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UNIT 1 Ecology

Definition of Ecology

1. **Ecology** is the study of the relationships between living organisms, including humans, and their physical environment; it seeks to understand the vital connections between plants and animals and the world around them.
2. Ecology - Coined by **Ernst Haeckel**, a branch of Biology that studies organisation in their environment. Study of interaction of biotic with abiotic.
 - a. Cells → Tissue → Organisms → Species → Population → Community → Ecosystem → Biomes → Biosphere → Earth → Universe (GoldiLocks)
3. **Species**
 - a. Definition - When the members having similar genetic makeup who can interbreed and produce fertile offspring are known as species.
 - b. Keystone species
 - i. Definition - Some of the species have disproportionately larger effects on the communities in which they occur. These species determine the ability of a large number of other species in the community to survive. If such species disappear, it could lead to the extinction of other species such other important species are known as Keystone species Example
 1. All the top level predators - Tiger, Lion, Cheetah.
 2. Elephant is a keystone species in the tropical Evergreen forest.
 - a. Elephants play with mud and make lakes, which provide water to other animals in the jungle.
 3. Corals form an important part of the ocean food chain and support very high ocean diversity.
 4. Insects and honey bees - They engage in cross pollination, which increases genetic and species diversity and prevent occurrence of diseases.

5. **Wild Durian Tree** - Endemic only to WGs, it attracts insects, birds, reptiles, monkeys etc thus supports WGs ecosystem.

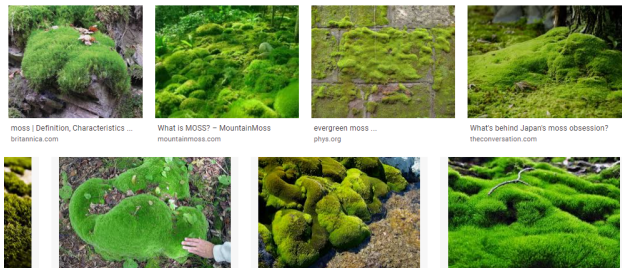
c. Indicator/sentinel species

- i. Serve as an early warning mechanism because they are sensitive to environmental conditions hence also called SENTINEL species.
- ii. A bioindicator is a **living organism** that gives us an idea of the health of an ecosystem. Some organisms are very sensitive to pollution in their environment, so if pollutants are present, the organism may change its Morphology, physiology or Behaviour, or it could even die, allowing scientists to calculate atmospheric alterations.
- iii. All top level predators are indicative species.
 1. Healthy tiger, Healthy Jungle.
- iv. To monitor air Pollution:
 - a. **Lichens**
 - i. (a symbiosis among Cyanobacteria, algae, and/or fungi)
 - ii. A lichen is a composite organism that arises from algae or cyanobacteria living among filaments of multiple fungi in a symbiotic relationship (PT 2014).
 - iii. The combined lichen has properties different from those of its component organisms. Lichens come in many colours, sizes, and forms.
 - iv. Indicate Acid Rain.
 - v. Some species indicate low air pollution.
 - vi. https://www.youtube.com/watch?v=Fkw_VF5zDT0
 - b. Bryophytes (a collective term for mosses, hornworts and liverworts).
 - i. **Liverworts**
 1. The Marchantiophyta are a division of non-vascular land plants commonly referred to as hepatics or liverworts. Like mosses and hornworts, they have a gametophyte-dominant life cycle,

in which cells of the plant carry only a single set of genetic information.

2.

- ii. **Mosses** are a phylum of nonvascular plants. They produce spores for reproduction instead of seeds and don't grow flowers, wood or true roots. Instead of roots, all species of **moss** have rhizoids. The **mosses** sit within a division of plants called the Bryophyta under the subdivision Musci.



iii.

iv. Hornworts

- 1. Hornworts are a group of bryophytes (a group of non-vascular plants) constituting the division Anthocerotophyta. The common name refers to the elongated horn-like structure, which is the sporophyte. As in mosses and liverworts, the flattened, green plant body of a hornwort is the gametophyte plant.



2.

- v. To monitor water pollution:
 - a. **Algae blooms love Nutrients.**
 - i. Algal Bloom or Marine Bloom or Water Bloom is a rapid increase in the population of algae in an aquatic system.

