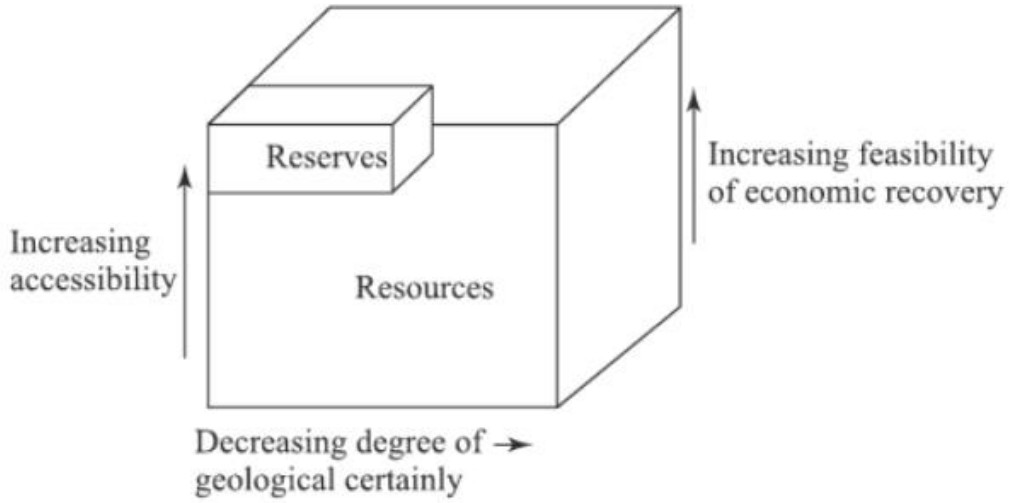
Natural Resources

Introduction

- Resources
- Reserves



- Perpetual, Renewable and Non-Renewable Resources
- Biotic and Abiotic Resources

Forest Resources

- Types of forest resources –

i. Old-Growth or ancient forests

ii. Second-growth forests

iii. Plantations

Forest-Resource Type	*Canopy Layer*	*Biodiversity*	*Prone to Disease*
(i) Old-growth	Several	More	Less
(ii) Second-growth	One	Less	More
(iii) Plantations	One	Least	Maximum

- Forest functions-

Influence climate, control run-off, control flood, prevent soil erosion, provide wildlife habitat, reduce wind erosion, remove pollutants, reduce noise, recycle nutrients, sustain local communities.

Deforestation

- Deforestation and forest degradation

- Causes – population explosion, commercial logging, agriculture, mining, dams, acid rain, developmental and housing projects, forest fires.

- Effects of deforestation – soil erosion, more droughts and floods, habitat loss of wildlife, extinction of some species, local and global climate changes, global warming, harm to fisheries, danger for local communities.

Deforestation

- Annual deforestation rate is given by,

$$r = \left\{1 - \left(1 - \frac{A_B - A_E}{A_B}\right)^{1/t}\right\} \times 100$$

Where, r = annual deforestation rate (%)

A_B = area of the forest at the beginning of the period

A_E = area of the forest at the end of the period

t = time period

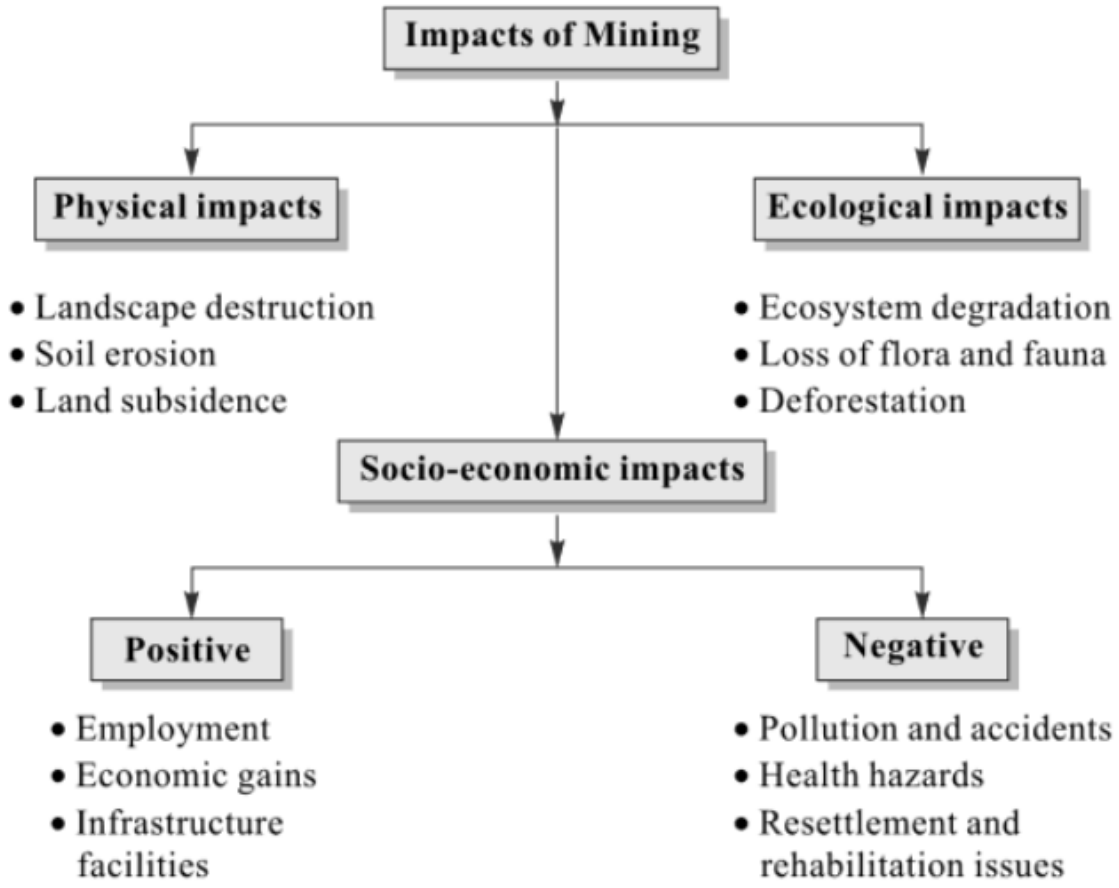
- Economic impacts of deforestation
- Environmental impacts – on atmosphere, hydrosphere, lithosphere, biosphere

Timber extraction

- Timber- wood throughout its processing time from the time it is cut to the time it is used as structural material
- Timber extraction methods-
    i. Clear felling
    ii. Handlogging
    iii. Reduced impact logging
    iv. Selective logging
    v. Mechanized logging
- Impacts – deforestation, forest degradation, forest fires, harm to nature and atmosphere, climate change, soil erosion and siltation.

