



UNIT 3

Anthropogenic disaster



Human-Made Disasters

- Disasters having elements of human intent, negligence, error, failure of human-made systems. Such events result in huge losses of life & property along with damage to people's mental, physical & social well-being.

Nuclear Disaster

- A Nuclear Radiation Disaster is an event that leads to significant consequences to people, the environment or the facility such as lethal effects to individuals both living & unborn. Excessive radioactivity release to the environment leads to unstable environment, deadly effects on all living organisms(including plants).



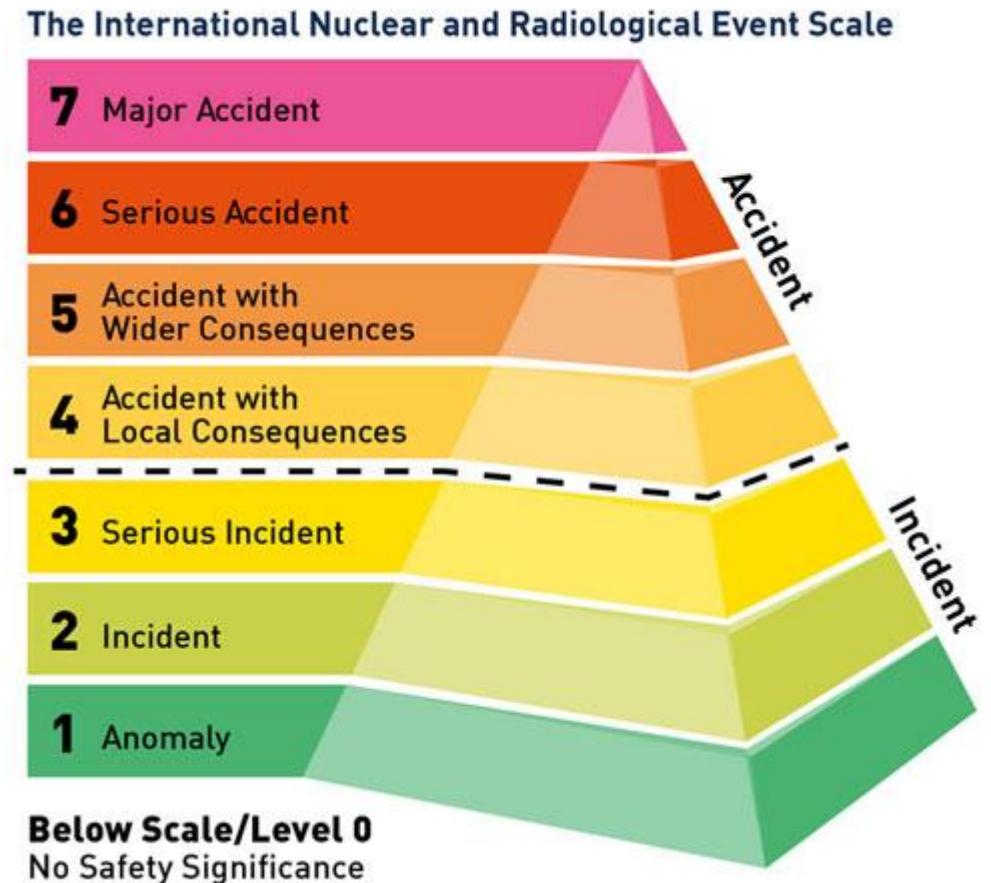
A nuclear disaster could take several forms . The most obvious would be a meltdown at a nuclear reactor plant . Though the plant might not explode, the result of such a disaster would very likely be the release of massive amount of radiation and radioactive material into the environment and it would take hundred years to decay to anything near “safe” levels .

Causes of Nuclear Disaster

- When a meltdown occurs in a reactor, the reactor "melts". That is, the temperature rises in the core so much that the fuel rods actually turn to liquid, like ice turns into water when heated. If the core continues to heat, the reactor would get so hot that the steel walls of the core would also melt. In a complete reactor meltdown, the extremely hot (about 2700 Celsius) molten uranium fuel rods would melt through the bottom of the reactor and actually sink about 50 feet into the earth beneath the power plant.
- The molten uranium would react with groundwater, producing large explosions of radioactive steam and debris that would affect nearby towns and population centers.

International Nuclear and Radiological Event Scale (INES)

- The International Nuclear and Radiological Event Scale (INES) is a **seven point scale**.
- Level 1 being the least significant, and Level 7 the most significant.
- Where an event is classified as Level 0 or ‘below scale’, this means it has no nuclear or radiological safety significance.



INES classifies nuclear and radiological accidents and incidents by considering three areas of impact:

- **People and the Environment** considers the radiation doses to people close to the location of the event and the widespread. It covers unplanned release of radioactive material from an installation.
- **Radiological Barriers and Control** covers events without any direct impact on people or the environment and only applies inside major facilities. It covers unplanned high radiation levels and spread of significant quantities of radioactive materials confined within the installation.
- **Defence-in-Depth** also covers events without any direct impact on people or the environment, but for which the range of measures put in place to prevent accidents did not function as intended.

Nuclear Disaster in Fukushima

- Following a major earthquake, a 15-metre tsunami disabled the power supply and cooling of three Fukushima Daiichi reactors, causing a nuclear accident on 11 March 2011. All three cores largely melted in the first three days.
- The accident was rated 7 on the INES scale, due to high radioactive releases over days 4 to 6, eventually a total of some 940 PBq ($I-131$ eq).
- PBq (petabecquerel, an SI unit of radioactivity equal to 10^{15} becquerels).
- There have been no deaths or cases of radiation sickness from the nuclear accident, but over 100,000 people had to be evacuated from their homes to ensure this.

Nuclear Disaster in Ukraine

- The Chernobyl disaster is the worst nuclear power plant accident in the history in the terms of cost and resulting deaths, and is one of only two classified as level 7 event on the international nuclear event scale.
- The battle to contain the contamination and avert a greater catastrophe ultimately involved over 500,000 workers and cost an estimated 18 billion.
- During the accident itself 31 people died, and long – term effects such as cancer and deformities are still being accounted for.

Consequences of Nuclear Disaster

- Nuclear explosions produce both immediate and delayed destructive effects.
- Immediate effects (blast, thermal radiation, prompt ionizing radiation) are produced and cause significant destruction within seconds or minutes of a nuclear detonation.
- The delayed effects (radioactive fallout and other possible environmental effects) inflict damage over an extended period ranging from hours to centuries, and can cause adverse effects in locations very distant from the site of the detonation.

Consequences of Nuclear Disaster

- Nuclear disaster can produce climate issues because the high temperatures of the nuclear fireball cause large amounts of nitrogen oxides to form from the oxygen and nitrogen in the atmosphere (very similar to what happens in combustion engines).
- Each megaton of yield will produce some 5000 tons of nitrogen oxides. The rising fireball of a high kiloton or megaton range warhead will carry these nitric oxides well up into the stratosphere, where they can reach the ozone layer.
- A series of large atmospheric explosions could significantly deplete the ozone layer

Ways to Mitigate Radiation Damage

- Fukushima disaster caused many people to become aware of potassium iodide tablets, available from your local drug store, via outlets online, and sometimes distributed by utilities or local officials to people living near nuclear facilities experiencing problems.
- This stable form of iodine, which is used by the thyroid gland to produce necessary hormones for metabolism and fetal brain development can protect your thyroid gland from radioactive iodine-131.
- But it does not protect against any other limiting isotopes likely to be released from a nuclear event.

Ways to Mitigate Radiation Damage

- However, these measures are not enough to completely moderate the harmful effects of a nuclear disaster.
- A nuclear disaster causes the depletion of the ozone layer which in turn leads to skin diseases.
- The only way to insure safety of people is to build robust nuclear reactors and efficient coolants.

Effects of Nuclear Disaster

- Nuclear explosions can release high levels of radiation, an energy that removes electrons.
- Nuclear radiation can damage DNA.
- While areas around a nuclear explosion are immediately exposed, radiation can also remain in the atmosphere for decades, traveling great distances before it settles to the ground-level air or earth's surface.
- Disposing of one's outer clothing can remove up to 90% of radioactive material after a nuclear disaster.
- The peace symbol was initially designed for the Direct Action Committee Against Nuclear War (DACP).

In case of a Nuclear Disaster

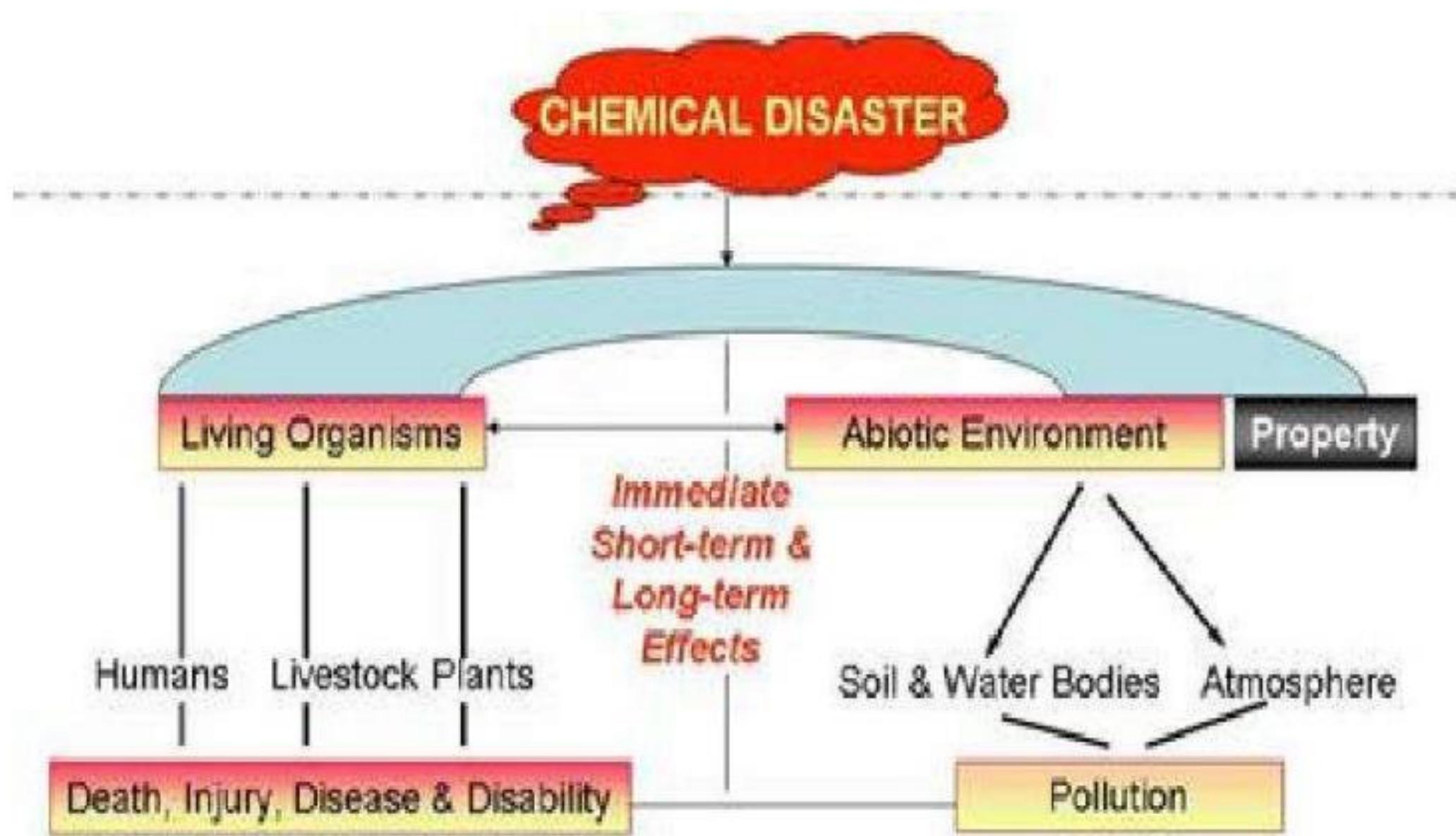
- People should stay inside buildings or areas far away from the nuclear plant.
- Phones should not be used unless absolutely necessary, the lines may collapse if everybody is using phones and phone lines are very necessary for emergency equipment.
- There should be a ban on consumption of agricultural products or water. For example in Japan there was a ban on consumption of products from near the nuclear plant.

Chemical or Industrial Disaster

- A Chemical Disaster is the unintentional release of hazardous substances which could harm Human health or the environment, these occur under certain circumstances such as fires, explosions, leakages or releases of toxic materials. Such events leads to illness, injury, disability or death, such events may occur where toxic materials are stored, transported or used.

Chemical Hazards

- Chemicals can affect the skin by contact or the body either through the digestive system or through the lungs if air is contaminated with chemicals, vapors, mist or dust. There can be an acute (immediate) effect, or a chronic (medium to long-term) effect from the accumulation of chemicals or substances in or on the body.



