12-17-2021

Carbon Sequestration Benefits of Coastal Restoration

Brendan Player

Carbon Sequestration Benefits of Coastal Restoration

Hampton Roads Sea Level Rise/Flooding Adaptation Forum

Natural and Nature-Based Solutions (Part 2)

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Stantec

Brendan Player MS

Associate, Environmental Planner

Carbon Sequestration SME

- Environmental Consultant supporting Stantec Consulting Services Inc.
- Supports Williamsburg, Virginia, working out of Coral Gables, Florida
- Received Master's Degree at Christopher Newport University studying stream and wetland biogeochemistry and ecology
- Background in environmental restoration and water quality
- Assists in leading a core Technical Carbon Team (TCT) studying nature-based carbon solutions
- Stantec Subject Matter Expert (SME) in Carbon Sequestration
- Works from coast to coast and internationally analyzing carbon impacts and storage across a variety of ecosystems (i.e., tidal marshes, mangroves, seagrasses, peatlands, forests, grasslands, and agriculture)
- Supports clients in generating carbon offsets for use in fulfillment of their corporate sustainability goals

- Personal: musician and married to a choral conductor

https://www.stantec.com/en/people/p/player-brendan

SaferTogether™

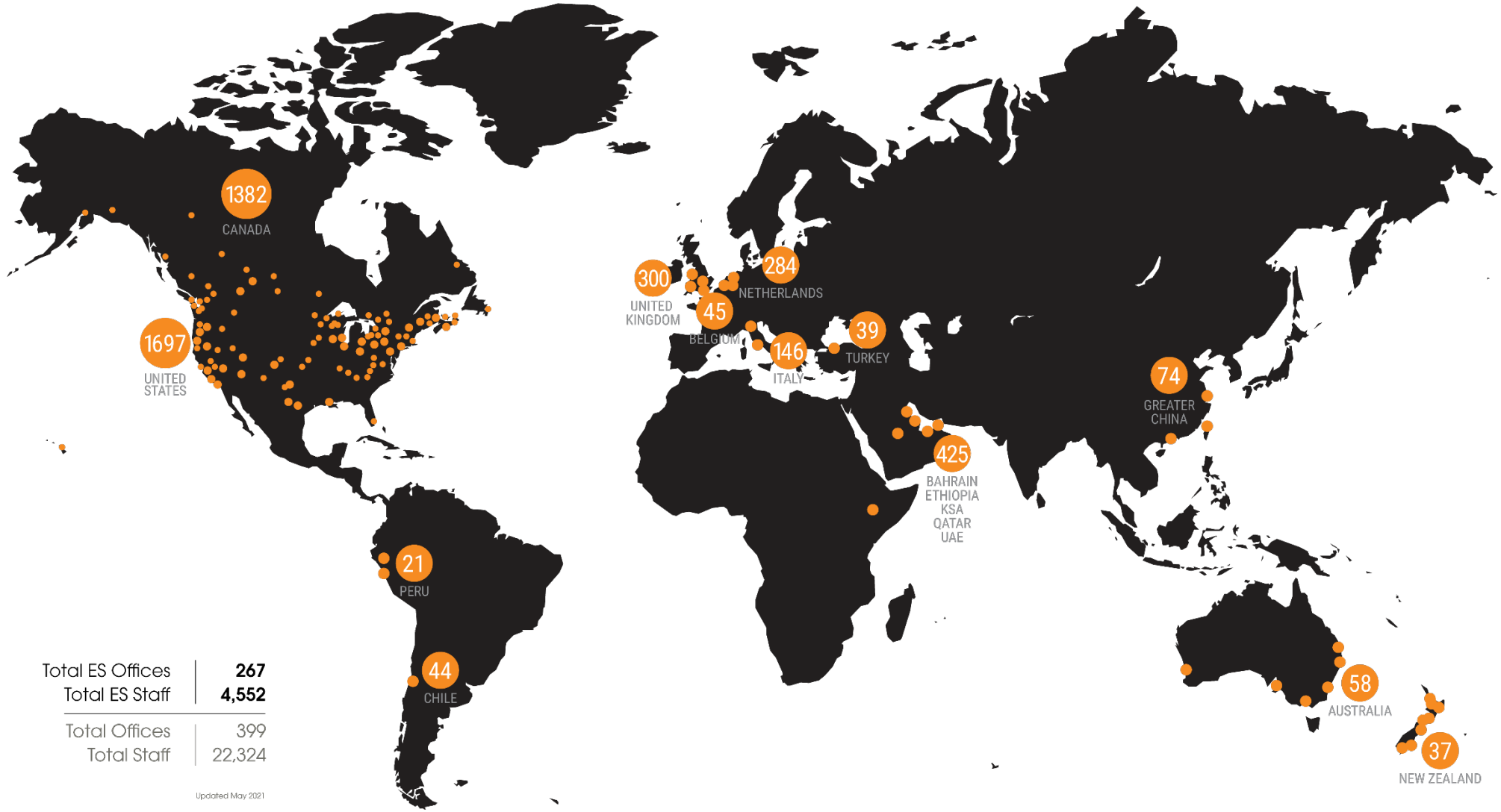
Safety Moment

Beware of ice, snow, down tree limbs, and other drivers around the holidays.

Agenda

- Who we are
- Context
- Coastal restoration and blue carbon
- Blue carbon example
- Summary
- Questions

