The Second State of Natural Resources Report (SoNaRR2020)

SoNaRR2020 Register coastal margins evidence

Natural Resources Wales

Final Report

About Natural Resources Wales

Natural Resources Wales's purpose is to pursue sustainable management of natural resources. This means looking after air, land, water, wildlife, plants and soil to improve Wales's well-being, and provide a better future for everyone.

Evidence at Natural Resources Wales

Natural Resources Wales is an evidence-informed organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

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Version 2.0	Erroneous links to table removed and added link to new SMP web page (page 16)

The Second State of Natural Resources Report (SoNaRR2020) contents

This document is one of a group of products that make up the second State of Natural Resources Report (SoNaRR2020). The full suite of products are:

Executive Summary. Foreword, Introduction, Summary and Conclusions. Published as a series of webpages in December 2020

The Natural Resource Registers. Drivers, Pressures, Impacts and Opportunities for Action for eight Broad Ecosystems. Published as a series of PDF documents and as an interactive infographic in December 2020

Assessments against the four Aims of SMNR. Published as a series of PDF documents in December 2020:

SoNaRR2020 Aim 1. Stocks of Natural Resources are Safeguarded and Enhanced

SoNaRR2020 Aim 2. Ecosystems are Resilient to Expected and Unforeseen Change

SoNaRR2020 Aim 3. Wales has Healthy Places for People, Protected from Environmental Risks

SoNaRR2020 Aim 4. Contributing to a Regenerative Economy, Achieving Sustainable Levels of Production and Consumption

The SoNaRR2020 Assessment of Biodiversity. Published in March 2021

Assessments by Broad Ecosystem. Published as a series of PDF documents in March 2021:

Assessment of the Achievement of SMNR: Coastal Margins

Assessment of the Achievement of SMNR: Enclosed Farmland

Assessment of the Achievement of SMNR: Freshwater

Assessment of the Achievement of SMNR: Marine

Assessment of the Achievement of SMNR: Mountains, Moorlands and Heaths

Assessment of the Achievement of SMNR: Woodlands

Assessment of the Achievement of SMNR: Urban

Assessment of the Achievement of SMNR: Semi-Natural Grassland

Assessments by Cross-cutting theme. Published as a series of PDF documents in March 2021:

Assessment of the Achievement of SMNR: Air Quality

Assessment of the Achievement of SMNR: Climate Change

Assessment of the Achievement of SMNR: Energy Efficiency

Assessment of the Achievement of SMNR: Invasive Non-native Species

Assessment of the Achievement of SMNR: Land use and Soils

Assessment of the Achievement of SMNR: Waste

Assessment of the Achievement of SMNR: Water Efficiency

Updated SoNaRR evidence needs. Published in March 2021

Acronyms and Glossary of terms. Published in December 2020 and updated in March 2021

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Coastal Margins Natural Resource Register Evidence List

SoNaRR2020

The evidence below has been extracted from the coastal margins chapter unless otherwise stated.

If the original piece of evidence is not cited within this document then it can be found in the coastal margins chapter or associated chapters, which will be published in March 2021. At that point this document will be superseded.

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Evidence List: Drivers, Pressures and Impacts Table

Climate Change

1. Sea Level Rise and increased likelihood of storm events

1.1. **Predicted to lead to the loss in extent of ecosystems and from coastal squeeze*, increased flooding, erosion and storm damage. (MCCIP, SMPs).** UK Climate Projections (UKCP18) show increasing sea level rise and increased likelihood of more intense and frequent storm events, which will inevitably result in increased wave action. Evidence indicates that there will be major changes to the dynamic coastal habitats on the Welsh coast in the next 10 to 20 years and beyond. Sea-level rise and erosion rates are the greatest risk to coastal habitats. Sea-level rise results in deeper waters and bigger waves reaching saltmarsh, dunes, shingle and maritime cliffs, causing erosion at the seaward edge.

Sea-level rise and more frequent storms will increase the likelihood of coastal flooding, erosion and potentially storm damage with increased risk to habitats (ASC, 2016).

