

## ENVIRONMENT: NCERT BOOKS SUMMARY- BY AMBALIKA SMITI

## CLIMATE

Climate	Average weather condition over longer period of time
Weather	Local change in climate, day to-day condition of the atmosphere at a place with respect to the temperature, humidity, rainfall, windspeed, etc. Vary over short period of time

## Variation in Temperature

- In Summer 55°C in the western Rajasthan
- Minus 45°C in winter around Leh.
- Churu in Rajasthan >50°C on a June day, it's hardly 19°C in Tawang (Arunachal Pradesh) on the same day.
- On a December night, temperature in Drass (Jammu and Kashmir) minus 45°C while Tiruvanantapuram or Chennai on the same night records 20°C or 22°C.

## Variation in rainfall

Snowfall in Himalaya, while rainfall in all other parts  
Cherrapunji Maysymram has highest rainfall while Jaislmer mostly dry

Very Hot	Jaislmer
Very Cold	Drass (J&K)
Moderate	Mumbai

## India- Major seasons - 4

Season	Features
Winter (Cold weather) Dec-Feb	<ul style="list-style-type: none"> <li>• Sunshine slant, Low Temperature</li> <li>• December and January are the coldest months</li> <li>• Temperature decreases from South to North</li> <li>• <b>northeast trade winds prevail</b> over the country, blow from land to sea</li> <li>• Most part has <b>dry</b> season</li> <li>• <b>rainfall occurs on the Tamil Nadu coast from these winds as, here they blow from sea to land.</b></li> <li>• A characteristic feature over the northern plains is the inflow of <i>cyclonic disturbances from the west and the northwest</i> which originate over the Mediterranean Sea and western Asia and move into India, along with the westerly flow. They <b>cause winter rains</b> locally known as '<b>mahawat</b>' over the plains and snowfall in the mountains. This rainfall are of immense importance for the cultivation of '<b>rabi</b>' crops</li> <li>• Peninsular region of India, however, does not have any well-defined cold weather season</li> </ul>
Summer (Hot weather) Mar-May	<ul style="list-style-type: none"> <li>• Sunray direct, high temperature</li> <li>• <b>Loo- Hot and dry wind blow during day, hot and dry westerly gusts from Pakistan and northwest India which dries out the region</b></li> </ul>

	<ul style="list-style-type: none"> <li>Dust storms are common called 'Kaal Baisakhi' in WB</li> <li>At the end pre-monsoon shower or mango showers</li> </ul>
South west Monsoon/Rainy season/Advancing monsoon Jun-Sep	<ul style="list-style-type: none"> <li>Onset of monsoon</li> <li>Moisture laden wind from Bay of Bengal and Arabian sea blow towards land</li> <li>Orographic rains in western ghats and NE</li> <li>Mawsynram in the southern ranges of the Khasi Hills receives the highest average rainfall in the world. (stalagmite and stalactite caves found here)</li> <li>Rainfall in the Ganga valley decreases from the east to the west.</li> <li>Rajasthan and parts of Gujarat get scanty rainfall.</li> <li>Has breaks- wet and dry spell</li> </ul>
Retreating Monsoon/Transition season	<ul style="list-style-type: none"> <li>Oct-Nov</li> <li>Winds blows form mainland to Bay of Bengal</li> <li>Part of India- AP and TN received rainfall</li> <li>October heat due to high temperature and humidity</li> </ul>

- Indian climate - Monsoon type
- Monsoon- taken from Arabic Mausim mean season
- India located in tropical region

#### Some Famous Local Storms of Hot Weather Season

(i) **Mango Shower** :Towards the end of summer, there are pre-monsoon showers which are a common phenomena in Kerala and coastal areas of Karnataka. Locally, they are known as mango showers since they help in the early ripening of mangoes.

(ii) **Blossom Shower** :With this shower, coffee flowers blossom in Kerala and nearby areas.

(iii) **Nor Westers** :These are dreaded evening thunderstorms in Bengal and Assam. Their notorious nature can be understood from the local nomenclature of 'Kalbaisakhi', a calamity of the month of Baisakh. These showers are useful for tea, jute and rice cultivation. In Assam, these storms are known as "Bardoli Chheerha".

(iv) **Loo** :Hot, dry and oppressing winds blowing in the Northern plains from Punjab to Bihar with higher intensity between Delhi and Patna.

#### Traditional Indian Seasons

Divided into 6 two monthly seasons

Seasons	Months (According to the Indian Calendar)	Months (According to the Indian Calendar)
Vasanta	Chaitra-Vaisakha	March-April
Grishma	Jyaistha-Asadha	May-June
Varsha	Sravana-Bhadra	July-August
Sharada	Asvina-Kartika	September-October
Hemanta	Margashirsa-Pausa	November-December
Shishira	Magha-Phalguna	January-February

#### Factors determining climate of India

- Location/Latitude:

- Tropic of cancer running through the middle of country from Rann of Kachha in west to Mizoram in east
- Southern part in tropical zone hence high temperature with low temperature variation
- Northern part subtropical and temperate zone with extreme climate with high temperature variations.

Himalayan Mountains in North

- acts a climate divide
- Provides shield to the cold northern winds originating from arctic
- Traps monsoon causing rainfall in northern regions

Distribution of Land and Water: Indian ocean on three sides

- differential heating of land and sea creates different air pressure zones in different seasons in and around the Indian subcontinent.
- Cause reversal of monsoon

**Altitude:** temperature decreases with height

- Agra and Darjiling are located on the same latitude, but temperature of January in Agra is 16°C while only 4°C in Darjiling.

#### 5. Distance from sea

- Coast line has equable climate
- Moderating influence on climate

#### 6. Relief

- Affects the temperature, air pressure, direction and speed of wind and the amount and distribution of rainfall
- More rainfall in windward side while leeward side remain dry

#### 7. Pressure and winds- Affected by following atmospheric condition

- Pressure and surface winds;
- Upper air circulation; and
- Western cyclonic disturbances and tropical cyclones.

[Click for more](#)

### Monsoons and the Economic Life in India

1. Monsoon is that axis around which revolves the entire agricultural cycle of India. It is because about 64 per cent people of India depend on agriculture for their livelihood and agriculture itself is based on southwest monsoon.
2. Except Himalayas all the parts of the country have temperature above the threshold level to grow the crops or plants throughout the year
3. Regional variations in monsoon climate help in growing various types of crops.
4. Variability of rainfall brings droughts or floods every year in some parts of the country.
5. Agricultural prosperity of India depends very much on timely and adequately distributed rainfall. If it fails, agriculture is adversely affected particularly in those regions where means of irrigation are not developed.
6. Sudden monsoon burst creates problem of soil erosion over large areas in India.
7. [Winter rainfall by temperate cyclones in north India is highly beneficial for rabi crops.](#)
8. [Regional climatic variation in India is reflected in the vast variety of food, clothes and house types.](#)

**Natural Vegetation:** A plant community that has been [left undisturbed](#) over a long time, so as to allow its individual species to adjust themselves to climate and soil conditions as fully as possible.

Grasses, shrubs and trees which grow without human interference.

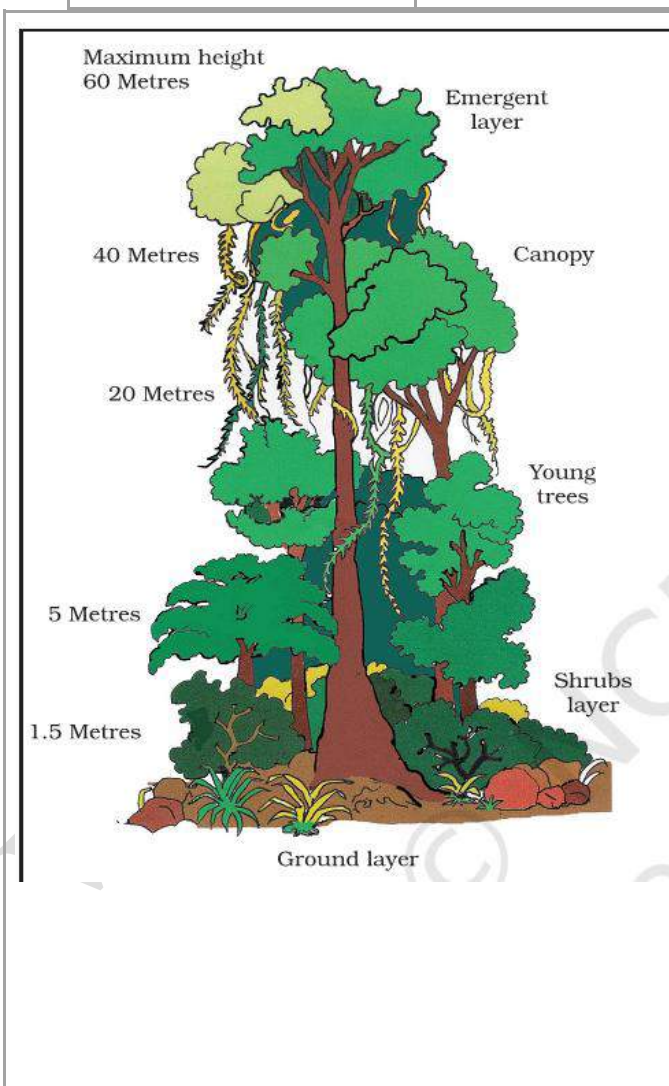
Himalayan heights	temperate vegetation
Western Ghats Andaman Nicobar Islands	Tropical rain forests
Deltaic regions	Tropical forests and mangroves
desert and semi desert areas of Rajasthan	Bushes and thorny vegetation

**5 types of Natura vegetation in India**

<p><b>Tropical evergreen/tropical rainforest/Semievergreen</b></p>	<ul style="list-style-type: none"> <li>In tropical region, heavy rainfall (200 cm), mean annual temperature of 22°C, short dry season, warm and wet climate</li> <li>Stratified Layers of dense forest, tall trees reaching upto 60 m, sunlight does not reach ground, multilayered structure, many species found</li> <li>Different plants shed leaves at different point hence evergreen</li> <li>Trees: Mahogany, ebony, rosewood, rubber, cinchona, aini</li> <li>Found in Andaman Nicobar , NE state, western slope of W.Ghats, upper part of Assam and TN Coast</li> <li>Animals: Monkey, Lemur, deer, elephants, one horned rhino (Assam, WB)</li> <li><b>Semi evergreen forests:</b> In <a href="#">less rainy parts of these regions</a>. Mixture of evergreen and moist deciduous trees. The undergrowing climbers provide an evergreen character to these forests. Main species are white <a href="#">cedar, hollock and kail</a>.</li> </ul>
<p><b>Tropical deciduous/ Monsoon Forest</b></p>	<ul style="list-style-type: none"> <li><a href="#">Most widespread and found in large part of India</a></li> <li>Rainfall 200-70 cm</li> <li>Less dense, shed their leaves at particular time in dry summer</li> <li>Sal, teak , peepal, neem , shisham</li> <li>MP, UP, Bihar, Jharkhand, Odisha, Maharashtra</li> <li>Lion, tiger, pig, deer, elephant</li> <li><b>Moist Deciduous:</b> <ul style="list-style-type: none"> <li>200-100 cm rainfall</li> <li>Eastern part of country, NE States along foothills of Himalaya, Jharkhand, West Odisha, Chhattisgarh, and eastern slope of W.Ghats</li> <li>Teak, Bamboo, Sal, Shiham, <b>Sandalwood</b>, khair, Kusum, Arjun, Mulberry, Hurra, Mahua, amla, Kusum</li> </ul> </li> <li><b>Dry Deciduous:</b> covers <a href="#">vast area of country</a> <ul style="list-style-type: none"> <li>100-70 cm rainfall</li> <li>At wetter margins, it has a transition to the moist deciduous, while on the</li> <li>drier margins to thorn forests</li> <li>Found in rainier part of peninsula plateau, plains of Bihar and UP</li> <li>In the higher rainfall regions of the Peninsular plateau and the northern Indian plain, these forests have a parkland</li> </ul> </li> </ul>

	<p>landscape with open stretches in which teak and other trees interspersed with patches of grass are common.</p> <ul style="list-style-type: none"> <li>Teal, Sal, <a href="#">Peepal</a>, <a href="#">Neem</a>, <a href="#">Tendu</a>, <a href="#">palas</a>, <a href="#">amaltas</a>, <a href="#">bel</a>, <a href="#">khair</a>, <a href="#">axlewood</a></li> </ul>
<b>Tropical Thorny forest and scrubs</b>	<ul style="list-style-type: none"> <li>In dry areas, less than 50-70 cm rainfall, arid and semi-arid regions</li> <li>NW part of India, Rajasthan, Punjab, Haryana, Gujarat, eastern slope of W Ghats, MP, <a href="#">Chhattisgarh</a>, UP</li> <li>Plants remain <a href="#">leafless for most part of the year</a>.</li> <li>Leaves in form of <a href="#">spines</a> to reduce water loss</li> <li>Cactus, khair, <b>babool</b>, keekar, Acacia, Palm, euphorbias, ber, wild date palm, <b>Khejri</b>, palas; Tussocky grass grows upto a height of 2 m as the under growth.</li> <li>Mice, Rabbit, fox, wolf, tiger, etc.</li> </ul>
<p><b>Montane Forest</b></p> <p><b>North</b> Tundra Alpines and pastures Temperate grassland Temperate forest Temperate wet-forest Deciduous</p> <p><b>South</b> Temperate (Sholas) Subtropical</p>	<ul style="list-style-type: none"> <li>In mountainous regions, higher altitude, At height 1500-2500 m, Low temperature</li> <li><a href="#">Succession of natural vegetation belt as we see from tropics to tundra</a></li> <li><b>Northern Mountain Forest</b></li> <li><a href="#">Deciduous</a> forest in foothills of Himalaya</li> <li><b>1000-2000 m: <u>Wet-temperate forest</u></b>, <a href="#">evergreen broad leaf tree like oak, chestnut</a>,</li> <li>hilly areas of West Bengal and Uttaranchal</li> <li><b>1500- 3000 m : <u>temperate forest</u></b>, coniferous tree like Chir pine, deodar, fir, spruce, cedar,</li> <li><b>Deodar</b>, a highly valued endemic species grows mainly in the <a href="#">western part of the Himalayan range</a>, is <a href="#">durable wood mainly used in construction</a>.</li> <li><b>Chinar and walnut, used in Kashmir</b> handicrafts, belong to this zone.</li> <li>Blue pine and spruce appear at altitudes of 2,225-3,048 m</li> <li><a href="#">Temperate grassland</a> at <a href="#">higher</a> altitude</li> <li><b>3600 m : <u>Alpines and pastures</u></b> silver fir, juniper, pines, birches, rhododendrons</li> <li>pastures are used extensively for transhumance by tribes like the Gujjars, the Bakarwals, the Bhotiyas and the Gaddis.</li> <li><b>Higher altitude:</b> Tundra vegetation, Mosses, Lichens</li> <li>Conical shaped trees, Trees: Chir , pine, deodar</li> <li>Kashmir stag, spotted deer, wild sheep, jackal, rabbit, yak, snow leopard, squirrels</li> <li><b>Southern Mountain Forest</b></li> <li>Three distinct areas of Peninsular India viz; the Western Ghats, the Vindhya and the Nilgiris</li> <li>They are <a href="#">closer to the tropics</a>, and <a href="#">only 1,500 m above the sea level</a>, vegetation is <a href="#">temperate in the higher regions</a>, and <a href="#">subtropical on the lower regions</a> of the Western Ghats, especially in Kerala, Tamil Nadu and Karnataka.</li> </ul>

	<ul style="list-style-type: none"> <li>The temperate forests are called <b>Sholas</b> in the Nilgiris, Anaimalai and Palani hills. Some of the other trees of this forest of economic significance include, <u>magnolia, laurel, cinchona and wattle</u>. Such forests are also found in the <u>Satpura and the Maikal ranges</u></li> </ul>
<b>Mangroves/Littoral and Swamp forests Forest</b>	<ul style="list-style-type: none"> <li>Can survive in <b>saline</b> water</li> <li><b>Wetland habitats:</b> About 70 per cent of this comprises areas under paddy cultivation</li> <li>Two sites — <u>Chilika Lake (Orissa) and Keoladeo National Park (Bharatpur)</u> are protected as <b>water-fowl</b> habitats under the <u>Convention of Wetlands of International Importance (Ramsar Convention)</u>.</li> <li><b>Mangroves:</b> 7 per cent of the world's mangrove forest in India</li> <li>Sunderbans (WB) and Andaman Nicobar Islands, Mahanadi, the Godavari and the Krishna deltas</li> <li>Sundari trees</li> <li>Royal Bengal Tiger, turtles, crocodiles, gharial,</li> </ul>



**Tropical Rainforest- Layers**

<b>Emergent</b>	Max height, from 40-60 m The tallest trees are the emergent, 200 feet, trunks 16 feet , broad-leaved, hardwood evergreens. Sunlight is plentiful Eagles, monkeys, bats and butterflies.
<b>Canopy</b>	20-40 m, primary layer of the forest and forms a <b>roof</b> over the two remaining layers. Have smooth, oval leaves that come to a point. It's a maze of leaves and branches. Food is abundant. Snakes, toucans and tree frogs.
<b>Young trees</b>	5-20 m, little sunshine, grows larger leaves Jaguars, red-eyed tree frogs and leopards, concentration of insects
<b>Shrubs</b>	1.5- 5 m
<b>Ground Layer</b>	0-1.5m

Pine (chirs) is needed to lay railway lines  
 Forest Cover in India - [Click Here](#)

### Functions of Forest

- Release oxygen and absorbs carbon dioxide
- Provide timber, wood, fruits, minor forest produce, fuel, medicines, lac, honey, gum, etc.
- Prevents soil erosion
- Natural habitat for wild life

**Van Mahotsav:** A program to save forests

### Medicinal Plants in India

Sarpgandha	Used to treat blood pressure; it is found only in India.
Jamun	The juice from ripe fruit is used to prepare vinegar which is carminative and diuretic, and has digestive properties. The powder of the seed is used for controlling diabetes.
Arjun	The fresh juice of leaves is a cure for <a href="#">earache</a> . It is also used to regulate blood pressure.
Babool	Leaves are used as a cure for <a href="#">eye sores</a> . Its gum is used as a <a href="#">tonic</a> .
Neem	Has high <a href="#">antibiotic</a> and <a href="#">antibacterial</a> properties.
Tulsi	Is used to cure cough and cold
Kachnar	Is used to cure <a href="#">asthma and ulcers</a> . The buds and roots are good for <a href="#">digestive</a> problems.
The Himalayan Yew ( <i>Taxus wallachiana</i> )	Parts of Himachal Pradesh and Arunachal Pradesh. A chemical compound called 'taxol' is extracted from the bark, needles, twigs and roots of this tree Used to treat some cancers – the drug is now the <a href="#">biggest selling anti-cancer drug in the world</a> . The species is under great threat due to over-exploitation.

