Net Zero
Infrastructure
Industry Coalition

Nature: the missing piece of the net zero puzzle

A decline in nature is a decline in the environment's ability to sequester and store greenhouse gases.

The climate, nature and resilience crisis

The world is facing a climate, nature and resilience crisis and this is not just an environmental emergency; it's a social crisis that demands action on multiple levels.

UK carbon emissions rose by 1.4% between 2021 and 2022,[1] continuing to give adverse impacts on our planet and raising the risk of disastrous consequences to society from extreme weather events.

Governments and industry stakeholders have, for some time, been acutely aware of the need to take action. The net zero stocktake 2023 showed 149 countries have committed to working towards net zero[2] with specific policies and targets. This includes the UK where public and private sector organisations have set, and are working towards, carbon reduction and net zero targets.

While international momentum for tackling adverse changes to our climate and pursuing net zero carbon emissions continues, there is also another topic rising fast up political and corporate agendas. There is a rapidly increasing focus on nature – its protection and promotion and the need to address its global decline. It is also evident that there is a growing emphasis on going beyond mitigating damage to having a net positive impact on biodiversity.

In December 2022 through the Kunming-Montreal Global Biodiversity Framework, 196 countries agreed to 23 targets aiming to half and reverse biodiversity loss by 2030.[3] Various government policies are now being introduced, for example England's first phase of mandatory biodiversity net gain (BNG) came into effect in February 2024 for new developments requiring planning applications (with some exceptions based on size). Similar biodiversity policies are being introduced for developments in Wales and Scotland to contribute towards nature's recovery, with Wales requiring net benefits for biodiversity on all developments and Scotland's Biodiversity Strategy setting the goal of nature positive by 2030.

1. Office of National Statistics, UK: Provisional estimates 2022. Available online: **Greenhouse gas emissions, UK – Office for National Statistics**
2. Evaluation methodology for national net zero targets, Climate Action Tracker, 2021. Available online: **Net zero targets | Climate Action Tracker**
3. Convention on Biological Diversity. 2030 Targets. Available online: **2030 Targets (with Guidance Notes) (cbd.int)**

To succeed in global environmental ambitions, however, we must treat climate action and nature conservations as interconnected goals. Climate change is one of the biggest drivers of biodiversity loss. The decline in biodiversity affects the environment's natural ability to absorb and store greenhouse gas emissions, and be resilient to climate change, thereby leading to an ongoing downward cycle. Additionally, the social aspects of these interdependent factors need to be fully understood and brought into the debate. How do these impacts intersect with global patterns of inequality and vulnerable communities and how can these impacts be simultaneously addressed? Now is the time to bring conversations, targets and actions together and tackle the crisis collectively.

This integrated approach is critical for the infrastructure industry. All too often, targets for net zero, nature and social inequality disconnected. Such siloed approaches can significantly hamper attainment of ambitious and well-intentional commitments and lead to unintended consequences for our planet, environment and communities.

I am pleased to support this publication as we embark on the path towards collective carbon and nature targets. Let us remember that our actions today shape the world for generations to come. If we work more collaboratively together, across industry and disciplines, we can shape build a resilient, sustainable and equitable future. Such siloed approaches can hamper progress for infrastructure to achieve the interconnected goal of net zero, nature positive and climate resilience. It can also lead to unintended consequences, such as net zero measures causing the loss of biodiversity.

Kerry Scott
Global Lead for
Environment and Society
Mott MacDonald

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> By addressing the climate, nature and resilience crisis as one, we can make the most effective use of our assets for the benefit of people and planet.

Nature on the net zero baseline

Net zero is a major driver across the infrastructure industry, which is reflected in the dedication and extensive work by the wider net zero community.

As the momentum towards net zero continues, we must now account for nature and its role in storing and sequestrating greenhouse gases (GHG): in other words, the baseline used to set net zero targets must include nature's storage and sequestration of greenhouse gases.

With nature on the baseline for net zero, we will quantify existing GHG storage and sequestration by the natural environment before an infrastructure development, and how that changes following the development. This is especially important if habitat is cleared to build and operate infrastructure, as then we will need to measure the loss of GHG storage and sequestration in order to assess whether landscaping and initiatives, such as BNG or payback the loss, address the debt in ways that resilient to climate change.

In turn, this deepens our understanding of whether net zero targets are truly on track. Rather than only bringing in nature later in the process to address residual carbon emissions, let's now account for losses to GHG storage and sequestration potential that, all too often, have not been captured as part of infrastructure development.

Fundamentally, this is bringing together net zero, nature positive and climate resilience into one holistic and integrated sustainability agenda for infrastructure development.

With the world facing a climate, nature and resilience crisis, let's overcome siloed approaches and instead recognise, measure and act on the intrinsic links between them when designing, building, operating and maintaining infrastructure.

What's in a baseline?

Across the infrastructure industry, there are various factors affecting how baselines for nature are set and understanding what influences the differences is important.