- ii. Algal Blooms may occur in freshwater as well as marine environments.
- iii. Reasons to have this
 - 1. Discharge of nutrients from the estuaries.
 - 2. Run off from the land during the monsoon.
 - 3. Upwelling in the seas.
- iv. **They** are often used to indicate large increases of nitrates and phosphates (**Eutrophication**) in lakes and rivers.
 - 2. Microorganisms are often used as health indicators of aquatic and terrestrial ecosystems as they have a rapid rate of growth, and react to even low levels of contaminants and other physicochemical and biological changes ex:
 - a. bacterium *Vogesella indigofera*.
- vi. Crow and Vulture indicate a bad waste management system in the city.
- vii. Frogs - are indicators of moisture and water vapour present in the atmosphere.
 - 1. In India in the last decade 32 species of frog have become extinct.
 - 2. Frogs are considered accurate indicators of environmental stress as they are highly susceptible to rainfall disturbances.
- viii. Stoneflies
 - 1. Indicate high oxygen levels in water.
- ix. Mosses (Air pollution) and Fungi
 - 1. Indicate **acidic soil**
- x. Greasewood
 - 1. Indicate soil salinity.
- xi. Molluscs
 - 1. Some molluscs indicate water pollution status.
- xii. **Tubifex worms**
 - 1. Indicate non potable, stagnant, oxygen poor water.
- xiii. Sparrow
 - 1. Being very sensitive to changes in the environment, is one of the most preferred indicator species of urban ecosystems.
- xiv. River otter

1. The otter is a strict carnivore and contaminants that occur in the environment may concentrate in the otter over time in a process known as **biomagnification**.

Scope and importance of Ecology & Environmental Science,

1. Ecology can be studied at several levels, from proteins and nucleic acids (in biochemistry and molecular biology), cells (in cellular biology), organisms (in botany, zoology, and other similar disciplines), and finally at the level of populations, communities, and ecosystems – which are the subjects of ecology.
2. Because of its focus on the broadest level of life and on the interrelations between living beings and their environment, ecology draws heavily on other branches of science, such as geology and geography, meteorology, pedology, chemistry, and physics. The behavioral relationship between individuals of a species – e.g. The study of the queen bee, and how it relates to the worker bees and the drones.
3. The organized activity of a species e.g. the activity of the bee assures the pollination of flowering plants.
4. A bee hive additionally produces honey which is consumed by other species, such as bears &
5. The consequences of the environmental change on the bee activity. Bees may die out due to environmental changes (see pollinator decline). The environment at the same time both affects and is a consequence of this activity and is thus intertwined with the survival of the species.

Biological levels of organization

1. Levels of organization are structures in nature, usually defined by part-whole relationships, with things at higher levels being composed of things at the next lower level.
2. Typical levels of organization that one finds in the literature include the atomic, molecular, cellular, tissue, organ, organismal, group, population, community, ecosystem, landscape, and biosphere levels.

3. References to levels of organization and related hierarchical depictions of nature are prominent in the life sciences and their philosophical study, and appear not only in introductory textbooks and lectures, but also in cutting-edge research articles and reviews. In philosophy, perennial debates such as reduction, emergence, mechanistic explanation, interdisciplinary relations, natural selection, and many other topics, also rely substantially on the notion.

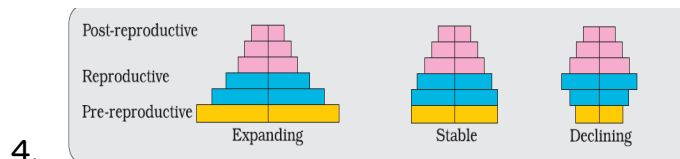
Population

1. Population - When Members of the same species in an area are known as Population

a. Members of the same population can interbreed.

b. Population attributes

- i. Include both organisms produced through sexual or Asexual Activities.
- ii. Population ecology is an important area of ecology because it links ecology to population genetics and evolution.
- iii. Birth rate and death rate ?? Do on your own.
- iv. Sex Ratio ?? Do on your own.
- v. Age Pyramid
 1. Expanding / Growing.
 2. Stable.
 3. Declining.



vi. Population Density

1. A Banyan Tree or 100 Parthenium plants.

c. Population growth

i. Natality

1. Natality refers to the number of births during a given period in the population that are added to the initial density.
2. Mortality
3. Immigration - aai
4. Emigration - exit

d. Population interaction

Table 13.1 : Population Interactions

| Species A | Species B | Name of Interaction |
|-----------|-----------|---------------------|
| + | + | <i>Mutualism</i> |
| - | - | <i>Competition</i> |
| + | - | <i>Predation</i> |
| + | - | <i>Parasitism</i> |
| + | 0 | <i>Commensalism</i> |
| - | 0 | <i>Amensalism</i> |

Both the species benefit in **mutualism** and both lose in **competition** in their interactions with each other. In both **parasitism** and **Predation** only one species benefits (parasite and predator, respectively) and the interaction

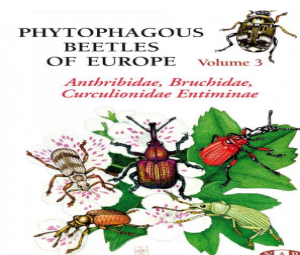
2.

i. Mutualism

1. This interaction confers benefits on both the interacting species.
2. Fungus and tree relationship. fungus or algae provide nutrients for the tree by taking them from soil and tree provide them carbohydrates to survive.
3. Association between Rhizobium and leguminous plants in which nitrogen fixation in legumes root nodules is carried out by bacteria belonging to genus Rhizobium.
 - a. The legume provides food and shelter to the bacteria and bacteria fixes nitrogen to legumes. Hence, both are benefited

ii. Predation

1. Butterflies v/s Moths
2. Phytophagous
 - a. Feeding on plant sap and other parts of plants.
 - b. Calotropis (AAK ka ped).
 - i. Aak plant produces highly poisonous cardiac glycosides.



iii. Competition

1. Process in which the fitness of one species (measured in terms of its 'r' the intrinsic rate of increase) is significantly lower in the presence of another species.
 2. Resource partitioning'
 - a. If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns.
- iv. Parasitism
1. Majority of Parasites harm their host.
 2. Many need intermediates , such as Malaria Parasite that needs a vector (mosquito).
 - a. Ectoparasites
 - i. Parasites that feed on the external surface of the host organism.
 1. Example lice(Juu) on humans and ticks on dogs
 - b. Endoparasites are those that live inside the host body at different sites (liver, kidney, lungs, red blood cells, etc.).
 - i. The life cycles of endoparasites are more complex because of their extreme specialisation.
 - c.
 - d. The female mosquito is not considered a parasite, although it needs our blood for reproduction.
 3. **Brood Parasitism** in birds is an example of parasitism in which the parasitic bird lays its eggs in the nest of its host and the host incubates them.
 - a. Cuckoo and Crow.
- v. Commensalism(+..0):



Cattle egret

Bird



The cattle egret is a cosmopolitan species of heron found in the tropics, subtropics and warm temperate zones. [Wikipedia](#)

Scientific name: *Bubulcus ibis*

Phylum: Chordata

Higher classification: *Bubulcus*

Rank: Species

Did you know: In 2008, cattle egrets were also reported as having moved into Ireland for the first time. [wikipedia.org](#)

- 1.
 2. Epiphytes are the small green plants which grow perched on larger plants for space only. For example orchids, mosses.
- vi. Ammensalism (- ... 0)



Ammensalism examples

- **Algal blooms** can lead to the death of many species of fish and other animals, however the algae do not benefit from the deaths of these individuals.
- **Black walnut trees** secrete a chemical from its roots which prevents the growth of neighboring trees.
- **Elephants** stepping on ants or leveling brush does not benefit the elephant but harms the ants and brush.



1.



