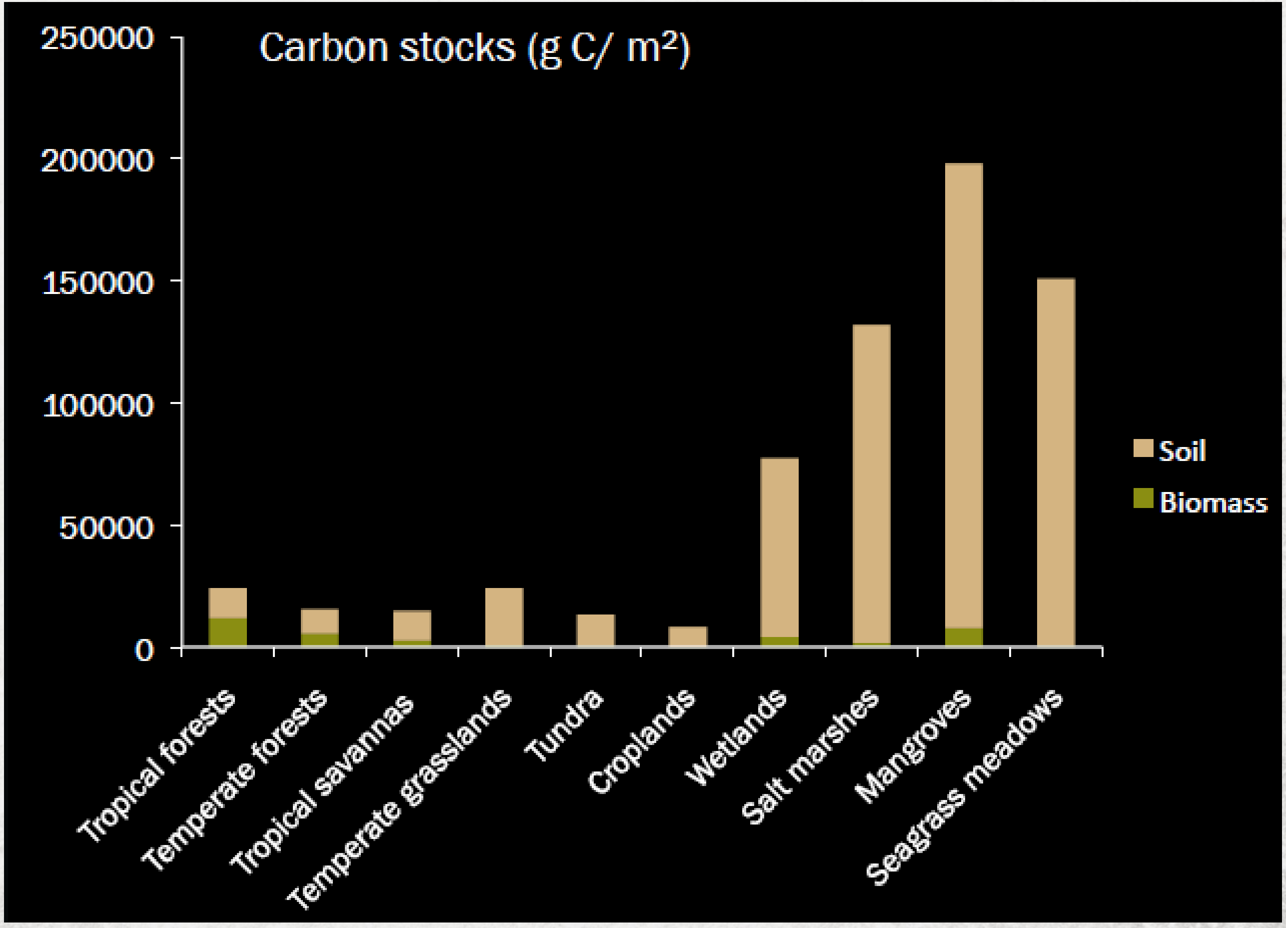
COASTAL BLUE CARBON

Marine InVEST

BLUE CARBON
FUN FACTS



THE BASICS
INVEST BLUE CARBON MODEL

InVEST integrated valuation of environmental services and tradeoffs

natural capital PROJECT

- "Blue Carbon " term is used to define carbon that is stored and sequestered in coastal vegetation and wetland habitats.
- These habitats are capable of storing, or "sinking", significant quantities of carbon in their plant matter and soils.
- CO_2 can become sequestered away as elemental carbon, effectively removing it from the atmosphere.
- Co-benefits:
  These habitats provide a multitude of other ecosystem services that benefit the people including nursery habitat, recreation opportunities, and shoreline protection.

