Spatial opportunity for coastal blue carbon in Aotearoa New Zealand

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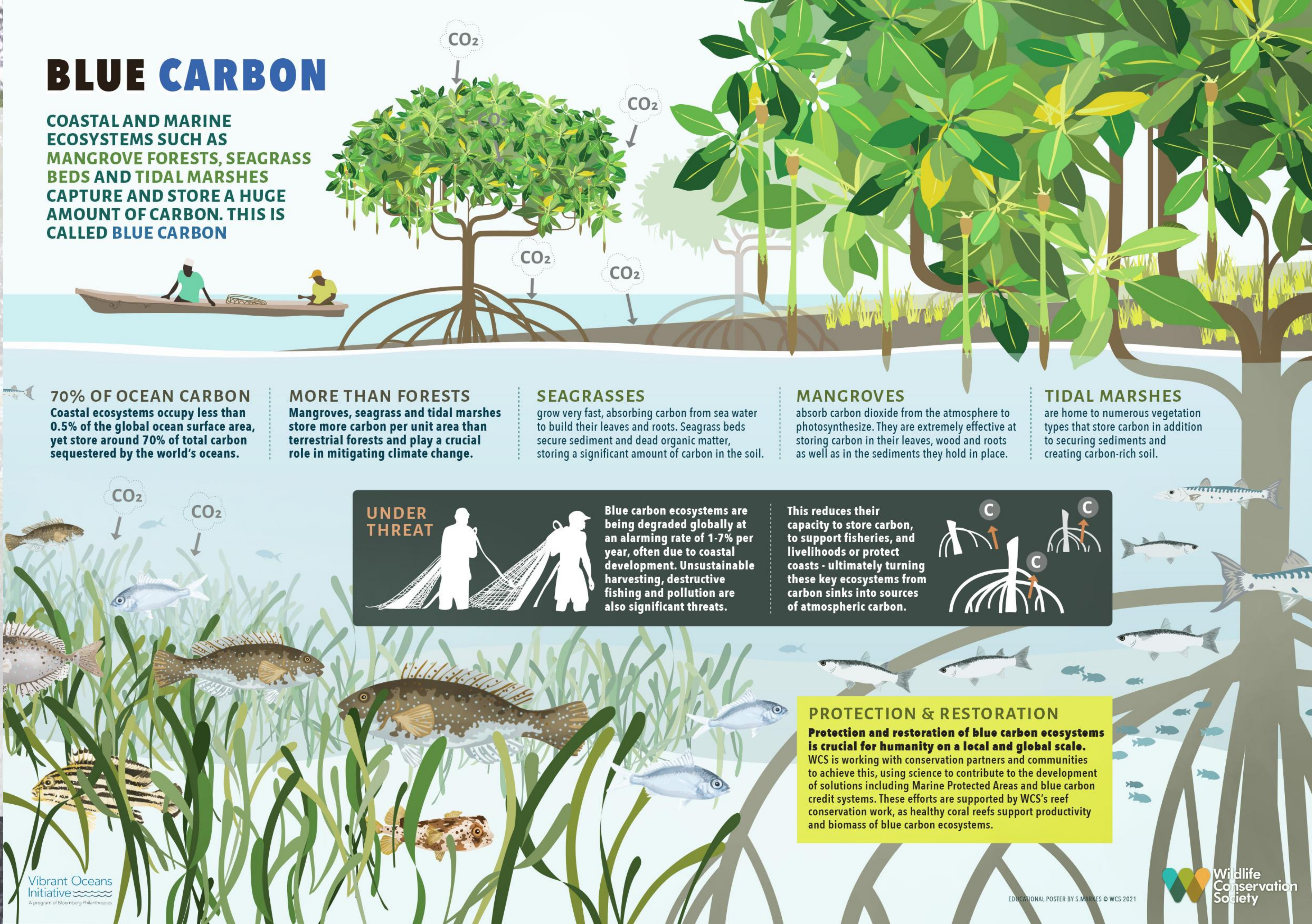
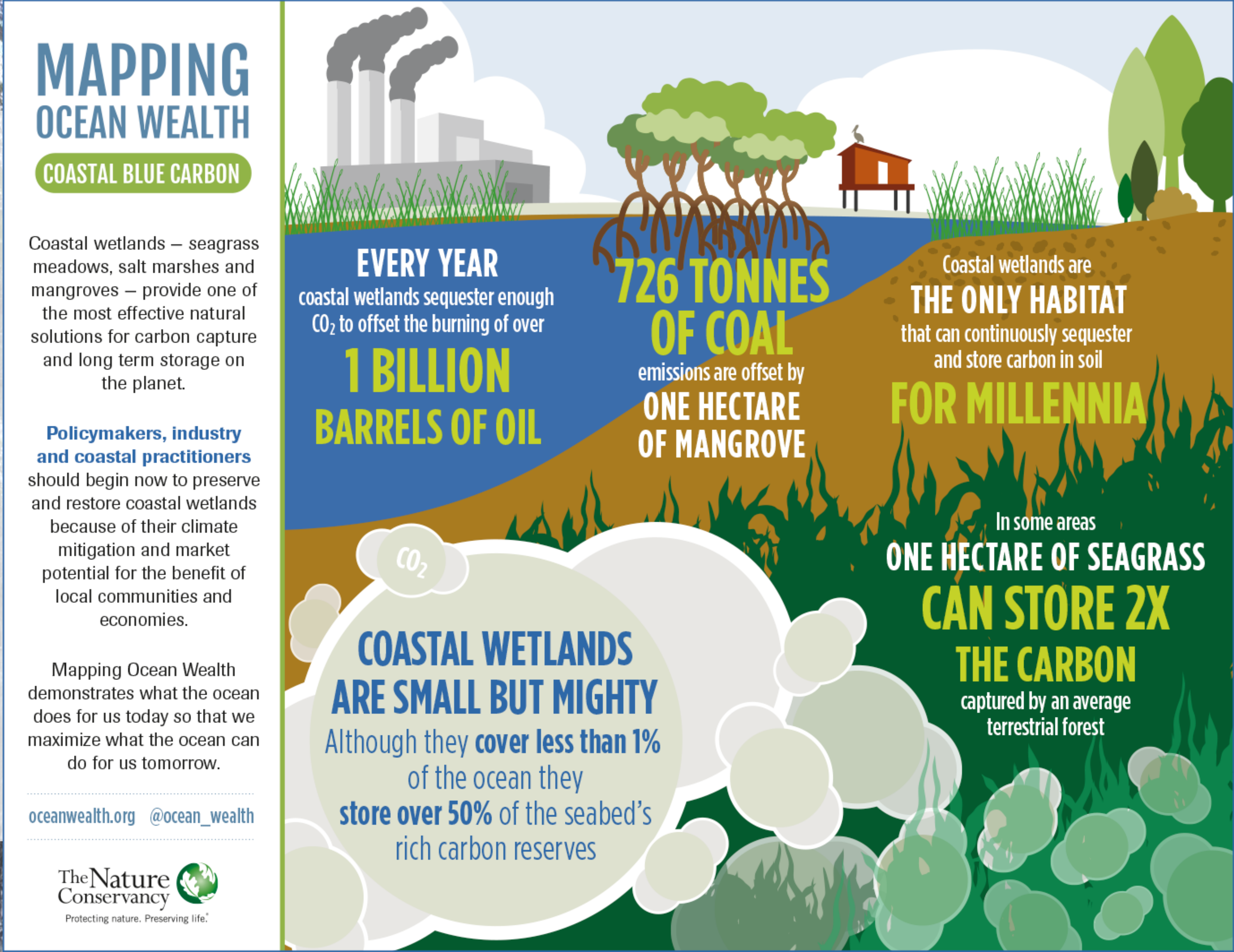
NIWA Taihoro Nukurangi

