WP5 Blue Carbon

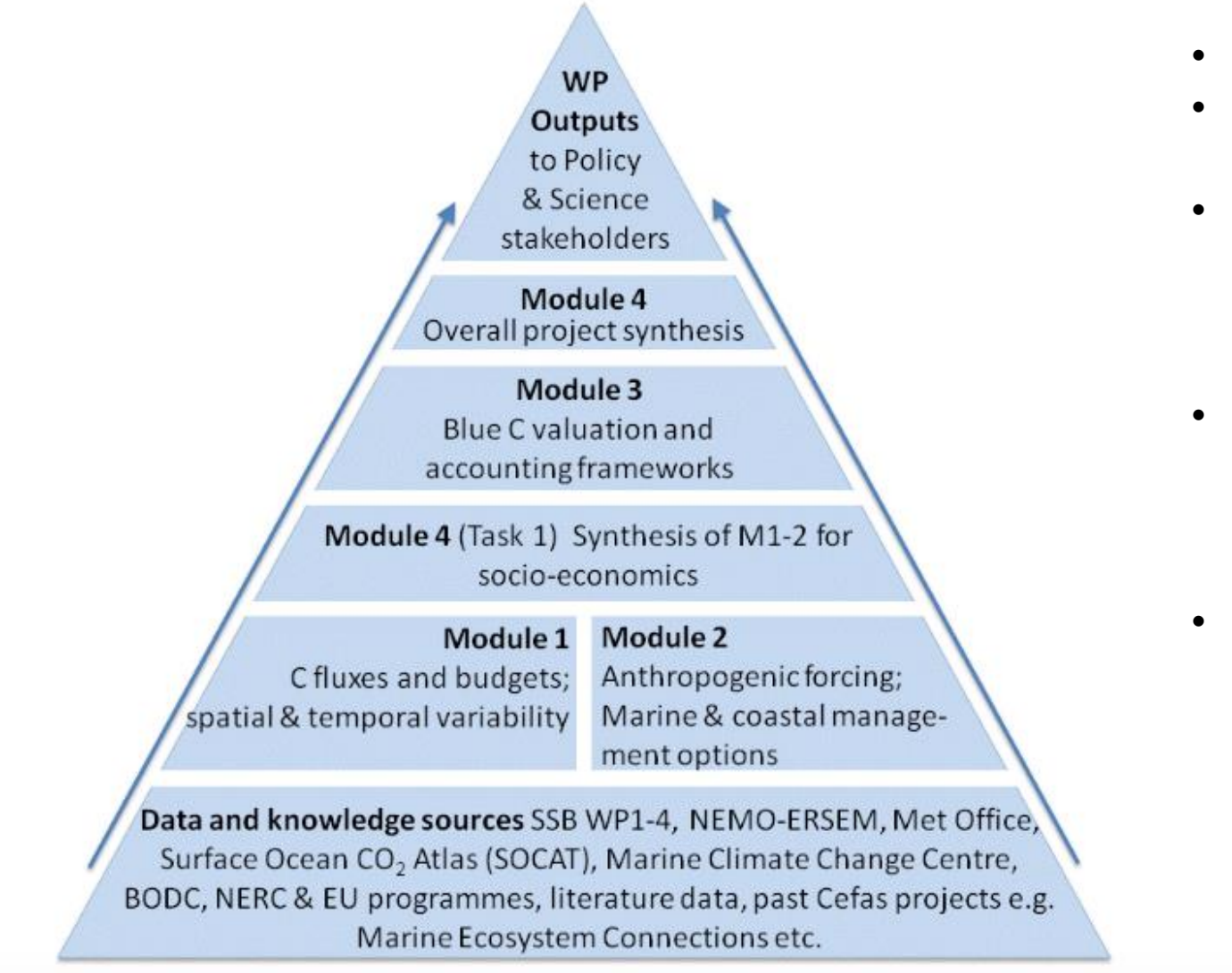
Martin Johnson (replaces Keith as WP lead)

