Exploring Biogeochemical Climate Solutions for Nutrient Removal in the Narragansett Bay Estuarine Ecosystem

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Eutrophication poses serious threats to coastal ecosystems globally, highlighting the urgent need for innovative and sustainable wastewater treatment solutions under a changing climate. This study explores the feasibility of integrating Saccharina latissima (sugar kelp) farming as a sustainable solution for nutrient removal in wastewater management in Narragansett Bay, Rhode Island. A customized sugar kelp farm was established in Portsmouth, RI, and monitored from February to April 2024. Analysis of kelp samples included growth metrics, tissue compositions represented by carbon and nitrogen (C and N), and their stable isotope ratios (d15N and d13C). Field data from the farm was used to develop a one-dimensional box model to examine nutrients uptake under five climate change scenarios, where up to 55% increase of water current speeds are projected due to higher local precipitation rates. Results indicate that sugar kelp can effectively reduce N levels by 32.56%, with a potential increase in N removal by up to 40.61% under projected climate conditions. This study is the first field experiment integrating sugar kelp farming into existing wastewater treatment framework in RI, demonstrating the feasibility and cost-effectiveness of this environmentally sustainable and climate resilient method to mitigate eutrophication and enhance coastal water quality.

Awards Won: