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Exploring the carbon sequestration potential of rewilding in the UK: policy and data needs to support net zero

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Key messages and recommendations

- **Rewilding is an approach within nature restoration that recognises the intrinsic value of nature and wild spaces when restoring degraded ecosystems.** Rewilding leads to the establishment of natural ecological processes at scale and, ultimately, supports ecosystems to become self-sustaining, self-organising and resilient. These benefits are significant and worthy of prioritisation in their own right.

- **Current UK environmental strategy and policy focuses on sustainable land use and nature restoration, with the new approach to subsidy payments taking a 'public money for public goods approach'.** At present, rewilding does not explicitly feature in post-Common Agricultural Policy (CAP) agri-environmental policy developments in any UK region. Access to incentives for nature restoration should be fair and support a just transition in rural communities and rewilding where appropriate.

- **Rewilding, when sited appropriately, can support achievement of the net zero target through its contributions to carbon sequestration and emissions reduction.** It can also protect and improve resilience of existing ecosystems alongside providing benefits for nature and the wider environment.

- **Current evidence gaps mean that the full spectrum of rewilding transitions are not represented in national greenhouse gas abatement plans.** Greater understanding of the interaction between rewilding and wider ecosystem-service delivery is needed.

- **Some habitats (woodland or peatland) that develop at defined steps within a rewilding transition are represented in the UK's Greenhouse Gas Inventory.** Land use change at local authority level is estimated probabilistically using spatially disaggregated and other survey data.

- **Carbon flux data for successional habitats such as species-rich grassland, heathland, scrub and scattered forest, along with coastal sea grass and salt marsh, are not yet of sufficient quality** to be included in the Greenhous Gas Inventory or in other net zero pathways.

- **This evidence gap can be filled by utilising satellite data, drone and radar applications** to better clarify and monitor the role of rewilding within net zero once this role has been directly observed and measured.

Scottish peatland. Photo: K Brembo, Unsplash

High-level recommendations for UK policymakers and government

1. **Policymakers should support work to improve the evidence base relating to carbon flux from rewilded land**, as current gaps are limiting the representation of rewilding within decarbonisation and greenhouse gas removal strategies for the agricultural and land use sectors.

2. **The Government should consider using the definition of rewilding currently being set out by expert communities** including the International Union for Conservation of Nature (IUCN) Rewilding Working Group (expected by summer 2025), if it proves appropriate. The Government and conservation agencies should then develop region- and habitat-specific guidance to reflect landscape responses to rewilding interventions.

3. **Central government and the devolved administrations should increase the level of detail in existing Greenhouse Gas Inventory categories** to reflect the real impacts of land use change that results from ecosystem restoration and conservation approaches. This would then support the reporting of actions aligned with rewilding.

4. **Central government and the devolved administrations should clarify to landowners what tools are appropriate for determining natural capital baselines** and consider the merits of nominating or creating an organisation to capture and manage carbon and greenhouse gas flux data (alongside wider socioeconomic and ecological data) from nature restoration projects, including those that follow rewilding principles.

5. **Central government and the devolved administrations should continue to fund case study and longitudinal research to improve the evidence base from the UK for rewilding,** at project and landscape scale, assessing the net benefits of, and trade-offs between, delivery of ecosystem services such as carbon sequestration, landscape resilience and nature restoration. Successional habitats should be prioritised, given the evidence gaps that currently exist.

6. **The Government needs to ensure that access to rewilding incentives is fair and supports a just transition in rural communities,** including recognising the importance of continued food production. Administering agencies should remove the obstacles to accessing environmental improvement incentives encountered by smallholders, tenant farmers and larger landowners and provide funding for skills development and knowledge exchange to maximise the uptake of post-CAP subsidies by these groups.

7. **Central government and the devolved administrations should incentivise rewilding,** including by promoting connectivity across all landscape types where appropriate, not just the uplands. The Environmental Land Management Scheme and devolved administrations' post-CAP frameworks should address this through supporting regenerative and nature-friendly farming and connectivity of 'wild' places.

Summary

Rewilding: aims and approaches

Rewilding is an approach to large-scale nature restoration and conservation that aims to increase the integration of natural ecological processes into managed and/or degraded landscapes. Increasingly, rewilding is being used to address both biodiversity loss and climate change, while also aiming to achieve a range of wider environmental and societal benefits.

At its core, the approach recognises the intrinsic value of nature and wild spaces and is seen as a process that facilitates the development of self-sustaining, self-organising and resilient ecosystems shaped by natural processes. Traditionally, it has been characterised by the reintroduction of locally extinct species to restore natural trophic interactions.

Rewilding practitioners utilise active and passive approaches. Active approaches 'kickstart' vegetation succession (e.g. through supplemental planting) or increase the complexity of an ecosystem (e.g. through re-naturalisation of rivers, or drainage blocking) in degraded environments where in the absence of such an intervention, the ecosystem would struggle to restore itself on human relevant timescales. Passive approaches are advocated where there are proximate seed sources to enable natural succession and ecosystem resilience to develop.

Conceptually, rewilding is aligned with 'Nature-based Solutions' (NbS) – broadly, these are protective and restorative actions to enhance the sustainability of ecosystems while enhancing benefits and resilience for humans and biodiversity. However, rewilding is distinct from other NbS in that it prioritises the intrinsic value of wildness rather than specifically using nature to address societal challenges.

Mainstream acceptance of rewilding has been hindered by disagreements among practitioners and researchers relating to whether projects can be truly considered to be 'rewilding' without reintroducing keystone predators on a large scale (there is rural opposition to this happening in the UK, as well as logistical challenges) and without there being minimal human intervention.

Distinguishing rewilding from nature restoration more broadly

In practice, there is a degree of overlap between rewilding and nature restoration. However, nature restoration aims to make improvements within a defined trajectory of transition and space, often within a specific ecological community or 'habitat', whereas rewilding interventions seek to support the healthy functioning and resilience of an entire ecosystem, generally at a larger scale. Further, rewilding does not target a desired 'end state' or explicitly safeguard an existing taxonomic precedent: instead, it focuses on present and future ecosystem functioning and resilience while aiming for minimal to no ongoing management over the long term.

Rewilding and net zero – improving the evidence base

The evidence base for greenhouse gas sequestration potential under rewilding is currently limited and must be strengthened for it to be a credible land use option to mitigate climate change and arrest nature decline. Given current knowledge gaps and high uncertainty around outcomes, rewilding is rarely represented in national abatement plans to meet emission reduction targets, whereas conventional abatement approaches in the industrial and energy sectors can be readily modelled and are included. As a result, the role of rewilding as a mitigation tool with benefits to nature has not been explicitly considered in net zero pathways. The UK's Climate Change Committee (CCC) acknowledges this in its Sixth Carbon Budget advice, by recognising the potential for rewilding to deliver environmental benefits but being unable to include the approach in scenarios due to the lack of robust data on the abatement potential.

The challenge for policymakers and regulators is to understand the efficacy of measures such as rewilding that have potential to deliver a wide range of public goods, in order to target incentives while not letting a lack of empirical evidence stultify action. This underlines the need for rewilding and

other NbS approaches to be multi-functional, delivering more than just carbon sequestration and considering biodiversity and wider benefits, including resilience to the impacts of climate change.

Rewilding in current agri-environmental and nature restoration policy in the UK

UK central government and the devolved administrations tend to use the term 'nature restoration' rather than 'rewilding' in land use and environmental strategy and policymaking. Past nature restoration policy has typically targeted specific outcomes, for example focussing on specific species and/or habitats, rather than aiming for wider ecosystem recovery. The removal in the UK of European Union agri-environmental subsidies under the Common Agricultural Policy (CAP) has created an opportunity to shift away from production subsidies under the Basic Payment Scheme (with some prior support under the CAP Pillar 2 for environmental improvement) towards wider societal benefits.

This change of strategy is exemplified in England by the 25 Year Environment Plan and the concept of 'public money for public goods' delivered through the Environmental Land Management scheme (ELMs) to incentivise more nature-friendly farming practices, countryside stewardship and landscape recovery. The other UK administrations have aligned post-Brexit agri-environmental support with the 'public money for public goods' philosophy to varying degrees. Beyond the Landscape Recovery Scheme (for England), which supports large scale ecological recovery efforts, most post-CAP incentives target improvements in discrete criteria such as woodland and hedgerow creation or peatland restoration.

The current suite of agri-environmental and nature restoration policies does not represent the paradigm shift necessary to support land managers to rewild their land through provision of government funds (this has not been a stated priority for any UK administration). Instead, rewilding is largely driven by groups who own land outright or manage land on behalf of non-governmental organisations, and who do not prioritise food production. Rewilding projects typically aim for the enhancement of nature and a diverse range of ecosystem services, with climate mitigation and adaptation one of many considerations.

Rewilding in net zero pathways and the UK's Greenhouse Gas Inventory

The UK's Greenhouse Gas Inventory is the formal reporting tool at the national scale of emission sources and sinks to the United Nations Framework Convention on Climate Change (UNFCCC). The inclusion of actions within the Inventory must adhere to the guidance of the Intergovernmental Panel on Climate Change (IPCC) and be attributable to specific anthropogenic activities that lead to additional emissions or sequestration. Where it is difficult to distinguish the relative contributions of anthropogenic activities and natural processes, the 'managed land proxy' can be applied – this assumes if land is managed, anthropogenic fluxes dominate. In turn, these must be underpinned by transparent, robust and evidence-based estimates, available over appropriate timescales, of those changes in greenhouse gas fluxes.

Measuring greenhouse gas flux at the local scale to capture discrete land use changes such as rewilding is not possible to do for national emissions reporting. Currently, probabilistic 'bottom-up' estimates that rely on a range of spatial and survey data sources are used to estimate local land use change. Rewilding, though initially involving a transition, typically has an end goal of being dominated by natural processes and becoming largely self-organising.

Data and evidence needed for rewilding to be better represented in net zero

While some activities that can be part of a rewilding project, such as peatland restoration and reforestation of native woodland, are already captured in national Inventory reporting, key habitats such as scrub and species-rich grassland are under-represented in the evidence base and therefore not represented in the Inventory. Improving representation of rewilding projects in emissions reporting at the national level will require addressing data challenges and developing the reporting framework to include the wide range of habitats relevant to rewilding trajectories. We suggest that it would be appropriate in some circumstances to use data from examples of more general nature restoration and studies of natural regeneration as a proxy for carbon stock and sequestration under rewilding.

The carbon sequestration potential of transitional (i.e. 'successional') and mosaic habitats is not well understood; these include species-rich grassland, heathland, scrub and scattered forest, along with coastal sea grass and salt marsh. This remains the most significant evidence gap in preventing rewilding transitions from being presented with accuracy. Bridging this gap would improve the evidence base by supplementing what is known about well-studied habitats such as woodland, peatland and grassland to better represent the entirety of the rewilding transition (e.g. the transition from farmland to tall grass, heath or scrub and then to forest) on shorter timescales, i.e. under five years. Thus, it would promote a more detailed understanding of landscape transitions and carbon flux.

If a decision is made to encourage rewilding for the purposes of carbon sequestration, then the Government should play an active role in identifying and supporting the development of standardised, robust protocols for projects to collect greenhouse gas data and environmental and socioeconomic data related to, or borne out of, rewilding projects. Such an effort should better utilise citizen science approaches where practicable, as well as remote sensing methods, such as satellite monitoring, drone surveillance and Lidar. Additionally, the Government should consier nominating or create a bespoke organisation to develop the data infrastructure to oversee and monitor rewilding efforts and ensure policymakers have accurate, up-to-date information to include in Greenhouse Gas Inventory reporting.

How rewilding is defined will steer what data and monitoring approaches are required to better represent it in net zero pathways. Applying a commonly used definition, spatial data could be correlated with activity data from regionally specific, species-rich grassland, scrub, scattered and closed canopy woodland, peatland and so on, to infer the carbon flux and net greenhouse gas position of a project over time. Such figures could then be used to improve representation of rewilding in net zero trajectories.

