

NAVIGATING HOPES AND THREATS:

How precaution should guide
marine Carbon Dioxide Removal
research and governance



OCEAN & CLIMATE
PLATFORM

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Suggested citation: Ocean & Climate Platform (2026), *Navigating Hopes and Threats: How Precaution Should Guide Marine Carbon Dioxide Removal Research and Governance*, Policy Brief.

Layout and infographic: Natacha Bigan

The publication of this document was made possible through the generous support of the Fondation de France, the French Development Agency (AFD), the French Office for Biodiversity (OFB), the French Ministry of Ecological Transition, Biodiversity and International Negotiations on Climate and Nature, and the Veolia Foundation.



About the Ocean & Climate Platform

The Ocean & Climate Platform (OCP) is an international network of more than 120 organisations from civil society – including NGOs, research institutes, foundations, businesses, local authorities, and intergovernmental organisations. Created in the lead-up to COP21 in Paris with the support of France and the Intergovernmental Oceanographic Commission of UNESCO, the OCP works to promote scientific expertise on the role played by the ocean and its ecosystems in the global climate system, and to advocate for stronger integration of ocean-climate-biodiversity interactions in decision-making. Acting as an interface between science and policy, the OCP provides a space for reflection and dialogue between the scientific community, civil society, and policy-makers, fostering a common and holistic approach to ocean health in the context of climate change and biodiversity loss.



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Acronyms

BBNJ	Biodiversity Beyond National Jurisdiction
CBD	Convention on Biological Diversity
CCUS	Carbon Capture, Utilisation and Storage
CDR	Carbon Dioxide Removal
CO ₂	Carbon Dioxide
COP	Conference of Parties
EIA	Environmental Impact Assessment
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection
GHG	Greenhouse Gases
Gt	Gigatonne
ICJ	International Court of Justice
IMO	International Maritime Organisation
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
mCDR	marine Carbon Dioxide Removal
MRV	Monitoring, Reporting and Verification
STB	Scientific and Technical Body
UN	United Nations
UNEA	United Nations Environment Assembly
UNCLOS	United Nations Convention on the Law of the Sea
UNFCCC	United Nations Framework Convention on Climate Change
UNHRC	United Nations Human Rights Council

Executive Summary

- **Marine Carbon Dioxide Removal (mCDR) techniques**, designed to enhance the ocean's ability to sequester and store carbon dioxide, are highly uncertain, particularly regarding their efficacy and potential risks for nature and people. As of today, they remain unproven as a scalable solution to mitigate climate change. In light of these uncertainties and risks, the priority must remain the urgent and drastic reduction of greenhouse gas emissions. Relying on the promise of mCDR as a "technical fix" could create a moral hazard, undermining decarbonisation efforts and increasing long-term risks.

- Nevertheless, **scientific research may be warranted to better assess the potential and risks of mCDR**, provided that robust safeguards ensure it is conducted safely and equitably. Such safeguards should:

- **Support fundamental research** to deepen our understanding of ocean processes and ecosystem functioning, including potential impacts of mCDR, and limit field experiments to small- or meso-scale, non-commercial tests that demonstrate environmental safety in line with international law.

- **Establish standards for safe and equitable research** by turning existing guidelines into operational criteria and integrating them across all stages of decision-making and scales of governance, including assessments and permitting processes.

- **Ensure mCDR research advances scientific knowledge rather than economic interests**, including by prohibiting the sale of carbon credits during experimental phases, and is supported by independent and transparent Monitoring, Reporting, and Verification, environmental impact assessments, and life cycle assessment.

- **Call on the IPCC and IPBES to systematically assess both the efficiency and risks associated with mCDR**, strengthen their collaboration on this issue, and develop climate scenarios that do not rely on unproven technologies.

- The **governance framework of mCDR is fragmented and inadequate**, creating regulatory gaps and incentivising forum-shopping. It **should be strengthened and harmonised** to enable safe and equitable research while preventing any premature deployment.

- Enhance coherence across relevant instruments and bodies, including by **adopting a UN Environment Assembly resolution** recalling the precautionary principle and **developing a shared assessment framework** for mCDR research.

- **Ensure governance frameworks are equitable and grounded in Free, Prior, and Informed Consent**, address potential negative impacts on communities, and support their meaningful participation and informed decision-making.

- **Support the implementation of existing obligations** under the Agreement on Marine Biodiversity of Areas Beyond National Jurisdictions **and decisions** under the London Protocol and the Convention on Biological Diversity to ensure their consistent application across frameworks **and effective translation into national legislation**.

Introduction

The world is not on track to meet the 1.5°C goal of the Paris Agreement, and the window of opportunity to course correct is rapidly narrowing. As the urgency to address climate change intensifies, interest in techniques designed to enhance the ocean's ability to sequester and store carbon dioxide – known as marine Carbon Dioxide Removal (mCDR) – is surging. While proponents argue that deployment could contribute to climate change mitigation, these techniques remain shrouded in uncertainty, particularly regarding their efficacy (efficiency, durability, and additionality) and potential negative impacts on nature and people.

Despite uncertainties, the risks associated with the development and potential deployment of mCDR are far-ranging¹. They include pollution, in the case of techniques aiming at dumping materials in the ocean (such as ocean alkalinity enhancement, see Focus below), but also the disruption of nutrient cycles and whole food chains. Deep-sea habitats are also particularly vulnerable to some techniques, such as those involving depositing biomass to the bottom of the ocean. Because of the dynamic nature of the ocean, these potential disruptions would likely not be contained and could spread across vast ocean areas, affecting different countries and communities.