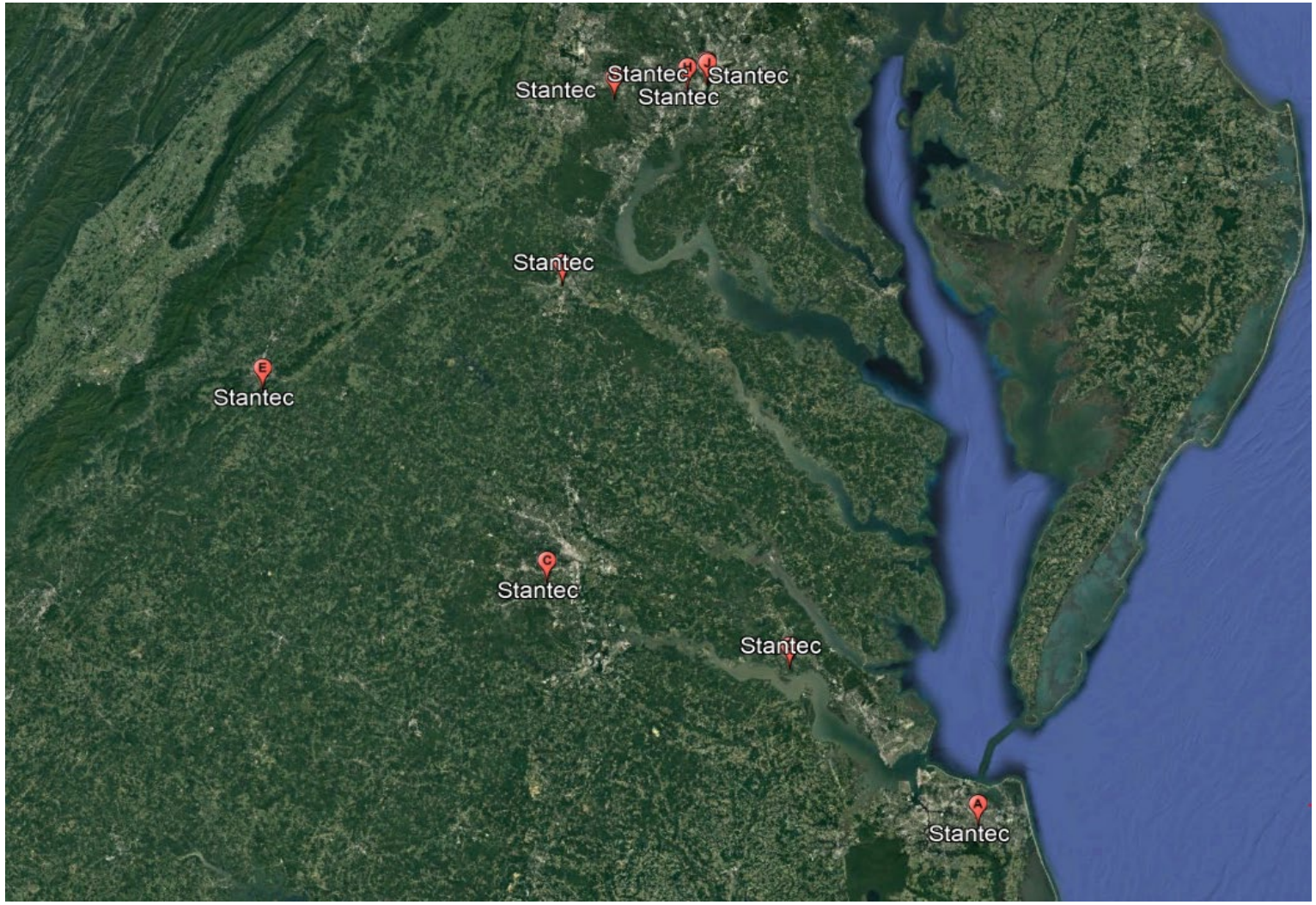
Where We're Located



Total ES Offices	**267**
Total ES Staff	**4,552**
Total Offices	399
Total Staff	22,324

Updated May 2021

Stantec in Virginia



Office locations instate

Arlington
Charlottesville
Fairfax
Fredericksburg
Richmond
Virginia Beach
Washington, DC
Williamsburg

Carbon Background

Compensatory versus voluntary market

MANY COMPANIES WORLDWIDE HAVE SET NET-ZERO OR CARBON NEUTRAL GOALS

Although definitions of Carbon Net Zero and Carbon Neutral vary, offsets are a significant part of any company's path towards these goals