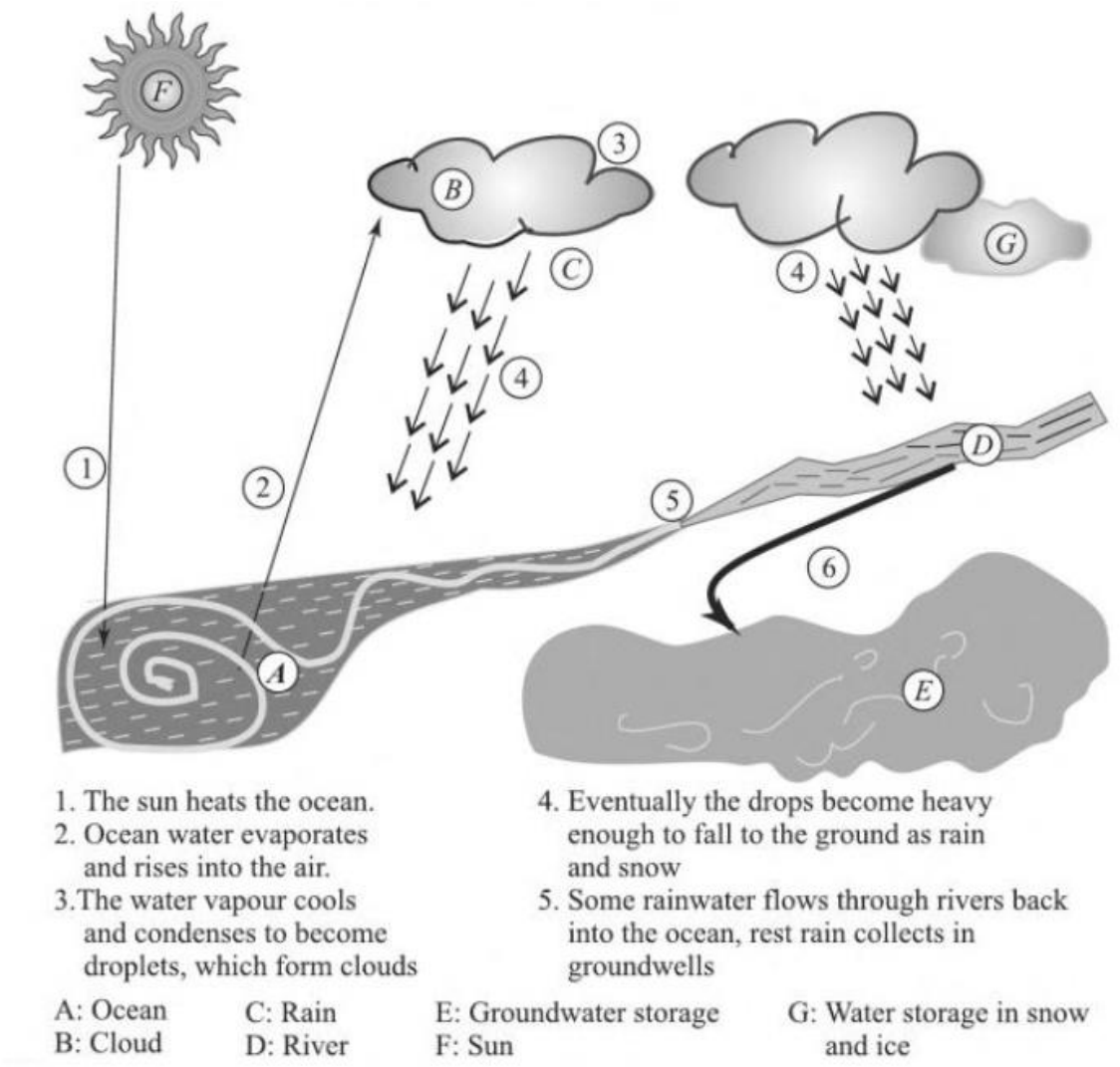
Mining

- Extraction of metals and minerals from the earth.
- Sustainable mining – socially acceptable, economic and environmentally compliant.



Water Resources

- Water – the elixir of life
- The water cycle –
  i. Evaporation
  ii. Sublimation
  iii. Condensation
  iv. Precipitation
  v. Surface run-off
  vi. Percolation



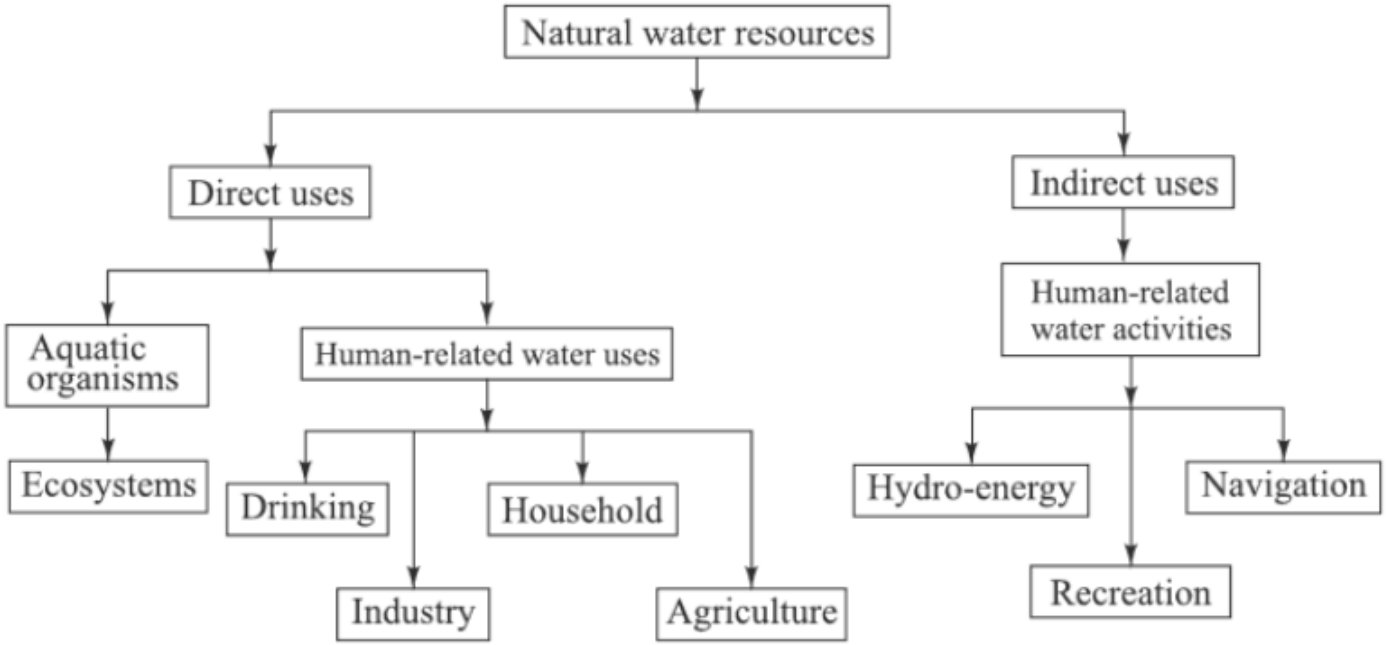
The Water Cycle

Significance	Problems arising from disturbing the water cycle
Maintenance of ecosystem	Ecosystem gets disturbed
Transport of minerals	Mineral transport disrupted
Purification	Purification process disturbed
Replenish the land with freshwater	Disturbs freshwater replenishment on land
Reshape the geological features of the earth	Processes for reshaping earth’s geological features get disturbed
Assist in cooling and warming of the atmosphere	Influence on climate gets disturbed.

Causes of water crisis in the world

- Population
- Spatial and temporal variations in available water
- Pollution
- Climate change
- Increase in extreme weather events

Uses and overuses of water resources

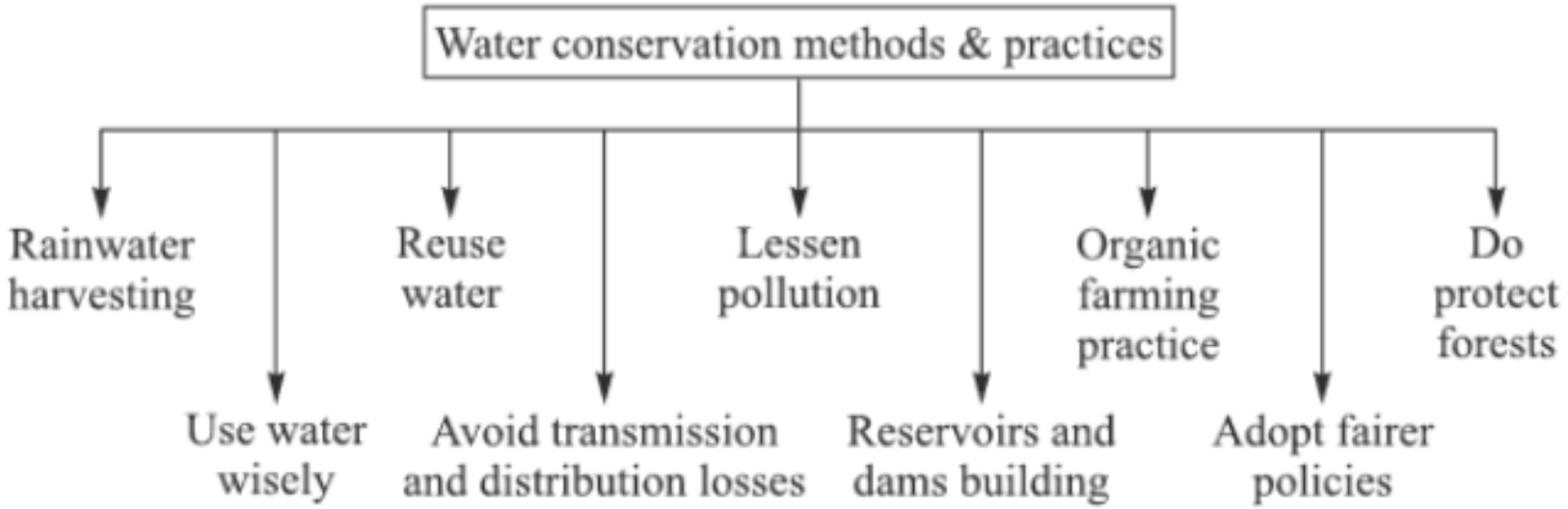


- **Excessive withdrawal from surface water**
- **Inefficient use of freshwater**
- **Excessive withdrawal from underground aquifers**