Is there scope to better utilise rewilding as a land use decarbonisation strategy?

Rewilding, as an NbS, can address both biodiversity and climate challenges, including through improved land complexity and resilience. The sequestration provided will deliver critical emission reductions and carbon removal required for the UK to meet net zero, along with nature benefits. In the UK, the bulk of reductions will come from decarbonisation of the wider economy. However, the evidence gaps described above mean that the current and future potential contribution rewilding can make to meeting net zero is subject to a high level of uncertainty, hence the strong need to address these gaps effectively and quickly.

Heathland at Chobham National Nature Reserve, Surrey.
Photo: Walter Bonnici, Unsplash

1. Introduction

This report synthesises the current policy, technical considerations and debate pertaining to rewilding in the UK, with a focus on what contribution, if any, rewilded land can make to supporting the decarbonisation of land use. The provision of other environmental, biodiversity and social benefits across England, Scotland, Wales and Northern Ireland is also considered.

Rewilding has often been framed as part of a binary land use system, where land is understood to be used solely for productive uses (e.g. agriculture) *or* put aside for nature, with none or very little overlap. Land use decisions in the UK must balance competing demands across nature restoration[1] and sequestration, food and energy production or housing and infrastructure development. These are highly context-dependent and require consideration of needs at the local or regional scale. Acknowledging these issues, the objective of this report is to better understand how rewilding is represented in discussions pertaining to the achievement of the legislated net zero target and what evidential or policy constraints might be limiting the contribution of rewilding to reducing greenhouse gas emissions and reporting on reduction targets in the UK.

In this introduction we set out the background and history of rewilding, how it fits into a continuum of nature restoration more broadly, and why it is advocated as a response to the nature and climate crises.

Box 1.1. Roundtables informing this report

The Grantham Research Institute on Climate Change and the Environment convened two roundtables in early and mid-2023 to support the writing of this report. There were 21 participants at the first policy-focused roundtable and 16 at the second roundtable, which had a technical focus. The workshops combined scene-setting presentations with plenary and group discussion.

Attendees representing research institutions, government agencies, environmental and farming NGOs discussed the carbon sequestration potential of rewilded land, barriers to data collection, modelling and challenges in defining rewilding. Discussion also focused on environmental, net-zero and land use policymaking in the context of rewilding.

The contents of this report have been guided by the roundtable discussions, particularly in terms of how individual organisations understand the topic through a practical 'on the ground' perspective and regarding expert opinion relating to evidential and policy constraints. However, the analysis and conclusions reached have been equally informed by document review and policy analysis conducted after guidance was received at the roundtables. Section 4 consolidates views from the roundtables alongside the authors' analysis of the literature.

What is rewilding?

Rewilding can be considered an umbrella term for a range of conservation activities, from unassisted vegetation colonisation on former agricultural land to the translocation of regionally extinct (or functional analogues of) extinct species to restore trophic networks (Schulte to Bühne, Pettorelli, et al., 2022). However, rewilding is debated by conservationists, land managers and researchers because it can mean different things to different people and has no clearly defined process, habitat size, management style or outcomes (Carver et al., 2021). This is argued by Jepson and Schepers (2016) to be both a limitation and an opportunity, by exposing rewilding to charges of a lack of clarity and 'sensationalist media interpretations' but also creating common but differentiated modes of conservation, grounded in principles that align with the priority of a state, region or landowner.

[1] The term 'nature restoration' encompasses multiple concepts, including ecological and/or ecosystem restoration and nature recovery.

Defining rewilding can be difficult (indeed, Hayward et al. [2019] identify 14 definitions). It can be interpreted as a continuum, a binary state or an open-ended process. The definition we used in the workshops informing this report is provided in Box 1.2.

Box 1.2. Terminology

For the purposes of the roundtable discussions, the Grantham Research Institute co-designed the following non-exhaustive definition of **rewilding** (while acknowledging the definition's limitations):

Rewilding is an approach **to large-scale nature restoration** and **conservation** that aims to increase the integration of natural ecological processes into managed and/or degraded landscapes.

Key principles can include protecting and reintroducing **keystone species**, removing invasive species, ending damaging practices and **restoring degraded landscapes**. There are proponents of active and passive rewilding approaches. Some practitioners see benefits in continued human intervention in landscapes that are 'rewilded' or undergoing a rewilding transition such as **managed grazing or active management** to support desirable habitat assemblages and the species that depend on them. For other practitioners, the goal of rewilding is to move towards the **removal of anthropogenic influences** entirely and in so doing support ecosystems to become self-sustaining.

To be considered successful, rewilding should not be introduced without engagement and support from **local communities** and where possible should be designed to deliver **socioeconomic** and **environmental benefits** simultaneously.

Principles of rewilding

The key principles associated with rewilding are large-scale interconnectedness of habitats, self-functioning ecosystems and reintroduction of keystone species. These principles emerged from North American ecological conservation thought. However, in the main, rewilding practitioners have moved towards redefining rewilding as the re-establishment of natural processes in functionally degraded ecological systems using socially inclusive approaches, putting them on a trajectory to being more ecologically complex, more self-sustaining, more self-organising and more likely to adapt to rapid human-induced changes, including climate change (Pettorelli et al., 2019).

There remains debate among rewilding practitioners and researchers about what (in both ecological and philosophical terms) can constitute a rewilding project. The process the International Union for Conservation of Nature (IUCN) has undertaken in developing its own organisational definition is neatly representative of such debate. A definition proposed in 2019[2] by the IUCN's Rewilding Thematic Group (a taskforce within the Commission on Environmental Management) created 10 principles that rewilding projects should adhere to (summarised in Box 1.3 below). The definition was aligned with early rewilding principles, in particular *wildness*, *remoteness* and *intactness*. Recognising that the definition represents just one school of thought, the IUCN has commissioned a new working group to co-develop a new definition, which is expected to be introduced by summer 2025.

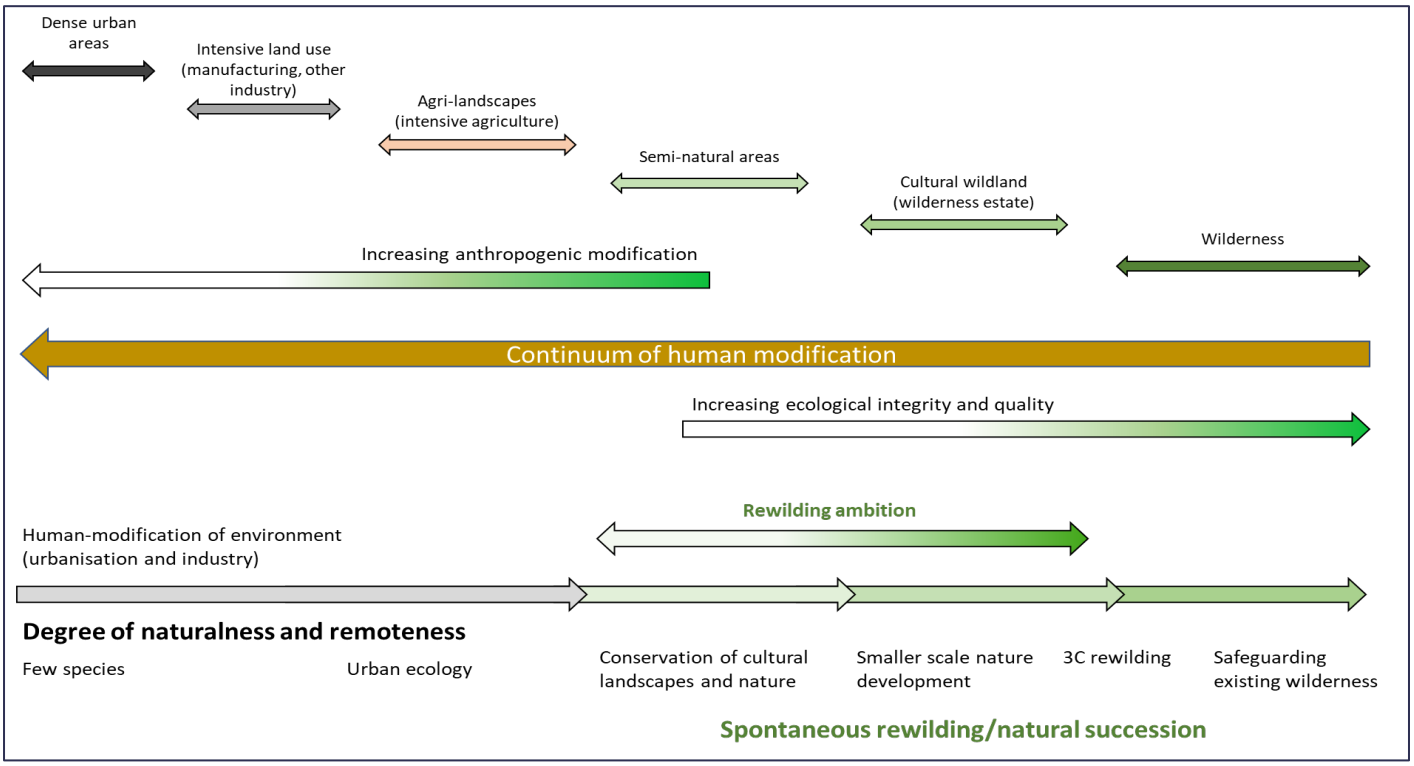
The wilderness continuum represented in Figure 1.1 illustrates the complexity of nature/human relations, and the challenges of defining rewilding given the differing degrees of ambition and management interventions. (See Section 4 for a discussion of the meaning of 'wildness' versus 'wilderness'.)

[2]The Rewilding Thematic Group's full definition of rewilding was: *The process of rebuilding, following major human disturbance, a natural ecosystem by restoring natural processes and the complete or near complete food-web at all trophic levels as a self-sustaining and resilient ecosystem using biota that would have been present had the disturbance not occurred.*

Box 1.3. Ten principles of rewilding (summary) – IUCN Rewilding Thematic Group

1. Rewilding uses wildlife to **restore food webs** and food chains.
2. Rewilding plans should identify core rewilded areas, and ways to **connect** them, and ensure outcomes are to the mutual benefit of people and nature.
3. Rewilding **requires local engagement** and community support.
4. Rewilding focuses on the **recovery of ecological processes**, interactions and conditions based on similar healthy ecosystems.
5. Rewilding recognises that **ecosystems are dynamic** and constantly changing.
6. Rewilding should anticipate the effects of **climate change** and act as a tool to **mitigate** its impacts.
7. Rewilding is informed by science and considers **local knowledge**.
8. Rewilding recognises the **intrinsic value** of all species.
9. Rewilding is **adaptive** and dependent on monitoring and feedback.
10. Rewilding represents a **paradigm shift** in the coexistence of humans and nature.

Figure 1.1. Wilderness continuum



Source: Carver et al. (2021)

Recent conceptual development of rewilding approaches

The earliest definition of rewilding (see also Box 1.4) included keystone predator reintroductions and the transition of large swathes of land to wilderness states that were argued to have existed prior to extensive environmental modification by humans (Soulé and Noss, 1998). This definition is now seen as best suited to certain geographical locations: where there is enough land (at least 10,000 hectares [ha]) for large herbivores to roam in relative isolation from human interference and where the reintroduction of keystone predators such as wolves does not impact proximate livestock farms. However, such associations tend to be front of mind when critiques are levelled against rewilding, with

local communities concerned about predator introductions, lack of input into project development, spillover effects and marginalisation of food production (Fraanje and Garnett, 2022).

Concern has been expressed by rural communities about rewilding projects where there is a perception that they have been developed without broad consultation and community buy-in (Wynne-Jones et al., 2018). Mikołajczak et al. (2022) pull together England-specific evidence that implies costs or benefits to farmers and land managers from introducing herbivores and carnivores, and other spillover effects, e.g. vegetation encroachment on boundaries or changes to local landscape and place-identity. Pettorelli and Bullock (2023), in acknowledging that there remain substantial differences among conservation ecologists with regard to how rewilding should be practised, including the place of apex predator reintroductions (in terms of trophic rebalancing, degrees of human engagement or spatial extent of the project), chart a middle course by contending that rewilding facilitates the development of self-sustaining, self-organising and resilient ecosystems shaped by natural processes.

