Demystifying Carbon Dioxide Removal December roundup

Dear all,

Last week, COP28 dragged on past its finishing date due to contention around the language on fossil fuels and disagreements over guidance for carbon markets and removals. Although the conference ended without new rules on carbon trading under Article 6 of the Paris Agreement, removals attracted more attention than in previous years, reflected in record numbers of events and announcements on the topic.

What feels like months' worth of climate report releases were packed into the two weeks of COP, delivering far from uplifting news on where we stand on 1.5°C. We look at what is at stake if we overshoot temperature goals, where CDR can help and where it is more unclear.

Lastly, we discuss new developments in enhanced weathering and biochar, including large-scale financing for enhanced weathering using rock dust, and the most substantial evidence for the permanent storage of carbon in biochar to date.

As always, please feel free to share this newsletter with anyone who may be interested. You can <u>sign up here</u>, or <u>click here</u> to see an archive of previous editions. Don't hesitate to get in touch if you have any questions, suggestions or feedback.

Wishing you happy holidays and see you in the new year, Victoria victoria.kalyvas@gsccnetwork.org

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Stat of the month:

0.01 million tonnes

The amount of carbon <u>CDR</u> removes from the atmosphere per year - more than <u>a million times</u> smaller than current CO2 emissions from fossil fuels.



No CDR consensus at COP28

COP28 closed one day later than planned with a deal that calls for a "transitioning away" from fossil fuels in energy systems. While some were disappointed that the final text <u>did not explicitly call for a</u> <u>fossil fuel "phase out"</u>, it is an important milestone that fossil fuels were mentioned at all. The final text also called for "accelerating zero- and low-emission technologies" including "<u>removal</u> <u>technologies</u>," particularly in hard-to-abate sectors.

Despite going into overtime, COP28 was <u>unsuccessful in reaching a consensus on carbon markets</u>. Negotiating texts for Articles 6.2 and 6.4, which set out guidelines for the trading of carbon credits, were both <u>riddled with issues</u> that raised concerns from countries and NGO groups. Disagreements over <u>confidentiality and rules for authorising credits</u> blocked an agreement on Article 6.2, while loose guidance on Article 6.4, <u>particularly on removals</u>, posed an <u>integrity issue for the EU and Latin American states</u>.

"<u>Negotiators made the best of a bad situation</u>," according to NGO Carbon Market Watch, resulting in a "<u>bittersweet</u>" outcome. While no text is better than a bad text, it means that defining the rules for carbon markets in the Paris Agreement will <u>drag on for yet another year</u>, into discussions at COP29. In the meantime, countries and companies - like the <u>UAE's Blue Carbon</u> - <u>continue to announce new</u> <u>deals in the absence of proper guidelines</u>. This has raised concern, as it means there are <u>no</u> <u>standards to follow and no requirements for countries to share information</u> about deals. Juliana Kessler, Research Associate at think tank Perspectives Climate Research, told Carbon Brief that "the resulting lack of guidance <u>causes uncertainty and undermines transparency</u> – leaving key design choices to states engaging in bilateral Article 6.2 cooperation without a guiding star."



"Outside the conference venue, COP negotiations were informed by what feels like months' worth of climate report releases crammed into two weeks." The <u>only part of Article 6 that was adopted</u> was text on the <u>lesser-known Article 6.8</u>, covering nonmarket approaches. Under Article 6.8, countries can cooperate on climate action without trading emissions, through, for example, transferring finance or technology. Non-market approaches are <u>not</u> <u>clearly defined</u>, but could potentially encompass the transfer of finance, knowledge and tech for CDR and monitoring, reporting and verification (MRV). Some countries and organisations believe that Article 6.8 could be a better way <u>to support emissions reductions and removals</u>, without the integrity concerns of carbon markets, and may be particularly useful for providing financing for forests.

CDR also drew attention outside the negotiating rooms. There were several national commitments covering carbon removals and <u>at least 75 removals events at COP</u> - which is significant given that "three years ago, the topic wasn't even on the agenda." Denmark, Finland and Panama launched the Group of Negative Emitters. Panama has already reached this goal -more than <u>63% of the country is covered in forests</u>, which act as a carbon sink - while Finland and Denmark <u>hope to achieve this by</u> 2035 and 2045 respectively, through a combination of emissions cuts, forest expansion and investment in new carbon capture and removal tech. Other countries <u>announced their participation in the Carbon Management Challenge</u>, pledging to invest in and scale up carbon capture and storage (CCS) and carbon removals, with the aim of reaching gigatonne-level removals by 2030. However, one concern around the initiative - also seen in <u>COP decisions</u> - was that CCS and CDR are <u>lumped together</u>. It is important to remember that <u>they play different roles</u> - CDR removes carbon before it reaches the atmosphere to prevent additional emissions.

