

IIPA 2022

Environmental Ecology, Bio-diversity & Climate Change

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh



2022

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Climate Change

Chapter 1

Short Answers

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2022

This chapter contains:

- Climate Change
- Global Warming
- Effects of Global warming
- Greenhouse effect
- Greenhouse gas
- Climate forcing
- Global Warming Potential (GWP)

1. Climate Change

"Climate change" is defined as a change in climate that is caused by human activity and alters the composition of the global atmosphere, in addition to natural climate variability observed over comparable time periods. When people today talk about "climate change," they are referring to changes in climate over the last 100 years that are primarily due to human activities.

A shift in long-term weather patterns is referred to as "climate change". Climate change is the cumulative shift of long-term weather patterns, i.e. changes in climate, rather than a change in weather on a single day. For example, a winter day in Jammu might be bright and warm, but the average weather, or climate, predicts that the winters in Jammu would be cold, with snow and rain. Jammu's winter pattern has shifted from the regular winter pattern, which is an example of climate change.

Climate change refers to the observable consequences of the ongoing warming trend. Climate change is often measured through decades-long shifts in temperature, rainfall, snowfall, and wind patterns. Climate change is caused by humans burning vast amounts of fossil fuels (coal, oil, and natural gas), as well as deforestation (when forests are cut down or burned, they can no longer store carbon, and the carbon is released to the atmosphere).

1.1 Global Warming

"A rise in the temperature of the atmosphere at the Earth's surface and in the troposphere, which can lead to changes in global climate patterns, is referred to as global warming." Global warming can be caused by a number of factors, both natural and human induced. "Global warming" is a term that is commonly used to describe the warming that can occur as a result of increased greenhouse gas emissions from human activities.

1.1.1 Effects of global warming

Following are the major effects of global warming:

- a) **Rise in Temperature:** The earth's temperature has risen dramatically as a result of global warming. The earth's temperature has risen by 1 degree since 1880. This has resulted in an increase in glacier melting, which has resulted in a rise in sea level. This could have devastating effects on coastal regions.

- b) **Threats to the Ecosystem:** Coral reefs have been damaged by global warming, which might result in the extinction of plants and animals. The fragility of coral reefs has been exacerbated by rising global temperatures.
- c) **Climate Change:** Climate change has occurred as a result of global warming. Some areas are experiencing droughts, while others are experiencing floods. Global warming is to blame for this climatic imbalance.
- d) **Spread of Diseases:** Heat and humidity patterns alter as a result of global warming. This has resulted in the spread of diseases-carrying mosquitos.
- e) **High Mortality Rates:** The average death toll frequently increases when floods, tsunamis, and other natural disasters become more common. Furthermore, such incidents have the potential to transmit illnesses that endanger human life.
- f) **Loss of Natural Habitat:** Several plants and animals lose their habitats as a result of global climate change. In this situation, the creatures are forced to leave their natural habitat, and many of them become extinct as a result. This is yet another major impact of global warming on biodiversity.

1.2 Greenhouse effect

The greenhouse effect is a natural process that causes the surface of the Earth to warm. Some of the sun's energy is reflected back into space, while the remainder is absorbed and re-radiated by greenhouse gases. The absorbed energy heats the earth's atmosphere and surface. This process keeps the Earth's temperature roughly 33°C warmer than it would be otherwise, allowing life on earth to exist. A greenhouse is a glass structure that lets light in but retains heat within, keeping the building warm even when it's freezing outside.

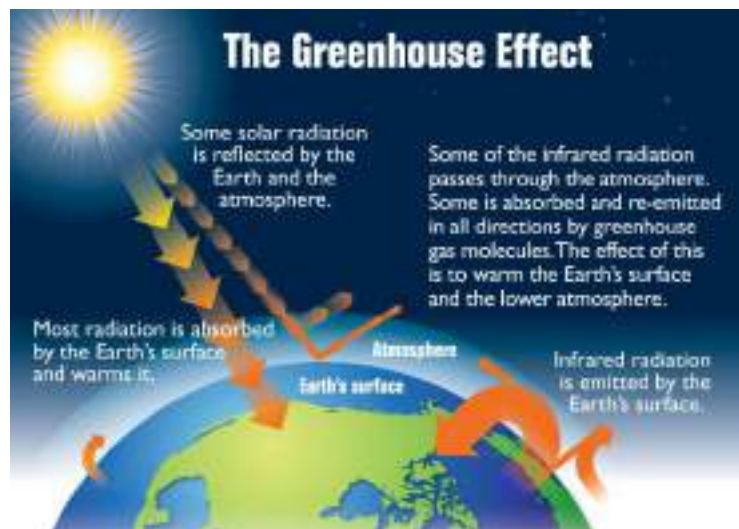


Fig 1. The greenhouse effect

Imagine a warm, sunny day with the sun shining brightly on the earth to better understand how the greenhouse effect works. This sunlight (short-wave radiation) heats the Earth as it passes through the atmosphere. A portion of this energy is absorbed by the Earth's surface, transformed into heat (long wave radiation), and then reflected back into space. However, part of this heat is retained by the various greenhouse gases and does not escape into space as it passes through the atmosphere. This, in turn, heats the earth's atmosphere, much like a greenhouse window that lets light in while keeping the heat inside to keep the plants warm. Because part of the heat cannot escape into space, it accumulates and heats the planet. The greenhouse effect is what we call this. As a result, the more greenhouse gases in the atmosphere, the more heat is trapped on the planet.

1.3 Greenhouse gases

Greenhouse gases are natural and artificial gaseous elements of the atmosphere that absorb and re-emit infrared energy. Following are the types of greenhouse gases:

1.3.1 Water vapour

The greenhouse effect is primarily caused by water vapour, and humans are not directly responsible for producing enough of this gas to modify its concentration in the atmosphere. CO₂ and other greenhouse gases, on the other hand, increase the amount of water vapour in the air by boosting evaporation rates. Unlike CO₂, which may stay in the atmosphere for years, water vapour moves fast through the atmosphere, evaporating from the oceans and other sources before falling as rain or snow. Because the rate of evaporation increases with temperature, the amount of water vapour in the air (and the amount of warming it generates) is directly proportional to the amount of other greenhouse gases in the air.

1.3.2 Carbon dioxide (CO₂)

The primary greenhouse gas emitted by human activity is carbon dioxide (CO₂). As part of the Earth's carbon cycle, carbon dioxide is naturally present in the atmosphere (the natural circulation of carbon among the atmosphere, oceans, soil, plants, and animals). Human activities impact the carbon cycle by increasing CO₂ levels in the atmosphere and decreasing natural sinks, such as deforestation, that remove CO₂. CO₂ emissions come from a variety of natural sources, but human-caused emissions are to blame for the rise in the atmosphere since the industrial revolution.

1.3.3 Methane (CH₄)

Natural sources such as wetlands, as well as human activities such as leakage from natural gas systems and the raising of livestock, generate methane (CH₄). CH₄ is removed from the atmosphere through natural processes in soil and chemical reactions in the atmosphere.

1.3.4 Nitrous Oxide (N₂O)

Nitrous oxide (N₂O) is a naturally occurring gas in the atmosphere that is produced as part of the Earth's nitrogen cycle. It comes from a variety of sources. Agriculture, fossil fuel burning, wastewater management, and industrial operations, on the other hand, are increasing the amount of N₂O in the atmosphere.

1.3.5 Fluorinated Gases

They are emitted through a variety of industrial processes such as aluminum and semiconductor manufacturing & Substitution for Ozone-Depleting Substances. In comparison to other greenhouse gases, several fluorinated gases have extremely high global warming potentials (GWPs). Fluorinated gases mix well in the atmosphere and disperse widely once they are released. Fluorinated gases are removed from the atmosphere only when they are destroyed by sunlight in the far upper atmosphere. Fluorinated gases, in general, are the most potent and long-lasting greenhouse gases produced by human activity. There are three main categories of fluorinated gases:

- Hydrofluorocarbons (HFCs),
- Perfluorocarbons (PFCs),
- Sulfur Hexafluoride (SF₆).

1.3.6 Ozone (O₃)

At ground level, ozone acts as a greenhouse gas, absorbing some of the earth's infrared radiation. Tropospheric ozone, also known as ground-level ozone, is produced by chemical interactions between nitrogen oxides (NO_x) and volatile organic molecules (VOC). Because ozone does not exist in consistent amounts over the world, quantifying its greenhouse gas potency is challenging. However, the most commonly accepted scientific assessments of climate change imply that

tropospheric ozone has a radiative forcing of around 25% that of carbon dioxide. Ozone is responsible for around 10% of the greenhouse impact caused by humans.

1.3.7 Black Carbon

Black carbon (BC) is a solid particle or aerosol (not a gas) that contributes to global warming. Soot, often known as black carbon, is a kind of particulate air pollutant produced by incomplete combustion. It is made up of pure carbon in various connected forms.

1.3.8 Aerosols

Sea salt, mineral dust, ash, soot, sulphates, nitrates, and black carbon are examples of aerosols that are suspended in the air, both naturally and artificially. They stay in the air for about 10 days, scattering and absorbing solar radiation. Aerosols also act as nuclei for water droplets, increasing cloud formation and reducing the amount of radiation reaching the earth, resulting in a net cooling effect. In a nutshell, greenhouse gases warm the surface while aerosols cool it.

1.4 Climate Forcing

Any influence on climate that comes from outside the climate system is referred to as climate forcing. The oceans, land surface, cryosphere, biosphere, and atmosphere are all part of the climate system. Climate forcing is a major contributor to climate change. Climate forcings, on the other hand, are variables in the climate system that either increase or decrease the climate system's effects. Surface reflectivity (albedo), human-induced changes in greenhouse gases, and air aerosols are examples of external forcing (volcanic sulphates, industrial output).

Positive (amplified) forcings, such as greenhouse gases, increase the warming of the earth, whereas negatively (dampening) forcings, such as aerosols and suspended particles, cool it down. In the pre-industrial era, humans contributed more to negative forcings, leading the earth to cool. However, the earth's warming due to exponential growth in greenhouse gas emissions has revealed that the latter has been contributing to global warming ahead of the former in recent times.

1.5 Global Warming Potential (GWP)

The impact of each gas on global warming is described by its global warming potential. In terms of climate impact, the two most important characteristics of a GHG are how well it absorbs energy (preventing it from escaping to space) and how long it stays in the atmosphere. In comparison to

carbon dioxide, a gas's Global Warming Potential (GWP) is a measure of the total energy it absorbs over a specific time period (typically 100 years). Higher GWP gases absorb more energy per pound than lower GWP gases, and so contribute more to global warming.

Table 1. GWP & Lifetime of Green House Gases

S.No.	Gas	GWP (100 years)	Lifetime (years)
1.	Carbon di oxide	1	100
2.	Methane	21	12
3.	Nitrous oxide	310	120
4.	Hydrofluorocarbons (HFCs)	140-11,700	1-270
5.	Perfluorocarbons (PFCs)	6,500-9,200	800-50,000
6.	Sulfur hexafluoride (SF ₆)	23,900	3,200

- The GWP of carbon dioxide (CO₂) is 1 and it serves as a baseline for other GWP values.
- The greater the GWP, the greater the amount of warming caused by the gas. For example, methane has a 100-year GWP of 21, which implies that over a 100-year period, methane will produce 21 times as much heat as an equivalent mass of carbon dioxide.
- On a 100-year time scale, methane (CH₄) has a GWP more than 20 times that of CO₂. On average, CH₄ emitted today lasts only 12 years in the atmosphere. On a pound-for-pound basis, however, CH₄ absorbs more energy than CO₂, resulting in a larger GWP.
- For a 100-year timescale, Nitrous Oxide (N₂O) has a GWP 310 times that of CO₂. Today's N₂O emissions last an average of 120 years in the atmosphere.
- High-GWP gases include chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), hydro chlorofluorocarbons (HCFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆), which trap significantly more heat for a given mass than CO₂.

1.6 Salient Features

- A shift in long-term weather patterns is referred to as “climate change”.
- A rise in the temperature of the atmosphere at the Earth's surface and in the troposphere, which can lead to changes in global climate patterns, is referred to as global warming.

- Global warming has various effects associated with it such as: Rise in temperature, threats to the ecosystem, climate change, spread of diseases, high mortality rate and loss of natural habitat.
- Greenhouse gases are natural and artificial gaseous elements of the atmosphere that absorb and re-emit infrared energy. It includes: water vapour, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), fluorinated gases, ozone (O₃), black carbon and aerosols.
- Any influence on climate that comes from outside the climate system is referred to as climate forcing. Positive (amplified) forcings, such as greenhouse gases, increase the warming of the earth, whereas negatively (dampening) forcings, such as aerosols and suspended particles, cool it down.
- The impact of each gas on global warming is described by its global warming potential. In terms of climate impact, the two most important characteristics of a GHG are how well it absorbs energy (preventing it from escaping to space) and how long it stays in the atmosphere.

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Impacts of Climate Change

Chapter 2

Short Answers

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2022

This chapter contains:

- Impacts of Climate Change

2. Impacts of climate change

Climate change is already having visible effects on the world. The Earth is warming, rainfall patterns are changing, and sea levels are rising. These changes can increase the risk of heatwaves, floods and droughts. Impacts of climate change can be studied under the following heads:

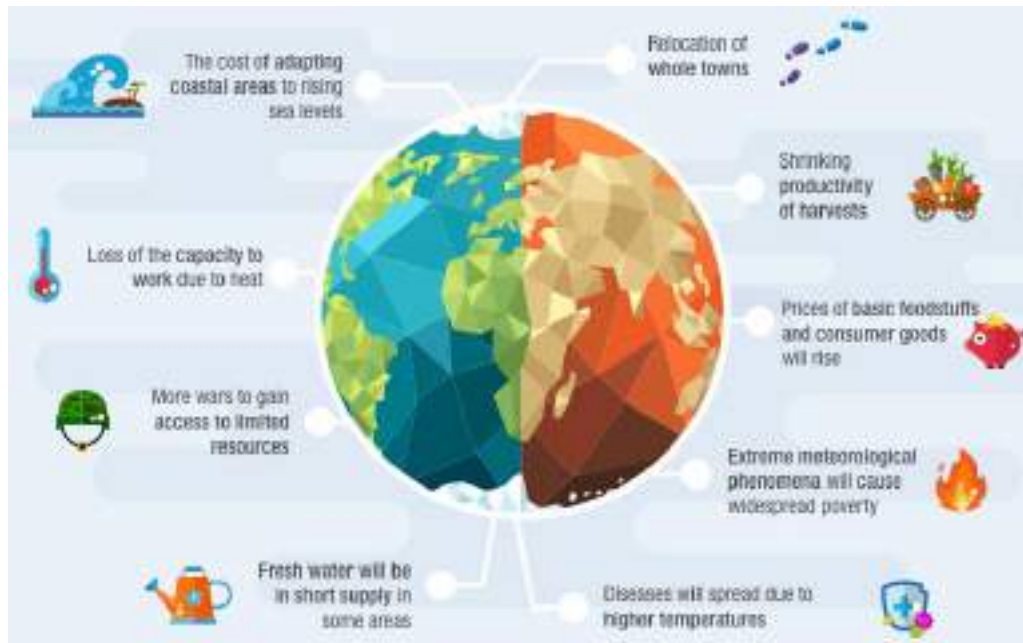


Fig 3. Social and economic impact of climate change

2.1 Agriculture and Food security

- Climate change may have an influence on crop productivity as well as the types of crops that can be cultivated in certain areas by affecting agricultural inputs such as irrigation water, solar radiation levels that affect plant development, and pest prevalence.
- Rice: While worldwide rice yields have increased, India's rice output has decreased significantly due to rising temperatures and lesser rainfall towards the end of the growing season. Rice yields may have been nearly 6% greater if climate change had not occurred.
- Wheat: Extremely high temperatures in Northern India, exceeding 34°C, have had a significant negative impact on wheat yields, and increasing temperatures will only exacerbate the problem.
- Seasonal water scarcity, increasing temperatures, and seawater intrusion would all threaten crop production, putting the country's food security in jeopardy.