Impacts of over-utilisation of water resources

- Disrupt freshwater ecosystems
- Risk to ecosystem functions
- Degradation of water quality and declining water tables
- Harm to aquatic and marine life

Water Conservation



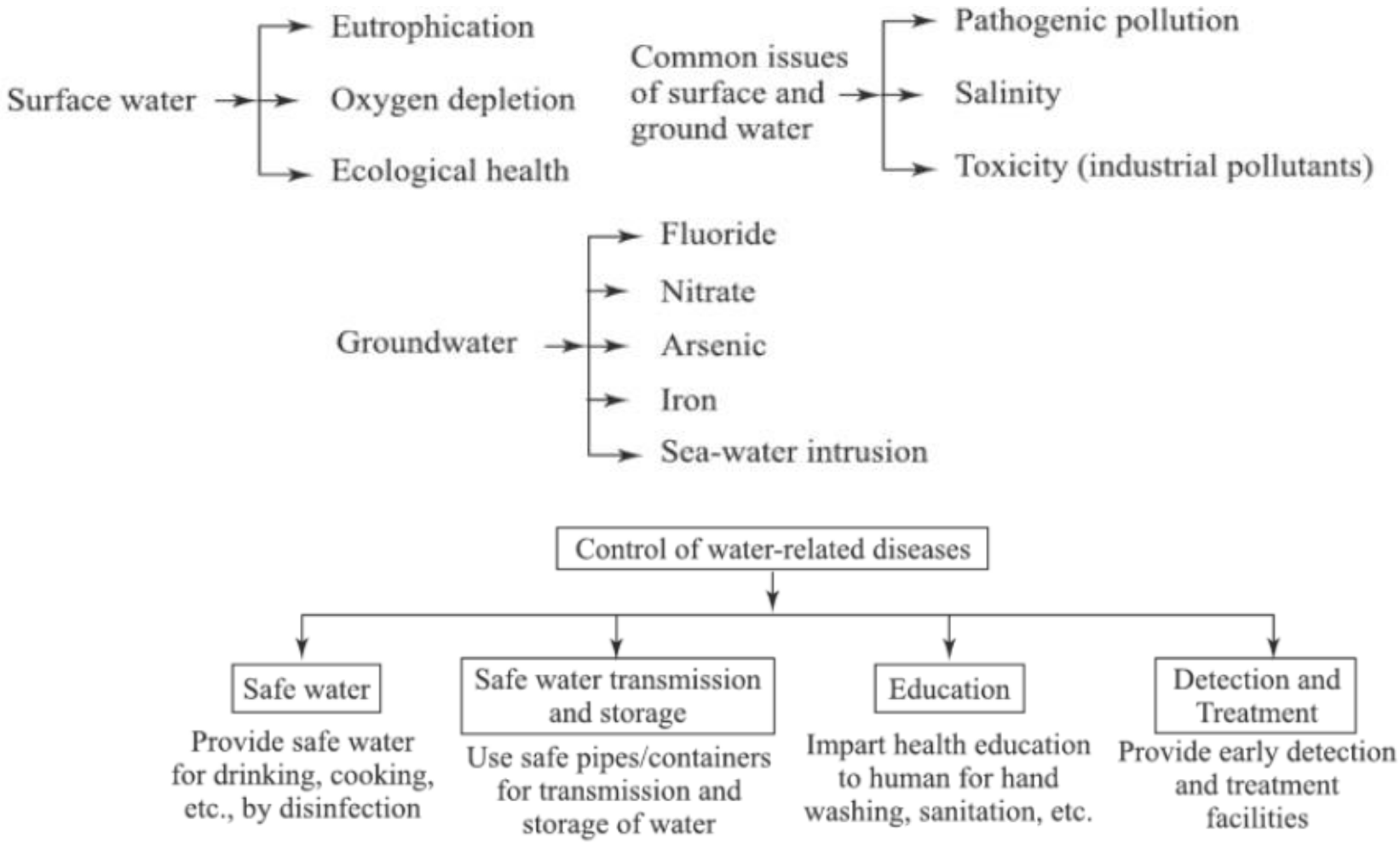
Characteristics of good quality water

(a) It is transparent, colorless and odourless.
(b) It has sufficient oxygen concentration for marine life to survive.
(c) It is free from bacteriological contamination.
(d) It is free from any water pollution.
(e) It is free from excessive nutrients like N, P, etc., which are responsible for eutrophication.
(f) It is fit for the intended use.

Self purification of rivers

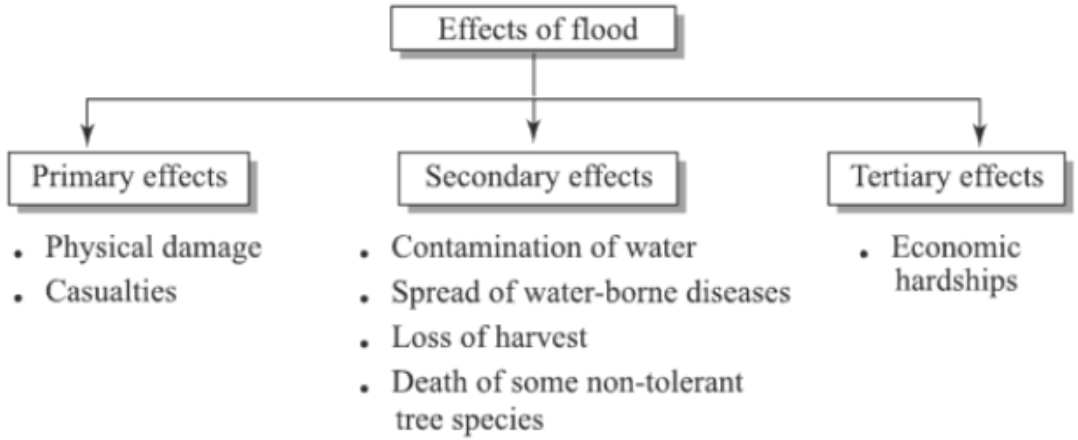
- Phyto-remediation
- Aeration
- Sedimentation
- Adsorption
- Dilution
- Floatation
- Microbial degradation

Important quality issues of water



Natural Resources

Floods



Benefits of Floods The more frequent and smaller floods can bring following benefits:

(i) Water Availability Floods helps in recharging of groundwater. Flood waters provide much-needed water resources in arid and semi-arid regions where precipitation events are unevenly distributed throughout the year.

(ii) Ecosystem Services Specially freshwater floods play an important role in maintaining ecosystems in river corridors and in maintaining floodplain biodiversity.

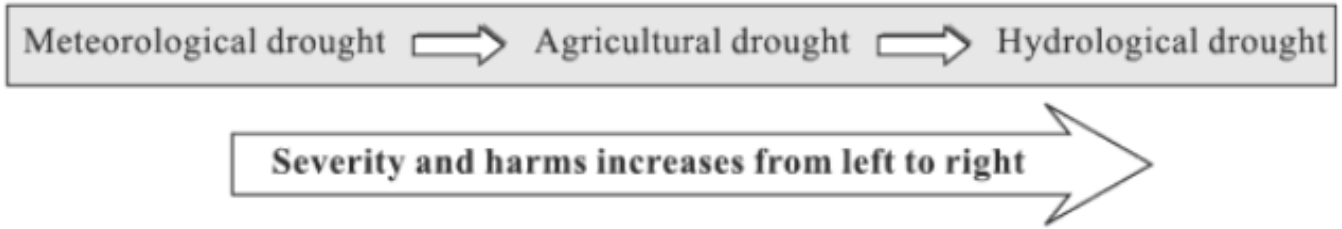
(iii) Increase in Soil fertility Floods help in making the soil more fertile by providing nutrients to soil.

