Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as Deemed - to - be - University under section 3 of UGC Act 1956)

Social and Environmental Engineering

Unit 2

BIODIVERSITY

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OVERVIEW

* Overview
* Biodiversity
* Levels of biodiversity
* Biogeographical classification of India
* Values of Biodiversity
* Unit 2 Biodiversity:
* Biodiversity at global,
* national,local levels
* Hotspots of biodiversity
* Threats to biodiversity
* Conservation of
* biodiversity

* **What is biodiversity?**

* **Biodiversity** is the variation of life forms within a given ecosystem, biome or for the entire Earth.
* Biodiversity is often used as a measure of the health of biological systems

What are the levels of Biodiversity?

Biological diversity is usually considered at three different levels:

1. genetic diversity,
2. species diversity
3. ecosystem diversity.

Genetic diversity

* Genetic diversity refers to the variety of genetic information contained in all of the individual plants, animals and microorganisms.

* Genetic diversity occurs within and between populations of species as well as between species.

Genetic diversity

* Within any given species, there are several varieties or strains or races which slightly differ from each other
* No. of genes range from about 1000 in bacteria and 400,000 or more in many flowering plants.
* No two members of the same species are genetically identical.

Species diversity

* Species diversity refers to the variety of living species.

Species diversity

* About 10 – 14 million species is present
* Most of them are insects and microorganisms
* 1.8 million species is identified ,named and catalogued
* 270000-plant varieties
* 45000-vertebrates
* 950000-insects
* 10,000 new species are identified every year

Ecosystem diversity

* Ecosystem diversity

  relates to the variety of habitats, biotic communities, and ecological processes.

How will you measure species diversity?

- species richness
- species abundance
- species evenness
- taxonomic or phylogenetic diversity.

Species richness…

- In general, there are more species per unit area in the tropics than in temperate regions
- and far more species in temperate regions than there are in polar regions.

Species Evenness

- Evenness is a measure of the relative abundance of the different species making up the richness of an area.
- Evenness can be calculated as:

$$\text{Relative abundance} = \frac{\text{number of individuals of a species}}{\text{total number of individuals}}$$

Species evenness

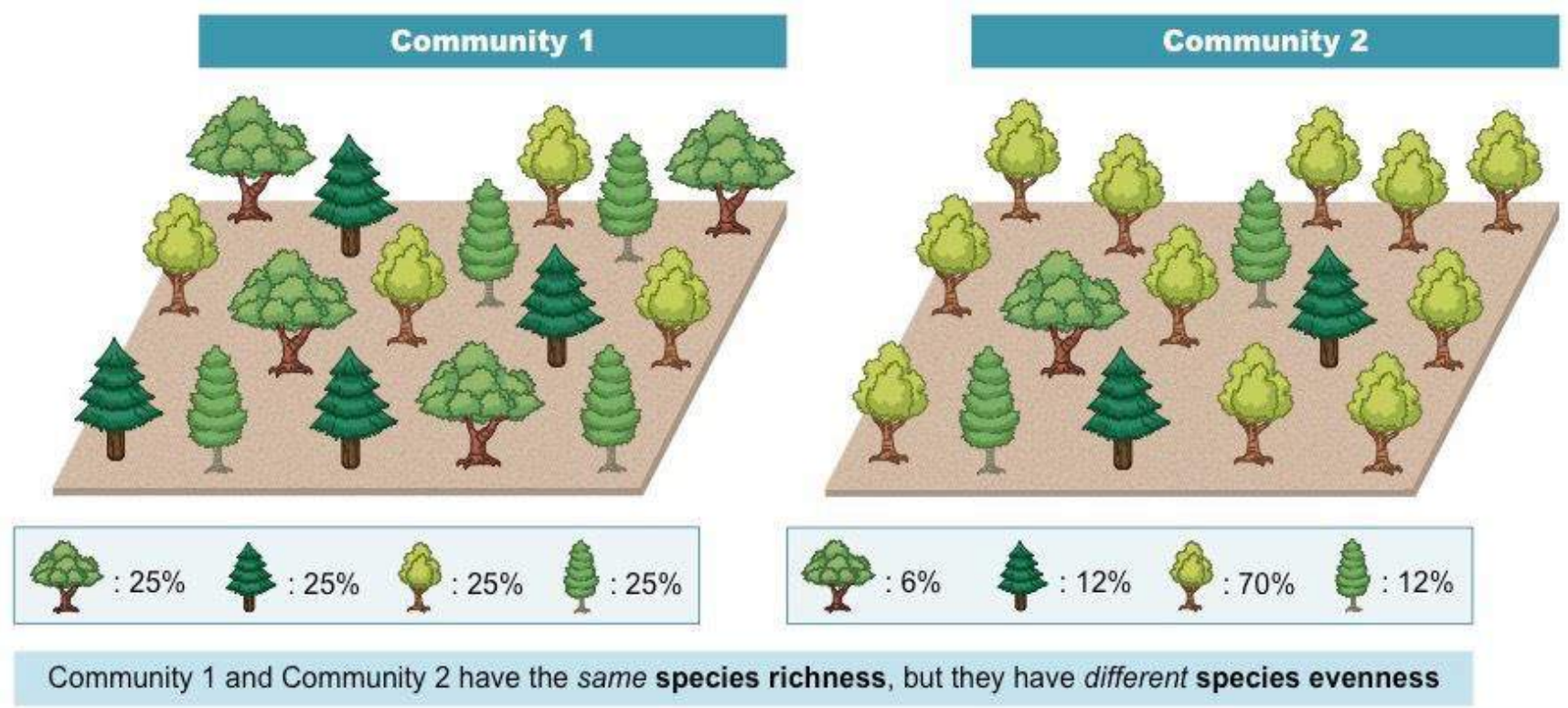
- Another measure of species diversity is the species evenness.
- Species evenness is the relative abundance with which each species is represented in an area.

Species evenness - kinds

- High species evenness

- Low species evenness

Species evenness vs richness



Species evenness…

- High species evenness

An ecosystem where all the species are represented by the same number of individuals has a high species evenness.

- Low species evenness

An ecosystem where some species are represented by many individuals, and other species are represented by very few individuals has a low species evenness.

Taxonomic or phylogenetic diversity

- Taxonomic or phylogenetic diversity considers the genetic relationships between different groups of species.

- Biodiversity is most commonly measured in taxonomic richness. For example, it is common to describe how diverse a genus or a geographic area is by counting the number of species within them.
- Phylogenetic diversity (PD), a measurement of the branch lengths in a phylogenetic tree, is a better measure of biodiversity that provides a comparable, evolutionary measure of biodiversity not possible with species counts. Despite its advantages, PD is rarely used as the primary measure of biodiversity.

WHY IS BIOLOGICAL DIVERSITY IMPORTANT?

- Today, as ever, human beings are dependent for their sustenance, health, well-being and enjoyment of life on fundamental biological systems and proces
- Humanity derives all of its food and many medicines and industrial products from the wild and domesticated components of biological diversity.

WHY IS BIOLOGICAL DIVERSITY IMPORTANT?

- Biotic resources also serve recreation and tourism

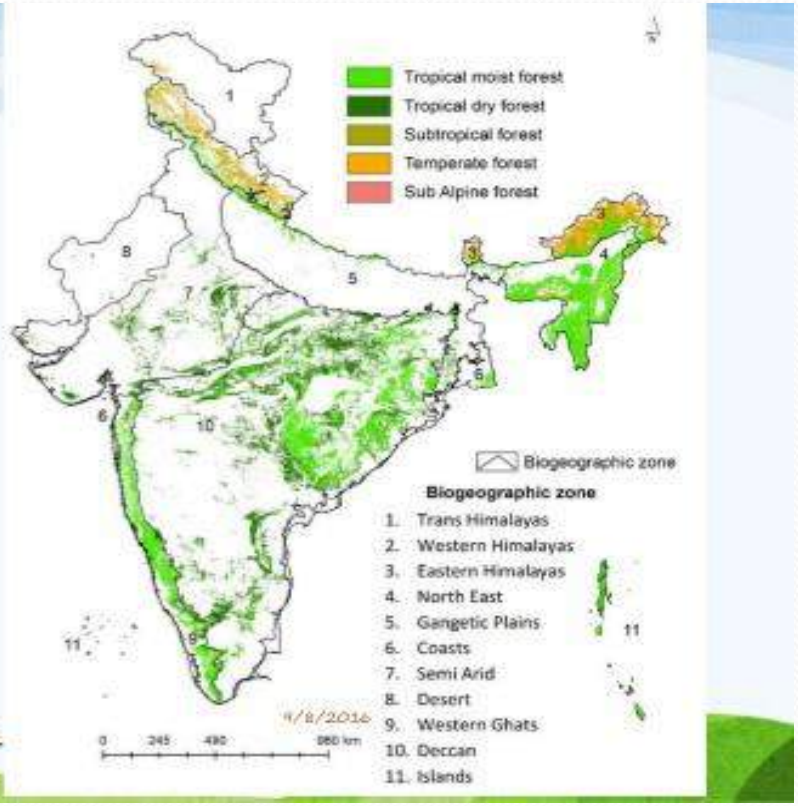
What does the biodiversity provide us?

- Soil formation
- Nutrient Cycling
- Water Regulation and Supply
- Recreation
- Climate Regulation
- Habitat
- Protection from Floods and Storms
- Food and Raw Materials
- Atmospheric Gas Regulation
- Pollination
- Weed control agents
- Pest control
- Maintaining huge genetic library

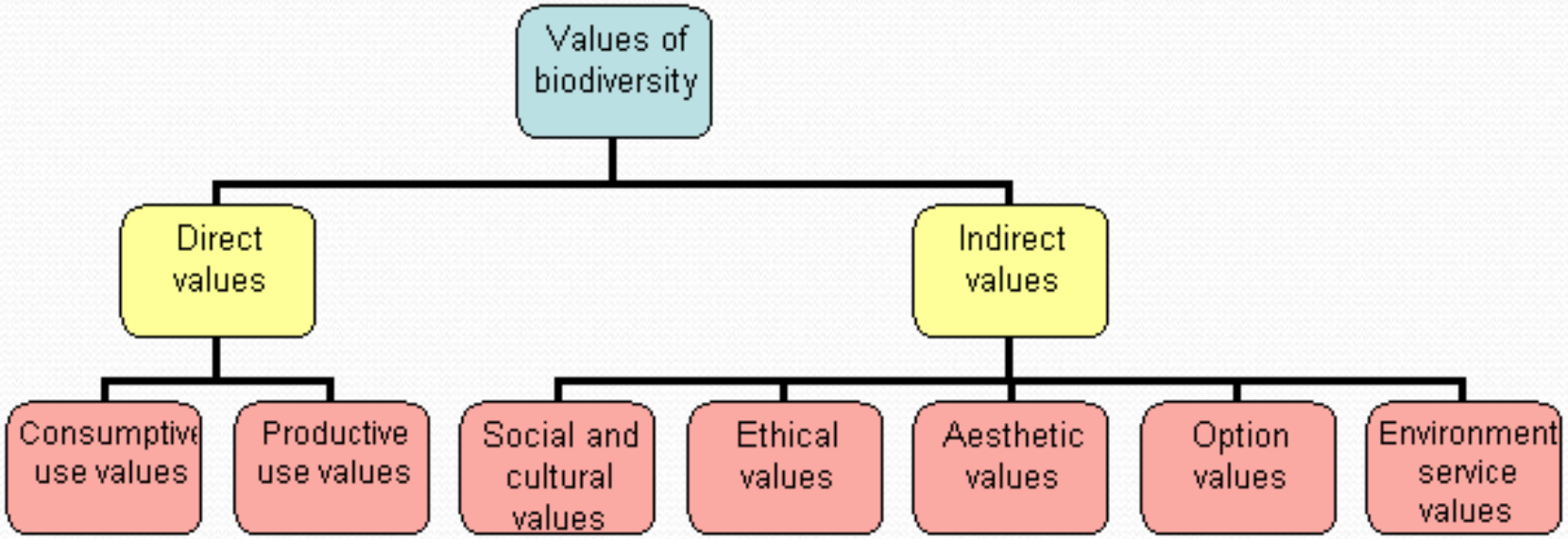
Biogeographical classification of India

OVERVIEW

- Trans Himalayan zone.
- Himalayan zone
- Desert zone.
- Semiarid zone.
- Western ghat zone.
- Deccan plateau zone.
- Gangetic plain zone.
- North east zone.
- Coastal zone.
- Islands present near the shore line.



Values of Biodiversity



Values of biodiversity

- **Direct utilitarian value**
- Biodiversity is consumed by humans as food and is used to feed stock.
- It provides materials such as timber and fibre, medicines, chemicals and genetic material.

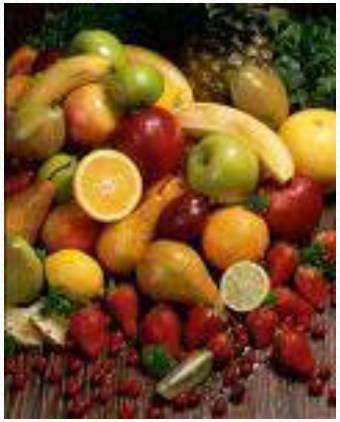
Values of biodiversity

- **Indirect utilitarian values**
- maintenance of 'ecosystem services'.
- maintaining water quality in catchments,
- moderating atmospheric processes or weather,
- conserving fertility of soil,
- maintaining coastal function,
- removing wastes from water or soil,
- maintaining evolutionary potential in ecosystems, cycling of nutrients, pest control, and pollination of crops.

Values of biodiversity

- **Consumptive use value** is usually assigned to goods consumed locally that are neither bought nor sold and therefore do not contribut economy of a country.
- This consumptive use value can also be seen in the use of fuel wood for heating and cooking
- people use **fuel wood and other forms of biomass for cooking and heating** .

Values of biodiversity



- **Productive use values** are assigned to those goods harvested from the environment, which are bought and sold locally, nationally or internationally.

- Major products include *construction timber, fuel wood, fish and shellfish, fruits and vegetables and seaweed,* to name a few.

Ethical value

EVERY SPECIES HAS A VALUE AND ROLE IN NATURE. IT HAS A RIGHT TO EXIST, WHETHER OR NOT IT IS KNOWN TO BE USEFUL TO HUMANS.

IN FACT, SINCE HUMANS HAVE GAINED SO MUCH POWER OVER NATURE, THEY SHOULD CONSERVE ALL THE SPECIES. ALL LIFE IS IMPORTANT AND MUST BE PROTECTED. IT IS THUS AN ETHICAL AND MORAL ISSUE.

Aesthetic values

- flowers,
- birds, trees or
- whales, and as
- components of natural or semi-natural landscapes such as
- **Parks, gardens,natural animal habitats,forests,mountains seashores etc.,**

Values of biodiversity

- **Future or 'option' values**

- For all of the above values, there is the added dimension of keeping options open for the future.

