Vegetated Coastal Ecosystems in the IPCC Wetlands 2013 Supplement.

Hilary Kennedy, Bangor University.

CHAPTER 4 COASTAL WETLANDS

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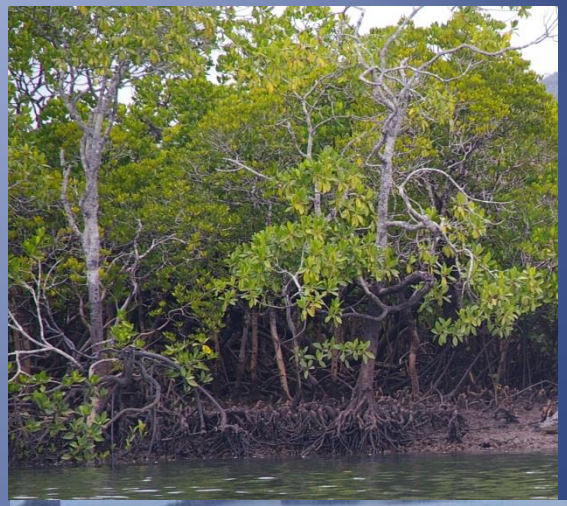

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- What, where and why?
- Management practices
- Emissions and removals of
  carbon dioxide (CO_2)
  methane (CH_4)
  nitrous oxide (N_2O)

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Mangroves are forested wetlands living along coasts within low latitudes.

What & where

Indonesia, Australia, Brazil, and Nigeria accommodate about 43% of the world's mangroves, which comprise a total global area of about 138,000 km^2

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Tidal marshes vegetation is dominated by salt tolerant grasses and herbaceous plants.

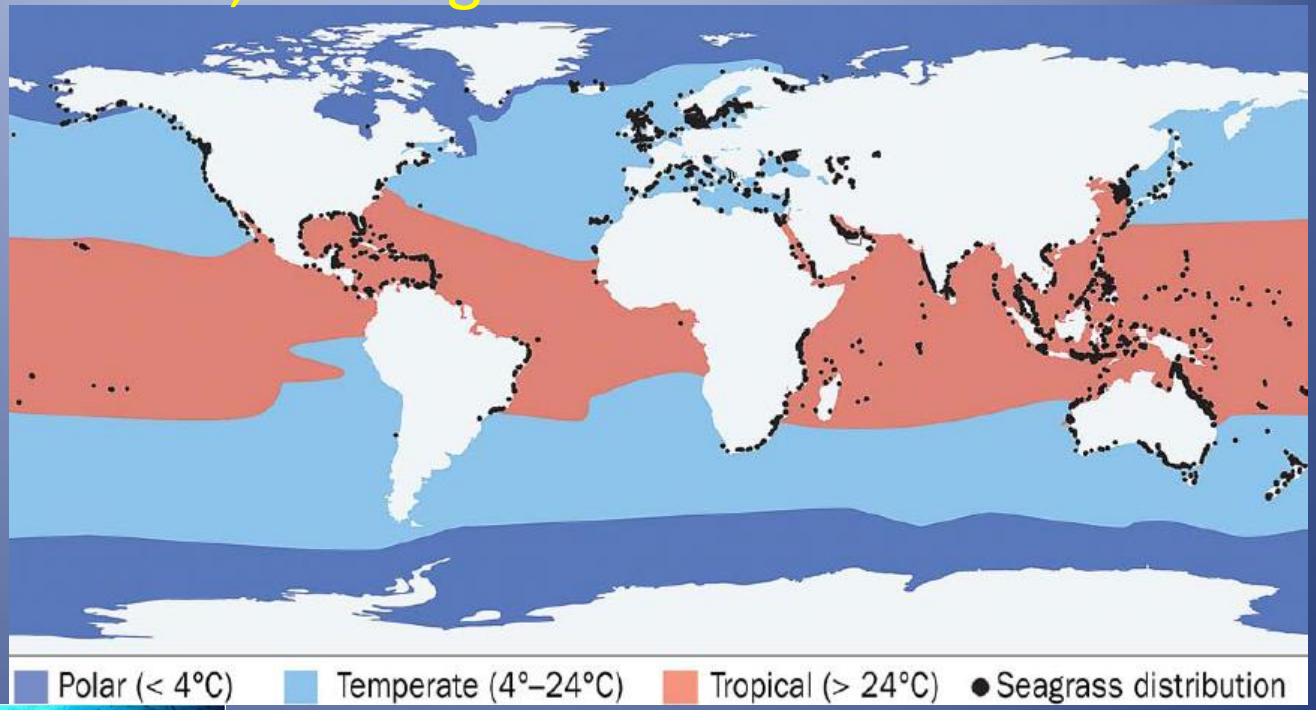
What
&
where

Salt marshes are widespread and an areal extent of 200,000-400,000 km^2

Photo by permission of G. Chmura

Seagrasses are flowering *vascular plants* that inhabit shallow areas of oceans, estuaries, and lagoons worldwide.

