The Developing Network of Blue Carbon Activities: Why Humboldt Bay – Eel River

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Ecosystem Services of Coastal Blue Carbon Ecosystems: Tidal Forest, Marsh & Seagrass

- Biological diversity
- Water quality and storage
- Flood and storm buffering
- Forest and non-timber forest products
- Aesthetic and ecotourism values
- Fish and Shellfish
- Carbon Sinks

Blue Carbon: 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 Governments
  - Establish science research
  - Recognize wetlands in national accounting
  - Agency awareness, action, funding

- Local Demonstration and Activities
  - Landscape level accounting
  - Establish carbon market opportunities
  - Look for synergistic conservation benefits
  - Demonstration projects and public awareness

Key outputs:
- International demonstration and application of “blue forests” values
- Active experience sharing, learning and replication

National and Sub-national Blue Carbon Demonstration Activities

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Climate Services from Coastal Ecosystems: Blue Carbon and Green Infrastructure

UNFCCC Conference of Parties, 20
US Center
Lima, Peru, December 8, 2014
Goal of Restoration (Adaptation)

Wetland Management Learning Curve
1. Recognize value of wetland management
2. Establish examples of good practice
3. Achieve multi-use functional landscape
4. Adaptation to climate change
5. Incorporate GHG fluxes and storage

Blue Carbon Interventions:
- Policy adjustment
- Management actions
- Carbon finance projects

Ecosystems in focus for climate change mitigation
- Forest
- Tidal Forest
- Peatland
- Tidal Marshes
- Seagrass

Distribution of carbon in coastal ecosystems
- Soil-Carbon Values for First Meter of Depth Only (Total Depth = Several Meters)
- Seagrasses
- Tidal Salt Marshes
- Estuarine Mangroves
- Oceanic Mangroves
- All Tropical Forests

Data summarized in Crooks et al., 2011; Murray et al., 2011, Donato et al., 2011
Emissions from One Drained Wetland:
Sacramento-San Joaquin Delta

Area under agriculture: 180,000 ha
Rate of subsidence (in): 1 inch
3-5 million tCO2/yr released from Delta

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

Accommodation space: 3 billion m³

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

“proto-peat” ACCRETION

Net Carbon Sequestration Potential

<table>
<thead>
<tr>
<th>Wetland Type</th>
<th>Carbon Sequestration Potential (ton CO₂/acre/yr)</th>
<th>Methane Production Potential (ton CO₂/acre/yr)</th>
<th>Net balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshes</td>
<td>High (3.2 – 3.7)</td>
<td>Low (-0.5)</td>
<td>High C sequestration</td>
</tr>
<tr>
<td>Salt Marsh (very 3.5–3.8)</td>
<td>High (2.0 – 3.7)</td>
<td>Low (-0.5)</td>
<td>High C sequestration</td>
</tr>
<tr>
<td>Mangrove</td>
<td>High (2.0 – 3.7)</td>
<td>Low (-0.5)</td>
<td>High C sequestration</td>
</tr>
<tr>
<td>Reddish Tidal Marsh (v. 3.0–3.5)</td>
<td>High (2.0 – 3.7)</td>
<td>Low (-0.5)</td>
<td>High C sequestration</td>
</tr>
<tr>
<td>Reddish Tidal Marsh (Managed)</td>
<td>Very High (2.0 – 3.7)</td>
<td>Very High (2.0 – 3.7)</td>
<td>Potential very high C sequestration</td>
</tr>
<tr>
<td>Estuarine Forest</td>
<td>High (3.0 – 3.7)</td>
<td>Low (-0.5)</td>
<td>High C sequestration</td>
</tr>
</tbody>
</table>

Greenhouse gases

<table>
<thead>
<tr>
<th>Gas</th>
<th>Current (1998)</th>
<th>Global warming Potential</th>
<th>Percent increase since 1750</th>
<th>Radiative forcing (W/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide CO₂</td>
<td>365 ppm</td>
<td>1</td>
<td>31%</td>
<td>1.46</td>
</tr>
<tr>
<td>Methane CH₄</td>
<td>1,745 ppb</td>
<td>21</td>
<td>(25, 34)</td>
<td>150%</td>
</tr>
<tr>
<td>Nitrous oxide N₂O</td>
<td>314 ppb</td>
<td>310</td>
<td>16%</td>
<td>0.15</td>
</tr>
</tbody>
</table>

The Humber Estuary

405 km of levees
870 km² of drained wetlands

Loss of biomes and carbon stocks.
Sequestration reduced 99%
Ongoing emissions

(Andrews et al. 2000)
Recent Activity

- IUCN and UNEP Reports on Blue Carbon (2010)
- Climate Action Reserve - Tidal Wetlands Offeres Paper (PWA and SAAC 2010)
- RAIE Blue Ribbon Panel and Action Plan 126 forecasted 2015
- NCEAS Working Group – Salt wetlands carbon model
- International Blue Carbon Initiative (2011 onwards)
  - Scientific Working Group
  - Policy Working Group
- Reports (2011):
  - World Bank, IUCN, USAFPA – Global activities and policy implications
  - State University, Indonesia Potential
  - Climate Focus – International Policy

IPCC Wetlands Supplement for National GHG Accounting (2011-2013)

- Voluntary Carbon Standards
  - Recognize wetlands activities
  - Methodology for Tidal Wetlands and Seagrass Restoration in review
  - Conservation Methodology in Development

- Working Groups
  - US Federal Agency Blue Carbon Group
  - US National (US-WBG) – task to opportunistic AC and present projects
  - Groups: projects – Indonesia, Metegagni, Austria, New York, Costa Rica, Oregon, Washington (?)

