NatureScot Research Report 1271 - Case studies in Large Scale Nature Restoration and Rewilding

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Keywords

biodiversity; climate change; green finance; land use; nature; rewilding; socio-economic

Background

The research explores barriers and opportunities to large-scale nature restoration projects (LSNR) and rewilding through case studies. Within the literature a range of terminology is used to describe nature restoration at the landscape scale, however the projects included in the study include a broad spectrum of approaches and project scales, which may not be all recognised as ‘rewilding’. The approach involved the evaluation of 25 case studies, ten of which were explored in greater detail and were informed by one-

to-one interviews. The research included analysis of how LSNR / rewilding can be financed using a variety of different financing mechanisms. The research also sought to identify the potential socio-economic impacts of projects, however it needs to be noted that the evidence base is incomplete, and the data is mostly qualitative.

Main findings

Project aims, objectives & timescales

- LSNR / rewilding projects have varied principal aims and objectives, including restoring habitats and natural processes, enhancing carbon sequestration and storage, and moving to models of land management which are environmentally and economically sustainable.
- All case study projects had broader aims and objectives which reflect the multi-benefit character of nature restoration projects covering social and economic as well as environmental objectives.
- Most projects are driven by a focus on restoring natural processes or habitats that are being lost. Several projects focus on aspects of climate mitigation including peatland restoration or woodland creation and regeneration. A number of projects aim to increase the diversity and resilience of ecosystems to climate and other changes.

Project benefits

- LSNR / rewilding projects potentially have a range of economic impacts, directly and indirectly, positive and negative. Overall, most of the case studies do not have quantitative data to enable assessment of overall net effects on employment/income on the land affected or in the wider economy compared with the baseline. These data do not appear to be routinely captured.
- Social benefits are identified in relation to employment, volunteering, recreation, education and engagement, with mental health benefits from employment and flood risk reduction.
- Learning from other projects nationally and internationally is beneficial for project management and development, and knowledge sharing needs to be supported.

Issues and barriers

- A persistent barrier to effective implementation is that of translating a vision into a functional delivery framework that is underpinned by sufficient staff and funding.
- Engagement with local stakeholders is important to overcome areas of potential conflict or perceptions of impacts of land management change on surrounding areas. This needs to be supported by ongoing engagement.
- Funding related barriers include lack of alignment of project aims with existing funding schemes and short-term funding cycles being out of step with the long-term project aims.

- Project funders vary significantly in their administration and reporting requirements and although some appear burdensome, most of the detailed case studies did not suggest it had been a barrier to project delivery. It can often be difficult to capture changes at the scale at which LSNR / rewilding projects operate because monitoring data is typically spatially discrete, although some projects have involved academics in monitoring and evaluation of benefits.
- Upland LSNR typically face fewer barriers, however deer management is an issue for the Scottish Highlands, particularly where projects focus on woodland expansion, but also in relation to peatland restoration.

Delivery mechanisms

- The most straightforward pattern of project implementation appears to be for owner-occupied estates which, subject to the influence of regulators, are under the control of a single owner.
- Partnership working tends to be beneficial to project delivery, however this requires significant time inputs to influence landowners to bring about land management change.

Fitting LSNR / rewilding with the wider environmental policy context

- In lowland agricultural LSNR projects, the role of agri-environment funding is significant in the delivery of the projects which reduce the area of productive agricultural land.
- Coastal realignment projects can include significant engineering work to reflect the dynamic coastal edge and management of natural processes. The disruptive nature of significant engineering work may require additional mitigation for protected species impacted by the works.
- Green finance is evolving, both for wider environmental outcomes and specifically within nature restoration. One of the main challenges with ecological financial markets is that they are not yet widely understood in terms of the benefits they deliver and the investment vehicles that are required to support them.
- The report includes a set of recommendations for further work on the potential of LSNR / rewilding.

Acronyms

AES	Agri-Environmental Scheme
AONB	Area of Outstanding Natural Beauty
ATN	Associação Transumância e Natureza
BNG	Biodiversity Net Gain

CAP	Common Agricultural Policy
CS	Countryside Stewardship
CSGN	Central Scotland Green Network
DofE	Duke of Edinburgh Award Scheme
EA	Environment Agency
ELM	Environmental Land Management
ELP	Endangered Landscapes Programme
ERDF	European Regional Development Fund
ES	Environmental Stewardship
EU	European Union
FBT	Farm Business Tenancy
FCS	Favourable Conservation status
FTE	Full Time Equivalent
GES	Good Ecological status
HOWL	Highland Outdoor and Wilderness Learning
ICM	International Commission on Management of the Oostvaardersplassen
IDB	Internal Drainage Board
LCA	Landscape Character Area
LNP	Local Nature Partnership

LSNR	Large-scale Nature Restoration
NCA	National Character Area
NE	Natural England
NFM	Natural Flood Management
NIA	Nature Improvement Area/s
NLCA	National Landscape Characteristic Area
NNR	National Nature Reserve
NPF4	Fourth National Planning Framework
NUC	Northern Upland Chain
MWT	Montgomery Wildlife Trust
PES	Payments for Ecosystem Services
PROW	Public Rights of Way
RLUP	Regional Land Use Plans
RTE	Regulated tidal exchange
SAC	Special Area of Conservation
SCI	Site of Community Interest
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage (now NatureScot)
SPA	Special Protection Area

SRDP	Scotland Rural Development Programme
SSSI	Site of Special Scientific Interest
SWFBI	South West Farmland Bird Initiative
TEK	Traditional Ecological Knowledge
TENT	The European Nature Trust
UN	United Nations
UXO	Unexploded ordnance
WWNP	Working with natural processes
WWT	Wildfowl and Wetlands Trust

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Introduction

LUC in association with ABPmer, Accelar, and Rayment Consulting Ltd were commissioned by NatureScot in September 2020 to review large-scale nature restoration (LSNR) and rewilding case studies.

The report sets out the findings from 15 high level and ten more detailed case studies. This includes an analysis of key opportunities and barriers from existing projects. This is followed by a discussion of approaches that could help mainstream LSNR and rewilding projects, including green finance models.

Project context

Within Scotland, the key policy context for the study includes the climate emergency and biodiversity crisis, both of which were declared by the First Minister of Scotland in May 2019. The Scottish Government has set ambitious targets for achieving net zero emissions to address the climate emergency, supported within the Climate Change Plan

Update (2020), which sets out key ambitions to increase woodland creation to 18,000 hectares a year in 2024/25 and increase levels of peatland restoration (Scottish Government, 2020). Likewise, there are national, EU and global targets to address the biodiversity crisis, including the Scottish Biodiversity Statement of Intent (published December 2020) (Scottish Government, 2020), EU Biodiversity Strategy for 2030 (European Commission, 2020) and the updated post-2020 Global Biodiversity Framework (Convention on Biological Diversity, 2020).

At an international level, UN Member States are implementing a Decade on Ecosystem Restoration to realise the benefits of ecosystem restoration to increase social, economic and ecological resilience and to ensure that healthy ecosystems play a critical role towards achieving the Sustainable Development Goals by 2030. The UN Decade on Ecosystem Restoration is running from 2021 – 2030, aligning with the deadline for the Sustainable Development Goals and the timeline for the last chance to prevent catastrophic climate change.

Definitions

This study has used the terminology LSNR (Large-Scale Nature Restoration) to reflect the aims and scope of the study. Within the literature a range of other terminology is used, principally ‘rewilding’, and further discussion on definitions is provided in Context for Large Scale Nature Restoration / Rewilding section.

Project aims

The aims of the project are as follows:

Draw lessons from a selection of existing LSNR / rewilding projects in the UK and the rest of Europe on approaches to the development of LSNR / rewilding.

1. Identify the opportunities, incentives and obstacles to LSNR / rewilding projects in Scotland.
2. Explore how LSNR could be rolled out under future agricultural and land use policy– and approaches to blend public and private finance for LSNR / rewilding projects.
3. Outline how these projects could be delivered, considering potential socio-economic impacts.

Structure of the report

The structure of this report is as follows:

- Methodology
- Project context
- Study findings
- Green Finance
- Recommendations

The ten detailed case studies and 15 high level case studies are included as Annex 1 - Detailed Case Studies and Annex 2 - High Level Case Studies of this report respectively. Annex 3 - Long list of funding models includes the long list of funding models (which is supported by a separate Excel spreadsheet). Annex 4 - Short-Listed Profiles Chosen for Further Research includes short-listed profiles chosen for further research. Annex 5 - Green Finance Stakeholder Interview Discussion Points provides an overview of the finance interview structure. Annex 6 - Case Studies Interview format provides an overview of the structure for the ten detailed case study interviews.

