Blue Carbon - the sea, the coast, and the climate crisis

Richard White - NatureBureau

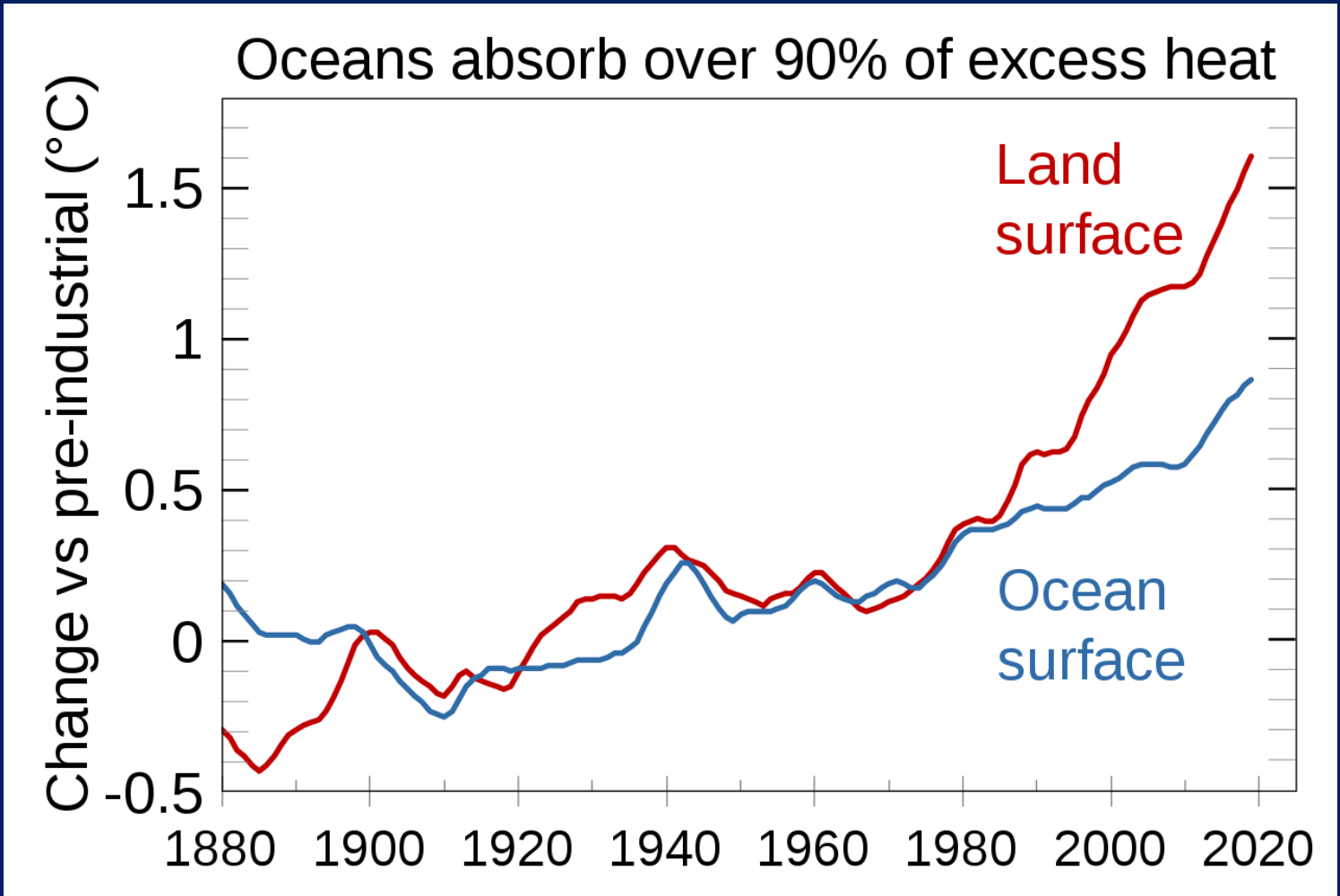
Blue Carbon - the sea, the coast, and the climate crisis

