Coastal Blue Carbon Ecosystems & Climate Change

SAULE AKHMETKALIYEVA

UNIVERSITY COLLEGE DUBLIN

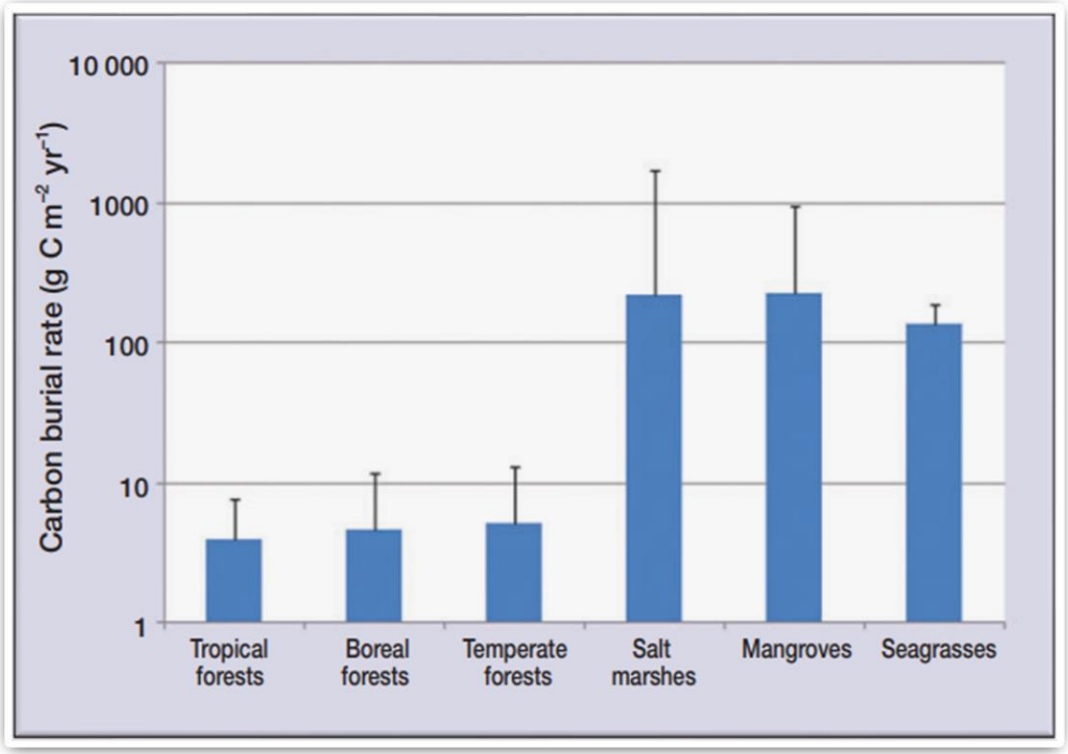
What is Blue Carbon?

Oceans and coastal marine systems play a significant role in the global carbon cycle, representing the largest long-term sink of carbon.

Blue Carbon (BC) refers to the carbon sequestered and stored by the oceans (Nellemen et al., 2009), in particular the carbon accumulating in vegetated, tidally influenced coastal ecosystems such as tidal marshes, mangroves and seagrass meadows (International Blue Carbon Scientific Working Group, 2015).

