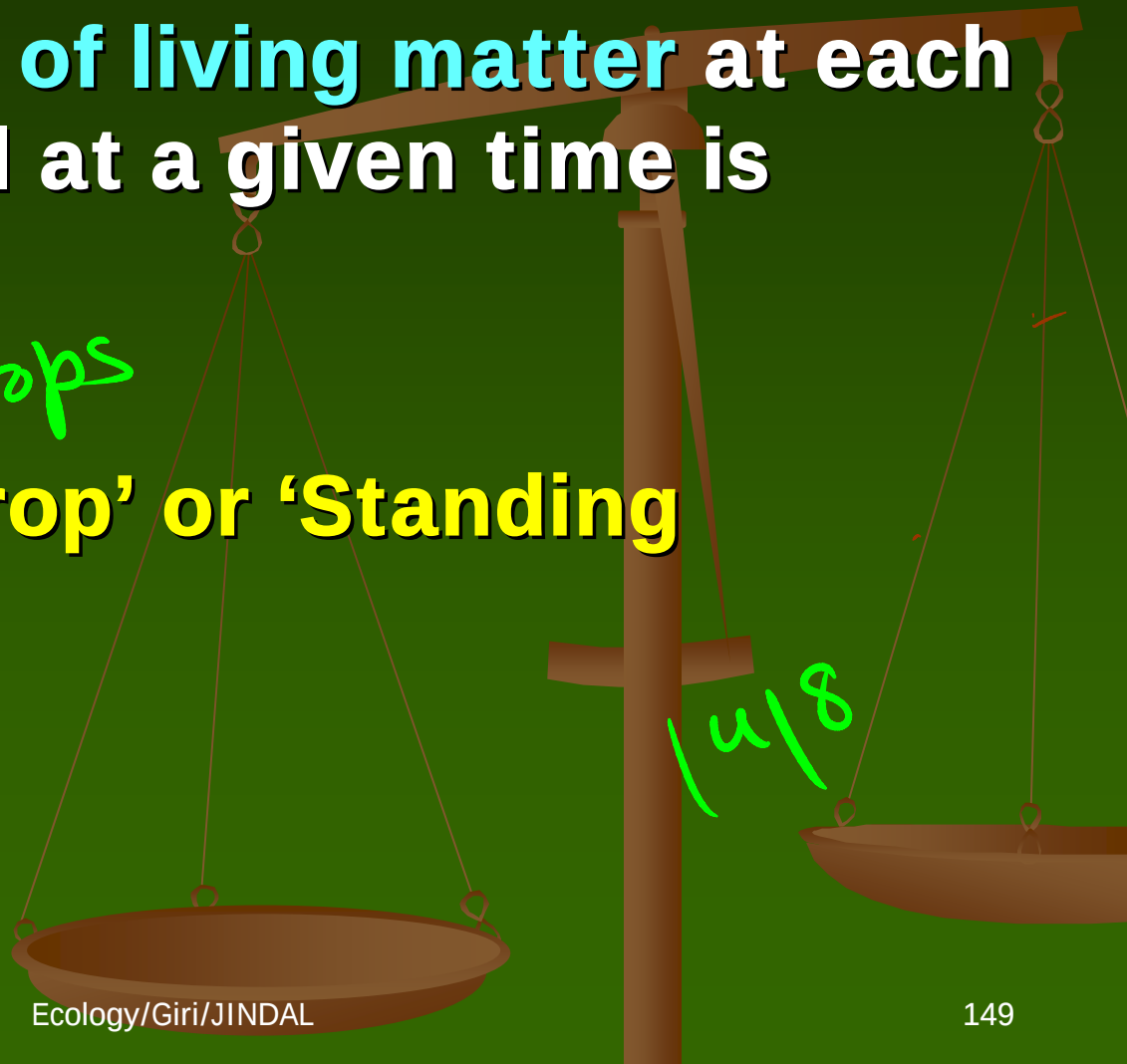
- **Herbivores → Primary Consumer : Second Trophic Level.**
- **Carnivores → Secondary Consumer: Third Trophic Level.**
- **Sec. Carnivores → Tertiary Consumer : Fourth Trophic Level.**

L-6/10 ….& Trophic Levels.

- The amount of living matter at each trophic level at a given time is known as

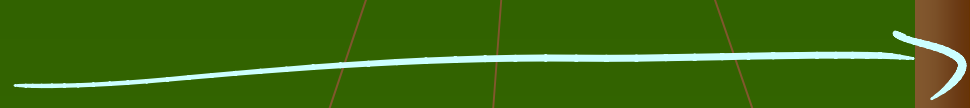
Crops

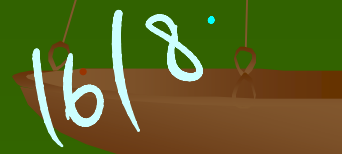
- 'Standing Crop' or 'Standing Biomass'



L-7/1 Energy flow in Ecosystem

- **Energy Flow in Ecosystem:-**
- **Flow of energy in an ecosystem takes place through the food chain and**
- **keeps the ecosystem going.**
- **The most important feature is 'Unidirectional' or 'One Way Flow'.**





L-7/1 Energy flow in Ecosystem

- This is 'Unidirectional' or 'One Way Flow'.

Governed by laws of thermodynamics-

- 1st Law of Thermodynamics:-

"Energy is neither created nor destroyed but may be transferred from one form to another"

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L-7/1 Energy flow in Ecosystem

2nd Law of Thermodynamics:-

- "During energy transfer there is degradation of energy".

- The energy from the Sun enters the living world through Photosynthesis.

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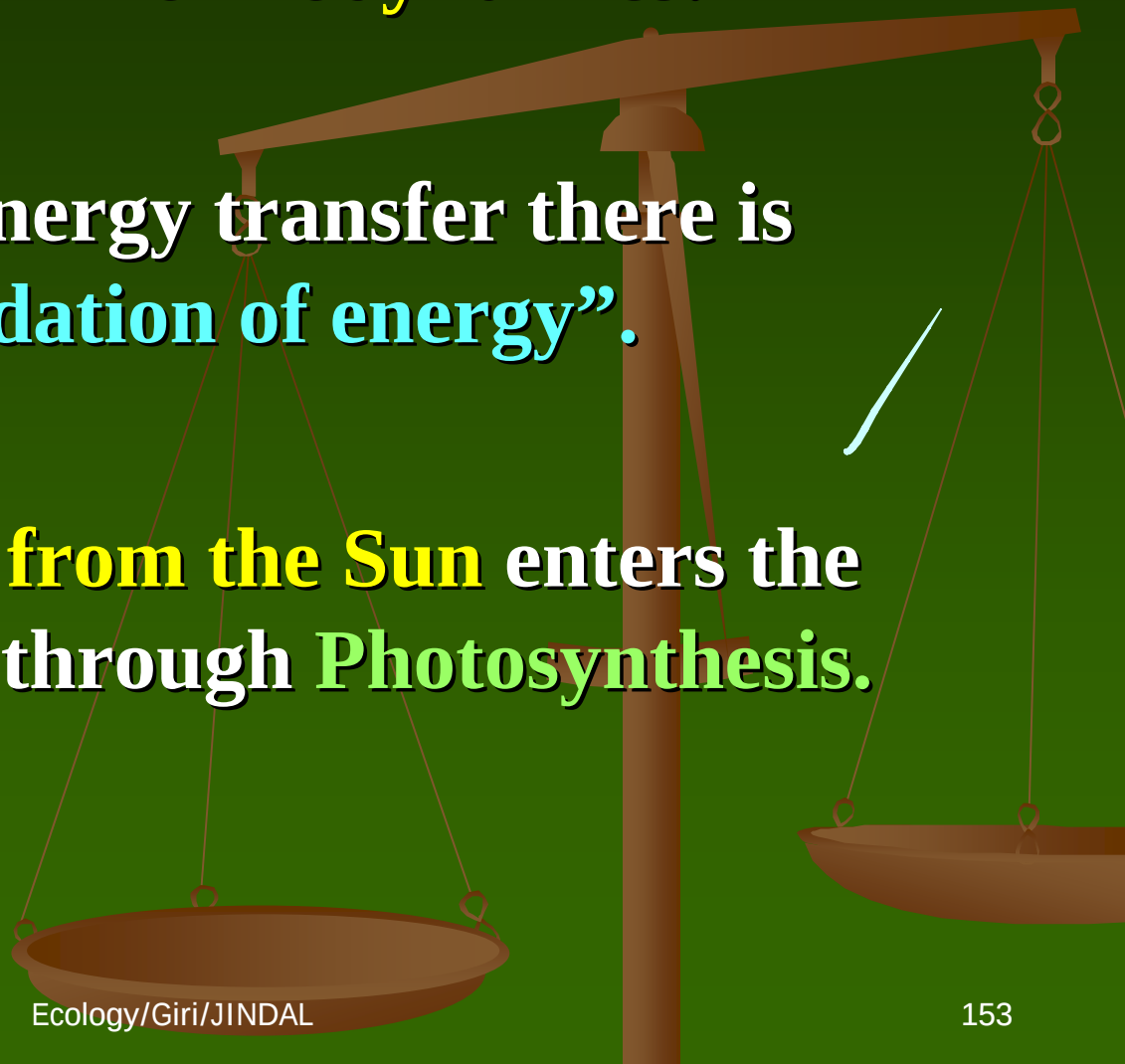
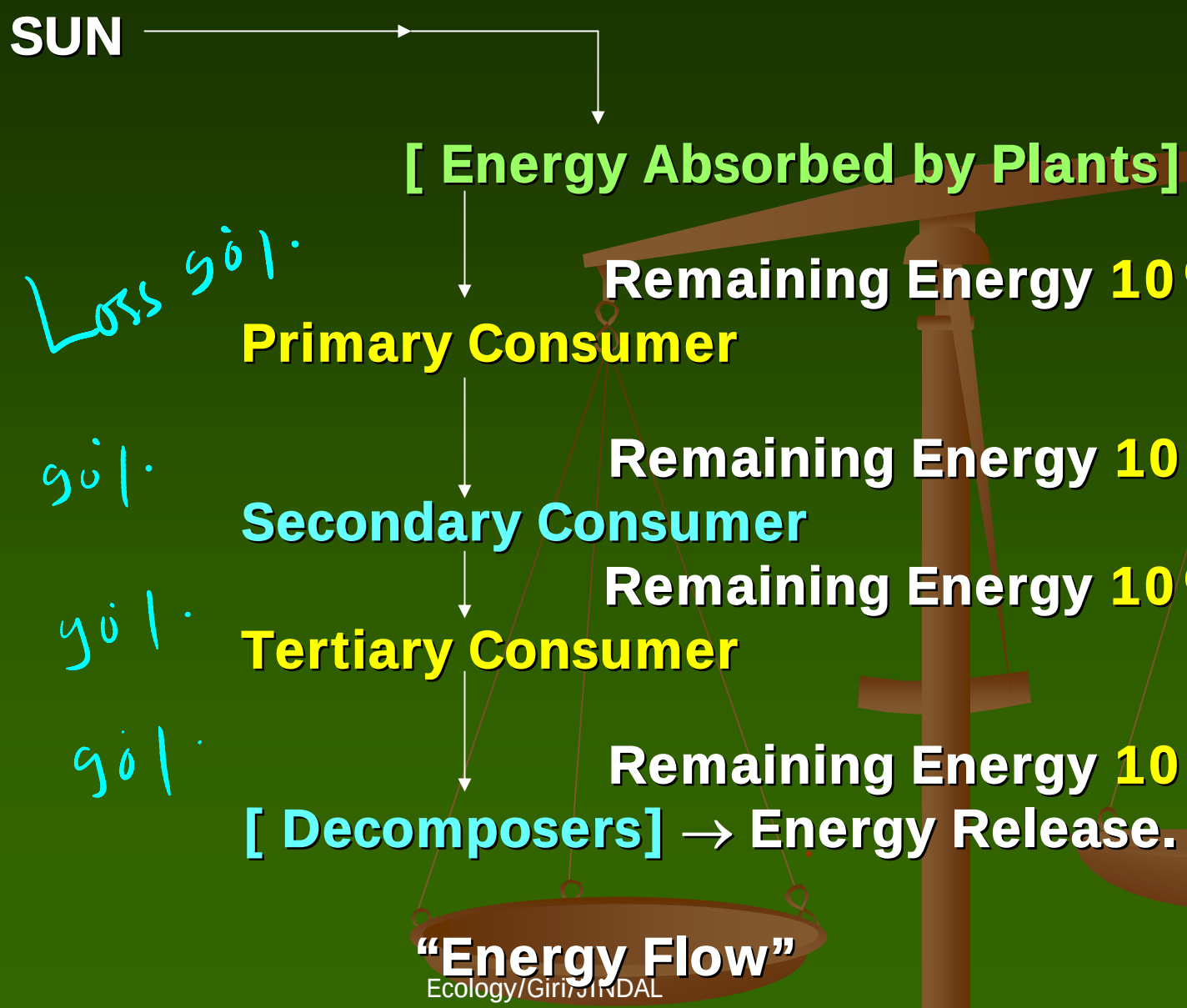


L-7/2 Energy flow in Ecosystem



"Energy Flow"

L-7/2 Energy flow in Ecosystem

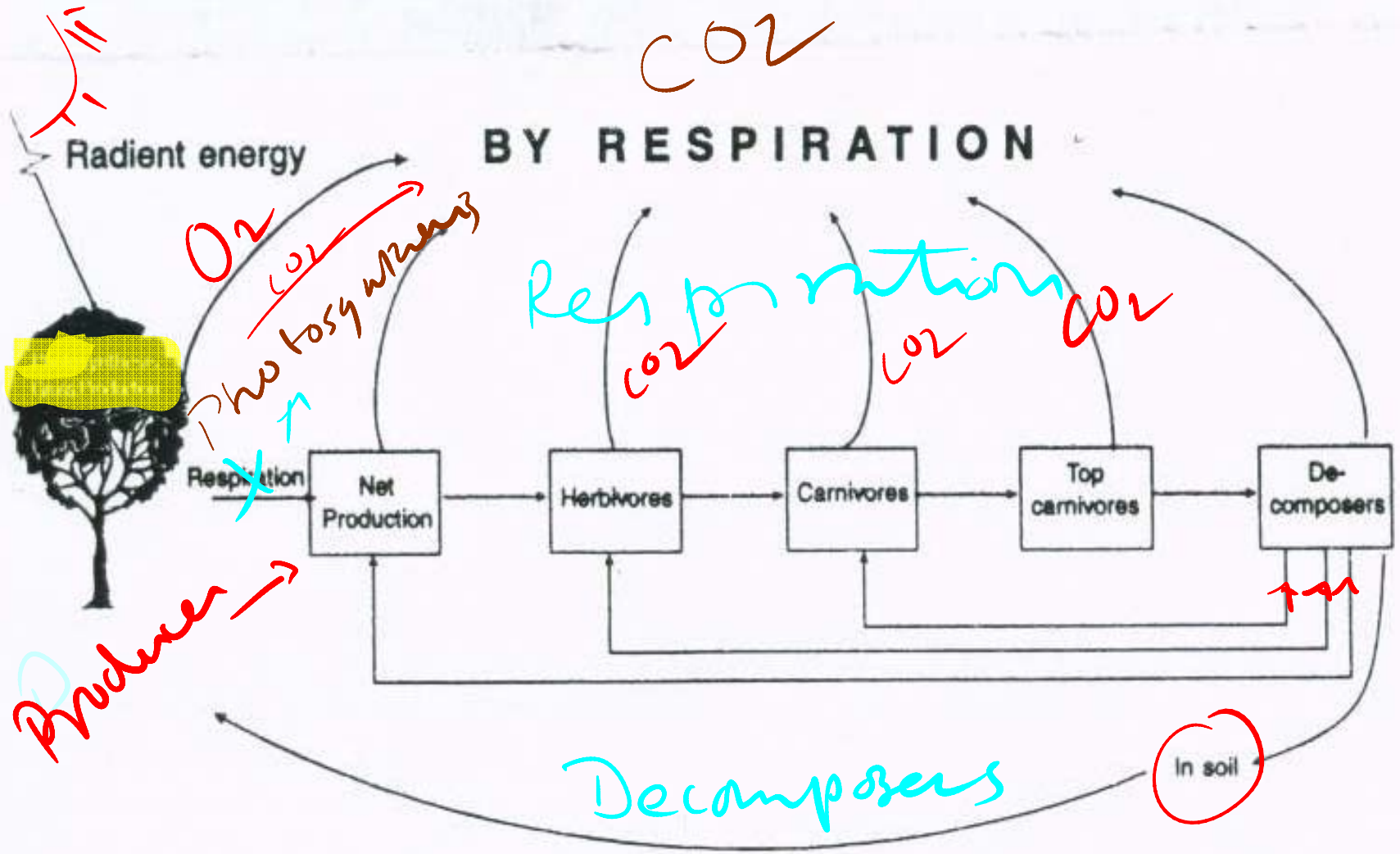


Fig. Energy flow in a Ecosystem

L-7/3 Energy flow in Ecosystem

- Thus there is a **continuous loss of energy** within each trophic level-

- **from producer to consumer** in an ecosystem.