Where coastal habitats cannot migrate inland, due to the presence of a sea defence, sea-level rise and increased erosion would be likely to lead to habitat loss. This is known as 'coastal squeeze. Shoreline management plans (Atkins, 2010, Halcrow, 2012a & 2012b, Royal Haskoning, 2012) estimate significant losses of *intertidal habitat* (which includes saltmarsh); 3,485ha lost by 2105 from SACs in Wales due to coastal squeeze. The figure for predicted losses has not been adjusted to allow for estuary infilling (which drives marsh expansion) or morphological response to sea level rise and in that context, are seen as a worst-case scenario. Evidence from scientific research has found that saltmarsh can respond to sea level rise by vertical accretion, given adequate sediment supply (Jones *et al*., 2011, Burden *et al*., 2020) therefore, short-term losses due to sea level rise may not be as great as predicted by simple topographic models. In the long term there are uncertainties surrounding sediment supply. Without increases in sediment supply to the coast, trends of lateral marsh erosion are likely to continue and may reverse trends in expansion in the northern regions of Great Britain (Ladd *et al*., 2019).

An average loss of sand dune area of 2% over 20 years and 8% by 2080 due to sea-level rise is projected (Jones et al., 2013). Saline lagoons are one of the most vulnerable habitats to climate change, with their physical, chemical and ecological characteristics all likely to be affected (MCCIP, 2018). The overall extent of coastal lagoons is likely to decline in the long-term, sea level rise and increases in storminess will lead to the slow retreat of barriers, and in some cases catastrophic breaches (MCCIP, 2018). Sea-level rise may present opportunities for creation of new lagoonal habitat, where sea water inundates low-lying land and freshwater areas (Jones *et al*., 2011).

Numerous species are threatened by habitat loss due to coastal squeeze and changes to the tidal range, e.g. Baltic bryum (*Bryum marratii*) one of Wales' rarest

and most threatened mosses, which occupies the transitional zone between upper saltmarsh and sand dune is under threat from sea-level rise (Callaghan & Farr, 2018).

1.2. **Increased risk to people, properties, infrastructure and agricultural land, terrestrial and freshwater habitats**
Currently coastal flooding is a risk for 62,300 residential properties and 8,750 non-residential properties in Wales.

Sea-level rise and more frequent storms will increase the likelihood of coastal flooding, erosion and potentially storm damage with increased risk to people, properties and infrastructure (ASC, 2016).

1.3. **Likely to lead to changes to species composition and habitat distribution. (MCCIP, Burden *et al.,* 2020, Jones et al., 2013).**
Climate change is likely to exacerbate the effects of existing pressures and lead to changes in species distribution in the coastal margin habitats (Burden *et al.,* 2020). Changes in patterns of rainfall or temperature will affect vegetation composition of many coastal wetlands (MCCIP 2020a). Changes in weather patterns are already beginning to affect biodiversity, e.g. the loss of oysterplant (*Mertensia maritima*) from shingle in North Wales has been attributed to a warming climate (Jones *et al*., 2013). The number and range of some invasive non-native species is likely to increase with the changing climate (Barrow 2020).

2. Temperature change and changes to rainfall patterns.

2.1. **Predicted to lead to the loss in extent of ecosystems and from coastal squeeze*, increased flooding, erosion and storm damage. (MCCIP, SMPs).**
Same Evidence as 1.1

2.2. **Likely to lead to changes to species composition and habitat distribution. (MCCIP, Burden *et al.,* 2020, Jones et al., 2013).**

Same Evidence as 1.3

Pollution

3. Air Pollution

3.1. **Atmospheric nitrogen and ammonia deposition leading to increases in competitive grass species, accelerated succession and loss of pioneer, stress tolerant and open ground species. (APIS, Aggenbach *et al*., (2017); Kooijman *et al*., (2017); Plassmann *et al*., (2010); Jones *et al*., (2004); Plassmann *et al*., 2008).**
Atmospheric nitrogen and ammonia deposition are a significant issue, even small levels of inputs can accumulate over time in soils leading to eutrophication. Dunes and cliff top coastal heath which are adapted to nutrient poor conditions are particularly vulnerable (APIS, Plassmann *et al*., 2008).

Dune grasslands in Wales display the largest reduction in the percentage area exceeded for nutrient Nitrogen of all habitats assessed; 31.1% (1998-2003) to 16.5% (2016-2018) (Rowe *et al*., 2020) however, this the habitat is still being impacted by nutrient Nitrogen leading to accelerated stabilisation and succession.