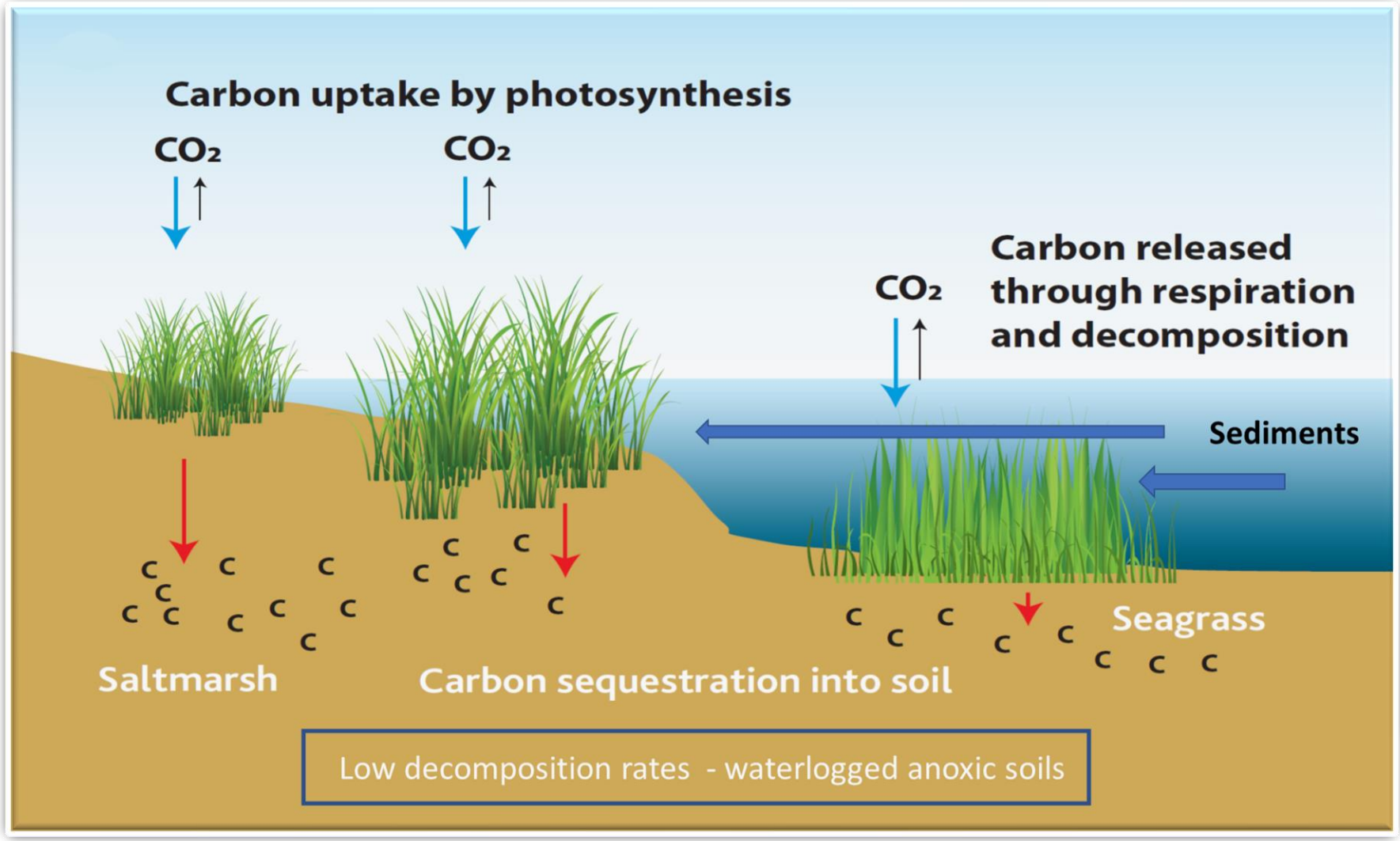
Why is Blue Carbon Important?

- Coastal vegetated habitats can sequester carbon for over a millennia (Duarte et al., 2005).
- Although occupying less than 2% of ocean area (‹5 % global land area), vegetated coastal habitats are estimated to account for up to 50% of carbon burial in marine sediments (Duarte, 2005).
- Despite their relatively small area, BCEs store carbon at a rate an order of magnitude higher than terrestrial ecosystems, making them a valuable tool for climate mitigation and adaptation (McLeod et al., 2011).