- Climate change impacts
- Climate change mitigation
- Management implications

Climate change impacts

- Ocean warming

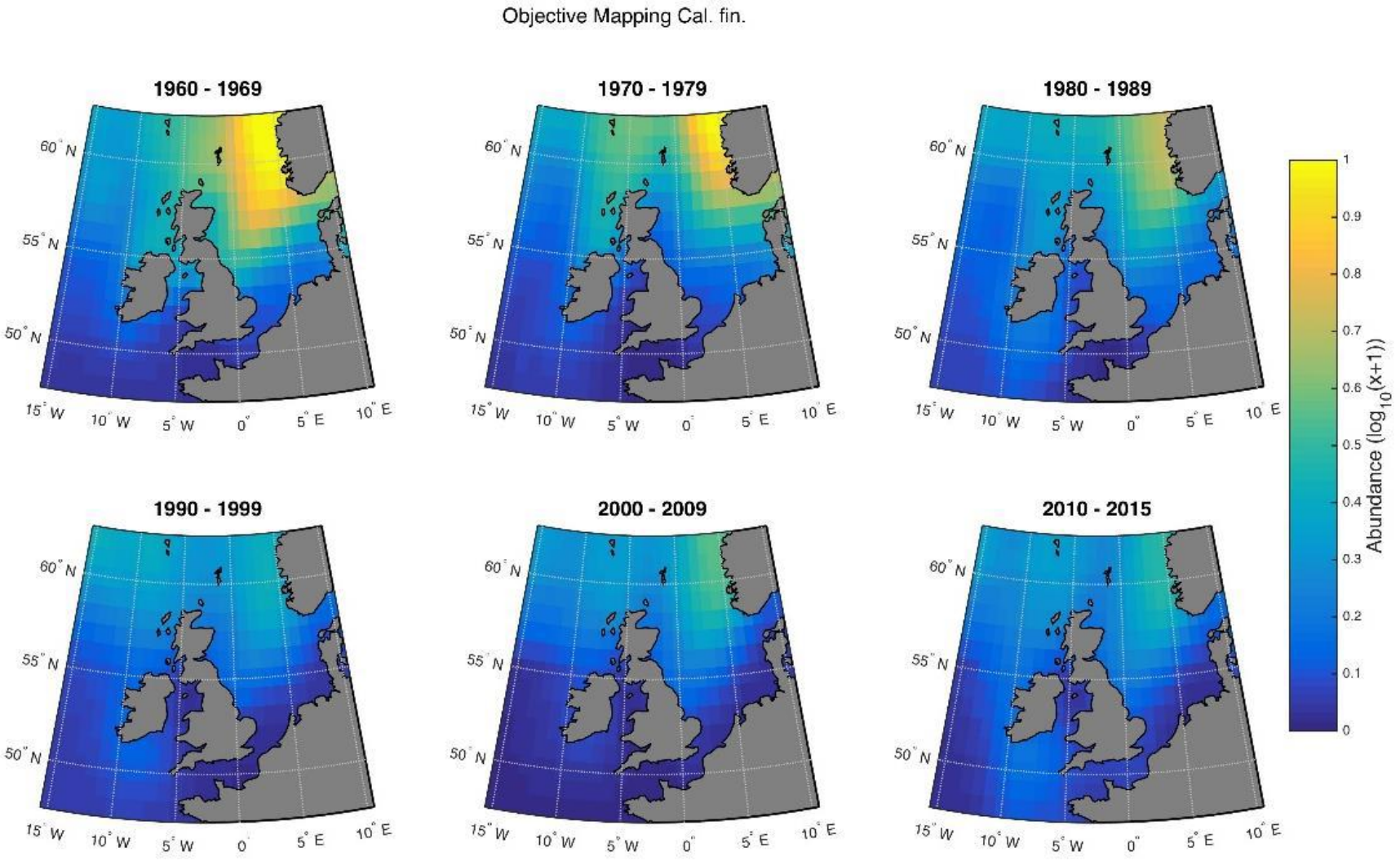
Ocean warming



Climate change impacts

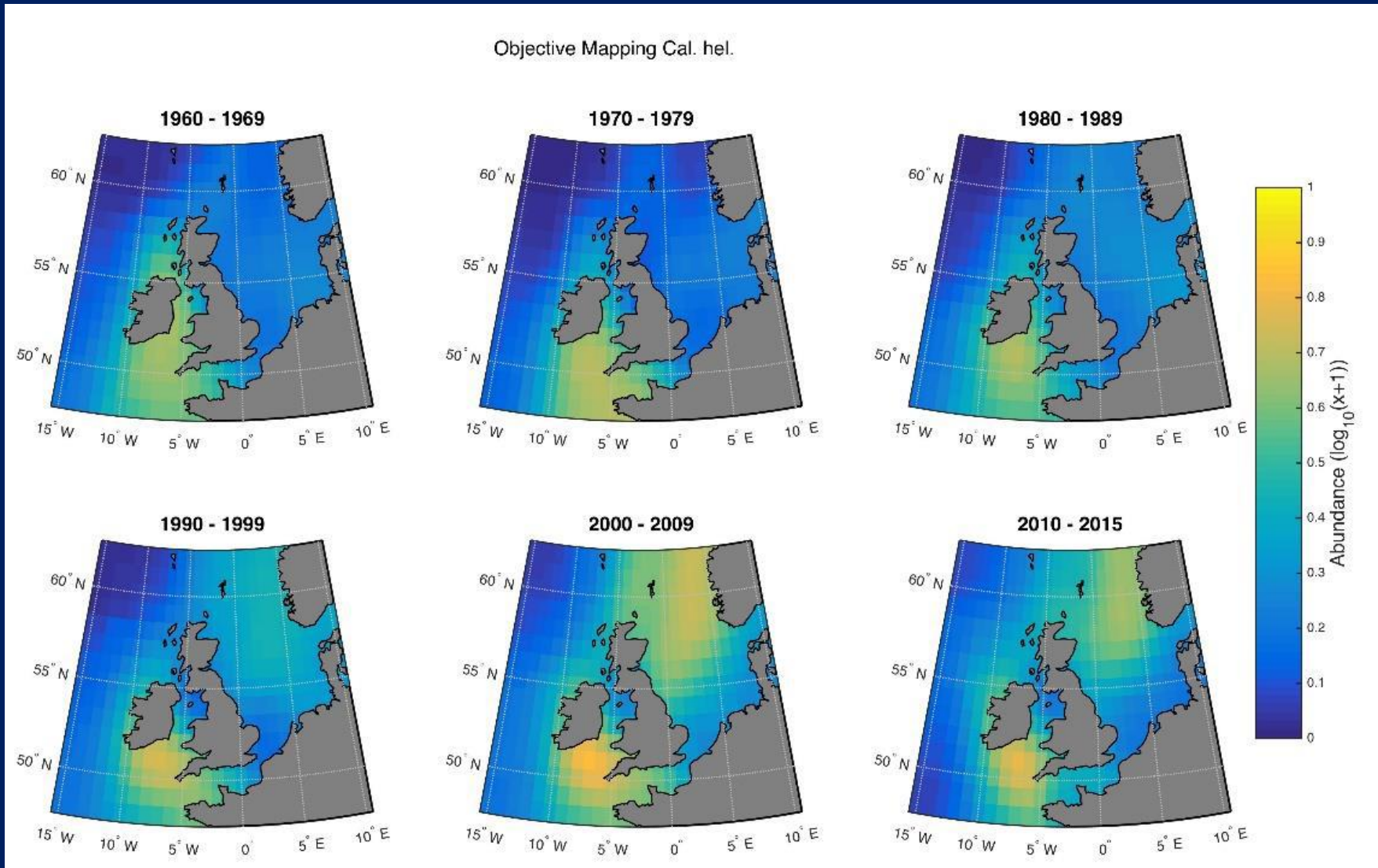
- Ocean warming
  - shifting species distribution

Cold-water plankton



Edwards, M. et. al. (2020) Plankton, jellyfish and climate in the North-East Atlantic. MCCIP Science Review 2020, 322–353.

Temperate-water plankton

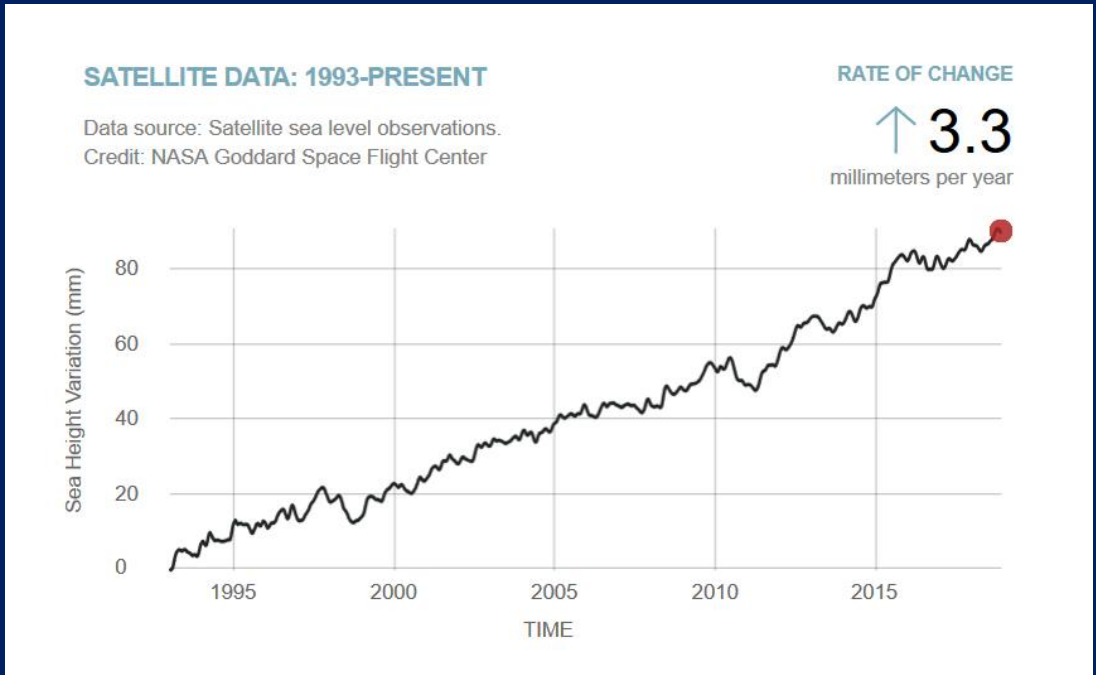


Edwards, M. et. al. (2020) Plankton, jellyfish and climate in the North-East Atlantic. MCCIP Science Review 2020, 322–353.

