ECOSTRUCTURE

Climate Change Adaptation through Ecologically-Sensitive Coastal Infrastructure

POLICY BRIEF: WALES

Policies and Legal Instruments Supporting the Eco-Engineering of Marine Artificial Structures in Wales

Developed by the **Ecostructure** project

ecostructureproject.aber.ac.uk

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1 Protecting the Welsh Coastline

Stretching some 2740km, Wales' vast coastline is already seeing the impacts of climate change. Rising sea levels and coastal erosion are particular pressures to which the Welsh coastline and its coastal communities are not yet environmentally, socially or economically resilient. With 60% of the population living at or near the coast, an estimated 245,000 properties along the Welsh coast stand at risk of flooding from rivers, the sea, and surface water.[1]

Protecting coastal communities from these pressures has increased the need for coastal defence structures to protect the places people live and to facilitate economic activity at the coast.[2] However, the traditional model of coastal defence in Wales has relied on hard artificial structures such as seawalls and groynes (also termed 'grey-infrastructure'). These artificial coastal structures come at the expense of natural coastal habitats and the ecosystem services they provide – including their ability to serve as natural flood defences. To meet the needs of our coastal communities, economies, and environments, urgent discussions are therefore needed about the effectiveness – both financial and ecological – of traditional coastal defences, and how new infrastructural approaches that use nature-based solutions can mitigate the impacts of climate change with less cost to the environment.

ABOVE

Ecostructure researchers prepare to scan a seawall in Nefyn, Wales.

AUTHORS

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Read more Ecostructure publications at ecostructureproject.aber.ac.uk/publications

2 Nature-based Solutions

Nature-based solutions are innovations that are inspired and supported by nature that are cost-effective and provide environmental, social and economic benefits, helping to build resilience[3]. Nature-based solutions bring diverse, natural features and processes back into landscapes and use nature's complex system processes in order to achieve desired outcomes, such as reduced flooding or erosion risk.

Nature-based solutions (NbS) and Natural Flood Management are two important policy directions in Wales, forming a key part of the national approach to Flood and Coastal Erosion Risk Management (FCERM). The 2020 FCERM policy statement for Wales calls for the use of nature-based solutions in the upgrade and expansion of national flood defences and infrastructure.[4] NbS – along with hybrid approaches such as 'green-grey infrastructure' – are also being actively promoted across Welsh environmental legislation and coastal management policies. Both the Welsh Natural Resources Policy 2017 and the Welsh Marine Area Statement 2022 include the delivery of nature-based solutions as one of three national priorities. The latter outlines a vision in which "Wales has a sustainable and resilient coastline through the delivery of coastal adaptation in line with Shoreline Management Plans and nature-based solutions as a part of coastal management wherever possible."[5] Together, these policies provide a pathway for the delivery of nature-based solutions such as ecological engineering within coastal and marine infrastructure works.

BELOW:

Adding crevices to the surface of artificial coastal structures can provide shelter for coastal organisms like sea snails, barnacles, and seaweeds.

3 Eco-Engineering for Coastal Defences

Ecological engineering, or **eco-engineering**, is one pathway to bring nature-based solutions into coastal protection. Eco-engineering is the design and implementation of beneficial environmental enhancements into engineered structures to the benefit of both human society and the natural environment.[6] [7] [8] [9] [10] The uptake of eco-engineering designs, from green roofs to engineered wildlife corridors that pass over motorways, has steadily progressed as recognition of its environmental, economic, and well-being benefits has spread. When applied to artificial coastal structures like seawalls, piers, rock groynes and jetties – structures that support human activities or protect coastal communities and landscapes from erosion or storm surges – eco-engineering can add structural, economic, and/or social value.[11] [12] [13]

ABOVE:

An artificial rock pool added onto a seawall provides shelter for marine life when the tide goes out.

While hard coastal structures often replace and disrupt complex natural habitats and processes, adding or building in eco-engineering enhancements can help mitigate some of the harmful impacts of artificial coastal structures and enhance the biodiversity found on them[14]. Such enhancements can either be retrofitted to an existing structure or incorporated into the development of planned structures, and include designs such as artificial rock pools; the addition of textured surfaces, pits and crevices; and habitat units that target specific species of interest.

4 The Ecostructure Project

A five-year research project examining eco-engineering enhancements for marine artificial structures

ABOVE:

Ecostructure researchers at Swansea University prepare to launch a unit designed to provide habitat for lobsters at an offshore wind farm.

