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Challenges and Lessons Learned in Implementing Blue Carbon Projects

Sarah K. Mack, PhD, CFM

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Tierra Resources

- **Mission:** To conserve, protect, and restore coastal wetland ecosystems by creating innovative solutions that support investment into blue carbon
- **About Us:** Founded in 2007. Recognized innovator and quality leader in the research, development, and monetization of blue carbon.
- **Tierra International Foundation:** 501(c)3 Founded in 2016

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Webinar Overview

- Carbon Market Opportunities study
  - Eligible restoration techniques
  - Wetland restoration carbon modeling
  - Prevented wetland loss carbon modeling
  - Potential offset volumes
- The 5 biggest challenges
- Local project examples
  - Black mangrove air seeding
  - Luling wetland assimilation

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Carbon Market Opportunities
for Louisiana's Coastal Wetlands

Carbon Market Opportunities
for Louisiana's Coastal Wetlands

- **Evaluate commercial potential of blue carbon in LA**
  - Identify scalable wetland carbon restoration methods
  - Carbon impacts of incorporating prevented wetland loss
  - Determine Louisiana's potential offset supply
  - Develop financial estimates of Louisiana's blue carbon
  - Identify information needs
    - Future scientific research
    - Wetland carbon offset programs

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Restoration of Degraded Deltaic Wetlands of the Mississippi Delta

Sarah K. Mack, PhD, CFM
Robert R. Lane, PhD
John W. Day, PhD

2012

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American Carbon Registry

Wetland Carbon Restoration Techniques

- River Diversions
- Hydrologic Restoration
- Marsh Creation
- Wetland Assimilation
- Mangrove Plantings

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Key Equation

Carbon Offset = Project Cseq – Baseline Cseq

Carbon Offset = $C_{ACR,t} = (\Delta C_{ACTUAL} - \Delta C_{BSL}) * (1\text{-}LK) * (1 - UNC)$

Carbon Offsets ($mtCO_2e/ac/yr$)

Developed a database of C seq rates from MRD wetlands
Entirely from peer reviewed scientific literature

Restoration technique	Baseline C Seq.	Project C Seq.	Net Offset
Marsh creation	Data unavailable		
Hydro/diversion forested	4.7	8.5	3.8
Hydro/diversion emergent	3.2	4.0	0.8
Wetland assimilation forested	4.7	11.7	7.0
Wetland assimilation emergent	3.2	6.3	3.1
Mangrove planting	3.8	5.8	2.0

Potential Offset Volume

- Carbon sequestration rates were applied to the potential restoration acreage as determined by:
  - *Louisiana's Coastal Master Plan for a Sustainable Coast*
  - Potential project development analyses and mapping:
    - Mangrove planting
    - Wetland assimilation
- 20% buffer deduction was applied
  - Can range from 10% to > 50%
- 50 year project length:
  - Corresponds with *Louisiana's Coastal Master Plan for a Sustainable Coast*
  - *ACR requires a 40-year crediting period and 40-year project life

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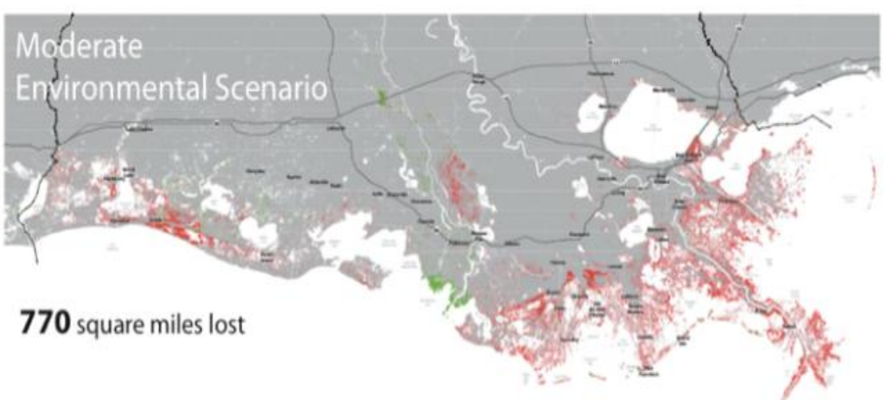
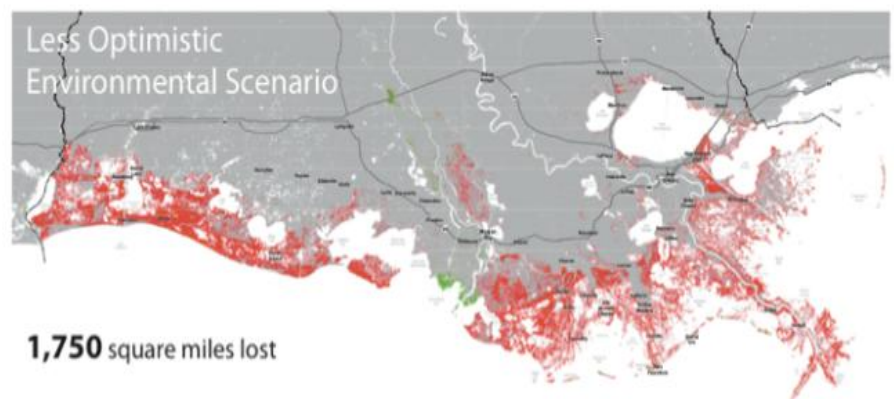
Prevented Wetland Loss Offset Volume