What
&
where



Seagrass meadows are found in every continent except Antartica with an areal extent of 200,000-600,000 km^2

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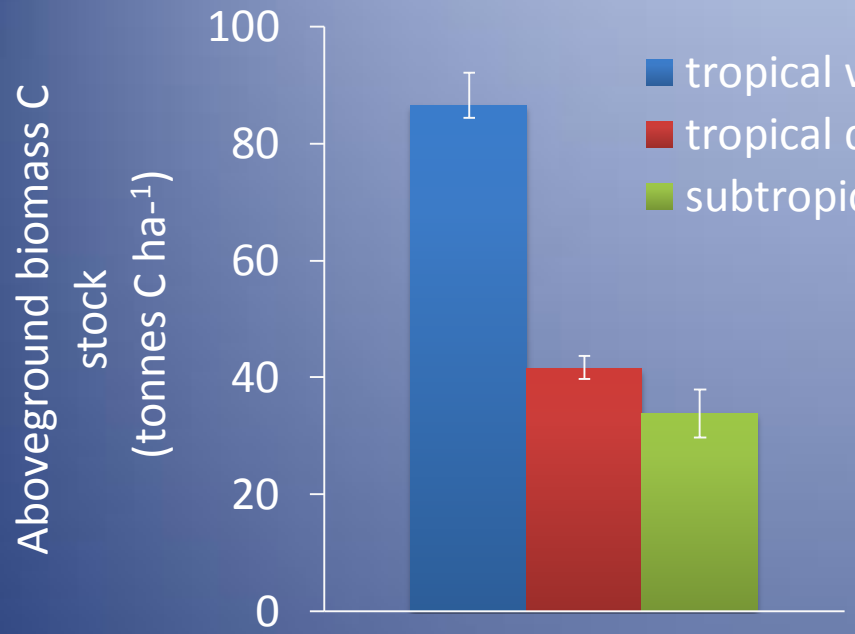
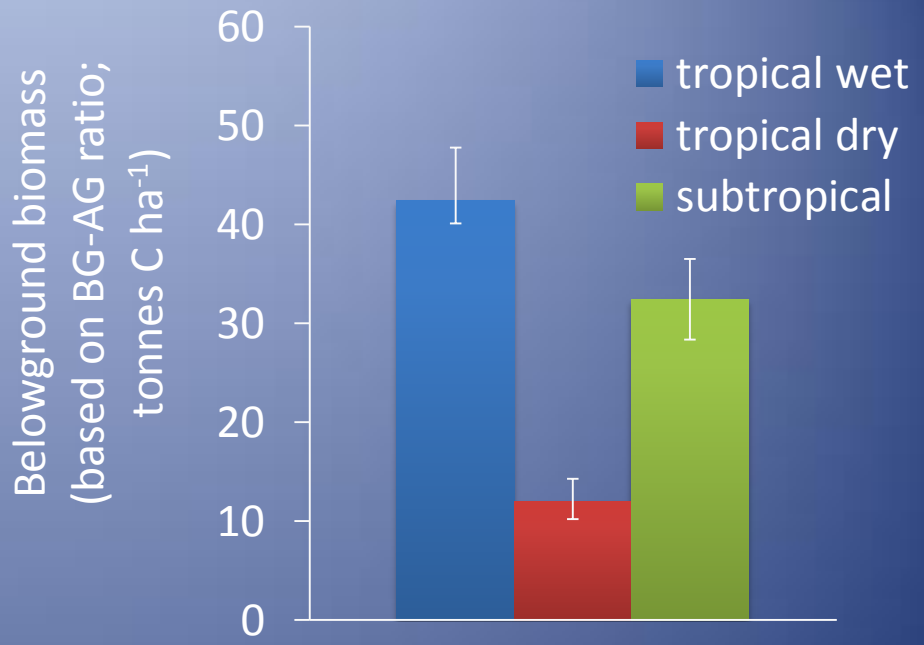
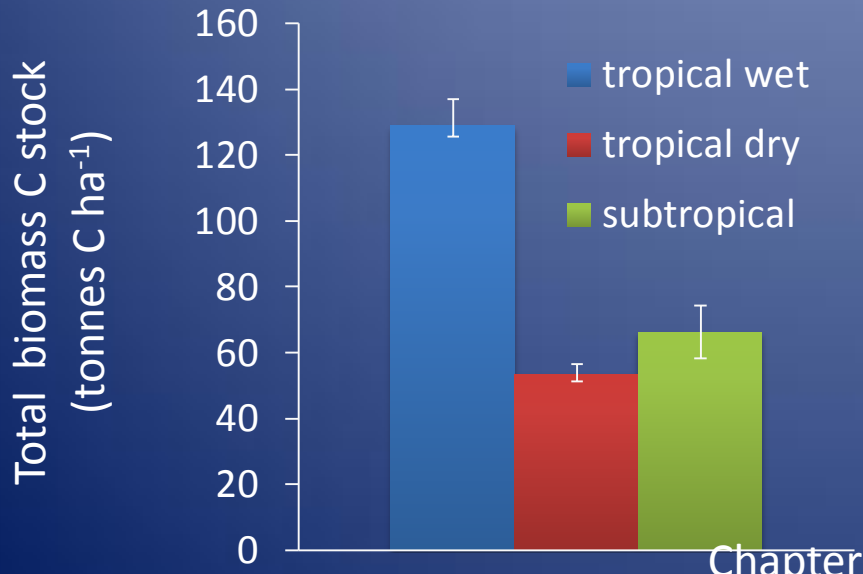
Mangrove biomass