These environmental risks could translate into social and economic ones, endangering the invaluable services ecosystems provide to people.

As of today, mCDR remains unproven as a scalable solution to mitigate climate change^{2,3}. The priority must remain the urgent and drastic reduction of greenhouse gas emissions. Relying on the promise of mCDR as a “technical fix” could create a moral hazard, undermining decarbonisation efforts and increasing long-term risks by drawing political attention and financial resources away from proven, ready-to-implement solutions. Climate action should not come at the expense of nature and people. It is vital to safeguard ecosystem integrity and the continued provision of ecosystem services, including climate regulation.

Nevertheless, scientific research may be warranted to assess the potential and risks of mCDR, provided that robust safeguards are in place to ensure it is conducted safely and equitably. In this context, the governance framework of mCDR, currently fragmented and inadequate, should also be strengthened and harmonised across existing international agreements to enable safe research while preventing any premature deployment.

FOCUS : Understanding marine Carbon Dioxide Removal (mCDR)

Although the terms carbon dioxide removal and geoengineering are often used interchangeably, they are not strictly synonymous. Geoengineering refers to a broad suite of technologies and large-scale interventions designed to deliberately alter environmental systems in order to mitigate or offset the impacts of anthropogenic climate change. It includes several subcategories, most notably carbon dioxide removal (CDR), solar radiation management, and ice management approaches. CDR encompasses a variety of approaches aimed at removing carbon dioxide from the atmosphere and ensuring its long-term storage, either on land or in the ocean. If deployed at a large scale with the explicit objective of mitigating climate change, CDR can therefore be considered as a category of geoengineering.

1/ Brun, V. et al. (2026). Three challenges to marine carbon dioxide removal. Available here.

2/ Doney, S., K. et al. (2025). Principles for Responsible and Effective Marine Carbon Dioxide Removal Development and Governance. Washington, DC: World Resources Institute. Available here.

3/ GESAMP (2019). High level review of a wide range of proposed marine geoengineering techniques. Rep. Stud. GESAMP No. 98, 144 p. Available here.

Marine CDR (mCDR) refers to approaches designed to restore, increase or mimic marine biophysical processes to capture and store carbon dioxide, thereby increasing the ocean's ability to do so. Different classifications of mCDR exist, distinguishing them based on the process and ecosystems they target. Building on a recent research paper coordinated by the Ocean & Climate Platform⁴, this policy brief classifies mCDR into three types of approaches: biological, chemical, and physical (Figure 1). Biological approaches primarily rely on ocean based photosynthesis, while chemical and physical ones involve altering the concentration or distribution of CO₂ in seawater.

Blue carbon conservation and restoration is usually included in the definition of mCDR. Yet, it is often contrasted with other approaches for two main reasons. First, it is the only mCDR technique that is both technologically mature and considered relatively safe, representing a “low-regret” option with important co-benefits for nature and people. Second, its estimated carbon capture potential is limited to about only 1% of current emissions (or 0.1 to less than 1 Gt CO₂/year). The rest of mCDR techniques, on the other hand, are meant to be deployed over wide expanses of the ocean, which could have large-scale impacts on marine ecosystems and processes and require international cooperation to be managed. In this context, this brief focuses primarily on the challenges and governance of mCDR techniques shown in Figure 1, excluding blue carbon ecosystem conservation and restoration.