Overview

- Improve quantification of estuarine, near-shore and shelf sea carbon sinks
- Improve understanding of how these change with time (climate change scenarios) and under management scenarios
- Link these findings to carbon accounting and valuation
- Suggest monitoring approach

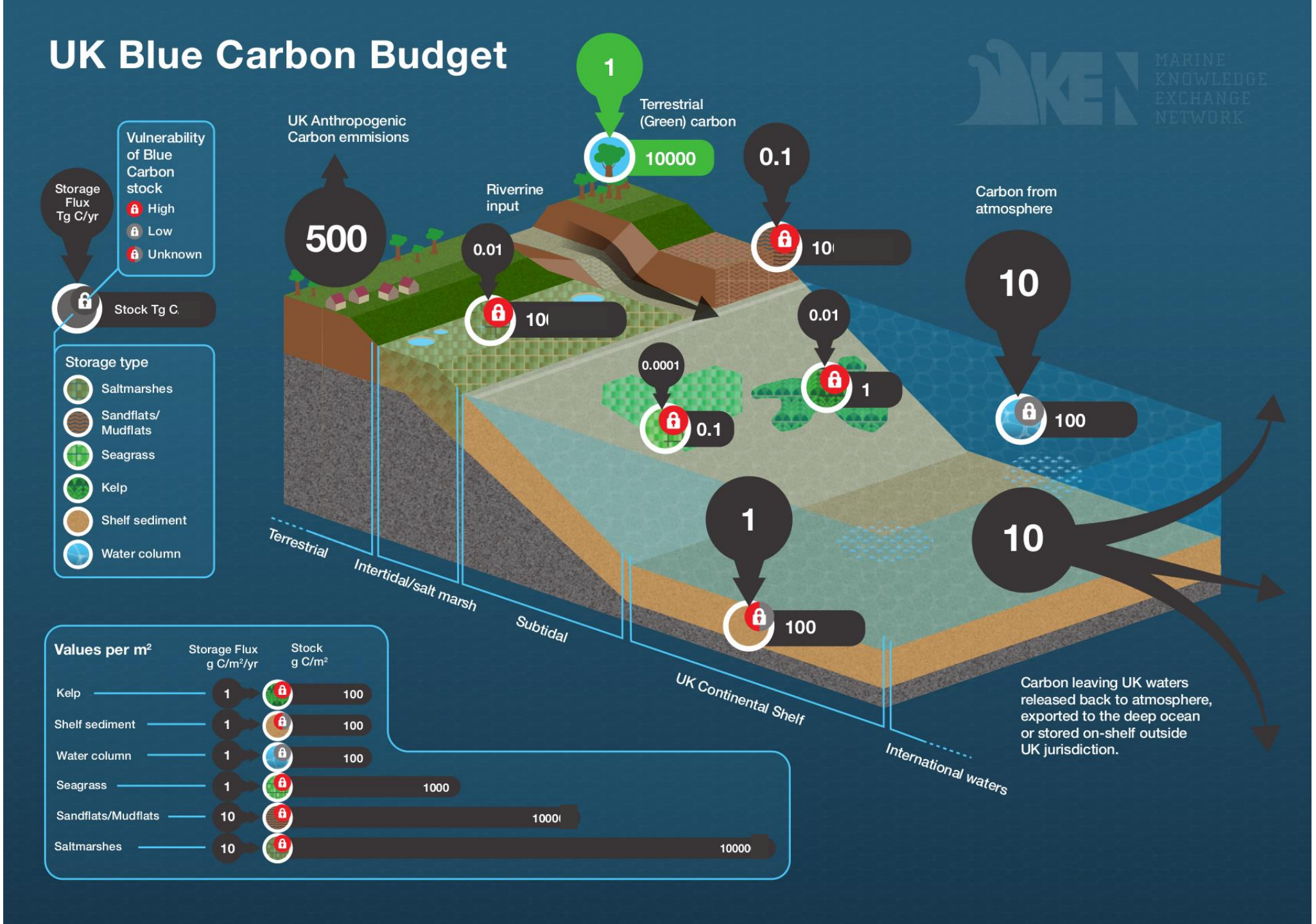
- ***No Celtic Sea focus***
- ***No fieldwork***
- ***Link to existing datasets, SSB fieldwork, SSB modelling***