Methodology

This section of the report describes the approach to the research. It sets out the approach to identifying and selecting the case studies, summarises the key characteristics of the case studies and the approach to data collection and analysis.

Identifying and selecting the case studies

The first stage in identifying potential case studies was based on a review of information from previous Large Scale Nature Restoration (LSNR) and rewilding projects, internet searches (including the Rewilding Europe website) and suggestions from the project team and steering group based on existing knowledge. The long list of case studies was then collated in a table which recorded summary information available for each case study.

Project scale was discussed at the project inception meeting in order to identify parameters for identifying the case studies. Different scales were identified for lowland and upland projects. The scale for lowland projects was initially set as over or around 1,000 hectares (ha) and the scale for upland projects set as over 10,000 ha. However, it was recognised that flexibility was required within these parameters. The review of the case studies in the lowland context identified that these projects were typically below 1,000 ha. The spectrum of projects to be included was also agreed to include both more ‘natural’ projects and those including a higher proportion of land managed for agriculture, based on project specifications and early discussions with NatureScot.

This process led to the creation of a ‘long list’ of candidate LSNR and rewilding projects, all at different points along a continuum in terms of delivery stage and ambitions. The term ‘large-scale nature restoration (LSNR) was used to reflect the fact that not all of the projects reviewed could be characterised as ‘rewilding’ (see Guiding principles for rewilding section).

Summary information on the project scale, location and type was gathered for just over 70 projects. An initial review including the availability of information on the candidate project and feedback from the project steering group was used to identify 15 high-level case studies and ten detailed case studies. The projects were selected to ensure they covered a range of geographic locations, habitat types, project types and scales and a variety of organisations/partnership approaches (public sector, private sector, NGOs, protected landscapes). No suitable community-led project was identified.

The characteristics of the selected case studies are summarised in Table 2.1 below.

Table 2.1. Summary information for the 15 high level and 10 detailed case studies

High level case studies

-	Location	Land type	Project type	Project area (ha) approx.
Alladale Estate	Sutherland, Scotland	Upland	Rewilding*, peatland and woodland restoration, species reintroduction	9,000
Balcaskie Estate	Fife, Scotland	Lowland	Sustainable farming, agroecology	1,800
Bunloit	Inverness-shire, Scotland	Upland	Sustainable land management for climate change and biodiversity, rewilding*	500
Glen Affric	Inverness-shire, Scotland	Upland	Woodland restoration	14,500
Glen Tanar	Aberdeenshire, Scotland	Upland	Sustainable land management	10,000
Great Fen	Huntingdon, England	Lowland	Wetland restoration	3,000
Great Trossachs Forest	Trossachs, Scotland	Upland	Woodland restoration	4,400
Knepp Castle Estate	West Sussex, England	Lowland	Rewilding*, sustainable land management	1,416
Steart	Somerset, England	Coastal	Coastal management with nature-based solutions	400
Sunart Oakwoods	Argyll, Scotland	Upland	Woodland restoration	10,000

-	Location	Land type	Project type	Project area (ha) approx.
Temple Farm	Wiltshire, England	Lowland	Nature-friendly farming, agri-environment and sustainable land management	800
Thorneythwaite Farm	Cumbria, England	Upland	Sustainable land management	122
Greater Coa Valley	Portugal	Upland	Rewilding*, species reintroduction, habitat creation and management of fire risk	100, 000
Central Apennines	Italy	Upland	Rewilding*, habitat connectivity	100,000
Oostvaardersplassen	Netherlands	Lowland	Rewilding*, wetland with species reintroduction	5,600

-	Location	Land type	Project type	Project area (ha) approx.
Cairngorms Connect	Cairngorms, Scotland	Upland	Peatland and woodland restoration	60,000
Forsinard Flows	Sutherland, Scotland	Upland	Peatland restoration	21, 000
Holnicote Estate	Somerset, England	Lowland	River restoration	4,000
Pumlumon	Mid - Wales	Upland	Peatland restoration, native woodland expansion and sustainable land management	40,000

-	Location	Land type	Project type	Project area (ha) approx.
South west Norway	Norway	Upland	Natural woodland regeneration	*Undefined* *Regional scale*
The Northern Upland Chain Local Nature Partnership	Northern England	Upland	High nature value farming	105,000
Tweed catchment	Borders, Scotland	Lowland	River restoration	500,000 (catchment area)
Wallasea Island	Essex, England	Coastal	Coastal management with nature-based solutions, restoration of wild habitats	850
Wild Ennerdale	Cumbria, England	Upland	Woodland restoration, sustainable land management	4,750
Wild Ken Hill	Norfolk, England	Lowland	Rewilding*, restoration of natural systems, sustainable land management, regenerative farming (agroecology)	1,600

Detailed case studies

*Rewilding is mentioned for projects where ‘rewilding’ is an explicit objective. However, other projects can also contribute to rewilding landscapes.

Information collated for each case study

Information was collated for the 15 high level and ten detailed case studies. The latter includes the following information:

- Administrative and socio-economic context;
- Landscape and land-use context for the surrounding area;
- Environmental baseline prior to the LSNR restoration;

- Level of ambition in restoration/rewilding including vision, objectives and aims;
- Environmental and ecological impacts;
- Social impacts, including information on community engagement;
- Economic impacts;
- Key barriers and opportunities including land tenure, community opposition and integration with other land management aims;
- Partnership models and funding; and
- Additional resources.

Detailed case study interviews

Interviews were undertaken for the ten detailed case studies. The purpose of interviews with representatives of each LSNR project was to focus on key issues emerging from the desk review, exploring key barriers, local community and economic effects and different funding models. Interview questions were identified based on the review of the existing case study information, to reflect any information gaps or areas of interest and the project research questions.

The invitation to interview included a detailed project briefing paper. Once accepted, interview questions were developed and tailored for each case study and then sent to the interviewee prior to the interview. Interviews were conducted between December 2020 - January 2021 and took place via Microsoft Teams. Data obtained through the interviews were fully compliant with GDPR and all participants were provided with, and agreed to, LUC's privacy statement. An overview of the main interview topics is provided in Annex 6 - Case Studies Interview format.

The information collected through the interview process is wholly qualitative. It is also important to note that the views expressed by the consultees are not necessarily reflective of the organisation they represent; but are based on their own professional experience of the LSNR project. To maintain confidentiality and for data protection purposes, the names of the individuals interviewed for this research have been withheld.

All interviewees were given the opportunity to review the information for each case study to ensure they were content with how the information they contributed is presented.

Approach to the analysis

The project findings are structured around a number of research questions which were defined at the start of the study. These have been further expanded where appropriate to reflect issues which have been identified from the case study review process. The analysis of the case studies explores key opportunities and barriers identified from the case studies as per the research questions listed below and relates them to the Scottish context.

Research questions (grouped by themes):

Project aims, objectives and timescales:

- What are the principal drivers, aims and objectives of LSNR / rewilding projects?
- How have initial projects ‘seeded’ future projects?
- Over what timescale are projects planned, and implemented?

Have projects taken account of future environmental change (e.g. climate, increased risk of disease / pathogens) or are they aiming to restore existing or past ecosystems? How is resilience ensured?

Project benefits:

- What are the main benefits (environmental, economic and community) or services that have been delivered by different kinds of projects?
- What lessons are there in terms of optimising community and local economic impacts associated with projects?
- How do you ensure achievements and benefits are secured long-term? How do you avoid losing benefits derived from the project? Does this require loose/adaptive management?

Issues and barriers:

- What are the key barriers that have been encountered by projects in Scotland and elsewhere and how have these been overcome?
- Were there any conflicts between restoration measures and other conservation interests or other land uses? What value was attached to the pre-existing biodiversity or landscape and was this seen as a barrier to change?
- What is the influence of land tenure (owner occupied, tenanted, community owned)? Are there specific barriers or opportunities that apply to schemes in lowland agricultural areas, in the Highlands, in areas with crofting or common grazings, on the coast or within the Central Belt?
- Did the projects encounter any cultural barriers, for example perceptions around the role of land managers or established land uses – and how were these overcome?
- Was deer management critical to nature restoration? How was management of deer achieved and funded? Is deer management placed on a sustainable footing for the future?

