



Carbon Footprint and Sequestration: Importance and need to meet Climate Targets under UNFCCC.

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ABSTRACT:

The paper discusses about Carbon Footprint and Carbon Sequestration. [United Nations Environment Programme \(UNEP\)](#) has released a report titled- *The Emissions Gap Report 2023*: which shows the world's state of affairs related to emissions, the paper discusses the key highlights of the report. The need for urgent climate action is crucial to avoid the alarming trajectory of temperature rise. Apart from this mitigation effort, net-zero pledges, progress and challenges, India's initiatives are also discussed. Carbon Sequestration methods and techniques such as Technological Carbon Sequestration, Graphene production, Direct Air Capture (DAC) are also discussed. The paper also discusses India's Nationally Determined Contributions, gives suggestions for lowering the Carbon footprint at individual and household level.

Key words: Carbon Footprint, Carbon Sequestration, Direct Air Capture (DAC), Global Emissions Trends, Carbon Sequestration methods and techniques.

INTRODUCTION

The basic attribute of the world is that it is constantly evolving. The climate, at any particular time and place, is in a constant state of change. However, numerous anthropogenic activities such as deforestation, fossil fuel burning, release of greenhouse gases into the atmosphere are currently disrupting nature's equilibrium and causing an unparalleled pace of changes in all aspects of the environment. The atmosphere is warming. Climate change is primarily driven by the high concentration of greenhouse gases which are mainly emitted by anthropogenic actions (Jones *et al.*, 2023). Carbon dioxide, which has existed in the atmosphere for about 200 years due to its peculiar properties, is responsible for more than 55 percent of current global warming caused by GHGs created by human activities. Its concentration has risen by more than 30% since pre-industrial times (around 1750) and if current trends continue, scientists expect that by 2050, the earth would have warmed by an average of 1.5 to 4.5 degrees Celsius.

Carbon footprint is relatively a new field to study the impact of climate change induced by human activities and also used to measure all greenhouse gas emission in carbon dioxide equivalent. The carbon footprint measures the emission of greenhouse gases, i.e. methane, nitrous oxide and carbon dioxide that contribute to global warming. According to the World Health Organization (WHO), carbon footprint is a measure of the impact people's activities have on the amount of carbon dioxide (CO₂) produced through the burning of fossil fuels and is expressed as a weight of CO₂ emissions produced in tonnes.

Carbon sequestration is the capture of carbon dioxide (CO₂) and refers specifically to: "The process of removing carbon from the atmosphere and depositing it in a reservoir." Carbon sequestration is the removal of the air carbon dioxide and its storage in terrestrial ecosystems for a much-extended period of time. Plants, through their growing period, act as sink for atmospheric carbon. Therefore, growing vegetation in metropolitan areas can be a potential contributor in decreasing the concentration of CO₂ in atmosphere by its accumulation in the form of biomass. As trees grow and their biomass expands, they extract carbon from the air and store it in the plant tissues (Mathews *et al.*, 2000) resulting in subsequent growth of various parts. Active absorption of CO₂ from the atmosphere in photosynthetic process and its successive stockpiling in the biomass of growing trees or plants is the carbon storage (Baes *et al.*, 1977).

GLOBAL SCENARIO:

The top 10 countries in terms of MtCO₂ emissions (in million tons of CO₂)

RANK	COUNTRY	Mt CO ₂ (million tons of CO ₂)	Percentage of world CO ₂ emission
1	China	12,667	32.88%
2	United States of America	5,057	12.6%
3	India	2,830	6.99%
4	Russia	2,032	4.96%
5	Japan	1,083	2.81%
6	Indonesia	729	1.8%
8	Iran	691	1.78%
7	Germany	673	1.75%
9	Saudi Arabia	663	1.66%
10	South Korea	636	1.53%

Source: Sourced via [Global Carbon Project](#) and [World Population Review](#).

GLOBAL INITIATIVES:

Emissions Gap Report 2023: UNEP

[United Nations Environment Programme \(UNEP\)](#) has released a report titled- The Emissions Gap Report 2023: Broken Record – Temperatures hit new highs, yet world fails to cut emissions (again), stating that urgent Climate Action is crucial to avoid the alarming trajectory of Temperature Rise.

The report is the 14th edition in a series that brings together many of the world's top climate scientists to look at future trends in greenhouse gas emissions and provide potential solutions to the challenge of [Global Warming](#).

Emissions Gap Report: The EGR is UNEP's spotlight report launched annually in advance of the Annual Climate negotiations. The EGR tracks the gap between where global emissions are heading with current country commitments and where they ought to be to limit warming to 1.5°C.

Key highlights of the report:

- Temperature Rise Trajectory:
 - Current pledges under the [Paris Agreement](#) set the world on a course for a 2.5-2.9°C temperature rise above pre-industrial levels by the end of this century.
- Paris Agreement (also known as the Conference of Parties 21 or COP 21) is a landmark environmental accord that was adopted in 2015 to address climate change and its negative impacts.
 - To limit warming to 1.5-2°C, substantial emission cuts of 28-42% by 2030 are necessary.
- Global Emissions Trends:

[Greenhouse Gas Emissions \(GHG\)](#) hit a new record of 57.4 Gigatonnes of Carbon Dioxide Equivalent (GtCO₂e) in 2022, with a 1.2% increase from the previous year.

