Backspace

UNIT-01

- Jacob Von Verkal introduce environment in ecology.
- Environment $\xrightarrow{\text{french word}}$ Environner (enclose, encircle, surround)

Environment

Physical | Social & cultural | Psychological

Segments of Environment –

① Atmosphere :- protective layer of gas surrounds the world.
- NO one Actually can never have much knowledge here :-

N_2 - 78%.	He - 0.0005%.		
O_2 - 21%.	CH_4 - 0.0002%.		
Ar - 0.93%.	Kr - 0.0001%.		
CO_2 - 0.036%.	H_2 - 0.00009%.		
Ne - 0.002%.	Xe - 0.000008%.		

② Hydrosphere :- water resources
- Ocean contain 97%. – Marine
- Polar icecaps & glaciers - 2%. – Fresh H_2O
- Only 1%. available as fresh water for human consumption

polar icecaps > glaciers

③ Lithosphere :- Outer mantle
- Minerals found in earth crust and soil, om, air & water.

④ Biosphere :- Living species
- their interaction with env, including atmo, hydro & litho.

Imp. of Environmental Studies

① Env issues are worldwide.
② Development & environment
③ Population Rapid Growth.
④ Need diff development approach.
⑤ Wise developmental Studies
⑥ Mishra report :–
- (i) Holism
- (ii) Ecosystem
- (iii) Succession
- (iv) Conversation.

- Mishra - Basic requirement
  - (i) Impact of human activities on env.
  - (ii) Value system
  - (iii) plan & design for sustainable development
  - (iv) Env. edu.

Scope :–

(i) Env R & D
(ii) Green Advocacy
(iii) Green marketing
(iv) Green media
(v) Env Consulting

DMCIT - (Do month continue
Imp topic)

Reductionism

Approach	key Idea
Disciplinary	- One subj. only
Intra d.	- within one discipline
Multi d.	- many disciplines, work separately
Cross d.	- One discipline viewed through another
Inter d.	- Discipline integrated
Trans d.	- Beyond disciplines, real world focus

Holism

Troposphere :-

- contain 80% mass
- 18 km - on equator,
  8 km - on pole
- All weather phenomenon
- Lapse rate
  - +ve LR
    - temp ↓ with height
    - Unstable
  - -LR
    - temp ↑ with H
    - stable
- Jet stream at tropopause, strong wind blows eastward.
- PBL :- planetary boundary layer, lowest layer of troposphere where wind is controlled by friction.
  - PBL < thinner → night / winter
    thicker → day / summer
- Mixing height

Stratosphere :-

- 19% mass
- 12 - 50 km
- 90% Ozone
- No weather phenomenon
- Air blows horizontally

- 1 Dobson = 1/100 mm
- UVA - 320 - 400 nm (Earth)
- UVB - 280 - 320 nm (some)
- UVC - < 280 nm (NO)

Mesosphere :-

- upto 80 km
- coldest
- protects from meteors as asteroids.

Thermosphere :-

- 85 - 500 km
- Hottest (He, O_2, N_2)
- Radio Broadcasting
- Aurora
  - Northern A. Borealis
  - Southern A. Australis
- Ionosphere - e⁻ charged particles

Exosphere :-

- 500 - 1000 km
- Escape into space
- Air is very thin,
- Lack of gravity
- satellites orbit of Earth.

Region	Altitude	Temp.	characteristics
Tropo	0-12 km	15 to -60	weather occurs
Strato	12-50	-60 to -2	Ozone layer
Meso	50-80	-2 to -100	Meteors burn
Thermo	> 80	-100 to 2000	Aurora, satellite, Ions & Radio occurs.