(iv) Improved Fisheries Flooding adds a lot of nutrients to lakes and rivers which help in improved fisheries for some years. Fish, like weather fish, make use of floods to reach new habitats.

(v) Benefits to Birds Birds profit from the boost in production caused by flooding.

(vi) Higher Viability of Hydro-energy Projects The viability for hydrological based renewable source of energy is higher in flood-prone regions.

Drought



Impacts of drought –

- On agriculture
- On the environment
- On health
- Social impacts
- Economic impacts

Water conflicts

Some specific examples of conflicts over water:

(i) Conflict between Poor and Rich The rural peasants are poor and only require a pot full of drinking water. The urban elite is rich and uses large quantities of water for meeting the requirements of water-intensive sewage systems, space cooling, gardening, etc. This results in conflict.

(ii) Conflicts between Agricultural Usage of Water Conflict also exists between water-intensive cultivation of commercial crops for high cash returns and wise water use for protective irrigation of necessary food crops essential for survival.

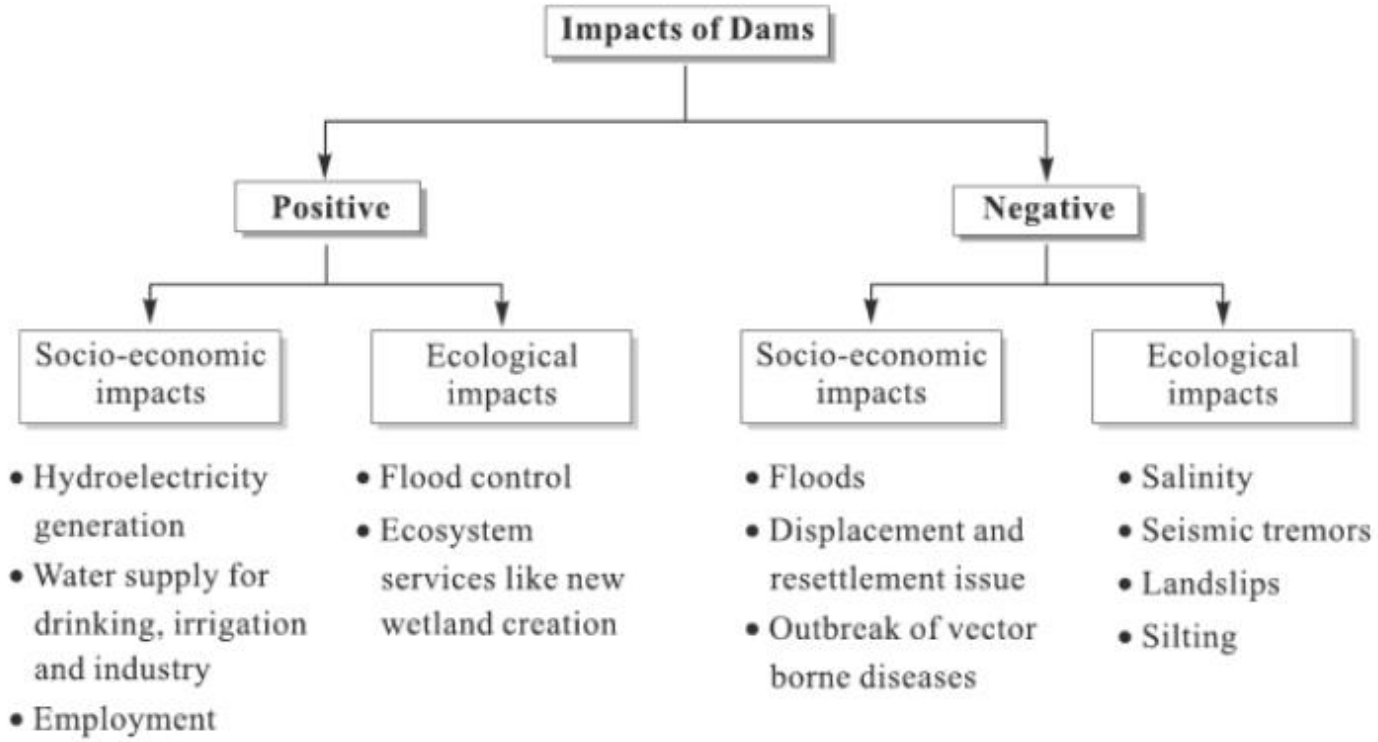
(iii) Interstate Conflicts Sometimes water projects of upstream states influence the quantity and quality of water flow in the basin. This reduces the possibilities of water use by downstream states resulting in inter-state conflicts.

(iv) Intrastate Conflicts State-planned extraction of timber or minerals in the river catchment affect the river flow and generate conflicts downstream.

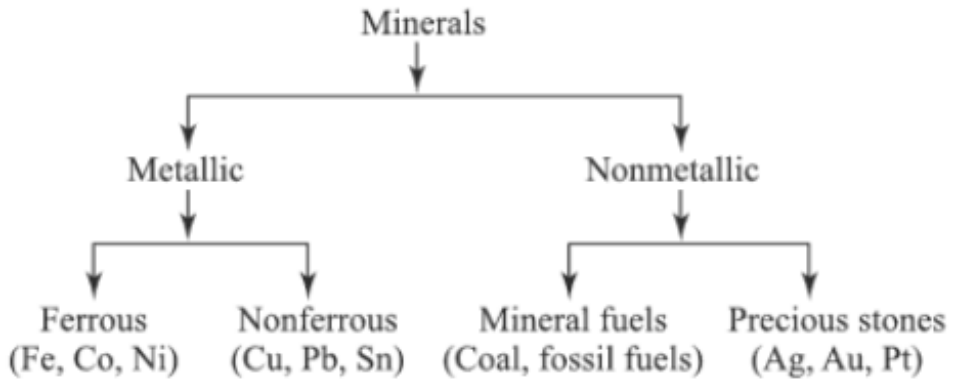
State-planned agricultural production based on large irrigation projects to generate marketable surpluses of cash crops conflicts with people's needs for local food production.

(v) Across Borders Conflicts India, Bangladesh and Nepal are disputing the best use of water of the Ganges–Brahmaputra basin. India and Nepal want to exploit the basin's huge hydroelectric power-generating potential, whereas Bangladesh wants the water management in such a way so as to minimise water shortages during dry months and flooding during monsoon months.

Dams


Impacts of Dams
Positive
Negative
Socio-economic impacts
Ecological impacts
Socio-economic impacts
Ecological impacts
• Hydroelectricity generation
• Water supply for drinking, irrigation and industry
• Employment
• Flood control
• Ecosystem services like new wetland creation
• Floods
• Displacement and resettlement issue
• Outbreak of vector borne diseases
• Salinity
• Seismic tremors
• Landslips
• Silting

Mineral Resources



4 R's for sustainable use of mineral resources

REDUCE RECYCLE REGULATE RESEARCH

Environmental Effects of Extracting and Using Mineral Resources

The impacts on forest, land, occupation, water, ecological functions, rehabilitation of population, or impact on flowers due to pollution created during extraction and use of mineral resources are

(i) Deforestation including to loss of flora and fauna.
(ii) Degradation of land due to excavations.
(iii) Occupational health hazards.
(iv) Pollution of ground and surface water resources due to accidental or periodic discharge of pollutants.
(v) Damage to local ecological functions, nutrient cycling and biodiversity due to alterations in water availability or quality.
(vi) Problem in rehabilitation of affected population.
(vii) Pollution of air due to emission of dust and poisonous gases during mining and processing stages. Problems in providing living environment and clean water, air, etc., for the *survival* of large number of workers who have migrated nearby mine sites.
(viii) Problems in the safe disposal of tremendous amounts of solid waste generated during mining.

