

Climate Change

- Climate change refers to long-term shifts in temperatures and weather patterns.
- These shifts may be natural, such as through variations in the solar cycle. But since the 1800s, human activities have been the main driver of climate change, primarily due to emissions of greenhouse gases (GHGs) from burning of fossil fuels, e.g., coal, oil and gas.
- GHGS act like a blanket wrapped around the Earth, trapping the outgoing longwave (infrared) radiation from the earth surface and thus raising global atmospheric temperature.

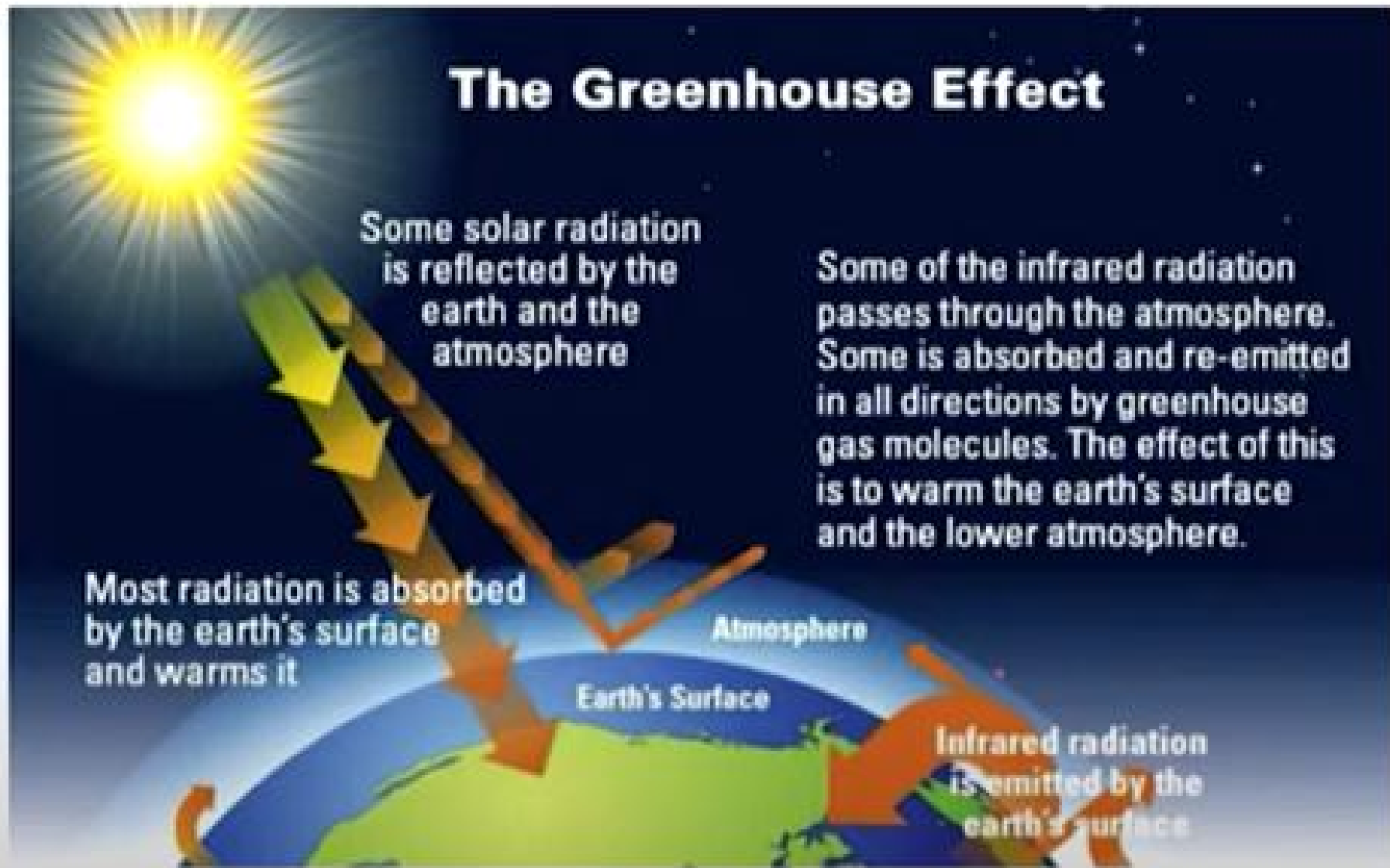
As a sign or effect/outcome of climate change, multiple lines of evidence show changes in the weather, oceans, and ecosystems, such as:

- Changing temperature and precipitation patterns.
- Increases in ocean temperatures and sea level.
- Melting of glaciers and sea ice.
- Changes in the frequency, intensity, and duration of extreme weather events.
- Shifts in ecosystem characteristics, like the length of the growing season, timing of flower blooms, and migration of birds.

