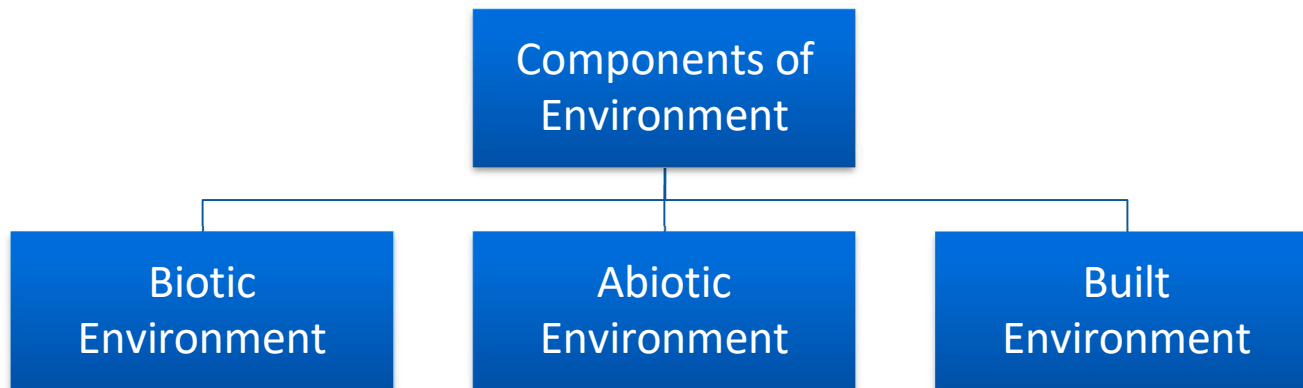


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- UNIT 1: INTRODUCTION TO ENVIRONMENTAL STUDIES-
Multidisciplinary nature Of environmental studies; Scope and importance; Concept of sustainability and sustainable development.
- UNIT 2: ECOSYSTEMS - Structure and function of an ecosystem; Energy flow in an ecosystem: Food Chains, Food webs, and Ecological succession; Case studies- Forest Ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem(Ponds, streams, lakes, rivers, oceans, estuaries)
- UNIT 3: NATURAL RESOURCES- Land resources and land use change; Land degradation, soil erosion and desertification; Deforestation: Causes and impacts due to mining, dam building othe n environment, forests, Biodiversity and tribal populations; Water: Use and over-exploitation of surfagroundwaterd water, floods, droughts, conflicts over water (international & inter-state); Energy resources: Renewablnonrenewableewable energy sources, use of alternate energy sources, growing energy needs, case studies.
- UNIT 4: Biodiversity and Conservation- Levels of biological diversit : genetic, species and ecosystem diversity; Biogeographic zones of India- Biodiversity patterns and global biodiversity hot spots; India as a mega-biodiversity nation- Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex- situ conservation of biodiversity; Ecosystem and biodiversity
-
- services: Ecological, economic, social, ethical, aesthetic and Informational value.

- **UNIT 5: ENVIRONMENTAL POLLUTION-** Types, causes, effects and controls; Nuclear hazard and human health risks; Solid waste management: Control measures industrial waste; Pollution case studies.
- **UNIT 6: Environmental Policies & Practices-** Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD); Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.
- **UNIT 7: HUMAN COMMUNITIES AND THE ENVIRONMENT-**
Human population growth- Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management :floods, earthquake, cyclones and landslides; Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

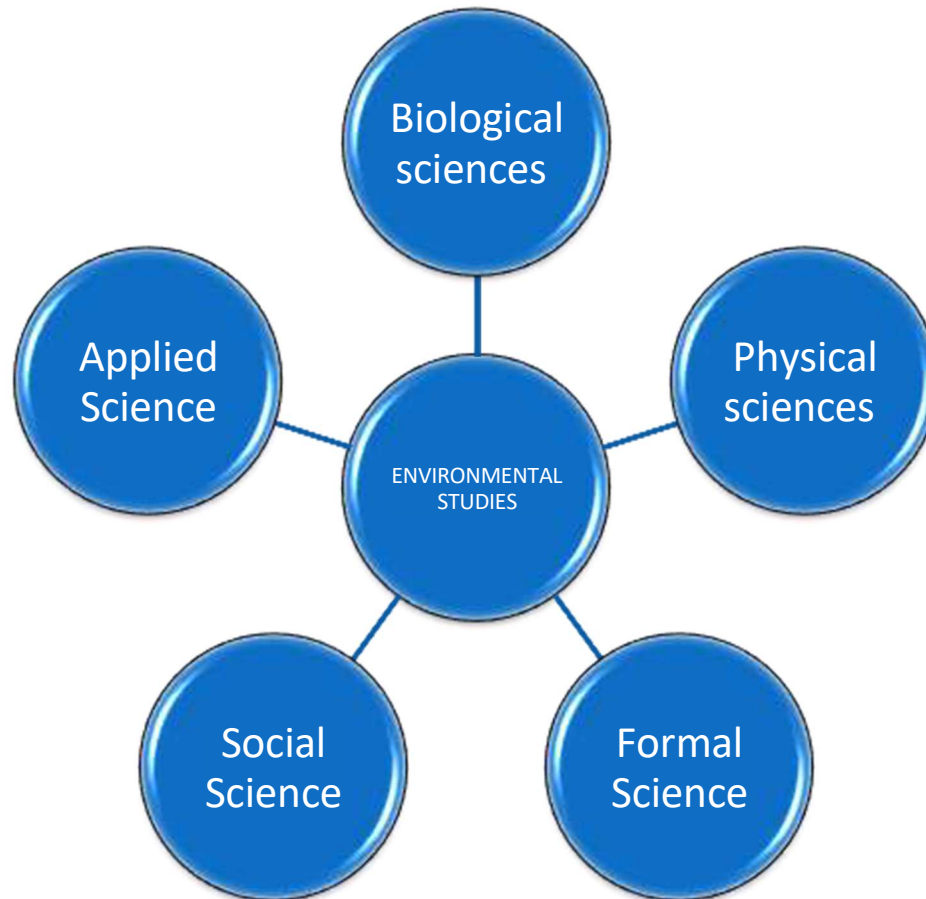
UNIT 1

- **MEANING:** Environment is the sum total of conditions that surrounds us at a given point of time and space.
- The term environment is derived from a French word “Environia” means *to surround*. It refers to both abiotic (physical or non-living) and biotic (living) environment
- **MULTIDISCIPLINARY NATURE OF**



-

- **ENVIRONMENTAL STUDIES-** The study of environmental components is multidisciplinary in nature.



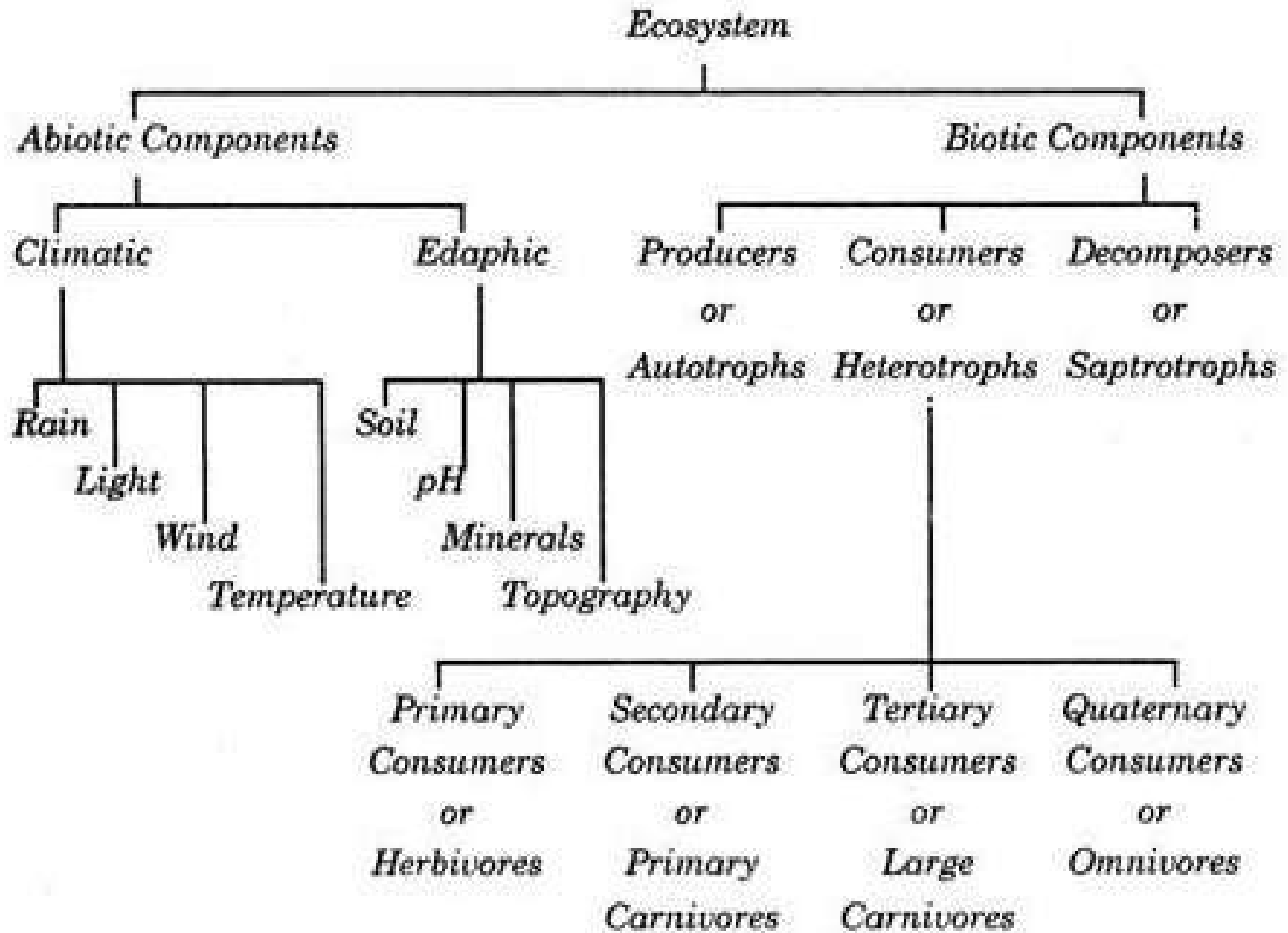
- **SCOPE AND IMPORTANCE OF ENVIRONMENTAL STUDIES-**
- Three major areas of applicability of the subject are
 - (i) Management of natural resources
 - (ii) Conservation of ecosystem and biodiversity, and
 - (iii) Prevention and control of pollution.
- **The scopes and importance summarized-**
 - ✓ The study creates awareness among the people
 - ✓ It provides the knowledge about ecological systems and cause and effect relationships.
 - ✓ Provides necessary information about biodiversity richness and the potential dangers.
 - ✓ It enables one to evaluate alternative responses to environmental issues.
 - ✓ The study tries to identify and develop appropriate and indigenous eco-friendly skills and technologies to various environmental issues.
 - ✓ The study enables theoretical knowledge into practice and the multiple uses of environment.

- **Sustainable Development-** The United Nations Conference on Environment and Development (UNCED) defines this using the concept of **sustainable development**. *“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*
- Sustainable development is based on the three pillars of sustainability: economic, environmental and social sustainability
- At the United Nations Sustainable Development Summit in 2015, world leaders adopted the 2030 Agenda for Sustainable Development, which includes a set of 17 Sustainable Development Goals (SDGs).

Unit 2

- **Meaning: Ecosystem-** An ecosystem is a dynamic entity composed of a biological community and its associated abiotic environment. Often the dynamic interactions that occur within an ecosystem are numerous and complex.
- The term "**ecosystem**" was first used in 1935 in a publication by British ecologist Arthur Tansley.
- **Ecology** (from Greek: οἶκος, "house", or "environment"; -λογία, "study of") is the branch of biology which studies the interactions among organisms and their environment.

