

The Science of Blue Carbon

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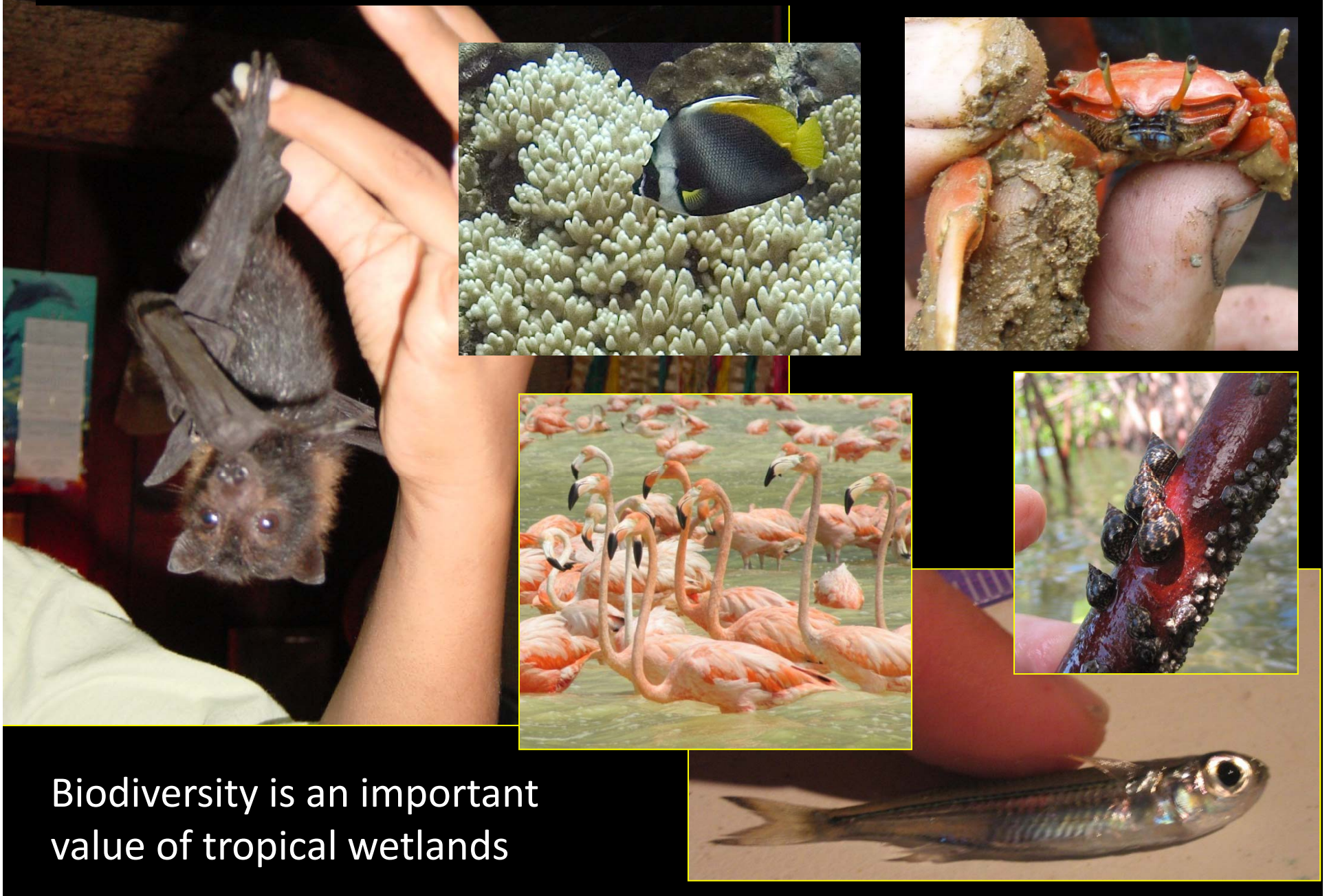
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Climate Change and
Watersheds Program



Ecosystem services from coastal environments



Biodiversity is an important value of tropical wetlands

Ecosystem services - Fisheries

75% of all tropical commercial fish species spend part of their lives in the mangroves, where they encounter:

- nursery grounds
- shelter
- food





Coastal protection, education, ecotourism, science, and traditional and spiritual values are also important services provided by coastal ecosystems.

