Whooping Cranes and Carbon Credits

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The Whooping crane is a charismatic endangered species that has returned from the brink of extinction since the 1930s, when there were only 17 individuals in the wild. The population now stands at over 500 thanks in large part to the establishment of Aransas National Wildlife Refuge and other protected areas. However, that progress is threatened by sea level rise, which is expected to destroy the wintering territories of the Texas Aransas-Wood Buffalo National Park (Canada) migratory wild flock. This tiny population of cranes managed to survive thanks to the habitat productivity of the Aransas area. However, the birds' dependence on this productivity has limited their range, making them vulnerable to late-season hurricanes and now sea level rise.

Although Whooping cranes are observed in Texas coastal rice fields and flooded pastures during the winter, most mating pairs and cinnamon-splotched youngsters overwinter in coastal salt marshes, where they hunt blue crabs and eat Carolina wolfberries. Unfortunately, these wintering grounds are predicted to vanish due to sea level rise. The loss of coastal wetlands would be devastating to this historic wintering flock of Whooping cranes. There are efforts underway to purchase land to facilitate wetland migration inland, but they do not meet the scale of the problem.

To date, there has been no comprehensive effort to protect the current wintering habitat of these endangered cranes from sea level rise. However, BCarbon, a non-profit carbon credit registry located in Houston, has developed an approach that offers the potential to protect this habitat and pay for its conservation with private sector financing.

The BCarbon Living Shoreline Carbon Credit Program

In 2022, BCarbon assembled a group of leading coastal scientists, engineers, and practitioners to develop a process for protecting coastal wetlands from sea level rise. The solution that was agreed upon was to seek to protect the wetland edges from erosion by building living shorelines optimized to trap sediment. In addition, over time, marsh elevations in these now-protected areas can be

enhanced by application of dredge material in certain locations. The erosive exposure of wetlands is shown in Figure 1.

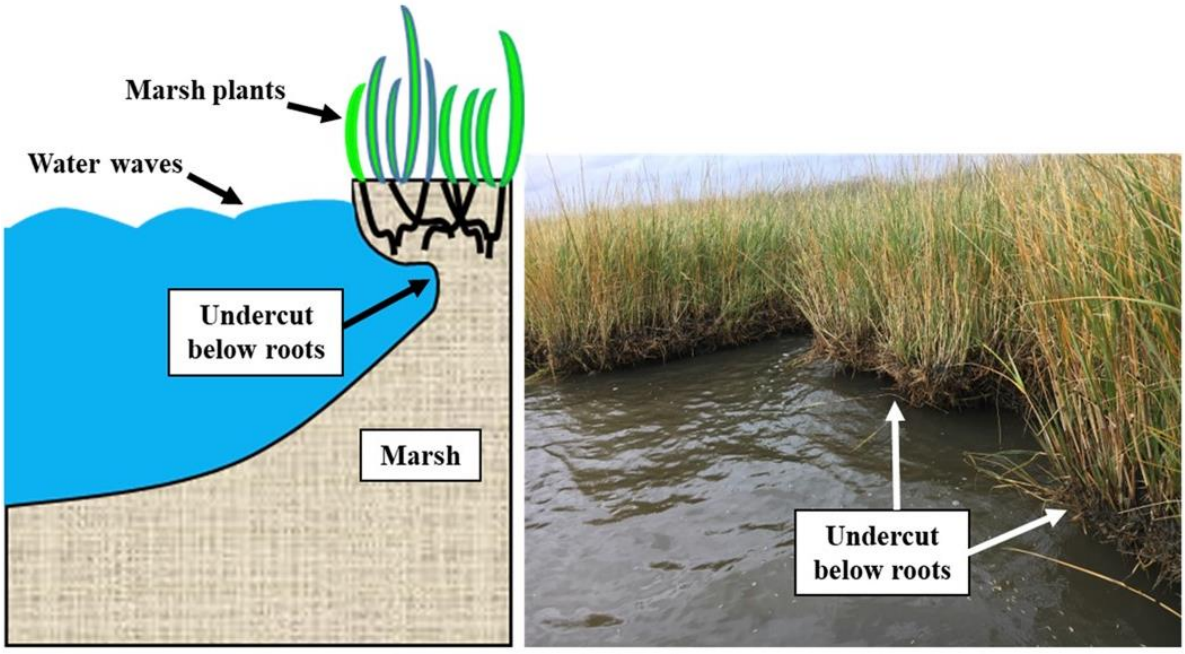

Figure 1. Diagram and photos describing how marsh erosion occurs. Graphic by Sapkota and White, 2019.

In addition to protecting the wetlands themselves, the living shoreline shields the massive amounts of organic carbon stored within them. Without protection from the living shoreline, this carbon would be released when the marsh dies from drowning and erodes away. This has already happened in coastal Louisiana, where miles of wetlands have been lost. By protecting the wetland and helping it keep up with sea level rise, the living shoreline also enables the issuance of annual carbon credits for the carbon removed from the atmosphere by marsh vegetation and stored in the protected soil. A diagram showing the location of the living shoreline and two different carbon crediting processes is shown in Figure 2.

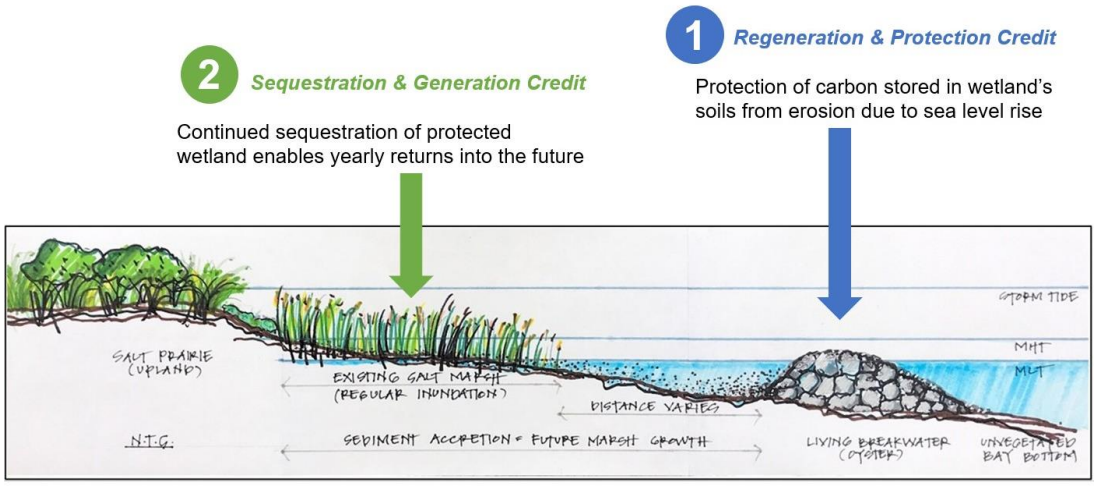

Figure 2. Diagram showing the location of the living shoreline and its role in protecting the marsh from erosion. Also shown are the types of carbon credits that are issued after construction of the breakwater structure. Graphic by Lalise Mason for BCarbon.

By protecting the stored carbon and enabling the continued drawdown of carbon dioxide from the atmosphere and storage in the soil, the living shoreline construction enables BCarbon to issue carbon dioxide credits that can be used to offset a company's carbon footprint. Living shoreline projects generate credits that can be purchased by companies seeking to address their carbon emissions.

Under the BCarbon Protocol, a coastal wetland is evaluated from several perspectives. First, what is the type and extent of the wetland? Second, how is the wetland shown to be affected by sea level rise in 2075 by the Sea Level Affecting Marshes Model (SLAMM)?[1] And third, what is the amount of carbon stored in the wetland soils that will be lost to erosion when the marsh dies?

These three pieces of information provide the basis for a decision as to whether the area is a candidate for living shoreline construction. Then, based on the cost of construction of the living shoreline (which will vary depending on erosion potential, wind fetch, water depth, etc.), a decision can be made as to the needed development price of the credit and whether the market will bear such a price increment at a given time. Projections can be made into the future, and innovative project partnerships can be considered wherein credits do not

[1] SLAMM is a tool originally developed by Warren Pinnacle and adapted by the Harte Research Institute for use in the GLO's Texas Coastal Resiliency Master Plan. It identifies how wetlands are likely to be impacted by sea level rise.

completely cover the cost of project construction but help offset it, potentially in combination with more traditional public restoration funding.

In the case of the Whooping cranes occupying generally low/moderate carbon sites of the Texas coast, the hope is that the importance of protecting the wintering grounds of these endangered birds will justify a higher price that might lead to significant miles of protected shoreline. In the remainder of this paper, the opportunities for the protection of crane wintering habitat will be demonstrated.

Wintering Ground of the Whooping Cranes

Most of the historic wintering grounds of the wild Whooping crane flock are located in and around Aransas National Wildlife Refuge. These wetlands occur in San Antonio, Aransas, St. Charles, Mesquite, Carlos, Copano, and more recently Matagorda Bay. Many of the key wintering territories are shown below in Figure 3.

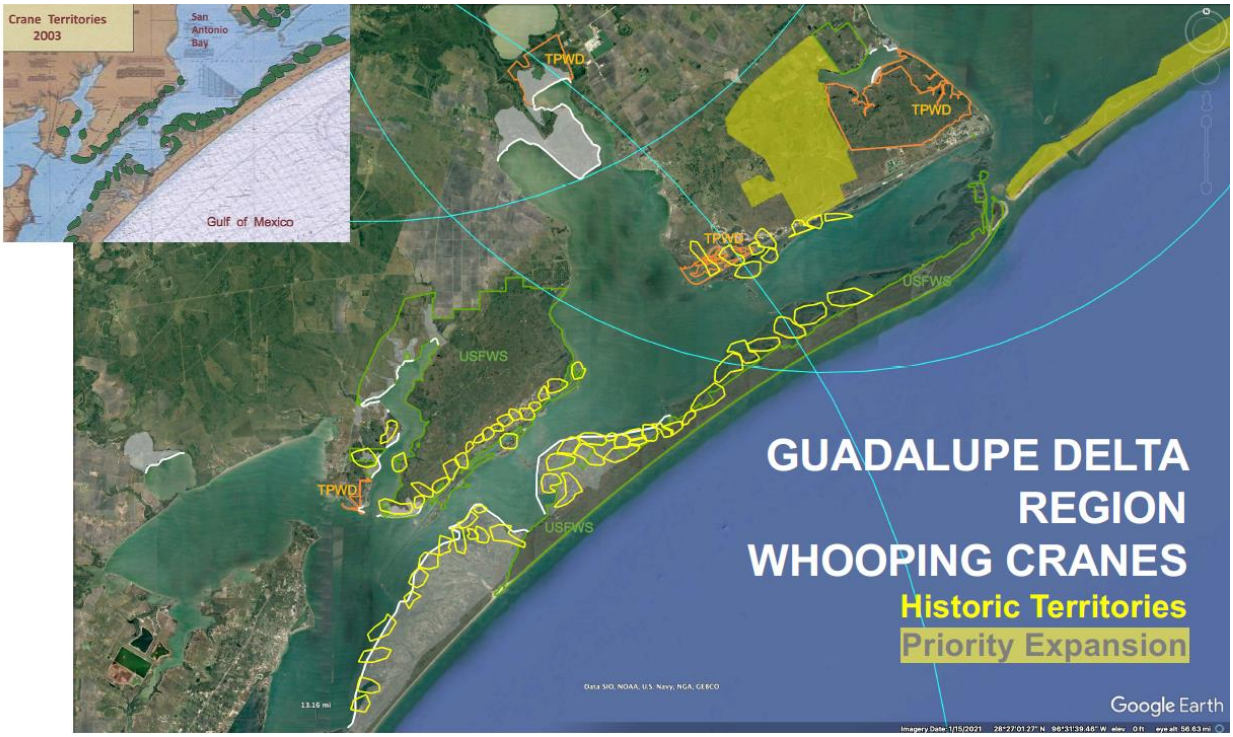

Figure 3. Historic wintering territories of Whooping crane families. The original map prepared by Tom Stehn is shown in the top left. Additional crane habitat data from the International Crane Foundation. The yellow circles represent these same territories presented in geographic information format. Map by Lalise Mason for BCarbon.

In Figure 3, each area delineated in yellow represents a territory that has been used historically by wintering cranes as documented by Tom Stehn, whose original 2003 map is shown in the upper left quadrant of the figure. These territories are passed down from one generation to another. They are the wintering homes of specific paired cranes. This has been proven through observations of banded birds using the same territory year after year.

There are approximately 60 historic territories identified in Figure 3. Since 2003, some of these territories have become crowded, compressed, and altered due to rising crane populations and competition for key resources. Cranes are also beginning to exploit new eastward territories, but this is a very slow process. We know there are many additional new crane locations, particularly around Powderhorn Lake and the Oyster Lake area of Matagorda Bay and in the northern part of Copano Bay. Together, these territories provide habitat for most of the wintering wild flock. Losing them would inflict enormous damage on the population.

In an effort to protect these sites, BCarbon has undertaken an evaluation of several project areas to determine the feasibility of creating carbon credits at a reasonable price. It is important to note that carbon levels in the marshes of the Texas coast diminish from north to south due, among other factors, to lower freshwater and sediment inflows south of the Brazos River. Pairing the potential protection of an endangered species with the purchase of a carbon credit could increase the value of the credit and make living shoreline projects economically feasible in more areas of the coast. There would be other benefits too, such as the protection of nurseries of the coastal fishery, which is critical for recreational angling.

Potential Whooping Crane Territory Projects

In this section, a proposed project to protect eight Whooping crane territories is outlined. Matagorda Island is a barrier island across from the Aransas National Wildlife Refuge. It contains many of the key territories of the wintering cranes. In this case study, the area circled in red is evaluated to determine the feasibility of protecting eight wintering crane territories with a single project.

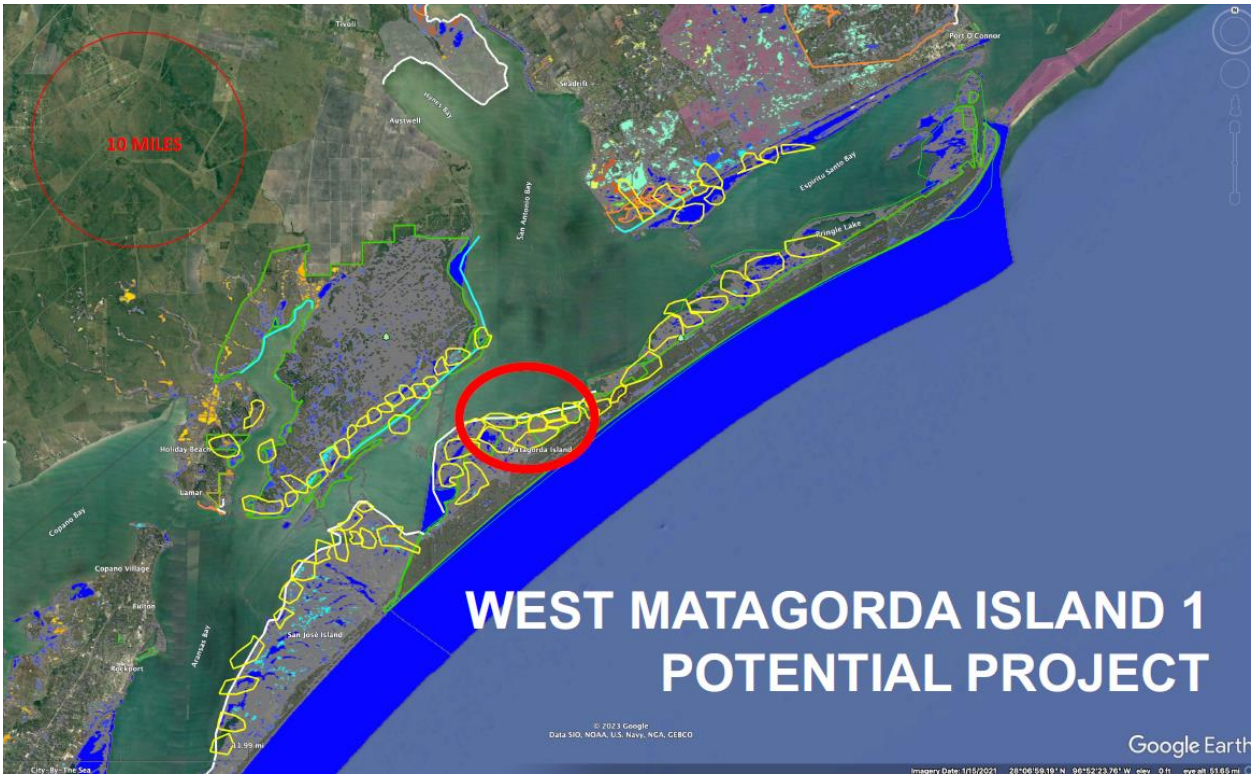

Figure 4. Map showing Whooping crane territories with a project area on West Matagorda Island outlined in red. Map by Lalise Mason for BCarbon.

In the figure below, the impact of sea level rise on these territories as indicated by the SLAMM results is shown. By and large, all eight of these territories are inundated by 2075, without action. In this same image, the white line indicates a 3.5 mile living shoreline project. At an estimated cost of $2 million per mile the initial investment to protect these wetlands would be $7 million, a significant sum. Protecting all of the crane territories would likely require well over $100 million.

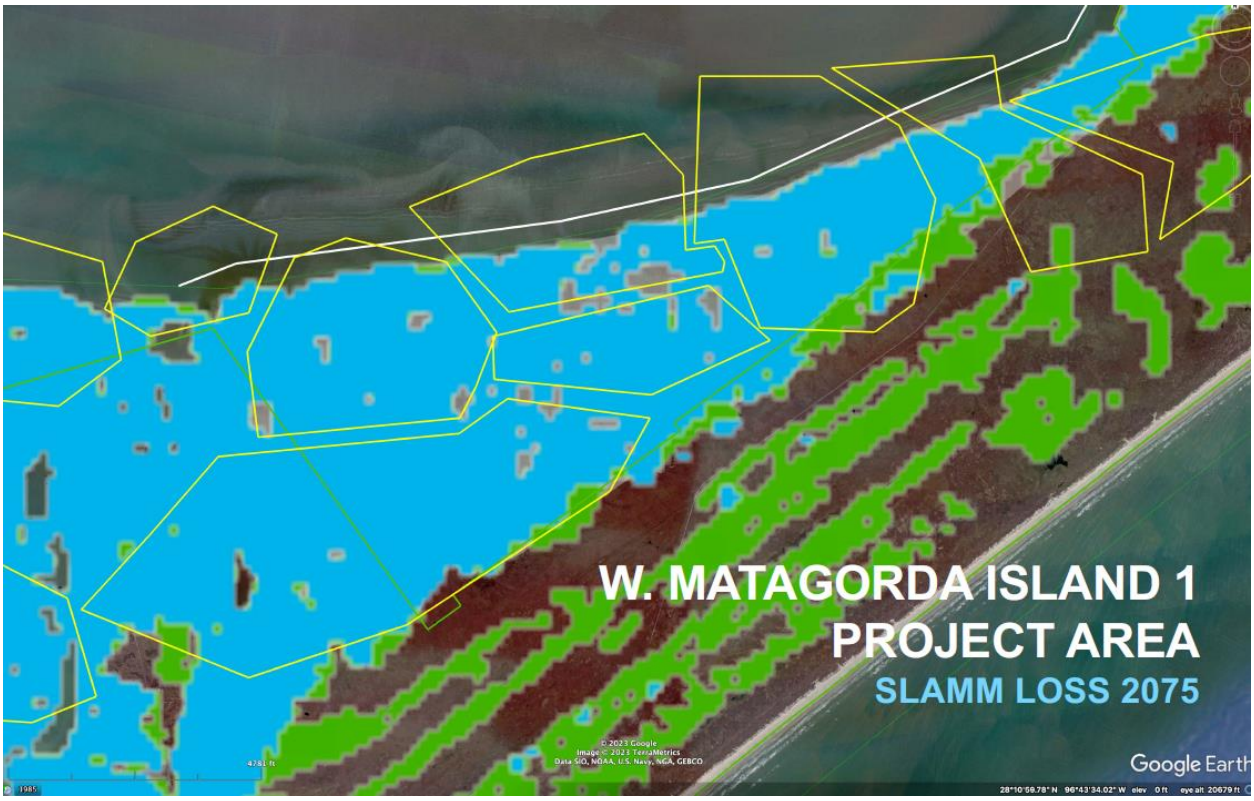

Figure 5. Detailed map of Matagorda Island project area showing Whooping crane territories in yellow and marshes lost to sea level rise in blue. Map by Lalise Mason for BCarbon.

As shown in Figure 5, the linear living shoreline would protect an area that would otherwise be lost to sea level rise by 2075. As depicted, this project would be 3.5 miles long and protect approximately 1700 acres. Of particular importance is the carbon stored in these wetlands expressed as carbon dioxide equivalent, or CO2e. According to the database created by Dr. Rusty Feagin of Texas A&M University, the soil protected by the living shoreline contains about 230 tons of CO2e per acre. For 1700 acres, the carbon yield would therefore be about 340,000 tons.