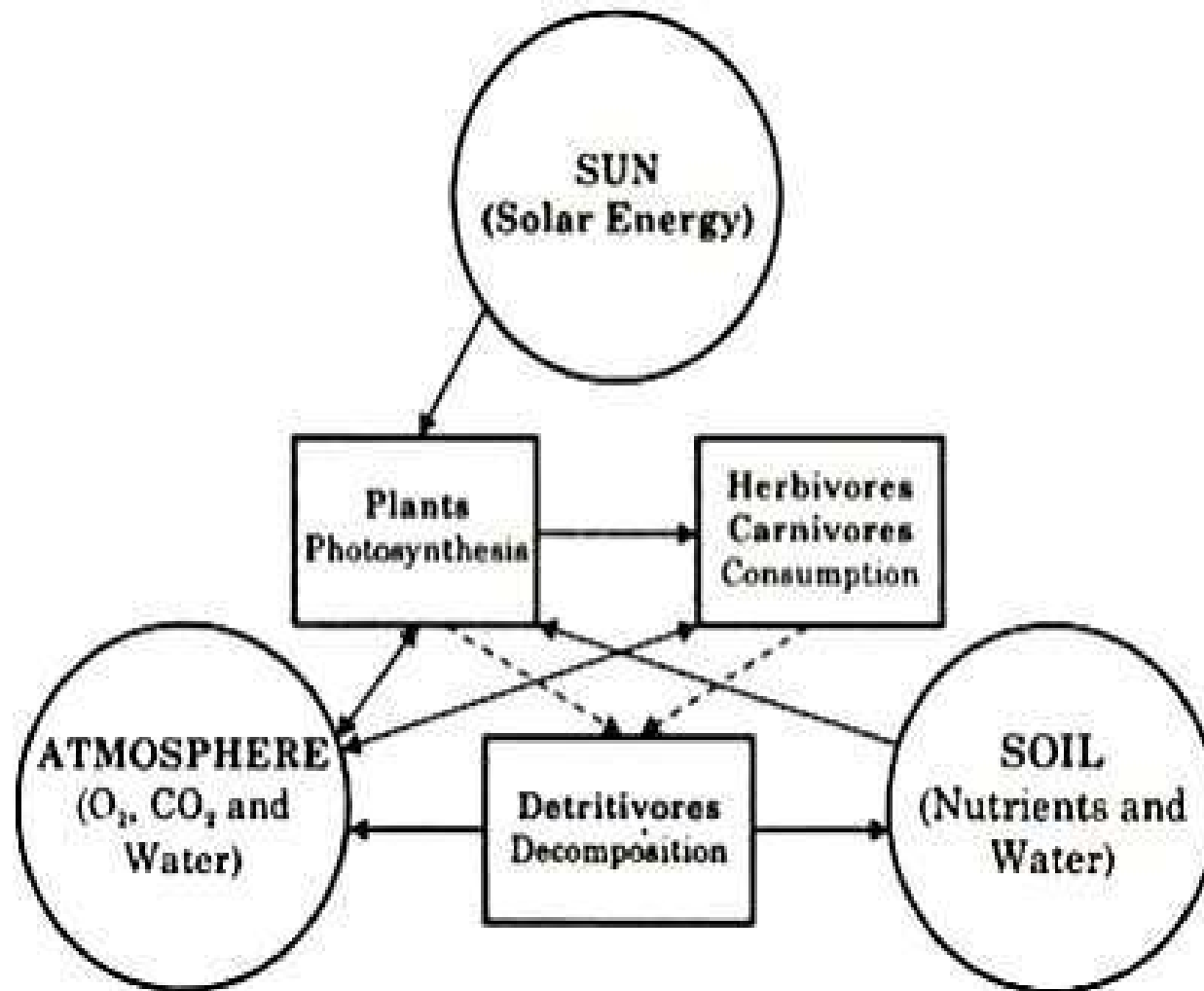
- **COMPONENTS OF AN ECOSYSTEM**



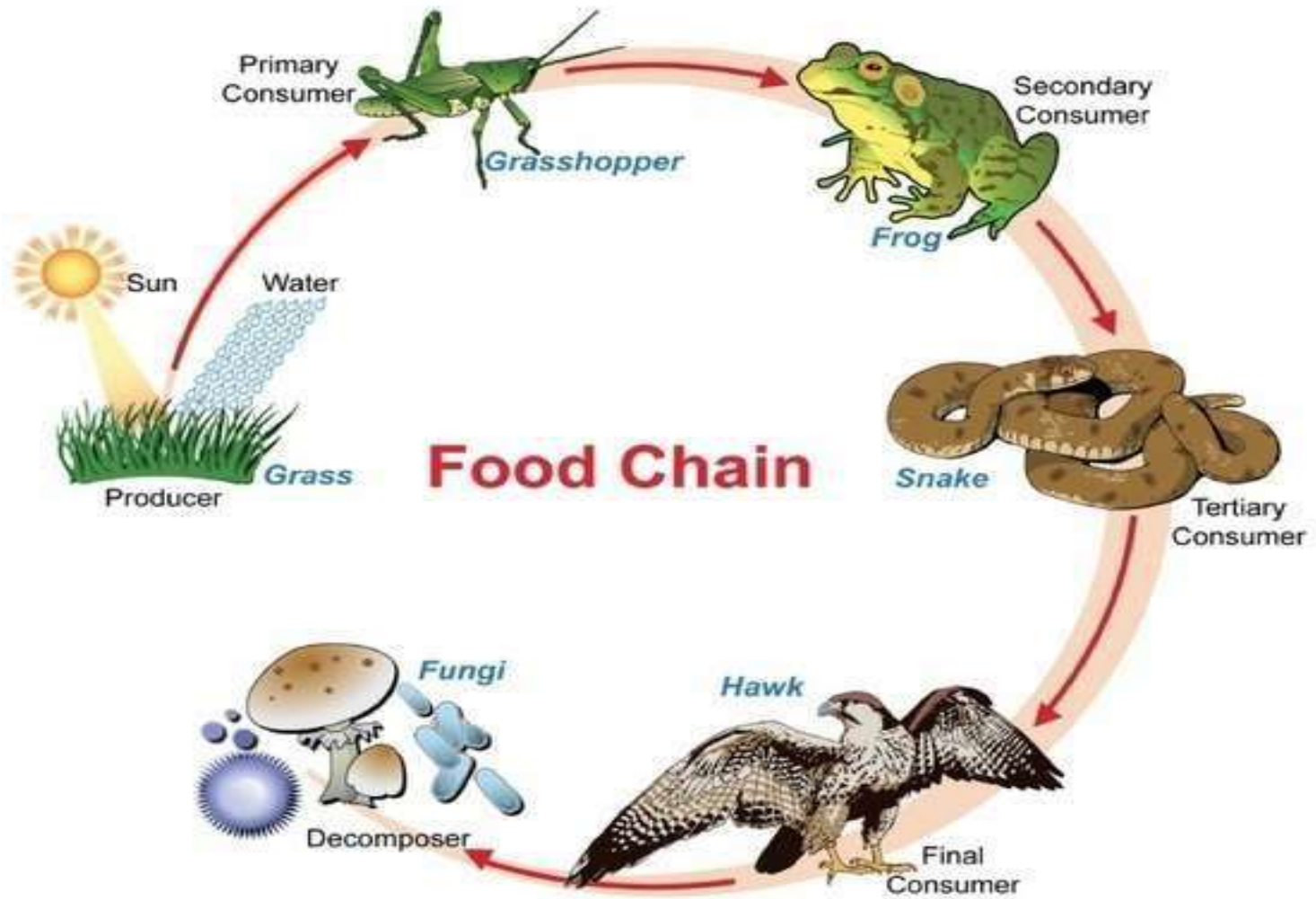
- **Each ecosystem has two main components: Abiotic and Biotic**
- **Abiotic components are mainly of two types:**
 - (a) Climatic Factors:** Which include rain, temperature, light, wind, humidity etc.
 - (b) Edaphic Factors:** Which include soil, pH, topography minerals etc.
- **Biotic components can be classified into three main groups:**
 - (A) Producers**
 - (B) Consumers**
 - (C) Decomposers or Reducers.**

- **Producers** are the living organisms in the ecosystem that take in energy from sunlight and use it to transform carbon dioxide and oxygen into sugars. *Plants, algae and photosynthetic bacteria* are all examples of producers. As the green plants manufacture their own food they are known as **Autotrophs** (i.e. auto = self, trophos = feeder).
- **Consumers (heterotrophs)** are living organisms in the ecosystem that get their energy from consuming other organisms. Herbivores eat producers, carnivores eat other animals and omnivores eat both.
- **Decomposers(Saprotrophs)** are the living component of the ecosystem that breaks down waste material and dead organisms. Examples of decomposers include earthworms, dung beetles and many species of fungi and bacteria.

ENERGY FLOW IN AN ECOSYSTEM

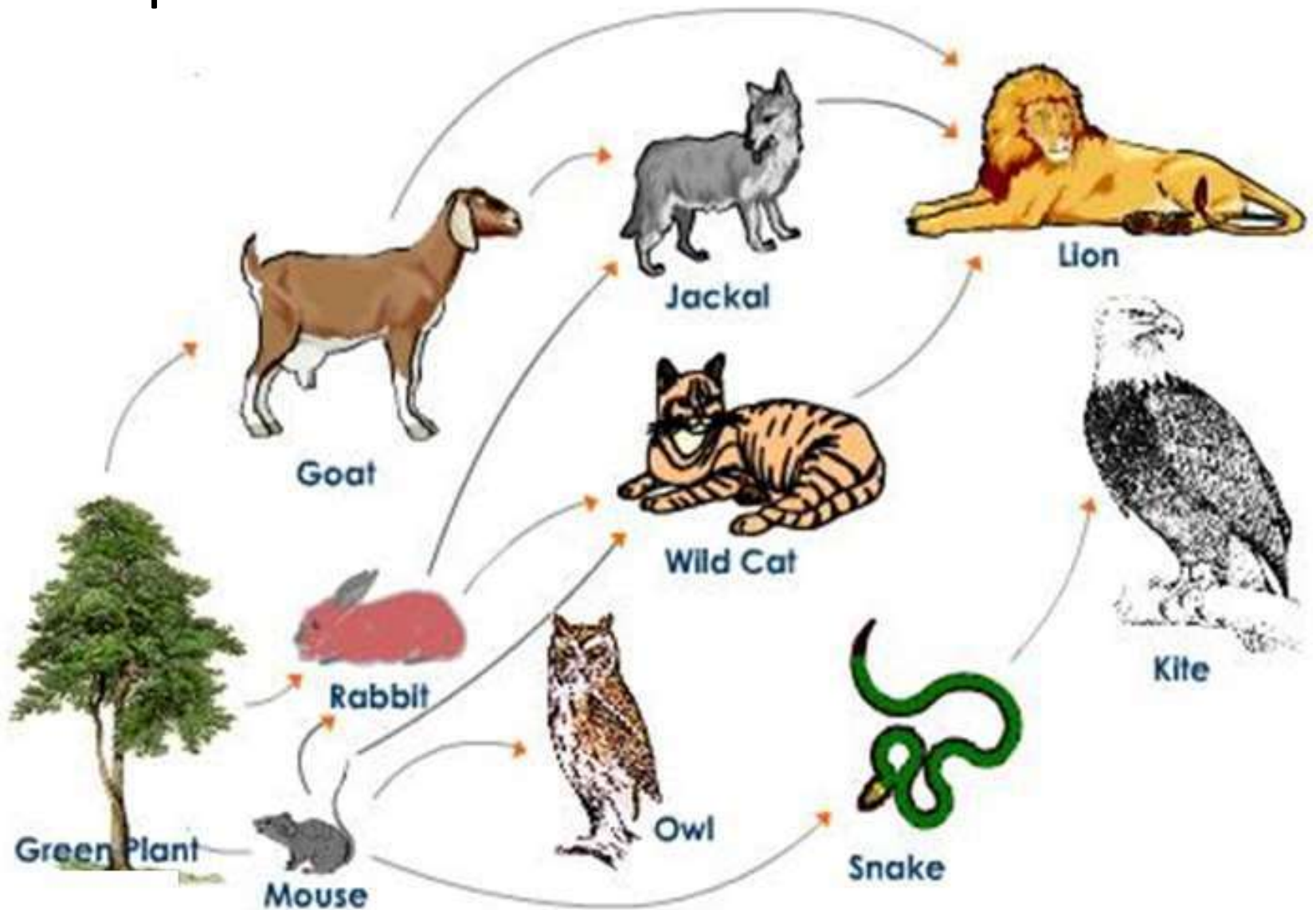


- **Trophic level-** The producers and consumers in the ecosystem can be arranged into different feeding groups and are known as trophic level or the feeding level.
 - ✓ The producers (plants) represent the first trophic level.
 - ✓ Herbivores (primary consumers) present the second trophic level.
 - ✓ Primary carnivores (secondary consumers) represent the third trophic level
 - ✓ Top carnivores tertiary consumers) represent the last level.
- **FOOD CHAIN-** A food chain is a linear network of links in a food web starting from producer organisms(such as grass or trees which use radiation from the Sun to make their food) and end g at pex predator species (like grizzly bears or killer whales), detritivores (like earthworms or woodlice), or decomposer species (such as fungi or bacteria).



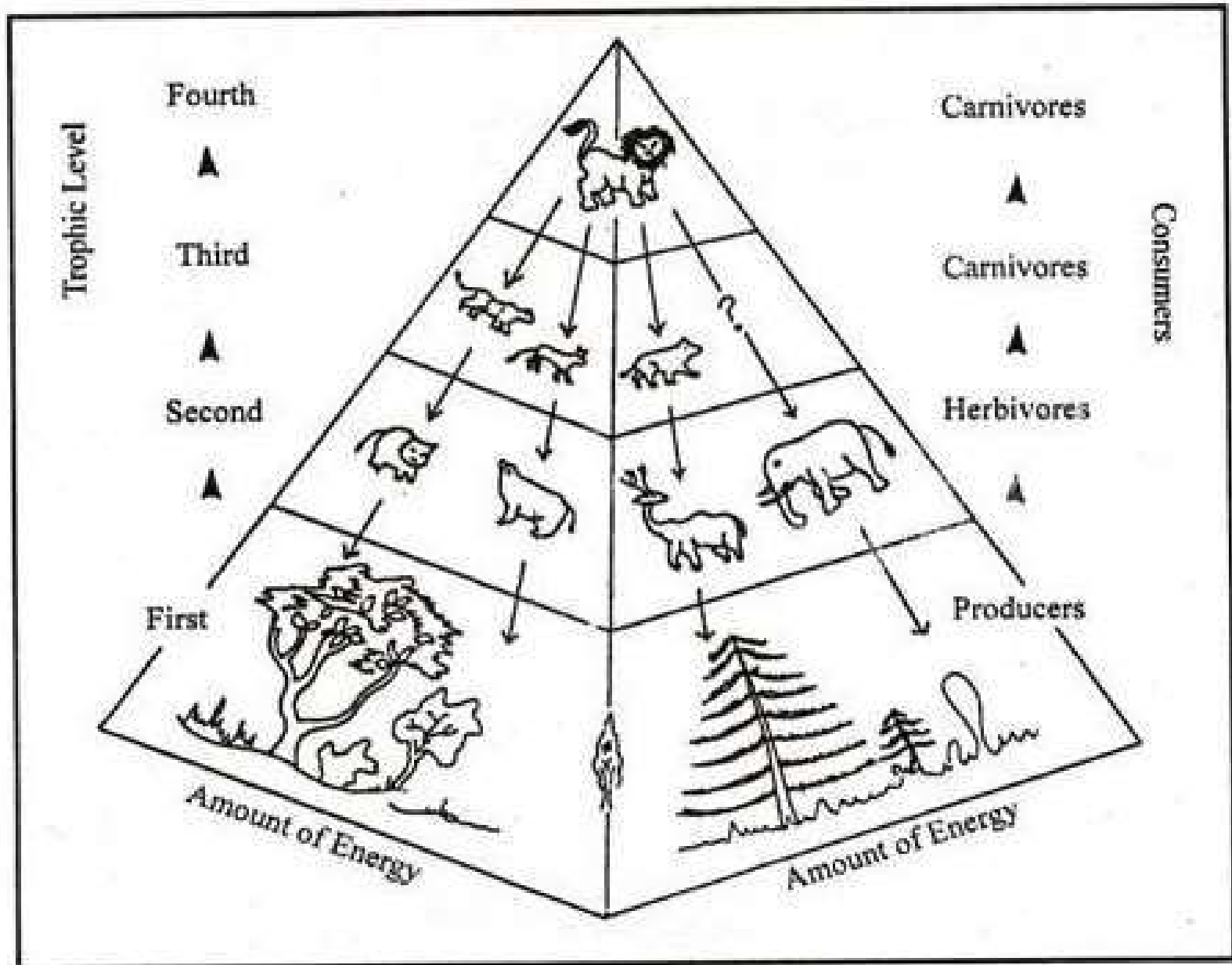
- **Food chains are of three types:**
 1. *Grazing food chain* - starts from green plants and from autotrophs it goes to herbivores to carnivores and so on.
 2. *Parasitic food chain*- It goes from large organisms to smaller ones without outright killing as in the case of predator.
 3. *Saprophytic or detritus food chain*- starts with the dead organic remains including metabolic wastes and exudates derived from grazing food chain.
- **Food Web** - Food web is an important conceptual tool for illustrating the feeding relationships among species within a community, revealing species interactions and community structure, and understanding the dynamics of energy transfer in an ecosystem.