Delivery mechanisms:

Are there particular partnership / delivery models that make it easier or more difficult to initiate and deliver these projects?

- How are successful projects facilitated and developed? How is momentum maintained?
- What kinds of funding models have proven successful in delivering projects? What novel models offer potential to combine public and private finance, tapping into emerging markets for carbon or other environmental ‘goods’?

Fitting LSNR / rewilding with the wider environmental policy context:

- What policy changes are needed to make LSNR / rewilding in Scotland more attractive to landowners, land managers and communities?
- How can LSNR / rewilding projects form part of high nature value farming initiatives? Should LSNR focus on low quality or marginal farmland?
- Is there scope to deliver LSNR / rewilding within broader management or delivery vehicles such as biospheres, national parks, National Scenic Areas or the Central Scotland Green Network (CSGN)?

Local economic impacts

The economic impacts of LSNR / rewilding projects have been identified through exploration within the detailed case study interview questions. Broadly the economic effects depend on:

- Land management practices and associated employment and expenditures;
- Changes in the delivery of ecosystem services (provisioning, regulating and cultural services) and the opportunities they provide for local businesses; and
- Other effects (e.g. damage from pests and predators, effects on land prices, community reactions etc.)

Large-scale nature restoration involve changes in land management which are likely to have direct impacts on employment and purchases of goods and services (impacting on local supply chains). To assess economic impacts, we need to examine:

- Changes in employment in existing land management sectors (agriculture, forestry, game management etc.).
- Changes in expenditures on purchased goods and services (contractors, machinery, equipment, materials, chemicals, other services etc.), especially locally sourced services.
- Employment and expenditures– including capital operations (e.g. restoration works, fencing etc.) and ongoing management operations (e.g. monitoring, deer management etc.).

Higher levels of employment and expenditure increase the cost of managing land but also its impact on local economies (in terms of jobs and local incomes). Restoration involving lower levels of management interventions (e.g. natural regeneration of forests) may be cost effective in meeting conservation priorities but can have negative impacts on local economies. However, there can be new opportunities arising from these projects particularly in areas with declining economies.

Ecosystem Services

In relation to ecosystem services, LSNR / rewilding can be expected to affect:

- Provisioning services – e.g. output of food, timber and other materials. There may be changes in the volume (e.g. reduced food output), type (e.g. replacement of commercial breeds with conservation livestock, farming with wild food) and value of outputs. There may also be changes in the way produce is processed and marketed (e.g. potential growth in small-scale local processing businesses).
- Regulating services – e.g. carbon sequestration, water purification, flood management – which may have market values (e.g. traded carbon) or wider benefits for society.
- Cultural services – e.g. recreation, tourism, education, scientific benefits. Tourism impacts may involve increases in general visitor numbers as well as more specialist interests (nature watching, hunting, fishing, scientific study). These may have positive impacts through visitor expenditures on site and in wider local economies. LSNR / rewilding projects may also have a marked impact on other non-marketable cultural services (e.g. sense of place, aesthetics).

Other Effects

Other effects which need to be considered include:

- Impacts from pests and predators – concerns have been expressed about the reintroduction of large predators such as lynx and wolf and damage caused by other species such as beaver. Effects on populations of herbivores and the impacts of non-native species also need to be considered.
- Effects on land prices and land value – these depend on the effects of changes in ecosystem services identified above and could be negative (e.g. reduced agricultural land values) or positive (e.g. enhanced tourism, countryside sports, payments for public goods such as carbon credits). Land value is important given that the capital value of land is often used as a lever for other funding / loans. The impact of woodland planting for instance under the current capital value approach can affect the ability to obtain funding or loans: a broader approach of natural capital valuation would be beneficial here.
- Community impacts – LSNR / rewilding projects and their associated economic impacts may affect local communities positively or negatively, by changing the identity and perception of the local area and its people, and the relationship communities have with an area.

Sensitivities

The report has drawn on a range of information from desk-based review and interview responses. The case studies highlighted a number of sensitivities, particularly around conflicts between land management aims and between key players within different projects. The case studies were based on interviews with key contacts, but did not gather the wider views of surrounding land managers or communities and their perceptions of the case study projects.

Context for Large Scale Nature Restoration / Rewilding

Defining large scale nature restoration and exploring terminology

Ecosystem restoration (also referred to as landscape-scale or large-scale nature restoration) is defined as a process of assisting the recovery of ecosystems that have been degraded, damaged or destroyed (Gann, et al., 2019). Large-scale restoration of nature can significantly contribute to addressing the biodiversity and climate crises through the deployment of ecologically viable nature-based solutions, improving the conservation status and the connectivity of European sites (e.g. Special Protection Areas and Special Areas of Conservation), protecting and restoring carbon sinks and enhancing the functionality of biodiversity and ecosystem services (Fernandez et al., 2020).

Within the discourse of conservation and more recently ecosystem restoration, the terminology has been evolving rapidly. The boundaries between different terms are often blurred and unclear. Rewilding, as one of the newest terms, is a specific form of ecological restoration that promotes self-sustainable ecosystems that provide important services to people and nature while requiring minimum human management in the long term (Fernandez et al., 2020).

Rewilding as a term emerged from the Wildlands Project, which was founded in 1991 and had the aim of creating North American core wilderness (Jørgensen, 2015). (The concept of wilderness has been the subject of debate on the American continent in particular with regards to first nations' original use of the land.) The project focused on securing large-scale and well connected core areas and releasing keystone species such as wolves. The approach later became known as 3Cs approach (core areas, corridors and carnivores) (Lorimer, et al., 2016). The term rewilding is considered as controversial for a number of reasons. There are concerns often raised by communities within the locality of projects who have the perception that rewilding projects can lead to displacement. Historically, some conservation activities have led to displacement of local populations, as the areas have become protected for wildlife, watersheds, reefs, forests or rare ecosystems, while in others humans and wildlife have coexisted. There can be generalisations asserting a definite conflict between nature and human presence in protected areas, which is equally true for an assumption that harmonious and sustainable relationships between nature and humans can and will prevail (Agrawal & Redford, 2009).

Accordingly, it has been argued that rewilding, as a term, has been applied to a range of visions and land management practices and therefore has lost its original meaning (Jørgensen, 2015). However, broadly speaking when rewilding is used to describe a project, it usually points to a long-term aim of maintaining or increasing biodiversity, while simultaneously reducing the impact of present and past human interventions through restoration of species and ecological processes (Lorimer, et al., 2016). Rewilding also stresses the emotional experience and perception of wild nature and wild ecosystems without human intervention. In fact, conventional restoration projects often aim to minimise human intervention, however some level of management is critical to replace ecosystem processes that have been lost due to human activities or to maintain important

aspects of cultural landscapes (Perino, et al., 2019). Therefore, it is difficult to clearly differentiate between large-scale nature restoration and rewilding; hence various types of projects along a spectrum were investigated in this research.

In Europe, unlike in North America, greater importance is afforded to large-scale nature restoration through approaches such as naturalistic grazing, which includes grazing hardy animals outside of a field-based farming system, or reestablishing a population of large herbivores. The second approach focuses on enabling large herbivores such as cattle, horses, wild boar, beavers or bison, to graze and browse and through this restore or create complex and species rich ecosystems on reclaimed areas or those previously used for agriculture or forestry (Lorimer, et al., 2016). In Europe, agricultural activities may continue to some extent within the 'restored' landscape. For this reason, the project also looked at farms, and the type of farming systems that are found in nature restoration projects.

The definition of ‘large scale’ was explored early in the project inception and it was recognised that this varies within the landscape context. Although indicative thresholds were set to guide the case study selection of greater than 10,000 ha for upland examples and greater than 1,000 ha for lowland examples a more flexible approach was then applied. ‘Large-scale’ case studies are partly dependent on land ownership and the development of collaborative partnerships. Land ownership patterns vary in different geographical locations with the largest case studies in Scotland being within the Highlands. Large-scale collaborative projects identified within Britain included Cairngorms Connect, the Northern Upland Chain Nature Partnership, Pumlumon, the Great Trossachs Forest and Sunart Oakwoods.

