GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING

UNIT 1: ENVIRONEMNT, EXOSYSTEM, BIODIVERSITY SYLLABUS

- Environment
  - ✓ Definition
  - ✓ Scope & importance
  - ✓ Need for Awareness
- Ecosystem
  - ✓ Concept, structure & function
  - ✓ Energy flow
  - ✓ Ecological succession
  - ✓ Food chain, food web, pyramids
  - ✓ Types of Ecosystem (types, characters, structure and function, components)
    - ❑ Forest
    - ❑ Grassland
    - ❑ Desert
    - ❑ Aquatic
- Biodiversity
  - ✓ Definition, 3 types of biodiversity (genetic, species, ecosystem)
  - ✓ Biogeograhical classification of INDIA

- Biodiversity (cont.)
  - Values of biodiversity
    - Productive
    - Consumptive
    - Social
    - Ethical
    - Aesthetic
    - Optional
  - Biodiversity levels – Local, National, Global
  - INDIA – a mega diversity Nation
  - Hotspots of Bio diversity
    - Habitat loss
    - Poaching
    - Man – wildlife conflicts
  - Threats to Bio diversity
  - Endangered and endemic species of INDIA
  - Conservation of Bio diversity
    - In-situ & ex-situ

- Field study of simple ecosystems
  - Pond, river, hill slopes, etc.

Environment:

Definitions:

Environment – a French word "Environner" – to encircle or surround.

The **sum total** of water, air and land and the inter-relationships that exists among them and with the human beings, other living organisms and materials.

Environment:

According to Boring: A person's environment consists of the sum total of the stimulation which he receives from his conception until his death.

According to Douglas and Holland: **the term environment is used to describe in the aggregate, all the external forces, influences and conditions, which affect the life ,nature,behaviour and the growth ,development and maturity of living organisms.**

External forces: **Physical,economic,political,cultural,social,moral and emotional activity**

Other Definitions:

Environmental Science – Study of environment, its biotic & abiotic components and their interrelationship.

Environmental Engineering – Application of environmental principles to the protection and enhancement.

Environmental Studies – Awareness on Environmental protection.

*Scope of Environment: Four segments

- Atmosphere : Virtual Ocean of Air
- Hydrosphere : The surface of Earth filled with any form of Water
- Lithosphere : Outer shell of the Earth composed of crust and the rigid outer most mantle
- Biosphere : The place on earth where life exists

Elements of Environment:

1)Physical 2)Biological 3)Cultural

Scope of Environment:

- Awareness and sensitivity + related problems.

- Motivate active participation.

- Identifying and solving environmental problems and skills.

- Necessity of conservation of natural resources.

- Environmental programs.

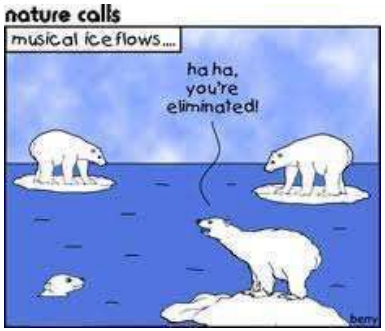
Importance of Environment:

- Global vs. Local Nature of Environment.

Global Warming

Depletion of Ozone Layer

Dwindling Forest & Energy Resources



Loss of Global Diversity

Importance of Environment:

- Individualistic Nature of Environment.

Drinking Water

Hygienic Living

Fresh Air

Fertile Land

Healthy Food

Sustainable Energy

Importance-significant reasons

1. Environment issues being of internal importance
2. Problems cropped in the wake of development
3. Explosively increase in pollution
4. Need for an alternative solution
5. Need to save Humanity from extinction
6. Need for Wise planning of development

Need for Public Awareness:

Environmental issues received International Attention on June 5, 1972 at Stockholm (Sweden)

- Pressure caused due to population increase, urbanization and poverty – Govt. and NGOs for creating awareness.
- Environmental pollution cannot be removed by laws alone – need active participation from the public / individuals.

Summary:

- Implementation of Environmental Protection Plans.
- Developing societies, lifestyle and attitudes – self-oriented.
- Environmental pollution awareness.

Need for Public Awareness:

Types of Public Awareness:

- **Pressure Group** - influence the government and also industries.
- **Watch Dog** - protect the interest of public against environmental hazardous activities.
- **Advisory Council** – as advisory committee to keep environment suitable for living.
- **Enforcing Environmental Laws** – service utilized to enforce the environmental laws

General:

World Environment Day – June 5 to raise global awareness of the need to take positive environmental action. It is run by the United Nations Environment Programme (UNEP).

Theme 2014 - The theme for this year's World Environment Day celebrations is Rise our voice not the sea level.

According to the UN Food and Agriculture Organization (FAO**), every year 1.3 billion tonnes of food is wasted**. This is equivalent to the same amount produced in the whole of sub-Saharan Africa.

One in every 7 people in the world go to bed hungry and more than **20,000 children under the age of 5 die daily from hunger**.

Think – Eat – Save: encourages you to become more aware of the environmental impact of the food choices you make and empowers you to make informed decisions.

*What is hazard?

- Hazard is the potential for harm.
- A hazard is often associated with a condition or activity that can cause undesired consequences such as injury or illness if left uncontrolled.
- Basically, a hazard can cause harm or adverse health effects to individuals or to organizations as property or equipment losses.

*Types of hazard

*1) Chemical hazards

- Chemicals can affect skin by contact.
- Chemicals can also enter our body either through the inhalation or digestive system if air is contaminated with chemicals, vapor, mist or dust.
- The accumulation of chemicals in or on our body will cause acute (immediate) effect or chronic (long-term) effect.

*2) Physical hazards

- Physical hazard will cause injury risks on our body.
- This category includes the hazards from working in confined spaces, being hit by flying objects, caught in explosions, hurt by collapsing machinery, falling from heights and tripping on obstacles.

* 3) Biological hazards (biohazards)

- Biohazards refer to biological substances that pose a harm to the health of living organisms.
- Sources of biological hazards may include insects, bacteria, fungi, plants, worms, animals and viruses.
- These sources can cause a variety of health effects ranging from skin irritation and allergies to infections, cancer and so on.

Identify hazards

Determine the hazards and hazardous events of the equipment under control and the control system

Identify causes

Analyse the event sequences leading to the hazardous events identified

Determine risks

To ***analyse the risk*** associated with the hazardous events

Hazard Analysis Objectives

Ecosystem:

Concept:

Ecosystem is a **self-regulating** group of biotic communities of species **interacting** with one another and with their non-living environment **exchanging** energy and matter.

Ecology is a scientific study of interactions between living and their environment. It discovers and understands the relationship between living things and their environment.

Ecologist is a person who studies about ecology

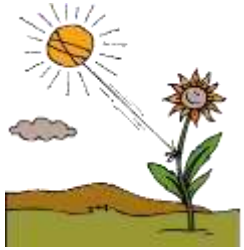
*types of ecosystem

Ecosystem:

Structure:

ECOSYSTEM

- Living (Biotic)
  - Producers
  - Consumers
    - Herbivores
    - Carnivores
    - Omnivores
    - Detritivores
  - Decomposers (bacteria & fungi)



- Non Living (Abiotic)
  - **Physical Factors** → **Sun light, rainfall, wind, latitude, soil type, water)**
  - **Chemical Factors** → **Carbon, hydrogen, oxygen, sulphur)**

Biosphere

Parts of the earth's air, water, and soil where life is found

Ecosystem

A community of different species interacting with one another and with their nonliving environment of matter and energy

Community

Populations of different species living in a particular place, and potentially interacting with each other

Population

A group of individuals of the same species living in a particular place

Organism

An individual living being

Cell

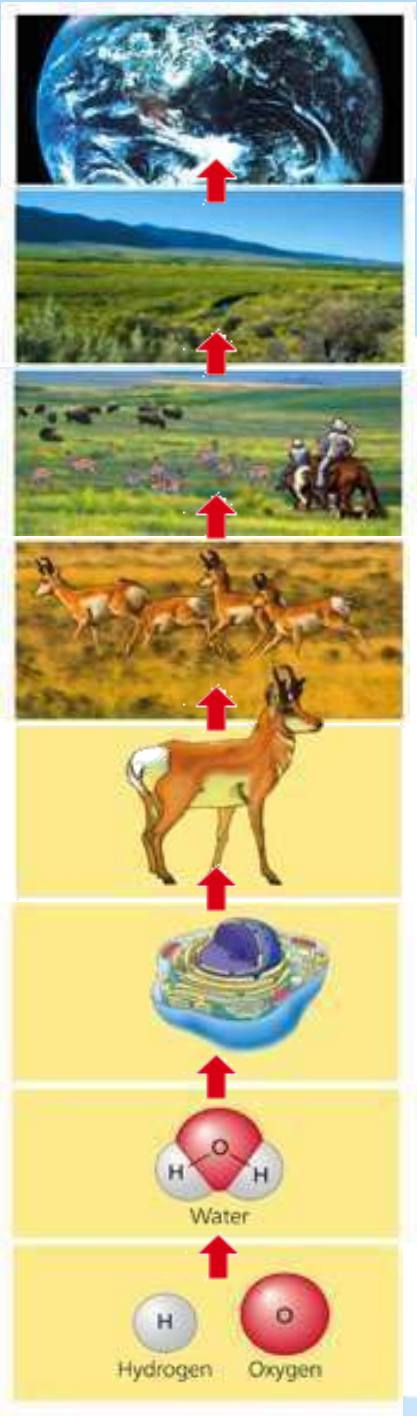
The fundamental structural and functional unit of life

Molecule

Chemical combination of two or more atoms of the same or different elements

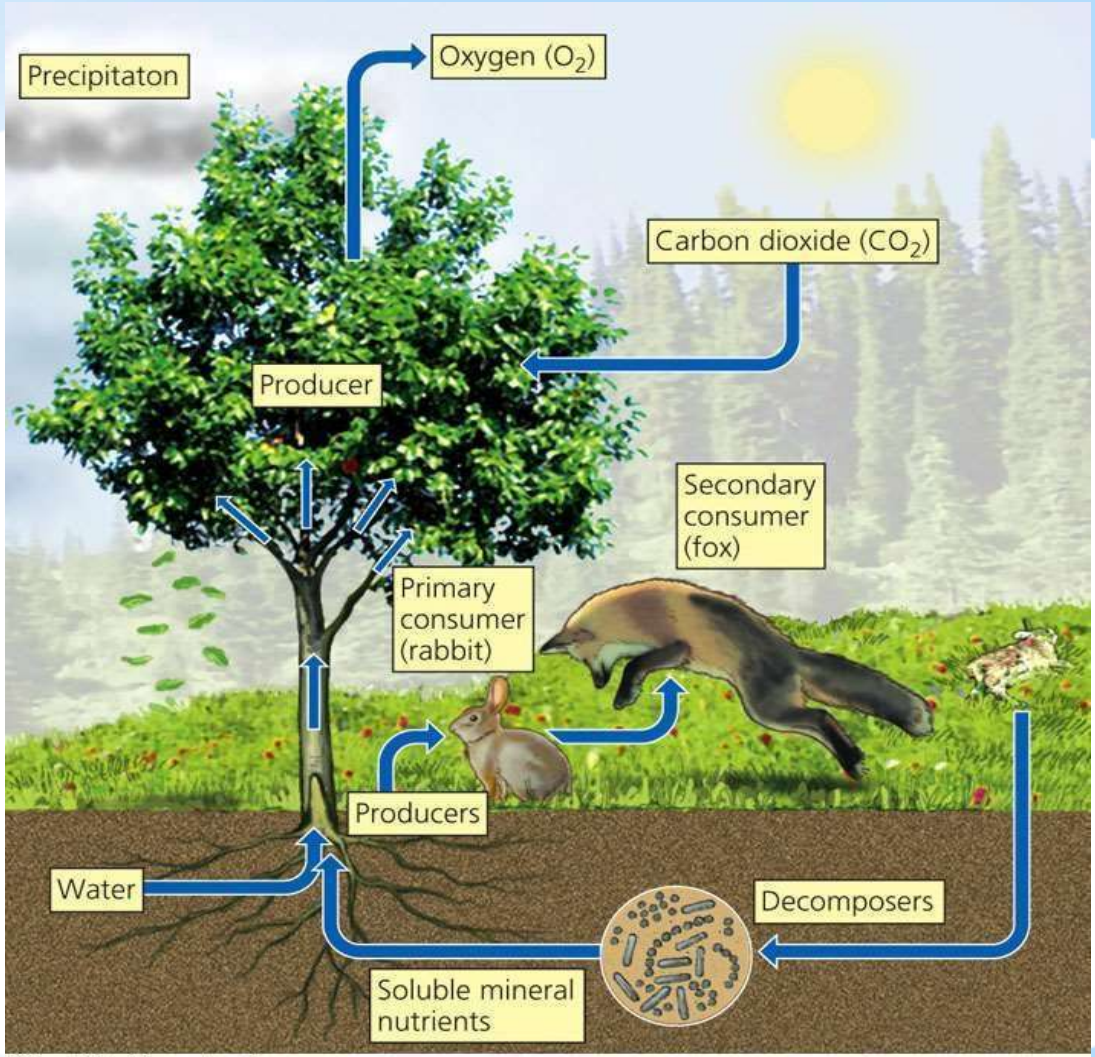
Atom

Smallest unit of a chemical element that exhibits its chemical properties



Stepped Art

* Major Biotic and Abiotic Components of an Ecosystem



Ecosystem:

Functional Attributes:

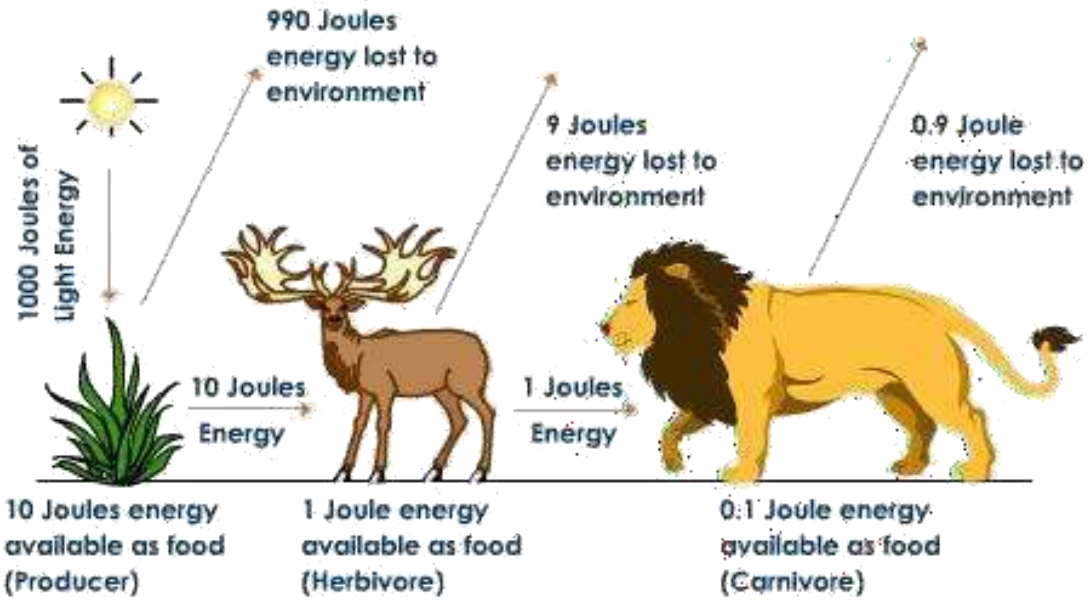
Primary Functions - Manufacture of starch (photosynthesis)

Secondary Functions - Distributing energy in the form of food to all consumers

Ecosystem:

Function Studies:

Energy and Material Flow - Flow of energy in an ecosystem takes place through the food chain and it is energy flow which keeps the ecosystem going.



Progressive Loss of Energy in Food Chain

Food Chain - The sequence of eating and being eater in an ecosystem is known as food chain

or

Transfer of food energy from the plants through a series of organisms is referred to as food chain

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Autotrophs Vs Heterotrophs

Food chain in Various Condition

1. Food chain in a grass land
2. Food chain in a pond
3. Food chain in a forest

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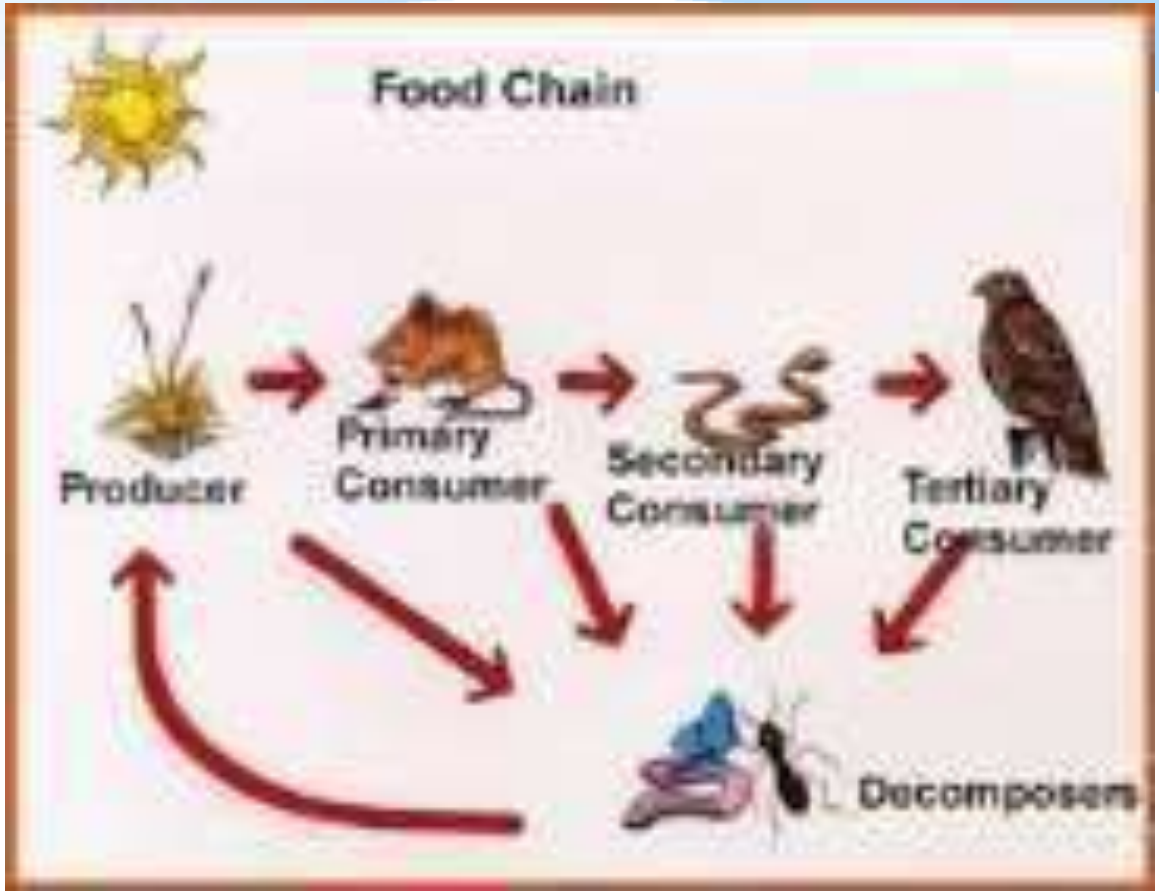
1.Food chain in a grass land



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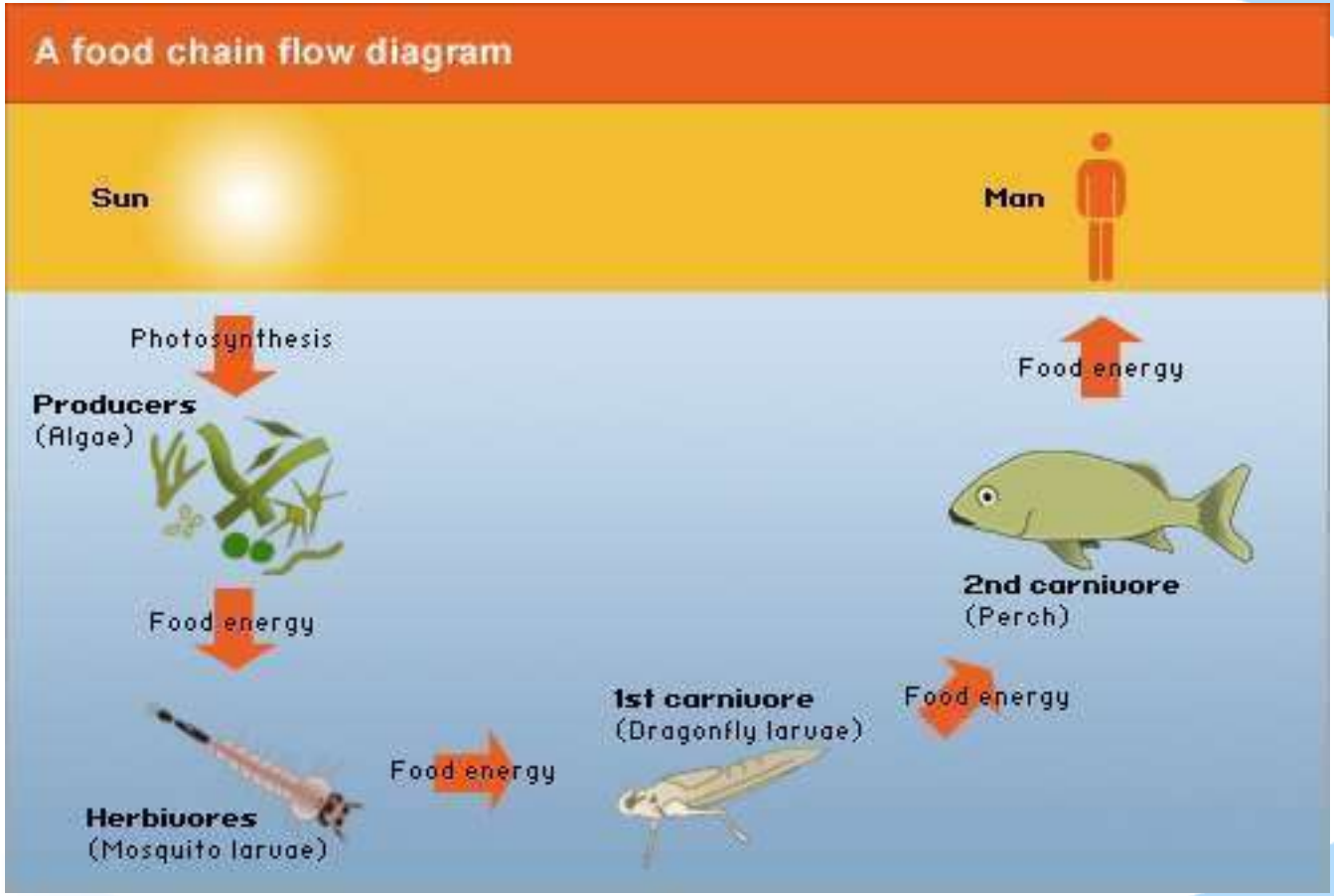
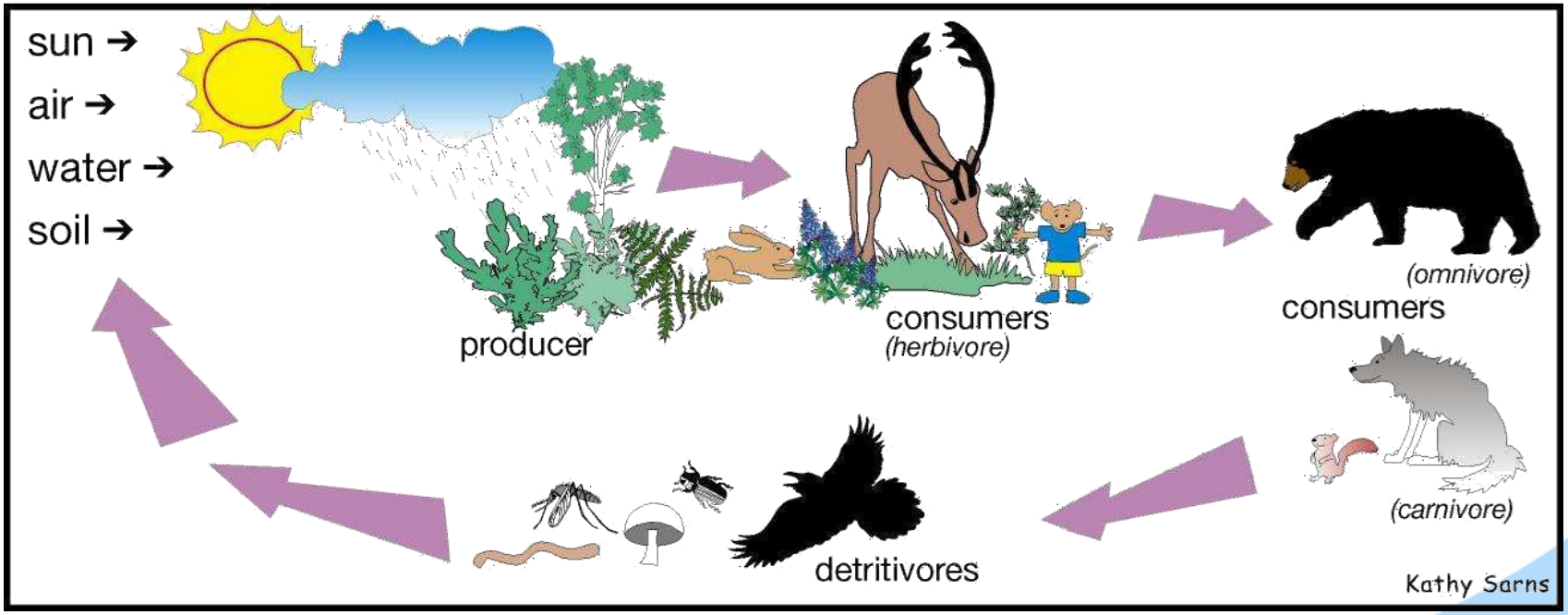
2.Food chain in a pond

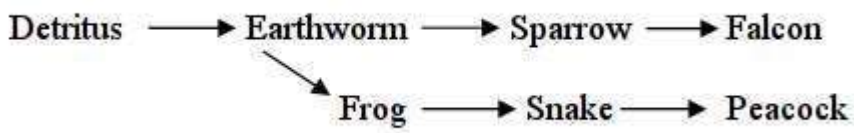


3.Food chain in a forest

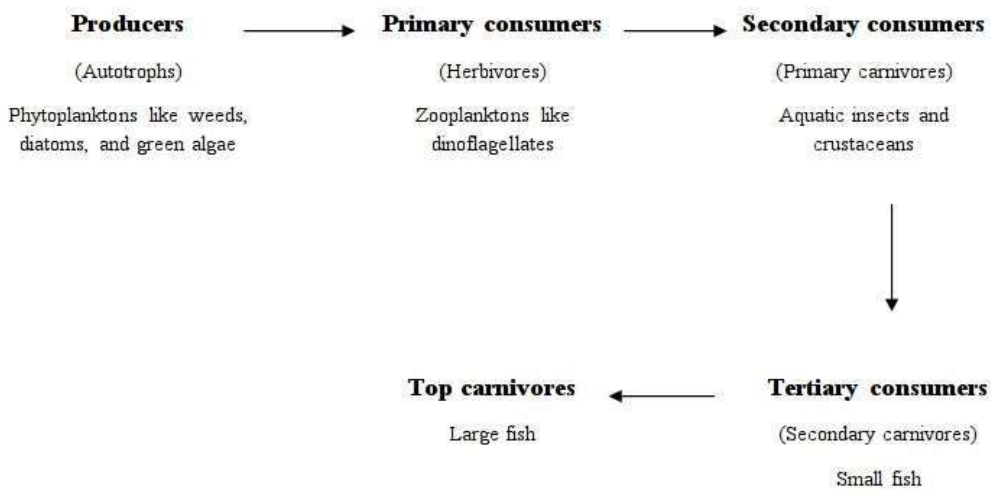


TYPES OF FOOD CHAIN

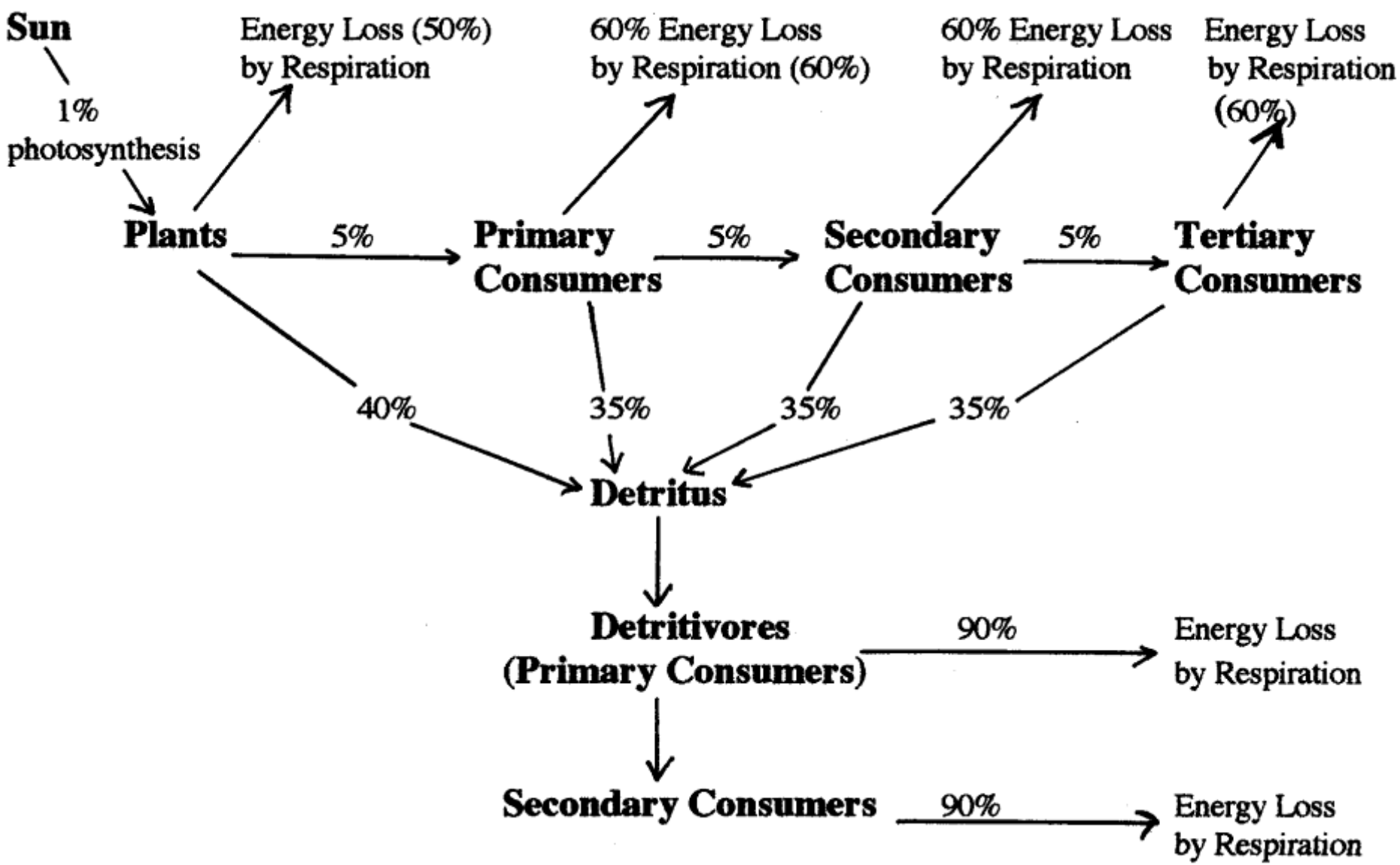
1. **Detritus food chain-** It starts with dead organic material or detritus which is consumed by the decomposers or detrivores. Smaller carnivores feed on these detrivores. The smaller carnivores are in turn consumed by larger carnivores and so on. The food energy passes from one trophic level to another. Example of a detritus food chain is given below:



2. **Grazing food chain-** It is the most common food chain and is also known as predator food chain. This food chain is made up of producers, consumers and decomposers. Example of a grazing food chain in an aquatic ecosystem is

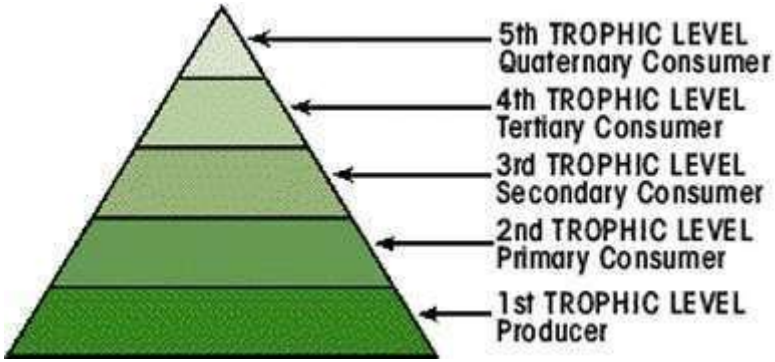


ENERGY FLOW IN GRASS LAND AND FOREST ECOSYSTEM

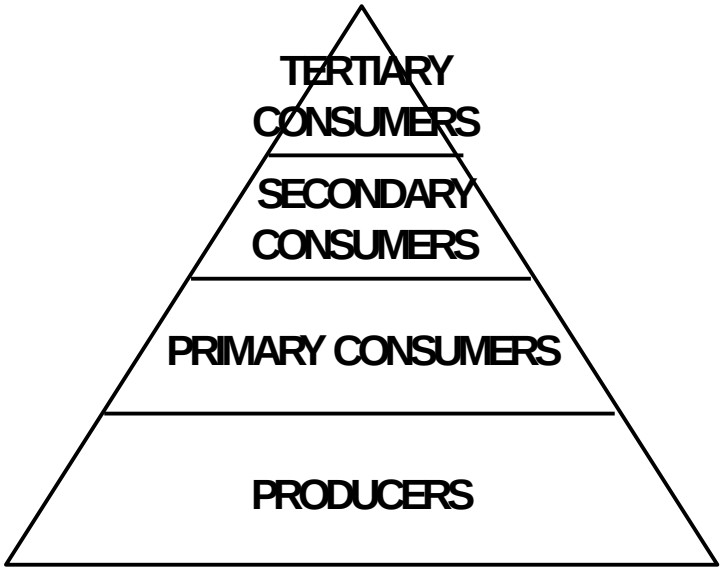


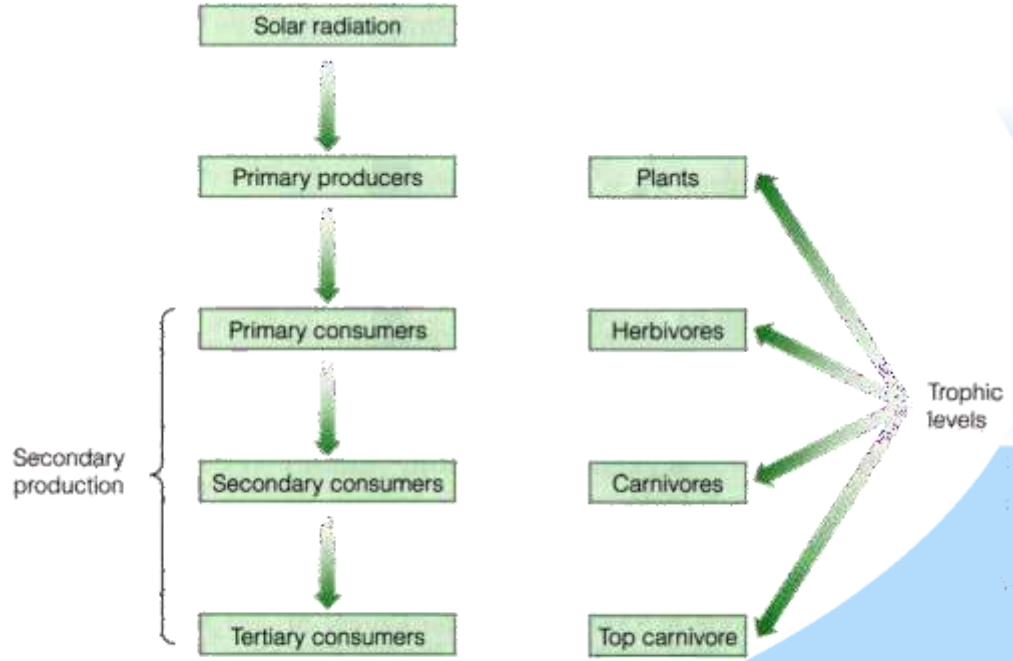
*TROPHIC LEVELS

Trophic Levels - The position occupied by an organism in a food chain.



Trophic Levels - The position occupied by an organism in a food chain.



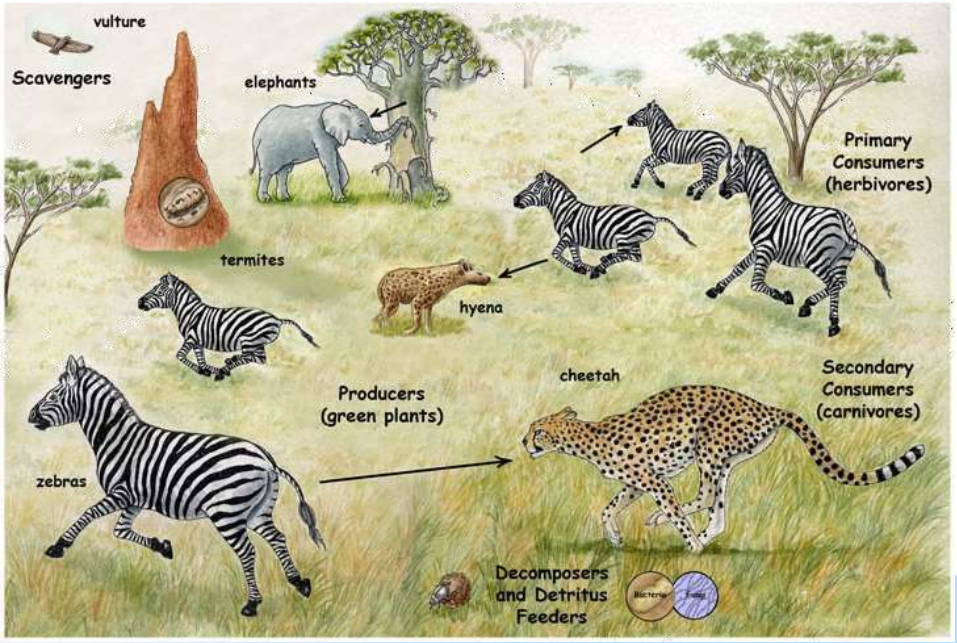


The schematic structure of a food chain. Each trophic level may contain many species.

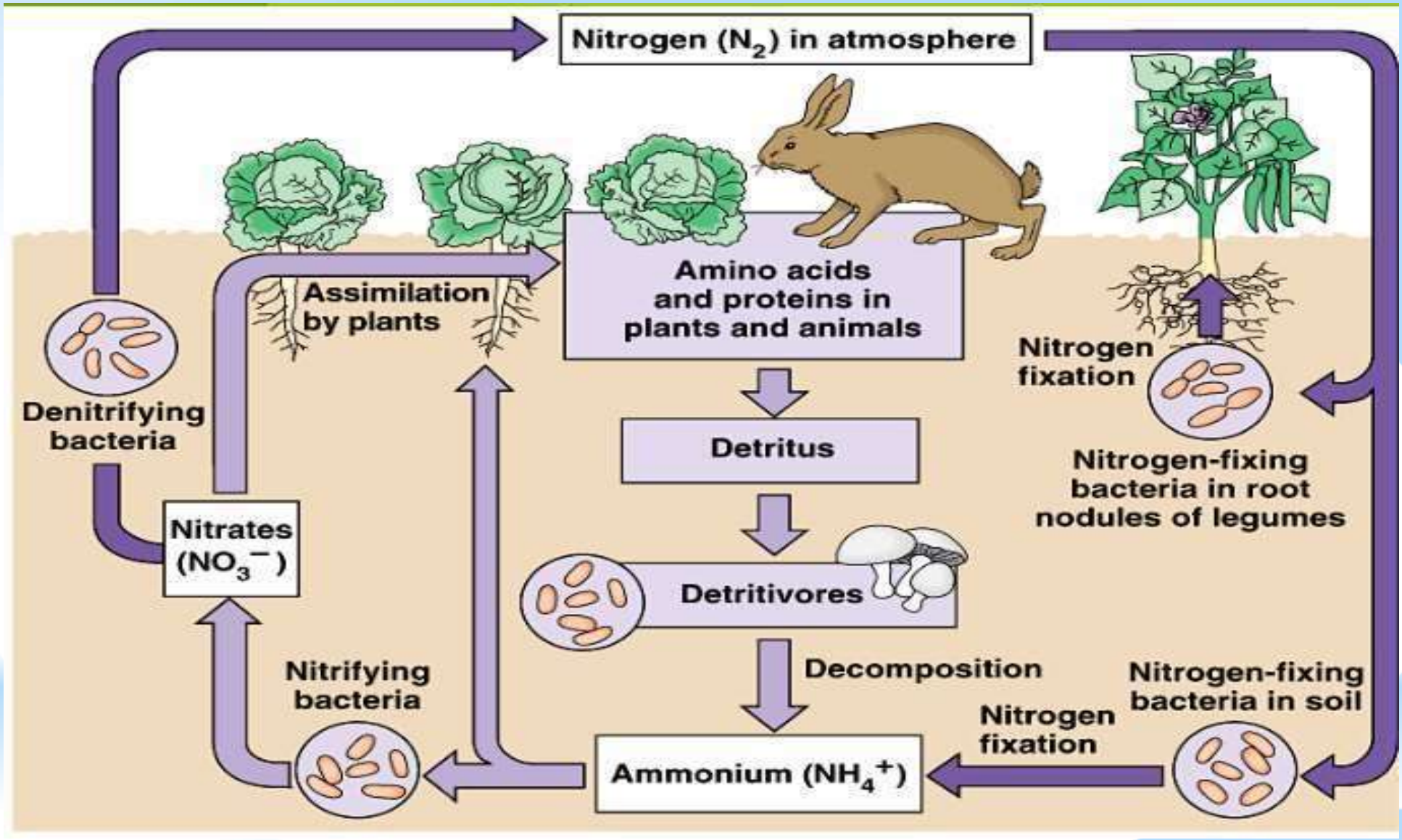
Food Web:

Food web is a network of food chains where different types of organisms are connected at different tropic levels.
(or)
The food chain in an area forms the food web

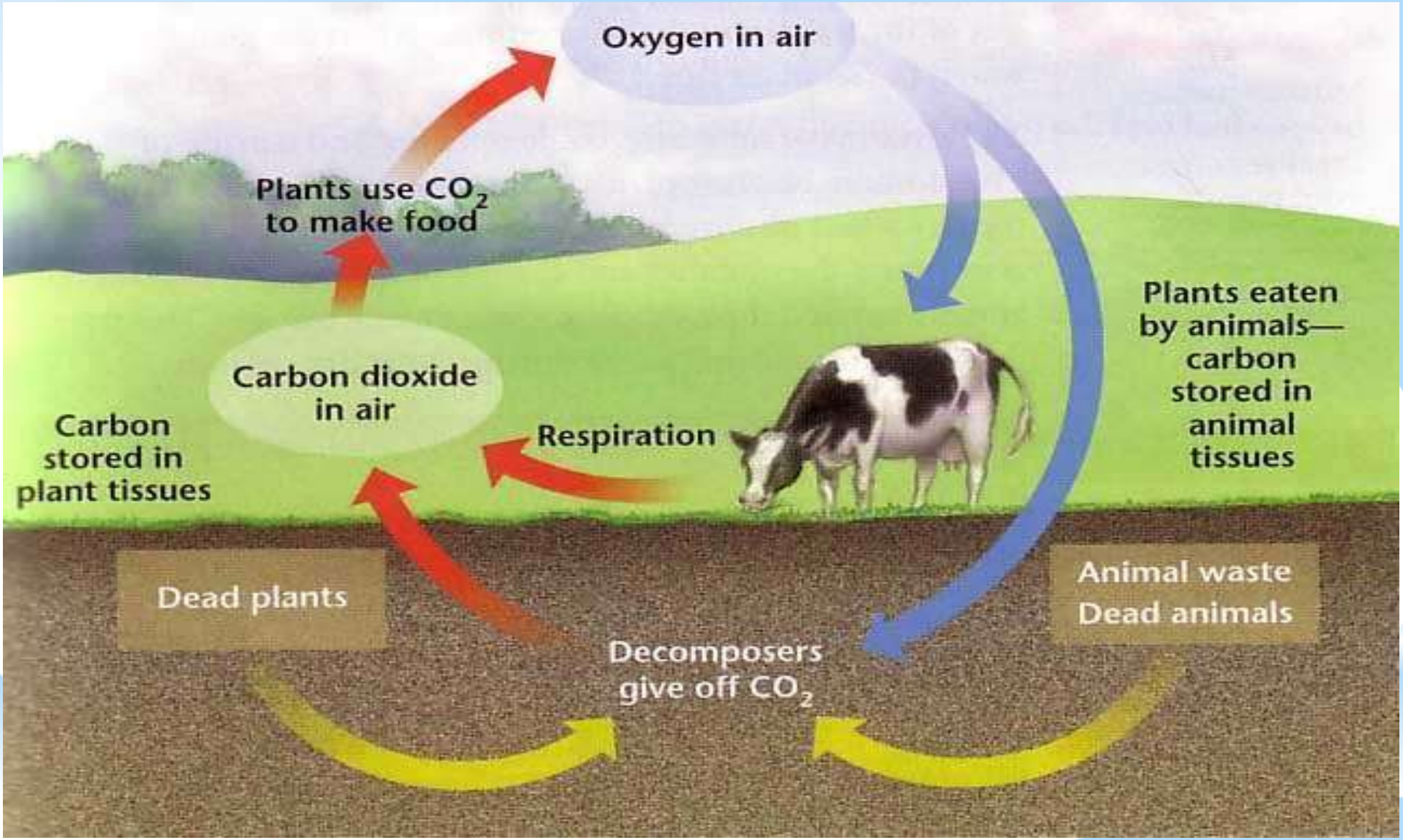
Food chain Vs Food web- difference, importance



NITROGEN CYCLE



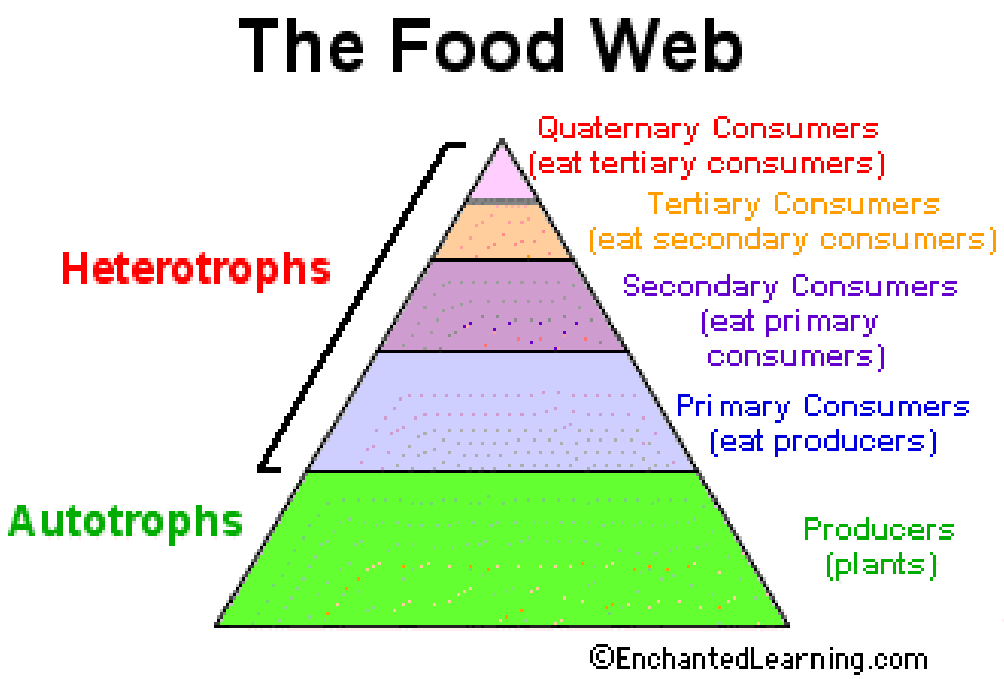
OXYGEN CYCLE



Ecological Pyramids:

Graphic representation of tropic structure and function of an ecosystem starting with producers at the base and successive tropic levels forming the apex is known as ecological pyramid.

Autotrophs Vs Heterotrophs



*Types:

- **Pyramids of numbers** - The number of individual organisms at each tropic level
- **Pyramids of biomass** - The total biomass at each tropic level in a food chain
- **Pyramids of energy** - The amount of energy present at each tropic level

*Ecological Pyramids

* An ecological pyramid is a diagram that shows the relationship amounts of energy or matter contained within each trophic level in a food web or food chain.

* <u>Energy Pyramid</u> only 10% of the energy available within one trophic level is transferred to organisms at the next trophic level.

*Pyramids Continued

- Biomass pyramids show the total amount of living tissue available at each trophic level. This shows the amount of tissue available for the next trophic level.
- Numbers pyramid shows the number of species at each trophic level.
- Because each trophic level harvests only about one tenth of the energy from the level below, it can support only about one 10th the amount of living tissue.

*Feeding Relationships

- Energy flow through an ecosystem in one direction, from the sun or inorganic compounds to autotrophs (producers) and then to various heterotrophs (consumers).
- Food Chains are a series of steps in which organisms transfer energy by eating or being eaten.
- Food webs show the complex interactions within an ecosystem.
- Each step in a food chain or web is called a trophic level. Producers make up the first step, consumers make up the higher levels.

*ECOLOGICAL PYRAMIDS

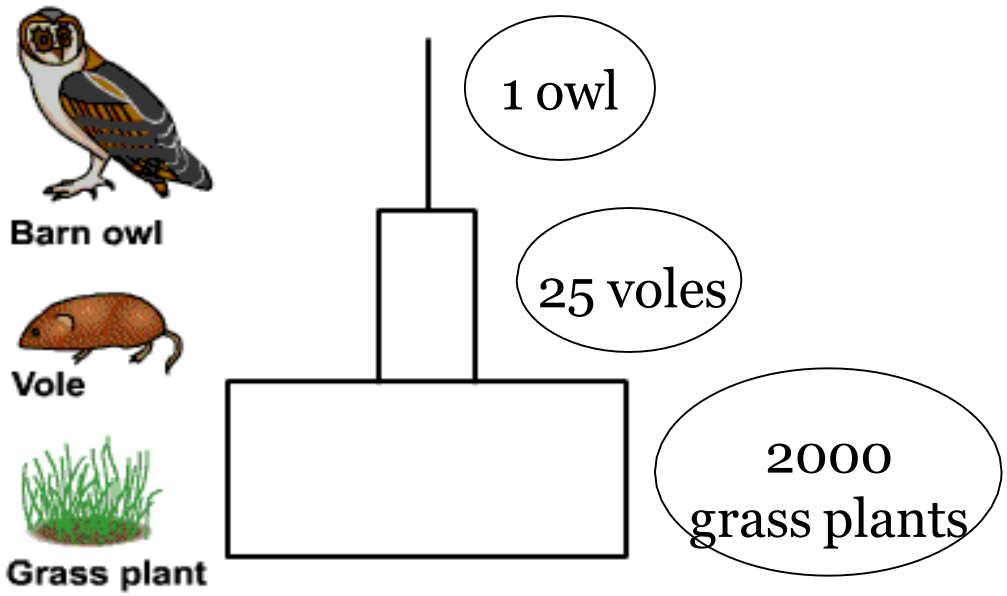
*Food chains and food webs do not give any information about the numbers of organisms involved.

*This information can be shown through ecological pyramids.

*Shows the number of organisms at each trophic level per unit area of an ecosystem.

PYRAMID OF NUMBERS

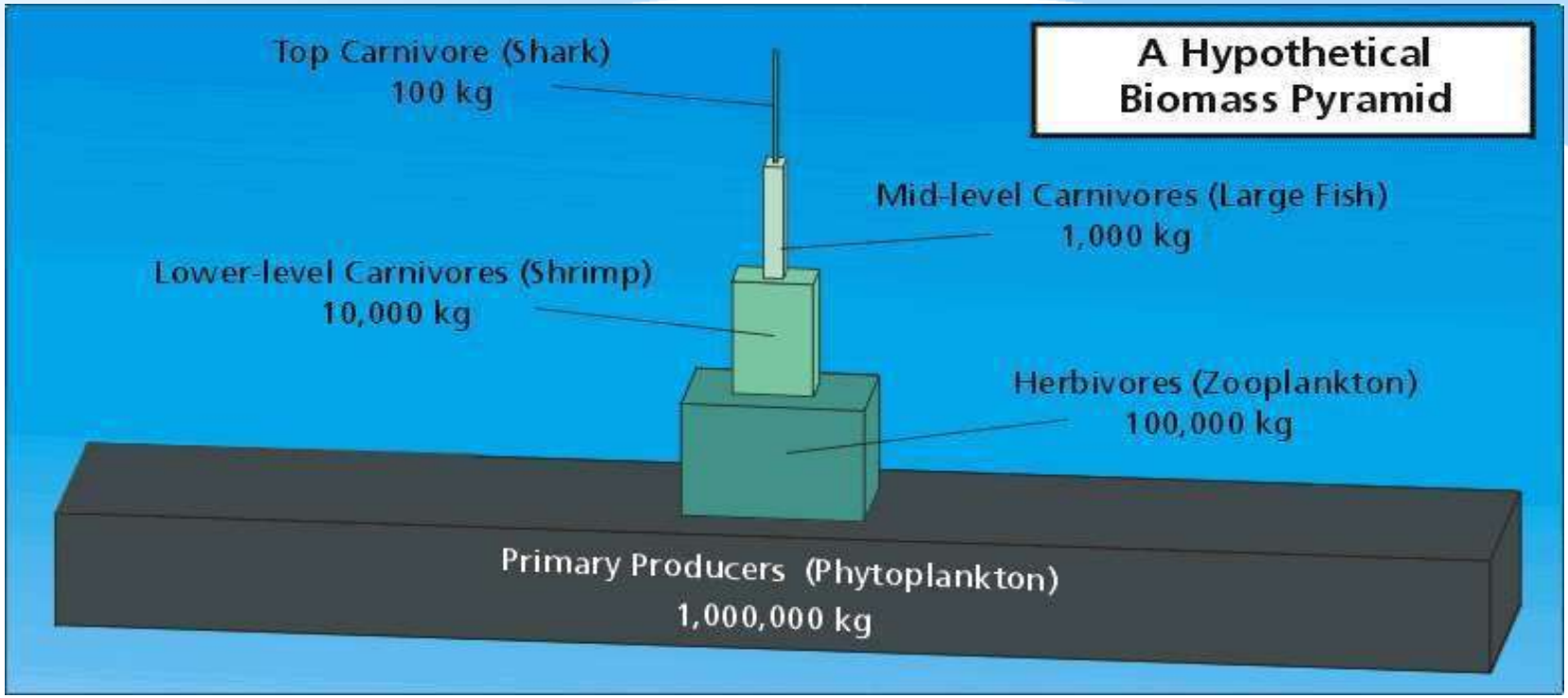
Pyramid of numbers displays the number of individuals at each level.



- The total amount of matter present in organisms of an ecosystem at each trophic level is biomass.
- Biomass is preferred to the use of numbers of organisms because individual organisms can vary in size. It is the total mass not the size that is important.
- Pyramid of biomass records the total dry organic matter of organisms at each trophic level in a given area of an ecosystem.

Biomass Pyramids

Displays the biomass at each trophic level.



*PYRAMID OF ENERGY

Energy Pyramid

In nature, ecological efficiency varies from 5% to 20% energy available between successive trophic levels (95% to 80% loss). About 10% efficiency is a general rule.

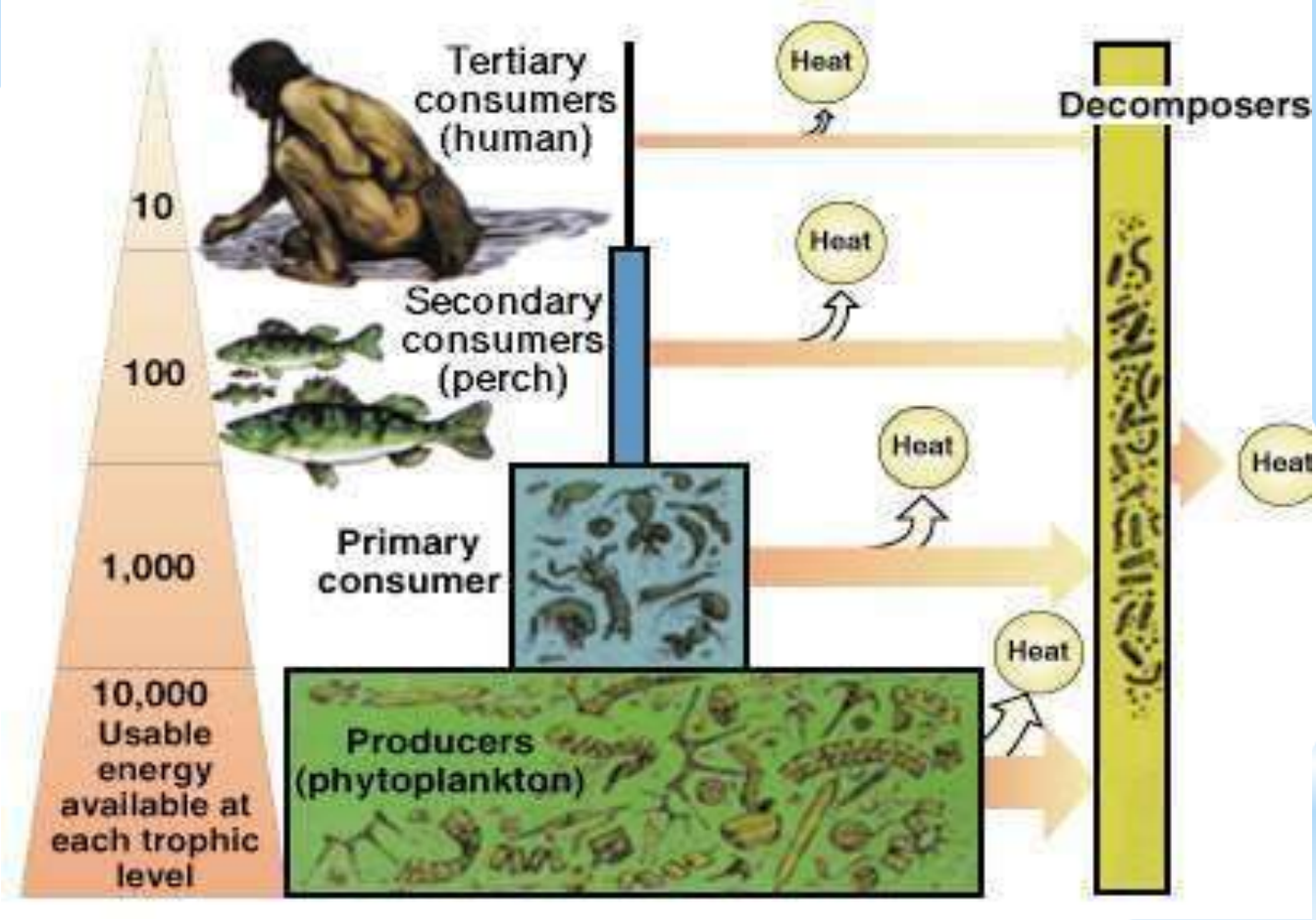
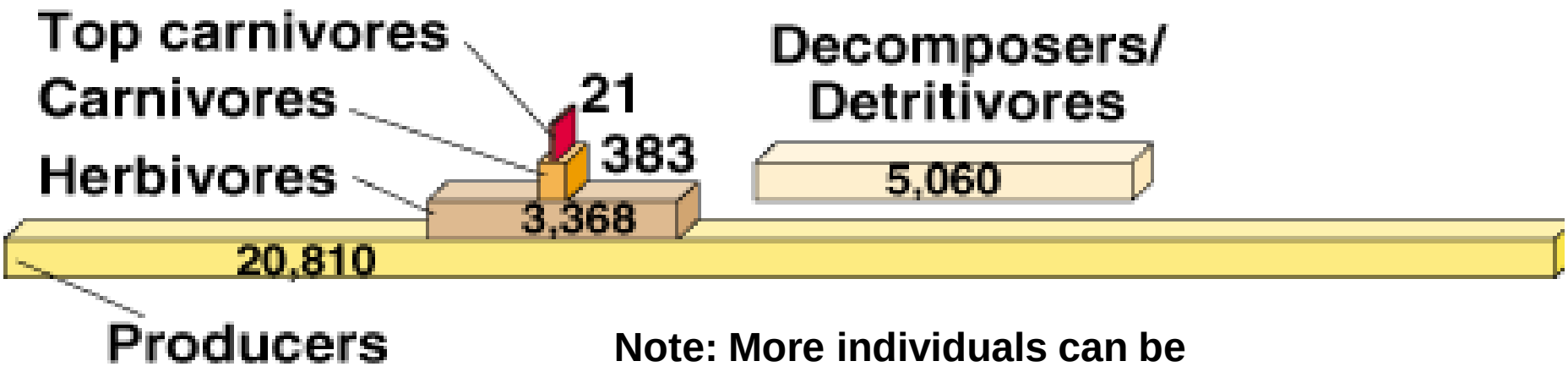


Fig. 4–19

Another Energy Pyramid

Annual pyramid of energy flow (in kilocalories per square meter per year) for an aquatic ecosystem in Silver Springs, FL.

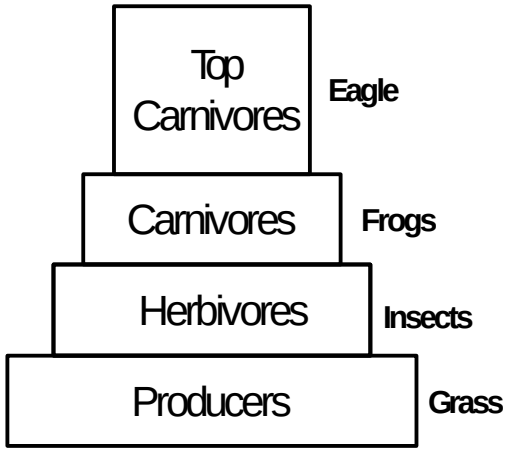


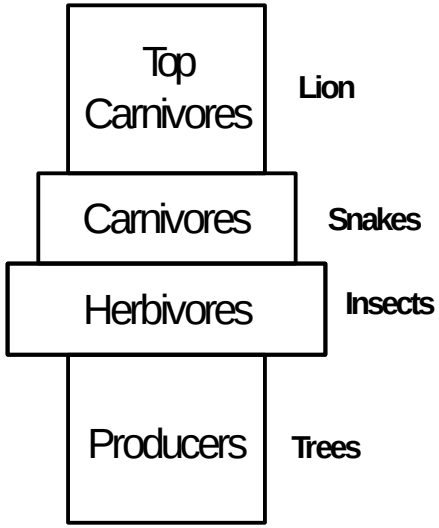
Note: More individuals can be supported at lower trophic levels. Less energy is lost.

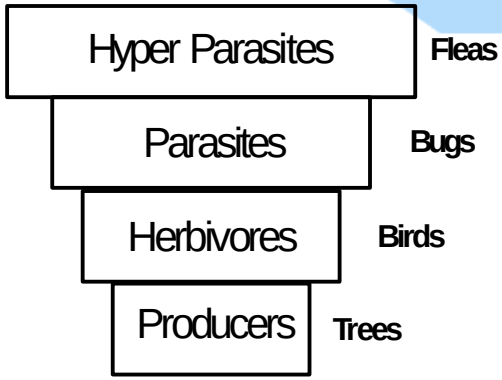
Ecosystem:

Pyramids of Numbers:

- It represents the number of individual organisms at each tropical levels

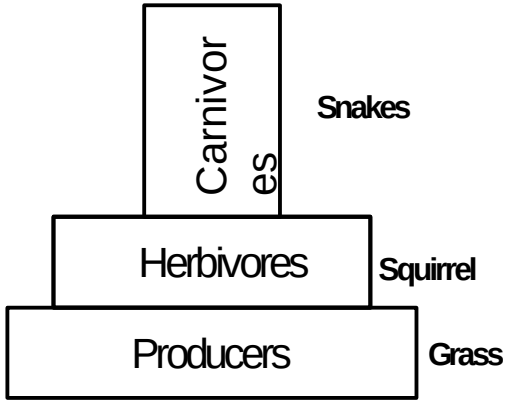


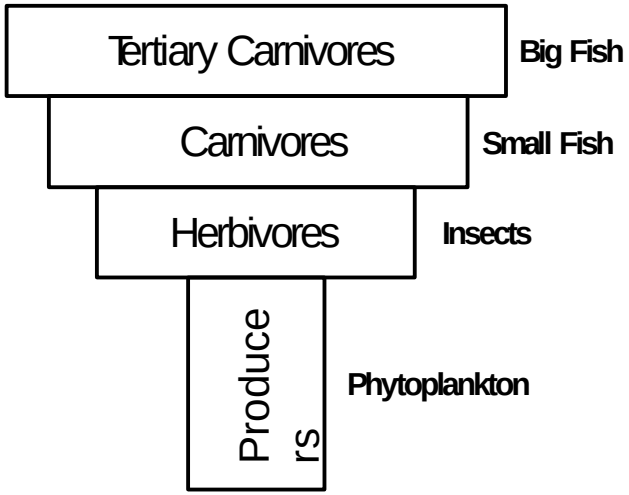




Pyramids of Biomass:

- It is based on the total biomass at each trophic level of a food chain

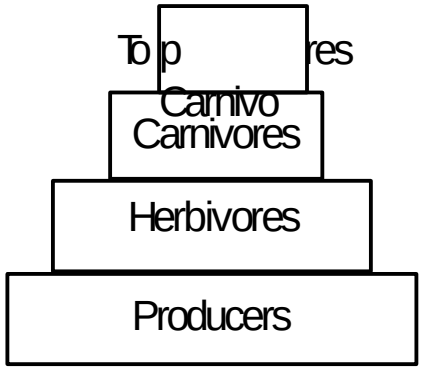




Pyramids of Energy:

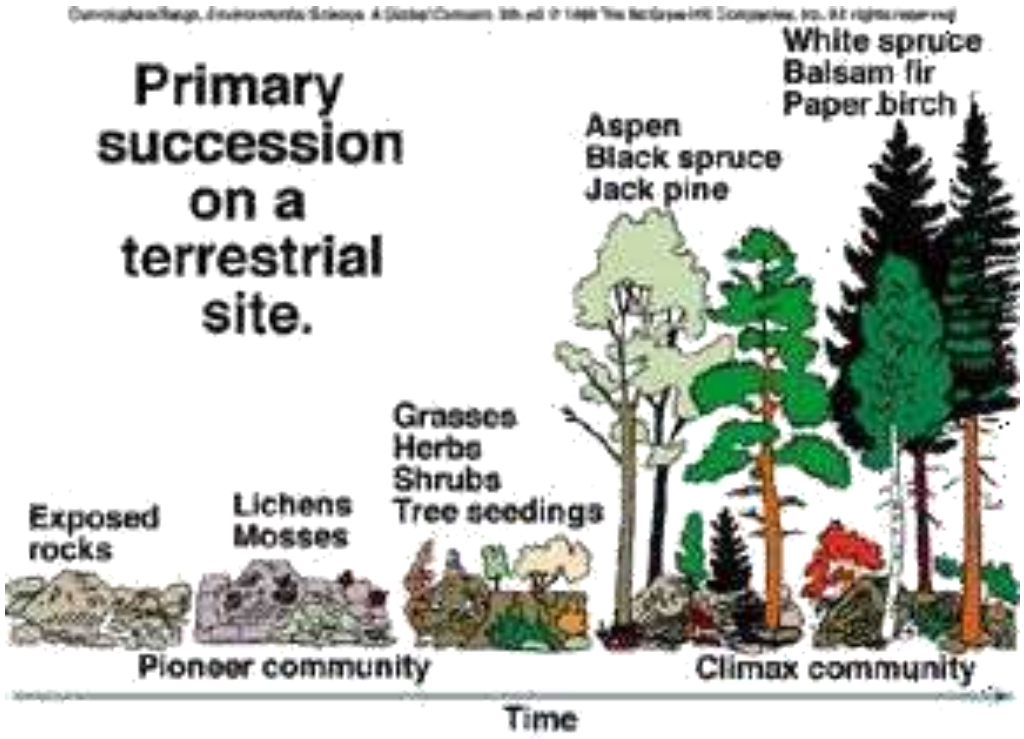
- It is based on the amount of energy present at each trophic levels.

- It gives the best representation of trophic relationship. *(always upright)*



Ecological Succession:

The progressive replacement of one community by another till the development of stable community in a particular area.



Process of Succession:

Process of succession takes place in a symmetrical order of sequential steps

➢ **Nudation –** Development of a bare area without any life form.

Causes:

Land Slides

Volcano

Drought

Glaciers

Topographical Factor

Climatic Factor

Process of Succession:

Process of succession takes place in a symmetrical order of sequential steps

- **Nudation –** Development of a bare area without any life form.

Causes:

Biotic Factor

Process of Succession:

Process of succession takes place in a symmetrical order of sequential steps

- **Invasion –** Successful establishment of one or more species on a bare area through dispersal or migration.

Process:

Process of Succession;

Process of succession takes place in a symmetrical order of sequential steps

- **Competition and Coaction –** Competition between inter and intra species for space, water and nutrition called coaction

- **Reaction –** Living organisms grow, use water from substratum and they in turn have strong influence on the environment which is modified to a large extent. Modifications may become unstable for existing species and favour new species which replaces them. This is called seral communities.
- **Stabilization –** The succession ultimately culminates (ends) in more or less stable community called climax which is in equilibrium with the environment. It is characterized by maximum biomass and symbiotic linkages between organism and are maintained quite efficiently.

Ecosystem:

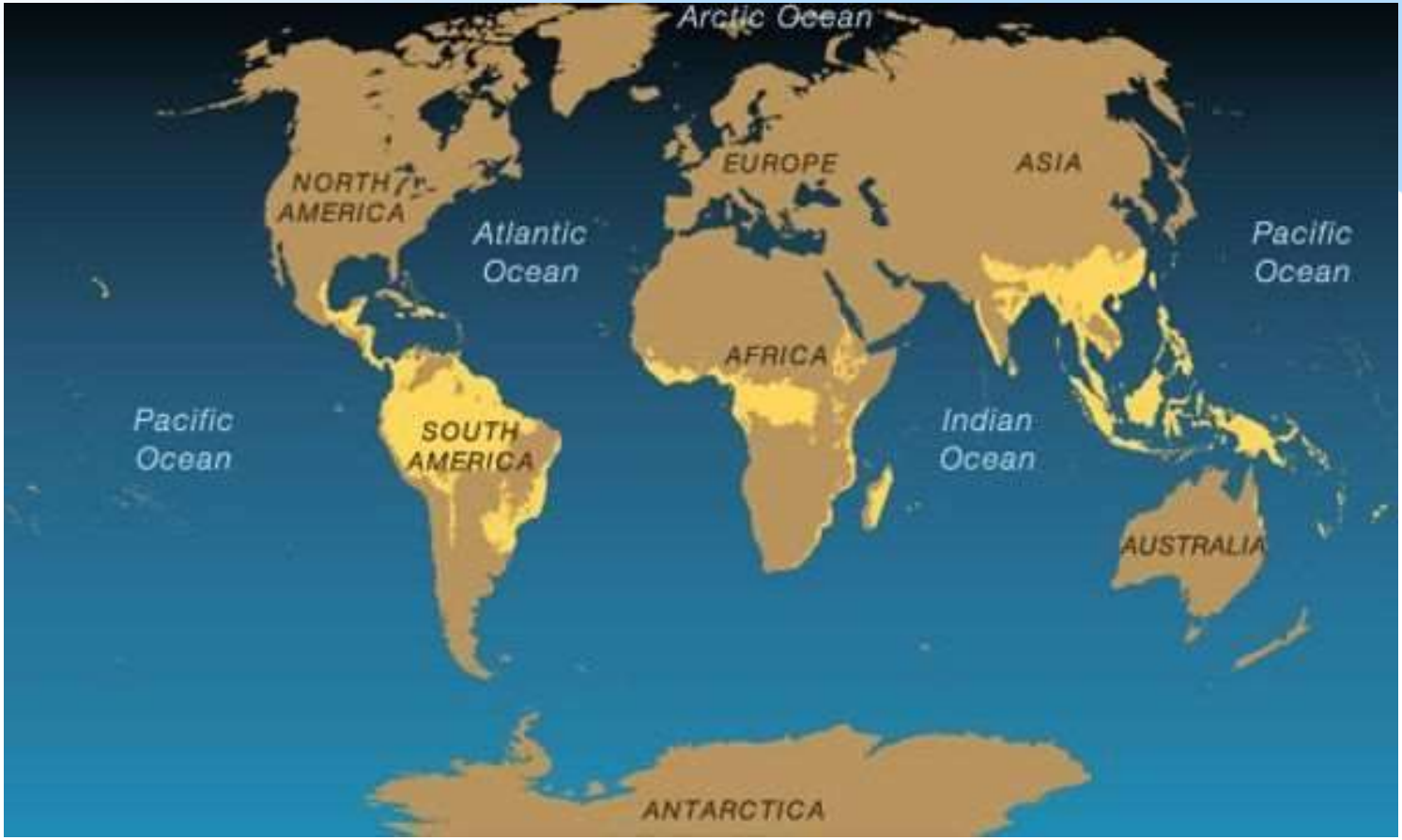
Types:

- **Forest Ecosystem –** A forest ecosystem is the one in which a tall and dense trees grow that support many animals and birds.

  - **Classification**: Depending upon the climate conditions forests can be classified into the following types.
    - Tropical rain forests
    - Tropical deciduous forests
    - Tropical scrub forests
    - Temperate rain forests
    - Temperate deciduous forests

Types:

- **i)Tropical Rain Forest:**
  - The tropical rainforest is a hot, moist biome found near Earth's equator.
  - The world's largest tropical rainforests are in South America, Africa, and Southeast Asia.
  - Tropical rainforests receive from 60 to 160 inches of precipitation that is fairly evenly distributed throughout the year.
  - The combination of constant warmth and abundant moisture makes the tropical rainforest a suitable environment for many plants and animals.
  - Tropical rainforests contain the greatest biodiversity in the world. Over 15 million species of plants and animals live within this biome


Arctic Ocean
NORTH AMERICA
Atlantic Ocean
EUROPE
ASIA
Pacific Ocean
AFRICA
Pacific Ocean
SOUTH AMERICA
Indian Ocean
AUSTRALIA
ANTARCTICA

- **ii)Tropical Deciduous Forest:**

  - Tropical deciduous forests are also called the "Monsoon forests".
  - Long dry season of summer leads these forests to shed their leaves in order to prevent evaporation.
  - Period of shedding the leaves varies for each species of trees. Hence, all the trees do not shed leaves at one and the same time.
  - Tropical deciduous forests are grown in the areas with annual rainfall of 70-200 cm.
  - Sandal wood, Shisam, Mahua, Sal, Teak and Bamboo are important species of trees. They are famous for their economic importance. They supply timber for use in various activities.

  - **Shed –prevent -evaporation**

- **Tropical Deciduous Forest:**
  - Moist deciduous and the dry deciduous forests are **two major categories** of these forests.
    - The moist deciduous forests are found in Shiwalik foothills, Bhabar, Tarai, Chhota Nagpur Plateau, the North-eastern Deccan Plateau and North-south strip to the east of the Western Ghats.
    - The dry deciduous forests are grown in the Central India where rainfall is comparatively less.

Moist Forests Teak

Dry Forests Sal

- **iii) Tropical Scrub Forest:**

  - It is one of the biomes that make up arid land.
  - This type of biome also consists of desert and areas of low-lying, dense underbrush.
  - It is an area of little precipitation, plenty of continuous winds, poor drainage and medium to poor soil quality.
  - The plants and animals of the tropical scrub forest have adapted to flourish in this harsh environment.

- **Tropical Scrub Forest:**
  - Tropical scrub forests, or chaparral as they are referred to in California, are found across the southern United States, along the Mediterranean coastline, in north and central Africa and within the interior of Australia.
  - Average annual rainfall is only 2 to 9 inches, and the temperature fluctuates very little, averaging near 64 degrees Fahrenheit all year round.
  - Virtually all tropical scrub forest is found in the same equatorial region, and temperatures fluctuate little regardless of season.

*iv)Temperate Rainforest

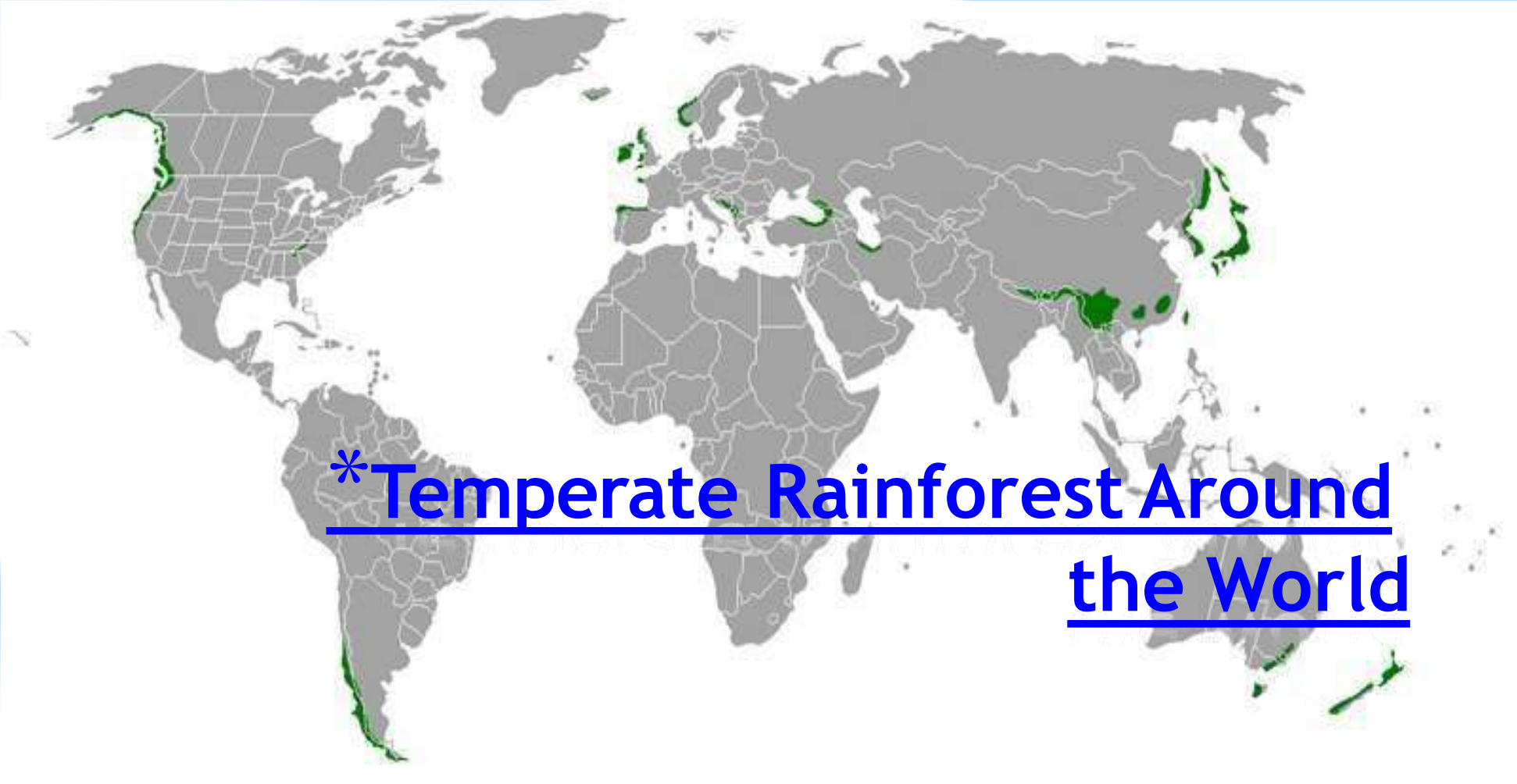
*Mid Latitudes.

*1000- 1200 mm of Rain per year average some receive more.

*Winter temperatures rarely drop below freezing.

*Summer Temperatures rarely exceed 80 degrees.

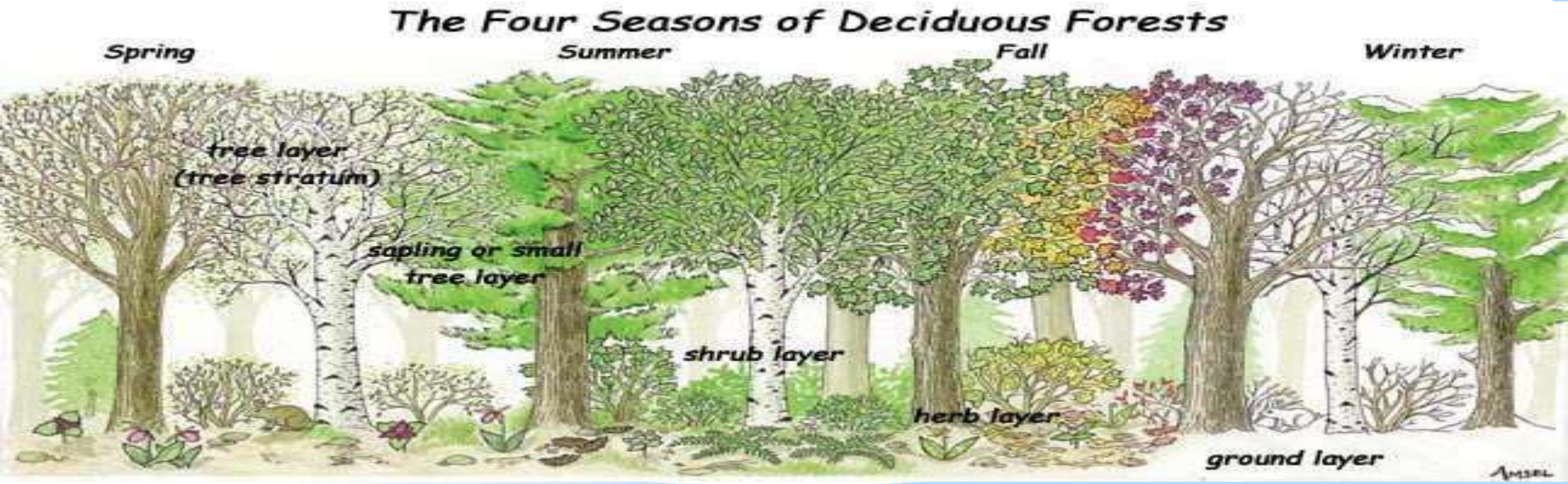
*Mild wet winters and cool, foggy and clouded summers.



*Temperate Rainforest Around the World

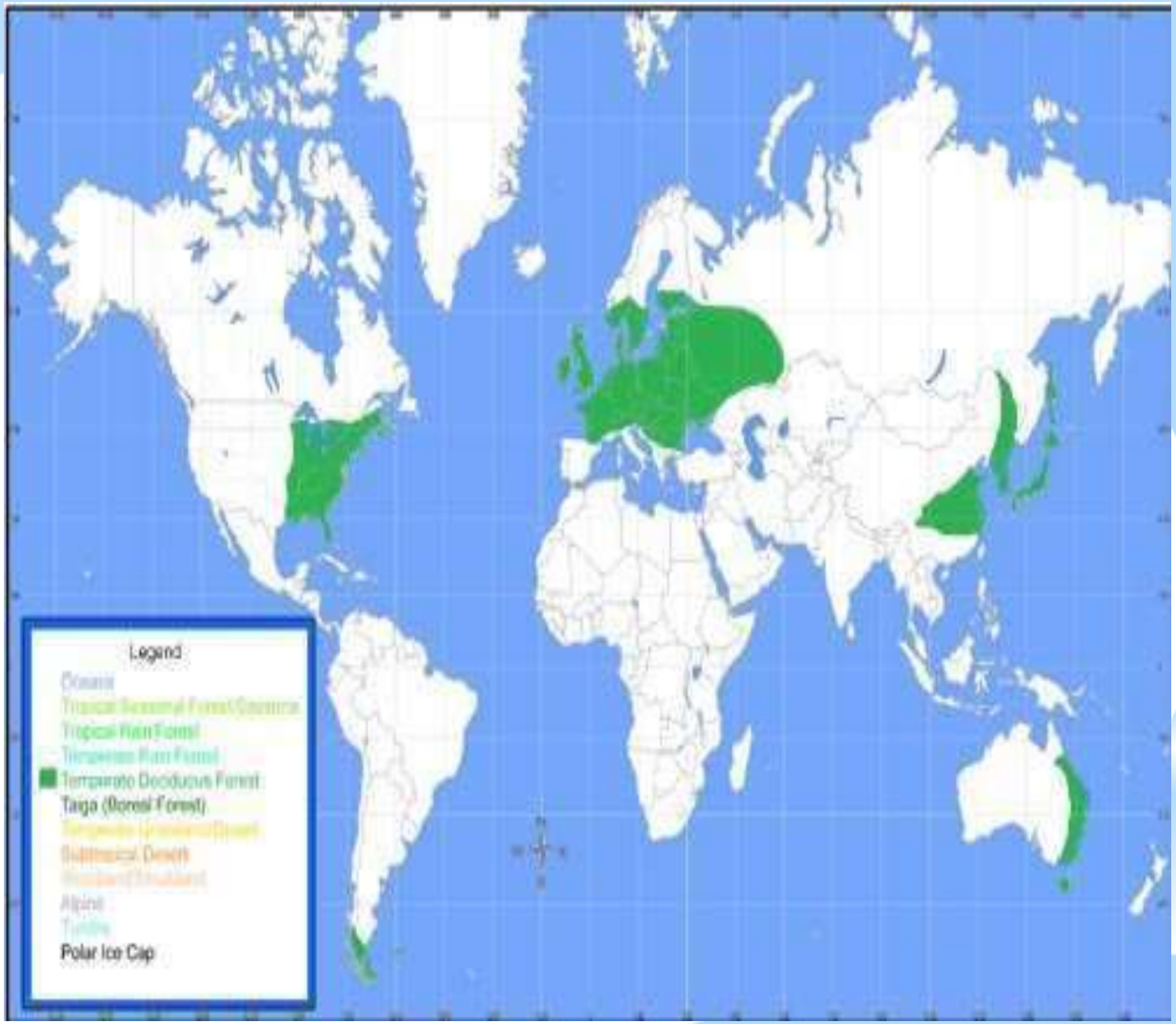
A **DECIDUOUS FOREST** is used to describe a type of forest trees **shed** their leaves during the cold months of the year and re-grow new leaves the next Spring.

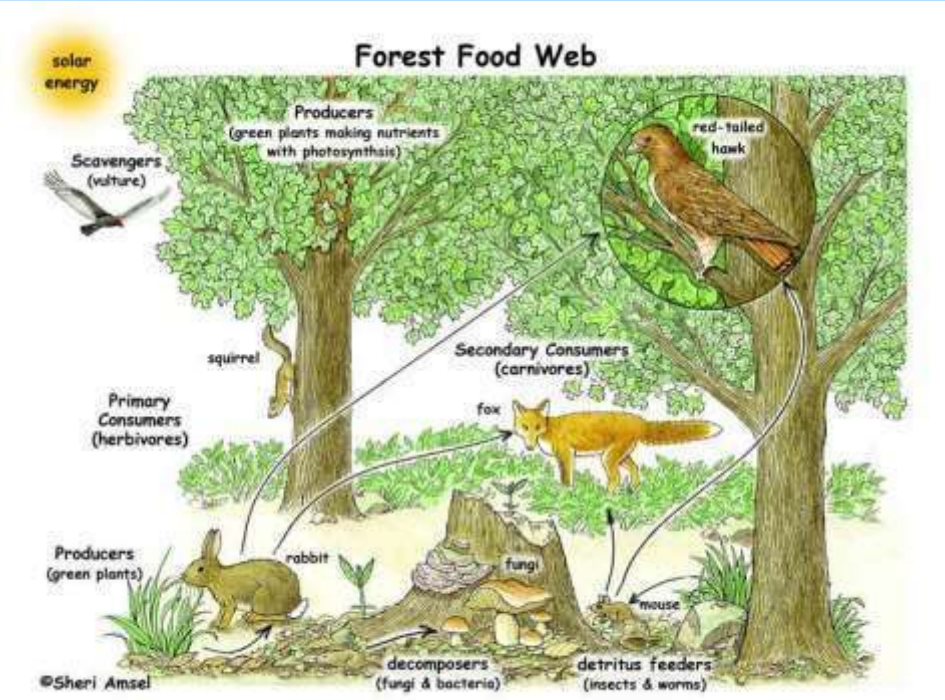
The major characteristic is that it has **4 DISTINCT SEASONS**!



*LOCATION

- *Eastern third of the North America
- *western Europe
- *China, Korea, Japan and Australia
- *southern tip of South America
- *The only part of Texas that has this type of forest is far East Texas




Forest Food Web
solar energy
Producers
(green plants making nutrients with photosynthesis)
Scavengers
(vulture)
red-tailed hawk
squirrel
Secondary Consumers
(carnivores)
Primary Consumers
(herbivores)
fox
Producers
(green plants)
rabbit
fungi
mouse
decomposers
(fungi & bacteria)
detritus feeders
(insects & worms)
©Sheri Amsel

Grassland Ecosystem:

- Grassland occupies about 20% of earth's surface. In addition to grass species, some trees and shrubs are also present.

Types:

Depending upon the climate conditions grassland can be classified into three types

- Tropical grasslands – savannas

- Temperate grassland – pampas, steppes, prairies

- Polar grassland

Ecosystem ~ Tropical Grasslands

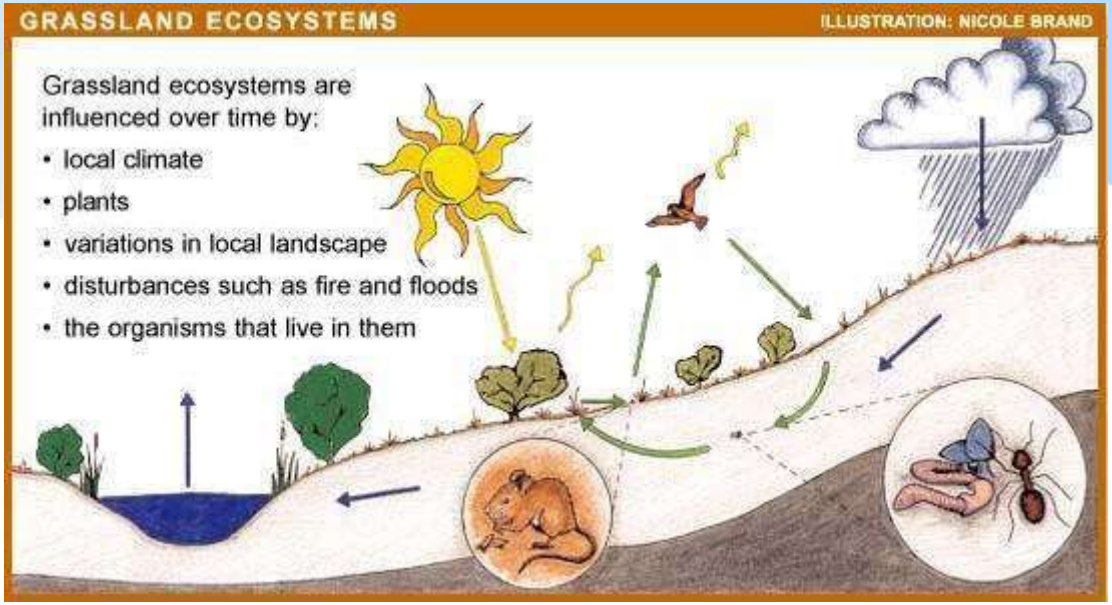
(The Savanna)

Grassland Characteristics:

- It is a plain land occupied by grasses
- Soil is very rich in nutrients and organic matter
- It is ideal place for grazing animals.
- It is characterized by low or uneven rainfall

Grassland Structure:

- Biotic
  - Producers (grass, shrubs, forbs etc.)
  - Consumers (cow, buffaloes, deer, etc.)
  - Decomposers (fungi and bacteria)
- Abiotic
  - Physical Factor (rainfall, light, temperature)
  - Chemical Factor (organic and inorganic matter, nutrient)


GRASSLAND ECOSYSTEMS
ILLUSTRATION: NICOLE BRAND
Grassland ecosystems are influenced over time by:
• local climate
• plants
• variations in local landscape
• disturbances such as fire and floods
• the organisms that live in them

Desert Ecosystem:

- It is regions where evaporation exceeds precipitations.
- It occupies about 35% of our world's land area.

Types:

Depending upon the climate conditions grassland can be classified into three types

- Tropical Desert – Sahara, Thar
- Temperate Desert – Mojave
- Polar Desert - Gobi

Desert Ecosystem Characteristics:

- The desert air is dry and the climate is hot.
- Annual rainfall is less than 25 cm
- The soil is very poor nutrients and organic matter
- Vegetation is poor

Desert Ecosystem Structure:

- Biotic
  - Producers (Shrubs, Bushes, Few Trees)
  - Consumers (Squirrels, Mice, Rabbits)
  - Decomposers (Fungi, Bacteria)
- Abiotic
  - **Physical Factor (Rainfall, Light, Temperature)**
  - **Chemical Factor (Organic and Inorganic matters)**

Aquatic Ecosystem:

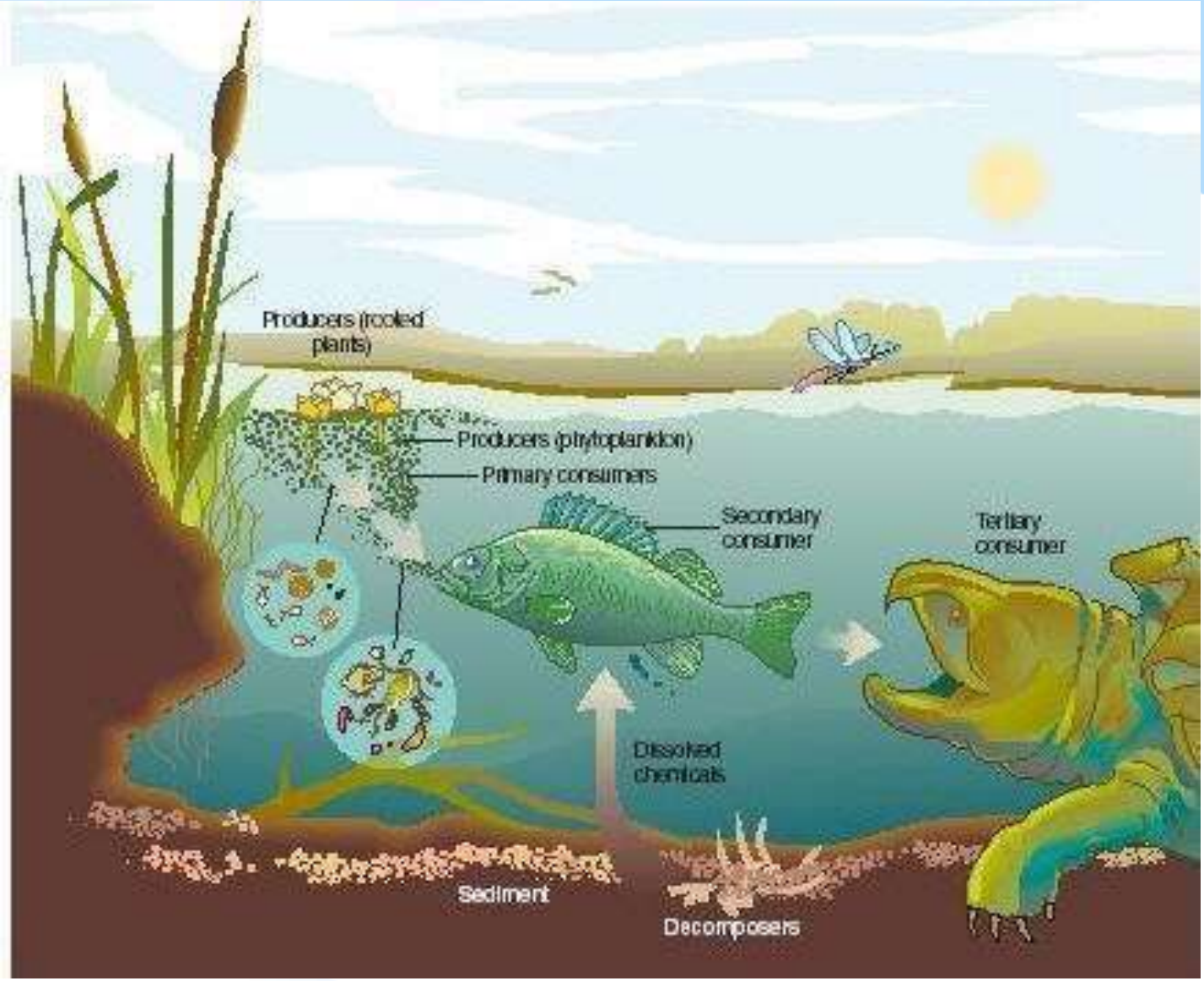
- An aquatic ecosystem is an ecosystem in a body of water.
- Communities of organisms that are dependent on each other and on their environment live in aquatic ecosystems.

Types:

- Fresh water
  - Pond
  - Lake
  - River
- Salt water
  - Ocean
  - Estuarine

Pond Ecosystem:

- Small bodies of freshwater with shallow and still water, marsh, and aquatic plants.
- They can be further divided into four zones:
  - vegetation zone
  - open water
  - bottom mud
  - surface film.
- The size and depth of ponds often varies greatly with the time of year; many ponds are produced by spring flooding from rivers.
- Food webs are based both on free-floating algae and upon aquatic plants.
- There is usually a diverse array of aquatic life, with a few examples including algae, snails, fish, beetles, water bugs, frogs, turtles, otters and muskrats.
- Top predators may include large fish, herons, or alligators.
- Since fish are a major predator upon amphibian larvae, ponds that dry up each year, thereby killing resident fish, provide important refugia for amphibian breeding
- .



1.vegetation zone
2.open water
3.bottom mud
4.surface film.

Pond Ecosystem Characteristics;

- It is temporary
- It is a stagnant fresh water body
- It may be seasonal

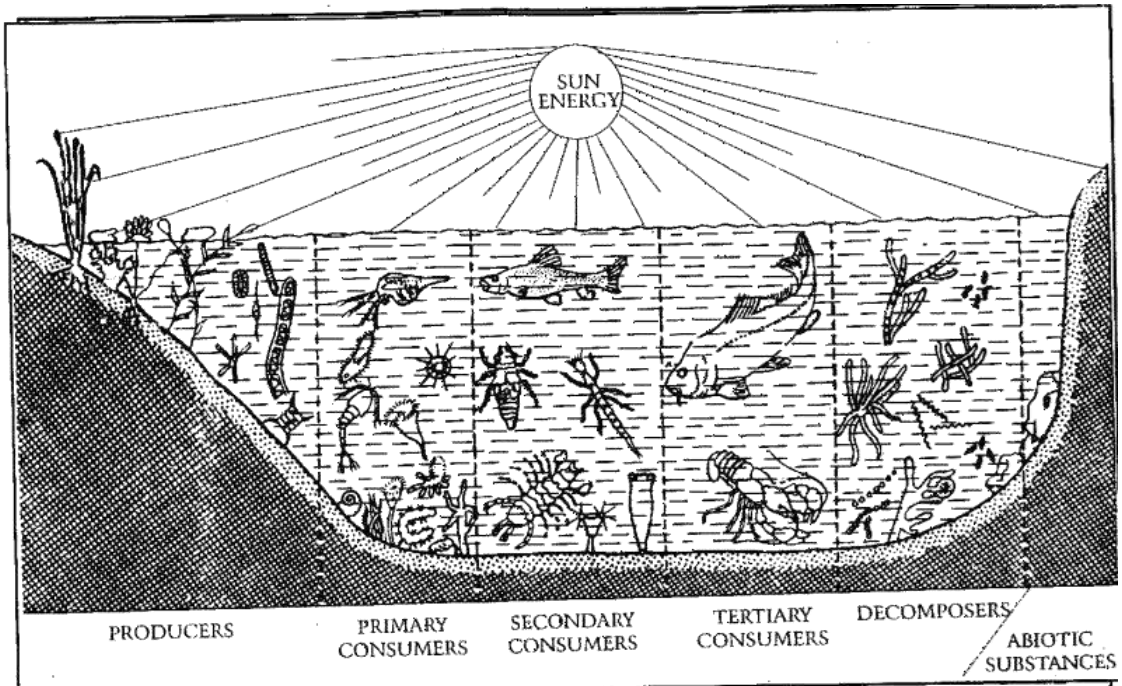


Fig. 9.2 Pond ecosystem

Lake Ecosystem:

- Lake ecosystems can be divided into zones.

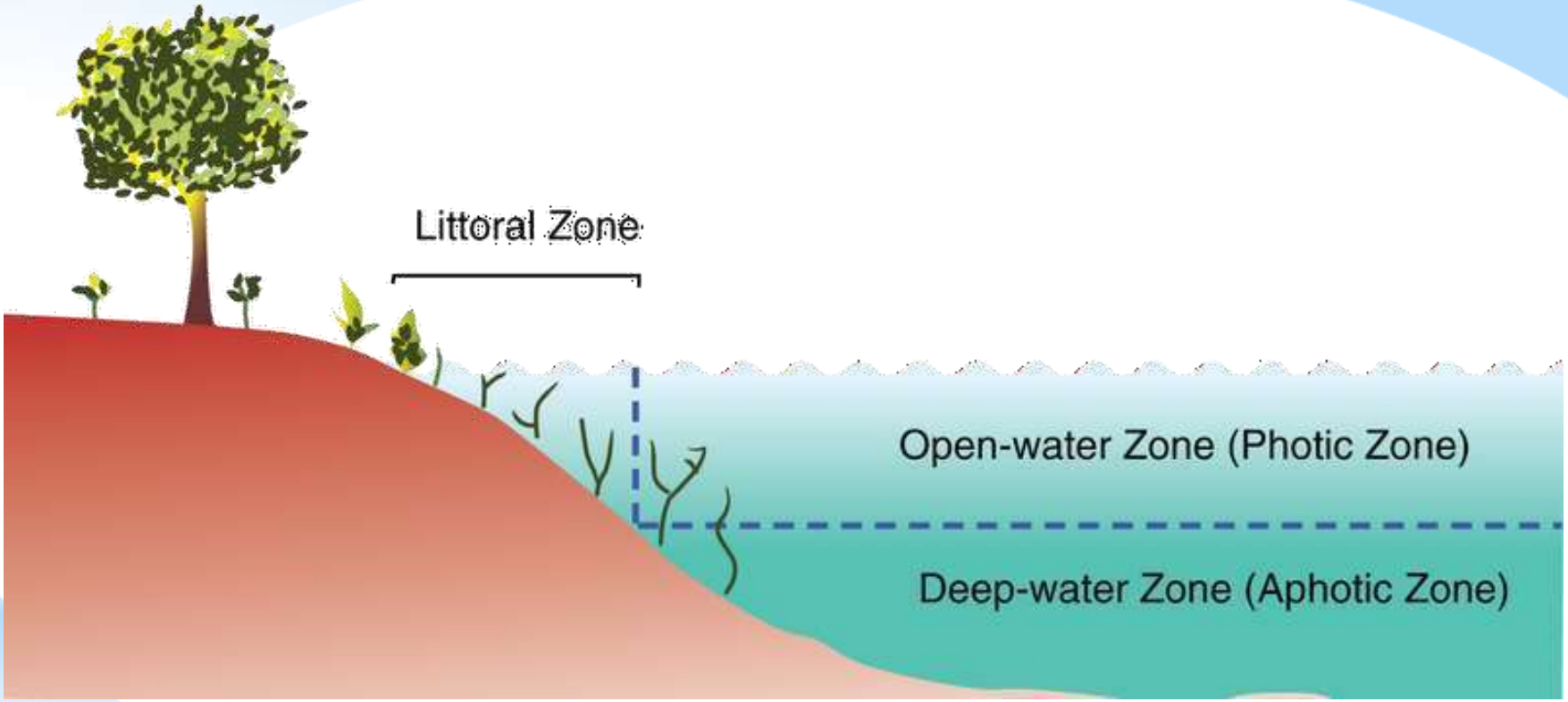
- One common system divides lakes into three zones (see figure).

- The first, the littoral zone - shallow zone near the shore, where rooted wetland plants occur.

- The offshore is divided into two further zones, an open water zone and a deep water zone.
  - In the open water zone (or photic zone) sunlight supports photosynthetic algae, and the species that feed upon them.
  - In the deep water zone(or aphotic zone), sunlight is not available and the food web is based on detritus entering from the littoral and photic zones.

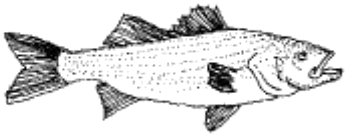
- The off shore areas may be called the pelagic zone, and the aphotic zone may be called the profundal zone.

- Inland from the littoral zone one can also frequently identify a riparian zone which has plants still affected by the presence of the lake—this can include effects from windfalls, spring flooding, and winter ice damage.


Littoral Zone
Open-water Zone (Photic Zone)
Deep-water Zone (Aphotic Zone)

Lake Ecosystem Characteristics:

- It is a shallow fresh water body
- It is a permanent water body
- It helps in irrigation and drinking
- Organism : Planktons, Nektons, Neustons, Benthos, Periphytons



Types of Lakes:

Oligotrophic
(Low Nutrient)

Eutrophic
(High Nutrient)

Dystrophic
(Low pH)

Endemic
(Has Fauna)

Desert Salt
(High Salt)

Volcanic
(Volcanic Eruption)

Meromictic
(Rich in Salt)

Artificial
(Due to Dams)

River Ecosystem:

- The ecosystem of a river is the river viewed as a system operating in its natural environment, and includes biotic (living) interactions amongst plants, animals and micro-organisms, as well as abiotic (non-living) physical and chemical interactions.

- River ecosystems are prime examples of lotic ecosystems.

- Lotic refers to flowing water, from the Latin lotus, washed.

River Ecosystem Characteristics:

- Flow is unidirectional.
- There is a state of continuous physical change.
- There is a high degree of spatial and temporal heterogeneity at all scales (microhabitats).
- Variability between lotic systems is quite high.
- The biota is specialized to live with flow conditions

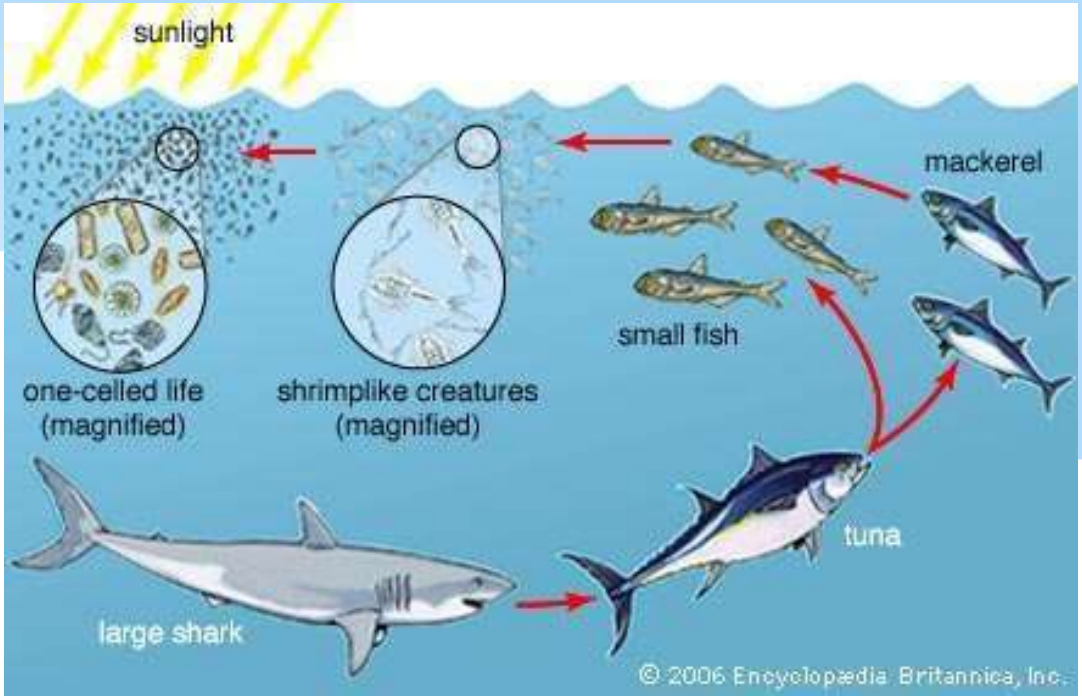
Ocean Ecosystem:

- Marine ecosystems are among the largest of Earth's aquatic ecosystems.
- They include oceans, salt marsh and intertidal ecology, estuaries and lagoons, mangroves and coral reefs, the deep sea and the sea floor.
- They can be contrasted with freshwater ecosystems, which have a lower salt content.
- Marine waters cover two-thirds of the surface of the Earth. Such places are considered ecosystems because the plant life supports the animal life and vice-versa.

Ocean Ecosystem Characteristics:

- Marine ecosystems are very important for the overall health of both marine and terrestrial environments.
- According to the World Resource Centre, coastal habitats alone account for approximately 1/3 of all marine biological productivity, and estuarine ecosystems (i.e., salt marshes, sea-grasses, mangrove forests) are among the most productive regions on the planet.
- Marine ecosystems such as coral reefs, provide food and shelter to the highest levels of marine diversity in the world.
- Marine ecosystems usually have a large biodiversity and are therefore thought to have a good resistance against invasive species.

Ocean Ecosystem Structure:



Types of Zones:

- Coastal Zone – Warm, nutrient rich shallow water
- Open Sea – Deepest
  - Euphotic Zone – Receives abundant light and shows high photosynthetic activities.
  - Bathyal Zone – It receives dull light
  - Abyssal Zone – It is the dark zone (2 – 5km deep)

Estuarine Ecosystem:

- An estuary is a partly enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea.
- Estuaries form a transition zone between river environments and maritime environments and are subject to both marine influences, such as tides, waves, and the influx of saline water.
- The inflows of both sea water and fresh water provide high levels of nutrients in both the water column and sediment, making estuaries among the most productive natural habitats in the world.

Klamath River – North California

Estuarine Ecosystem Characteristics:

Estuaries are transition Zones

- Water characteristics are periodically changed
- Salinity remains highest during the summer and lowest during the winter.
- It is strongly affected by tidal action.
- The organisms (Eurythermal and Euryhaline) present in estuaries show a wide range of tolerance to temperature and salinity.

Biodiversity:

Definition:

- Biodiversity is the degree of variation of life forms within a given species, ecosystem, biome, or planet.
- Terrestrial biodiversity tends to be highest at low latitudes near the equator, which seems to be the result of the warm climate and high primary productivity.
- Marine biodiversity tends to be highest along coasts in the Western Pacific, where sea surface temperature is highest and in mid-latitudinal band in all oceans.
- Biodiversity generally tends to cluster in hotspots, and has been increasing through time but will be likely to slow in the future.
- Rapid environmental changes typically cause mass extinctions. One estimate is that <1%-3% of the species that have existed on Earth are extant.

Biodiversity:

Definition:

- Biologists most often define biodiversity as the "totality of genes, species, and ecosystems of a region".
- An advantage of this definition is that it seems to describe most circumstances and presents a unified view of the traditional three levels at which biological variety has been identified:
- Species diversity
- Ecosystem diversity
- Genetic diversity

Species Diversity:

- Species diversity is the effective number of different species that are represented in a collection of individuals (a dataset).
- The effective number of species refers to the number of equally-abundant species needed to obtain the same mean proportional species abundance as that observed in the dataset of interest (where all species may not be equally abundant).
- Species diversity consists of two components, species richness and species evenness.

Ecosystem Diversity:

- Ecosystem diversity refers to the diversity of a place at the level of ecosystems.
- Ecosystem diversity can also refer to the variety of ecosystems present in a biosphere, the variety of species and ecological processes that occur in different physical settings.

2001

2002

Genetic Diversity:

- Genetic diversity, the level of biodiversity, refers to the total number of genetic characteristics in the genetic makeup of a species.
- It is distinguished from genetic variability, which describes the tendency of genetic characteristics to vary.
- Genetic diversity serves as a way for populations to adapt to changing environments.
- With more variation, it is more likely that some individuals in a population will possess variations of alleles that are suited for the environment.
- Those individuals are more likely to survive to produce offspring bearing that allele.
- The population will continue for more generations because of the success of these individuals.

Genetic Diversity:

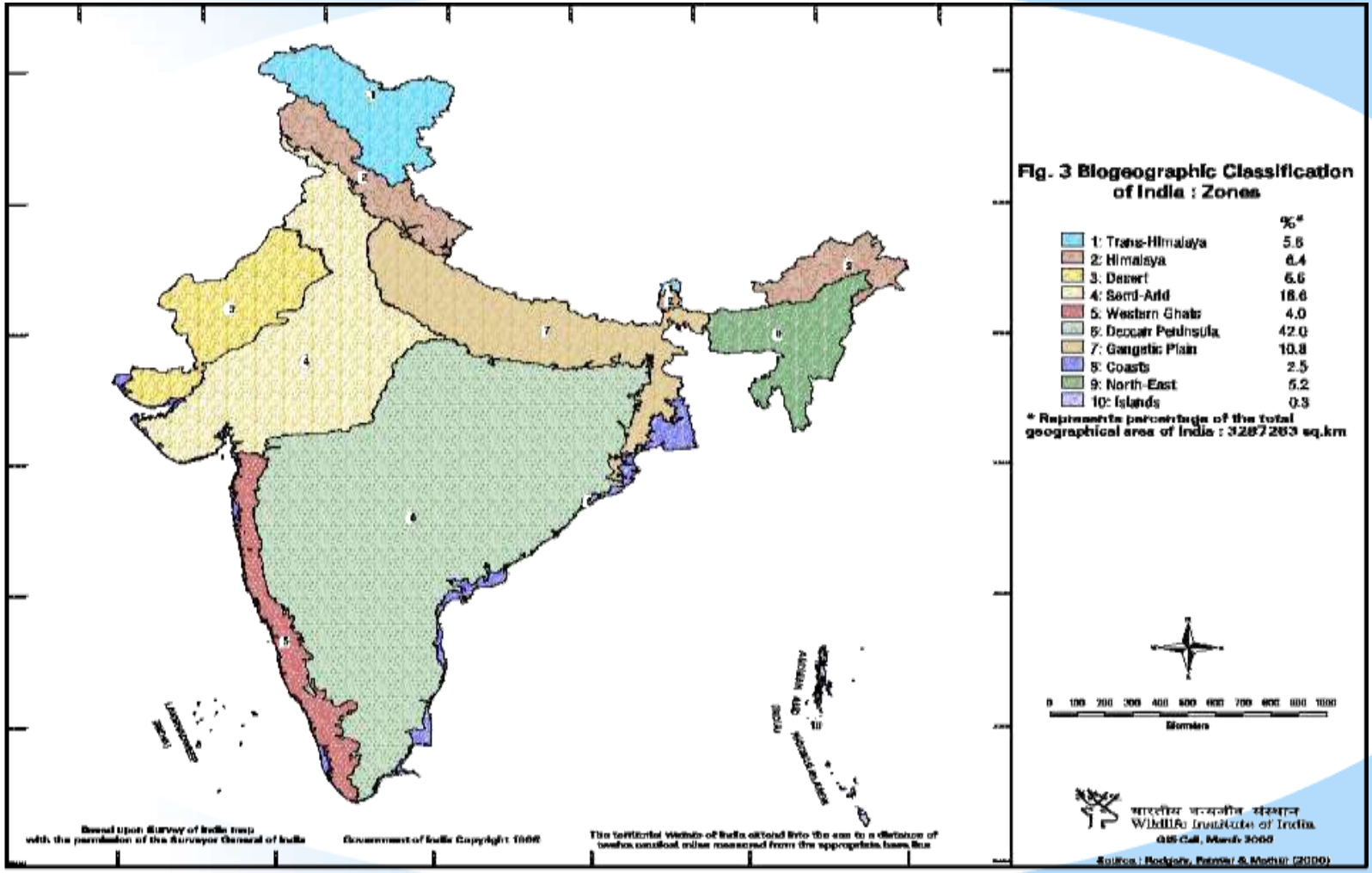
Biogeographically Classification of India:

- India has different types of climate and topography in different parts of the country and these variations have induced enormous variability in flora and fauna.
- It occupies tenth position among the plant rich nations of the world.
- Biogeography deals with the study of distribution, evolution, dispersal and environmental relationship of plants and animals in time and space.
- In our country, it has been classified into ten biogeographic zones. Each of these zones has its own characteristic climate, soil, topography and biodiversity.

