Carbon Core and Farmers Antigua Trust Present:

Expected Carbon Sequestration Estimates for Antigua and Barbuda

A joint initiative between Carbon Core, Farmers Antigua Trust and the Government of Antigua

Introduction

The carbon sequestered by mangroves and other marine systems is referred to as "blue carbon" because it's stored in coastal and marine ecosystems. Blue carbon habitats (mangroves, salt marshes, and seagrasses) cover less than 0.5% of the seabed but are responsible for the sequestration of over half of all carbon captured by living organisms globally.

Carbon sequestration refers to the process by which CO_2 is captured from the atmosphere and stored over the long term. This process can occur naturally in various ecosystems, including forests, oceans, and soil. Mangroves, in particular, are highly efficient at carbon sequestration.

Carbon Sequestration in Mangroves, Seagrass and Coral Reefs.

Mangroves are coastal ecosystems present across many tropical and subtropical regions of the world. These ecosystems are characterized by their unique ability to withstand harsh coastal conditions, making them important protective barriers against coastal erosion, storms, and sea-level rise. Additionally, mangroves are notable for their high rates of carbon sequestration, a crucial aspect in mitigating climate change. Together with seagrass and corals these ecological systems make up a crucial integrated biodynamic system for both environmental, agricultural and climate processes.

Research indicates that mangroves sequester carbon at a much higher rate per area than most other forest types, with estimates ranging from 200 to 400 metric tons of CO_2 per hectare annually. They store three to four times more carbon per equivalent area than terrestrial forests, largely due to their ability to trap sediments and organic matter carried by tidal waters, preventing its release back into the atmosphere.

Seagrasses are another vital component of "blue carbon" ecosystems, alongside mangroves and salt marshes. They are highly productive plants that can capture and store carbon at a substantial

rate. On average, seagrass meadows are estimated to sequester about 138 grams of carbon per square meter per year, which is equivalent to approximately 1.38 metric tons of carbon per hectare per year. However, this rate can vary greatly depending on factors such as the seagrass species, water temperature, light availability, and nutrient levels. Notably, the carbon sequestration potential of seagrasses is not limited to the plants themselves. Much of the carbon is stored in the sediment beneath seagrass meadows, where it can remain trapped for thousands of years if the ecosystem remains undisturbed. Despite covering less than 0.2% of the ocean floor, seagrasses are estimated to be responsible for up to 10% of the carbon buried in ocean sediment annually.

Coral reefs, including those in the Caribbean, are complex and biodiverse ecosystems known for their immense value in terms of fisheries, tourism, and coastal protection. While they are not direct carbon sinks like mangroves or seagrasses, their role in the carbon cycle is still significant.

The primary way coral reefs participate in carbon sequestration is indirectly through their contribution to marine productivity. Corals facilitate the process of carbon sequestration by providing habitats for numerous species of marine life, many of which contribute to primary production and the transfer of carbon within the ecosystem. For instance, reef-dwelling parrotfish and surgeonfish feed on algae and dead coral, processes that result in the production of sand and help sequester carbon into the seabed. However, quantifying the exact rate of carbon sequestration in coral reefs is challenging due to the complexity of these ecosystems and the variety of processes involved.

Moreover, it's important to note that while the impact of coral reefs on carbon sequestration is significant, it's dwarfed by their importance in other ecological roles such as providing habitats for marine species and protecting shorelines from storm surges. Coral reefs are currently under threat due to climate change, ocean acidification, overfishing, and pollution, which jeopardizes not only their carbon sequestration capacity but also the many other ecosystem services they provide.

Threats to Marine systems and their Sequestration Capacity

Despite the significant role mangroves play in carbon sequestration, they are under threat from various human activities, including deforestation, coastal development, and aquaculture. When mangroves are destroyed, they release stored carbon back into the atmosphere, contributing to

increased levels of atmospheric CO_2, efforts to prevent these losses relate to direct efforts in carbon sequestration and climate mitigation.