Offsets= certified climate benefit representing either avoided emissions or improved capture

Unit of measurement= Metric Tonne of CO_2e

(verified carbon units, certified emissions reductions, etc.)

Offsets are quantified and certified under registry systems after having undergone a third-party review

Nature-Based Solutions (NbS)

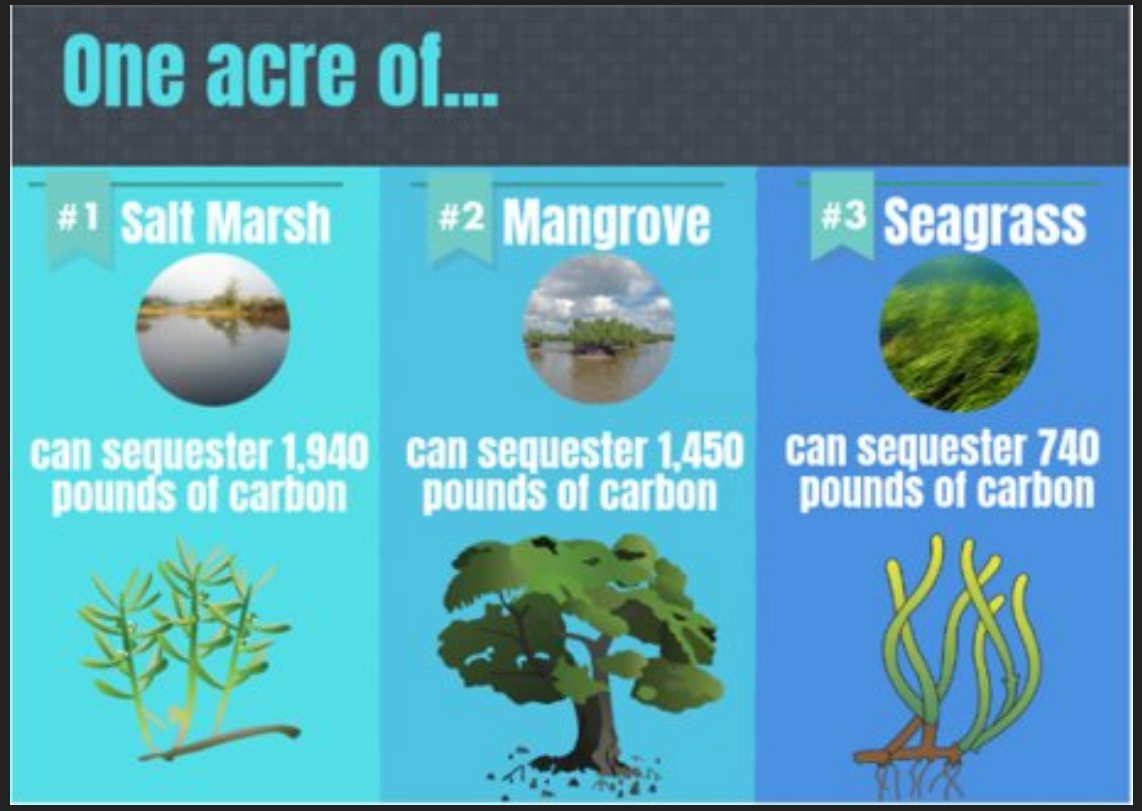
NATURAL SYSTEMS HELP COMBAT CLIMATE CHANGE AND GENERATE A VARIETY OF CO-BENEFITS

