
EXECUTIVE SUMMARY

INTRODUCTION

Nature-based solutions (NbS) address societal problems in ways that benefit both people and nature. The main focus of this report is the joint role of NbS for addressing the climate and biodiversity crises we currently face. Natural habitats act as NbS for climate if they sequester carbon (contributing to Net Zero targets) or provide adaptation to climate change effects (for example, reducing flooding, protecting coastline against sea-level rise or creating cool spaces in cities). As well as these climate benefits, they can enhance biodiversity, create improved and more resilient ecosystem functioning, enhance human wellbeing

and provide economic benefits, in terms of monetary value and job creation. Despite the huge range of benefits NbS have, they should be seen as complementary to other climate and conservation actions, not as a replacement to them.

This Executive Summary provides five key themes which emerge across the report, across the multiple habitats and multiple NbS studied. Six 'priority' habitats for NbS are given at the end of the summary. However, we emphasise that all habitats covered in the report can act as NbS and all can play a role in addressing the climate and biodiversity crises.

FIVE OVERARCHING THEMES:

1. NATURE-BASED SOLUTIONS FOR CLIMATE AND NATURE

NbS enable nature to help resolve the problems of climate change, both in reducing atmospheric greenhouse gas concentration and adapting our infrastructure. They are not a panacea for meeting Net Zero by 2050 and cannot be seen as a substitute for the significant emissions reductions across other sectors that are needed to meet this goal. Some NbS, such as peatland restoration are valuable because they reduce emissions. Other NbS can help to offset emissions that cannot feasibly be reduced by economic, behavioural or technological change. It is essential to implement NbS at a large scale to deliver sufficient benefit for climate change mitigation.

NbS can also help us to adapt to climate change, not least in reducing flood risk and protecting coastal communities from rising sea levels and storm surges. Many ecosystems, including rivers, wetlands and woodlands, are themselves vulnerable to climate change, and action will be needed to facilitate their adaptation if they are to provide NbS in return.

Strategic and well-executed NbS will simultaneously provide significant additional public goods. This includes biodiversity benefits that could help drive the delivery of conservation targets and also benefit people's health and wellbeing. Potentially perverse biodiversity outcomes need to be recognised and avoided, including the loss of high-biodiversity, low-carbon habitats (see *theme 4* below).

NbS should seek to maximise outcomes for climate,

biodiversity and people. Any intervention that has an overall negative impact on one of climate, biodiversity or local communities, even if beneficial to other areas, should not be considered a NbS.

Key message: NbS can make an important contribution to Net Zero, biodiversity and climate change adaptation targets, so long as they are not treated as a substitute for widespread emission reductions or wider nature conservation action.

2. NATURE-BASED SOLUTIONS FOR HEALTH AND PROSPERITY

In the wake of COVID-19, NbS can be particularly effective in stimulating 'green' employment in the short term and supporting sustainable economic growth in the medium term, forming part of a green approach and investment to economic recovery. Nonetheless, delivering NbS at the scale necessary to make a significant difference will require state investment as well as changes in the legislative and policy architecture to encourage private investment. Clear markets beyond corporate social responsibility need to be identified and developed for which the state will need to maintain an active role. The environmental and financial benefits of private investment also need to be carefully monitored.

Spending time among nature can boost human health and wellbeing, which became particularly apparent during the recent pandemic as more people spent time in nature, benefitting from its restorative effects.

The human health and wellbeing benefits derived from NbS are of additional and widespread value to the benefits delivered for nature and in addressing climate change. However, given the expertise of the majority of British Ecological Society members, human health and wellbeing aspects of NbS have not been evaluated in detail in this report.

Key message: NbS provide human wellbeing and economic benefits. Routes for private investment alongside public finance are emerging but need further development.

3. GETTING THE RIGHT FRAMEWORKS AND POLICIES IN PLACE TO DELIVER NATURE-BASED SOLUTIONS AT SCALE: A WINDOW OF OPPORTUNITY

Each nation of the United Kingdom is currently developing many post-European Union policies. This creates a window of opportunity to ensure that cornerstone policies and legislation for the environment, society and economy enable the delivery of effective NbS at scale. Ambitious post-Brexit proposals, combined with long-term targets (e.g. Net Zero for greenhouse gas emissions by 2050) can create a favourable environment for adopting NbS and for stimulating private and public investment.

With foundations in both nature and societal outcomes, NbS require a broad policy and governance scope, and shared knowledge resources. Multiple interests are involved in the governance of NbS across a variety of scales and there are challenges associated with working across different policy areas, as well as generating effective partnerships. We recommend a working group or groups to assess both the opportunities, and the existing policy and governance frameworks, to deliver NbS.

When delivered at scale, NbS actions often have to be coordinated across whole landscapes and have local 'buy-in' for their success. Achieving collaboration requires mechanisms that can build the necessary social capital and help normalise NbS environmental management within the land/marine management community, and in the local community and societal beneficiaries of NbS. In both these broad sectors, there may be a wide range of attitudes towards biodiversity and its management as well as to the requirements and means of climate change adaptation and mitigation. New and novel NbS projects require knowledge exchange and collaborative ways of working. With a mix of private and public interests, state involvement in governance structures can be vital for the effectiveness of NbS and enforcement of regulations.