- All **biological activities** involves **utilization of energy.**

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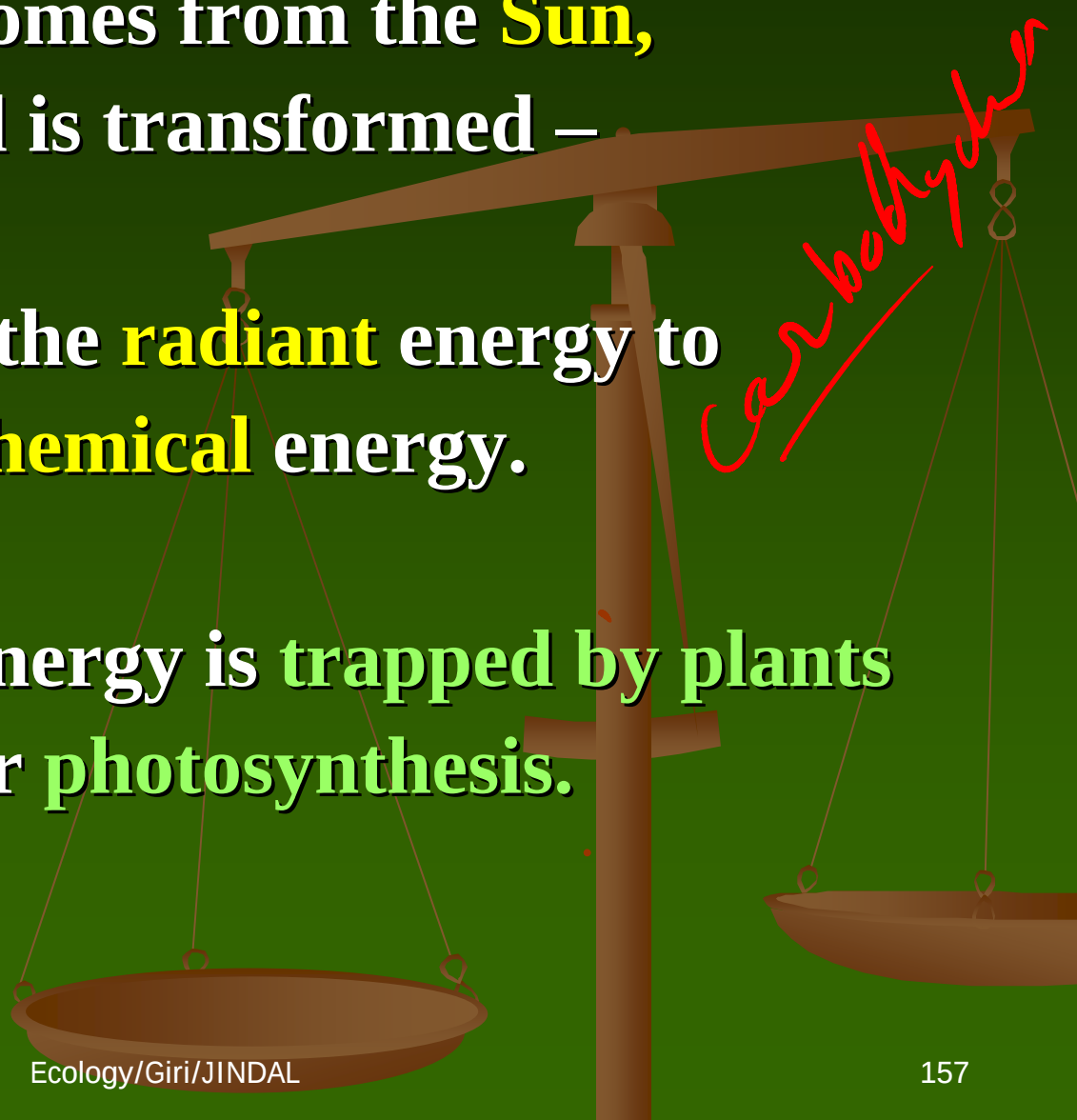
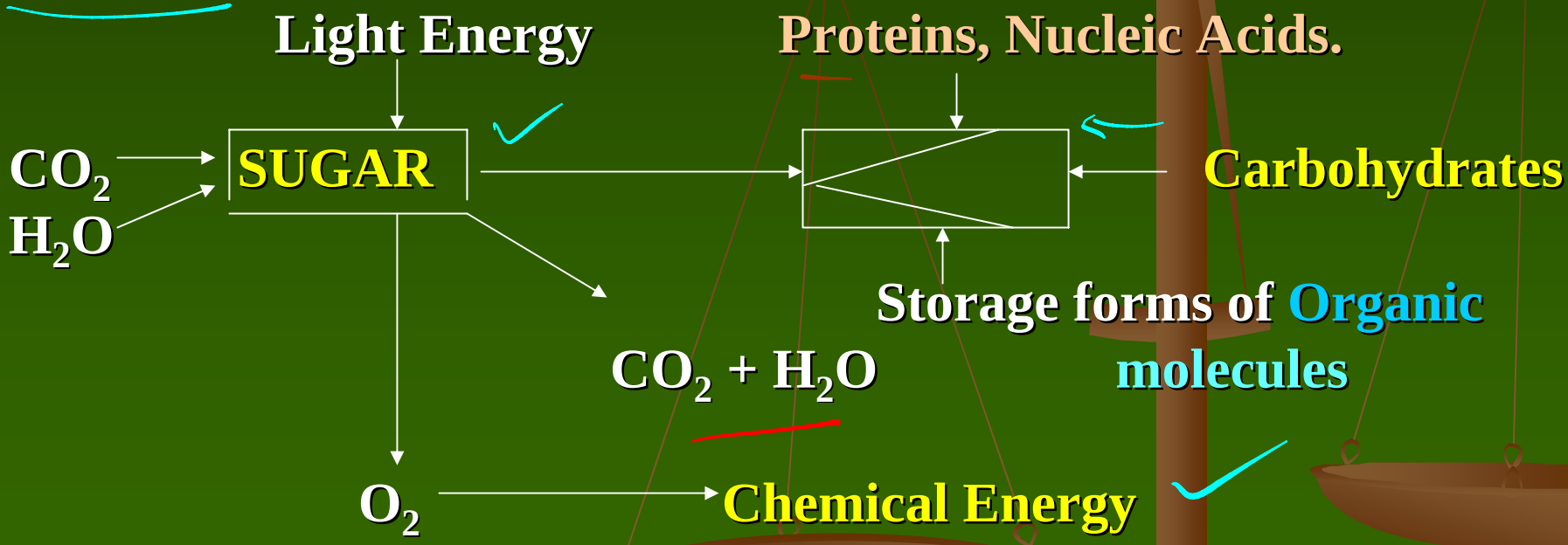
L-7/3b Energy flow in Ecosystem

- It comes from the **Sun,** and is transformed –
- from the **radiant** energy to **chemical** energy.
- **Radiant** energy is **trapped by plants** for **photosynthesis.**



L-7/3a Energy flow in Ecosystem

- Further this sugar can be converted into cellulose, proteins, nucleic acids etc.



L-7/3b Energy flow in Ecosystem

Energy Flow Model:- was explained by

E. P. Odum.

- **The flow of energy takes place in a 'Unidirectional' manner**

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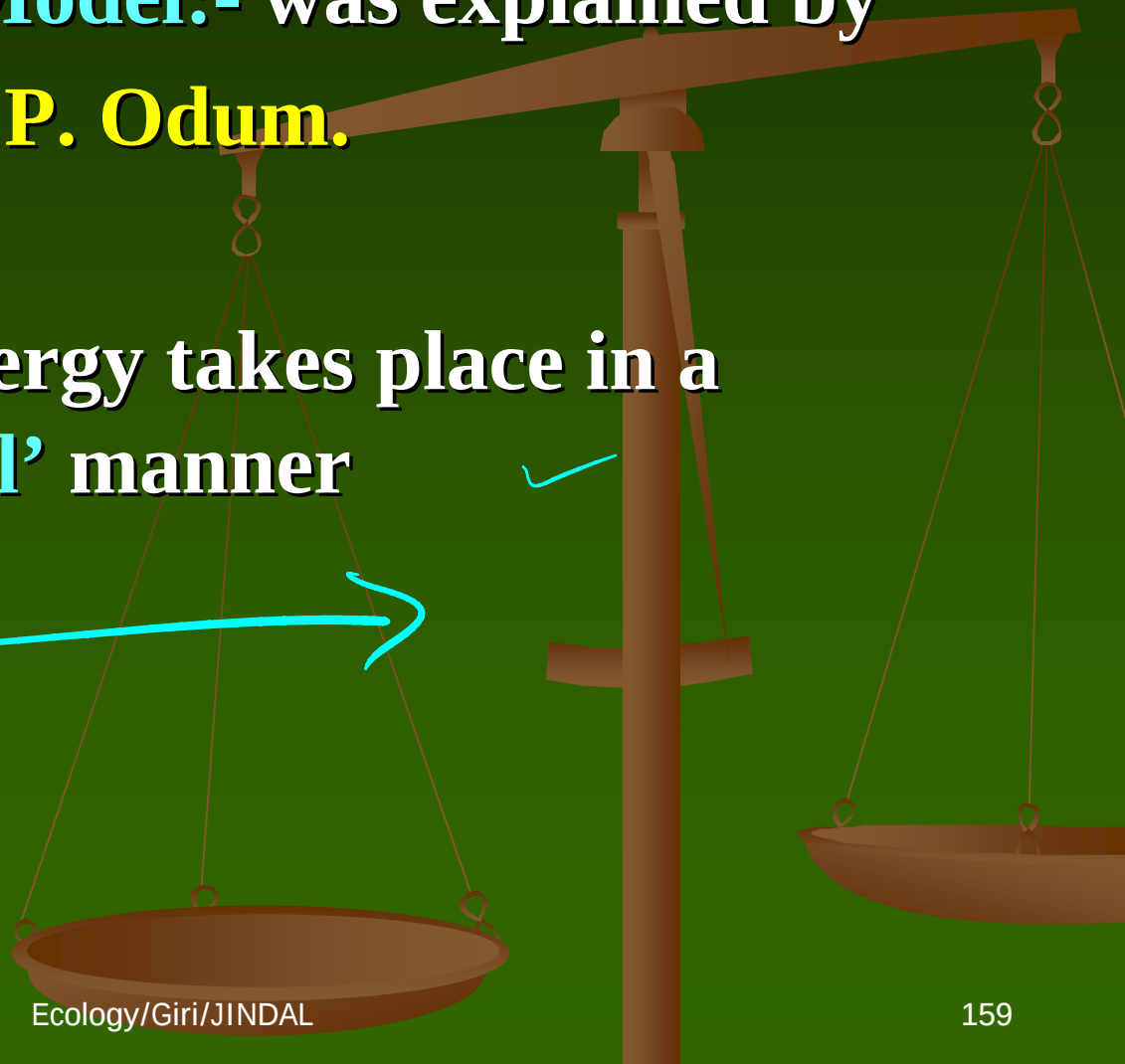

L-7/3c Energy flow in Ecosystem

- through a single channel of
- green plants or producers to
- herbivores and carnivores.

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L-7/3c Energy flow in Ecosystem

Diagram shows a model-

- There is a gradual decline in energy level-

due to loss of energy at

- each successive trophic level in

a grazing food chain.

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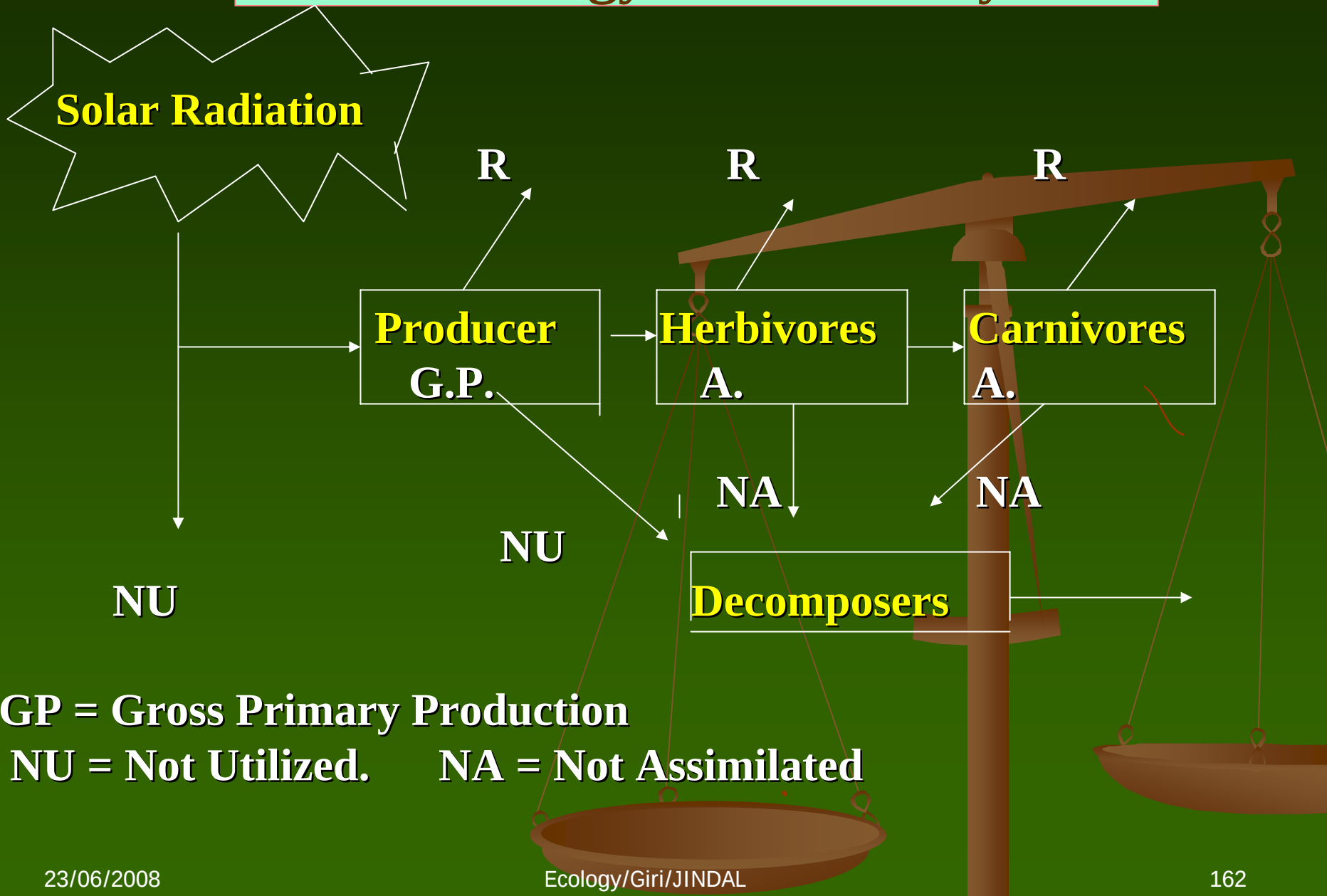
L-7/3c Energy flow in Ecosystem



GP = Gross Primary Production

NU = Not Utilized. NA = Not Assimilated

L-8/1 Cycling of Nutrients

Cycling of Nutrients:-

Nutrients like carbon, nitrogen, oxygen etc. have-

Circular paths through biotic and abiotic components and are known as

- **'Cycling of Nutrients' or**

'Biogeochemical Cycles'.

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L-8/1 Cycling of Nutrients

- ‘Cycling of Nutrients’ or
- ‘Biogeochemical Cycles’.

- Water also moves in a cycle, known as
- ‘Hydrological Cycle’.

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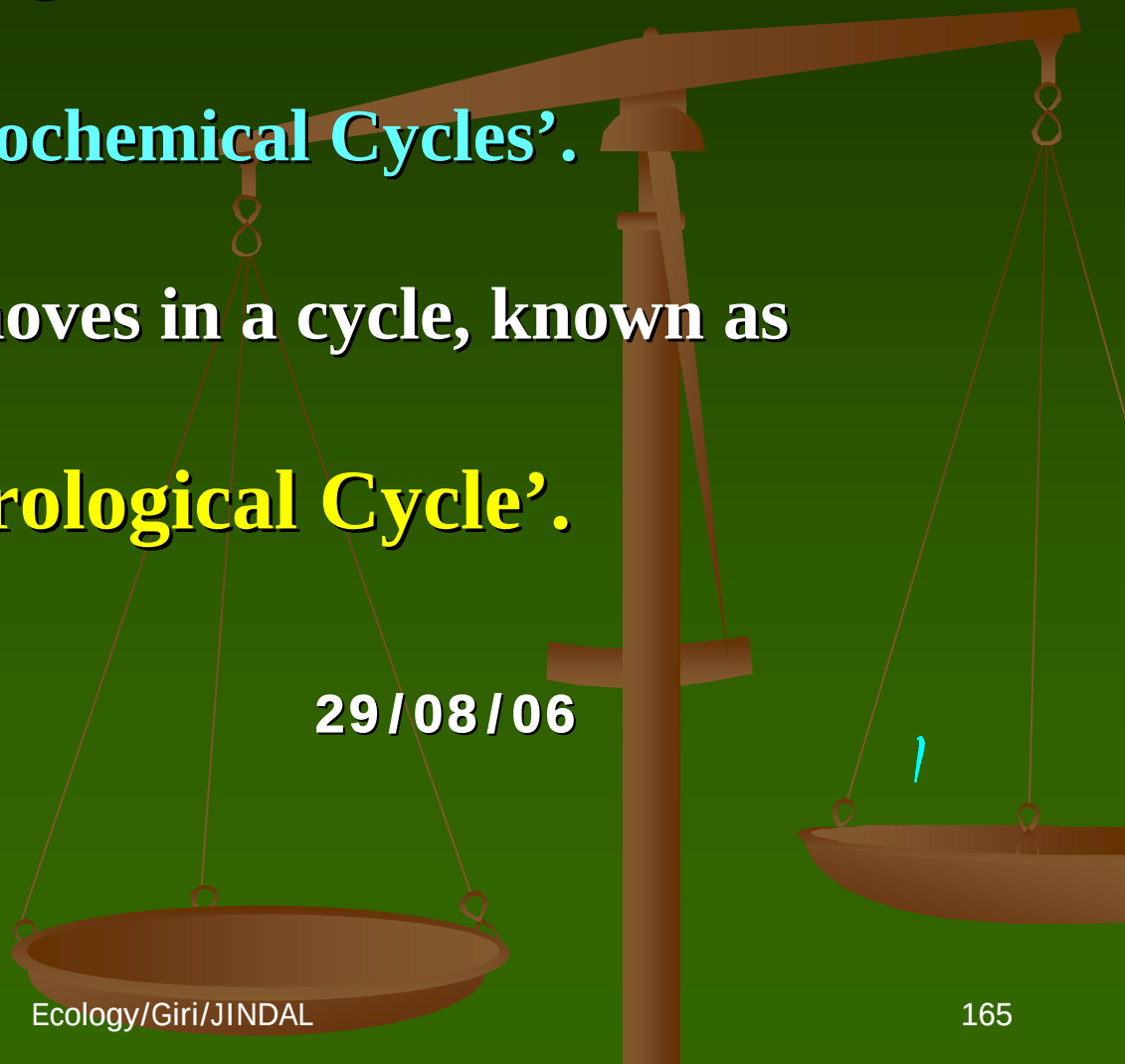

L-8/1 Cycling of Nutrients

1. Water Cycle or Hydrological Cycle:-

- Water from the transpiring plants,
- oceans, rivers and lakes
- evaporates into atmosphere.

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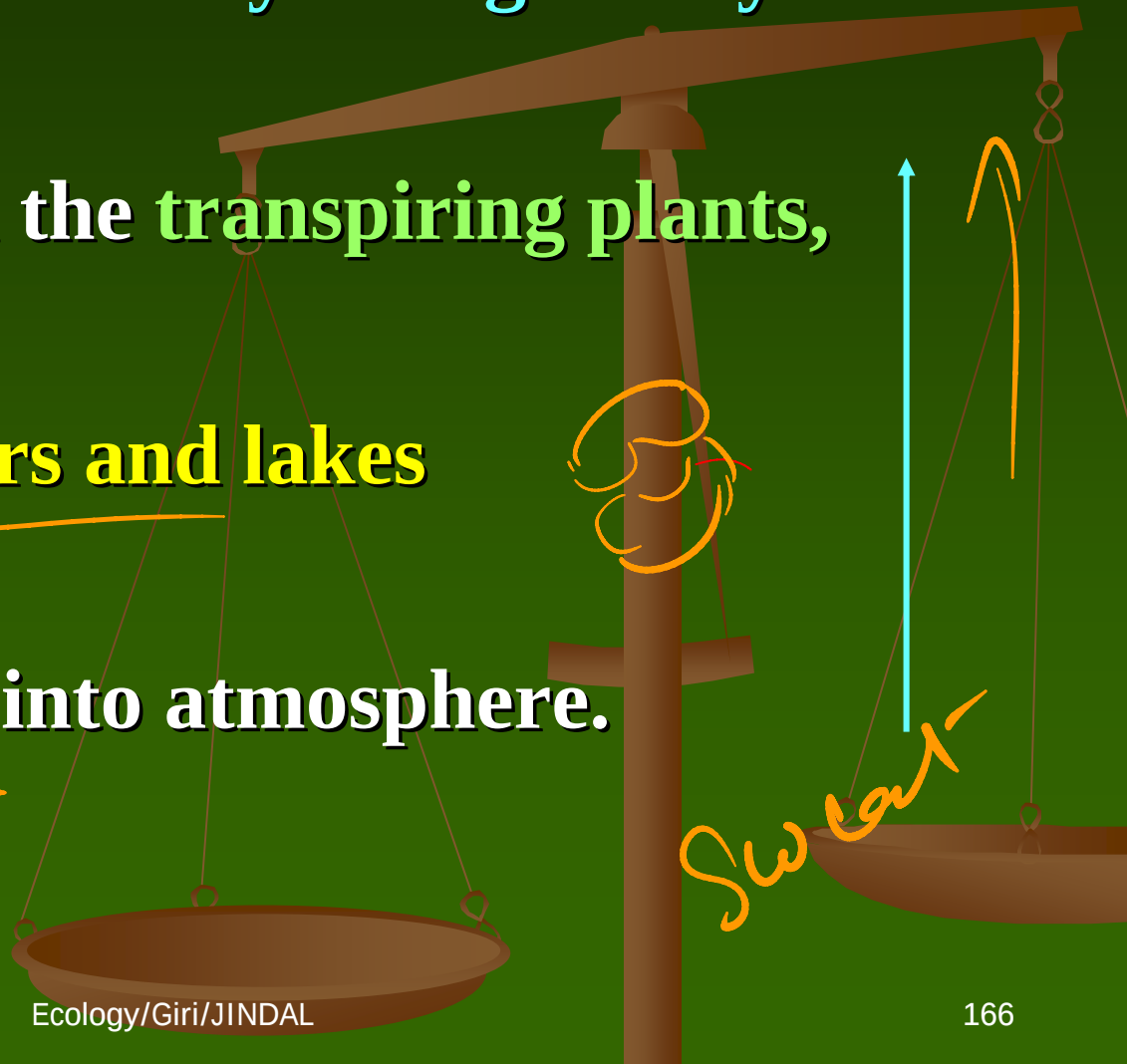

L-8/1 Cycling of Nutrients

1. Water Cycle or Hydrological Cycle:-

- Water vapors cool and condense to
- form clouds & water.

