

Increasing Scotland's Blue Carbon Stock by Creating More Saltmarsh Habitats Through Managed Realignment



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1. Summary

Scotland's coast is vulnerable to climate change. This poster summarizes the scope for creating carbon rich saltmarsh habitats using managed realignment. This will improve the resilience of Scotland's coast and deliver climate adaptation and mitigation action.

2. Introduction

Saltmarshes

- Vegetated intertidal ecosystems¹ which
 - support **unique biodiversity**¹;
 - provide **coastal protection** from storms and floods, alongside other ecosystem services¹;
 - Are estimated to **store 50% of global marine carbon** through in-situ accumulation and the trapping of sediment^{1,2};
 - **Store carbon efficiently**, with minimal greenhouse gas (GHG) emissions².

Sea-level Rise (SLR)

- **Climate change is causing increasing rates of global sea-level rise (SLR)** and increases in storm intensity and frequency³.
- On current trends, it is estimated that **£1.2 billion of Scottish coastal assets will be at risk by 2050**³.
- The future rate of SLR is largely dependent on which emissions track is followed (Fig. 1)³.

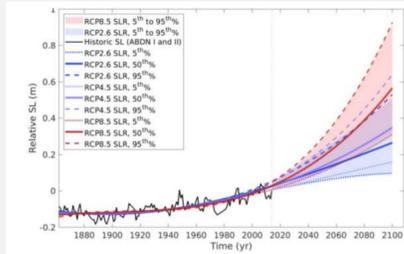


Figure 1³. Sea-level change projections under different emissions scenarios for Aberdeen, Scotland. RCP2.6 represents a low-emissions scenario, RCP4.5 medium emissions, RCP8.5 high emissions. Currently, the UK is on track for RCP8.5.

- **It is thought that saltmarshes would be able to keep pace with SLR**, if allowed to function naturally⁴.
- **Scotland's coast is highly developed, so saltmarshes are often either fragmented or prevented from migrating inland** by barriers such as sea walls and are at risk of becoming drowned or eroded⁵.
- One way to mitigate this is by removing the barrier – this is called managed realignment (MR).



Figure 2⁹. Managed realignment site at Nigg Bay, Cromarty Firth.

Managed Realignment (MR)

- **Aims to create intertidal habitats such as saltmarshes** for benefits such as flood mitigation, reduced coastal defense costs and habitat loss compensation⁵.
- SEPA define MR as “*The removal of part (breach) or all of existing coastal structures. Where there is no naturally occurring high ground, new flood protection structures are created further inland, creating a new or ‘set back’ line of protection*”⁶.
- By creating saltmarsh habitat, **additional ecosystem services are realised**⁵.
- There is some debate about how the function of a MR saltmarsh compares to that of an equivalent mature saltmarsh^{7,8}.

Barriers to Managed Realignment

- **MR has high upfront costs**, although recent work has shown that they are cost-effective over longer periods^{10,11}.
- There is a common view that MR is “losing a battle with the sea”⁴. **Public perception** can be massively improved by engaging stakeholders in decision making⁴.
- **In Scotland, land users such as farmers, who often benefit from hard defences, are responsible for the protection of their land**, but broader society (which subsidises agriculture) is affected the most by coastal management techniques⁴.

3. Scottish Saltmarsh Extent

- There are 54.8 km² of saltmarsh in Scotland, 13% of the UK total¹².
- **In Scotland, many saltmarshes have been lost due to land reclaim** for uses such as agriculture⁵.
- This is estimated to have resulted in **51% loss of saltmarsh habitat in the Firth of Forth**⁵.

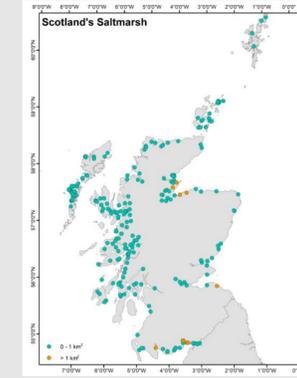


Figure 3¹². Map of Scottish saltmarsh habitats. Green circles show saltmarsh habitat, orange circles highlight sites >1 km².

4. Distribution of MR Sites in Scotland

- There have only been **4 MR projects implemented to date** (Fig. 4)¹³.
- Due to ongoing glacio-isostatic uplift, most of Scotland has slower relative SLR than the rest of the UK⁴, so MR hasn't been an urgent requirement so far.
- With sea levels expected to rise significantly over the coming decades, **MR should become a priority**.

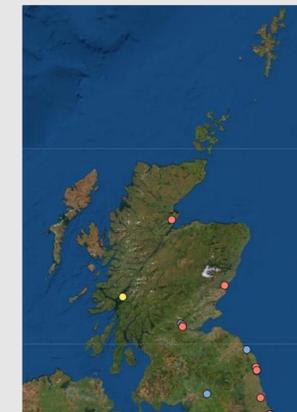


Figure 4¹³. Map of Scottish managed realignment sites. The MR sites are red dots. All other sites are either not MR or not in Scotland.

5. Where are the Likely Future MR Locations in Scotland

- **Areas where historic saltmarshes have been reclaimed** for land uses such as agriculture are the most relevant to realign¹¹.
- **The Firth of Forth** is an ideal location, due to the high degree of reclamation and it has high sediment supplies^{11,14}.
- Fig. 5 shows a case study for Tynninghame Bay, Dunbar, using LiDAR data to show saltmarsh extent under different scenarios.

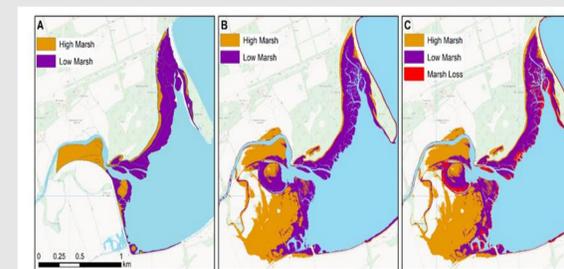


Figure 5¹⁵. Tynninghame Bay (Dunbar). (A) Map of Tynninghame Bay saltmarshes¹⁶. (B) Potential extent of the saltmarsh if the sea wall was removed. (C) Marsh loss due to future (2050) modelled sea level (RCP8.5, 50th percentile).

6. Blue Carbon Potential

- **Most MR sites initially accrete rapidly**, due to the landward side of the breach being compacted through land use^{17,18,19}.
- **Under IPCC guidelines the habitat can be classed as saltmarsh when vegetation cover reaches 10%**²⁰.
- Once this occurs, the carbon underneath can be accounted for²⁰.
- **Most of the carbon initially stored comes from off-site sources**^{19,21,22}.
- For MR carbon accounting, it must be proven that any carbon accreted from off-site would have otherwise been lost to the atmosphere^{19,22}.
- **MR saltmarshes can take decades to have equivalent carbon stores** to mature saltmarshes⁷.
- **MR has the potential to create new carbon stores**, yet this has never been a criterion for implementation in Scotland^{10,12}.
- **There is growing public and private sector interest** in using carbon credits to offset GHG emissions^{10,11}.

7. Further Work

- Empirical data on carbon accretion versus GHG emissions** following MR.
- Empirical data on MR site carbon sources**, and how these vary over time.
- Work to close policy gaps** to aid funding of MR projects.
- Increase stakeholder engagement** to improve public perception of MR.

8. Conclusions

- Climate change is causing increased rates of SLR and storm intensity in Scotland.
- Recreating old saltmarsh habitats using MR can improve coastal resilience and may help Scotland reach net zero GHG emissions.
- The closure of policy and knowledge gaps will aid the implementation of MR projects in Scotland.

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