Within this chapter the term ‘rewilding’ is used where it is referred to in the relevant literature sources, however this report uses the term ‘large-scale nature restoration’, reflecting the broader scope of the study and recognition of the various stages and degrees of nature restoration represented within the case studies. Table 3.1 below illustrates the EU Biodiversity Strategy four-tier ecosystem restoration model. This model illustrates the different stages which may be relevant to the case studies included.

Table 3.1. EU biodiversity strategy four-tier ecosystem restoration model

4-Tier Ecosystem Restoration Model

-	Types of areas	Baseline
Level 1	Satisfactory abiotic conditions. Key species, properties and processes of ecosystem patches and their functions, at site level and at landscape level, are in good to excellent condition.	‘wilderness’ areas and N2000 habitats and species in Favourable Conservation Status (FCS), rivers and lakes in good ecological status (GES), marine ecosystems in GES

-	Types of areas	Baseline
Level 2	Satisfactory abiotic conditions, some disrupted ecological processes and functions, either at site level or at landscape level or at both levels. Reduced or declining diversity and key species, compared to L1 but retains stable populations of some native species.	N2000 habitats and species not in FCS
Level 3	Highly modified abiotic conditions, many disrupted ecological processes and functions, either at site level or at landscape level or at both levels. Dominated by artificial habitats but retains some native species and stable populations.	Non-protected rural areas, not including intensive agriculture
Level 4	Highly modified abiotic conditions, severely reduced ecological processes and functions, both at site level and at landscape level. Dominated by artificial habitats with few and/or declining populations of native species; traces of original ecosystem hardly visible.	'heavily modified ecosystems' (e.g. Intensive agriculture, build urban areas, roads, airports, brownfield areas, heavily modified water bodies); heavily degraded 'natural' and 'semi-natural' ecosystems

Adapted from Lammerant et al. (2014)

Key barriers and opportunities

Environmental and ecological

Nature restoration directly targets restoring ecological functions and processes instead of particular biodiversity compositional states, and as a result the effects of restoration may be indirect and unexpected (Perino, et al., 2019). Restoration efforts often mainly target vegetation, such as removal of non-native plants and purposeful planting of desirable native species. Such an approach hopes to restore the plant community and allow other services to recover in their own time (Kaiser-Bunbury, et al., 2017). It is suggested that for successful nature restoration, ensuring long-term protection of biodiversity and landscapes and utilising a flexible approach to the project are crucial (Perino, et al., 2019), so is realising that ecosystems are dynamic and are constantly changing (Carver, et al., 2021). It is also shown by Macmillan (2021) that rewilding is likely to generate significant environmental benefits when comparing to competing land uses especially in terms of ecosystem processes, biodiversity and climate change mitigation. However, this

may differ by location, and in areas such as upland SACs, SPAs or SSSIs, it may be more uncertain (Macmillan, 2021), depending on the nature of the restoration project and the requirements of key species.

Large herbivores play an important role in providing dung and carrion, facilitating seed dispersal, and modifying the physical and biotic environment in many ways e.g. by grazing, trampling, and building dams (by beavers). In rewilding, they play a key role in restoring trophic interactions (Carver, et al., 2021). Due to the absence of top-down control by carnivores, high densities of large herbivores can negatively impact the abundance and diversity of other species groups (Perino, et al., 2019). Therefore, management of herbivores is necessary to enable restoration of other species. Most natural habitats across the UK are under pressure from deer (Fuller & Gill, 2001) – and notably so in the Scottish Highlands. Hence, deer management is an issue and achieving sustainable numbers is critical to the restoration process.

Studies have suggested that there are a number of risks and uncertainties specifically associated with rewilding mainly because of its experimental nature (Lorimer, et al., 2016). Some of the key risks are linked to species introductions and reintroductions, such as a depletion of donor populations, risks of introducing disease, or low genetic variability among the introduced individuals (ibid.). Uncertainties relate to effects of bringing species back or taxon substitution, where similar species are introduced instead of the original ones (ibid.). There are also limitations linked to the status of animals, in terms of whether they are kept or not kept and protected by the 1976 European Convention which requires ensuring that animals are free from hunger, thirst, discomfort, pain, injury and disease; additionally leaving animals to die may have a negative public response (Lorimer, et al., 2016). Scotland has legislation for this through the Scottish Code for Conservation Translocations (NSFR, 2014) Permissions and licensing are provided by NatureScot and the Scottish Government. One of the examples illustrating this issue is Alladale Wilderness Reserve in Scotland, where the vision of the project has been restricted by existing regulations, under which the reserve has a zoo status and requires keeping elks separate from predators (Lorimer, et al., 2016).

Additional obstacles in nature restoration, identified by Sandon et al. (2019), are linked with conservation policy, which serves as an institutional barrier to rewilding. Specifically, it requires the maintenance of the UK's 77 Habitats Directive Annex I Habitats. This Directive is based on a fixed date baseline of 1994 and as a result promotes a static and preservation focused conservation approach to ensure that the species are in a 'favourable condition' (Sandom, et al., 2019). This approach however fails to recognise the natural dynamism of habitats and species, and the need for adaptive approaches. Moreover, landscape management policies do not provide sufficient opportunities for nature restoration to be implemented on a broader scale, because they incentivise damaging agricultural activities on lower quality soils, hindering opportunities for nature to flourish (Perino, et al., 2019). Measures to mitigate the adverse effects of these agricultural activities, such as agri-environment schemes, have been historically underfunded (RSPB, 2018).

Resilience to climate change

It is important to recognise that future climate change will present challenges to the meaning of ‘restoration’. Climate change impacts pose significant uncertainties to rewilding projects, and they need to be considered at the planning stage to ensure that the project’s potential to absorb, ameliorate and tackle the effects of climate change is exploited (Carver, et al., 2021). The focus should be on creating functioning ecosystems in good condition, rather than restoring a particular ecosystem which may no longer be viable within a changing environmental context. There are also opportunities for nature-based solutions with the restoration of natural processes and habitats that contribute to the resilience of society and the environment to climate change, such as reducing flood risk or safeguarding carbon stores.

Social

Humans cannot be separated from nature. When making plans to restore nature, humans, their impacts and relation to the place must be included (Jørgensen, 2015). Over the centuries, humans have influenced species composition and their networks by hunting, harvesting and planting selected species for agriculture and forestry (Perino, et al., 2019). Intensification of agricultural practices and simplification of landscapes from the 20th century has had a severe impact on biodiversity (Wilson, et al., 2009). However, it is also suggested that rewilding requires a paradigm shift in the co-existence of humans and nature so that fully functioning trophic systems are possible and degradation and overexploitation of ecosystems are no longer accepted (Carver, et al., 2021).

In Scotland, large-scale nature restoration has not been positively embraced in all locations, especially by local communities, as it is potentially reminiscent of the forced displacement that took place during the Clearances of the Highlands in the 19th century (Lorimer, et al., 2016). Research conducted by McMorran, Price and Warren (2008) has highlighted that the Clearances of the Highlands still provoke powerful emotions. These became particularly apparent during the long process of identifying Wild Land Areas. Some local people have strongly objected to labelling land on which generations of their ancestors had lived and worked as ‘wild’ as they felt that this equalled to erasing human history from the picture (McMorran, et al., 2008). Careful consideration of the value attached to cultural landscapes and recognition of the fact that nature restoration may be in conflict with the current norms (e.g. of those living locally and those who derive benefits from a landscape who may live elsewhere) are needed. Taking such approach may result in a conclusion that a project is not appropriate in a certain location (Lorimer, et al., 2016). Resistance to nature restoration from landowners and occupiers was mentioned by multiple studies reflecting a variety of cultural, economic, and practical factors (Sandom, et al., 2019). Landscape-scale projects will require collaboration and long-term commitments from individual landowners in order to apply more ambitious nature restoration plans (ibid.). It is important to have a thorough understanding of interacting ecosystem processes leading to resilience, and of the socio-economic context in which an ecosystem restoration project will take place (Perino, et al., 2019). There is the potential for establishing partnerships, which will often be required for LSNR, and these

should include local communities, landowners, farmers and other stakeholders. If a consensus is not found, and a project is imposed against the will of public groups, there is the potential for serious conflicts (Lorimer, et al., 2016). Moreover, not only local partnerships, engagement and support are crucial for the success of a rewilding project, but also inclusion of Traditional Ecological Knowledge (TEK) and other local knowledge. As these can help inform adaptive management framework and gathering evidence (Carver, et al., 2021).