**National Animal:** Tiger

**National Bird:** Peacock

Asiatic Lions	Gir Forest, Gujarat ( <a href="#">last remaining habitat of Asiatic lion</a> )
One horned Rhino	Assam, WB
Elephant	Assam, Kerala, Karnataka,
Camels	Great Indian Desert
Wild Ass	Rann of Kutchchh
Wild goats, Snow leopards, bears	Himalayas

India is only country in the world that has both [lion and tiger](#)

**Migratory Birds:** [Pelican](#), [Siberian Crane](#), [Stork](#), [Flamingo](#), [Pintail Duck](#) and [Curlew](#), migrate in winters to India

[Siberian crane](#) that comes from Siberia to places like [Bharatpur in Rajasthan](#) and [Sultanpur in Haryana](#),

Wildlife protection Act- 1972

### Types of Plants

<b>Herbs</b>	Green, tender stem; short; may not have many branches
<b>Shrubs</b>	Stem hard but not thick, branches starting at base
<b>Trees</b>	Tall; hard, thick, brown stem; branches in upper part
<b>Creepers</b>	Cannot stand uprights and spread in the ground
<b>Climbers</b>	Take support of neighboring structure to climb up

- **Stem** Conducts water and minerals to the leaves

### Leaf:

#### Parts of leaf-

- Petiole: Part attached to stem
- Lamina: broader part of leaf
- Midrib: thick vein in the middle
- Veins: thin lines on the leaves; **design made out of veins is called venation**
  - Reticulate: Both sides of midrib
  - Parallel: vein are parallel

*Functions of leaf:* Photosynthesis, transpiration

**Transpiration:** Process by which water comes out of leaves in the form of water vapor

Also includes a process called **guttation**, which is the loss of **water in liquid** form from the uninjured leaf or stem of the plant, principally through **water stomata**.

**About 10 percent of the moisture found in the atmosphere is released by plants through transpiration.**

**Photosynthesis:** Preparation of food by plants in presence of sunlight, water and carbon dioxide, release oxygen

**Starch:** Food stored in plants

### Roots

#### Types of roots

- Tap root: Main root
- Lateral root: smaller roots
- Fibrous root: Does not have main root and all roots similar

**Function of Root:** Absorbs water and mineral from the soil, anchor plants firmly in ground

Types of leaf venation	Types of Roots
Parallel	Fibrous
Reticulate	Tap

Carrot, radish, sweet potato, turnip and tapioca are roots

### Flowers- Parts

- **Petals:** Part of open flower
- **Sepals:** Middle part of flower
- **Stamens: Long filament like middle part**
  - Anther- the bead like top part of stamen



- Filament: long rod like structure
- **Pistils:** Innermost part of flower
  - Ovary :lowermost and swollen part of the pistil.
    - Ovules: Bead like structure in ovary
  - Style: Between ovary and stigma
  - Stigma: Top part

**Pollination:****Habitat and Adaptation**

Habitat	Features
Terrestrial	Lives in land, grassland, desert forest
Aquatic	Lives in water, Ponds, swamps, rivers, oceans.

**Adaptation:** Presence of specific features or certain habits, which enable a plant or an animal to live in its surroundings, happens over thousand years. Any attribute of the organism (morphological, physiological, behavioural) that enables the organism to survive and reproduce in its habitat.

**Acclimatization:** Small changes that take place in the body of a single organism over short periods, to overcome small problems due to changes in the surrounding

**Habitat:** Surroundings in which organisms live

<b>Saline</b>	Found in sea, salty water; organisms use air dissolved in water
<b>Terrestrial Desert</b>	<p>Very hot in day, cold at night            Little water available            Desert plants lose very little water through transpiration.</p> <p><b>Leaves:</b>            Either absent, very small, or they are present in the shape of spines (helps in reducing loss of water).</p> <ul style="list-style-type: none"> <li>● Special photosynthetic pathway (CAM) that enables their stomata to remain closed during day time</li> </ul> <p><b>Stem:</b></p> <ul style="list-style-type: none"> <li>● The leaf-like structure in cactus is infact stem</li> <li>● Stomata arranged in deep pits</li> <li>● Succulent stem to conserve water</li> <li>● Photosynthesis carried out by stem</li> <li>● Thick waxy layer which help retain water</li> <li>● Opuntia, have no leaves – they are reduced to spines–and the photosynthetic function is taken over by the flattened stems.</li> </ul> <p><b>Roots:</b> Go deep into the soil to absorb water</p> <p><b>Camel:</b> Long legs to keep their body away from heat of sand</p> <ul style="list-style-type: none"> <li>● Hump of camel stores water</li> <li>● Foot: flat to move easily in sand</li> <li>● Excrete small amount of urine, dung is dry, do not sweat, so loose very little water from body and hence can survive without water for long</li> </ul>
<b>Terrestrial Mountain</b>	<p><b>Animals</b>            Thick Skin or fur to protect from cold            Long hair to keep warm</p>

	Strong hooves
<b>Tropical Rainforest</b>	<p><b>Red-eyed frog</b> has sticky pads on its feet to help it climb trees</p> <p><b>Monkeys</b> have long tails for grasping branches.</p> <p><b>Bird Toucan</b> possesses a long, large beak to reach the fruits on branches which are otherwise too weak to support its weight</p> <p><b>Lion-tailed macaque</b> (also called Beard ape) lives in the rainforests of Western Ghats, Has silver-white mane, which surrounds the head from the cheeks down to its chin, good climber</p> <p><b>Elephant:</b> Long trunk, strong sense of smell, Tusks are modified teeth, Large ears of the elephant help it to hear even very soft sounds. They also help the elephant to keep cool</p>
<b>Grassland</b>	<p><b>Lions:</b> Light brown color helps it hide in dry grassland when it preys Eyes in front help it locate the prey</p> <p><b>Deer</b> Eyes on side to look around for predator Strong teeth to chew hard plants Long hear to hear movements Speed to help run away from danger</p>
<b>Aquatic Animals</b>	<p><b>Fish:</b> Slippery and <i>streamlined</i> body help protect it and easy movement in water <i>Flat fins and tails</i> help them to change directions and keep their body balance in water. <i>Gills</i> present in the fish help them to use oxygen dissolved in water Whales and dolphins have nostrils or blowholes to breathe located in upper part of head</p> <p><b>Plants</b> Have shallow roots, main function to hold plants</p> <p><b>Amphibian:</b> Frog</p>
<b>Polar Regions</b>	<p><b>Polar Bear</b></p> <ul style="list-style-type: none"> <li>• Carnivorous bear whose <b>native range lies largely within the Arctic Circle</b>, encompassing the Arctic Ocean, its surrounding seas and surrounding land masses.</li> <li>• Their scientific name means "<b>maritime bear</b>".</li> <li>• Polar bears hunt their preferred food of seals from the edge of sea ice, often living off fat reserves when no sea ice is present.</li> <li>• The polar bear is classified as a <b>vulnerable species, with eight of the nineteen polar bear subpopulations in decline</b>.</li> <li>• The World Conservation Union (IUCN) estimates that there are between 20,000-25,000 polar bears in the world.</li> <li>• <b>White fur</b> so that they are not easily visible in the snowy white background. It protects them from their predators. It also helps them in catching their prey.</li> <li>• To protect them from extreme cold, they have <b>two thick layers of fur</b>. They also have a layer of <b>fat</b> under their skin. In fact, they are so well-insulated that they have to <b>move slowly and rest often to avoid getting overheated</b>.</li> </ul>

- Good swimmer, large and wide paws help walking and swimming, long curved and sharp claws
- Can remain under water for long, has strong sense of smell which helps locate and catch prey
- Polar Bear is not found in Antarctica
- GHGs causing Climate warming reducing polar bears' summer sea ice habitat.
- Polar bears use sea ice for feeding, mating and giving birth. When the ice retreats in the summer, polar bears are forced to the land. The land-based food would not help bears adapt to the loss of sea ice.

#### Penguin

- White and merges well with the white background
- has a thick skin and a lot of fat to protect it from cold.
- Huddle to keep warm
- Are good swimmers, streamlines body and webbed feet

Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. (This is called the **Allen's Rule.**) In the polar seas aquatic mammals like seals have a thick layer of fat (blubber) below their skin that acts as an insulator and reduces loss of body heat

- Kangaroo rat in North American deserts is capable of meeting all its water requirements through its internal fat oxidation (in which water is a byproduct). It also has the ability to concentrate its urine so that minimal volume of water is used to remove excretory products.
- Altitude sickness: Nausea, fatigue and heart palpitations at higher altitudes. There is low atmospheric pressure at high altitudes, the body does not get enough oxygen and hence RBC production increases to adapt and rate of respiration increases.

**Table 5.1 : Temperature Characteristics of the Vegetation Zones**

Vegetation Zones	Mean annual Average Temp. (in degree C)	Mean Temp. in January (in degrees C)	Remarks
Tropical	Above 24°C	Above 18°	No Frost
Sub-tropical	17°C to 24°C	10°C to 18°C	Frost is rare
Temperate	7°C to 17°C	-1°C to (-10) °C	Frost some snow
Alpine	Below 7°C	Below-1°C	Snow

Source : Environment Atlas of India, June 2001. Central Pollution Control Board Delhi

**Composting:** Rotting and conversion of material into manure

**Vermicomposting:** Redworm used for composting

Earthworm is called farmer's friend.

**Landfill** is an area where the garbage collected from a city or town is dumped.

**Humus:** thick brown or black substance that remains after most of the organic litter has decomposed, contains Nitrogen. Air and water move easily through the loose soil, and oxygen can reach the roots of plants. Can be prepared through composting

#### Class 7th: Geography- Earth Our Environment

- |             |   |
|-------------|---|
| Lithosphere | • Solid crust, or hard top layer of earth, outer uppermost, coolest, most rigid |
|-------------|---|

	<ul style="list-style-type: none"> <li>Made of rocks, minerals, layer of soil</li> <li>Various landforms such as plains, mountain, valleys, plateau</li> <li>Oceanic crust and continental crust</li> <li>15 major tectonic plates</li> </ul>
Atmosphere	Thin layer of air surrounding earth
Hydrosphere	Water
Biosphere	Land, water and air interacts where plants and animal kingdom live

## Lithosphere

- Continent:** Landmass ,
  - Highest peak- Mt everest, Nepal
  - Lowest trench: Mariana trench, Pacific
  - 7 continents: Asia, Europe, Africa, North America, South America, Australia and Antarctica

### Asia- largest continent,

- one third of total land area
- The Tropic of Cancer passes through this continent.
- Separated from Europe by the [Ural mountains](#) on the west

### Africa- 2nd largest continent

- Tropic of Cancer, Capricorn and Equator pass through it
- Equator runs almost in the middle
- Largest hot desert- Sahara
- Longest river- Nile

### North America- 3rd largest

- Linked to south America by narrow channel of land called Isthmus of Panama

### 4. Europe:

- Arctic Circle passes through it.
- Bound by water bodies on three side

### 5. South America:

- [Andes](#)- world's longest mountain range
- World's [largest river \(by volume of water\)](#)- Amazon

### 6. Antarctica- southern hemisphere

- South pole lies at its center
- Research stations- Maitri and Dakhsin Gangotri of India

### 7. Australia: Smallest continent

- Island continent

- Isthmus- A narrow strip of land joining two landmasses
- Strait- A narrow strip of water joining two large waterbodies

## Hydrosphere

- Ocean** - Water bodies, all oceans connected to one another
- 0.03% Fresh water
- 4 major oceans: Pacific, Atlantic, Indian, Arctic
- Pacific**
  - Largest ocean- one third of earth

- Deepest Mariana trench
- Circular in shape
- Atlantic : 2nd largest, S shaped
- Highly indented coastline provide ideal location for natural harbour and ports
- Busiest ocean

### 3. Indian

- Named after country India
- Triangular in shape

### 4. Arctic

- Connected with pacific ocean through Berring strait

Ocean Movement- Waves, Tides, Ocean currents

[Atmosphere](#)

## ECOLOGY

Father of Ecology in India- Ramdeo Misra

Due to his efforts, the Government of India established the [National Committee for Environmental Planning and Coordination](#) (1972) which, in later years, paved the way for the establishment of the [Ministry of Environment and Forests](#) (1984).

## Organism and its Environment

**Ecology** is derived from the Greek word 'oikos' meaning 'house',

Ecology is the study of the earth as a 'household', of plants, human beings, animals and micro-organisms.

A German zoologist [Ernst Haeckel](#), who used the term as 'oekologie' in 1869, became the first person to use the term 'ecology'.

**Ecology** is a subject which studies the [interactions among organisms and between the organism and its physical \(abiotic\) environment](#).

Ecology is basically concerned with [four levels of biological organisation – organisms, populations, communities and biomes](#).

A **habitat** in the ecological sense is the totality of the physical and chemical factors that constitute the general environment.

## Ecosystem

A system consisting of biotic and abiotic components is known as **ecosystem**

## Types of Ecosystem

- A **biome** is a plant and animal community that covers a [large geographical area](#). A biome can be defined as the total assemblage of plant and animal species interacting within specific conditions. These include rainfall, temperature, humidity and soil conditions. Some of the major biomes of the world are: forest, grassland, desert and tundra biomes

## Components Structure and Functions of Environment/Habitat :

<b>Biotic</b>	Living things in habitat, ex: producers, consumers, decomposers
<b>Abiotic</b>	Non-living things such as air, water, soil, sunlight, heat etc.

*Note: Earthworm breathe through skin*

Natural Ecosystem: Ponds, Lakes

Man-made: Garden, crop-fields

### Types of Biome

There are five major biomes — forest, desert, grassland aquatic and altitudinal biomes

[www.iasbaba.com](http://www.iasbaba.com)

Table 15.1 : World Biomes

Biomes	Subtypes	Regions	Climatic Characteristics	Soil	Flora and Fauna
Forest	A. Tropical 1. Equitorial 2. Deciduous B. Temperate C. Boreal	A1. 10° N-S A2. 10° - 25° N-S B. Eastern North America, N.E. Asia, Western and Central Europe C. Broad belt of Eurasia and North America, parts of Siberia, Alaska, Canada and Scandinavia	A1. Temp. 20-25°C, evenly distributed A2. Temp. 25-30°C, Rainfall, ave. ann. 1,000mm, seasonal B. Temp. 20-30° C, Rainfall evenly distributed 750-1,500mm, Well-defined seasons and distinct winter. C. Short moist moderately warm summers and long cold dry winter; very low temperatures. Precipitation mostly snowfall 400 - 1,000mm	A1. Acidic, poor in nutrients A2. Rich in nutrients B. Fertile, en-riched with decaying litter C. Acidic and poor in nutrients, thin soil cover	A1. Multi-layered canopy tall and large trees A2. Less dense, trees of medium height; many varieties co-exist. Insects, bats, birds and mammals are common species in both B. Moderately dense broad leaved trees. With less diversity of plant species. Oak, Beach, Maple etc. are some common species. Squirrels, rabbits, skunks, birds, black bears, mountain lions etc. C. Evergreen conifers like pine, fur and spruce etc. Wood peckers, hawks, bears, wolves, deer, hares and bats are common animals
Desert	A. Hot and Dry desert B. Semi arid desert C. Coastal desert D. Cold desert	A. S a h a r a , K a l a h a r i , Marusthali, Rub-el-Khali B. Marginal areas of hot deserts C. Atacama D. Tundra climatic regions	A. Temp. 20 - 45°C. B. 21 - 38°C. C. 15 - 35°C. D. 2 - 25°C A-D Rainfall is less than 50 mm	Rich in nutrients with little or no organic matter	A-C. Scanty vegetation; few large mammals, insects, reptiles and birds D. Rabbits, rats, antelopes and ground squirrels
Grassland	A. Tropical Savannah B. Temperate Steppe	A. Large areas of Africa, Australia, South America and India B. Parts of Eurasia and North America	A. Warm hot climates, Rainfall 500-1,250 mm B. Hot summers and cold winter. Rainfall 500 - 900 mm	A. Porous with thin layer of humus. B. Thin flocculated soil, rich in bases	A. Grasses; trees and large shrubs absent; giraffes, zebras, buffalos, leopards, hyenas, elephants, mice, moles, snakes and worms etc., are common animals B. Grasses; occasional trees such as cottonwoods, oaks and willows; gazelles, zebras, rhin-

					oceros, wild horses, lions, varieties of birds, worms, snakes etc., are common animals
Aquatic	A. Freshwater B. Marine	A. Lakes, streams, rivers and wetlands B. Oceans, coral reefs, lagoons and estuaries	A-B Temperatures vary widely with cooler air temperatures and high humidity	A. Water, swamps and marshes B. Water, tidal swamps and marshes	Algal and other aquatic and marine plant communities with varieties of water dwelling animals
Altitudinal	—	Slopes of high mountain ranges like the Himalayas, the Andes and the Rockies	Temperature and precipitation vary depending upon latitudinal zone	Regolith over slopes	Deciduous to tundra vegetation varying according to altitude

### Biogeochemical cycle

**Ecological balance** is a state of dynamic equilibrium within a community of organisms in a habitat or ecosystem. This occurs through competition and cooperation

**Factors influencing life of organisms:** Temperature, Water, Light, Soil

**Eurythermal :** Organisms that can tolerate and thrive in a wide range of temperatures

**Stenothermal:** Vast majority of organisms are restricted to a narrow range of temperatures.

**Mango** trees do **not** and cannot grow in **temperate** countries like Canada and Germany, **snow** leopards are not found in **Kerala** forests and **tuna** fish are **rarely** caught **beyond tropical latitudes**.

### Salinity

- is less than 5 per cent in inland waters
- 30-35 per cent the sea and
- > 100 per cent in some **hypersaline** lagoons.

**Euryhaline:** Organisms tolerant of a wide range of salinities

**Stenohaline:** restricted to a narrow range of salinities

Many freshwater animals cannot live for long in sea water and vice versa because of the osmotic problems, they would face.

### Responses to Abiotic Factors

**Homeostasis:** Process through which organism try to maintain the constancy of its internal environment despite varying external environmental conditions that tend to upset its homeostasis.

**Regulate:** Some organisms are able to maintain homeostasis by physiological (sometimes behavioural also) means which ensures constant body temperature, constant osmotic concentration, etc.

- All **birds and mammals**, and a very few lower vertebrate and invertebrate species are indeed capable of such regulation (thermoregulation and osmoregulation)
- **Plants do not have such mechanisms to maintain internal temperatures.**



**Conform** :Cannot maintain internal body temperature. Temperature and osmotic concentration changes as the ambient temperature and osmotic concentration change . These animals or plants are conformers.

