

Carbon-Dioxide Removal

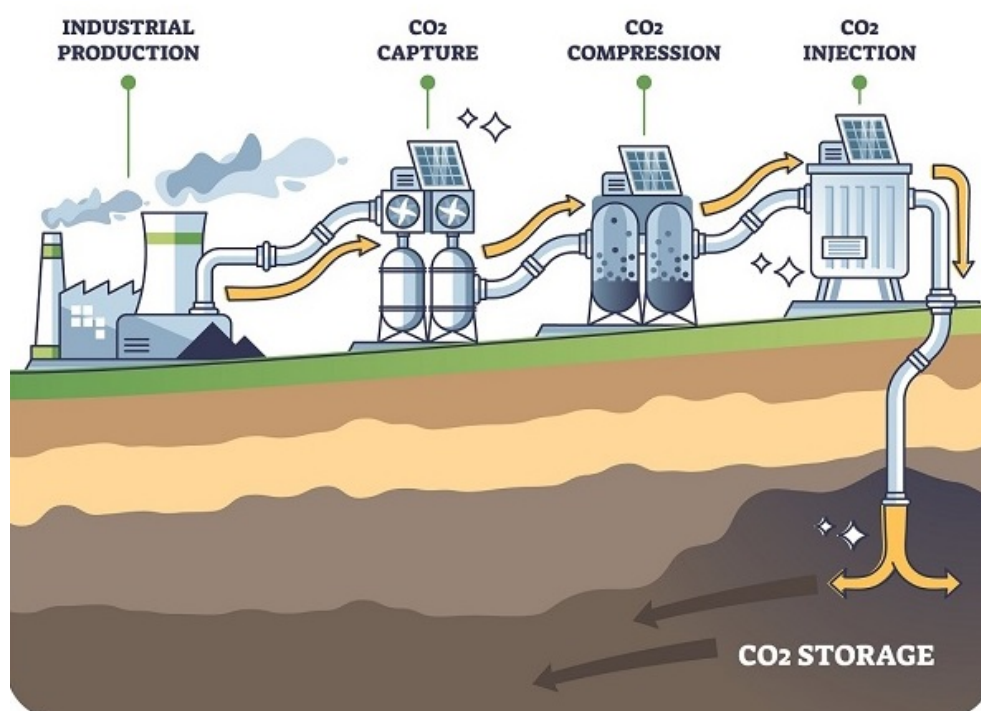
Why in news?

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 (CO₂) from our atmosphere through deliberate and intentional human actions.
- It captures CO₂ 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"> • Afforestation • Reforestation • Agricultural practices that sequester carbon in soils (carbon farming)

Technological process	<ul style="list-style-type: none"> • Bioenergy with Carbon Capture and Storage (BECCS) • Direct Air Carbon Capture and Storage (DACCS) • Enhanced rock weathering
------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- **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 CO₂ per year, which is equivalent to 4% of the greenhouse gases emitted per year by human activities.