Climate change impacts

- Ocean warming
  - shifting species distribution
  - sea level rise

Ocean warming - sea level rise



https://climate.nasa.gov/vital-signs/sea-level/

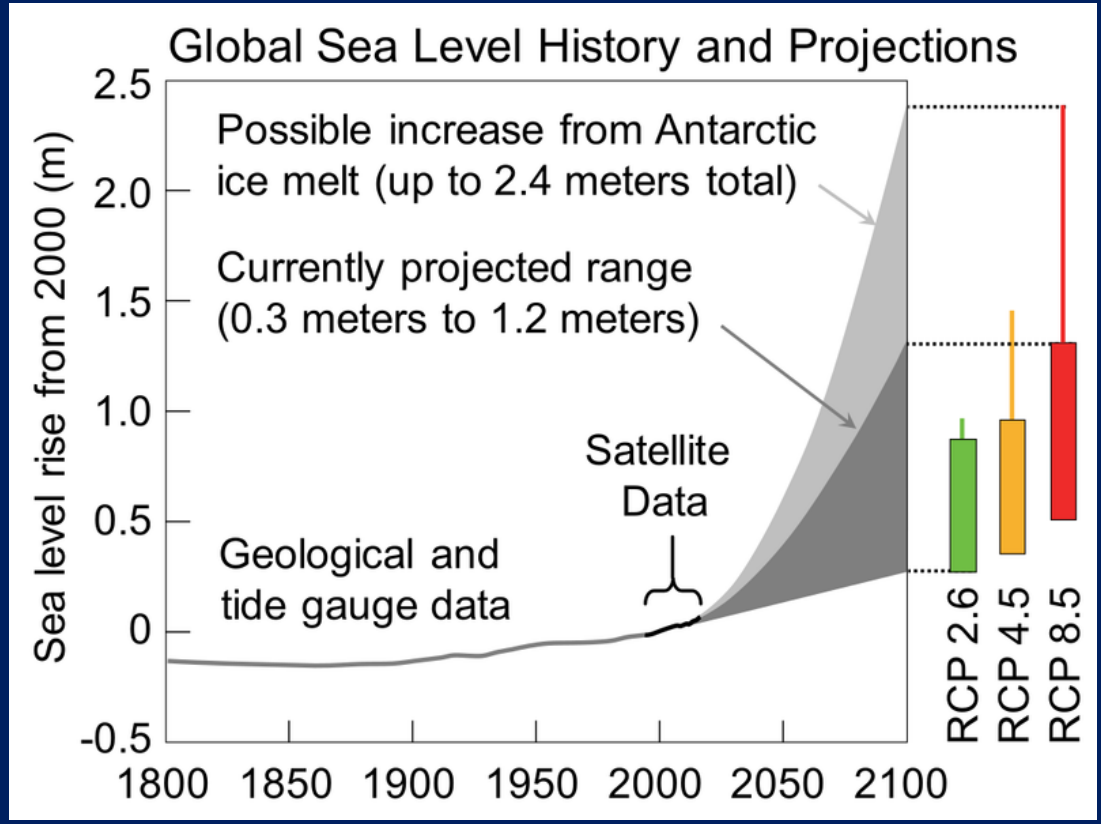
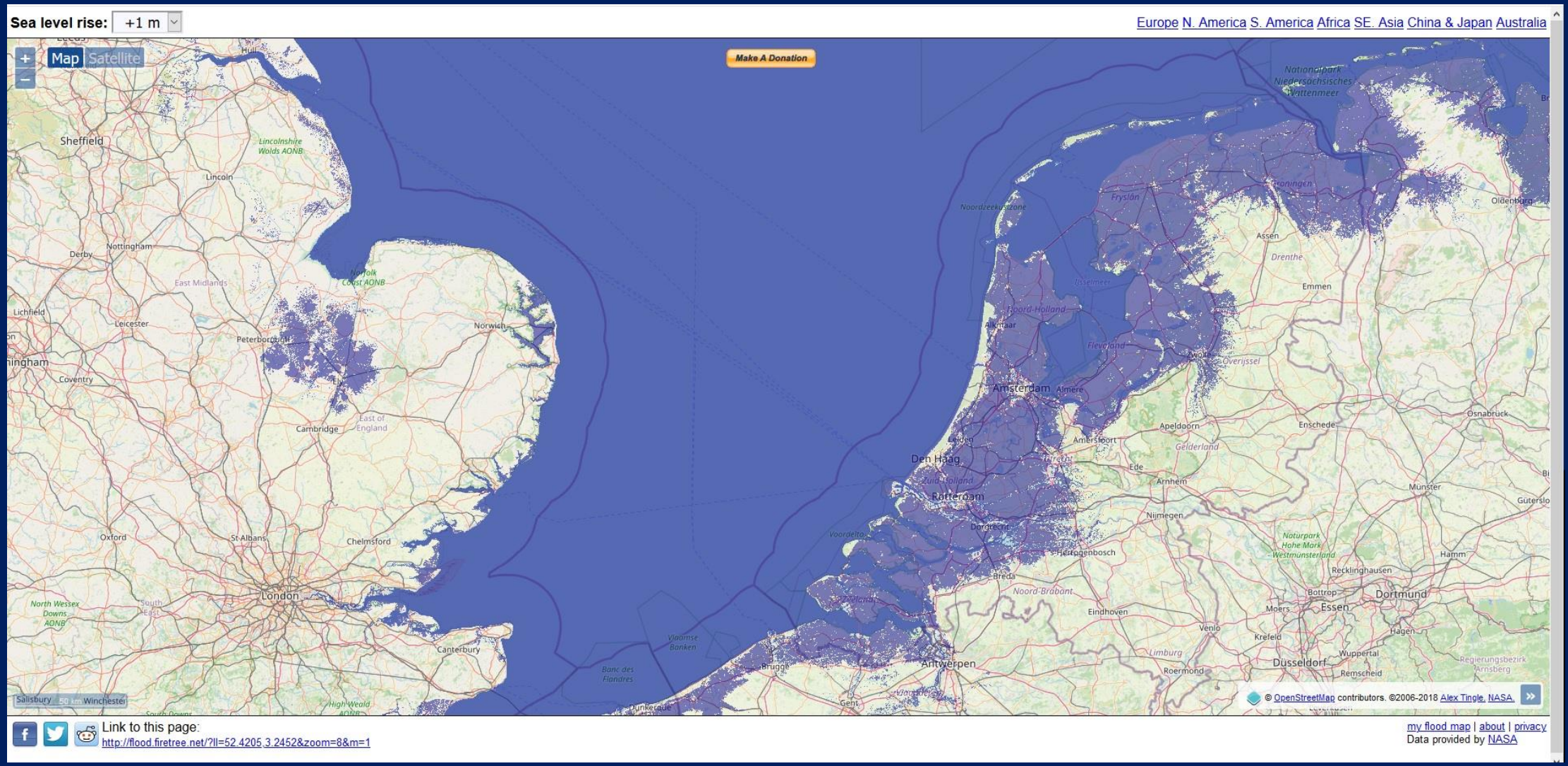