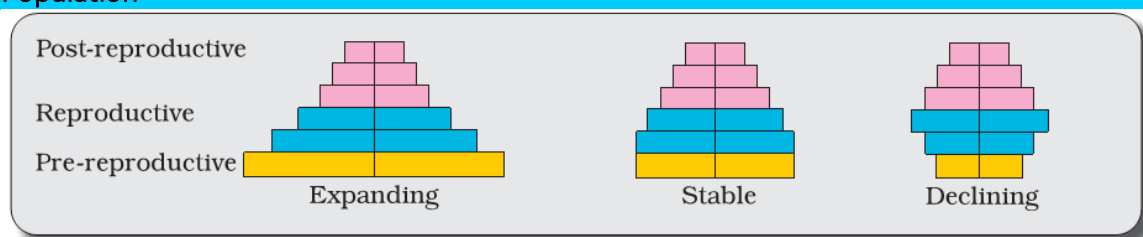
Small animals have a **larger surface area relative to their volume, they tend to lose body heat very fast** when it is cold outside; then they have to expend much energy to generate body heat through metabolism. This is the main reason why very **small animals are rarely found in polar regions.**

**In stressful condition, organisms have two alternatives:**

- **Migrate** : Move away temporarily from stressful location. Every **winter** the famous Keolado National Park (Bhartpur) in Rajasthan host thousands of migratory birds coming from **Siberia** and other extremely cold northern regions.
- **Suspend**: Go into state of **dormancy**
  - a. **Hibernation**: Avoid stress by escaping time. Ex: **Bear** in winter
  - b. **Aestivation**: **Snails and fish** to avoid summer–related problems-heat and desiccation
  - c. **Diapause**: A stage of **suspended development** by **zooplanktons** in lakes and ponds

**Archaeobacteria**: Flourish at very **high temperature** such as in hydrothermal vent where temperature goes upto 100 degree C.

## Population



**Figure 13.4** Representation of age pyramids for human population

## Population Growth

**Four basic processes** affecting population growth. Two of which (natality and immigration) contribute an increase in population density and two (mortality and emigration) to a decrease.

- (i) **Natality** refers to the number of **births** during a given period in the population that are added to the initial density.
- (ii) **Mortality** is the number of **deaths** in the population during a given period.
- (iii) **Immigration** is the number of individuals of the same species that have **come into** the habitat from elsewhere during the time period under consideration.
- (iv) **Emigration** is the number of individuals of the population **who left the habitat** and gone elsewhere during the time period under consideration.

**Table 13.1 : Population Interactions**

Species A	Species B	Name of Interaction
+	+	Mutualism
-	-	Competition
+	-	Predation
+	-	Parasitism
+	0	Commensalism
-	0	Amensalism

Predation, parasitism and commensalisms share a common characteristic—the interacting species live closely together.

**Phytophagous:** Mostly **insects** feeding on **plant sap and other parts of plants**

**Ectoparasites:** Feed on **external surface of host**. Ex: Lice in human hair, ticks on dogs

**Endoparasite:** Live inside the host body

**Brood parasitism** in **birds** is a fascinating example of parasitism in which the parasitic bird lays its eggs in the nest of its host and lets the host incubate them. Ex: Koel keeping its egg in crow's nest

**Commensalism:** An **orchid** growing as an **epiphyte** on a mango branch, and **barnacles** growing on the back of a whale

**Mutualism:** **Lichens** represent an intimate mutualistic relationship between a *fungus and photosynthesizing algae or cyanobacteria*. Similarly, the **mycorrhizae** are associations between **fungi** and the roots of **higher plants**.

- 5th June: World Environment Day

### Aspects of Environment

#### • Productivity

- **Primary Production:** The amount of biomass or organic production over a unit area during a time period. Expressed in terms of **weight and energy**.
  - The rate of biomass production is called productivity.
  - Primary productivity depends on the plant species inhabiting a particular area, environmental factors, availability of nutrients and photosynthetic capacity of plants. Therefore, it varies in different types of ecosystems.
  - Land has higher productivity than ocean
- **Gross Primary productivity (GPP):** Rate of production of organic matter during productivity. A considerable amount is utilized by plants in respiration.
- **Net Primary Productivity:** GPP-Loss during respiration . It is the **available biomass for consumption** of heterotrophs (herbivore or decomposers)
- **Secondary Productivity:** Rate of formation of new organic matter by consumers

#### Decomposition

- **Decomposition** of complex organic matter into inorganic substances like carbon dioxide, nitrogen, water and other nutrients by decomposers.
- **Detritus:** Dead plant remains such as leaves, bark, flowers and dead remains of animals, including fecal matter, which is the raw material for decomposition.

- Steps in the process of decomposition are [fragmentation, leaching, catabolism, humification and mineralisation](#)
- Detritivores (e.g., earthworm) break down detritus into smaller particles.
- Fragmentation: Breaking down of detritus into small particles
- Leaching: Water soluble inorganic nutrients go down into the soil horizon and get precipitated as [unavailable salts](#).
- Catabolism: [Bacterial and fungal enzymes](#) degrade detritus into simpler inorganic substances.
- These steps occur simultaneously.
- Humification and mineralisation [occur during decomposition](#) in the soil.
  - Humification leads accumulation of [dark matter amorphous substance](#) called Humus that is [highly resistant to microbial action](#) and undergoes decomposition at an [extremely slow rate](#). Being colloidal in nature it serves as a reservoir of nutrients.
- Mineralisation: Humus is further degraded by some microbes and release of inorganic nutrients occur.

#### Factor affecting Decomposition:

Is an oxygen-requiring process.

Chemical composition of detritus and climatic factors.

- **Slow rate**- if detritus is rich in [lignin and chitin](#)
- **Quick** if rich in nitrogen and water-soluble substances like sugars.

Temperature and soil moisture regulate decomposition through their effects on the activities of soil microbes.

- Warm and moist environment favour decomposition
- Low temperature and anaerobiosis inhibit decomposition

#### Energy Flow

- Sun is all source of energy for all ecosystem on earth
- Photosynthetically Active Radiationc (PAR): Less than 50% of incident solar radiation. Plants absorb only 2-10 % of this PAR
- Energy Flow is unidirectional
- Types of Organisms based on food

**Producers/Autotrophs:** Produces food for themselves and for consumers, Ex: Plants, trees, Phytoplanktons

**Consumers/Heterotrophs:** Depend on Producer directly or indirectly for food

Primary Consumers/Herbivores: Feed on producers directly. Ex: Insects, birds, etc.

Secondary consumers: Feed on primary consumers

○ Carnivore

- Primary carnivore: Feed on herbivore
- Secondary carnivore: feed on primary carnivore

Top carnivores: hawks and mongooses

Omnivore- eat both plant and animal

Decomposers/Saprotrophs: **Detritus** food chain starts with dead organic matter. It made of decomposers mainly fungi and bacteria. Ex: vulture, crows

**Food Web:** Natural interconnection of [food chains](#)

**10 percent Law:** Only 10% of the energy is transferred to each trophic level from lower trophic level.

Ecological Pyramids: [click here](#)

Nutrient Cycle: [click here](#)

- Main reservoir of carbon is water then dry weight of organisms.

**Stratification:** Vertical distribution of different species occupying different levels

[Interior of earth](#)

### Rocks and Minerals

<b>Rocks</b>	Natural mass of mineral matter of which earth crust is made. Rocks are combination of <a href="#">homogenous</a> substance minerals
<b>Minerals</b>	Homogenous naturally occurring substance with <a href="#">definite internal structure</a> have <a href="#">certain physical properties and chemical composition</a>

**Types of rocks:**

Igneous: From molten magma, also called primary rocks

- Intrusive: Magma solidifies inside crust, cools down slowly, form large grains, Ex: Granite
- Extrusive: Magma solidifies on the surface, cools down rapidly, fine grained, ex: basalt, Deccan plateau

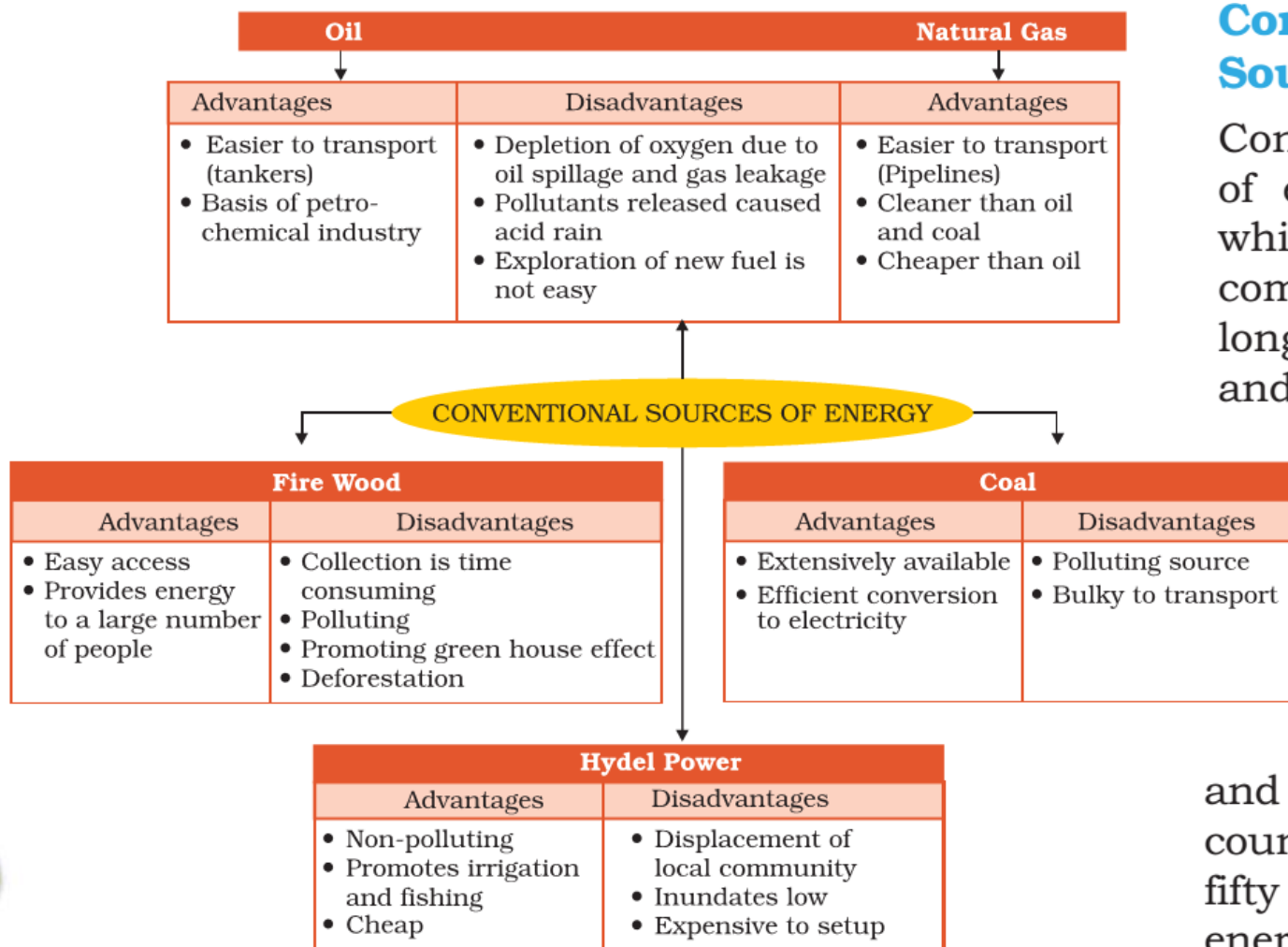
- Sedimentary : Compressed hardened sediments, Ex: sandstone
- Metamorphic: changed from igneous and sedimentary. Clay to slate, limestone to marble

**Rock Cycle:** Transformation of rock from one form to another

**Power resources: ENERGY**

### Conventional Sources of energy

- Which have been in use for long time



**Fig 3.10: Conventional Sources of Energy**

- Coal, petroleum, natural gas - fossil fuels : Are main conventional sources
- Slow process of conversion of dead vegetation into coal is called carbonisation.

**Coal**

Most abundantly found fossil fuel

Coal is also referred as Buried Sunshine.

<b>Lignite</b>	Lowest grade brown in color, soft and high content of moisture content Neyveli, TN
<b>Bituminous</b>	Buried deep and subjected to increased temperature. Commercial and metallurgical use, high grade, used for smelting iron in blast furnace
<b>Anthracite</b>	Best grade hard coal

World coal producers: China, USA, Germany, Russia, South Africa and France.

In India coal occurs in rock series of two main geological ages

- **Gondwana:**
  - Metallurgical coal
  - 200 million years in age

- Damodar valley (West Bengal-Jharkhand), Jharia, Raniganj, Bokaro, Godavari, Mahanadi, Son and Wardha valley

**Tertiary** deposits : About 55 million years old.

- **North eastern** states of Meghalaya, Assam, Arunachal Pradesh and Nagaland.

Coal is a bulky material, loses weight on use as it is reduced to ash. Hence, heavy industries and thermal power

stations are located on or near the coalfields

### Charcoal

When **wood** is burnt in a **limited supply of oxygen**, water and volatile materials present in it get removed and charcoal is left behind as the residue. Charcoal burns **without flames**, is comparatively **smokeless** and

has a **higher heat generation** efficiency.

### Petroleum

Petroleum and its derivatives are called **Black Gold**

Nodal industry for synthetic textile, fertiliser and numerous chemical industries

The chief petroleum producing countries are Iran, Iraq, Saudi Arabia and Qatar

Occur in **Anticlines and fault traps in rock formation of tertiary age**

Mumbai High (63%), Gujarat (18%), Assam (16%)

Ankaleshwar in Gujarat most important field.

Assam - Digboi oldest

Digboi, Naharkatiya and Moran-Hugrijan are important oil fields

### Natural Gas

Clean energy

Found in association **with or without petroleum**

**Reserves:** Jaisalmer, Krishna- Godavari basin, Gulf of Cambay. Andaman and Nicobar islands

Hazira-Vijaipur Jagdishpur cross country gas pipeline links Mumbai High and Bassien with the fertilizer, power and industrial complexes in western and northern India.

Power and fertilizer industries are the key users of natural gas

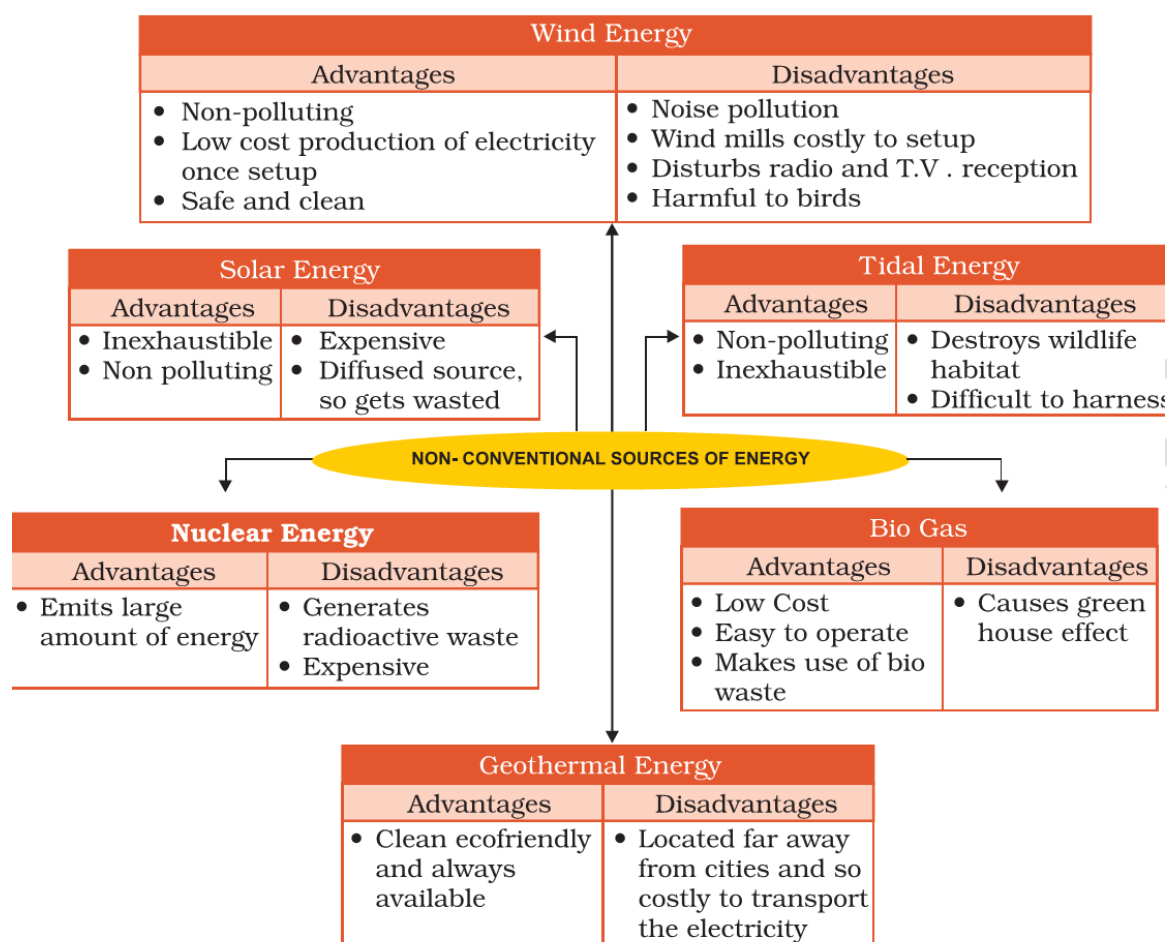
### Hydel Power

**Norway** was the **first** country in the world to develop **hydroelectricity**

The site of the world's first solar and wind powered bus shelter is in Scotland.

1/4th of the world's electricity is produced by hydel power. The leading producers of hydel power in the world are Paraguay, Norway, Brazil, and China

### Non-conventional Sources of Energy



**Fig 3.16: Non-conventional Sources of Energy**

#### Bio-Gas:

Methane (75%), Carbon dioxide, hydrogen and hydrogen sulphide, leaves **no residue**, burns **without smoke**, high heating capacity

**Slurry of Bio-Gas:** Good manure, contains **Nitrogen and Phosphorous**

**Bio-Fuel:** Jojoba, Jatropha, Pongamia, used coffee ground, alligator fat

#### Wind Energy:

**Denmark:** More than 25% energy from windmills, is called **country of winds**.

Harnessing Wind energy for production of electricity: Germany (1st) - > India (5th)

**Largest (in India) wind mill :** Kanyakumari, India

Largest wind farm cluster is located in **Tamil Nadu from Nagarcoil to Madurai**.

Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms.