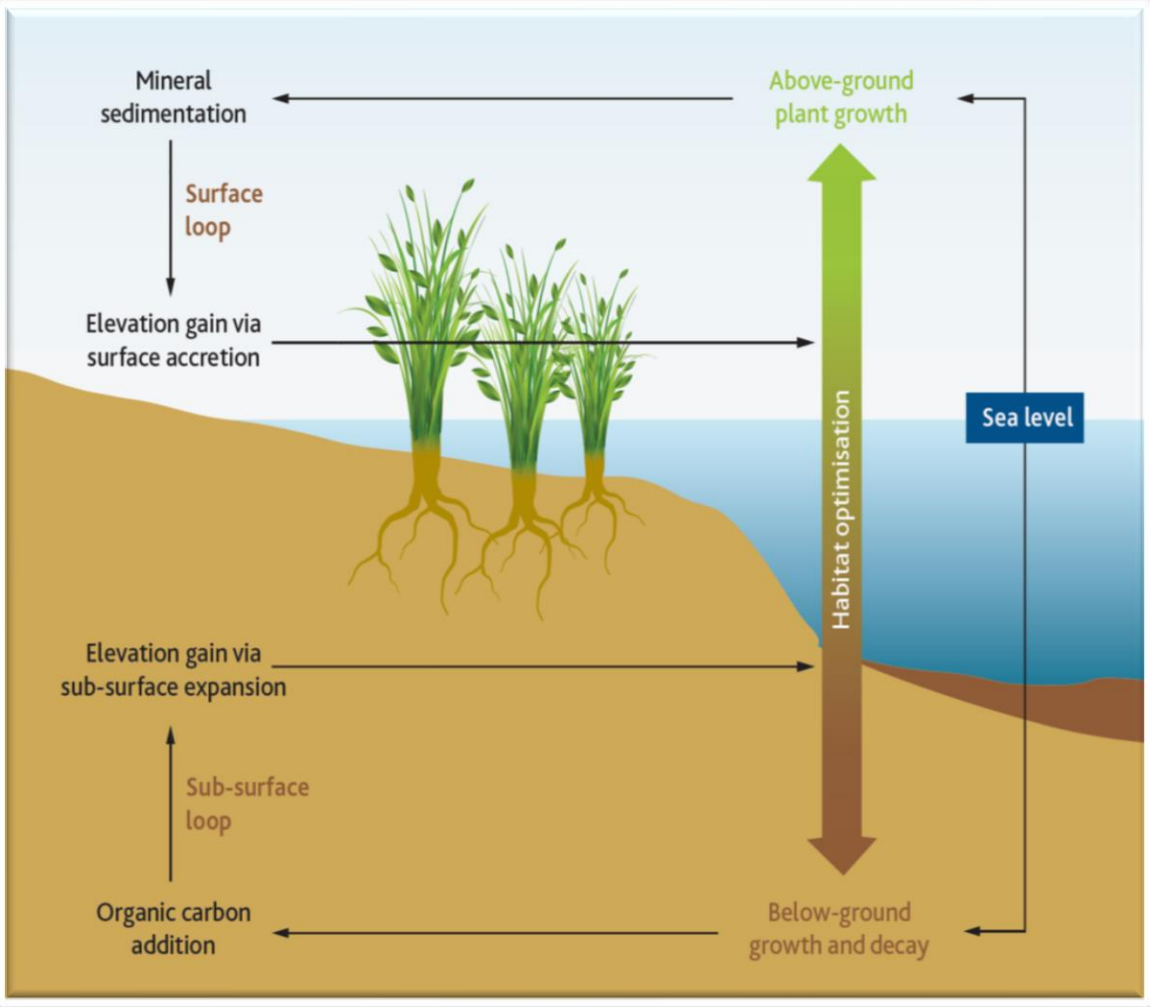


McLeod et al. (2011). Front Ecol Environ; 9(10): 552–560

How Carbon Captured and Stored



How Climate Change Affects Blue Carbon Ecosystems



Warming simultaneously accelerates sea-level rise and alters in situ process rates that regulate marsh elevation and vulnerability to drowning, namely production, decomposition, and vertical accretion.

Aboveground and belowground production increase with temperature, which is expected to accelerate both vertical accretion and carbon inputs to the soil.

Temperature-driven increases in decomposition, which can reduce marsh stability and potentially offset benefits from increased productivity.

