Connecting Wetlands Restoration and Soil Conservation to the Carbon Market and Beyond

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Blue Carbon: The Role of Watershed Stewardship in the Carbon Market

Bay Area Watershed Network
February 21st, 2013, Oakland, CA.

Photo: Lisa Windham-Myers
Ecosystems in focus for climate change mitigation

- Forest
- Peatland
- Mangroves
- Tidal Marshes
- Seagrass
Carbon from plants gather in soil and builds up over thousands of years
Distribution of carbon in coastal ecosystems

Mean soil organic carbon
Mean living biomass

Donato et al., 2011 (Nature Geoscience); Crooks et al., 2011 (World Bank); Murray et al., 2011 (Duke Report); Fourqurean et al., 1012 (Nature Geoscience); Pendleton et al., 2012 PlosOne
## Rates of Wetland Loss

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Global Extent (km²)</th>
<th>Annual Rate Of Loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal Marsh</td>
<td>400,000</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Mangrove</td>
<td>160,000</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Seagrass</td>
<td>300-600,000</td>
<td>1 - 2</td>
</tr>
</tbody>
</table>
# Estimating Global “Blue Carbon” Emissions from Conversion and Degradation of Vegetated Coastal Ecosystems

Linwood Pendleton\textsuperscript{1,9}, Daniel C. Donato\textsuperscript{2,3,9}, Brian C. Murray\textsuperscript{1}, Stephen Crooks\textsuperscript{3}, W. Aaron Jenkins\textsuperscript{1}, Samantha Sifleet\textsuperscript{4}, Christopher Craft\textsuperscript{5}, James W. Fourqurean\textsuperscript{6}, J. Boone Kauffman\textsuperscript{7}, Núria Marbà\textsuperscript{8}, Patrick Megonigal\textsuperscript{9}, Emily Pidgeon\textsuperscript{10}, Dorothee Herr\textsuperscript{11}, David Gordon\textsuperscript{1}, Alexis Baldera\textsuperscript{12}

## Table 1. Estimates of carbon released by land-use change in coastal ecosystems globally and associated economic impact.

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Global extent (Mha)</th>
<th>Current conversion rate (% yr\textsuperscript{-1})</th>
<th>Near-surface carbon susceptible (top meter sediment+biomass, Mg CO\textsubscript{2} ha\textsuperscript{-1})</th>
<th>Carbon emissions (Pg CO\textsubscript{2} yr\textsuperscript{-1})</th>
<th>Economic cost (Billion US$ yr\textsuperscript{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal Marsh</td>
<td>2.2–40 (5.1)</td>
<td>1.0–2.0 (1.5)</td>
<td>237–949 (593)</td>
<td>0.02–0.24 (0.06)</td>
<td>0.64–9.7 (2.6)</td>
</tr>
<tr>
<td>Mangroves</td>
<td>13.8–15.2 (14.5)</td>
<td>0.7–3.0 (1.9)</td>
<td>373–1492 (933)</td>
<td>0.09–0.45 (0.24)</td>
<td>3.6–18.5 (9.8)</td>
</tr>
<tr>
<td>Seagrass</td>
<td>17.7–60 (30)</td>
<td>0.4–2.6 (1.5)</td>
<td>131–522 (326)</td>
<td>0.05–0.33 (0.15)</td>
<td>1.9–13.7 (6.1)</td>
</tr>
<tr>
<td>Total</td>
<td>33.7–115.2 (48.9)</td>
<td></td>
<td></td>
<td>0.15–1.02 (0.45)</td>
<td>6.1–41.9 (18.5)</td>
</tr>
</tbody>
</table>

Compare to national emissions from all sources

- Poland
- Japan
The Delta

High organic sedimentation
Low mineral sedimentation

Once established marshplain is insensitive to mineral sedimentation

Former natural morphology reflected processes set in motion 6000 years ago
Pre-1880: Freshwater Tidal Marsh

1900's: Elevation Loss

2000's: Increased Levee Maintenance

or Levee Failure

SOURCE:
DWR 2007 LiDAR, ESA-PWA 2012

Elevations and ROAs of Delta-Suisun Marsh Planning Area
Emissions from One Drained Wetland: Sacramento-San Joaquin Delta

Area under agriculture: 180,000 ha

Rate of subsidence (in): 1 inch

5 million tCO₂/yr released from Delta

1 GtCO₂ release in c.150 years
4000 years of carbon emitted
Equiv. carbon held in 25% of California’s forests

Accommodation space: 3 billion m³
Levee Decisions and Sustainability for the Sacramento-San Joaquin Delta

Robyn Suddeth, Jeff Mount, Jay Lund

Center for Watershed Sciences
University of California, Davis

July 13, 2009

Fragile levee system prone to failure.

