



# **Supporting natural coastal ecosystems to reduce the effects of climate change and flooding**

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# *What is Texas Coastal Exchange?*



- A non-profit conservation organization
- Dedicated to supporting the long-term resilience of the Texas coast
- Incorporated as a Texas Non-Profit Organization, applied for Federal 501(c)3
- Launched our first initiative in August 2019

## *Mission*

To educate the public and **develop, test, and implement** innovative tools and approaches to promote the protection and restoration of coastal habitats.

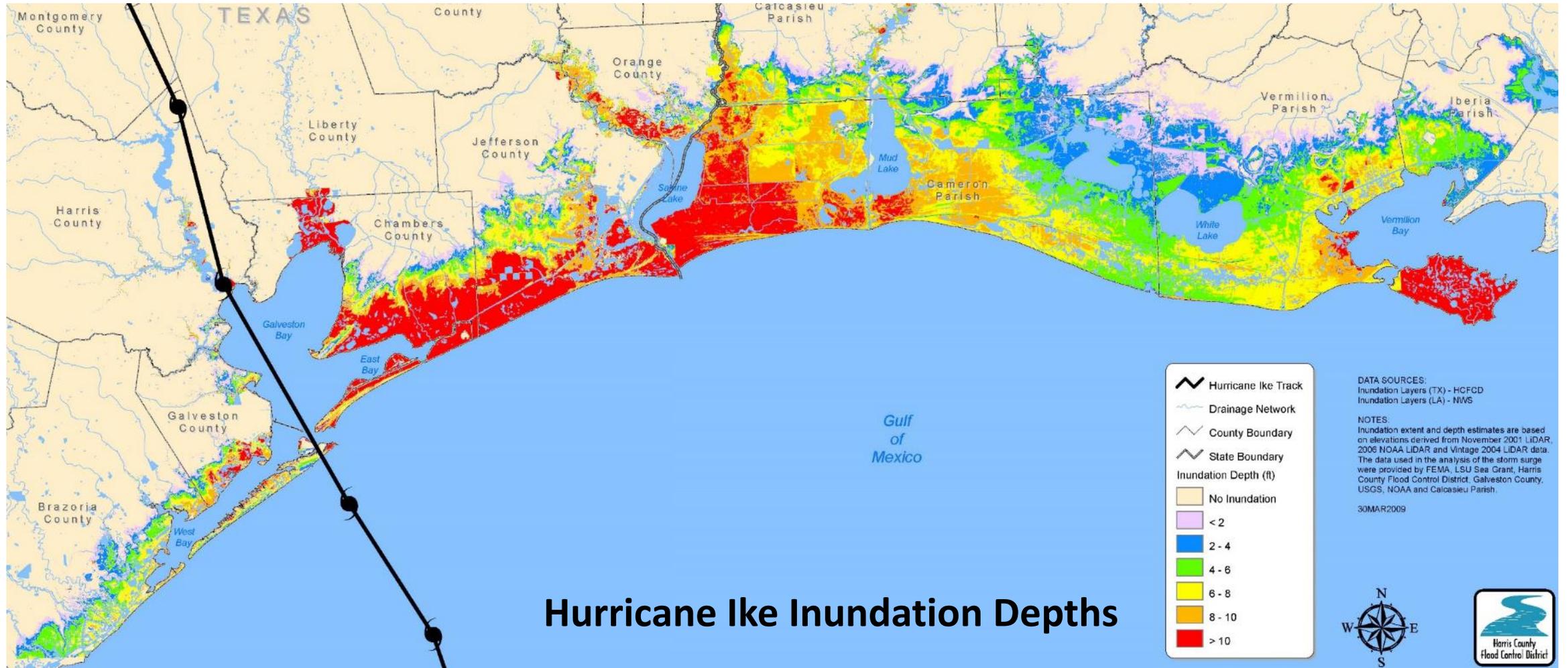
## *Vision*

To help build a resilient Texas coast supported by an informed public who values the great natural ecosystems of our region and understands and supports the benefits they provide to us all.