- Water returns to the earth
- as rain and snow.

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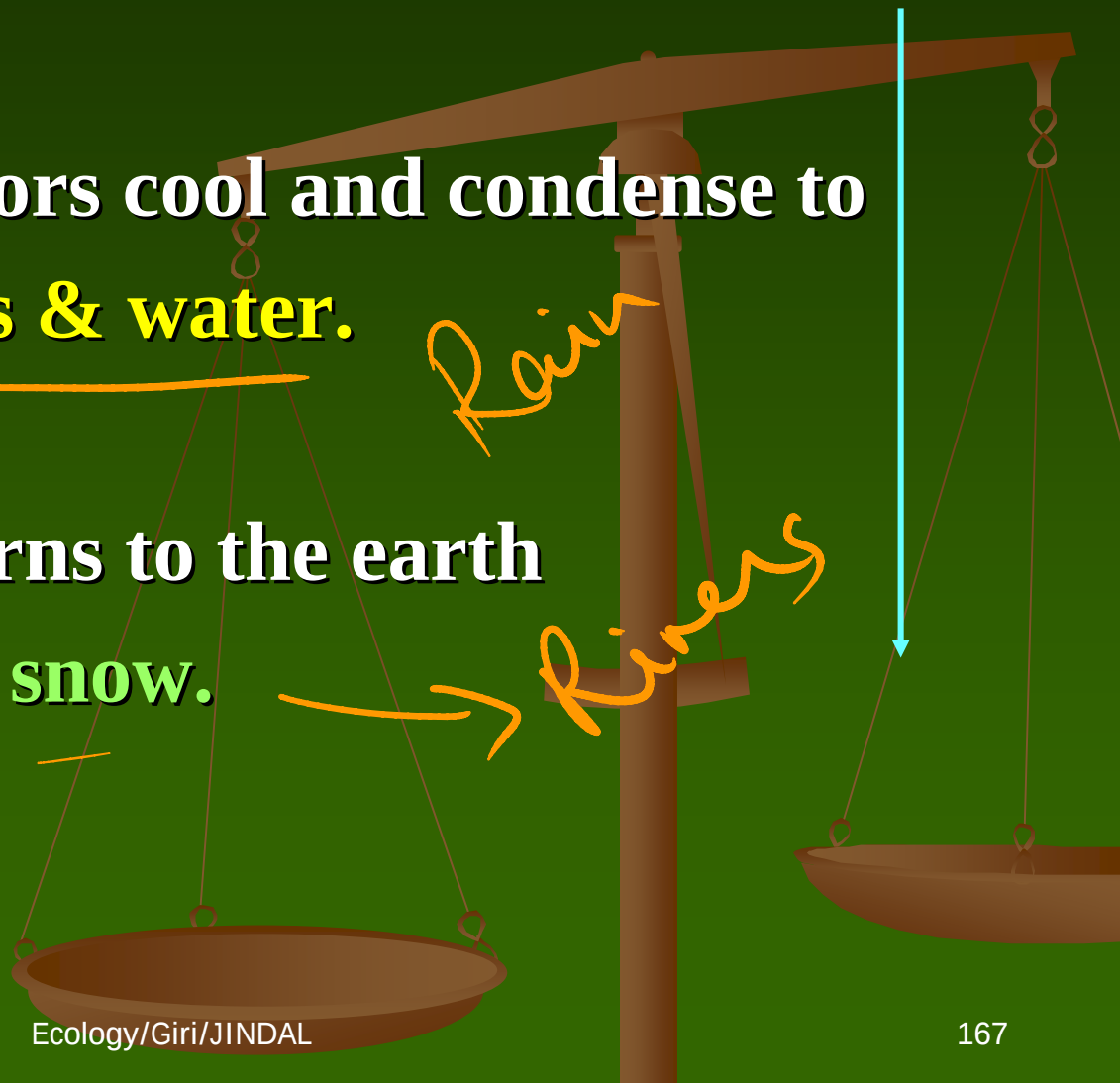


L-8/1a Cycling of Nutrients

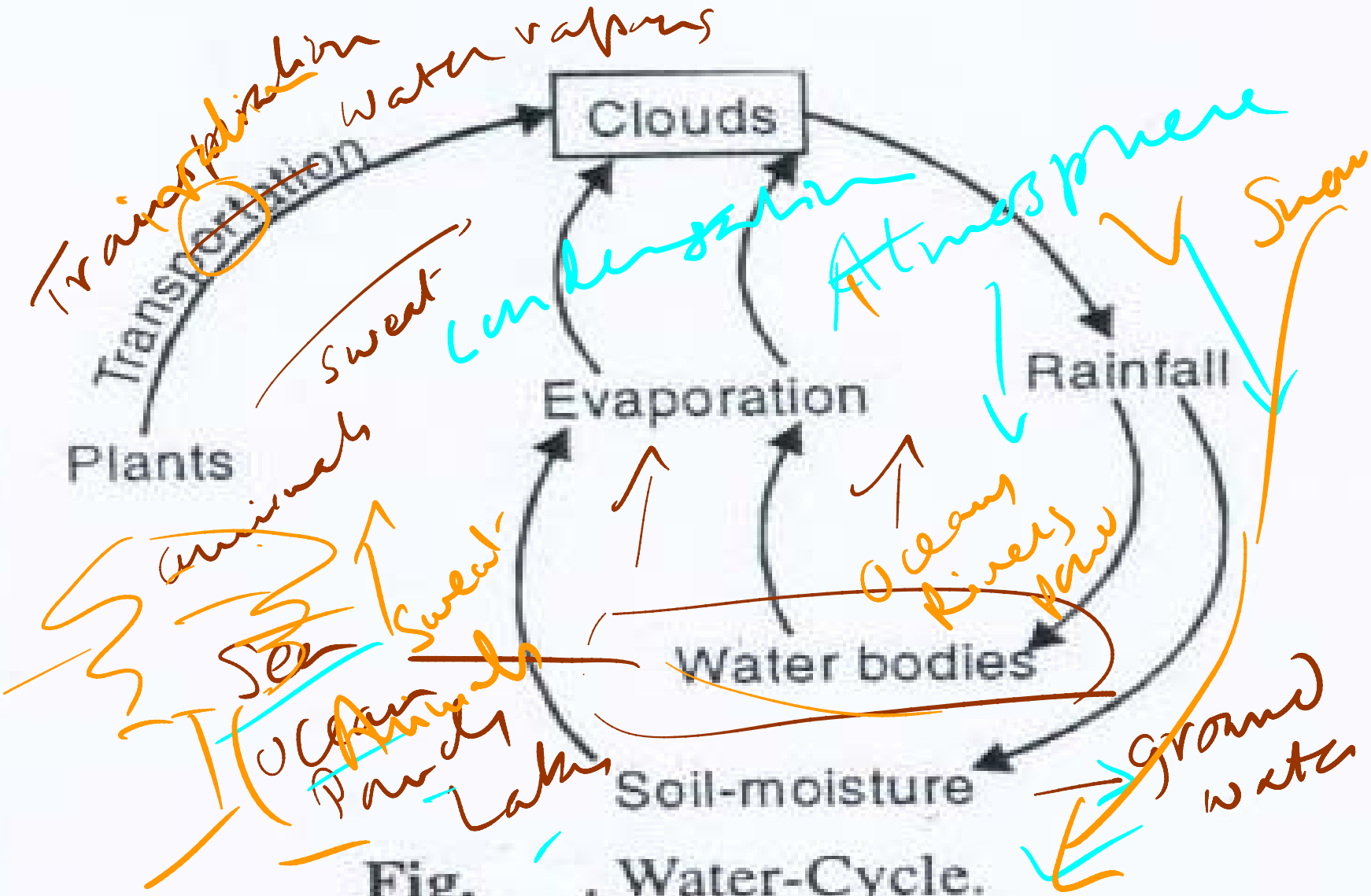
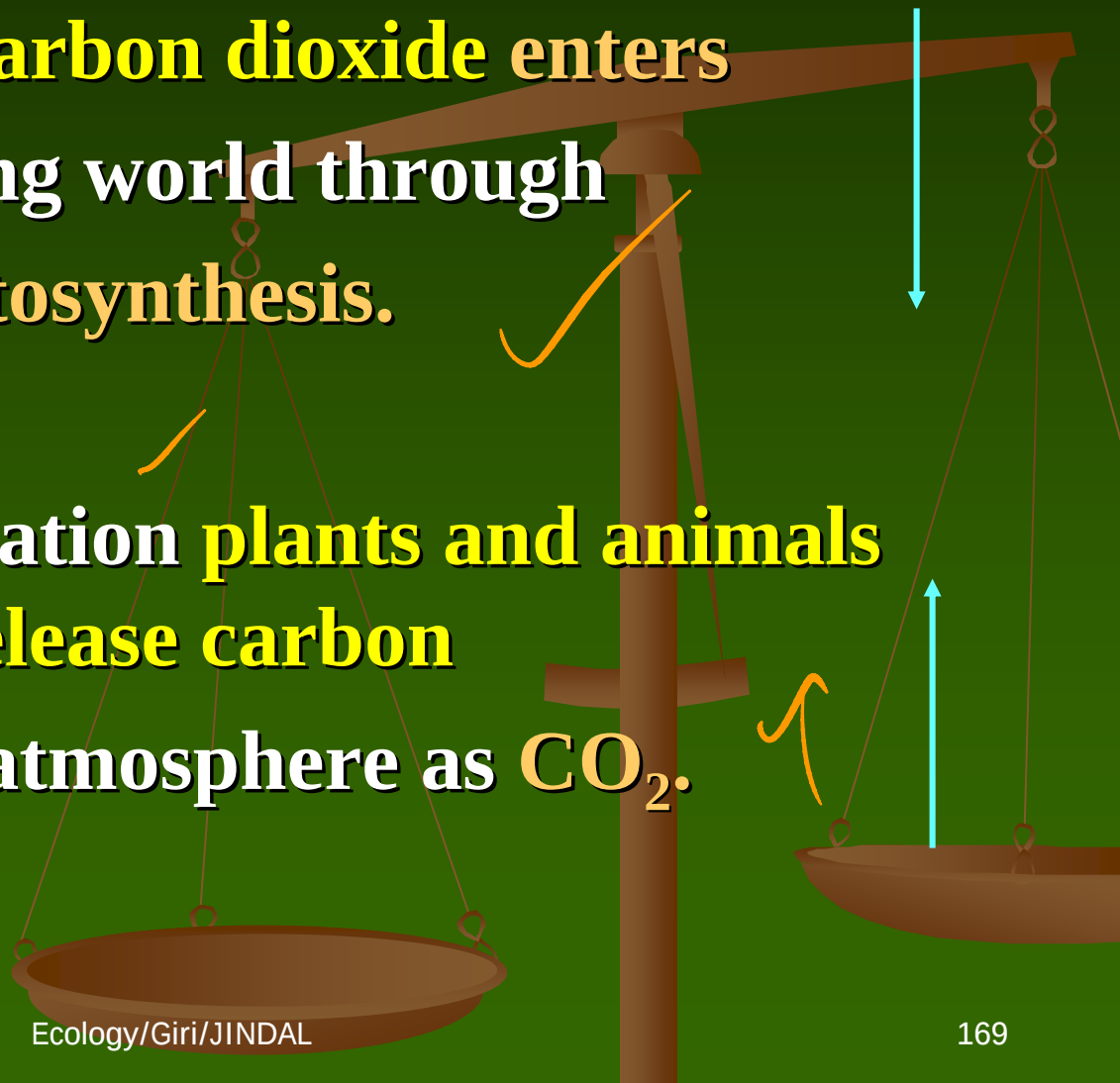


Fig. . Water-Cycle.

L-8/2 Cycling of Nutrients

Carbon Cycle:-

- Most of carbon dioxide enters the living world through Photosynthesis.



- During respiration plants and animals release carbon
  - back in atmosphere as CO_2.

L-8/2 Cycling of Nutrients

Carbon Cycle:- ……..

- The dead plants and animals are
- decomposed by micro-organism to release CO_2.

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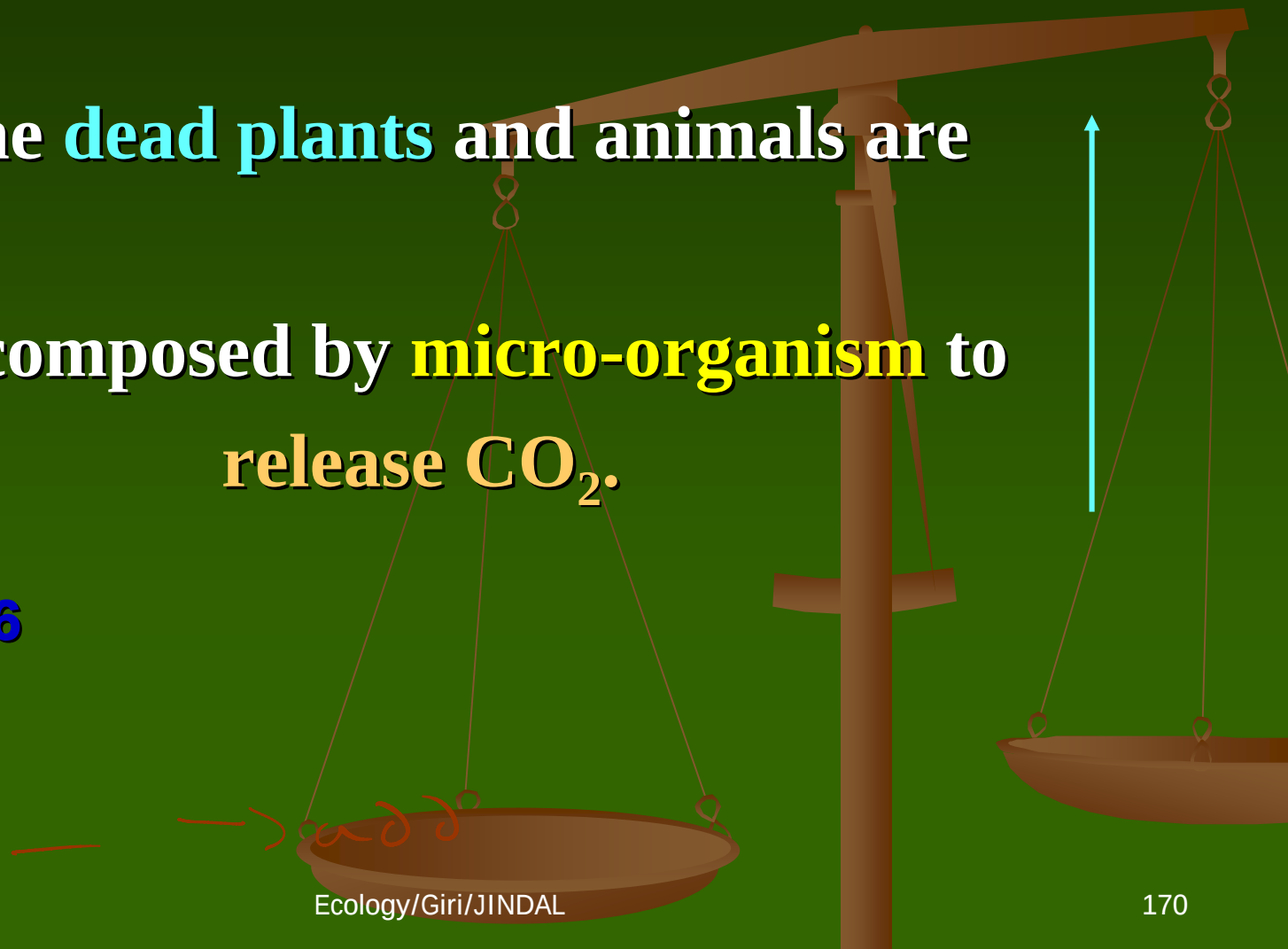

L-8/2a Cycling of Nutrients

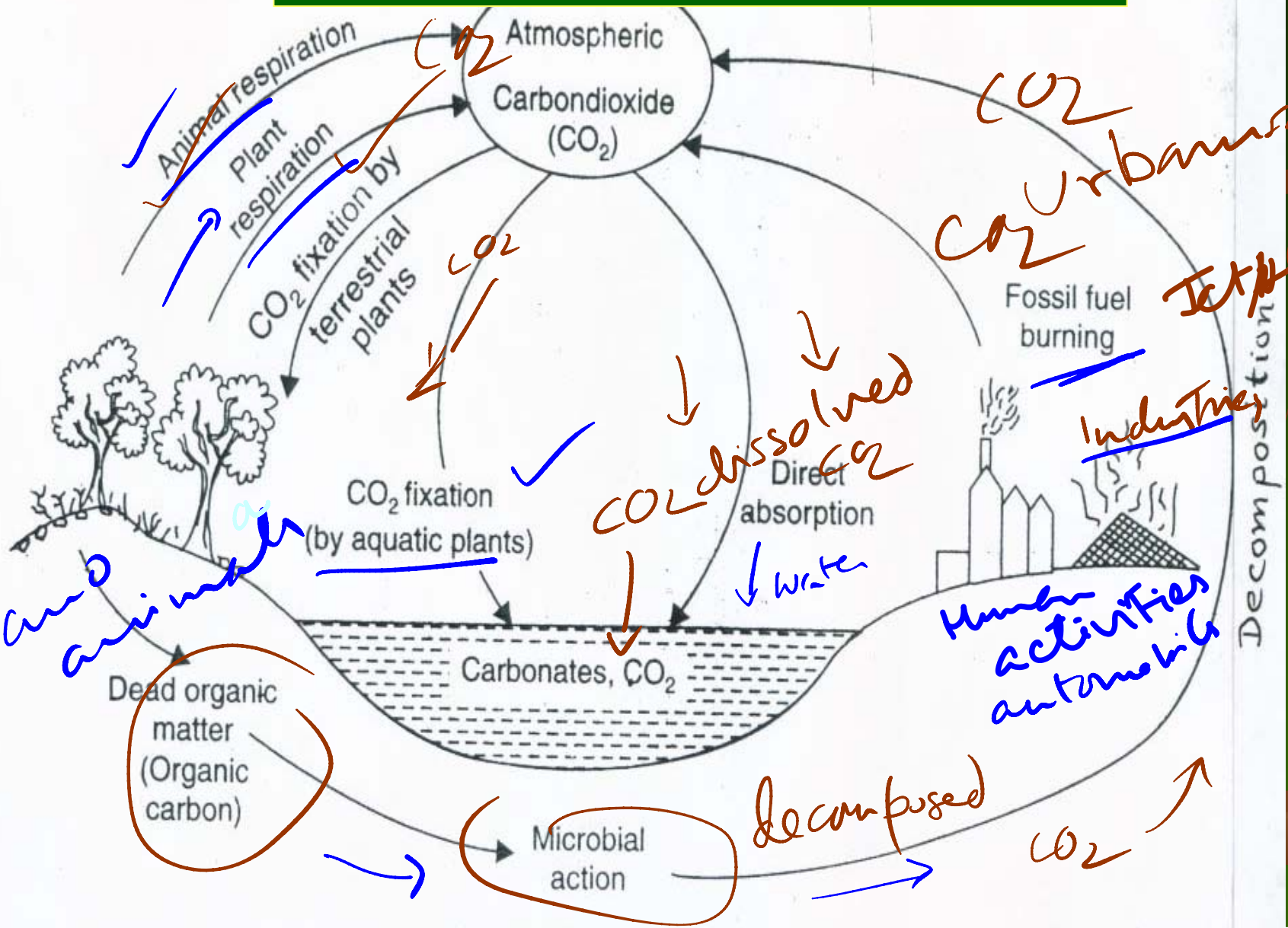

Fig. Carbon cycle.