Community

1. Community - Consists of members of a population of different species in a Geographical area.

Ecosystem

1. An Ecosystem is a self-regulatory unit capable of maintaining homeostasis (refers to maintenance of steady state, in an ecosystem), it occurs by feedback mechanism. Feedback can be +ve or -Ve.
 - a. It is mainly -ve feedback which brings balance in an ecosystem.
2. The word ecosystem was coined by Arthur Tansley which means interaction that occurs b/w biotic and abiotic components. In other words Ecosystem is an interaction between living organisms and their environment (non living components).
 - a. Biotic components are producers, consumers and decomposers.
 - i. The Biotic components consist of living organisms such as plants, animals and decomposers. They are divided into producers or autotrophs. They manufacture their own food through photosynthesis or chemosynthesis.
 - ii. **Producers /Autotrophs**
 1. Photosynthesis (PS)is a natural carbon sequestration or carbon fixing mechanism in which solar energy is turned into sugar and oxygen. PS can occur only upto a depth of 200 metre in the aquatic ecosystem and therefore the major part of food production in the ecosystem is through chemosynthesis.
 2. Chemosynthesis is a process which uses energy released by inorganic chemical reactions to produce food. It occurs in the absence of sunlight therefore an important part of the ocean as well bacteria living around hot springs and geysers as well as volcanic vents.
 - iii. Consumers / Heterotrophs -Other nourishing , they are divided into
 1. Herbivores or primary consumer
 2. Carnivores
 3. Predators
 4. Omnivores
 - iv. **Detritivores and decomposers**
 1. These are classified into saprophyte or true decomposers which include bacteria, fungus, mushroom and mouse.
 2. While the detritivores include the animals which eat the dead . ex Earthworm, vultures, rats, dogs, etc.
 3. As the vulture is the top level predator, excessive and unregulated use of Diclofenac is causing intestinal/

internal rupture in the vultures. Resultant in the extinction of Vultures in India. Hence Diclofenac is banned in the veterinary industry.

- v. Non veg & Env - Sustainable living and reduction in food insecurity , reduction of hunger and reduction of carbon footprint require promotion of veg.
- b. Abiotic components
 - i. They may influence the Survival and condition of an ecosystem , known as a limiting factor.
 - ii. Eury- more, Steno- less.
 - iii. Light
 - 1. Sunlight is a limiting factor, below a depth of 200 m in the aquatic ecosystem.
 - a. Photic = light reach.
 - b. Aphotic- Light not reach- depth >200 m
 - iv. Nutrients
 - 1. More BOD (organic waste) and COD (Inorganic waste) means more pollution.
 - 2. In recent days due to excessive pollution of water bodies by industrial chemicals, by plastics dead zones are created in the water bodies.because as the sunlight is limited the photosynthesis stops and hence BOD & COD increases , which indicates that the amount of oxygen has reduced making the water bodies of the world a biological desert.
 - 3. WWF (World wildlife forum) has released report “worlds top rivers at risk”, which identified major dyeing rivers of the world. 5/10 rivers are in asia along.
 - a. Yangtze is dying due to DAMS and not pollution -China
 - b. Mekong - Indo-CHina
 - c. Salween - Myanmar.
 - d. Ganga due to Pollution - India
 - e. Indus - India, Pak.
 - v. Oxygen - ?? Do on your own.
 - vi. Moisture /water - Is the limiting factor in desert and Savanna grassland therefore trees do not develop in these biomes.
 - 1. Euryhaline → **wide range**

- a. Some organisms are tolerant of a wide range of salinities.
2. Stenohaline → Some are restricted to a narrow range.
3. Many freshwater Animals cannot live for long in seawater and vice versa because of the osmotic problems.
- vii. Temperature → Limiting factor in higher latitudes and higher altitudes.
 1. Eurythermal - **wide range**
 - a. A few organisms can tolerate and thrive in a **wide range** of temperatures.
 2. Stenothermal → Narrow Range
 - a. A vast majority of them are restricted to a narrow range of temperatures.

Biosphere

1. The biosphere is made up of the parts of Earth where life exists. The biosphere extends from the deepest root systems of trees to the dark environment of ocean trenches, to lush rain forests and high mountaintops.
2. Scientists describe the Earth in terms of spheres. The solid surface layer of the Earth is the lithosphere. The atmosphere is the layer of air that stretches above the lithosphere. The Earth's water—on the surface, in the ground, and in the air—makes up the hydrosphere.
3. Since life exists on the ground, in the air, and in the water, the biosphere overlaps all these spheres. Although the biosphere measures about 20 kilometers (12 miles) from top to bottom, almost all life exists between about 500 meters (1,640 feet) below the ocean's surface to about 6 kilometers (3.75 miles) above sea level.