Two former members of the US Department of Energy (DOE) have also claimed the US also does not quite understand the role of CDR. In a paper published in July, Emily Grubert and Shuchi Talati wrote that limited CDR resources are <u>currently being misallocated</u> - used to cancel out corporate emissions, rather than being treated as a public good <u>like "waste management" with "larger global stakes</u>". "You really need to save [CDR] for the stuff you can't eliminate, <u>not just the stuff that's expensive to eliminate</u>. That means using carbon removal to address things like the emissions from the fertilizer used to feed populations in poor parts of the world, not for avoiding the hassle and expense of retrofitting a cement plant," Grubert told MIT Tech Review.



Climate science lowdown

Outside the conference venue, COP negotiations were informed by what feels like months' worth of climate report releases crammed into two weeks.

An <u>assessment of the global carbon budget</u> concluded that overshooting 1.5°C is becoming inevitable. Even if we temporarily breach the temperature limit, the remaining budget will <u>be gone in</u> <u>around seven years</u> without rapid and steep cuts in emissions. This year's assessment took a closer look at CDR, finding that outside of removals from land use, CDR removes <u>only 0.01 million tonnes</u> <u>of carbon per year</u>, "more than <u>a million times smaller than current fossil CO2 emissions</u>." According to Pierre Friedlingstein, the report's lead author, if removals scale up "by a factor of 100 in the next 10 to 20 years, that would be amazing, <u>but they won't scale up by a factor of 1 million</u>".

Another report, summarising <u>10 new Insights in climate science</u>, echoed concerns around keeping to 1.5°C of warming and called for robust policies on CDR as part of mitigation efforts. At the same time, the report said that this should not be a substitute for deep sustained emission reduction and we should not over-rely on natural carbon sinks. These findings were reflected in an <u>open letter</u> written in the first week of COP28, signed by nearly 1500 climate researchers (and counting) from across the world, including many IPCC authors. "The science is clear: there <u>is no room for ambiguity</u> on the required action for achieving net zero carbon dioxide emissions by 2050," the letter said.

New research also shed some light on the assumption that <u>CDR can simply balance out emissions</u> in the atmosphere. The authors show that unless other factors are considered, "<u>balancing CO2</u> <u>emissions with removals will not achieve the intended climate goal</u>." The permanence of carbon storage is a key factor, but there are other combinations of biological, geological and physical issues that receive less attention. For example, planting more trees, particularly in areas where it snows, can reduce the reflection of light from the sun and <u>contribute further to warming</u>. Some CDR methods might increase levels of other greenhouse gases - use of fertilisers for growing plants for reforestation, restoration of coastal ecosystems, or for use in bioenergy with carbon capture and storage (BECCS) can result in nitrous oxide and methane emissions. Therefore, "policies designed to offset greenhouse gas emissions, <u>need to consider the full suite of climate effects</u> of the proposed CDR to ensure intended climate goals are not compromised."

Another reason why we need to avoid overreliance on CDR is to minimise the risk of hitting climate tipping points associated with <u>overshooting 1.5°C of warming</u>. Climate tipping points are when a self-perpetuating cycle of changes causes <u>an earth system (e.g., a rainforest)</u> to transform into a totally different state (e.g., a desert), causing huge and irreversible changes to the climate. The world's most exhaustive review of global tipping points warned that the Earth is on a "<u>disastrous trajectory</u>" towards tipping points that "pose some of the gravest threats faced by humanity." While the IPCC had referred to tipping points as 'low likelihood, high impact' events, this review of the science upgrades them to having "<u>high likelihood, high impact</u>" and urged that "global mitigation should now assume an emergency footing" due to the scale of threat. The authors identified over 25 tipping out that we are already at risk of <u>passing five of these thresholds</u> and a further three tipping points are at risk of being triggered at 1.5°C of warming. Perhaps not the positive note you were hoping to end the year on.



Rock dust and biochar

McKinsey put out a new report on scaling carbon removals which estimated that <u>investment in</u> <u>carbon removal capacity is expected to reach between USD 100-400 billion by 2030</u>. If we want to reach net zero by 2050, this investment should be at least USD 500 billion in 2030 and USD six trillion in 2050 (McKinsey <u>has a stake in driving demand</u>, so take these figures with a grain of salt). This represents a steep jump from the <u>USD 13 billion that global CDR capacity</u> has received to date. A key finding of the report is that while technology-based CDR costs are expected to decline over time, <u>nature-based removals will likely get more expensive</u> as land resources become constrained.



"The findings represent the most concrete evidence of biochar's permanence to date. This is particularly important as biochar made up '<u>92% of</u> <u>permanent carbon removal</u> <u>sales</u> in the first part of 2023."