Cliff top coastal heath and coastal grasslands are also Nitrogen sensitive habitats and are likely to be being impacted, however, there is no data specifically related to critical load exceedances for coastal vegetation community types.

4. Water Pollution

4.1. **Elevated nutrient levels and chemical contaminants are detrimental to the functioning of the system as a whole, and to condition of specific habitats and species. Greatest impacts relate to lagoons but saltmarsh is also associated with waterbodies with poor water quality.** (NRW 2015, NRW 2018, A17: Green & Lindenbaum, 2019).
Coastal lagoons are particularly vulnerable to eutrophication from agricultural inputs via run-off from surface waters and groundwater sources; these contribute to reduced condition of the habitat and impact species. Monitoring data included observations of phytoplankton blooms and high levels of algae growth (Green and Lindenbaum 2019).

Land Use Change

5. Agricultural Intensification

5.1. **Habitat loss, fragmentation and declines in condition and biodiversity** (UKNEA, Blackstock *et al*., 2010, see other references in 1.2 e.g. Davidson (2020) and Howe 2015).
The coastal margin habitats have been reduced in extent relative to their past distribution (Jones *et al.,* 2011). Historic large-scale loss of extent was primarily due to land claim, agricultural intensification and development (Jones *et al.,* 2011), Blackstock *et al*., 2010) leaving only a very narrow coastal zone, generally bordered by land managed intensively for agriculture leaving no space for 'rollback' of coastal habitats as a response to erosion, causing habitat loss and fragmentation.

Recent European Habitats Directive (Article 17) reporting recorded intensive grazing was assessed as a 'high' pressure for Atlantic salt meadows (saltmarsh) saltmarsh and medium for sea cliffs (JNCC Article 17 reports).

Overgrazing typically results in short, uniform swards and the loss of grazing-sensitive plant species and restricts the ability plants to flower. Davidson (2020), found that intensively grazed saltmarshes were to be amongst the least valuable habitats for all bee types, however even extensive grazing reduced bee abundance because of the loss of key flowering species.

Welsh soft cliffs support invertebrate species and faunas of national importance (Howe, 2015). Agricultural improvement of cliff-top hinterlands restricts nesting and foraging activities of invertebrate species characteristic of soft cliffs and acts to fragment and isolate sections of soft cliff (Howe, 2015). The main threat to soft cliff invertebrates in Wales is the loss of headlands to agricultural improvement, alterations to natural drainage patterns, a fertiliser and pesticide run-off (Howe, 2015).

In Great Britain, over 50% of saltmarsh breeding redshank have been lost since 1985 (Malpas *et al*., 2013; Sharps, 2015). Common redshank declines in Wales

have been largely driven by agricultural intensification resulting in a lack of available nest sites with recovery hampered by predation and grazing pressures during the breeding season.

6. Insufficient Management

6.1. **Impacting extent and condition of coastal habitats and species** (UKNEA, Blackstock et al., 2010, see other references in 1.2).
Abandonment of pastoral systems is a primary pressure for sea cliffs (Jones *et al.,* 2011) Under Article 17 (JNCC 2019) reporting agricultural abandonment was listed as a high pressure for sea cliffs and sand dune and under-grazing was listed as a high pressure for sea cliffs and a medium pressure for saltmarsh. Abandonment of traditional grazing is particularly widespread on clifftops where scrub is replacing coastal grasslands and heath, threatening numerous higher plants, bryophytes and lichens. On the upper saltmarsh, a suite of plant species, including Slender hare's-ear (*Bupleurum tenuissimum*) and Sea barley (*Hordeum marinum*), rely on short swards and bare ground created by cattle poaching. Population fluctuations, severe declines and losses in some areas are closely linked to grazing levels.

7. Built Development and Infrastructure

7.1. **Development pressures primarily currently relate to leisure and tourism, such as caravan parks and golf courses. These lead to habitat loss, fragmentation and constriction of the coastal zone and hinterland affecting the potential for habitat rollback** (Jones et al., 2011) **Marine renewable energy is a threat** (JNCC 2019).
All habitats have been affected by coastal development for industry, housing and tourism (Jones 2011).

The sand lizard (*Lacerta agilis*) and natterjack toad (*Bufo calamita*) both became extinct in Wales by the 1960s (Howe 2018, a & b), as a result of development and sea defence work leading to habitat loss and fragmentation of sand dunes. The sand lizard and natterjack toad Recovery Project 2011-2014 carried out successful reintroductions of these species as part of the Species Recovery Project and the UK Biodiversity Action Plan.