Advocacy organisations in the UK have aligned their definition of rewilding with such framing. For example, Rewilding Britain describes the practice as "*the large-scale restoration of ecosystems to the point where nature is allowed to take care of itself. Rewilding seeks to reinstate natural processes and, where appropriate, missing species – allowing them to shape the landscape and the habitats within... Rewilding encourages a balance between people and the rest of nature so that we thrive together.*"[3] Definitions like this seek to broaden the appeal of rewilding beyond environmentalists and conservationists and defuse tensions surrounding predator reintroductions with farming communities, while ensuring that local communities are included and consulted throughout a rewilding process (Sandom et al., 2019).

Salcott Creek, Old Hall Marshes salt marsh, Essex.
Photo: Matthew Barker, geograph.org

[3] https://www.rewildingbritain.org.uk/why-rewild/what-is-rewilding/an-introduction-to-rewilding/defining-rewilding

Box 1.4. History of rewilding

Rewilding as a concept was borne out of debate and advances in conservation biology in the early 1990s. Early rewilding thought leaders such as Soulé and Noss (1998) advocated a '3C approach': creating large 'cores' (potentially more than 100,000 ha) free from human interference, 'corridors' that link 'cores' and the reintroduction of keystone 'carnivores', which manage ecosystems through predation dynamics.

Within landscape-scale rewilding projects, an important question for rewilding advocates has historically been that of the desired end state. Rewilding is typically split into open-ended or targeted approaches. Two early (but now uncommon) approaches, Pleistocene and Holocene rewilding, are defined by the end state targeted (Fraanje and Garnett, 2022):

- *Pleistocene* rewilding projects (more than 100,000 ha in size) set a benchmark target for landscapes to resemble the Pleistocene geological epoch (~2.5 million years ago until ~11,700 years ago), a period where landscapes were shaped by the complex trophic[4] interactions of large carnivores and grazers.
- *Holocene* rewilding projects target restoration of landscapes (1,000–10,000 ha in size) to one typical of the Holocene epoch up until industrialisation and mechanised agriculture took hold (between 11,700 years ago and the mid-to-late 19th century). Holocene rewilding is more concerned with the introduction of ancient (or proxy) herbivore species to manage smaller landscapes in closer proximity to human population centres.

Rewilding is also characterised by both active and passive approaches during project inception and the emphasis placed on restoring trophic dynamics.

- *Trophic, or active*, rewilding involves deliberately restoring trophic complexity at landscape scale through management interventions. Trophic rewilding is intentionally broad and can include the introduction of keystone predator species and/or large herbivores and interventions to restore ecosystems to better support the multiplicity of animal and plant species that have struggled or disappeared over the Holocene.
- *Passive* rewilding denotes an approach to rewilding where no human intervention is envisaged and typically involves abandoning land, whereas active rewilding draws from classic nature restoration processes (discussed below) to 'kickstart' ecological recovery in degraded ecosystems.

Differences between nature restoration and rewilding

Though it is considered within the remit of nature restoration, rewilding is distinct in a number of key ways. Nature restoration refers to the process of assisting the recovery of a degraded, damaged or destroyed ecosystem to its original or otherwise targeted state (Gann et al., 2019), using well-understood principles and techniques, driven by human-led decisions. Given the goals of nature restoration, management techniques to align on-the-ground project conditions with a desired benchmark (related to site preparation, biota introduction and maintenance) are costly and necessarily spatially constrained (Pettorelli and Bullock, 2023). Nature restoration has set goals and management strategies to achieve these aims.

Rewilding, while including some active management interventions, generally differs from nature restoration in three key ways, as identified by du Toit and Pettorelli (2019):

- Rewilding aims for minimal to no ongoing management in the long term.
- Rewilding focuses on present and future ecosystem functioning and resilience, enabling the ecosystem to continually adapt and self-organise in response to environmental change.

[4] The 'trophic system' refers to the place of various organisms at different feeding (trophic) levels and how they interact with other organisms within an ecosystem.

- With rewilding, preserving the pre-transition taxonomic precedent is of little importance – instead, taxonomic replacement is promoted for extinct native species that once underpinned the delivery of key ecological functions.

Importantly, beyond Pleistocene and Holocene approaches, rewilding does not have a pre-defined outcome, and there may be no desired end point (Waylen and Marshall, 2023). Additionally, rewilding (as originally conceptualised) is designed to operate at a large scale in both space and time, emphasising habitat connectivity and keystone species reintroduction (Soulé and Noss, 1998). This means that it can take many decades to see the full benefits of rewilding (as it can for restoration) while also being more controversial than nature restoration given the early emphasis on reintroducing large carnivores.

Additional points of difference between nature restoration and rewilding include:

- **Top-down vs. bottom-up approach:** Nature restoration is typically a top-down approach, with humans taking the lead in planning and implementing the restoration activities. Rewilding, on the other hand, is a bottom-up approach that allows natural processes to develop autonomously.
- **Focus on discrete variables vs. ecosystem function:** Nature restoration typically focuses on discrete variables such as restoring certain species. Rewilding, on the other hand, focuses on restoring healthy, self-sustaining ecosystem function.

Rewilding also implies a more dynamic and functionalist approach, with less predictable or desirable outcomes for certain biota, even those with high conservation value that were prioritised under traditional nature restoration (Lorimer et al., 2015). Pettorelli and Bullock (2023) explore the commonalities between nature restoration and rewilding, and find that the different focuses (nature restoration on targeted species, and rewilding on ecosystem functioning), can be combined where practicable to enhance ecosystem recovery and thus carbon sequestration (among other outcomes). This could manifest in nature restoration and rewilding approaches conducted in tandem (as per Figure 1.1) in the same landscape, or traditional restoration 'kickstarting' a rewilding pathway, e.g. blocking drainage channels to rewet degraded peatland.

Why is rewilding advocated as a response to the nature and climate crises?

The nature crisis and the climate crisis are interrelated, and actions to address them should be integrated. Advocates of rewilding argue the approach can address the twin nature and climate crises simultaneously, while increasing the resilience and transformative capacity of nature (Schulte to Bühne, Pettorelli, et al., 2022). Nature is already being affected by climate change but can contribute to carbon sequestration if managed and protected appropriately (Girardin et al., 2021). Similarly, nature can be a source of carbon emissions if it is not adequately protected and can also protect humans against some of the negative effects of climate change if managed well.

Reaching net zero emissions by 2050 is a statutory requirement[5] for the UK. Between 1990 and 2020, the agricultural sector, which uses around 70% of the country's land area, decreased its annual greenhouse gas emissions by 17% (using the GWP100 metric[6]). However, annual emissions have been static over the past decade. Overall, agriculture was responsible for 11% of the UK's emissions in 2021 (BEIS and DESNZ, 2023), compared with 7% in 1990. The CCC's balanced pathway for the Sixth Carbon Budget (2033–2037) projects that agriculture will be responsible for 13% of the UK's net emissions in 2030 and 20% by 2035 as other economic sectors achieve faster decarbonisation (CCC, 2020). In the CCC's Balanced Pathway the net sink from the land use sector[7] would only partially offset continued emissions from agriculture (2020a). These estimates include conventional

[5] Climate Change Act 2008 (2050 Target Amendment) Order 2019

[6] The 100-year global warming potential (GWP100) metric, used to compare methane and carbon dioxide emissions.

[7] Though closely related, the Land Use, Land Use Change and Forestry (LULUCF) and Agriculture sectors are two distinct categories. Carbon stock changes from forests, wetlands, settlements, harvested wood products and from land under agricultural use, such as grassland and croplands, are allocated to the LULUCF sector. Also included within LULUCF are emissions of other non-CO_2 gases from drainage and rewetting of soils (excluding croplands and intensive grasslands which are assigned to Agriculture), nitrogen mineralisation associated with loss and gain of soil organic matter, and fires. The Agriculture sector includes greenhouse gas emissions from livestock, agricultural soils and agricultural machinery.

afforestation scenarios (including conifers, native broadleaves and a mixed approach), which, compared with rewilded landscapes, are assumed to sequester carbon dioxide more rapidly (while potentially being more exposed to more climate risks) over shorter time periods (under 100 years). More detailed evidence regarding the understood greenhouse gas benefits of rewilding is included in Section 3.

Alongside the need to sequester carbon, there is the need to counter pressures on nature. The UK has precious few ecosystems that can be considered truly natural, with all habitats impacted by human modification. The 2022 UK Biodiversity Indicators documented short- and long-term deterioration across key metrics, such as the abundance of priority land- and sea-based species, and a decline in the condition of protected sites in the UK in recent years (JNCC, 2022).

The natural environment can play a vital role in mitigating climate change, as healthy ecosystems take up and store a significant amount of carbon in soils, sediments and vegetation (Gregg et al., 2021). The destruction and degradation of natural habitats through urban and industrial expansion and damaging agricultural practices have resulted in carbon being lost on a large scale. Restoring natural systems can start to reverse this damage at the same time as supporting and enhancing biodiversity, while delivering co-benefits for climate change adaptation, soil health, water management and society (ibid.).

Rewilding is argued by many to offer significant benefits in terms of ecosystem and biodiversity health, and building the resilience of landscapes to drought, wildfire risk and other severe weather events, given the improved retention and/or regulation of water flow. Beyond the biophysical benefits are those related to natural amenity, and the opportunity for recreation in rewilded areas (Bradfer-Lawrence et al., 2021). These benefits are summarised below.

Climate mitigation benefits

- **Grassland.** There exist large areas of converted grassland (used for livestock grazing) in the UK's broadleaf forest biome.[8] If a proportion of this land were reforested, or marginal areas of this land were reforested, there would be a likely increase in net carbon sequestration. Creation of species-rich grassland and floodplain meadows also offers potential to build soil carbon on sites that have soils that have previously been degraded. However, at present, there are few data on the greenhouse gas sequestration dynamics from rewilded land (Sandom et al., 2019).
- **Peatland.** Peatlands comprise around 10% of Britain's land area. In 2021, peatland within the Land Use, Land Use Change and Forestry (LULUCF) and Agriculture reporting sectors emitted around 17.3 million tonnes of CO_2 equivalent (Mt CO_2e) per annum due to degradation of their organic soils (UK Centre for Ecology and Hydrology, pers. comm.). Restoring peatland by raising water levels, promoting appropriate vegetation cover and reducing grazing pressure could abate these emissions, mitigating climate change while supporting the particular species that suffer as a result of their degradation.
- **Coastal habitats.** Though not currently included in the UK Greenhouse Gas Inventory, coastal habitats such as saltmarsh and seagrass store significant amounts of carbon that is at risk of disturbance from development, sea level rise and habitat degradation. Restoration of these systems can capture carbon via vegetation and depositional processes while providing wider benefits for flood risk management, biodiversity, tourism and fisheries.
- **Successional habitats.**[9] Species-rich grassland, heathland and other more early successional habitats generally store more carbon than under intensive agriculture. These habitats can be created and maintained (often in a mosaic) by lower intensity grazing systems, with or without introducing large predators.

[8] The National Food Strategy identifies extensively grazed land to be inefficient in food production terms and that it would be "uneconomic without payments for nature".

[9] Successional habitats are those where the mix of species changes over time, with different species assemblages 'succeeding' one another. Areas can be maintained in a 'successional state', for example through low intensity grazing. However, in the absence of herbivory or other disturbance, the vegetation community will continue to be replaced by another, based on existing seed source and vegetation biome, until a stable or 'climax' community is reached.