FOUR CARBON POOLS

MANGROVE EXAMPLE

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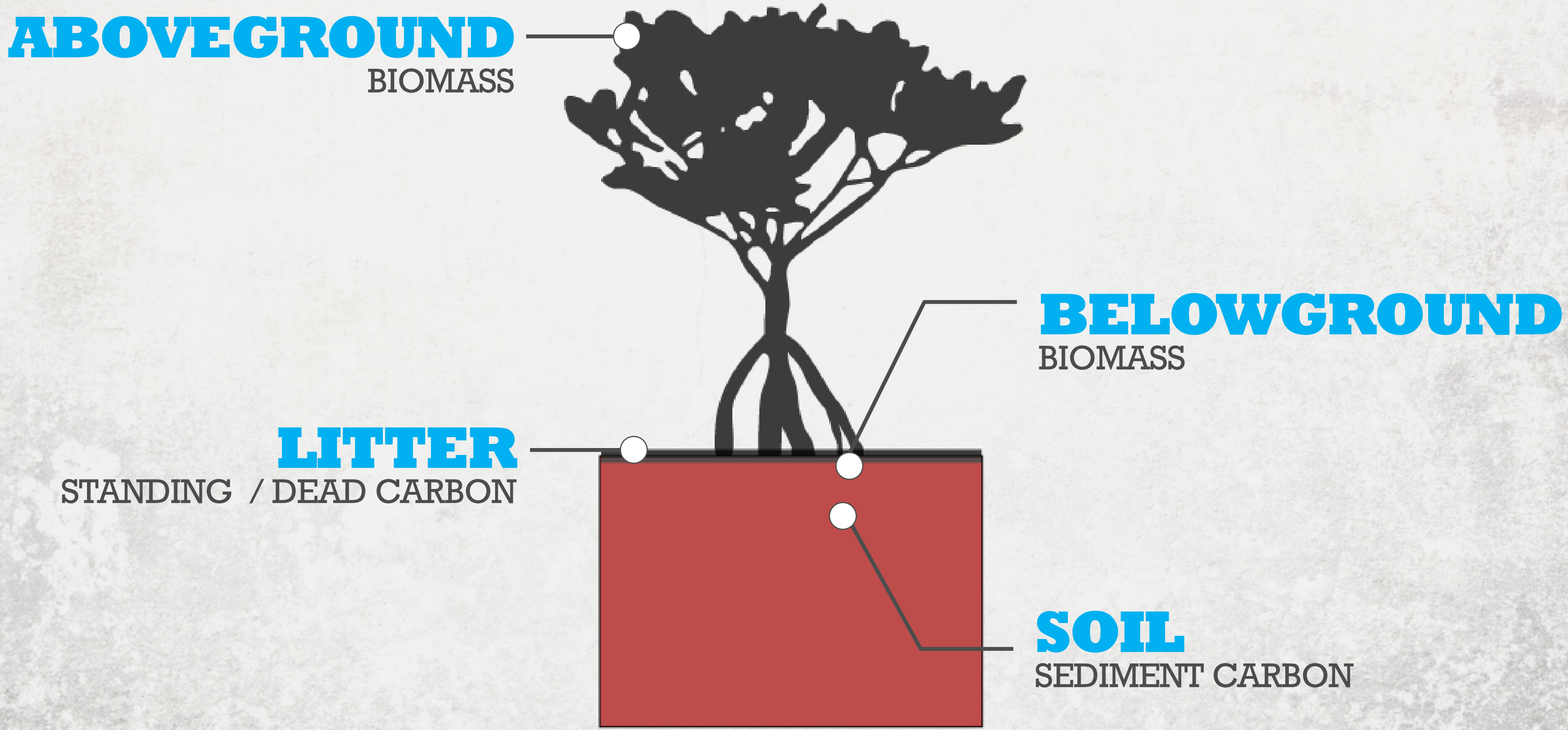


MODEL STEPS
BLUE CARBON

- Quantify carbon stored and sequestered under status quo
- Quantify changes under alternative management
- Value the avoided emissions (social or market)

MANGROVE

MARSH

SEAGRASS

OTHER

?

