



Carbon  
Removal  
Alliance

# Marine carbon removal

The ocean is the earth's greatest carbon sink, but increasing carbon dioxide in the ocean leads to intensifying ocean acidification, rising temperatures, and eroding coastlines. As a result, marine industries and coastal communities are facing increasing challenges to seafood production, coastal infrastructure, and tourism. Marine carbon dioxide removal (mCDR) provides multiple approaches to remove carbon dioxide from the ocean, restore our ocean ecosystems, and protect communities from damage.

Photo courtesy of Ebb

## How does mCDR work?

There are several different types of carbon removal that can be deployed in the oceans, including ocean alkalinity enhancement, direct ocean capture, and biomass sinking.

**Ocean alkalinity enhancement:** Alkalinity enhancement uses minerals that react naturally with the carbon dioxide in ocean water to increase the ability of our oceans to safely store additional carbon dioxide. In doing so, this practice can reduce localized ocean acidity. This practice can be utilized along coastlines or beaches, or integrated into water treatment facilities. These technologies have the potential scale to remove a billion metric tons of carbon dioxide each year.

**Direct ocean capture:** Direct ocean capture uses electrochemical processes to remove carbon dioxide dissolved in seawater, allowing it to absorb more from the atmosphere, and could scale up to a billion metric tons of annual carbon dioxide removal. Some direct ocean capture technologies can also produce saleable green hydrogen as a coproduct.

**Biomass sinking:** Agricultural waste, like plant stalks, are baled and sunk deep into areas of the ocean that lack oxygen. This prevents the biomass from decomposing and stores the carbon captured when the plants were growing.

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### CRA MEMBER COMPANIES



## Potential impacts of mCDR

Marine carbon removal can support existing ocean industries, protect coastal communities, and generate new economic opportunities and jobs in the carbon removal industry.

- **Protect the seafood industry:** Ocean acidification is shown to limit the growth and harvest of shellfish and finfish as well as other marine agriculture like kelp farming. This will result in annual losses of tens of millions of dollars across the global shrimping, mollusk farming, and fishing industries. Increasing marine carbon removal protects these industries and improves national food security.
- **Job creation:** Direct ocean capture and ocean alkalinity enhancement could create nearly 40,000 jobs over the next decade.
- **New revenue streams for water treatment and waste management:** Marine CDR can integrate with existing wastewater management practices to improve waste handling, improve the longevity of critical water infrastructure, and create new revenue streams through carbon credits.
- **Environmental protection:** Reducing ocean acidification protects key ocean environments, especially coral reefs and shorelines, preserving those ecosystems and protecting tourism in those areas.
- **Coastal restoration:** Coastline erosion can damage infrastructure and threaten seaside communities. Beach restoration projects can protect coastlines while providing carbon removal benefits.



### WHAT IS CARBON REMOVAL?

Carbon removal consists of activities that are intended to remove carbon dioxide from the atmosphere or ocean and store it in a stable and durable form in order to develop American leadership in the carbon removal industry while creating domestic jobs and economic opportunities.

Photo courtesy of Ebb

### CASE STUDY:

CREW Carbon has partnered with a Virginia sanitation district that treats 225 million gallons of wastewater per day for nearly two million people. CREW has integrated its carbon removal process at HRSD's Army Base Wastewater Treatment Plant in Norfolk, VA to improve their wastewater treatment by replacing hazardous and costly chemicals, and annually

saving the district more than \$100,000 while removing thousands of tons of carbon dioxide. CREW currently sources its crushed limestone from a quarry in western Virginia and plans to expand their local supply chain to further regional economic development.

## Policy recommendations

1. Improve clarity and timelines across existing permitting regimes, including those established through the CWA and MPRSA.
2. Help companies beginning the permitting process by sharing high-level takeaways from projects that have already successfully navigated the process.
3. Leverage the government's unique role as a trusted educator to share information on co-benefits, risk management, and community engagement best practices for mCDR.
4. Establish a multi-agency pre-permitting consultative process with a designated lead office in which individual companies can meet with all agencies involved in permitting to align on project details, goals, and processes.
5. Consider small modifications to pathways under the Clean Water Act (CWA) and Marine Protection, Research, and Sanctuaries Act (MPRSA) that account for the specific inputs and outputs associated with mCDR, along with its unique risks and environmental benefits.
6. Clarify that mCDR projects that have both research and commercial outcomes are eligible under MPRSA, and consider leveraging special permitting authority to grant permits in the near-term for mid-sized projects.
7. Develop and recruit more in-house agency staff expertise on marine CDR by expanding NOAA's Knauss Fellowship Program and leveraging the Intergovernmental Personnel Act (IPA) to bring marine CDR experts from NGOs into government.
8. Ensure marine carbon removal pathways are included in technology-neutral carbon removal policies.
9. Support the ReSCUE Oceans Act