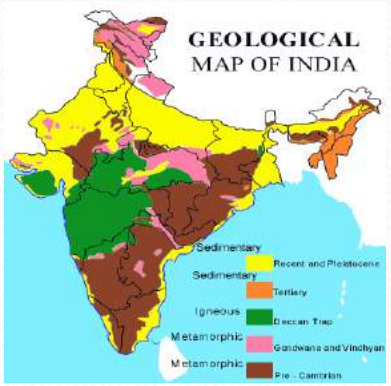
- there may be uses for species or genetic diversity yet to be discovered, such as for food or medicine.

Unit 2 Biodiversity

- Biodiversity at Global, National and local levels
- *Biodiversity is the measure of the variety of earth's animal, plant and microbial species; of genetic differences within species; and of the ecosystems that support the species. Out of an estimated 30 million species on earth, only one-sixth has been identified and authenticated in the past 200 years.*
- There are at present 1.8 million species
- known and documented by scientists
- in the world. However, scientists have
- estimated that the number of species
- of plants and animals on earth could
- vary from 1.5 to 20 billion! Thus the
- majority of species are yet to be
- discovered.

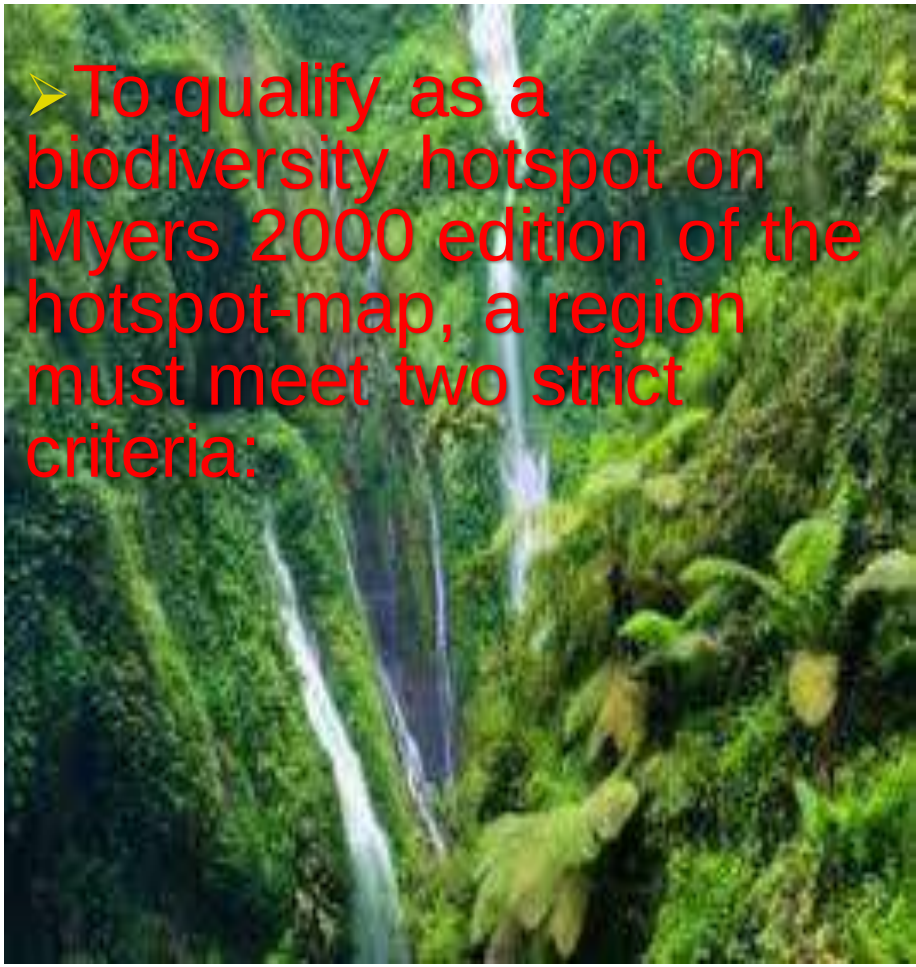
India: Megadiverity nation

- Almost all the biogeographical regions of the world are represented here in India. With a mere 2.4% of the total land area of the world, the known biodiversity of India contributes 8.22% of the known global biodiversity.
- India is one of the twelve mega-diversity nations of the world accounting for 7.31% of the global faunal and 10.88% of the global floral total species.
- Ministry of Forests and Environment (MOEF) reports that India has at present 89,317 species of fauna and 45,364 species of flora representing about 7.31% of the world fauna and 10.88% the world flora described so far.



Biodiversity hotspot

- A **biodiversity hotspot** is a biogeographic region with significant levels of **biodiversity** that is threatened with destruction.
- It must contain at least 0.5% or 1,500 species of vascular plants as endemics, and
- it has to have lost at least 70% of its primary vegetation
- **Eg.The Western Ghats and Sri Lanka**



Biodiversity hotspots

- Biodiversity hotspots are the regions which have high level of endemic species.
- https://youtu.be/-0Cdykz_wao
- https://www.youtube.com/watch?v=-0Cdykz_wao&authuser=0

- No. of biodiversity hotspots in the world: 36
- In India:4
- Himalayas, Indo-Burma, Western Ghats & Sundaland

Threats to biodiversity

- Habitat loss
- Poaching of wildlife
- Man-wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity
- Insitu Conservation
- Exsitu Conservation

Threats to biodiversity

- What are the human actions that threaten biodiversity?
- As the human population passes the 6 billion mark, we have transformed, **degraded or destroyed roughly half of the word's forests**.

  We appropriate roughly half of the world's net primary productivity for human use.
- We appropriate most available fresh water, and **we harvest virtually all of the available productivity of the oceans**. It is little wonder that species are disappearing and ecosystems are being destroyed.

Threats to biodiversity…

Causes for accelerated extinctions

- There are several causes for accelerated extinctions:
  - Loss and fragmentation of habitat - considered the number one cause
  - Commercial hunting and harvest
  - Introduction and influence of exotic species
  - Pest/predator control programs
  - Pollution
  - Loss of keystone species
  - Biological limitations of sensitive species

Habitat loss

- **Habitat destruction** (also termed **habitat loss** and **habitat** reduction) is the process by which a natural **habitat** becomes incapable of supporting its native species. The organisms that previously inhabited the site are displaced or die, thereby reducing **biodiversity** and species abundance.

Poaching of wildlife

Man – Wildlife conflict

Endangered and Endemic Species Found Only in India

- **Asiatic Lion**, Gir Forest. ...
- **Sangai Deer**, Loktak Lake. ...
- **Lion Tailed Macaque**, Western Ghats. ...
- Kashmir Stag, Kashmir Valley. ...
- **Nilgiri Tahr**, Nilgiri Hills. ...
- Purple Frog, Western Ghats. ...
- Pygmy Hog, Assam.

- # Critically Endangered animals

1. Jenkin's Shrew
2. Malabar Large Spotted Civet
3. Namdapha Flying Squirrel
4. Pygmy Hog
5. Salim Ali's Fruit Bat
6. Sumatran Rhinoceros
7. Wroughton's Free Tailed Bat

Endangered animals

- 1. Asiatic Lion
2. Asiatic Black Bear
3. Desert Cat
4. Great Indian Rhinoceros
5. Indian Elephant or Asian Elephant
6. Blue Whale
7. Capped Leaf Monkey
8. Fin Whale
9. Ganges River Dolphin
10. Hispid Hare
11. Indus River Dolphin
12. Red Panda

Endemic species

- Endemic species are animals or plants exist only in some particular areas and nowhere else in the world. In India, endemic species are mostly in Himalaya and Western Ghats. The endemic animals in India are :
  1. Lion tailed Macaque
  2. Nilgiri Langur
  3. Brown Palm Civet
  4. Nilgiri Tahr

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Sangai Deer
Located in Loktak Lake

Loktak Lake, one of the largest freshwater **lakes** in the entireworld,is **situated** at

Manipur.

Asiatic lion

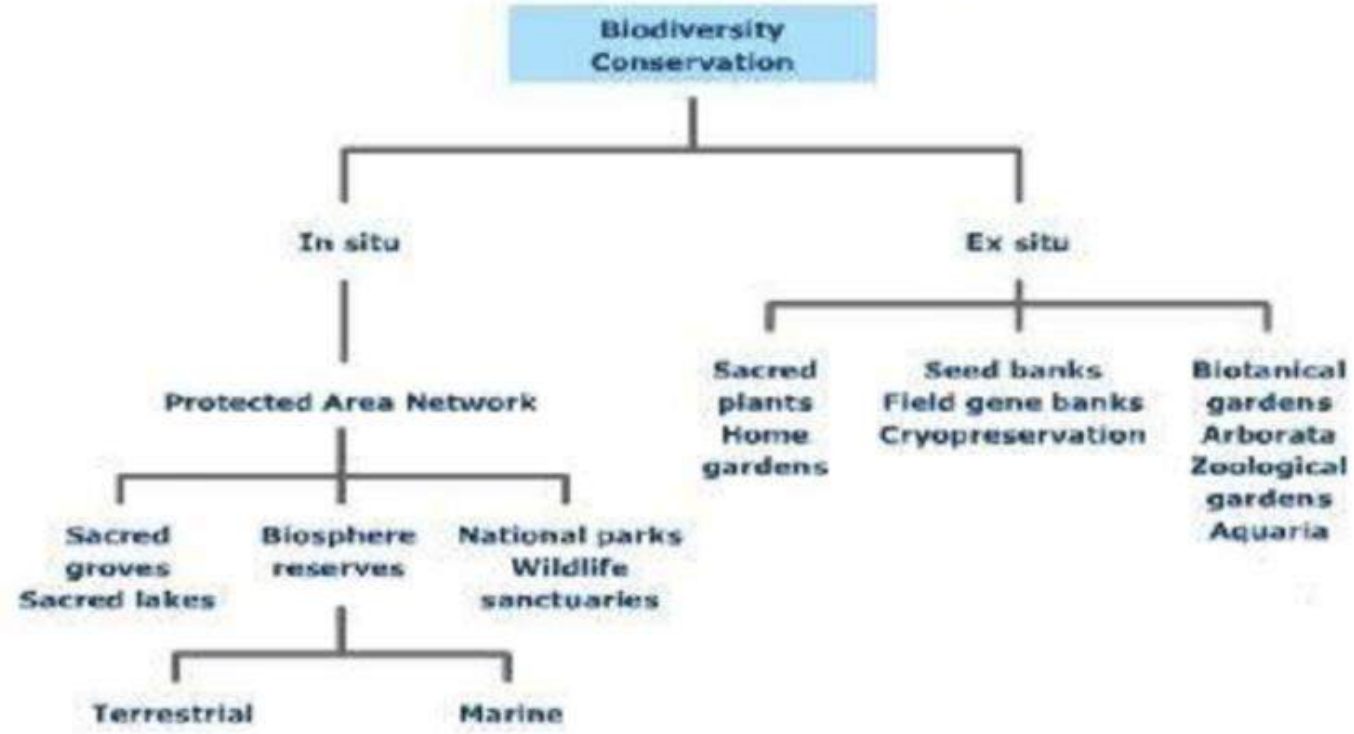
Insitu conservation

- **In-situ conservation**, which is also known as "on-site conservation", refers to the conservation of wild species in their natural habitats and environment.
- In India, the conservation of forest areas preserve through Protected Areas like:
- National Parks, Wildlife Sanctuaries and Biosphere Reserves.
- Promotions of *In-situ* conservation of Medicinal Plants is also important to the AYUSH due to its dependants on Medicinal Plants.

Ex-situ conservation

- Ex-situ conservation is the preservation of components of biological diversity outside their natural habitats.
- Some of these include:
- Gene banks, e.g. seed banks, sperm and ova banks, field banks;
- In vitro plant tissue and microbial culture collections;
- Captive breeding of animals and artificial propagation of plants,
- with possible reintroduction into the wild; and
- Collecting living organisms for zoos, aquaria, and botanic gardens
- for research and public awareness.

BIODIVERSITY CONSERVATION



Insitu:Advantages

- It doesn't involve removing species from their natural ecosystems.
- It is not as disruptive as ex situ conservation, i.e. ecological integrity is maintained.
- It involves protection of larger populations and conservation of organisms and their habitat as a whole.
- The organisms/species get the opportunity to evolve.
- Allows and facilitates scientific studies of the area.

In situ : Disadvantages

- It requires larger areas
- Animals are always under threat of several diseases or any natural disasters.
- Risk of increased inbreeding and thus reduced fitness which is known as homozygosity.
- The animal species could be less productive and thus expensive to be monitored and maintained.
- Poachers and ecological tourists may find these thriving habitats as an opportunity and may cause harm.

Ex situ:Advantages

- **Ex situ conservation**
- It involves protection of species from external threats like predation and poaching.
- Selective breeding processes are put in place.
- It involves reintroduction of several organisms that have left their natural habitat
- Improvised quality of off-springs can be obtained

Exsitu: disadvantages

- **Ex situ conservation**
- It can be considered only for a few kinds of species.
- Due to human interference, rare species remain under threat.
- Interbreeding
- Hybridization
- Captive species show divergent genetics.
- Poor germination rate.
- Costly method of conservation.
- Harm to seeds by pests.

Thank you

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Course :Social and Environmental Engineering

Course Code : U20CYHT01

Topic : Unit 5 HUMAN POPULATION AND THE ENVIRONMENT

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Human population

- **Population growth** is the **increase** in the number of individuals in a **population**. Global human **population growth** amounts to around 83 million annually, or 1.1% per year.
- Global population as on 09 March 2021: **7,850,967,949**

- Population explosion refers to the rapid and dramatic rise in world population that has occurred over the last few hundred years. Between 1959 and 2000, the world's population increased from 2.5 billion to 6.1 billion people.

