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COASTAL HABITAT RESTORATION

Cwm Ivy Marsh management, assessment and future

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Abstract

The specific threat to a coastal site being assessed in this report is the Cwm Ivy seawall collapse. It was providing flood defence to protect the grazing marsh and providing habitats for species such as *Vertigo angustior* (narrow-mouthed whorled snail).

Through “unmanaged realignment” the seawall breach allowed the seawater into the freshwater marsh, which consequently transitioned to saltmarsh.

As a result, the saltmarsh has provided excellent new habitat for a wide range of species of flora and fauna including *Pandion haliaetus* (osprey). It is also still used as grazing marsh. However, local residents have been upset at the loss of part of the Wales Coast Path.

This report assesses whether the new saltmarsh habitat provides beneficial ecosystem services such as biodiversity, blue carbon sequestration, flood mitigation, water purification and recreation, compared to the pre-existing freshwater marsh, and makes recommendations for not rebuilding the seawall. However, the causes of the decline in *V. angustior* must be identified and addressed through appropriate management to facilitate population recovery.

AI acknowledgement

I confirm that I have not used any AI tools in the research and creation of this assignment. I confirm that I have not presented any AI generated materials as my own work. I have copies of my drafts, notes, and other resources that I used, which I may be asked to provide in evidence.

Contents

1	Introduction	1
2	Management	3
3	Impact to ecosystem services	6
3.1	Biodiversity.....	6
3.2	Blue carbon.....	8
3.3	Flood mitigation.....	8
3.4	Water Purification.....	9
3.5	Recreation.....	10
4	Future.....	11
5	References.....	13

List of Figures

Figure 1-1 A row of trees that once marked the sea defence at Cwm Ivy (Morris, 2021)	2
Figure 2-1 Shoreline Management Plan Policies in Wales (NRW, 2024)	3
Figure 2-2 Proposed options to create new saltmarsh at Cwm Ivy (NRW, 2015).....	3
Figure 3-1 Orthophotography of Cwm Ivy Marsh (Dale, et al., 2021)	7
Figure 3-2 E.Hill, Horses grazing at Cwm Ivy, 2025	7
Figure 3-3 High-resolution hydrodynamic modelling showing how saltmarsh vegetation changes estuary hydrodynamics (Fairchild, et al., 2021).....	9
Figure 4-1 V.angustior compared to V.substriata (NRW, 2014)	11

1 Introduction

Protecting the coastline from sea-level rise requires a range of responses, including both hard protection (e.g. seawalls) and Ecosystem-based Adaptation (EbA) – sustainable management, conservation and restoration of ecosystems (IPCC, 2019). Coastal ecosystems, such as wetlands, are already impacted by coastal squeeze - the prevention of landward transgression of habitats in response to rising sea-levels, caused by anthropogenic influences, in conjunction with other coastal processes (UK Government, 2021).

Cwm Ivy Marsh, located on North Gower coast (figure 3-1), was protected by a seawall built in the 17th century to reclaim salt marshland from the sea for farmland (National Trust, n.d.; Kearsley-Evans, 2014). Reclamation of coastal wetlands provided a high return on investment during these times, with nutrient-rich alluvium supporting high yields of crops, including grass and cereals (Rippon, 2000). Cwm Ivy enclosure - a marshy grassland with freshwater drainage system, fixed dune grassland and limestone grassland - was used for pastureland. This lowland fen meadow was also designated as a Site of Special Scientific Interest (SSSI), supporting habitat for numerous species including aquatic invertebrates, wildfowl and waders (NRW, 2002; Welsh Government, 2020). Fens are also a peatland type, which not only provide diverse habitats, but also provide multiple other ecosystem services (ES) including carbon sequestration, water purification, and flood control (NRW, n.d.).

In November 2013, the inland stream swelled by relentless rain flowed at "unprecedented levels" and overwhelmed the sluice gate, forcing a small hole under the sea wall. The subsequent winter storms, high tides, and additional rain widened this hole until the wall finally failed in August 2014, allowing the sea to reclaim the land (National Trust, n.d.). The flooding in of saltwater killed off the existing pastureland, including stately Corsican pines and willow trees, creating a "dead forest" look as shown in figure 1-1 (Morris, 2021).

