Sustainable Strategies for Carbon Management in Coastal Zones: Role for the Dredging Sector

Erik van Eekelen presenting for:
Pieter van der Klis, Paris Sansoglou & Frederik Mink

Environment Committee
European Dredging Association

Presentation's Objectives

Demonstrate that:

⇨Blue Carbon should be part of sustainable strategies for carbon management in coastal zones !

⇨Building with Nature provides a frame to design and implement innovative approaches for waterborne infrastructures including pro-active carbon management.

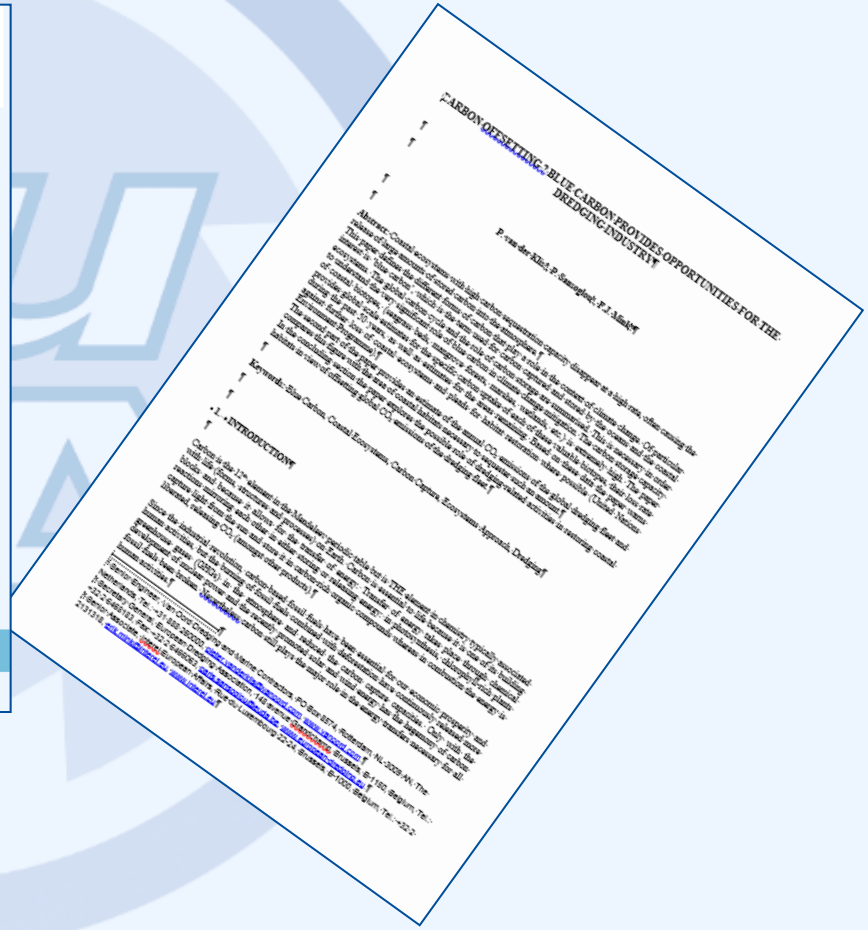
And:

Provide food for thought on the role of the dredging sector in global and local carbon management strategies.

Agenda

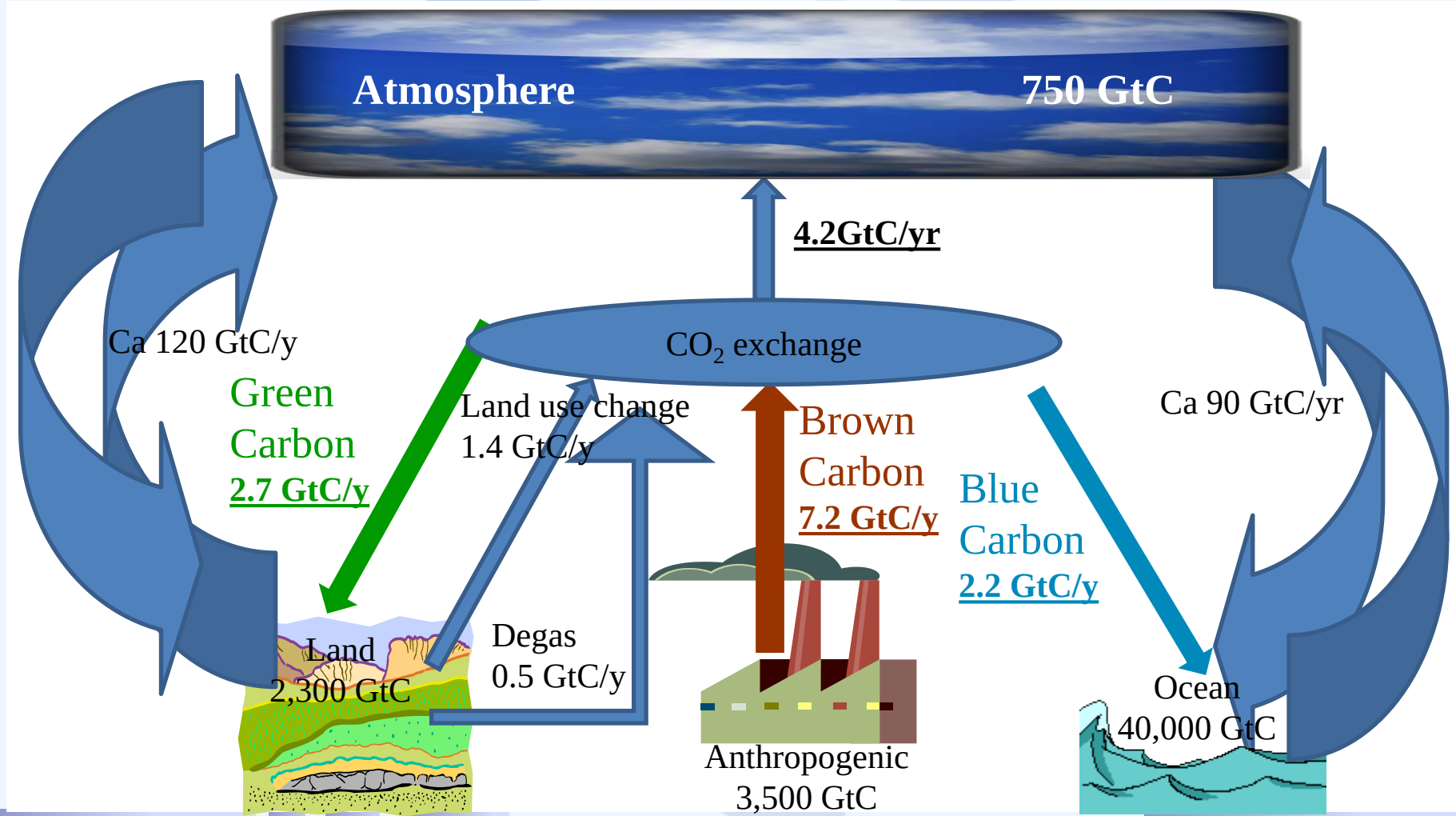
- Introduction
- ‘Blue carbon’
- The Way Forward
- Case study
- Conclusion