# Initial inception: Hurricane Ike



Built off of post-Ike Research at Rice University's SSPEED Center



# Observations



## Flooded Marsh

- Reduces surge energy
- Holds flood waters



## Recovers rapidly

- Sediment and nutrient dispersal can promote increased productivity

# How to Protect Natural Coastal Lands?



Has evolved over 10+ years into multiple initiatives



- Non-profit
- Regional Texas Coast focus
- Donor and grantee framework
- Education and outreach is a major component

Houston  
Wilderness  
Green Think  
Tank



Rice University  
SSPEED Center



Louisiana  
Coastal Exchange



- Project based approach
- Estimates values of all ecosystem services for mitigation

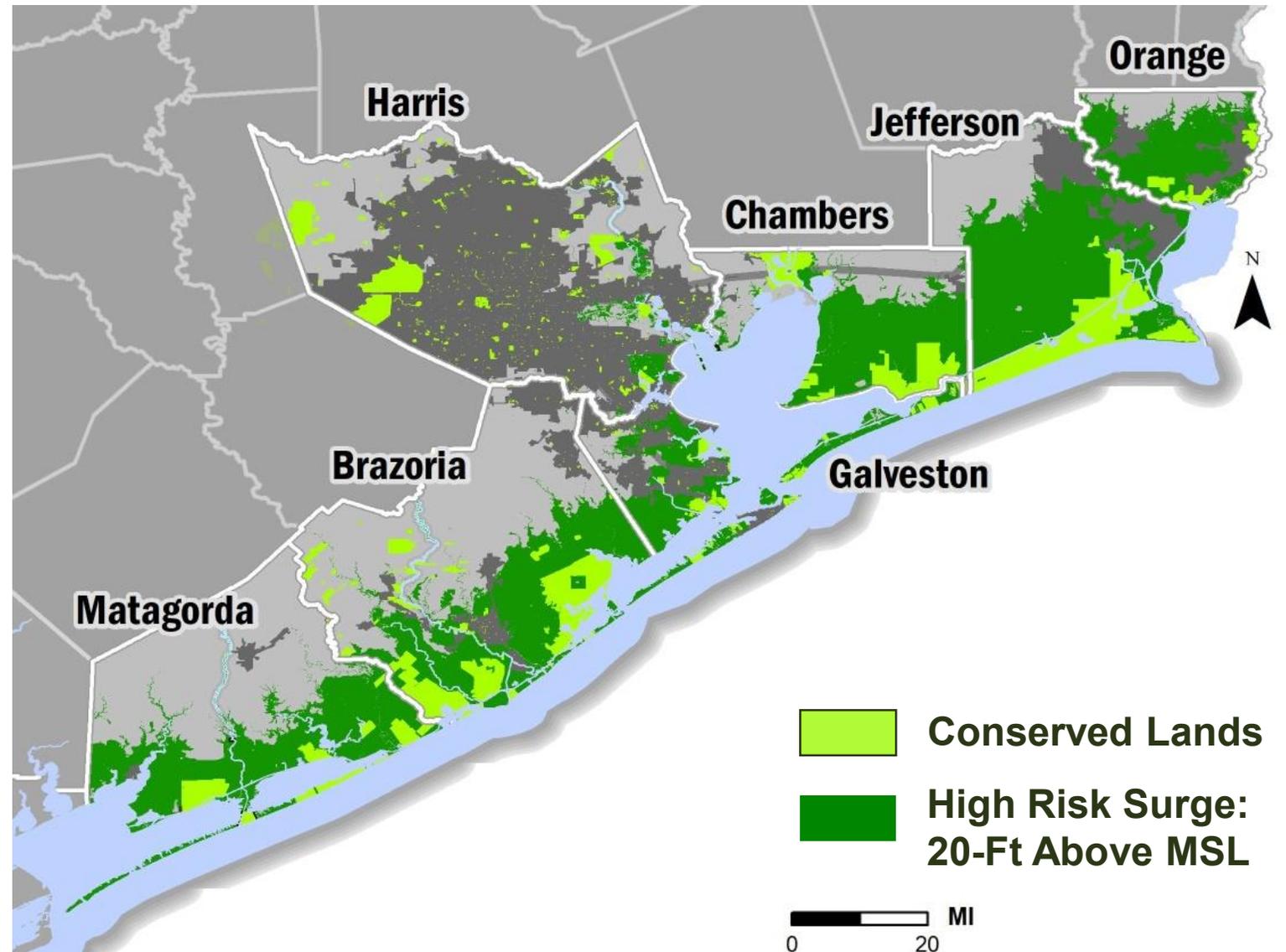


- For profit public benefit corporation
- Grazing and rangeland
- National focus
- Large volume carbon markets

# How to Keep These Natural Lands Natural?

How do we incentivize protecting 2 million acres at or below 20 ft elevation?