Ecosystems both release and capture different greenhouse gasses

- Targeted restoration, enhancement, and management strategies can either reduce emissions or improve carbon sequestration
- Climate benefits from certain projects can be quantified and occasionally certified for sale as offsets
- NbS for carbon can also generate a multiplicity of benefits
  - Water quality
  - Biodiversity
  - Infrastructure protection
  - Human health and wellbeing
  - Air quality
  - Etc.

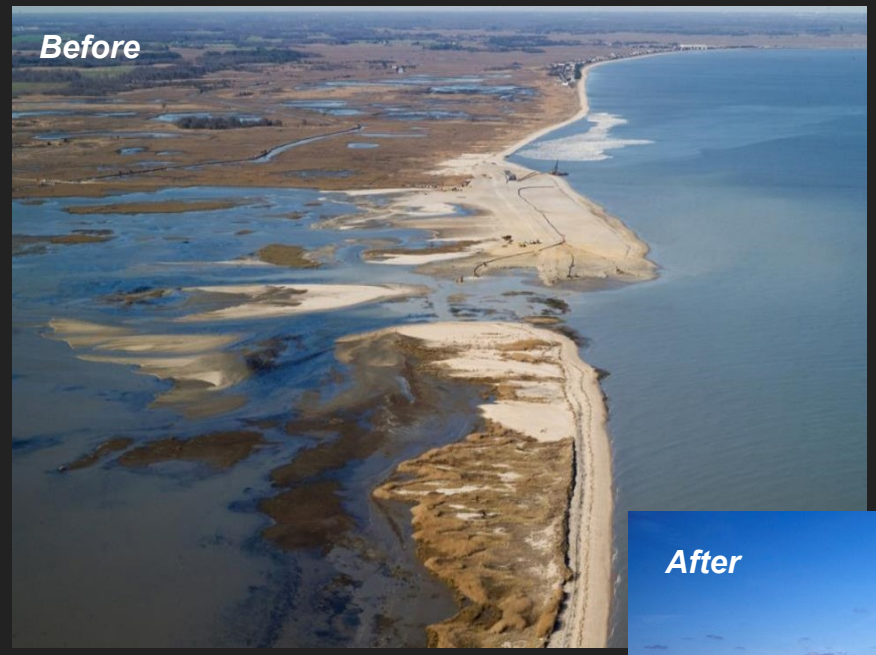
Coastal Restoration and Blue Carbon

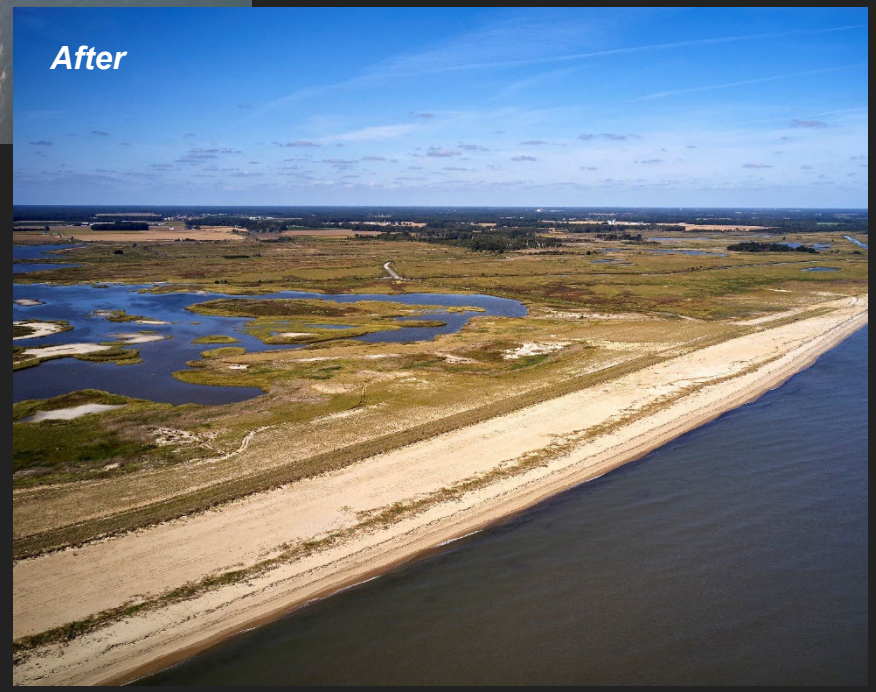
- **Blue carbon**: Greenhouse gasses produced and captured by tidal saline and brackish marshes, mangroves, and seagrasses
- Sequester a large quantity of carbon per unit area, while producing less emissions than freshwater wetlands
- Protect our coastlines by absorbing wave action and help to reduce flooding and damage to infrastructure



Prime Hook National Wildlife Refuge

- 10,000 acres of shoreline and wetland restored in Delaware following Hurricane Sandy
- $40M construction value
- Critical habitat for migratory birds, fish, and other wildlife
- Analyze hurricane impact to build protective beach barrier system
- Post-hoc assessment of carbon capture
- Brackish Marsh -> freshwater marsh -> degraded salt marsh -> brackish marsh