L-8/3 Cycling of Nutrients

Nitrogen Cycle:-

- N_2 in the atmosphere is in the elemental from & can not be used as such by the living organisms.

- It has to be 'fixed' with other elements such as H_2 , C or O_2 to

- become usable for the green plants.

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L-8/3a Cycling of Nutrients

Nitrogen is continuously entering into the air –

- by the action of denitrifying bacteria and-

returning through the action of

- lightening and electrification.

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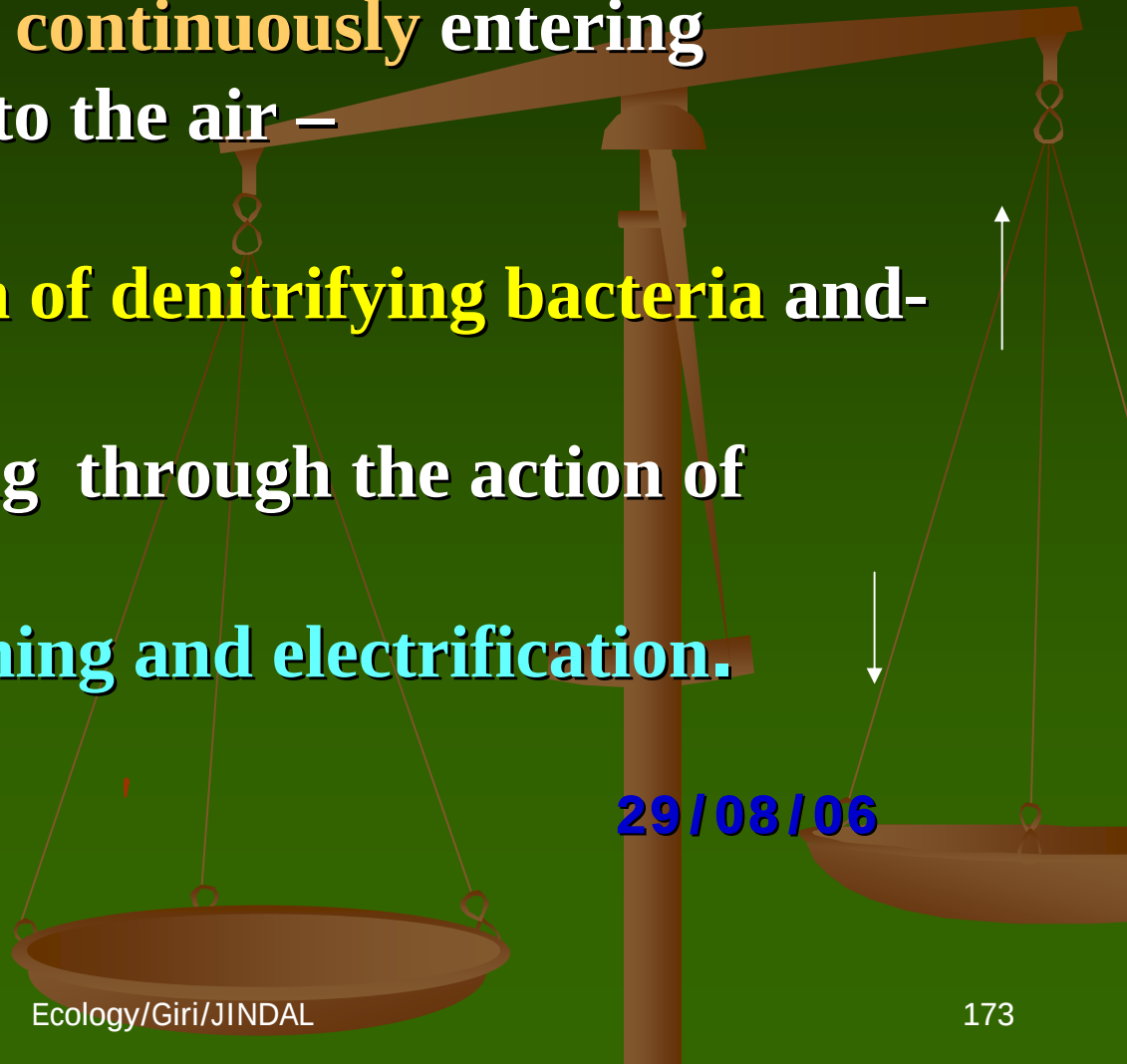

L-8/3a Cycling of Nutrients

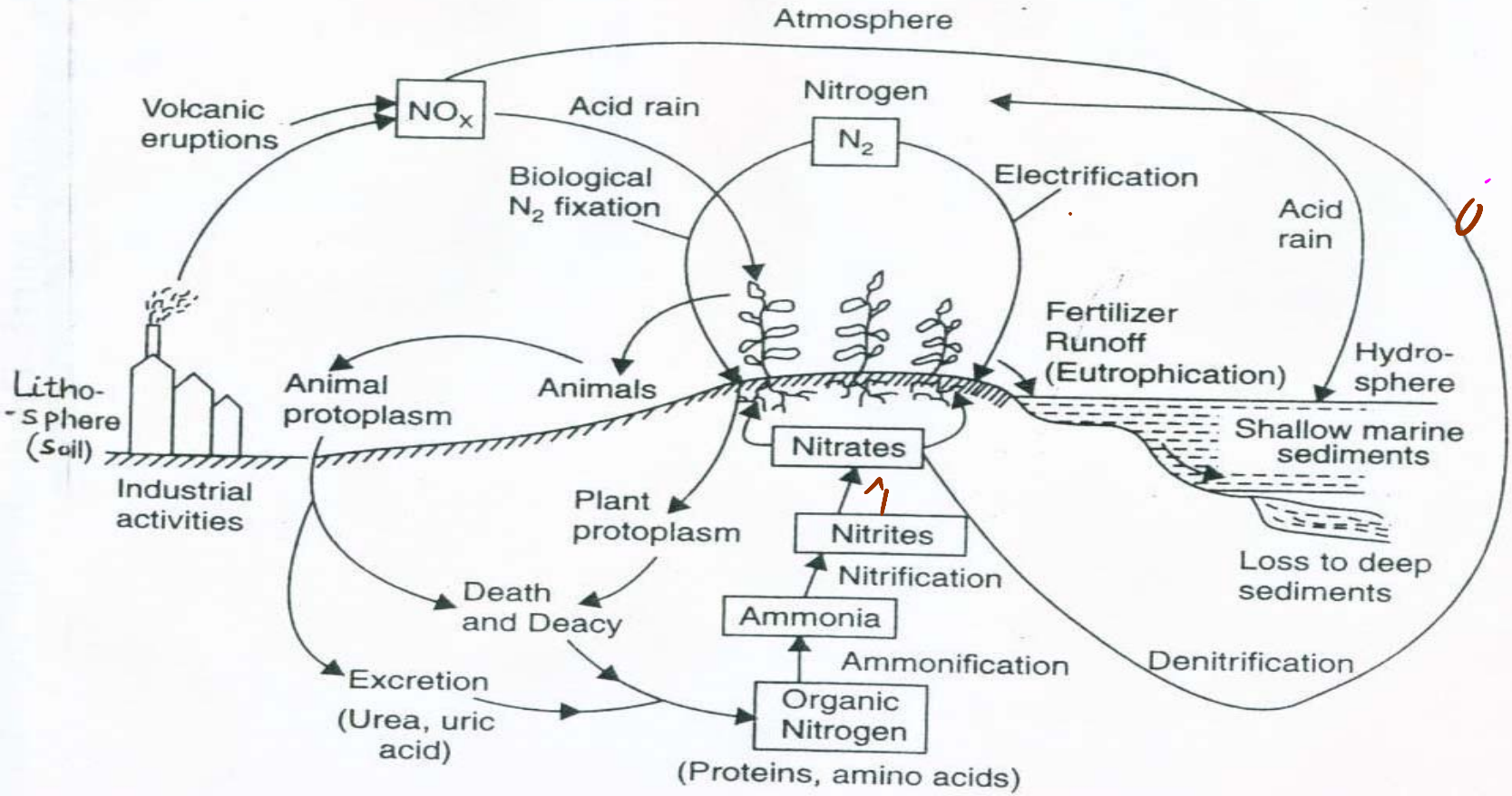

Fig. Nitrogen cycle—a gaseous cycle with major reserve as N_2 (78%) in the atmosphere. Circulation of N- between living components and soil/atmosphere is mediated by a group of micro-organisms which convert one form of N into another.

L-8/4 Cycling of Nutrients

Oxygen Cycle:-

- Oxygen required for respiration in plants and animals enters the body directly from the air.
- Oxygen return to the surrounding in the form of CO_2 or H_2O.

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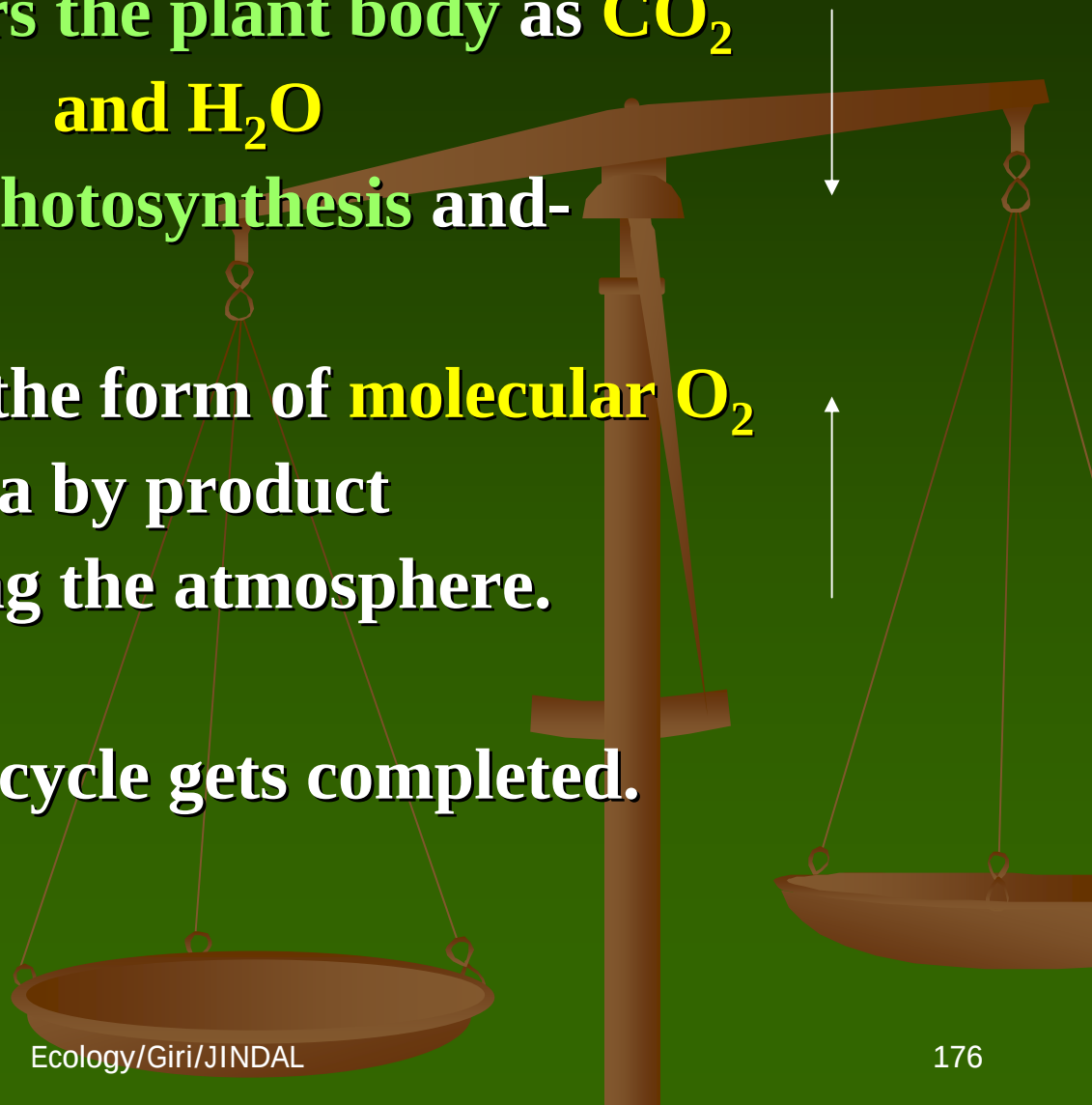
L-8/4 Cycling of Nutrients

- It also enters the plant body as CO_2 and H_2O during photosynthesis and-

- released in the form of molecular O_2 as a by product purifying the atmosphere.

- And the cycle gets completed.



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L-8/4a Cycling of Nutrients

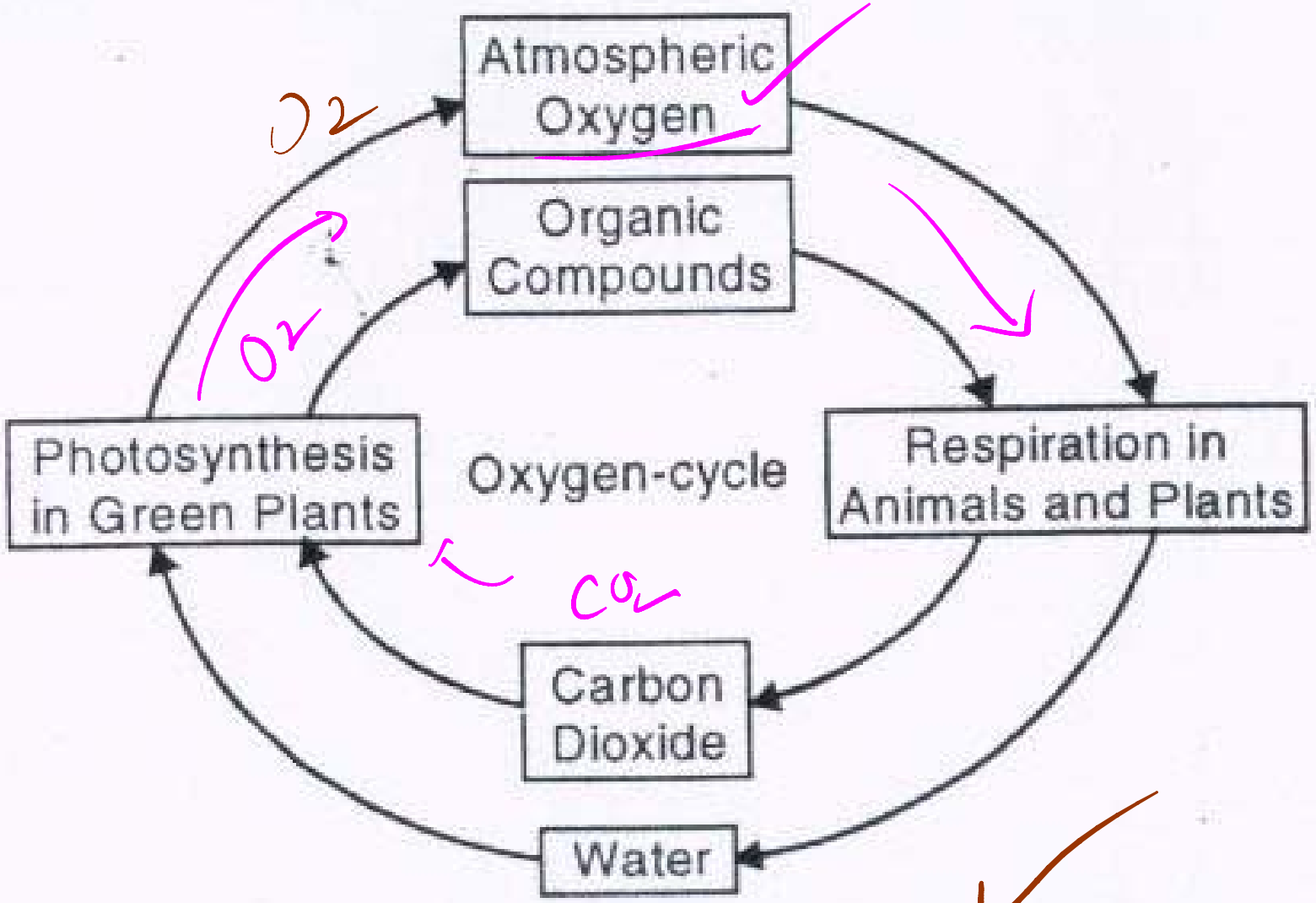

Fig. Oxygen-Cycle.


