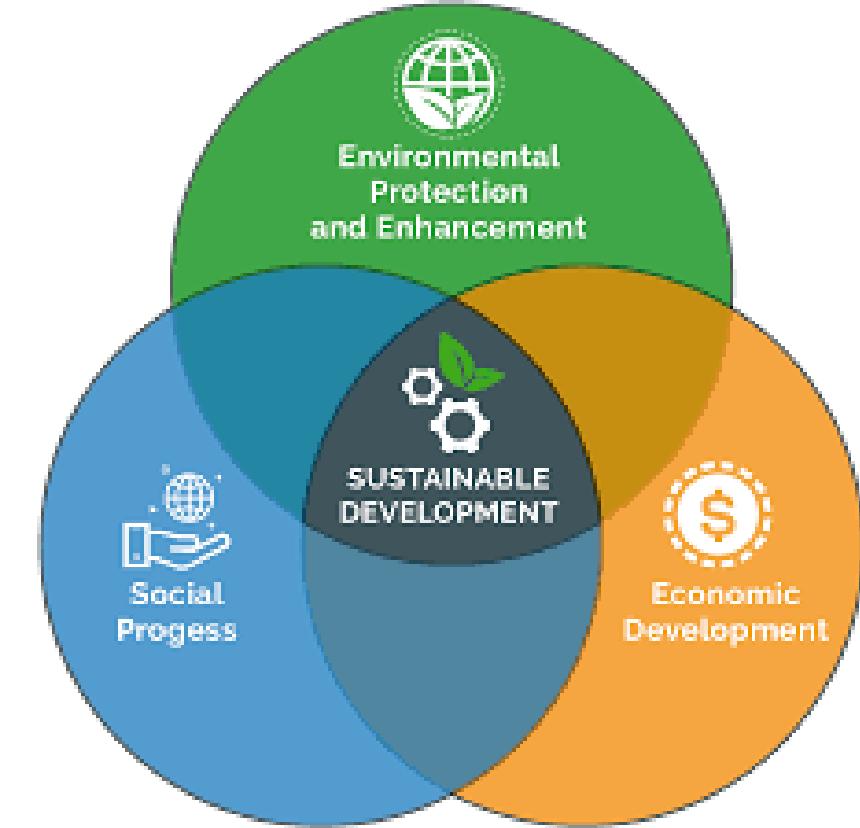


Unit III

- **Social issues and Environment:** Concept of sustainable development; Urban problems related to energy; Water conservation; Waste land reclamation; Resettlement and Rehabilitation; Climate change; Nuclear Accidents; Consumerism and waste products; Laws related to Environment; Pollution, Forest, and Wild life; Environmental impact assessment.

Sustainable Development

- *Sustainable Development* is the process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations.'
- It is the development that meets the needs of the present without compromising the needs of future generations.
- There are **two schools of thought regarding our attitude towards Mother Nature: Frontier Mentality or the Throwaway Society and the Sustainable Society.**



- **Frontier Mentality:** It is a human centric view, mostly believed by technocrats and economists. This is **based on following ideas:**

- (i) The world has an unlimited supply of resources for human use.
- (ii) Humans are apart from nature.
- (iii) Nature is something to overcome.
- (iv) Technology will advance with these ideas but only at the cost of our natural resources which are very limited.



Sustainable Development:

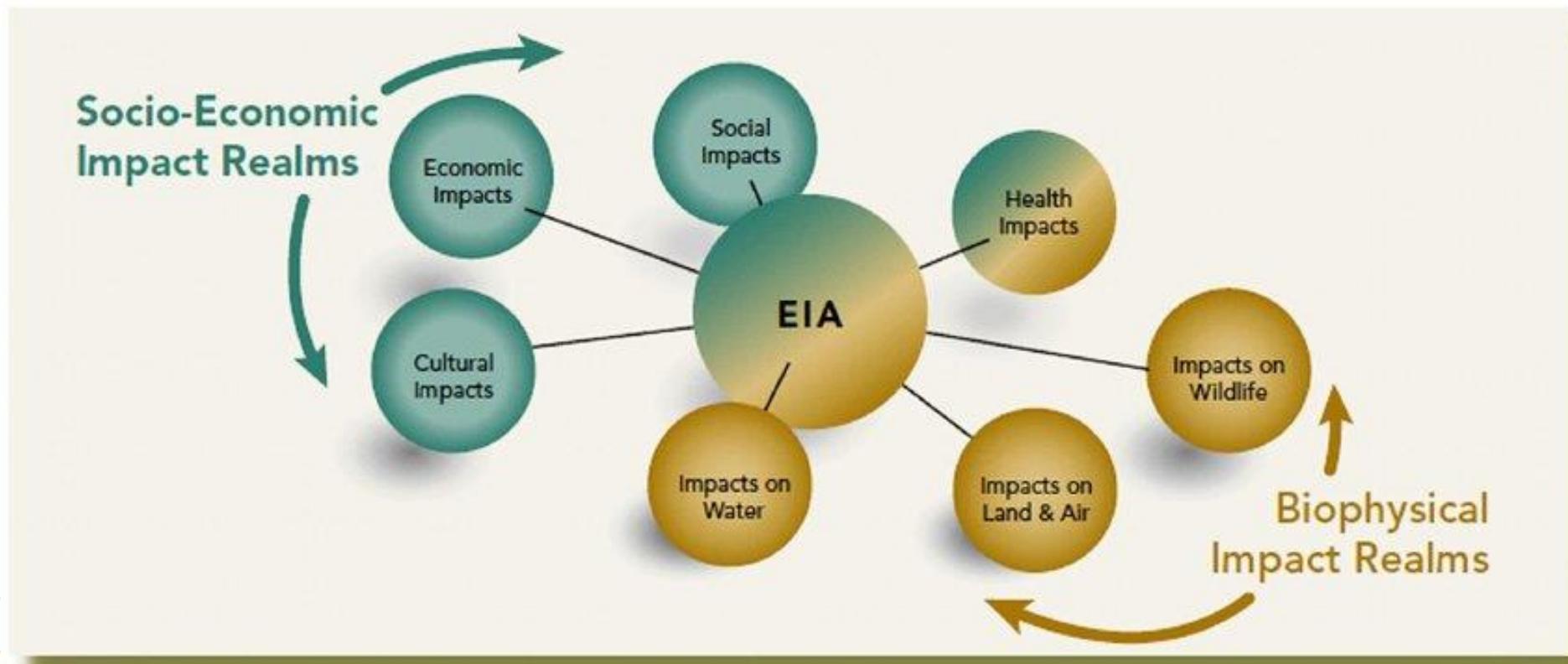
- The other group, which consists mainly of environmentalists and conservationists, believes in Mahatma Gandhi's philosophy: 'Earth provides enough to satisfy every man's need but not any man's greed.'
- According to **environmentalists and conservationists**, the continuation of the present trend will make the world both more populated and polluted. The rich will be richer and the poor will be poorer.
- This will lead to greater political and economical instability increasing the threat of nuclear war and also an ecological crisis.
- The **strategies to be followed for this model are:**
 - (i) Conservation and reduction of excessive use of resources.
 - (ii) Recycling and reuse of materials.
 - (iii) More use of renewable resources (solar energy) than non-renewable resources (oil, coal) for energy.

- In the current strategy of economic development, the natural resources of the world are being used up at a much faster rate without any consideration for our future generation and the environmental degradation being caused.
- This type of developmental strategy is simply unsustainable for the long term development of the world.
- Sustainable development believes in equality between countries and continents, gender, age, race and class.
- It maintains a balance between social and economic development along with protection of the environment.
- At the Rio de Janeiro conference in 1992, several documents were created for the United Nations Conference on Environment and Development (UNCED). These documents conclusively pointed out to the need to care for the earth as the environment was closely connected to development.

Environment Impact Assessment

- In the sustainable development strategy, each activity that is expected to bring about economic growth must consider its environmental impact through a scientific Environmental Impact Assessment (EIA). Thus, it is consistent with long-term development and growth.
- For example, large dams, highways and the mining industry are all essential for our social and economic development.
- At the same time, this developmental work means the use of natural resources, loss of forest cover, depletion of biodiversity and increase in pollution.
- Thus, for every project, according to the sustainable development strategy, a scientific EIA is done. The economic benefit of a project is weighed against the possible environmental costs.





Persistent problems leading to degradation of environment

- Poverty
- Social injustice
- Over population

These problems cannot be solved by one nation alone and therefore, collective efforts of everybody is required for sustainable care of this planet.

Urban Problems Related to Energy

- Energy is one of the major pillars of economic development of the society.
- Economic growth along with a growing population will obviously consume a lot of energy.
- To meet the enormous energy needs and for long term sustainability, we should be more specific about the most efficient and cost-effective manner of energy use.
- This can be achieved through:
 - (i) the use of more renewable energy resources than non-renewable energy resources
 - (ii) Urban planning for more efficient energy utilization.
 - (iii) Change of lifestyle to increase community involvement, which means using car pools.
 - (iv) In India, the importance of the development of renewable energy sources as an alternative to fossil fuels for a sustainable energy base has been recognized since 1970. Since then, considerable effort has gone into the development, trial and introduction of a variety of non-conventional energy technologies in the industry and for domestic use

- The Ministry of Non-Conventional Energy Sources, Government of India is involved in the implementation of these programs for the development, demonstration and utilization of renewable energy-based technologies such as:

- (i) Solar photovoltaic.
- (ii) Wind power generation and water pumping.
- (iii) Solar power.
- (iv) Geothermal energy.
- (v) Energy recovery from municipal and industrial waste.
- (vi) Chemical source of energy.
- (vii) Fuel cell.
- (viii) Alternative fuel for transportation.
- (ix) Biomass combustion.
- (x) Hydroelectricity.