Overview



- Desk-based study
- Phase 1 – early SSB, compiling and utilising existing data
- Phase 2 (now) integrating input from SSB to produce best estimate
  - UK Blue Carbon budget
  - Likely future changes
- Carbon accounting and valuation mechanisms
  - Development and application to natural science data
- Overarching issues
  - What is Blue Carbon? How do we make sure definitions make biogeochemical sense?

Order of Magnitude Budget



Key findings so far

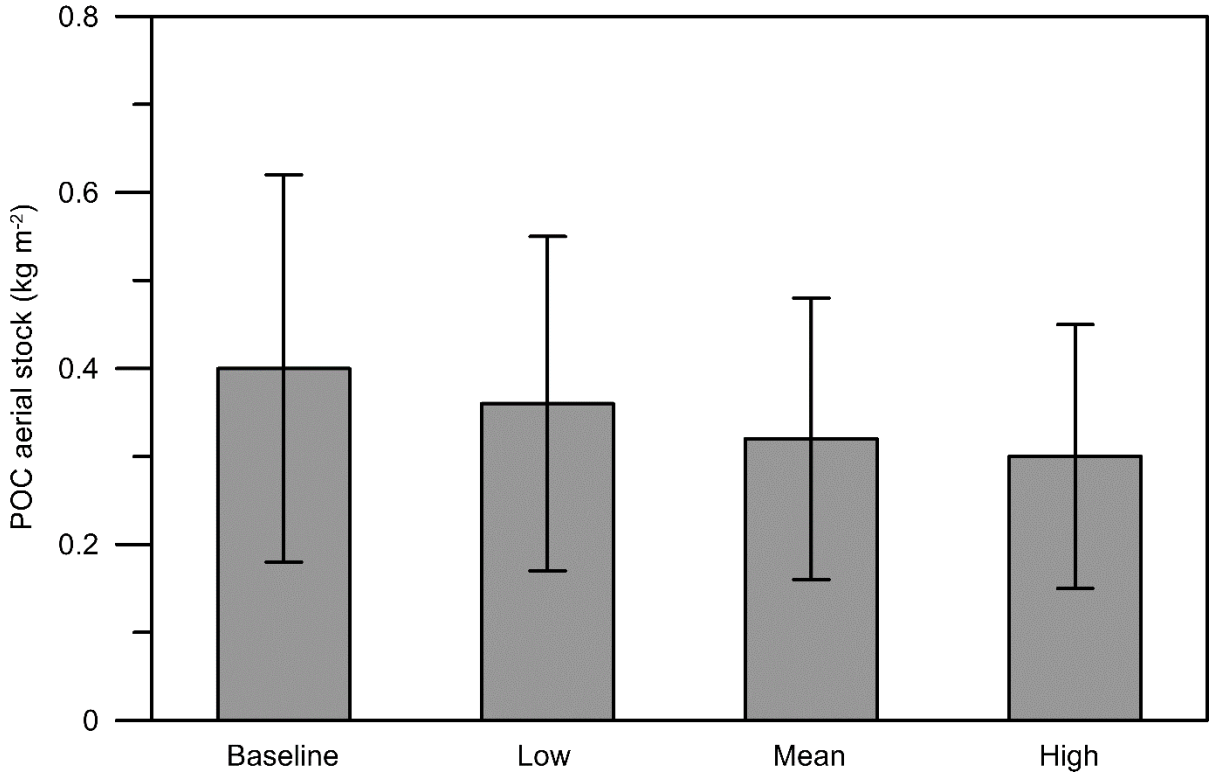
- Shelf sediments represent a considerable stock of carbon

