

# A Code of Conduct for Marine Carbon Dioxide Removal Research

# EXECUTIVE SUMMARY

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To keep planetary warming to 1.5°C above pre-industrial levels, it is increasingly clear that active removal of atmospheric carbon dioxide will be required, alongside rapid, dramatic reductions in greenhouse gas emissions.<sup>1</sup> Multiple approaches for removing carbon dioxide from the atmosphere are being explored, including many using the ocean.<sup>2</sup> To date, marine carbon dioxide removal (mCDR) has received less attention than terrestrial carbon dioxide removal approaches,<sup>3,4</sup> but its potential to contribute to net zero pathways has led to considerable investments in mCDR research.<sup>5</sup>

Given the clear need to inform societal decision-making on the role mCDR can play in solving the climate crisis, it is imperative that researchers begin to answer questions about its effectiveness and impacts. Yet overly hasty deployment of new ocean-based climate interventions risks harm to communities and ecosystems and could jeopardize public perception of the field as a whole.<sup>6</sup> In addition, the harms, risks and benefits of mCDR efforts are unlikely to be evenly distributed. Unabated, climate change could have a devastating impact on global ecosystems and human populations, and the impacts of mCDR should be contemplated in this context. However, this code of conduct exclusively applies to mCDR research and does not attempt to put any affiliated risk in the context of the risk of delaying climate action. The code's purpose is to ensure that the impacts of mCDR research activities themselves are adequately understood and accounted for as they progress.

1 Intergovernmental Panel on Climate Change, AR6 Synthesis Report: Climate Change 2023. <https://www.ipcc.ch/report/ar6/syr/>

2 National Academies of Science, Engineering, and Medicine, "A Research Strategy for Ocean-Based Carbon Dioxide Removal and Sequestration," 2021. <https://nap.nationalacademies.org/catalog/26278/a-research-strategy-for-ocean-based-carbon-dioxide-removal-and-sequestration>

3 Keller, D. P., Brent, K., Bach, L. T., & Rickles, W. (2021). Editorial: The Role of Ocean-Based Negative Emission Technologies for Climate Mitigation. *Frontiers in Climate*, 3, 94. <https://doi.org/10.3389/fclim.2021.743816>

4 Babiker, M., G. Berndes, K. Blok, B. Cohen, A. Cowie, O. Geden, V. Ginzburg, A. Leip, P. Smith, M. Sugiyama, F. Yamba, 2022: Cross-sectoral perspectives. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. [doi: 10.1017/9781009157926.005](https://doi.org/10.1017/9781009157926.005)

5 NASEM, *Supra* note 2.

6 Bellamy, R., et al., "Public perceptions of geoengineering research governance: An experimental deliberative approach," *Global Environmental Change*, Vol. 45, July 2017. Available at: <https://www.sciencedirect.com/science/article/pii/S0959378016302230>

The code provides a roadmap of processes, procedures, and activities that project leads should follow to ensure that decisions regarding whether, when, where, and how to conduct mCDR research are informed by relevant ethical, scientific, economic, environmental, and regulatory considerations.

As the world pursues diverse, dynamic, and effective climate solutions, works such as this one, which aims to find a balance between rapid development on the one hand and careful consideration of unforeseen eventualities on the other, are required. Such a balance will contribute meaningfully to heading off the worst impacts of climate change while safeguarding fundamental marine ecosystems and their vital contributions to a life-sustaining planet.

## Foundational Principles

Due to the diversity of considerations making mCDR decision-making this code integrates insights from three central approaches, specifically those focused on: building good relationships in situations with historical and contemporary injustices; responsible innovation; and legal principles for governing activities that could pose risks to the environment. The principles described here are interconnected, and the order in which they are listed is not intended to connote a ranked priority or importance.

- **Awareness of power imbalances** is a foundational principle which recognizes that all research activities take place in contexts which may be characterized by historical and/or contemporary power imbalances.
- **Inclusiveness** requires the development and use of a research process in which a wide range of individuals, communities, and types of knowledge should be involved in planning, implementing and evaluating the success of the mCDR project.
- **Consent** is a direct manifestation of recognizing people's dignity. Seeking consent includes taking actions to ensure that people's perspectives and philosophical values are integrated into decisions that will directly affect them and that they have substantial voice in decision processes.
- **Reciprocity** stems from awareness that relationships are at the heart of any research project and that these relationships generate obligations of care, respect and consideration to each other.
- **Reflexivity** refers to the practice of critically examining one's own actions, commitments, and assumptions. It involves recognizing the limitations of any specific type of knowledge, including scientific knowledge, and acknowledging that different perspectives on an issue may exist.
- **Responsiveness and trust** are tightly linked to consent and anticipation in situations of uncertainty, or during research processes focused on new ideas or innovations. Trust requires repeated demonstrations of respect for consent, combined with responsiveness to concerns from diverse stakeholders as they emerge through the research process. Responsiveness means that the actual concerns and experiences raised by stakeholders are openly considered as a research project progresses and actual changes may be made in accordance with these concerns.
- **Accountability** is the recognition that project leads have a range of obligations to diverse actors beyond themselves, that failing to meet these obligations carries consequences, and that those involved in such projects should take responsibility for their actions.
- **Anticipation and Precaution:** Anticipation requires that everyone involved in or affected by proposed research activities actively envisage what sorts of futures might result, and transparently discuss their assumptions about which of these futures, if any, may be considered both scientifically feasible and socially desirable.