- Majority privately owned
- Especially inland areas
- More susceptible to development
- **Ecosystem Services** being provided by these natural lands benefit all
- Often go unnoticed, until they are lost to development



# Coastal Landowners

- Ranchers, farmers, as well as conservation organizations
- Have strong link to their land and are often invested in keeping it natural
- Difficult to maintain large areas of natural lands



Ranchers and cattle along the upper Texas Coast crossing the Gulf Intracoastal Waterway.  
Photograph by Geoff Winningham



From [www.houstontx.gov](http://www.houstontx.gov)  
Sunrise over Buffalo Bayou  
Photo © Robb Harper

# General Public

- Concentrated in Houston metro area
- Receive benefits from the natural coastal lands
- May not be aware of them
- Limited means to support them

# *Numerous ecosystem services provide benefits to the public*



- Storm surge protection
- Flood storage
- Carbon sequestration
- Water supply enhancement
- Fishery productivity
- Endangered species habitat
- Neo-tropical migrant bird habitat
- Waterfowl habitat



# Focus on Carbon Sequestration



- The amount of CO<sub>2</sub> that is removed from the atmosphere and stored as live and dead plant material both above and below ground per year

## Annual Carbon Storage Rate

- Measured in tons of CO<sub>2</sub> per acre per year
- Focus on long-term storage in soil and woody biomass (decades to centuries)
- Use peer reviewed scientific literature to estimate an average annual carbon storage rate for different ecosystems



