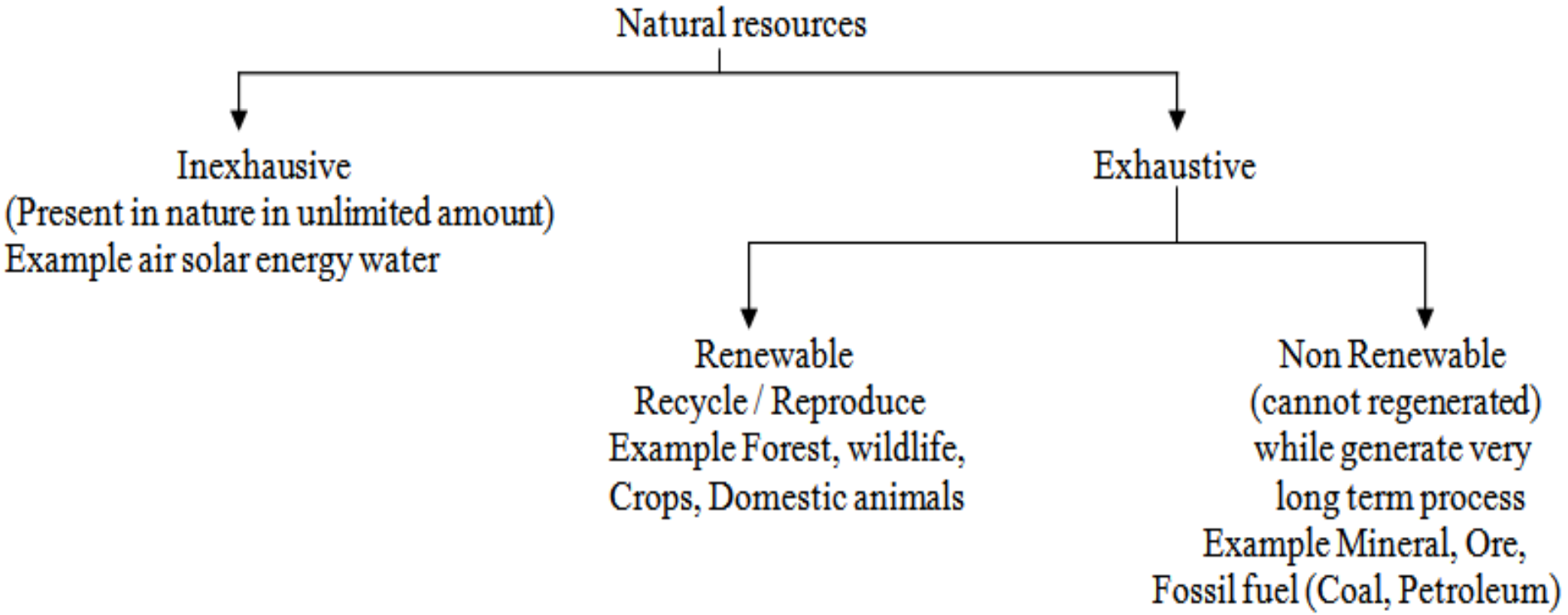
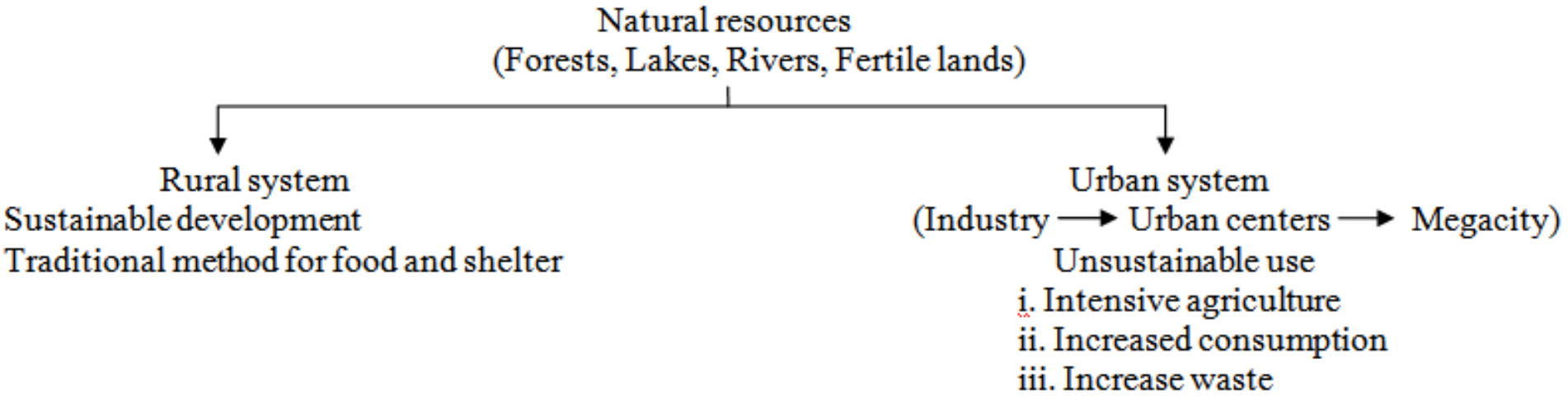
Unit 2

Natural Resources

- **Nature**
- The natural, physical or material world of universe.
- The Trees, Forest, Birds and Animals are all an example of nature.

- **Natural resources**
- Resources means reserve source of supply.
- Life on this planet Earth depends upon a variety of goods and services provided by the nature which are known as Natural Resources.
- Example Forest, Water, Air, Land, Food, Crops, Energy, Coal, Fossil fuel, Wildlife.


Natural resources
Inexhausive
(Present in nature in unlimited amount)
Example air solar energy water
Exhaustive
Renewable
Recycle / Reproduce
Example Forest, wildlife,
Crops, Domestic animals
Non Renewable
(cannot regenerated)
while generate very
long term process
Example Mineral, Ore,
Fossil fuel (Coal, Petroleum)



- Shift in pressure of natural resource from rural to Urban.
- Developed country denoted as “The North”.
- Developing country denoted as “The South”.

- **Ecological footprint (EF)**
- This is a measure of human demand on the Earth’s resource in relation to the earth capacity to regenerate through resources. Thus the per capita EF provides a means to compare consumption and lifestyle which checking this against the earth ability to provide for this consumption.
- In 2018, US EF is 5 Global hectares (gha) While India EF is 0.7 (gha).

How many Earths do we need

If the world's population lived like...

Source: Global Footprint Network National Footprint Accounts 2018

Forest Resources

Environmental use value of a big tree Rs 1000000, commercial use value Rs 30000.

Use

Local use

- i. Food plant (Rice, Wheat etc).
- ii. Fodder for cattle (various types of grasses).
- iii. Fuel wood for cooking (*Acacia* sp. , *Eucalyptus* sp.) short branches.
- iv. Poles for building homes (*Acacia* sp. , *Eucalyptus* sp.) long branches are used.
- v. Timber for construction of home (*Acacia* sp. *Eucalyptus* sp.) long branches are used.

- **Local use**
- vi. Fiber for ropes (Jute, Hemp (bast fibre)).
- vi. Sericulture for silk (*Morus* sp (Mulberry plant))
- vii. Apiculture for honey (bees collected from various plants)
- viii. Medicinal plants for traditional medicine (Holy basil, Coriander, Mint)
- ix. Investigation plant as a source for new modern drugs.

- **Market use**
- i. Timber extraction for construction, industrial use for paper.
- ii. Fuel wood, fruit, fiber, gum.

- **Water and watershed conservation**
- i. Reducing rate of surface runoff water.
- ii. Preventing flash floods and soil erosion.
- iii. Producing prolonged gradual run off, thus preventing drought conditions.

- **Temperature regulation**
- i. Absorption of solar heat during evapotranspiration.
- ii. Maintaining CO_2 level for plant growth.
- iii. Maintaining local climatic conditions.

- **Soil conservation**
- i. Holding soil (preventing Rain from directly washing soil away).
- ii. Maintaining soil nutrient.
- iii. Regulation of hydrological cycle.

- **Pollution moderation**
- i. Photosynthesis process maintaining oxygen level.