## Code of Conduct

The goal of this code of conduct is to provide a roadmap of processes, procedures, and activities that project leads should follow to ensure that decisions regarding whether, when, where, and how to conduct mCDR research are informed by relevant ethical, scientific, economic, environmental, and regulatory considerations. Unless specified otherwise, the code's guidelines are intended to apply to researchers, funders, developers, regulators, community stakeholders, and any others who have or contribute to decision-making obligations in any given mCDR effort, while recognizing that the exact configuration of those individuals will vary in each case.

The guidelines are presented here in summary form. For a deeper description of each individual guideline, please see the [full report](#).

### I. PLANNING AND SCOPING

#### A. Engage Fully with Relevant Legal Frameworks

1. Identify and adhere to potentially relevant international and domestic laws.
2. Seek out areas with more robust legal frameworks to ensure projects will be compliant with environmental principles.
3. View legal requirements as a floor rather than a ceiling.
4. Be mindful of and coordinate with all present and (to the extent practicable) future ocean users, including non-humans, to consider how the proposed activity might impact those users.

#### B. Co-Develop All Research as Dictated by Scale and Scope

1. Project funders must ensure that resources are available for co-design processes.
2. Establish inclusive decision-making processes.
3. Co-produce benefit and compensation mechanisms with stakeholders before project implementation and ensure they are periodically reviewed by stakeholders.
4. Clearly communicate anticipated research outcomes with stakeholders.

5. Situate research planning within local, traditional and Indigenous knowledge and practice.

#### C. Implement Clear and Transparent Research Processes Throughout

1. Prior to the execution of a research project, create a data management plan to explain what type of data is anticipated from the project and how it might be collected, monitored, shared, and archived.
2. Design research projects to have planned strategies for communication and dissemination of results, including to non-academic audiences, beyond involved stakeholders.

#### D. Identify and Communicate Potential Social and Environmental Outcomes

1. Take a systems approach to scoping in order to anticipate the full range of harms, risks, and benefits and any interactions that may emerge amongst them.
2. Clearly identify and communicate the duration, location, and spatial scale of any research activity and its outcomes.
3. Differentiate between direct and indirect outcomes.
4. Identify and differentiate amongst risk-bearers and beneficiaries of research activities.
5. Acknowledge historically rooted inequities, which are frequently ongoing.
6. Acknowledge and address uncertainties.
7. Explore possible future outcomes in collaboration with stakeholders.

### II. EXECUTION OF RESEARCH

#### A. Establish, Maintain, and (as Necessary) Revise Monitoring and Evaluation Processes

1. Establish or maintain monitoring and evaluation processes for mCDR activities.
2. Establish or amend monitoring systems and procedures for collection of baseline data using identification of intended and potentially unintended outcomes of mCDR research that occurred during scoping.

## B. Implement the Planned Iterative Approach to Research

1. Involve stakeholders in the execution of the research plan they helped to co-develop.
2. Involve communities in the ongoing monitoring and evaluation of research projects.
3. Ensure inclusive decision-making regarding project changes.

## C. Share Data Access, Knowledge Ownership, and Information

1. Facilitate collaborative partnerships between mCDR project leaders from developed countries or regions to less-developed countries or regions during project operations.
2. Prioritize and promote local and Indigenous knowledge.

## B. Document and Address any Environmental and Other Harms from the Project

1. Identify and document all environmental and other harms arising from mCDR research projects.
2. Consider whether outcomes identified at the conclusion of a project were foreseen during the planning stage and, if not, how they were missed.
3. Determine where there is the potential for ongoing adverse impacts after the conclusion of an mCDR research project and take steps to mitigate and manage those impacts.
4. Identify all those who have already been, or could in the future be, impacted by ongoing harms.

## C. Identify and Promote the Fair Sharing of Ongoing Benefits from Research

1. Ensure ongoing equitable/fair sharing of benefits, and accessibility of data after the conclusion of research.
2. Evaluate outcomes against any benefit sharing plan that was developed for the project.

## III. CONCLUSION OF RESEARCH

### A. Address the Material Footprint of Research

1. Remove infrastructure, equipment, and other project materials.

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