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The Significance of Quantifying Carbon Capture Capacity and Conservation Potential of Salt Marshes: A Proposal for Río Negro Province, Argentina

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Abstract

Quantifying the carbon capture capacity and conservation potential of salt marshes is crucial for addressing climate change and protecting these valuable ecosystems. Robust methodologies and comprehensive monitoring programs are essential for understanding their functioning, identifying threats, and implementing effective restoration strategies. By integrating scientific knowledge, public awareness, and sustainable management practices, we can safeguard salt marshes and contribute to global sustainability goals.

Keywords: Salt marshes; Blue carbon; Río Negro Province; Argentina, VM0033, VM0007

Introduction

The global concern regarding climate change and the need to conserve and restore carbon sink ecosystems have emphasized the importance of conducting comprehensive surveys in coastal areas to assess carbon sequestration potential, biodiversity, and ecosystem services [1]. However, such surveys evaluating carbon sequestration potential and associated benefits in coastal areas, particularly salt marshes, have not been conducted in Argentina. Salt marshes are highly productive and dynamic ecosystems that offer a wide range of services, including coastal protection, sediment stabilization, water filtration, biodiversity maintenance, and significant carbon sequestration capacity [2-6].

The province of Río Negro, located in northern Patagonia, Argentina, encompasses a coastline extending over 300 kilometers along the Atlantic Ocean (Figure 1) [7]. This region hosts diverse marine and coastal habitats, including sandy beaches, cliffs, and salt marshes [8] (Figure 2). These ecosystems support rich biodiversity and play a crucial role in the local economy through activities such as fishing, tourism, and natural resource extraction. However, these natural areas face threats like coastal development, pollution, climate change, trawling, and the invasion of exotic species. As a result, the ability of salt marshes to provide essential ecosystem services, act as carbon sinks, and support local and regional communities is at risk [9].

Globally, salt marshes are recognized for their capacity to capture and store carbon, making them valuable allies in the fight against climate change. This function, known as "blue carbon capture," is crucial for maintaining carbon cycle equilibrium and reducing greenhouse gas concentrations in the atmosphere [10]. Moreover, the proposed surveys represent an opportunity to finance sustainable projects. The quantification and trading of carbon capture by salt marshes in the voluntary carbon market or emissions trading systems can generate economic benefits, promoting the conservation and restoration of these ecosystems [11].

Carbon credits provide a means to promote environmental conservation and restoration by allowing entities to offset their greenhouse gas emissions through the acquisition and financing of projects that reduce or capture emissions elsewhere. Therefore,

the survey and future projects based on it will be eligible to obtain economic resources through the generation and sale of carbon credits, ensuring their implementation and long-term sustainability [12]. The survey data will enable the analysis of factors influencing the health and conservation of salt marshes, such as coastal development, pollution, climate change, trawling, and the invasion of exotic species. It will help identify the main threats to these ecosystems and propose specific conservation and restoration actions for each study area. These actions may involve creating protected areas, implementing monitoring and tracking programs, and promoting sustainable practices in human activities impacting salt marshes [13].

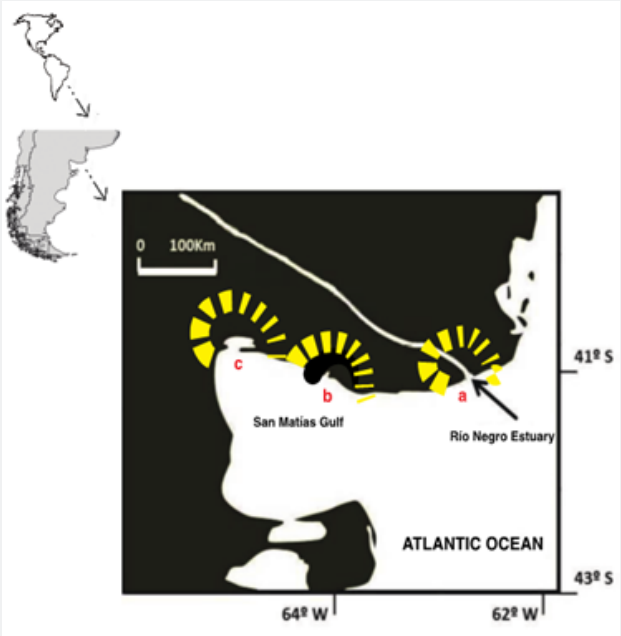

Figure 1: The map shows the geographical distribution of the main salt marsh of Spartina species (yellow draws). a- Río Negro Estuary salt Marshes. b- Caleta de los Loros Salt Marshes and c- Marshes of San Antonio Bay.