Water Conservation

- With increase in population, the demand for more food crop and water has also increased.
- At the same time, growing industrialization and demand for more agricultural land has led to deforestation.
- But with deforestation, the surface run-off increases and the ground water table thus drops as water cannot percolate into the ground with no vegetation.
- The perennial rivers are also becoming seasonal due to the lack of forest cover.
- With the advancement of science and technology, ground water is also constantly withdrawn to meet the water demand. Hence, the water table is continuously receding

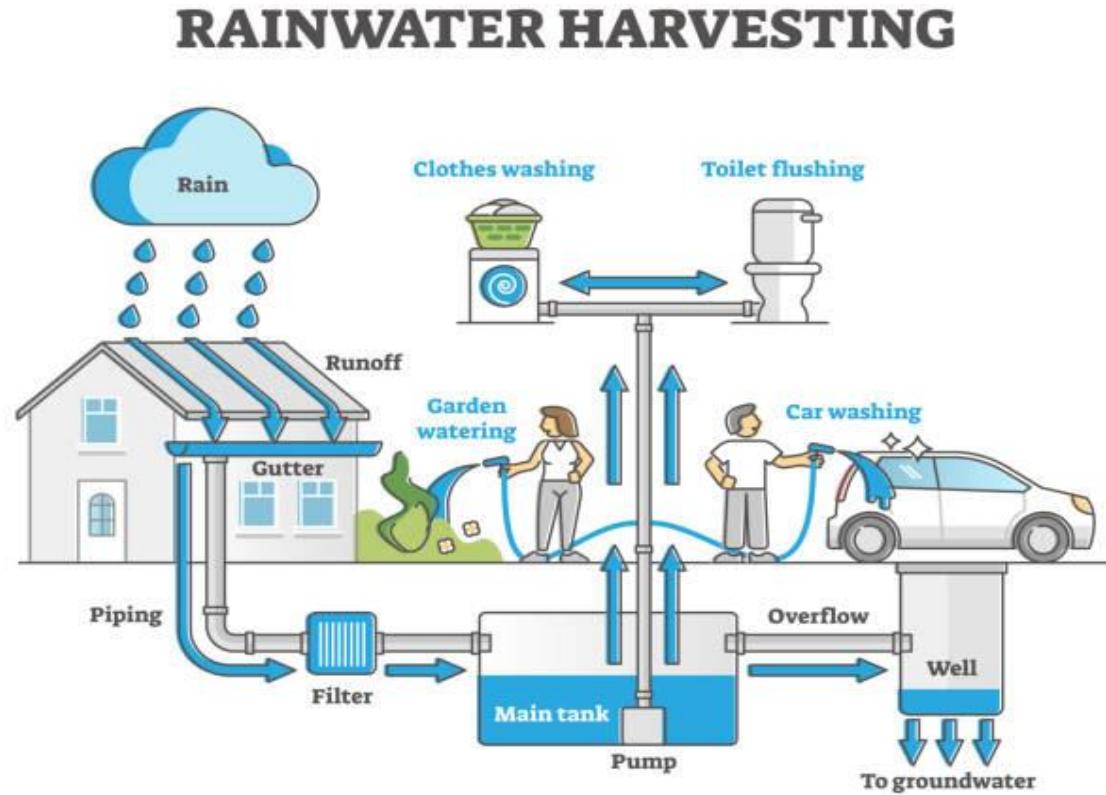


Methods for water conservation

- Using the drip-irrigation method to water the plants near their roots in agricultural fields rather than the traditional method.
- Proper pipes should be used and leakages should be checked periodically.
- Using water from a bucket rather than using it directly from the tap
- Utilizing used water (water used after washing vegetables, cereals and clothes) for the kitchen garden, cleaning floors and also by collecting rain water in buckets during the rainy season.
- Maintaining some ground covered with vegetation, around our house. This will allow for easy percolation of rain water.

Rain Water Harvesting

- Rain water harvesting is an age old method of collecting rain water on the roof tops and then using it directly or storing it for use when the rainy season is over. This method is widely practiced particularly in dry areas all over the world.
- Several techniques are available for efficient rain water harvesting.
- **Traditionally**, rain water is stored in open storage bodies such as lakes, ponds and tanks. It is still practiced in villages (**Surface water**)
- In rural areas the harvested rain water is stored in underground tanks. Underground storage tanks have an additional advantage over surface water storage tanks as there is no loss of water through evaporation.

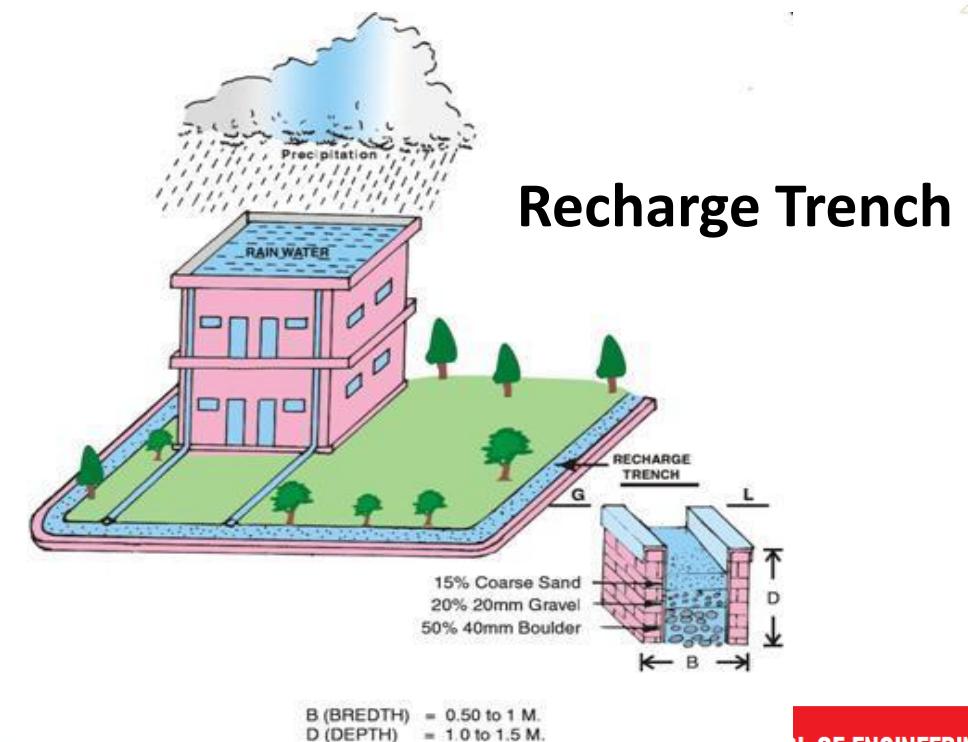
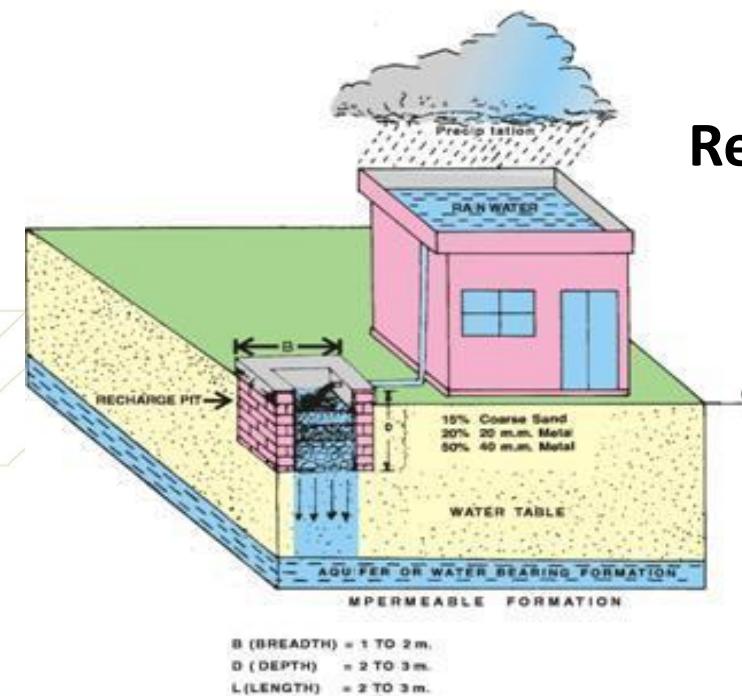


- Rain Water Harvesting Techniques
- There are **two main techniques for rain water harvesting:**
 - (i) **Storage of rain water on the surface** for future use.
 - (ii) **Recharge of ground water.**
- Recharge of ground water is a recent concept and the structures used for the purpose are:
 - (i) **Pits:** For recharging a shallow aquifer, recharge pits are constructed. These are one to two metre wide and three metre deep and backfilled with boulders, gravels and coarse sand to aid filtration before percolation to the ground.

- (ii) **Trenches:** About 0.5 to one metre wide, one to 1.5 metre deep and up to 20 metre long trenches are constructed where a permeable stream is available at a shallow depth.
- (iii) **Dug Wells:** Existing dug wells may be utilized as recharge structures. The excess water should be allowed to pass through a filter bed before putting it into the well.
- (iv) **Hand Pumps:** Existing hand pumps may also be used as recharge structures for aquifers. The water should pass through the filter media before percolation.
- (v) **Recharge Shaft:** For recharging shallow aquifers located near a clayey surface, recharge shafts of 0.5 to three metres diameter and 10 to 15 metres deep are constructed and backfilled with boulders, gravels and coarse sand.

(vi) **Lateral Shafts with Bore Wells:** A similar technique is used to recharge upper as well as deeper aquifer levels.

(vii) **Spreading Technique:** If the permeable strata starts from the top, then water is allowed to spread in streams/nullahs, making check dams, nullah bunds, cement plugs or in a percolation pond.