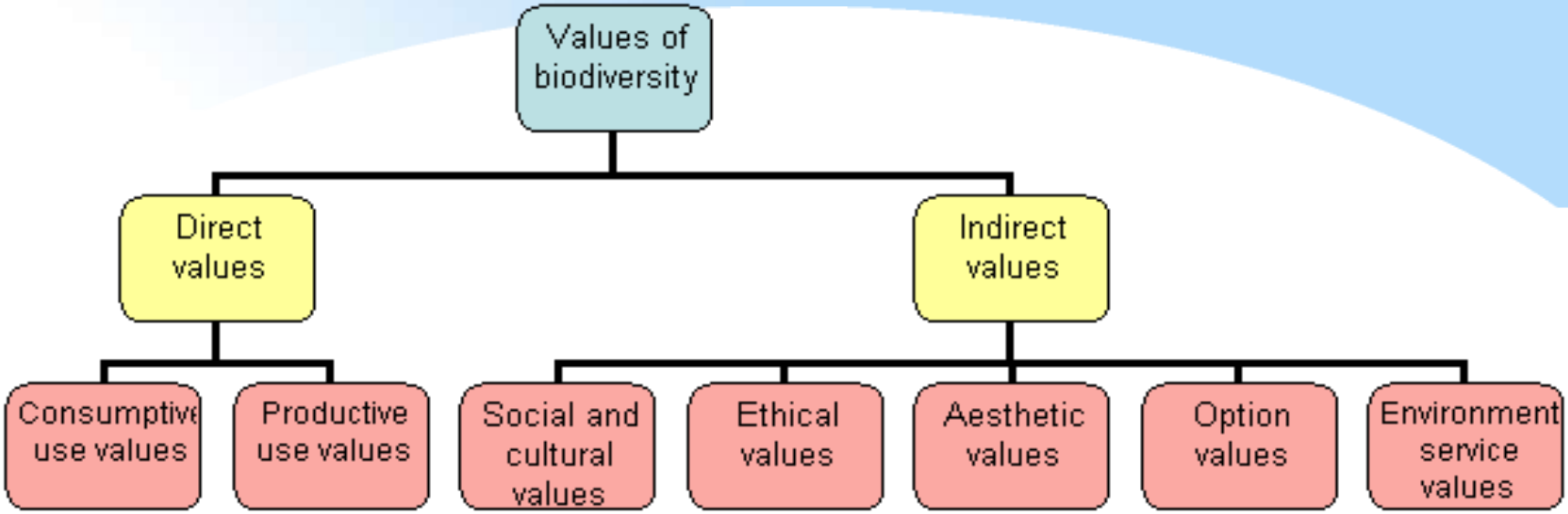
Biogeographically Classification of India:

- Biogeographic classification of India is the division of India according to biogeographic characteristics. Biogeography is the study of distribution of species (biology), organisms, and ecosystems in geographic space and through geological time. The biogeographic zones of India are as follows:
  - Himalayan zone
  - Desert zone
  - Semiarid zone
  - Western Ghats zone
  - Deccan plateau zone
  - Gangetic plain zone
  - North east zone
  - Coastal zone
  - Islands present near the shore line
  - Trans Himalayan zone.

Biogeographically Classification of India:



Values of Biodiversity:

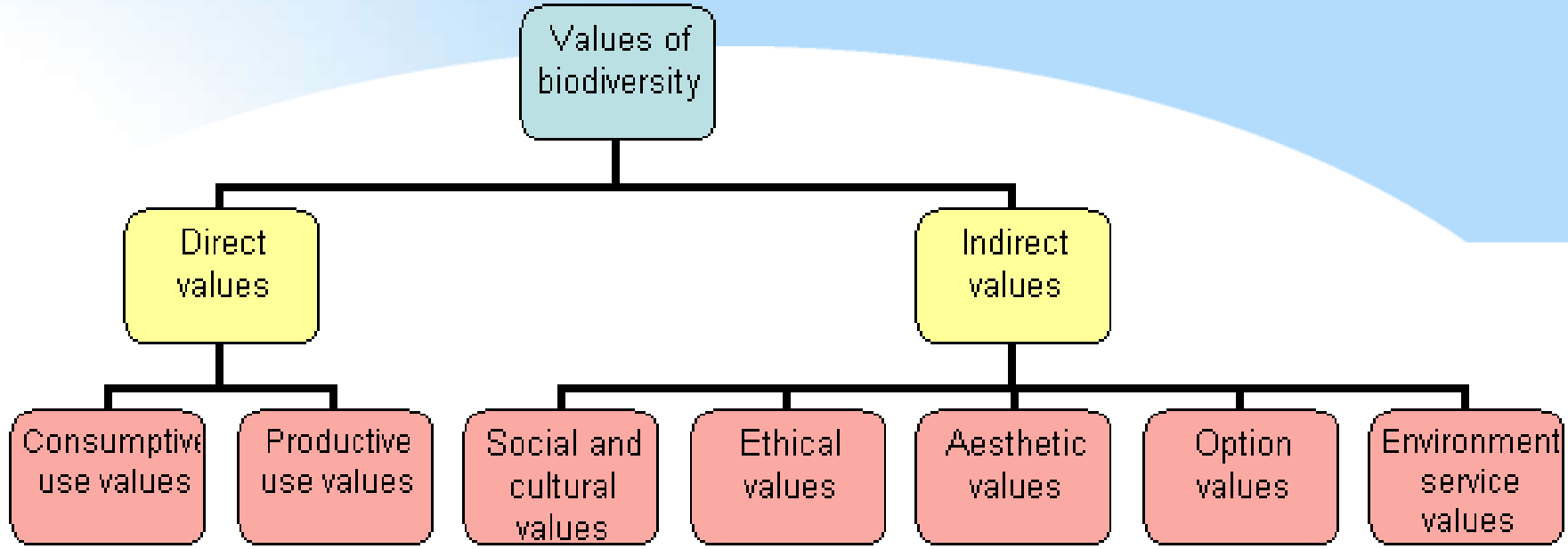


Food

Fuel

Drug

Value of Biodiversity:

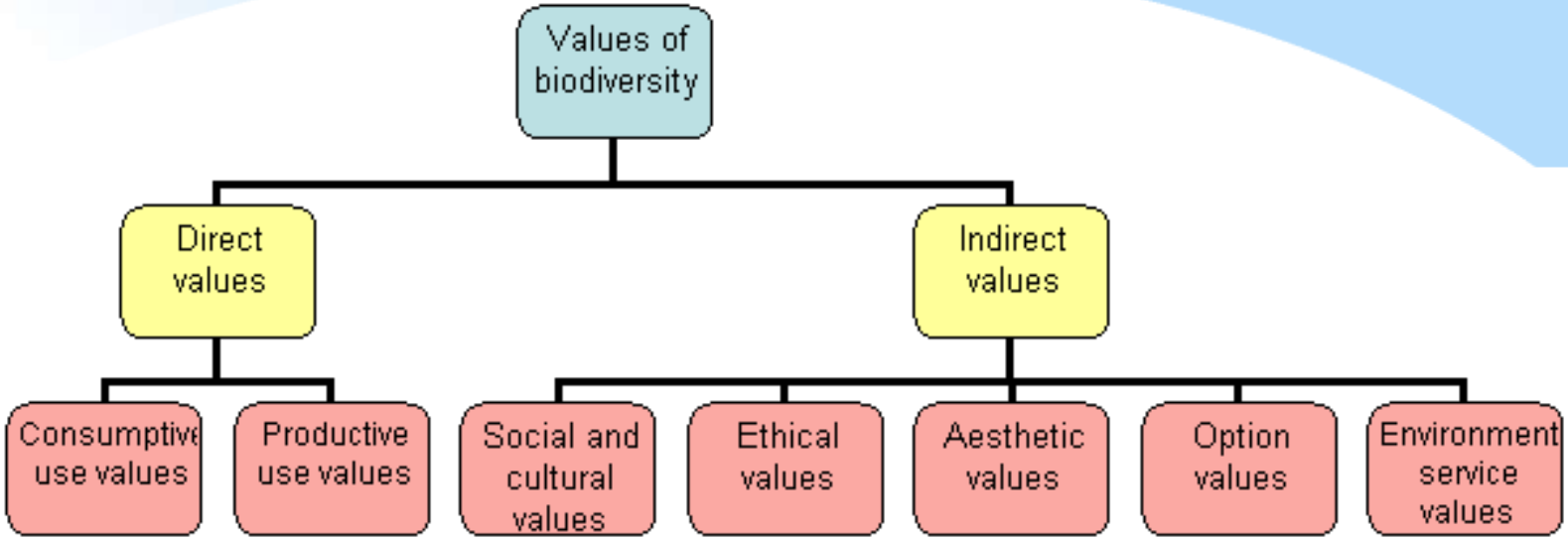


Elephant Tusk

Silk

Wool

Value of Biodiversity:

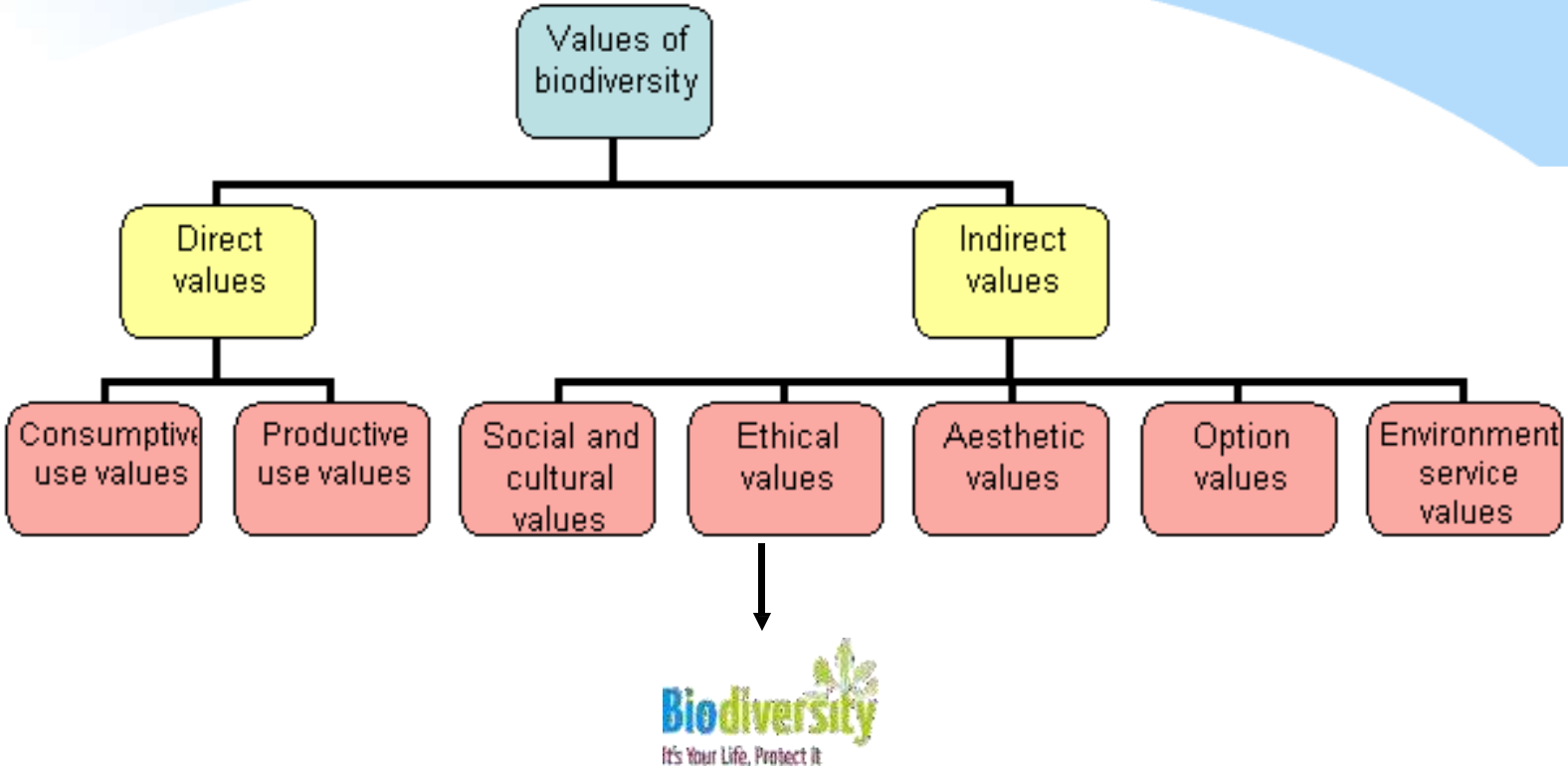


Tulsi Plant

Sacred Flowers

Snakes

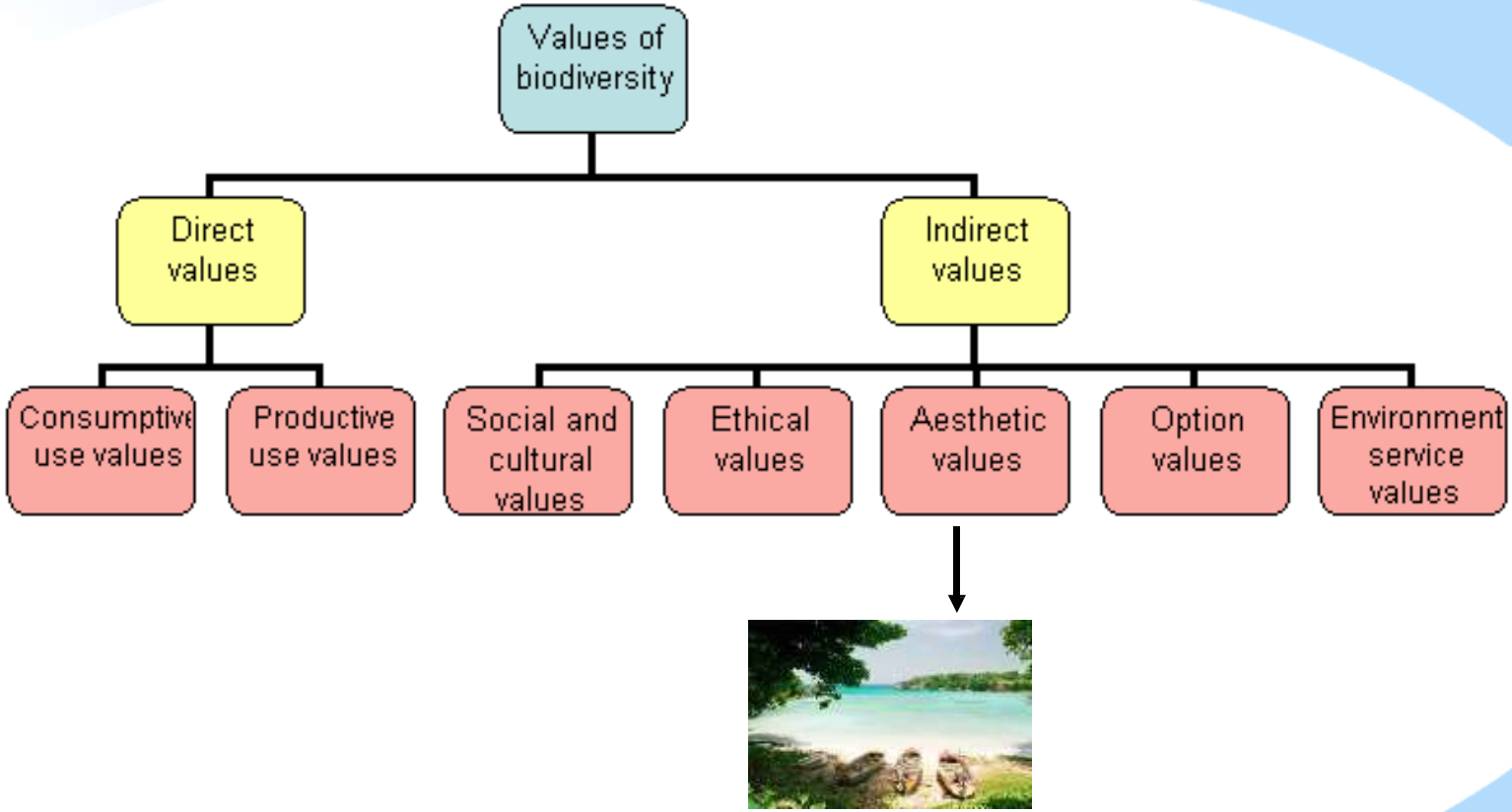
Value of Biodiversity:



Biodiversity
It's Your Life, Protect It

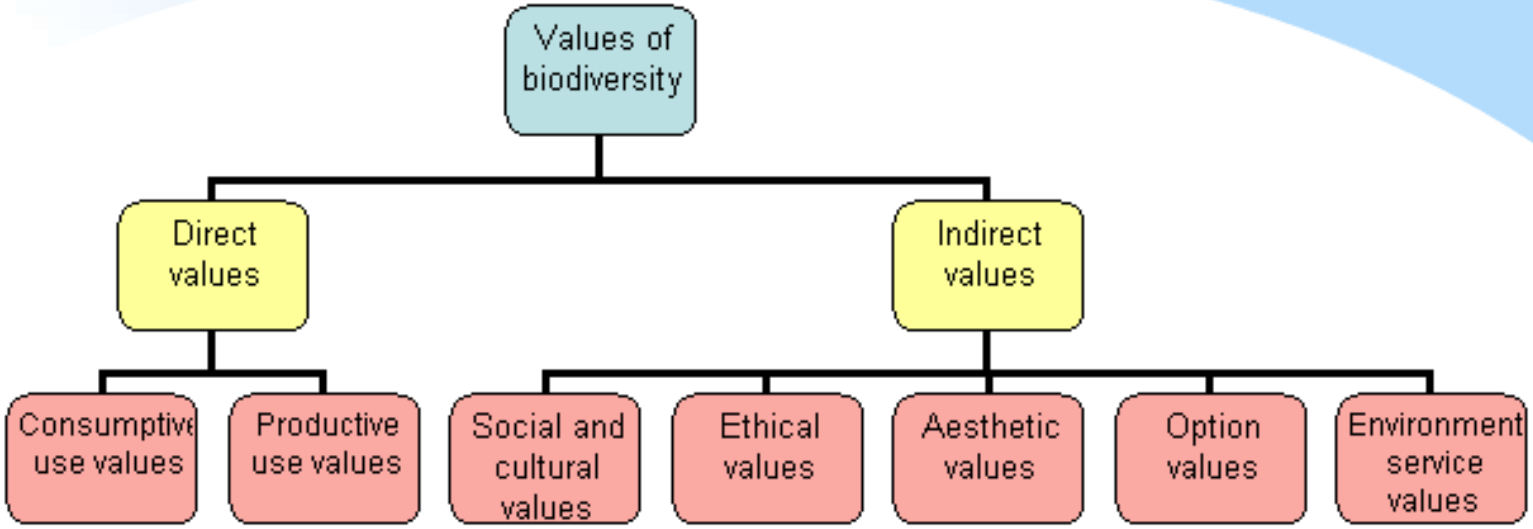
Awareness

Value of Biodiversity:



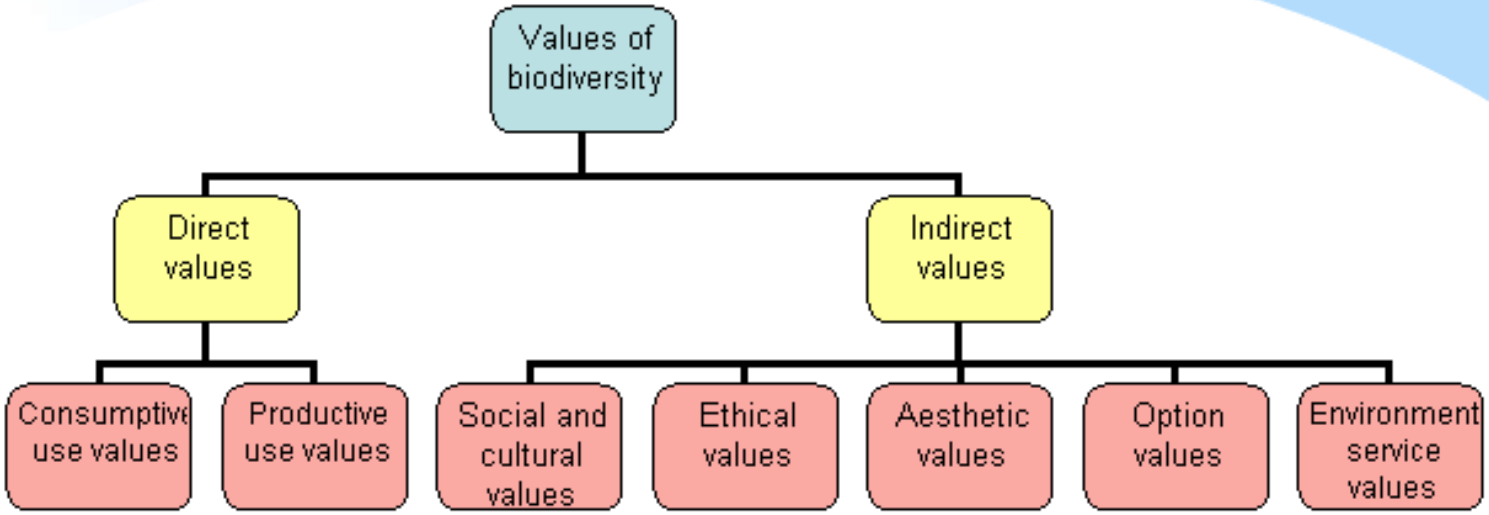
Tourism

Value of Biodiversity:



Potential Cure

Value of Biodiversity:



Preventing Soil Erosion

Flood Prevention

Global Warming Awareness

Bio diversity levels:

❖ At local level

Types	Point richness	Alpha	Beta	Gamma
Definition	No of species in a single point in a given space	No of species in a small homogeneous area	Rate of change in species composition across different habitats	Rate of change in species composition across large land scape
Examples	For given particular area	Sea ,River	North pole	Earth

At National Level:

India ranks:

- 1st – Mega bio diversity
- 10th - plant richness.
- 11th - endemic vertebrates
- 6th – biodiversity & crop cultivation
- Out of 36 world hotspots, 4 is in India

➢ The Himalayas.

➢ Indo-Burma Region.

➢ The Western Ghats.

➢ Sundaland.

Biodiversity Levels:

Global Biodiversity:

- Terrestrial biodiversity of earth is called as biomes.

- Biomes : the largest ecological units present in different geographic areas and are named after the dominant vegetation
eg. Tropical rain forests, tall grass prairies, savannas, desert, tundra.

Tropical rain forests :

- Largest storehouse of biodiversity
- About 50 to 80% of global biodiversity lies in these rainforests.
- More than 1/4th of the world's prescription drugs are extracted
- 70% Cancer fighting plants.
- One of the creeping vines in rainforests at Cameroon to cure AIDS virus

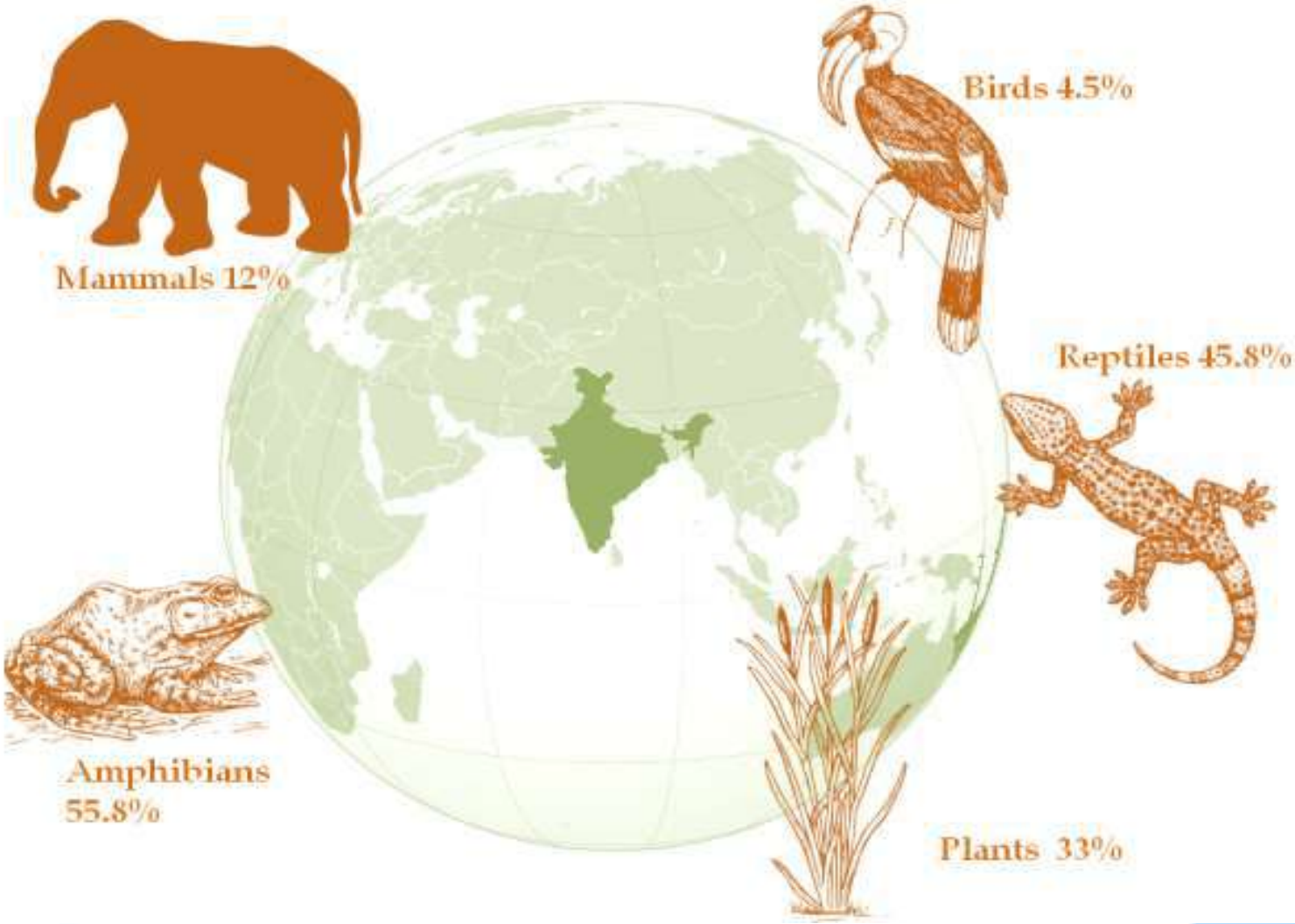
India as a Mega-diversity Nation:

- India contains about 8% of world's biodiversity on 2% of the earth's surface.
- India records 47,000 species of plants
- 81,000 species of animals which is about 7% and 6.5% of global flora and fauna.
- India is home to 5 world heritage sites.
- 33% of life forms are found in India and is one among the 12 mega diversity countries.
- 33 Botanical Gardens, 89 National Parks, 275 Zoos, 504 sanctuaries and 12 biosphere reserves in India.
- Western Ghats are site of maximum endemism (species which are restricted only to a particular area. 62% Amphibians and 50% lizards)
- 5000 species of flowering plants had their origin in India.
- Center of origin of 166 species of crop plants and 320 species of wild relatives of cultivated

Mega-diverse Countries

According to Conservation International, there were 17 'Mega-diverse' countries, which had at least 5,000 endemic plant species and possess marine ecosystem:

Endemism in India's Biodiversity

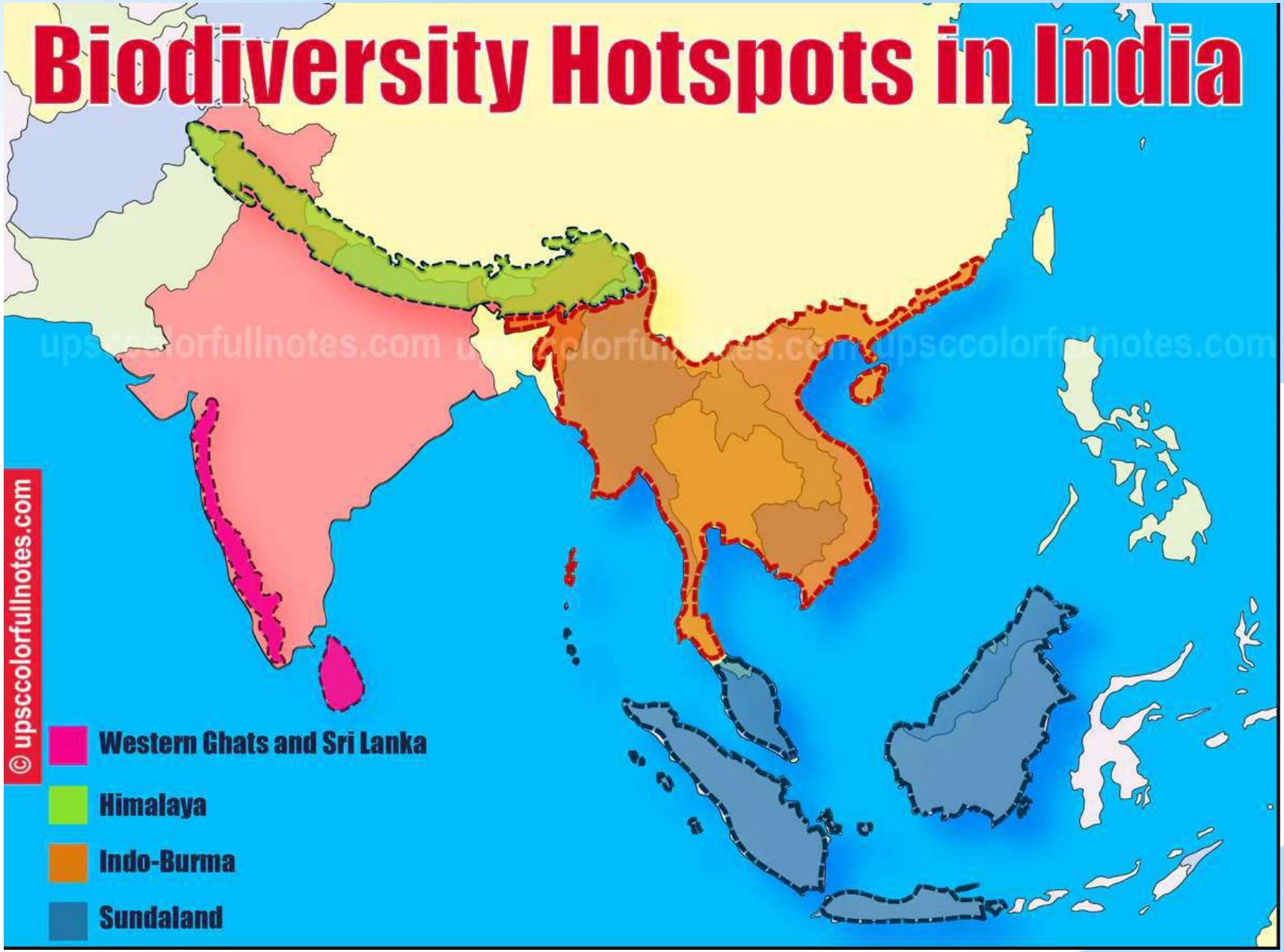


India as a Mega-diversity Nation:

- Along 7500Km long coastline of our country in the mangroves, estuaries, coral reefs, back waters etc there exists a rich biodiversity.
- 340 species of corals of world are found here.
- Rich in mollusks, crustaceans, polychaetes and corals.
- Several species of Mangrove plants and sea grasses are found in our country.
- Indian forests cover 64.1 million hectares having a rich biodiversity of plants in Trans-Himalayan, north-west, west, central and eastern Himalayan forests, western ghats, coasts, deserts, Gangetic plains, Andaman and Nicobar, Lakshadweep islands.

Hot Spots of Biodiversity :

- Areas which exhibit high species richness as well as high species endemism (restricted to only a particular region) are termed as hot spots of biodiversity.
- Hotspots cover less than 2% of the world's land area are found to have about 50% of the terrestrial biodiversity.
- According to Myer's et al (2000) an area is designated as a hotspot when it contains at least 0.5% of the plant species as endemics.
- About 40% of the terrestrial plants and 20% of vertebrate species are endemic and found in these hotspots.
- After the tropical rain forests, the second highest number of endemic plant species are found in the Mediterranean. Broadly, these hot spots are in Western Amazon, Madagascar, North and East Borneo, North Eastern Australia, W.Africa and Brazilian Atlantic forests.


Biodiversity Hotspots in India
© upsccolorfullnotes.com
Western Ghats and Sri Lanka
Himalaya
Indo-Burma
Sundaland

4 hotspots in INDIA:

- Himalayas
  - Over 3000km stretch, elevation around 500m to 8000m
  - 300 mammals species, 977 birds, 176 reptiles, 105 amphibians, 269 fresh water fish
  - 11,157 taxas of flowering plants
- Western Ghats
  - Elevation ranges 300 to 2965m.
  - Anaimudi in kerala, dhodabetta & Mukurthi in TN,
- Indo-Burma region
  - Includes North east INDIA, Bangladesh Myanmar.
  - 7 endemic birds, 28 centres of plant diversity
  - Lowland evergreen forest
  - 15k – 20k vascular plants
  - 45% of globally threatened species
  - 50 species of orchids, 130 birds species, 670 reptiles, 380 amphibians.
- Sundaland
  - Covers Malaysia, Indonesia, Philippines, Singapore, brunei.
  - 7000 groups of islands
  - One of the richest biodiversity hotspot.
  - 15k plants, 2k orchids, 769 birds, 380 mammals, 243 reptiles

Threats to Biodiversity:

- Extinction or elimination of a species is a natural process of evolution
- The process of extinction has become faster due to human civilization
- The figure of extinction is at a rate of 10,000 species per year or 27 per day.
- One third to two-third of our current biodiversity will be lost by the year 2050
- Causes:
  - Loss of Habitat or Habitat Degradation
  - Poaching
  - Invasion of Non-native Species
  - Pollution
  - Over-exploitation of Resources
  - Global Environmental Change

Man-Wildlife Conflicts:

- Wildlife causing damage and danger to humans and properties – crops/houses
- In Samalpur (Orissa) 195 humans were killed in the last 5 years by elephants.
- Humans responded by killing 98 elephants and injuring 30 elephants.
- In Nepal, 17 peoples were killed in the Royal Chitwan National Park by a man-eating tiger.
- Electrical fencing, explosives were some of the methods adopted by villages to kill wild animals.
- Causes:
  - Human encroachment into forest areas
  - Animals suffering from illness, weak and injured take humans
  - Lack of alternate cultivation practices (paddy, sugarcane) by forest department for animals like elephants when bamboo leaves are not available.
  - Electric fencing causes injury to animals, which in return turn violent
  - Poor cash compensation by govt. to farmers for crop damages, turn farmer to take revenge on wild animals

Endangered Species of India:

- Extinct species - When it is not seen in the wild for 50 years at a stretch. Eg., Dodo, passenger pigeon.
- Endangered species - When its number has been reduced to a critical level or whose habitats are drastically reduced and if such a species is not protected and conserved, its in immediate danger of extinction.
- Vulnerable species - If a population of a species is facing continuous decline due to overexploitation or habitual destruction.
- Rare species - Species which are not endangered or vulnerable at present but at a risk.
- International Union for Conservation of Nature and Natural Resources (IUCN) publishes Red Data Book (list of endangered species of plants and animals.
- Nearly 450 plant species have been identified as categories of endangered, threatened or rare.

Endemic Species of India:

- Species which are restricted only to a particular area are known as endemic
- Out of 47,000 species of plants in our country 7,000 are endemic.
- Indian subcontinent has about 62% endemic flora, restricted namely to Himalayas, Khasi Hills and Western Ghats.
- Endemic Flora : Sapria Himalayana, Pitcher plants and Orchids
- Out of 81,000 animal species – large number of species are described to be endemic
- Western Ghats: 62% amphibians, 50% Lizards are endemic
- Endemic species : reticulated python, Indian Salamander and Viviparous toad.

Conservation of Biodiversity:

- In Situ Conservation (within habitat) - achieved by protection of wild flora and fauna in nature itself.
  - Eg. Biosphere reserves, National Parks, Sanctuaries, Reserve forests etc.
- Ex Situ Conservation (outside habitat) - done by establishment of gene banks, seed banks, zoos, botanical gardens, culture collections.

Conservation of Biodiversity:

- In Situ Conservation:
  - 7 major biosphere reserves, 80 national parks, 420 wild-life sanctuaries, 120 Botanical gardens in our country covering 4% of geographic area.
  - **Biosphere reserves** - conserve some representative ecosystems as a whole for long-term in situ conservation.
    - In India, we have Nanda Devi(U.P.),Nokrek (Meghalaya), Manas (Assam), Sunderbans (West Bengal), Gulf of Mannar (T.N.),Nilgiri (Karnataka, Kerala,T.N.),Great Nicobars, Similipal (Orissa) biosphere reserves.
  - **National Park** - area dedicated for the conservation of wildlife along with its environment. Its meant for enjoyment through tourism.
    - Grazing of domestic animals, all private rights, forestry activities are prohibited within a National Park

Conservation of Biodiversity:

- **Wildlife Sanctuaries** - Protected areas where killing, hunting, shooting or capturing of wildlife are prohibited except under the control of highest authority.
  - Project Tiger, Gir Lion Project, Crocodile Breeding Project, Project Elephant, Snow Leopard Project.

Conservation of Biodiversity:

- Ex Suit Conservation:
  - Conservation of crop varieties, wild relatives of crops and all local varieties (conserve total genetic variability of crop species for future crop improvement).
  - Important Gene bank/Seed bank facilities :
  - National Bureau of Plant Genetic Resources (NBPGR) : located in New Delhi.
  - Agricultural, horticultural crops, their wild relatives are preserved by cryo-preservation of seeds, pollen etc by using liquid nitrogen at a temp as low as -196 ^{0}c.

- Ex Suit Conservation:
  - Varieties of rice, pearl millet, Brassica, turnip, radish, tomato, onion, carrot, chilli, tobacco, poppy etc : preserved in liquid nitrogen for several years without losing seed viability.
  - National Bureau of Animal Genetic Resources (NBAGR) located at Karnal, Haryana. Preserves semen of domesticated bovine animals.
  - National Facility for plant tissue culture repository (NFPTCR) : development of facility of conservation of varieties of crop plants/trees by tissue culture.

Unit II
Environmental Pollution

UNIT II: ENVIRONMENTAL POLLUTION

Syllabus

Definition – causes, effects and control measures of:

(a) Air pollution
(b) Water pollution
(c) Soil pollution
(d) Marine pollution
(e) Noise pollution
(f) Thermal pollution
(g) Nuclear hazards

solid waste management:

causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies

Disaster management:
floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial /Agricultural.

* General:






*Pollution:

Definition:

- Pollution is the introduction of **contaminants into the natural environment** that cause adverse change.
- Pollution can take the form of chemical substances or energy, such as noise, heat or light.
- Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants.
- Pollution is often classed as **point source** or **nonpoint source pollution.**

* Classifications:

The major forms of pollution are listed below along with the particular contaminant relevant to each of them:

- Air pollution - The release of chemicals and particulates into the atmosphere.
- Light pollution - Includes light trespass, over-illumination and astronomical interference.
- Littering - The criminal throwing of inappropriate man-made objects, unremoved, onto public and private properties.
- Noise pollution:- which encompasses roadway noise, aircraft noise, industrial noise as well as high-intensity sonar.

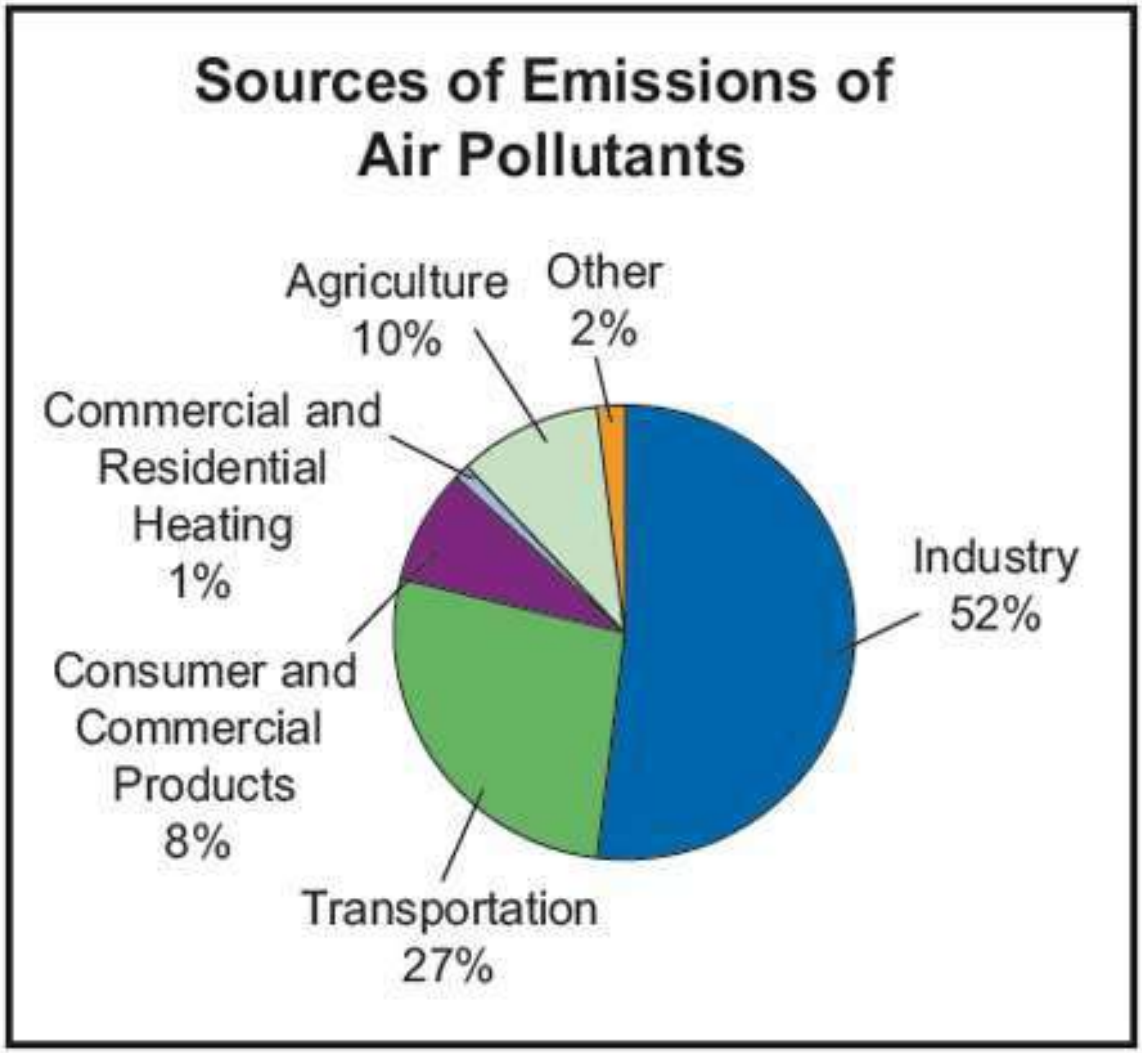
a) Soil Pollution - Occurs when chemicals are released by spill or underground leakage.

- Thermal pollution – It is a temperature change in natural water bodies caused by human influence, such as use of water as coolant in a power plant.
- Visual pollution - Which can refer to the presence of overhead power lines, motorway billboards, scarred landforms (as from strip mining), open storage of trash, municipal solid waste or space debris.
- Water pollution - by the discharge of wastewater from commercial and industrial waste (intentionally or through spills) into surface waters.

* Air Pollution:

- Air pollution is the introduction into the atmosphere of chemicals, particulates, or biological materials that cause discomfort, disease, or death to humans, damage other living organisms such as food crops, or damage the natural environment or built environment.
- The atmosphere is a complex dynamic natural gaseous system that is essential to support life on planet Earth. Stratospheric ozone depletion due to air pollution has long been recognized as a threat to human health as well as to the Earth's ecosystems.

*Sources of emissions



* Causes of Air Pollution:

Anthropogenic Sources / Man-made Sources:

- Stationary Sources" include smoke stacks of power plants, manufacturing facilities (factories) and waste incinerators, as well as furnaces and other types of fuel-burning heating devices.
- "Mobile Sources" include motor vehicles, marine vessels, aircraft and the effect of sound etc.
- Chemicals, dust and controlled burn practices in agriculture and forestry management.
- Fumes from paint, hair spray, varnish, aerosol sprays and other solvents
- Waste deposition in landfills, which generate methane. Methane is highly flammable and may form explosive mixtures with air.
- Military, such as nuclear weapons, toxic gases, germ warfare and rocketry

* Causes of Man Made Air Pollution – Ex: Nuclear Explosion

* Causes of Air Pollution:

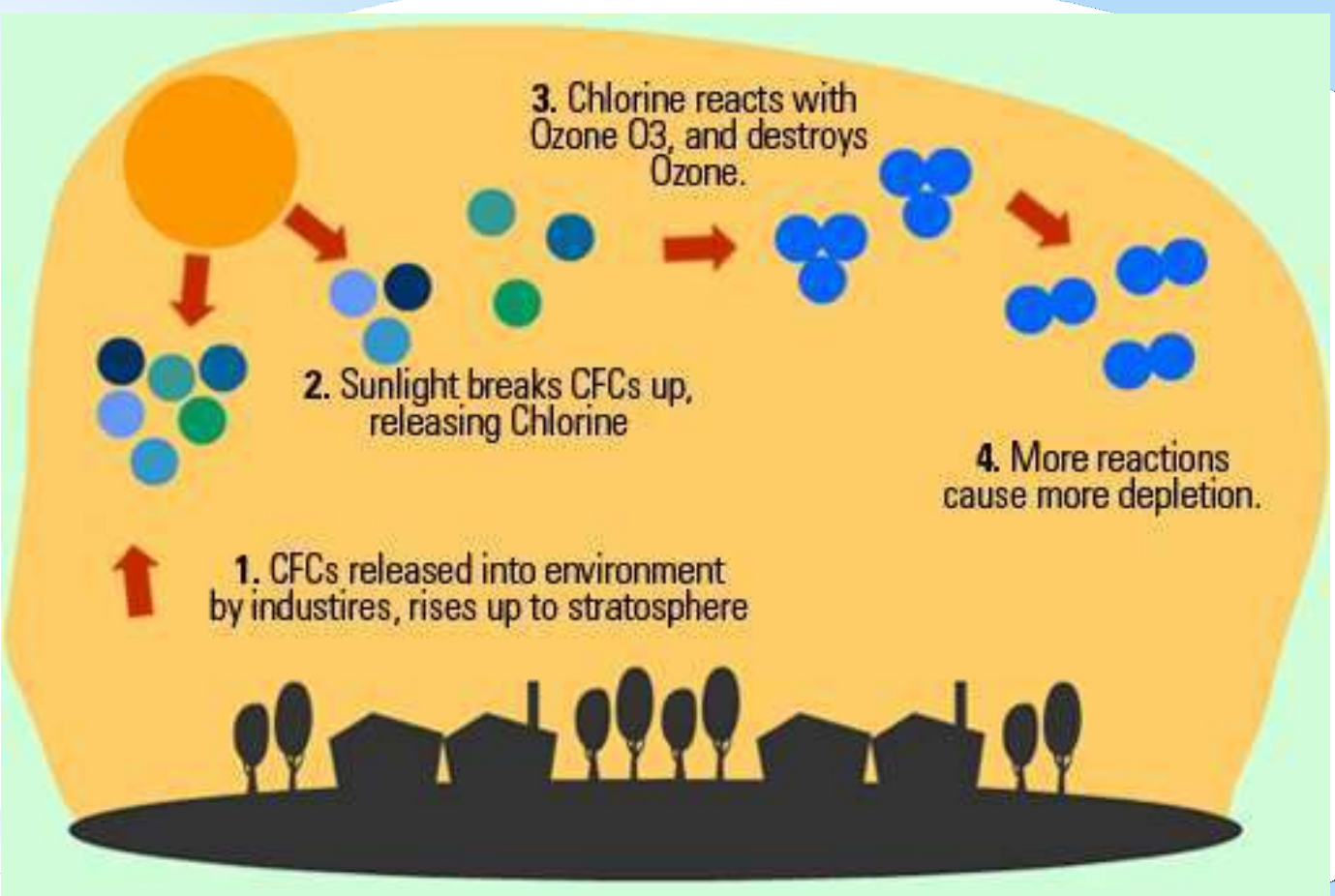
Natural Sources:

- Dust from natural sources, usually large areas of land with little or no vegetation
- Methane, emitted by the digestion of food by animals, for example cattle
- Radon gas from radioactive decay within the Earth's crust.
- Smoke and carbon monoxide from wildfires
- Vegetation, in some regions, emits environmentally significant amounts of pollutants on warmer days. These react with primary anthropogenic pollutants—specifically, NO_x, SO_2, and anthropogenic organic carbon compounds—to produce a seasonal haze of secondary pollutants.
- Volcanic activity, which produce sulphur, chlorine, and ash particulates

*

Causes of Natural Air Pollution – Ex: Dust Storm at Texas

* Effects of Air Pollution:



* Effects of Air Pollution:

Effects on Human:

- Pollutants damage to human respiratory system
- Bigger particles – trapped and eliminated through nose hair & mucus present in nose liner
- Smaller particles – reach tracheobronchial system – trapped by mucus – eliminated by spitting or swallowing

Long term exposure:

- SO_2 (coal): constriction of respiratory passage, bronchitis
- SO_2 (with SPM): forms acid sulphate particles – affects lungs
- NO_x (NO_2): lung irritation, chronic bronchitis, emphysema
- CO: Binds with haemoglobin of blood – carboxyhaemoglobin – resulting in suffocation due to non-transport of oxygen – dizziness, unconsciousness, death

Long term exposure..

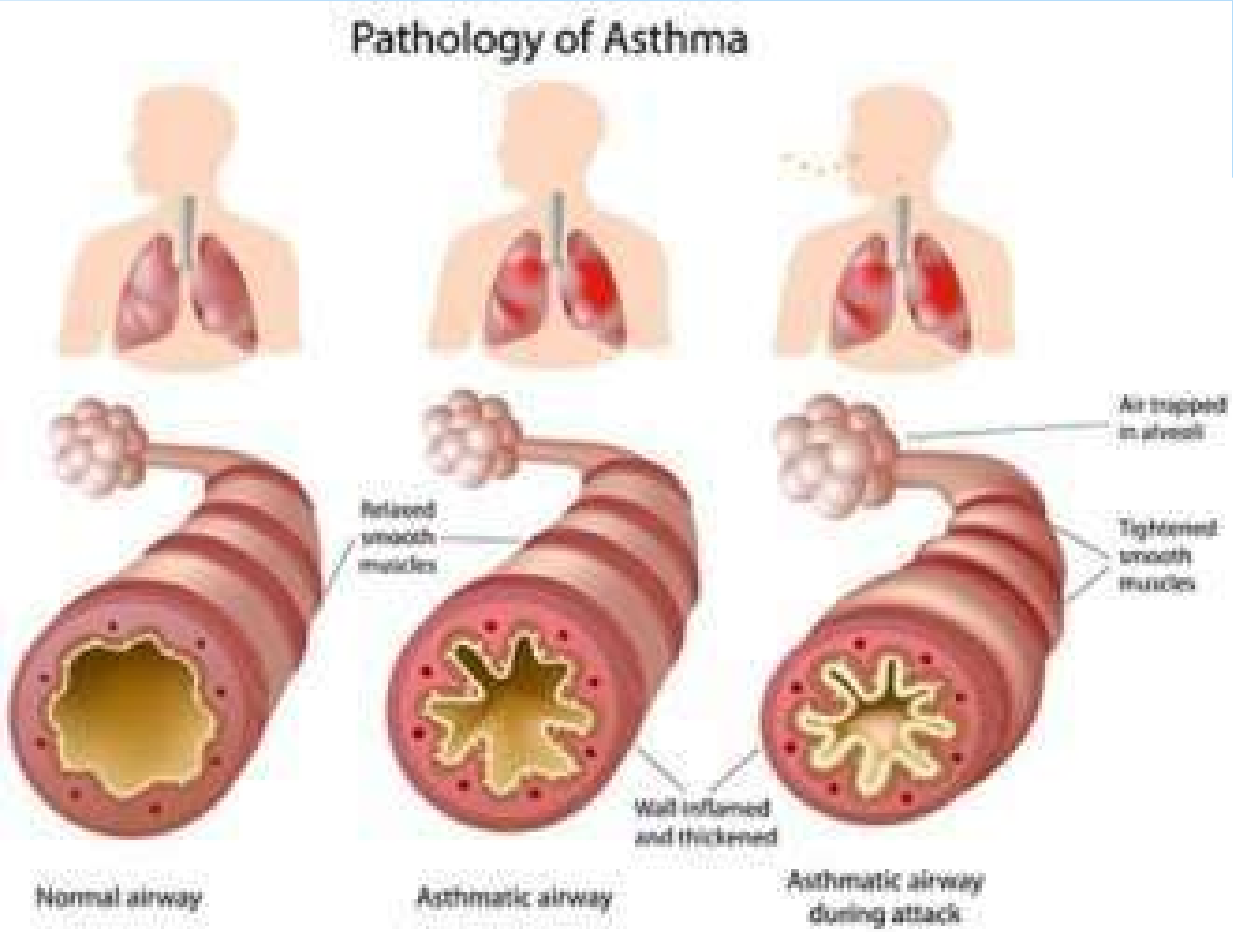
- Cigarette smoke - Lung, cancer, asthma, bronchitis, emphysema (damage to air sacs – loss of lung elasticity & acute shortness of breath)

- Suspended particle (with toxins) - lung tissue damage, asthma, bronchitis & cancer

- Benzene, HCHO, Polychlorinated biphenyls, toxic metals, dioxins: mutation, cancer, reproduction problems

- Hazardous materials - Asbestos, beryllium, mercury, arsenic, radioactive materials cause lung diseases and/or affects kidney, liver, spleen, brain etc.

*Asthma stages



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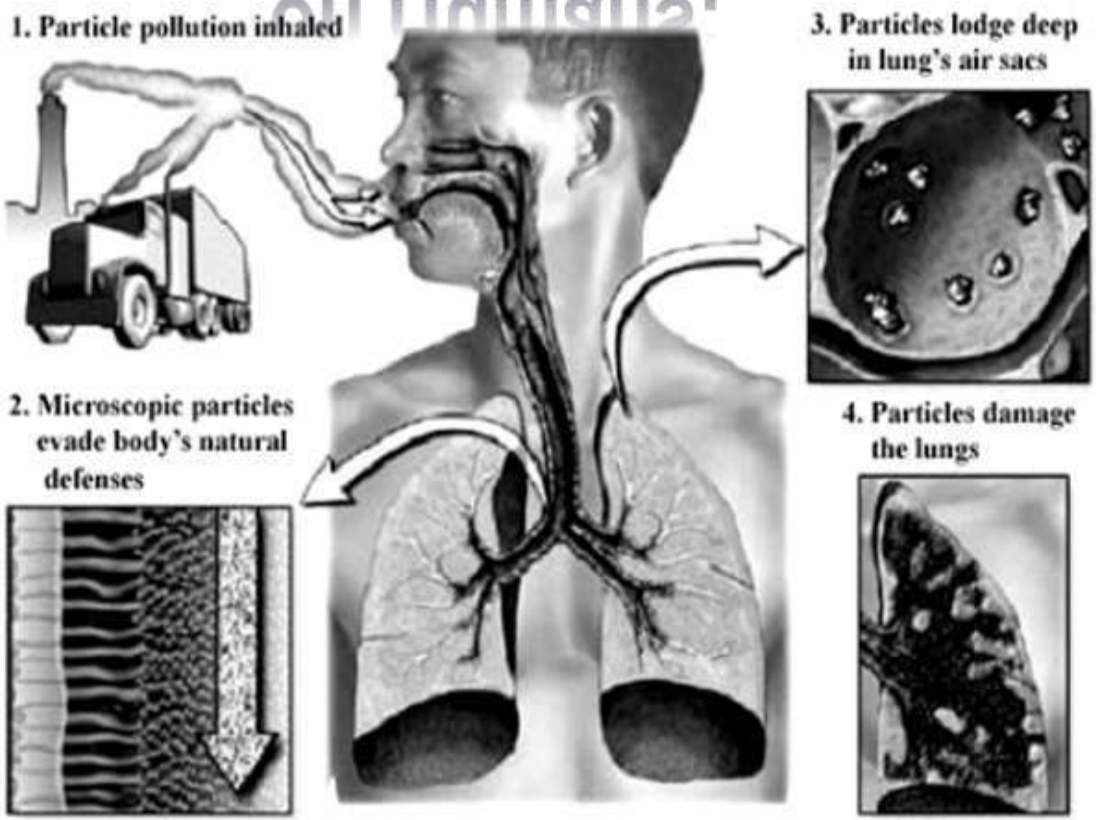
Effects of Air Pollution on Humans:



* Effects of Air Pollution on plants:

- Air pollutants enter through stomata (leaf pores through with gases diffuse) – destroying chlorophyll and affecting photosynthesis.
- Pollutants – erode waxy coating of the leaves called cuticle, which prevents excess H_2O loss and damage from diseases, pests, drought and frost.
- Damage to leaf structure causes necrosis (dead area of leaf), chlorosis (loss or reduction of chlorophyll causes yellowing of leaf) or epinasty (downward curling of leaf) & abscission (dropping of leaves)
- Particulates - plug stomata thus reduces sunlight availability
- SO_2 - bleaching, chlorosis, necrosis of leaves

Effects on Plants..:

- NO_2 - increased abscission and suppressed plant growth
- O_3 - flecks on leaf surface, premature aging, necrosis and bleaching
- Peroxyacetyl nitrate (PAN) – silvering of lower surface of leaf, damage to young and sensitive leaves, suppress growth
- Fluorides - necrosis of leaf tip;
- Ethylene - epinasty, leaf abscission and dropping of flowers
- Air pollutants (SO2 / NOx) mixes with rain resulting in high acidity (low pH) in fresh water lakes – thus affecting fishes – resulting in injuries & death.

* Effects of Air Pollution on Plants

:

- Effects on Materials:

- SO_2 / NO_x - with moisture (H_2SO_4 / HNO_3) - <u>corrosion</u>
- Corrodes - metal parts of buildings, vehicles, bridges, railway tracks etc.
- <u>Disfigurement</u> of statue and monuments made of marble and limestone (e.g. Taj Mahal)
- Brittling of pages and leather binding
- SO_2 affects leather, fabrics, paints and paper
- O_3 - cracking of rubber, nylon
- NO_x & O_3 - Fading of cotton and rayon fabrics

Effects of Air Pollution on Materials:

* Control of Air Pollution:

- Setting of industries after proper environmental impact assessment studies
- Modification of process and/or equipment
- Use of appropriate materials
- Use of low sulphur coal in industries or removing sulphur from coal
- Removing NO_x during combustion and controlling flow of air and fuel in industrial boilers
- Vehicular pollution checking – catalytic converters – reducing carbon monoxide and hydrocarbon emission
- Slow and cooler fuel burning – reduces NO_x emission
- Use of mass transport system, bicycles etc
- Use of clean fuels (hydrogen gas)
- Use of non-conventional sources of energy
- Planting more trees
- Reducing pollution at its source

* Control of Air Pollution – At source:

- Gaseous pollutants: Physical adsorption on porous solid materials – activated charcoal, silica gel, fuller earth, etc.
- Effluent gases are trapped in liquid absorbent (SO_2 trapped in NH_3 solution)
- Combustion at optimal conditions of oxygen and temperature - reduces pollution
- Particulate matters - Improved trapping devices with controllable flow rate, collective efficiency, costs, particle characteristics.
- Devices used:
  - Cyclones - for larger particles (>10 mm)
  - Bag house filters - for smaller particles
  - Wet Scrubbers - for toxic and acidic gases
  - Electrostatic precipitator - nanosize particle
    - parallel-plate type
    - wire and pipe type

* Case study -Air pollution in Delhi

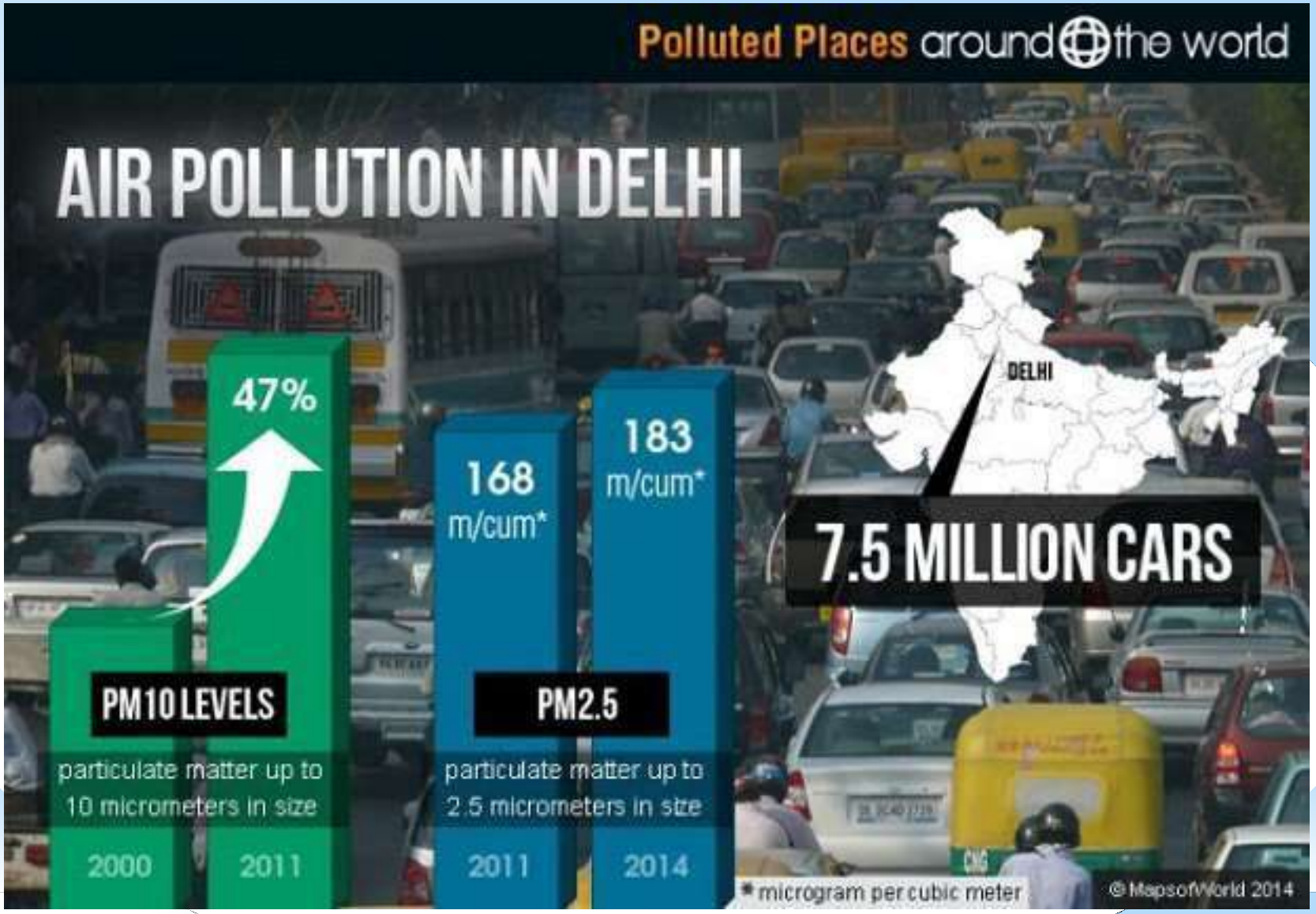
AIR POLLUTION IN DELHI

Source	Contribution in %		
	PM2.5	SO2	NOx
Transport	17	2	53
Gen sets	6	4	25
Brick kilns	15	11	2
Industry	14	23	11
Construction	5	-	1
Waste burning	8	1	1
Road dust	6	-	-
Power plants	16	55	7
Domestic	12	6	1

KILLER AIR

Estimated health impacts of air pollution in Delhi

- Premature mortality: **7,350 to 16,200**
- Chronic bronchitis in adults: **53,500**
- Acute bronchitis in children: **391,000**
- Cardiac hospital admissions: **6,700**
- Asthma attacks: **6 million**
- Days with restricted activity: **51 million**
- Days with respiratory symptoms: **244 million**


Polluted Places around the world
AIR POLLUTION IN DELHI
47%
PM10 LEVELS
particulate matter up to 10 micrometers in size
2000
2011
168 m/cum*
183 m/cum*
PM2.5
particulate matter up to 2.5 micrometers in size
2011
2014
DELHI
7.5 MILLION CARS
* microgram per cubic meter
© MapsofWorld 2014

Capital has more toxic particles in its air than other major Indian metros

DELHI IS INDIA'S ASTHMA CAPITAL

DELHI has the highest levels of Respirable Suspended Particulate Matter (RSPM) among the four metros, exposing its residents to a greater risk of asthma than people elsewhere in the country.

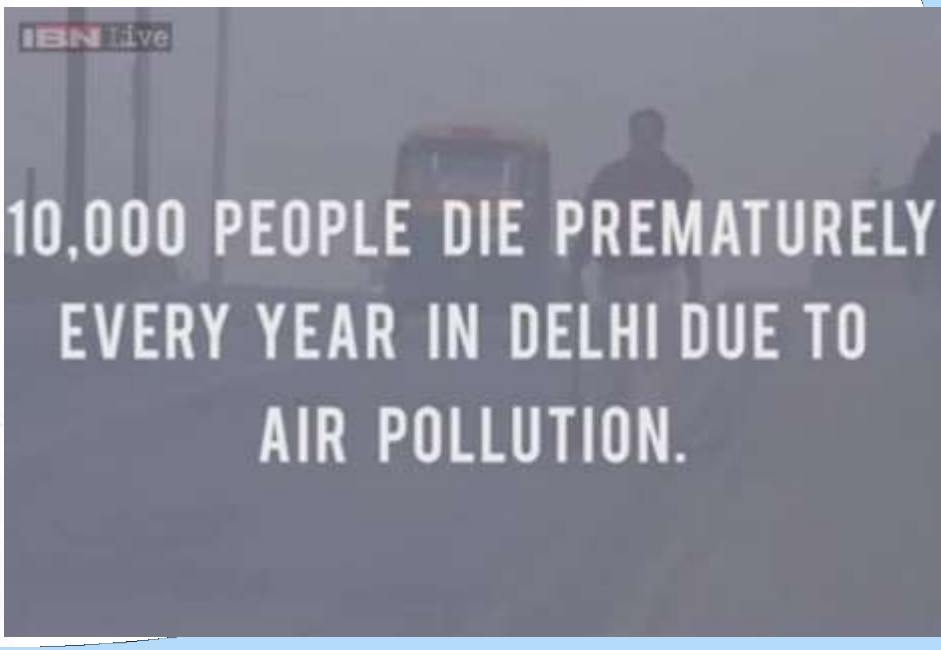
By **Meenal Dubey** in New Delhi

Acceptable levels of RSPM should not be more than 60 microgram (mg) per cubic meter (cu m) annually. In 2008, Delhi's RSPM was recorded at a shocking 149 mg/cu m, according to a report published by the Central Pollution Control Board (CPCB) with the help of data collected between January and August 2008.

This is well above Mumbai's RSPM mark of 118 mg/cu m, Kolkata's 104 mg / cu m and Chennai's 54 mg/cu m.

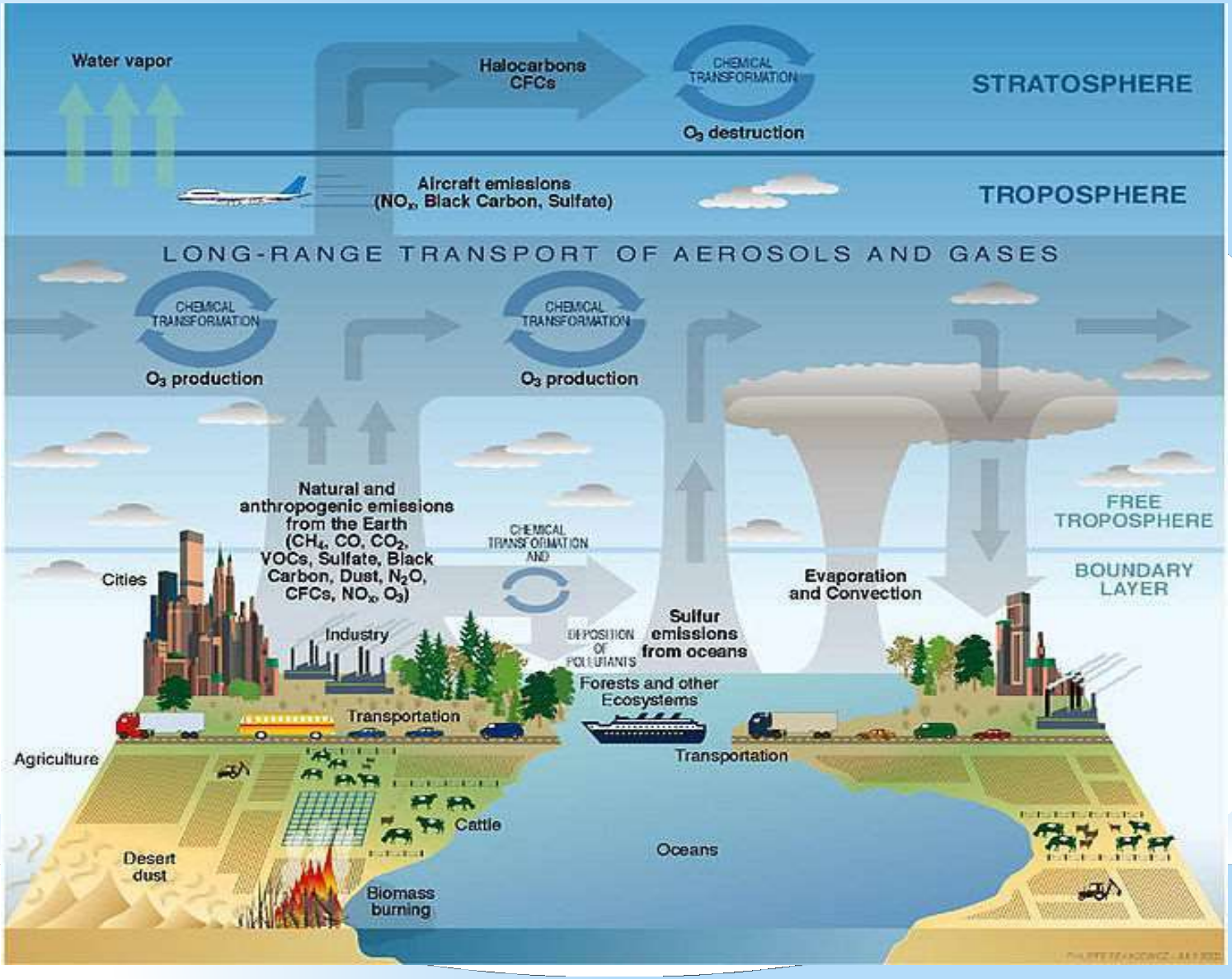
It is no secret that India's capital is highly

Turn to Page 6

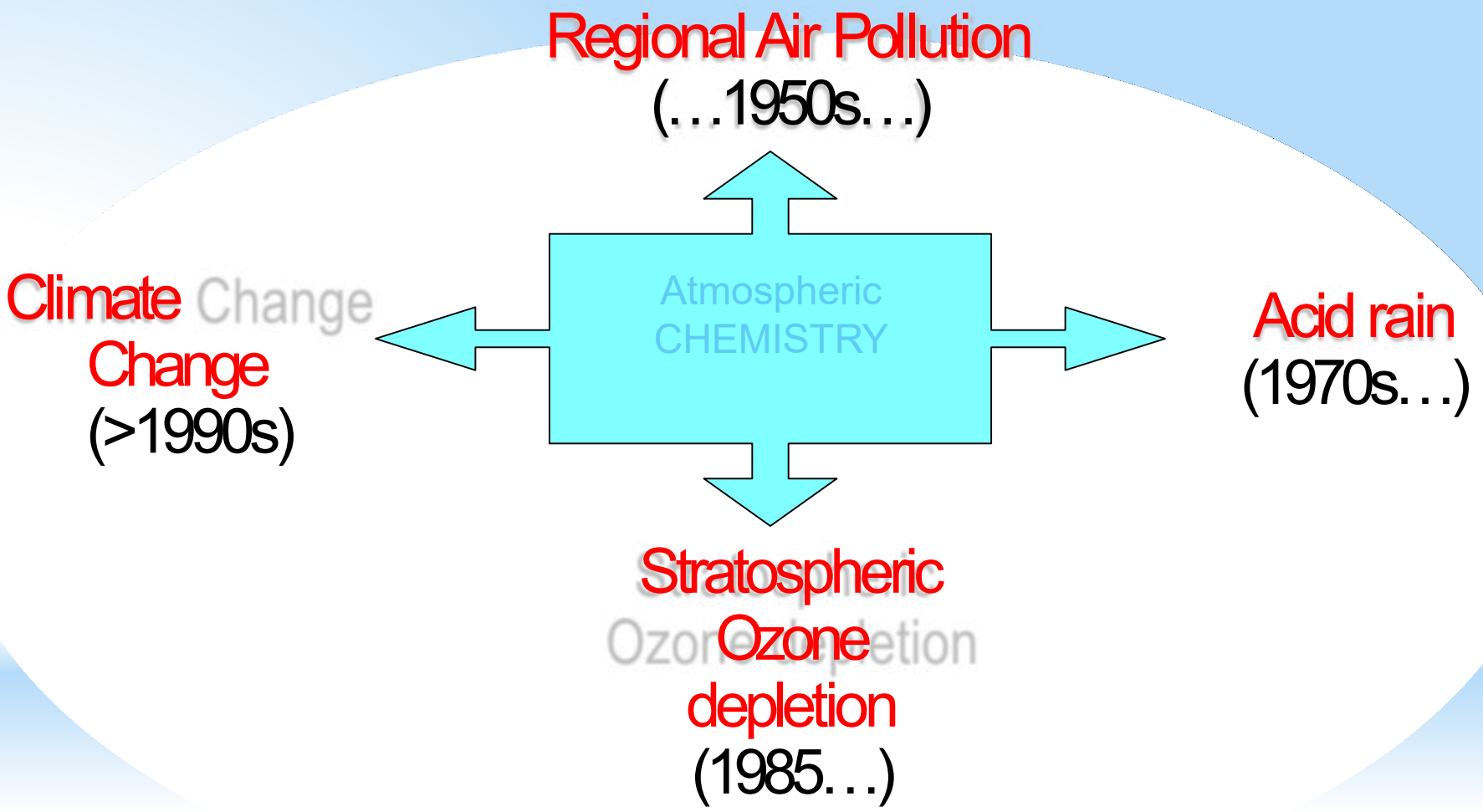


*ATMOSPHERIC CHEMISTRY

Atmospheric Chemistry and Physics: from Air Pollution to Climate Change



* IMPORTANCE OF ATMOSPHERIC CHEMISTRY



Composition of Earth's Atmosphere

Important gases in the Earth's Atmosphere
(Note: Influence not necessarily proportional to % by volume!)

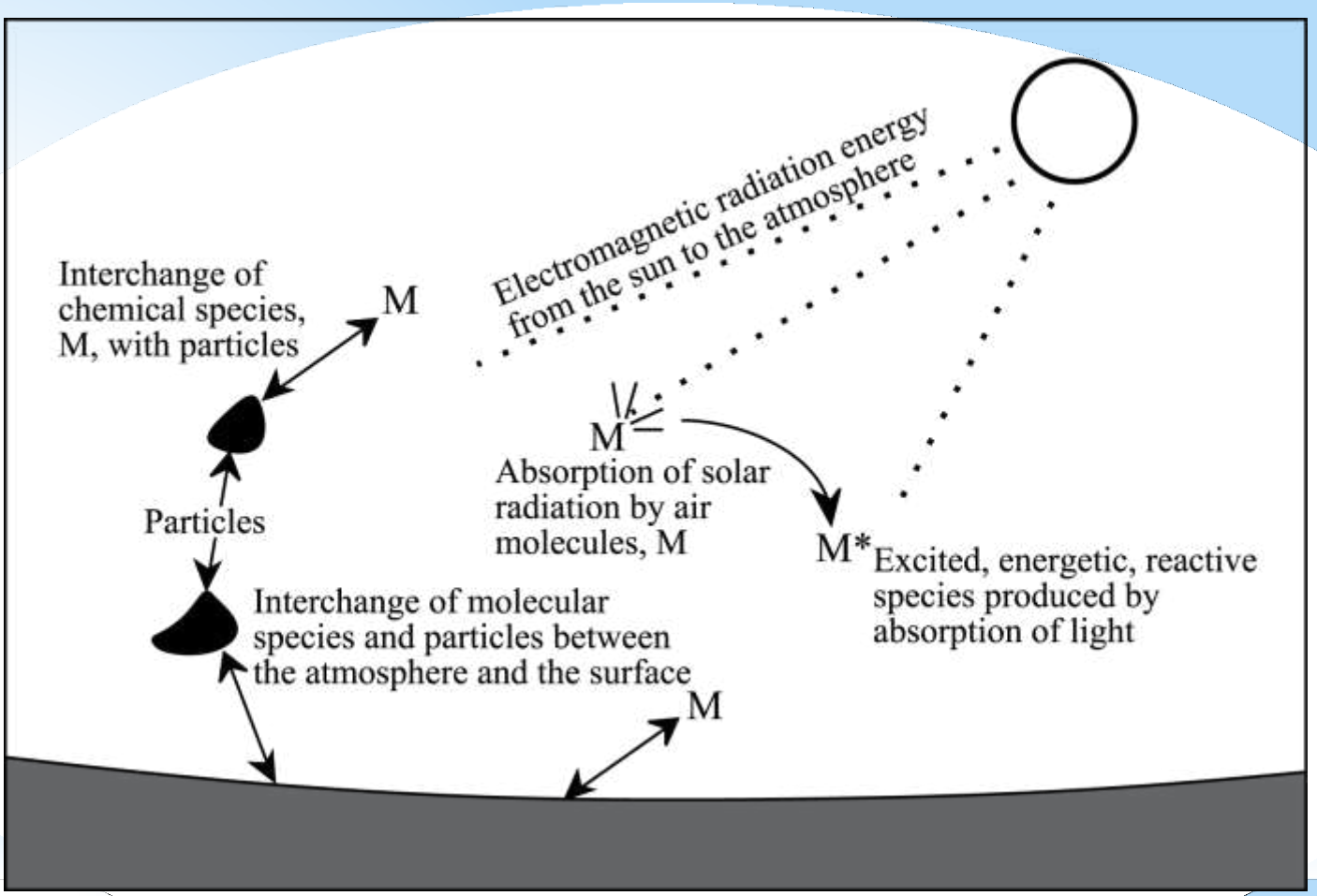
•TABLE 1.1

Composition of the Atmosphere Near the Earth's Surface

PERMANENT GASES			VARIABLE GASES			
Gas	Symbol	Percent (by Volume) Dry Air	Gas (and Particles)	Symbol	Percent (by Volume)	Parts per Million (ppm)*
Nitrogen	N_2	78.08	Water vapor	H_2O	0 to 4	
Oxygen	O_2	20.95	Carbon dioxide	CO_2	0.038	380*
Argon	Ar	0.93	Methane	CH_4	0.00017	1.7
Neon	Ne	0.0018	Nitrous oxide	N_2O	0.00003	0.3
Helium	He	0.0005	Ozone	O_3	0.000004	0.04†
Hydrogen	H_2	0.00006	Particles (dust, soot, etc.)		0.000001	0.01–0.15
Xenon	Xe	0.000009	Chlorofluorocarbons (CFCs)		0.00000002	0.0002

*For CO_2, 380 parts per million means that out of every million air molecules, 380 are CO_2 molecules.
†Stratospheric values at altitudes between 11 km and 50 km are about 5 to 12 ppm.

* Chemical and Photochemical Reactions in the Atmosphere



Important Aspects of Atmospheric Chemical Processes

* Chemical and Photochemical Reactions in the Atmosphere

Important Atmospheric Chemical Species

* Inorganic oxides: CO, CO_2, NO_2, SO_2
* Oxidants: O_3, H_2O_2, HO• radical, HO_2• radical, ROO• radicals, NO_3 radical
* Reductants: CO, SO_2, H_2S
* Hydrocarbons: Natural CH_4, pollutant alkanes, alkenes, aromatics
* Oxidized organics: Aldehydes, ketones, acids, organic nitrates
* Photochemically active species: NO_2, formaldehyde
* Acids: H_2SO_4, H_2SO_3, HNO_3
* Bases: NH_3
* Salts: NH_4HSO_4
* Unstable reactive species: Electronically excited nitrogen dioxide (NO_2*), HO•

Solid and liquid particles in aerosols and clouds

* Sources and sinks for gas-phase species
* Sites for surface reactions on solids
* Aqueous phase reactions in water droplets

* Chemical and Photochemical Reactions in the Atmosphere

Two Very Important Factors in Atmospheric Chemistry:

(i) Radiant solar energy

* Photons put high energy into individual molecules

(ii) Hydroxyl radical, HO•

*Most important highly reactive intermediate

* Chemical and Photochemical Reactions in the Atmosphere

Photochemical Processes

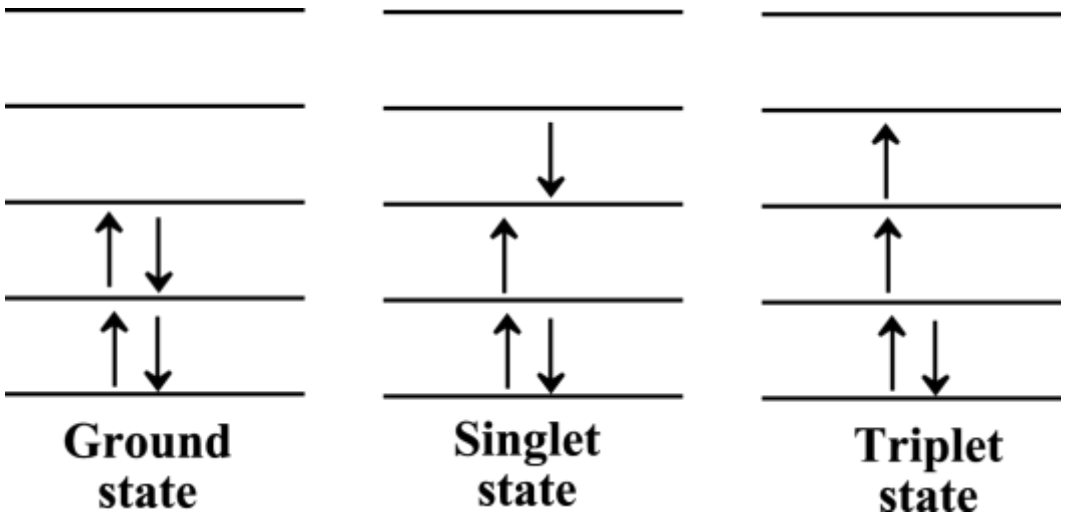
* From photons of energetic solar electromagnetic radiation, $h\nu$
* Produce electronically excited species designated *

$$NO_2 + h\nu \rightarrow NO_2^*$$

* Excited species tend to be highly reactive in the atmosphere
* Two other reactive species
  * Free radicals with unpaired electrons: $H_3C\bullet$, $HO\bullet$
  * Ions such as O^+ (uncommon in lower atmosphere)

* Chemical and Photochemical Reactions in the Atmosphere

* Electronically Excited Species
  * Absorption of a photon, usually of ultraviolet radiation, can energize molecules, atoms, or radicals to *electronically excited states*



Electronically excited states where the arrows represent directions of electron spin

* Chemical and Photochemical Reactions in the Atmosphere

Loss of Excitation Energy from Electronically Excited Species

(i) Emission of a photon (light): $NO_2^* \rightarrow NO_2 + h\nu$

Called *luminescence* if instantaneous, *phosphorescence* if slower and

Chemiluminescence when the excited species that emits a photon is formed as the result of a chemical reaction

$$O_3 + NO \rightarrow O_2 + NO_2^* \text{ (luminescent species)}$$

(ii) Direct reaction of an excited species

$$O_2^* + O_3 \rightarrow 2O_2 + O$$

(iii) Dissociation

$$NO_2^* \rightarrow NO + O \text{ (very important tropospheric reaction)}$$

$$O_2^* \rightarrow O + O \text{ (important in stratosphere leading to } O_3\text{)}$$

(iv) Photoionization (formation of ions in the ionsphere)

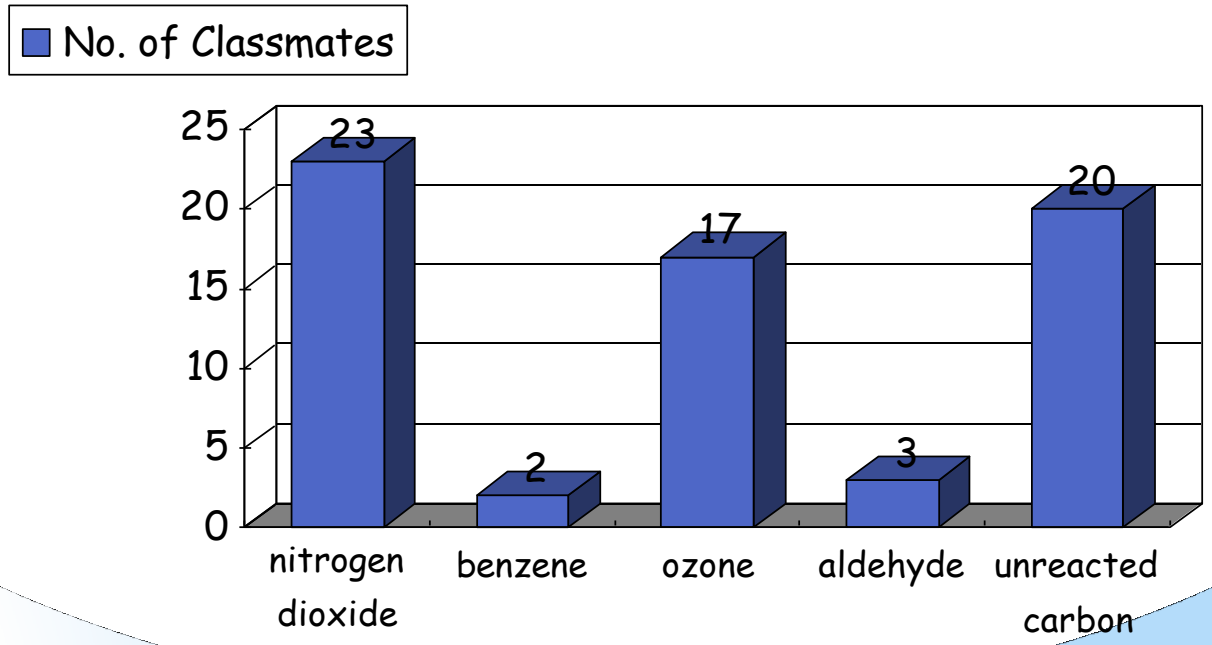
$$N_2^* \rightarrow N_{2+} + e_-$$

Smog

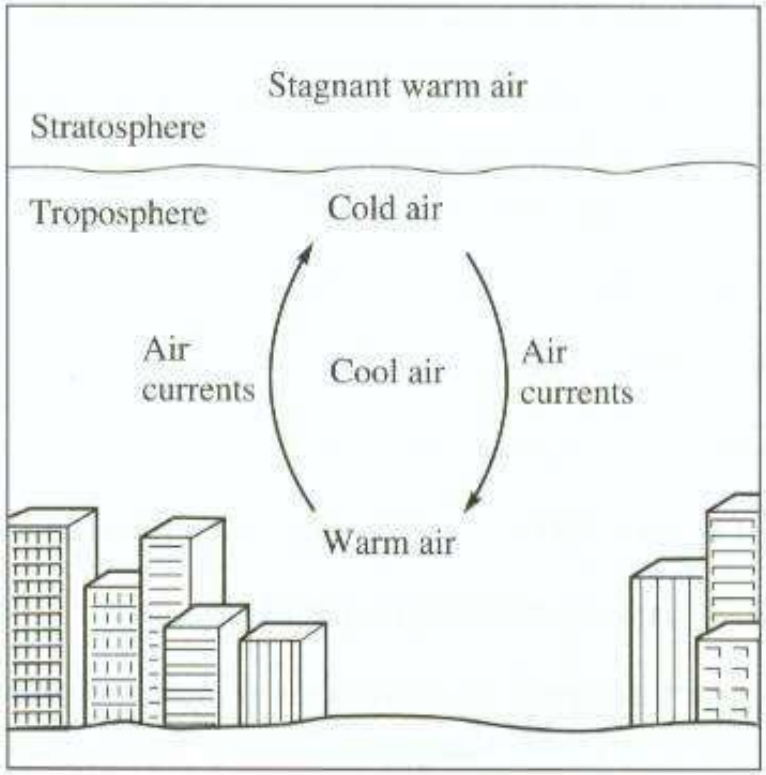
*The word ‘smog’ comes from two words: smoke and fog.

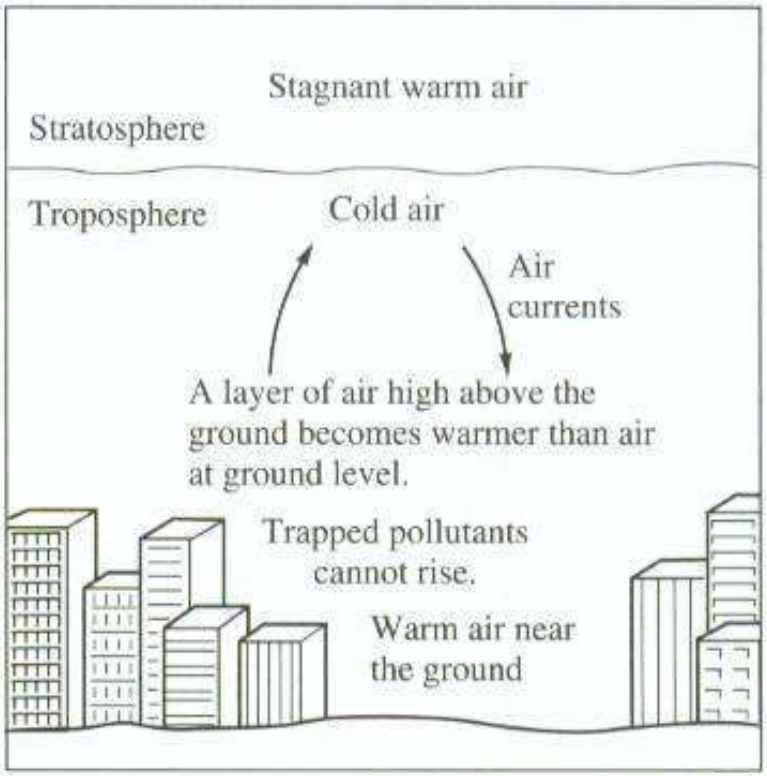
*Characterize visible combination of smoke and fog

Photochemical smog is a mixture of pollutants,

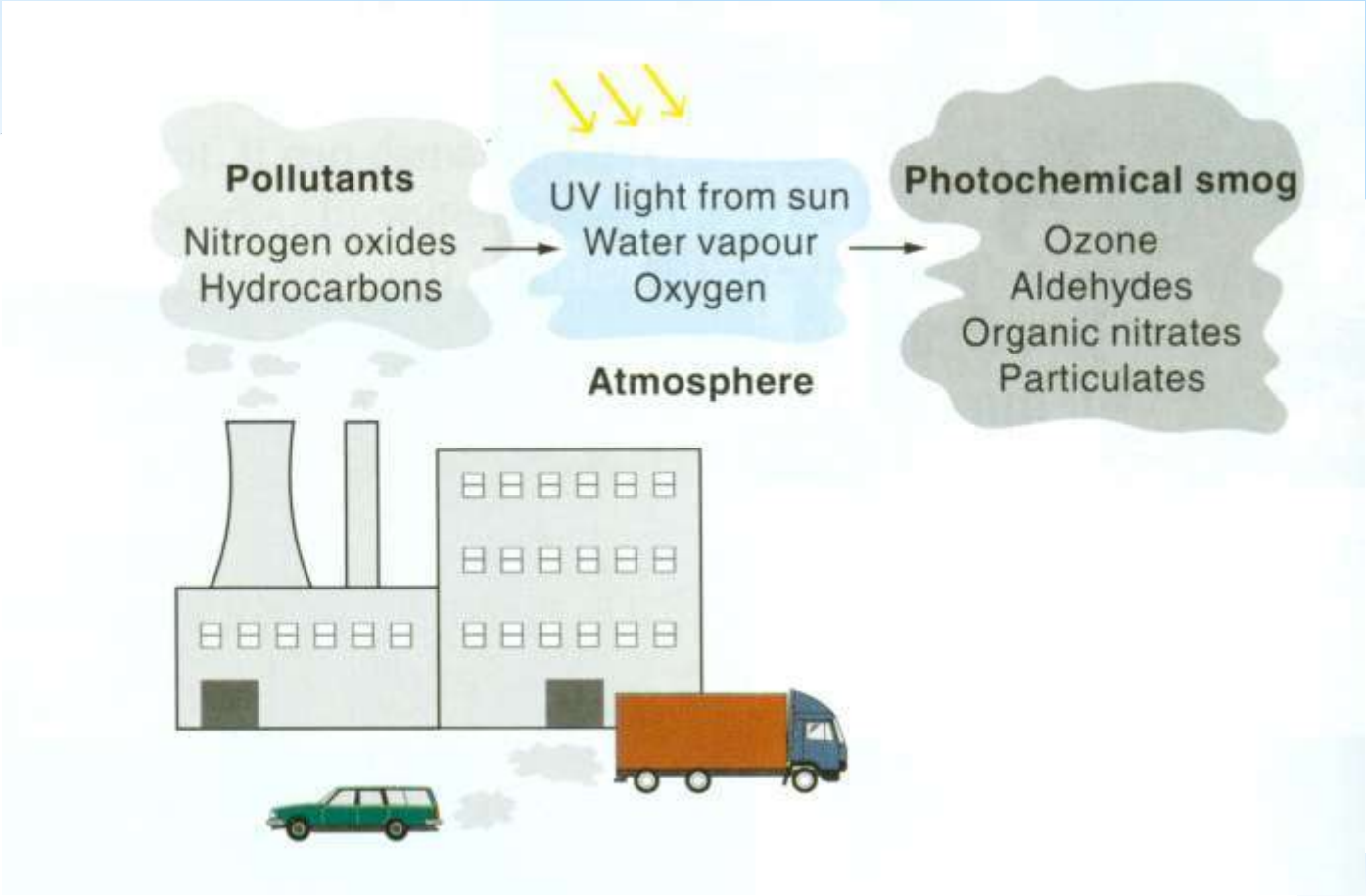


*Temperature Inversion

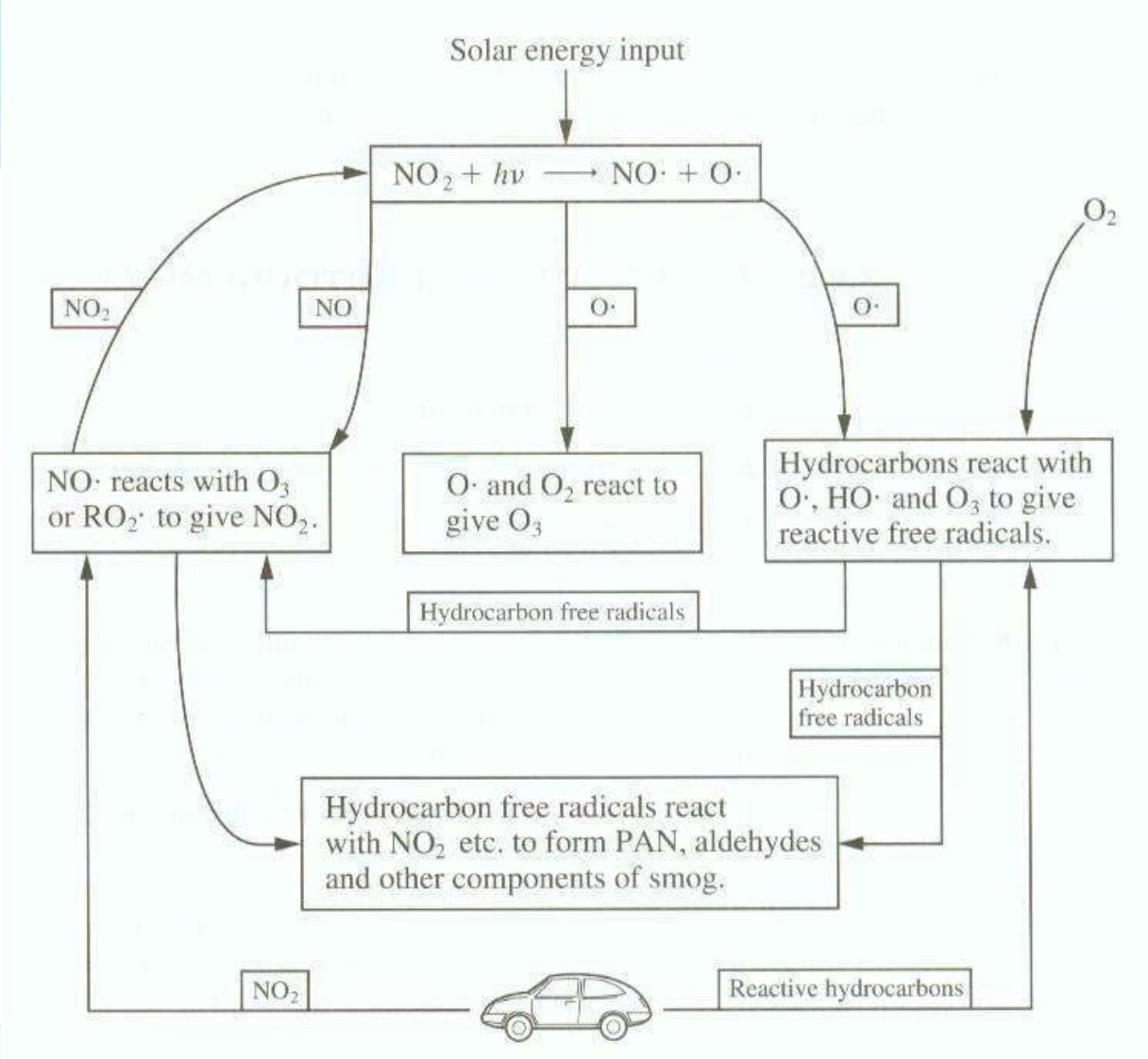




Formation

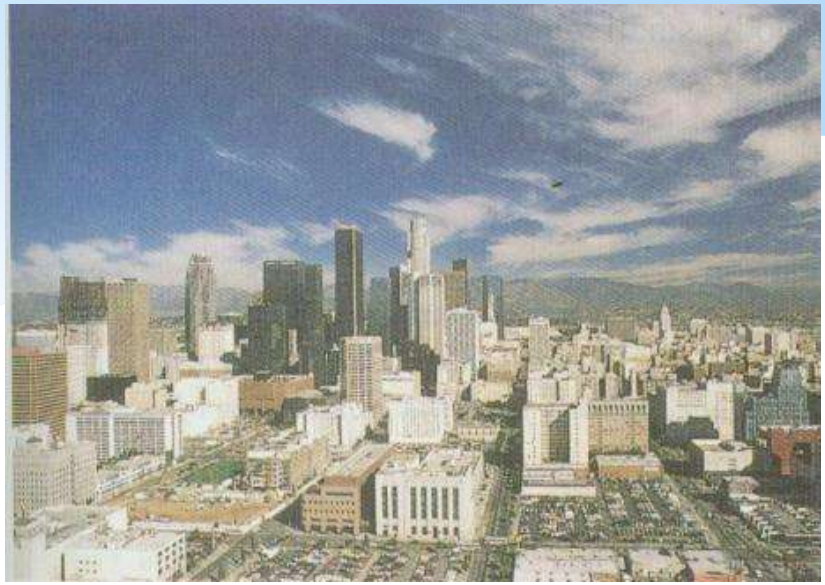

Pollutants
Nitrogen oxides
Hydrocarbons
UV light from sun
Water vapour
Oxygen
Atmosphere
Photochemical smog
Ozone
Aldehydes
Organic nitrates
Particulates

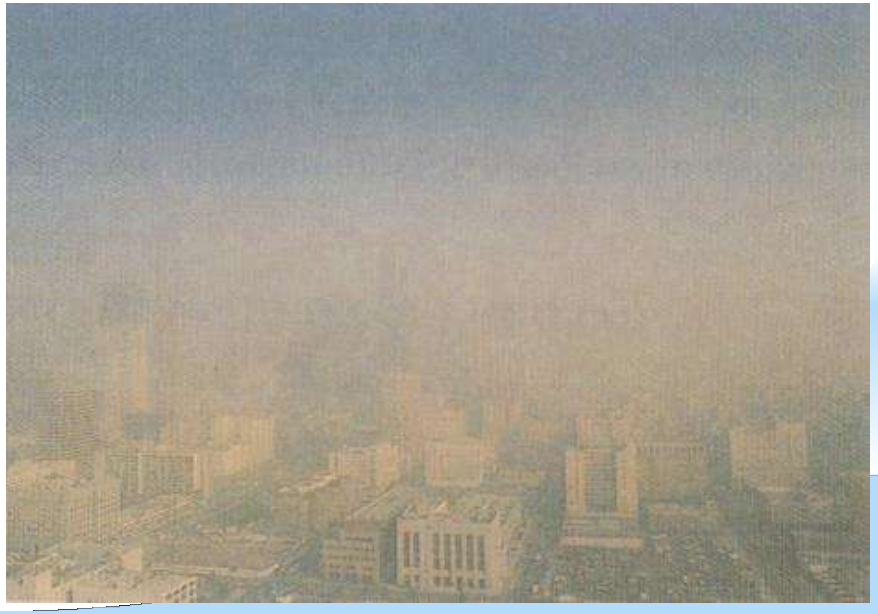
Formation


Solar energy input
$NO_2 + h\nu \longrightarrow NO\cdot + O\cdot$
O_2
NO_2
NO
O·
O·
NO· reacts with O_3 or $RO_2\cdot$ to give NO_2.
O· and O_2 react to give O_3
Hydrocarbons react with O·, HO· and O_3 to give reactive free radicals.
Hydrocarbon free radicals
Hydrocarbon free radicals
Hydrocarbon free radicals react with NO_2 etc. to form PAN, aldehydes and other components of smog.
NO_2
Reactive hydrocarbons

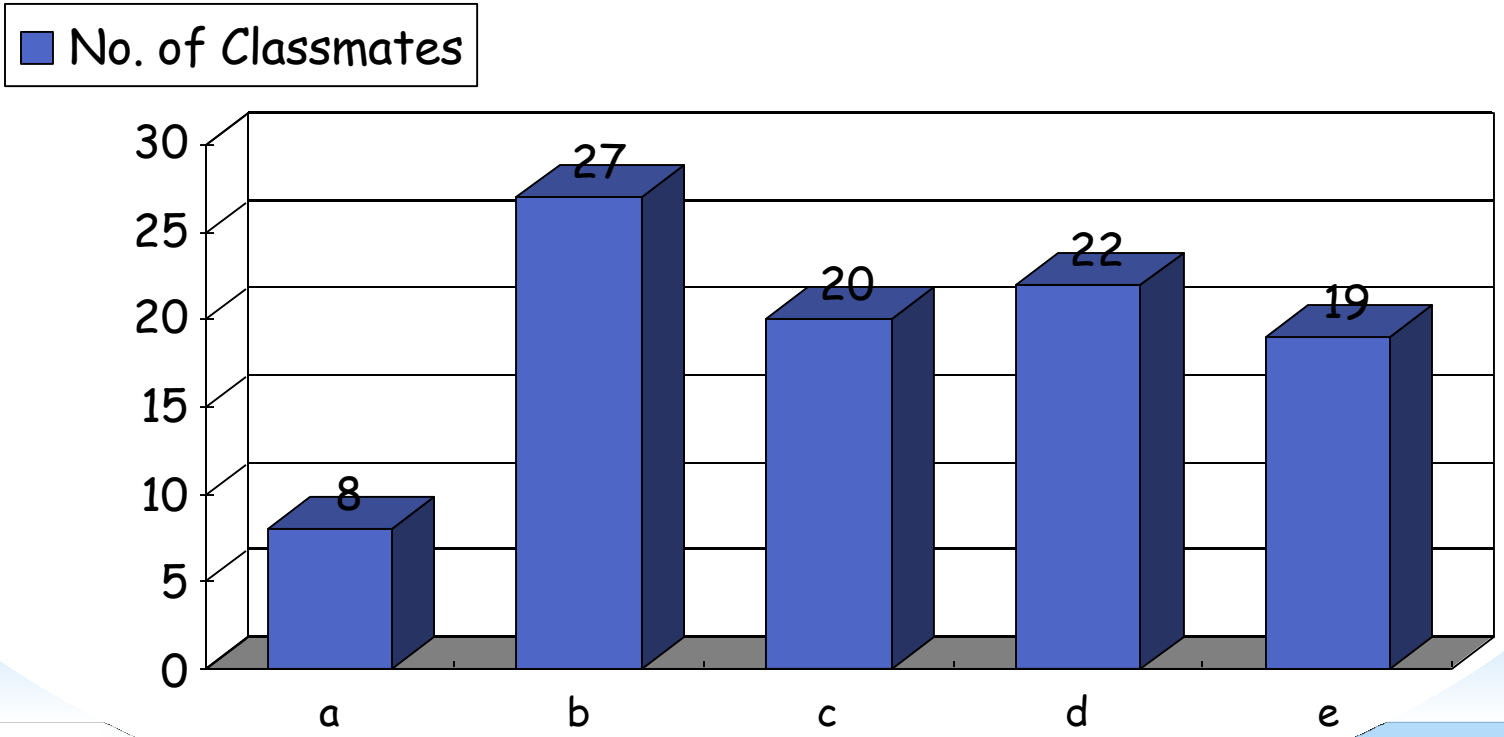
(*a*)

(*b*)





* What are the disadvantages of having photochemical smog?



a. headaches b. eye, nose and throat irritation c. impaired lung function
d. coughing and wheeling e. damaging plants

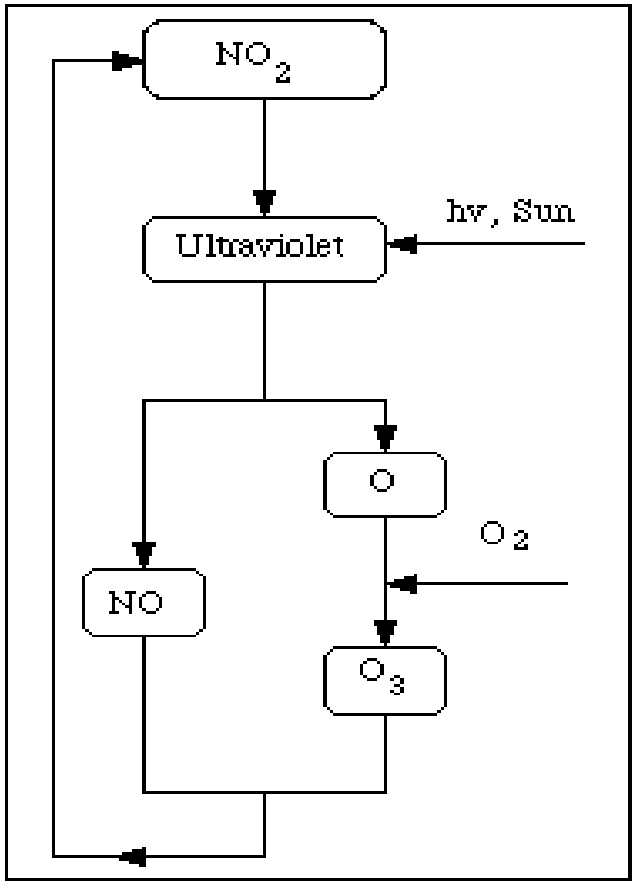
*Formation of Ozone

Troposphere Ozone:

* $NO_2 + h\nu \rightarrow NO + O$
* $O + O_2 \xrightarrow{O_3}$

Sources:

* Exhaust gases From Motor vehicles
* Unburnt Hydrocarbons



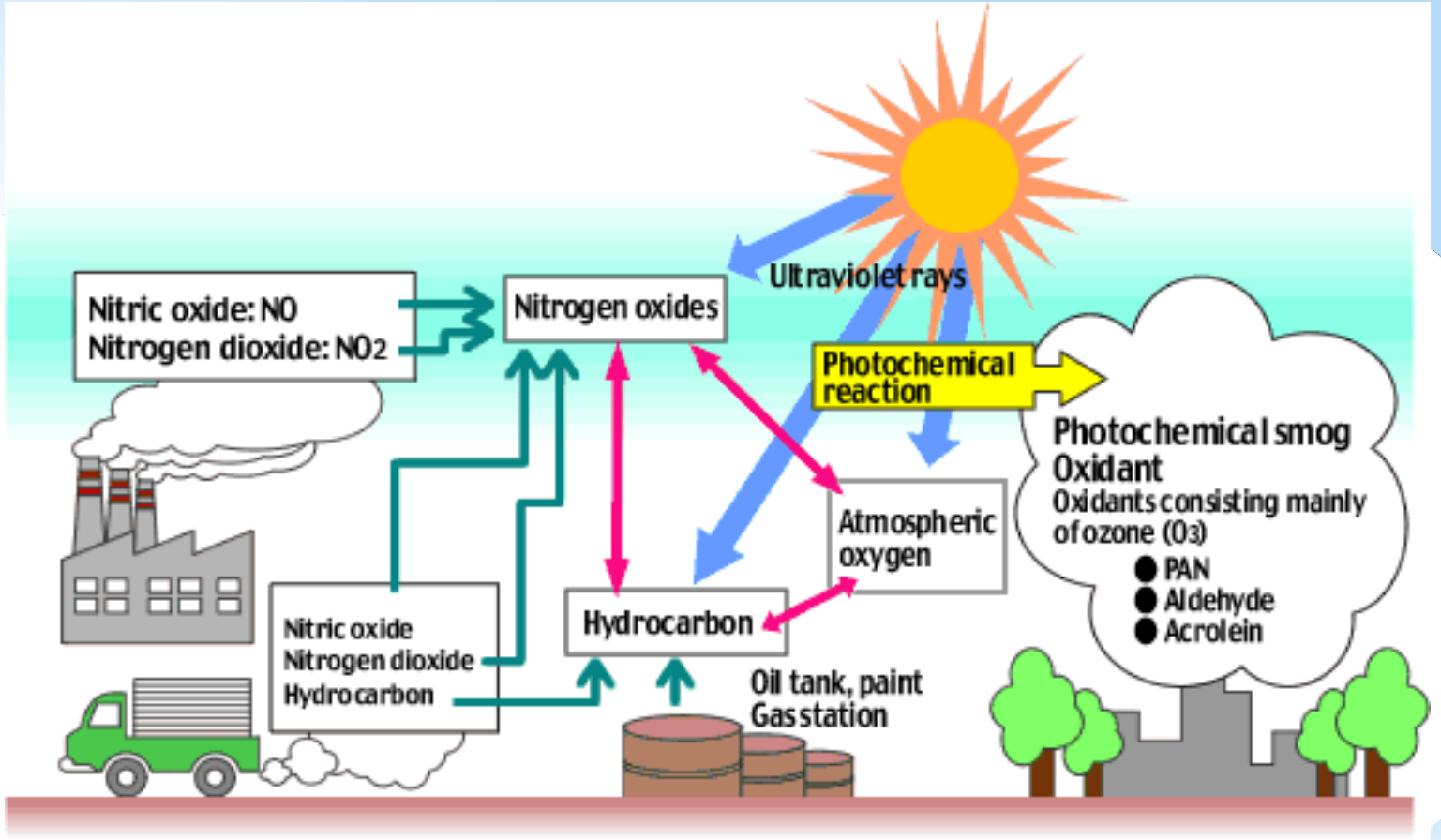
*Formation of PAN

Peroxyacetyl Nitrates (PAN)

Are secondary pollutants formed from peroxyacid radicals and NO_2

* $\mathbf{CH_3CHO} + OH^{\bullet} \longrightarrow CH_3C^{\bullet}O + H_2O$
* $CH_3C^{\bullet}O + O_2 \longrightarrow CH_3C(O)OO^{\bullet}$ (acetylperoxy)
* $CH_3C(O)OO^{\bullet} + {}^{\bullet}NO_2 \longrightarrow \mathbf{CH_3C(O)OONO_2}$ **(PAN)**

*Generation Mechanism

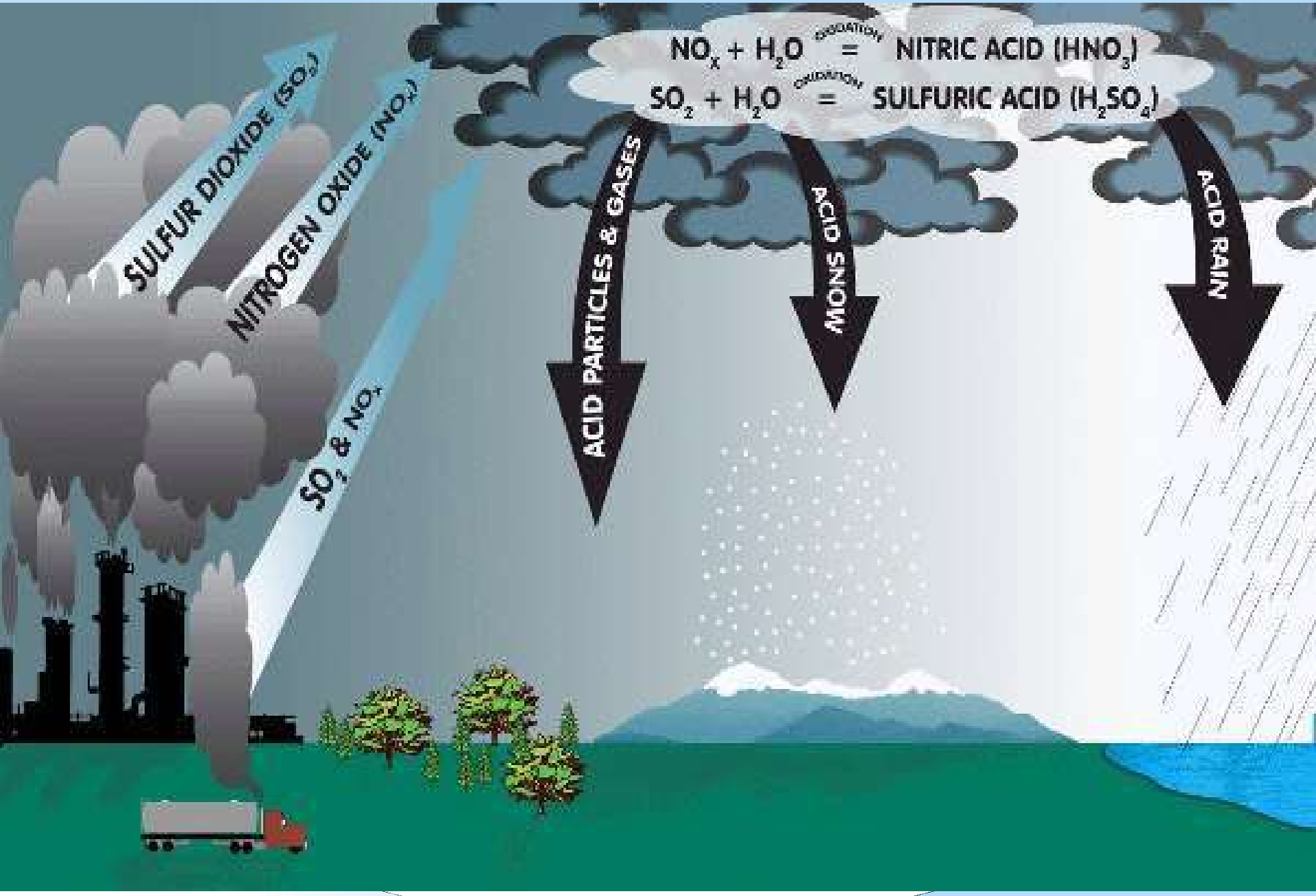


* Effects on human health:

* Ozone
  * Cause acute respiratory problems
  * Aggravate asthma
  * Cause temporary decreases in lung function in healthy adults
  * Lead to hospital admissions and emergency room visits
  * Impair the body's immune system
* Peroxyacetylnitrate (PANs)
  * Respiratory and eye irritants
  * Mutagenic- causing skin cancer

*Formation of Acid Rain

- *Formed when gases, such as CO_2 and SO_2 react with the water in the atmosphere
- *The pH of Rain drops
  - *As low as pH of 2
  - *Very harmful to our living environment


$NO_x + H_2O \xrightarrow{\text{OXIDATION}} = NITRIC ACID (HNO_3)$
$SO_2 + H_2O \xrightarrow{\text{OXIDATION}} = SULFURIC ACID (H_2SO_4)$
SULFUR DIOXIDE (SO_2)
NITROGEN OXIDE (NO_x)
SO_2 & NO_x
ACID PARTICLES & GASES
ACID SNOW
ACID RAIN

*Examples

*When CO_2 reacts with water, carbonic acid is formed.