Within this document, when we discuss a baseline, we refer to habitats pre-existing on a site before the proposed development takes place. These habitats have value in terms of biodiversity. They also have value in the GHG they sequester over time, and in the GHG they have stored up to the point of project commencement.

The relationship between net zero, nature and climate resilience is an expansive and complex topic. For this document, we focus on how change in nature from before to after a development project will affect the natural environment's capacity to store and sequester carbon, and how that change must be positive for development to be truly sustainable.

Further resources highlighting the complexity and breadth of conversation about net zero, nature and climate resilience that compliment this report:

IEMA article – Net gain to net zero: why we must design biodiversity net gain to help tackle climate change

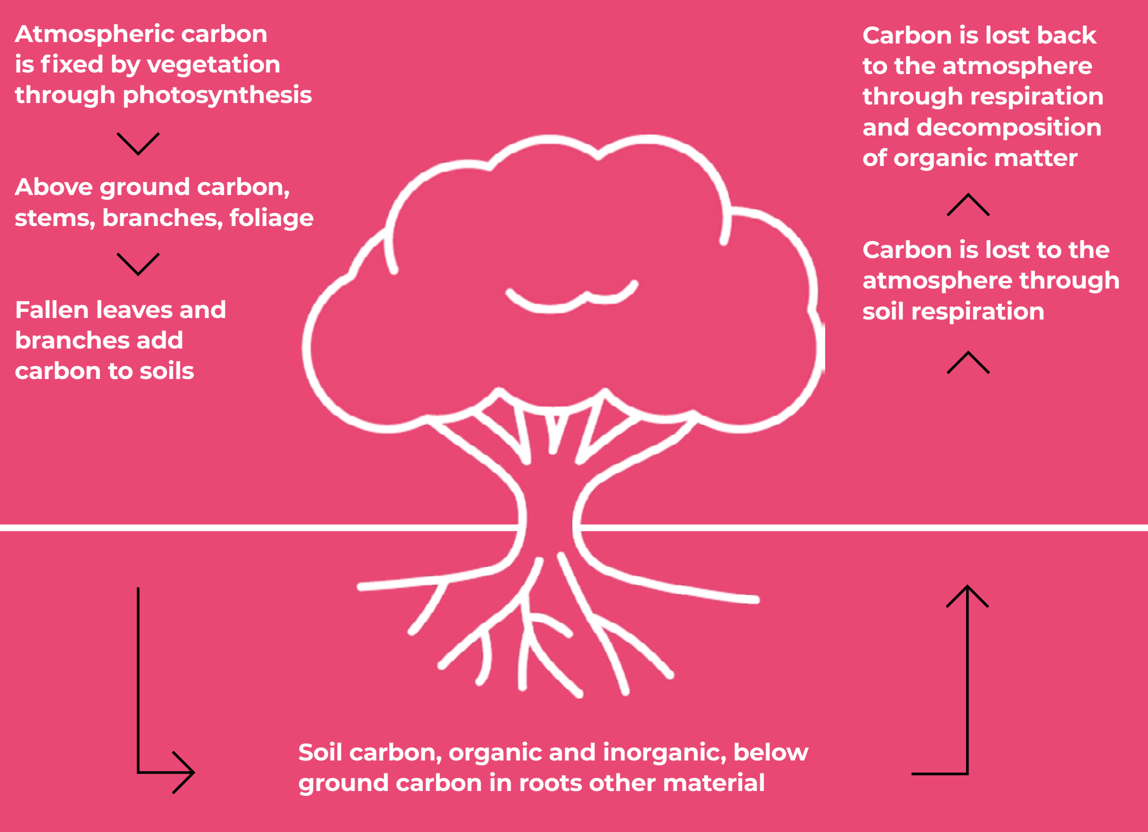
Land use: policies for net zero UK, Climate Change Committee

Nature-based infrastructure, UN Environment Programme

State of nature report, State of Nature Partnership

PAS 2080:2023

The natural carbon cycle



The invisible carbon gap

Net zero is now widely integrated within government policies and corporate sustainability agendas.

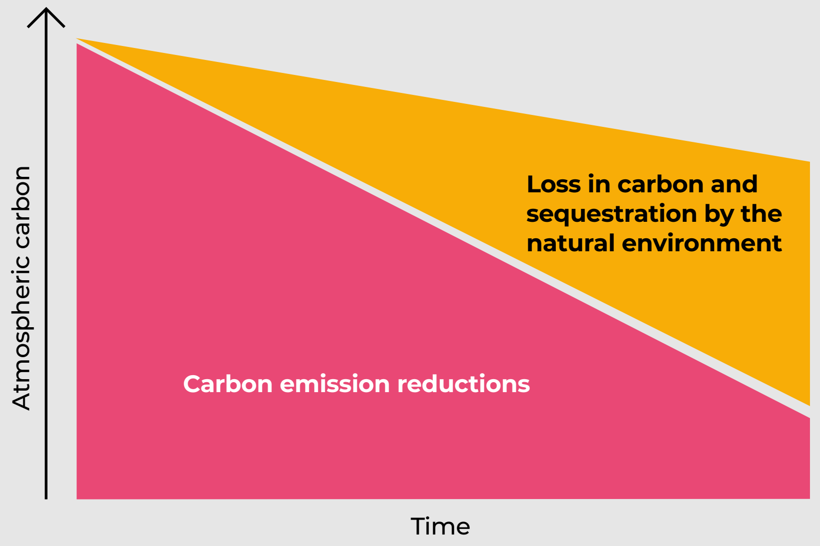
However, frequently nature is missing from the baseline used to set net zero targets. This leaves an invisible carbon gap: losses and gains in carbon storage and sequestration by the natural environment from before to after infrastructure development. In turn, this results in uncertainty as to whether we are truly making progress towards net zero.