- *Louisiana's Coastal Master Plan for a Sustainable Coast* modeled a 'future without action" over a 50-year time frame
- Two scenarios:
  - 'moderate scenario' = low loss rate
  - 'less optimistic scenario' = high loss rate
- Top 50 cm of wetland soil horizon ~ 200 $mtCO_2e/ac$
- 25-75% of carbon in top 50 cm of sediment
- **20,000,000-100,000,000 $mtCO_2e$ over 50 years**

low loss rate



high loss rate



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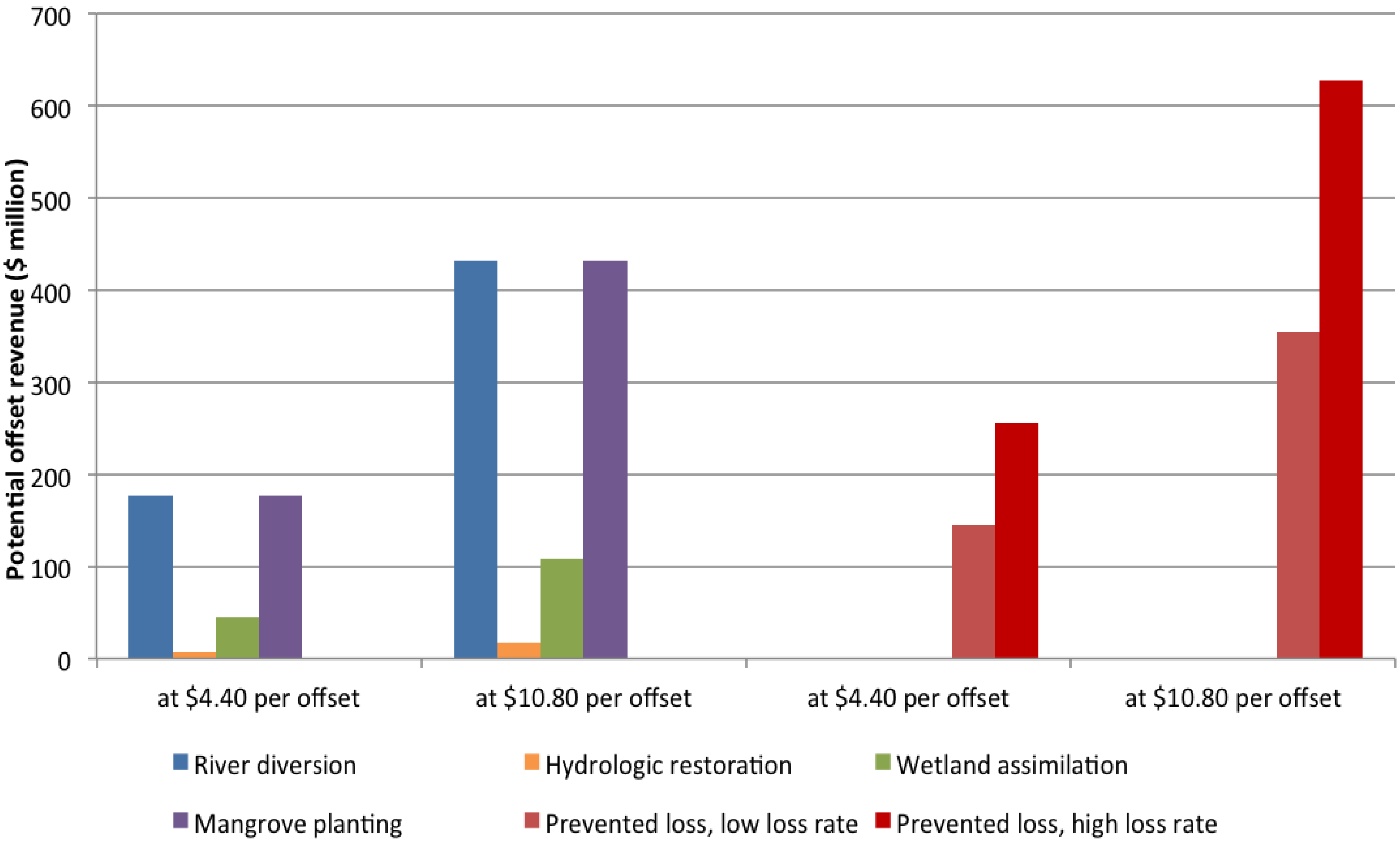
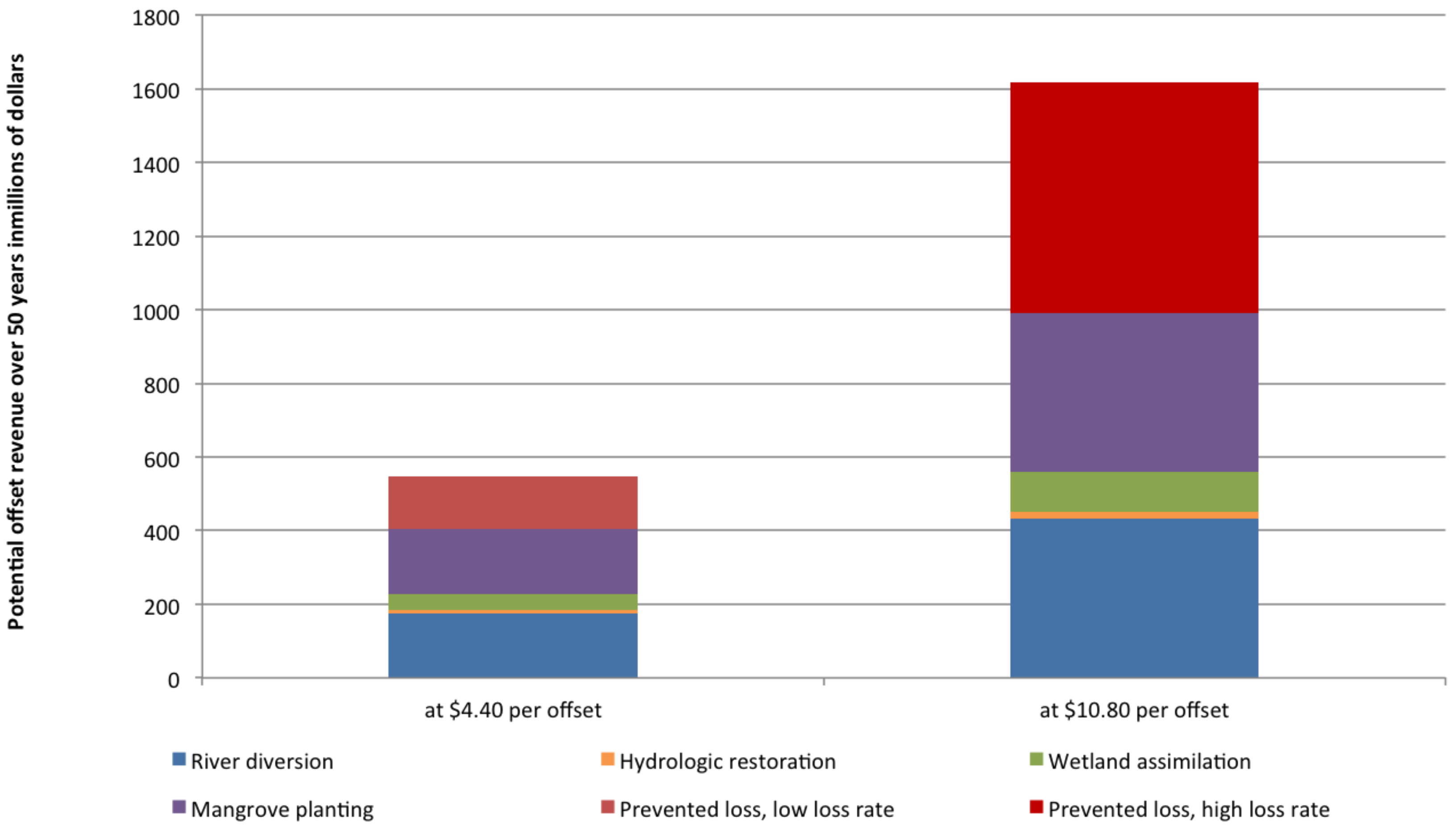
Restoration vs. Prevented Loss



