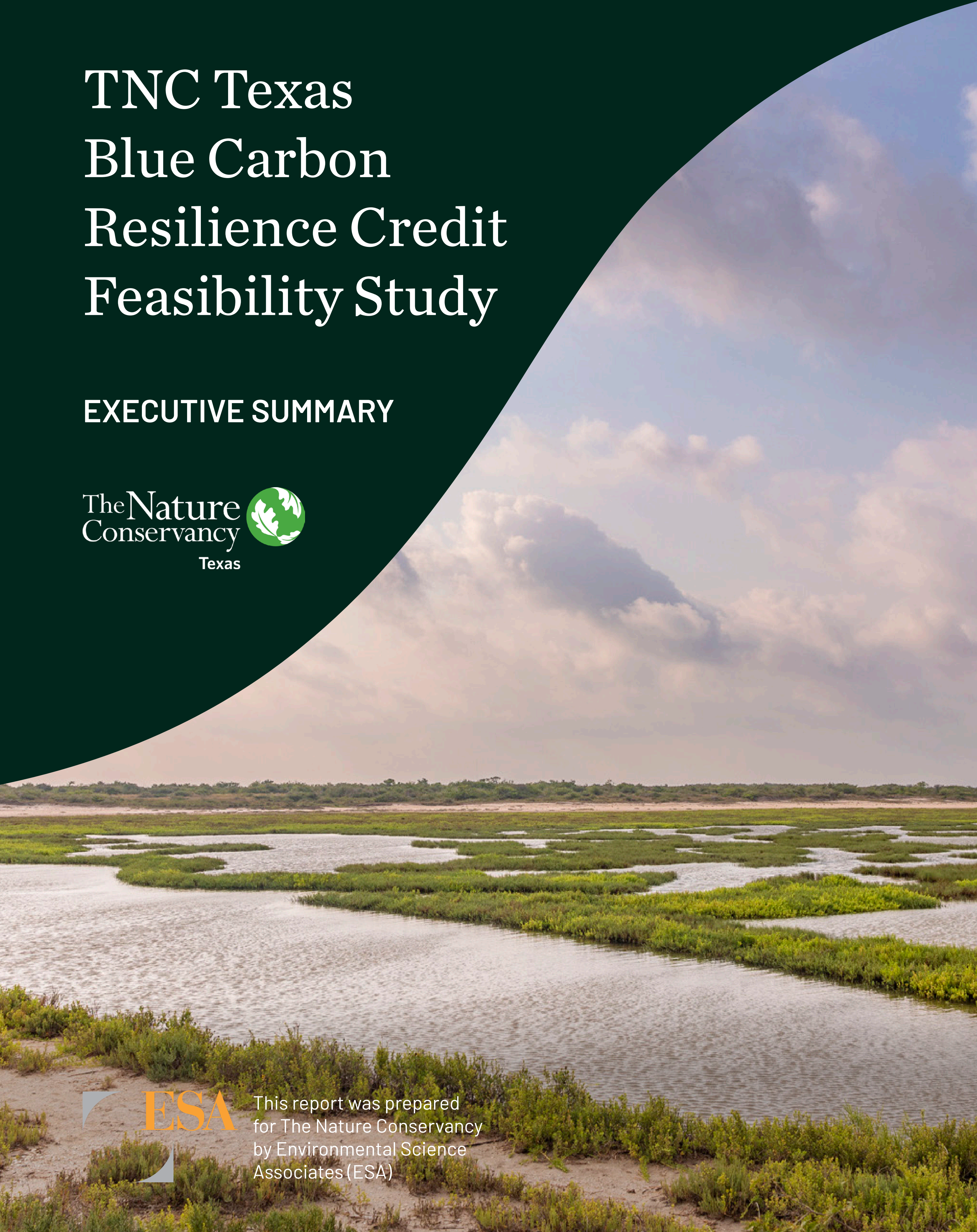
TNC Texas Blue Carbon Resilience Credit Feasibility Study

EXECUTIVE SUMMARY

The Nature Conservancy
Texas



ESA

This report was prepared for The Nature Conservancy by Environmental Science Associates (ESA)