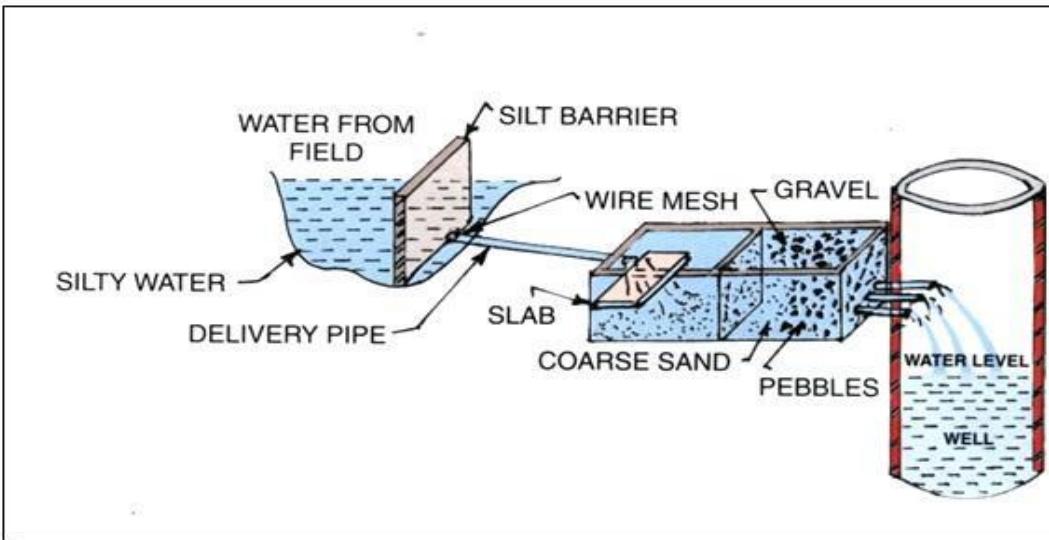




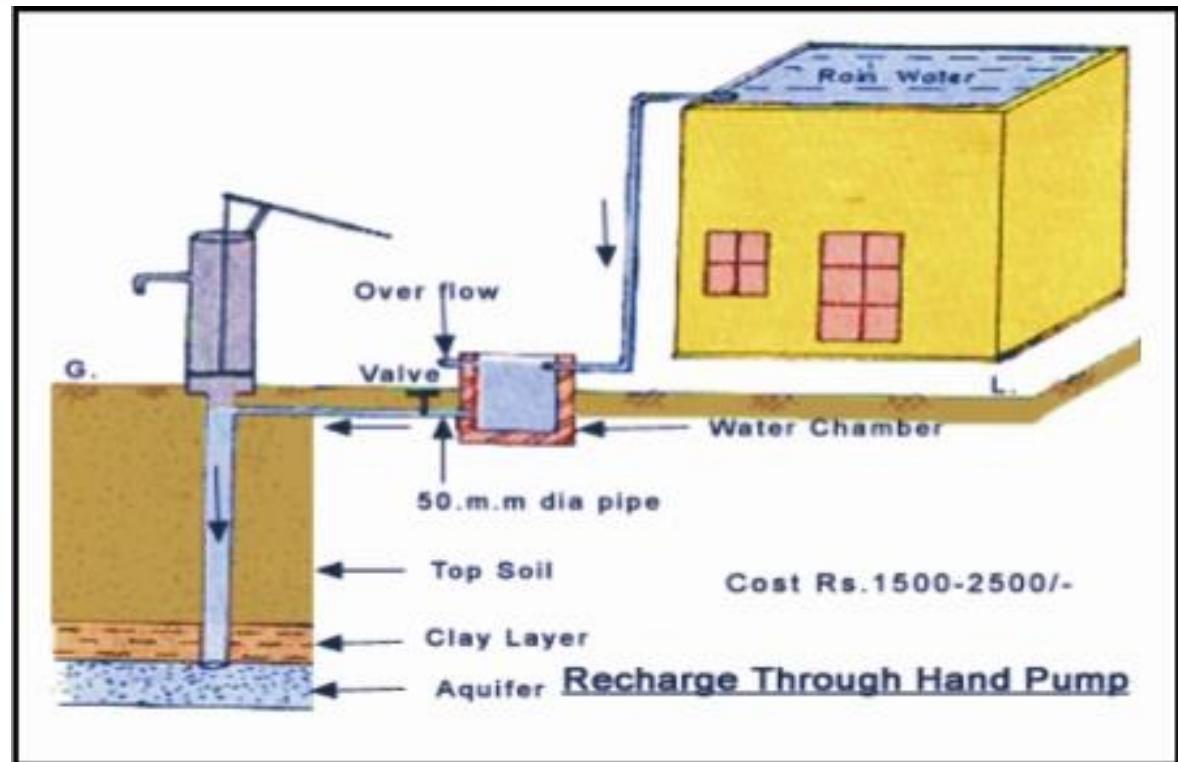
Abandoned Dug Well



Abandoned Dug Well fitted with
Rain Water Harvesting Mechanism



DUG WELLS

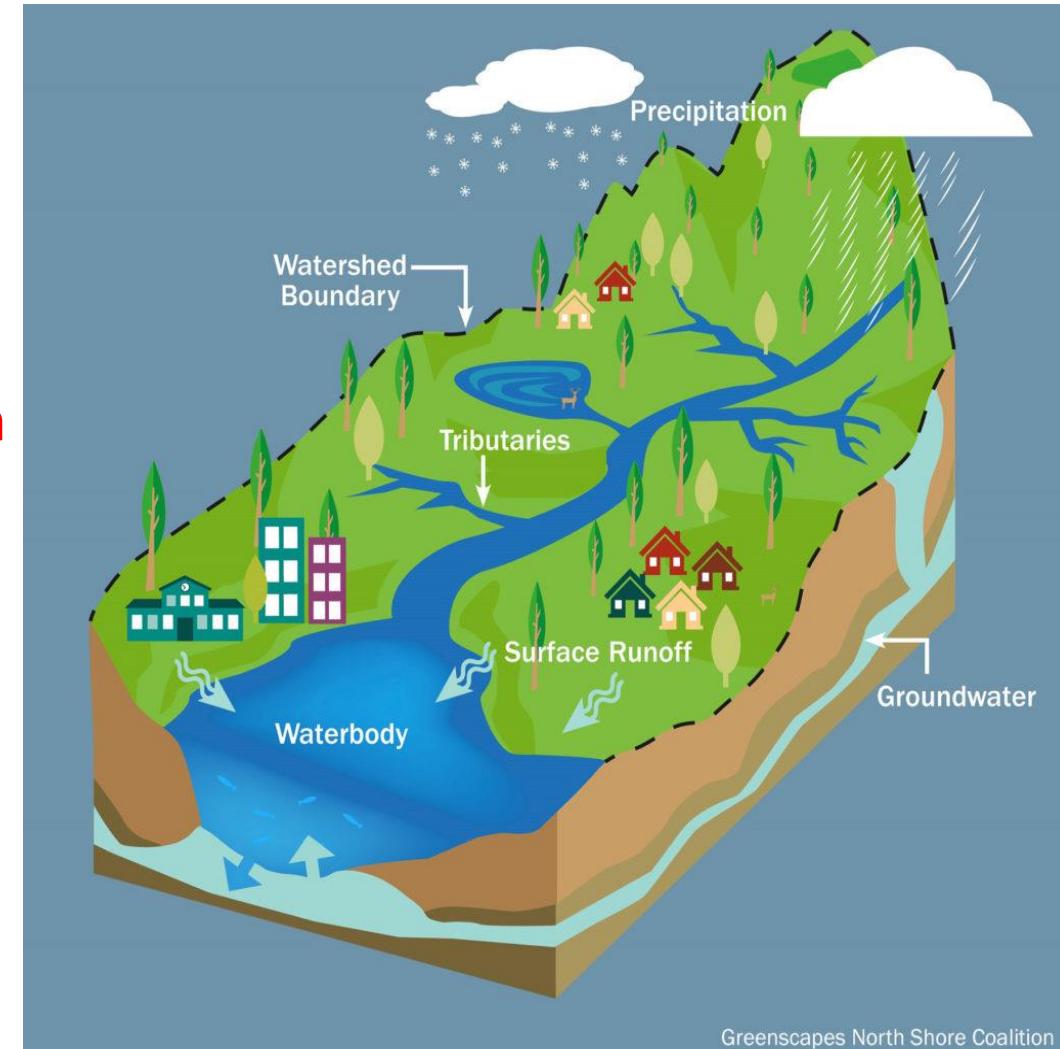


HAND PUMPS

- In addition to these, **in urban areas roof top and road top collection of rain water is also used to recharge aquifers.**
- In India, all the traditional houses, forts and palaces have a roof top rain water harvesting system. The collected rain water from the roof top is stored in underground tanks.
- In the hilly areas of North Bengal (Darjeeling), all the houses have a roof top rain water harvesting system. They use the collected rain water immediately or store it for a very short period. They do not have an underground storage system.
- These days, the Central Ground Water Board along with the civic authorities is encouraging artificial recharging of ground water through rain water harvesting.
- Laws are being framed to make the rain water harvesting system compulsory in all the newly-constructed buildings.

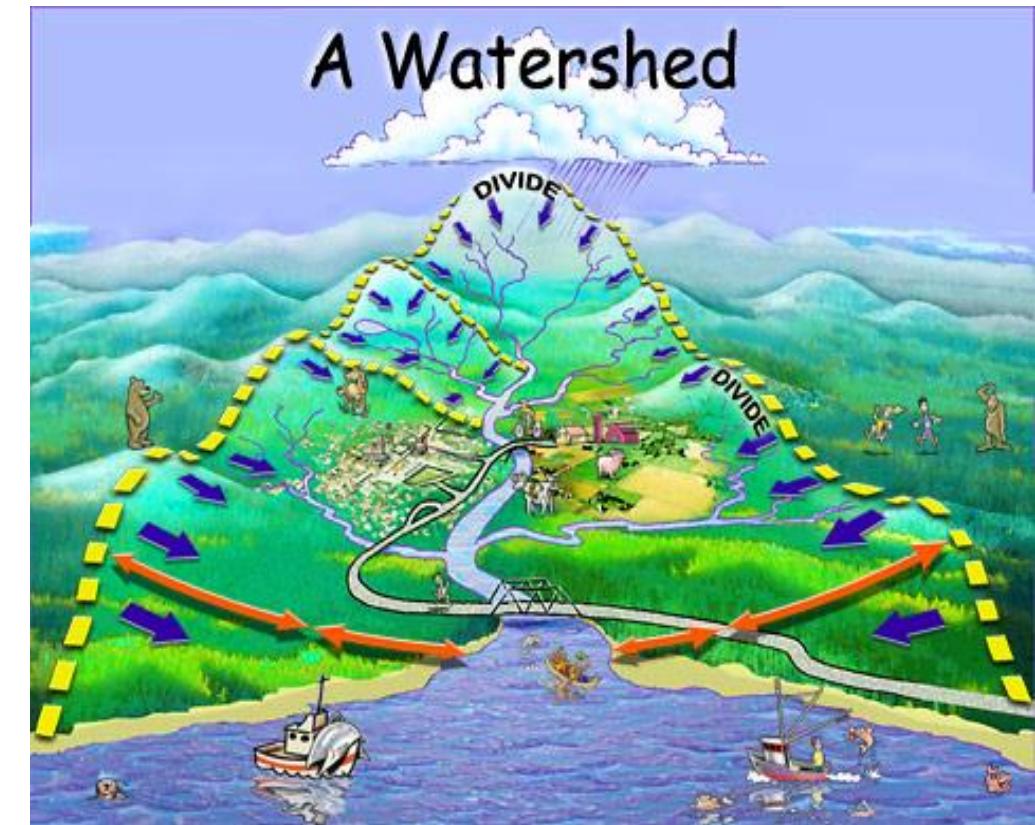
Watershed Management

- A watershed is a geographic unit (a piece of land) that collects, stores, and releases water. Collected water comes from rain, snow and fog. This water is stored in lakes, ponds, sub-surface soil and geological formations.
- The stored water is then released through rivers, streams and ground water flow. Thus, a watershed can be described as a land from where water drains into a particular stream, river, lake, wetland, estuary and even the ocean
- Watersheds can be large or small. Every stream, tributary, or river has an associated watershed, and small watersheds join to become larger watersheds.
- Watershed is a natural system and all lands (and all humans, wildlife and activity on that land) are part of one or other watershed.