**Nagarcoil and Jaisalmer** are well known for effective use of **wind energy** in the country.

Windfarms are found in Netherlands, Germany, Denmark, UK, USA and Spain

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Environment friendly, efficient, renewable</li> </ul>	<ul style="list-style-type: none"> <li>• Needs Large space and wind should blow for greater parts of the year</li> </ul>

<ul style="list-style-type: none"> <li>No recurring expense</li> </ul>	<ul style="list-style-type: none"> <li>Need high level of maintenance due to vagaries of weather</li> <li>Wind speed higher than 15 m/s</li> <li>Needs back up facilities</li> <li>Initial cost of establishment very high</li> </ul>
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## Solar Energy

**Photovoltaic Cell:** Convert solar energy to electricity

Solar energy reaching unit area at outer edge of the earth's atmosphere exposed perpendicularly to the rays of the Sun at the average distance between the Sun and earth is known as the **solar constant**. It is estimated to be approximately 1.4 kJ per second per square metre or 1.4 kW/m

- The site of the **world's first solar and wind powered bus shelter** is in **Scotland**

### Solar cells

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>Has no moving parts, requires little maintenance, works satisfactorily without the use of any focusing device</li> <li>Can be set up in remote an inaccessible areas or very sparsely populated area where laying of transmission line may be expensive and not commercially viable.</li> </ul>	<ul style="list-style-type: none"> <li>Special grade <b>silicon</b> limited</li> <li>Process of manufacture is <b>expensive</b></li> <li><b>Silver</b> used in connecting cells is expensive</li> <li>High cost but <b>low efficiency</b></li> </ul>

Silicon used for making solar cells, is abundant in nature but availability of the special grade silicon for making solar cells is limited

Domestic use of solar cells is, however, limited due to its high cost

## Energy from sea:

Tidal, wave, ocean thermal energy.

### Tidal Energy

Energy from ocean tides used in moving turbines using floodgates

The first tidal energy station was built in **France**.

Gulf of Khambhat, the Gulf of Kuchchh in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy

**Russia, France and the Gulf of Kachchh** in India have huge tidal mill farms

### Ocean Thermal energy:

Can only be used if ocean surface temperature **difference** and the at 2km below sea level is at **least 20 degree** Celsius. The warm surface can be used to **boil a volatile liquid ammonia** which vaporizes and used to move to the turbine. The cold water from the depth of the ocean is pumped up and condense vapour again to liquid.

### Geothermal energy:

**Hot spot:** Due to geological changes, **molten rocks** formed in the deeper hot regions of earth's crust are pushed upward and trapped in certain regions called hot spots.

When underground water comes in contact with hotspots, **steam** get generated. Sometime this hot water gets **outlet to the surface and called hot springs**.

The steam trapped in the rock can be routed through pipes to a turbine and used to generate electricity.

**Geo-thermal based power plants** found in **USA(1), New Zealand, Iceland, Philippines**



- **Experimental** projects have been set up in India to harness geothermal energy. One is located in the **Parvati valley near Manikarn in Himachal Pradesh** and the other is located in the **Puga Valley, Ladakh**.

### Nuclear or Atomic energy

Uranium and Thorium available in Jharkhand and the Aravalli ranges of Rajasthan

Monazite sands of Kerala is also rich in Thorium

**USA and Europe leading nuclear power producers.**

Nuclear Fission	Nuclear Fusion
<ul style="list-style-type: none"> <li>• Heavy atoms break into smaller nuclei</li> <li>• Nuclear reactors are based on this Ex: Uranium, Plutonium, thorium</li> </ul>	<ul style="list-style-type: none"> <li>• Two lighter atom fuses together to create heavy atom</li> <li>• Source of energy in the Sun and other stars Hydrogen bomb</li> </ul>

### Nuclear reactors in India

Tarapur-Maharashtra	Kakarapar- Gujarat
Rana Pratap Sagar- Rajasthan	Kalpakkam- TN
Narora- UP	Kaiga- Karnataka
Jaitapur (under cons.)- Maharashtra	Kudankulam-TN (largest)

### Disadvantages of Nuclear Power generation

Storage and disposal of spent fuel which is radioactive and cause several health hazards.

High cost of installation,

high risk of environmental contamination

Limited availability of uranium

**Renewable Source of Energy:** Energy source that can be regenerated

### Earth Movement- Basic forces

15 major tectonic plates in Lithosphere: North American, Caribbean, South American, Scotia, Antarctic, Eurasian, Arabian, African, Indian, Philippine, Australian, Pacific, Juan de Fuca, Cocos, and Nazca.

Tectonic activities causes earthquake, volcanoes etc

Endogenic		Exogenic
Act in interior		Act on surface
Sudden	<b>Diastrophic</b> (slow movement)	Erosional and Depositional
Earthquake Volcano Landslide	Building mountains	River Winds Sea-waves Glaciers

**Earthquake:** Vibration on earth

Tectonic activities and human activity can produce earthquakes.

Focus: Point inside earth where earthquake generates

Epicentre: point on earth surface vertically above focus

Seismograph: Earthquake measurement

**Scale of measurement**

**Ritcher:** Earthquake intensity

**Mercalli:** Based on intensity of destruction

### Types of earthquake

P waves or longitudinal waves

S waves or transverse waves

L waves or surface waves

### Landforms

Landforms are result of two processes

Internal	External
leads to the upliftment and sinking of the earth's surface at several places	Continuous wearing down (erosion) and rebuilding(deposition) of the land surface.

### Mountains:

Fold	Block	Volcanic
<p><b>Young fold</b> mountains with rugged relief and high conical peaks: Himalayan and Alps</p> <p><b>old fold</b> mountain: Aravali range in India, Appalachians in North America and the Ural in Russia</p>	Displaced vertically Rhine valley and the Vosges in Europe	Mt.Kilimanjaro in Africa and Mt.Fujiyama in Japan

Weathering	Breaking of rocks
Erosion	Wearing <b>away</b> of landscape

**Mauna Kea (Hawaii)** in the Pacific Ocean is an **undersea** mountain. It is **higher than Mount Everest** being 10,205 metres high

### Significance of mountains

Storehouse of water, glaciers on mountains are source of rivers

Forest provides food, fodder, raisins, timber, etc.

Orographic rainfall

Spot for tourism

Hydroelectric power from river upper courses

Rich flora and fauna

River valley and terraces ideal for cultivation

### Plateau

Deccan plateau in India is one of the oldest plateaus. The East African Plateau in Kenya, Tanzania and Uganda and the Western plateau of Australia

Tibetan Plateau- oldest, called roof of the world

African plateau- gold and diamond mining

Chhotanagpur plateau- iron, coal, manganese, **Hundru Falls on river Subarnrekha**

**Peninsula:** Surrounded by water on **three** sides

**Waterfalls**

Angel falls	Venezuela, South America
Niagra Falls	Border of Canada US
Victoria Falls	On the border of Zambia-Zimbabwe

**Features of river course:** Meanders, Ox-bow lake, Flood plains, levees, delta

**Features of Sea erosion:** Sea-caves, sea-arches, stacks, cliffs

**Features of Glacier Landforms:** Moraines

**Wind landforms:** Mushroom rock, sandunes, Loess

Large deposits of loess found in China

**Atmosphere**

Envelope of air

99% of total air mass is confined to 32km

oxygen will be almost in negligible quantity at the height of 120 km.

Carbon dioxide and water vapour are found only up to 90 km from the surface of the earth.

Heated from **below** through **radiation** and air **above** heated due to **convection**

**Composition of atmosphere**

**Table 8.1 : Permanent Gases of the Atmosphere**

Constituent	Formula	Percentage by Volume
Nitrogen	N <sub>2</sub>	78.08
Oxygen	O <sub>2</sub>	20.95
Argon	Ar	0.93
Carbon dioxide	CO <sub>2</sub>	0.036
Neon	Ne	0.002
Helium	He	0.0005
Krypto	Kr	0.001
Xenon	Xe	0.00009
Hydrogen	H <sub>2</sub>	0.00005

**Ozone O<sub>3</sub>**

Is a **deadlypoison**

Shields atmosphere from UV rays

From **10-50 km** height

**Water vapour**

Decreases with height and from equator to pole

Cause **greenhouse** effect, contribute to atmosphere **stability**

**Dust Particles**

Concentrated in the lower layers of the atmosphere

**Higher concentration** of dust particles is found in **subtropical and temperate** regions due to **dry winds** in comparison to equatorial and polar regions.

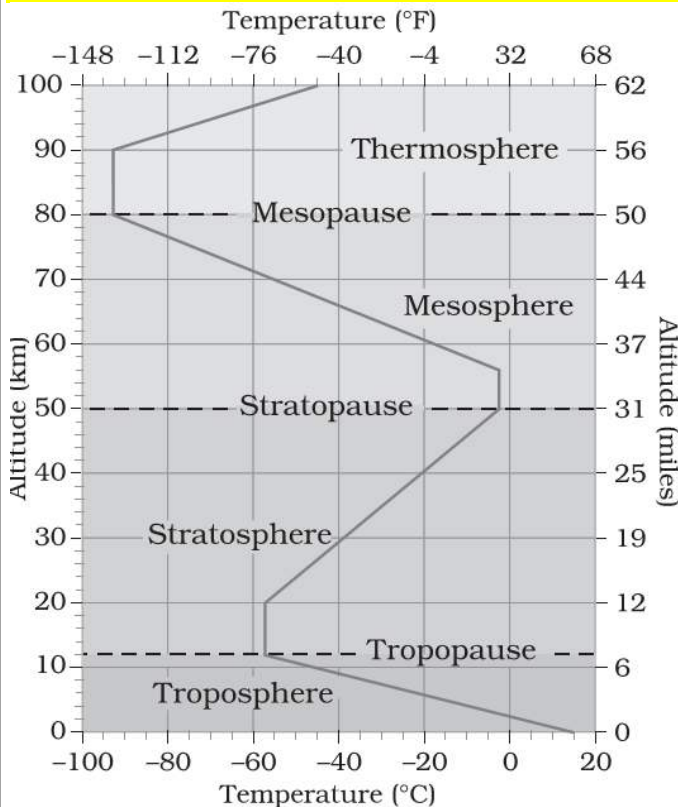
Are **hygroscopic** nuclei around which water vapour condenses to produce clouds

## Structure of atmosphere

Density is highest near the surface of the earth and decreases with increasing altitude

Five different layers depending upon the temperature condition: troposphere, stratosphere, mesosphere, thermosphere/ionosphere and exosphere

### Structure of atmosphere



**Tropopause:** Separates troposphere & stratosphere  
 -80°C over equator and -45°C over poles  
 temperature nearly constant

**Stratopause:** Separates stratosphere & mesosphere

**Mesopause:** Separates mesosphere & Thermosphere

### Troposphere

- **Average height 13 km**, Air we breathe, Weather phenomena, contains dust particles and water vapour.
- 8 km in poles, 18 km in equator
- Thickness greatest at the equator because heat is transported to great heights by strong convectional currents
- The temperature decreases at the rate of 1°C for every 165m of height.
- Most important layer for all biological activity.
- turbulent, dusty zone containing air, much water vapour and cloud

### Stratosphere

- **Upto 50km**, free from cloud and weather phenomenon
- **Airplanes** fly in this layer
- Ozone (is poisonous) layer -> protects from UV rays
- Temperature increases with height
- Contains **dinitrogen, dioxygen, ozone** and little water vapour

### Mesosphere

- 80 km
- **Meteorites** burn in this layer
- Temp decreases with height (-100°C at 80km)

### Thermosphere or Ionosphere

- 80-400kms, Temperature rises very rapidly
- **Ionosphere** lies here, contains electrically charged particles
- **Radio transmission**

### Exosphere

- Uppermost layer, very thin
- Little known about this layer

## SOLAR RADIATION, HEAT BALANCE AND TEMPERATURE

### Solar Radiation

**Insolation:** Incoming solar radiation intercepted by earth

#### Variability of Insolation

Insolation varies during day and season in a year. Factors that cause these variations in insolation are :

- the rotation of earth on its axis;
- Angle of inclination of the sun's rays;
- Length of the day;
- Transparency of the atmosphere;
- Configuration of land in terms of its aspect.

The last two however, have less influence

#### Rotation of earth on its axis

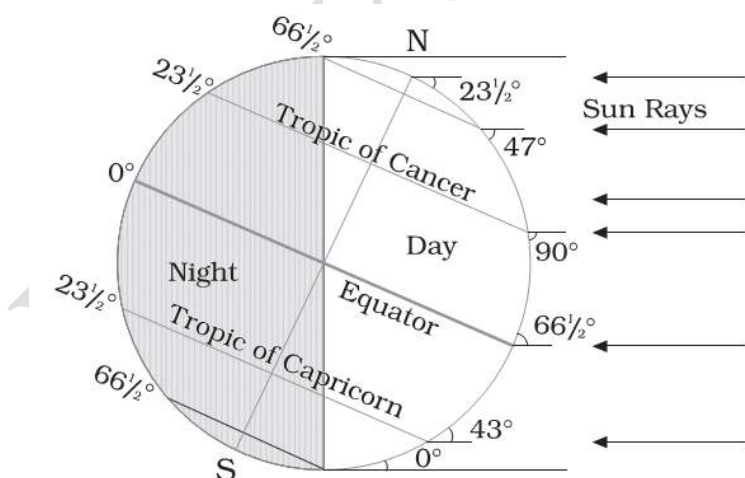
- Earth's axis make  $66\frac{1}{2}^\circ$  with orbital plane
- **Greater** influence
- Aphelion: Earth farthest from sun, **4th July**
- Perihelion: Earth nearest to the sun, **3rd Jan** , more insolation

#### Angle of inclination of the sun's rays;

- Depends on latitude of place
- **Higher latitude, less angle, more slant rays, more covered area, net energy per unit area low**
- Slant rays has to pass through greater depth resulting in more absorption, scattering and diffusion
- So, insolation decreases from equator toward pole

**Table 9.1 : Length of the Day in Hours and Minutes on Winter and Summer Solstices in the Northern Hemisphere**

Latitude	0°	20°	40°	60°	90°
December 22	12h 00m	10h 48m	9h 8m	5h 33m	0
June 21	12 h	13h 12m	14h 52m	18h 27m	6 months



**Figure 9.1 : Summer Solstice**

#### Transparency of the atmosphere

- Atmosphere transparent to short wave solar radiation.

- Color of sky due to scattering of visible part of sun rays by small suspended particles in troposphere
- The red colour of the rising and the setting sun and the blue colour of the sky are the result of scattering of light within the atmosphere.

### Spatial distribution of Insolation

- Varies from about 320 Watt/m<sup>2</sup> in the tropics to about 70 Watt/m<sup>2</sup> in the poles.
- **Maximum insolation** over the **subtropical deserts**, where the **cloudiness is the least**.
- **Equator** receives comparatively **less insolation than the tropics**.
- Generally, at the same latitude the insolation is more over the continent than over the oceans.
- In winter, the middle and higher latitudes receive less radiation than in summer.

### Heating cooling effect of atmosphere

#### Processes of heat distribution

Conduction	<ul style="list-style-type: none"> <li>• When two bodies of unequal temperature are in <b>contact</b></li> <li>• Energy flow from warmer to colder till both attains same temperature</li> <li>• In lower layer of atmosphere in contact with land</li> </ul>
Convection	<ul style="list-style-type: none"> <li>• Warm air rises vertical heating upper atmosphere</li> <li>• <b>Confined to troposphere</b></li> </ul>
Radiation	<ul style="list-style-type: none"> <li>• From sun to earth without any medium</li> </ul>
Advection	<ul style="list-style-type: none"> <li>• Transfer of heat through <b>horizontal</b> air movement</li> <li>• <b>More</b> important than vertical</li> <li>• In middle latitudes, most of diurnal (day and night) variation in daily weather are caused by advection alone. In tropical regions particularly in northern India during summer season <b>local winds called 'loo' is the outcome of advection process</b>.</li> </ul>

### Terrestrial Radiation

Heating of atmosphere by heated earth surface

### Heat Budget

- Reflected amount of radiation is called **albedo**

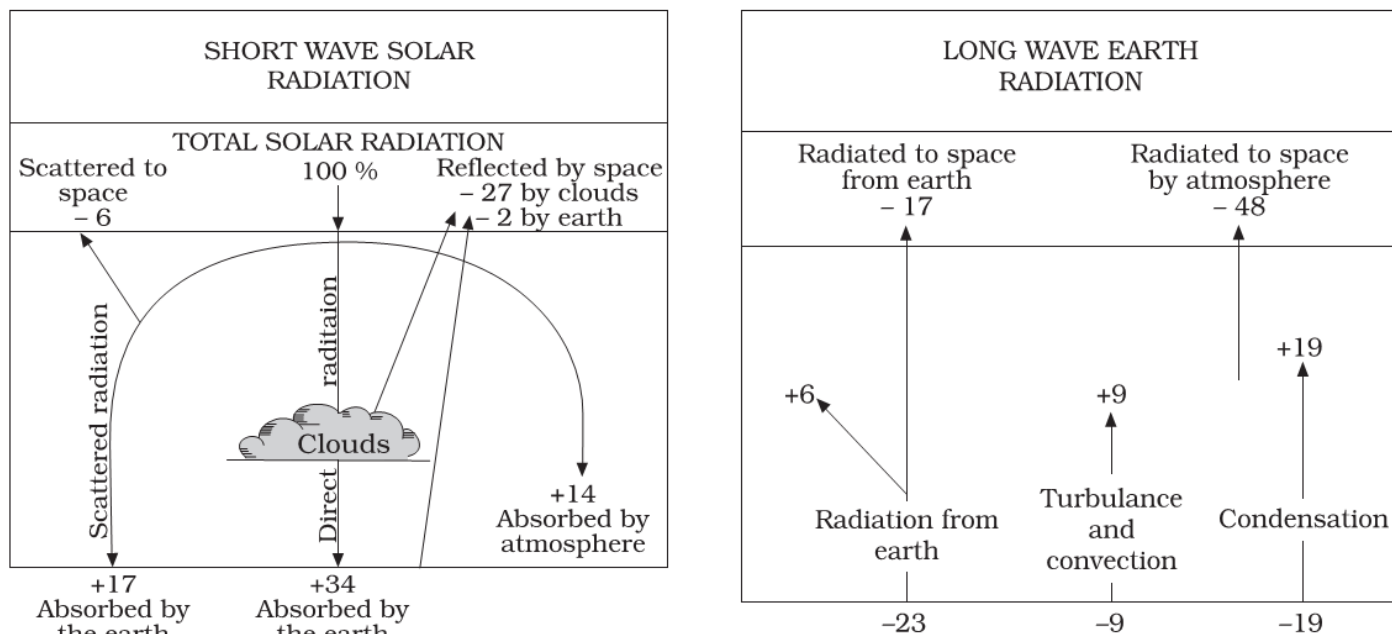


Figure 9.2 : Heat budget of the earth

### Variation in heat budget

- Surplus of net radiation balance between 40 degrees north and south and the regions near the poles have a deficit.
- The surplus heat energy from the tropics is redistributed pole wards and as a result the tropics do not get progressively heated up due to the accumulation of excess heat or the high latitudes get permanently frozen due to excess deficit.