4. Biosphere Reserves

- a. People play an important part in maintaining the flow of energy in the biosphere. Sometimes, however, people disrupt the flow. For example, in the atmosphere, oxygen levels decrease and carbon dioxide levels increase when people clear forests or burn fossil fuels such as coal and oil. Oil spills and industrial wastes threaten life in the hydrosphere. The future of the biosphere will depend on how people interact with other living things within the zone of life.

- b. In the early 1970s, the United Nations established a project called Man and the Biosphere Programme (MAB), which promotes sustainable development. A network of biosphere reserves exists to establish a working, balanced relationship between people and the natural world.
 - c. Currently, there are 563 biosphere reserves all over the world. The first biosphere reserve was established in Yangambi, Democratic Republic of Congo. Yangambi, in the fertile Congo River Basin, has 32,000 species of trees and such endemic species as forest elephants and red river hogs. The biosphere reserve at Yangambi supports activities such as sustainable agriculture, hunting, and mining.
5. India Biosphere reserves are discussed in other relevant chapter.

Climatic factors –

- a. It refers to the sum total of weather conditions and variations over a large area for a long period of time (more than 30 years).
 - b. **Monsoon** (Arabic ‘**mausim**’ means season)
 - i. Monsoon refers to the **seasonal reversal of winds**.
 - c. **Climate controls**
 - i. Latitude
 - ii. Altitude
 - iii. Pressure and Wind system
 - iv. Distance from Sea
 - v. Ocean current
 - vi. Relief features.
2. **Weather(मौसम)**
- a. It refers to the state of the atmosphere over an area at any point of time.
3. **Coriolis force (Ferrel’s law):**
- a. An apparent force caused by the **earth’s rotation**.
 - b. The Coriolis force is responsible for deflecting winds towards the right in the northern hemisphere and towards the left in the southern hemisphere.
 - c. This is also known as ‘Ferrel’s Law’.
 - d. At the equator, the Coriolis force is zero and the winds blows perpendicular to the isobars.
 - i. The low pressure gets filled instead of getting intensified. Therefore, Tropical cyclones are not formed near the equator

Solar Temperature

1. Temperature

- a. Temperature taken in daylight/ direct sunlight, called “ **temperature in the Sun**.
- b. Line joining the same lines is called ISOTHERM.
- c. Stevenson screen
 - i. The **Stevenson Screen** or thermometer **screen** is a standard shelter (from rain, snow and high winds, but also leaves and animals) for meteorological instruments, particularly wet and dry bulb thermometers used to record humidity and air temperature.