Marine renewable energy has been listed as a threat under Articl 17 Reporting for saltmarsh habitats (JNCC 2019). In recent years several tidal lagoon energy projects have been proposed which would impact coastal habitats, sometimes over very significant areas. It has been demonstrated that tidal stream turbines can lead to a significant effect on flows and sediment dynamics (Neill *et al*., 2009, Ramos *et al*., 2014).

8. Unmanaged Access, Sport and Recreational Activity

8.1. **Disturbance to species e.g. ground nesting birds**
Lowen *et al*., 2008

8.2. **Trampling and vehicle use can lead to erosion and declines in habitat extent and condition**
Excessive tourism can damage sensitive habitats (Jones 2011). Tourism and leisure activities is listed as a pressure against numerous coastal feature under Article 17 Reporting (JNCC 2019). Moderate to high trampling can increase bare

ground, soil compaction; loss of sensitive species and declines in flowering and seed production all reduced, (Lowen *et. al.,* 2008)

Correlations between recreational activity and reduced bird breeding success or reduced breeding numbers have been shown in numerous studies. Several field studies report that birds' nests are trampled or driven over more frequently in disturbed than in undisturbed areas, that rates of abandonment of eggs or chicks or deaths to exposure are higher in disturbed areas or that rates of egg and/or chick predation are higher in disturbed than undisturbed areas (Lowen *et. al.,* 2008).

9. Historic Inappropriate Afforestation

9.1. **Habitat loss, constraints to natural dynamics and species loss** (UKNEA, Rhind, 2008, Rhind & Jones, 2009, Wallace & Jones, 2020)**.**
Forestry affects 1680ha of sand dune habitat in Wales. Afforestation has caused significant loss of extent of dune vegetation and continues to impact condition due to lowering of the dune aquifer and sand stabilization (Jones 2011, Rhind, 2008, Rhind & Jones, 2009, Wallace & Jones, 2020).; the sand dunes lose natural dynamism and become 'fossilised relics' of former biodiverse systems.

10. Physical Modifications

10.1. **Preventing the natural functioning of the dynamic coastal habitats essential for maintaining extent and condition** (Brazier et al., 2007, Burden et al., 2020).
The Much of the Welsh coastline (almost 28%) has been modified by coastal defences and groynes which protect land claimed for agriculture and development, including housing, industry and transport links (Brazier et al., 2007). These have changed the shape of the coastline and caused hydromorphological pressures, preventing and/or constricting natural physical processes such as tidal inundation, channel movements and natural erosion.

For Article 17 reporting (JNCC 2019) modification to the coastline was listed as a high pressure for saltmarsh, shingle and as a medium pressure for dunes and sea cliff (relating to soft cliffs).

Constraints to physical processes compromise the ability of the dynamic coastal habitats to adapt to both natural change and now, critically, to climate change (Burden et al., 2020), decreasing their ability to function as natural coastal defences.

10.2. **Disruption to sediment supplies leading to habitat loss and interruption of natural succession** (Pye *et al*., 2017)**.**

11. Accelerated Succession

11.1. **Loss of pioneer habitats and species dependant on them on Sand dunes** (Pye & Blott (2017); Van der Biest *et al*., (2017); Pye *et al*., (2014); Provoost *et al*., (2011); Howe *et al*., (2010); Woodman, 2018, Callaghan *et al.,* 2020, Howe *et al*., 2012, Bratton, 2012).
Succession from early pioneer habitats to mature stabilised communities is a natural process; however, dune systems in particular have become increasingly dominated by late successional communities, with a significant loss of the pioneer

open habitats and species Woodman, 2018, Callaghan *et al.,* 2020, Howe *et al*., 2012, Bratton, 2012). Accelerated succession in sand dunes is a result of numerous pressures. These include; agricultural abandonment, crashing rabbit populations, atmospheric nitrogen and ammonia deposition, anthropogenic activities to stabilise dunes and natural processes.

Populations of plant species including fen orchid (*Liparis loeselii*) (Woodman, 2018), specialist dune bryophytes (Callaghan *et al*., 2020) including petalwort (*Petalophyllum ralfsii*) and several invertebrate species (Howe *et al*., 2012) have all suffered with the decline in area of early successional and pioneer sand dune habitats.