Accounting for nature's carbon sequestration and carbon storage before development and how that changes post development is essential.

Net zero is now widely integrated within government policies and corporate sustainability agendas. However, frequently nature is missing from the baseline used to set net zero targets.

This leaves an invisible carbon gap, where we do not capture losses in carbon storage from damage to our natural environment alongside our emissions reductions. This means there is a gap between where the reported emissions reductions suggest we are on our journey to net zero, and where we actually are. In turn, this results in uncertainty as to whether we are truly making progress towards net zero. By capturing this invisible carbon gap, we can make informed-decisions on integrated approaches to achieve net zero and nature positive in ways that are resilient to climate change.

Potential invisible carbon gap impact



Transitioning towards net zero without accounting for nature will create an invisible carbon gap between the initiatives we put in place and true net zero, which can only be delivered by considering sequestration of carbon in nature.

The PAS 2080:2023 standard

PAS 2080:2023 sets out a holistic view across the built environment incorporating both buildings and infrastructure. It is a globally applicable standard for managing carbon in buildings and infrastructure. It aims to reduce carbon through intelligent design, construction and use.

This established framework already integrates nature, as illustrated overleaf. To do more, PAS 2080 and other such carbon guidance could highlight the critical importance of accounting for nature on baselines used to set net zero targets, and demonstrate this holistic approach to how nature fits with the net zero agenda.

It specifies the requirements for the management of whole-life carbon in the provision, operation, use and end-of-life of new projects or programmes of work, as well as the management or retrofit of existing assets and networks.

How does nature fit within PAS 2080?

Below are excerpts from PAS 2080 where the importance of nature is referenced.

Delivered within planetary boundaries

PAS 2080 places significance on systems thinking and the importance of integrating decarbonisation with resilience and prioritising nature in the decision-making. Highlighting that all development in all projects and programmes of work will have to be delivered within planetary boundaries.

See PAS 2080 Section 6

Beyond the project extent

PAS 2080 requires users to look at all emissions (including emission impacts from land disturbance when delivering a project or programme of works) within and beyond the project boundary. PAS 2080 also requires users to consider all carbon reduction effects from nature-based solutions.

See PAS 2080 Section 7

The avoidance of emissions

PAS 2080 encourages users to consider nature-based solutions, not only for GHG removals but also to avoid emissions associated with grey infrastructure. PAS 2080 encourages carbon to be part of the decision-making process from the start, while acknowledging the data limitations at early project stages. Having the approximate emissions at the start to help drive the right solution, adds clarity on the value of nature-based solutions which, by replacing grey infrastructure, pre-emptively avoids emissions.

See PAS 2080 Section 5

A provable baseline

PAS 2080 places importance on unintended consequences of emissions from land disturbance when delivering a project. All such emissions will have to be accounted for and mitigation measures proposed. The baseline is important for any interventions that remove or cause increase in emissions.

See PAS 2080 Section 8

Whole life resilience

PAS 2080 states that it is important to consider climate hazards and resilience in whole life carbon management. For example, if there are proposed carbon reduction or removal solutions as part of a project then the value chain is encouraged to account for how future climate hazards, or other future operating environments, could affect the performance in the long term.