Temp :- Thermo > Tropo > Strato > Meso

Density & pressure ↓ with height - Tropo > strato > M >

- Heterosphere - stratified by molecular weight - O_2, O, H & H.
  - ↳ Above mesosphere
- Homosphere - Uniform mixing - N_2, O_2, Ar
  - ↳ Till mesosphere

Structure of Hydrosphere :-

Ocean - 97%.
polar ice caps & glacier - 2%.
only 1% available as surface water

Components :- (1) Oceans : size ↓
Pacific > Atlantic > Indian > Antartic > Arctic

(2) Freshwater : 2.5 - 3%
River, lakes, ponds & streams

(3) Glacial water (cryosphere) :
Glacier & ice tops - 70% of freshwater

→ Distribution of water on Earth :-
Ocean - 97%.
Ice caps & glacier - 2%.
Ground water - 0.6%.
Lakes - 0.01%.
soil moisture - 0.005%.
Atmosphere - 0.001%.
River - 0.0001%.
Biosphere - 0.00004%.

seawater composition :-
Cl > Na > SO_4^{-2} > Mg^{+} > Ca^{+2} > K^{+}
(Chl Na sath me calcium khayenge Bhai)

NOTE Salinity ↑ by evaporation & salinity ↓ by precipitation

Salinity levels :-
(1) Fresh water - <0.05%.
(2) Brakish - 0.05 - 3%.
(3) saline - 3-5%.
(4) Brine - >5%.

Seawater Residence Time :-
Chl Na Maggi sath calcium khayenge bhai
Cl > Na > Mg > SO_4 > Ca > K > HCO_3

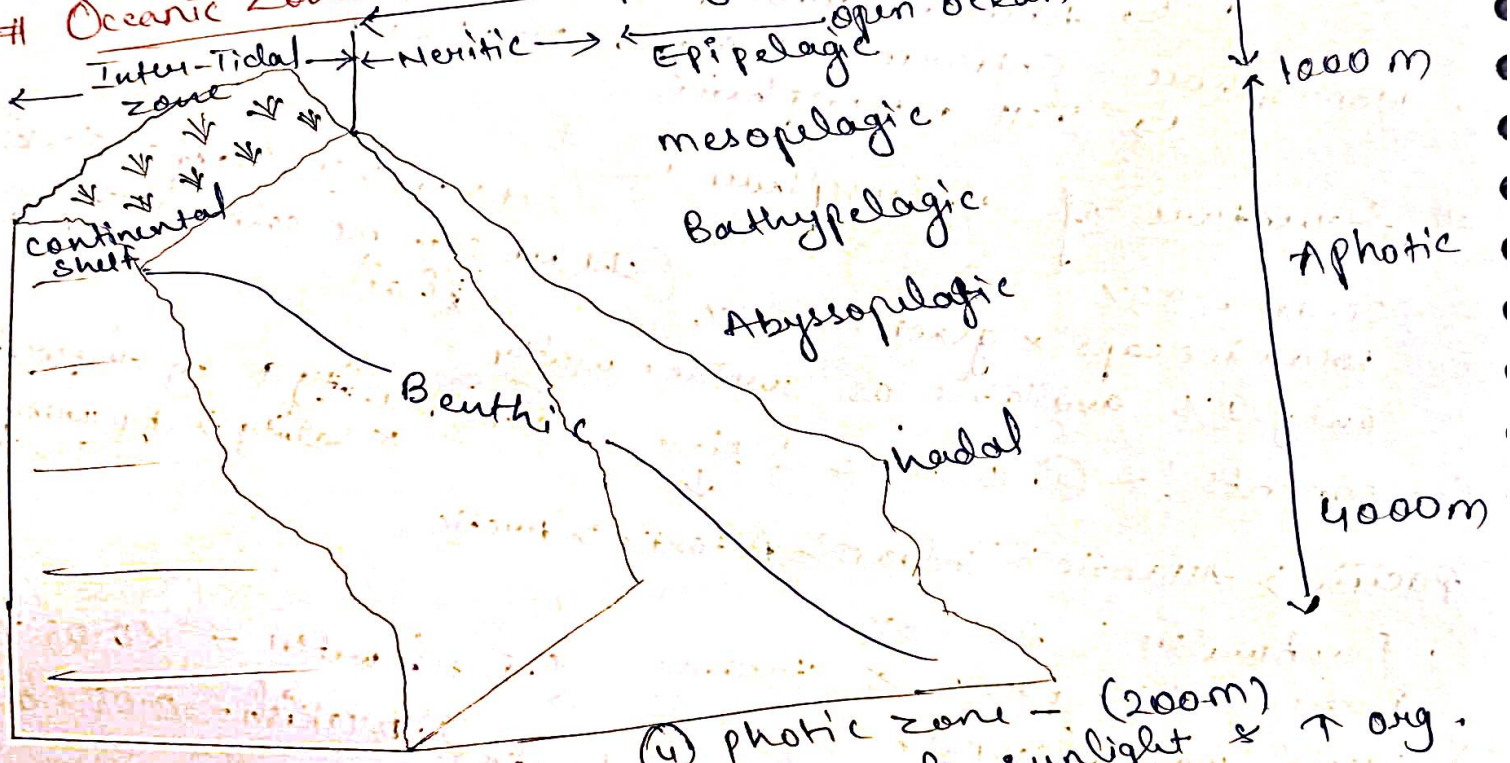
Conc. of Ions in River water :-
HCO_3 > Ca > SO_4 > Cl > Na > Mg > K