- If temperatures rise by 2°C by the 2050s, the country may need to import more than twice as much food grain as it would without climate change.
- Crop diversification, more efficient water usage, improved soil management methods, and the development of drought-resistant crops can all help to mitigate some of the negative consequences.

2.2 Water stress and water insecurity

- Water shortage is spreading, resulting in food poverty and increased water competition both within and between countries.
- In both hemispheres, warming has resulted in a loss in mountain glaciers and snow cover, which is expected to intensify throughout the 21st century. As a result, water availability, hydropower potential, and the seasonal flow of rivers in regions supplied by melt water from major mountain ranges (e.g. Hindu-Kush, Himalaya, Andes) would be reduced.
- Water scarcity is already a problem in many places of India. Urbanization, population increase, economic development, and rising agricultural and industrial water demands are all projected to exacerbate the issue.
- Water shortages are predicted to worsen in certain regions as monsoon rainfall is becoming more unpredictable.
- According to studies, the threat to water security is quite significant in central India, in the Western Ghats mountain ranges, and in India's northeastern regions.
- Some of these dangers can be mitigated by improvements in irrigation systems, water harvesting techniques, and more effective agricultural water management.

2.3 Rise in Sea Levels

- Sea level rise is caused by both thermal expansion and melting of ice sheet. Since 1993, satellite data reveal that sea level has been increasing at a pace per year that is much greater than the average over the previous half-century.
- With faster ice sheet disintegration, the IPCC projects that sea levels will rise quickly. Flooding might force 330 million people to relocate permanently or temporarily if global temperatures rise 3–4°C.
- Tropical storms will become more powerful as the seas warm.

- Sea level rise poses a serious threat to the coastal states of Maharashtra, Goa, and Gujarat, which might flood land (particularly agricultural land) and harm coastal infrastructure and other property.
- Land loss and rising floods are also a concern in Mumbai's northern suburbs, such as Versova Beach and other inhabited regions near tidal mud flats and creeks.
- The coral reefs that India has in its biosphere reserves are particularly saline sensitive, and as a result, increasing sea levels endanger their survival. Not only the coral reefs, but also phytoplankton, fish stocks, and human lives that rely on them are in severe risk.

2.4 Ecosystems and Bio-diversity

- Climate Change has the potential to cause immense biodiversity loss, impacting both individual species and ecosystems that enable economic growth and human well-being.
- Future extinctions of flora and fauna are expected to be human-caused, meaning that they will occur as a result of human activity.
- Many species may not be able to relocate quickly enough to avoid the effects that rising temperatures will bring to their natural habitats.
- It has a devastating effect on marine ecosystems. They will be influenced not just by rising sea temperatures and changes in ocean circulation, but also by increasing dissolved carbon dioxide (carbonic acid) concentrations, which will cause ocean acidification. This is predicted to have a negative impact on shell-forming organisms, corals, and the ecosystems that depend on them.

2.5 Impact on India's Bio-diversity

- India is a land rich in biodiversity, with everything from glaciers to deserts. Climate change, on the other hand, is posing a serious danger to its ecosystems. Mountain ecosystems are biodiversity hotspots. Temperature rises and human activities, on the other hand, are fragmenting and degrading mountain biodiversity.
- Glacial Lake Outburst Floods (GLOFs) are also expected to become more common in the eastern and central Himalayas, causing catastrophic floods downstream and substantial damage to “life, property, forests, crops, and infrastructure”.
- The melting glaciers of the Himalayas have a significant influence because they give rise to perennial rivers, which help agriculture flourish.

- Recent research have revealed that deserts are expanding, resulting in a process known as desertification.
- Mangrove forests (wetlands) along rivers and coasts serve as a carbon sink as well as a habitat for a varied range of flora and animals.
- Flooding (that may be caused by the rising sea levels) and cyclones are naturally protected by the wetlands.
- Coral bleaching is the most visible example of climate change harming the marine ecosystem.
- Even the rivers in Peninsular India are dependent on the monsoons, hence the Peninsular Ecosystem is essentially a monsoon-based ecosystem.
- India relies significantly on the monsoon to meet its agricultural and water demands, as well as to conserve and propagate its diverse ecosystem. The shifting patterns of the Indian monsoons are connected to climate change.

2.6 Climate change and health

- Climate change poses several threats to humanity's existence. A warmer, more unpredictable climate would result in greater levels of certain air pollutants, as well as increased disease transmission through polluted water and food.
- Human health is directly affected by climate change. For example, the possibility of a negative impact on human health increases as the temperature warms. Due to the increased frequency and intensity of heat waves and other extreme weather events, it is expected that the number of deaths would rise.
- Floods and droughts are becoming more common as a result of climate change and rising global temperatures, increasing the risk of disease infection. Drought-related shortages of freshwater and flood-related pollution of freshwater sources compromise hygiene, leading to an increase in diarrheal disease rates.
- Due to predicted changes in the hydrological cycle, endemic morbidity and mortality due to diarrheal disease predominantly related with floods and droughts are likely to grow throughout East, South, and South-East Asia.
- Flooding also provides breeding grounds for disease-carrying insects like mosquitos. Flooded and drought-prone areas see large-scale movement of people to more stable areas, resulting in

overcrowding and unsanitary circumstances, which can lead to disease spread such as Japanese encephalitis and malaria.

- The spread of infectious illnesses is aided by climate change. Diseases that were once exclusive to a single geographic location spread to other places.
- Greenhouse gas emissions are to blame for the depletion of the ozone layer, which shields the Earth from the sun's deadly direct rays. Increased exposure to the sun's ultra violet rays due to stratospheric ozone depletion leads to an increase in the incidence of skin cancer. It could also lead to an increase in the number of people suffering from eye diseases such as cataract. It is also thought to cause suppression of the immune system.

2.7 Salient Features

- Climate change have various impacts such as rise in sea temperature, water shortage, impacts on agriculture, ecosystem & biodiversity and human health.
- Climate change may have an influence on crop productivity. It is predicted, if temperatures rise by 2°C by the 2050s, the country may need to import more than twice as much food grain as it would without climate change.
- Water scarcity is already a problem in many places of India. Water shortage is spreading, resulting in food poverty.
- Sea level rise is caused by both thermal expansion and melting of ice sheet. With faster melting of ice sheet, the sea levels will rise quickly. Sea level rise poses a serious threat to the coastal states of Maharashtra, Goa and Gujarat, which might flood land and harm coastal infrastructure and other property.
- Climate Change has the potential to cause immense biodiversity loss, impacting both individual species and ecosystems that enable economic growth and human well-being.
- Temperature rises and human activities are fragmenting and degrading mountain biodiversity.
- The spread of infectious illnesses is aided by climate change. Diseases that were once exclusive to a single geographic location spread to other places.

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Climate Change – Mitigation and Adaptation

Chapter 3

Short Answers

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2022

This chapter contains:

- Carbon Sequestration
- Carbon Sink
- Green Carbon
- Blue Carbon
- Carbon Credit
- Carbon offsetting
- Carbon tax
- Adaptation Strategies

3. Climate Change – Mitigation and Adaptation

Since it is already committed to some degree of climate change, there must be a two-pronged strategy to combating it: Reducing emissions of heat-trapping greenhouse gases and stabilizing their levels in the atmosphere ("mitigation"); Adapting to climate change that is already underway ("adaptation").

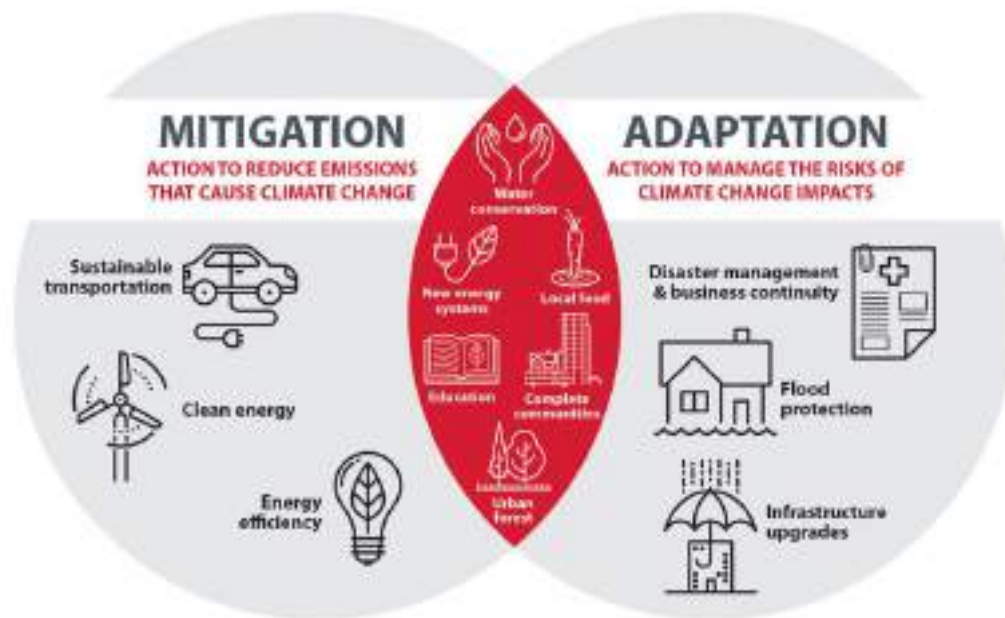


Fig 3. Climate change – Mitigation and Adaptation strategies

3.1 Mitigation Strategies

Mitigation refers to measures taken to reduce greenhouse gas concentrations in the atmosphere, thereby limiting the extent to which the global climate system changes. Mitigation involves following strategies:

3.1.1 Carbon Sequestration

Carbon capture and storage, commonly known as CCS or carbon sequestration, refers to technologies that absorb CO₂ from power plants, industrial sites, or even straight from the atmosphere and store it permanently underground. Carbon sequestration is the long-term storing of carbon dioxide or other forms of carbon with the goal of reducing or deferring global warming. It has been considered as a technique to limit the accumulation of greenhouse gases in the atmosphere and oceans, which are emitted by burning fossil fuels.

3.1.1.1 Sinks

Carbon sequestration can be accomplished by pumping carbon into 'carbon sinks,' which are areas that absorb carbon.

- **Natural sinks:** Oceans, forests, soil and so forth.
- **Artificial sinks:** Depleted oil reserves, un-mineable mines, etc.

Carbon capture has been around for a long time. Carbon capture has been utilized by the oil and gas industries to improve oil and gas recovery for decades. We have just lately begun to consider carbon capture for environmental reasons.

There are three main steps to carbon capture and storage (CCS):

- Trapping and separating the CO₂ from other gases,
- Transporting this captured CO₂ to a storage location, and
- Storing that CO₂ far away from the atmosphere (underground or deep in the ocean).

3.1.1.2 Types of Sequestration

There are number of technologies under investigation for sequestering carbon from the atmosphere. These can be discussed under three main categories:

- **Ocean Sequestration:** Direct injection or fertilization of carbon in the waters.
- **Geologic Sequestration:** Natural pore spaces in geologic formations act as long-term carbon dioxide storage reservoirs. Geologic sequestration is regarded to offer the most immediate application potential.
- **Terrestrial Sequestration:** Soils and plants, which act as natural carbon sinks, store a significant quantity of carbon. Increasing carbon fixation through photosynthesis, delaying or lowering organic matter decomposition, and modifying land use practices can all help these natural sinks absorb more carbon.

3.1.2 Carbon Sink

Any natural or manmade reservoir that collects and stores some carbon-containing chemical compound for an indefinite period, decreasing CO₂ levels in the atmosphere, is known as a carbon sink. Unlike black and brown carbon, which contribute to atmospheric greenhouse gas emissions,

green and blue carbon absorb greenhouse gas emissions. Carbon Sink can be studied under following heads:

3.1.2.1 Green Carbon

Green carbon is carbon that is extracted from the atmosphere by photosynthesis and stored in plants and soil in natural ecosystems. It is an important aspect of the global carbon cycle. Many plants and most crops have short lives and release a significant amount of carbon at the end of each season, but forest biomass accumulates carbon over decades and millennia. Furthermore, forests may store a lot of CO₂ in a short amount of time, typically several decades. Afforestation and reforestation are two options for increasing biological carbon sequestration.

3.1.2.2 Blue Carbon

Blue Carbon refers to coastal, aquatic and marine carbon sinks held by the indicative vegetation, marine organism and sediments. Coastal ecosystems like tidal marshes, mangroves, and seagrasses, in particular, extract carbon from the atmosphere and ocean by storing it in plants and depositing it in the sediment underneath them through natural processes. These coastal ecosystems

are extremely effective at sequestering and storing carbon; each square mile of these systems may extract more carbon from the atmosphere and oceans than a mature tropical forest can. Furthermore, coastal ecosystems have been discovered to store massive amounts of carbon in organic rich sediments, up to 5 times that of many temperate and tropical forests. These ecosystems are found in all continents, except Antarctica.

Do you know?

The Blue Carbon Initiative is the first integrated program with a comprehensive and coordinated global agenda focused on mitigating climate change through the conservation and restoration of coastal marine ecosystems.

3.1.3 Carbon Credit

A carbon credit is a tradable certificate or permit that represents the right to emit one tonne of carbon dioxide or comparable carbon dioxide (tCO₂e). One carbon credit is equal to one tonne of carbon dioxide, or carbon dioxide equivalent gases in some markets. A carbon credit is earned by an organization that generates one tonne less carbon or carbon dioxide equivalent than the standard amount of carbon emission permitted for its outfit or activity. Developing nations such as India

and China are expected to be the major sellers of carbon credits, while Europe will be the greatest purchasers.