Causes of climate change

- Since the Industrial Revolution, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere, which has changed the global temperature and earth's climate.
- Natural processes, such as changes in the sun's energy and volcanic eruptions, also affect the earth's climate.
- Human activities have contributed substantially to climate change through:
 - Greenhouse Gas Emissions
 - Reflectivity or Absorption of the Sun's Energy

Greenhouse effect



Green House Effect

The greenhouse effect is a natural process that occurs in the Earth's atmosphere and is essential for maintaining a habitable climate on our planet. It works as follows:

1.Solar Radiation: Energy from the sun, primarily in the form of visible and ultraviolet (UV) light, reaches the Earth's atmosphere.

2.Absorption of Solar Energy: Some of this incoming solar radiation is absorbed by the Earth's surface, warming the planet.

3.Re-Emission of Heat: The Earth then radiates this absorbed energy back into the atmosphere in the form of **infrared (IR) radiation, which has longer** wavelengths than the incoming solar radiation.

4.Greenhouse Gases: Certain gases in the Earth's atmosphere, known as greenhouse gases (GHGs), include water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and others. These GHGs are transparent to incoming solar radiation but are effective at trapping outgoing infrared radiation.

5.Heat Trapping: As the Earth's surface emits heat in the form of IR radiation, greenhouse gases absorb some of this energy. Instead of allowing this heat to escape directly into space, the greenhouse gases re-radiate some of it back toward the Earth's surface.

6.Warming Effect: This process effectively traps heat in the lower atmosphere and keeps the planet warmer than it would be if these greenhouse gases were not present. It creates a stable temperature range that allows for the existence of life as we know it.

In essence, the greenhouse effect is like a natural "blanket" in the Earth's atmosphere that helps regulate the planet's temperature. Without this effect, the Earth would be much colder, making it inhospitable for many forms of life.

However, the enhanced greenhouse effect, driven by the increased concentration of greenhouse gases, especially carbon dioxide from human activities such as burning fossil fuels and deforestation, has led to an imbalance in the natural system. This enhanced greenhouse effect has contributed to global warming and climate change, resulting in rising temperatures, more frequent and severe weather events, and other environmental impacts.

Green House Gases

Greenhouse gases (GHGs) are gases in the Earth's atmosphere that can trap heat and contribute to the greenhouse effect, leading to an increase in global temperatures. These gases play a significant role in climate change. Some of the most important greenhouse gases include:

- **Carbon Dioxide (CO₂):** Carbon dioxide is the most abundant and well-known greenhouse gas. It is primarily produced by the burning of fossil fuels (coal, oil, and natural gas), deforestation, and various industrial processes.
- **Methane (CH₄):** Methane is a potent greenhouse gas, with a much greater heat-trapping ability per molecule than carbon dioxide. It is released during the production and transport of coal, oil, and natural gas, as well as from livestock and other agricultural practices.
- **Nitrous Oxide (N₂O):** Nitrous oxide is released from agricultural and industrial activities, as well as from the combustion of fossil fuels and solid waste.
- **Water Vapor (H₂O):** Water vapor is the most abundant greenhouse gas, but its concentration is largely controlled by natural processes, and its role in climate change is primarily as a feedback mechanism.

Green House Gases

- **Ozone (O₃):** While ozone in the upper atmosphere (stratosphere) protects us from harmful ultraviolet radiation, ground-level ozone is a greenhouse gas and air pollutant produced by chemical reactions between other pollutants in the presence of sunlight.
- **Chlorofluorocarbons (CFCs):** Chlorofluorocarbons are synthetic compounds used in refrigeration, air conditioning, and aerosol propellants. They were a major contributor to ozone depletion in the stratosphere but have a high global warming potential as well.
- **Hydrofluorocarbons (HFCs):** Hydrofluorocarbons are synthetic gases used as replacements for CFCs in refrigeration and air conditioning. They do not deplete the ozone layer but have a significant global warming potential.
- **Perfluorocarbons (PFCs):** Perfluorocarbons are synthetic gases used in various industrial applications, such as the electronics industry. They have high global warming potentials.
- **Sulfur Hexafluoride (SF₆):** Sulfur hexafluoride is another synthetic gas used in electrical equipment and as a tracer gas for leak detection. It has an extremely high global warming potential.

