Tidal restoration to coastal wetlands reduces greenhouse emissions, study finds

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Restoring tidal flow to enclosed freshwater wetlands is key to reducing greenhouse gas emissions and helping reach Australia's carbon reduction targets a Griffith-led study found. Published in *Restoration Ecology*, the

study compared the greenhouse gas emitted by impounded freshwater coastal wetlands with those from tidally connected mangrove and saltmarshes in the Queensland's Burdekin catchment.

"The freshwater impounded wetlands, created when tidal flows to coastal wetlands are artificially restricted, had more than a 100-fold higher methane emissions compared to mangroves and saltmarsh," said lead author Charles Cadier, a Ph.D. candidate at Australian Rivers Institute and the Coastal & Marine Research Center.

Tidally influenced coastal wetlands, made up of mangroves, tidal marshes, and seagrass meadows, are known as "blue carbon" ecosystems for the ability of their soils to accumulate significant amounts of carbon. Although they occupy less than 2% of the ocean area, they're responsible for nearly 50% of carbon burial in marine sediments.

"Globally wetlands have been rapidly decreasing over the last century with the change in land use affecting coastal wetlands' capacity to sequester carbon," said co-author Dr. Fernanda Adame Vivanco, a senior research fellow at Australian Rivers Institute and the Coastal & Marine Research Center.

"When the carbon stored in soils are disturbed and exposed to oxygen, carbon dioxide is liberated to the atmosphere, converting them from sinks to sources of greenhouse gases."

Freshwater wetlands are also the single largest natural source of methane, a potent greenhouse gas 25 times more powerful than carbon dioxide. Freshwater wetlands are thought to account for a quarter of the global methane emissions.

"The waterlogged conditions in these enclosed wetlands promotes methane production by soil bacteria, emitting significantly more

methane than mangroves and saltmarsh," Mr. Cadier said.

"Our research found that freshwater impounded wetlands emitted about 100-times the CO_2 equivalents emitted from mangroves and saltmarshes.

Dr. Adame suggests that "restoring the tidal flow to freshwater-impounded wetlands, is likely to result in significantly less greenhouse gas emissions, specifically from reduced methane production."

"This is generally a result of modified soil properties, favoring bacterial communities that will outcompete methane producers."

Mr. Cadier concludes that, "Although tidal restoration projects in the Great Barrier Reef should consider the values of each wetland type and avoid the 'one size fits all' approach, the restoration of impounded freshwater wetlands can provide an emission reduction option that helps meet Australia's carbon reduction emission targets, particularly for incentives to avoided methane emissions."

More information: Charles Cadier et al, Tidal restoration to reduce greenhouse gas emissions from freshwater impounded coastal wetlands, *Restoration Ecology* (2022). DOI: 10.1111/rec.13829

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