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Effective climate change mitigation in the form of seagrass restoration projects

Seagrass restoration projects could effectively mitigate climate change, capturing up to 1337 tons of CO_2 per hectare after 50 years, new research suggests. If a carbon tax system was in place, the researchers add, these schemes would likely provide returns at least equal to the initial investment needed, assuming the tax was set at an appropriate level.

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Seagrass meadows have high rates of carbon burial as they contain fast-growing species and can trap sediment floating in the water. Furthermore, they do not suffer from wildfires and are less susceptible to disputes over ownership, as may be the case with habitats used to capture CO_2 on land. Unfortunately, seagrass meadows are declining in oceans around the world as a result of human activities, such as dredging, and excess nutrients from agriculture or sewage outfall.

In this study, partly funded by the EU projects BIOMARES[1] and OPERAs[2], researchers investigated the potential of seagrass restoration projects to capture CO_2. They developed a mathematical model to estimate the potential carbon capture over 50 years using the growth rates of five species of seagrass: *Cymodocea nodosa, Halodule wrightii, Syringodium filiforme, Zostera marina* and *Zostera noltii*.

The researchers assumed that the seagrass meadows would be established using 1 m^2 mats of seagrass, as this has been a successful method for existing restoration projects. Rates of carbon capture were calculated, including both the carbon trapped as sediment and that absorbed by the plants as they grow.

The results show that for all species the rates of carbon capture increase slowly at first but become much faster over time. After 50 years (starting from a hundred planting units per hectare), the total amount captured ranged from 177 tons of CO_2 (using the species *Zostera marina*) to 1337 tons (using the fast growing species *Halodule wrightii*).

The researchers also investigated the most efficient planting density. They found that increasing the density of planting units increased the total amount of CO_2 accumulated after 50 years, until a density of a hundred units per hectare was reached. After this point, increasing planting density did not result in any increase in the amount accumulated.

They conclude that evaluating the carbon capture of seagrass beds after short periods, for example, less than 5 years–the typical duration of a seagrass restoration project–is likely to give disappointing estimates. However, as this analysis shows, results from short-term projects may be misleading as rates of carbon accumulation increase rapidly over longer periods. This is because of the nature of seagrass growth; a single plant will branch into two shoots, then four etc., thus doubling at each stage and rooting as it extends along the seafloor. This study is in fact likely to underestimate the amount of carbon captured, the researchers add, because it only considered growth of the initial plants when, in fact, seed production would also enable colonisation of new areas.

The researchers also considered whether these seagrass restoration projects would be profitable if a carbon tax were implemented. They found that if CO_2 is given a value of US $12-25 (€8.8-18.4) per ton, along with a social cost of US $43 (€31.6) per ton, the seagrass projects would recover US $12 000-43 000 (€8 825-31 622) per hectare. This is roughly how much they cost to implement. However, the researchers highlight that the added benefits of enhanced biodiversity were not included in this calculation, which would increase the value of these projects even further.

1.Biomares - Restoration and Management of Biodiversity in the Marine Park Site Arrábida-Espichel was supported by the European Commission. See: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3164.

2.OPERAs (Operational Potential of Ecosystem Research Applications) is supported by the European Commission under the Seventh Framework Programme. See: http://operas-project.eu/