**The $25-$1000 range and inadequate argument on the restoration of the mangrove-seagrass ecosystems**


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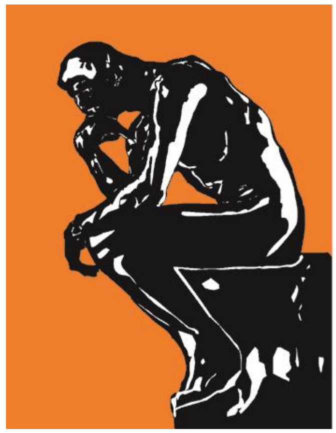

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In May 2023, Fakhraee *et al.* published a research article titled “Ocean alkalinity enhancement through restoration of blue carbon ecosystems” in *Nature Sustainability* [1].

The estimations and arguments leading to the conclusion of the possibility of using mangroves and seagrass are presented in Figure 1.

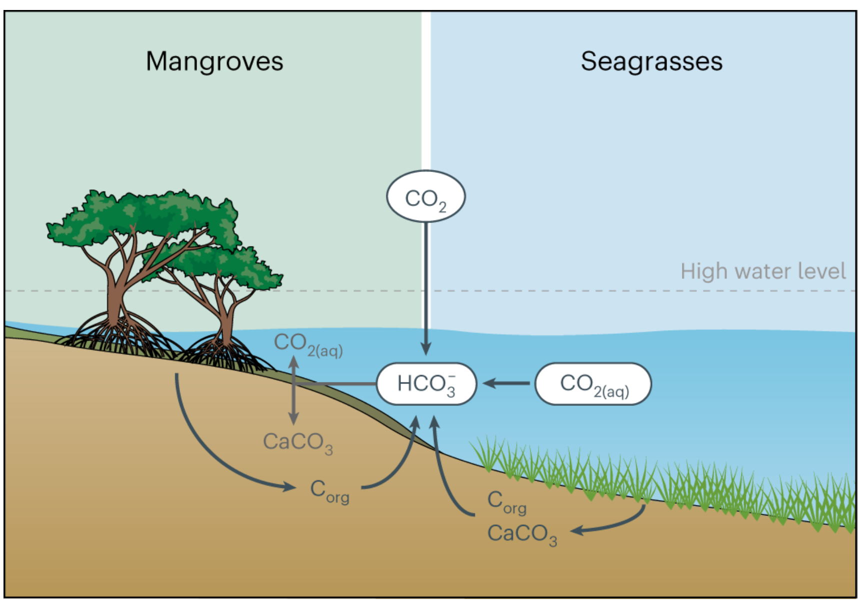


Figure 1. The blue carbon benthic alkalinity pump [1].

In this essay, we discuss an assessment of the costs of restoring and maintaining the mangrove-seagrass ecosystems indicated in the article [1]. The verbatim quote of that assessment is provided below (with some editions to increase readability but still keep the original article's ideas).

> **"Restoration costs of seagrass and mangroves**
>
> The potentially high cost of seagrass and mangrove restoration and maintenance represents a barrier to the robust growth of a blue carbon market, despite the obvious societal and ecological co-benefits. Full restoration costs for previous mangrove and seagrass restoration projects can be as high as 100,000 USD/ha. Most of this cost is maintenance and monitoring of the project after its completion to ensure survival and reproducibility. The restoration of seagrass is generally viewed to be labour-intensive and requires several years for the full completion of the project. However, restoration of mangrove systems is typically more cost effective, with a median cost of restoration of ~1,000 USD/ha. However, the cost of mangrove restoration can be as low as 25 USD/ha per year. In this light, alkalinity based CO2 removal associated with mangrove and/or seagrass restoration could potentially offset a sizable fraction of the overall cost of many restoration projects. For instance, at a nominal carbon price of 100 USD/tCO2 alkalinity-based CO2 removal alone would offset costs of up to 200–1,200 USD/ha annually for the restoration/maintenance of mangrove ecosystems."

Notably, the cost of restoring and maintaining ecological areas of mangroves is estimated to range widely from $25 to $1000. According to the authors, even if the cost is $1000/ha, it is still very economical compared to seagrass beds, which can cost up to $100,000/ha.

This intuitive assessment oversimplifies the difficult reality of regenerating, restoring, and maintaining environmental capacity. According to Nguyen & Jones [2], the nature of the relationship between residents' social-environmental perceptions and behaviors within the context of investment costs is much more intricate than Fakhraee et al.'s assessments.

The following arguments, based on the semiconducting principle of monetary and environmental values exchange [3], can illustrate some drawbacks of the oversimplified assessments:

Firstly, this wide range of cost suggestions will confuse planning because 1000 is 40 times larger than 25! So, when confronted with a given solution, what number should we consider in the planning process? One of the most concerning aspects of the business community's investment activities (also a significant risk) is that they will run out of money in the middle of an investment. For environmental activities, is this risk not worth worrying about? Moreover, to determine if the investment is sufficient, such a huge difference in the recommended figure will make calculations difficult, as it will simply produce confusion and hesitation. Besides, because the activities linked with the ecosystem need large-scale consideration, offering an average figure for investment per hectare is ineffective. Thousands of hectares will involve many other costs, not just $25/ha. (This small number is hard to believe, but we'll discuss it later.)

Second, it cannot be said that restoring ecological functions is simply a matter of financial investment. In fact, the business sector must be included as they are a group with capacity, relationships, financial resources, and maybe practical needs/interests in this task. Businesses have substantial direct effects on the exploitation of environmental resources and the creation of ecological consequences. Who can restore vegetation while businesses continue to exploit and have the resources to influence the regulatory corridor to keep activities going? Thus, the cost to restore mangroves is not just $1000, but it must include expenditures to prevent further exploitation, legal costs to modify choices, and costs for adjusting investment structure, regional economic investment, etc.

Third, the most important partner, also the implementation agent to restore mangroves, is the residents, who are also the workers in this work. When residents lack the necessary resources for sustenance, it is inherent for them to exploit the environment as a method of survival because every human decision is almost always based on their need for survival. Supposedly, the mangrove-seagrass ecosystem is very well restored and needs to be maintained permanently after restoration, but that maintenance prevents the residents from sustaining their livelihood and leads to their dislocation. Then, could the maintenance be implemented?

Although the abovementioned three points are insufficient, they certainly cannot be answered. Therefore, it is hard to believe that some simple arguments about "feasibility" can be applied to the community in a large ecological space.

Like the saying of Mr. Kingfisher:

"Well, the problem is he cannot fall asleep on an empty stomach" [4].

## References


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