Hazardous chemicals

- Flammable or explosive

Gasoline, kerosene

- Irritating to skin, lungs, eyes

Strong acids, strong alkali (lye), paint fumes

- Interfere with oxygen uptake, delivery, and use in body

Carbon monoxide, Hydrogen sulfide, cyanide

Significant Chemical disasters occurred in world

1. In 2005,petroleum refinery in texas city, United States ,15 were killed.
2. Sep 2001,300 tonnes of ammonium nitrate explosion taken places in the AZF/Grande Paroisse plant of Toulouse (France), causing 31 deaths, hundreds of casualties, and enormous damages.
3. Feb 2000,poisonous chemical leak of cyanide near Baia Mare, Romania, into the Someş River by the gold mining company Aurul, a joint-venture of the Australian company. It also took place 2.5 million people were killed.
4. On 27 June 2014 a massive fire broke out following a blast in Gas Authority of India Limited (GAIL) 18" size underground gas Pipeline at Nagaram, East Godavari districtin East Godavari district of Andhra Pradesh, India.

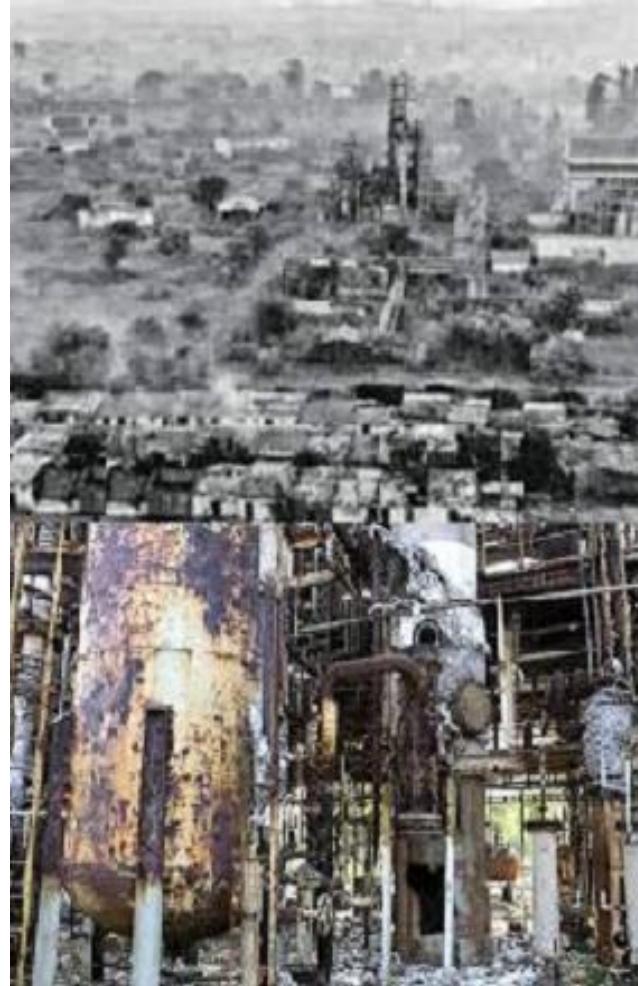
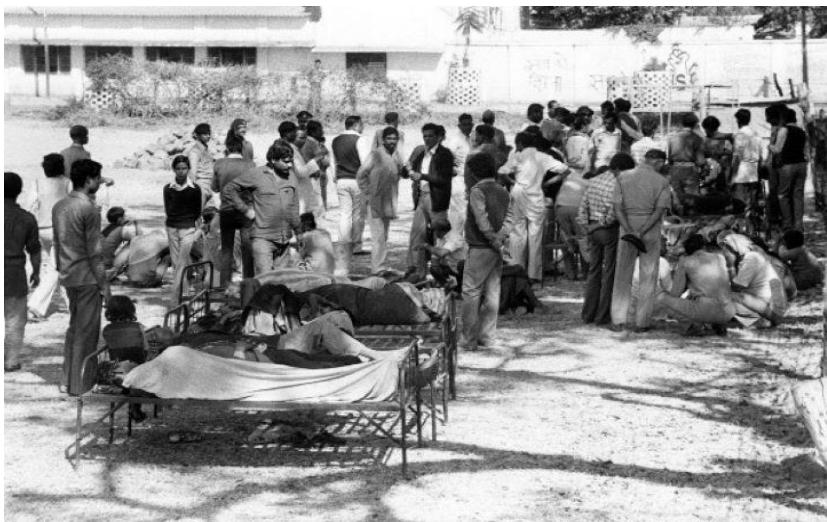
Bhopal Scenario - The worst industrial disaster

- The Bhopal disaster, also referred to as the Bhopal gas tragedy was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, IndiaUnion Carbide Corporation.
- Over 500,000 people were exposed to methyl isocyanate (MIC) gas.
- Release of Methyl Isocyanate - • Clear, colorless, sharp smelling liquid • Highly flammable • Extremely toxic • Volatile reaction with water in about 10 minutes
- Social Effects - • No or little earnings reduced self esteem • Heavy loans to pay for medicines • Children future destroyed • Children could be affected for life • Forgotten by media.
- Among the 500,000 people exposed to the gas: – 20,000 have died till date – 120,000 continue to suffer • Out of every 3 children born after the Bhopal disaster, only 1 survived.

How?

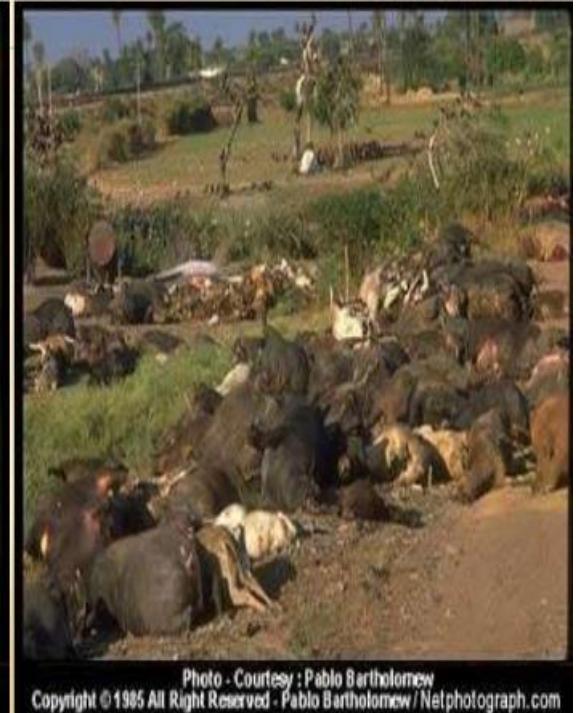
- The disaster happened because water entered a tank containing Methyl isocyanate. This caused a chemical reaction which resulted in the buildup of much Carbon dioxide, among other things.
- The resulting reaction increased the temperature inside the tank to reach over 200 °C (392 °F). The pressure was more than the tank was built to withstand.
- The tank had valves to control the pressure. These were triggered in an emergency, which reduced the pressure. As a result, large amounts of toxic gases were released into the environment.
- The pipes were rusty. The rust in the iron pipes made the reaction faster.
- All the contents of the tank were released within a period of about two hours.
- The water had entered the tank because of a sequence of events. The tank had been maintained badly. When cleaning work was done, water entered the tank.

Bhopal Gas tragedy



Environmental Impact

- Over 2,000 animals were killed by the **gas** that night, most of them livestock that people relied on for food.
- The heavy **gas** was absorbed into local rivers, making the water undrinkable and poisoning the fish.



Biological Disaster

- Biological Disasters are also known as biohazards, these refers to biological substances that pose a threat to the health of living organisms, primarily that of humans. Such events may include medical waste or samples of micro-organisms, viruses or toxins that may affect or alter human health & other living organisms as well.

Common examples of biological hazards include:

- Malaria, Dengue fever
- Meningitis, influenza
- Pest infestations
- Zoonoses - HIV, H5N1 virus (Bird flu), H1N1 (Swine Flu), the plague, Anthrax, Cholera, Leptospirosis
- Medical wastes - Used needles, medication that has expired etc.

A society or community can be seen as vulnerable to biological hazards because of the following:

- Poor sanitation practices: indiscriminate dumping, polluting of drainage channels and sewers, consumption of contaminated water or food etc.
- Hospitals and medical centres dispose of medical wastes improperly
- Limited border control and protection
- Lack of understanding of the risks and causes of the hazards
- Limited or non-existent hazard response capabilities i.e. trained and well equipped personnel who know how to respond to a biologically hazardous incident.
- Hospitals have limited or non-existent quarantine capabilities to control the spread of diseases or treat affected persons.
- Limited access to vaccines that prevent the spread
- No known cure or vaccine for biological agents
- Civil unrest, malicious intent or terrorist activity existing the country

How to reduce vulnerability

- There are strict penalties for poor sanitation and that it is promoted extensively in public education campaigns
- Ensure that hospitals follow standard procedures for disposal of medical
- Border controls should be vigilant for any potential threats. This can be achieved through training of personnel.
- Existing HAZMAT capabilities should be strengthened to ensure that they are prepared for potential threats and are drilled in response
- Improved mechanisms for obtaining sufficient vaccines when they are developed
- Monitoring of groups and individuals pose a potential threat.

Accidental Disaster

- An Accidental Disaster is an unforeseen & unplanned event or circumstance, often with lack of intention or necessity. It usually implies a generally negative outcome which might have been avoided or prevented if the circumstances leading up to the accident had been recognized & acted upon prior to it's occurrence.

Forest Fire

- The most common hazard in forests is forests fire. Forests fires are as old as the forests themselves.
- They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region.
- During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twinges, which could burst into flames ignited by the slightest spark.
- Forest fire causes imbalances in nature and endangers biodiversity by reducing faunal and floral wealth.

CAUSES OF FOREST FIRE

- **Natural causes-** Many forest fires start from natural causes such as lightning which set trees on fire. However, rain extinguishes such fires without causing much damage. High atmospheric temperatures and dryness (low humidity) offer favorable circumstance for a fire to start.
- **Man made causes-** Fire is caused when a source of fire like naked flame, cigarette or bidi, electric spark or any source of ignition comes into contact with inflammable material.

Environmental causes

- **Environmental causes** are largely related to climatic conditions such as temperature, wind speed and direction, level of moisture in soil and atmosphere and duration of dry spells. Other natural causes are the friction of bamboos swaying due to high wind velocity and rolling stones that result in sparks setting off fires in highly inflammable leaf litter on the forest floor.

Human related causes

- **Human related causes** result from human activity as well as methods of forest management. These can be intentional or unintentional, for example:
- graziers and gatherers of various forest products starting small fires to obtain good grazing grass as well as to facilitate gathering of minor forest produce like flowers of *Madhuca indica* and leaves of *Diospyros melanoxylon*
- the centuries old practice of shifting cultivation (especially in the North-Eastern region of India and in parts of the States of Orissa and Andhra Pradesh).
- the use of fires by villagers to ward off wild animals
- fires lit intentionally by people living around forests for recreation
- fires started accidentally by careless visitors to forests who discard cigarette butts.

Classification of Forest Fire

Forest fire can broadly be classified into three categories;

- Natural or controlled forest fire.
- Forest fires caused by heat generated in the litter and other biomes in summer through carelessness of people (human neglect) and
- Forest fires purposely caused by local inhabitants.

Types of Forest Fire

There are two types of forest fire i) Surface Fire and ii) Crown Fire

- **Surface Fire**

A forest fire may burn primarily as a surface fire, spreading along the ground as the surface litter (senescent leaves and twigs and dry grasses etc) on the forest floor and is engulfed by the spreading flames.

- **Crown Fire**

The other type of forest fire is a crown fire in which the crown of trees and shrubs burn, often sustained by a surface fire. A crown fire is particularly very dangerous in a coniferous forest because resinous material given off burning logs burn furiously. On hill slopes, if the fire starts downhill, it spreads up fast as heated air adjacent to a slope tends to flow up the slope spreading flames along with it. If the fire starts uphill, there is less likelihood of it spreading downwards.

EFFECT OF FOREST FIRE

Fires are a major cause of forest degradation and have wide ranging adverse ecological, economic and social impacts, including:

- loss of valuable timber resources
- degradation of catchment areas
- loss of biodiversity and extinction of plants and animals
- loss of wildlife habitat and depletion of wildlife
- loss of natural regeneration and reduction in forest cover
- global warming
- loss of carbon sink resource and increase in percentage of CO₂ in atmosphere
- change in the microclimate of the area with unhealthy living conditions
- soil erosion affecting productivity of soils and production
- ozone layer depletion
- health problems leading to diseases
- loss of livelihood for tribal people and the rural poor, as approximately 300 million people are directly dependent upon collection of non-timber forest products from forest areas for their livelihood.

Need for Forest Management

- The incidence of forest fires in the country is on the increase and more area is burned each year. The major cause of this failure is the piecemeal approach to the problem. Both the national focus and the technical resources required for sustaining a systematic forest fire management programme are lacking in the country. Important forest fire management elements like strategic fire centres, coordination among Ministries, funding, human resource development, fire research, fire management, and extension programmes are missing.
- Taking into consideration the serious nature of the problem, it is necessary to make some major improvements in the forest fire management strategy for the country. The Ministry of Environment and Forests, Government of India, has prepared a National Master Plan for Forest Fire Control.

