Blue Carbon

Seagrass as a Tool for Ocean Acidification and Climate Change Management in California

CALIFORNIA OCEAN SCIENCE TRUST

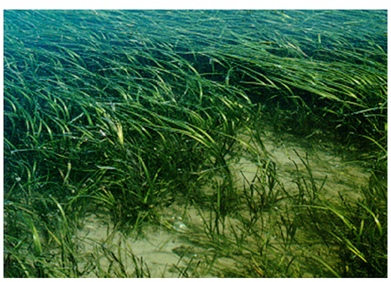
West Coast Ocean Acidification & Hypoxia Science Panel

OCEAN PROTECTION COUNCIL

What is Blue Carbon?

Blue carbon ecosystems are marine **coastal systems that remove large amounts of CO_2** from the ocean for storage in their tissues and sediments.

By reducing concentrations of this greenhouse gas, blue carbon habitats can help mitigate climate change. Seagrass beds and tidal salt marshes are California's blue carbon systems, and have earned this name for their disproportionally high carbon burial ability. Salt marshes, which are not submerged, can remove CO_2 from the atmosphere to bury in sediments. Seagrasses are an aquatic plant, so in addition to burying carbon, they have the ability to remove CO_2 directly from seawater, potentially mitigating ocean acidification (OA) as well as climate change. Thus, in addition to the other well-documented ecosystem services seagrasses provide, their conservation and restoration could remove excess CO_2 from the atmosphere and decrease the severity of acidifying waters along our coast.



Seagrass Bed

Tidal Salt Marsh

Ocean Acidification (OA)

Shells dissolve in acidified water

25 to 35% of carbon dioxide emitted from human activity is absorbed by the oceans. This CO_2 reacts with seawater, lowering the pH and raising the acidity. This net increase in acidity can affect marine ecosystems globally, and is particularly harmful to organisms that use calcium carbonate such as corals, oysters, and small calcifying plankton that serve as food sources to many larger animals.

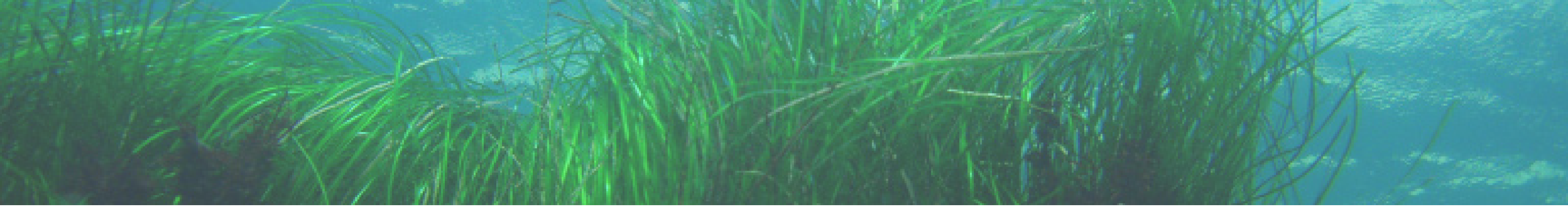
What do we know about seagrasses' ability to mitigate OA and climate change?

Short-term CO_2 removal: **Seagrasses** can **influence coastal chemistry** by locally reducing CO_2 levels in bays and estuaries.

Seagrasses remove CO_2 from seawater and convert it into living tissue through photosynthesis. This CO_2 uptake can occur at sufficiently rapid rates to improve water quality for organisms sensitive to carbon chemistry changes. Although a substantial fraction of this carbon is released at night or when plant tissue decomposes, active photosynthesis could offer a means to locally reduce CO_2 in shallow coastal environments during the day.

Long-term carbon sequestration: **Seagrasses** can **remove and store carbon** in their sediments.

A portion of the CO_2 converted into vegetation can be permanently buried in sediments, representing the long-term removal of CO_2. Due to this burial, seagrass habitats hold some of the highest carbon concentrations on the planet, and serve as a 'carbon sink' by reducing global atmospheric CO_2 concentrations. This long-term storage does not provide immediate, local mitigation of OA because burial cannot occur at sufficiently rapid rates to alter water chemistry. However, burial does remove excess carbon from the system (the underlying cause of OA), making long-term storage valuable on the global scale of OA mitigation.



What questions remain?

What affects seagrasses' OA and climate change mitigation ability?

Although it is evident that seagrasses have the potential to mitigate OA and climate change, it is not comprehensively understood how this ability varies with seagrass density, size, tidal cycle, season and others factors. We also don't fully understand how California's carbon burial rates may differ from seagrass burial rates in other parts of the world. Understanding what affects seagrasses' ability to serve as effective carbon reservoirs and ameliorate OA will better inform management decisions.

Where should we target seagrass restoration and conservation to maximize climate change and OA benefits and ensure success?

Significant seagrass restoration has occurred on the state level, yet not all of this restoration has been successful. Seagrass bed size can fluctuate due to natural cycles, but multiple anthropogenic stressors (pollution, riverine input, industrial activity, erosion) may exacerbate bed die-off. To understand where to most efficiently conduct restoration and conservation, we need to improve our understanding of the factors that impact restoration success.

What are the current and future directions for state management?

Monitor and quantify the carbon services restored and existing seagrass beds provide.

Although there is already active seagrass restoration occurring throughout the state, very few efforts exist to determine if restored or existing beds are serving to mitigate OA or climate change impacts. Monitoring and quantifying the carbon services seagrass provides will improve our ability to maximize these benefits for future seagrass restoration and conservation.

Conduct pilot projects to improve restoration success and identify where seagrasses can meaningfully ameliorate OA and climate change.

As we explore OA and climate change management options, proof-of-concept demonstration studies should be supported to address current knowledge gaps. When conducted across a range of habitats, these pilot projects can provide managers with new, useable knowledge of where and when protection and restoration of seagrass will sufficiently remove CO_2 to meaningfully mitigate OA and climate change.

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Executive Summary and supporting Panel products available at

www.westcoastoah.org

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