Since the late 1980s, fen orchid has been lost from three out of five sand dune systems in Wales and there has been a huge long-term decline in the numbers of individual plants (Woodman, 2018). The population at Kenfig declined from an estimated 20,000+ in 1987-1992 (Jones, 1995) to c.1000 in 2017 (Wilkinson & Hayes, 2018).

INNS, Pests and Diseases

12. INNS

12.1. **Outcompete native species threatening diversity and acting as stabilisers on dune systems** (Article 17).
Article 17 reporting 2018 identified invasive non-native species as a medium pressure for sand dunes, sea cliffs and coastal lagoons (Creer, 2019; Lewis, 2019; and Green & Lindenbaum, 2019) and as a threat to Saltmarsh.

Evidence from INNS Chapter
The heat map of occurrence records of INNS of interest to Wales which impact on the coastal margin ecosystem in Wales shows that there are more records concentrated in south Wales, the Llyn, Anglesey and on the north Wales coast and appear to correlate to the location of dune systems. The INNS of interest to Wales that primarily impact coastal margins affect biodiversity by outcompeting native plants and forming monocultures or reducing the functionality of ecosystems particularly within dune system by acting as stabilisers, they can also reduce access and the amenity value of these areas.

Evidence List: Opportunities for Action

Aim 1: Stocks of Natural Resources are safeguarded and enhanced

Delivery of coastal adaptation through nature-based solutions

Mitigation for the effects of climate change can be achieved through coastal adaptation and the implementation of nature-based solutions. Significant opportunities exist to manage the coast sustainably, allowing coastal processes to

occur and coastal margin habitats to respond and adapt naturally to climate change. These opportunities will also support wellbeing through the alleviation of flood risk to people and property and helping communities to adapt.

The effects of climate change are already beginning to impact coastal habitats and the wellbeing of coastal communities. Therefore, timely action is required to support the planning & prioritisation of key work and overcome barriers to the implementation of coastal adaptation and nature-based 'green infrastructure' solutions.

Improve source to sea catchment management of nutrients, chemicals, and pathogens.

Understanding pollution pathways is essential for effective action. Developing measures to address this pollution is challenging, as the sources reflect, widespread lifestyle choices and food and energy production (transport, housing, agricultural emissions), the wider economy and agriculture. Tackling the numerous sources of pollution, including overcoming the consequences of past pollution such as nutrient enrichment of soils, needs an integrated approach. However, the sources of pollution are numerous and generally originate away from the coastal margin habitats.

Continuing to tackle water quality through Opportunity Catchments to fully integrate land and sea. The wider opportunities provided through area statements and the wider framework of marine planning now established provide additional focus on estuarine, coastal and marine waters and the link to their freshwater catchments. Elements to improve water quality through the delivery of sustainable agriculture could lead to widespread improvements.

Consider production of strategic programs of measures in response to poor air quality, falling below critical levels set for sensitive habitats and species.

Evidence from Climate Change Chapter
Similar adaptation strategies can be put in place along the coast. Some measures, such as beach nourishment, work with the natural processes but reduce the risk of flooding and coastal erosion. In addition, constructing flood defence walls and embankments, such as in Newport to protect against tidal flooding, can protect against higher coastal floods. In other areas, managed realignment, which allows the shoreline to move naturally, may be more appropriate. Shoreline Management Plans will be crucial to decision-making to protect Wales' coastline

Evidence from Climate Change Chapter
A range of measures must be put in place to reduce the risk of river and flash floods. The draft National Strategy for Flood and Coastal Erosion Risk Management (Welsh Government, 2019) recognises that a more holistic approach is needed to manage all types of flooding, in order to encourage wider resilience and to improve awareness and delivery of sustainable schemes that deliver wider well-being benefits. Introducing natural flood risk management measures, such as river and floodplain restoration and leaky barriers either in isolation or in conjunction with more traditional engineered defences can help to increase water storage and improve a river's ability to manage flood water.

Aim 2: Resilient Ecosystems

Protect, enhance and restore coastal margin habitats to improve resilience and safeguard services including natural flood defence and carbon sequestration.

Resource protected site management to achieve good condition and landscape scale restoration to restore extent, condition, connectivity and biodiversity. Ensure understanding and implementation of the SMNR approach in assessing ecological value and ecosystems services provided by coastal habitats in development planning and EIA regulations (Agriculture).

