

To whom it concerns,

This response letter from the British Geological Survey (BGS), and feedback within, relate to the enquiry by the Ocean Conservation All Party Parliamentary Group (AAPG) into ocean-based solutions to climate change, and the role of blue carbon. Several representatives from the BGS have compiled the below feedback, with combined expertise in active coastal dynamics, the geological character of the UK's seabed and shallow sub-surface, and organic geochemistry (with specific focus on carbon behaviour).

We have arranged our feedback by providing answers to specific questions asked by the AAPG, and have only addressed those questions that we have relevant expertise and significant experience. We're happy to provide further information if required.

Many thanks,
Dayton Dove
Marine Geoscientist
British Geological Survey
dayt@bgs.ac.uk

Feedback submitted via email to: contact@oceanappg.org

BGS responses below in [blue](#)

AAPG Questions:

1. What role can ocean-based solutions play in tackling climate change?

Ocean-based solutions can play a role in both mitigating and adapting to climate change around the world coastal communities that are facing an unprecedented challenge in responding to sea level rise and associated changes. For many, responding through incremental adaptation and action may be appropriate (although not without limits). This may include progressively raising defences, nourishing beaches, and other conventional management measures. Such actions are well supported by existing governance structures and investment vehicles. For others however, continuing to provide protection from flooding may not be technically feasible or financially viable. For these communities, transformational adaptation will be needed (including realignment or relocation). Implementing transformational change, however, is difficult and requires a clarity of long-term planning and a means of supporting communities to take early action in making this transition. Sayers et al. (2022, [DOI](#)) explores the scale of the transformational challenge in England through to 2100. The combined influences of relative Sea Level Rise and the local lowering of the foreshore platform due to increased wave-driven surface erosion are considered. The realism of published shoreline policies (set out within England's Shoreline Management Plans) are assessed based on projected changes in flood risk and benefit-cost considerations. The assessment suggests 1,600–1,900 km (~30 per cent) of England's shoreline currently designated as a 'Hold-the-Line' policy is likely to see increasing pressure to realign (assuming a rise in Global Mean Surface Temperature of between 2 and 4 °C by 2100) with implications for ~120,000–160,000 residential and non-residential properties by the 2050s. It is likely that a proportion of these properties will require relocation. It is not possible to say how many this will be. This will be a matter for government, and the associated policy and funding priorities it decides as a consequence will influence local outcomes. In this context, ocean-based solutions play a key role in the urgent need of transformational adaptation in responding to the increasing risk of flooding and coastal erosion in England and worldwide.

2. Do you feel that the Government is doing enough to support blue carbon and blue carbon projects? What action would you like them to take?

More action could be taken to better characterise carbon in the marine environment, both within the water column, and the sediments that host significant amounts of carbon. In order to accurately predict the behaviour and evolution of carbon within sediments, and to actively manage this resource, it is key to first characterise the existing carbon within the UK's dynamic marine environment. Existing science relating to UK waters is very immature. This has led to highly variable predictions of carbon stock within marine sediments. Beyond quantifying carbon stocks, it is also important to understand the variable stability of this carbon, which depends both on the source of the carbon and the sedimentary environment in which it's found.

In order to ensure effective management of our blue carbon resources, more support for fundamental and baseline mapping of the seabed environment, together with a suite of geochemical and molecular analyses, should be considered in a number of exemplar areas.). Better understanding of the stocks and behaviour of marine sedimentary carbon is a highly achievable task. This will require support of a multi-disciplinary approach that includes geochemistry, acoustic mapping, oceanography, sedimentology and geomorphology, together with spatial modelling and statistics.

3. What kinds of ocean/nature-based solutions would you like to see implemented and how would they benefit a) coastal communities, b) flood prevention, and c) tackling climate change?