Adaptation and resilience

- **Wildfires.** Enhancing landscapes through making wetter areas with more ecological complexity reduces the risk of wildfire (Wang et al., 2023). This is most pronounced where large herbivores disrupt contiguous vegetation cover through biomass consumption, in so doing creating a more complex, heterogenous ecosystem more resilient to the spread of wildfire (Malhi et al., 2022).
- **Flooding.** Increasing woodland cover and other above-ground biomass results in greater absorption and reduced water runoff from land, which can reduce downstream flood risk (Jepson and Schepers, 2016). Rewetting wetlands and peatlands can support increased water retention and slow water flow. Similar benefits are achieved with the re-naturalisation of river channels. Flood protection can also be achieved through reintroducing beavers, for their natural flood management (Puttock et al., 2021).
- **Other ecosystem services.** Other adaptive benefits from rewilding include water purification, improved soil health and pollination. These are the (historically) unpriced benefits accruing from interventions in a landscape, but which provide services we would otherwise pay for.

Rural economic development

- **Tourism.** Rewilding can attract visitors who are interested in experiencing nature and wildlife. This can create jobs in the tourism industry, such as tour guides, accommodation providers, and food and beverage vendors (Rewilding Britain, 2019).
- **Other economic development.** Although just one individual example, the Knepp Estate in West Sussex, once intensively farmed and now a rewilding project, illustrates how new rural businesses can develop and leverage the environmental benefits of rewilding to boost on-farm income and provide employment in nature tourism, accommodation and artisanal farm products (Tree, 2018). It should be noted that Knepp does also benefit from first-mover advantage, security of tenure and proximity to urban centres.

Both the roundtables considered the importance of recognising that landscape recovery takes time, and when viewed purely through a sequestration lens, results may be discouraging for landowners and policymakers. It was further noted that rewilding should not be seen as a panacea for net zero or biodiversity restoration. It has its place in nature and landscape restoration efforts but given the emphasis on supporting natural autonomy, outcomes are far from certain in terms of net gains for net zero and biodiversity on human timescales, as rewilding responses are highly contingent on baseline ecological health and the degree of intervention within the strategy. However, if rewilding is understood to be a latter step on a continuum of land use (Figure 1.1), the 'speed' of a transition becomes less important than the fact that a transition away from extractive and degrading land uses has begun.

The first beaver dam to have been constructed in the wild in Scotland in the last 400 years.
Photo: Patrick Mackie, geograph.org

2. Rewilding in the UK policy landscape - overview

After providing some UK-wide background, this section summarises how rewilding is represented in policy, research, funding and delivery mechanisms within England and the three devolved administrations. The Appendix provides information on the various funding and support mechanisms available to land managers to support rewilding.

Background

Most policy and incentive schemes within the UK that are relevant to rewilding have been developed to replace the European Union's Common Agricultural Policy (CAP), following Brexit.[10] Under the CAP, landowners received payments based on area, with additional funding based on income foregone if they participated in environmental stewardship schemes.

Replacements for the CAP are at different stages of implementation across the UK, but typically target delivery of ecosystem services alongside the maintenance of sustainable food production. In England, schemes are now open to land managers that emphasise the approach of 'public money for public goods'.

The UK's administrations, in the main, do not use the term rewilding in land use, environmental or other policy documents or instruments. Instead, as identified by Waylen and Marshall (2023), terms such as nature restoration or recovery and nature regeneration are used. Nor is there is notable use of the term rewilding elsewhere in the UK public sector, beyond references by NatureScot (Scotland's non-departmental public body responsible for natural heritage) – see Box 2.1 below. The general avoidance of the term perhaps reflects the broader applicability of 'nature restoration' and the desire to evade the potential contention associated with 'rewilding'. Analysing how rewilding is represented in UK policymaking necessitates referring to agricultural, land use and environmental policy more broadly, and allowing the phrases 'landscape restoration', 'peatland restoration' or 'woodland creation' to stand in as imperfect proxies for rewilding (acknowledging that these are not necessarily examples of nature-based solutions [NbS] or rewilding).

The Conservative MP and former Minister for Energy and Clean Growth, Chris Skidmore, led an independent review of the Government's approach to delivering the net zero target, in 2023. His report identified linkages between the nature and climate crises and argued for an expansion of the Government's current woodland creation and peatland restoration policies. Recognising evidence gaps relevant to rewilding land uses, the review recommended the expansion of research by Natural England to investigate the carbon storage and sequestration of under-researched Greenhouse Gas Inventory categories, such as saltmarsh and mudflats, seagrass and seabed sediments. The Government's *Powering Up Britain: The Net Zero Growth Plan* acknowledges that maximising co-benefits for climate and nature will be required to meet net zero (HM Government, 2023d), with quantified emissions abatement assigned to policies supporting reforestation and peatland restoration in the 2023 *Carbon Budget Delivery Plan* (published to articulate the Government's proposals and policies to enable carbon budgets to be met) (HM Government, 2023a).

Current policy, research, funding and delivery mechanisms

England

Farming and land management: The Environmental Land Management scheme (ELMs) is the key relevant scheme in England. It provides three mechanisms through which land managers and farmers can receive payments for delivering environmental goods:

- The **Sustainable Farming Incentive** (available since 2023) introduces standards whereby farmers are paid to take actions that have a positive environmental impact, alongside the

[10] As a result of the UK decision to leave the EU, the EU CAP will cease to apply, but the existing CAP architecture and rules will be transferred into domestic law, via the EU (Withdrawal) Act 2018 and the Direct Payments to Farmers (Legislative Continuity) Act 2020.

production of food, such as reducing the use of pesticides, herbicides and inorganic fertiliser, introducing rotational grazing and improving manure management.

- The **Local Nature Recovery** scheme (to be online by the end of 2024) will subsidise local environmental restoration projects and replaces the CAP's Countryside Stewardship scheme. The scheme will encourage farmers to collaborate to enhance aspects of their local environment and is expected to contribute to afforestation targets, peatland restoration, habitat creation and restoration and natural flood management.
- Finally, the **Landscape Recovery Scheme** will fund long-term projects that involve substantial land use change or ecosystem enhancement such as rewilding, large-scale tree-planting and peatland/salt marsh restoration.

ELMs, and especially the Landscape Recovery Scheme (LRS), have been well received by environmental advocacy groups such as Rewilding Britain,[11] given the funding availability for large-scale nature restoration across two themes: recovery and restoration of threatened native species and restoring England's streams and rivers. The Government estimates that the pilot round of the LRS will deliver at least 10,000 ha of restored habitat and 25–50 kt of CO_2e savings per annum (Department for Environment, Food & Rural Affairs [Defra], 2023). Interestingly, documentation by Defra detailing the 2021–2024 Agricultural Transition Period explicitly aligns the LRS with "rewilding in places where that's appropriate" (Defra, 2020).

However, a recent report by the House of Lords Land Use in England Committee (2022) contends that ELMs has been hampered by uncertainty about how it will work, especially for tenant farmers and smallholders. In addition, it identified a need for the Government to invest in capacity-building for land managers to ensure there is a pipeline of independent experts to advise landowners or catchment groups about their options. The report made several recommendations to the Government that are relevant to the support of rewilding in England, which can be summarised as follows:

- Funding for NbS needs to include sufficient support for effective monitoring and auditing of projects.
- The future Land Use Framework needs to better align agri-environmental regulations to encourage afforestation and woodland management, but also to incentivise 'the right tree in the right place', given that tree planting may not always be suitable.
- As afforestation targets in England are not being met, attention needs to be paid to the development of incentives, support and regulations to improve progress on this front.
- More evidence about afforestation is needed, and access to high-quality, user-friendly data should be improved, along with better monitoring and evaluation of policies. (The independent *Review of Net Zero* also highlighted data constraints as inhibiting large-scale nature restoration in pursuit of net zero.)

The Government, in its response (much of which relates solely to afforestation) to the report, contends that a forthcoming 2023 'Land Use Framework' will be an adequate response to many of the recommendations proffered by the House of Lords' report. The Government pushed back against a need for better quality afforestation data by arguing:

> "Forestry Statistics are published annually by Forest Research and the National Forest Inventory on woodland area by age and species... The Forestry Commission's annual Key Performance Indicators include more detail on planting in England broken down by funding source, species type and annual rates of woodland loss and net change in woodland area. The recently legislated statutory tree canopy and woodland cover target also requires that monitoring and reporting are in place with respect to the interim and final legally binding targets." (HM Government, 2023c)

[11] See statement, 26 January 2023: https://www.rewildingbritain.org.uk/about-us/what-we-say/policy/elm-public-statement

It also stated that afforestation policy in support of net zero and nature restoration targets:

> "...should only plant or naturally establish trees where they provide a net benefit to the environment. Better informed targeting maps could support in delivering this and help identify where planting can provide natural capital benefits while being sensitive to environmental and social constraints." (ibid.)

Biodiversity: The Nature Recovery Network (NRN) is another relevant initiative, led by Natural England and Defra, to "restore and enhance England's wildlife rich places". The NRN seeks to enhance sites with designations for nature conservation by restoring 75% of protected terrestrial (including freshwater) sites in addition to creating 500,000 ha of additional habitat in non-protected areas. Other objectives, with goals closely aligned with the outputs of rewilding, emphasise climate adaptation through natural solutions to reduce carbon and manage flood risk, and sustaining ecosystems such as improved soil, clean water and clean air. However, the NRN does not make explicit reference to rewilding.

Despite the varied policy and funding support for nature restoration, including the initiatives mentioned above, recent analysis by the CCC (2023a) indicates that two targets relevant to rewilding in England are significantly off track: targets to increase woodland creation to 7,500 ha per year and to restore 30,000 ha of peatland per year, both by 2025. Analysis against the Carbon Budget Delivery Plan indicates that only 3,130 ha of woodland were created in England in 2023. Peatland restoration is also lagging behind, with only 4,323 ha restored in 2022.

Scotland

In the main, rewilding is not a term used by the Scottish Government. NatureScot, the agency responsible for safeguarding Scotland's natural heritage, is the only public institution that references rewilding (see Box 2.1 for the definition it uses). These references are on its organisational website and in a large synthesis report (Undercroft et al., 2022).

Farming: Powers over agricultural and land use policy in Scotland are devolved. The Scottish government is proposing a four-tiered system of farm support, under The Agriculture (Retained EU Law and Data) (Scotland) Bill,[12] with area-based income support in the first tier and additional payments available for farm sustainability measures, nature-based projects and landscape- or catchment-scale work. The Scottish Government has committed that 50% of direct area payments will be attached to enhanced conditionalities (i.e. for climate and nature) under Tier 2 of the model. This is closely aligned with the CAP.

Forests and peatland: Within the context of 'nature-based' greenhouse gas removal, Scotland has an afforestation target of 13,500 ha per year, increasing to 18,000 ha per year by 2024/2025. Total planting in 2020/2021 was 10,000 ha (CCC, 2022b). Forestry and woodland delivery are underpinned

Box 2.1. A rewilding definition for Scotland's public sector

Research commissioned by **NatureScot** developed the following definition of rewilding for use by Scotland's public sector:

Rewilding means enabling nature's recovery, while reflecting and respecting Scotland's society and heritage, to achieve more resilient and autonomous ecosystems.

Rewilding is part of a set of terms and approaches to landscape and nature management; it differs from other approaches in seeking to enable natural processes which eventually require relatively little management by humans.

As with all landscape management, rewilding should be achieved by processes that engage and ideally benefit local communities, in line with Scotland's Land Rights and Responsibilities Statement, to support a Just Transition. (Waylen and Marshall, 2023)

[12] The Agriculture (Retained EU Law and Data) (Scotland) Bill, gives Scottish Ministers the opportunity to modify retained EU law (Scottish Government, 2020).

Ancient Caledonian Forest, Glen Tanar. Photo: Phil Smith, geograph.org

by the 2019–2029 Scottish Forestry Strategy. Additionally, Scotland has a National Peatland Plan, published in 2021, which supports policy development and delivery to protect and restore peatland, promote sustainable management and limit negative impacts from extraction. Restoration targets have been consistently missed (ibid.), with the 2021 total of 8,000 ha well below both the 20,000 ha target in the Peatland Plan, and the CCC's Balanced Pathway recommendation of 45,000 ha annually from 2022.