International Warming Experiments

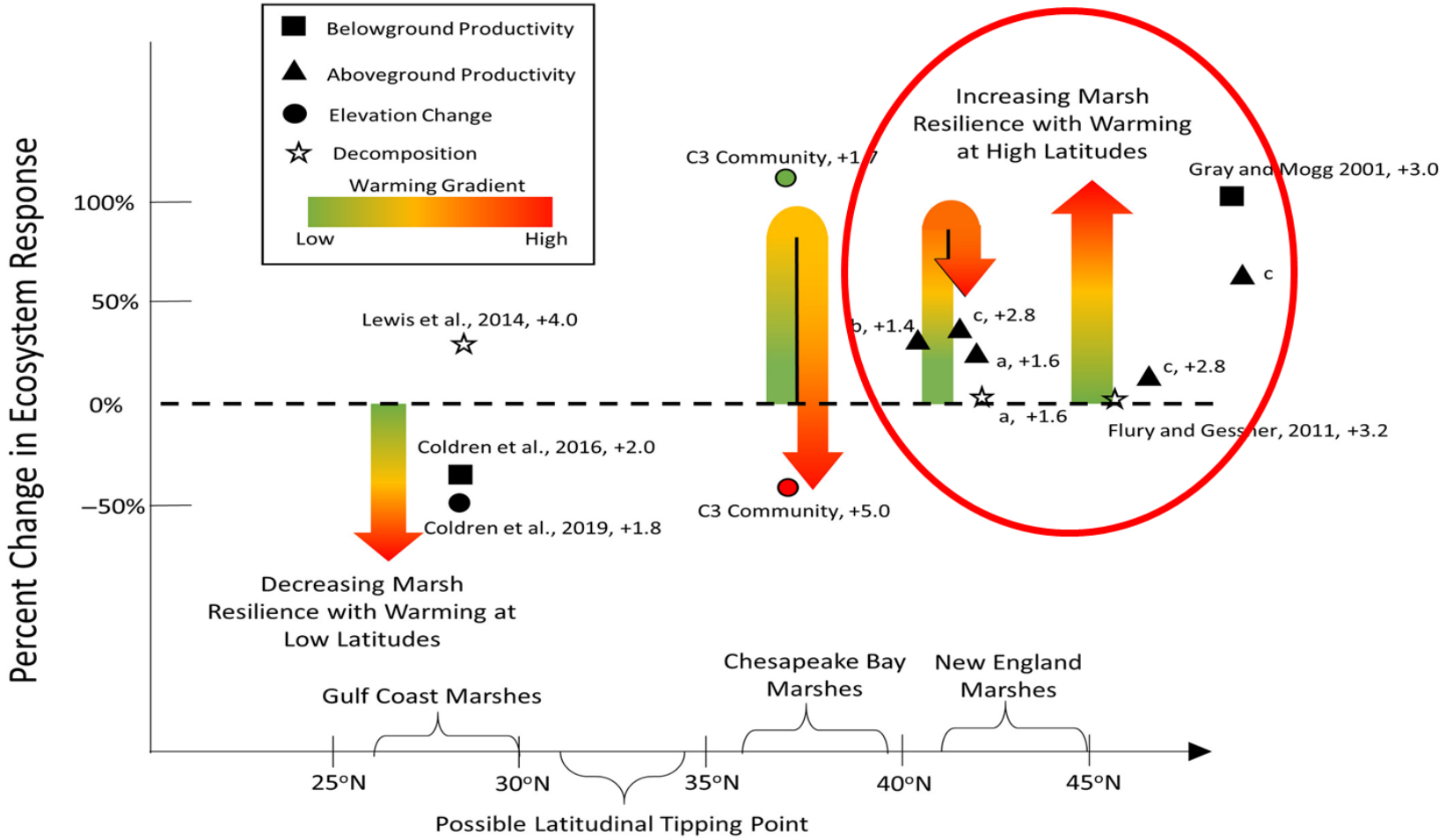
- **MERIT**
- Marsh Ecosystem Response to Increased Temperature – Wadden Sea

- **SMARTX**
- Saltmarsh Accretion Response to Temperature Experiment
- Smithsonian Environmental Research Centre

- **NordSalt**

- Need for more sites!