Defra quick scoping review on coastal Nature Based Solutions (NBS) since 2017 has been published in early August ([URL](#)). The findings show examples of successful implementation of coastal NBS using coastal wetland, beach, dune, and reef ecosystems, and for using NBS alongside hard structures. The research found that there are common enablers and best design practices for using each of these types of NBS. These include suitable size and conditions to allow for the establishment of natural processes and enabling legislation and finance models. The review highlights developments in the evidence base for better modelling of coastal wetlands and dune NBS, developments in specific guidelines for best practices, and a drive to better define economic value for the range of ecosystem services provided by coastal NBS. Case studies demonstrate approaches to using NBS. There remains a need to gather this evidence and standardise monitoring and evaluation metrics. A further review of tools and methods to assess the efficacy of coastal NBS is recommended, alongside continued engagement with local, regional, and national actors. The learnings from this report have important lessons for planning, implementation, monitoring, and evaluation of projects using NBS for flood and coastal erosion risk management (FCERM).

4. Do you feel that there is enough funding and support for research into how the ocean absorbs carbon?

We have no specific comment on level of funding. However, we do consider that a greater proportion should be directed towards baseline mapping of the seabed environment. The UK lags behind many other countries in this regard, in terms of surveying the fundamental bathymetry (topography) of the seabed. This activity requires supporting secondary characterisation of the seabed environment (e.g. sediment composition, shallow geological character, and seabed vulnerability (function of variable geological character and oceanographic forcings). This information is essential if we are to accurately forecast and manage carbon in the marine environment.

The BGS has recently begun a project undertaking detailed mapping of seabed geology in select areas. This project however could be easily scaled up, in collaboration with further UK

marine science bodies (e.g. UKHO, JNCC, Cefas), to deliver excellent thematic mapping and characterisation of the UK 's seabed environment.

5. What is the net benefit (carbon stored minus carbon used) for each Blue Carbon approach and for how long is the carbon stored in the ocean in each case?

No response at present.

6. Do you agree with the recommendation by the Lords Science and Technology Committee, in its report "Nature-based solutions: rhetoric or reality?", that blue carbon mapping is needed in the UK's exclusive economic zone?

We agree, based on our expertise of coastal dynamics, geochemical studies of estuarine and marine carbon, and our general knowledge seabed and sub-surface environment around the UK. The fate and behaviour of carbon in the marine environment is complex, and sedimentary carbon is known to be both a significant store, but also potential source of organic carbon if disturbed and lost to the water column/atmosphere. Efforts to forecast changes in blue carbon, and to manage this resource will be fundamentally flawed if the existing carbon stock is not better constrained. To do this we need to better understand the distribution, source, relative stability of this carbon within a varied and dynamic sedimentary environment.

7. What additional benefits might the implementation of nature-based solutions in the marine environment bring such as skills training, capacity-building, sustainable development, and job creation?

No response at present.

8. Carbon dioxide removal (CDR) ideas are also being discussed for the open ocean, beyond the continental shelves, as well as for the coastal zone (e.g., US National Academy report). How do the benefits, risks and costs compare if CDR techniques were applied to each of these parts of the marine system?

No response at present.

9. How do the lack of verifiable standards of data and scientific evidence hinder investments in blue carbon projects across coastal and deep ocean components of the marine ecosystem?

No response at present.

10. What kinds of engineering solutions could contribute to scaling up and increasing the feasibility of nature-based solutions in marine environments?

Along the coast of Great Britain, Northern Ireland and UK Overseas Territories, engineering solutions that could make NBS feasible in the long term are likely to be site-specific. In the context of an urgently needed transformational adaption pathways, we should see in the incoming years a transitional period where both hard engineering and more novel NBS will co-exists. The efficacy of the hybrid solutions will be determined against the level of protection that they provide locally and in present times, but also regionally and over time under different climate and development pathways scenarios. This will require to better understand how land, rivers, oceans, the sea bed, atmosphere and humans act in combination, and all these components play into coastal flooding and erosion today and by 2100 and beyond. The UKRI project on UK Coastal Hazards, Multi-hazard Controls on Flooding and Erosion ([CHAMFER](#), 2022-2027) will provide tools to analyse the efficacy of future NBS; work with government departments, public sector organisations, and industry users to inform and support coastal adaptation and resilience-building options.