### Temperature:

The degree of hotness and coldness of the air

Instrument	Measures
Thermometer	Temperature
Barometer	Pressure
Raingauge	Rainfall
Wind vane	Wind velocity

### Factors controlling temperature distribution

- The **latitude** of the place: Insolation varies according to latitude and hence temperature
- **Altitude** of the place: Temperature decreases with height. The rate of decrease of temperature with height is termed as the **normal lapse rate**. It is **6.5°C per 1,000 m**.
- Distance from the sea : Sea has moderating effect
- Air mass circulation and presence of warm and cold ocean currents: Places with warm(cold) air mass has high(low)temperature. Places near warm(cold) ocean current are warm (cold)
- Local aspects.

### Distribution of temperature

- **Isotherms** are lines joining places having **equal temperature**

- Generally isotherms are generally parallel to the latitude. The deviation from this general trend is more pronounced in January than in July, especially in N Hemisphere as land surface is much larger here
- In **January** the isotherms **deviate to the north** over the ocean and to the **south over the continent**. This can be seen on the North Atlantic Ocean. The presence of **warm ocean currents, Gulf Stream and North Atlantic drift, make the Northern Atlantic Ocean warmer** and the isotherms bend towards the north. Over the land the temperature decreases sharply and the isotherms bend towards south in Europe
- The **effect of the ocean is well pronounced in the southern hemisphere**. Here the isotherms are more or less parallel to the latitudes and the variation in temperature is more gradual than in the northern hemisphere.
- In **July** the **isotherms generally run parallel to the latitude**. The highest range of temperature is more than 60°C over the north-eastern part of Eurasian continent. This is due to **continentality**.

## Atmospheric Circulation and weather system

**Air pressure:** Pressure exerted by the weight of air on the earth's surface, measured with **mercury or aneroid barometer**.

- Highest at sea level
- High temperature -> Low pressure -> cloudy sky, wet weather
- Low temperature -> High pressure -> clear and sunny sky
- **Air moves from high to low pressure area**

**Vertical variation in Pressure:** Air pressure decreases with height, **1mb for each 10m** increase in elevation. The vertical pressure gradient force is much larger than that of the horizontal pressure gradient. But, it is generally balanced by a nearly equal but opposite gravitational force. Hence, we **do not experience strong upward winds**.

### Horizontal Variation of Pressure

- **Causes Wind:** Movement of air
- Wind is named after direction **from** which it is blown
- **Isobars** are lines connecting places having equal **pressure**
- Low pressure system is enclosed by one or more isobars with the lowest pressure in the centre.
- High-pressure system is also enclosed by one or more isobars with the highest pressure in the centre.

## World distribution of Sea Level Pressure

### Wind pressure belt and system



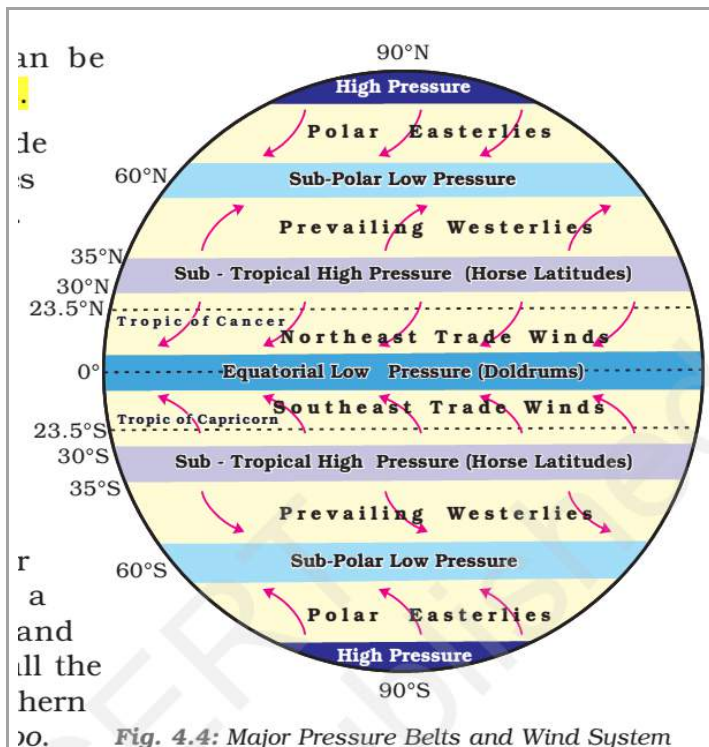


Fig. 4.4: Major Pressure Belts and Wind System

### Winds

<b>Permanent Winds</b>	Blows constantly throughout the year Trade winds Westerlies Easterlies
<b>Seasonal winds</b>	Changes direction with seasons Monsoon
<b>Local winds</b>	Loo, Khamsin, Chinnok, Bora, Land breeze, sea breeze

### Pressure Belts

- **Equatorial low (Doldrums):** Sea level pressure is low near equator.
- **Subtropical highs (Horse latitude):** Along 30° N and 30° S are found the high-pressure areas.
- **Sub polar lows:** Further pole wards along 60° N and 60° S, low-pressure belts.
- **Polar High:** High pressure near poles
  - Pressure belts are not permanent and oscillates with the movement of sun
  - In the northern hemisphere in winter they move southwards and in the summer northwards

### Factors affecting velocity and direction of wind

- **Wind:** Air in Motion.
- Wind blows from high to low pressure
- Wind at surface experience friction

### Factors

- **Pressure gradient force**
  - The rate of change of pressure with respect to distance is the **pressure gradient**
  - Closer isobars high pressure gradient, weak where isobars are apart
- **Frictional force**
  - Affects the speed of the wind.
  - It is greatest at the surface
  - Its influence generally extends upto an elevation of 1 - 3 km.
  - Over the sea surface the friction is minimal.
- **Coriolis force**
  - The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force
  - It deflects wind to

- Right in the northern hemisphere
- Left in the southern hemisphere.
- Higher wind velocity more deflection
- **Directly proportional to the angle of latitude, so maximum at poles and absent at equator.**
- Acts perpendicular to the **pressure gradient force**.
- The pressure gradient force is perpendicular to an **isobar**. The higher the pressure gradient force, the more is the velocity of the wind and the larger is the deflection in the direction of wind.
- As a result of these two forces operating perpendicular to each other, in the low-pressure areas the wind blows around it.
- **At the equator, the Coriolis force is zero and the wind blows perpendicular to the isobars. The low pressure gets filled instead of getting intensified. That is the reason why tropical cyclones are not formed near the equator.**
- In addition, **the gravitational force** acts downwards

**Pressure and wind**

**Geostrophic wind:** When isobars are straight and when there is no friction, the **pressure gradient force is balanced by the Coriolis force** and the resultant **wind blows parallel** to the isobar. This generally happens in upper atmosphere at 3-4 km above surface, here frictional force does not act.

**Cyclones and Anticyclone**

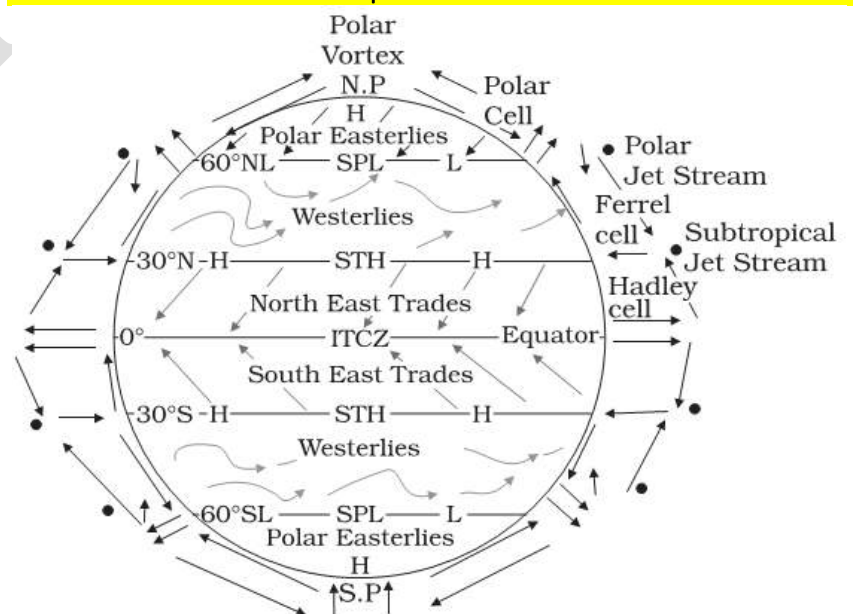
**Table 10.2 : Pattern of Wind Direction in Cyclones and Anticyclones**

Pressure System	Pressure Condition at the Centre	Pattern of Wind Direction	
		Northern Hemisphere	Southern Hemisphere
Cyclone	Low	Anticlockwise	Clockwise
Anticyclone	High	Clockwise	Anticlockwise

**General circulation of the atmosphere**

- The pattern of the movement of the planetary wind is Called General circulation of atmosphere
- The pattern of planetary winds largely depends on :
  - (i) latitudinal variation of atmospheric heating;
  - (ii) emergence of pressure belts;
  - (iii) the migration of belts following apparent path of the sun;
  - (iv) the distribution of continents and oceans;
  - (v) the rotation of earth.

**General circulation of atmosphere**



**Inter-tropical convergence zone**

**ITCZ:** Convergence of easterlies from both sides of tropics near equator.

**Cells: Circulation from surface upward and vice-versa**

- Hadley Cell: Between equator and tropics; easterlies and ascending of warm air from equator to tropics
- Ferrel Cell: Between tropics and mid latitudes; westerlies and sinking cold air from pole
- Polar Cell: At polar latitude; polar easterlies

**General atmospheric circulation and its effects on Oceans**

- Warming and cooling of pacific ocean most important
- **EL Nino (EN)**: warm central pacific water drifts towards South America replacing cold peruvian current
- **Southern Oscillation (SO)** : Change in pressure condition over pacific
- **ENSO**: El-Nino + SO
- Strong ENSO, large weather variations across world; heavy rainfall in arid S America while draught in Australia and India and floods in china

**Local winds**

- Land and sea Breeze
- Mountain and Valley winds: During day valley breeze (mountain slope heats up, warm air rises, air from valley to fill the resulting gap), during night mountain breeze (vice-versa, mountain cools fast)
  - Cool air, of the high plateaus and ice fields draining into the valley is called **katabatic wind**

**Air Masses**

**Air mass**: Large body of air with **distinctive characteristics in terms of temperature and humidity** with little horizontal variation

**Source regions**: Homogenous surface on which air mass forms.

**Classification of air mass on the basis of source regions**

Maritime tropical (mT): over Warm tropical and subtropical oceans

Continental tropical (cT): subtropical hot deserts

Maritime polar (mP) : relatively cold high latitude oceans

Continental polar (cP): very cold snow covered continents in high latitudes

Continental arctic (cA): Permanently ice covered continents in the Arctic and Antarctica

**Fronts**

**Fronts**: **Boundary** zone of meeting of two air masses. The **fronts occur in middle latitudes** and are characterized by **steep gradient in temperature and pressure**. It brings abrupt changes in temperature and cause the air to rise to form clouds and cause precipitation

**4 types:**

Cold : Cold air moves towards warm air

Warm: warm air mass moves towards cold air

Stationary: Remain stationary

Occluded: warm air mass sandwiched between two cold air masses and warm air mass is fully lifted above the land surface

**Mid Latitude or Extra Tropical Cyclone**

Develops in Mid and high latitude beyond tropics

Differences in tropical and extra tropical cyclones

Extra Tropical Cyclone	Tropical Cyclone
Has <b>clear frontal system</b>	Does not have
Can originate over the land and sea.	originate <b>only over the seas</b> and on reaching the land they dissipate

Affects larger area	Smaller areas comparatively
Lower than tropical cyclone	Wind velocity is much higher and destructive
Moves West to east	Moves east to west

### Tropical Cyclone

Violent storms originating over warm tropical ocean

One of the most devastating natural calamities

#### Various Names

- Cyclones in the Indian Ocean
- Hurricanes in the Atlantic
- Typhoons in the Western Pacific and South China Sea
- Willy-willies in the Western Australia.

**Favorable conditions** for the formation and intensification of tropical storms are:

Large sea surface with temperature higher than 27° C;

Presence of the Coriolis force

Small variations in the vertical wind speed

A pre-existing weak low-pressure area or low-level-cyclonic circulation

Upper divergence above the sea level system

**Landfall:** Place where tropical cyclone crosses the coast

The cyclones, which cross 20°N latitude generally, recurve and they are more destructive

#### Characteristics of mature tropical cyclone

<b>Eye</b>	Centre of storm Region of calm with subsiding air
<b>Spirally circulating wind</b>	150-250 km diameter
<b>Eye wall</b>	Around eye where there is a strong spiralling ascent of air to greater height reaching the tropopause. The wind reaches maximum velocity in this region, reaching as high as 250 km per hour. Torrential rain occurs here.

### Thunderstorms and Tornado

Short duration, occur over small area but violent

Caused by intense convection on hot moist day

well-grown cumulonimbus cloud producing thunder and lightening

Cloud extending to sub-zero temperature, then hailstorms

**Tornado:** From severe thunderstorms sometimes spiralling wind descends like a trunk of an elephant with great force, with very low pressure at the centre, causing massive destruction on its way. Such a phenomenon is

called a tornado. Tornadoes generally occur in middle latitudes. The tornado over the sea is called water sprouts.

### Water in atmosphere

Continuous exchange of water between: Evaporation, transpiration, condensation, precipitation

**Humidity:** Moisture in air

Absolute Humidity	Actual amount of water present in atmosphere
-------------------	--

	Wt. of water/ volume of air; unit: gm per cubic meter
Relative humidity	Percentage of moisture present in air as compared to its capacity

Warm air : high capacity to absorb water

Relative humidity greater over ocean and lower over continent

**Saturated Air:** Air containing moisture to its full capacity

**Dew point:** Temperature at which **saturation** occurs.

**Evaporation:** Conversion from liquid to gas. Mainly caused by heat

**Latent heat of vaporization:** Temperature at which evaporation occurs

Greater movement of air greater evaporation as saturated air is replaced by unsaturated one

**Condensation:** from vapour to liquid, caused by loss of heat

- Hygroscopic condensation nuclei- particles of dust, smoke and salt from the ocean
- Condensation depends on volume of air, temperature, humidity, pressure.
- Condensation takes place when
  - Temperature of the air is reduced to dew point with its volume remaining constant (most favourable)
  - Both the volume and the temperature are reduced;
  - Moisture is added to the air through evaporation

**Sublimation:** Direct conversion from vapour to solid

### Forms of Moisture in atmosphere

Dew	<ul style="list-style-type: none"> <li>• Moisture deposited in the form of <b>water droplets</b> on <b>cooler</b> surfaces of <b>solid</b> objects such as stones, grass blades and plant leaves</li> <li>• Ideal conditions: Clear sky, calm air, high relative humidity, and cold and long nights.</li> <li>• <b>Dew point is above the freezing point</b></li> </ul>
Frost	<ul style="list-style-type: none"> <li>• Form on cold surfaces when condensation takes place <b>below</b> freezing point</li> <li>• Dew point is at or below the freezing point.</li> <li>• Excess moisture is deposited in the form of minute <b>ice crystals</b> instead of water droplets.</li> <li>• Ideal conditions: Same as dew</li> </ul>
Fog and Mist	<ul style="list-style-type: none"> <li>• When the temperature of an air mass containing a large quantity of water vapour falls all of a sudden, condensation takes place within itself on fine dust particles, smoke, salt particles</li> <li>• <b>Fog is a cloud</b> with its base at or very near to the ground.</li> <li>• <b>Visibility</b> becomes <b>poor</b> to zero.</li> <li>• In urban and industrial centres smoke provides plenty of nuclei which help the formation of fog and mist.</li> <li>• Smog: Smoke + Fog</li> <li>• <b><i>Mist contains more moisture than the fog.</i></b></li> <li>• <b>Mists</b> are frequent over <b>mountains</b> as the rising warm air up the slopes meets a cold surface.</li> <li>• Fogs are drier than mist and they are prevalent where warm currents of air come in contact with cold currents.</li> </ul>
Clouds	<ul style="list-style-type: none"> <li>• Mass of minute water droplets or tiny crystals of ice formed by the condensation of the water vapour in free air at considerable elevations</li> </ul>

According to their height, expanse, density and transparency or opaqueness clouds are grouped under four

**types :**

<b>Cirrus</b>	<ul style="list-style-type: none"> <li>• 8,000 - 12,000m</li> <li>• Thin detached cloud having feathery appearance</li> <li>• White in color</li> </ul>
<b>Cumulus</b>	<ul style="list-style-type: none"> <li>• Like cotton <b>wool</b></li> <li>• 4000-7000 m</li> <li>• Exists in <b>patches</b>, scattered</li> </ul>
<b>Stratus</b>	<ul style="list-style-type: none"> <li>• Layered clouds</li> <li>• Covers <b>large</b> portion of sky</li> </ul>
<b>Nimbus</b>	<ul style="list-style-type: none"> <li>• Black or dark <b>grey</b></li> <li>• Formed at <b>middle</b> level or near the surface</li> <li>• Extremely <b>dense</b>, opaque to sunray</li> <li>• <b>Shapeless</b> masses of thick vapour</li> </ul>

Combination of these four gives rise to:  
 High clouds – cirrus, cirrostratus, cirrocumulus;  
 Middle clouds – altostratus and altocumulus;  
 Low clouds – stratocumulus and nimbostratus  
 Clouds with **extensive vertical development** – cumulus(fair weather) and cumulonimbus (instability)



**Water resources**

**Groundwater:** Water from rainfall that percolates into ground and collected over hard rocks by infiltration through cracks.

**Aquifers:** Layers of hard rock where ground water is stored

**Precipitation**

Release of moisture

- **Rainfall** : Precipitation in form of water
- **Snowfall**: [When temp. is lower than 0°](#), precipitation in form of [snowflakes](#)
- **Sleet**: frozen raindrops and refrozen melted snow-water
- **Hailstones**: [Drops](#) of rain after being released by the clouds when passes through [colder layer](#) become [solidified](#) into small rounded solid pieces of ice and reach the surface of the earth. Hailstones have several concentric layers of ice one over the other.

