Wetland Peat Accumulation and Carbon Crediting for Coastal Socio-Ecological System Resilience

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Integrating social and ecological research to increase marsh and community resilience

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Funded by the NERRS Science Collaborative Program
Situating the Project
The Socio-Ecological System of the Deal Island Peninsula

Chesapeake Bay Watershed
Why this Project: The Challenges

- Future health of marshes and communities
- Marsh degradation and loss
- Sea-level rise, flooding, storms, ditching, socio-economic change
- Weak relationships among stakeholders
- Lack of scientific knowledge of socio-ecological system function
Human Impacts on Marshes
An ever-growing team of stakeholders...

- Skipjack Heritage Inc.
- Somerset County Board of Commissioners
- Somerset County Planning and Zoning
- Somerset Soil Conservation District
Integrated socio-ecological research + Collaborative Learning = INCREASED RESILIENCE OF SOCIO-ECOLOGICAL SYSTEM (MARSHES AND COMMUNITIES)
Integrated collaborative research projects: Heritage, Flooding, and Marsh Restoration
Restoration of ditch-drained marshes
Soils and the Socio-ecological System

- Accretion and sustainability
- Water quality improvement
- Carbon sequestration and greenhouse gases
- Wildlife habitat
- Hunting and fishing
- Erosion protection
- Storm surge protection
Soils and the Socio-ecological System

• Accretion and sustainability
• Water quality improvement
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Soil survey

• 3000 hectares Transquaking and Mispillion
  – Euic, mesic Typic Sulfihemists
  – Loamy, mixed, euic, mesic Terric Sulfihemists
  – >41 cm peat

• 2000 hectares Tangier and Sunken
  – Fine-silty, mixed, mesic Typic Endoaqualfs
  – <20 cm peat
Ditch-drained marsh restoration study sites

Site Pair 1

Site Pair 2
Peat Depth at Deal Island Sites
Summer 2012

- Unditched 2
- Ditched 2
- Unditched 1
- Ditched 1

Peat Depth (cm)
International Tidal Wetland and Seagrass Accounting Methodologies for the Verified Carbon Standard

Brian Needelman, University of Maryland
Igino Emmer, Silvestrum
Steve Emmett-Mattox, Restore America’s Estuaries
Steve Crooks, Environmental Science Associates
Pat Megonigal, SERC
Doug Myers, Chesapeake Bay Foundation
Matthew Oreskay and Karen McGlathery, Univ. of VA

Joint Aquatic Sciences Meeting
May 18-23, 2014
Portland, OR
Verified Carbon Standard

The Gold Standard

Verified Carbon Standard and Blue Carbon

- Wetland requirements: approved 2013
- Coastal wetland creation: approved 2014
  - Focused on Louisiana
- Tidal wetland restoration: undergoing validation
- Tidal wetland conservation: in prep
Land use scope of methodology

- Tidal Marshes
- Mangroves
- Seagrasses
- Tidal swamps
Greenhouse gases in methodology

• GHG’s: carbon dioxide, methane, and nitrous oxide
• Baseline and with-project scenarios
  – Including stop-loss
Scientific and policy challenges

• Methane emission estimation in fresh and brackish systems
• Allochthonous carbon
• Carbon fate following submergence
• Additionality: Principle that GHG reductions must be a result of the C funding
Thank you

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Funding
Maryland Department of Natural Resources Power Plant Research Program
Restore America's Estuaries
Goals and principles used in developing methodology

- Scientifically credible
- Feasible to implement
- Flexible
- Insufficient science -> onus upon project proponents
Marshes and storm surge

• Weak rule of thumb: 4 km of marsh dampens 0.3 m of storm surge
Observations

• Soils do matter in this system
  – Accretion rates

• Long-term perspective
  – Mapping of future marsh loss and transgression zones
  – Management and restoration options to increase elevation/accretion

• Transdisciplinary Research
More information:

Dive into our project website for more information!

www.DealIslandMarshandCommunityProject.org

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Rubbed Fiber at Deal Island Sites
Summer 2012
(0-20 cm)

- Unditched 2
- Ditched 2
- Unditched 1
- Ditched 1

Rubbed Fiber (%)

(*)
Greenhouse gas accounting options

- Published data
- Default values
- Field-collected data
- Proxies
- Validated models
Greenhouse gas accounting: Soil carbon

• Default value:
  – 1.4 Mg C per ha per year for non-seagrass (Chmura et al. 2003)
Greenhouse gas accounting: Allochthonous Carbon

- “Allochthonous” carbon = carbon photosynthesized outside of the project area and deposited into it.
- Should only count if it would have been returned to atmosphere without the project.
Greenhouse gas accounting: Allochthonous Carbon

- Estimated from soil carbon concentrations
- Assumptions:
  - All mineral material deposited as sediment with 1.5% refractory C (Andrews et al. 2011)
  - 100% of this C retained in system
Alloch C % (of total accumulated C)

\[ y = 179.62x^{-1.195} \]
Methane

• Default values only for salinity > 18 ppt
Salinity versus methane flux

Poffenbarger, Needelman & Megonigal, Wetlands, 2011
Climate Benefits of Sequestration Offset by Methane

Offset by Methane

Poffenbarger, Needelman & Megonigal, Wetlands, 2011

Log methane flux (g m$^{-2}$ yr$^{-1}$)

Salinity

Δ Radiative Forcing from Soil Carbon Sequestration

Poffenbarger, Needelman & Megonigal, Wetlands, 2011
Number of sampling plots

![Graph showing the relationship between sample size per strata and coefficient of variation (CV). The graph indicates a positive correlation, with sample size increasing as the coefficient of variation increases.]

Sample size per strata

Coefficient of Variation (CV)
Greenhouse gas accounting: Methane

- Default values
  - Only for salinity > 18 ppt
- Field-collected data
- Published data
- Proxies
- Validated models