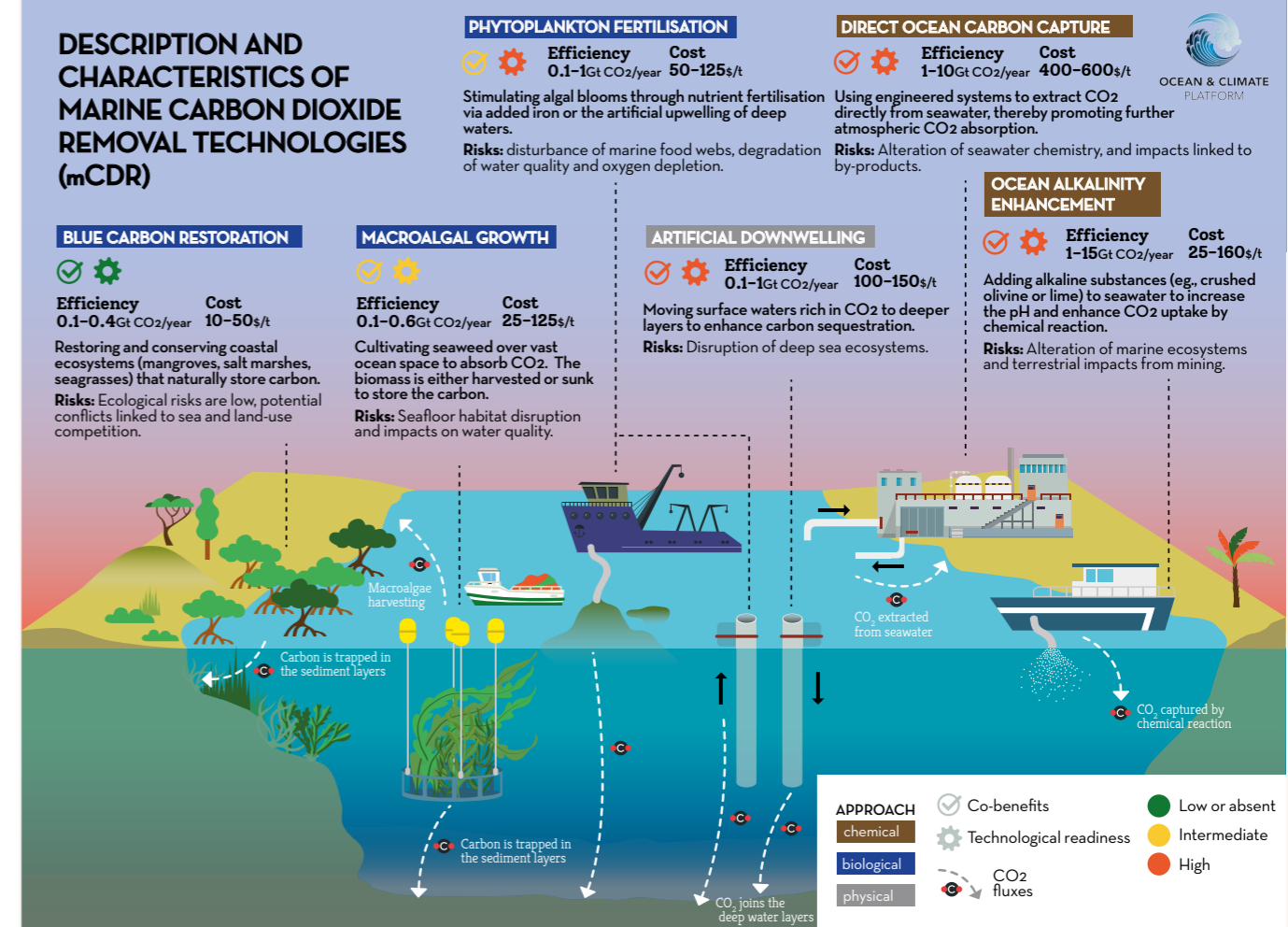


Figure 1. Description and characteristic of the main mCDR techniques. Technological readiness and price are assessed based on published literature, see: Brun, V. et al. (2026). Three challenges to marine carbon dioxide removal (available here). “National waters” and “High seas” refer to the probability for each technique to be implemented in these areas.

4/ Brun, V. et al. (2026). Three challenges to marine carbon dioxide removal. Available here.

1 Safe and equitable mCDR research

Assessing the effectiveness and risks of mCDR is significantly constrained by persistent knowledge gaps⁵, with insufficient evidence that they could reliably capture and durably store carbon. Potential disruptions of these activities to marine ecosystems and the communities that depend on them remain largely unknown. With the objective to address these uncertainties, researchers and companies are currently conducting fundamental research and field experiments which may carry social and ecological risks. While mCDR research is necessary to evaluate the potential of these techniques, it must be conducted in a safe and equitable way.

1.1. Support scientific research

Research on mCDR aims to answer two complementary questions: do these techniques have the potential to capture and store significant amounts of CO₂ for centuries to millennia? Can they do so without causing significant ecological and social harm? Addressing these uncertainties first requires strengthening our understanding of ocean processes and their linkages to mCDR activities. This should be supported through well-funded, independent, and interdisciplinary research that goes beyond the biophysical aspects of mCDR to include its broader socio-ecological consequences, as well as ethics and governance dimensions.

• **Support fundamental research to deepen our understanding of ocean biophysical processes, biodiversity, ecosystem functioning, ecosystem services, and how mCDR could affect them.** Current understanding of basic ocean processes, such as the carbon and nutrient cycles, remains limited. More fundamental research is needed to deepen our understanding of these processes, and how mCDR could affect them. As funding for ocean observation and research is currently at risk, countries must urgently secure and improve their *in situ* and satellite observation capacities, as well as their ocean modelling capabilities. They must also allocate additional funding to secure long-term oceanographic research through universities and research institutions. Interdisciplinary research, including human and social sciences, is also key to understanding mCDR beyond its biophysical dimensions and should be supported. International cooperation must focus on capacity-building and data-sharing, including through the shared use of research infrastructures (such as vessels and observatories). This is vital to address current disparities and ensure equitable research capacities globally, particularly for low- to middle-income countries.

• **Limit field experiments to small- or meso-scale non-commercial tests that demonstrate environmental safety in line with international law⁶.** Open ocean field trials can be considered as a comple-

ment to fundamental research, models, and laboratory experiments, but they must be subject to strong safeguards to ensure their safety and transparency. While mCDR field experiments are already being planned and conducted by consortia of public and private actors in countries where legislation allows for it, these activities remain controversial due to the environmental and social risks they may pose. To remain safe, field experiments should be limited to small- or meso-scale non-commercial tests that demonstrate environmental safety. However, there is currently no internationally-agreed definition of what constitutes a small- or meso-scale experiment, and the issue remains subject to debate among experts. Typically, such experiments may range from a few hectares to a few square kilometers, but the dispersion of materials due to the ocean and the major differences in how each mCDR technique works makes it difficult to apply a general rule. Technique-specific guidelines should therefore be developed. Aside from their spatial extent, being “small-scale” signifies that experiments should be conducted in a controlled setting, with well-designed impact assessments, and for the sole purpose of advancing scientific research.

• **Communicate the results of mCDR experiments in a transparent and balanced way to avoid sending an overly optimistic message about their climate mitigation**

potential. An optimistic narrative on the potential future ability of technologies could carry the risk to deter the decarbonisation efforts needed to curb emissions. Transparency is also a question of equity, as these results could be valuable to build knowledge capacity in countries with less research capacity, but would also be fundamental to inform the communities potentially affected by field trials.