Biodiversity: The draft Scottish Biodiversity Strategy, a high-level policy-focused strategy, targets several outcomes of relevance to rewilding across land and seascapes. The strategy aims for ecosystems to be "...diverse, healthy, resilient and deliver a wide range of ecosystem services", while enlarging and better maintaining protected areas and the abundance and distribution of species. Of relevance to net zero, tree planting and improved woodland management and connectivity to encourage natural succession and a diversity of tree species, along with peatland and blue carbon habitat restoration, are seen to be central to climate change mitigation and adaptation efforts.

The Scottish Biodiversity Strategy has a number of targets relevant to rewilding:

- By 2045 Scotland will have restored and regenerated biodiversity across land, freshwater and seas.
- Scotland's natural environment, its habitats, ecosystems and species, will be diverse, thriving, resilient and adapting to climate change.
- Regenerated biodiversity will drive a sustainable economy and support thriving communities, and people will play their part in the stewardship of nature for future generations.

Wales

Farming and land management: Rewilding is not mentioned in Welsh agri-environmental policymaking. Agriculture, land use, land-use change and forestry policy areas are primarily the responsibility of the Welsh Government. Post-Brexit, the Senedd Cymru (Welsh Parliament) passed the Agriculture (Wales) Bill, which sets out a framework for post-CAP agricultural support. Under the bill, sustainable land management will be the guiding principle for agricultural and land use policy.

The Sustainable Farming Scheme (SFS) gives effect to the goals of sustainable land management and provides funding for measures that deliver environmental benefits. Farmers must carry out specific 'universal actions' to be eligible to receive payments. Universal actions largely relate to on-farm sustainability measures, but there are also obligations to restore semi-natural peatland and a baseline obligation to have 10% tree cover on-farm.

Biodiversity: The Nature Recovery Action Plan for Wales sets out ambitions to reverse the decline in biodiversity in Wales. The Plan builds upon a 2015 Nature Recovery Strategy. Consistent with other government documents reviewed during preparation of this report, the Plan refers to 'nature recovery' rather than 'rewilding'. It supports spatial targeting for biodiversity restoration and better alignment of central government responses with the climate and biodiversity crises.

Forests and peatland: Wales's peatland and afforestation/woodland management targets are not yet being met, as pointed out in the CCC's *Progress Report* for Wales (CCC, 2023b):

- The Welsh Government's afforestation target is 2,000 ha/year. In 2020/2021 only 580 ha was achieved. Reaching the ambition of 43,000 ha of cumulative new woodland in the 2020s will remain challenging, given that around 4,000 ha will need to be planted per year.
- There is a commitment to increase the current target of 600–800 ha of annual peatland restoration to 1,800 ha a year by 2030/2031. Skills shortages in delivery bodies, and increased landowner engagement to support a steady supply of land, will need to be addressed to reach this target. Funding commitments giving effect to the identified shortcomings have yet to be formalised.

Northern Ireland

Farming: Agricultural support is a fully devolved matter in Northern Ireland. Development of post-CAP policy has been hindered by the fact that the Northern Ireland Assembly has not sat since May 2022, with policy decisions not forthcoming as a result. In March 2022, a paper titled *Future Agricultural Policy Decisions for Northern Ireland* was published, outlining a post-CAP agricultural support framework. Alongside production-focused support, a Farming with Nature Package will provide land managers with outcome-focused support for providing public goods in the form of nature restoration and other environmental improvements (e.g. expansion of tree cover, hedgerow management, unfarmed margins and buffer strips). The package will target uptake of habitat restoration and connectivity measures at a landscape scale, including on land in conacre [let land] and common land.

Biodiversity: An updated *Biodiversity Strategy for Northern Ireland* is under development and slated for introduction prior to the end of 2023 (Department of Agriculture, Environment and Rural Affairs [DAERA], 2022). This strategy, as articulated by DAERA in the *Northern Ireland Peatland Strategy*, will "take account of [United Nations Convention on Biological Diversity] COP15 targets to be agreed in September 2022... the targets commit DAERA to consider actions on a number of important issues, including sustainable food production, ending the illegal wildlife trade and implementing nature-based solutions for tackling climate change and reversing biodiversity loss" (DAERA, 2022). Using the language of "important issues" suggests high ambition but this is not yet reflected in the Assembly's policy.

Soil health: DAERA is currently rolling out a pioneering soil health project, recognising the importance of robust baselines when seeking to provide incentives for environmental improvements. The Soil Nutrient Health Scheme (SNHS), running from 2022 to 2026, aims to test the vast majority of the 650,000 paddocks used for farming in Northern Ireland in order to help farmers manage their nutrient applications and better understand natural capital baselines. The SNHS will seek to establish and refresh baseline data on carbon stored in agricultural soils and above-ground biomass. When baseline carbon stocks are calculated, DAERA proposes to validate these stocks within the Greenhouse Gas Inventory and engage with stakeholders on the design of "possible schemes to incentivise the farming of carbon as a business enterprise". Given the scope of the SNHS, the project is being rolled out zonally, with emphasis on capacity-building for land managers in the early stages of the project.

Forests and peatland: The current *Northern Ireland Forestry Strategy* aims to achieve 12% forest cover by 2050. Underpinning this is a commitment by DAERA to establish 9,000 ha of new woodland by 2030 through the Forests for Our Future afforestation programme. The current level of woodland creation falls far short of what the CCC (2023c) models in the Balanced Pathway: Northern Ireland averaged 226 ha per year over the last decade, which will need to increase to 1,000 ha by 2024, and 3,100 ha by 2035.

The Northern Ireland Peatland Strategy is a draft policy with conservation and restoration ambitions. The policy will support development of a Peatland Asset Register, restoration demonstration sites and funding for conservation management plans, research and awareness-raising. No specific restoration targets currently exist under the Peatland Strategy Implementation Plan. Of Northern Ireland's 240,000 ha of peatland, 80% is considered degraded. The CCC's Stretch Ambition pathway projects a reduction in the total degraded peatland to 53% by 2030, 32% by 2040 and 24% by 2050.

3. Rewilding in climate change mitigation and net zero pathways in the UK

This section begins by conceptually identifying rewilding in relation to nature-based solutions. It then provides an overview of the potential for rewilding to play a role in decarbonising the land use sector and identifies evidence gaps, and data and monitoring needs, for rewilding to be reflected in net zero pathways in the UK.

Rewilding as a nature-based solution to climate change

Alongside rapid and deep decarbonisation of the wider economy, greenhouse gas removal measures will be needed to capture residual emissions and meet net zero in the UK. Nature-based solutions (NbS)[13] for climate offer the potential for high-integrity greenhouse gas removals via sequestration and storage of carbon dioxide from the atmosphere in vegetation, soils and sediments while providing benefits for local biodiversity and communities (UNEP, 2022). It has been estimated that globally, land-based NbS could provide around one-third of the sequestration and abatement of greenhouse gases by 2030 (Griscom et al., 2017). However, this uptake will weaken if tipping points take hold and cascade (Lenton, 2013). Coastal and marine systems also play an important role in the regulation of climate, with around 30% of global anthropogenic emissions being taken up by the ocean, though measures that harness the oceans to actively remove and sequester carbon are less well quantified than those on land (Friedlingstein et al., 2022).

Examples of NbS encompass a wide range of actions across the protection and restoration of natural systems, including the rewilding of land. NbS can be cost-effective in comparison with engineered approaches if sited appropriately, adapting and evolving with a changing climate and potentially reducing maintenance costs over the long term (Seddon, 2022).

Outcomes of land use change are highly variable and the benefits that can be achieved are dependent on location. NbS to address climate change are most effective in providing mitigation benefits when they are applied to land that is degraded or already depleted of carbon, whereas old, undisturbed habitats may hold significant carbon stocks that require protection (Gregg et al., 2021).

Prior to the COP26 climate conference held in Glasgow, a UK-based consortium of academic and conservation leaders was convened by the Nature-based Solutions Initiative. It set out four high-level principles to ensure the long-term resilience of NbS for climate, which in summary are:[14]

1. NbS are not an alternative to the phase-out of fossil fuels and decarbonisation
2. NbS involve the protection, restoration and/or management of a wide range of systems on both land and sea
3. NbS must be created in partnership with local communities, respecting indigenous and other rights
4. NbS should support or enhance biodiversity at all trophic levels, from the gene to the ecosystem.

There are parallels here with the principles of rewilding, which also requires careful siting and community engagement to ensure delivery of resilient landscapes, wider socioeconomic opportunities and ecosystem services alongside its core goals of healthy ecosystems and protection and enhancement of biodiversity (IUCN, 2021). In addition, if sited appropriately, rewilding may come with reduced risk of perverse outcomes due to it being less driven by intervention and more focused on self-sustaining and self-organising ecosystems (Wang et al., 2023).

[13] The UN Environment Assembly Resolution on Nature-based Solutions formally adopted the following definition of NbS: "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits".

[14] See https://nbsguidelines.info/

In the previous sections, we have detailed the range of definitions relating to rewilding, and its commonalities/differences with nature restoration and/or habitat management. The fact that there is this range makes assigning current and potential abatement to specific land use change under rewilding extremely difficult. For example, the CCC, in its advice regarding the Sixth Carbon Budget, recognised the potential for rewilding to deliver environmental benefits but was unable to distinctly include the approach in its scenarios due to the lack of robust evidence on the abatement potential (CCC, 2020). Similarly, the Government's *Carbon Budget Delivery Plan* does not assign future abatement to rewilding actions but includes the aspiration to "maximise co-benefits for climate and nature alongside other priority outcomes" (HM Government, 2023a).

Formal pathways that must meet statutory requirements typically seek to align with measures included in the UK's Greenhouse Gas Inventory, given its role as the accounting framework for UNFCCC reporting (Section 4 contains more detail on the challenges of recognising rewilding within the Inventory). However, groups that are not constrained by this framework have not disaggregated rewilding abatement from that delivered by wider nature restoration and nature-friendly agricultural practices: this provides another indication of the analytical challenges associated with quantifying the potential contribution of rewilding. Instead, groups such as Rewilding Britain and the WWF in their assessment of the contribution of land use change to support decarbonisation focus on measures that are positive for nature at a range of scales and intensities.

Though nature-based climate solutions (including those that align with rewilding) can address both the biodiversity and climate crises, the sequestration they provide will deliver a relatively small, though important, proportion of the emissions reduction required for the UK to meet net zero, with the bulk coming from decarbonisation of the wider economy. Looking to 2100, Bradfer-Lawrence et al. (2021) highlight the modest contribution to the UK's net zero target from peatland restoration and woodland and saltmarsh creation even under ambitious land availability and landowner uptake scenarios. This underlines the need for NbS for climate approaches to be multi-functional, delivering more than just carbon sequestration and considering biodiversity and wider benefits, including resilience in the face of a changing climate. Girardin et al. (2021) consider NbS from a global perspective, stating that for climate approaches they will have real but limited mitigation benefits in the short term. However, they will continue to act long past the deadline for net zero targets, meaning such approaches need to be resilient, designed for longevity, and consider their wider impacts on biodiversity, communities, equity and other environmental priorities.

Quantifying the carbon storage and sequestration potential of rewilding

A fundamental part of rewilding is to champion the approach as a tool for nature restoration, recognising the intrinsic value of nature and wild spaces. However, as discussed above, rewilding projects are increasingly being initiated to address both biodiversity loss and the climate crisis, alongside a range of wider environmental and societal benefits. The focus on climate benefits, such as carbon sequestration and enhancement of carbon stocks, means it is important that change can be robustly quantified at a range of scales. This includes both nationally, to assess the contribution and effectiveness of rewilding in providing mitigation benefits, and at the local and regional scales, to meet the needs of land managers helping them to understand the impact of their efforts and to gain financial and other support for their delivery.

A land use framework pilot, supported by the UK's Geospatial Commission, has indicated that land managers and stakeholders are in favour of restoring degraded habitats and creating new habitats but need support to understand how the landscape works holistically, where carbon is stored and lost, and which carbon management interventions are most effective in light of new agri-environmental subsidies (HM Government, 2023b). These difficulties can be addressed by providing good-quality spatial and carbon flux data for each land parcel, including an assessment of how these values could change under different management interventions and/or financial models.