- Individual or collective action directly affects the watersheds
- Depletion in the ground water table, drying of small streams after the monsoons, floods, and the spread of desertification are some of the consequences of an affected watershed.
- The **watershed management programme** was started in India in 1999 to control these adverse effects.
- It provides scientifically-based education to maintain the viable natural resource management of agriculture production while conserving, protecting and restoring watersheds to secure water both in quality and quantity for drinking, agriculture and sanitation.
- The method includes mapping of the watershed area, construction of a series of long trenches and mounds along hill contours to hold rain water and allowing it to percolate into the ground.
- Plantation of trees and grass is done to enhance seeping of water to the ground and to prevent water contamination, torrents and landslides.

- The main **benefits of watershed management** can be listed as follows:
 - (i) It **recharges the ground water**, potentially reducing water storage during dry spells.
 - (ii) It **reduces severity of floods downstream** by retaining water and releasing it during the dry periods.
 - (iii) It **protects stream banks and shore lines from erosion**.
 - (iv) It **improves water quality** by breaking down, removing, using and retaining nutrients, organic waste and sediments carried to the wetlands with run-off from the watershed



- (v) It provides food and other products such as commercial fish and shell fish for human use.
- (vi) It provides fish and wildlife, including numerous rare and endangered species, food, habitat, breeding grounds and resting areas.
- (vii) It increases opportunities for recreation, bird watching, photography and outdoor education.

Case Study

- **The City of Dawn:** Auroville, the city of dawn, is situated about five kilometers away from the sea 10 km north of Pondicherry and 150 km south of Chennai. It is designed as a universal town where people from all over the world live in peace and progressive harmony.
- About 35 years ago, Auroville was a desert land caused by 200 years of deforestation and overuse. This barren land was exposed to wind and water erosion with the fall of water tables, decreasing crop yield, and a deeply furrowed erosion channel
- **Herald Kraft**, an expert in water conservation and watershed management of Berlin, Germany, studied the situation and said that if water could be conserved then construction of the city is possible.

- Kraft built two watersheds. Starting from the top of the watershed, bunds were made around individual fields so that no water could overflow to another field.
- All the fields were protected from cattle grazing by planting thorny plants along the bunds. Small dams were also made to stop the flow of water into valley.
- Plantation was done first on land. Indigenous tree species were used in seriously degraded lands.
- As the vegetation started growing, the microclimate also changed. In this way, with effective watershed management, Auroville has been transformed from a desert into a lush and verdant jungle supporting a thriving diverse community of people, plants and animals.

BEFORE



AFTER



Wasteland Reclamation

- Wasteland reclamation is the process of turning barren, sterile wasteland into something that is fertile and suitable for habitation and cultivation
- The formation of wasteland is nothing but the result of increasing overuse and abuse of our land resource.

- **Wasteland land can be classified** as:

- (i) Barren and uncultivable land.
- (ii) **Fallow land** (Fallow land is a piece of land that is normally used for farming but that is left with no crops on it for a season in order to let it recover its fertility)
- (iii) Fallow and cultivable wasteland.
- (iv) saline and alkaline land
- (v) water eroded wasteland



- All types of wastelands should be reclaimed for productive use for:
 - (a) Meeting the constant demand for agricultural land for our ever growing population.
 - (b) Afforestation to maintain ecological balance.
 - (c) Protection of natural resources.

- Simple methods:

1. By reducing the salt content of soil through leaching and flushing and using gypsum, urea, potash and compost before planting, crops can convert fallow and cultivable wasteland into a usable one.
2. **Agro forestry** is used in fallow lands for multiple use of trees, agricultural crops or livestock management.

→ This is done by planting trees and cultivating crops in between or under trees to form an integrated system of biological production within a specified area.

- **Benefits of Agroforestry**

- Agroforestry **mimics natural ecosystems** far more closely than monocultures do, where one single crop is grown over large areas of land.
- This can lead to a **rise in productivity**, as trees and plants find ways to interact and support each other symbiotically.
- planting trees between crops **reduces soil erosion** – their roots bind the soil in place so that it doesn't wash awash during heavy rain or strong wind
- Trees **add an extra crop that gives the farmer protection against poor harvests**. Fruit, nuts or timber can provide an alternative income stream if the main crop fails
- To **combat climate change**, we need to cut greenhouse gas emissions. Trees are a great way to achieve this, because they take carbon from the atmosphere and store it safely deep in the soil.

- In India, the National Wasteland Development Board was established in 1985 to formulate action plans to stop further land degradation.
- In 1992, the Board was transferred under the Ministry of Rural Development with the formation of a new department of Wasteland Development.
- Five districts in the country (under the state ministry) — Sundargarh, Purulia, Almora, Bellary and Durgapur — have been chosen for the implementation of the plan for reforestation and reclamation of degraded lands by the Ministry of Environment and Forests.

Case Study

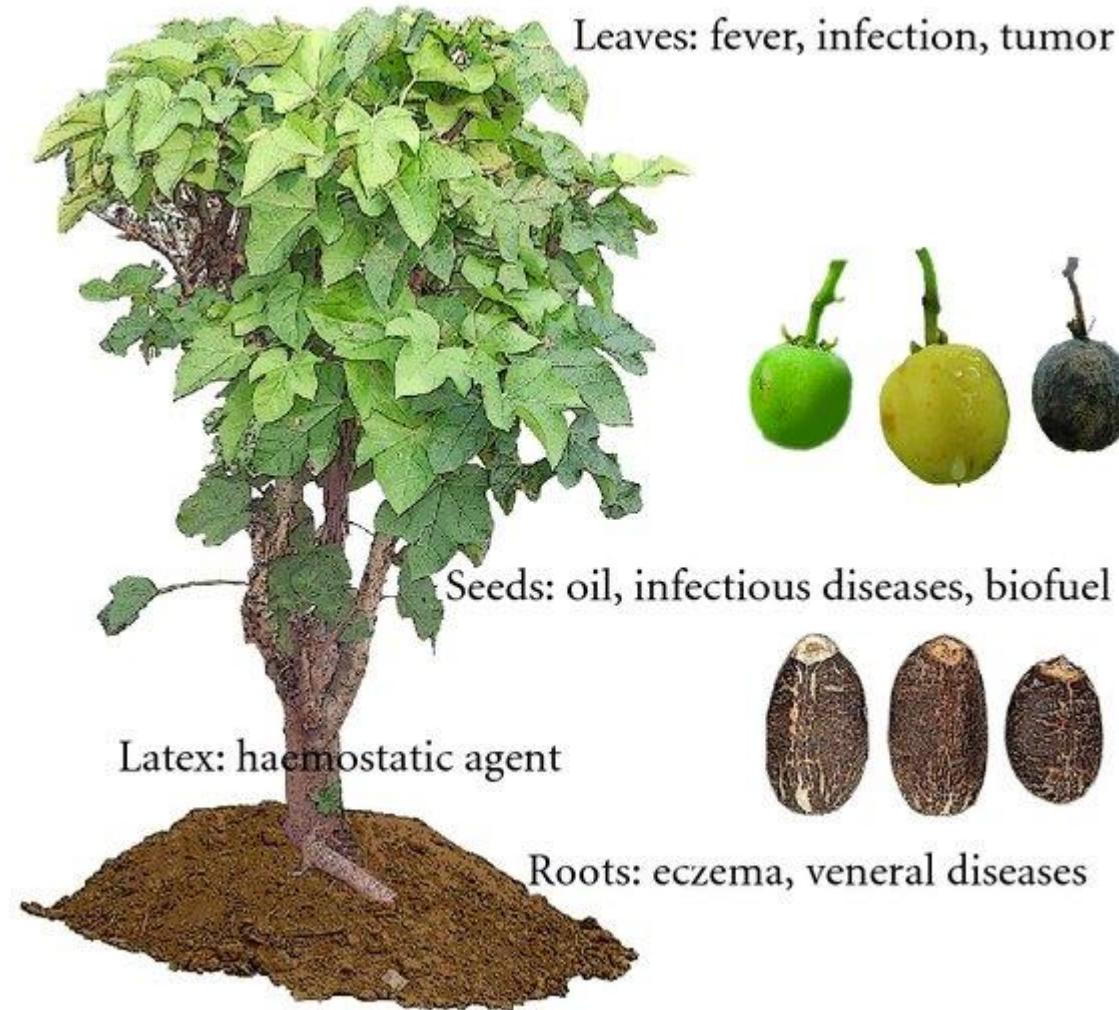
- **Biodiesel from Wastelands:**
- Plantation of *Jatropha curcas* is a unique case of wasteland reclamation.
- *Jatropha curcas* which produces oil-rich seeds is known to survive in eroded land and requires limited amount of water, nutrients and capital inputs.
- *Jatropha curcas* trees not only grow in uncultivable wastelands but also yield vegetable oil suitable for conversion into biodiesel.
- The concept of substituting biodiesel produced from plantations from eroded soils for conventional diesel fuel has gained widespread attention in India.



Image ID: B91ETD
www.alamy.com

- Besides the use of *Jatropha curcas* trees as substitute of diesel, the following are some of the other uses of the Jatropha tree:
 - To make soap, lubricants and candles.
 - It is a raw material for plastic and synthetic fibres.
 - It is a raw material for medicines.
- *Jatropha curcas* trees can be planted through joint forest management. It is hardy in nature, has a short gestation period, high rate of recovery and high quality of oil.