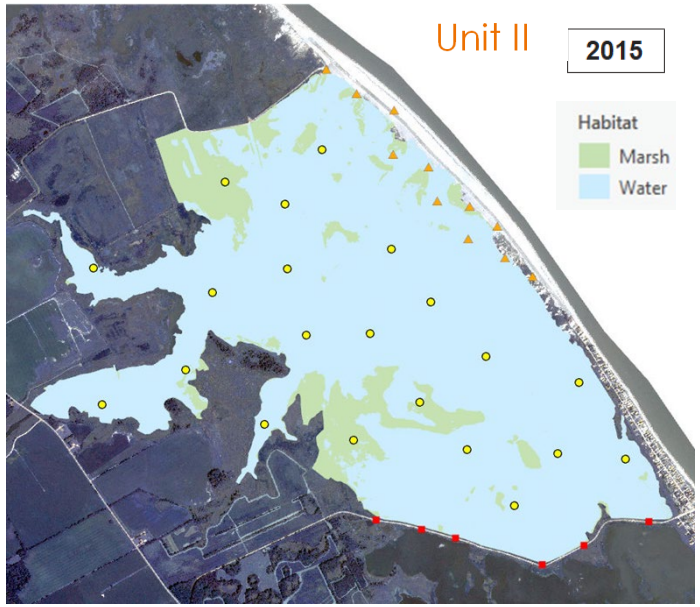
MILTON, DELAWARE

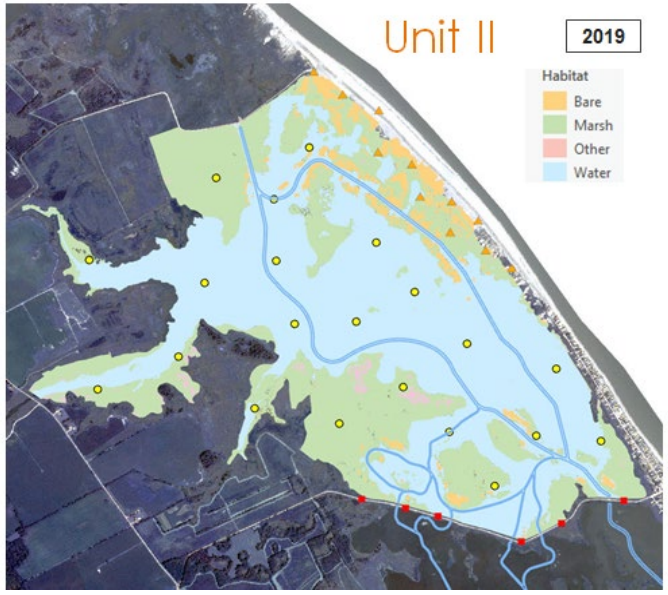
Prime Hook

Field Monitoring and Vegetation Growth

Unit II (Years 2015 to 2018)

- Open Water area decreased from 87% to 59%
- Marsh, bare ground, and other area increased from 13% to 41%
