OAS ଅର୍ଥାତ୍
Study OAS
For A Better Odisha

Pocket Notes

ENVIRONMENT

For OPSC, OSSC & Other
State Level Exams.
Last Minute Revise

Index

33. Carbon Market
34. Carbon Sink
35. Types of Hydrogen (Grey, Blue, Green, etc.)
36. UNFCCC
37. Kyoto Protocol
38. Earth Summit (Rio 1992)
39. Global Environment Facility (GEF)
40. IPCC
41. Paris Agreement
42. International Solar Alliance (ISA)
43. Stockholm Conference (1972)
44. Nairobi Declaration (1982)
45. Brundtland Report (1987)
46. Convention on Biological Diversity (CBD)
47. Cartagena Protocol
48. Nagoya Protocol
49. CITES
50. UN Convention to Combat Desertification (UNCCD)
51. Vienna Convention
52. Montreal Protocol
53. Kigali Amendment
54. Ramsar Convention
55. Montreux Record
56. Basel Convention
57. Minamata Convention

Environment & Ecology

1. Environment

- Everything that surrounds an organism → **biotic (living) + abiotic (non-living)**.
- Components: **Lithosphere (land), Hydrosphere (water), Atmosphere (air), Biosphere (life zone)**.
- Functions: Provides resources, assimilates waste, sustains life.

2. Ecology

- **Study of interactions** among organisms & between organism–environment.
- Term coined by **Ernst Haeckel (1869)**.
- Levels of organisation:
  - Individual → Population → Community → Ecosystem → Biome → Biosphere.
- Branches:
  - **Autecology:** Study of single species.
  - **Synecology:** Study of communities.

3. Holism

- Coined by **Jan Smuts (1926)**.
- Concept: "Whole is greater than sum of parts."
- In ecology → ecosystems & environment must be studied as an **integrated whole** (not in isolation).
- Contrast: **Reductionism** = studying parts individually.

4. Ecosystem

- Functional unit of nature → community of organisms + physical environment, interacting through energy flow & nutrient cycles.
- **Types:**
  - **Natural:** Forest, grassland, desert, aquatic.
  - **Artificial:** Cropland, aquarium.
- **Structure:**
  - **Biotic:** Producers (plants), consumers (herbivores, carnivores, omnivores), decomposers (fungi, bacteria).
  - **Abiotic:** Light, temp, water, nutrients.
- **Functions:**
  - Energy flow (unidirectional – Sun → Producers → Consumers → Decomposers).
  - Nutrient cycling (biogeochemical cycles: carbon, nitrogen, phosphorus).
  - Ecological balance & productivity.

Food Chain & Food Web

Food Chain

- Sequential transfer of energy from producers → herbivores → carnivores → decomposers.
- **Types:**
    1. **Grazing food chain:** Starts with plants (Grass → Deer → Tiger).
    2. **Detritus food chain:** Starts with dead matter (Leaf litter → Earthworm → Bird).
- **Features:**
    - Always straight, single pathway.
    - Short chains more stable (energy loss at each level).

Food Web

- Interconnected food chains in an ecosystem.
- **Significance:**
    - Provides stability to ecosystem.
    - Alternative energy pathways.
- Example: In a forest, deer, rabbit, and goat feed on plants; tiger, lion, and wild dog feed on them.

Biotic Interactions

Positive Interactions

1. **Mutualism (+/+)** → Both benefit.
    - Eg: Pollination (bees & flowers).
2. **Commensalism (+/0)** → One benefits, other unaffected.
    - Eg: Orchid on tree, barnacles on whale.
3. **Protocooperation (+/+)** → Both benefit but non-obligatory.
    - Eg: Cattle egrets & grazing cattle.

Negative Interactions

1. **Parasitism (+/–)** → Parasite benefits, host harmed.
    - Eg: Malarial parasite in humans, Cuscuta on plants.
2. **Predation (+/–)** → Predator kills & eats prey.
    - Eg: Lion & deer.
3. **Amensalism (0/–)** → One harmed, other unaffected.
    - Eg: Penicillium secretes antibiotic killing bacteria.
4. **Competition (–/–)** → Both species harmed (fight for same resource).
    - Eg: Tiger & lion competing for prey.

Ecological Pyramids

- Graphical representation of trophic structure in ecosystem (Elton, 1927).
- **Types:**
    1. **Pyramid of Number:** Number of organisms at each trophic level.
        - Upright (Grassland: Grass → Grasshopper → Frog → Snake → Hawk).
        - Inverted (Tree ecosystem: Tree → Birds → Parasites).
    2. **Pyramid of Biomass:** Biomass at trophic levels.
        - Upright (Forest).
        - Inverted (Aquatic, since phytoplankton biomass < zooplankton).
    3. **Pyramid of Energy:** Flow of energy (always **upright** due to 2nd law of thermodynamics).

Note: Energy pyramids are always upright; number & biomass may be inverted.

Bioaccumulation

- Gradual buildup of non-biodegradable pollutants (like pesticides, heavy metals) in an organism's tissues.
- **Occurs at:** Organism level.
- **Examples:**
    - Mercury accumulation in fish.
    - Lead in human bones.

Biomagnification

- Increase in concentration of toxic substances as they move up the **food chain**.
- **Occurred at** Ecosystem level across trophic levels.
- **Examples:**
    - DDT concentration higher in predatory birds → eggshell thinning.
    - Mercury from water → fish → humans.

Bioaccumulation vs Biomagnification

Feature	Bio accumulation	Bio magnification
Level	Within an organism	Across food chain
Cause	Repeated intake	Transfer through trophic levels
Example	Mercury in fish	DDT in birds through aquatic chain

Ecological Succession

- Gradual, predictable change in species composition of a community over time.
- **Types:**
  - **Primary Succession:** On bare areas (rocks, sand, newly formed ponds). Starts with pioneer species (lichens, algae).
  - **Secondary Succession:** On previously inhabited but disturbed areas (abandoned fields, burnt forests). Faster than primary.
- **Stages (Seral Stages):**
  - **Pioneer Stage** – first colonisers (lichens, mosses).
  - **Intermediate Communities** – herbs, shrubs.
  - **Climax Community** – stable, self-sustaining, in equilibrium with climate.
- **Pathways:**
  - **Hydrarch (Hydrosere):** Starts in water → climax forest.
  - **Xerarch (Xerosere):** Starts in dry habitat → climax forest.
- **Laws:** Directional, orderly, leads to stability & higher biodiversity.

Nutrient (Biogeochemical) Cycles

1. Carbon Cycle

- Source: Atmosphere (CO_2).
- Fixation: Photosynthesis.
- Return: Respiration, decomposition, combustion, volcanic eruptions.
- Major sink: Oceans, forests.
- Imbalance → Global warming.

2. Nitrogen Cycle

- Steps:
  - **Fixation:** Atmospheric N_2 → Ammonia (by Rhizobium, lightning).
  - **Nitrification:** Ammonia → Nitrites → Nitrates.
  - **Assimilation:** Plants absorb nitrates.
  - **Ammonification:** Dead matter → Ammonia.
  - **Denitrification:** Nitrates → N_2 (by Pseudomonas).

3. Phosphorus Cycle

- Source: Rocks (weathering).
- No significant gaseous phase.
- Absorbed by plants → animals → returned via decay.
- Limiting factor for productivity in ecosystems.

4. Water (Hydrological) Cycle

- Processes: Evaporation → Condensation → Precipitation → Runoff → Infiltration.
- Driven by solar energy.

Aquatic Ecosystem, Coral Reefs & Mangroves

Aquatic Ecosystem

Life exists not only on land but also in water. Aquatic ecosystems are broadly of two types: **freshwater** (ponds, lakes, rivers, wetlands) and **marine** (oceans, estuaries, coastal waters).

- **Freshwater systems** support fishes, amphibians, aquatic plants, plankton, and provide vital resources like drinking water and irrigation.
- **Marine systems** are larger and more stable, influencing global climate and nutrient cycles. They house plankton at the base of the food chain and larger species like whales and dolphins.
- Both are critical for oxygen production (phytoplankton produce nearly 50% of global oxygen) and for regulating temperature.

