The British Academy

House of Lords Science and Technology Select Committee inquiry on Nature-based Solutions for Climate Change

Evidence from The British Academy, September 2021

1. The British Academy, the UK's national academy for the humanities and social sciences, welcomes the opportunity to respond to the select committee's inquiry on Nature-based Solutions for Climate Change. The Academy has undertaken a range of work on the theme of Nature-based Solutions (NbS) in the lead up to COP26. This work has involved collaboration with the other UK National Academies and UKRI, as well as a range of researchers, practitioners, and policy makers from across the world. As part of our COP26 Briefing Series the Academy expects to publish a series of briefings on specific aspects of NbS (connections to the Green Economy; at the intersection of biodiversity and climate change; just and ethical implementation). The Academy will also launch an interactive platform of NbS initiatives ready for at COP26, working with experts at NbSI and CEU. In this response we set out some of the insights which have emerged from the evidence reviewed during this work.

2. NbS has considerable potential and should be seen as central to the UK's efforts to achieve net zero alongside technological developments. NbS also have the potential to make an important contribution to decarbonisation in the UK and internationally. NbS can help to mitigate climate change through, for example, sequestering carbon and keeping it out of the atmosphere.[1]

3. One particularly important form of NbS is coastal habitat restoration. This is interesting in terms of the geographical distribution of the restored habitats and the relative local versus global impact of such NbS approaches. On a 'per hectare basis', coastal saltmarshes, for example, sequester more carbon than tropical rainforests, but in terms of the area occupied by these habitats globally, the latter are far more extensive. The former, however, are more ubiquitous across all latitudes and thus the restoration effort (geographical spread of restoration effort) can arguably be more directly distributed more equitably across countries globally. These relatively 'softer' and 'more dynamic' coastal management options thus fulfil a critical element of our societal transition towards an already altered climatic and sea state over the short to medium term.[2]

4. The UK coast is changing due to accelerating sea-level rise and coastal erosion, resulting in loss of intertidal habitats and increasing pressure on existing flood defences. The Essex coast in south-east England has lost 91% of its intertidal salt marsh over the past

[1] R. Lal, (2004) 'Soil carbon sequestration to mitigate climate change', *Geoderma*, Volume 123, Issues 1–2, p. 1-22, https://doi.org/10.1016/j.geoderma.2004.01.032.
[2] A. Burden, A. Garbutt, C. D. Evans, (2019) 'Effect of restoration on saltmarsh carbon accumulation in Eastern England', *Biology* Letters, Volume 15 http://doi.org/10.1098/rsbl.2018.0773.

400 years due to past land claims for agriculture and increasing coastal erosion and sea-level rise. Wallasea Island was enclosed in sea walls and used for grazing marsh until it was drained and converted to arable land in the 1930s. The site is in an important estuary for biodiversity, close to the Thames Gateway – one of Europe's largest economic regeneration areas. Between 2009 and 2016, the Royal Society for the Protection of Birds (RSPB) undertook a managed realignment on the site to restore intertidal habitat, creating more space for sea water in the estuary and access for visitors. More than 3 million metric tonnes of earth were brought by boat from the tunnels of a large rail infrastructure project in London to help create a 115 ha intertidal area of saltmarsh, islands and mudflats. The reserve covers more than 740 ha, two-thirds of which have now been transformed from arable farmland to saltmarsh, mudflats, lagoons and grazing marsh. Visitor numbers for 12 months to end March 2017 were 21,000, representing a 40% increase on the previous year. Wallasea Island is now a wildlife-rich habitat and a popular site for people to visit.[3]