An assessment framework is needed for NbS that enables transparent assessments at multiple spatial scales and can be utilised by all key stakeholders. Agreeing clear outcomes and benefits for nature and climate change at the inception of NbS projects is vital to successful monitoring and assessment. Assessment frameworks may need to be a multi-phase process to incorporate assessments at the range of scales required for NbS initiatives. Successfully assessing adaptation may be made difficult by lack of a 'control' situation and by difficulties in attributing impacts to climate change. Existing assessment frameworks, such as the Strategic Environmental Assessment Regulations and the Environmental Impact Assessment Regulations, should be evaluated and adapted to ensure they are able to assess NbS initiatives. There is also an overarching need to ensure that policies across different sectors work well together across multiple interests and deliver the multiple benefits of NbS.

With the right frameworks in place to underpin NbS, they can make a significant contribution to national and international commitments. Long-term policies, goals and government commitments are necessary however to support long-term investment, research and monitoring of the functionality of NbS, as well as their delivery.

Key message: NbS opportunities and delivery approaches are evolving, and policy, governance and evaluation methods need to develop to encourage uptake and achieve the benefits.

4. GETTING THE RIGHT NATURE-BASED SOLUTIONS IN THE RIGHT PLACES

Strategic spatial planning and detailed project plans are necessary to integrate NbS with land use and ensure both biodiversity and climate benefits. It is also essential to address any trade-offs and avoid perverse outcomes. This requires the right data, diagnostic tools and the capacity and expertise to interpret and find solutions for all objectives and desired outcomes. This will require an increase in present capacity, including in the

public sector, both nationally and locally, with many local authorities lacking the resources to employ ecological and environmental specialists. An appropriate multi-stakeholder and multi-level governance framework can help overcome existing resource and skill deficits by combining public and private sector input, but must ensure independence of assessments from narrow sectoral interests.

NbS may involve the substitution of one habitat for another, so it is vital to understand factors such as underlying soil conditions, habitat quality and potential biodiversity losses and gains, to ensure positive outcomes. For instance, woodland creation on some species poor, low productivity grasslands may be a good NbS for climate change mitigation. However, on a species rich grassland it could damage biodiversity and where grassland is found on degraded peat soils, restoration by re-wetting is likely to have better NbS outcomes for biodiversity and greenhouse gas reduction. Good spatial datasets can help with targeting but, in many cases, site specific environmental assessments for NbS initiatives will need to be conducted by suitably qualified experts to ensure the appropriate beneficial outcomes for nature that NbS require.

Effective planning for NbS at appropriate spatial scales can also help to capitalise on the co-benefits that can be delivered by NbS. For example, tree planting is an effective method of carbon sequestration and if strategically planned, tree planting alongside rivers has the potential to sequester carbon, reduce flood risk, stabilise river banks and also cool water temperature for vulnerable species. Currently planning systems in the UK are fragmented with multiple policies and bodies governing different sectors within a geographic area. Existing governance structures do not therefore lend themselves to the strategically designed and cross sectoral approaches that successful NbS delivery often requires.

Cities and urban areas face a multitude of competing interests and challenges and it is particularly important that NbS have clear co-benefits there to attract funding and bring a range of benefits to these environments and their inhabitants. The recent pandemic has reminded us of the importance of access to green space and the wellbeing benefits of nature. This has been particularly pronounced in urban areas and has

also shone a light on unequal access to nature. Implementing NbS will benefit from appropriate socio-economic data to ensure, for instance, that NbS are helping to redress both environmental and social inequalities.

A variety of landscape-level planning approaches relevant to NbS exist or are emerging. These include the Ecosystem Approach, Local Plans, Local Natural Capital Plans, Catchment Management Plans, Landscape Enterprise Networks, the Nature Recovery Network and Local Nature Recovery Strategies, Local Nature Partnerships (LNPs), Farmer Clusters and forthcoming environment and green growth strategies across the UK. These participatory, interdisciplinary and evidence-based approaches aim to balance conservation of biodiversity and the sustainable use of natural resources with fair and equitable sharing of the benefits and also the potential to contribute climate change solutions.

Key message: The multiple benefits of NbS require careful spatial and project planning to deliver multi-sectoral benefits.

5. GETTING THE RIGHT EVIDENCE FOR NBS

Knowledge and evidence about the opportunities and effectiveness of different NbS interventions is lacking. For example, techniques for measuring carbon sequestration are well established in a research context, but differ between habitats and, often with a site-specific context, are rarely used for evaluating wider environment management or large-scale monitoring and surveys. This affects our ability to incorporate NbS into project-based carbon accounting – which may hamper the use of carbon credit finance, if site carbon fluxes cannot be measured or accurately estimated.

Key research gaps are summarised in *Appendix 2*. Examples include the relative benefits of natural woodland regeneration versus afforestation as a NbS, and what the appropriate management standards are for the latter. The criteria and standards required for an activity to be deemed as NbS must be clear and strengthened to ensure that projects deliver climate, biodiversity and human benefits.