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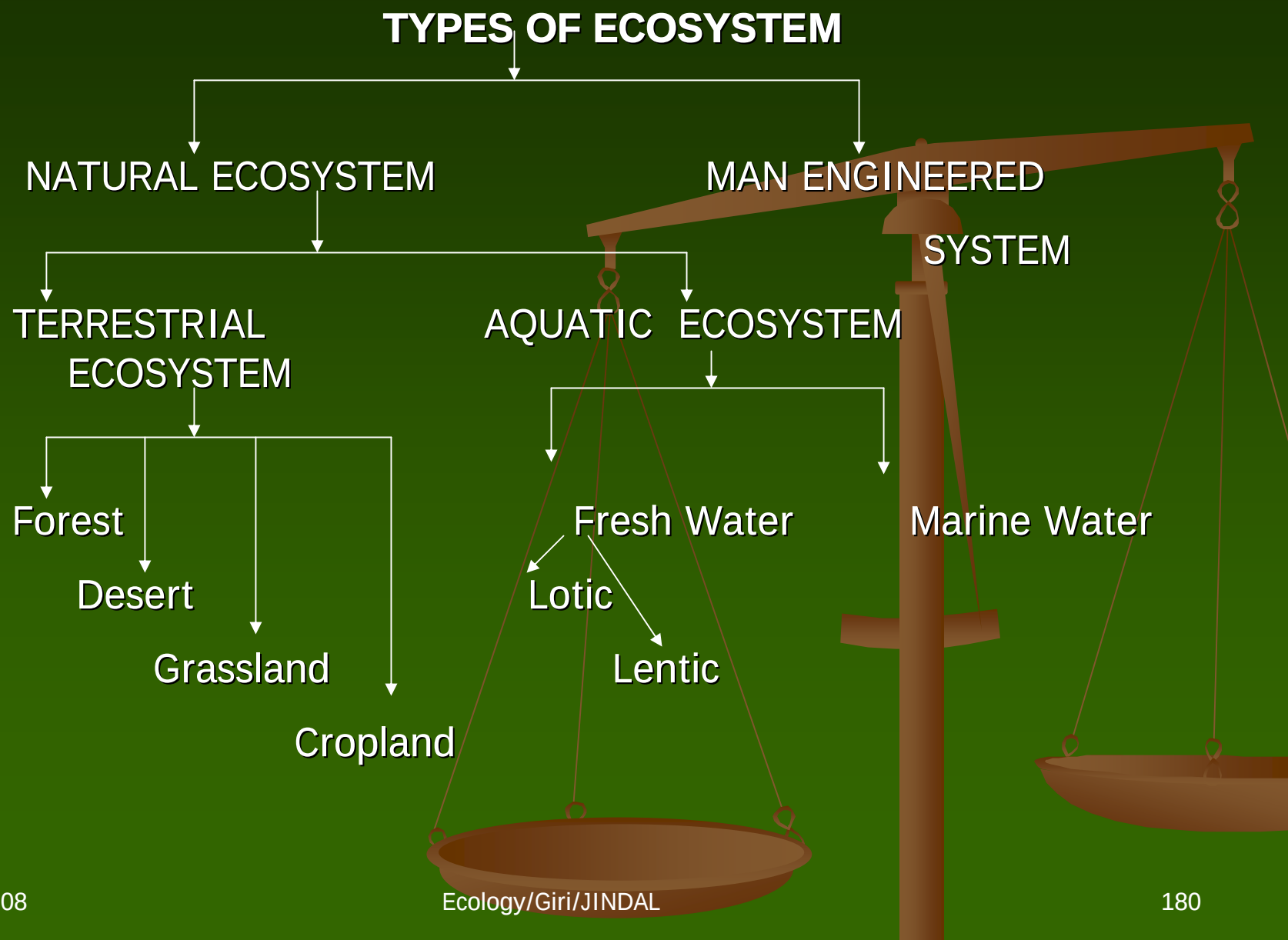
L-9/1.1 Types of Ecosystem



L-9/1.1 Types of Ecosystem

Types of Ecosystem:-

A. Forest Ecosystem:-

- These have predominance of trees of a large number of species-
- herbs, shrubs, climbers, lichens and algae
- and a wide variety of wild animals and birds.

Forests can be of various types-

L-9/1.2 Types of Ecosystem

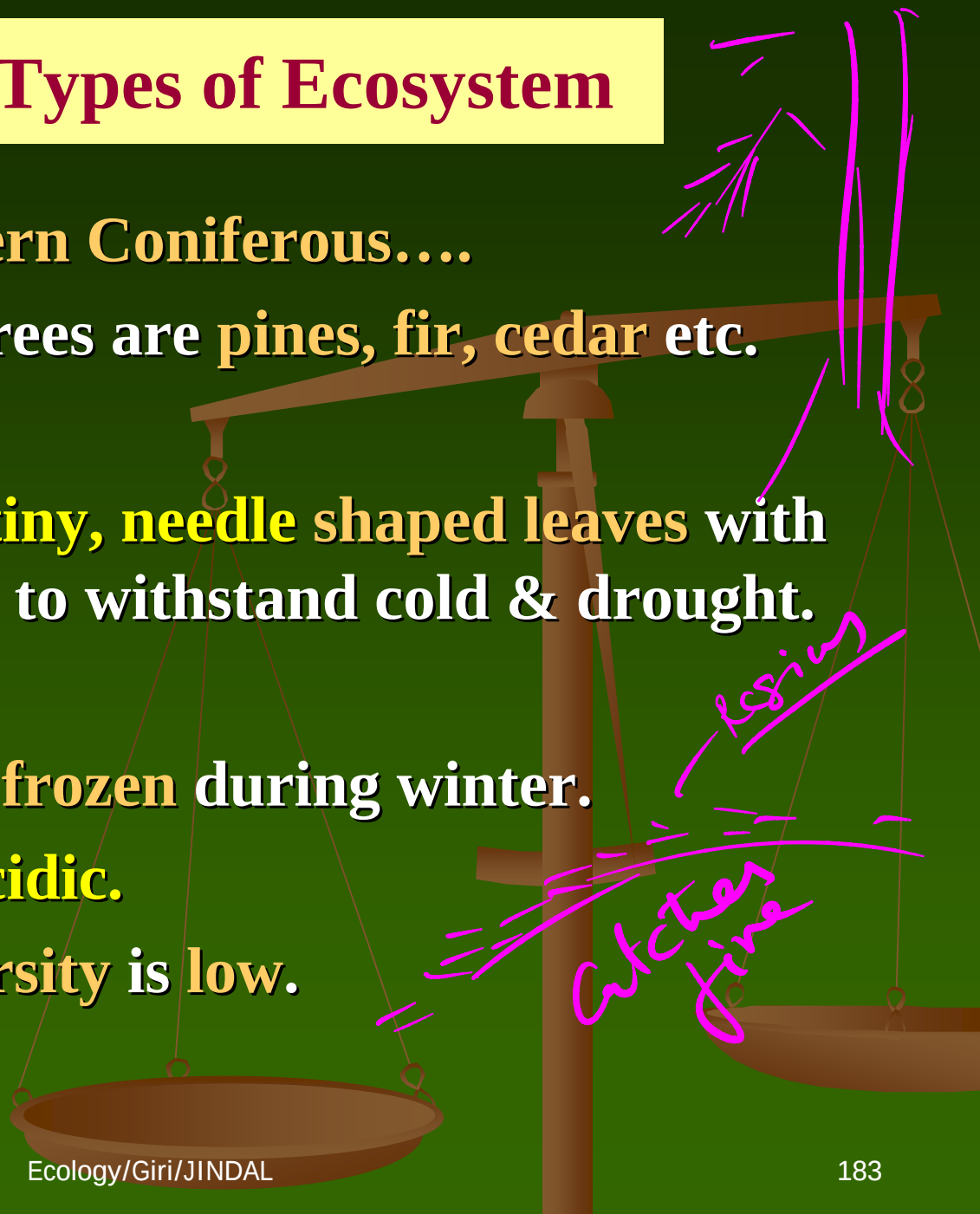
1. Northern Coniferous Forest:-

- These are known as Evergreen or Boreal forest.
- In northern areas of north America, Europe, Japan,
- winters are long, cold and dry.
- Sunlight is available for a few hours only.

L-9/1.2 Types of Ecosystem

Northern Coniferous….

- The major trees are pines, fir, cedar etc.
- which have tiny, needle shaped leaves with waxy coating to withstand cold & drought.
- The soil get frozen during winter.
- The soil is acidic.
- Species diversity is low.

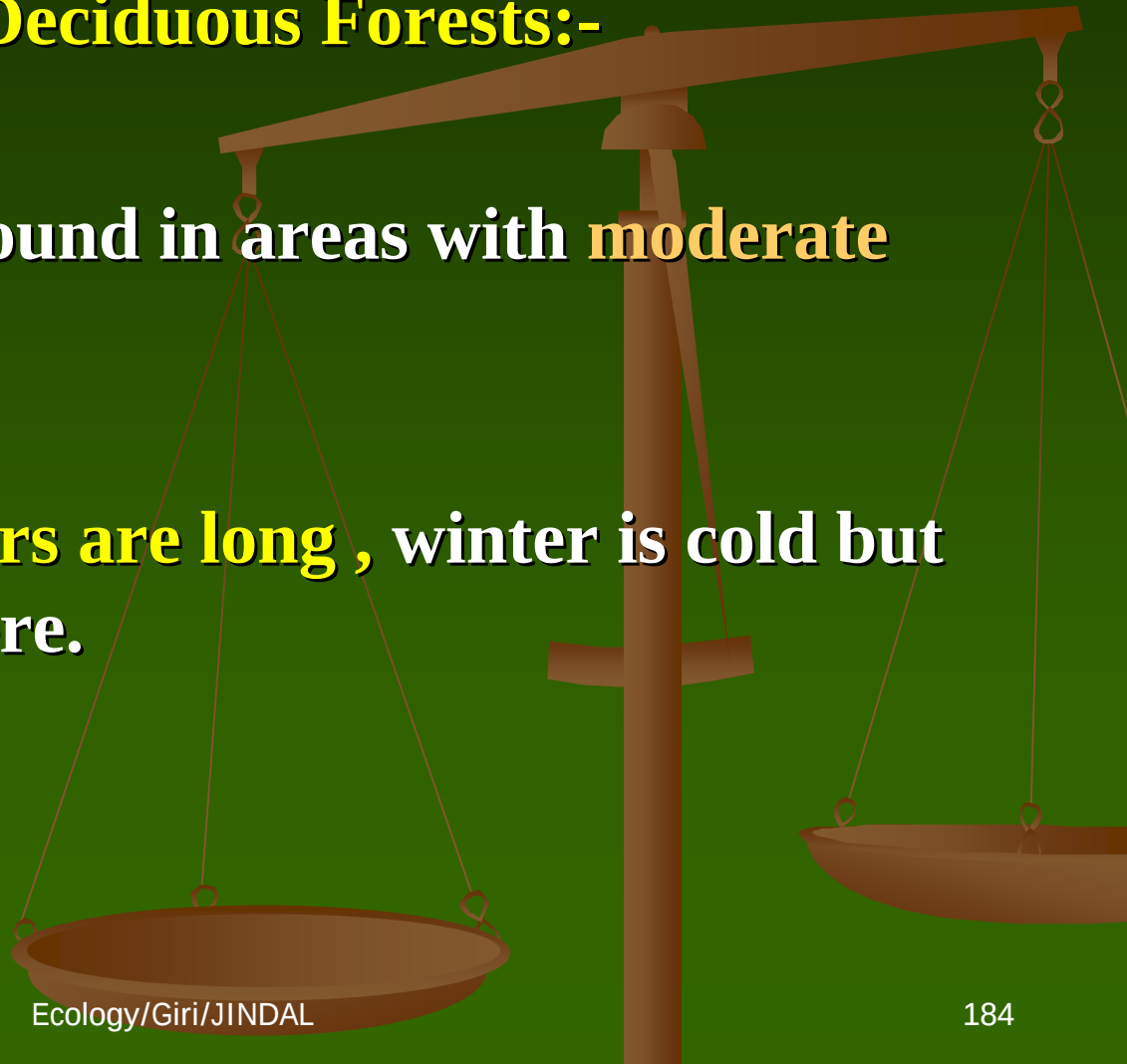


L-9/1.3 Types of Ecosystem

2. Temperate Forests

i) Temperate Deciduous Forests:-

- These are found in areas with moderate temp.
- The summers are long , winter is cold but not too severe.



Deciduous Forest Ecosystem

Beech–maple forest in fall, New York.

Young deciduous forest in winter, Massachusetts.

L-9/1.3 Types of Ecosystem

2. Temperate Forests…

i) Temperate Deciduous Forests:-

- Abundant rainfall throughout the year.
- Trees are broad leaf deciduous trees like Oak, hickory, Poplar etc.
- Animals are deer, bear, squirrels.

L-9/1.4 Types of Ecosystem

i) Temperate Evergreen Forest:-

- They are warm dry in summer & cool, moist in winter.
- Found in north America & Australia.
- Trees are absent but shrubs are many.
- The plants have great power of regeneration.

L-9/1.4 Types of Ecosystem

ii)Temperate Rain Forest:-

- These are found in temperate areas with adequate rainfall.
- Dominated by coniferous trees like pines, firs, redwood etc.
- Some evergreen broad leaf trees are also found.
- Less diversity of flora & fauna.

L-9/2 Types of Ecosystem

3. Tropical Forest:

- These are found in tropical zones of world and have
- high rainfall and temperature. These are three types –

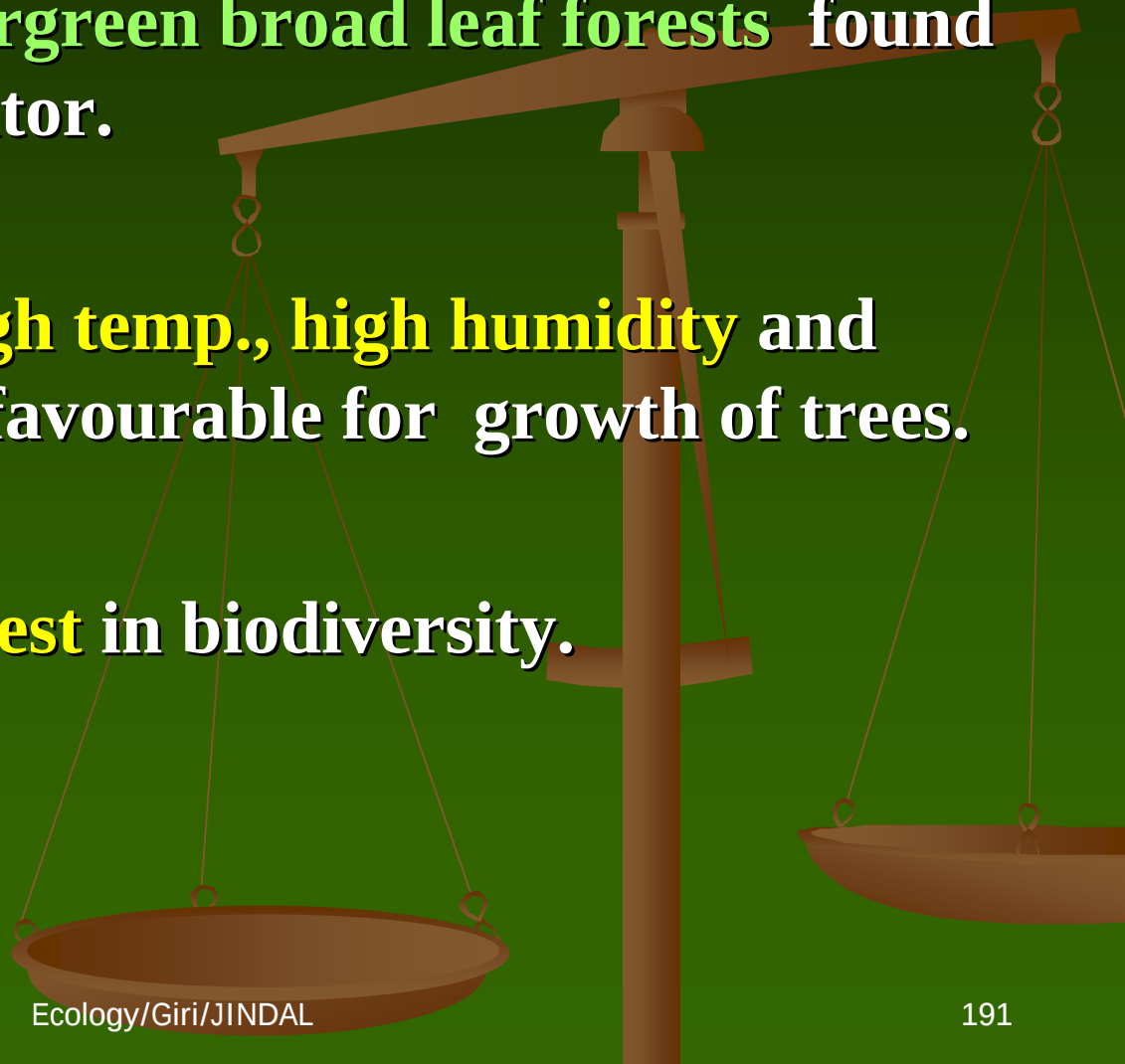
i) Tropical Rain Forest:-

- next

L-9/2 Types of Ecosystem

Tropical Rain Forest:-

- They are **evergreen broad leaf forests** found near the equator.
- They have **high temp., high humidity** and **high rainfall** favourable for growth of trees.
- They are **richest** in biodiversity.



L-9/2 Types of Ecosystem

Tropical Rain Forest:-

- The flowers of forest are very – very large, colourful, fragrant and attractive-
- which helps in pollination by insects, birds, bats etc.
- Rafflesia Arnold is the biggest flower (Kg weight).
- The silent valley in Kerala is the only tropical rain forest lying in India.

L-9/3 Types of Ecosystem

ii) Tropical Deciduous Forest:-

- These are found a little away from the equator.
- The climate is warm throughout the year.
- Rain occurs only during monsoon.
- The different deciduous trees lose their leaves during long dry Summer

L-9/3 Types of Ecosystem

ii) Tropical Deciduous Forest:-

iii) Tropical Shrub Forests:-

- They are fond in areas where the dry season is even longer.
- there are small deciduous trees and shrubs.

L-9/4 Types of Ecosystem

Northern Coniferous Forest	Temperate Forest	Tropical Forest
	a) Temperate Deciduous Forest	(a) Tropical Rain Forest
	b) Temperate Evergreen Forest	b) Tropical Deciduous Forest
	(c) Temperate Rain Forest	(c) Tropical Scrub Forest

L-9/4a Types of Ecosystem

Grassland Ecosystem:-

- Grasslands are dominated by grass.
- Sometimes a few trees and shrubs are also found.
- Rainfall is average but erratic.
- Limited grazing helps to improve the net primary production of the grasslands but –

L-9/4a Types of Ecosystem

Grassland Ecosystem:-

- overgrazing leads to degradation of these grasslands.

- There are three types of grasslands:

(i) Tropical Grasslands

(ii) Temperate Grasslands

(iii) Polar Grasslands.

L-9/5 Types of Ecosystem

Tropical Grasslands:-

- These are found near the borders of tropical rain forests.
- In Africa, these are known as Savannas,
- having tall grass, scattered shrubs and stunted trees.
- The savannas has zebras, giraffes, gazelle, antelopes etc.

L-9/5 Types of Ecosystem

Tropical Grasslands…..

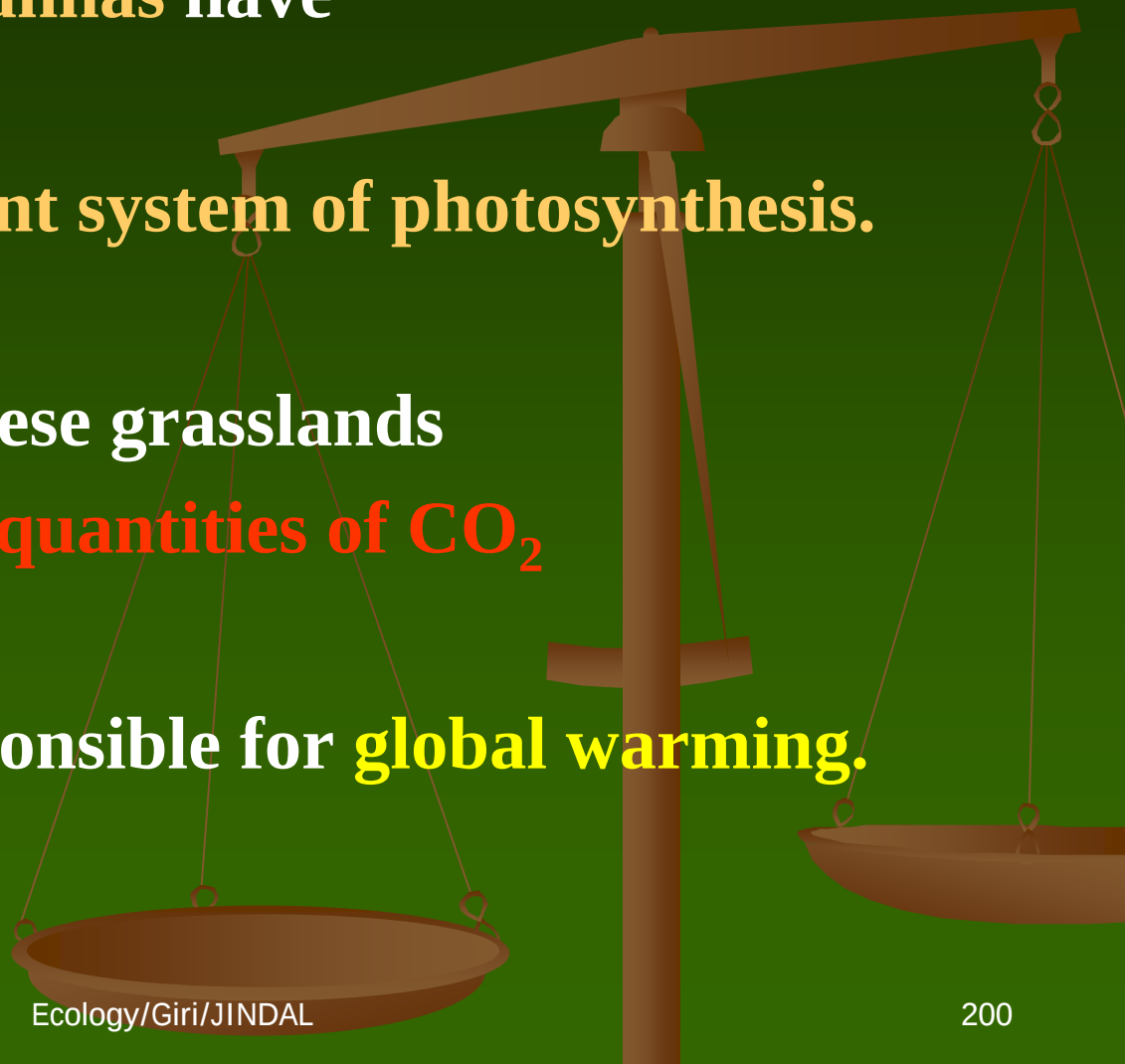
- During dry season, fires are quite common.
- Termite mounds are very common here.
- The termites gather the detritus i.e. dead organic matter
- have a lot of cellulose and build up a mound.