Over 1.8 million offsets per year – almost 92 million offsets over 50 years! (20% buffer deduction)

Enhancement and Prevented Loss "Stackable"



Factors Influencing Funding

- Price of the carbon offset
- Inclusion of wetlands in California's compliance market
- Incorporating prevented wetland loss in carbon accounting
- The amount of wetlands that can be successfully restored for the project life
- Costs for developing a project
- Eligibility rules
  - Start date
  - Easement type
  - Use of federal funds
  - Buffer deductions

Challenge 1.
Cost of Restoration

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Cost of Restoration

Restoration Technique	Restoration Cost / Acre
River diversions	$20,000/acre
Hydrologic management	$4,000/acre
Marsh creation	$156,000/acre
Mangrove restoration in FL	$70,000/acre
Mangrove air seeding	$3,000/acre

Source: Coastal Master Plan, USACE, Tierra

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Challenge 2.
Market Dynamics

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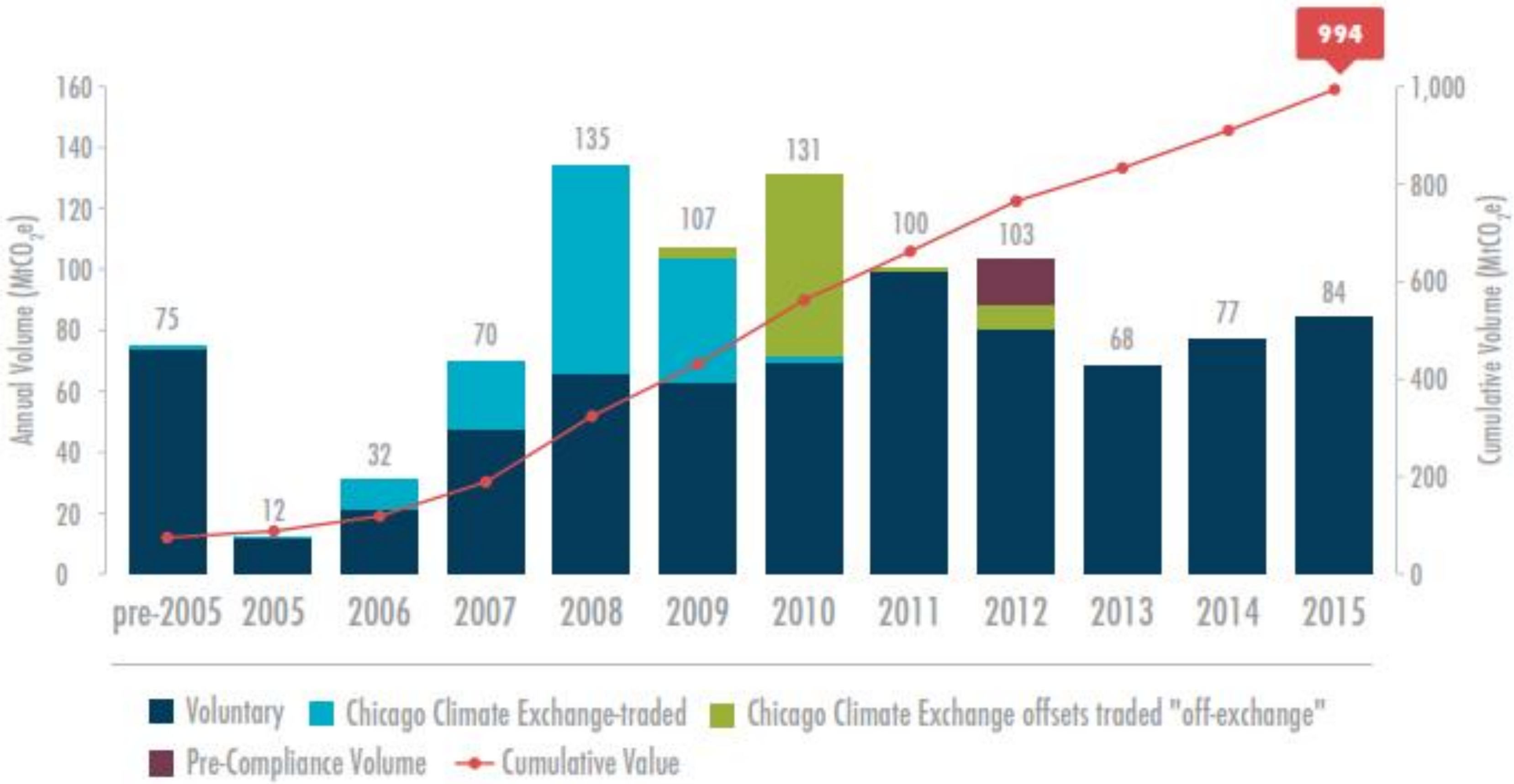
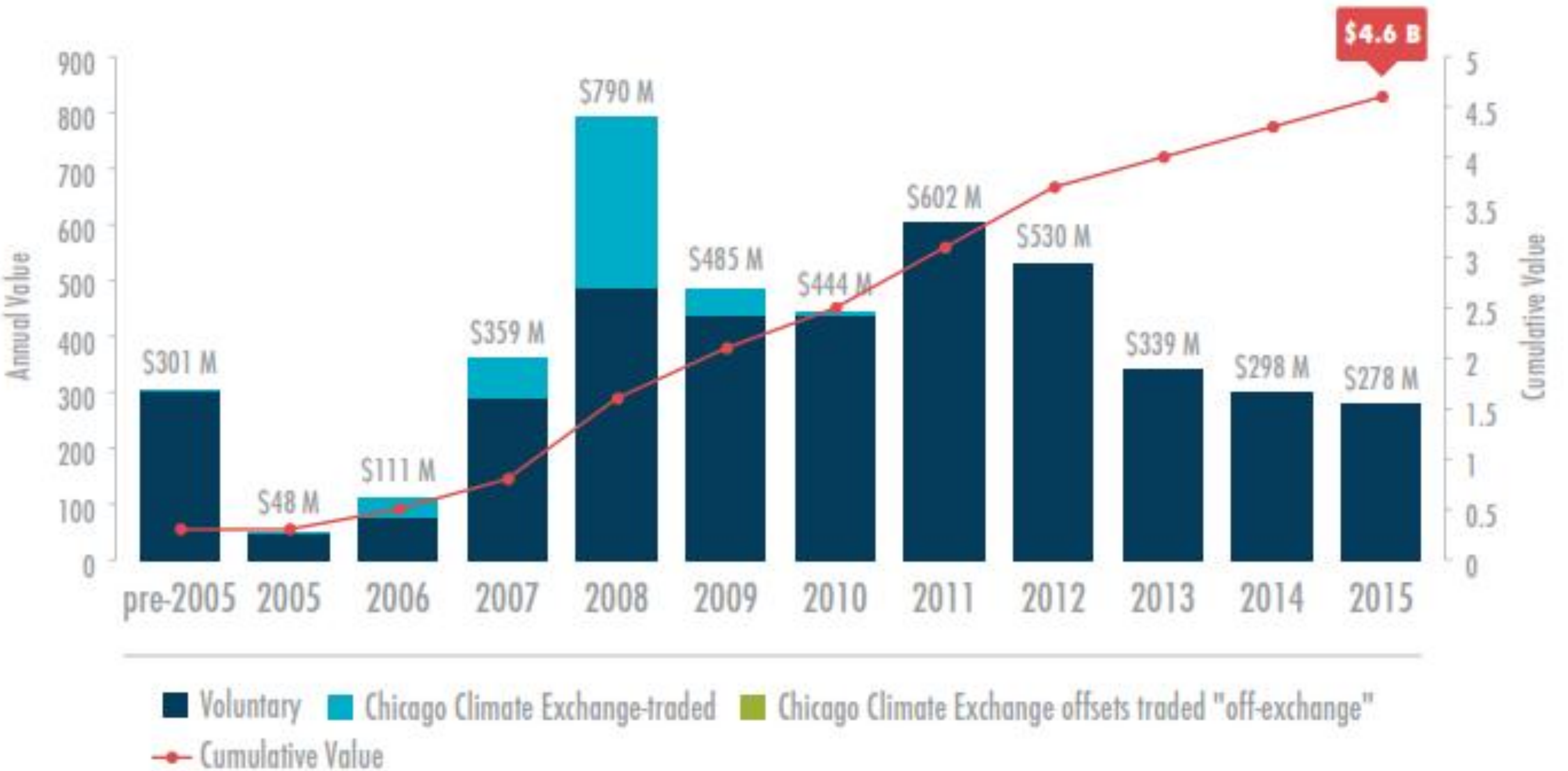
Overall Voluntary Market Growth of 10%