See PAS 2080 Section 6

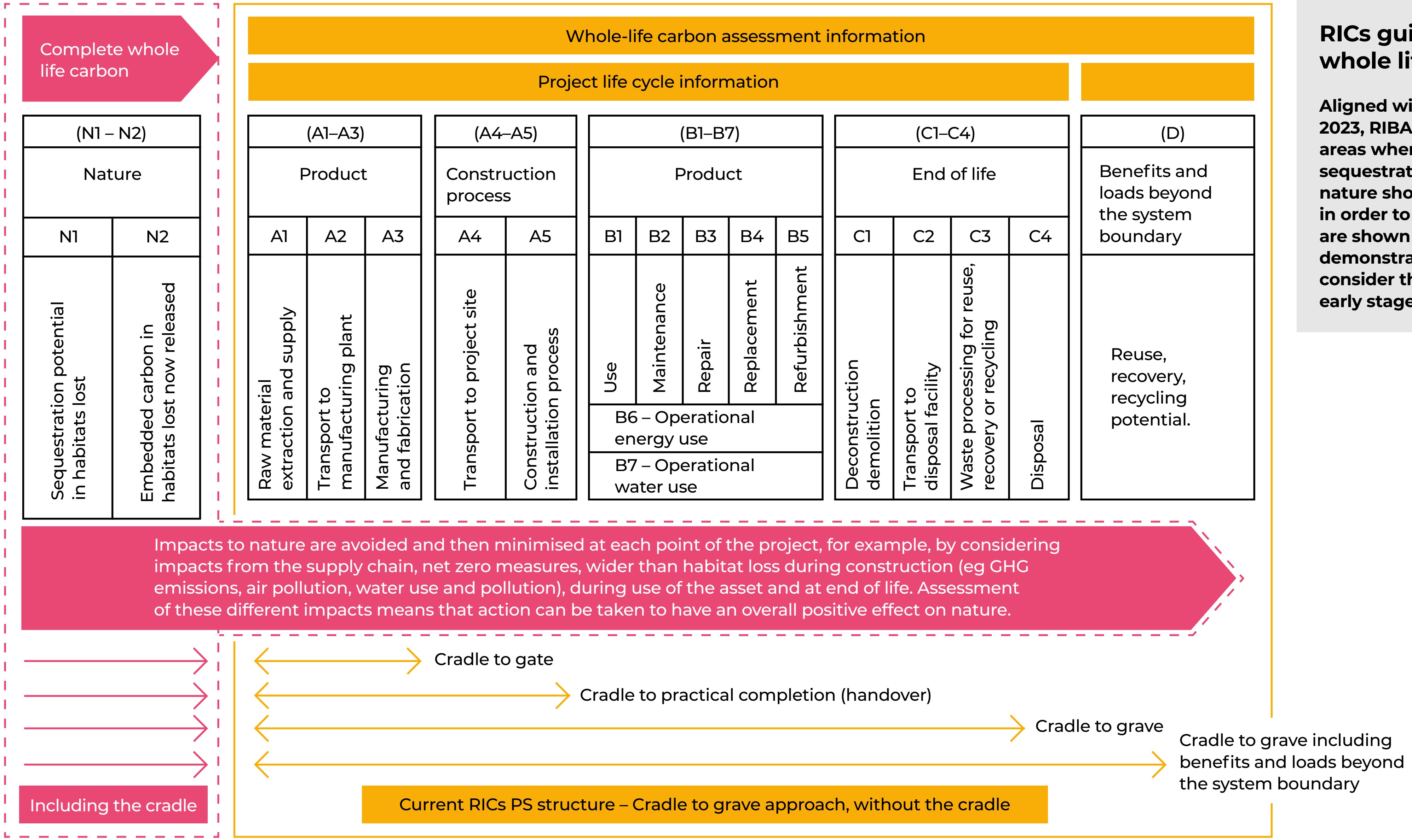
Integrating nature within net zero

On the next page, the RIBA guidance aligned with RICs guidance 2023 for assessing whole life carbon in construction projects has been annotated, to illustrate where the carbon sequestration potential of nature could be included on a baseline for net zero.

Examples of how achieving BNG can boost carbon sequestration rates in natural habitats in line with the RIBA guidance are presented in the NZIIC's thought leadership article which appeared in the Impact Assessment Outlook Journal on "Connecting net gain and net zero: why we must design BNG to help tackle climate change".[4]

4. IEMA Journal, Connecting net gain and net zero: why we must design biodiversity net gain to help tackle climate change. Available online at: **J52083_IEMA_OutookJournal_vol19_v4.pdf**

RICs framework to integrate nature with net zero



RICs guidance on whole life carbon.[5]

Aligned with RICs guidance 2023, RIBAs framework the areas where the carbon sequestration potential of nature should be considered in order to set a baseline are shown in pink and demonstrates the need to consider this issue at the early stages of a project.