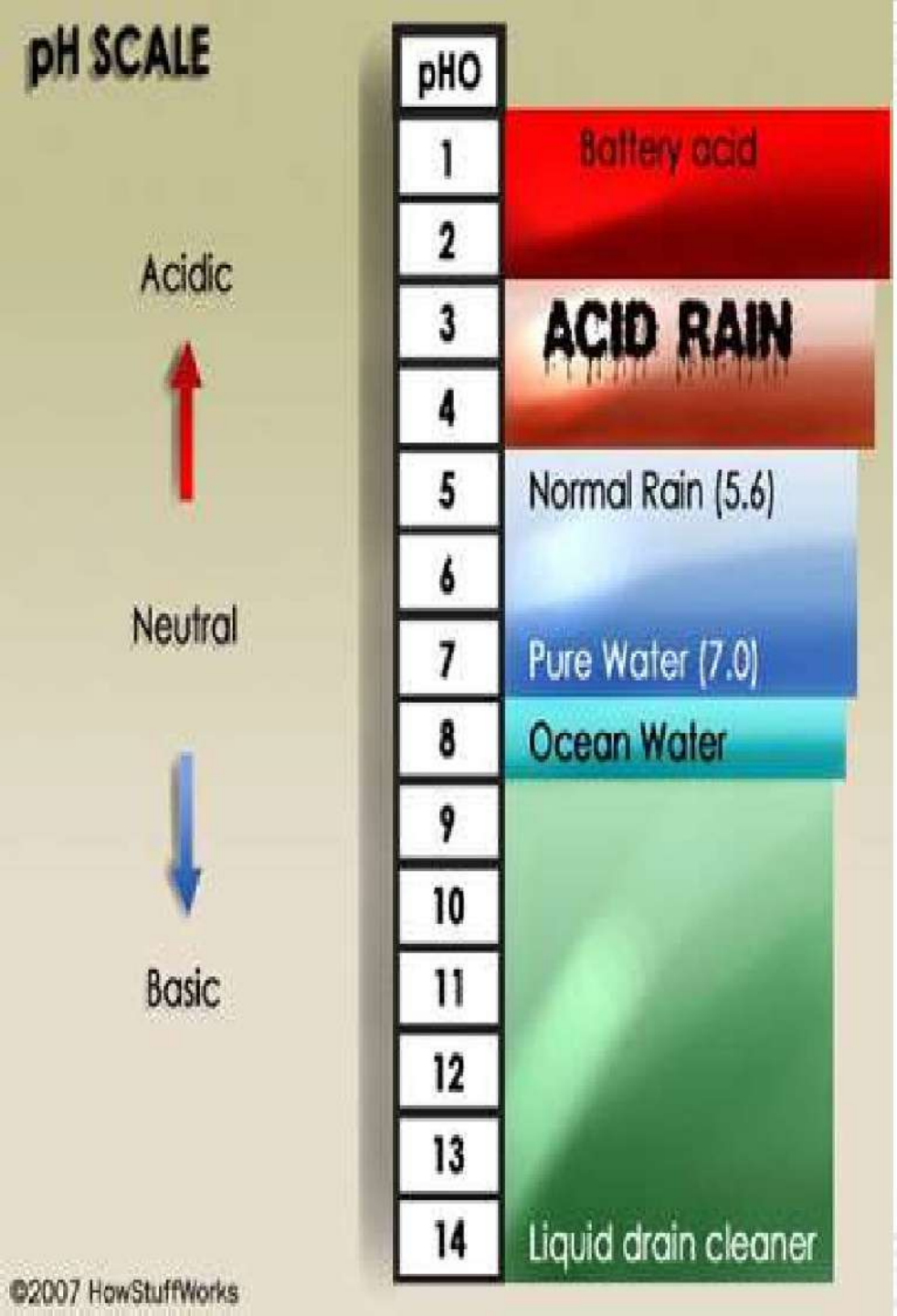
CO_2 (g)+H_2O(l)-→H_2CO_3(aq)

*When SO_2 reacts with water, sulfurous acid is formed.

SO_2 (g)+H_2O(l)-→H_2SO_3(aq)

*When NO_2 reacts with water, nitric acid is formed.

$2NO_2$(g)+H_2O(l)-→HNO_2(aq)+HNO_3(aq)



Concentration of Hydrogen ions compared to distilled water		Examples
10,000,000	pH 0	Battery acid
1,000,000	pH 1	Hydrochloric acid
100,000	pH 2	Lemon juice, vinegar
10,000	pH 3	Grapefruit, soft drink
1,000	pH 4	Tomato juice, acid rain
100	pH 5	Black coffee
10	pH 6	Urine, saliva
1	pH 7	"Pure" water
1/10	pH 8	Sea water
1/100	pH 9	Baking soda.
1/1,000	pH 10	Great Salt Lake
1/10,000	pH 11	Ammonia solution
1/100,000	pH 12	Soapy water
1/1,000,000	pH 13	Bleach
1/10,000,000	pH 14	Liquid drain cleaner

*How does Acid Rain effect us

*It kills micro-organisms
*It poisons plants
*It damages metals and limestone
*It kills fish

Acid Rain Effects on Sculptures

1908 1969

C. Ophardt, c. 2003

SEAoNY

Figure D-17 Seat connection in fire-damaged W14 column from WTC 7.

* Mitigation procedure- Control of particulate and gaseous emission

PARTICULATE

- Cyclones
- Electrostatic Precipitators
- Fabric Filter
- Wet Scrubbers

GASES

- Adsorption Towers
- Thermal Incernation
- Catalytic Combustion

Fabric Filter

Wet Scrubbers

* General Methods for Control of (SO_2 Emissions)

* Use Flue Gas Desulfurization Systems

* Use Alternative Energy Sources, such as Hydro-Power or Nuclear-Power

Hydro-Power Generation

Flue Gas Desulfurization Systems

*Flue Gas Desulfurization

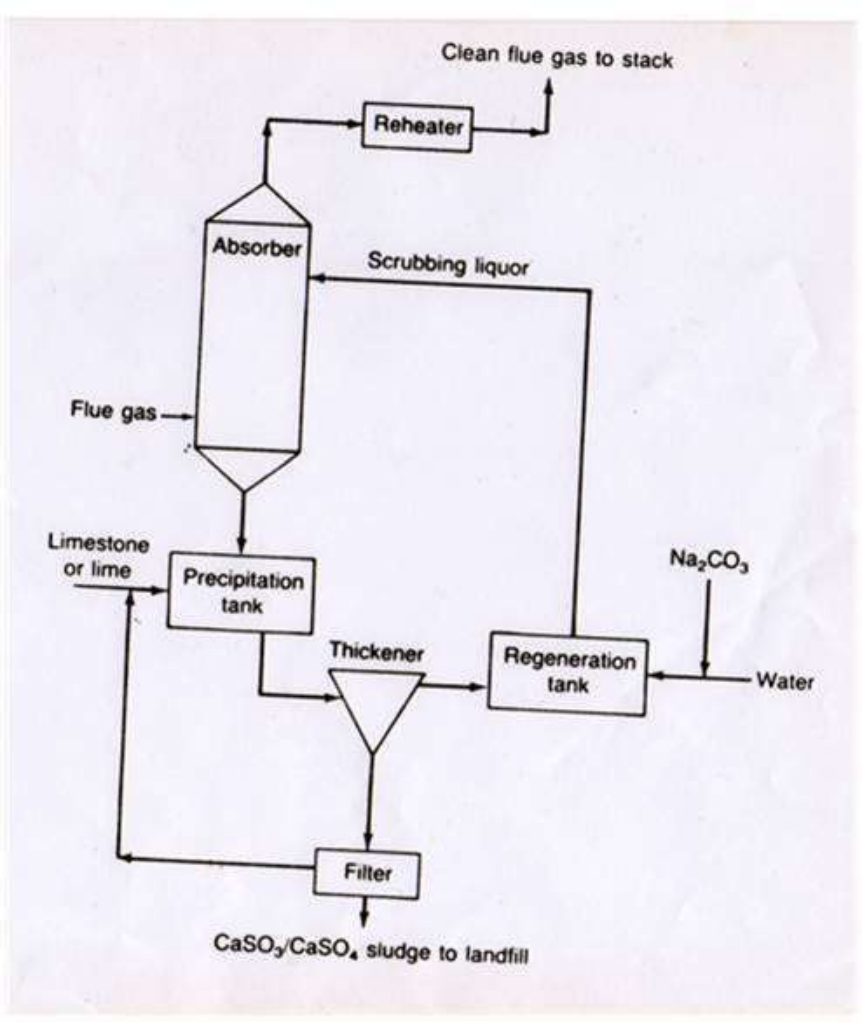
- SO_2 scrubbing, or Flue Gas Desulfurization processes can be classified as:
  - Throwaway or Regenerative, depending upon whether the recovered sulfur is discarded or recycled.
  - Wet or Dry, depending upon whether the scrubber is a liquid or a solid.

- **Flue Gas Desulfurization Processes**

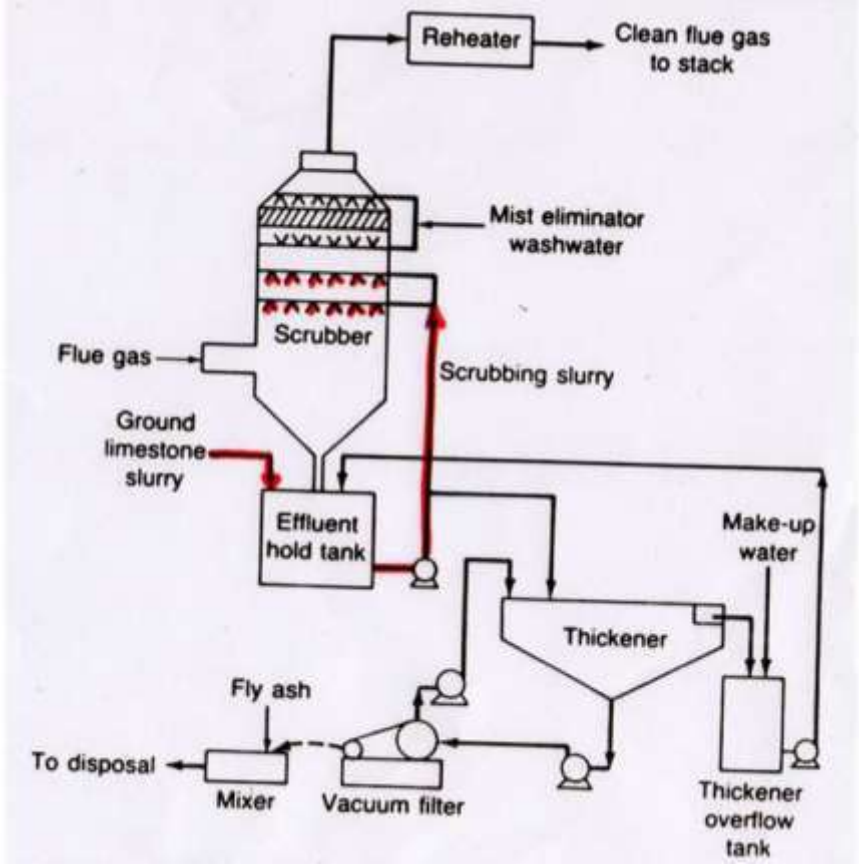
  The major flue gas desulfurization (FGD), processes are :
  - Limestone Scrubbing
  - Lime Scrubbing
  - Dual Alkali Processes
  - Lime Spray Drying
  - Wellman-Lord Process

Flue Gas Desulfurization Systems

*Limestone Scrubbing



*Lime Scrubbing



*Dual Alkali System

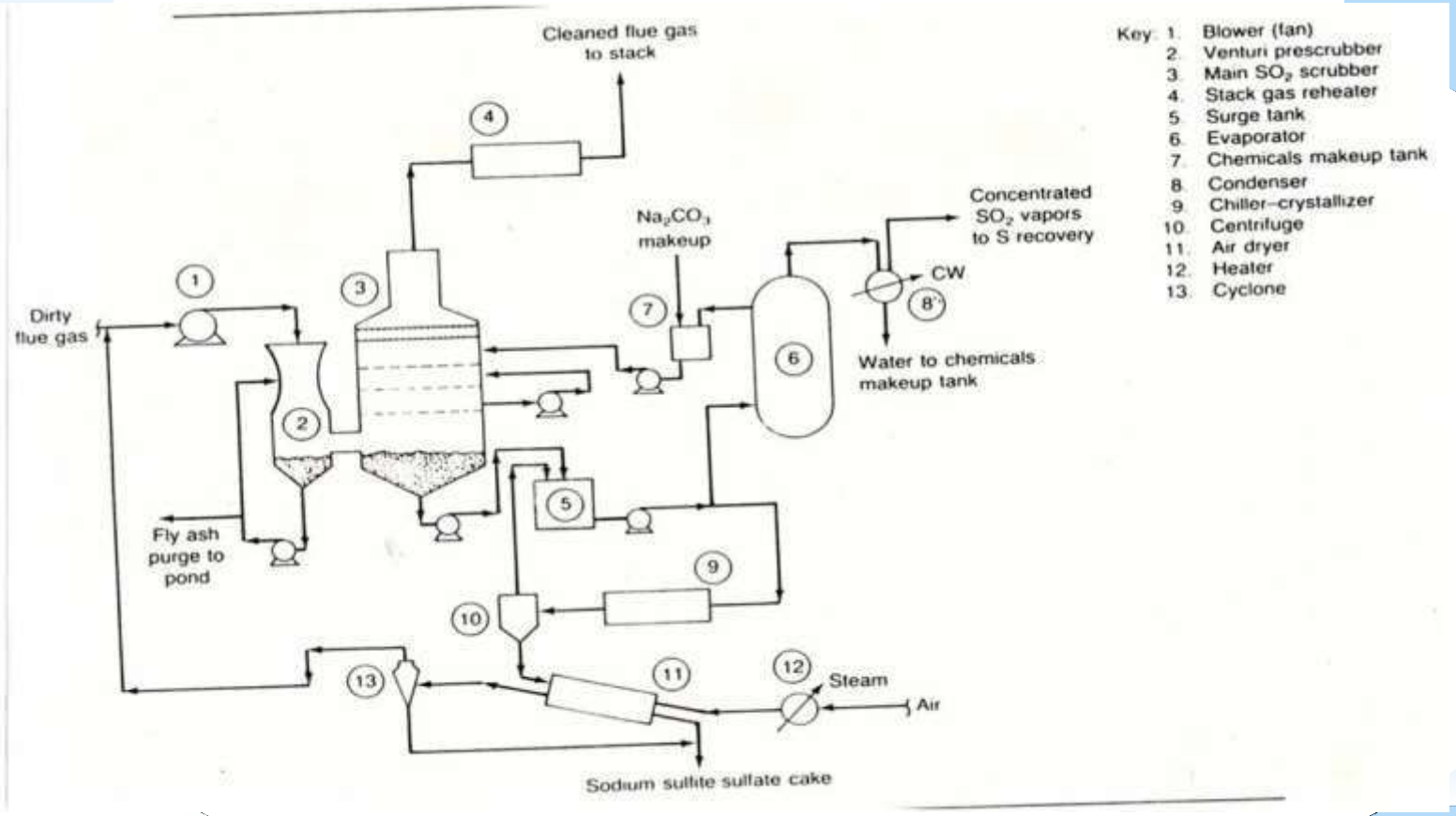
- Lime and Limestone scrubbing lead to deposits inside spray tower.
- The deposits can lead to plugging of the nozzles through which the scrubbing slurry is sprayed.
- The Dual Alkali system uses two regents to remove the sulfur dioxide.
- Sodium sulfite / Sodium hydroxide are used for the absorption of sulfur dioxide inside the spray chamber.
- The resulting sodium salts are soluble in water,so no deposits are formed.
- The spray water is treated with lime or limestone, along with make-up sodium hydroxide or sodium carbonate.
- The sulfite / sulfate ions are precipitated, and the sodium hydroxide is regenerated.

*Lime – Spray Drying

* Lime Slurry is sprayed into the chamber
* The sulfur dioxide is absorbed by the slurry
* The liquid-to-gas ratio is maintained such that the spray dries before it reaches the bottom of the chamber
* The dry solids are carried out with the gas, and are collected in fabric filtration unit
* This system needs lower maintenance, lower capital costs, and lower energy usage

*Wellman – Lord Process

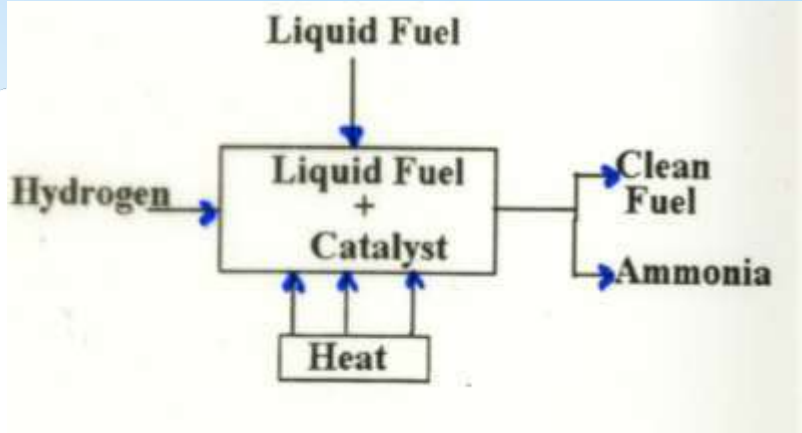
Schematic process flow diagram – SO2 scrubbing and recovery system



Control of nitrogen Oxides(NO_x)

* NO_x control can be achieved by:
  - Fuel Denitrogenation
  - Combustion Modification
  - Modification of operating conditions
  - Tail-end control equipment
    - Selective Catalytic Reduction
    - Selective Non - Catalytic Reduction
    - Electron Beam Radiation
    - Staged Combustion

*Fuel Denitrogenation



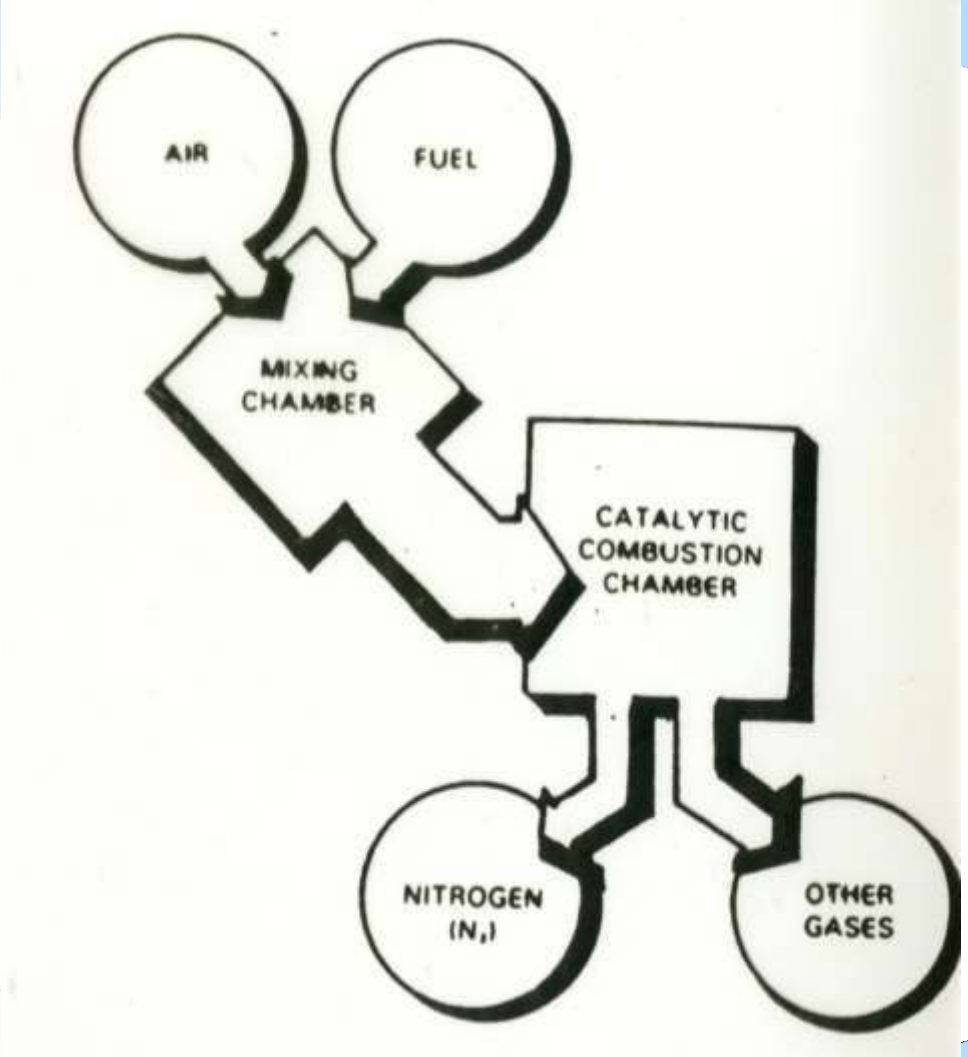
- One approach of fuel denitrogenation is to remove a large part of the nitrogen contained in the fuels. Nitrogen is removed from liquid fuels by mixing the fuels with hydrogen gas, heating the mixture and using a catalyst to cause nitrogen in the fuel and gaseous hydrogen to unite. This produces ammonia and cleaner fuel.
  - This technology can reduce the nitrogen contained in both naturally occurring and synthetic fuels.

*Combustion Modification

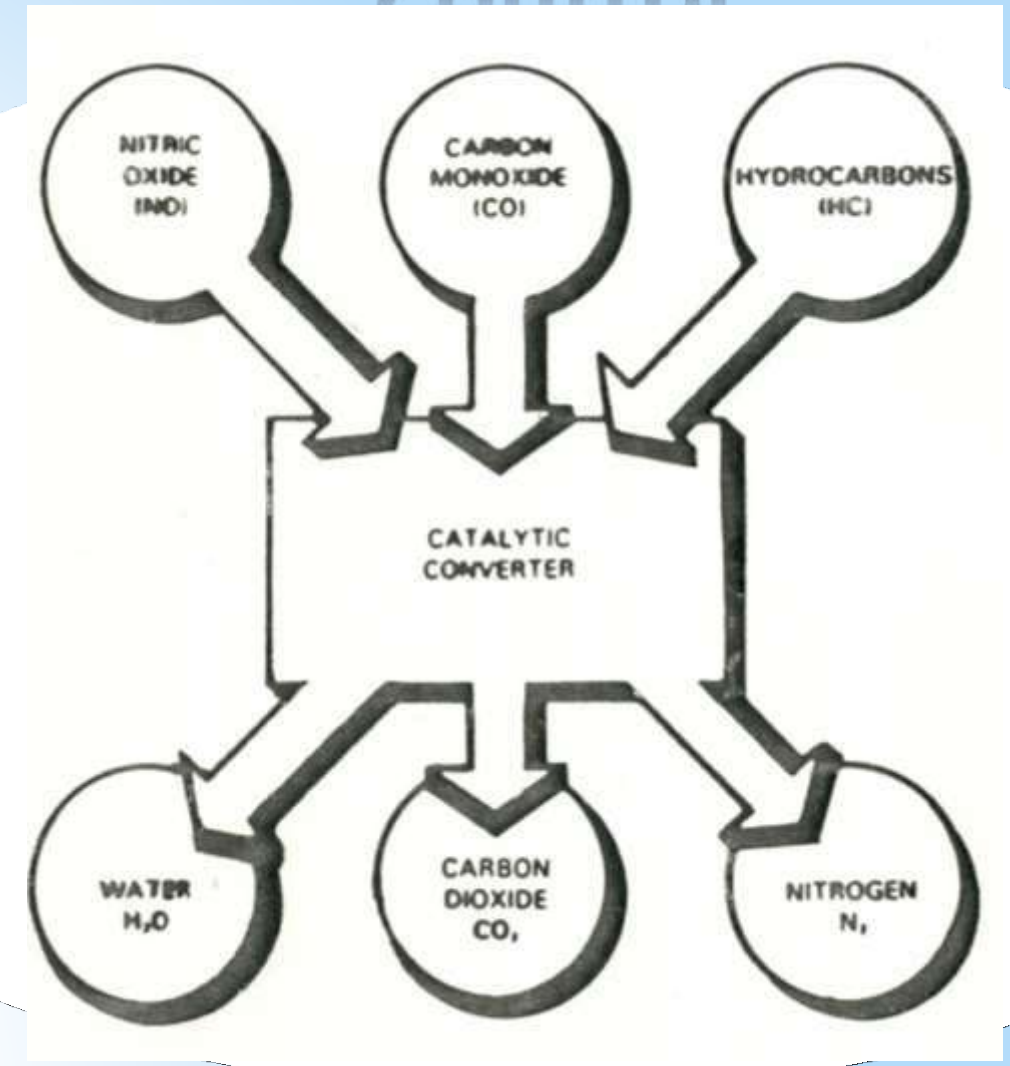
*Combustion control uses one of the following strategies:

- Reduce peak temperatures of the flame zone. The methods are :
  - increase the rate of flame cooling
  - decrease the adiabatic flame temperature by dilution
- Reduce residence time in the flame zone. For this we change the shape of the flame zone
- Reduce Oxygen concentration in the flame one. This can be accomplished by:
  - decreasing the excess air
  - controlled mixing of fuel and air
  - using a fuel rich primary flame zone

*Catalytic Combustion



*Catalytic Emission Control



* Modification Of Operating Conditions

* The operating conditions can be modified to achieve significant reductions in the rate of thermal NOx production. the various methods are:

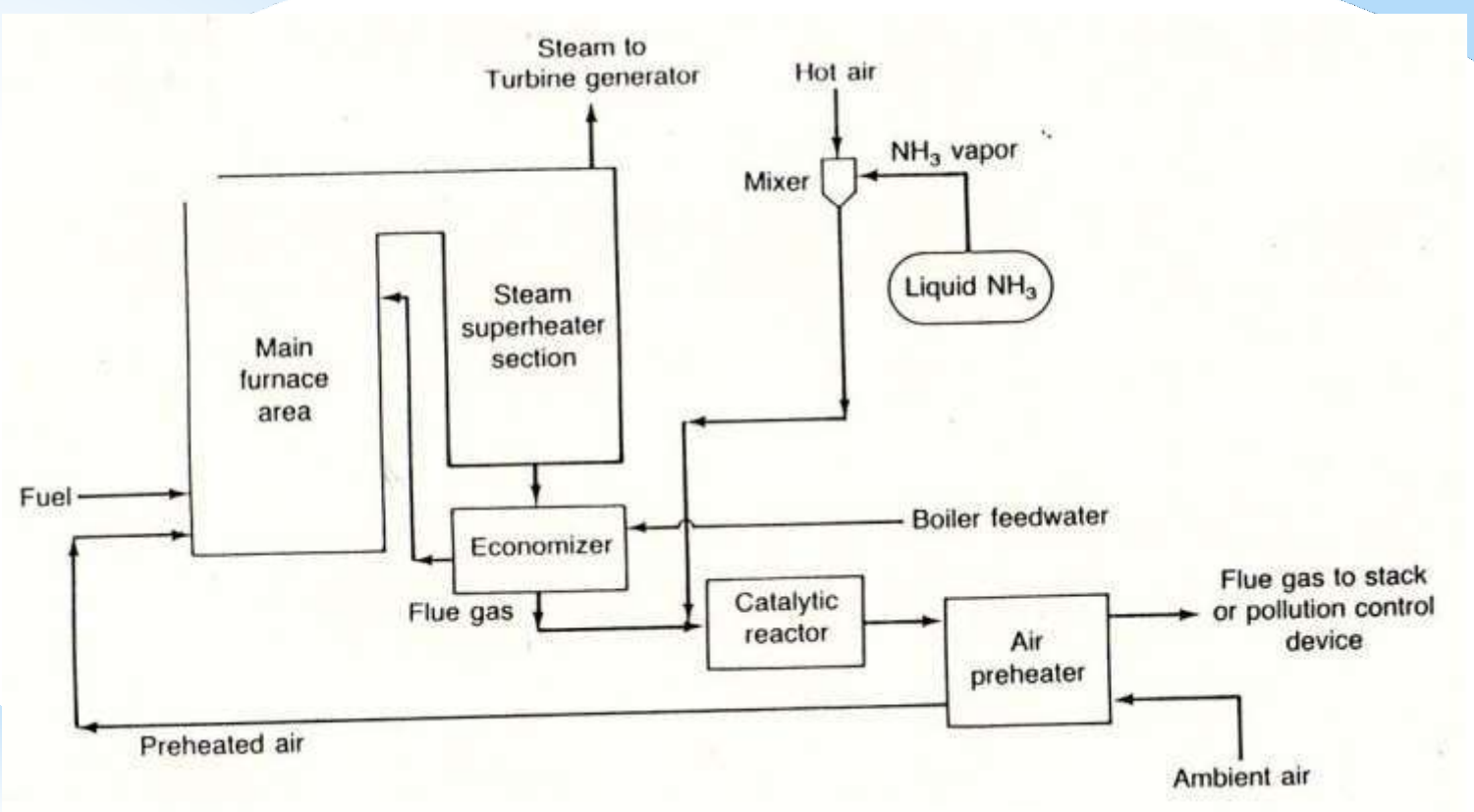
- Low-excess firing
- Off-stoichiometric combustion (staged combustion)
- Flue gas recirculation
- Reduced air preheat
- Reduced firing rates
- Water Injection

*Tail-end Control Processes

- Combustion modification and modification of operating conditions provide significant reductions in NOx, but not enough to meet regulations.
  - For further reduction in emissions, tail-end control equipment is required.
  - Some of the control processes are:
    - Selective Catalytic Reduction
    - Selective Non-catalytic Reduction
    - Electron Beam Radiation
    - Staged Combustion

*Selective Catalytic Reduction (SCR)

Schematic process flow diagram – NO_X control



*Selective Non-catalytic Reduction (SNR)

* At higher temperatures (900-1000°C), NH_3 will reduce NO_X to nitrogen without a catalyst.

* At NH_3 : NO_X molar ratios 1:1 to 2:1, about 40-60%reduction is obtained.

* SNR is cheaper than SCR in terms of operation cost and capital cost.

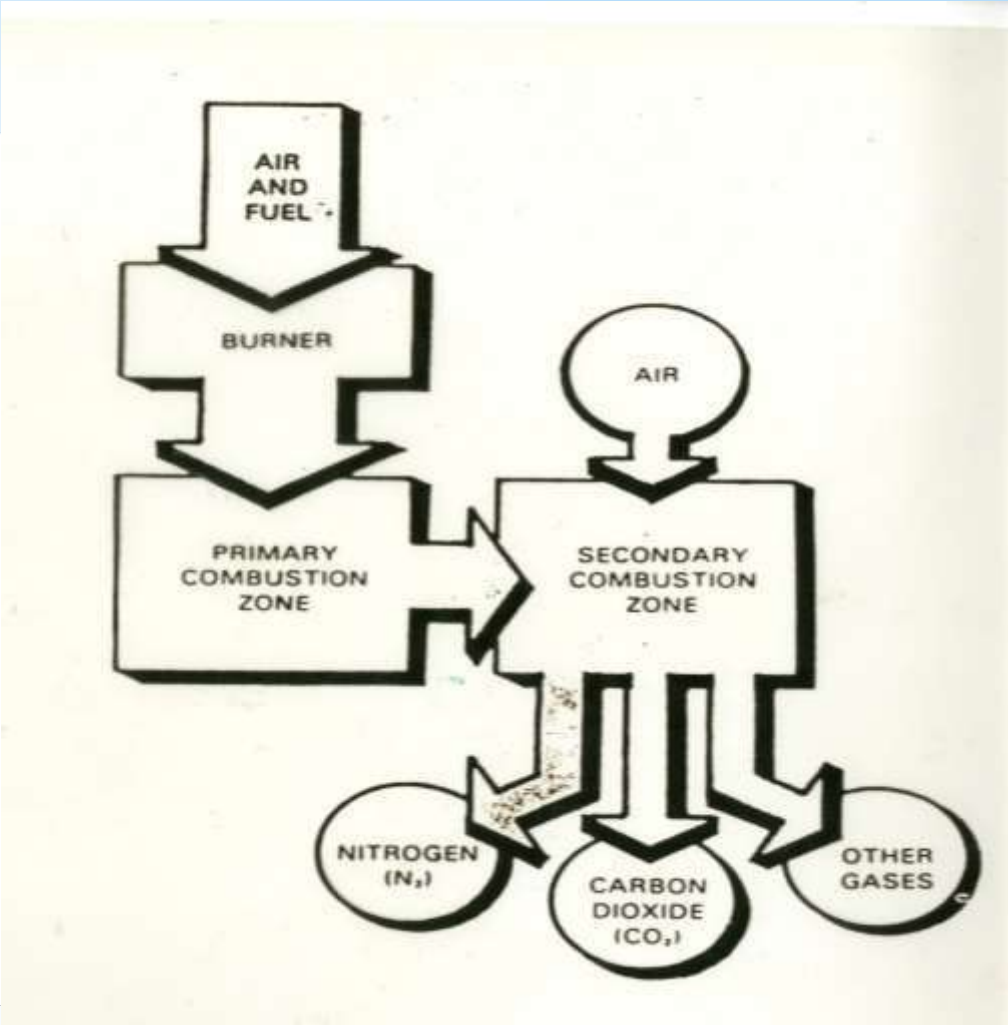
* Tight temperature controls are needed. At lower temperatures, un-reacted ammonia is emitted. At higher temperatures ammonia is oxidized to NO.

*Electron Beam Radiation

*This treatment process is under development, and is not widely used. Work is underway to determine the feasibility of electron beam radiation for neutralizing hazardous wastes and air toxics.

- Irradiation of flue gases containing NOx or SOx produce nitrate and sulfate ions.
- The addition of water and ammonia produces NH_4NO_3, and $(NH_4)_2SO_4$
- The solids are removed from the gas, and are sold as fertilizers.

*Staged Combustion



*Staged Combustion

*PRINCIPLE

- Initially, less air is supplied to bring about incomplete combustion
- Nitrogen is not oxidized. Carbon particles and CO are released.
- In the second stage, more air is supplied to complete the combustion of carbon and carbon monoxide.

30% to 50% reductions in NOx emissions are achieved.

* Control of CO Emissions

- Control carbon monoxide formation.

  Note : CO & NOx control strategies are in conflict.

- Stationary Sources
  - Proper Design
  - Installation
  - Operation
  - Maintenance
- Process Industries
  - Burn in furnaces or waste heat boilers.

PARTICULATE MATTER CONTROL

* Industrial Sources of Particulate Emissions

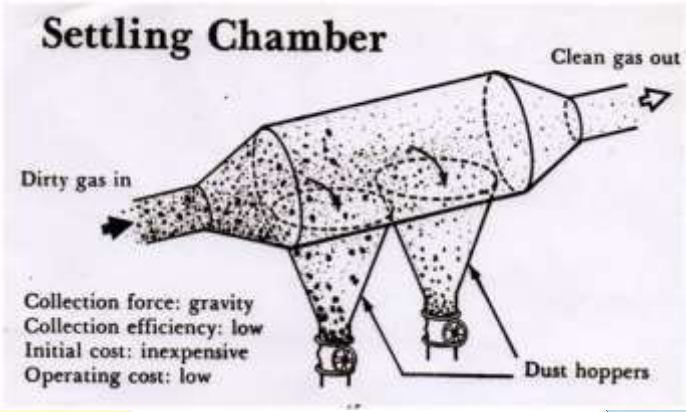
- Iron & Steel Mills, the blast furnaces, steel making furnaces.
- Petroleum Refineries, the catalyst regenerators, air-blown asphalt stills, and sludge burners.
- Portland cement industry
- Asphalt batching plants
- Production of sulfuric acid
- Production of phosphoric acid
- Soap and Synthetic detergent manufacturing
- Glass & glass fiber industry
- Instant coffee plants

* EFFECTS OF PARTICULATE EMISSIONS

Primary Effects

- Reduction of visibility
  - size distribution and refractive index of the particles
  - direct absorption of light by particles
  - direct light scattering by particles
  - 150 micro g / m^3 concentration ~ average visibility of 5 miles (satisfactory for air and ground transportation)
- Soiling of nuisance
  - increase cost of building maintenance, cleaning of furnishings, and households
  - threshold limit is 200 - 250 micro g / m^3 (dust)
  - levels of 400 - 500 micro g / m^3 considered as nuisance

*General Methods For Control Of Particulate Emissions



* Five Basic Types of Dust Collectors :

Gravity and Momentum collectors

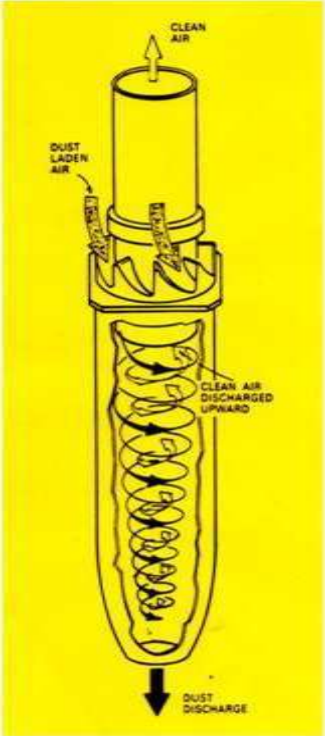
- Settling chambers, louvers, baffle chambers

Centrifugal Collectors

- Cyclones
- Mechanical centrifugal collectors

Fabric Filters

- Baghouses
- Fabric collectors



* General Methods For Control Of Particulate Emissions (Contd.)

Electrostatic Precipitators

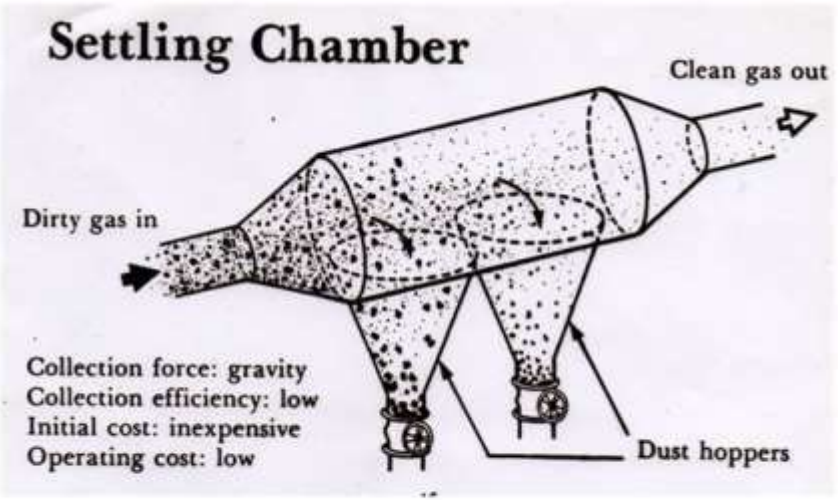
- Tubular
- Plate
- Wet
- Dry

Wet Collectors

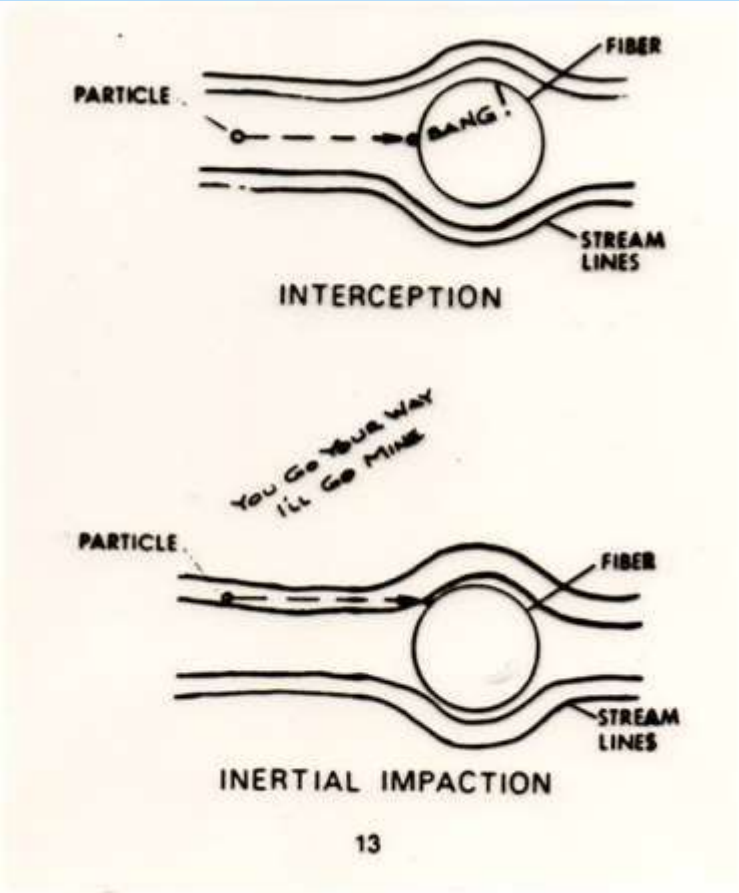
- Spray towers
- Impingement scrubbers
- Wet cyclones
- Peaked towers
- Mobile bed scrubbers

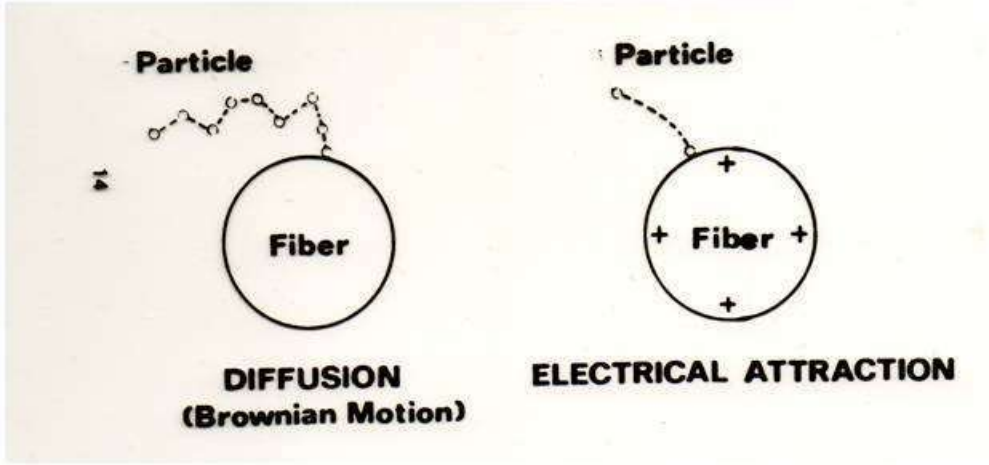
*Particulate Collection Mechanism

- Gravity Settling
- Centrifugal Impaction
- Inertial Impaction
- Direct Interception
- Diffusion
- Electrostatic Effects

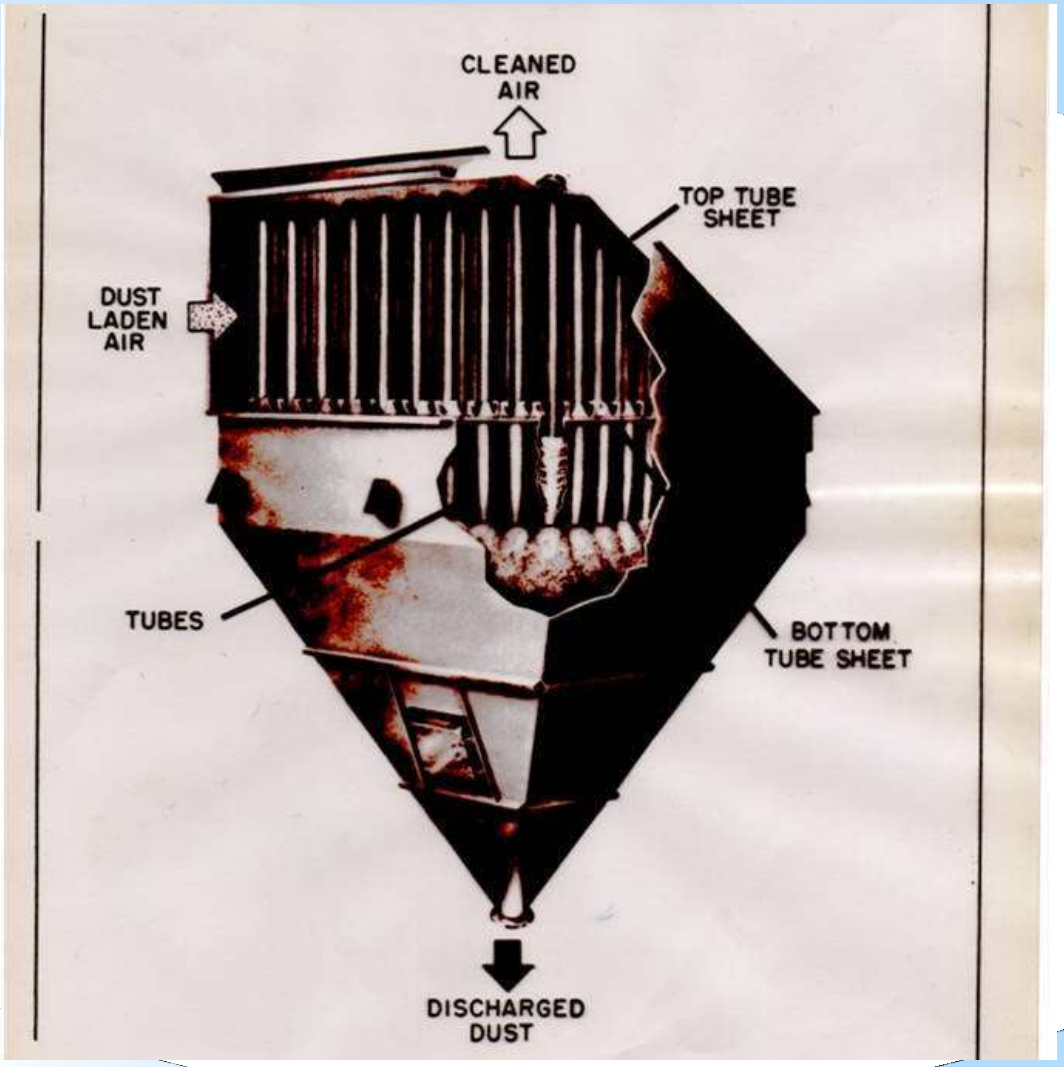


Gravity Settling





Tubular Dust Collector Arrangement for an ESP

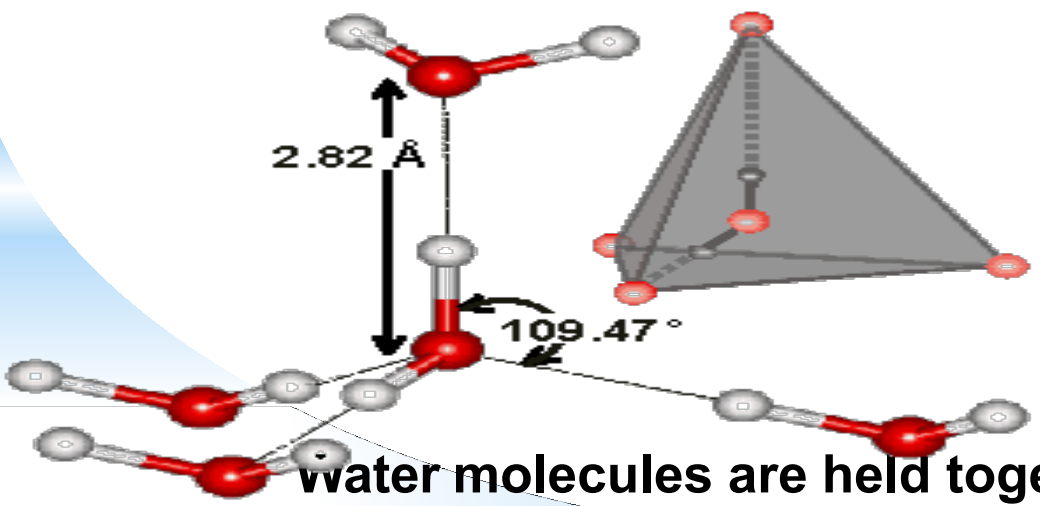


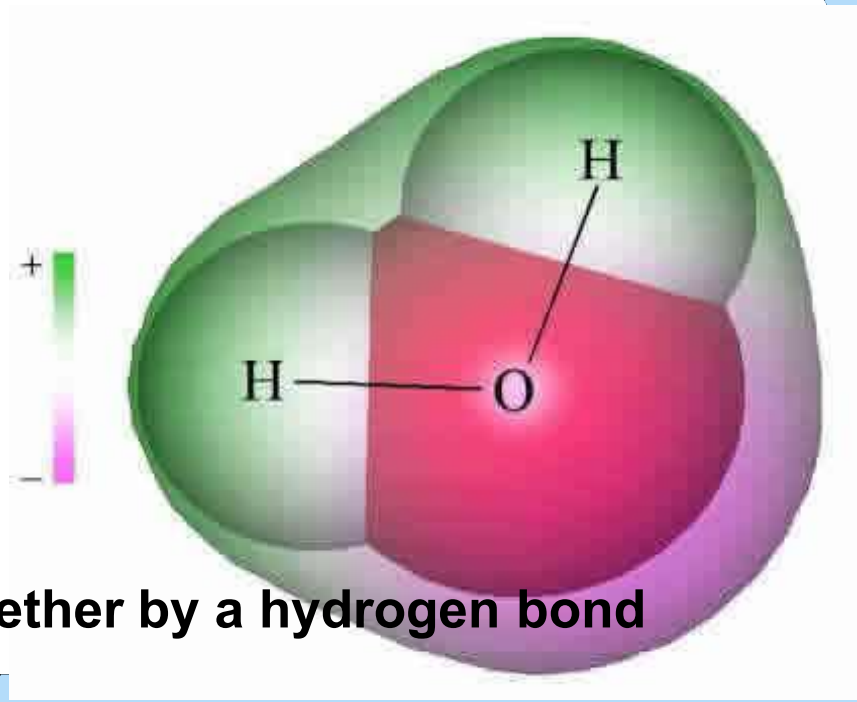
*Water Pollution

Physical and Chemical Properties of Terrestrial Water

*The Water Molecule

- *Water is formed when two hydrogen atoms bond to one oxygen atom.
- *Not symmetrical
- *Electrons spend more time near the (O) and less time near the (H)
- *Water molecule is polar





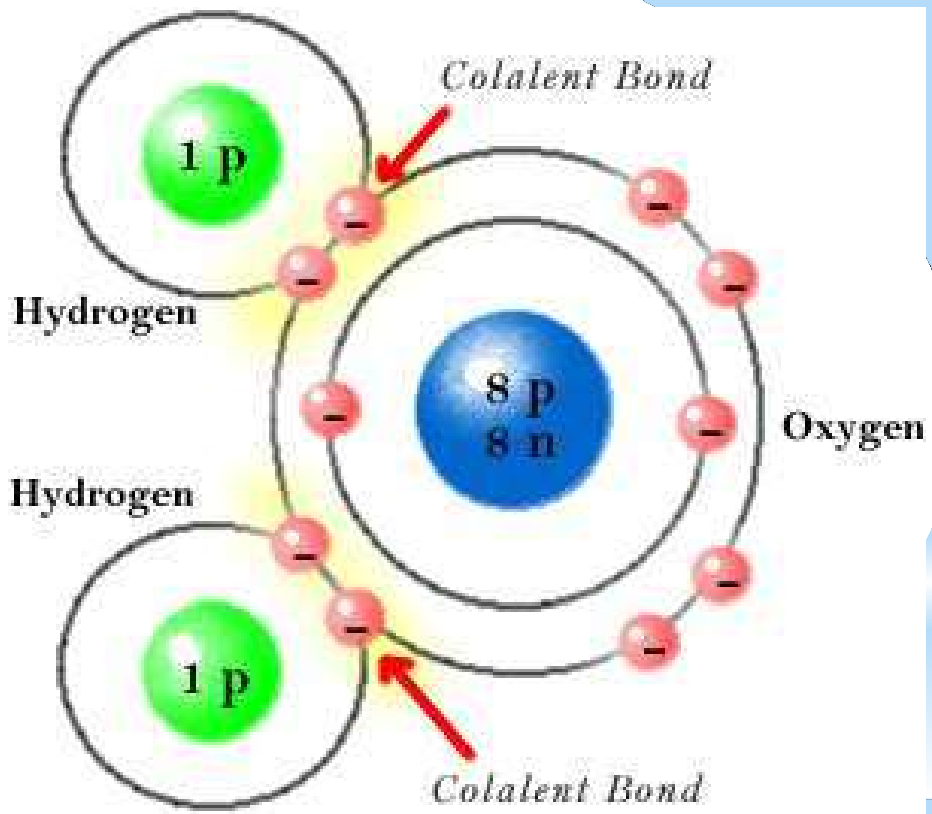
Water molecules are held together by a hydrogen bond

*The Water Molecule

*There is a greater concentration of electrons around the nucleus of the oxygen than around the hydrogen.

*Therefore, the hydrogen end is slightly positive and the **oxygen** end is slightly **negative**……

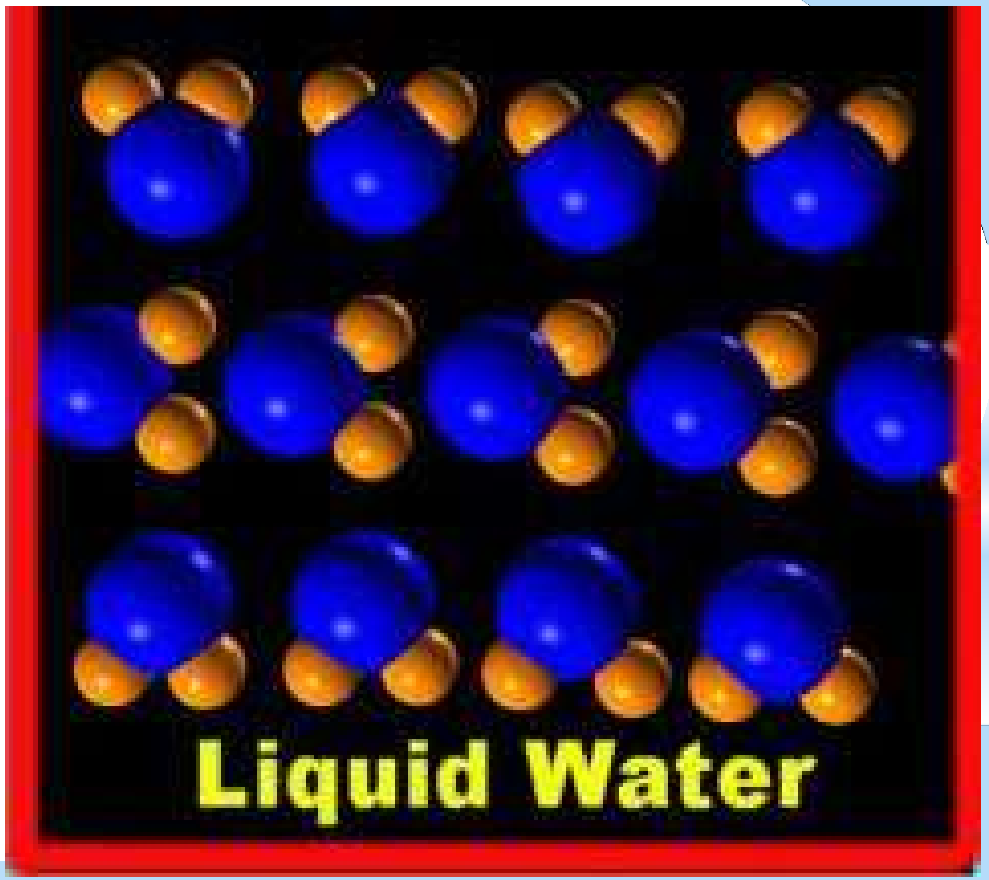
Dipolar



Bohr Model of H_2O

*The Water Molecule

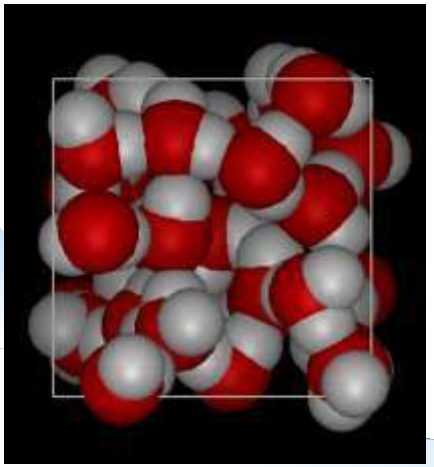
*When water molecules attract to one another, the hydrogen end of one molecule is attracted to the oxygen end of another.



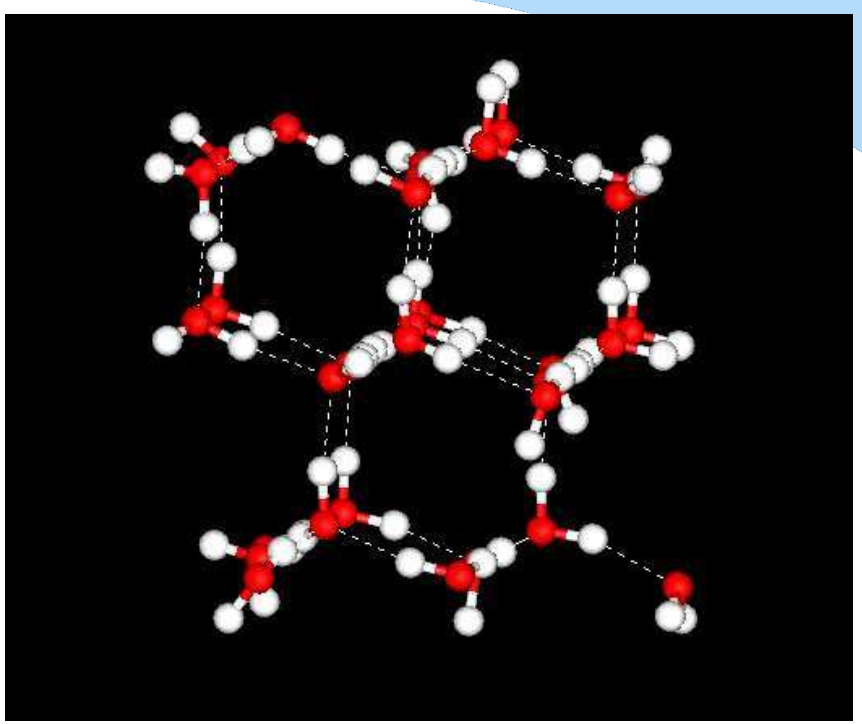
*States of Water

*Water is the only substance found on Earth in all three states (phases):

1. Liquid



*States of Water

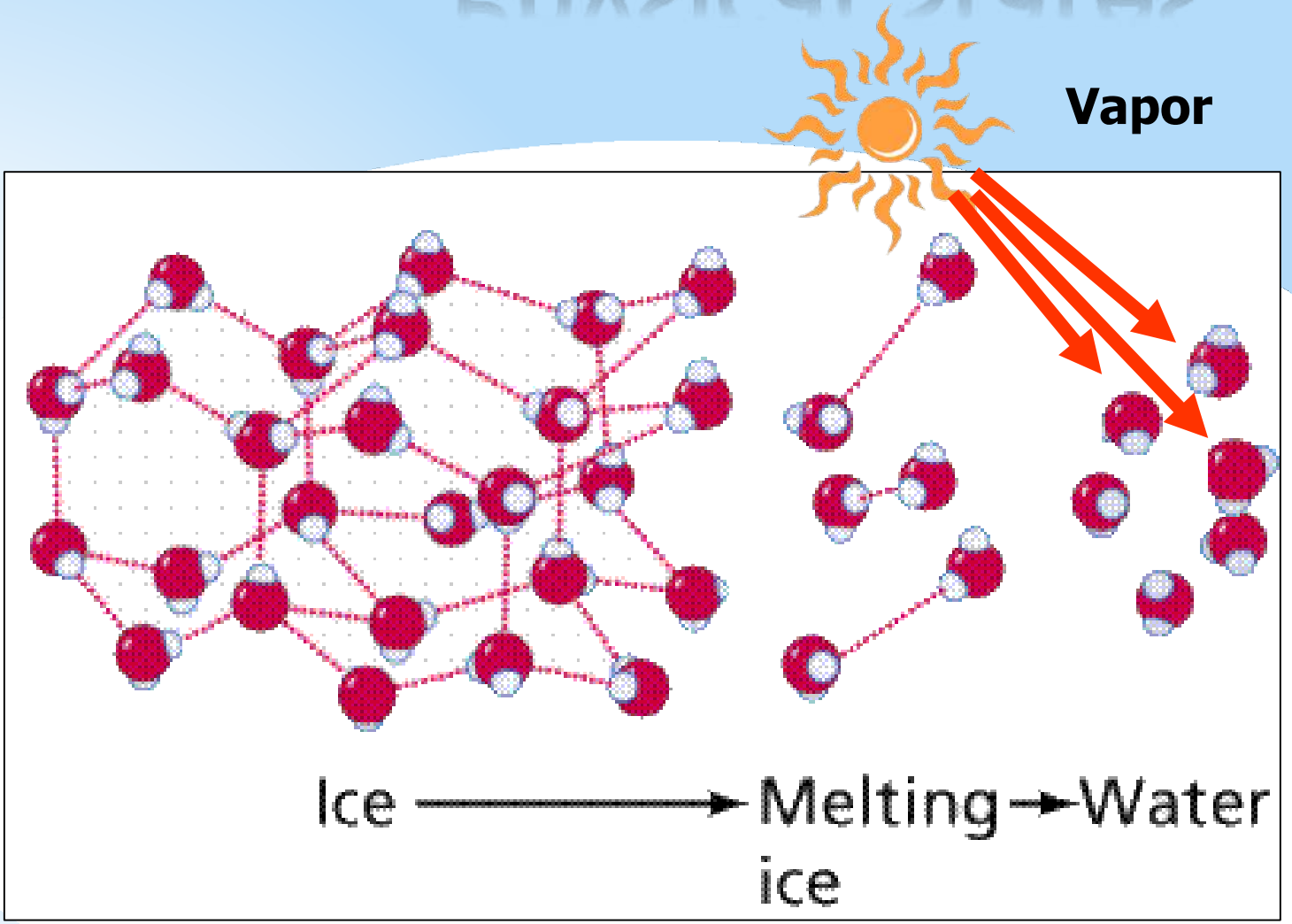


2. Solid (Ice)

*States of Water

3. Gas (Steam or Vapor)

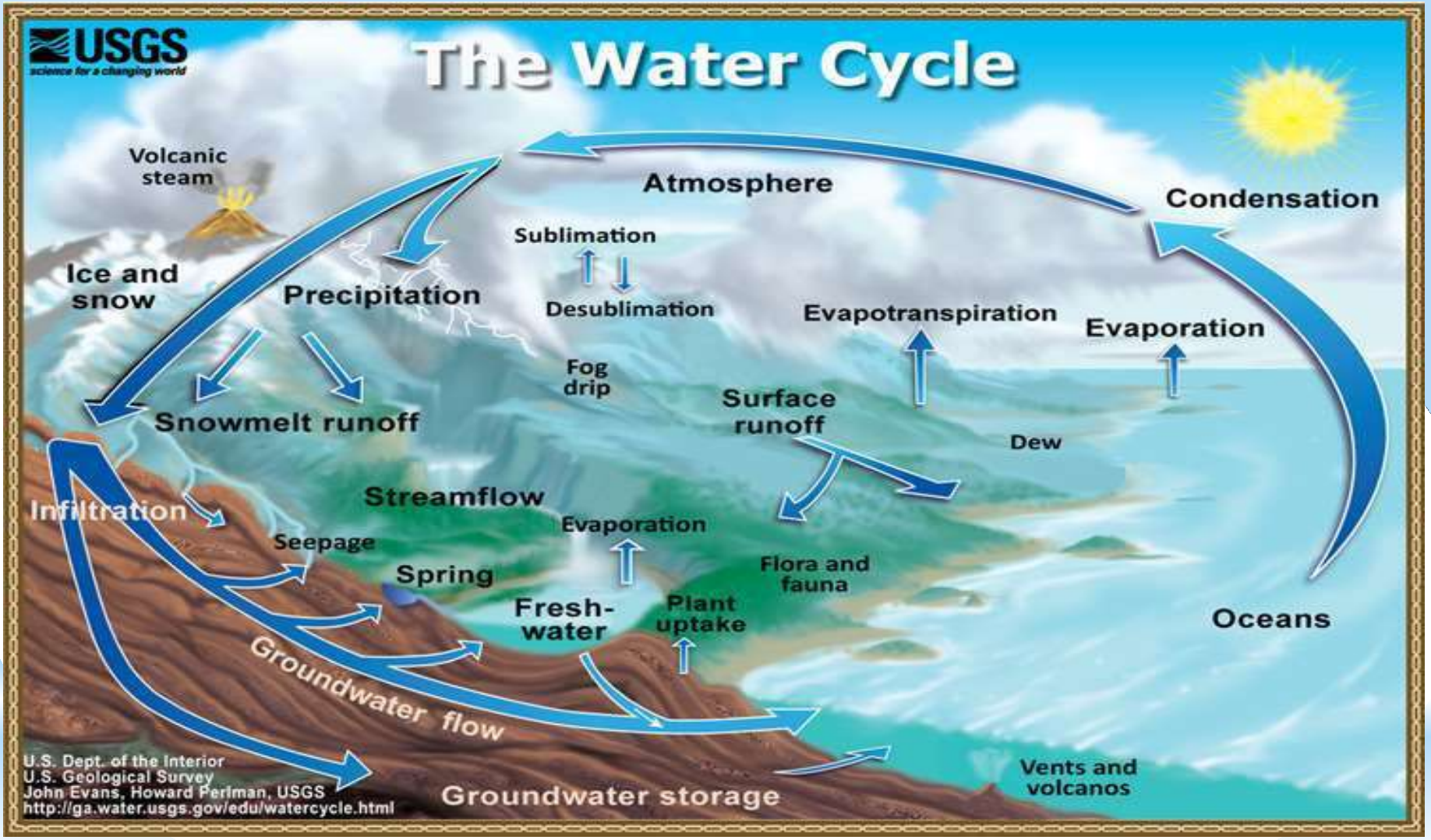
*Physical States



*States of Water

*Water molecules are constantly moving

*Temperature increase = Increase in movement


USGS
science for a changing world
The Water Cycle
Volcanic steam
Atmosphere
Condensation
Sublimation
Desublimation
Ice and snow
Precipitation
Evapotranspiration
Evaporation
Fog drip
Surface runoff
Snowmelt runoff
Dew
Streamflow
Infiltration
Evaporation
Seepage
Spring
Flora and fauna
Fresh-water
Plant uptake
Oceans
Groundwater flow
Vents and volcanos
Groundwater storage
U.S. Dept. of the Interior
U.S. Geological Survey
John Evans, Howard Perlman, USGS
http://ga.water.usgs.gov/edu/watercycle.html

*States of Water

*When water molecules move faster, they tend to break their hydrogen bonds.

This is called

Evaporation

Credit: Kidzone Fun Facts

*States of Water

*When gas or vapor molecules slow down, they clump or join together.

This is called
Condensation

*States of Water

*As water becomes cooler, it becomes less dense:

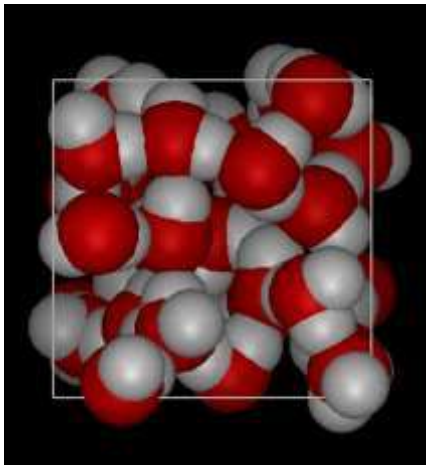
1 gram per cubic cm at 39.2^{o}

0.95865 gram per cubic cm at 212°

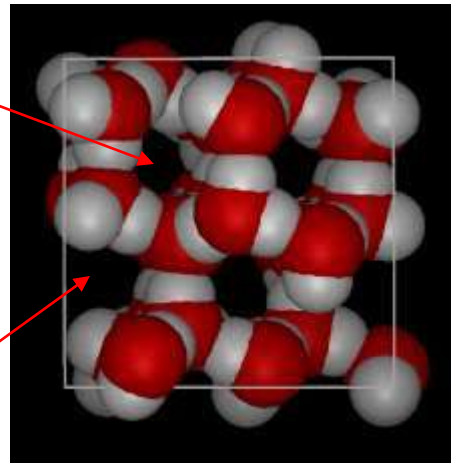
*States of Water

*As water changes from a liquid to a solid, molecules form crystals.

In ice crystals, molecules are spaced further apart.



Liquid



Solid (Ice)

*States of Water

*Since molecules are spaced further apart, ice is less dense than water (it floats)

Helpful for aquatic organisms; forms a "blanket"

If ice was more dense than water, lakes would freeze from the bottom upwards.

*Surface Tension

*Next to mercury, water has the highest surface tension of all liquids.

This is a result of the tendency of water molecules to attract to one another, or cohere, at the surface of any accumulation of water.

*Surface Tension

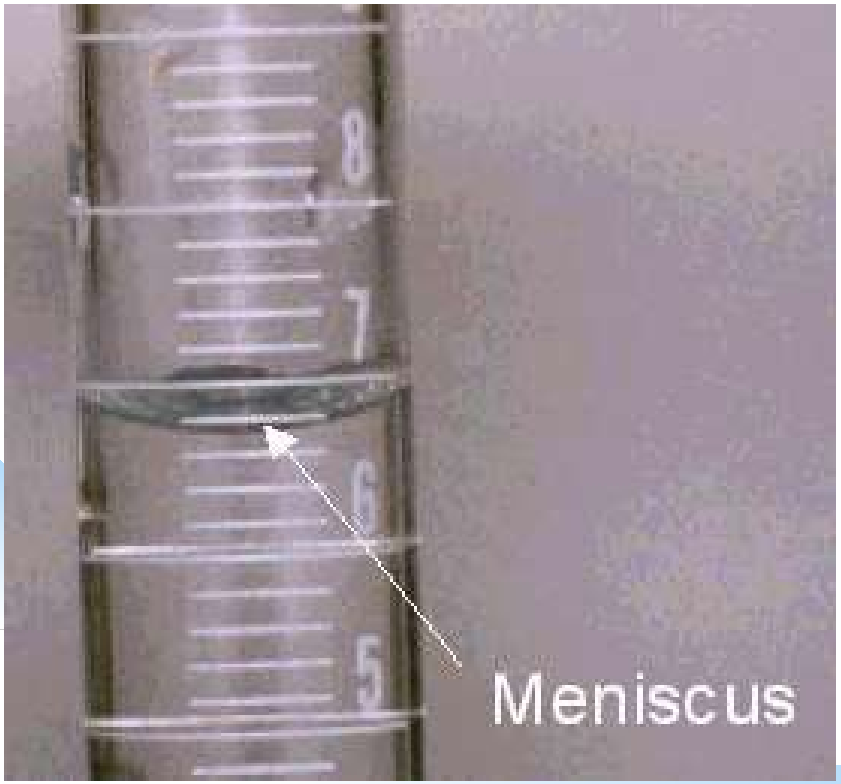
- *Surface tension allows insects to walk on water.
- *Interaction between hydrogen bonding and the earth's gravitational pull

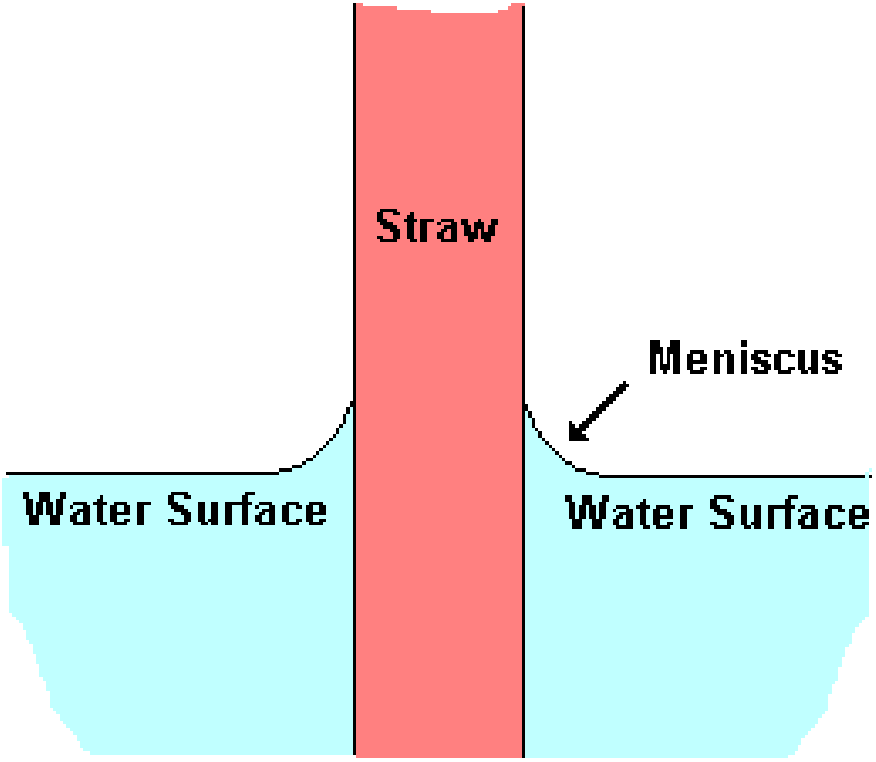
*Surface Tension

*Cohesion- the attraction between water molecules to each other through Hydrogen bonds (H)

*Surface Tension

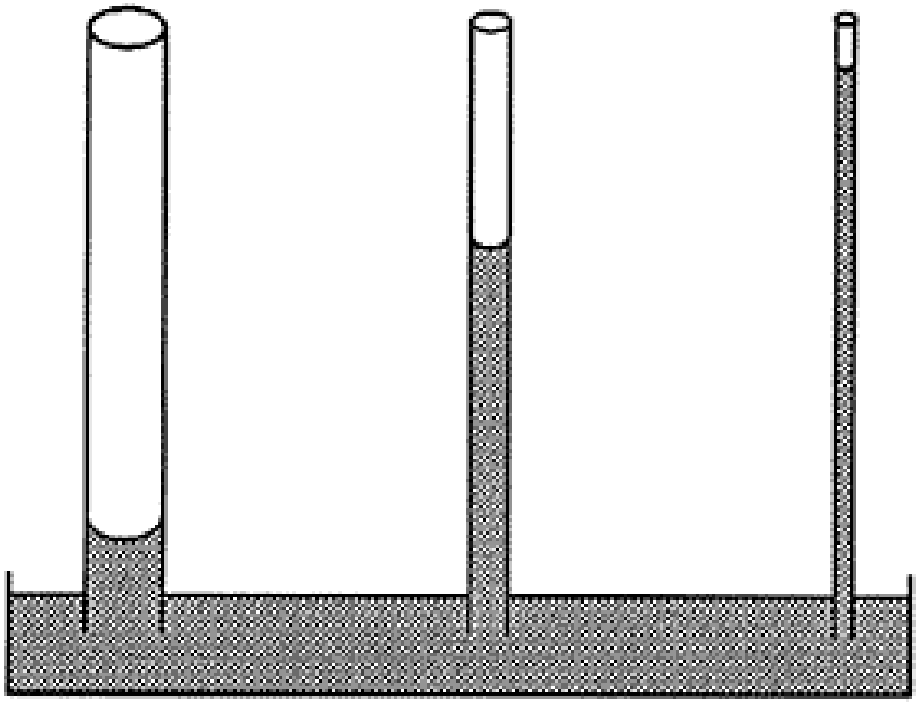
*Adhesion- the attraction of water molecules to another substance.





*Surface Tension

*Capillarity- the movement of water within the spaces of a porous material due to the forces of surface tension, adhesion, and cohesion.

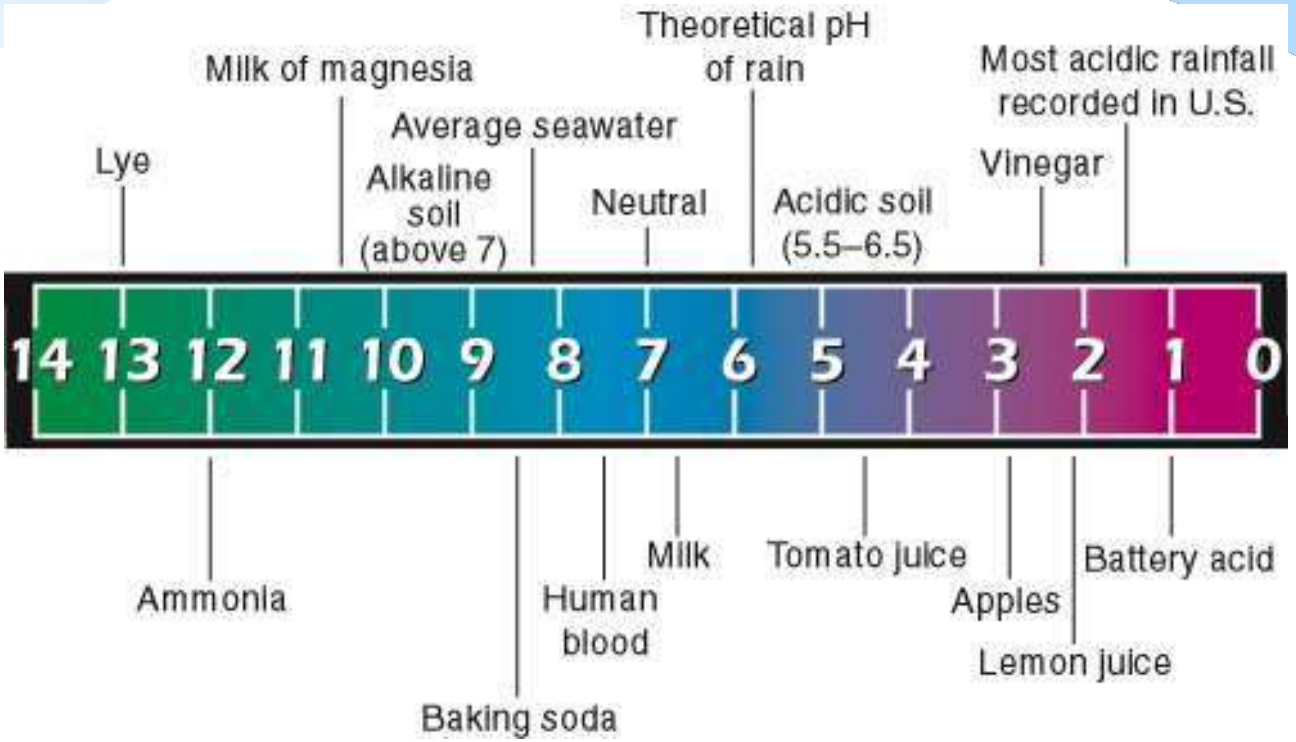


Allows water to climb from soil into plants

*pH: Alkalinity/Acidity

* The measurement of the H+ ions found in that particular substance
* The scale goes from 0 to 14
* 7 is neutral
* Below 7 is acidic
* Above 7 is alkaline (or basic)
* One pH unit represents a ten-fold change in H+ concentration

*The pH Scale


Theoretical pH of rain
Milk of magnesia
Most acidic rainfall recorded in U.S.
Average seawater
Lye
Alkaline soil (above 7)
Neutral
Acidic soil (5.5–6.5)
Vinegar
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Milk
Tomato juice
Battery acid
Ammonia
Human blood
Apples
Lemon juice
Baking soda

*Water as a Solvent

- *Since water can dissolve more things than any other natural substance, it is known as the " **Universal Solvent**"
- *Properties of Solvents include:
- *Interacts with other polar compounds
- *Is repelled by non-polar compounds
- *Small size allows it to saturate areas
- *Can convey other substances in solutions

*Water as a Solvent

*Water is especially good at dissolving salts

Salts form from the combination of particles with opposite electrical charges (or ions)

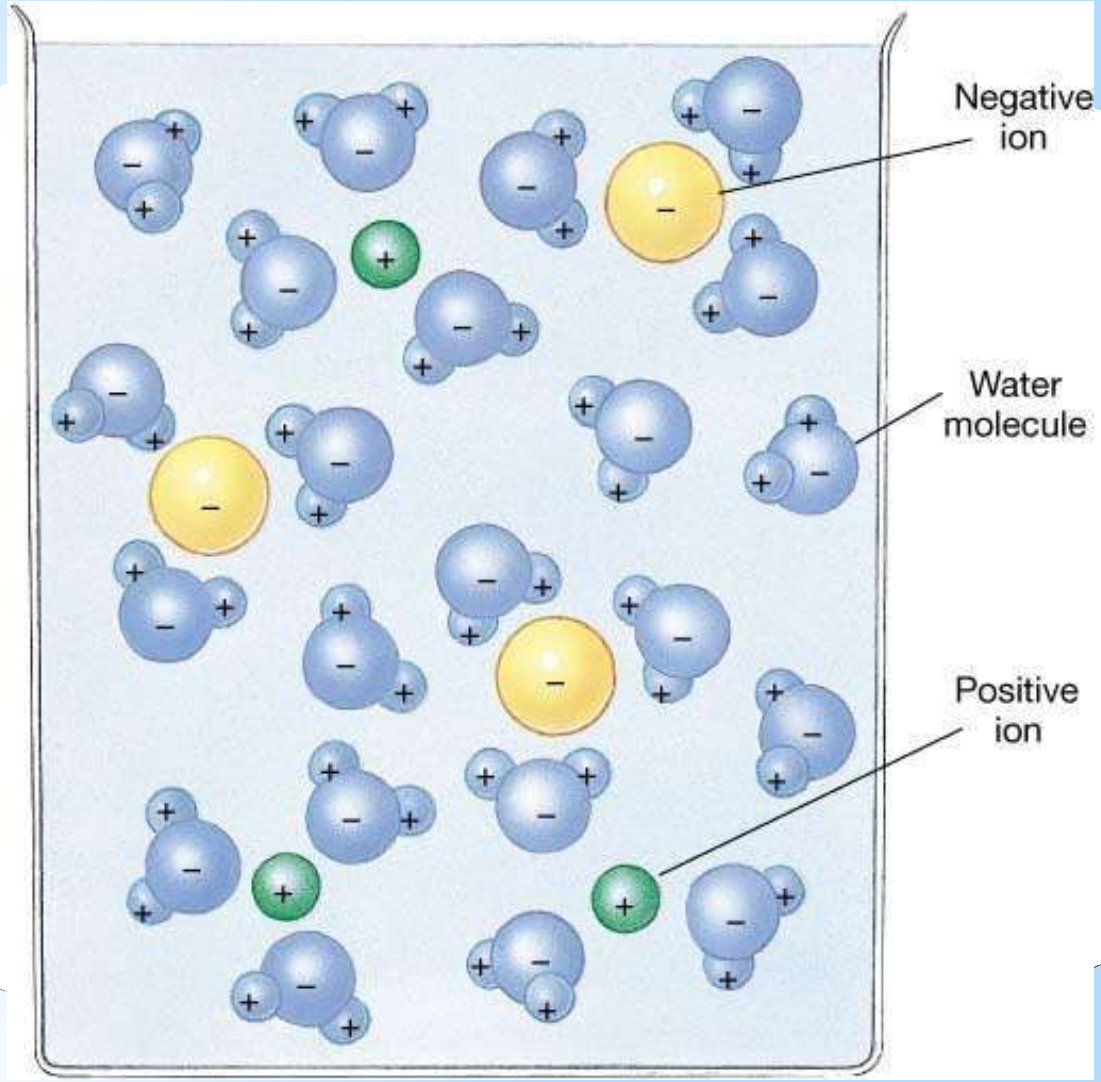
EX. $Na^{+} + Cl^{-} = NaCl$

*When salt is placed in water, the strongly charged salt ions attract to the weaker charged water molecules.

*Water molecules surround each ion.

*Salt crystals fall apart, or dissociates, and the salt dissolves.

*Water as a Solvent



*Physical and chemical properties of Marine water

*Terrestrial habitats exhibit extreme ranges in temperature and receive varying amounts of sunlight, precipitation, and wind.

*Additionally, they have other unique chemical and physical properties that make them suitable places for one species to live, but completely uninhabitable for another.

*So, too, oceanic habitats exhibit chemical and physical properties that make certain ocean zones suitable or unsuitable places for different species to live.

*In fact, chemical and physical properties of the ocean are crucial to the survival of marine organisms.

* This chapter addresses the chemical (salinity and dissolved gases) and physical (temperature, density, buoyancy, waves, tides, and currents) properties of ocean water that are delicately intermingled to produce one of the most self-sustaining life support systems on earth

* A. Salinity
* The ocean is salty. But what makes it salty when the water flowing into it is from freshwater rivers, streams, and precipitation?
* Freshwater rivers and streams weather, or slowly wear away, the rocks and soils they flow over as they make their descent from mountainous and other inland regions toward the ocean.
* Rocks and soils release inorganic salts and other chemical compounds as they are weathered by this continuous flow of water.
* These inorganic salts and other chemical compounds are finally deposited in the oceans at the end of their journey from far away inland places.
* Additionally, precipitation causes fresh water and chemical compounds to be released from the atmosphere into the oceans.

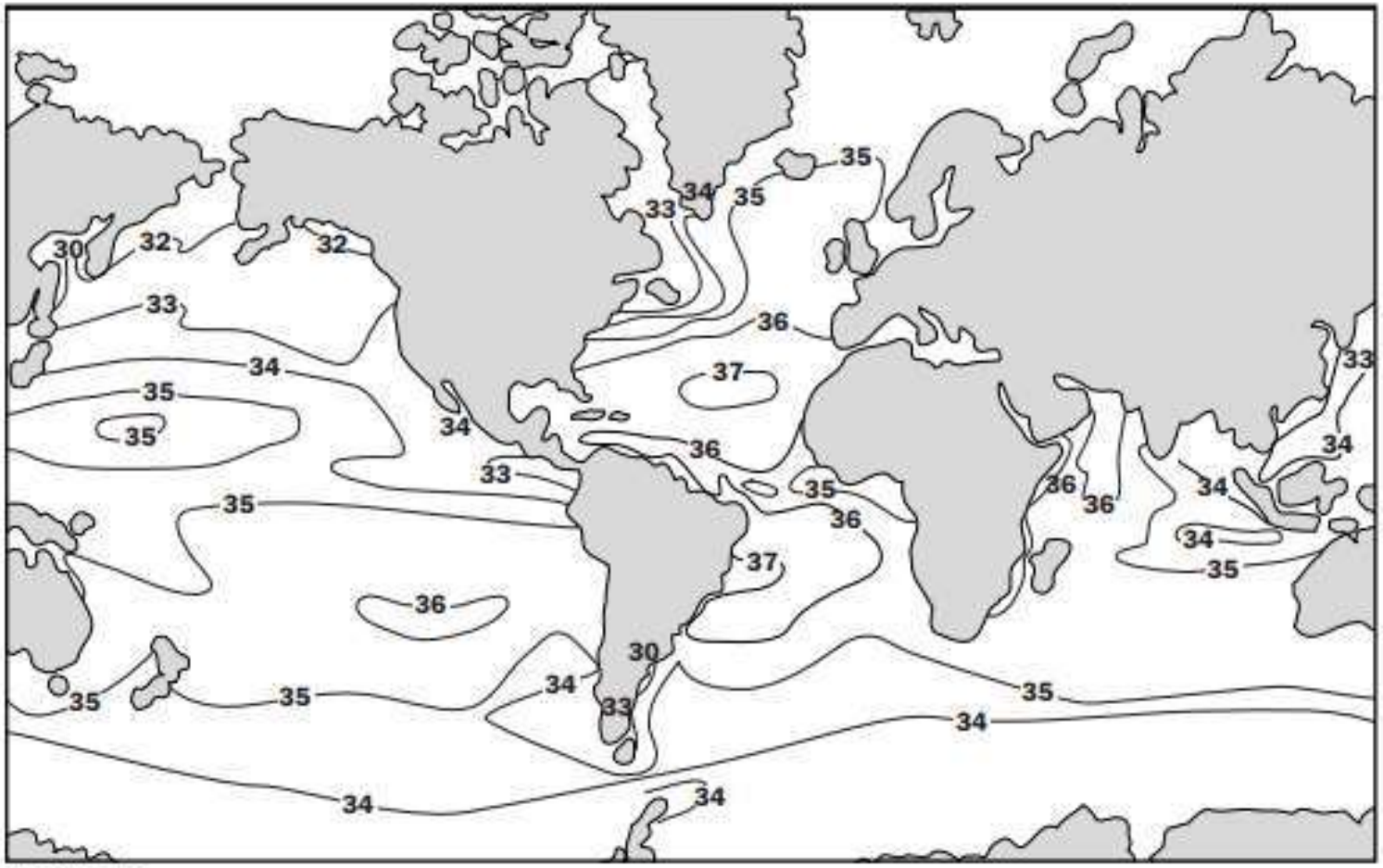


Figure 2-1.
Worldwide surface salinity distribution expressed in parts per thousand.

*B.Temperature

*Temperature is one of the most important
*physical factors affecting the distribution of life
*in the oceans. Additionally, temperature
*controls the rate at which organisms metabolize, or break down, food items into nutrients
*that they can use. Exchange of gases, such as
*oxygen (O2) and carbon dioxide (CO2), in the
*marine environment is greatly affected by

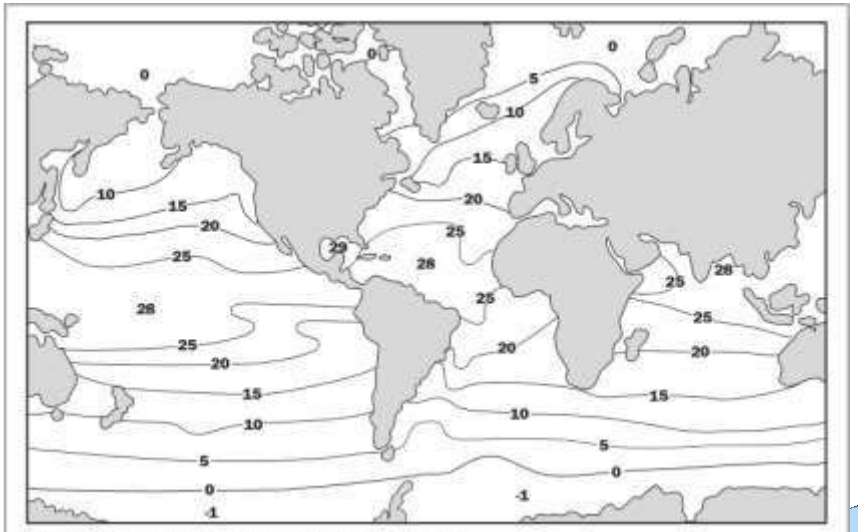


Figure 2-2. *Worldwide surface temperature distribution (in °C).*

*C. Density

*Variations in density, or the ratio of mass to volume, of the ocean are a function of salinity and temperature.

*Oceanic waters with higher salinities are more dense than oceanic waters with lower salinities.

* In other words, a liter of water with a salinity of 36‰ weighs more than a liter of water with a salinity of 32‰.

* Additionally, waters that have cooler temperatures have higher densities than waters with warmer temperatures.

*Ocean waters with higher salinities and cooler temperatures have the greatest densities.

*Dense water masses actually “sink” toward the ocean floor, while less dense ocean water masses “float” at or near the ocean’s surface

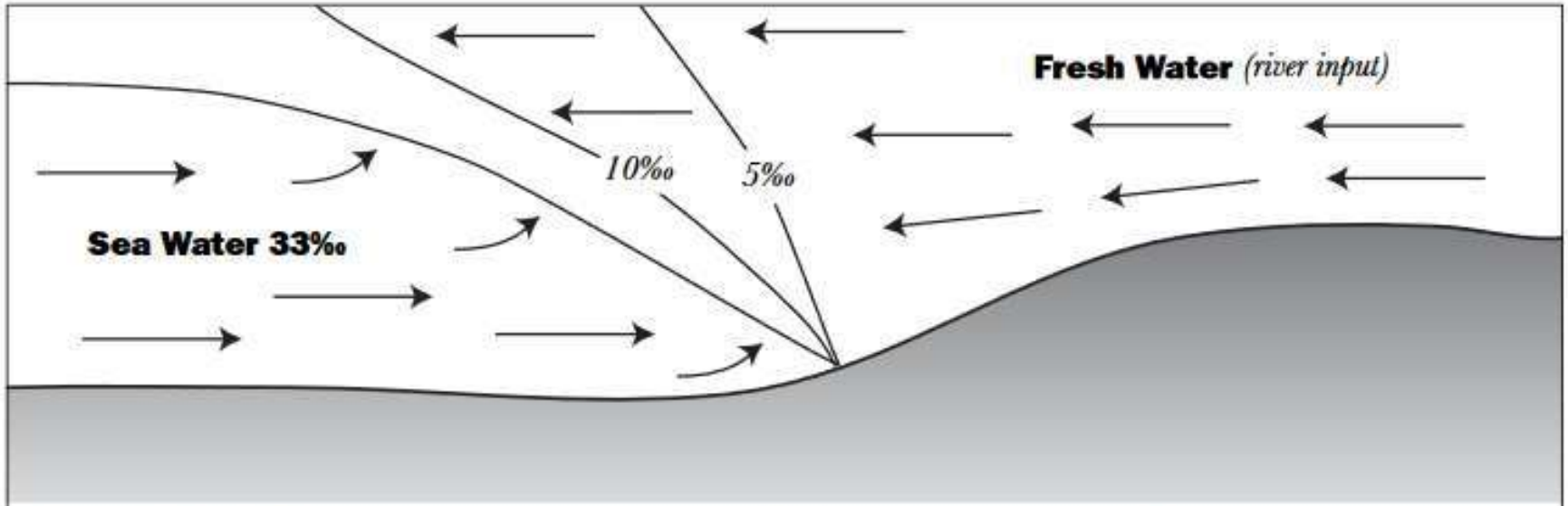


Figure 2-4. *Fresh water entering an estuary from a river is less dense than the salt water. In some estuaries, a wedge of denser salt water is created as the fresh water overrides denser water.*

*D. Buoyancy

* Just as water masses with different densities either sink below or float on top of one another, objects that are denser than water sink while objects that are less dense than water float.
* Buoyancy is defined as the ability to remain afloat in a liquid.
* Because salt water is more dense than fresh water, salt water provides greater buoyancy to an object floating on the surface than does fresh water.

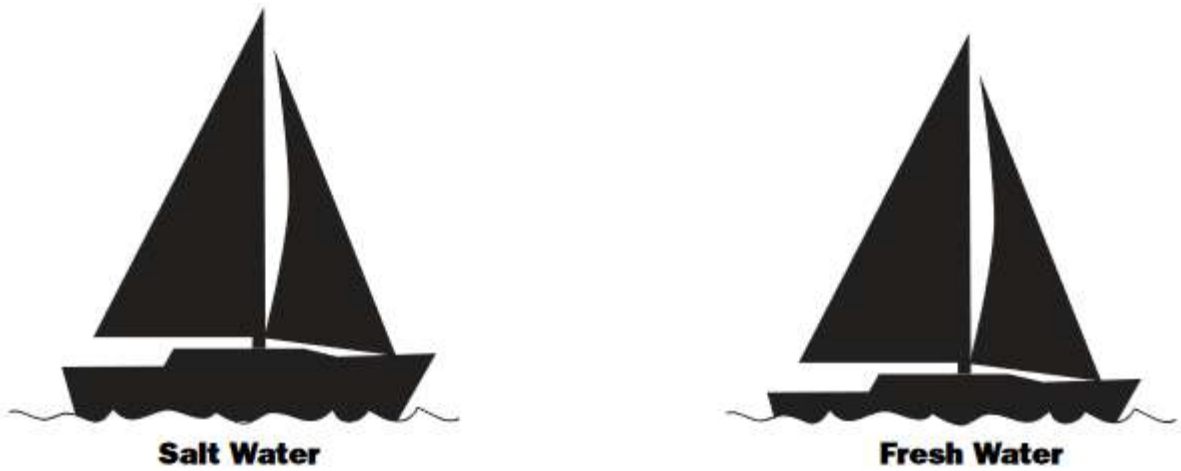


Figure 2-5. *An object is more buoyant in salt water than in fresh water.*

* **F. Waves**
* Wind is a form of energy. Wind energy blowing along the surface of the ocean is transferred to the ocean as waves and
* currents (also see Section H).
* Waves originate in the open ocean and, in many cases,the waves we see along the coast were generated far away at sea (Fig. 2-7).
* The size of a wave depends on 3 factors: (1) the velocity of the wind, (2) the wind's duration,or the length of time the wind blows, and (3)fetch, or the distance of the ocean over which the wind is blowing.
* The harder the wind blows and the longer it blows, the greater its velocity and duration and the larger the waves.
* The longer the fetch, the larger the waves that are produced

Figure 2-7.
Plunging waves on a beach.

* Water quality Parameters

Physical

* >Temperature
* >Light
* >Turbidity

Chemical

* >Dissolved oxygen (DO)
* >pH
* >Salinity
* >Co2
* >Ammonia

Biological

Water quality parameter

- are considered of primary importance to the quality of drinking water
- the EPA drinking water standards are categorized as primary drinking water standards and secondary drinking water standards
- Primary drinking water standards regulate organic and inorganic chemicals, microbial pathogens, and radioactive elements that may affect the safety of drinking water
- Secondary drinking water standards regulate chloride, colour, copper, corrosivity, foaming agents, iron, manganese, odour, pH, sulfates, total dissolved solids, and zinc, all of which may affect qualities of drinking water like taste, odour, colour, and appearance.

*Temperature

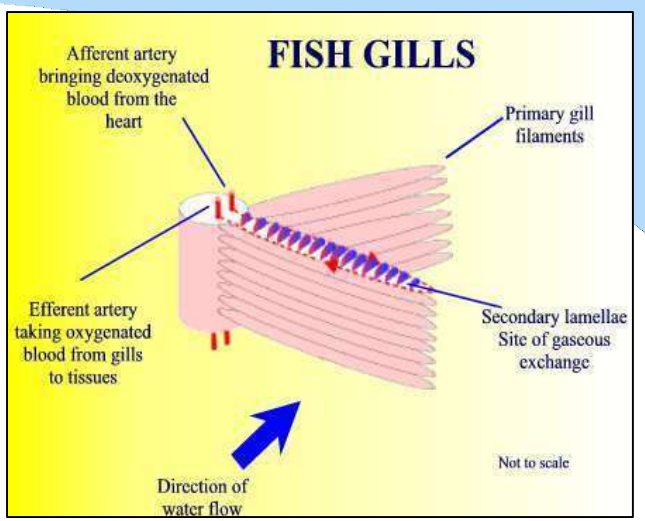
- *Temperature affects physical, chemical, and biological processes in water
  - *Chemical example: DO decreases as temperature increases
  - *Biological example: fish seek *thermal refuges*
- *Temperature affected by depth
  - *Causes lake turnover
- *Loss of streamside shade trees causes temperature to increase

*Dissolved Oxygen

- *Atmosphere consists of 21% O_2
- *Water consists of <1% O_2
- *When water and atmosphere come into *intimate* contact, O_2 tends to diffuse into water
  - *Occurs as water passes over riffles, rapids, and falls and to a lesser extent in still water
- *Aquatic plants also pump O_2 into water
  - *During daytime when they are undergoing *photosynthesis*

*Dissolved Oxygen

- *Fish depend on DO in water
  - *O_2 diffuses from water to blood in gills
- *When DO concentrations in water drop below 5 milligrams per liter (mg/L) most fish have trouble



*pH

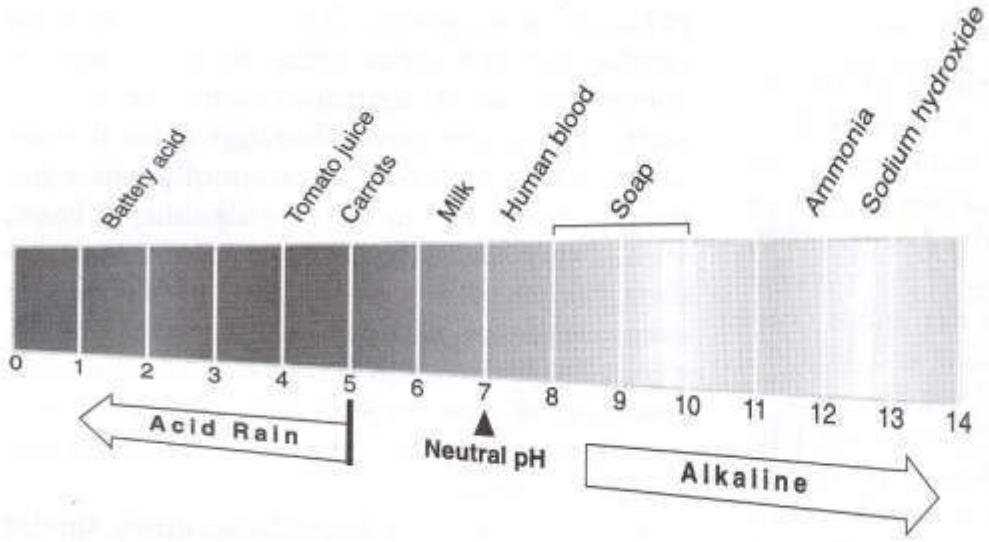
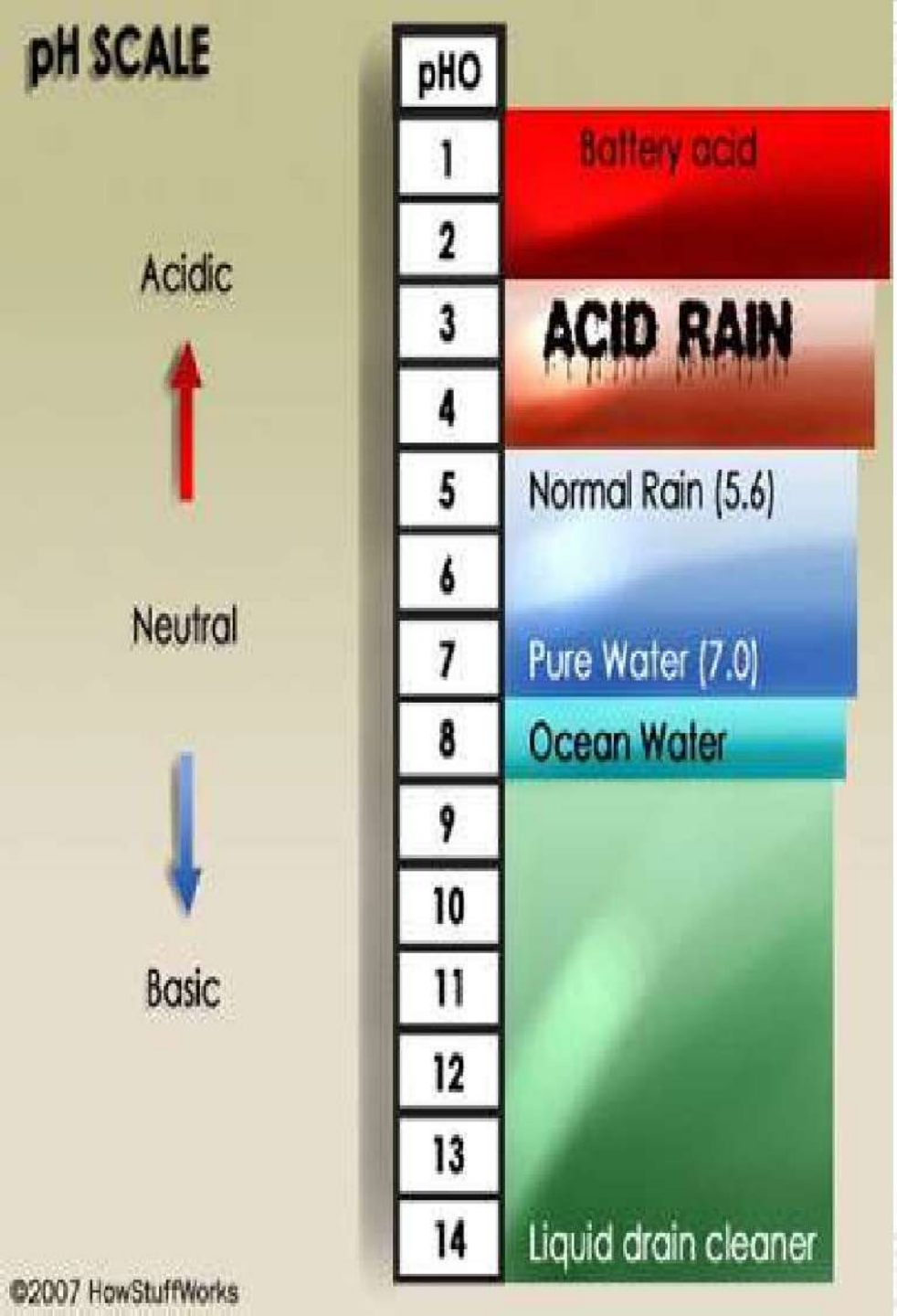


FIG. 5.2. pH is a measure of the amount of hydrogen ions in solution and is equal to the negative logarithm of the hydrogen ion concentration. The term *pH* is from the French *pouvoir hydrogene*, meaning "power of hydrogen." The common pH scale extends from 0 to 14 and covers the range of pH of most common solutions. A few extremely acidic solutions, such as concentrated battery acid, can have a negative pH, and a few highly caustic (basic) solutions have pH values of 15 or higher.



Concentration of Hydrogen ions compared to distilled water		Examples
10,000,000	pH 0	Battery acid
1,000,000	pH 1	Hydrochloric acid
100,000	pH 2	Lemon juice, vinegar
10,000	pH 3	Grapefruit, soft drink
1,000	pH 4	Tomato juice, acid rain
100	pH 5	Black coffee
10	pH 6	Urine, saliva
1	pH 7	"Pure" water
1/10	pH 8	Sea water
1/100	pH 9	Baking soda.
1/1,000	pH 10	Great Salt Lake
1/10,000	pH 11	Ammonia solution
1/100,000	pH 12	Soapy water
1/1,000,000	pH 13	Bleach
1/10,000,000	pH 14	Liquid drain cleaner

*pH

- *pH = power of 10 for the H ion concentration (drop the minus sign)
- *Pure distilled water has a pH of 7 (neutral)
  - * $1 \times 10^{-7} = 0.0000001$ moles H^+ per liter
- *Most rivers and lakes have a pH of 4 to 9
- *Fish have a narrow range that varies by species
  - *pH outside the range can cause damage to gills, eyes, skin, etc.

*Turbidity

- *Clarity of water
- *Measured as light penetration in nephelometric turbidity units (NTU)
- *Also measured with a Secchi disk
  - *Record the depth at which you can no longer see the banded colors on the disk

FIG. 5.3. A Secchi disk provides valuable data on turbidity. Markings on the rope indicate depth to the scientist.

Secchi disk depth comparison from clear (left) to murky (right)
http://earthobservatory.nasa.gov/Study/WaterQuality/water_quality2.html

*Water Pollution

- Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater).
- Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.
- Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities.

* Water Pollution:-statistical data

- Water pollution is a major global problem which requires on-going evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells).
- It has been suggested that it is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily.
- An estimated 700 million Indians have no access to a proper toilet, and 1,000 Indian children die of diarrheal sickness every day.
- Some 90% of China's cities suffer from some degree of water pollution, and nearly 500 million people lack access to safe drinking water.
- In the most recent national report on water quality in the United States, 45 percent of assessed stream miles, 47 percent of assessed lake acres, and 32 percent of assessed bays and estuarine square miles were classified as polluted.

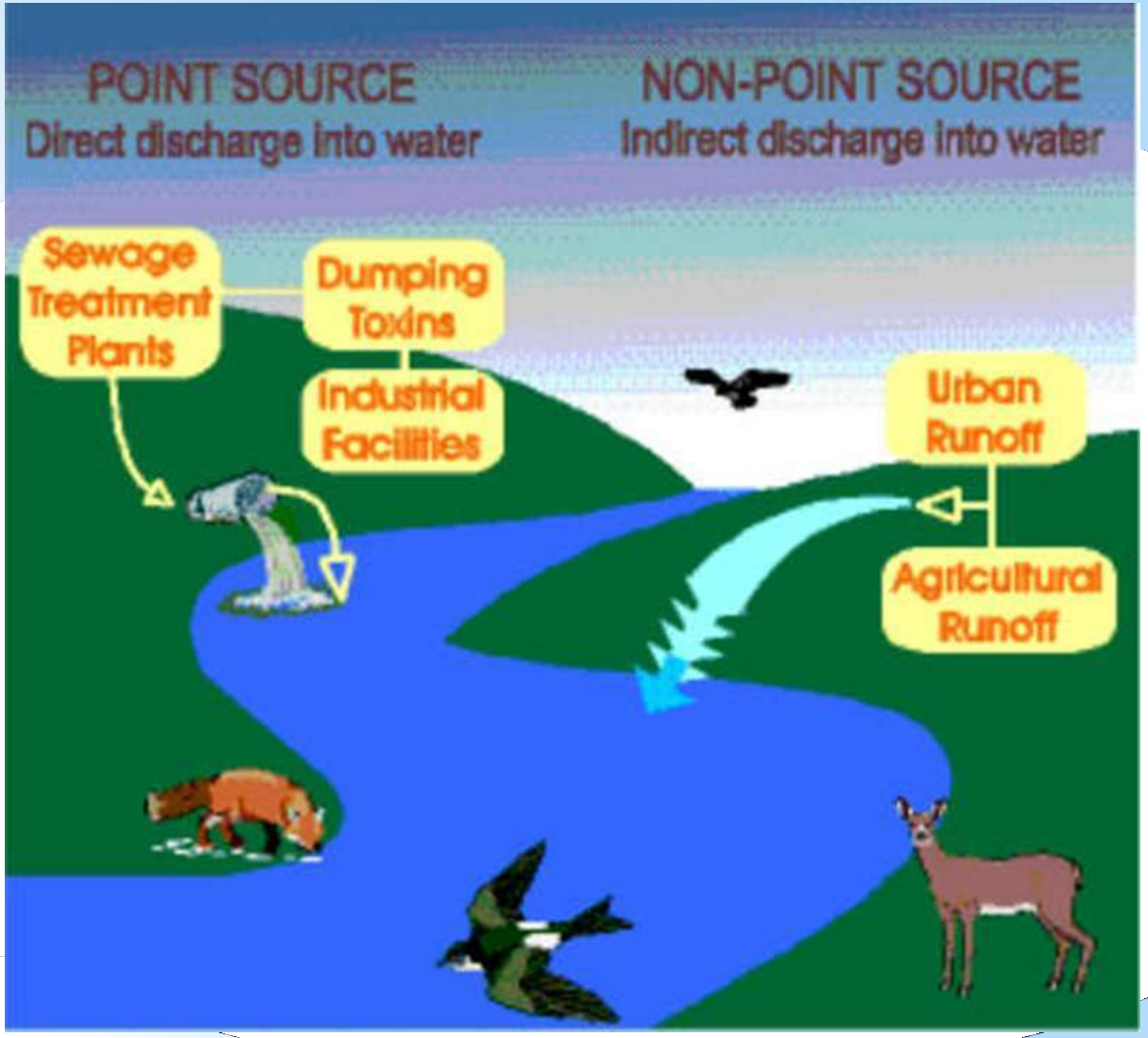
*Sources:

- **Point Source:**
  - Point source water pollution refers to contaminants that enter a waterway from a single, identifiable source, such as a pipe or ditch.
  - Ex: Discharges from a sewage treatment plant, a factory, or a city storm drain.

Non Point Source:

* Nonpoint source (NPS) pollution refers to both water and air pollution from diffuse sources.
* Nonpoint source water pollution affects a water body from sources such as polluted runoff from agricultural areas draining into a river, or wind-borne debris blowing out to sea.
* Nutrient runoff in storm water from "sheet flow" over an agricultural field or a forest are also cited as examples of NPS pollution.
* Contaminated storm water washed off of parking lots, roads and highways, called urban runoff, is sometimes included under the category of NPS pollution. However, this runoff is typically channelled into storm drain systems and discharged through pipes to local surface waters, and is a point source

* Diagrammatic Representation :



* Ground Water:

- It constitutes to about 6.2% of total water available on earth – 30 time more than surface water
- Ground water is less prone to pollution – soil mantle acts as cation exchanger to retain various contaminants.
- Potential sources of ground water pollution – septic tanks, industry (textile, tanneries), deep well injection, mining etc.
- Ground water contaminated with arsenic, fluoride and nitrate is a serious health hazard

* Surface Water:

- Sewage, Industrial effluents – toxic chemicals
- Synthetic detergents, Agrochemicals, Oil and
- Waste heat

*Effects:

Oxygen demanding wastes:

*Organic matters reaching water bodies are decomposed by micro-organisms present in water

*Degradation is aided by the dissolved O2 in water

*Dissolved Oxygen (DO) – amount of oxygen dissolved in a given quantity of water at a particular temperature and atmospheric pressure

*Amount of DO depends on aeration, photosynthetic activity in water, respiration of animals and plants and ambient temperature

*Saturation value of DO varies from 8-15 mg/L

*Fishes require 5-8 mg/L and for species like crap – 3 mg/L

*Lower DO value harmful to species existence, oxygen depletion (deoxygenation) releases phosphates from bottom sediments – causing eutrophication.