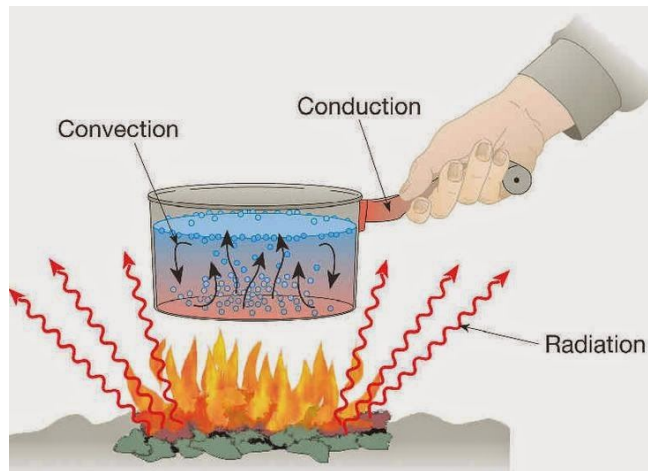


- ii.
- d. When the temperature drops alcohol contracts.
- e. Earth receives 2 cal / sq cm/ min at the top of the atmosphere in the form of SHORT WAVE High energy. Transparent to GHG.
- f. Measurement
 - i. Diurnal Range(per day), Annual range,
 - ii. Thermometre (Mercury expands when Heated and contracts when cooling).
$$\text{Fahrenheit} = (1.8 \times ^\circ\text{C.}) + 32^\circ\text{F.}$$
 - iii. Temperature in the sun - at daytime when sun is overhead, it measures direct insolation.
 - iv. Isotherms - Line joining surface having same temperature.
- g. Factors Controlling temperature
 - i. Latitude
 - 1. Max at 20* c in the Northern hemisphere.
 - 2. Not at the equator due to more clouds. Also called the temperature equator.
 - 3. Decreases toward poles
 - ii. Longitude
- h. Distribution of temperature
 - i. Horizontal
 - ii. Vertical - It drop 1°F with 300 feet height (ascent).
- i. Inversion of temperature (TI)
 - i. **What do you mean by the phenomenon of TI in Meteorology ? How does it affect the weather and the habitants of the place ? (200 W)**
 - 1. A- Normally, temperature decreases with increase in elevation. It is called **normal lapse rate**. At times, the situation is reversed and the normal lapse rate is inverted. It is called Inversion of temperature.

2. Inversion is usually of short duration but quite common nonetheless.
 3. Condition - A **long winter night** with **clear skies** and **still air** is ideal situation for inversion.
 - a. The heat of the day is radiated off during the night, and by early morning hours, the earth is **cooler than the air above**.
 - b. Over polar areas, temperature inversion is normal throughout the year.
 4. Weather affect -
 - a. Surface inversion promotes **stability in the lower layers** of the atmosphere.
 - i. Smoke and dust particles get collected beneath the inversion layer and spread horizontally to fill the lower strata of the atmosphere.
 - b. **Dense fogs** in mornings are common occurrences especially during winter season.
 - i. This inversion commonly lasts for few hours until the sun comes up and begins to warm the earth.
 5. The inversion takes place in hills and mountains due to **air drainage**.
 - a. Cold air at the hills and mountains, produced during night, flows under the influence of gravity. Being heavy and dense, the cold air acts almost like water and moves down the slope to pile up deeply in pockets and valley bottoms with warm air above. This is called **air drainage**. It protects plants from frost damages.
2. Insolation - Energy received from incoming solar light.
 - a. Water - Upto 400 metre got heated in the ocean. Water requires more heat to raise 1C than land. Transparent
 - b. Land - Opaque , land gets more heated.
 3. Variability of Insolation at the Surface of the Earth
 - a. Latitude.
 - b. The **rotation** of the earth on its axis;
 - c. The angle of inclination(झुकाव का कोण) of the sun's rays;
 - d. The **length** of the day;
 - e. The transparency of the atmosphere;
 - f. The configuration of land in terms of its aspect.
 1. The last two however, have less influence.
 - g. The Passage of Solar Radiation through the Atmosphere
 - h. Spatial Distribution of Insolation at the Earth's Surface
 - i. Heating and cooling of the Atmosphere.
 - j. Angle of incidence and distribution

4. Heat budget of the earth

- a. **Radiation (विकिरण)** - Heat passes by waves / **Radiation**.
Conduction(संचालन / प्रवाहकत्व) - Land passes heat to the upper layer which is in direct contact with it.
- b. **Convection** - Air moves vertically and transfers heat to the upper layer.
 - i. **Advection** - **Convection transfer of heat through horizontal movement**



c.

5. Terrestrial radiation - Earth jo input radiation heat leti hai usse vapas environment ka temp increase karti he. Isse hi TR bolte hai.