TOP 20 LARGEST COUNTRIES BY POPULATION

- 1 China 1,443,162,773
- 2 India 1,389,467,378
- 3 U.S.A. 332,347,689
- 4 Indonesia 275,543,376
- 5 Pakistan 223,931,359
- 6 Brazil 213,608,591
- 7 Nigeria 209,792,241
- 8 Bangladesh 165,834,004
- 9 Russia 145,977,443
- 10 Mexico 129,878,600

- 11 Japan_____126,212,024
- 12 Ethiopia____116,999,380
- 13 Philippines__110,604,138
- 14 Egypt_____103,700,710
- 15 Vietnam_____97,948,598
- 16 D.R. Congo__91,526,681
- 17 Turkey_____84,973,001
- 18 Germany____83,968,783
- 19 Iran_____84,746,424
- 20 Thailand_____69,920,687

Variation among nations

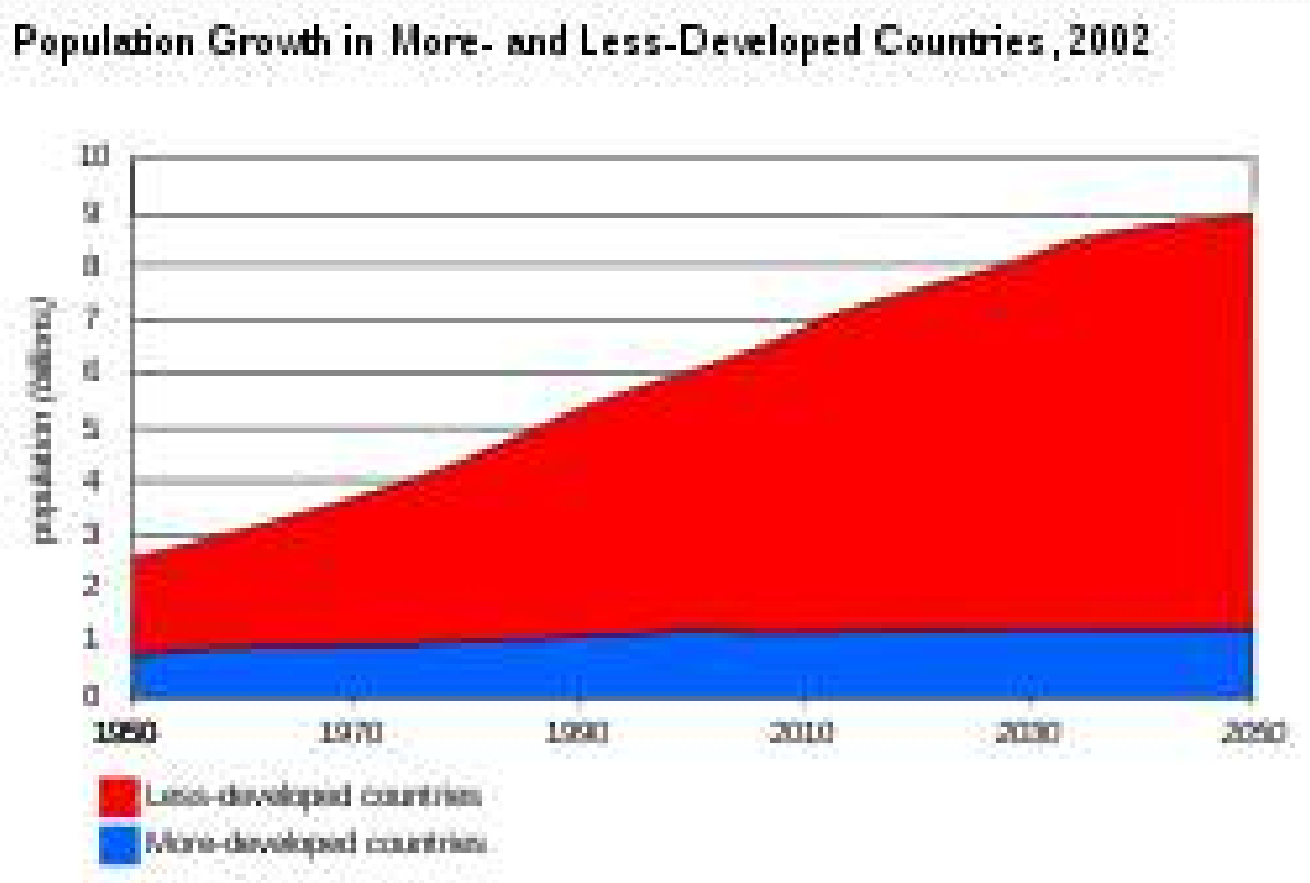
- Afghanistan and Ethiopia have high birthrates and high death rates, while Guatemala and Syria have high birth rates and low death rates. Sweden and UK are characterized by low birthrates and death rates.
- Russia and Germany have low birthrates and high death rates due to political unrest. Population density is highest in South Asia. 60% of world population depends on 30% of its land. Average density of world population is 42 persons per square km and India's density is 324 persons/sq km.

Population growth

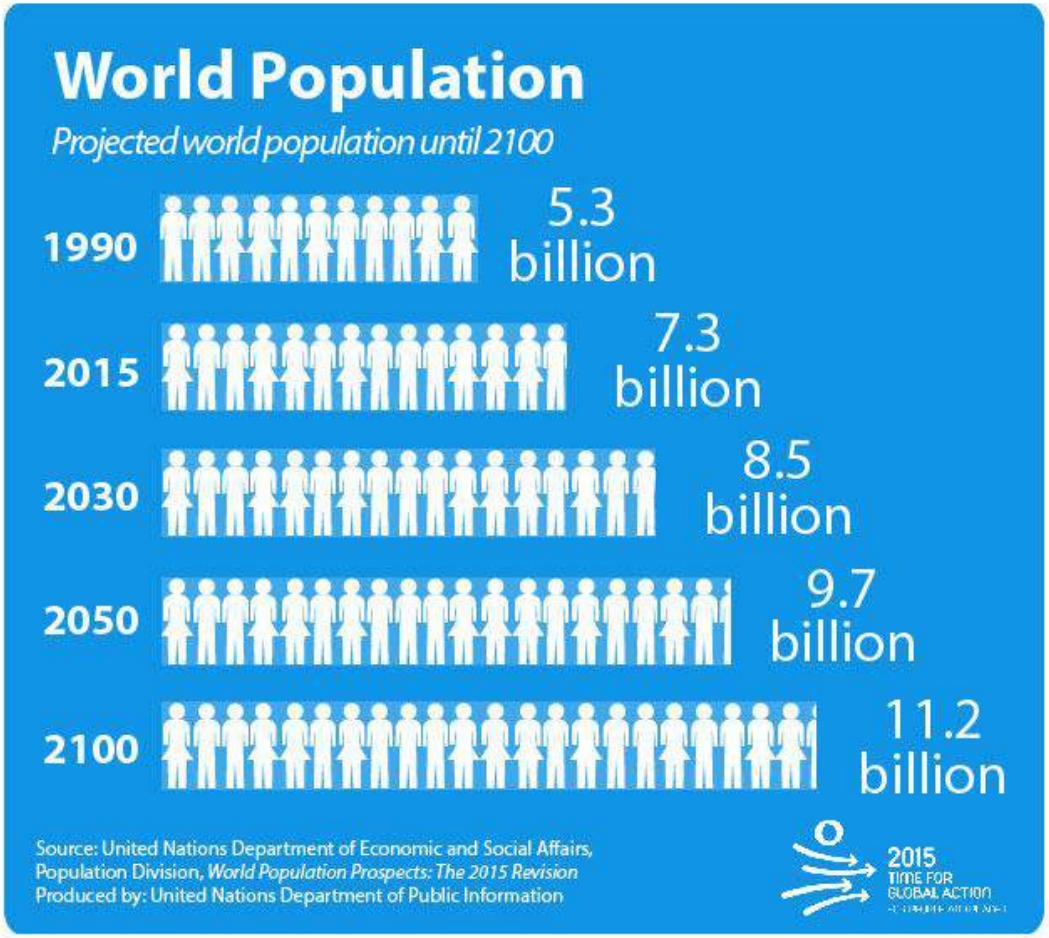
Population growth

- The factors responsible for population growth are increased fertility rate and birth rate, decreased mortality and morbidity rates. Ignorance, Illiteracy and gender discrimination are the other reasons for the growth of population.

Population Growth in More- and Less-Developed Countries, 2002



World population-Projected



- Birth rate means number of births per 1000 people in a geographical area.

- Fertility rate means number of children born per woman per life time. Zero population growth means number of births equals the number of deaths.

Human rights

- Human rights are rights inherent to all human beings, regardless of gender, nationality, place of residency, sex, ethnicity, religion, color or and other categorization.

Human rights

Human rights

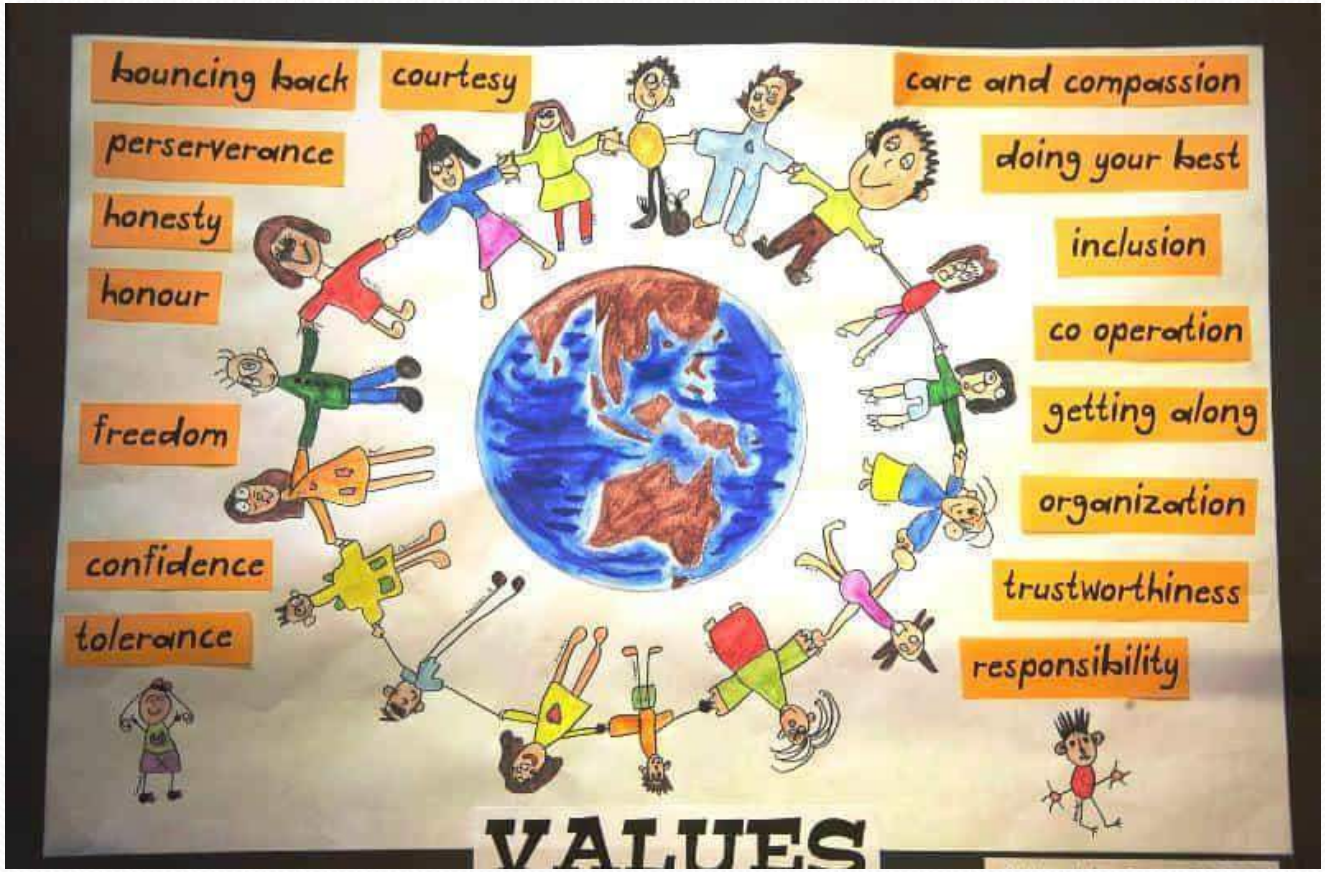
- Human rights are rights inherent to all human beings, regardless of gender, nationality, place of residency, sex, ethnicity, religion, color or and other categorization.


"To Deny People Their Human Rights
Is To Challenge Their Very Humanity."
-Nelson Mandela

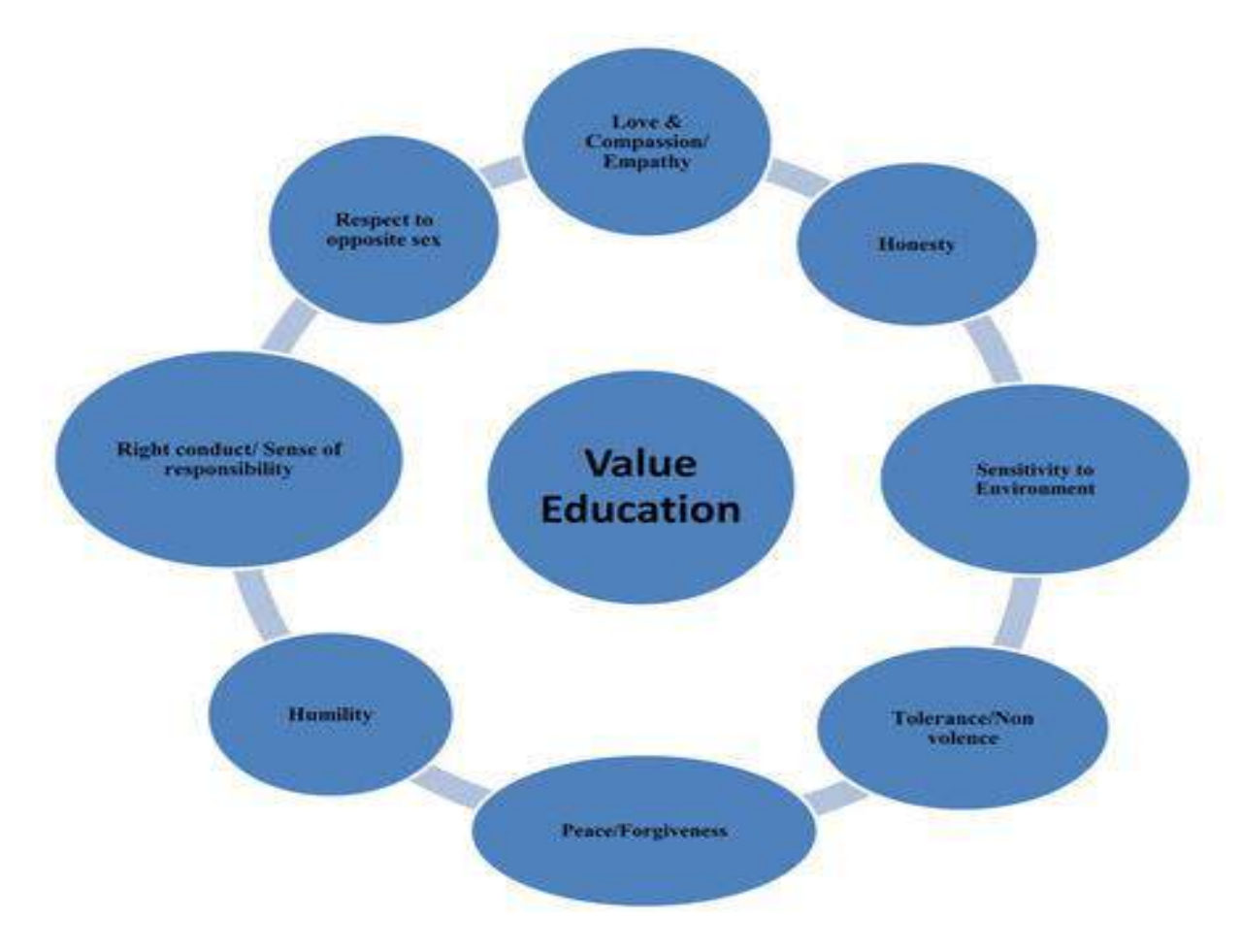
Value Education

- **Value-education is the aggregate of all the process by means of which a person develops abilities, attitudes and other forms of behaviour of the positive values in the society in which he lives.**

Value Education



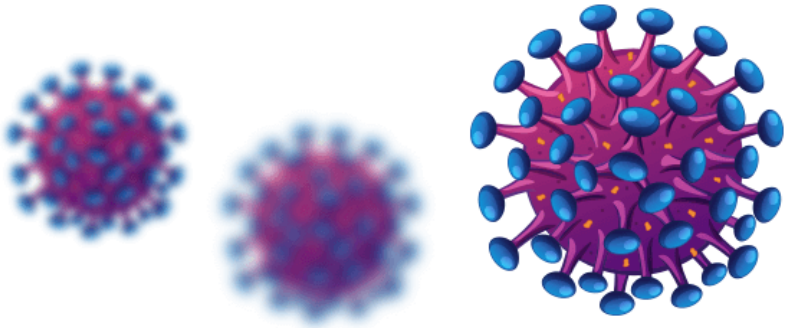
Value Education



HIV/AIDS

WHAT IS HIV?