Reflectivity or Absorption of the Sun's Energy

- Activities such as agriculture, road construction, and deforestation can change the reflectivity of the earth's surface, leading to local warming or cooling.
- This effect is observed in heat islands, which are urban centers that are warmer than the surrounding, less populated areas.
- One reason that these areas are warmer is that buildings, pavement, and roofs tend to reflect less sunlight than natural surfaces.

Natural processes of climate change

Changes in the Earth's Orbit and Rotation

- Changes in the earth's orbit and its axis of rotation have had a big impact on climate in the past.
- For example, the amount of summer sunshine on the Northern Hemisphere, which is affected by changes in the planet's orbit, appears to be affecting the past cycles of ice ages.
- The earth has experienced long periods of cold
- temperatures (ice ages), as well as shorter interglacial periods (periods between ice ages) of relatively warmer temperatures.

Natural processes of climate change

Volcanic Activity

Volcanoes have played a noticeable role in climate as the volcanic eruptions release large quantities of carbon dioxide in the atmosphere.

Some explosive volcano eruptions can throw particulate matter into the upper atmosphere, where they can reflect enough sunlight back to space to cool the surface of the planet for several years.

Changes in Naturally Occurring Carbon Dioxide Concentrations

Over the last several hundred years, carbon dioxide levels varied along with the glacial cycles.

During warm interglacial periods, carbon dioxide levels were higher.

During cool glacial periods, carbon dioxide levels were lower.

The heating or cooling of the earth's surface and oceans can cause changes in the natural sources and sinks of these gases, and thus change greenhouse gas concentrations in the atmosphere.

Climate change indicators and impacts

- Weather and Climate
- Oceans – its sink for CO₂, Sea level rise can happen, acidity of sea water
- Snow and Ice- many forms of Sea and ice in earth there is change in ste (liquid and solid)
- Health and society will be impacted- Heat waves etc
- Impact on ecosystem- timing of flower blooming, migration of birds

Recent events of climate change

- During the last days of June 2021, Pacific northwest areas of the U.S. and Canada experienced temperatures never previously observed, with records broken in multiple cities by several degrees Celsius.
- Temperatures far above 40 °C (104 °F) occurred on Sunday 27 to Tuesday 29 June in the Pacific northwest areas of the U.S. and western Provinces of Canada.
- The observed temperatures were so extreme that they lie far outside the range of historically observed temperatures.

Recent events of climate change

- High precipitation and Lower snow fall.

Cloudbursts in Himalayan Region

- Increasing incidents of cloudbursts in Jammu and Kashmir, Himachal Pradesh and Uttarakhand are a clear evidence of climate change.
- Every year, cloud bursting events cause massive loss of life, property, infrastructure, agricultural lands and other facilities.
- The earlier disasters show that the growing outbreak of rains and its associated flash floods, debris flows and landslides are important reasons for damages and destructions.

Impacts of climate change

- Temp increase
- Time of growing/frost free seasons will increase
- Precipitation will increase (Himalayan regions will increase)
- South west it might decrease
- 1-8 feet rise in sea level by 2100
- More draughts and heat waves

Response to climate change

Mitigation

- Reduce GHG
- Shift to renewal resources

Adaptation

- Structures to protect the coastal areas/sea level rise
- In regional level agricultural yield can be increased.

International treaties

- The fast industrialization and urbanization across the world have resulted in numerous environmental problems, e.g., climate change, ozone depletion, global warming, deforestation, acid rain, etc.
- Such environmental issues or problems are transboundary in nature and usually have a global scope.
- They can only be properly handled through international collaboration, which requires all countries to work together to achieve common objectives.