The National Trust (NT) and Natural Resources Wales (NRW) decided not to repair the wall, aligning with NT's "shifting shores" policy to adapt to coastal change rather than fight it - a practical application of the EbA response to sea-level rise of the Intergovernmental Panel on Climate Change (IPCC) (National Trust, n.d.; IPCC, 2019;

NRW, 2015). However, this decision caused upset among some residents as it blocked part of the Wales Coast Path (Wilson, et al., 2021). This local opposition highlights the importance of recognising and integrating recreational ES, which are theorised to contribute to improved management of protected areas by aligning conservation objectives with public use and well-being (Rice, et al., 2020).



Figure 1-1 A row of trees that once marked the sea defence at Cwm Ivy (Morris, 2021)

2 Management

Following the breach of the Cwm Ivy seawall in 2014, a No Active Intervention (NAI) policy was adopted. This aligns with EbA, also known as Nature-Based Solutions (NbS), which are increasingly recognised as viable flood risk management strategies alongside conventional engineered solutions (IPCC, 2019; NRW, 2024). Figure 2-1 shows the move from the traditional “Hold the Line” policy to more adaptive, sustainable approaches in Wales.

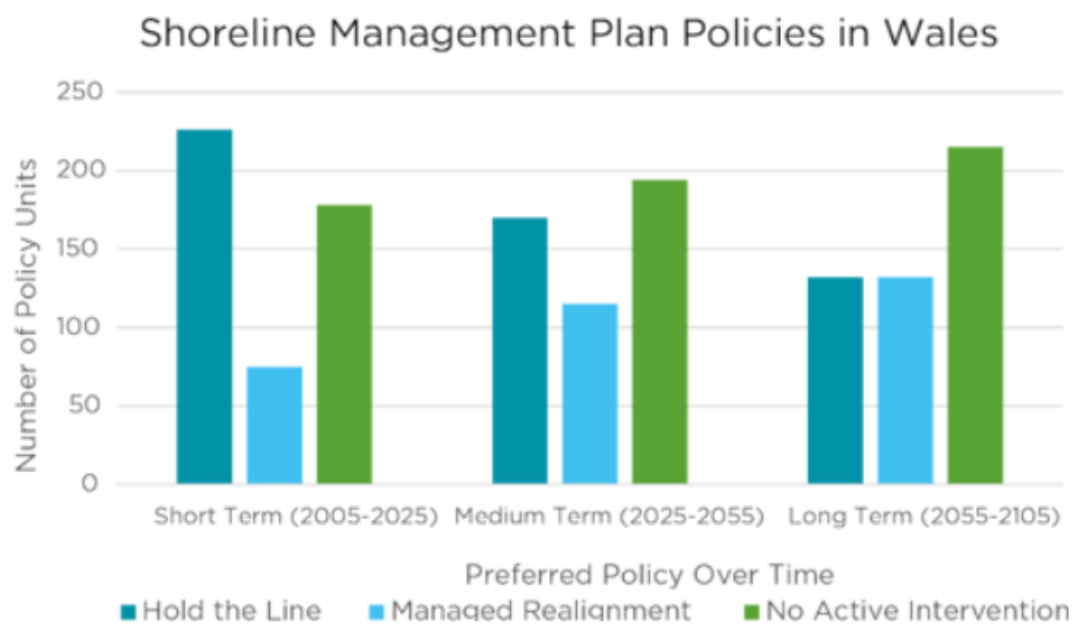


Figure 2-1 Shoreline Management Plan Policies in Wales (NRW, 2024)

In 2015, NRW proposed several options for creating new saltmarsh at Cwm Ivy as shown in figure 4-2.

