

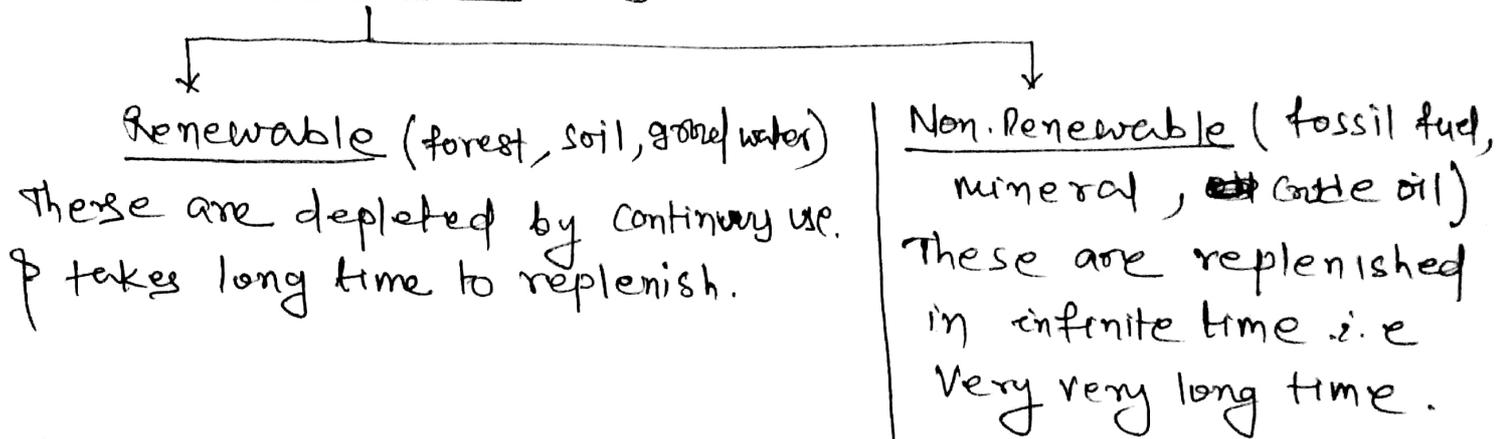
- Environment is the sum of all physical, chemical, geographical, social, economical factors that surround the living organism.
- The biotic parts of hydrosphere, lithosphere & atmosphere which provide support for the survival of organism on the Earth is called Biosphere.
- Env. Studies is a multidisciplinary branch of science which include physics, chemistry, biology, mathematics, agriculture, medicine, geography etc.
- The progress of development in industry, agriculture, transportation & technology has adversely affected the Environment over the years.
- Env. pollution, deforestation, soil erosion, global warming, population explosion has threatened the existence of life on the Earth.
- Many species of life has been extincted, many are endangered. Therefore Env. studies at all levels are introduced to create awareness about the issues among the people.
- The study of individual organism/species is known as Autecology while that of a group of organisms of different species is known as synecology.
- The Govt. has enacted Acts for the cause. Nationally & Internally summits, meetings, debate, slogans & such other creative & innovative happenings are conducted.

Natural Resources

→ These are the materials found in nature that can be converted into useful things for mankind.
 e.g. minerals, water, air, sunlight, forest and so on.

→ There are two types of natural resources.

1. Exhaustible e.g. forest, fuel, water, minerals etc.



→ Stock Resources are the minerals because they are used only once.

→ When resources are excessively used, it gets depleted and consequently poses threat to the future generation.

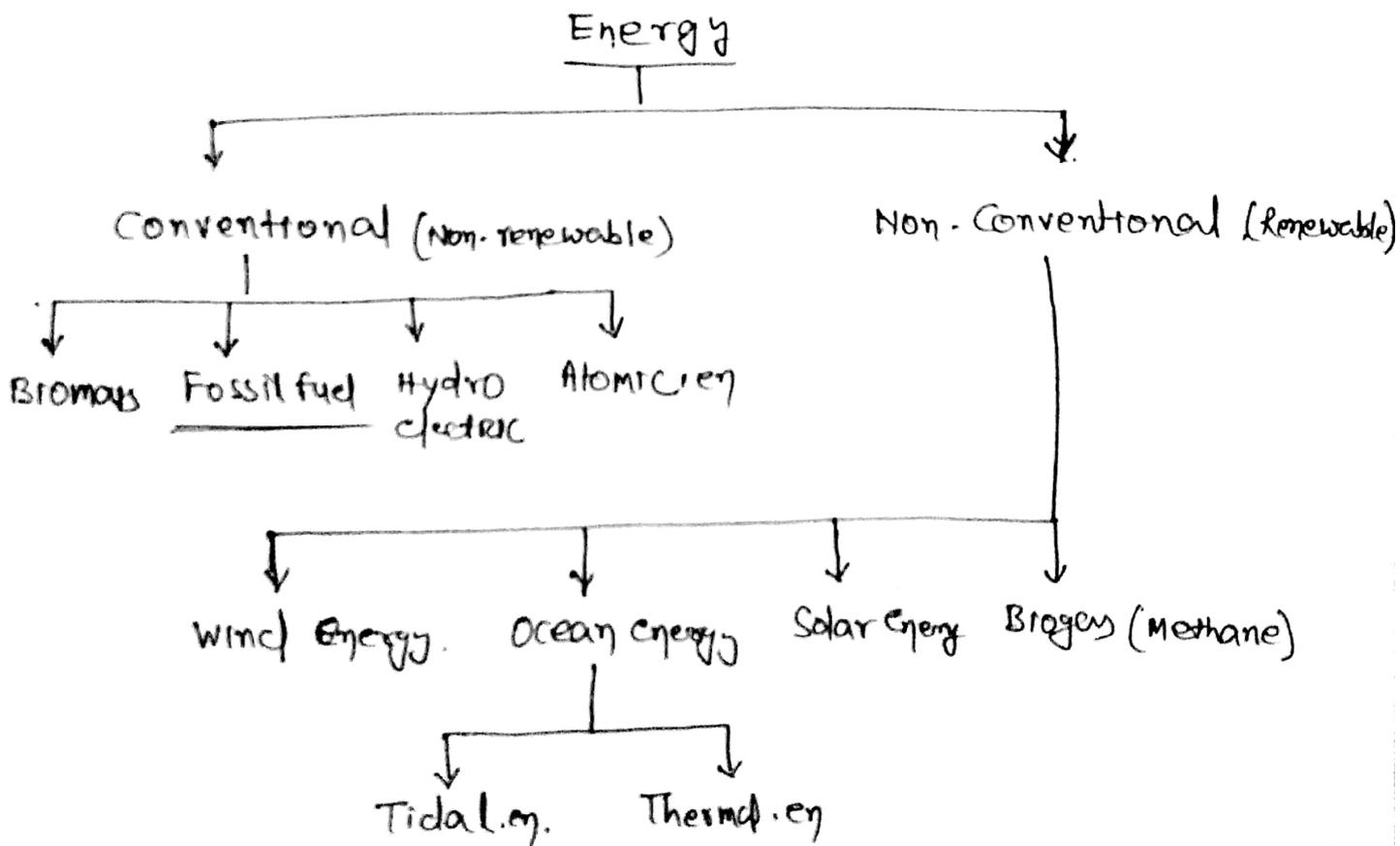
→ Hence use of natural resources should depend on its availability, values & necessities, technology.