- Example for food web-



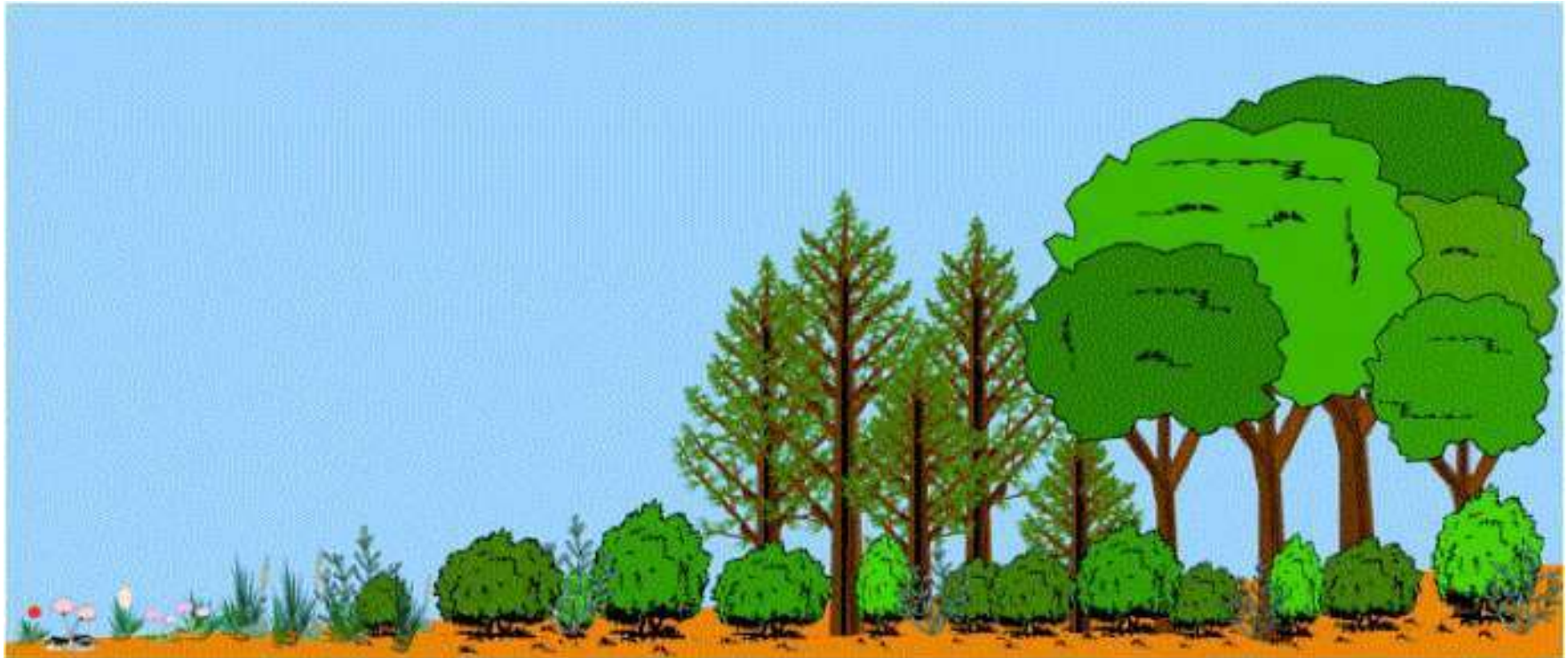
- **Ecological Pyramid-** An ecological pyramid (also trophic pyramid, eltonian pyramid, energy pyramid, or sometimes food pyramid) is a graphical representation designed to show the biomass or bio productivity at each trophic level in a given ecosystem.

- **Types of Ecological pyramid**
 1. **Pyramid of numbers** - This shows the number of organisms in each trophic level without any consideration for their size.
 2. **Pyramid of biomass** - This indicates the total mass of organisms at each trophic level. Usually, this type of pyramid is largest at the bottom and gets smaller going up, but exceptions do exist.
 3. **Pyramid of Energy:** When production is considered in terms of energy, the pyramid indicates not only the amount of energy flow at each level, but more important, the actual role the various organisms play in the transfer of energy.



An Ecological Pyramid.

- **Ecological Succession-** is the process of change in the species structure of an ecological community over time. The time scale can be decades (for example, after a wildfire), or even millions of years after a mass extinction.
- **Types**
 - ✓ In *primary succession*, newly exposed or newly formed rock is colonized by living things for the first time.
 - ✓ In *secondary succession*, an area that was previously occupied by living things is disturbed, then re- colonized following the disturbance.
 - ✓ In ecology, *climax community*, or climatic climax community, is a historic term for a biological community of plants, animals, and fungi which, through the process of ecological succession in the development of vegetation in an area over time, have reached a steady state.



Annual
Plants

Perennial
Plants and
Grasses

Shrubs

Softwood
Trees - Pines

Hardwood
Trees



Time

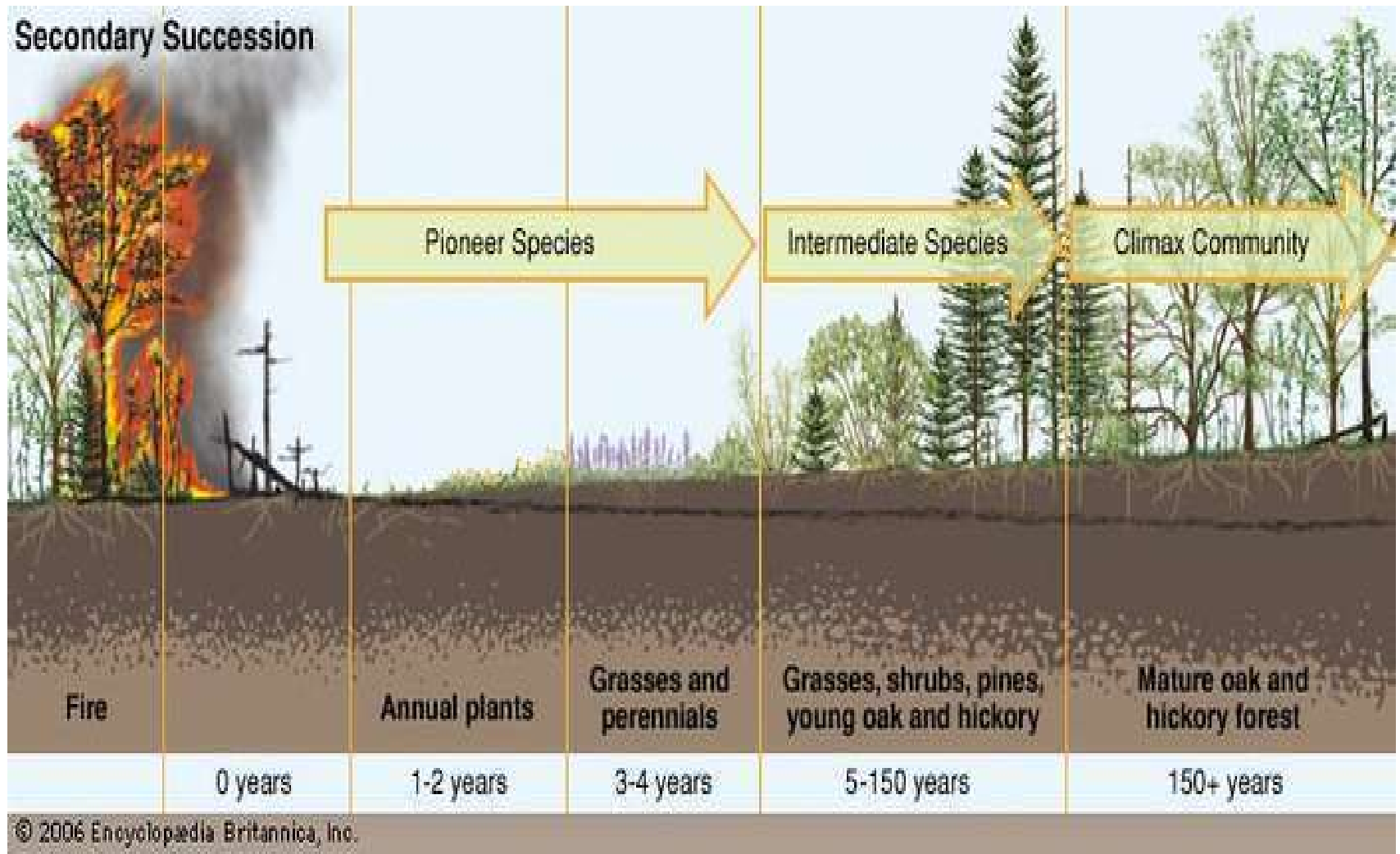
3 Years

5 Years

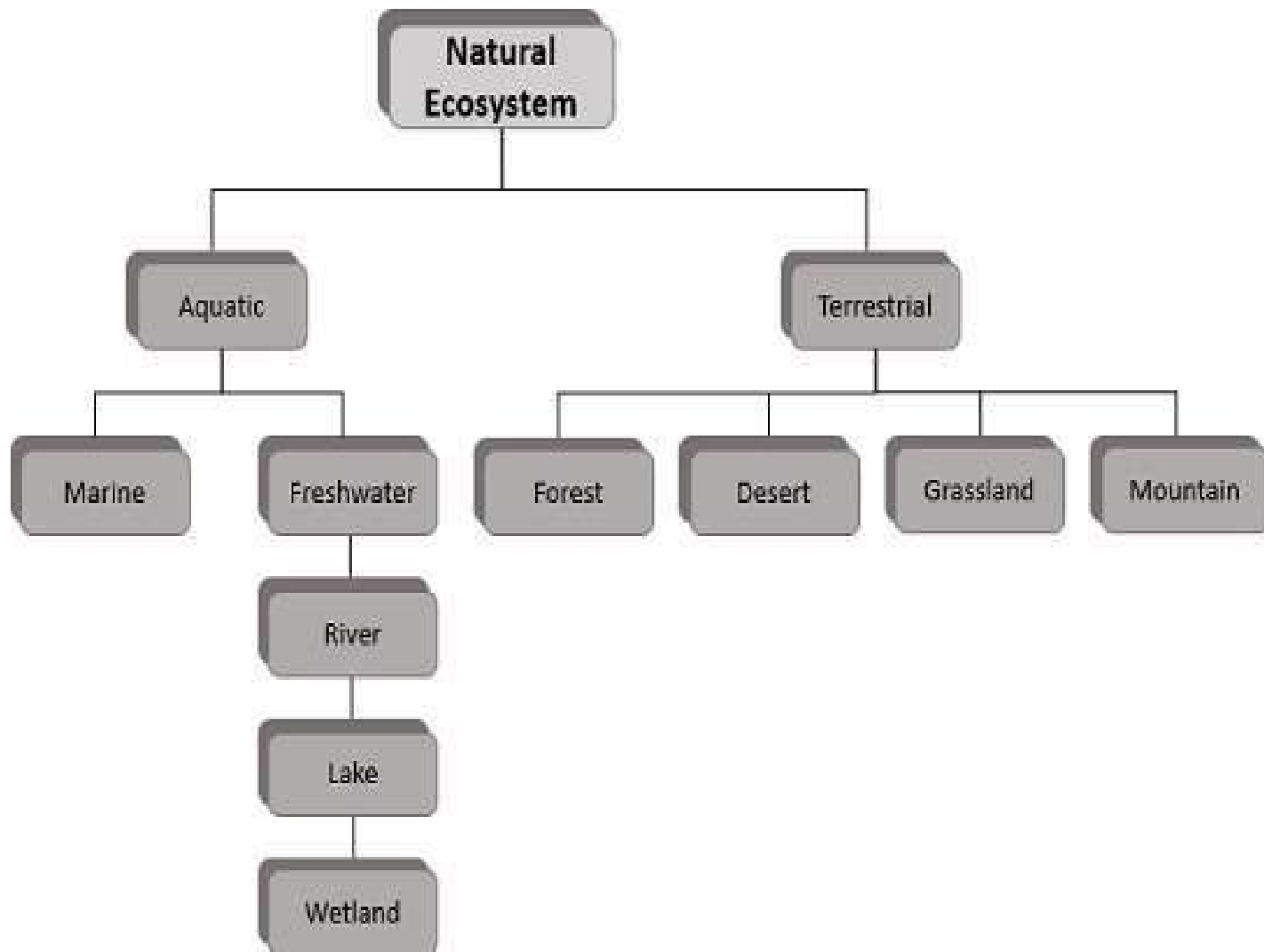
40+ Years

Primary Succession

Secondary succession



- **TYPES OF ECOSYSTEM**



- **Forest Ecosystem-** A forest ecosystem is a natural woodland unit consisting of all plants, animals and micro- organisms (Biotic components) in that area functioning together with all of the non-living physical (abiotic) factors of the environment.

Example: Deciduous forests.

- **Types of forest in India-**

1. **Moist tropical Forest** (annual rainfall ranges between 200 and 250 cm)

2. **Dry tropical Forest** (average annual rainfall ranges varies from 51 cm to 151)

3. **Montane temperate Forest**

4. **Montane sub tropical Forest**

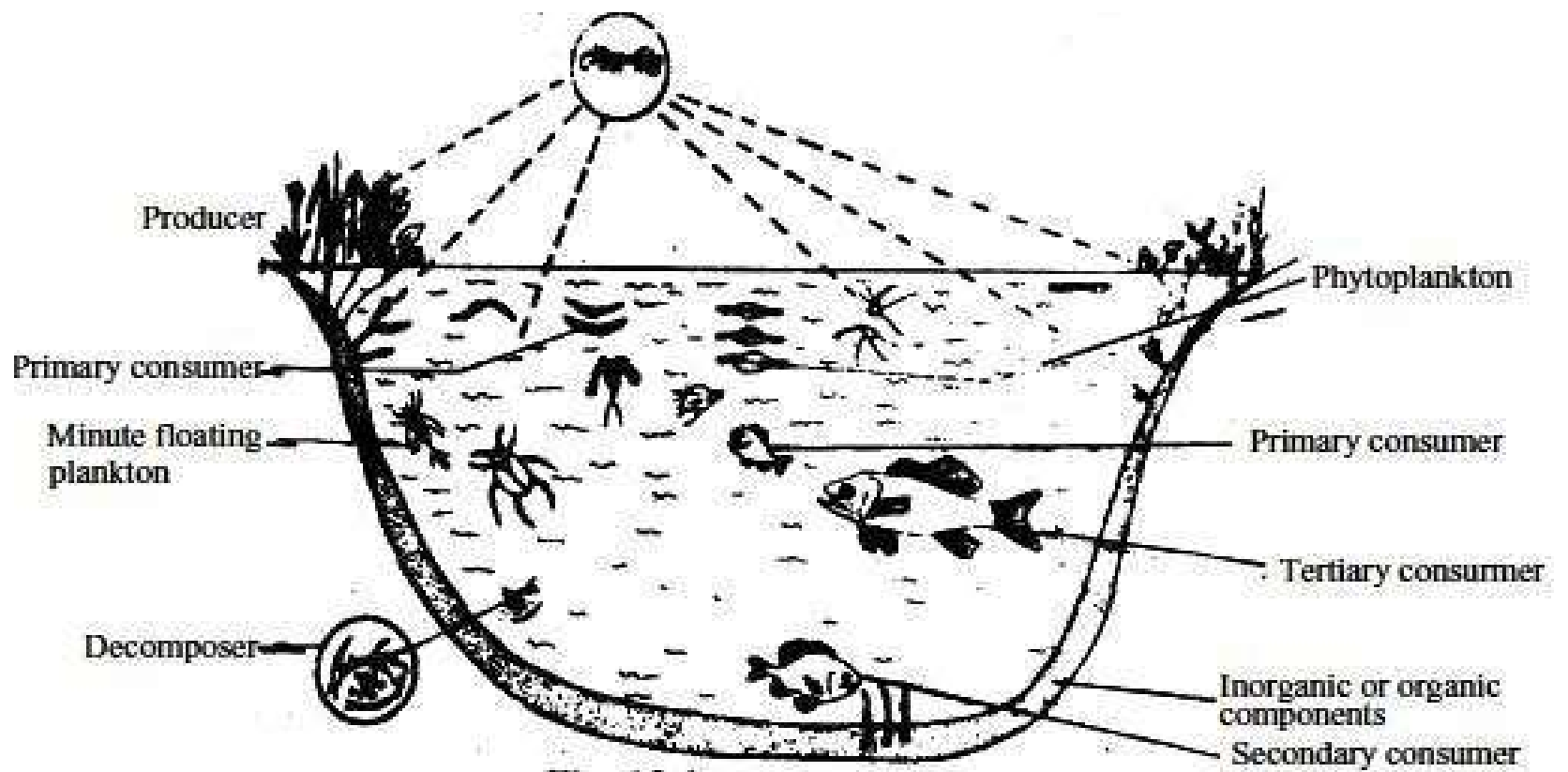
5. **Alpine Forest**

6. **Sub Alpine Forest**

- **Grassland ecosystem-** A biological community that contains few trees or shrubs, is characterized by mixed herbaceous (nonwoody) vegetation cover, and is dominated by grasses or grass like plants.