Tidal Research

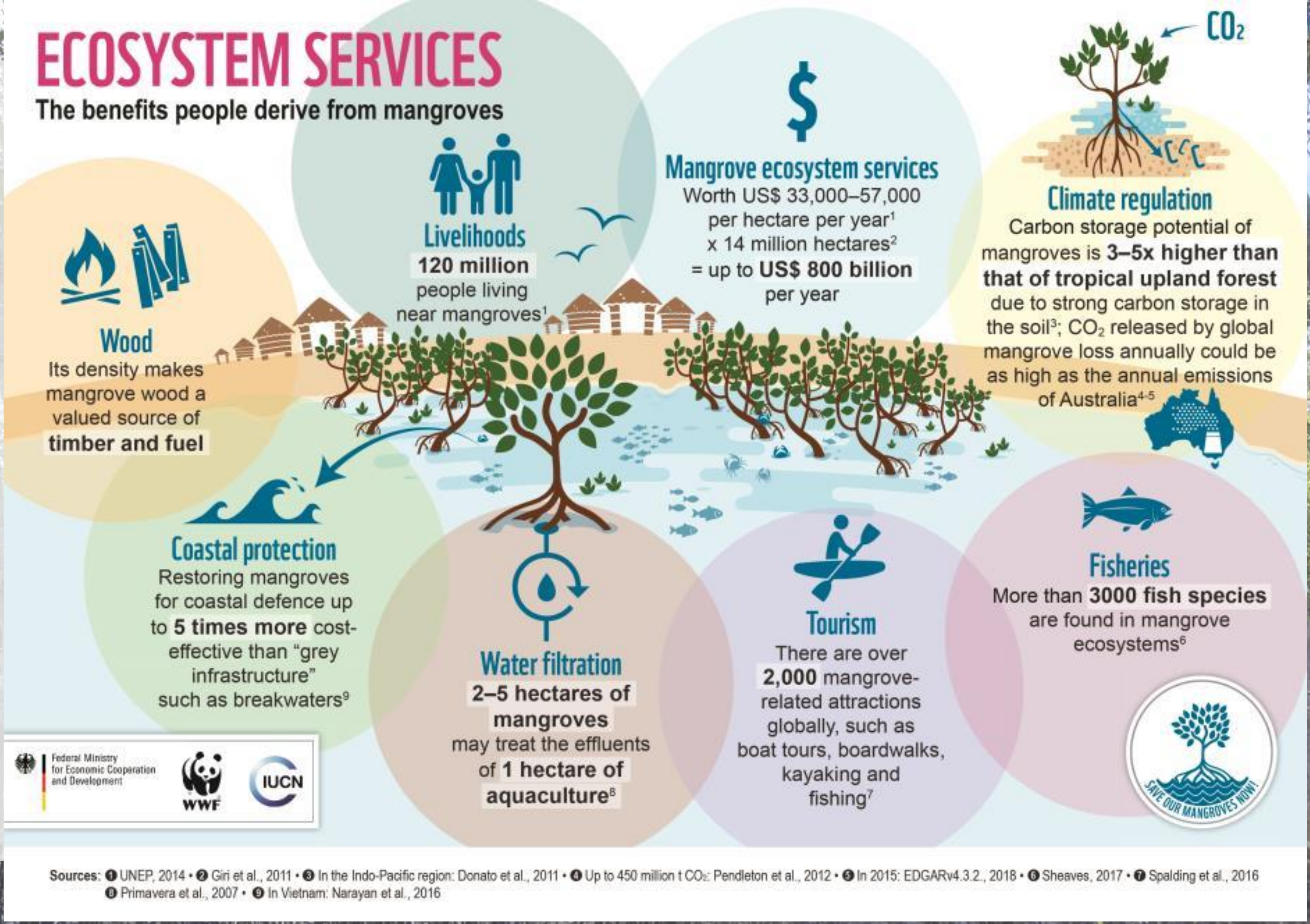
What is (coastal) blue carbon?