2. Inexhaustible e.g. sunlight, air

These resources don't get depleted no matter how much we use it. These are alternative sources of energy ~~for~~ to meet the current demand/need.

→ In present days there is a need of proper planning and management for optimum use of these resources.

- Energy is a basic requirement for all living organisms. There are various sources of energy. Energy consumption of a nation is considered as its development index.
- As the economy of a country grows, its energy intensity rises due to corresponding increase in its En. Consumption.
- Energy requirement depends on
- * Demographic changes
 - * Efficient end-use devices
 - * Technological improvement.
- The sources of energy can be classified as follows.



- Renewable sources of energy are the alternate/energy for future generation.
- Fossil fuels are named so because they are formed under the earth's crust from the fossils/dead remains of living organisms.

wind Energy.

- Wind energy is converted into electric energy with the help of turbines. It is the converted form of kinetic energy.
- Wind blows from warmer region to colder region, wind mills are setup in coastal as well as hotter areas.
- Normal wind speed of 75 km/hr is suitable for the purpose.
- There are two types of wind mills.
 - * Vertical axis wind turbine (\perp to the wind stream)
 - * Horizontal axis wind turbine (\parallel to the wind stream)
- It is an eco-friendly & non-polluting form of energy.
- India has nearly 208 wind power stations with an estimated potential of 20,000 MW (5th in the world)
- A wind generator produces lesser power in summer and at higher altitude because the pressure as well as density falls (lowers).
- The only demerit of wind power is that we don't get average speed wind throughout the year.
- Wind towers are generally installed 100m away and 10m above any obstacle.
- The average capacity of installed wind power facility in India is 250 - 1000 kW.
- The subsystem of a wind mill include a tower, drive train, gearbox & a generator along with other equipments.
- Wind power is used for pumping water, sailing ships & such other applications.

Hydro Electricity.

- Potential Energy of water is converted into electric Energy. Also known as hydel projects
- Falling water from a suitable head rotates turbines which in turn connected to a generator produces electricity.
- Micro (100 kW) and Mini (~1000 kW) hydel projects much setup, while large projects needs dams to build.
- This is economic, eco-friendly & clean energy. India's small hydropower is estimated about 10000 MW.
- Water used for hydropower generation is later used for irrigation & agricultural work and public purposes.
- The only demerit of hydel projects is deforestation, land submergence and rehabilitation.
example: Hirakud Dam project on Mahanadi river.

Geothermal Energy

- It is the heat energy stored under earth's crust. These are areas containing volcanoes, geysers, hot springs.
- Devices for harnessing this energy includes; heat-exchangers & steam turbines.
- North west Himalayan region & western coast in India has potential geo-th. energy.
- Though it is an environment friendly energy, but not economic to be used for public purposes.

Bio-Energy.

- This form of energy is derived from the carbonaceous waste of natural & human activities.
- A bio-gas plant has a digester in which the slurry is fermented. The fuel gas produced is piped for domestic uses. The spent slurry is then used as manure.
- Some bio-mass can be directly converted to liquid fuels i.e. bio-diesel & ethanol.

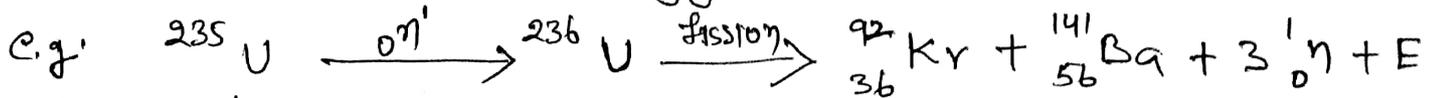
Nuclear Energy.

→ Nucl. energy is harnessed by the splitting of heavy nuclei called radioactive elements i.e. U, Th etc.

→ This process is called nuclear fission.

The elements are made to hit with fast moving projectiles like neutrons.

→ The fission reaction leads to chain reaction and an enormous amount of energy is released.



→ The nucl. power projects in India is based on — pressurized Heavy water Reactor (PHWR) type, where Heavy water (D_2O) is used as moderator.

→ The role of moderator is to slow down the speed of neutron in order to control the fission process.

→ The amount of heat energy released by the fission of 1 gm of ${}^{235}\text{U}$ is $8.22 \times 10^7 \text{ kJ}$ which is equal to the energy produced by burning of 2.5 metric tons of premium coal.

→ Besides having enormous energy potential, its main demerit is the radioactive nature of the fissioned material left after use.

→ Radioactive radiations are potentially dangerous & cause cancer, skin disease, organ amputation.

→ Radioactive waste disposal is even more threatening and there is no full proof technique for it.

* At present the wastes are disposed off by burring deep under the ground or sea bed.