Image: Efbrazil

https://creativecommons.org/licenses/by-sa/4.0/deed.en

Ocean warming - sea level rise



Ocean warming - sea level rise

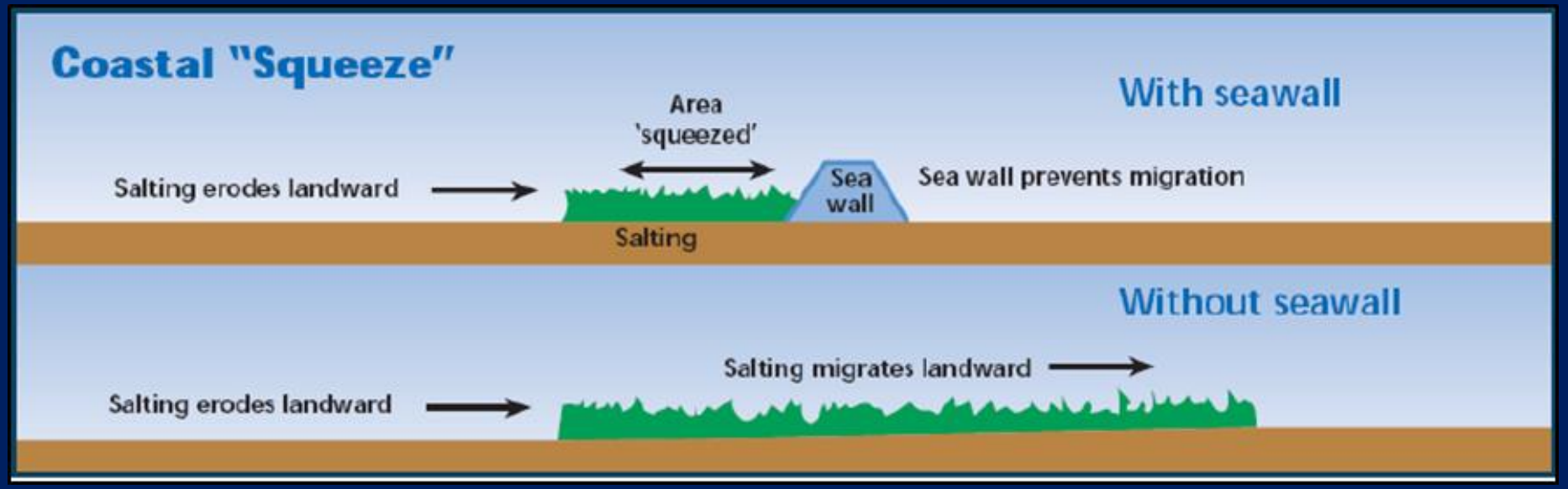


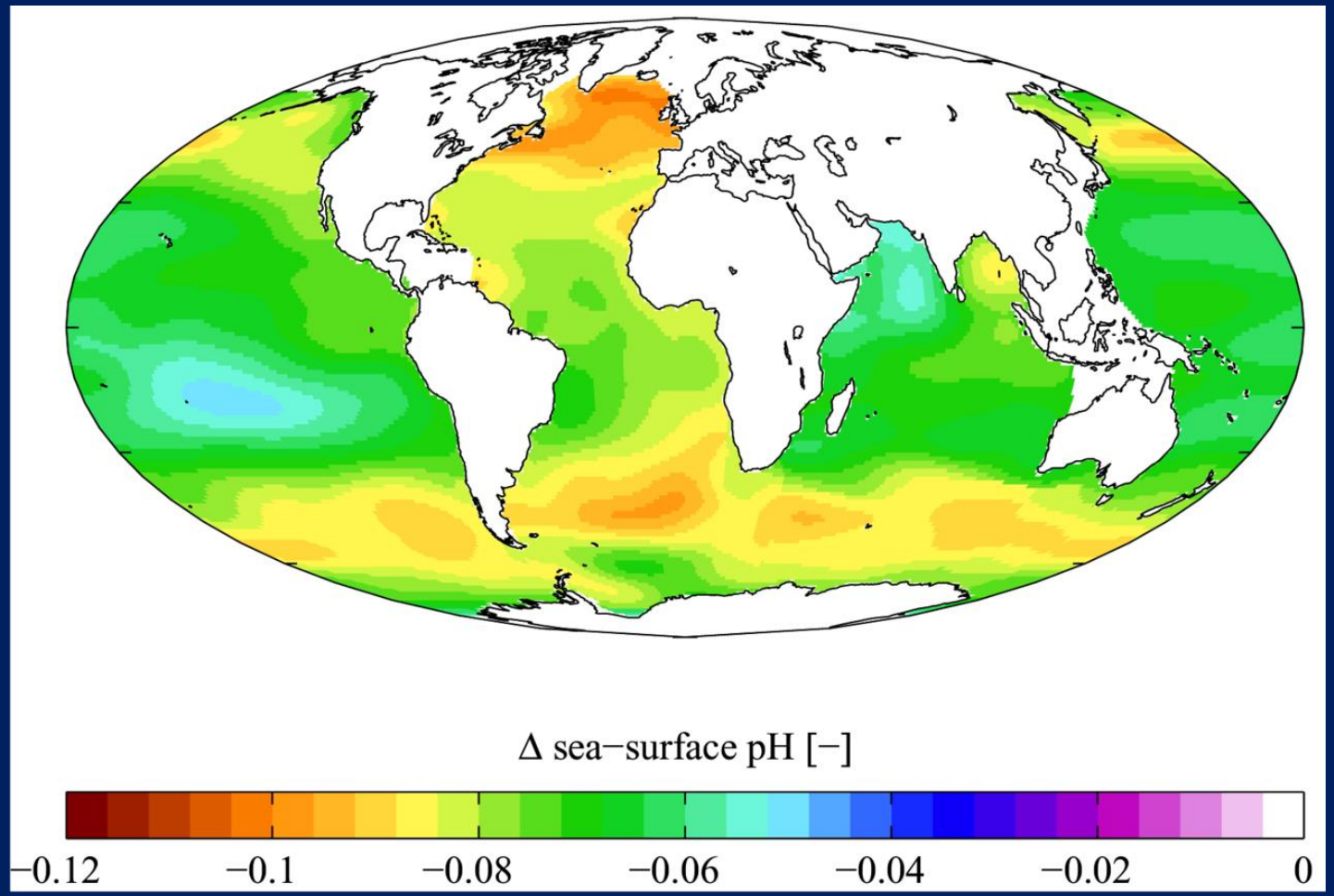
Image: Environment Agency

Climate change impacts

- Ocean warming
  - shift in species distribution
  - sea level rise
- Ocean acidification

Ocean acidification

Estimated change in sea surface pH from the pre-industrial period (1700s) to the present day (1990s).



