The past, present, and potential future of estuarine and coastal habitats in the East Coast of England

Tiziana Luisetti

Restoring Estuarine and Coastal Habitats in the North East Atlantic (REACH North East Atlantic)

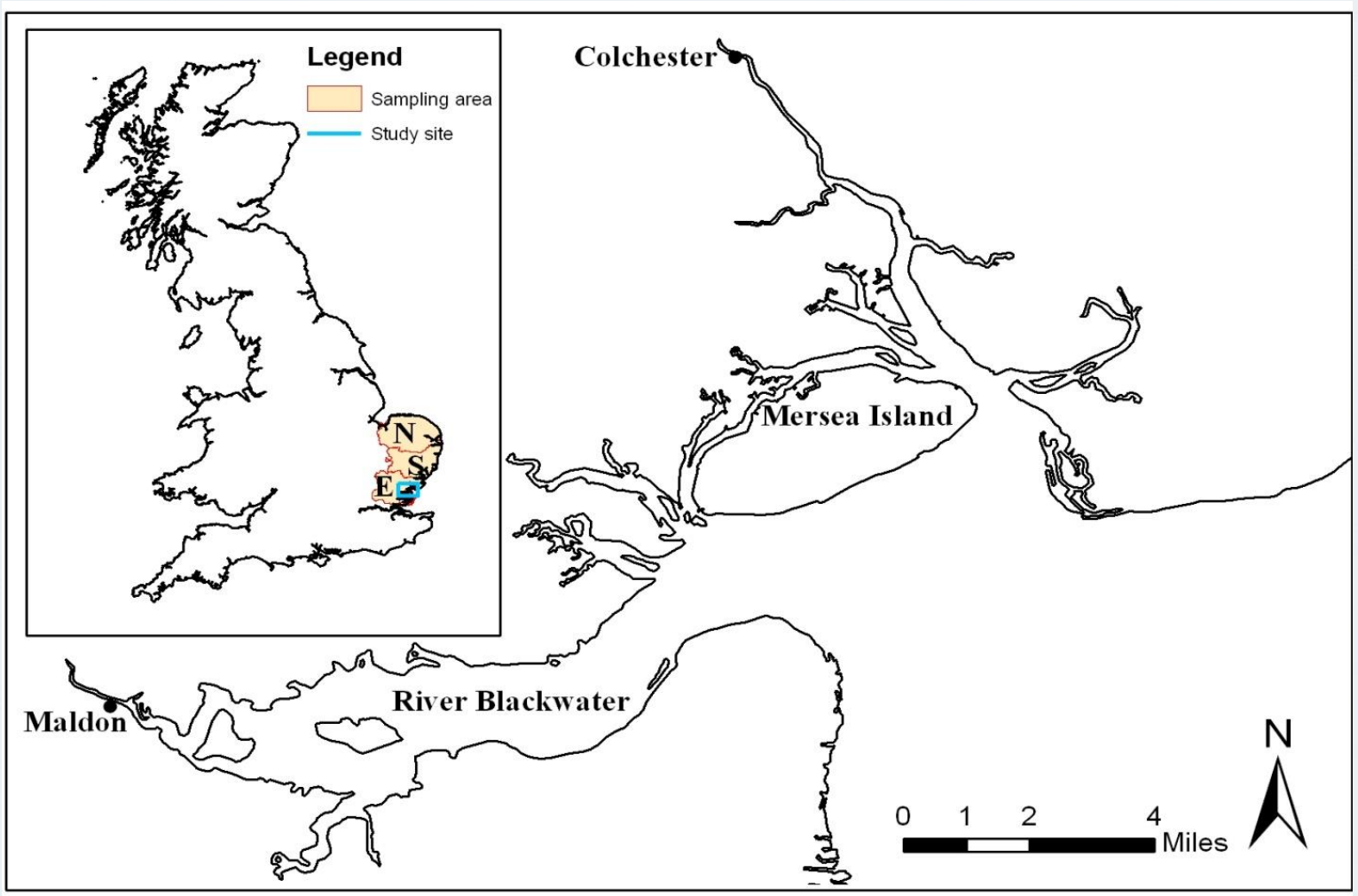
Natural History Museum, London 16thJuly, 2019