- **Nitrogen and Phosphorous compounds (nutrients)**
  - Addition of nitrogen and phosphorous containing compounds – aids growth of algae and other plants – die and decay consume oxygen of water
  - Anaerobic conditions produce foul smelling gases
  - Excess growth or decomposition of plant material changes the concentration of CO_2 – alternation of water pH
  - Changes in water pH, oxygen and temperature will change many physico-chemical characteristics of water
- **Pathogens**
  - Wastewater (sewage) contain many pathogenic (disease causing) and non-pathogenic micro-organisms and many viruses.
  - Water borne disease – cholera, dysentery, typhoid, jaundice etc., are spread through contamination

Toxic compounds

- Pollutants such as heavy metals, pesticides, cyanides etc., are harmful to aquatic organisms
- The demand of DO increases with addition of biodegradable organic matter which is expressed as biological oxygen demand (BOD)
- BOD – amount of DO required to aerobically decompose biodegradable organic matter of a given volume of water over a period of 5 days at 20 deg C
- More BOD value – poor water quality
- Non-biodegradable compounds like Pesticides and Mercury results in bioaccumulation – subsequently to biomagnification. **E.g. DDT in food chain**

- Mercury toxicity (methyl mercury, lipid soluble) - minamata disease to humans – through consumption of fishes – leading to paralysis
- Cadmium toxicity – Itai-Itai disease – consumed through rice contaminated with Cd – irrigation water containing effluents from smelters and mine drainage – bones, liver, kidney, lungs, pancreas and thyroid are affected
- Arsenic pollution in Bangladesh and West Bengal – Leprosy like skin disease
- Excess nitrate – Blue baby syndrome or methaemoglobinemia
- Excess fluoride – Fluorosis – Defects in teeth and bones

* Control:

- **Point source pollution control:**
  - Waste water treatment
  - Advance sewage treatment
- **Non Point source pollution control:**
  - Judicious use of agrochemicals – reduces surface runoff and leaching – avoid using on sloped lands
  - Nitrogen fixing plants to supplement the fertilizer use
  - Adopting integrated pest management
  - Prevent run-off of manure – nutrient rich water can be used as fertilizers in the fields
  - Separate drainage of sewage and rainwater
  - Planting trees – reduces pollution by sediments and also prevents soil erosion

*Waste water treatment

*Preliminary treatment

*Primary(or)settling process

*Secondary (or)biological process

i)trickling filter process

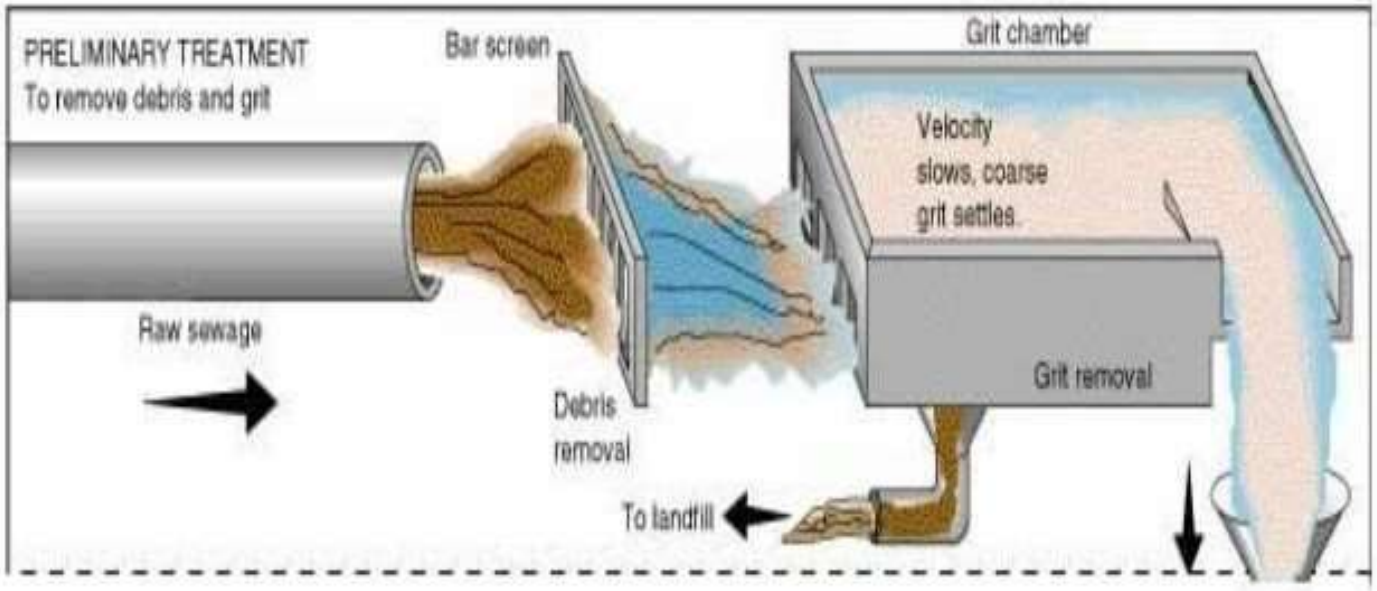
ii)activated sludge process

*Tertiary treatment

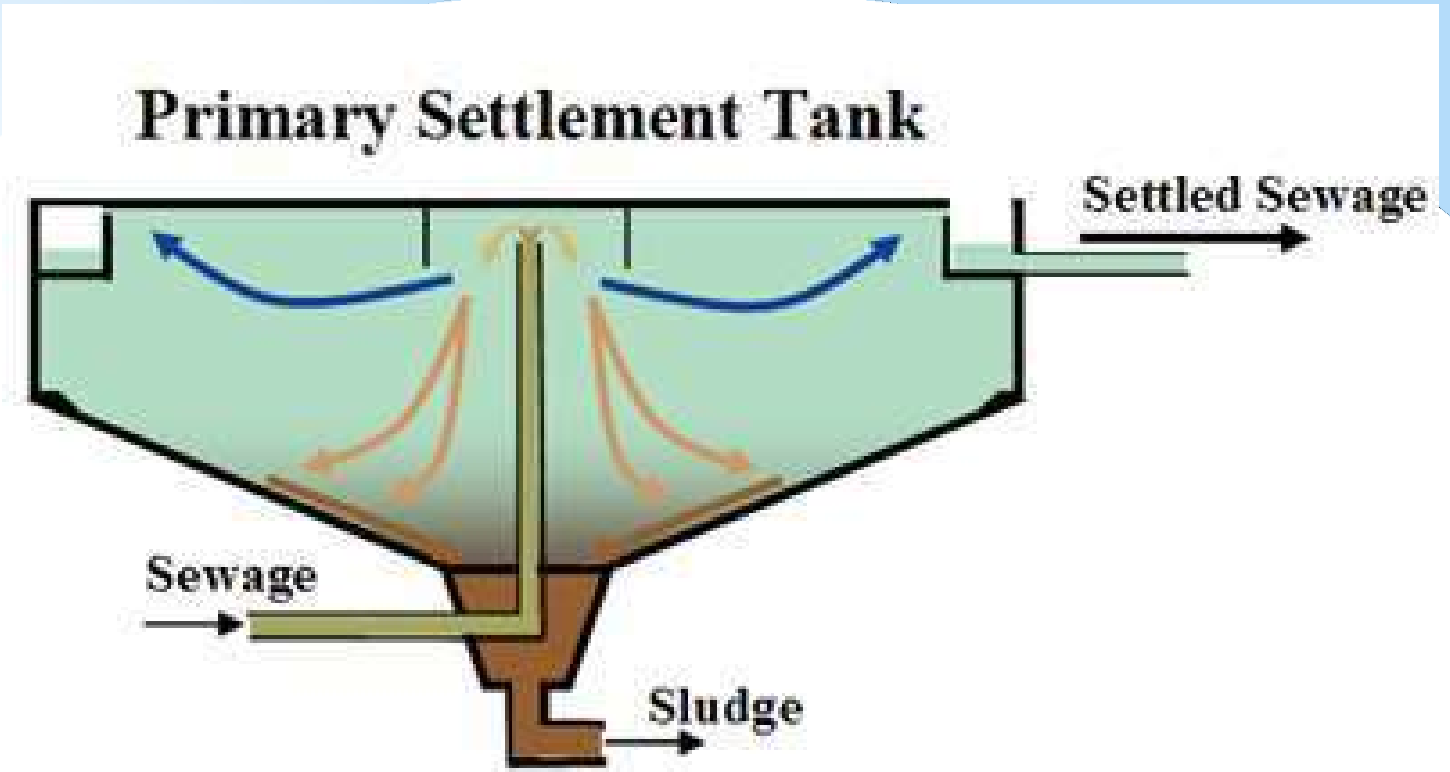
*Disposal of sludge

Step 1

Preliminary Treatment

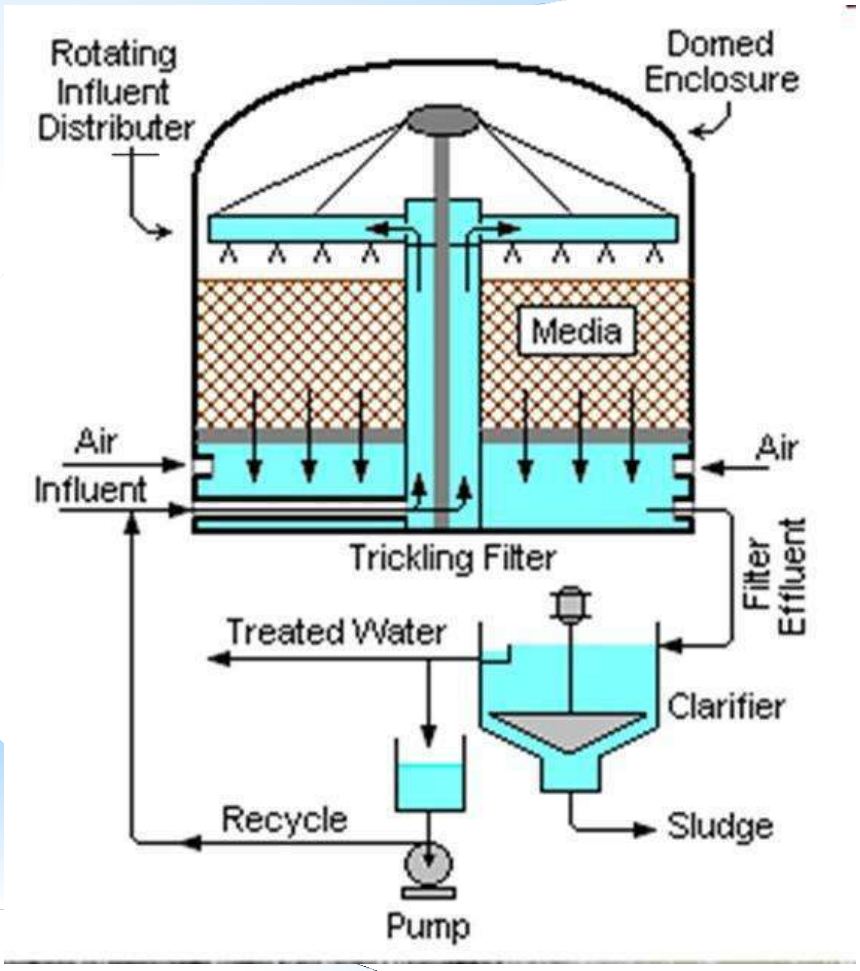


Step 2



* Secondary (or)Biological process

i)Trickling filter process



Step 3

*ii)Activated sludge process

* Soil Pollution:

- Soil contamination or soil pollution is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment.
- It is typically caused by industrial activity, agricultural chemicals, or improper disposal of waste.
- The most common chemicals involved are petroleum hydrocarbons, polynuclear aromatic hydrocarbons (such as naphthalene and benzo(a)pyrene), solvents, pesticides, lead, and other heavy metals. Contamination is correlated with the degree of industrialization and intensity of chemical usage.
- The concern over soil contamination stems primarily from health risks, from direct contact with the contaminated soil, vapours from the contaminants, and from secondary contamination of water supplies within and underlying the soil.

* Causes:

- Application of pesticides and fertilizers
- Mining
- Oil and fuel dumping
- Disposal of coal ash
- Leaching from landfills
- Drainage of contaminated surface water into the soil
- Discharging urine and faeces in the open

* Effects:

- Soil pollution by sewage and industrial effluents – affects human health
- Alkalis, pesticides, insecticides, heavy metal industrial discharge affects soil fertility – by changing the physical, chemical and biological properties of soil
- Reduction in soil productivity – by inhibition of non-target organisms, soil flora and fauna by persistent toxic chemicals
- Accumulation of chemical in food chain
- Sewage sludges contains pathogenic bacteria, viruses and intestinal worms

- Decomposing organic matter in soil produces toxic vapours.
- Radioactive fallout on vegetation – enters food chain. Radio isotopes replaces essential elements resulting in abnormalities
  - E.g. Sr-90 replacing Ca in bones and tissue results in brittle bones – prone to fractures
- Nitrogen and phosphorous from fertilizers in soil reaches water bodies resulting in eutrophication
- Ground water contamination – percolation of chemicals in soil

BIG MONEY IN PHARMA BUSINESS

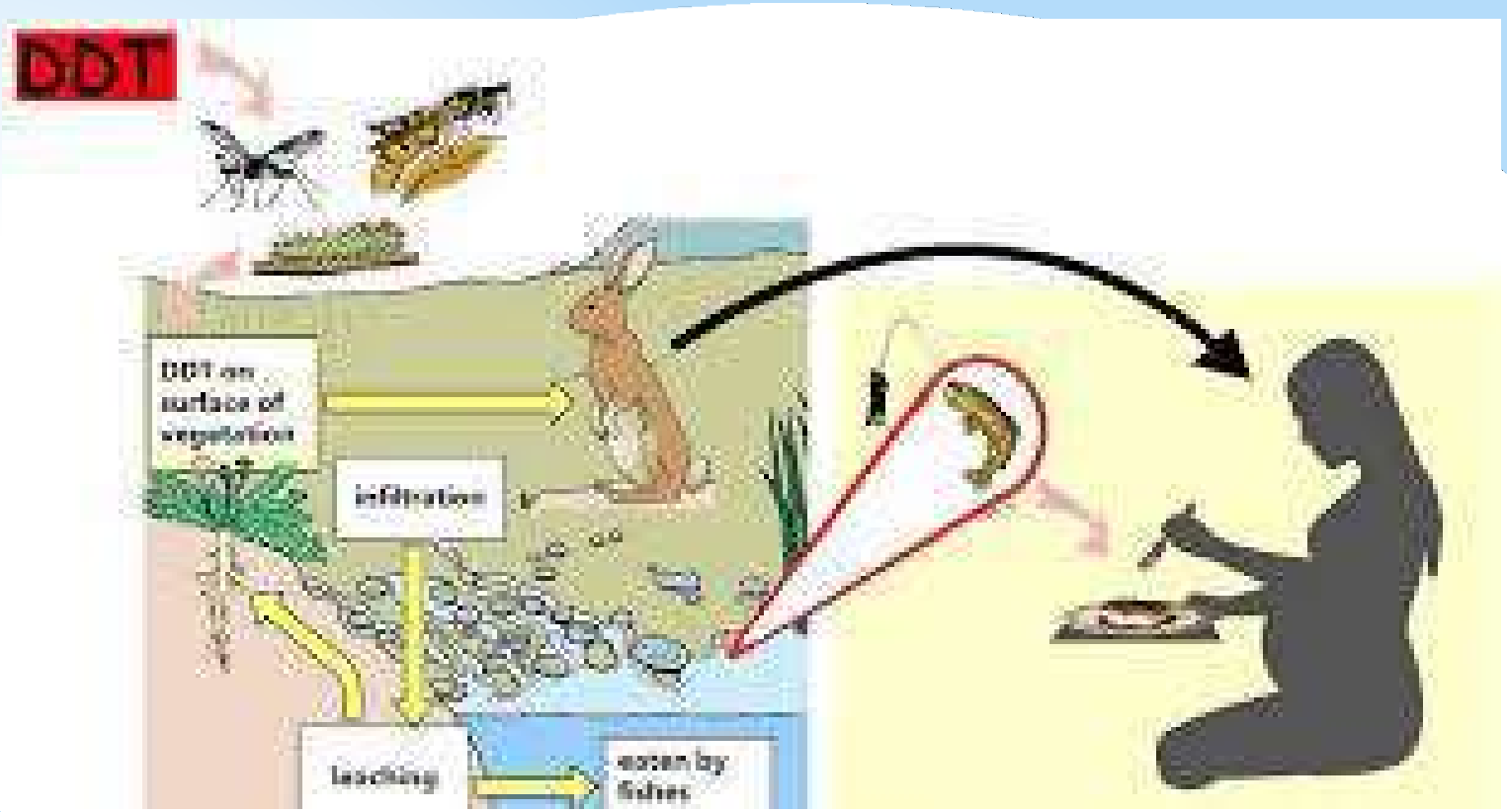
Top 10 pharmaceutical deals in the recent past

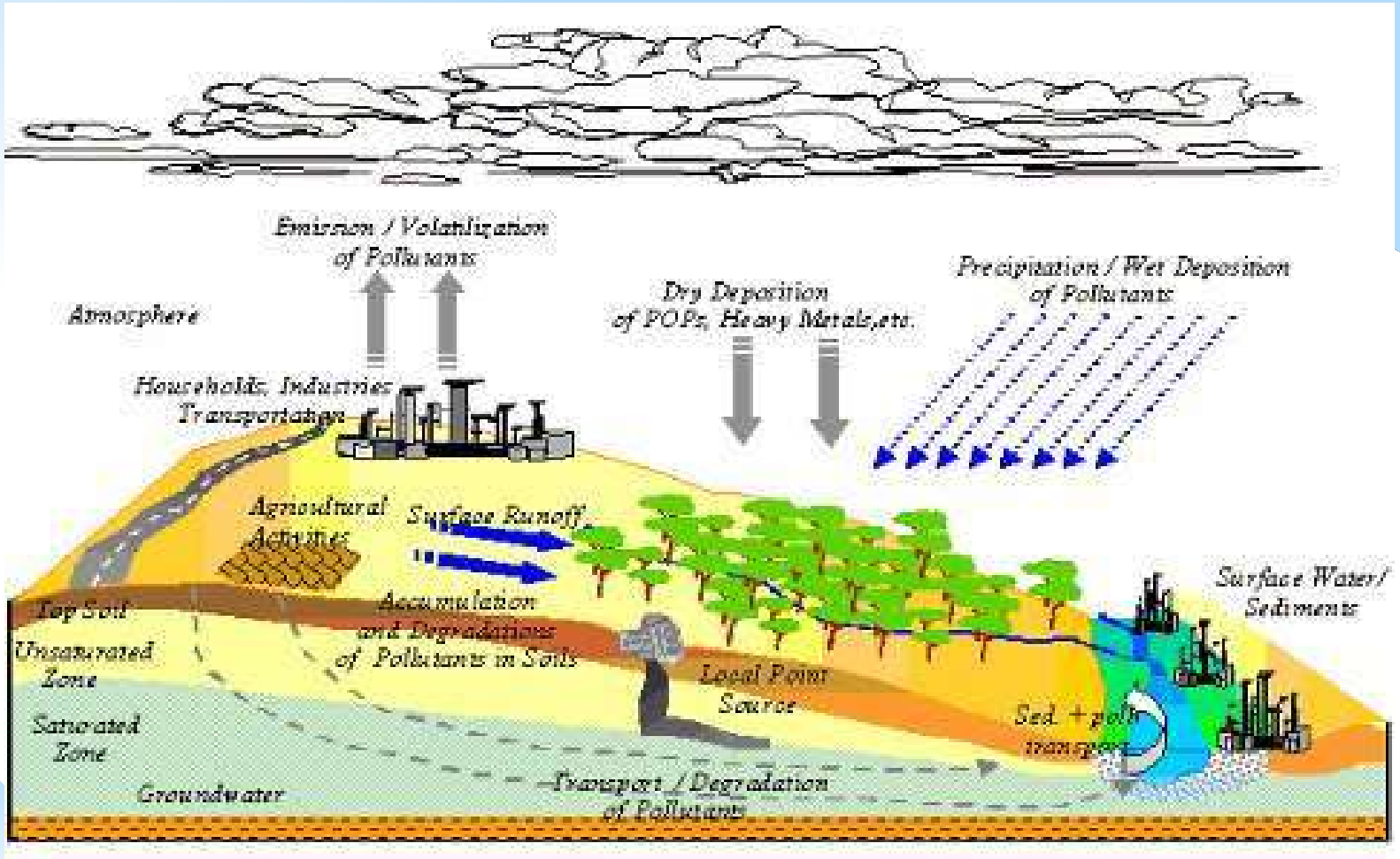
Teva is buying the generic drug business of Allergan for $40.5 billion in cash and stock. This makes it the second-largest deal in the sector in recent times. A look at the some major deals:

Target/Date announced	Deal value ($ bn)	Acquirer
Allergan Nov 17,'14	66.4	Actavis PLC
Mylan NV Apr 21,'15	40.0	Teva Pharmaceuticals
Perrigo Co PLC Apr 8,'15	29.9	Mylan
Pharmacydics Mar 4,'15	19.9	AbbVie Inc
Hospira Feb 5,'15	16.8	Pfizer Inc
GlaxoSmithKline PLC-Oncology Apr 22,'14	16.0	Novartis AG
Salix Pharmaceuticals Feb 22,'15	15.9	Valeant
Merck & Co (consumer care) May 6,'14	14.2	Bayer AG
Cubist Pharmaceuticals Dec 8,'14	8.5	Merck & Co
Abbott Labs (non-US markets) Jul 14,'14	5.5	Mylan

Source: Thomson Reuters


தமிழ்நாடு
வனத் துறை
சதுப்புநில வனப்பகுதி
பள்ளிக்கரணை
அரசு ஆணை எண் : 52 [FR-14]
பறவைகளை காப்போம்
சதுப்புநிலம் மேம்பட
குப்பைகளை தவிர்ப்பீர்


DDT
DDT on surface of vegetation
infiltration
leaching
eaten by fishes


Emission / Volatilization of Pollutants
Atmosphere
Dry Deposition of POPs, Heavy Metals,etc.
Precipitation / Wet Deposition of Pollutants
Households, Industries Transportation
Agricultural Activities
Surface Runoff
Top Soil
Unsaturated Zone
Accumulation and Degradations of Pollutants in Soils
Local Point Source
Surface Water/ Sediments
Sed. + poll. transport
Saturated Zone
Groundwater
Transport / Degradation of Pollutants

* Control:

- Proper treatment of effluents before discharge
- Proper collection and disposal of solid waste
- Recovery of useful products from waste
- Generation of biogas from biodegradable organic waste
- Methane generation from cattle dung – biogas plant
- Microbial degradation of biodegradable substances

* SOLID WASTE MANAGEMENT

*OVERVIEW

- *Kinds of Wastes
- *Waste Generation
- *Solid Waste in India
- *Solid Waste management methods

*What are Wastes?

Waste (also known as **rubbish**, **refuse**, **garbage**, **junk**) is unwanted or useless materials. In biology, waste is any of the many unwanted substances expelled from living organisms, metabolic waste; such as urea and sweat.

*Kinds of Wastes

Solid wastes: wastes in solid forms, domestic, commercial and industrial wastes Examples: *plastics , bottles, cans, papers, scrap iron, and other trash*

Liquid Wastes: wastes in liquid form Examples: *domestic washings, chemicals, oils, waste water from ponds, manufacturing industries and other sources.*

Bio-degradable :can be degraded (paper, wood, fruits and others)

Non-biodegradable :cannot be degraded (plastics, bottles, old machines, cans, Styrofoam containers and others)

Hazardous wastes: Substances unsafe to use commercially, industrially, agriculturally, or economically and have any of the following properties- ignitability, corrosivity, reactivity & toxicity.

Non-hazardous : Substances safe to use commercially, industrially, agriculturally, or economically and do not have any of those properties mentioned above. These substances usually create disposal problems.

* Classification of wastes according to their origin and type

- **Municipal Solid wastes:** Solid wastes that include household garbage, rubbish, construction & packaging materials, trade refuges etc. are managed by any municipality.
- **Bio-medical wastes:** Solid or liquid wastes including containers, products generated during diagnosis, treatment & research activities of medical sciences.
- **Industrial wastes:** Liquid and solid wastes that are generated by manufacturing & processing units of various industries like chemical, petroleum, coal, metal gas, sanitary & paper etc.
- **Agricultural wastes:** Wastes generated from farming activities. These substances are mostly biodegradable.
- **Fishery wastes:** Wastes generated due to fishery activities.
- **E-wastes:** Electronic wastes generated from any modern establishments. They may be described as discarded electrical or electronic devices. Some electronic scrap components, such as CRTs, wires, circuits, mobile, computers etc.

*Sources of Wastes

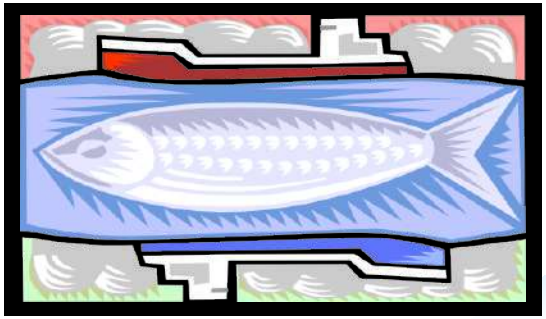
Households

Industry

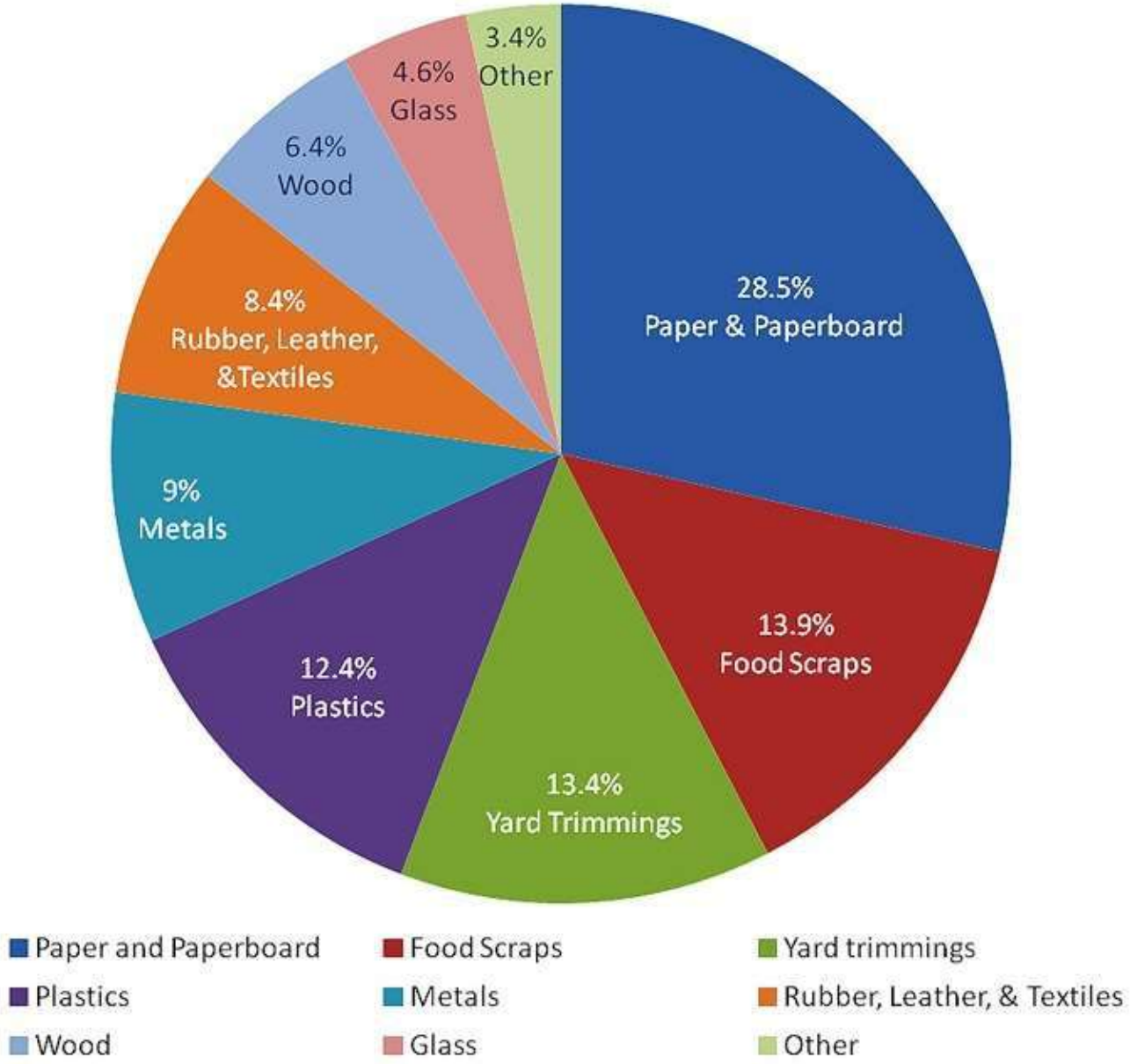
*Sources of Wastes

Agriculture

Fisheries



Sources of Wastes



*STRUCTURE OF SOLID WASTE

Solid Waste

- Refuse
  - goods,
  - Garbage
    - Vegetables, Meats, food Wastes and other readily Degradable organic wastes
  - Rubbish
    - non-degradable (glass, rubber, Metals, plastics non-metal set)
    - slowly degradable (paper, wood Products, textiles etc.)
- Trash
  - Bulky wastes (TV, refrigerators
  - Broken furniture, etc.)

WASTE GENERATIONS RATES OF SOME ASIAN COUNTRIES

Country	GNI[a]	Waste generation [kg/capita day]	Reference
Nepal	240	0.2 - 0.5	(UNEP, 2001)
Cambodia	260	1.0	(Yem, 2001)
Lao PDR	290	0.7	(Hoornweg, 1999)
Bangladesh	370	0.5	(Hoornweg, 1999)
Vietnam	390	0.55	(Hoornweg, 1999)
Pakistan	440	0.6 - 0.8	(World Wildlife Fund, 2001)
India	450	0.3 - 0.6	(Ahmed, 2000; Akolkar, 2001)
Indonesia	570	0.8 - 1.0	(Mukawi, 2001)
China	840	0.8	(Hoornweg, 1999)
Sri Lanka	850	0.2 - 0.9	(Jayatilake, 2001; Hoornweg, 1999)
Philippines	1040	0.3 - 0.7	(World Bank, 2001)
Thailand	2000	1.1	(Hoornweg, 1999)

MSW GENERATION FROM THE METROPOLITANS OF INDIA

State/Union Territory	*City*	*Urban Population in Lakhs (2001)*	*MSW generated (MT/day)*
Andhra Pradesh	Hyderabad	3829753	957
Andhra Pradesh	Visakhapatnam	982904	246
Bihar	Patna	1961532	588
Delhi	New Delhi	350000	272
Delhi	Delhi	13363471	6000
Gujarat	Ahmedabad	4215497	1265
Gujarat	Surat City	2433835	730
Gujarat	Vadodara	1491045	447
Karnataka	Bangalore	1304008	326
Kerala	Kochi	275225	69
Maharashtra	Mumbai	11914398	7500
Maharashtra	Nagpur	2040175	700
Maharashtra	Pune	2540000	1000
Madhya Pradesh	Bhopal	1482718	445
Madhya Pradesh	Indore	1550880	465
Punjab	Ludhiana	1429709	500
Rajasthan	Jaipur	1870771	561
Tamil Nadu	Chennai	4343645	1086
Tamil Nadu	Coimbatore	1501373	375
Tamil Nadu	Madurai	1233083	308
Uttar Pradesh	Kanpur	2725207	954
Uttar Pradesh	Lucknow	2262369	792
Uttar Pradesh	Varanasi	1250039	438
West Bengal	Kolkata	4572876	1143
Grand Total	-	70924513	27167

* Solid Waste in India

* 7.2 million tonnes of hazardous waste
* One Sq km of additional landfill area every-year
* Rs 1600 crore for treatment & disposal of these wastes
* In addition to this industries discharge about 150 million tonnes of high volume low hazard waste every year, which is mostly dumped on open low lying land areas.

Growth of Solid Waste In India

* Waste is growing by leaps & bounds
* In 1981-91, population of Mumbai increased from 8.2 million to 12.3 million
* During the same period, municipal solid waste has grown from 3200 tonnes to 5355 tonne, an increase of 67%
* City like Bangalore produces 2000 tonnes of waste per annum.
* Waste collection is very low for all Indian cities.

* Waste Collection in India

* **Primarily by the city municipality**

  -No gradation of waste product e.g. bio-degradable, glasses, polybags, paper shreds etc

  -Dumps these wastes to the city outskirts

* **Local raddiwala / kabadiwala**
* -Collecting small iron pieces by magnets

  -Collecting glass bottles

  -Collecting paper for recycling

How solid waste affected us in recent years?

* In Mumbai (2005) clogged the sewage line due to large no. of plastic bags.
* Blast in the Bhusan Steel factory at Noida, caused due to imported scrap from Iran
* Reduction in the number of migratory birds due to consumption of contaminated foods
* animals dying on streets and farmland due to consumption of plastic bags, which blocks the food movement in their stomach

* HEALTH IMPACTS OF SOLID WASTE

*Exposure to hazardous waste can affect human health, children being more vulnerable to these pollutants.

*Improperly operated incineration plants cause air pollution and improperly managed and designed landfills attract all types of insects that spread disease.

*Direct handling of solid waste results in chronic diseases with the waste workers.

*1.LAND FILL

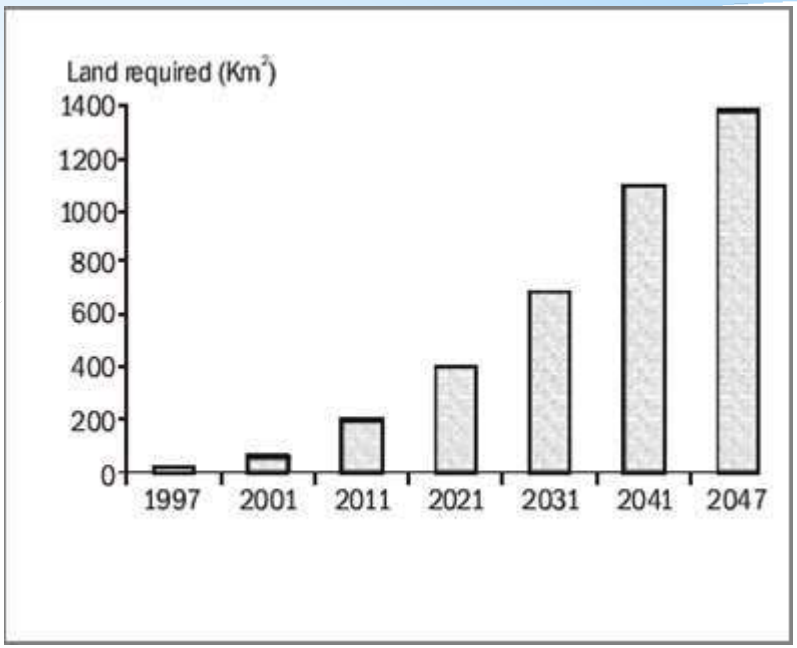
* It is the most traditional method of waste disposal.
* Waste is directly dumped into disused quarries, mining voids or borrow pits.
* Disposed waste is compacted and covered with soil
* Gases generated by the decomposing waste materials are often burnt to generate power.
* It is generally used for domestic waste.

ADVANTAGES

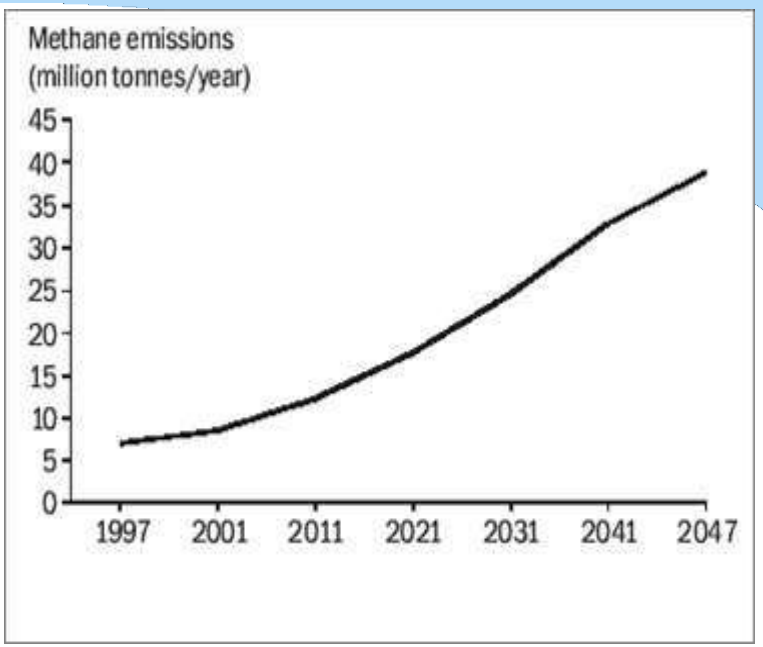
- Landfill site is a cheap waste disposal option for the local council.
- Jobs will be created for local people.
- Lots of different types of waste can be disposed of by landfill in comparison to other waste disposal methods.
- The gases given off by the landfill site could be collected and used for generating power.

DISADVANTAGES

- The site will look ugly while it is being used for landfill.
- Dangerous gases are given off from landfill sites that cause local air pollution and contribute to global warming.
- Local streams could become polluted with toxins seeping through the ground from the landfill site.
- Once the site has been filled it might not be able to be used for redevelopment as it might be too polluted.



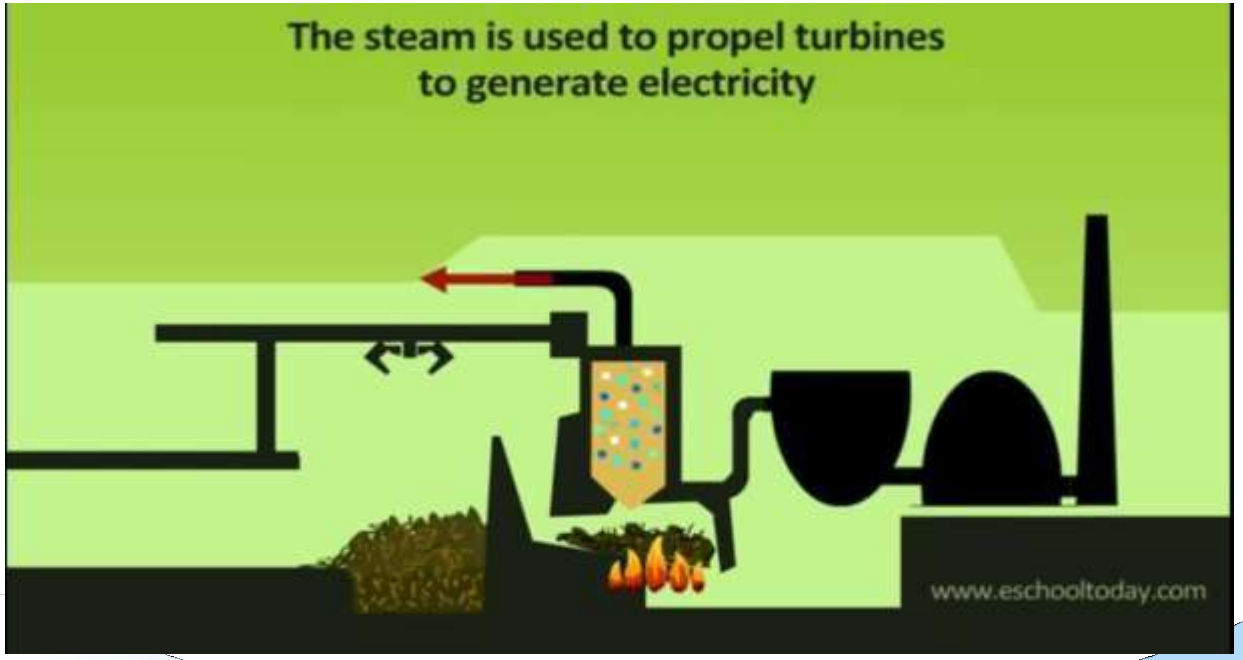
LAND REQUIRED FOR DISPOSAL OF MSW



EMMISION OF METHANE FROM LANDFILL

* 2. INCINERATION

* Incineration is a waste treatment process that involves the combustion of solid waste at 1000C.
* waste materials are converted into ash, flue gas, and heat.
* The ash is mostly formed by the inorganic constituents of the waste and gases due to organic waste.
* the heat generated by incineration is used to generate electric power.



* ADVANTAGES

- Minimum of land is needed compared to other disposal methods.
- The weight of the waste is reduced to 25% of the initial value.
- No risk of polluting local streams and ground waters as in landfills.
- Incineration plants can be located close to residential areas.
- Gases are used to generate power.

DISADVANTAGES

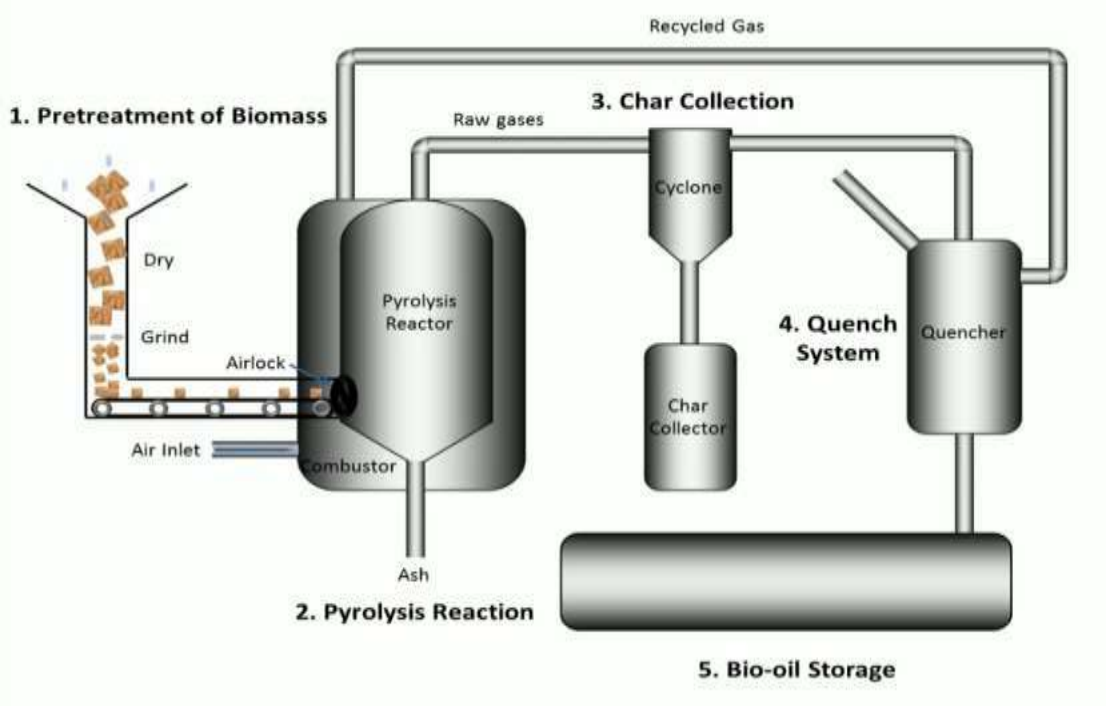
- Expensive
- Required skilled labour.
- The chemicals that would be released into the air could be strong pollutants and may destroy ozone layer (major disadvantage).
- high energy requirement.

*COMPACTION:

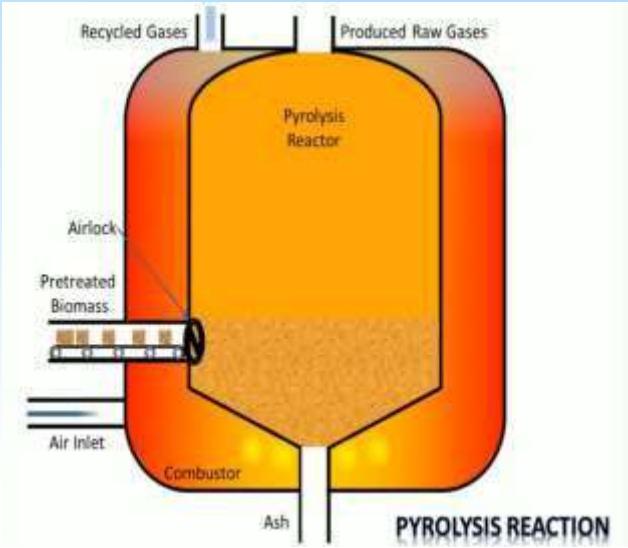
- The waste is compacted or compressed. It also breaks up large or fragile items of waste.
- This process is conspicuous in the feed at the back end of many garbage collection vehicles. Deposit refuse at bottom of slope for best compaction and control of blowing litter.

*PYROLYSIS:-

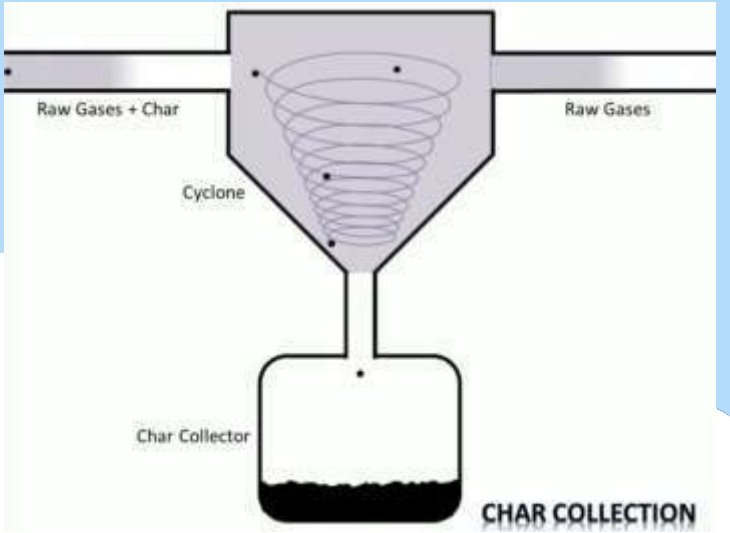
* Pyrolysis is defined as thermal degradation of waste in the absence of air to produce char, pyrolysis oil and syngas, e.g. the conversion of wood to charcoal also it is defined as destructive distillation of waste in the absence of oxygen. External source of heat is employed in this process.



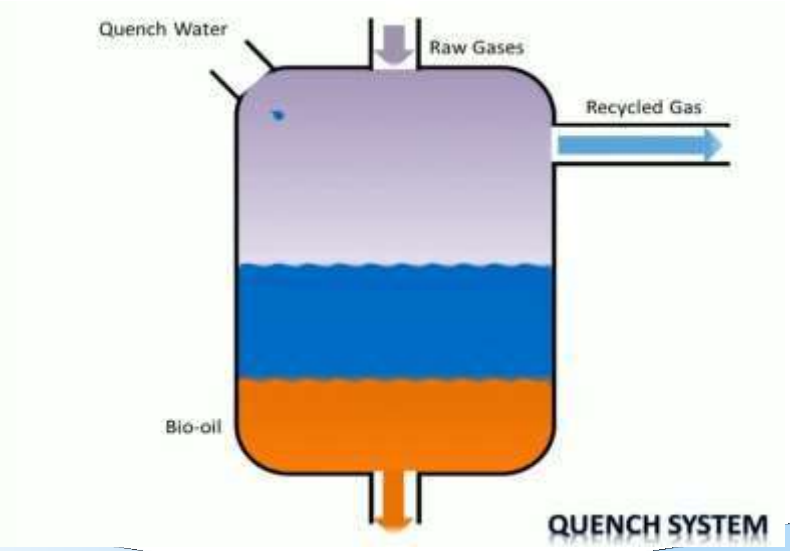
1


Recycled Gases
Produced Raw Gases
Pyrolysis Reactor
Airlock
Pretreated Biomass
Air Inlet
Combustor
Ash
PYROLYSIS REACTION

2


Raw Gases + Char
Raw Gases
Cyclone
Char Collector
CHAR COLLECTION

3


Quench Water
Raw Gases
Recycled Gas
Bio-oil
QUENCH SYSTEM

*The 3 R's

* **REDUCE**
  * You can help by *PRECYCLING*. 1/3 of all garbage is packaging.
  * Buy things that are in packages that can be recycled or are made of recycled materia
  * When you buy something small, say no thanks to a bag.
* **REUSE**
  * Many things can be reused before you throw them out.
  * Use coffee cans and cottage cheese containers for storage
  * Use backs of paper or backs of used envelopes for jotting notes
  * Put leftovers in resalable containers instead of using wraps and foil
  * Use old clothes as rags for cleaning instead of paper towels
  * Have a garage sale or donate clothes, books or toys that you don't use anymore
* **RECYCLE**
  * Each year we use:
    * 25 billion plastic containers
    * 30 billion bottles & jars
    * 65 billion aluminum cans
    * 100 billion pounds of paper

*CONCLUSION:

* It is found that with increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. Waste that is not properly managed, especially excreta and other liquid and solid waste from households and the community, are a serious health hazard and lead to the spread of infectious diseases.

* Marine Pollution

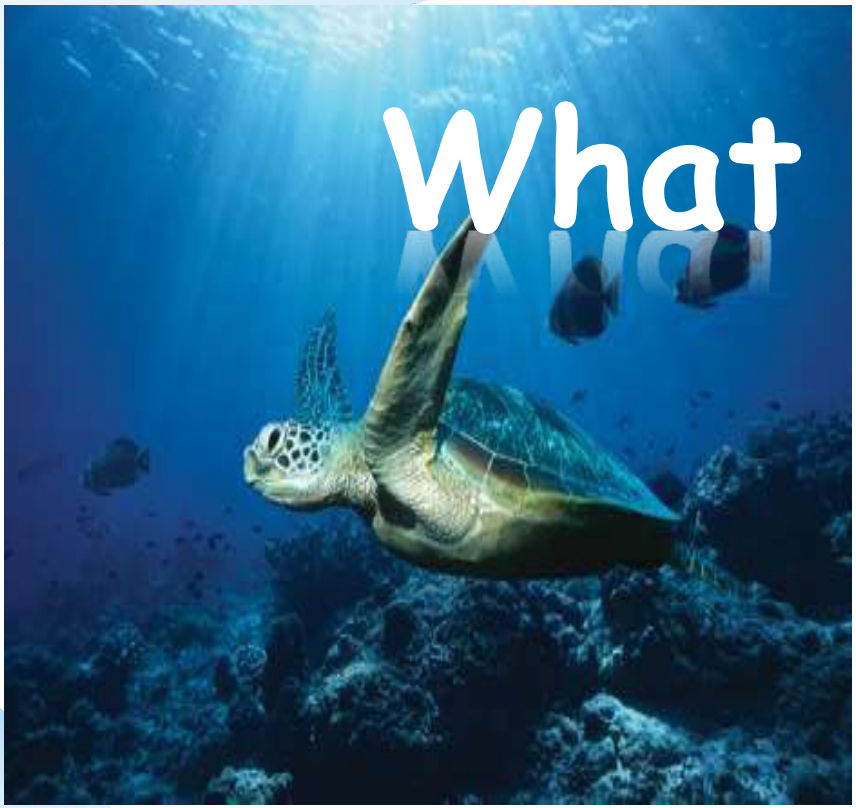
*Introduction

* The sea is indispensable to life on earth
* Coral reefs.
* Marine accidents potentially cause serious harm .

*What has Happened & What can happen

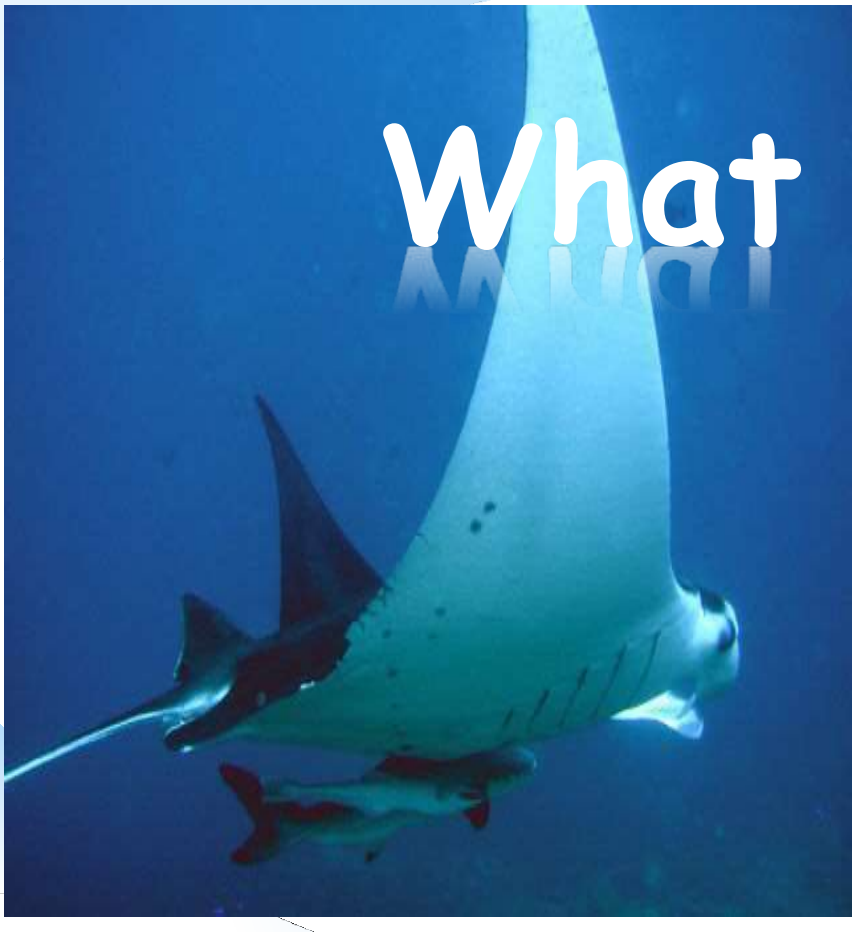
*What has Happened & What can happen

*What has Happened & What can happen

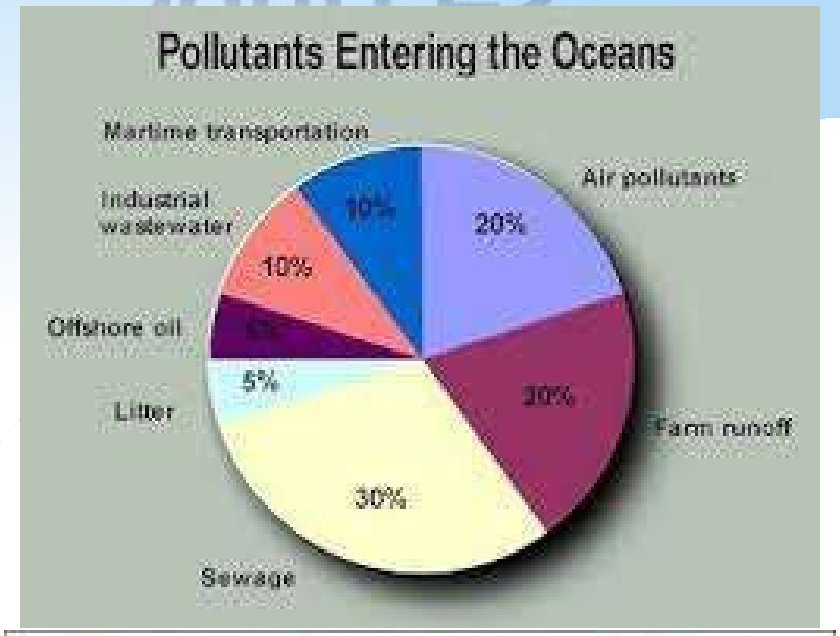


*What has Happened & What can happen

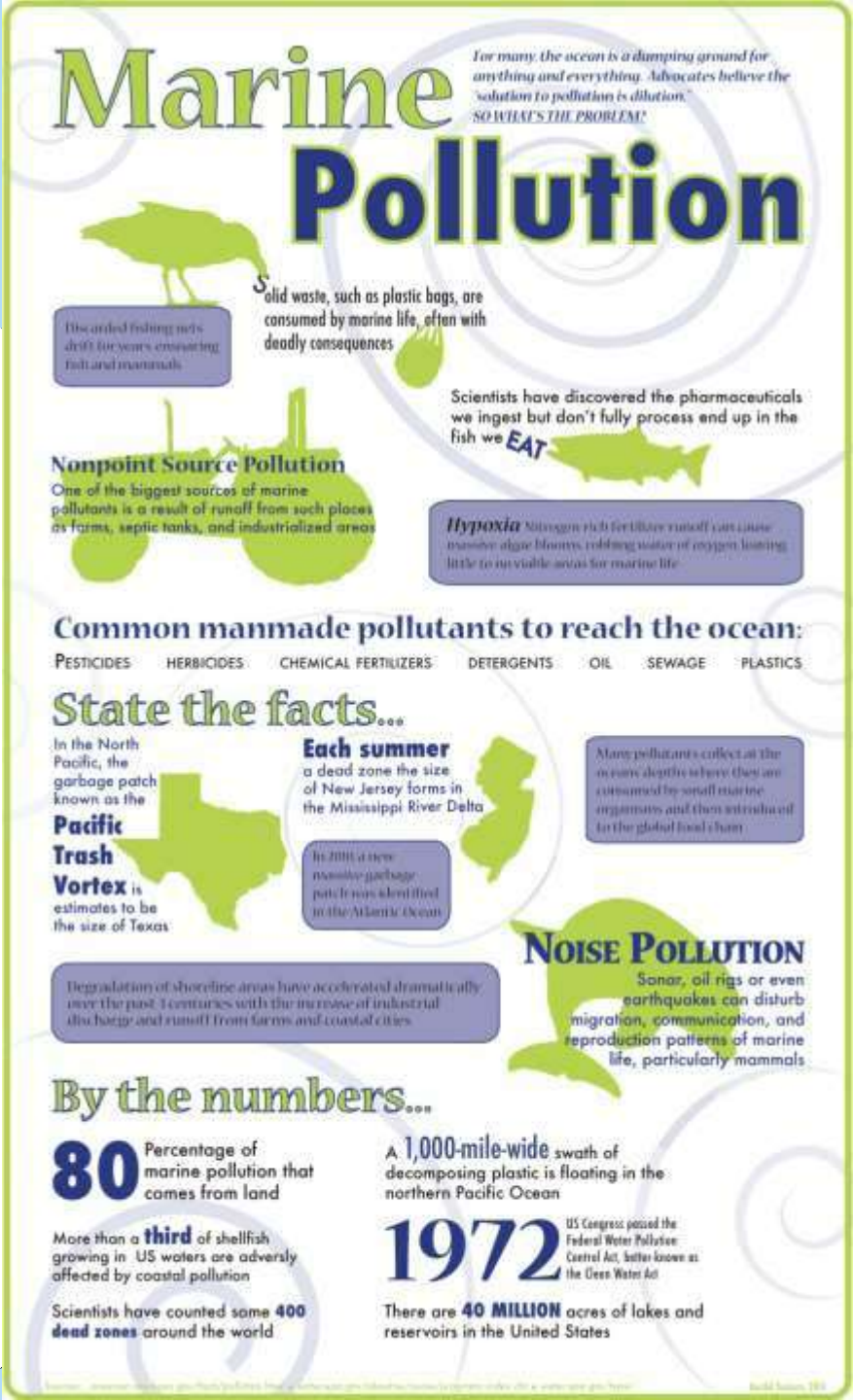
*What has Happened & What can happen



*Sources


Pollutants Entering the Oceans
Marine transportation
10%
Air pollutants
20%
Industrial wastewater
10%
Offshore oil
5%
Litter
20%
Farm runoff
30%
Sewage


Breakdown times for Common Marine Debris Items
Newspaper: 4-6 weeks
Cotton Towel: 6 months
Cigarette Butt: 1-5 years
Plastic Bag: 10-20 years
Tin Can: 50 years
Aluminum Can: 80-200 years
Plastic Bottle: 450 years
Glass Bottle: 1 million years


Marine Pollution
For many, the ocean is a dumping ground for anything and everything. Advocates believe the "solution to pollution is dilution." SO WHAT'S THE PROBLEM?
Solid waste, such as plastic bags, are consumed by marine life, often with deadly consequences
Discarded fishing nets drift for years ensnaring fish and mammals
Scientists have discovered the pharmaceuticals we ingest but don't fully process end up in the fish we EAT
Nonpoint Source Pollution
One of the biggest sources of marine pollutants is a result of runoff from such places as farms, septic tanks, and industrialized areas
Hypoxia Nitrogen rich fertilizer runoff can cause massive algae blooms, robbing water of oxygen leaving little to no viable areas for marine life
Common manmade pollutants to reach the ocean:
PESTICIDES HERBICIDES CHEMICAL FERTILIZERS DETERGENTS OIL SEWAGE PLASTICS
State the facts...
In the North Pacific, the garbage patch known as the Pacific Trash Vortex is estimates to be the size of Texas
Each summer a dead zone the size of New Jersey forms in the Mississippi River Delta
In 2010, a new massive garbage patch was identified in the Atlantic Ocean
Many pollutants collect at the ocean depths where they are consumed by small marine organisms and then introduced to the global food chain
Degradation of shoreline areas have accelerated dramatically over the past 3 centuries with the increase of industrial discharge and runoff from farms and coastal cities
NOISE POLLUTION
Sonar, oil rigs or even earthquakes can disturb migration, communication, and reproduction patterns of marine life, particularly mammals
By the numbers...
80 Percentage of marine pollution that comes from land
More than a third of shellfish growing in US waters are adversly affected by coastal pollution
Scientists have counted some 400 dead zones around the world
A 1,000-mile-wide swath of decomposing plastic is floating in the northern Pacific Ocean
1972 US Congress passed the Federal Water Pollution Control Act, better known as the Clean Water Act
There are 40 MILLION acres of lakes and reservoirs in the United States

* Causes :

*Toxic Ocean Pollutants:

- Sources : The leaking of landfills, dumps, mines and farms.
- Enters our food chain .
- Lead: Affects brain, kidneys.

Effects :

- Food poisoning.

* Causes:

*Marine Garbage :

- Virtual dumping ground for trash.
- Fishing nets, plastics, general household garbage.
- Animals sometimes eat trash products and die.

Effects :

- Depletes the oxygen

* Causes:

*Sewage Disposal in Ocean

- Great Stink of London
- Nutrient loading in the ocean ecosystem.

Effects :

- Poisoning of shellfish fisheries.

*Causes:

*Non-Point Pollutants

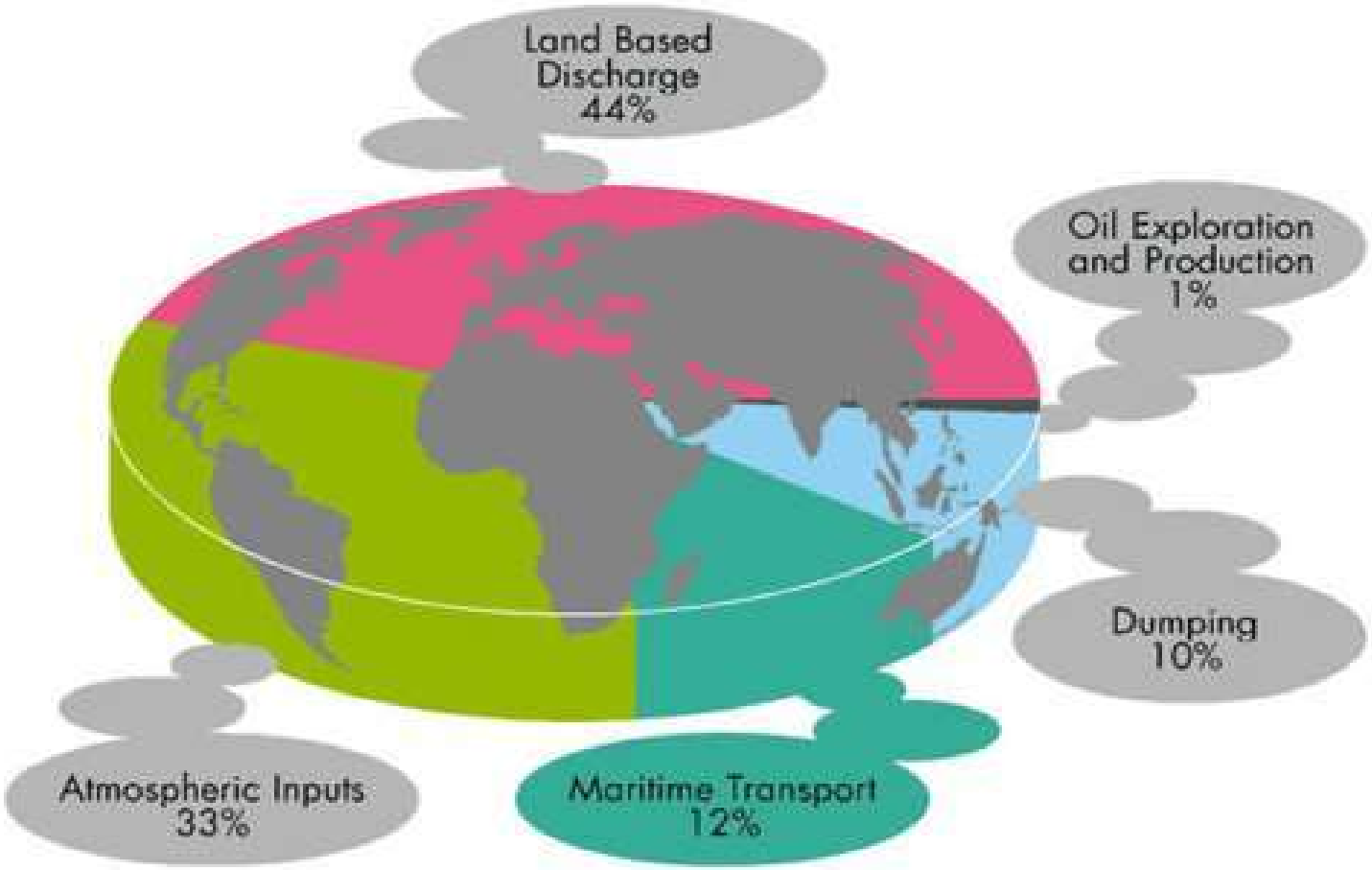
- Sources : Farmland, Industries, Urban & Atmospheric Runoffs .
- Eutrophication.

Effects :

- Contaminate coastal swimming areas and seafood,

spreading cholera, typhoid and other diseases

The origin of various sources of pollution are listed below :



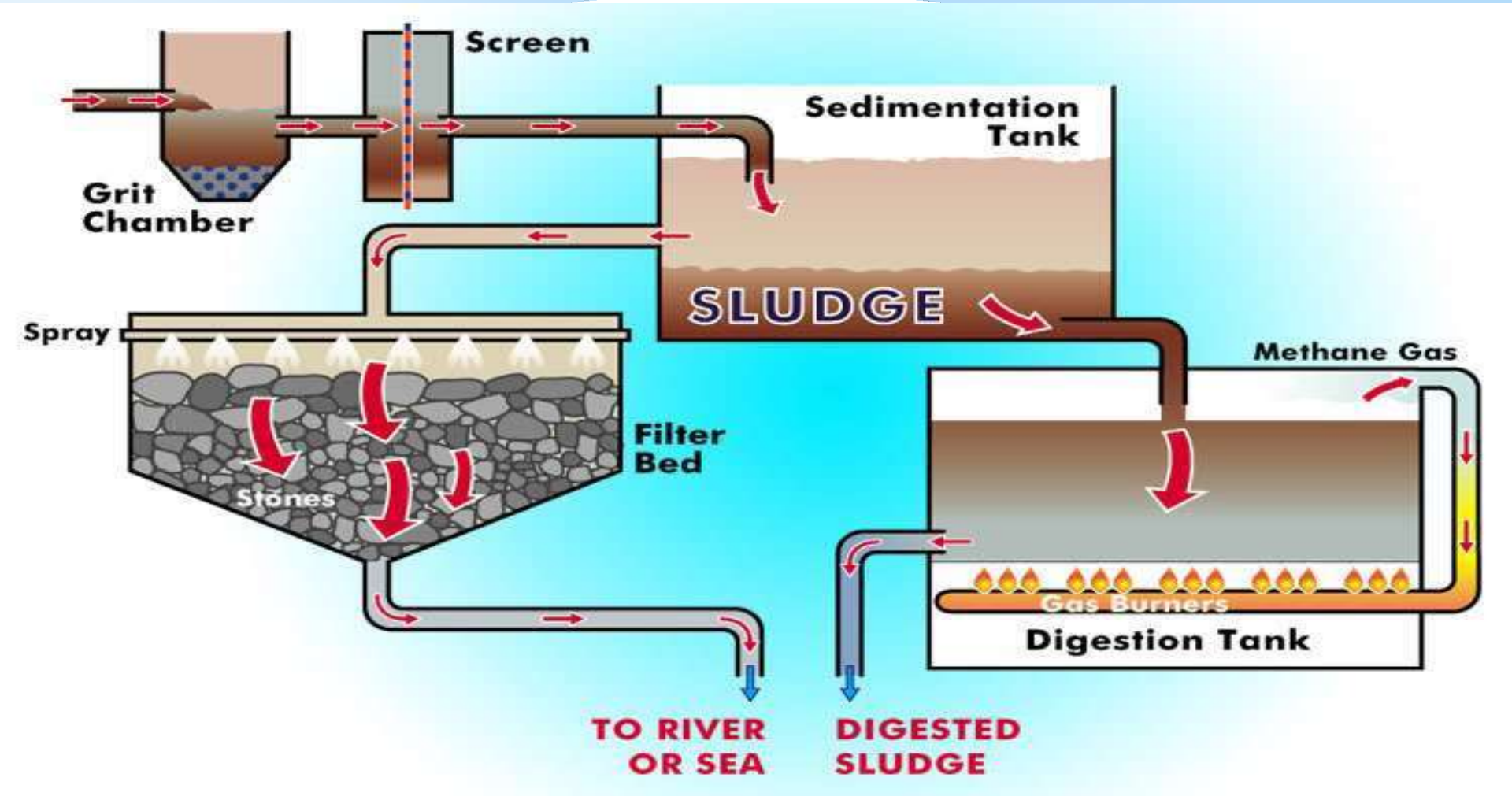
Marine Pollution Chart

*Spills - Detection and Cleanup

- Strict discipline
- emergency contingency plan
- Oil spill clean up equipment

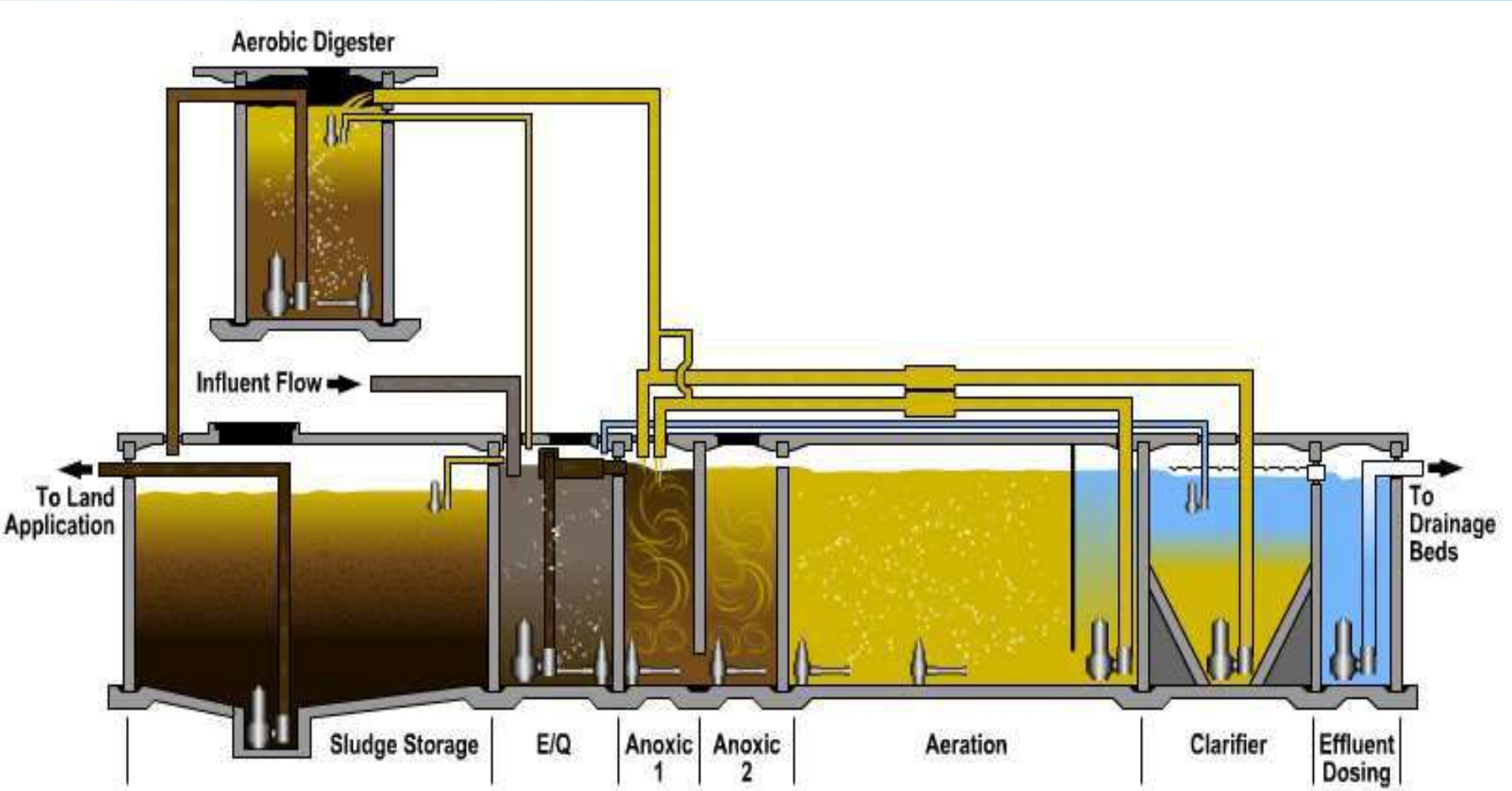
*Domestic sewage

- Green infrastructure approach
- Septic tank



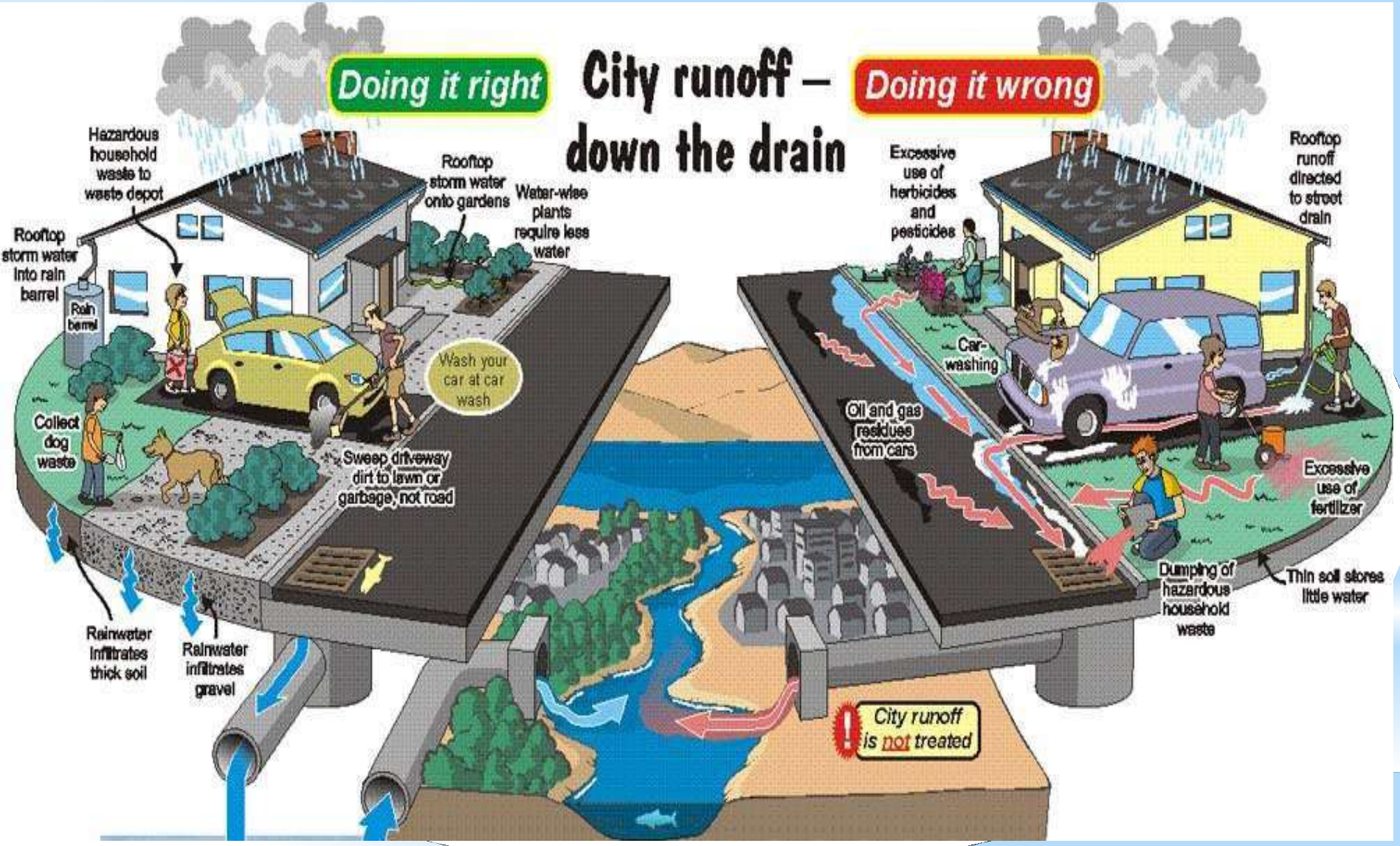
*Industrial wastewater treatment

- Dissolved air flotation



*Urban runoff

- Best management practices



*Marine Pollution in Chennai

*In Newspaper

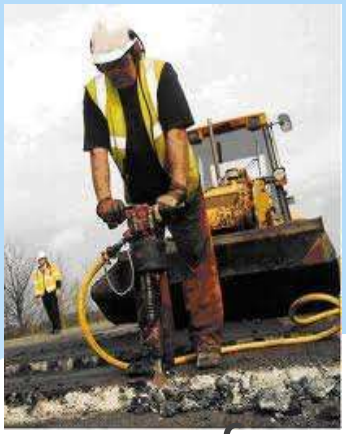
* **Chemical company in SIPCOT discharged effluents into River Uppanar(cuddalore) in Tamil Nadu**
* By Express News Service | Published: 19th June 2017 05:59 AM |
* Last Updated: 19th June 2017 05:59 AM

*Noise pollution

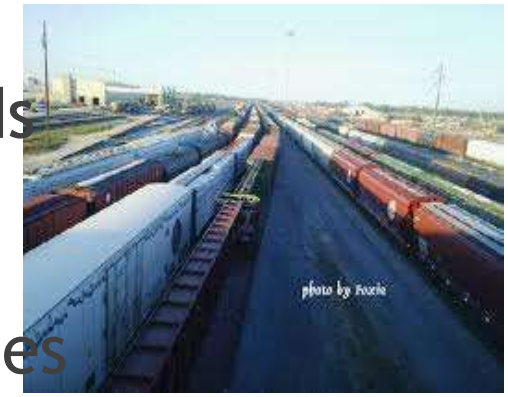
- Noise pollution is a pleasing or excessive noise that may disrupt the activity or balance of human or animal life.
- The source of most outdoor noise worldwide is mainly caused by machines and transportation systems, motor vehicles, aircrafts, and trains.
- Indoor noise is caused by machines, building activities, music performances, and especially in some workplaces. There is no great difference whether noise-induced hearing loss is brought about by outside (e.g. trains) or inside (e.g. music) noise.

- Decibel (feeble sound, a human ear can hear) is the standard unit for measurement of sound. It is one tenth of “BEL” (Bel - named after Alexander Graham Bell).
- Decibel is a unit of measurement which is used to indicate how loud a sound is.
- Continuous exposure to sound above 80 decibels could be harmful.
- Usually >100 db is the level at which sound becomes physically painful.

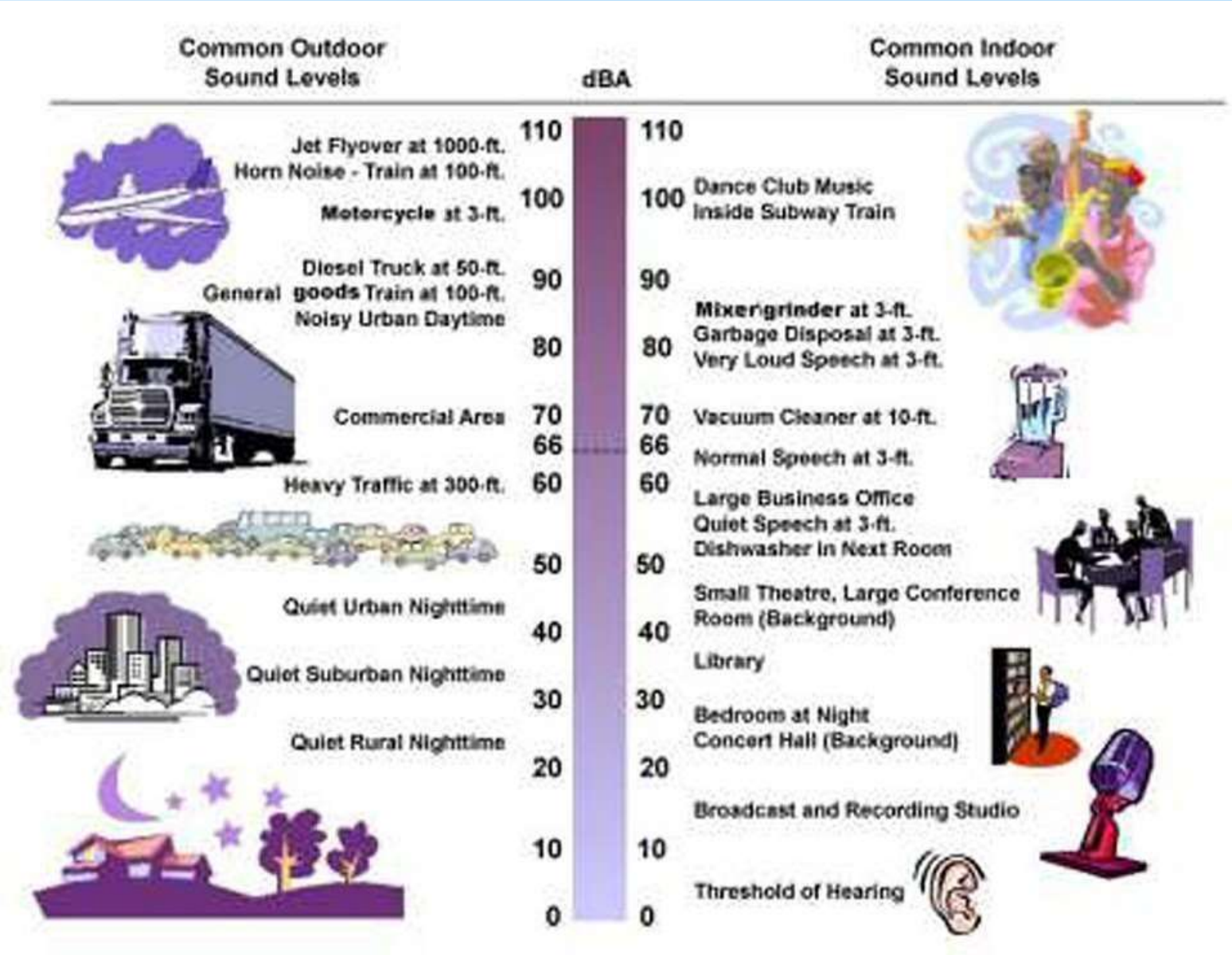
* Sources:



- By- products of industrialization, urbanizations and modern civilization
- Road Traffic Noise
- Air Craft Noise
- Noise from railroads
- Construction Noise
- Noise from Industries



* Levels:


Common Outdoor Sound Levels
dBA
Common Indoor Sound Levels
Jet Flyover at 1000-ft.
Horn Noise - Train at 100-ft.
Motorcycle at 3-ft.
Diesel Truck at 50-ft.
General goods Train at 100-ft.
Noisy Urban Daytime
Commercial Area
Heavy Traffic at 300-ft.
Quiet Urban Nighttime
Quiet Suburban Nighttime
Quiet Rural Nighttime
110
100
90
80
70
66
60
50
40
30
20
10
0
Dance Club Music
Inside Subway Train
Mixer/grinder at 3-ft.
Garbage Disposal at 3-ft.
Very Loud Speech at 3-ft.
Vacuum Cleaner at 10-ft.
Normal Speech at 3-ft.
Large Business Office
Quiet Speech at 3-ft.
Dishwasher in Next Room
Small Theatre, Large Conference Room (Background)
Library
Bedroom at Night
Concert Hall (Background)
Broadcast and Recording Studio
Threshold of Hearing

* Effects:

- **Hearing Problems:**
  - Exposure to noise can damage one of the most vital organs of the body, the ear.
  - When the sound level crosses the 70dB mark, it becomes noise for the ear. Noise levels above 80 decibels produce damaging effects to the ear.
  - When ear is exposed to extreme loud noise (above 100 decibels) for a considerable period of time, it can cause irreparable damage and lead to permanent hearing loss.
- **Cardiovascular Issues:**
  - A noisy environment can be a source of heart related problems.
  - Studies have shown that high intensity sound cause a dramatic **rise in blood pressure.**

* Effects:

- **Sleep Disturbances:**
  - This is one of the noise pollution effects that can deter your overall well being.
  - Noise can interrupt a good night's sleep, and when this occurs, the person feels extremely annoyed and uncomfortable.
  - People deprived of uninterrupted sleep show a sharp dip in their energy levels which often results into extreme fatigue. This can considerably decrease a person's ability to work efficiently.
- **Interference in Verbal Communication:**
  - A noisy environment that produces more than 50-60 decibels simply does not allow 2 people to communicate properly.
  - Interpreting the speech of a second person becomes quite difficult and may lead to misunderstandings.

* Effects:

- **Mental Health Problems:**
  - Exposure to loud sound can lead to elevated stress levels as well as stimulate violent behavior. A constant noise in the vicinity can also trigger headaches, make people tense and anxious, and disturb emotional balance.

- **Other Problems:**
  - Digestive spasms and stomach disorders
  - Dilation of the pupil of the eye
  - It causes headache, irritability and nervousness, feeling of fatigue and decreases work efficiency.
  - Noise also affects the developing embryo in mothers uterus.

* Control:

- People living in the heart of city or near the airport, often have to bear the brunt of high noise levels. To decrease noise, one can install dual-paned windows. Offices, too can use windows to curb noise levels. Soundproofing is another alternative that can be looked at to reduce excessive sound levels.
- Use of music systems and television sets with high volumes can cause noise pollution at home. Instead, using these appliances with the volume kept at a moderate level is a better option.
- An effective way to manage noise would be to wear ear protection while working in noisy conditions. Animals should be moved to some other place, away from the noise source, thereby decreasing their noise exposure time.
- Vehicles and factory machines need to be maintained properly and checked from time to time. Lack of maintenance will not only increase noise levels, but also decrease the efficiency of these machines.
- Making a change in design and operation of machines, vibration control, sound proof cabins and sound-absorbing materials can reduce. it.

*Thermal Pollution:

- Thermal pollution is the degradation of water quality by any process that changes ambient water temperature.
- A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers.
- When water used as a coolant is returned to the natural environment at a higher temperature, the change in temperature decreases oxygen supply, and affects ecosystem composition.
- Urban runoff–stormwater discharged to surface waters from roads and parking lots–can also be a source of elevated water temperatures.
- When a power plant first opens or shuts down for repair or other causes, fish and other organisms adapted to particular temperature range can be killed by the abrupt change in water temperature known as "thermal shock."

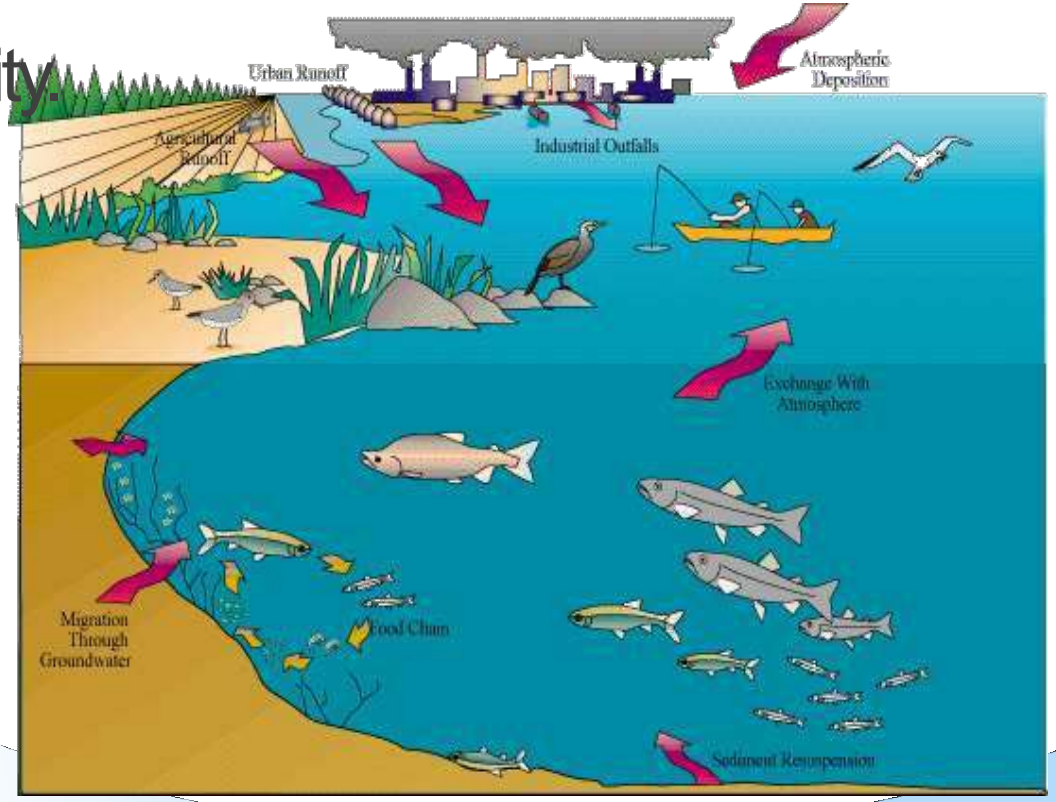
* Effects:

* **Warm water:**

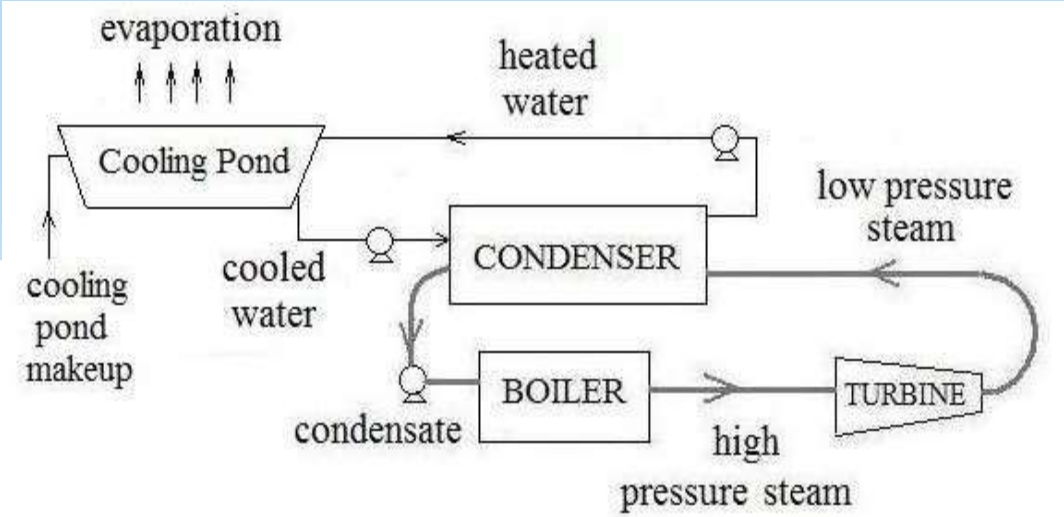
- Elevated temperature typically decreases the level of dissolved oxygen of water. This can harm aquatic animals such as fish, amphibians and other aquatic organisms.
- Thermal pollution may also increase the metabolic rate of aquatic animals - result in fewer resources
- Some fish species will avoid stream segments or coastal areas adjacent to a thermal discharge. Biodiversity can be decreased as a result.
- High temperature limits oxygen dispersion into deeper waters, contributing to anaerobic conditions. This can lead to increased bacteria levels when there is ample food supply. Many aquatic species will fail to reproduce at elevated temperatures.

* Cold water:

Releases of unnaturally cold water from reservoirs can dramatically change the fish and macro invertebrate fauna of rivers, and reduce river productivity.



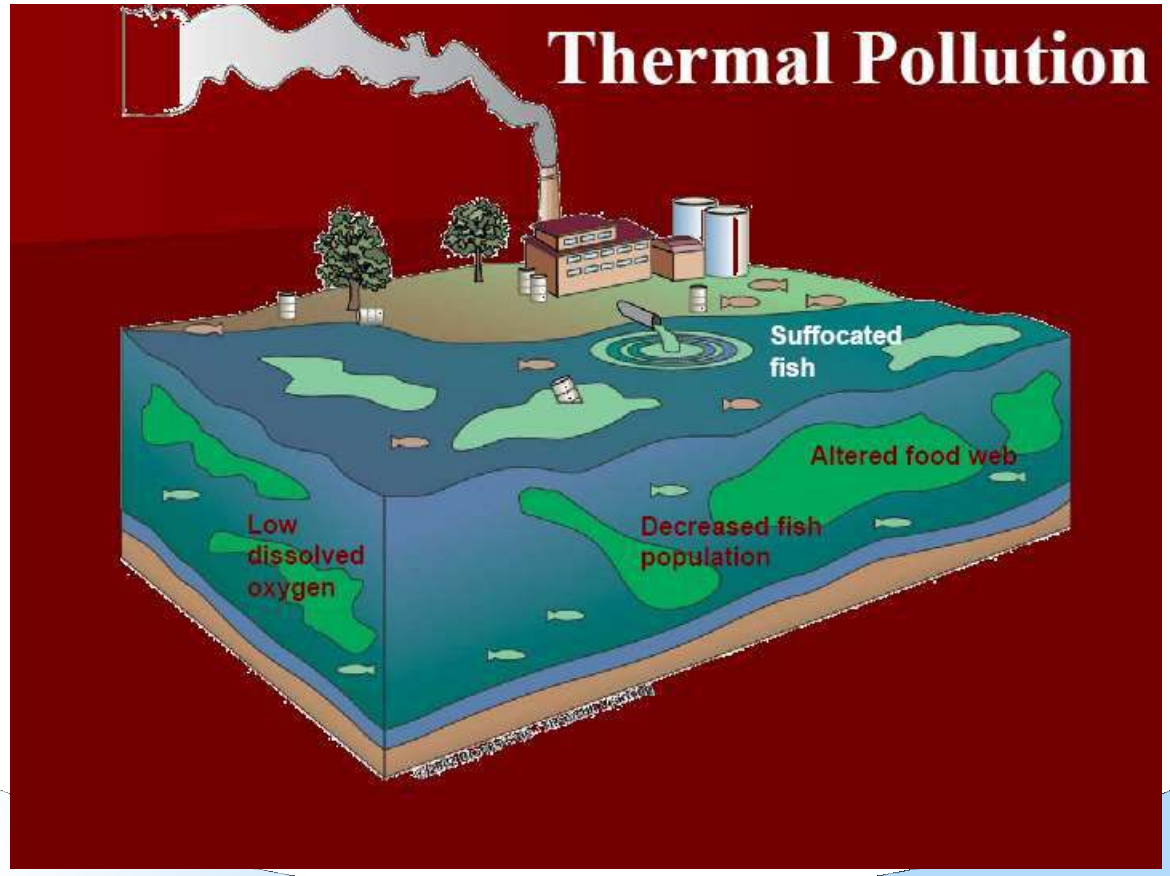
* Control:



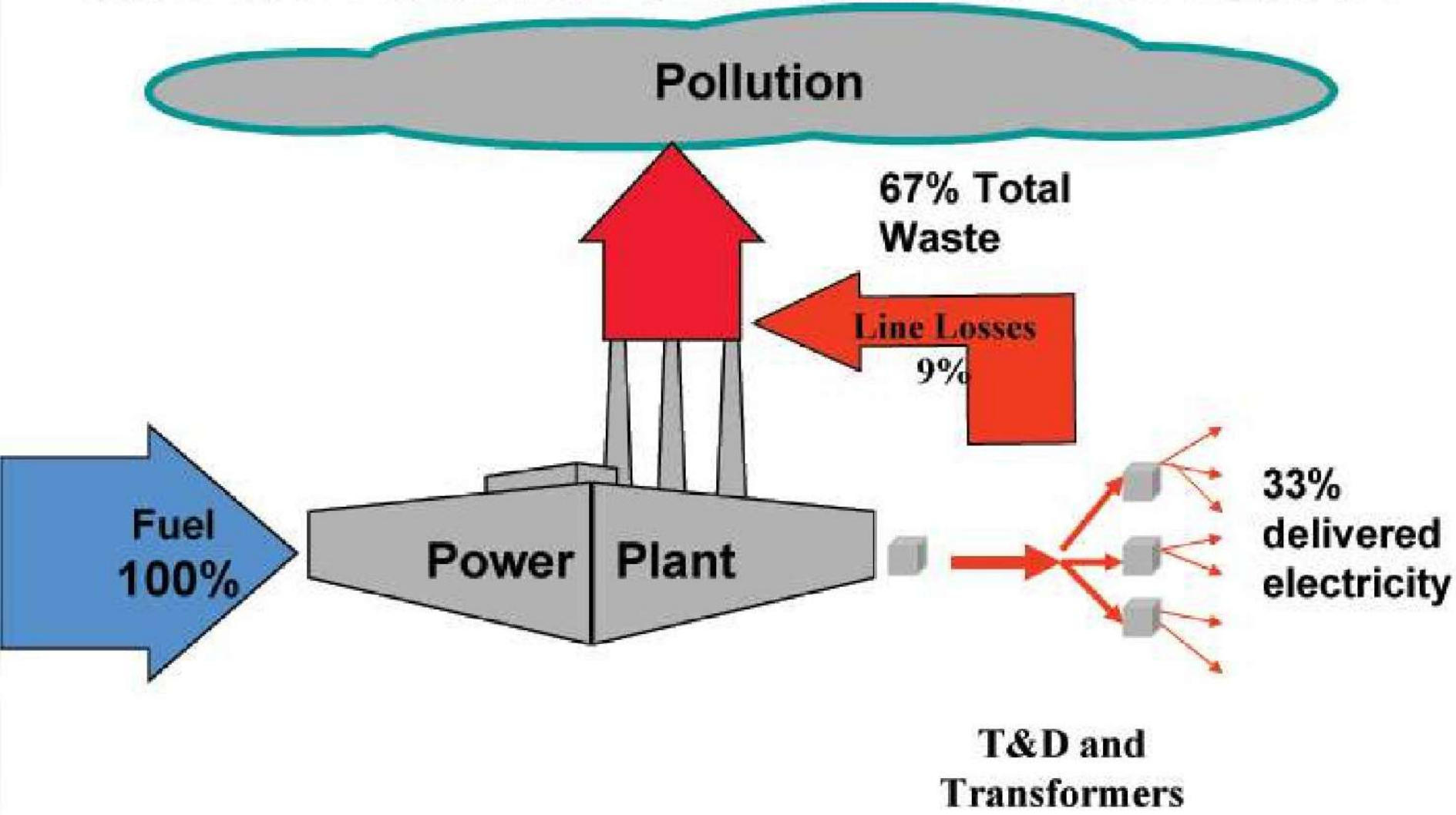
- Cooling Ponds
- Spray Ponds
- Cooling Towers *(video lecture)*

*THERMAL POLLUTION

ADDITION OF EXCESS OF UNDESIRABLE HEAT TO WATER THAT MAKES IT HARMFUL TO MAN, ANIMAL OR AQUATIC LIFE



Conventional Central Generation



*Waste Heat from Power Plants

Table 9.5 HEAT CHARACTERISTICS OF TYPICAL STEAM ELECTRIC PLANTS (VALUES IN Btu PER kWh)

Plant Type	Thermal Efficiency (%)	Required Heat Input	Total Waste Heat	Lost to Boiler Stack*	Heat Discharged to the Condenser	Cooling Water Requirement (ft^3/s/MW of capacity†)
Fossil fuel	33	10,500	7100	1600	5500	1.6
Fossil fuel (recent)	40	8600	5200	1300	3900	1.15
Light water reactor	33	10,500	7100	500	6600	1.9

*Approximately 10 to 15% × required input for fossil fuel; approximately 3 to 5% × required input for nuclear.

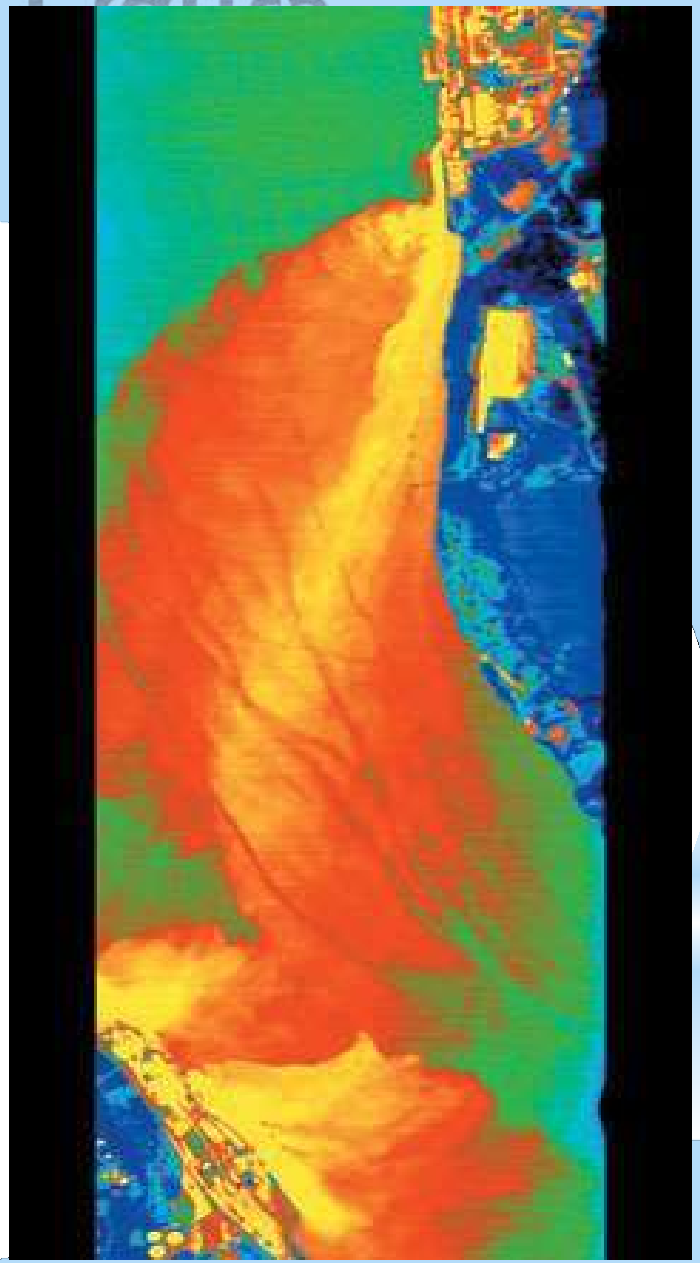
†Based on an inlet temperature in the range of 70°F to 80°F and a temperature rise across the condenser of 15°F (8°C).

Source: R. Rimberg, "Utilization of Waste Heat from Power Plants," William Andrews Pub. LLC, 1974.

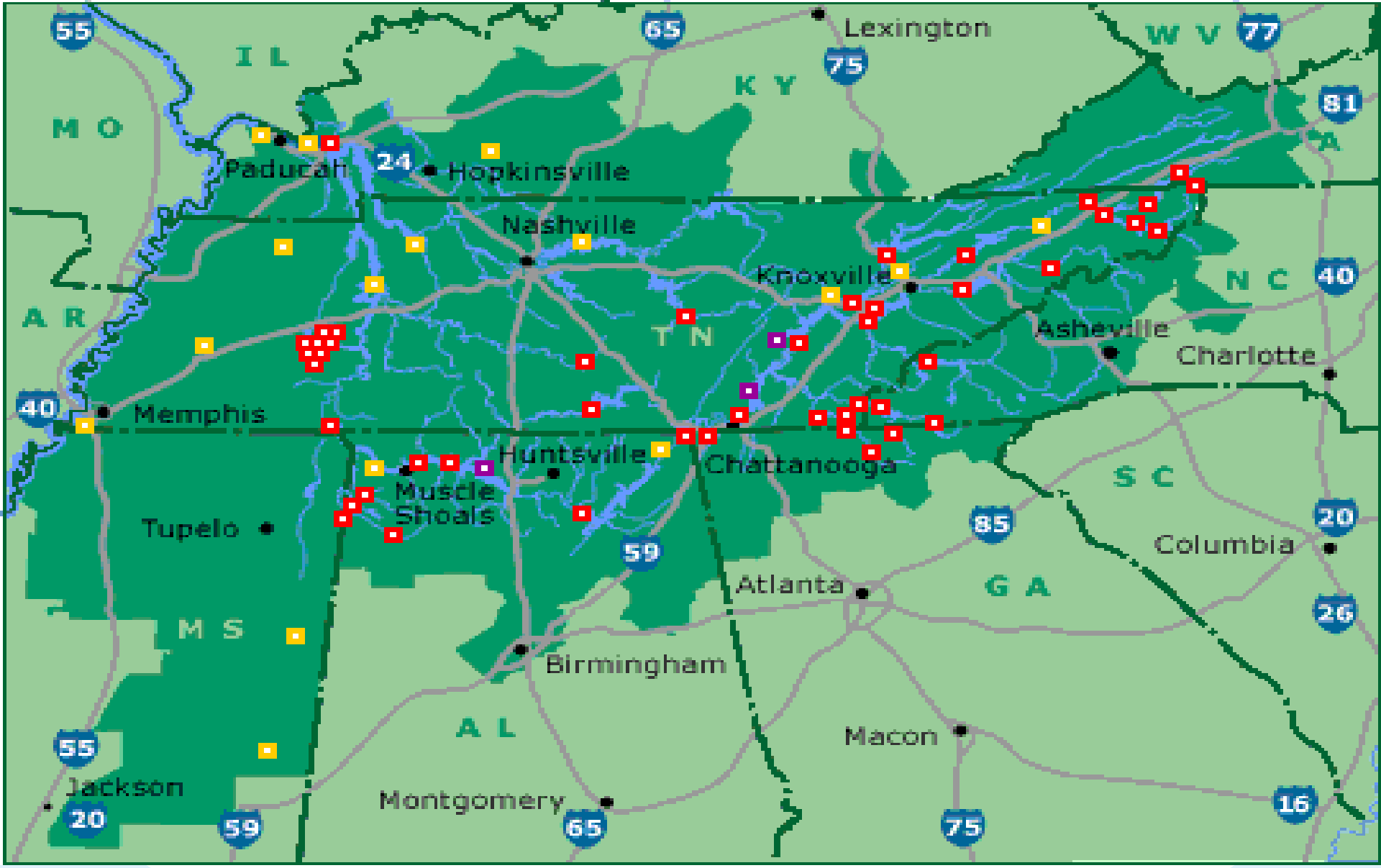
*Nuclear Power Plants

*Nuclear power plants use water as a cooling agent.

*After the water is used, it is put back into a water supply at 9-20°C warmer



This 1988 thermal image of the Hudson River highlights temperature changes caused by discharge of **2.5 billion gallons of water each day from the Indian Point power plant**. The plant sits in the upper right of the photo — hot water in the discharge canal is visible in yellow and red, spreading and cooling across the entire width of the river. Two additional outflows from the Lovett coal-fired power plant are also clearly visible against the natural temperature of the water, in green and blue.



Red – reservoirs **Yellow – Fossil Plants** **Purple – Nuclear Plants**

*CAUSES

DISCHARGE OF HEATED WATER OR HOT WASTE MATERIAL INTO WATER BODIES FROM

*NUCLEAR POWER PLANTS

*INDUSTRIAL EFFLUENTS

*DOMESTIC SEWAGE

*HYDRO-ELECTRIC POWER

*COAL FIRED POWER PLANTS

*NUCLEAR POWER PLANTS

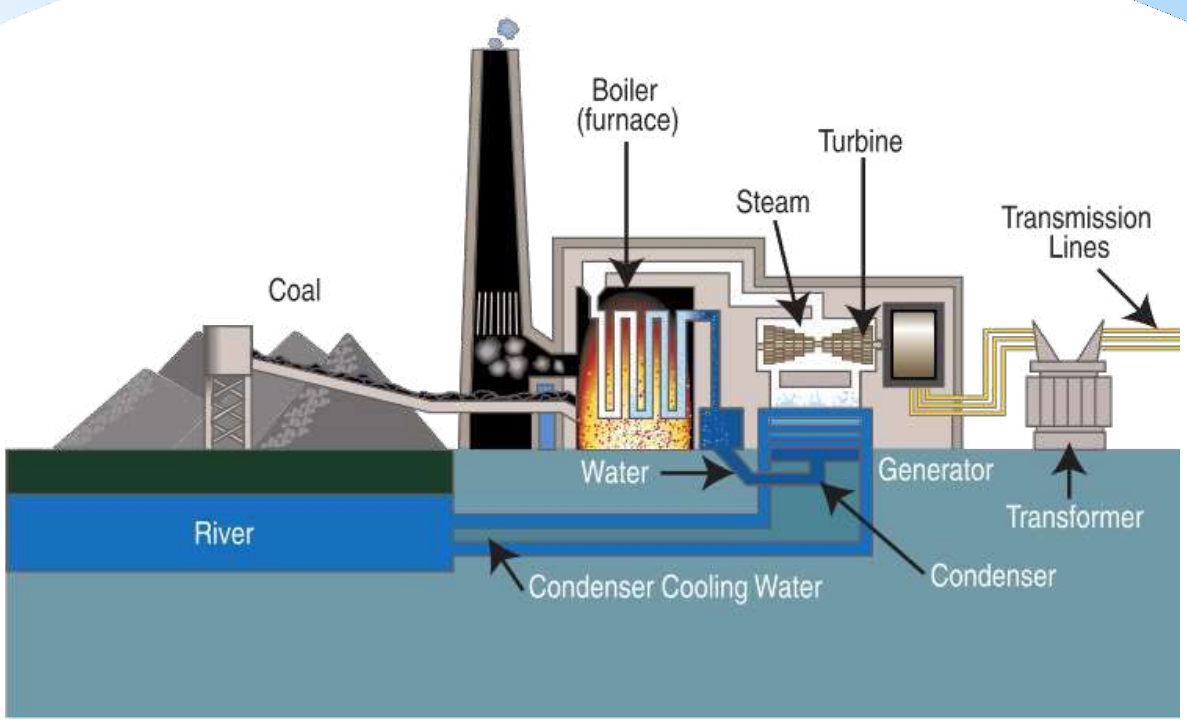
- Nuclear power plants use water as a cooling agent.
- After the water is used, it is put back into a water supply at 9-20°C
- Emissions from nuclear reactor increase the temperature of water bodies.

1. Reaktor
2. Regulační tyče
3. Aktivní zóna – palivové soubory
4. Ocelová tlaková nádoba
5. Voda pod tlakem
6. Čerpadlo
7. Parogenerátor
8. Pára
9. Ochranná obálka
10. Parní turbína
11. Kondenzátor
12. Elektrický generátor
13. Transformátor
14. Chladicí věž
15. Rozvod elektrické energie

*Coal-fired power plants

- ✓ Coal is utilized as a fuel
- ✓ Condenser coils are cooled with water from nearby lake or river
- ✓ The heated effluents <u>decrease the DO of water</u>
- ✓ Damages the marine organisms

*Coal-fired power plants-process



*Industrial Effluents

- ✓Discharged water from steam-electric power industry using turbo generators will have a higher temperature ranging from 6 to 9˚C than the receiving water
- ✓In modern stations, producing 100 MW, nearly one million gallons are discharged in an hour with increase in temperature of the cooling water passing by 8 to 10 ˚C

*Domestic sewage

✓Sewage is commonly discharged into lakes,canals or streams

✓Municipal sewage normally has a higher temperature than the receiving water

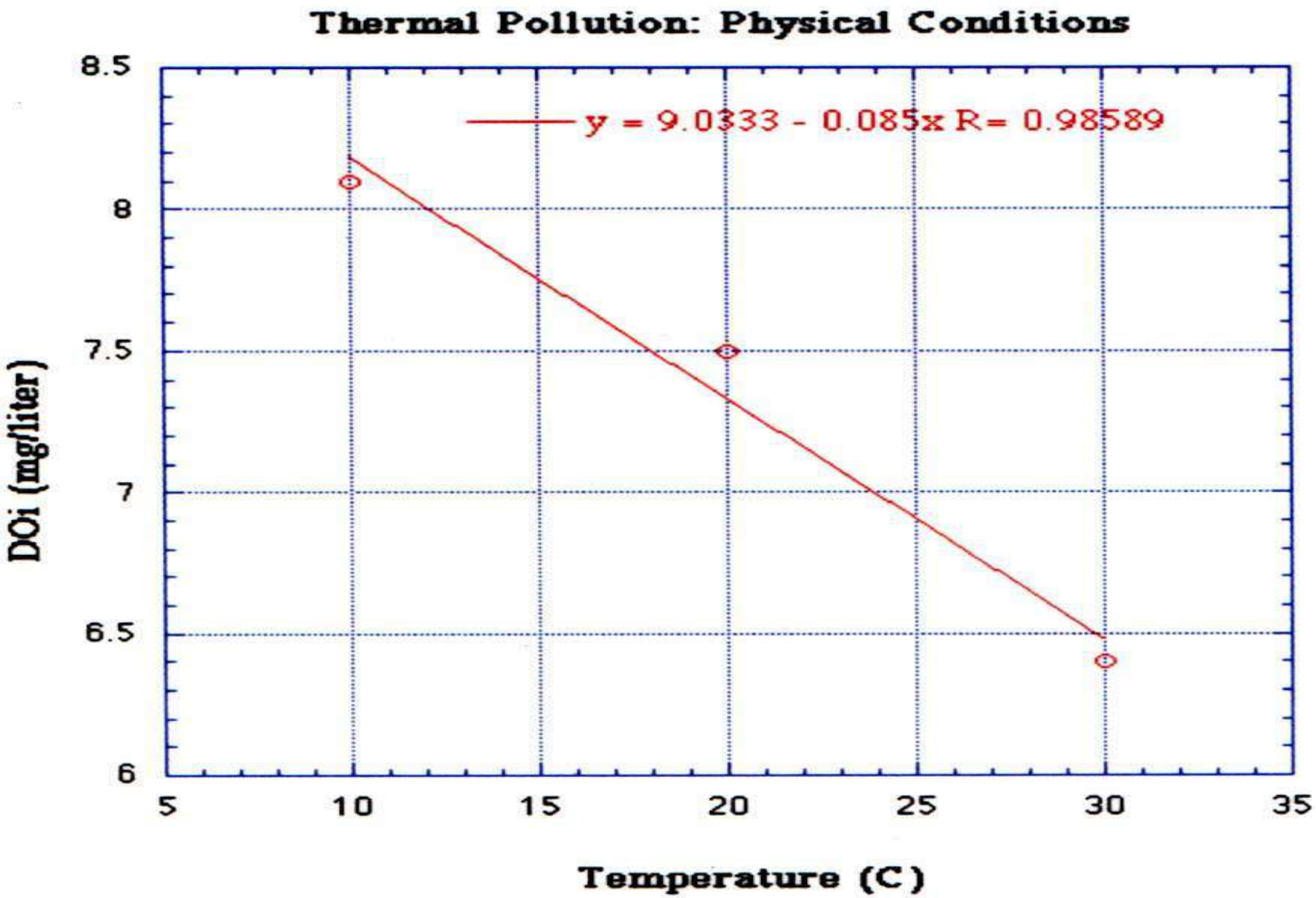
✓Increase in temperature of the receiving water decreases the DO of water.

✓The foul smelling gases increased in water resulting in death of marine organisms

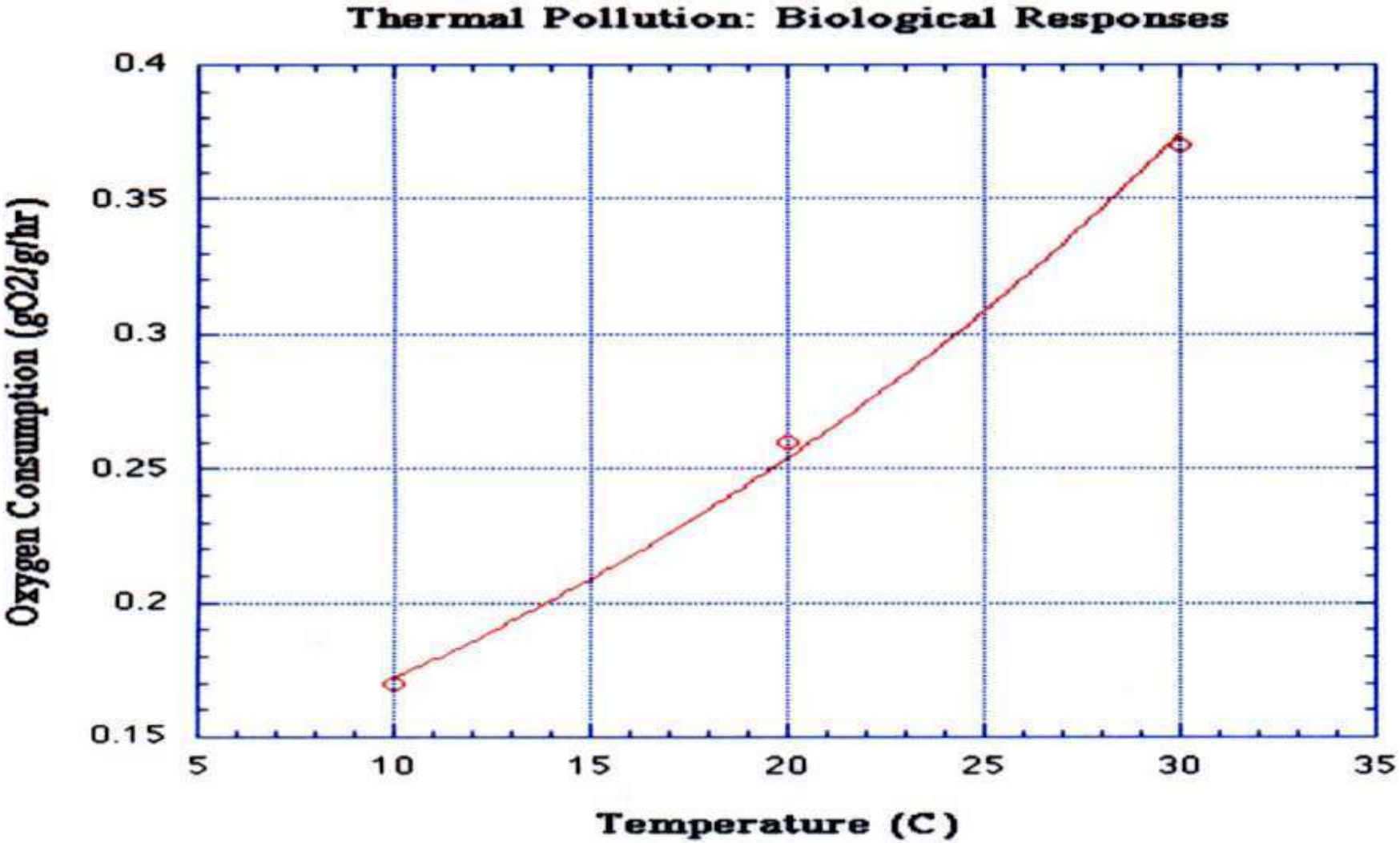
*Hydro electric power generation

- ✓Generation of hydroelectric power sometimes results in negative thermal loading in water systems
- ✓Creates less heat on water sources less than nuclear power plant

*Dissolved Oxygen vs Temp



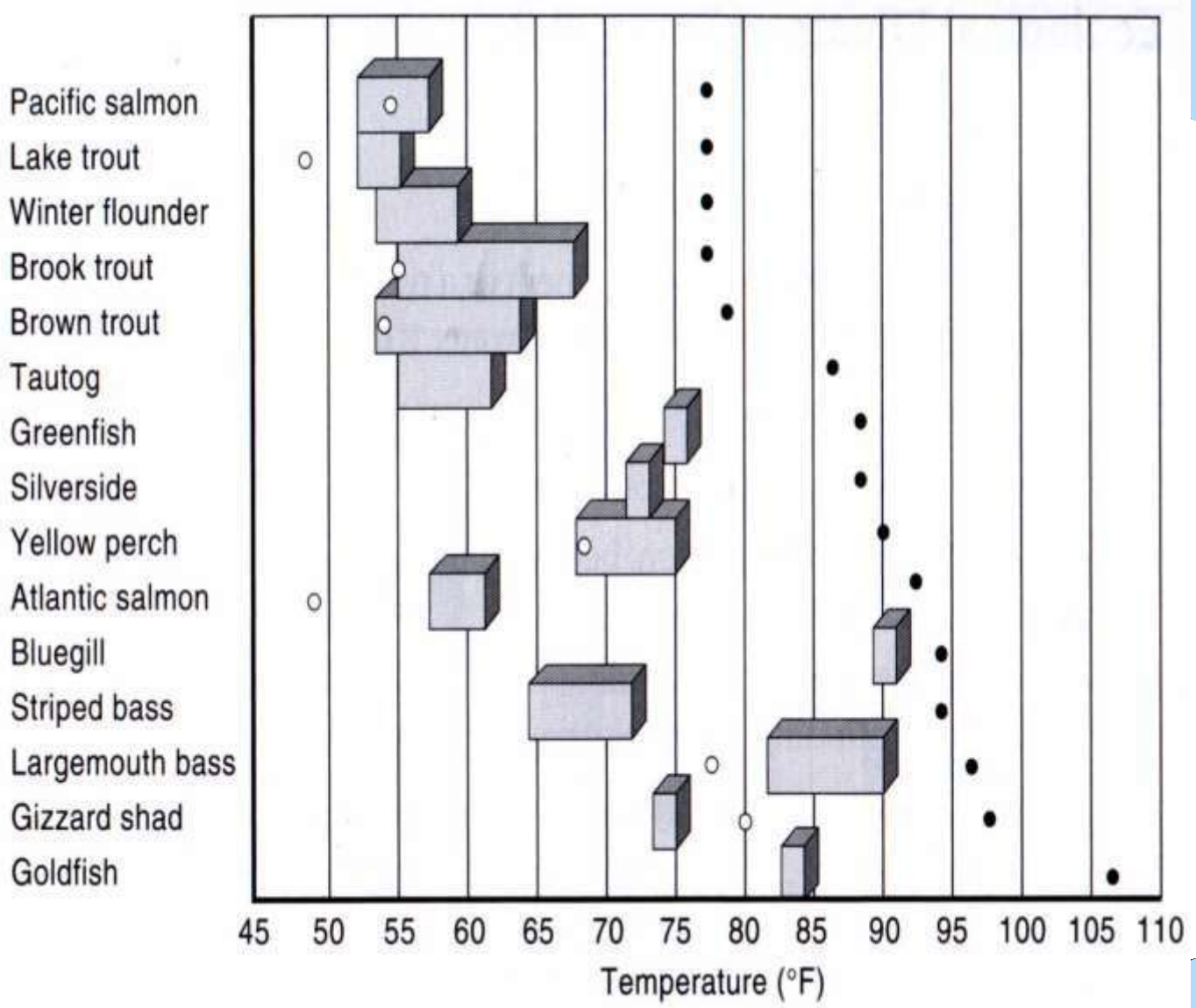
*Fish Oxygen Use vs. Temperature



Effects of Increased Water Temperature

- Thermal shock – aquatic life adapted to a certain water temperature can go into shock when the temp is changed even 1 or 2 degrees C.
- Oxygen dissolved in water decreases
- Increases the rate of photosynthesis, which increases the amount of plant growth, developing eutrophic conditions
- Increases the metabolic rate of fish, which increases their need for oxygen

*Fish: Response to Temperature



Solid dot:
Upper lethal
Limit for a
Given species

Open dot:
Best T for
spawning

Solid blocks:
Preferred
Temperature
Range

*The Future is Now

TVA chief: Discharge temperatures within limits

Associated Press

CHATTANOOGA — Sum-
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Calabrese-Benton, a spokeswoman for the Tennessee Department of Environment and Conservation.
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Record heat could put TVA in hot water

By Pam Sohn
Staff Writer

The summer's heat wave and the prospect of global warming could affect TVA's future nuclear power generation or at least change how the utility controls water levels along the Tennessee River.