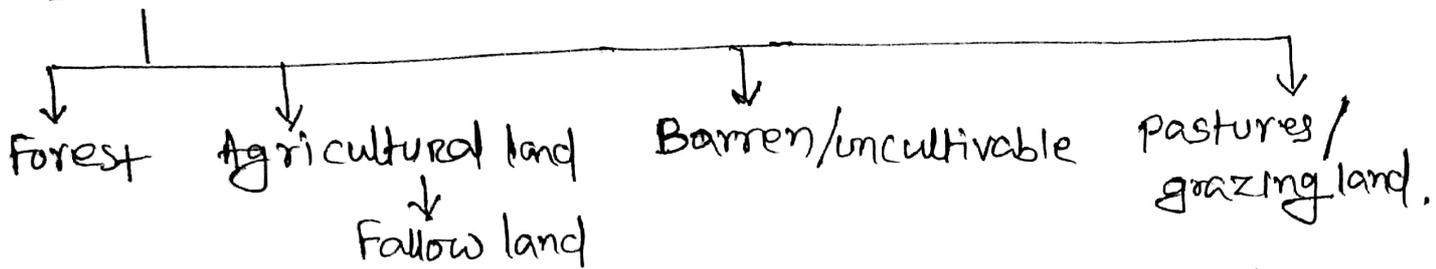
Land Resources

Lecture-8

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→ This valuable resource provide us food, fibre, fuel, ~~and~~ minerals & other basic amenities.

→ classification:



→ * Mapping of land for its classification is known as Land-Capability which depends upon factors like Texture, permeability, wetness, slope & erosion.

→ Top layer of the land is called soil. It is classified

as * Alluvial soil (Agriculture)

* Black Soil: shallow - deep land

* Red soil: contain iron - content.

* Laterites: " oxides of Al, Fe, Mn

* Desert soil: " quartz, feldspar, sand

* Acid soil: has $pH < 7$ (< 5.5)

→ Soil Erosion is the weathering of top layer soil by agents like water, wind & landslides.

* Sheet erosion removes a thin soil cover from a large area/field.

* Rill erosion occurs due to unchecked sheet erosion

* Gully erosion occurs " " Rill erosion.

→ Continuous degradation of forest habitat due to natural / artificial causes is called deforestation.

* natural causes: Flood, storm, landslides, earthquake et

* Artificial " : Construction, Transport, Industries, urbanisation, mining etc

* Forest fire

- Harmful effects of deforestation are .
- * Atmospheric pollution
 - * Soil erosion
 - * Loss of animal habitat, fuels & fodder
 - * Loss of food resources & valuable forest produce
 - * ~~Forest fire~~

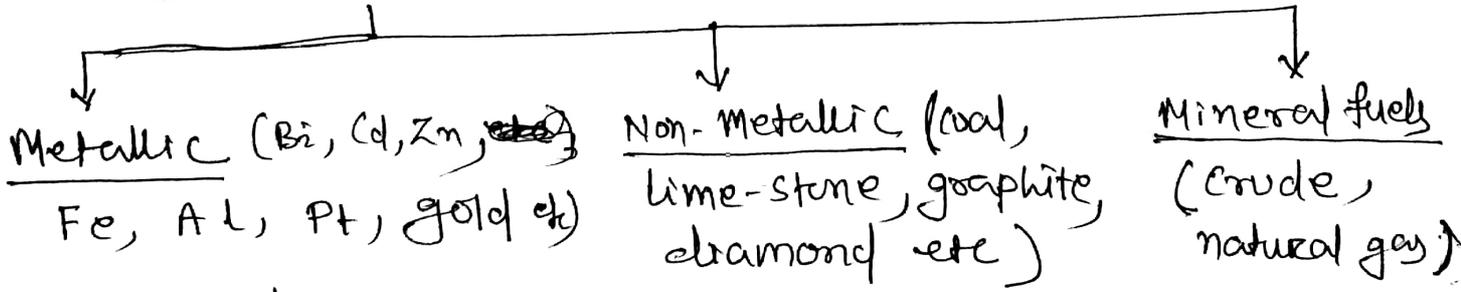
- Deforestation needs to be and can be controlled by
- * Afforestation (plantation)
 - * Farming (cyclic Agriculture)
 - * Long-term planning and management
 - * enactment of Acts & Laws and their enforcement

Mineral Resources

Lecture-9

→ This valuable resource is obtained from mines in solid or liquid state. It is formed under earth's crust at tough atmospheric condition for long time.

→ Types of minerals.



→ India has vast mineral deposits across locations i.e coal (Odisha, Bihar, CG, Jharkhand), Iron (Odisha, Jharkhand, W.B, Kataka), gold (Kataka, A.P), petroleum (Assam, Gujarat, Maharashtra) and so on.

- There are environmental as well as health hazards - related to mineral extraction & uses.
- * Diseases (asthma, skin, Lungs & so on)
 - * Deforestation, land degradation, air pollution, ground water pollution, soil erosion, noise pollution
 - * Climate change

Conservation of Natural Resources:

Lecture-11

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→ Proper planning for the conservation of natural resources is known as Conservation Management which needs:

- * Env. planning
- * Evaluation
- * Monitoring and
- * Impact assessment

} Every individual has certain role/duty to conserve the natural resources.

- 1. As resources are limited & exhaustible, they should not be over-exploited.
2. people should be sensitized by awareness programmes.
3. Afforestation & plantation to be done in large scale.
4. Mixed cropping, crop rotation, proper use of fertilizers, insecticide & pesticides should be taught to farmers.
5. Install/practise rain water harvesting facilities.
6. proper waste disposal, composting to be done
7. Use renewable energy sources as much as possible.
8. Use drip & sprinkle irrigation for agriculture
9. Maintain a balance between human needs & availability of resources and educate local people.

Equitable Use of resources for sustainable life.