5. Embodied and whole life carbon assessment for architects sustainable design (architecture.com)

Assessing the baseline potential

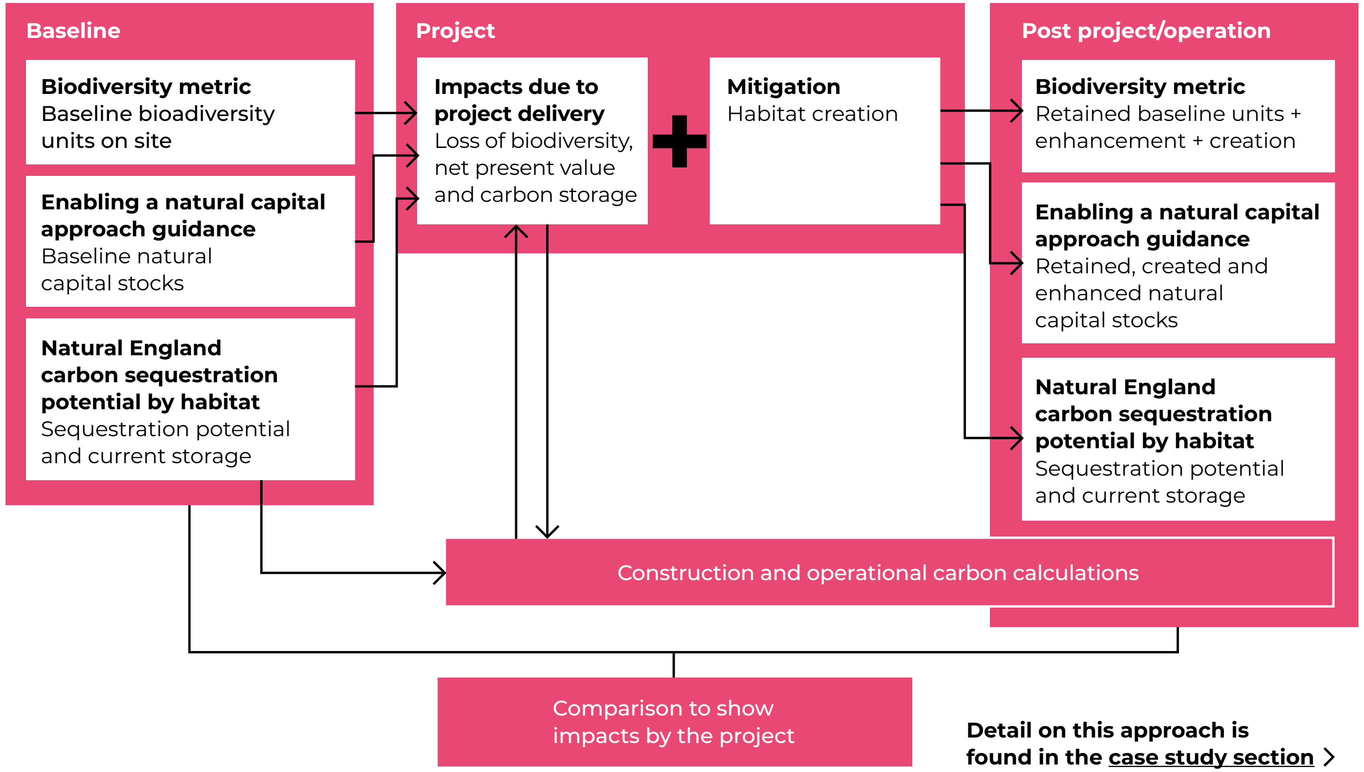
Use of natural capital accounting, which is a tool to measure the stock and condition of an ecosystem and accounting and reporting it in standard way, means that the value of biodiversity and carbon sequestration potential can be jointly assessed and measured.

Mott MacDonald has trialled assessment of a site's biodiversity and carbon baseline using natural capital accounting to demonstrate the method, which are outlined in more detail with case studies at the end of this report. The trial used a combination of the Department for Environment, Food & Rural Affairs' Enabling a Natural Capital Approach guidance, HM Treasury's The Green Book (2022) and Natural England's Biodiversity Metric 3.1.

The approach was retrospectively applied to a number of projects to assess the baseline of habitats for their value in biodiversity units and carbon sequestration potential. These values were then assessed using the total area of habitats with the site baseline and retained stocks compared with the habitats created and enhanced through the work to give a value to the net change in stocks.

The results showed a change in biodiversity units and carbon sequestration potential from before compared with after the development project, as well as over the 30-year duration of BNG.

How carbon and biodiversity accounting can be undertaken on development projects



Detail on this approach is found in the case study section >

UK's current position on carbon and nature

Using a high-level approach based on publicly available data, a comparison was undertaken of the UK's carbon targets and published emissions, and the UK's nature targets and condition of UK's biodiversity indicators.

Carbon

Target to reduce emissions by 78% by 2035[6] compared to 1990 levels, let's look at how the UK is doing: 1990 emissions[7] = 806 $MtCO_2e$

Target emission levels of 177.32 $MtCO_2e$ by 2035

So where are we?
2022 emissions[7] = 512 $MtCO_2e$

How much do we need to reduce by year to get there?
27.89 $MtCO_2e$/yr. reduction to reach our goals

Equivalent to a **5.4% reduction** each year

Between 2021 and 2022 carbon emissions **increased by 1.4%**.

Nature

Nature positive by 2030 from a 2020 baseline.
Based on the 2023 update to the UK's Biodiversity Indicators[8] a comparison of short and long term biodiversity trends was completed.

- In the long-term **14 measures show deterioration** (35%);
- In the short-term **17 measures show deterioration** (45%).

Of the measures with sufficient data to establish conclusions, this equates to a 10% increase in deterioration in the short-term trends compared to the longer-term. This highlights that biodiversity in the UK is still significantly declining.

