

## Carbon-Dioxide Removal

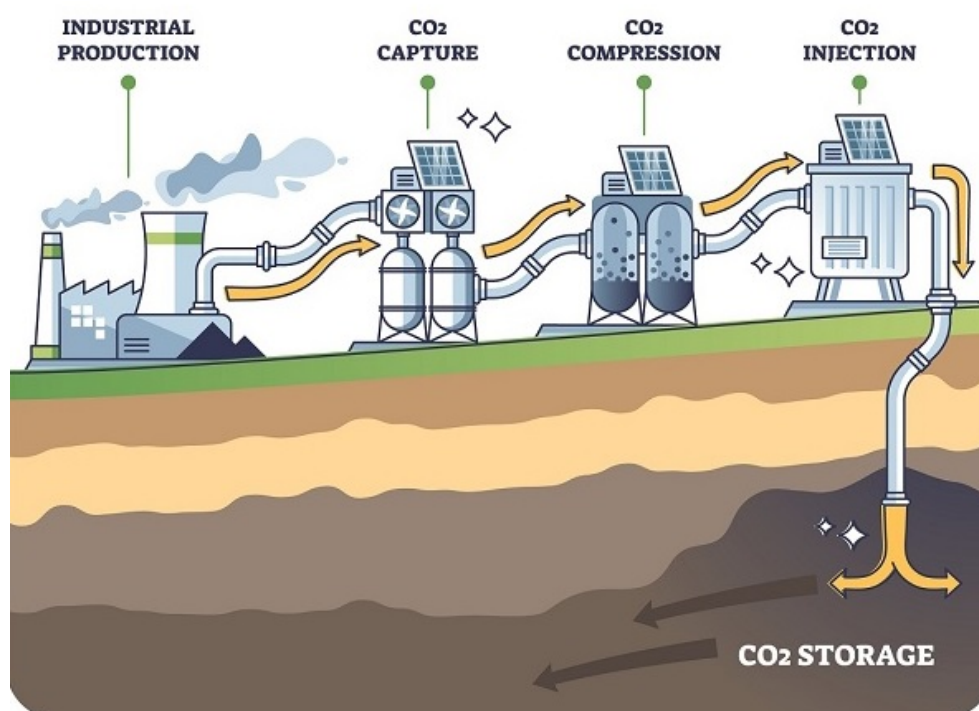
### Why in news?

As nations gather for the [COP 28](#) in Dubai, the question of carbon capture's future role in a climate-friendly world will be in focus.

### What is Carbon Dioxide Removal (CDR)?

- **Carbon removal**- Using technologies, practices, and approaches to remove carbon dioxide (CO<sub>2</sub>) from our atmosphere through deliberate and intentional human actions.
- It captures CO<sub>2</sub> from the atmosphere and locks it away for decades or centuries in plants, soils, oceans, rocks, saline aquifers, depleted oil wells, or long-lived products like cement.

## CARBON CAPTURE PROCESS



- **Process**- CDR can be done through traditional or technological processes or both.

Process	Examples
Traditional process	<ul style="list-style-type: none"> <li>• Afforestation</li> <li>• Reforestation</li> <li>• Agricultural practices that sequester carbon in soils (carbon farming)</li> </ul>

<b>Technological process</b>	<ul style="list-style-type: none"> <li>• Bioenergy with Carbon Capture and Storage (BECCS)</li> <li>• Direct Air Carbon Capture and Storage (DACCS)</li> <li>• Enhanced rock weathering</li> </ul>
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- **Forms of CDR**- The most common form of carbon capture technology involves *capturing the gas from a point source* like an industrial smokestack.
- **Carbon storage**- It includes
  - **Carbon capture and storage (CCS)** - The carbon can be moved directly to permanent underground storage.
  - **Carbon capture, utilization, and storage (CCUS)** - Carbon can be used in another industrial purpose first.

As of 2023, CDR is estimated to remove around 2 gigatons of CO<sub>2</sub> per year, which is equivalent to 4% of the greenhouse gases emitted per year by human activities.