Temperature Optimum for Marsh Resilience

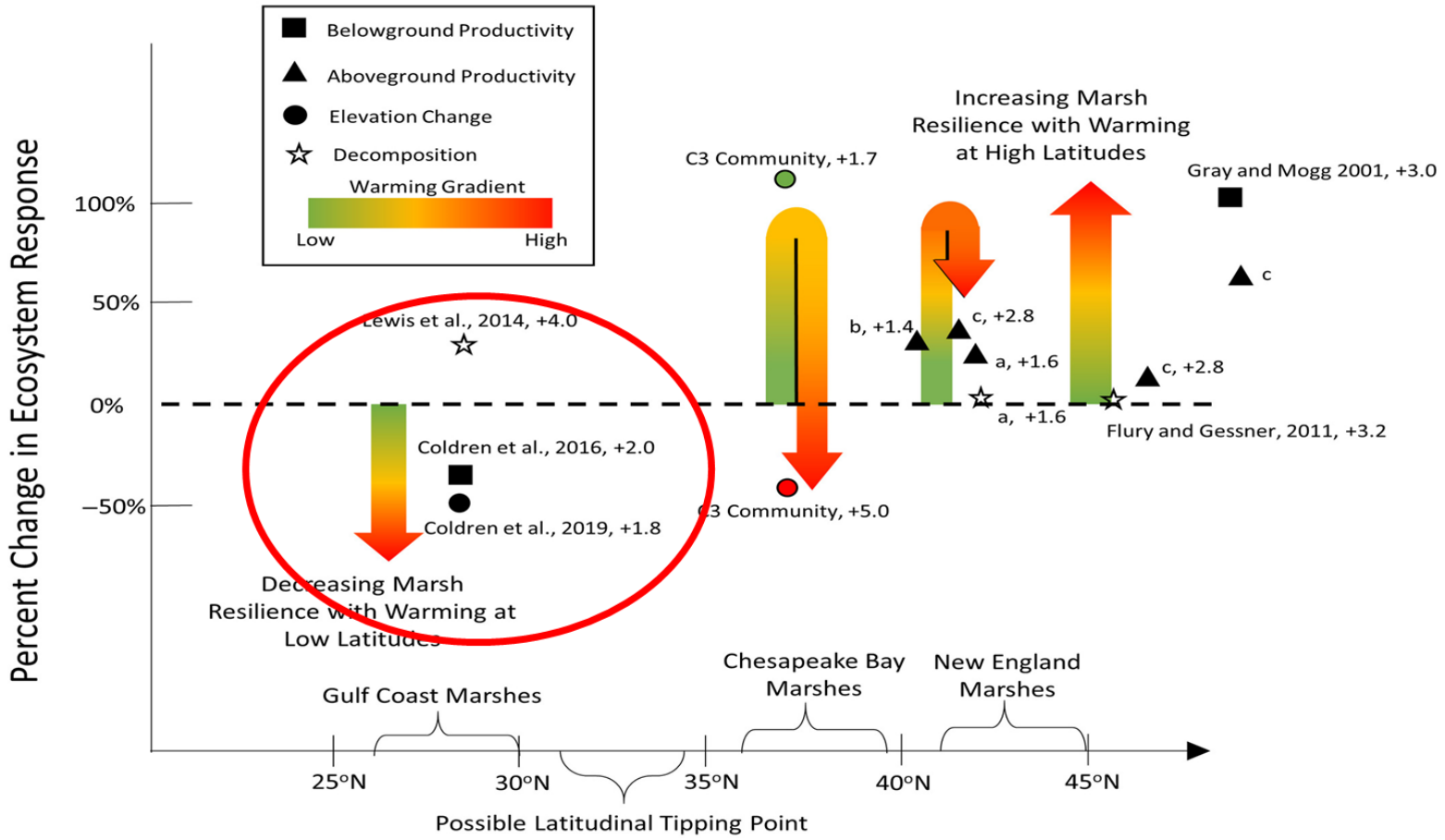


Smith et al. (2022). Global Change Biology; 28 (10): 3236-3245

Increased aboveground plant-surface and belowground soil temperatures found that a moderate amount of warming (1.7°C above ambient temperatures) consistently maximized root growth, marsh elevation gain, and belowground carbon accumulation.