Estero Damas, Costa Rica

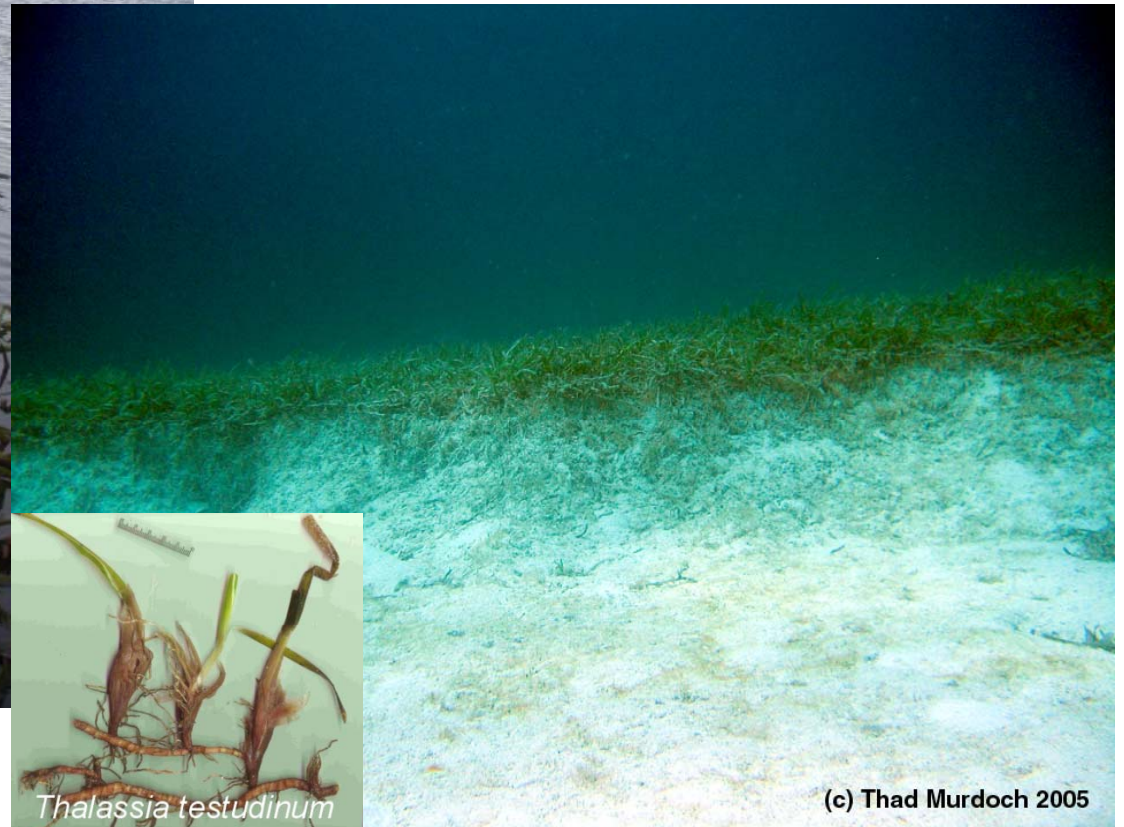
Carbon sequestration



Blue Carbon

sinks include:

Seagrass meadows



Seagrass, Babeldoab Island, Palau

(c) Thad Murdoch 2005



Mangroves (tall & dwarf): *Rhizophora spp.*, *Pelliciera rhizophorae*,
Avicennia germinans, *Laguncularia racemosa*