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Cover Photo: Port Bay near Rockport, Texas © Kenny Braun; **Next Page:** Mad Island Marsh Preserve © Ian Shive

Project Overview

Our natural coastal and marine environments not only offer protection from the rising seas and stronger storms brought on by anthropogenic climate change, but also draw down atmospheric greenhouse gases (GHGs). While the protective ability of these habitats has long been understood, the latter benefit, so-called "blue carbon," has increasingly attracted attention in recent years from scientists, policymakers, land managers, and landowners. Peer-reviewed scientific literature has demonstrated the great significance of wetlands—especially salt marsh, mangroves, and seagrass—for both carbon uptake and storage, the process of capturing carbon dioxide from the atmosphere and storing it over time in plant materials and sediments (e.g., Pendleton et al. 2012).

Globally, these coastal ecosystems are being lost at an alarming rate; many studies focus on the diminishing carbon sequestration capacities and resilience associated with such losses. The Gulf Coast is home to 37 percent of U.S. coastal wetlands, facing both increasing tropical storm intensity and frequency and sea-level rise rates hastened by land subsidence. Texas has lost more than 7 million wetland acres, which is nearly the combined acreage of Dallas, Fort Worth, Houston, and San Antonio (Texas Parks and Wildlife Department 2003). These phenomena make it important to understand, protect, restore, and value the region's blue carbon habitats.

This feasibility study seeks to contribute to the body of knowledge around blue carbon and assess feasibility for developing market projects in Texas. Four project types were evaluated, and recommendations provided to support future project scoping and design considerations.

One challenge of bringing blue carbon credits to market is the interdisciplinary nature of such projects. For example, determining the permanence of the blue carbon credits requires assessment of physical factors (such as sea-level rise resiliency) and a potentially changing legal landscape, as carbon offsets generated must be permanent (e.g. for 100 years, as required by standards such as Verra's Verified Carbon Standard). Another challenge is the timeline of expected carbon revenues in supporting the project activities— it can take time for those revenues to be generated as carbon benefits accrue from project activities. Therefore, this study evaluates the market, technical, financial, legal, and organizational feasibility of restoration and conservation projects, while also considering the social impacts of blue carbon restoration.

Based on stakeholder feedback gathered during a series of webinars and meetings conducted in spring 2021, four high-priority project types have been identified for the Texas coast: (1) land/easement acquisition, (2) hydrological restoration, (3) beneficial use of dredge material, and (4) erosion control.

Site Analysis

1. Land or Easement Acquisition

The Nature Conservancy in Texas (TNC) is working to secure an easement on a 1,200-acre property in Port Bay, less than 10 miles from Rockport in Aransas County. The easement would limit development of the site and maintain the land management in perpetuity. Though this property adjoins the Mission-Aransas National Estuarine Research Reserve, it is in an area that faces intensive development pressure. The tract in question is adjacent to an area of low-density development and a sand mining operation. An industrial disposal site sits less than a mile across the bay from this site. The acquisition or protection of this site through an easement agreement would protect its important salt marsh and salty prairie habitats from being turned into residential or industrial use.

This initial analysis shows that the Port Bay site provides enough carbon credits to make the project financially feasible, assuming a carbon price of $14/metric ton or greater. *However, the biggest uncertainty in the analysis is the determination of "additionality," which requires demonstration of an imminent threat of habitat loss.* It is currently unclear how quickly development would happen without the project activity (i.e., conservation easement). Further analysis of the historic land-use change and future land-use projections is recommended to understand the timing of expected development at the site without the easement in place to confirm that the baseline scenario is appropriate. A key component will be conservation easement language that allows for development of carbon credits. Lastly, funding sources need to be vetted to ensure that they allow for development of carbon credits, and the role of blue carbon finance in the project needs to be determined.