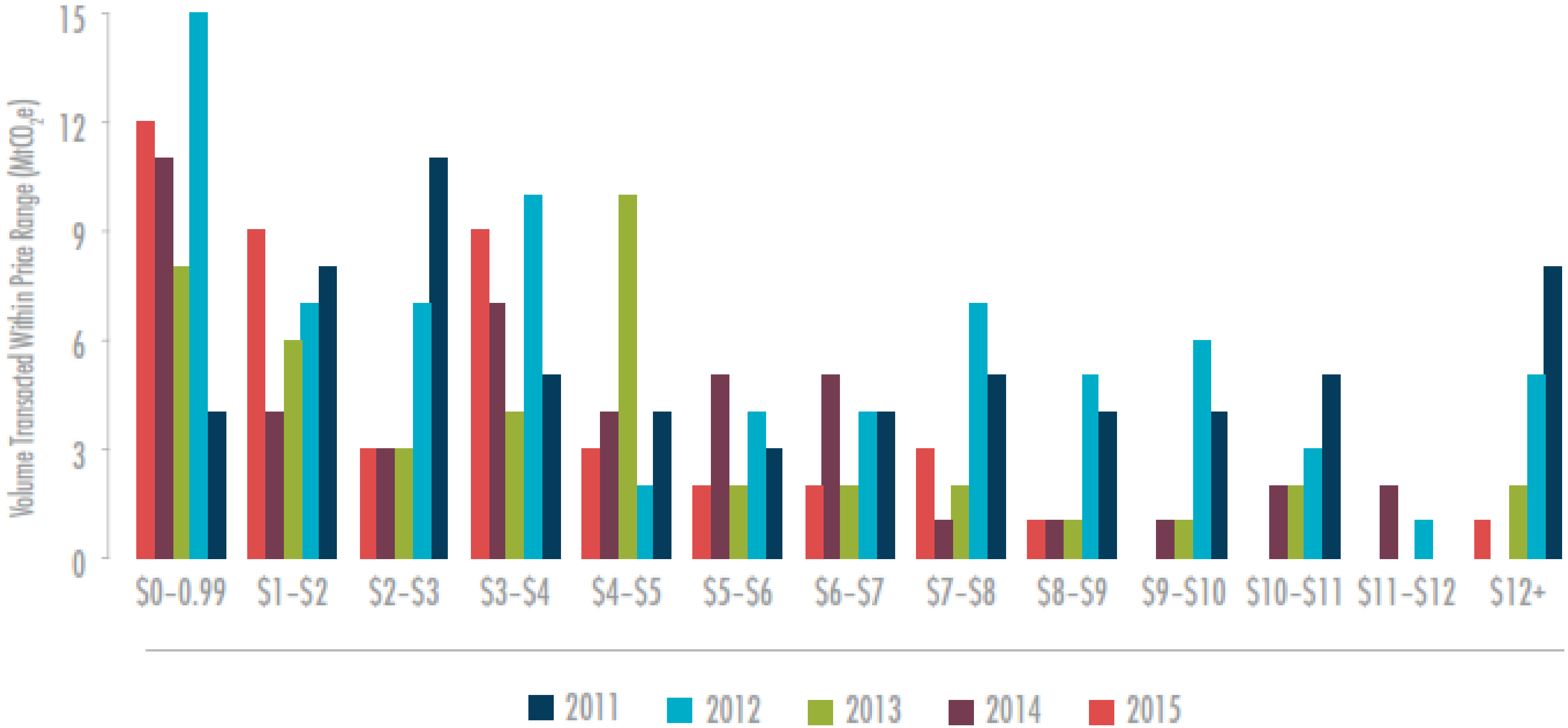
Source: Ecosystem Marketplace 2016

Lower Overall Market Value of $278 M



Source: Ecosystem Marketplace 2016

All-Time Low of $3.3/tonne



52% of all 2015 offsets transacted at less than $3/tonne

Supply greater than demand

Source: Ecosystem Marketplace 2016

California Compliance Market?

- Predicted shortage of supply
- Price of offset higher
  - just-below allowance prices
  - currently $12.7/tonne at auction
- Wetlands currently not included
- Need success in voluntary market
- California methodology in certification
- Double verification
- 100 year timeline

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Don't take a long swim…
on a super windy day
in Barataria Bay just yet;-)

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We still have Paris!

