



Greenhouse Gas Concentrations Hit Record Highs: UN

For Prelims: [United Nations](#), [World Meteorological Organization](#), [Greenhouse gases](#), [Paris Agreement](#), [Kyoto Protocol](#), [Paris Agreement](#), [International Solar Alliance](#), [Global Biofuel Alliance](#)

For Mains: Major Factors Responsible for Rising Greenhouse Gases Concentration, Major Implications of Rising Greenhouse Gas Concentrations, Key Initiatives to Curb Greenhouse Gas Emission.

[Source: TH](#)

Why in News?

Recently, the [United Nations](#) issued a warning highlighting the unprecedented surge in [greenhouse gas concentrations in the atmosphere](#), setting new records in 2022.

- **UN's [World Meteorological Organization \(WMO\)](#)'s 19th Annual Greenhouse Gas Bulletin** outlines the concerning implications, foreseeing heightened temperatures, intensified extreme weather events, and elevated sea levels as a consequence.

What are the Major Highlights of the Bulletin?

- **Unprecedented Greenhouse Gas Levels:** WMO in its 19th annual Greenhouse Gas Bulletin stated that levels of the three main greenhouse gases: [carbon dioxide](#), **methane**, and **nitrous oxide**, all surpassed previous records, marking an escalation in their atmospheric presence.
 - In 2022, **carbon dioxide concentrations reached 418 parts per million, methane at 1,923 parts per billion, and nitrous oxide at 336 parts per billion**, significantly surpassing pre-industrial levels by 150%, 264%, and 124%, respectively.
 - Of the three major greenhouse gases, carbon dioxide (CO₂) accounts for about **64% of the warming effect on the climate**.
 - Methane ranks as the second-largest contributor to climate change, causing about **16% of warming**.
 - Nitrous oxide contributes around 7% to the warming effect.
- **Challenges to Paris Agreement Goals:** The **2015 [Paris Agreement](#)** aimed to limit global warming to below two degrees Celsius above pre-industrial levels and preferably 1.5C. Unfortunately, the **global mean temperature in 2022 already exceeded the 1.5C mark**, reaching **1.15C above pre-industrial levels**.
 - The current trajectory indicates a grim reality, a temperature rise significantly surpassing the Paris Agreement's targets by the end of the century, leading to catastrophic consequences like extreme weather, ice melt, and ocean acidification.
- **Projected Climate Disruptions:** The continuous rise in these heat-trapping gases forecasts a future plagued by intensified climate disruptions.
 - The bulletin underscores the **imperative need to swiftly reduce [fossil fuel consumption](#)** to mitigate these escalating risks.
 - The climate system could be **nearing critical "tipping points,"** where certain changes lead to irreversible cascades, like the **rapid die-back of the Amazon, North Atlantic**

circulation slowdown, and destabilization of major ice sheets.

What are Greenhouse Gases?

- **Greenhouse gases (GHGs) are a group of naturally occurring and human-generated gases** present in the Earth's atmosphere.
 - These gases have the unique property of absorbing and emitting heat, trapping thermal energy within the atmosphere.
- They **act as a thermal blanket, allowing sunlight to enter the atmosphere** while preventing a significant portion of the absorbed heat from escaping back into space.
 - This phenomenon, known as the greenhouse effect, helps regulate the Earth's temperature, making it habitable for life.
- However, human activities, such as burning fossil fuels, deforestation and industrial processes, have significantly increased the concentration of these gases, **amplifying the greenhouse effect and leading to global warming and subsequent climate change.**
- Some major greenhouse gases include: **Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O) and water vapour.**

What are the Major Factors Responsible for Rising Greenhouse Gases Concentration?