How much do they store though? (carbon)



Co-benefits (other ecosystem services)



The Aotearoa New Zealand (NZ) context

- NZ has committed to reducing GHG emissions and aims to transition to a low-emissions economy
- One way to reduce emissions is to store carbon (sequestration) in marine and coastal environments (blue carbon)
- This can be done by restoring coastal habitats

Stuff

The unexpected climate plans of the new Government

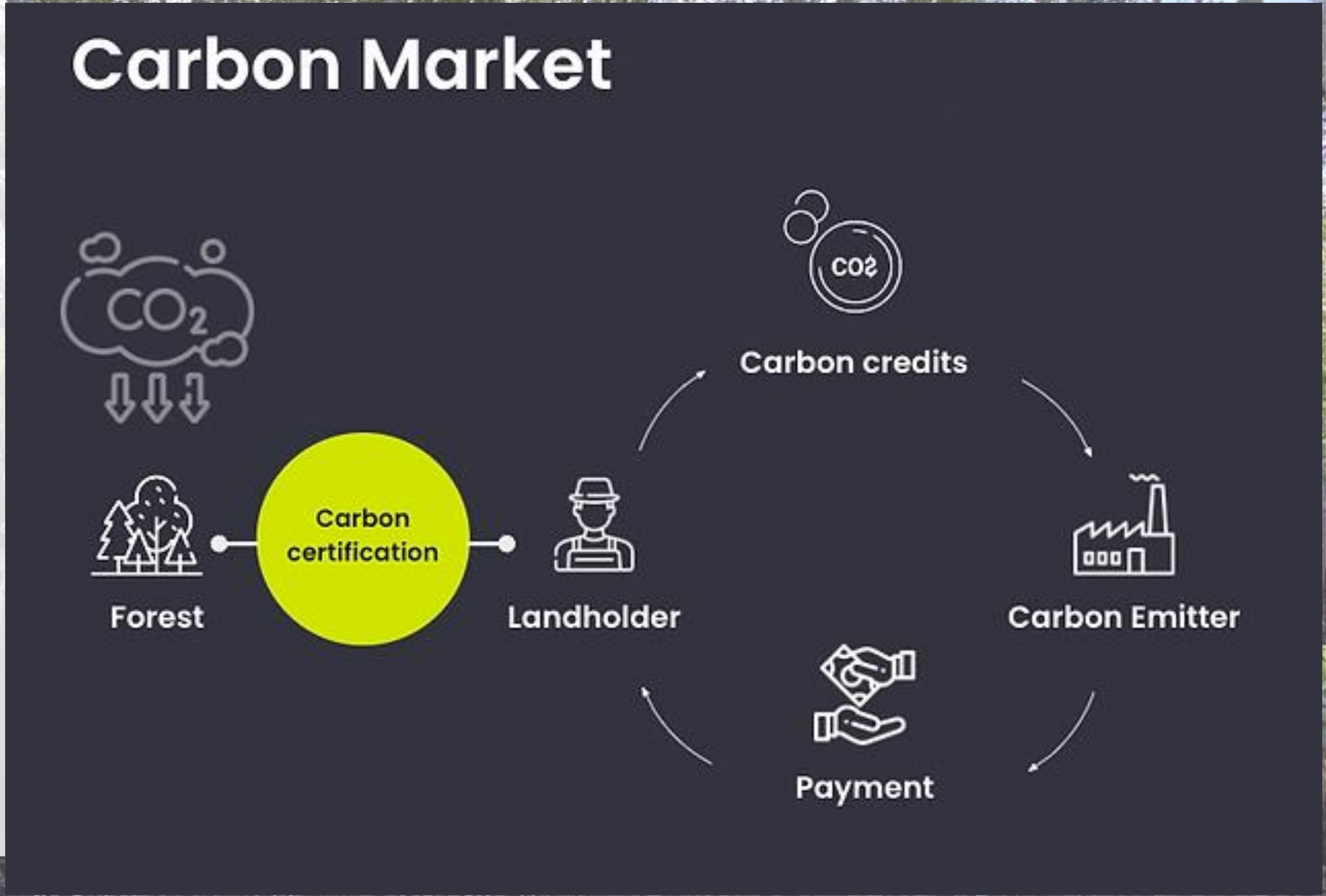
Olivia Wannan

November 28, 2023, · 08:58am

Support for kelp forests and mangroves. According to proponents, coastal and at-sea forests (often called “blue carbon”) should receive the same rewards as those with land-based forests, which are eligible for government carbon credits that can be sold to big emitters. They’ll be buoyed by a commitment with NZ First to undertake “work to recognise other forms of carbon sequestration, including blue carbon”.