No active intervention We could work with nature to allow the saltmarsh to develop naturally. The breach will continue to widen naturally as other sections of the embankment are likely to fail in the future	Widen the breach We could remove more of the embankment and widen the breach to allow the tide to flow into and out of the marsh more easily.
Create multiple breaches We could create several breaches in the embankment to further improve how the tide flows into and out of the marsh	Undertake small-scale works in the marsh There is evidence of a historic network of saltmarsh creeks across the marsh. This option will consider whether excavation of these 'paleo-channels' would improve how seawater flows across the site

Figure 2-2 Proposed options to create new saltmarsh at Cwm Ivy (NRW, 2015)

NAI resulted in unmanaged realignment (uMR) of the site, reverting Cwm Ivy from freshwater marsh to saltmarsh. An emerging area of interest, uMR refers to sites where defences have breached and are subsequently allowed to evolve naturally. This contrasts with managed realignment (MR), which involves the deliberate, human-engineered breaching of coastal defences at pre-determined locations. Whilst uMR and MR can both be regarded as NbS, there is evidence that MR sites typically support lower abundance and diversity of key plant species and greater areas of bare ground than pre-existing reference sites. However, the processes underlying the evolution and development of uMR sites are not well understood, and there is uncertainty of benefit of uMR as a NbS to saltmarsh habitat loss (Williams, 2023; Dale, 2024; Welsh Government, 2019).

Vegetated saltmarsh and mudflats (intertidal habitats) provide a range of ES including coastal flood protection, blue carbon sequestration, contaminant reduction, nursery habitat for juvenile fish species as well as habitat for various other species (Dale, et al., 2017; Williams, 2023; Bennett, et al., 2023). Since 1843, approximately 2,500 km² of intertidal habitat has been lost from estuaries across England and Wales, largely as a result of anthropogenic pressures. Whilst these were mainly due to (re)claimed land for agricultural purposes, other pressures include erosion that leads to fragmentation of marsh with creek-widening, and diminished sediment accumulation in marshes as the pace of sea-level rise increases. Declining sedimentation leads to habitat loss and potential shifts in species distributions (do Amaral Camara Lima, 2025; Dale, 2024; NRW, 2021).

NRW (2021) identifies three main techniques for intertidal saltmarsh and mudflat creation or restoration, the main option being MR including regulated tidal exchange (RTE). RTE allows for the seawall to remain intact, with highly controlled tidal inundation using pipes, culverts, weirs and/or sluices. MR schemes can be very successful especially when combined with optimising morphological complexity of marshes increasing niche availability and biodiversity.

The Cwm Ivy Habitat Creation Project, aiming to recreate up to 39 hectares of saltmarsh, is needed to offset saltmarsh losses resulting from new and ongoing maintenance of coastal flood defences elsewhere in Carmarthen Bay and the Loughor Estuary (NRW, 2015). Within months of the seawall breach at Cwm Ivy, saltmarsh

plant species were beginning to colonise the site. Projects focused on restoring and creating blue carbon habitats, such as Cwm Ivy, are already safeguarded within Wales's extensive network of marine protected areas (MPAs). Management of MPAs is designed to strengthen habitat resilience to future change, while protecting and enhancing overall habitat quality (NRW, 2022b; NRW, 2020).

3 Impact to ecosystem services

3.1 Biodiversity

The Cwm Ivy habitat creation site continues developing successfully, and by 2019, NT in collaboration with Brighton and Swansea Universities, a wide network of volunteers, and with funding from NRW, was able to collate five years of data collected since the seawall breach. They demonstrated excellent outcomes for both habitat development and biodiversity. Saltmarsh has become well-established, progressing from pioneer species to more mature plants. Low grazing intensity has allowed marsh flowers to thrive, providing for pollinating insects. Within the creek systems, marine invertebrates are also well-established, and evidence of otters has been recorded across the site. The area is regularly used by a wide range of bird species, including *Vanellus vanellus* (lapwing), *Tadorna tadorna* (shelduck), *Circus aeruginosus* (marsh harrier), *Egretta garzetta* (little egret) and *Pandion haliaetus* (osprey) (Welsh Government, 2019-2020).

However, the UK Government (2019) reported that the population of *Vertigo angustior* (narrow-mouthed whorl snail) on Whiteford Burrows (including Cwm Ivy) was sharply declined during monitoring in May 2016. Whiteford Burrows had been regarded as the species' largest, and one of few, locations in the UK and had been "relatively stable during the period 1993 to 2012". The report states that the *V. angustior* population is a Special Area of Conservation (SAC) feature that was previously in favourable condition, but is now assessed as being in "unfavourable condition with a decreasing trend". It identifies the principal threat to *V. angustior* habitat in Wales as "successional changes in coastal ecotones" where grazing management is absent, as well as the impacts of sea-level rise where this leads to substantial alteration of this species' ecotonal habitat.

Whilst there is increasing evidence to say that MR sites have lower biodiversity than pre-existing 'natural' saltmarshes, there is less data for uMR sites. Whilst Dale et al. (2021) did find evidence that the redox profile at Cwm Ivy was comparable to that of a "natural" saltmarsh, with evidence of anoxic conditions confined to non-vegetated mudflat areas, this was attributed to absence of intensive arable agriculture before the site was breached, rather than to the breaching process itself. Figure 3-1 shows aerial views of the sites used for this study, whilst providing the location for Cwm Ivy Marsh

(both inserts); the dashed black line represents the site outline, with the breached wall as the North East boundary.

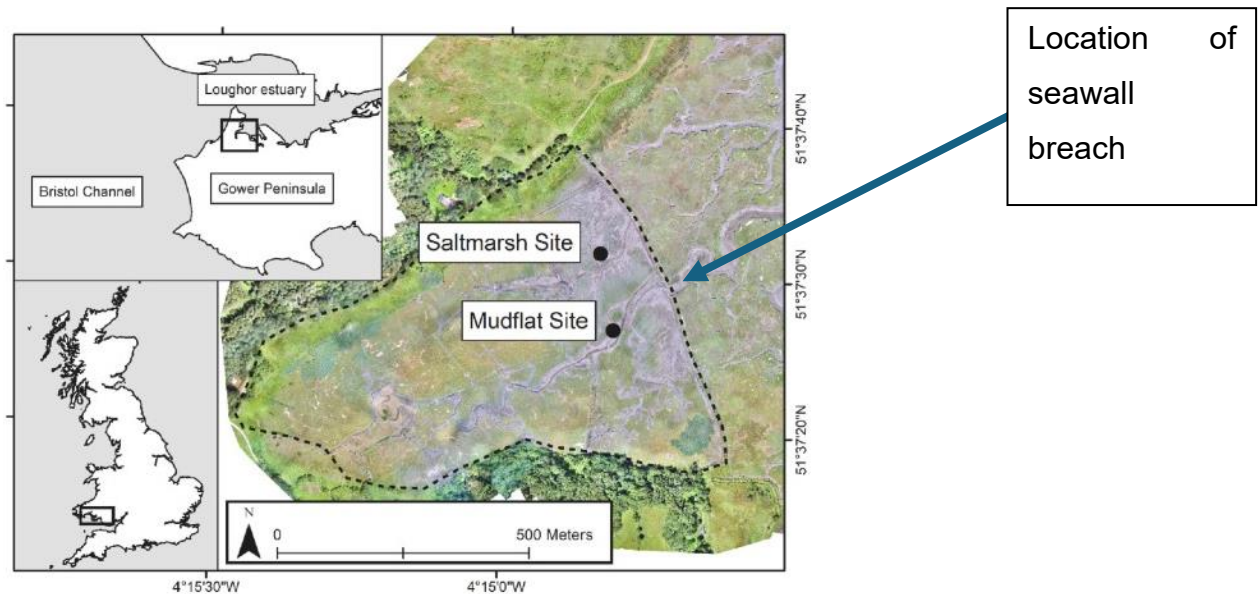


Figure 3-1 Orthophotography of Cwm Ivy Marsh (Dale, et al., 2021)

Whilst Cwm Ivy was designated a SSSI in 2002, it is not clear whether it remains a SSSI since the seawall collapse (NRW, 2002). However, despite the decline in *V. angustior*, Cwm Ivy continues to provide biodiverse marshland habitat for important species. The marsh is also used for grazing sheep and horses (figure 3-2) with Gower Saltmarsh Lamb holding UK Geographical Indication Protected Designation of Origin status (Welsh Government, 2021).



Figure 3-2 E.Hill, Horses grazing at Cwm Ivy, 2025

3.2 Blue carbon

Coastal habitats contribute to blue carbon storage, with saltmarshes in Wales sequestering carbon at a rate of 0.084 kg/m²/yr, approximately 18% of the sequestration rate per unit area for Welsh forests (NRW, 2022a). Comparatively, arable on lowland fen peat sequesters carbon at an even lower rate of 0.036kg/m²/yr, with peat decomposition tending to be high and therefore peat depth being shallow. Also, insertion of drainage ditches within or around fens can cause them to degenerate (Joint Nature Conservation Committee, 2019; The Open University, 2017).