Forest cover in India

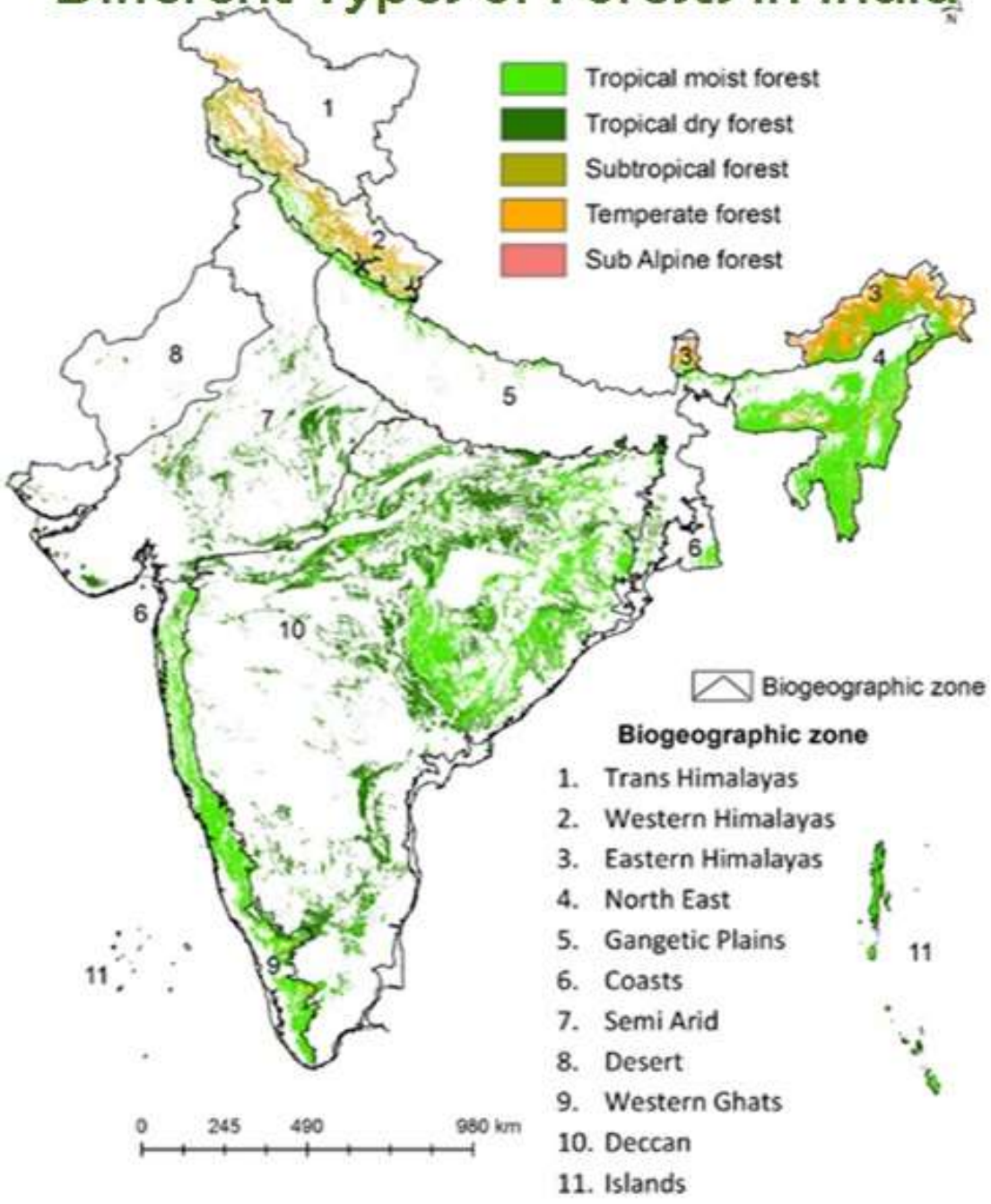
- **Forest cover** is the total geographical area declared as forest by the government.

- As of 2019, the total forest cover in India is 712,249 Sq km (71.22 million hectares), which is 21.67 percent of the total geographical area. Whereas, the total forest and tree cover in India is 807,276 Sq km (80.73 million hectors), which is 24.56 percent of the total geographical area of the country.

Forest cover over the years

Year	Total forest area (in sq km)	% of forested area	%change
2019	712,249	21.67%	0.13%
2017	708,273	21.54%	0.20%
2015	701,673	21.34%	0.11%
2013	697,898	21.23%	0.18%
2011	692,027	21.05%	

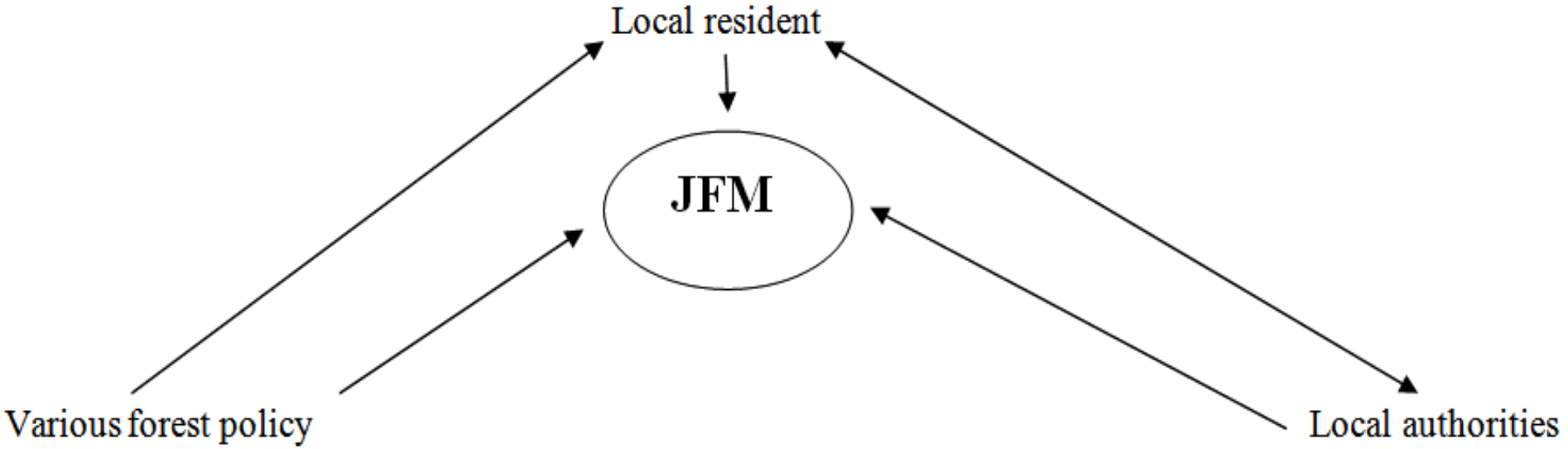
Different Types of Forests in India



- Madhya Pradesh **largest forest** covers India.
- Arunachal Pradesh second largest.
- Lakshadweep highest forest cover
- **Highest decreased forest covers**
- 1. Nagaland (-2.71%),
- 2. Mizoram (-2.58 %).

- **India ranked 10th in the world.**
- **India covers 2.4 % in the world.**

- **Joint forest management (JFM)**
- Arabani, West Medinipur, West Bengal, 1972.
- JFM is the official and popular in India for partnership in forest movement involving both the state forest departments and local communities.
- The policies and objective of JFM detailed in the Indian comprehensive National Forest policy of 1988 and Joint Forest Management guidelines of 1990 of the Government of India.



Triangular approach

- Accidentally originated in West Bengal at the Arabari forest range in 1972 was to prevent the unprotected grazing and illegal harvesting of major hardwood products Sal.
- Theme of sharing of forest was introduced by Ajit Kumar Banerjee (divisional forest officer arabari forest range)

Deforestation

- (Destruction of forest cover)

We over exploiting our forests

- i. Due to wood cutting for raw materials like Timber, pulp wood, fuel wood etc.
- ii. Clearing of forests to create more agricultural land.
- iii. Mining activities lead to clearing of forest.
- iv. Big hydropower projects result in large scale destruction of forests.
- v. Rapid industrialization.
- vi. Urbanization.
- vii. Illegal logging.
- viii. Irrigation.

Major causes of deforestation

- i. Shifting cultivation

  Practices slash and Burn agriculture occurs in North East Assam, Andhra Pradesh, Madhya Pradesh, Bihar.
- ii. Fuel requirement

  1947 (65 million tons)

  2001 (500 million tons)
- iii. Raw material for industrial use

  Furniture, Railway sleepers, plywood, pulp for paper.
- iv. Development project

  Hydro electric project, Big dams, Mining, Road constructing.
- v. Growing food need

  Rapidly growing population agricultural lands
- vi. Overgrazing
- vii. Forest fires

Effects of deforestation

- i. Threaten many wildlife species
- ii. Loss of biodiversity
- iii. Problems of soil erosion
- iv. Loss of soil fertility
- v. Desertification
- vi. Global warming increases (added more CO_2)
- vii. Flooding and Drought
- viii. Pollution
- ix. Shortage of Food
- x. Affected animal and ultimately human

Global Warming

Pollution

Drought

Desertification

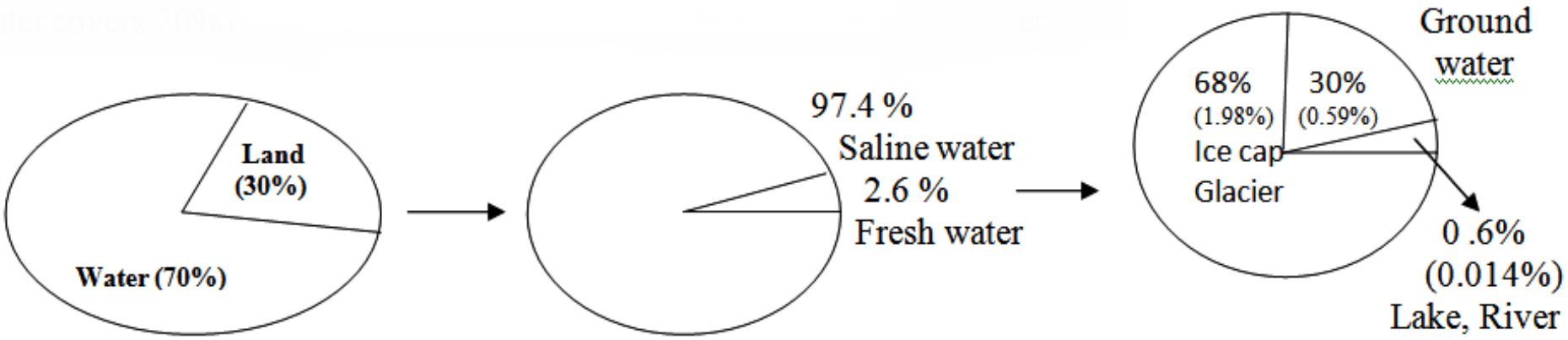
Animal & Plant Life Affected

Shortage of food

Flooding of Rivers

Water Resources

- A hydrosphere is the total amount of water on a planet.
- **Hydrosphere** cover's third quarter (3/4) of the Earth surface (70%).
- A major part of Hydrosphere is made in the ecosystem in the ocean **(96% or 97.5%)** while only small part in freshwater (**4% or 2.5%**)
- Water covers 70% of the Earth surface but only 2.5 % of this are fresh water.