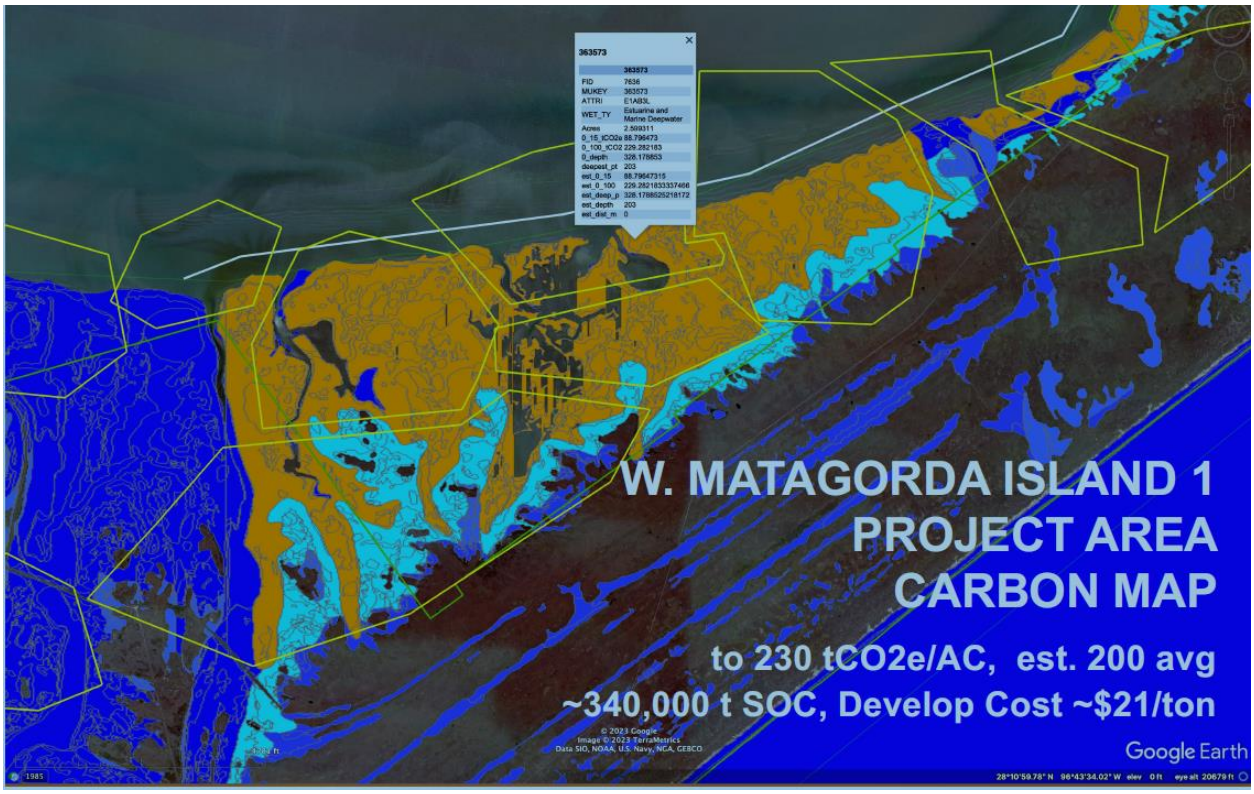

Figure 6. Map showing Matagorda Island project area indicating the levels of carbon stored in the wetland soil. Map by Lalise Mason for BCarbon.

A key issue addressed by this exercise is the break-even price for each carbon credit created. In this example, the construction cost of creating 340,000 tons of carbon credits is about $7 million. This does not include administrative and developmental costs. Simple division indicates that the carbon credits to protect eight Whooping crane territories must yield more than $21 per ton (or credit) for the project to be economical for the project developer.

Conclusion

Construction of living shorelines and financing that construction with the sale of carbon credits would likely benefit the health and long-term welfare of the wild Whooping crane flock. BCarbon will develop proposals for Whooping crane projects with different pricing structures that account for the amount of carbon protected and the cost of construction. In all cases, the living shorelines will be seeded with oyster spat, which will also help the project keep up with sea level rise. This approach offers the potential to protect crucial habitat that will

otherwise very likely disappear. If we do nothing, we will lose these historic Whooping crane wintering grounds, and potentially the cranes that occupy them.