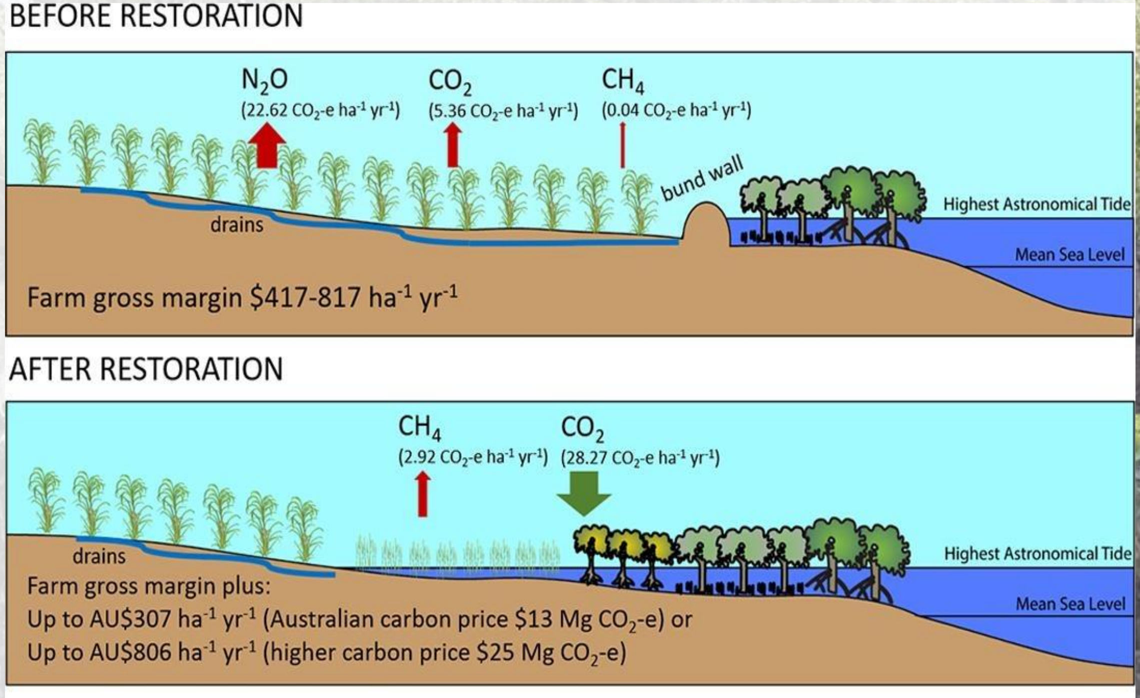
Blue carbon opportunity in Aotearoa

- Carbon credits are generated when we restore drained land to coastal habitat
- because the coastal habitats will store more carbon than drained land
- the difference in carbon storage = carbon credits



Blue carbon projects in Aotearoa

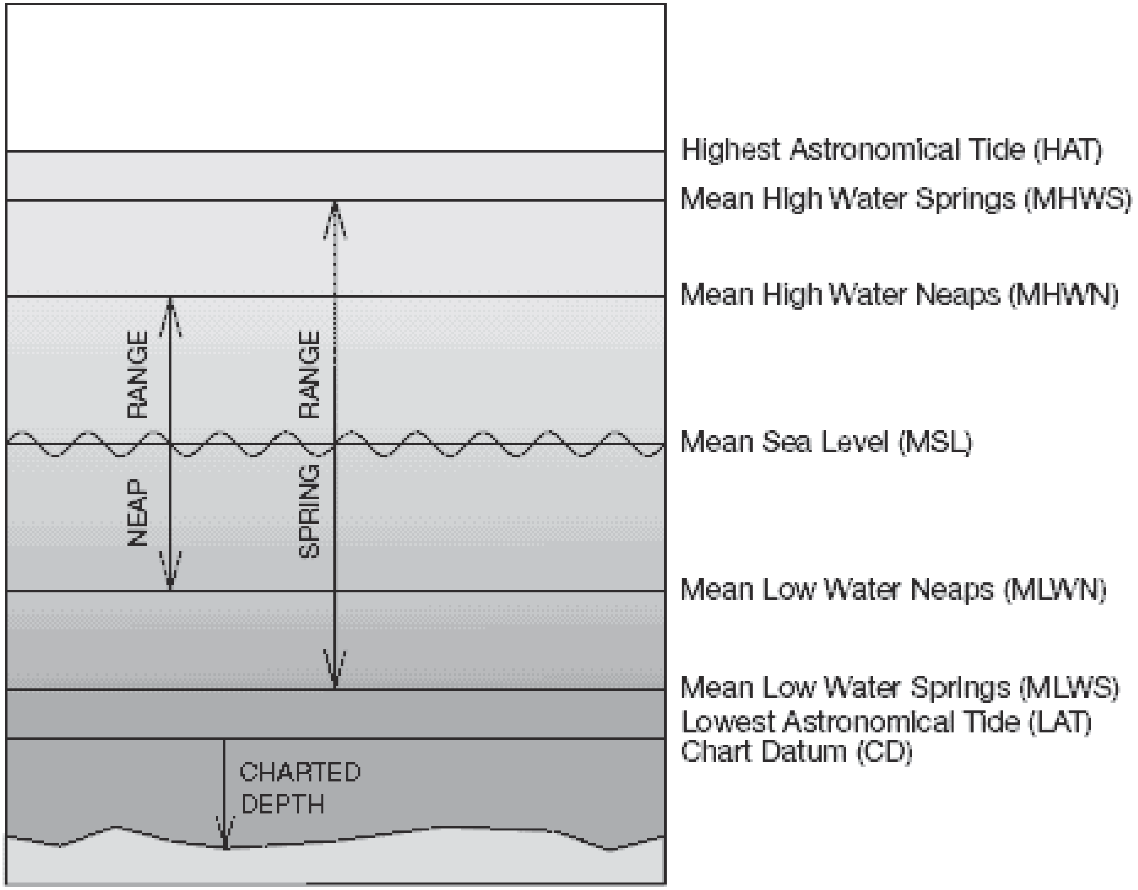
- Lots of coastal land has been drained for farming
- Drained land would historically be inundated by the sea during tides
- Tidal barriers like sea walls or gates on drains stop the land from going under water
- Tidal restoration would remove those man-made barriers and allow the coastal habitat to come back ->