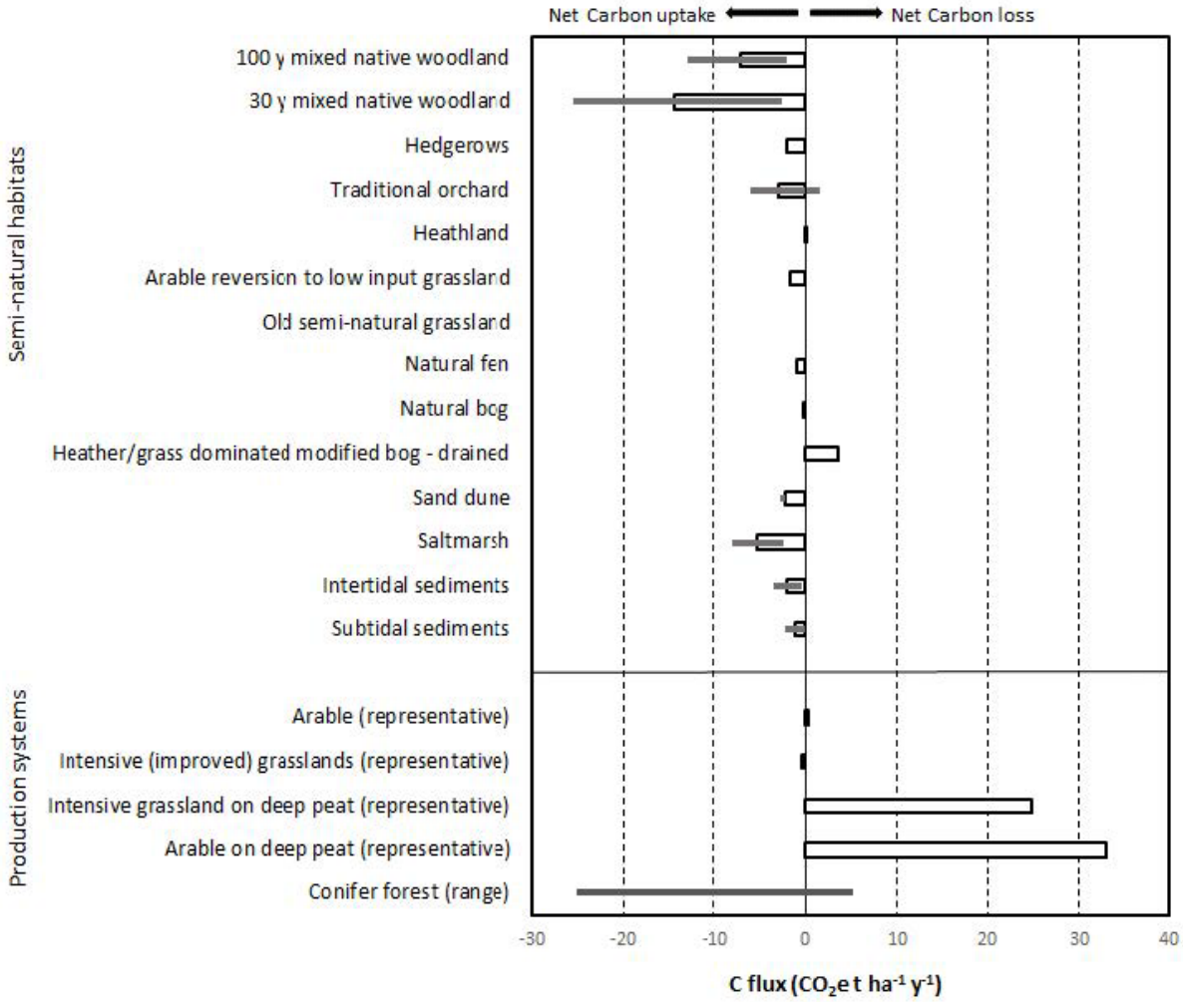
Data gaps

Robust, long-term data sets derived from rewilding projects are scant. This presents a challenge compounded by the fact that the definition of rewilding can encompass a wide range of land use states, transitions and outcomes. These may include rewetted peatland or woodland establishment,

which have well-understood carbon sequestration dynamics, but also re-naturalisation of rivers, coastal realignment, the introduction of regionally extinct predators or browsing animals with a view to supporting a transition towards novel vegetation assemblages, or wilder grazing systems that create a mosaic of early and later successional habitats. The state of knowledge regarding the carbon accumulation within these rewilding typologies is not very detailed and presents challenges for those seeking to quantify the climate mitigation potential of rewilding. However, despite this issue it is clear from the literature that restorative land management approaches with a focus on nature, particularly on the use of degraded land, can deliver carbon sequestration benefits (Girardin et al., 2021).

We suggest that it would be appropriate in some circumstances to use data from examples of more general nature restoration as a proxy for carbon stock and sequestration under rewilding. Though rewilding is disaggregated from such approaches, the underlying actions at a habitat scale are similar, differing mainly in intention of management and trajectory in reaching a self-sustaining state. Natural England, in a review of evidence regarding carbon storage and sequestration by semi-natural habitats relevant to the UK (terrestrial, coastal and marine, including freshwater systems), set out that natural systems have a greater capacity for carbon storage than intensively managed and extractive land uses (see Figure 3.1; Gregg et al., 2021). Protecting existing, at-risk carbon stocks of established habitats will deliver the most benefits for both climate and biodiversity, as these may have taken centuries to millennia to become established and can be quickly lost if disturbed or degraded. However, the review highlights significant evidence gaps, particularly relating to habitats that represent successional states that are relevant to rewilding, such as scrub and species-rich grasslands, and dynamic systems such as flood plains and coastal habitats, as well as a lack of consistency in monitoring and reporting. Targeted investment is required to fill evidence gaps and work towards reducing uncertainty bounds in representative emission factors.

Figure 3.1. Carbon flux in contrasting habitats and land management systems, using representative data



Source: Gregg et al. (2021)

Alongside data challenges, it is also difficult to predict the trajectory of land use transition under rewilding projects. This is required when setting out and quantifying the potential contribution of such land use change towards targets such as net zero. Again, this is another aspect of rewilding that is distinct from traditional nature restoration approaches that may have a designated species or habitat in mind, rather than supporting natural ecological succession (Carver, 2016).

Evidence from experiments and research

In the UK two broad, high-level categories can be defined to help steer the embedding of rewilding approaches into emission targets (admittedly, simplifying a complex ecological process): first, for scrub and open grassland and second, for closed woodland (J. Bullock, pers. comm.). Using remote sensing approaches following the establishment of a rewilding approach at the Knepp Estate in Sussex, Schulte to Buhne, Ross et al. (2022) were able to describe the land cover transition over a 20-year period. This captured a decrease of 41% in total land area under brown agriculture[15] and grass, a six-fold increase in areas covered with shrubs, and a 40.9% increase in areas with trees. Areas where large herbivores were initially absent were characterised by more pronounced land cover change and higher rates of primary productivity. Zu Ermgassen et al. (2018) reported rewilding was an effective nature restoration technique on moorland in the Scottish Highlands. They reported increased above-ground woody biomass and, after 15 years, restored natural tree recruitment. Increased monitoring and reporting of land cover change under rewilding strategies will provide an important evidence base in supporting more accurate representation of rewilding trajectories within land use models used to inform climate mitigation policies.

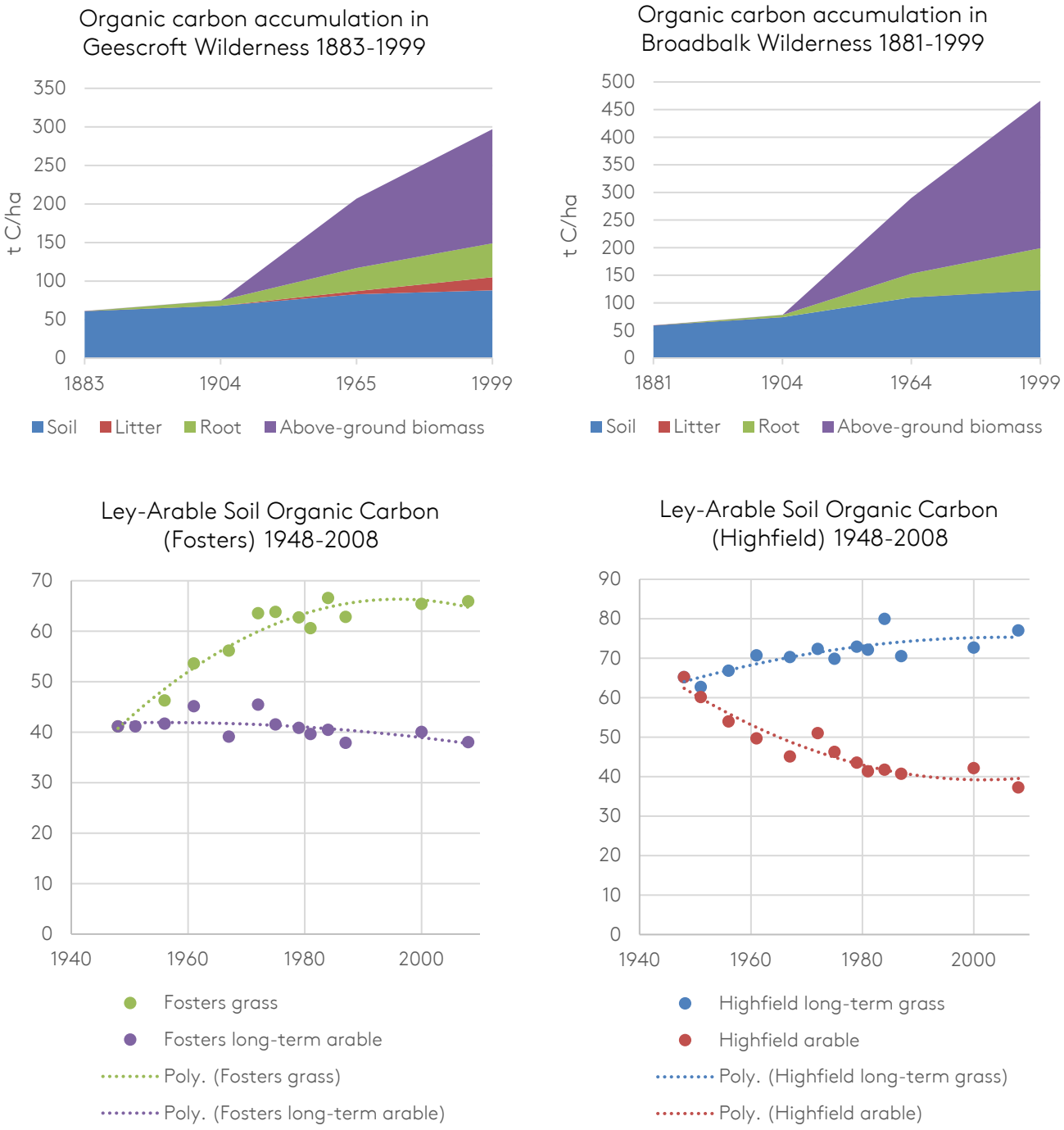
Land use change that prioritises emissions abatement can be highly interventionist, with plans often including planting both native and non-native tree species at high density and scale, or allocating land use for the establishment of biomass crops. These actions could result in perverse outcomes such as biodiversity loss and decline of ecosystem services due to monocultural land uses if not planned appropriately. Plans in which nature restoration or rewilding is the central principle are nature-led but may present an opportunity cost for carbon, particularly in the short term, as such approaches may involve a time lag before ecosystem functional processes become established. For example, degraded peatland soils will require past management interventions such as drainage channels to be restored before natural processes can become established, while natural regeneration of woodland requires an appropriate seed source within the vicinity.

However, developing evidence suggests that in the appropriate context, and with an available seed source, allowing natural processes to flourish can mitigate this potential lag while having wider benefits. In their study of passive rewilding of abandoned farmland in southern England, Broughton et al. (2021) report that closed canopy woodland, resilient to weather and grazing disturbance, reached comparable height structure with older woodlands within around 50 years.