Seagrass biomass

1 tonne ha^{-1}

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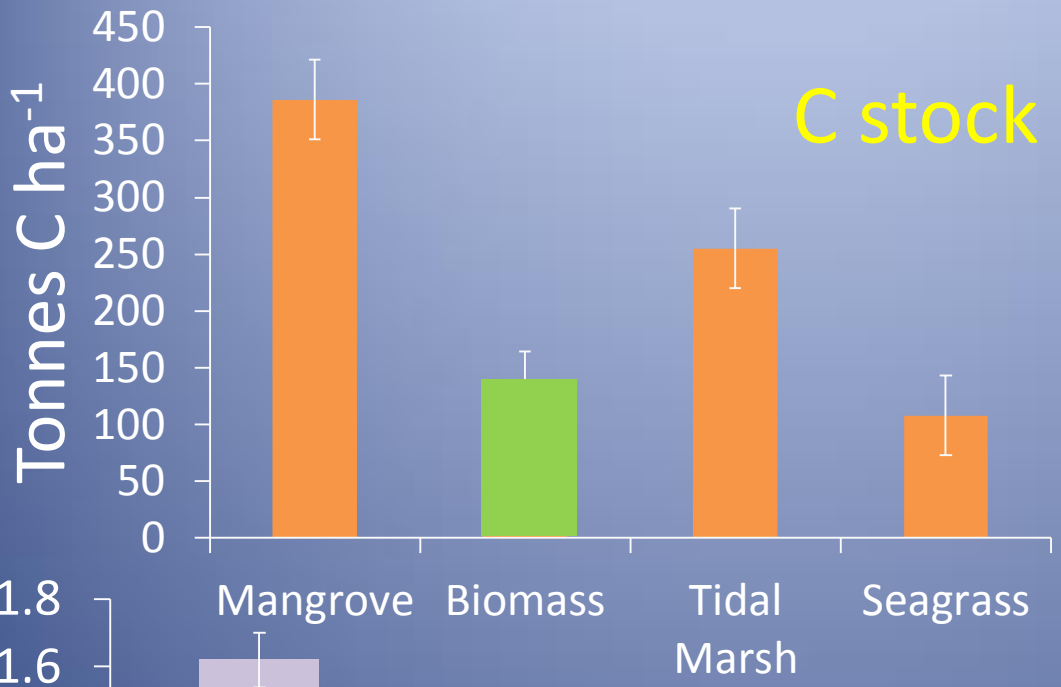
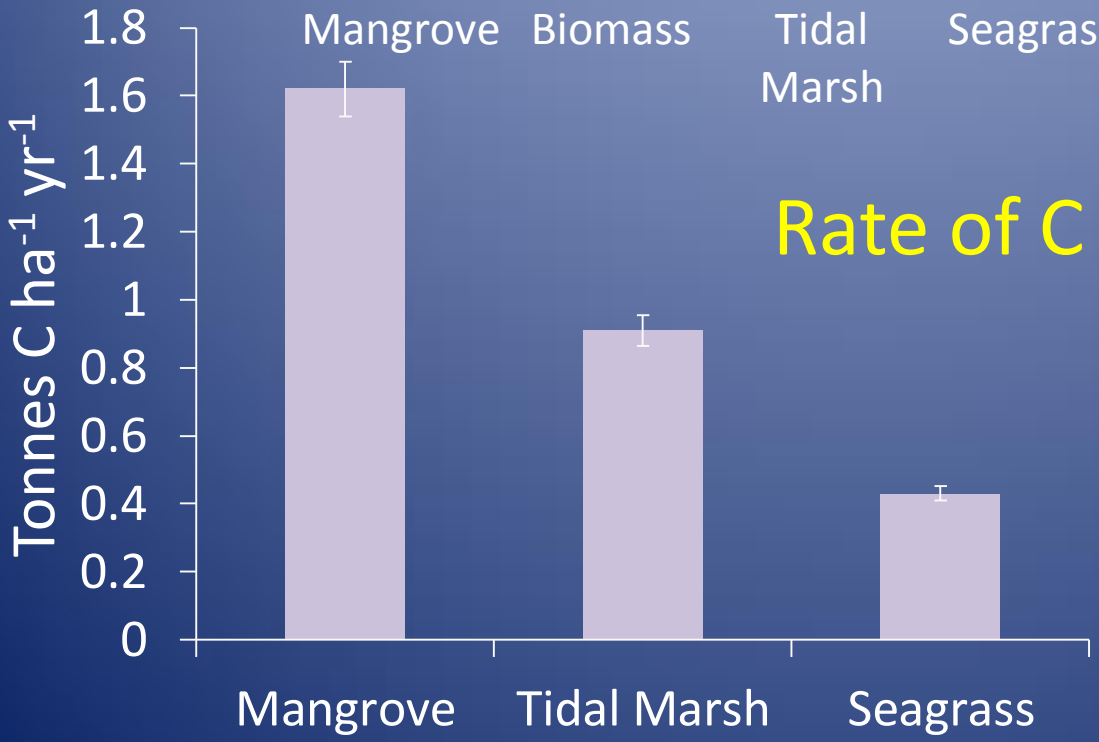