Managing sediment supply may be critical to mitigate coastal impact from climate change (Ladd *et al*., 2019). Coastal management aimed at reconnecting sand dunes and shingle structures to their source sediment areas would be likely to have considerable local benefits in vulnerable locations (Jones *et al*., 2011), for both biodiversity and natural flood defence. Supporting major coastal adaptation schemes to ensure offset habitat is created to compensate for habitat predicted to be lost through coastal squeeze (by assets maintained by risk management authorities).

Ensuring that compensation habitat also created to offset coastal squeeze including where this is caused by assets not maintained by risk management authorities.

Ensuring that protected site boundaries reflect the changing nature of the coastline into the future, allowing for rollback of habitats and coastal realignment.

Aim 3: Healthy Places for People

Deliver coastal adaptation through nature-based solutions

Mitigation for the effects of climate change could be achieved through coastal adaptation and the implementation of nature-based solutions. Sustainable management in line with Shoreline Management Plans could also support **wellbeing** through the alleviation of flood risk to people and property.

Consideration of hybrid approaches to flood protection where hard engineered sea walls and other flood protection are enhanced for biodiversity can have multiple benefits. The ‘Greening the Grey’ research project found that even though costs for these hybrid approaches tended to be higher, there were additional returns compared to traditional hard engineering which included; enhanced ecosystem services, helping to meet statutory mitigation requirements, social benefits (Naylor *et al*., 2017).

The effects of climate change are already beginning to impact coastal habitats and the wellbeing of coastal communities. Therefore, timely action is required to support the planning & prioritisation of key work and overcome barriers (financial, legal and social) to the implementation of coastal adaptation and nature-based ‘green infrastructure’ solutions.

Restore saltmarsh habitat to boost carbon sequestration.

Landscape scale habitat restoration projects, such as dune and estuary restoration represent significant opportunities for maximising carbon capture; saltmarsh in particular is very efficient at carbon sequestration (Chmura *et al*., 2003).

Maximising wellbeing opportunities in the coastal margins

There are multiple potential opportunities for the PSBs to explore and address opportunities to maximise benefits from the marine and coastal environment around Wales (Ibrahim 2020).

Identify mechanisms to ensure that inappropriate development does not occur in areas of coastal flood and erosion risk, and that enable at risk communities to relocate to support the aspirations for coastal adaptation.

Support and delivery of placemaking projects which have multiple benefits for both environment and wellbeing at the coast. Projects should build an environmental appreciation, awareness and renew cultural associations with the coast, particularly where communities have been cut off from the coast by large roads and railway lines.

Highlight the potential benefits of nature-prescribing at the coast, including preventative health care.

Support communities living with coastal risk and uncertain futures in their personal resilience and emotional wellbeing.

Work with non-government organisations, businesses and the education sector to embed environmentally sensitive behaviours within communities.

To encourage coastal access particularly away from the most popular and most sensitive areas, reducing actual and potential damage and disturbance to habitats and species and by means of public transport.

Aim 4: A Regenerative Economy

Deliver nature-based solutions at the coast.

Economic benefits from natural flood defences that can help reduce the need for hard engineered sea defences and flood defence maintenance. Therefore, protecting, restoring and managing coastal habitats for defence provision is conducive to the circular economy.

Continue to promote the use of nature-based solutions (green infrastructure) to manage coastal erosion and flood risk can be cost effective and have multiple benefits in terms of for example the beneficial use of dredged materials. This approach can simultaneously provide flood defence, create habitats for wildlife, protect carbon stores, be places for us to enjoy and can attract tourism to boost local economies.

Deliver sustainable agriculture. Continuing to work with farmers and land managers by providing incentives and support to ensure sustainable agricultural management.

Work with and support (and continue to) farmers and land managers to adopt or maintain sustainable agriculture on the coast, which could both deliver the practical habitat management essential for achieving good condition both within and outside of protected sites and support faming communities on the coast.

Overcome barriers which prevent landowners from grazing coastal margin habitats where they have been abandoned or where there is under management and facilitate assistance to landowners to achieve appropriate stocking levels. Issues relating to the lack of heavy stock grazing, livestock disturbance by dogs and people and livestock access to high tide refuges on saltmarsh need to be resolved.