Salinity :-

1. Premium Bottled H_2O - 0.3%.
2. Tap water - 0.8%.
3. Baltic sea - 10%.
4. Normal open ocean - 33-38%.
5. Great salt Lake - 280%.
6. Dead sea - 330%.

Organisms
↓
population
↓
community
↓
Ecosystem
↓
Landscape
↓
Biome
↓
Biosphere → Ecosphere

Oceanic zones :-



1. Intertidal zone -
   - closest to shore
   - High tide - cover with H_2O
   - Low tide - ——— Air
2. Neritic zone -
   - Over continental shelf
   - Richest fishing ground
   - Rich Nutrient & sunlight
3. Ocean zone -
   - Open ocean
   - Lack Nutrient & Organism
   - Deep water
4. photic zone - (200m)
   - Enough sunlight & ↑ org.
5. Aphotic zone -
   - Not enough sunlight & org ↓
   - Below 200m.
6. Benthic zone -
   Ocean floor, Bottom dwellers.

Oceanic Land forms :-

- Seamount : Underwater volcanic mountains
- Guyots – flat-topped seamounts
- Island – landmass completely surrounded by water
- Ocean Trenches – Deepest part of Ocean
  e.g. : Mariana Trench
- Mid Ocean Ridge – Underground mountain chain formed by plate movement.
- Submarine canyons – Deep, narrow valley cut into continental shelf & slope under ocean.

Fresh water Bodies :-

→ Around 0.8%.

Lentic
↓
Standing water
(pond, pools, etc)

Lotic
↓
Moving water
(River, stream)

conc. :- $HCO_3 > Ca > SO_4 > Cl > Na > Mg > K$

Layers of Lakes :-

① Littoral – Top layer, near shore
- Enough sunlight
- Rooted & floating Aquatic flora

② Limnetic – Near top
- Sunlight enters
- planktons < Phyto Zoo
- fresh water fish ↑

③ Profundal –
- colder & denser
- little light penetrate
- Short lifespan

④ Benthic – Bottom
- Dwellers
- depend on dead & decay i.e. scavengers
- No light

Lakes :- On Nutrient Basis

(i) Oligotrophic :-
- Nutrient ↓,
- Productivity ↓
- clear water.