Human Immunodeficiency Virus (HIV) is a virus that attacks cells that help the body fight infection.



There's no cure, but it is **treatable** with medicine.

HIV.gov

- HIV is a virus that attacks cells in the immune system, which is our body's natural defence against illness. The virus destroys a type of white blood cell in the immune system called a T-helper cell, and makes copies of itself inside these cells. T-helper cells are also referred to as CD4 cells.
- As HIV destroys more CD4 cells and makes more copies of itself, it gradually weakens a person's immune system. This means that someone who has HIV, and isn't taking antiretroviral treatment, will find it harder and harder to fight off infections and diseases.

- HIV continues to be a major global public health issue, having claimed almost 33 million lives so far. However, with increasing access to effective HIV prevention, diagnosis, treatment and care, including for opportunistic infections, HIV infection has become a manageable chronic health condition, enabling people living with HIV to lead long and healthy lives.

- AIDS is a set of symptoms (or syndrome as opposed to a virus) caused by HIV. A person is said to have AIDS when their immune system is too weak to fight off infection, and they develop certain defining symptoms and illnesses. This is the last stage of HIV, when the infection is very advanced, and if left untreated will lead to death.

Family welfare programme

- India launched the National Family Welfare Programme in 1951 with the objective of "reducing the birth rate to the extent necessary to stabilize the population at a level consistent with the requirement of the National economy. The Family Welfare Programme in India is recognized as a priority area, and is being implemented as a 100% Centrally sponsored programme.

Environment and human health

- air pollution can cause respiratory disease, heavy metals can cause neurotoxicity, global climate change is likely to fuel the spread of infectious diseases.
- . Environmental health issues traditionally have been addressed at the international level within the context of such issues as ozone depletion, climate change, and biodiversity. Countries have tried to address these issues through the multilateral process, such as multilateral agreements and commissions, bilateral assistance and cooperation.

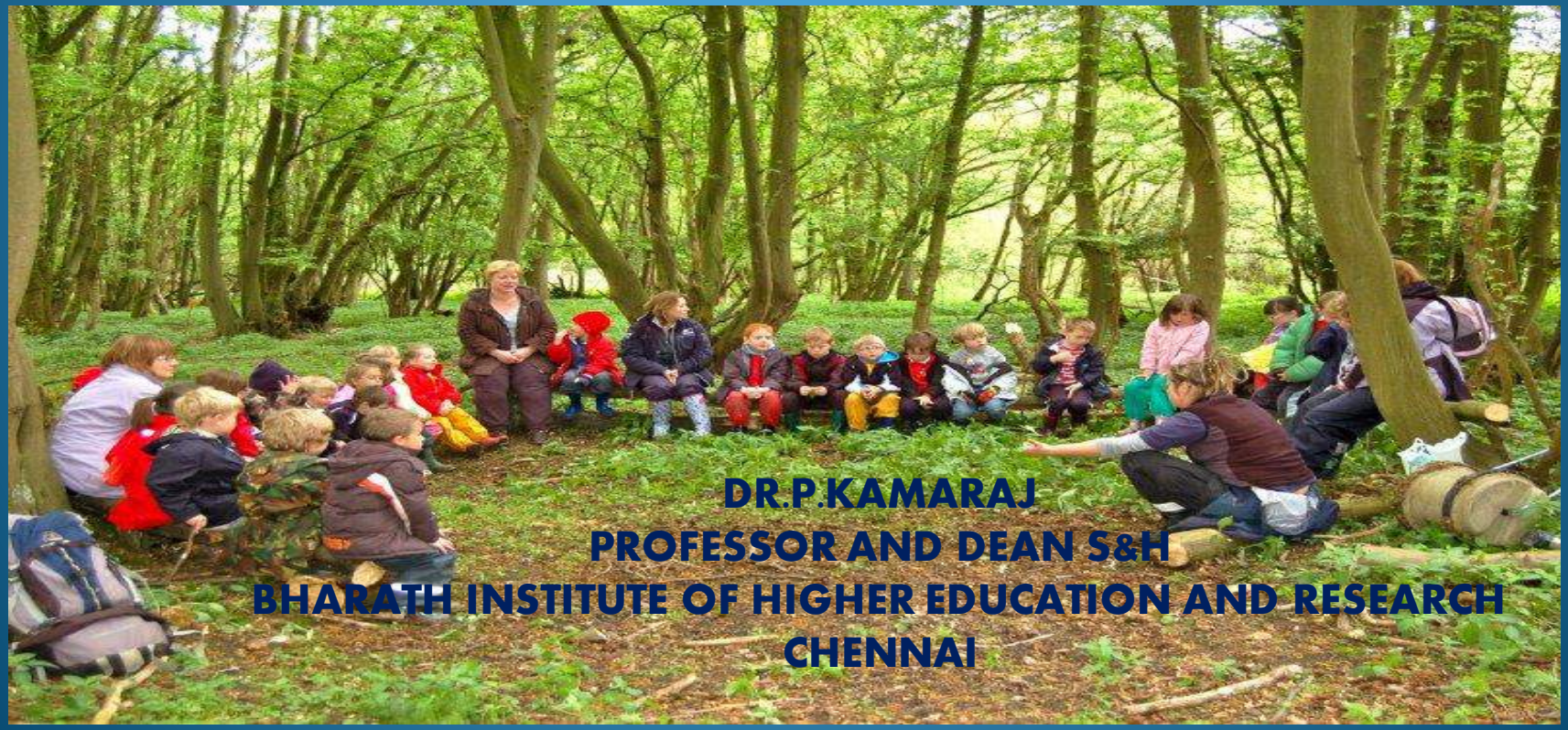
Thank you

U20CYHT01

Social and Environmental Engineering

Unit 1 Environment and Ecosystems

DR.P.KAMARAJ, PROFESSOR & DEAN S&H,BIHER



Environment

- The environment can be defined as a sum total of all the living and non-living elements and their effects which influence human life. While all living or biotic elements are animals, plants, forests, fisheries, and birds, etc. The non-living or abiotic elements include water, land, sunlight, rocks, and air, etc.

Ecosystem

- Ecosystem is a community or group of living organisms that live in and interact with each other in a specific environment.

- For instance, tropical forest is an ecosystem made up of living beings such as trees, plants, insects or animals, micro-organisms that are in constant interaction between themselves and that are affected by other physical (sun, temperature) or chemical (oxygen or nutrients) components.

Scope and Importance of Environment

- **Environment** plays an **important** role in healthy living and the existence of life on planet earth. Earth is a home for different living species and we all are dependent on the **environment** for food, air, water, and other needs. Therefore, it is **important** for every individual to save and protect our **environment**.

- The ecosystem (all the communities of living organisms found in a specific place, their habitats and their interactions) in which we live provides natural services for humans and all other species that are essential to our health, quality of life and survival.
- For example, our forests remove carbon dioxide and other pollutants from the air we breathe and also cool our air temperatures, reducing the formation of ground-level ozone, a pollutant that can cause heart and lung problems to worsen;
- our wetlands store storm water, filter and make harmless storm water pollutants, and recharge our aquifers (where most of us get our drinking water) with these filtered waters.

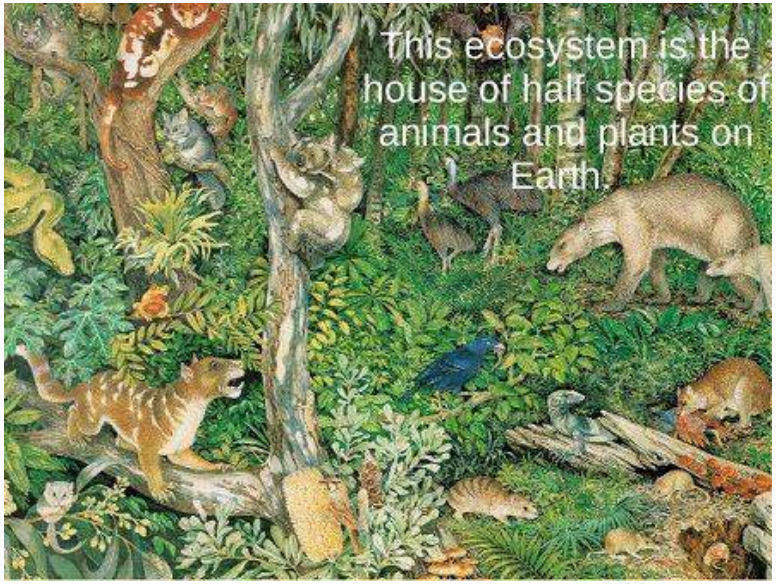
Public awareness

- **Public awareness** plays an important role in the prevention of environmental degradation. Mobilising the masses into taking action when government and state policies fail is essential because of the alarming rate at which climate change and pollution are harming the world.

Types of ecosytem

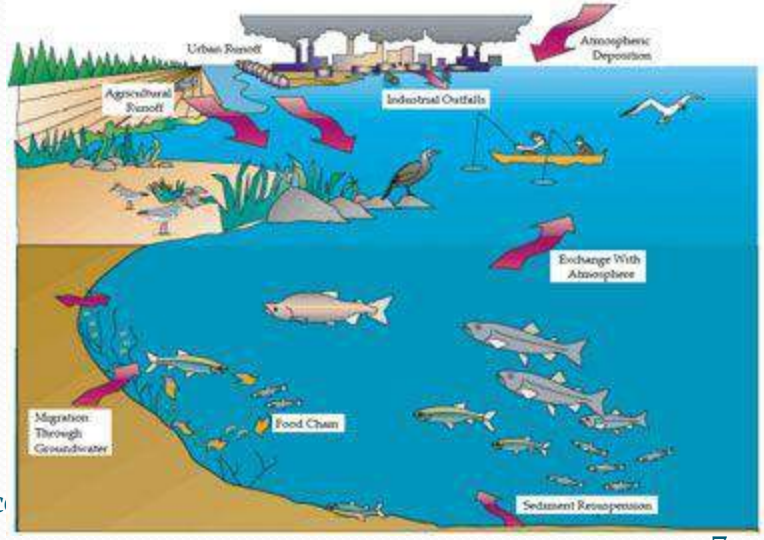
1.Terrestrial ecosystems

(deserts, grasslands and forests)