- Countries push to commit beyond 2° C
  - 100 countries collectively aim for 1.5° C
  - 128 subnational jurisdictions also commit
- Sustainable Development Goals referenced
  - Protecting the environment
- Private sector more present than ever!
- 1000 companies call for a price on carbon
  - Set "Science-Based Targets"
  - Seek to "inset" their supply chain

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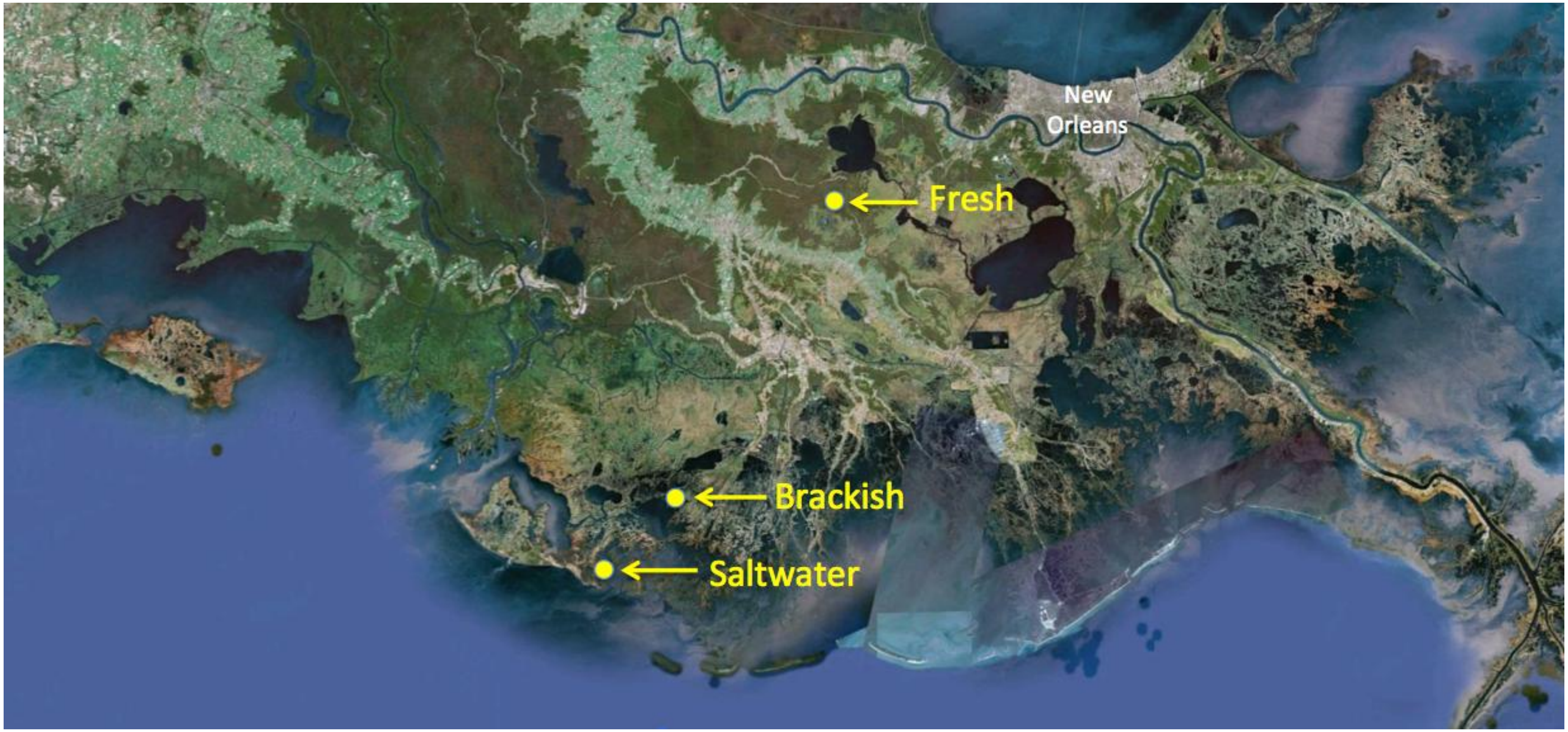
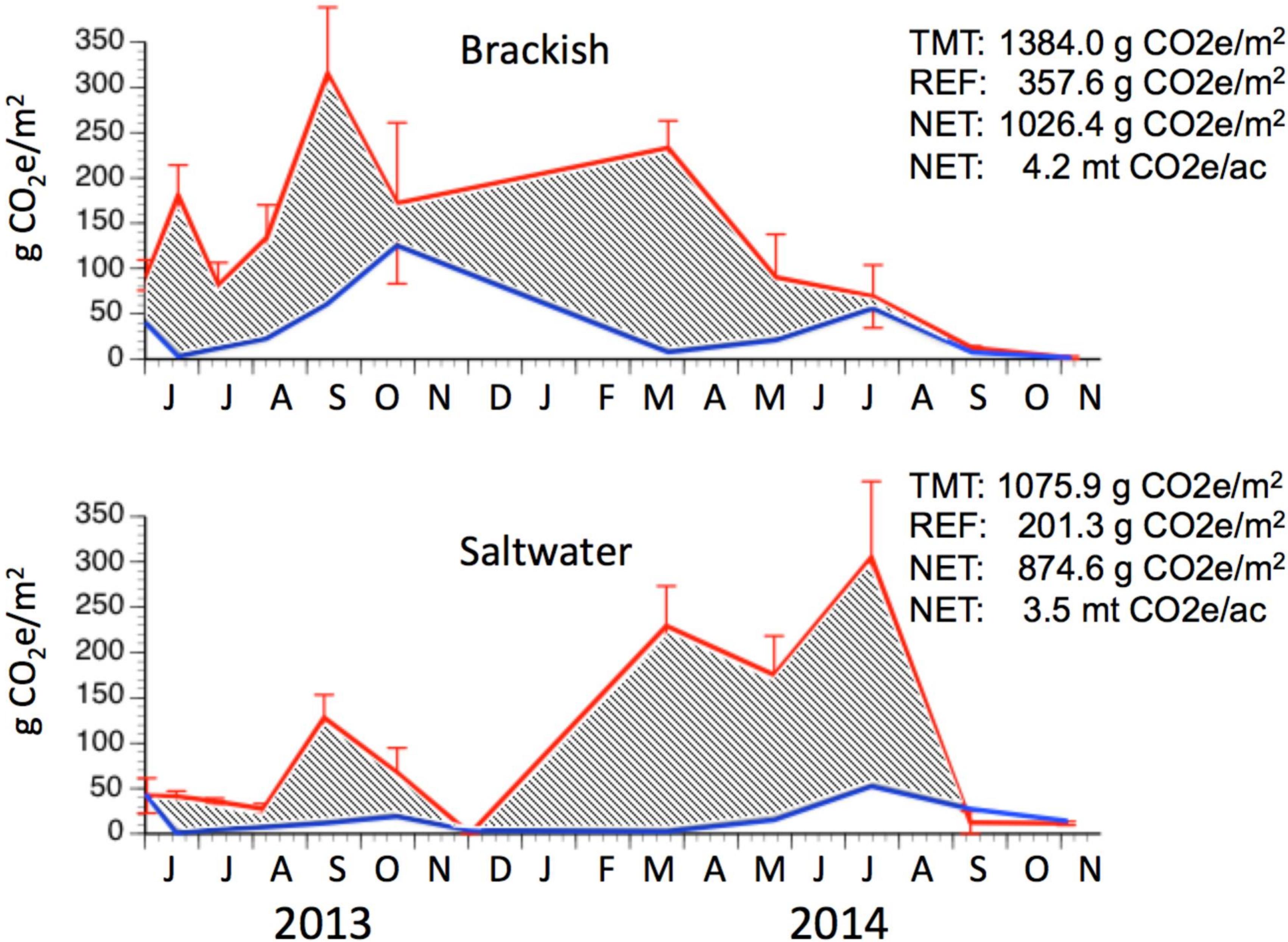
Challenge 3.
Optimizing Offsets

