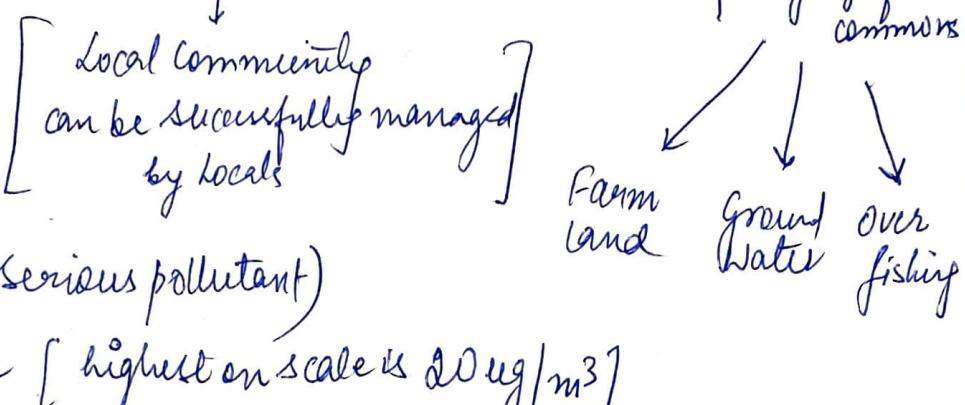


Ch - 1

Major Issues

- (1) Global Warming
- (2) Ozone layer depletion
- (3) Extinction
- (4) Pollution
- (5) Resource depletion

- * Worldwide Ban on CFCs → Montreal Protocol (1987)
- * Gases → HCFCs, CFC, Bromo-Methane, CCly
- * Tragedy of Commons: Grazing lands → Great Britain Ireland
- * 54% of India's Groundwater is decreasing
- * Elinor Ostrom → first woman to win Nobel Prize in Eco.



- * US → PM 2.5 (most serious pollutant)
- * upto 10 ug/m³ is safe [highest on scale is 20 ug/m³] (green)
- * New Delhi is most polluted city, WHO says India has 13/20. polluted cities
- * 6th mass extinction has begun
- * Charles David Keeling was a geochemist → instrument to take precise measurements of CO₂ in atm
Mauna Loa in Hawaii → world's longest cont. CO₂ measuring station away from the mainland. US → he took readings from 1957 to 1960
- * Inc of roughly 100 ppm of CO₂ in atm in 1957.
- * Latest Reading of CO₂ → 413.15 ppm.
- * Ice cores are cylindrical blocks dug out of permafrost -
- * Ice core drilling of atmosphere composition of planet → Can decipher amount of CO₂ in atmosphere
- * 7 ice ages so far
- * Too much CO₂ in past 8,00,000 years -

- * Ocean acidification has increased by 30 percent.
- * Temperature rises by 6 degrees.
- * Paris Climate Agreement COP21 signed in 2015, has ambition goal of keeping Global temp rise by 200 to below 2°C with aspiration to keep it below 1.5°C.

* Cities at risk from climate change → Miami
 → Lagos
 → Jakarta
 → New Delhi
 → Bagdad

Sustainable Development : Development that meets the needs of the present without compromising the ability of future generation to meet their own needs.

GDP : measures the monetary value of final goods and services produced in a country in a given period of time.

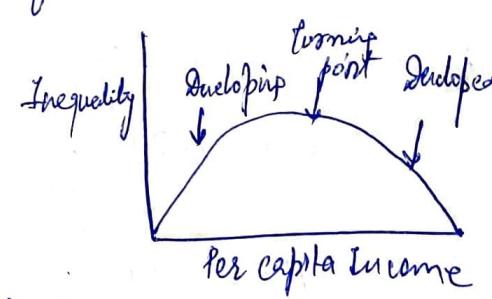
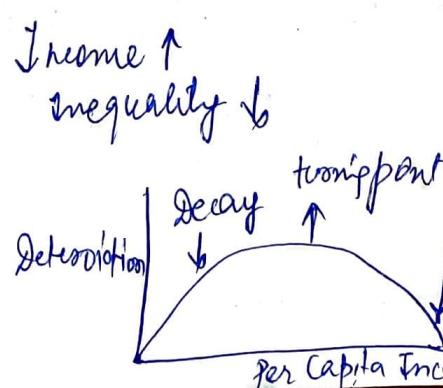
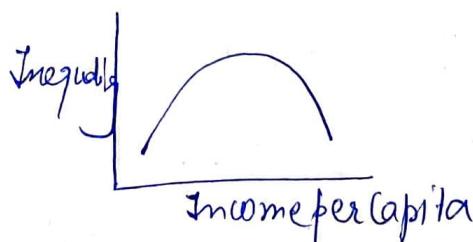
In our country development is measured in terms of GDP.