5. NbS can help us to adapt to the effects of climate change by reducing harm and damage from extreme events such as flooding, sea level rise and extreme heat events. This is especially so through the linked processes of ecosystem-based adaptation and ecosystem-based disaster risk reduction. 'Managed realignment' refers to the restoration of natural foreshores where land reclamation for agriculture or other human land use has caused the loss of intertidal ecosystems. In most cases, this means in practice that reclaimed land is released back into the intertidal zone by breaching constructed sea defences and river levees, but it could also be seen as part of what might/can be more widely defined as 'nature-based coastal management'. This might include the creation of a wider ('seaward realigned') shoreline through the artificial delivery of sediment to the nearshore region, as has been attempted in some NW European large-scale beach / dune nourishment schemes (e.g. the 'Zandmotor' in The Netherlands or the 'Sand Engine' on the Norfolk coast of the UK).[4] Managed realignment can thus be seen as a NbS to the challenges arising from rising sea levels and accompanying elevated coastal flood and erosion risk, as well as biodiversity loss, and increased atmospheric CO2 concentrations. It also addresses the need to provide 'blue-green' spaces that support human health and wellbeing.

6. NbS provides a clear bridge between biodiversity and climate change action and bringing these agendas together is key. NbS can also provide a much wider range of benefits, which can create a society that is resilient and better placed to cope with climate-related shocks and stresses). These may include biodiversity conservation as a basis for healthy ecosystems; food security; and health, wellbeing and social connectivity.[5]

7. There is increasing evidence that urban nature can provide a range of benefits to human health and well-being and can significantly reduce urban heat and ameliorate pollution.[6] Other beneficial contributions provided by NbS include food provision, carbon sequestration, water purification, artistic inspiration, aesthetic enjoyment, religious and

[3] RSPB, (2020), https://www.rspb.org.uk/our-work/casework/cases/wallasea-island/; P. Dasgupta, (2021), *The Economics of Biodiversity: The Dasgupta Review.* (London: HM Treasury) p. 458.
[4] F. Staudt, R. Gijsman, C. Ganal, *et al.* (2021) 'The sustainability of beach nourishments: a review of nourishment and environmental monitoring practice', *Journal of Coastal Conservation* Volume 25, Issue 34 https://doi.org/10.1007/s11852-021-00801-y; V. Vikolainen, J. Flikweert, H. Bressers, K. Lulofs, (2017) 'Governance context for coastal innovations in England: The case of Sandscaping in North Norfolk', *Ocean & Coastal Management,* Volume 145, pp.82-93, https://doi.org/10.1016/j.ocecoaman.2017.05.012.
[5] C. M. Raymond, N. Frantzeskaki, N. Kabisch, P. Berry, M. Breil, M. Razvan Nita, D. Geneletti, C. Calfapietra, (2017) 'A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas', *Environmental Science & Policy*, Volume 77, pp. 15-24, https://doi.org/10.1016/j.envsci.2017.07.008.
[6] F. Aram, E. Higueras García, E. Solgi, S. Mansournia, (2019) 'Urban green space cooling effect in cities', *Heliyon*, Volume 5, Issue 4, https://doi.org/10.1016/j.heliyon.2019.e01339; M. van den Bosch, Å. Ode Sang (2017) 'Urban natural environments as nature-based solutions for improved public health - A systematic review of reviews'. *Environmental Research* doi: 10.1016/j.envres.2017.05.040.

spiritual fulfilment, as well as the promotion of social cohesion, a sense of identity and the support to the local economy (e.g. nature-based tourism).[7]

8. NbS must be delivered across the UK, in rural and urban areas, and have the potential to help deliver government ambitions with regards to levelling up by creating jobs, improving infrastructure, and giving communities a stronger voice over local assets. NbS also have an important role to play in resilience and recovery from the COVID-19 pandemic. Indeed, recovery from shocks and stresses can be a moment for 'building back greener'. One aspect of this is to consider more fully how natural and semi-natural spaces can be embedded within planning and policy at local and national levels to help to build societal resilience, and support a just transition to a net-zero society.