Coral Reefs

Called the **"rainforests of the sea"**, coral reefs are among the most diverse ecosystems. They are built by tiny animals called **coral polyps**, which secrete calcium carbonate to form hard skeletons.

- **Types:** Fringing reef, Barrier reef, Atoll.
- **Conditions:** Warm shallow water (20–30°C), clear sunlight, salinity ~27–40 ppt.
- **Importance:**
  - Protect coasts from erosion.
  - Provide livelihood (fisheries, tourism).
  - Store immense biodiversity.
- **Threats:** Coral bleaching due to rising sea temperature, ocean acidification, pollution, overfishing.
- **India:** Major reefs at **Gulf of Mannar, Lakshadweep, Andaman & Nicobar Islands**.

Mangroves

Mangroves are salt-tolerant trees and shrubs found in intertidal coastal zones. Their stilt roots and pneumatophores (breathing roots) make them unique survivors in brackish water.

- **Functions:**
  - Buffer against cyclones and tsunamis.
  - Prevent coastal erosion.
  - Nursery grounds for fish and crustaceans.
  - Carbon sinks (blue carbon ecosystem).
- **India:** Largest mangrove forest = **Sundarbans (UNESCO World Heritage Site)**; also found in **Mahanadi delta (Odisha), Godavari-Krishna, Andaman-Nicobar**.
- **Threats:** Shrimp farming, coastal development, rising sea levels.

Wetland Ecosystem

Wetlands are those transitional zones where land and water meet, creating unique ecosystems rich in biodiversity. They may be **natural** (lakes, marshes, floodplains, estuaries) or **man-made** (reservoirs, tanks).

- **Functions:**
  - Act as **"kidneys of the landscape"** by filtering pollutants and recharging groundwater.
  - Control floods by absorbing excess water.
  - Provide breeding grounds for fish, migratory birds, amphibians.
  - Store carbon, helping in climate regulation.
- **Threats:** Encroachment, drainage for agriculture, industrial effluents, invasive species.
- **India:**
  - Ramsar Convention (1971) protects wetlands of international importance.
  - As of 2023, India has **75 Ramsar sites** (largest in Asia).
  - Examples: Chilika Lake (Odisha), Keoladeo (Rajasthan), Loktak Lake (Manipur), Vembanad (Kerala).

Terrestrial Ecosystem

These are ecosystems found on land. They are influenced by factors like rainfall, temperature, and soil, leading to different biomes.

- **Major Types:**
    1. **Forest Ecosystem** – tropical rainforests, deciduous, coniferous; high biodiversity, carbon sinks.
    2. **Grassland Ecosystem** – savannas, prairies; dominated by grasses; support grazing animals.
    3. **Desert Ecosystem** – hot (Thar) and cold (Ladakh); scarce rainfall, drought-adapted plants (xerophytes) and animals.
    4. **Mountain Ecosystem** – Himalayas, Western Ghats; altitudinal variation → alpine meadows, temperate forests.
- **Functions:**
    - Provide food, timber, medicines, ecosystem services.
    - Regulate global climate and water cycle.
    - Support diverse cultures and livelihoods.
- **Threats:** Deforestation, mining, agriculture expansion, urbanisation, forest fires.

Biodiversity

Levels of Biodiversity

Biodiversity simply means the variety of life on Earth. It exists at three interrelated levels:

1. **Genetic Diversity**
    - Variation in genes within a species.
    - Ensures adaptability and resilience.
    - Eg: Different varieties of rice or wheat in India.
2. **Species Diversity**
    - Variety of species within a habitat or region.
    - Measured by **species richness** (number of species) and **species evenness** (distribution of individuals).
    - Eg: Western Ghats have high amphibian diversity.
3. **Ecosystem Diversity**
    - Variety of ecosystems or habitats in a given region.
    - Eg: Himalayas (alpine meadows), Rajasthan (deserts), Sundarbans (mangroves), Chilika (wetland).

Measurement of Biodiversity

Scientists use different indices to measure biodiversity because it is not just about counting species but also about their relative abundance.