L-9/5 Types of Ecosystem

Tropical Grasslands…..

- Tropical savannas have
- highly efficient system of photosynthesis.

- Burning of these grasslands
- release huge quantities of CO_2
- which is responsible for global warming.



L-9/5 Types of Ecosystem

Temperate Grasslands:-

- They are usually found on flat, gentle, sloped hills,
- winters are very cold but summers are hot and dry.
- Intense grazing and summer fires do not allow shrubs.

L-9/5 Types of Ecosystem

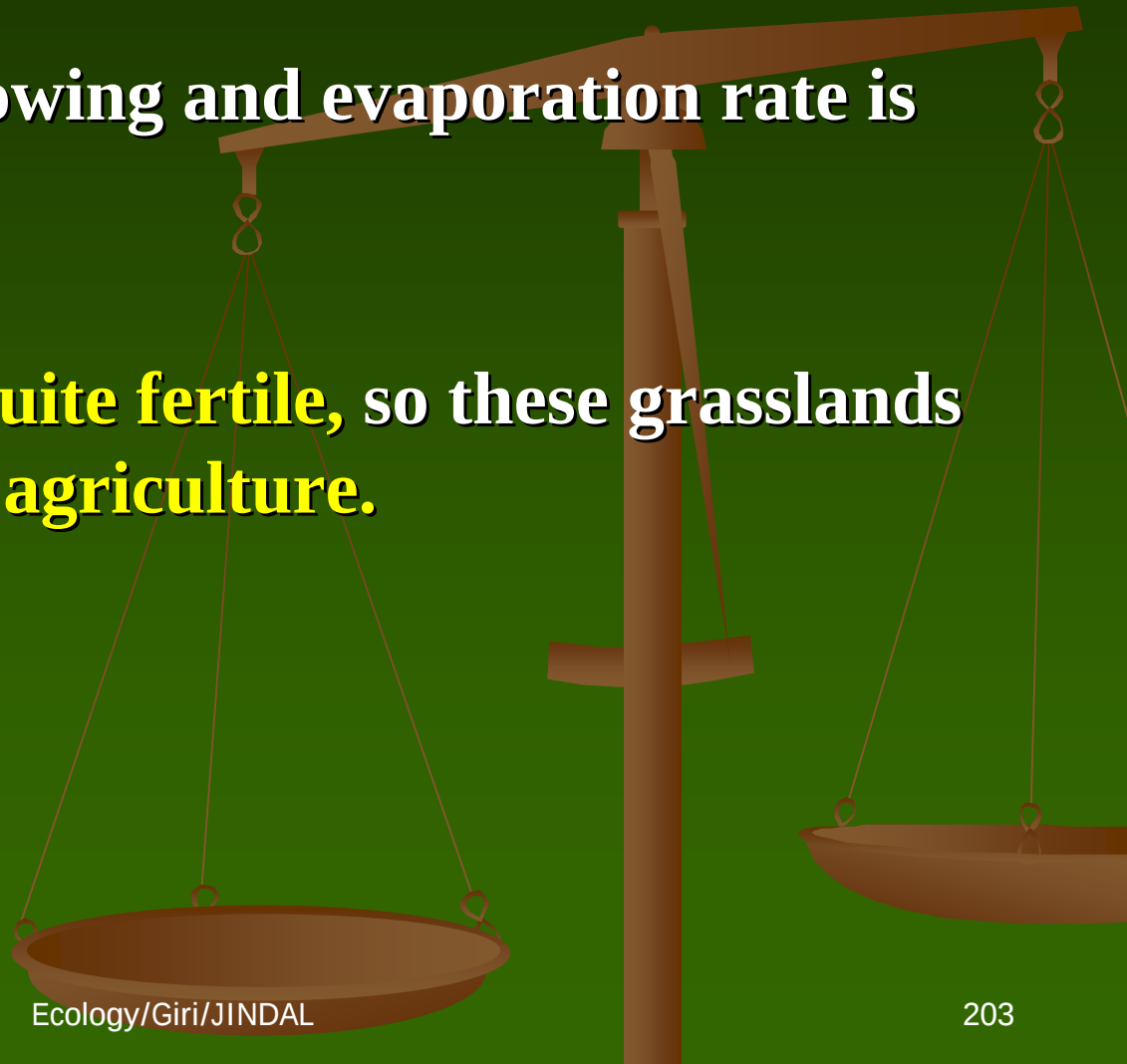
Temperate Grasslands….

- In United States and Canada these grasslands are known as Prairies,
- in South America as Pampas and in
- Asia they are known as Steppes.

L-9/5 Types of Ecosystem

Temperate Grasslands…

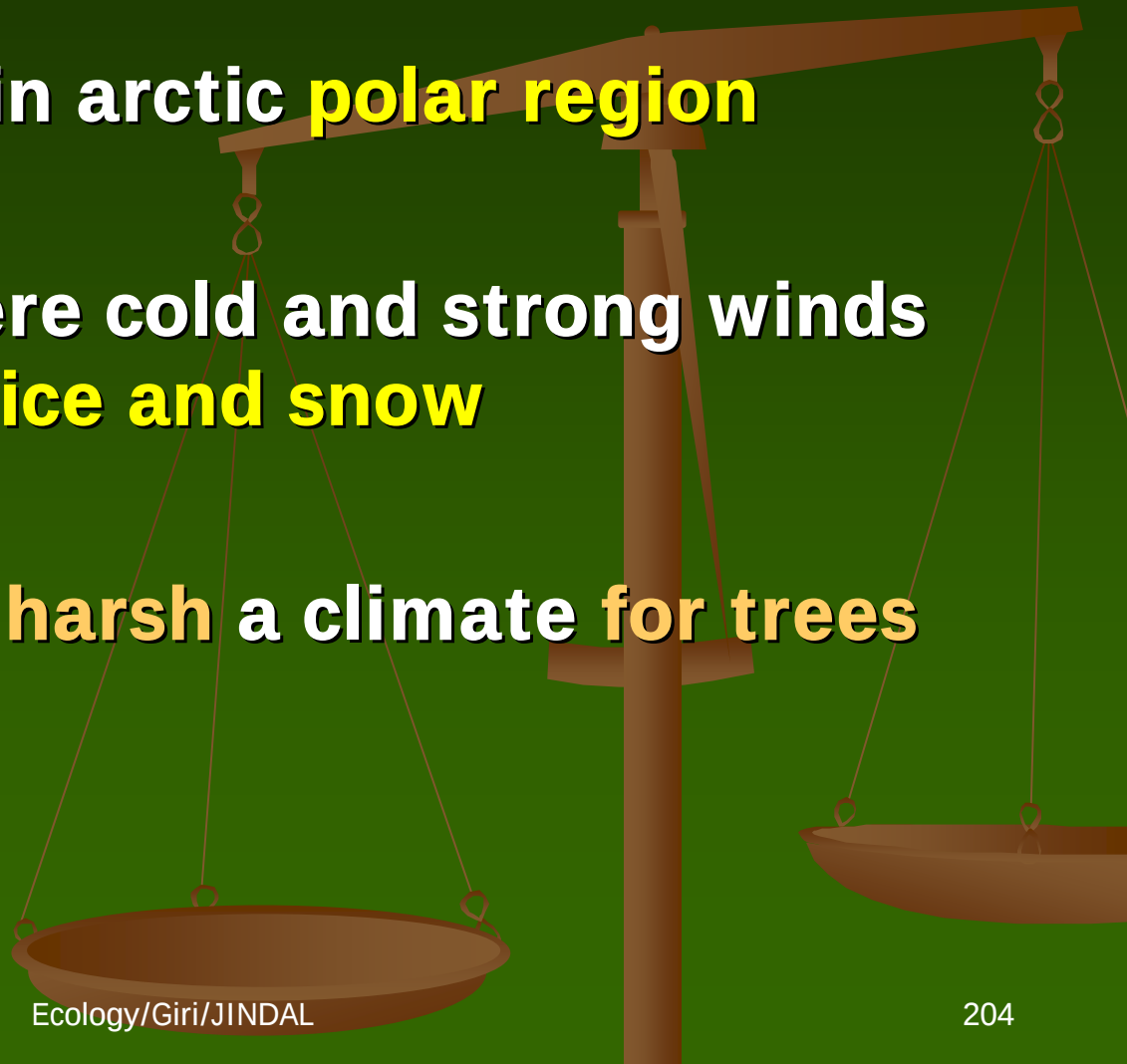
- Winds keep blowing and evaporation rate is very high.
- The soils are quite fertile, so these grasslands are cleared for agriculture.



L-9/5 Types of Ecosystem

Polar Grasslands (Arctic Tundra):-

- are found in arctic polar region
- where severe cold and strong winds along with ice and snow
- create too harsh a climate for trees to grow.



L-9/5 Types of Ecosystem

Polar Grasslands (Arctic Tundra):-

- In summers the sun shines almost round the clock.
- Several small annual plants grow in the summer.
- The animals include Arctic wolf, weasel, arctic fox, reindeer.

L-9/5 Types of Ecosystem

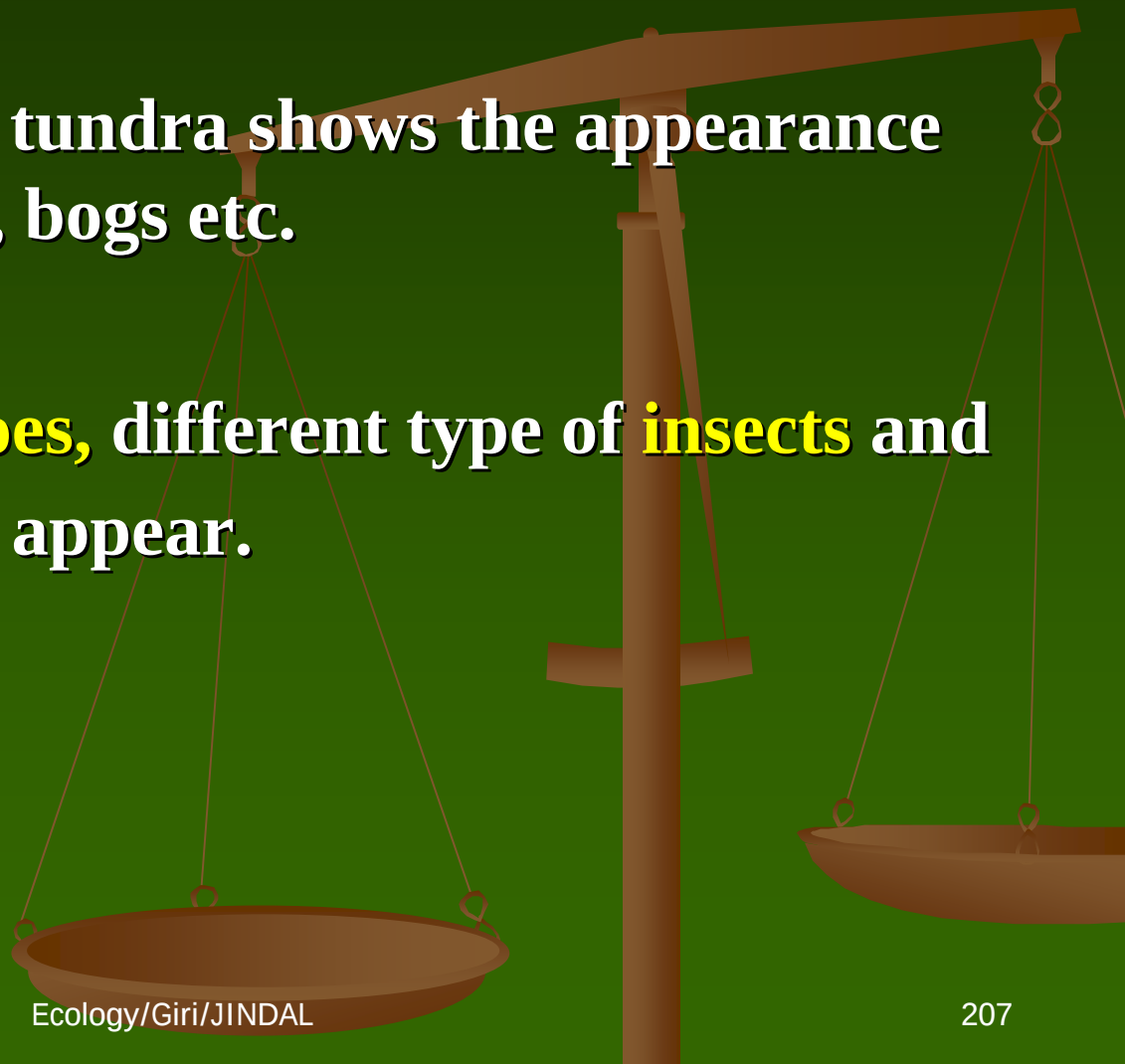
Polar Grasslands (Arctic Tundra)..

- The animals include **Arctic wolf, weasel, arctic fox, reindeer.**
- **A thick layer of ice** remains frozen under the soil surface
- throughout the year and is known as **permafrost.**

L-9/5 Types of Ecosystem

Polar Grasslands (Arctic Tundra)..

- In summer, the tundra shows the appearance of shallow lakes, bogs etc.
- where **mosquitoes,** different type of **insects** and **migratory birds** appear.



L-9/5 Types of Ecosystem

2. Aquatic Ecosystem:-

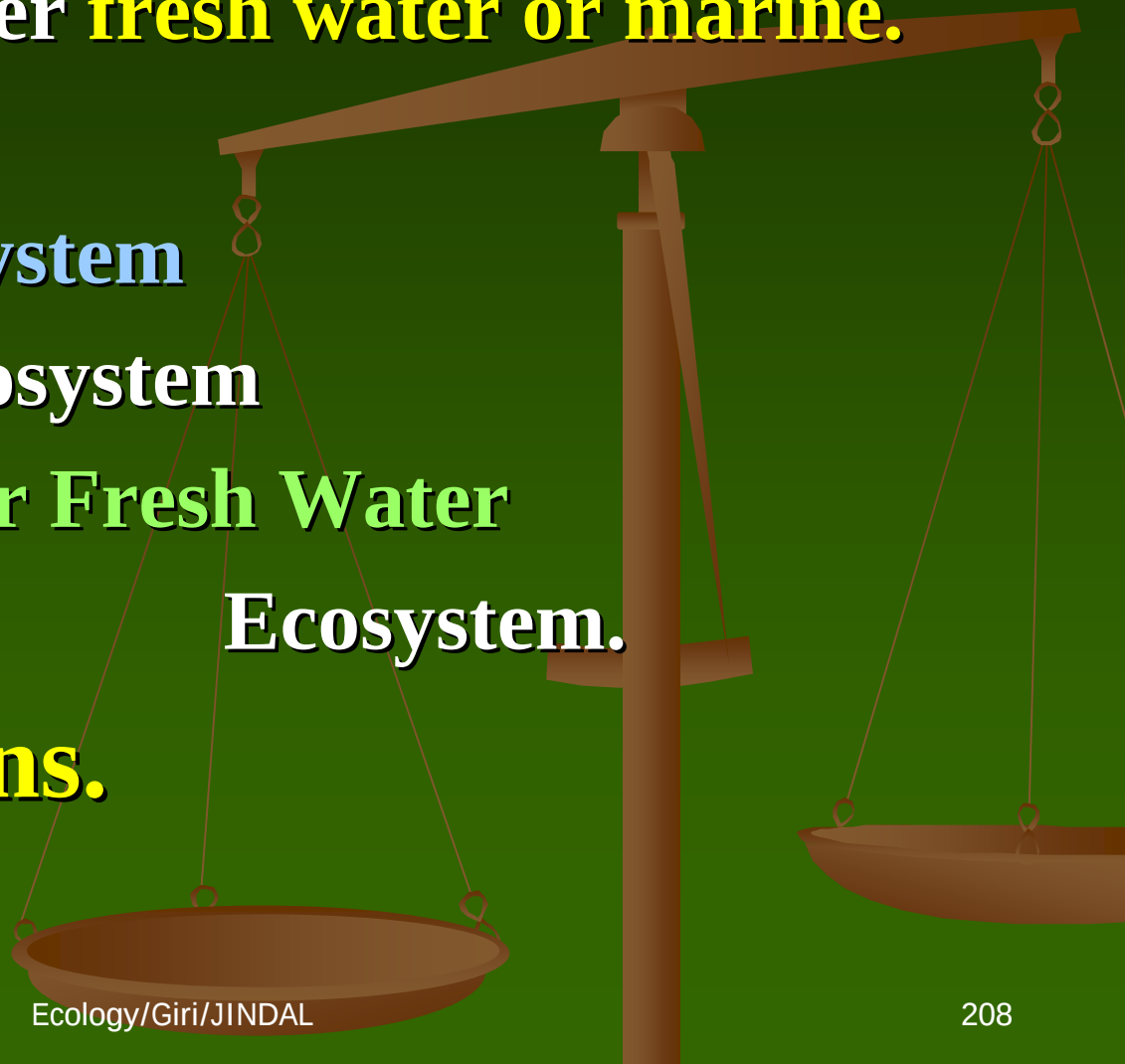
These are either fresh water or marine.

(i) Pond Ecosystem

(ii) Lake Ecosystem

(iii) Streams or Fresh Water Ecosystem.

(iv) Oceans.