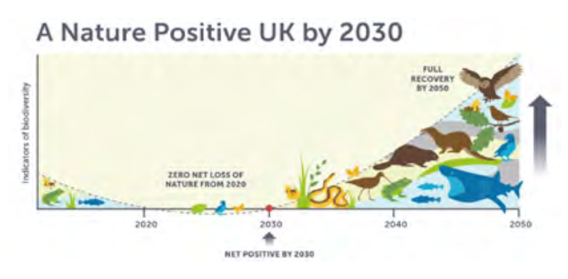


Image Source: RSPB Decade of Action[9]

6. UK Government. Sixth Carbon Budget. Available online: legislation.gov.uk
7. Department for Business, Energy & Industrial Strategy. Available online: Final UK greenhouse gas emissions national statistics: 1990 to 2020. Department for Environment, Food and Rural Affairs. UK
8. Biodiversity Indicators. Available online: UK Biodiversity indicators
9. Available online: RSPB, Decade of Action

UK's position on carbon and nature

The UK Government has targets to plant 30,000ha of woodland each year from 2024.[10] But how does this compare with the UK's carbon emission targets?

Woodland planting

UK target – 30,000ha of new woodland annually between 2024 and 2050 which – if delivered – will result in 780,000ha of new woodland by the end of the period.

We know woodland sequesters carbon, so how much of an impact could this sequestration have?

Carbon sequestration

Taking the timeframe of the UK's carbon targets (to reduce emissions by 78% by 2035 compared to 1990 levels), if we are planting 30,000ha woodland a year from 2024 this equates to 36,000ha new woodland creation by 2035.

Each year 1ha of woodland (30 year average assumed, see UK Woodland Carbon Code)[11] sequesters 15tCO_2e, over the 12 years leading up to 2035, this equates to 360,000ha of woodland having a cumulative, rolling carbon sequestration of 29.7MtCO_2e (i.e. accounting for the first 30,000ha being in place for 12 years, the next 30,000ha in place for 11 years and so on).

Returning to the UK's target emission reduction of 334MtCO_2e by 2035, this 29.7MtCO_2e from woodland creation is about 10% of the target. Extrapolating this further, by 2050 this equates to carbon sequestration of 158MtCO_2e from the woodland planted as part of this initiative.

After 40 years since the first 30,000ha was planted – assuming planting stops at 2050 – the amount of carbon sequestered by these habitats could be approximately 333MtCO_2e.

The gap

While this assessment demonstrates the potential in future carbon sequestration through new woodland creation, it does not capture or account for losses in existing carbon storage and future sequestration potential of the areas used for the planting. For example, if the 30,000ha a year of new planting required any habitat removal, the full total calculated would not be delivered, highlighting the need for the carbon "value" of existing sites to be recognised.

NB: this comparison is intended to indicate potential relationships, based on the following assumptions: 30,000ha planted each year of mixed native woodland, with sequestration values taken from Natural England's Carbon Sequestration by Habitat Second review, uses a 30 year average, and only accounts for the top 300mm of soil.

10. DEFRA, England Tree Strategy. Available online: **defra.gov.uk**
11. UK Woodland Carbon Code. Available online: **woodlandcarboncode.org.uk**

A call to action

We face a climate, nature and resilience crisis.

In the infrastructure sector we have the ability to analyse the positive and negative impacts our projects have on nature and carbon together. We can use this to inform decision making, from the outset of projects through their full lifecycle, enabling us to make active decisions to protect the natural environment and work towards our net zero targets together.

Tools already exist for this, and it is possible to track change in GHG storage and sequestration of a development site over a project lifecycle. We ask companies and projects to pilot a new approach, whereby nature's GHG storage and sequestration is on the baseline for net zero, and change between before and after development is assessed alongside construction and operational carbon calculations.

We invite feedback to create a suite of case studies and aim to host events to share lessons learnt about this approach.

Please get in touch for further guidance on how to apply this assessment process to your project, or to provide your findings from this process. All case studies provided will be used for best practice examples to contribute to a knowledge bank of removing the carbon gap from infrastructure projects.

If you would like to know more, do contact us: **NZIIC@mottmac.com**

What is the Net Zero Infrastructure Industry Coalition?

The UK political system has shown genuine global leadership on climate change, but to turn ambition into reality demands equal levels of leadership from businesses, and from the infrastructure industry in particular.

This report was produced as part of a programme of work the Net Zero Infrastructure Industry Coalition, which was formed in 2019 in response to the UK government's 2050 net zero greenhouse gas (GHG) emissions commitment.

Our launch report, 'Building a net zero economy: planning and practical action to transition our economic infrastructure for a net zero future' is available **here**.

Coalition members include Mott MacDonald, Skanska, the UK Collaboratorium for Research in Infrastructure & Cities, UK Green Building Council, Anglian Water, Transport for London, Engie, Pinsent Masons, KPMG, Energy Systems Catapult, Carbon Trust and Leeds City Council.

The aim of the Coalition is to harness our collective expertise to support the delivery of UK net zero. Our belief is that net zero must become an industry-wide mission that transcends traditional business relationships to become a fundamental part of the way we all work, much like health and safety has over recent decades. Our vision is that the UK's engineering and infrastructure sectors rapidly mobilise to meet the net zero challenge.

The workstream that resulted in this report was led by Mott MacDonald with support from a working group which consists of UKCRIC, KPMG and the wider NZIIC.