- **Species Richness** → Number of species present in a community.
- **Species Evenness** → How evenly individuals are distributed among species.
- **Alpha Diversity** → Diversity within a habitat (e.g., a single forest patch).
- **Beta Diversity** → Diversity between two habitats (e.g., forest vs grassland).
- **Gamma Diversity** → Overall diversity at regional/global level.
- **Shannon Index / Simpson's Index** → Statistical measures combining richness & evenness.

Biodiversity Conservation – Strategies

Conservation means protecting and managing biodiversity so that it is available for present and future generations. Broadly, two complementary strategies are followed:

1. In-situ Conservation (On-site, natural habitat)

This is the best way to conserve species within their natural ecosystem, allowing them to interact, evolve and adapt.

- **Biosphere Reserves** → Large areas protecting ecosystems & genetic resources (e.g., Nilgiri, Simlipal, Sundarbans).
- **National Parks** → Strict protection; no human activity (e.g., Kaziranga, Gir, Nanda Devi).
- **Wildlife Sanctuaries** → Protection with some human activity allowed (e.g., Chilika, Bhitarkanika).
- **Reserved & Protected Forests** (under Indian Forest Act).
- **Sacred Groves** → Community-protected forest patches with rich biodiversity (e.g., Khasi Hills, Meghalaya).

Benefit: Maintains ecological processes naturally.
It cannot cover all species, especially small populations.

2. Ex-situ Conservation (Off-site, outside natural habitat)

Here species are conserved in controlled settings, useful for critically endangered species.

- **Botanical Gardens** → Cultivation & research of plant diversity (e.g., Indian Botanical Garden, Howrah).
- **Zoological Parks** → Captive breeding & education (e.g., Nandankanan Zoo, Odisha).
- **Seed Banks / Gene Banks** → Preserve genetic material (e.g., National Bureau of Plant Genetic Resources, Delhi; Svalbard Global Seed Vault).
- **Cryopreservation** → Storage of gametes/embryos at ultra-low temperature.
- **Tissue Culture & Micropropagation** → Rapid multiplication of rare plants.

Merit: Vital for species on the brink of extinction.
Limitation: Expensive, doesn't preserve natural interactions.

India's Legal & Policy Support

- **Wildlife Protection Act, 1972** (amended).
- **Biological Diversity Act, 2002.**
- International: **CBD (1992), CITES, Ramsar Convention.**

Ozone Hole

- **Ozone layer** in the stratosphere (15–35 km) shields Earth from harmful UV-B rays.
- **Ozone hole** = Severe thinning of ozone, especially over Antarctica (spring season).
- Caused by **CFCs, Halons** releasing chlorine & bromine that destroy ozone molecules.
- **Effects:** Skin cancer, cataracts, reduced crop yield, weakened immune system.
- **Response:** Montreal Protocol (1987) – global agreement to phase out ozone-depleting substances; India a party.

Polar Vortex

- A **large area of low pressure & cold air** around both poles, strongest in winter.
- In stratosphere, weak vortex allows mixing of ozone-depleting chemicals, enhancing ozone hole formation over Antarctica.
- Recently, polar vortex disruptions also linked to extreme weather events (cold waves in North America, Europe).

Ocean Acidification

- Oceans absorb ~30% of atmospheric CO_2 → reacts with water → forms carbonic acid.
- Lowers **pH of ocean water** (pre-industrial: 8.2 → now ~8.1).
- **Impact:**
  - Dissolves calcium carbonate → threatens corals, shellfish, plankton.
  - Disrupts marine food chains and fisheries.
- Called **"evil twin of global warming."**
- India: Coral reefs (Andamans, Lakshadweep, Gulf of Mannar) most vulnerable.

Acid Rain

- Rainfall with pH < 5.6 due to atmospheric pollution.
- Formed by **SO_2 & NOx** (from industries, vehicles, power plants) mixing with water → sulfuric & nitric acids.
- **Effects:**
  - Damages crops, forests, aquatic life.
  - Corrodes monuments (e.g., Taj Mahal – "marble cancer").
- **Control:** Shift to low-sulfur fuels, scrubbers, renewable energy.