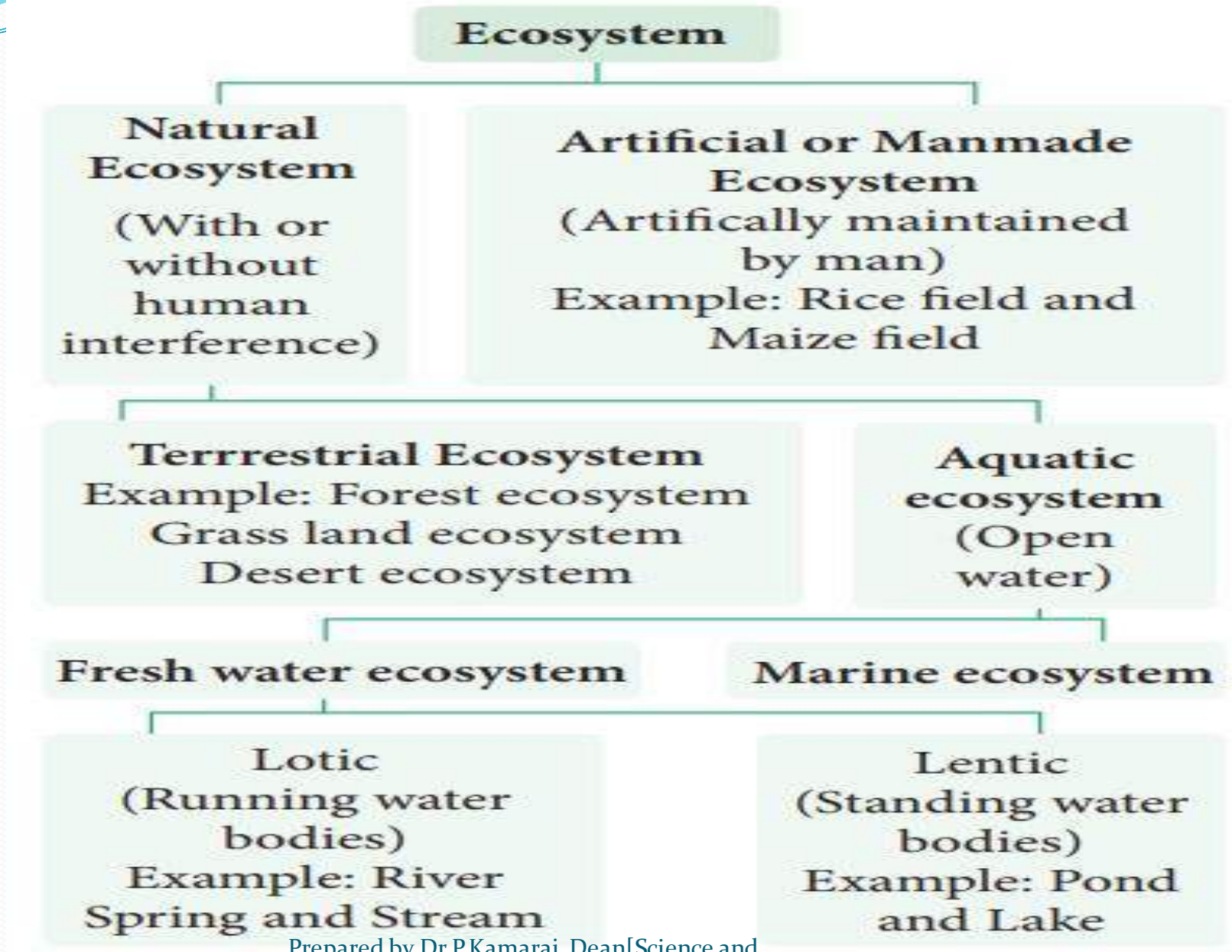


2.Aquatic ecosystems

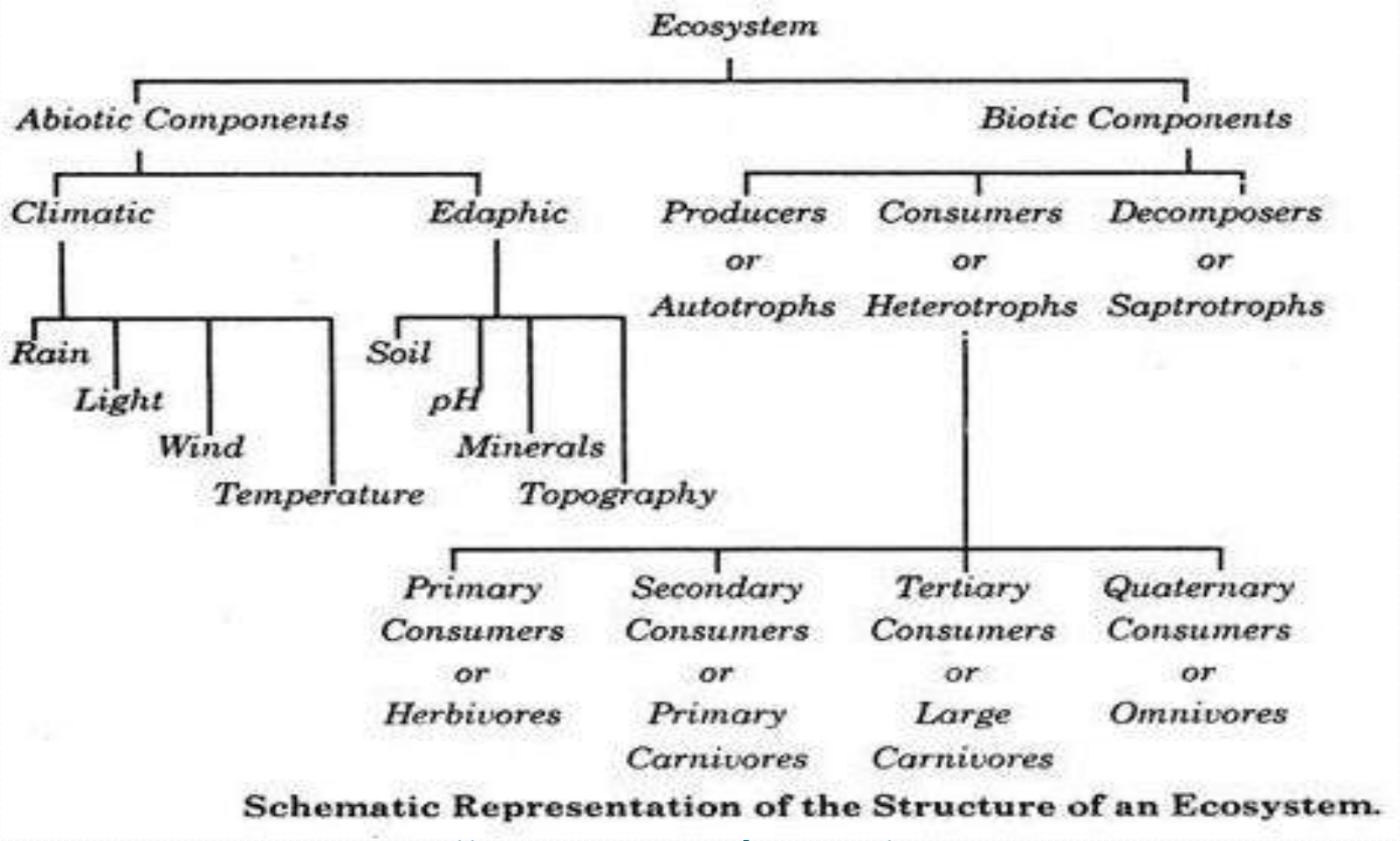
(Marine , Fresh water)



Ecosystem-structure and function


Ecosystem
Natural Ecosystem
(With or without human interference)
Artificial or Manmade Ecosystem
(Artifically maintained by man)
Example: Rice field and Maize field
Terrrestrial Ecosystem
Example: Forest ecosystem
Grass land ecosystem
Desert ecosystem
Aquatic ecosystem
(Open water)
Fresh water ecosystem
Marine ecosystem
Lotic
(Running water bodies)
Example: River Spring and Stream
Lentic
(Standing water bodies)
Example: Pond and Lake

structure



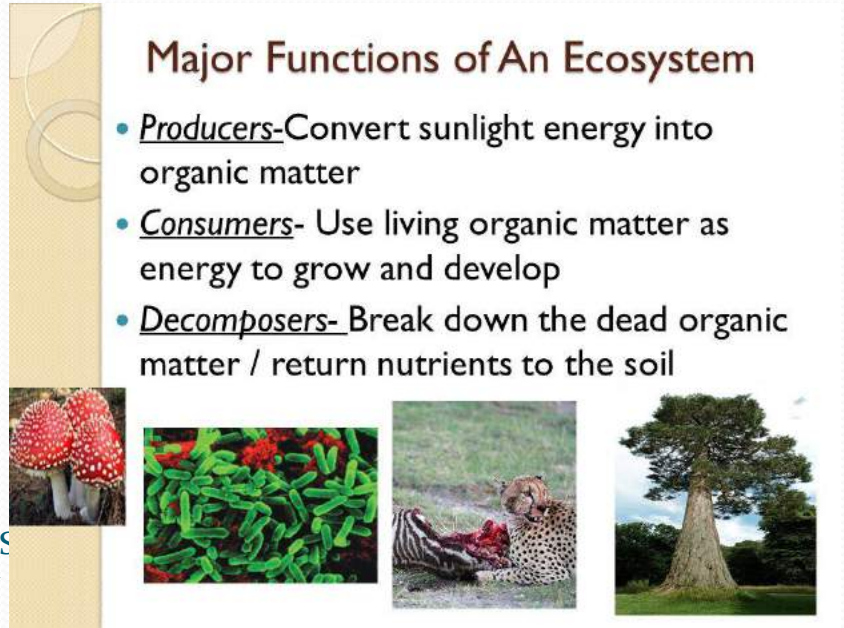
Schematic Representation of the Structure of an Ecosystem.

Structure and function of an ecosystem

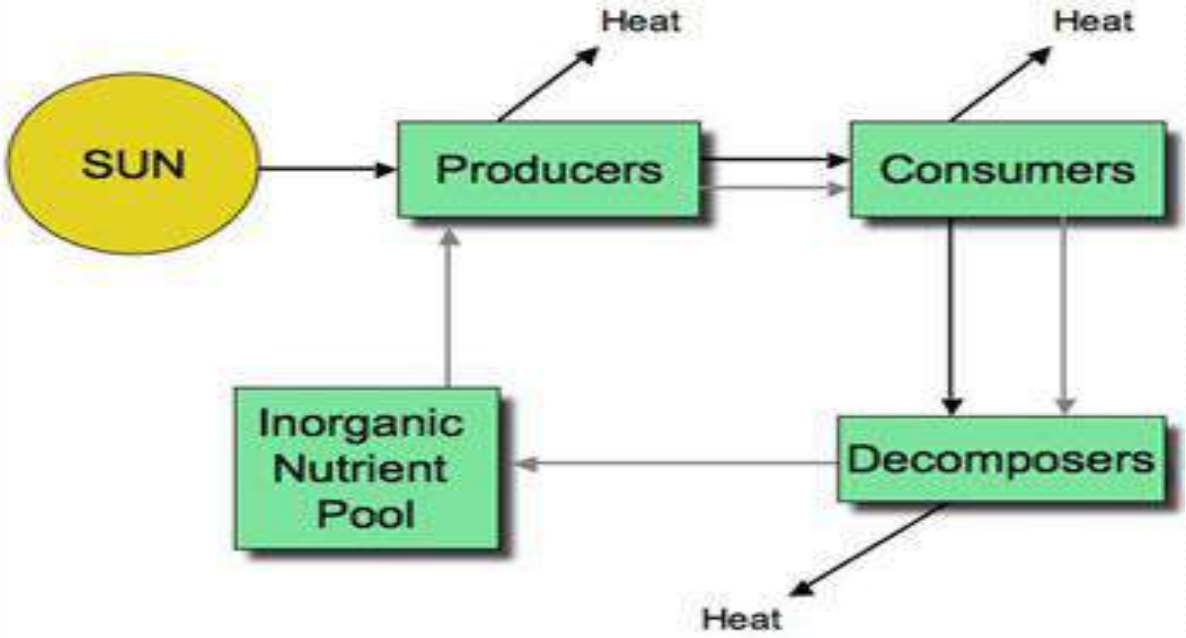
- Components of an ecosystem
- **Abiotic**
- basic inorganic elements and compounds, such as **soil,** water, oxygen, calcium carbonates, phosphates and a variety of organic compounds; physical factors such as **moisture, wind currents and solar radiation**
- **Biotic**
- 1. Producers (Autotrophic components),
- 2. Consumers, and
- 3. Decomposers or reducers and transformers

- **Producer :** These are the autotrophic, chlorophyll-bearing organisms, which produce their own food.
- **Consumers :** A consumer which gets nutrition by eating plants is called **Primary consumers** (herbivore) (eg) Rabbit, deer and cow.
- **The Secondary Consumer:** (carnivores) is an animal that eats the flesh of herbivores (eg) cats and dogs.
- **Tertiary Consumers:** are the type of carnivores, which prey upon other carnivores. (eg) Lion, tiger and vulture.
- **Decomposers**
- Decomposers attack the dead remains of producers and consumers and degrade the complex organic substances into simpler compounds to derive their nutrients. The decomposers play very important role in maintaining the dynamic nature of ecosystem (eg.) bacteria, fungi, some insects

- The functions of an ecosystem include energy creation,
- sharing of energy and cycling of materials between the living and nonliving components of an ecosystem.



Energy flow in an ecosystem

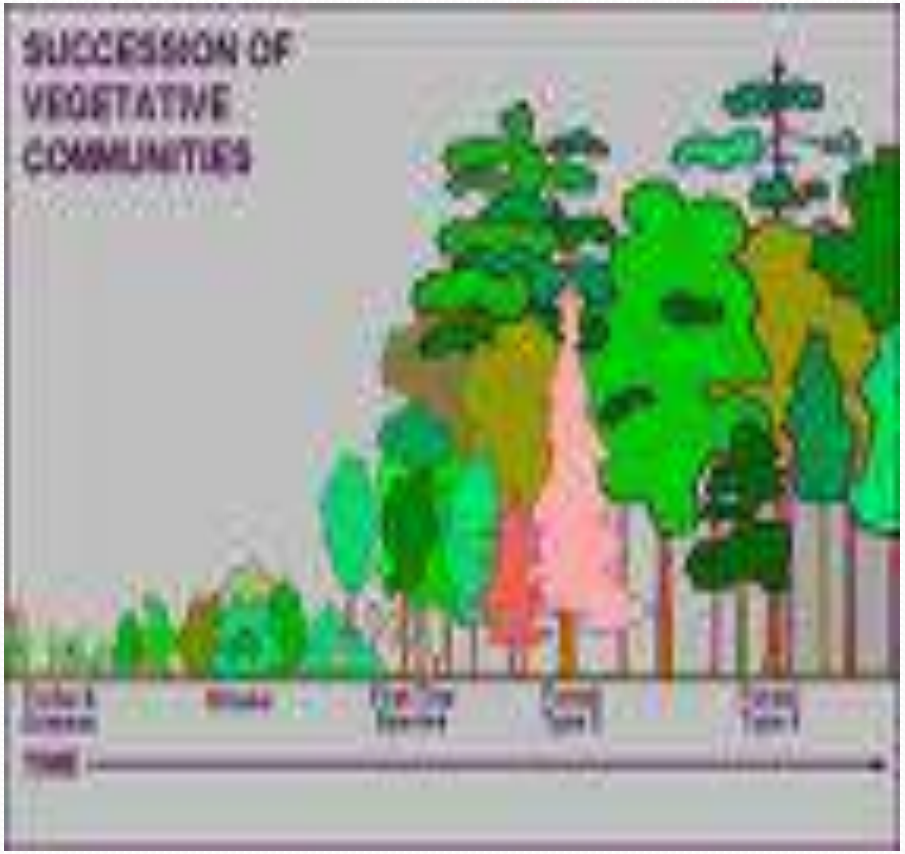


Some of the facts about energy flow:

- The ultimate source of energy (for most ecosystems) is the sun
- The ultimate fate of energy in ecosystems is for it to be lost as heat.
- Energy and nutrients are passed from organism to organism through the food chain as one organism eats another.
- Decomposers remove the last energy from the remains of organisms.
- Inorganic nutrients are cycled, energy is not.

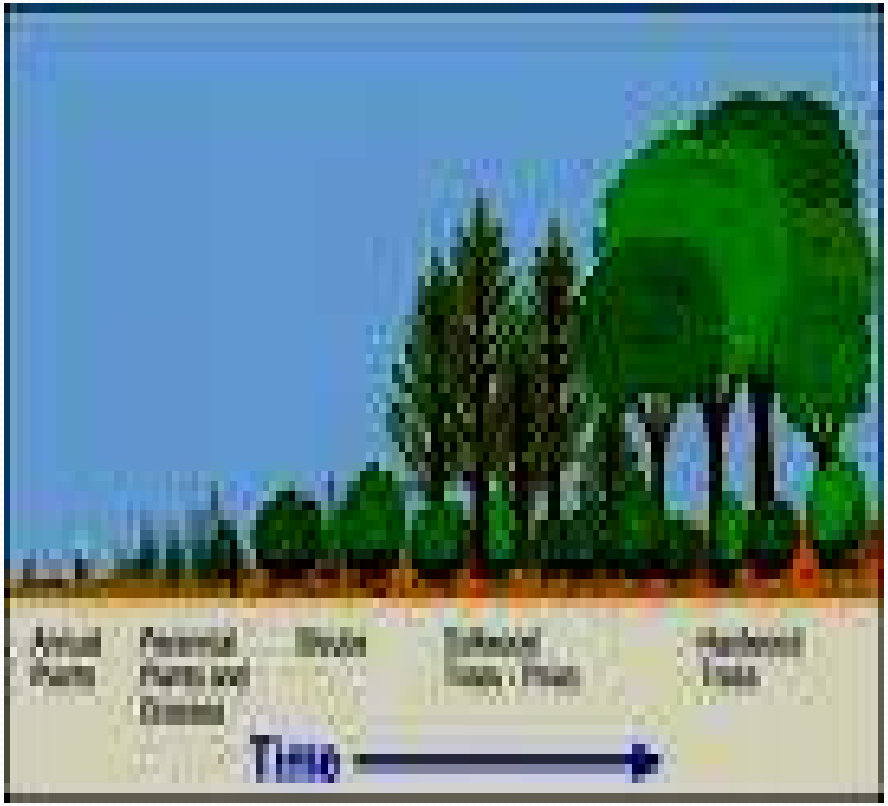
Ecological Succession

- This represents the gradual changes that occur in an ecosystem over a long period of time, due to the modification of the physical environment of the ecosystem.
- This modification of the abiotic component of the ecosystem is followed by the modification of the biotic component of the ecosystem. Succession can be **primary** or **secondary**.



Primary succession

- is the beginning of vegetation in a bare area; for example appearance of lichens on a rock. Lichens are referred to as first plant community or **pioneer species**.
- Other plants later follow the lichens, examples are the mosses, then grasses and herbs and finally other plants.