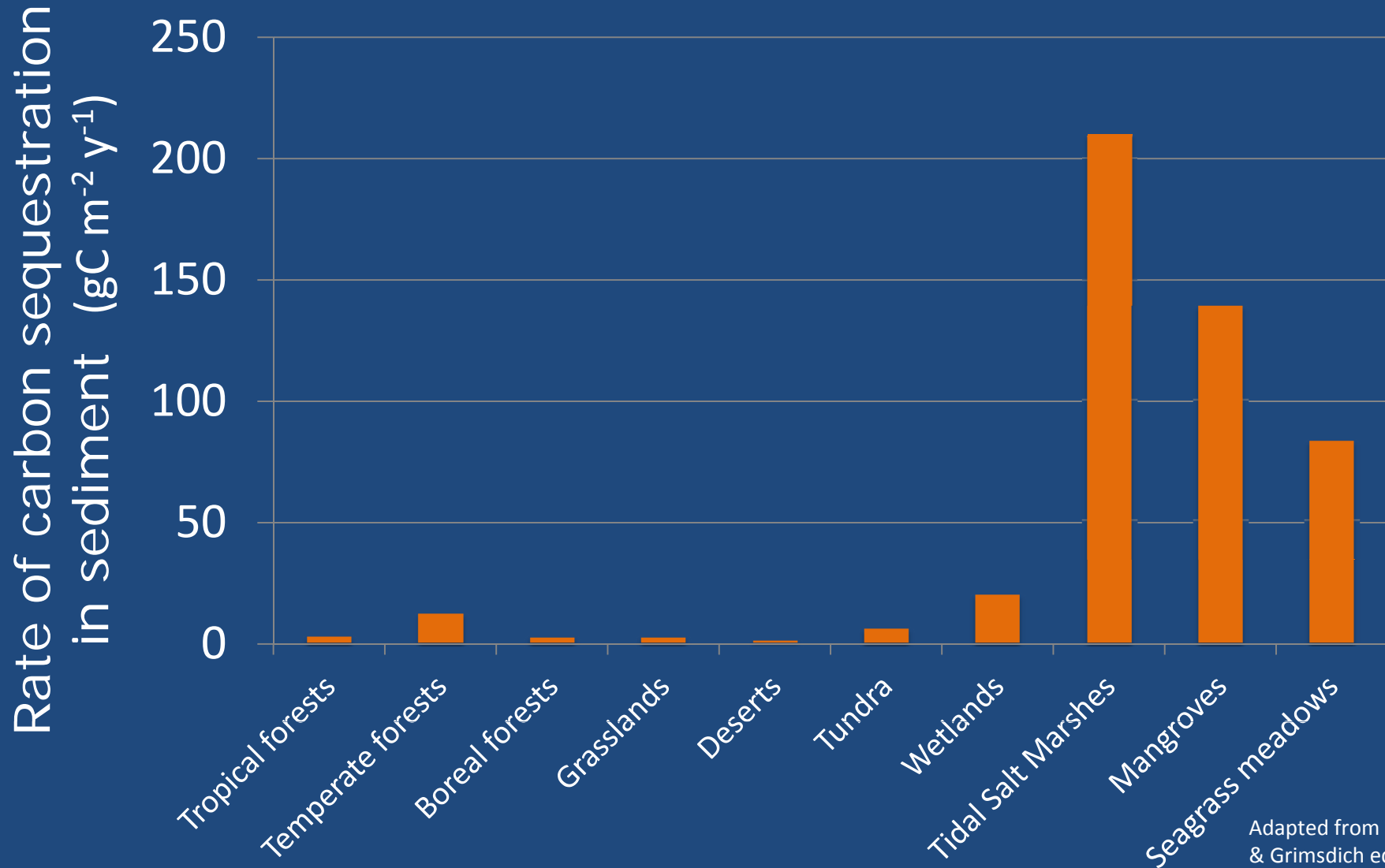
Estero Damas, Costa Rica



Salt marshes

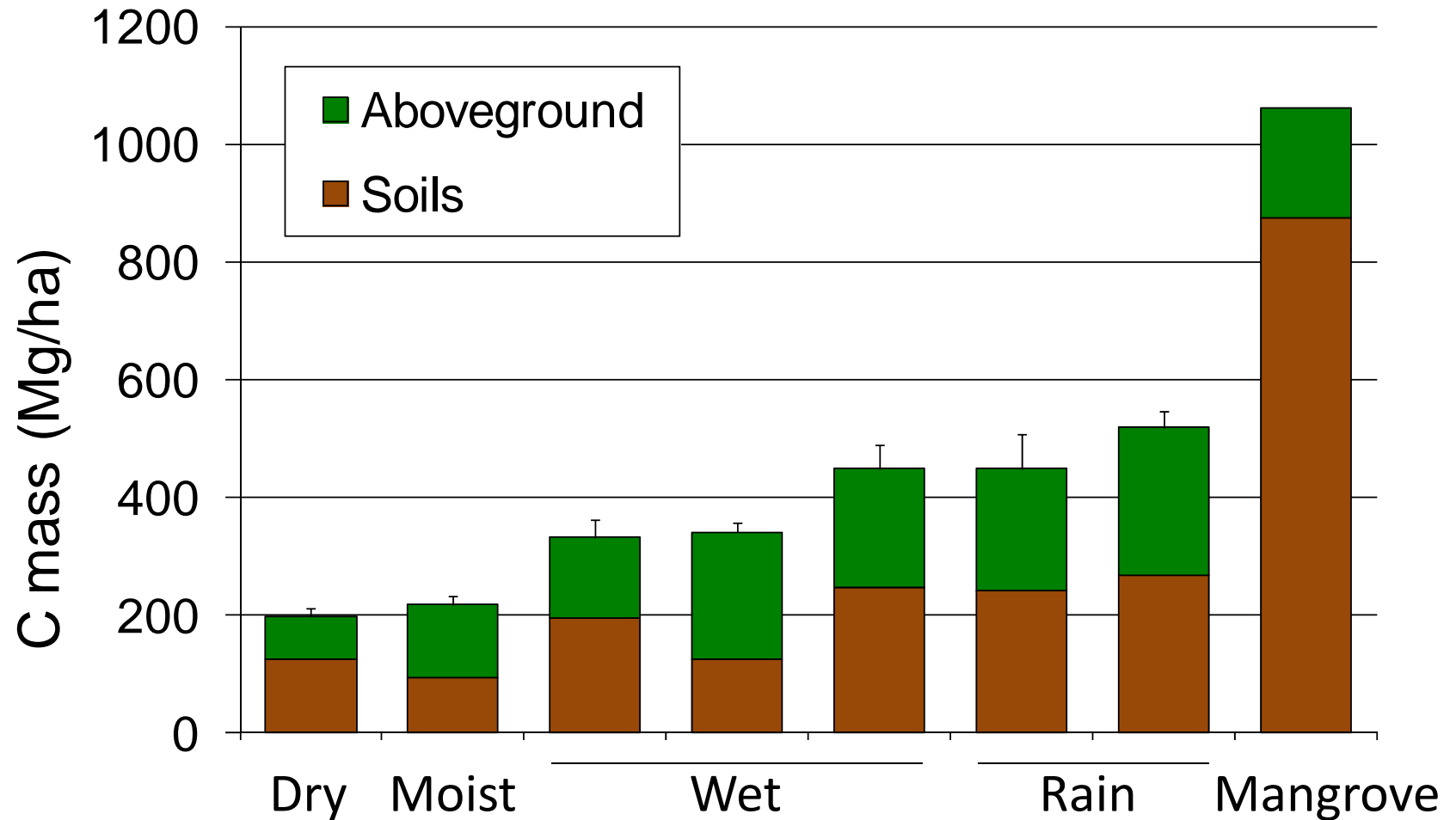
Reserva Biosfera Sian Kaan, México

Coastal ecosystems have high carbon sequestration rates

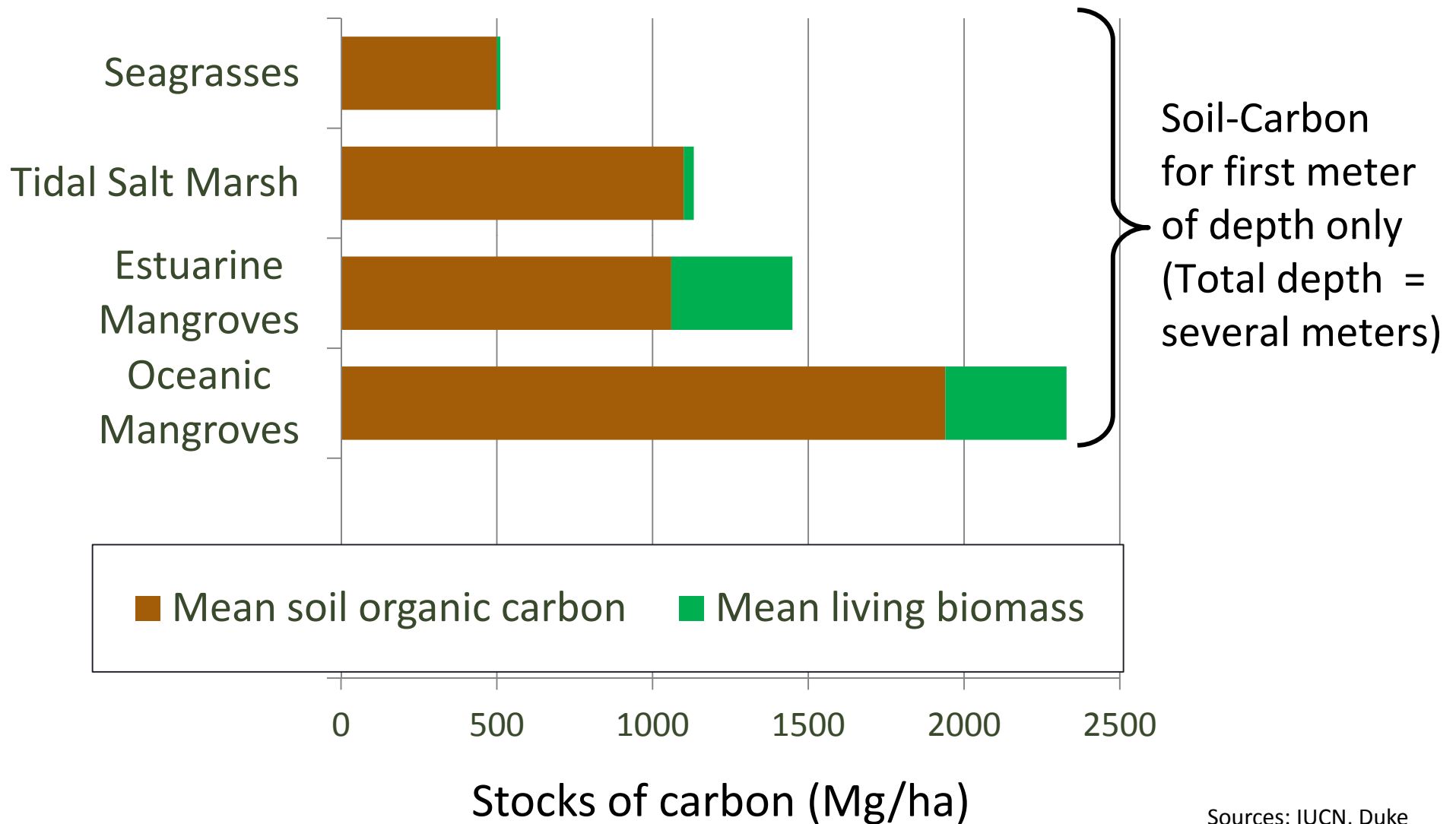


Adapted from Laffoley & Grimsdich eds. 2009

Total ecosystem carbon stocks: Costa Rican upland forests vs. mangroves



Coastal habitats protect significant amounts of carbon



These ecosystems are being lost rapidly