1.2. Establish standards for safe and equitable research

Existing **guidelines and codes of conduct for mCDR research**, such as the Aspen Institute’s Code of Conduct⁷ and American Geophysical Union’s Ethical Framework for Climate Intervention Research⁸, outline **key foundational principles for safe mCDR research**. These include public participation, responsible research, and consideration of the different forms of equity^{9,10}. Public participation, for instance, makes it an imperative for the public and stakeholders to participate fairly in the design and implementation of mCDR projects, and not just be informed of their objectives and outcomes. However, these **principles remain too broad and must be operationalised** to be effectively carried forward.

5/ Brun, V. et al. (2026). Three challenges to marine carbon dioxide removal. [Available here](#).
6/ CBD (2010). Decision X/33. Biodiversity and climate change. [Available here](#).

7/ Aspen Institute (2023). A Code of Conduct for Marine Carbon Dioxide Removal Research. [Available here](#).

8/ American Geophysical Union (2024). Ethical Framework Principles for climate intervention research. [Available here](#).

9/ Askenazy, P., Debré, P., Ganascia, J.G., Gourier, D., Jeandel, C. et al. (2021) COMETS Avis 2021-41 - Science, risques et principe de précaution. [Rapport de recherche] AVIS n°2021-41, COMETS. [Available here](#).

10/ Askenazy, P., Bustarret, E., Claeys, A., Courtier-Orgogozo, V., Jacquier, M., Leclerc, O. et al. (2025) COMETS Avis 2025-47 - Manipuler les virus, manipuler le climat ? AVIS n°2025-47, COMETS. [Available here](#).

- **Turn existing research guidelines into specific assessment and regulation frameworks.** While existing guidelines are highly valuable, they remain merely principles. To be effective, they must be translated from broad ethical guidance to operational criteria and systematically embedded across all decision-making stages and scales of governance, including assessment and permitting processes. This requires moving beyond tick-the-box principles to detailed, context- and technique-specific mandatory standards that are fully integrated into international and national law, as well as sectoral and local regulations. This also demands a contextual definition of broad principles such as *precautionary, ecosystem protection, public participation, or equity*, associating them with measurable thresholds that can guide decisions on whether research can proceed at all. In addition, the inclusion of scientists from academic institutions with no vested interests in the deployed technology should be encouraged to develop these guidelines.

1.3. Guide research funding and prevent conflicts of interest

Funding for mCDR relies on a mix of public and private sources, with philanthropies playing a particularly important role as they can fill in the gaps when public funds for public-interest research are cut. Yet, today, **a majority of mCDR funding goes toward developing field trials driven by commercial interests**, risking another “tragedy of the commons” scenario in which private profits are pursued while risks and liabilities are borne by the public – calling current funding priorities into question.

- **Develop guidelines to ensure that financing of mCDR research is directed toward safe, equitable, and transparent activities dedicated to advance scientific progress.** Considering the risks and ethical implications of trials and potential deployments, there is a need for guidelines to help funders navigate the financing of mCDR research projects, including by establishing explicit expectations for financial disclosure and transparency. These guidelines should be developed by a broad consortium of actors including specialised mCDR researchers, civil society representatives, particularly of Indigenous and local communities potentially affected by mCDR, policy-makers, as well as representatives of industry, funding agencies, and philanthropic organisations. These guidelines shall:

- Be grounded in existing ethical frameworks and codes of conduct, compliance with which should constitute a prerequisite for funding.
- Prohibit reliance on carbon credit revenues during the research phase, in order to avoid premature commercialisation incentives and conflicts of interest.
- Include robust transparency requirements to ensure open access to data, methodologies, and project results.
- Align research and funding priorities with identified knowledge gaps, rather than short-term commercial prospects.
- Ensure that funding allocated to mCDR does not come at the expense of investments in decarbonisation and emissions reduction.

- **Prevent the premature sale of carbon credits from scientific experiments. The growing involvement of the private sector in mCDR research raises concerns about conflicts of interests.** Close to 1 million mCDR carbon credits have been sold to this

date, of which about 30 000 are listed as delivered on online platforms¹¹, mostly by four companies: Planetary, CREW Carbon, Carbon Run, and Running Tide. Other companies have been relying on the pre-sale of credits as an investment in their activities, such as Ebb Carbon that recently concluded a deal with Microsoft to deliver up to 350 000 credits in the future¹². Selling credits before the underlying removal and durability claims can be independently verified risks rewarding overstated or unproven results while undermining the credibility of the carbon credit market.

- **Ensure any field trial is dedicated to advancing scientific understanding of mCDR supported by independent and transparent Monitoring, Reporting and Verification (MRV), Environmental Impact Assessment (EIA), and Life Cycle Assessment (LCA).** Considering that mCDR techniques are at an experimental stage, mCDR field trials should solely be conducted to advance scientific knowledge. Conflicts of interests are inherent to these activities, as the expected profits from deployments depend on the success or failure of the experiment. Instead of being designed as profit-generating enterprises, trials should be embedded in strategies aimed at filling the research gaps identified in scientific literature and by Indigenous peoples and local communities. Their results should also be published, and as much as possible, be subject to peer review. The additionality of carbon capture and environmental safety have to be demonstrated through well designed and transparent MRV, LCAs, and EIAs. Third-party verification is critical to limit conflicts of interest, but it has two limits in the current conditions. First, MRV protocols are not well established with

commonly agreed-upon standards for verification. Second, as MRV companies economically depend on the verification of carbon credits, they are also subject to conflicts of interest. Ensuring mCDR research remains dedicated to advancing its scientific understanding requires a wide array of regulations and safeguards, discussed in the second section of this brief.

1.4. Strengthen science-policy integration

International science-policy bodies – including the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) – play a key role **in providing the scientific foundation for decision-making for climate policy.** Notably, this role is recognised by both the International Court of Justice (ICJ) and the International Tribunal for the Law of the Sea, who categorise the IPCC as representative of the best available science.