Port Bay near Rockport, Texas © Kenny Braun; **Above:** Powderhorn © Jerod Foster

2. Hydrologic Restoration

The hydrologic restoration case study involves the installation of culverts under Boathouse Road, which is located at Welder Flats near Seadrift on San Antonio Bay. The property is managed by the Coastal Bend Bays and Estuaries Program and the Natural Resources Conservation Service holds a 2,000-acre easement on the property. The site, which contains upland, high- and low-marsh, salt-flat, and submerged vegetation habitats, is split by Boathouse Road, which has led to a significant difference between marsh habitat quality on different sides of the road. The marsh on the west side is hypersaline and underperforming due to its inability to receive flushing events, while the marsh on the east side is generally healthy habitat with greater connection to the watershed and freshwater. Much of the habitat is at a very low elevation and vulnerable to even small amounts of sea-level rise. The project would involve installing a series of culverts under Boathouse Road to provide better hydrologic connection to the west-side marsh.

The analysis showed that the elevation at the Welder Flats site is so low that most of the existing marsh today would convert to submerged habitat by 2050, with or without restoration. While the project would allow the area west of Boathouse Road to keep up with sea-level rise a little bit longer, *it is still not enough to maintain intertidal habitats through 2100.* The project is relatively low in cost and would create a significant amount of temporary climate benefits through assumed migration of submerged vegetation, but any credits generated would be at risk of reversal due to sea-level rise before the 100-year permanence required by standards like Verra's.

Boathouse Road at Welder Flats © Lindsey Sheehan, ESA

3. Beneficial Use of Dredged Material

BUS 6 Site in Corpus Christi Bay © Port of Corpus Christi Staff

In 2017, the Port of Corpus Christi Authority (PCCA) completed the La Quinta Terminal Aquatic Habitat Mitigation project at the BUS 6 site. The project provided compensatory mitigation required by the U.S. Army Corps of Engineers (USACE) to offset impacts due to the expansion of the navigational channel on the north side of Corpus Christi Bay. The project involved construction of an approximately 9,000-foot armored berm (with 185 acres of dredged material placed behind the berm) and planting of smooth cordgrass and shoal grass/seagrass. Because this project is compensatory mitigation for the La Quinta Terminal, it would not qualify for blue carbon credit generation as the project would not be considered additional. However, it still provides an important case study for the viability of beneficial reuse of dredged material projects to generate carbon credits.

This analysis showed that the La Quinta Terminal Aquatic Habitat Mitigation project has low financial feasibility for blue carbon project development due to the high cost of project activities. Further, while the PCCA owns the site, other projects with seagrass restoration would have to navigate a lease and the legal considerations of selling credits with the Texas General Land Office (GLO), which owns and manages submerged lands statewide. *However, other beneficial use projects may be more financially viable if dredging is required for other purposes.* For example, the Gulf Intracoastal Waterway requires regular dredging, so a project in the vicinity of the waterway may be cost effective. Beneficial reuse of dredged material could also be used to help marshes keep up with sea-level rise through thin layer placement. This would be cheaper if a site is already established, unlike the BUS 6 site, where a berm had to be built before the dredged material could be placed to create the habitat. Helping marshes keep up with sea-level rise would maintain existing soil carbon as well as the habitat.

4. Erosion Control

Two sites were analyzed for erosion control projects. The Cohn Preserve/Croaker Hole wetland complex includes wetlands, tidal flats, coastal prairie, mangroves, and seagrass. The site is challenged by shoreline breaching and rapid shoreline retreat set in motion by recent storms and the winter freeze in February 2021, further destabilizing the shoreline. Local project partners cite a shoreline erosion rate of at least 5–10 feet per year. The proposed project would involve construction of two graded riprap breakwaters, set to an elevation to attenuate typical winter storm waves, with sediment placed landward of them to form high to low marsh habitat. The project would protect the exposed bay shoreline and the back bay system. The analysis showed that since the project only protects the habitat directly behind the breakwater (roughly 1,400 linear feet), the carbon benefits are relatively low (490 metric tons CO2 equivalent), and the project cost relatively high (nearly $4.2 million). *The current project scale would not be a feasible blue carbon project due to financial infeasibility.*