Need for Forest Management

This plan proposes to introduce a well-coordinated and integrated fire-management programme that includes the following components:

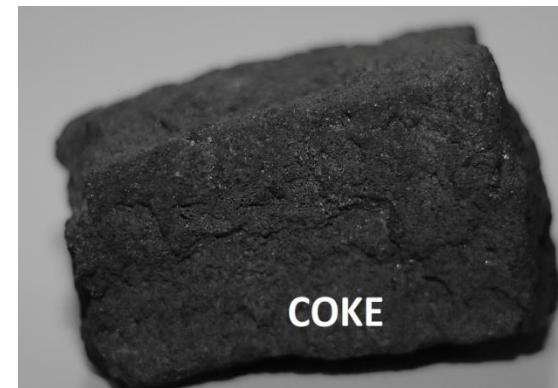
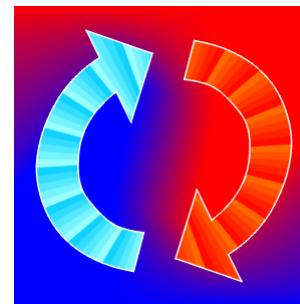
- Prevention of human-caused fires through education and environmental modification. It will include silvicultural activities, engineering works, people participation, and education and enforcement. It is proposed that more emphasis be given to people participation through Joint Forest Fire Management for fire prevention.
- Prompt detection of fires through a well coordinated network of observation points, efficient ground patrolling, and communication networks. Remote sensing technology is to be given due importance in fire detection. For successful fire management and administration, a National Fire Danger Rating System (NFDRS) and Fire Forecasting System are to be developed in the country.
- Fast initial attack measures.
- Vigorous follow up action.
- Introducing a forest fuel modification system at strategic points.
- Firefighting resources.

COAL

- Coal is a combustible, sedimentary, organic rock, formed from **vegetation**. In other words coal is a **fossil fuel** created from the remains of **plants** that lived millions of years ago. It is considered as **non renewable source** of energy because it takes too much time to form.

Coal

- Sedimentary formation of **carbonaceous** character that is **derived from vegetable matter** involving a **set of processes** such as **burial, compaction and biochemical transformation**.
- Some varieties are rich in volatile matter.



- Principle Constituents: **Fixed carbon, moisture, volatile matter and mineral matter.**
- Most essential raw material in the extraction of metals.

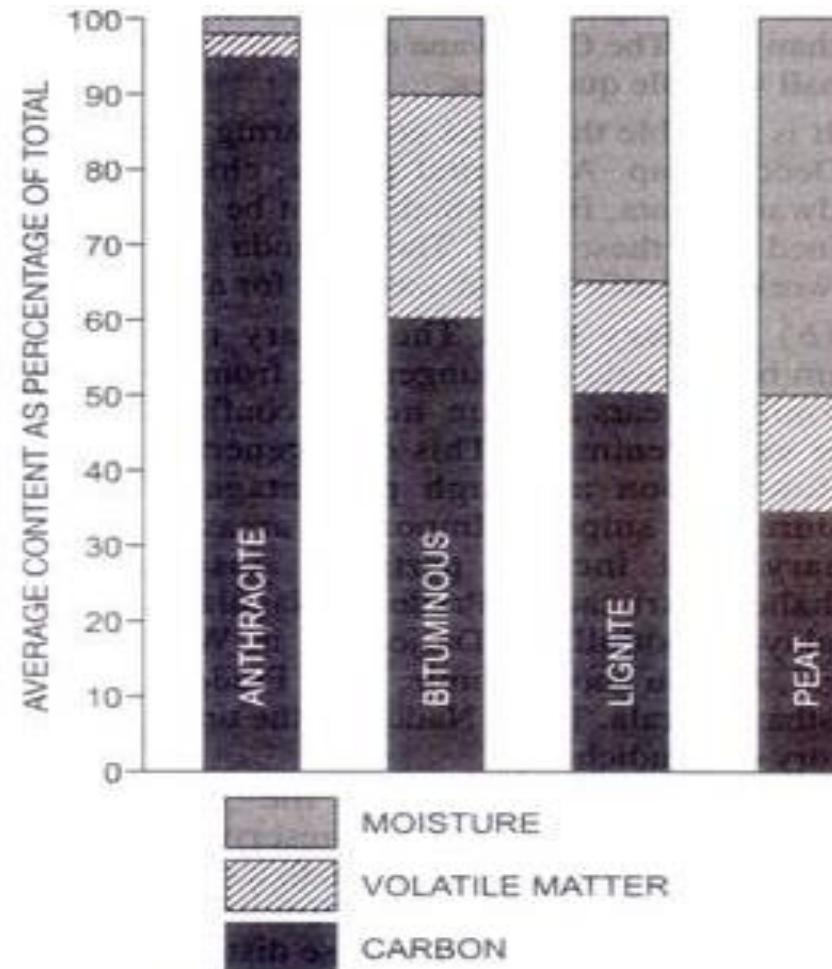
Chemical Composition

- **Carbon**, oxygen, hydrogen, nitrogen, traces of sulphur and phosphorous.
- Coals may contain varying proportion of mineral matter –residues of the mineral constituents of the plants.
These can be **detrital** in origin.
 - Carbon (60-90 percent)
 - Oxygen (2-20 percent)
 - Hydrogen (1-12 percent)
 - Nitrogen (1-3 percent)
- Among the mineral matter, **silica** is quite common.

Classification

- Rank of coal “Degree of transformation” of wood into coal by deposition, compaction and biochemical changes.

1. Peat
2. Lignite
3. Sub-bituminous
4. Bituminous coal
5. Anthracite
6. Graphite



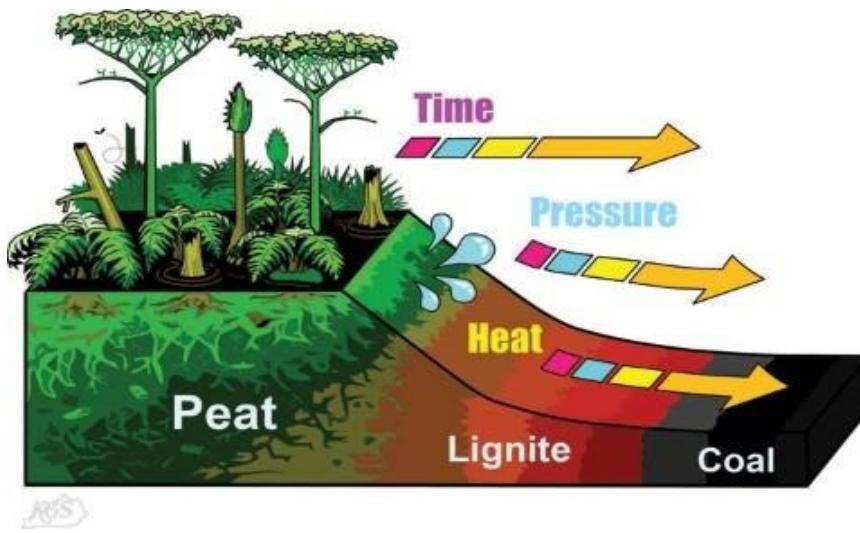
PEAT

- Partly changed vegetable matter in the **first stage of transformation to coal.**
- The vegetable structure and the evidence of its process of transformation is clearly seen.



Lignite (Brown Coal)

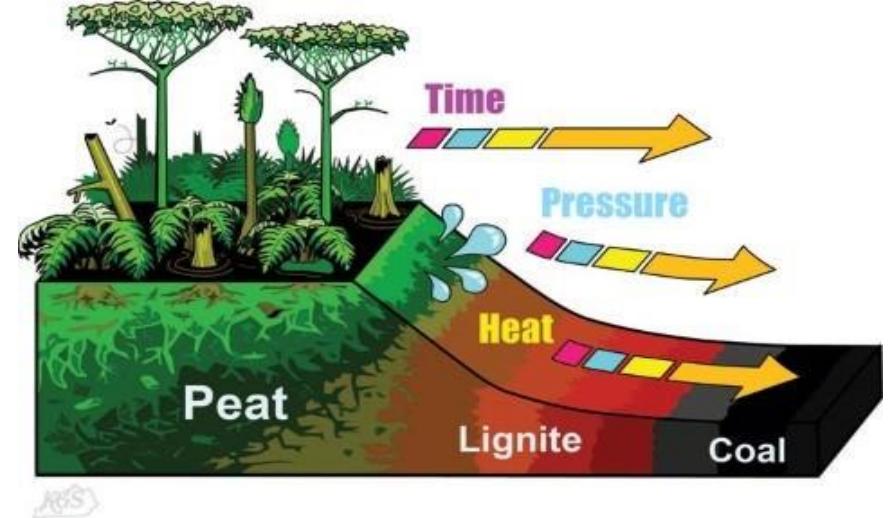
- Lignite is generally yellow to dark brown or rarely black coal that **formed from peat at shallow depths** and temperatures lower than 100 °C (212 °F).
- The transformation of **vegetable matter to coal-like material is almost complete.**



- It is compact and **earthy in texture** and has a **brown streak**. Fibrous texture is also shown by some lignites.

Bituminous Coals (Common Coal, Coking Coal or Caking Coal)

- Commercial coals.
- The original **vegetable matter** has been **fully transformed** into **carbonaceous material** so that it forms hard, brittle and compact mass.
- Black in color and compact.
- Burns with yellow flame.
- **Black streak** and can burn freely.
- Categorized based of its carbon content.



Bituminous Coal

- It shows banded structure and **rich in carbon and poor in moisture content.**
- **Carbon content: 70-90%; volatile matter : 20 -45 %.**
- The bands in the bituminous coal are of dull and bright varieties, which show an alternating arrangement : **vitrain, clarain, durain and fusain.**

Anthracite

- Coal of highest rank – original **organic source** has been **completely transformed** into **carbonaceous** substance.
- It is very hard, jet black in color, compact and metallic luster.
- **Difficult to ignite** and burns with a typically blue flame without emitting any smoke.
- Domestic Fuel; used for steam raising; heating purposes. Since low volatile matter content, not suitable for making coke.

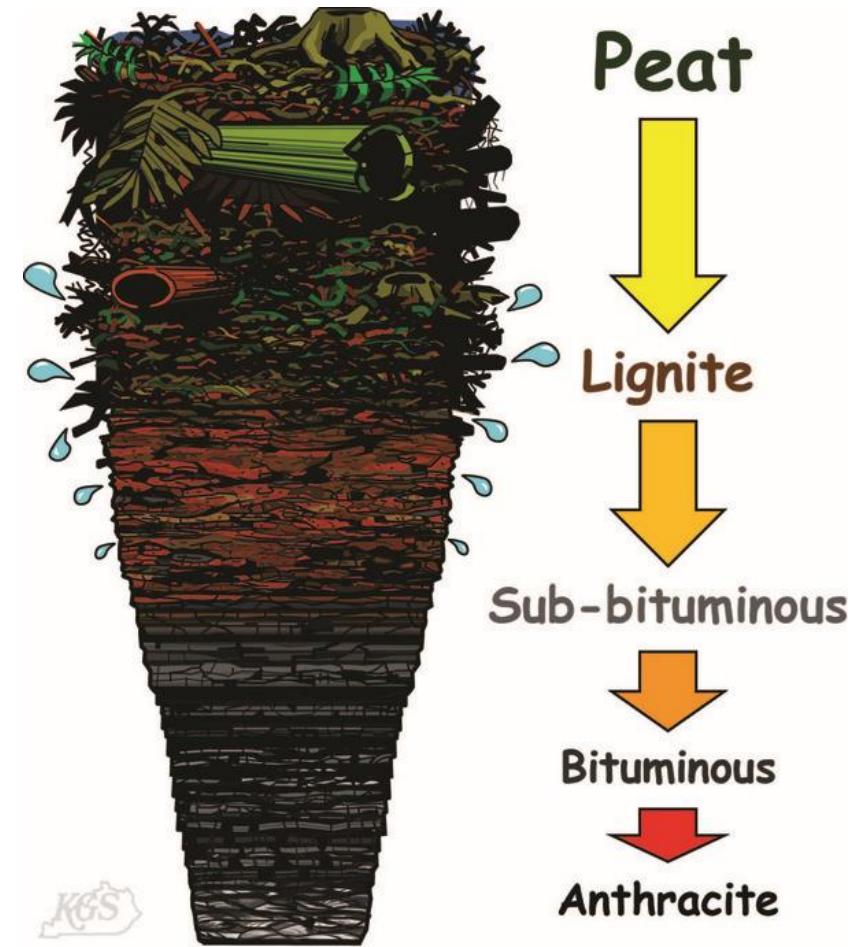
Formation of Coal

1. Vegetable matter

accumulation

2. Transformation of

vegetable matter into coal



Formation of Coal

- **Peat** is an accumulation of partially decayed vegetation matter.
- For the peat to become coal, it must be buried by sediment.
- 10 vertical feet of original peat material is required to produce 1 vertical foot of coal.



Formation of Coal

Phase 1. Aerobic decay

- In the **first few inches of peat, aerobic (oxygen needing) bacterial decay reduces the volume by as much as 50%.**
- Because the water is stagnant and the peat is almost impermeable, the bacteria soon use up all the available oxygen and die, ending the first stage of decay.