C stock in upper 1m of soil



Rate of C accumulation in soil

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Why?
Loss of mangrove.

http://mangroveactionproject.org/issues/shrimp-farming

Table 4.2: Current mangrove swamp areas, percent loss, annual loss rate, and percent of original area lost per year, for the mangroves of the continents and the world

	Current mangrove area (km^2)	% loss of mangrove forest area	Annual rate of loss ($km^2\ y^{-1}$)	% of original area lost per year
Asia	77,169	36	628	1.52
Africa	36,529	32	274	1.25
Australasia	10,287	14	231	1.99
Americas	43,161	38	2,251	3.62
World	166,876	35	2,834	2.07

Source: Data from Valiela et al. 2001.

Why?
Loss of mangrove.

Table 4.6: Recent activities in mangrove forests that have led to loss of habitat

	% of total
Shrimp culture	38
Forestry uses	26
Fish culture	14
Diversion of fresh water	11
Land reclamation	5
Herbicides	3
Agriculture	1
Salt ponds	<1
Coastal development	<1

Source: Adapted from data compiled from numerous sources (Valiela, Bowen, and York 2001).

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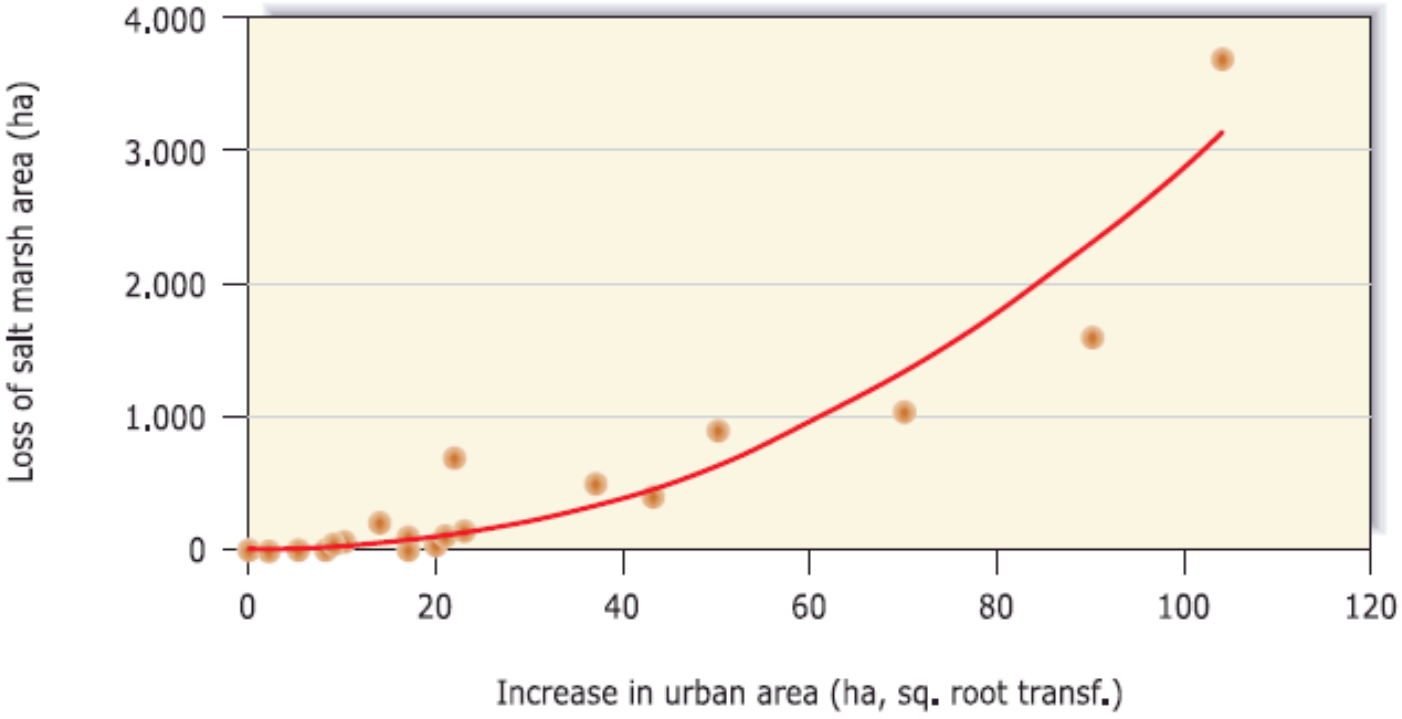
Why? Loss of tidal marsh