"That worries us," said Tennessee Valley Authority President Tom Kilgore of whether warm water temperatures, drought and hotter days might force less power production from Browns Ferry and Sequoyah Nuclear plants.

In Europe, July's heat wave and drought prompted utility companies in France, Spain and

See TVA, Page A6

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Saturday, 08/18/07

Hot weather forces partial shutdown of TVA nuclear plant

Plant not designed to run in hot temperatures says spokesman

By JAY REEVES
Associated Press Writer

BIRMINGHAM, Ala. (AP) – One reactor at a north Alabama nuclear plant was idle
d at reduced power because of the record-breaking heat
ry watchdog said could be a sign of trouble for nuclear

ty said it shut down the Unit 2 reactor at Browns Ferry
operations 25 percent at the plant's other two reactors
the Tennessee River, which is used to cool the plant.

"This all comes down to the drought and the hot weather," said plant spokesman

baum said the shutdown highlights a problem for nuclear
vironmentally friendly by President Bush, who visited

f global warming. These plants don't do very well in extremely hot weather," said Lochbaum, a former Browns Ferry engineer now with the Union of Concerned Scientists in Washington.

10/13/07

TVA looking for ways to weather drought

Advisory panel floats ideas including educating public to connect water, energy

BY ANDREW EDER
edera@knews.com

In the midst of one of the driest years on record, a group of stakeholders from across TVA's service area gathered in Knoxville this week to advise the federal utility on how to deal with future droughts.

ON KNOX NEWS.COM

■ Read TVA's draft drought management plan.

Among the suggestions: Form a drought-management committee, be aggressive in communicating with the public and make clear the connection between water and energy Authority on its management of natural resources. Most of the council's members gathered Thursday and Friday in TVA's service area.

TVA staffers briefed the council on the drought and its effects on water and

The shoreline has been widened along the French Broad River at Douglas Lake near Dandridge.

*Wanted Water Quality Board Actions

1. The Water Quality Board requests TDEC conduct a study of the cumulative water quality impacts of the thermal pollution caused by existing and proposed power generating plants on the Tennessee River, including the climatic scenarios of prolonged drought and warmer temperatures.

2. The Water Quality Board requests that TDEC participate in the environmental scoping of the impacts upon the waters of the State of TN of the proposed TVA Bellefonte, AL nuclear power plants and report periodically to the Board.

*CONTROL MEASURES

*Cooling towers

*Cooling ponds

*Spray ponds

*Artificial lakes


Just because you can't see it, doesn't mean it isn't there
advertisers without borders

Role Of An Individual In Prevention Of Pollution

Prevention can be done by some suggestions as given:

- Lay greater emphasis on pollution prevention than pollution control.
- Use ecofriendly products.
- Cut down the use of CFCs as they destroy the ozone layer.
- Use CFC free refrigerators.
- Do not use polystyrene cups that have CFC molecules in them.
- Improve energy efficiency, which reduces the amount of waste energy.
- Saving electricity.
- Reduce the production of wastes.
- Use mass transport system. Decrease the use of automobiles.
- Do not put pesticides, paints or other harmful chemicals into ground water.
- Use only minimum required amount of water for various activities.
- Use rechargeable batteries, which will reduce metal pollution.
- Plant more trees, as they absorb many toxic gases and can purify the air by releasing oxygen.
- Check pollution growth so that demand of material is under control.

*NATURAL RESOURCES UNIT 3

SYLLABUS

- FOREST RESOURCES
- WATER RESOURCES
- MINERAL RESOURCES
- FOOD RESOURCES
- ENERGY RESOURCES
- LAND RESOURCES

NATURAL RESOURCES

Natural resources are the sources which are useful to man or can be transformed into a useful product.

Natural resources are classified into two types.

1. Renewable resources.
2. Non-renewable resources.

1. Renewable resources

Resources that are capable of being regenerated by ecological processes within a reasonable time period are called renewable resources. They have the potential to renew themselves

Examples - Soil, water, air, wildlife, natural vegetation.

The renewable resources are further sub classified into two types.

1. Continuous resources

These resources are continuously renewed.

Examples - Solar energy, wind, tidal energy.

2. Extrinsic resources

These resources are prone to breakdown or degradation, yet are available continuously if well managed.

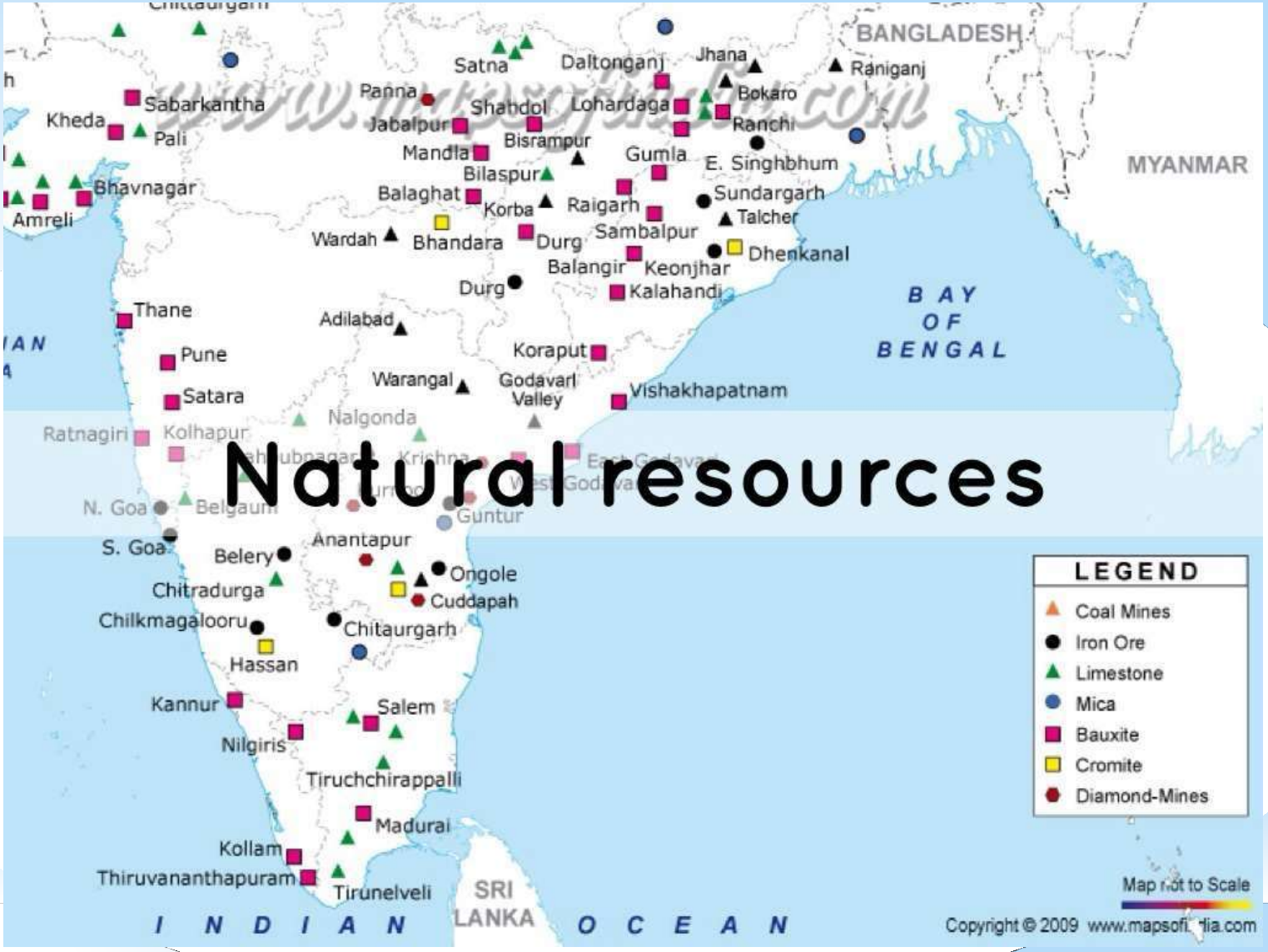
Example – Human skills, institutions, management abilities

Non-renewable resources

Resources that are not capable of being regenerated by ecological processes are called non-renewable resources.

Examples - Minerals, coal, oil, natural gas, ground water.

Natural resources



FOREST RESOURCES

Forests are one of the most important renewable natural resources on this earth.

About one-third of the world's land surface is covered with forest.

Forests are an important components of our environment and economy.

Besides economy, forests provide fuel wood, coal, furniture, checks air pollution, soil erosion, saves the hill-slopes from landslides

Types of Forest

According to the type of vegetation, forests are classified into three major types.

1. Evergreen forests.
2. Deciduous forests.
3. Coniferous forests.

1. Evergreen forests

Evergreen forests are generally found in the equatorial regions, where the temperature and rainfall is very high. Due to heavy rainfall throughout the year these forests are evergreen.

Example - The silent valley in Kerala. Important trees: Teak, mahogany, rosewood.

2. Deciduous forests

These forests are of two types

(a) Tropical deciduous forests

(b) Temperature deciduous forests

(a)Tropical deciduous forests: These forests are generally found in the tropical monsoon. As these forests receive only seasonal rainfall, they shed their leaves during the summer

season.

Important tress: Teak, sandalwood, pillaimarudhu.

(b)Temperature deciduous forests: Due to severe winter with heavy snowfall the trees shed their leaves just before the winter season.

3. Coniferous forests

The snow slides down the Sloping sides of the trees. The needle type leaves preserve the moisture.

Important trees: Pine tree, spruce tree.

Functions of the forest

1. Forests perform very important functions both to humans and nature.
2. They are habitats to millions of plants, animals and wildlife.
3. They recycle rainwater and remove pollutants from air. They control water quality and quantity
4. They moderate temperature and weather and help to maintain humidity.

5. They influence soil Conditions and prevent soil erosion and perform watershed functions.
6. They promote tourism and contribute aesthetic beauty.

Uses or Benefits of Forests

Commercial uses

Man depends heavily on a larger number of plant and animal products from forests for his daily needs.

They provide us a large number of commercial goods.

Commercial uses of Forest

Name of the products	Uses
1. Forests supply wood	used as fuel.
2. Forests supply wood for various industries	used as raw materials as· pulp, paper board, timber etc.,
3. Forests supply minor forest products	give products like gums, resins, dyes, etc.,
4. Many plants	these are utilized in preparing medicines and drugs.
5. Forest produces variety of animal products	gives honey, ivory, hides etc.,
6. Many forest lands are used for	used for grazing, mining, recreation and for dams.

Ecological Uses

1. Production of oxygen: During photosynthesis trees produce oxygen which is essential for life on earth.

2. Reducing global warming: The main greenhouse gas carbon dioxide (C02) is absorbed by the trees (forests).

Trees absorb the main greenhouse gas, carbon dioxide (C02), which is a raw material for photosynthesis.

Thus the problem of global warming, caused by greenhouse gas CO2, is reduced.

3. Soil conservation: Roots of trees (forests) bind the soil tightly and prevent soil erosion. They also act as wind breaks.

4.Regulation of hydrological cycle: Watersheds in forest act like giant sponges, which absorb rainfall, slow down the runoff and slowly release the water for recharge of springs.

5.Pollution moderators: Forests can absorb many toxic gases and noises and help in preventing air and noise pollution.

6.Wildlife habitat: Forests are the homes of millions of wild animals and plants.

Aesthetic Value

Forests also have aesthetic value and serve as gene reserve of important species.

Examples.

1. Tribals utilize bamboo and wild grass for erecting the huts to reside and for making other products like mats, baskets, cots, etc., used in their daily lives.
2. There are variety of daily plants whose fruits, leaves, seeds, roots are used as food by tribals and poor people who live nearer to the forest range.
3. Many kinds of alcoholic drinks and medicines are derived from forest plants.
4. Aromatic oils and other oils, used for lighting and cooking, are also obtained from forests.

Touristic Value

Ecotourism provides a growing income for those who have facilitated it. Several countries are now attracting the tourists

OVER EXPLOITATION OF FOREST

- Due to overpopulation the materials supplied by the forest like food, medicine, shelter, wood and fuel is not sufficient to meet the people's demand.
- Hence exploitation of forest materials is going on increasing day by day.
- With growing civilization, the demand for raw materials like timber, pulp, minerals, fuel wood, etc., increases resulting in large scale logging, mining, road building and cleaning of forests.

Reason for over exploitation in India

It has been estimated that in India the minimum area of forests required to maintain good ecological balance is about 33% of total area.

But, at present it is only about 22%. So over exploitation of forest materials occur.

Causes of over exploitation

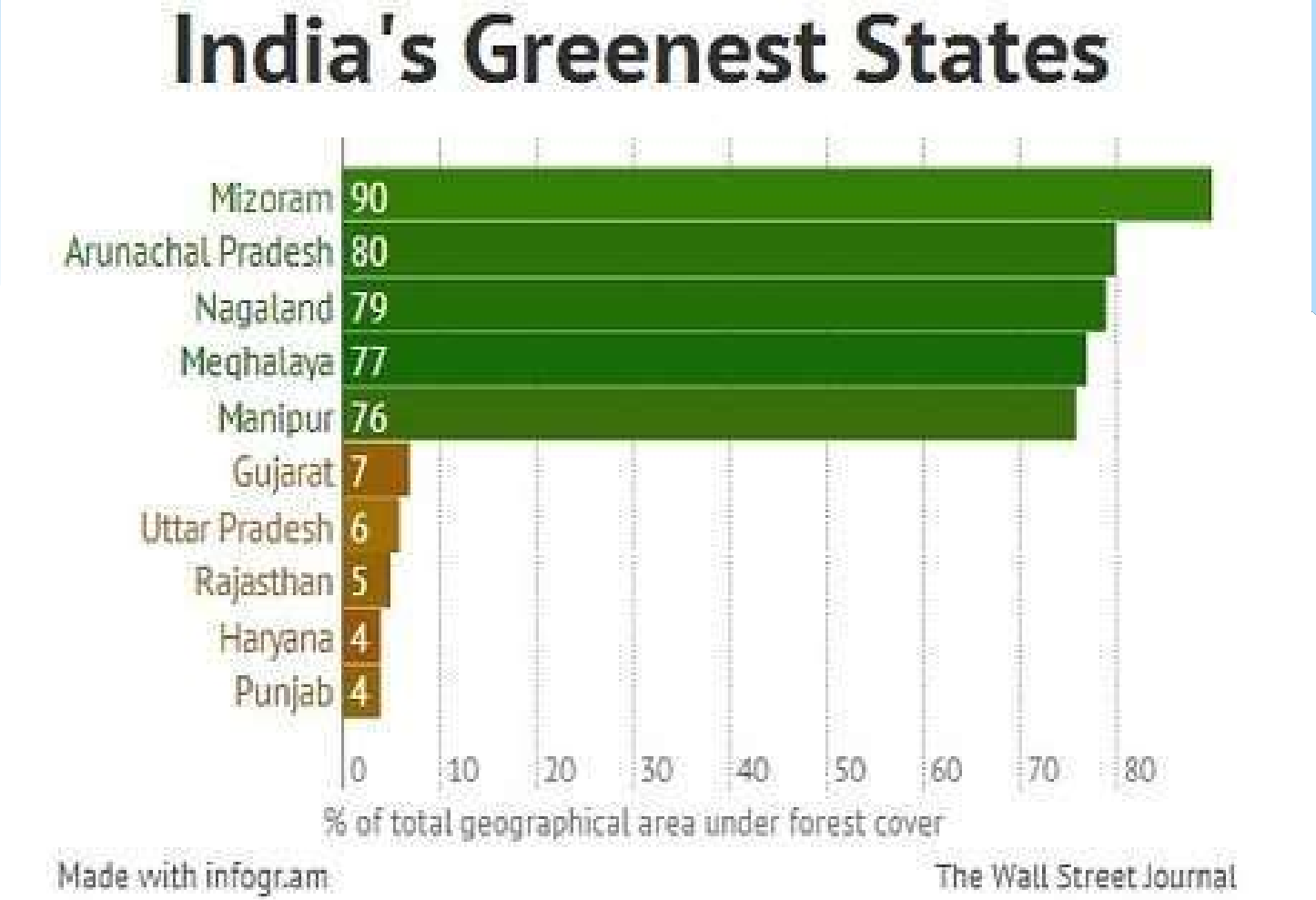
(a) Increasing agricultural production.

(b) Increasing industrial activities.

(c) Increase in demand of wood resources.

Effects (or) Consequences of Over exploitation

1. Over-exploitation of the forest resources led to migration of the farmers.
2. Environmental damage caused by over-exploitation is heavy.
3. The tropical forests are destroyed at very fast rate.
4. Countless plant species and animals are endangered.
5. Marine populations will go into extinction.
6. Dumping of wastes into land, Water and air has become a severe problem.


India's Greenest States
Mizoram 90
Arunachal Pradesh 80
Nagaland 79
Meqhalaya 77
Manipur 76
Gujarat 7
Uttar Pradesh 6
Rajasthan 5
Haryana 4
Punjab 4
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20
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70
80
% of total geographical area under forest cover
Made with infogr.am
The Wall Street Journal

DEFORESTATION

Deforestation is process of removal of or elimination of forest resources due to many natural or man-made activities. In general deforestation means destruction of forests.

Deforestation in India

Deforestation is a continuous process. In India about 1.3 hectares of forest land has been lost.

The percapita availability of forest in India is 0.08 hectares per person, which is much lower than the world average of 0.8 hectares.

The presence of wasteland is a sign of deforestation of India.

Causes of Deforestation

1. Developmental Projects:

Development projects cause deforestation in two ways.

(i) Through submergence of forest area underwater.

(ii) Destruction of forest area.

Examples. Big dams, hydroelectric projects, construction

2. Mining operations

Mining have a serious impact on forest areas. Mining operation reduces the forest area.

Examples Mica, coal, manganese, limestone, etc

3. Raw materials for industries

Wood is the important raw material for so many purposes. Example - For making boxes, furnitures, match-boxes, pulp, etc.,

4. Fuel requirements

In India both rural and tribal population depend on the forest for meeting their daily need of fuel wood, which leads to the pressure on forest, ultimately to deforestation

6. Forest fires

Forest fire is one of the major causes for deforestation. Due to human interruption and rise in ambient temperature, forest fire is happened often nowadays. Thus, due to forest fire thousands of forest area gets destructed.

Consequences (or) ill effects (or) impact of deforestation on the environment

Since many people are dependent on forest resources, deforestation will have the following social, economic and ecological effects.

1. **Global warming**

   Cutting and burning of forest trees increases the CO2 content in the atmosphere, which in turn changes the global climatic pattern, rising sea levels and depletion of the protective ozone layer.

2. **Loss of genetic diversity**

   Destruction of our forest destroys the greatest storehouse of genetic diversity on earth, which provides new food and medicines for the entire world

3. **Soil erosion**

   Deforestation also causes soil erosion, landslides, floods and drought. Natural vegetation acts as a natural barrier to reduce the wind velocity, this in turn reduces soil erosion. 6000 million tons of soil gets eroded every year in India.

4. Loss of biodiversity

Most of the species are very sensitive to any disturbance and changes. When the plants no longer exist, animals that depend on them for food and habitat become extinct.

5. Loss of food grains

As a result of soil erosion, the countries lose the food grains.

6. Unemployment problems

The people living around forest areas lose their livelihood.

7. Flood and Landslides

Frequent floods, landslides in hilly areas and wind speed are heavy.

Preventive measures (or) avoid of deforestation (or) methods of conservation of forests

1. New plants of more or less the same variety should be planted to replace the trees cut down for timber.
2. Use of wood for fuel should be discouraged.
3. Forest pests can be controlled by spraying pesticides by using aeroplanes.
4. Forest fire must be controlled by modem techniques.

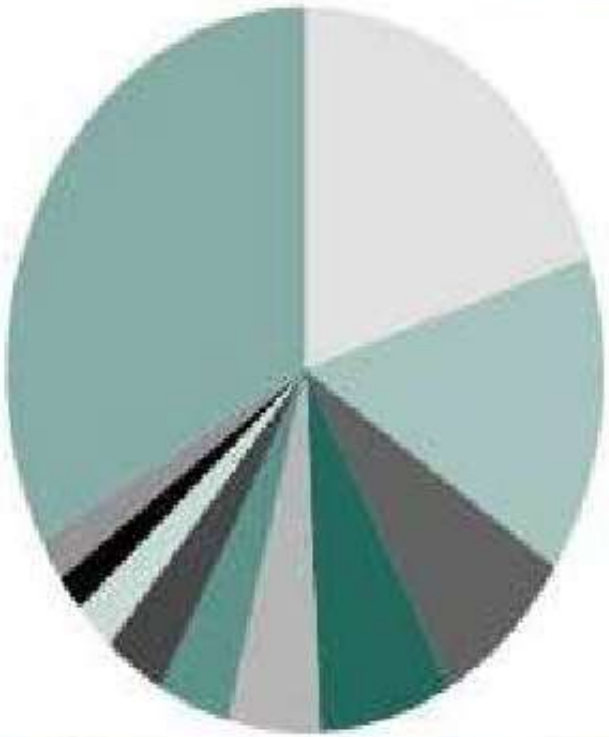
5. Over grazing by cattle must be controlled.

6. Steps should be taken by the government to discourage the migration of people into the islands from mainland.

7. Education and awareness programmes must be conducted.

8. Strict implementation of law of Forest Conservation Act.

Ten countries with largest forest areas (million ha)



Russian Federation	809
Brazil	478
Canada	310
United States	303
China	197
Australia	164
Democratic Republic of the Congo	134
Indonesia	88
Peru	69
India	68
Others	1 333

CASE STUDIES

Deforestation in Himalaya region, involves clearing of natural forests and plantation of monocultures like eucalyptus, camadulensis, etc.,.

Due to this, nutrient cycling has become poor and the soil is losing their fertility. Thus the entire west Khasihill, Himalayas, Ladakh, Garhwal are now facing the serious problems of deforestation

Disappearing Tea gardens in Chhota Nagpur

Deforestation activities in the hilly region of Chhota Nagpur decline the rainfall to such an extent that tea-gardens are disappeared from the region.

MORE DISASTERS WAITING TO HAPPEN?

DEVELOPMENT SWALLOWS DENSE FORESTS

Data in lakh sq km

243 UPA rule (2004-13)

330 Proposals pending with NDA govt

148 Total area of Delhi

GREEN INDIA MISSION

At present **24%**

Target under govt's Green India Mission **33%**

Forest Cover *Includes existing tree cover

THE CATCH | Dense forests take 20-40 years to grow

STATUS OF FOREST COVER IN PUNE (in sq km)

1993	779
2005	1361
2011	1732
2013	1734

CAN NEW FORESTS PREVENT ECODISASTER? NO

- Most of the increase is in new forest cover that have **shallow roots** and hence **cannot hold** on to **soil or water**
- Almost **entire dense forest cover** converted to **moderately dense** cover
- Forest cover in **Maharashtra** has **overall declined** by **14 sq km** between 2011-13

FOREST COVER INCREASES, BUT ONLY SPARSE
From 1993-2013

Total forest cover increase in sq km **57,791**

Open (sparse) forest area **45,376**

TIMBER EXTRACTION

Uses of Timber

1. Timber is used as raw materials for various wood based industries like pulp and paper, composite wood, furniture, etc.,
2. Timber is also used for various developmental activities like railways, boats, road construction etc.,

Consequences (or) effects of timber extraction

1. Large scale timber extraction causes deforestation.
2. Timber extraction leads to soil erosion, loss of fertility, landslides and loss of biodiversity.
3. Timber extraction also leads to loss of tribal culture and extinction of tribal people.
4. Timber extraction reduces thickness of forest.

Indian Scenario

In India, industries consume about 28 million cu.mts/year of wood. But, annual forest growth is only about 12 million cu.mts/year

MINING

Mining is the process of extracting mineral resources and fossil fuels like coal from the earth.

These deposits are found in the forest region and any operation of mining will naturally affect the forest.

Mining operation requires removal of vegetation along with underlying soil mantle.

Types of mining

1. **Surface mining** - It involves mining of minerals from the shallow deposits,
2. **Underground mining** - It involves mining of minerals from deep deposits.

Steps involved in Mining

Mining operation involves the following five steps

1. exploration (investigation and searching of minerals)
2. development
3. exploitation (extraction of minerals)
4. ore processing (separation of ore)
5. extraction and purification of minerals.

The extent of damage by underground mining to the forest resources is significantly less than that of surface mining,

Hence, surface mining is adopted for mineral extraction, which needs enormous amount of land area for its operation and management.

Effects of mining (or) Impacts of mining

1. Mining activity not only destroys trees, but also pollutes soil, water and air with heavy metal toxins that are almost impossible to remove.
2. Destruction of natural habitat at the min and waste disposal sites

3. Due to continuous removal of minerals, forest covers, trenches are formed on the ground, leading to water logged area, of minerals, which in turn contaminates the ground water.

4. During mining operations, Vibrations are developed which leads to earthquake.

5. When materials are disturbed in significant quantities during mining process, large quantities of sediments are transported by water erosion.

6. Noise pollution is another major problem from mining operations.

7. Mining reduces the shape and size of the forest areas.

8. Sometimes landslides may also occur as a result of continuous mining in forest area.

9. Pollution of surface and ground water resources due to the discharge of waste minerals m water.

10. Migration of tribal people from mining areas to other areas for searching land and food.

DAMS AND THEIR EFFECTS ON FORESTS AND TRIBAL PEOPLE

Dams are the massive artificial structures built across the river to create a reservoir in order to store water for many beneficial purposes.

Dams are also responsible for the destruction of vast areas of forest and displacement of local people.

Indian Scenario

India has more than 1600 large dams

State	**Number of dams**
Maharastra	more than 600 dams
Gujarat	more than 250 dams
Madhya Pradesh	more than 130 darns

Effects of dam on Forest

1. Thousands of hectares of forest have been cleared for executing river valley projects.
2. In addition to the dam construction, the forest is also cleared for residential accommodation, office buildings, storing materials, laying roads, etc.,
3. Hydroelectric projects also have led to widespread loss of forest in recent years.
4. Construction of darns under these projects led to killing of wild animals and destroying aquatic life.
5. Hydroelectric projects provide opportunities for the spread of water borne diseases.
6. The big river valley projects also cause water logging which leads to salinity and in tum reduces the fertility of the land.

Examples

1. Narmada Sagar project: It has submerged 3.5 lakh hectares of forest comprising teak and bamboo trees.
2. Tehri dam: It has submerged 1000 hectares of forest affecting about 430 species of plants.

Effects of dam on tribal people

1. The greatest social cost of big dam is the widespread displacement of tribal people, such a biodiversity cannot be tolerated.
2. Displacement and cultural change affects the tribal people both mentally and physically. They do not accommodate the modem food habits and life styles.

3. Tribal people are ill-treated by the modem society.

4. Many of the displaced people were not recognized and resettled or compensated.

5. Tribal people and their culture cannot be questioned and destroyed.

6. Generally, the body conditions of tribal people (lived in forest) will not suit with the new areas and hence they will be affected by many diseases.

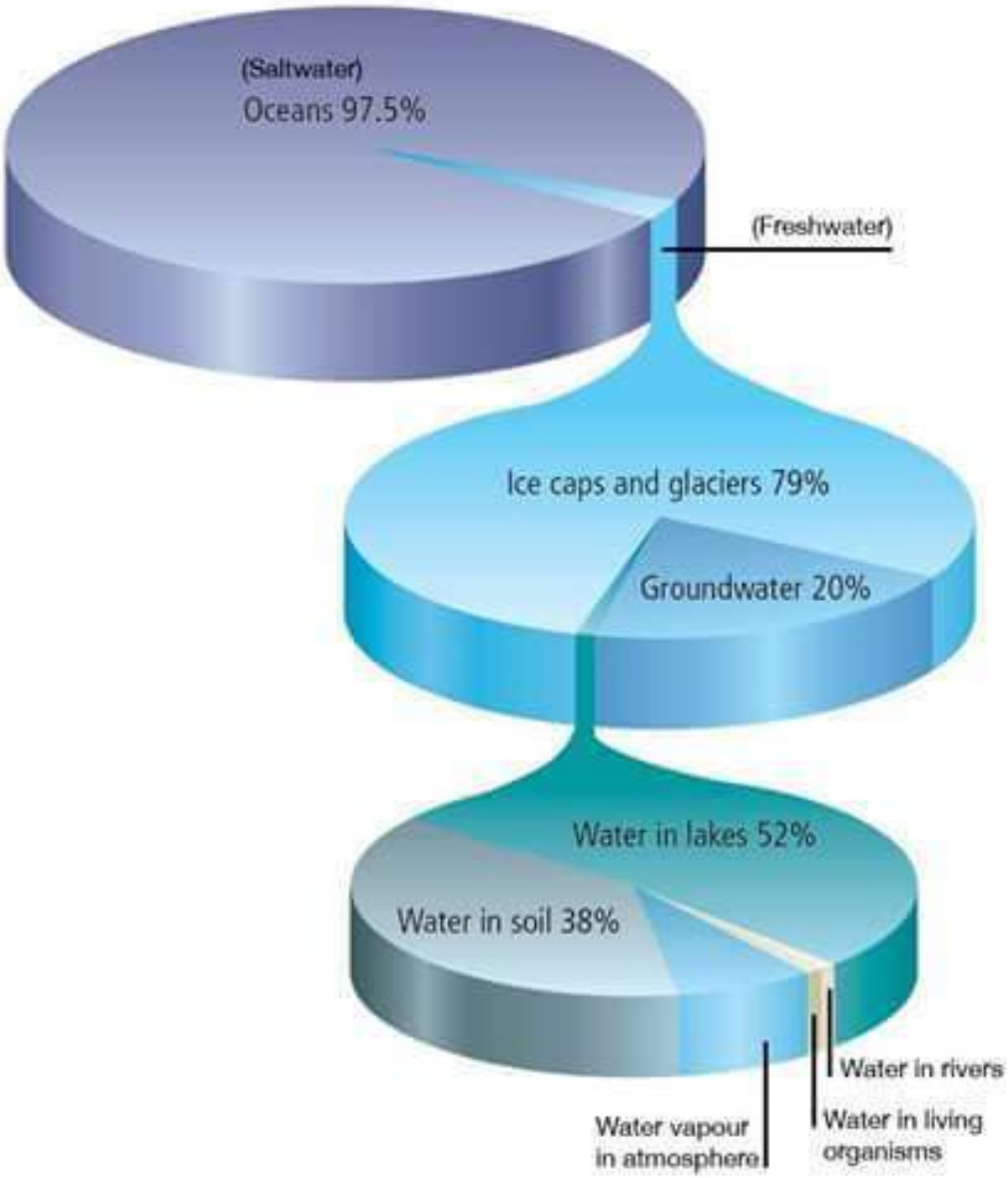
*Proposed layout for Dam construction

WATER RESOURCES

Water is an important component of all the living beings. Nearly 80% of earth's surface is covered with water. All organisms are made up of mostly by water.

Examples

1. A tree is made up of 60% by weight of water.
2. Animals are made up of 50-65% of water.


(Saltwater)
Oceans 97.5%
(Freshwater)
Ice caps and glaciers 79%
Groundwater 20%
Water in lakes 52%
Water in soil 38%
Water in rivers
Water vapour in atmosphere
Water in living organisms

Hydrological cycle

Hydrological cycle involves the following steps.

1. Evaporation
2. Condensation and precipitation.
3. Transpiration and respiration.

1. Evaporation

Heat energy from the sun constantly causes evaporation from all the water surfaces. Oceans, rivers, streams, lakes, ponds and the surfaces of terrestrial organisms lose water due to evaporation.

The energy, from the sun, also drives the weather systems, which move the clouds (water vapour) from one place to another.

2. Condensation and precipitation

Rain fall occurs due to the condensation of water from a gaseous state in the atmosphere and falls to earth.

Once water condenses, it is pulled into the ground by gravity.

Gravity continues to operate either pulling the water underground (ground water) or across the surface (surface run-off).

3. Transpiration and respiration

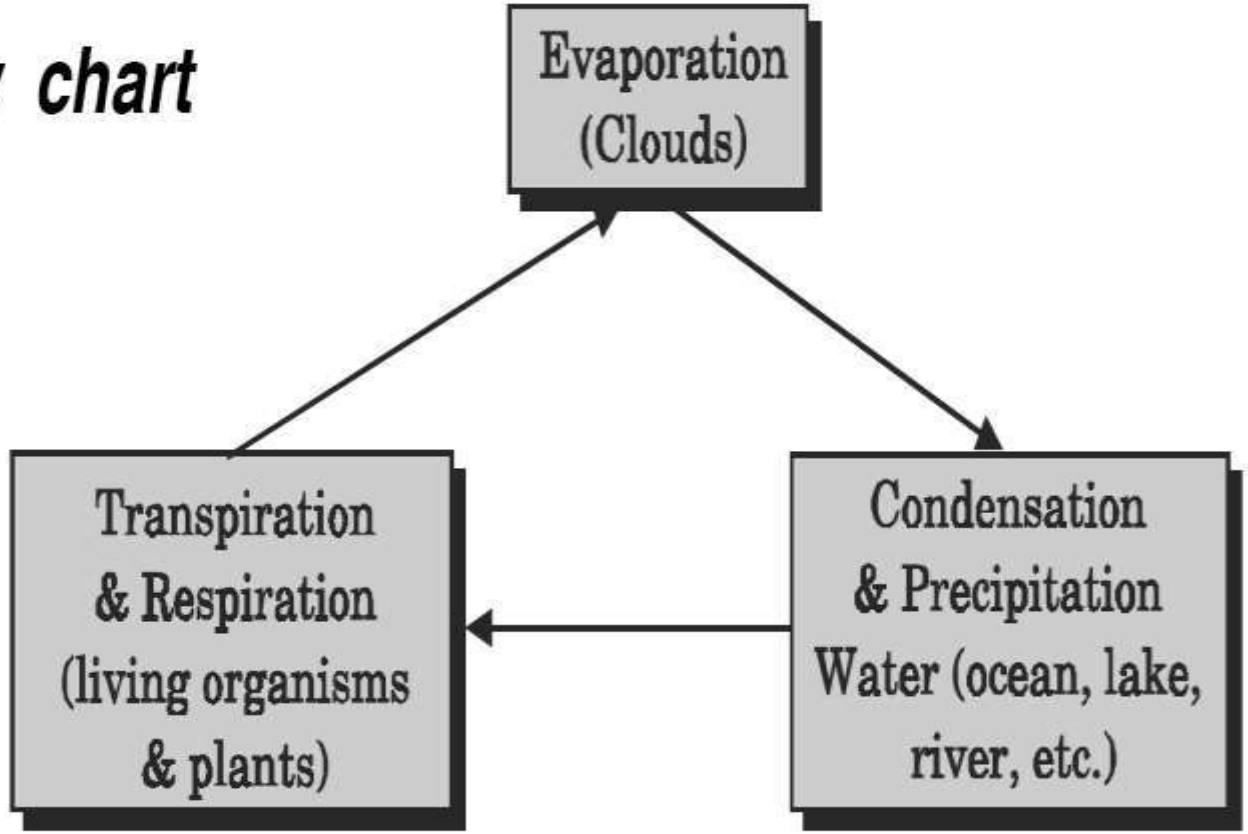
Most of the organisms contain significant amount of water (90% of their body weight).

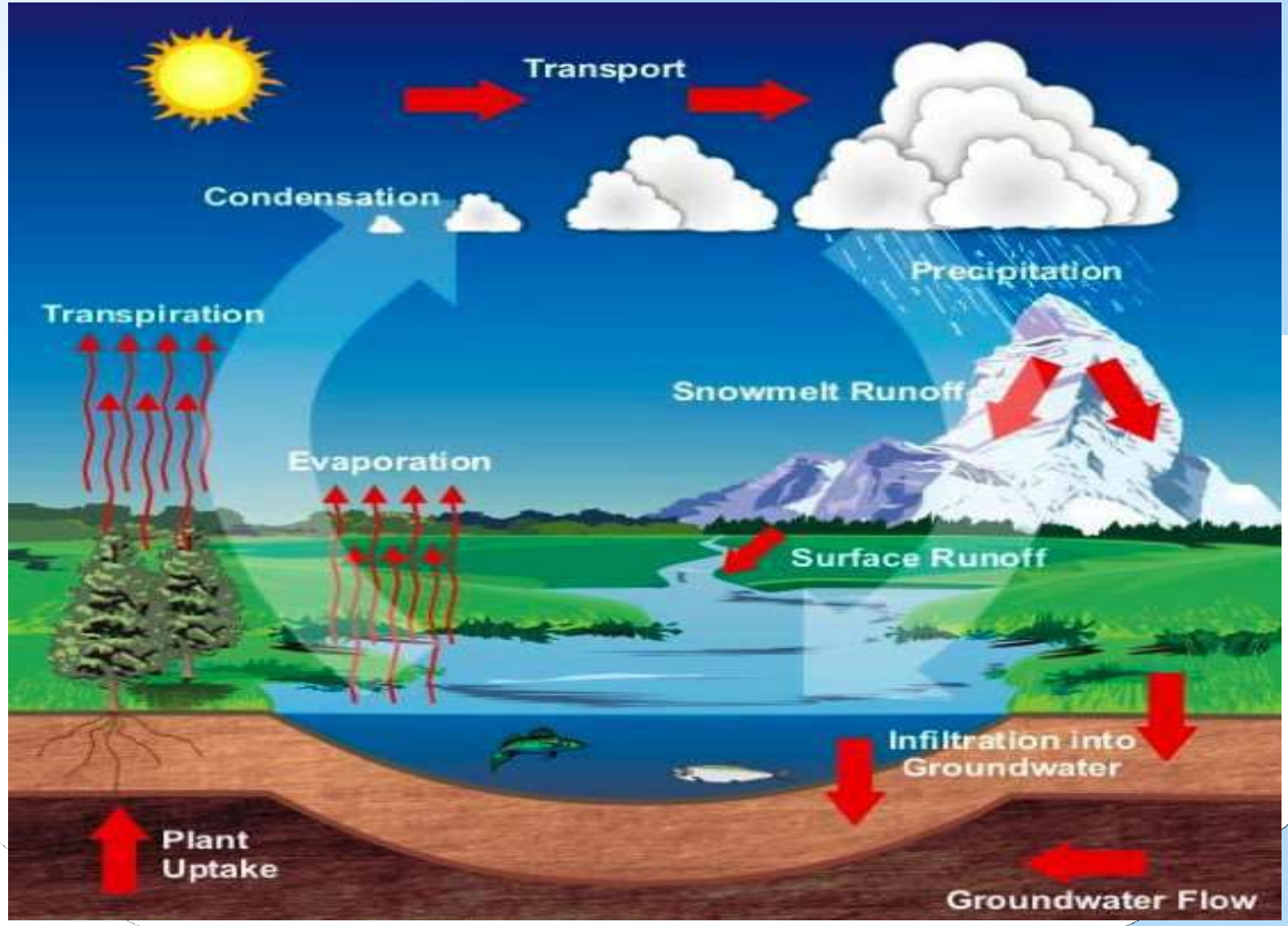
Plants use the soil water for photosynthesis and to transport materials within them. Much of the water, they absorb through their roots, is lost to the atmosphere from the leaves. This process is known as transpiration.

In animals and plants, the breakdown of sugars to produce energy (known as respiration) with the liberation of by-products carbondioxide and water.

Thus, the process of evaporation, condensation and transpiration is called hydrological cycle

Flow chart


Evaporation
(Clouds)
Condensation
& Precipitation
Water (ocean, lake,
river, etc.)
Transpiration
& Respiration
(living organisms
& plants)


Transport
Condensation
Precipitation
Transpiration
Snowmelt Runoff
Evaporation
Surface Runoff
Infiltration into
Groundwater
Plant
Uptake
Groundwater Flow

Distribution of water resources

About 97.4% by volume of water is found in oceans and is too salty and cannot used for drinking, irrigation and industrial purposes.

Of the remaining 2.6% fresh water most of which is locked up in ice or in deep ground water.

Thus only about 0.014% of the earth's total volume of water is easily available to us as usable ground water

Types of Fresh Water Resources

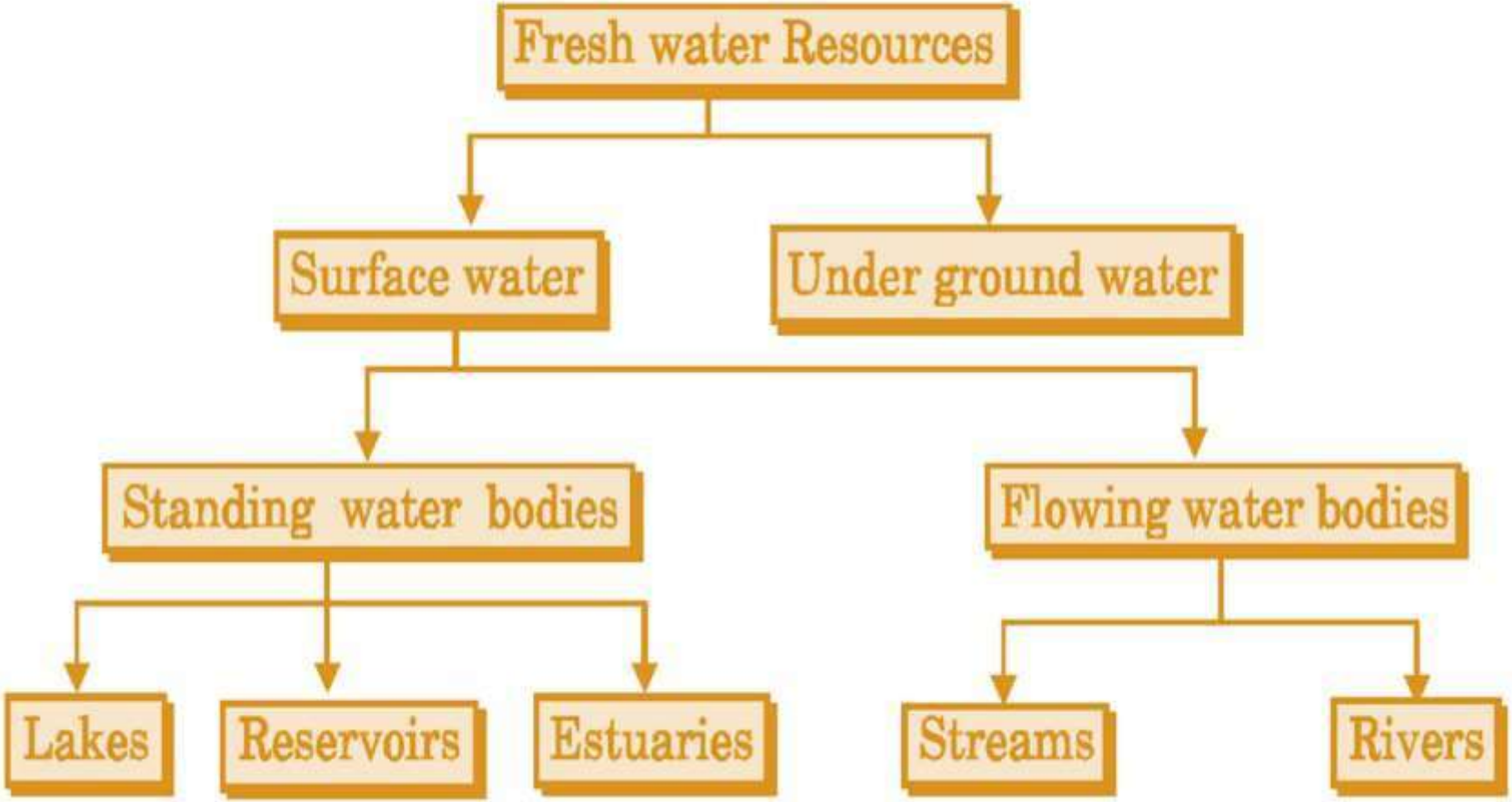
Fresh water resources may be broadly classified into two types.

1. Surface water.

(a) Standing water bodies - Lakes, reservoirs, estuaries.

(b) Running water bodies: Streams, rivers.

2. Underground water.


Fresh water Resources
Surface water
Under ground water
Standing water bodies
Flowing water bodies
Lakes
Reservoirs
Estuaries
Streams
Rivers

Uses of water-Different Types

1. Consumptive Use

Here water is completely utilised and it is not reused.

Example - In domestic application, industry and irrigation.

2. Non-Consumptive use

Here water is not completely utilised and it is reused.

Example – Hydropower plant

3. Other important uses of water

1. Water is mainly used for domestic purposes like drinking, cooking, bathing and washing etc.,
2. Water is also used for commercial purposes like hotels, theatres, educational institutions, offices, etc.,
3. Another important use of water is for irrigation, like agriculture. Almost 60-70% of the fresh water is used for irrigation.
4. 20-30% of the total fresh water is used for so many industrial operations like refineries, iron and steel, paper and pulp industries.
5. Water is very essential for the sustainance of all the living organisms.
6. Water also plays a key role in sculpting the earth's surface, moderating climate and diluting pollutants.

OVER-UTILIZATION of WATER (SURFACE AND GROUND WATER)

The rapid increase in population and industrial growth has increased the demand for water resources.

Due to increase of ground water usage, the annual extraction of ground water is in far excess than the natural recharge.

Effects on over-utilization of water (or) Consequences of overdrawing of ground water

1. Decrease of Ground Water

Due to increased usage of ground water, the ground water level decreases.

Reason

Other reasons for decrease of ground water are

(a) The erratic and inadequate rainfall results in reduction in storage of water in reservoirs.

(b) The building construction activities are sealing the permeable soil zone, reducing the area for percolation of rain water and increase in surface runoff.

2. Ground subsidence

When the ground water withdrawal is more than the recharge rate, the sediments in the aquifer get compacted which results in sinking of over lying land surface. This process is known as ground subsidence.

Problems

1. Structural damage in buildings.
2. Fracture in pipes.
3. Reversing the flow of canals and tidal flooding.

3. Lowering of water table

Over utilization of ground water in arid and semi-arid regions for agriculture disturbs the state of equilibrium of the reservoir (disturb the hydrological cycle)in the region. This causes foIIowing problems.

Problems

1. Lowering of water table.

2.Decreased pressure in the aquifers and changes in the speed and direction of water flow.

4. Intrusion of salt water

In coastal areas, over exploitation of ground water would lead to rapid intrusion of salt water from sea

Problem - Water cannot be used drinking and agriculture.

5. Earthquake and landslides

Over-utilization of ground leads to decrease in water level, which cause earth quake, land slides and famine.

6. Drying up of wells

As a result of over utilization of ground water, the level of ground water getting depleted at much faster rates than they can be regenerated. This leads to drying up of dug as well as bore wells.

7. Pollution of water

When ground water level near the agricultural land decreases, water, containing the nitrogen as nitrate fertilizer, percolates rapidly into the ground and poIlute the ground water.

Problem: Water becomes unsuitable for potable use by infants, when nitrate concentration exceeds 45 mgs / lit.

DAMS-BENEFITS AND PROBLEMS

Dams are built across the river in order to store water for irrigation, hydroelectric power generation and flood control.

Most of the dams are built to serve for more than one purpose called "multi-purpose dams".

These dams are called as the Temples of modem India by the country's first Prime Minister, Jawaharlal Nehru.

Benefits of constructing dams

1. Dams are built to control flood and store flood water.
2. Sometimes dams are used for diverting part or all of the water from river into a channel.
3. Dams are used mainly for drinking and agricultural purposes.
4. Dams are built for generating electricity.
5. Dams are used for recreational purposes.
6. Navigation and fishery can be developed in the dam areas.

Benefits of constructing dams

1. Upstream problems

a) Displacement of tribal people.

b) Loss of non-forest land.

c) Loss of forests, flora and fauna.

d) Landslips, sedimentation and siltation occur.

e) Stagnation and water logging around reservoirs retards plant growth.

f) Breeding of vectors and spread diseases and spreading of vector-borne diseases

g) Reservoir induced seismicity (RlS) causes earthquakes.

(h) Navigation and aquaculture activities can be developed in the dam area.

Downstream problems

a) Water logging and salinity due to over irrigation.

b) Reduced water flow and silt deposition in rivers.

c) Salt water intrusion at river mouth.

d) Since the sediments carrying nutrients get deposited in the reservoir, the fertility of the land along the river gets reduced.

e) Sometimes, due to structural defects the dam may collapse suddenly and destroy many living organisms .

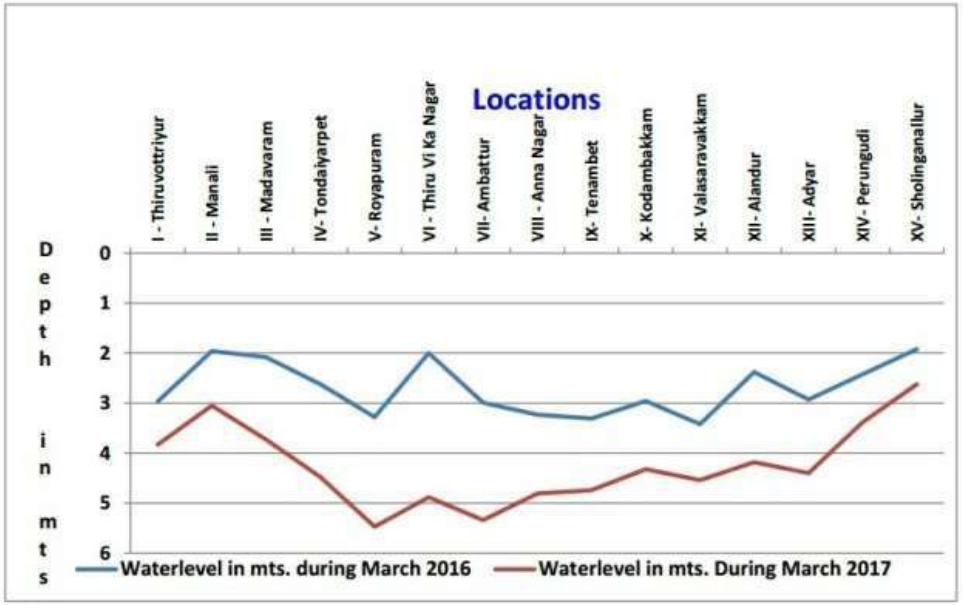
f) Salt water intrusion at river mouth.

STORAGE AS ON 27.6.2017

WITH REFERENCE TO MEAN SEA LEVEL

 RESERVOIR	Full Tank Level (ft.)	Full Capacity (mcft)	Level (ft)	Storage (Mcft)	Inflow (cusecs)	Outflow (cusecs)	Rainfall (mm)	Storage as on same day last year (mcft)
POONDI	140.00	3231	118.46	20.00	0	1	0.0	1033.00
CHOLAVARAM	64.50	881	0.00	0.00	0	0	0.0	80.00
REDHILLS	50.20	3300	23.94	33.00	0	37	0.0	1256.00
SUB TOTAL	-	7412	-	53.00	-	-	-	2,369.00
CHEMBARAMBAKKAM	85.40	3645	63.79	53.00	0	10	0.0	1996.00
TOTAL	-	11057	-	106.00	-	-	-	4,365.00
ENTRY POINT	-	-	-	-	0	-	0.0	-
KORATTUR ANICUT	-	-	-	-	-	-	0.0	-
TAMARAIPAKKAM	-	-	-	-	-	-	0.0	-

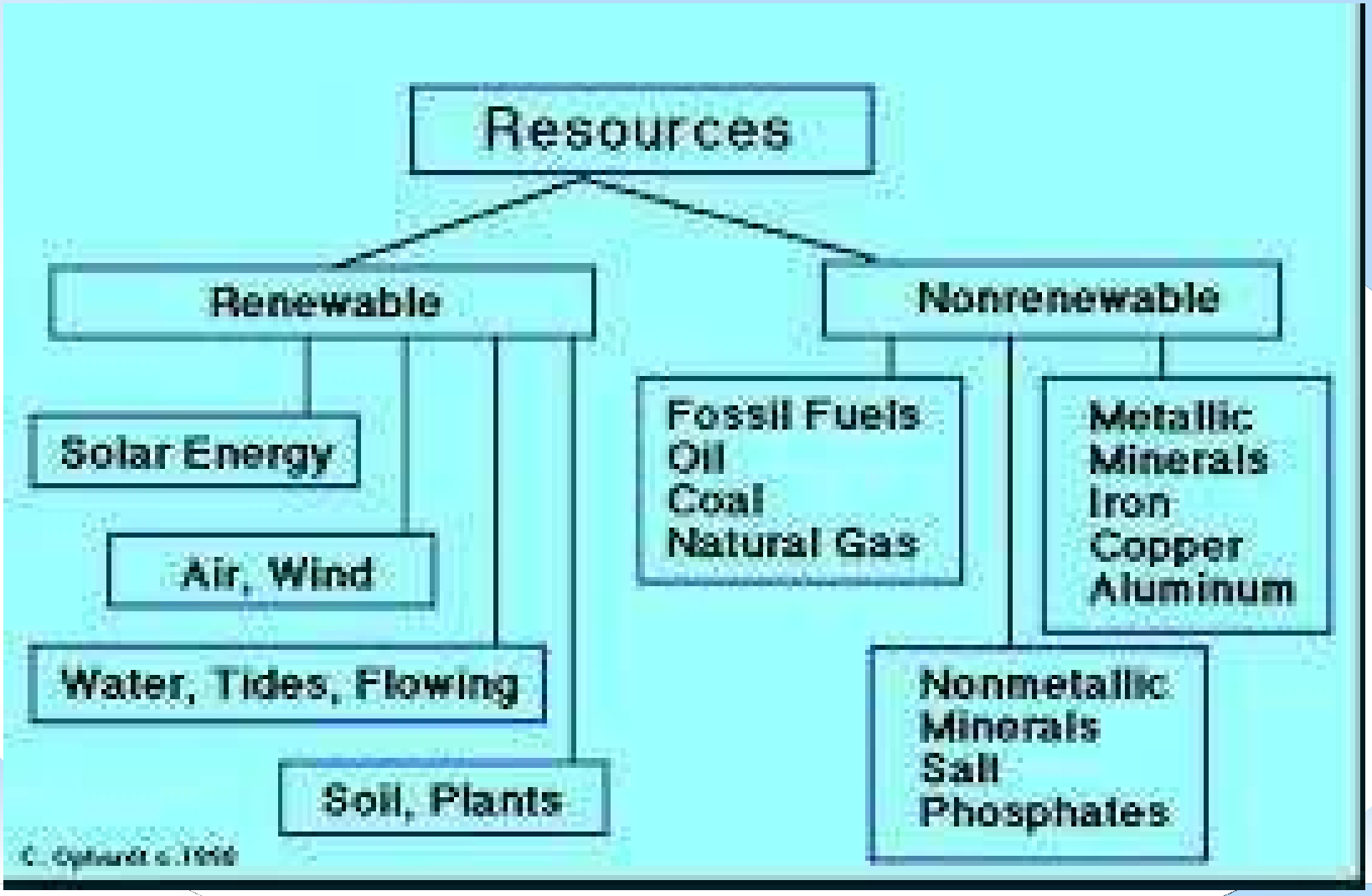
Credit: Chennai MetroWater



The comparative statement of average water level in 15 areas of Chennai City during the month of March 2016 and March 2017 shows that there is a fall in the water level in the range of 0.70 mts (Sholinganallur) to 2.88 mts (Thiru-Vi-Ka-Nagar) below ground level. Considering the situation Chennai Metro water requests the residents of Chennai City to conserve the water in the following methods:

- Use the treated Metro water for drinking and cooking only.
- Ensure that the pipes and taps are leak proof.
- Close the tap while shaving and brushing teeth.
- Divert the bathroom and kitchen water to garden / Plants.
- Close the tap while not in use.

PUBLIC RELATIONS MANAGER
Chennai Metrowater


Resources
Renewable
Nonrenewable
Solar Energy
Air, Wind
Water, Tides, Flowing
Soil, Plants
Fossil Fuels
Oil
Coal
Natural Gas
Metallic
Minerals
Iron
Copper
Aluminum
Nonmetallic
Minerals
Salt
Phosphates

MINERAL RESOURCES

Minerals are naturally occurring substances having definite chemical composition and physical properties.

Ores

Ores are minerals or combination of minerals from which useful substances, such as metals, can be profitably extracted and used for manufacture.

Formation of mineral deposits

Concentration of minerals at a particular spot, gives rise to a mineral deposit. Formation of this deposits is a very slow biological process, even it takes millions of years to develop as a mineral deposit.

Various biological processes

1. Mineral deposits are formed due to the biological decomposition of dead animals and organic matters.
2. Mineral deposits are also formed due to the concentration of minerals during cooling of molten rock (lava from volcano).
3. Mineral deposits are also formed due to evaporation of sea water.
4. Mineral deposits are formed due to oxidation-reduction reaction inside the earth.
5. Formation of mineral deposits due to concentration of minerals during weathering, transport and sedimentation

Classification of Mineral Resources

U.S. Geological Survey divides non-renewable mineral resources into 3 categories.

1. Identified resources
2. Undiscovered resources
3. Reserves

1. Identified resources:

The location, existence, quantity and quality of these mineral resources are known by the direct geological evidence and measurements

2.Undiscovered resources: These mineral resources are assumed to exist on the basis of geological knowledge and theory but their specific locations, quality and quantity are unknown.

3.Reserves: These mineral resources are identified resources, from which a usable minerals can be extracted profitably.

Uses and exploitation of minerals

Minerals are used in a large number of ways in everyday in domestic, agricultural, industrial and commercial sectors.

Economy and political power of the country is determined from the number of reserves of minerals and technical know-how to extract the elements

The important uses of minerals are as follows.

1. Development of industrial plants and machinery. Examples - Iron, aluminium, copper, etc.,
2. Construction, housing, settlements. Example - Iron, aluminium, nickel, etc.,
3. Generation of energy. Example – Coal, Lignite, Uranium etc
4. Designing of defence equipments, weapons, ornaments
5. Agriculture purposes, as fertilizers, seed dressings and fungicides. Example Zineb – containing zinc and Maneb - containing manganese

6. Jewellery – Example - Gold, silver, platinum and diamond.

6. Making of alloys for various purposes. Examples - Phosphorites.

7. Communication purposes. Examples – Telephone wires, cables, electronic devices.

8. Medicinal purposes – particularly in ayurvedic system – Example – Sulphur pyrites

Distribution and uses of major metallic and non-metallic minerals

Metal	Major World Reserves	Major Uses
Aluminium	Australia, Guinea, Jamacia.	Packing food items, transportation.
Chromium	CIS, South Africa.	For making high strength steel alloys, in textile/tanning industries.
Copper	U.S.A., Canada, CIS, Chile, Zambia.	Electric and electronic goods, building, construction, vessels.
Iron	CIS, South America, Canada, U.S.A	Heavy machinery, steel production.
Lead	North America, U.S.A., CIS.	Leaded gasoline, Car batteries, paints, ammunition.

Metal	Major World Reserves	Major Uses
Manganese	South Africa, CIS, Brazil, Gabon.	For making high strength, heat resistant steel alloys.
Platinum	South Africa, CIS.	Use in automobiles, catalytic converters, electronics, Medical uses.
Gold	South Africa, CIS, Canada.	Ornaments, medical use, electronic use, use in aerospace.
Silver	Canada, South Africa, Mexico.	Photography, electronics & jewellery.
Nickel	CIS, Canada, New Caledonia.	Chemical industry.

Major uses of Non-metallic minerals

Non-metal Mineral	Major Uses
Silicate minerals	Sand and gravel for construction, bricks, paving, etc.,
Limestone	Used for concrete, building stone, used in agriculture for neutralizing acid soils, used in cement industry.
Gypsum	Used in plaster, wall-board, in agriculture.
Potash, Phosphorite	Used as fertilizers.
Sulphur pyrites	Used in medicine, car battery.

Classification of minerals

Minerals are classified into two ways based on their composition and usage

1. Based on Composition

1. Metallic minerals: Metallic minerals are the one from which various metals can be extracted.

   Example - lron, aluminium, copper, zinc, etc.,

2. Non-metallic minerals: Non-metallic minerals are the one from which various non-metallic compound can be extracted.

   Example - Quartz, feldspar, dolomite, calcite, etc.

2. Based on Usage

1. Critical minerals: These are essential for the economic power of a country.

Examples - Iron, aluminium, copper and gold.

2.Strategic minerals: These are required for the defence of a country.

Examples - Manganese, cobalt, platinum and chromium.

Mineral wealth of India

India has the following mineral resources.

1. **Iron:** Iron occurs as haematite, Fe203 in Bihar, Orissa, Maharashtra, Tamil Nadu, Goa, and Madhya Pradesh. Clay, Iron ores are found in Karnataka.
2. **Coal:** Coal is available in large quantities in Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Orissa and West Bengal.
3. **Manganese:** Next to Russia, we are the biggest producers of manganese. Manganese ore is found in Madhya Pradesh, Orissa, Maharashtra, Andhra Pradesh, Bihar, Rajasthan, Tamil Nadu, Karnataka, Goa and Gujarat.

4. **Copper:** Copper occurs in Bihar, Andhra Pradesh, Madhya Pradesh, Orissa, Karnataka, Rajasthan, Gujarat and Sikkim.
5. **Gold:** Gold is found in free state in Karnataka, Andhra Pradesh, and in the alluvial sands of the Ganga, the Brahmaputra and the Irrawaddy.
6. **Aluminium:** Bauxite, an ore of aluminium is available in Madhya Pradesh, Bihar, Orissa, Salem (T.N), Gujarat, Maharashtra, Karnataka and Kashmir.
7. **Tin:** Tin occurs as limestone in Bihar, Orissa and Rajasthan.
8. **Chromium:** Chromium is found as Chrome iron ore in Bihar, Orissa, Maharashtra, Tamilnadu and Karnataka.

9. **Limestone:** Limestone is available in Satra, Katni and Rohtasgarh. Marble is found in Jaipur and Madhya Pradesh.

10. **Mica:** India is the chief producer of mica. It occurs in Bihar, Andhra Pradesh and Rajasthan.

11. **Monozite:** It is the costly thorium ore (Rs. 40,000 per tonne) which occurs in Travancore and India has sole monopoly for it.

12. **Petroleum:** Gujarat, Assam, and Maharashtra are rich in Petroleum. Lakshadweep and the off-shore areas in the continental shelf are equally rich.

13. **Lead and Zinc:** Lead and zinc are found in Gujarat and Rajasthan. Lead deposits are known to exist in Andhra Pradesh and Orissa.
14. **Precious Stones:** Aquamarine and emerald are mined in Rajasthan.
15. **Magnesite**: Magnesite occurs in Tamil Nadu and Sikkim
16. **Ilmenite and Rutile**: They are found in Kerala and Tamil Nadu
17. **Gypsum:** It occurs in Rajasthan, Tamilnadu Jammu and Kashmir.

Environmental effects (or) impacts of extracting and using mineral resources.

Most important environmental concern arises from the extraction and processing of minerals during mining, melting, roasting, etc

Mining

Mining is the process of extraction of metals from a mineral deposit.

Types of mining

(a) Surface mining: Surface mining is the process of extraction of raw materials from the near surface deposits.

(b) Underground mining. It is the process of extraction of raw materials below the earth's surface. It includes,

(i) Open-pit mining: Open-pit mining machines dig holes and remove the ores.

Example: Iron, copper, limestone, and marble etc.

(ii) Dredging: In dredging, chained buckets and draglines are used, which scrap up the minerals from under-water mineral deposit.

(iii) Strip mining: In strip mining, the ore is stripped off by using bulldozers, stripping wheels.

Environmental damage

Environmental damage, caused by mining activities, are as follows.

1. **Devegetation and defacing of landscape:** Topsoil as well as the vegetation are removed from the mining area. Large scale deforestation or devegetation leads to several ecological losses and also landscape gets badly affected.

2. **Groundwater contamination:** Mining disturbs and also pollutes the ground water. Usually sulphur, present as an impurity in many ores, gets converted into sulphuric acid due to microbial action, which makes the water acidic. Some heavy metals also get leached into groundwater.

3. **Surface water pollution:** Drainage of acid mines often contaminates the nearby streams and lakes. The acidic water is harmful to many aquatic lives. Radioactive substances like uranium also contaminate the surface water and kill many aquatic animals.
4. **Air pollution:** Smelting and roasting are done to purify the metals, which emits enormous amounts of air pollutants damaging the nearby vegetation. The suspended particulate matter (SPM), SOx arsenic particles, cadmium, lead, etc., contaminate the atmosphere and public suffer from several health problems.
5. **Subsidence of land:** It is mainly associated with underground mining. Subsidence of mining area results in cracks in houses, tilting of buildings, bending of rail tracks.

Effects of over exploitation of Mineral resources

1. Rapid depletion of mineral deposits.
2. Over exploitation of mineral resources leads to wastage and dissemination of mineral deposits.
3. Over exploitation of mineral resources causes environmental pollution.
4. Over exploitation needs heavy energy requirement.

Management of Mineral resources

1. The efficient use and protection of mineral resources.
2. Modernization of mining industries
3. Search for new deposit
4. Reuse and recycling of the metals
5. Environmental impacts can be minimized by adopting eco-friendly mining technology
6. The low grade ores can be better utilized by using microbial-leaching techniques.

Case Studies

Mining and quarrying in Udaipur

About 200 open cast mining and quarrying centres are found available in Udaipur, of which 100 mining and quarrying centres are illegal and involved in stone mining.(i.e., soapstone, building stone, rock phosphate and dolomite.) Nearly 150 tonnes of explosives are used per month in blasting of mines and quarry, which pollute the air, soil and water. This blasting activity adversely affects irrigation and wildlife.

Mining in Sariska Tiger Reserve in Aravalli range

The Aravalli range is spread in the North-west India covering Gujarat, Rajasthan, Haryana and Delhi. The hill region is very rich in biodiversity as well as mineral resources. The Sariska Tiger reserve, in Aravalli series, is very rich in wildlife and has enormous mineral reserves like quartzite, marble and granite.

Mining operations around the Sariska Tiger reserve has made many areas permanently infertile and barren. So we must preserve the Aravalli series as National Heritage.

The Supreme Court has directed the centre and state government of Rajasthan to ensure that all mining activity within the series be stopped. But, still some illegal mining is in progress

Quarrying Thorium and Uranium in Kanyakumari district

Indian Rare Earths Corporation is quarrying sands, which is enriched with Uranium and Thorium, near the sea shore in Manali, Kanyakumari District. It leads to the loss of many coconut plantation and sea shore beauty.

Extraction of Aluminium

The process of extraction of aluminium from its ore bauxite is highly polluting, because large amount of power and chemicals are being consumed.

For the manufacture of 1 tonne of aluminium metal, the materials required are

1. 5.5 Tonnes of Bauxite.
2. 1.3 Tonnes of Coal.
3. 0.6 Ton of anode carbon.
4. 0.25 Ton of fuel oil.
5. 0.1 Ton of fluoride salt.
6. 16 MWH of electricity.

Of the above materials, only 1 ton of aluminium is obtained as a finished product and the rest solids, liquids and gases are toxic effluents.

Among the effluents, the largest (1.2 ton) and most toxic is red mud. This red mud has to be stored in isolated tanks for long period of time.

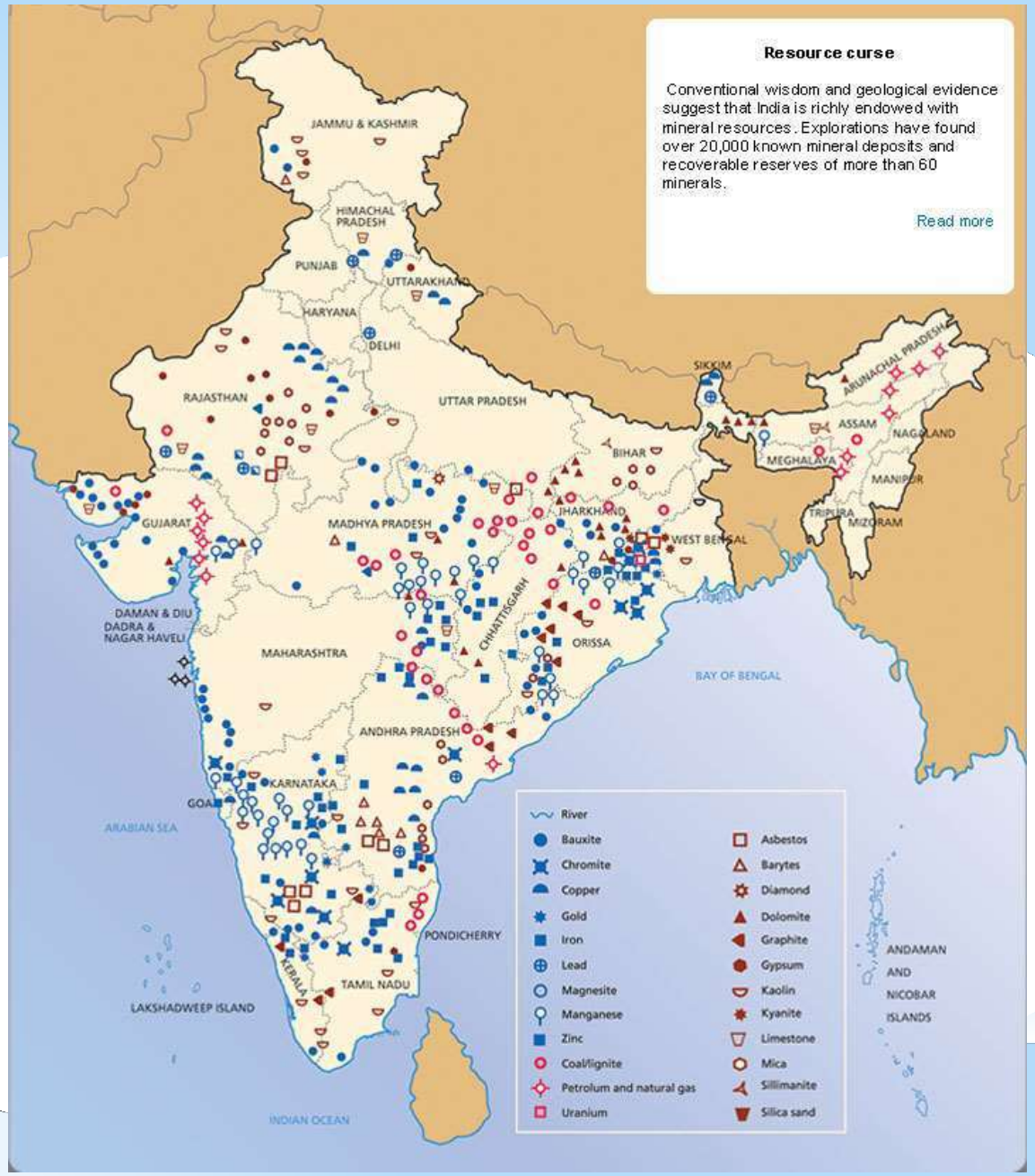
Further the land locked in storage of red mud become barren and also pollutes ground and surface waters

Remedy Measures

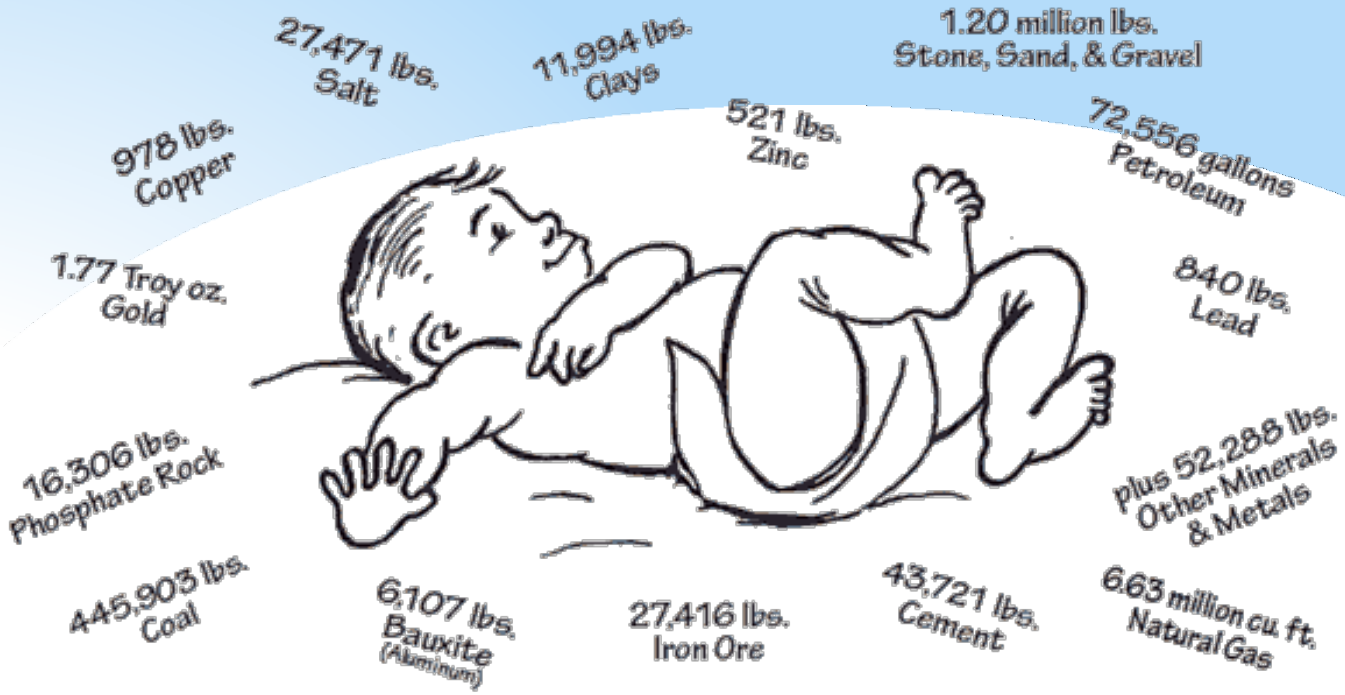
The best solution is, the red mud should be considered as a raw material for secondary industry. The valuable ingredients of red mud including titanium dioxide, aluminium oxide, ferric oxide, sodium oxide and calcium oxide should be recovered.

CLASSES OF MINERALS

METALS	NON METALS	FUELS
• Copper • Nickel • Gold • Silver • Iron	• Sand • Gravel • Clay • Limestone • Salt	• Oil • Gas • Coal


Resource curse
Conventional wisdom and geological evidence suggest that India is richly endowed with mineral resources. Explorations have found over 20,000 known mineral deposits and recoverable reserves of more than 60 minerals.
Read more
JAMMU & KASHMIR
HIMACHAL PRADESH
PUNJAB
UTTARAKHAND
HARYANA
DELHI
RAJASTHAN
UTTAR PRADESH
SIKKIM
ARUNACHAL PRADESH
ASSAM
NAGALAND
MEGHALAYA
MANIPUR
TRIPURA
MIZORAM
BIHAR
JHARKHAND
WEST BENGAL
GUJARAT
MADHYA PRADESH
CHHATTISGARH
ORISSA
DAMAN & DIU
DADRA & NAGAR HAVELI
MAHARASHTRA
ANDHRA PRADESH
KARNATAKA
GOA
KERALA
TAMIL NADU
PONDICHERRY
BAY OF BENGAL
ARABIAN SEA
LAKSHADWEEP ISLAND
INDIAN OCEAN
ANDAMAN AND NICOBAR ISLANDS
River
Bauxite
Chromite
Copper
Gold
Iron
Lead
Magnesite
Manganese
Zinc
Coal/lignite
Petrolum and natural gas
Uranium
Asbestos
Barytes
Diamond
Dolomite
Graphite
Gypsum
Kaolin
Kyanite
Limestone
Mica
Sillimanite
Silica sand

Every American Born Will Need...



3 million pounds of minerals, metals, and fuels in their lifetime

Learn more at www.MineralsEducationCoalition.org

WHAT ARE SOME MINERAL RESOURCES & THEIR USES?

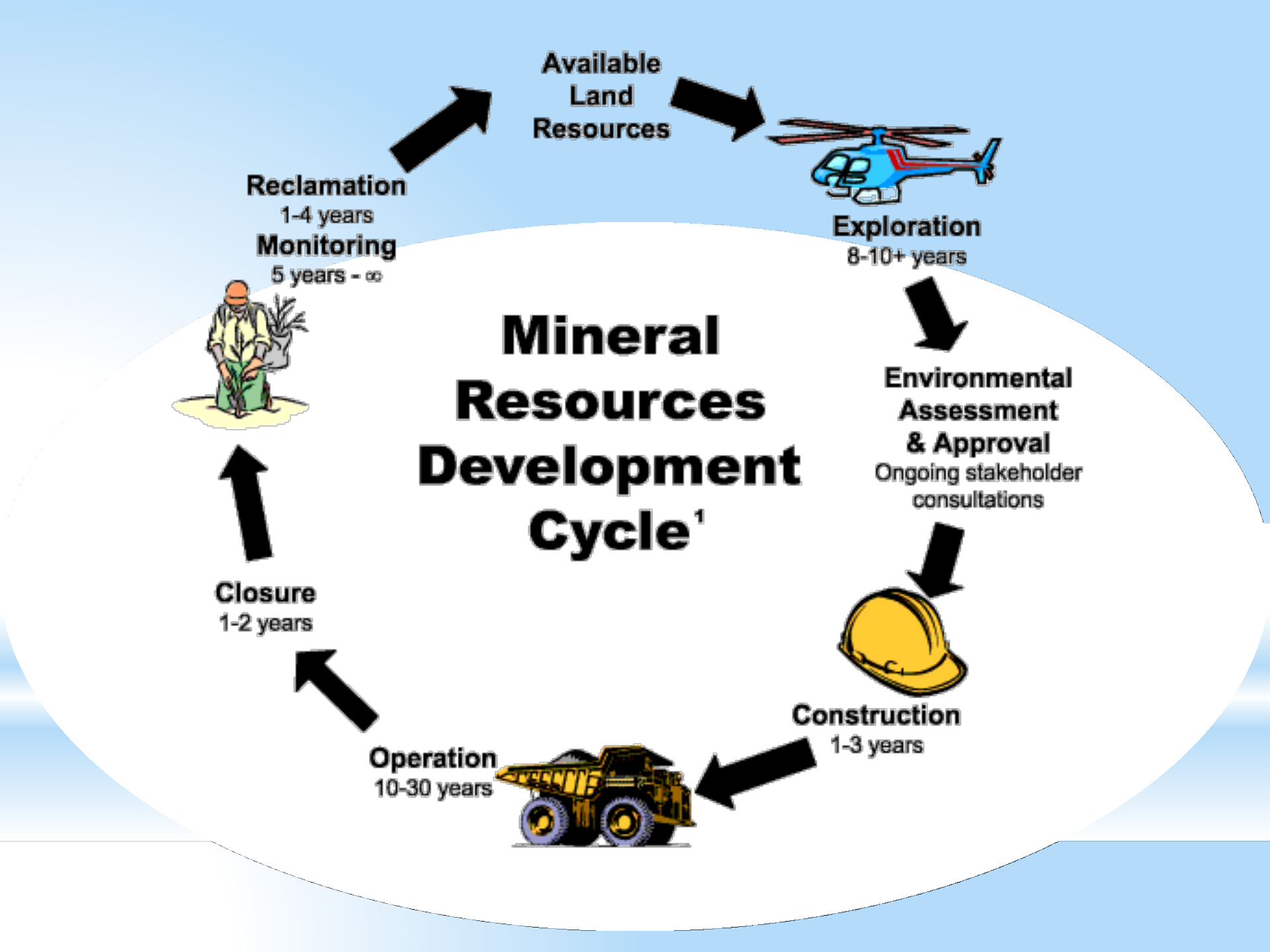
- Non-metallic minerals
  - Good insulators
  - Shiny or dull surfaces
  - Can be transluscent
  - Have variety of uses
  - Examples:
    - Gypsum- used to make sheetrock/wallboard
    - Sand/gravel- glass, building materials, computer chips
    - Sulfur- gunpowder, rubber
    - Phosphorus- fertilizer
    - Gemstones- jewelry (diamonds, ruby)

WHAT ARE SOME MINERAL RESOURCES & THEIR USES?

- Metallic minerals
  - Shiny surfaces, opaque
  - Can be pounded, pressed, stretched
  - Good conductors of heat, electricity
  - Durable, can resist corrosion
  - Can be combined to make an alloy
    - Alloys combine desirable properties of 2 different metals
    - Ex: titanium can be alloyed with aluminum to make strong, lightweight metal used to make stealth fighter
  - Examples:
    - Aluminum- cans, siding, cars
    - Copper- wires, heating, plumbing
    - Gold- computers, spacecraft, medicine
    - Iron- steel

WHAT IS THE DIFFERENCE BETWEEN AN ORE MINERAL AND A GANGUE MINERAL?

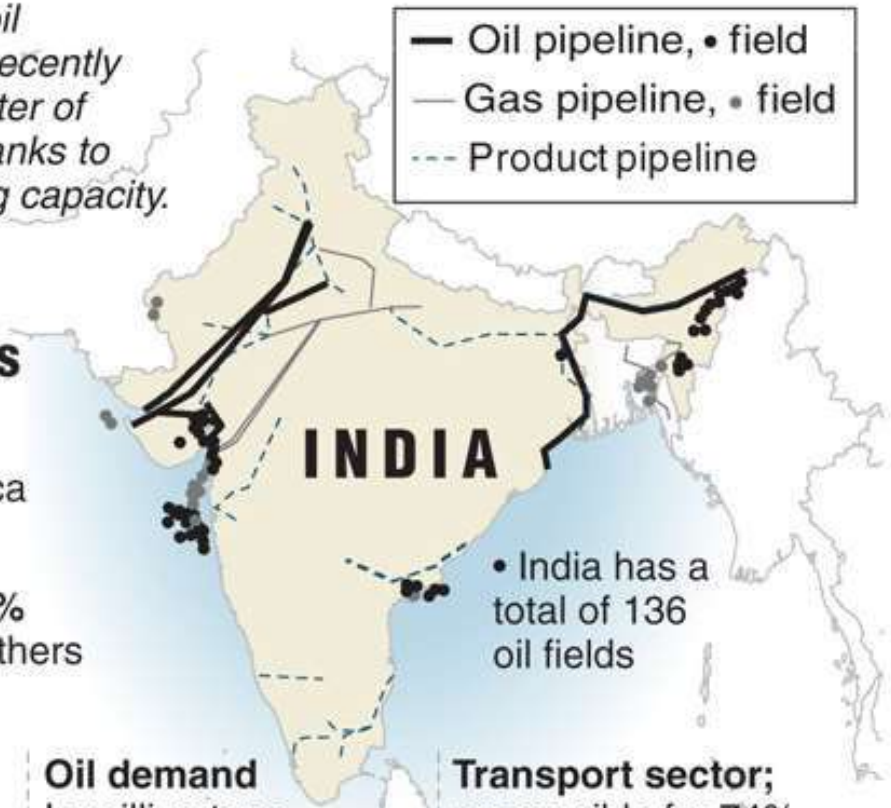
- ***Ore minerals-*** contain elements of some economic value
  - Ex: bauxite contains aluminum
  - Ex: halite contains rock salt
- ***Gangue minerals-*** have no commercial value- basically waste rock
- Consider a Hershey's bar with almonds…
  - Gangue = wrapper
  - Ore mineral = chocolate
  - Element of economic value = almonds


Mineral Resources Development Cycle[1]
Available Land Resources
Exploration
8-10+ years
Environmental Assessment & Approval
Ongoing stakeholder consultations
Construction
1-3 years
Operation
10-30 years
Closure
1-2 years
Reclamation
1-4 years
Monitoring
5 years - ∞

India and Oil

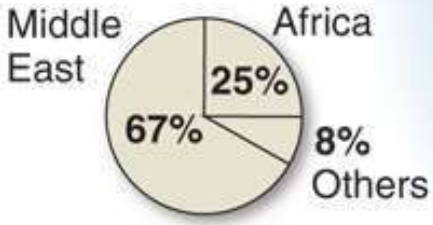
India is a large net oil importer, but it has recently become a net exporter of refined products, thanks to expansion of refining capacity.

Main oil, gas infrastructure



Crude oil imports

By origin



Total crude oil production
In thousand barrels per day

2006	793
2015	730
2030	517

Oil demand
In million tons (metric) of oil equivalent

2005	129
2015	173
2030	272

Transport sector; responsible for 74% of oil demand

Number of vehicles

68 million (2004)

295 million (2030 est.)

Source: International Energy Agency

Graphic: Jutta Scheibe, Majbrit Hoyrup


~~மீத்தேன்~~ அரக்கன்!
காவிரி டெல்டா பாலைவனமாகும் பயங்கரம்

* MINING SCAM IN TAMIL NADU

* >TAMIL NADU -13.7 LAKH TONNES OF RAW SAND-MINNED-THORIUM

>STORED IN TIRUNELVELI DISTRICT

>1.87 LAKH TONNES OF BEACH SAND MINERALS-EXPORTED- LAST FIVE YEARS-TUTICORIN PORT .

>1LAKH CRORE

REPORTED-THE HINDU-DATED JANUARY 14TH 2017.

File photograph of each sand minerals being processed. Credit: Special Arrangement

FOOD RESOURCES

Food is an essential requirement for the human survival. Each person has a minimum food requirement. The main components of food are carbohydrates, fats, proteins, minerals and vitamins.

Types of Food Supply

Historically humans have dependent on three systems for their food supply.

1. **Croplands**:

   It mostly produces grains and provide about 76% of the world's food.

   Examples: Rice, wheat, maize, barley, sugarcane, potato, etc.,

2. Rangelands:

It produces food mainly from the grazing livestock and provide about 17% of the world's food.

Examples: Meat, milk, fruits, etc.,

3. Oceans:

Oceanic fisheries supply about 7% of the world's food.

Examples: Fish, prawn, crab, etc.,

Major Food Sources

Earth is provided with more than thousands of edible plants and animals. However only 15 plants and 8 terrestrial animal species supply 90% of our global intake of calories.

Examples: Rice, wheat, maize, potato, barley, sugarcane, pulses, fruits, vegetables, milk, meat, fish and sea food.

Rice, wheat and maize are the major grains, provide more than 50% of the calories people consume.

World Food problems

1. We know that 79% of the total area of the earth is covered with water. Only 21% of the earth surface is land, of which most of the areas are forest, desert, mountains, barren areas, only less percentage of the land is cultivated.

- So the food supplied from the rest of the land is not enough to feed all the people. The problem of population explosion has made it worse. The world population increases and cultivable land area decreases. Therefore world food problem arises.

2. Environmental degradation like soil erosion, water logging, water pollution, salinity, affect agricultural lands.

3. Urbanisation is another problem in developing countries, which deteriorates the agricultural lands.

4. Since the food grains like rice, wheat, com and the vegetable like potato are the major food for the people all over the world, the food problem raises.

5. A key problem is the human activity, which degrade most of the earth's net primary productivity which supports all life.

Under nutrition and Malnutrition

1. **Nutritious (or) nutrition (or) nourished:** To maintain good health and resist disease, we need large amount of macronutrients such as carbohydrates, proteins, and fats and smaller amount of micronutrients such as vitamins A, C and E and minerals such as iron, calcium and iodine.

The Food and Agriculture Organization (FAO) of United Nations estimated that on an average, the minimum calorie intake on a global scale is 2,500 calories / day.

2. **Under nutrition (or) under nourished**:

People who cannot buy enough food to meet their basic energy needs (carbohydrates) suffer from under nutrition. They receive less than 90% of these minimum dietary calories.

Effect of under nutrition: Suffer from mental retardation and infectious diseases such as measles and diarrhoea.

3. **Malnutrition (or) malnourished:**

Besides the minimum calorie intake we also need proteins, minerals, vitamins, iron and iodine.

Deficiency or lack of nutrition often leads to malnutrition resulting in several diseases.

S. No.	Deficiency of nutrient	Effects
1.	Proteins	Growth
2.	Iron	Anemia
3.	Iodine	Goitre, cretinism
4.	Vitamin A	Blindness

Thus chronically under nourished and malnourished people is disease prone and are too weak to work or think clearly.

Indian Scenario: Although India is the third largest producer of crops, nearly 300 million Indians are still under nourished.

World Food Summit, 1996: The World Food Summit, 1996 has set the goal to reduce the number of under nourished and malnourished people to just half by 2015.

CHANGES CAUSED BY OVERGRAZING AND AGRICULTURE

Overgrazing is a process of, "eating away the forest vegetation without giving it a chance to regenerate",

India leads in livestock population in the world. The huge livestock population requires more grazing land or pasture area. Very often we find that the livestock is grazing on a particular piece of grassland (or) pasture, which surpass the carrying capacity.

Effects (or) impacts of overgrazing

1. Land degradation

Overgrazing removes the cover of vegetation over the soil and the exposed soil gets compacted. So the roots of plant cannot go much deep into the soil and the adequate soil moisture is not available.

Thus, overgrazing leads to organically poor, dry, compacted soil, this cannot be used for further cultivation.

2. Soil erosion

Due to overgrazing by livestock, the cover of vegetation gets removed from the soil. The roots of the grass are very good binders of the soil. When the grasses are removed, the soil becomes loose by the action of wind and rainfall.

3. Loss of useful species:

Overgrazing also affects the composition of plant population and their regeneration capacity. The grassland consists of grasses and forbs with high nutritive value. When the livestock grazes the grasses heavily, the root stocks, which carry the food reserve gets destroyed. Now other secondary species will appear in their place, which are less nutritive in nature. Some livestock keep on overgrazing these species also.

Agriculture

Agriculture is an art, science and industry of managing the growth of plants and animals for human use.

Agriculture includes cultivation of the soil, growing and harvesting crops, breeding and raising livestock, dairying and forestry.


Russian Federation
Canada
United States of America
Mexico
Brazil
Bolivia
Paraguay
Argentina
Chile
Uruguay
Peru
Colombia
Venezuela
Guyana
Suriname
Algeria
Libya
Egypt
Mali
Niger
Chad
Sudan
Ethiopia
Kenya
Dem. Rep. of Congo
Angola
Zambia
Namibia
Botswana
Madagascar
Kazakhstan
Mongolia
China
India
Japan
Philippines
Indonesia
Malaysia
Papua New Guinea
Australia
New Zealand
It costs on average just US 25 cents a day to feed a hungry child and change her life forever.
While food is the most basic of human needs required for survival, on average, 1 in 8 people go to bed hungry each night.
We can achieve Zero Hunger in our lifetimes. Halving hunger by 2015, as pledged in the Millennium Development Goals, is the first step.
Hunger Map 2013
Proportion of total population undernourished, 2011–13
<2%
2-14.9%
15-24.9%
25-34.9%
35% and over
Very low undernourishment
Moderately low undernourishment
Moderately high undernourishment
High undernourishment
Very high undernourishment
Missing or insufficient data
WFP
World Food Programme
wfp.org
ZERO HUNGER CHALLENGE
Take a look at our interactive hunger map at http://cdn.wfp.org/hungermap/


RISING FOOD PRICES
Rising food prices have pushed 44 million people into extreme poverty and hunger since June 2010.
EXTREME POVERTY AND HUNGER
That's twice the population of Australia

WHAT'S WRONG WITH OUR FOOD SYSTEM?

Every night **1 in 7 people go to bed hungry**–that's almost 1 billion people worldwide. People are hungry not because there isn't enough food produced but because our food system is broken. In fact, **80% of the world's hungry are directly involved in food production**. We can address this hunger if we support small-scale food producers, tackle climate change and reduce food waste.

CLIMATE CHANGE & FOOD PRICES

The average **price of staple foods could more than double by 2030**– with more than half of that increase due to changes in average temperatures and rainfall patterns.

HIGH TEMPERATURES

In July 2010, temperatures exceeded 40°C (104°F) in Russia, destroying millions of acres of wheat. Wheat **production plunged 30%** and the **price internationally increased by 85%**.

DROUGHT

In 2010, a drought in Ukraine caused wheat **production to plummet 20%** compared to the year before.

MONSOON

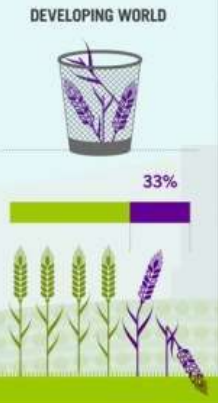
Heavy rainfall and multiple typhoons hit Southeast Asia in 2011, severely affecting 6% of the region's total rice area and **driving prices up by 30%** in some areas.

WASTE

In both industrialized and developing countries, unacceptable quantities of food are wasted but for entirely different reasons.

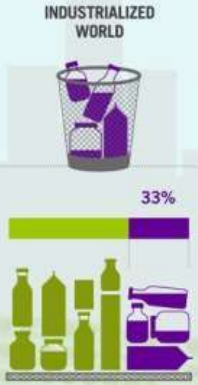
HARVEST WASTE

Currently, developing countries waste **nearly one third of food supply**. With better access to adequate storage, refrigeration and transportation this could be reduced.



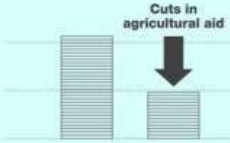
CONSUMER WASTE

In industrialized countries we, as consumers and retailers, throw away **about one third of all food** that is produced.



HUNGER

There have been **cuts of more than 50% in government aid** to small-scale producers, even though the majority of the world's hungry are involved in food production.



1 IN 7 ON THE PLANET GO HUNGRY

60% OF THE HUNGRY ARE WOMEN

By providing women with equal access to farming resources such as **tools, seeds and transport**

100–150 MILLION COULD HAVE ENOUGH TO EAT

CHANGE CAN HAPPEN

By investing in small-scale farmers, Brazil reduced the number of people living in poverty by 20 million between 2003-9. We can tackle extreme hunger by helping small-scale producers grow more food more sustainably.

GROW FOOD. LIFE. PLANET. OXFAM www.oxfam.org/grow

Types of Agriculture

The two major types of agricultural systems are

1. Traditional agriculture .
2. Modern agriculture

1. Traditional agriculture

It involves small plot, simple tools, surface water, organic fertilizers and a mix of crops.

They produce enough and a mix of crops. They produce enough food for their families and to sell it for their income.

Effects (or) impacts of Traditional agriculture

a.Deforestation: Cutting and burning of trees in forests to clear the land for cultivation results in loss of forest cover.

b. Soil erosion: Clearing of forest cover exposes the soil to wind and rainfall, resulting in loss of top fertile soil layer.

c.Loss of nutrients: During cutting and burning of trees, organic matter in the soil gets destroyed and most of the nutrients are taken up by the crops within a short period.

Thus the soil becomes poor in nutrient, which makes the farmers shift to another area.

Modern Agriculture

It makes use of hybrid seeds of single crop variety, high-tech equipments, lot of fertilizers, pesticides and water to produce large amount of single crops.

Effects (or) impacts of modern agriculture (or) adverse effects of agricultural practices (or) Environmental effects of agriculture

(a) Micronutrient imbalance

Most of the chemical fertilizers, used in modem agriculture, contain nitrogen, phosphorus and potassium (N, P, K), which are macronutrients.

When excess of fertilizers are used in the fields, it causes micronutrient imbalance.

Examples:

Excessive use of fertilizer in Punjab and Haryana has caused deficiency of the micronutrient zinc in the soil, which affects the productivity of the soil.

(b) Blue Baby syndrome (Nitrate pollution)

When Nitrogenous fertilizers are applied in the fields, they leach deep into the soil and contaminate the ground water. The nitrate concentration in the water gets increased.

When the nitrate concentration exceeds 25 mg / lit, they cause serious health problem called "Blue Baby syndrome". This disease affects infants and leads even to death.

(c) Eutrophication.

A large proportion of N and P fertilizers, used In crop field is washed off by the runoff water and reaches the water bodies causing over nourishment of the lake. This process is known as Eutrophication.

Due to eutrophication lake gets attacked by algal bloom. These algal species use up the nutrients rapidly and grow very fast. Since the time of algal species is less they die quickly and pollute the water, which in turn affect the aquatic life.

2 Problems in using pesticides

In order to improve the crop yield, lot of pesticides are used in the agriculture.

(i)First generation pesticides - Sulphur, arsenic, lead or mercury are used to kill the pests.

(ii)Second generation pesticides - DDT (Dichloro .Diphenyl Trichloromethane) kill the pests.

Although these pesticides protect our crops from huge losses due to pests, they produce number of side-effects.

(a)Death of non-target organisms

Some pest species usually survive even after the pesticide spray, which generates highly resistant generations. They are immune to all type of pesticides and are called superpests.

(c) Bio-magnification

Many of the pesticides are non-biodegradable and keep on concentrating in the food chain. This process is called bio-magnification. These pesticides in a bio-magnified form are harmful to the human beings.

(d) Risk of cancer

Pesticides enhance the risks of cancer in two ways.

(i) It directly acts as carcinogens.

(ii) It indirectly Suppress the immune system.

Desired qualities of an ideal pesticide

(i) An ideal pesticide must kill only the target species.

(ii) It must be a biodegradable.

(iii) It should not produce new pests.

(iv) It should not produce any toxic pesticide vapour.

(v) Excessive synthetic pesticide should not be used.

(vi) Chlorinated pesticides and organophosphate pesticides are hazardous, so they should not be used.

3. Water logging

Water logging is the land where water stand for most of the year.

Problems (or) Effects in water logging

During water-logged conditions, pore-voids in the soil get filled with' water and the soil-air gets depleted.

In such a condition the roots of the plants do not get adequate air for respiration. So, mechanical strength of the soil decreases and crop yield falls.

Causes of water logging

1. Excessive water supply to the croplands.
2. Heavy rain.
3. Poor drainage.

Remedy

Preventing excessive irrigation, sub surface draining technology and bio-drainage by trees like Eucalyptus tree are some method of preventing water logging.

4. Salinity

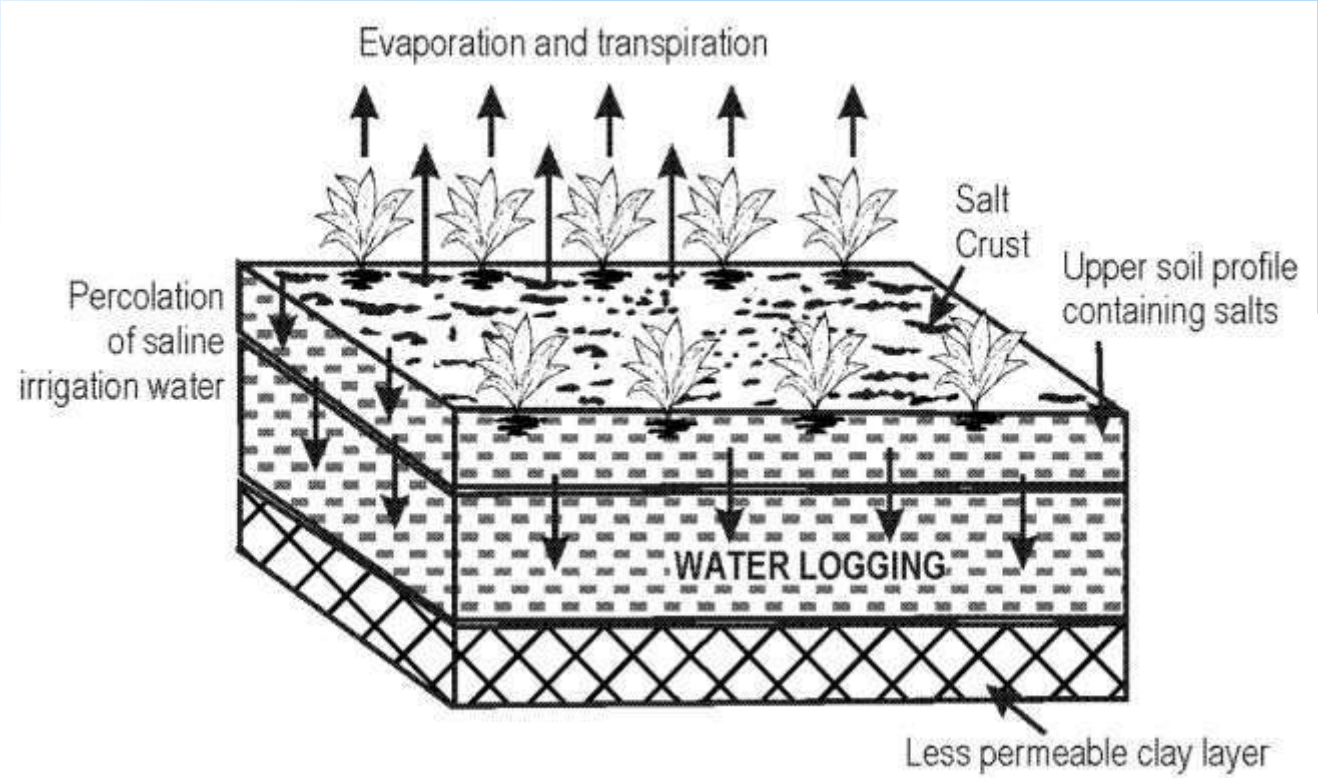
The water, not absorbed by the soil, undergo evaporation leaving behind a thin layer of dissolved salts in the topsoil. This process of accumulation of salts is called salinity of the soil.

The saline soils are characterized by the accumulation of soluble salts like sodium chloride, calcium chloride, magnesium chloride, sodium sulphate, sodium bicarbonates and sodium carbonates. The pH of the water exceeds 8.0 (alkaline).

Problems in Salinity

Most of the water, used for irrigation comes only from canal or ground, which unlike rainwater contains dissolved salts. Under dry climates, the water gets evaporated leaving behind the salt in the upper portion of the soil.

Due to salinity, the soil becomes alkaline and crop yield decreases.



Remedy

The salt deposit is removed by flushing them out by applying more good quality water to such soils.

Using sub-surface drainage system the salt water is flushed out slowly

CASE STUDIES

Water logging and Salinity in Haryana and Rajasthan

Introduction of canal irrigation in Haryana state resulted in rise in water-table followed by water-logging and salinity in many agricultural lands causing huge economic losses as a result of decrease in crop productivity.

Similarly Rajasthan has also suffered badly due to the biggest irrigation project, "Indira Gandhi Canal Project", which converts a big area into water soaked waste land.

It has been reported in Delhi, that the high accumulation of pesticides and DDT (DichIoro Diphenyl Trichloromethane) in the body of mothers causes premature deliveries or low birth weight infants (or) death of many children.

Pesticide in Pepsi and Coca-cola

Food Centre for Science and Environment (CSE) India has reported that Pepsi and Coca-Cola companies are selling soft drinks with pesticide content 30-40 times higher than EU guidelines permit.

It also said that the total average pesticide content in all Pepsi products were 0.0180 mgs/lit, while in coco-cola products 0.0150 mgs/lit, which are 30-40 times higher than European Union limits. This damages the nervous system.

The centre said the reason for high pesticide content in India is due to the use of ground water in soft drinks and bottled water industries.

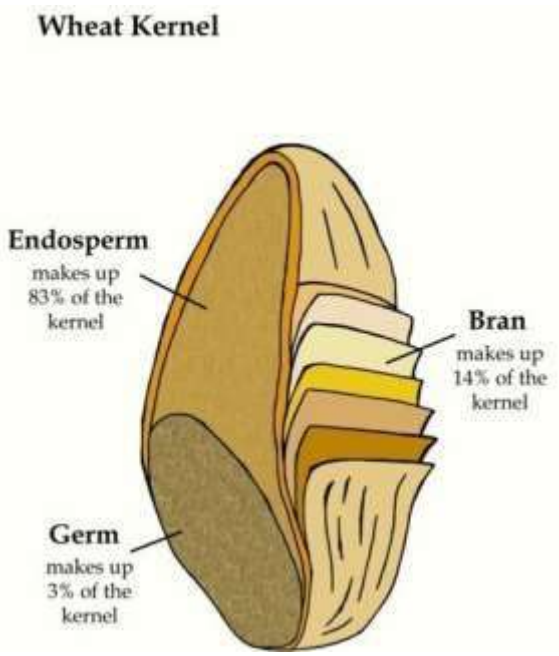
MAIDA…THE END CARD FOR YOU??!!

*White flour is tasty but not healthy:

*White flour regulates glucose/sugar in your body

*White Flour is Acidic

*White flour creates digestive issues



*Killer Diet!!!


Maida is made by removing the outer
bran from the whole wheat. It is then
mixed with chemicals like benzyl peroxide
and alloxan to make it whitish and soft.

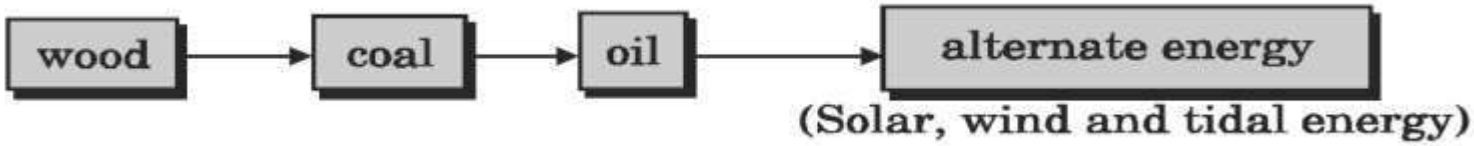
ENERGY RESOURCES

Energy is defined as “the capacity to do work”

Energy is available on the earth in a number of forms.

All developmental activities in the world are directly or indirectly dependent upon energy. Both production and energy utilization are the indicators of a country’s progress.

The first form of energy is fire. Wood is the main source of energy, which is later replaced by coal. Coal is now being replaced by oil and gas



Growing energy needs

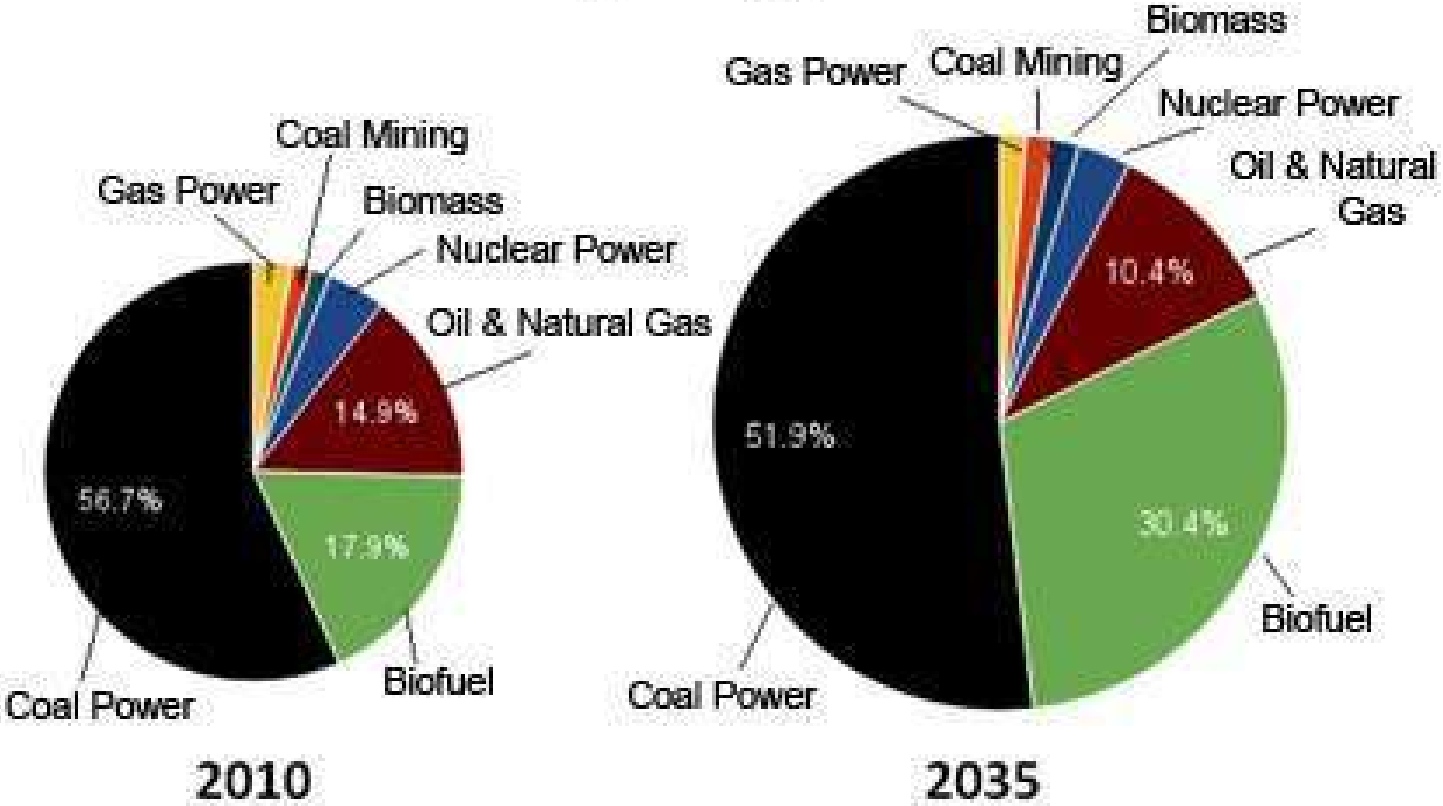
All industrial process like, mining, transport, lighting, heating and cooling in buildings, all require energy.

With the demands of growing population, the world is facing further energy deficit.

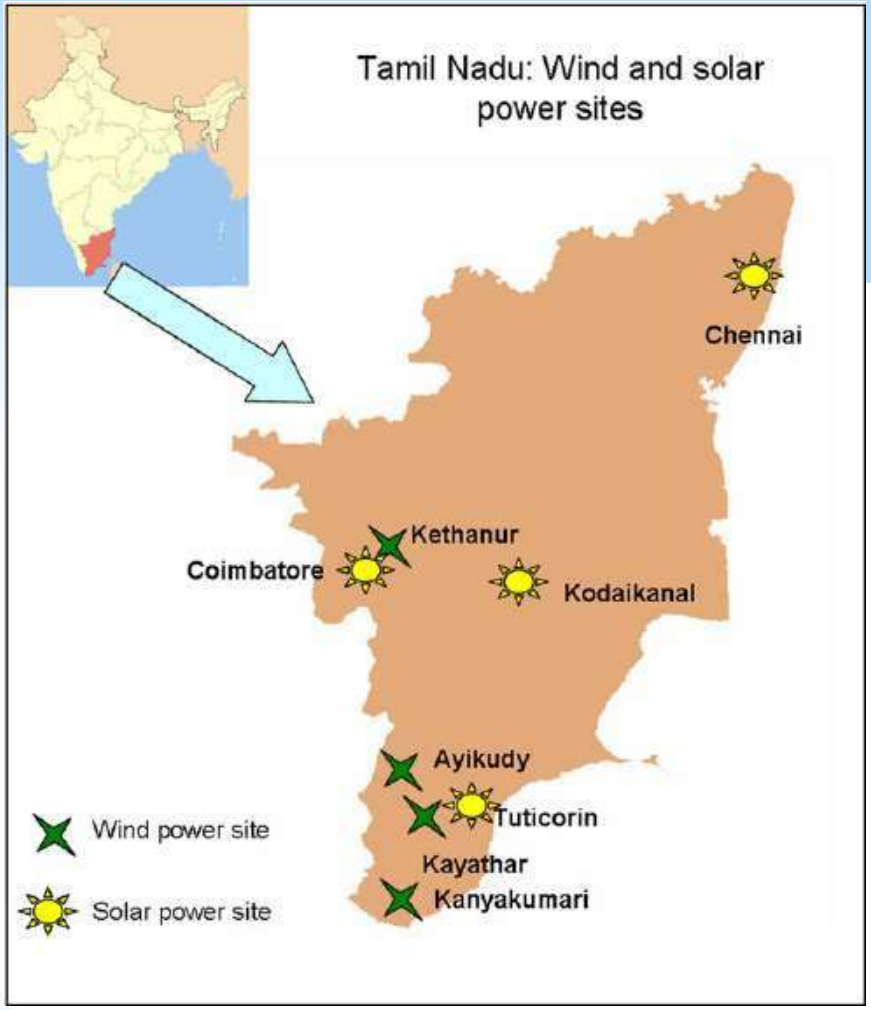
Our life style is also changing from a simple way of life to a luxurious life style.

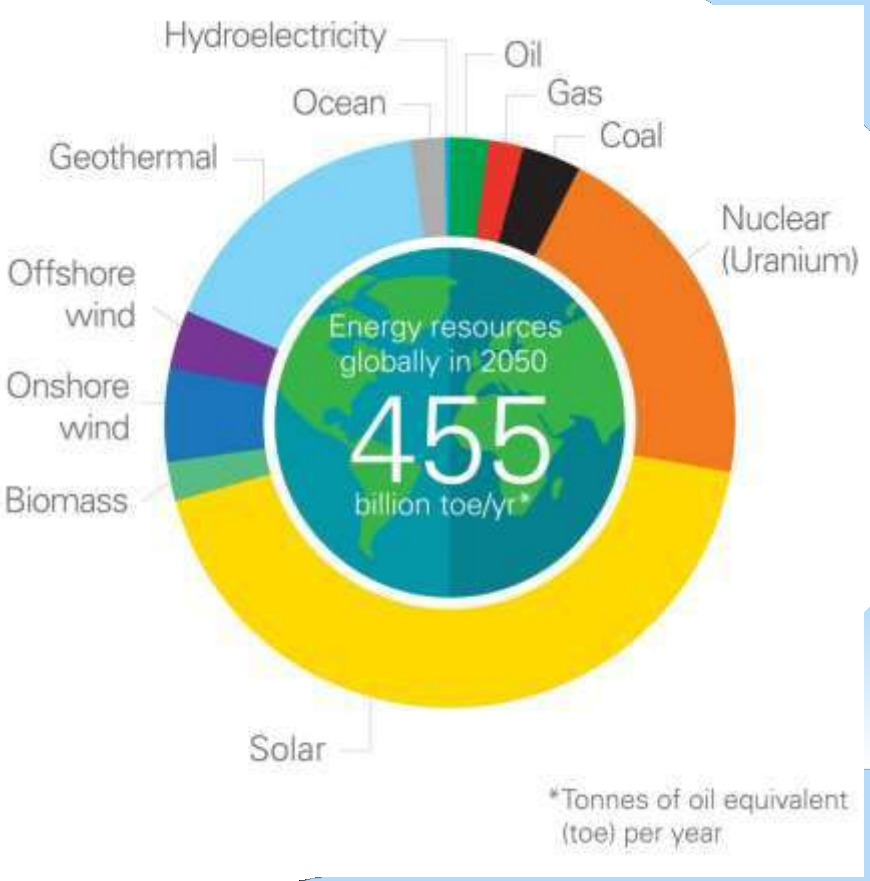
At present 95% of the commercial energy is available only from the fossil fuels like coal, oil and natural gas, and are not going to last for many more years.