• RISING INCOME INEQUALITY [Economical Kuznets curve]
 • ENVIRONMENTAL DEGRADATION [Environmental Kuznets curve]

Relating growth and income distribution

Relating growth and environment

Simon Kuznets : First person to introduce Concept of GDP.



Ch-2

- Renewable Resources → DTEC, Solar, Wind, Geothermal, Biomass, Tidal, Hydro are examples of renewable energy.
- Non Renewable Resources → fossil fuels, natural gas, oil, and coal
- India has forest cover of 6,97,898 sq km (27.23%)
- Largest forest cover is in Madhya Pradesh > Assam > Chhattisgarh
- 3 types of Energy :
 - Renewable
 - Non Renewable
 - SustainableApprox usage in World : Oil 37%
coal 25%
gas 23%
- Coal was first fossil fuel to be used on industrial scale
- Tamil Nadu has highest of Wind power.
- 2 basic types of devices for solar energy → ① Solar thermal collectors
② Photovoltaic collectors
- For tidal energy height should be 5m or less of waves
- Hydro power is largest source of energy
- Biomass to Biogas → 65% CH₄, 30% CO₂
- NUCLEAR ENERGY is renewable and economic alternative for coal
 - It is an alternative to fossil fuels.
- Sustainable energy [Nuclear fission]
- Earth's 67% of surface is covered with water, Only less than 2.7% is freshwater
- Most is locked in ice caps and glaciers.
- Drought occurs when rainfall is less than 400 mm/year
- Ganga-Brahmaputra-Meghna carry about 60% of total river flow Assam, Bihar, ~~Uttarakhand~~ U.P → flood prone areas
- 16% of land area spread over 16 states is drought prone.
- Rainwater harvesting is a process of augmenting the natural filtration of rainwater into underground formation by some artificial methods

- 2 types of harvesting — surface run off
→ roof top ~~run off~~
- Waterman of India — RATENDRA SINGH
- Aravali River in Rajasthan → has a magic over 10 years,
- Interlinking Rivers project — aims to transfer water from surplus to deficit areas
- Iron, Aluminium, Zinc, manganese, copper are imp. raw materials for industrial use.
- Non-metal resources — coal, salt, clay, cement, silica
- India is world's largest producer of MICA

$\begin{matrix} 3^{\text{rd}} & \rightarrow \text{CHROMITE} \\ 2^{\text{nd}} & \rightarrow \text{COAL} \\ 4^{\text{th}} & \rightarrow \text{IRON ORE} \\ 6^{\text{th}} & \rightarrow \text{BAUXITE AND MANGANESE} \\ 2^{\text{nd}} & \rightarrow \text{CRUDE STEEL} \end{matrix}$

- Two types of Mining → Surface & Underground
 - Surface → $\begin{matrix} \text{Termal} \\ (\text{open}) \end{matrix}$
 - Underground → $\begin{matrix} \text{Shaft} \end{matrix}$

- Kudremukh & Kolar → mining ghost towns

- Factors controlling soil formation:
 - Parent material
 - Time
 - Climate [temp & precipitation]
 - Plants & animals
 - slope [flat terrain]

zones or layers of soil is called Horizons

O horizon → organic matter } topsoil

A horizon → organic and mineral }

C horizon → little organic matter → loss of nutrients
(leaching)

B horizon → zone of accumulation

C horizon → partly altered parent material

Eltuation : The movement of various dissolved or suspended chemicals downward through the soil due to movement of ground water

Types of Erosion:

- Sheet Erosion — loosened soil particles by overland flow
- Rill Erosion — when intensity of rain increases sheet flow begins to concentrate on land surface.
- Gully Erosion — when run off water accumulates

Bioremediation is a waste management technique that involves the use of organisms to remove or neutralize pollutants from a contaminated site