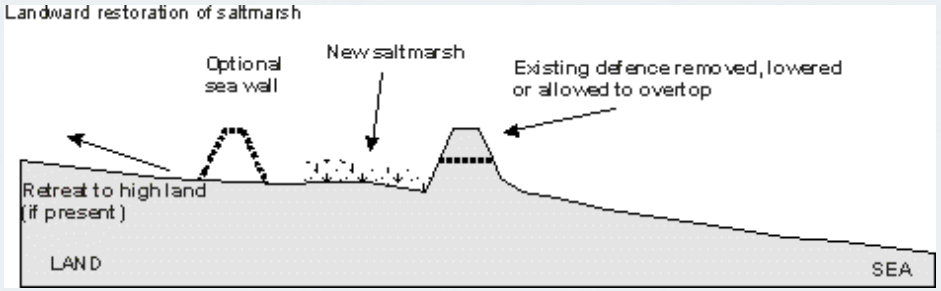
Centre for Environment Fisheries & Aquaculture Science

World Class Science for the Marine and Freshwater Environment

Cefas

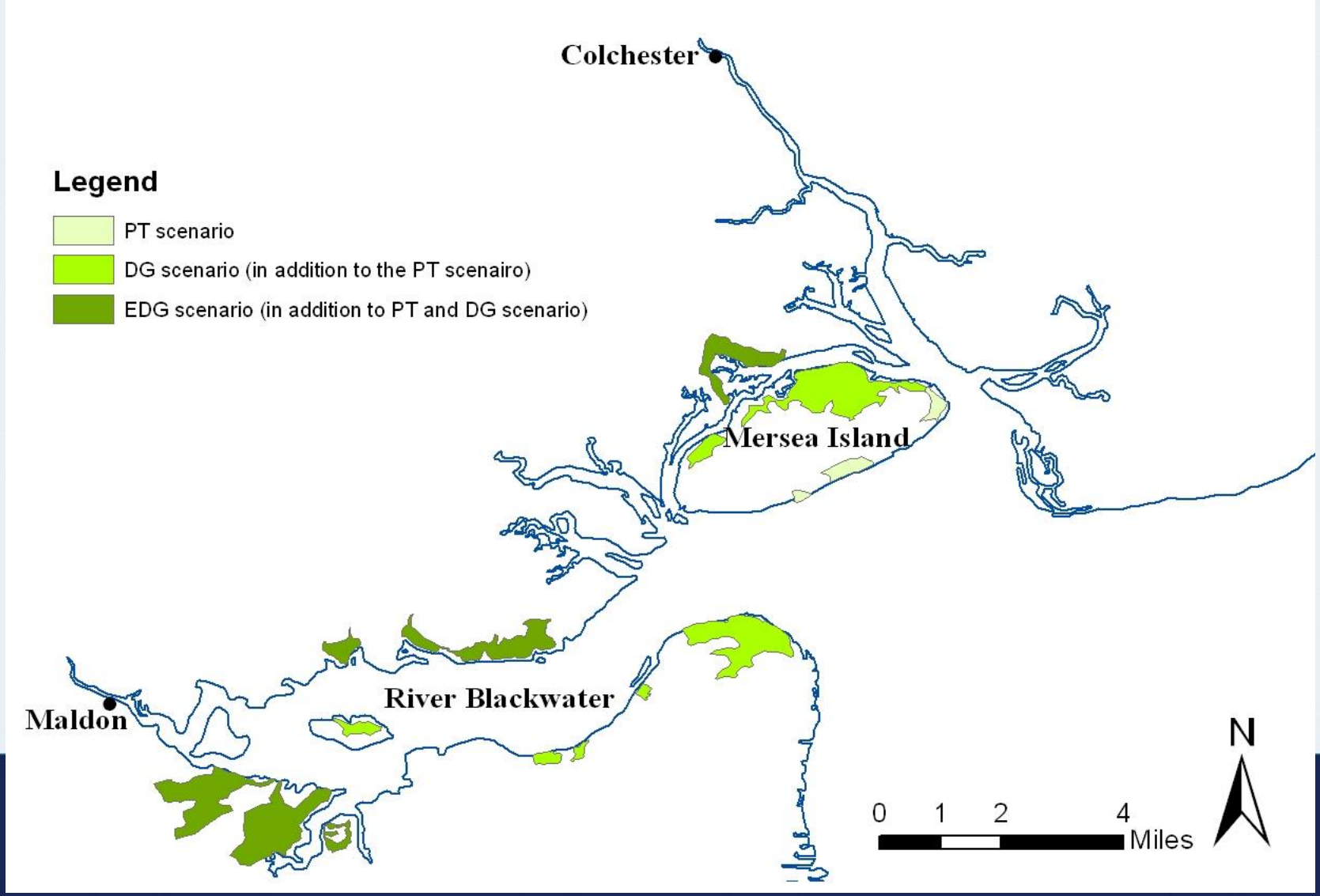
Blackwater estuary (2007)





