WHITEPAPER

A forward-looking vision for the role of nature-based solutions in future-resilient infrastructure

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Introduction

An ageing asset base combined with shifting weather patterns and soaring demand means our national infrastructure is under more pressure than ever before.

While we seek to extend the life of critical infrastructure in an era of climate transition, we must think outside the box to find solutions that can withstand the challenges ahead, sustain and evolve in parallel with our changing world.

Nature is the key to a resilient future. Unlike the rigidity of grey infrastructure, nature-based solutions (NBS) are flexible, and have the innate capacity to respond to changing circumstances and new environmental conditions. NBS hold the power to mitigate some of the most devastating effects of climate change, and we're increasingly using them as part of our response to flooding, poor air and water quality, and extreme temperatures. We must respect and protect nature, if it is going to remain an effective tool for the future.

Working with nature

Time and time again, we've seen the devastation that can occur when nature is removed to make way for built infrastructure. Since the levees failed in New Orleans during hurricane Katrina, there's been an ongoing effort to re-establish natural wetlands. In some South-East Asian countries affected by the 2004 Boxing Day tsunami, the process of re-introducing mangroves to help protect communities is still in progress, 20 years on. Until recently, rivers across the world were being engineered to be straighter – mostly to facilitate building developments and urban planning. Now we're seeing our water resources disappear, the benefits of reviving natural watercourses are becoming more understood, to connect flood plains and reduce flood risk, increase habitat diversity and build broader climate resilience. Efforts are underway to restore the sinuosity of rivers, but this process is gradual, and sometimes unfeasible in densely populated urban regions.

We now have to reengineer nature back into our cities and towns to reduce the impact of climate change. By mimicking through sustainable urban drainage and biophilic architecture, for example, we can create significant benefits in built-up urban areas, for everyone. Reconnecting people with nature is proven to generate health benefits that underpin stable workforces and build thriving communities.

There's no doubt that built infrastructure has a solid part to play in a climate-resilient future, but not at the expense of nature. Destroying nature to make way for built infrastructure is counterproductive, and as we have seen, once gone, it can be an incredibly difficult to re-naturalise. By undervaluing nature in the past, we have unknowingly undone millennia of work put in by the natural environment to build incredible natural resilience.

We need to consider nature in everything we do, and bring the best of grey and green solutions together, in order to stand up to climate change, long-term.

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Case study: Supporting nature with nature

At junction 10 of the M25 in southeast England, Cockcrow Bridge will be the UK's first green bridge supporting heathland habitats. The commons on either side of the bridge are made up of lowland heath – one of the UK's rarest habitat. The area is a stronghold for lowland heath in the UK, but more than 85% has been lost in the last 200 years.

The bridge will create connectivity and climate resilience at landscape-scale, and benefit rare wildlife by reducing mortality from road traffic collisions, enabling species expansion and increasing breeding opportunities.

An ancient and sustainable approach lifting cut turf will expose bare ground – a vital habitat for specialist heathland invertebrates and plants. It encourages growth of the natural mosaic of plants, root systems and seed banks, and associated soil fungi and fauna are transferred with the turf, supporting the natural establishment of heathland vegetation.

The design will enable cattle from the adjoining common to graze the bridge – a natural management technique that will help create habitat complexity and ecological niches, especially for the small animals and invertebrates the bridge is designed to support.

Nature as critical infrastructure

While a great deal of work has gone on over the past decade to raise the profile of NBS – and of nature more generally – it hasn't gone far enough. NBS are now considered as part of standard infrastructure design, which is certainly a nod in the right direction, but we need to move away from a tick-box culture and position nature up-front and centre.

Ultimately, nature should be recognised as critical infrastructure.

Nature has been proven to perform critical functions, and can provide equal – if not better – services than built assets. For example, wetlands and reedbeds are just as effective at cleaning water as chemical treatment systems and play a pivotal role in flood risk reduction by slowing the flow upstream. Unlike built infrastructure, NBS can evolve, shift and improve over time. Nature is inherently adaptable, which is an incredibly valuable characteristic amid a changing climate. Instead of having to invest and upgrade assets in response to environmental changes, NBS naturally flexes with the environment, often with little intervention. And rather than deteriorating over time, NBS often become more effective over time.

Not only does nature perform; it overperforms. Whereas a built asset is designed to carry out a particular function or respond to a particular issue, NBS, by their very nature, simultaneously deliver a range of functions. Not only do they have the capacity to work in harmony with built infrastructure; they can actually improve it. For example, if NBS are used to slow the flow during heavy rainfall, this takes some of the load away from pumps at the pumping station, and in doing so, extends their lifespan. Trees can protect built infrastructure by creating shade and reducing the impact of extreme heat on building materials, and their roots have been shown to physically bolster the structure of verges and riverbanks, making them less likely to fail. Nature clearly has the potential to reduce the lifecycle costs of built assets, and enhance their performance.