9. There are a range of key stakeholders for the implementation of NbS in the UK, especially across the intersection of NbS, green jobs, and a just transition. Restoration of nature and NbS protects many existing jobs which are threatened by the increasing frequency and severity of natural disasters and impacts of climate change on productivity and working conditions.[8]

10. The Green Alliance Policy Insight on Levelling Up through Nature identifies two broad categories of NbS-based jobs: degree-level managerial and planning positions; and entry-level vocational and technical positions.[9] Skills gaps in ecology, engineering, financing and vocational qualifications will need to be identified and filled.

11. NbS need to be planned and monitored at the national and local level to ensure net zero goals are met. NbS should be designed, implemented, managed and monitored by or in partnership with local communities through a process that fully respects and champions local rights and knowledge, and generates local benefits. NbS are often closely associated with places and the local communities who manage and use the sites, and benefit from some of the resulting ecosystem services. In common with the conservation of our natural assets, community and civil society engagement and good governance is essential to bring together the breadth of experiences and knowledge across institutions.[10]

12. The implementation of NbS should be integrated with other government policies for landscapes and seascapes, for example, agricultural, forestry, and land-use planning policies. COP26 is a good starting point to implement a more systemic approach to NbS, with initiatives like the Forest Agriculture and Commodity Trade (FACT) dialogue which have the potential to connect NbS and the need to transform unsustainable patterns of production and consumption.[11]

13. Scientific uncertainties persist in understanding the effects of NbS and their inclusion in carbon accounting. A major barrier to achieving this is the lack of comprehensiveness in current carbon accounting which has focused on flows rather than stocks of carbon and led to perverse outcomes. Keith et al propose a new approach to carbon accounting based on the whole carbon cycle, covering both stocks and flows, and linking changes

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[7] IPBES (2018), 'The IPBES Assessment Report on Land Degradation and Restoration', L. Montanarella, R. Scholes, and A. Brainich eds., *Secretariat of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services*. (Bonn: IPBES Secretariat); G. Naumann, L. Alfieri, K. Wyser, L. Mentaschi, R. Betts, A., Carrao, H., et al. (2018). 'Global changes in drought conditions under different levels of warming'. *Geophysical Research Letters*, Volume 45, pp. 3285– 3296. https://doi.org/10.1002/2017GL076521

[8] ILO (2018), *World Employment and Social Outlook 2018: Greening with Jobs*; Dasgupta, *The Economics of Biodiversity,* p. 459.

[9] Green Alliance, 2021 https://green-alliance.org.uk/resources/Jobs_for_a_green_recovery.pdf

[10] Dasgupta, *The Economics of Biodiversity*, p. 457; Hughes, T. P., M. L. Barnes, D. R. Bellwood, J. E. Cinner, G. S. Cumming, J. B. C. Jackson, J. Kleypas, I. A. van de Leemput, J. M. Lough, T. H. Morrison, S. R. Palumbi, E. H. van Nes, and M. Scheffer (2017), 'Coral reefs in the Anthropocene', *Nature,* Volume 546(7656), pp. 82–90; N. Seddon, A. Chausson, P. Berry, C. A. J. Girardin, A. Smith, and B. Turner (2020), 'Understanding the Value and Limits of Nature-Based Solutions to Climate Change and Other Global Challenges', *Philosophical Transactions of the Royal Society* B, 375(1794), 20190120.

[11] https://www.gov.uk/government/news/joint-statement-on-principles-for-collaboration-under-the-forest-agriculture-and-commodity-trade-fact-dialogue

due to human activities with responses in the biosphere and atmosphere following the System of Environmental-Economic Accounting – Ecosystem Accounts (SEEA-EA) framework. They identify enhancements to accounting, namely: inclusion of all carbon reservoirs, changes in their condition and stability, disaggregated flows, and coverage of all land areas.[12]