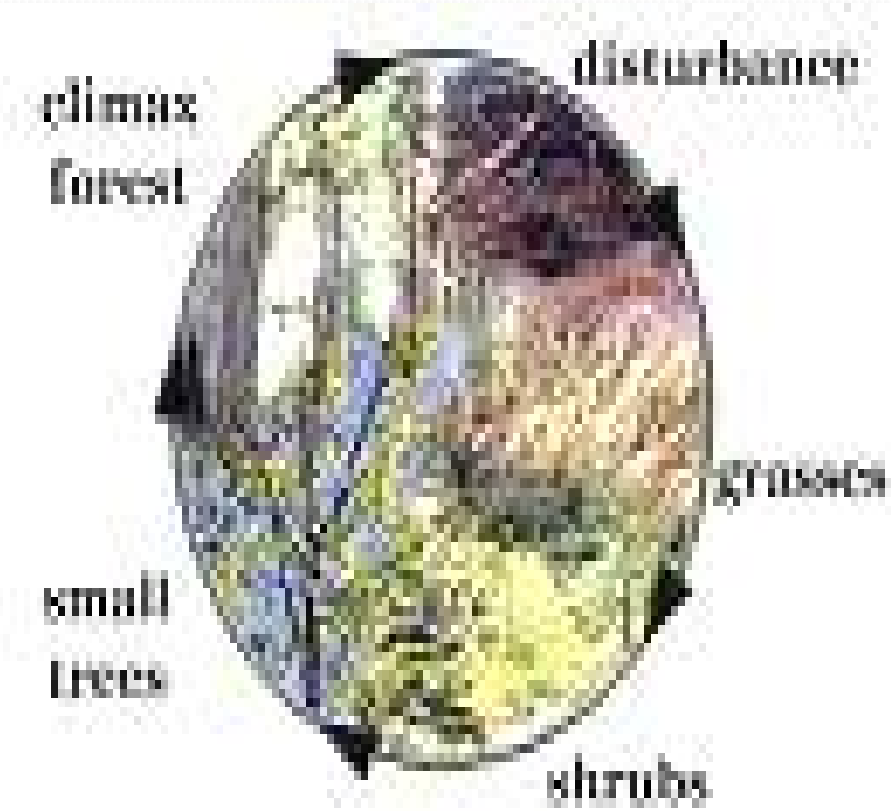


Secondary succession

- A vegetation that was destroyed by either natural forces or humans comes back to live. For example, a land that might have been destroyed by fire or man, after a period of time, begins to support vegetation.

Climax Community

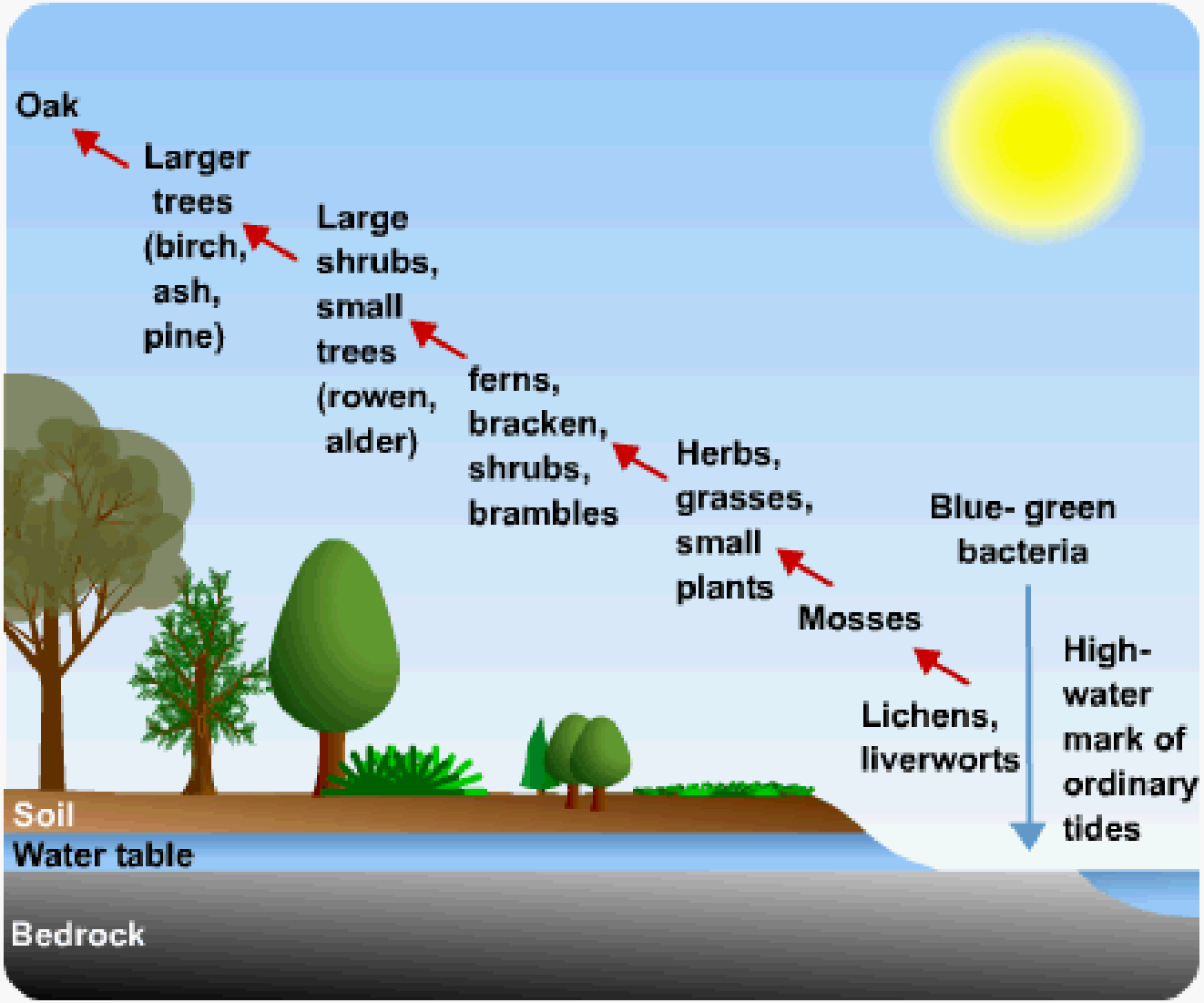
- In a community, where everything is stable, no new plants are growing, the community is referred to as stable or Climax Community



Ecological succession-Stages

- **Nudation**-development of bare site
- **Invasion**-establishment of species in bare area
- **Competion and coaction**- competion for nutrition, light,space/ interaction among organisms
- **Reaction**-replacement of communities
- **Stabilization**-climax community established

Succession…


Oak
Larger trees (birch, ash, pine)
Large shrubs, small trees (rowen, alder)
ferns, bracken, shrubs, brambles
Herbs, grasses, small plants
Mosses
Lichens, liverworts
Blue- green bacteria
High-water mark of ordinary tides
Soil
Water table
Bedrock

What is a food chain?

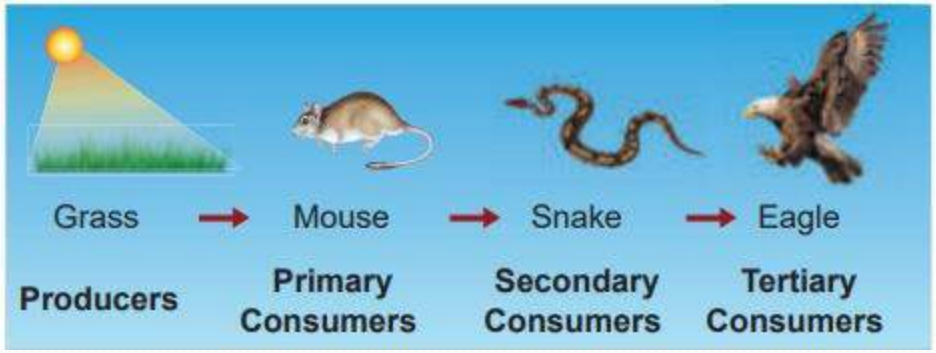
- A simple linear pathway in which food is transferred from one level to the next in an ecosystem.
- Each food chain always begins with producers / autotrophs, followed by herbivores (primary consumers), followed by carnivores (secondary consumers and tertiary consumers), and finally omnivores.
- A **food chain** is the flow of energy from one organism to the next

- **Grass→Grasshopper→Toad→Snake→ Hawk→Bacteria of decay**

Food chain -Types

- Grazing
- Parasitic
- Detritus

grazing food chain



Parasitic food chain

- Trees→ Fruit eating birds→ Lice and bugs (parasite)→ Bacteria and fungi(hyper parasite)

Parasitic food chain Human ->lice

Human ->lice

Detritus food chain

One which goes from dead organic matter to organisms and then to detritus feeding organisms.

Do you know why there are **more herbivores than carnivores**?

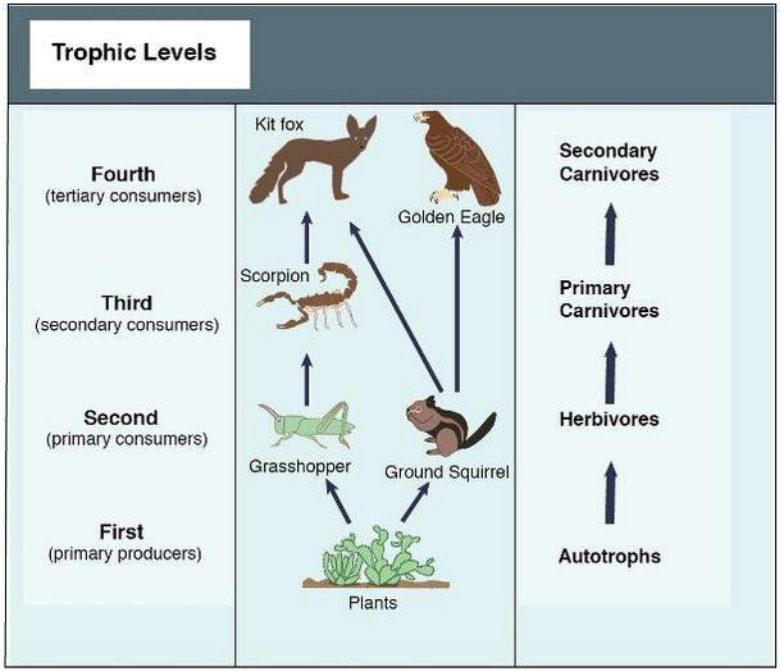
- In a food chain, energy is passed from one link to another. When a herbivore eats, only a fraction of the energy (that it gets from the plant food) becomes new body mass; the rest of the energy is lost as waste or used up by the herbivore to carry out its life processes (e.g., movement, digestion, reproduction). Therefore, when the herbivore is eaten by a carnivore, it passes only a small amount of total energy (that it has received) to the carnivore.
- Of the energy transferred from the herbivore to the carnivore, some energy will be "wasted" or "used up" by the carnivore. The carnivore then has to eat many herbivores to get enough energy to grow.

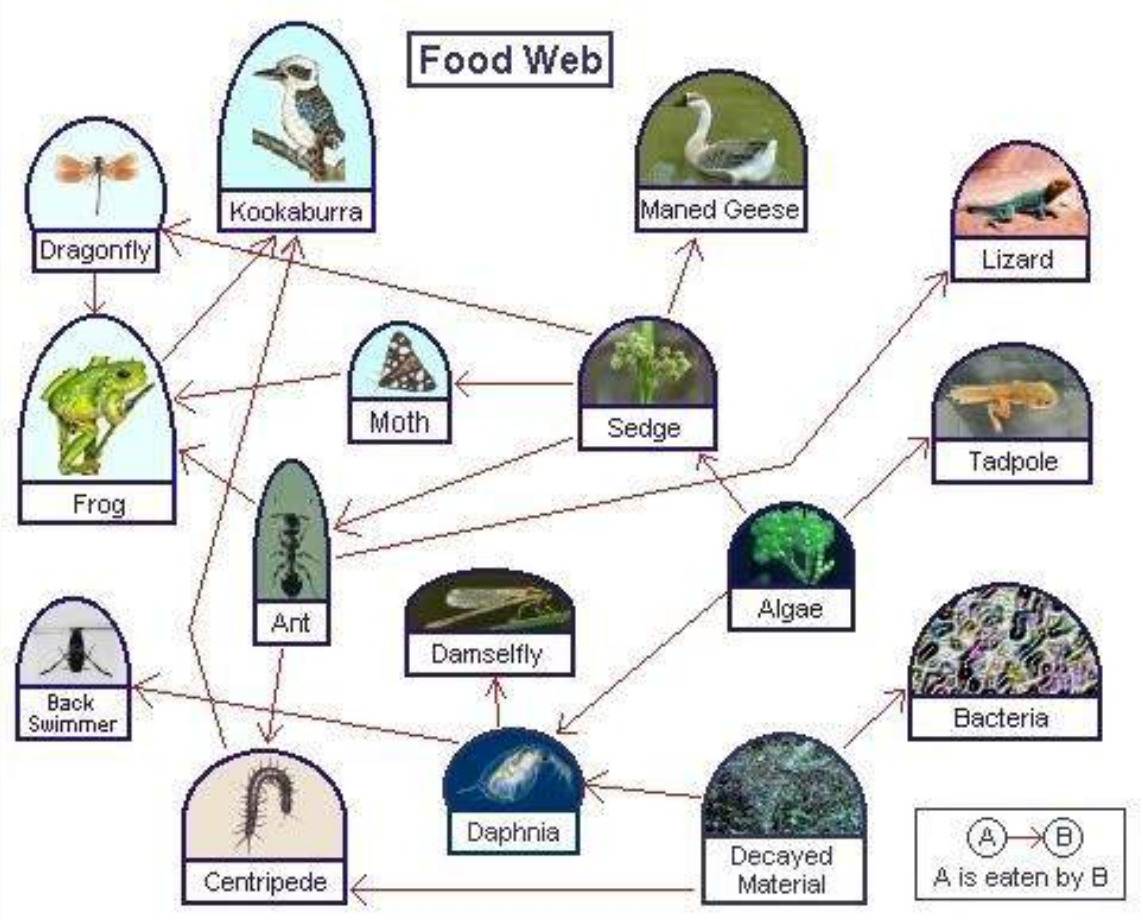
Food Webs

A **food web** (or **food** cycle) is the natural interconnection of **food chains** and a graphical representation (usually an image) of what-eats-what in an ecological community. Another name for **food web** is consumer-resource system

FOOD WEB

A **food web** represents multiple pathways through which energy and matter flow through an ecosystem.