Growing Energy Thirst



Source: International Energy Agency, current policies scenario


Tamil Nadu: Wind and solar power sites
Chennai
Kethanur
Coimbatore
Kodaikanal
Ayikudy
Tuticorin
Kayathar
Kanyakumari
Wind power site
Solar power site


Hydroelectricity
Oil
Ocean
Gas
Coal
Geothermal
Nuclear (Uranium)
Offshore wind
Onshore wind
Biomass
Solar
Energy resources globally in 2050
455
billion toe/yr*
*Tonnes of oil equivalent (toe) per year

Energy Distribution-World Scenario

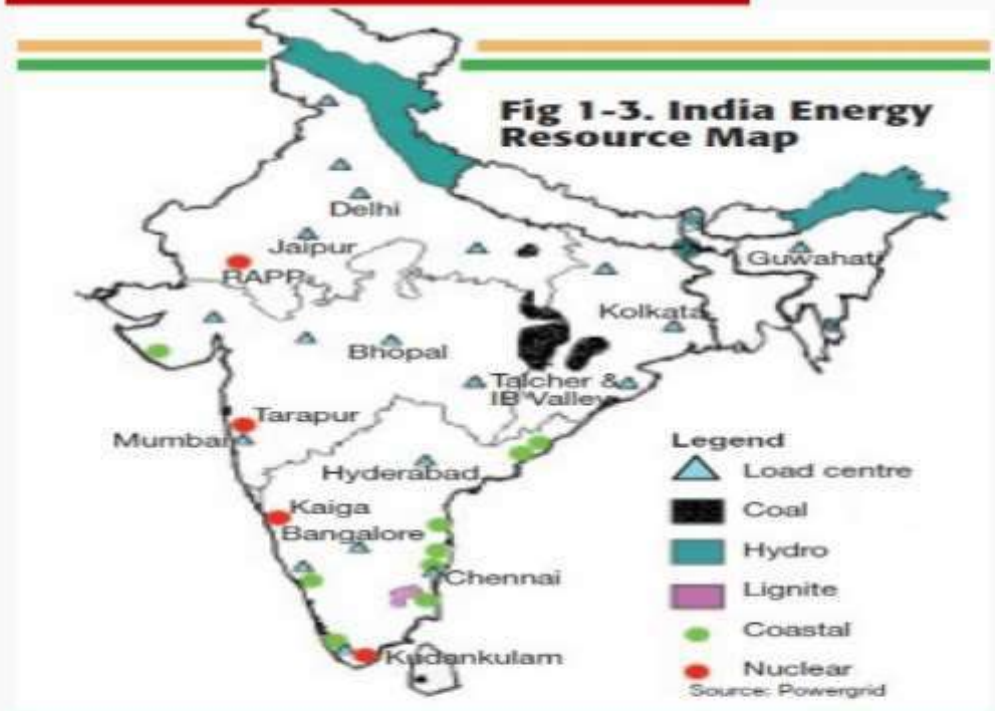
Developed countries like U.S.A and Canada constitute only 5% of the world's population, but consume 25% of the available world's energy resources.

It has been observed, that in USA and Canada an average person consumes 300 GJ (Giga Joules; equal to 60 barrels of oil) per year.

But in poor countries like Bhutan, Nepal and Ethiopia, an average person consumes less than 1 GJ per year. So a person in a developed country consumes almost as much energy in a single day as one person consumes in a whole year in a poor country.

From the above scenario it is clear that our life style and standard of living are closely related to energy needs.

INDIA: ENERGY RESOURCE MAP



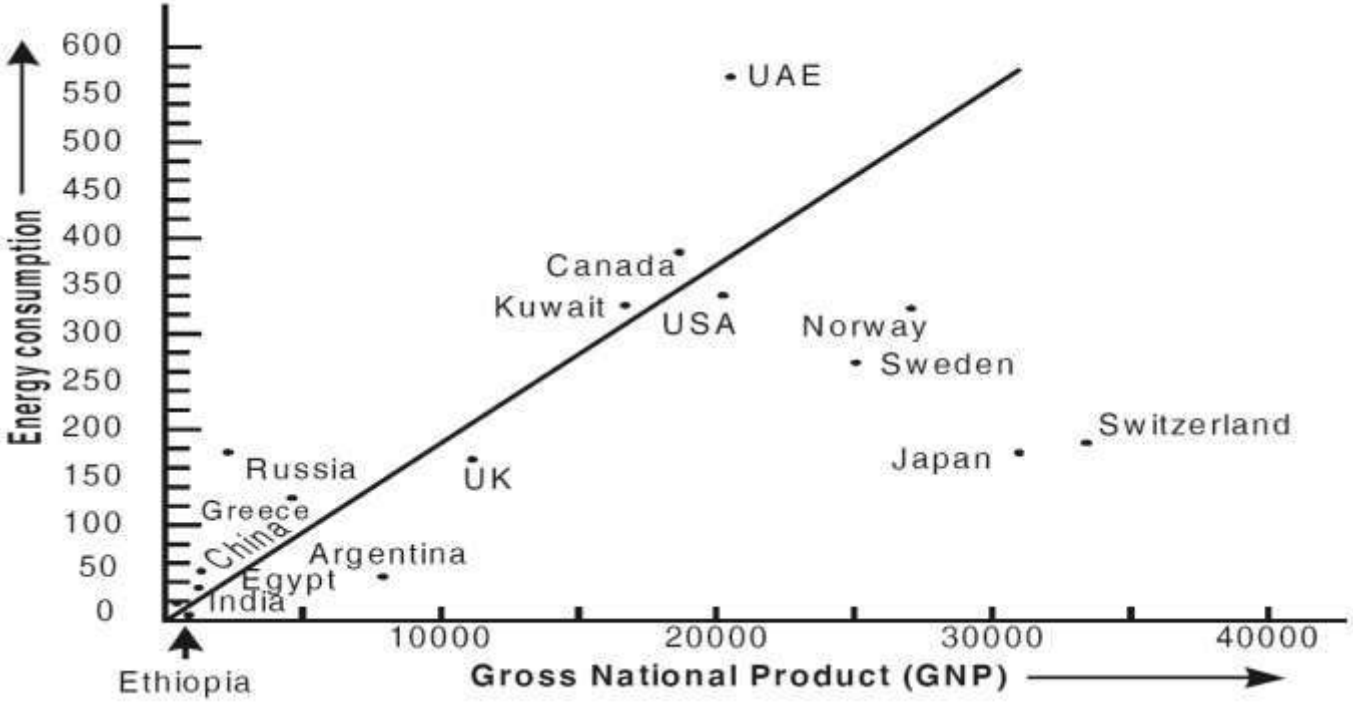
- Concentrated mainly in East India, Gujarat and S. India
- Mainly public sector
- 84 minerals
- Fuel: 82%
- Metallic: 8%
- Non-Metallic: 4%
- Minor: 6%

Source: Powergrid

Percapita Energy Use

The figure shows the correlation between percapita energy use and GNP (Gross National Product).

The developed countries like U.S.A, Japan, Switzerland, etc., with high GNP show high energy use while the poor countries like India, China, Ethiopia with low GNP show low energy use



RENEWABLE AND NON-RENEWABLE ENERGY RESOURCES

Based on continual utility, natural resources can be classified into two types.

1. Renewable energy resources.
2. Non-renewable energy resources.

Renewable energy resources (or) Non-Conventional energy resources

Renewable energy resources are natural resources which can be regenerated continuously and are inexhaustible. They can be used again and again in an endless manner.

Merits of renewable energy resources

1. Unlimited supply.
2. Provides energy security.
3. Fits into sustainable development concept.
4. Reliable and the devices are modular in size.
5. Decentralized energy production.

2 Non-renewable energy resources (or) conventional energy sources

Non-renewable energy resources are natural resources, which cannot be regenerated once they are exhausted. They cannot be used again.

Examples: Coal, petroleum, natural gas and nuclear fuels.

Wood is renewable resources but not coal-why?

Wood is renewable resources because we can get new wood by growing a sapling into a tree within 15-20 years.

But the formation of coal from trees has taken million of years and cannot be regenerated in our life time.

RENEWABLE ENERGY RESOURCES

Solar energy - The energy that we get directly from the sun is called solar energy.

The nuclear fusion reactions occurring inside the sun release enormous amount of energy in the form of heat and light. Several techniques are available for collecting, converting and using solar energy.

Renewable Energy

The United States currently relies heavily on coal, oil, and natural gas for its energy. Fossil fuels are nonrenewable, that is, they draw on finite resources that will eventually dwindle, becoming too expensive or too environmentally damaging to retrieve. In contrast, **renewable energy resources are constantly replenished and will never run out.**

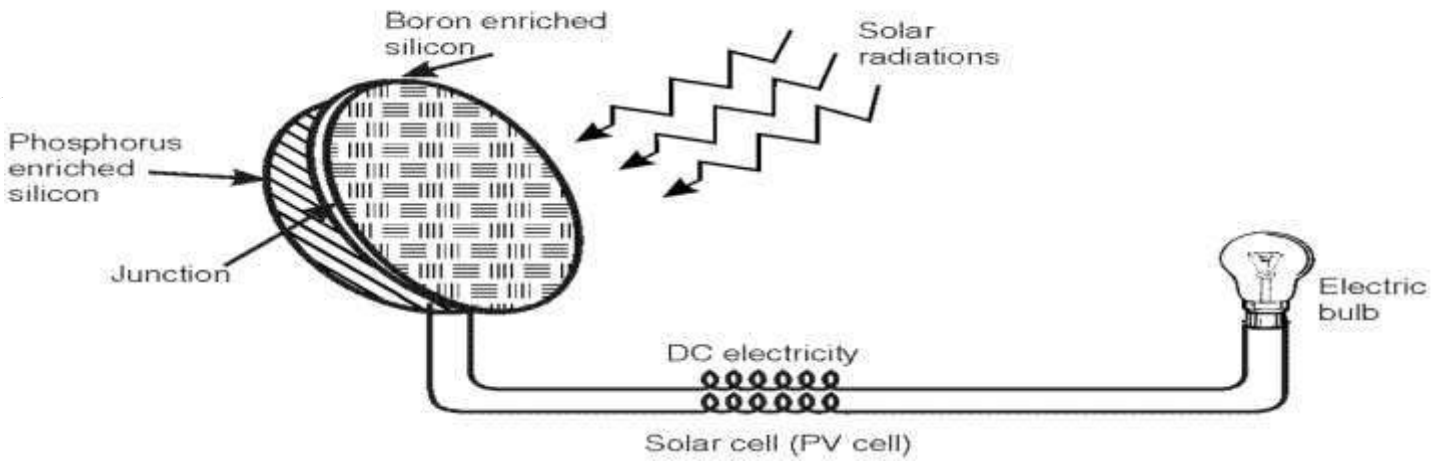
Types of Renewable Energy

Solar	Wind	Biomass	Hydrogen	Geothermal	Ocean	Hydropower
Uses: • Solar Power Plant	**Uses:** • Wind Power Plant	**Uses:** • Biofuels • Biopower • Bioproducts	**Uses:** • Fuel Cells	**Uses:** • Geothermal • Power Plant • Heat Pumps	**Uses:** • Tidal Power • Wave Power • Thermal	**Uses:** • Hydropower Plant

Methods of Harvesting Solar Energy

Some important solar energy harvesting devices are given below.

1. Solar cells (or) photovoltaic cells (or) PV cells



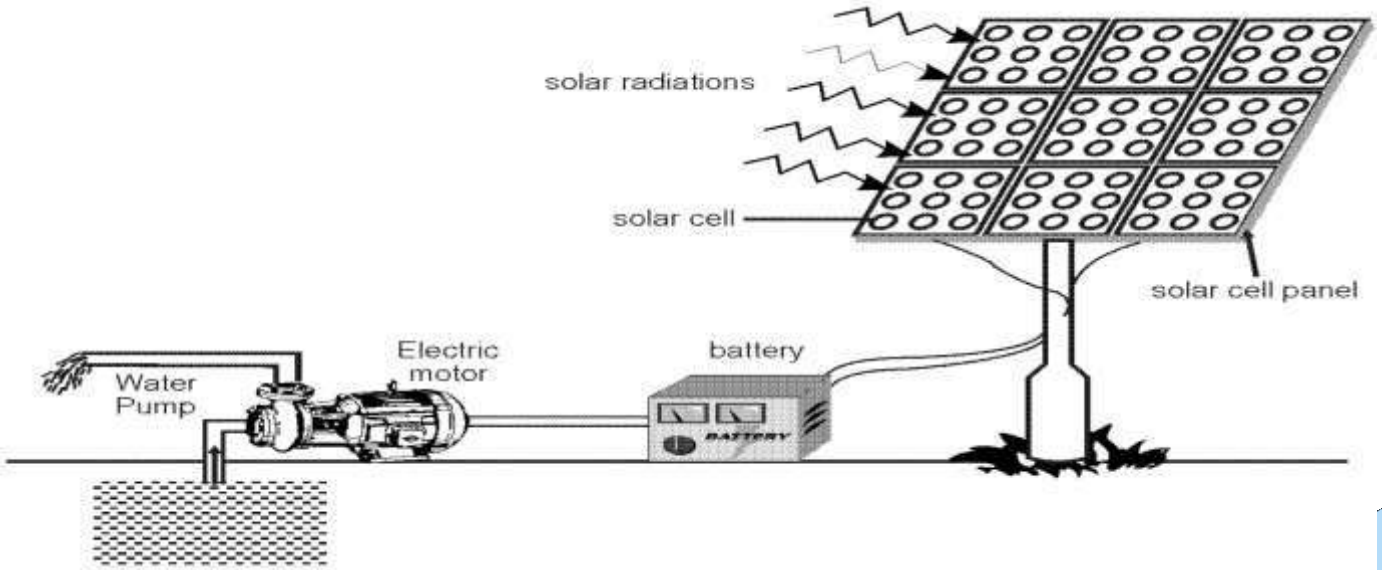
Solar cells consists of a p-type semiconductor (such as Si doped with B) and n-type semiconductor (such as Si doped with P). They are in close contact with each other. When the solar rays fall on the top layer of p-type semiconductor, the electrons from the valence band get promoted to the conduction band and cross the p-n junction into n-type semiconductor. There by potential difference between two layers is created, which causes flow of electrons (ie., an electric current).

Uses

Used in calculators, electronic watches, street lights, water pumps to run radios and TVs.

Solar Battery

When a large number of solar cells are connected in series it form a solar battery. Solar battery produce more electricity which is enough to run water pump, to run street-light, etc., They are used in remote areas where conventional electricity supply is a problem.



2. Solar Heat Collectors

Solar heat collectors consist of natural materials like stones, bricks (or) materials like glass, which can absorb heat during the day time and release it slowly at night.

Uses - It is generally used in cold places, where houses are kept in hot condition using solar heat collectors.

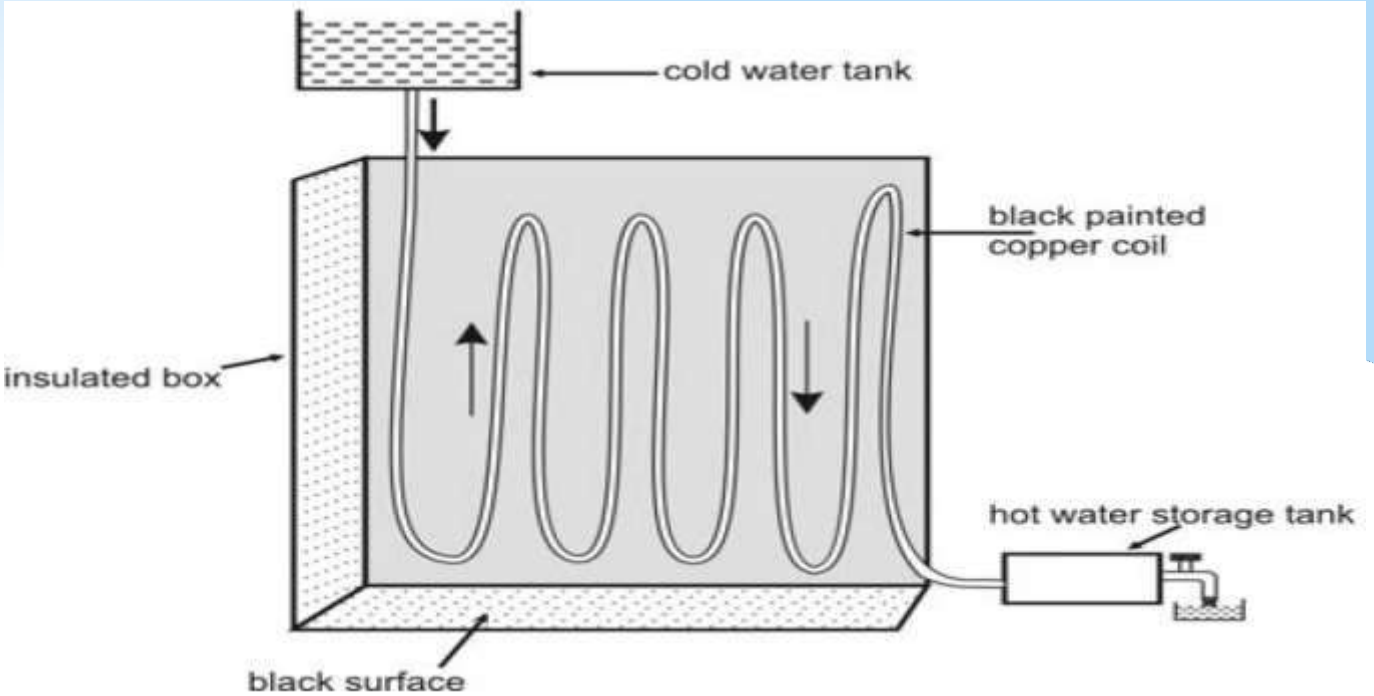
3. Solar water heater

It consists of an insulated box inside of which is painted with black paint.

It is also provided with a glass lid to receive and store solar heat.

Inside the box it has black painted copper coil, through which cold water is allowed to flow in, which gets heated up and flows out into a storage tank.

From the storage tank water is then supplied through pipes.



Significance of solar energy

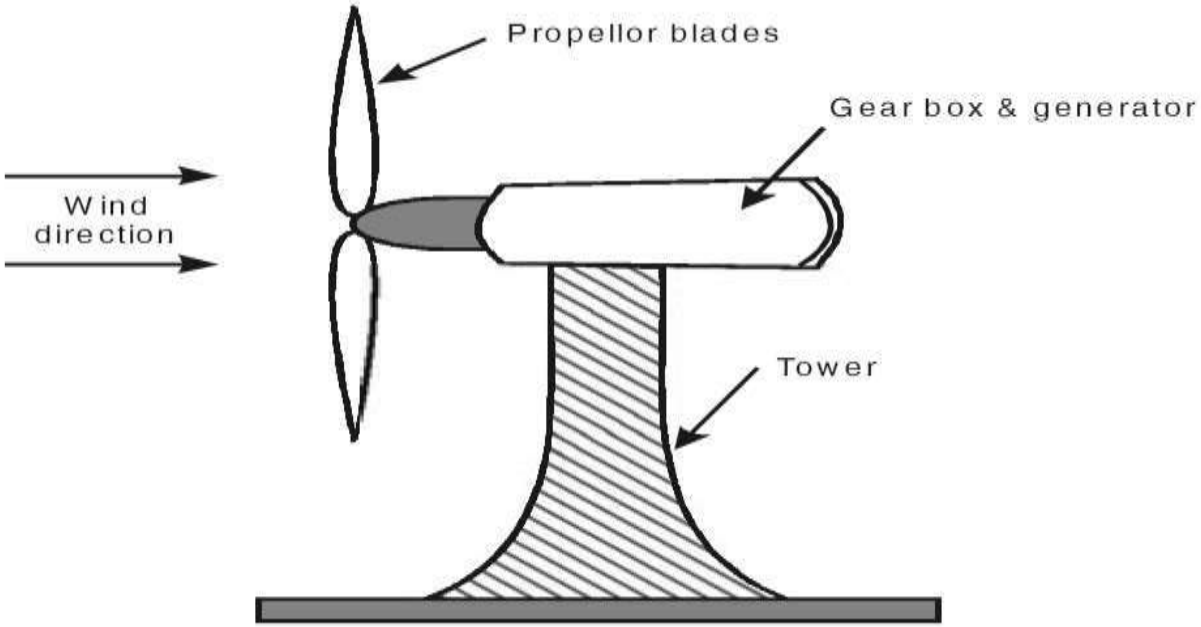
1. Solar cells are noise and pollution free.
2. Solar water heaters, cookers, require neither fuel nor attention while cooking food.
3. Solar cells. can be used in remote and isolated areas, forests, hilly regions.

Wind energy

Moving air is called wind. Energy recovered from the force of the wind is called wind energy. The energy possessed by wind is because of its high speed. The wind energy is harnessed by making use of wind mills.

1. Wind Mills

The strike of blowing wind on the blades of the wind mill make it rotating continuously. The rotational motion of the blade drives a number of machines like water pump, flour mills and electric generators.



2. Wind Farms.

When a large number of wind mills are installed and joined together in a definite pattern ir forms a wind farm. The wind farms, produce a large amount of electricity

The minimum speed required for satisfactory working of wind generator is 15 km/hr.

Advantages

1. It does not cause any pollution.

2. It is very cheap

Significance of wind energy

1. The generation period of wind energy is low and power generation starts from commissioning.
2. It is recommended to broaden the nation's energy options for new energy sources.
3. It is made available easily in many off-shore, on-shore and remote areas.

Ocean energy

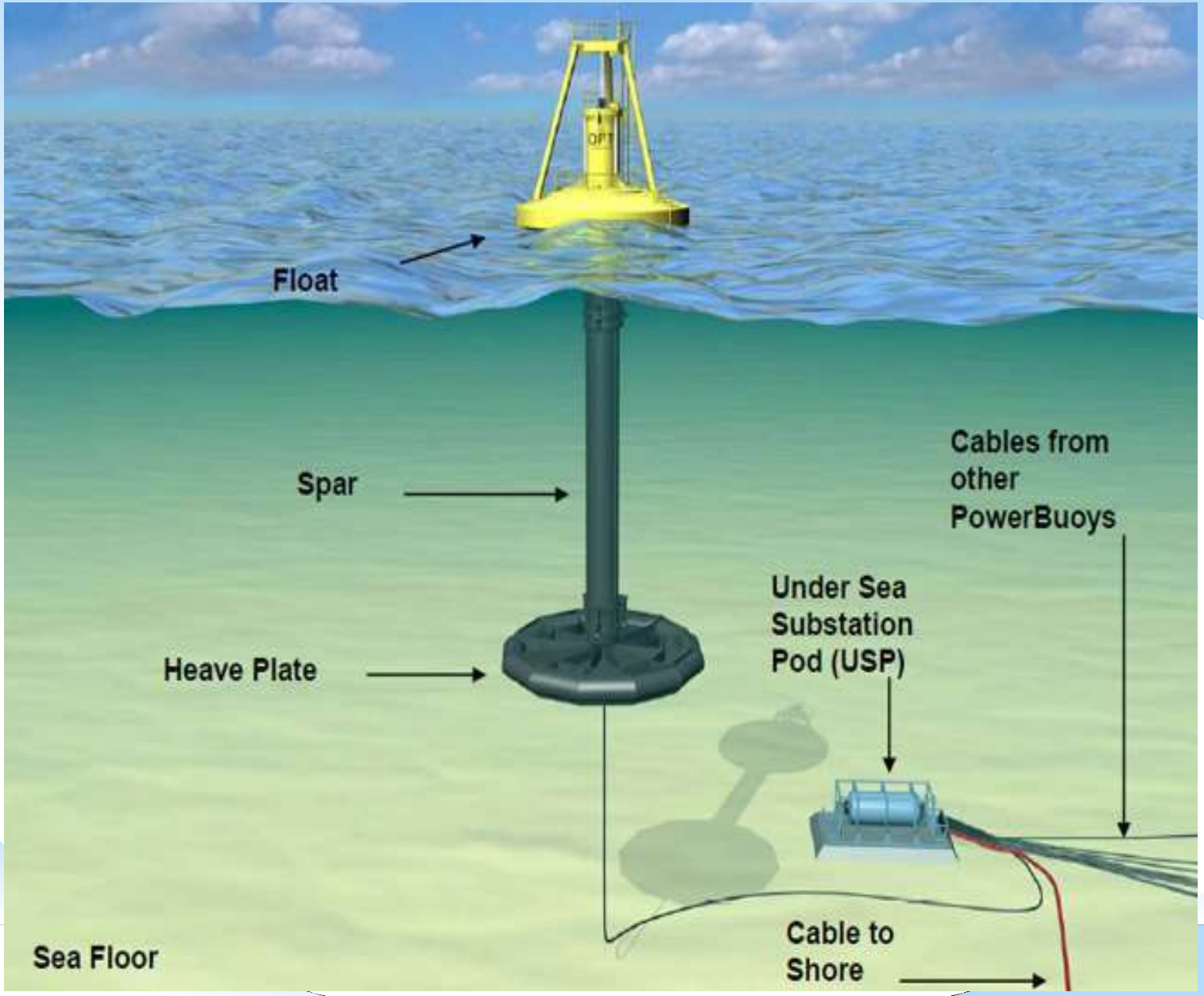
Ocean can also be used for generating energy 10 the following ways.

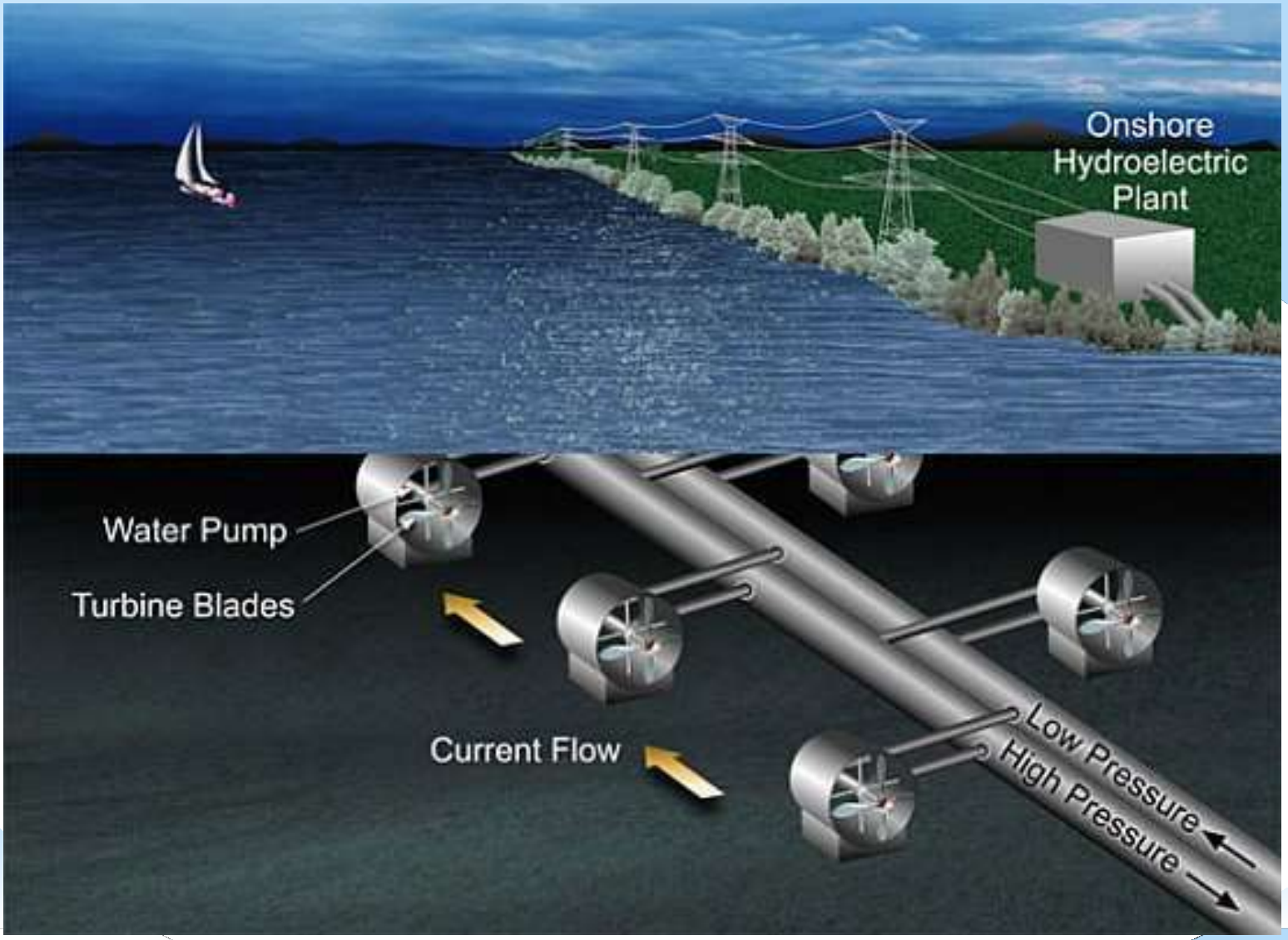
1. Tidal energy (or) Tidal power

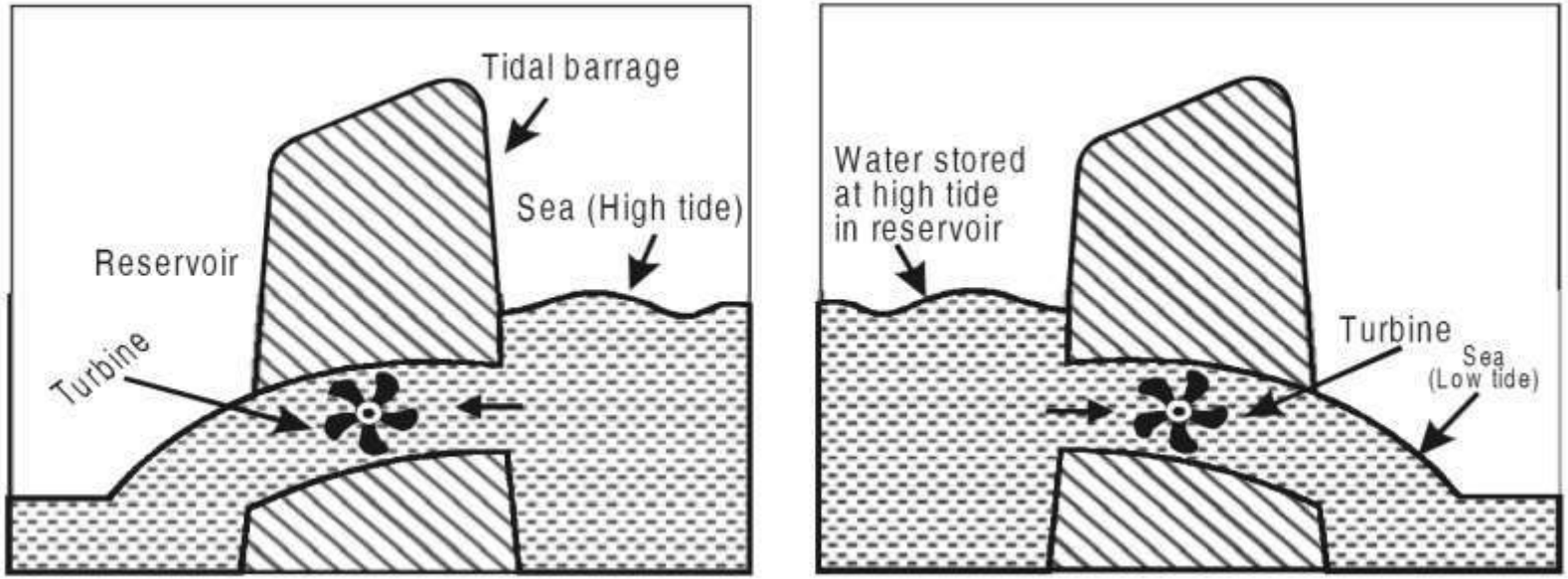
Ocean tides, produced by gravitational forces of sun and moon, contain enormous amount of energy. The 'high tide' and 'low tide' refer to the rise and fall of water in the oceans. The tidal energy can be harnessed by constructing a tidal barrage.

During high tide, the sea-water is allowed to flow into the reservoir of the barrage and rotates the turbine, which in turn produces electricity by rotating the generators.

During low tide, when the sea level is low, the sea water stored in the barrage reservoir is allowed to flow into the sea and again rotates the turbine.


Float
Spar
Heave Plate
Cables from other PowerBuoys
Under Sea Substation Pod (USP)
Cable to Shore
Sea Floor


Onshore
Hydroelectric
Plant
Water Pump
Turbine Blades
Current Flow
Low Pressure
High Pressure



Water flows into the reservoir from sea. **Water flows out from the reservoir to the sea.**

Significance of tidal energy

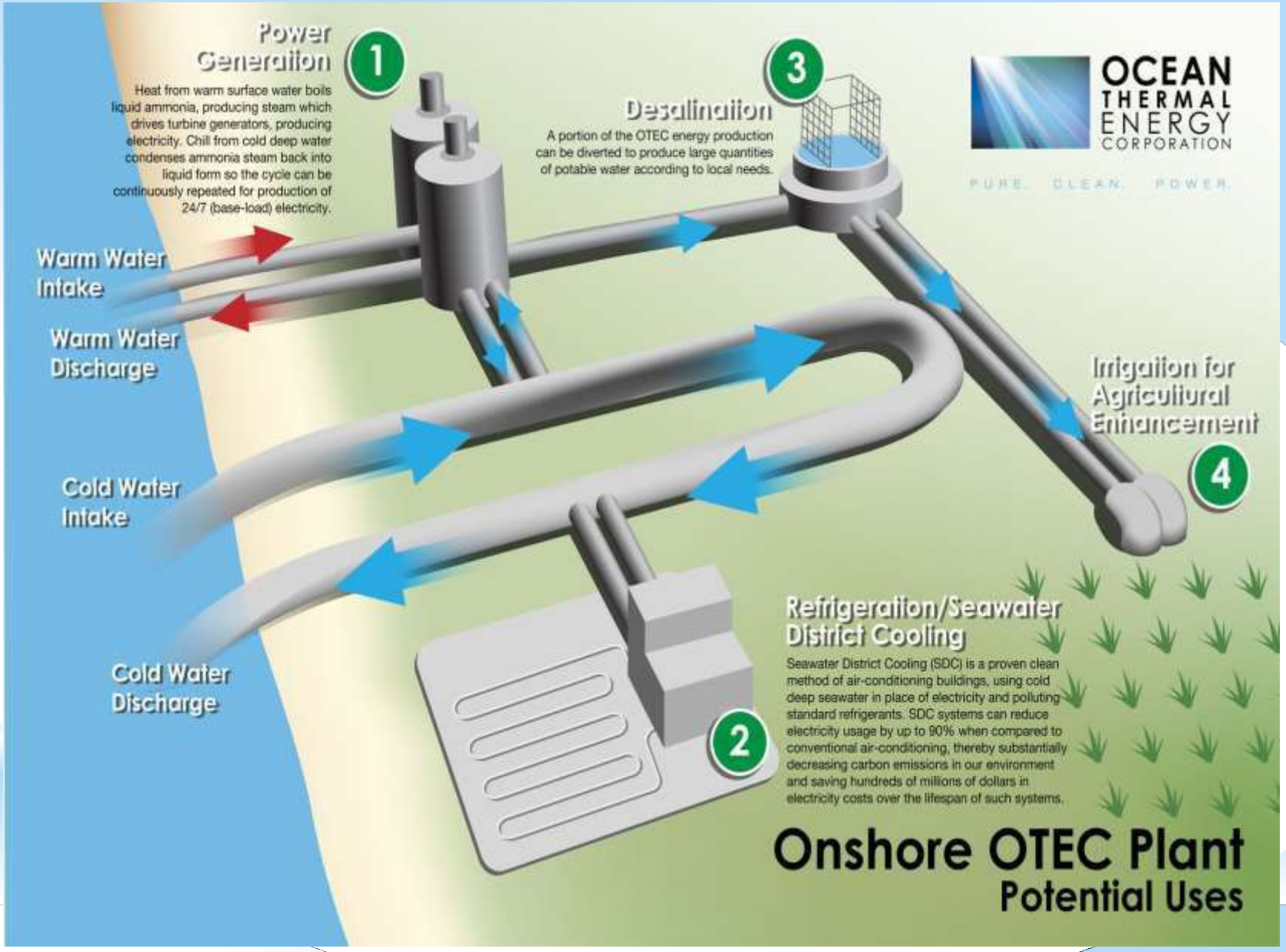
1. Tidal power plants do not require large valuable lands as they are on the bay or areas of estuaries
2. As the sea water is inexhaustible, it is completely, it is independent of the uncertainty of precipitation (rainfall)
3. It is pollution-free energy source as it does not use any fuel and also does not produce any waste

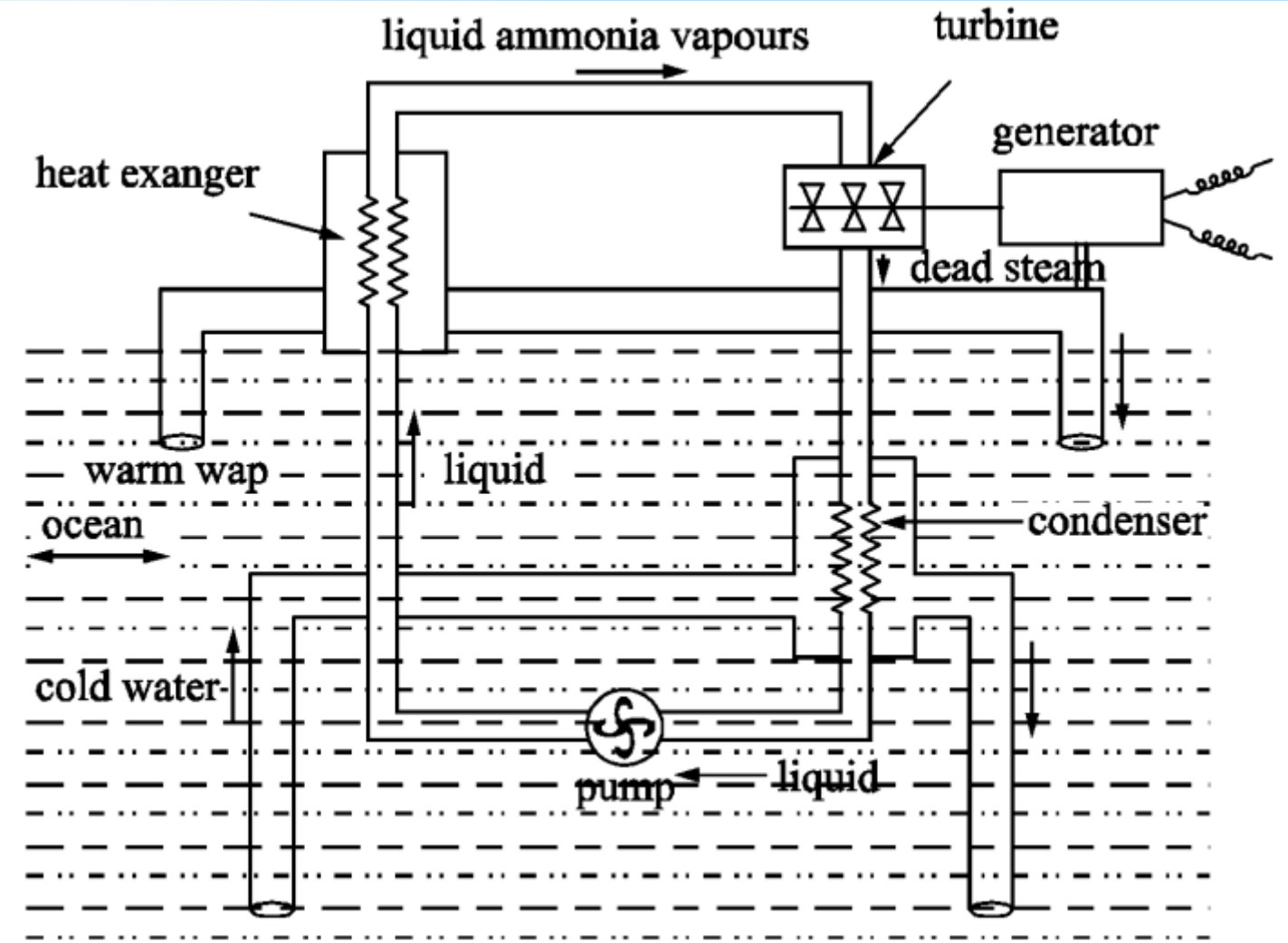
2. **Ocean thermal energy (OTE)**

There is often large temperature difference between the surface level and deeper level of the tropical oceans. This temperature difference can be utilized to generate electricity. ***The energy available due to the difference in temperature of water is called ocean thermal energy***.

Condition

The temperature difference should be of 20°C or more is required between surface water and deeper water.


Power Generation
1
Heat from warm surface water boils liquid ammonia, producing steam which drives turbine generators, producing electricity. Chill from cold deep water condenses ammonia steam back into liquid form so the cycle can be continuously repeated for production of 24/7 (base-load) electricity.
Desalination
3
A portion of the OTEC energy production can be diverted to produce large quantities of potable water according to local needs.
OCEAN THERMAL ENERGY CORPORATION
PURE. CLEAN. POWER.
Warm Water Intake
Warm Water Discharge
Irrigation for Agricultural Enhancement
4
Cold Water Intake
Cold Water Discharge
Refrigeration/Seawater District Cooling
2
Seawater District Cooling (SDC) is a proven clean method of air-conditioning buildings, using cold deep seawater in place of electricity and polluting standard refrigerants. SDC systems can reduce electricity usage by up to 90% when compared to conventional air-conditioning, thereby substantially decreasing carbon emissions in our environment and saving hundreds of millions of dollars in electricity costs over the lifespan of such systems.
Onshore OTEC Plant
Potential Uses


liquid ammonia vapours
turbine
generator
heat exanger
dead steam
warm wap
liquid
ocean
condenser
cold water
pump
liquid

The warm surface water of ocean is used to boil a low boiling liquid like ammonia. The high vapour pressure of the liquid, formed by boiling, is then used to turn the turbine of the generator and generates electricity. The cold water from the deeper ocean is pumped to cool and condense the vapour into liquid.

Significance of OTE

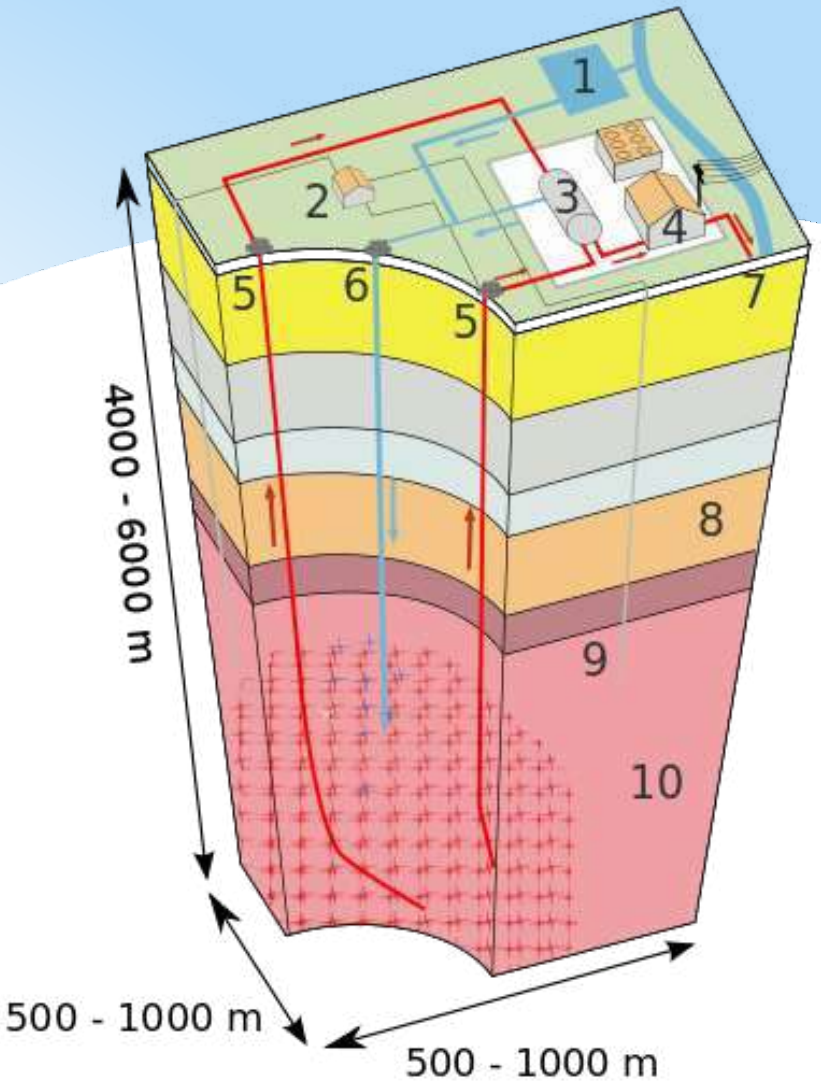
1. OTE is continuous, renewable and pollution free.
2. The use of cold deep water, as the chiller fluid in air-conditioning, has also been proposed.
3. Electric power generated by OTE can be used to produce hydrogen.

3. Geo-thermal energy

Temperature of the earth increases at a rate of 20 – 75°C per km, when we move down the earth surface. High temperature and high pressure steam fields exist below the earth's surface in many places. The energy harnessed from the high temperature present inside the earth is called geothermal energy.

1. Natural geysers

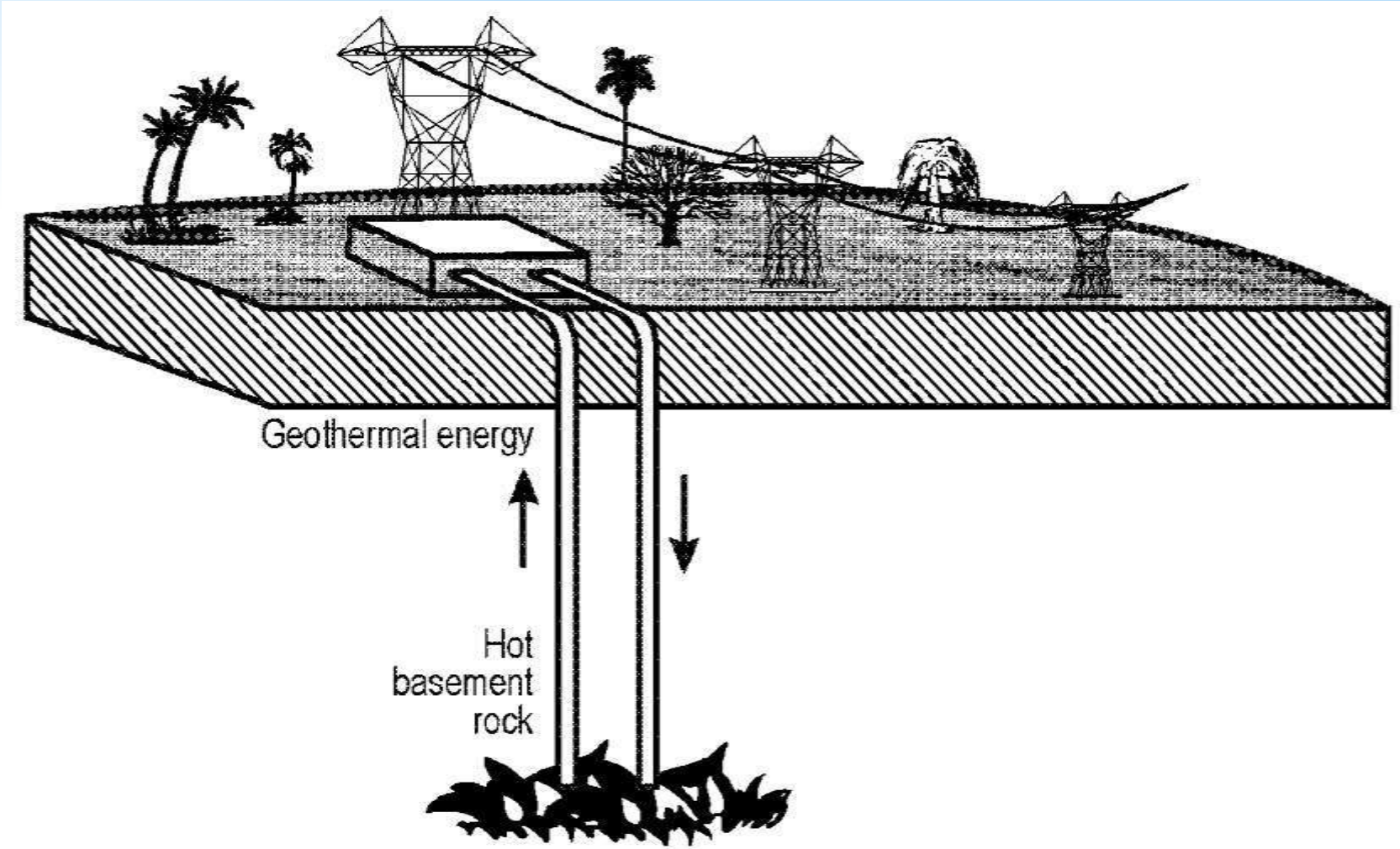
In some places, the hot water (or) steam comes out of the ground through cracks naturally in the form of natural geysers.


1
2
3
4
5
6
5
7
8
9
10
4000 - 6000 m
500 - 1000 m
500 - 1000 m

2. *Artificial geysers*

In some places, we can artificially drill a hole up to the hot region and by sending a pipe in it, we can make the hot water or steam to rush out through the pipe with very high pressure.

Thus, the hot water (or) steam coming out from the natural (or) artificial geysers is allowed to rotate the turbine of a generator to produce electricity.



Geo-thermal Energy

Significance of geo-thermal energy

1. The power generation level is higher for geo-thermal than for solar and wind energies.

2. Geo-thermal power plants can be brought on line more quickly than most other energy sources.

3. GTE is effectively and efficiently used for direct uses such as hot water bath, resorts, aquaculture, green houses.

Biomass energy

Biomass is the organic matter, produced by plants or animals, used as sources of energy. Most of the biomass is burned directly for heating, cooling and industrial purposes.

Wood, crop residues, seeds, cattle dung, sewage, agricultural wastes, etc.,

1. Biofuels

Biofuels are the fuels, obtained by the fermentation of biomass.

Ethanol, methanol.


Agriculture
Urban
Forest
Pits, Chaff, Shells
Pruning Scraps
Construction & Demolition Wood
Yard Trimmings
Non-Recyclable Organics
Forest Slash
Combustion
Electricity
Power Plant

(a) Ethanol: Ethanol can be produced from the sugarcane. Its calorific value is less when compared to petrol, and produces much less heat than petrol.

(b) Methanol: Methanol can be easily obtained from ethanol or sugar-containing plants. Its calorific value is also too low when compared to gasoline and diesel.

(c) Gasohol: Gasohol is a mixture of ethanol + gasoline. In India trial is being carried out to use Gasohol in cars and buses.

2. Hydrogen Fuel

Hydrogen can be produced by thermal dissociation or photolysis or electrolysis of water. It possess high calorific value. It is non-polluting, because the combustion product is water.

Hydrogen can be produced by thermal dissociation or photolysis or electrolysis of water. It possess high calorific value. It is non-polluting, because the combustion product is water.

$$2H_2 + O_2 \longrightarrow 2H_2O + 150\ KJ$$

Disadvantages of hydrogen fuel

1. Hydrogen is highly inflammable and explosive in nature.
2. Safe handling is required.
3. It is difficult to store and transport.

Significance of bio-energy

1. The cost of obtaining bio-energy through bio-gas plant is less than the cost of obtaining energy from fossil fuels.

2. Biomass consumes more CO_2 than is released during combustion of biomass.

3. It provides a stored form of energy and in many cases in a form suitable for vehicle propulsion.

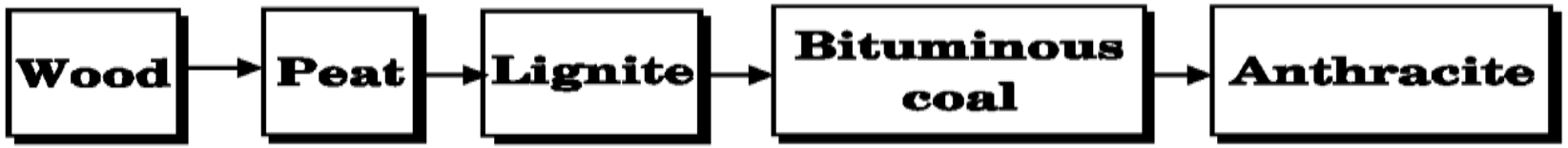
NON-RENEWABLE ENERGY SOURCES

Coal

Coal is a solid fossil fuel formed in several stages as buried remains of land plants that lived 300-400 million year ago, were subjected to intense heat and pressure over millions of years.

Various stages of coal

The various stages of coal during the coalification of wood is



The carbon content of Anthracite is 90% and its calorific value is 8700 k.cal. The carbon content of bituminous, lignite and peat are 80, 70 and 60% respectively.

India has about 5% of worlds coal. Indian coal is not good because of poor heat capacity.

Disadvantages of using coal

1. When coal is burnt it produces CO_2, causes global warming.

2. Since coal contains impurities like S and N, it produces toxic gases during burning.

Petroleum

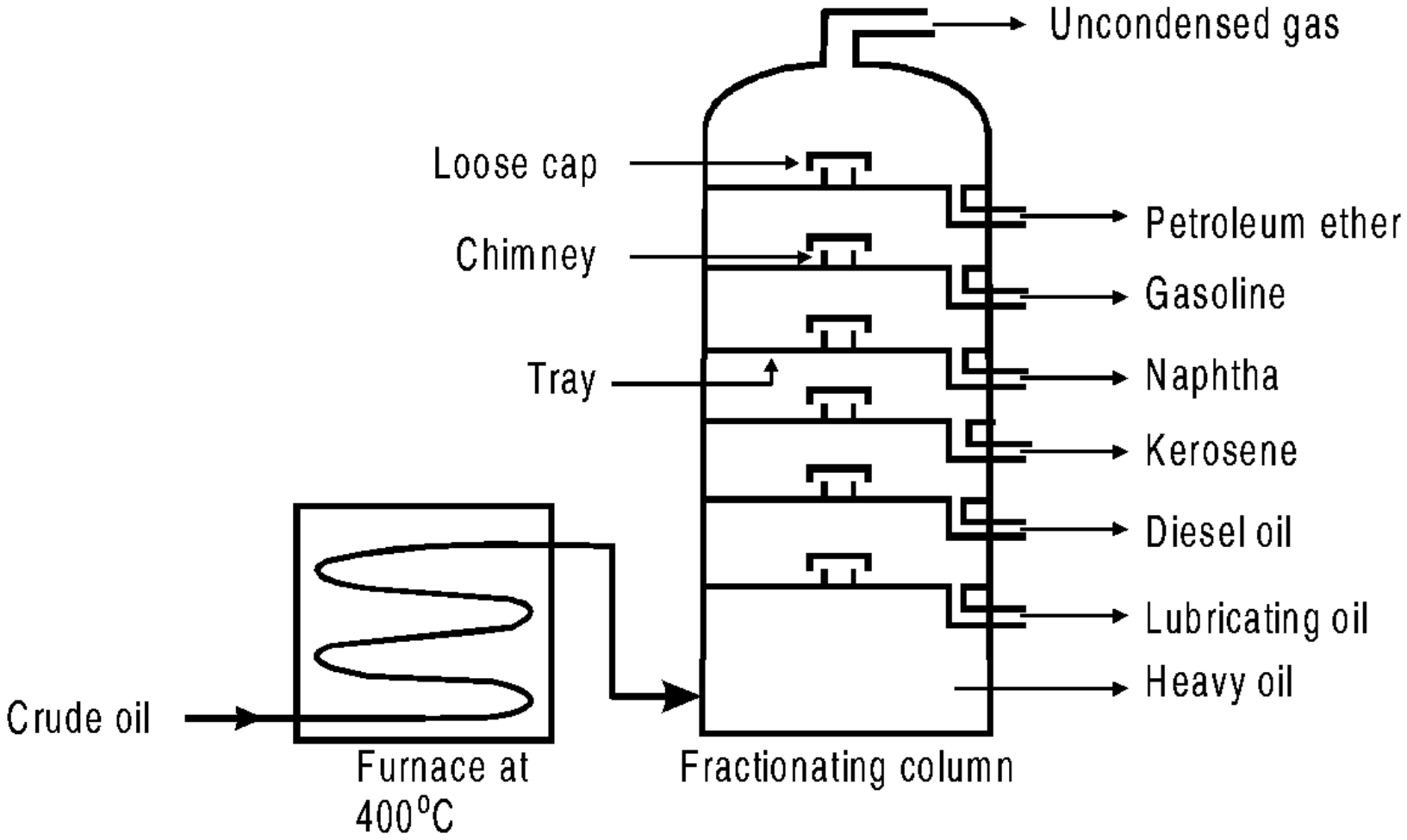
Petroleum or crude oil is a thick liquid consisting of more than hundreds of combustible hydrocarbons with small amount of S, O, N as impurities.

Occurrence

The fossil fuel (coal and petroleum) was formed by the decomposition of dead animals and plants, that were buried under lake and ocean at high temperature and pressure for million of years.

Fractional distillation

From the crude-petroleum oil, the various hydrocarbons are separated by purifying and fractionating the crude petroleum oil.



Fractionating column

LPG (Liquefied petroleum gas)

Petroleum gas, obtained during cracking and fractional distillation, can be easily converted into liquid under high pressure as LPG. LPG is colourless and odourless gas.

But during bottling some mercaptans is added, which produces bad odour, thereby any leakage of LPG from the cylinder can be detected instantaneously.

Natural gas is found above the oil in oil well. It is a mixture of 50-90% methane and small amount of other hydrocarbons.

Its calorific value ranges from 12,000-14,000 k . cal/m3

Natural gases are of two types.

1. Dry gas: If the natural gas contains lower hydrocarbons like methane and ethane, it is called dry gas.
2. Wet gas: If the natural gas contains higher hydrocarbons like propane, butane along with methane it is called wet gas.

Like petroleum oil, natural gas is also formed by the decomposition of dead animals and plants, that were buried under lake and ocean, at high temperature and pressure for million of years.

NUCLEAR ENERGY

Dr. H. Bhabha was the father of nuclear power development in India. India has 10 nuclear reactors, which produce 2% of India's electricity. Nuclear energy can be produced by two type of reactions.

1. By nuclear fission.
2. By nuclear fusion.

Nuclear fission

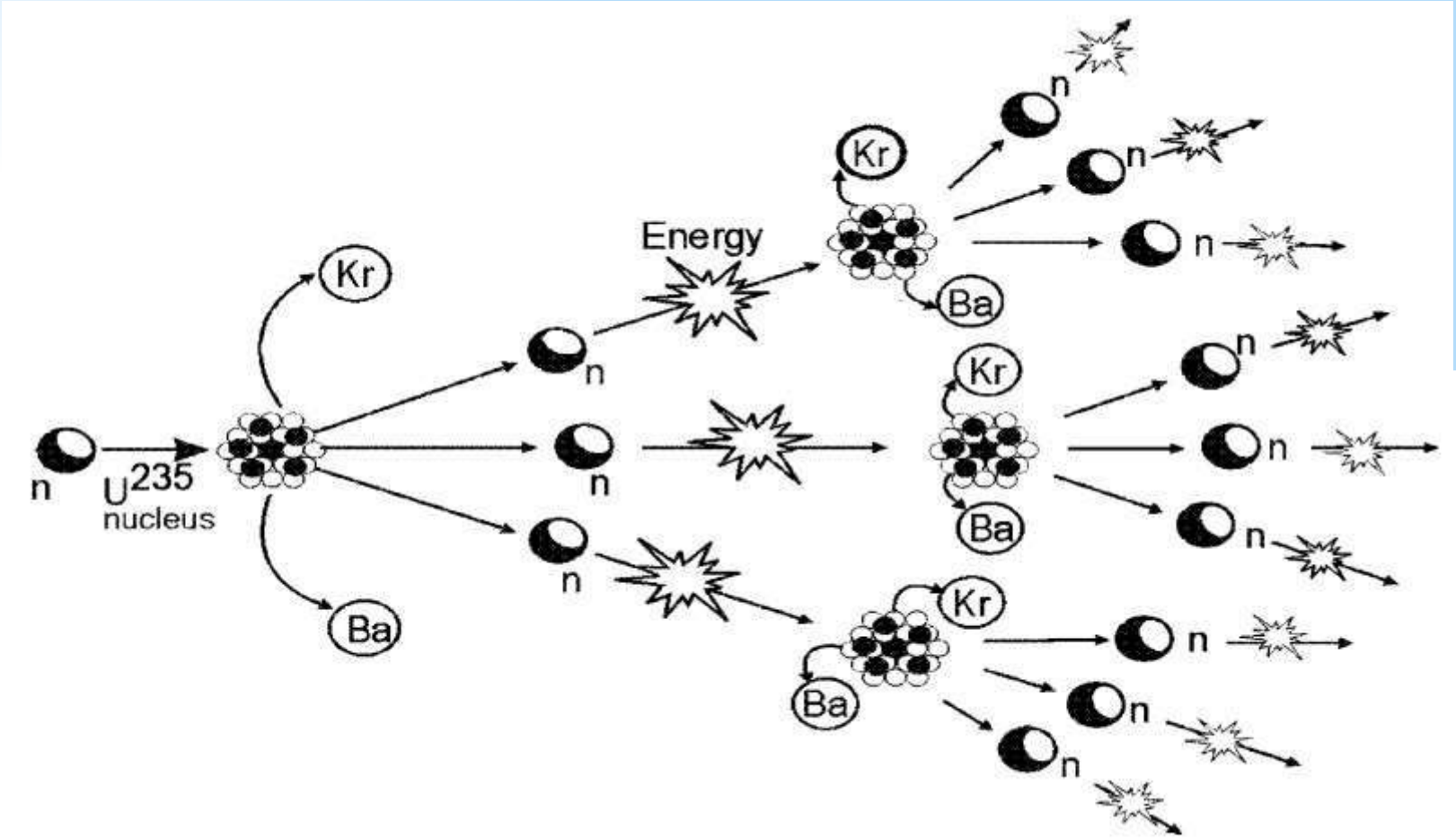
Nuclear fission is a nuclear change in which heavier nucleus are split into lighter nuclei, on bombardment by fast moving neutrons, and a large amount of energy is released through a chain reaction.

Fission of U^{235}

When U^{235} nucleus is hit by a thermal neutron, it undergoes the following reaction with the release of 3 neutrons.

$$U_{92}^{235} + n_0^1 \longrightarrow Ba_{56}^{139} + Kr_{36}^{94} + 3n_0^1 + \text{Energy}$$

Each of the above 3 neutrons strikes another U^{235} nucleus causing (3×3) 9 subsequent reactions. These 9 reactions further give rise to (3×9) 27 reactions. This process of propagation of the reaction by multiplication in threes at each fission is called **chain reaction.**



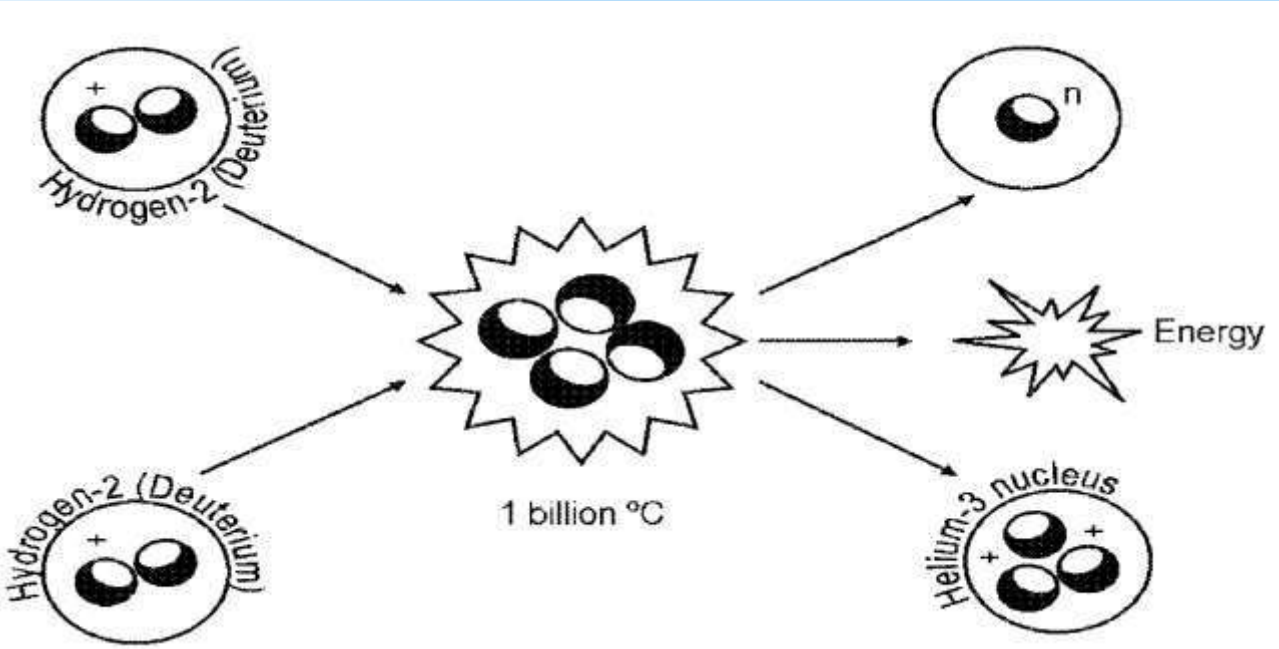
Nuclear fission-a chain reaction

Nuclear fusion

Nuclear fusion is a nuclear change in which lighter nucleus are combined together at extremely high temperatures (1 billion °C) to form heavier nucleus and a large amount of energy is released.

Fusion of H_1^2

Two hydrogen-2 (Deuterium) atoms may fuse to form a helium at 1 billion °C with the release of large amount of energy.



Nuclear fusion reaction between two H-2 (Deuterium)

Nuclear power in India

Tarapur (Maharastra), Ranapratap Sagar (Rajasthan), Kalpakkam (Tamil Nadu) and Narora (U.P).

Comparison of coal power with nuclear power

S. No.	Coal power	Nuclear power
1.	Coal is called fossil fuel. It is formed from the remain of plants and animals for over million of year.	Nuclear power is generated either from nuclear fission or fusion reaction.
2.	Coal power produces about 90% of world's total energy demands.	Nuclear power produces around 11% of world's energy needs.
3.	Much smaller energy changes are involved during the combustion of coal.	The energy changes involved is many million times greater.

S. No.	Coal power	Nuclear power
4.	Generation of coal power is governed by the temperature and pressure.	But temperature and pressure have no effect on generation of nuclear power.
5.	Similar products are obtained as a result of their combustion.	New products are formed.
6.	During combustion, there is no loss in total mass of coal.	Loss of mass occurs, during combustion of nuclear fuels.

S. No.	Coal power	Nuclear power
7.	Atomic number of elements, involved, do not change.	Atomic number of elements, involved, changes.
8.	Combustion of coal involves changes only in the electronic configuration of atoms and not in nuclei.	But combustion of nuclear fuels involves changes both in electronic configurations and nuclei of atoms.
9.	Burning of fossil fuel produces CO_2, which contributes to green house effect. Coal also contains sulphur, nitrogen and other toxic gases which leads to air pollution.	The nuclear reaction are very dangerous. Any leakage from the reactor may cause devasting nuclear pollution and hence huge money has to be spent on safety aspects.

S. No.	Coal power	Nuclear power
10.	Air pollution can be minimised by adopting preventive measurers.	Disposal of nuclear wastes is a big problem.
11.	Pollution level is low.	Radio active pollutants, released from nuclear power plants, are chronically hazardous. The dangerous radiowaste cannot be buried in land without the risk of polluting the soil and under ground water.

USES OF ALTERNATE ENERGY RESOURCES

Need of Alternate (Renewable) Energy Sources (or) Role of Alternate (Renewable) Energy sources in environmental impact

1. The importance of solar energy can be emphasized particularly in view of the fact that fossil fuels and other conventional sources are not free from environmental implications.
2. Energy sources which have least pollution, safety and security snags and are universally available have the best enhance of large scale utilization in future.
3. Hydro-electric power generation is expected to upset the ecological balance existing on earth.
4. Besides space heating, hydel power plants critically pollute the aquatic and terrestrial biota.

5. Radioactive pollutants released from nuclear power plants are chronically hazardous. The commissioning of boiling water power reactors (BWRS) have resulted in the critical accumulation of large number of long lived radionuclides in water.
6. The dangerous radiowaste cannot be buried in land without the risk of polluting soil and underground water. Nor the waste can be dumped into the rivers without poisoning aquatic life and human beings as well.
7. The burning of coal, oil, wood, dung cakes and petroleum products have well debated environmental problems. The smoke so produced causes respiratory and digestive problems leading to lungs, stomach and eye diseases.
8. The disposal of fly ash requires large ash ponds and may pose a severe problem considering the limited availability of land. So, the non conventional sources of energy needed.

Objectives

(a) To provide more energy to meet the requirements of increasing population.

(b) To reduce environmental pollution and

(c) To reduce safety and security risks associated with the use of nuclear energy.

CASE STUDIES

Wind energy in India

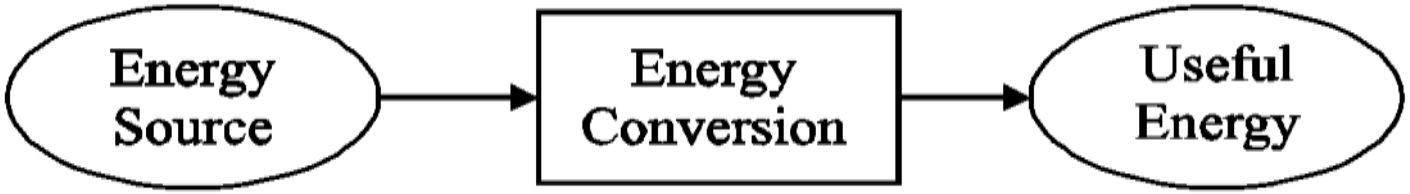
India is generating 1200 Mw electricity using the wind energy. The largest wind farm of our country is near Kanyakumari in Tamil Nadu, which generates 380 Mw electricity.

Hydrogen-fuel cell car

General motor company of China discovered the experimental cars, which run on electric motors fueled by hydrogen and oxygen. This car produces no emission, only water droplets and water vapour come out of the exhaust pipe. This motor company hopes that its cars will be commercially available by 2010.

ENERGY CONVERSION PROCESSES

Energy conversion process is the process of changing energy from one form to another.



Examples for diffrent energy conversion

Energy Sources	Types of energy	Energy after conversion
Hydro (water)	Potential Energy	Kinetic Energy → Electrical energy.
Wind, Hydro	Kinetic Energy	Electrical Energy.
Geothermal, Ocean-thermal	Thermal Energy	Mechanical Energy → Electrical Energy.
Solar	Radiant Energy	Thermal Energy → Electrical Energy.
Oil, Coal-gas, Biomass	Chemical Energy	Thermal Energy → Electrical Energy.
Uranium, Thorium	Nuclear Energy	Thermal Energy → Mechanical Energy → Electrical Eneregy.

Anaerobic Digestion

Anaerobic digestion is a series of biological processes in which micro-organisms break down biodegradable materials in the absence of oxygen. One of the end product is bio-gas. Anaerobic digestion is used to convert live stock mannure, municiple waste water solids, food waste, high strength industrial waste water and residuals, fats, oils and greases into bio-gas.

Various steps involved in Anaerobic Digestion

Anaerobic digestion involves the following four stages of biological and chemical reactions.

Hydrolysis

The digestion process begins with bacterial hydrolysis of the input materials to break down insoluble organic polymers to soluble materials such as carbohydrates and make them avaiable for other bacteria.

Acidogenesis

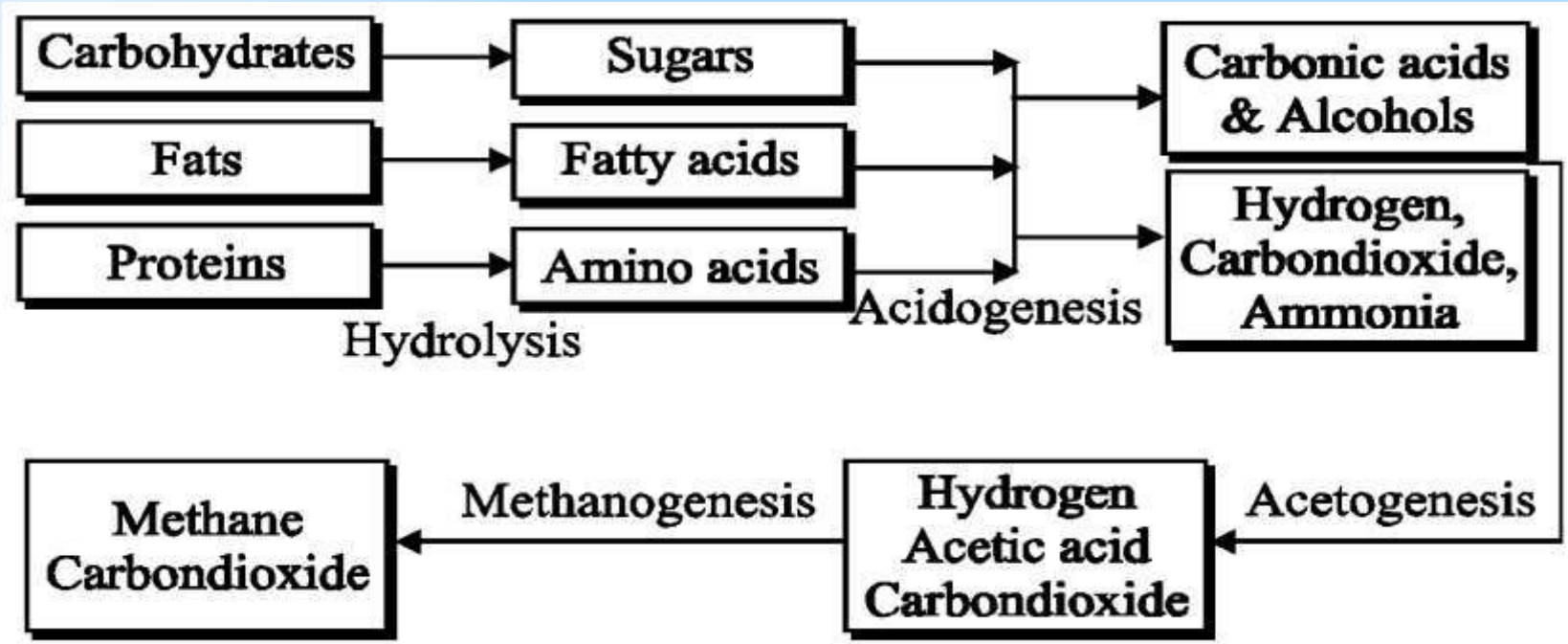
Then, acidogenic bacteria converts the sugars and amino acids into carbondioxide, hydrogen, ammonia and organic acids.

Acetogenesis

These organic acids are converted into acetic acid along with additional ammonia, hydrogen and carbon dioxide by the acetogenic bacteria acetic (acid-forming bacteria).

Methanogenesis

Finally, the above products are converted into methane and carbondioxide by methanogenesis (methane - forming bacteria).



Thus, the final chemical reaction for the overall processes is

$$C_6H_{12}O_6 \longrightarrow 3CH_4 + 3CO_2$$

Bio-gas (or) Gobar Gas

Bio-gas is a mixture of various gases formed by the anaerobic degradation of biological matter (cow dung) in the absence of free oxygen.

Composition of Bio-gas

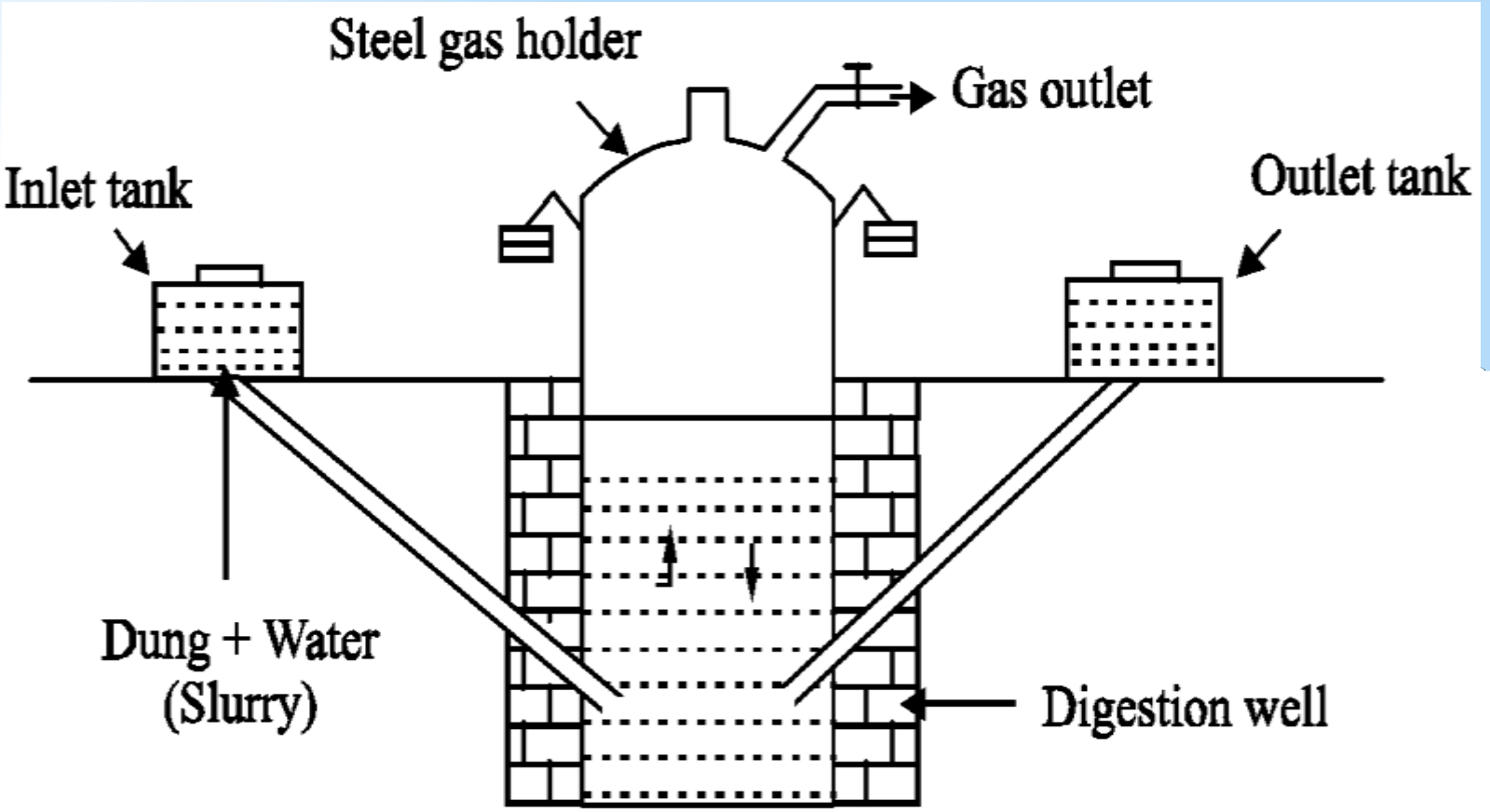
Compound	%
Methane	50-75
Carbondioxide	25-50
Nitrogen	0-10
Hydrogen	0-1
Hydrogen Sulphide	0-3
Oxygen	0

Production of bio-gas

Bio-gas is produced in a bio-gas plant.

Construction

Bio-gas plant or Gobar gas plant consists of a well like under ground tank (called digester) covered with dome shaped roof with a gas out let pipe. The dome of the digester acts as gas holder. On the left hand side of the digester there is a sloping inlet chamber through which cattle dung + water slurry is introduced. On the right hand side, there is a outlet chamber, through which spent dung slurry gets collected.



Biogas Plant

Working

Slurry (animal dung + water) is fed into the digester through the inlet chamber. The slurry, in the digester, is left for about two months for fermentation. Anaerobic micro-organisms are responsible for this action. As a result of anaerobic fermentation, bio-gas is collected in the dome.

When sufficient amount of bio-gas is collected in the dome, it exerts a large pressure on the slurry and this in turn forces the spent slurry to the over flow tank through the outlet chamber.

Once the bio-gas plant starts functioning more and more slurry may be fed into the digester to get continuous supply of bio-gas.

Uses of bio-gas

1. Bio-gas is used for cooking food and heating water.
2. It is used to run engines.
3. It is also used as an illuminant in villages.
4. It is used for running tube-well and water pump-set engines.
5. It is directly used in gas turbines and fuel cells for producing electricity.

CASE STUDIES

A. **WIND ENERGY IN INDIA** – India generates 1200MW electricity using wind energy.. The largest wind farm is in Kanyakumari, which generates 380mw electricity.

B. **HYDROGEN-FUEL CELL CAR** - General motor company of China discovered an electric car fueled by hydrogen and oxygen. This car produces no emission, only water come out of the exhaust pipe.

LAND RESOURCES

Land as a resource

Land is the most important and valuable resources for mankind as it provides food, fibre, wood, medicine and other biological materials needed for food.

Soil is the mixture of inorganic at erials (rocks and minerals) and organic materials (dead animals and plants).

Top soil is classified as a renewable resources, because it is continuously regenerated by natural process at a very slow rate.

But, if the rate of erosion is faster than the rate of renewal, then the soil becomes a non- renewable resource.

Uses of land resources

1. Land provide, food, wood, minerals, etc., for us.
2. Land nurtures the plants and animals that provides our food and shelter.
3. Land is used as watershed or reservoir.
4. Land acts as a dust bin for most of the wastes, created by the modern society.
5. Land is used for construction of buildings, industries.

Land (soil) degradation

Land degradation is the process of deterioration of soil or loss of fertility of the soil.

Harmful effects of land (soil) degradation

1. The soil texture and structure are deteriorated.
2. Loss of soil fertility, due to loss of invaluable nutrients.
3. Increase in water logging, salinity, alkalinity and acidity problems.
4. Loss of economic social and biodiversity.

Causes of (or factors influencing) land degradation

1. Population: As population increases, more land is needed for producing food, fibre and fuel wood. Hence there is more and more pressure on the limited land resources, which are getting degraded due to over exploitation.
2. Urbanization: The increased urbanization due to population growth reduce the extent of agricultural land. To compensate the loss of agricultural land, new lands comprising natural ecosystems such as forests are cleared. Thus urbanization leads to deforestation, which intum affects millions of plant and animal species.
3. Fertilizers and pesticides: Increased applications of fertilizers and pesticides are needed to increase farm output in the new lands, which again leads to pollution of land and water and soil degradation.

4. Damage of top soil: Increase in food production generally leads to damage of top soil through nutrient depletion.
5. Water-logging, soil erosion, salination and contamination of the soil with industrial wastes all cause land degradation.

Soil Erosion

Soil erosion is the process of removal of superficial layer of the soil from one place to another. Soil erosion also removes the soil components and surface litter.

Types of soil erosion

1. Normal erosion: It is caused by the gradual removal of top soil by the natural processes. The rate of erosion is slower.

2. Accelerated erosion:

It is mainly caused by man-made activities. The rate of erosion is much faster than the rate of formation of soil.

Effects of soil erosion

1. Soil fertility is lost because of loss of top soil layer.
2. Loss of its ability to hold water and sediment.
3. Sediment runoff can pollute water and kill aquatic life.

Causes of (factors causing) soil erosion

1. ***Water:*** Water affects soil erosion in the form of rain, run-off, rapid flow, wave action.

2. ***Wind:*** Wind is the important climatic agent, which carry away the fine particles of soil and creates soil erosion.

3. ***Biotic agents:*** Overgrazing, mining and deforestation are the major biotic agents, cause soil erosion.

Due to these processes, the top soil is disturbed and exposed directly to the action of various physical forces, which induces erosion.

35% of the world soil erosion is due to overgrazing.

30% of the world soil erosion is due to deforestation.

4. ***Landslides:*** It also causes soil erosion.

5. ***Construction:*** Construction of dams, buildings, roads removes the protective vegetal cover and leads to soil erosion.

Control of soil erosion (or) soil conservation practices

In order to control soil erosion and conserve the soil, the following conservation practices are applied.

1. Conservational till farming (or) no-till-farming: In tradition method, the land is ploughed and soil is broken up and leveled to make a planting surface. This disturbs the soil and makes it susceptible to erosion. However, no-till-farming causes minimum disturbance to the top soil. Here the tilling machines make slits in the unploughed soil and inject seeds, fertilizers and water in the slit. So the seed germinates and the crop grows.

2. Contour farming: It involves planting crops in rows across the contour of gently sloped land. Each row acts as a small dam to hold soil and to slow water runoff.

Contour farming

3. Terracing: It involves conversion of steep slopes into a series of broad terraces, which run across the contour. This retains water for crops and reduces soil erosion by controlling run off.

Terracing

4. Alley cropping (or) Agro forestry: It involves planting crops in strips or alleys between rows of trees of shrubs, that can provide fruits and fuel wood. Even when the crop is harvested, the soil will not be eroded because trees and shrubs still remain on the soil and hold the soil particles.

Alley cropping

5. Wind breaks or shelter belts: The trees are planted in long rows along the boundary of cultivated lands, which block the wind and reduces soil erosion. Wind breaks help in retaining soil moisture, supply of some wood for fuel and provide habitats for birds.

Wind breaks

Desertification

- Desertification is a progressive destruction or degradation of arid or semiarid lands to desert.
- It is also a form of land degradation.
- Desertification leads to the conversion of range lands or irrigated croplands to desert like conditions in which agricultural productivity falls.
- Desertification is characterised by devegetation, depletion of ground water, salination and soil erosion.

Harmful effects of desertification

1. Around 80% of the productive land in the arid and semi-arid regions are converted into desert.
2. Around 600 million people are threatened by desertification.

Causes of Desertification (or) reasons for desertification

1. Deforestation: The process of denuding and degrading a forest land initiates a desert. If there is no vegetation to hold back the rain water, soil cannot soak and groundwater level do not increases. This also increases, soil erosion, loss of fertility.
2. Over grazing: The increase in cattle population heavily graze the grass land or forests and as a result denude the land area. The denuded land becomes dry, loose and more prone to soil erosion and leads to desert.
3. Water Management: Over utilization of groundwater, particularly in coastal regions, resulting in saline water intrusion into aquifers, which is unfit for irrigation.

4. Mining and quarrying : These activities are also responsible for loss of vegetal cover and denudation of extensive land area leading to desertification.
5. Climate change: Formation of deserts may also take place due to climate change, ie., failure of monsoon, frequent droughts.
6. Pollution: Excessive use of fertilizers and pesticides and disposal of toxic water into the land also leads to desertification

Man induced Landslides

Landslides

- Landslides are the downward and outward movement of a slope composed of earth materials such as rock, soil, artificial fills.
- Other names of landslides are rockslide, debris slide, slump, earth flow and soil creep.

Man induced landslides

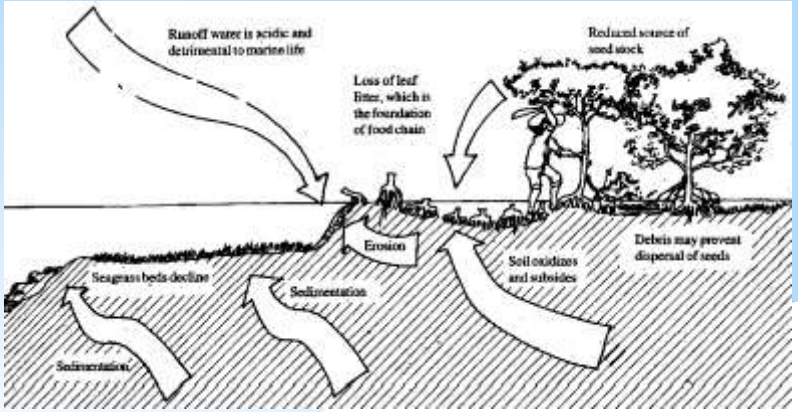
- During construction of roads and mining activities huge portions of fragile mountainous areas are cut and thrown into adjacent areas and streams.
- These land masses weaken the already fragile mountain slopes and lead to landslides called man induced landslides.

Harmful effect of man induced landslides

1. Landslide increases the turbidity of nearby streams, thereby reducing their productivity.
2. Destruction of communication links.
3. Loss of habitat and biodiversity.
4. Loss of infrastructure and economic loss.

Causes of land slides

1. Removal of vegetation: Deforestation in the sloppy area creates soil erosion, which leads to landslides.
2. Underground mining: These activities cause subsidence of the ground
3. Transport: Due to the movement of buses and trains in the unstable sloppy region causes landslides.
4. Addition of weight: Addition of extra weight (or) construction on the slope areas leads to landslide.
5. Ground water level: Over exploitation of ground water also leads to landslides.


Runoff water is acidic and detrimental to marine life
Reduced source of seed stock
Loss of leaf litter, which is the foundation of food chain
Erosion
Debris may prevent dispersal of seeds
Soil oxidizes and subsides
Seagrass beds decline
Sedimentation
Sedimentation

ROLE OF AN INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES (Environmental protection)

- Since resources are being exhaustible, it is the duty of every individual on this earth to conserve the natural resources in such a way that they must be available for future generation also.
- Individual must understand the essential of natural resources.
- Due to advancement in technology and population growth, the present world is facing lot of problems on degradation of natural resources.

Measures recommended for conservation of natural resource

1. Conservation of Energy

1. Switch off lights, fans and other appliances when not in use.
2. Use solar heater for cooking your food on sunny . days, which will cut down your LPG expenses.
3. Dry the clothes in sunlight instead of driers.
4. Grow trees near the houses and get a cool breeze and shade. This will cut off your electricity charges on AC and coolers.
5. Use always pressure cooker.
6. Ride bicycle or just walk instead of using car and scooter

II. Conservation of water

1. Use minimum water for all domestic purposes.
2. Check for water leaks in pipes and toilets and repair them promptly.
3. Reuse the soapy water, after washing clothes, for washing off the courtyards, drive ways, etc.,
4. Use drip irrigation to improve irrigation efficiency and reduce evaporation.
5. The wasted water, coming out from kitchen, bath tub, can. be used for watering the plants.
6. Build rainwater harvesting system in your house

III. Conservation of soil

1. Grow different types of plants, herbs, trees and grass in your garden and open areas, which bind the soil and prevent its erosion.
2. While constructing the house don't uproot the trees as far as possible.
3. Don't irrigate the plants using a strong flow of water, as it will wash off the top soil.
4. Soil erosion can be prevented by the use of sprinkling irrigation.
5. Use green manure in the garden, which will protect the soil.
6. Use mixed cropping, so that some specific soil nutrients will not get depleted.

IV. Conservation of Food Resources

1. Eat only minimum amount of food. A void over eating.
2. Don’t wastes the food instead gives it to someone before getting spoiled.
3. Cook only required amount of the food.
4. Don't cook food unnecessarily.
5. Don't store large amounts of food grains and protect them from damaging insects.

Conservation of Forest

1. Use non-timber products.
2. Plant more trees and protect them.
3. Grassing, fishing must be controlled.
4. Minimise the use of papers and fuel wood.
5. Avoid of executing developmental work like dam, road, construction in forest areas.

EQUITABLE USE OF RESOURCES FOR SUSTAINABLE LIFE STYLE

Sustainable development

- Sustainable development is the development of healthy environment without damaging the natural resources.
- In other words, all the natural resources must be used in such a way that it must be available for the future generation also.

Unsustainable development

- Unsustainable development is the degradation of the environment due to over utilization and over exploitation of the natural resources.

Life style in different countries

The life style in world can be explained in two ways.

1. Most developed countries (MDCs)
2. Less developed countries (LDCs)

1. Life style in most developed countries

- The most developed countries have only 22% of world's population, but they are using 88% of its natural resources.
- Their income is nearly 85% of total global income. They contribute more proportion to its pollution.
- As the rich countries are developing more, they are consuming more natural resources and polluting the environment more.
- The sustainability of the earth's life supporting system is under threat.

2. Life style in less developed countries

- The less developed countries have 78% of the world's population and are using only about 12% of its natural resources.
- Their income is only 15% of total global income. They have very low industrial growth.
- They are still struggling hard with their large population and poverty problems.
- They are consuming too low natural resources leading to unsustainability.

Causes of unsustainability

The main cause is due to the difference between the less developed and more developed countries. i.e.,

(i)Over population in poor countries, consume too low resources with low income.

(ii) Rich countries consume more resources with more income.

Conditions for sustainable life style

In order to achieve sustainable life styles,

1. It is essential to achieve a more balanced and equitable distribution of land resources and income to meet everyone's basic needs.
2. The rich countries should lower down their consumption levels, while the minimum needs of the poor should be fulfilled by providing them resources.

Thus more balanced and equitable use of resources will reduce the differences between the most developed countries and less developed countries and will lead to sustainable development.

INTRODUCTION TO ENVIRONMENTAL BIOCHEMISTRY

- Biochemistry is used in environmental science to understand the effects of environment on living organisms as they interact with environmental pollutants.
- These pollutants are referred to as xenobiotics.
- Xenobiotics can be ingested, inhaled or absorbed through the skin.
- Using biochemistry it is possible to study how different pollutants behave once if they are in the body.

Definition

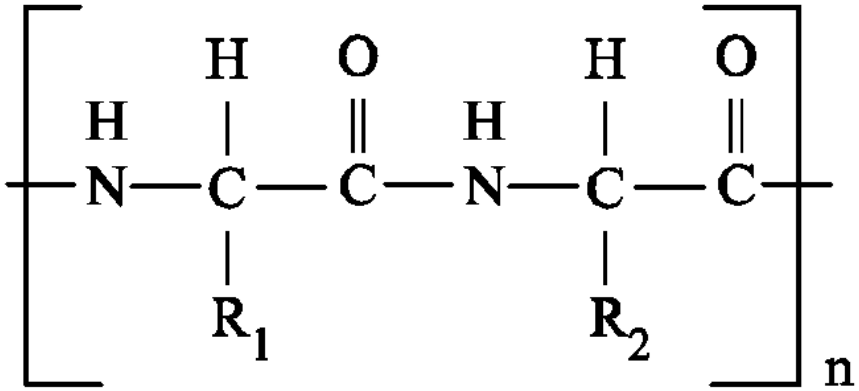
Environmental biochemistry involves approaches to treat polluted air, waste water and solid waste using metabolic activities of micro-organisms.

Aim of environmental biochemistry

1. It aims to manufacture of products in environmentally harmonious ways, which allows for the minimization of harmful solids, liquids or gaseous outputs.
2. It also aims to create cleaner ecosystems.

Proteins

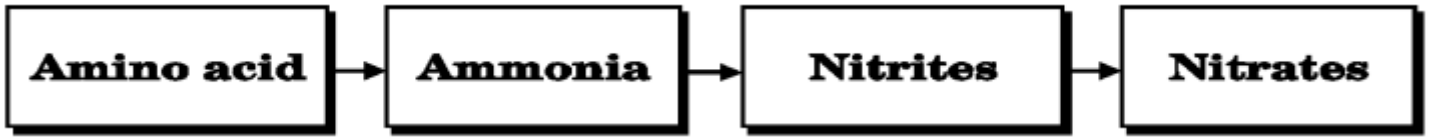
- Protein is the principle constituent of animal origin.
- All raw animals and plant food stuffs contain protein, but in plants it occurs in lesser extends.
- Proteins are complex in chemical structure and unstable being subjected to many forms of decomposition
- The structure of protein is



- All proteins contain carbon along with hydrogen, nitrogen and oxygen, which are common to all organic substances.
- When proteins are present in large quantities extremely foul odours are produced because of their decomposition.

Degradation of proteins

- Environmental toxins can damage proteins.
- If a damaged protein is not repaired, it is degraded easily. The degradation of a protein, usually by hydrolysis, at one or more of its peptide bonds.
- Generally biological degradation of protein in nature follows three steps and different organisms metabolize product at each step



Biochemical degradation of pollutants

- Most of the organic matter, present in waste water, includes degradable carbohydrates, proteins and lipids of different complexities.
- The treatment of such waste water aims at oxidising or degrading the organic compounds, so as to decrease the biological oxygen demand (BOD).
- The degradation is performed by a single micro-organism or a group of micro-organisms under aerobic or anaerobic conditions.

Types of Biodegradable pollutants

Based on degradability, pollutants can be grouped into four types.

1. Very easily degradable
2. Easily degradable
3. Potentially degradable
4. Very slowly degradable

1. Very Easily degradable

- **Pollutants** - Simple sugars, amino acids, organic acids, simple short polymers.
- **Organisms** - Bacteria, fungi, protozoa and algae posses the ability to degrade these pollutants.
- Generally it constitutes a small amount of the pollutants the environments that are quickly removed by the microbes for their growth. It occurs under aerobic conditions
- Time for removal - These pollutants are removed within hours of their release

2. Easily degradable

- **Pollutants** - Branched and straight chained polysaccharides, proteins, fatty acids.
- **Organisms** - More than one bacterial strain accelerates the degradation process.
- Generally degradation of such pollutants do not necessarily require adaptation of the micro-organisms.
- Time for removal - These pollutants are removed in 10 - 14 days.

3. Potentially degradable Pollutants:

- Complex substances like saturated fatty oils, lipo proteins, fats and aliphatic aromatic hydrocarbons.
- **Organisms** - Extremely high bacterial densities are required for this degradation.
- Degradation of such pollutants occurs slowly with prolonged exo-enzyme activity at extremely high bacterial densities. Only adaptive strains of bacteria are able to perform the degradation of such pollutants, but to accelerate degradation artificial conditions are required for enhancing the bacterial growth.
- Time for removal - These pollutants are removed in 3 weeks.

Very slowly degradable

Pollutants:

Ligno cellulose, Organo chlorines, PCB, OC, insecticides and some aromatic hydrocarbons belong to this category.

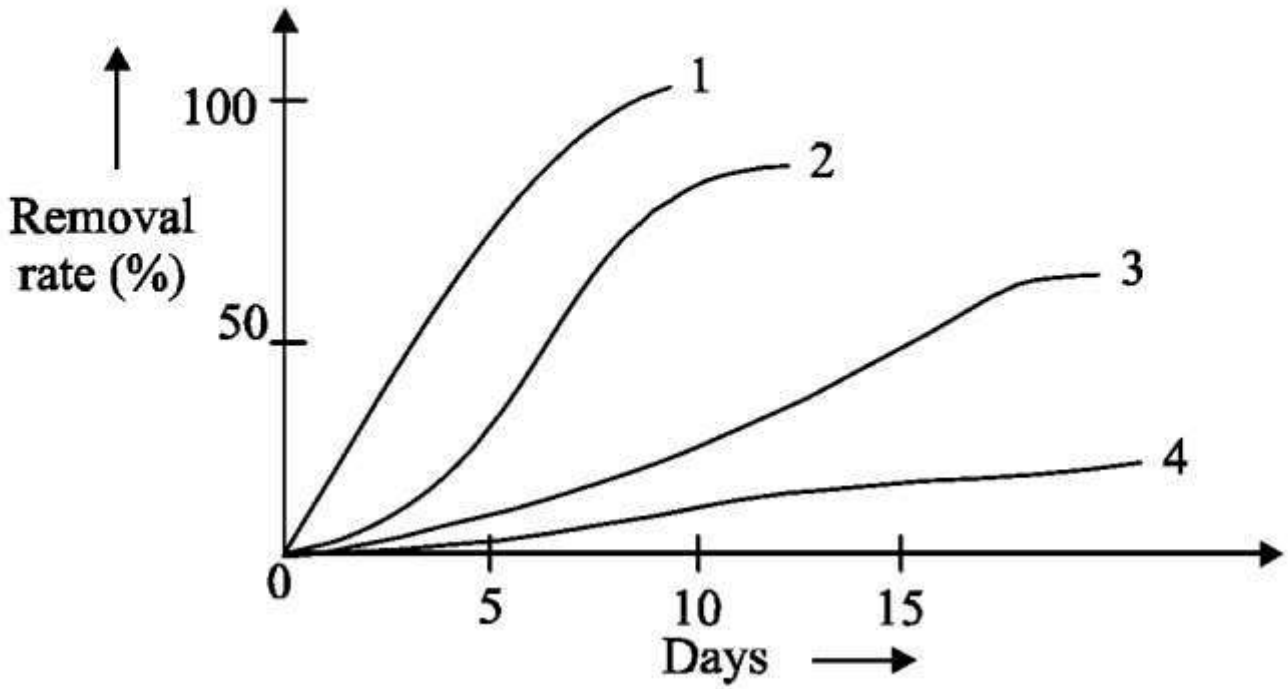
Organisms:

Very high microbial biomass is required for this degradation.

Degradation of such pollutants requires a comparatively high concentration of exoenzymes to initiate the degradation process. Artificial inoculation, growth subsidisation and addition of growth supporting substances (nutrients and vitamins) accelerate the degradation time.

Degradation curve

Degradation curve for different types of pollutants is given below.



Degradation curve for different types of pollutants

Bioconversion of pollutants

Bioconversion is the change of pollutants (wastes) into a source of energy by the action of micro-organisms. It is the cheap and safe method.

Examples

1. Bioconversion of biomass into ethanol, methanol (or) methane.
2. Bioconversion of organic materials like plant, animal wastes into useful products.
3. Bioconversion of lignocellulosic wastes into reducing sugars.

Types of Bioconversion

1. Enzymatic hydrolysis
2. Synthesis gas fermentation
3. Composing

1. Enzymatic hydrolysis

A feedstock is mixed with strong enzymes which converts a portion of cellulosic material into sugar which can then be fermented into ethanol.

2. Synthesis gas fermentation

A feed stock is mixed with 30% water and is gasified in a closed environment into a "syn gas" using carbon monoxide and hydrogen. The cooled syngas is then converted into usable products through exposure to bacteria.

3. Composing

A feedstock of organic matter is subjected to some organisms to reduce and covert organic waste into high quality food stuff and oil rich material for the biodiesel industry.

UNIT 4: SOCIAL ISSUES AND THE ENVIRONMENT

SYLLABUS

- Sustainable development
- water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people
- Role of non-governmental organization
- Environmental ethics: Issues and possible solutions
- climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust
- case studies.
- wasteland reclamation
- consumerism and waste products
- Environment production act – Air & Water (Prevention and control of Pollution) act
- Wildlife protection act – Forest conservation act
- Enforcement machinery involved in environmental legislation
- central and state pollution control boards
- Public awareness.

* From unsustainable to sustainable development:

Brundland commission describes sustainable development as the development that meet needs of present generation without compromising ability of future generations to meet their own need

Concept of sustainable development:

A symbiotic relationship between consumer human race and producer natural

* Compatibility between ecology and economics

Aim of sustainable development:

* **Intergenerational equity-** in economic, psychological, and sociological contexts, is the concept or idea of fairness or justice in relationships between children, youth, adults and seniors, particularly in terms of treatment and interactions

* **Intra generational technology**

Significance of sustainable development:

*Developing appropriate technology

*Reduce , reuse, recycle of natural resources

*Providing environmental education and awareness

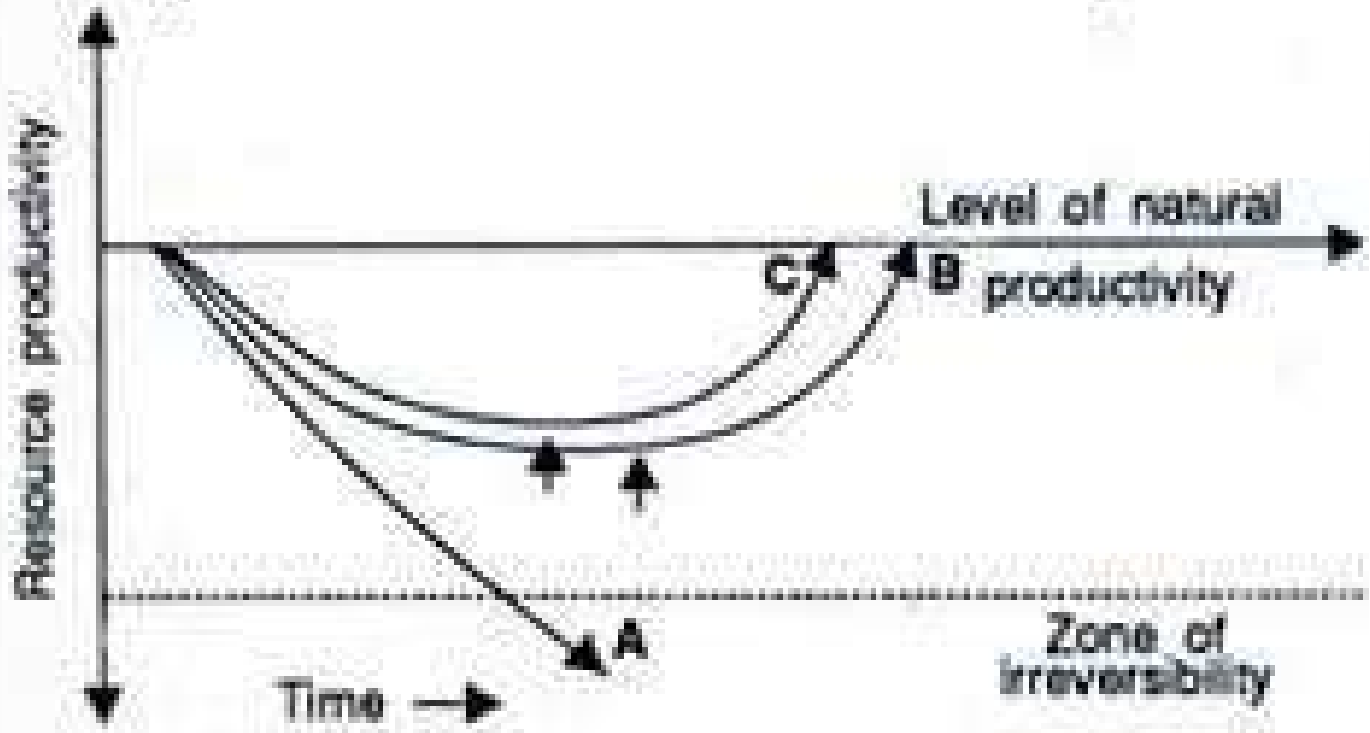
*Consumption of renewable resources

*Conservation of nonrenewable resources

* Population control


Create Value
PROFIT
Eliminate Waste
Recognize Interdependence
SUSTAINABLE DEVELOPMENT MATRIX
Energy Flows
Share Knowledge
PLANET
PEOPLE
Model Nature
Humans & Nature Co-exist
Accept Responsibility
Quality of Life

The process of sustainability



1. *Society A is undergoing a process of unsustainable development.*
2. *Society C is more capable of making sustainable use of its natural resources than society B. The latter's learning period is longer.*
3. *Arrows show the point when the society begins to learn from its mistakes and change its behaviour accordingly.*

* Urban problems related to energy:

Urbanization:

* Movement of human population from rural areas top urban areas for betterment of education, communication, health, employment etc

Causes;

* Cities are main centers of economic growth, trade, transportation, education, medical facilities and employment

Urban sprawl:

* Urban growth is fast , so difficult to accommodate with their limited area .So cities spread into rural areas

Urban energy requirement:

* Residential and commercial lighting § Public and private transportation
* Electrical and electronic appliances

Solution:

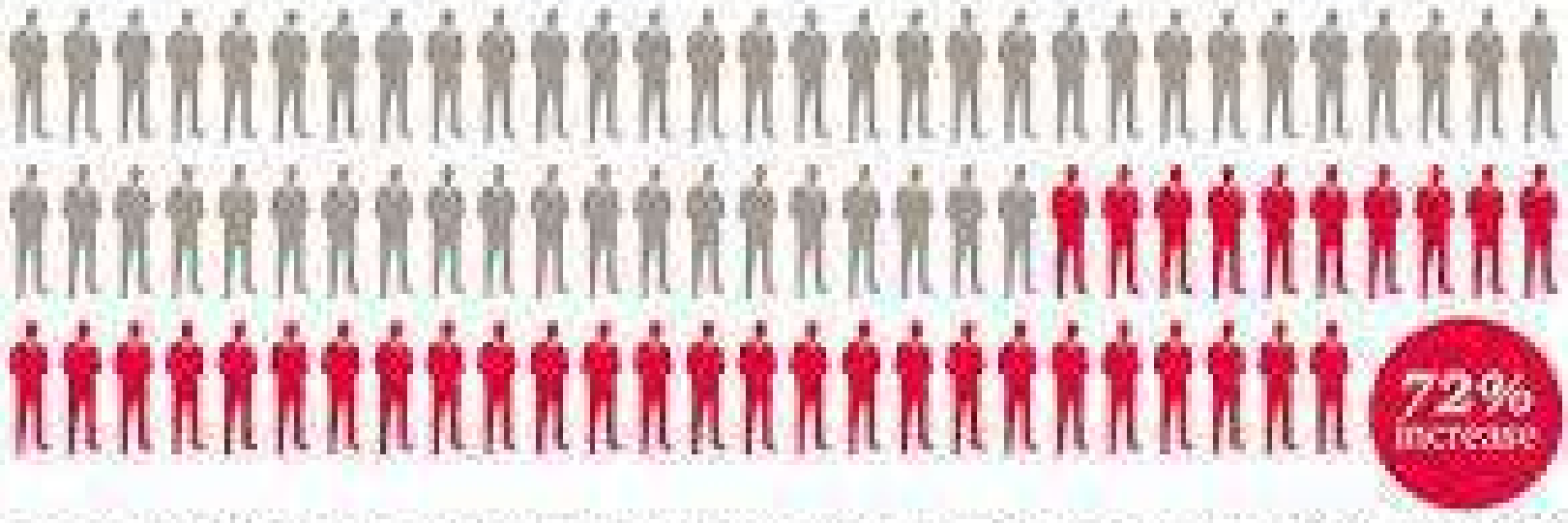
*Use public transport instead of motor cycles

*Energy consumption must be minimized

*Use solar and wind energy

*Impose strict laws, penalty, and energy audit

World urban population



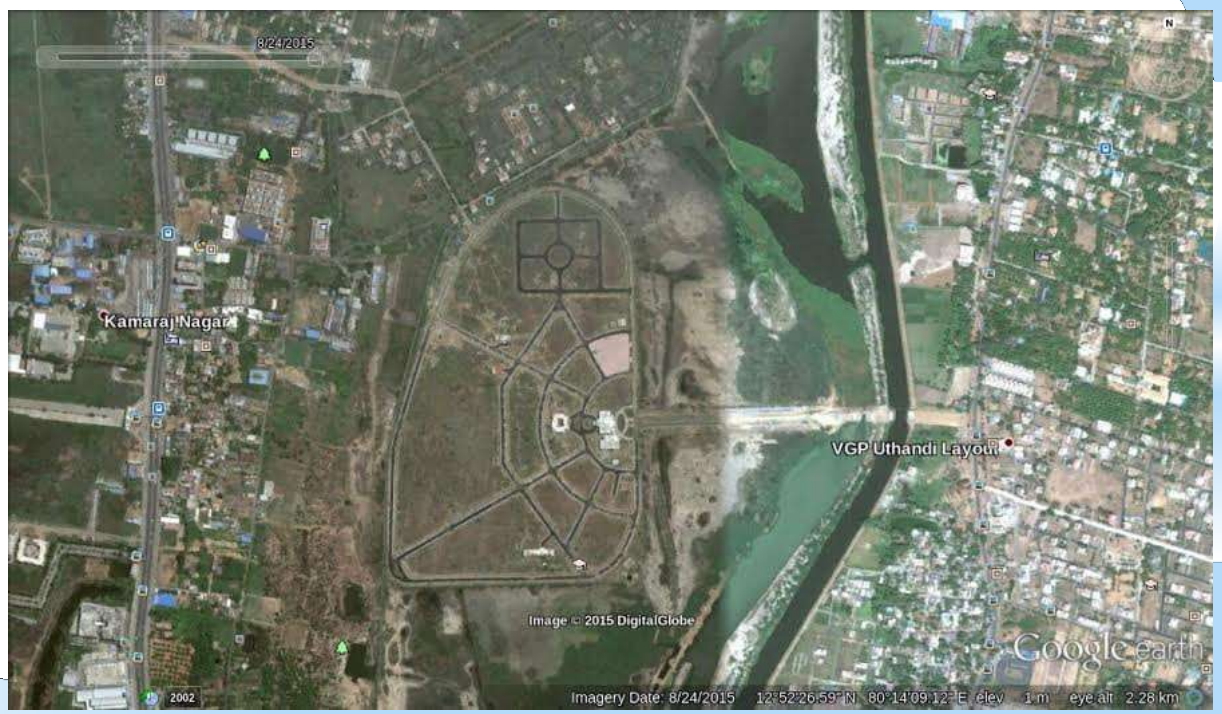
The world urban population is expected to increase by 72% by 2050

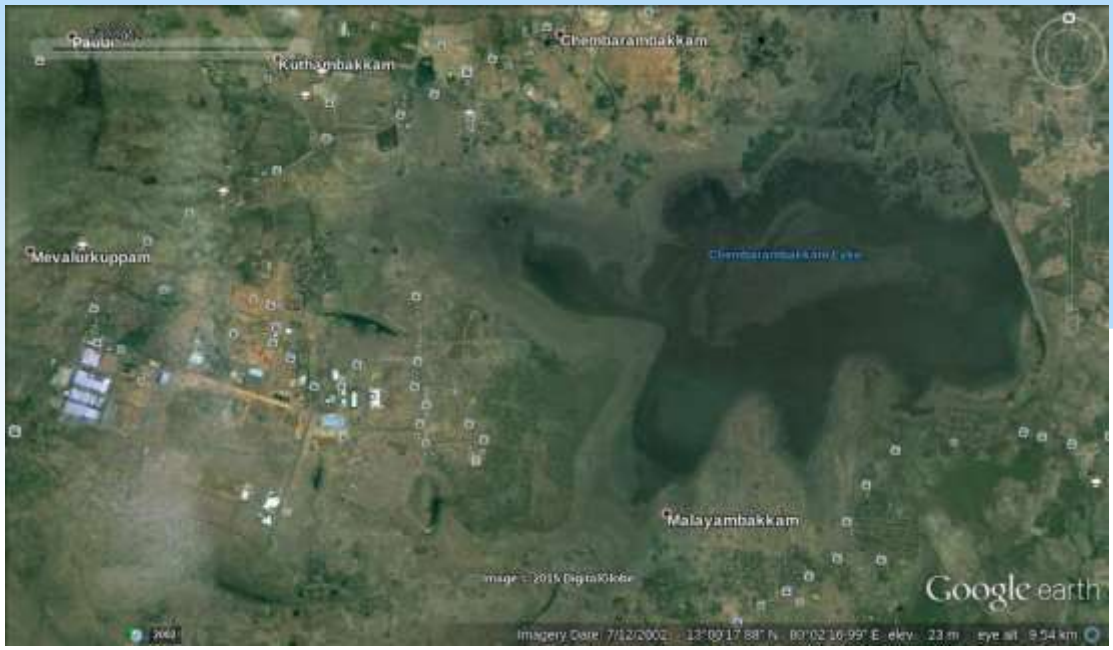
Source: World Urbanization Prospects: 2011 Revision; Produced by the UN Department of Economic and Social Affairs

*How bottomless realty development brought Chennai to its knees

UTHANDI

This (X)university is coming up in a flat sandy area, which is part of a floodplain on the western side of the Buckingham Canal and Kovalam Creek at Uthandi. While the picture above was taken in 2002, the image below shows the same area in 2015.