- Fossil CO₂ emissions account for approximately two thirds of current GHG emissions using 100-year global warming potentials.
- According to multiple datasets, fossil CO₂ emissions grew between 0.8–1.5% in 2022 and were the main contributor to the overall increase in GHG emissions. In 2022, fluorinated gases emissions grew by 5.5%, followed by Methane at 1.8% and nitrous oxide (N₂O) at 0.9%.

GHG emissions across the G20 also increased by 1.2% in 2022. However, members vary widely in their trends with increases in China, India, Indonesia and the United States of America, but decreases in Brazil, the European Union and the Russian Federation. Collectively, the G20 currently accounts for 76% of global emissions.

Mitigation Efforts:

- If current policies and pledges continue, global warming will likely reach 3°C above pre-industrial levels by the end of the century.
- Implementing unconditional [Nationally Determined Contributions \(NDCs\)](#) could limit the rise to 2.9°C, while conditional NDCs might cap it at 2.5°C.
- **Net-Zero Pledges:**

- Although countries have made Net-Zero Pledges, none of the [G20 Countries](#) are reducing emissions at a pace consistent with their targets.
- Even in the most optimistic scenario, the likelihood of limiting warming to 1.5°C is only 14%.

▪ **Progress and Challenges:**

Policy progress since the Paris Agreement has reduced the implementation gap but it is not sufficient. Nine countries updated their NDCs, potentially reducing emissions by about 9% annually by 2030. However, further reductions are essential to establish least-cost pathways for limiting global warming to 1.5°C.

India's Initiatives: Under United National Framework Convention to Climate Change (UNFCCC), Conference of Parties (COP)

COP26 Commitments: At the Glasgow Summit, India pledged to cut emissions to net zero by 2070, outlining a five-pronged "Panchamitra" climate action plan:

- Achieve 500 GW of non-fossil energy capacity by 2030.
- Source 50% of energy requirements from renewable sources by 2030.
- Reduce projected carbon emissions by 1 billion tonnes by 2030.
- Lower carbon intensity of the economy by 45% by 2030 compared to 2005 levels.
- Reach net-zero emissions by 2070.

CARBON SEQUESTRATION METHODS AND TECHNIQUES: Broadly the methods can be studied as

Technological Carbon Sequestration: Scientists are exploring new ways to remove and store carbon from the atmosphere using innovative technologies. Researchers are also starting to look beyond removal of carbon dioxide and are now looking at more ways it can be used as a resource.

Graphene Production: The use of carbon dioxide as a raw material to produce graphene, a technological material. Graphene is used to create screens for smart phones and other tech devices. Graphene production is limited to specific industries but is an example of how carbon dioxide can be used as a resource and a solution in reducing emissions from the atmosphere.

Direct Air Capture (DAC): A means to capture carbon directly from the air using advanced technology plants. However, this process is energy intensive and expensive, ranging from \$500-\$800 per ton of carbon removed. While the techniques such as direct air capture can be effective, they are still too costly to implement on a mass scale.

Engineered Molecules: Scientists are engineering molecules that can change shape by creating new kinds of compounds capable of singling out and capturing carbon dioxide from the air. The engineered molecules act as a filter, only attracting the element it was engineered to seek.

10 WAYS TO REDUCE YOUR CARBON FOOTPRINT:

- **Reduce consumption:** Think before you buy and avoid unnecessary purchases.
- **Reuse:** Use reusable items and repair them instead of replacing them.
- **Recycle:** Recycle your waste and follow your national guidelines.
- **Reduce energy use:** Turn off lights and unplug appliances when not in use. Lower your thermostat in the winter and raise it in the summer.
- **Reduce water use:** Turn down your water heater to 120°F and use a low-flow showerhead.
- **Change your diet:** Limit your meat intake, especially beef. Choose fish caught in a sustainable manner.
- **Change your travel habits:** Walk, bike, or use public transportation instead of driving.
- **Use energy-efficient products:** Look for the ENERGY STAR® symbol when buying new products.
- **Insulate your home:** Close doors immediately to keep heat in.
- **Switch to renewables:** Switch to renewable energy.

CONCLUSION:

About 25 percent of our carbon emissions have historically been captured by Earth's forests, farms and grasslands. The trees in urban settlements, through their fast growth rates, have great potential to absorb CO₂ and effectively combat climate change (Bayat *et al.*, 2012). Scientists and land managers are

working to keep landscapes vegetated and soil hydrated for plants to grow and sequester carbon. As much as 30 percent of the carbon dioxide we emit from burning fossil fuels is absorbed by the upper layer of the ocean. But this raises the water's acidity, and ocean acidification makes it harder for marine animals to build their shells. Scientists and the fishing industry are taking proactive steps to monitor the changes from carbon sequestration and adapt fishing practices. We can do several things to control our carbon footprints on a personal level. Studies have proven that the environmental impact of switching to energy-efficient appliances in your home can be significant because the generation of electricity leaves a large footprint.

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