Land
(30%)
Water (70%)
97.4 %
Saline water
2.6 %
Fresh water
68%
(1.98%)
Ice cap
Glacier
30%
(0.59%)
Ground
water
0 .6%
(0.014%)
Lake, River

- **Water use and overexploitation**
- Due to its (water) unique properties water is of multiple use for all living organisms.
- Human beings use water for drinking, irrigation, transportation, washing and waste disposal for industries and used as a coolant for thermal power plants.
- Water withdrawal taking water from ground water or surface water resource.

- **At a global level**
- 70% of the water is used for agriculture (93% in India).
- 22% for industry.
- 8% for domestic.

- A person needs a minimum of **20 to 40 liters** of water per day for drinking and sanitation.

- The UN has estimated that by the year 2050, 4 billion people will be seriously affected by water shortage.
- i. **Karnataka** and **Tamilnadu** are fighting over the water of **Kaveri** (Cauvery).
- ii. **Karnataka** and **Andhra Pradesh** are fighting over the water of **Krishna river**.
- iii. **India** and **Bangladesh** already have a negotiated agreement on the use of the **Ganges river**.
- iv. **India** and **Bangladesh** are fighting over the water of **Teesta river.**
- v. **Punjab** and **Haryana** are fighting over **Water of Ravi River** water and the **Satluj Yamuna link** (SYL) Canal dispute.
- vi. **Ethiopia** and **Egypt** are fighting over the water of **Nile**.
- vii. **Jordan, Syria** and **Israel** are fighting over the water of **Jordan river**.

The next war in the Middle East will be fought over water, not politics

— Boutros Boutros-Ghali —

Effects of excess usage of groundwater

- **i. Ground subsidence**

  When groundwater withdrawal is more than its recharge rate the sediments in the Aquifer get compacted a phenomenon known as ground subsidence.

- **ii. Lowering of water level**.
- **iii. Water logging.**

  When excessive irrigation is done with brackish water it raises the water table gradually leading to water logging and salinity problem.

- **iv. Water pollution.**

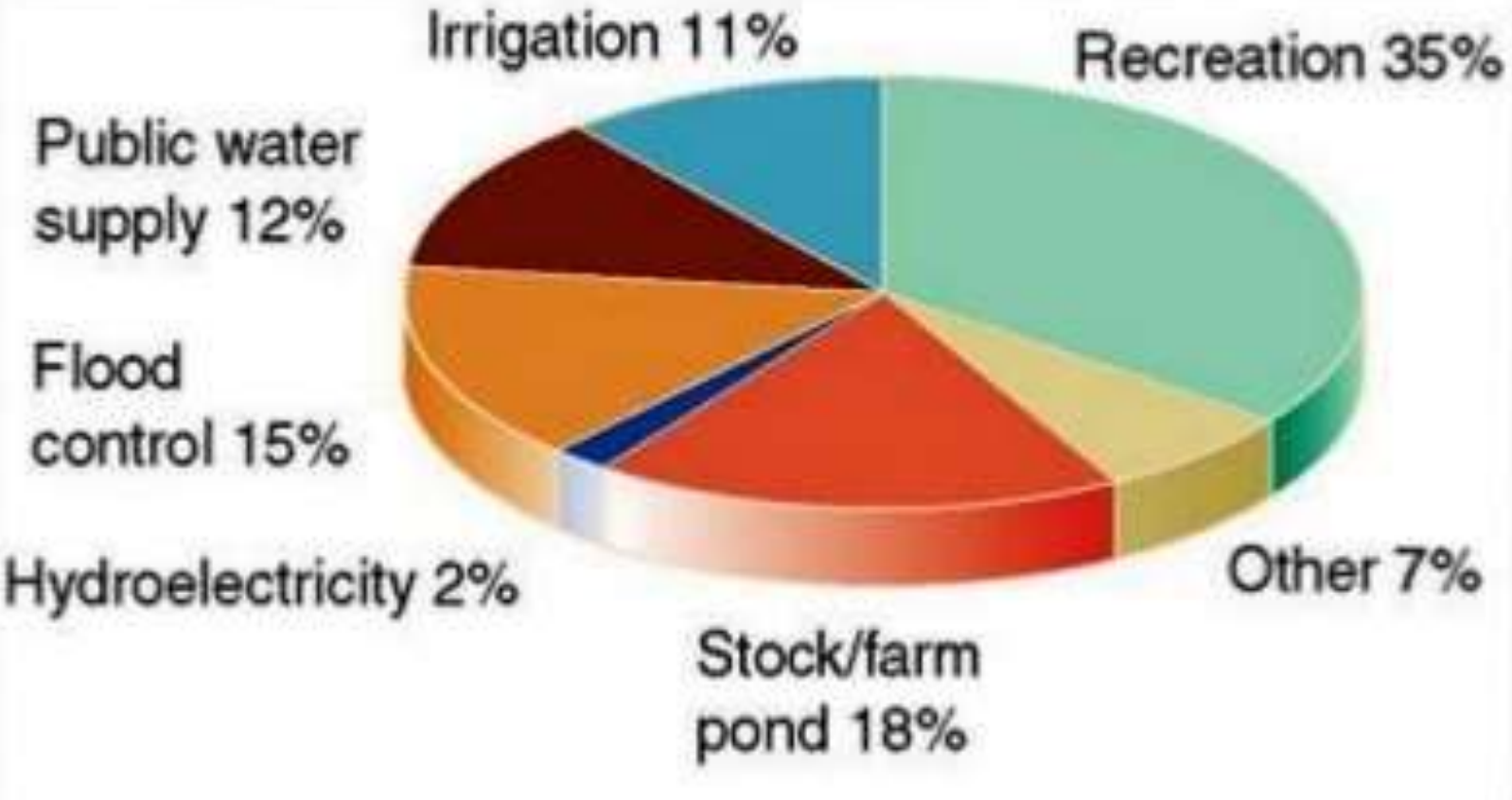
Dams

- A dam is a barrier that restricts the flow of water (river).

Dam provides many Benefits

- i. Electricity generation (hydropower).
- ii. Waste management.
- iii. Wildlife habitat.
- iv. Irrigation water supply.
- v. Drinking water supply.
- vi. Promotion of navigation or shipping.
- Vii. Promotion of Recreation.
- viii. Promotion of fisheries.
- ix. Reduction in famines.
- x. Prevention of flood.
- xi. Employment.

- Primary benefits of dams :



Drawbacks of Dams

- **Negative ecological impacts**
- i. Loss of biodiversity (natural environment is destroyed)
- ii. Deforestation (Habitat alteration)
- iii. Water logging (Cause serious geological damage)
- iv. Flash flood.
- v. Change in water flow
- vi. Sediment capture.
- **Negative socio economic impacts**
- i. Submergence of villages and fertile land.
- ii. Displacement of native people.
- iii. Resettlement issues (human's wildlife)
- iv. Outbreak of Vector borne disease.
- v. Effect in river ecosystem.