CHEMBARAMBAKKAM

Here, auto manufacturers and their suppliers have populated hydrologically sensitive catchment areas with their factories. The image above was taken in 2002, while the picture below is from 2015

ORAGADAM

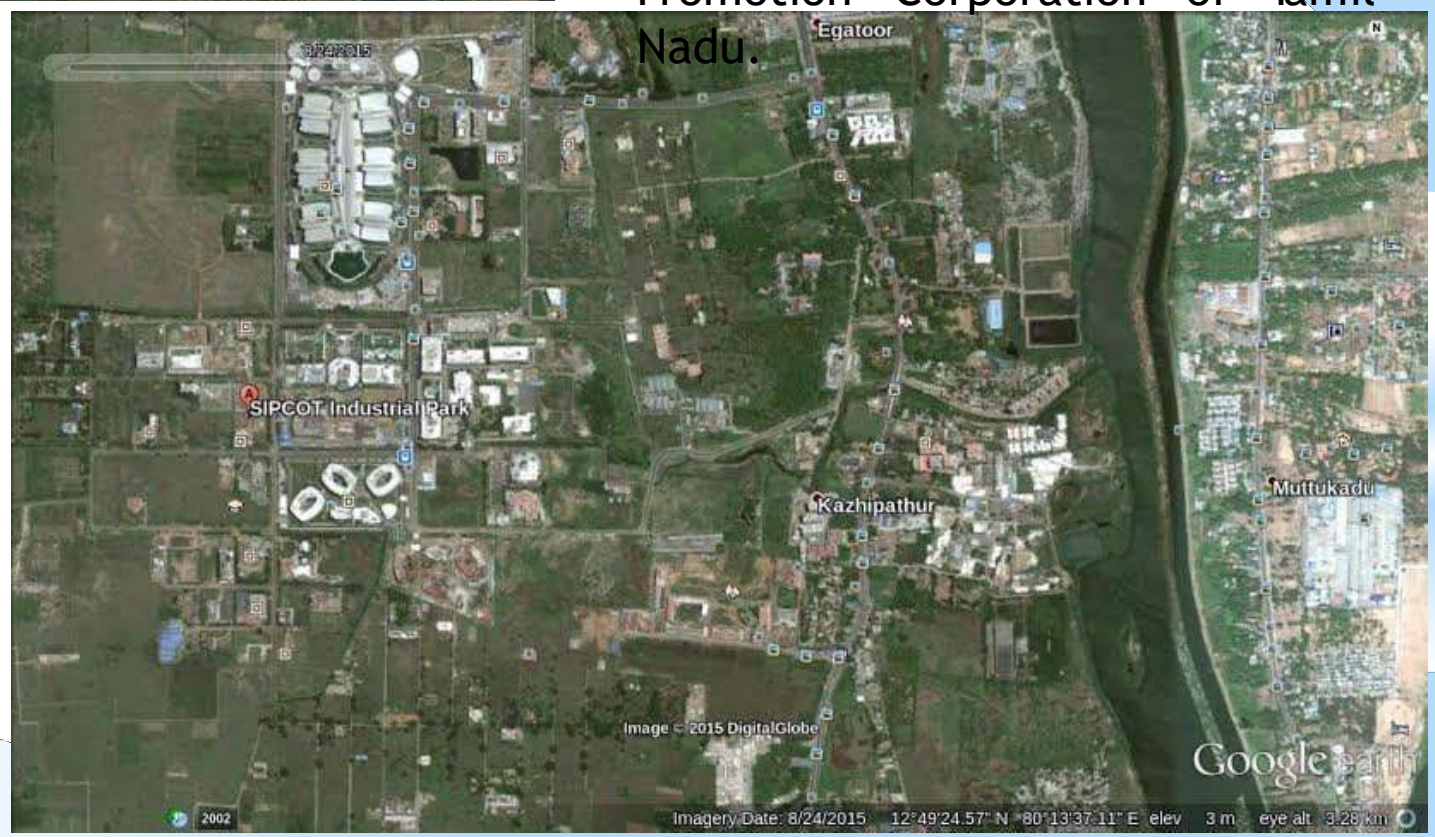
The image from 2006, above, shows water bodies, paddy lands and forests, while the 2014 version below shows the auto factories of Renault Nissan, Daimler Benz and Ford.

VELACHERY

Above, what you see, is the area from 2000. This was before the Chennai Mass Rapid Transit System and the explosion of construction. The image below is from this year.

SIRUSERI(OMR)

In the image from 2002, above, you can see Siruseri as the converging point for floodwaters from two drainage systems entering the Kovalam creek. The 2015 image, below, shows how IT industries have come up here with the help of State Industries Promotion Corporation of Tamil Nadu.



Water conservation:

* Process of saving water for future utilization

Water source:

* § Fresh water
* § River
* § Stream § Pond
* § Ocean

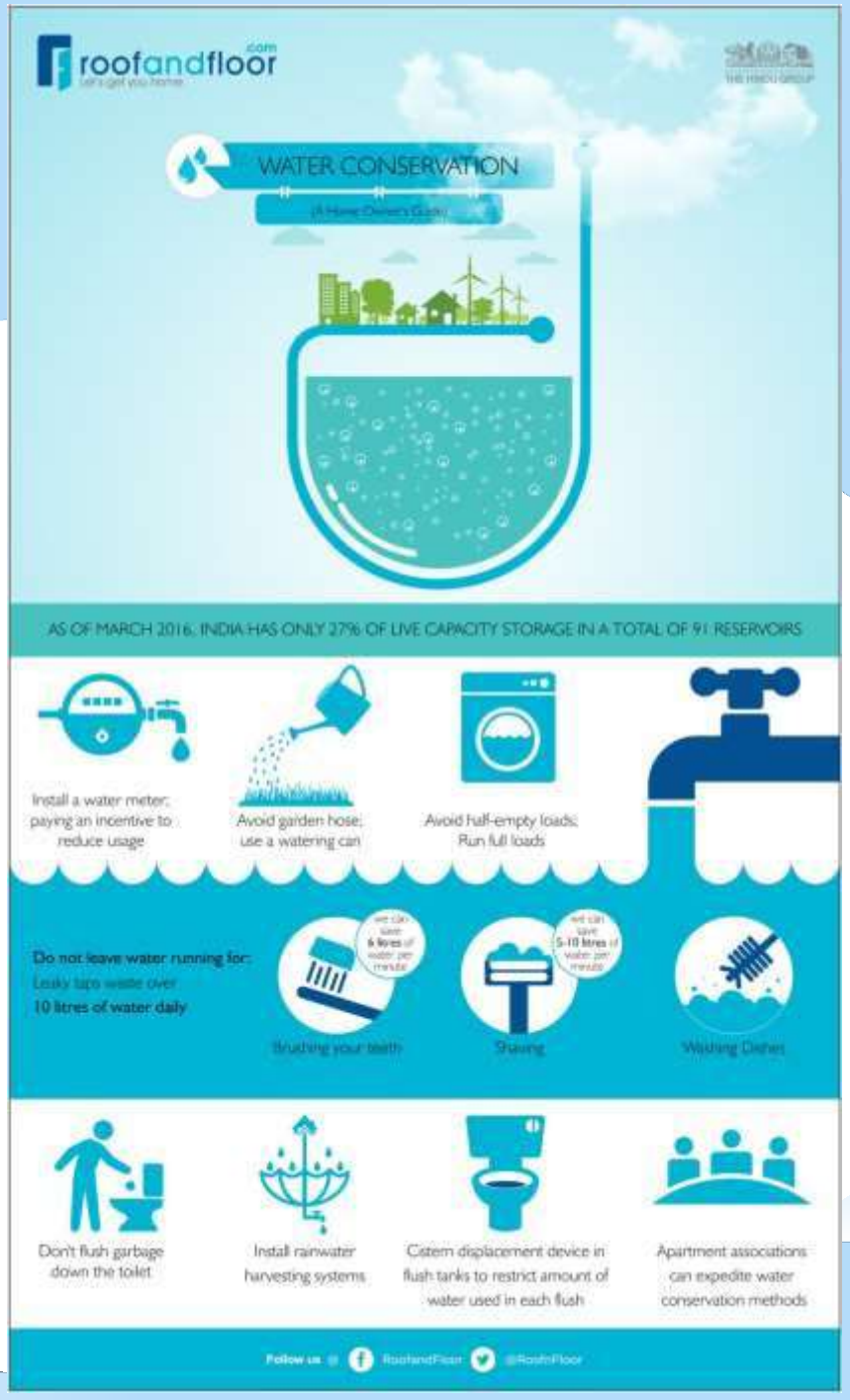
Need for water conservation:

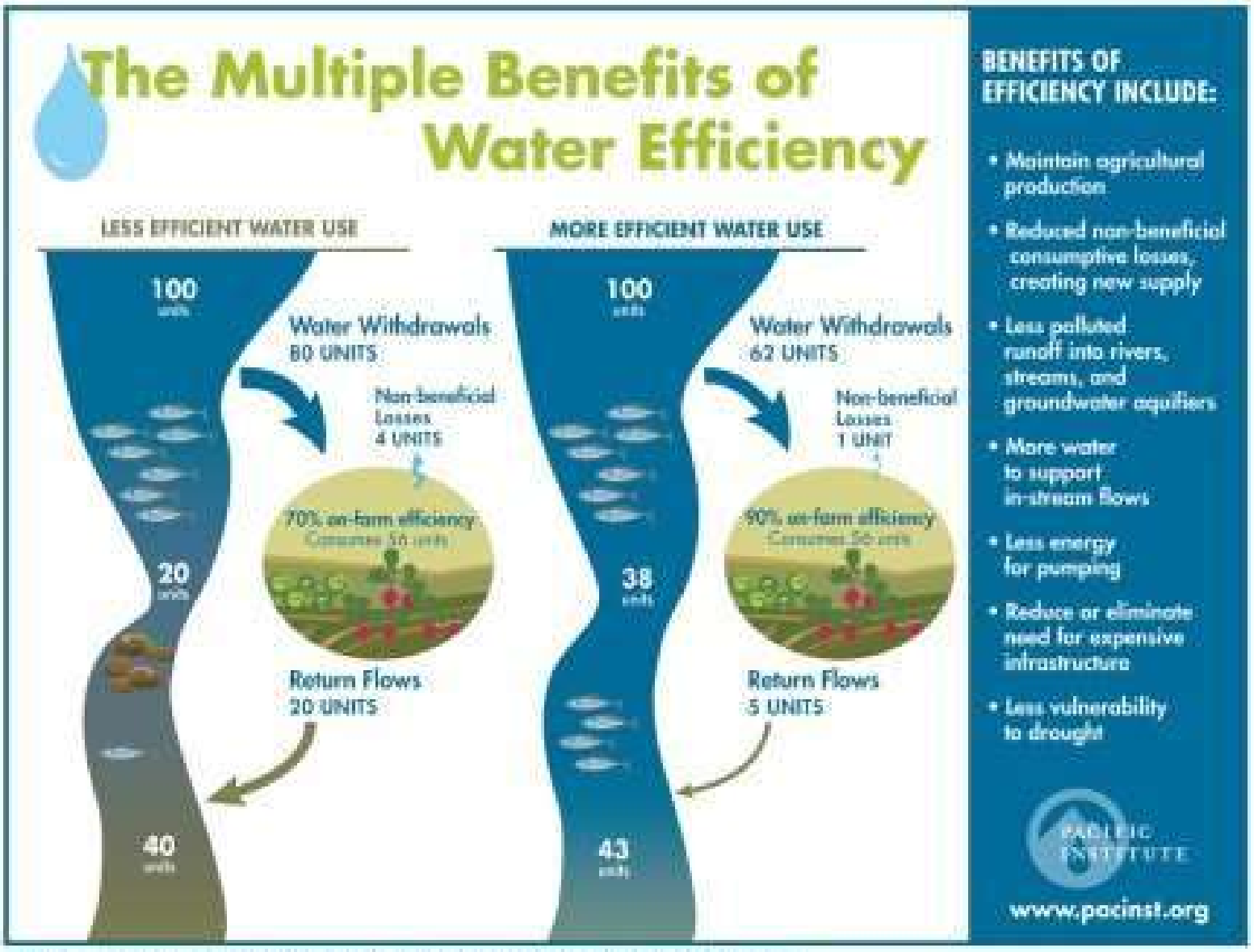
* § Population increases water requirement also increases
* § Due to deforestation annual rainfall decreases
* § Over exploitation of ground water

Ways of water conservation

* § Reducing evaporation loss § Reducing irrigation loss
* § Reuse water
* § Avoid sewage discharge Water conservation method
* § **Rain water harvesting**
* **§ Watershed management**


Average Indoor Household Water Use
Toilet 20%
Clothes Washer 19%
Shower 19%
Faucets 19%
Leaks 14%
Bath 5%
Dishwasher 1%
Other 3%


roofandfloor.com
WATER CONSERVATION
AS OF MARCH 2016, INDIA HAS ONLY 27% OF LIVE CAPACITY STORAGE IN A TOTAL OF 91 RESERVOIRS
Install a water meter; paying an incentive to reduce usage
Avoid garden hose; use a watering can
Avoid half-empty loads; Run full loads
Do not leave water running for:
Leaky taps waste over 10 litres of water daily
Brushing your teeth
Shaving
Washing Dishes
Don't flush garbage down the toilet
Install rainwater harvesting systems
Cistern displacement device in flush tanks to restrict amount of water used in each flush
Apartment associations can expedite water conservation methods
Follow us @ RoofandFloor @RoofnFloor



*Numbers in this figure are for illustrative purposes. Actual quantities would depend on site-specific conditions.

OUR FOUR NATIONAL TAPS

SINGAPORE IS A WATER SCARCE COUNTRY BUT OUR FOUR NATIONAL WATER TAPS ENSURE US A SUSTAINABLE AND RELIABLE WATER SUPPLY.

LOCAL CATCHMENT WATER

NEWater

IMPORTED WATER

DESALINATED WATER

*Rain water harvesting

Objective:

* To meet increasing demands of water

* Raise water table by recharging ground water

* Reduce ground water contamination from salt water intrusion

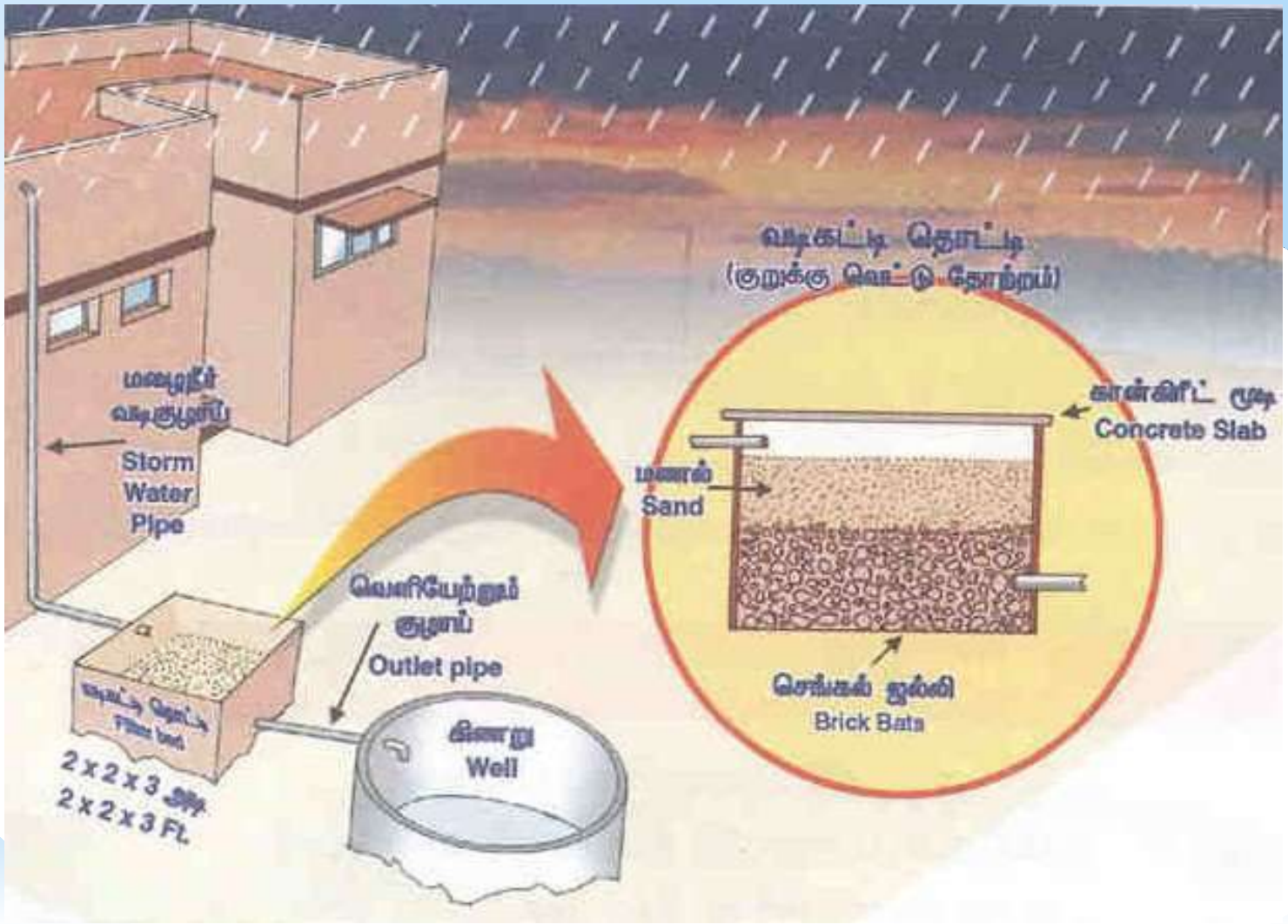
* **Roof top rainwater harvesting**

> Involves collecting water that falls on roof of house

> Rainwater from roof top, road surface, play ground diverted to surface tank Advantages of rainwater harvesting

>Increases the well water availability § Raise ground water level

> Minimizes soil erosion


வடிகட்டி தொட்டி
(குறுக்கு வெட்டு தோற்றம்)
மழைநீர் வடிகுழாய்
Storm Water Pipe
கான்கிரீட் மூடி
Concrete Slab
மணல்
Sand
வெளியேற்றுக் குழாய்
Outlet pipe
செங்கல் துண்டு
Brick Bats
கிணறு
Well
2 x 2 x 3 அடி
2 x 2 x 3 Ft.

Watershed management:

*It is defined as land area bounded by divide line from which water drains under influence of gravity in to stream, lakes, reservoir.

*Eg. Pits, dams, Farm, ponds, Himalaya.

Types

*1. Micro
*2. Mini
*3. Macro

Watershed—the area that drains into a lake, stream, or river via streams or ditches, directly over the ground surface, or through the ground.

Watershed Management;

* The management of rainfall & resultant runoff.

Forestry

* Halt deforestation, provide vegetative cover, degraded land and supplement folder and fuel wood resources available to rural communities

Agriculture

* -Aims to increase agricultural productivity in sustained manner and to diversify crop production
* -Major objective shall be achieved through organizing farmers, training camps and exposure visits.
* -Construct check dams, water harvesting tanks, storage tanks and channels , repair of old channels , implementing measures to check soil erosion

Horticulture

* establishment of private orchard § Rejuvenation of existing orchards
* Distribution of horticulture plant for home garden planting. § Animal husbandry
* Energy conservation
* Community participation
* Training and awareness programme

Advantages of Watershed projects

*-Improved access to drinking water in project areas during drought - Increase in cultivation area leading to increase in employment

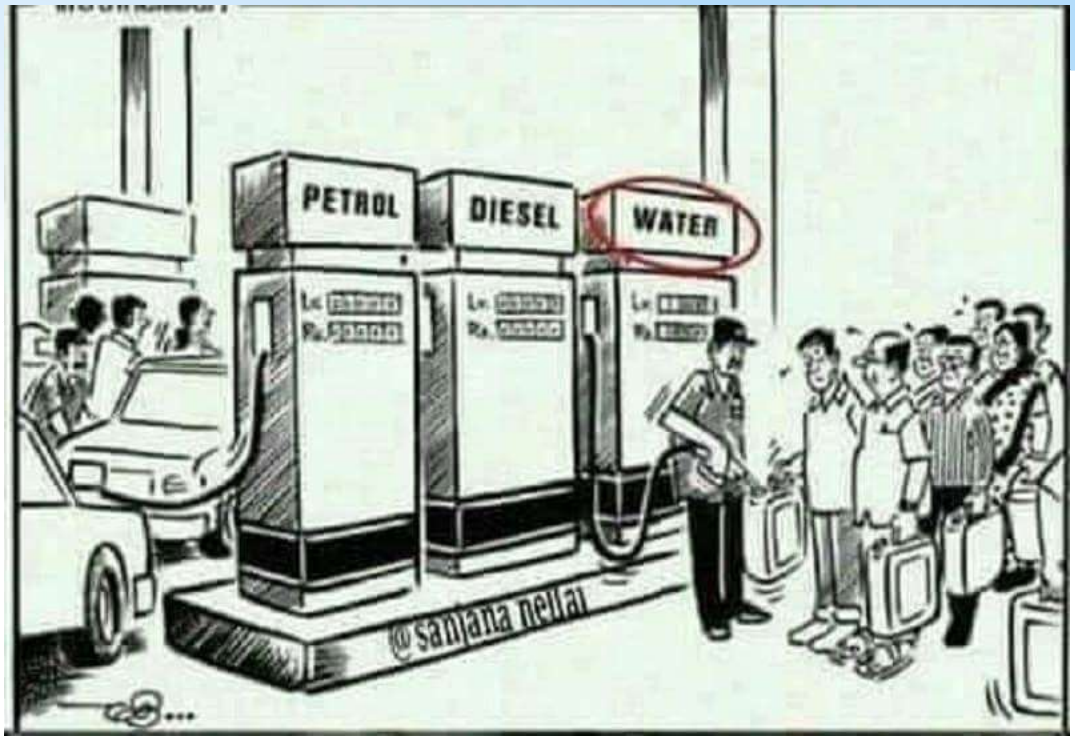
*-Increase in crop yield, resulting better income to rural population

*-Improved availability of fodder for animals and increase in milk yield - Increase in employment & involvement of women

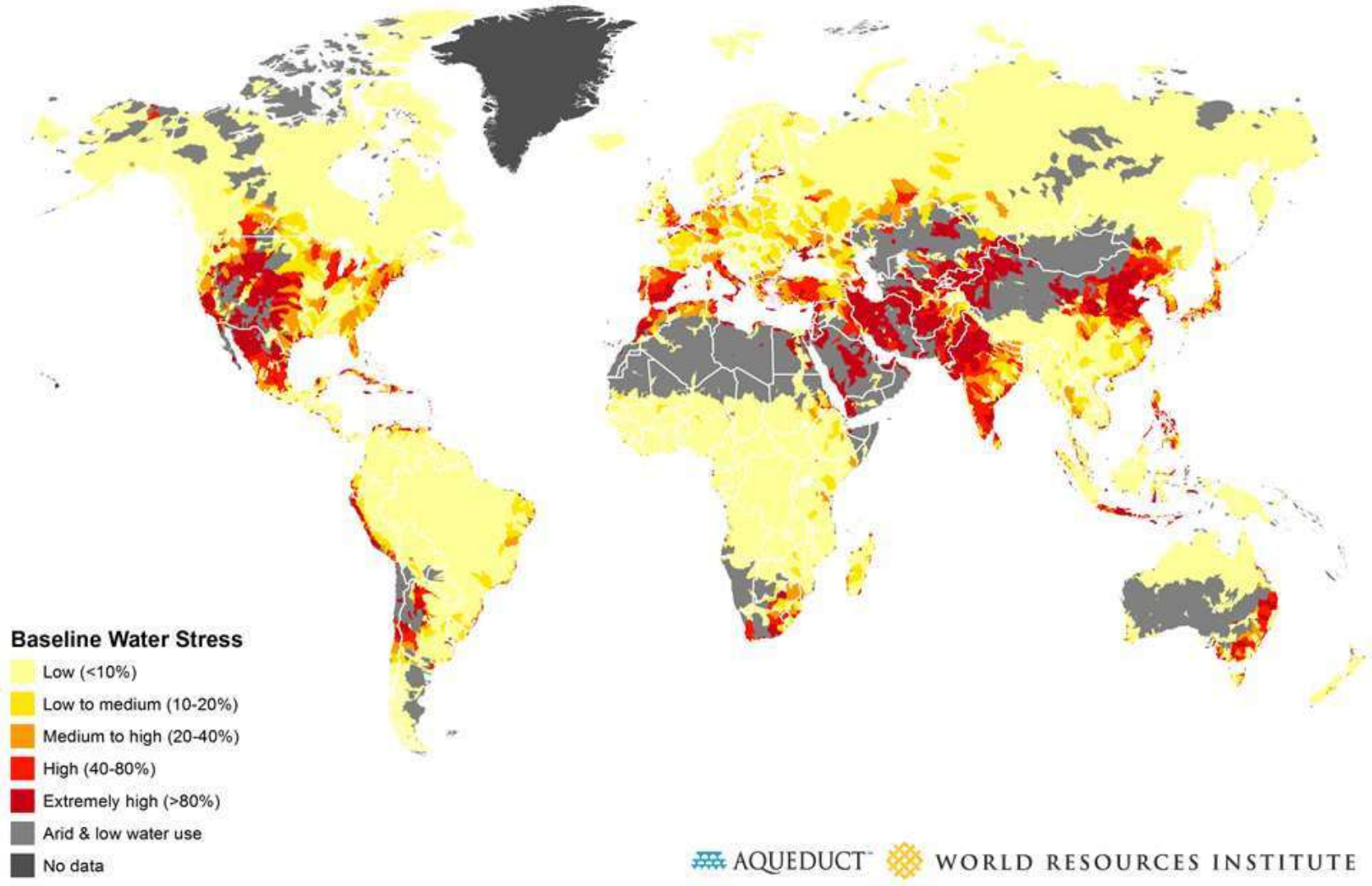
*-Increase in net returns from all crops. Decrease in soil erosion.

*-Restoration of ecological balance.

*Alarm facts!

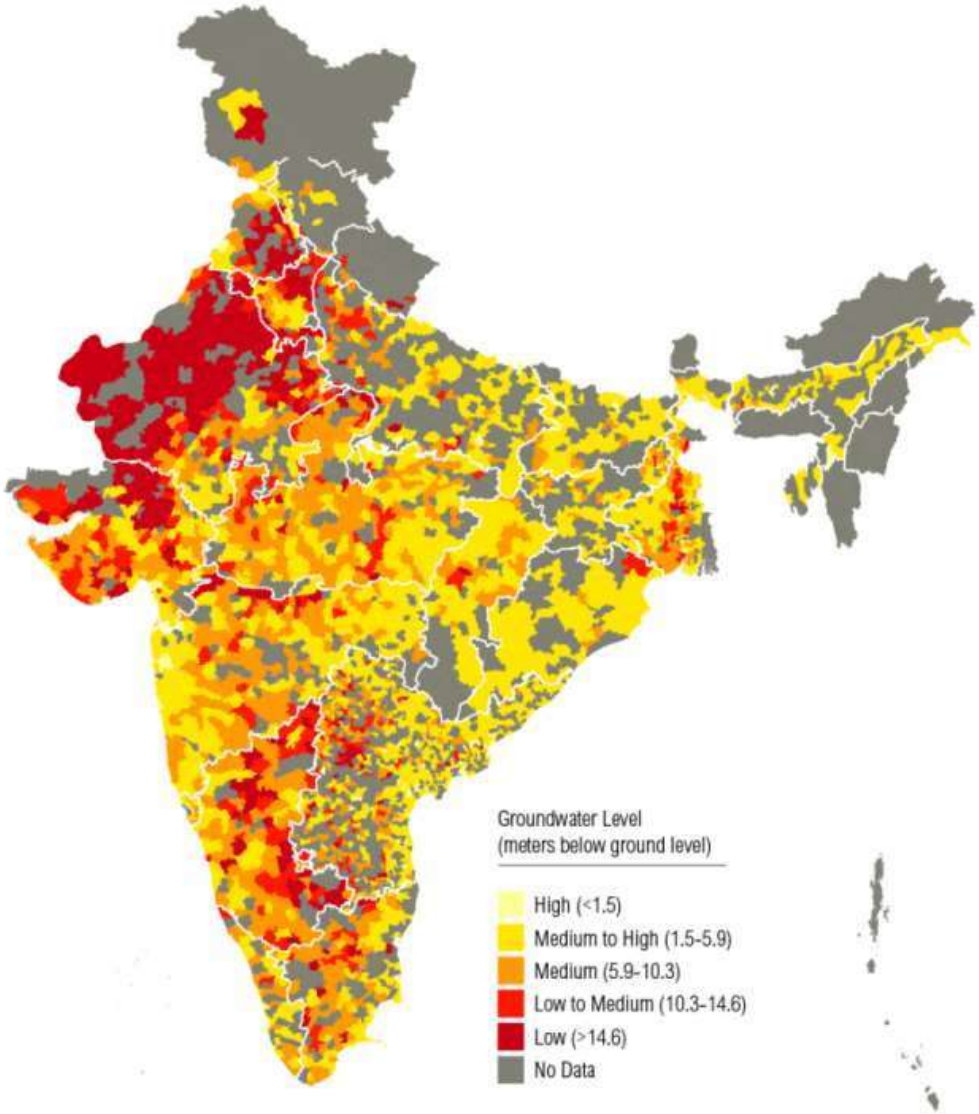


WATER STRESS AROUND THE WORLD



54%

of India's Ground-water Wells Are Decreasing



www.indiawatertool.in

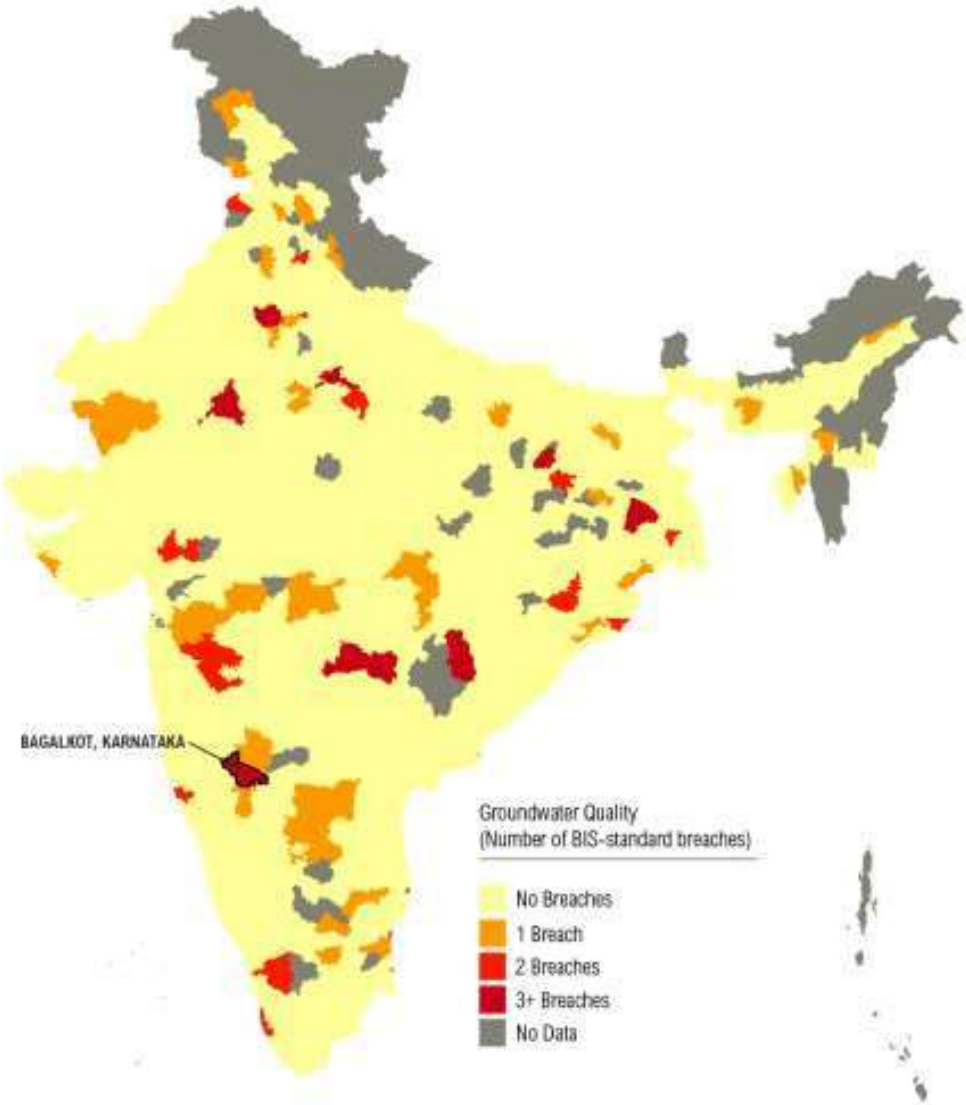
WORLD RESOURCES INSTITUTE

More than

100

MILLION

People Live in Areas of Poor Water Quality



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WATER CRISIS MAKING INTERNATIONAL HEADLINES

The Washington Post

Southwest braces as Lake Mead water levels drop

FINANCIAL TIMES

Nestlé warns water scarcity 'more urgent' than climate change

FINANCIAL TIMES

Water shortage shuts Coca-Cola plant in India

Forbes

THIRSTY FOR INVESTMENTS IN WATER

NATIONAL GEOGRAPHIC

If You Think the Water Crisis Can't Get Worse, Wait Until the Aquifers Are Drained

HOUSTON CHRONICLE

Water woes force big brewers to tighten the tap

Bloomberg

Sao Paulo Told to Cut Water or Risk Running Out in 100 Days

BangaloreMirror

MAJOR WATER SCARCITY THREAT LOOMS OVER INDIA

THE WALL STREET JOURNAL.

California Drought Squeezes Wells State Considers Regulating Groundwater Use for First Time

ECOLAB®

*Case study

*

Resettlement and Rehabilitation of people:

* **Resettlement** – simple relocation or displacement of human population.

* **Rehabilitation** – making, system to work again by allowing, system to function naturally. Includes replacing the lost economic assets, Safeguard Employment, Provide safe land for building

*Repair damaged infrastructure.

Effects:

>Loss of land
> Loss of recourse
>Unsatisfactory compenasation
>Social and cultural problems
>Changes in tradition of indigenous people
> Spread of disease
>Submergence of valuable forest
>Waterlogging
>Extinction of wild life

LANDING IN TROUBLE

Changes in Land Acquisition, Rehabilitation and Resettlement Act, 2013

2013	2014
CONSENT REQUIRED of 80% of land owners in acquisition for private and public-private partnership projects	**NOT REQUIRED** for national security, defence, rural infrastructure, industrial corridors and social infrastructure
SOCIAL IMPACT assessment is a must for every acquisition	**NOT REQUIRED** for national security, defence, rural infra, industrial corridors
MULTI-CROP AND fertile land can be acquired only in extreme circumstances	**MULTI-CROP** irrigated land can be acquired for national security, defence, rural infra
COMPENSATION WILL be four times the market price for rural double for urban land	**UNCHANGED**

INDIATODAY.IN NEW DELHI, MARCH 11, 2015 | UPDATED 13:11 IST

Land Bill 2015 passed by Lok Sabha with nine amendments

The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill 2015, also known as Land Bill 2015 has been passed by the Lok Sabha on March 10, 2015.


Narendra Modi in Parliament

RELATED STORIES

- Digital Gender Atlas: launched for girls' education
- Rotavirus vaccine: India's first indigenous anti-virus launched
- Stree and Nari Shakti Puraskar presented to Indian women
- India at third lowest in women business leadership
- Reliance Infra power discoms' license cancelled

The **Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill 2015**, also known as **Land Bill 2015** has been passed by the Lok Sabha on March 10, 2015.

HIGHLIGHTS OF THE LAND BILL 2015:

- The government made nine amendments to the bill, all of them were adopted.
- Lok Janshakti Party extended support to the Bill.
- A proposal of compulsory employment to at least one member of an affected family of a 'farm labourer' was accepted by the government.
- Whereas amendments to consent clause and Social Impact Assessment (SIA) were rejected.
- During the session, Congress, Samajhwadi Party, RJD, Trinamool Congress and BJD had walked out of the House
- While NDA ally Shiv Sena abstained as the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Amendment) Bill 2015
- Union Minister of Rural Development, Panchayati Raj, Sanitation & Drinking Water, Chaudhary Birender Singh moves the land acquisition and rehabilitation amendment bill
- Deependra Hooda seeks two percent reservation on government jobs for farmers who lost the job, which was rejected
- Mr Singh moves suspension of rules, which was adopted by the Government
- Due to drifts in the ideas of the parties and the government, the bill was passed through voice vote.

However, the Congress was not pleased by the government's efforts and is sure to oppose the Bill in the Rajya Sabha.

THE NINE AMENDMENTS THAT WERE ADOPTED IN THE LAND BILL 2015 ARE:

1. Government to acquire land for government bodies, corporations
2. Farmers may get right to appeal/ complain over land acquisition hearing and redressal of grievances at the district level
3. Panchayat's nod may be compulsory for acquiring tribal land
4. Social Infrastructure under PPP, not anymore in exempted category
5. Replacing the term 'private entity' with 'private enterprise'
6. Compulsory employment to one member of the affected family of farm labourers
7. Limiting the industrial corridor to one kilometer on both the sides of the highways and railways
8. Ceiling on land for acquisition in industrial corridors
9. Hassle free mechanism for grievances redressal of land losers

* Case study

JABGAON – DISPLACEMENT WITHOUT REHABILITATION

THE CASE STUDY OF A VILLAGE TO BE AFFECTED BY THE INDIRA SAGAR PARIYOJANA

* The following is an overview of displacement, which will follow the construction of the dam.
* 1. 249 villages are to be submerged by the dam.
* 2. Total population to be displaced is 80572.
* 3. Total number of families to be displaced is 30739.
* 4. Total area to be submerged 91348 ha.
* 5. Total forest land to be submerged is 41111 ha.

*Case study

The 45-year-old farmer from a nondescript Madhya Pradesh village had acted in protest against acquisition of his land for a private power plant.

*Major acquisition of lands in India

* In 2008, Singur in West Bengal witnessed largescale violence after the then Left Front government acquired over 700 acres of farmland for the Tatas' ambitious Nano project
* Proposed Rs 52,000-crore plant by the Korean steel major in Odisha's Jagatsinghpur district.
* In mineral-rich Jharkhand -Activists estimate that around 25 lakh tribal people have been displaced from their homes since 1947 due to mining activities and deforestation.

The requirement of land for the Thermal Power Plant and Integrated Steel Plant is tabled below

SI. No.	Purpose	Requirement in Acres
1	Utkal B-2 Coal Project (295.79 Ac.) O.B. Dump (308.23 Ac.)	604.02
2	1005 MW Thermal Power Plant & Ash Pond	926.04
3	Integrated Steel Plant (Including Township)	210.145
4	Administrative Building	11.18
5	Service corridor to accommodate raw water pipe line, coal conveyors, haul road for over burden & power evacuation line	50.00 (Approx)
	Total	**1801.39**

Oases of success

SHENDRA-BIDKIN PROJECT (MAHARASHTRA)

Total area required
84 sq km

Land acquired for Phase I with consent of all land owners
32 sq km

Compensation
₹1,840 cr

or an average of
₹ 23 lakh/acre

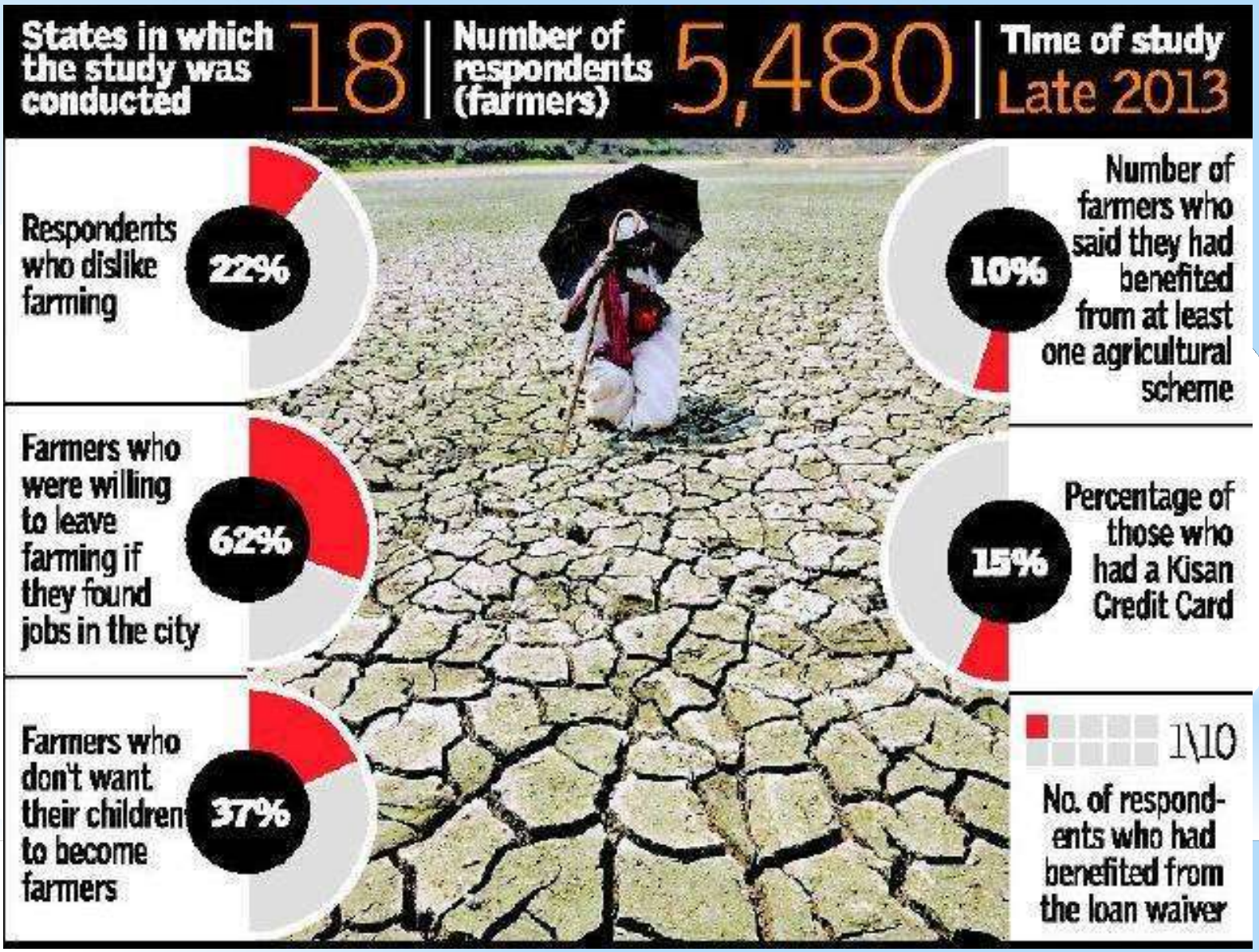
(nearly double the market price)

Time taken for acquisition
2 years

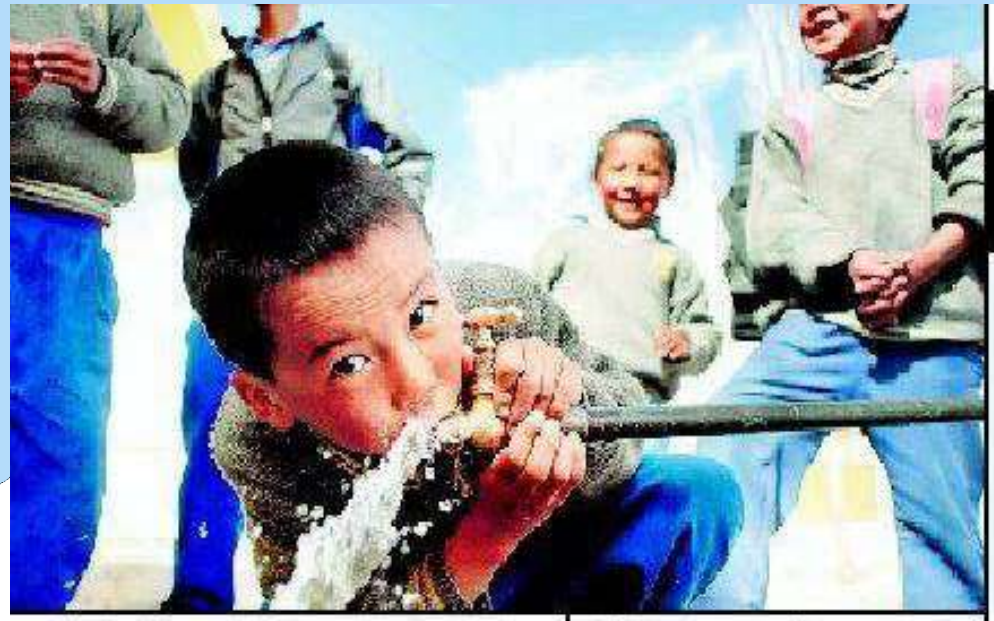
OTHER BEST PRACTICES

- Gujarat offers market prices & developed land as part of compensation
- Skill upgradation centres and employment for land-owners' family also offered
- Haryana puts up market rates for land on website
- Andhra Pradesh offers guaranteed employment for one member of land owner's family

*Right at the Target



Shocking facts!!



HOMELESS PEOPLE

➤Number of people forced to leave their homes

43 million

Total no. of people who have been **displaced within their country**

26 million

Total no. of people who are **refugees**

15-16 million

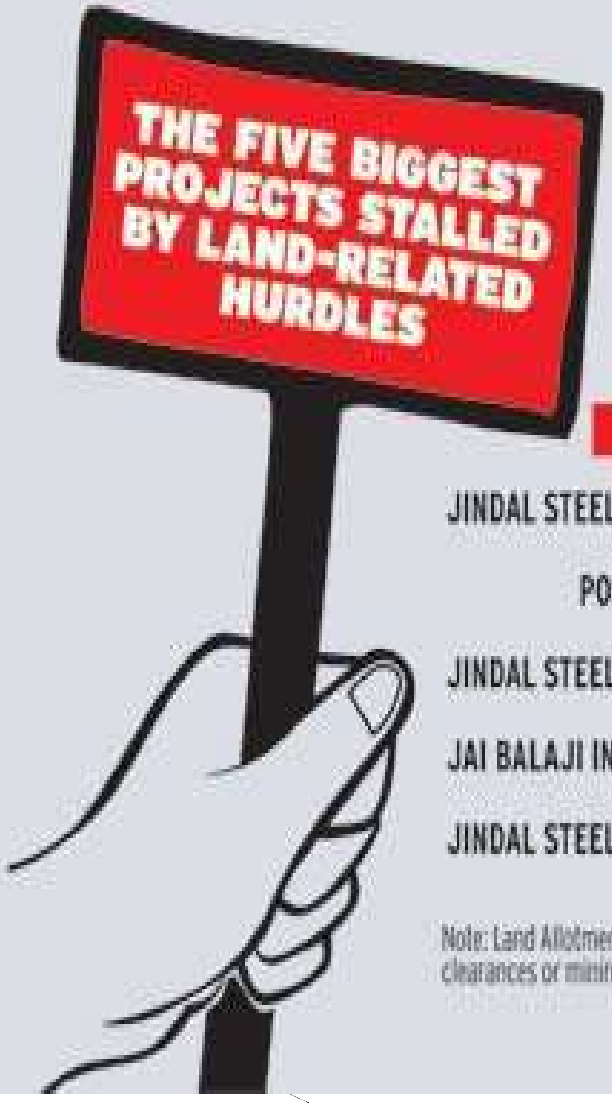
People who are **asylum-seekers**

1 million

Total no. of people in India who have been **displaced** within the country **due to development projects**

60-65 million

➤**India has the highest number of people displaced for development projects**



PROMOTER	PROJECT TYPE	LOCATION	INVESTMENT (₹ CRORE)
JINDAL STEEL & POWER	STEEL EXPANSION	CHHATTISGARH	42,375
POSCO INDIA	FINISHED STEEL	KARNATAKA	32,336
JINDAL STEEL & POWER	STEEL	JHARKHAND	30,000
JAI BALAJI INDUSTRIES	INTEGRATED STEEL PROJECT	WEST BENGAL	25,000
JINDAL STEEL & POWER	STEEL PLANT	ODISHA	25,000

Note: Land Allotment may not be only cause for delay in all the above cases. In some instances, other causes such as pending environment clearances or mining rights may also be responsible for delays

Source: Confederation of Indian Industry, April 2012

*Protest against land acquisition

*Resettlement

Malaipattu village
(near Manimangalam-Tambaram road)affected by flood 2015

* ROLE OF NGOs AND VOLUNTARY AGENCIES IN PRESERVING THE ENVIRONMENT

* INTRODUCTION

* **Environment** literally means surrounding and everything that affect an organism during its lifetime.
* Environment not only include surface features, flora and fauna on it, but it also includes a zone of the **atmosphere** and **hydrosphere** - above and a mantle of the **geological structure** - below.
* It is "Sum total of all conditions and influences that affect the development and life of an organism".
* It includes

Abiotic components like physical (sunlight, water, temperature, soil) chemical (proteins, minerals, fats)

Biotic components like autotrophs (producers) and heterotrophs (consumers)

NEED FOR PROTECTING THE ENVIRONMENT

* Over the past three centuries, humans are increasingly prone to adopt land, to suit their own purposes, due to which the area of land used for agriculture and the **global economy expanded** manifold.
* The land area devoted to **cropland has expanded** by 450% in the past 300 years, amounting to a world increase of about 12.4 million Sq.kms.
* The net **loss of forests** due to human action amounts to 15 to 20% of the world's forest area.

With the advent of Industrialization from 19th century, there developed many areas of concern for humanity, among which *"Environment"* is one of the prime aspects.

ABOUT NGOs AND VOLUNTARY AGENCIES

* The World Bank defines **NGOs** as "private organizations that pursue activities to relieve suffering, promote the interests of the poor, protect the environment, provide basic social services, or undertake community development."
* **Voluntary Organization** is "Any organization that uses the human resources of volunteers for achieving its main purpose".
* International non-governmental organizations have a history dating back to **1839**.
* However, the phrase "non-governmental organization" only came into **popular use** with the establishment of the United Nations Organization in 1945.

Globalization during the 20th century gave rise to the importance of NGOs.

* **According to a survey conducted by UNO there are 48 different terms and acronyms, some of them are given below:**

BINGOs	Big International NGOs
BONGOs	Business Organized NGOs
CBOs	Community Based Organizations
GONGOs	Government Organized NGOs
CSOs	Civil Society Organizations
IPOs	Indigenous Peoples' Organizations
GROs	Grassroots Organizations
GSCOs	Global Social Change Organizations
NPOs	Nonprofit Organizations
SCOs	Social Change Organizations
TNGOs	Transnational NGOs
MANGOs	Market Advocacy NGOs
NGDOs	Non-Governmental Development Organizations
VOs	Voluntary Organizations
ENGOs	**Environmental NGOs**

CHARACTERISTICS OF NGOs

* Environmental Monitoring and Reporting
* Protecting the environment
* Management of Resources and Environment: Community Based Projects
* Providing basic social services
* Awareness-Raising, Campaigning and Advocacy
* Education, Training and Capacity Building
* Government and NGO Partnerships
* Regional and International Cooperation and Networking
* Engaging in suffering relief activities
* Promoting interest of the poor
* Advocating community development
* Environmental Management Plans
* Promotion of renewable energy
* Biodiversity & Wildlife conservation
* Various other research activities and movements

NGOs AND VOLUNTARY AGENCIES WORKING WORLDWIDE

INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES (IUCN)

Type : World's First Global Environmental Organization.
Founded In : 1948
Focus Area : Nature Conservation, Biodiversity, Nature-based solutions.

IT'S ROLE:

* To promote mutually beneficial conservation arrangements.
* Promoting development as well as assisting people and nations to better preserve their flora and fauna.
* Aims to mobilize communities working for biodiversity conservation, sustainable development and poverty reduction.
* Efforts to halt biodiversity loss.
* Valuing and Conserving Nature.
* Effective and Equitable Governance of Nature's Use.
* Deploying Nature-based Solutions to Global Challenges in Climate, Food and Development.

source: www.iucn.org

THE NATURE CONSERVANCY

Type : US Charitable Environmental Organization.
Founded In : 1951
Focus Area : Conservation by Design - land conservation techniques.

The Nature Conservancy
Protecting nature. Preserving life.™

IT'S ROLE

* Works to preserve the lands and waters on which all life depends.
* Pioneered new land preservation techniques such as the conservation easement and debt for nature swaps.
* Recognizing the threat habitat fragmentation brings to plants and animals.
* Plant a Billion Trees Campaign is an effort to restore 2,500,000 acres (10,100 km2) of land and plant 1 billion trees by 2015 in the Atlantic Forest of Brazil.
* Helps slow climate change and helps to regulate the atmosphere and stabilize global climate.

source: www.nature.org

WORLD WIDE FUND FOR NATURE (WWF)

Type : International Non-governmental Organization.
Founded In : 1961
Focus Area : Environmentalism, Conservation, Ecology.

IT'S ROLE

* Working on issues regarding the conservation, research and res the environment.
* Its mission is "to halt and reverse the destruction of our environment".
* Its work focuses on the conservation of forests, freshwater ecosystems, oceans and coasts.
* It is also concerned with endangered species, pollution and climate change.
* Its mission to: “Stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature.

source: www.panda.org

ENVIRONMENTAL DEFENSE FUND

Type Non-profit Environmental Advocacy Group.
Founded In : 1967
Focus Area : Environmentalism.

IT'S ROLE

* It works on issues including global warming, ecosystem restoration, oceans, and human health, and advocates using sound science, economics and law to find environmental solutions.
* Aims to reduce the pollution and curtail global warming.
* Works to protect marine ecosystems by creating sustainable fisheries.
* Focus on cutting air pollution from utilities and transportation systems.
* Works to promote ecosystem-friendly policy, helping landowners benefit from healthier land, water and wildlife.
* The organization promotes the use of markets and incentives to help solve environmental problems.

source: www.edf.org

GREENPEACE

Type : Non-governmental Environmental Organization.

Founded In : 1969

Focus Area : Global Warming, Deforestation, Overfishing, Genetic Engineering and Anti-nuclear Issues.

IT'S ROLE

* Its goal is to "ensure the ability of the Earth to nurture life in all its diversity".
* Defending our oceans by challenging wasteful and destructive fishing, and creating a global network of marine reserves.
* Working for disarmament and peace by reducing dependence on finite resources and calling for the elimination of all nuclear weapons.
* Creating a toxin free future with safer alternatives to hazardous chemicals in today's products and manufacturing.
* Campaigning for sustainable agriculture by encouraging socially and ecologically responsible farming practices.

source: www.greenpeace.org

EARTHWATCH INSTITUTE

Type : International Non-profit Organization.
Founded In : 1971
Focus Area : Environmental Research.

IT'S ROLE

* Its research area is wildlife conservation, rainforest ecology, marine science and archaeology.
* Find ways to help communities migrate the impacts of climate change and/or adapt to the changes.
* Safeguard combined genetic, ecological, cultural, and linguistic variation discovered in the native biological and cultural communities.
* To enhance and protect biodiversity in global ecosystems that provide valuable goods and services, such as clean drinking water, food, timber and medicines.
* To protect marine biodiversity such as the highly threatened coastal habitats including mangroves and coral reefs.

source: www.earthwatch.org

FAUNA AND FLORA INTERNATIONAL (FFI)

Type : International Conservation Charity And Non-governmental Organization.

Founded In : 1951

Focus Area : Safeguard the Future of Southern Africa's Mammals.

IT'S ROLE

* Played a key role in establishing many of today's global conservation infrastructure like IUCN, WWF and CITES.
* It has a seven-step approach to conserving biodiversity:
  * Building local capacity for conservation
  * Integrating biodiversity and human needs
  * Direct protection of species and habitats
  * Securing land for conservation
  * Emergency response to conservation needs
  * Influencing policy and the practice of conservation
  * Bridging the gap between business and biodiversity

source: www.fauna-flora.org

WORLD RESOURCES INSTITUTE (WRI)

Type : Independent, Non-partisan, Non-profit Organization.

Founded In : 1982

Focus Area : Environment and Socio-Economic Development.

WORLD RESOURCES INSTITUTE

IT'S ROLE

* To build transformative solutions that protect the earth and improve people's lives.
* Protect the global climate system from further harm due to emissions of greenhouse gases and help humanity and the natural world adapt to unavoidable climate change.
* Empower people and strengthen institutions to foster environmentally sound and socially equitable decision-making.
* Reverse rapid degradation of ecosystems and assure their capacity to provide humans with needed goods and services.

source: www.wri.org

FOREST STEWARDSHIP COUNCIL (FSC)

Type : International Not For-profit, Multi-stakeholder Org.
Founded In : 1993
Focus Area : Sustainable Forestry.

IT'S ROLE

* Its main tools for achieving responsible management of the forests are standard setting, certification and labelling of forest products.
* Aims to "provide businesses and consumers with a tool to influence how forests worldwide are managed".
* Its mission is to "promote environmentally appropriate, socially beneficial and economically viable management of the world's forests".
* It works towards six program areas: Forests, Chain of Custody, Social Policy, Monitoring and Evaluation, Quality Assurance and Ecosystem Services.

source: www.fsc.org

THE EARTH INSTITUTE

Type : Non–profit Organization.
Founded In : 1995
Focus Area : Interdisciplinary Research Projects

The Earth Institute
AT COLUMBIA UNIVERSITY

IT'S ROLE

* Its mission is to address complex issues facing the planet and its inhabitants, with particular focus on sustainable development and the needs of the world's poor.
* Its activities are guided by the idea that science and technological tools that already exist could be applied to greatly improve conditions for the world's poor, while preserving the natural systems that support life on Earth.
* It supports pioneering projects in the biological, engineering, social, and health sciences, while actively encouraging interdisciplinary projects—often combining natural and social sciences—in pursuit of solutions to real world problems.

source: www.earth.columbia.edu

NGOs WORKING IN

INDIA

* Assam Science Society
* Bombay Natural History Society
* Centre For Environmental Education (CEE)
* Centre For Science And Environment (CSE)
* CPR Environmental Education Centre-(JV-)(Ministry of Environment)
* Kerala Sastra Sahitiya Parishad
* Kalpavriksh

KARNATAKA

* Eco Watch
* Environment Support Group
* Jalasangama Andolan
* Saahas

*Top 10 NGO's in India 2016

*Give India
*Teach For India
*CRY
*Smile Foundation India
*Plan India
*Help Age India
*Pratham
*Goonj
*Uday Foundation India
*Deepalaya

CONCLUSION

* The Fundamental objective of NGO is to act as **catalyst** in bringing about local, national and international initiative and community participation in overall improvement in quality of life and environment.
* It would also **help the Government** to obtain relevant information for promoting and facilitate the implementation of major environmental programs.
* The increase in the **range of their activities** reflects not only the increasing professionalism with which major groups are fulfilling their obligations and responsibilities.
* A number of public interest groups have also strengthened their **participation at grassroots** and community levels, and have played a vital role, not only in awareness-raising and campaigning, but also in education, training and capacity-building.
* Their activities show that they **effectively use all media of communication**, traditional as well as the new communication technologies, to disseminate information to the grassroots and to strengthen networking.

* Environmental ethics:-

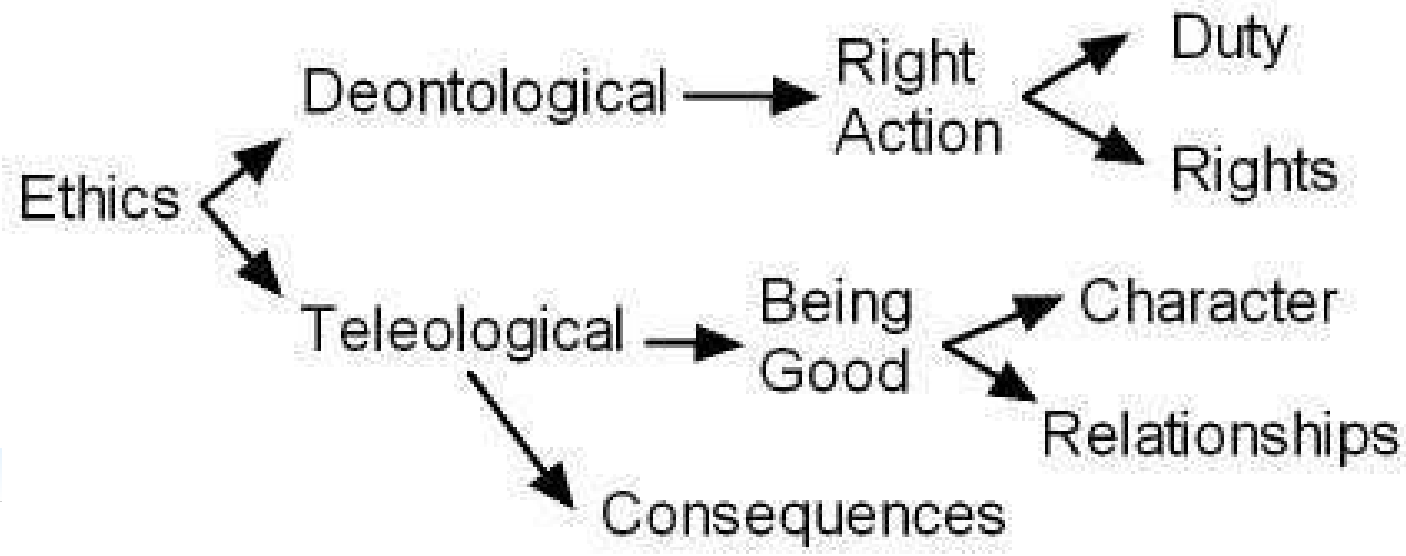
* Over exploitation of forests, land, water as well as various living components of biosphere and failure to tackle the problem of pollution and environmental degradation are exposing the humanly to the thread of a global environment crisis.

* It emphasis that real development cannot occur unless the strategies which are formulated are implemented are environmentally sustainable.
* Even though our government is formulating several rules, regulations, policies, laws, it is the duty of each and every one to protect our nature.

* Therefore human beings are ethically responsible for the preservation of the world's ecological integrity.
* The environment ethics literally means conscious efforts to protect environment and to maintain its stability from the pollutants.

Following are some of the ways to safeguard environment.

1.To sacrifice the consumption of some of the good which reduces environment quality
2. Minimize the resource utilization and conservation
3.Adopt sustainable and eco friendly development. (e.g) reduction of waste, recycling, waste management and harvesting non conventional energy
If we change as individuals then the society will also by itself. The society is nothing but an extension of the individual.



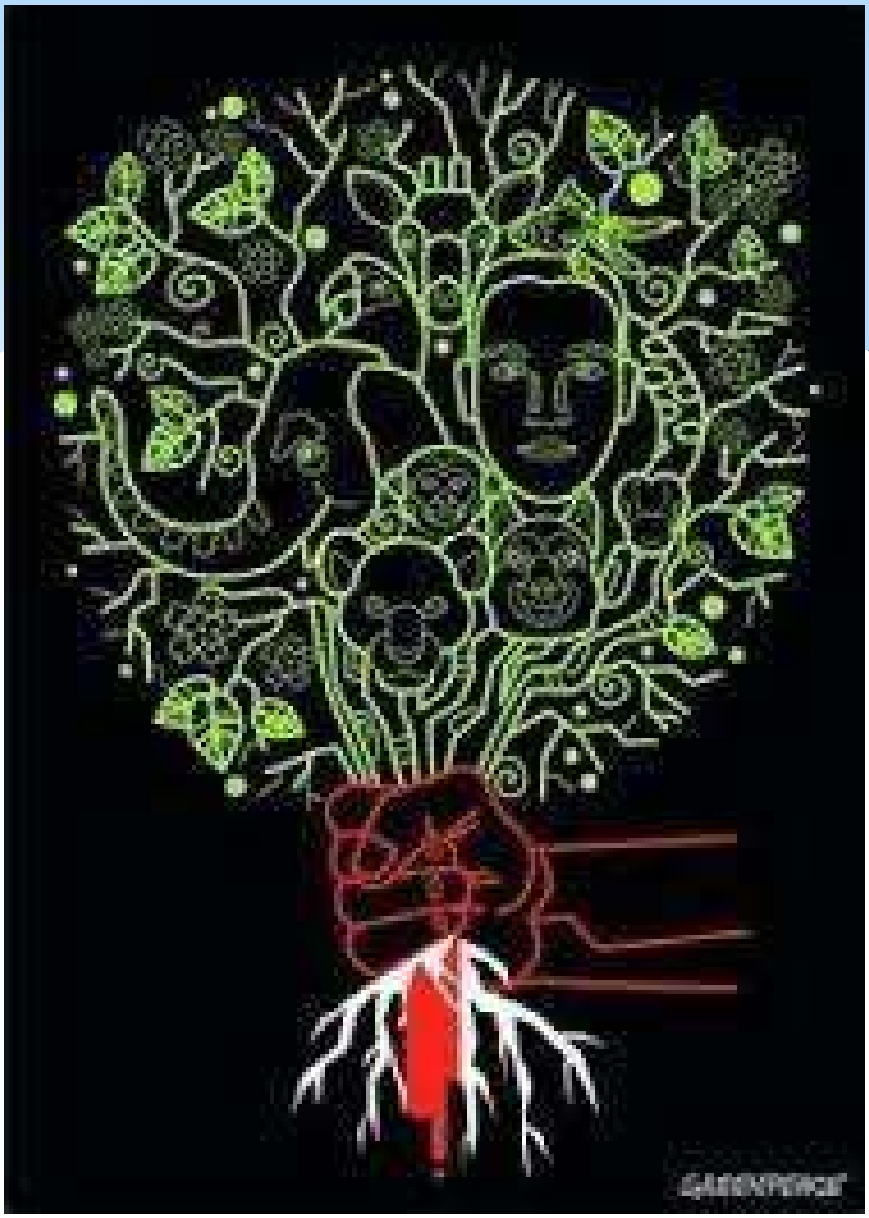
*Some questions in Environment Ethics

*Should present conserve resources for future Generation?

Are humans justified in driving other species to extinction?

Is it Ok for some Communities to be exposed to more pollution than others?

Is it Ok to destroy a forest to create jobs for people?


GREENPEACE

*12 Principles of Green Chemistry

1. **Prevention.** It is better to prevent waste than to treat or clean up waste after it is formed.
2. **Atom Economy.** Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.
3. **Less Hazardous Chemical Synthesis.** Whenever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. **Designing Safer Chemicals.** Chemical products should be designed to preserve efficacy of the function while reducing toxicity.
5. **Safer Solvents and Auxiliaries.** The use of auxiliary substances (solvents, separation agents, etc.) should be made unnecessary whenever possible and, when used, innocuous.
6. **Design for Energy Efficiency.** Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure.

*12 Principles of Green Chemistry

7. **Use of Renewable Feedstocks.** A raw material or feedstock should be renewable rather than depleting whenever technically and economically practical.
8. **Reduce Derivatives.** Unnecessary derivatization (blocking group, protection/deprotection, temporary modification of physical/chemical processes) should be avoided whenever possible .
9. **Catalysis.** Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. **Design for Degradation.** Chemical products should be designed so that at the end of their function they do not persist in the environment and instead break down into innocuous degradation products.
11. **Real-time Analysis for Pollution Prevention.** Analytical methodologies need to be further developed to allow for real-time in-process monitoring and control prior to the formation of hazardous substances.
12. **Inherently Safer Chemistry for Accident Prevention.** Substance and the form of a substance used in a chemical process should be chosen so as to minimize the potential for chemical accidents, including releases, explosions, and fires.

*Nuclear Accidents

*Nuclear energy was researched and discovered by man as a source of alternate energy which would be clean and cheap compared to fossil fuels.

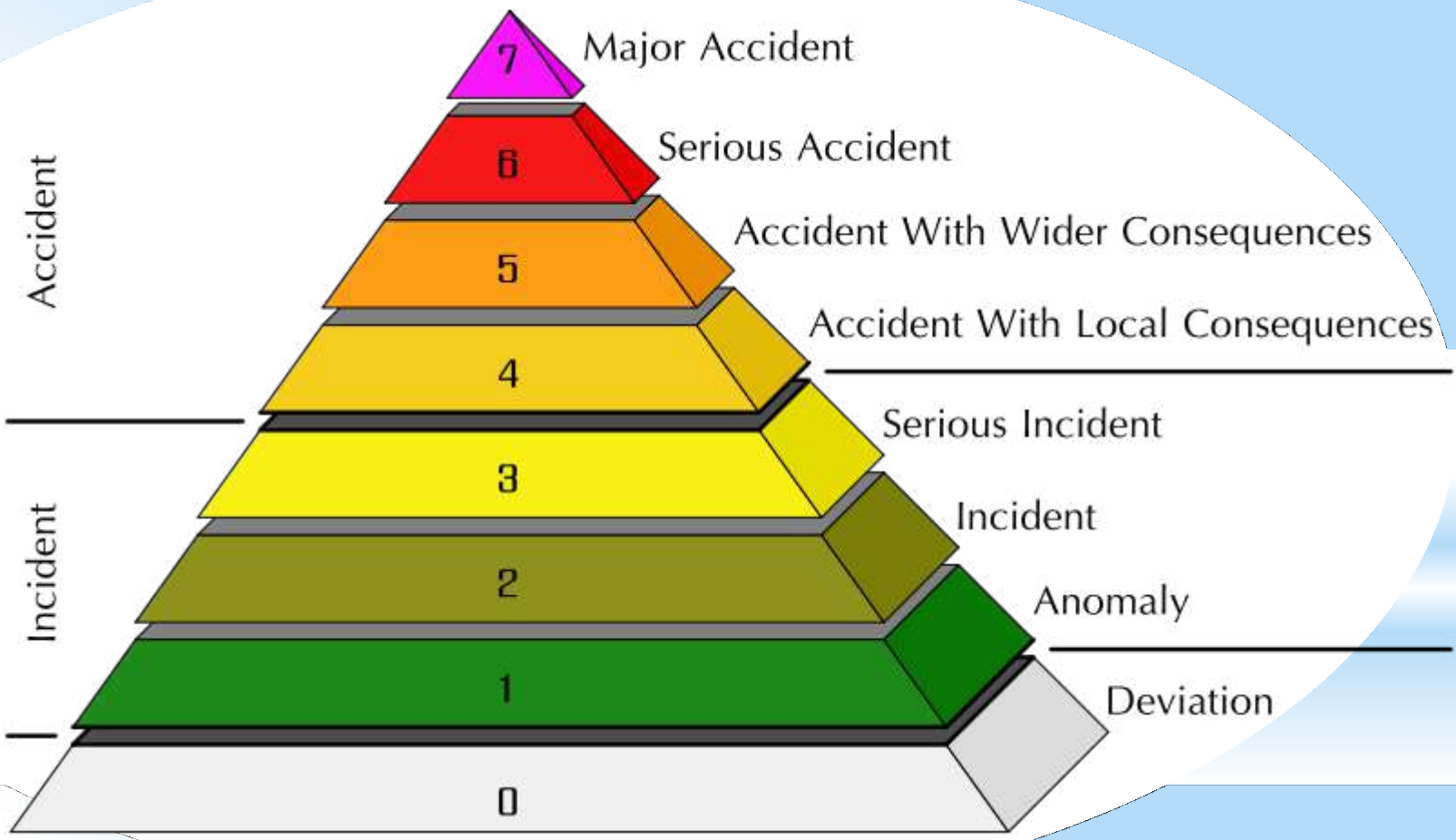
*And although this did happen, along with the benefits of nuclear energy came its downfalls.

*In the short history of nuclear energy there have been accidents that have surpassed any natural calamity or other energy source extraction in their impacts.

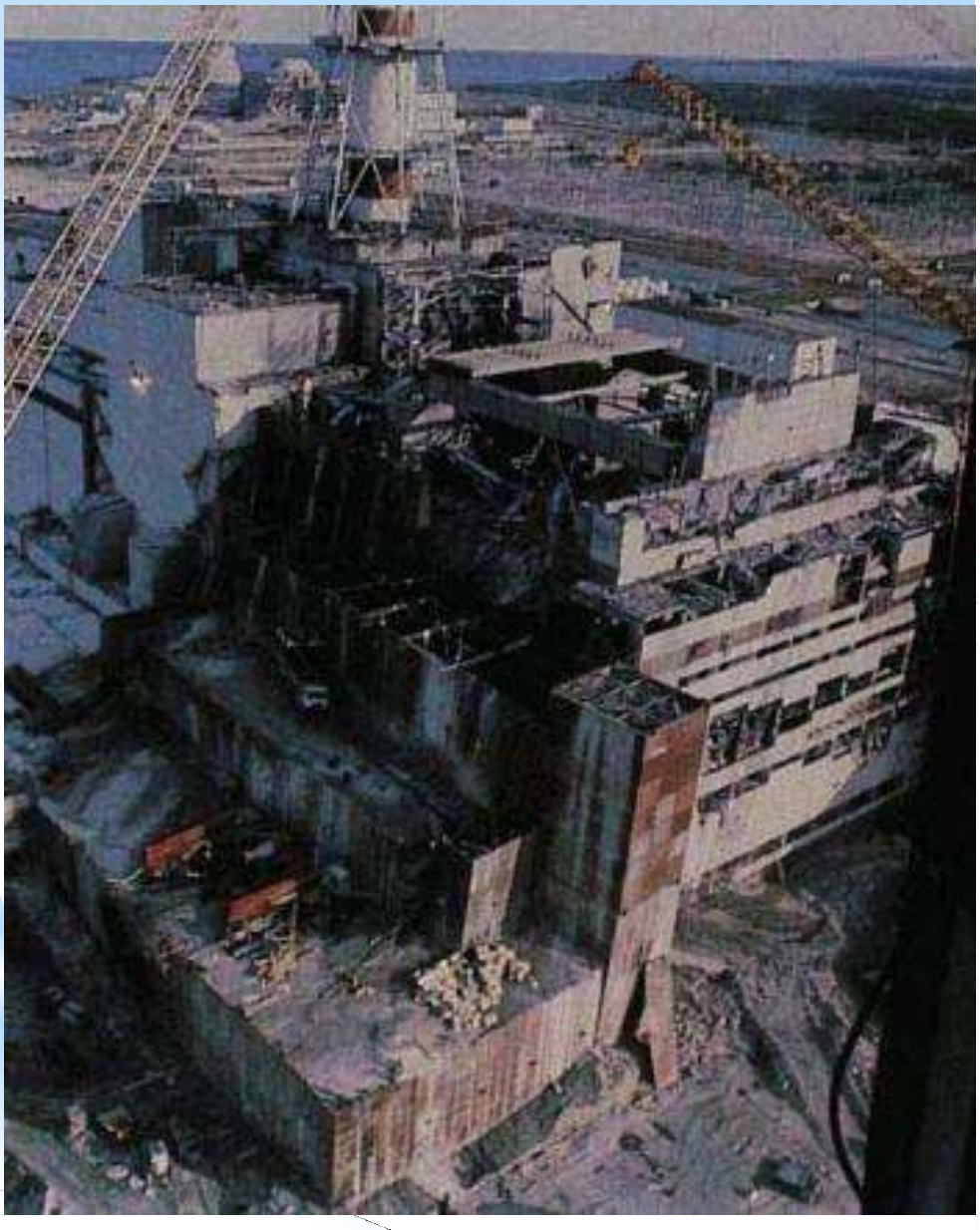
*A single nuclear accident can cause loss of life, long-term illness and destruction of property on a large scale for a long period of time.

* Radioactivity and radioactive fallout leads to cancer, genetic disorders and death in the affected area for decades after, thus affecting all forms of life for generations to come

*International Nuclear Event Scale



* Fukushima daiichi nuclear disaster-2011

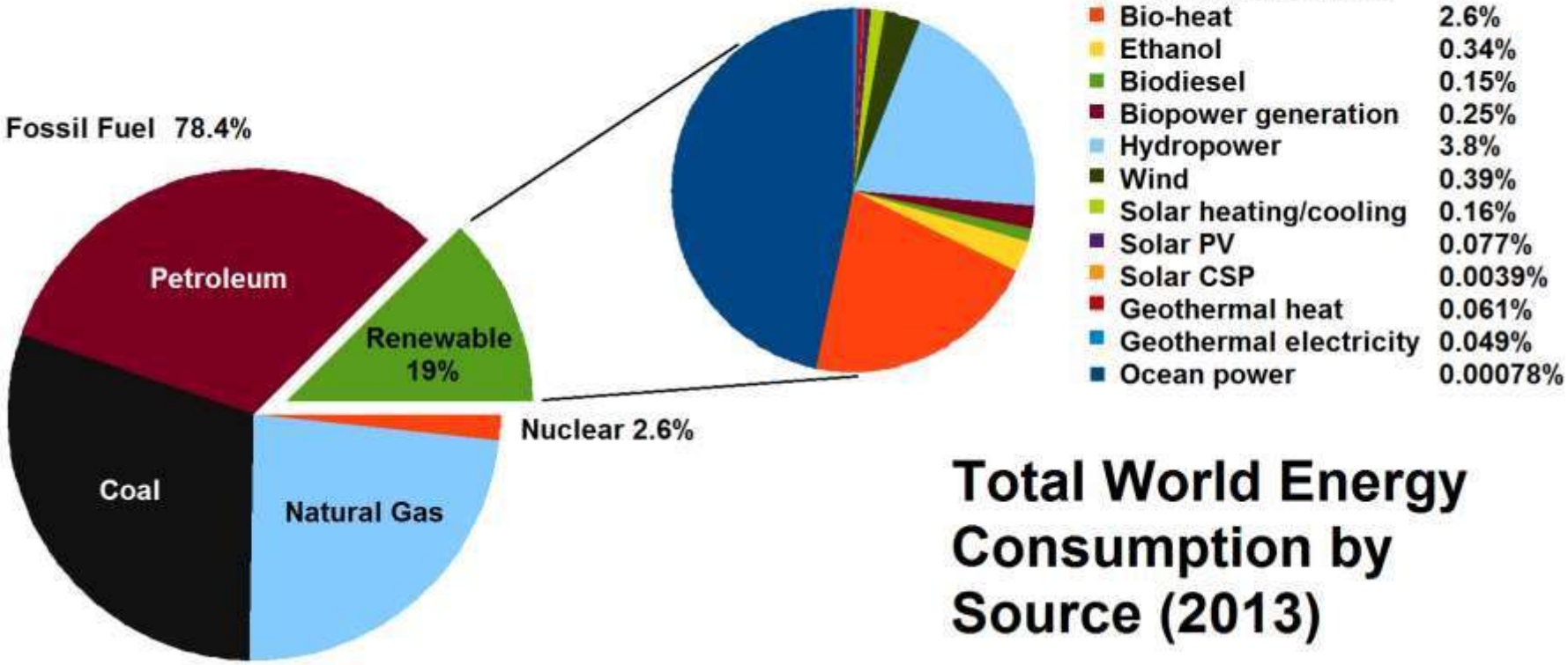


*Nuclear Holocaust

* The use of nuclear energy in war has had devastating effects on man and earth.
* The Hiroshima and Nagasaki incident during World War II, the only use of nuclear power in war in history, is one of the worst disasters in history.
* In 1945, the United States dropped atomic bombs in Japan over the towns of Hiroshima and Nagasaki.
* These two atomic bombs killed thousands of people, left many thousands injured and devastated everything for miles around.
* The effects of the radiation from these nuclear bombs can still be seen today in the form of cancer and genetic mutations in the affected children and survivors of the incident.

* CASE STUDY
Nuclear disasters and leakages

* In 1986 the Nuclear Power Station at Chernobyl in USSR developed a problem that led to a fire and a number of explosions in its Nuclear Reactor.
* The radioactive dust spread over many kilometers and covered not only Europe but North America as well.
* Three people died in the explosion and 28 shortly after due to radiation exposure.
* Some 259 sick were hospitalized.
* As the area had to be evacuated 1,35,000 people had to be moved immediately and another 1.5 lac by
* 1991.
* As radioactive fall out continued even more people had to be moved. An estimated 6.5 lakh people may have been seriously affected.
* They may get cancer, thyroid tumours, and cataracts, and suffer from a lowered immune mechanism.
* As radioactivity passes from grass to herbivores, sheep in Scotland and Reindeer in Lapland were affected and were unfit for human consumption.
* Vegetable, fruit and milk were contaminated in Europe.
* A French Nuclear Waste Processing Center in Normandy may have affected the lives of
* children playing nearby.
* They may develop leukemia (blood cancer) in later life.



Total World Energy Consumption by Source (2013)

MAXIMUM OUTPUT 1,000 MW

WHO GETS WHAT...	Tamil Nadu	Kerala	Karnataka	Andhra Pradesh	Puducherry
	562.5 MW	133 MW	221 MW	50 MW	33.5 MW

THE STORY SO FAR

NOV 20, 1988: Agreement signed by then Prime Minister Rajiv Gandhi and Soviet President Gorbachev

FEB 12, 2002: India signs the biggest contract with Russia for the nuclear power station

AUG 13, 2011: Villagers in and around the plant raise a banner of protest against the project

Sept 19, 2011: CM Jayalalithaa demands that Centre temporarily stop project considering people's apprehensions

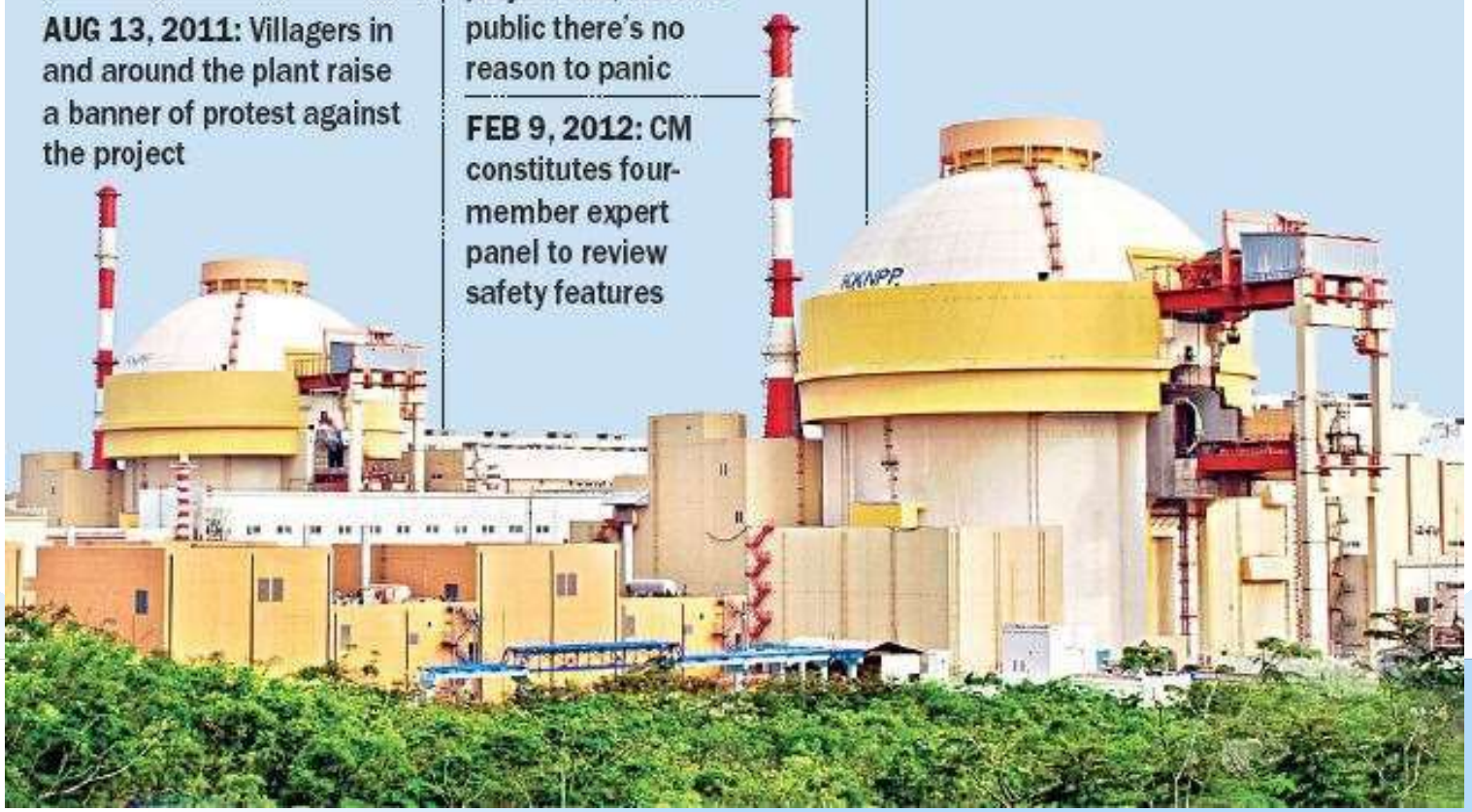
Nov 6, 2011: Kalam visits project site, assures public there's no reason to panic

FEB 9, 2012: CM constitutes four-member expert panel to review safety features

May 6, 2013: Supreme Court gives green light for commissioning plant

July 13, 2013: Attains criticality for the first time

Nov 29, 2013: Unit-1 generates 400 MW for first time



Waste land Reclamation:

* Any land which is not put to optimal use is defined as waste land.
* The waste land do not fulfill their life sustain potential wasteland contributes about 20.17% of the total geographical area of India.

Reasons for formation

* Over grazing and over exploitation
* Toxic effluent discharged from sewage and industrial wastes
* Mining activities destroy forest and cultivable land
* Use of pesticides also produce wasteland
* Erosion, desertification, water logging also degrade land

Wastelands can be reclaimed by the following way

* Conserving the soil – land is brought under vegetal cover. This can be done by growing grasses and shrubs
* To reclaim the land/soil, effective participation of the people, voluntary agencies and government is very important

* Consumerism and Waste Products

* Consumerism refers to the consumption of resources by the people.
* Early human societies used to consume much less resources.
* But the consumerism has increased to a very large extent.
* Consumerism is related to both population size and increase in demands due to change in life style.

* Population has increased tremendously. World Bank estimates our population to reach 11 billion by 2045.
* Two types of conditions of population and consumerism exists.

1. People over – population: When there are more people than available food, water and other resources in an area – causes degradation of limited resources – poverty and under nourishments.Low Developed Countries (LDC) are more prone to these conditions.

There is less per capita consumption although the overall consumption is high.

2. Consumption over – population: These conditions occur in more developed countries (MDC). Population size is smaller but the resource consumption is high due to luxurious life style (i.e.) per capita consumption is high.

More consumption of resources lead to high waste generation – greater is the degradation of the environment.

According to Paul Ehrlich and John Hodlren model

Overall environmental impact = no. of people x per capita use of resources x waste generated per unit of resources

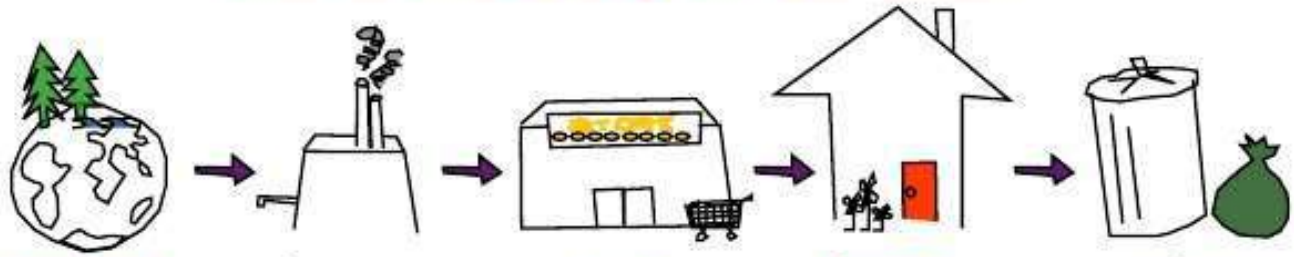
Parameter	MDC	LDC
No. of people	low	High
Per capita consumption of resources	high	Low
Waste generated	high	Low

Over all environmental impact of these two types of consumerism may be same or even greater in case of MDC.

Comparison of consumption and waste generation

Parameter	Global value %	
	USA	India
Population	4.7	16
Production of goods	21	1
Energy use	25	3
Pollutants and wastes	25	3
CFC Production	22	0.7

this is the story of our stuff:



resources

are collected, often by harming the environment, and sent to the

factories

where lots of waste is produced until a product is ready to go to the

store.

people come and buy buy buy and take more stuff than they need back to their

homes,

and they use these products for a short time and then throw them in the

garbage

even though we are producing much too much waste, and have no where to put it all!


TRASH CATEGORIES
Infographic
PLASTIC
14%
GLASS
11%
MIXED WASTE
11%
E-WASTE
4%
BATTERIES
12%
LIGHT BULBS
5%
METAL
10%
PAPER
9%
ORGANIC
24%
shutterstock


SCAFÉ
McDonald's
Gillette
SAMSUNG
NOKIA
Marlboro
Globalization
By Guille3691

CON-SUME-RISM STATS

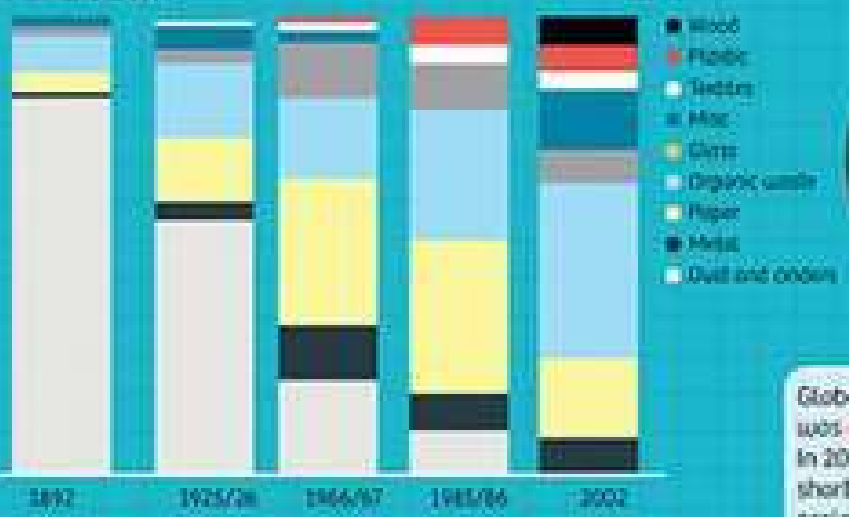
Sometimes it can be difficult to visualize just how much we consume. While purchasing "green this" and "eco-friendly that" is all well and good, one of the root causes of our environmental problems is hyper consumption. We simply buy too much of what we don't really need. So, we leave here some statistics on three major topics of consumerism: food, cars, and trash

80% of the population that lives in North America and Western Europe accounts for

60% of private consumption spending

$2 Half the world lives on less than **2 dollars** a day

What's in our garbage?
From 1892 to 2002



Global oil production is currently about **81 million** barrels a day and is predicted to fall to **39 million** barrels a day by 2030, due to diminishing resources

Global coal consumption in 1980 was **6,129,498 million** short tons*. In 2006, it was **6,743,786 million** short tons. Coal consumption is projected to grow at about **2.5% per year** over the next 20 years.

EAT LOCAL

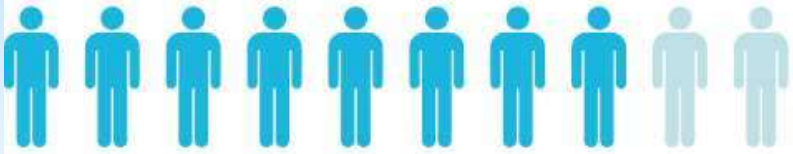
* 1 short ton = 907.1847 kilograms

*KFC MUTANT CHICKENS!!

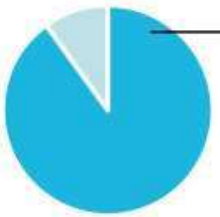
STIMULATES CONSUMERISM!!!!...

Next Time when you visit KFC
remember you are eating this chicken

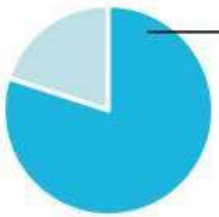
A nation of food wasters



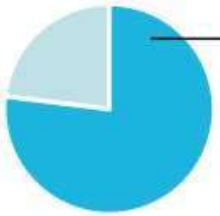
8 in 10 are bothered when they waste food



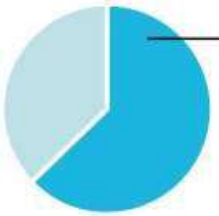
90% feel it is a waste of money



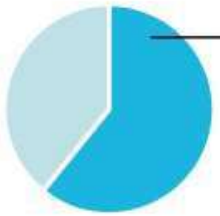
80% eat at home; 39% of them have leftovers



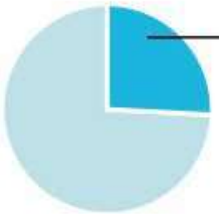
77% think they should reduce waste to improve the environment



63% throw food away because it has expired



61% would waste less food if they had more information on how to plan meals and store food



26% buy more than enough food 70% of the time to ensure they have plenty to eat

Source: NATIONAL ENVIRONMENT AGENCY ST GRAPHICS

Hindustan Unilever Limited

* Environment (Protection) Act, 1986

* CG is to take action to protect and improve environment and SG to co ordinate actions.
* CG to set up

1. Std of quality of air, water or soil
2. Maximum permissible limits of concentration of pollutants (including noise pollutant)
3. procedures and safe guard for handling hazardous items
4. Prohibition of using hazardous items
5. Prohibition and restriction of certain industries in certain area
6. Procedure and safe guard for prevention of accidents

Environment (Protection) Rules, 1986

* SPCB(*State Pollution Control Board)* is to follow the guidelines provided in schedule VI. Some are as follows

* 1.Advises industries for treating the waste water and gases – use of technology – achieve prescribed std.
* 2. Encourage recycling and reusing the wastes
* 3. Encourage recovery of biogas, energy and reusable matter
* 4. Discharge of effluents and emissions into environment is permitted by SPCB after taking into account capacity of the receiving water body
* 5. To emphasize clean technology to increase fuel efficiency and decrease environmental pollutants
* The act provides for environmental Audit for checking complying with the environmental laws and regulations.

* Air (Prevention & Control of Pollution) Act, 1981

Salient features

*1. Prevention, control and abatement of air pollution

*2. Air pollution has been defined as the presence of any solid, liquid or gaseous substance (including noise) in the atmosphere in such a concentration that may be or tend to be harmful to human being or any other living creature or plants or property or environment.

*3. Noise pollution – inserted in 1987

*4. CPCB & SPCB similar to water pollution board

*5. Section 20 provides for emission std to auto mobile

*6. Section 19 provides for SG to declare „air pollution control area"in consultation with SPCB

*7. Direction of PCB can be appealed in the appellate authority.

* Water (prevention and control of pollution) Act 1974:

*Maintaining and restoring the wholesomeness of water by preventing and controlling its pollution. The salient features and provisions of Act are summed as follows.

*1. Maintenance and Restoration of Quality – surface and ground water

*2. Establishment of central PCB and state PCB

*3. Confers powers and functions to CPCB and SPCB

*4. The act provides for funds, budgets, accounts and audits of the CPCB & SPCB

*5. The act provides penalties for the defaulters and duties and powers

* Wildlife [protection] act, 1972:

* Land mark in the history of wildlife legislation.
* 1976 the powers are transferred from state to central government.
* [I B of W L] was created in 1952 in our country which after WLA, 1972, took up the task of setting National parks and sanctuaries.

Wildlife [protection] Act

* 1 Defines wild life related terminology.
* 2 Provide appointments of advisory Board, wildlife warden, their powers & duties etc.
* 3 Prohibition of hunting of endangered species [was first] mentioned.
* 4 List of endangered species is provided.
* 5 Guides central 200 authorities.
* 6 Provides grants for setting up of national parks, wild life sanctuaries etc.
* 7 The Act imposes ban on trade & commence of scheduled animals.
* 8 Provides legal proves to officers to punish the offenders.
* 9 Provide captive breeding programme for endangered species.

* Many conservation projects for endangered species were started under this act.

* Lion 1972;

* Tigers 1973

* Crocodile [1974];

* Deer 1981.

* Forest (conservation) Act, 1980

* It deals with conservation of forest and includes reserve forest, protected forest and any forest land irrespective of ownership.

Salient features

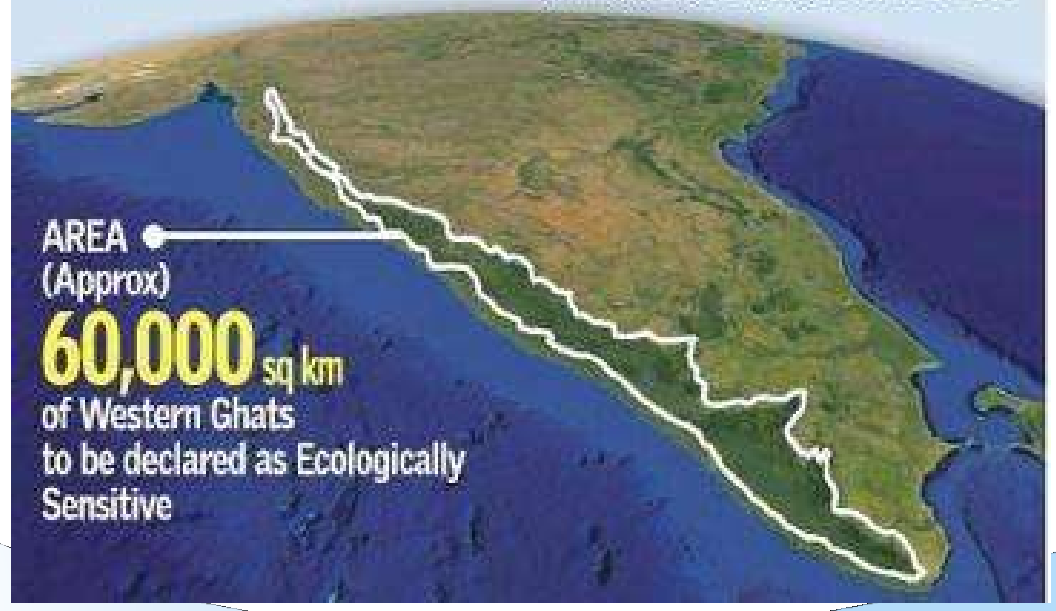
* 1. State government can use forest only forestry purpose.
* 2. Provision for conservation of all types of forests. Advisory committee appointed for funding conservation
* 3. Illegal non-forest activity within a forest area can be immediately stopped under this act. Non forest activity means clearing land for cash-crop agriculture, mining etc.

* However construction in forest for wild life or forest management is exempted from non forestry activity.

CENTRE'S DECISION WILL MAKE WESTERN GHATS THE LARGEST PROTECTED FORESTS IN INDIA

SAFEGUARDING THE ECOSYSTEM

- Bar on **mining, quarrying** and **thermal power plants**
- All other projects only with consent of **gram sabha** after **cumulative impact assessment**
- Stringent conditions for **hydroelectric projects**
- **Windmills** to be permitted
- **Hill areas** with high population density not to be touched
- Moratorium on mining in **Sindhudurg and Ratnagiri** to be revoked
- Decision on **Athirapally** and **Gundya** hydro projects deferred



1992 Amendment:

* 1. This amendment allows transmission lines, seismic surveys, exploration drilling and hydro electric project in forest area without cutting trees or with limited cutting of trees – prior approval CG to be sought.

* 2. Wild life sanctuaries, National parks etc. are prohibited from exploration except with CG prior approval.

* 3. Cultivation of coffee, rubber, tea (cash crop), fruit bearing trees, oil yielding trees, trees of medicinal values are also prohibited in reserved forest area with out prior approval from CG. Has this may create imbalance to ecology of the forest.

* 4. Tusser (a type of silk yielding insect) cultivation in forest area is allowed since it discourages monoculture practices in forests and improves biodiversity.

* 5. Plantation of mulberry for rearing silk worm is prohibited.

* 6. Proposal sent to CG for non-forestry activity must have a cost benefit analysis and environmental impact statement (EIS).

*Draw backs of wild life (protection) act

* Fall out of Stockholm conference not localized
* Ownership certificate of animals article – illegal trading
* Trade through J & K. This act not applicable to J&K
* Offender to get just 3 years imprisonment and or Rs.25000/- fine. Draw backs of the forest (conservation) act 1980

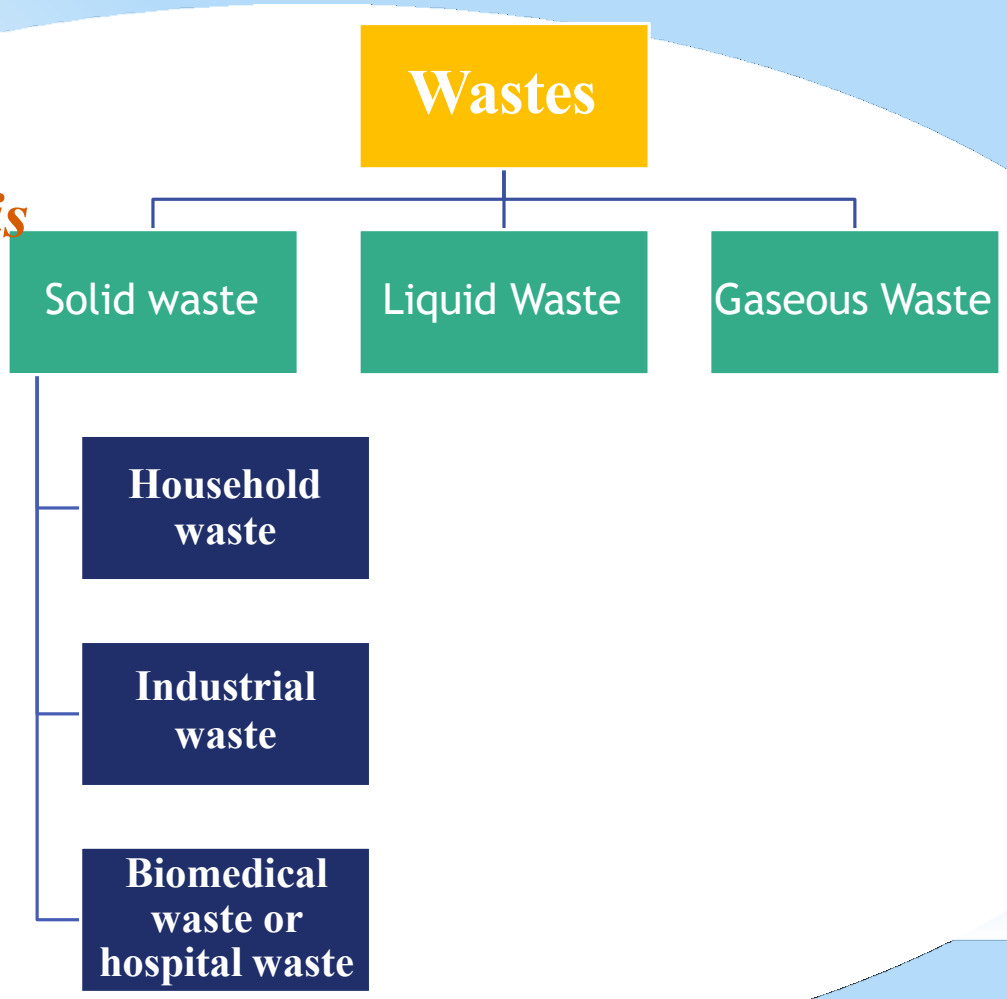
* Inheritance of exploitative and consumerist elements of the British period
* Tribal people (i.e.) inhabitants of forest are left by the act
* Instead of attracting public support (tribal) it has intrigued in the human rights.
* Protection of trees, birds and animals have marginalized poor people.

* Bio-Medical Waste Management

*WASTES

WASTES

"Something which is not put into proper usage at a given time".



* What is Bio-medical waste ??

Definition

* Anything tested or used on an individual, or any trash from biological experiments are medical waste

Generated from

* Waste generated by health care facility
* Research facility
* Laboratories

Hazardous health care waste

* 85% waste is non infectious
* 10% are infectious
* 5% are hazardous

*History

- In the late 1980's
  - Items such as used syringes washed up on several East Coast beaches USA
  - HIV and HPV virus infection
  - Lead to development of Biomedical Waste Management Law in USA.
- However in India the seriousness about the management came into lime light only after 1990's.

*WHO has estimated that

*in 2000

*injections with contaminated syringes caused:

- 21 million hepatitis B virus (HBV) infections (32% of all new infections);
- Two million hepatitis C virus (HCV) infections (40% of all new infections);
- 260 000 HIV infections (5% of all new)

*Laws of Biomedical Waste Management

On 20th July 1998

*Ministry of Environment and Forests (MoEF), Govt. of India, Framed a rule known ***as 'Bio-medical Waste (Management and Handling) Rules, 1998.'***

*Provides uniform guidelines and code of practice for Bio-medical waste management.

According to this rule ***Bio-Medical Waste***

"Any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in the production of testing of biological"

*Biomedical waste Statistics

Developed Countries- *1-5 kg/bed/day, with variations among countries.*

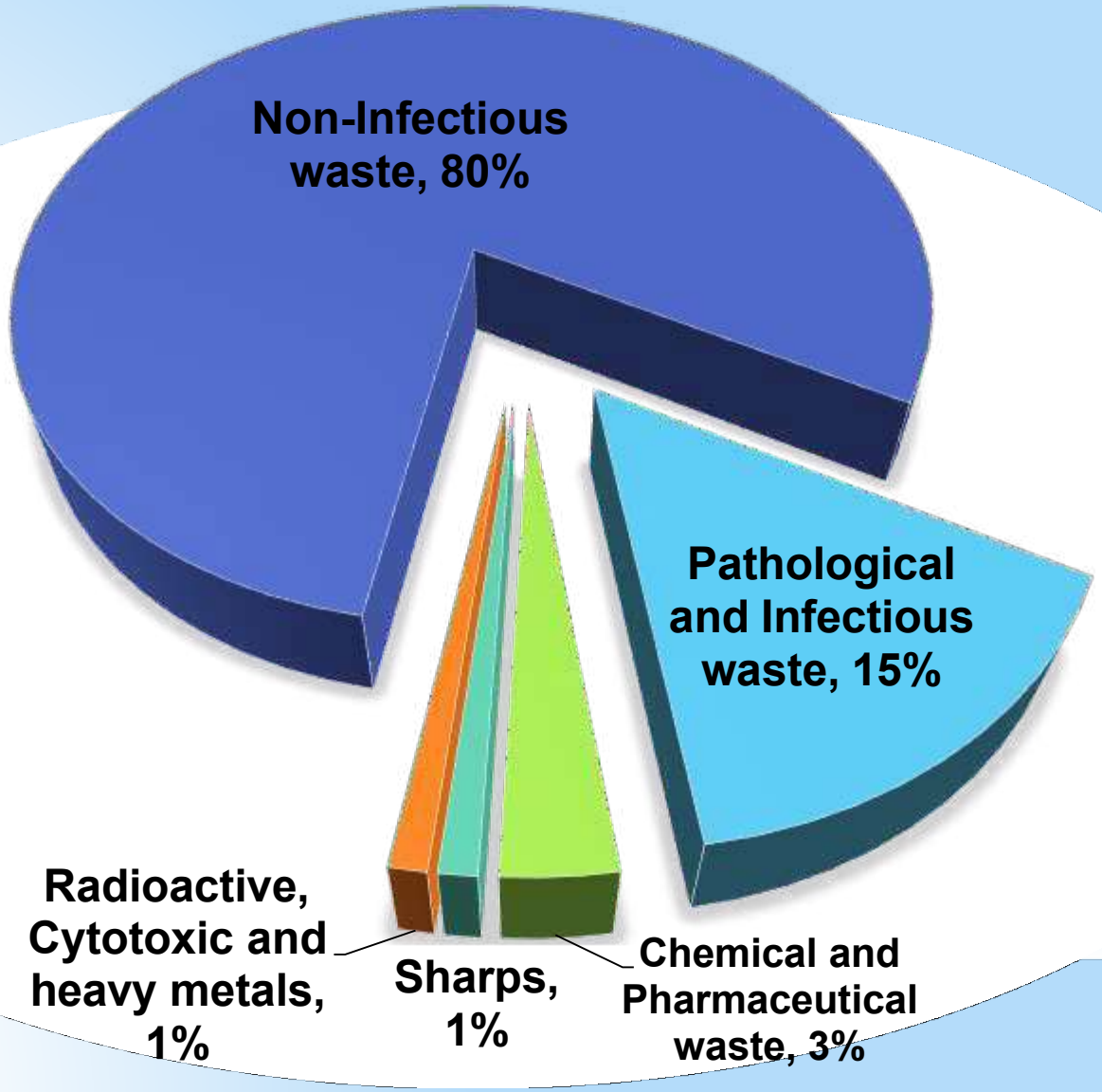
In India-

- *1-2 kg/bed/day with variation among Govt. and Private establishments.*

- *Approximately 506.74 tons/ day wastes generated*

- *Out of which only 57% waste undergoes proper disposal*

* Categories of Bio-Medical Wastes



* Components of Bio-medical waste

Components	Examples
*Human anatomical waste	*Tissues, organs, body parts
*Animal waste	*Generated during research/experimentation, from veterinary hospitals
*Microbiology and biotechnology waste	* Laboratory cultures, micro-organisms, human and animal cell cultures, toxins
*Waste sharps	*hypodermic needles, syringes, scalpels, broken glass *Generated from any of the infected areas
*Liquid waste	

Components of Bio-medical waste (Cont…)

Components	Examples
▪ Soiled waste	*Dressing, bandages, plaster casts, material contaminated with blood
▪ Chemical waste	*Alcohol, Sulphuric acid, chlorine powder, Glutaraldehyde, Picric acid, fertiliser, ammonia
▪ Discarded medicines and cyto-toxic drugs	*Barium enema, X-rays, Cancer chemotherapy, tar-based products
▪ Radioactive Components ▪ Incineration ash	*EtBr, Radioactive components

Pharmaceutical Waste

Sharp Waste

Genotoxic waste

Cytotoxic drugs

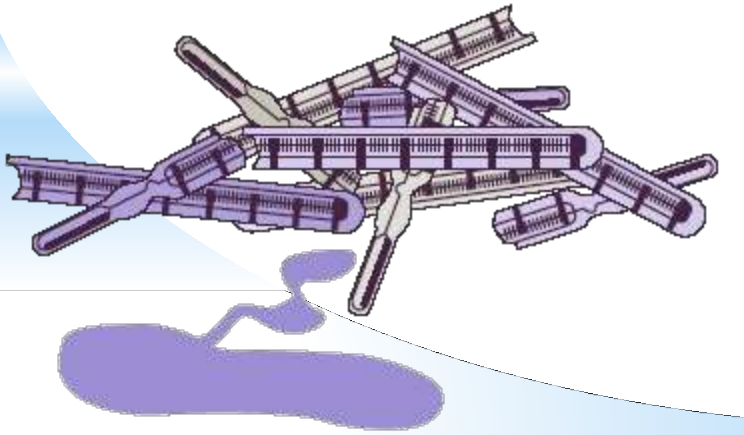
Chemical waste

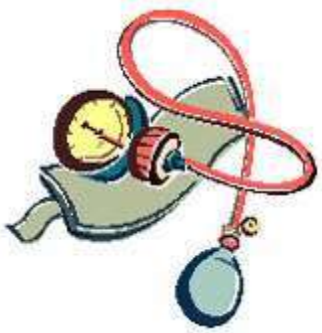
Lab reagents

Waste with high content of heavy metals

Worn out batteries

BROKEN MERCURY THERMOMETERS





Blood pressure guages

PRESSURISED CONTAINERS

Aerosol cans

Gas cartridges

Gas cylinders

Radioactive waste

* The exposure to hazardous health care waste can result in

1. Infection
2. Genotoxicity and Cytotoxicity
3. Chemical toxicity
4. Radioactivity hazards.
5. Physical injuries
6. Public sensitivity.

*Infection

The infectious agents enter in he body through

- Puncture,
- Abrasion,
- Cut in the skin;
- Through mucous membranes;
- By inhalation and ingestion.

*Most Common Infections

1. **Gastro enteric through faeces and/or vomit**
   e.g. *Salmonella, Vibrio Cholera, Helminthes*
   Hepatitis A
2. **Respiratory through inhaled secretions**
   e.g. *Mycobacterium tuberculosis; measles virus;*
   streptococcus pneumonae
3. **Ocular infections through eye secretions**
   e.g. *Herpes virus*,
4. **Skin infection through pus**
   e.g. *Streptococcus spp* ,
5. **Meningitis through Cerebrospinal fluid**
   e.g. *neisseria meningitides*,

* Most Common Infection Cont.

6. Blood borne diseases

- AIDS
- Septicaemia and bacteraemia
- Viral Hepatitis B & C

7. Hemorrhagic fevers through body fluids

- Junin, Lassa, Ebola and Marburg viruses

*Genotoxicity and Cytotoxicity

- Irritant to skin and eyes
  E.g. alkylating agent, intercalating agent
- Carcinogenic and Mutagenic
  e.g. Secondary neoplasia due to chemotherapy

Chemical Toxicity

- Many drugs are hazardous
- May cause intoxication , burns, poisoning on exposure

*Radioactivity Hazards

Radioactive waste exposure may cause headache, dizziness, vomiting, genotoxicity and tissue damage

Physical Injuries

May result from sharps, chemicals and explosive agents

Public sensitivity

Visual impact of the anatomical waste, recognizable body parts

*Classification of Waste Category as per WHO standard

Cat- 1	**Human Anatomical Wastes**
Cat- 2	Animal Anatomical Wastes
Cat- 3	Microbiology and Biotechnology wastes
Cat- 4	Waste Sharps
Cat- 5	Discarded medicines and Cytotoxic drugs

Classification of Waste Category as per WHO standard cont…

Cat- 6	**Sailed Wastes**
Cat- 7	Solid Wastes
Cat- 8	Liquid wastes
Cat- 9	Incineration Ash
Cat- 10	Chemical wastes

*Pharmaceutical Waste

Blood bags found in the mun$_{12}$ic$_{7}$ipal waste stream in violation of rules for such waste.

*Hospital waste disposal

Categories of Biomedical Waste Schedule as per WHO Standard

WASTE CATEGORY	TYPE OF WASTE	TREATMENT AND DISPOSAL OPTION
Category No. 1	Human Anatomical Waste (Human tissues, organs, body parts)	Incineration@ / deep burial*
Category No. 2	Animal Waste (Animal tissues, organs, body parts, carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals and colleges, discharge from hospitals, animal houses)	Incineration@ / deep burial*
Category No. 3	Microbiology & Biotechnology Waste (Wastes from laboratory cultures, stocks or specimen of live micro organisms or attenuated vaccines, human and animal cell cultures used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins and devices used for transfer of cultures)	Local autoclaving/ microwaving / incineration@

Categories of Biomedical Waste Schedule as per WHO standards Cont….

Category No. 4	Waste Sharps (Needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)	Disinfecting (chemical treatment@@ / autoclaving / microwaving and mutilation / shredding
Category No. 5	Discarded Medicine and Cytotoxic drugs (Wastes comprising of outdated, contaminated and discarded medicines)	Incineration@ / destruction and drugs disposal in secured landfills
Category No. 6	Soiled Waste (Items contaminated with body fluids including cotton, dressings, soiled plaster casts, lines, bedding and other materials contaminated with blood.)	Incineration@ / autoclaving / microwaving
Category No. 7	Solid Waste (Waste generated from disposable items other than the waste sharps such as tubing, catheters, intravenous sets, etc.)	Disinfecting by chemical treatment@@ / autoclaving / microwaving and mutilation / shredding# #

Categories of Biomedical Waste Schedule as per WHO standards cont….

Category No. 8	Liquid Waste (Waste generated from the laboratory and washing, cleaning, house keeping and disinfecting activities)	Disinfecting by chemical treatment@@ and discharge into drains
Category No. 9	Incineration Ash (Ash from incineration of any biomedical waste)	Disposal in municipal landfill
Category No.10	Chemical Waste (Chemicals used in production of biologicals, chemicals used in disinfecting, as insecticides, etc.)	Chemical treatment @@ and discharge into drains for liquids and secured landfill for solids.

* Color Coding For Segregation of BMW

COLOR	WASTE	TREATMENT
Yellow	Human & Animal anatomical waste / Micro-biology waste and soiled cotton/dressings/linen/beddings etc.	Incineration / Deep burial
Red	Tubings, Catheters, IV sets.	Autoclaving / Microwaving / Chemical treatment
Blue / White	Waste sharps (Needles, Syringes, Scalpels, blades etc.)	Autoclaving / Microwaving / Chemical treatment & Destruction / Shredding
Black	Discarded medicines/cytotoxic drugs, Incineration ash, Chemical waste.	Disposal in secured landfill

* STEPS IN THE MANAGEMENT OF BIOMEDICAL WASTE

1. *Survey of waste generated.*
2. *Segregation of hospital waste.*
3. *Collection & Categorization of waste.*
4. *Storage of waste.(Not beyond 48 hrs.)*
5. *Transportation of waste.*
6. *Treatment of waste.*

* Steps to Manage Hazardous Wastes before Disposal

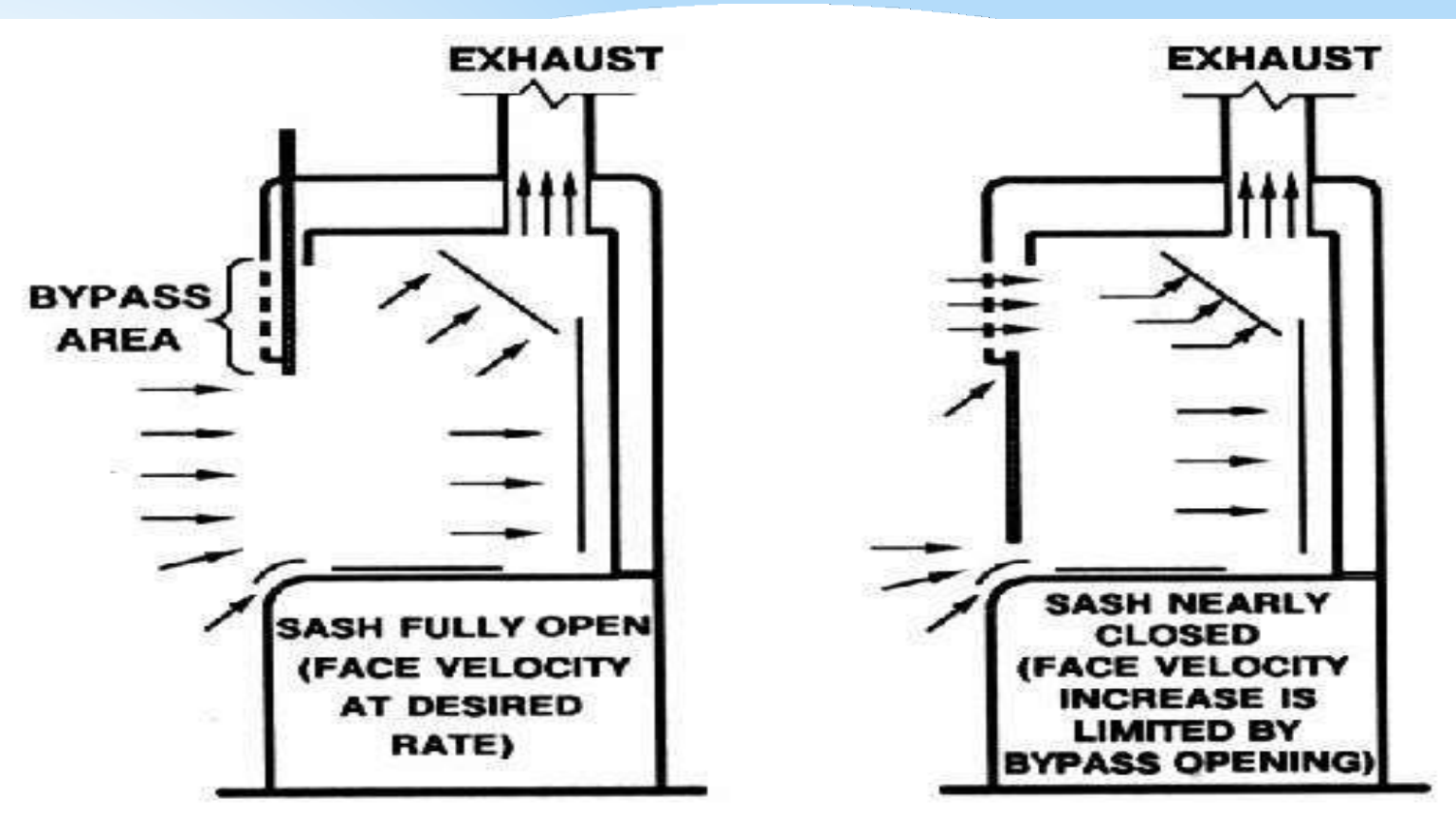
1. Know what hazards you have
2. Purchase smallest quantity needed, and don't purchase hazardous materials if safe alternative exists

**Use mercury-free thermometers

*Steps to Manage Hazardous Wastes (cont..)