Figure 4.4: Loss of salt marsh area relative to increase in urbanized land area in southern New England, United States. Urban growth expressed as square root transformation of the values.



Source: Adapted from Bromberg and Bertness 2005.

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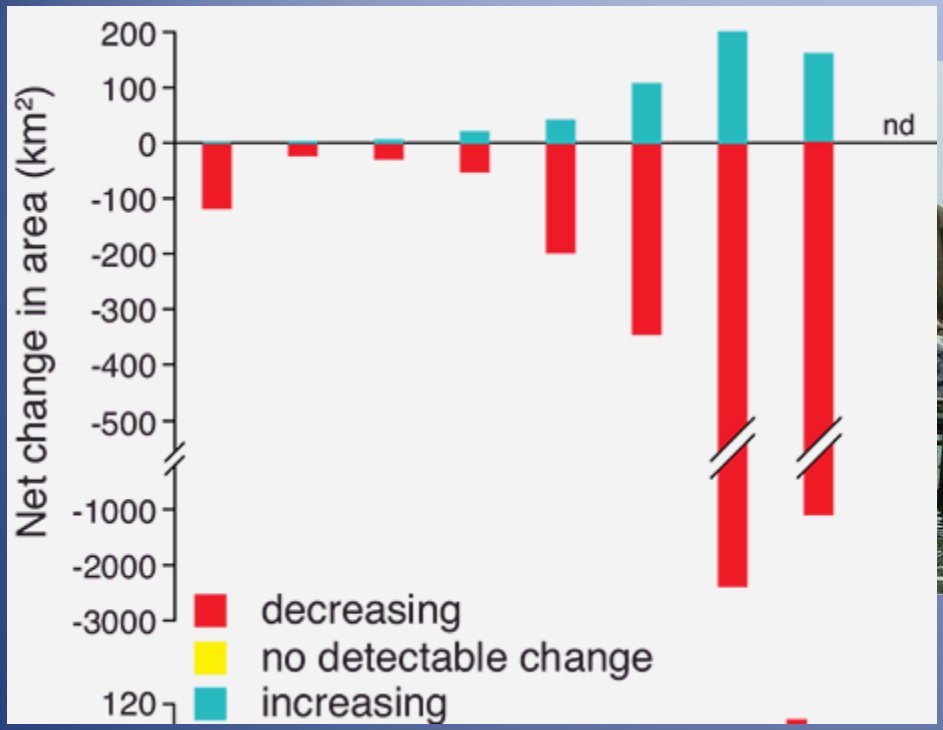
Why? Loss of seagrass meadows



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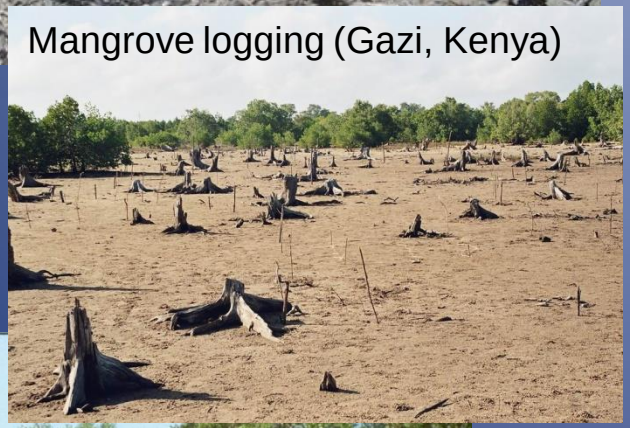
Chapter 4

- Forest management in mangroves
- Extraction – including excavation and construction phase for aquaculture and salt production
- Aquaculture- during use
- Drainage
- Rewetting and revegetation

1] Forest management



Default data for estimating C stock change in mangrove living biomass and dead wood pools