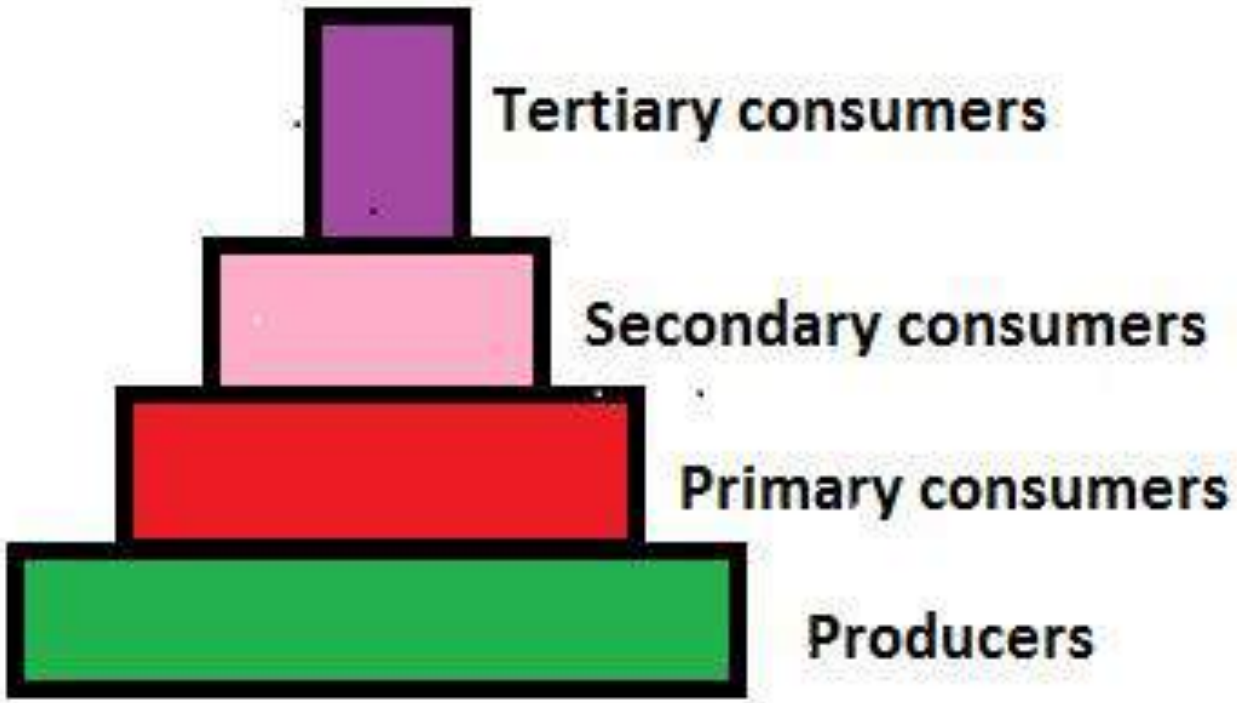

Food Web
Kookaburra
Maned Geese
Dragonfly
Lizard
Moth
Sedge
Frog
Tadpole
Ant
Algae
Damselfly
Back Swimmer
Bacteria
Daphnia
Centripede
Decayed Material
A
B
A is eaten by B

Ecological pyramid or Eltonian pyramid

- An **ecological pyramid** is a graphical representation of the relationship between different organisms in an **ecosystem**.
- The concept of ecological pyramid was developed by Charles Elton (1927), so these pyramids are also known as **Eltonian pyramids.**

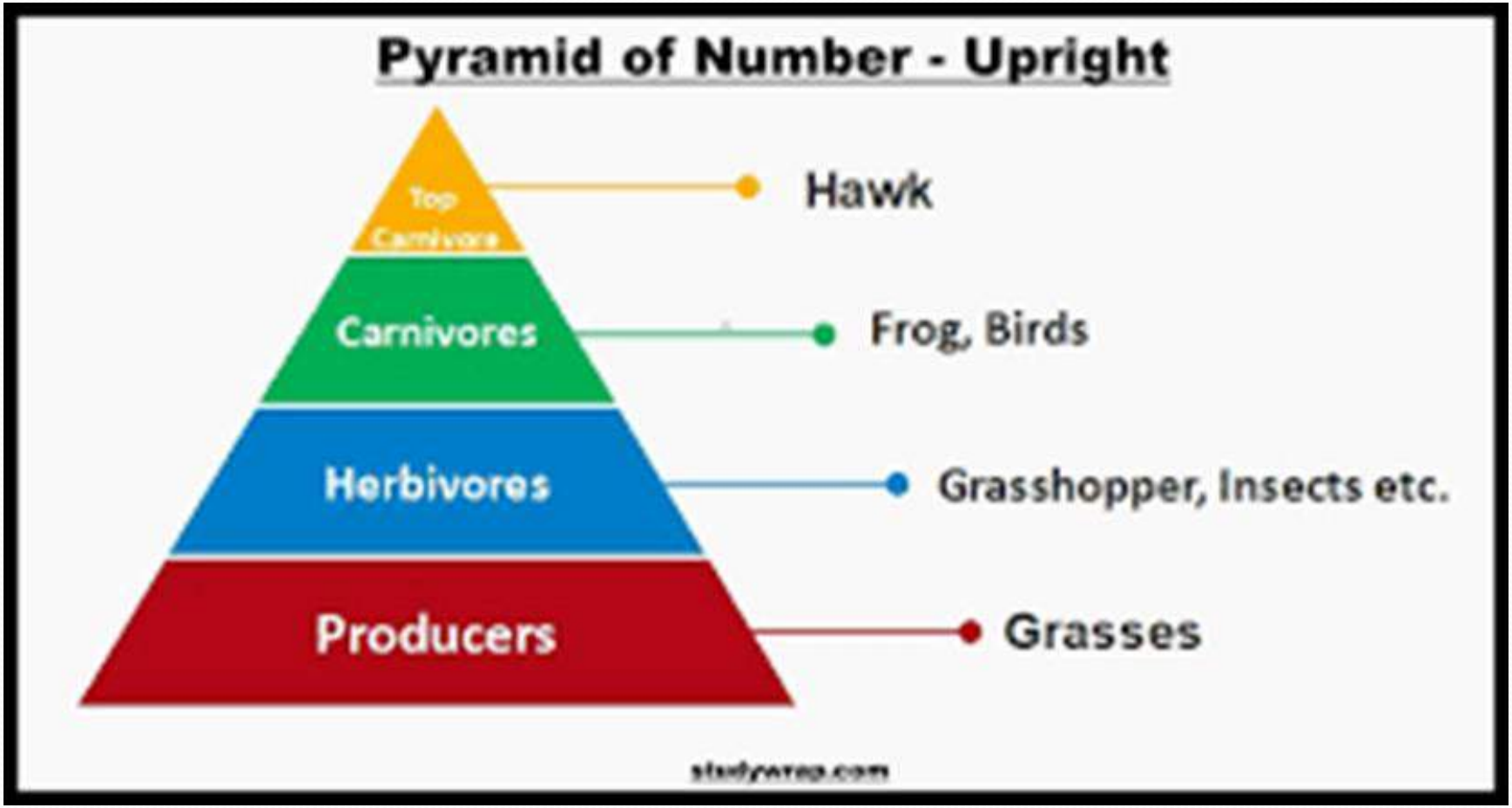
Pyramid of numbers

- A pyramid of numbers is a graphical representation that shows the number of organisms at each trophic level. It is an upright pyramid in light of the fact that in an ecosystem, the producers are always more in number than other trophic levels.



Pyramid of numbers

Pyramid of number upright



Pyramid of number inverted

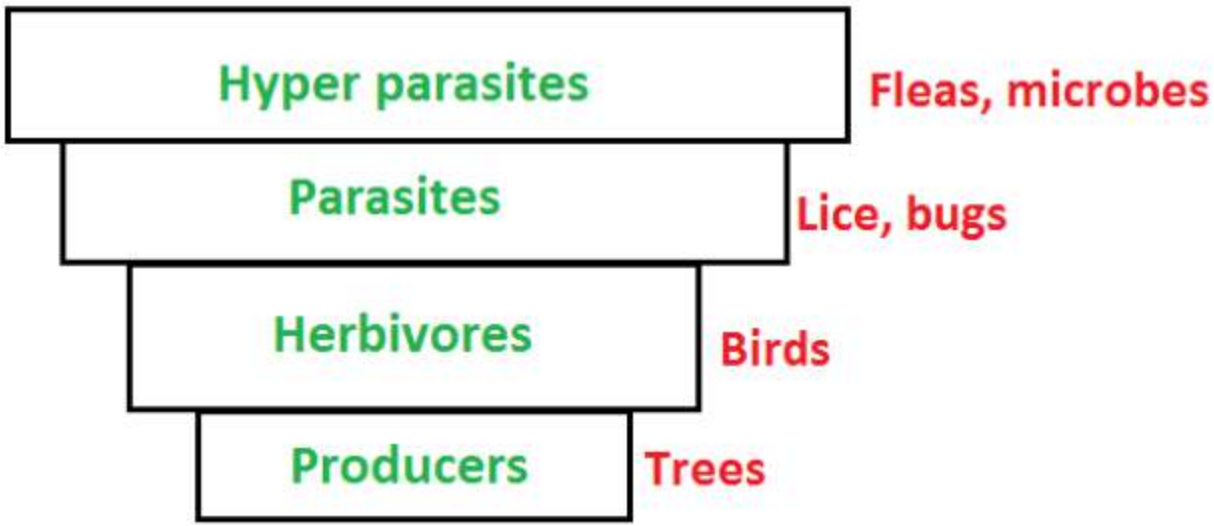
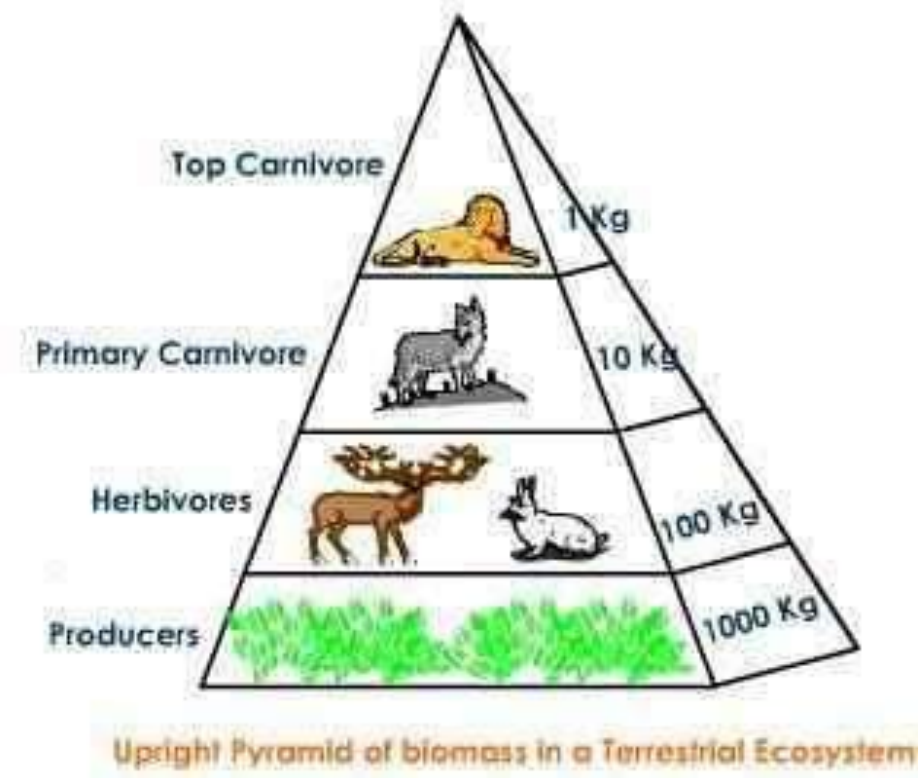
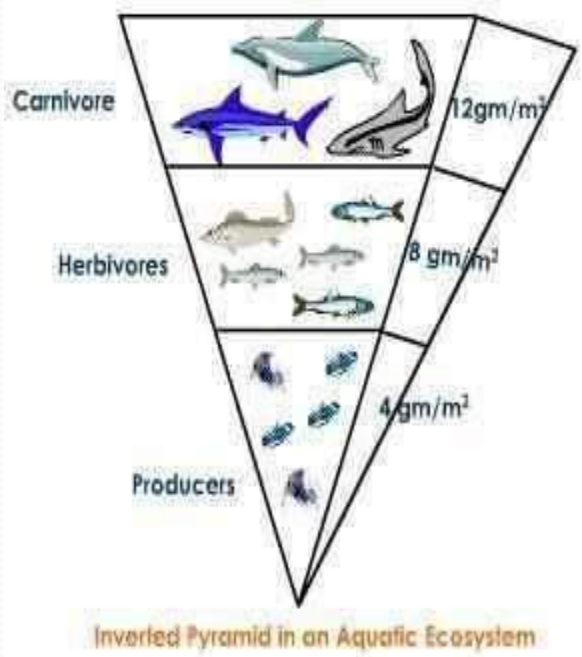