Prevented Wetland Loss Research





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Challenge 4.
Reduce Project Development Costs and Simplify Monitoring, Reporting, and Verification

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GHG Emissions

- Measuring GHG's may be cost prohibitive
  - High variability
  - Costs of towers or operating chambers
- Restoration has no net increase in GHG's
- Further research to justify exclusion of GHG emissions especially methane.
- Holm et al. 2016 used eddy covariance to prove net sink in freshwater wetlands.
- Wetland net sinks over longer time periods.
  - Poffenbarger et al. 2011
  - Whiting and Chanton 2001
  - Mitsch et al. 2013
- Develop regional GHG emission factors

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Technical Recommendations

- Modify Louisiana's Coastal Reference Monitoring System (CRMS) program to include carbon offset monitoring parameters
- Develop wetland carbon and GHG emission models
- Database for wetland management info
- Aggregation or grouping of projects to decrease project development costs

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Challenge 5.
Policy

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Policy Strategy

- Costs of restoration exceed carbon revenues.
- Carbon finance to be leveraged with traditional restoration programs.
- New public-private paradigms must be developed
  - Government program?
  - Partnership to match other types of funding
    - Long-term monitoring and maintenance
    - Local cost share
    - Expand a project such as with plantings
- What about additionality?

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Policy Recommendations

Advocate with carbon standards

- Use of federal funds,
- Environmental credit stacking,
- Eligible types of conservation easements,
- Crediting period length for wetland restoration.

Publish lessons learned from existing pilots

- Analyses of costs and benefits
- Examples of public-private paradigms

Projects

Pilot: Insight Into Ecological Conditions

- Nested one-acre sites to determine optimal ecological conditions
- 10 planted seedling and broadcast propagule sites 2012 & 2014
- 5 aerial dispersal sites 2012 & 2013

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Mangrove Air Seeding Successful!

- 1st globally to successfully use crop duster airplanes
- A fraction of the cost of conventional restoration
- Mangrove roots prevent erosion and reduce hurricane surge

Photo courtesy of ConocoPhillips

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Determining Scalability

- LiDAR remote sensing = 5cm resolution
- Developed equation for optimal mangrove establishment
- Further incorporated:
  - Eustatic sea level rise
  - Localized subsidence
  - Localized accretion from pilot sites
- Could not incorporate:
  - Edge erosion
  - Increased rates of sea level rise

Window of Opportunity

Dularge/Terrebonne West = 31-59 years
Dularge/Terrebonne East = 21-31 years
Leeville Port Fourchon = 14-21 years

DOES NOT INCLUDE EDGE EROSION OR INCREASED RATE OF SEA LEVEL RISE!