Formation of Coal

Phase 2. Anerobic decay

- A second type of bacteria exists in the swamp that **requires no oxygen**. These anerobic bacteria continue the decay process **reducing the volume** still further.
- Anerobic decay produces more **acids** and when the acidity gets too high, it kills off the remaining bacteria ending all decay.

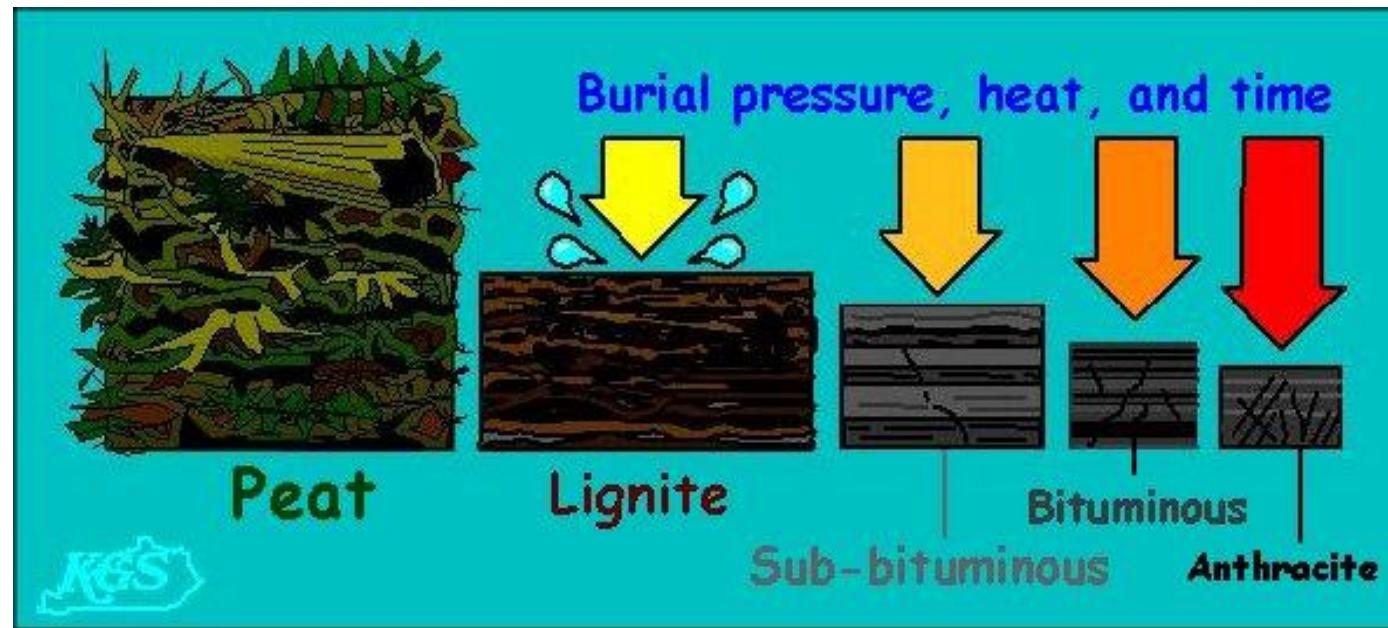
Formation of Coal

Phase 3. Bituminization

- After the bacterial decay stages, the peat must be buried under thousands of feet of sediment that provides an insulating blanket trapping the natural heat rising to the surface.
- Once the temperature reaches 100°C, (212°F) the bituminization process begins.
- Chemical reactions drive off **water, oxygen and hydrogen** which raises the percentage of carbon.

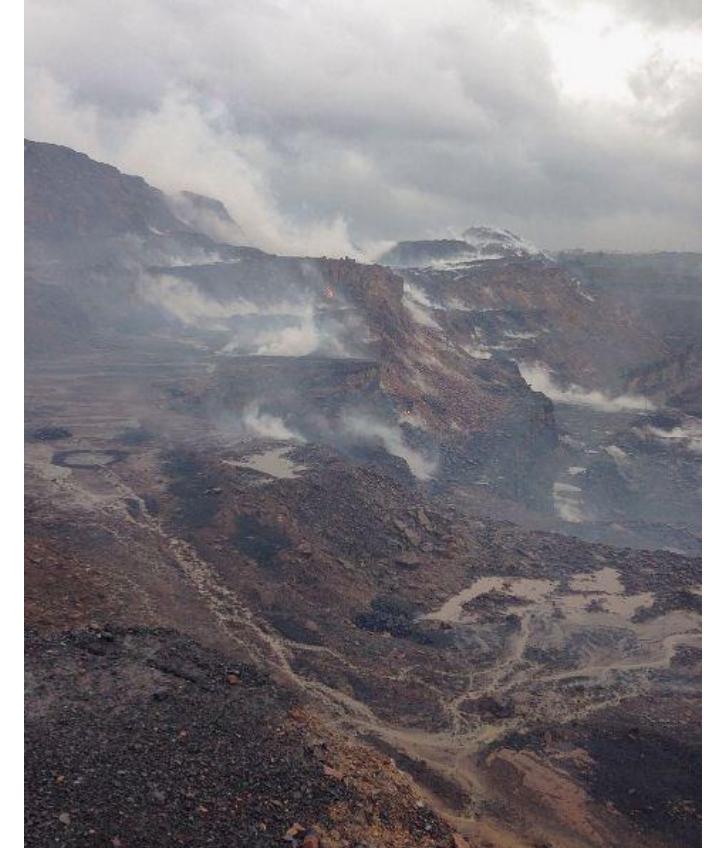
Formation of Coal

- The stages of this trend proceed from plant debris through peat, lignite, sub-bituminous coal, bituminous coal, to anthracite coal.
- Takes millions of years to convert peat to anthracite coal.



Coal Fire

- Coal mine fires are widespread, and currently thousands are burning throughout the world, especially in India, China, and the USA.
- Coal, a non-renewable source of energy, is found in several parts of the world. The coal layers are mined by two methods: **open cast mining and underground mining**. The number of coal fires has increased dramatically since the Industrial Revolution as a result of human activity such as mining, land clearing, and anthropogenic climate change .
- The impacts of coal mine fires may be considered in health, environmental and economic terms.



The Jharia coal field fire

- The Jharia coalfield in Bihar is an exclusive storehouse of prime **coke** coal in the country, consisting of **23 large underground and 9 large open cast mines**.
- The mining activities in these coalfields started in 1894 and had really intensified in 1925. **The history of coal-mine fire in Jharia coalfield can be traced back to 1916** when the first fire was detected.
- At present, more than 70 mine fires are reported from this region.



The Jharia coal field fire

- Coal is formed from organic matter with a high carbon content, which when exposed to certain conditions (temperature, moisture, oxygen etc.) tends to ignite/ burn spontaneously at rather low temperatures. This may occur naturally or the combustion process may be triggered by other causes.
- However, once a coal seam catches fire, and efforts to stop it an early stage fail, **it may continue to burn for tens to hundreds of years**, depending primarily on the **availability of coal and oxygen**. Coal fires have occurred in nearly all parts of the world like India, the US, Indonesia, South Africa, Australia, China, Germany and many other countries.
- However, the nature and magnitude of the problem differs from country to country. **In India, the fire in the Jharia coalfield has mainly been due to unscientific mining and extraction of coal in the past.**

The Jharia coal field fire

- Fires may occur in coal layers that are exposed to the surface of the earth or areas close to it. These are visible to the naked eye. Also, fires erupt in the underground seams, which have large cracks that serve as channels for oxygen to the burning coal.
- The main cause of natural coal fires are lightening, forest fires, bush fires, etc.
- Among human causes are accidents, negligent acts, domestic fires, lighting fires in abandoned underground mines for heating or distilling alcohol etc.
- Besides, burning away of an important energy resource, it creates problems for exploitation of coal, poses danger to humankind, raises the temperature of the area, and when present **underground, can cause land to subside**.

The Jharia coal field fire

- The pollution caused by these fires affects air, water, and land. Smoke, from these fires contains **poisonous gases such as oxides and dioxides of carbon, nitrogen and sulphur**, which along with particulate matter are the causes of several lung and skin diseases.
- High levels of suspended particulate matter increase respiratory diseases such as **chronic bronchitis and asthma**, while the gases contribute to **global warming** besides causing health hazards to the exposed population.
- Methane emission from coal mining depends on the mining methods, depth of coal mining, coal quality and entrapped gas content in the coal seams.
- These fires also pollute **water** by contaminating it and **increasing its acidity**, which is due to a certain percentage of sulphur that is present in coal.
- These fires lead to degradation of land and does not allow any vegetation to grow in the area.

The Jharia coal field fire

- The measures for controlling coal mine fires, in the case of Jharia coalfields, include bull dozing, leveling and covering with soil to prevent the entry of oxygen and to stabilize the land for vegetation.
- Fire fighting in this area requires relocation of a large population, which poses to be a bigger problem than the actual fire fighting operations.

Oil Well Fire

- **Oil well fires** are oil or gas wells that have caught on fire and burn. Oil well fires can be the result of human actions, such as accidents or arson, or natural events, such as lightning.
- They can exist on a small scale, such as an oil field spill catching fire, or on a huge scale, as in geyser-like jets of flames from ignited high pressure wells.
- A frequent cause of a well fire is a high-pressure blowout during drilling operations.



Air Pollution

- Presence of substances in the surrounding atmosphere generated by man's activities that interfere with human health, safety, comfort.
- Direct effect of air pollution can influence the structure & function of ecosystem, affecting quality of life.
- Nevertheless, public health practitioners and decision makers in developing countries need to be aware of the potential health risks caused by air and water pollution and to know where to find the more detailed information required to handle a specific situation.

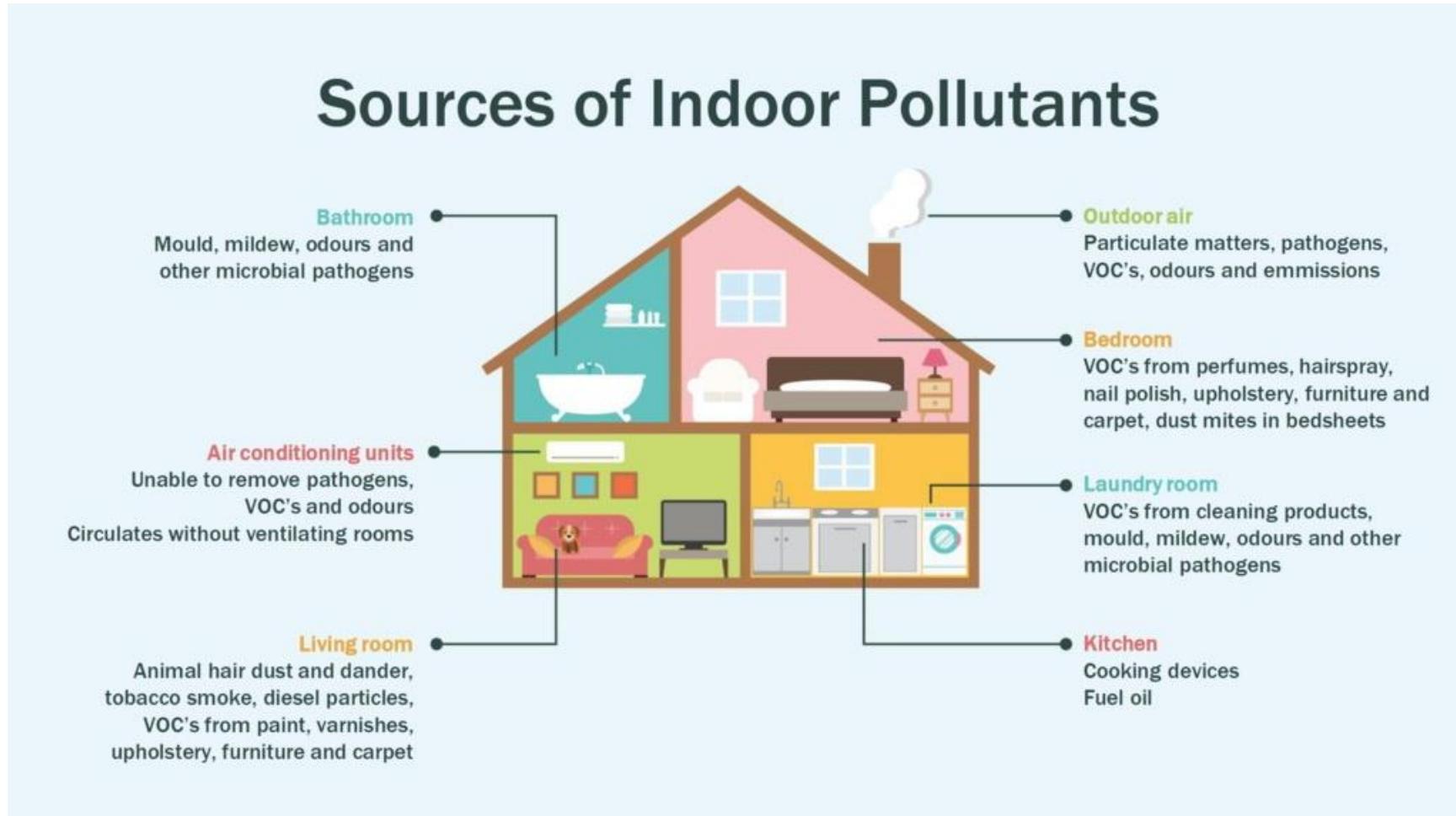
Types of air pollution

- Outdoor air pollution
 - ✓ Smog
 - ✓ Particulates
 - ✓ Greenhouse gases
- Indoor air pollution