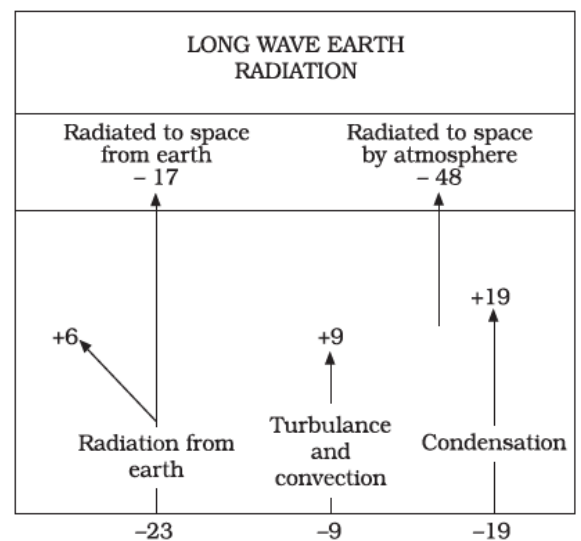
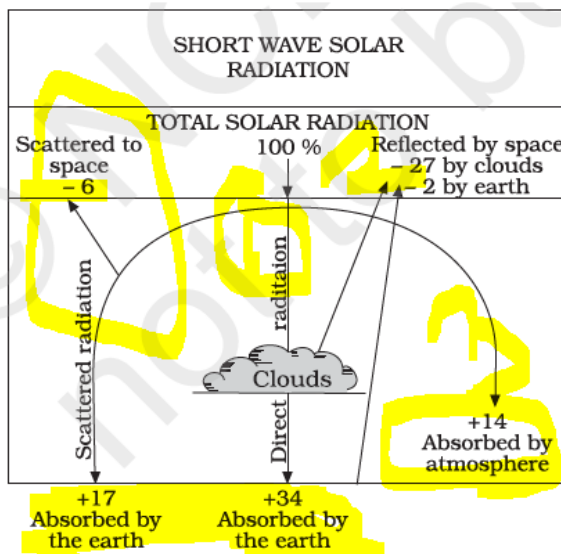
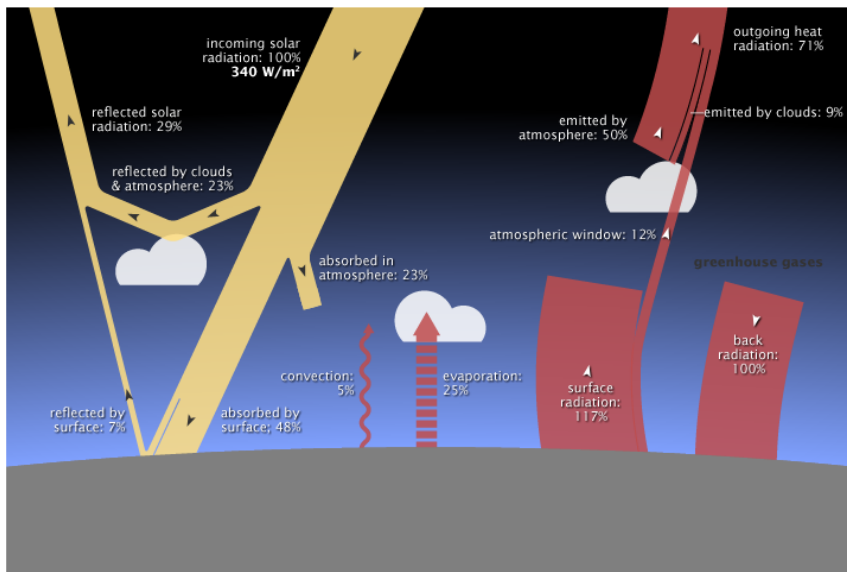


Figure 9.2 : Heat budget of the earth

- 6.
- 7. Incoming = $100 - 27 = 73 - 14 = 59 - 6 = 53 - 2 = 51$ (34 direct and 17 scattered).



- 8.
9. Variations in the net heat budget of the earth surface

Precipitation.

1. Measured by metal instrument Rain Gauge. Isohyet - places with the same mean annual rainfall.
2. The monsoons are experienced in the tropical area roughly between **20° N and 20°S**.
3. The differential **heating and cooling of land and water** creates low pressure(कम दबाव) on the landmass of India while the seas around experience comparatively **high pressure**.
 - a. The **shift** of the position of ITCZ in summer, over the Ganga plain (this is the equatorial trough normally positioned about 5°N of the equator. It is also known as the **monsoon trough(मानसून का गर्त)** during the monsoon season).
 - b. The presence of the **high-pressure area, east of Madagascar**, approximately at 20°S over the Indian Ocean. The intensity and position of this high-pressure area affects the Indian Monsoon.
 - c. The **Tibetan plateau gets intensely heated** during summer, which results in strong vertical air currents and the formation of low pressure over the plateau at about 9 km above sea level.
 - d. The movement of the westerly jet stream to the north of the Himalayas and the presence of the tropical easterly jet stream over the Indian peninsula during summer.
4. Journey of Monsoon in India
 - a. The monsoon arrives at the southern tip (**Malabar coast, मालाबार तट**) of the Indian peninsula generally by the first week of June. Subsequently, it proceeds into two – the Arabian Sea branch and the Bay of Bengal branch.
 - i. The Arabian Sea branch reaches Mumbai (**Konkan coast**)

about ten days later on approximately the 10th of June.