Hagger et al. (2022)

Method – Identify area under tidal influence

- Applied tidal data to a coastal LiDAR digital elevation model (DEM)
- 1 = low intertidal (MLWS to MLWN)
- 2 = low-mid intertidal (MLWN to MSL)
- 3 = mid-upper intertidal (MSL to MLWN)
- 4 = upper intertidal (MLWN to MLWS



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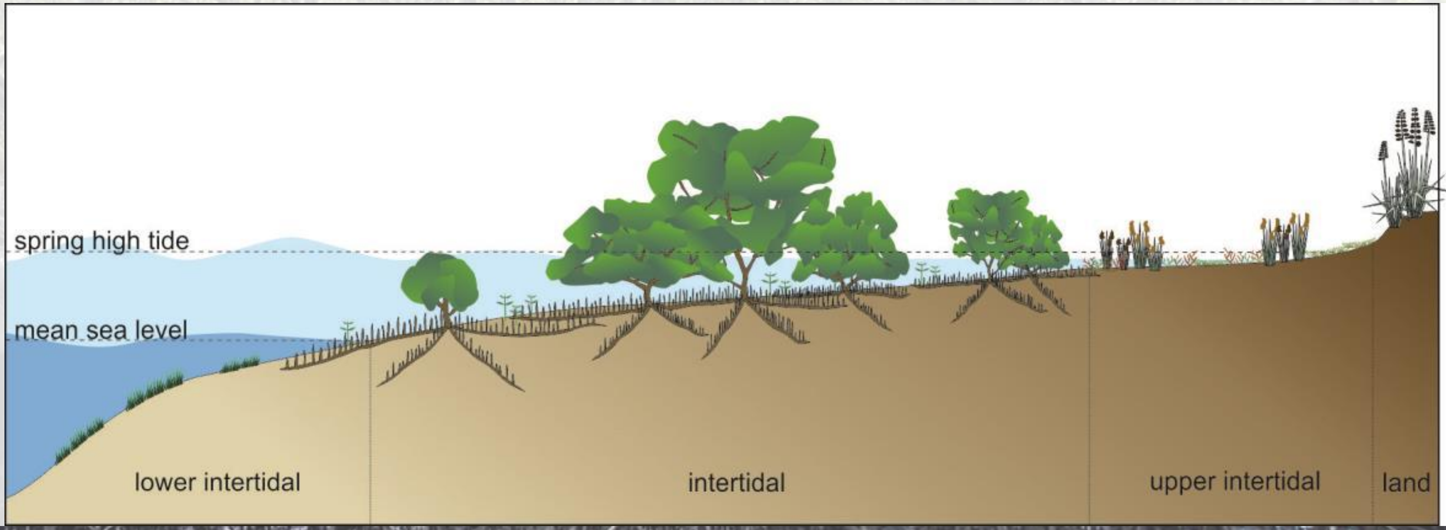
Method – tidal zones and habitat type

- Saltmarsh occurs in the above neap tides
- Mangroves occur above mid tide north of Kawhia/Ohiwa
- Seagrass occurs in the lower intertidal (below mean tide)
- These habitats have different carbon sequestration rates and co-benefits (e.g., biodiversity, coastal protection …)