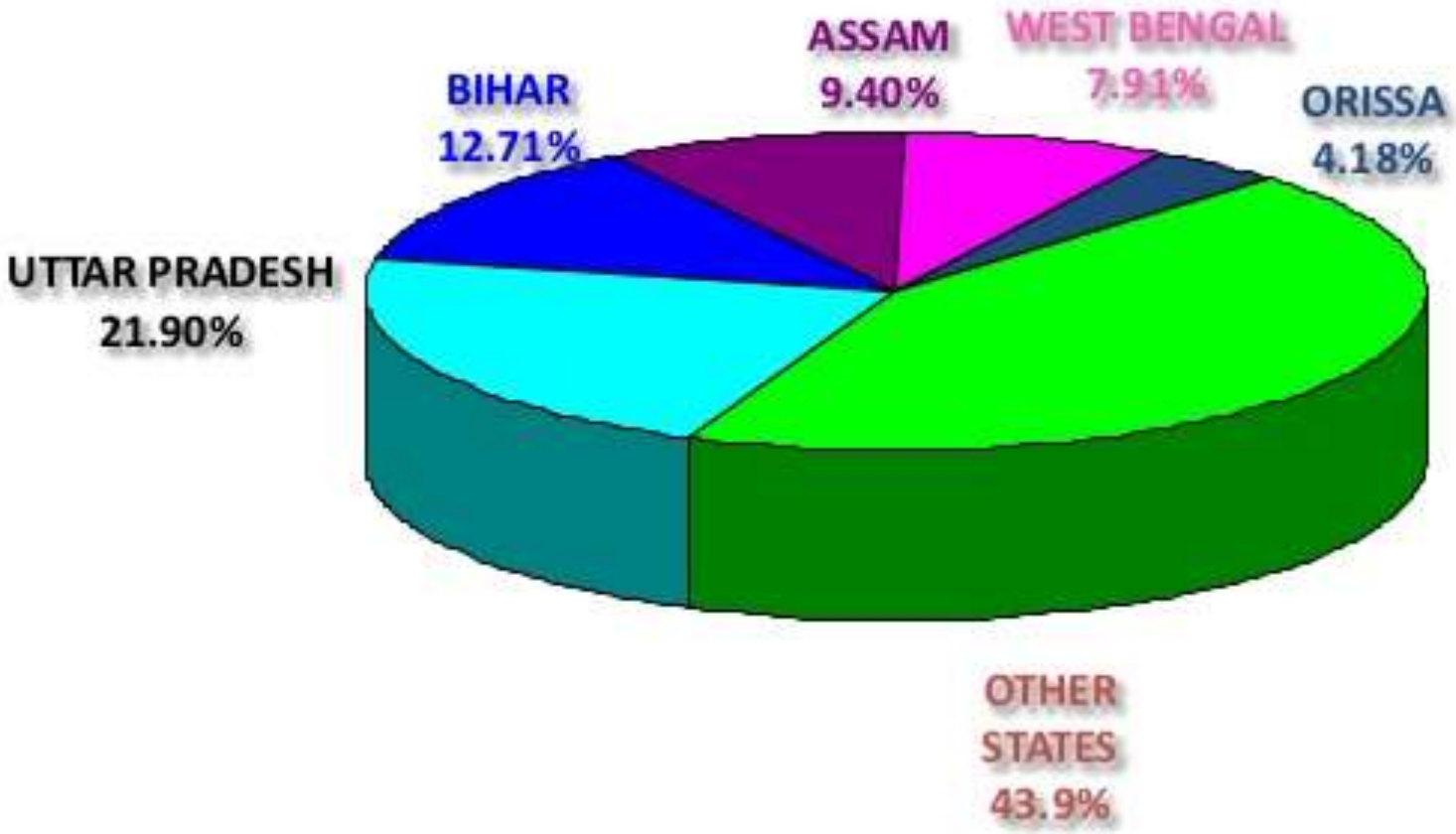
Some important Dams in India

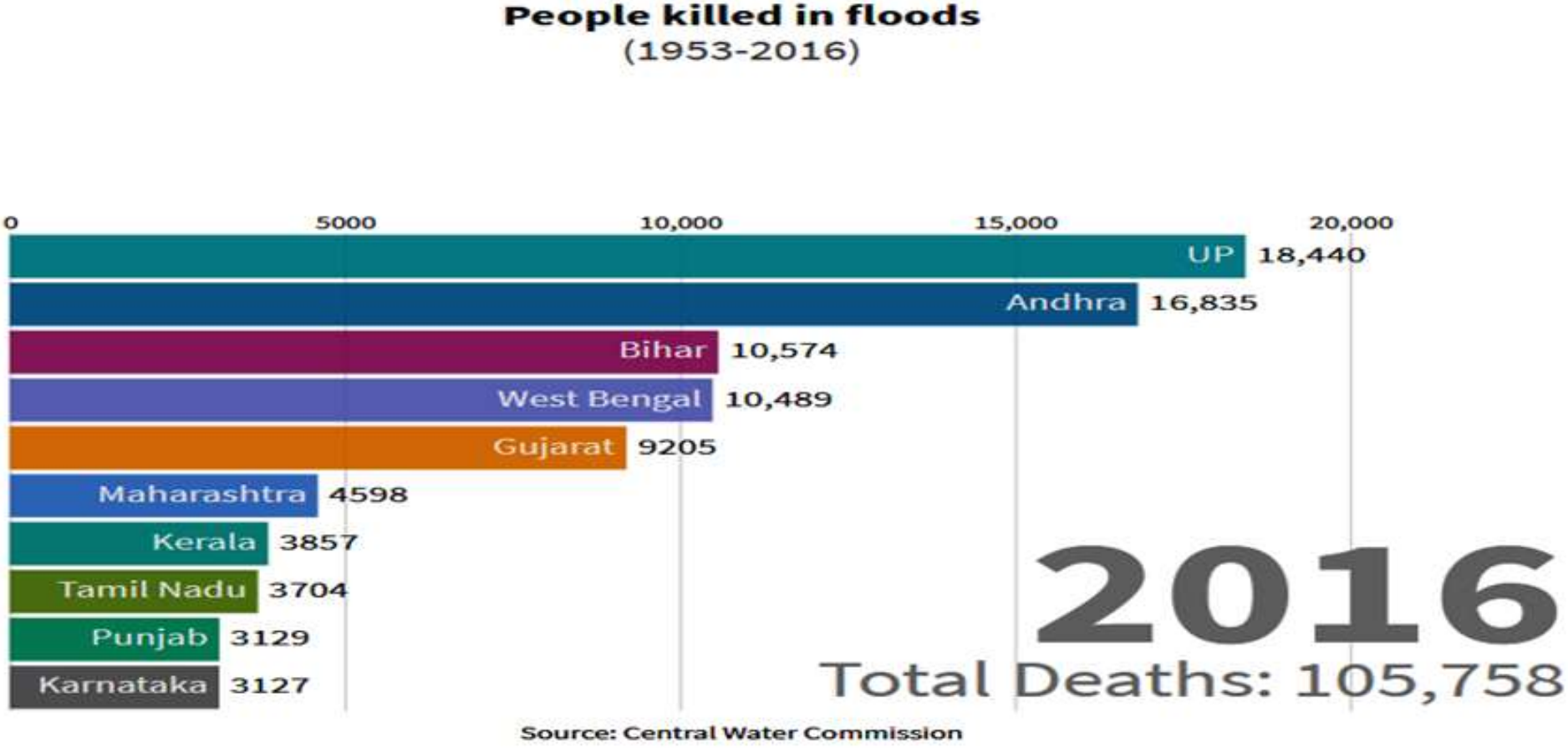
Dams	Location	River
Tehri Dam (highest)	Uttarakhand	Bhagirathi
Bhakra Nangal Dam (largest)	Himachal Pradesh	Sutlej
Sardar Sarovar Dam	Gujarat	Narmada
Hirakud Dam	Orissa	Mahanadi
Nagarjuna Sagar Dam	Telangana	Krishna
DVC (Damodar Valley Corporation)	West Bengal	Damodar

Flood

- A flood is an overflow of water on normally dry ground. This is most commonly due to an overflowing river, a dam break, snowmelt, or heavy rainfall.
- In some countries like India and Bangladesh rainfall doesn't occur throughout the year, rather, **90%** of it is concentrated into a few months (**June to September**). Heavy rainfall often causes floods in the low lying coastal areas.
- There are several anthropogenic activities like deforestation, overgrazing, mining, Rapid industrialization, global warming etc that results in flood, which otherwise is a **natural disaster**.
- Floods have been Regular Feature of India and Bangladesh causing huge economic loss as well as loss of life.

INDIA
FLOOD PRONE AREA




People killed in floods
(1953-2016)
0
5000
10,000
15,000
20,000
UP 18,440
Andhra 16,835
Bihar 10,574
West Bengal 10,489
Gujarat 9205
Maharashtra 4598
Kerala 3857
Tamil Nadu 3704
Punjab 3129
Karnataka 3127
2016
Total Deaths: 105,758
Source: Central Water Commission

Time	Location	Died (humans)	Causes
June 2013	North India Uttarakhand	5700	Cloudburst
June 2015	Gujarat	70	Heavy rain
November - December 2015	Chennai	500	heavy rain
July to August 2016	Assam	124	Heavy rain
July 2017	Gujarat	200	Heavy rain
August 2018	Kerala	445	Monsoon rainfall
July to August 2019	Kerala	121	Monsoon rainfall
July to August 2019	Karnataka	24	Monsoon rainfall
May – August 2020	Assam	149	Heavy rain

Drought

- When annual rainfall is below normal and less than evaporation drought conditions are created.
- Drought areas thus faced with irregular period of famine.
- Agriculture have no income in this years and as they have no steady income.
- Drought is a meteological phenomenon but due to several anthropogenic causes like overgrazing, deforestation, mining etc.

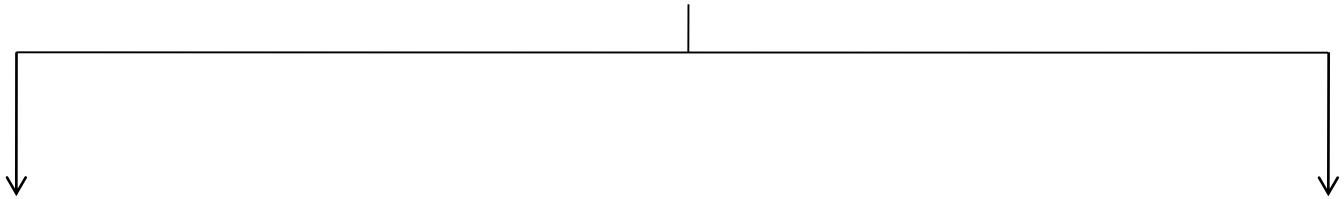
- Drought in India has resulted in tens of millions of deaths over the course of the 18th, 19th, and 20th centuries.
- This is particularly true of major drought-prone regions such as southern and eastern Maharashtra, northern Karnataka, Andhra Pradesh, Odisha, Gujarat, Telangana and Rajasthan.
- In the past, droughts have periodically led to major Indian famines, including the **Bengal famine of 1770**, in which up to one third of the population in affected areas died; the 1876–1877 famine, in which over five million people died; and the 1899 famine, in which over 4.5 million died. 1972 Maharashtra drought affected 2.5 crore people

Mineral resources

- Minerals are naturally occurring inorganic crystalline solids having a definite chemical composition and characteristic physical properties.

- Minerals are formed over a period of millions of years in the earth's crust these minerals are composed of some elements like silicon, oxygen, iron, copper, magnesium, calcium, aluminium, etc.

Minerals



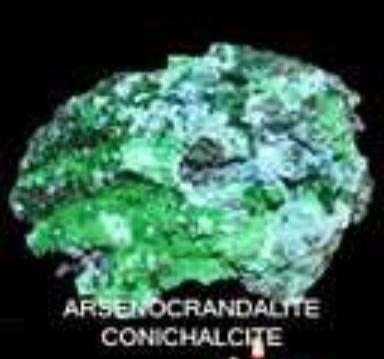
Non Metallic

Graphite, diamond, Quartz, feldspar, Coal, salt, clay, cement, silica, Emerald.