### Types of rainfall- on the basis of origin

Convictional	Due to convection, common in summer Common in the equatorial regions and interior parts of the continents, particularly in the Northern hemisphere.
Orographic or relief	<ul style="list-style-type: none"> <li>• Rainfall on windward side of mountains</li> <li>• The area situated on the leeward side, which gets less rainfall is known as the rain-shadow area</li> </ul>
Cyclonic or frontal	At cyclonic <a href="#">fronts</a>

### World Distribution of rainfall

Water distribution uneven around the world and also uneven inside India.

From the equator towards the poles, rainfall goes on decreasing

Coastal areas of the world receive greater amounts of rainfall than the interior

More rainfall over Oceans than on the landmasses

Between the latitudes **35° and 40°N and S** of the equator, the rain is **heavier** on the **eastern** coasts and goes on decreasing towards the west.

But, between **45° and 65°N and S** of equator, due to the **westerlies**, the rainfall is first received on the **western margins** of the continents and it goes on decreasing towards the east.

Wherever mountains run parallel to the coast, the rain is greater on the coastal plain on the windward side and it decreases towards the leeward side.

### Major precipitation regimes of world

**Heavy rainfall (>200 cm per annum)**

- The equatorial belt,
- Windward slopes of the mountains along the western coasts in the cool temperate zone
- The coastal areas of the monsoon land

**Moderate rainfall(100 - 200 cm):**

- Interior continental area
- Coastal areas of continent

**Rainfall (50 - 100 cm):** The [central](#) parts of the tropical land and the eastern and interior parts of the temperate lands

**Very low rainfall (<50 cm):** Areas lying in the [rain shadow zone](#) of the interior of the continents and [high latitudes](#)

Rainfall is distributed evenly throughout the year in the equatorial belt and in the western parts of cool temperate region.

Mawsymnram, Meghalaya - Highest rainfall in the world

**Rainwater harvesting:** Collection of rainwater to recharge groundwater or for normal usage

Rainwater harvesting in India :

Khadins, tanks and nadis in Rajasthan,  
Bandharas and tals in Maharashtra,  
Bundhis in Madhya Pradesh and Uttar Pradesh,  
Ahars and pynes in Bihar,  
Kulhs in Himachal Pradesh,  
ponds in the Kandi belt of Jammu region,  
Eris(tanks) in Tamil Nadu,  
surangamsin Kerala, and  
Kattas in Karnataka

**Tamil Nadu** is first state in India which made roof water harvesting compulsory to all houses across state.

**Bhadu Festival:** West Bengal

**Advantages of water stored in ground:**

- Does not get contaminated by waste or micro organisms
- Does not evaporate but spread out to recharge wells and provide moistures for vegetation over large area
- Does not provide a breeding ground for mosquitoes etc. as in case of stagnant water

**Bawri** was the traditional way of collecting water.

**Drip Irrigation :** Technique of watering plants by making use of narrow tubings which deliver water directly at the base of the plant



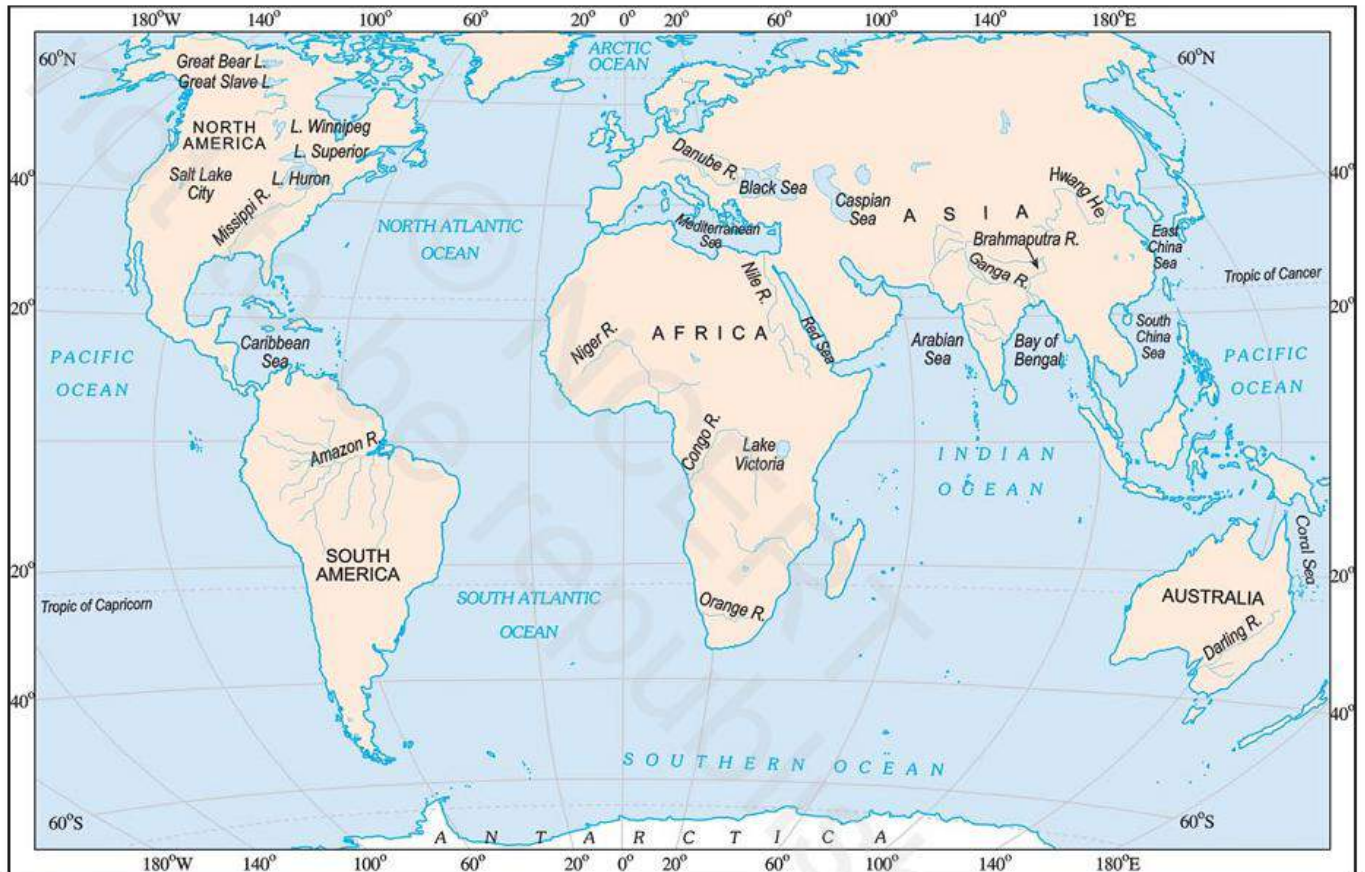


Fig. 5.2: World – Major Seas, Lakes and Rivers

### 22nd March - World Water Day

On 22 March 2005, the GA of UN proclaimed the period 2005– 2015 as the International Decade for action on “Water for life”. Aimed to reduce to half the number of people who do not have access to safe drinking water

Labrador Ocean current is cold current  
Gulf Stream is a warm current

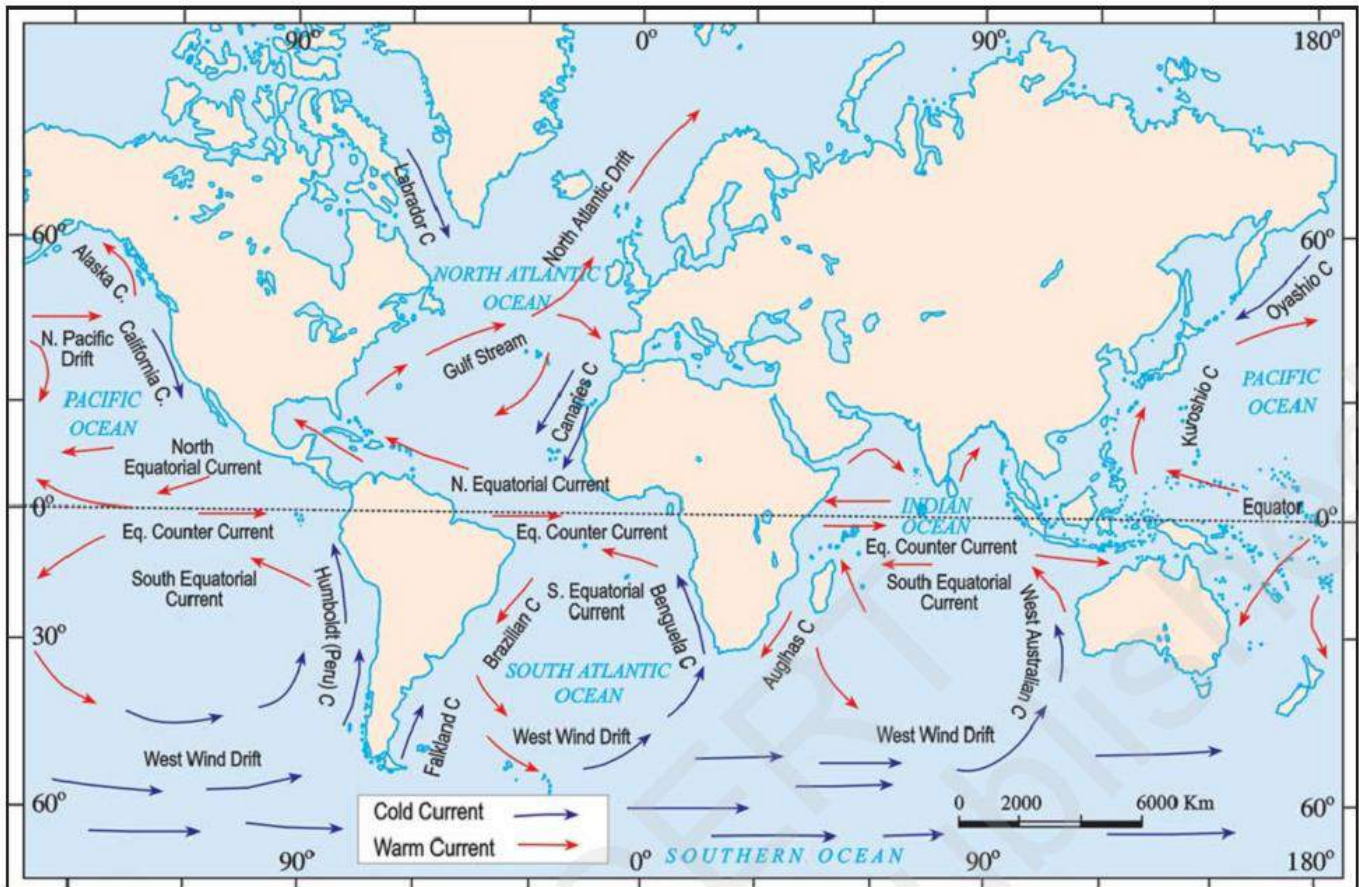


Fig. 5.6: Ocean Currents

The tropical evergreen forest in Brazil is so enormous that it is like the **lungs of the earth**

#### Forests- Types

<p><b>Tropical Evergreen/tropical rainforests</b></p>	<ul style="list-style-type: none"> <li>• Hot climate, Near equator , close to tropics, heavy rainfall</li> <li>• Days and nights are almost equal in length throughout the year</li> <li>• Thick forest, thick canopy, sunlight does not reach ground</li> <li>• Wide variety of plants and animals</li> <li>• No particular dry season, trees does not shed trees all at a time</li> <li>• Hardwood trees: Rosewood, ebony , Mahogany</li> <li>• Anaconda, monkeys, apes, gorillas, tigers, elephants, leopards, lizards, snakes, birds and insects, <a href="#">Lion tailed macaque</a></li> <li>• Western Ghats and Assam in India, Southeast Asia, Central America and Central Africa, Malaysia, Indonesia, Brazil, Republic of Congo, Kenya, Uganda, and Nigeria</li> </ul>
<p><b>Tropical deciduous</b></p>	<ul style="list-style-type: none"> <li>• Monsoon forest</li> <li>• India ,northern Australia and in central America</li> <li>• Experience seasonal changes. Trees shed their leaves in the dry season</li> <li>• Hardwood trees: Sal, teak, neem and shisham</li> </ul>
<p><b>Temperate Evergreen</b></p>	<ul style="list-style-type: none"> <li>• <a href="#">Mid-latitudinal coastal region</a></li> <li>• Along the <a href="#">eastern</a> margin of the continents</li> <li>• E.g., In south east USA, South China and in South East Brazil.</li> <li>• Both <a href="#">hard and soft wood</a> trees like oak, pine, eucalyptus, etc.</li> </ul>

<b>Temperate Deciduous</b>	<ul style="list-style-type: none"> <li>• Higher latitudes</li> <li>• north eastern part of USA, China, New Zealand, Chile and also found in the coastal regions of Western Europe.</li> <li>• Shed their leaves in the dry season.</li> <li>• common trees are oak, ash, beech</li> </ul>
<b>Mediterranean</b>	<ul style="list-style-type: none"> <li>• In west and south west margins of the continents, areas around the Mediterranean sea in Europe, Africa and Asia, California in the USA, south west Africa, south western South America and South west Australia</li> <li>• hot dry summers and mild rainy winters.</li> <li>• Citrus fruits such as oranges, figs, olives and grapes</li> </ul>
<b>Coniferous/ Taiga.</b>	<ul style="list-style-type: none"> <li>• tall, softwood evergreen</li> <li>• used for manufacturing paper and newsprint, Match boxes , packing boxes</li> <li>• softwood. Chir, pine, cedar</li> <li>• Silver fox, mink,</li> </ul>

**Grassland**

Tropical Grassland	<p>either side of the equator and extend till the tropics moderate to low rainfall. Tall grass, about 3 to 4 metres in height. Savannah grasslands of Africa</p>
Temperate	<p>Mid-latitude zones and in the interior part of the continents Short and nutritious grasses</p>
Thorny Bushes	<p>Desert, western margins of the continent scanty rain and scorching heat</p>
Tundra, Polar Region	<p>Extreme climate, covered with snow, sun does not set (rise) for 6 months Short summer, polar regions Mosses, lichens, Polar bear, fishes, musk oxen, reindeers, whales, Seal, walruses, Arctic owl, Polar bear and snow foxes</p>

**Tropical Grasslands**

East Africa-	Savanna
Brazil-	Campos
Venezuela-	Llanos

**Temperate Grasslands**

Argentina-	Pampas
N. America-	Prairie
S. Africa-	Veld

C. Asia-	Steppe
Australia-	Down

**Transhumance:** Seasonal Movement of people

The **Trans-Siberian Railway** is the [longest railway system](#) connecting St. Petersburg in Western Russia to Vladivostok on the Pacific coast



**Important Ports of world:** Singapore and Mumbai in Asia, New York, Los Angeles in North America, Rio de Janeiro in South America, Durban and Cape Town in Africa, Sydney in Australia, London and Rotterdam in Europe

**Amazon Basin in S America**



**Maloca:** Large apartment like houses made of wood with slanting roof  
**Prairies**

Rocky mountain in west, great lakes in east

Covers parts of US and Canada

USA- area drained by Mississippi river, in Canada by Saskatchewan river  
 tribes like the Apache, the Crow, the Cree and the Pawnee.

Native Americans often called "Red Indians"

Continental type climate, moderate rainfall, extreme temperatures

Large cattle farms called ranches

Known as the "Granaries of the world," due to the huge surplus of wheat production

**Chinook** is a **hot wind** that blows in **winter** and therefore raises the temperature within a short time. This increase in temperature results in the melting of snow, making pasture land available for grazing of animals.

### Velds

Temperate grassland of **S. Africa**, bound by the **Drakensburg Mountains on the east and the Kalahari desert in west**

Orange and Limpopo drain the region  
mild climate due to the influence of the Indian Ocean. Winters are cold and dry, rainfall mainly in the summer months from November to February

Occupation: cattle rearing and mining

**Johannesberg: Gold** capital of world

**Kimberly- diamond** mining

### Sahara Desert

N.Africa,

World's largest desert

Touches **eleven** countries- are Algeria, Tunisia, Libya, Egypt, Sudan, Chad, Niger, Mali, Mauritania, Western Sahara and Morocco

Nomadic tribes: **Bedouins and Tuaregs**.

### Cold desert- Ladakh

Ladakh is also known as **Khapa-chan** which means snow land.