Case studies

The following case studies set out Mott MacDonald's method to calculate carbon sequestration rates of BNG designs, making this essential link as a starting point to address the joint biodiversity and climate crises through infrastructure development. The method provides a practical and pragmatic approach as to how carbon sequestration rates of BNG designs can be assessed using open access, government approved data and best practice guidance.

The assessment measured carbon sequestration rates of existing habitats and of proposed BNG designs. The assessment determined the natural capital stocks (habitats that currently exist within a scheme footprint), measured the anticipated change in stocks based on scheme proposals, and then estimated the resulting change in carbon sequestration and associated monetary value over a 30-year period. The assessment currently does not consider the carbon already stored in existing and proposed natural capital stocks.

Further work is also required to improve spatial and temporal data quality; further research should evaluate:

- How habitat condition changes and other habitat characteristics affect carbon sequestration rates;
- How time delays in construction and BNG can be applied to the time horizon calculations, as well as how temporary disturbance affect carbon storage quantities (e.g. temporarily stockpiling carbon-rich soil);
- How best to include confidence levels for biophysical parameters in reporting.

Moreover, to improve valuation evidence, further research should also:

- Develop evidence parameters for the net present social value of BNG proposals (value of all benefits, less all costs);
- Consider benefit-cost ratio between the cost of constructing and maintaining the created habitat against the value of carbon sequestration and other benefits from ecosystem services, such as recreational value and natural hazard regulation.

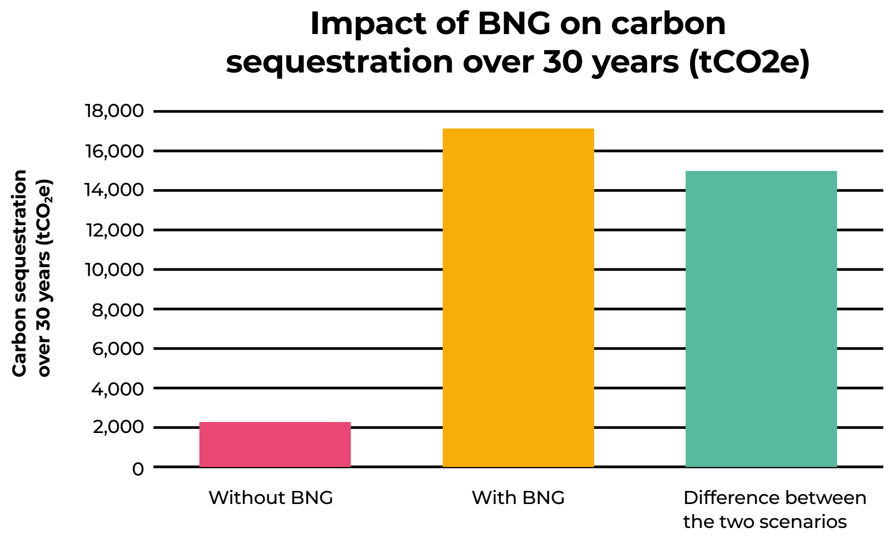
A major road scheme

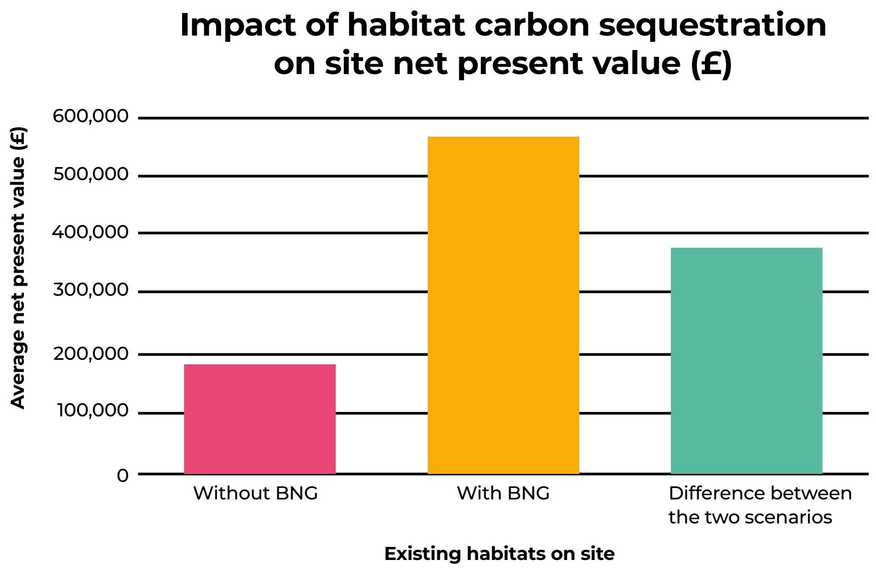
The first project to use the process of comparing carbon and biodiversity on a baseline was a major highways scheme.

Before work on the project started, the scheme boundary contained mostly intensively farmed arable land (~500ha) with a mix of grasslands, some scrub and small woodland pockets. The change in habitat under the scheme's BNG design involved a loss of arable land, gains in scrub and large gains in other neutral grassland and woodland.