3.3 Flood mitigation

The winter storms of 2013–14 in the UK demonstrated how major storm events can elevate coastal water levels by over 5m above astronomical tides, leading to widespread coastal flooding. As climate change intensifies storm-driven coastal flooding, saltmarshes are increasingly recognised for their role in flood mitigation where this has traditionally been managed by engineering hardened defence structures. Although flood risk is elevated in estuarine environments, many estuaries are characterised by extensive saltmarsh that can mitigate this risk (Fairchild, et al., 2021). Within the Loughor estuary, Fairfield, et al. (2021) investigated how saltmarsh vegetation changes estuary hydrodynamics using high-resolution hydrodynamic models. They found that with increasing width of vegetated saltmarsh, there was localised relative reduction of both wave height and flood depth at the marsh edges, most pronounced for vegetated marsh compared to unvegetated marsh. They also found that with increasing distance upstream, relative wave height was reduced, and this was most pronounced for 1 in 100 year storms when comparing vegetated marsh to unvegetated marsh. Figure 3-3 illustrates these findings with lines representing vegetated (green) and grazed (blue) marshes, and where marsh vegetation is absent (red).

The research did not make any assessment of the flood mitigating effects of the marsh prior to the Cwm Ivy seawall breach to be able to make any comparisons of before and after.

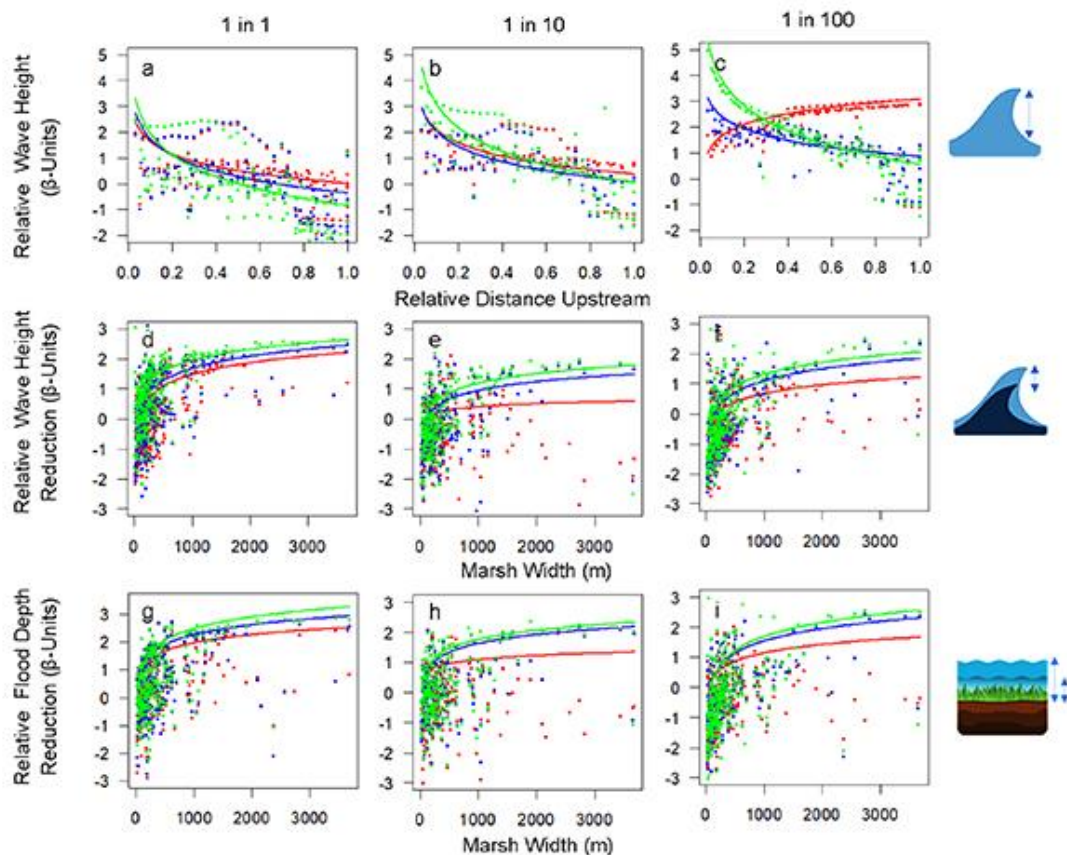


Figure 3-3 High-resolution hydrodynamic modelling showing how saltmarsh vegetation changes estuary hydrodynamics (Fairchild, et al., 2021)

