

Polar Blue Carbon

Blue carbon refers to the carbon dioxide (CO₂) removed from the atmosphere by global ocean ecosystems, through plant growth and the accumulation and burial of organic matter.

Where is blue carbon stored?

The majority of carbon that is sequestered (i.e. buried in seafloor sediment) occurs in coastal ecosystems. As ocean temperatures continue to rise, blue carbon sinks in polar regions are becoming increasingly valuable and as new ice-free areas open up, macroalgal species (e.g. kelp and seaweed) have started to extend towards the poles. Protection of these important carbon reservoirs should be considered as part of global efforts to mitigate climate change.

Natural negative feedbacks on climate change

Polar carbon sinks work as efficient negative feedbacks on climate change, reducing the potential for increasing climate changes.

Known polar negative feedbacks include:

- Broadening of existing sinks over polar continental shelves from seasonal sea ice loss
- Formation of new sinks where ice shelves collapse
- New sinks from glacier retreat opening up fjords

As these new sinks continue to increase, research is required to determine how much carbon they can sequester.

Protection of natural negative feedbacks are cost effective methods for safeguarding blue carbon globally.

To continue to benefit from polar carbon sinks and buy more time against climate change, deep-sea ecosystems and pathways such as macroalgal storage to sequestration require quality protection from negative human impacts.

What is the fate of macroalgal blue carbon?

Capture

Weeks to months

Macroalgae convert dissolved inorganic CO₂ absorbed from the atmosphere and convert it into organic carbon and energy via photosynthesis.

Storage

Months to years

Macroalgae fix and store CO₂ in their tissues but the ultimate fate of this carbon is unknown. Is it washed ashore and remineralized or integrated into terrestrial carbon sinks (e.g., saltmarshes)? Is it retained in polar fjord sediments? Or is it transported offshore?

Sequestration

Centuries to millennia

An unknown proportion of coastal macroalgae will be sequestered when it reaches carbon sinks in the deep-sea. On the seafloor it is broken down by microbes, consumed by benthic animals or buried. Once carbon is buried below the surface oxygenated sediment it becomes sequestered.