- **Fossil Fuel Combustion:** The predominant contributor to **carbon dioxide (CO₂) emissions is the burning of fossil fuels for energy.**
 - Industrial activities, transportation, and power generation heavily rely on coal releasing CO₂ into the atmosphere.
- **Deforestation and Land Use Changes:** Forests act as [carbon sinks](#), **absorbing CO₂.** Deforestation and land-use changes, primarily for agriculture or urbanization, reduce these sinks, **releasing stored carbon and reducing the Earth's capacity to absorb CO₂.**
 - Deforestation has **transformed sections of the [Amazon rainforest](#)**, previously a carbon sink, into a significant emitter of carbon.
- **Agricultural Practices:** Agriculture contributes significantly to **methane (CH₄) and nitrous oxide (N₂O) emissions.** Livestock farming generates methane, while the use of nitrogen-based fertilizers releases nitrous oxide.
- **Improper Waste Management:** Improper waste management, **especially in landfills**, leads to the generation of methane as organic waste decomposes in anaerobic conditions.
- **Natural Processes:** [Volcanic eruptions](#), **wildfires, and natural decay** processes also release GHGs. While these events have occurred historically, **human activities have exacerbated their frequency and impact.**
- **Urbanization and Population Growth:** Rapid **urban expansion and population growth** increase energy demand, vehicular emissions, and the need for infrastructure, leading to higher GHG emissions.
- **Permafrost Thaw and Methane Release:** As permafrost thaws due to rising temperatures, **it releases methane, a potent greenhouse gas trapped within the frozen soil.**
 - This **creates a feedback loop**, where more methane released exacerbates global warming, further accelerating permafrost thaw.

What can be the Major Implications of Rising Greenhouse Gas Concentrations?

- **Induced Climate Change:** Increased greenhouse gases intensify the greenhouse effect, **trapping more heat in the atmosphere.**
 - This results in **global warming, leading to altered weather patterns**, rising temperatures, and shifts in precipitation, which can cause **droughts, [heatwaves](#), floods, and more severe storms.**
- **Melting Ice and Rising Sea Levels:** Warming temperatures **cause glaciers and polar ice caps to melt**, contributing to rising sea levels.

- This phenomenon **poses threats to coastal communities, biodiversity, and infrastructure**, leading to coastal erosion and increased risks of flooding.
- **Food and Water Security:** Changes in temperature and precipitation patterns can **affect agricultural productivity**, leading to crop failures and reduced food security.
 - **Water scarcity or excessive rainfall** can impact water availability for drinking, agriculture, and industry.
- **Ocean Acidification:** Excess CO₂ absorbed by oceans leads to [acidification](#), impacting marine life.
 - **Acidic waters hinder the ability of certain marine organisms to build shells and skeletons**, affecting coral reefs, shellfish, and plankton—the foundation of marine food chains.
- **Geopolitical Tensions: Climate-induced displacement**, resource scarcity, and competition for habitable areas could lead to **geopolitical tensions and conflicts over land, water, and resources**, particularly in regions already facing socio-political instability.

What are the Key Initiatives to Curb Greenhouse Gas Emission?

- **Global:**
 - [Kyoto Protocol](#)
 - [Paris Agreement](#)
 - [International Solar Alliance](#)
 - [Global Biofuel Alliance](#)
- **India:**
 - **Bharat Stage-IV (BS-IV) to [Bharat Stage-VI \(BS-VI\) emission norms](#)**
 - [National Action Plan on Climate Change \(NAPCC\)](#)
 - [Energy Conservation \(Amendment\) Act 2022](#)
 - [India's Intended Nationally Determined Contributions \(INDCs\)](#)
 - [Panchamrit Goal](#)

Way Forward

- **Mitigation Strategies:** Implement policies and technologies focused on **reducing greenhouse gas emissions** across sectors such as energy, transportation, industry, and agriculture.
 - This includes **transitioning to renewable energy sources, improving energy efficiency**, promoting sustainable land use, and reducing fossil fuel dependence.
- **Adaptation Measures:** Develop and implement adaptation strategies to cope with the existing and projected impacts of climate change.
 - This involves **enhancing resilience in infrastructure, agriculture, water management, and urban planning** to withstand extreme weather events and changing climate patterns.
- **International Collaboration:** Foster global cooperation and commitment to climate action through international agreements and partnerships.
 - Encourage nations to **honor and strengthen their commitments under agreements like the Paris Agreement**, setting ambitious targets to limit global temperature rise.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Mains

Q. Discuss global warming and mention its effects on the global climate. Explain the control measures to bring down the level of greenhouse gases which cause global warming, in the light of the Kyoto Protocol, 1997. **(2022)**

Q. Describe the major outcomes of the 26th session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). What are the commitments made by India in this conference? **(2021)**

Q. Assess the impact of global warming on the coral life system with examples. **(2019)**

Q. 'Climate Change' is a global problem. How will India be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? **(2017)**

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