Economic drivers and impacts on rewilding

It is suggested that rewilding can outperform low-yielding forest plantations in terms of sequestered carbon which remain in-situ (Svenning, 2020), and emissions from, for example, soil disruption, would potentially be diminished (Macmillan, 2021). Moreover, LSNR / rewilding can provide numerous secondary benefits for Scotland as illustrated by development of green finance options, including Payments for Ecosystem Services (PES), biodiversity banks and carbon credits / offsetting, in addition to tourism related benefits (Svenning, 2020). There is scope to further develop and capitalise on nature-based tourism, which is currently worth at least £1.4 billion annually to the Scottish economy and supports approximately 39,000 full-time jobs (NatureScot, 2019). To give an example, currently tourism associated with sea eagles on the island of Mull attracts visitor spending of about £2 million annually and dolphin watching off the east coast another £4 million. Reintroductions of species could deliver similar profits and for example, a beaver release site was estimated to be worth around £2 million to the local economy (Bryden, et al., 2010).

Economic barriers to such projects include subsidy policy which has traditionally focused on supporting production and associated activities rather than seeing the different values of the ecosystem services (Sandom, et al., 2019). Another barrier is the inheritance tax relief which allows for land and property occupied for agricultural purposes to be passed to the next generation free of tax, but only when agricultural activities are continued; hence it does not apply to land used for conservation purposes (ibid.). A further barrier is the cost of acquiring the area of land needed, as well as the opportunity costs/income foregone of long-term changes in land use, particularly on more productive agricultural land or where current land uses are heavily subsidised by landowners.

Funding/Partnerships

As mentioned briefly before, successful large-scale ecological restoration will require partnerships from across the area designated for a project. Establishment of partnerships may take time and will demand resilience considering different organisational structures, staff turnover and short-term funding. Moreover, it is crucial to bring all stakeholders on board, establish trust with them and ensure that they are aware of the availability of external funds that can support conservation land uses. Some of the key obstacles to overcome will include finding institutional strategies that secure long-term conservation outcomes that can be continued beyond the funding period and provide income to support the longevity of the project. Where community-based projects are to be taken

forward, there may be different support needs and partnership working required to bring these to fruition. Large-scale nature restoration projects are considered to be complex due to their nature of blended governmental and private tenure and management requiring the creation of hybrid institutions and evolving partnerships (Adams, et al., 2016). In fact, large-scale projects may originally be less profitable for landowners (Adams, et al., 2016), hence government involvement and funding are crucial. The case studies identified that there are a range of additional economic benefits that can be realised through LSNR / rewilding projects, such as contributing to local supply chains; these should be considered (and quantified if possible) when developing a project. Diverse landscapes can support a greater range of income streams as shown by the examples of Knepp Estate or South West Norway.

Guiding principles for rewilding

Carver et al. (2021) have drawn on a global advisory group of rewilding experts to outline a definition and a series of ten guiding principles for rewilding. The principles explicitly state that rewilding sits upon a continuum of scale, connectivity, and level of human influence, and aims to restore ecosystem structure and functions to achieve a self-sustaining autonomous nature. It recognises that the context for rewilding projects is key to success and implementing site-specific interpretations will be most successful at achieving the aims of rewilding. The principles are set out below and include additional description and interpretation within the Scottish context and in relation to socio-economic implications.

Principle	Key elements	Possible socio-economic implications	What are the barriers and opportunities for mainstreaming?

Principle	Key elements	Possible socio-economic implications	What are the barriers and opportunities for mainstreaming?
1. Rewilding utilizes wildlife to restore trophic interactions.	The presence of large herbivores, apex predators, and keystone species should regulate species populations and result in self-sustaining ecosystem	Re-introduction of apex predators raises risk or perceived risk of conflicts with socio-economic interests, e.g. through predation of livestock. As well as costs of damage inflicted, this has implications for management of perceived conflicts, and may require schemes to manage conflicts, avoid damage or compensate for losses. Incorporating large herbivores into self-sustaining ecosystems is likely to require less human management than livestock farming systems, with limited costs, employment or revenues, though establishment will have cost and labour implications, and there may be opportunities for sales of high value meat at low volume. Predators and large herbivores may be attractive to visitors and help to enhance tourism revenues, with positive economic impacts.	What tropic levels are missing? What keystone species could play a role in the ecosystem? What are the i) ecological, ii) physical iii) landownership and iv) societal barriers to restoring the damage?

Principle	Key elements	Possible socio-economic implications	What are the barriers and opportunities for mainstreaming?
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Core areas with self-sustaining natural ecosystems Connectivity between core areas Coexistence between wild species humans, and livestock	Landscape-scale planning for rewilding requires skills development and creates new employment opportunities for specialist landscape planners.	What are the i) ecological, ii) physical and iii) landownership barriers to establishing core areas and connected zones?
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Reference point of a self-sustaining and resilient ecosystem	Ecosystem restoration requires capital works, incurring costs and generating employment, and sometimes revenues (e.g. sale of non-native timber) Recovery of ecosystem processes should enhance the delivery of a range of ecosystem services, with benefits for people and the economy – e.g. enhanced regulation of water quality and flows should reduce damage costs and investment in flood defences/ water treatment infrastructure.	What is the ecological reference point? What native species or habitats should be being sought?

Principle	Key elements	Possible socio-economic implications	What are the barriers and opportunities for mainstreaming?
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	External and internal change over time is a fundamental attribute of ecosystems. Rewilding should provide space for this natural change.	Linked to 3., dynamic ecosystems should be more resilient to future change (e.g. as a result of climate) and maintain ecosystem service delivery and its socio-economic benefits over time	What are the current and future threats to the ecosystem (storms, floods, wildfire and large-scale changes in climate, agricultural land use change, agricultural impacts on water quality, aquaculture, shipping, flood defence etc.)? How does the project aim to respond to these threats?
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	Rewilding projects have medium to long-term timescales and should have the capacity to absorb, ameliorate and or tack the effects of climate change. Habitat connectivity is important to this.	Restoration of ecosystems such as forests and peatlands can be a cost-effective means of mitigating climate change, reducing climate impacts and costs, and attracting carbon market investment, as well as enhancing ecosystems resilience to climate change, linked to 3 and 4.	What are the opportunities within the landscape for climate change adaptation and mitigation?

Principle	Key elements	Possible socio-economic implications	What are the barriers and opportunities for mainstreaming?
6. Rewilding requires local engagement and support.	Rewilding should be inclusive of all stakeholders and encourage public understanding, and address barriers to acceptance.	Community and stakeholder engagement are integral to rewilding, building a significant social dimension; effective engagement should help to ensure that rewilding delivers socio-economic benefits, including benefits for recreation. Volunteering plays an important role in some projects.	What are the characteristics of the local community and population? Who are the key stakeholders? How are the local community engaged with the LSNR? What barriers and opportunities are there?
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Local knowledge can inform rewilding projects, although care should be taken to acknowledge knowledge gaps. Projects can form the basis for knowledge generation, data and information of use to further projects.	Implications for skills and employment for scientists, and engagement of local communities to ensure that rewilding benefits from local knowledge	What existing knowledge is there about the area (e.g. designations), what is the local community's level of engagement with the ecosystem? What knowledge can the local community provide that would be beneficial for the project?
8. Rewilding is adaptive and dependent on monitoring and feedback.	Monitoring is essential to understand whether rewilding is working as planned. Rewilding projects should use data to identify problems and possible solutions.	Implications for skills and employment for ecologists engaged in monitoring of rewilding schemes, and communications specialists engaged in community engagement and feedback	What monitoring and feedback is required? What ways are there to ensure monitoring and feedback?

Principle	Key elements	Possible socio-economic implications	What are the barriers and opportunities for mainstreaming?
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Natural ecosystems provide ecosystem services, but rewilding should primarily be an ecocentric rather than anthropocentric activity.	Biodiversity policies recognise that natural ecosystems have intrinsic value as well as being important for delivery of ecosystem services of benefit to people; rewilding may deliver intrinsic values more cost-effectively than human interventions	How much can human control be removed? What management interventions are likely to be required?
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Society should no longer accept degraded ecosystems and over exploitation of nature.	Important role of awareness raising and engagement to encourage people to rethink their relationship with nature and support this paradigm shift	What are the opportunities for changing public perception of degraded and exploited ecosystems?