Food Resources

- Food security –

i. Food availability
ii. Food access
iii. Food use

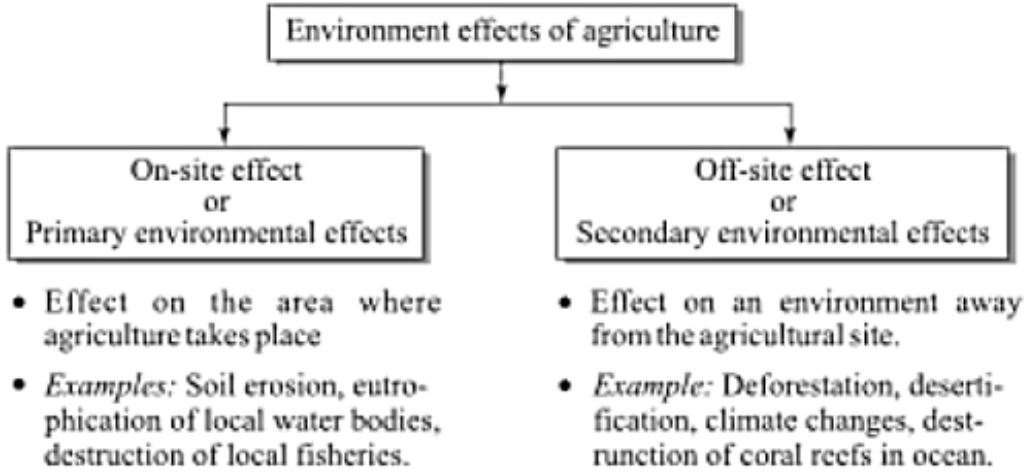
- World food problems –

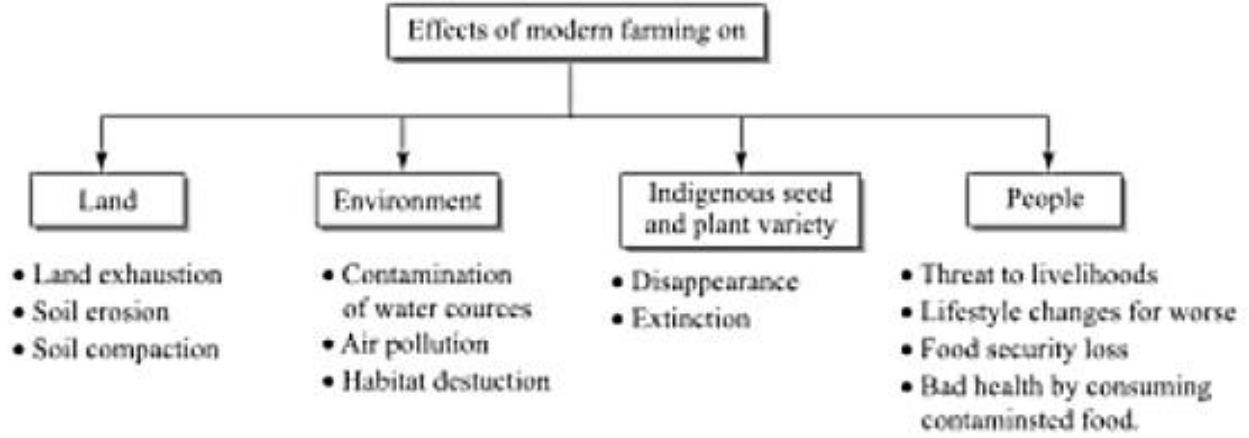
i. Undernourishment
ii. Malnourishment
iii. Overnourishment

Agriculture

- Modern agriculture
- Intensive agriculture and organic farming
- Sustainable agriculture
- Conservation tillage
- Integrated Crop Management

Impacts of agriculture





Fertilizer problems

- Fertilizer burn

i. Leaf burn

ii. Discolouration

- Fertiliser run-off causes eutrophication
- Soil damage
- Health problems

Pesticide problems

- Affect water supply
- Affect aquatic life
- Insects
- Birds (Bioaccumulation and biomagnification)
- Humans

Risk = f(Hazard, Exposure)

GREEN REVOLUTION

Waterlogging and salinity

- Caused by over-irrigation of soils
- Affect crop productivity

Note:

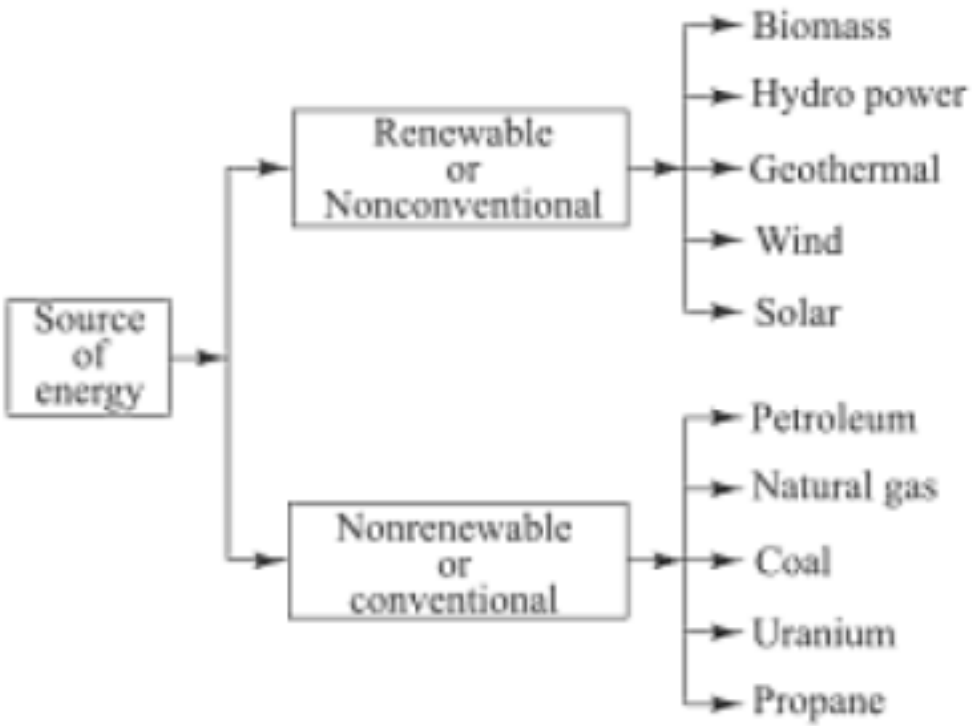
How has agriculture contributed to water pollution, air pollution, loss of biodiversity and soil erosion?

Impacts of overgrazing

- Soil quality decreases
- Soil properties decrease (porosity, moisture holding capacity and infiltration rate)
- Growth of thorny shrubs/poisonous plants may increase
- Desertification and soil erosion