Evidence List: Assessment of SMNR

Aim 1: Stocks of Natural Resources are safeguarded and enhanced

Aim 1: Progress towards meeting the aim

Biodiversity has declined in line with losses in extent, condition and connectivity of coastal habitats. Within the last 50 years we have seen a number of extinctions of invertebrates, lower plants and higher plants and there are further species on the brink of being lost from Wales (Sectio 2.1) . Stabilisation of soft cliffs has caused loss of exposed bare ground, seepages, and pioneer plant communities upon which many of these specialist soft cliff invertebrates depend for their survival (Howe 2015). Populations of plant species including fen orchid (*Liparis loeselii*) (Woodman, 2018), specialist dune bryophytes (Callaghan *et al*., 2020) including petalwort (*Petalophyllum ralfsii*) and several invertebrate species (Howe *et al*., 2012) have all suffered with the decline in area of early successional and pioneer sand dune habitats. However, since 2012 there has been significant improvements in **fen orchid** numbers at Kenfig, with numbers rising from 473 to 4200 in 2019. These improvements have been driven by a programme of site management. A further, very small population has been re-established at Whiteford Burrows.

The Sands of LIFE and Dynamic Dunescapes projects are currently helping to restore early successional habitats within dunes to enable recovery of many threatened dunes species. Early results at Newborough have shown positive effects for beetle species associated with pioneer slacks recolonising for example the rove beetles *Bledius subniger* and *Gabrius osseticus*, the ground beetles *Dyschirius politus* and *Bembidion pallidipenne* which had not been recorded on the site since the 1960s were recorded in excavated dune slacks in 2014.

Wales supports nearly 80% of the UK breeding population of chough (*Phyrrhocorax pyrrhocorax*) (Hayhow *et al*., 2018), found primarily along the western coastal fringe.

1.1. There is little evidence for the losses outside of protected sites, however, continued pressures mean that slow decline is inevitable.

A high proportion of the coastal habitats are within the protected sites series (>85% excluding lagoons) and this statutory protection has been a key factor in reducing habitat loss within the coastal margin habitats (Section 2.1 SoNaRR Chapter Figure 1. Extent of coastal margin habitat within Wales and the percentage of the coastal habitat under statutory protection (where data exists for broad habitats).

1.2. Site level conservation management is leading to significant localised improvements in the condition; this is often achieved through SSSI management agreements. >20% of salt marsh, sea cliff and sand dune (combined) are within the Glastir Advanced Agri Environment Scheme, 12 % are within management agreements (Section 2.1 Table 1. Extent of coastal margin habitats within Glastir Advanced agri-environment scheme agreements 2018. Figure 2 Proportion of saltmarsh, sand dune and sea cliffs within SSSI Management Agreements).

1.3. Several larger landscape scale initiatives to which aim to restore habitat extent, condition, connectivity and dynamics have been implemented: Sands of Life, Farming for the Future, Dynamic Dunescapes, Conserving the Park.

1.4. The National Habitat Creation Programme has established a realignment scheme at Cwm Ivy on North Gower (c. 39ha) as part of a programme to create compensation habitat to offset loss due to coastal squeeze caused by coastal defences owned and maintained by Risk Management Authorities in Wales, and further larger projects are at the planning stage.

Aim 2: Resilient Ecosystems

Aim 2: Progress towards and Obstacles remaining to meeting the aim

Resilience of coastal margin ecosystem

Recent European Habitats Directive (Article 17) reporting (JNCC, 2019) showed that many of the coastal margin habitats continue to decline in extent and condition with the future prospects for many features being poor. This is due to a range of pressures resulting from human activities and has led to inevitable declines in biodiversity supported by coastal margin habitats.

Several larger landscape scale initiatives to which aim to restore habitat extent, condition, connectivity and dynamics have been implemented, these should support resilience (detailed above).

Shoreline Management Plans (SMP) set the preferred policy for sustainable management of the coastline of Wales over the next 100 years and take sea-level rise into account. If SMP policies, which integrate the protection of habitats and people, are implemented this will significantly reduce risk from coastal erosion.

The use of nature-based solutions is encouraged in the National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in Wales 2020 (in prep). The FCERM Business Case guidance for flood defence projects requires at least one nature-based option to be taken through to the short list of options.