Metallic

Bauxite, latrine, haematite, granite, Marble, limestone, gold, silver, Platinum, Magnesium, Copper, chromium, aluminium

MINERAL SPECIMENS

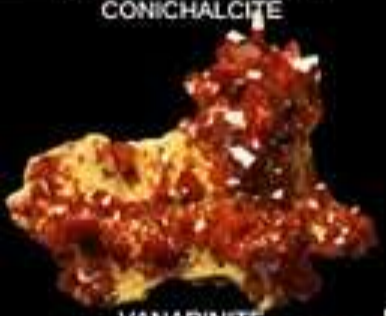

ARSENOCRANDALITE
CONICHALCITE


VANDANITE


SPESSARTITE GARNET


HEMIMORPHITE


QUARTZ


VANADINITE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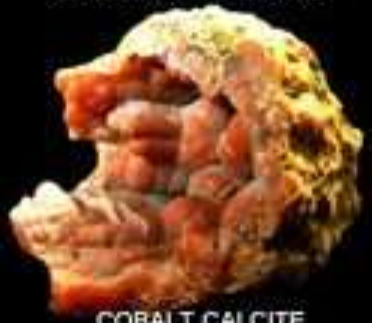

COBALT CALCITE
STALACTITE


TOURMALINE


AZURITE


AZURITE MALACHITE
ARAGONITE CONICHALCITE


DESERT ROSE
GYPSUM SELENITE


CALCITE


QUARTZ

Mining

- Mineral and their ores need to be extracted from the earth's interior so that they can be used this process is known as mining.
- **Mining operation generally progress through 4 stages**
- **i. Prospecting**

  Searching for minerals
- **ii. Exploration**

  Assessing the size, shape, location and economic value of the deposit.
- **iii. Development**

  The work of preparing access to the deposit so that the minerals can be extracted from it.
- **iv. Exploitation**

  Extracting the minerals from the mines.

Mineral resources in India

- **Some major minerals of India**
- **A. Energy generating minerals**

- **i. Coal and lignite**
- West Bengal, Jharkhand, Orissa, Madhya Pradesh, Andhra Pradesh,

- **ii. Uranium**
- Jharkhand, Andhra Pradesh (Nellore, Nalgonda), Meghalaya, Rajasthan (Ajmer)

- **Some major minerals of India**
- **B. Other commercially used minerals**

- **i. Aluminium (bauxite ore)**
- Jharkhand, West Bengal, Madhya Pradesh, Maharashtra, Tamil Nadu.

- **ii. Iron (haematite and magnetite ore)**
- Jharkhand, Orissa, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Goa.

- **iii. Copper (copper pyrites)**
- Rajasthan (Khetri), Bihar, Jharkhand, Karnataka, Madhya Pradesh, West Bengal, Andhra Pradesh, Uttarakhand.

Use and Exploitation

- The main uses of minerals are as follows
- **i. Development of industrial plants and machinery.**
- **Aluminium** – Transportation, Electronics.
- **Chromium -** High strength Steel alloys, textile industries.
- **Copper -** Electric and electronic goods.
- **Iron -** heavy machinery, steel production.
- **Lead -** car batteries, paint.
- **Manganese -** for making high strength, heat resistant, Steel alloys.
- **Platinum -** automobiles, electronics.
- **Gold** – Ornaments, medical use, electronics.
- **Silver -** Photography, Jewellery, electronics.

- The main uses of minerals are as follows

- ii. Generation of energy (example coal, lignite, Uranium).
- iii. Defence equipment (weapons, ornaments).
- iv. Construction
- v. Transportation
- vi. Communication (telephone, wires, cables)
- vii. Medicinal system.
- vii. Agriculture (as fertilizer, fungicides (example maneb, containing manganese)
- viii. Jewellery (for example gold, silver, Platinum)

Social impacts of mining

- **Positive socio economic impacts**

- i. Employment

- ii. Infrastructure facilities.

- iii. Economic gains

- **Negative socio economic impacts**
- i. Resettlement and Rehabilitation issues (Shifting of people from their place)
- ii. Health hazards due to long term exposure to hazardous chemicals. (asbestosis, silicosis, black lung disease).
- iii. Deforestation and soil erosion.
- iv. Loss of flora and fauna.
- v. Ecosystem degradation.
- vi. Groundwater contamination
- (sulphur $\rightarrow$ sulphuric acid $\rightarrow$ water acidic)
- vii. Surface water pollution (example Uranium).

Mining problem in India and its impact

i. Improper waste disposal in Malanjkhand's copper mines

A copper mining project in Balaghat's Birsa block, Madhya Pradesh leads to serious environmental hazards; it have to pay a big environmental price like skin itching, laboured breathing. Highly acidic bluish green water leads to several diseases among the cattle.

Mining problem in India and its impact

ii. Mining and quarrying in Udaipur

200 cast mining and quarrying centres in Udaipur are involved in stone mining including soapstone, dolomite, building stone etc about 150 tonnes of explosives are used per month in blasting. It also results in water pollution. It had adverse effect upon the fauna and birds.

Mining problem in India and its impact

iii. Mining in Sariska Tiger Reserve in Aravallis

Mining operations within and around the Sariska Tiger Reserve has left many areas permanently infertile and barren. The precious wildlife is under serious threat. Aravali Range includes Gujarat, Rajasthan, Haryana and Delhi.

Food Resource

- The main food resources include rice, wheat, maize, potato, barley, oats, sweet potato, sugarcane, sorghum, millet or so common fruits and vegetables, milk, meat, chicken, fish and seafood.

- **Different Mineral deficiency Diseases**
- Iron – Anaemia,
- Iodine – Goitre,
- Vitamin A – Blindness.

- **Green Revolution** was promoted to boost up our food grain production.

- **Blue revolution** was initiated to produce more fish, shellfish, shrimp, oysters etc.

- India is the third largest producer of staple crops.
- An estimated 300 million Indians are still under malnutrition.
- India has only half as much land as USA, but it has nearly three times population to feed. Our food problems are directly related to population.
- The modern practice of intensive agricultural pollutes our waterways and lands with excessive use of fertilizers and pesticides.

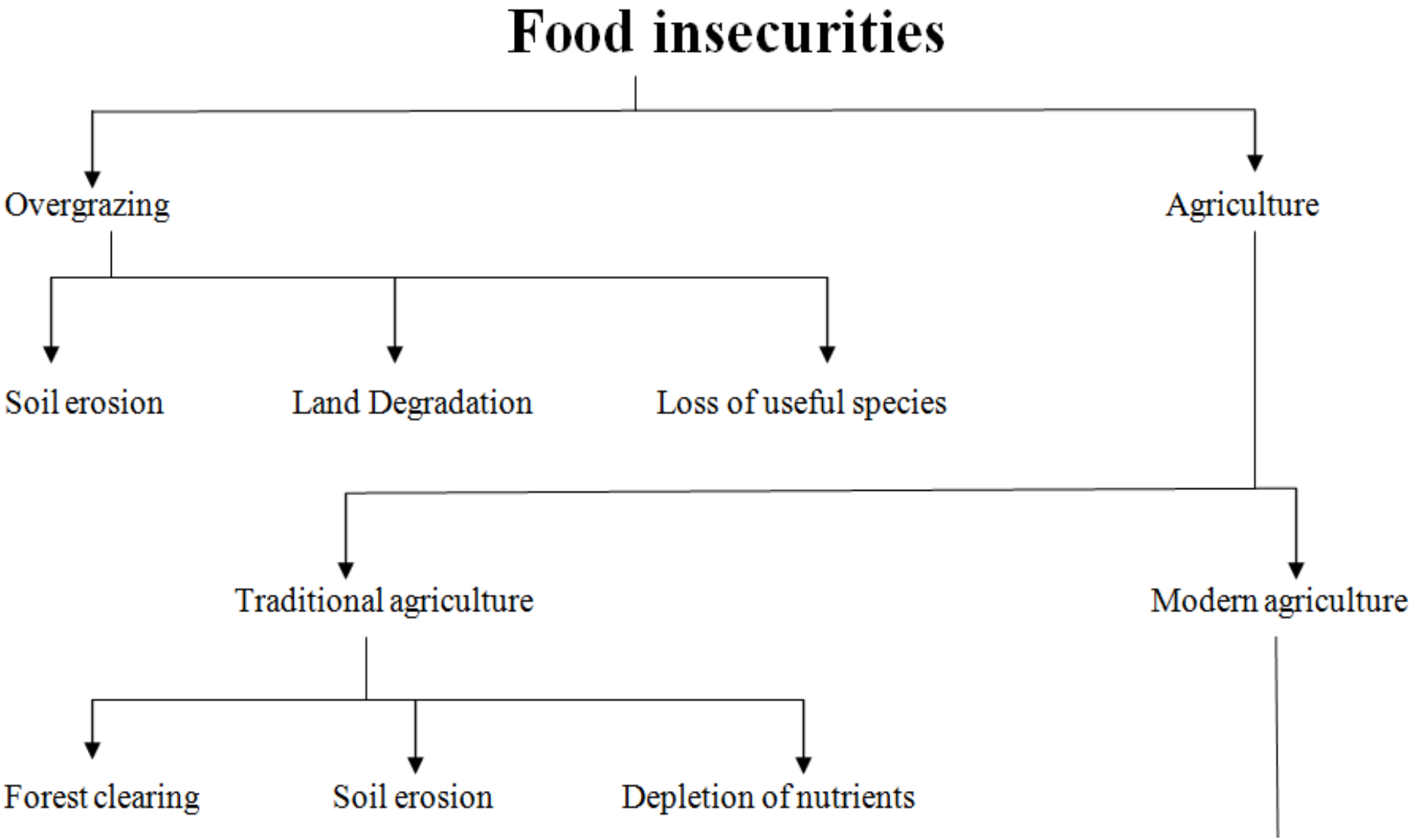
- Poor Environmental agricultural practices such as slash-and-burn, shifting cultivation degrade the forest.