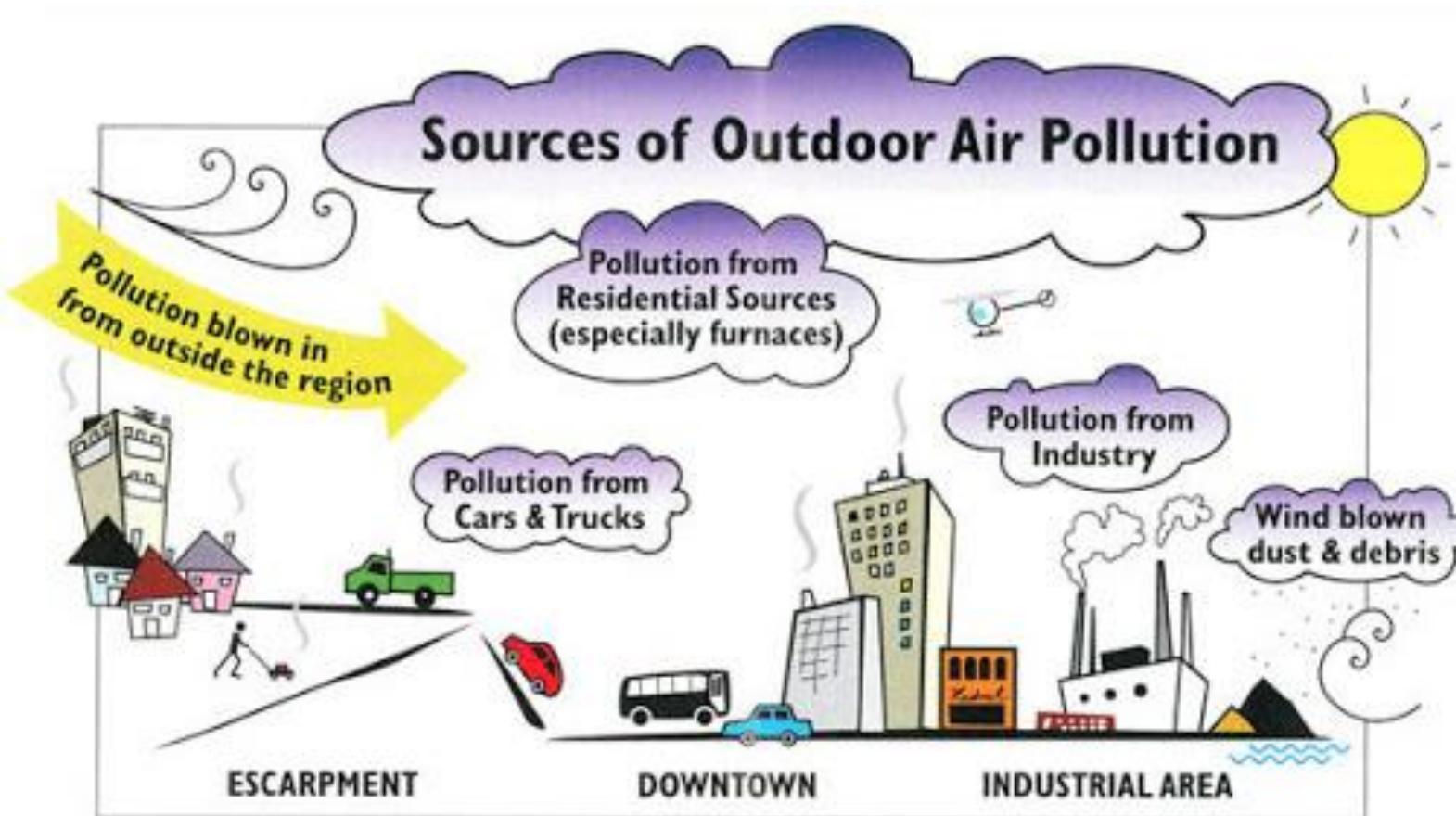
Indoor air pollution

- One of the 4 most critical global environmental problem, (women & children)
- Contributes to:
 - acute resp. infection (children)
 - Chronic lung disease (adult)
 - Cancer
 - Adverse pregnancy outcomes

Sources of Indoor Air pollution



Sources of outdoor Air pollution



Effects

- Human effect
 - ✓ e.g.: diseases
- Environmental effect
 - ✓ Acid rain
 - ✓ Ozone depletion
 - ✓ Global climate changes
 - ✓ haze
- Social & economic aspects
 - ✓ Destruction of plant & animal life
 - ✓ Corrosion of metal

Prevention & control

- Containment: enclosure, ventilation, air cleaning
- Replacement: replacing a technology process causing air pollution by a new process that does not
- Dilution: Planting trees/re-forestation
- Legislation: enacted The Air (prevention & control) Act, enforcement of standard for ambient air quality, create smokeless zone
- International action: establish international network of laboratories

Water Pollution

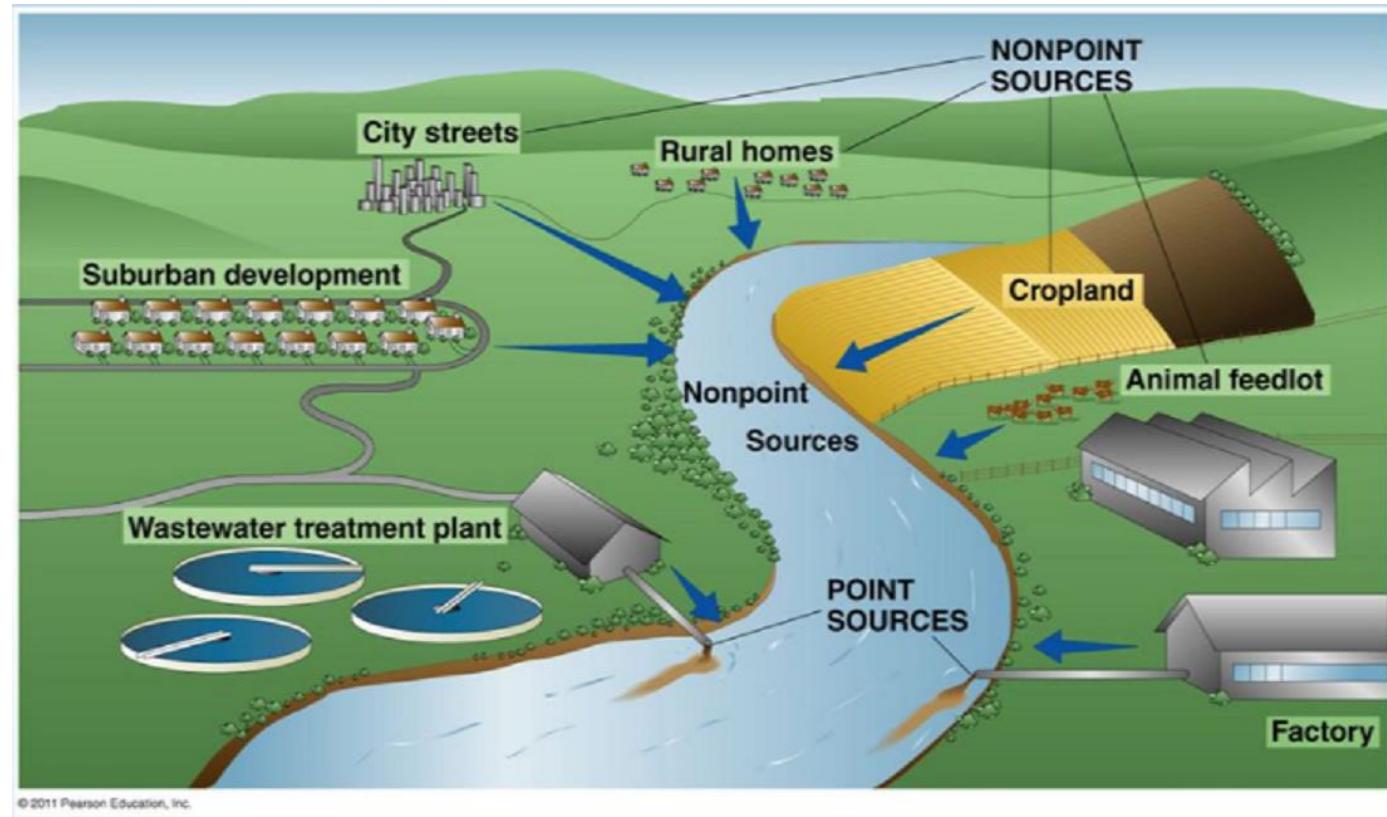
The contamination of natural water bodies by chemical, physical, radioactive or pathogenic microbial substances

Indicator of pollution:

- Total suspended solid
- Biochemical oxygen demand at 20°C
- Conc. Of chloride, nitrogen & phosphorus
- Absence of dissolved oxygen

Causes

- Human activity- urbanization & industrialization
- Sources of pollution:



Water related diseases

- Biological
 - ✓ Presence of infective agents
 - ✓ Presence of an aquatic host
- Chemical
 - ✓ Industrial & agricultural wastes
 - ✓ Pollutants: detergent solvents, cyanide, heavy metal, mineral & organic acids
 - ✓ May affects man's health direct & indirectly

Prevention & control

- Public awareness
- Laws, standards and practices should be established
- Reforestation
- A regular qualitative and quantitative monitoring of fresh water resources.

Water Purification

Purification of water on a large scale

a) Storage

- Physical changes
- Chemical changes
- Biological changes

b) Filtration

- Slow sand filter and
- rapid sand filter

c) Disinfection

- Chlorination (chlorine gas, chloramine, perchloron)
- UV radiation

Purification of water on a small scale

1) Household purification

- a. Boiling
- b. Chemical disinfection
 - (Bleaching powder, Chlorine tablets, Iodine, Potassium permanganate, Alum)

c. Filtration

- Ceramic filters

2) Disinfection of wells

- a. By adding bleaching powder

Industrial Waste Water Pollution

- **Industrial waste** is the waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process such as that of factories, industries, mills, and mining operations.
- Industrial waste may be solid, liquid or gaseous.
- Industrial waste may pollute the air, the soil, or nearby water sources, eventually ending up in the sea.
- This resulted in serious pollution problems and caused negative effects to the ecosystem and human's life.

TYPES OF INDUSTRIAL WASTEWATER

- There are many types of industrial wastewater based on different industries and contaminants
- Each sector produces its own particular combination of pollutants
The treatment of industrial wastewater must be designed specifically for the particular type of effluent produced
- Generally industrial wastewater can be divided in to two types

Organic and Inorganic

Sector	Pollutant
Iron and steel	Oil, Metals, Acids, Phenols and Cyanides
Textiles and leather	Solids, Sulfates and Chromium
Pulp and paper	Solids, Chlorinated organic compounds
Petrochemical and refineries	Mineral oils, Phenols and Chromium
Chemicals	Organic chemicals, Heavy metals and Cyanide
Non ferrous metals	Fluorine
Microelectronics	Organic chemicals
Mining	Metals, Acids and Salts

Inorganic industrial wastewater

- Wastewater produced mainly from
 - ✓ Coal and steel industries
 - ✓ Commercial enterprises
 - ✓ Industries for surface processing of metals (electroplating plants)
- These wastewaters contain large proportion of suspended matter, which can be eliminated by sedimentation.
- Often together with flocculation means addition of iron or aluminium salts, flocculation agents and some kinds of organic polymers

COAL WASHING

- In the separation of coal from dead rock large amounts of water is used, this water contains large amounts of coal and rock particles known as Coal washing water.
- This water is recycled by the removal of coal and rock particles through flotation and sedimentation processes.



ROLLING MILLS

- Rolling mills means a steel mill where metal is rolled into sheets and bars.
- Wastewater from rolling mills contain mineral oil and require additional installations such as scum boards, skim-off apparatus for the retention and removal of mineral oils.



Organic industrial wastewater pollution

Wastewater produced mainly from

- Chemical industries which mainly use organic substances for chemical reactions.
- Pharmaceutical factories
- Tanneries and leather factories
- Textile factories
- Paper manufacturing industries
- Synthetic detergents
- Organic dye stuff
- Glue and adhesive industries

Waste water from pharmaceutical industries

- The quality of wastewater from these industries varies to a great deal owing to variety of basic raw materials, working processes and waste products.
- Waste substances include extraction residues of natural and synthetic solvents, used nutrient solutions and many other organics.
- Usually concentration of COD is around 5000- 15000mg/L. Concentration of BOD is relatively low.
- **The ratio of BOD/COD is lower than 30% which means wastewater has a poor biodegradability.**
- Such wastewater has bad odour high pH value and it needs strong pre-treatment method, followed by a biological treatment process with a long reaction time.

