SERVICES, EMISSIONS AND VALUES OF MANGROVES AND THEIR IMPORTANCE FOR INCLUSION IN CLIMATE CHANGE MITIGATION AND ADAPTATION STRATEGIES

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UNFCCC Workshop on technical and scientific aspects of ecosystems with high-carbon reservoirs not covered by other agenda items under the Convention, such as coastal marine ecosystems, in the context of wider mitigation and adaptation efforts.
Mangroves - a unique tropical forest type

- 138,000 - 152,000 Km² (145,000 Km²)
- Occur in tropical and subtropical tidal zones
- Widely Distributed - 123 countries
- Critical provision of ecosystem services

Spalding et al. (2010)
Mangroves - Tremendous range in structural diversity
Avicennia marina mangrove Abu Dhabi, UAE
Mangle Bajo, Parque Nacional Montecristi, Republica Dominicana
Mangroves are considered as high priorities in climate change adaptation and mitigation strategies throughout the world.

This is for at least 4 reasons:

1. They have exceptionally high carbon stocks – among the highest of any ecosystem on earth;
2. Their rates of land cover change/deforestation are the highest in the tropics;
3. Their emissions from land cover change far exceed emissions from land conversion of upland forests; and
4. Mangroves provide a number of ecosystem services that are vital to the sustainability of local communities, livelihoods, and infrastructure.
Ecosystem Services of Coastal Ecosystems: mangroves, seagrass, and marshes

- Biological diversity
- Water quality and timing
- Flood and storm damage
- Forest and non-timber forest products
- Aesthetic and ecotourism values
- Fish and Shellfish
- Carbon Sinks (of great importance with respect to REDD+ and other mitigation strategies)
There exists unique biodiversity values in mangroves.
Spoonbill and Ibis, Islas de los pajaros, Honduras
Proboscis Monkey in Nipa Palm, Sekonya River, Central Kalimantan Indonesia
Sundarbans Reserve Forest (Ganges Delta) Bangladesh
32-75% of all tropical commercial fish species pass part of their lives in the mangroves, where they encounter:

- nursery grounds
- shelter
- food

32 - 75% de todas las especies comerciales de peces tropicales pasan parte de su vida en los manglares, donde se encuentran:

- zonas de cría
- abrigo
- comida
Ecotourism, Inspirational, and spiritual values

Estero Damas, Costa Rica
Mangroves function to protect coastal settlements from storm (and tsunami) damage in a changing climate.
Economic values of mangroves (in US Dollars)

- $200,000-900,000/ha - all products and services they provide (Wells et al. 2006)
- $300,000/km of shoreline storm protection and flood control in Malaysian coastline (From Gilman et al. 2008)
- Value of mangroves for fisheries - $37,500/ha /yr (Mexico) (Aburto-Oropeza et al. 2008)

“Social value” of Blue carbon = $41.00/ton (Pendleton et al. 2012)
Forest Carbon stocks

Data are from: IPCC, 2001: Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change; Donato et al. (2011), and this presentation.
Stratified sampling across Countries allows for Tier 2 or even Tier 3 level of certainty

Examples- Honduras, Indonesia, Yap, Kosrae UAE
Currently, on average, between 1-7% of blue carbon sinks are being lost annually:

- Upstream disruptions
- Salt Ponds
- Aquaculture
- Rice/Agriculture
- Road development /hydrological disruptions
- Coastal development
What are the emissions from mangrove conversion?

**Conversion/Land use**

- **C stock** = 3132 Mg CO2e/ha

**Greenhouse gas emissions**

- **TOTAL**
  - 2601 Mg CO2e/ha

**Loss of Ecosystem Services**

- Fish/Shellfish
- Coast Protection
- Water quality, etc.

**350 Mg CO2e/ha; a 89% loss**

Camaronera abandonado, Monte Cristi, RD
What are the emissions from rain forest conversion to cattle pasture?

**Total Greenhouse gas emissions**
620 Mg CO$_2$e/ha

**Loss of other Ecosystem Services:**
- Biodiversity
- Water quality, etc.

- **Tropical evergreen forest (602 Mg CO$_2$e/ha)**
- **Slash burn**
- **Cattle pasture, Brazilian Amazon (8 Mg CO$_2$/ha)**
Soil Cores from Mangrove above and a site converted to shrimp ponds, Dom. Rep.

C concentration  11.29% Mangrove; 1.01% Shrimp Pond
N concentration  3.7 mg/g Mangrove; 0.2 mg/g Shrimp Pond
Potential Emissions from Conversion of forests and mangroves

Emissions of C (CO2e Mg/ha)

- Amazon RF
- Mex Dry Forest
- Brazilian Cerrado
- Mangrove 30 cm soil loss
- Pendleton et al.
- Costa Rica conversion
- RD Bajo
- RD Medio
- RD Tall
- all mangroves

Aboveground CH4
Aboveground CO2
Soil CH4
Soil CO2
Accurate MRV is possible for mangroves

Protocols for the measurement, monitoring and reporting of structure, biomass and carbon stocks in mangrove forests

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Land cover change of the Mahakam delta, East Kalimantan, Indonesian from 2000 to 2010 (bottom). The figure shows the forest cover fraction in 2000 (a) and 2010 (b), and absolute change in forest cover fraction between 2000 and 2010.

- Accurate monitoring of activity data is possible with remote sensing.
- C stocks, emissions, and sequestration is possible with combinations of field and remote sensing – examples Indonesia, Dominican Republic, Yap FSM.
SUMMARY

Why are mangroves so attractive for REDD+, other NAMAs, and Adaptation?

- There are a number of critical ecosystem services provided by mangroves;
- The carbon stocks in mangroves are among the highest of any ecosystem on earth;
- Rates of land use/land cover change in mangrove conversion are high;
- Greenhouse gas emissions from mangrove conversion are high;
- The MRV is possible in mangroves.
Thank you

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