Example: Savanna, Shivalik Hills

- **Desert ecosystem-** A *desert ecosystem* is defined by interactions between organism populations, the climate in which they live, and any other non-living influences on the habitat. Example: Gobi, Great Basin, and Namib Deserts. Antarctica is a desert, but there are no camels or *sand dunes*.
- **Aquatic ecosystem-** An aquatic ecosystem is an ecosystem in a body of water. . The two main types of aquatic ecosystems are *marine ecosystems* and *freshwater ecosystems*.
- **Pond ecosystem-** A pond is a self-sufficient and an ideal example of the ecosystem. In a pond, the intimate relation between the inhabiting living and non-living components is well understood. The non-living objects are various types of organic and inorganic substances such as water, sun rays, CO₂, oxygen, calcium, phosphorus etc. The living components are producers, primary consumers, secondary consumers, tertiary consumers and various types of decomposers.



KNOW THIS....

- **Estuary** : An estuary is a partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. (Ex: Thane creek)
- **Wetland**: is a zone of flat lands that has groundwater of shallow depth and that ascend to the surface in determined periods, forming lagoons and marshes, until where they come to live hundreds of species. There are five classes of wetlands: marine, estuarine, lake, riparian and marshy.(Ex: Chilika lake)
- **Mangrove**: is a grouping of semi-submerged trees that have been flooded with water, with high levels of salinity and therefore they develop and survive in coastal lands. The trees grow on long roots, which like stilts raise the trunks above the level of the waters.(Ex: Sunderbans)
- **Coral reef**: it is one of the richest aquatic ecosystems of the planet, product of the great amount of species that inhabit in them (fish, snails, corals and algae). (Ex: Andaman and Nicobar island)





UNIT 3 NATURAL RESOURCES

- **Meaning-** Materials or substances occurring in nature which can be exploited for economic gain.
- **Classification of Natural Resources**
 - Renewable and Non-renewable Natural Resources
 - Biotic and Abiotic Natural Resources
 - Stock Natural Resources (Stock natural resources are those that are present in the environment but t the necessary expertise or technology to have them exploited. *Hydrogen* is an example of a stock natural resource.)
- **Land use** - It involves the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods.
- **Types of land use in India**
 - ✓ Forests area- According to National Forest Policy 1952, the reporting area of the forest must be 33.3% of the total land.
 - ✓ Land not available for cultivation
 - ✓ Cultivable waste land

✓ Fallow land -The land which is not utilized for cultivation for last 3 to 5 years is considered as fallow land.

✓ Net area sown

- **Significant negative effects of land use:**

- Impact on water cycle

- Impact on ground and surface water

- Emission of water pollutants

- Emission of air pollutants

- Destruction of wildlife due to habitat destruction

- Degradation of soil

- **Land degradation-** Land degradation is a process in which the value of the biophysical environment is affected by a combination of human-induced processes acting upon the land.

- The change in the characteristic and quality of soil which adversely affect its fertility is called as Degradation.
 - Loss of natural fertility of soil because of loss of nutrients.
 - Less vegetation cover
 - Changes in the characteristic of soil.
 - Pollution of water resources from the contamination of soil through which water sweeps into ground or runoff to the water bodies.
 - Changes in climatic conditions because of unbalanced created in the environment.
- **Causes of Land degradation**
 - Deforestation
 - Overgrazing
 - Agricultural practices
 - Industrialization
 - Urbanization



- **Control Measures for Land Degradation-**

1. Strip farming

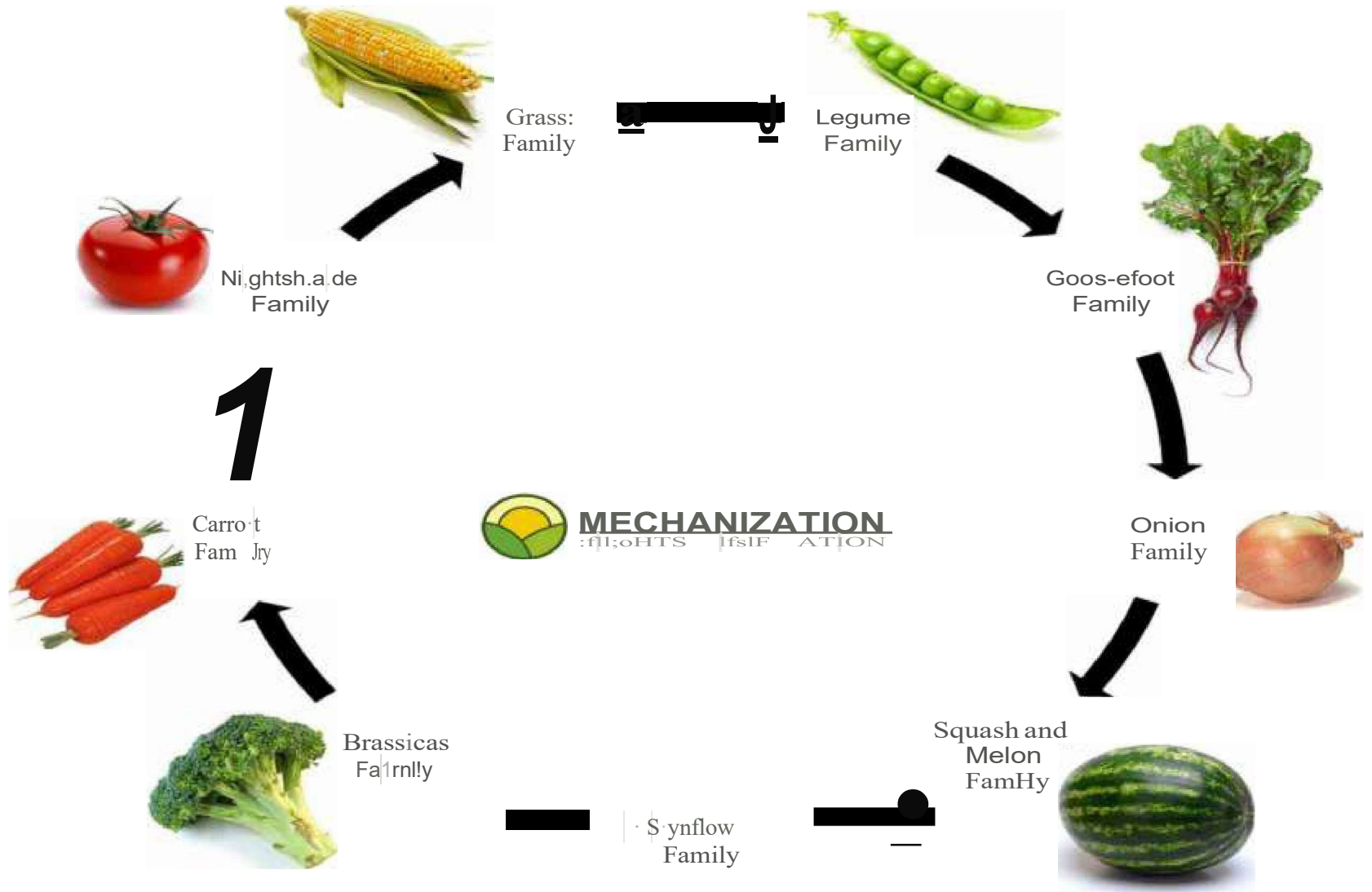
2. Crop Rotation

3. Ridge and Furrow Formation

4. Construction of Dams

5. Contour Farming





- **Desertification-** is a type of land degradation in which a relatively dry area of land becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife.
- **Causes of Desertification-**
 - Overgrazing
 - Deforestation
 - Farming Practices
 - Urbanization and other types of land development
 - Climate Change
 - Stripping the land of resources
 - Natural Disasters

- **Effects of Desertification**

- ✓ Farming becomes next to impossible
- ✓ Hunger
- ✓ Flooding
- ✓ Poor Water Quality
- ✓ Overpopulation
- ✓ Poverty



- **Preventive measures of land degradation**

- Land and water management

- Protection of vegetative cover

- Alternative Farming and Industrial Techniques

- Establish economic opportunities outside dry lands

- Great Green Wall -Eleven countries in Sahel-Saharan Africa

- Djibouti, Eritrea, Ethiopia, Sudan, Chad, Niger, Nigeria, Mali, Burkina Faso, Mauritania and Senegal — have focused efforts to fight against land degradation and revive native plant life to the landscape. The initiative, managed in part by the Global Environment Facility (GEF), plants a line of trees as a sustainable way of regenerating the parkland and serves as an example for other problematic locations.



THE GREAT GREEN WALL INITIATIVE



CJ

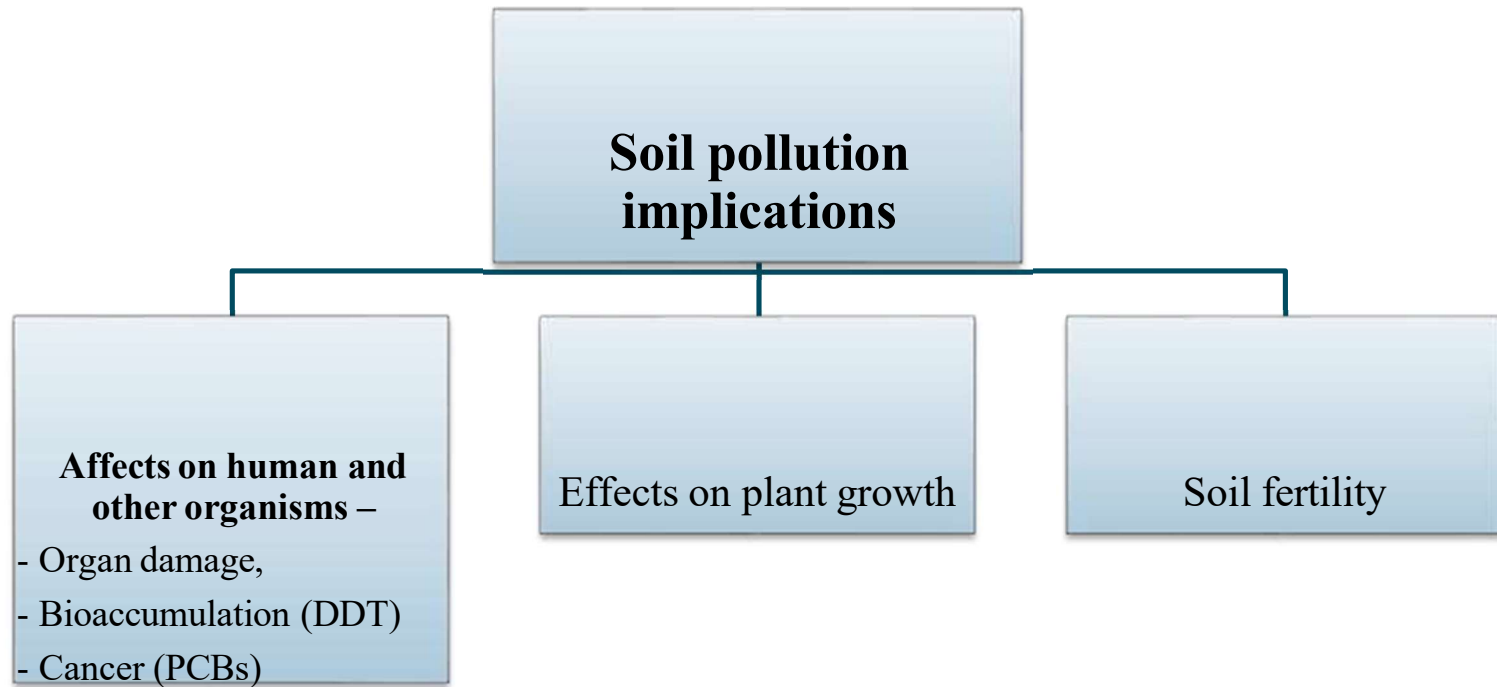
• PARTICIPATING COUNTRIES

FOCUS AREA

- **Soil erosion**
 - **Soil-** Soil is a mixture of mineral and organic matter, gases, liquids, and the countless organisms that together support life on Earth.
 - Soil is formed due to weathering of rocks.

 - **Forms of soil or land pollution**
 - Land degradation
 - Desertification
 - Soil piping
 - Soil salination
 - Causes of Soil Erosion
1. Wind
 2. Water
 3. Overgrazing

4. Deforestation



- **Soil conservation**

1. Aforestation
2. Crop Rotation
3. Terrace Farming
4. Building Dams
5. Shelterbelts
6. Embankments 7, Vanmohotsav



- **Deforestation-** Deforestation is the permanent destruction of forests in order to make the land available for other uses.
- **Causes**
 - ✓ To make more land available for housing and urbanization
 - ✓ To harvest timber to create commercial items such as paper, furniture and homes
 - ✓ To create ingredients that are highly prized consumer items, such as the oil from palm trees
 - ✓ To create room for cattle ranching



Dams and their Effects on Forests and Tribal People





Dams and their Effects on Forests and Tribal People

- The dams' effects have included much more than forest loss and the major environmental changes have impacted on local people, at both the dam site and in the entire river basin.
- The best agricultural soils flooded by the reservoir
- River's flora and fauna begins to disappear.
- Number of health hazards, starting with diseases introduced by the thousands of workers that are brought in to build the dam (including AIDS, syphilis, tuberculosis, measles and others) and ending with diseases related to the reservoir itself (malaria, schistosomiasis, river blindness, etc.)

Impact of mining on environment, rural population and sources of livelihood

- Water pollution
- Air pollution
- Noise pollution
- The child labours
- influx of number of diseases like blood pressure. Diabetes, asthma, skin diseases, allergy are the gifts of 'mining'
- Mining has eaten up the livelihood of many people.
- Frequent movement of ore filled lorries in the village has created lot of congestion and movement of public transport difficult.
- The mine owners and middlemen have destroyed the common property and resources of many people. They have acquired rural tanks, ponds, lake and Gomala's.