Ecosystem	Area (km^2)	Depth (m)	Aerial stock ($kgC\ m^{-2}$)	Density ($kgC\ m^{-3}$)	Total stock (PgC)
Mangroves (global)	137,760[6] - 152,361[7]	0.5->3[8]	102.3[8]	55±4[9]	4-20[8]
Seagrass beds (global)	300,000[10] - 600,000[11]	1[12]	14.7[12]	14.7	4.2-8.4[12]
Salt marshes (global)	21,988[9] - 400,000[10]	0.5[9]	19.5[9]	39	0.43±0.03[9]
NW European shelf sediment	1,111,812[5]	0.1[5]	0.39[5]	3.9	0.23-0.88[5]

Diesing, M. *et al.* Predicting the standing stock of organic carbon in surface sediments of the North-West European continental shelf. *Biogeochemistry* 1–18 (2017). doi:10.1007/s10533-017-0310-4

Key findings so far

- And may loose considerable amounts of carbon with warming



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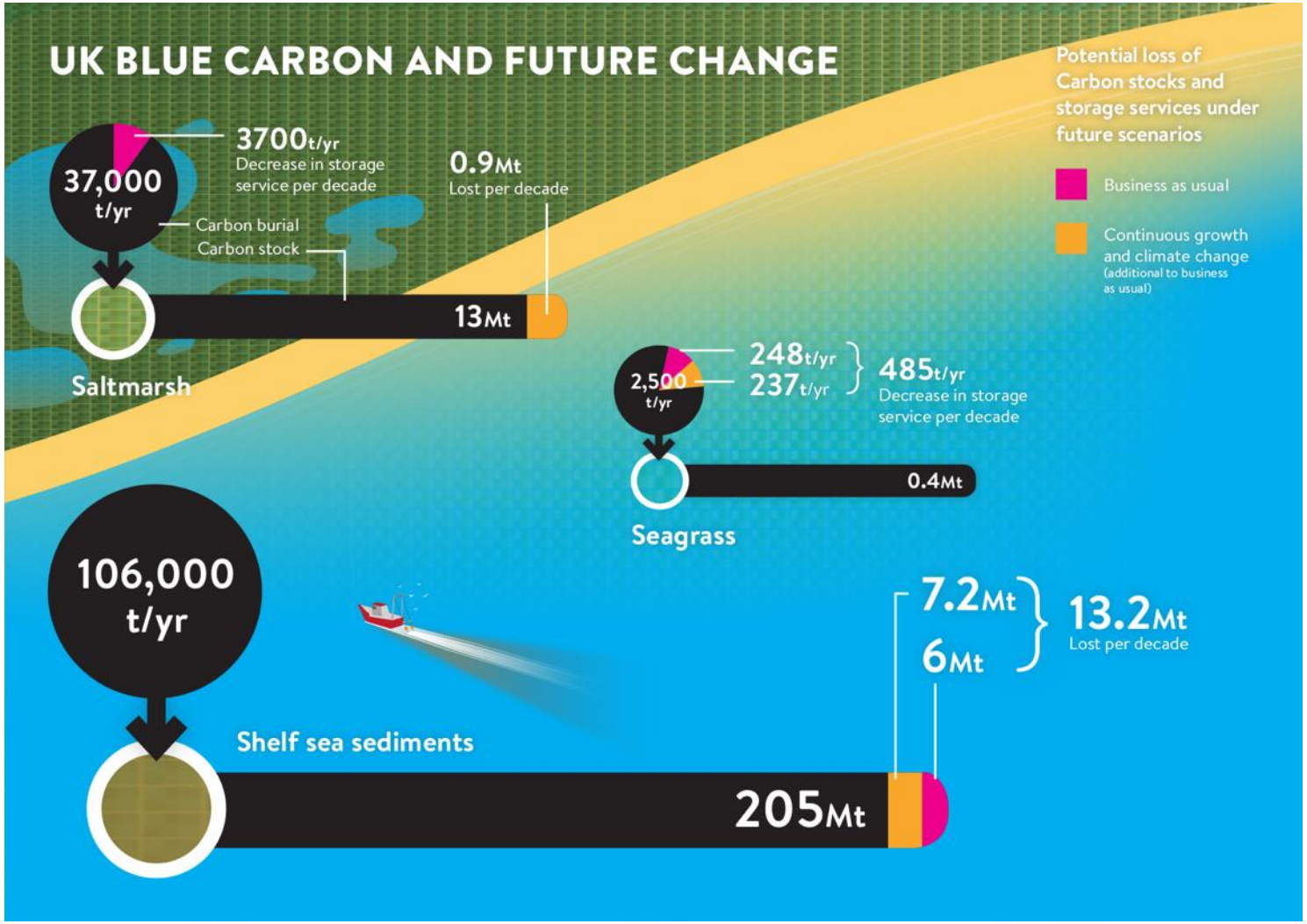
Key findings so far