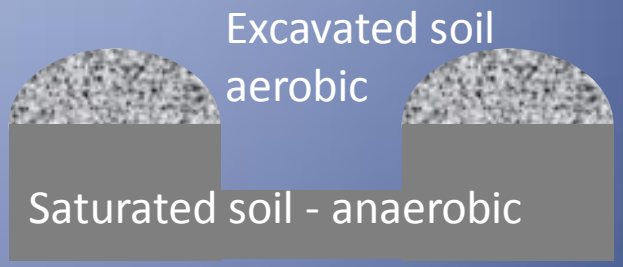
- Above ground biomass
- Above ground biomass growth
- Ratio of below ground to above ground biomass
- C fraction of above ground biomass
- Wood density
- Litter and dead wood C stocks

Photo by permission of M Skov,

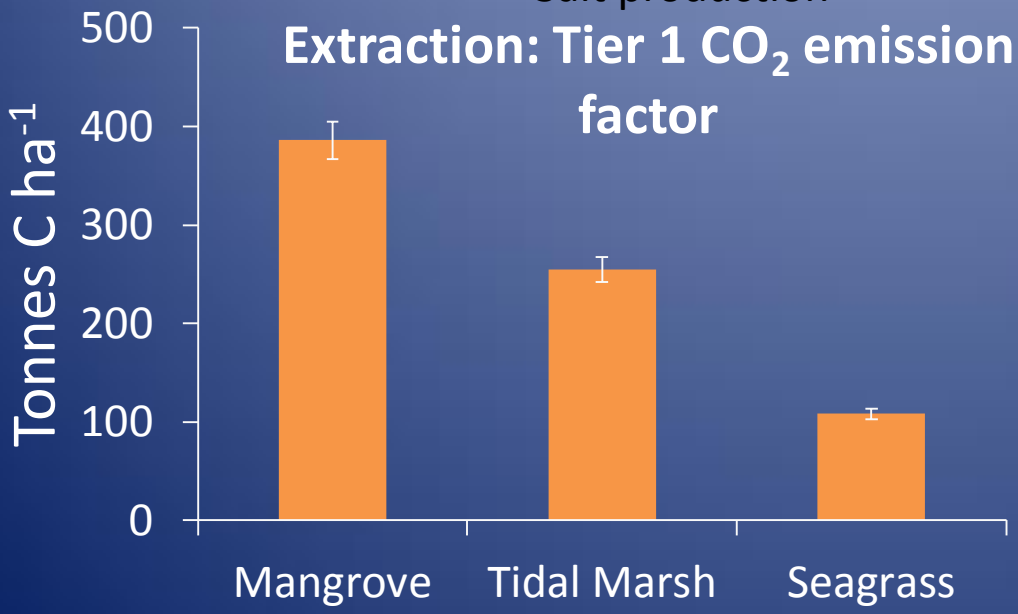
2] Extraction: including excavation and aquaculture and salt production – construction phase

Salt production

Construction phase



Soil extraction assumed 1metre depth.



aquaculture

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Photo by permission of G Chmura

3] Drainage

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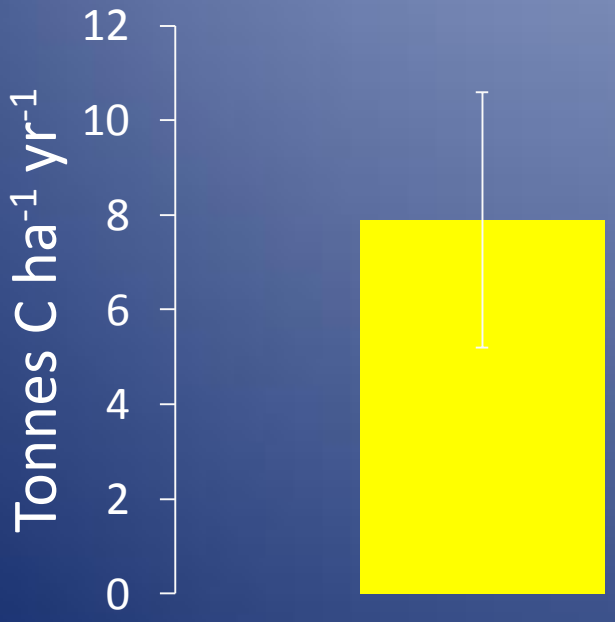
Tier 1 default emission factor on aggregated organic and mineral soils for mangrove & tidal marsh



http://www.ecologylink.com/essex-wildlife-trust-blackwater-estuary-phase-1-mapping/