Introduction
WODCON XX Brussels 2013



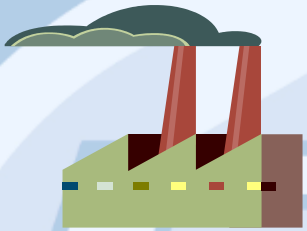
Blue Carbon

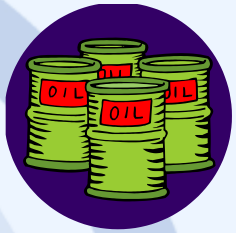
Carbon Cycle:
CO_2 Emissions vs CO_2 Capture



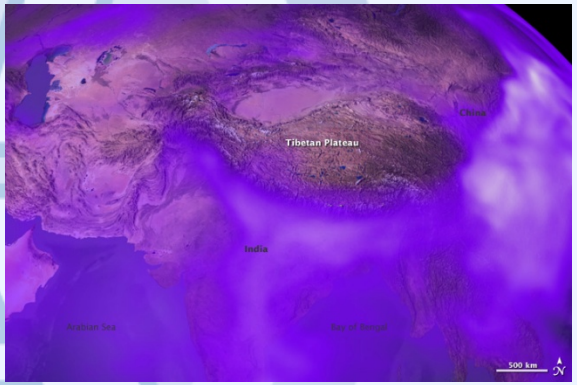
Blue Carbon:
A Colourful Story

Brown carbon:





Black carbon:



Green carbon:

Blue carbon:

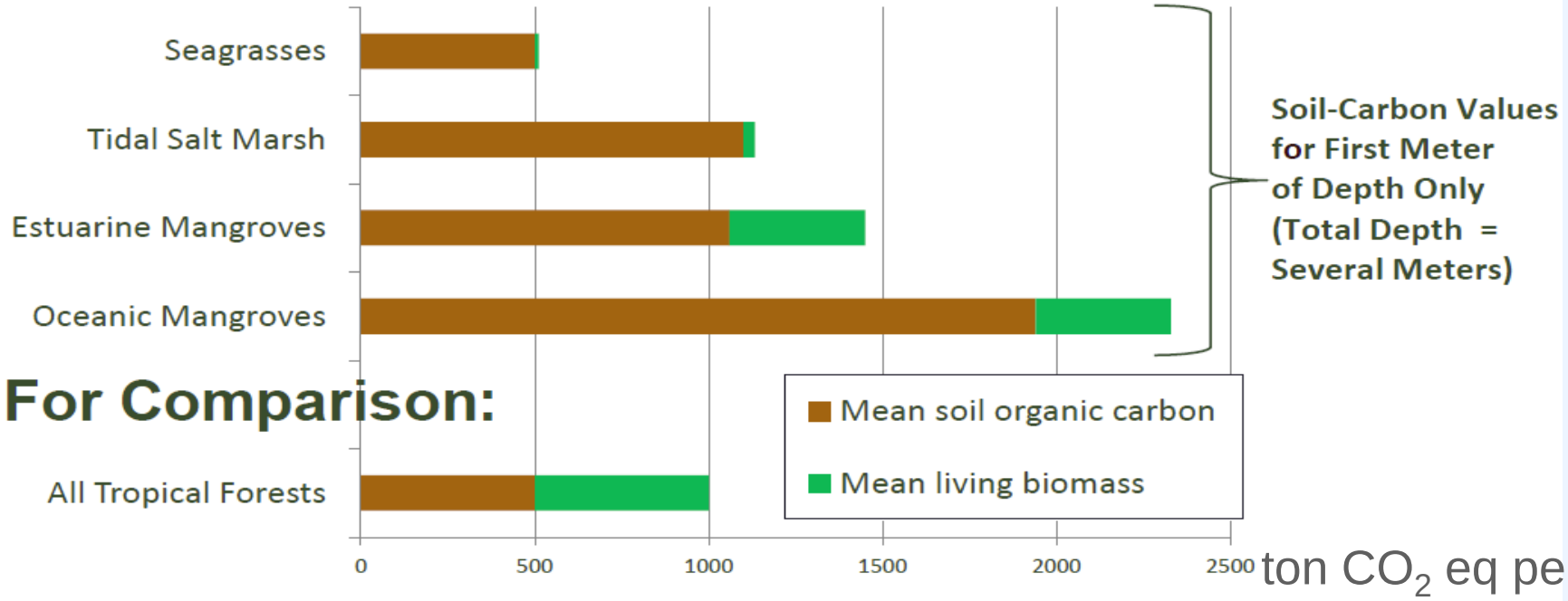
Carbon captured and stored by the world's oceans and coastal biotopes.