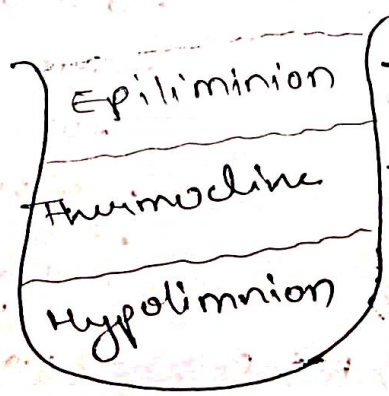
(ii) Mesotrophic :-
- B/w oligo & eutrophic

(iii) Eutrophic :-
- Nutrient ↑
- Bad water
- productivity ↑

(iv) Hyper Eutrophic
- Extreme Nutrient
- Human activity ↑

(v) Dystrophic Lake :-
- Accumulation of OM derived from outside Lake

Lake stratification :-



Summer: E - 22°C
T - 14°C
H - 10°C
↳ (strong) S.

Fall: E - 6°C
T - 5°C
H - 4°C

Spring: E - 6°C
T - 4°C
H - 5°C

Winter: E - 3°C
T - 4°C
H - 5°C
↳ (weak)

Stratification

6 common lake stratification:

① Amictic - No mixing
② cold monomictic - Once in summer
③ Dimictic lake - two Summer & winter
④ warm monomictic - Once in winter
⑤ Oligomictic - Occassionally
⑥ polymictic - Frequent mixing

② MANTLE:
- Mass - 68% of Earth
- Vol. - 84% of Earth
- ↑ Density
- Oxygen & Silicon is Abundant

Compositional layers:-
Crust - 0-100 km (silicates)
Mantle - 100-2900 km (silicates)
core - 2900-6370 km (NiFe)

Mechanical layers:-
Lithosphere - 0-100, (rigid)
Asthenosphere - 100-350 km (soft)
Mesosphere - 350-2900 (stiff plastic)
Outer core - 2900-5100 (liquid)
Inner core - 5100-870 km (solid)
Barysphere.

LITHO-SPHERE:- ① CORE:

→ Outer part of solid Earth.
→ It is bounded by atmosphere & Asthenosphere.

→ Oceanic
- Denser
- Mafic (rich in magnesium & iron) and ultramafic.
- Basalt (SiMa)
- Thinner
- i.e. 5 kms
- Dark colour.

→ Continental
- AKA crust
- Granitic rock i.e. SiAl
- Less dense
- cover 40% of Earth surface
- 70% of total Vol. of crust
- older
- 30 kms
- Light colour

③ CORE:-
→ NiFe (Iron > Nickel)
→ 3500 - 6000°C as hot as sun
→ densest layer

Note - Temp, pressure & density increase with depth from lithe to core.

* proportion of element in Earth:-
Fe > O > Si > Mg > Ni > Ca > Al

Abundance: O > Si > Al > Fe > Ca > Na > K > Mg

Discontinuity :-

① Conrad - b/w upper & lower crust
② Mohorovic - b/w crust & mantle
③ Repiti - b/w outer & inner mantle
④ Gutenberg - b/w mantle & core
⑤ Lehman - Outer & inner core

Meteorology :-

① Micro - <1km & few hours
e.g. smoke, dust, turbulence

② Meso - 1 - 1000 km & few days
e.g. land/sea breeze, Tornadoes.

③ Macro/synoptic - 1000 - 10,000 km
few weeks
e.g. cyclones, typhoons, Hurricanes

④ Planetary/Globally - >10,000 km & few months.
e.g. Monsoon, Elnino, Lanina, ITCZ.

Biosphere :-

- Zone of life, i.e. atmo + hydro + litho
- Sun - source of energy to sustain life
- Biosphere coined by Eduard Suess, 1875
- Prokaryotes - first terrestrial living forms, could exist without O_2
- Photosynthesis :-

$$CO_2 + H_2O \xrightarrow[\text{light}]{\text{sun}} \text{sugar} + O_2$$

- O_2 & other gases sustains life started to appear in earth.

+ As a result, Biosphere create a food chain.