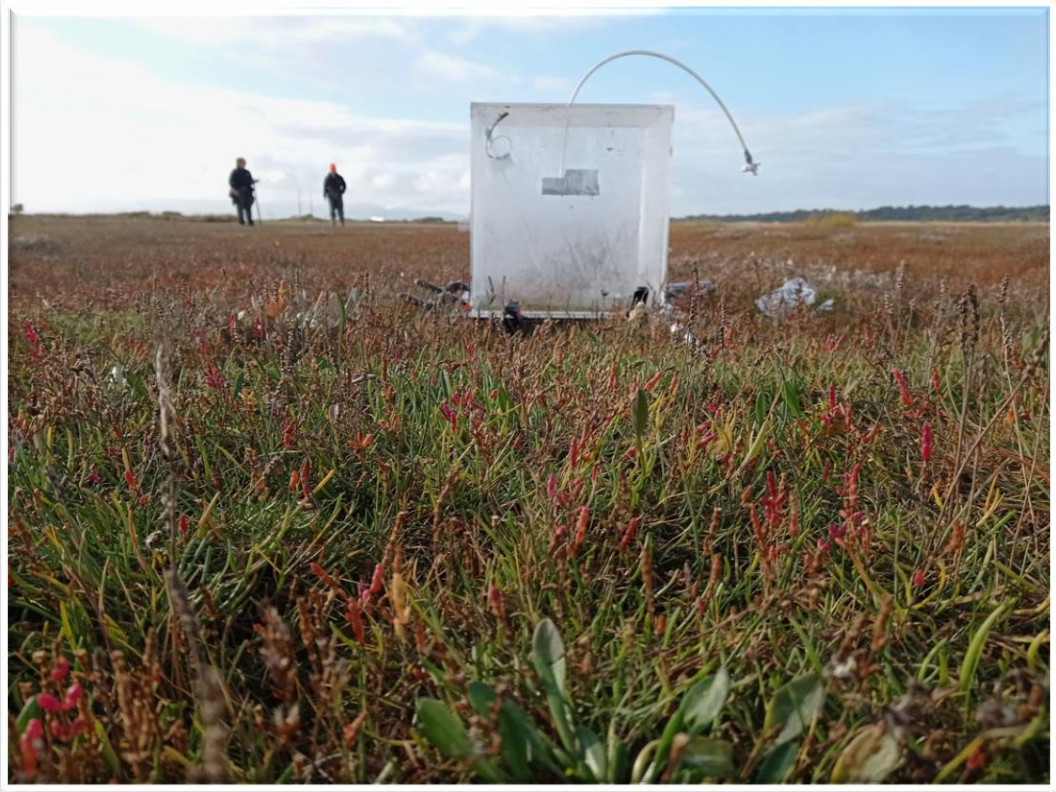
Marsh elevation loss observed at higher temperatures was associated with increased carbon mineralization and increased microtopographic heterogeneity, a potential early warning signal of marsh drowning.

Temperature Optimum for Marsh Resilience



Smith et al. (2022). Global Change Biology; 28 (10): 3236-3245

How will Blue Carbon Ecosystems in Ireland Respond?



Foras na Mara
Marine Institute

epa
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

BLUE C
INVESTIGATING IRELAND'S
BLUE CARBON POTENTIAL

BlueC: Investigating Ireland's Blue Carbon Potential Through a Scientific, Socio-economic and Legislative Approach