International treaties

- **Vienna Convention, 1985**
- The Vienna Convention is the first international agreement dedicated to protecting the ozone layer. The Convention was signed in 1985.
- • It was the first convention of any kind to be signed by every country involved, taking effect in 1988 and reaching universal ratification in 2009.
- **Effect of Vienna Convention, 1985**
- A key result of the Vienna Convention has been the Montreal Protocol (1987), which plays a significant role in restoring the ozone layer.
- Assuming continued full compliance with the phase-out of ozone-depleting substances under the Montreal Protocol, the ozone layer is expected to eventually recover over most of the globe.
- This recovery is expected to occur before mid of the 21st century in mid-latitudes and the Arctic, and somewhat later for the Antarctic ozone hole.

Montreal Protocol, 1987

- The Montreal Protocol is a global agreement that aims to protect the Earth's ozone layer by phasing out the ozone layer depleting substances. This phase-out plan includes both the production and consumption of ozone-depleting substances.
- This agreement was signed in 1987 and entered into force in 1989. The parties to the Protocol meet once a year to make decisions to ensure the successful implementation of the agreement.
- This protocol, ratified by 197 nations and is the first agreement in UN history to achieve universal adoption. It is widely recognized as the most excellent effective global environmental action.

Montreal Protocol, 1987

- The Protocol was amended six times since it came into force.
- The most recent amendment was the Kigali Amendment, which called for the phase-down of hydrofluorocarbons (HFCs) in 2016.
- A batch of ozone-depleting chemicals was replaced with HFCs. They are potent greenhouse gases and thus contributors to climate change, even though they do not damage the ozone layer.

Earth Summit/ UNCED, 1992

- The "Rio Earth Summit," officially known as the **United Nations Conference on Environment and Development (UNCED)**, was a landmark international conference held in Rio de Janeiro, Brazil, in **June 1992**. The summit is also often referred to as the "Rio Summit" or the "Earth Summit." It marked a turning point in global environmental diplomacy and led to the adoption of several significant agreements and declarations. Here are some key outcomes and highlights of the Rio Earth Summit:

Earth Summit

1. Agenda 21: The conference produced Agenda 21, a comprehensive action plan for **sustainable development**. It outlined strategies for addressing various environmental and developmental challenges, including poverty, pollution, deforestation, and more. Agenda 21 called for a new global partnership to promote sustainable development.

2. Rio Declaration on Environment and Development: The Rio Declaration outlined 27 principles that provide a foundation for sustainable development. It emphasized the integration of environmental and developmental concerns, the precautionary principle, and the principle of common but differentiated responsibilities.

3. Climate Change: The Rio Earth Summit marked an important step in the international response to climate change. **The United Nations Framework Convention on Climate Change (UNFCCC)** was opened for signature at the summit. It set the stage for subsequent climate negotiations, including the Kyoto Protocol and the Paris Agreement.

Earth Summit

4.Biodiversity: The Convention on Biological Diversity (CBD) was also opened for signature at the summit. It aimed to conserve biological diversity, promote sustainable use of biological resources, and ensure the fair and equitable sharing of benefits arising from genetic resources.

5.Forest Principles: The summit produced the Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation, and Sustainable Development of All Types of Forests. This document addressed global forest management issues.

6.Women's Rights: The Rio Declaration included Principle 20, which highlighted the critical role of women in achieving sustainable development and the need for their full participation.

The Rio Earth Summit was attended by representatives from 172 countries, including numerous heads of state, and a wide range of non-governmental organizations and civil society groups. It served as a platform for raising awareness about environmental issues, sustainable development, and the need for international cooperation.

UNFCCC, 1992, The United Nations Framework Convention on Climate Change

- The UNFCCC was adopted at the Earth Summit in Rio de Janeiro, Brazil, in 1992, and it entered into force on March 21, 1994. The treaty represents a global commitment to address climate change and serves as the foundation for international efforts to combat it.
- **Objective:** The primary objective of the UNFCCC is to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system. In other words, it seeks to mitigate climate change and promote adaptation to its impacts.
- The UNFCCC entered into force on March 21 1994, ratified by 197 countries.