3.1.4 Carbon Offsetting

Carbon offsets are credits for greenhouse gas emissions reductions achieved in another site, such as wind farms, which provide renewable energy while reducing the demand for fossil-fuel-powered energy. Carbon offsets are quantified and sold in metric tonnes of carbon dioxide equivalent (CO₂e). When you purchase one tonne of carbon offsets, you are removing one tonne of carbon dioxide from the atmosphere that would otherwise be there.

Carbon offsetting is sometimes the quickest approach for enterprises to achieve the deepest reductions, and it also provides additional advantages at the project site, such as employment opportunities, community development programmes, and training and education.

To be credible, a carbon offset must demonstrate that it is additional (the reduction in emissions would not have occurred without the carbon finance), that it will be retired from the carbon market so that it cannot be double counted, and that it addresses issues such as permanence (it delivers the reductions it claims), and leakage (the emission reduction in one area does not cause an increase in emissions in another).

3.1.5 Carbon Tax

Carbon tax is a proposed alternative to the protocol's existing 'cap and trade' system. This tax is calculated depending on the quantity of carbon in a fuel, such as coal. The goal of this tax is to encourage people to adopt alternative energy sources instead of fossil fuels. If a carbon tax was implemented, it would be phased in, starting at low amount and gradually increasing to allow for the development of better industries and technology. There are five main reasons why a carbon tax would be preferable to a "cap and trade" system:

- **Predictability:** The tax might help predict energy prices, making investments in energy efficiency and alternative fuels more feasible.
- **Implementation:** In comparison to the legalities that come with the 'cap and trade' method, a carbon tax might be implemented considerably faster.

- **Understandable:** The carbon tax is easier to comprehend and so more likely to be accepted by the general public.
- **Lack of Manipulation:** Because of its simplicity, special interest groups have a harder time manipulating a carbon tax.
- **Rebates:** The carbon tax, like other types of taxes, may be subject to public rebates.

Example: Consumers view a steel piece of goods made in a carbon-fueled blast furnace and subsequently forged and cut with oxyacetylene (carbon emitting) as good and affordable when compared to an aluminium one of same quality but higher cost created in an electric furnace and poured (so no direct carbon use, just a question of where the electricity came from). By imposing a large enough carbon tax, you may switch people from using the Steel version (with a large lifetime carbon foot print and now very expensive), have the aluminium smelter commission a nuclear reactor (very small carbon foot print and more expensive than natural gas, but less than natural gas + carbon tax). As a consequence, carbon emissions are reduced significantly, and the client pays a higher price for the goods (and a shift of power from natural gas to nuclear).

3.2 Adaptation Strategies

In the context of climate change, adaptation refers to actions taken to mitigate the negative effects of climate change (for example, switching to drought-resistant crops, establishing/protecting a coastal buffer zone, developing an effective early warning system, erecting flood barriers, and so on). Adapting to life in a changing environment involves making adjustments to the current or predicted future climate.

Adaptation solutions differ by location, are difficult to forecast, and entail several trade-offs. Understanding local hazards and making plans to manage them is the first step in adapting to climate change. The next stage is to take action—to put processes in place to respond to current impacts while we prepare for an uncertain future. Diversifying crops that can withstand warmer, drier, or wetter conditions; ensuring infrastructure can withstand more extreme weather; assisting communities in reducing their risk of sea level rise and increased floods; and ensuring we manage our food, water, and other natural resources wisely in the context of a changing climate are all examples of these actions.

3.3 Salient Features

- Mitigation refers to measures taken to reduce greenhouse gas concentrations in the atmosphere, thereby limiting the extent to which the global climate system changes.
- Mitigation involves strategies like: carbon sequestration, carbon sink, carbon credit, carbon offsetting, carbon tax and geo-engineering.
- Carbon capture and storage, commonly known as CCS or carbon sequestration, refers to technologies that absorb CO₂ from power plants, industrial sites, or even straight from the atmosphere and store it permanently underground. Carbon sequestration can be accomplished by pumping carbon into 'carbon sinks,' which are areas that absorb carbon.
- Any natural or manmade reservoir that collects and stores some carbon-containing chemical compound for an indefinite period, decreasing CO₂ levels in the atmosphere, is known as a carbon sink.
- Green carbon is carbon that is extracted from the atmosphere by photosynthesis and stored in plants and soil in natural ecosystems.
- Blue Carbon refers to coastal, aquatic and marine carbon sinks held by the indicative vegetation, marine organism and sediments.
- A carbon credit is a tradable certificate or permit that represents the right to emit one tonne of carbon dioxide or comparable carbon dioxide (tCO₂e). One carbon credit is equal to one tonne of carbon dioxide, or carbon dioxide equivalent gases in some markets.
- Carbon offsets are credits for greenhouse gas emissions reductions achieved in another site, such as wind farms, which provide renewable energy while reducing the demand for fossil-fuel-powered energy.
- Carbon tax is an alternative to existing 'cap and trade' system. This tax is calculated depending on the quantity of carbon in a fuel, such as coal.
- Adaptation refers to actions taken to mitigate the negative effects of climate change. Understanding local hazards and making plans to manage them; putting the processes in place to respond to current impacts while preparing for an uncertain future are the steps for adaptation. Diversifying crops that can withstand warmer, drier, or wetter conditions; ensuring infrastructure can withstand more extreme weather are some examples of it.

IIPA 2022

Sustainable Development

Chapter 4

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh



2022

This chapter contains:

- Sustainable Development
- Pillars of Sustainable Development
- Sustainable Development Goals
- Sustainable Development Report, 2021
- Sustainable Development Goal Index, 2021
- Sustainable Development Goal Dashboard

4. Sustainable Development

The United Nations' overarching paradigm is sustainable development. The Brundtland Commission Report of 1987 defined the notion of sustainable development as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Sustainable development aims to provide the fundamental requirements of all people, particularly the poor, such as employment, food, energy, water, and housing, by guaranteeing the expansion of agriculture, manufacturing, power, and services while taking environmental issues into account.

Economic expansion has lifted more than 660 million people out of poverty and boosted the income levels of millions more during the last two decades, but it has done so at the price of the environment and poor communities far too often.

Through a variety of market, policy, and institutional failures. The natural capital of the Earth has been utilized in inefficient and wasteful ways, with little consideration for the underlying consequences of resource depletion. For decades, the burning of fossil fuels fueled rapid growth, but it also had catastrophic implications, with climate change now threatening to reverse decades of progress. Hundreds of millions of people have been left behind as a result of growth patterns: 1.2 billion people still lack access to electricity, 870 million are malnourished, and 780 million do not have access to clean, safe drinking water.

To reduce poverty and build shared prosperity for today's population and future generations, sustainable development recognizes that progress must be both inclusive and ecologically sound. It is resource-efficient and meticulously organized to provide immediate and long-term benefits to people, the environment, and prosperity.

4.1 Pillars of Sustainable Development

People, planet, prosperity, peace, and partnerships are the five pillars of sustainable development, which have been articulated through the "5 P's," or five pillars of sustainable development. These 5 P's give a new framework for doing due diligence for any action addressing global development and social concerns. To be sustainable, a development intervention must consider the social, economic, and ecological consequences it causes, as well as the tradeoffs and spinoffs it causes.

For a development intervention to be sustainable, decision makers must examine how it will be developed, owned, and carried out in collaboration, including with those who will be affected by the intervention's outcomes. In addition, one must consider the dimension of peace and governance, analyzing the larger societal context in terms of drivers of tension and conflict, as well as their impact on social cohesion and inclusion, and predicting the repercussions that may result in escalation or appeasement.

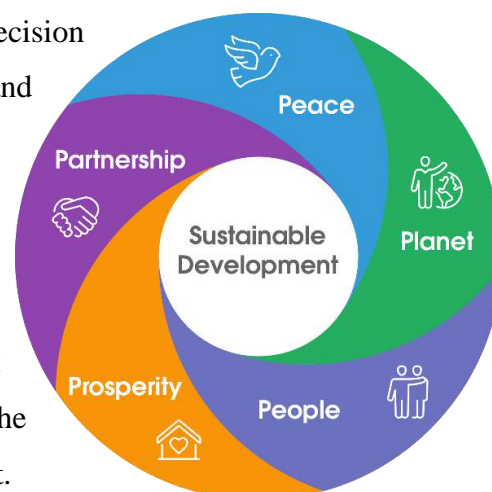


Fig. 4.1 Pillars of sustainable development

Table 4. Five pillars of sustainable development with its description

Pillar	Description
People	To eradicate poverty and hunger in all of their forms and dimensions, and to ensure that all people can live in dignity, equality, and a healthy environment.
Planet	To safeguard the world from degradation, especially via sustainable consumption and production, sustainable natural resource management, and urgent climate change action, so that it can meet the requirements of present and future generations.
Prosperity	To ensure that all people can live happy and fulfilled lives, and that economic, social, and technical growth occurs in a way that is environmentally friendly.
Peace	To foster peaceful, just, and inclusive society that are free of violence. There can be no sustainable development without peace and no peace without sustainable development.
Partnership	To mobilize the resources needed to carry out this Agenda through a revitalized Global Partnership for Sustainable Development, based on a spirit of strengthened global solidarity and focused on the needs of the world's poorest and most vulnerable people, and involving all countries, stakeholders, and people.

4.2 Sustainable Development Goals

The Sustainable Development Goals (SDGs), also known as the Global Goals, were first discussed at the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012. They were approved by all United Nations Member States in 2015. The UNDP's sustainable development goals replaced the Millennium Development Goals (MDGs), which began a global effort to combat poverty in 2000. The United Nations' Sustainable Development Goals were adopted as a universal call to action to eradicate poverty, protect the environment, and secure peace and prosperity for all people by 2030.



Fig. 4.2 Sustainable Development Goals

4.2.1 Goal 1: No Poverty

This goal aims to end poverty in all its forms everywhere.

Important targets of this goal are as follows:

- By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day.
- By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.
- By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services.

- By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

4.2.2 Goal 2: Zero Hunger

This goal aims to end hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Important targets of this goal are as follows:

- By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.
- By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.
- By 2030, double the agricultural productivity and incomes of small-scale food producers.

4.2.3 Goal 3: Good health and well-being

This goal aims to ensure healthy lives and promote well-being for all at all ages.

Important targets of this goal are as follows:

- By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births.
- By 2030, end preventable deaths of new-born and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births.
- By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.
- By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.
- By 2020, halve the number of global deaths and injuries from road traffic accidents.
- Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.

- By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

4.2.4 Goal 4: Quality Education

This goal aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Important targets of this goal are as follows:

- By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.
- By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education.
- By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.
- By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training.

4.2.5 Goal 5: Gender Equality

This goal aims to achieve gender equality and empower all women and girls.

Important targets of this goal are as follows:

- End all forms of discrimination against all women and girls everywhere.
- Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.
- Eliminate all harmful practices, such as child, early and forced marriage.
- Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies.

4.2.6 Goal 6: Clean water and sanitation

This goal aims to ensure availability and sustainable management of water and sanitation for all.

Important targets of this goal are as follows:

- By 2030, achieve universal and equitable access to safe and affordable drinking water for all.
- By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
- By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

4.2.7 Goal 7: Affordable and clean energy

This goal aims to ensure access to affordable, reliable, sustainable and modern energy for all.

Important targets of this goal are as follows:

- By 2030, ensure universal access to affordable, reliable and modern energy services.
- By 2030, increase substantially the share of renewable energy in the global energy mix.
- By 2030, double the global rate of improvement in energy efficiency.

4.2.8 Goal 8: Decent work and economic growth

This goal aims to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Important targets of this goal are as follows:

- Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries.
- By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.
- Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms.

- By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products.

4.2.9 Goal 9: Industry, innovation and infrastructure

This goal aims to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Important targets of this goal are as follows:

- Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.

4.2.10 Goal 10: Reduced inequalities

This goal aims to reduce inequality within and among countries.

Important targets of this goal are as follows:

- By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average.
- By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.

4.2.11 Goal 11: Sustainable cities and communities

This goal aims to make cities and human settlements inclusive, safe, resilient and sustainable.

Important targets of this goal are as follows:

- By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.
- By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.
- By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

4.2.12 Goal 12: Responsible consumption and production

This goal aims to ensure sustainable consumption and production patterns.

Important targets of this goal are as follows:

- Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries.
- By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

4.2.13 Goal 13: Climate Action

This goal aims to take urgent action to combat climate change and its impacts.

Important targets of this goal are as follows:

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries.

4.2.14 Goal 14: Life below water

This goal aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Important targets of this goal are as follows:

- By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.
- By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.
- By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based

management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.

4.2.15 Goal 15: Life on land

This goal aims to protect, restore and promote sustainable use of terrestrial ecosystems.

Important targets of this goal are as follows:

- By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.
- By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.
- By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services.

4.2.16 Goal 16: Peace, justice and strong institutions

This goal aims to promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

Important targets of this goal are as follows:

- Significantly reduce all forms of violence and related death rates everywhere.
- End abuse, exploitation, trafficking and all forms of violence against and torture of children.
- By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime.

4.2.17 Goal 17: Partnerships for the goals

This goal aims to strengthen the means of implementation and revitalize the global partnership for sustainable development.

Important targets of this goal are as follows:

- Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection.

- Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress.

4.3 Sustainable Development Report, 2021

Data on countries' progress toward the SDGs is included in the Sustainable Development Report 2021 (SDR2021). The sixth edition of the global SDG Index and Dashboards is included. It is not an official SDG monitoring tool; rather, it supplements national statistical offices' and international organizations' efforts to collect and standardize SDG indicators. To that purpose, the SDR2021 offers the most up-to-date data from official (UN, World Bank, etc.) and non-official (research institutes and non-governmental organizations) data sources, as well as quantitative thresholds determined from science for SDGs that lack a specific objective in the UN document.

4.3.1 Sustainable Development Goal Index, 2021

The SDG Index evaluates each country's overall performance on the 17 SDGs, giving each Goal equal weight. The score indicates where a country is in relation to the worst possible outcome (0) and the best, or target outcome (100). Finland's overall index score (85.9), for example, indicates that it is 86 percent of the way to the best possible outcome in each of the 17 Goals.

With a score of 60.07, India came in 120th place. According to available (pre-pandemic) trajectories, development in the areas of sustainable consumption and production, climate action, and biodiversity protection (SDGs 12–15) has been insufficient in many high-income countries.

This is partially owing to the SDGs' nature, which are primarily concerned with ending extreme poverty and ensuring equal access to basic services and infrastructure (SDGs 1–9). Furthermore, poorer countries are more likely to lack the infrastructure and institutions needed to solve the fundamental environmental concerns addressed by SDGs 12–15. Yet, before the pandemic hit, most low-income countries – with the exception of those experiencing ongoing armed conflict or civil war – were making progress towards ending extreme poverty and providing access to basic services and infrastructure, particularly in relation to SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth). However, in many situations, the COVID-19 pandemic has resulted in reversals of SDG progress. The image given below shows the progress in the world for each SDG since 2015 in percentage points (pp).