Carbon Uptake (variability):
Comparison between selected Coastal Biotopes

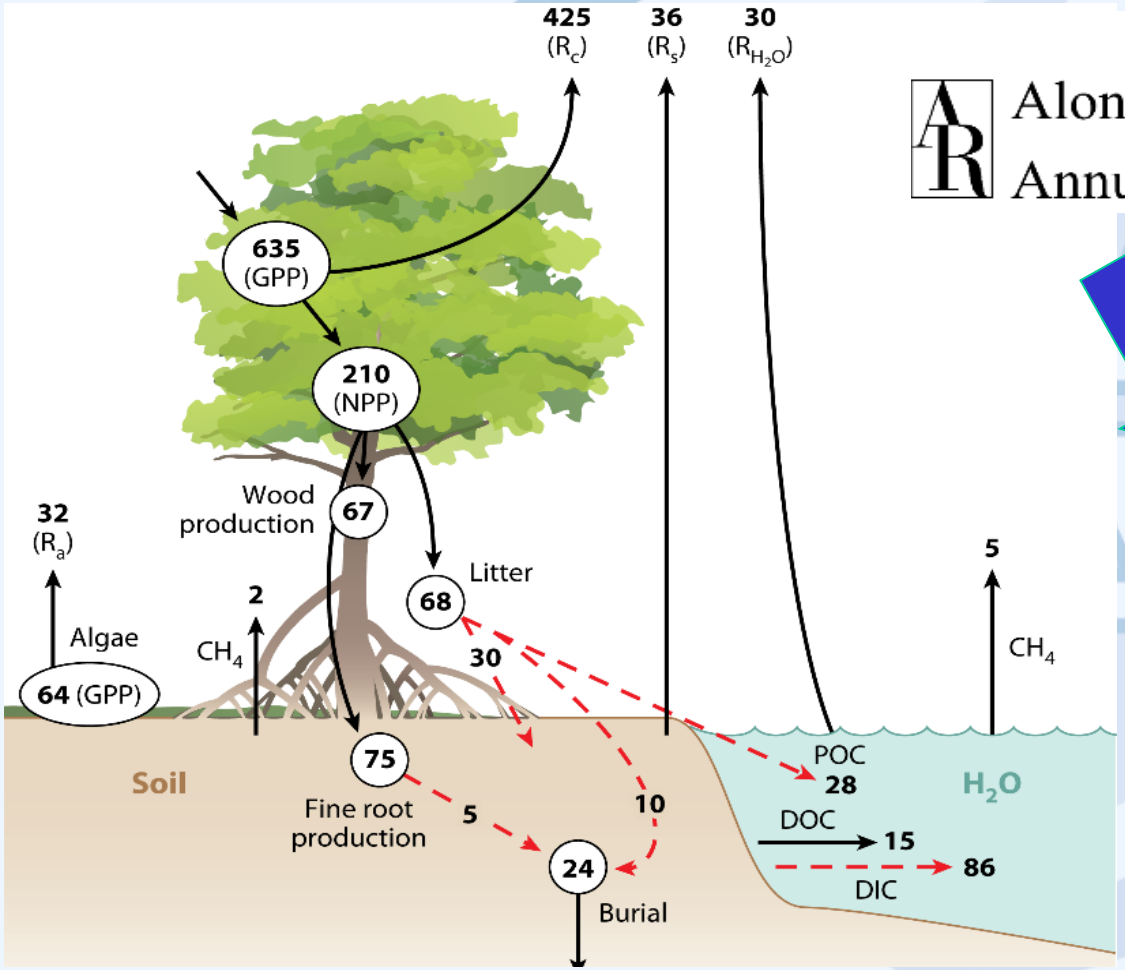
Biotope	Rate carbon burial (sequestration) gC/m²/yr - (MgC/ha/yr)	Estimated net carbon retention in biomass gC/m²/yr – (MgC/ha/yr)	Total rate gC/m²/yr (MgC/ha/yr) (NECB)
Seagrass	140 +/- 40 (1.4+/-0.4)	1-10 (0.01-0.1)	100-180 (1.0-1.8)
Saltmarsh	220 +/- 25 (2.2+/-0.25)	10-30 (0.1-0.3)	210-270 (2.1-2.7)
Mangroves	175+/- 25 (1.75+/-0.25)	150-400 (1.5-4.0)	300-600 (3.0-6.0)