L-9/5 Types of Ecosystem

Aquatic Ecosystem:-

(i) Pond Ecosystem:-

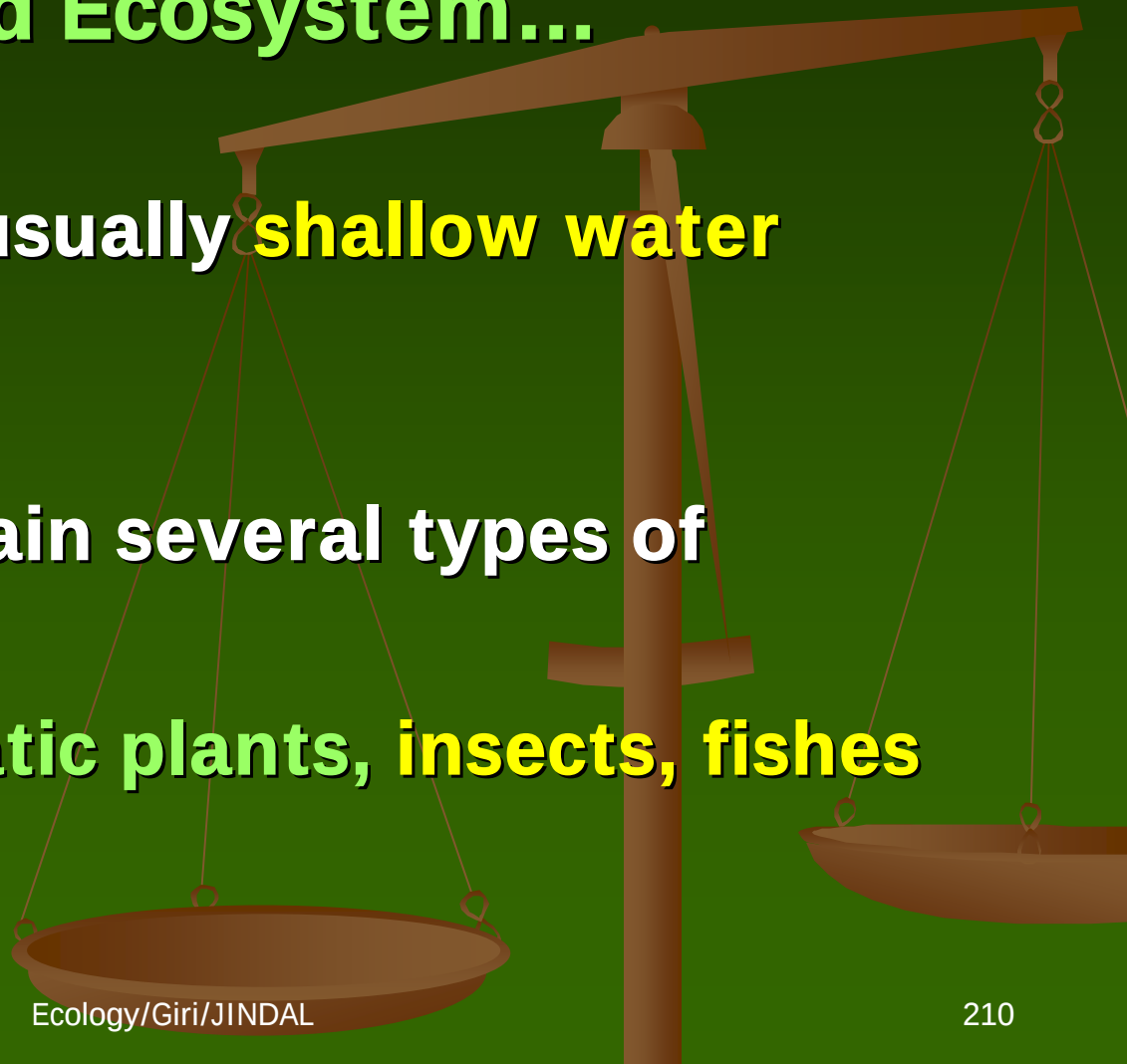
- It is small fresh water aquatic ecosystem.
- Here water is stagnant.
- Ponds have enough water during rainy season.

L-9/5 Types of Ecosystem

Aquatic Ecosystem:-

Pond Ecosystem....

- Ponds are usually shallow water bodies.
- These contain several types of
- algae, aquatic plants, insects, fishes and birds.



L-9/5 Types of Ecosystem

Aquatic Ecosystem:-

Pond Ecosystem…

- The ponds are however, very often exposed to
- tremendous anthropogenic (man – generated) pressures.
- They are used for washing cloths, bathing, swimming, cattle bathing
- and drinking etc. and therefore get polluted.

L-9/5 Types of Ecosystem

ii) Lake Ecosystem:-

- Lakes are usually big freshwater bodies with standing water.
- They have a shallow water zone called **Littoral zone.**
- An open – water zone where penetration of sunlight takes place called **Limnetic zone.**

Lake Plankton Ecosystem (GFC):

L-9/5 Types of Ecosystem

Lake Ecosystem….

…….

- **Deep bottom area where light penetration is negligible is called profundal zone.**

- **The Dal Lake in Srinagar,**
- **Naini lake in Nainital and**
- **Loktak lake in Manipur**

are some famous lakes in India.

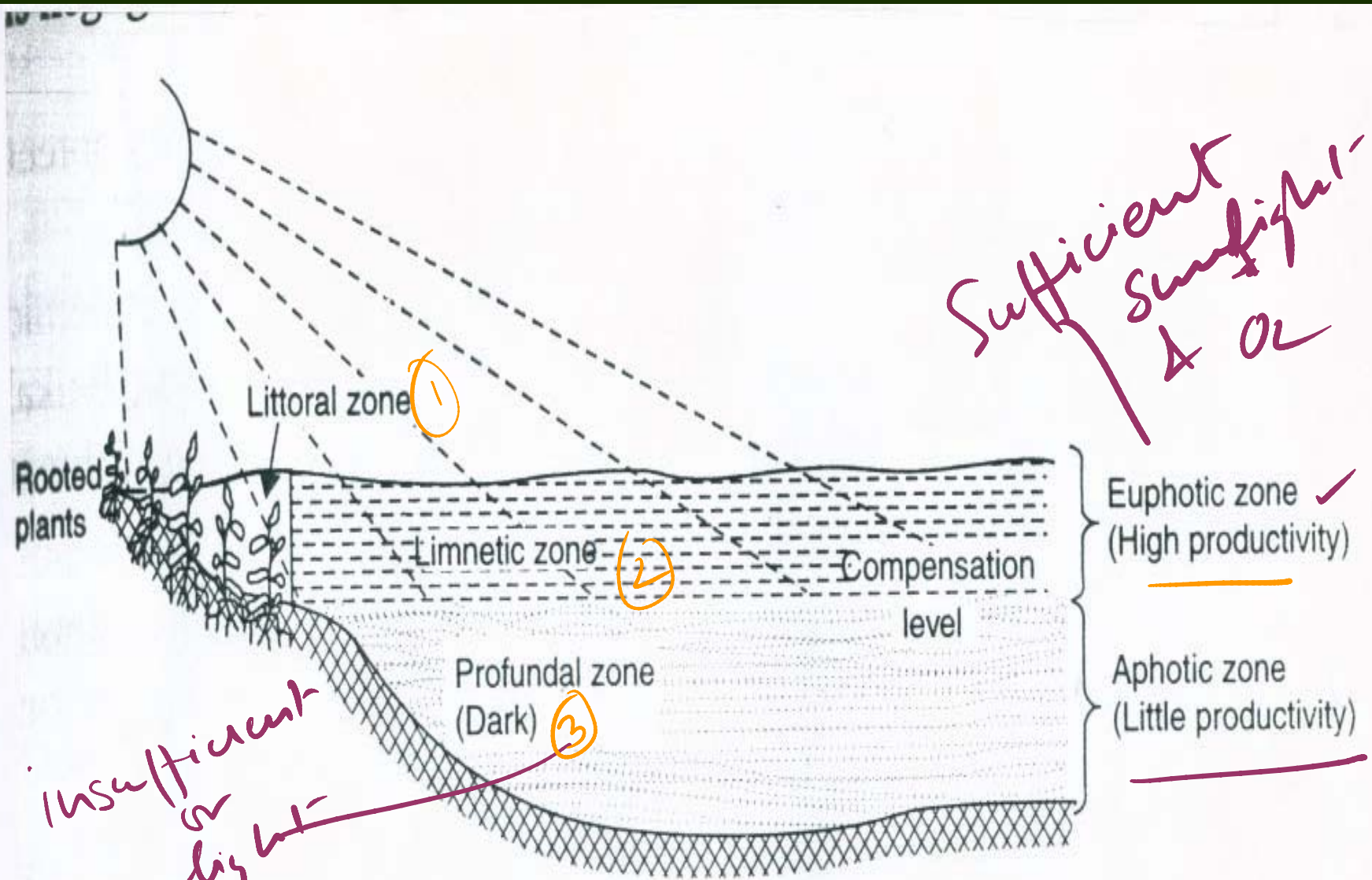


Fig. Zonation in a lake ecosystem.

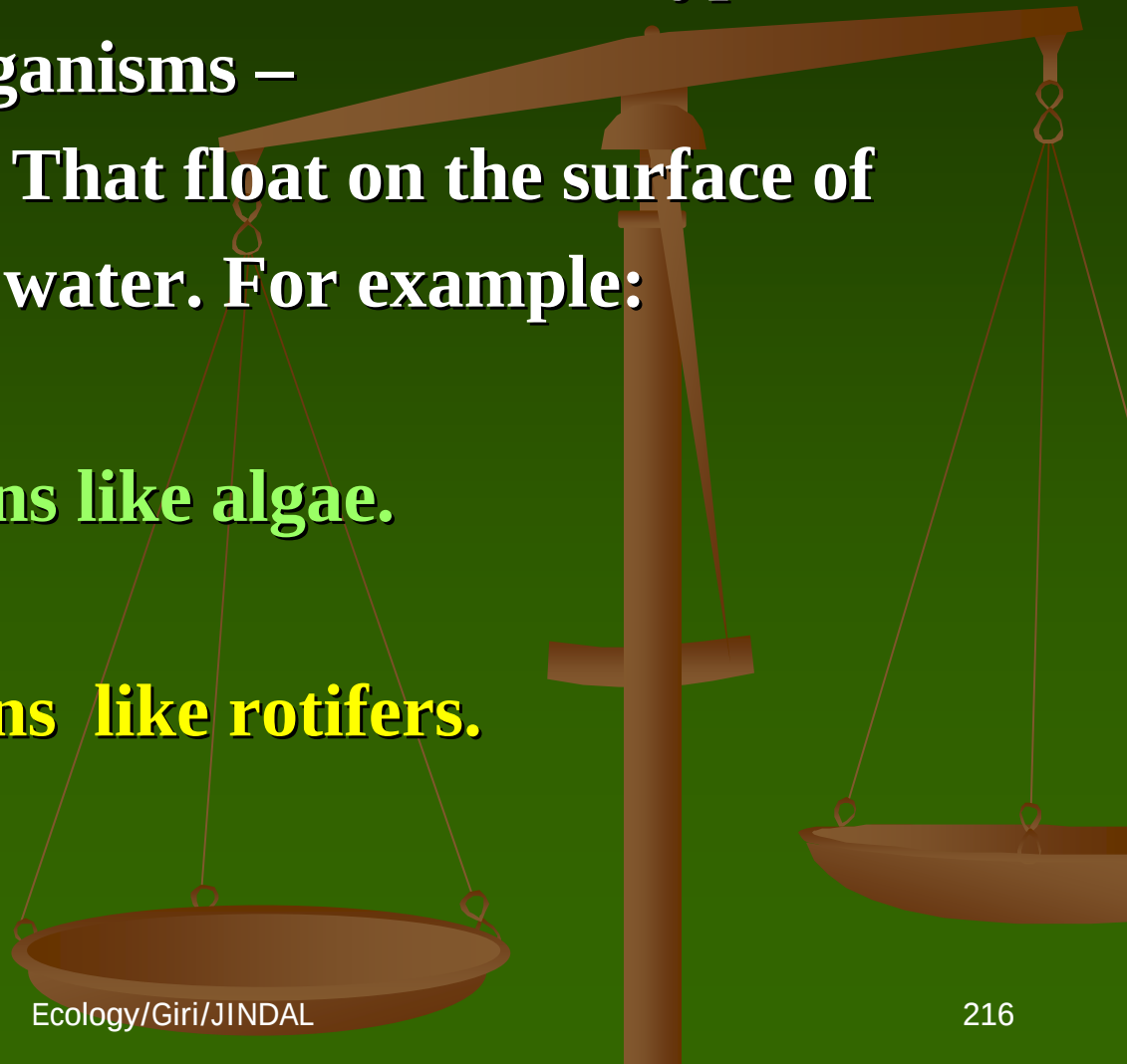
L-9/5 Types of Ecosystem

Organisms:- The lakes have several types of organisms –

(a) **Planktons** – That float on the surface of water. For example:

Phytoplanktons like algae.

Zooplanktons like rotifers.



L-9/5 Types of Ecosystem

Organisms:-

(a) Planktons –

(b) Nektons – That swim. e.g. Fishes.

(c) Neustons– That rest or swim on the surface.

(d) Benthos – That are attached to bottom sediment. e.g. Snail.

L-9/5 Types of Ecosystem

Types of Lake –

Some important types of lakes are-

- **Oligotrophic Lake** – Which have low nutrient concentration (clear water)

- **Eutrophic Lake** – Which are **overnourished** by nutrients. e.g. N_2 and P, usually as a result of **agricultural run-off.**

L-9/5 Types of Ecosystem

Types of Lake (contd.)

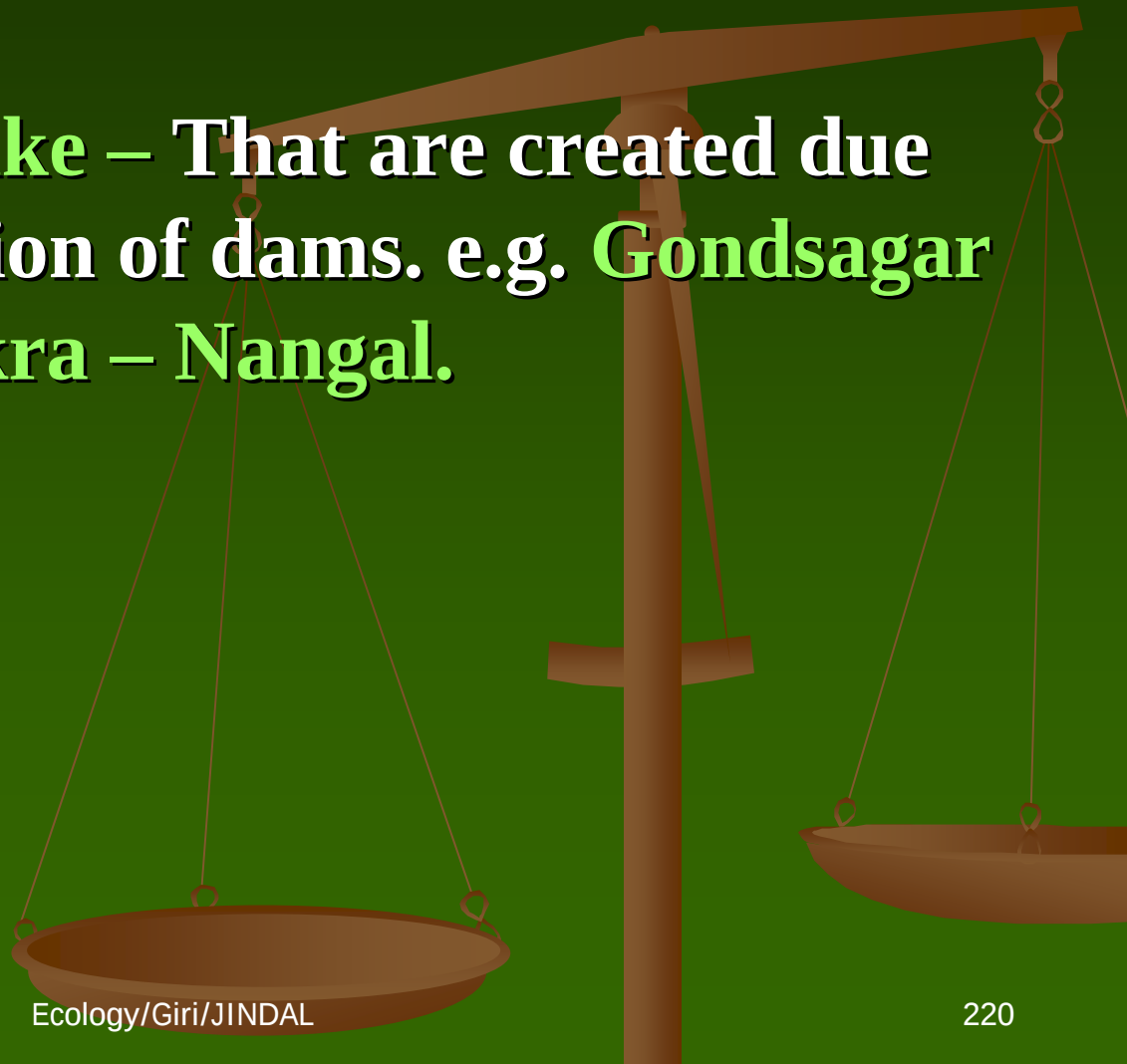
- **Endemic Lake –** The deepest lake, which is now suffering from industrial pollution.

- **Volcanic Lake –** That receive water from magma after volcanic eruptions. e.g. Many lakes in Japan.

L-9/5 Types of Ecosystem

Types of Lake (contd.)

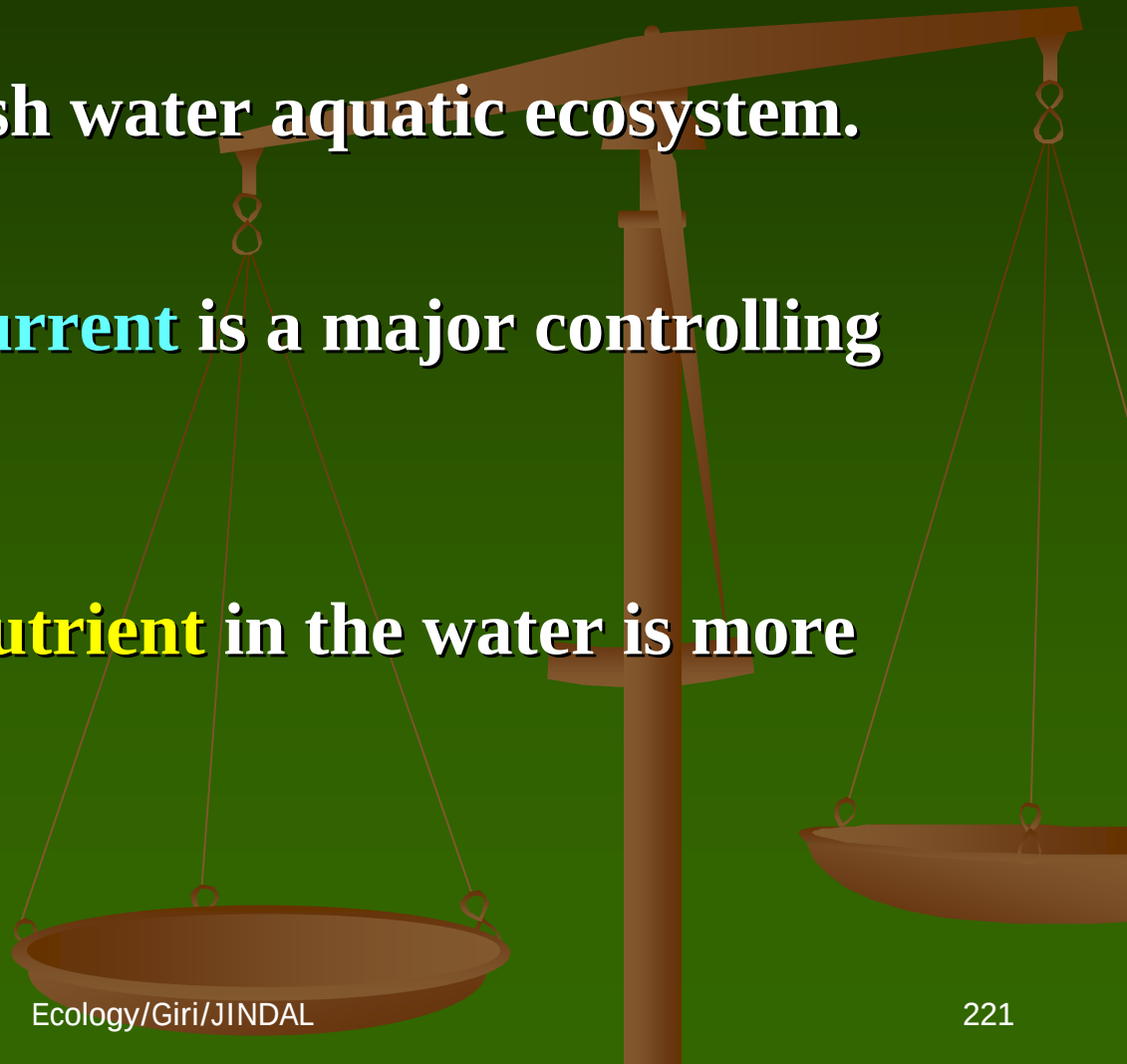
- **Artificial Lake – That are created due to construction of dams. e.g. Gondsagar lake at Bhakra – Nangal.**



L-9/5 Types of Ecosystem

Fresh Water Ecosystem or Streams:-

- These are fresh water aquatic ecosystem.
- Here water current is a major controlling factor,
- oxygen and nutrient in the water is more uniform.