UNFCCC (The United Nations Framework Convention on Climate Change), 1992

- **Principles:** The UNFCCC is guided by several fundamental principles, including the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC). This principle acknowledges that all countries share a common responsibility for addressing climate change but recognizes that developed countries should take the lead due to their historical contributions to greenhouse gas emissions and their greater capacity to address the issue.
- **Subsidiary Bodies:** The UNFCCC establishes subsidiary bodies, such as the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI), which support the negotiation and implementation of climate agreements.
- **Kyoto Protocol:** The UNFCCC led to the negotiation of the Kyoto Protocol, an international treaty adopted in 1997 that established legally binding emissions reduction targets for developed countries. The protocol had a commitment period from 2008 to 2012 and aimed to reduce greenhouse gas emissions, primarily carbon dioxide.
- **Paris Agreement:** The **Paris Agreement, adopted in 2015 at COP21**, is a landmark international climate agreement that operates under the framework of the UNFCCC. It sets out specific measures to limit global warming and enhance countries' climate action through Nationally Determined Contributions (NDCs).

UNFCCC, 1992

- The UNFCCC instituted a process for the countries to generate and share data about domestic GHG emissions.
- Under the UNFCCC, all parties were required to submit national GHG inventories, and developed countries must submit more detailed descriptions of mitigation policies and projections of the estimated impacts of these policies on GHG emissions.

UNFCCC 1992

- The parties announced a goal of stabilizing GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
- Developed countries agreed to adopt national policies to mitigate climate change and return to their 1990 levels of anthropogenic emissions of GHGs.
- Developing countries were expected to contribute to climate mitigation because of their superior capacity to undertake mitigation and more significant contribution to the problem of climate change.

Kyoto protocol, 1997

- The Kyoto Protocol is an international treaty aimed at addressing **global climate change** by setting legally binding **emissions reduction targets** for developed countries.
- Adopted on December 11, 1997, in Kyoto, Japan, as an extension of the United Nations Framework Convention on Climate Change (UNFCCC), and it entered into force on February 16, 2005.

Kyoto protocol, 1997

Key points about the Kyoto Protocol include:

Emissions Reduction Targets (specific targets for developed countries, often referred to as "Annex I" countries)

Emissions of six greenhouse gases—carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆)—to an average of about 5.2% below 1990 levels over the first commitment period from 2008 to 2012. and 18% over the second commitment from 2013-2020

Flexibility Mechanisms: The Kyoto Protocol introduced flexible mechanisms to help countries meet their emissions reduction targets more cost-effectively.

Differentiated Responsibilities: The protocol reflects the principle of common but differentiated responsibilities and respective capabilities.

Enforcement: The protocol includes procedures for monitoring and reporting emissions data, as well as compliance mechanisms to ensure that countries meet their obligations. Failure to meet targets could result in penalties.

Commitment Periods: The Kyoto Protocol allows for multiple commitment periods, each with its set of emissions reduction targets

COP21 and the Paris Agreement: The Kyoto Protocol paved the way for the negotiation and adoption of the Paris Agreement at COP21 in 2015. The Paris Agreement includes commitments from a broader group of countries, not just developed nations, to limit global warming, reflecting an updated approach to global climate action.

Kyoto protocol, 1997

❖ The Protocol offers three market-based mechanisms to its Parties.

International Emissions
Trading

Clean Development
Mechanism

Joint implementation

Kyoto Protocol, 1997

- 1. International Emissions Trading
 - Emissions trading, as specified in Article 17 of the Kyoto Protocol.
 - Emission trading allows countries to sell their excess emission units (1 unit equivalent to 1 ton of CO₂) to those countries that are over their targets.
 - A new commodity was created in the form of emission reductions. Since CO₂ is the principal GHG, people speak simply of trading in carbon.