Loss of Biodiversity due to Mining



Bhadra river
30th September, 2002



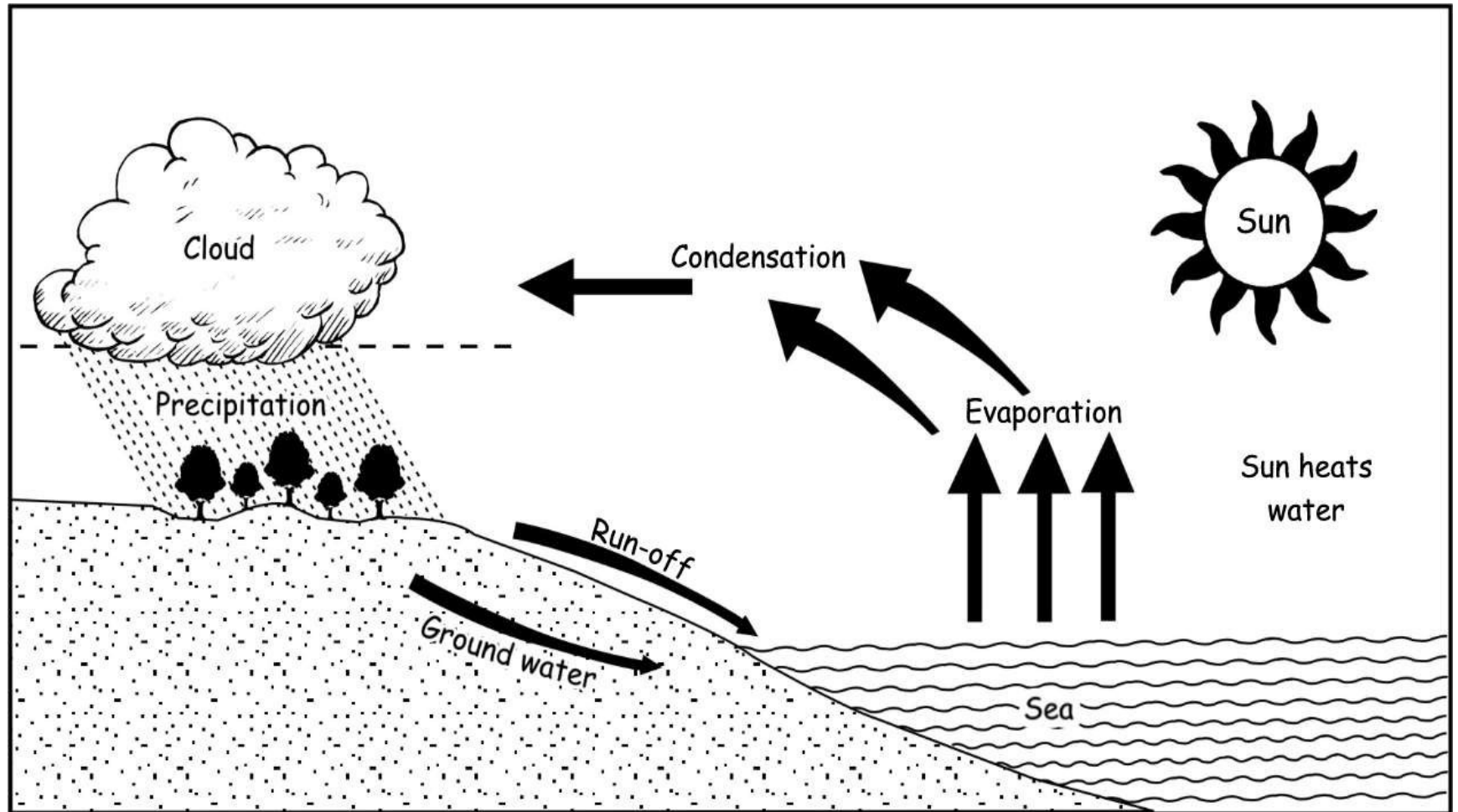
Bhadra river
18th October, 2010



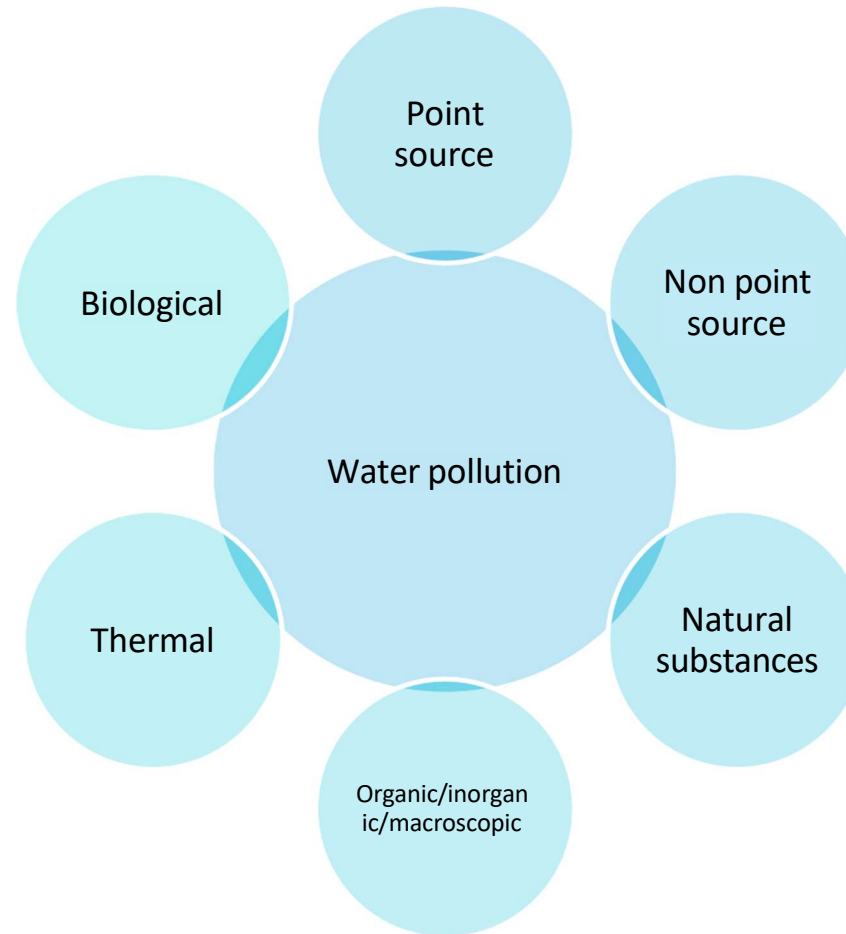
WATER

- Water is a transparent fluid which forms the world's streams, lakes, oceans and rain, and is the major constituent of the fluids of organisms.
- Water covers 71% of the Earth's surface, it is vital for all known forms of life. On Earth, 96.5% of the planet's crust water is found in seas and oceans, 1.7% in groundwater, 1.7% in glaciers and the ice caps.
- Only 2.5% of the water is fresh water and 98.8% of that water is in the form of ice and groundwater.
- Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products
- **Hydrology** - is the study of the movement, distribution, and quality of water

throughout the Earth.



- **Water pollution-** Water pollution is the changes in physical, chemical and biological characteristics of water.
- Causes



- **Water borne microbial diseases-** Infectious diseases can be spread through contaminated water and some of these water-borne diseases are *Typhoid, Cholera, Paratyphoid Fever, Dysentery, Jaundice and Malaria.*
- **Know this: Minamata disease-** Minamata disease was first discovered in Minamata city in Kumamoto prefecture, Japan, in 1956. It was caused by the release of methyl-mercury in the industrial wastewater from the Chisso Corporation's chemical factory, which continued from 1932 to 1968.
- **Groundwater contamination** - occurs when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use. Materials from the land's surface can move through the soil and end up in the groundwater. In addition, it is possible for untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills to contaminate groundwater.

- **Floods-** Flooding occurs when an extreme volume of water is carried by rivers, creeks and many other geographical features into areas where the water cannot be drained adequately.
- **Drought-** A **drought** is a period of below-average precipitation in a given region; resulting in prolonged shortages in the water supply, whether atmospheric, surface water or ground water.
- **Types of Drought**
 - ✓ Meteorological drought
 - ✓ Agricultural drought
 - ✓ Hydrological drought
 - ✓ Socioeconomic drought

- **The Effects of Drought**

- **Environmental Impacts**

- Drying out of water bodies
- Reduction in soil quality
- Unsuitable conditions for plant and vegetation survival
- Migration and even death of Animals and Wildlife

- **Economic Impacts of Droughts**

- Increased budgetary spending by farmers
- Reduced crop yields
- Industrial and governmental losses

- **Social Impacts**

- Hunger, anemia, malnutrition, and deaths
- Migration of people and anxiety

Conflicts over water (international & inter-state)

- Water conflict is a term describing a conflict between countries, states, or groups over an access to water resources.
- According to UNESCO, the current conflicts occur mainly in-
 - ✓ Middle East (disputes stemming from the Euphrates and Tigris Rivers among Turkey, Syria, and Iraq;
 - ✓ Central Asia (the Aral Sea conflict among Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan and Kyrgyzstan).
 - ✓ Jordan River conflict among Israel, Lebanon, Jordan and the State of Palestine), in Africa (Nile River- related conflicts among Egypt, Ethiopia, and Sudan),

The Indus Waters Treaty

- The Indus Waters Treaty is a water-distribution treaty between India and Pakistan, brokered by the World Bank to use the water available in the Indus System of Rivers located in India. The Indus Waters Treaty (IWT) was signed in Karachi on September 19, 1960 by the first Prime Minister of India Pandit Jawaharlal Nehru and then President of Pakistan Ayub Khan.
- According to this agreement, control over the water flowing in three "eastern" rivers of India — the *Beas, the Ravi and the Sutlej* with the mean flow of 33 million acre-feet (MAF) — was given to India, while control over the water flowing in three "western" rivers of India — the *Indus, the Chenab and the Jhelum* with the mean flow of 80 MAF — was given to Pakistan.

Conflicts over water: inter-state

DISPUTE	STATES INVOLVED
Ravi and Beas water dispute	Punjab, Haryana and Rajasthan
Vansadhara river water dispute	Odisha and Andhra Pradesh
Mahadayi/Mandovi river dispute	Goa, Karnataka and Maharashtra
Krishna river water dispute tribunal	Maharashtra, Karnataka and Andhra Pradesh
Cauvery water dispute	Tamil Nadu and Karnataka
Indirasagar (Polavaram) project (Andhra Pradesh)	Odisha, Andhra Pradesh, Telangana and Chhattisgarh
Babhali barrage issue	Andhra Pradesh and Maharashtra
Mullaiperiyar dam Issue	Kerala and Tamil Nadu

Source: Mint research

Energy resources: Renewable and non renewable energy sources

All things that are useful to us are called resources. Air, water, land, soil, forest etc are all resources. Resources are useful raw materials that we get from nature.

- **Classification of Resources**
 - Renewable resources
 - Non Renewable resources

Meaning: Renewable resources

Renewable resources are those resources that can be replenished or renewed naturally over time. Air, water, wind, solar energy etc are all renewable resources. Renewable resources can be easily renewed by nature.

Meaning: Non renewable resources

Non-renewable resources are those natural resources that are available in limited quantity. These resources cannot be renewed or replenished in short duration. Therefore they are also known as *exhaustible resources*. Examples- coal, natural gas, petroleum etc.

NUCLEAR ENERGY

Nuclear Power Station	State	Total capacity (MW)
Tarapur	Maharashtra	1,400
Rawatbhata	Rajasthan	1,180
Kudankulam	Tamil Nadu	2,000
Kaiga	Karnataka	880
Kakrapar	Gujarat	440
Kalpakkam	Tamil Nadu	440
Narora	Uttar Pradesh	440

- **Alternative energy** - is any energy source that is an alternative to fossil fuel. These alternatives are intended to address concerns about fossil fuels, such as its high carbon dioxide emissions, an important factor in global warming. Marine energy, hydroelectric, wind, geothermal and solar power are all alternative sources of energy.
- **Hydro electricity** captures energy from falling water.

Power station	State	Total capacity (MW)	Power station	State	Total capacity (MW)
Tehri Dam	Uttarakhand	2400 MW	Sharavathi	Karnataka	1469 MW
Srisaïlam Dam	Andhra Pradesh	1670 MW	Kalinadi	Karnataka	1240 MW
Nagarjunasagar	Andhra Pradesh	965 MW	Linganamakki Dam	Karnataka	55 MW
Sardar Sarovar	Gujarat	1450 MW	Idukki	Kerala	780 MW
Baspa-II	Himachal Pradesh	300 MW	Bansagar Dam	Madhya Pradesh	425 MW
Nathpa Jhakri	Himachal Pradesh	1500 MW	Bargi Dam	Madhya Pradesh	105 MW
Bhakra Dam	Punjab	1325 MW	Madikheda Dam	Madhya Pradesh	60 MW
Dehar	Himachal Pradesh	990 MW	Omkareshwar	Madhya Pradesh	520 MW
Baira Suil	Himachal Pradesh	180 MW	Indira Sagar	Madhya Pradesh	1000 MW
Chamera-I	Himachal Pradesh	540 MW	Loktak	Manipur	105 MW
Chamera-II	Himachal Pradesh	300 MW	Khuga Dam	Manipur	
Pong	Himachal Pradesh	396 MW	Koyna	Maharashtra	1920 MW
Uri Hydroelectric Dam	Jammu & Kashmir	480 MW	Mulshi Dam	Maharashtra	150 MW
Dulhasti	Jammu & Kashmir	390 MW	Jayakwadi Dam	Maharashtra	12 MW
Salal	Jammu & Kashmir	690 MW	Kolkewadi Dam	Maharashtra	MW
Dhauliganga-I	Uttarakhand	280 MW	Rangeet	Sikkim	60 MW
Loharinag	Uttarakhand	600 MW	Teesta-V	Sikkim	510 MW

Wind energy is the generation of electricity from wind, commonly by using propeller-like turbines.

Power plant	Producer	Location	State	Total capacity (MW)
Muppandal windfarm	Muppandal Wind	Kanyakumari	Tamil Nadu	1500
Jaisalmer Wind Park	Suzlon Energy	Jaisalmer	Rajasthan	1064
Brahmanvel windfarm	Parakh Agro Industries	Dhule	Maharashtra	528
Dhalgaon windfarm	Gadre Marine Exports	Sangli	Maharashtra	278
Vankusawade Wind Park	Suzlon Energy Ltd.	Satara District.	Maharashtra	259
Damanjodi Wind Power Plant	Suzlon Energy Ltd.	Damanjodi	Odisha	99
Acciona Tuppadahalli	Tuppadahalli Energy India Private Limited	Chitradurga District	Karnataka	56.1
Dangiri Wind Farm	Oil India Ltd.	Jaisalmer	Rajasthan	54
Cape Comorin	Aban Loyd Chiles Offshore Ltd.	Kanyakumari	Tamil Nadu	33
Kayathar Subhash	Subhash Ltd.	Kayathar	Tamil Nadu	30

- **Solar energy** is the use of energy from the sun. Heat from the sun can be used for solar thermal applications or light can be converted into electricity via photovoltaic devices.
- **Know this: World's largest solar park**

The world's largest solar park set up at an investment of Rs 16,500 crore at Pavagada in Karnataka's Tumakuru district was launched with the 2,000 MW capacity, named as 'Shakti Sthala', spans across 13,000 acres.

- **Geothermal energy** is the use of the earth's internal heat to boil water for heating buildings or generating electricity.
- **Biofuel and ethanol** are plant-derived gasoline substitutes for powering vehicles.
- **Hydrogen** can be used as a carrier of energy, produced by various technologies such as cracking of hydrocarbons or water electrolysis.

Growing energy needs in India

- India's energy consumption is set to grow 4.2% a year by 2035, faster than that of all major economies in the world, according to BP Energy Outlook.

- India, Asia's second biggest energy consumer since 2008, had in 2015 overtaken Japan as the world's third largest oil consuming country behind the US and China.
- Globally, energy demand will increase by about 30% by 2035. Natural gas consumption will grow faster than either oil or coal, expanding at 1.6% a year.
- Coal demand will peak in the mid-2020s, as China moves toward cleaner, lower carbon fuels, the report said. Here's a look...