The second erosion control site is at Mad Island Marsh Preserve along the Gulf Intracoastal Waterway in Matagorda County. Its location along the waterway has led to erosion problems, with 1 to 3 feet of the shoreline eroding each year on average and rates as high as 8 ft/yr in some locations (Mangham 2005). To address this problem and protect critical habitat, TNC is leading an effort to construct a 2.3-mile nearshore breakwater along the shoreline of the preserve. The project has progressed to 60% of engineering design as of May 2022. The analysis showed that the project results in more emissions than the non-project scenario because the project protects a large area of freshwater marsh that emits a substantial amount of methane. In the non-project scenario, saltwater intrusion will likely cause a habitat conversion from freshwater marsh to salt marsh, which produces negligible methane. As a result, the project is not technically feasible as a blue carbon project.

These two examples of erosion control projects demonstrate the need for a scalable project size where protection of saline estuarine habitat is the focus.

Photos, top to bottom: Mad Island Marsh Preserve © Steven Goertz; Francine Cohn Preserve © Lindsey Sheehan, ESA; Francine Cohn Preserve © Sonia Nájera

Site Analysis Conclusions

Table 1. A summary of the projects and feasibility considerations.

Site	Project Type	Approx Size (ac)	Cost[1]	Project Lifespan[2] (years)	Carbon Sequestration Benefit of Project over Baseline (t)	Break-even Price (per t)	Feasibility
Port Bay	Land or easement acquisition	1,200	$1,000,000	100	236,000	$14	Feasible if proof of additionality
Welder Flats	Hydrologic restoration	5,940	$326,000	77	42,500	$57	Low technical feasibility due to SLR
La Quinta Terminal	Beneficial use of dredged material	75	$5,183,400	60	10,700	$1,590	Low financial feasibility
Cohn Preserve	Erosion control	100	$4,049,000	30	490	$4,000	Low financial and technical feasibility due to scale
Mad Island	Erosion control	380	$10,000,000	100	(1,117,300)	N/A	Technically infeasible