Levee upgrades expensive, minimal improved reliability.

“…maintaining the current Delta landscape is is unlikely to be economical from a business or land use perspective.”
Carbon Capture Wetland Farm Bio-Sequestration

Stops peat oxidation and accretes “proto-peat” rapidly

- Continuously submerged about 1 ft
- Low oxygen conditions
- Balance between plant growth and reduced decomposition
- Average annual soil sequestration: 1 kg C m\(^{-2}\) yr\(^{-1}\) in soil

![Graph showing land surface change and probable subsidence over time]

“proto-peat” ACCRETION

- 37 MT CO\(_2\) ha\(^{-1}\) yr\(^{-1}\)
- 20 MT CO\(_2\) ha\(^{-1}\) yr\(^{-1}\)

Miller et al. 2008, SFEWS
Wetlands Carbon management: The Game Plan

• United Nations Framework Convention on Climate Change
  – Brief national climate change negotiators
  – Identify policy opportunities
  – Engage IPCC
  – International demonstration (e.g. GEF project)

• National Government
  – Establish science research (e.g. NSF, NOAA)
  – Recognize wetlands in national accounting
  – Agency awareness and action

• Local
  – Landscape level accounting
  – Establish carbon market opportunities
  – Look for synergistic conservation benefits
  – Demonstration projects and public awareness
Blue Ribbon Panel: Action Plan

Foundational Issues
Defining Project Types
Eligibility
Quantifying GHG Reductions
Permanence

Regional Case Studies
Managed (Tidal) Freshwater Marsh
Salt Marsh
Large Deltas (e.g. Mississippi)
(Mangroves, seagrasses added)
(Seasonal floodplains)

http://estuaries.org/climate-change.html
Climate Change Negotiations, Cancun: The big break!
2013 Supplement
to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands

Chapter 4
Coastal Wetlands!

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Guanghui Lin (China)
Tiffany Troxler (USA)
Blue Carbon Open Symposium

- European Parliament Intergroup meeting
- High attendance from different EU stakeholders, including MEPs and Directors EU Commission - DGs
- Representatives from the Blue Carbon Science Working Group – Kauffman, Fourquerean and Crooks.
- Awareness raising, discussion, networking
New Working Groups

- International Blue Carbon Working Groups
- US Federal Interagency BC Group
- World Bank Blue Carbon WG
- Other Nations
  - Indonesia, Costa Rica, Abu Dhabi, Australia
Wetlands Restoration and Conservation (WRC)
Adopted into Standard Oct 4, 2012
http://v-c-s.org/wetlands_restoration_conservation

Other Categories:
• Afforestation, Reforestation, Revegetation (ARR)
• Agricultural Land Management (ALM)
• Improved Forest Management (IFM)
• Reduced Emissions from Deforestation and Degradation (REDD)
Standards for project activities
- General requirements and guidance on GHG accounting
- Procedures for validation and verification
- Registry and clearing house for ‘carbon credits’

Methodologies are step-by-step explanations of how emission reductions or removals are to be estimated in line with the requirements following accepted scientific good practice.

Project description or design documents provide information on how a specific project complies with the requirements and applies the methodology.
Characteristics of Good Projects

**Size**
- There are economies of scale that accompany large projects
  - Reduced costs of implementation
  - Reduced cost of monitoring, reporting and verification (MRV)
  - However, possible to aggregate multiple small projects

**Low complexity**
- Incorporating Ch4 into accounting adds cost
- For tidal marshes need to project forward response to SLR

**Baseline emissions**
- Reducing or preventing ongoing emissions from organic soils is creditable
- Restoration is additional
Next Steps - Demonstration

• Landscape GHG assessment
  – Baseline GHG budgets
  – With management GHG budgets
  – Merger with climate change adaptation

• Feasibility and demonstration
  – Sacramento San Joaquin Delta
  – Tidal marshes
  – Seasonal Floodplains

• Stacking of credits