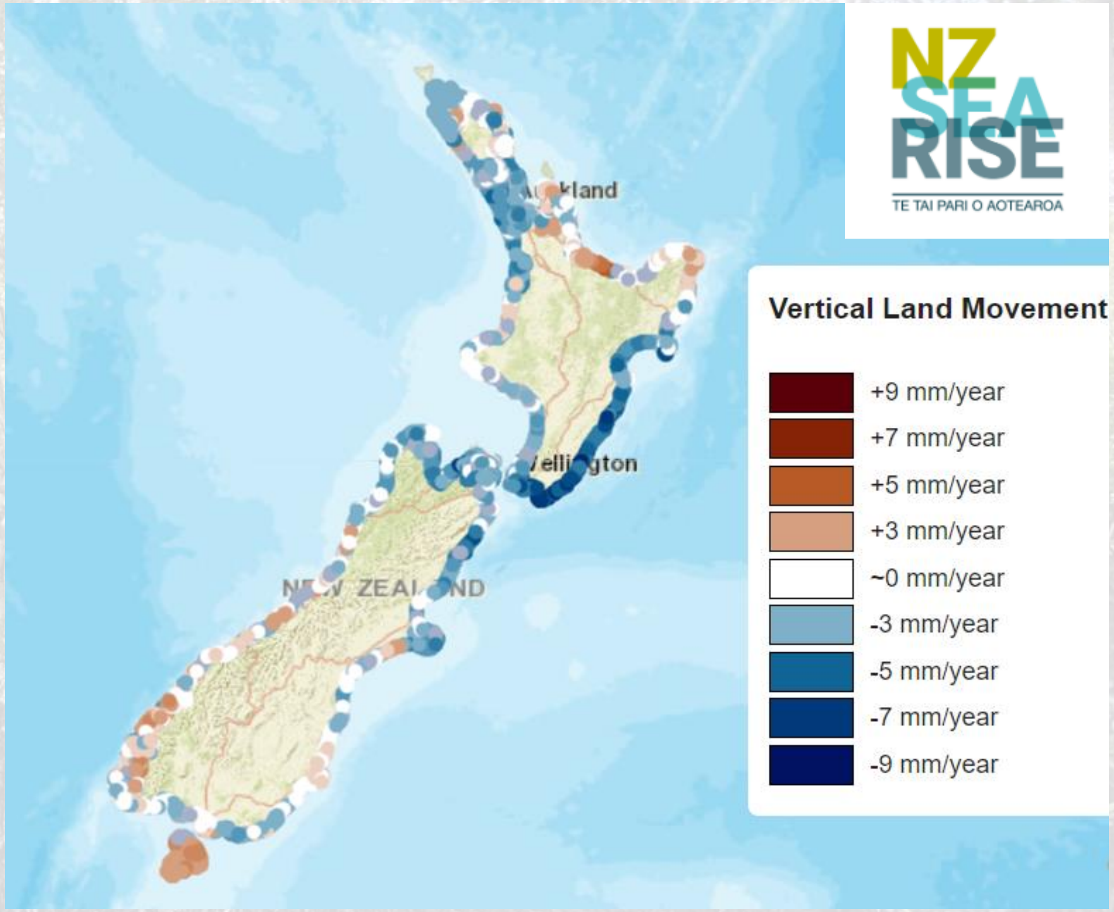
Horstman, E. M., Lundquist, C. J., Bryan, K. R., Bulmer, R. H., Mullarney, J. C., & Stokes, D. J. (2018). The dynamics of expanding mangroves in New Zealand. *Threats to mangrove forests: hazards, vulnerability, and management*, 23-51.

Results – total current opportunity

Tidal zone drained area (ha)	1 - MLWS to MLWN	2 - MLWN to MSL	3 - MSL to MHWN	4 - MHWN to MHWS	Total ha
Northland	462	696	3,326	8,961	13,444
Auckland	93	508	1,403	2,306	4,310
Waikato	504	1,078	4,100	9,287	14,969
Bay of Plenty	364	1,537	3,856	3,308	9,065
Gisborne	187	198	409	349	1,143
Hawkes Bay	223	724	1,177	837	2,961
Taranaki	23	293	261	239	816
Horizons	353	281	841	2,459	3,934
Wellington	108	188	259	723	1,278
Tasman	38	92	175	521	826
Nelson	18	25	24	179	246
Marlborough	855	475	1,034	4,002	6,366
West Coast	2,433	2,294	1,828	1,943	8,498
Canterbury	20	265	823	4,442	5,550
Otago	301	3,186	4,198	3,818	11,502
Southland	1	1	1	395	398

Method – relative sea level rise

- Three sea level rise scenarios
  - SSP 2-2.6: low emissions (+2°C)
  - SSP 2-4.5: moderate emissions (+2.7)
  - SSP 3-7.0: high emissions (3°C)
- Two timeframes
  - 2050: start blue carbon projects soon (20-year timeframe)
  - 2080: future blue carbon projects to meet 2050 emissions targets
- Vertical land movement
  - Averaged for each region (+/- SLR)



Results – current land uses

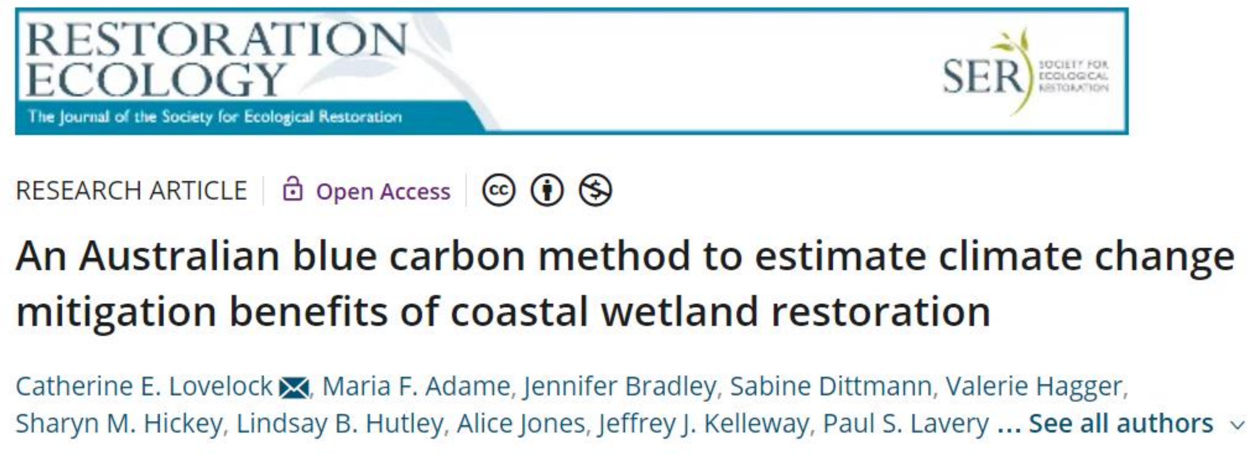
- 58% of blue carbon opportunity NZ-wide is drained grassland
- 29% is currently wetland (marginal ponded pastures, degraded blue habitats, or conservation land).
- Forested areas (6%) could include supratidal habitats that are included in the Australian BlueCAM (e.g., kanuka, harakeke)