Environmental Pollution

1. Primary Pollutants

- **Directly emitted** from a source into the atmosphere.
- Examples:
  - CO (vehicles, incomplete combustion).
  - SO_2 (thermal plants).
  - NO (fossil fuel burning).
  - Particulate matter (construction, industries).
  - Lead, ammonia.
- **Effect:** Immediate impact on air quality.

2. Secondary Pollutants

- Not emitted directly; formed by **chemical reactions** of primary pollutants in the atmosphere.
- Examples:
  - Ozone (O_3) in troposphere (from NOx + hydrocarbons in sunlight).
  - Smog (photochemical: NOx + VOCs + sunlight).
  - PAN (Peroxyacetyl nitrate).
  - Sulfuric acid & nitric acid (acid rain).
- **Effect:** Often more harmful than primary pollutants.

3. Biodegradable Pollutants

- Broken down naturally by microorganisms (bacteria, fungi).
- Impact is temporary if load is small.
- Examples: Sewage, food waste, cow dung, paper, agricultural residues.
- **Risk:** Excess load → water pollution, eutrophication.

4. Non-Biodegradable Pollutants

- Cannot be decomposed naturally; persist for long periods.
- Undergo **bioaccumulation** and **biomagnification** in food chains.
- Examples: Plastics, DDT, heavy metals (mercury, lead, cadmium), radioactive waste.
- **Risk:** Chronic health hazards, long-term ecological damage.

Types of Pollution

1. **Air Pollution**
   - Pollutants: SO_2, NOx, CO, PM2.5/PM10, O_3, lead.
   - Sources: Vehicles, industries, biomass burning.
   - Effects: Smog, respiratory disease, acid rain, global warming.
2. **Water Pollution**
   - Pollutants: Sewage, heavy metals (Hg, Pb, As), pesticides, plastics.
   - Effects: Eutrophication, loss of aquatic biodiversity, unsafe drinking water.
3. **Soil Pollution**
   - Causes: Excess fertilizers, pesticides, industrial waste.
   - Effects: Reduced fertility, biomagnification.
4. **Noise Pollution**
   - Sources: Vehicles, industries, loudspeakers.
   - Effects: Stress, hearing loss, sleep disturbance.
5. **Radioactive Pollution**
   - Sources: Nuclear tests, accidents (Chernobyl, Fukushima).
   - Effects: Genetic mutations, cancers.

National Ambient Air Quality Standards (NAAQS, 2009)

- 12 pollutants monitored: PM10, PM2.5, SO_2, NO_2, O_3, CO, Pb, NH_3, benzene, benzo(a)pyrene, As, Ni.
- Prepared by **CPCB** (under Air Act, 1981).

Air Quality Index (AQI)

- Launched in **2014** (Swachh Bharat mission).
- **Six categories:** Good, Satisfactory, Moderate, Poor, Very Poor, Severe.
- Pollutants: Same 8 from NAAQS (including PM, SO_2, NO_2, O_3, CO, NH_3, Pb).
- India's AQI linked to **System of Air Quality Forecasting and Research (SAFAR)**.

Eutrophication

- Excess nutrients (N, P) in water → algal bloom.
- Algae die → decomposers consume oxygen → hypoxia.
- Effects: Fish kills, dead zones (e.g., Gulf of Mexico).
- India: Vembanad Lake, Bellandur Lake.

Diseases Linked to Pollutants

- **Air Pollution:** Asthma, COPD, lung cancer.
- **Water Pollution:**
  - Fluorosis (excess fluoride).
  - Minamata Disease (Hg poisoning, Japan).
  - Itai-Itai Disease (Cd poisoning, Japan).
  - Blue Baby Syndrome (nitrate-contaminated water).
- **Soil/Crop Contamination:** Pesticide poisoning, endocrine disruption.
- **Radioactive:** Leukemia, birth defects.

Carbon Trading

- A system where countries/companies **buy and sell carbon credits** (permits to emit CO_2).
- 1 credit = permission to emit **1 tonne of CO_2 (or equivalent GHGs)**.
- Encourages firms to reduce emissions → sell surplus credits to others.
- Eg: **Clean Development Mechanism (CDM)** under Kyoto Protocol allowed developed nations to fund emission-reducing projects in developing nations like India.