- b. The Arabian Sea and the Bay of Bengal branches of the monsoon merge over the **northwestern part of the Ganga plains**.
- c. Withdrawal or the retreat of the monsoon is a more gradual process (Not burst).
- d. The withdrawal(first time) of the monsoon begins in **northwestern states** of India by early September.
 - i. **The withdrawal from the southern half of the peninsula is fairly rapid.**
- e. The bulk of the rainfall of the **Coromandel Coast** is derived from the moisture brought by this setting in of **Northeast Monsoon(पूर्वोत्तर मानसून)**.

5. The advancing monsoon

- a. Mawsynram in the southern ranges of the **Khasi Hills** receives the highest average rainfall in the world.
 - i. **Mawsynram, the wettest place on the earth is also reputed for its** stalagmite and stalactite caves.
- b. Another phenomenon associated with the monsoon is its tendency to have '**breaks**' in rainfall. Thus, it has wet and dry spells. In other words, the monsoon rains take place only for a few days at a time. **They are interspersed with rainless intervals**. These breaks in monsoon are related to the movement of the monsoon trough.

6. For various reasons, the trough and its axis keep on moving northward or southward, which determines the spatial distribution of rainfall.

- a. When the axis of the monsoon trough (ITCZ) lies over the plains, rainfall is good in these parts. On the other hand, whenever the axis shifts closer to the Himalayas, there are longer dry spells in the plains, and widespread rain occur in the mountainous catchment areas of the Himalayan ® s. These heavy rains bring in their wake, devastating floods causing damage to life and property in the plains. The frequency and intensity of tropical depressions too, determine the amount and duration of monsoon rains. These depressions form at the head of the Bay of Bengal and cross over to the mainland.

7. The Retreating Monsoon ()

- a. While day temperatures are high, the nights are cool and pleasant. The land is still moist. Owing to the conditions of high temperature and humidity, the weather becomes rather oppressive during the day. This is commonly known as '**October heat**'.
- b. The bulk of the rainfall of the Coromandel Coast is derived from depressions and cyclones.

Wind direction and speed

1. About Winds

a. Anemometer measures the speed of wind.

i. Wind vane or weather cock measures the direction.

ii. Katabatic (Cold) अधोगामी

1. **Katabatic wind** (from the Greek: katabaino - to go down) is the generic term for downslope winds flowing from high elevations of mountains, plateaus, and hills down their slopes to the valleys or plains below

iii. **Anabatic winds (HOT)**

1. Anabatic Winds are upslope winds driven by warmer surface temperatures on a mountain slope than the surrounding air column.

2. Adiabatic process.

iv. Horizontal winds near the earth surface respond to the combined effect of three forces –

1. the pressure gradient force
2. the frictional force (1-3 km)- over the sea it is minimal.
3. Coriolis force (Ferrel's law):
 - a. It deflects winds towards the **right in the northern hemisphere** and towards the left in the southern hemisphere.
 - b. At the equator, CF is zero and the winds blow perpendicular to the isobars.
 - i. The low pressure gets filled instead of getting intensified. Therefore, Tropical cyclones are not formed near the equator
 - c. **Geostrophic wind(भूविक्षेपी वायु)**
 - d. Winds blow parallel to the Isobars as Coriolis force balances pressure gradient.

2. Planetary seasonal and local

a. **Planetary winds** - Is the combined form of general circulation of the atmosphere. **Factors responsible for its working are**

- i. Latitudinal variation of atmospheric heating
- ii. Emergence of pressure belts
- iii. Migration of belts following apparent path of the sun
- iv. The distribution of continents and oceans
- v. The rotation of earth (**Coriolis - Ferrel's law of attraction**).

b. Major Planetary winds

- i. NH