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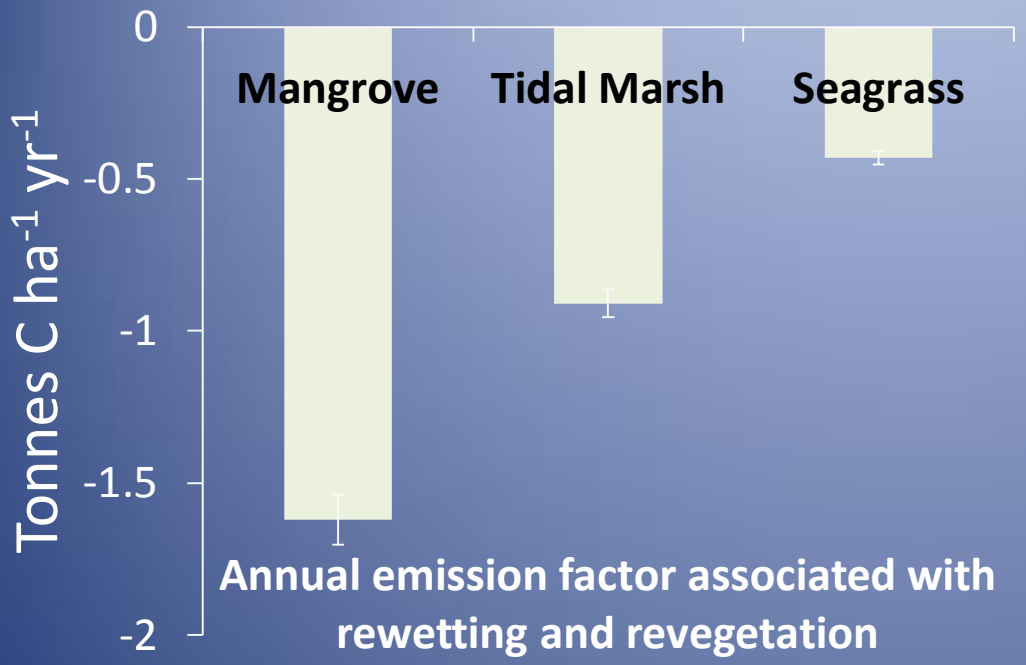
4] Rewetting and revegetation



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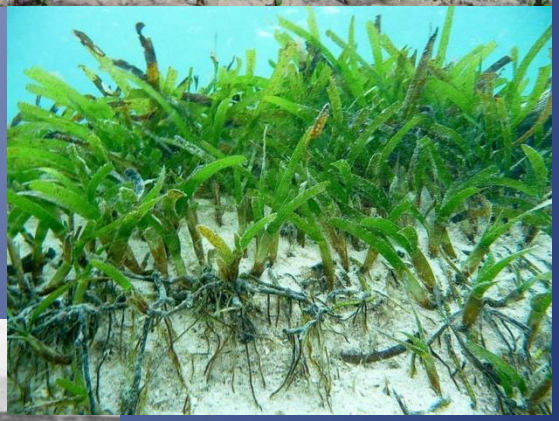
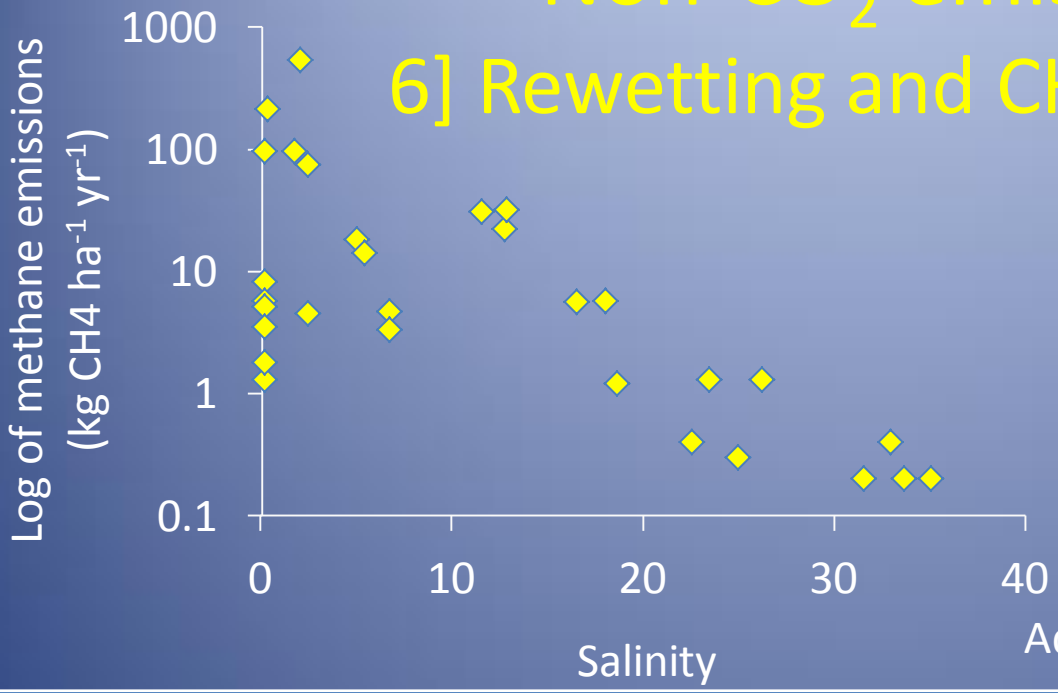