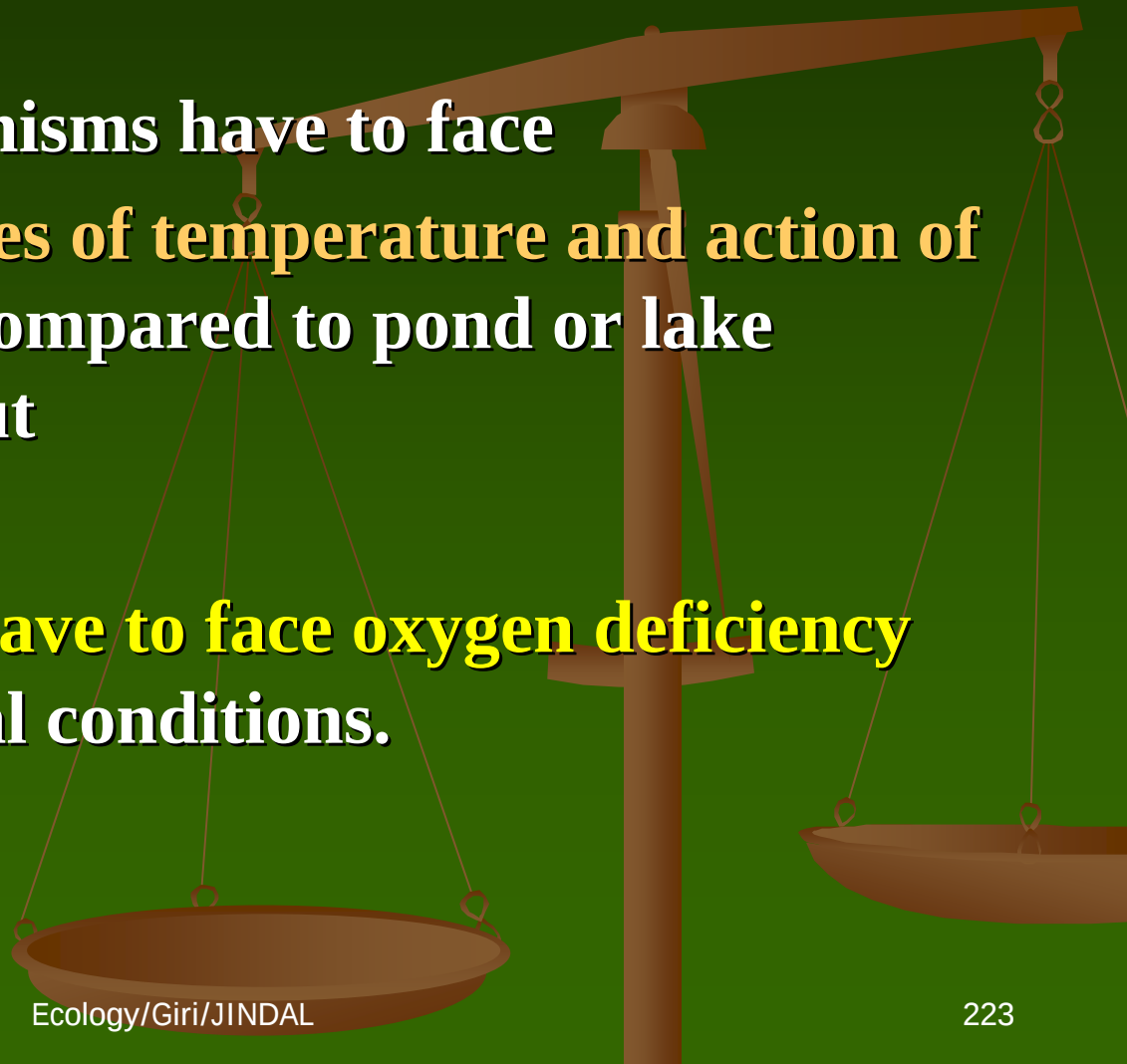
Stream Ecosystem

L-9/5 Types of Ecosystem

Fresh Water Ecosystem or Streams…

- .....
- Stream organisms have to face
- more extremes of temperature and action of currents as compared to pond or lake organisms but

- they do not have to face oxygen deficiency under natural conditions.

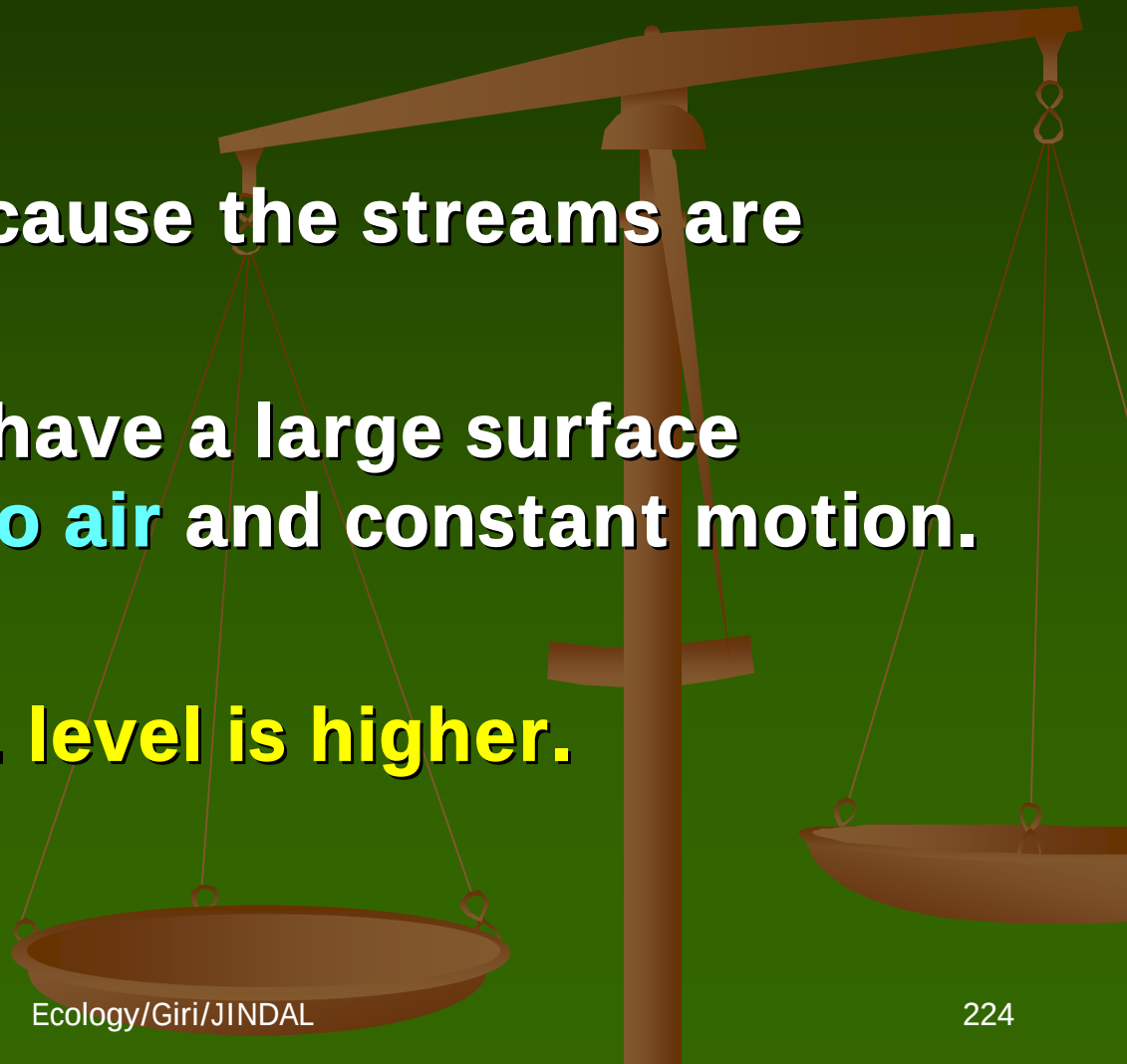


L-9/5 Types of Ecosystem

Fresh Water Ecosystem or Streams...

.....

- **This is because the streams are**
- **shallow, have a large surface exposed to air and constant motion.**
- **Their D.O. level is higher.**



L-9/5 Types of Ecosystem

River Ecosystem :-

- Rivers are large steams that
- flow downward from mountain highlands and
- flowing through the planes
- fall into the sea.
- The mountain Highland part has cold, clear waters rushing down…..

L-9/5 Types of Ecosystem

River Ecosystem :-

- The mountain Highland part has cold, clear waters rushing down as
- water falls with large amounts of D. O.
- The plants are attached to rocks and fishes are
- cold water, high oxygen requiring fish like trouts.

L-9/5 Types of Ecosystem

River Ecosystem (contd.)

In the Second Phase –

- on the gentle slopes the waters are warmer and support a
- luxuriant growth of plants and less oxygen requiring fishes.

In the Third Phase –

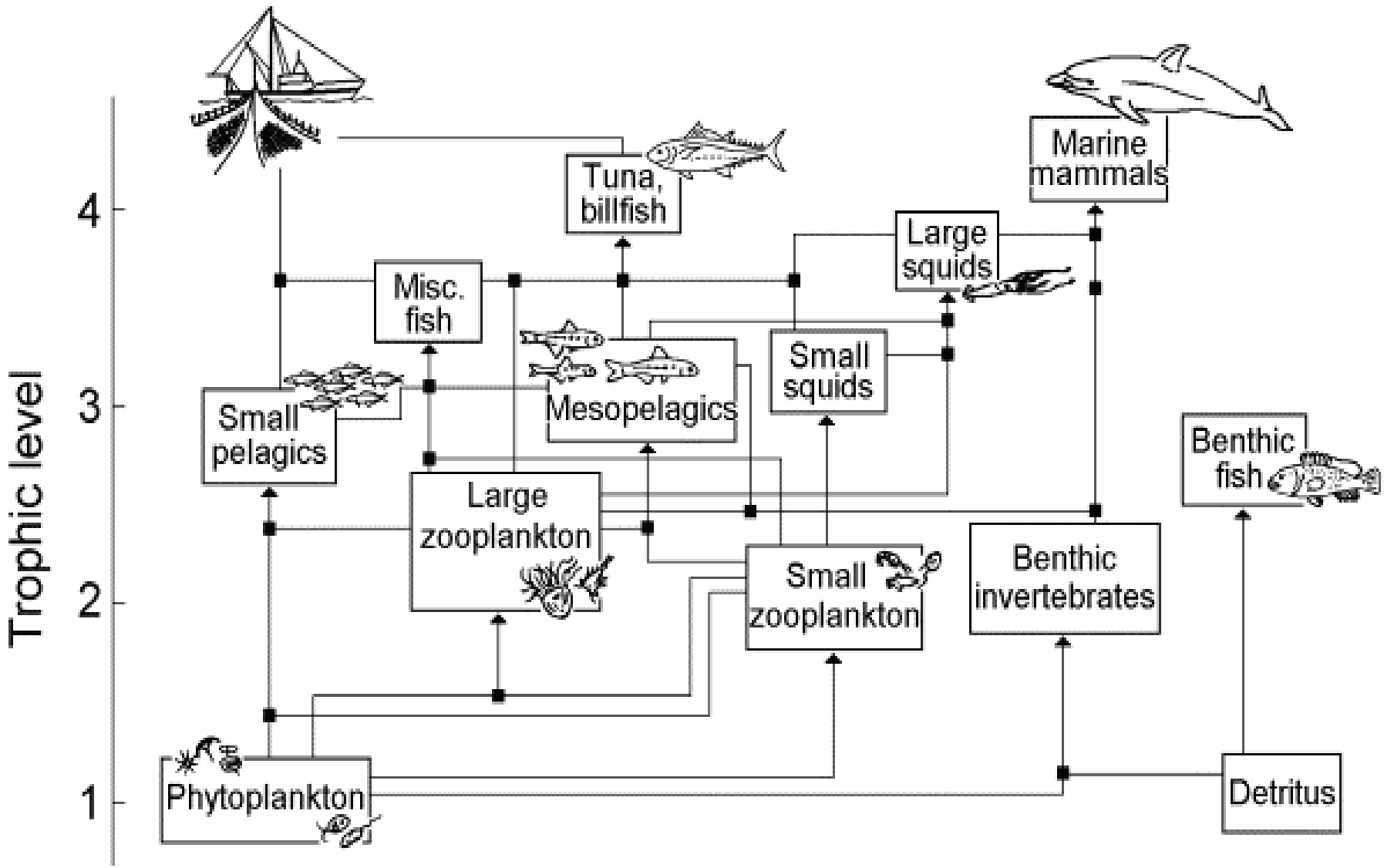
- The river water are very rich in biotic diversity.

L-9/5 Types of Ecosystem

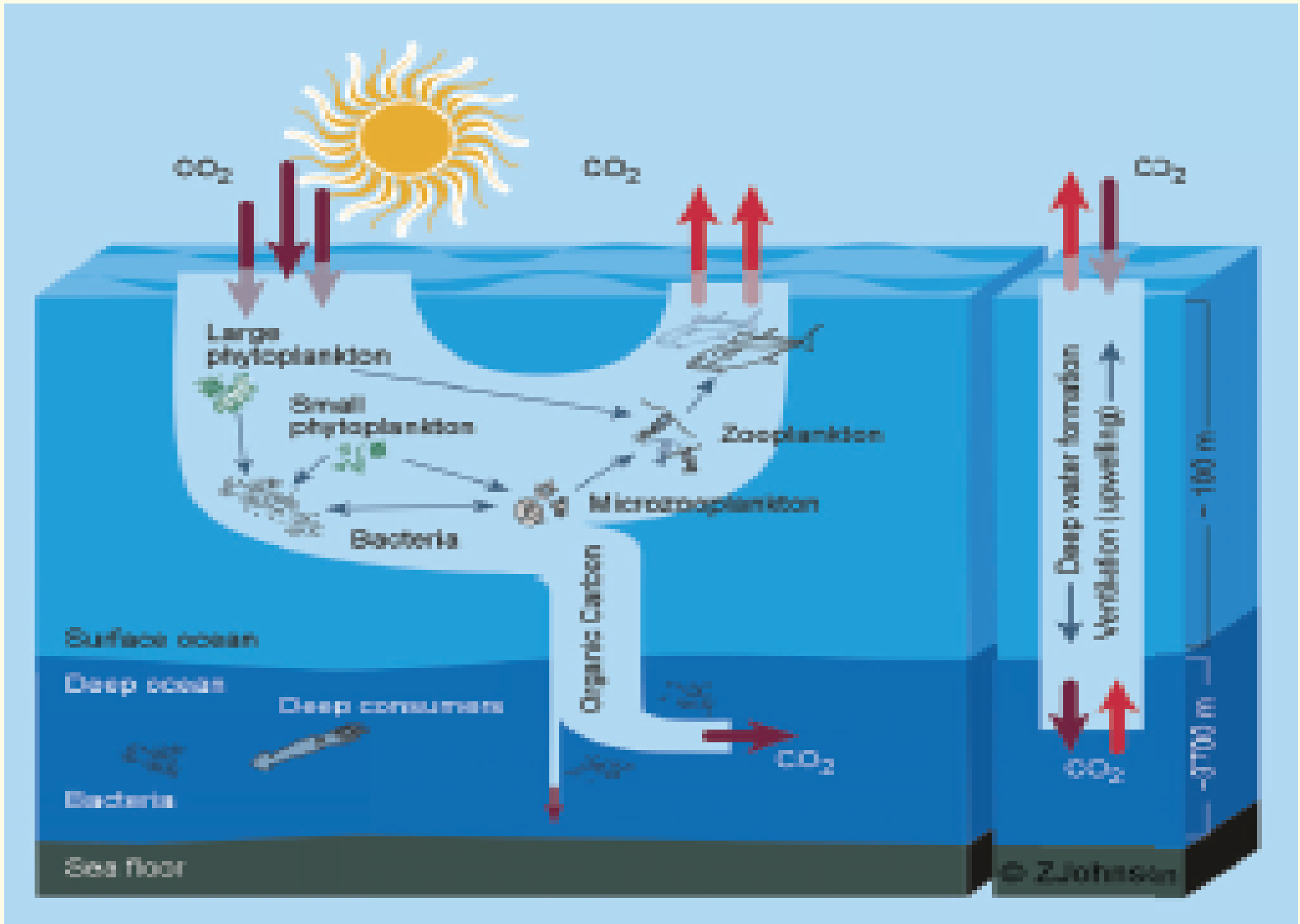
Oceans:-

- These are gigantic reservoirs of water covering
- more than 70% of our earth's surface.
- They play a key role in the survival of
- about 2,50,000 marine species, serving as food for humans and other organisms.

A simplified marine food web



A simplified open-ocean food web



L-9/5 Types of Ecosystem

Oceans….

- **Oceans provide us Fe, P, Mg, oil, natural gas, sand and gravel.**
- **Oceans are the major sinks of CO2 and play important role in**
- **regulating many biogeochemical cycles, thereby regulating the earth's climate.**

L-9/5 Types of Ecosystem

Costal Zone:- With relatively warm, nutrient rich shallow water. Due to **high nutrients** and ample sunlight this is the zone of **high primary productivity.**

Open Sea:-

- It is the deeper part of the ocean.
- It is vertically divided into three regions.

(i) **Euphotic** zone

(ii) **Bathyal** zone and

(iii) Abyssal zone.

UNIT-I ASSIGNMENT-1

Q.1. Discuss the following:

a) Components of environment

b) Components of ecosystem.

Q.2. Write in brief about

i) Environmental segments.

ii) environmental degradation.

iii) E.I.A.

Q.3. Give a brief account on

a) energy flow in eco-system.

b) Types of ecosystem.

P.T.O.

UNIT-I ASSIGNMENT-1

Q.4. Write short notes on :

a) Food chain & Food web

b) Trophic Levels & Types of Pyramids

Q.5. Explain The following :

i) Hydrological cycle

ii) Carbon cycle

iii) Nitrogen and Oxygen cycle


THANKS