Ocean acidification

Species at Risk

Image: Coral polyps (Dr. James P. McVey, NOAA Sea Grant Program); Olympia oyster (Feet wet (Flickr)); Pteropod (Matt Wilson/Jay Clark, NOAA NMFS AFSC)

Image from: The Skeptical Science website by Skeptical Science

Climate change impacts

- Ocean warming
  - shift in species distribution
  - sea level rise
- Ocean acidification
- MCCIP Report Card

Climate change mitigation

- Oceanic carbon

Oceanic Carbon

- 83% of the global carbon cycle is circulated through the ocean
- Ocean acidification
- Seabed habitats and sediments

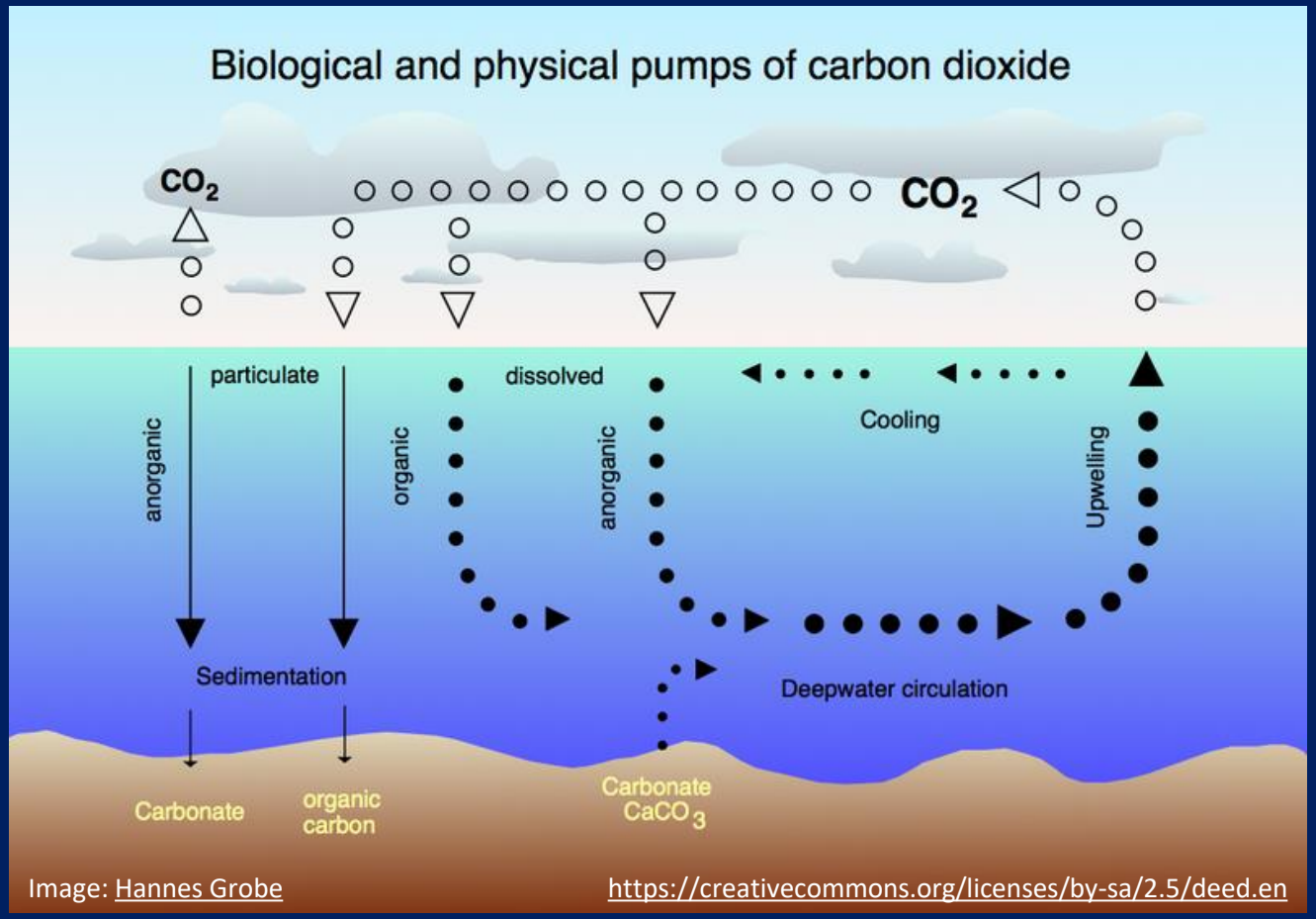


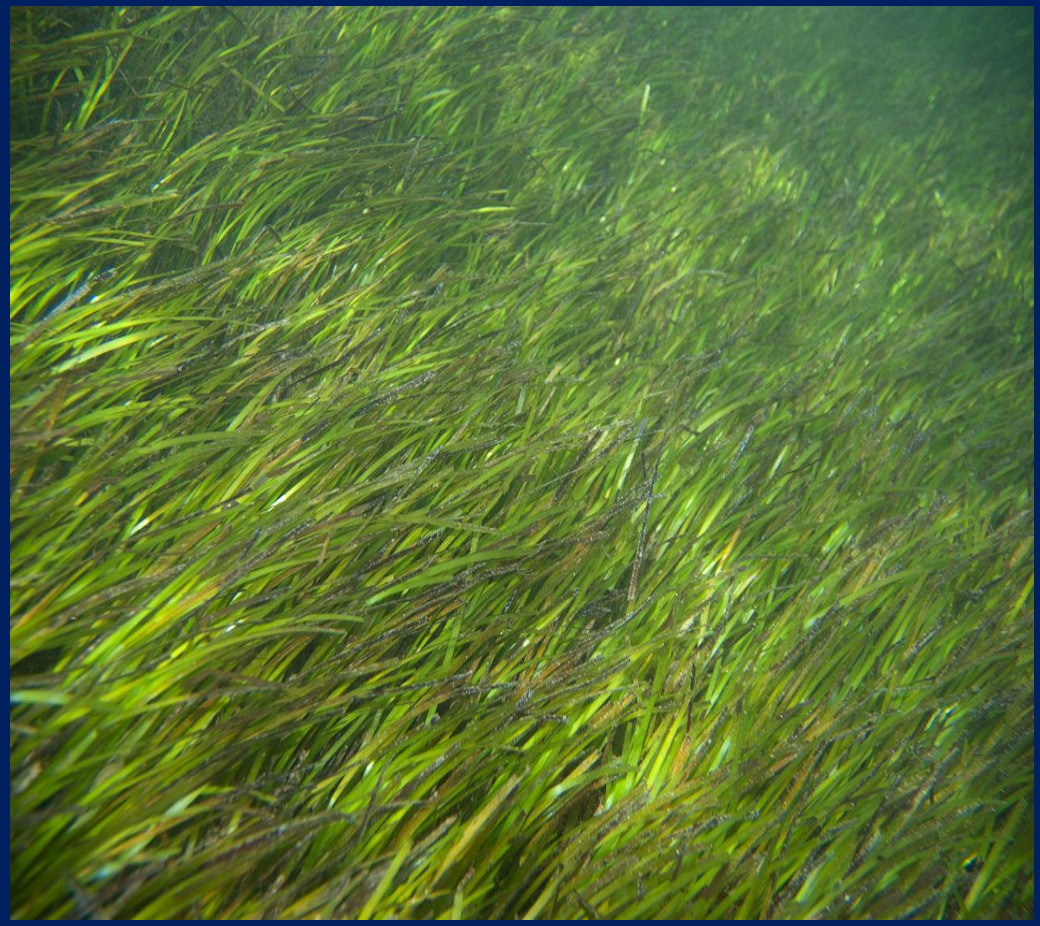
Image: Hannes Grobe

Climate change mitigation

- Oceanic carbon
- Coastal habitats
  - Seagrass
  - Saltmarsh

Seagrass

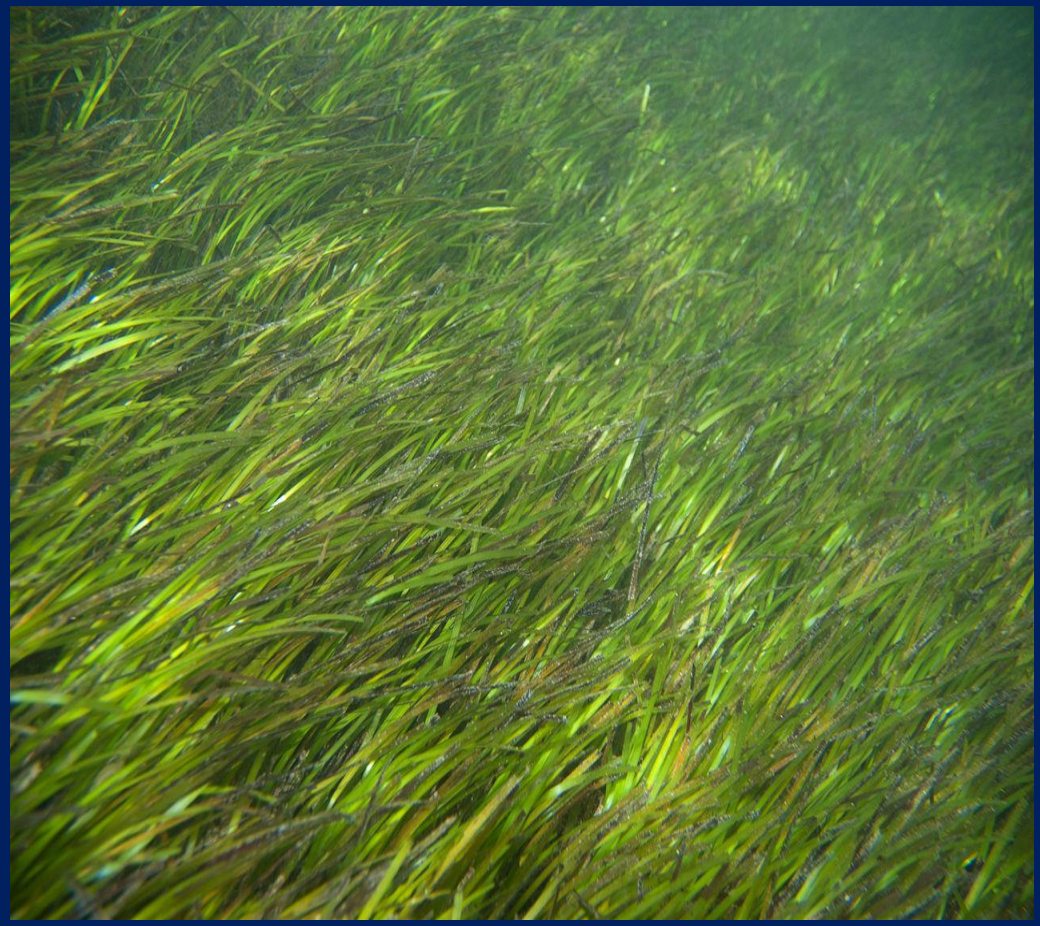
- Carbon captured in:
  - biomass – leaves, roots, rhizomes
  - sediment – trapped particles
- How much?
  - Complicated
  - inter-site variability
  - Carbon cycle