- Salinity characteristics remained similar between the degraded and restored condition





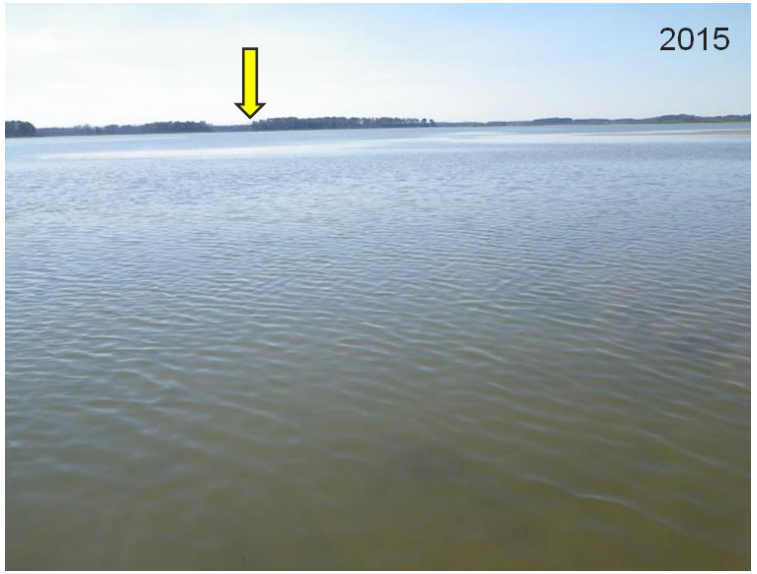
Prime Hook

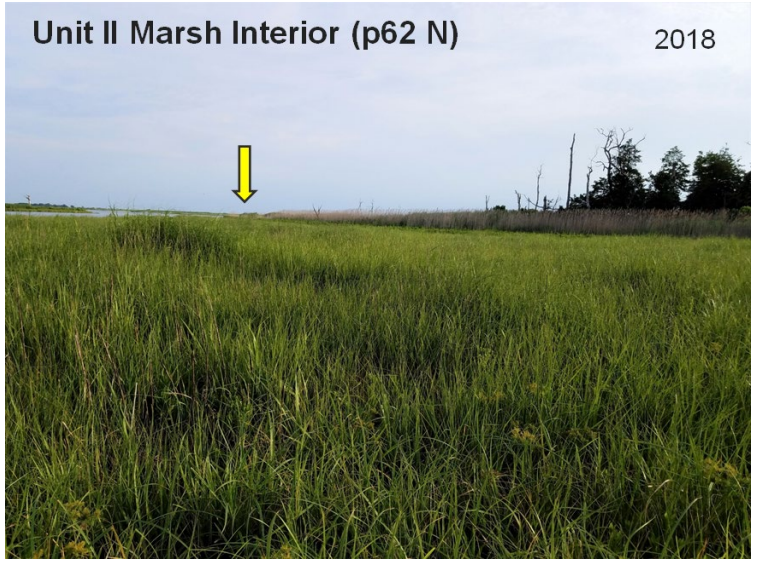
Vegetation Carbon Sequestration

Unit II (Years 2015 to 2018)