- The loss of nutrients and the overuse of agricultural chemicals are major factors in land degradation.

- Salinisation and water logging has affected a large amount of agricultural land world wise.

- **Carrying Capacity** of any system is the maximum population that can be supported by it on a sustainable basis (without any deterioration).

- The FAO (Food and Agricultural organization) defines sustainable agriculture as that which conserves land, water, plants, animal genetic resources does not degrade the environment and economically viable and socially acceptable.


Food insecurities
Overgrazing
Agriculture
Soil erosion
Land Degradation
Loss of useful species
Traditional agriculture
Modern agriculture
Forest clearing
Soil erosion
Depletion of nutrients

Fertilizer related impacts

Water logging

Pesticide related impacts

Salinity problem

- Micronutrient imbalance (MI)
  Micronutrient - N, P, K
  (Excessive use of fertilizers cause MI)

- Nitrate pollution
  Blue Body Syndrome
  Nitrates get concentrated in the water and become the cause of a serious health hazard. This disease affects the Infants to maximum extent causing even death.

- Eutrophication
  a large portion of Nitrogen and Phosphorus used in crop fields is washed off and along with runoff water reach the water bodies causing eutrophication.
  (Rapid increase of algal and plant growth)

- Pesticides related problems
  DDT (dichlorodiphenyltrichloroethane)
  Discovered Paul Mueller (1939)
  1st generation pesticides S, lead, Arsenic, Mercury
  2nd generation pesticides - DDT.
  After 1940 synthetic pesticides are used they have a number of side effects.

- Creating resistance in pest and producing new pest (super pest).

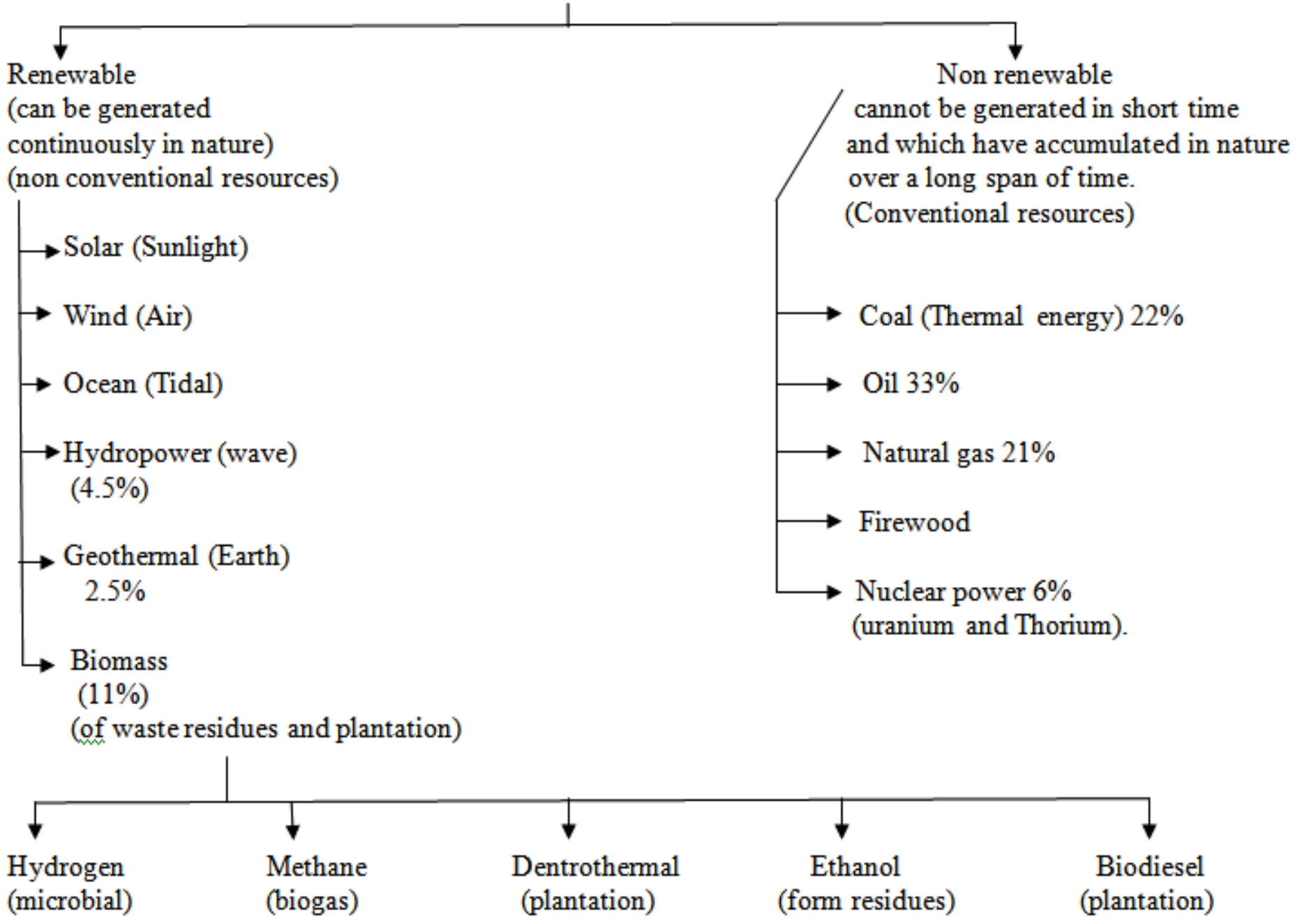
- Death of non target organism.

- Biomagnifications
  Increase in the concentration of Persistent chemical by the organism at successive tropical level in a food chain.

Energy Resources

- The first form of energy Technology probably was the Fire Which produced heat and used for cooking.
- Wind and hydro power have also been used for the last 10000 years.
- The invention of steam engines replaced the burning of wood by coal and coal was later replaced to a great extent by oil.
- Energy consumption of a nation is usually considered as an index of its development.
- The sun is the primary source of energy.
- We use energy for household purpose agriculture production of industrial goods and for transportation.

Energy Sources



Renewable energy

1. Solar Energy

- The nuclear fusion reaction occurring inside the sun release enormous quantities of energy in the form of heat and light.

- Today we have developed several methods of collecting this energy for heating water and generating electricity.

- **i. Solar cooker**
- The food cooked in solar cooker is more nutrients nutritious due to slow heating.
- A solar cooker is a metal box, which is black on the inside to absorb and retain heat.
- The lid has a reflective surface to reflect the heat from the sun into the box.

- **ii. Solar Water Heater**
- Most solar water heating systems have two main parts the Solar collector and the Storage tank. The Solar Energy collector heats the water which then flows to a well insulated Storage tank.

- **iii. Solar cell / PV cell / Photo voltaic cell**
- Solar cells are made of thin layer of semiconductor material like silicon and gallium. When solar radiation fall on them, a potential difference is produced which causes flow of electron and produce electricity. Solar cells are widely used in calculator, electronic watches, Street lighting, traffic signals, water pumps etc.

- **iv. Solar Power Plant**
- Concave reflector or mirror which conservation of sun energy into electricity.
- Bhadla Solar Park, Rajasthan.
- Pavagada Solar Park, Karnataka.
- Kamuthi Solar Power Project, Tamil Nadu.

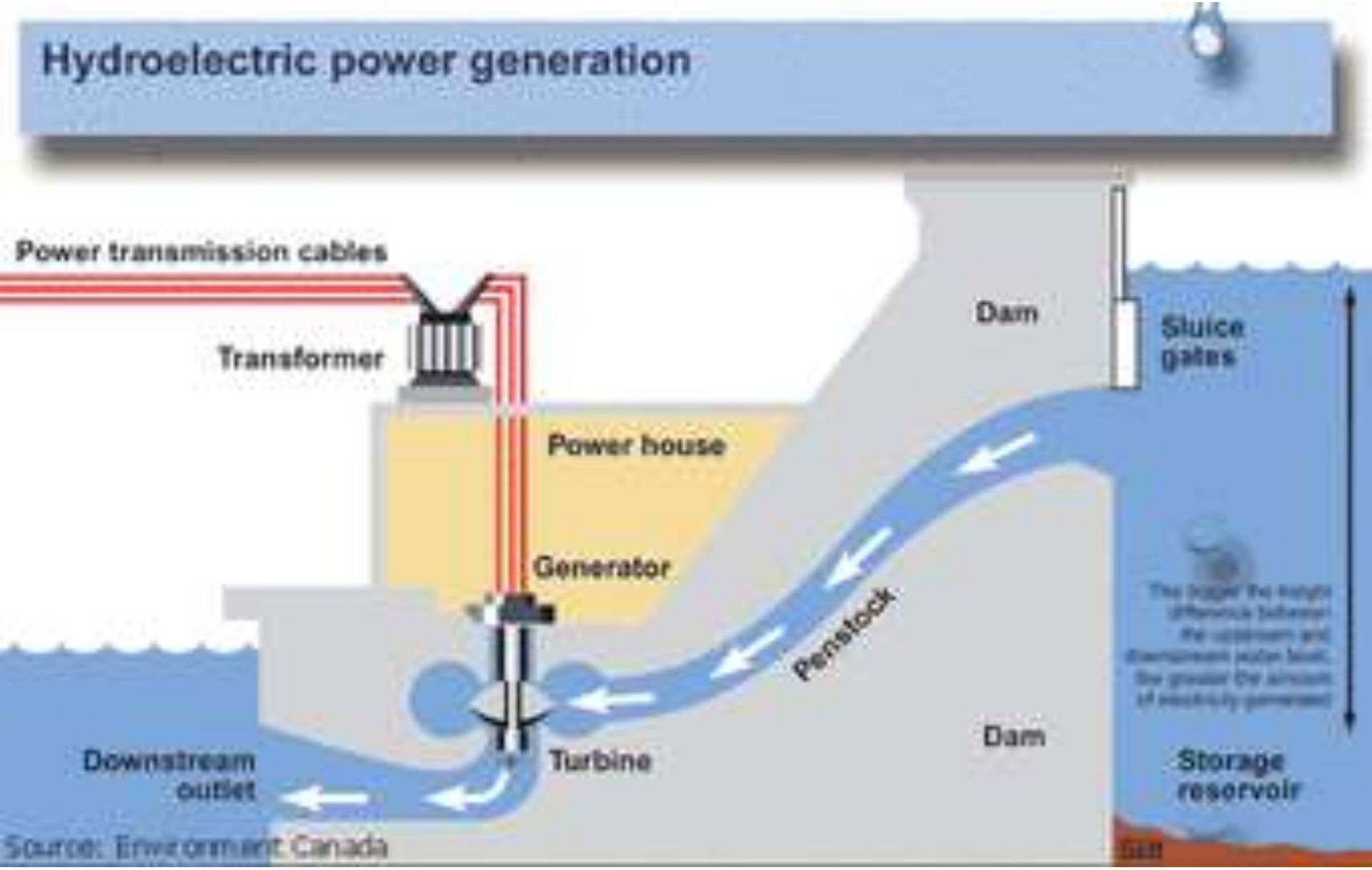
- **2. Wind energy**
- The high speed winds have a lot of energy in them as kinetic energy due to their motion. The driving force of winds is the sun.