• *Jatropha curcas*



Resettlement and Rehabilitation

- Across the globe nearly 10 million people per annum are affected by forced displacement due to infrastructural projects such as dams, mines, roads, industries and power plants.
- They lose their shelter and livelihood and some of them die due to hunger and poverty.
- In India, planned development in growth sectors such as power, mining, heavy industry and irrigation, immediately after Independence had already displaced about 30 to 50 million persons. Only about 25 per cent of this number was resettled.
- Despite awareness about issues relating to the resettlement and rehabilitation of the displaced persons, very little attention is paid to them.
- Rather these projects focus on the economic efficiency and not on the person to be displaced from their land, livelihood and their socio-cultural life



Displacement problems due to dams:

- The big river valley projects have one of the most serious socio economic impacts due to large scale displacement of local people from their ancestral home and loss of their traditional profession or occupation.
- In India due to big dam construction, more than 20 million people are estimated to have been directly or indirectly affected by these dams
- The Hirakund dam has displaced more than 20,000 people residing about 250 villages.
- Tehri dam and Sardar sarovar dam also have same issues.
- The Three Gorges Dam, located on the Yangtze River in the Hubei province in China, has also been called China's "Dam of Doom". It is known to be the one of the largest dam structures in the world. It is also the single largest producer of hydroelectricity in the world. At the time it was built, it flooded 13 cities, 140 towns, and 1,352 villages, and led to the forced displacement of more than 1.5 million people. If it collapses, it will affect about 500 million people living close to or downstream of the river Yangtze.

Displacement due to mining:

- Mining is another developmental activity which causes displacement of the native people.
- Several thousands of hectares of land area is covered in mining operation and the native people are displaced.
- Sometimes displacement of local people is due to accidents occurring in mined areas like subsidence of land that often leads to shifting of people.
- Jharia coal fields, Jharkhand have been posing big problems to the residents due to underground fires and they are asked to vacate the area.
- According to latest estimates, about Rs.18,000 crores will be spent for shifting the population while the cost of extinguishing the fire would be around 8,000 crore.



Environmental Ethics

- Ethics deal with moral duty and obligations and gives rise to a set of values, which in turn are used to judge the appropriateness of a particular conduct or behaviour.
- Consciousness of ecological consequences has led the society to adopt environmental ethics.
- The new environmental ethics give as much importance to revitalising growth as they do to sustainability, that is, to developmental processes that last



- **Some of the ethical guidelines on environmental protection are enlisted below:**

- (i) The earth is the habitat of all living species and not of human beings alone.
- (ii) Natural resources and energies are depleting fast. We must protect them.
- (iii) Keep yourself informed about ecological changes and developments.
- (iv) Involve yourself in the care of the earth and experience nature.
- (v) Respect nature, you are a part of it.
- (vi) Observe austerity, reserve scarce resources for the future and the future generations.
- (vii) Become involved in the environmental movement and bring about a change in the attitudes and acts towards nature of people known to you.
- (viii) Think of the global cause and act for local protection.
- (ix) We must be cooperative, honest, affectionate and polite to society and nature.

Climate change

- Climate change is a change in the average temperature and cycles of weather over a long period of time.
- Climate change disrupts weather patterns and causes extreme weather events to become more common. These include hurricane activity, droughts and floods.
- As the global temperature has increased, so has the number of reported natural disasters.



Why Is Climate Change a Problem?

Rising temperatures are causing sea levels to increase.

The rising water can cover coastal areas, destroying habitats and displacing whole populations from low-lying areas.



Data source: NASA (GESS)

Rising sea levels are driven by two main processes:

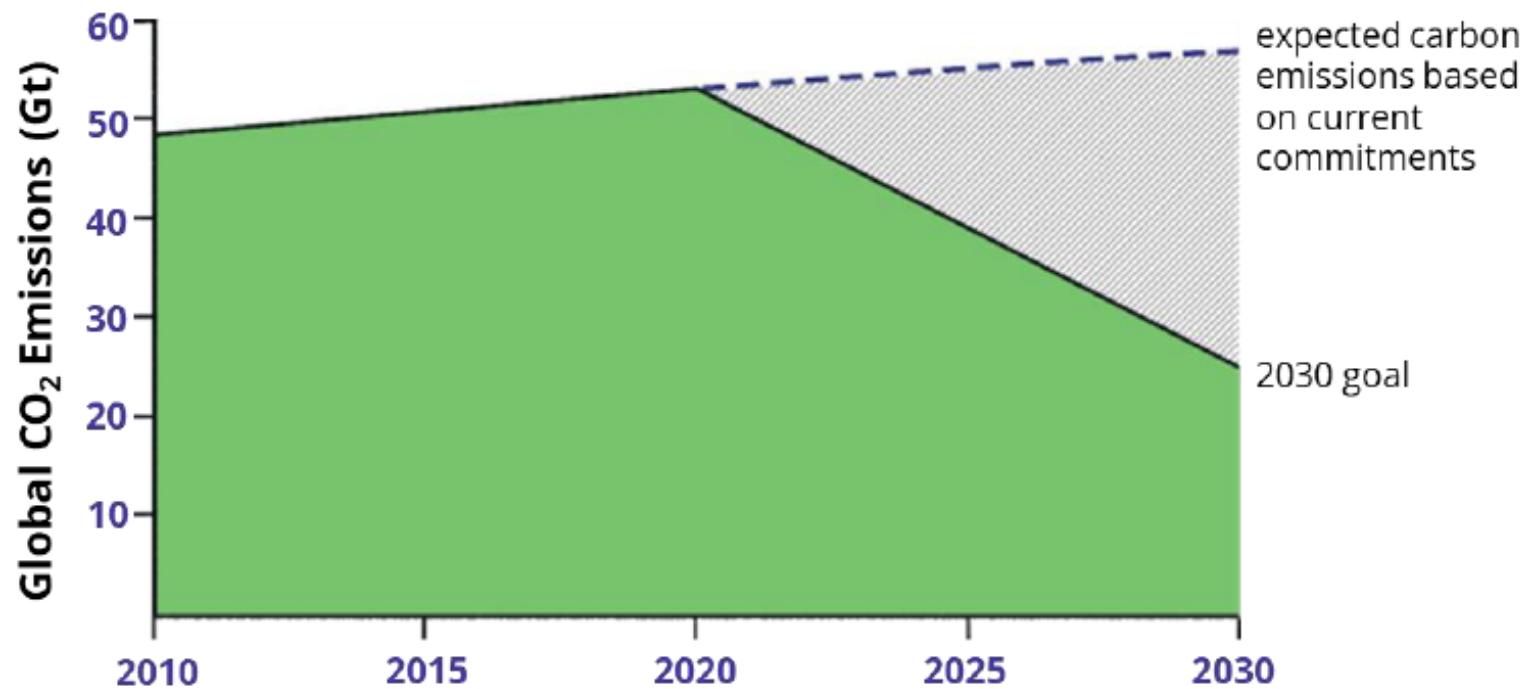
- 1. Ice Melt:** When the atmosphere and ocean get warmer, ice sheets and glaciers melt, resulting in the addition of fresh water to the ocean.
- 2. Thermal Expansion:** As ocean water gets warmer, it expands, causing sea levels to rise.



Causes of climate change

- Climate change can be caused gradually by natural processes or suddenly by large events, such as a massive meteorite strike or volcanic activity. However, the rapid climate change we are experiencing now is due to three main human activities:
- Burning fossil fuels for heating and cooking, generating electricity and powering vehicles releases carbon dioxide into the atmosphere.
- Deforestation (destruction of forests) releases carbon dioxide and reduces the number of trees able to capture carbon dioxide from the atmosphere.
- Reduction of biodiversity creates an unstable ecosystem. Nature loss leads to ecosystems that are less able to capture carbon from the atmosphere and less resilient to rising temperatures.

Global carbon dioxide emissions continued to rise and are now 62% higher than they were in 1990. Global net CO₂ emissions need to fall by 45% from 2010 levels by 2030 to limit global warming to 1.5°C.



- To respond to climatic changes, negotiations began in 1991 under the United Nations, so as to formulate an international treaty on global climate protection. This was finalized at the **Earth Summit at Rio de Janeiro in June 1992.**
- The convention has a few binding requirements and calls for nations to limit carbon dioxide and other Greenhouse gases emissions by removal through sinks of Greenhouse gases. It does not set out specific targets or time frames for reducing emissions
- The effect was found inadequate and the Kyoto Protocol to the United Nations Framework Convention on climate change decided in December, 1997 in Kyoto, Japan to commit specific, legally-binding emission reduction targets for six Greenhouse gases — carbon dioxide, methane, nitrous oxide, hydro-fluorocarbons, perfluorinated compounds and sulphur hexafluoride by industrialized nations.
- The protocol was opened for signature on March 16, 1998.

- The mechanisms suggested to improve the Kyoto Protocol include IET, CDM and ETS. They are explained below:
- **IET (International Emission Trading):** It is a voluntary project between a developed and developing country to reduce Greenhouse gas emission or increase carbon sequestration through afforestation.
- **CDM (Clean Development Mechanism):** It is IET in a new form — Greenhouse gas reduction projects between Annexure-B (developed)and non Annexure-B (developing) countries that result in Certified Emission Reductions (CERS).
- **ETS:** Emission Trading Scheme is a market-based policy instrument that allows the Greenhouse producing corporate to reduce its emissions at a minimum cost.

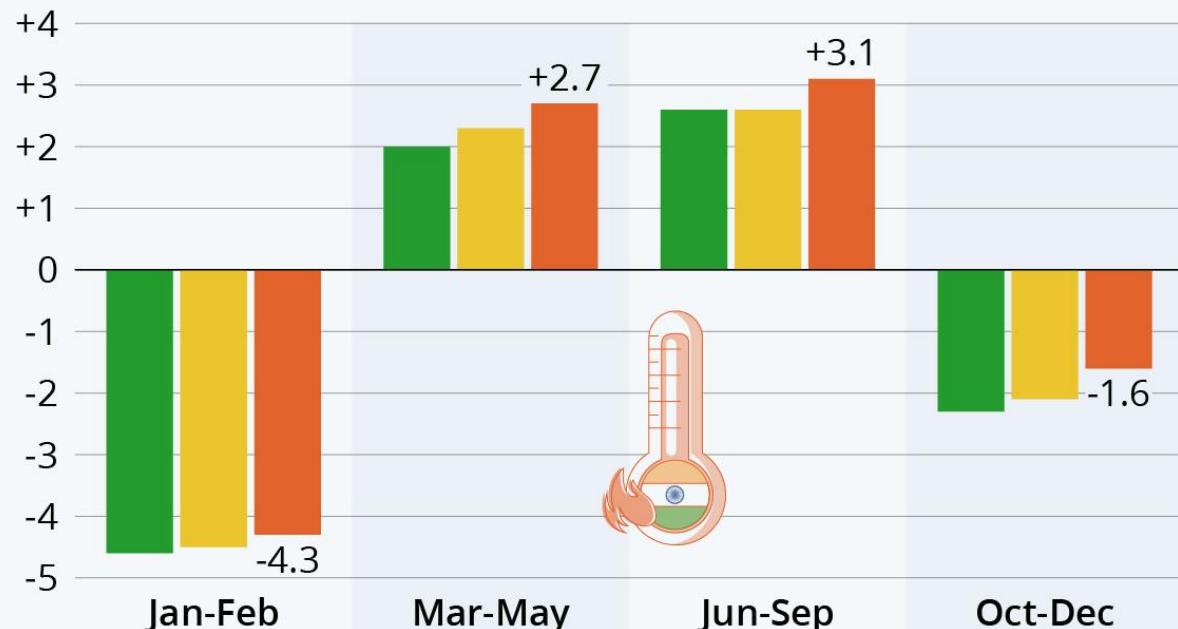
India and climate change

- First, India does not have current obligations to reduce emissions. But in the future there will be international pressure on India for necessitating correct emission inventories in reduction measures.
- Second, we need to develop our emission target basis of norm and measurement and reliable measurement devices.
- Third, we need to develop our disaster mitigation plan since global intervention; global warming, climate change and extreme meteorological events are not ruled out.