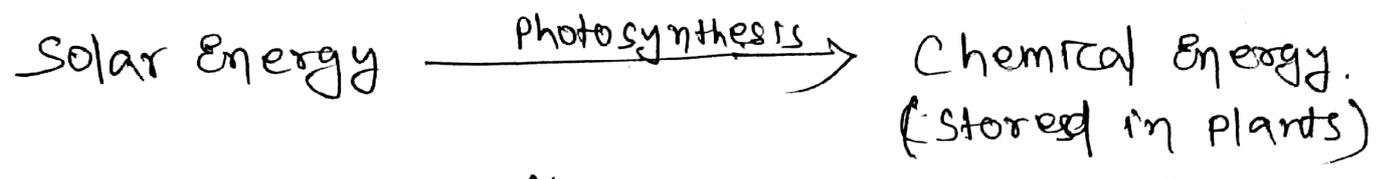
→ The natural resources are ^{not} equally or uniformly distributed across the earth. But there should be equal distribution of n/r for all irrespective of rich or poor.

→ There must be a balance between the need and — consumption for these valuable n/resources.

→ Every country therefore puts stress on the equal distribution of n/r which is known as Equitable Use.

Energy Flow in Ecosystem

→ Energy is needed for every biological activity. It flows in the ecosystem in the given sequence.



* Energy flow in the ecosystem is unidirectional.
i.e from producers \longrightarrow Consumers.

→ There is no 100% flow of energy from producers to consumers. • It flows by 10% from one segment to another in the chain.

* It is called 10% rule of energy flow in ecosystem.

→ Ecological succession:

It is the phenomenon of change undergone by the biotic communities in structure, organisation, physiognomy of the environment at a place in — course of time.

→ The changes are rapid at the initial stage until a dynamic equilibrium is reached; It is then called a stable community.

→ A complete succession is called SERE.

→ Types of Eco-Succession.

↓
Primary Succession.
Species colonize in a virtually free environment.

↓
Secondary Succession
Species develop at location previously occupied

Food chain

→ The Energy flow from one trophic level to another is known as food chain.

producers → Carnivores.

→ Two type of food chains are distinguished in nature.

→ Grazing food chain.

green plants → Herbivores → Carnivores

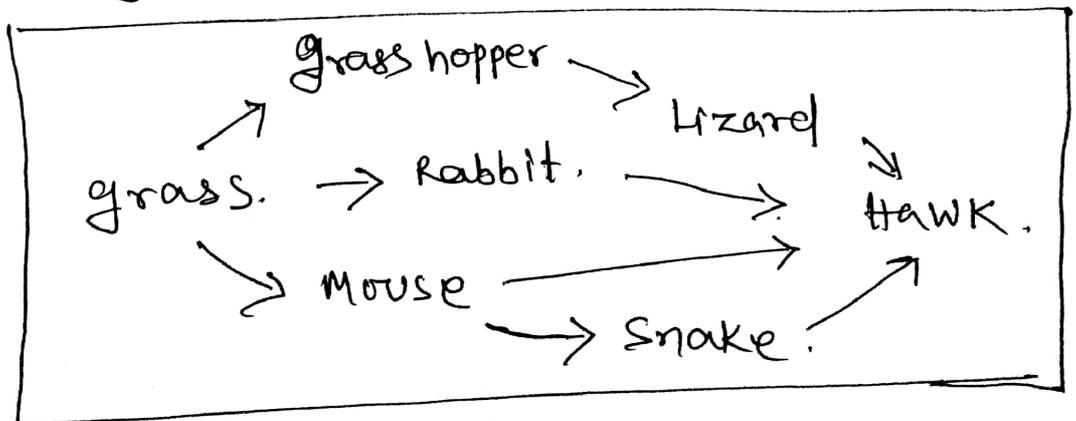
→ Detritus food chain: It is the organic waste, dead matters derived from grazing chain. The energy stored in detritus serve as — source for a group of organisms called detritivores

e.g. algae, bacteria, fungi, insects, mites etc.

They are less dependent on solar energy.

→ Food webs are networks of food chains where different types of organisms are connected at various trophic levels so that there are a number of options of eating and being eaten.

e.g.

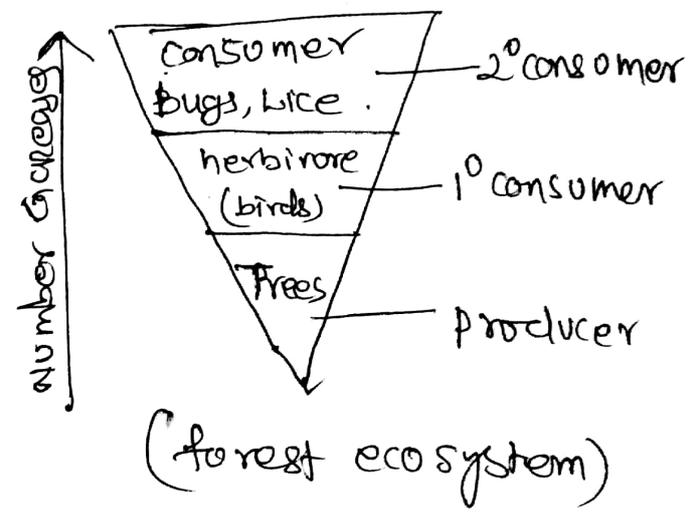
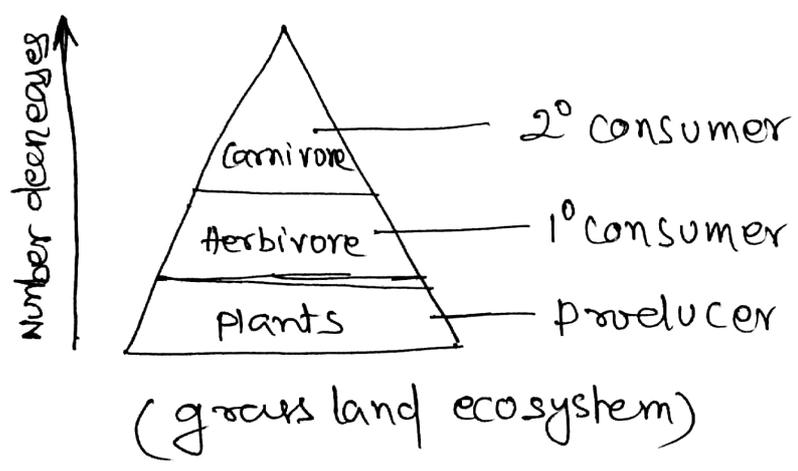


Ecological pyramid.