Wastewater from tannery plants

- A tannery is one of the most water intensive plants.
- The wastewater resulting from the different processes are as follows:
 - ✓ Soaking & washing 22.5%
 - ✓ Liming 17.5%
 - ✓ Rinsing 5.5%
 - ✓ Plumping and bathing 19%
 - ✓ Chrome tanning 2%
 - ✓ Bark tanning 2%
 - ✓ Washing & drumming 31.5%

Effects on environment and human

- Biodegradable wastes deplete DO in the receiving stream affect the flora and fauna.
- Drinking contaminated water
- Swimming in polluted water
- Contact with chemically polluted water

Effects on animals, birds and mammals

- Human-created waste that has deliberately or accidentally become afloat in a lake, sea, ocean or waterway.
- 200 turtles in Australia's surround waters die each year.
- Birds and mammals become coated with oil.

Measuring Water pollution

- Water pollution can be measured by three methods: physical, chemical and biological methods.
- Most involve collection of samples, followed by specialized analytical tests.
- Physical testing: Common physical tests of water include temperature and solid concentrations (turbidity and TSS “total suspended solids)
- Chemical testing: Water samples are examined using the principles of analytical chemistry. Frequently used to analyse BOD, COD, pH, nutrients and metals (zn,cd,cu etc.)
- Biological testing: Involves use of plant, animal or microbial indicators to monitor the health of aquatic ecosystem. (copepods,crustaceans)

CONTROL MEASURES

- Some industries produce ordinary domestic sewage that can be treated by municipal facilities.
- Industries that generate wastewater with
 - High concentration of pollutants (oil and grease),
 - Toxic pollutants (heavy metals, volatile organic compounds) and Other non conventional pollutants such as ammonia need specialized treatment systems.
- Some industries install a pre-treatment equipment system to remove toxic components and then send partially treated wastewater to municipal system.
- Industries generating large volumes of wastewater typically operate their own complete in-situ treatment systems.
- Some industries are successfully re-designing their manufacturing processes to reduce or to eliminate pollutants through a process called Pollution prevention.

- The Clean Water Act of 1972 was designed to “restore and maintain the chemical, physical, and biological integrity of the nation’s waters.” ☐ The Marine Protection, Research and Sanctuaries Act of 1972 strengthened the laws against ocean dumping.

3 R's To Prevent Water Pollution:

- REFUSE : Say NO to water pollution
- RECYCLE : Recycle water
- REDUCE : Minimize use of water

DEFORESTATION

INTRODUCTION: DEFORESTATION



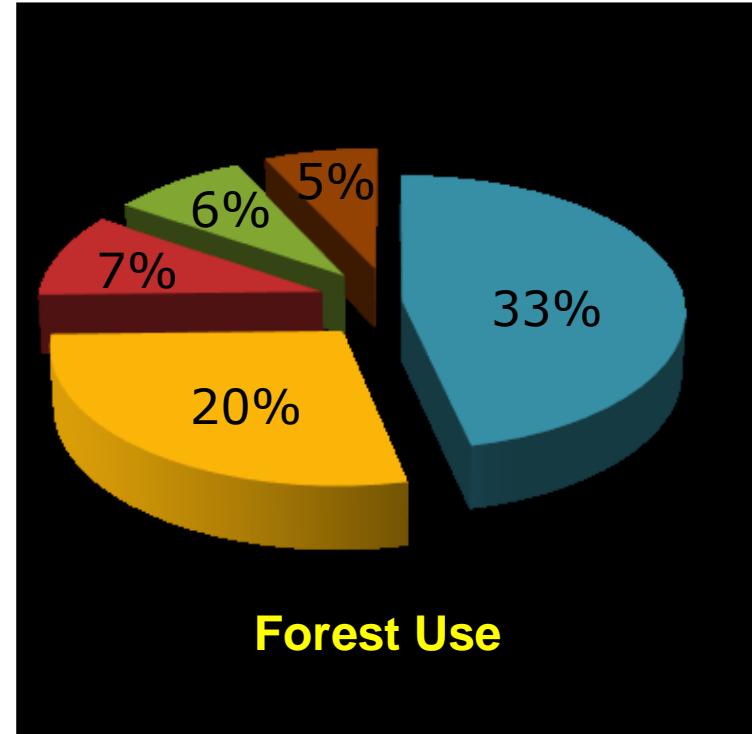
- Forests cover **31%** of the land area on our planet.
- They produce vital oxygen and provide homes for people and wildlife.
- Many of the world's most threatened and endangered animals live in these forests.
- 1.6 billion people rely on benefits forests offer, including food, fresh water, clothing, traditional medicine and shelter.

WHAT IS DEFORESTATION?

Deforestation is when humans remove or clear large areas of forest lands and related ecosystems for non-forest use. These include clearing for farming purposes, ranching and urban use. In these cases, trees are never re-planted.



- Since the industrial age, about half of world's original forests have been destroyed and millions of animals and living things have been endangered. Despite the improvements in education, information and general awareness of the importance of forests, deforestation has not reduced much.



- Electricity generation
- Industry
- Agriculture
- Commercial
- residential

FOREST ARE THE ‘ LUNGS OF THE EARTH’



Causes Of Deforestation



1. AGRICULTURAL ACTIVITIES:

As earlier mentioned in the overview, agricultural activities are one of the major factors affecting deforestation. Due to overgrowing demand for food products, huge amount of trees are fell down to grow crops and for cattle grazing.



2. LOGGING:

Apart from this, wood based industries like paper, match-sticks, furniture etc also need a substantial amount of wood supply. Wood is used as fuel both directly and indirectly, therefore trees are chopped for supplies. Firewood and charcoal are examples of wood being used as fuel. Some of these industries thrive on illegal wood cutting and felling of trees.



3. URBANIZATION:

Further on order to gain access to these forests, the construction of roads are undertaken; here again trees are chopped to create roads.

Overpopulation too directly affects forest covers, as with the expansion of cities more land is needed to establish housing and settlements. Therefore forest land is reclaimed.



©Ron Niebrugge/WildNatureImages.com

4. DESERTIFICATION OF LAND:

Some of the other factors that lead to deforestation are also part natural and part anthropogenic like Desertification of land. It occurs due to land abuse making it unfit for growth of trees. Many industries in petrochemicals release their waste into rivers which results in soil erosion and make it unfit to grow plants and trees.



Yangtze river, China.



SOIL EROSION IN CENTRAL AFRICAN REPUBLIC

5. MINING:

Oil and coal mining require considerable amount of forest land. Apart from this, roads and highways have to be built to make way for trucks and other equipment. The waste that comes out from mining pollutes the environment and effects the nearby species.



6. FIRES:

Another example would be forest blazes; Hundreds of trees are lost each year due to forest fires in various portions of the world. This happens due to extreme warm summers and milder winters. Fires, whether causes by man or nature results in huge loss of forest cover.

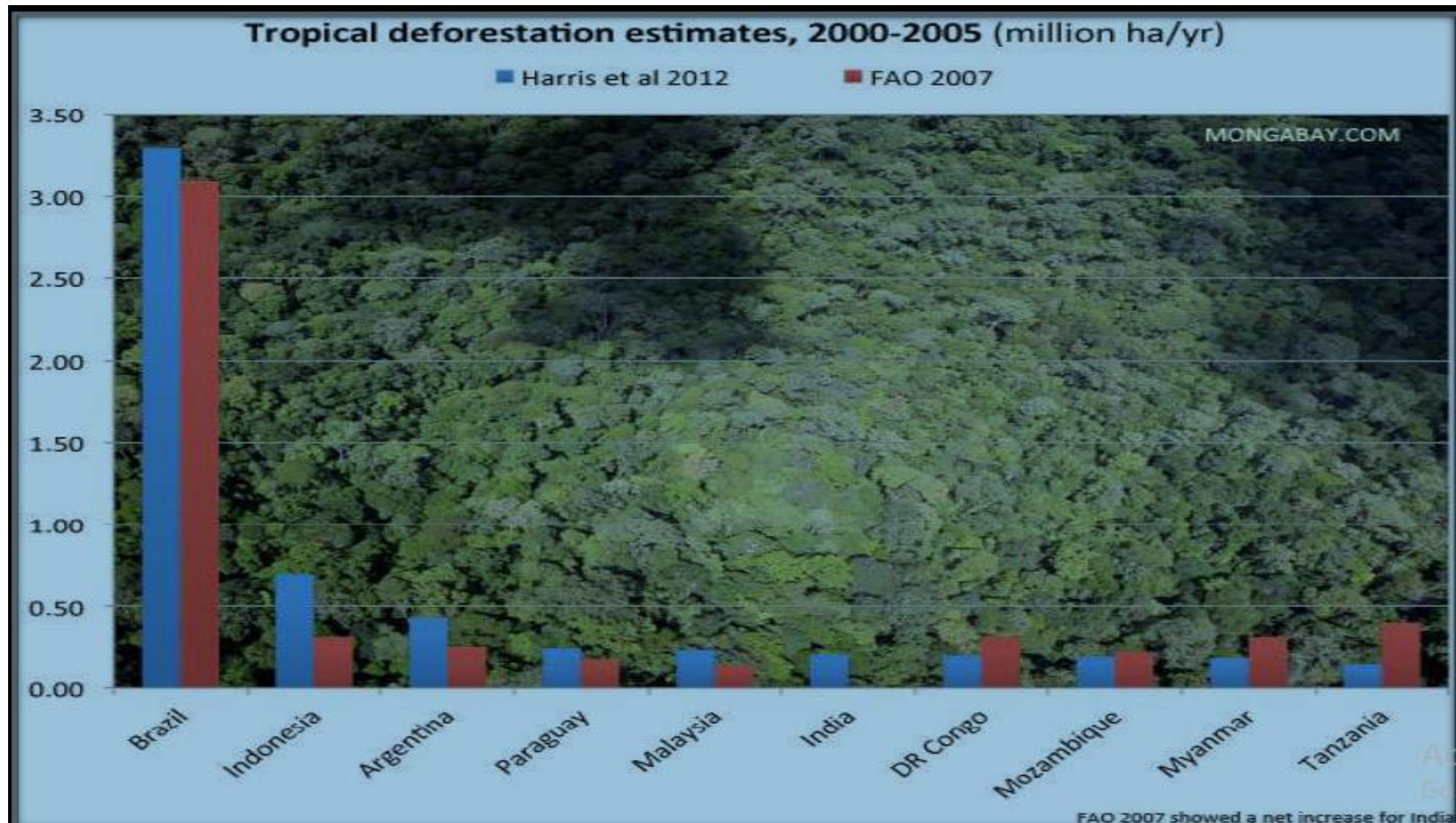


Ecuador-northern western south America



Manmade fire at para , BRAZIL.