Source: English Nature

Areas suitable for realignment in the Blackwater estuary under the different scenarios



Criteria to identify MR areas

GIS maps were created to identify suitable areas of realignment responding to the following criteria:

- The **area below the High Spring Tide Level** - maximum area of intertidal habitat that could be created;
- **Present land use of the area** - underdeveloped areas as the more appropriate; natural protected areas, SSSI and SAC, etc were excluded;
- The **infrastructure** of the area;
- **Size**, **shape**, **land elevation** (setback above the HSTL) and **proximity** to existing intertidal habitats

CBA: NPVs calculation

$$NPV_t^{mr} = (PV_t^{mr} - PV_t^{sq})$$

Net Present Value (NPV)
of the option

B – C of the BASELINE (HTL)

B – C of an ALTERNATIVE (MR)
Option 1: minor realignment (PT)
Option 2: major realignment (DG)
Option 3: max ecosystem services (EDG)

COSTS and BENEFITS

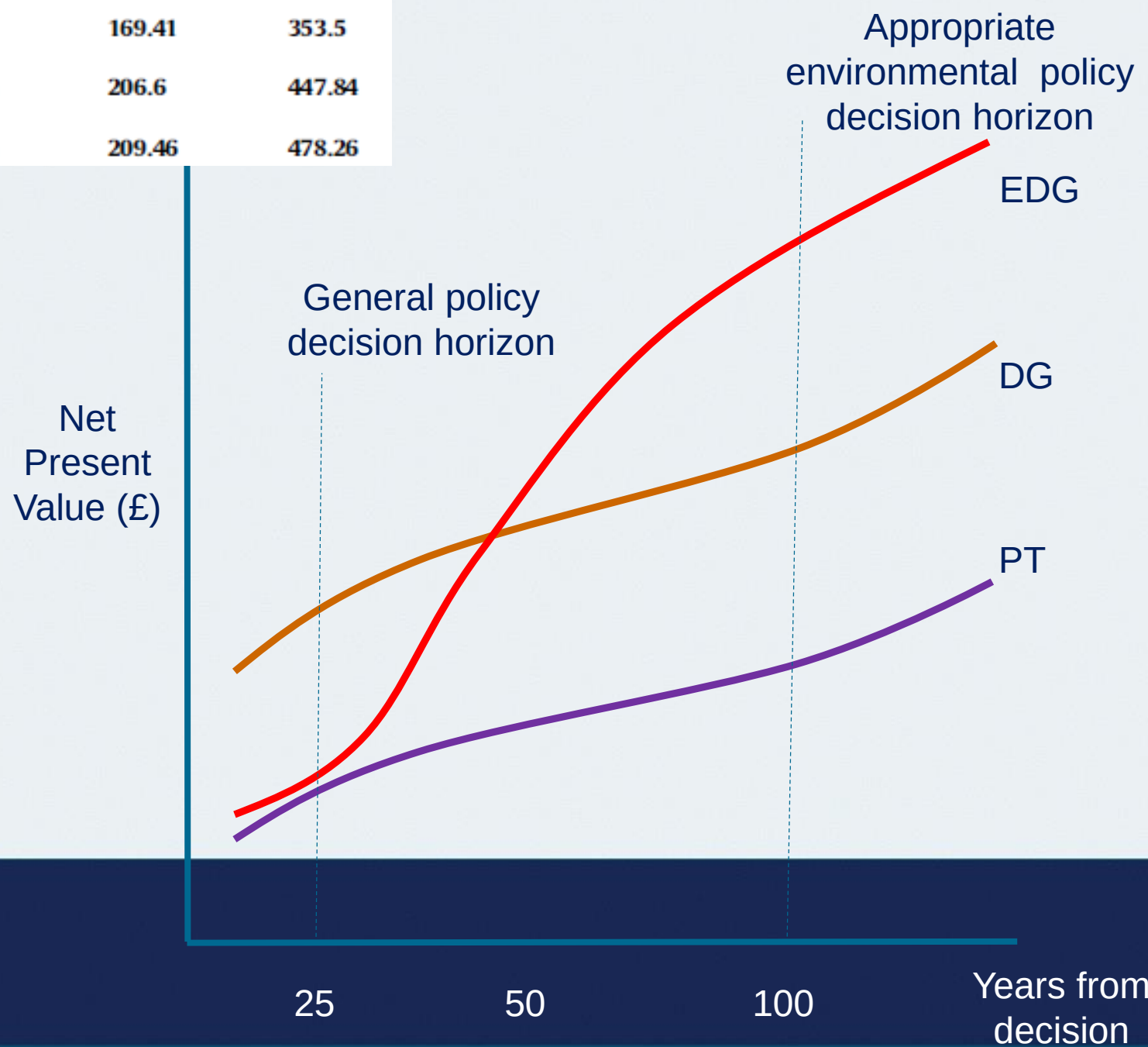
ECOSYSTEM SERVICES / BENEFITS

- Flood defence / Flood defence cost savings
- Carbon storage / Healthy climate
- Fisheries production / Food
- Composite environmental benefit (places and seascapes-biodiversity-water quality) / Recreation

COSTS

- Capital cost of realignment (realigning defences)
- Maintenance cost of non-realigned defences
- Maintenance cost of realigned defences
- Agricultural land (opportunity cost)

Discount rate: **gamma**			
Policy targets (PT)			
NPV = PV(PT) − PV(HTL)	**82.9**	**169.41**	**353.5**
Deep green (DG)			
NPV = PV(DG) − PV(HTL)	**93.24**	**206.6**	**447.84**
Extended deep green (EDG)			
NPV = PV(EDG) − PV(HTL)	**83.14**	**209.46**	**478.26**



Humber estuary (2012)

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Coastal Zone Ecosystem Services: From science to values and decision making; a case study