1. Project implementation cost only. 2. Habitat longevity before it is drowned due to sea-level rise.

Above: Port Bay near Rockport, Texas © Kenny Braun

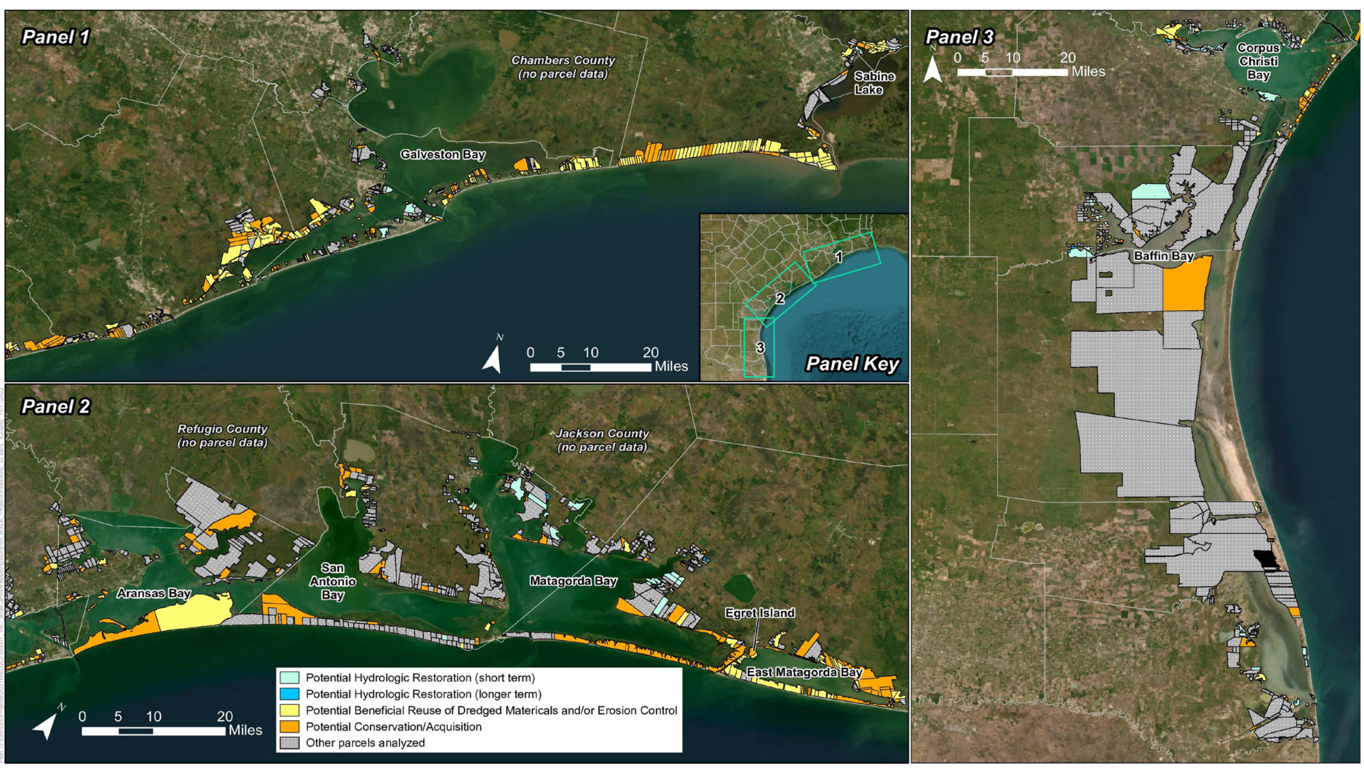
Landscape Feasibility

An analysis was done to evaluate where conservation, hydrologic restoration, beneficial use of sediment, and erosion control projects could occur along the entire Texas coast. To identify land-based, blue carbon credit project opportunities, parcel data from Texas Natural Resources Information System were intersected with a variety of other datasets to characterize parcels by vulnerability to flooding, size, and current landcover use/habitat type.

Parcels mapped as grassland, barren, pasture/hay, developed open space, or shrub/scrub and that are vulnerable to 4 feet of sea-level rise were identified as potential conservation easement or acquisition sites. These sites would be analogous to the Port Bay site—that is, by conserving the property now, land would be preserved for wetlands migration space as sea-level rise progresses. These results are visualized in **Figure 1** as the orange parcels. There are 795 parcels identified as conservation/acquisition sites comprising more than 630,000 acres. While more site-specific data is needed to accurately evaluate the potential blue carbon credits for these sites, a (very) rough estimate shows that land or easement acquisition that would allow lands to convert to wetland by 2100 could result in sequestration of up to 18 million metric tons of CO_2 equivalent. Additional analysis would be needed to determine the threat from development and ensure additionality.

Sites that are currently classified as barren land, cultivated crops, developed open space (primarily lawns), and pasture/hay—and which abut current-day shoreline—could be candidates for hydrologic restoration. This concept relies on the assumption that agricultural or urban development on the Texas Coast may be built out on top of historic marshes, as is much of the United States. However, the hydrologic conditions needed for restoration are difficult to determine from this kind of desktop analysis, requiring local knowledge to further develop. Parcels of those land cover classes within 1 foot of Mean Higher High Water were mapped as candidates for short-term hydrologic restoration. Parcels that would be inundated with 4 feet of sea-level rise were mapped as potential long-term hydrologic restoration sites. These are shown in light (short term) and dark (long term) blue in Figure 1. There are 134 parcels identified as hydrologic restoration sites and more than 81,000 acres.

The potential amount of blue carbon can be (very) roughly estimated by assuming that these short-term sites are grassland under baseline conditions and could be converted to salt/brackish tidal marsh under project conditions and maintained as wetland for 30 years. This could result in 3.2 million metric tons of CO_2 equivalent being sequestered by 2060. For long-term sites, assuming restoration occurs in 2080 and the sites are maintained as wetlands for 20 years (since sea level will be rising faster than in 2030), the sites could sequester 380,000 metric tons of CO_2 equivalent by 2100.