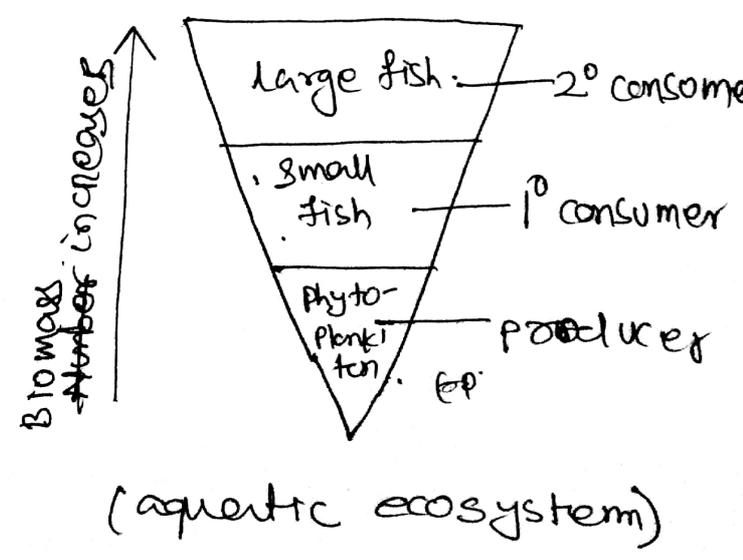
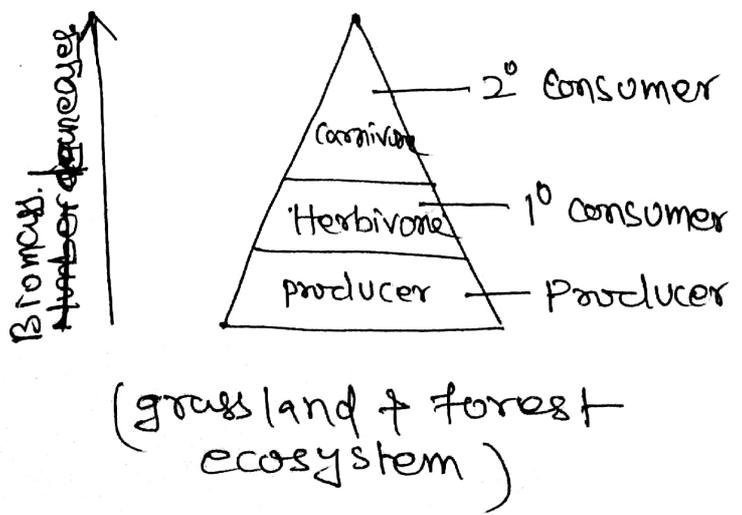
- The number of animal decreases progressively as we go up in the food chain.
- There is some relation between the numbers, biomass and energy content of the producers, consumers (secondary, tertiary). This is known as Ecological-Pyramids or Eltonian pyramids.

→ Eco-pyramids are of three types.

1. pyramids of numbers.

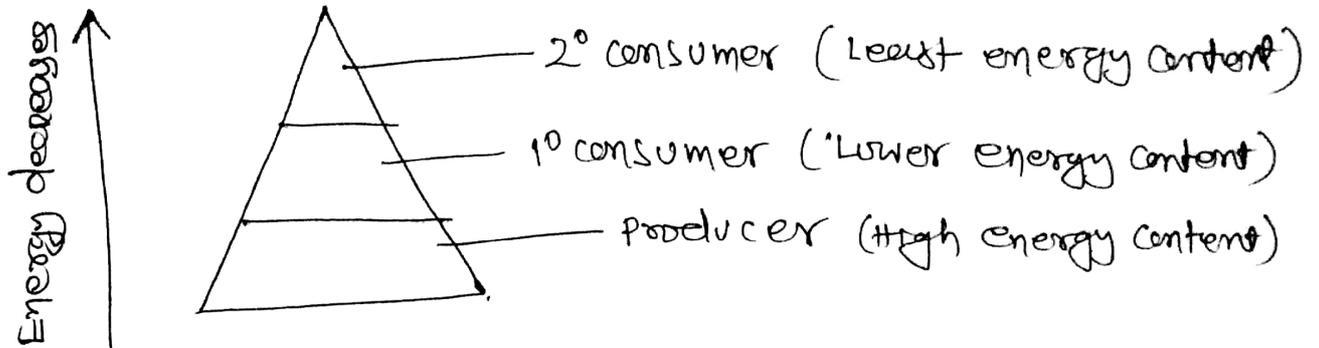


2. pyramid of biomass (weight)



③ Pyramid of Energy

It represents the total quantity of energy utilized by different trophic levels organisms of an ecosystem per unit area over a period of time.



(for all types of ecosystems)

* only a fraction of energy is transferred to the next trophic level (producer → consumer).

Environmental Pollution.

- The environment consists of Atmosphere, Hydrosphere & Lithosphere which have definite composition.
- Due to any reason, if the composition changes then we call it environmental pollution.
- There are different types of pollutions i.e.
 1. Air pollution
 2. Water pollution
 3. Noise pollution
 4. Soil pollution
- Air pollution: Natural activities like forest-fire, volcanic eruption, flood etc and man-made activities like burning of fossil fuel, deforestation, uses of environment unfriendly materials have caused air pollution.
- CO, NO₂, SO₂ & hydrocarbons are primary pollutants and ozone, PAN, photochemical smog are secondary air pollutants. Secondary pollutants are derived from primary pollutants by chemical reaction.
- particulates are finely divided solids floating in the atmosphere. e.g. smoke, dust, aerosol, fog.
- Heavy metals like Pb, Hg, As are poisonous in nature. These are released into the atmosphere by burning of fuel, from various industries.
- Air pollution cause extensive damage to materials, vegetation, animals, reduce visibility, human health.
- * These pollutants need to be identified and controlled at an early stage.