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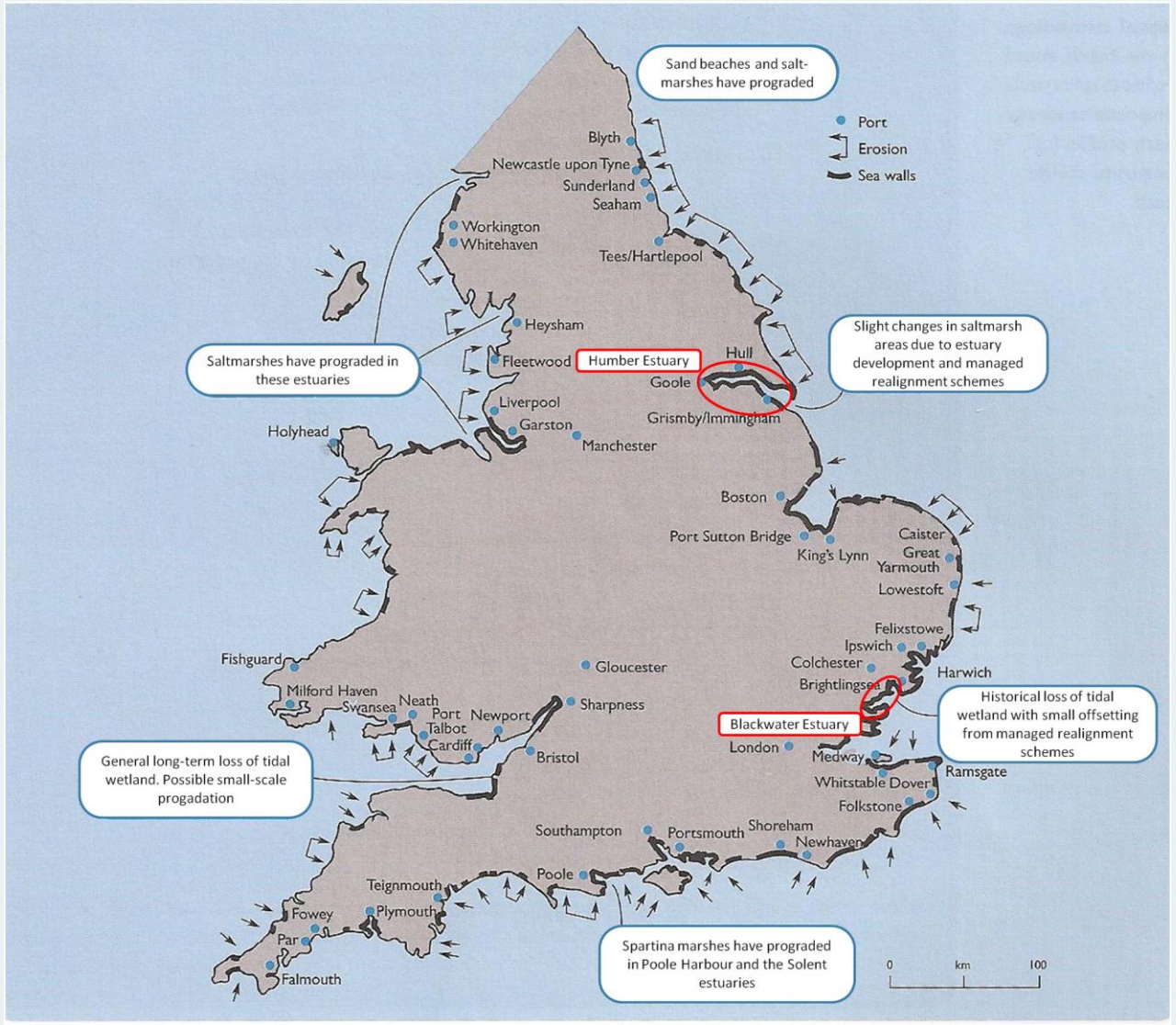
Methodological challenges

Challenge 1: socio-ecological system complexity when valuing ecosystem services
Challenge 2: ecosystem stock and services flow sustainability and valuation
Challenge 3: the incorporation of the issue of scale when valuing ecosystem services



Humber estuary – Results and further research

Issues addressed in the study

- A recognition of socio-ecological system complexity when valuing ecosystem services
- The need to distinguish between ecosystem stock and service flow sustainability and valuation
- An acknowledgement of the difficulties posed by the issues of scale and transferability when valuing ecosystem services, and their incorporation in policy appraisal methods such as CBA

Because of socio-ecological system complexity, careful consideration is required in the use and application of *benefit transfer* to ecosystem service values, both in terms of biophysical data and welfare value estimates to supply reliable information for policy making.