- Globally significant carbon store
  - top 1m – 19.9 x 10^9 tonnes
  - global fossil fuel and cement production in 2014



Seagrass image: Paul Asman and Jill Lenoble - seagrass *Halodule uninervis* Uploaded by Amada44, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=25253750

Seagrass

- Carbon captured in:
  - biomass – 2%
  - sediment – 98%
- How much?
  - Complicated
  - inter-site variability
  - Carbon cycle
- Globally significant carbon store
  - top 1m – 19.9 x 10^9 tonnes
  - global fossil fuel and cement production in 2014



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Saltmarsh

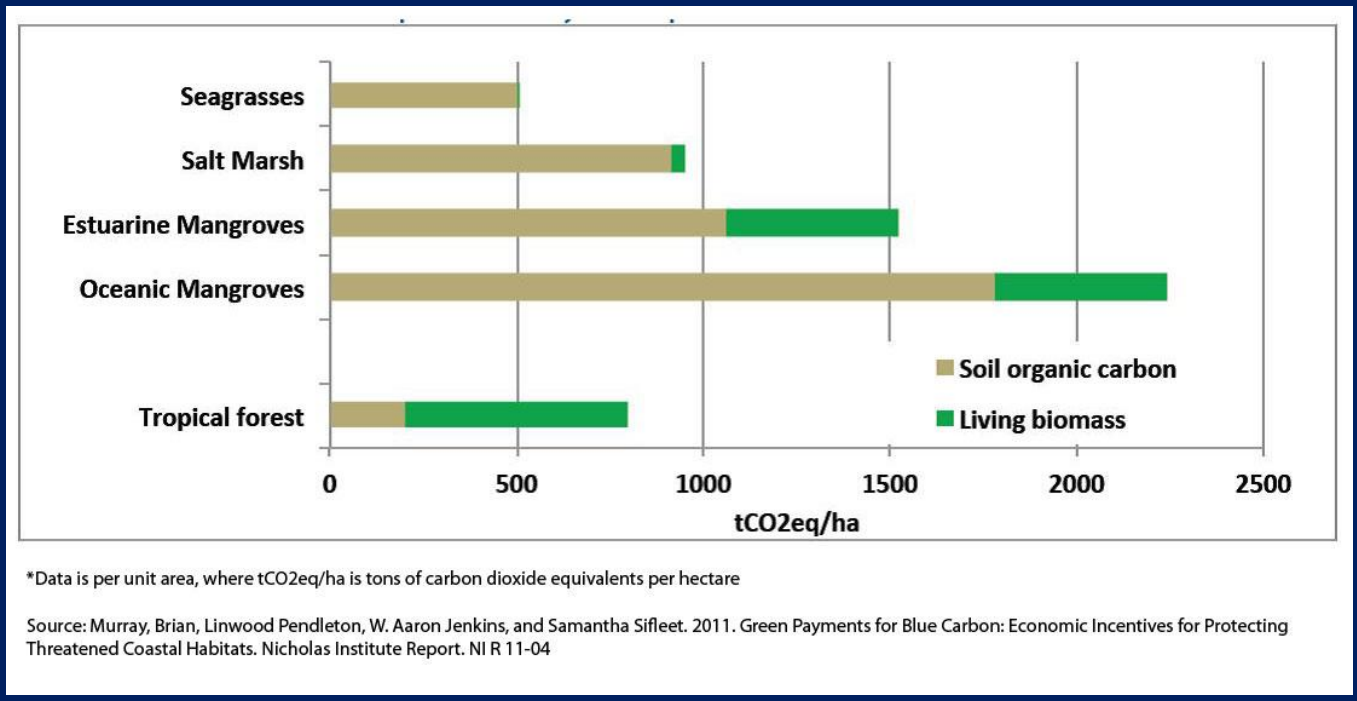
- Carbon captured in:
  - biomass – plants
  - sediments – soil
- How much?
  - More complicated!
- Globally significant carbon store
  - top 1m – 1.3 x 10^9 tonnes?
  - deeper?

Saltmarsh

- Carbon captured in:
  - biomass – 10%
  - sediments – 90%
- How much?
  - More complicated!
- Globally significant carbon store
  - top 1m – 1.3 x 10^9 tonnes?
  - deeper?