Ecostructure, a research project part-funded by the European Regional Development Fund (ERDF) through the Ireland Wales Cooperation Programme 2014-2020, brought together five leading universities in Wales and Ireland to research and raise awareness of eco-engineering solutions to the challenge of coastal adaptation to climate change in the Irish Sea.

Ecostructure has generated new evidence for eco-engineering approaches that improve the value of artificial structures as habitats for marine wildlife. These approaches – such as mountable rock pools, the addition of texture on concrete surfaces, and habitat units that act similarly to nest boxes – can also introduce secondary benefits to marine artificial structures for coastal communities, such as:

- green spaces for public well-being
- habitats for commercially-important fish and shellfish
- water quality and nutrient cycling
- and more.

LINKS

View Ecostructure's tools and outputs.

View publications on eco-engineering.

As part of Ecostructure, a review of the regulatory landscape relevant to coastal infrastructure was conducted to identify pathways through which coastal eco-engineering could be incorporated in Wales. Through this work we identified legal

requirements, policies, and management practices that could support the uptake of eco-engineering in planning while simultaneously aligning with Welsh/UK policy on biodiversity and climate change adaptation. The findings of this review are summarised in this brief.

5 Welsh Legislation and Policies to Support Eco-Engineering of Coastal Structures

Various legislation and policies may be used to justify and support eco-engineering projects and approaches. The most relevant have been described below to encourage the uptake of eco-engineering enhancements and projects in Wales.

5.1 FCERM Legislative Framework

CONSERVATION EVIDENCE

Read Ecostructure's synopsis of the current evidence on eco-engineering.

- Explore Online
- View the Report
- Watch the Video

Flood and Coastal Erosion Risk Management (FCERM) is a key avenue through which eco-engineering enhancements may be delivered in coastal protection. While there is no statutory duty to protect against flooding or coastal erosion, authorities exercise permissive powers. However, FCERM governance in Wales is complex and spread across a range of public, private, and third sector actors, including civil society. Today, FCERM is delivered by a number of organisations, including 28 Risk Management Authorities, which must work together on FCERM activities. These Risk Management Authorities include Natural Resources Wales, 22 Local Authorities, four water companies, and the Welsh Government (e.g. for schemes and reporting).

Natural Resources Wales is responsible for managing all flood risk originating from rivers and the sea and has a strategic oversight and general supervisory role. For coastal defences, ownership is split between Natural Resources Wales, Local Authorities and private owners (e.g. the Crown Estate, National Trust, infrastructure providers such as Network Rail, and private citizens).

5.2 Governing Legislation

Objectives and regulatory measures incorporated under the following legislation may be useful in support of agencies, developers, or public bodies who may wish to incorporate an eco-engineering proposal into their planning activities.

- The National Strategy for Flood and Coastal Erosion Risk Management in Wales 2020 prioritises investment to the most at-risk communities. Objective C acknowledges the importance of green-grey interventions in flood alleviation and coastal erosion, and calls for the use of green-grey interventions such as bolt-on rockpools to improve the biodiversity, ecology and aesthetics of engineered structures, whilst maintaining the integrity of defences. The FCERM Business Case Guidance encourages the inclusion of wider benefits in flood defence schemes, for example economic gain and environmental and social improvements.

- The Flood and Water Management Act 2010 requires that local authorities consider sustainability in developing solutions and work with natural processes to enhance the environment where possible.

- The Marine and Coastal Access Act 2009 establishes a framework for development activities in marine conservation zones and for planning in both inshore (from the High-Water Spring Tide Mark to the 12 nautical miles limit of territorial waters) and offshore (up to 200 nautical miles) areas. Through this regulatory mechanism, eco-engineering can be included in marine licensable activities to aid in meeting environmental goals.

- The Coast Protection Act 1949 provides for executing measures against erosion and encroachment of the coast. Such works relate to construction, alteration, improvement, repair, maintenance,

BIOPREDICT

BioPredict is an Ecostructure tool that helps predict the biological communities that will be supported by proposed new artificial structures on the coast of the Irish Sea.

Explore the Tool

ECOSTRUCTURE MAPPING REPOSITORY

Ecostructure produced GIS maps of 3405 artificial structures and 1260 coastal flood defences on the Irish and Welsh shores of the Irish Sea, indicating the current extent of coastal hardening and providing a basis for predicting further developments in response to climate change.

Request maps here.