- Growth within the first year is roughly 3 t of carbon per hectare
- Growth beyond year one is a 1 to 1 ratio
- Small reversal in year 2019
- Total improved vegetative sequestration to date is 1,304.33 t CO_2e

Year	Hectares	Change in Hectares	Tonnes of Carbon
Baseline	412.38	0.00	0.00
2016	482.40	70.01	210.04
2017	691.22	208.82	208.82
2018	694.86	3.64	3.64
2019	628.09	-66.77	-66.77
		Total (t C)	355.73
		Total (t CO_2e)	**1,304.33**





Prime Hook

Soil Emissions

Unit II (Years 2015 to 2018)

- Salinity remained largely unchanged
- Enhanced carbon sequestration is derived from growing marsh area
- Onsite emissions will vary depending on soil characteristics, salinity, inundation, vegetation, etc.
- Does not factor in flux from open water areas

Scenario	Hectares	t CO_2 ha^{-1} yr^{-1}	t CH_4 ha^{-1} yr^{-1}	t CO_2e ha^{-1} yr^{-1}	t CO_2e yr^{-1}	Enhanced Annual Emissions Reductions (t CO_2e yr^{-1})
Baseline	412.38	-7.66	0.16	-3.31	-1,365.54	714.26
Project	628.09				-2,079.80	

https://coastalchangelab.files.wordpress.com/2019/01/finalreport_may_2018.pdf
https://link.springer.com/article/10.1007%2Fs13157-011-0197-0

Prime Hook Emissions Summary

Projection	Scenario	Marsh Area	4 Year Emissions (t CO2e)			30 Year Emissions (t CO2e)			4-Year Offsets	30-Year Offsets
		Ha	Soil	Vegetation	Total	Soil	Vegetation	Total		
Brackish degraded to brackish restored	Baseline	412	-5,462	0	-5,462	-40,966	0	-40,966		
	Project	628	-8,319	-1,304	-9,624	-62,394	-1,304	-63,698	4,161	**22,732**
Freshwater marsh to brackish marsh	Baseline	628	3,645	0	3,645	27,334	0	27,334		
	Project	628	-8,319	0	-8,319	-62,394	0	-62,394	11,964	**89,728**