To evaluate the climate mitigation potential change and safeguard our coastal communities, it's vital to protect and restore mangrove ecosystems. Conservation and restoration efforts can help enhance carbon sequestration, preserve biodiversity, and maintain the essential services that these ecosystems provide.

Estimates.

Antigua and Barbuda have a reported area of over 400 square kilometers, assuming that about 25% of the land area is mangroves; there would be an estimate of between 2 to 4 million metric tons of CO_2 sequestered annually. Given that seagrasses can sequester about 1.38 metric tons of carbon per hectare per year, we can calculate the total amount of carbon that could be sequestered by seagrasses in an area of 28 million acres could be as much as 15.6 million metric tons.

The total amount of carbon sequestered by seagrasses in an area of 28 million acres would be approximately 15.6 million metric tons of carbon per year. Coral reefs, play an indirect role in carbon sequestration by providing habitats for marine species that contribute to the carbon cycle, making it more difficult to quantify their sequestration potential. Coral reefs' contribution to carbon sequestration is highly variable and depends on factors such as the species composition and health of the reef. The challenge is to provide a specific estimate for the carbon sequestration potential of 28 million acres of coral reefs without additional specific information. However, conserving and restoring both seagrasses and coral reefs is essential for maintaining the health of marine ecosystems and their capacity to sequester carbon.

Ecosystem	**Area**	**Carbon Sequestration Rate**	**Total Carbon Sequestered Annually**
Mangroves	100 km² (10,000 ha)	200-400 metric tons/ha/year	2-4 million metric tons
Seagrasses	28 million acres (11.3 million ha)	1.38 metric tons/ha/year	15.6 million metric tons
Coral Reefs	28 million acres (11.3 million ha)	Not quantifiable	Not quantifiable
Totals	-	-	**17.6 - 19.6 million metric tons (excluding Coral Reefs)**

At the present rate of between 40 and 80 USD per ton the total valuation of the Carbon Credit potential is over **1 Billion USD per year**.

According to World Bank data, Antigua and Barbuda emitted approximately 0.12 metric tons of CO_2 per capita in 2014. With a population of around 100,000, this would equate to approximately 12,000 metric tons of CO_2. Further analysis will be required to verify and

establish a more accurate representation, however these estimates would indicate, as expected that Antigua and Barbuda have a net negative carbon impact.

Recommendations and measurements

Future research should aim to refine the estimates of carbon sequestration in mangroves, sea grass and corals and quantify the impact of various human activities on this sequestration capacity. Policy efforts should focus on the protection and restoration of these resources and the incorporation of conservation into national and international carbon offset programs, which Carbon Core can provide. Under writing of the process will be critical in the establishment of credits for Antigua Barbuda and Redonda and enable international trade and comparison within the Carbon Core and Farmers Antigua Trust network and beyond.

Initial Estimated Costs

The estimated mangrove volumetric analysis and terrain mapping will take approximately 3 months. The total estimated cost for initiation is 196,000 USD starting with mangroves and seagrass with the incorporation of data connected to Geographic Information Systems (GIS) to generate tradable carbon credits through Carbon Cores proprietary technology. Evaluations and measurements to be done at 6-month intervals to determine the actual sequestration values of each mangrove and seagrass region while methods to establish a robust quantification of the coral values is established. This cost can be recuperated through the establishment of carbon credits generated by Carbon Core and managed through the Farmers Antigua Trust Registry, and should provide a net benefit to the country; which could potentially be equivalent to the country's current GDP.

Conclusion

The enlistment of Carbon Core and Farmers Antigua Trust should provide a method for which Antigua Barbuda and Redonda can show their carbon emissions are less, up to a million times less, than the amounts sequestered by their natural resources. Carbon Core and Farmers Antigua Trust can enable Antigua Barbuda and Redonda to maximize their natural resources with the potential to have an extremely positive national and global impact on both environment and economy.