- Guidelines for Coastal Wetland Carbon Projects

2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands

1. Introduction
2. Cross cutting guidance on organic soils
3. Rewetting and restoration of organic soils
4. Coastal wetlands
5. Other freshwater wetlands
6. Constructed wetlands
7. Good practice and implications for reporting

Adopted by IPCC Oct 2013, Published Feb 2014
http://www.ipcc-nggip.iges.or.jp/

Example Project Activities Likely to be Covered by VCS Coastal Wetlands Restoration Methodology

- Rewetting of drained wetlands (dike breach, managed wetlands)
- Subsidence reversal (managed reed beds soil building)
- Restoring sediment supply
- Lowering of water levels on impounded wetlands
- Raising soil surfaces with dredged material
- Restoring salinity conditions
- Improving water quality
- Revegetation (marsh / forest)
- Combinations of the above

Lessons from Conservation and Restoration Planning

1. Have a clear and coherent planning approach
2. Plan conservation and restoration in the wider landscape context
3. Prioritize sites (not all are suitable)
4. Restore physical processes and ecosystem dynamics
5. Recognize the value of project design and engineering
6. Understand the restoration trajectory and ecological thresholds
7. Conserve and restore ecosystems sooner rather than later
8. Restoration of historic conditions is not always possible
9. Avoid transplantation of non-indigenous species
10. Be patient
Lessons learnt from carbon projects

1. Assume ownership of the project
2. Choose and demarcate the site(s) carefully
3. Choose the project standard and project delivery cycle
4. Access the market early
5. Link the project to other finance options
6. Check the costs and prepare for economies of scale

Lessons from community engagement

1. Invest in pre-project community capacity building
   - E.g. Field schools
2. Build capacity within government
   - National support
   - Subnational support
3. Meet in the middle
   - Train extensionists,
   - stakeholder communication
4. Establish livelihoods programs

Steps in Blue Carbon Project Planning

1. Define project concept and perform preliminary feasibility assessment.
2. Define target market and select a carbon standard
3. Establish effective community engagement
4. Design project activities
5. Assess permanence risk and develop mitigation strategy
6. Secure project development finance and structure agreements
7. Provide for legal due diligence and assess carbon rights
8. Provide for social and environmental impacts assessment
9. Maintain ongoing liaison with regulators.

U.S. Blue Carbon Demonstration Activities

- Understanding landscape GHG fluxes (national & local science)
- Incorporating wetlands into the national GHG inventory
- Supporting national and sub-national blue carbon working groups
- Building technology for blue carbon monitoring
- Modeling coastal system response to climate change
- Connecting blue carbon and green infrastructure
- Developing policy and market tools (CalC Market, VCS Methodology)
- Linking climate change adaptation and mitigation
- Supporting international demonstration activities

“Blue” Carbon Monitoring System

Product 1: National Scale - stock-based 30m resolution C pool maps (1992-2011) via NOAA’s C-CAP (NLCD) linked with regional SLR and SSURGO 1m soil data.

Product 2: Sentinel Site - stock-based and process-based maps, where:
- Field and remote sensing data availability (abundance and quality)
- Within-site range of tidal wetland categories
- Salinity
- Vegetation types
- Landuse (degradation, restoration)
- Between-site range of climate variables

Product 3: Price of Precision Error Analysis (30m v 250m, Tier 1,2,3, Algorithms)
Snohomish Estuary Blue Carbon Assessment

- 4749 ha of drained wetlands
- 29% of wetland loss in Puget Sound
- 1353 ha of restoration planned.

Planned restoration of 1,353 ha would yield 1,176,000 tons CO₂ sequestration at current sea level

Full restoration of 4,393 ha would yield 4,495,000 tons CO₂ sequestration at current sea level

www.estuaries.org

Future Landscape

Project Wetland Response to SLR

Modeling with Marsh98

SSC: 300 mg/L (very high)
SSC: 150 mg/L (high)
SSC: 50 mg/L (low)

SLR Scenario: NRC-III
Organic sedimentation rate: 1.0 mm/yr

Ventura Coastal Resilience Project

Model change in shoreline, flood risk
Develop management scenarios
AFOLU GHG assessment
Include wetland GHG's

Assessing the Blue Carbon Benefits of Habitat Restoration in Tampa Bay

Managed retreat
Hold line

www.estuaries.org www.TBEP.org
Blue Carbon
Horizontal Level
An example of blue carbon, with green-grey infrastructure to provide climate mitigation, flood protection cost reduction and ecosystem benefits.

Living River Concept
Adopted Nationally by US Army Corps of Engineers
Benefits:
- flood risk and cost reduction
- improved river ecosystem
- recovery of blue carbon ecosystems

Where do we want to go?
• Growing network of connected groups and demonstration projects (all level of governance)
• Improved science to support management and policy
• Building resilience:
  – Connecting mitigation and adaptation
  – Connecting climate change financing and coastal management
  – Engaging communities
  – Linking carbon and nitrogen markets
  – Linking blue carbon and ocean acidification
• Strategic planning

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