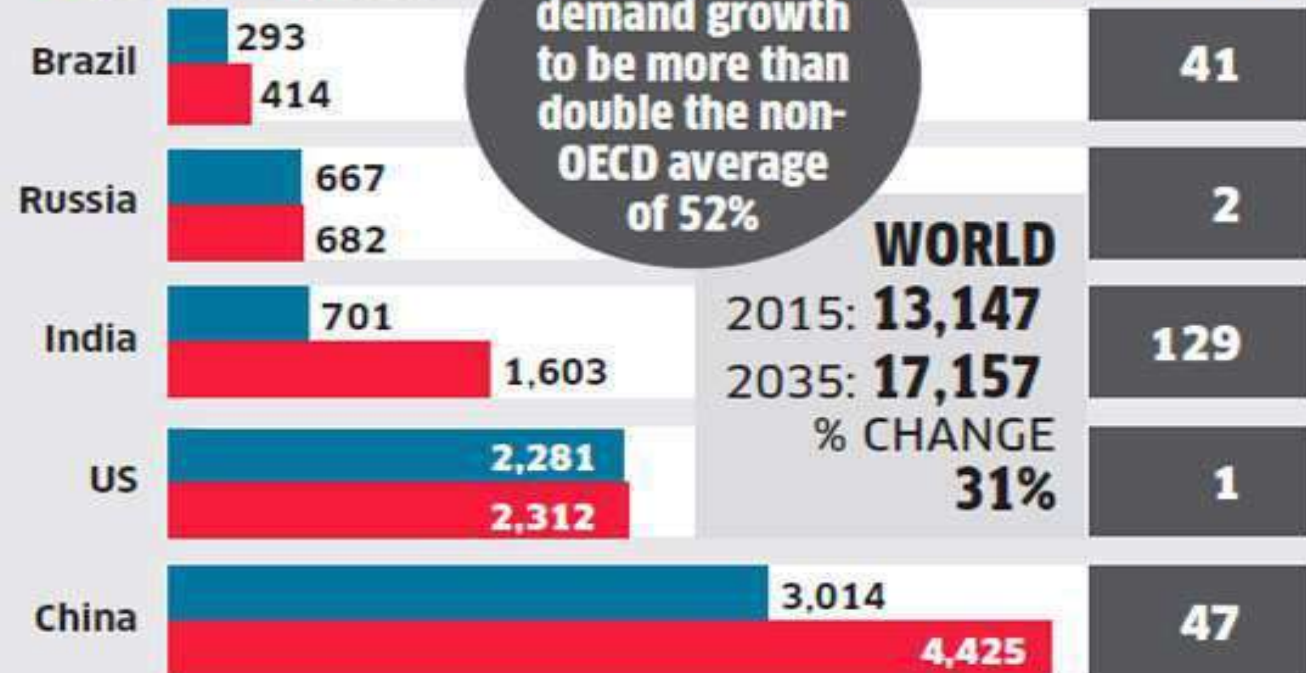
At 129%, India's energy consumption growth to be highest among major economies

Total primary energy consumption

(units in Mtoe)

■ 2015 ■ 2035

% Change
2015-'35



UNIT 4

- **Biodiversity** is the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems.
- **Defn.** According to the *United Nations Environment Programme* (UNEP), biodiversity typically measures variation at the genetic, species, and ecosystem level.
- **Benefits of biodiversity**
 - Provisioning services such as food, clean water, timber, fibre and genetic resources
 - Regulating services such as climate, floods, disease, water quality and pollination
 - Cultural services such as recreational, aesthetic and spiritual benefits
 - Supporting services such as soil formation and nutrient cycling

- **LEVELS/TYPES/ ELEMENTS OF BIODIVERSITY**

- **Genetic Diversity**– It is basically the variety of species expressed at the genetic level by each individual in a species. No two individuals belonging to the same species are exactly similar. For example, in the species of human beings, each human shows a lot of diversity in comparison to another human.
- **Species Diversity** – It is the biodiversity observed within a community. It stands for the number and distribution of species. The number of species in a region varies widely depending upon the varied environmental conditions. For example, it is usually observed that civilizations residing beside water bodies show more species than the one compared to the areas away from water bodies.
- **Ecological diversity** – It defines the diversity observed among the ecosystems in a particular region. Different ecosystems like mangroves, rainforests, deserts, etc., show a great variety of life forms residing in them.

- **Biodiversity is defined & measured on two components viz. richness & evenness**
- **Richness:** Expressed as the number of species found in a community
- **Evenness:** Proportions of species or functional groups present on a site. The more equal species are in proportion to each other the greater the evenness of the site. A site with low evenness indicates that a few species dominate the site.
- **Biogeography** is the study of the distribution of species (biology), organisms, and ecosystems in geographic space and through geological time. There are ten biogeographic zones in India.

Ten biogeographic zones in India

- Trans-Himalayan Region
- Himalayan Zone
- Indian Desert Zone
- Semi Arid Region
- Western Ghats
- Deccan Plateau
- Gangetic Plain
- North East Region
- Coastal Region
- Andaman and Nicobar Islands

- **A biodiversity hotspot** is a biogeographic region with significant levels of biodiversity that is threatened with destruction. For example forests are considered as biodiversity hotspots. The Status is designated by International Union for Conservation of Nature (IUCN).
- The British biologist Norman Myers coined the term "biodiversity hotspot" in 1988.
- **The Global Convention on Biological Diversity**, signed in 1992 at the Earth Summit, describes biodiversity as the "variability among all living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part, this includes diversity within species, between species and of ecosystems. "
- [Conservation International](#) (CI) adopted Myers' hotspots as its institutional blueprint in 1989, and in 1996, the organization made the decision to undertake a reassessment of the hotspots concept.
- According to CI, to qualify as a hotspot a region must meet two strict criteria: it must contain at least 1,500 species of vascular plants (> 0.5% of the world's total) as endemics, and it has to have lost at least 70% of its original habitat. In 1999, CI

identified 25 biodiversity hotspots in the book “Hotspots: Earth’s biologically Richest and Most Endangered Terrestrial Eco regions”.

- **BIODIVERSITY HOTSPOTS IN INDIA**

1. Himalaya: Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar)
2. Indo-Burma: Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China)
3. Sundalands: Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines)
4. Western Ghats and Sri Lanka: Includes entire Western Ghats (and Sri Lanka)

Know this- 2010: International year for Biodiversity, declared by United Nations

- **22 May:** International day for Biological diversity, declared by United Nations

Endangered and endemic species of India

- Species that are found only in a particular region are known as endemic species. Almost 60% the *endemic species* in India are found in Himalayas and the Western Ghats.
- *Extinct species* is no longer found in the world.
- *Vulnerable species* is one whose population is facing continuous decline due to habitat destruction or over exploitation. However, it is still abundant.
- *Rare species* is localized within a restricted area or is thinly scattered over an extensive area. Such species are not endangered or vulnerable.
- **Know this: Red Data Book-** The RED-data book contains a list of endangered species of plants and animals. It contains a list of species of that are endangered but might become extinct in the near future if not protected.

- Some of the rarest animals found in India are:
 - Asiatic cheetah
 - Asiatic Lion
 - Asiatic Wild Ass
 - Bengal Fox
 - Gaur
 - Indian Elephant
 - Indian Rhinoceros
 - Marbled Cat
 - Markhor



- **Endangered species in the world**

- *Habitat loss*

- *Poaching of wildlife*

- *man-wildlife conflicts*

- *biological invasions*

- **Impact of loss of Biodiversity**

- Increased vulnerability of species extinction

- Ecological imbalance

- Reduced sources of food, structural materials, medicinal and genetic resources

- Cost increase to the society

- **Poaching of wildlife-** Poaching is illegal hunting, killing or capturing of wild animals also referred to the illegal harvesting of wild plant species. It's an environmental crime against the natural resources, illegal hunting of wildlife for animal products such as ivory, horn, teeth, skin and bone.
 - Indian Pangolin is the most Poached Species of 2015 in India
 - Black magic behind illegal Barn Owl trade in India
 - Monitor Lizards are new target of Poachers in North East
 - Poaching Of Migratory Birds In Chilika Lake
 - Poachers Kill Ganga River Dolphin in Bihar
- **Objectives as well as advantages of conservation of biodiversity**
 - Conservation of biological diversity leads to conservation of essential

ecological diversity to preserve the continuity of food chains.

- The genetic diversity of plants and animals is preserved.
- It ensures the sustainable utilisation of life support systems on earth.
- It provides a vast knowledge of potential use to the scientific community.
- A reservoir of wild animals and plants is preserved, thus enabling them to be introduced, if need be, in the surrounding areas.
- Biological diversity provides immediate benefits to the society such as recreation and tourism.

Conservation of biodiversity: Types

- **Ex situ conservation**
 - Conserving biodiversity outside the areas where they naturally occur is known as ex situ conservation. Here, animals and plants are reared or cultivated in areas like zoological or botanical parks.
- **In situ conservation**
 - Conserving the animals and plants in their natural habitats is known as in situ conservation. This includes the establishment of
 - National parks and sanctuaries
 - Biosphere reserves
 - Nature reserves
 - Reserved and protected forests
 - Preservation plots

- Reserved forests

- **Agro biodiversity conservation**

Convention of biodiversity

- The aim of the Convention on Biological Diversity is 'the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.'

Notable projects to save the species

- **Project Tiger**

- Project Tiger was initiated as a Central Sector Scheme in 1973 with 9 tiger reserves located in different habitat types in 9 different states.

There are totally 18 Reserves in 13 states. At present tiger Conservation has been viewed in India not only as an effort to save an endangered

species but, with equal importance, also as a means of preserving biotypes of sizeable

magnitude.

- **Crocodile Breeding Project**

- The project was started in Orissa and then extended to several other states in April 1975 with UNDP assistance. The main objective was to protect the three endangered species of crocodiles namely - *Gavialis gangeticus*, *Crocodylus palustris* and the salt water crocodile, *Crocodylus porosus*.

- **Lesser Cats Project**

- The project was launched in 1976 with the assistance of WWF in India for conservation of four species of lesser cats e.g. *Felis bengalensis* Kerr, *Felis marmota* Martin, *Felis lemruinki* Vigors Horsfield and *Felis viverrina* Bennet, found in Sikkim and Northern part of West Bengal.

- **The Manipur Brow-antlered Deer Project**

- This was launched in 1981 in Manipur to save the brow-antlered deer (*Cervus eldi eldi*) which is on the verge of extinction. The habitat includes 35 sq.km. of park and sanctuary. The population of the deer has increased from 18 to 27.

- **Project Elephant**

- It was launched in 1991 to protect the Asiatic elephant which is also a highly endangered species because of large scale poaching.

- **Project Rhino**

- It was launched in 1987 in Kaziranga Wildlife Sanctuary in Assam to save the lesser one horned rhinoceros from extinction. It covers an area of 430 sq.km. and is the natural of the dwindling rhino.

- **Himalayan musk deer project**

- This was launched in 1981 to save the endangered musk deer which is facing

extinction. Captive breeding has yielded good results.

- **Project Hangul**

- This project was launched in 1970 in Kashmir valley to save the highly endangered Kashmir stag (*Cervus elaphus hanglu*) which is facing extinction. As a result their population has increased



- **Ecosystem Services**

- Ecosystem services are processes provided by nature that support human life. These services include the decomposition of waste, pollination, water purification, moderation of floods, and renewal of soil fertility.

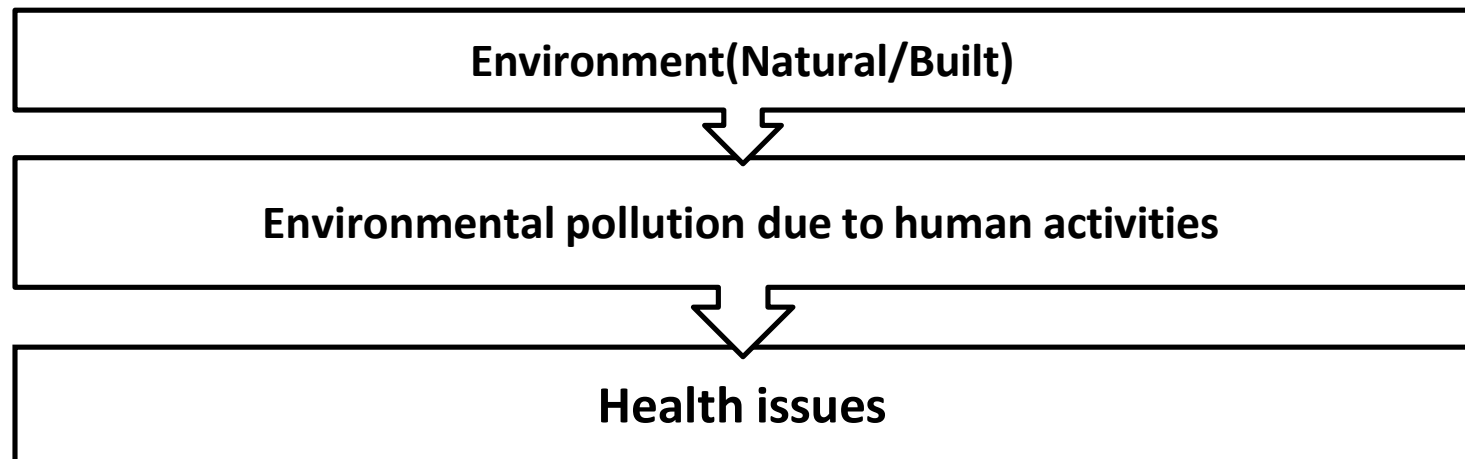
- **Ecotourism** is travel with the desire to view, sustain, and support natural ecosystems and local cultures. Support from ecotourism can reduce habitat destruction, preserve species that suffer from poaching and illegal trade in the pet market, plus provide jobs for the local economy.

- **Social and Spiritual Benefits**

- Throughout most of human history, conservation has involved protecting nature for the spiritual gifts it provides, and protecting sacred places in the local landscape.

UNIT 5

Environment is the sum total of conditions in which an organism has to survive or maintain its life process. It influences the growth and development of living forms.



- **TYPES OR FORMS OF ENVIRONMENTAL POLLUTION**

1. Air pollution

2. Water pollution

3. Soil or land pollution

4. Noise pollution

5. Thermal pollution

6. Visual pollution



- **Air pollution** is the contamination of air by smoke and harmful gases, mainly oxides of carbon, sulfur, and nitrogen.
- **Pollutant** is a substance which causes pollution. The pollutant may be solid, liquid or gas.
- **Major primary air pollutants produced by human activity**
 1. Sulfur dioxide (SO₂)
 2. Nitrogen dioxide (NO₂)
 3. Ozone (O₃)
 4. Carbon monoxide (CO)
 5. Carbon dioxide (CO₂)

- **Acid rain** is a rain or any other form of precipitation that is unusually acidic in nature (low pH), which is caused by emissions of sulfur dioxide and nitrogen oxide, which react with the water molecules in the atmosphere to produce acids. It can have harmful effects on plants, aquatic animals and infrastructure or buildings and monuments. The classic example is Taj Mahal, which is affected by acid rain.



