Natural Coastal Carbon Sinks

The missing sinks in the climate change debate?
1. Nature-based solution to climate change

1. Coastal Carbon Sinks: Current Knowledge
   Tidal Salt Marshes
   Mangrove Forests
   Seagrass Meadows
   Kelp Forests
   Oceanic Carbon Sinks

3. Building a roadmap
Ocean Services

- Oceans cover 71% of Earth’s surface

- food, livelihoods, transport, trade, protection, enjoyment

Climate:
- => climate regulation: currents, sea ice, evaporation, clouds
- => store most of the sun’s energy, act as a heat buffer
- => the largest CO2 sink, absorbing around 50% of atmospheric CO2 every year
Nature-based solutions

- Cost-effective, economic, scalable and safe approaches
- Can store large amounts of carbon
- Increasing recognition including under UNFCCC
- Advanced approaches for terrestrial systems/forests

- Same for marine/coastal ecosystems?
- How big is the climate wedge? how much is hype?
Coastal Carbon Sinks

- ‘The Management of Natural Coastal Carbon Sinks’ & ‘Blue Carbon’

- Synthesizing science, assessing potential
  - Tidal salt marshes
  - Mangroves
  - Seagrasses
  - Kelp Forests
  - Coral reefs (carbon neutral or a slight source, not covered here)
Tidal Salt Marshes

- Long-term storage in sediment $210 \text{ gC m}^{-2} \text{yr}^{-1}$
- 1-2% of the total carbon sink in USA
- No or low production of methane

- Extensive loss from dredging, tilling, draining, construction of roads
- Threatened by sea level rise
Mangrove Forests

- Long-term storage in sediment
  \[ \text{139 gCm}^{-2}\text{yr}^{-1} \]
- Global area c 160,000 km\(^2\)
- No or low production of methane

- More than 50% of mangrove forests lost: over-harvesting, conversion for aquaculture and salt-ponds, land based activities...
Seagrass Meadows

- Long-term storage in sediment
  83 gCm$^{-2}$yr$^{-1}$
- c. 300,000 km$^2$
- Turnover time of biomass is long

- Significant areas lost through human activities that lead to eutrophication and siltation.
Kelp Forests

- High productivity
- Rapid biomass turnover, as high as 10 times per year
- Transport to permanent sinks unknown

- Big areas of kelp forests lost or degraded from unsustainable land use practices and human harvests of top predators
## Summary

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>C-content Plants (g C m(^{-2}))</th>
<th>C-content Soil (g C m(^{-2}))</th>
<th>Area (*10(^{12})m(^{2}))</th>
<th>C-stock Plants (Pg C)</th>
<th>C-stock Soil (Pg C)</th>
<th>Long term c-burial (gC m(^{-2}) yr(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal Salt Marshes</td>
<td></td>
<td></td>
<td>(0.22 reported)</td>
<td></td>
<td></td>
<td>210</td>
</tr>
<tr>
<td>Mangroves</td>
<td>7,990</td>
<td></td>
<td>0.152</td>
<td>1.2</td>
<td></td>
<td>139</td>
</tr>
<tr>
<td>Seagrass meadows</td>
<td>184</td>
<td>7000</td>
<td>0.3</td>
<td>0.06</td>
<td>2.1</td>
<td>83</td>
</tr>
<tr>
<td>Kelp Forests</td>
<td>120-720</td>
<td>na</td>
<td>0.02-0.4</td>
<td>0.009-0.02</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Tropical Forests</td>
<td>12,045</td>
<td>12,273</td>
<td>17.6</td>
<td>212</td>
<td>216</td>
<td>2.3-2.4</td>
</tr>
<tr>
<td>Temperate forests</td>
<td>5,673</td>
<td>9,615</td>
<td>10.4</td>
<td>59</td>
<td>100</td>
<td>1.4-12.0</td>
</tr>
</tbody>
</table>
• High pelagic productivity, high recycling
  => carbon export to permanent sinks a small fraction of total production
  => but a significant amount

• Other important groups, e.g. benthic echinoderms
Potential for Mitigation

• Some natural coastal carbon sinks show
  – a high carbon storage capacity by unit area
  – a high capacity for long-term carbon sequestration in sediment
⇒ comparative value up to 10x temperate and 50x tropical forests

• Management: avoid loss, degradation and conversion, promote ecosystem health and services, restoration

• To what extent can carbon sequestration be enhanced or emissions avoided?
Gaps and challenges

• Incomplete inventories – spatial extent, trends
• Lack of data on sequestration potential, fluxes and permanence in sinks
• No international mechanism that recognizes or protects the value of marine and coastal ecosystems as carbon sinks (e.g. UNFCCC and related IPCC processes)
• Possible pitfalls
  – Adding rather than removing loopholes in policy frameworks
  – Shortcomings in carbon markets can be exploited
  – “Over-selling” the potential – but also underestimating it
Building a roadmap

• Mission critical elements that form the core of our program:

  ➔ Quantifying the carbon storage potential: research and mapping
  ➔ Developing carbon accounting and financing: methodologies and pilot tests
  ➔ Instigating policy change: research, dialogue and capacity building
  ➔ Understanding the broader context: other/ocean systems
Moving ahead

• **Convening the global community**
  – Coherence and coordination, a stronger voice
  – Roundtable held in Washington DC in March 2010 and at the Global Ocean Conference in Paris, CBD and UNFCCC CoPs

• **Influencing international processes**
  – better consideration of natural coastal carbon sinks under UNFCCC and its related scientific body the IPCC;
  – working with and supporting UNFCCC and governments to develop adequate policy and disseminate best-practices;
Moving ahead

• Advancing and supporting cutting-edge scientific research
  – E.g. permanence of carbon storage and our ability to influence this
  – IUCN is supporting the development of a global synthesis map of coastal carbon sinks

• Developing carbon accounting and finance mechanisms
  – Methodologies for including coastal wetlands in national greenhouse gas inventories
  – Trade in ‘blue carbon credits’
  – Exploring existing compliance and voluntary market mechanisms
Moving ahead

• **Implementation and pilot testing**
  – Integration with Ecosystem-based Adaptation programmes
  – Establishing a network of sites that can sell ‘blue carbon credits’ through available markets
  – already starting to take off

• **Understanding the broader ocean context**
  – Further work to better define other carbon sinks, such as in oceanic systems, and opportunities for policy or practical action
Partnerships

- WB: Mapping project
- UNEP: GEF TR project in development

- Research institutions: e.g. University of Queensland, Woods Hole, IAEA Marine Lab
- NGOs: CI, TNC, WWF, Forest Trend, NRDC, etc.
- Site partners: e.g. Mangroves for the Future initiative
- Private sector: e.g. partners testing carbon trading/offset programmes, as well as financing
- Foundations: e.g. Linden Trust, Walton Foundation, others
Timeline and Milestones

• 2010-11
  – Critical mass for policy influencing
  – Consortium for field research established
  – Some ‘Blue carbon’ National Appropriate Mitigation Actions (NAMA)
  – Report on oceanic carbon sinks

• 2011-12
  – Carbon accounting methodologies development and testing
  – Carbon trade pilot projects
  – Several countries committed to coastal nature based mitigation

• 2012-14
  – Methodologies considered (approved?) by IPCC
  – and reflected in negotiations under UNFCCC
  – Possible financing mechanism (cf REDD)
Funding

- Estimated cost over 3 years
- Quantifying the potential: USD 1 – 1.5 million depending on geographic coverage
- Field Testing: USD 1 million
- Accounting and finance: USD 500,000
- Policy Change: USD 500,000