Applied research across disciplines will be key for NbS innovation and evaluation. Whilst this may attract some private funding, strong government funding will be necessary, including to provide assurance of independence from vested interests.

It is also necessary to overcome barriers often experienced in getting scientific research accepted, understood and translated effectively into policy and practice. This includes the use of academic vocabulary by ecologists and conservationists, the promotion of tools and models that are complex and difficult to understand, and failure to capture the inherent value of nature in economic models. Characteristics of scientific assessments that have successfully influenced policymaking include a multi-disciplinary approach, involvement of decision makers and other stakeholders in the assessment process, a clear statement of the implications for human wellbeing and effective communication, both directly and indirectly via the media, for example, with decision makers and the public.

Key message: There are knowledge gaps and uncertainties which hamper the more widespread use of NbS. These knowledge gaps are a barrier to developing the full potential of NbS for climate, nature and people.

EFFECTIVE NBS FOR DELIVERING BIODIVERSITY AND CLIMATE CHANGE BENEFITS

The following table summarises effective NbS identified in the report where there is a good degree of confidence in the available evidence. A number of other habitats and NbS have been explored in detail and gaps in research have been

highlighted, although it should be stressed that all NbS are important and should be considered as part of a broad portfolio of projects. For executive summaries of each chapter, please see *Appendix 1*.

NbS/Habitat	Climate change mitigation potential	Climate change adaptation potential	Biodiversity potential	Specific policy recommendations
Peatlands	Peatlands store around 3 billion tonnes of carbon in the UK but are emitting an estimated 23 million tonnes of carbon dioxide equivalent (CO ₂ e) annually (c. 5% UK emissions) as a result of drainage and degradation. Restoration can reduce and eventually halt these emissions.	Peatland can help slow water flow during storms. Restoration reduces peatland vulnerability to climate change.	Restoration can help re-establish rare species and distinct peatland biodiversity on extensive areas of degraded habitat.	Restore degraded peatlands; drainage should be stopped and reversed. Continue to develop Peatland Code and public financing. End burning on blanket bogs.
Woodlands	The UK's forests currently store around 1.09 billion tonnes of carbon and sequester about 4.6% of the country's total emissions. They currently cover 13% UK land area and there is scope to increase this significantly.	Woodlands can provide adaptation through reducing flood risk, and provide shade and cooling in rural and urban settings.	New native woodland will increase woodland biodiversity and robustness to climate change. Increasing woodland connectivity will also benefit biodiversity.	Successful woodland NbS requires specific spatial and ecological planning. Avoid species rich grasslands, peat and other organic soils. Increase native woodland area, increase connectivity, and encourage natural or assisted regeneration of native species.

NbS/Habitat	Climate change mitigation potential	Climate change adaptation potential	Biodiversity potential	Specific policy recommendations
Saltmarsh	Establishment of saltmarsh habitats will provide sequestration and burial of carbon from local, marine, freshwater and terrestrial sources in saltmarsh sediment.	Saltmarshes provide coastal protection from sea-level rise and storms.	Saltmarsh provides a high biodiversity coastal habitat especially for many bird species.	Establishment of more saltmarsh, as proposed in existing shoreline management plans and Climate Change Committee targets.
Arable Landscapes: Hedgerows and Field Margins	High soil carbon levels are found under and adjacent to hedgerows and in field margins.	These areas improve water infiltration into the soil store storm runoff. They can prevent soil erosion, and capture pollution (e.g. fertilizer).	13 Section 41 bird species use hedgerows as primary habitat. Hedgerows have rich biodiversity, including high levels of plants, fungi and invertebrates, including pollinators. These habitats increase ecological connectivity. The high biodiversity in these habitats enhances pest management of adjacent crops.	Ensure protection and re-establishment of hedgerows. High-priority for future post-CAP environmental payments across the UK.
Arable Landscapes: Agroforestry	Agroforestry provides carbon sequestration and storage with average storage estimated to be up to 63 tonnes of carbon per hectare due to increased presence of trees.	Agroforestry provides adaptation through reduced flood risk, microclimate benefits and prevention of soil erosion.	Agroforestry provides increased biodiversity due to tree cover and hence habitat for many species including invertebrates and birds.	New public and private land management funding should incentivise a significant increase in agroforestry.
Urban Street Trees	Increased carbon sequestration from tree growth and habitat creation (small compared to national carbon budget)	Trees provide a localised cooling effect; estimated to save £22 million in annual energy consumption across inner London for example. Trees enhance recreation and connection to nature.	Increased numbers of trees provide increased biodiversity through enhanced green spaces, and increased connectivity.	Increase urban green space and features across urban policy sectors including planning, amenity, recreation and health, with focus on native species to ensure NbS.

CLOSING STATEMENT

NbS have great potential to tackle the two defining crises of our age. This report provides examples of opportunities for NbS across a range of habitats, as well as discussion of some of the complexities involved in planning for NbS. The report also outlines a detailed analysis of the tools, financial mechanisms and policies required for effective delivery in a UK context. Policy change will be necessary to overcome some of the challenges associated with NbS and to ensure that they fulfil their potential, yet the rewards are vital in meeting national climate change and biodiversity targets.