SOURCE: MRLC, NOAA, TNRIS

TNC Blue Carbon Feasibility Study

Figure 1. Wetland Conservation and Restoration Opportunities

Parcels mapped as primarily wetland and vulnerable to 1 foot of sea-level rise were assumed to be potential beneficial reuse of dredged material projects (e.g., via thin-layer placement) to prevent drowning in the near term. While erosion data for the entire coastline is not available, this category of parcels could also potentially benefit from erosion control projects like the Mad Island and Cohn Preserve case studies.

In the next phase of work, sites where erosion control projects may be feasible could be identified by analyzing wind fetch data to determine the wave energy at a site, and/or by speaking with local land managers to understand where erosion rates are the highest. There are 316 parcels identified as beneficial reuse of dredged material sites and more than 253,000 acres. The potential amount of blue carbon can be (very) roughly estimated by assuming that beneficial reuse of dredged material or erosion control helps maintain these wetland areas for 30 years longer than under baseline conditions. This could result in 17.9 million metric tons of CO_2 equivalent sequestered over 30 years. However, the permanence of wetland habitat later in the century needs to be evaluated for the feasibility of carbon credit projects.

Photos, top and bottom: Port Bay © Kenny Braun

Conclusions and Future Considerations

The landscape of the Texas Gulf Coast and its blue carbon habitats offers many lessons for carbon credit project development. The Port Bay (land or easement acquisition site) could be potentially viable on the voluntary carbon market; however, additionality challenges remain. The Welder Flats site would also be viable if additional management or restoration measures taken could ensure 100-year permanence. None of the remaining three sites studied here would be viable in their current state on the voluntary carbon market, but it is important to remember that they have unique combinations of characteristics that make it difficult to generalize outcomes by project type.

Overall, there are challenges in using the carbon market to incentivize projects which are immediately vulnerable to sea-level rise due to permanence issues, or to preserve future wetland migration areas due to the complexity of demonstrating threat and emission impacts once converted. Wetland migration projects also often have longer-project timelines, depending on the rates of erosion, habitat loss, and subsequent expansion of wetlands into upland habitat. It could be a challenge to balance the timeline of credit generation with the expectation of offset purchasers.

The analysis indicated that land/easement acquisition and hydrologic restoration projects are the more promising methods, while beneficial reuse of dredged material may be feasible in different situations. When protecting parcels that have a credible, serious threat of development (i.e., can argue additionality), land or easement acquisition was the most cost-effective case study in this report. Acquisition of (or placing a conservation easement on) existing marsh habitat provides the largest difference in carbon between baseline (no-project) and project scenarios. It's the only project type where the existing soil carbon pool across the entire site is lost in the baseline condition. The historic buildup of carbon in the soils is much greater than the amount of carbon that can accumulate over the course of the study, so projects that prioritize protecting this carbon pool will result in the biggest carbon benefit. However, this may be the highest-risk project type because it relies on proving that development would occur, which is challenging to prove definitively. Additionally, local research is needed to understand the timing of carbon release back into the atmosphere due to the proposed development.

Based on the case studies, the hydrologic restoration project at Welder Flats was the cheapest project type by an order of magnitude. Similar projects that could dramatically improve the functioning of a wetland system for a low price are much more likely to be viable on the voluntary carbon market than high-cost projects like the erosion control projects at Cohn Preserve/Croaker Hole and Mad Island Management Preserve. The high cost for projects involving breakwaters or a flood protection berm (at La Quinta Terminal Mitigation site) is likely to make these projects infeasible, unless the project can be scaled to a larger wetland project area.

While not specifically analyzed, projects involving beneficial use of sediment are expected to both protect existing carbon pools from sea-level rise and encourage the development of new stores of carbon. Several groups have beneficial reuse planning, including the GLO, Ducks Unlimited, USACE, and PCCA; this is a topic of growing interest across the industry. Thin layer placement of dredged material is an emerging restoration technique that helps marshes keep up with sea-level rise and may be a cost-effective way to beneficially use dredge spoils, if the distance between the dredge and placement sites is five miles or less. A project with existing marsh that is expected to be lost to sea-level rise and that uses thin layer placement to maintain habitats may be feasible on the voluntary carbon market.