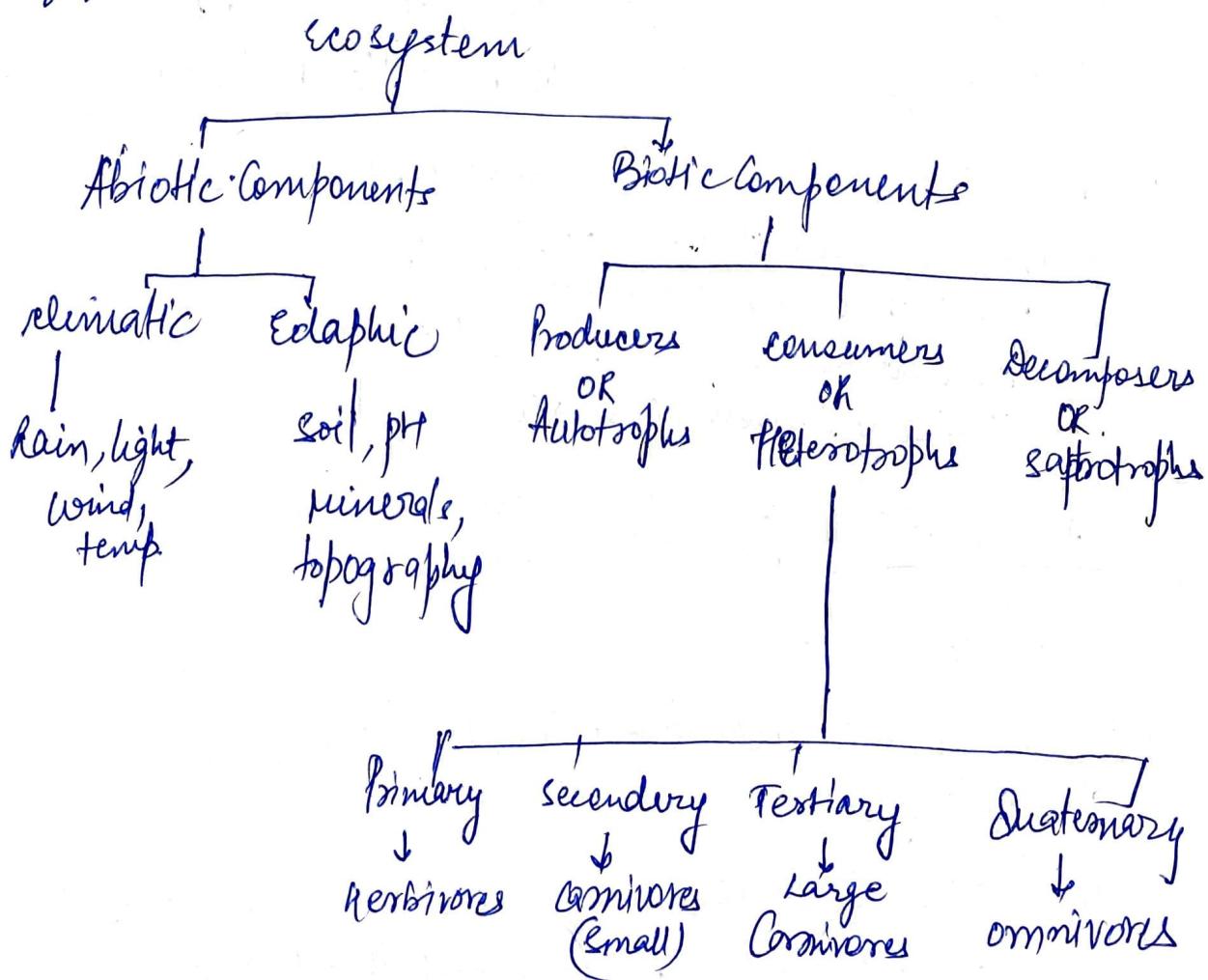
Ch-3

Ecology is the study of habitation. [Ernest Haeckel in 1886]

OR
scientific study of relationship of living organisms with each other and with their environment.

Ecosystem → Abiotic + Biotic

Biome → A large ecosystem like a forest or an ocean where large numbers of flora and fauna live in their environment.