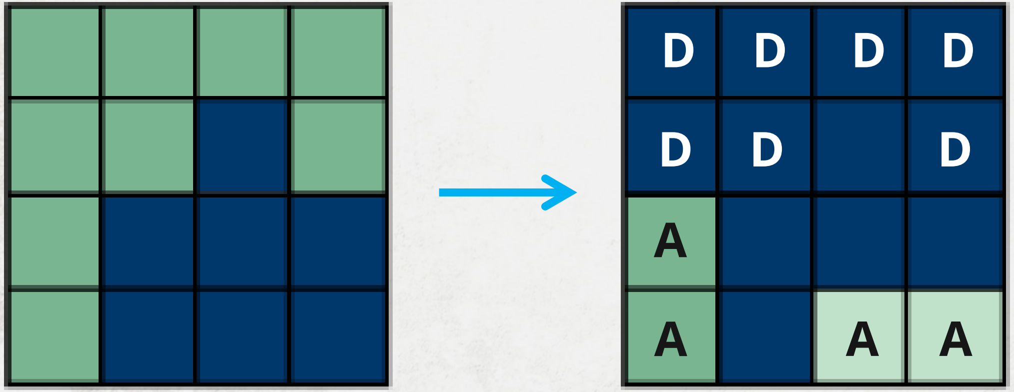
BLUE CARBON MODEL
FRAMEWORK

1. ESTIMATE LAND COVER AT DIFFERENT TIME STEPS (e.g. SLAMM)
2. BLUE CARBON PRE-PROCESSOR
3. BLUE CARBON CORE MODEL
4. SYNTHESIZE RESULTS

InVEST

integrated valuation of environmental services and tradeoffs

HOW IT WORKS
PRE-PROCESSOR



TIME 1

TIME 2

D = Disturbance
- **Low**
- **Medium**
- **High**

A = Accumulation
(vegetation/age-specific rate)

HOW IT WORKS
CORE MODEL

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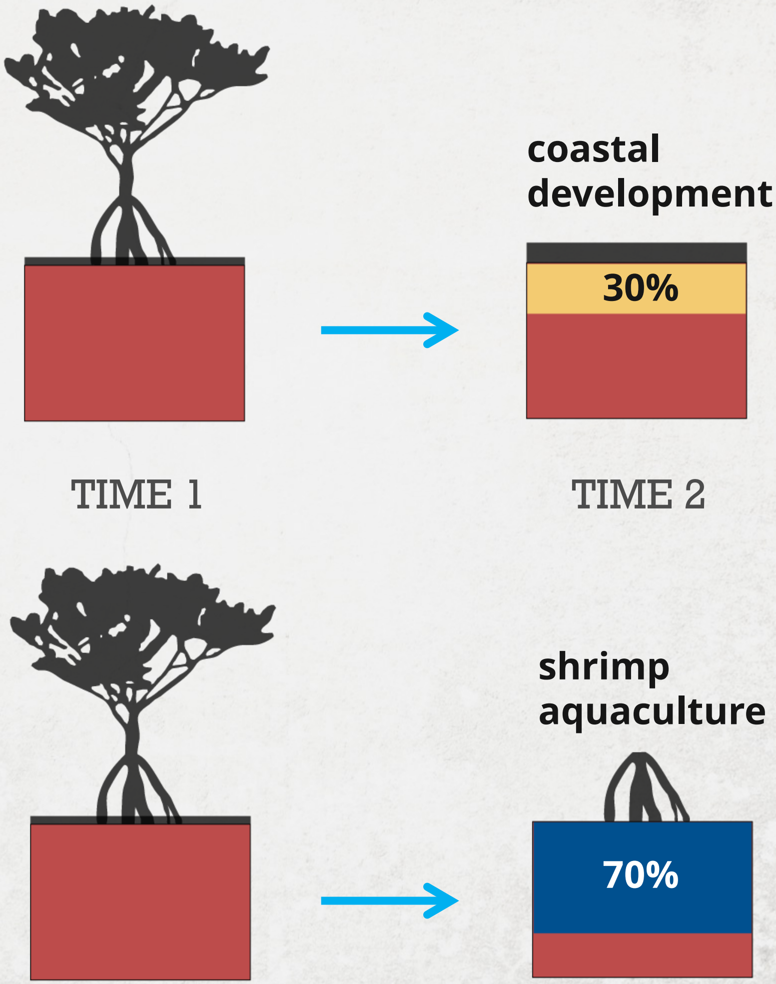
DISTURBANCE