***Coastal Wetlands***

Initial Launch 2019



***Bottomland Hardwood Forests***

2020



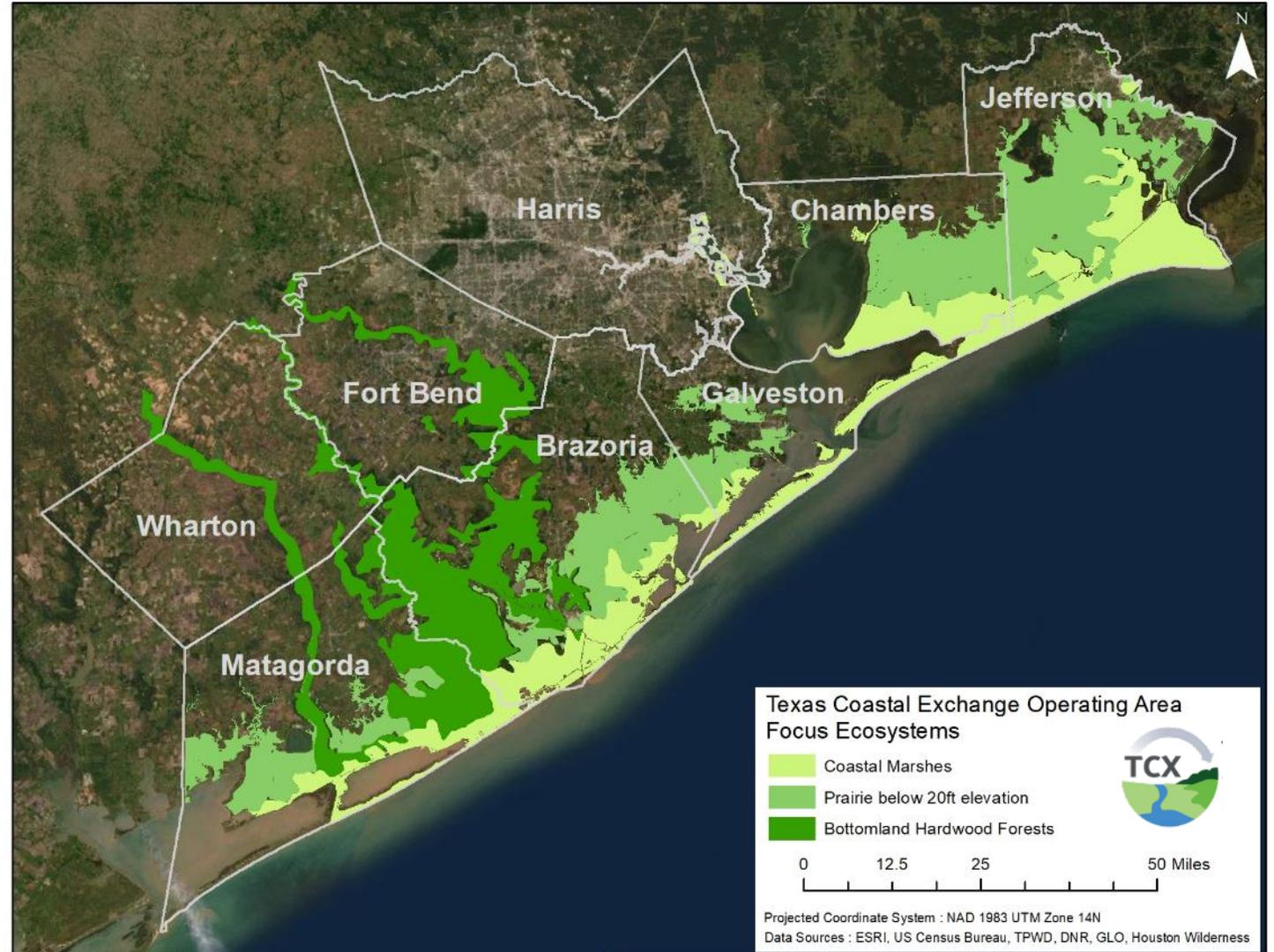
***Coastal Prairies***

2020

# Operating Area and Focus Ecosystems



- Focus on the upper Texas coast from Matagorda County to Jefferson County
- Include Sabine Lake, Galveston Bay, and Matagorda Bay
- Includes:
  - Coastal wetlands
  - Bottomland hardwood forests
  - Prairies below 20 ft elevation



# Salt and Brackish Wetlands



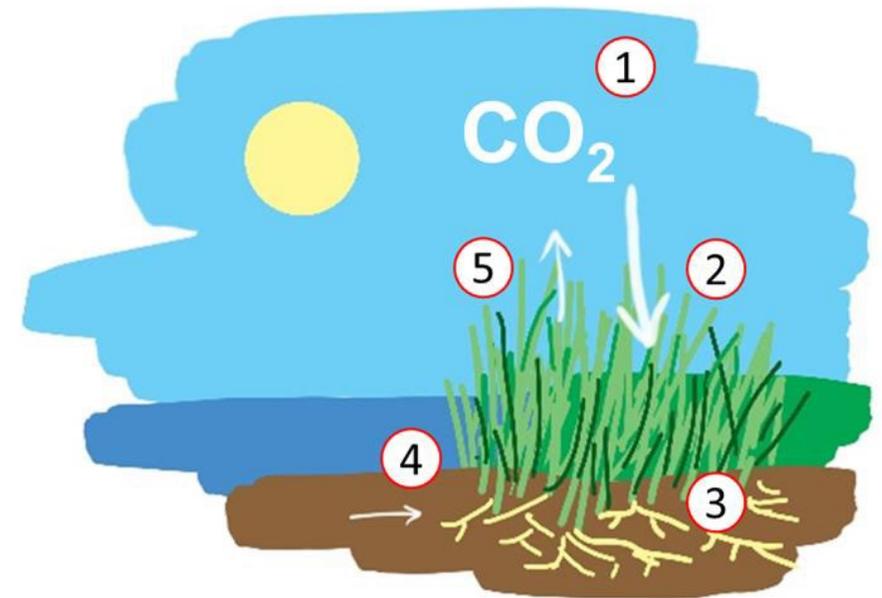
- First line of defense with regard to storm surge
- Numerous ecosystem services
- Despite protections, 1000s of acres lost every year
- Incentivizes landowners to allow coastal marshes to migrate inland

“Coastal Squeeze”

- High rates of annual carbon storage in soil
- Published literature values better constrained
- Focus on upper Texas coast
  - Matagorda County to Jefferson County
- Determined a representative annual carbon storage rate for upper Texas coast salt and brackish marshes:

**2 metric tons of CO<sub>2</sub> per acre per year**

(Cahoon and Turner 1989; Callaway et al. 1997; Chmura et al. 2003; Cahoon et al. 2011; Hopkinson et al. 2012; Hanson and Nestlerode 2014; Ouyang and Lee 2014; Nahlik and Fennessy 2016; Hinson et al. 2017; Wilkinson et al. 2018)



1. Atmospheric CO<sub>2</sub> is at the highest level in human history.
2. CO<sub>2</sub> is removed from the atmosphere by plants through photosynthesis.
3. Plants use the CO<sub>2</sub> to grow, producing roots, leaves, and stems.
4. Dead roots remain in the soil because their decomposition is slowed due to tidal flooding by sea water, leading to high rates of carbon storage in coastal wetland soils.
5. Some of the CO<sub>2</sub> returns to the atmosphere due to plant and bacterial respiration, but the majority of it remains stored in

# Carbon Storage Program Overview



## Carbon Storage Maintenance Grants



Landowners submit grant applications along with maps of their property to be evaluated by TCX for inclusion in our annual carbon storage capacity.