Ollscoil na Gaillimhe
University of Galway

UCD DUBLIN

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

bluec.ie

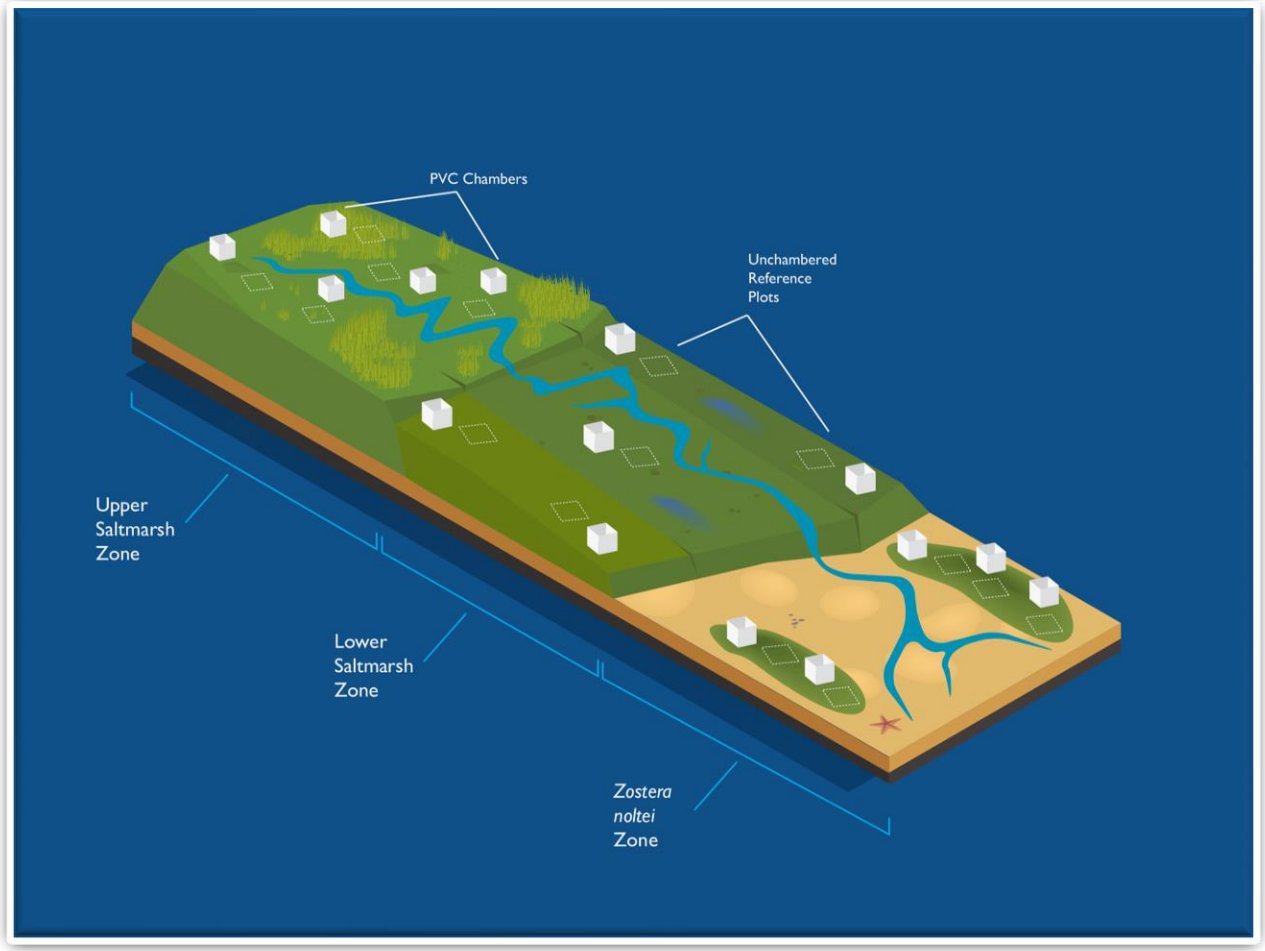
@BlueC_Research

Climate Change Responses

Passive warming manipulation experiment:

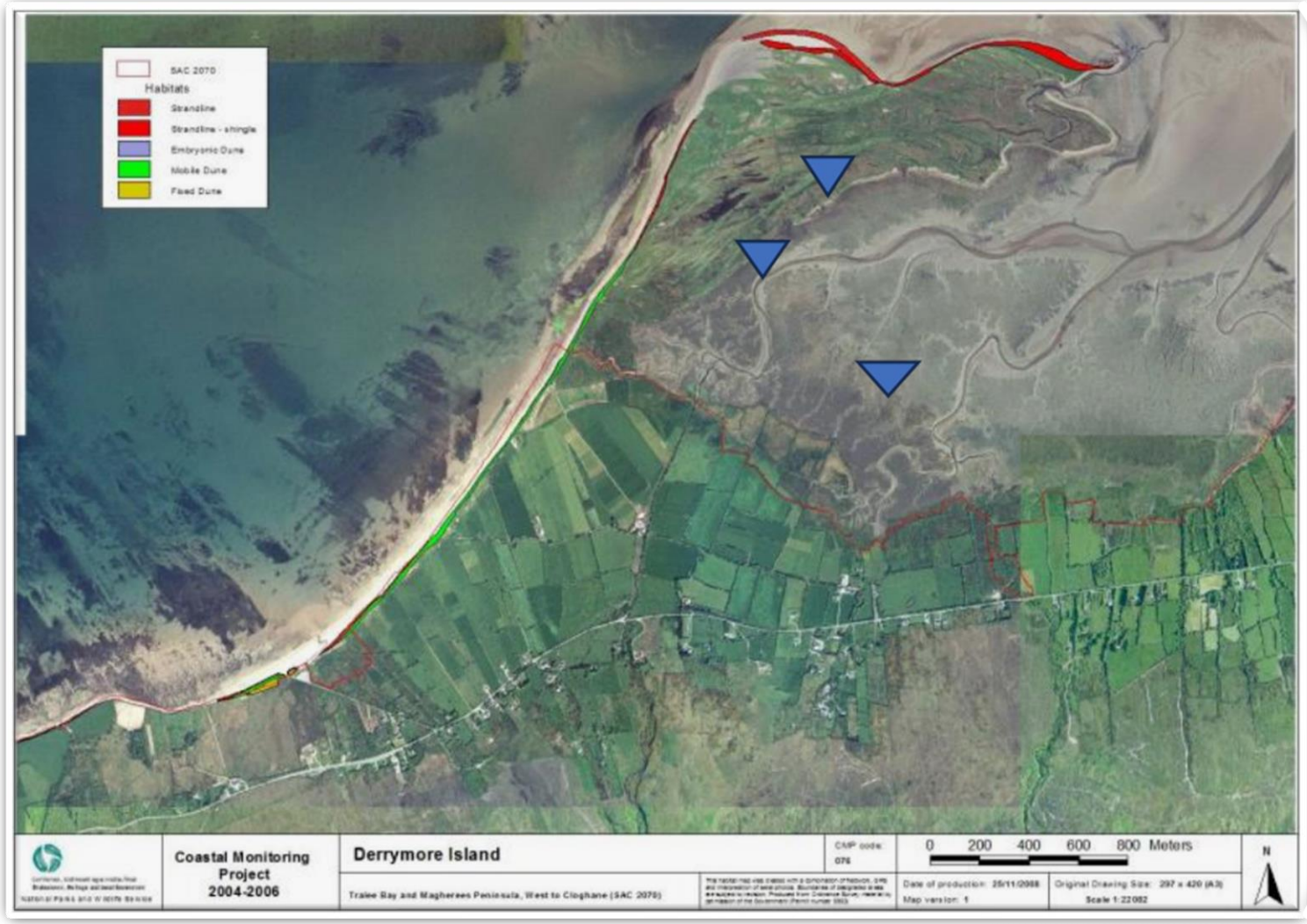
- Passive warming chambers
- Recording vegetation changes
- Monitoring elevation change

BLUE
INVESTIGATING IRELAND'S BLUE CARBON POTENTIAL



BLUE
INVESTIGATING IRELAND'S BLUE CARBON POTENTIAL

Ollscoil na Gaillimhe University of Galway
UCD DUBLIN
UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh



▼ Potential areas for chambers

bluec.ie
@BlueC_Research


THANK YOU!
saule.akhmetkaliyeva@ucd.ie