The Wilderness plots at the Rothamsted Experimental Farm in Hertfordshire exemplify the quantification of carbon gains that can be made under passive rewilding projects. The Wilderness plots are two former arable plots that were fenced off in 1883 and allowed to regenerate naturally. Carbon accumulation in soil, litter roots and above-ground biomass at the two sites indicate that regenerating woodland on abandoned farmland has a potentially large capacity for sequestering carbon. The Geescroft site (acidic soil, oak-dominated woodland) accumulated 2.00 tonnes of carbon per hectare (t C/ha) per year over the 118-year period 1883–1999, while Broadbalk (chalk soil, mixed-deciduous woodland) accumulated 3.44 t C/ha per year (Poulton et al., 2003). Both sites demonstrated long-term steady accumulation of carbon under two 'rewilding scenarios' (ley-arable -> woodland and pasture -> woodland) for over a century, and sequestration rates substantially higher than on a conventional arable/pasture land use regime (see Figure 2.2 below). However, the Rothamsted Wilderness plots are relatively small and close to a seed source, facilitating their establishment.

[15] The authors of the Knepp study define 'brown agriculture' as: ploughed, recently seeded fields or fields that display limited to no greenery on satellite imagery.

Figure 2.2. Rothamsted wilderness plots



Note: A ley is grassland sown as part of crop rotation.
Source: Rothamstead Research (2018a, 2018b); Perryman (2015a, 2015b)

Bauld et al. (2023) report that natural colonisation is highly variable (e.g. reliant on grazing pressure, existence and quality of seedbank and seed source), with new woodland establishment limited to 70–174m from existing forests and trees. This suggests that while effective in some contexts, natural colonisation will need to be supplemented with interventions such as tree planting to be effective in meeting climate and biodiversity needs, which reflects the arguments made by Pettorelli and Bullock (2022) that mixing rewilding and restoration may be the best way to achieve desired outcomes.

Other emerging research at the Knepp Estate indicates that rewilding management affects where carbon is sequestered within a habitat and suggests grazing pressure may promote carbon storage in biomass rather than hinder it. Preliminary evidence, which has not yet been peer-reviewed, indicates

that grazing by free-roaming herbivores drives changes in the morphology of trees and scrubland, promoting increased branching and allocation of carbon to below-ground root biomass (N Burrell, pers. comm.). The scrub component of landscapes, often not captured in carbon assessments or literature, may therefore represent an under-reported carbon stock. While conservation-based grazing may support the shift to more carbon-rich mosaic landscapes, for example when compared with previously intensively-managed land, potential gains in sequestration by soils and vegetation will need to be balanced with the emissions of methane and nitrous oxide, which have high global warming potential, that result from ruminant livestock and their waste (Garnett et al., 2017).

The UK's Greenhouse Gas Inventory and its representation of rewilding

The UK's Greenhouse Gas Inventory acts as the formal national-level reporting tool for emission sources and sinks to the UNFCCC and Parliament. Inclusion of actions within the Inventory must adhere to IPCC guidance as mandated by the UNFCCC and be attributable to specific anthropogenic activities that lead to additional greenhouse gas emissions or sequestration. Where it is difficult to distinguish the relative contributions of anthropogenic activities and natural processes, the 'managed land proxy' can be applied: this assumes that if land is managed, anthropogenic fluxes dominate. In turn, these must be underpinned by transparent, robust and evidence-based estimates, available over appropriate timescales, of changes in greenhouse gas fluxes. Consideration should also be given to scale, with the Inventory taking a 'top-down' approach to estimating emissions at the country level. Disaggregated reporting at finer spatial scales, required to capture the emissions impact of changes at a local scale (e.g. ensuring representation of discrete land use change such as land restoration or rewilding), is currently not possible, with 'bottom-up' estimates (e.g. emissions at a local authority scale) produced probabilistically.

Capturing the emissions and abatement offered by rewilding projects may be limited by these requirements. Rewilding, though initially a process of transition, typically has an end goal of being dominated by natural processes and/or being self-functioning. Ecosystems in the UK, due to millennia of human interference, could be considered to be influenced by a legacy of land use change or indirectly impacted by anthropogenic activities (e.g. acid deposition in the uplands, or nutrient loading in wetland systems). Therefore, though the process of rewilding would be eligible for reporting (subject to evidence), once 'rewilded', the emissions and sequestration may fall out of scope of national reporting, given land could be considered unmanaged and therefore any sequestration non-additional to what would happen without human intervention.

As the Inventory is designed to account for point sources of emissions (i.e. industrial sources) or removals on land (e.g. from defined blocks of woodland), a case could be made that the component parts of rewilding are already captured. The LULUCF sector captures land use change via reporting within the grasslands and woodland categories, while peatlands and their management are captured under the organic soil categories embedded within the LULUCF subsectors. However, these could be considered siloed, missing out the dynamic and successional habitats that form part of the rewilding transition and connectivity, a key principle of the concept. For example, distinct categories representing species-rich grassland, heathland and forms of natural regeneration and scrub are not included and existing categories (e.g. grasslands) would require further disaggregation for them to be accurately represented. The terrestrial-focussed reporting structure of the Inventory also excludes coastal and marine systems. Though the potential for carbon sequestration eligible for inclusion has been assessed to be relatively small (CCC, 2022a), these ecosystems receive carbon from terrestrial sources upstream and therefore represent an important part of the connectivity between land and sea.

Evidence gaps, monitoring and reporting

Overcoming the barriers to improved representation of rewilding projects in emissions reporting at the UK scale will require addressing both the underpinning data challenges (see previous section) and development of the greenhouse gas reporting framework to include the wide range of habitats relevant to rewilding trajectories of transition. Current and developing projects can play a significant role in filling evidence gaps, providing empirical field-based data mapped to the spatially defined areas of projects. The UK LULUCF Inventory reporting currently utilises a range of spatial datasets

such as those providing national coverage (e.g. the UK Centre for Ecology & Hydrology's Land Cover Map and Countryside Survey), alongside more locally focused reporting such as the provision of peat restoration mapping by each of the UK administrations. The provision of standardised reported project data from rewilding projects could complement this, providing robust, spatially-aligned data at local scales.

Approaches to monitoring will also need to be standardised, to support consistency and alignment across projects. This is particularly important in the monitoring of habitat carbon stock and exchange given what is known about the heterogeneity in carbon flux in the literature (Gregg et al., 2021), especially if citizen science approaches are advocated. Steps to achieve this are being taken, such as in the approach by Rewilding Britain, which aims to provide monitoring guidance to network members, taking a systems approach that includes biodiversity, ecosystem functioning and socioeconomic factors (pers. comm.). In 2021, Natural England launched a programme of research under the title 'Nature-based Solutions for Climate Change at the Landscape Scale'. This sets out to measure carbon storage and sequestration in underrepresented habitats such as grassland, scrub and hedgerows with a view to fill gaps in the evidence base such as those relevant for rewilding. With the appropriate support, such on-the-ground approaches could be complemented by remote sensing techniques, fulfilling the need to track outcomes at scale such as connectivity and ecological transition across a landscape (Schulte to Buhne, Pettorelli et al., 2022).

The Knepp Estate was recently used as a case study, using freely available satellite data to ascertain how rewilding impacted land cover change (Schulte to Buhne, Ross et al., 2022). This analysis used Landsat Collection 2 Tier 1 Surface Reflectance satellite data at 30m resolution and the Normalized Difference Vegetation Index to analyse change between 2000 and 2020. While the study did not measure carbon fluxes or stocks, it did demonstrate the potential for such techniques, if paired with robust emission factors, to offer rewilding projects effective reporting approaches to climate mitigation outcomes.

A Tamworth pig on the Knepp Estate rewilding project in West Sussex.
Photo: Ian Cunliffe, geograph.org

4. Rewilding and decarbonisation of land use in the UK

This section consolidates findings from the previous three sections on rewilding and its conceptual development, the UK policy landscape and implications for net zero. Input from the two roundtables has also been integrated into this section, drawing together these two strands of evidence and highlighting key findings.

Current agri-environmental policy and rewilding in the UK

Nature restoration, rather than rewilding, features in environmental strategy and policymaking by the UK and devolved administrations. These policies incentivise restoration of defined priority species and habitats over discrete periods. All administrations are falling short of woodland creation and peatland restoration targets (which have been used in this report as imperfect proxies of policies supporting rewilding). If the UK administrations are not currently meeting discrete targets habitat-specific nature restoration, the step change in policy to support management change required for rewilding targets will be a barrier. Given the focus of rewilding on restoring natural dynamics and self-sufficiency in ecosystems at a landscape scale (not to mention species reintroduction) this may prove challenging under current policy and delivery frameworks.

Snapshot of relevant UK policy:

- In England, the Landscape Recovery Scheme (LRS) within the Environmental Land Management scheme (ELMs) has proved popular, being over-subscribed in the first round. The LRS operates at a scale of 500–5,000ha to support key rewilding aims, which represents a step change in philosophy. However, with only 0.07–0.1% of England's landmass covered by the LRS, meaningful contribution through this element of ELMs to net zero is no surety.
- In Scotland, research commissioned by the government explores rewilding within existing policies, but public bodies currently lack incentives for rewilding, including for sequestration, and traditional nature restoration processes prevail under the Scottish Biodiversity Strategy.
- In Wales, 'universal actions' under the Sustainable Farming Scheme support more nature-friendly land use practices but are misaligned with rewilding principles.
- In Northern Ireland, agri-environmental policy is not expected to diverge substantially from the CAP. The Soil Nutrient Health Scheme reflects a coordinated approach for aligning land use practice with nutrient reduction targets and potential participation in nature carbon markets.

Roundtable input[16]

Policy in the UK administrations is misaligned with effective rewilding processes. In England, the momentum of ELMs has slowed down, with Defra focusing on data collection and operational policy rather than expanding pilots and landowner participation. Greater emphasis needs to be placed on raising awareness of post-CAP subsidies and skills development to ensure land managers understand and can fully engage with these schemes in order to leverage maximum benefits for climate and nature.

The opportunity cost of permanent land use change must be addressed through alternative income sources, such as nature carbon markets and government subsidies. Without public and private financial pathways that are fit for purpose, undercapitalised landowners, smallholders and tenant farmers will struggle to justify the opportunity cost to begin rewilding transitions given current funding rates are inadequate to cover active rewilding transitions (in terms of baselining, preparation, planting, maintenance and labour).

[16] These sub-sections represent key views and points raised in discussion at the two roundtables (see Box 1.1). Where an individual's view has been included, this is mentioned. The authors' own views are not necessarily represented in these sub-sections.

The misalignment of incentives potentially creates challenges between landlords and tenants, who may have opposing views on how land should be managed. Land managers are hesitant to move early in making changes to their management systems, given the policy uncertainty. For example, there could be challenges in attempting to align the (at times divergent) interests of graziers on common land, given the confusion around LRS funding rates, contract structure and landowner requirements.

Data collection and monitoring

Predicting rewilding's contribution to net zero is complex given the evidence gaps identified, the lack of a precise definition and variations in project design. Predictive models are considered inaccurate, emphasising the need for endpoint measurements to assess rewilding's relationship with carbon sequestration for informed long-term policies.

Operating at rewilding-relevant scales comes with substantial technical challenges related to the quantification and monitoring of carbon fluxes across different habitat types, which differ by climate, soil type, management style and scale. Many rewilding projects place emphasis on natural colonisation in pursuit of resilient self-sufficient ecosystems. However, the outcomes of such 'interventions' cannot be accurately predicted for reporting purposes. Presently, these unknowns create substantial challenges for policymakers attempting to incentivise rewilding in pursuit of net zero given that there is no 'end goal' and little regional or biota-specific data to measure progress against, or reward.