LOW INTENSITY

HIGH INTENSITY



Half Life = 7.5 yrs
Every 7.5 years, half of carbon stored in the top 30% or 70% is lost to emissions

BLUE CARBON
GLOBAL DATABASE

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Location	General Location	Latitude	Longitude	Tonnes CO2e/ha/yr	Study	Year	Citation	Original Article if Cited in Review
Tijuana Slough, Calif.	California	32.50	-117.10	12.58	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld,	Cahoon et al 1996
Tijuana Slough, Calif.	California	32.60	-117.10	1.58	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld,	Cahoon unpublished data 1993
Alviso, San Francisco Bay, Calif.	California	37.50	-122.00	14.12	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld,	Patrick and DeLaune 1990
Bird Island, San Francisco Bay, Calif.	California	37.60	-122.20	1.98	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld,	Patrick and DeLaune 1990

Location	General	Lattitude	Longitude	Tonnes CO2e/ha/yr	Study	Year	Citation	Original Citation
South Africa	South Africa	-32.38	17.84	13.39	Cebrian	2002	Cebrian, J. (2002).	Baird and Ulanowicz 1993
Alfacs Bay Spain	Spain	40.60	0.63	1.74	Cebrian	2002	Cebrian, J. (2002).	Cebrian et al. 2000
Beafort NC	NC	14.32	94.55	0.39	Cebrian	2002	Cebrian, J. (2002).	Kenworthy and Thayer 1984
Florida Bay	FL Keys	25.00	85.58	0.84	Cebrian	2002	Cebrian, J. (2002).	Kenworthy and Thayer 1984
Florida Bay	FL Keys	3.63	103.52	0.87	Cebrian	2002	Cebrian, J. (2002).	Kenworthy and Thayer 1984
Beafort NC	NC	-7.05	112.48	0.92	Cebrian	2002	Cebrian, J. (2002).	Kenworthy and Thayer 1984

SPEC_LOC	GEN_LOC	LAT	LONG	TCO2eHaYr	STUDY	YEAR	CITATION
SW Florida	FL Keyes	25.80	-81.54	0.13	Cebrian	2002	Cebrian, J. (2002). "Variability and control of carbon con
Victoria Australia	Australia	-38.50	144.66	0.19	Cebrian	2002	Cebrian, J. (2002). "Variability and control of carbon con
Rookery Bay, Fla.	FL Keyes	26.00	-81.70	0.73	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld, et al. (2003). "Global carbo
Core 576, Herbert River region, Australia	Australia	-18.50	146.32	0.95	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld, et al. (2003). "Global carbo
SW Florida	FL Keyes	25.80	-81.54	0.99	Cebrian	2002	Cebrian, J. (2002). "Variability and control of carbon con
SW Florida	FL Keyes	25.80	-81.54	1.11	Cebrian	2002	Cebrian, J. (2002). "Variability and control of carbon con
Rookery Bay, Fla.	FL Keyes	26.00	-81.70	1.43	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld, et al. (2003). "Global carbo
Puerto Rico	Puerto Rico	18.54	-66.53	1.61	Cebrian	2002	Cebrian, J. (2002). "Variability and control of carbon con
HMF 3, Hinchinbrook Channel, Australia	Australia	-18.36	146.16	1.76	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld, et al. (2003). "Global carbo
Pohnpei Island, Micronesia	Micronesia	6.52	158.20	1.94	Fujimoto et al.	1999	Fujimoto, K., A. Imaya, et al. (1999). "Belowground carb
HM 2, Hinchinbrook Channel, Australia	Australia	-18.36	146.16	2.46	Chmura et al.	2003	Chmura, G. L., S. C. Anisfeld, et al. (2003). "Global carbo