Fig. 4.3 Progress in the world for each SDG since 2015 in percentage points (PP)

4.3.2 Sustainable Development Goal Dashboard

The SDG dashboards display performance in terms of levels and trends, highlighting each country's strengths and weaknesses in connection to 17 goals.

- Overall, OECD member countries are closer to meeting the goals than other countries, but none of them are on track to achieve all 17 SDGs.
- Since the goals were adopted in 2015, East and South Asia has made more progress in achieving the SDGs than any other area. SDG 1 (No Poverty) and SDG 4 (Quality Education) are the two areas where the region excels.
- Eastern Europe and Central Asia are on average the most near to attaining SDG 1 (No Poverty) and SDG 4 (Quality Education). SDG 16 (Peace, Justice, and Strong Institutions) remains a challenge in comparison to other areas.
- SDG 7 (Affordable and Clean Energy) is where Latin American and Caribbean countries excel, but they face significant challenges on several other SDGs.
- Countries in the Middle East and North Africa show great disparity in their performance on the SDGs and progress being made. For several years, ongoing conflicts in some countries

have resulted in low and worsening performance on most SDGs, particularly SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), and SDG 16 (Peace, Justice and Strong Institutions).

The SDG dashboards (levels and trends) for 2021 by region and income group are listed below:

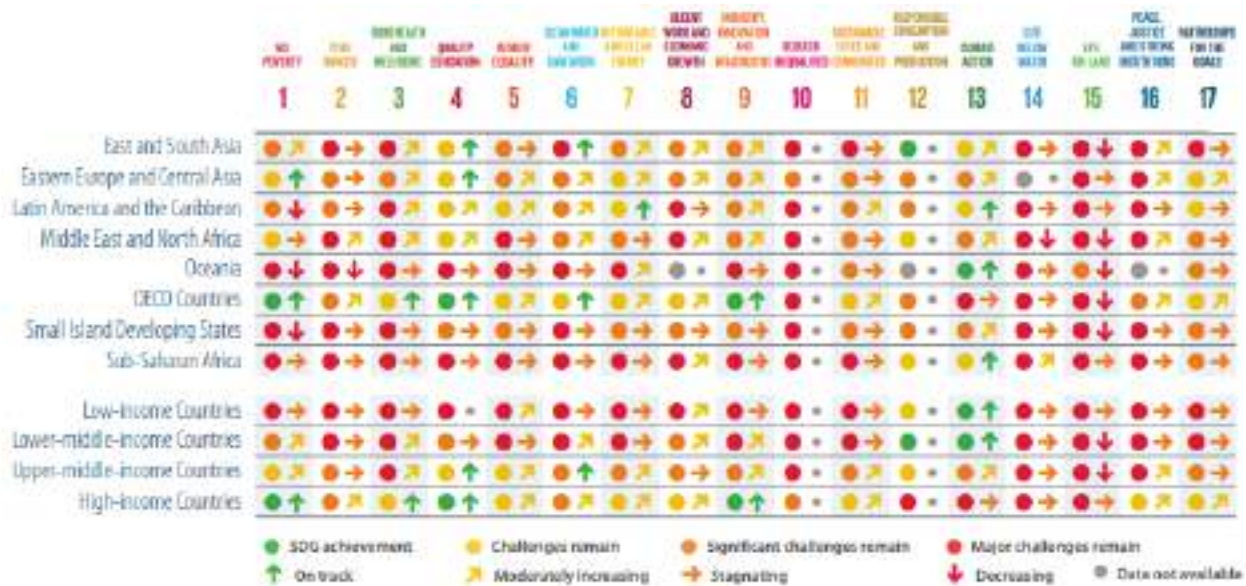


Fig. 4.4 Sustainable Development Goal Dashboard

4.4 Salient Features

- The Brundtland Commission Report of 1987 defined the notion of sustainable development as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”
- People, planet, prosperity, peace, and partnerships are the five pillars of sustainable development, which have been articulated through the "5 P's," or five pillars of sustainable development.
- The Sustainable Development Goals (SDGs), also known as the Global Goals, were first discussed at the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012.
- There are 17 SDGs: No poverty; zero hunger; good health and well-being; quality education; gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry, innovation and infrastructure; reduced inequalities; sustainable

cities and communities; responsible consumption and production; climate action; life below water; life on land; peace, justice and strong institutions; and partnerships for the goals.

- Sustainable Development Report 2021 (SDR2021) shows data on countries' progress toward the SDGs.
- The SDG Index evaluates each country's overall performance on the 17 SDGs, giving each Goal equal weight. The score indicates where a country is in relation to the worst possible outcome (0) and the best, or target outcome (100).
- The SDG dashboards display performance in terms of levels and trends, highlighting each country's strengths and weaknesses in connection to 17 goals.

IIPA 2022

Climate Change – Institutions and Agreements

Chapter 5

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh



2022

This chapter contains:

- United Nations Conference on the Human Environment (UNCHE)
- United Nations Environment Programme (UNEP)
- United Nations Conference on Environment and Development (UNCED)
- United Nations Commission on Sustainable Development (CSD)
- United Nations Framework Convention on Climate Change (UNFCCC)
- Kyoto Protocol, COP 3
- COP 15-27
- Intergovernmental Panel on Climate Change (IPCC)
- National Action Plan on Climate Change (NAPCC)
- National Adaptation Fund for Climate Change (NAFCC)
- REDD & REDD+

5. Climate Change Institutions and Agreements

5.1 United Nations Conference on the Human Environment (UNCHE)

The first United Nations (UN) conference to focus on international environmental issues was the United Nations Conference on the Human Environment, often known as the Stockholm Conference. The conference, held from June 5 to 16, 1972 in Stockholm, Sweden, represented a growing interest in conservation concerns throughout the world and lay the foundation for global environmental regulation. The Stockholm Conference's final declaration was an environmental manifesto that highlighted the finite nature of Earth's resources and the need for mankind to protect them. In December 1972, the United Nations Environment Programme (UNEP) was established as a result of the Stockholm Conference to coordinate global efforts to promote sustainability and protect the natural environment.

The Stockholm Conference began with a proposal from Sweden in 1968 that the United Nations host an international conference to evaluate environmental problems and identify those that would require international cooperation to solve. Delegations from 114 countries attended the 1972 conference. (Due to the exclusion of the German Democratic Republic [East Germany], which did not hold a UN seat at the time, it was boycotted by Soviet-bloc countries.) The final declaration, which elucidated 26 environmental principles, was a prominent example of documents developed during the conference that influenced international environmental law. The conference also produced the "Framework for Environmental Action," an action plan containing 109 specific recommendations on human settlements, natural resource management, pollution, environmental education and social aspects of the environment, development, and international organizations.

5.2 United Nations Environment Programme (UNEP)

The United Nations Environment Programme (UNEP) was launched as a result of the United Nations Conference on Human Environment (UNCHE) in order to encourage UN agencies to integrate environmental measures into their programmes. The UNEP is headquartered in Nairobi, Kenya. It is the world's leading environmental authority, setting the global environmental agenda, promoting the UN system's coherent implementation of the environmental dimension of sustainable development, and serving as an authoritative advocate for the global environment. UNEP's mission is to provide leadership and encourage partnership in caring for the environment

by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations.

5.3 United Nations Conference on Environment and Development (UNCED)

United Nations Conference on Environment and Development (UNCED) is also known as the Rio Summit; Rio Conference; Earth Summit was held in Rio de Janeiro in June 1992. Its main goal was to alleviate the global environmental system by implementing sustainable development. Following are some other issues addressed:

- Systematic scrutiny of production patterns, notably the production of toxic components, such as lead in gasoline, or poisonous waste, including radioactive chemicals.
- Alternative energy sources to replace the usage of fossil fuels, which are linked to global climate change.
- A new reliance on public transportation systems to reduce vehicle emissions, city congestion, and health problems caused by polluted air and smog.
- Growing water scarcity.

The Earth Summit resulted in the following documents:

5.3.1 Rio Declaration on Environment and Development

The Rio Declaration on Environment and Development, often shortened to Rio Declaration, was a short document produced at the 1992 United Nations “Conference on Environment and Development” (UNCED), informally known as the Earth Summit. The Rio Declaration consisted of 27 principles intended to guide future sustainable development around the world.

5.3.2 Agenda 21

Agenda 21 is an action plan of the United Nations (UN) related to sustainable development and was an outcome of the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in 1992. It is a comprehensive blueprint of action to be taken globally, nationally and locally by organizations of the UN, governments, and major groups in every area in which humans directly affect the environment.

The number 21 refers to an agenda for the 21st century. Agenda 21 was supposed to be implemented at the international, national, regional, and local levels. As proposed in Chapter 28

of the document, several national and state governments have legislated or advised municipal governments to take steps to implement the plan locally. 'Local Agenda 21' or 'LA21' is a term used to describe such programmes.

5.3.3 Forest Principles

The forest principles (also known as the Rio Forest Principles) are an informal term for the UNCED-produced Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation, and Sustainable Development of All Types of Forests (1992). It is a non-binding document that provides various conservation and sustainable development forestry recommendations. The negotiation of the document, at the Earth Summit was complicated by demands from developing nations in the Group of 77 for increased foreign aid in order to pay for the setting aside of forest reserves. Developed nations resisted those demands and the final document was a compromise.

In addition, two legally binding conventions aimed at preventing global climate change and the eradication of the diversity of biological species were opened for signature at the summit.

- United Nations Framework Convention on Climate Change (UNFCCC)
- The convention on biological diversity

5.4 United Nation Commission on Sustainable Development (CSD)

The United Nations Commission for Sustainable Development (CSD) was established in December 1992 by the United Nations General Assembly. The following are its functions:

- Reviewing progress in the implementation of Agenda 21 and the Rio Declaration on Environment and Development.
- At the local, national, regional, and international levels, providing policy guidance to follow up on the Johannesburg Plan of Implementation (JPOI).
- Promoting dialogue and building partnerships for sustainable development with governments, the international community and the major groups identified in Agenda 21 as key actors outside the central government who have a major role to play in the transition towards sustainable development.

5.5 United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change acknowledges that the climate system is a shared resource whose stability may be influenced by carbon dioxide and other greenhouse gas emissions. It establishes a broad framework for international efforts to combat climate change. Under the convention, governments are required:

- To collect and exchange data on greenhouse gas emissions, national policies, and best practices.
- Launch national strategies for reducing greenhouse gas emissions and adapting to anticipated consequences, including financial and technological assistance to developing countries.
- Prepare to adapt to the effects of climate change by working together.

5.6 Kyoto Protocol, COP 3

On December 11, 1997, the Kyoto Protocol was adopted. It took effect on February 16, 2005, after a lengthy ratification process. The Kyoto Protocol now has 192 parties. In short, the Kyoto Protocol operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries and economies in transition to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets. The Convention itself only asks those countries to adopt policies and measures on mitigation and to report periodically.

Classification of Parties

Annex I: There are 43 parties to the UNFCCC listed in Annex 1 of the Convention, including the European Union. These parties are classified as industrialized (developed) countries and “economies in transition” (EITs).

Annex II: There are 24 parties to the UNFCCC listed in Annex II of the convention, including the European Union. These parties are made up of members of the OECD. Annex II Parties are required to provide financial and technical support to the EITs and developing countries to assist them in reducing their greenhouse gas emissions (climate change mitigation) and manage the impacts of climate change (climate change adaptation).

Least-developed countries (LDCs): 49 parties are LDCs and are given special status under the treaty in view of their limited capacity to adapt to the effects of climate change.

Non-Annex I: Parties to the UNFCCC not listed in Annex-I of the convention are mostly low-income developing countries. Developing countries may volunteer to become Annex-I countries when they are sufficiently developed.

The Kyoto Protocol is based on the Convention's principles and provisions, and it follows the Convention's annex-based structure. Because it recognizes that developed countries are mostly responsible for the current high levels of GHG emissions in the atmosphere, it only binds them and lays a higher burden on them under the principle of "common but differentiated responsibility and respective capabilities." The Kyoto Protocol's Annex B sets binding emission reduction targets for 37 industrialized countries and economies in transition, as well as the European Union. Over the five-year period 2008–2012, these targets sum up to an average 5% decrease in emissions relative to 1990 levels (the first commitment period).

One of the most important aspects of the Kyoto Protocol was the creation of flexible market mechanisms based on the trading of emission permits. Countries must meet their targets largely through national measures under the Protocol. However, the Protocol also offers them an additional means to meet their targets by way of three market-based mechanisms:

5.6.1 International Emission Trading

Parties to the Kyoto Protocol who have made commitments (Annex B Parties) have agreed to set emission reduction targets. Over the commitment period of 2008-2012, these targets are expressed as levels of allowable emissions, or assigned amounts. The allowable emissions are classified into assigned amount units (AAUs).

Emissions trading, as defined in Article 17 of the Kyoto Protocol, permits countries with excess emission units - emissions that have been allowed but not "used" - to sell them to countries that have exceeded their targets. As a result, a new commodity in the form of emission reductions or removals was formed. People simply refer to carbon trading since carbon dioxide is the most common greenhouse gas. Carbon is now tracked and traded like any other commodity. The "carbon market" is the term for this.

5.6.2 Clean Development Mechanism (CDM)

A country having an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) can implement an emission-reduction project in developing countries under the Clean Development Mechanism (CDM), as outlined in Article 12 of the Protocol. These projects can earn saleable certified emission reduction (CER) credits, each of which is equal to one tonne of CO₂ and can be used to achieve Kyoto targets.

Many consider the mechanism to be a trailblazer. It's the world's first global environmental investment and credit scheme, providing CERs, a standardized emissions offset instrument. A CDM project activity might include, for example, a solar-panel-powered rural electrification project or the installation of more energy-efficient boilers. The mechanism promotes sustainable development and emission reductions while providing industrialized countries with some flexibility in meeting their emission reduction or limitation targets.

5.6.3 Joint Implementation (JI)

The mechanism known as "joint implementation," defined in Article 6 of the Kyoto Protocol, allows a country with a Kyoto Protocol emission reduction or limitation commitment (Annex B Party) to earn emission reduction units (ERUs) from an emission-reduction or emission-removal project in another Annex B Party, each ERU equaling one tonne of CO₂, which can be counted towards meeting its Kyoto target. Joint implementation allows Parties to achieve a portion of their Kyoto commitments in a flexible and cost-effective manner, while the host Party benefits from foreign investment and technology transfer.