Coastal habitats

- Cover less than 2% of the total ocean area
- Account for approximately 50% of the total carbon sequestered in ocean sediments



Note: figures are per unit area, not global total

Climate change mitigation

- Oceanic carbon
- Coastal habitats
  - Seagrass
  - Saltmarsh
- Aquaculture

Shellfish aquaculture

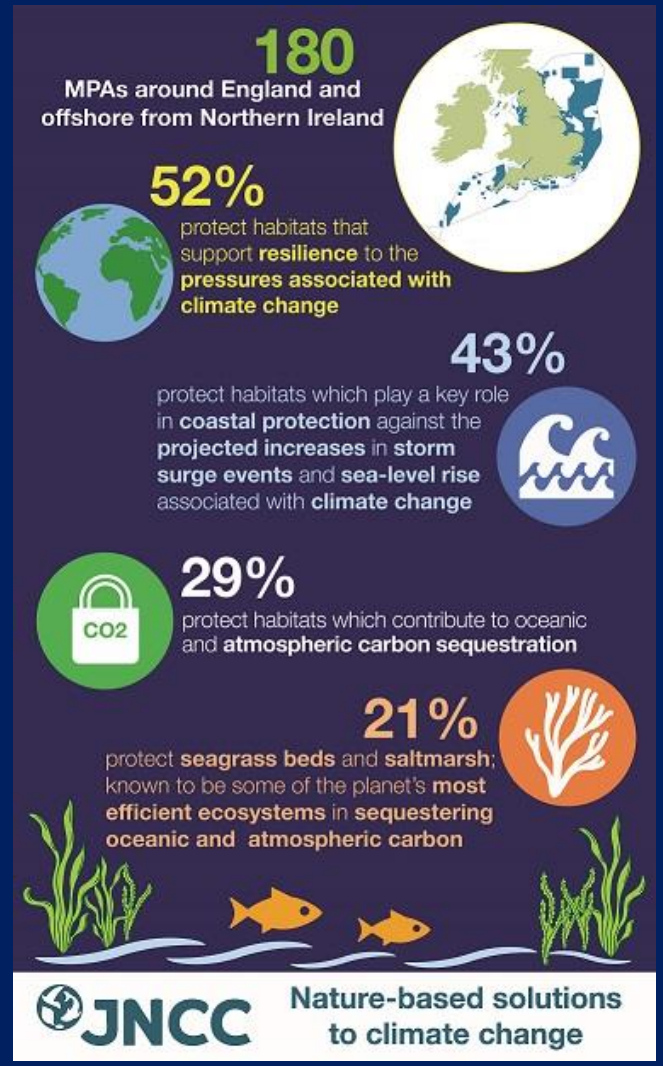
- Carbon stored as shell
- Estimates from Scotland
  - 180 kg CO^2-eq/t mussel
  - 359 kg CO^2-eq/t oysters
- EU shellfish production 2017
  - 626,000t
  - mostly mussels, with some oyster

Management implications

- Protection

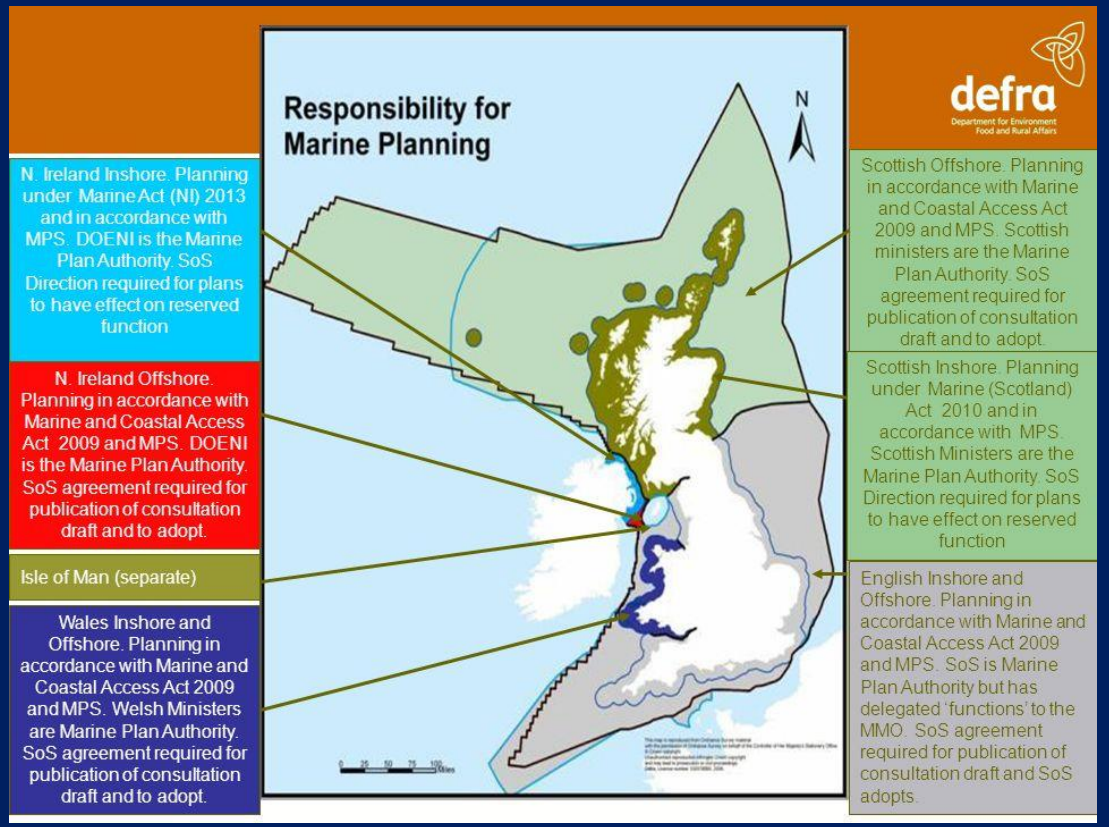
Protection

- At least 49% of UK seagrass coverage has been lost in the last 35 years
- 100ha of saltmarsh lost per year
- Marine Protected Areas
  - effective management
  - post-Brexit



Protection

- At least 49% of UK seagrass coverage has been lost in the last 35 years
- 100ha of saltmarsh lost per year
- Marine Protected Areas
  - effective management
  - post-Brexit
- Marine Planning
  - appropriate policies
  - monitoring and updating