Upstream disruptions



Aquaculture



Rice/Agriculture



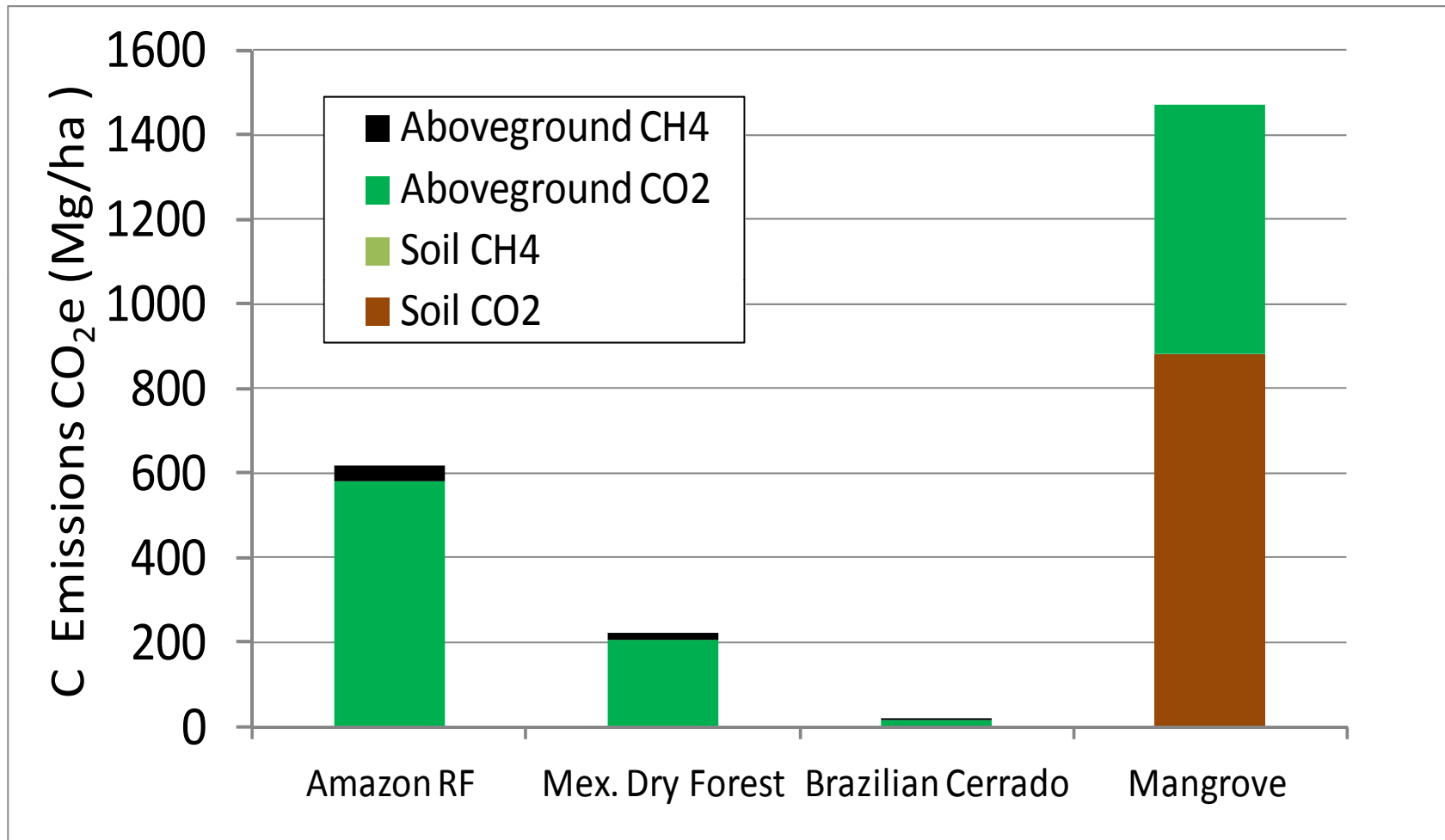
Road development/
hydrological disruptions



Pollution

Modeled fire emissions

Forest conversion



Data are from Kauffman et al 2004, Steele 2000, de Castro 1996, and Donato et al. 2011

Data from rainforest and methods to predict emissions from fires are from Guild et al. (2004) *Ecol Apps* 14:232-246.

Mangrove emissions are based on the assumptions of 1 the oxidation of top 30 cm of soils C.

Global carbon emissions

- Global emissions from conversion:
 - Mangroves: 0.02 – 0.12 PgC yr⁻¹
 - Seagrass: 0.06 – 0.3 PgC yr⁻¹
 - Salt marshes: unknown
- Or as much as:
 - 10 - 23% of emissions from deforestation
 - 40% of peat swamp emissions

1 terragram (Tg) = 10⁶ Mg or 10¹² g (1 million Mg)

1 gigaton (GT) = 10¹⁵g = 1 petagram (Pg) (1 billion Mg)



Pan et al. 2011
Donato et al. 2011
Fourqurean et al. *In prep.*

Costa Rica: demonstration site

- REDD+ FCPF country
- Technical and human capacity
- Payment for ecosystem services system
- Strong institutionalility
- Political support and legal frameworks



Térraba-Sierpe, Costa Rica

Summary

- Coastal ecosystems as important providers of multiple environmental services
- They can play an important role in climate change mitigation efforts
 - Large carbon stocks & high rates of accumulation
 - Threats to their persistence
- Costa Rica as a blue carbon demonstration site

¡Gracias!