5.7 Bali Meet

Bali meet, In December 2007, was the meeting of 190 countries that are parties to the UN Climate Change Treaty. The objectives of Bali Meet are as follows:

- The treaty's aim was to persuade the world to take action to reduce greenhouse gas emissions, which cause climate change.
- The purpose of the meeting in Bali was to discuss what would happen after 2012, i.e., what countries should do once the first phase of Kyoto ends in 2012.
- As per developed countries after 2012, even developing countries like India and China, who are increasing their emissions as their economies grow economically, would have to make

some form of emission reduction. This necessitated a comprehensive rewrite of the current United Nations convention.

- The nations have agreed on a new set of principles in Bali that will assist them decide on a post-2012 deal.

5.7.1 Bali Roadmap

The Bali road map was adopted by the participating nations as a two-year process to finalize a binding agreement in Copenhagen in 2009. The Bali roadmap includes:

- The Bali Action Plan (BAP),
- The Ad Hoc working group on further commitments for Annex 1 Parties under the Kyoto Protocol negotiations and their 2009 deadline,
- Launch of the Adaptation Fund,
- Technology transfer decisions and,
- On reducing deforestation-related emissions.

5.7.2 Bali Action Plan

The conference of parties decided to launch a comprehensive process to enable the convention's implementation through long-term cooperative action up to and beyond 2012, by addressing the following issues:

- A common vision for long-term cooperation, including a long-term global emission reduction goal.
- Increased national and international action on climate change mitigation.
- Enhanced action on adaptation.
- Improved technology development and transfer to support mitigation and adaptation actions.
- Increased efforts to provide financial resources and investments to promote mitigation, adaptation, and technological cooperation actions.

5.8 Copenhagen Climate Change Conference, COP 15

The Copenhagen Summit was the 15th meeting of parties of the UNFCCC, hence, also called the COP15 Summit. In 2009, it was held in Copenhagen, Denmark. The 15th Conference of the Parties (COP 15) was a crucial event in the negotiating process.

- It made significant progress in negotiations on the infrastructure required for effective global climate change cooperation, including changes to the Kyoto Protocol's Clean Development Mechanism.
- Significant progress was made in narrowing down options and clarifying choices needed to be made on key issues later on in the negotiations.
- It resulted in the Copenhagen Accord, which stated a strong political intent to limit carbon emissions and respond to climate change in the short and long term.

5.8.1 Copenhagen Accord

The Copenhagen Accord included a number of significant elements on which governments' views were quite similar. The long-term goal of limiting the maximum global average temperature increase to no more than 2°C over pre-industrial levels, which will be reviewed in 2015, was included. However, there was no consensus on how to accomplish this in practice. It also included a recommendation to consider limiting global warming to 1.5°C, which is a crucial demand of vulnerable developing countries. Other key components included:

- Promises from developed countries to fund actions in developing countries to reduce greenhouse gas emissions and adapt to the unavoidable repercussions of climate change. Developed countries promised to provide US\$30 billion for the period 2010-2012, and to mobilize long-term finance of a further US\$100 billion a year by 2020 from a variety of sources.
- Agreement on the measurement, reporting and verification of developing country actions, including a reference to "international consultation and analysis", which had yet to be defined.
- The establishment of four new bodies: a mechanism on REDD-plus, a High-Level Panel under the COP to study implementation of financial provisions, the Copenhagen Green Climate Fund, and a Technology Mechanism.

5.9 Cancun Climate Change Conference, COP 16

From November 29 to December 10, 2010, the United Nations Climate Change Conference was held in Cancun, Mexico. This was the 16th session of the Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC), so referred as COP 16. This was

also the 6th session of the Conference of the Parties, usually known as CMP6, which served as the conference of the Parties to the Kyoto Protocol.

Aside from the Cancun agreement, COP 16 produced three mechanisms: the Technology Mechanism, the Green Climate Fund, and the Adaptation Fund.

5.9.1 The Cancun Agreement

The Cancun Agreements were a set of major decisions by the international community to confront the long-term challenge of climate change collectively and comprehensively over time, as well as to take urgent meaningful action to speed up the global response to it.

The agreements reached on December 11 in Cancun, Mexico, at the 2010 United Nations Climate Change Conference represented significant progress in capturing plans to reduce greenhouse gas emissions and assist developing nations in protecting themselves from climate impacts and building their own sustainable futures. Simply put, the key goals of the Cancun Agreements are:

- a) Mitigation:** Establish clear goals and a timetable for reducing human-caused greenhouse gas emissions over time in order to keep global average temperature rise below 2°C encourage all countries to participate in reducing these emissions, based on their respective responsibilities and capabilities. Review progress toward the 2° goal, as well as whether the aim should be enhanced in the future, including consideration of a 1.5°C goal, by 2015, based on the best scientific knowledge available.
- b) Transparency of actions:** Ensure that the actions taken by countries are transparent on a global scale, and that global progress toward the 2°C goal is assessed on a regular basis.
- c) Technology:** Boost efforts to address climate change by mobilizing clean technology development and transfer, bringing it to the right place at the right time and for the best effect on both adaptation and mitigation.
- d) Finance:** To enable developing countries to take stronger and more effective action, mobilize and give scaled-up finances in the short and long term. Set up the Green Climate Fund to aid developing nations in reducing and adapting to the effects of climate change.
- e) Adaptation:** Assist the world's most vulnerable people in adapting to climate change's unavoidable effects by taking a coordinated approach to adaptation.

- f) **Forests:** Protect the world's forests, which constitute a huge carbon sink. Governments have decided to take concrete action on forests in developing countries, which will become more common in the future.
- g) **Capacity building:** To tackle the overall challenge, build global capability, particularly in developing nations; construct effective institutions and procedures to guarantee that these goals are met.

5.9.2 Technology Mechanism

A technology mechanism is expected to facilitate the implementation of enhanced action on technology development and transfer in order to support action on mitigation and adaptation to climate change.

5.9.3 Green Climate Fund

The Green Climate Fund (GCF) is the world's largest environmental fund, with the goal of supporting poor nations in lowering greenhouse gas emissions and preparing for climate change adaptation. This is accomplished by providing funds for projects, programmes, policies, and other activities through a cutting-edge funding window. It was formally established as a financing mechanism by the United Nations Framework Convention on Climate Change (UNFCCC) in 2010. It's in the Songdo district of South Korea.

The goal of the GCF is to facilitate a paradigm shift toward low-emission, climate-resilient development by aiding developing countries in limiting or reducing greenhouse gas emissions (mitigation) and adapting to the effects of climate change (adaptation). The GCF's aim is to make a significant and ambitious contribution to global efforts to accomplish the international community's climate change goals, given the urgency and severity of climate change.

5.9.4 Adaptation Fund

The Adaptation Fund was intended to fund specific adaptation projects and programmes in developing countries that are particularly vulnerable to the negative consequences of climate change and are signatories to the Kyoto Protocol. The Adaptation Fund is supported by a portion of the earnings from Clean Development Mechanism project activities as well as other funding sources. A CDM project activity's share of revenues is equal to 2% of certified emission reductions (CERs) issued. The Adaptation Fund Board is in responsible for supervising and managing the

fund (AFB). The AFB meets at least twice a year and is made up of 16 members and 16 alternates. The Global Environment Facility (GEF) offers secretariat services to the AFB upon invitation from parties, while the World Bank serves as the trustee of the Adaptation Fund on an interim basis.

5.10 Durban Climate Change Conference, COP 17

The United Nations Climate Change Conference in Durban was a turning point in climate change negotiations. Governments clearly recognized the need for a new universal, legal agreement to deal with climate change beyond 2020 in Durban, where everyone will play their part to the best of their capacity and everyone will be able to share the advantages of success.

The following are the outcomes of the Durban Summit:

- New deal to be finalized by 2015 and launched by 2020.
- The Kyoto Protocol's second phase has been secured.
- The Green Climate Fund has been established, however it is currently empty. A green technology development framework has also been established.
- In future climate discussions, equity will be reintroduced.
- Adaptation mechanism; Transparency mechanism.
- Secures ten years of economic development without carbon reduction, intellectual property rights, or technologies that aren't as strongly grounded in the New Deal.

5.11 Doha Climate Change Conference, COP 18

Governments consolidated the accomplishments of the past three years of international climate change negotiations during the 2012 UN Climate Change Conference in Doha, Qatar (COP18/CMP8), and opened the door to much higher ambition and action on all levels. Governments have made a number of choices, including:

- They reaffirmed their commitment and established a deadline for adopting a worldwide climate accord by 2015, which will take effect in 2020.
- Streamlined the negotiations, completing the work under the Bali Action Plan to concentrate on the new work towards a 2015 agreement under a single negotiating stream in the Ad hoc Working Group on the Durban Platform for Enhanced Action (ADP).

- They emphasized the importance of increasing their goal to reduce greenhouse gas emissions (GHGs) and assisting vulnerable countries in adapting.
- Launched a new commitment period under the Kyoto Protocol, ensuring that the treaty's fundamental legal and accounting models are preserved and reinforcing the principle that developed countries must lead mandatory greenhouse gas emission reductions.
- Further progress were made towards the establishment of financial and technological support, as well as new institutions, to enable clean energy investments and sustainable growth in developing countries.

5.11.1 Amendment of the Kyoto Protocol

The Kyoto Protocol, which is the only existing and binding agreement under which developed countries take quantitative pledges to reduce greenhouse gas emissions, was amended to allow it to continue in its current form. Specifically:

- Governments agreed to a second commitment period of eight years, which began on January 1, 2013.
- The Protocol's valuable accounting rules were preserved, and legal requirements that will allow it to continue smoothly were agreed upon.
- Countries who are taking on further Kyoto Protocol commitments agreed to reassess their commitments by 2014 at the latest, with the purpose of increasing their respective levels of ambition.
- The Kyoto Protocol's Market Mechanisms; the Clean Development Mechanism (CDM), Joint Implementation (JI) and International Emissions Trading (IET) will continue.
- Access to the mechanisms remains uninterrupted for all developed countries that have accepted targets for the second commitment period.
- With the adoption of tables for biannual reports known as common tabular format, a major element was added to the measuring, reporting, and verification (MRV) framework for developed countries, therefore improving transparency and accountability.
- Surplus assigned amount units (AAUs) can be carried over indefinitely from the Kyoto Protocol's first to second commitment periods by Annex-I Parties with a target for the second commitment period, but there are restrictions on how these carried-over AAUs can be used in

the second commitment period and quantitative limits on how many of these units can be acquired from other Parties.

5.11.2 Completion of new infrastructure

Governments pushed the completion of new infrastructure to channel technology and finance to developing countries, as well as the complete execution of this infrastructure and assistance, in Doha. Most notably, they:

- Endorsed the Republic of Korea's nomination as the host of the Green Climate Fund (GCF) and the Standing Committee on Finance's work plan. In Songdo, the GCF was expected to begin work in the second half of 2013.
- Confirmed, Climate Technology Center (CTC) will be hosted by a UNEP-led consortium for a five-year first period. CTC is the UNFCCC Technology Mechanism's implementation arm, along with its associated Network. The formation of the CTCN Advisory Board was also agreed upon by the governments.

5.12 Warsaw Climate Change Conference, COP 19

Governments made more important decisions at the UN Climate Change Conference in Warsaw in order to stay on track for a universal climate agreement in 2015. The 2015 agreement aimed to achieve two goals:

- First, to unite nations in a global effort to decrease emissions quickly enough to map humanity's longer-term route out of the danger zone of climate change while also creating adaptation capacity.
- Second, to encourage more rapid and broad action.

5.12.1 Closing the pre-2020 ambition gap

Before the new agreement takes effect in 2020, governments agreed to strengthen measures to close the "ambition gap," or the difference between what has been committed so far and what is necessary to keep the globe below a maximum average temperature rise of 2°C. They will step up their technical examination of opportunities with a high potential for reducing greenhouse gas emissions, and they will meet with Ministers on a regular basis to discuss the matter. Governments will also speed up the deployment of regulations and environmentally friendly technology to

achieve this goal. They also urge for the cancellation of Certified Emission Reductions (CERs) under the Kyoto Protocol's Clean Development Mechanism on a voluntary basis.

5.12.2 Cutting emissions from deforestation - "the Warsaw Framework for REDD+"

Governments came to an agreement on a set of measures to minimize emissions caused by deforestation and forest degradation. The decisions are the result of seven years of work, and their agreement represents a significant step forward in climate action. Deforestation is responsible for around 20% of global CO₂ emissions. The series of decisions promotes forest preservation and sustainable forest management, with immediate advantages for those who live near forests. The package establishes a framework for action transparency and integrity, as well as clarifies support coordination. It lays the groundwork for results-based payments if developing countries can show that forests are being protected. The package is backed by initial commitments of USD 280 million for this aim.

5.12.3 Progress towards accountability

The framework for measuring, reporting, and verifying mitigation efforts, including those undertaken by developing nations, is now fully functioning. This agreement by governments is significant because it implies that nations' mitigation, sustainability, and support efforts can now be better measured, which is a major accomplishment after many years of hard work. Donors and investors who may be interested in supporting nationally suitable mitigation activities will build confidence as a result of this.

5.12.4 Technology to boost action on climate change

The Climate Technology Centre and Network (CTCN), whose mission is to promote technology collaboration and transfer to developing countries, is already operational. The CTCN's Advisory Board came to an agreement on the CTCN's rules. This implies that the CTCN, which was established in Cancun in 2010, is now ready to assist developing countries in response to their requests for assistance through their national designated entities. The CTCN is prepared to respond to requests from developing countries about technological development and transfer.

5.13 Lima Climate Change Conference, COP 20

The 20th Conference of the Parties and the 10th Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol were held in Lima, Peru, from December 1 to 14. Other significant accomplishments, decisions, and "firsts" in the history of the international climate process were obtained at the Lima Climate Conference. Prior to and during the COP, both developed and developing countries made pledges that increased the capitalization of the new Green Climate Fund (GCF) above its initial \$10 billion aim.

Transparency and confidence-building reached new heights as a number of developed countries agreed to be questioned about their emissions targets as part of a new procedure known as Multilateral Assessment. The Lima Ministerial Declaration on Education and Awareness-Raising encourages countries to include climate change into school curriculum and climate awareness into the national development plans.

5.13.1 Steps Forward on Adaptation

In Lima, progress was made on elevating adaptation onto the same level as the curbing and cutting of curbing greenhouse gas emissions. This will be accomplished by:

- Recognition that National Adaptation Plans (NAPs) offer an important way of delivering resilience.
- NAPs will now be more visible on the UNFCCC website, which should increase their chances of gaining support.
- Discussions with the Green Climate Fund (GCF) on how nations may be assisted with their NAPs have been given the green light, which should result in an increase in the number of these plans coming forward for assistance.
- The COP President, Manuel Pulgar-Vidal, created the NAP Global Network, which includes Peru, the United States, Germany, the Philippines, Togo, the United Kingdom, Jamaica, and Japan.
- The Lima Adaptation Knowledge Initiative, a Nairobi Work Programme pilot project in the Andes, has demonstrated that identifying adaptive requirements of communities may be effectively recorded.