The calculations indicated that habitat changes under the scheme's BNG design increased carbon sequestration overall. From a sequestration baseline of **2.29MtCO_2e** compared to a post-BNG carbon sequestration value of **17.16MtCO_2e**, the total change in carbon sequestration was an increase of **14.87MtCO_2e** over the 30-year period.

Subsequently, the net present value of these sites changed from baseline no-BNG estimates of **£101,200 (low)** to **£474,300 (high)** to a post-BNG net present value of **£279,000 (low)** to **£849,500 (high)**. On average, the net present value of the sites increased by **£377,700** post BNG.





Small urban development

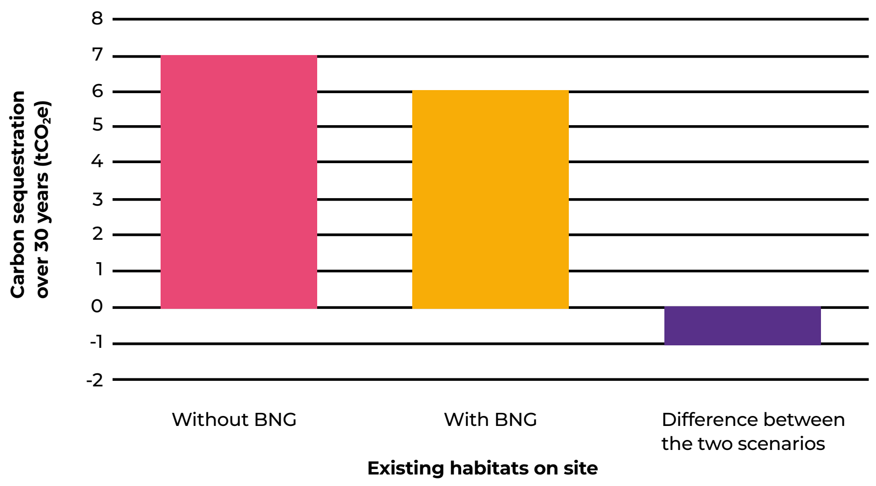
The assessment technique was also applied to a small urban development.

Before development, the scheme boundary contained mostly modified grassland with typical street shrub planting. The change in habitat under the scheme's BNG design involved a loss of grasslands and shrub, with some urban planting. BNG was to be achieved through offsite grassland enhancement.

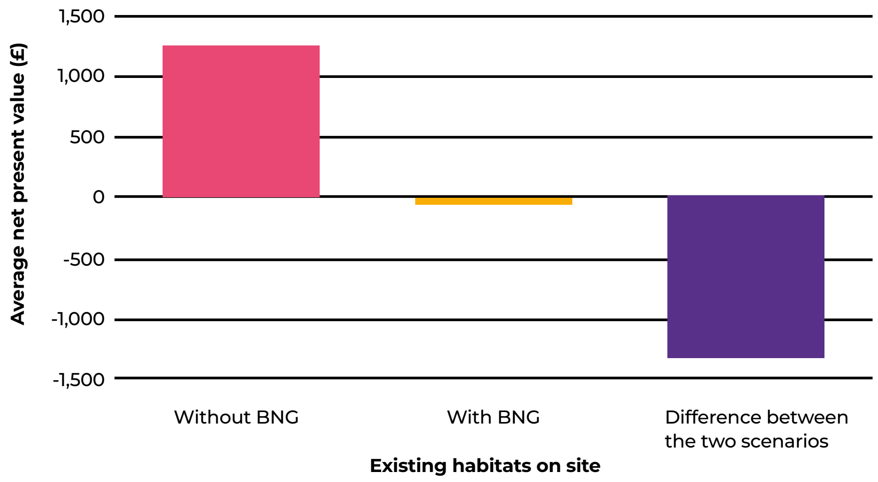
The calculations indicated that habitat changes under the scheme's BNG design decreased carbon sequestration overall. From a sequestration baseline of **7tCO_2e** to post-BNG **6tCO_2e**, the total change in carbon sequestration was reduced by **-1tCO_2e** over the 30-year period. Subsequently, the net value of these sites changed from baseline no-BNG estimates of **£600 (low)** to **£1,900 (high)** to a post-BNG net value of **-£80 (low)** to **-£30 (high)**. On average, the net present value of the sites decreased by **£1,305** post BNG.

The decrease is the result of BNG being achieved by enhancing the condition of existing habitats, rather than creation of new habitats. This is an option to achieve BNG, particularly for urban developments where habitat creation may prove difficult. Restoration of degraded ecosystems is also central to nature recovery. However, the assessment was not able to account for carbon storage benefits from enhancing existing habitats. This may be partially explained from a lack of disaggregated data on habitat quality in relation to carbon, which should be considered further in the future as it offers potential for improvement.

Impact of BNG on carbon sequestration over 30 years (tCO_2e)



Impact of habitat carbon sequestration on site net present value (£)



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