- Ecological niche → An ecological niche is the match of a species to a specific environmental condition
 - Waders are type of birds which wade into water to get food from the mud/sand underneath.
 - Flamingoes → ~~filter feed~~, dabbling ducks feed by flipping, Avocets feed on insects.
 - Waders belongs to one family but have different ecological niche
 - Energy flows in one direction, Earth is a closed system
(matter can not escape from its boundaries)
- Biogeochemical cycle : (biological, geological, chemical)
Includes. Water Cycle, Carbon Cycle, Oxygen Cycle, Nitrogen cycle, Phosphorous cycle)

→ Food chain : Producers + consumers + decomposers
 ↳ [show energy transfer]

→ Interconnected food chain is called food web

→ ~~1 2 3~~ 1st level > 2nd level > 3rd level 3 law of conservation of energy

→ Trophic level is a position occupied by organism in food chain
→ Producers are at Base → 1st level
Primary consumers → 2nd level
Secondary consumers → 3rd level
Tertiary consumers → top level

Biomass

- more at producers
- less at consumers

↓
Weight of living things

- Biodiversity is total of species, populations, communities, and ecosystems.
- Holdridge life zones encapsulates the amount of life present in various ecosystems. (Grasslands & Pelagic zone of Oceans)

- India is home to 33% of life forms, 8% biodiversity, 2% land area
- 60% of this wealth is found in Western Ghats
- Natural systems provide society with many goods and services (Pollination, flood control, Non-timber forest, Raw materials, Recreation)
- Timber (200 billion USD)
- Effect of climate change - temporal trophic mismatch
- International Union for Conservation of Nature (IUCN) Red List founded in 1964

(EX) (EW) (CR) (EN) (VU) (CD) (NT) (LC)
 Extinct Threatened Lower risk

- Biodiversity
 - In-situ (on site / original habitat)
 - ex-situ (off site / built habitat)
 - eg - botanical gardens, zoos, aquaria

- Svalbard Global Seed Vault is an underground secure seed vault on an isolated island in Norway → No absolute loss
- Chang La Gene Bank, Leh; second largest seed bank

Ch-4

- Types of pollution - Air, Land, Nuclear, Water, Noise pollution
- Air pollution is measured in terms of (SPM), Nitrogen Oxide & Sulphur Dioxide.
- Particle size vary from 0.5 microns to 100 microns in atmosphere

Primary pollutant : Ash from Volcano
Carbon monoxide from motor Vehicle

Secondary pollutant : Ground level Ozone → makeup photochemical smog

Sulphur oxides (SO_2) is emitted from burning of coal & oil (NO_2). → high temp combustion -

CO_x → emitted from combustion and respiration

CO → incomplete combustion of fuel such as Natural gas, coal or wood.

PM → smoke and dust

VOC → volatile organic Compounds → Hydrocarbon fuel vapors and solvents,

CFCs → harmful to ozone layer emitted from products.

NH_3 → emitted from agricultural process

Toxic metals - lead, copper, cadmium.

Radioactive Pollutants

Secondary pollutants : Particulate matter formed from smog. NO_2 , O_3 from NO_x and VOCs
PAN (Peroxyacetyl Nitrate) from NO_x and VOC_x

Land pollution → ② types

Solid waste soil pollution

Nuclear pollution

high level waste low level waste

[spent fuel rods]

[clothing, syringe, needle,]

Nuclear pools are 12 m deep, water cools the fuel and provides radiological protection shielding from their radiation

- PH value acceptable (6.5 - 8.5)

Noise level chart

150 decibels	- Jet take off
140	- Gun shot
130	- Jack hammer, Rock concert
120	- Car stereo
110	- Headphones
100	- Factory
90	- Subway
80	- Busy street
70	- Restaurant
60	- Conversation

SION flyover. [sound barriers attached to avoid the sound of traffic to enter the hospital]

- Damage by Noise pollution → death of certain species of beached whales, due to Military SONAR

Ch- 5

- * The department of Environment was established in 1980 (later C. Ministry of Environment & Forests in 1985)
- * Environment Protection Act, 1986. [umbrella legislation]
Handling and management of Hazardous Wastes rules in
- * Article 51A (g) (Fundamental duties) → imposes responsibility 1989 on every citizen to protect wildlife
- * Article 21. Protection of life and personal liberty
- * 42nd Amendment Act → changes in seventh schedule of constitution.
- * The Indian Forest Act, 1927 deals with 4 Categories of