- **Water pollution** is the changes in physical, chemical and biological characteristics of water.
- **Water borne microbial diseases-**
 - **Pesticides** – can damage the nervous system and cause cancer because of the carbonates and organophosphates that they contain. Chlorides can cause reproductive and endocrinal damage.
 - **Nitrates** – are especially dangerous to babies that drink formula milk. It restricts the amount of oxygen in the brain and cause the “blue baby” syndrome.
 - **Lead** – can accumulate in the body and damage the central nervous system. Over exposure of lead leads to lower IQ level in small kids.
 - **Arsenic** – causes liver damage, skin cancer and vascular diseases
 - **Flourides** - in excessive amounts can make your teeth yellow and cause damage to the spinal cord and leads to skeletal flourosis..
 - **Petrochemicals** – even with very low exposure, can cause cancer.

- **Sound** is the vibrations that travel through the air or another medium and can be heard when they reach a person's or animal's ear. A sound, especially one that is loud or unpleasant or that causes disturbance is *noise*.

- **Causes of Noise**

1. Industrialization
2. Poor Urban Planning
3. Social Events
4. Transportation
5. Construction Activities
6. Household Chores



- **Effects of Noise**

- (i) Physical Effects- The immediate and acute effect of noise pollution is impairment of hearing (i.e. total deafness.)

- (ii) Physiological Effects-

- (a) Depression and fatigue which considerably reduces the efficiency of a person.
 - (b) Insomnia as a result of lack of undisturbed and refreshing sleep
 - (c) Straining of senses and annoyance as a result of slow but persistent noise from motorcycles, alarm clocks, call bells, telephone rings etc.
 - (d) Affecting of psychomotor performance of a person by a sudden loud sound
 - (e) Emotional disturbance: Noise is annoying and the annoyance depends on many factors not merely the intensity of the sound but also repetition, because even a sound of small intensity (e.g. dripping tap or clicking of clock) may become annoying, simply by repetition.

Noise pollution level and its harmful effects

Level in Decibels(dB)	Effects
up to 23	No disturbance
30—60	Stress, tension, psychological effects especially at upper range.
60—90	Damage to health, psychological and vegetative (disturbance in stomach-gall function, pains in muscles, high blood pressure, disturbance in sleeping)
90—120	Damages to health and ontological (ear diseases) effects
Above 120	Death of hearing tissues



NUCLEAR HAZARD AND HUMAN HEALTH RISK

- **Radiation** is a fairly general term that can be used to describe the transfer of energy through space away from a source.
- **Nuclear hazard** is an actual or potential release of radioactive material at a commercial nuclear power plant or a transportation accident.
- **Sources/causes of nuclear hazards**
 - 1) Mining and processing of radioactive ores;
 - 2) Use of radioactive material in nuclear power plants;

- 3) Use of radioactive isotopes in medical, industrial and research applications;
and
- 4) Use of radioactive materials in nuclear weapons.

Effects of nuclear hazards

- 1) Radiations may break chemical bonds, such as DNA in cells. This affects the genetic make-up and control mechanisms.
- 2) Exposure at low doses of radiations (100-250 rads), men do not die but begin to suffer from fatigue, nausea, vomiting and loss of hair.
- 3) Exposure at higher doses (400-500 rads), the bone marrow is affected, blood cells are reduced, natural resistance and fighting capacity against germs is reduced, blood fails to clot, and the irradiated person soon dies of infection and bleeding.
- 4) Higher irradiation doses (10,000 rads) kill the organisms by damaging the tissues of heart, brain, etc.

- **Control of nuclear hazards**

- 1) Leakages from nuclear reactors, careless handling, transport and use of radioactive fuels, fission products and radioactive isotopes have to be totally stopped;
- 2) Safety measures should be enforced strictly;
- 3) Waste disposal must be careful, efficient and effective;
- 4) There should be regular monitoring and quantitative analysis through frequent sampling in the risk areas;
- 5) Preventive measures should be followed so that background radiation levels do not exceed the permissible limits;
- 6) Appropriate steps should be taken against occupational exposure;
- 7) Safety measures should be strengthened against nuclear accidents.

Nuclear Disasters

The Chernobyl disaster- 1986



Fukushima nuclear accident - 2011



SOLID WASTE MANAGEMENT

- **Swachh Bharat Abhiyan (Clean India)**- The campaign was officially launched on 2 October 2014 at Rajghat, New Delhi, where Prime Minister Narendra Modi himself cleaned the road. It was performed in remembrance of Mahatma Gandhi's words. It is India's biggest ever cleanliness drive and 3 million government employees and school and college students of India participated in this event.



- **Solid Waste-** The term solid waste means, material such as household garbage, food wastes, yard wastes, and demolition or construction debris. It also includes discarded items like household appliances, furniture, scrap metal, machinery, car parts and abandoned or junk vehicles.
- **Waste Management** is defined as the discipline associated with control of generation, storage, collection, transport or transfer, processing and disposal of waste materials in a way that match with the best principles of public health, conservation, economics, aesthetic, engineering and other environmental considerations.
- **The major sources of Muncipal Solid waste(MSW) -**
 - Domestic Waste
 - Commercial waste
 - Industrial waste

TYPE	COMPOSITION
Garbage	Vegetable waste, animal waste, food waste. Generally biodegradable in nature.
Rubbish	Consists of combustible and non-combustible solid waste, excluding food waste
Litter	Bits of paper, discarded wrappings, bottles and lefts lying around in public places
Domestic waste	Range of materials such as paper, plastic, organic, hazardous (insecticides).
Industrial waste	Scraps and metal flakes which don't have economic value
Agricultural waste	Empty containers of pesticides, chemicals, vegetation from clearing land.
Construction and demolition waste	Debris, concrete, metal, paint, tiles etc
Medical/ hospital waste	Needles, syringes, outdated drugs, used cotton, diapers, bandages etc
Commercial waste	From hotels, tourism etc
Institutional wastes	From educational institutes, Government centers etc

Source	Typical waste generators	Types of solid wastes
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes.).
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants.	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes.
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes.
Institutional	Schools, hospitals, prisons, government centers.	Same as commercial.
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants.	Street sweepings; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas; sludge.

Process (manufacturing, etc.)	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing.	Industrial process wastes, scrap materials, off-specification products, tailings.
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms.	Spoiled food wastes, agricultural wastes, hazardous wastes (e.g., pesticides).

Characterization, Collection, Transportation and Disposal methods

- Physical and Chemical Characteristics of MSW in Indian Cities are as follows-
 - Physical characteristics- Paper, Rubber leather and synthetics, glass, metals etc
 - Chemical characteristics- Moisture, organic matter, Chemical composition etc
- The waste can be segregated as-
 - Biodegradable- Kitchen, garden waste
 - Non biodegradable- Recyclable, toxic and Soiled waste
 - Recyclable waste- Plastics, paper, glass, metal
 - Toxic waste- chemicals, old medicines, batteries, pesticides containers, shoe polish etc
 - Soiled waste- hospital waste such as cloth soiled with blood and other body fluids.



Organic

Left over food, Fruit peels, Leaves & twigs, Floor sweepings, Biscuits, Flowers, Soil & sand, Hair



Paper

White paper, Note books & covers, Small pieces of paper, Newspaper, Coloured paper, Cardboard, Chart paper, Tetra Paks, Paper cups



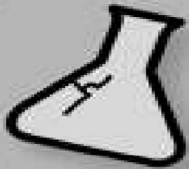
Plastic

Plastic bags, Juice, soft drink & water bottles, Milk packets, Pens & refills, Scissors, Glue sticks & bottles, Paint pallets & bowls, Broken sharpeners, Broken dusters



Mixed

Dirty or wet waste, Food packaging, Sweet, chocolate & biscuit wrappers, Pencil shavings, Erasers, Crayons, Thermocol, Broken shoes & slippers, Cloth



Glass

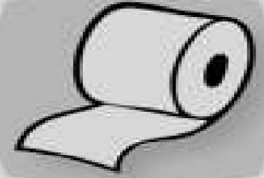
Glass jars, Dettol Bottles, Pipettes, Test tubes, Lab bottles, Drinking glasses, Ink bottles



Metal

Aluminium foil cans, Paper clips, Thumb tacks, Metal bottle caps, Metal accessories, Broken hole punchers, Broken staplers

CJ



Sanitary

Used tissue paper, Spilled toilet paper, Sanitary pads, Diapers

- **Collection of Municipal Solid Waste-**
- Community Bins
- House-to-House
- Curbside Pick-Up
- Self Delivered
- Contracted or Delegated Service
- **Transportation and storage of MSW-** Transportation of waste from the waste storage locations to the disposal site is done through a variety of vehicles such as three-wheelers, tractors, tippers and trucks. A few cities use modern hydraulic vehicles as well.
- **Methods of MSW disposal-**
- Landfills
- Incineration
- Recycling
- Sanitary landfills
- Open dumps
- Composting

- **Alternative waste treatment techniques**
- Fermentation
- Pyrolysis
- Gasification
- **Hazardous waste-** Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment.

Components	Source
Heavy metals(Arsenic, Nickel, Chromium, Cadmium, lead, manganese, mercury etc)	Mining, refining, smelting
Hydro carbons (Benzene, Vinyl chloride)	Petrochemical, Solvent industries
Pesticides	Pesticide industry
Organic chemicals(Dioxin)	Waste incineration

- **Non hazardous Waste Components**

Components	Source
Sugar bagasses, Sugar molasses, Fermentative Yeast biomass	Sugar Mills
organs, Tissues, Blood of animals	Slaughter houses
Pulp, Wood wastes and Paper boards	Paper mills
Whey and Milk cream	Dairy Plants
Animal excreta and body fluids	Animal Husbandries
Pulp wastes	Fruits and vegetable processing units

Electronic waste or e-waste describes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered e- waste.

Categories of electrical and electronic equipment

- Centralized data processing: Mainframes, Minicomputers
- Personal Computing: Personal Computers (Central Processing Unit with input and output devices)
- Personal Computing: Laptop Computers(Central Processing Unit with input and output devices)
- Personal Computing: Notebook Computers
- Personal Computing: Notepad Computers
- Printers including cartridges
- Copying equipment

- Electrical and electronic typewriters
- User terminals and systems
- Telephones
- Cordless telephones
- Cellular telephones
- Television sets (including sets based on (Liquid Crystal Display and Light Emitting Diode technology
- Refrigerator
- Washing Machine
- Air-conditioners excluding centralised air conditioning plants

POLLUTION CASES

1. Sewage pollution of the River Ganga
 2. Effects of acid rain on Taj Mahal
 3. Odd even rule in Delhi
 4. Ambient Air Quality Standards in India
- **Policy**
 - The Municipal Solid Wastes (Management & Handling) Rules, 2000
 - Hazardous Material (Management, Handling and Trans boundary Movement) Rules 2007 was published by the Government of India in the Ministry of Environment and Forest vide number S.O.1676 (E), dated 28th September, 2007 in the Gazette of India.

UNIT 6

Environmental Policies & Practices

- **Climate** (from Ancient Greek klima, meaning inclination) is commonly defined as the weather averaged over a long period. The standard averaging period is 30 years, but other periods may be used depending on the purpose.
- **Climate change** may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions.
- **Climatology** is the study that includes periodicity of weather events over years to millennia, as well as changes in long-term average weather patterns, in relation to atmospheric conditions.

From highest to lowest, the five main layers of atmosphere are

- Exosphere: 700 to 10,000 km (440 to 6,200 miles)
- Thermosphere: 80 to 700 km (50 to 440 miles)
- Mesosphere: 50 to 80 km (31 to 50 miles)
- Stratosphere: 12 to 50 km (7 to 31 miles)
- Troposphere: 0 to 12 km (0 to 7 miles)

- **The impact of climate change on agriculture**
- **Agriculture practices and climate change**
 - Deforestation
 - Chemical applications
 - Land usage pattern
- **The impact of climate change on human health-**
 - **Infectious Diseases**
 - **Extreme Weather Events**
 - **Higher Temperatures**
 - **Air Quality**

- **Global warming-** A gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, CFCs, and other pollutants.
- **Green house gases-** is any gaseous compound in the atmosphere that is capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere. By increasing the heat in the atmosphere, greenhouse gases are responsible for the *greenhouse effect*, which ultimately leads to global warming.

Major green house gases

- [Water vapor](#) (H₂O)
- [Carbon dioxide](#) (CO₂)
- [Methane](#) (CH₄)
- [Nitrous oxide](#) (N₂O)
- [Ozone](#) (O₃)

- [Chlorofluorocarbons](#) (CFCs)
- **Impact of Global Warming**
- changes in agricultural productivity
- Rising sea level
- Melting of the ice caps leads to loss of habitat near the poles.
- Bleaching of Coral Reefs due to warming seas and acidification due to carbonic acid formation
- Loss of Plankton due to warming sea.
- **Intergovernmental Panel on Climatic Change (IPCC)-**
- 1998, the Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP)
- Current Chairperson- Hoesung Lee

- HQ- Geneva
- 2007 Noble peace prize shared between IPCC and Al Gore.
- R K Pachauri was the Chairperson during 2007.
- **Ozone layer depletion**
- **Ozone** is an inorganic gas with pale blue color and with a distinctively pungent smell.
- Ozone layer (a portion of the stratosphere with a higher concentration of ozone, from two to eight ppm) is beneficial, preventing damaging ultraviolet light from reaching the Earth's surface, to the benefit of both plants and animals.
- Ozone layer thickness is expressed in terms of **Dobson** units
- Ozone gas is a strong oxidizing agent, which reacts with sulfur and nitrogen to form SO_2 and NO_2 and leads to acid rain formation in the atmosphere.

- **Acid rain** is a rain or any other form of precipitation that is unusually acidic in nature (low pH), which is caused by emissions of sulfur dioxide and nitrogen oxide, which react with the water molecules in the atmosphere to produce acids.
- The pH scale measures how acidic or basic a substance is. The pH scale ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic. A pH greater than 7 is basic.
- **Effects of acid rain**
 - Health problems linked to skin, heart, asthma, bronchitis
etc
 - Death of aquatic bodies due to acidification of water sources
 - Soil pollution
 - Ecological imbalances
 - Damages of buildings, monuments and statues.

- **ENVIRONMENT LAWS**

- **Environmental Protection Act (EPA), 1986**

- **The Forest (Conservation) Act, 1980**

- **Wild Life (Protection) Act 1972**

- **The air (prevention and control of pollution) act, 1981**

- **The Water (Prevention and Control of Pollution) Act, 1974**

- **INTERNATIONAL AGREEMENTS**

- **Montreal protocol**

- **Kyoto protocol**

- **Montreal protocol-** The *Montreal Protocol* is an agreement signed by all UN members concerning the role humans play in the destruction of the stratospheric *ozone layer*. Prior to current debates about climate change and global warming, every nation in the UN agreed that humans needed to halt ozone damage by air pollutants. After being signed in 1987 and put into action in 1989, the Montreal Protocol has been successful in phasing out the use of dangerous CFC aerosol chemicals and preventing further damage to the ozone layer.
- **Kyoto protocol-** The *Kyoto Protocol* of 1997 is probably the most well-known of the UNFCCC updates concerning climate change. At a meeting in Kyoto, Japan, many nations agreed to set limits on carbon dioxide and other greenhouse gas emissions. The nations that signed the Kyoto Protocol agreed to a binding contract to limit their *greenhouse gas emissions*
- **Convention on Biological Diversity (CBD)-** The *Convention on Biological*

Diversity (CBD) is an international convention whose focus is on preserving **global biodiversity** in the age of *genetically modified organisms*. The *Cartagena Protocol on Biosafety* is an agreement created by members of the CBD to safely control the transportation of genetically modified organisms.