The carbon storage capacity is determined based on property size, ecosystem type, and carbon storage rates based on values found in scientific literature.

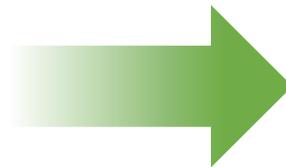
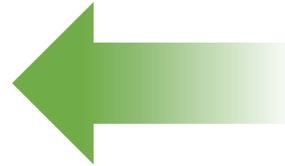
## Carbon Footprint Donations



Donations will support grants that will be distributed to landowners annually.



Donations will be accepted from individuals, organizations, and businesses until the total carbon storage capacity is filled.



# Carbon Storage Maintenance Grants



- Funded by Carbon Footprint Donations
- Made annually to participating landowners
- Rigorous application process
- Land Area Determination
  - Review of ecosystem extent by TCX science team
  - Using high resolution current and historical aerial imagery
  - LiDAR elevation data
  - National Wetland Inventory data
  - Other publicly available environmental datasets
- Once complete, ecosystem area is listed on the donation capacity database
- Guarantees that donations are only collected equivalent to the area of the coast that is being protected
- Distributed to on *pro rata* basis to landowners at end of fiscal year



Herff and Wyatt Cornelius, Sargent, TX. Melissa Phillip, Houston Chronicle

# Outline of Area Determination Steps



## Galveston Bay Foundation Pierce Marsh example

Obtain property boundary from land owner

Convert to GIS map file

Outline coastal wetland (salt and brackish marsh) area based on most recent aerial imagery



Total parcel size 2,242 acres



Estimated coastal wetland area from aerial imagery  
1,249 acres

# Outline of Area Determination Steps



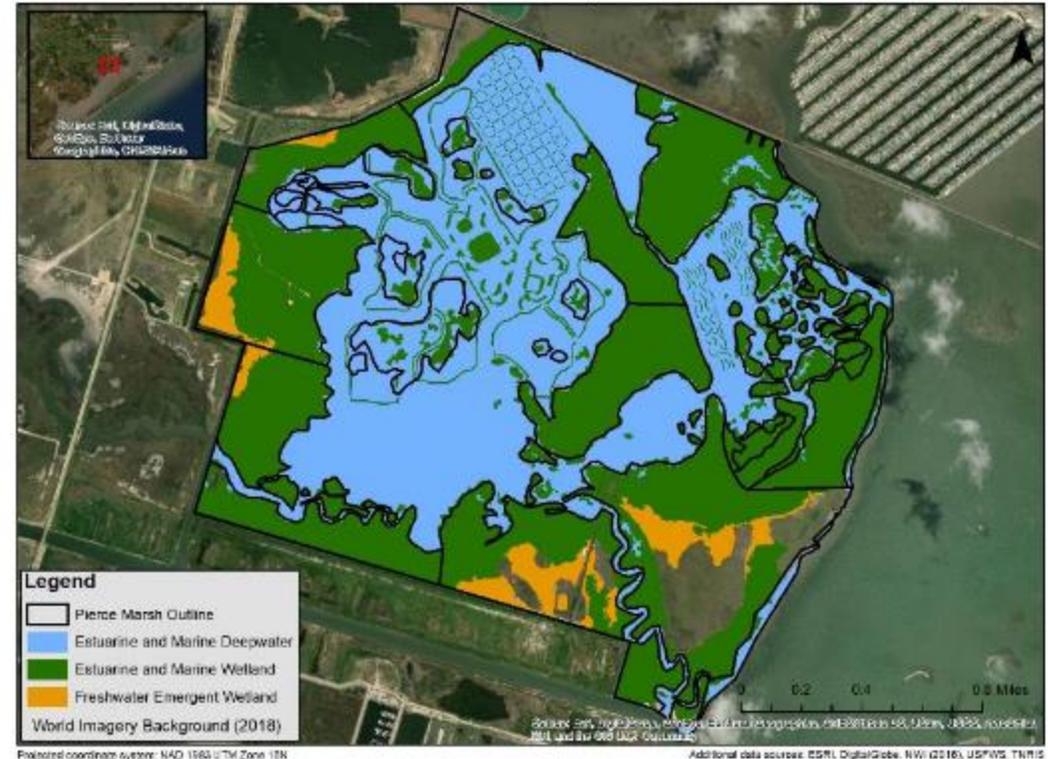
## Galveston Bay Foundation Pierce Marsh example