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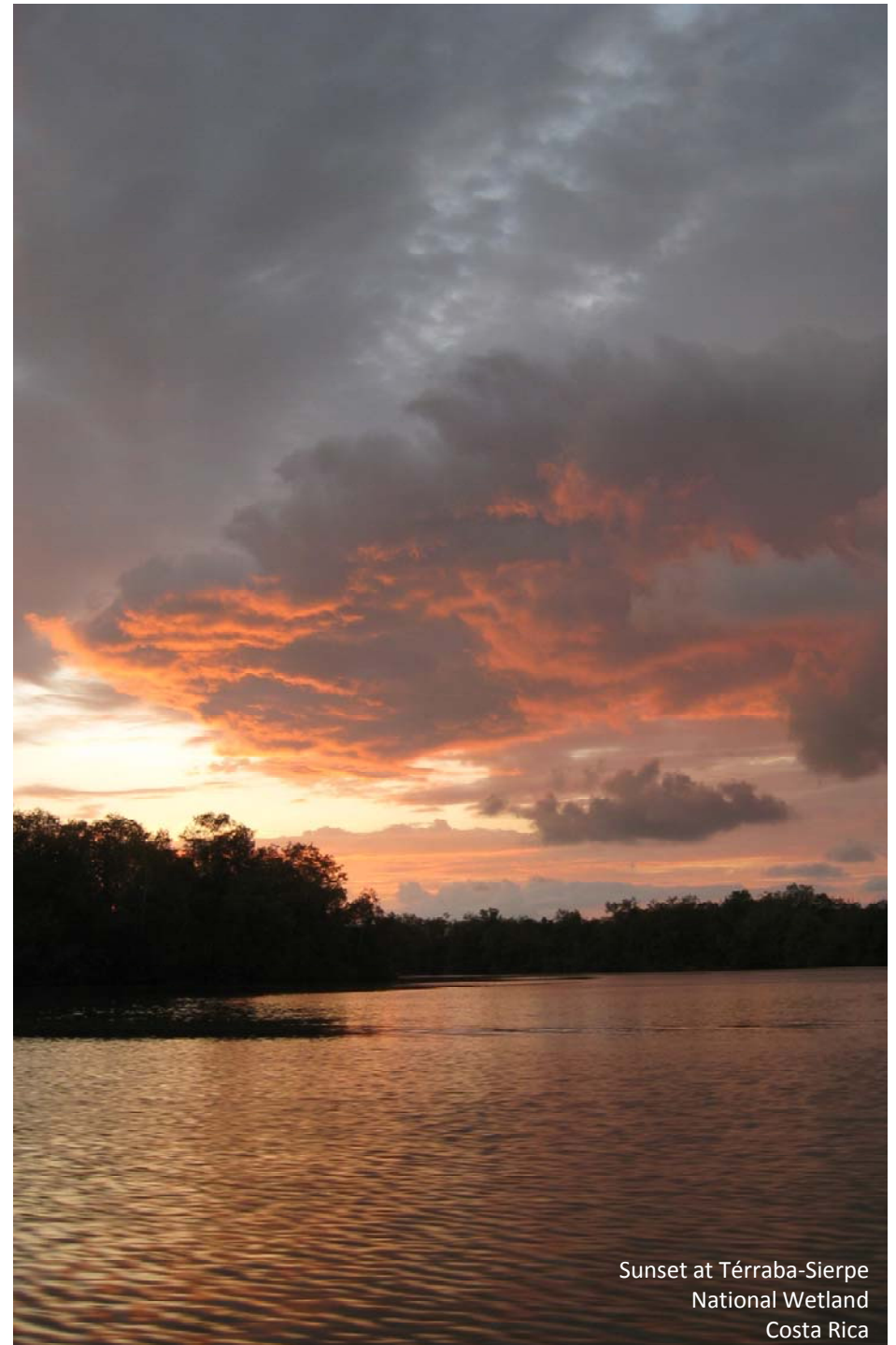


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Sunset at Terraba-Sierpe
National Wetland
Costa Rica