Carbon Uptake (variability):
Comparison between selected Coastal Biotopes

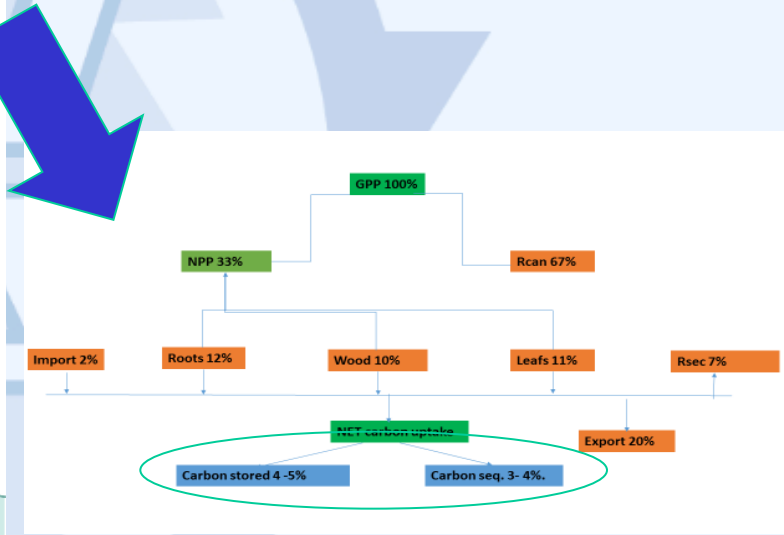
Coastal Habitats Protect Massive Amounts of Carbon



Carbon Uptake:
Carbon Budget for Mangrove Ecosystems



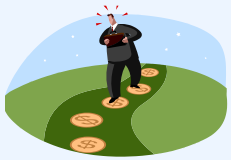
Alongi DM. 2014.
Annu. Rev. Mar. Sci. 6:195–219



Carbon stored 4-5% Carbon seq. 3-4%

Conclusions ‘Blue carbon’

- More information available demonstrating magnitude of ‘Blue Carbon’ uptake
- Variability within and between biotopes becomes more clear (latitude, age, etc.)
- Information base for mangroves most well-known

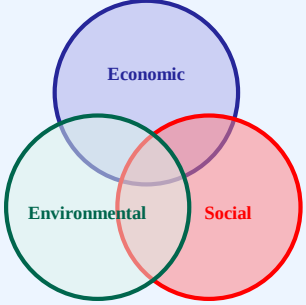


The Way Forward

Carbon Strategies

	Investment based	Operational
Strategy at company/ project level	(1) Invest in **fleet efficiency** or alternative fuels 	(2) Project-based: offset loss of mangroves / salt marsh / seagrass (**replant**). 
Strategy/Policy at sector/intersector level	(3) Up-front **investment** in large plantations 	(4) **Carbon trading**: buy CO_2 certificates to compensate for project or fleet emissions 

Which Solution ?
Need for a Paradigm Shift



⇨ From defensive approach, minimising environmental impact,

"Environment = Constraint"

⇨ To constructive approach, optimising full (socio-)economic and environmental potential.

"Environment = Opportunity"

Considering the project's added value to:

Safety ? | Nature ? | Attractiveness ? | Sustainability ? | Society ? Economy ?

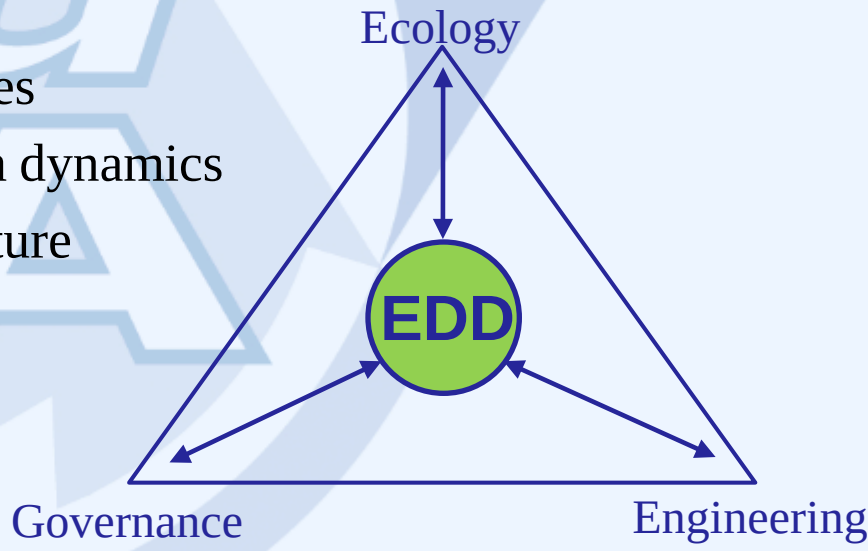
Paradigm shift:
Building with Nature

"Eco-Dynamic Design & Development"

⇨the dynamics of the natural system become the starting point for design and realisation of maritime infrastructures:

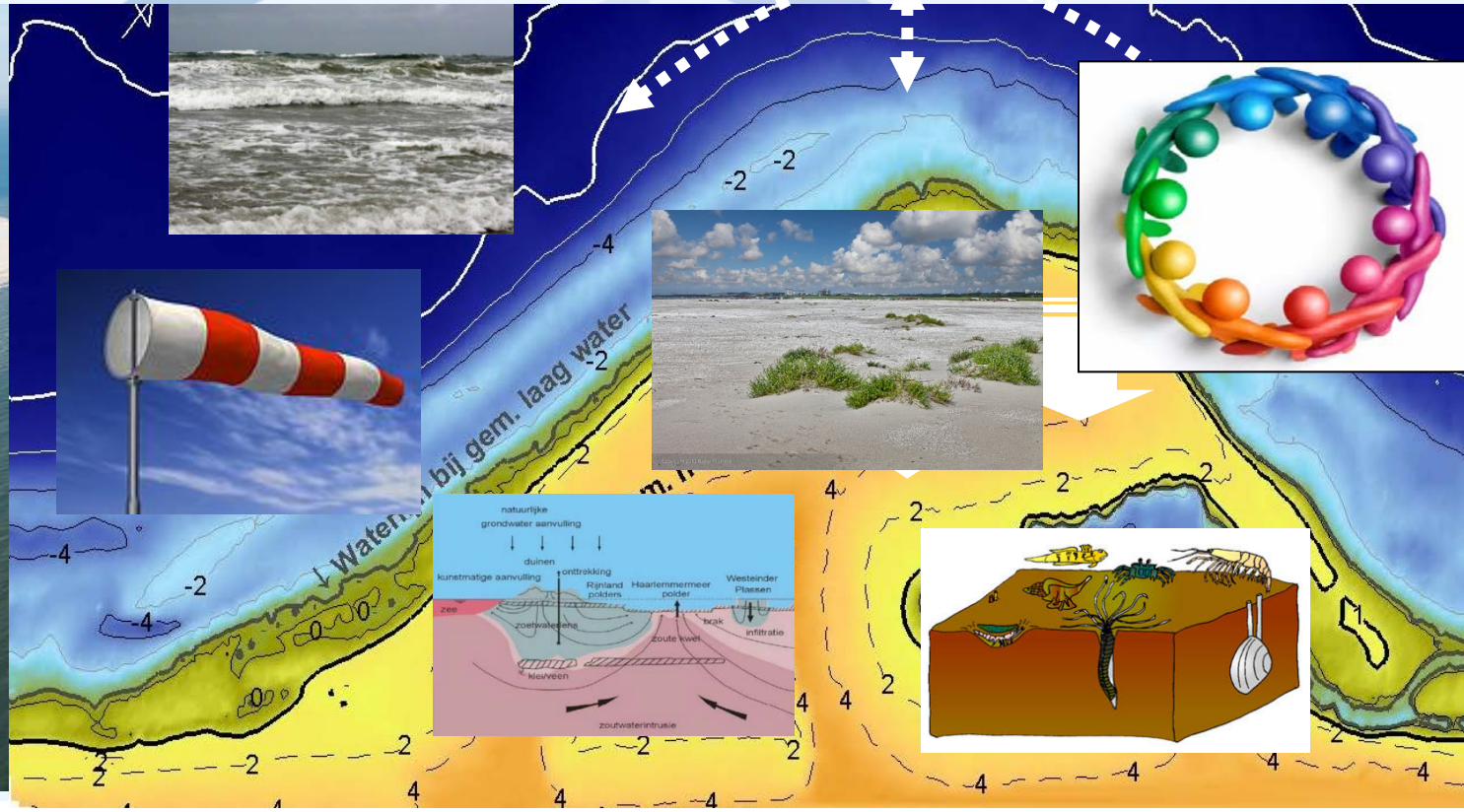
- ✓ Make optimal use of natural processes
- ✓ Design fits with natural (eco-)system dynamics
- ✓ Explore opportunities to promote nature development

⇨Key disciplines are integrated (Engineering, Ecology & Governance).



Project's Multiple Purposes
Mirrored by inter-disciplinary research

Pilot Sand Motor
Delfland Coast



- Coastal Protection
- Dune formation
- Hydrology and geochemistry
- Marine ecology
- Terrestrial ecology
- Governance

& Carbon uptake!!

Current co-operation @ EcoShape

Dredgers

Boskalis
Dredging & Marine Experts

Van Oord
Marine ingenuity

Consultants

Witteveen+Bos

ARCADIS
Infrastructuur · Water · Milieu · Gebouwen

Royal HaskoningDHV
Enhancing Society Together

NGO's

Wetlands International

Stichting De Noordzee
The North Sea Foundation

Knowledge institute

Deltares
Enabling Delta Life

Goal:

To develop and construct marine eng. projects that leave a much smaller CO_2 footprint over their entire lifecycle

Ultimate aim:

To achieve at least a 20% smaller CO_2 footprint over the lifecycle of marine eng. projects constructed after 2020

Exposure of Coastal Cities:
Threat or opportunity?