14. Frameworks for the regulation and financing of nature-based solutions are necessary for NbS to function at scale. For example, deforestation-free supply chains or a redirection of subsidies harmful to biodiversity. Regulatory obligations can also be placed on the water industry, for example when the Environment Agency placed the River Ingol wetland site, run by Anglian Water, under the Water Industry National Environment Programme for AMP6 (2015-2020).[13] An analysis of the benefits of ecosystem restoration considered the capital investment and maintenance costs (94 studies) compared to the monetary value of ecosystem services provided (225 studies). The study found that benefit cost ratios ranged from 0.5:1 (coral reefs and coastal systems, worst-case scenario) to as high as 35:1 (grasslands, best-case scenario) and reported that most of the studies analysed provided net benefits.[14]

15. Economic evaluation of NbS has rarely been conducted. But there are examples we can look to. For example, restored rivers have been shown to provide large benefits. Eight restored rivers in Europe, for instance, were found to provide net social economic benefits over unrestored rivers, of €1,400 ± 600 ha -1 yr -1 associated with an increase in cultural and regulating services, while provisioning services remained the same.[15]

16. There is also emerging evidence that NbS can help with alleviating the effects of extreme weather events like flooding. Analysis of the flood alleviation potential of ecosystem-based adaptation of two river catchments in Fiji found that NbS were more cost-effective than hard infrastructure options. Planting riparian buffer vegetation was the most cost-effective option, yielding benefit-cost ratios of between 2.8 and 21.6. Upland afforestation provided the greatest benefits overall, yielding net present values between 12.7 and 101.8 million Fijian dollars (approximately US$6.1-48.9 million). Of the hard infrastructure options, river dredging provided the greatest benefits, but costs were high relative to the benefits, and the benefits were only accrued in part of the catchment downstream.[16]

17. The Academy expect to publish a series of briefings on specific aspects of NBS (connections to the Green Economy; at the intersection of biodiversity and climate change; just and ethical implementation) as part of our COP26 Briefing Series,[17] and launch an interactive platform of initiatives at COP26.

For further information on this response, please contact Georgina Fitzgibbon, g.fitzgibbon@thebritishacademy.ac.uk

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[12] H. Keith, M. Vardon, C. Obst, V. Young, R. A. Houghton, B. and Mackey, (2021). 'Evaluating nature-based solutions for climate mitigation and conservation requires comprehensive carbon accounting'. *Science of the Total Environment* 769:144341. doi: 10.1016/j.scitotenv.2020.144341

[13] R. J. Cooper, E. Hawkins, J. Locke, T. Thomas, J. and Tosney, (2020), 'Assessing the environmental and economic efficacy of two integrated constructed wetlands at mitigating eutrophication risk from sewage effluent'. *Water and Environment Journal*, 34: 669-678. https://doi.org/10.1111/wej.12605

[14] R. S. De Groot, J. Blignaut, S. Van Der Ploeg, J. Aronson, T. Elmqvist, and J. Farley (2013), 'Benefits of Investing in Ecosystem Restoration', *Conservation Biology*, 27(6), 1286–1293; Dasgupta, P. (2021), *The Economics of Biodiversity,* p.459.

[15] J. E. Vermaat, A. J. Wagtendonk, R. Brouwer, O. Sheremet, E. Ansink, T. Brockhoff, M. Plug, S. Hellsten, J. Aroviita, L. Tylec, M. Giełczewski, L. Kohut, K. Brabec, J. Haverkamp, M. Poppe, K. Böck, M. Coerssen, J. Segersten, and D. Hering (2016), 'Assessing the Societal Benefits of River Restoration Using the Ecosystem Services Approach', *Hydrobiologia*, Volume 769(1), pp. 121–135.

[16] Daigneault, Brown, and Gawith, (2016), 'Dredging versus hedging: Comparing hard infrastructure to ecosystem-based adaptation to flooding', *Ecological Economics*, Volume 122, issue C, pp. 25-35; Dasgupta, P. (2021), *The Economics of Biodiversity*, p.458.

[17] https://www.thebritishacademy.ac.uk/projects/knowledge-frontiers-cop26-briefings/