

New Ocean Visions Report: Can Phytoplankton Help Close the Carbon Dioxide Removal Gap?

Assessment outlines priority actions needed to answer this timely question

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Ocean Visions today released a [comprehensive plan](#) to answer critical questions regarding whether and how phytoplankton, the microscopic algae at the base of marine food webs, might contribute to the large-scale carbon dioxide removal (CDR) needed to meet global climate goals.



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[The report](#) evaluates the current state of knowledge on this category of marine carbon dioxide removal (mCDR) approaches that would enhance the



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ocean’s natural ability to absorb and store carbon. The report identifies what is already known about phytoplankton-based pathways, as well as the key scientific, environmental, and social questions that still must be answered so that decisions about future development or deployment can be made.

“Addressing the greatest threat to the ocean—ongoing climate disruption—requires that society both cut

greenhouse gas emissions and remove enormous amounts of carbon dioxide pollution,” said Ocean Visions CEO Brad Ack. “This report highlights the remaining work needed to determine whether and how phytoplankton-based approaches can contribute to climate stabilization.”

The ocean is the largest carbon reservoir on Earth and has already absorbed about 25 percent of all carbon dioxide (CO₂) emitted from human activities. Phytoplankton—microscopic marine plants—absorb CO₂ as they grow and, through natural biological processes, a portion of that carbon sinks into the deep ocean where it can be stored for hundreds to thousands of years.

Phytoplankton-based approaches aim to increase the growth of these organisms and the

amount of carbon that is ultimately stored in the deep ocean. The best-known example of phytoplankton-based approaches is called ocean iron fertilization, whereby small amounts of iron are added to the ocean to stimulate phytoplankton growth. Numerous field trials have shown this can indeed boost phytoplankton growth, yet major uncertainties remain about efficacy and potential environmental impacts.

“We think phytoplankton-based approaches could potentially be an important part of a global CDR portfolio, but only if we are able to address key knowledge gaps and risks,” said Ocean Visions Chief Scientist David Kowek. “This report highlights the most significant uncertainties for phytoplankton-based pathways, outlines a plan of responsible research to narrow those uncertainties, and suggests a path for the global community to follow to be able to make informed choices about whether phytoplankton-based mCDR approaches are effective enough, durable enough, and safe enough to move such methods forward and scale.”

The report concluded that:

- There is strong evidence that phytoplankton-based pathways have the potential to meaningfully contribute to CDR goals
- Continued research and testing is necessary to determine whether phytoplankton-based pathways should be pursued at scale
- Decisions should be guided by scientific evidence, ethical considerations, and public engagement

Informed by an international advisory board, the report was produced through a year-long investigation of all known phytoplankton-based approaches and focused on those with potential to reach climate-relevant scale. The work incorporated extensive literature review, multiple rounds of expert interviews and workshops, and a public comment period. Numerous comments received at the draft stage were incorporated into the final report. That feedback and a summary of resulting changes can be found [here](#).

“The depth of the assessment highlighted both the real potential and the gaps that continued research must address,” said Leticia Cotrim da Cunha, Associate Professor and Coordinator of the Chemical Oceanography Laboratory at State University of Rio de Janeiro (UERJ) and an advisor for the report. “The report outlines and recommends a research framework anchored in inclusive engagement to guide future studies of phytoplankton-based strategies.”

Across all phytoplankton-based pathways, the report identifies priority research needs, including:

- Improving quantification of net CDR via phytoplankton-based pathways by identifying the largest sources of uncertainty in these estimates and setting clear targets to reduce this uncertainty
- Improving ocean biogeochemical models to better understand long-term storage and large-

scale impacts

- Strengthening understanding of the biological carbon pump, including how climate change is already altering it
- Advancing carefully designed field trials that maximize learning while addressing environmental and social concerns

The report calls for consideration of a dedicated research, development, and demonstration program on phytoplankton-based pathways, applying a stage-gate framework marked by clear decision points to advance, refine, pause, or stop efforts. Such a program could help coordinate research efforts, uphold transparency and ethical standards, and mobilize global collaboration.

"This thorough and inclusive review of phytoplankton-based carbon removal strategies offers a critical road map for evaluating the potential of these approaches to responsibly and effectively contribute to a comprehensive CDR portfolio," said Marc von Keitz, Director for Oceans at the Grantham Environmental Trust (GET). "In the coming weeks, GET is planning to announce a significant new funding initiative to specifically address key research needs identified in this report."

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About Ocean Visions

Ocean Visions is a nonprofit ocean conservation organization pursuing bold solutions to counter and reverse climate impacts on ocean health. Working with a global network of partners, we explore, evaluate, and advance innovations to address climate-driven harm to the ocean. Learn more at www.oceanvisions.org

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