5.13.2 More Countries Accept the Kyoto Protocol Doha Amendment

The Doha Amendment has now received the agreement of Nauru and Tuvalu, bringing the total number of Parties to 21—144 are required to bring it into force. The United Nations is urging states to ratify the Kyoto Protocol's second commitment period, or global emissions reduction pact, as soon as possible in order to give global climate action a boost in the years running up to 2020.

5.13.3 New climate action portal

With UNFCCC cooperation, Peru's government established a new platform to raise awareness of the wealth of climate action among cities, regions, corporations, and investors, including those participating in international cooperative initiatives. The portal, named the Nazca Climate Action Portal, is intended to boost momentum in the run-up to Paris by showcasing the wealth of non-state action.

5.13.4 Lima Work Programme on Gender

Women's roles are critical in the fight against climate change, and they must be enhanced. The Lima Conference agreed on a Lima Work Programme on Gender to enhance gender balance and promote gender sensitivity in climate policy development and implementation.

5.13.5 UNFCCC NAMA Day

A special gathering was held to discuss how to cut emissions using so-called “nationally appropriate mitigation actions” (NAMA). NAMAs are plans by developing countries to cut emissions and develop in a sustainable manner that can be backed up by developed countries. The UNFCCC secretariat has set up a register to match requests for assistance with offers of support.

5.13.6 Climate action on the ground celebrated by the UN

The UNFCCC Secretariat's Momentum for Change Initiative gave awards to representatives of some of the world's greatest climate solutions that encourage further climate action. This year's Momentum for Change initiative featured the area of Information and Communication Technology for the first time.

5.14 Paris Climate Change Conference, COP 21

The Paris Agreement on Climate Change is a legally binding international agreement on the subject of climate change. It was adopted by 196 Parties at COP 21 in Paris on December 12, 2015, and went into effect on November 4, 2016. Its objective is to keep global warming considerably below 2°C, ideally 1.5, relative to pre-industrial levels. Countries want to accomplish global peaking of greenhouse gas emissions as soon as possible to produce a climate neutral world by mid-century in order to meet this long-term temperature objective. The Paris Agreement is a defining moment in the international climate change process because it is the first time that a legally binding agreement binds all nations together in a common cause to fight climate change and adapt to its repercussions.

The Paris Agreement's implementation necessitates economic and societal transformations based on the best available science. The Paris Agreement is based on a five-year cycle of countries taking progressively aggressive climate action. Countries must submit their climate action plans, known as nationally determined contributions, by 2020. (NDCs).

5.14.1 Nationally Determined Contributions (NDCs)

Countries outline steps they will take to decrease greenhouse gas emissions in their NDCs in order to meet the Paris Agreement's goals. Countries also describe the steps they will take to improve resilience and adapt to the effects of rising temperatures in their NDCs.

5.14.2 Long-Term Strategies

To better frame the efforts towards the long-term goal, the Paris Agreement invites countries to formulate and submit by 2020 long-term low greenhouse gas emission development strategies (LT-LEDS). LT-LEDS provide the long-term horizon to the NDCs. Unlike NDCs, they are not mandatory. Nevertheless, they place the NDCs into the context of countries' long-term planning and development priorities, providing a vision and direction for future development.

5.15 Marrakech Climate Change Conference, COP 22

The Marrakech meeting was the 22nd Session of the Conference of the Parties to the U.N. Framework Convention on Climate Change (UNFCCC), known as COP 22. It also served as the inaugural meeting of the Paris Agreement's governing body, known as the CMA. The conference

incorporated the twenty-second Conference of the Parties (COP22), the twelfth meeting of the parties for the Kyoto Protocol (CMP12), and the first meeting of the parties for the Paris Agreement (CMA1). The purpose of the conference was to discuss and implement plans about combating climate change and to “[demonstrate] to the world that the implementation of the Paris Agreement is underway”. Participants collaborate to develop global climate change solutions. Following are the salient outcomes:

- **International Solar Alliance:** India went to Marrakesh with a draft Framework Agreement on International Solar Alliance, which 26 countries signed. The Agreement will take the shape of an international treaty once 15 countries that have signed up, ratify it.
- **Adaptation of African Agriculture (AAA):** The triple-A initiative seeks to climate-proof agriculture in Africa by promoting sustainable soil management, better water management, and risk mitigation strategies. 27 African countries are already on the platform.
- **Mission Innovation:** There will be greater research collaborations between these countries, which together account for almost 80% of all investments into clean energy research. The mission has identified 7 innovation challenges, including smart grids, carbon capture and sequestration, building of storage cells for solar energy, clean energy materials and sustainable biofuels. Science Based Targets initiative got a boost in Marrakech when over 200 companies worldwide committed to emissions reductions targets.
- **Climate Vulnerable Forum:** Member countries stressed that the target should be to keep global temperature rise to within 1.5°C (not 2) from pre-industrial times. They vowed to update their climate action plans before 2020 to bring in greater ambition, and prepare a long-term low-carbon development strategy for 2050 with a 1.5°C target in mind. They also said they would strive to reach 100% renewable energy production between 2030 and 2050.
- **Sub-national jurisdictions target:** 165 sub-national jurisdictions, calling themselves the Under2s, announced that they would reduce their emissions by 80-95 per cent below 1990 levels and limit their per capita emissions to under 2 tonnes of carbon dioxide by 2050. These governments range across states like California, New York and Telangana and cities like Manchester and Sao Paulo, and contribute to over a third of the global economy.
- **2050 Pathway Platform:** This is an effort to get countries, cities and businesses to accept long-term targets for climate action. Countries have submitted 5-year or 10-year action plans as part of their commitments under the Paris deal.

- **Warsaw International Mechanism for Loss and Damage**, the framework for a five-year rolling work plan was approved. It will serve as the basis for developing corresponding activities, starting with the first meeting in 2017. Since adaptation has limitations, this is a global mechanism to provide support to countries that sustain ongoing and future harm from climate change. The aim will be to address issues such as extreme events, non-economic losses, displacement, migration, slow-moving climatic changes and risk management. Nearly 200 nations attending the COP22 to the UNFCCC have adopted Marrakech Action Proclamation for Our Climate and Sustainable Development.

One focus in Marrakech was to clarify all the rules related to NDCs so that each country could be confident that others were being transparent about their actions.

5.16 Bonn Climate Change Conference, COP 23

At the UN Climate Change Conference (COP23, from 6 to 17 November, 2017) nations of the world met to advance the aims and ambitions of the Paris Agreement and achieve progress on its implementation guidelines. The conference, officially referred as COP 23/ CMP 13/ CMA 1-2, took place in Bonn, Germany, hosted by the secretariat of the UN Framework Convention on Climate Change (UNFCCC), and presided over by Fiji. It concluded with countries putting in place a roadmap for ‘Talanoa Dialogue’, a year-long process to assess countries’ progress on climate actions.

5.16.1 Talanoa Dialogue

Talanoa is a traditional approach used in Fiji and other Pacific islands to engage in an inclusive, participatory and transparent dialogue to resolve differences without putting any blame on any one. As per COP23 decision, it has been structured around three questions to arrive at answers with consensus: Where are we? ; Where do we want to go? ; How do we get there?

The dialogue will be conducted in a manner that promotes enhanced ambition. It will help parties to UNFCCC review their actions and discuss way forward in terms of raising ambitions before 2020. It will consider efforts of Parties on mitigation action and financial and technical support, as appropriate, as one of its elements, in the pre-2020 period under 1997 Kyoto Protocol.

5.16.2 Obligations under Kyoto Protocol

The COP23 outlined what all the rich nations need to do as far as their pre-2020 actions under Kyoto Protocol are concerned. It was crucial demand of developing countries. The pre-2020 actions refer to existing obligations of small group rich and developed nations to take mitigation actions under Kyoto Protocol. On the other hand, post-2020 actions are meant for all countries as per their nationally determined contributions (NDCs) under 2015 Paris Agreement.

5.17 Katowice Climate Change Conference, COP 24

COP24 is the informal name for the 24th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). COP24 took place from 2-14 December 2018, in Katowice, Poland. Following are the outcomes of the conference:

- Paris Rulebook: The COP-24 finalized a “rulebook” to operationalize 2015 Paris Agreement.
- The rulebook set out how countries will provide information about their Nationally Determined Contributions describing their domestic climate actions, mitigation and adaptation measures.
- The rulebook covers areas such as how countries should report their greenhouse gas emissions, contributions to climate finance, what rules should apply to voluntary market mechanisms, such as carbon trading etc.
- The rulebook has addressed some concerns about the opaqueness of climate financing, such as, developed nations will have to provide hard data on the sources of future financial flows. Climate finance refers to local, national or transnational financing—drawn from public, private and alternative sources of financing. It seeks to support mitigation and adaptation actions that will address climate change.
- The UNFCCC, the Kyoto Protocol and the Paris Agreement call for financial assistance from developed countries to developing and less developed countries in accordance with the principle of “common but differentiated responsibility and respective capabilities”. Under Paris Agreement, developed countries have committed to provide \$100 billion annually from 2020 for dealing with climate change.
- The rulebook describes which loans, concessions and grants can be classified as climate finance, how they should be accounted for, and the kind of information about them needed to be submitted.

- The modalities and procedures for Monitoring and Progress Report System proposal (MPR) to (INDC) were also discussed.

5.18 Madrid Climate Change Conference, COP 25

The 25th edition of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) or COP25 began from December 2, 2018 in Madrid (Spain). Originally, the Summit was scheduled to be held at Chile (South America) but violent mass movement across the country made Chile reluctant from hosting the event. The prime objective of the conference was to complete the rule-book to the 2015 Paris Agreement that would become effective in 2020 to replace the 1997 Kyoto Protocol (comes to an end in 2020).

- The issues like the creation of new carbon markets, emission reduction targets, country's individual targets, etc. remained unresolved during COP24 at Katowice (Poland) 2019. Thus the rulebook under the Paris Agreement could not be finalized.
- The summit also discussed the functioning of international emissions trading systems, compensation for poor countries to deal with rising sea levels and other consequences of climate change.
- It considered the Annual Emissions Gap Report, produced by the UN Environment Programme (UNEP) and a series of reports from the Intergovernmental Panel on Climate Change (IPCC). Both the reports summarized that the goal of keeping average temperatures within 1.5°C from pre-industrial times is "on the brink of becoming impossible." As the overall emissions are still increasing worldwide.
- The processes and methods of reporting information about climate change would be fixed during the summit. Specifically, the developing countries will try to ensure that there are greater appreciation and recognition of the issue of loss and damage due to climate change. There was a demand to institute a mechanism to compensate countries that suffer major losses due to climate change-induced events like cyclones or floods.
- It puts into efforts for committing to a long-term action plan to fight climate change. So far only 71 countries, most of them small emitters, have committed themselves to achieve net-zero emissions by 2050.

5.19 Glasgow Climate Change Conference, COP 26

The 26th UN Climate Change Conference of the Parties (COP26) was held in Glasgow. The 26th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) was initially scheduled to take place between November 9 and 19, 2020, but due to the COVID-19 pandemic, it was rescheduled. It started on October 31, 2021.

5.19.1 Minutes of the Meeting: Achievements & Setbacks

- **New Global and Country Targets:** The Glasgow Summit has urged countries to consider strengthening their 2030 targets by COP27 to be held in Egypt in 2022. The summit targeted global warming not to exceed +1.5°C and got about 140 countries to announce target dates for bringing emissions down to net zero. The achievement is significant as in the Paris Agreement, the developing countries did not agree to reduce emissions but just the “emissions-intensity” of GDP. India has also joined the consensus and announced its net-zero target of 2070. This is a step ahead from India’s past position where it never accepted the need to reduce emissions.
- **Glasgow Breakthrough Agenda:** A potentially important development which emerged out of COP26 (but outside the COP process) is the Glasgow Breakthrough Agenda endorsed by 42 countries (including India). This is a cooperative effort to accelerate the development and deployment of clean technologies and sustainable solutions in areas such as clean power, road transport, steel and hydrogen.
- **Phasing-Down Coal Consumption:** Coal is the dirtiest of fossil fuels and an early phasing out of coal is clearly desirable. European countries have pushed hard for its phase out; however, developing countries have resisted this. A middle path, as suggested by India, was referred to at the COP26 calling for a “phase-down” of coal-based power.
- **Best Case Scenario:** An early assessment by Climate Action Tracker (CAT), an independent organisation, suggests that the targets declared, if fully achieved, could limit global warming to around +1.8°C. However, it also warns that the targets for 2030 are insufficiently ambitious. Unless significantly tightened, the world is more likely to end up seeing global temperatures rise by 2.1°C to 2.4°C.

5.19.2 Setbacks of the Meeting

- **Voluntary Targets:** The targets set at the meeting are voluntary with no mechanism for enforcement or penalties for non-compliance. Many targets are conditional on availability of adequate financial support.
- **Lack of Specific Details and Actions:** Many countries have not provided details on specific actions to be taken which would determine the actual trajectory to net zero which creates uncertainty about what will be achieved.
- **Failure in Securing Climate Finance:** The summit's mild admonition only urges the developed country parties to scale up their provision of climate finance. It failed to firmly secure funding commitments from developed nations.
- **Unequal Distribution of Carbon Budget:** The world's top three largest emitters (China, USA, and Europe) which account for about 30% of the world's population, would take up 78% of the carbon budget. China intends to hit peak emissions only by 2030, before going down to net zero in 2060; it would take up 54% of the global carbon budget against a global population share of only 18.7%. The US, with 4.2% of the total population, would take up 14.2% of the budget and Europe, with 6.8%, would take up 9.5%. This problem reflects the fact that focusing on net-zero dates does not ensure a fair apportioning of the available carbon space if the initial position in terms of emissions varies so greatly.

5.20 Sharm El-Sheikh Climate Change Conference, COP 27

The United Nations Framework Convention on Climate Change (UNFCCC) will hold its 27th Conference of the Parties (COP 27) at Sharm El-Sheikh, Egypt. COP 27 was supposed to take place from November 8 to November 20, 2021. COP 26 was postponed from November 2020 to November 2021 due to the COVID-19 epidemic. As a result, COP 27 will be held from November 7 to November 18, 2022.

5.21 Intergovernmental Panel on Climate Change (IPCC)

The IPCC is the United Nations body for assessing the science related to climate change. The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and the UN Environment Programme (UNEP). Its main activity is to prepare Assessment Reports, special reports, and methodology reports assessing the state of knowledge of climate change. However, the IPCC does

not itself engage in scientific research. Instead, it asks scientists from around the world to go through all the relevant scientific literature related to climate change and draw up the logical conclusions.