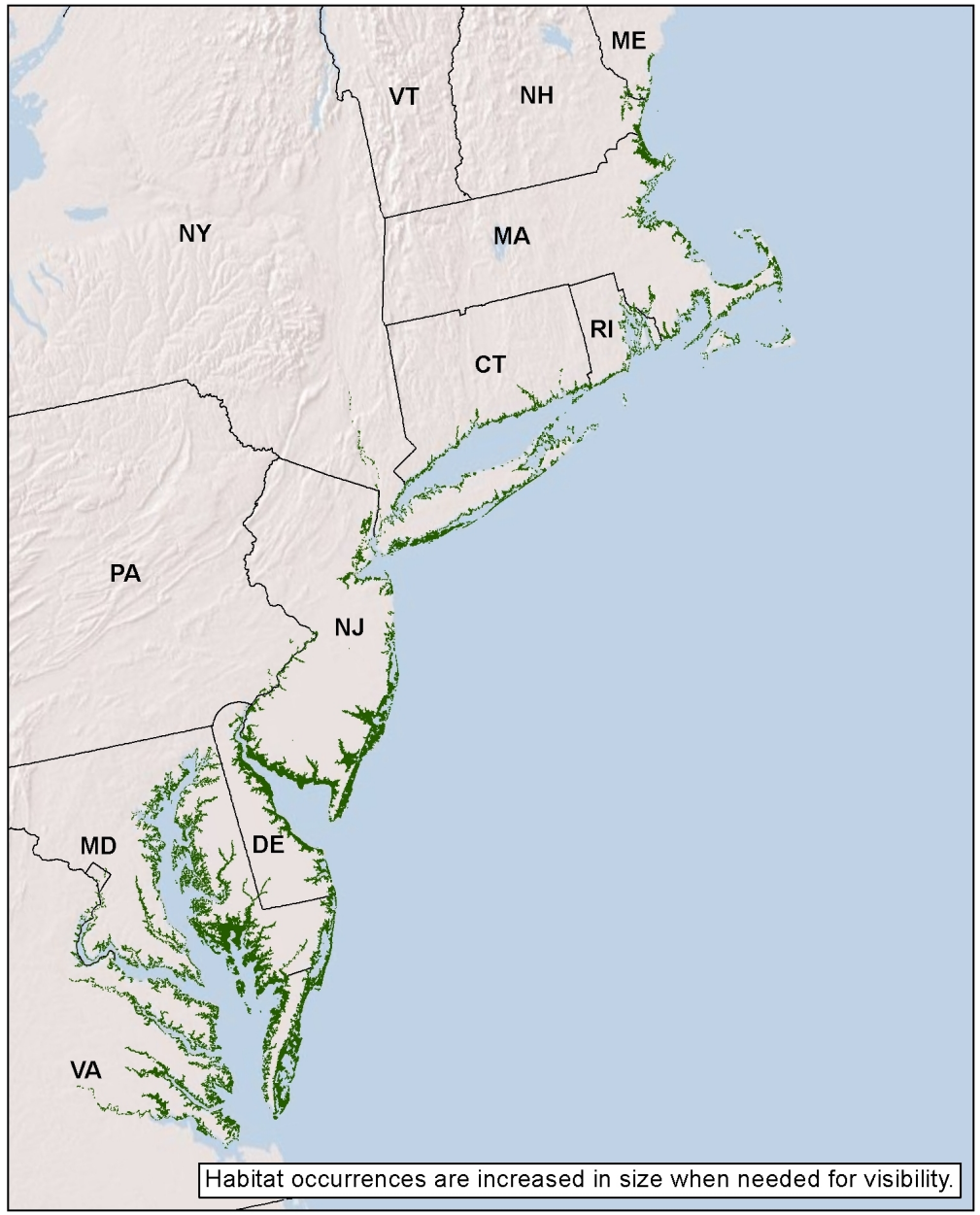
Prime Hook Example (degraded baseline conditions):

- Restoring Prime Hook generated climate benefits equivalent to approximately 4,161 offsets after 4 years
- The site had the potential to generate 22,732 offsets after 30 years
- 30-year projection assumes no further change in vegetation or marsh area

Salinity-Based Restoration:

- If the site would have been restored to brackish conditions from the original freshwater, it would have the potential to generate an estimated 11,964 offsets after 4 years and 89,728 offsets after 30-years

22,732 t CO_2e= 2,568,713 gallons of gasoline= 3,916 US drivers



Challenges and Opportunities

Challenges

- High degree of variability and difficult to predict
- Subject to non-permanence risks (sea level rise, hurricanes, etc.)
- Inundation, salinity, and vegetation type substantially change GHG flux
- Some coastal restoration projects can be engineering and cost intensive

Opportunities

- Brackish marsh net soil GHG sequestration= 1.34 tCO_2e per acre per year
- Coastal restoration generates many benefits outside of carbon
- The cost of carbon is increasing exponentially along with demands
- Looking towards States with extensive blue and teal carbon resources

Summary

- Blue carbon systems have high sequestration potential
- Coastal restoration can be used to generate creditable offsets representing a multitude of co-benefits
- Offset sales can be used to recover costs or generate revenue
- Projects that restore tidal wetland hydrology, altering inundation and/or salinity generate the highest credit yield for the lowest cost of implementation
- The cost of carbon is growing exponentially and is not expected to match the global demand

Questions?