Land ownership, land valuation and land taxation system in Scotland

Land ownership in Scotland may pose certain challenges to large-scale nature restoration projects, as a significant proportion of land is concentrated in few hands. The Scottish Government has aimed to map who owns which part of the country and so far, only managed to register about a third of the country's total land mass. It is estimated that 57% of rural land is in private hands, with approximately 12.5% owned by public bodies, 3% under community ownership and 2.5% owned by charities and other third sector organisations. It is suggested that as much as over a half of the country's rural land is owned by only 423 people. By far the biggest landowner is the Scottish nation, on behalf of which, government agencies and other public bodies manage the land (Scottish Government, 2014).

One of the key issues linked with private landowners is that they often are absentee landlords living elsewhere, not paying much attention to the land. According to Registers of Scotland (RoS) 6% of landowners are registered with an address outside of Scotland. The vast majority of these live elsewhere within the UK, however about 25% of these landowners live overseas. Hutcheon (2016) cites sources estimating that 750,000 acres of land are owned in overseas tax havens, while another separate RoS data suggests

that offshore companies own property in Scotland worth £2.9bn. Owning property through tax havens means that the landowners do not pay inheritance duties and capital gains tax (Picken & Nicholson, 2018).

The Scottish Land Commission report suggests that land value taxation could help deliver Scotland's land reform objectives and to introduce a more progressive and equitable system (Scottish Land Commission, 2018).

Study findings

The following chapters set out the findings of the 15 high level case studies and ten case studies selected for detailed analysis of Large-Scale Nature Restoration (LSNR) and group the research questions by theme:

- Project aims, objectives and timescale
- Project Benefits
- Issues and Barriers
- Delivery mechanisms
- Fitting large-scale nature restoration and rewilding within the wider policy context

The findings on the 25 case studies are followed by Green Finance section, which explores issues around green finance.

Project aims, objectives and timescale

What are the principal drivers, aims and objectives of LSNR / rewilding projects?

Project baseline

Understanding the environmental baseline before the start of aproject is important for measuring the degree of change which the project brings about.. A landscape which already includes a higher proportion of the features or habitats that directly support the project vision will provide a different starting point to a highly managed landscape that has lost the majority of the habitats or species which the project is seeking to restore.

Within the fifteen high-level case studies, there appears to be some distinction particularly between Highland Scotland, which include a core of existing habitats, (such as native woodland), and those which are located in more intensively managed arable or pastoral landscapes and are seeking to create habitats from a less biodiversity rich baseline.

Case studies where existing native woodlands were identified as part of the baseline include Alladale, Bunloit, Glen Affric, Glen Tanar, Great Trossachs Forest, Sunart and Thorneythwaite Farm. The benefit of existing native woodland are that it provides a key seed source for natural regeneration and ecosystem restoration, supporting the project alongside actions such as woodland planting and grazing management. However, the degree to which the quality of the environmental baseline influences the vision and

ambition of the project is not clear, from the current sample. Some of the examples within the fifteen case studies include projects with high levels of ambition for nature restoration which are not based on existing high quality habitat such as Great Fen, Knepp Castle, Steart and Oostvaardersplassen.

Another factor identified from the case studies and linked to the existing environmental baseline is the association with existing protected areas. From the high level case studies, those with existing national or international conservation designations include Alladale (SAC), Glen Affric (SAC and SPA), Glen Tanar (SAC), Great Fen (NNR), Great Trossachs Forest (designated a NNR during the project operation), Sunart (SAC), and Thorneythwaite (SAC). (Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), were developed under the European Commission 'Habitats Directive' (Directive 92/43/EEC) and the 'Birds Directive' (Directive 79/409/EEC). SACs are strictly protected sites designated under the Directive 92/43/EEC (the 'Habitats Directive'). SPAs are strictly protected sites classified in accordance with Article 4 of Directive 2009/147/EC (the 'Birds Directive') for rare and vulnerable birds (identified in Annex II of the Directive) and also for regularly occurring migratory species. These Directives resulted in legislation being adopted into Scots law through The Conservation (Natural Habitats, &c.) Regulations 1994 as amended. Collectively, SPAs, SACs and Ramsar sites will be referred to as 'European sites' in this report.) From the international examples the Central Apennines includes the Abruzzo, Lazio and Molise National Parks. As an alternative driver, land abandonment in the Greater Coa Valley means that nature restoration provides a good opportunity to change and boost the local economy.

Project vision and aims

The vision of eleven of the high-level case studies is the restoration of naturally functioning ecosystems. This is the case for Alladale, Bunloit, Glen Affric, Great Fen, Great Trossachs Forest, Knepp Castle, Steart, Sunart and the three international examples of the Greater Coa Valley, Central Apennines and Oostvaardersplassen. However, within these examples there are also varying levels of economic productivity from agriculture and forestry. Examples which are seeking to maintain a higher proportion of other traditional land uses include Glen Tanar which seeks to maintain farming, forestry and sporting activities. Balcaskie and Temple Farm are incorporating areas of high nature value alongside larger areas of agricultural production.

For the detailed case studies, the aim of restoring biodiversity or supporting the recovery of natural processes was common to all the projects examined in greater detail, though their emphasis and focus varied considerably.

Several were focused on areas where peatland restoration and management is a key objective. These included Forsinard Flows in Caithness where a key objective was to restore peatland damaged by coniferous plantations established in the 1970s and 1980s, and Pumlumon and the Northern Upland Chain, both of which have extensive areas of blanket bog and peat which had been damaged by past land management practices such as drainage.

Other projects are focused on the water environment, aiming to restore natural river systems, enhance riparian habitats and, across the wider catchment, tackle issues such as flooding or poor water quality. The Tweed Forum, for example, which is a partnership approach rather than a project as such, has worked across the Tweed catchment, facilitating a wide range of projects focused on the water environment. At a smaller scale, the Holnicote Estate has sought to deliver sustainable flood management, initially focused on the river itself but more recently extending into management of the wider catchment. Similarly, the Wild Ennerdale project looks to restore natural processes along the catchment that serves Ennerdale Water.

One case study project, Wallasea Island in Essex, was in part designed to create coastal and particularly intertidal habitats to compensate for losses elsewhere caused by sea level rise.

In contrast to these NGO and public agency led projects, Wild Ken Hill provides an example of a private estate where the decision to change direction reflected a desire to address radically the climate and ecological emergency and, in the face of commercial challenges, to put the farm business on a more sustainable footing.

Excluded from this list is the example of south-west Norway which does not have aims as such but is the product of patterns of land ownership and management, a sustainable approach to deer management, a high level of economic support and devolution of decision making to rural communities.

Wider project objectives

All projects have a broad range of environmental, social and local economic objectives and are designed to deliver multiple benefits. Common amongst these objectives are the following themes:

- Creating new opportunities for public access and recreation, including in areas where opportunities to experience nature were previously limited: The Wallasea Island project, for example, aimed to provide an extensive area of accessible coastal land for the quiet enjoyment of nature and open space through the creation of new coastal wetland habitats of high value for wildlife.
- Raising public awareness of key climate and / or biodiversity issues, such as the importance of managing the carbon captured and stored in peatland: the Forsinard Flows project, for example, aimed to restore blanket bog while promoting and developing knowledge about the role of peat and carbon storage.

- Demonstrating the potential to move to more environmentally and economically sustainable forms of land management in areas where farm incomes have been low and declining: The vision for the Northern Uplands Chain Local Nature Partnership (LNP), for example, is to produce locally distinctive, high-quality food in a way that secures the long-term economic viability of High Nature Value farming and that is characteristic of the uplands. Ken Hill Estate aimed to demonstrate use of 'rewilding' as a tool for environmental benefit and as a way for landowners/managers to reinvigorate businesses. South-west Norway provides an interesting example of how an environmentally and economically sustainable model could work.
- Building resilience to climate change and other land management or economic changes: The Pumlumon project, for example, aimed to use peatland restoration to increase water storage and reduce the risk of downstream flooding in an area of Wales with high rainfall and projected increases due to climate change. Wallasea Island aimed to deliver a more sustainable approach to managed coastal realignment in the face of sea level rise due to climate change.
- Building partnerships, supporting dialogue, demonstrating and sharing best practice and facilitating change: The Tweed Forum, for example, aimed to engage a wide range of stakeholders from government, agencies, local communities, interest groups and landowners.
- Supporting local economic diversification including a focus on new local businesses and ecotourism: Most projects aimed to use nature restoration to support sustainable tourism and recreation by creating new access opportunities, habitats or enhanced landscapes. Pumlumon, for example, aimed to create a new wildlife-based attraction while new ecotourism businesses were an important element of Ken Hill Estate's new business model.
- Enhancing environmental quality – soils, landscape, water quality and air quality: Ken Hill Estate, for example, identified 'recovered' soils as a key objective in achieving its new model of land management. River and peatland projects aimed to address issues of soil erosion and improve water quality.