Deben estuary (2018-19) - Suffolk Marine Pioneer

	Option A	Option B	Option C
Area of new saltmarsh	25 acres (17 football pitches)	74 acres (49 football pitches)	No new saltmarshes
Number of protected bird species observable	3	4	No change
Distance from where you live	20 miles	40 miles	N/A
Public access to new saltmarsh	No Public Access	Public Access permitted	N/A
One off increase in council tax	£6	£12	No cost
Which would you choose?	○	○	○

Deben estuary - Suffolk Marine Pioneer CE results

Hypothetical project	Description
Project 1 Small-scale restoration with access	12 acres restored marsh, with public access, no bird species have conservation benefit
Project 2 Medium-scale restoration with access	62 acres restored marsh, with public access, no bird species have conservation benefit
Project 3 Medium-scale restoration and biodiversity target without access	62 acres restored marsh, with no public access, no bird species have conservation benefit
Project 4 Large-scale restoration and biodiversity targets with access	125 acres restored marsh, with public access, 3 bird species have conservation benefit
Project 5 Large-scale restoration with access	125 acres restored marsh, with public access, no species have conservation benefit
Project 6 Large-scale restoration and biodiversity target without access	125 acres restored marsh, with no public access, 3 species have conservation benefit
Project 7 Recreation and biodiversity focused	250 acres restored marsh, with public access, 5 species have conservation benefit
Project 8 Bird species preservation focused	250 acres restored marsh, with no public access, 5 species have conservation benefit
Project 9 Saltmarsh restoration focused	250 acres restored marsh, with no public access, 1 species have conservation benefit

Hypothetical project	Average WTP (per person)	Aggregate WTP EE-V*	Aggregate WTP DE-V*
Project 1 Small-scale restoration with access	£1.00	£1,009,666	£662,593
Project 2 Medium-scale restoration with access	£2.40	£2,423,198	£1,590,224
Project 3 Medium-scale restoration and biodiversity target without access	£0	---	---
Project 4 Large-scale restoration and biodiversity targets with access	£9.60	£9,692,792	£6,360,895
Project 5 Large-scale restoration with access	£4.20	£4,240,593	£2,782,892
Project 6 Large-scale restoration and biodiversity target without access	£0	---	---
Project 7 Recreation and biodiversity (with access)	£16.80	£16,962,387	£11,131,567
Project 8 Bird species preservation without access	£6.10	£6,158,962	£4,041,819
Project 9 Saltmarsh restoration without access	£0.60	£605,799	£397,556

Beyond Blue carbon

Ecosystem Services 35 (2019) 67–76

Contents lists available at ScienceDirect

Ecosystem Services

journal homepage: www.elsevier.com/locate/ecoser

Quantifying and valuing carbon flows and stores in coastal and shelf ecosystems in the UK

Tiziana Luisetti[a,*], R. Kerry Turner[b], Julian E. Andrews[b], Timothy D. Jickells[b], Silke Kröger[a], Markus Diesing[a,c], Lucille Paltriguera[a,d], Martin T. Johnson[a,b], Eleanor R. Parker[a], Dorothee C.E. Bakker[b], Keith Weston[a]