Land use	All regions (ha)
Grassland - High producing	40,022
Wetland - Open water	17,684
Grassland - Low producing	7,630
Wetland - Vegetated non forest	6,676
Natural Forest	4,606
Other	2,904
Cropland - Annual	1,837
Grassland - With woody biomass	1,506
Settlements or built-up area	1,152
Cropland - Orchards and vineyards	864
Planted Forest - Pre 1990	341
Post 1989 Forest	85

Results – current land ownership

- >90% is privately owned land
- 7,808 ha of crown land in the total area available for blue carbon (~9% of total opportunity)

- In Australia the blueCAM policy is under agriculture
- Privately owned pasture is tidally restored to blue habitats to gain carbon credits


RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration
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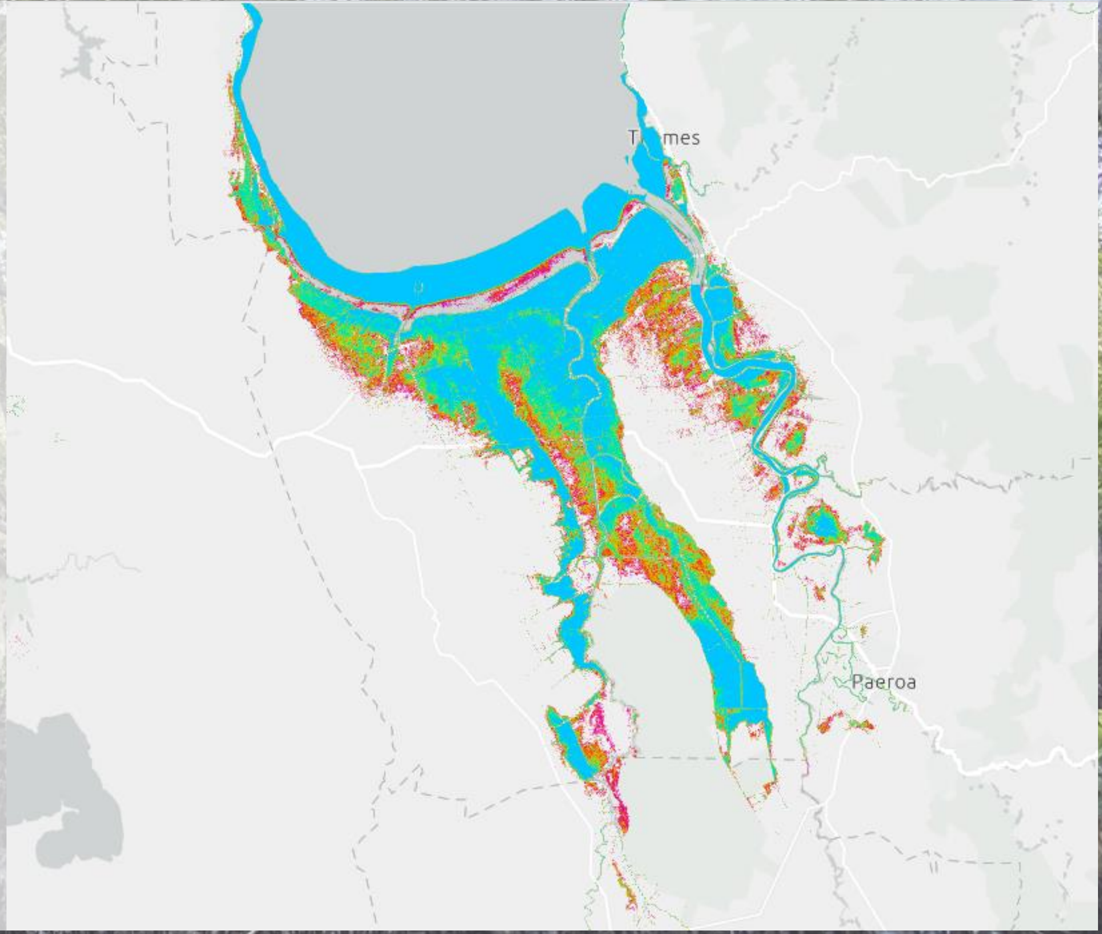
RESEARCH ARTICLE | Open Access

An Australian blue carbon method to estimate climate change mitigation benefits of coastal wetland restoration

Catherine E. Lovelock, Maria F. Adame, Jennifer Bradley, Sabine Dittmann, Valerie Hagger, Sharyn M. Hickey, Lindsay B. Hutley, Alice Jones, Jeffrey J. Kelleway, Paul S. Lavery ... See all authors

Results – under sea level rise

- Blue = current blue carbon area within the tidal zone
- Hotness = blue carbon opportunity under increasing sea level rise to 2080.
- E.g., Thames – sea wall removing tidal influence
- Some of the current areas will become sub-tidal



Conclusions and recommendations

- Large opportunity and only increasing under sea level rise
- Most blue carbon opportunity is currently grassland, and most is privately owned
- Legislation should reflect this – follow Australia's lead?