Many of these objectives underpinned the broader aims of the projects and should not therefore be regarded as secondary objectives.

How have initial projects ‘seeded’ future projects?

The initial short-term project examples of Holnicote Estate and Forsinard Flows are useful to illustrate discussion of how one project may 'seed’ other projects and to understand whether this can lead to greater gains in the future.

It is not as simple as an initial project leading to greater gains. However, what emerges is that an initial project generates momentum for further nature restoration work in a given area, often with wider stakeholder engagement and improved access to funding as there is a track record of action being taken on the ground. The wider policy context is also of particular importance, including the focus on achieving climate change targets and the role of peatland restoration to sequester and store carbon (mostly led by the Peatland ACTION project in Scotland). The ongoing peatland restoration work by the RSPB at

Forsinard Flows demonstrates these points, with a longstanding focus on peatland restoration meaning they hope to now be in a place to secure a 5-year funding programme for peatland restoration with the Scottish Government - a vast improvement for project planning and restoration success from the current annual grant system. Long-term planning is vital to effectively deliver larger scale projects and sustain the benefits. It is also important for operational delivery of peatland restoration; by providing job security, it encourages key contractors to make investments in equipment.

River restoration and natural flood management work at Holnicote Estate has evolved in a short space of time from focusing on minimising flood risk through conventional, in-channel engineering to restoring natural river functions through a pioneering approach that works with natural processes to restore the water connection to its floodplain, delivering greater benefits for floodplain function, biodiversity and local communities. The evolution of thinking at Holnicote Estate of a joined up, landscape-scale intervention has developed in tandem with local partners (e.g. Exmoor National Park) and the project aims and objectives fortunately aligned with those of available funding sources (EU Interreg 2 Seas Co-Adapt) to enable the project to begin when it did in 2018.

Over what timescale are projects planned, and implemented?

The timescale of the visions set out for the high-level case studies is not always clear from the available information. It can however be inferred to some extent from the ambition of the project; for example, those based on restoring woodland are based on the long-term timescale of tree growth (Sunart. or Glen Affric, as a woodland LSNR is based on a 150 – 200-year timescale. Great Fen, which is a wetland project, has a 50-year timescale. It is also recognised that flexibility is a key element of LSNR, as illustrated by the approach at Wild Ennerdale where high-level management plans at a landscape-scale allow space for natural processes to occur and for dynamic and perhaps unexpected change. Therefore, it is recommended that long-term projects are regularly reviewed and allowa level of flexibility.

The interview process for the detailed case studies enabled discussion of projects' timescales. Both Forsinard Flows and Holnicote Estate Flood risk demonstration projects ran over short, discrete time scales (approx. 5 years), which aligned solely with funding sources. However, there has been, and continues to be, ongoing work to restore habitats at both sites (peatlands at Forsinard Flows and rivers at Holnicote Estate). The methods and approaches continue to evolve, with a shift to a new approach of Stage 0 restoration being piloted at Holnicote Estate (EU funded and 5-year project timescale from 2018-2023).

Wallasea Island, a coastal project, was initially intended to run over a shorter timescale than what transpired (currently 17 years). The initial planning permission was granted to 2019, 10 years on from the original consent for imported fill. However, the focus has been on the outcomes and how to deliver the project, rather than the timescale, and the method of delivering outcomes has evolved and developed over time. An adaptive approach can be hugely useful, with the focus on the desired outcomes rather than the

method of delivery. Projects should not be fixed to a rigid timescale. Similarly, the Pumlumon Project began in 2007 after a long gestation period and is ongoing. (It should be noted that there is another, more recent project (commenced 2017) in a similar area to the Pumlumon Project. 'Summit to Sea' is being hosted by RSPB Cymru, and Montgomeryshire Wildlife Trust - who lead the Pumlumon Project - are one of the project partners alongside many other partners (e.g., The Woodland Trust, PLAS Marine Special Area of Conservation, Marine Conservation Society, Whale and Dolphin Conservation). The projects are two separate projects, but their aims are aligned.) It has been sustained through 5-year windows of funding much the same as the discrete project timeframes of Holnicote Estate and Forsinard Flows but is leading the way in exploring private financial models and new markets to support restoration, expanding upon the PES approach first adopted there.

Projects that have a longer-term, or indefinite timescale include the Tweed Forum, Wild Ennerdale, Northern Uplands Chain LNP and Cairngorms Connect. Due to their nature of being a partnership group combining key stakeholders, they are not defined projects as such and instead provide an approach to land management and a mechanism for delivery of specific projects. Tweed Forum and Wild Ennerdale are longer-standing partnerships that have been running successfully for 30 years and 20 years respectively, whilst Northern Uplands Chain LNP and Cairngorms Connect were established more recently, in 2012 and 2014 respectively. Although the Cairngorms Connect partnership is relatively new, its ambitions are long-standing with the foundations based upon a long history of management of the four individual partners across the project area. The Wild Ken Hill project began recently (2018-2019) and, with its long-term ambition, has no discrete time frame.

Working with natural processes requires an open and flexible approach. The Wild Ennerdale partnership consider natural processes to be the fifth partner in the project, and shy away from fixed timescales in which objectives must be achieved, to allow space for ecosystem processes to unfold and for management to respond accordingly. Their stewardship plan is based around a set of 15 principles that guide management decision making, with an overarching principle that any action taken should fit within, and refer back to, the vision at all times. The flexibility in approach is also important given the nature of discrete funding cycles which tend to fund LSNR projects. Furthermore, project teams or partnerships may be required to adapt project aims slightly to 'fit' with a potential funding source.

South-west Norway is unique insofar as it is not a discrete project or even a partnership, rather a set of circumstances at the regional scale that have allowed the unfolding of a process of natural woodland regeneration, over a long timescale. Regeneration has progressed since the 1950s and 1960s, though it has taken place more rapidly in the past 10 years. Eventually the woodland regeneration will slow as the extent of land available to regenerate is finite. One discrete active restoration project discussed was that of Hjerkinn (similar to Cairngorms plateau) which is largely government funded and has run in two phases from 2006-2020. The project involved restoring an active military range ,which

required all vegetation to be removed due to the presence of unexploded ordnance. There were some key lessons learnt around techniques for restoration of blanket bog and woodland at 1000m above sea level, which could be of relevance to the Cairngorms.

Have projects taken account of future environmental change (e.g. climate, increased risk of disease / pathogens) or are they aiming to restore existing or past ecosystems? How is resilience ensured?

The emphasis of most projects is on moving towards land management practices that reflect and restore natural processes. In some cases, this represents changes to patterns of land management, and the restoration of ecosystems which existed in the past. In others, it means a radical change in land management and the creation of new ecosystems and habitats. Ken Hill Estate, for example, has developed a model which closely reflects the characteristics of three soil types present across the land holding. Areas of poor, sandy soil which were in arable cultivation until recently, provide a focus for rewilding. Areas of poorly draining soils are being used to restore fen woodland, while more productive soils provide the basis for regenerative agriculture alongside traditional conservation methods. The resulting pattern of land management is the product of working with the environment rather than a deliberate attempt to restore a landscape that has been lost. At the other end of the scale, the Wallasea Island Project has created a new and dynamic coastal landscape in an area that was previously under arable cultivation. The aim here is to create intertidal habitats to compensate those being lost elsewhere as a result of sea level rise and coastal squeeze. The project has created an artificial coastal landscape of excavated lagoons, sea wall breaches and areas of higher ground. It is again a solution based on working with natural processes but through the creation of a new and dynamic ecosystem.