Natural Resources

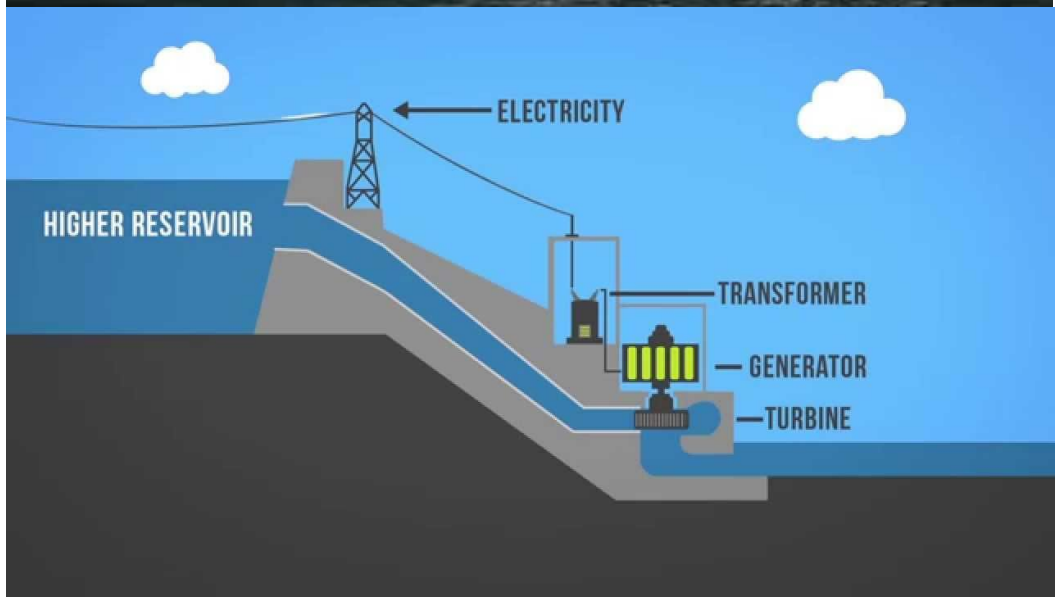
Energy Resources

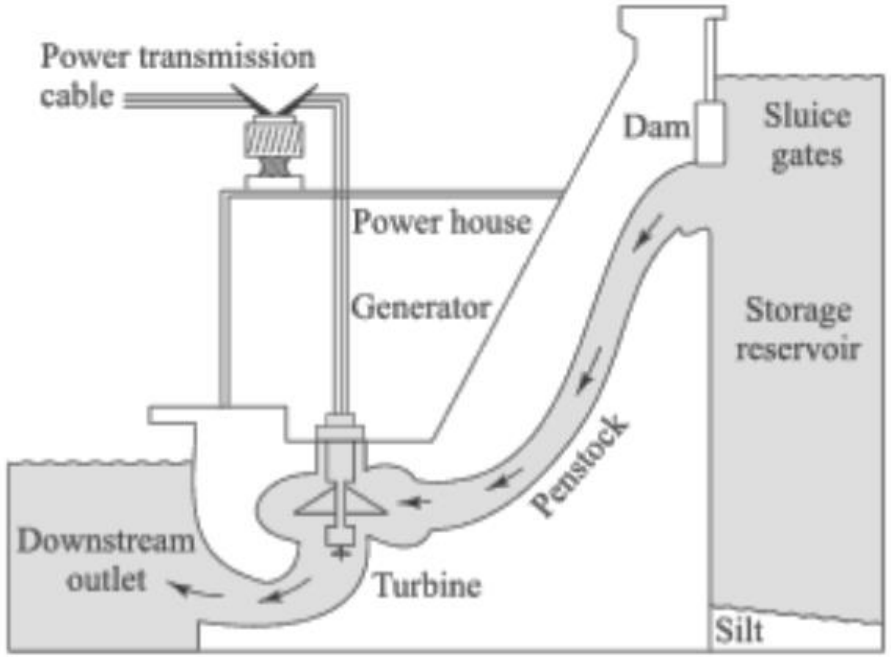


Differences between conventional and nonconventional sources of energies

	Conventional Sources of Energy		***Nonconventional Sources of Energy***
(i)	They are fully developed.	(i)	They are still undergoing development.
(ii)	They use nonrenewable resources.	(ii)	They use renewable resources.
(iii)	Inexpensive.	(iii)	Expensive.
(iv)	Require established technologies.	(iv)	Require new technologies which are still under research and development.
(v)	Ecologically not safe for usage.	(v)	Ecologically safe to use.
(vi)	Available in limited quantity.	(vi)	Available in plenty.
(vii)	Carbon and other greenhouse gas emissions from the combustion of coal, natural gas, etc., are known to have disastrous environmental and health consequences. These gases are also major culprit in climate change.	(vii)	Free from such problems.
(viii)	*Examples:* Petroleum, coal, etc.	(viii)	*Examples:* Solar, wind and hydropower, etc.