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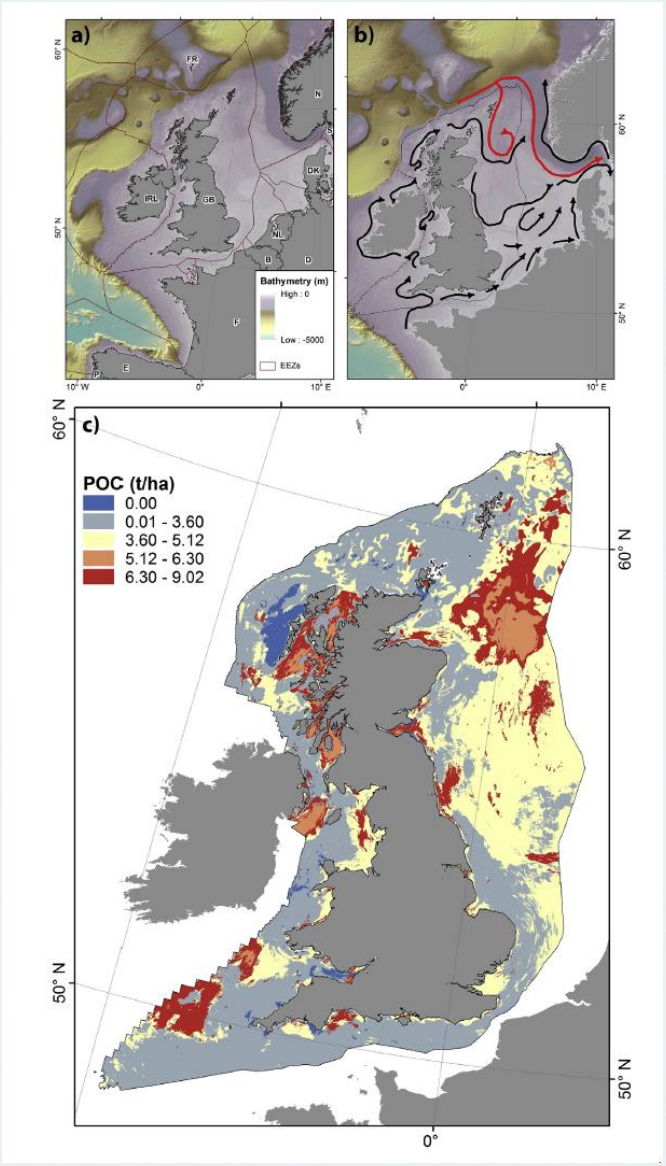

c Particulate Organic Carbon (POC) concentration and stocks of the upper 10 cm of the sediment column in t/ha
b Generalised water circulation patterns