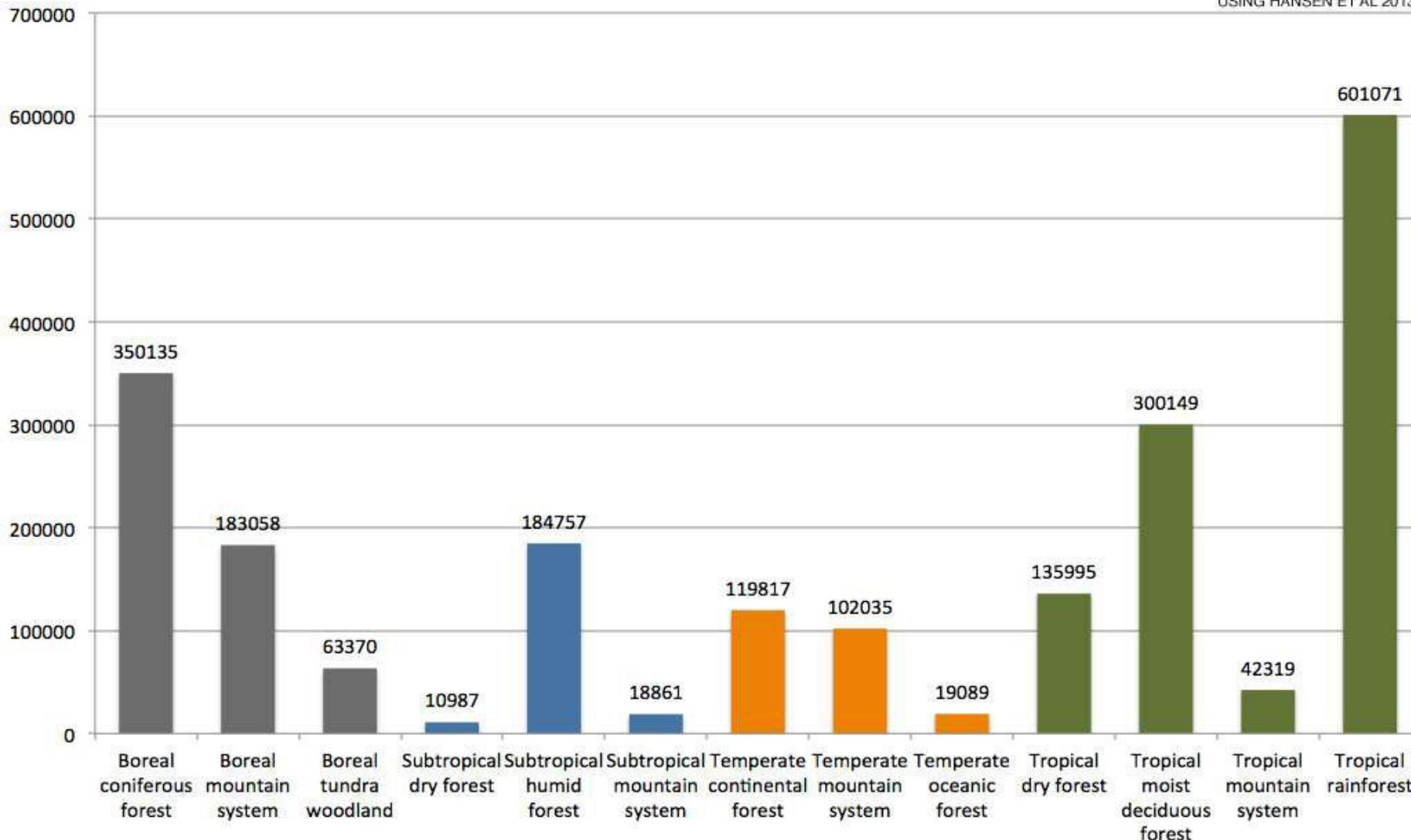
GLOBAL DEFORESTATION



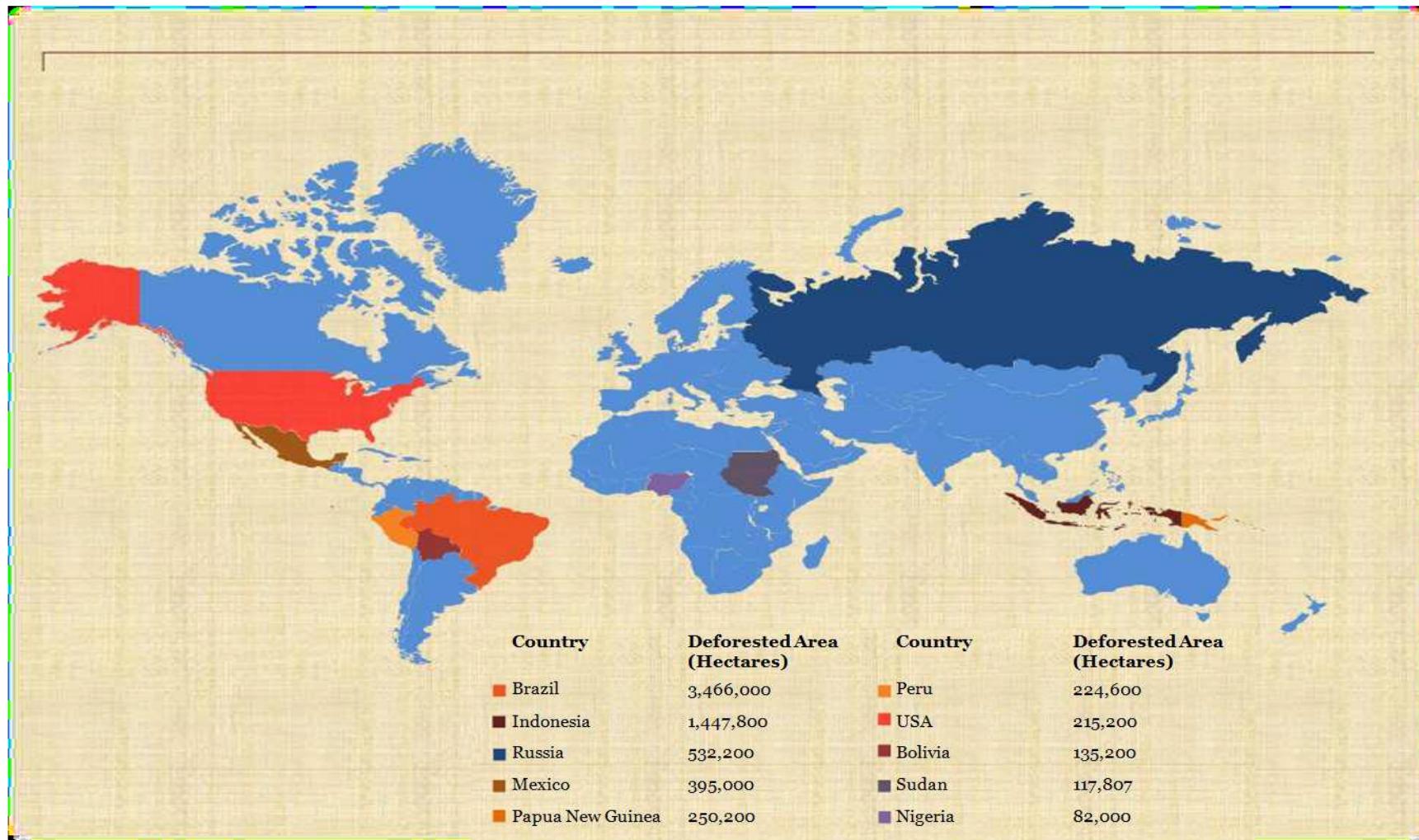
DEFORESTATION IN DIFFERENT TYPES OF FOREST

Forest loss by ecozone, 2000-2012 (sq km)