Biosphere
- Abiotic
  - litho
  - atmo
  - hydro
- Biotic
  - producer
  - consumer
  - Decomposer

Food chain - series of Org. through which food energy flows in ecosystem.

Grasses → Grass → Frog → Snake
Grasses → hopper → Trophical level

= food chain

Types - ① Grazing food chain
② Detritus food chain

+ Energy flow is uni-directional.
Only 10% energy tran- for

Food web :-

Many interconnected food chains.
e.g. no. of option of eating & being eaten at each Trophic leve

Law of Thermodynamics :-

① zeroth law :- two bodies are in thermal equilibrium with third body, they are equilibrium with each othe

② first law :- Energy cannot be created or destroyed only transformed.

③ second law :- Entropy always increase

④ Third law :- At absolute zero (0K), entropy of perfect crystal is zero.

* Only 10% gasses and 90% loss.
* plant utilize only 1% during Photo-synthesis.

T. consumer 10 kcal (10%)
S. consumer 100 kcal (10%)
P. consumer - 1000 kcal (10%)
producer - 10,000 kcal (1%)
1,000,000 kcal of sunlight

Factors affecting Biosphere :-
(i) Earth tilting
(ii) Natural disaster
(iii) some smaller factor - erosion, etc.

Most abundant element within Biosphere :-
Trick - 'Hai KON calcium potassium"

H - 49%
C - 25%
O - 24%
N - 0.272%
Ca - 0.072%
K - 0.44%

NOTE :- Radioactive element - crust

Thermodynamics - Is a macroscopic Sci., deals with bulk system & does not deal with molecular constitution of matter

System - portion of universe which is under observation.
Surrounding - Everything else in universe except system
Universe = System + Surrounding
Energy, mass

	Energy	mass
Open	✓	✓
close	✓	×
Isolated	×	×

Thermodynamic process :-
the primary state variables are only defined when the system is at equilibrium with its surroundings.

Types :-
① Isothermal - constant temp. ex- Melting of ice
->Heat enter or exit system to maintain constant temp.
↳ Thermoflask, fridge cooling
② Adiabatic process - Involves no heat change
③ Isobaric - constant pressure
↳ Boiling water in open pan
④ Isochoric - constant volume
↳ Heating food in sealed cooker

Branches of Thermodynamics
(i) classical T. :- Macroscopic approach to analyze matter's behaviours.
(ii) statistical T. :- Every molecule is in spotlight, their interaction, behavior.
(iii) chemical T. :- work & heat interact during chemical reaction & changing states
(iv) Equilibrium T. :- How energy & matter change as they approach equilibrium

Heat transfer :-
occurs due to temp. diff.
① conduction - molecule to molecule transfer Heat (Solid)
② convection - By vertical movement (Liquid)
③ Advection - By horizonal movement en- ooo
④ Radiation - Energy transfer through air or space.

Mass and Energy Transfer :—

(Fick's law) ↓ (Fourier's law)

① Evaporation : water turns from liquid to vapour.

factors :- surface area ↑, temp ↑, humidity decrease, wind speed ↑ Results in ↑ Evaporation.

② condensation : ↑ vapor into liquid water.

Results in precipitation.

③ precipitation : clouds discharge water as rain, sleet, snow, hail.

- Drizzle — < 0.5 mm
- Rain — > 0.5 mm
- Snow — ice crystal
- Sleet — Frozen rain

Material Balance :—

Input = Output + Accumulation

Input → Generation, consumption → Output

+ Mixer - Multiple feed into one output

40g oil + 7g yeast + 500g flour + 3g salt + 375g water → mixer → 975g dough

+ Splitter - split into multiple streams

925g dough (90% dough, 10% flour) ← 325g dough (90% dough, 10% flour) + 600g dough (90% dough, 10% flour)

+ Separator - same as splitter but in diff proportion

925g dough (90% dough) ← 325g dough (75% dough, 25% flour) + 600g dough (98% dough)

+ Reactor :

dough → reactor → Bread

Meteorological parameter :