- Vulnerability to trawling, habitat loss (salt marsh and sea grass)
- Tiziana will tell you more about this tomorrow

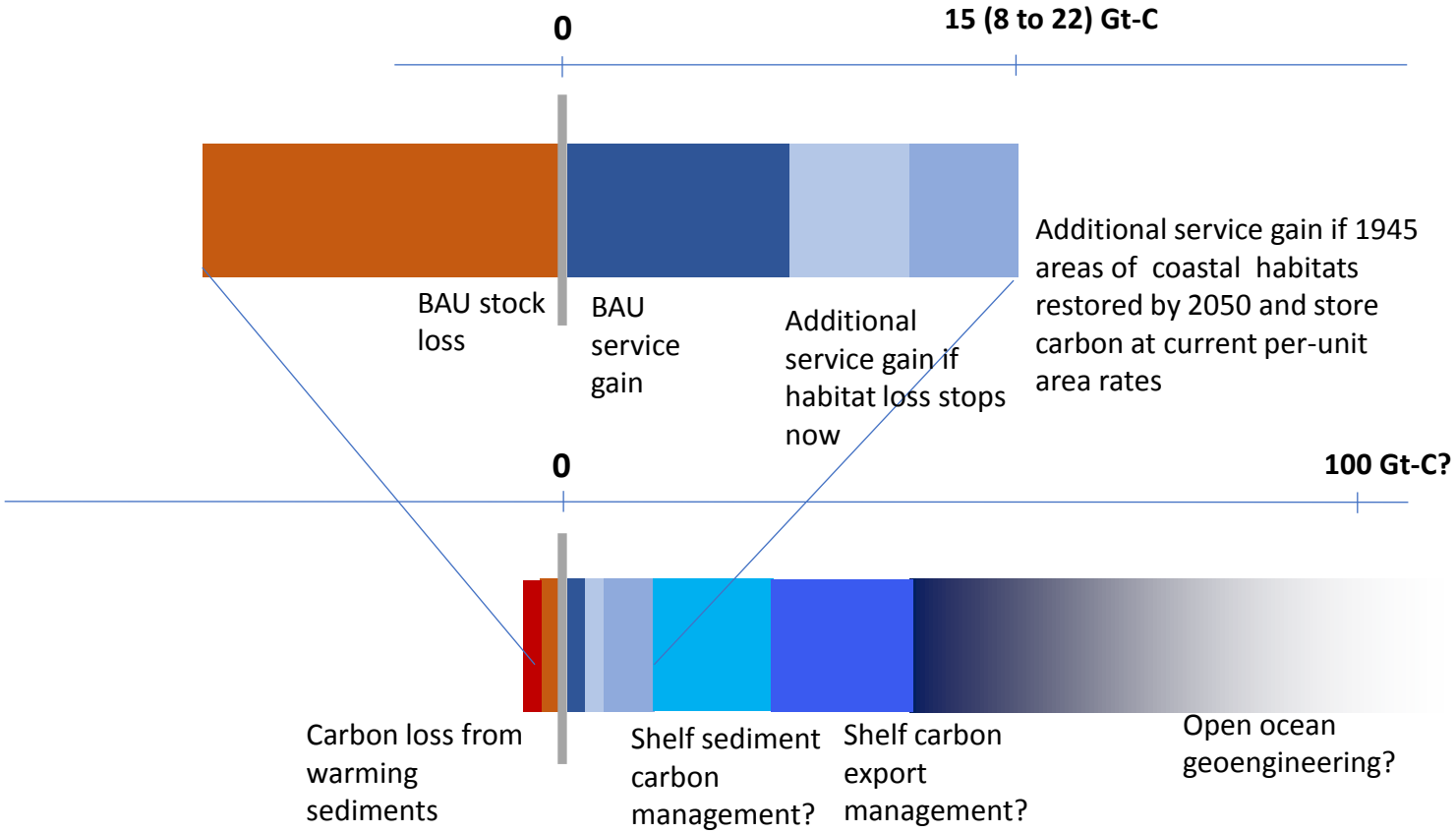
Blue Carbon's shelf life; quantifying and valuing coastal and shelf-sea carbon storage, Luisetti, T., J. Andrews, R. K. Turner, T. Jickells, S. Kroeger, M. Diesing, L. Paltriguera, M. Johnson, E.R. Parker, D. Bakker and K. Weston, submitted to Nature Sustainability