→ Air pollution can be controlled by.

1. using modified procedure or new process and timely monitoring it.
2. Proper site selection for various developmental activities like industry setup.
3. use of selective absorbant and adsorbent for capping gaseous effluents.
4. use of filters, precipitators, scrubbers to check particulate matters.
5. vegetation, afforestation & planting trees can check air pollution.
6. Use of alternative energy i.e solar energy.
7. use of public transport
8. Spreading awarner among people by news-paper, electronic media, social networks, organising competitions, debates, poster makings etc.

Electrostatic precipitator (ESP)

→ It consists of a series of plates which are charged to high voltage. (50 KV).

→ particles with diameter < 0.0001 cm when passes through the plates get charged and precipitate along oppositely charged plates

→ This is used at the chimney of factory & heavy industries.

→ This is caused when the normal composition of water is altered by various agents.

→ Various types of ~~water~~ ^{water} pollutants are

* Oxygen-demanding waste: These are substances which deplete D.O in water for decomposition of organic waste in water.

* Disease causing pathogens or microorganisms.

* Synthetic organic compounds i.e pesticides, detergents, paints, pharmaceuticals etc.

* suspended solids & sediments

* sewage & agricultural run-off

* oil spills

* Inorganic pollutants like heavy metals (Pb, Hg, Cd), metalloids (As, Sb, Se) & non metals (F⁻)

* Rise in the temperature of water ~~by~~ body depletes the D.O level.

→ * Effects of water pollution.

* Alter the taste of water and thus make it unfit for drinking.

* Excess acidic, alkaline or salty water is corrosive in nature

* Pathogens cause water-borne diseases.

* Suspended solids interfere the aeration and photosynthetic activities of aq. flora

* Radioactive isotopes ~~are~~ in water are toxic to aq. life forms.

* Volatile substances (alcohol, ethers) may cause explosion - in sewages.

Control of water pollution:

Lecture-4

(4)

- Water treatment plants construction
- Minimal use of fertilizers, pesticides & insecticides
- People should be encouraged to recycle & reuse water.
- Improved scientific methodology should be used.
- Deforestation should be discouraged.
- Techniques like adsorption, electro dialysis, reverse osmosis can be used for pollutant removal.

Oxygen-Demand, (OD)

- organic wastes and certain chemicals need oxygen for its decomposition in water.
- The oxygen requirement for such purpose is known as oxygen demand or (OD).
- There are two types of OD, i.e.
 - * BOD: It is the oxygen need in mg/l or ppm by bacteria & other microorganism in water to oxidise organic matter present in water.
 - * COD: It is the oxygen need in mg/l or ppm by organic and oxidisable inorganic matter in water.
 - * $COD \gg BOD$ (Appx. 1.6 times).

contd.

Noise pollution.

- Unwanted sound is called noise pollution. It is measured from the sound frequency which is cycles/second or Hertz (Hz)
- Audible sound frequency for human being is 20 Hz — 20 KHz.
- sounds $> 20 \text{ KHz}$ is known as ultrasound and
" $< 20 \text{ Hz}$ is called infrasound.
- The sound intensity or loudness is measured in terms of a unit called decibel (dB).

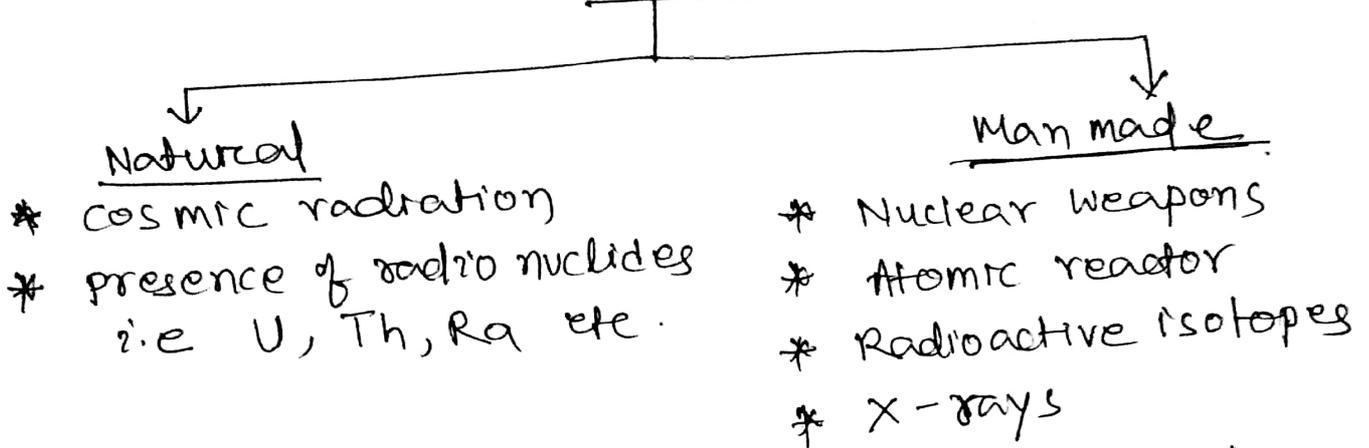
$$1(\text{dB}) = 10 \log \frac{\text{Measured sound intensity}}{\text{Reference sound intensity.}}$$

- * A normal conversation measures 60 dB.
- * Sound level of $> 80 \text{ dB}$ is injurious.

Effects of sound pollution & its control:

- Physiological disorder e.g. loss of physical control, dizziness, disorientation.
- Psychological disorder e.g. Mental or nervous illness, sleep disorder, depression.
- Hearing loss is caused by prolonged high noise.
- Noise pollution can be controlled by.
 - * Application of sound proof technology & materials.
 - * Residential localities should be away from highway & industries.
 - * Enactment of strict legislation & its compliance.

→ It is also known as Radioactive pollution.