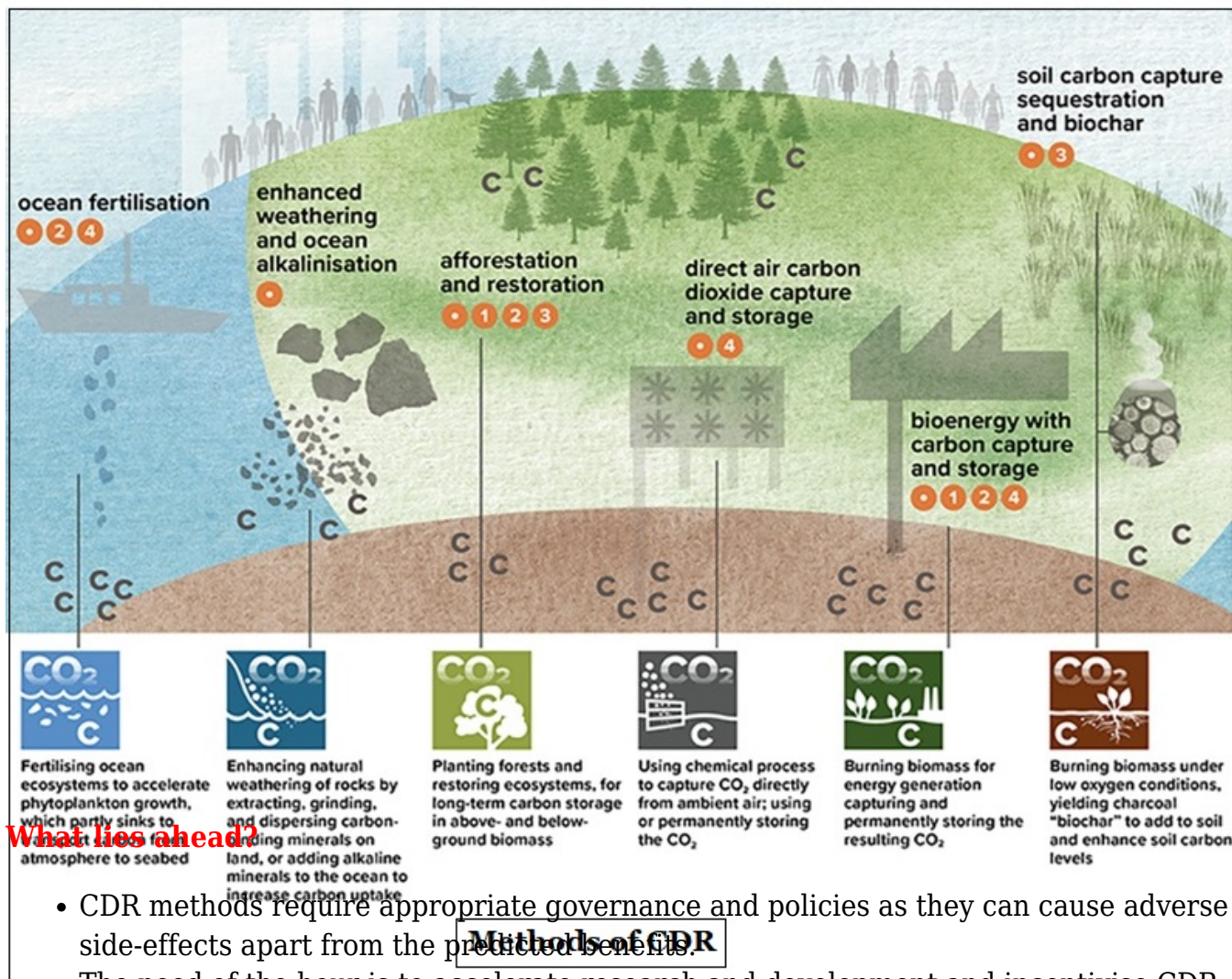
What are the different CDR methods?

CDR method	About	Challenges
Afforestation/Reforestation	<ul style="list-style-type: none"> • Converts abandoned or degraded agricultural lands into forests. • Additional trees can sequester more carbon dioxide from the atmosphere. 	<ul style="list-style-type: none"> • Increases the competition for land. • May limit the options for food production and biodiversity conservation.
Biochar	<ul style="list-style-type: none"> • A substance produced by <i>burning organic waste</i> from agricultural lands and forests in a controlled process called <i>pyrolysis</i>. • Improve soil quality, which in turn improves soil fertility, productivity and crop yield. 	<ul style="list-style-type: none"> • Health and environmental impacts of particulate matter produced during pyrolysis. • Sourcing sustainable biomass at a scale.
BECCS	<ul style="list-style-type: none"> • Combines energy production, biological carbon removal and geological storage. • Uses biomass in combustion to generate energy, then captures the emitted carbon for geological injection. 	<ul style="list-style-type: none"> • Can create <i>competition for land use</i> with food production, placing pressure on food security. • Can increase the use of fertilisers.
DACCS	<ul style="list-style-type: none"> • <i>Extracts CO₂ directly</i> from the atmosphere, and is permanently stored in geological formation or used for other application. 	<ul style="list-style-type: none"> • Accelerates fossil fuel extraction activities, potential CO₂ leakage from storage sites
Enhanced rock weathering	<ul style="list-style-type: none"> • Involves <i>pulverising silicate rocks</i> to bypass the conventionally slow weathering action. 	<ul style="list-style-type: none"> • Energy intensive process and generates emissions.

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.



What lies ahead?

- 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 CO2 removal explained](#)
2. [The Hindu- Why carbon capture is no easy solution](#)