How India Is Heating Up

Average divergence from mean temperature at the beginning of the last century in India, by decade (in °C)

■ 1911-20 ■ 1961-70 ■ 2011-2020



IMPACT IN INDIA



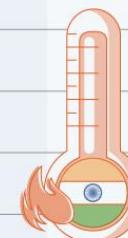
An extremely wet monsoon that occurs once in **100 years** may occur every 10 years by the end of this century



Kolkata and Mumbai are vulnerable to extreme river floods, intense tropical cyclones, rising sea levels, and high temperatures



Significant reduction in crop yields because of rising temperature and erratic rainfall. Some **63 million** people may no longer be able to meet their caloric demand



Average of mean temperature 1901-10 used as baseline
Sources: India Meteorological Department, Ministry of Earth Sciences via MOSPI EnviStats India report

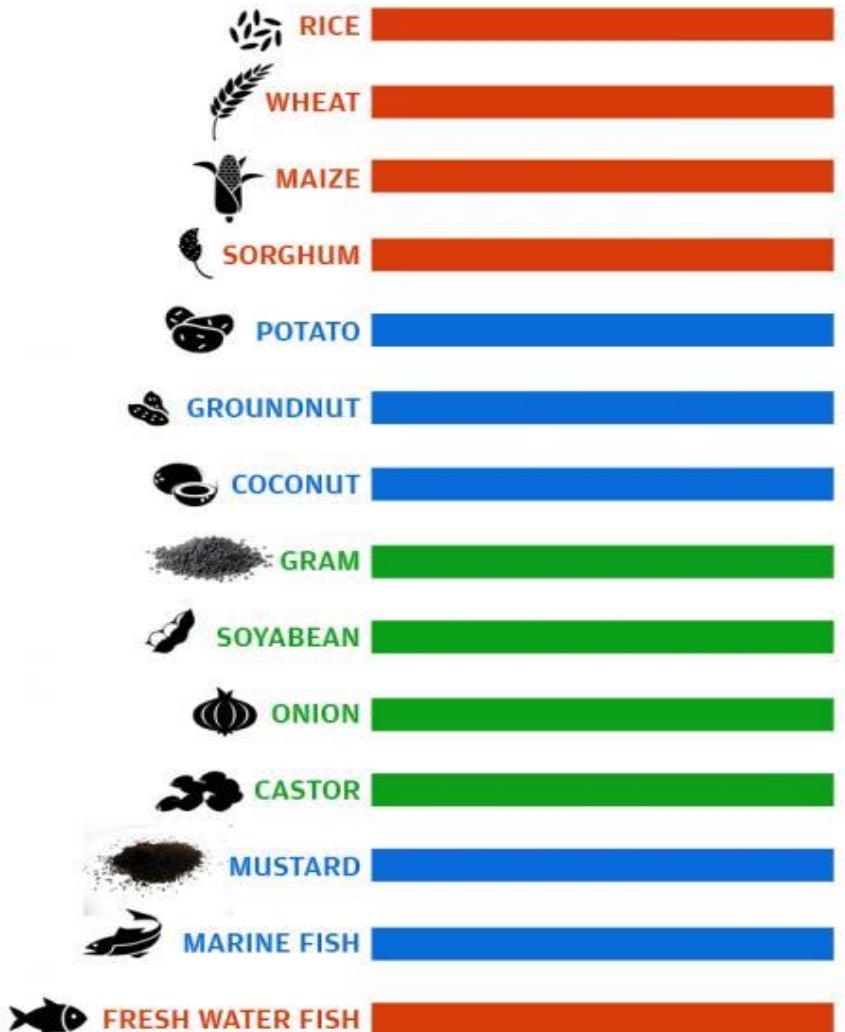


statista

India - Commodity wise impacts

(from modelling)

■ NEGATIVE ■ MIXED ■ POSITIVE



- Rising temperature affects flowering and leads to pests and disease buildup. Flood and excess rain over a short duration of time cause extensive damage to crops
- Climate change affects all the three aspects of food security: availability, access and absorption. When production decreases, availability of food decreases. Climate change hits poor the most. They don't have income to buy the food, so their access to it is affected. This, in turn, has an impact on health and affects absorption.
- climate change has about 4-9 per cent impact on agriculture each year. As agriculture contributes 15 per cent to India's GDP, climate change presumably causes about 1.5 per cent loss in GDP

Greenhouse Effect of Global Warming

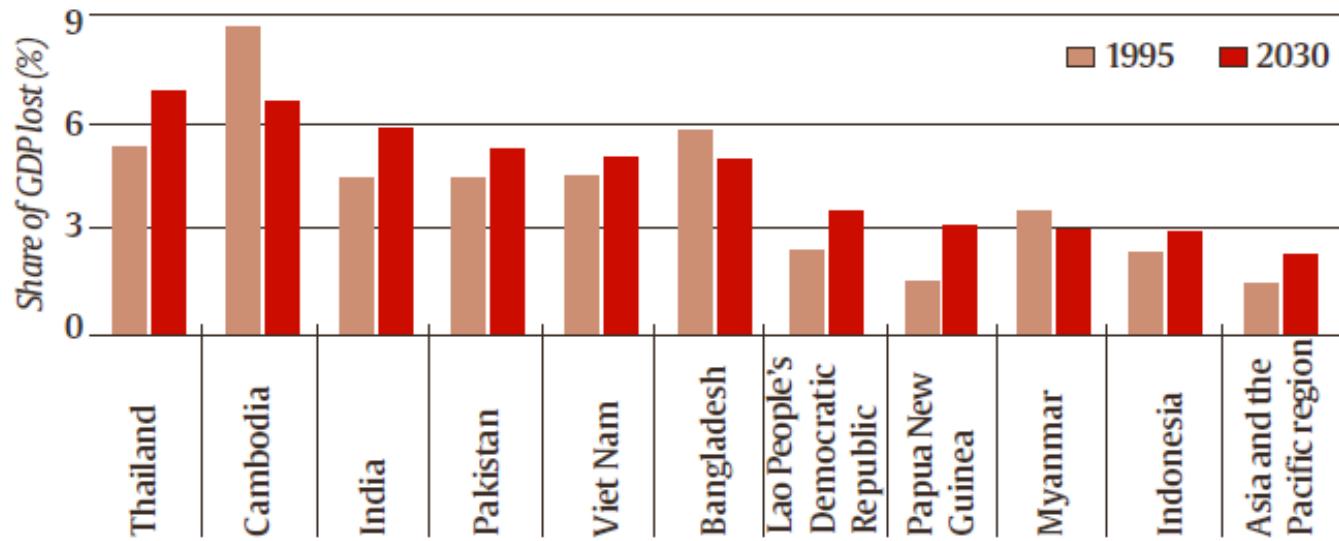
- The **Greenhouse effect** is the phenomenon of the progressive warming up of the earth's surface due to the excessive presence of some gases such as carbon dioxide and methane in the atmosphere.
- Continuous increase in burning of fossil fuels increases the carbon dioxide content of the atmosphere. It has been estimated that about 50 per cent content of atmospheric carbon dioxide is from combustion of fossil fuel.
- other gases such as methane, chlorofluorocarbon and ozone released from industries, also play an important role in the temperature regulation process
- **These gases prevent heat to escape into space. Hence, these gases are known as Greenhouse gases**



Consequences of Global Warming

- Increase in surface temperature due to increase in the concentration of Greenhouse gases will increase the evaporation of surface water thereby raising the temperature further
- The Greenhouse effect will raise the temperature at the poles resulting in partial melting of glaciers and ice caps. This will raise the water level by as much as two meters in the ocean.
- This rise in sea level will decrease the ice-gap of Greenland and will threaten the coastal countries. It will submerge densely populated places like Bangladesh, Shanghai and Maldives and coastal cities in India like Chennai and Goa.
- An increase in Greenhouse gases, mainly carbon dioxide, will result in increasing the number of cyclones and hurricanes and the melting of snow in the high mountains to cause floods

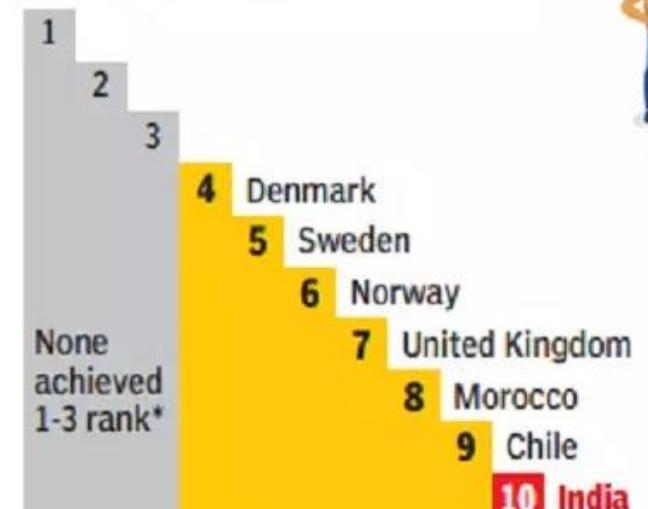
Percentage of GDP lost to heat stress under a 1.5°C global warming scenario,
ten most affected countries in Asia and the Pacific, 1995 and 2030 (projections)



Source: ILO estimates based on data from the ILOSTAT database and the HadGEM2 and GFDL-ESM2M climate models.