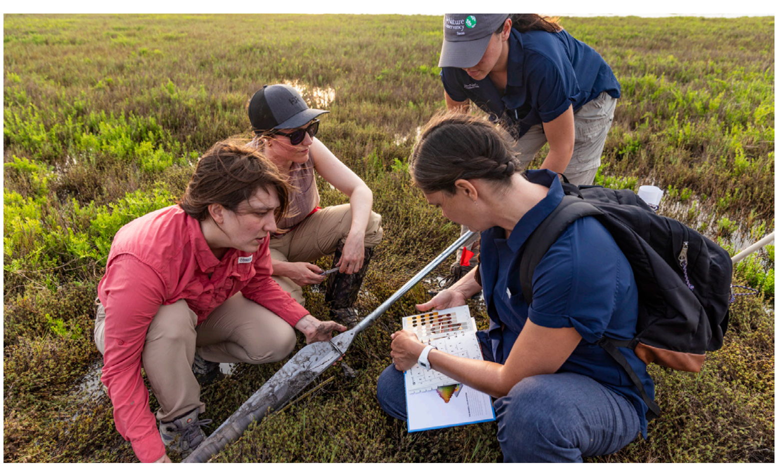
As the financial landscape of carbon credits develops, it will be important to stay informed of changes and how they may affect the viability of carbon projects. This study found that in the market's current state, viable projects should consider near-term habitat impacts that can generate a carbon benefit over the next decade to entice near-term investment from carbon offset buyers. In addition, larger project scale is required for financial feasibility. Any project progressing past this pre-feasibility stage will require more thorough legal review of relevant and current title report and easement documents. Finally, as climate change exacerbates existing environmental inequities, carbon credit projects can more carefully consider opportunities for meaningful community involvement or benefits.

Blue Carbon Ecosystem Benefits

SPECIES
Over 95 percent of Gulf of Mexico recreational and commercial fish species rely on Texas coastal wetlands during their life cycle.

RESILIENCE
Tidal wetlands buffer neighboring areas from flood damage and can reduce flood peaks by up to 60%.

WATER QUALITY
Wetlands filter and absorb nutrients and can remove 90% of sediments from run-off.



Left: Port Bay © Kenny Braun; **Right:** Cohn Preserve © Lindsey Sheehan, ESA

Next Steps

While this study considered five different projects, similar data needs and next steps were identified across the project sites. More site-specific data is needed to refine the technical feasibility for any project that moves forward, including:

- Topographic and bathymetric data
- Vegetation mapping
- Soil carbon pool quantity and sequestration rate by habitat type
- Erosion rates
- Accretion rates
- Salinity in different habitats
- Current title reports
- Future land-use changes
- Construction emissions from building the project

Additionally, next steps for projects along the Texas coast include:

- Analyzing how carbon credits can be considered permanent when habitats are faced with flat elevations, a small tide range, and sea-level rise. This could include habitat evolution modeling looking at a range of sea-level rise projections to better understand the sensitivity to sea-level rise; studying what happens to soil carbon when habitats become submerged or eroded; and studying how seagrasses may be able to migrate into submerged habitats and maintain soil carbon.
- Working with the GLO to determine how existing submerged habitats could be credited, and how crediting could work for habitats that become submerged over the project timeline. Also working with GLO to understand the pricing structure for their leases and how it might change if credits are being sold.
- Identifying partners to work on legislation to authorize blue carbon sales.
- Identifying a marsh thin-layer placement project to assess the feasibility of a lower-cost, beneficial-use project. This could include working with groups who do regular dredging (PCCA or others such as USACE) to better understand dredging placement requirements and costs.

Future scoping of pilot project locations should consider landscape interventions that could result in a larger project scale. The Texas Coastal Resiliency Master Plan may be a good resource to consider project location options. In addition to carbon credits, projects may consider quantifying resilience benefits for application of the developing Coastal Resilience methodology under Verra's Sustainable Development Verified Impact Standard. Resilience credits under this methodology are generated annually (in terms of risk reduction) and do not have the same additionality or permanence requirements as carbon credits.

Above: Port Bay © Kenny Braun