Look at historical aerial imagery to better understand areas that have changed over time, such as restoration or erosion

Look at National Wetland Inventory (NWI) maps, most recent release in 2016



Salt Marsh 1142 acres, Restored Salt Marsh 111 acres  
Both restored and natural salt marsh 1253 acres



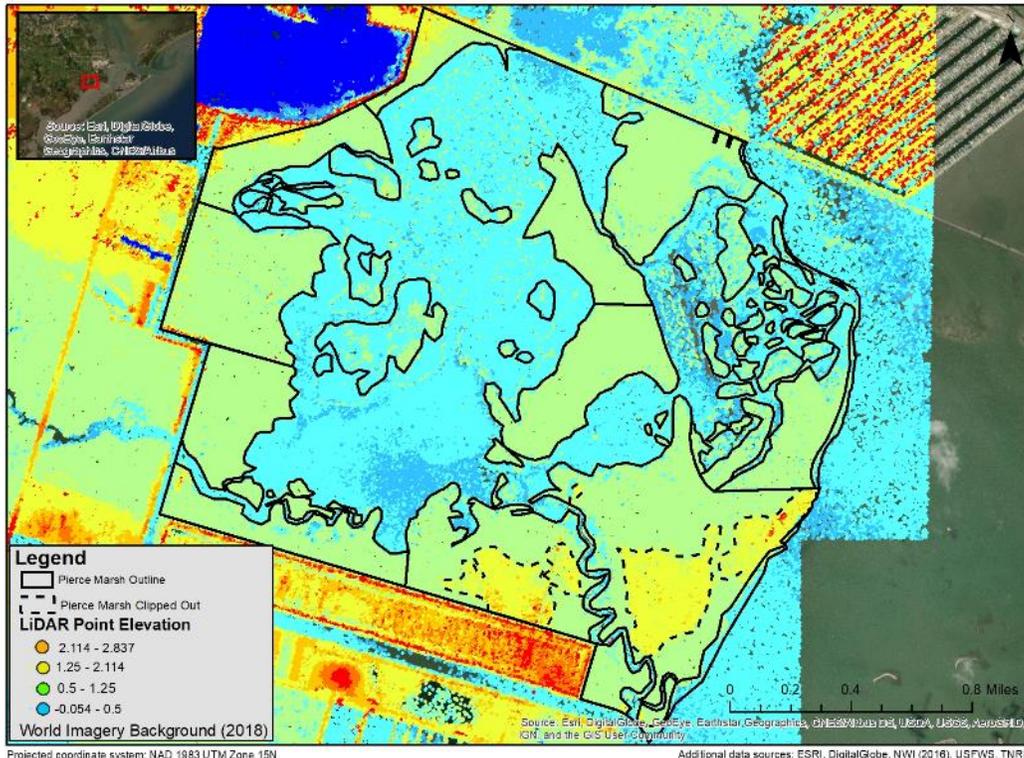
Restoration not included in NWI  
Freshwater emergent, will investigate further

# Outline of Area Determination Steps



## Galveston Bay Foundation Pierce Marsh example

Look at elevation relative to sea level, from publicly available state and federal LiDAR datasets



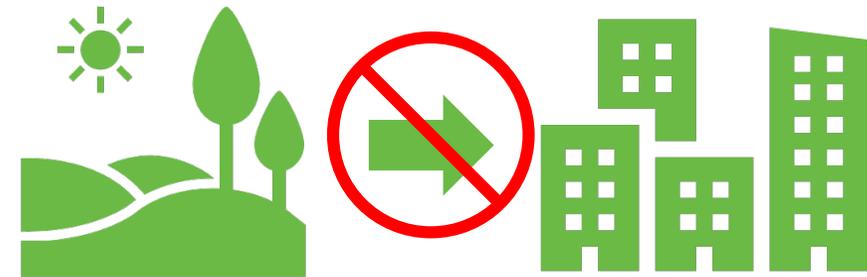
Expected elevation of densely vegetated salt marsh can be seen in light green, the higher elevation areas in yellow which correspond to freshwater in NWI were removed