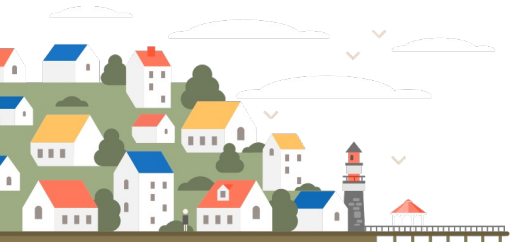
demolition, or removal works for protecting land against encroachment or erosion by the sea. Development above the low water mark requires planning permission under the Town and Country Planning Act 1990. Works that combat erosion and are capable of altering the coast fall under the remit of the Town and Country Planning Regulations 1999. Coastal Erosion Risk Management Authorities have permissive powers to carry out coastal protection works under this act – subject to approval by Natural Resources Wales.

- The proposed UK Environmental Bill, which is currently in the reporting stage in the House of Lords, presents a unique opportunity for eco-engineering to be promoted within national infrastructure developments, in line with flood and coastal erosion risk management strategies.

- The Well-being of Future Generations Act outlines 7 well-being goals that can be used to support the justification for eco-engineering projects aimed at enhancing the coastal built environment and brings benefits to wildlife and communities. FCERM projects carried out under the Coastal Risk Management Programme scheme should identify and achieve wider benefits in line with the Well-being of Future Generations Act 2015. For example, the inclusion of biodiversity enhancements and provision of habitats in coastal defence works would meet this recommendation.

- Environment Wales Act tasks public authorities to 'maintain and enhance biodiversity'. Part 1.7 of the Act requires the compilation of biodiversity lists (habitats and species) and a corresponding duty to maintain and enhance biodiversity. Eco-engineering interventions could be targeted towards habitats and species listed within the associated Annex.

Part 1, Section 22 of the Act establishes that statutory requirements may be conferred exemptions in the case of 'experimental schemes', defined as those which *"develop or apply new or modified methods, concepts or techniques"* or *"develop or test proposals for regulatory change"*, including inquiries and investigations. Eco-engineering interventions may be considered under this scale and thus reduce regulatory burden.



PUBLICATIONS

Read peer-reviewed research, reports, and guidance documents produced by Ecostructure.

Our Publications

Part 7 of the Act establishes the Flood and Coastal Erosion Committee, which advises Welsh Ministers on Flood and Coastal Erosion Risk Management. The Act grants Welsh Ministers with the powers to suspend certain statutory requirements in order to enable experimental schemes that support the Sustainable Management of Natural Resources. For example, eco-engineering interventions within FCERM schemes could benefit from this simplified planning and consenting processes.

- Shoreline Management Plans (SMPs) are non-statutory, high-level policy documents for coastal FCERM planning. Within the scope of SMPs, ecological engineering interventions are suitable for Hold the Line, Managed Realignment, and Advance the Line policies. There are four SMPs specific to the Welsh Coast:

  - Anchor Head to Lavernock Point (Severn Estuary, Monmouthshire Council)
  - Lavernock Point to St Ann's Head (South Wales, Carmarthenshire)
  - St Ann's Head to Great Ormes Head (West of Wales, Pembrokeshire)
  - Great Ormes Head to Scotland (Northwest England and North Wales, Blackpool Borough)

These SMP regions can serve as a roadmap to identify coastal defence infrastructure that may suitable for eco-engineering interventions.

RIGHT:

Ecostructure researchers and stakeholders discuss eco-engineering opportunities in Wales.

5.3 Planning Policies Related to Eco-Engineering

Generally, the planning system and associated policy in Wales supports the integration of biodiversity conservation and ecological improvement in the coastal zone, providing opportunities for the uptake of eco-engineering. The following policies are particularly relevant, and may provide justification for eco-engineering interventions and projects.

Planning Policy Wales requires for planning authorities to compensate for biodiversity losses where damage is unavoidable by an infrastructural project. Section 6.4.21 specifies within its mitigation hierarchy that compensatory measures that support national and regional targets for biodiversity enhancements through habitat restoration and creation must be sought by planning authorities. Therefore, it will be of particular benefit to grey-green project groups to identify nature improvement areas, nature action zones, and living landscapes where eco-engineering interventions may be suitable.

Planning Policy Wales also requires that planning authorities maintain and enhance biodiversity in the exercise of their functions, calling for developments to provide a net benefit for biodiversity. A letter from the Welsh Government to the Heads of Planning (2019) clarifies that "where biodiversity enhancement is not proposed as part of an application, significant weight will be given to its absence, and unless other significant material considerations indicate otherwise it will be necessary to refuse permission."