Fig: Pyramid of numbers in Parasitic Food Chain

Pyramid of biomass – upright, inverted



Upright Pyramid of biomass in a Terrestrial Ecosystem

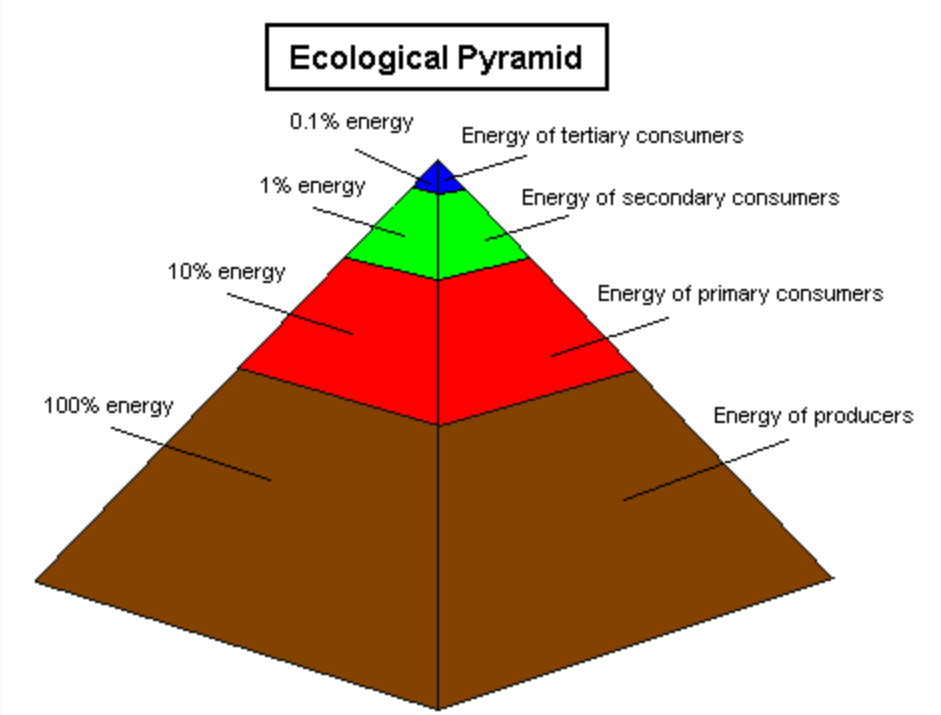


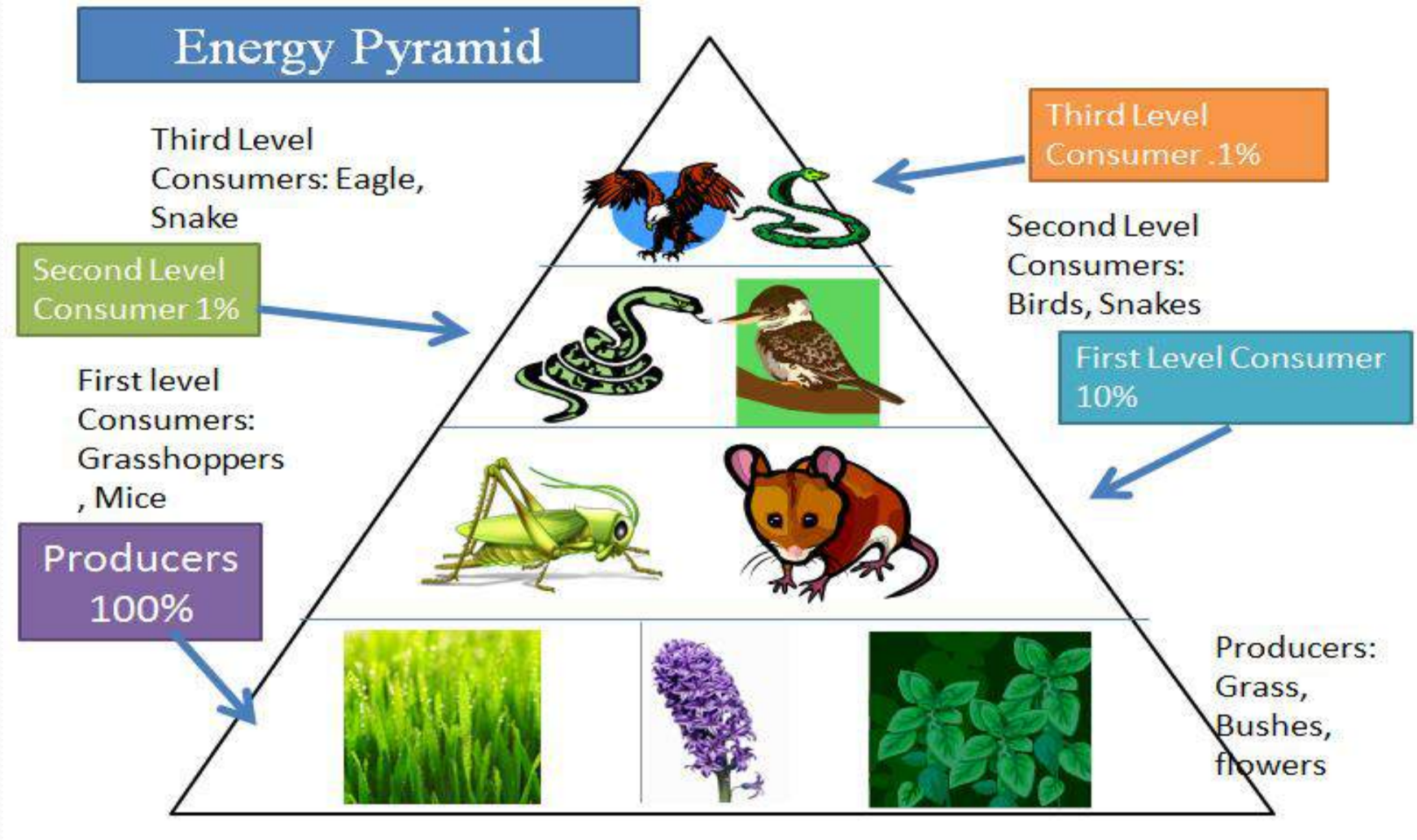
Inverted Pyramid in an Aquatic Ecosystem

Pyramid of energy

- One way to calculate the energy transfer is by measuring or sizing the energy at one tr ophic level and then at the next. **Calorie** is a unit of measure used for energy. The energy transfer from one trophic level to the next is about 10%.
- For example, if there are 10,000 calories at one level, only 1,000 are transferred to the next. This 10% energy and material transfer rule can be depicted with an ecological pyramid that looks like this.

Pyramid of energy




Energy Pyramid
Third Level Consumers: Eagle, Snake
Second Level Consumer 1%
First level Consumers: Grasshoppers , Mice
Producers 100%
Third Level Consumer .1%
Second Level Consumers: Birds, Snakes
First Level Consumer 10%
Producers: Grass, Bushes, flowers

What are Biomes?

- These are the terrestrial divisions in the biosphere.
- These are large **climax communities in the biosphere.**
- Biomes are determined by the climatic conditions of the area. **The amount of yearly precipitation determines whether the biome is a desert, grassland or a forest.**
- The altitude determines the temperature, this is also very important in the development of biomes. The major biomes are:
  Deserts, **grass lands,forests etc.,**

Characteristics of ecosystems

- (a)Forest ecosystem
- (b)grassland ecosystem
- (c) desert ecosystem
- (d) aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

The forest biome

- There are three major types of forests, classified according to latitude:
- Tropical
- Temperate
- Boreal forests (taiga)

Tropical forests

Canopy in tropical forests is multilayered and continuous, allowing little light penetration.

- Flora is highly diverse: one square kilometer may contain as many as 100 different tree species. Trees are 25-35 m tall, with buttressed trunks and shallow roots, mostly evergreen, with large dark green leaves. Plants such as orchids, bromeliads, vines (lianas), ferns, mosses, and palms are present in tropical forests.
- Fauna include numerous birds, bats, small mammals, and insects.

Types of Temperate forest

- *moist conifer and evergreen broad-leaved forests*: wet winters and dry summers (rainfall is concentrated in the winter months and winters are relatively mild).
- *dry conifer forests*: dominate higher elevation zones; low precipitation.
- *mediterranean forests*: precipitation is concentrated in winter, less than 1000 mm per year.
- *temperate coniferous*: mild winters, high annual precipitation (greater than 2000 mm).
- *temperate broad-leaved rainforests*: mild, frost-free winters, high precipitation (more than 1500 mm) evenly distributed throughout the year.

Boreal forest (taiga)

- Boreal forests, or taiga, represent the largest terrestial biome. Occuring between 50 and 60 degrees north latitudes, boreal forests can be found in the broad belt of Eurasia and North America: two-thirds in Siberia with the rest in Scandinavia, Alaska, and Canada.
- Seasons are divided into short, moist, and moderately warm summers and long, cold, and dry winters.
- The length of the growing season in boreal forests is 130 days.
- Temperatures are very low.
- Precipitation is primarily in the form of snow, 40-100 cm annually.
- Soil is thin, nutrient-poor, and acidic.
- Canopy permits low light penetration, and as a result, understory is limited.
- Flora consist mostly of cold-tolerant evergreen conifers with needle-like leaves, such as pine, fir, and spruce.
- Fauna include woodpeckers, hawks, moose, bear, weasel, lynx, fox, wolf, deer, hares, chipmunks, shrews, and bats.

The grassland biome

- Grasslands are characterized as lands dominated by grasses rather than large shrubs or trees

Tropical grasslands or savannas

- Savanna is grassland with scattered individual trees.
- Savannas of one sort or another cover almost half the surface of Africa and large areas of Australia, South America, and India.
- Climate is the most important factor in creating a savanna.
- Savannas are always found in warm or hot climates where the annual rainfall is from about 50.8 to 127 cm (20-50 inches) per year.

Temperate grassland

- Temperate grasslands are characterized as having grasses as the dominant vegetation. Trees and large shrubs are absent.
- Temperatures vary more from summer to winter, and the amount of rainfall is less in temperate grasslands than in savannas.
- The major manifestations are the veldts of South Africa, the puszta of Hungary, the pampas of Argentina and Uruguay, the steppes of the former Soviet Union, and the plains and prairies of central North America.
- Temperate grasslands have hot summers and cold winters. Rainfall is moderate.
- The amount of annual rainfall influences the height of grassland vegetation, with taller grasses in wetter regions

Biodiversity

- **What is biodiversity?**

- **Biodiversity** is the variation of life forms within a given ecosystem, biome or for the entire Earth.
- Biodiversity is often used as a measure of the health of biological systems

Introduction to biodiversity

3 Levels of biodiversity

- Gentic diversity
- Species diversity
- Ecosystem diversity

Genetic diversity

- Genetic diversity refers to the variety of genetic information contained in all of the individual plants, animals and microorganisms.

- Genetic diversity occurs within and between populations of species as well as between species.

Genetic diversity

- Within any given species, there are several varieties or strains or races which slightly differ from each other
- No. of genes range from about 1000 in bacteria and 400,000 or more in many flowering plants.
- No two members of the same species are genetically identical.

Prepared by Dr.P.Kamaraj, Dean [Science and Humanities], Bharath University, Chennai

Species diversity

- Species diversity refers to the variety of living species.

Species diversity

- About 10 – 14 million species is present
- Most of them are insects and microorganisms
- 1.8 million species is identified ,named and catalogued
- 270000-plant varieties
- 45000-vertebrates
- 950000-insects
- 10,000 new species are identified every year

Ecosystem diversity

- Ecosystem diversity

  relates to the variety of habitats, biotic communities, and ecological processes.

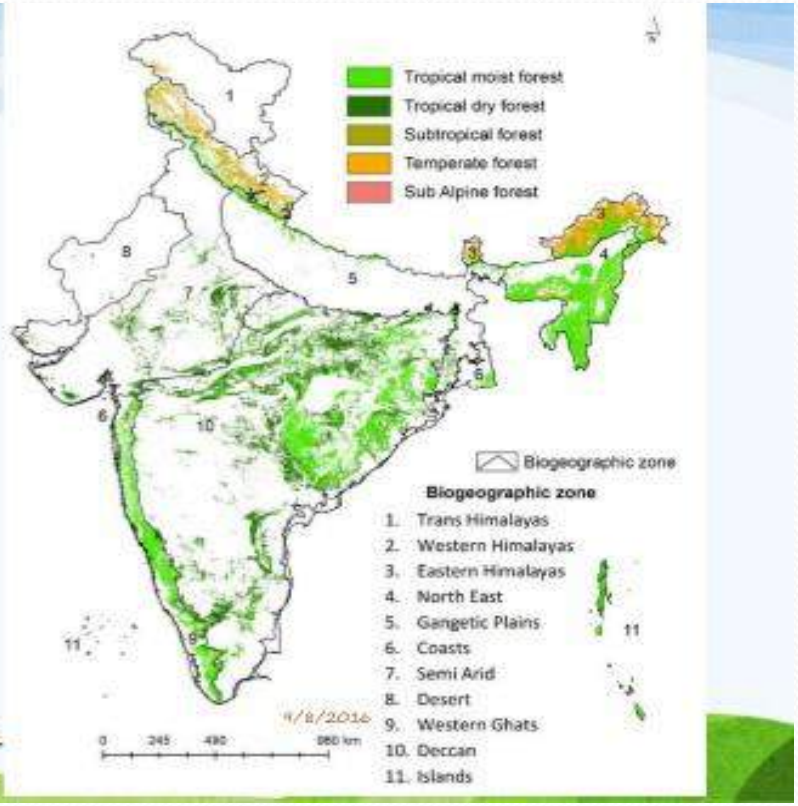
Biogeographical classification of India

- **Biogeographic classification of India** is the division of **India** according to **biogeographic** characteristics.
- **Biogeography** is the study of the distribution of species (biology), organisms, and ecosystems in geographic space and through geological time.

Biogeographical classification of India

OVERVIEW

- Trans Himalayan zone.
- Himalayan zone
- Desert zone.
- Semiarid zone.
- Western ghat zone.
- Deccan plateau zone.
- Gangetic plain zone.
- North east zone.
- Coastal zone.
- Islands present near the shore line.



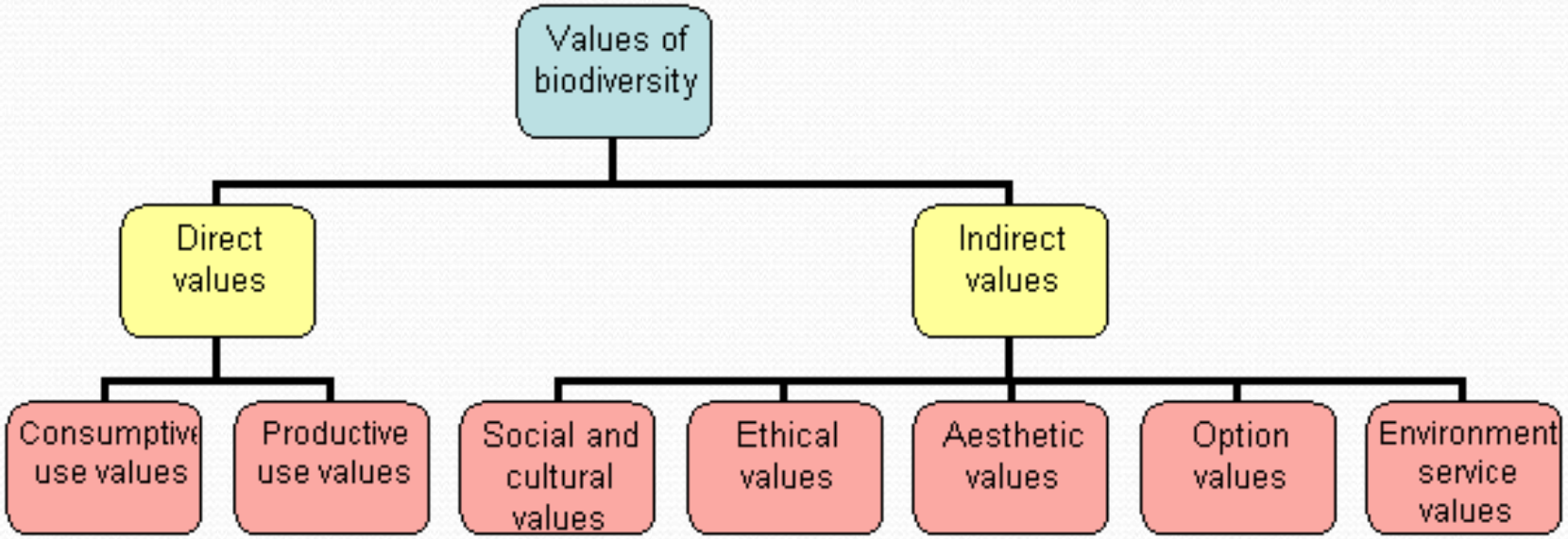
Values of biodiversity

- Consumptive use
- Productive use
- Social
- Ethical
- Aesthetic
- Option

Species evenness

- Another measure of species diversity is the species evenness.
- Species evenness is the relative abundance with which each species is represented in an area.

Values of Biodiversity



Values of biodiversity

- **Aesthetic and recreational values**
- **Intrinsic, spiritual and ethical values**
- **Consumptive use value**
- **Productive use values**
- **Direct utilitarian value**
- **Indirect utilitarian values**
- **Scientific and educational values**
- **Option or Future values**

Values of biodiversity

- **Aesthetic and recreational values**
- flowers,
- birds, trees or whales, and as
- components of natural or semi-natural landscapes such as
- **Parks, gardens,natural animal habitats,forests,mountains seashores etc.,**