→ Radioactive radiations cause damage to

- * RNA, DNA, Enzymes, cells, tissues, organs etc.
- * Long ~~life~~ time (Long half-lives)
- * The damage caused depends upon the energy & type of radiation.

* The energy is expressed in Rads.

1 Rad = absorption of 100 ergs or 10^{-8} J / gm of tissue.

* The total biological effect of radiation is expressed in Rems.

Number of rems = $n \times$ Number of rads

where $n = 1$ for β , γ & X-rays and
 $= 10$ for α -rays or high en. neutrons.

→ Nuclear Hazards can be controlled by

- * disposal after treatment of rad. waste
- * concentrate, contain & stored out of people's reach
- * usually buried under earth or under deep sea.

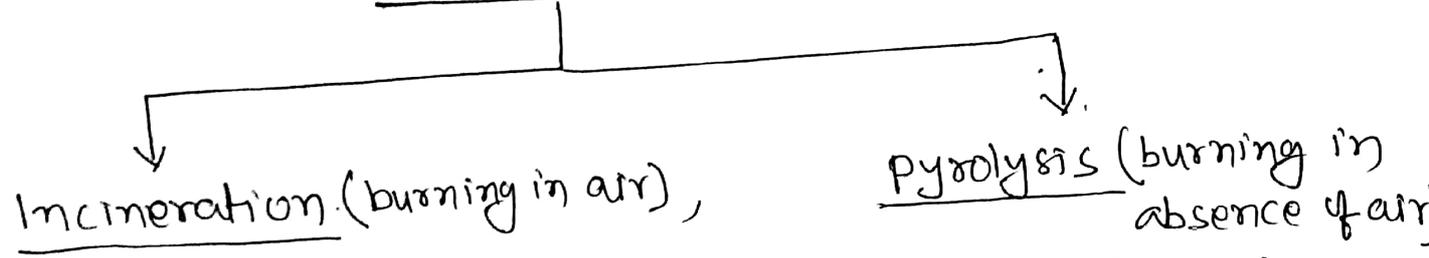
Solid Waste Management

Lecture-7

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- Any material which is unused / discarded by human-being or from animal activities is known as solid waste.
- There are various classification of solid waste which need to be identified, examined for composition and subsequently treated and disposed off.
- Among the various sources, some imp. sources are
 - * Municipal waste (park, office, hospital, public places etc)
 - * Industrial " (factory, construction, mining etc)
 - * Agricultural " (field, dairies, farms, live stock etc)
 - * Hazardous " (electronic, radioactive, biological etc)
- solid waste has many harmful effects e.g.
 1. Growth of microorganisms like, bacteria, fungi, viruses etc.
 2. Cause infectious diseases like cholera, diarrhoea etc
 3. Heavy metals, fumes, smokes etc. from industries cause skin, eye, bronchitic & such other hazards.
 4. Accumulated waste clog drainage, pollute ground as well as underground water & soil.
 5. pesticides, batteries, plastics etc. cause toxic effects on the environment and organisms as well.
- Solid waste management is the collection, transportation, processing and finally disposal of it.
- Solid waste can be disposed off by
 1. Physical removal, sorting out them to reusable decomposable & non-decomposable items.
 2. Dumping the waste away from human habitation.
 3. The waste is spread & bulldozed (compacting) and then the compacted layers are piled - which is known as Bailing.

- 4. The volume of the waste is reduced by grinding (Pulverisation) for easy handling.
- 5. Decomposable waste is processed to make manure (Composting) by microbial activity.
- 6. Waste is scientifically filled in low lands (Landfills)
- 7. Burning of waste under controlled condition is known as Thermal process

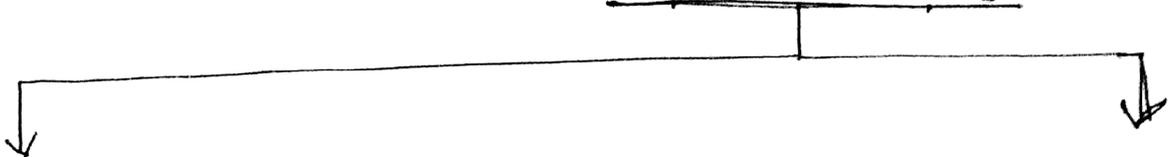


- However all these practices are not free from hazards. Therefore these need to be Reduced, Recycled and Reused (3R).
- Every individual has to extend his/her bit of effort to control and manage the solid wastes by
 - * Awareness programmes
 - * Plantation & conservation of forest
 - * Discourage the use of waste producing things & materials
 - * Control population growth
 - * Govt. should bring strict laws & enforcement for this cause.
 - * Setting up sewage treatment facilities.

Sustainable Development

- Population growth and people's need has led the development of human society.
- Development in the form of Infrastructure, Road & Transport, Construction, Industrial Set up, Mining, habitation & agriculture has put - enormous pressure on natural resources.
- over exploitation of these limited & valuable resources may lead to the collapse of the inter-related systems on the earth.
- If such development continues, a day will come when there will be dearth of resources. To get rid of such disaster we have to focus on sustainable development.
- Thus S.D may be defined as the developments that meet the needs of the present without - compromising the ability of the future generation to meet their needs.
- * So development and Environment protection must go simultaneously.
- * The Earth summit at Rio-de-janeiro in 1992 emphasis on S.D and put the world on its path.
- S.D can be brought about by the following measures:
 1. promoting environmental education & awareness.
 2. 3-R, approach (Reduce, Reuse & Recycle).
 3. use of appropriate & latest technology.

4. Utilize resources as per Carrying Capacity of the Env.



a. Supporting Capacity.

It has been formed of productive & protective systems.

b. Assimilative Capacity.

It has been formed of the systems using wastes produced by human activity.

5. ~~Efforts~~ must also be given to enrich the resources base.

Rain Water Harvesting.

Lecture-2.