Still to do:

- Future scenarios with NEMO-ERSEM (Climate change, Nutrient fluxes, Trawling) and comparison with baseline runs (most runs complete, analysis still to do)
- Synthesis of key environmental controls on carbon storage across model runds and validation of findings with observations
- Recommendations to Defra on optimising / managing / valuing carbon storage in the UK and wider shelf areas, including development of new economic frameworks and governance to facilitate this

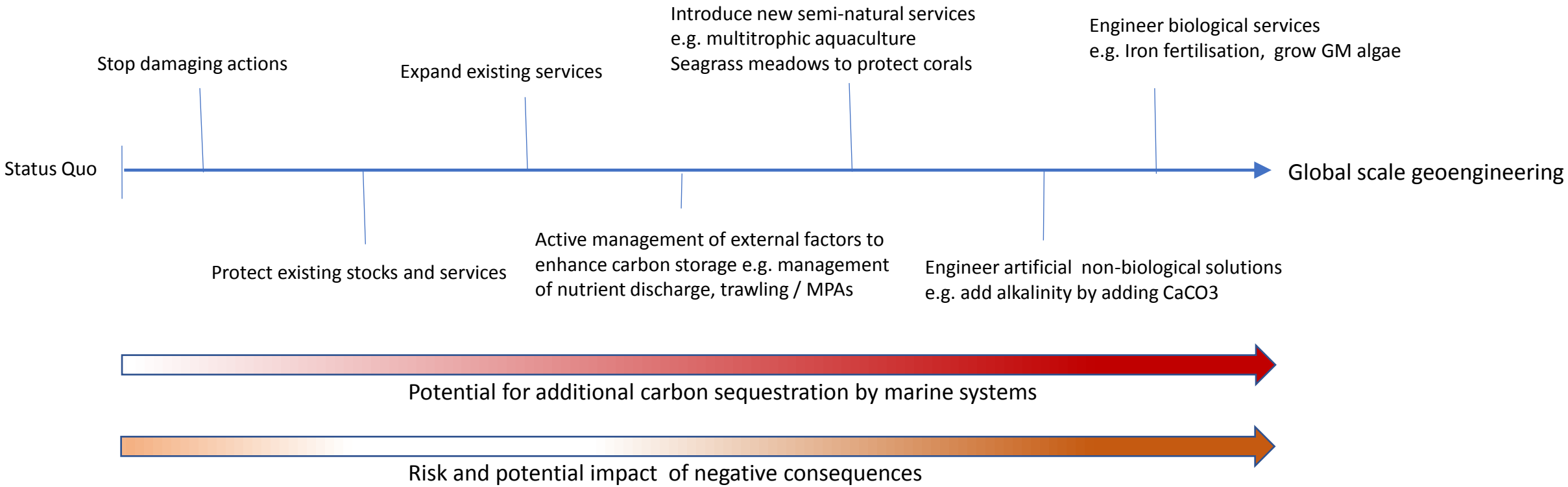
SOLAS science and society working group on *"valuing carbon and the ocean's role"*