Coastal protection Sea grass

Coastal protection Mangroves

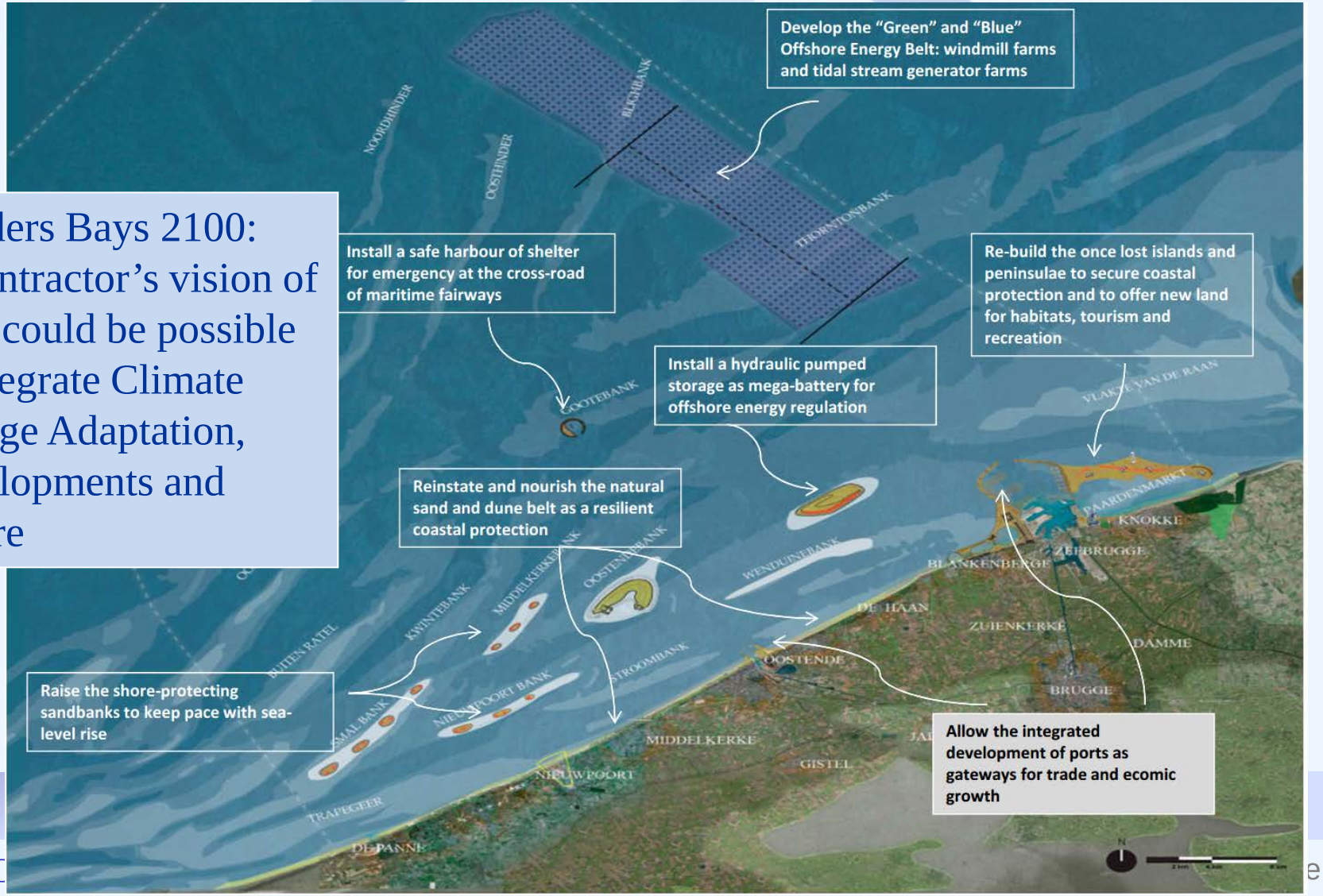
Exposure to floods in cities

Ranking by population exposure	Ranking by value of property and infrastructure assets exposure
1. Kolkata (India)	1. Miami (USA)
2. Mumbai (India)	2. Guangzhou (China)
3. Dhaka (Bangladesh)	3. New York (USA)
4. Guangzhou (China)	4. Kolkata (India)
5. Ho Chi Minh City (Vietnam)	5. Shanghai (China)
6. Shanghai (China)	6. Mumbai (India)
7. Bangkok (Thailand)	7. Tianjin (China)
8. Rangoon (Myanmar)	8. Tokyo (Japan)
9. Miami (USA)	9. Hong Kong (China)
10. Hai Phong (Vietnam)	10. Bangkok (Thailand)

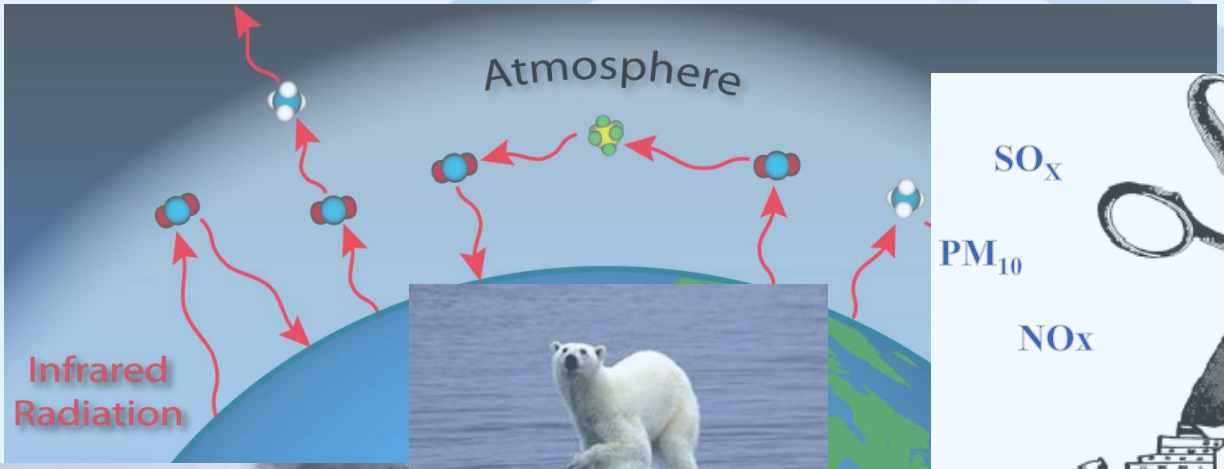
Source: UN Global Report on human settlements 2011

