Carbon Storage and Emissions from Coastal Ecosystems

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Managing Coastal Ecosystems for Climate Mitigation

Climate Change and Response Expo
COP 17, Durban, Dec 7th 2011
Ecosystems in focus for climate change mitigation

- Forest
- Peatland
- Mangroves
- Tidal Marshes
- Seagrass
Long-term carbon sequestration and storage

Carbon from plants gather in soil and builds up over thousands of years.
Peat Accumulation: Belize Example

McKee & Vervaeke, 2009
Distribution of carbon in coastal ecosystems

- **Tidal Salt Marsh**: $5.1 \pm 1.4 \text{ tCO}_2 \text{e/ha/yr}$
- **Seagrasses**: $8.0 \pm 0.9 \text{ tCO}_2 \text{e/ha/yr}$
- **Estuarine Mangroves**: $8.3 \pm 1.4 \text{ tCO}_2 \text{e/ha/yr}$
- **Oceanic Mangroves**: $0.2 \pm 0.1 \text{ tCO}_2 \text{e/ha/yr}$
- **All Tropical Forests**: $5.1 \pm 1.4 \text{ tCO}_2 \text{e/ha/yr}$

Data summarized in Crooks *et al.*, 2011; Murray *et al.*, 2011
Global Carbon Burial by Ecosystem (Mt C / yr)

Total Area (km²): Coastal 640, Forests 43,700, Peatlands, 3,850
## 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>
Long-term release of carbon from organic soils
Emissions from One Drained Wetland

Area under agriculture: 180,000 ha
Rate of subsidence (in): 1 inch

5 to 7.5 million tCO$_2$/yr released from Delta

1 GtCO$_2$ release in c.100 years
4000 years of carbon emitted

Equiv. carbon held in 25% of California’s forests
CO₂ Emissions from Drained Wetlands (million tons)
How Big is Blue Carbon?

**Globally:**
~10-20% as big as REDD

<table>
<thead>
<tr>
<th>CO₂ Emissions (Mt/year)</th>
<th>REDD</th>
<th>Peat</th>
<th>Blue Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>~4,000</td>
<td></td>
<td>~2,000</td>
<td>~300-900</td>
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</table>

**Nationally:**
Potentially more in coastal tropical countries

Coastal wetlands are very rich in Blue Carbon
International Blue Carbon Scientific Working Group

Near term

• Support of IPCC
  • Wetlands GHG national accounting

• Global Coastal Carbon Data Archive
  • Development of emissions factors

• Guidance documents
  - Field data collection
  - National assessment

• Inform developing policy

Long term

• Scientific guidance
• Global network development
• Demonstration and publication
Conclusions

- Coastal are an important component of the global carbon cycle
  - Sequester carbon
  - Hold dense carbon stocks in soil pool
  - Emit carbon when disturbed.

- Emissions or significant
  - Wetlands emit large quantities of CO$_2$ directly to the atmosphere when drained. (insufficiently studied – priority focus for future research)
  - Emissions from drained wetlands highest in first few year
  - Organic rich soils may release centuries to millennia of carbon within a few decades.

- Climate change mitigation
  - Conservation most effective activity for preventing release of carbon
  - Restore coastal ecosystems to reestablish long term sequestration
  - Embed coastal ecosystem CC mitigation within adaptation planning
Thank you!

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