Final salt and brackish marsh area determination  
**1130 acres**

# Carbon Footprint Donations



- Voluntary donations made by general public
- In an amount equivalent to their calculated **annual carbon footprint**
- First encourage and educate public on ways to reduce emissions
- Provide links to carbon footprint calculators at:  
[texascoastalexchange.org](https://texascoastalexchange.org)
- **Not a carbon credit or offset**
  - Donation goes to support the maintenance of the annual carbon storage equal to donors carbon footprint
- **Supporting ongoing natural carbon removal** from the atmosphere
- **Preventing Land Use Change**
  - An important component of reducing atmospheric carbon concentrations





# *How does donating to TCX affect atmospheric CO<sub>2</sub> concentrations?*

- Supports on-going annual carbon storage
- **Land Use Change** (natural → developed) contributes to CO<sub>2</sub> emissions
  - Releases of stored carbon stocks
  - Loss of ongoing carbon fluxes
- Supports **maintenance and protection** of current natural CO<sub>2</sub> removal from the atmosphere as well as the stocks built up over time
- **Incentivizes increased protection, restoration, and expansion**
  - Salt and brackish wetlands – “coastal squeeze”
  - Bottomland hardwood forests – logging and development
  - Coastal prairie – development

# Preventing Land Use Change



## IPCC Special Report on Climate Change and Land

<https://www.ipcc.ch/report/srccl/>

“Changes in land conditions, either from land-use or climate change, affect global and regional climate”

**Global Land Use and Land Use  
Change Net Emissions (2007-16)**

**$5.2 \pm 2.6 \text{ Gt CO}_2 \text{ yr}^{-1}$**



**Global Natural Land Net  
Removals (2007-16)**

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# Preventing Land Use Change



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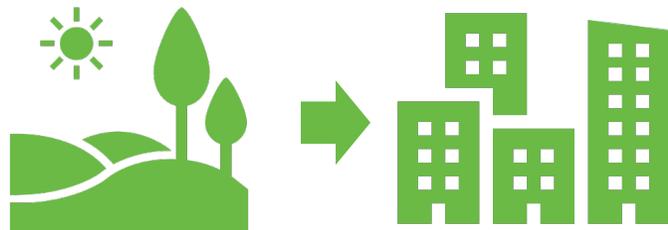
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**Want to see this  
decrease**



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# *TCX timeline and future outlook*



## *Last Quarter of 2019*

Continue Launch of Carbon Storage Program

Accepting donations to support 2019 participating landowners

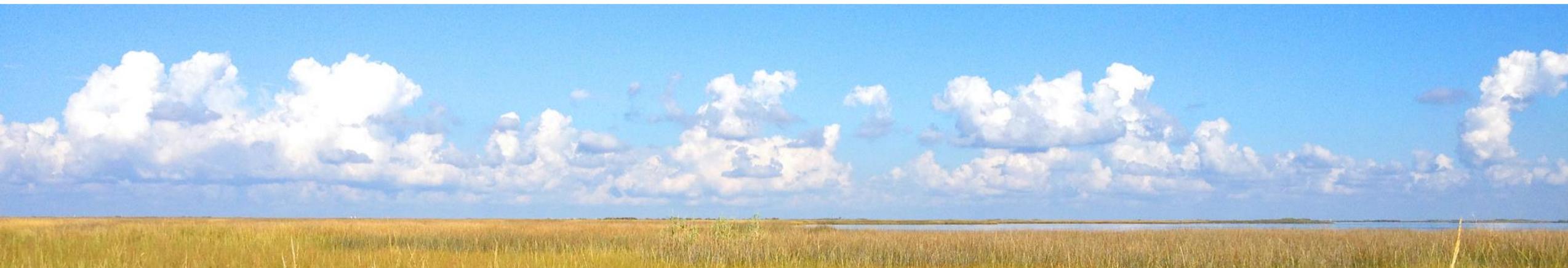
- Donation Inventory finalized Nov 1<sup>st</sup>

## *2020*

Will expand open to new landowner applicants and include additional ecosystems

Accepting donations to support 2020 participating landowners

Expand Education Outreach program





# Texas Coastal Exchange

Thank you!  
Questions?

Learn more at:

[texascoastalexchange.org](https://texascoastalexchange.org)

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