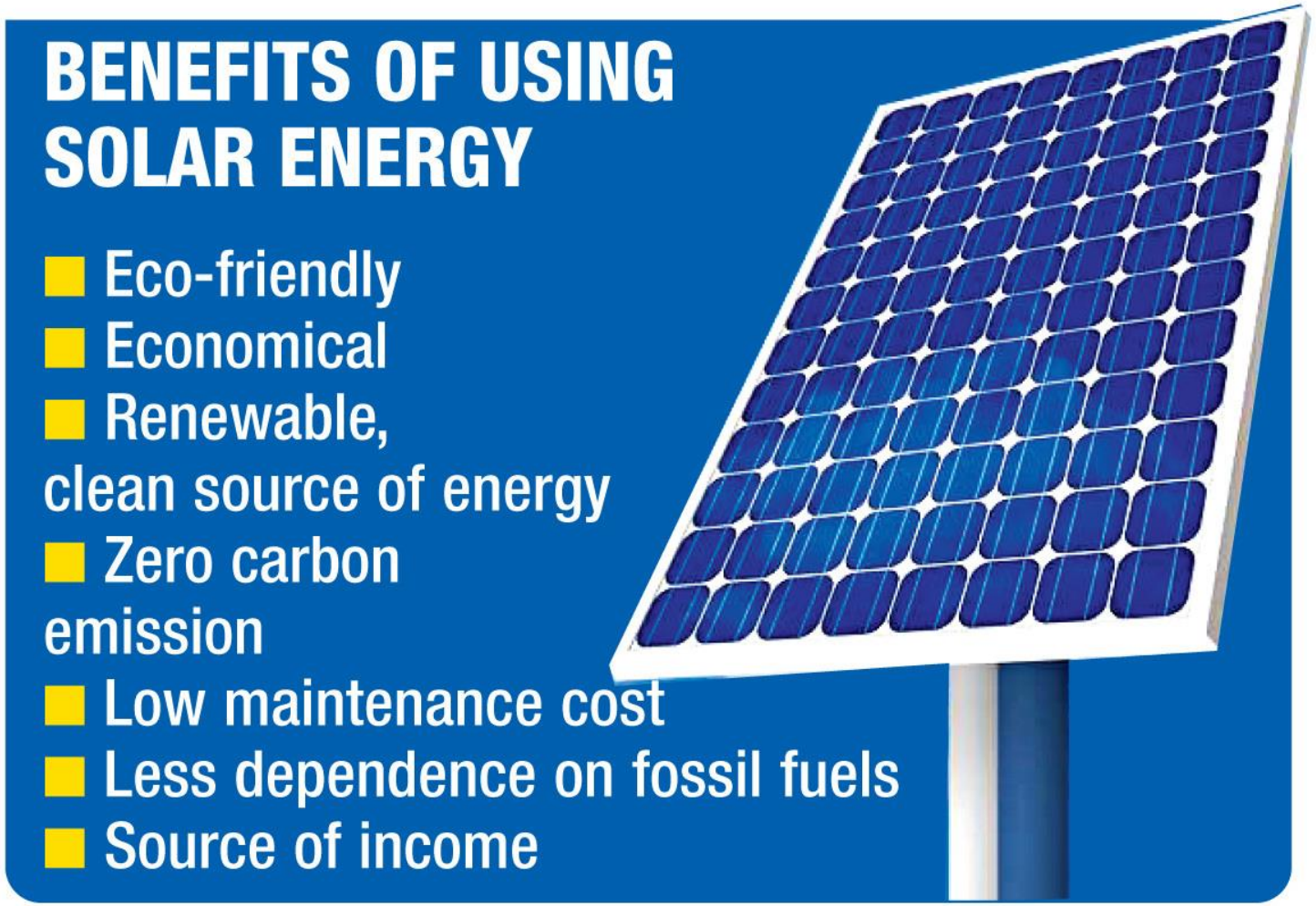
Hydroelectric Energy



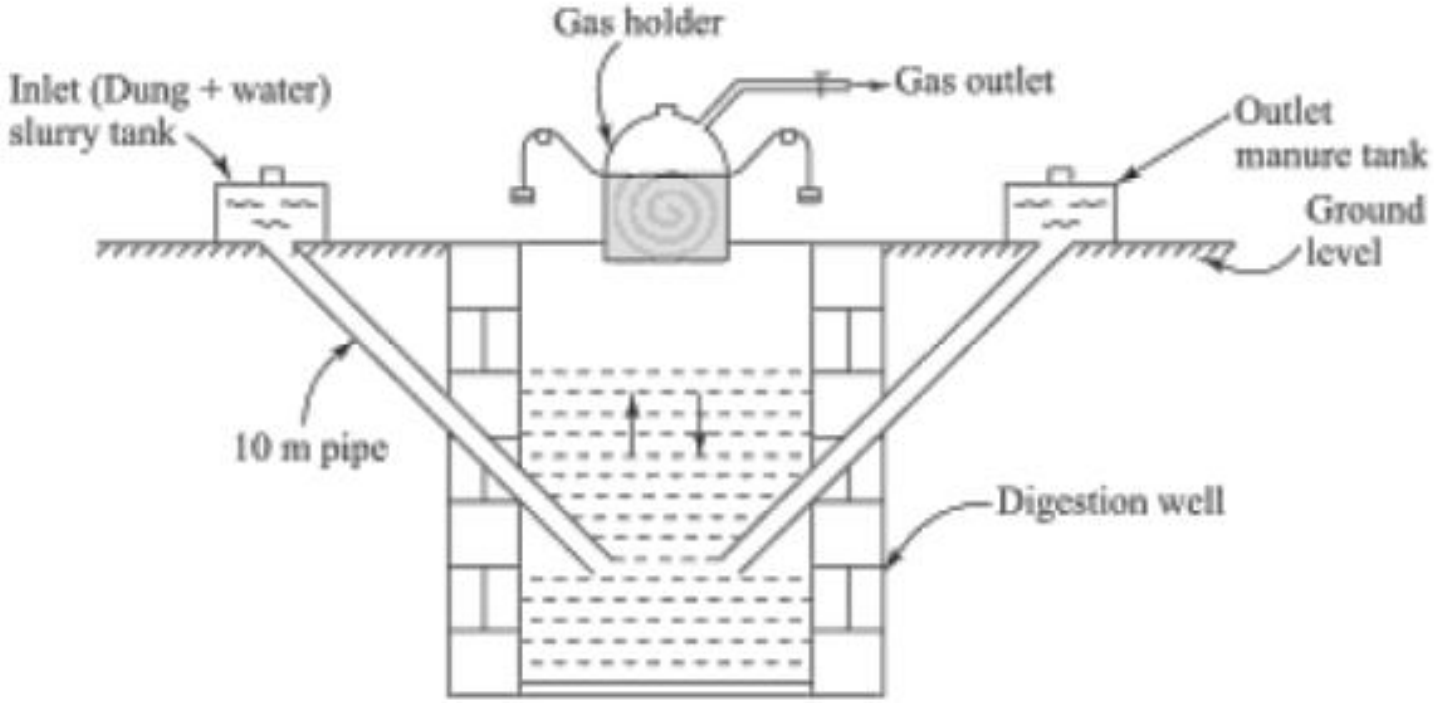


Generation of hydro-electric energy using a dam

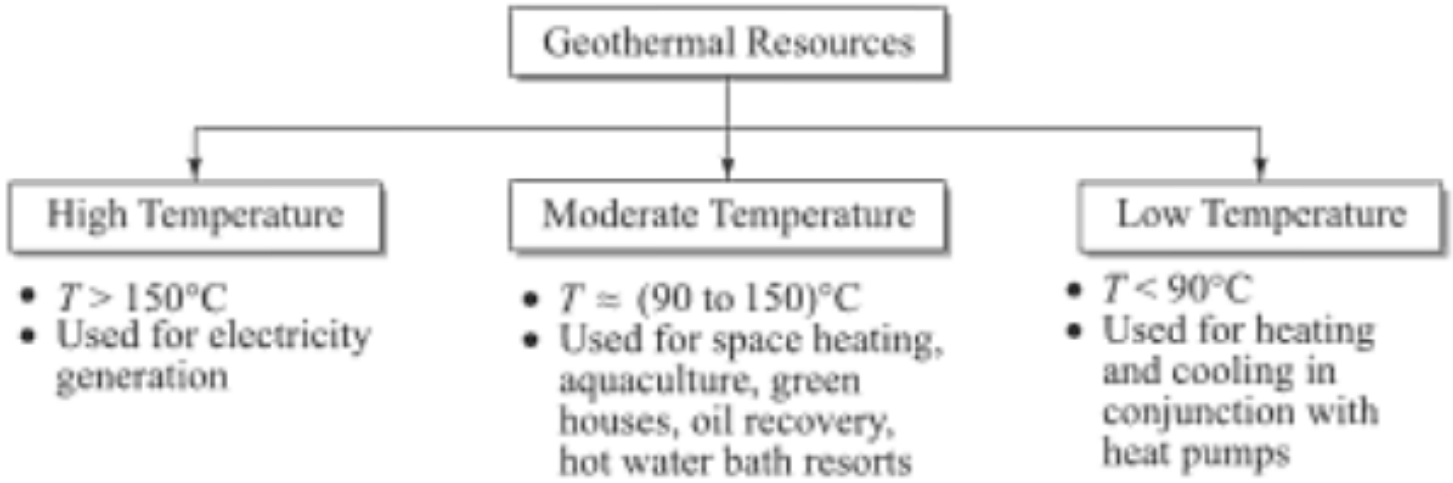
Solar Energy



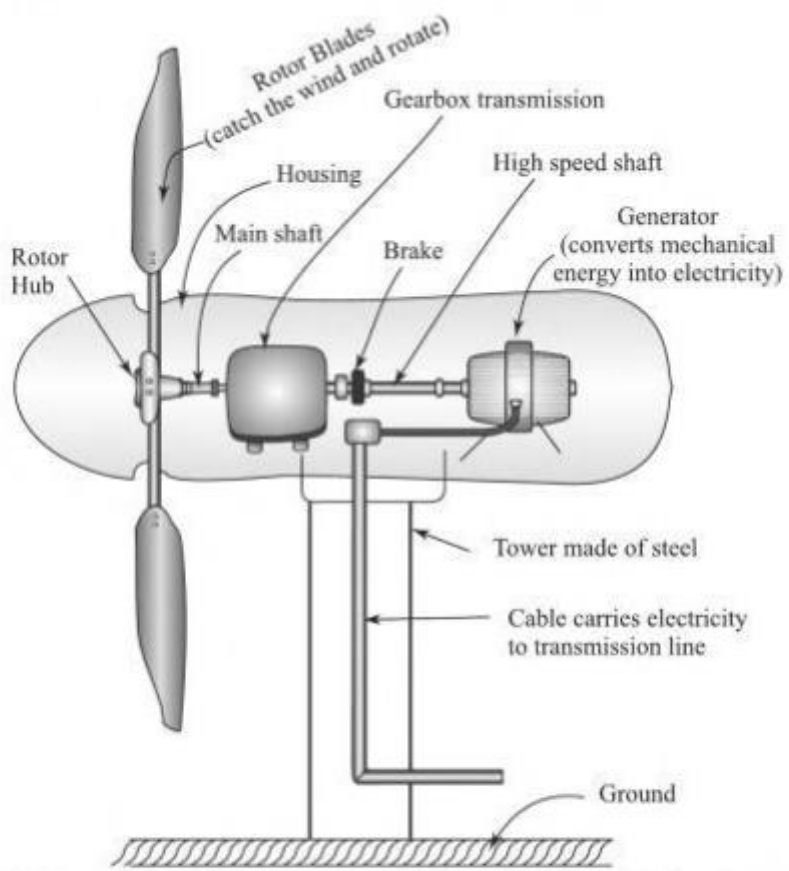
Biomass, Biogas and Biofuel



Geothermal Energy



Wind Energy

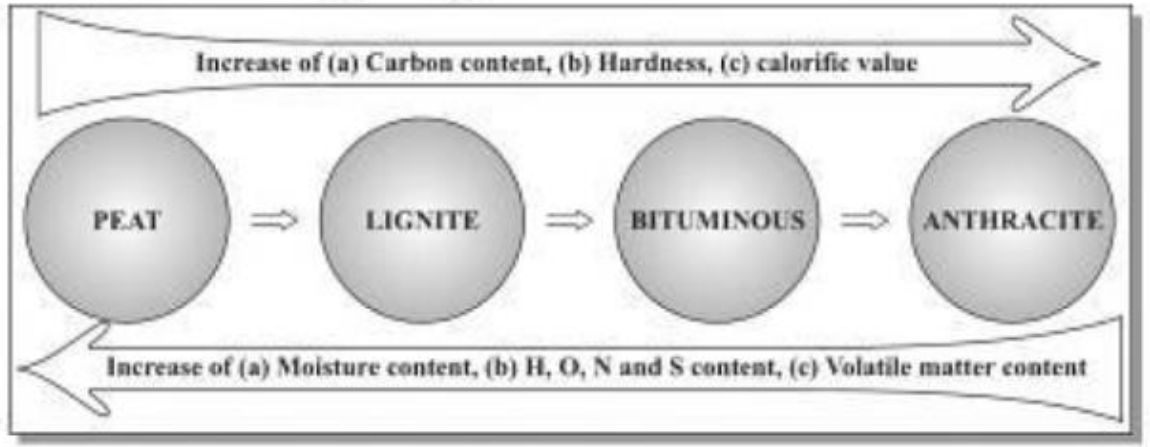


[A windmill essentially consists of a structure similar to large electric fan that is erected at some height on a rigid support. Inflow of wind activates rotor hub and blades. These hub and blades then spin the main shaft and gearbox. Generator in turn is spinned by gearbox, resulting in electrical output]

How does a wind turbine work?