+ Atmospheric pressure :—

→ Instrument : Barometer

→ pressure ∝ 1/Height (due to gravity)

→ cause : Gravity, Altitude, temp. (pressure ↑ in cold air & vice-versa. Earth's rotation, solar heat

$P = \rho_{Hg} g h$

ρ_{Hg} = density of mercury

g = gravity

h = height

Barometric Law :—

~~$P(z) = P(0) e^{-z/H}$~~

$P_z = P_0 e^{-\frac{z}{H}}$

$P_0 = 10^5$ Pa

NOTE :- + Pascal - $1 N/m^2$

+ mm Hg - Mercury support in barometer

+ Torr - 1 mm Hg

+ Atm - 760 mm Hg

760 torr

1.013×10^5 Pa

101.3 KPa

14.700 PSi

+ 1 PSi = 6.89×10^3 Pa

ept of DO, BOD and
ion, pH and Redox
emical cycles –
Biochemical
Se), CO, O_3,
lorimetry,
, Flame
P-MS),

Humidity :– Amt of water vapour present in air.

Instrument – Hygrometer.

① Relative H :– $\frac{\text{water vapour at dew point}}{\text{water vapour capacity}} \times 100$

② Absolute H :– $\frac{\text{Mass of water vapour}}{\text{Volume of Air}}$

③ Specific H :– $\frac{\text{Mass of VP}}{\text{Mass of total air}}$

④ Mixing Ratio :– $\frac{\text{Mass of VP}}{\text{Mass of dry air}}$

⑤ Saturation mixing Ratio = $\frac{\text{Mass of VP for saturation}}{\text{Mass of dry air}}$

Relative humidity = $\frac{\text{Absolute Humidity}}{\text{Max. WP in air holds}}$

Mass Transfer :–

→ Advection :– Movement of mass ~~from an area of high conc.~~ due to bulk flow of a fluid.
e.g. chemical travelling down a river.

→ Diffusion :– Movement of mass from an area of high conc. to low conc.

→ Dispersion :– Spreading of mass caused by variation in fluid velocity.
ex. water moving faster in center of a pipe than at edges.

Fick's law
→ Mass Transfer
→ Conc. gradient
→ Diffusion coefficient

Fourier's law
→ Heat energy transfer.
→ Temp. gradient
→ Thermal conductivity

Lapse Rate :– change in temp while moving upward from troposphere.

* Adiabatic – where heat is neither added nor subtracted from system.

+ Diabatic – heat is added or subtracted

+ ELR – Actual air temp at any height in atmosphere
6.5°C per km

Atmospheric Stability :

① Unstable : Air is warmer & lighter than surrounding air.
Upar jayega → Unstable

② Stable : Air parcel is cooler & denser than surrounding air.
Sink downward → stable

③ Neutral : Air parcel has same temp & density as surroundings.
Neither sink nor rises

DALR – 9.8°C/km
MALR – 6.5°C/km
ELR – 5°C/km

Air T – Unstable
Air 2 – Stable

ELR > DALR - Unstable
ELR < DALR - Stable
ELR = DALR - Neutral
SALR < ELR < DALR - conditionally stable

Instrument - Thermometer
Measured in a stevenson screen to avoid direct sunlight.

Factors Affecting Temp :-
① Latitude ④ Ocean currents
② Altitude ⑤ cloud cover
③ Distance from sea

→ Ambient temp :- temp of surrounding air in a particular environment at given time

Vertual temp = Given temp + Mixing Ratio / 6

$$T_v = T + \frac{w}{6}$$

(OR)

$$T_v = T(1 + 0.61q)$$

q = Specific humidity

EMR : The sun emits is referred to as solar radiation.

Global solar radiation = Diffused + Direct

some are absorbed, scattered & reflected by : Air molecules, water vapour, clouds, Dust, pollutants, forest fires, volcanoes.