MONGABAY.COM
USING HANSEN ET AL 2013



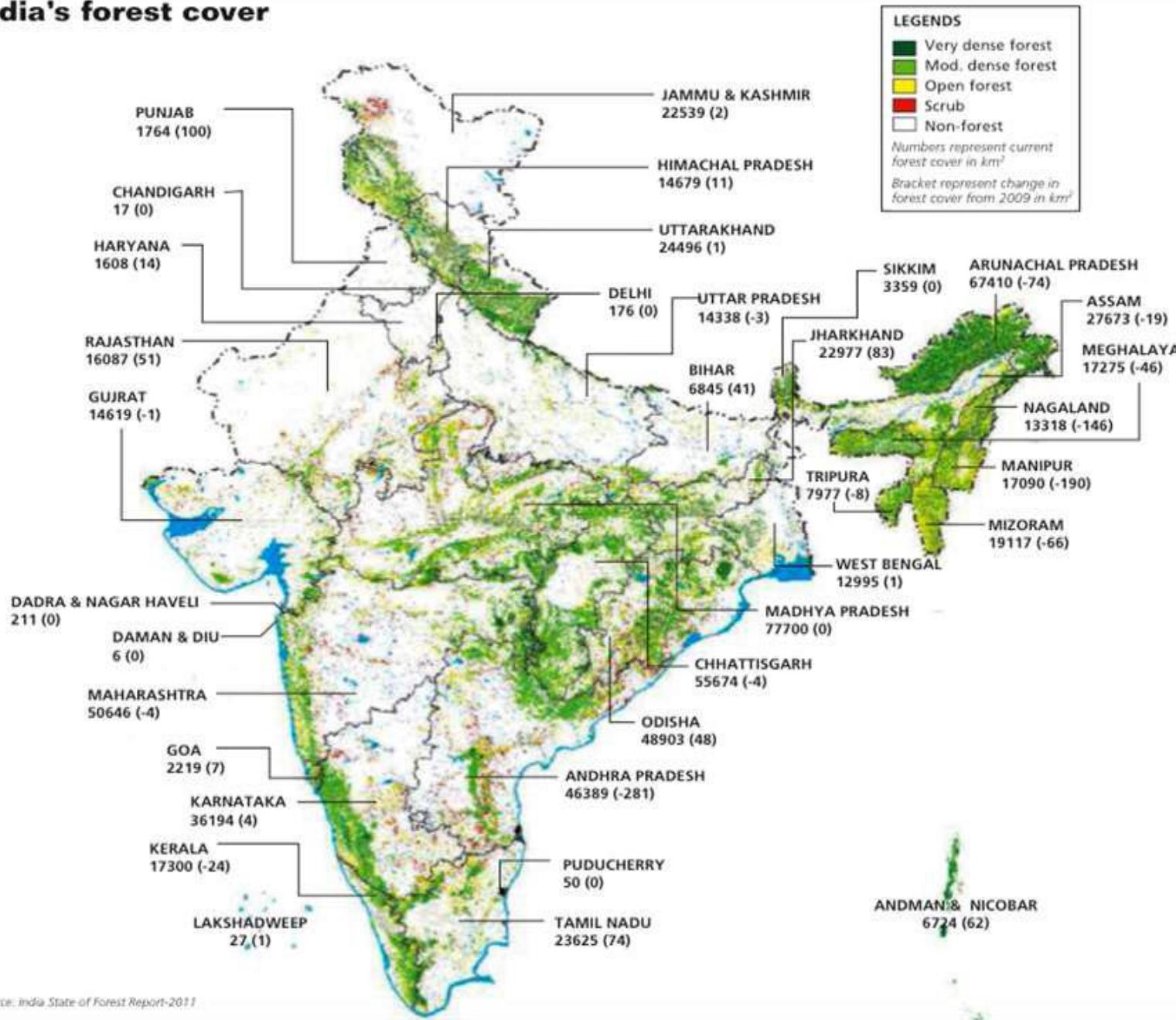
TOP 10 COUNTRIES WITH HIGHEST RATE OF DEFORESTATION



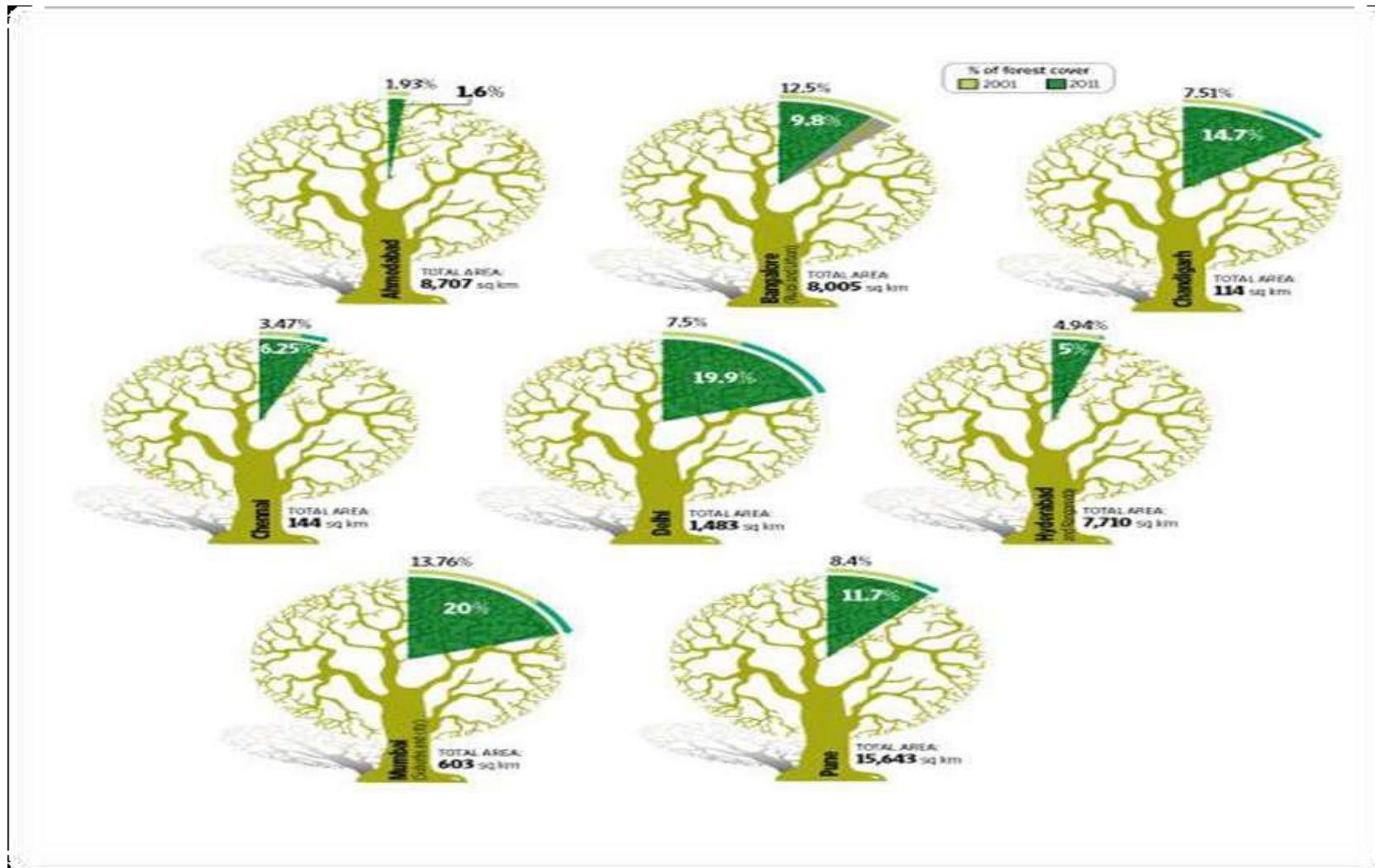
DEFORESTATION OVER THE YEARS



India's forest cover



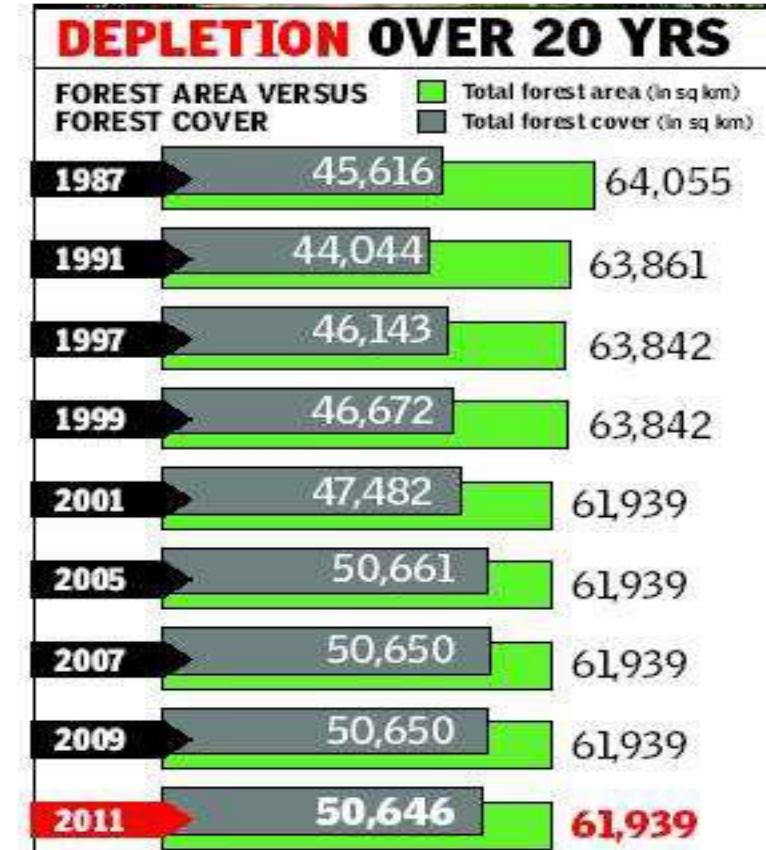
INDIA DEFORESTATION STATISTICS



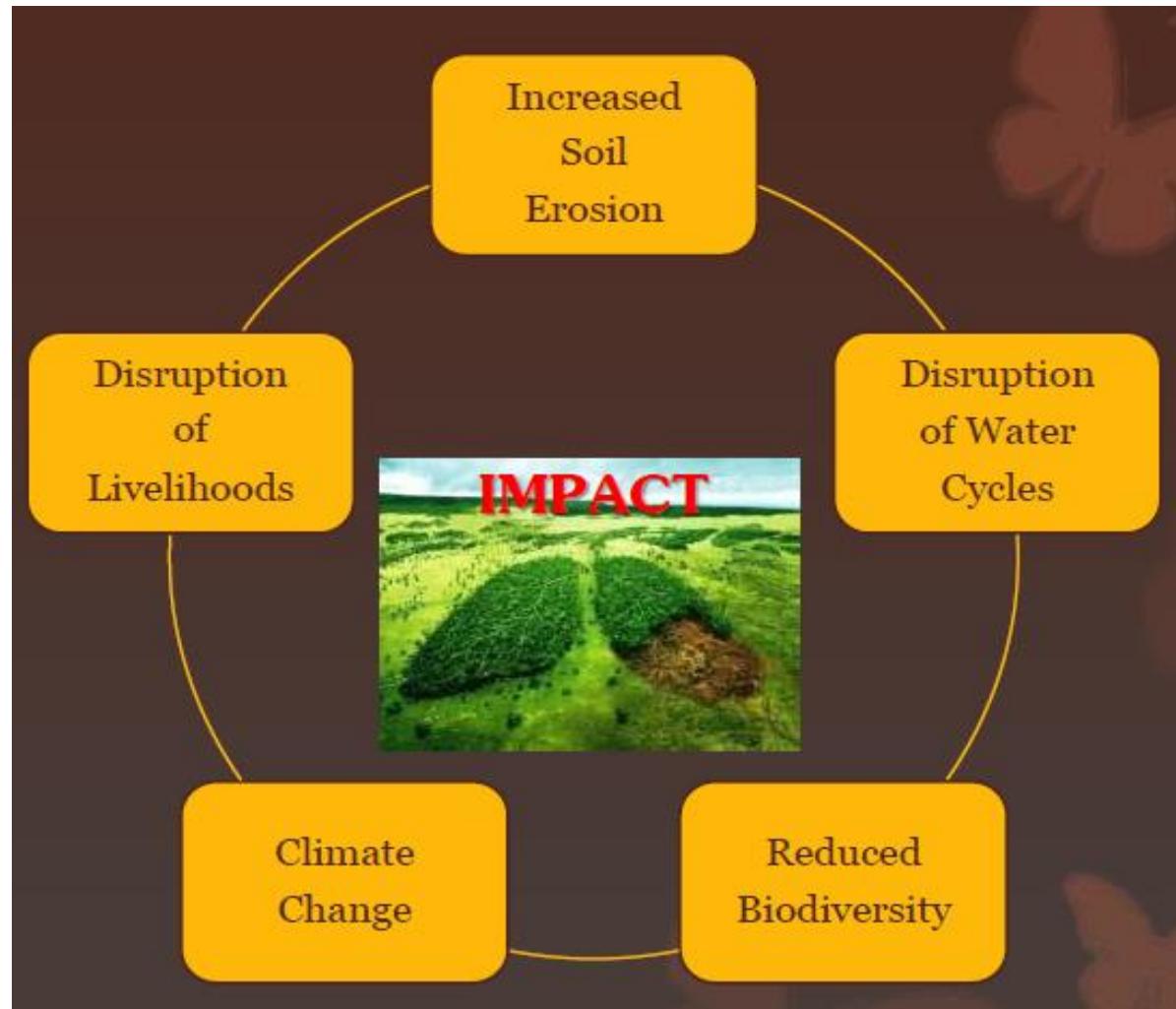
MAHARASHTRA DEFORESTATION STATISTICS

The report by FRA states that a total of 247756 sq km forest area recognized as individuals' forest area was under tree cover in 2005-11. But sadly, only 202607 sq km is currently under forest cover.

The forest dependent community became vulnerable to the adverse impact of GHG emission(4,57,486.6 tonnes) for soil and water conservation, ecosystem services and access of minor forest produce due to wrong recognition of rights under FRA.



ENVIRONMENTAL & ECONOMICAL IMPACTS



SHORT TERM ENVIRONMENTAL EFFECTS

INCREASED SOIL EROSION



- No trees anchoring the fertile soil.
- Erosion is sweeping the land into rivers.
- The agricultural plants replacing the forests are unable to hold onto the soil.
- As fertile soil washes away producers move on, clearing more forests.

DISRUPTION OF WATER CYCLE



- Trees play a key role in the local water cycle.
- Keep balance between the water on the land and the water in the atmosphere.
- Disrupted balance changes the precipitation and river flow.

LONG TERM ENVIRONMENTAL EFFECTS

REDUCED BIODIVERSITY



- 80 % species can be found in tropical rainforests.
- Often unable to survive in the small fragments of forested land left behind.
- Accessible to hunters and poachers.
- Leading to extinction.

CLIMATE CHANGE



- Forests help to mitigate carbon dioxide and other greenhouse gas emissions.
- When cut, burned or otherwise removed they become carbon source.
- Deforestation represents 15% of greenhouse gas emissions.
- Rising temperatures, changed patterns of weather and increase of extreme weather events.

Predicted impacts of deforestation on weather patterns and crop yields around the world: results from computer modeling studies

Greenpeace: An Impending Storm (2013)

Europe

Deforestation in Asia could lead to changes in European storm track location and intensity (Snyder, 2010), while Amazon deforestation may increase annual rainfall in northern Europe. This could impact crop yields.

Turkey

20-25% decrease in rainfall in western Turkey could occur due to southeast Asian deforestation (Avissar & Werth, 2005). This could impact crop yields.

Siberia

Temperature decrease of $>1^{\circ}\text{C}$ possibly due to Asian deforestation (Schneck & Moosbrugger, 2011).

Asia

The East Asian monsoon flow was suggested to weaken over eastern China and the South China Sea, but was enhanced over mainland southeast Asia following Asian deforestation (Sen et al., 2004; Sen et al., 2010).



USA

A 5-35% rainfall decrease in Midwest USA was linked to African deforestation, which is likely to impact crop harvests. A 25% decrease in rainfall in Texas was suggested after Amazon deforestation (Avissar & Werth, 2005).

South America

Temperature increase was related to Asian deforestation (Schneck & Moosbrugger, 2011). This could impact crop such as wheat, maize, soybean and coffee (Medvigy et al., 2012).

Africa

Increased surface temperatures were associated with Asian deforestation (Schneck & Moosbrugger, 2011). The West African monsoon was indicated to weaken due to reduced northward moisture transport (Abiodun et al., 2008). This could impact crop yields and increase water stress.

Arabian Peninsula

Rainfall was predicted to increase by 15-30% following African deforestation, or increase by 45% following Amazon deforestation (Avissar & Werth, 2005). This could impact crop yields.

ECONOMICAL EFFECTS

DISRUPTION OF LIVELIHOODS

- Deforestation greatly influences many lives.
- In Southeast Asia deforestation contributed to migration and social conflicts.
- In Brazil the poor people are constantly pressured to move from their villages often to remote soy plantations where they have to work under inhumane conditions.
- Destroying sources of medicine.
- Increasing food insecurity.
- Flooding causing loss of many lives and homes.



DISASTERS



MALIN VILLAGE DISASTER:

A landslide in Pune that has killed more than 100 people and left scores missing may have been a man-made disaster caused by deforestation to make way for farming, experts say. Hopes of finding survivors are fading after heavy rains triggered Wednesday's landslide, burying dozens of homes in the village of Malin in Maharashtra. While the blame falls on crucial yet often deadly monsoons – which annually trigger landslides and floods – geologists and environmentalists said the tragedy was avoidable.

There are two types of landslides: naturally-induced and human-induced. The current landslide is possibly due to human activities like farming and road construction.



- Environmentalists blame a government income generation scheme that required hill slopes to be flattened and thousands of trees to be felled. According to the Hindustan Times, official data indicates that nearly 28,000 trees were cut, but unofficial figures put the count at 300,000. Reports have also suggested that heavy machinery such as backhoes were used to level the slopes, which has contributed to loosening the soil to such an extent that it has impacted the hill's drainage of water.
- “Relentless rain naturally was the trigger. But the use of heavy machinery to flatten land for agriculture and deforested area may have aggravated the crumbling of the hill top,” said Ashim Kumar Saha from the Geographical Survey of India in The Hindu.



BUTIBORI DISASTER:

Once a source of drinking water for animals and agriculture, the perennial Chornala in zudpi jungle, 36km from Nagpur near Butibori industrial area, is now turning out to be a disaster for farmers and villagers of Wathoda and Jaipur, 7km from the five-star industrial estate.

Maharashtra Pollution Control Board (MPCB) report released on July 3, by regional officer NH Shivangi has confirmed spent acid being discharged untreated by galvanizing units had burnt the soil and land near the stream.

Clandestine dumping of acid in the Chornala for the past four years by unidentified industrial units is playing havoc with cattle, crop and also health of people near it. Harried farmers, who could not sense the slow poisoning by the acid, formally launched a complaint with Maharashtra Pollution Control Board (MPCB) on June 27, after cattle started dying and crops started getting damaged which led to massive deforestation in the area.



**ACID DUMPING
IN BUTIBORI, NAGPUR**

SOLUTIONS

CORPORATION

- If corporations have the ability to destroy the world's rainforests, they also have the power to help save them.

GOVERNMENTS

- Governments are able to enact ambitious domestic and international forest policies that have wide-ranging effects.

INDIVIDUALS

- As individuals, we contribute significantly to deforestation with our lifestyle, hence we have the responsibility to keep ourselves in check.

CORPORATION

IMPLEMENT ANTI-DEFORESTATION POLICIES



- Corporations can implement anti deforestation policies that require suppliers and other stakeholders to operate in ways that do not harm the environment

MINIMISE PAPER WASTAGE AND ENCOURAGE RECYCLING

- Corporations are huge consumers of paper. Management can work towards a paper-free office by shifting towards email and soft-copies, and also encourage their employees to recycle



GOVERNMENTS

REFORESTATION



- The cutting down of trees must be countered by replacing old ones that were cut with young ones. Trees are being planted every year, but still they do not match the number of trees that we lost.

SUPPORT ORGANIZATIONS THAT PUSH FOR ANTI-DEFORESTATION



- Governments have the resources to allow anti deforestation organizations to get their sphere of influence. This is a good way to indirectly solve deforestation

INDIVIDUALS

Everybody, even children, can be conscious of the need to recycle. Instead of Throwing paper away, we can always seek to recycle it or use it for other purposes



GO PAPERLESS

For ecological deforestation to end, paper consumption must be drastically reduced.
Opting for paperless bills, checks and payments significantly contributes towards
mending the harmful effects of deforestation



EDUCATE OTHERS OF THE NEED TO FIGHT DEFORESTATION



What's better than one person fighting deforestation?

Two people doing the same thing. Spread your knowledge and urge others to follow in your footsteps and fight deforestation.

END