Fossil Fuels

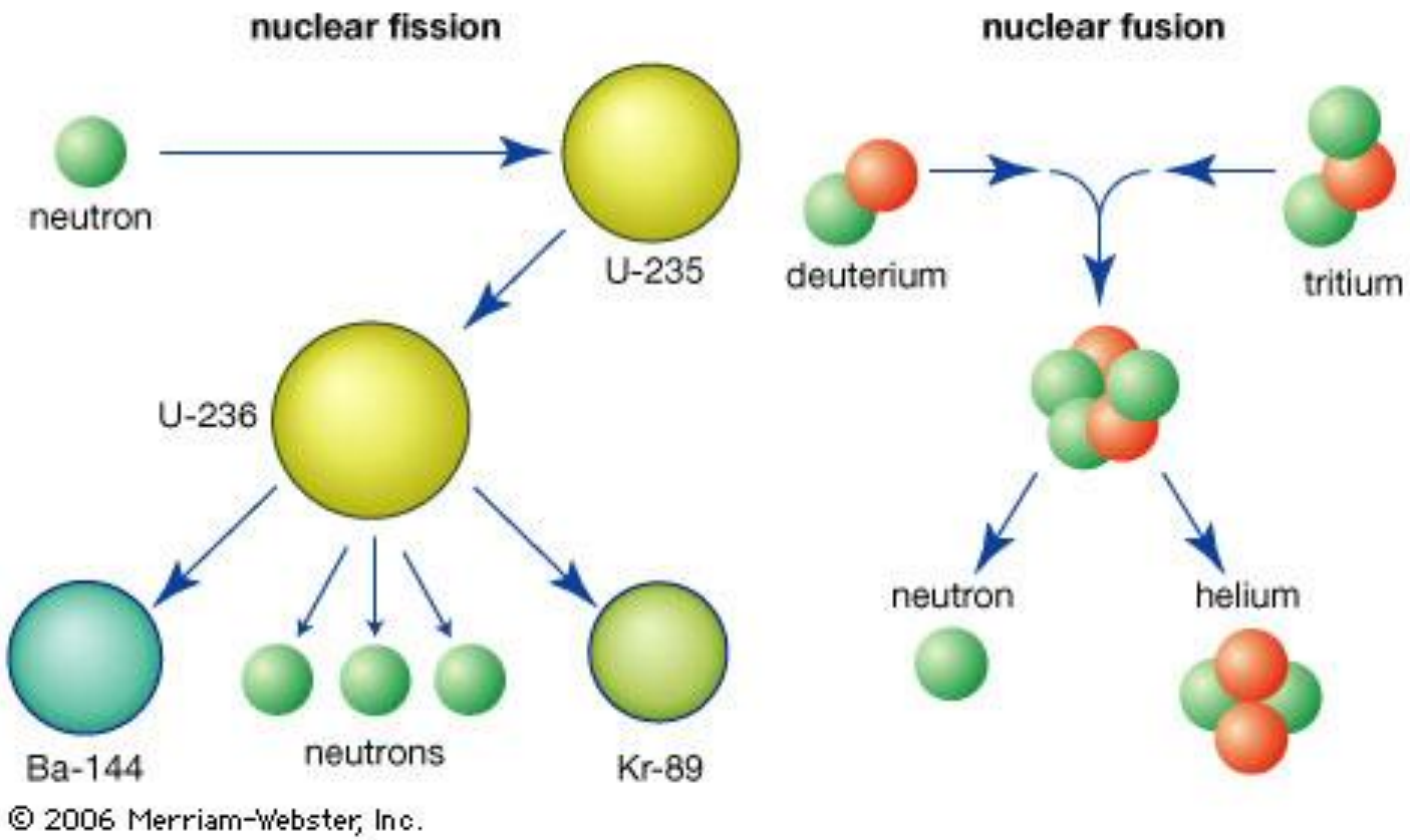
1. COAL



2. PETROLEUM

3. NATURAL GAS

Nuclear Energy



Hydrogen as an Alternative Source of Energy

Advantages of Hydrogen as an Important Energy Carrier in the Future

(i) ***Pollution free*** Hydrogen is a pollution free fuel.

(ii) ***Economical*** It is less costly to ship hydrogen by pipeline than sending electricity over long distances by wire in some instances.

(iii) ***Various Applications*** It can be used for transportation, heating and power generation in places where it is difficult to use electricity.

(iv) ***Easy Storage*** A large volume of hydrogen can be easily stored in a number of different ways.

(v) ***High Efficiency*** Hydrogen is considered a highly efficient fuel.

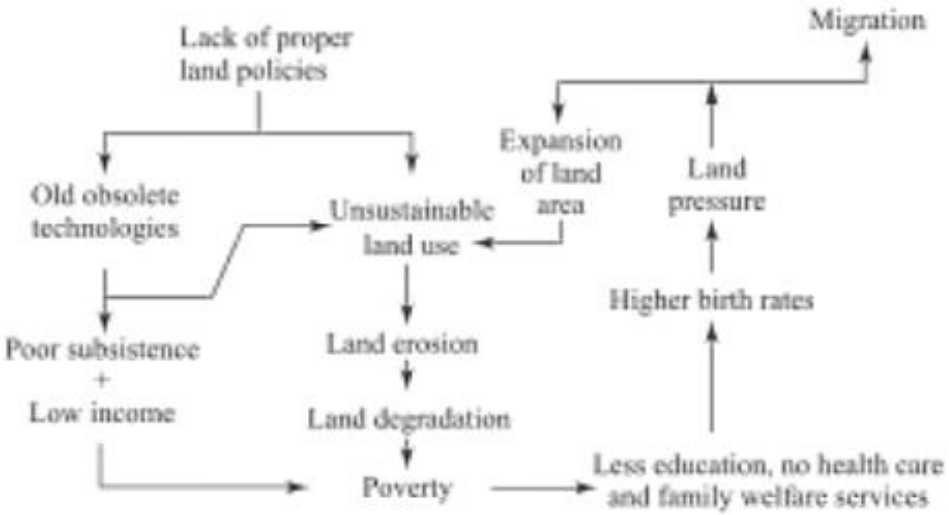
Limitations of Hydrogen Energy The use of hydrogen as an alternative future source of energy is limited by

(i) Its low availability in pure H_2 form in the environment

(ii) Difficulty in handling, storing and transportation of H_2

(iii) Requirement of energy for the production of H_2

Land as a resource



Causes of land degradation

Land degradation
Human induced landslides
Soil erosion
Desertification

Conservation of Natural Resources

(i) Reduce usage of nonrenewable natural resources such as fossil fuels.
(ii) Preferably use renewable and environment-friendly energy resources like solar energy, wind energy, etc.
(iii) Avoid deforestation and conserve forest resources.
(iv) Help in afforestation by planting trees along the roadside, wastelands, etc., through social forestry programmes.
(v) Use biogas for cooking instead of fuel wood in rural areas.
(vi) Turn off unused appliances to reduce energy requirements.
(vii) Reduce usage of vehicles for energy saving avoiding pollution and conserving natural resources.
(viii) Preferably use ecofriendly products made through green technology.
(ix) Use less paper, reuse paper and recycle paper for saving forest and water resources.
(x) Donate money for conservation activities.
(xi) Reduce the use of chemical fertilisers. Use compost. It is a mix of dead plants and dirt which is buried underground for a few weeks. The compost can then be digged out for addition to soil and making it fertile and healthy.
(xii) Help governments to protect an entire wetland or a large section of tropical rainforest.