Instrument :
Pyranometer - Both direct & diffused.
pyrehelionometer - Only for direct.

Wind Rose : provide wind direction and speed at a specific place.
→ Length of each bar or spoke in circle indicates how frequently the wind blows from the direction it is pointing.

Megadiverse country :-
17 countries :-
US, India, China, South Africa, Brazil, Mexico, Madagascar, congo, Indonesia, Malaysia, Ecuador, Philippines, Venezuela, Peru, Colombia & Papua New Guinea.

10 Biogeographic Region :-
① Deccan plateau - 42%.
② semi Arid Region - 16.6%
③ Gangetic plains - 10.8%
④ Indian Desert - 6.6%
⑤ Himalayan - 6.4%
⑥ Trans-Himalayan - 5.6%
⑦ North East - 5.2%
⑧ western ghat - 4%.
⑨ coastal Region - 2.5%
⑩ Island - 0.3%.

Trick :- DO sow gav
Indian Himalaya Tak
Nahi western Coastal
Island tak hai

15 Agro-climatic zones of India :-

Zone	Location	Soil	Crops
• Western Himalayan	J&K, HP, Uttaralchand	Mountain soil	Apple, maize
• Eastern Himalayan	Sikkim, Arunachal P.	Forest soil	Tea, rice
• Lower Gangetic	West Bengal	Alluvial	Rice, jute
• Middle Gangetic	Bihar, East UP	—	wheat, Rice
• Upper Gangetic	West UP	—	Sugarcane, wheat
• Trans-Gangetic	Punjab Haryana	—	wheat, cotton
• Eastern plateau & hills	Odisha, C.G.	Red & Laterite	Rice, pulses
• central plateau & hills	MP	Black & Red soil	soybean & wheat
• Western plateau & hills	Maharastra	Black	cotton, jowar
• Southern plateau & hills	Karnataka, Telangana	Red	Millets, groundnut
• East coast plain & hills	TN & AP	Alluvial & Red	Rice, coconut
• West coast plain & Ghats	Kerala, Konkan	Laterite	spices, rubber
• Gujarat plain & Hills	Gujarat	Black	cotton, groundnut
• western Dry Region	Rajasthan	Sandy desert soil	Bajra, guar
• Island	Andaman & Nicobar, Lakshadweep	Laterite	coconut, spices

Sustainable Development :

→ Brundtland commission established by UN, 1983
→ Our common future
→ 1987 → Report
→ In 1992, UN conference on Env & dev. (Earth Summit) formed.
→ MDGs - 8 goals & SDGs - 17 goals
→ In 2002, Johannesburg declaration at Rio+10 Reviewed Earth sumit
→ In 2012, Rio+20 summit laid foundation for SDGs.

MDGs :- Every Amazing girl Read in college Every Day (2000-2015)

① Eradicte poverty & Hunger
② Achive primary Edu.
③ Gender equality
④ Reduce child mortality
⑤ Improve maternal health
⑥ Combate HIV/AIDS
⑦ Ensure Env. Sustainability
⑧ Develop glob global partnership

SDGs :- 2015-2030, 17 Goals
- Not legally binding
- Transforming our world.

① No poverty
② zero hunger
③ Good health
④ Quality Edu
⑤ Gender equality
⑥ clean water & sanitation
⑦ Affordable clean energy
⑧ Decent Job & employment
⑨ Industry & Innovation
⑩ Reduce inequality
⑪ Sustainable cities & construct
⑫ Responsible consumption & production
⑬ climate action
⑭ Life below water
⑮ Life on land
⑯ Peace & Justice
⑰ Global partnership.

4 : 9 : 4
Economy : society : Environment

5 P's :- People, planet, prosperity, Peace & partnership.

→ 10th Sustainable Development Report, 2025 - India Ranks 99th of 167 countries.

Environmental Ethics :-

→ Frontier Ethic -
- Earth has unlimited supply of Resources
- Anthropocentric
- Meant for human consumpti
- Human success is measured in terms of control over the natural world.