3. Limit use and access to trained persons with personal protective gear

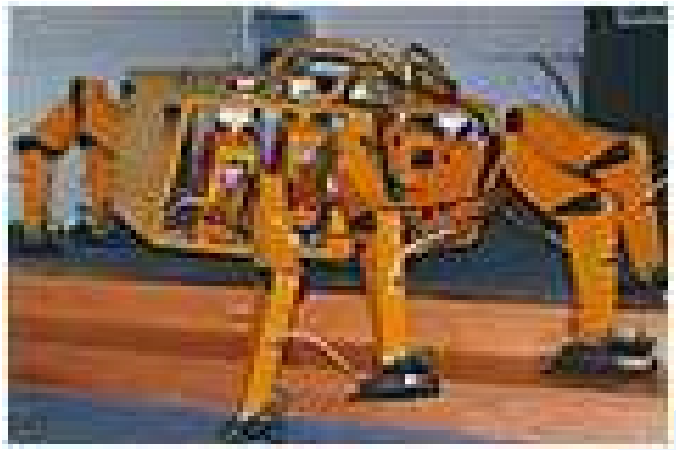
* 4. Use Engineering Controls such as Ventilation, Hoods for Select Hazards



*5. Get Rid of Unnecessary Stuff

- Don’t accumulate unneeded products
- Don’t let peroxides and oxidising agents turn into bombs

Photo of bomb robot called into hospital to dispose of picric acid.



GHS - Hazard Pictograms and Related Hazard Classes

Exploding Bomb
- Explosives
- Self-reactives
- Organic Peroxides

Corrosion
- Skin corrosion/burns
- Eye damage
- Corrosive to metals

Flame Over Circle
- Oxidizing gases
- Oxidizing liquids
- Oxidizing solids

Gas Cylinder
- Gases under pressure

Enviroment
- Aquatic toxicity

Skull & Crossbones
- Acute toxicity (fatal or toxic)

Exclamation Mark
- Irritant (eye & skin)
- Skin sensitizer
- Acute toxicity
- Narcotic effects
- Respiratory tract irritant
- Hazardous to ozone layer (non-mandatory)

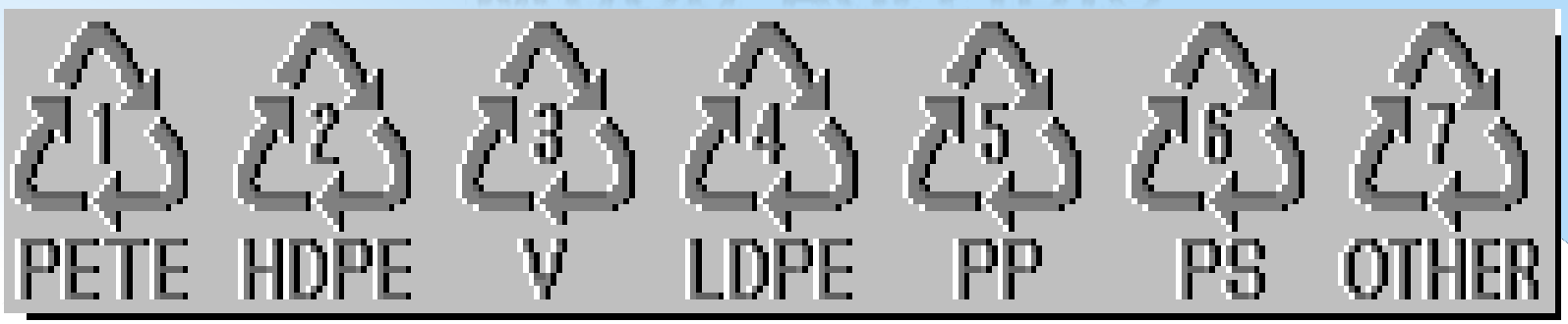
Health Hazard
- Carcinogen
- Mutagenicity
- Reprodcutive toxicity
- Respiratory sensitizer
- Target organ toxicity
- Aspiration toxicity

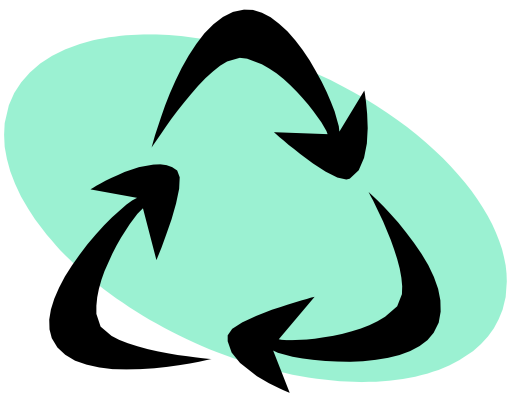
Flame
- Flammables
- Pyrophorics
- Self-heating
- Emits flammable gas
- Self-reactives
- Organic peroxides

*7. Communicate about Workplace Hazards

- *Job description
- *Posters on doors
- *Labels on hazards
- *Give feedback on use of PPE and disposal in evaluation
- *Role model safe use and disposal
- *Contact point who is responsible

*8. Recycle Products When Possible





*Source Reduction

- Source Reduction - ways to lessen the amount of material
  - Segregation - keeping noninfectious waste out of the infectious waste stream
  - Minimization - reduce or eliminate waste at the source
  - Engineering controls - methods to reduce quantity of waste(smaller containers)

*Conclusion

- Thus refuse disposal cannot be solved without public education.
- Individual participation is required.
- Municipality and government should pay importance to disposal of waste economically.
- Thus educating and motivating oneself first is important and then preach others about it.
-

*Ecomark

*What is the Eco-Mark?

*Eco-Mark is an eco-labelling scheme which was constituted by the Government of India in 1991 for easy identification of environment-friendly products.

*Objectives of the Scheme:

*The specific objectives of the scheme are as follow:

*To provide an incentive for manufacturers and importers to reduce adverse environmental impact of products.

*To reward genuine initiatives by companies to reduce adverse environmental impact of their products.

*To assist consumers to become environmentally responsible in their daily lives by providing information to take account of environmental factors in their purchase decisions.

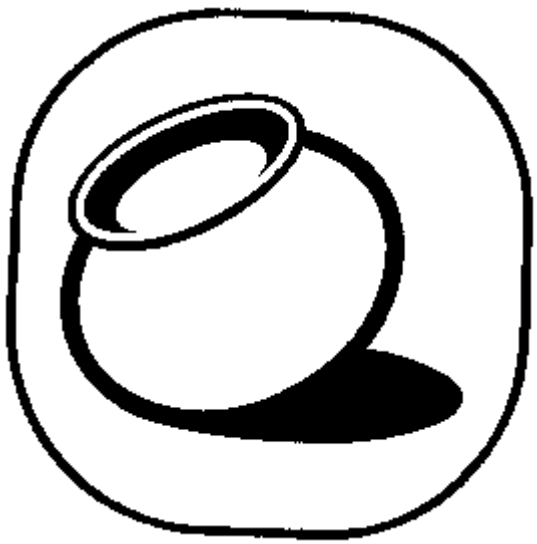
*To encourage citizens to purchase products which have less harmful environmental impacts

*Ultimately to improve the quality of the environment and to encourage the sustainable management of resources.

*Eco-Mark Logo:

*The Eco-Mark logo is that of an earthen pot as indicated in the figure below.

*Eco-Mark Scheme of India Logo



*Scope of Eco-Mark:

*The Eco-Mark scheme initially covered about 16 product categories covering a wide range of products.

* i.e. the Criteria for evaluating products under these categories were initially analyzed and identified.

* At a later point, a 17th category was included.

*The product criteria were developed using a cradle-to-grave approach keeping in mind full life-cycle considerations of the environmental impact of the product i.e.

*All stages from raw materials to manufacturing, usage and disposal were analyzed and evaluated to determine the criteria.

* **Unique feature of the Eco-Mark vis-a-vis other Eco-Labels**
* Eco-Mark is unique when compared to other eco-labels in one aspect;
* it also necessitated meeting the quality requirements of BIS (Bureau of Indian Standards)
* **Three Committees set-up for the Eco-Mark Scheme**
* A Steering Committee in the Ministry of Environments and Forests
* A Technical Committee in the Central Pollution Control Board (CPCB)
* Bureau of Indian Standards (BIS) for assessment and certification purposes

*Association with International Bodies:

*Central Pollution Control Board (CPCB) is a member of GEN (Global Ecolabelling Network) and has been a member since 2000.

*However the Eco-Mark scheme was not very effective in India, and as such eco-labelling as a concept is still relatively unknown.

*The government has tried to revitalize the scheme many times, but the efforts have not borne fruit.

*In spite of the wide range of product categories, there were very limited applications for the Eco-Mark label.

* In the 18 years since its inception, less than 20 companies have obtained the Eco-Mark label.

Environmental Legislation

* 1972 June 5th – Environment was first discussed as an agenda in UN conference on Human Environment. There after every year 5th June is celebrated as Environment Day.

Constitutional Provisions:

* Added in 1976 – Article 48A – "The state shall endeavor to protect and improve the environment and to safeguard forests and wildlife of the country"

* Article 51A (g): "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures".

* By these two articles one constitution makes environment protection and conservation as one of our fundamental duties.

*Central and state pollution control Board:

*Central pollution control Board (CPCB):

*1. Advices CG in matters – prevention and control of water pollution

*2. Co ordinates SPCB and provide technical assistance and guidance

*3. Training programs for prevention and control of pollution by mass media and other ways

*4. Publishes statistical and technical details about pollution

*5. Prepares manual for treatment and disposal of sewerage and trade effluents

*6. Lays std for water quality parameters

*7. plans nation-wide programs for prevention, control or abatement of pollution 8. Laboratories for analysis of water, sewage or trade effluents

*State pollution control Board (SPCB):

*SPCB has similar functions as SPCB and governed by CPCB

*1. SPCB advises state government w.r.t. location of any industry that might pollute.

*2. Lays std for effluents to take samples from streams, wells or trade effluents or sewage passing through an industry. Samples taken are analysed at recognized labs. If the sample is not confirming to the water quality std, then the unit is neglected

*3. Every industry to obtain consent from PCB before commencing an effluent unit by applying in prescribed form with fee

*Enforcement of environmental legislation - major issues

*1. Target of 33% of land to be covered by forest not achieved

*2. Rivers turning to open sewers

*3. Big towns and cities polluted

*4. Wild life endangered

*5. EFP (Effluent Treatment Plant) or Air Pollution Control devices are expensive – leads to closure of units. Government should provide subsidy for small units.

*6. Pollution control laws not backed up by policy pronouncements or guidelines

*7. Chairman of PCB – political nominee. Hence political interference.

*8. Involving public in decision making envisaged by policy statement of the ministry of environment and forest (1992) is only in paper.


Fights tartar build-up
Fights cavities
Whitens teeth
†*Colgate toothpaste contains sodium fluoride which is, in our opinion, an effective decay preventative agent and is of significant value when used in a conscientiously applied program of oral hygiene and regular professional care.*
Canadian Dental Association
Sodium Fluoride 0.243% w/w Tetrapotassium Pyrophosphate 6.2% w/w
Do not swallow toothpaste. Use only a pea-sized amount for children under six years.
Two Leading Brand Canadian Toothpaste Warning
FIGHTS CAVITIES – Contains Fluoristat for effective cavity protection
FIGHTS TARTAR – Special tartar blockers provide clinically proven effective tartar prevention
†*Crest contains sodium fluoride which is, in our opinion, an effective decay preventive agent, and is of significant value when used in a conscientiously applied program of oral hygiene and regular professional care.*
CANADIAN DENTAL ASSOCIATION
Do not swallow. Children under 6 years of age should use only a pea-sized amount and be supervised while brushing.
Sodium fluoride 0.243% w/w, tetrapotassium pyrophosphate 3.82% w/w, sodium acid pyrophosphate 2.10% w/w, tetrasodium pyrophosphate
PROCTER & GAMBLE INC., TORONTO,
WaterlooWatch.com


Tide
Tide
Tide
Tide
CAUTION: MAY IRRITATE EYES.
CHILDREN. FIRST AID TREATMENT:
PRECAUCIÓN: PUEDE IRRITAR LOS OJOS.
Evite el contacto con los ojos. MANTENGA FUERA DEL ALCANCE DE LOS NIÑOS.
PRIMEROS AUXILIOS:


WARNING
This product has not been pasteurized and, therefore, may contain harmful bacteria that can cause serious illness in children, the elderly and persons with weakened immune systems.
WHOLE FOODS


Nutrition Facts
Serv. Size 1 Bottle
Calories 240
Amount/Serving
Total Fat 0g 0%
Sodium 3%
Total Carb 22%
Sugars
Protein 0g
Coke
original formula
www.coke.com
please recycle
CA CRV


including Rose, Jasmine & Lavender.
AIR FRESHENER VICTORIAN POT POURRI
EXTREMELY FLAMMABLE
CAUTION: USE ONLY AS DIRECTED
Keep out of reach of children.
Pressurised container: Protect from sunlight and do not expose to temperatures exceeding 50°C. Do not pierce or burn, even after use. Do not spray on or near a naked flame or any incandescent material. Keep away from sources of ignition – No Smoking.
300ml
405


HIGH FRUCTOSE CORN SYRUP
NATURAL FLAVORS, CAFFEINE

*Disaster Management


N55NW

*Introduction

* Any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services on a scale, sufficient to warrant an extraordinary response from outside the affected community or area.
* (WHO) A disaster can be defined as an occurrence either nature or man made that causes human suffering and creates human needs that victim cannot alleviate without assistance.

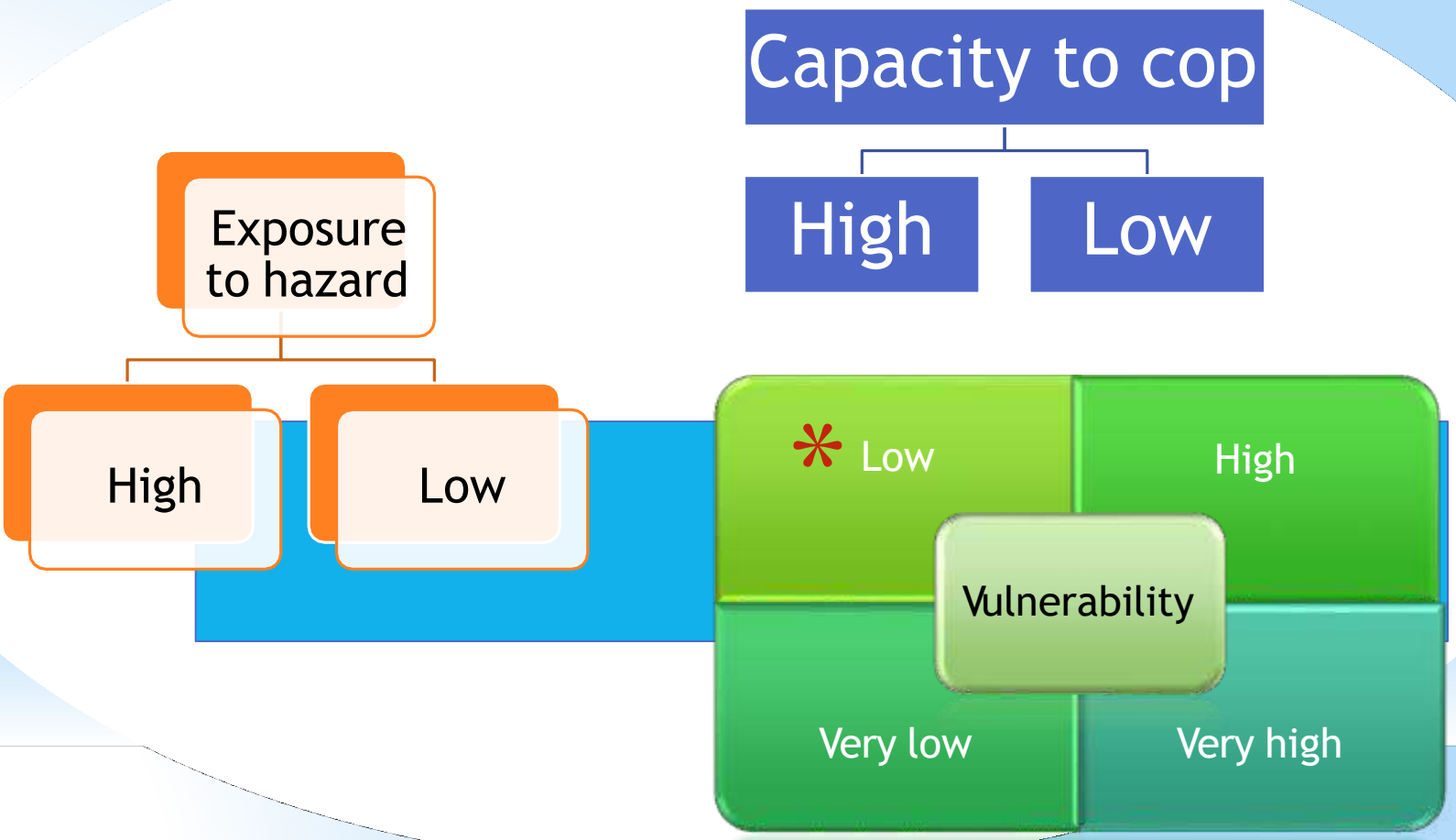
*Hazard

- *Any phenomenon that has the potential to cause disruption or damage to people and their environment.
- *When hazard involves elements of risks, vulnerabilities and capacities, they can turn into disasters.
- *Hazards may be inevitable but disasters can be prevented.

"A hazard is natural event while the disaster is its consequence. A hazard is perceived natural event which threatens both life and property…… A disaster is a realization of this hazard."

-John Whittow

The propensity of things to be damaged by a hazard.



Natural Disasters

- Meteorological
- Topographical
- Environmental

Man made Disasters

- Technological
- Industrial
- Warfare

*Natural Disasters

Meteorological Disasters

- Floods
- Tsunami
- Cyclone
- Hurricane
- Typhoon
- Snow storm
- Blizzard
- Hail storm

Topographical Disasters

- Earthquake
- Volcanic Eruptions
- Landslides and Avalanches
- Asteroids
- Limnic eruptions

Environmental Disasters

- Global warming
- El Niño-Southern Oscillation
- Ozone depletion-UVB Radiation
- Solar flare

Man made Disasters

Technological

- Transport failure
- Public place failure
- Fire

Industrial

- Chemical spills
- Radioactive spills

Warfare

- War
- Terrorism
- Internal conflicts
- Civil unrest

*Disaster Management

- The body of policy and administrative decisions and operational activities that pertain to various stages of a disaster at all levels.
- An applied science which seeks, by systemic observation and analysis of disasters, to improve measures relating to prevention, emergency response, recovery and mitigation.
- Encompasses all aspects of planning for, and responding to disasters, including both pre and post disaster activities.

*Disaster Management

A continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for-

- Prevention of danger or threat of any disaster.
- Reduction of risk of any disaster or its severity or consequences.
- Capacity-building.
- Preparedness to deal with any disaster.
- Prompt response to any threatening disaster situation or disaster.
- Assessing the severity or magnitude of effects of any disaster.
- Evacuation, rescue and relief.
- Rehabilitation and reconstruction.


Activities that reduce effects of disasters
• Building codes & zoning
• Vulnerability analyses
• Public education
Prepared-ness
Activities prior to a disaster.
• Preparedness plans
•Emergency exercises
• Training,
• Warning systems
Mitigation
Integrated Disaster Management
Response
Activities following a disaster.
• Temporary housing
• Claims processing
• Grants
• Medical care
Recovery
Activities during a disaster.
• Public warning systems
• Emergency operations
• Search & rescue

*Proactive strategy

*PHASES OF DISASTER MANAGEMENT

- Disaster Preparedness
- Disaster Impact
- Disaster Response
- Disaster Recovery
- Disaster Mitigation

Disaster Preparedness

Disaster preparedness - is ongoing multisectoral activity.

Integral part of the national system responsible for developing plans and programmes for

disaster management,

prevention,

mitigation,

response,

rehabilitation and

reconstruction.

Disaster Preparedness

Co-ordination of a variety of sectors to carry out-

- Evaluation of the risk.
- Adopt standards and regulations.
- Organize communication and response mechanism.
- Ensure all resources- ready and easily mobilized.
- Develop public education programmes.
- Coordinate information with news media.
- Disaster simulation exercises.

Disaster Response

Immediate reaction to disaster as the disaster is anticipated, or soon after it begins in order to assess the needs, reduce the suffering, limit the spread and consequences of the disaster, open up the way to rehabilitation.

By-

- Mass evacuation
- Search and rescue
- Emergency medical services
- Securing food and water
- Maintenance of Law & Order

*Public Awareness

Public awareness to protect the environment

*Public awareness

* After the scientific and industrial revolution in the recent past, there has been immense impact of man on his environment and balance of the ecosystem as a whole/the environment.
* Industrialization , urbanisation, deforestation , use of insecticides, pesticides, improper use of fertilizers and chemicals in environment are some contributing factors which challenged the life of man, animals specially birds and other organisms.
* Human activities are causing many kinds of environmental pollutions for which public awareness is necessary.
* The Active co-operation of every one, at every level of social organizations is needed for issues concerning environment.

* Over exploitation of natural resources is a basic concern for everybody. Therefore, we should accept the family planning schemes this will not only reduce the population but also solve the problems of food and rehabilitation.
* There must be planning about the effects and control measures of environmental pollution. Govt. should initiate and help by awareness campaigns to save environment.
* There should be the integral part of our educational programmes. Like, We should discourage to use fuel vehicles, until it is not necessary , over use of water, for cleaning and other purposes should be decreased . Rain water harvesting is another example for using the rain water instead flowing out.
* Any government at its own level cannot achieve the goals of sustainable development until the public has a participatory role in it.

* It is only possible only when public aware about the ecological and environmental issues. For example ban the littering of polythene cannot be successful until the public understands the environmental implications of the same.
* Public should understand about the fact that if we degrading our environment, we are harming ourselves.
* This is the duty of educated people to educate the others about the adverse effect on environment.
* Govt. alone cannot do anything until unless every citizen is aware of the environmental pollution & their effects.
* Everyone need to make aware and motivate each and every individual for environmental consciousness.

UNIT 5: HUMAN POPULATION AND THE ENVIRONMENT

SYLLABUS

- Population growth, variation among nations – population explosion
- family welfare programme
- environment and human health
- human rights
- value education
- HIV / AIDS
- women and child welfare
- role of information technology in Environment and human health
- Case studies.

POPULATION GROWTH AND ENVIRONMENT

* Population growth

* It is a group of individuals belonging to the same species, which live in a given area at a given time.

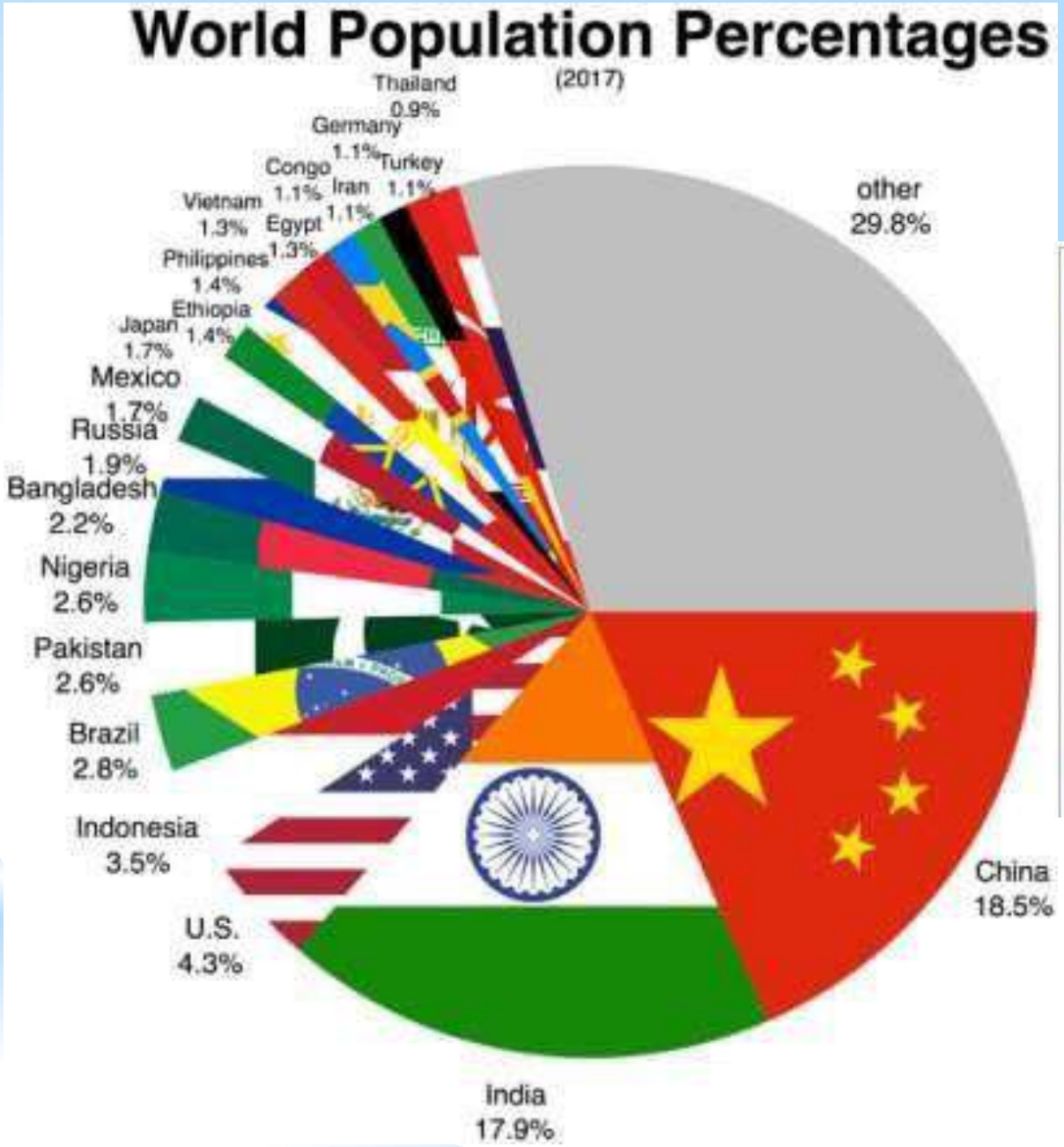
* Population density

* It is expressed as the number of individuals of the population per unit area or per unit volume.

* In demographics, the world population is the total number of humans currently living.

The world population was estimated to have reached 7.5 billion in April 2017.

The United Nations estimates it will further increase to 11.2 billion in the year 2100.



World population (millions, UN estimates)[23]

#	Top ten most populous countries	2000	2015	2030*
1	China*	1,270	1,376	1,416
2	India	1,053	1,311	1,528
3	United States	283	322	356
4	Indonesia	212	258	295
5	Brazil	176	208	229
6	Pakistan	138	189	245
7	Nigeria	123	182	263
8	Bangladesh	131	161	186
9	Russia	146	143	139
10	Mexico	103	127	148
	World total	6,127	7,349	8,501

Parameters affecting population size

* Birth rate or Natality
* Death rate or Mortality
* Immigration
* Emigration

Characteristics of population growth

* Exponential growth
* Doubling time
* Infant mortality rate
* Total fertility rates
* Replacement level
* Male-Female ratio
* Demographic transition

Problems of population Growth

* Increasing demands for food and natural resources
* Inadequate housing and health services
* Loss of agricultural lands
* Unemployment and socio-political unrest.
* Environmental pollution.

Causes of population Growth

* Decrease in death rate and increase in birth rate.
* Availability of antibiotics, Food, clean water, air, etc.
* Decreases the famine-related deaths and infant mortality.
* In agricultural based countries- Children are required

Variation of population among nation based on structure

* Pre-productive population (0-14 years)
* Reproductive population (15-44 years)
* Post Reproductive population (above 45 years)

* Pyramid shaped variation of population
  * Pyramid structure

    Example : India, Bangladesh, Ethiopia, etc.

    Increase the population growth
* Bell shaped variation of population

  Population growth is stable

  Example : USA, UK, Canada etc
* Urn shaped variation of population

  Decrease of population growth

  Example : Germany, Italy, Sweden

*Population Explosion

The enormous increases in population , due to low death rate and high birth rate is termed as population explosion.

Reason of Population Explosion

- *Invention of modern medical facilities
- *Illiteracy

Effect of Population Explosion

- *Poverty
- *Environmental degradation
- *Unsustainable environment-over exploitation of natural resources

FAMILY WELFARE PROGRAMME

INTRODUCTION

- Family planning means planning by individuals or couples to have the children when they want them.This is responsible parenthood.
- Family welfare programme includes not only planning of births ,but they welfare of whole family by means of total family health care.
- The family welfare programme has high priority in India, because its success depends upon the quality of life of all citizen.

* History of family welfare programme

- It was started in the year 1951.
- In 1977,the government of India redesignated the “national family planning programme” as the “national family programme”, and also changed the name of the ministry of health and family planning to ministry of health and family welfare.
- India is the first country if the world, that implemented the family welfare programme at government level.

*Concept of family welfare programme

- The concept of welfare is basically related to quality of life.
- As such it includes education, nutrition, health, employment, women's welfare and rights, shelter, safe drinking water-all vital factors associated with the concept of welfare.
- It is centrally sponsored programme. For this, the states receive 100% assistance from central government.

*Aims and objectives of family welfare programme

The government of India in the ministry of health and family welfare have started the operational aims and objectives of family welfare programme as follows:

- To promote the adoption of small family size norm, on the basis of voluntary acceptance.
- To ensure adequate supply of contraceptives to all eligible couples within easy each.
- Using the means of mass communication and interpersonal communication to overcome the social and cultural hindrances in adopting the programme or extensive use of public health education for family planning.

*Education functions and motivation

- Explaining the importance and necessity of family planning to masses.
- Using various techniques of teaching and communication to propagate the message of family planning to common man.
- Motivation the eligible couple to use contraceptives and education them about its uses.
- Motivating people for family planning.

*ENVIRONMENT AND HEALTH

* INTRODUCTION TO ENVIRONMENT AND HEALTH

OBJECTIVES:

At the end of this session the participants should be able to conceptualize:

-health in its physical, mental, social and spiritual context.

-environment to be an important factor in the interaction of agent and Host in the epidemiological or ecological triad.

-the physical, biological and psychosocial environment and understand their impact on health.

* COURSE OUTLINE

- Concept of Health and disease.
- Determinants of health ---- Environmental determinant
- Interaction of agent, host and environmental factors ---- Epidemiological triad
- Definition of environment ---- Internal environment and External environment, Macro-environment and micro environment.
- Components of environment ---- Physical, Biological and Psychosocial.

HEALTH

"HEALTH IS A STATE OF COMPLETE PHYSICAL, MENTAL, SOCIAL AND SPIRITUAL WELL-BEING AND NOT MERELY THE ABSENCE OF DISEASE OR INFIRMITY."

in recent years the statement is amplified to include,

"THE ABILITY TO LEAD A SOCIALLY AND ECONOMICALLY PRODUCTIVE LIFE."

HOLISTIC CONCEPT OF HEALTH:

This concept recognizes the strength of social, economic, political and environmental influences on health

*DETERMINANTS OF HEALTH:

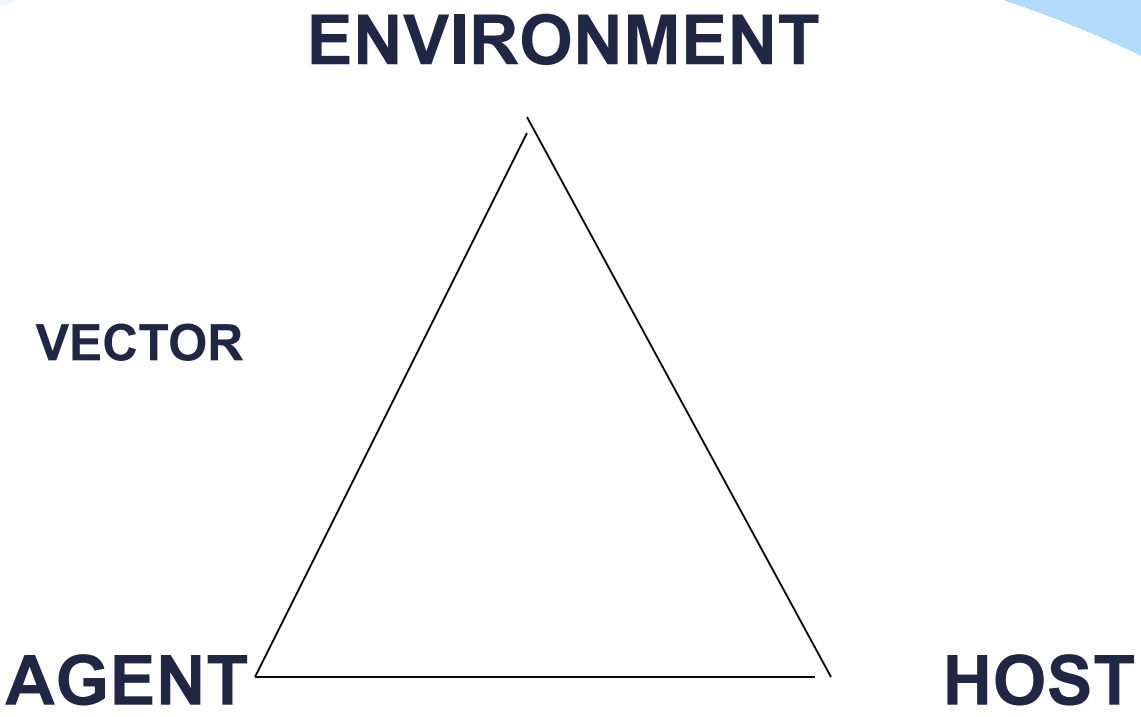
* Heredity
* Health and family welfare services
* Environment
* Life-style
* Socio-economic conditions
* Others

* CONCEPT OF DISEASE

Disease result from complex interaction between man, an agent and the environment.

From ecological point of view disease is defined as “maladjustment of the human organism to the environment”.

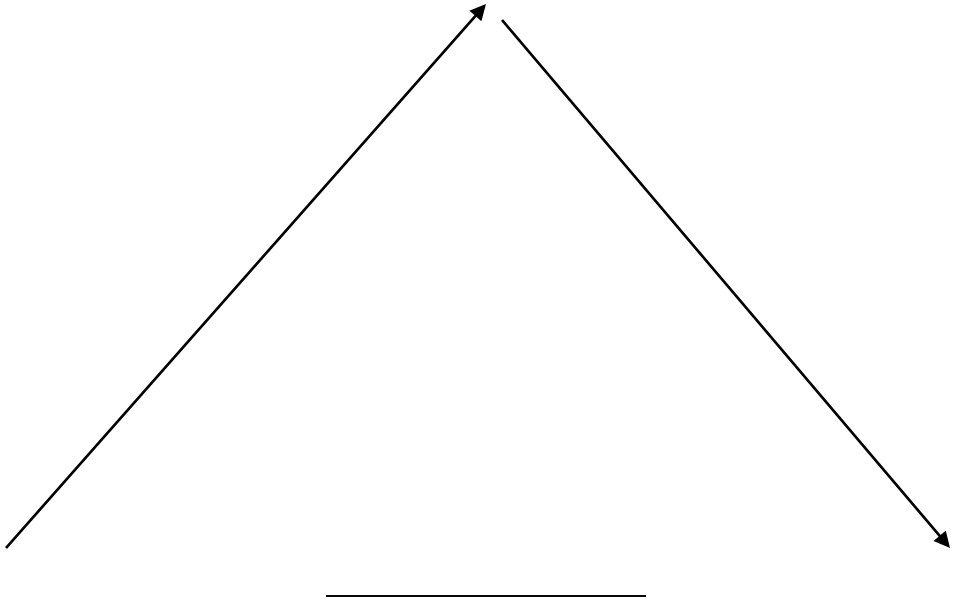
* EPIDEMIOLOGICAL TRIAD



* ENVIRONMENTAL IMPACT

Environment

(Physical, biological and psychosocial)



Human activities **health of individual**

ENVIRONMENT

All that which is external to man is the environment broadly speaking.

The concept of environment is complex.

The external environment or the Macro-environment is said to be responsible for millions of preventable diseases originating in it. Micro-environment is the Domestic environment in which man lives.

The term Internal environment is some time used for the environment inside the body

EXTERNAL ENVIRONMENT:

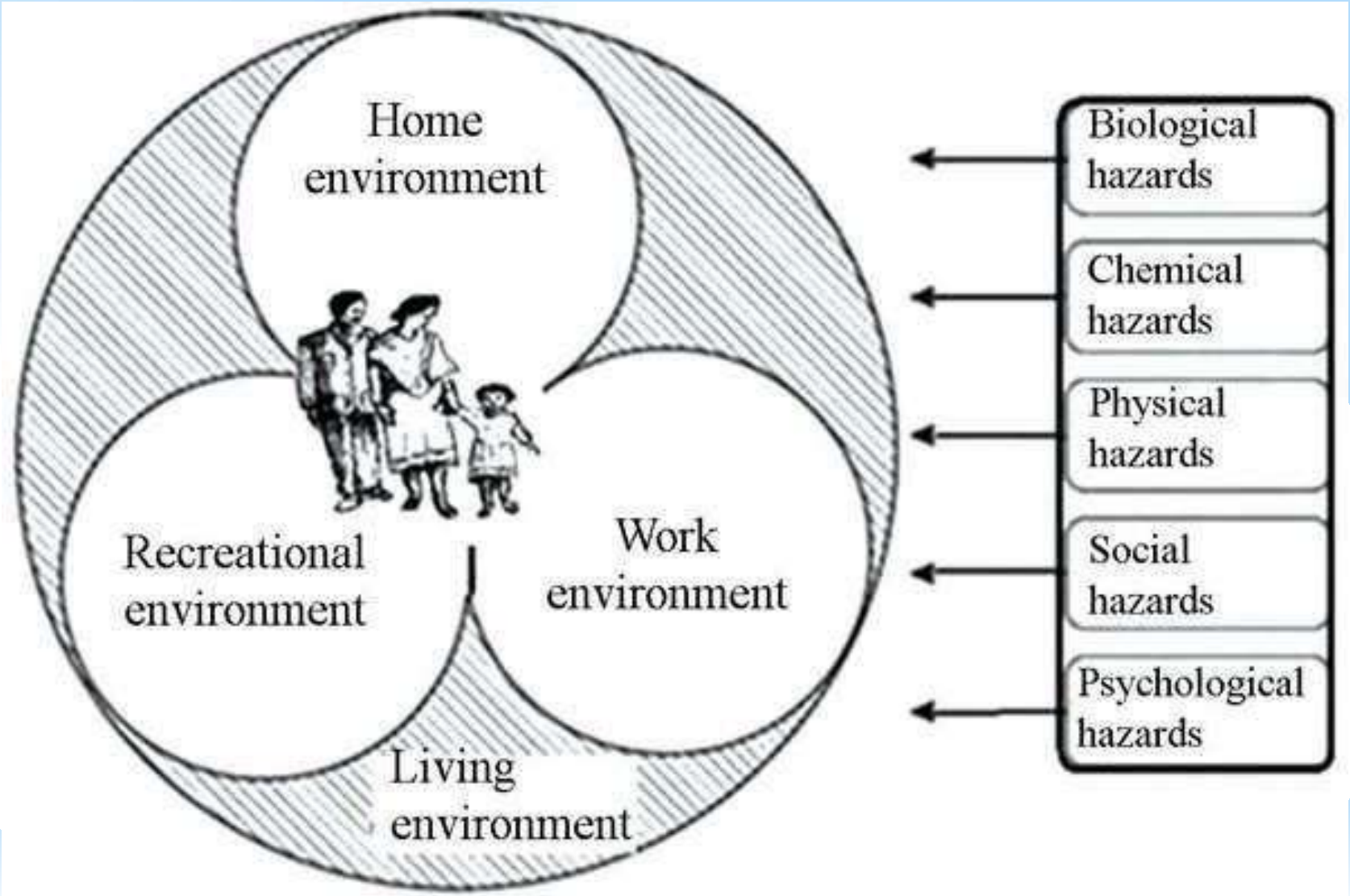
"All that is external to the individual human host, living and non-living, and with which he is in constant interaction".

* COMPONENTS OF ENVIRONMENT:

PHYSICAL: air, water, soil, housing, climate, geography, heat, light, noise, debris, radiation, etc.

BIOLOGICAL: man, viruses, microbial agents, insects, rodents, animals and plants, etc.

PSYCHOSOCIAL: cultural values, customs, beliefs, habits, attitudes, morals, religion, education, lifestyles, community life, health services, social and political organization.


Home environment
Recreational environment
Work environment
Living environment
Biological hazards
Chemical hazards
Physical hazards
Social hazards
Psychological hazards

Environmental hazards

Environmental hazards may be biological, chemical, physical, psychological, sociological, or site and location hazards.

The environment is all external conditions, circumstances, and influences surrounding and affecting the growth and development of an organism or community of organisms.

Environmental health is the study and management of environmental conditions that affect the health and well-being of humans.

* Biological hazards

These are living organisms or their products that are harmful to humans

A. Water-borne diseases are diseases that are transmitted in drinking water

1. Examples are polio virus, hepatitis A virus, Salmonella, Shigella, cholera, amoebic dysentery, Giardia, and Cryptosporidium.
2. These disease organisms are shed into the water in feces, and can produce illness in those who consume untreated, contaminated water.
3. Our municipal water treatment facilities are usually able to purify water by removing these agents or killing them by disinfecting the water.

*

B. Food-borne diseases

are diseases transmitted in or on food

1.Examples of food-borne agents are the bacteria Salmonella, serotype enteritidis, Escherichia coli 0157:H7, as well as other agents.
2.To protect against food-borne diseases, sanitarians from local health departments routinely inspect food service establishments (restaurants) and retail food outlets (supermarkets) to verify that food is being stored and handled properly.

* C. Vector-borne diseases

are those transmitted by insects or other arthropods

1. Examples are St. Louis encephalitis and La Crosse encephalitis transmitted by mosquitoes and plague and murine typhus transmitted by fleas.
2. Improper environmental management can cause vector-borne disease outbreaks.

* II: Chemical hazards

result from mismanagement or misuse of chemicals resulting in an unacceptable risk to human health

A. Pesticides are chemicals

that have been manufactured for the purpose of reducing populations of undesirable organisms (pests)

1.Examples of categories of pesticides are herbicides and insecticides.
2. Most pesticides kill non-target organisms as well as the target, or pest species.
3.The wise use of pesticides can protect human health and agricultural crops.

* B. Environmental tobacco smoke (ETS)

is an environmental hazard produced by millions that smoke

1.Diseases associated with ETS include lung cancer and perhaps heart disease.

2. ETS contains 4, 000 substances.

3. The EPA has classified ETS as a Class A carcinogen.

4. Smoking has been increasingly restricted from public buildings and from many private work sites.

5.Regulation of smoking seems to be the best approach to controlling this pollutant

* C. Lead

is a naturally occurring element that is used in the manufacturing of many industrial and domestic products

1.Health problems associated with the over exposure to lead are anemia, birth defects, bone damage, neurological damage, kidney damage, and others.

2. Exposure is by ingestion and inhalation.

3.Children are particularly at risk from eating peeling lead paint.

4.The prevalence of very high blood lead levels among young children declined significantly between 1984 and 1994 primarily because the removal of lead from gasoline.

5.Occupational exposure is a major source of lead intake for adults.

* III. Physical hazards

include airborne particles, humidity, equipment design and radiation

A. Radon contamination results from over exposure to radon gas.

1. Radon gas arises naturally from the earth and sometimes occurs at dangerous levels in buildings and homes.
2. Breathing in radon gas can cause lung cancer.
3. Homes can be tested for the presence of radon gas for $20.

IV. Sociological hazards

are those that result from living in a society where one experiences noise, lack of privacy and overcrowding.

A. Population growth may be a sociological hazard.

1. Principles

a.Growth of living populations can be expressed as an S curve with a lag phase, log phase and equilibrium phase.

b.When environmental resources can support no further growth, the population has reached the equilibrium phase and the environment is said to be at its carrying capacity

*V. Site and Location Hazards

A. Natural disasters are geographical and meteorological events of such magnitude and proximity to communities that they produce significant damage and injuries.

1. Examples are cyclones, earthquakes, floods, hurricanes, tornadoes, typhoons, and volcanic eruptions.
2. The magnitude of devastation of these events can sometimes be great.
3. Biological, psychological and sociological hazards may increase following a natural disaster.

*Human Rights

*Human Rights are the fundamental rights, which are possessed by all human beings irrespective of their caste, nationality, sex and language.

*Universal Declaration of Human Rights

*Human right to Freedom.
*Human right to Property.
*Human right to Freedom of Religion.
*Human right to Culture and Education.
*Human right to Constitutional Remedies.
*Human right to Equality.
*Human right against Exploitation.
*Human right to Food and Environment.
*Human right to Good Health.

*Indian Constitution

- Article 14: Provides Equality before Law.
- Article 15: Prohibits Discrimination.
- Article 16: Provides Equal Opportunity
- Article 19: Provides Freedom of Speech and Expression.
- Article 20: Provides Protection from Conviction.
- Article 22: Lays down the Rights of a person in Custody.
- Article 23: Prohibits forms of Forced Labour.
- Article 24: Prohibits appointment of Child Labourers.
- Article 25: Provides Freedom to Practice any Religion.
- Article 26: Right to establish Charitable Institutions.
- Article 27: Prohibits Tax for Promoting Religion.
- Article 28: Guarantees Secular Character in Education.
- Article 29: Right to conserve their Language for Minorities.
- Article 30: Right of Minority to run Educational Institutions.
- Article 32: Right to Constitutional Remedies for enforcement of Rights by proceeding in Supreme Court.

*Value Education

- An instrument used to analyse our behaviour and provide proper direction to our Youths.
- Teaches them the distinction Between Right and Wrong.
- Educate them to be Compassionate, helpful, generous and tolerant.

Value-Based Environmental Education

- Provides knowledge about principles of Ecology,Fundamentals of Environment and Biodiversity.
- Creates a sense of duty to take care of the natural resources and to manage them in a sustainable way.

*TYPES OF VALUES

*Social values
*Cultural values
*Individual values
*Global values
*Spiritual values

*Types of Education

1. Formal education
2. Value education

* Types of Values

- Universal Values or Social Values: Expresses the human nature reflected as joy, compassion, tolerance, service, truth, etc.
- Cultural Values: To reflect true and the false behaviour of human beings in language, aesthetics, education, law, economics, etc.
- Individual Values: Parents and Teachers shape individual values to a greater extent.
- Global Values: To reduce disturbance of Harmony leading to ecological imbalance.
- Spiritual Values: To become more self-disciplined.

The Value of Education

Parents speak up on what truly matters


HIV
AIDS

*What Are HIV & AIDS?

*HIV~ (Human Immunodeficiency Virus) The virus compromises the body's ability to handle disease and causes AIDS.

*AIDS~ (Acquired Immune Deficiency Syndrome) It is related to HIV, but they are not one in the same. A person has AIDS only in the final stages of HIV, after the immune system becomes unable to defend itself against foreign invaders like bacteria, other viruses, and allows the development of certain cancers.

*STATISTICS

- Since 1981 1.7 million people in the U.S. are estimated to have been infected with HIV.
- 1 in 5 of those infected are unaware.
- MSM (***Men who have sex with men***) accounted for 61% of all new HIV infections in the U.S. in 2009.
- Over 619,000 with HIV have already died since the epidemic began.

*ETIOLOGY

- The world first became aware of AIDS in the early 1980's.
- Researchers aren't sure exactly when and how HIV developed.
- The most likely theories assume that HIV-1 was transmitted to humans from chimpanzees sometime in the early 20th century.

*SYMPTOMS

When HIV emerges from latency (the period when someone with HIV shows no signs of it) symptoms can include:

- Dry, flaky skin (Xeroderma)
- Chronic fatigue
- Fever that comes and goes (Pyrexia)
- Diarrhea that lasts more than a week
- Heavy night sweats (Hyperhidrosis)
- Rapid weight loss
- Swollen lymph nodes
- White spots on tongue, mouth & throat

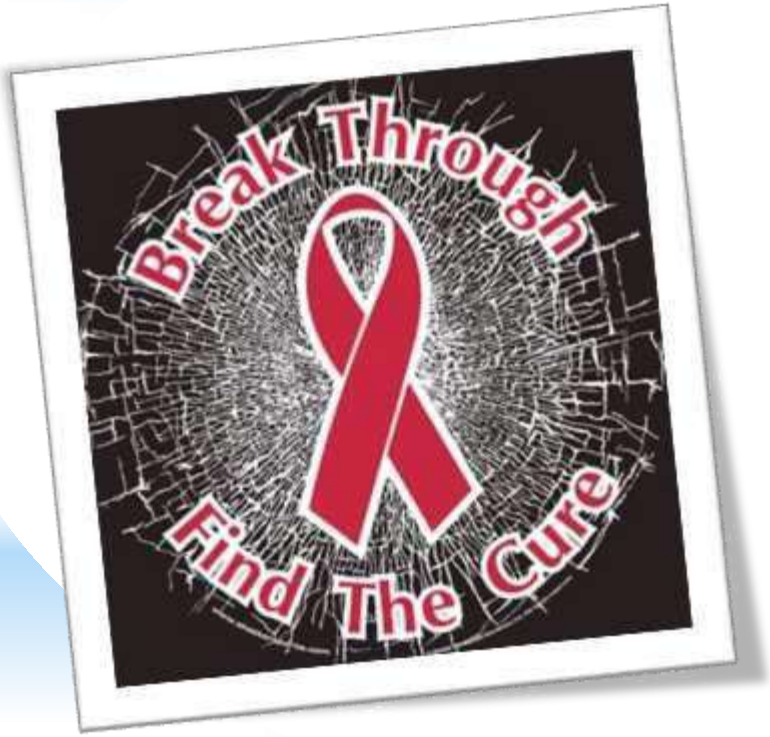
*DIAGNOSIS

To be tested for HIV you usually give a sample of blood, urine or a swab of fluids from your mouth.

It is recommended that if you are sexually active or have multiple partners you should be tested every 6 months.

*TREATMENT

There is no cure for HIV. Antiretroviral therapy can reduce the presence of the virus in the body, but can not eliminate it.



The prognosis for those with HIV is improving with the development of antiretroviral drugs that help reduce the amount of HIV in the blood to an “undetectable viral load”

*PREVENTION

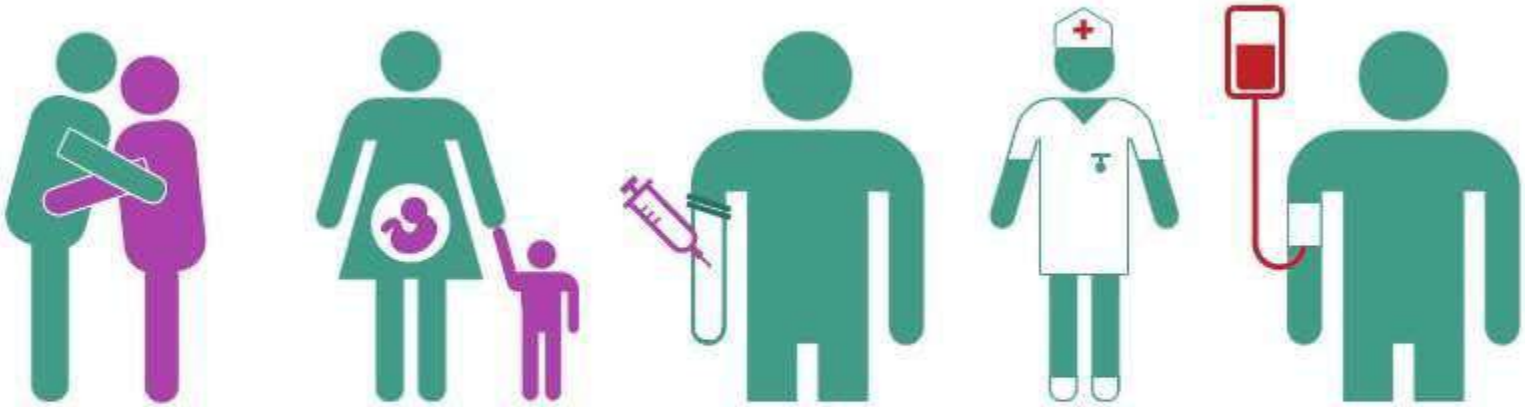
- To prevent HIV transmission during sex you need to use a condom.
- HIV can be spread through vaginal, anal or oral sex.
- Open sores from STDs like herpes & syphilis provide gateways for HIV to enter the body.
- Gonorrhea & Chlamydia may weaken the skin & mucous barriers that help prevent infection.
- If you inject drugs, use a new sterile needle each time to significantly reduce the risk of HIV transmission.

*FACTS

- ✓HIV is not airborne and cannot be caught by touching skin, sweat or saliva.
- ✓You cannot get HIV by holding hands or sharing drinks.
- ✓Mosquito's do not inject other peoples blood when they bite and so can’t spread HIV.

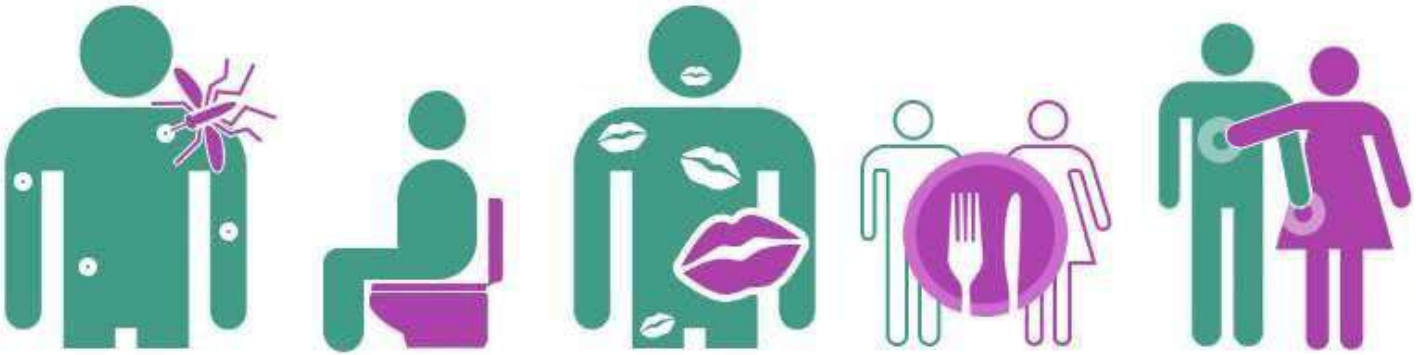
FACTS!!

YOU CAN GET HIV VIA...

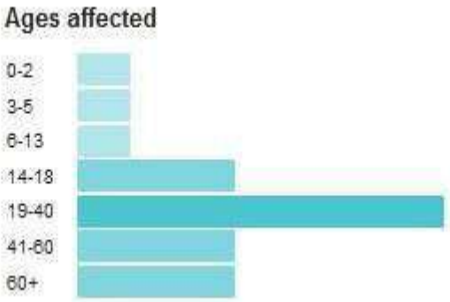


Unprotected sex | Pregnancy, childbirth & | Injecting drugs | Working in healthcare | Blood transfusions & organ/tissue transplants

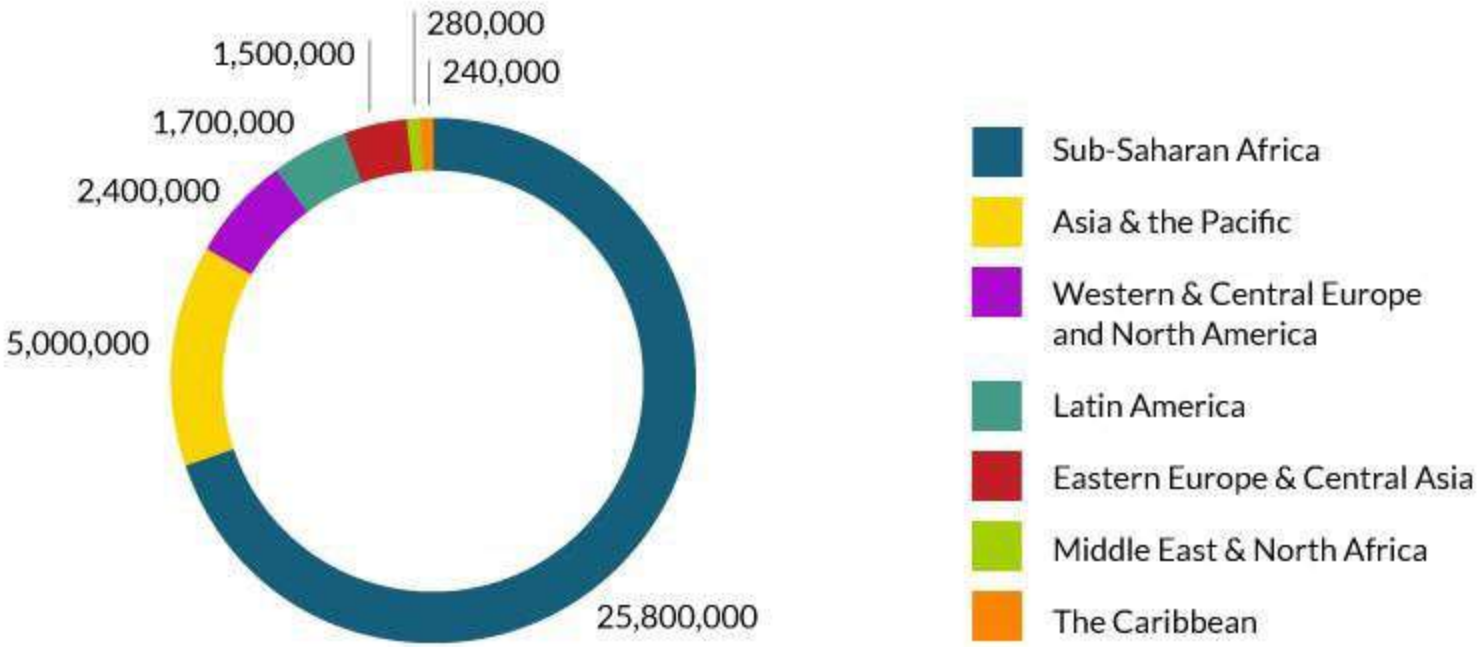
HIV IS NOT TRANSMITTED BY...

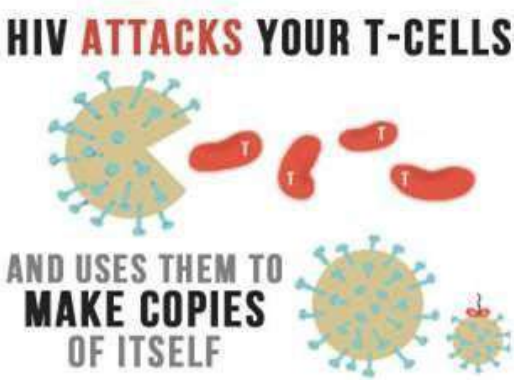


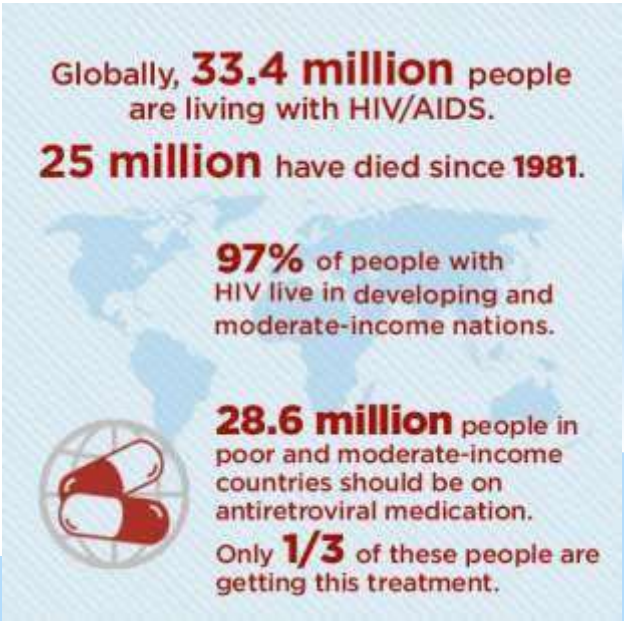
Insect bites | Toilet seats | Kissing | Sharing cutlery | Touching



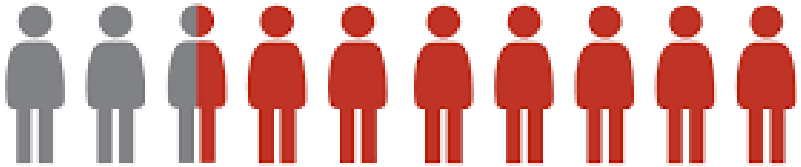
Number of people living with HIV worldwide







Just **25%** of people with HIV are successfully keeping their virus under control through treatment; **75%** are not



*Women Welfare

Main Aim: To improve the status of the women by providing opportunities in education, employment and economical independence.

Need for Women Welfare:

- As women suffer Gender Discrimination.
- Due to physical and mental torture given to them.
- Violation of Human Rights to Women.
- Neglection of Women in Policy making and decision making.

* Objectives of Women Welfare

- To provide Education.
- To impart Vocational Training.
- To generate awareness about the environment.
- To improve employment opportunities.
- To restore Dignity, Status and Equality.

National Commission for Women

a national commission has been created by indian government to take care of the welfare of women. its main objectives are

- to examine constitutional and human rights for women.
- to review existing legislations.
- to sensitize the enforcement and administrative machinery to women's causes.

* Organizations Towards Women Welfare

- NNWM (National Network for Women and Mining): Fighting for the “Gender Audit” of India’s mining companies.
- UNDW (United Nations Decade for Women): Women welfare related issues on international agenda.
- CEDAW (Convention on Elimination of all forms of Discrimination against Women)
- NGO’s as Mahila Mandals
- Ministry for Women and Child Welfare

EDUCATION

2015 UPDATE: % ENROLLED IN SECONDARY SCHOOL*

	AFRICA	WORLD	ASIA	LAC	NORTH AMERICA	OCEANIA	EUROPE
FEMALE	49%	76%	77%	92%	95%	98%	108%
MALE	54%	78%	78%	87%	96%	106%	109%

EMPLOYMENT

2015 UPDATE: % NONAGRICULTURAL WAGE EARNERS WHO ARE WOMEN

ASIA	AFRICA	WORLD	LAC	OCEANIA	EUROPE	NORTH AMERICA
25%	30%	34%	44%	47%	48%	48%

GOVERNMENT

2015 UPDATE: % PARLIAMENTARIANS WHO ARE WOMEN

ASIA	WORLD	AFRICA	NORTH AMERICA	LAC	EUROPE	OCEANIA
18%	20%	21%	21%	23%	25%	25%

*Child Welfare

- Children occupy 40% of the total population.
- Out of 21 Million Children born every year in India, 20 Million are estimated to be working as Child Labours in hazardous industries.

Reason:

Poverty

and

Want of Money

*Organizations towards Child Welfare

*UN Conventions on Rights of Child

It formulated a set of International Standards to promote and protect the well being of Children in our society.

RIGHTS OF CHILDREN:

…Right to Survival

…Right to Participation

…Right to Development

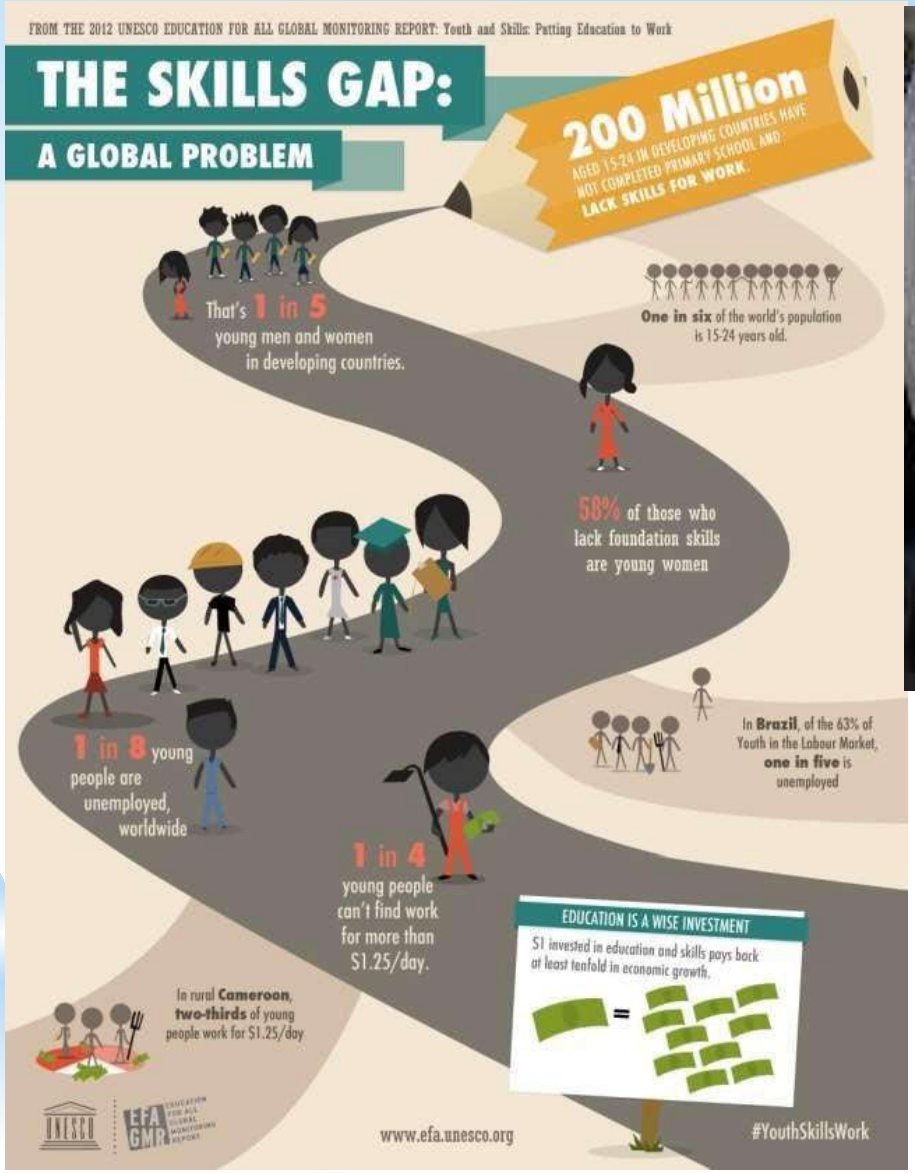
…Right to Protection

* Ministry of HRD:

Concentrates on Childs Health, Education, Nutrition, Sanitation and Environment

* Centre for Science and Environment (CSE): Its Scientific report says that "Children consume more water, food and air than adults and hence more susceptible to environmental contamination.

So it is essential to keep our environment clean to children for better and healthy life.


FROM THE 2012 UNESCO EDUCATION FOR ALL GLOBAL MONITORING REPORT: Youth and Skills: Putting Education to Work
THE SKILLS GAP:
A GLOBAL PROBLEM
200 Million
AGED 15-24 IN DEVELOPING COUNTRIES HAVE NOT COMPLETED PRIMARY SCHOOL AND LACK SKILLS FOR WORK.
That's 1 in 5 young men and women in developing countries.
One in six of the world's population is 15-24 years old.
58% of those who lack foundation skills are young women
1 in 8 young people are unemployed, worldwide
In Brazil, of the 63% of Youth in the Labour Market, one in five is unemployed
1 in 4 young people can't find work for more than $1.25/day.
EDUCATION IS A WISE INVESTMENT
$1 invested in education and skills pays back at least tenfold in economic growth.
In rural Cameroon, two-thirds of young people work for $1.25/day
www.efa.unesco.org
#YouthSkillsWork


waste
recycle
reuse
reduce
water
petrol
oil
power
food
vegetation
electricity
solar-power
wind-power
global-warming
protect
environment
sustainability

WHAT IS EIA?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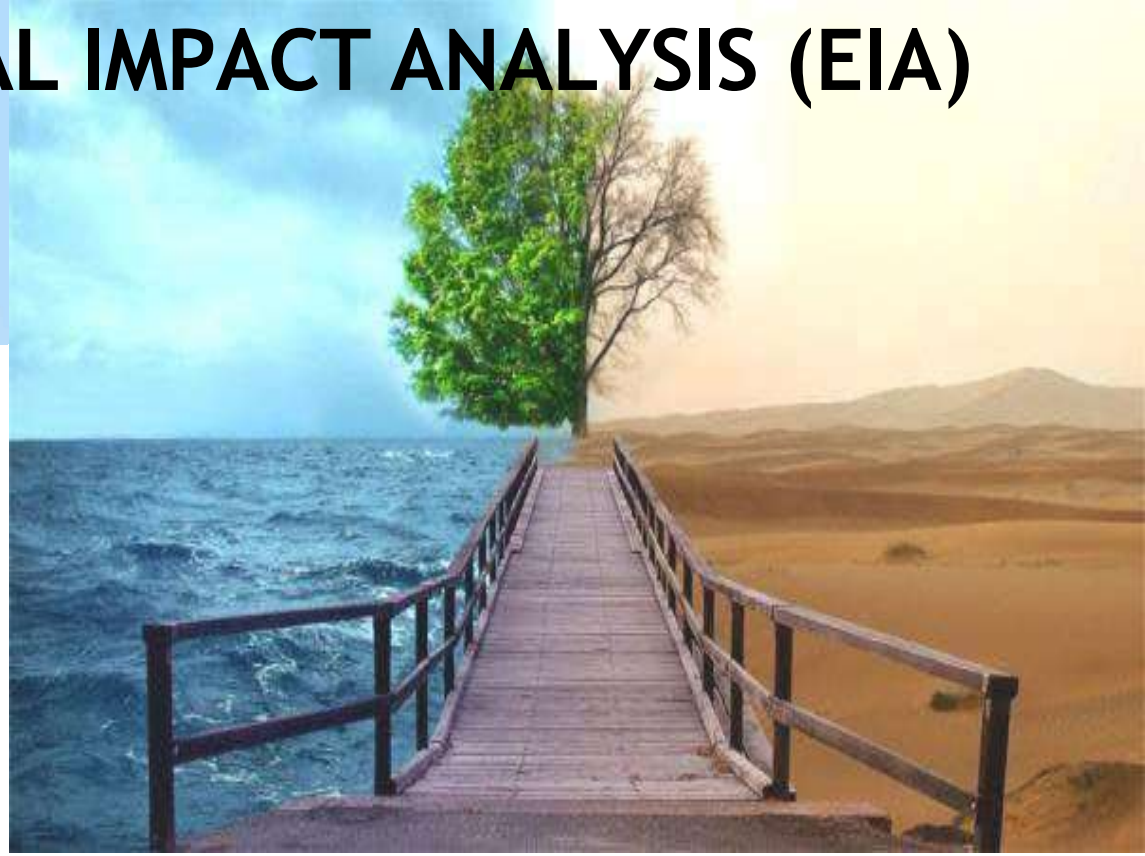
ENVIRONMENTAL IMPACT ANALYSIS (EIA)



It refers to the evaluation of the environmental impacts likely to raise from a major project significantly affecting the environment.

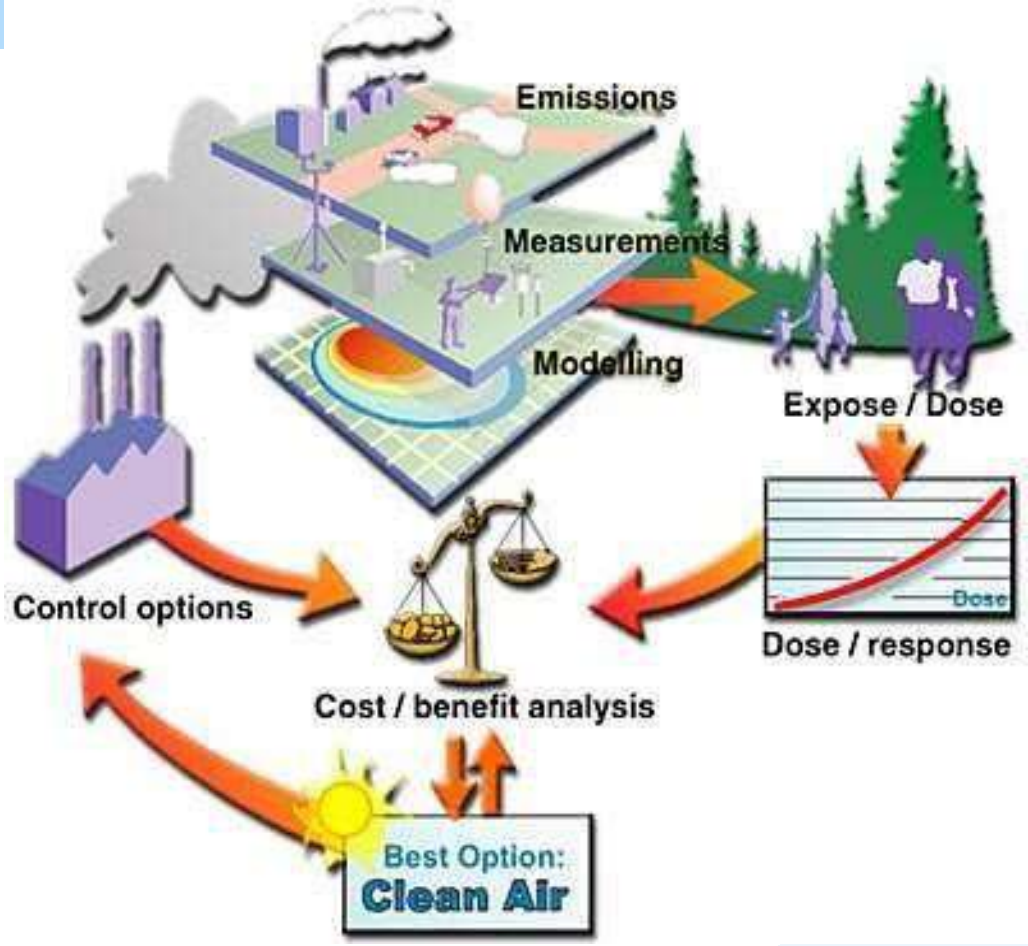
WHAT IS THE PURPOSE OF EIA?

❖It promotes sustainable development by identifying environmentally sound practice and mitigation measures for developments.

❖To ensure that environmental consequences were taken into account during planning, designing & decision Making process.

❖To influence how it is subsequently managed during its implementation.

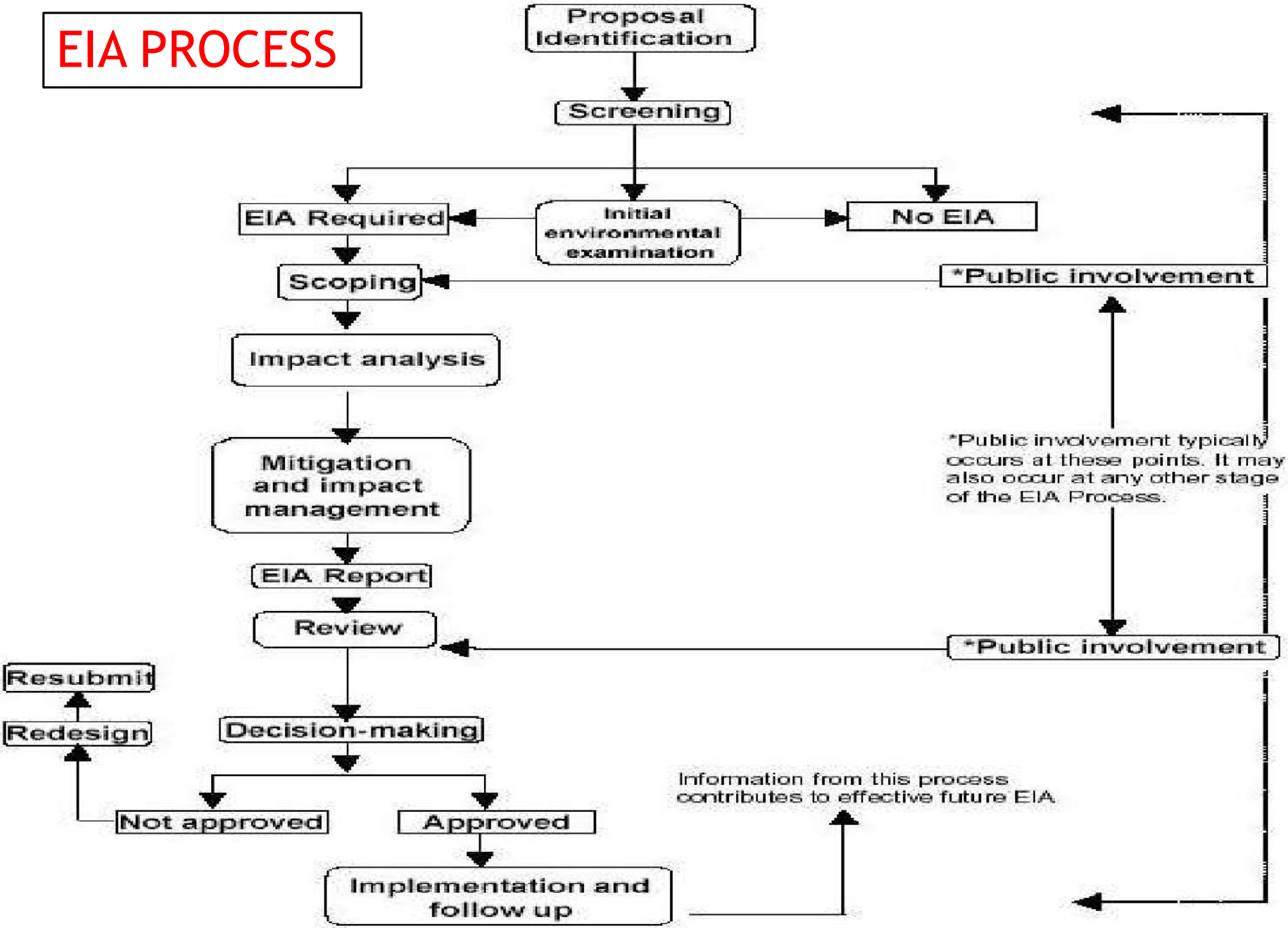
❖The adverse impacts could be avoided or reduce.



*THE ORIGIN OF EIA

Environmental Impact Assessment emerged in the United States as a response to the rise of environmental movements of the 1960s that raised awareness of the serious environmental effects of human activities which were inadequately controlled by existing planning regulation and pollution control measures.

EIA PROCESS


Proposal Identification
Screening
EIA Required
Initial environmental examination
No EIA
Scoping
*Public involvement
Impact analysis
Mitigation and impact management
*Public involvement typically occurs at these points. It may also occur at any other stage of the EIA Process.
EIA Report
Review
*Public involvement
Resubmit
Redesign
Decision-making
Not approved
Approved
Information from this process contributes to effective future EIA
Implementation and follow up

SCREENING

It often results in a categorization of the project and from this a decision is made on whether or not a full EIA is to be carried out.

SCOPING

It is the process of determining which are the most critical issues to study and will involve community participation to some degree. It is at this early stage that EIA can most strongly influence the outline proposal.

PREDICTION AND MITIGATION

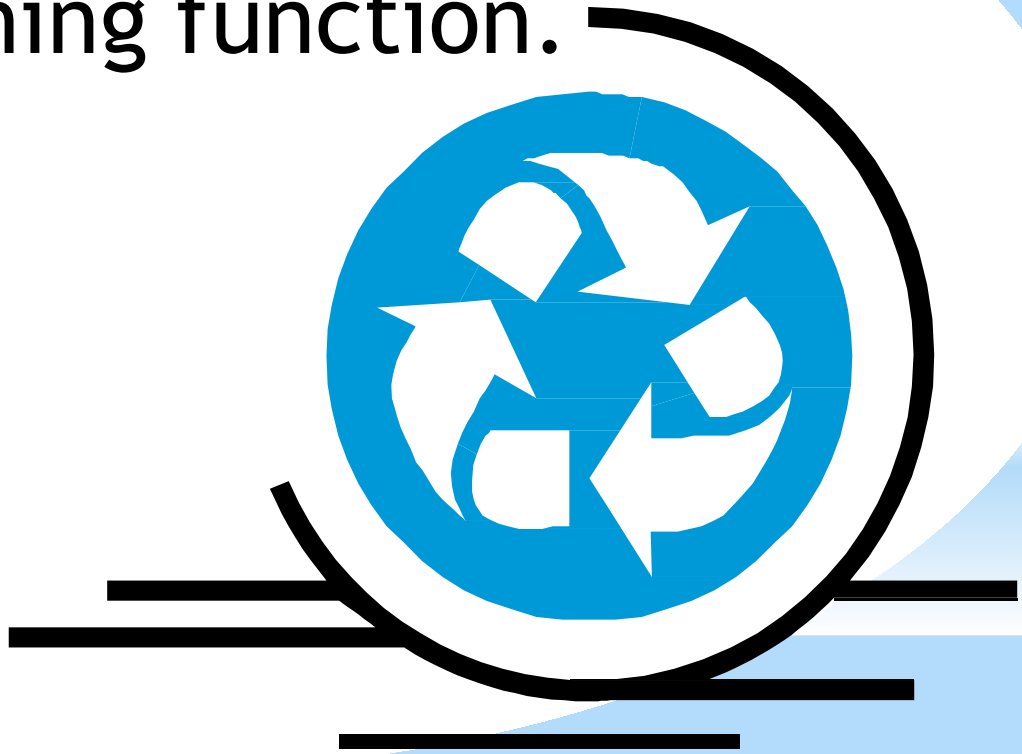
Detailed prediction and mitigation studies follow scoping and are carried out in parallel with feasibility studies.

MANAGING AND MONITORING

The main output report is called an *Environmental Impact Statement*, and contains a detailed plan for managing and monitoring environmental impacts both during and after implementation.

AUDIT /REVIEW

Finally, an audit of the EIA process is carried out some time after implementation. The audit serves a useful feedback and learning function.

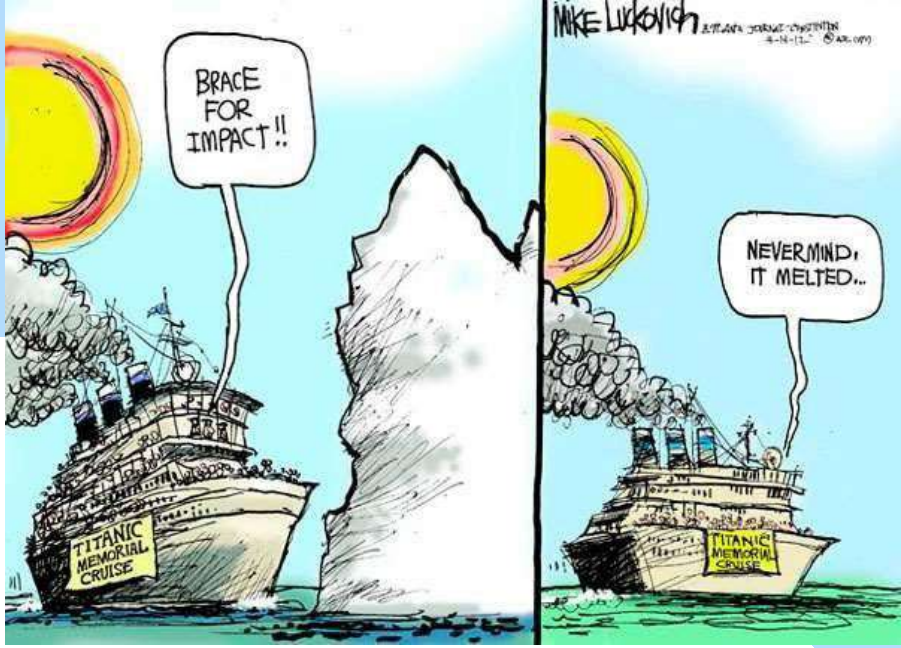


EXTERNALITIES OF EIA

Positive Externalities:

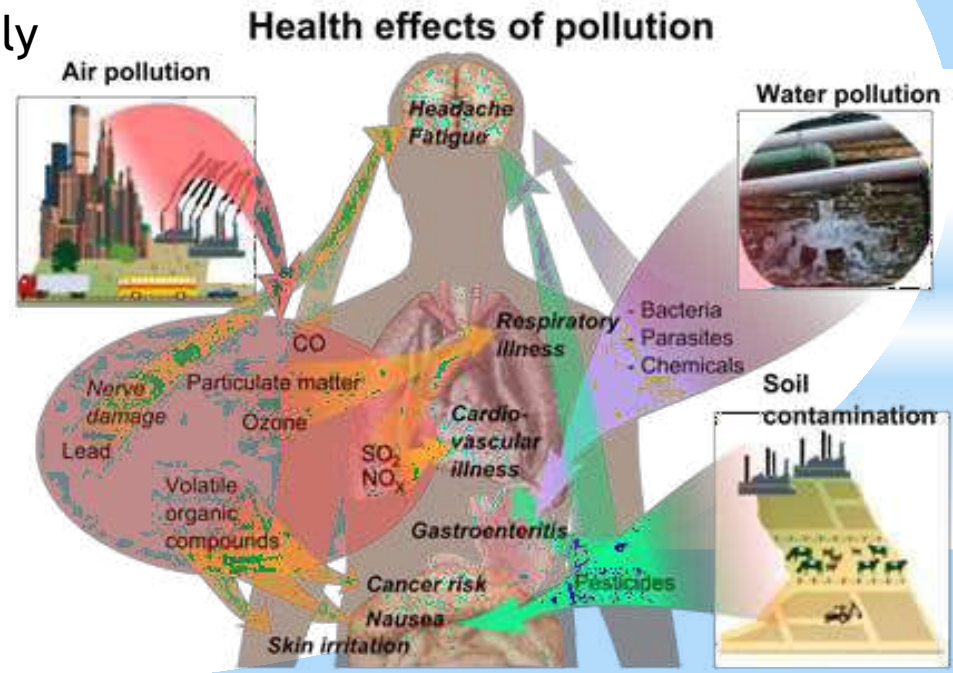
1. New jobs generated, economic growth stimulated.
2. Growth of local business enterprises supported.
3. Development of supporting and complementary industries.
4. Influx of capital and disposable income.

Negative Externalities:



- **Social impacts**:
  1. Impacts on health of local population.
  2. Increase in crime and deviant behaviour.
  3. Additional pressure on the existing physical infrastructure (sewage, water supply etc.).
  4. Changed cultural values.

- **Environmental impacts**:
  1. Depletion of natural resources.
  2. Destruction of habitats.
  3. Change in ph, oxygen level, toxicity of water.
  4. Global warming.
  5. Ozone depletion.



CONCLUSION

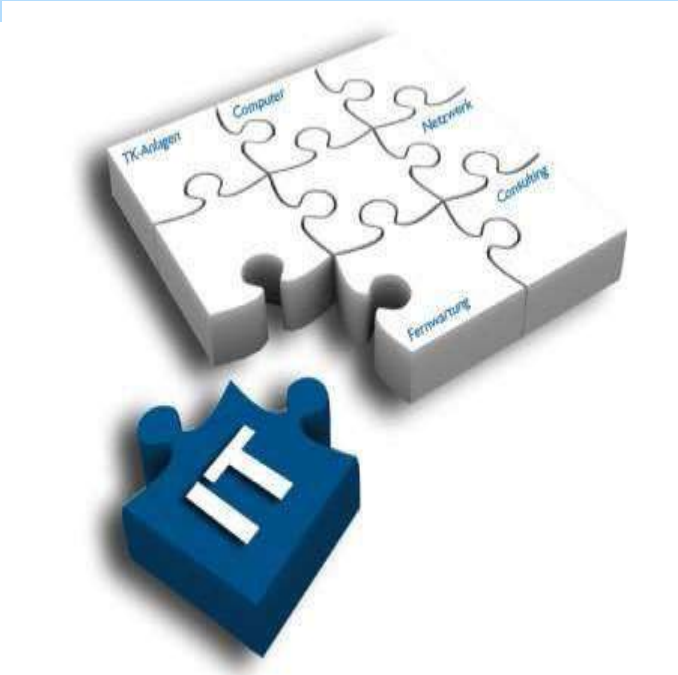
Environment Impact Assessment is a very beneficial step to check, whether the project is environment friendly or not.

Since economic development is result of interaction between natural resources and technology supported by designed for people, so all human activity should be economic, social and environment friendly.

* Role OF IT IN ENVIRONMENT & HUMAN HEALTH

*What's IT ??

Information technology (IT) is the use of any computers, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data.



*IT in India

- IT is the second major Industrial Sector in INDIA.
- It is also the most developing industry.
- Digital INDIA initiative launched by Indian gov.
- Important role in revenue. Employs 2.5 million. Growing at over 9% p.a.
- India is one of the biggest IT capitals of the modern world
- Bangalore, Hyderabad, Kolkata, Chennai, Trivandrum, Noida, Mumbai and Pune contribute to 90% of all the IT export.

*IT FOR ENVIRONMENT

- Easily Accessible Around The World
- Dramatically reduces costs, increases speed, improved productivity and opens up new challenges and opportunities.
- Disaster Management
- Control Over Production
- Inspire environmental action
- Corporate Responsibility
- Reduces Waste

*

*Inspire environmental action

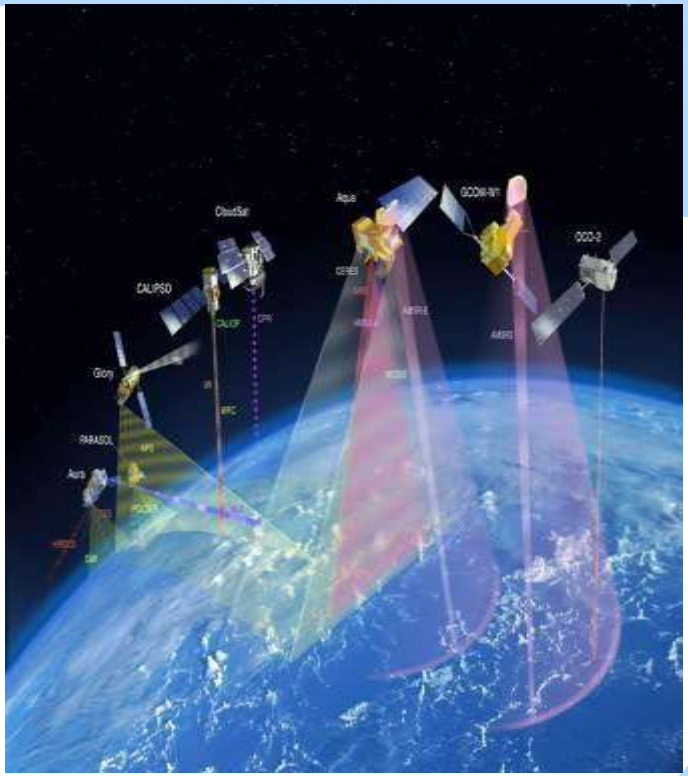
* IT in disaster management

* Though it is not possible to completely avoid the natural disasters, but the sufferings can be minimized by creating proper awareness of the likely disasters and its impact by developing a suitable warning system, disaster preparedness and management of disasters through application of information technology tools.
* The changing trends have opened up a large number of scientific and technological resources and skills to reduce disaster risk.
* Its main applications are :

- GIS and Remote Sensing
- Internet

*Remote sensing

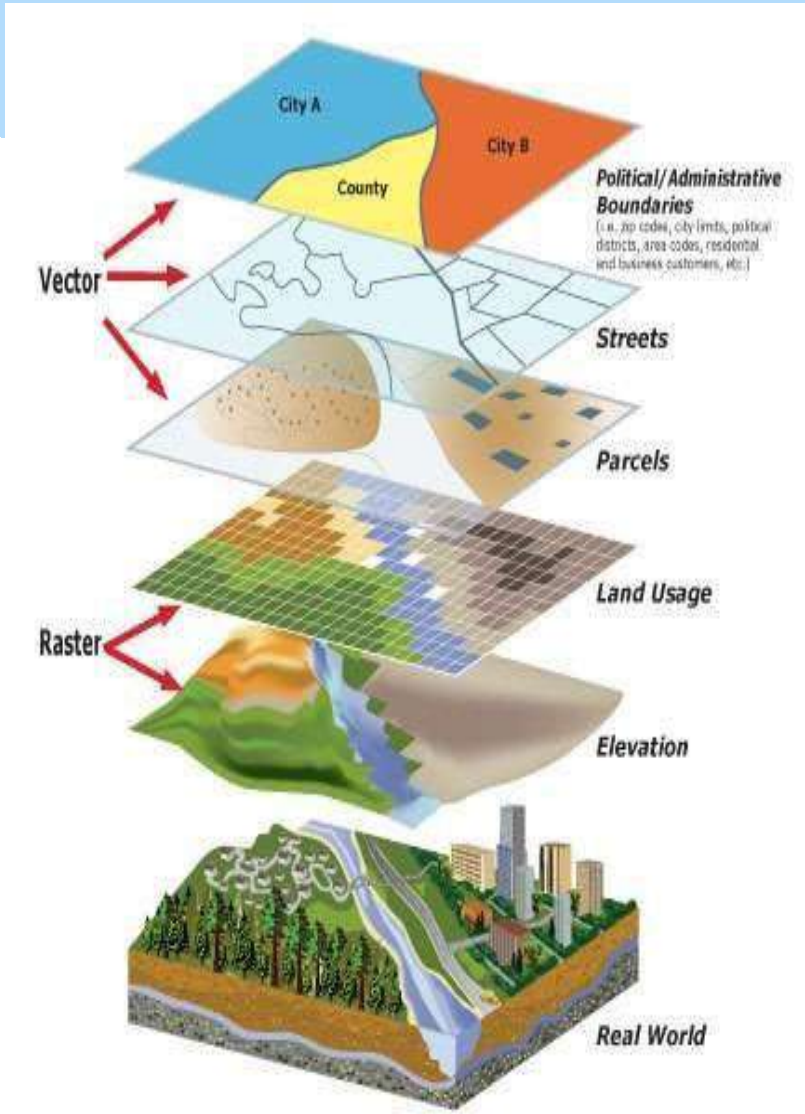
- Collection of information about an object or phenomenon without making physical contact.
- Generally refers to using aerial sensor technologies to detect and classify objects on earth.
- New sensors being developed rapidly.
- Important for weather forecasts, climate change or natural disasters.



* GIS-Geographical Information System

- It is Designed to capture, store, manipulate, analyse, manage and present all types of spatial or geographical data.
- Broader academic discipline of Geoinformatics.
- Science underlying geographic concepts, applications and systems.
- Can use GIS to study the environment, report on the phenomena and model the working and responding of environment to natural and man-made factors.

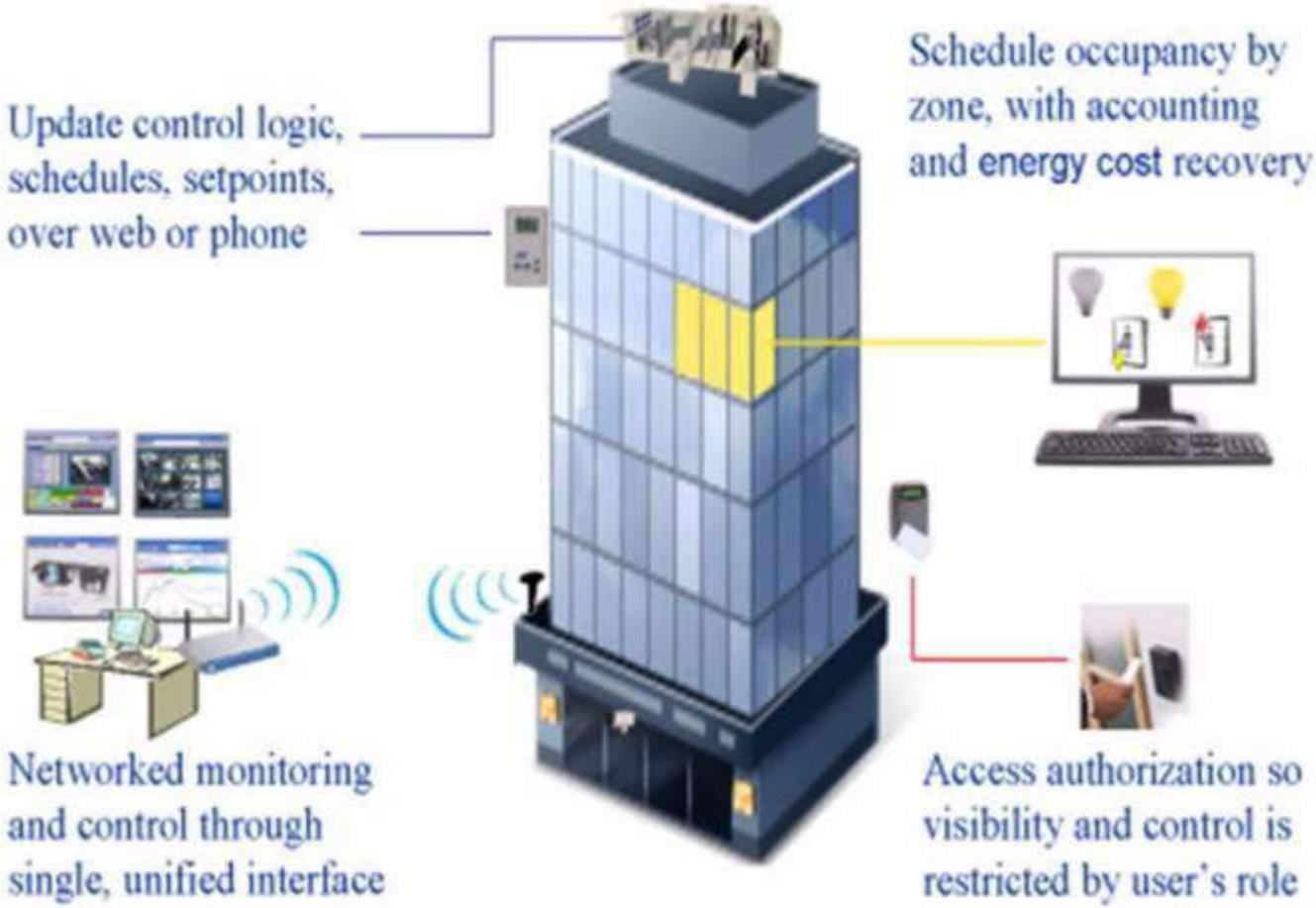
*



* APPLICATION OF REMOTE SENSING AND GIS

- Monitoring wind erosion and water logging
- Monitoring the condition of remnant vegetation
- Cereal crop yield mapping and predicting salinity
- Monitoring rangeland condition
- Cost Effective. Can monitor broader areas
- Measure changes in wildlife habitat encroachment
- Model events such as drought impact on forest health
- Improve workflow processes from data gathering and analysis to publication and distribution of findings.

*CONTROL OVER PRODUCTION



*CORPORATE Responsibility

*IT REDUCES waste

- We can store practically unlimited amount of books, pictures and other data that reduces paper waste to a large extent, that helps us in saving a lots of trees.
- Nowadays, the use of E-bills has significantly increased, which also contribute in saving trees.
- Statistical analysis of production and demand over time, accessible worldwide can significantly reduce the wastage.

*E-Cycling

- Obsolete Electronics such as PCs and phones become toxins and carcinogens.
- E-Cycling transforms them into primary and secondary raw materials. Primary consists of working parts like chips etc. and secondary raw materials like zinc, copper, lead, sulphur etc.
- IT Waste is completely recyclable through E-Cycling, so it does not affect the environment or human health in any harmful way.

#FACT : Apple do not uses Lead(Pb) and Arsenic(As) like harmful materials in its products and all of its data centres run on renewable energy.

ROLE OF IT IN HUMAN HEALTH

* Biological equipment

- Most of the biological equipment (be it Lab or Diagnostic medicine) run on programs and algorithms.
- This makes the machines user-friendly and time saving.
- Most machines run on pre-designed programs with specific applications which make usage easier.
- Additive manufacturing (or 3D Printing) also makes use of programming techniques.

*Controlling diseases

- Isolation is one of the major step in controlling highly infectious diseases.
- IT helps in spreading awareness about diseases and preventive measures to be taken.
- This reduces panic and provides information about prevention and if infected, treatment options.
- Several airports in many countries, screened passengers for high temperature and other symptoms via thermal sensors and computers without any manual labour need. This was possible due to applying IT services in medical fields.

*Biomechanics

- Robots that emulate or simulate living biological organisms or are inspired by them chemically or mechanically.
- Nanotechnology use is also being studied.
- Nano-bots are programmed to act as delivery systems within the organism (like blood).
- In biomimicry, robots have to be programmed to make the mechanism simpler and more effective.
- Research on humanoid robots is also becoming increasingly popular.

*E-health

- eHealth is a relatively recent term for healthcare practice supported by electronic processes and communication.
- In case of mental illnesses like depression, eHealth provided anonymity to users. It is also easily accessible.
- It is gaining momentum in academic research as well as in psychology, clinical work, and mental health counselling.

*Databases

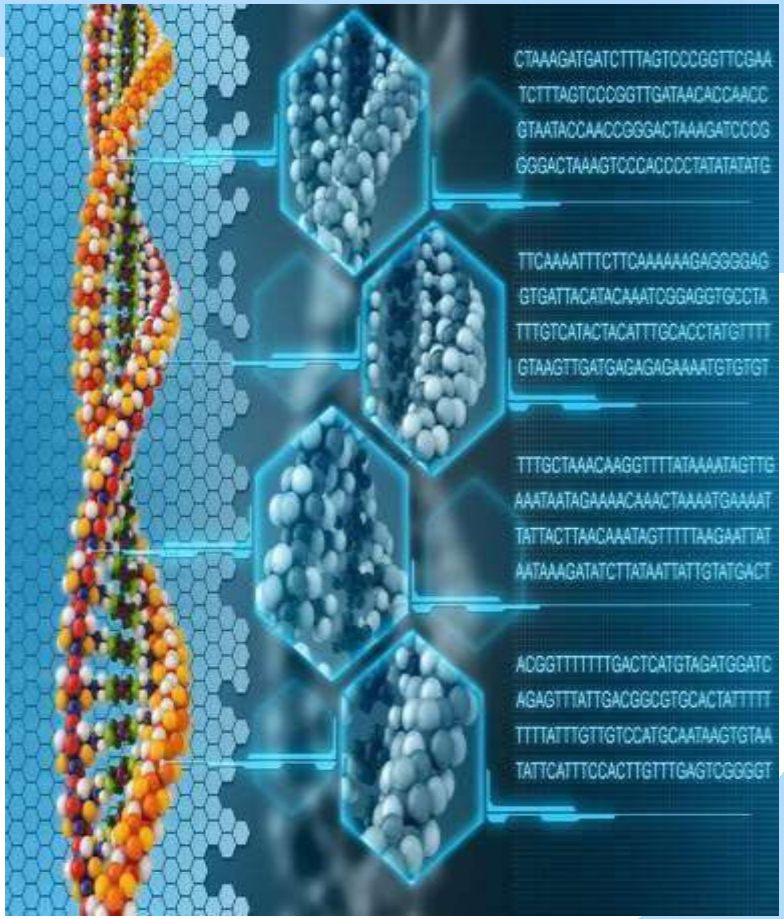
- Data regarding birth, death rates, immunization programs can be maintained more accurately than before in health centres due to computers.
- Information and statistics about diseases like malaria, fluorosis, AIDS, etc.
- DNA databases and genetic information about population, medical records, fingerprints, etc can be stored and accessed.

*Telemedicine

- Use of telecommunication and information technologies in order to provide clinical care at a distance.
- Helps eliminate distance barriers.
- Saves lives in critical care and emergency situations.
- Benefit remote regions with specialists living far away.
- Also eliminates the possibility of transmission in case of infectious diseases. E.g. In MRSA cases

*Bioinformatics

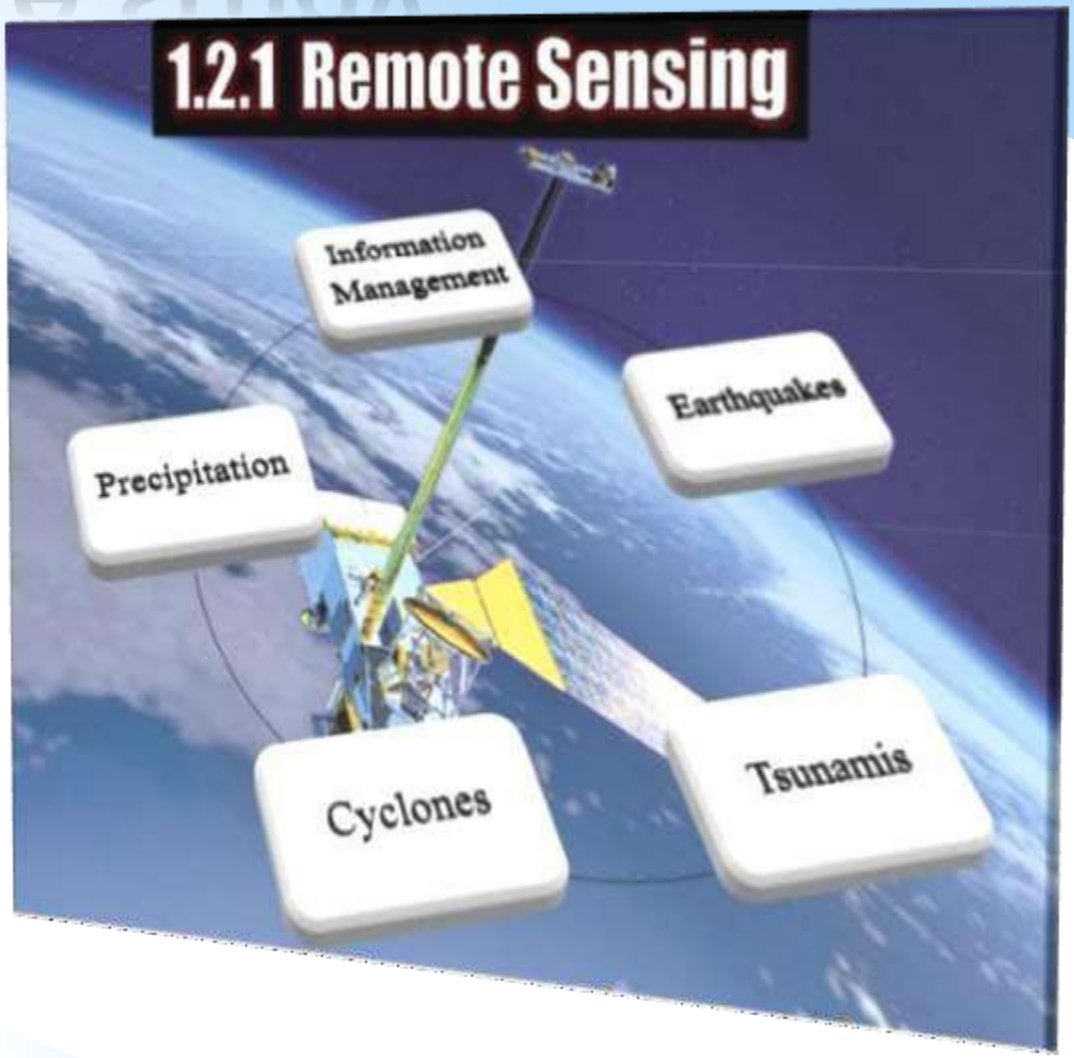
- Inter-disciplinary field that develops methods and software tools for understanding biological data.
- Combines computer science, statistics, mathematics and engineering to study and process biological data.
- Bioinformatics is widely used for drug discovery and thus contributing to human health.
- Creating Hybrid vegetation that are more sustainable under harsh conditions.



*M-Health

- **mHealth** is an abbreviation for **mobile health**, a term used for the practice of medicine and public health supported by mobile devices.
- There are more than 2,00,000 mHealth apps available to consumers and they have increased more than 100 percent over the past two years.
- Improve patients' health condition by enabling him to keep a track of his healthcare.
- They provide a great support in maintaining individual fitness.

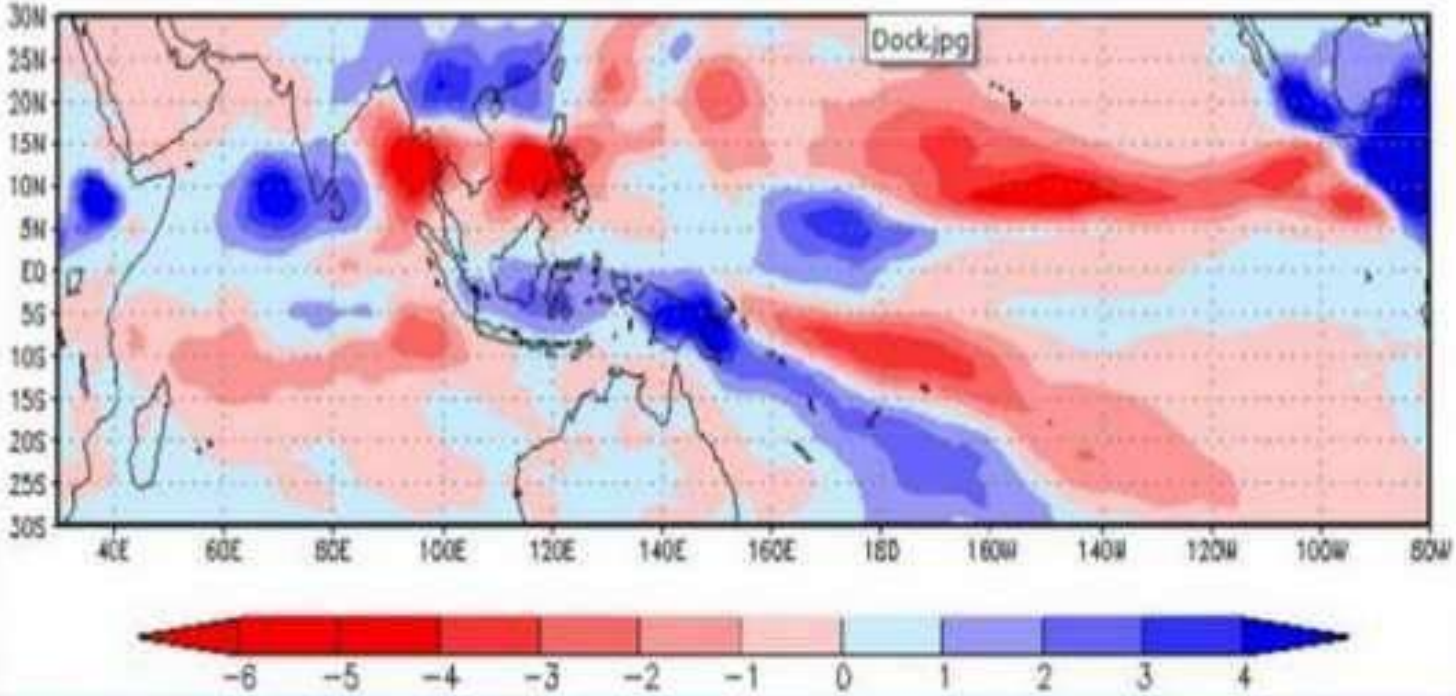
*Case study


1.2.1 Remote Sensing
Information Management
Earthquakes
Precipitation
Cyclones
Tsunamis

Swine Flu Map

Rainfall Anomaly (mm/day) JJAS 2011

(Using CFS Forecast SST June 2011)

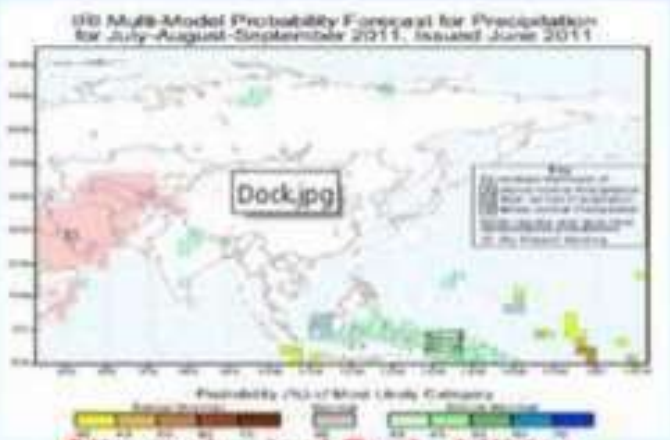


Rainfall over country as a whole Close to Normal

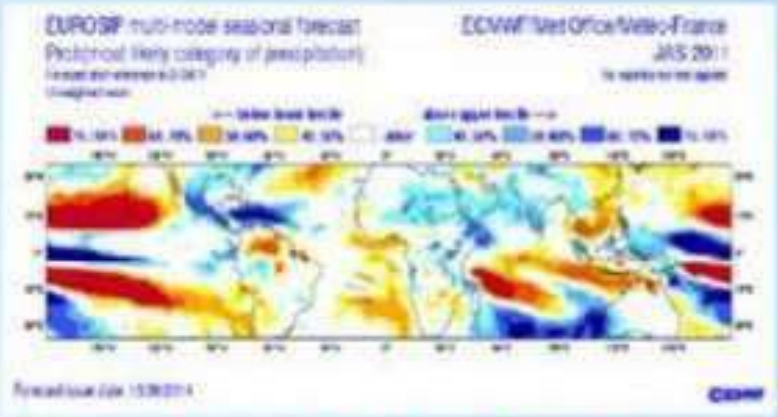
29th June, 2010

भारत मौसम विज्ञान विभाग

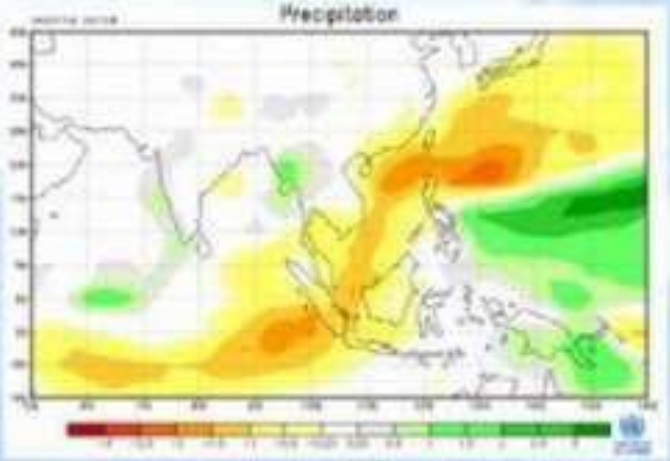
INDIA METEOROLOGICAL DEPARTMENT



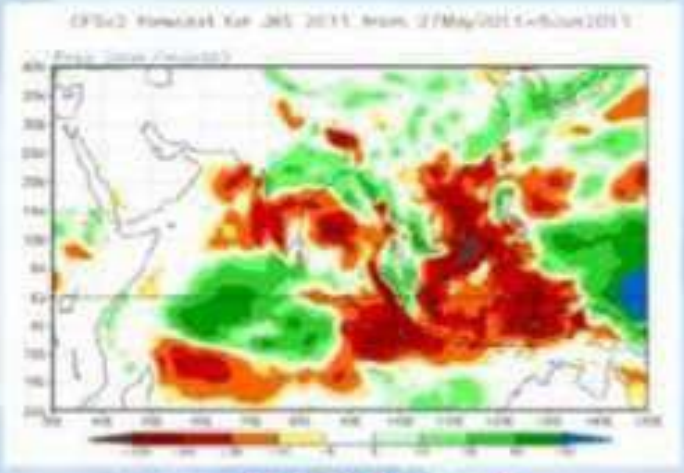
Climatological Probabilities



Normal to Above Normal



Normal



Below Normal

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