HAT-TRICK FOR INDIA

Where do countries stand in Climate Change Performance Index (CCPI) Ranking



India's track record

*No country performed well enough in all four assessed categories to achieve perfect score on CCPI

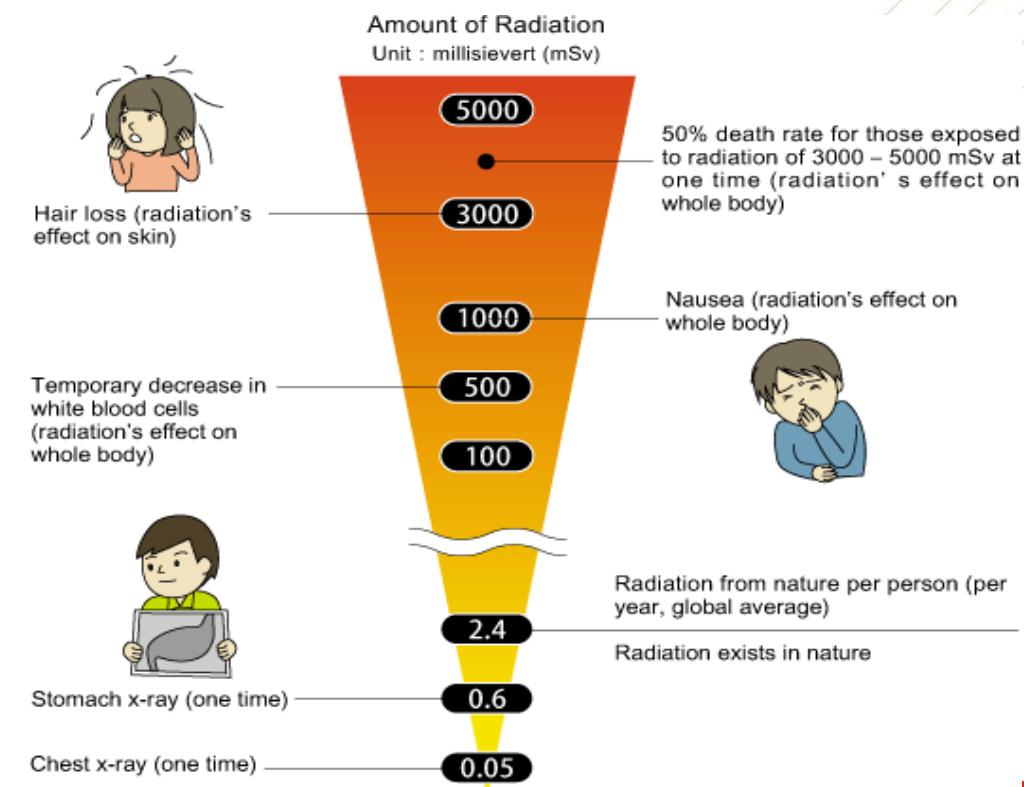
- This list is prepared by assessing the performance of 57 countries and European Union in 4 Categories: GHG emissions (40%), renewable energy (20%), energy use (20%) and climate policy (20%)
- The biggest current emitter of greenhouse gases (GHG) China at 33 rank while USA is at the bottom of the list.

Control Measures:

- Increasing global warming due to an increase in the Greenhouse effect can be controlled by adopting the following measures:
 - (i) Use of solar energy and biogas instead of fossil fuels on a large scale.
 - (ii) By putting a check on population explosion mainly in densely populated countries, which will help in decreasing the quantity of CO₂ and chloro fluoro carbons released.
 - (iii) Afforestation program should be followed on a massive scale and deforestation should be banned so as to maintain forests in at least one-third of the geographical area, as forests regulate the balance in atmospheric CO₂.
 - (iv) By attaching anti-pollution devices such as catalytic converters and using unleaded petrol, emission of Greenhouse gases from automobiles can be reduced.

Nuclear Accidents

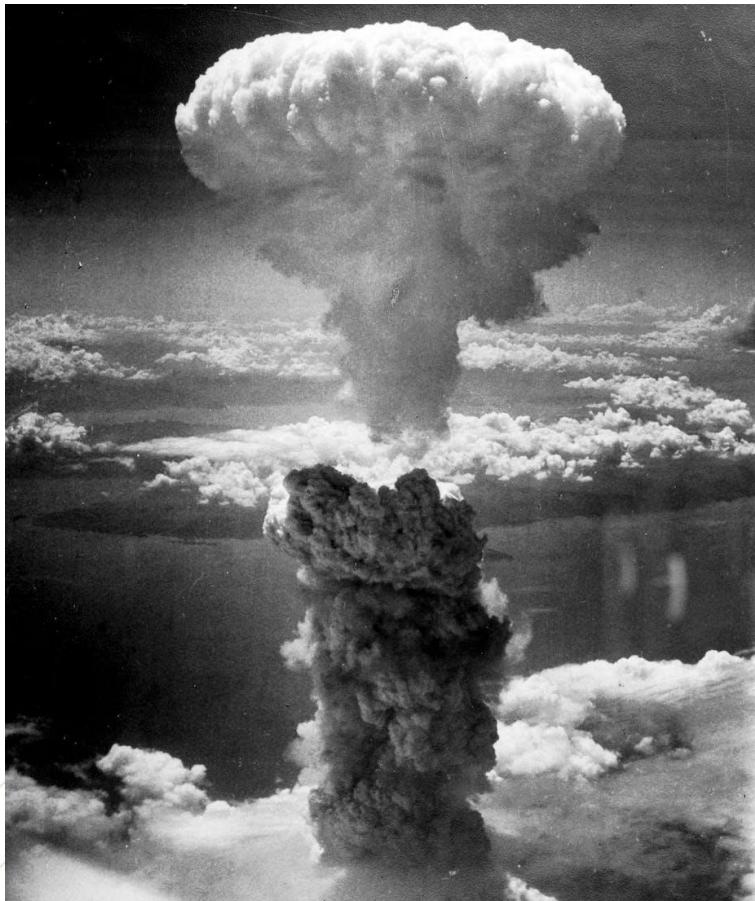
- Radiation use and emission is widespread.
 - radio isotopes are used for detection of ulcers and treatment of cancer.
 - X-rays are a very useful tool in medical science for the diagnosis of fractures in our body.
 - Laser rays are used for bloodless operations in serious patients.
 - Nuclear energy is used for the generation of electricity.



Hiroshima & Nagasaki Nuclear Accident

- The uranium bomb detonated over Hiroshima on 6 August 1945 had an explosive yield equal to 15,000 tonnes of TNT. It razed and burnt around 70 per cent of all buildings and caused an estimated 140,000 deaths by the end of 1945, along with increased rates of cancer and chronic disease among the survivors.
- A slightly larger plutonium bomb exploded over Nagasaki three days later levelled 6.7 sq km. of the city and killed 74,000 people by the end of 1945. Ground temperatures reached 4,000°C and radioactive rain poured down.
- Five to six years after the bombings, the incidence of leukaemia increased noticeably among survivors. After about a decade, survivors began suffering from thyroid, breast, lung and other cancers at higher than normal rates.
- Pregnant women exposed to the bombings experienced higher rates of miscarriage and deaths among their infants; their children were more likely to have intellectual disabilities, impaired growth and an increased risk of developing cancer.

Hiroshima & Nagasaki Nuclear Accident



Chernobyl nuclear mishap

- Chernobyl disaster, accident in 1986 at the Chernobyl nuclear power station in the Soviet Union
- The station consisted of four reactors, each capable of producing 1,000 megawatts of electric power
- On April 28 the chain reaction in the core went out of control. Several explosions triggered a large fireball and blew off the heavy steel and concrete lid of the reactor.
- This and the ensuing fire in the graphite reactor core released large amounts of radioactive material into the atmosphere, where it was carried great distances by air currents
- Between 50 and 185 million curies of radionuclides (radioactive forms of chemical elements) escaped into the atmosphere—several times more radioactivity than that created by the atomic bombs dropped on Hiroshima and Nagasaki, Japan.
- This radioactivity was spread by the wind over Belarus, Russia, and Ukraine and soon reached as far west as France and Italy. Millions of acres of forest and farmland were contaminated, and, although many thousands of people were evacuated, hundreds of thousands more remained in contaminated areas.

Consumerism and Waste Products

- Today, people consume more products and services and thus more resources and energies of the earth are depleting fast.
- With increase in population, the amount of resources and energy consumed is increasing which results in a corresponding increase in waste disposal
- The life cycle of the products and services has been shortened and even they have become 'disposable' for single use such as injection syringes, paper cups, cans, bottles, plastic cartons
- with a rapid increase in population, the amount of resources and energy consumed is increasing which results in a corresponding increase in waste disposal, both in quality and quantity.



- Large quantities of solid, liquid and gaseous wastes generated by modern societies, mineral refuse, e-waste, biomedical waste, agriculture waste fertilizer and pesticide overuse, burning of waste and waste dumping in the rivers and oceans all pose a serious threat to environment management
- **Careful and judicious utilization of resources and recovery of used material by recycling of waste are essential today.**
- We must minimize the generation of waste at the source itself by improving the process efficiency with minimal use of resources
- We must follow 4 R's: Reduce, Refuse, Reuse and Recycle

Plastic waste: a major problem

- Plastic has become an indispensable part of modern life — cars, computers, bottles, telephone, clothing and packaging—it is used everywhere.
- Although plastic is non-biodegradable, its versatility in physical properties and unique formability has made plastic recyclable.
- Plastics can be recycled mechanically, chemically or thermally to produce new articles.
- In India, the Department of Science and Technology and Indian Oil Corporation are jointly working on the method of converting used plastics into petrol, diesel and LPG and expect to be India's first plant for recovering petrol, diesel and LPG from waste plastics

AROUND 60% OF INDIA'S PLASTIC WASTE IS RECYCLED

Total Plastic Waste Generated Every Day

15,342 tonnes



Figure: Plastic waste recycled in India

-say-
~to~
PLASTIC



Say
NO
to Plastic
CUTLERY

Say
NO
to
PLAS-
tic
BOTTLES



Say
NO
to
Plastic
straws
and
cutlery

Say
NO
to Plastic
STRAWS



Say
NO
to Plastic
straws
and
cutlery

PLASTIC WASTE POSES A HUGE THREAT TO MARINE ECOLOGY

There are
8 million
tonnes of
plastic waste
entering the
ocean every
year

The total plastic
in the ocean
amounts to
**150
million
tonnes**

Plastic packaging
accounts for
62% of all
items recovered
in coastal clean-
up efforts