Kyoto Protocol, 1997

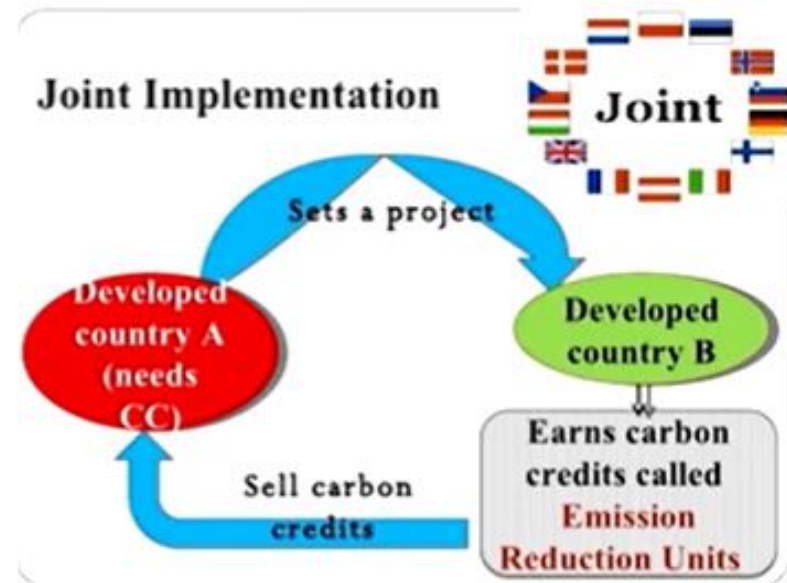
2. Clean Development Mechanism

- This mechanism, as defined in Article 12 of the Kyoto Protocol.
- This mechanism allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission- reduction project in developing countries.

Kyoto Protocol, 1997

3. Joint implementation

- This mechanism, as defined in Article 6 of the Kyoto Protocol.
- This mechanism allows a nation with an emission reduction under the Kyoto Protocol to earn emission reduction units from an emission-reduction or emission-removal project.



Kyoto protocol, 1997

- The result of this protocol provides evidence that it has succeeded in reducing the GHG emissions of the industrialized countries that ratified the protocol.
- The estimated reduction in GHG emissions is approximately 7% less than the Non-Kyoto protocol scenario.

Paris Agreement, 2015

- The agreement was adopted on December 12, 2015, at the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) in Paris, France. It entered into force on November 4, 2016

Key points:

- **Global Temperature Goal:** The central goal of the Paris Agreement is to limit the increase in global average temperature to well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 degrees Celsius.
- **Nationally Determined Contributions (NDCs):** Under the Paris Agreement, each participating country, known as a Party, is required to submit its NDC, which outlines its specific climate action plan and goals for reducing greenhouse gas emissions and enhancing climate resilience.
- **Transparency and Accountability:** The agreement includes provisions for increased transparency, reporting, and review of countries' emissions and progress in implementing their NDCs.
- **Adaptation:** The Paris Agreement recognizes the importance of adapting to the impacts of climate change, particularly for vulnerable and developing countries.
- **Climate Finance:** Developed countries commit to providing financial support to developing countries to assist them in both mitigating and adapting to climate change. The agreement reaffirms the goal of mobilizing \$100 billion per year in climate finance.

Paris Agreement, 2015

Key points:

- **Loss and Damage:** The agreement acknowledges the concept of "loss and damage" associated with the impacts of climate change that cannot be avoided or adapted to. It encourages international cooperation on addressing this issue.
- **Technology Transfer:** The Paris Agreement promotes the sharing of environmentally sound technologies and best practices to support climate action, particularly in developing countries.
- **Global Stocktake:** Parties to the agreement conduct a global stocktake every five years to assess the collective progress toward the long-term temperature goals and to consider whether more ambitious actions are needed.

Paris Agreement, 2015

Effect of Paris Agreement

- This Agreement strongly emphasizes climate-related capacity-building for developing nations, supported by developed countries.
- Low-carbon solutions came as a result of the agreement.
- Carbon neutrality targets are being set by an increasing number of countries, regions, cities, and companies.
- Zero-carbon solutions could be competitive in industries accounting for more than 70% of global emissions by 2030.

COP 26, 2021

- COP26, or the 26th UN Climate Change Conference of the Parties, is one of the most recent major climate conferences, which took place in Glasgow, Scotland, from October 31 to November 12, 2021. The conference was organized under the United Nations Framework Convention on Climate Change (UNFCCC)

Key objectives and outcomes of COP26 included:

1. **Updating NDCs:** One of the central goals of COP26 was to encourage countries to submit updated and more ambitious Nationally Determined Contributions (NDCs) to reduce greenhouse gas emissions.
2. **Enhancing Climate Finance:** COP26 focused on climate finance, particularly the goal of mobilizing \$100 billion per year to support developing countries in their climate mitigation and adaptation efforts
3. **Adaptation and Loss and Damage:** Addressing the concept of "loss and damage" associated with climate-related losses.
4. **Phasing Out Coal and Fossil Fuels:** There was a strong focus on the need to transition away from coal and other fossil fuels to reduce emissions and limit global warming.
5. **Nature and Biodiversity:** Recognizing the importance of nature and biodiversity in climate action, COP26 addressed the protection and restoration of ecosystems
6. **Youth and Civil Society Engagement:** COP26 saw active engagement from youth and civil society groups advocating for more ambitious climate action and holding leaders accountable.
7. **Rulebook:** The conference finalized the rulebook for implementing the Paris Agreement, providing guidance on key operational and procedural aspects of the agreement