- **Develop climate scenarios that do not rely on unproven technologies and explicitly acknowledge uncertainties and potential bias.** The IPCC does not outline a plan or establish a definite target for CDR. Rather, it synthesises published scenarios, with different – and in some cases near-zero – levels of CDR. The Sixth Assessment Report makes it clear that deep and rapid emissions reductions remain the priority, with CDR mostly considered to tackle residual emissions. Importantly, it does not present mCDR as a solution, but rather flags it as immature and risky. It is essential to understand that the re-

11/ The website CDR.fyi ([LeaderBoards page](#)) records all carbon credits that were sold. In the case of mCDR, these credits include marine biomass, alkalinity enhancement, and direct ocean capture.

12/ Tarbell, B. (2024). Ebb Carbon and Microsoft: a landmark carbon dioxide removal agreement. [Available here](#).

quired scale of CDR is not an unavoidable necessity but reflects underlying political choices. Current pathways often embed specific socioeconomic assumptions, such as material growth, which in turn increase projected reliance on CDR technologies. Assessing these needs is therefore a key ethical issue, as alternative development pathways based on immediate structural change could substantially reduce the level of CDR required.

- **Call on the IPCC, in its assessment of mCDR, to also consider the literature on efficacy and risks, not only feasibility, including in its forthcoming Methodology Report on Carbon Dioxide Removal Technologies.** The IPCC Seventh Assessment Report, currently under preparation, will include a chapter dedicated to CDR. However, the existing literature on mCDR continues to provide limited consideration of the environmental and socio-economic risks, due to a paucity of experiments dedicated to assessing them. Considering the IPCC's role as synthesising existing literature, it is important to acknowledge these gaps. In parallel, the IPCC is also working on a Methodology Report on CDR Technologies, Carbon Capture, Utilisation, and Storage for National Greenhouse Gas Inventories, which might include a few marine techniques such as direct ocean capture. This represents a key opportunity to embed environmental and social safeguards into inventory methods by requiring disclosure of key ecological and community impacts where CDR is reported. The report should provide method-specific guidance on system boundaries, baselines, leakage, permanence, risk assessment, and uncertainty treatment that is consistent with Paris-rulebook MRV principles. It should reinforce transparency and comparability by requiring standardised reporting tables, documentation of assumptions and data sources, and alignment with existing IPCC Guidelines. It is essential that countries

cannot use CDR accounting to obscure weak mitigation and double counting.

- **Strengthen collaboration between the IPCC and IPBES on mCDR, ensuring a comprehensive approach that addresses both efficiency and environmental risks.** While the IPBES has not assessed geo-engineering or CDR approaches as directly and systematically as its climate counterpart, the IPCC, the issues have been briefly addressed in the context of biodiversity risks and uncertainties. Beyond strengthening their consideration within their own reports, collaboration between the IPBES and IPCC should be enhanced to ensure a more comprehensive approach to CDR, encompassing both efficiency and environmental risks. Scientists contributing to one assessment report could, for example, be invited to participate in the other – and vice versa. In particular, the IPCC could learn from IPBES how to better integrate Indigenous, traditional, and local knowledge into its assessments to achieve a more accurate understanding of local risks. More broadly, in the case of mCDR, this collaboration could be extended to include the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP).