In 2014, there was
**1 kg of plastic in the
ocean for every
5 kg of fish, and by
2050 there will
be more plastic
than fish**



Figure: Whale killed by plastic waste



Figure: Plastics recovered inside the whale

Plastic waste management

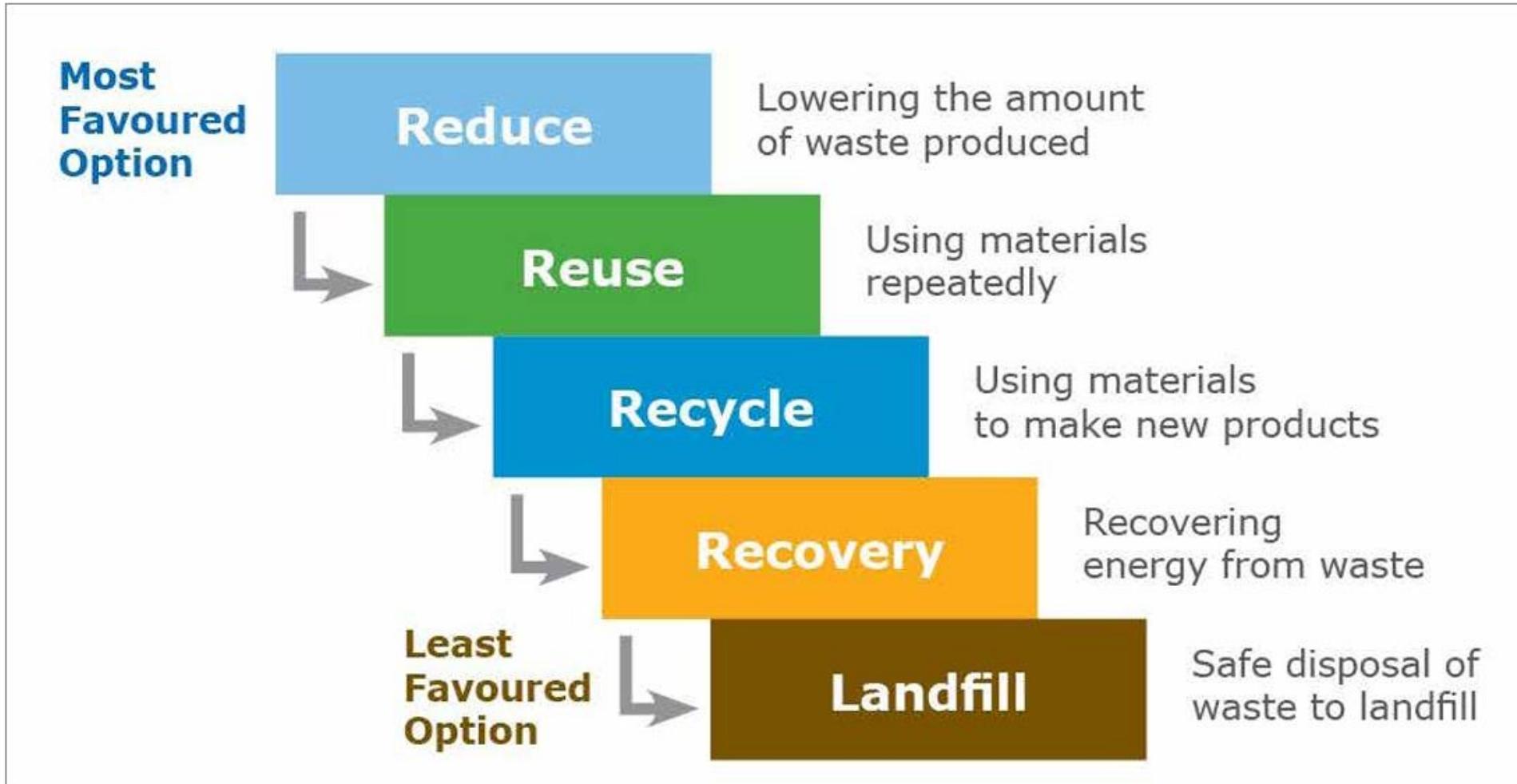


Figure: Management of Plastic Waste

Laws Relating to Environment, Pollution, Forest and Wildlife

- (i) The Factories Act, 1948.
- (ii) The Insecticides Act, 1968.
- (iii) The Water (Prevention and Control of Pollution) Act, 1974.
- (iv) The Air (Prosecution and Control of the Pollution) Act, 1981.
- (v) The Forest (Conservation) Act, 1980.
- (vi) The Wildlife (Protection) Act, 1972.
- (vii) The Environment (Protection) Act, 1986.

- The environmental laws and protection Act To protect the environment and to conserve natural resources, various laws have been made. Many Acts have been introduced after 1947 (independence). Water Act and Wild life Protection Act were passed in 1974. Government of India has established a National Committee on Environmental Planning and Co-ordination.

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

- This was the **first National law of India on pollution control.**
- This act defines water pollution and determines penalties.
- The Water Pollution Board at the Central and State levels has been set up for the prevention and control of water pollution in all sources of water under its jurisdiction.
- They also determine the permissible and impermissible levels of water pollution.
- This act was **amended in 1977 and 1978** to improve the financial condition of the state boards through implementation of a water tax for use of water by industrial and local authorities.

The Air (Prevention and Control of Pollution) Act, 1981

- This Act regulates and controls emission from automobiles and industrial plants.
- The Central Board for Prevention and Control of Water Pollution is authorized to implement and enforce this act also.
- This body determines the standards of air quality.
- The Central Board is empowered to coordinate the activities of the State Boards.
- After consultation with the State Board, the state government may declare an area within the state as:
 - (i) Air pollution control area.
 - (ii) Prohibit the use of any fuel other than the approved one in the area of air pollution.
 - (iii) Nobody can operate any industrial plant in air pollution control area without the consent of the State Board.

Forest Conservation Act, 1980

- The India Forest Act of 1927 was amended in 1980 to prohibit the state governments from declaring any reserve forest as non-reserve without prior approval of the central authority.
- This amendment has restricted the efforts of the state governments to use forest land for non-forest purposes.

Wildlife Protection Act, 1972

- This Act was enacted in 1972 to provide necessary protection against serious threats to wildlife by the expansion and advancement of agriculture, industry and urbanization. The Indian Board of Wildlife was set up in 1952 to protect the wildlife resources and prevent gene erosion.
- Various wildlife parks and sanctuaries were created; projects were launched to save endangered species such as lions (1972), tigers (1973), crocodiles (1974) and brown antlered deer (1981). India became a party to the Convention of International Trade in Endangered Species of Fauna and Flora (CITES) in 1976 and started a national component of the UNESCO's Man and the Biosphere Programme (1971).
- The Wildlife Protection Act, (1972), was enacted to provide protection to wild animals and birds by:
 - (i) Constitution of wildlife advisory board in each state.
 - (ii) Regulating the hunting of wild animals and birds.
 - (iii) Specifying the procedures for declaring areas of sanctuaries and national park.
 - (iv) Regulating the possession, acquisition and trade of wild animals as well as animal products

Environment Protection Act, 1986

- After the Bhopal gas tragedy in 1984, a series of new environmental laws were enacted. Through the Environmental (Protection) Act 1986, the Central Government has acquired the following powers:
- (i) Laying down standards for emission or discharge of pollutants from various sources and for environmental quality.
 - (ii) Restricting area in which industries operation may or may not be carried out subject to certain safeguards.
 - (iii) Laying down safeguards for the prevention of accidents and remedial measures in case of accidents.
 - (iv) Procedures and protection for hazardous substance handling.
 - (v) Issuing directions to any person, officer or authorities for closure, prohibition or regulation in electricity or water supply or any other services. This act also empowers a person to complain to the court regarding violation of the provisions of the Act after having given a notice of 60 days to the prescribed authorities. A violator of the Environmental Protection Act can face imprisonment up to five years and a fine of up to Rs one lakh.

Environment Impact Assessment

- Analysis of any possible change in the environmental quality, adverse or beneficial , caused by a developmental project of government or private company is known as Environmental Impact Assessment.
- As matter of government policy , it is compulsory for any enterprise (government/private) to include EIA in the planning stage of any developmental project and submit it to the central government for clearance.
- The primary goal of the EIA procedure is to predict any adverse or beneficiaeffects of a project on the natural and urban environment. This is done so thatmeasures can be taken to minimize or eliminate the harmful impacts when theproject is implemented.
- The prediction or assessment of impacts must be conducted by an interdisciplinary team including civil engineers and technicians, geologists, urban planners ,and biologists or ecologists.
- Certain substances may be any gas, liquid, or solid are considered significantpollutants because of very large emission rates or harmful and unwantedeffects.

Why we need EIA?

EIA is essentially a planning tool for preventing environmental problems due to an action.

It seeks to avoid costly mistake in project implementation,

- either because of environmental damages that are likely to arise during project implementation
- because of modifications that are required subsequently in order to make the action environmentally acceptable to government and community

EIAs have two roles - legal and educational.

➤ The legal one is quite straight forward: to ensure that development projects has a minimal impact on the environment in its entire 'lifecycle'.

➤ The educational one is equally important and probably a forerunner to the legal role - to educate everyone one involved - professionals and users included

- (i) Identifications of goals and objectives.
 - Identification of environmental components and their effects; presence or absence
- (ii) Survey, forecast and analysis.
 - Forecasting change in the environment;
 - estimation of probability of occurrence
- (iii) Formulation and evaluation of alternative plans.
 - Evaluation of importance, consequence and significance
- (iv) Decision, implementation and monitoring.
 - also comparison of trade-offs among various alternatives
- (v) Consultation and public participation.

- **The Factory (Amendment) Act of 1987**
- This Act is aimed at declaring the information of hazardous processes taking place inside the factory to its workers, local residents and government officials.
- This rule also allows the employees to inform the Factory Inspectorate directly regarding violation of safety rules during plant operation.
- According to the second amendment of the Environment (Protection) Act, 1992 all these industries are covered by Water and Air Pollution Act and also by Hazardous Waste Handling Act.
- According to this amendment, every industry is to submit an environmental audit report to the State Pollution Control Board on or before May 15 for the financial year ending on March 31.
- In order to reduce the pollution burden and optimum utilization of natural resources, a comparative statement from the previous year is to be submitted.