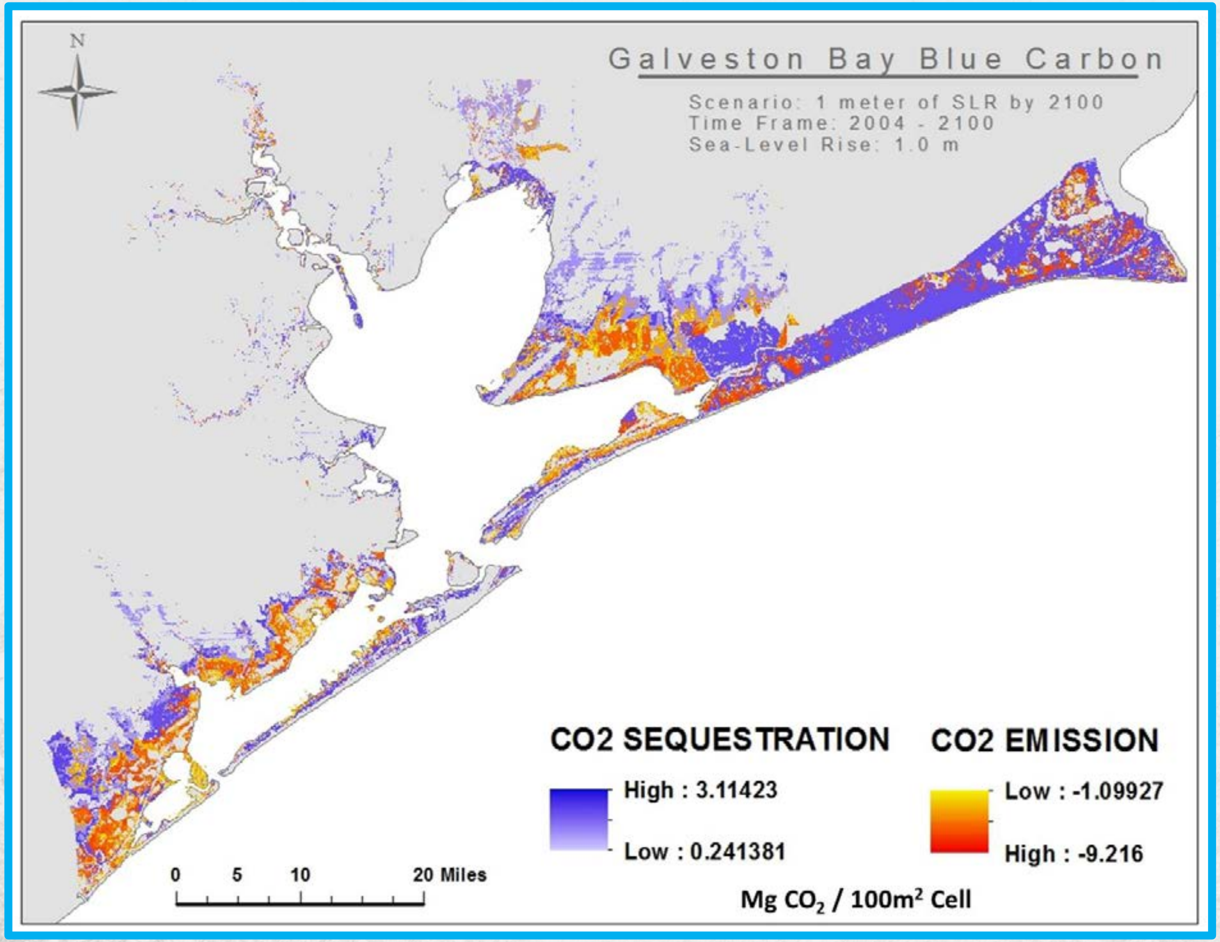
LIMITATIONS

- We assume all storage and accumulation occurrs in the aboveground biomass and sediments.
- We ignore increases in stock and accumulation with growth and aging of habitats.
- We assume that carbon is stored and accumulated linearly through time between the current and future scenarios.
- We assume that some human activities that may degrade coastal ecosystems do not disturb carbon in the sediments.