- Water is an essential natural resource and is under tremendous pressure due to increased demand.
- Conservation & preservation of water resource are urgently required to be done.
- Now a days Rain water harvesting has become a people's movement in urban as well as rural areas. It will go a long way in the management of ground water.
- The method and technique involved
 1. Roof-top harvesting: recharge underground water level through wells, borewells, shafts etc.
 2. Harnessing runoff in the catchments by constructing checkdams, gabions, dykes etc.
 3. Recharging treated urban & industrial effluents underground for irrigation.

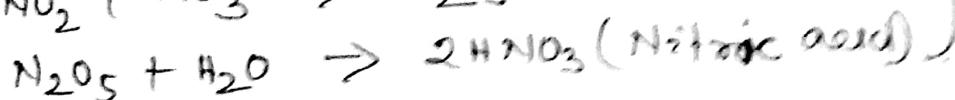
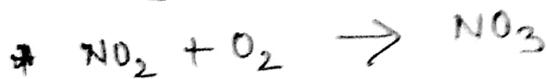
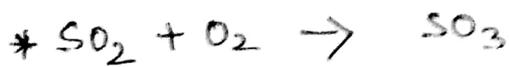
→ Watershed is a drainage area from which runoff resulting from precipitation flows past a single point into a large stream, river, lake or ocean.

Global Warming.

- The troposphere segment of the atmosphere traps heat and cause the average global temp. to rise. It is known as global warming.
- Green House Gases i.e. O_3 , CO_2 , CH_4 , N_2O , CFCs and moisture retain the heat and the process is known as Green - House effect.
- * CFCs are released from A.C, refrigerator, evaporation of industrial solvents, production of aerosols.
- * CH_4 is released by burning of biomass, anaerobic-digestion of vegetation/organic matter, use of natural gas, from petroleum industry.
- * N_2O is released from nylon products, breakdown of fertilizers in soil, livestock waste, nitrated ground water.
- * O_3 (ozone) comes from the oxidation of atmospheric oxygen, from organic compounds and nitrogen oxides.
- Global warming cause the following disastrous effects,
1. climate change, rainfall pattern, plant reproduction, biochemical cycles & species composition etc.
 2. Melting of polar ice caps cause rise in the sea level.
 3. Reduction in biodiversity in aquatic & terrestrial ecosystem.
 4. Alteration in the agricultural production. Some crops may grow unusually while some may not at all.
 5. Adversely affect human health and cause Eco-disturbance.
- Global warming can be controlled by.
1. Afforestation
 2. cut down the rate of use of CFCs & fossil fuels.
 3. use of non-conventional energy resources
 4. use photosynthetic algae to remove atmospheric CO_2
 5. Resort to sustainable development & use energy-efficiently by reducing waste.

Acid Rain

- When the pH of Rainwater is < 7 , it is known as acid rain. Often the pH becomes as low as 2-3.
- Gases like CO_2 , SO_2 , NO_2 are responsible for it.



Strongly acidic

- There are many adverse effects of acid rain are.

1. Threat to the survival of aquatic species.
2. Many useful bacterial & microorganisms are killed which hampers the photosynthesis in water.
3. Retard the agricultural growth & crop production.
4. Leaches useful elements like K, Ca, Mg etc from the top soil of the earth's surface.
5. Cause extensive damage to marbles, limestone, mortar and ~~base~~ corrodes buildings & other materials.
6. Cause health hazards like it affects the nervous system, respiratory, digestive systems, skin irritation etc.

- Ozone O_3 is an Env. friendly gas present in the bottom layer of stratosphere (15-50 km of atmosphere).
- It acts as a shield and protect us from the harmful UV radiation of the sunlight which cause darkening of skin, skin cancer etc.
- Ozone is formed in the atmosphere from oxygen in presence of sunlight.

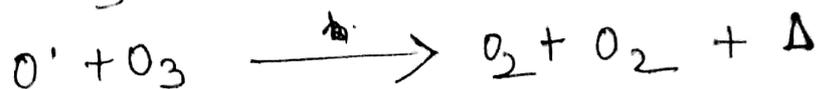
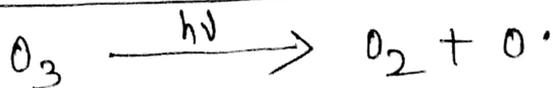


- The thickness of ozone layer (10 ppm) is measured in - Dobson Unit (DU).

1 DU = 0.01 mm at $0^{\circ}C$ and 760 mm of Hg pressure.

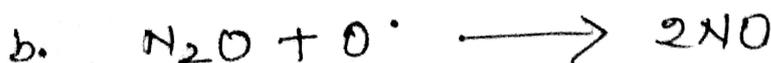
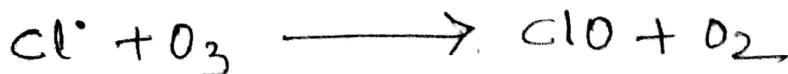
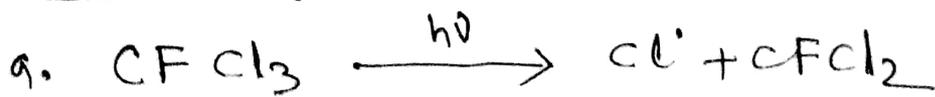
- Due to Env. pollution the ozone layer is fast-depleting from the atmosphere by two mechanism.

1. Natural process.



* Though depletion of O_3 is a natural process, a dynamic equilibrium is maintained between its formation & depletion.

2. Anthropogenic process. (man made/caused)



* NO is also formed by $N_2 + O_2 \xrightarrow{h\nu} 2NO$

→ Agents like CFCs, ClO_x, NO_x etc. cause its depletion.

There are many harmful effects of O₃-loss.

1. Cause carcinogenic hazards.
2. Cause cataract and photokeratitis (eye-disease)
3. It is toxic for aquatic species & phytoplanktons.
4. Loss of plant protein & nutrients.
5. produce intense heat ~~which~~ in the atmosphere which cause water evaporation (stomatal) & loss of soil moisture.

→ For env. balance the amount of O₃ in the atmosphere should be maintained.

→ The use of CFCs & other such gases should be replaced by alternative & env friendly agents.