a EEZs

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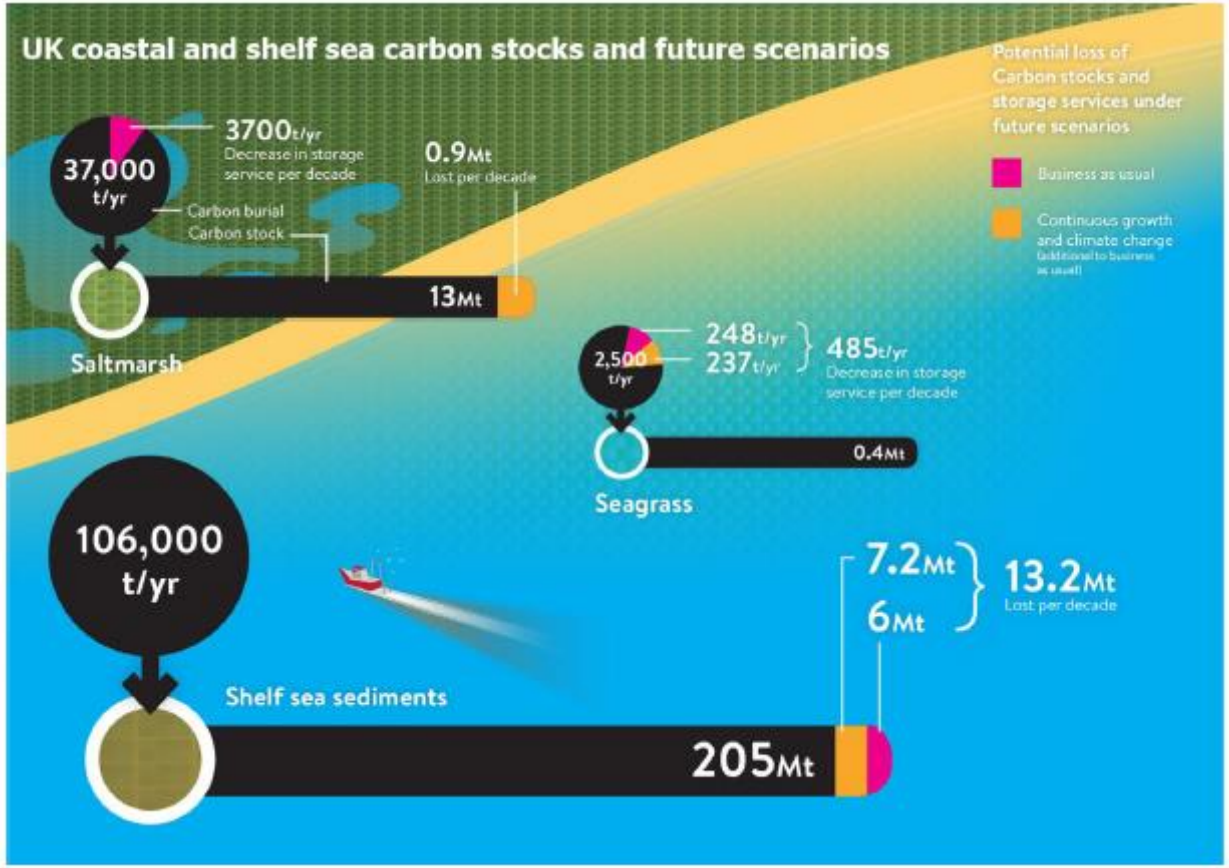
UK’s coastal and shelf sea C stocks and potential loss of C stocks and storage services under future scenarios