APPLICATION
FOCUS

WHAT IS THE AMOUNT OF CARBON STORED AND SEQUESTERED BY COASTAL MARSHES FOR 1-METER SEA LEVEL RISE SCENARIO?

Galveston, TX
USA



N
Galveston Bay Blue Carbon
Scenario: 1 meter of SLR by 2100
Time Frame: 2004 - 2100
Sea-Level Rise: 1.0 m
CO2 SEQUESTRATION
High : 3.11423
Low : 0.241381
CO2 EMISSION
Low : -1.09927
High : -9.216
0 5 10 20 Miles
Mg CO2 / 100m2 Cell

SEQUESTRATION AND EMISSION

SUMMARY

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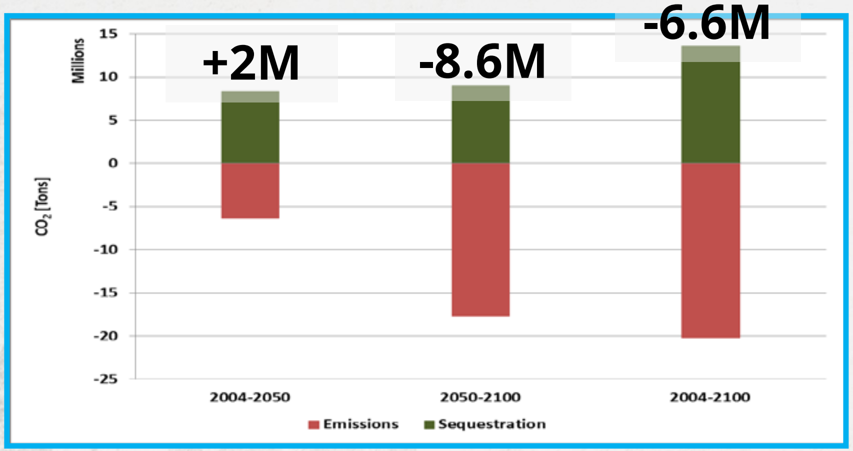
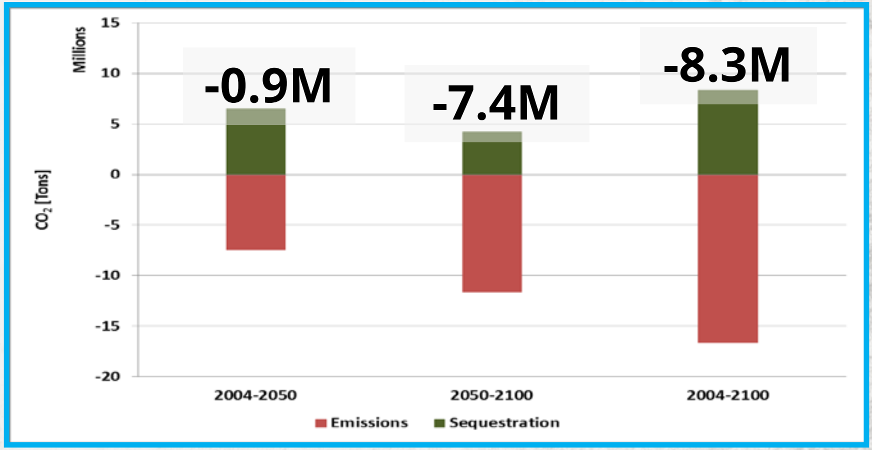
MIGRATION ALLOWED



NO MIGRATION



- Galveston Bay **emits carbon** under 1 meter sea level rise
- Emissions increases if marsh does <u>not</u> migrate
- <u>Uncertainty analysis</u>: mostly driven by the wide variation in accumulation rates