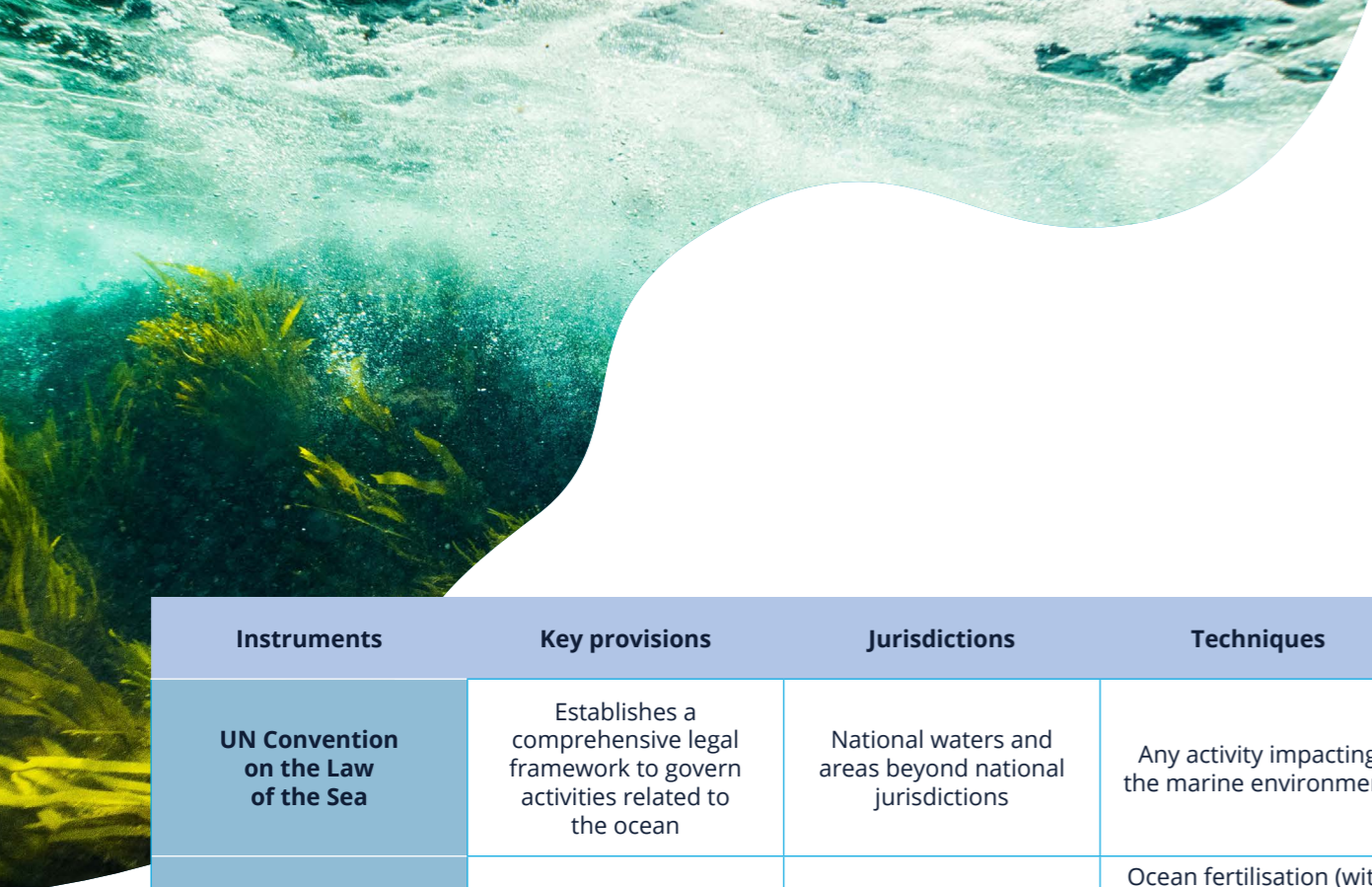


2. A precautionary governance framework for mCDR

Most existing environmental regulatory mechanisms were established before the development of CDR, making them **reactive and inadequate for addressing the unique complexities and uncertainties of these approaches**. This is particularly evident in the case of mCDR, as ocean governance is already highly fragmented. While the UN Convention on the Law of the Sea – often referred to as the ‘Constitution for the Ocean’ – provides the overarching legal framework for ocean management and use, its provisions are implemented through a range of sector-specific frameworks – many of which are relevant for

mCDR (see Table 1). As a result, mCDR is subject to a **patchwork of partially overlapping and often insufficient frameworks**, creating governance gaps and incentivising “forum-shopping”¹³, which may, in turn, facilitate premature deployment. The governance framework should therefore be **strengthened and harmonised to avoid premature deployment, while enabling scientists to conduct research** in a safe and equitable way.

13/ Forum-shopping emerges in fragmented governance systems where overlapping institutions have different mandates, rules, or levels of stringency. It refers to the strategic practice of selecting among institutions or regimes to obtain outcomes more favourable to specific interests. In the context of mCDR, this creates a risk that actors, including private companies, may seek venues that offer weaker regulation, lower oversight requirements, or more permissive authorisation process. See: Murphy, H., and Kellow, A. (2013). Forum Shopping in Global Governance: Understanding States, Business and NGOs in Multiple Arenas. Global Policy. [Available here](#).



2.1. Harmonise the Global Governance Framework

Given the fragmented governance landscape, the **priority should be to enhance coherence across existing frameworks** and reduce opportunities for “forum-shopping”. This harmonisation effort should **be guided by the precautionary principle**. While its function is protective, requiring decision-makers to act cautiously when activities may cause unknown or dangerous impacts, some have argued that not pursuing CDR is itself the risk – an interpretation which undermines the meaning of the precautionary principle as a safeguarding principle of customary international law and thereby erodes legal consistency.

- **Develop one assessment framework shared across relevant institutions, ensuring it comprehensively addresses climate, environmental, and socioeconomic aspects.** While the general Assessment Framework of the London Protocol (Annex 5) – the only set of rules currently regulating mCDR research – is operational, it has key limitations, including its narrow focus on ocean fertilisation. Even if it could be extended, as is currently under discussion, its scope would remain limited to the Protocol’s mandate on pollution from dumping. A unified assessment framework, building on this model, is therefore needed to ensure consistent and coherent evaluation across mCDR techniques.

- **Adopt a UN Environment Assembly (UNEA) resolution.** Sitting above the fragmented negotiating siloes of international conventions, with a focus on environmental issues, UNEA could play a key role in strengthening coherence in CDR governance.

To date, CDR has not been addressed, with past attempts to adopt a geo-engineering resolution failing due to grouping with, or a focus on, solar radiation management. In this context, a revised approach, focusing solely on CDR, would be a constructive alternative. This resolution should recall the mitigation hierarchy, acknowledge the potential of natural sinks and uphold the precautionary principle, recognising efficiency uncertainties and environmental and socioeconomic risks of CDR and mCDR in particular. It should also recall relevant decisions under international frameworks and States’ obligations to comply with treaty law and customary international law, such as the obligation to prevent transboundary environmental harm, as well as reference the International Tribunal for the Law Of the Sea and ICJ Advisory Opinions on Climate Change Obligations of States¹⁴.

- **Enhance coordination and collaboration across the various instruments, bodies, and frameworks addressing mCDR, including through the UN-Oceans mechanism.** The current fragmentation of mCDR governance risks creating duplication and regulatory inconsistencies. Strengthening coordination among the various instruments, bodies, and frameworks addressing mCDR could enable systematic, information-sharing, support alignment of regulatory approaches, and facilitate early identification of governance conflicts. The UN-Oceans interagency coordination mechanism was designed to promote information exchange and policy coherence across UN entities, and mCDR could be addressed as a relevant cross-cutting topic. This would help inform both States and regional bodies, supporting more coherent and consistent guidance.