Carbon Offsetting

- Compensating one's carbon emissions by investing in projects that **remove or reduce CO_2 elsewhere**.
- Eg: Planting trees, funding renewable energy projects, afforestation drives.
- Individuals, airlines, and corporations often use it to become "carbon neutral."

Carbon Tax

- **Direct tax** imposed on the carbon content of fossil fuels.
- Purpose: Disincentivize polluting fuels, encourage cleaner alternatives.
- Eg: Sweden, Canada levy carbon taxes; in India → **Clean Energy Cess** on coal (2010, later renamed as GST Compensation Cess).

Carbon Market

- Broader platform for all **carbon-related transactions** → includes trading, offsetting, credits.
- Two types:
  - **Compliance market:** Created by regulatory requirements (Kyoto, EU-ETS).
  - **Voluntary market:** Companies/individuals buy offsets to show responsibility.
- India launched **Carbon Credit Trading Scheme (2023)** to build a domestic carbon market.

Carbon Sink

- Any system that absorbs more carbon than it emits.
- **Natural sinks:** Forests, oceans, soil.
- **Artificial sinks:** Carbon capture & storage (CCS) technologies.
- India's target: Create **2.5–3 billion tonnes of CO_2 equivalent carbon sink by 2030** (through afforestation, as per Paris Agreement commitments).

Types of Hydrogen

Hydrogen is the cleanest fuel when burnt (produces only water), but its **environmental impact depends on how it is produced**. Hence, hydrogen is colour-coded:

1. Grey Hydrogen

- Produced from **natural gas (methane)** through *steam methane reforming (SMR)*.
- CO_2 released into atmosphere (no capture).
- Cheapest, but polluting.
- Currently >70% of global hydrogen production.

2. Blue Hydrogen

- Also from **natural gas**, but with **Carbon Capture & Storage (CCS)**.
- Emissions reduced (though not zero).
- Considered transitional fuel towards clean hydrogen.

3. Green Hydrogen

- Produced using **renewable energy (solar, wind, hydro)** for *electrolysis of water*.
- No CO_2 emissions.
- India's **National Green Hydrogen Mission (2023):** Target 5 MMT annual production by 2030.
- Key to India's net-zero 2070 goal.

4. Brown/Black Hydrogen

- Made from **coal gasification**.
- Brown → lignite coal; Black → bituminous coal.
- Highly polluting due to CO_2 release.

5. Pink/Red/Purple Hydrogen

- Generated using **nuclear power (electrolysis powered by nuclear energy)**.
- Low emissions, but nuclear safety issues.

6. Turquoise Hydrogen

- Produced via **methane pyrolysis** → yields hydrogen + solid carbon (instead of CO_2).
- Still experimental but promising.

7. Yellow Hydrogen

- Produced using **solar power** directly for electrolysis.

8. White Hydrogen

- Naturally occurring **geological hydrogen** found underground.
- Still under research and exploration.

International Environmental Conventions & Institutions

1. UNFCCC (United Nations Framework Convention on Climate Change)

- Established at **Earth Summit, Rio (1992)**.
- Objective: Stabilize GHG concentrations.
- **COP (Conference of Parties)** = decision-making body.
- India ratified in 1993; HQ → Bonn, Germany.

2. Kyoto Protocol (1997, effective 2005)

- Legally binding treaty under UNFCCC.
- **Commitment period:** 2008–2012 (1st), 2013–2020 (2nd, Doha Amendment).
- **Principle:** *Common but Differentiated Responsibilities (CBDR).*
- Created **Carbon Credit Mechanisms:**
  - Clean Development Mechanism (CDM).
  - Joint Implementation (JI).
  - Emission Trading.
- India a signatory; no binding emission cut.

3. Earth Summit (1992, Rio de Janeiro)

- Also called **UNCED (United Nations Conference on Environment & Development).**
- Outcomes:
  - Agenda 21 (sustainable development blueprint).
  - UNFCCC, UNCBD (Biodiversity), UNCCD (Desertification).
  - Principle of *Sustainable Development*.

4. Global Environment Facility (GEF, 1991)

- Financial mechanism for global environmental projects.
- Partners: UNDP, UNEP, World Bank.
- Funds projects in **biodiversity, climate change, land degradation, POPs, international waters.**
- India is a founding member.