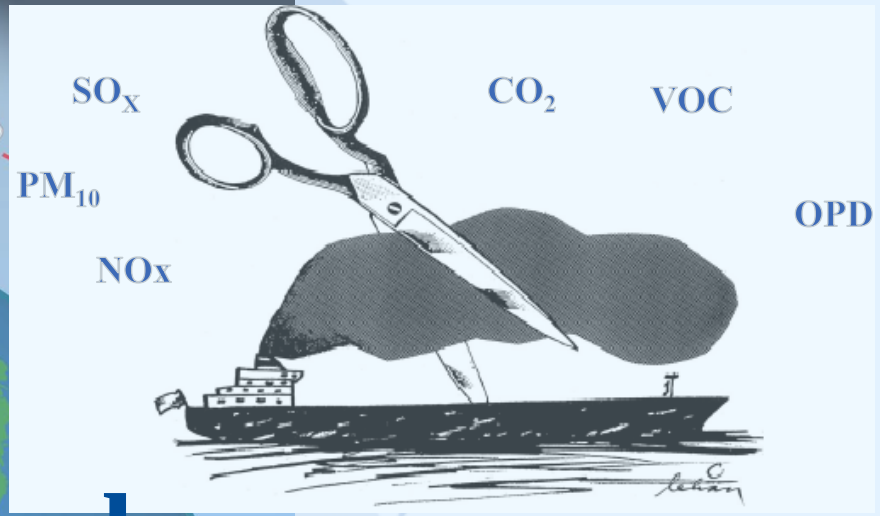
Climate Change Adaptation
Flanders Bays 2100 - Innovative Solutions

Flanders Bays 2100:
A Contractor's vision of what could be possible to integrate Climate Change Adaptation, Developments and Nature



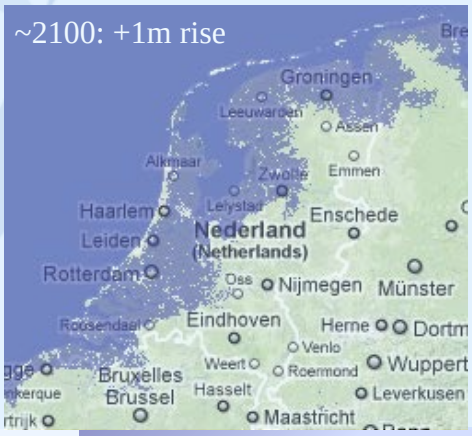
Building with Nature pilot
Mangrove restoration Demak


Atmosphere
Infrared
Radiation


SOX
CO2
VOC
PM10
OPD
NOx

Case study


Groningen
Leeuwarden
Assen
Alkmaar
Zwolle
Emmen
Haarlem
Lelystad
Enschede
Leiden
Nederland
(Netherlands)
Rotterdam
Oss
Nijmegen
Münster
Eindhoven
Herne
Venlo
Weert
Roermond
Wuppert
Bruxelles
Brussel
Hasselt
Leverkusen
Maastricht


~2100: +1m rise
Groningen
Leeuwarden
Assen
Alkmaar
Zwolle
Emmen
Haarlem
Lelystad
Enschede
Leiden
Nederland
(Netherlands)
Rotterdam
Oss
Nijmegen
Münster
Eindhoven
Herne
Venlo
Weert
Roermond
Wuppert
Bruxelles
Brussel
Hasselt
Leverkusen
Maastricht

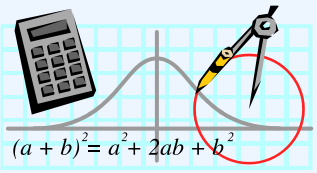
Case Study
Dredging of access channel to estuarine port

Features: estuarine port 20 km upstream from the coastline;
access channel bordered by extensive mangrove forest (both sides);
navigational access difficult due to strongly meanders;
navigational depth (8m draught ships)

Option I: construct a **new direct access channel**;
of 15 km length and a width of 150m and low tide depth of the channel of 9m;
cutting through mangrove forest;
15 million m^3 needs to be dredged and disposed placed at sea.

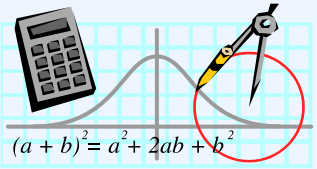
Option II:**alternative solution**
maintain port entry via the river (in part);
deepened (in part) to 10 m over a stretch of 16 km;
access completed by a shorter channel of 3 km length and 150 m width;
in addition build **artificial island** near estuary's mouth with dredged material surrounded by a dyke or bund (using sandy material from the river bed;
replant artificial island with mangroves.