Assessment Reports: The IPCC's Assessment Reports (ARs), which are produced every few years, are the most comprehensive and widely accepted scientific evaluations of the state of the Earth's climate. They form the basis for government policies to tackle climate change, and provide the scientific foundation for the international climate change negotiations. Six Assessment Reports have been published so far.

1. The **first Assessment Report (1990)** stated that human-caused emissions are significantly increasing greenhouse gas concentrations in the atmosphere. In the previous 100 years, global temperatures have risen by 0.3 to 0.6°C. In the business-as-usual scenario, temperatures would rise by 2°C by 2025, and 4°C by 2100, relative to pre-industrial levels. By 2100, sea levels were expected to climb 65 cm. The UN Framework Convention on Climate Change (UNFCCC), often known as the Rio Summit, was negotiated on the basis of this study in 1992.
2. In light of new evidence, the **second Assessment Report (1995)** updated the expected rise in global temperatures to 3°C over pre-industrial levels by 2100 and the projected rise in sea level to 50 cm. The rise in global temperature of 0.3 to 0.6°C since the late 1800s was "unlikely to be entirely natural in origin," according to the report. AR2 served as the scientific foundation for the Kyoto Protocol, which was signed in 1997.
3. The **third Assessment Report (2001)** revised the projected rise in global temperatures to 1.4 to 5.8 degrees Celsius by 2100 compared to 1990. According to the report, the expected rate of warming was unparalleled in the past 10,000 years. The report predicted increased rainfall on average, as well as a rise in sea levels of up to 80 cm by 2100 compared to 1990 levels. Glaciers will recede in the twenty-first century, and extreme weather events would grow in frequency, intensity, and length, according to the report. The study revealed fresh and stronger evidence that human activities were the primary cause of global warming.
4. According to the **fourth Assessment Report (2007)**, greenhouse gas emissions grew by 70% between 1970 and 2004, and CO₂ concentrations in the atmosphere reaching their highest level in 650,000 years in 2005 (379 ppm). Global temperatures might climb 4.5 degrees Celsius beyond pre-industrial levels by 2100, and sea levels could be 60 centimeters higher than 1990

levels in the worst-case scenario. The IPCC report was awarded the Nobel Peace Prize in 2007. It was the scientific input for the 2009 climate conference in Copenhagen.

5. According to the **fifth Assessment Report (2014)**, human activities were responsible for more than half of the temperature rise since 1950, and atmospheric concentrations of carbon dioxide, methane, and nitrous oxide were "unprecedented" in the previous 800,000 years. Global temperatures might climb by as much as 4.8 degrees Celsius by 2100 compared to pre-industrial times, and more frequent and longer heat waves were "virtually certain." According to the report, a "large fraction of species" faced extinction, and food security would be jeopardized. AR5 provided the scientific foundation for the negotiation of 2015 Paris Agreement.

5.21.1 Assessment Report 6 (AR6)

The Sixth Assessment Report (AR6) of the United Nations Intergovernmental Panel on Climate Change (IPCC) is the sixth in a series of reports intended to assess scientific, technical, and socio-economic information concerning climate change. It has been divided into three sections:

The Working Group I contribution to the Sixth Assessment Report, Climate Change 2021: The Physical Science Basis which was released on 9 August 2021. It has warned that 1.5°C warming is likely to be achieved before 2040 itself.

The Working Group II contribution, Climate Change 2022: Impacts, Adaptation and Vulnerability which was released on 28 February 2022. It has included risks to, and vulnerabilities of, mega-cities around the world. For example, it has said Mumbai is at high risk of sea-level rise and flooding, while Ahmedabad faces serious danger of heat-waves.

For the first time, the IPCC report has looked at the health impacts of climate change. It has found that climate change is increasing vector-borne and water-borne diseases such as malaria or dengue, particularly in sub-tropical regions of Asia. It has also said deaths related to circulatory, respiratory, diabetic and infectious diseases, as well as infant mortality, are likely to increase with a rise in temperature. Increasing frequency of extreme weather events like heat waves, flooding and drought, and even air pollution was contributing to under-nutrition, allergic diseases and even mental disorders.

The Working Group III contribution, Climate Change 2022: Mitigation of Climate Change which was released on 4 April 2022. Following are the key takeaways from the Summary of Policy Makers (SPM):

1. Greenhouse gas (GHG) emissions were 54 per cent higher in 2019 than they were in 1990, but growth is slowing.
2. Least developed countries emitted only 3.3 per cent of global emissions in 2019.
3. Pledges to the Paris Agreement are insufficient, emissions must fall 43 per cent by 2030 compared to 2019.
4. Abundant and affordable solutions exist across sectors including energy, buildings, and transport, as well as individual behavioral changes.
5. The impact on GDP would be negligible and the long-term benefits of cutting emissions immediately would outweigh the initial costs.
6. Finance falls short, especially in developing countries, but there is sufficient money in the world to close this gap.

5.22 National Action Plan on Climate Change (NAPCC)

In 2008, India announced its first National Action Plan on Climate Change (NAPCC), which included current and future policies and programmes addressing climate mitigation and adaptation. The National Action Plan is structured around eight national missions that reflect multidimensional, long-term, and integrated strategies for accomplishing critical climate change goals.

Emphasizing the overriding priority of maintaining high economic growth rates to raise living standards, the plan identified measures that promote our development objectives while also yielding co-benefits for addressing climate change effectively. It asserted that these national measures would be more successful with assistance from developed countries and pledged that India's per capita greenhouse gas emissions "will at no point exceed that of developed countries even as we pursue our development objectives".

5.22.1 National Solar Mission

The National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge.

The objective of this mission is to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.

5.22.2 The National Mission for Enhanced Energy Efficiency

The Government of India already has a number of initiatives to promote energy efficiency. In addition to these, the NAPCC calls for:

- Mandating specific energy consumption decreases in large energy consuming industries and creating a framework to certify excess energy savings along with market based mechanisms to trade these savings.
- Innovative measures to make energy efficient appliances/products in certain sectors more affordable.
- Creation of mechanisms to help finance demand side management pro-programmes by capturing future energy savings and enabling public-private-partnerships for this.
- Developing fiscal measures to promote energy efficiency such as tax incentives for including differential taxation on energy efficient certified appliances.

5.22.3 National Mission on Sustainable Habitat

The aim of the Mission is to make habitats more sustainable through a threefold approach that includes:

- Improvements in energy efficiency of buildings in residential and commercial sector
- Management of Municipal Solid Waste (MSW)
- Promote urban public transport

5.22.4 National Water Mission

The National Water Mission aims at conserving water, minimizing wastage and ensuring more equitable distribution through integrated water resource management. The Water Mission will develop a framework to increase the water use efficiency by 20%. It calls for strategies to tackle variability in rainfall and river flows such as enhancing surface and underground water storage, rainwater harvesting and more efficient irrigation systems like sprinklers or drip irrigation.

5.22.5 National Mission for Sustaining the Himalayan Ecosystem

The Plan calls for empowering local communities especially Panchayats to play a greater role in managing ecological resources. It also reaffirms the following measures mentioned in the National Environment Policy, 2006.

- Adopting appropriate land-use planning and water-shed management practices for sustainable development of mountain ecosystems.
- Adopting best practices for infrastructure construction in mountain regions to avoid or minimize damage to sensitive ecosystems and despoiling of landscapes.
- Encouraging cultivation of traditional varieties of crops and horticulture by promoting organic farming, enabling farmers to realize a price premium.
- Promoting sustainable tourism based on best practices and multi-stakeholder partnerships to enable local communities to gain better livelihoods.
- Taking measures to regulate tourist inflows into mountain regions to ensure that the carrying capacity of the mountain ecosystem is not breached.
- Developing protection strategies for certain mountain scopes with unique “incomparable values”.

5.22.6 National Mission for a Green India

This Mission aims at enhancing ecosystem services such as carbon sinks. It builds on the Prime Minister’s Green India campaign for afforestation of 6 million hectares and the national target of increasing land area under forest cover from 23% to 33%. It is to be implemented on degraded forest land through Joint Forest Management Committees set up under State Departments of Forests. These Committees will promote direct action by communities.

5.22.7 National Mission for Sustainable Agriculture

The aim is to make Indian agriculture more resilient to climate change by identifying new varieties of crops, especially thermal resistant ones and alternative cropping patterns. This is to be supported by integration of traditional knowledge and practical systems, information technology and biotechnology, as well as new credit and insurance mechanisms.

5.22.8 National Mission on Strategic Knowledge for Climate Change

This Mission strives to work with the global community in research and technology development and collaboration through a variety of mechanisms and, in addition, will also have its own research agenda supported by a network of dedicated climate change related institutions and universities and a Climate Research Fund. The Mission will also encourage private sector initiatives for developing innovative technologies for adaptation and mitigation.

5.23 National Adaptation Fund for Climate Change (NAFCC)

The National Adaptation Fund for Climate Change (NAFCC) is a Central Sector Scheme set up in 2015-16. The aim of NAFCC is to support concrete adaptation activities which mitigate the adverse effects of climate change. The activities under this scheme are implemented in a project mode. The projects related to adaptation in sectors such as agriculture, animal husbandry, water, forestry, tourism etc. are eligible for funding under NAFCC. National Bank for Agriculture and Rural Development (NABARD) is the National Implementing Entity (NIE).

5.24 REDD & REDD+

REDD (Reducing Emissions from Deforestation and Forest Degradation) is a global effort to incentivize developing countries to conserve, better manage, and save their forest resources, therefore helping to combat climate change.

REDD+ goes beyond preventing deforestation and forest degradation by including incentives for positive aspects of conservation, sustainable forest management, and forest carbon stock enhancement. It envisions a flow of positive incentives for demonstrating a reduction in deforestation or improving the quality and extent of forest cover. It works on the basis of creating a financial value for the carbon stored and enhanced in biomass and soil of standing forests. Countries that cut emissions and practice sustainable forest management will be eligible for financial and resource incentives. REDD+ approach incorporates important benefits of livelihoods improvement, biodiversity conservation and food security services. India is underlying the following initiatives related to REDD+:

- In December 2008, India submitted a statement to the UNFCCC on "REDD, Sustainable Forest Management (SMF), and Afforestation and Reforestation (A&R)".

- A technical committee has been formed to establish methodologies and procedures for assessing and monitoring contributions of REDD+ actions.
- A National REDD+ Coordinating Agency is being established.
- India has developed a National REDD+ Strategy in accordance with the UNFCCC's REDD+ decisions. The policy is based on current national circumstances, which have been revised in accordance with India's National Action Plan on Climate Change, Green India Mission, and NDC to the UNFCCC. The strategy aims to address the causes of deforestation and forest degradation, as well as provide a pathway for improving forest carbon stocks and attaining sustainable forest management through REDD+ actions.

IIPA 2022

Climate Change

Chapter 6

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh



2022

This chapter contains:

- Chipko Movement
- Appiko Movement
- Sand Mining in India – Environmental Issues
- International Standards and Environment
- The National Wastelands Development Board (NWDB)
- Bioassay
- Electric Vehicles
- Melting of the Arctic and its Impacts
- Green Hydrogen
- Desertification and Land Degradation Atlas

6. Orphan Issues

6.1 Chipko Movement

It is a social-ecological movement that used Gandhian tactics of Satyagraha and nonviolent resistance to hug trees in order to save them from falling. With growing awareness of rapid deforestation, the modern Chipko movement began in the early 1970s in Uttarakhand's Garhwal Himalayas. The turning point in this struggle took place on March 26, 1974, when a group of peasant women in Reni village, Hemwalghati, Chamoli district, Uttarakhand, India, took action to prevent tree cutting and reclaim their traditional forest rights, which were threatened by the state Forest Department's contractor system.

Hundreds of similar activities took place at the grassroots level around the area as a result of their efforts. By the 1980s, the movement had expanded across India, resulting in the adoption of people-centered forest policies that put an end to open-cutting in areas as far away as the Vindhyas and the Western Ghats. However, the first recorded event of Chipko occurred in 1730 AD in village Khejarli, Jodhpur district, when 363 Bishnois, led by Amrita Devi, sacrificed their lives by hugging green Khejri trees, which were considered sacred by the community, and braved the axes of loggers sent by the local ruler; it is now regarded as an inspiration and a precursor for the Chipko movement of Garhwal.

6.2 Appiko Movement

In India, the Appiko movement was a revolutionary environmental conservation movement. The Chipko movement in the Himalayan state of Uttarakhand inspired people in Karnataka's district in southern India to initiate a similar initiative to safeguard their forests. Salkani men, women, and children "hugged the trees" at Kalase forest in September 1983. (In Kannada, "hugging" is referred to as appiko). The Appiko movement sparked a fresh wave of awareness across southern India.

6.3 Sand Mining in India - Environmental Issues

Sand is an important mineral for our society because it protects the environment, acts as a buffer against strong tidal waves and storms, provides habitat for crustacean species and marine organisms, and is used in the production of concrete, filling roads, building sites, bricks, glass, sandpapers, reclamations, and in tourism industry in beach attractions. Sand mining is the process

of removing sand and gravel from the ground. As the need for sand grows in industry and construction, this activity is becoming an environmental concern.

Thousands of tonnes of sand are being illegally mined to meet the rising demand of the construction industry and for mineral extraction, despite a Supreme Court order prohibiting sand mining without the required clearance from the required authorities and placing limits on the quantities that can be mined. Let's talk about the sand mining situation in India. There are various environmental reasons for this and other bans across India. Sand serves as an aquifer and a natural carpet at the river's bottom. Downstream erosion causes changes in channel bed and habitat type, as well as the deepening of rivers and estuaries and the widening of river mouths, as this layer is stripped away. Local groundwater is impacted when the river system recedes, causing water scarcities that exacerbate agricultural and local livelihoods.

Ground water shortages have been identified as the primary issue with river sand mining in terms of legal measures. Experts also point to significant habitat and ecological issues, such as “direct loss of stream reserve habitat, disturbances of species attached to streambed deposits, reduced light penetration, reduced primary production, and reduced feeding opportunities”, which are less considered in legal action but crucially important.

6.3.1 Environmental consequences of sand mining

- **Forcing the river to change its course:** Sand and boulders operate as a barrier for the riverbed, preventing it from shifting direction.
- Illegally dredged sand is equivalent to robbing water. Sand contains a lot of water, and when it's mined and loaded onto trucks carelessly, a lot of water is lost in the process.
- **Depletion of groundwater tables:** Sand, which is part of the aquifer, functions as a link between the running river and the water table in a riverbed. Illegal and excessive sand mining in the Papagani catchment area in Karnataka, for example, has resulted in groundwater depletion and environmental degradation in communities along the river's banks in both Andhra Pradesh and Karnataka.
- **Adversely impacting the habitat of micro-organisms:** There are many microorganisms that are not visible or well-known but are important for soil structure and fertility. Sand dredging physically deprives them of their environment.