One CDR company that is receiving funding to scale up is Lithos. Frontier Fund has invested USD 57 million in the 'rock-dust' start-up, in what Bloomberg called "<u>its biggest bet yet</u>". Lithos has been paid to remove 154,000 tonnes of carbon between 2024 and 2028 via enhanced rock weathering. This involves grinding up rocks like basalt and olivine and spreading them across large areas of land to <u>speed up the process by which they naturally take up CO2</u>. While the company is quite new, Nan Ransohoff, head of Frontier, said that "Lithos has demonstrated an impressive ability to execute" and "<u>relies very heavily on measuring</u>" removals at a time when most companies are still focusing on modelling. Climate scientists David Beerling and David Ho thought that the funding from Frontier "<u>will help push enhanced rock weathering toward the point where companies and governments feel confident that it works</u>".

According to scientists, another land-based approach could be a CDR winner. A new study looked at the permanence of carbon stored in biochar, finding that <u>76% of the biochar samples it assessed</u> <u>contained carbon stored in one of the most stable forms</u>, known as Inertinite. Inertinite takes over

<u>100 million years</u> to decay - so the carbon isn't getting released any time soon. The findings represent the most concrete evidence of biochar's permanence to date. This is particularly important as biochar made up "<u>92% of permanent carbon removal sales</u> in the first part of 2023," and large-scale deals continue. Microsoft, for example, just bought <u>32,000 tonnes of removal credits</u> from a biochar project in Bolivia.



Our pick of the news

<u>'Magical' tech innovations a distraction from real solutions, climate experts warn</u> (The Guardian) "Overemphasis on innovation and carbon removal risks distracting from main goal of stopping use of fossil fuels, say scientists."

Why Deleting Carbon From the Atmosphere Is So Controversial (Wired)

There are many differing perspectives on CDR, particularly when it comes to COP ambition.

The Hijack and Reclamation of Direct Air Capture (Atmos)

A key concern of COP28 was the record presence of oil and gas lobbyists. "The industry holds a <u>vice</u> <u>grip over the event</u>, and DAC is their trojan horse," writes Jason Dinh.

<u>Harnessing the oceans to 'bury' carbon has huge potential – and risk – so NZ needs to move with</u> <u>caution</u> (The Conversation)

New Zealand is making policy that will consider "bringing wetlands into the emissions trading scheme, and to investigate the potential of kelp farms to sequester CO2," with potential benefits and risks.

Can Indigenous inclusivity be the key to successful carbon markets? (AI Jazeera)

Among ongoing integrity issues in carbon markets, indigenous communities stress why they need to be included in carbon market discussions that affect their land.

Climate tech is back-and this time, it can't afford to fail (MIT Tech Review)

As a new wave of climate start-ups rapidly try to commercialise their technologies, MIT Tech Review looks back at the clean tech boom a decade earlier, where start-ups faced similar challenges and not all survived.



Useful resources this month

<u>Publication</u>: Bellona has put together a report on managing expectations for negative emissions technologies and practices. They highlight that the supply of removals will be insufficient for the current expected demand and outline key considerations for allocating CDR based on who should be responsible for deployment and who should be allowed to use CDR to counterbalance emissions.

<u>Paper</u>: A review in Nature Climate Change found that more severe and frequent wildfires are outpacing the capacity of many ecosystems to recover - causing some landscapes, like carbon-rich forests, to shift to ecosystems with a lower capacity to remove CO2 from the atmosphere, like grasslands.

Tracker: Carbon180 has put together a tracker to explore US federal funding for CDR over the years.

<u>Commentary</u>: Carbon Plan explains why corn ethanol carbon capture and storage projects don't remove CO2 from the atmosphere, "no matter how you do the math".

Report: UNESCO has released a report warning of ethical risks of climate engineering.

<u>Blog</u>: CDR academic group CO2RE outlines why not all carbon removals are created equally and how we can govern permanence.

<u>Partnership</u>: Sweden and Switzerland signed a declaration of intent at COP28 to test international trading of CDR by trading small levels of removals.

<u>Research</u>: EU CDR non-profit Carbon Gap finds that industries with low emissions and high profits, like banking, finance and insurance industries, have the most capacity to invest in CDR, but all sectors could afford to offset the remaining 10% of their emissions with permanent removals.

<u>Market report</u>: A market research firm valued the global CDR market at USD 485 million in 2022 and predicts it could reach 2073 million by 2031.

<u>Map</u>: Carbon Removals at COP released an interactive map to explore over 130 project developers all over the world and the stories of the people behind them.

<u>Video</u>: During COP, the IPCC ran an event on CDR knowledge gaps and research priorities, such as expanding guidance on removals accounting and better incorporating sustainability into modelling.

<u>Analysis</u>: A new report was released on "roads to removal" in the US, concluding that with today's technologies, removing a gigatonne of CO2 each year <u>would cost around USD 130 billion in 2050</u> - equivalent to 0.5% of current GDP.

<u>Brief</u>: Zero Carbon Analytics has put together a brief breaking down what temperature overshoot and tipping points actually means.

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Each month the demystifying carbon dioxide removal newsletter digs into the world of CDR to bring you the latest stories on everything from carbon credits and net-zero plans to nature-based solutions (NbS) and new technologies. Feel free to forward this email to your colleagues!

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