**Chiru or the Tibetan antelope** is an **endangered** species. It is hunted for its wool known as **shahtoosh**, which is light in weight and extremely warm

National **Highway 1A connects Leh to Kashmir Valley through the Zoji la Pass**

**Manali - Leh** highway crosses four passes, Rohtang la, Baralacha la, Lungalacha la and Tanglang la.

**Gangri- Glacier**

famous monasteries are **Hemis, Thiksey, Shey and Lamayuru**

Inhabited by **Buddhist and Muslims**

### Ganges river dolphin or Susu or Blind dolphin-

- Found in Ganga, Brahmaputra, Meghna, Karnaphuli- Sangu river systems in Nepal, India and Bangladesh
  - **IUCN endangered species**
  - The presence of **Susu** is an indication of the **health** of the river
- Merino sheep is a popular species and their wool is very warm  
Lepcha tribe: Northern part of West Bengal, Assam

## SOIL

### Soil Formation

#### Factors affecting soil formation

- Topography, Wind, rainfall, light, humidity, temperature, parent rock, climate, relief, flora and fauna, vegetation, time

**Soil Profile:** Vertical layers in which soil is arranged. These layers are called horizons

Top soil/ A Horizon	<ul style="list-style-type: none"> <li>• Uppermost layer, Dark in color, rich in humus and nutrients</li> <li>• soft porous and retain water</li> <li>• Provide shelter for many living organisms such as worms, rodents, moles and beetles.</li> <li>• The <b>roots</b> of small plants are embedded entirely in the <b>topsoil</b></li> </ul>
Middle Layer/ B Horizon/ Subsoil	<ul style="list-style-type: none"> <li>• Most <b>compact and hard</b>, below top soil,</li> <li>• <b>Less humus but rich in minerals, sand , silt and clay</b></li> </ul>
C Horizon	<ul style="list-style-type: none"> <li>• Small lumps of rocks, cracks, crevices, weathered parent rock material</li> <li>• This layer is <b>first stage</b> in the soil formation</li> </ul>
Bedrock	<ul style="list-style-type: none"> <li>• Hard and difficult to dig, parent rock</li> </ul>

### Classification of Soil

#### Classification of Soil in ancient time

**Urvara**- Fertile

**Usara**- Sterile

#### Classification of Soil on the basis of proportion of various particles of different sizes (Texture)

<b>Sandy Soil</b>	More big particles, cannot fit closely together, Large spaces between them filled with air. Sand is well <b>aerated</b> and water can <b>drain quickly</b> , Tend to be light, well aerated and rather dry.
<b>Clay</b>	Finer particles, pack tightly together, heavy, leaving less space for air, <b>retains water</b> Suitable for growing cereals
<b>Loamy</b>	Small and large particles almost equal, <b>mixture of sand, clay and silt</b> (size between clay and sand, found on river bed) Best soil for growing plant, has high and right water retention capacity

- Soil survey of India- 1956
- The National Bureau of Soil Survey and the Land Use Planning Institute under the control of the Indian Council of Agricultural Research (ICAR)

#### ICAR Classification of Soil

**ICAR has classified the soils of India into the following order as per the USDA soil taxonomy**

Sl. No.	Order	Area (in Thousand Hectares)	Percentage
(i)	Inceptisols	130372.90	39.74
(ii)	Entisols	92131.71	28.08
(iii)	Alfisols	44448.68	13.55
(iv)	Vertisols	27960.00	8.52
(v)	Aridisols	14069.00	4.28
(vi)	Ultisols	8250.00	2.51
(vi)	Mollisols	1320.00	0.40
(viii)	Others	9503.10	2.92
<b>Total</b>			<b>100</b>

### Classification on the basis of genesis, colour, composition and location

Soil Type in India	Details
(i) Alluvial soils	<ul style="list-style-type: none"> <li>• Most widespread, 40% of covered area</li> <li>• Northern plains and the river valleys, deposited by Indus, Ganga, Brahmaputra</li> <li>• Also extend in Rajasthan and Gujarat through a narrow corridor, found in the eastern coastal plains particularly in the deltas of Mahanadi, Godavari, Krishna and Kaveri rivers</li> <li>• Depositional soil</li> <li>• Nature from sandy loam to clay, contains various proportions of sand, silt and clay</li> <li>• Near the place of the break of slope, the soils are coarse. Such soils are more common in <b>piedmont plains such as Duars, Chos and Terai</b>.</li> <li>• Rich in <b>potash</b>, phosphoric acid and lime but poor in <b>phosphorous</b>.</li> <li>• 2 types <ul style="list-style-type: none"> <li>• Khadar: <b>new</b> alluvium deposited by floods annually, enriched with fine silts and fertile.</li> <li>• Bhangar: <b>older</b> alluvium, deposited <b>away from the flood plain</b>, high concentration of kankars</li> </ul> </li> <li>• Both contain calcareous concretions (Kankars). More <b>loamy and clayey in the lower and middle</b> Ganga plain and the Brahmaputra valley. The sand content <b>decreases from the west to east</b>.</li> <li>• ideal for the growth of sugarcane, paddy, wheat and other cereal and pulse crops</li> <li>• <b>Color</b>: Light grey to ash grey, Its shades depend on the depth of the deposition, the texture of the materials, and the time taken for attaining maturity.</li> <li>• Intensively cultivated , densely populated</li> </ul>
(ii) Black soils Regur Soil' or the 'Black Cotton Soil'	<ul style="list-style-type: none"> <li>• Deccan Plateau (basalt region) in Maharashtra, Shaurashtra, Malwa, MP, Gujarat, AP and some parts of TN</li> <li>• Clayey, deep and impermeable</li> <li>• It swell and become sticky when wet and shrink when dried. So, during the dry</li> </ul>



	<p>season, these soil develop wide cracks. Thus, there occurs a kind of 'self-ploughing'.</p> <ul style="list-style-type: none"> <li>Retains moisture for long time</li> <li>Rich in <b>lime, calcium carbonate, iron, magnesia, alumina, potash</b>. Lack in <b>phosphorous, nitrogen and organic matter</b>.</li> <li>Colour: Deep black to grey</li> </ul>
(iii) Red and Yellow soils	<ul style="list-style-type: none"> <li>Develops on <b>crystalline igneous rocks</b> in areas of <b>low</b> rainfall in the eastern and southern part of the Deccan Plateau.</li> <li>Reddish colour due to <b>iron</b></li> <li>Looks yellow when it occurs in a <b>hydrated</b> form.</li> <li>The <b>fine</b>-grained red and yellow soils are normally <b>fertile</b>, whereas <b>coarse</b>-grained soils found in dry upland areas are <b>poor</b> in fertility.</li> <li>Poor in <b>nitrogen, phosphorous and humus</b></li> </ul>
(iv) Laterite soils	<ul style="list-style-type: none"> <li>Later mean <b>brick</b>, develop in areas with <b>high temperature and high rainfall</b> causes intense <b>leaching</b> of Lime and silica</li> <li>Soils rich in iron oxide and aluminium</li> <li>Humus content of the soil is removed fast by bacteria.</li> <li><b>Poor in organic matter, nitrogen, phosphate and calcium</b>, while <b>iron oxide and potash are in excess</b>.</li> <li>Not suitable for cultivation, manures and fertilizers are required for making the soils fertile for cultivation. <b>Tea and coffee</b> can be grown with adequate soil conservation techniques.</li> <li>Tamil Nadu, Andhra Pradesh and Kerala are more suitable for tree crops like <b>cashewnut</b>.</li> <li>Widely cut as <b>bricks</b></li> <li>Karnataka, Kerala, Tamil Nadu, Madhya Pradesh and the hilly areas of Orissa and Assam</li> </ul>
(v) Arid soils	<ul style="list-style-type: none"> <li>Red to brown in color.</li> <li>Generally <b>sandy</b> in structure and <b>saline</b> in nature.</li> <li>In some area salt content is very high and used for salt obtaining common salt.</li> <li>Due to the dry climate, high temperature and accelerated evaporation, they <b>lack moisture and humus</b>.</li> <li>Nitrogen is insufficient and the phosphate content is normal. Lower horizons of the soil are occupied by 'kankar' layers because of the increasing calcium content downwards.</li> <li>Arid topography.</li> <li>Poor and contain little humus and organic matter</li> </ul>
(vi) Saline soils	<ul style="list-style-type: none"> <li>Usara soils, <b>infertile</b></li> <li>Contain a larger proportion of <b>sodium, potassium and magnesium</b>, Lack in nitrogen and calcium.</li> <li>Have more salts</li> <li>Occur in arid and semi-arid regions, and in <b>waterlogged and swampy areas</b>.</li> <li>Sandy to loamy.</li> <li><b>Gypsum</b> is added to solve the problem of salinity</li> </ul>

(vii) Peaty soils	<ul style="list-style-type: none"> <li>In areas of heavy rainfall and high humidity</li> <li>Large quantity of <b>dead organic</b> gives a rich <b>humus</b> and organic content to the soil. (40-50%)</li> <li>Normally heavy and black in color, <b>alkaline</b> also</li> </ul>
(viii) Forest soils	<ul style="list-style-type: none"> <li>In area of forest with sufficient rainfall in hilly and mountainous regions.</li> <li>Loamy and silty on valley sides and coarse-grained in the upper slopes.</li> <li>In the snow covered areas of Himalayas, these soils experience denudation and are acidic with low humus content</li> </ul>

### Soil erosion and conservation

**Soil Degradation:** Decline in soil fertility

**Soil Erosion:** Decline in soil cover, denudation of soil and subsequent washing

- Wind and water are powerful agents of erosion. Wind effective in dry arid region
- Erosion by water**
  - Sheet erosion:** In **flat** land top layer eroded, hardly noticeable.
  - Gully erosion:** In **steep** slopes, gully deepen with rainfall. A region with a large number of deep gullies or ravines unfit for cultivation is called a **badland topography**

### Soil conservation

- Methodology to maintain soil fertility, prevent soil erosion and exhaustion, and improve the degraded condition of the soil.

### Methods of soil conservation

<b>Mulching</b>	Bare ground between plants covered with layer of organic matter like straw to retain moisture
<b>Contour barrier</b>	Stones, grasses, soil used to build contour barriers, trenches made in front of barrier to collect water
<b>Rock Dam</b>	Rocks piles to slow down water flow to prevent gullies formation and soil loss.
<b>Terrace Farming</b>	Made in steep slopes so that flat surface is available for cropping, reduce surface run-offs and soil erosion
<b>Intercropping</b>	Growing two or more crops <b>simultaneously</b> on the same piece of land but in <b>definite</b> pattern (in alternative rows)
<b>Mixed cropping</b>	Growing two or more crops <b>simultaneously</b> on the same piece of land
<b>Contour ploughing</b>	Ploughing <b>parallel to contours</b> of hill slope
<b>Shelter belts</b>	In <b>coastal</b> and dry areas, rows of <b>trees</b> planted to check <b>wind</b> movement.
<b>Crop rotation</b>	Growing different crops in pre-planned <b>succession</b> , help in replenishment of soil
<b>Strip cropping</b>	Large fields can be divided into strips. <b>Strips of grass are left to grow between the crops. This breaks up the force of the wind.</b>

**Agriculture**

Agriculture	Cultivation of crops
Sericulture	Silk worm
Viticulture	Grapes
Pisciculture	Fish
Horticulture	Flower, Fruits and vegetables

**Agricultural Systems**

<b>Subsistence Farming</b>	Meets the needs of family only	<ul style="list-style-type: none"> <li>Consume all what is grown</li> </ul>
	Intensive subsistence	<ul style="list-style-type: none"> <li>In small plot of land, labour intensive, high doses of biochemical used</li> <li>Thickly populated region like South east Asia, India</li> <li>Grow more than one crop annually</li> <li>High yield per acre but low yield per person</li> </ul>
	Primitive subsistence farming	<ul style="list-style-type: none"> <li><b>Shifting cultivation</b> : thickly populated forest areas of Amazon basin, NE India, SE Asia, tropical Africa, south and central America; area has <b>heavy rainfall and quick generation</b> of forest</li> <li><b>Nomadic herding</b>: In semi-arid and arid region like Sahara, Rajasthan J&amp;K, central Asia.</li> </ul>
<b>Commercial Farming</b>	For commercial purpose	<ul style="list-style-type: none"> <li>Semi-arid lands of the mid-latitudes, <b>temperate grassland</b> of N America, Europe and Asia</li> <li>Best developed in Eurasian steppes, the Canadian and American Prairies, the Pampas of Argentina, the Velds of South Africa, the Australian Downs and the Canterbury Plains of New Zealand.</li> <li>Higher doses of modern inputs, e.g. high yielding variety (HYV) seeds, Large farm, use of chemical fertilisers, insecticides and pesticides in order to obtain higher productivity</li> <li>High yield per person but low yield per acre</li> </ul>
<b>Plantation Farming</b>	Type of commercial farming	<ul style="list-style-type: none"> <li>Introduced by the <b>Europeans</b></li> <li>Large estates or plantations, large capital investment, managerial and technical support, scientific methods of cultivation, single crop specialization, cheap labour, and a good system of transportation.</li> <li>Single crop of tea, coffee, sugarcane, cashew, banana, etc. on large area</li> <li>Tea- Assam and WB, Coffee in Karnataka</li> </ul>

**Shifting Cultivation/Slash and burn agriculture:** The vegetation is usually cleared by fire, and the ashes add to the fertility of the soil. Major problems is that the cycle of jhum becomes less and less due to loss of fertility in different parcels.

- Population increase, fallow period declines
- The consequences of slash-and-burn techniques for ecosystems are **almost always destructive**
- This method results in loss of habitat for many species
- **Slash-and-char** is an alternative that alleviates some of the negative ecological implications of traditional slash-and-burn techniques

Jhuming	NE India
Dipa	Chhattishgarh, Andaman and Nicobar
Podu or Penda	Andhra pradesh
Bewar or Dahiya	MP
Milpa	Mexico, Central America
Roca	Brazil
Ladang	Malaysia, Indonesia
Conuco	Venzuela
Masole	Central Africa
Ray	Vietnam
Pama Dabi' or 'Koman ' or Bringa'	Odisha
Kumari	Western Ghats
'Valre' or 'Waltre'	SE Rajasthan
Khil	Himalayan Belt
Kuruwa	Jharkhand

**Mixed farming:**

- Simultaneous **cropping and livestock** rearing.
- Found in highly **developed parts of the world**, e.g. North-western Europe, Eastern North America, parts of Eurasia and the temperate latitudes of Southern continents, Argentina, SE Australia, New Zealand and South Africa
- High expenditure on farm machinery, use of chemical fertilizers and manure, with skill and expertise.

**Dairy Farming:** Most advanced and efficient type of rearing of milch animals. It is highly capital intensive. Emphasis on cattle breeding, health care and veterinary services.

- highly **labour intensive** as it involves rigorous care in feeding and milching
- **No off season**
- Three main regions of commercial dairy farming.  
 The largest is North Western Europe  
 Canada  
 South Eastern Australia, New Zealand and Tasmania

**Mediterranean Agriculture:**

- o Highly [specialized commercial](#) agriculture
- o Practiced in the countries on either side of the Mediterranean sea in Europe and in north Africa from Tunisia to Atlantic coast, southern California, central Chile, south western parts of South Africa and south western parts of Australia.
- o This region is an important [supplier of citrus fruits](#)
- o **Viticulture** or grape cultivation is a specialty
- o [Advantage of Mediterranean agriculture is that more valuable crops such as fruits and vegetables are grown in winters when there is great demand in European and North American market.](#)

**Truck Farming:** The regions where farmers specialize in [vegetables](#) only, the farming is known as truck farming. The distance of truck farms from the market is governed by the distance that a truck can cover overnight, hence the name truck farming.

**Cattle rearing of :**

Milch Animals:	Who gives milk, eg: cows	<b>Cow breeds:</b> Exotic/foreign : Jersey, brown Swiss- long lactation period <b>Local</b> : Red Sindhi, Sahiwal , excellent resistance to disease
Draught animal:	Provide labour, eg: buffaloes	

**Animal Feed**

<b>Roughage</b>	Fibrous
<b>Concentrate</b>	Low in fiber but high in protein and other nutrient

**Fishery**

**Marine fish varieties:** Pomphret, Makarel, Tuna, Sardines, Bombay duck, mullets, bhetki, shrimps, oysters (pearl), shellfish like prawns, mussels

Mariculture: Culture fisheries

**Brackish water:** where fresh and marine water mixes together such as [lagoon, estuaries](#)

**Apiaries:** Bee Farm

**Hybridization:** Crossing between [genetically dissimilar](#) plants which can be [inter-varietal, interspecific and intergeneric](#)

**Genetic Modification :** Introduce [specific gene for particular characteristic](#)

**Factors for which variety improvement is done in crops**

Higher yield Improved quality Biotic and Abiotic resistance	Change in maturity duration Wider adaptability Desired Agronomic characteristics
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**Crops**

**Major Crops- Food grains**

Paddy/Rice	<ul style="list-style-type: none"> <li>Alluvial clayey soil rich in clay and organic matter with <a href="#">good water retention capacity</a></li> <li>High temperature, high humidity and high rainfall (above 100cm)</li> <li>In tropical and subtropical region</li> <li><b>Ranking in rice production:</b> China &gt; India &gt; Japan &gt; Sri Lanka &gt; Egypt</li> <li><b>India</b> <ul style="list-style-type: none"> <li>Southern states and West Bengal: 2-3 crops of rice in an agricultural year.</li> <li>In WB 3 crops of rice called 'aus', 'aman' and 'boro' grown.</li> <li>Himalayas and northwestern parts: grown as a kharif crop during southwest Monsoon seas</li> <li>Rice cultivation in the irrigated areas of Punjab and Haryan</li> <li>Production: WB&gt; Punjab &gt; UP &gt; AP &gt; TN</li> <li>Yield: Punjab&gt; TN &gt; Haryana &gt; AP &gt; WB &gt; Kerala</li> <li>Low yield in MP, Chhatishgarh, Odisha</li> </ul> </li> </ul>
Wheat	<ul style="list-style-type: none"> <li>Fine clayey soil fertile and rich in <b>humus</b>, <a href="#">well drained loam soil</a></li> <li>Moderate temperature and rainfall of <a href="#">50-75 cm evenly distributed</a> during growing season and bright sunshine during harvesting</li> <li>USA, Canada, Argentina, Russia, Ukraine, Australia, India (in winter)</li> <li><b>India</b> <ul style="list-style-type: none"> <li>12% of world wheat production</li> <li>Rabi crop under irrigated condition</li> <li>Production: Uttar Pradesh, Punjab, Haryana, Rajasthan and Madhya Pradesh</li> <li>Yield: Punjab &gt;Haryana</li> <li>MP, Himachal Pradesh, J&amp;K has low yield</li> </ul> </li> </ul>
Lentils (Masoor) pulses	<p>Loamy soil which drains water easily Rich in protein , increase soil fertility by nitrogen fixation MP, UP, Raj, Maha, Kar</p>
Cotton	<p>India original home for cotton. Kharif crop Drier part of Black and alluvial, Sandy and Loamy soil, which <a href="#">drains water easily and retains plenty of air</a> High temperature, light rainfall, 210 frost free days and bright sunshine Mah, Guj, MP,Kar ,AP, Telengana , TN, Punjab China&gt;India, USA, Pakistan, Brazil, Egypt</p>
Millets	<p>Less fertile and sandy soil Nigeria, China, Niger <b>Jowar</b>- rainfed crop (Mah, Kar, AP, MP), Sorghum most cropped among coarse cereals, Maharashtra leading producer of Jowar <b>Ragi</b> rich in <a href="#">iron</a>, <a href="#">calcium</a>, <a href="#">micro nutrients</a>, <a href="#">roughage</a> (Kar, TN, HP, Utt, Sikkim, Jhr, Aru P) <b>Bajra</b>- Hot and dry climatic region, hardy crop, Sandy soil and shallow black soil (Raj, UP, Mah, Guj, Haryana)</p>
Maize	<p>Used as both food and fodder Moderate temperature, Rainfall and lots of sunshine (21-27 degree C) Well-drained fertile old alluvial soil N America, Brazil, China, Russia , India , Mexico</p>