Case Study
Dredging of access channel to estuarine port



	Option I	Option II
Mangrove area removed	300 ha	60 ha
Volume of material to be dredged (river bed)	-	7,200,000 m³
Volume of material to be dredged (mangrove soil) m³	15,000,000 m³	3,000,000 m³
Surface area artificial island (new mangrove plantation)	-	60 ha

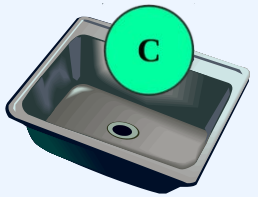
Case Study
Dredging of access channel to estuarine port



	Option I	Eqv. carbon 'cost'	Option II	Eqv. carbon 'cost'	Difference in C 'cost' impact (euro)
Carbon emitted by dredgers	8,200 MgC	246,000	2,730 MgC	81,900	164,100
Carbon 'lost' (long term exposure to atmosphere)	30,000 MgC	900,000	6,000 MgC	180,000	720,000
Carbon uptake capacity removed	900 MgC/yr (300 ha)	27,000 euro/yr	180 MgC /yr (60 ha)	5,400 euro/yr	21,600 euro/yr
Carbon uptake capacity planted as compensation	-	-	(long term) 180 MgC/yr		5,400 euro/yr

Conclusion

Blue Carbon
An Innovative Instrument for CO_2 Policy



Blue carbon:

- ✓ oceans & coastal biotopes that are **natural carbon sinks** (mangroves, seagrasses, salt marshes, coral reefs, etc.);
- ✓ captures atmospheric CO_2 through the plants' **photosynthesis**;
- ✓ stores carbon in the long-term through the natural growth processes in the ecosystems' plants and animals (respectively the **gross primary and secondary productions**).

Prerequisites

- ✓ Establishment of **Market Based Measures** (MBM);
- ✓ **Political recognition** (IMO, EU); and
- ✓ direct link (market certification) to MBM;
- ✓ Functioning MBM market.

CO_2 emissions reduction:

✓emissions reductions cannot be disconnected from **global economy** (and global trade);

✓-40% by 2050 are impossible to achieve if only acting on the **emission sources**;

✓Blue Carbon reduces **CO_2 atmospheric concentrations**

= offsetting opportunities that can be bought/sold.

Side benefits

✓Ecosystems provide a range of valuable other (ecosystem)services

✓Pro-active integration in nature-based coastal development project (eg Building with Nature)

✓Interesting projects

Conclusion

- ⇨Blue Carbon should be part of sustainable strategies for carbon management in coastal zones !
- ⇨Pro-active carbon management includes either:
  - ⇨Project based replanting (strategy 2)
  - ⇨Upfront investment in large-scale carbon uptake (strategy 3)
- ⇨Pro-active carbon management using nature based design (eg Building with Nature) provides opportunities to the dredging industry!

Thank you !

- European Dredging Association:

  148 Avenue Grandchamp, B-1150 Brussels
  e-mail: info@euda.be
  Tel.: +322 6468183
  Fax : +322 6466063

- Website:
  www.european-dredging.eu

More on Building with Nature @:

EcoShape

www.ecoshape.nl

Vlaamse Baaien
Veilig, natuurlijk, aantrekkelijk, duurzaam, ontwikkelend

www.vlaamsebaaien.com


EUROPEAN DREDGING ASSOCIATION

EUROPEAN DREDGING ASSOCIATION

"EuDA is the official interface between the European dredging industry and the European Institutions"

- founded in 1993
- represents the European Dredging Companies
- from 16 EU Members States
- world leaders (top 4)
- with a turnover (2014): € 9.2 bn
- +/- 25,000 European direct employment
- >50,000 indirect employment (*supply and service companies*)

Coastal Biotopes provide various Ecosystem Services

Ecosystem services ✓: Yes; (✓): maybe.	**Mangrove forests**	**Salt marshes**	**Seagrass beds**
Ecological:			
- erosion protection	✓	✓	✓
- barrier saline intrusion	✓	✓	
- bird colonies	✓	✓	
- carbon sequestration	✓	✓	✓
- water purification	✓	✓	✓
Economic:			
- nursery for fish	✓	✓	✓
- habitat fish	✓		✓
- grow seafood	✓	✓	✓
- bees/honey	✓		
- construction material	✓		
- fire wood	✓		
- potential for trading CO_2 emission rights	✓	✓	**(✓)**
Social:			
- plants for medicine	✓		
- support local community (‘commons’)	✓		
- bird watching		✓	
- ecological/underwater ‘tourism’	**(✓)**	✓	✓

Carbon market programmes

Carbon Market Programme	Regulatory/ Voluntary	Remarks	Range of carbon price (euro/$MgCO_2$)
Kyoto reduction goals (global)	Regulatory	Certified Emission Rights (CERs) can be used for compliance with Kyoto commitments	Approx. 20
EU- ETS (regional)	Regulatory	EU market mechanism to comply with Kyoto (cap and trade) (industry, power generation, ...)	8 - 25
Regional Initiatives (ex. California,…)	Regulatory	Regulatory initiatives (cap and trade)	8-12
Voluntary Carbon Offsets	Voluntary	Companies, individuals, events, buy emission certificates directly or via carbon traders	8-20

Mimicking Nature
Islands and Human Activities

Natural or artificial islands fulfil ecologic, economic, logistics and coastal management functions and provide additional space for:

- ☞Ports (including safe place of anchorage/refuge);
- ☞Agriculture, Fisheries – Aquaculture;
- ☞Industrial and Manufacturing Activities;
- ☞Residence & Tourism – Cultural and Recreational Activities;
- ☞Nature (unique nature reserves, unique ecosystems);
- ☞Military Activities – Security related Activities.

Islands can also provide:

- ☞Coastal protection services (e.g. reducing coastal erosion);
- ☞Mineral and Energy Resources.

Artificial islands or peninsulas are designed for multiple purposes.