The National Trusts' coastal adaptation policy 'Shifting Shores' (National Trust, 2015) includes creation of space for roll back of habitats. The National Trust has begun to implement this policy at Welsh coastal properties.

The Site of Special Scientific Interest (SSSI) Guidelines for Coastlands (Rees *et al*., 2019) have been recently updated to enable the boundaries of any new SSSIs to be drawn to account for 'likely future change' to account for coastal processes such as erosion and to make the sites series more resilient to climate change (Rees *et al*., 2019).

Aim 3: Healthy Places for People

Aim 3: Progress towards meeting the aim

Whilst work has continued for Public Service Boards (PSBs) across Wales since the publication of the wellbeing plans, there are multiple opportunities for the PSBs to explore and address opportunities to maximise benefits from the marine and coastal environment around Wales (Ibrahim 2020).

3.1 Flood Defence

Coastal defences help to make coastal communities a safer place to live. Almost a quarter of the Welsh coast is eroding (Eurosion, 2004) and over the next 100 years, 2,126 properties are expected to be at risk from coastal erosion. Currently coastal flooding is a risk for 62,300 residential properties and 8,750 non-residential properties in Wales. An estimated £3 billion of damages were avoided during the winter of 2013/14 thanks to our network of coastal defence infrastructure. However, over the medium to long term, the on-going maintenance needs of flood defences is a challenge and, in some cases, may be economically and physically unviable.

3.2 Climate change

Carbon sequestration and storage helps to regulate the increased CO_2 contributing to climate change. Coastal margin habitats, particularly saltmarsh hold significant stocks of carbon; a recent study has shown that Welsh saltmarshes hold up to 50 t C ha^{-1} in the top 10 cm of soil (Ford *et al*.,2019) and sequester 6,397 tonnes per year (Armstrong, (2020).

If current trends of habitat loss continue, the capacity of the coastal habitats within the UK (sand dune, saltmarsh and machair combined) both the ability to sequester and store CO_2 will be significantly reduced, with a reduction in value of around £0.25 billion (2000-2060; 3.5% discount rate) (Beaumont *et al.,* 2014).

3.3 – 3.7 Cultural services

LANDMAP (NRW 2020) indicates a pattern of high and outstanding landscape evaluations in the coastal zone. Excluding built up or wooded parts, landscape value was recorded in 2020 as being Outstanding (35%), High (56%), moderate (8%) and Low (0%) (White et al., 2020).

Coastal landscapes provide the greatest financial value in terms of tourism and leisure (Jones et al., 2011) Large sections of the Wales Coast Path run along the coastal

margin habitats. However, coastal communities are some of the most deprived in terms of economy, health and education in the UK. (Corfe, 2017).

Aim 4: A Regenerative Economy

Aim 4: Progress towards meeting the aim

Sustainable Agriculture

4.1 Livestock grazing for agriculture is carried out, primarily on saltmarsh, cliff tops habitat and sand dune. Many of the coastal vegetation communities are reliant on appropriate levels of livestock grazing for maintenance. Saltmarsh can provide valuable grazing including the production of 'saltmarsh lamb', a premium product for Wales.

4.2 Saltmarshes play an important nursery role for some species of fish.
Sea bass: in 2018, landings into the UK by UK vessels were valued at £4.3 million (MMO 2019). The existing extent of UK saltmarsh is probably insufficient to fulfil demand for certain fish types. If the extent and/or condition of this habitat declines further, and fish stocks are not managed sustainably, the future integrity of this natural capital stock may be compromised (UKNEA, 2014). There is a lack of evidence of the scale of the contribution of Welsh saltmarshes make to this role.

Nature Based Solutions for Erosion and Flood Defence

4.3 Natural flood defences are provided by coastal habitats: sand dunes and shingle banks provide barriers to flooding and saltmarsh fronting sea defences reduces the erosive forces of the sea by absorbing some of the wave energy (Möller, 2014). This can help reduce the need for hard engineered sea defences and flood defence maintenance.

4.4 There are a small but growing number of examples of the use of beneficial use of dredged materials within Wales for example, beach nourishment at Talacre (Coastal Engineering UK Ltd., 2011).

The coastal zone can provide a shared focus at all levels of society which encourages community cohesion. The human desire to be near coastal waters is an innate aspect of both human settlement choices and leisure behaviour (Kelly, 2018).

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