Figure 2: Image of Caleta de los Loros Salt Marsh.

The scarcity of comparable studies and surveys in Argentina emphasizes the importance of projects like these in bridging knowledge gaps and generating vital information for the conservation and sustainable management of coastal ecosystems. These initiatives also have the potential to enhance public awareness and foster dedication to protecting these ecosystems and recognizing their role in carbon sequestration and mitigating climate change. Establishing a baseline is a crucial aspect of any

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conservation and restoration project as it provides a reference for the initial state of an ecosystem before the implementation of management or intervention actions [14,15]. Therefore, it is necessary to conduct surveys of salt marshes in three specific areas within the province of Río Negro: Caleta de los Loros, the salt marshes of Bahía de San Antonio, and the estuary of the Río Negro. These surveys will focus on assessing the health and conservation status of these ecosystems, identifying flora and fauna species, and estimating their carbon capture capacity and potential for generating carbon credits. The results will be crucial for developing subsequent conservation and restoration strategies and for local and global climate change mitigation efforts [16].

To accurately assess the carbon capture capacity and potential for carbon credit generation of salt marshes in Río Negro, a rigorous and detailed methodology must be implemented to ensure the collection of precise and representative data. The proposed surveys should adopt the VM0033 and VM0007 methodologies developed by Verra, which are internationally recognized standards for quantifying greenhouse gas emission reductions through the conservation and enhancement of carbon storage in wetland ecosystems. [16-20]. This project will present a unique opportunity to demonstrate, in our personal opinion, the applicability and effectiveness of these methodologies in the local context, as they have not been previously utilized in Argentina.

We propose the creation of projects that aim to incorporate the VM0033 and VM0007 methodologies. In our opinion, these methodologies offer valuable opportunities to directly measure carbon capture in wetland ecosystems. By estimating plant biomass and coverage, carbon accumulation rate in sediments, and carbon storage in different ecosystem compartments, we can gain important insights into the carbon sequestration potential of these ecosystems. We strongly believe that applying these internationally validated methodologies across multiple projects will not only provide comparable data for global studies and carbon credit projects but also make significant contributions to the conservation and restoration of salt marshes in our region. By implementing these projects, we can collectively make strides in understanding and mitigating climate change, which is of utmost importance.

To obtain representative data, a random stratified sampling approach will be employed in the study areas. Homogeneous sampling units will be defined using satellite imagery and preliminary field data, and random sampling points will be selected within each unit to ensure equitable spatial distribution. At each sampling point, in-situ measurements will be conducted to assess the health and conservation status of the salt marshes and estimate their carbon capture capacity. This includes identifying and quantifying flora and fauna species, measuring plant biomass and coverage using $1m^2$ quadrats, and collecting sediment samples for carbon content analysis. The collected data on plant biomass and coverage, along with sediment carbon content, will be used to estimate the carbon capture capacity of the salt marshes. Species-specific allometric equations will be applied to relate plant biomass and coverage to the carbon capture rate. Additionally, the carbon accumulation rate in the sediments will be calculated by estimating the sedimentation rate and organic carbon content, providing insights into long-term carbon storage.

We recommend the utilization of mathematical and statistical models to analyze the survey data, identify trends and patterns, and predict the future evolution of the salt marshes and their carbon capture capacity. These models should take into account variables such as plant biomass and coverage, carbon capture rate, sediment carbon content, and environmental conditions. By employing these models, we can enhance our understanding of the dynamics and potential of salt marshes, enabling us to develop informed strategies for their conservation and carbon sequestration [21].

Conclusion

In conclusion, quantifying the carbon capture capacity and conservation potential of salt marshes is of utmost importance, as expressed by the authors. These ecosystems play a vital role in climate change mitigation and provide valuable services. By employing rigorous methodologies, comprehensive monitoring, and restoration strategies, we can enhance our understanding of salt marsh ecosystems, identify threats, and support targeted conservation actions. By integrating scientific knowledge, raising public awareness, and adopting sustainable management practices, we can protect and restore these habitats, ensuring their long-term resilience and contributing to global sustainability efforts.

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