Ecosystems:
Saltmarshes
Seagrasses
Shelf sea sediments

Scenarios:
Business as usual
Continuous growth and climate change

Restoration

(Anthropogenic disturbances vs human management)

PV (US$ billion) of the economic loss of the C sequestration benefit in the BAU and CG&CC scenarios over 25 years (2016-2040), and the benefits of a Restoration scenario

Blue Carbon compartment	Annual tC storage lost due to spatial extent loss[a]	Net tonnes of C released per year due to other disturbances[a]	Other disturbances	The cost to society of the lost C sequestration and storage service due to spatial extent lost (US$ billion)			The cost to society of C released (US$ billion)[b]		
				Abatement cost: all relevant year values (BEIS, 2017)*	Social Cost of Carbon: US$50 (Tol, 2005)	Social Cost of Carbon: all relevant year values (Nordhaus, 2017)	Abatement cost: all relevant year values (BEIS, 2017)*	Social Cost of Carbon: US$50 (Tol, 2005)	Social Cost of Carbon: all relevant year values (Nordhaus, 2017)
Business as usual (BAU)									
Saltmarsh	369[b]	n/a	n/a	0.002	0.0003	0.0009			
Seagrass	25	n/a	n/a	0.00015	0.00002	0.00006			
Shelf sea sediments	n/a	975,856	0.02 tC/ha/year released from one trawl pass				6	0.8	2.5
TOT Present Value loss value				0.00215	0.00032	0.00096	6	0.8	2.5
Continuous growth and climate change (CG&CC)									
Saltmarsh	369[b]	91,771[c]	300 tC/ha released due to disturbance of top 1 m	0.002	0.0003	0.0009	0.5	0.075	0.2
Seagrass	50	n/a	n/a	0.0003	0.00004	0.0001			
Shelf sea sediments	n/a	1,951,712	0.04 tC/ha/year released from two trawl passes				12	1.6	5
TOT Present Value loss value				0.0023	0.00034	0.001	12.5	1.7	5.2
Saltmarsh restoration (US$ billion)							0.01	0.006	0.0016

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Valuation, co-benefits, monetary accounting, governance and management

Goods/Benefits provided	Saltmarshes	Seagrasses	Shelf sea sediments
Provisioning services			
	Food (through fish nurseries)	Food (through fish nurseries) Fertiliser and biofuels Medicines and blue biotechnology	
Regulating services			
	Healthy climate (through carbon sequestration and storage) Prevention of coastal erosion Sea defence	Healthy climate (through carbon sequestration and storage) Prevention of coastal erosion	Healthy climate (through carbon sequestration and storage)
	Waste burial/removal/neutralisation	Waste burial/removal/neutralisation	Waste burial/removal/neutralisation
Cultural services			
	Tourism and nature watching Spiritual and cultural well-being Aesthetic benefits		
	Education, research Human health benefits	Education, research	Education, research