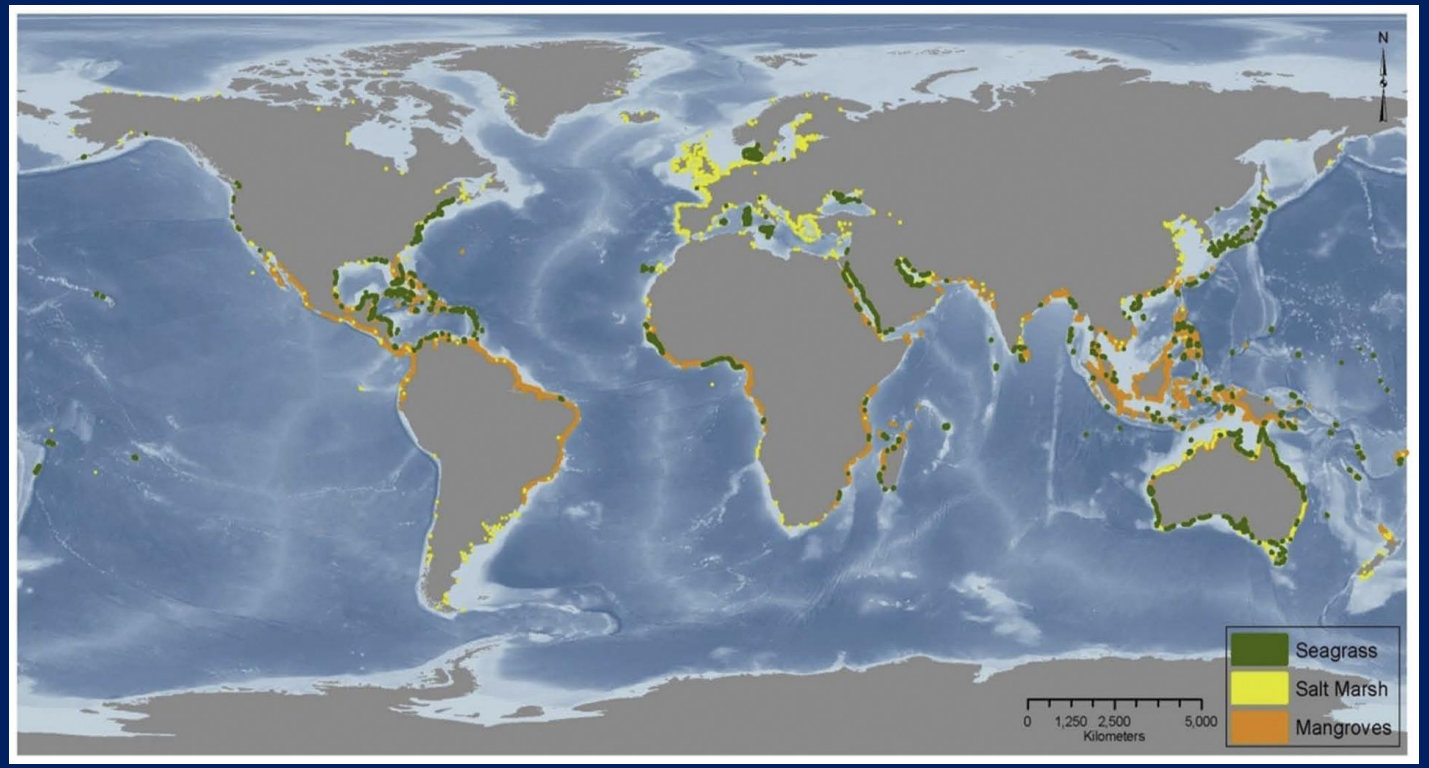


Management implications

- Protection
- Restoration

Restoration

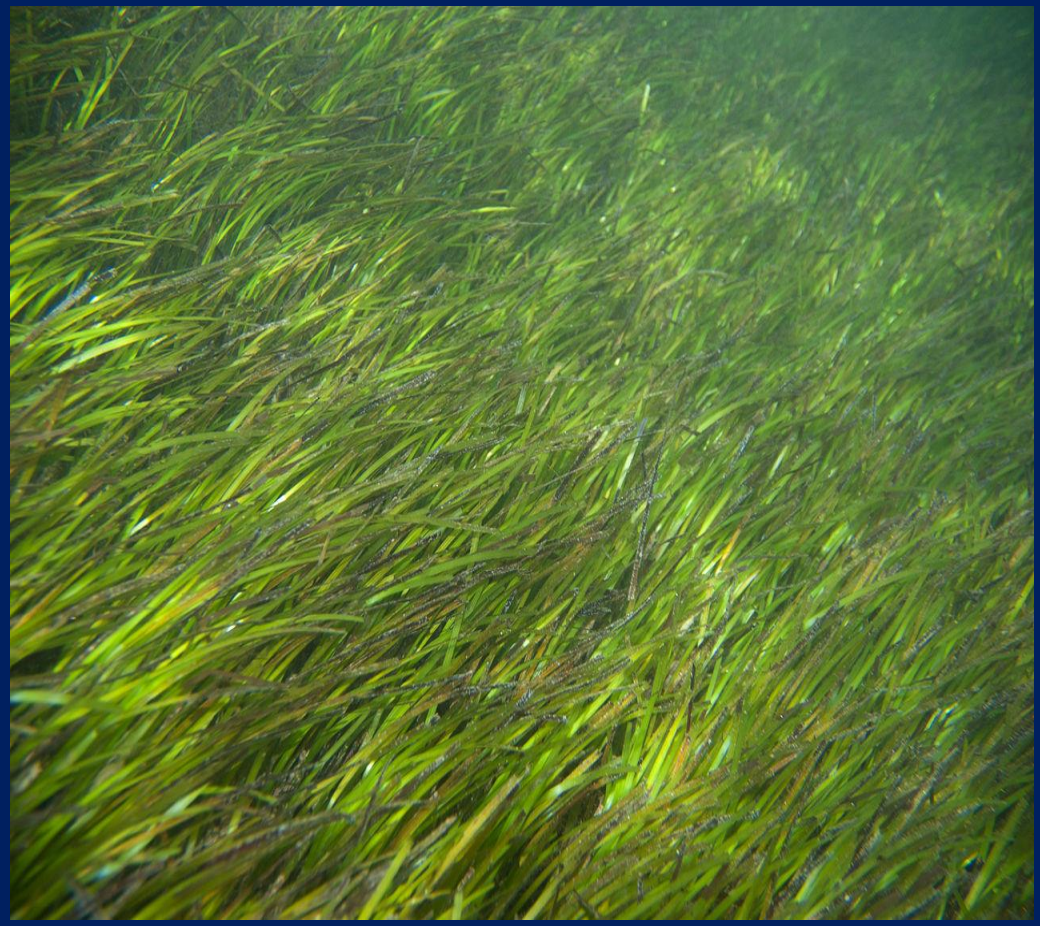
- Global projects
  - www.thebluecarboninitiative.org



By Linwood Pendleton , Daniel C. Donato , Brian C. Murray, Stephen Crooks, W. Aaron Jenkins, Samantha Sifleet, Christopher Craft, James W. Fourqurean, J. Boone Kauffman, Núria Marbà, Patrick Megonigal, Emily Pidgeon, Dorothee Herr, David Gordon, Alexis Baldera - Pendleton L, Donato DC, Murray BC, Crooks S, Jenkins WA, Sifleet S, et al. (2012) Estimating Global "Blue Carbon" Emissions from Conversion and Degradation of Vegetated Coastal Ecosystems. PLoS ONE 7(9): e43542. doi:10.1371/journal.pone.0043542, CC0, https://commons.wikimedia.org/w/index.php?curid=47083470

Restoration

- Global projects
  - www.thebluecarboninitiative.org
- UK seagrass
  - www.projectseagrass.org/seagrass-ocean-rescue/



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Restoration

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  - www.thebluecarboninitiative.org
- UK seagrass
  - www.projectseagrass.org/seagrass-ocean-rescue/
- UK saltmarsh
  - www.essexwt.org.uk/news/restoring-saltmarshes-blackwater-estuary
  - synergy.st-andrews.ac.uk/serg/saltmarsh/
  - www.nationaltrust.org.uk/projects/coastal-adaptation-in-action-at-cwm-ivy

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- Any questions?