Photo by permission of G Chmura , M Skov and M Bjork

Non-CO_2 emissions
6] Rewetting and CH_4 emissions



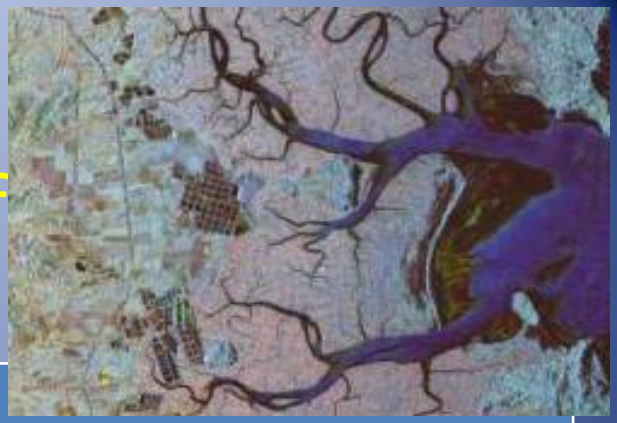
Adapted from Poffenbarger et al., 2007

TABLE 4.14 EMISSION FACTORS FOR CH_4 FOR TIER 1 ESTIMATION OF REWETTED LAND PREVIOUSLY VEGETATED BY TIDAL MARSHES AND MANGROVES

Vegetation Type	Salinity (ppt)	EF_{rewet} (kg CH_4 ha^{-1} y^{-1})	EF_{rewet} Range (kg CH_4 ha^{-1} y^{-1})	95%CI[4]
Tidal freshwater and brackish marsh and mangrove[1]	<18	193.7[2]	10.95 – 5392	**99.8, 358**
Tidal saline water marsh and mangrove[1]	**>18**	**0[3]**	**0-40**	

Non-CO_2 emissions

7] N_2O emissions during the phase of aquaculture use



http://airsar.jpl.nasa.gov/index_detail.html

Phase	CO_2	N_2O
Construction	Mangrove and tidal marsh	No guidance[1]
Use	No guidance[1]	Mangrove, tidal marsh and seagrass meadow
Abandonment	No guidance[1]	No guidance[1]
[1]No suitable Tier 1 methodologies are available.		

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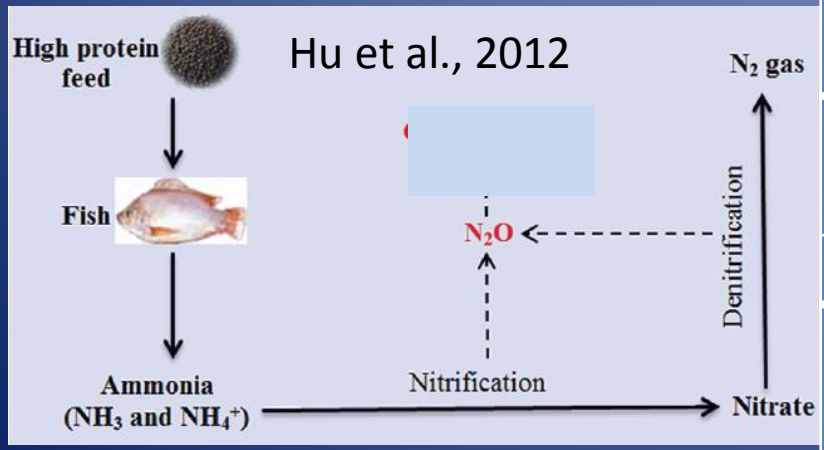

Hu et al., 2012

Emission factors (EF_F) for N_2Oemission from aquaculture in mangroves, tidal marshes and seagrass meadows	
Default EF (kg N_2O-N per kg fish produced)	Uncertainty Range
0.00169	0.00163-0.00502
Approach used by Hu et al., 2012 using N in feed to fish biomass: Hargreaves 1998, Protein content of fish biomass: USDA nutrient database for Standard Reference Nutrient Data Laboratory, N content of protein: Nelson & Cox 2013, N to N_2O conversion:Hu et al., 2013, Kong et al., 2013; Kampschrew et al. 2008 ; Ahn et al 2010	

Photo

COVERAGE OF CHAPTER 4 - CONCLUSION

This Chapter updates guidance contained in the *2006 IPCC Guidelines* to:

- provide default data for estimation of C stock changes in mangrove living biomass and dead wood pools for coastal wetlands at Tier 1.

This Chapter gives new:

- guidance for CO_2 emissions and removals from organic and mineral soils for the management activities of extraction (including construction of aquaculture and salt production ponds), drainage and rewetting and revegetation.
- default data for estimation of anthropogenic CO_2 emissions and removals for soils in mangrove, tidal marsh and seagrass meadows.
- guidance for N_2O emissions during aquaculture use
- guidance for CH_4 emissions for rewetting and revegetation of mangroves and tidal marshes