- The rotational motion of the blades drives in number of Machines like water pump, Flour Mills and electric generators.

- Wind farms are ideally located in coastal region, open grassland or hilly regions particularly mountain passes and ridges where the wind strong and steady.
- The wind power potential of India is estimated to be about 38.124 GW while at present we are generating about 37669 MW.
- The largest wind energy generate state in India was Tamil Nadu (9232 MW).
- Highest wind energy generate wind farm was Jaisalmer Wind Park, Rajasthan (1600MW).
- The principle problems of wind energy are bird kills, noise, effect on TV reception and aesthetic objection.

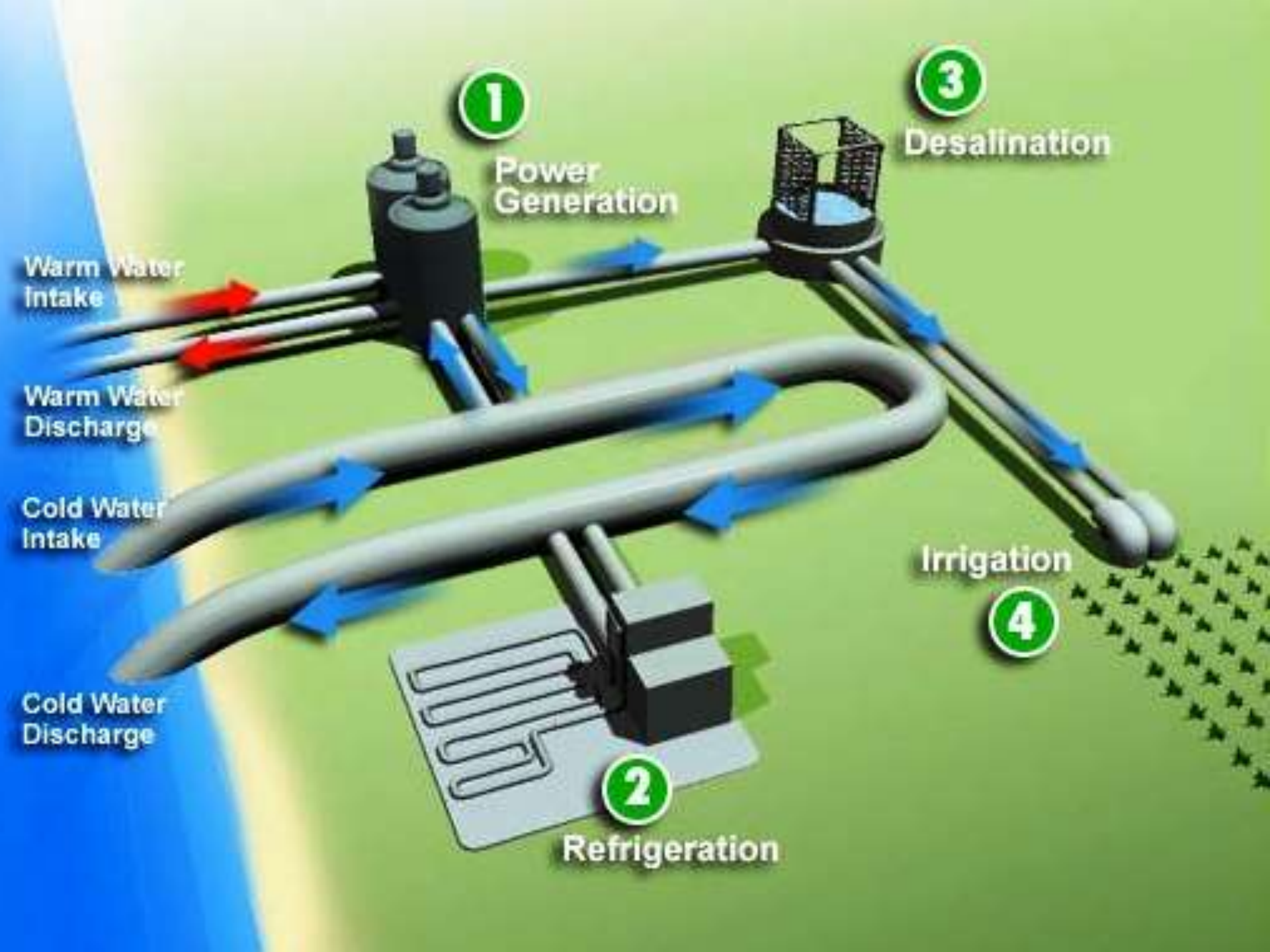
3. Hydropower

- The water flowing in a river is collected by constructing a big dam where the water is stored and allowed to fall from a height. The Blades of the turbine located at the bottom of the Dam move with the fast moving water which turn rotate the generator and produce electricity.
- Hydro power does not cause any pollution and hydropower project are multipurpose project helping in controlling flood used for irrigation, navigation etc.


Hydroelectric power generation
Power transmission cables
Transformer
Power house
Generator
Penstock
Turbine
Dam
Sluice gates
Dam
Downstream outlet
Storage reservoir
Source: Environment Canada

- **4. Tidal energy**
- Ocean tide produced by gravitational forces of sun and moon contain enormous amount of energy. The high tide and low tides refer to the Rise and fall of water in the oceans.
- During high tide, the sea water flow into the reservoir of the barrage and turns the turbine which in turn produce electricity by rotating the generator.
- During low tide when the sea level is low the sea water stored in the barrage reservoir flow out into the sea and again produce electricity.
- In India Gulf of Cambay, Gulf of Kutch and the Sunderban deltas are the tidal power sites.

- **5. Ocean Thermal Energy (OTE)**
- OTEC - Ocean Thermal Energy conversion (power plan)
- The energy available due to the difference in temperature of water at the surface of the Tropical and at deeper levels is called Ocean Thermal Energy.
- At present the Department of Ocean Development (DOD) has one plant in Tiruchendur in Tamil Nadu producing 1 MW a day.


1
Power Generation
3
Desalination
Warm Water Intake
Warm Water Discharge
Cold Water Intake
Cold Water Discharge
Irrigation
4
2
Refrigeration

- **6. Geothermal Energy**
- (Geo – earth, thermal – heat) Geothermal energy starts with hot molten Rock (called magma) deep inside the earth which surfaces at some parts of the earth crust. The heat rising from the magma warms underground pools of water known as geothermal reservoirs. It provides a steady stream of hot water that is pumped to the Earth surface.
- Hot spring (natural geysers) the steam or the hot water comes out of the ground naturally through cracks.
- Example - Bakreswar West Bengal.

- **7. Biomass / Bioenergy**
- An eco friendly energy.
- Biomass is a General term used for all material originating from photosynthesis.
- Biomass is the second generation biofuel.
- Biofuel is any fuel that derived from recently living organisms or their metabolic products.

- **i. Biogas**
- Biogas is a mixture of Methane, Carbon dioxide, Hydrogen and Hydrogen sulphite.
- The major constituent being methane.
- Biogas is produced by anaerobic degradation of animal waste (sometime plant wastes) in presence of water.

- **MNES (The ministry of non conventional energy sources).**
- **now (The ministry of New and renewable energy) MNRE**

- **ii. Biofuels**
- Biomass can be fermented to alcohol like ethanol and methanol which can be used as fuels.
- Ethanol can be easily produced from carbohydrate rich substance like sugarcane, corn and Sorghum.
- **Gasohol** mixture of ethanol and gasoline is a common fuel used in Brazil, Zimbabwe some part of India (Kanpur) for running cars and buses.
- Methanol is also useful as fuel which can be easily obtained from Woody plants.

- **a. Hydrogen as biofuel**
- Hydrogen from algae and bacteria.
- Hydrogen is third generation biofuel.
- As hydrogen burns in air it combines with oxygen to form water and large amount of energy is released.
- Green plants and micro algae have photolysis of water during photosynthesis.