- **Increased river erosion:** The River's erosion capability rises when sand and boulders are removed in an unimpeded manner using heavy machinery.
- **Damage to roads and bridges:** For example, at Vishnuprayag, rocks washed down with river water broke one side of the dam, and the water spilled out across the dam, inflicting extensive damage.
- **Threat to agriculture:** For example, despite several prohibitions and regulations, sand mining in the Bharathapuzha riverbed in Kerala continues apace. Water tables have dropped, and a region once known for its abundant rice crop now faces water scarcity. Groundwater levels have dropped dramatically in the villages and towns along the river, and wells are almost always dry.
- **Damage to coastal ecosystem:** This harmful illegal practice causes erosion along the shoreline in beaches and waterways. For example, shore levels have dropped at Kihim Beach near Alibaug, forcing locals to construct sea walls to defend themselves. It devastates the intertidal zone and increases the risk of saline water infiltration into fresh water. Coastal sand mining devastates fisheries, coral reefs, mangroves, and wetlands, and has resulted in the near extinction of Ghariyals, an Indian crocodile species. One of the most serious consequences of beach sand mining is the lack of protection against storm surges caused by tropical storms and tsunamis.
- Water availability for industrial, agricultural, and drinking purposes is decreasing.
- Loss of employment to farm workers.
- Threat to livelihoods.

6.4 International Standards and Environment

The ISO 14000 environmental management standards were created to assist businesses reduce the negative impact of their operations (processes, etc.) on the environment (i.e. cause adverse changes to air, water, or land). Comply with all applicable laws, regulations, and other environmental standards, and strive to improve in all of these areas.

ISO 14000 quality management is similar to ISO 9000 quality management in that both are concerned with the manufacturing process rather than the product itself. Certification is undertaken by third-party organisations rather than being issued directly by ISO, as it is with ISO 9000. When

auditing for both 9000 and 14000 compliance at the same time, the ISO 19011 audit standard is used.

6.4.1 List of ISO 14000 series standards

- ISO 14001 Environmental management systems—Requirements with guidance for use
- ISO 14004 Environmental management systems— General guidelines on principles, systems and support techniques
- ISO 14015 Environmental assessment of sites and organizations
- ISO 14020 series (14020 to 14025) Environmental labels and declarations
- ISO 14030 discusses post production environmental assessment
- ISO 14031 Environmental performance evaluation— Guidelines
- ISO 14040 series (14040 to 14049), Life Cycle Assessment, LCA, discusses pre-production planning and environment goal setting.
- ISO 14050 terms and definitions.
- ISO 14062 discusses making improvements to environmental impact goals.
- ISO 14063 Environmental communication —Guidelines and examples
- ISO 14064 Measuring, quantifying, and reducing Greenhouse Gas emissions.
- ISO 19011 which specifies one audit protocol

6.5 The National Wastelands Development Board (NWDB)

In 1985, the Ministry of Environment and Forests established the National Wastelands Development Board (NWDB) with the objective of:

- To increase the amount of trees and other forms of green cover on wastelands.
- To keep good land from being turned into wasteland.
- To design future plans and programmes for the management and development of the country's wastelands as part of the broader nodal policy.

The Board was transferred to the Ministry of Rural Development in 1992, and a new Department of Wastelands Development was established, with a Minister of State as its head.

6.6 Bioassay

A bioassay is a test that uses organisms to identify the presence or effects of any other physical or chemical factor, as well as any other sort of ecological disturbance. Bioassays are widely used in pollution studies. Bioassays can be carried out with any kind of organism. Bioassays with fish and insects, on the other hand, are very common. The goal is to determine whether a concentration is lethal or effective in causing mortality or other effects. They will eventually be utilized to determine a chemical's safe concentration or the maximum acceptable toxicant concentration (MATC). For a certain amount of time, the organism is exposed to various doses of a toxicant, and mortality, behavioral changes, and other signs of distress are recorded. The static bioassay test is one of three kinds, in which the organisms are exposed to the same toxicant solution throughout the duration of the experiment. Renewal bioassays and flow-through bioassays are the other two.

6.7 Electric Vehicles

Electric vehicles have the potential to help tackle climate change by lowering emissions and reducing reliance on fossil fuels throughout the world. An electric vehicle (EV) is one that is powered by an electric motor rather than an internal-combustion engine that burns a mixture of fuel and gases to generate power. Road and rail vehicles, surface and underwater vessels, electric aircraft, and electric spacecraft are all examples of electric vehicles. Despite the fact that the concept of electric vehicles has been around for a long time, it has drawn a lot of attention in the last decade as a result of the growing carbon footprint and other environmental implications of fuel-based vehicles. An electric vehicle can be self-contained using a battery, solar panels, fuel cells, or an electric generator to convert fuel to electricity, or it can be fueled by electricity from off-vehicle sources via a collector system.

6.7.1 Advantages of Electric Vehicles

- When compared to conventional internal combustion engine cars, electric cars (or electric vehicles, EVs) have a number of environmental advantages. They have the potential to cut greenhouse gas emissions, reduce petroleum dependence, minimize air pollution-related health effects, and emit little or no tailpipe emissions.
- Internal combustion engines consume fuel even while the car is parked, but electric vehicles do not consume energy when they are parked.

- The 'tank-to-wheels' efficiency of electric cars is around a factor of three higher than that of internal combustion engine vehicles.
- Unlike internal combustion engines, they can be accurately regulated and offer high torque right out of the box, and they don't require several gears to meet power curves. As a result, gearboxes and torque converters are no longer required.
- In electric vehicles, there is less vibration and noise.
- Electric motors are mechanically simple, achieving 90% energy conversion efficiency across a wide range of speeds and power output, and can be precisely controlled.

6.8 Melting of the Arctic and its impacts

The impacts of global warming may be observed most vividly in the Arctic region, which is warming twice as rapidly as the global average. The Arctic ice cap is rapidly shrinking, and the volume of Arctic sea ice has decreased by up to 75%. As the Arctic ice melts into the sea, it poses worldwide environmental issues. On the flip side, it opens up the Northern Sea Route (NSR), which connects the North Atlantic and the North Pacific through a short polar arc. According to many earth observation studies, this route might be ice-free in the summer by 2050, if not sooner. However, before completely commercializing the NSR, the international community must first understand the vital effect of melting arctic ice and the issues that come with it.



Fig. 6 Northern Sea Route (NSR)

6.8.1 Impact of Melting Arctic Ice

- **Global Climate:** The Arctic and Antarctic act like the world's refrigerator. They balance out other parts of the planet that absorb heat because they are covered in white snow and ice that reflect heat back into space (Albedo effect). Sea levels, salinity levels, and current and precipitation patterns will all be affected by the loss of ice and warmer seas. Furthermore, less ice means less heat is reflected, resulting in more extreme heat waves throughout the planet. As the polar jet stream—a high-pressure wind that orbits the Arctic region—is destabilized by warmer air, it might descend south, bringing the severe cold with it.

- **Coastal Communities:** Since 1900, the global average sea level has increased by around 7–8 inches, and the situation is becoming worse. Coastal cities and small island nations are put at risk by rising seas, which exacerbate coastal flooding and storm surge. The glacial melt of the Greenland ice sheet is a key predictor of future sea-level rise; if it melts completely, global sea levels might increase by 20 feet.
- **Food Security:** Polar vortexes, increasing heat waves, and weather unpredictability induced by ice loss are already wreaking havoc on crops that are vital to global food systems. For the world's most vulnerable, this unpredictability will imply higher prices and a growing crisis.
- **Permafrost & Global Warming:** Permafrost (permanently frozen ground) in the Arctic area stores a substantial amount of methane, a greenhouse gas that contributes to climate change. When it melts, the methane is released, speeding up the rate of global warming. The faster the arctic ice melts, the faster the permafrost melts. This will set off a vicious cycle that might lead to a climatic catastrophe.
- **Biodiversity Threat:** The melting of Arctic ice poses a severe danger to the region's diverse biodiversity. Habitat loss and degradation, as well as the lack of year-round ice and rising temperatures, are making it harder for Arctic marine life, plants, and birds to survive, while enticing species from lower latitudes to migrate north. Polar bears, walruses, arctic foxes, snowy owls, reindeer, and many more species are at risk when ice melts and permafrost melts. The tundra is already returning to swamp; permafrost is thawing, storms are wreaking havoc on coasts, and wildfires are devouring Canada and Russia's interior.

6.8.2 Flip-side & NSR

The NSR's opening of the Arctic brings significant commercial and economic opportunities, notably in shipping, energy, fisheries, and mineral resources. In comparison to the Suez route, the distance from Rotterdam to Yokohama will be reduced by 40%. Oil and natural gas deposits, estimated to be 22% of the world's new resources, mostly in the Arctic Ocean, will be open to access and mineral deposits including 25% of the global reserves of rare earth, buried in Greenland.

6.8.3 Associated Challenges

- **NSR, Not So Environmentally & Economically Viable:** The difficulties of exploiting the Arctic's resources are exacerbated by a lack of deep-water ports, the necessity for icebreakers, a shortage of workers qualified for arctic conditions, and high insurance costs. Mining and

deep-sea drilling, on the other hand, come at a high cost and pose significant environmental hazards.

- **The Arctic, Not a Global Common:** Unlike Antarctica, the Arctic is not a global common, and it is governed by the United Nations Convention of the Law of the Sea (UNCLOS). The five littoral states — Russia, Canada, Norway, Denmark (Greenland), and the United States — own a large portion of it, and exploitation of the new resources is fully within their rights. As a result, national economic interests may supersede over global Arctic conservation efforts.
- **Great Game Geo-Politics:** Russia, Canada, Norway and Denmark have overlapped claims for extended continental shelves, and the right to sea-bed resources. Russia, on the other hand, is the dominating force in the Arctic, with the longest coastline, half of the population, and a full-fledged strategic policy. The NSR, it claims, is located within its territorial seas. The US, on the other hand, argues that the passage is in international waters. China has positioned the Polar Silk Road as an extension of the Belt and Road Initiative (BRI), and has made significant investments in ports, energy, undersea infrastructure, and mining projects.

6.9 Green Hydrogen

Hydrogen, when produced by electrolysis using renewable energy, is known as Green Hydrogen. Green hydrogen gas is produced by splitting water into hydrogen and oxygen using an electrolyzer that may be powered by electricity generated from renewable energy sources. There is no carbon footprint with green hydrogen. Hydrogen that is in use these days is the primary source. Chemical techniques are utilized to release hydrogen from organic sources such as fossil fuels and biomass. Green hydrogen is used in industries such as chemicals, iron, steel, fertilizer and refining, transportation, heating, and power generation.

6.9.1 Benefits of Green Hydrogen

- Green hydrogen may be produced without emitting any hazardous gases, if renewable energy sources (such as solar panels) are utilized to create electricity for water electrolysis.
- It's a low-carbon compound that can help decarbonize industries including iron and steel, chemicals, and transportation.
- Green Hydrogen can be used as an energy storage alternative in the future to meet renewable energy intermittencies.

- Renewable energy that can't be stored or utilized by the grid can be channeled towards hydrogen production.
- Unlike coal and oil, hydrogen is a clean energy source that produces just water vapour and leaves no residue in the air.
- Green Hydrogen can be used for long distance mobilization such as in railways, large ships, buses or trucks, etc.

6.10 Desertification and Land Degradation Atlas

Land Degradation and Desertification have risen dramatically in recent years, according to a publication produced by ISRO (Indian Space Research Organization) titled "Desertification and Land Degradation Atlas." For the year 2018-19, the Atlas gives a state-by-state breakdown of degraded lands. It also includes a change analysis over a 15-year period, from 2003-05 to 2018-19.

6.10.1 Key Findings

- **Land Degradation:** Land Degradation: In 2018-19, land degradation affected 97.85 million hectares (MHA) of India's total geographical area (TGA) of 328.72 MHA. 'Desertification' is the word for land degradation in dryland regions (arid, semi-arid, and dry sub-humid). This indicates that in that year, 29.7% of the country's land was degraded. Land degradation occurred in 94.53 MHA (28.76% of the TGA) in 2003-05, according to a 20-year trend. In 2011-13, the number climbed to 96.40 MHA (29.32% of the TGA).
- **Desertification increased:** Desertification had also increased, in addition to land degradation. In 2018-19, 83.69 MHA of land underwent desertification. This was higher than the 81.48 MHA that was desertified in 2003-2005 and the 82.64 MHA that was desertified in 2011-13.
- **State Wise breakup:** Rajasthan, Maharashtra, Gujarat, Karnataka, Ladakh, Jharkhand, Odisha, Madhya Pradesh, and Telangana each contributed around 23.79 % of the country's total area suffering desertification/land degradation. A detailed examination of data in the atlas revealed that between 2011-13 and 2018-19, the amount of desertification in 28 of India's 31 states and union territories increased. This included Goa and Odisha, where desertification had declined between 2003-05 and 2011-13. Between 2003-05 and 2011-13, the rate of desertification increased in 25 of the 31 states and union territories. In 2018-2019, however, land degradation and desertification decreased in Uttar Pradesh, Rajasthan, and Telangana.

IIPA 2022

Important Days

Chapter 7

Short Answers

CSM – 06: Compiled by Dr. Shyamli Singh



2022

This chapter contains:

- Important Days

7. Important Days

Date	Day
2 nd February	World Wetlands Day
28 th February	National Science Day
3 rd March	World Wildlife Day
20 th March	World Sparrow Day
21 st March	International Day of Forest
22 nd March	World Water Day
23 rd March	World Meteorological Day
Last Saturday of March	Earth Hour Day
7 th April	World Health Day
18 th April	World Heritage Day
22 nd April	International Mother Earth Day
22 nd May	International Biodiversity Day
23 rd May	World Turtle Day
31 st May	Anti-Tobacco Day
5 th June	World Environment Day
8 th June	World Ocean Day
17 th June	World Day to Combat Desertification
22 nd June	World Rainforest Day
1 st Week of July	Van Mahotsav Day
11 th July	World Population Day
28 th July	World Nature Conservation Day
29 th July	International Tiger Day
10 th August	International Biodiesel day
12 th August	World Elephant Day
20 th August	Akhshay Urja Diwas
16 th September	International Ozone Day
Third Saturday of September	International Coastal Cleanup Day
28 th September	Green Consumer Day

Date	Day
2 nd - 8 th October	Wildlife Week
4 th October	World Animal Welfare Day
First Monday of October	World Habitat Day
13 th October	International day for Natural Disaster Reduction
24 th October	United Nations Day
2 nd December	National Pollution Prevention Day
3 rd December	Bhopal Gas Tragedy Day
5 th December	World Soil Day
11 th December	International Mountain Day
14 th December	National Energy Conservation Day