Stockholm Convention

The Stockholm Convention was adopted on May 22, 2001, and entered into force on May 17, 2004. Its primary objectives are to:

- **Eliminate or restrict the production, use, and release of 12 specific POPs (persistent organic pollutants) , often referred to as the "Dirty Dozen."** These include chemicals like DDT, Polychlorinated Biphenyls (PCBs) others. (they are majorly pesticides, insecticides, few are industrial by product
- Minimize the unintentional production of POPs as byproducts of industrial processes and waste.
- Promote the use of alternative, safer chemicals and technologies where feasible.
- Facilitate international cooperation and information exchange on the control and management of POPs.

Dirty Dozens

- **Aldrin:** A pesticide used on crops like corn and cotton.
- **Chlordane:** A pesticide used for termite control.
- **DDT (Dichlorodiphenyltrichloroethane):** A widely used insecticide known for its harmful effects on wildlife.
- **Dieldrin:** A pesticide used for various agricultural purposes.
- **Endrin:** A pesticide used to control insects on crops.
- **Heptachlor:** A pesticide used to control insects in soil.
- **Hexachlorobenzene (HCB):** Used as a fungicide and industrial chemical.
- **Mirex:** A fire retardant and pesticide used in various applications.
- **Polychlorinated Biphenyls (PCBs):** Used in electrical equipment and as a lubricant in transformers and capacitors.
- **Toxaphene:** A pesticide used on cotton and other crops.
- **Polychlorinated Dibenzop-dioxins (PCDDs):** A group of highly toxic and persistent compounds that are often byproducts of various industrial processes.
- **Polychlorinated Dibenzofurans (PCDFs):** Similar to PCDDs, these compounds are also highly toxic and persistent and often result from industrial processes.

Ramsar Convention, 1971

- The Ramsar Convention, officially known as the "Convention on Wetlands of International Importance, Especially Waterfowl Habitat," is an international treaty that focuses on the conservation and sustainable use of wetlands worldwide. The convention was adopted on February 2, 1971, in Ramsar, Iran, and it entered into force on December 21, 1975.
- **What are these ?** Described under conventions as “ Areas of Marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or Salt, including areas of Marine water the depth of which at low tide does not exceed six meters. For instance Dal Lake Kashmir , Chilika Lake (Odisha)

- ## Significance of wetlands

These unique Eco-Systems are important as they perform a variety of functions like water purification, water storage for use during dry periods of time; Natural barriers to floods; Recharge ground water; Helping control soil erosion; Habitat of animals and plants; Providing food for livestock; conserve bio-diversity; recreational value, etc.

RAMSAR CONVENTION, 1971

- **Objectives:** The primary objective of the Ramsar Convention is to promote the conservation and wise use of wetlands, emphasizing their ecological significance, biodiversity, and the services they provide.
- **Designation of Wetlands:** Parties to the convention (member countries) are encouraged to designate specific wetlands within their territories as "Ramsar Sites" of international importance. These designated sites are recognized for their ecological, botanical, zoological, limnological, or hydrological significance.
- **Sustainable Use:** The convention promotes the sustainable use of wetlands, which may include activities like fishing, agriculture, and recreation, while ensuring that the ecological character of the wetlands is maintained.
- **International Cooperation:** The Ramsar Convention encourages international cooperation and information exchange on wetland conservation and management.
- **Protection of Waterfowl:** Although initially focused on waterfowl habitat, the convention has broadened its scope to cover all aspects of wetland conservation and sustainable use.
- **Wise Use Principle:** The convention introduced the concept of the "wise use" of wetlands, which means using wetlands in a way that ensures the long-term ecological character of the area.
- **Ramsar Sites:** As per reports in January 2022, there were over 2,400 Ramsar Sites around the world, covering a wide range of wetland types, including marshes, swamps, lakes, rivers, and coastal areas.

Thank You