Instruments	Key provisions	Jurisdictions	Techniques
UN Convention on the Law of the Sea	Establishes a comprehensive legal framework to govern activities related to the ocean	National waters and areas beyond national jurisdictions	Any activity impacting the marine environment
London Convention & London Protocol	Protects the marine environment from dumping at sea (focusing on vessels and aircraft platforms)	National waters and areas beyond national jurisdictions	Ocean fertilisation (with attempts to include macroalgae cultivation, ocean alkalinity enhancement, marine cloud brightening and surface albedo enhancement)
Convention on Biological Diversity	Protects marine biodiversity and the communities that depend on marine resources	National waters	Geo-engineering, including in the marine environment
Agreement on Biodiversity Beyond National Jurisdiction	Establishes a legal framework for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction, including the possibility to establish marine protected areas and requiring environmental impact assessments	Areas beyond national jurisdictions, as well as activities conducted within national jurisdiction that have effects beyond it.	Any activity that meets the Agreement’s thresholds
UN Framework Convention on Climate Change	Provides a framework for climate change mitigation and finance	National waters	Any carbon removal activity

Table 1. A Patchwork of Main Relevant Global Frameworks for Governing mCDR

14/ ICJ (2025). Advisory Opinion: Obligations of States in respect of Climate Change. [Available here.](#)

2.2. Place Equity at the Heart of mCDR Governance

The potential **negative social and economic impacts** of mCDR are wide-ranging, resulting from detrimental ecological effects cascading to communities and societies, or increased competition over ocean uses and spaces. However, these risks are not adequately reflected in current governance and assessment frameworks. **Engagement with local communities must enable meaningful participation and informed decision-making.** Equity – across its different dimensions of recognition, procedure, and distribution – should be embedded in mCDR governance, upholding and putting into practice environmental justice.

- **Ensure governance frameworks are equitable and safeguard the rights of those who may be affected, in line with the Free, Prior, and Informed Consent principles.** Given the potential impacts of mCDR techniques on coastal communities, they should have the ethical and legal right to assess and refuse projects they deem undesirable or overly risky. Beyond consultations, engagement should be a genuine two-way process, grounded in meaningful participation, transparent decision-making, accountability for action, and access to effective dispute resolution processes. In addition, governments should require social and economic risk mitigation in field trial permitting, as well as equity-focused and social impact indicators – using, for instance, the Ocean Equity Index¹⁵.

- **Ensure economic power imbalances and legislative disparities do not lead to mCDR research and deployment being executed disproportionately in the Global South.** “Site-shopping” practices that externalise environmental and social impacts to regions with weaker regulatory frameworks and limited in-country capacity to assess the risks should be actively discouraged. This pattern is already visible across marine sectors, including deep-sea mining, where operators may target countries facing difficult trade-offs between short-term financial incentives and environmental risks.

- **Adopt a UN Human Rights Council (UNHRC) resolution to mitigate socio-economic risks and ensure the effective protection of human rights in mCDR research.** The UNHRC, which recognises the right to a clean, healthy, and sustainable environment, is well-positioned to better address socio-economic risks and participation dimensions of mCDR. Building on the preliminary work of its Advisory Committee¹⁶, the UNHRC should adopt a resolution addressing the human rights implications of geo-engineering, including mCDR. Such a resolution should clarify the obligations and responsibilities of States to promote, respect and protect procedural and substantive human rights in the context of the testing of mCDR techniques. It should also include specific considerations for developing countries, in particular Small Island Developing States.

2.3. Strengthen, Enforce, and Align Existing Decisions

Several decisions related to mCDR have already been adopted in key global fora, some dating back to the 2000s, **to prevent the commercial deployment of these techniques.** They now require strengthening, enforcement, and alignment across frameworks, as commitments under one regime are often not consistently carried over into others. A key challenge across frameworks will be to **translate international governance provisions into national legislation to ensure effective enforcement.**

- **Join the London Protocol and ratify its 2013 Amendment to support strong precautionary regulatory controls on marine geoengineering.** The Protocol remains the primary framework for governing marine geo-engineering, providing guidance on “legitimate” scientific research. Yet, its 2013 Amendment, which establishes a regulatory mechanism for marine geo-engineering, has still not entered into force, having been accepted by only 9 out of 56 Contracting Parties, while key mCDR actors, including the United States, have not ratified it. Wider signature and ratification, particularly by countries actively pursuing mCDR, are therefore essential to make precautionary requirements legally binding. In addition, the Protocol’s General Assessment Framework, which regulates mCDR research, should be strengthened. While comprehensive in principle, many of its provisions are not effectively implemented. Safeguards are needed to prevent economic interests from influencing research design and outcomes, ensure independent expert review, and improve transparency, including through

the establishment of a public registry. While it is the main framework for marine geoengineering, it has a relatively narrow scope – limited to activities classified as “dumping” and thereby excludes several techniques. Moreover, it does not assess climate effectiveness, limiting its ability to assess whether intended mitigation objectives are being achieved.

- **Develop technical guidance to operationalise and support effective implementation of Convention on Biological Diversity (CBD) decisions on geoengineering.** Unlike the London Protocol, the CBD does not provide an operational assessment framework for geo-engineering or CDR. Yet, it offers broader coverage across geoengineering techniques, addressing biodiversity, climate, and socioeconomic dimensions, backed by near-universal membership – making it a valuable forum to address mCDR and highlight the associated environmental risks. Its 2010 decision¹⁷, reaffirmed in 2024¹⁸, calls on Parties to ensure that no climate-related geo-engineering activities that may affect biodiversity, including mCDR, take place without an adequate scientific basis, except for small-scale scientific research. However, implementation remains limited and the decision is often overlooked in other fora, including under the Paris Agreement. More technical guidance is needed to help Parties translate this decision into national legislation and clarify the requirements for small-scale research. As the CBD appears to have taken a more “regulatory backseat”, with the London Protocol assuming a leading role, closer collaboration between the two, supported by GESAMP, could facilitate the development of these guidelines and work towards a unified assessment framework.