- Multifaceted (bacteria, algae) organism comprise the **hydrogenase** system capable of photo production of hydrogen.

- Green algae *Chlorella*, *Chlamydomonas*.
- Bacteria *E. coli*, *Citrobacter freundii*, *Rhodospirillum rubrum*

- **b. Ethanol**
- *Zymomonas mobilis*, *Saccharomyces cerevisiae*, *Candida shehatae*, *Clostridium sp.* all are ethanigenic microbes.

- **c. Biodiesel**
- *Jatropha curcas* (common name Bherenda)

- 1st generation biofuels derived from *Jatropha* (biofuels) and corn, cassava, sweet sorghum, sugar beet, sugarcane etc (bio ethanol).

- 2nd generation biofuel comprises Biomass chiefly cellulose and Lignin from plants.

- 3rd generation biofuel is hydrogen which are extracted from some algae and bacteria.

Non-renewable energy sources

- **A. Coal**
- Four types of Coals are
- **Anthracite (hard coal)** has minimum carbon 90%
- **Bituminous (soft coal)** has carbon 80%
- **Lignite** brown coal has carbon 70%
- **Peat** has carbon 60%
- Major coalfields in India are Raniganj, Jharia, Bokaro and Godavari valley.
- When coal is burnt it produces CO_2, which is a greenhouse gas responsible for causing enhanced global warming.

- **B. Petroleum**
- There are 13 countries in the world having 67% of the petroleum Reserves together form the OPEC (organization of Petroleum exporting countries).
- About $1/4^{th}$ of the oil Reserves are in Saudi Arabia.
- Crude petroleum is a complex mixture of alkane hydrocarbons (Petroleum gas, kerosene, Petrol, diesel, fuel oil, lubricating oil, paraffin, wax etc).
- **LPG (Liquefied Petroleum Gas)**
- Main component is butane (other propane, ethane).
- The petroleum gas is easily converted to liquid form under pressure as LPG.
- Oil fields in India located at Digboi (Assam), Gujarat Plains, Bombay High Offshore areas.

- **C. Natural gas**
- It is mainly composed of Methane (95%) with small amounts of propane and Ethane.
- It is a fossil fuel.

- **CNG (Compressed Natural Gas)**
- It is being used as an alternative to petrol and diesel for transport of vehicles.
- CNG use has greatly reduced vehicula pollution in the City.

- **SNG (Synthetic Natural Gas)**
- It is a mixture of carbon monoxide (CO) and hydrogen.

- **D. Nuclear energy**
- Nuclear energy can be generated by two types of reactions:
- **Nuclear Fission**

$$_{92}U^{235} + {}_{0}n^{1} = {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3{}_{0}n^{1} + \text{Energy}$$

- Nuclear reactors make use of nuclear chain reaction. This makes a self-sustaining nuclear chain reaction possible, releasing energy at a controlled rate in a nuclear reactor or at a very rapid, uncontrolled rate in a nuclear weapon.

- **Nuclear fusion**

$$_{1}H^{2} + {}_{1}H^{2} = {}_{2}He^{4} + \text{Energy (1 billion } {}^{o}C)$$

- 2 Hydrogen 2 (deuterium) = 1 billion ^{o}C
- Hydrogen 2 + Hydrogen 3 (Tritium) = 100 million ^{o}C
- Disposal of the nuclear waste big problem.

- **Nuclear Energy Station**

- Tarapur (Maharashtra first nuclear station), Narora (U.P.), Rana Pratap Sagar (Rajasthan), Kalpakkam (Tamil Nadu).

- **Research center - BARC (Bhabha Atomic Research Centre Mumbai).**

Natural Resources
Part 6

Land Resource

Land as a resource

- Landforms like hills, valleys, Plains, river basins and wetland include different resource generating areas that the people in them depend on.
- Land is a finite and valuable resource upon which we depend for our food, fibre and fuel wood.

Land Degradation

- Soil degradation is a real cause of alarm because soil formation is an extremely slow process (about 200 to 1000 years are needed for the formation of one inch or 2.5 cm soil) and the average annual erosion rate is 20-100 times more than renewal rate.
- The loss of the top soil or disturbance of the soil structure is known as soil erosion.
- Soil erosion results in the loss of fertility.

Soil erosion types

- i. Normal erosion / geologic erosion.

- ii. Accelerated erosion caused by anthropogenic (man made) activities.

  A. Climatic agents (water and wind).

  B. Biotic agents (excessive grazing, deforestation).

Agent of soil erosion

- i. Running water
- ii. Underground water
- iii. Moving ice glaciers
- iv. Wind.
- v. Sea waves.
- vi. Deforestation and overgrazing.

Landslides

- Natural calamities like heavy rainfall, earthquake, heavy flood, volcano etc creates landslides. Anthropological activities like construction of big dams, deforestation, mining, disposal of waste products from cities and industries road construction etc creates landslides.

Desertification

- Desertification is a type of land degradation in drylands in which biological productivity is lost due to natural processes or induced by human activities whereby fertile areas become increasingly arid.

- Desertification is characterized by devegetation, depletion of groundwater, salinization and severe soil erosion.

- **Causes of desertification**
- i. Deforestation
- ii. Overgrazing
- iii. Mining and quarrying

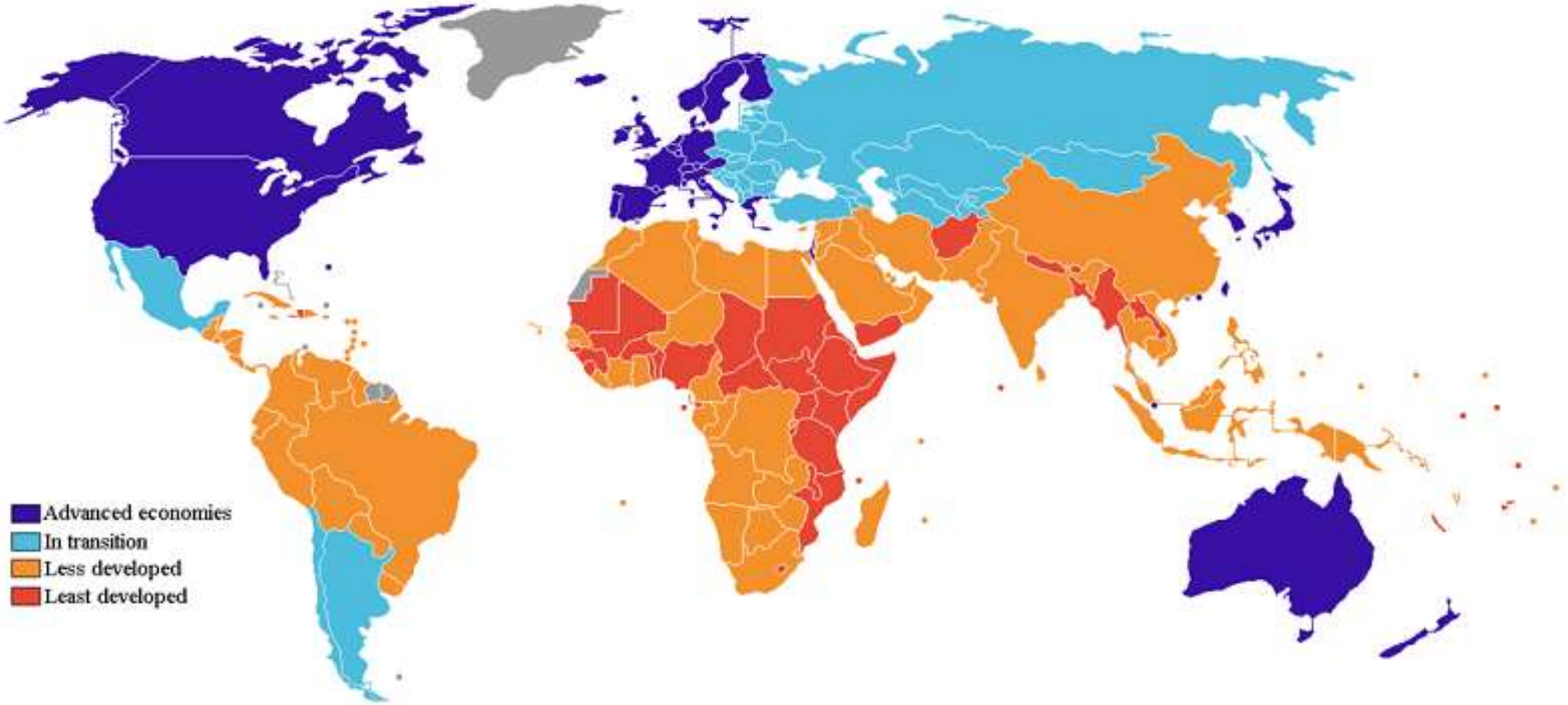
Conservation of natural resources

- Conserve water
- Conserve energy
- Protect the soil
- Promote sustainable agriculture
- Use of resources for sustainable development

- The global ecosystem has the capacity to sustain only a limited level of utilization.
- Renewable resources are being degraded by overuse and may be permanently destroyed. The two factors which are responsible for this Rapid depletion of natural resources are
- i. Increasing consumerism on the part of the affluent section society.
- ii. Rapid growth of population.

- The MDC (more developed countries) have only 22% of the world's population use 88% of its natural resources. The countries include USA, Canada, Japan, Australia, New Zealand, Western European countries.

- While the LDC (less developed countries) have 78% of world's population and use about 12% of the natural resources.
- The rich countries will have to lower down their consumption levels while the bare minimum needs of the poor have to be fulfilled by providing them resources.
- Lead to sustainable development for all and not just for a privileged group.


Advanced economies
In transition
Less developed
Least developed