3.4 Water Purification

Wetlands are efficient and effective at improving water quality from a range of sources, including agricultural and urban runoff, as well as domestic and industrial wastewater (Ferreira, et al., 2023).

As a peatland type, fens usually provide some water filtration, where not dug up or drained (NRW, n.d.). However, research on man-made wetlands has predominantly addressed treatment wetlands and reservoirs, and there is far less research assessing ES (including water purification) provided by man-made irrigated agricultural land (Xu, et al., 2020).

There are comparatively more research articles assessing ES provided by estuarine tidal marshes (Xu, et al., 2020). Saltmarsh plants have evolved sophisticated adaptations, to natural remediate against pollution by trapping and storing potentially

toxic compounds within their sediments and biomass (Cruz de Carvalho, et al., 2024). Saltmarsh plants can retain metals within estuarine environments, helping to reduce metal concentrations in the water and limiting their spread throughout the estuary, into coastal zones, and ultimately into underlying aquifers (Cunha, et al., 2024).

3.5 Recreation

The loss of part of the Wales Coast Path resulted in the loss of valuable recreational ES. However, Swansea Council, which is responsible for rights of way, is now exploring the feasibility of constructing a footbridge to span the gap, so the situation may be able to be remedied. There are also newly constructed hides from which there are a wide range of species to look out for on the marsh (Wales Online, 2025).

4 Future

With reference to the ES assessed in this report, it may be contended that saltmarsh at Cwm Ivy delivers greater value than that provided by the pre-existing lowland fen peat arable system. Saltmarsh can sequester blue carbon at a higher rate compared to lowland fen peat arable systems. As climate change intensifies storm flooding, saltmarshes are increasingly recognised for their role in coastal flood mitigation. However, whilst lowland fen meadow may provide flood control, and Cwm Ivy seawall itself provided localised flood defence, there does not appear to be any evidence to suggest that the presence of the fens could have mitigated storm flooding elsewhere in the Loughor estuary. Conversely, vegetated saltmarsh in the Loughor Estuary has been shown to mitigate storm flooding with estuary-scale surge attenuation, especially upstream. Climate change, anthropogenic pollution and expanding urbanisation threaten to weaken these protective effects, which also highlights their particular importance (Fairchild, et al., 2021). Furthermore, whilst all wetlands can purify water, there is limited research about this for irrigated agricultural land compared to estuarine tidal marshes. There is good evidence to show that tidal marshes can act as natural remediators of pollution.

However, there may be potential drawbacks to the presence of saltmarsh at Cwm Ivy including that some biodiversity may have been lost, including species populations which have SAC features such as the narrow-mouthed whorled snail pictured in figure 4-1. The causes of the decline in *V. angustior* must be identified and addressed through appropriate management to facilitate population recovery (UK Government, 2019).



Figure 4-1 *V.angustior* compared to *V.substriata* (NRW, 2014)

Overall, there does not seem to be a particularly strong argument for rebuilding the Cwm Ivy seawall. However, there is an argument for reinforcing the wall and reintroducing a sluice or other form of RTE (NRW, 2021) possibly in conjunction with a footbridge (Wales Online, 2025). Other possibilities for post-breach interventions considered on this site included widening the breach, creating multiple breaches or excavating 'paleo-channels' to improve how seawater flows through the site (NRW, 2015).

Whilst it is unknown whether the presence of saltmarsh at this site may or may not have had a deleterious effect on the population of *V.angustior*, the multifunctionality of all of the ES provided by saltmarsh must be weighed up against those provided by the pre-existing marsh at Cwm Ivy. Future recommendations would include not rebuilding the wall or exploring possibility of RTE with a footbridge, but investigating the causes of the decline of *V. angustior*.

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