5. IPCC (Intergovernmental Panel on Climate Change, 1988)

- Established by **UNEP & WMO**.
- Produces scientific reports on climate change (Assessment Reports – AR6 in 2021).

- Won **Nobel Peace Prize (2007)** along with Al Gore.
- Provides inputs to UNFCCC & Paris Agreement.

6. Paris Agreement (2015, COP-21)

- Successor to Kyoto; legally binding but flexible.
- Target: Limit warming to **well below 2°C**, strive for **1.5°C** (above pre-industrial levels).
- Introduced **NDCs (Nationally Determined Contributions).**
- India's NDC: Reduce emissions intensity of GDP by 45% by 2030 (from 2005 levels); 50% electricity from non-fossil fuel sources.
- Entered into force in 2016.

7. International Solar Alliance (ISA, 2015)

- Launched by **India & France** at Paris COP-21.
- HQ: Gurugram, India.
- Aim: Promote solar energy & reduce dependence on fossil fuels in **tropical countries (between Tropics of Cancer & Capricorn)**.
- First treaty-based intergovernmental org. headquartered in India.

Major Environmental Conventions & Protocols

1. Stockholm Conference (1972)

- First UN conference on environment (Sweden).
- Gave birth to **UNEP (United Nations Environment Programme)**.
- India represented by PM Indira Gandhi → "Poverty is the greatest polluter."

2. Nairobi Declaration (1982)

- Adopted at 10th anniversary of Stockholm.
- Strengthened UNEP's role in global environment governance.

3. Brundtland Report (1987)

- Published by **World Commission on Environment & Development (WCED)**.
- Titled **"Our Common Future."**
- Popularised the term **Sustainable Development** = meeting needs of present without compromising future.

4. Convention on Biological Diversity (CBD, 1992)

- Outcome of **Rio Earth Summit**.
- 3 Objectives: Conservation, Sustainable use, Fair & equitable sharing of benefits.
- India enacted **Biological Diversity Act, 2002**.
- Secretariat: Montreal, Canada.

5. Cartagena Protocol (2000, effective 2003)

- Supplement to CBD.
- Focus: Biosafety – regulating LMOs/GMOs movement across borders.

6. Nagoya Protocol (2010, effective 2014)

- Supplement to CBD.
- Focus: Access & Benefit Sharing (ABS) of genetic resources.

7. CITES (1973, Washington Convention)

- Convention on International Trade in Endangered Species of Wild Fauna & Flora.
- Regulates trade of ~35,000 species in 3 Appendices.
- India is a party; enforced via **Wildlife Protection Act, 1972**.

8. UN Convention to Combat Desertification (UNCCD, 1994)

- Only legally binding treaty on land degradation.
- India hosted COP-14 in 2019 (New Delhi).
- Goal: Land Degradation Neutrality by 2030.

9. Vienna Convention (1985)

- Framework treaty to protect **ozone layer**.
- No binding targets.
- Led to **Montreal Protocol (1987)**.

10. Montreal Protocol (1987, effective 1989)

- Legally binding treaty to phase out **Ozone Depleting Substances (ODS)** like CFCs.
- Considered most successful environmental treaty (universal ratification).

11. Kigali Amendment (2016)

- Amendment to Montreal Protocol.
- Phases out **HFCs** (not ODS, but strong GHGs).
- India to reduce HFCs by 85% by 2047 (with financial/tech support).

12. Ramsar Convention (1971, Iran)

- Global treaty on **wetland conservation**.
- India has **75 Ramsar sites (largest in Asia)** as of 2023.

Montreux Record

- Register of wetlands under Ramsar showing **ecological threats**.
- India: Keoladeo National Park (Rajasthan), Loktak Lake (Manipur).

13. Basel Convention (1989, effective 1992)

- Regulates **transboundary movement of hazardous waste & disposal**.
- 2019 amendment: India banned import of plastic waste.

14. Minamata Convention (2013, effective 2017)

- Focus: Reduce & eliminate mercury use, emissions, and releases.
- Named after Minamata disease (Japan, caused by mercury poisoning).
- India ratified in 2018.