- In general, there are some regions with much higher opportunity for coastal blue carbon projects – potential for inclusion into climate adaptation plans
- It's important to consider the other co-benefits these habitats provide – such as coastal protection

Thank you!

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Tidal Research: Richard Bulmer

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Tidal Research

Limitations

Blue carbon - legislation

- This is not a policy talk but we have recently published some work discussing this in NZ.
- Regardless it will be important to understand the opportunity for BC in NZ when legislation is drafted.

PERSPECTIVE article

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Sec. Marine Ecosystem Ecology
Volume 11 - 2024 | https://doi.org/10.3389/fmars.2024.1290107

This article is part of the Research Topic
Coastal Rewilding as a Nature-Based Solution
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Enabling coastal blue carbon in Aotearoa New Zealand: opportunities and challenges

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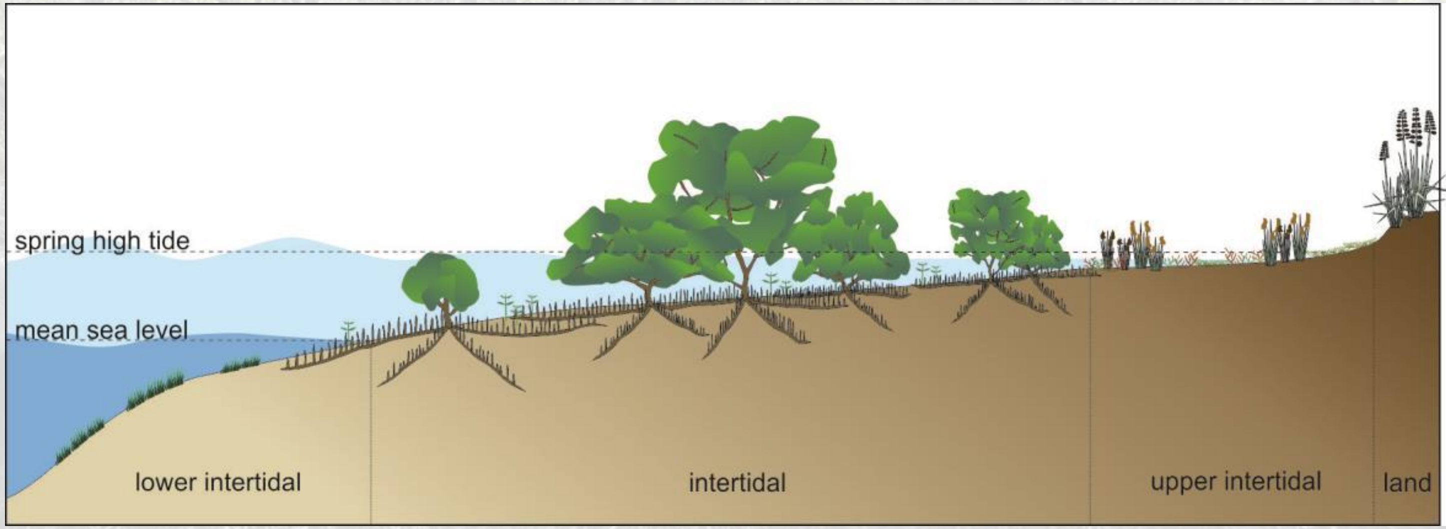
Blue carbon is the carbon sequestered by coastal and marine habitats such as mangroves, saltmarsh, and seagrasses. The carbon sequestration service provided by these habitats could help to mitigate climate change by reducing greenhouse gas (GHG) emissions, as well as providing other important ecosystem services. Restoration of coastal habitats for the purpose of sequestering blue carbon can generate carbon credits, potentially offsetting the costs of restoration and any lost revenue for landowners. Coastal blue carbon projects have been successfully implemented overseas, but a blue carbon market has not yet been established in Aotearoa New Zealand (ANZ). Here we identify key data gaps that will be necessary to fill to develop a blue carbon market in ANZ. Calculation of carbon abatement through development of a standardised method is the

Blue carbon issues in Aotearoa cont …

- Land tenure in the tidal zone is contested in Aotearoa
- The Marine and Coastal Area (Takutai Moana) Act 2011
- So, what happens when we allow the tide to come back on drained land?
- It is not clear that the landowners would keep tenure of the land or own the carbon credits



Blue carbon issues in Aotearoa cont …

- Economic viability $$$
- Costs = costs of restoration, permits for restoration works, lost profits from loss of farming land, and ongoing maintenance
- Benefits = carbon credits
- *At the moment* the economic benefits **do not** outweigh the costs in most places
- However, *in future*, sea level rise will flood much of this land and increasing storm surges will stop pumps from being able to keep land dry and in production … might not have a choice

Looking to the future

- Government could **subsidise restoration** – reduce restoration costs
- **lower farm gross margins** from reduced agricultural productivity in areas affected by seawater intrusion – reduce opportunity cost
- **Higher carbon prices** are expected – higher benefits
- Stack carbon credits with **coastal resilience or biodiversity credits** – higher benefits

- Land tenure for a moving foreshore?
- Incorporation into the emissions trading scheme?
- Blue carbon is not ready to go in Aotearoa yet! But huge potential …