Nature is the ultimate multitasker, and we continue to be amazed by the breadth of multi-benefit outcomes nature can yield, from carbon sequestration and soil quality to health and wellbeing, education and the economy. Green spaces are linked to increased wellbeing, connectivity and productivity, have a positive impact on community cohesion and underpin the local economy. In 2024 **the Green Finance Institute** calculated that ongoing degradation of nature in the UK could lead to an economic shock equivalent to a 12% reduction in GDP, affecting jobs, food prices, and investment.

The multi-benefits of NBS go beyond positive environmental impact: they build broader societal and economic resilience. As such, nature is critical for our future.

Moving nature up the agenda

In order to bring nature-based solutions to the fore, we need strong leadership from government and from industry, and we need to address challenges around policy, funding and skills.

Green infrastructure is not currently recognised as an asset class across any government policy documents. While there is a national strategy for energy and for transport, for example, there is no equivalent for nature. National Highways recently took the bold step to label its green estates as assets, and are leading by example to validate nature's vital role in a resilient future. But we need a steer from government to embed this philosophy across the full breadth of the industry. If we don't all come together and prioritise nature at the highest level, we will have real problems meeting the challenges of the future.

To implement NBS at scale, dedicated funding needs to be in place and investors need confidence that their money will get results. Right now, there's a rift between the recognition and implementation of NBS, despite its clear value proposition. Investor hesitation can stem from uncertainties around long-term return on investment (ROI), a lack of standardised metrics for success, and perceived risks associated with land-use change.

There is a desperate need to connect the dots by framing NBS as critical infrastructure. This will go some way to justifying long-term investment and make it more compelling to a diverse range of stakeholders. A robust investment framework is required to unlock the full potential of NBS and move from pilot projects to landscape-scale action with lasting impact.

The skillset of the workforce needs to be updated to mitigate the climate emergency ahead. We need to work with schools and universities to promote critical STEM subjects and teach students about the importance of green jobs in building a resilient future. Syllabuses need to be up-to-date and relevant for current and future climate challenges, and all new (and existing) engineers need to be proficient in green skills in order to take things forward and embed NBS into business as usual.

Nature does not recognise administrative boundaries: our approach to NBS must reflect this. Rivers flow across counties, wildlife migrates between jurisdictions, and ecosystems are interlinked. Processes need to be put in place to move beyond siloed approaches and facilitate collaboration between councils, regions and nations, in order to effectively harness the power of nature and its interconnectedness. Local nature recovery strategies won't work if they don't look beyond borders. We need to think in terms of natural systems, not political ones. That means considering entire catchments, or whole natural ecosystems, as a basis for planning and investment so we can successfully implement the most effective solutions.

Case study: Building a business case for nature

Spains Hall Estate is a sizable landholding that forms part of a large upstream catchment. AtkinsRéalis developed a land management scheme to create a business case for sustainability across the 600ha estate. As part of this, we tested two different natural flood management (NFM) measures to reduce flooding downstream: man-made leaky dams and beaver reintroduction.

Using our natural capital assessment valuation tool, Natural Capital Studio (NCS), along with detailed GIS mapping and management change design, we compared land cover data before and after the implementation of interventions. We looked at biodiversity, carbon sequestration, water purification, flood risk, soil erosion and recreation.

This wide-cast approach to ecosystem service assessment enabled us to demonstrate the full impact of NFM and land management changes. From flood risk management to recreation and health, we mapped a wide range of multi-benefits both on-site and beyond the estate boundaries, assigning monetary value to each of them and building a robust business case.

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Looking to the future

The policies, funding and skillsets needed to implement NBS at scale will require a cultural shift. In order to harness the broad-spectrum benefits of nature and realise its potential as a key building block for a resilient future, it needs to be re-framed as critical infrastructure, and prioritised as such. It requires a governance structure that supports collaboration across borders, joint decision-making and long-term stewardship.

Engineering needs to be redefined to incorporate nature at the highest level – and we should aspire to a world of infrastructure where trees are considered equally to steel, and nature is the norm. Nature must no longer be the role of the ecologist: a responsibility to champion nature as a tool for resilience needs to be embedded across all professions.

If we are going to build the level of resilience needed to address the climate challenge ahead, we need to respect the power of nature and work in partnership with it. We need to bring together the flexibility and adaptivity of nature with the reliability and relative speed of built infrastructure to create a truly collaborative approach to climate change that will stand the test of time.

This whitepaper was authored by Laura Liddaman, Associate Director – Nature Based Solutions, Claire Wansbury, Fellow and Technical Director, and Zoe Metcalfe, Global Practice Resilience Leader at AtkinsRéalis.