Billions of Assets at Risk

- $499 billion in oil & gas assets vulnerable in Gulf Coast
- $23.4 billion annual losses in Louisiana by year 2050 with no coastal restoration
- Port Fourchon national impacts 3 weeks of no service
  - $11.2 billion sales,
  - $3.1 billion household earnings,
  - 65,000 jobs nationally
  - 95% tonnage oil and gas related
- Land base of Louisiana Offshore Oil Port (LOOP)
  - Pipeline to 50% of U.S. refining capability

Source: Building a Resilient Energy Gulf Coast (2010);CWPRA (2012); GLPC (2014)

Scaling to 30,000 Acres in 10 years!

- Developed a proprietary seeding tool
- 40,000 acres ideal conditions today
- 30,000 acres is realistic
- Need to prioritize Port Fourchon region
  - Least sustainable wetlands
  - Most vulnerable infrastructure
  - Largest economic impacts
- Start scaling the technology fall 2016

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Carbon Market Challenges

- Proving scalability
- Reducing costs
  - $3,000 acre
  - Can't fund entirely with carbon
- 40-100 year timeline?
- Quantifying co-benefits
- Strategic partnerships
- New public-private paradigms

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Going Big or Losing Home

- Bigger, faster impact
- Most cost-efficient
- Increase community resilience
- Protect critical infrastructure
- Youth outreach mentorship program

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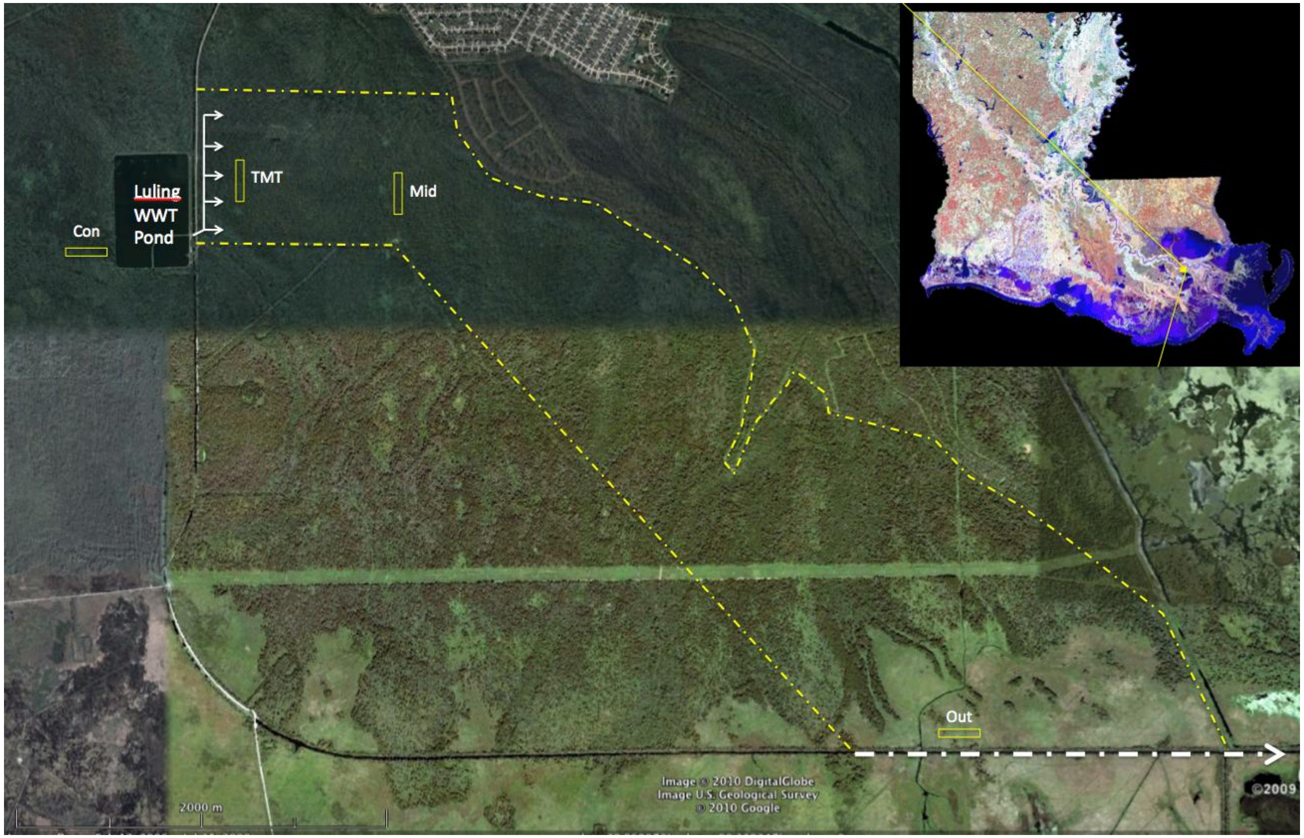
Luling Wetland Carbon Pilot!



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Moving Forward

- Creating a win-win transaction!
- Justify omitting GHG's
  - Holm et al. 2016
- Addressing additionality
- Long-term commitments?
- Stack nutrient credits
- Prove the concept
- Peer-reviewed article in 2016

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Final Conclusions

- Recent developments show growing recognition of wetlands’ role in climate change mitigation.
- There is significant offset supply in Louisiana.
- Louisiana is at the forefront of blue carbon initiatives globally.
- Open to collaboration to implement projects.
- Provide input into research activities.
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