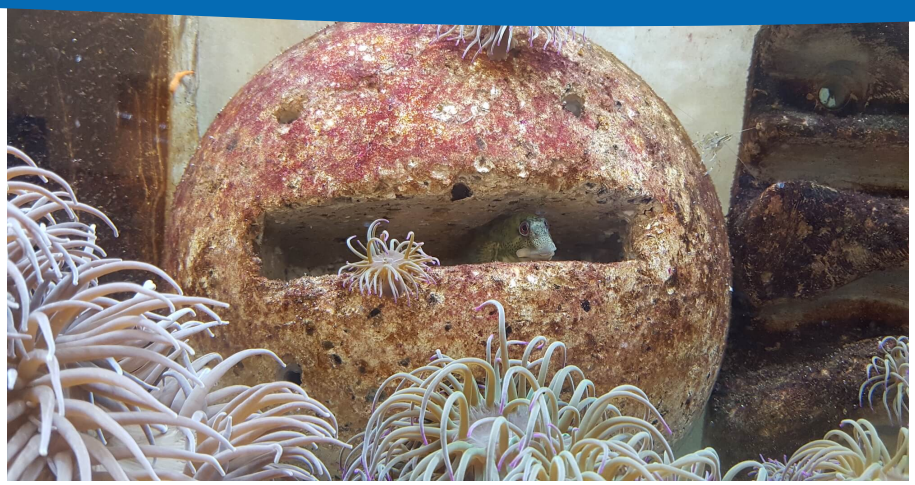
The policy also clarifies that "government resources for flood and coastal defences are directed at protecting existing developments and are not available to provide defences in anticipation of future developments". This signals that the only

EF PREDICT

Ecostructure's EFPredict can be used to predict the ecosystem functions of biological communities supported by artificial structures, from which it's possible to infer the ecosystem services that they might provide.

Explore the Tool

Ecostructure created experimental tiles that mimic the surfaces of natural rocky shores to see whether this surface texture might improve hard structures as homes for wildlife. At right, the tiles are shown before and after 18 months.



ABOVE RIGHT:

A prototype letterbox crevice unit providing shelter to a blenny.

type of suitable eco-engineering interventions of coastal structures will be in the form of retrofitting. Section 6.6.28 recommends that nature-based solutions should be the first type of intervention to be considered when improving flood defences in coastal and or/riverside locations.

5.4 Natural Resources Wales (NRW)

Natural Resources Wales (NRW) is tasked with the delivery of sustainable management of natural resources, with particular duties relating to biodiversity and ecosystem resilience. They are also responsible for managing flood risk originating from rivers and the sea. NRW thus has a unique remit with strategic oversight, and in this supervisory role they have been promoting and supporting the Ecostructure project since its start, while championing the use of coastal eco-engineering approaches in Wales.

Through a review of the four Welsh Shoreline Management Plans, NRW has identified areas using a 'Hold The Line' management policy where eco-engineering may be best suited. Here the incorporation of eco-engineering is not explicitly embedded within the policy designation but is highlighted as a viable approach, which is put forward for the consideration of stakeholders and coastal managers.

Stakeholder engagement – specifically with 'Coastal Groups' responsible for the production of Shoreline Management Plans, their implementation and monitoring – play a crucial role in the

EDUCATIONAL RESOURCES

Browse and download educational resources that have been produced as part of Ecostructure, including videos, fact sheets and field guides, and our best practice newsletters.

Explore Resources

LARVAL DISPERSAL TOOL

Our online larval dispersal tool uses hydrodynamic models to model dispersal of larvae from coastal locations in the Irish Sea, providing insights into the potential future spread of both native and non-native species.

Explore the Tool

delivery of coastal adaptation policy and plans. Liaising closely with stakeholders and Coastal Groups for increased awareness of eco-engineering solutions. Collaboration and engagement can realise eco-engineering interventions that incorporate diverse stakeholder expertise, local knowledge and local community support.

One of the key issues identified by the Welsh Coastal Groups Forum is the delivery of compensatory habitats and habitat creation through coastal schemes. In a recent 'refresh' of the Shoreline Management Plans, supplementary guidance was provided by NRW on their implementation, taking into account new legislation, climate change data, and planning guidance developments. The results from this review can be used to guide areas of intervention to further support eco-engineering uptake through SMPs.

7 Funding

The Coastal Risk Management Programme (CRMP) is an annual capital programme which provides bid funding to Risk Management Authorities for delivering capital works to reduce the risk of flooding and coastal erosion. This programme offers 100% funding for Natural Flood Management schemes and Natural Resources Wales (NRW) schemes, which presents a financial opportunity for the uptake of eco-engineering approaches.

FCERM projects carried out under the Coastal Risk Management Programme scheme should identify and achieve wider benefits in line with the Well-being of Future Generations Act 2015. For example, the inclusion of biodiversity enhancements and provision of habitats in coastal defence works would meet this recommendation.

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