- forests.
- (1) Reserve forest
 - (2) Village forests
 - (3) Protected forests
 - (4) Vengant forests

- Factories Act of 1948 (passed after Bhopal Gas Tragedy)
- Atomic Energy Act, 1962 and Radiation protection Rules of 1971 governs the regulation of nuclear energy
- Insecticides Act, 1968 → to implement recommendations of Kerala and Madras Food-Poisoning Cases Inquiry
- Insecticide rules of 1971 prescribed procedure for licensing
- Wildlife Protection Act - 1972
- Water (Prevention and Control of pollution) Act 1974
- Water Cess Act was passed to meet the expenses of central & state Water Boards.
- Forest Conservation Act - 1980
- Air Preservation and Control of pollution Act 1981
- Environmental Protection Act 1986
- The manufacture, storage, import of Hazardous Chemicals
- The Public Liability Insurance Act and Rules and Amendment 1989.
- National Environmental Tribunal Act - 1995
- The Biomedical waste Rules, 1998
- The Environment Siting (for Industrial Projects) - 1999
- The municipal solid waste (management & handling), 2000
- Ozone Depleting Substances. - 2000
- The Batteries Rules - 2001
- The Noise Pollution (Amendment) - 2002
- The Biological Diversity Act 2002
- Easement Act - 1882
- The Indian Fisheries Act 1897
- The River Boards Act, 1956
- The Merchant Shipping Act 1970

- The Coast Regulation Zone Notification. 1991
- The Motor Vehicles Act, 1988
- The National Green Tribunal Act 2010

Violation of Penalties Under the Act

- Prison up to 5 years or fine upto Rs 1 Lakh or Both
Addition of 5000 for every day continuing Violation

PUBLIC INTEREST LitIGATION

- EIA (Environmental Impact Assessment) is a management tool for ensuring optimal use of natural resource for Sustainable development.
- MoEF modified new EIA in Sep 2006
- Step Involved
 - (1) Screening
 - (2) Scoping
 - (3) Public consultation
 - (4) Appraisal
 - (5) Post Monitoring
- The Central Pollution Control Board (CPCB) was constituted in 1974 under Water Prevention & Control Act. Further it was entrusted with powers and functions under Air (Prevention and Control) Act 1981
- Central & State Pollution Board

Ch-6

Natural Disaster

Meteorological
Topographical
Environmental

Man-Made Disaster

Technological
Industrial
Warfare

- 4 types of Disasters - ① Natural ② Technological
③ Terrorist ④ Pandemic
- Nuclear reaction malfunction, largest uncontrolled release of radioactive materials.
↓
April 1986 [Chernobyl, Ukraine]
- Bhopal Gas Tragedy (Dec 3, 1984)
- Terrorist group Al-Qaeda (Sep 11) → US, Town square
- Early Warning System
 - (1) DART (Deep Ocean Assessment and Reporting System for Detection of Tsunami)
 - (2) Earthquake early Warning System
- Disaster management Cycle → Prevention
Mitigation
Preparedness] Pre disaster phase
- Relief
Recovery
Rebuilding] Post disaster phase
- NDRF: National disaster response force [2005]
- GIS is a tool that allows users to create interactive queries analyze spatial information, edit data, map

Nodal Agencies for Disasters

Natural - Agriculture

Air accidents - Civil Aviation

Civil strife - Home Affairs

Railway accidents - Railways

Chemical - Environment

Biological Disaster - Health & Farm Welfare

Nuclear accident - Atomic Energy

Nodal Agencies for Forecasting & Early Warning

Cyclone - Indian Meteorological Department

Tsunami - Indian National Centre for Oceanic Info

Earthquake - Indian Meteorological Department

Floods - Central Water Commission

Landslides - Geological Survey of India

Avalanche - DRDO

Chemicals

• Arsenic - Causes Cancer, circulatory problems

• Lead - heart disease

• Benzene - Leukemia

• Chromium - -

• Toluene - damages Central Nervous System

• Cadmium - -

• Zinc - harms aquatic life

• Mercury - Brain damage, kidney, Immune issues

• Pesticides - Neurological & Reproductive disorders

• E-Waste - Affects food chain