- workshops in October 2016 and April 2017 with international group (including China, Nigeria, Canada, US and various European countries)
- Developing ideas around global 'blue carbon' strategy

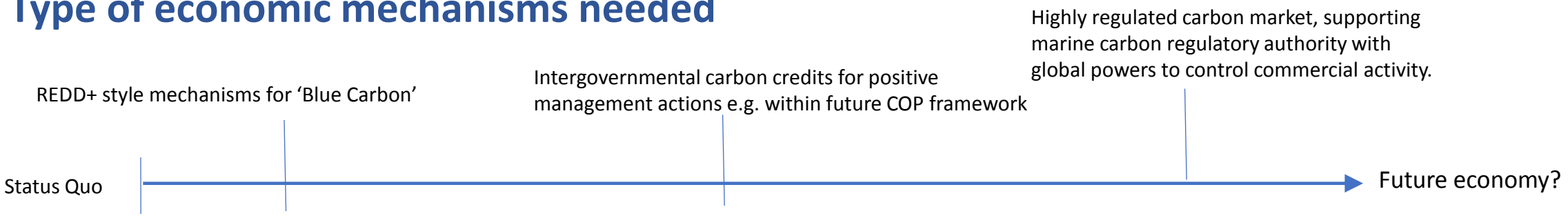


Emission scenario	Cumulative emissions 2017-2100	Amount remaining in atmosphere
RCP 2.5	300	90
RCP 4.5	800	320
RCP 6	1300	715
RCP 8.5	1900	1330

Type of management activity



Type of economic mechanisms needed



Note: This above are not contingent on a natural capital –based economy, but presumably we might expect better environmental outcomes if they were, particularly to the middle and right of this scale– this is something I think we need to get across either in this diagram or the text

Frontiers research topic:

- *Realizing the value of marine carbon storage: from biogeochemistry to socio-economics*
- Frontiers in Marine Science
- (at proposal stage)
- Likely deadlines: Abstract / EoI October 2017; Manuscript April 2018
- Contributions welcome!

Published / in prep. / planned papers… an incomplete list!

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Luisetti, T., J. Andrews, R. K. Turner, T. Jickells, S. Kroeger, M. Diesing, L. Paltriguera, M. Johnson, E.R. Parker, D. Bakker and K. Weston, Blue Carbon's shelf life; quantifying and valuing coastal and shelf-sea carbon storage, in discussion with Nature Sustainability

Johnson, M. et al., The Biogeochemistry of Blue Carbon: Typology, framework and key concepts, in prep

Johnson, M. et al., The Ocean's role in CO2 mitigation (global Blue Carbon from SOLAS perspective)

Q. What counts as blue carbon?

- Coastal habitats (this is the usual definition)
- Shelf sediments?
- Ecosystem services directly fixing large amounts of CO2 (i.e. photosynthesis)?
- Natural uptake of CO2 by the ocean?
- Export of (inorganic and/or organic) carbon-rich material from the shelf to the deep ocean?
- Non-carbon fixing processes whose absence would lead to more carbon in the atmosphere (e.g. anoxic, alkalinity-generating respiration)

A. Probably depends why you're asking the question. Key point: if you want to claim economic benefit for the UK it has to be demonstrable change through action – *natural processes have huge value but aren't tradeable*.