→ Sustainable ethic :-
- Earth has limited supply of resources.
- must conserve
- share with others.
- Growth is not sustainable
- Humans are part of Nature
- Human succeed best when they integrity & co-operate with nature.

→ Land Ethic :-

By Aldo Leopold, 1949.

→ He proposed including land in an ethical framework, which he termed the 'land ethic'.

- those who view soil as an item → grow like cabbages
- who see land as biota → grow tree which preserve ecosystem

→ "Anything is right when it tends to preserve the integrity, stability, & beauty of biotic community" otherwise wrong.

Qn. A sample of air has a relative humidity of 60%. Given that the saturation vapour pressure of water is 2260 Pa, calculated the VP of air at 20°C ?

$$RH = \frac{VP}{SVP} \times 100$$

$$VP = \frac{60 \times 2260}{100} = 1356 \text{ Pa}$$

Remote sensing :-

Without having to physically visit the location, determining physical characteristics.

NRSC - National RS centre

Responsible for data collection and processing, data distribution and disaster management support.

↳ It served as hub for hosting satellite data products from over 13 IRS satellites.

RRSCs - Regional RSC, they assist with a variety of RS duties both nationally & regionally.

* RS components :-

(1) Sensors :- device that is used to receive EMR from diff object & convert into signal that can be recorded & exhibited either in numerical data or image.

- Active: own source of light ex- LIDAR, Radar, Sounder, scatter and laser altimeter.
- Passive: light emitted by sun. ex- Radio Accelero-meter.

(2) Platform :- is sensor can

Types :- Ground level :- towers CCTV, & cranes

Aerial :- low & high altitude helicopter aircraft.

Spaceborne :- polar orbiting satellite, geostationary, space shuttles.

* Principles of RS :-

(i) Energy source or illumination.
(ii) Radiation and Atmosphere
(iii) Interaction with Target
(iv) Recording of energy by sensor
(v) Transmission, Reception & processing.
(vi) Interpretation & Analysis
(vii) Application

GIS :- framework for gathering managing and analyzing data.

discrete objects - House

continuous fields - rainfall amount or elevation.

data store

Raster

Vector

There are two principal data models for storing remotely sensed data :-

(i) Raster model - (where height) All types of aerial & imagery from active & passive sensors.
↳ 2D

(ii) point cloud model - Lidar data is only application.
↳ 3D

- Raster model is efficient manipulated as it is 2D.
- Data quality meets this dimensions - Accuracy, completeness, consistency, timeliness, validity and uniqueness, Lineage (or Linkage).
- Ground Truth Data :- Match the real & spatial data to authors AKA Reference and Ancillary data.

Orbit :-

① Geostationary orbits :
- commonly used for meteorological satellites → 36,000 km
- very high in sky with Earth's surface
- 24 hrs - revolution

② Sun synchronous / polar orbits :
- Env monitoring
- 300 - 1400 km above earth
- in 90 min of revolution.
- Ex - Radar sat, landsat, etc.

Softways :-

Open source
Freely available for both commercial & non commercial purpose.
ex - QGIS, Linux, Apache, wordpress, Drupal, Audacity, Libre office, Grass GIS, gvGIS, Open layer, SAGA GIS, ILWIS
- map server, Geo server, Post GIS, Leaflet, Erdas Imagine

closed source
paid ---
ex - windows OS, Adobe photoshop, iTunes, Microsoft office suite, Auto CAD, etc,

Band :-

primary - Tone / color
secondary - size, shape, Texture
Tertiary - pattern, hight, shadow
Higher - site, Association.

Resolution :-
No. of Pixel size results in clarity of data image.

4 types -

(i) Radiometric - sensitivity to intensity diff.
(ii) Temporal - frequency of data capture
(iii) Spatial - smallest detectable ground detail.
(iv) Spectral - Ability to distinguish wavelengths.