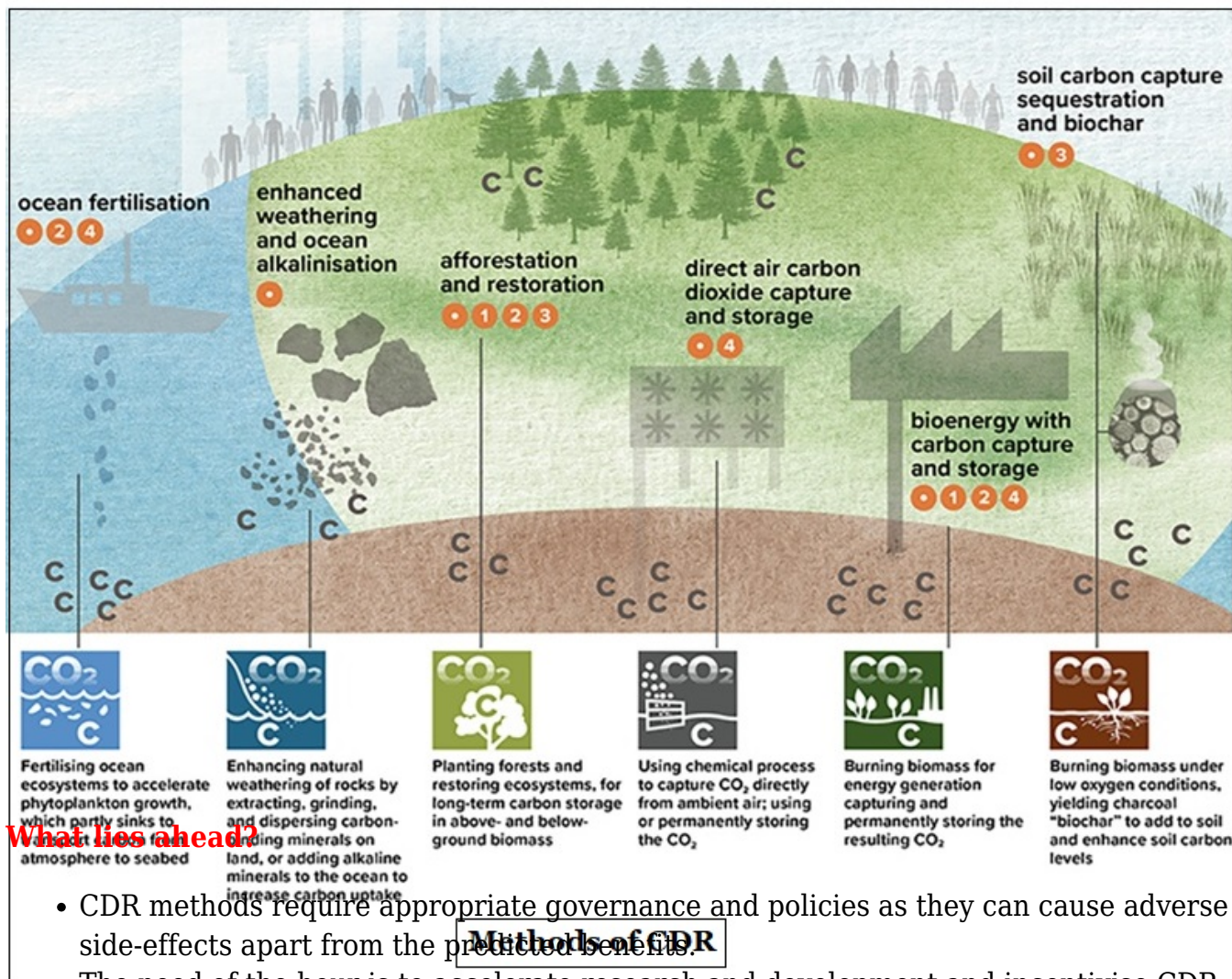
### What are the different CDR methods?

CDR method	About	Challenges
<b>Afforestation/ Reforestation</b>	<ul style="list-style-type: none"> <li>• Converts abandoned or degraded agricultural lands into forests.</li> <li>• Additional trees can sequester more carbon dioxide from the atmosphere.</li> </ul>	<ul style="list-style-type: none"> <li>• Increases the competition for land.</li> <li>• May limit the options for food production and biodiversity conservation.</li> </ul>
<b>Biochar</b>	<ul style="list-style-type: none"> <li>• A substance produced by <i>burning organic waste</i> from agricultural lands and forests in a controlled process called <i>pyrolysis</i>.</li> <li>• Improve soil quality, which in turn improves soil fertility, productivity and crop yield.</li> </ul>	<ul style="list-style-type: none"> <li>• Health and environmental impacts of particulate matter produced during pyrolysis.</li> <li>• Sourcing sustainable biomass at a scale.</li> </ul>
<b>BECCS</b>	<ul style="list-style-type: none"> <li>• Combines energy production, biological carbon removal and geological storage.</li> <li>• Uses biomass in combustion to generate energy, then captures the emitted carbon for geological injection.</li> </ul>	<ul style="list-style-type: none"> <li>• Can create <i>competition for land use</i> with food production, placing pressure on food security.</li> <li>• Can increase the use of fertilisers.</li> </ul>
<b>DACCS</b>	<ul style="list-style-type: none"> <li>• <i>Extracts CO<sub>2</sub> directly</i> from the atmosphere, and is permanently stored in geological formation or used for other application.</li> </ul>	<ul style="list-style-type: none"> <li>• Accelerates fossil fuel extraction activities, potential CO<sub>2</sub> leakage from storage sites</li> </ul>
<b>Enhanced rock weathering</b>	<ul style="list-style-type: none"> <li>• Involves <i>pulverising silicate rocks</i> to bypass the conventionally slow weathering action.</li> </ul>	<ul style="list-style-type: none"> <li>• Energy intensive process and generates emissions.</li> </ul>

**Ocean alkalinity enhancement**

• A chemical removal method that involves adding alkaline substances to seawater to accelerate the natural sink.

• Potential for increased greenhouse gas emissions and can release by-products like trace metals.



- CDR methods require appropriate governance and policies as they can cause adverse side-effects apart from the predicted benefits.
- The need of the hour is to accelerate research and development and incentivise CDR deployment, a political commitment, including reliable measurement, reporting, and verification of carbon flows as recommended by IPCC.

## References

1. [The Hindu- What is CO<sub>2</sub> removal explained](#)
2. [The Hindu- Why carbon capture is no easy solution](#)