15/ Blythe, et al. (2026). The Ocean Equity Index. Nature 650, 123-128 (2026). [Available here.](#)

16/ HRC (2023). Impact of new technologies intended for climate protection on the enjoyment of human rights. Report of the Human Rights Council Advisory Committee. [Available here.](#)

17/ CBD (2010). Decision X/33. Biodiversity and climate change. [Available here.](#)

18/ CBD (2024). Decision 16/22. Biodiversity and climate change. [Available here.](#)

- **Ensure that mCDR activities are subject to systematic screening under the Agreement on Biodiversity Beyond National Jurisdiction (BBNJ) and, where relevant thresholds are met, an EIA.** The BBNJ Agreement establishes a robust EIAs framework to prevent, mitigate, and manage significant adverse impacts on marine biodiversity¹⁹ – covering both activities beyond national jurisdiction and activities within national jurisdiction that may have impacts beyond it²⁰. While, in the second case, countries have a choice to use their national process or follow the BBNJ EIA procedure, they must in both cases ensure that activities are assessed prior to authorisation and public access to relevant information. This is particularly important for emerging activities, such as mCDR, to ensure climate action does not come at the expense of biodiversity. However, the Agreement has an exemption possibility for activities already covered by an existing international or regional framework²¹. Given the relative novelty of BBNJ, implementation experience remains very limited and many Parties are still aligning national legislation with international law. Clear guidance is needed to ensure coherence with instruments, such as the London Protocol, to avoid regulatory gaps, and uphold high environmental standards across regimes. Lastly, given the central role of the Scientific and Technical Body (STB) in providing guidance and external review for EIAs, its rapid constitution and operationalisation is a key priority, including timely appointment of members²². The inclusion of mCDR experts will be essential to develop targeted recommendations on standards and guidelines for mCDR-related EIAs.

- **Ensure that climate change mitigation under the Paris Agreement, particularly CDR activities, is pursued only where it does not undermine ecosystem integrity.** If efficiency can be demonstrated and risks successfully mitigated, mCDR could, in principle, contribute to the Paris Agreement goals – making it a relevant space for (careful) discussion. However, it is already presented as a climate solution, overlooking significant uncertainties. This directly undermines the Agreement’s commitment to ecosystem integrity, and overlooks decisions adopted in other fora, such as the CBD, to prevent premature deployment. At this stage, mCDR should be addressed exclusively in research-focused UNFCCC processes, for instance by dedicating a Research Dialogue to mCDR approaches, looking at efficiency, environmental and social risks, and economic costs. In particular, carbon crediting mechanisms under Article 6 of the Paris Agreement risk opening the door to mCDR-based credits, creating financial incentives for premature deployment. While activities related to blue carbon ecosystems may be legitimately included, other mCDR approaches should be excluded from eligibility for carbon credits under Article 6 until their environmental impacts are fully understood and can be effectively mitigated. In this context, Parties should apply the standards adopted at COP29²³ to ensure robust safeguard and maintain environmental integrity.

19/ High Seas Alliance (2023). Part IV of the BBNJ Agreement: Environmental impact assessments. [Available here.](#)

20/ The applicable threshold is an “activity that may cause substantial pollution of or significant and harmful changes to the marine environment”.

21/ This is based either on an equivalence test (i.e., where the framework is considered comparable to the BBNJ EIA process) or a design test (i.e., where the framework is demonstrated to be capable of preventing, mitigating or managing impacts below the thresholds that would otherwise trigger EIAs under BBNJ).

22/ Payne, C. (2026). IUCN brief for policy-makers: From entry into force to early implementation: Environmental impact assessments under the BBNJ Agreement. [Available here.](#)

23/ UNFCCC (2024). Requirements for activities involving removals under the Article 6.4 mechanism. [Available here.](#)

Conclusion

No climate action at the expense of nature and people

While the urgency of the climate crisis is undeniable, **slow progress on emissions reductions cannot justify actions that risk undermining ecological integrity.** The window to correct our climate trajectory is rapidly narrowing, but this emergency does not permit lowering environmental standards. On the contrary, **it is precisely when the stakes are highest that safeguards must be strongest.** We cannot afford to place the ocean at risk by premature deployment of mCDR techniques. **Decarbonisation has to remain the highest priority** for every State and private actor, while scientific research continues to advance in order to close the remaining knowledge gaps. The ocean has long stood as one of humanity’s greatest allies in the fight against climate change – quietly absorbing carbon and heat, while regulating the planet’s temperature. **Emissions reductions remain the most certain path to preserving this role, securing a stable climate for future generations and protecting the biodiversity and life-support it sustains.**

TO GO FURTHER...



The Ocean & Climate Platform has published a scientific article **“Three challenges to marine carbon dioxide removal”** in *npj Ocean Sustainability*. Drawing on a review of recent literature and insights from two expert workshops, it synthesises current knowledge and remaining uncertainties around the efficiency, risks, and governance implications of mCDR activities. The Platform also published the scientific brief **“Marine Carbon Dioxide Removal Technologies: Hopes and Threats”** to support broader understanding of these emerging techniques, providing an overview of the approaches being explored and their associated uncertainties.