Roundtable input

For carbon flux in rewilding projects to be monitored and reported on adequately, there is a need to overlay activity data with spatial data at a project level. Field experiments and longitudinal studies that measure or model carbon accumulation under different restoration scenarios exist, but concerted efforts to regularly synthesise and identify evidence gaps to support targeting of funding are limited (beyond that seen in Gregg et al., 2021). Current inconsistencies in carbon calculations across project methodologies are a further problem here. A consistent method is needed to bring together representative data streams from different habitats to support landowners and institutions participating in rewilding or nature carbon markets.

Government could consider nominating an organisation to capture and manage carbon and greenhouse gas flux data (alongside wider socioeconomic and ecological data) from rewilding and nature restoration projects. This could build on DAERA's Soil and Nutrient Health Scheme in Northern Ireland (this was broadly supported given the emphasis on relationship building, knowledge exchange and skills development for landowners regarding options to improve carbon sequestration and storage within their landholding). Participants also noted that the 2023 *Finding Common Ground* report by the Geospatial Commission (HM Government, 2023b) also recommends that future land use policy is supported by a shared, spatially-explicit evidence base that integrates data and scientific knowledge, and supports innovative decision technologies.

Rewilding and net zero pathways

Although rewilding offers climate benefits, its role in land use decarbonisation depends on large-scale implementation. Successional habitats such as species-rich grassland, heathland and scrub are not well understood in terms of carbon sequestration, thus there are significant research gaps that need to be filled for such analyses to be completed with any accuracy. Carbon budgets associated with rewilding would also need to include, potentially, the greenhouse gas abatement associated with replacing land used for ruminant livestock. Such an improvement in the evidence base would supplement what is known about established land uses in the Greenhouse Gas Inventory, such as woodland and peatland, and provide more granularity in the understanding of landscape transitions and carbon flows. However, careful consideration will need to be given to the costs of generating these insights compared with the expected carbon savings.

To integrate rewilding into the Greenhouse Gas Inventory for UNFCCC reporting and net zero considerations, it is crucial to have a precise definition of rewilding, backed by robust emission factors and activity data. Nothwithstanding disagreements on existing emission factors, accurate Monitoring,

Reporting and Verification systems are vital for inclusion in carbon reporting mechanisms and securing financial support for rewilding. As discussed, there may be a role for an umbrella organisation to standardise on-the-ground practices, including collating remote sensing data using a common methodology (e.g. Schulte to Bühne et al., 2022) and overlaying this data with regionally-specific activity data on grassland, scrub, woodland and peatland to infer carbon flux.

Roundtable input

Technological advancements in remote sensing, like Lidar and Sentinel, can provide relatively low-cost spatial data for estimating rewilding outcomes, aligning with LULUCF reporting. These technologies already inform LULUCF reporting for the Greenhouse Gas Inventory. Future advances in remote sensing and other techniques need to be planned for, and continue to be incorporated into policy and carbon accounting in the UK. Operating at rewilding-relevant scales presents technical challenges in quantifying carbon fluxes across diverse habitats, hindering accurate reporting for net zero. A consistent method is needed to synthesise and address evidence gaps in carbon accumulation, and the Government could usefully nominate an organisation to manage data and monitoring from rewilding and nature restoration projects.

There is a pressing need for diverse approaches, including natural regeneration, restoration and conservation management, to mitigate risks of projects becoming 'semi-natural monocultures'. One participant argued that existing emission factors for activities within the Inventory are flawed and need to be more robust, but this should not preclude rewilding from reaching higher evidential standards, given deficiencies within other categories.

Understanding the socioeconomic impacts and benefits of rewilding

Barriers to the acceptance of rewilding are linked to early rewilding definitions that prioritised wilderness,[17] conceptually separating humans from nature. More recent thinking advocates wildness in landscapes with a human presence (Ward, 2019). Rewilding in the UK aligns closely with European practice, which is more accepting of anthropogenic legacies (Sandom and Wynne-Jones, 2019). Evidence suggests public opinion is becoming largely supportive of rewilding aims, with a 2021 poll conducted by Rewilding Britain reporting that 81% support rewilding and 83% support Britain's national parks being made wilder. In popular culture, rewilding is often framed dichotomously with livestock farming – this is largely unavoidable as, by definition, rewilding seeks to restore the healthy functioning of degraded landscapes, which many established agricultural areas might fall under.

Whether or not one subscribes to a binary framing of rewilding versus farming, it remains unlikely that a valuation exercise will be able to satisfactorily quantify the net cultural, social and environmental benefits provided by these land uses. In attempting to straddle the farming/rewilding dichotomy that many see, Aglionby and Field (2023) place rewilding within a land use continuum (originally conceptualised in Dimbleby, 2021), where land use is graded based on its provision of ecosystem services proportionally to agricultural produce across a continuum:

High yield -> conventional -> regenerative -> low yield -> semi-natural -> wilderness

The UK also faces a challenge to balance the wider, multiple objectives that society requires from land, including food, nature and climate regulation. Other considerations include the siting of renewable energy installations, producing biomass domestically for energy feedstocks and timber to support low-carbon building materials (CCC, 2023a).

Sandom et al. (2019) emphasise farming's role in shaping UK landscapes and its cultural significance. Rewilding goals may conflict with agrarian culture and national identity, requiring careful engagement to prevent conflicts (Wynne-Jones et al., 2018). However, examples such as the Tarras Valley Nature Reserve in southern Scotland represent rewilding driven by the local community who wish to restore

[17] Ward (2019) describes the connection between rewilding and notions of 'wilderness' and 'going back'. These concepts, it is argued, are proffered by European and American men in Western environmental narratives, and are tied to colonialism where peoples are, and continue to be, excluded from their land and their histories are overwritten in pursuit of a pure, wild place. Ward sees an emphasis on wildness over wilderness as offering rewilding advocates the best potential to expand the concept and practice. Wildness is best understood as natural autonomy and is seen to offer most hope for the concept for human-nature coexistence in a rapidly urbanising world.

degraded land for future generations. Led by the Langholm Initiative, at over 2,000 ha the Tarras Valley site represents the largest-ever community buyout of land in southern Scotland.

Standardised monitoring of rewilding impacts on ecosystem services, socio-cultural values and economic indicators, as proposed by Sandom et al. (2019), would enhance understanding. Deep engagement in rural areas is essential, given the diversity of rewilding approaches and the need for more research on social preferences, perspectives and local impacts of rewilding transitions. Environmental benefits are better understood, but further research is needed on social aspects and the economic and cultural impacts of rewilding transitions in land use.

Roundtable input

Achieving social acceptance for rewilding requires careful consideration and monitoring of local community perceptions of land undergoing rewilding. Some of the public view rewilding as favouring, or being best suited to, larger, well-capitalised landowners – harming acceptability. Clarifying funding rates, contract structure and issues of tenure could help address concerns, given the need to enable a just transition for rural communities to land uses with lower emissions intensity and higher rates of carbon sequestration. There are also risks and trade-offs (and a need to manage these) of rewilding within broader food system goals, especially regarding emissions leakage (where food production is displaced to jurisdictions with higher emissions intensity) within the food system.

Gilfach Farm Nature Reserve, mid-Wales.
Photo: Chris Andrews, geograph.org

5. High-level recommendations for the UK government and administrations

Our research and analysis lead us to make the following recommendations for UK policymakers, central government and the devolved administrations:

1. **Policymakers should support work to improve the evidence base relating to carbon flux** from rewilded land, as current gaps are limiting the representation of rewilding within decarbonisation and greenhouse gas removal strategies for the agricultural and land use sectors.
2. **The Government should consider using the definition of rewilding currently being set out by expert communities** including the International Union for Conservation of Nature (IUCN) Rewilding Working Group (expected by summer 2025), if it proves appropriate. The Government and conservation agencies should then develop region- and habitat-specific guidance to reflect landscape responses to rewilding interventions.
3. **Central government and the devolved administrations should increase the level of detail in existing Greenhouse Gas Inventory categories** to reflect the real impacts of land use change that results from ecosystem restoration and conservation approaches. This would then support the reporting of actions aligned with rewilding.
4. **Central government and the devolved administrations should clarify to landowners what tools are appropriate for determining natural capital baselines** and consider the merits of nominating or creating an organisation to capture and manage carbon and greenhouse gas flux data (alongside wider socioeconomic and ecological data) from nature restoration projects, including those that follow rewilding principles.
5. **Central government and the devolved administrations should continue to fund case study and longitudinal research to improve the evidence base** from the UK for rewilding, at project and landscape scale, assessing the net benefits of, and trade-offs between, delivery of ecosystem services such as carbon sequestration, landscape resilience and nature restoration. Successional habitats should be prioritised, given the evidence gaps that currently exist.
6. **The Government needs to ensure that access to rewilding incentives is fair and supports a just transition in rural communities,** including recognising the importance of continued food production. Administering agencies should remove the obstacles to accessing environmental improvement incentives encountered by smallholders, tenant farmers and larger landowners and provide funding for skills development and knowledge exchange to maximise the uptake of post-CAP subsidies by these groups.
7. **Central government and the devolved administrations should incentivise rewilding,** including by promoting connectivity across all landscape types where appropriate, not just the uplands. The Environmental Land Management scheme and devolved administrations' post-CAP frameworks should address this through supporting regenerative and nature-friendly farming and connectivity of 'wild' places.

Appendix: Funding and delivery mechanisms in the UK that support land use carbon sink creation

Note that this list is non-exhaustive.

Administration	Support mechanism, date of establishment and description	Amount and expiry date
England	Nature for Climate Fund (2021): supports afforestation and woodland management, nursery and workforce/skills development.	£650m, available until 2025
	Big Nature Impact Fund (2022): provides seed funding for a public–private impact fund to invest in restoring nature.	£30m, expiry date unknown
	Nature Markets Framework (2023): strategy to expand markets for carbon and ecosystem services.	N/A
	Natural Environment Investment Readiness Fund (2022): competitive grants to support environmental projects in England that contribute to 25-year Environment Plan goals or produce revenue from ecosystem services.	Grants of £10,000–£100,000. Closed February 2022
	Nature Returns (2023): research programme to explore how nature restoration at large scales can integrate with food production, focusing on better greenhouse gas measurements.	£5m, expiry 2024
Scotland	Low Carbon Fund (2021): supports Scottish Forestry to expand national forests to reach 18,000 ha/year by 2024–2025, including £20m to increase nursery capacity.	£100m, expiry date unknown
	New Acquisition Strategy (2021): supports Forestry and Land Scotland to acquire land for commercial conifer or native woodland creation, or land suitable for peatland restoration.	£39m (30m investment by Scottish Government and £9m transfer of residual funds from woodland creation programme), expiry date unknown
	Support (2020): to restore 250,000 ha degraded peatland by 2030, at a target rate of 20,000 ha annually.	£250m, expiry 2030
	Nature Restoration Fund (2022): support to long-term, landscape-scale projects that address restoration and protection of terrestrial and marine habitat and species.	£65m, expiry 2026
Wales	Woodland Creation Grants (2023): fund for farmers and other landowners to plant trees and install fencing and gates.	£32m. Site maintenance payments are made for 12 years post planting alongside payments to compensate for a loss of agricultural income. Expiry date unknown.

	The National Peatland Action Programme (2020): funding restoration of peatland across Wales.	£5m invested to date, expiry date unknown
	Nature Networks Fund (2023): grant funding to improve condition and connectivity of protected land and marine sites.	£45m from 2022–2025
Northern Ireland	The Northern Ireland Peatland Strategy (2022): draft policy with conservation and restoration ambitions for peatlands within Northern Ireland. Will support development of a Peatland Asset Register, restoration demonstration sites and funding for conservation management plans, research and awareness-raising.	No funding identified
	Forest Expansion Scheme (2023): funds applicants to establish native/exotic woodland at up to 100% of the establishment costs and provides annual premium payments for 10 years.	Unknown
	Small Woodland Grant Scheme (2023): supports landowners to plant smaller scale native woodlands that are at least 0.2 ha in area. Funds planting of trees, new stock fencing where required and annual premium payments for a 10-year period.	Establishment grant is paid at £2,925/ha, 80% in year 1 and remaining 20% in year 5. Expiry date unknown.

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