	<b>India:</b> MP, AP, Kar, Raj, UP, Bihar, AP, Telangana,
Jute	<b>Golden Fibre</b> Well drained fertile Alluvial soil in flood plains where <b>soil is renewed</b> every year, high temperature during growth, heavy rainfall, humid climate WB>Bihar>Assam>Odisha>Meghalaya Tropical area, <b>India and Bangladesh leading producers</b>
Coffee	<b>Warm wet climate, well drained loamy soil</b> Varieties: Arabica (Initially brought from Yemen, in great demand, Nilgiri in Kar, Kerala, TN) <b>Hill slopes are more suitable</b> Brazil > Columbia > India
Tea	<b>Tropical and sub-tropical climates</b> endowed with <b>deep and fertile well-drained soil</b> , rich in <b>humus</b> and organic matter. Tea bushes require warm and moist frost-free climate all through the year . Frequent showers evenly distributed over the year ensure continuous growth of tender leaves. Tea is a <b>labour intensive industry</b> . Assam, hills of Darjeeling and Jalpaiguri districts, West Bengal, Tamil Nadu and Kerala. China> Turkey> India , Sri lanka, Kenya
Sugarcane	Tropical and subtropical Hot and humid climate, temp 21-27 C rainfall between 75-100cm Sugar, gur, jaggery, Khandsari, molasses UP, Mah, Kar, TN, AP, Telangana, Bihar, Punjab, Haryana Production: Brazil> India
Oil Seeds	<b>Groundnut</b> (Kharif crop ,half of the major oilseeds produced in India) <ul style="list-style-type: none"> <li>• Gujarat&gt; AP&gt; TN</li> <li>• China &gt; India</li> </ul> <b>Rapeseed:</b> Canada > China > India <b>Sesamum:</b> Kharif in North and Rabi in south <b>Castor:</b> Both Rabi and Kharif
Fruits and Vegetables	<b>China&gt; India</b> <ul style="list-style-type: none"> <li>• India grows both tropical and temperate fruits</li> <li>• Arabica variety initially brought from Yemen is produced in the country.</li> <li>• Mangoes of Maharashtra, Andhra Pradesh, Telangana, Uttar Pradesh and West Bengal,</li> <li>• Oranges of Nagpur and Cherrapunjee (Meghalaya),</li> <li>• Bananas of Kerala, Mizoram, Maharashtra and Tamil Nadu,</li> <li>• Lichi and guava of Uttar Pradesh and Bihar ,</li> <li>• Pineapples of Meghalaya</li> <li>• Grapes of Andhra Pradesh, Telangana and Maharashtra,</li> <li>• Apples, pears, apricots and walnuts of Jammu and Kashmir and Himachal Pradesh</li> </ul>
Rubber	<ul style="list-style-type: none"> <li>• <b>Equatorial</b> crop</li> <li>• Moist Humid climate, rainfall more than 200 cm and temperature above 25 °C</li> </ul>

	<ul style="list-style-type: none"> <li>• Kerala , TN, Kar, A&amp;N Island, Garo hills of Meghalaya</li> <li>• India rank 4th in natural rubber production</li> <li>• Raw material for : Tyres, Camel back, footwear, belt hoes, latex foam,</li> </ul>
Fibre	Cotton, Jute, Hemp, Silk

### Cropping seasons in India

#### Northern India

Kharif	Rainy Season, Jun-Sep S-W Monsoon	Paddy (Aus, Aman, Boro), Maize, Groundnut, Soyabean, cotton, pigeon pea, green gram, Jowar, Bajara, Tur(arahar), Moong, Urad, Jute, black gram, Harvested in Sep-Oct
Rabi	Winter season, Oct-Mar	Low temperate and sub-tropical crop Wheayt, barley, gram, peas, linseed, mustard Sown in Oct-Dec, Harvested in Apr-Jun
Zaid	Summer Apr-Jun	Short duration <b>Pulses and vegetables</b> , watermelon, musk melon, cucumber

However, this type of distinction in the cropping season *does not exist in southern* parts of the country. Here, the temperature is high enough to grow tropical crops during any period in the year provided the soil moisture is available. Therefore, in this region same crops can be grown thrice in an agricultural year provided there is sufficient soil moisture

#### Agricultural Practices:

(i) Preparation of soil :	<ul style="list-style-type: none"> <li>• Turn and loosen the soil, allows root to penetrate deep and breathe</li> <li>• <b>Help in growth of earthworm and microbes</b> which turn loosen soil and add humus</li> <li>• Brings nutrients to the top for the plants to absorb</li> <li>• Tilling/ploughing : turning and loosening of soil</li> </ul>
(ii) Sowing	<ul style="list-style-type: none"> <li>• Damaged seeds are hollow and lighter</li> </ul>
(iii) Adding manure and fertilizers	<ul style="list-style-type: none"> <li>• <b>Manure:</b> Organic substance made from decomposition of plants and animals, rich in humus, improves soil texture and water retaining capacity, makes soil porous, increases number of friendly microbes.</li> <li>• <b>Fertilizers:</b> Chemical substance rich in particular nutrient</li> </ul>
(iv) Irrigation	<ul style="list-style-type: none"> <li>• Plants contain nearly 90% water.</li> <li>• Sprinkler irrigation: More useful for <b>uneven areas</b></li> <li>• Drip irrigation: Water applied drop by drop exactly at the position of roots, best system, no water wastage at all</li> </ul>
(v) Protecting from weeds	<ul style="list-style-type: none"> <li>• weeds compete with the crop plants for water, nutrients, space and light hence affect the growth of the crop. Some weeds interfere even in harvesting and may be poisonous for animals and human beings</li> <li>• Weedicide: 2-4D</li> </ul>



	<ul style="list-style-type: none"> <li>Weeds: Xanthium (gokhru), Parthenium(gajar ghas), cyperinus rotundus (motha)</li> </ul>
(vi) Harvesting	<ul style="list-style-type: none"> <li>Harvesting festivals: Pongal, Baisakhi, Holi, Diwali, Nabanya and Bihu</li> </ul>
(vii) Storage	<ul style="list-style-type: none"> <li>Drying, fumigation</li> </ul>

**Rizhobium Bacteria:** Present in root nodules of leguminous plants, fixes atmospheric nitrogen  
**Leguminous plants** contains symbiotic bacteria Rizhobium, fixing nitrogen from atmospheric, molecular nitrogen (N<sub>2</sub>) into ammonia (NH<sub>3</sub>). Ex: Peas, Alfalfa, Peanuts, Soyabean, Lentil, Clover, Beans

**16 nutrients are essential for plants**

Table 15.1: Nutrients supplied by air, water and soil	
Source	Nutrients
Air	carbon, oxygen
Water	hydrogen, oxygen
Soil	(i) <b>Macronutrients:</b> nitrogen, phosphorus, potassium, calcium, magnesium, sulphur (ii) <b>Micronutrients:</b> iron, manganese, boron, zinc, copper, molybdenum, chlorine

Macro - required in large quantity (6)- NPKCaMgSu  
 Micro- Required in small quantity (7)- FeMnBZiCuMbCl

**Classification of manures on the basis of biological material content**

<b>Compost/Vermicomposting</b>	<ul style="list-style-type: none"> <li>Use farm waste material, livestock excreta, vegetable waste, animal waste, sewage waste, straw, eradicated weeds,</li> <li>decomposed in pits,</li> <li>rich in organic matter and nutrient</li> <li>Using earthworm for composting- vermicomposting</li> </ul>
<b>Green Manure</b>	<ul style="list-style-type: none"> <li>Prior to sowing <b>some plants like sun hemp, guar</b> etc. are grown and then <b>mulched</b>, these green plants turn in to green manure providing <b>nitrogen and phosphorus</b></li> </ul>

**Organic farming:** No genetic modification; organic manure used; fertilizers, pesticides chemicals not used or used minimally

**Difference between Fertilizer and Manure**

Fertiliser	Manure
A fertiliser is an <b>inorganic</b> salt	Manure is a <b>natural substance</b> obtained by the decomposition of cattle dung, human waste and plant residues.
A fertiliser is prepared in <b>factories</b>	Manure can be prepared in the <b>fields</b> .

A fertiliser does <b>not</b> provide any <b>humus</b> to the soil.	Manure provides a lot of <b>humus</b> to the soil.
Fertilisers are <b>very rich</b> in plant nutrients like nitrogen, phosphorus, Potassium	Manure is <b>relatively less rich</b> in plant nutrients

- Water borne diseases: cholera, typhoid, polio, meningitis, hepatitis, Jaundice, dysentery

**Microorganisms- Four major groups-** Bacteria, Fungi, Protozoa, Algae

**Pathogens:** Disease Causing Microorganism

Viral Diseases	Cold, Influenza, Polio, Chicken Pox,
Protozoa	Dysentery, <b>malaria</b> ,
Bacteria	TB, Typhoid
Communicable Diseases	Cholera, Common cold, chicken pox, Tuberculosis
Carriers of disease	Housefly, Mosquito
Anopheles Mosquito	Carries of <b>Malaria</b> protozoa
Andes Mosquito	Carrier of <b>dengue</b> virus

**Common Human disease caused by microorganisms**

Human Disease	Causative Microorganisms	Mode of transmission
Tuberculosis	Bacteria	Air
<b>Measles</b>	Virus	Air
Chicken pox	Virus	Air/Contact
Polio	Virus	Air/Contact
Cholera	Bacteria	Water/Food
Typhoid	Bacteria	Water
Hepatitis B	Virus	Water
Malaria	Protozoa	Mosquito
Anthrax in human and cattle	Bacteria	
Foot and Mouth disease in cattle	Virus	
<b>Plant Disease</b>		
Citrus Canker	Bacteria	Air
Rust of wheat	Fungi	Air/ seeds
Yellow vein mosaic of bheendi	Virus	Insects

**Friendly Microorganisms**

Curd	Lactobacillus bacteria
Yeast	Used in <a href="#">baking</a> industry, release carbon dioxide, preparation of <a href="#">alcohol and wine</a> Grown on natural sugar present in grains like wheat, barley, etc.
Common antibiotics made of bacteria and fungi	Streptomycin, tetracycline

- **Fermentation:** Conversion of [sugar into alcohol](#)
- Edward Jenner: vaccine for small pox

**Preservatives:** prevents growth of microorganism's, ex: Salt , edible oil, Sodium benzoate, sodium metabisulphite.

Preservation by salt	Pickle, fish, meat, amla, raw mangoes, tamarind
Preservation by sugar	Jam, jellies , squashes by reducing moisture content and inhibit bacterial growth
Oil and vinegar	Vegetables, fruits, fish, meat
Heat and cold treatments	Pasteurization - preservation of milk, by Louis Pasteur

- **Nitrogen** present in Protein, chlorophyll, nucleic acid, vitamins

**Wildlife Conservation-** [Click here](#)

### Pollution

**Carbon monoxide:** Incomplete combustion, reduces oxygen carrying capacity of blood

**Chlorofluorocarbons(CFCs):** Used in refrigerators, air conditioners and aerosol sprays. CFCs damage the [ozone](#) layer.

GHGs: methane, nitrous oxide, water vapour, Carbon dioxide, HFCs

- Ganga Action Plan launched in 1985
- **Amrita Devi Bishnoi Naional Award for Wildlife conservation**- in memory of Amrita Devi Bishnoi who sacrificed her life to save [Khejri](#) trees in [Jodhpur, Rajasthan](#). Given to individuals or communities from rural areas that have shown extraordinary courage and dedication in protecting wildlife.

### CLIMATE CHANGE

#### World Climate

#### Climate Classification- Approaches

1. **Empirical**- based on observed data
2. **Genetic**- according to their causes
3. **Applied**- for specific purpose

Koepfen classification of climate- empirical

**Table 12.1 : Climatic Groups According to Koeppen**

Group	Characteristics
A - Tropical	Average temperature of the coldest month is 18° C or higher
B - Dry Climates	Potential evaporation exceeds precipitation
C - Warm Temperate	The average temperature of the coldest month of the (Mid-latitude) climates years is higher than minus 3°C but below 18°C
D - Cold Snow Forest Climates	The average temperature of the coldest month is minus 3° C or below
E - Cold Climates	Average temperature for all months is below 10° C
H - High Land	Cold due to elevation

**Table 12.2 : Climatic Types According to Koeppen**

Group	Type	Letter Code	Characteristics
A-Tropical Humid Climate	Tropical wet	Af	No dry season
	Tropical monsoon	Am	Monsoonal, short dry season
	Tropical wet and dry	Aw	Winter dry season
B-Dry Climate	Subtropical steppe	BSh	Low-latitude semi arid or dry
	Subtropical desert	BWh	Low-latitude arid or dry
	Mid-latitude steppe	BSk	Mid-latitude semi arid or dry
	Mid-latitude desert	BWk	Mid-latitude arid or dry
C-Warm temperate (Mid-latitude) Climates	Humid subtropical	Cfa	No dry season, warm summer
	Mediterranean	Cs	Dry hot summer
	Marine west coast	Cfb	No dry season, warm and cool summer
D-Cold Snow-forest Climates	Humid continental	Df	No dry season, severe winter
	Subarctic	Dw	Winter dry and very severe
E-Cold Climates	Tundra	ET	No true summer
	Polar ice cap	EF	Perennial ice
H-Highland	Highland	H	Highland with snow cover

### Causes of climate change

#### Astronomical:

- **Changes in solar output** associated with **sunspot** activities. Increased sunspot, cooler wetter weather, decreased sunspot hotter drier weather
- **Millankovitch oscillations:** which infer cycles in the variations in the earth's orbital characteristics around the sun, the wobbling of the earth and the changes in the earth's axial tilt. All these alter the amount of insolation received from the sun, which in turn, might have a bearing on the climate.

#### Terrestrial :

- **Volcanism :** Throws lots of aerosols which reduces sun's radiation causing fall in earth's temperature
- **Anthropogenic** effect causing global warming.

1998 was the warmest year, probably not only for the 20th century but also for the whole millennium

### Difference in Global Warming and Climate Change

Global Warming	Long term warming of planet Global temperature rising since early 20th century especially from 1970s Since 1880, average temp rose by 0.8 degree C
Climate change	A <b>broader</b> term Encompasses global warming, but Also includes- rise in sea level, shrinking glaciers, changing plant booming times , accelerating ice melts- All consequences of warming caused by burning fossil fuels and putting up heat trapping gases in atmosphere Also caused by plate tectonics, volcanic eruptions

### Preventing Climate change - Two tier approach

<b>Mitigation</b>	Reducing the flow of GHGs into the atmosphere
<b>Adaptation</b>	Learning to live and adapt with the climate change that has already been set into motion

### Effects of Ozone Hole?

**Ozone hole:** Man-made hole in stratosphere at south pole during southern hemisphere spring due to use of **CFCs** in refrigerants, spray cans, etc.

<b>Does not cause climate change</b>	UV rays sips through these hole but account less than one percent of sun's energy
<b>Cause climate change</b>	<b>Ozone is powerful GHG</b> and destroying it made southern hemisphere colder resulting in faster winds near S. pole This can have impacts all the way to the equator, affecting tropical circulation and rainfall at lower latitudes. So it is not causing global warming, but it is affecting atmospheric circulation

Earth is sometimes called the **"Goldilocks" planet**– it's not too hot, not too cold, and the conditions are just right to allow life

17. If all of Earth's ice melts and flows into the ocean, what would happen to the planet's rotation?

A. The earth rotation will slow down

### CLIAMTE SUMMITS

[Climate Summit 2014](#), New York

GHG emitters ranking: 1.China> 2.USA> 3.India

### Environmental treaties

Treaty	Goals	Important events
<b>UNFCC</b>	Climate change 6 GHGs (CO <sub>2</sub> , CH <sub>4</sub> , SF <sub>6</sub> , HFCs, NO <sub>2</sub> , PFCs) Money- GEF	1st COP- Berlin 3rd COP - <a href="#">Kyoto 1997</a> , led to Kyoto Protocol <a href="#">15th COP-Copenhagen, Denmark-Copenhagen Accord-voluntary reduction of GHGs</a> COP20: 2014, Lima, Peru

		COP21, 2015: Paris, France
Convention of Biodiversity (CBD)	Three goals: Conservation, sustainable use, fair and equitable sharing, Money- GEF	Earth Summit, Rio De Janeiro 1992 by UNEP
	Cartagena Protocol	Biosafety
	Nagoya	Genetic resources
	Aichi Targets	Protect Biodiversity
Agenda 21	Sustainable Development	
	Rio+20	
Montreal Protocol	Ozone depleting gases (CFCs, HCFCs)	
Vienna Convention	Protection of the Ozone Layer	
Minamata	Convention on Mercury	
Stockholm Convention	Persistent Organic Pollutants	
Rotterdam Convention	Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	
CITES - IUCN	Convention on International trade in endangered species of flora and fauna	

#### Steps taken by India to combat Climate change

- NAPCC
- Earth Hour
- Under UNFCCC-Copenhagen Accord, India have pledged to reduce their carbon intensity—the amount of *GHG emissions per unit GDP—and 20-25%, respectively, against 2005 levels by 2020.*
- Coal Cess

#### National Action Plan for Climate Change

**Eight Missions under NAPCC:** Energy efficiency, solar energy, sustainable habitat, water, forestry, sustaining the Himalayan ecosystem, agriculture and strategic knowledge for climate change.

#### Prime Minister's Council on Climate Change (PMCCC)

- Established in 2007, responsible for framing the NAPCC in 2008
- The High Level Advisory, for co-coordinating action plans for assessment, adaptation and mitigation of climate change.
- Advise government on multiple climate change related issues and facilitated inter-

ministerial cooperation and coordination

- To be revived to accommodate more members from industrial sector
- Review the implementation of **eight mission** and comprehensive **assessment** of climate change policy

#### Challenges

- Lack of funding and co-ordination
- slow implementation of proposals
- Missions underperforming in relation to their targets.

#### Earth Hour

- Worldwide movement, held annually
- organized by the **World Wide Fund for Nature (WWF)**.
- Encouraging individuals, communities, households and businesses to turn off their **non-essential lights for one hour**, from 8:30 to 9:30 p.m. (local time) on the last Saturday in March
- Started as a lights-off event in **Sydney, Australia in 2007**. Today, Earth Hour engages a massive mainstream community on a broad range of environmental issues. The one-hour event continues to remain the key driver of the now larger movement.
- Earth Hour 2015 was on March 28, Earth Hour 2016 will be on March 29

#### Global Earth Hour Capital Competition

- 16 countries participated in Seoul.
- Seoul- winner, Global Earth Hour Capital 2015.
- **Thane** named India's Earth Hour Capital from India in the Earth Hour City.
- Aimed at **promoting renewable energy** and preparing for climate change.
- **Thane, Rajkot and Pune were the finalists from India.**
- **Pune** - special mention from the jury for its city mobility plan and its solar and waste-to-energy initiatives.
- **Rajkot**- in the field of **renewable** energy.
- Last year, **Coimbatore** was selected as the National Earth Hour Capital.
- Developments in Thane: The notable actions by the Thane city administration include
- The **mandatory use of solar water-heating systems** for municipal buildings and solutions such as wind-solar hybrid systems and use of solar energy for lighting and air-conditioning.
- The city plans **solar rooftop net metering-based** power generation and regular energy audits.
- An **energy service company (ESCO)** project for energy-efficient street lighting.
- Commissioning of a **bio-methanation** plant to treat municipal solid waste and generate electricity and three cyclic switching units for optimal use of streetlights.

**SOLAR:** target of generating 20,000 MW of solar power by 2020

Already achieved about 1200 mw presently.

#### Energy Efficiency:

Introduced an innovative trading mechanism (Namely PAT – Perform, Achieve and Trade) for energy efficiency.

#### Coal Cess:

- A National Clean energy Fund (NCEF)

- Ca\$h comes from cess on coal of (Rs. 50 per tonne, now 100 rs per tonne, now 200 Rs)
- this ca\$h is used for [financing renewable energy](#) and environment friendly projects.

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