- **NATURE RESERVES-**

- An area of land protected by the government so that plants and animals can live there without being harmed.

- **Biosphere reserves of India**

Name	State	Year
Nilgiri Biosphere Reserve	Tamil Nadu, Kerala, Karnataka	2000
Gulf of Mannar Biosphere Reserve	Tamil Nadu	2001
Sundarbans Biosphere Reserve	West Bengal	2001
Nanda Devi Biosphere Reserve	Uttarakhand	2004
Nokrek Biosphere Reserve	Meghalaya	2009
Pachmarhi Biosphere Reserve	Madhya Pradesh	2009
Simlipal Biosphere Reserve	Odisha	2009
Great Nicobar Biosphere Reserve	Great Nicobar	2013
Achanakmar-Amarkantak Biosphere Reserve	Chhattisgarh, Madhya Pradesh	2012
Agasthyamalai Biosphere Reserve	Kerala and Tamil Nadu	2016
Khangchendzonga National Park	Sikkim	2018

- **National Park-** An area of countryside, or occasionally sea or fresh water, protected by the state for the enjoyment of the general public or the preservation of wildlife

- **Top National parks and Wildlife sanctuaries in India**
 - Ranthambore National Park, Rajasthan
 - Jim Corbett National Park, Uttarakhand
 - Bandhavgarh National Park, Madhya Pradesh
 - Periyar National Park, Kerala
 - Kaziranga National Park, Assam
 - Sunderbans National Park, West Bengal
 - Kanha National Park, Madhya Pradesh
 - Mudumalai National Park, Tamil Nadu
 - Gir National Park, Gujarat
 - Bhanerghatta National Park, Karnataka

- Bandipur National Park, Karnataka
- Nagarhole National Park, Karnataka
- Sariska National Park, Rajasthan
- Bhadra Wildlife Sanctuary, Karnataka
- The Great Himalayan National Park, Himachal Pradesh
- Dandeli Wildlife Sanctuary, Karnataka
- Silent Valley National Park, Kerala
- Rajaji National Park, Uttarakhand

- **HUMAN- WILDLIFE CONFLICTS IN INDIAN CONTEXT**

- Human-Wildlife Conflict is the interaction between people and wildlife that results in negative impacts for human or wildlife populations wherever wildlife and people coexist and share limited resources.
- **Outcomes of Conflict**
- Injury and loss of life of humans and wildlife

- Crop damage, livestock depredation, predation of managed wildlife stock.
- Damage to human property.
- Trophic cascades.
- Destruction of habitat.
- Collapse of wildlife populations and reduction of geographic ranges.

TRIBAL POPULATIONS AND RIGHTS

- The word '*Tribe*' denotes a group of people living in fixed territory.
- **Adivasi** is the collective term for the indigenous peoples of mainland South Asia. Adivasi make up 8.6% of India's population, or 104 million people, according to the 2011 census.
- The term '**Scheduled Tribes**'(ST's) first appeared in the Constitution of India. Article 366 (25) defined scheduled tribes as "such tribes or tribal communities or parts of or groups within such tribes or tribal communities as are deemed under

Article 342 to be Scheduled Tribes for the purposes of this constitution".

- **CONSTITUTIONAL RIGHTS FOR TRIBALS**

- **Educational & Cultural Rights**

- Art. 15(4) - Special provisions for advancement of other backward classes (which includes STs);
- Art. 29 - Protection of Interests of Minorities (which includes STs);
- Art. 46 - The State shall promote, with special care, the educational and economic interests of the weaker sections of the people, and in particular, of the Scheduled Castes, and the Scheduled Tribes, and shall protect them from social injustice and all forms of exploitation,
- Art. 350 - Right to conserve distinct Language, Script or Culture;
- Art. 350 - Instruction in Mother Tongue.

- **Social Rights**

- Art. 23 - Prohibition of traffic in human beings and beggar and other similar form of forced labour
- Art. 24 - Forbidding Child Labour.

- **Economic Rights**

- Art.244 - Clause(1) Provisions of Fifth Schedule shall apply to the administration & control of the Scheduled Areas and Scheduled Tribes in any State other than the states of Assam, Meghalaya, Mizoram and Tripura which are covered under Sixth Schedule, under Clause (2) of this Article.
- Art. 275 - Grants in-Aid to specified States (STs &SAs) covered under Fifth and Sixth Schedules of the Constitution.

- **Political Rights**

- Art.164 (1) - Provides for Tribal Affairs Ministers in Bihar, MP and Orissa
- Art. 330 - Reservation of seats for STs in Lok Sabha
- Art. 337 - Reservation of seats for STs in State Legislatures
- Art. 334 - 10 years period for reservation (Amended several times to extend the period)
- Art. 243 - Reservation of seats in Panchayats
- Art. 371 - Special provisions in respect of NE States and Sikkim

- **Safeguards under Various laws**

- The Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act,1989 and the Rules 1995 framed there under. Bonded Labour System (Abolition) Act 1976 (in respect of Scheduled Tribes);

- The Child Labour (Prohibition and Regulation) Act 1986;
- States Acts & Regulations concerning alienation & restoration of land belonging to STs; Forest Conservation Act 1980
- Panchayatiraj (Extension to Scheduled Areas) Act 1996;
- Minimum Wages Act- 1948.



UNIT 7

HUMAN COMMUNITIES AND THE ENVIRONMENT

- **Demographics** : Statistical data relating to the population and particular groups within it.
- **Population**: All the inhabitants of a particular place.
- **Population Explosion**: A sudden, large increase in the size of a population.
- **World Population day** is an annual event, observed on *July 11 every year*, which seeks to raise awareness of global population issues. The event was established by the Governing Council of the United Nations Development Programme in 1989.

World population statistics

Rank	Country	2018 Population	2017 Population	Growth Rate	Area	2018 Density
1	<u>China</u>	1,41,50,45,928	1,40,95,17,397	0.39 %	9,706,961 km ²	146/km ²
2	<u>India</u>	1,35,40,51,854	1,33,91,80,127	1.11 %	3,287,590 km ²	412/km ²
3	<u>United</u>	32,67,66,	32,44,59,	0.71	9,372,610	35/km ²

	<u>States</u>	748	463	%	km ²	
4	<u>Indonesi</u>	26,67,94,	26,39,91,	1.06	1,904,569	140/km ²
	<u>a</u>	980	379	%	km ²	
5	<u>Brazil</u>	21,08,67,	20,92,88,	0.75	8,515,767	25/km ²
		954	278	%	km ²	

Global Population mix- As of 2012, the global sex ratio is approximately 1.01 males to 1 female. The greater number of men is possibly due to the significant sex imbalances evident in the Indian and Chinese populations. Approximately 26.3% of the global population is aged under 15, while 65.9% is aged 15–64 and 7.9% is aged 65 or over. The median age of the world's population was estimated to be 29.7 years in 2014, and is expected to rise to 37.9 years by 2050.

- **Population in India-** The population of India represents 17.99 percent of the world's total population which arguably means that one person in every 6 people on the planet is a resident of India. The country as a whole has a population density of 412 people per square kilometre, which ranks 31st in the world. In [Mumbai](#), the population density is 21,000 people per [square kilometre](#).

Name of City	Population
Mumbai	1,26,91,836



Delhi	1,09,27,986
Bengaluru	51,04,047
Kolkata	46,31,392
Chennai	43,28,063

India Demographics

- Data on ethnicity is not collected by the Indian census, although the CIA World Fact book estimates the population is 72% Indo-Aryan, 25% Dravidian, and 3% Mongoloid and other.
- Hinduism is the most common religion in India, accounting for about 80% of the population. Islam is the second-largest religion at 13% of the population. Other major religious groups in India are Christians (2.3%), Sikhs (1.9%), Buddhists (0.8%) and Jains (0.4%). People who claimed no religion are officially recorded under 'other' by the census. In 2011, 0.9% of Indians selected the 'No Religion' category.
- While the number of Indians living in urban areas has increased over the last two decades, about 67% of people still live in rural areas. In 2011, India had a literacy rate of 74%: 82% for men and 65% for women. The literacy rate varies wildly by state. Bihar is the least literate with a rate of 63.82%.
- **Causes of over population**
 - Poverty
 - Poor contraceptive use
 - Child labour

- Reduced mortality rates
- Fertility treatment
- Immigration
- **Impacts of Population Growth on Environment**
 - Air and water pollution
 - Deforestation
 - Depletion of ozone layer
 - Extinction of species
 - Global warming and climate change
 - Urbanization
 - Industrialisation
 - Generation of Waste

Impact on human health and welfare

Underlying Determinants	Possible Adverse Health and Safety Consequences
Inadequate water (quantity and quality), sanitation (wastewater and excreta removal) and solid waste disposal, improper hygiene (hand washing)	Diarrheas and vector-related diseases, eg, malaria, schistosomiasis, dengue
Improper water resource management (urban and rural), including poor drainage	Vector-related diseases, eg, malaria, schistosomiasis
Crowded housing and poor ventilation of smoke	Acute and chronic respiratory diseases, including lung cancer (from coal and tobacco smoke inhalation)
Exposures to vehicular and industrial air pollution	Respiratory diseases, some cancers, and loss of IQ in children
Population movement and encroachment and construction, which affect feeding and breeding grounds of vectors, such as mosquitoes	Vector-related diseases, eg, malaria, schistosomiasis, and dengue fever, may also help spread other infectious diseases eg HIV/AIDS, Ebola fever
Exposure to naturally occurring toxic substances	Poisoning from, eg, arsenic, manganese, and fluorides
Natural resource degradation, eg, mudslides, poor drainage, erosion	Injury and death from mudslides and flooding
Climate change, partly from combustion of greenhouse gases in transportation, industry and poor energy conservation in housing, fuel, commerce, industry	Injury/death from: extreme heat/cold, storms, floods, fires. Indirect effects: spread of vector-borne diseases, aggravation of respiratory diseases, population dislocation, water pollution from sea level rise, etc.
Ozone depletion from industrial and commercial activity	Skin cancer, cataracts. Indirect effects: compromised food production, etc.

- **Emerging and re-emerging diseases** have been defined as infectious diseases of humans whose occurrence during the past two decades has substantially increased or threatens to increase in the near future relative to populations affected, geographic distribution, or magnitude of impacts. Examples include *Ebola virus*, *West Nile virus*, *Zika virus*, *sudden acute respiratory syndrome (SARS)*, *H1N1 influenza*; *swine and avian influenza (swine, bird flu)*, *HIV*, and a variety of other viral, bacterial, and protozoa diseases.
- The **HIV/AIDS** epidemic has spread with ferocious speed. Virtually unknown 20 years ago, HIV has infected more than 60 million people worldwide. Each day, approximately 14,000 new infections occur, more than half of them among young people below age 25.

- **Steps to Control Population in India**

- initiate a bold population policy
- Increasing the welfare and status of women and girls
- spread of education, increasing awareness for the use of contraceptives and family planning methods
- sex education
- free distribution of contraceptives and condoms among the poor
- encouraging female empowerment
- more health care centres for the poor

Rehabilitation and resettlement

- **Rehabilitation:** The action of restoring someone to former privileges or reputation after a period of disfavour.

- **Resettlement:** the settlement of people in a different place.
- Development projects that displace people involuntarily generally give rise to severe economic, social, and environmental problems.
- **The five settlement types:**
 - involuntary resettlement,
 - new land settlement,
 - induced development,
 - indigenous peoples,
 - and cultural property
- Case studies-
- The Case study of a village to be affected by the indira sagar pariyojana
- Uttaranchal's disaster management

DISASTER MANAGEMENT

- A **disaster** is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources.
- The **Disaster Management Act, 2005** defines disaster as “a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area”.

- **Types of Disaster**

- 1. Natural disaster**

- Geophysical (e.g. Earthquakes, Landslides, Tsunamis and Volcanic Activity)
- Hydrological (e.g. Avalanches and Floods)
- Climatological (e.g. Extreme Temperatures, Drought and Wildfires)
- Meteorological (e.g. Cyclones and Storms/Wave Surges)
- Biological (e.g. Disease Epidemics and Insect/Animal Plagues)

- 2. Manmade disasters**

- Environmental Degradation
- Pollution
- Accidents (e.g. Industrial, Technological and Transport usually involving the production, use or transport of hazardous materials)

3. Complex Emergencies

- Food Insecurity
- Epidemics
- Armed Conflicts
- Displaced Populations
- Extensive Violence
- Displacements of Populations
- Loss of Life
- Widespread Damage to both Societies and Economies
- Need for Large-scale, Humanitarian Assistance across Multiple Agencies
- Political and Military Constraints which impact or prevent Humanitarian Assistance
- Increased Security Risks for Humanitarian Relief Workers

4. **Pandemic emergencies-** These emergencies involve a sudden onset of a contagious disease that affects health but also disrupts services and businesses, bringing economic and social costs.

The National Disaster Response Force (NDRF)

- Is a specialized force constituted "for the purpose of specialist response to a threatening disaster situation or disaster" under the Disaster Management Act, 2005. The "Apex Body for Disaster Management" in India is the National Disaster Management Authority (NDMA). The Chairman of the NDMA is the Prime Minister.



<p>Can the lost item be bought and sold for money?</p>	<p>Direct loss: Loss from contact with flood water</p>	<p>Indirect loss: No contact – loss as a consequence of flood water</p>
<p>Yes – monetary (tangible)</p>	<p>e.g. Buildings and contents, vehicles, livestock, crops, infrastructure</p>	<p>e.g. Disruption to transport, loss of value added in commerce and business interruption, legal costs associated with lawsuits</p>
<p>No – non-monetary (intangible)</p>	<p>e.g. Lives and injuries, loss of memorabilia, damage to cultural or heritage sites, ecological damage</p>	<p>e.g. Stress and anxiety, disruption to living , loss of community, loss of cultural and environmental sites, ecosystem resource loss</p>

- **Earthquake-** earthquakes are the rumblings, shaking or rolling of the earth's surface.
- A **seismograph**, or seismometer, is an instrument used to detect and record earthquakes. Generally, it consists of a mass attached to a fixed base. During an earthquake, the base moves and the mass does not.
- The **Richter magnitude scale** is a **scale** of numbers used to tell the size of earthquakes. Charles **Richter** developed the **Richter Scale** in 1935. His **scale** was based on the seismogram measured by a particular type of seismometer at a distance of 100 kilometres (62 mi) from the earthquake.

Richter Magnitude	Earthquake effects
0.2	Not felt by people
2-3	Felt little, by people
3-4	Ceiling lights swing
	Walls crack
5-6	Furniture moves
	Some buildings collapse

	Many buildings destroyed
8-Up	Toi 1 d,es;u .cono b 1ldin b iid!gesan r0-ds

- **Tsunami** - This is simply a series of massive ocean waves, triggered by an earthquake that has occurred in the sea (or ocean). The displaced water then runs ashore and into the land. This happens when the plates underneath the Earth's surface move (focus) so that one slips under another.
- **Land slides**- when the earth material loses its bonding, either through weathering, erosion, or too much water in the bedrock, the weight of the overlying rock will give way and gravity will pull the earth downhill.
- A **cyclone** is a system of winds rotating counter clockwise in the Northern Hemisphere around a low pressure centre. The swirling air rises and cools, creating clouds and precipitation.