Projects vary in the extent to which they address current and future climate risk. Several projects – including Holnicote, Wallasea Island, some of the work of the Tweed Forum and a current project at the RSPB's Insh Marsh in the Cairngorms Connect project area – are specifically designed to help address flood risk, and recognise the growing importance of interventions to adapt to the risk from climate change. Peatland restoration projects also reflect ways in which they can increase water storage and help reduce downstream flood risk, and recognising that a changing climate resulting in periods of higher temperatures and reduced rainfall may impact peatland hydrology. Projects such as Holnicote Estate and Wild Ken Hill recognise the importance of creating more diverse, healthy and resilient habitats which are able to respond to the challenges of environmental changes. Significantly, Ken Hill Estate's adoption of regenerative agriculture has also increased the resilience of agricultural production with yields being less affected by drought than in the past. The Wallasea Island Project is in part a response to past and future losses of intertidal habitat resulting from sea level rise. It has also been designed with future sea level rise in mind, with transitional saltmarsh making up a 'coastal adaptation zone' which could be permanently inundated in the future. Lagoons forming part of the scheme have been designed with a 50-year life though it is recognised that the scheme will need to evolve as conditions change.

There are also a number of projects with climate mitigation at their heart, most notably initiatives designed to protect and restore blanket bogs for example at Pumlumon, the Cairngorms and Forsinard.

Summary

- The projects reviewed have varied principal aims and objectives, including restoring habitats and natural processes, enhancing carbon sequestration and storage, and moving to models of land management which are environmentally and economically sustainable.
- All case study projects had broader aims and objectives which reflect the multi-benefit character of nature restoration projects covering social and economic as well as environmental objectives.
- Most projects are driven by a focus on restoring natural processes or habitats that are being lost. Several projects focus on aspects of climate mitigation including peatland restoration or woodland creation and regeneration. A number of projects aim to increase the diversity and resilience of ecosystems to climate and other changes.

Project Benefits

What are the main benefits (environmental, economic and community) or services that have been delivered?

Environmental benefits

The high-level case study projects generate specific ecological benefits and also wider environmental benefits. Benefits identified from the case studies, particularly the Scottish projects, include carbon capture and storage through tree planting and woodland and peatland restoration. Water environment related benefits include flood management, noted at Steart specifically in relation to sea level rise, and water quality improvements. For biodiversity, the benefits are focused on habitat creation and improved connectivity which supports climate change adaptation for key species relevant to each project. Creation of habitat networks and wildlife corridors is a common benefit throughout the high-level case studies, including Greater Coa Valley and Central Apennines, irrespective of their overall scale or level of ambition.

Managing grazing pressure from large herbivores to enable natural regeneration to occur is key to the success of a high proportion of the high-level case studies. For example, deer management to reduce grazing pressure in the Scottish Highlands case studies such as Alladale and Glen Affric is key to achieving the project aims. Conversely, in Oostvaardersplassen the excessive ‘success’ of the introduced herbivores, without sufficient management by top predators or culling, illustrates how this can lead to other challenges within a LSNR project, such as excessive grazing pressure and animal

welfare issues. Knepp Castle, which seeks to achieve near-natural grazing identifies animal welfare issues as one of the challenges of the approach for managing the grazing animals and the need for certain levels of intervention.

In contrast to managing existing herbivores, at the Greater Coa Valley in Portugal, the aims include the reintroduction of grazing animals required to support the return of predators such as Iberian lynx and wolf, and also introducing predatory bird species like the Bonelli’s eagle and Spanish imperial eagle. Within the Central Apennines, one of the aims is to boost the existing population of Marsican brown bears through reducing conflict and persecution by humans. This illustrates the challenges around managing established predators within an ecosystem where human conflict can occur. Within the UK context, the introduction of top mammal predators is controversial and challenging within the existing legislative framework, which is illustrated in the Alladale case study where some of the original aspirations cannot be fulfilled at present.

As might be expected, all of the detailed projects have resulted in new, expanded, enhanced or reconnected habitats. Many have reversed drainage associated with past land improvement, restoring wetlands, creating wet meadows, scrapes and pools together with naturally functioning peatland and new areas of intertidal and coastal habitat. Planting new native woodland, naturally regenerating woodlands, wet woodlands and a range of farmland habitats have also been delivered by several projects such as South West Norway, Cairngorms Connect, Forsinard Flows, the Northern Upland Chain Local Nature Partnership, Wild Ennerdale and the Wild Ken Hill.

These habitat enhancements have, in many cases, supported a greater diversity of species including protected and reintroduced native species. Most projects with a wetland component support increased bird populations. Forsinard Flows, for example, now supports growing numbers of upland waders while the number of birds of prey is also increasing. Wallasea Island has become nationally important for breeding and overwintering birds, supporting the UK's largest population of avocet, together with a range of mammals, reptiles, invertebrates and saltwater fish. Wild Ken Hill supports native deer, feral cattle and horses and has included a beaver release project. Removing sheep grazing from Ennerdale valley and introducing cattle has seen a dramatic increase in the number of upland bird species and population size in Wild Ennerdale. In addition, work to remove riverside conifer plantations in the Ennerdale valley has reduced fish deaths from acid flushes, bringing the Artic charr back from the brink of extinction. The move to regenerative agriculture includes greater reliance on beneficial invertebrates as an alternative to the use of chemical sprays.

Within the detailed case studies, several projects focus directly or indirectly on rivers and wetlands, delivering benefits in terms of reducing flood risk, addressing soil erosion and improving water quality. Examples include catchment-based projects such as on the Holnicote Estate, the work of the Tweed Forum, Cairngorms Connect and Wild Ennerdale. The Tweed Forum has facilitated significant river restoration projects and interventions to slow river flow and create 'natural' river obstructions. Peatland projects such as Forsinard Flows and Pumlumon are also helping to reduce flood risk and improve

water quality. Projects involving beaver releases are also likely to contribute to flood management, improvements in water quality and biodiversity. At Holnicote Estate, a pair of beavers released in January 2020 have built a dam within nine months, creating a 'wildlife-rich wetland' and a habitat that is more resilient to flood risk (National Trust, 2020). At Wild Ennerdale, the involvement of United Utilities in the partnership was driven by a desire to secure high water quality by influencing land management in the valley.

Peatland projects deliver important benefits in terms of protecting, restoring and enhancing the role of blanket bogs in absorbing and storing carbon. (The Centre for Ecology and Hydrology are currently undertaking a project measuring four UK peatland sites which aims to quantify the carbon balance of individual peatlands. One of the sites is Forsinard Flows. The website notes that given the importance of peatlands in the global carbon budget, there are surprisingly few sites at which enough measurements exist to determine whether they are currently acting as carbon sinks or sources). Examples include Forsinard Flows with its focus on removing non-native conifer plantations and reversing agricultural drainage and the Pumlumon and Northern Upland Chain LNP where peatlands have become eroded and damaged as a result of drainage. Projects facilitated by the Tweed Forum have included the enhancement of 125 ha of raised bog, while Cairngorms Connect is aiming to restore 10,000 ha of peat-rich habitats. The creation of new intertidal habitats as part of the Wallasea Island project has also increased carbon storage, through the creation of habitats with a known higher carbon sequestration value than the previous habitat.

Other environmental benefits delivered by the case study projects include landscape enhancement, including the management of traditional features such as walls, hedges and meadows, and invasive plant control.

Large-scale landscape change can also create a ‘new’ landscape which can be viewed both positively and negatively, depending on the values and perceptions of the observer.

Economic impacts

LSNR / rewilding projects potentially have a range of economic impacts, directly and indirectly, positive and negative. By changing the management of land, they can create new opportunities in restoration management, supporting new jobs and attracting new funding, while sometimes reducing mainstream farming and forestry management and its outputs. Changes in land management provide new opportunities for contractors and suppliers from different requirements from the land manager, and may have benefits for the production and marketing of nature-friendly produce, but may also impact on some existing agricultural and forestry supply chains. Restoration may enhance tourism and recreation activities, and increase the delivery of a range of ecosystem services, which may have market value or deliver wider public benefits.

The analysis of economic impacts has attempted to assess all relevant changes in economic activity, positive and negative, and direct/ indirect. The extent to which these benefits are understood, documented and quantified varies across the case study

examples. More evidence is presented for the detailed case studies, which have benefited from interviews with stakeholders and a more extensive evidence review. There are studies that have assessed economic impacts and benefits at only a subset of sites, with notable examples being assessments by RSPB of the benefits of Forsinard reserve, and analysis of the economic effects of Pumlumon. Where studies have not been undertaken, available evidence is often anecdotal or by way of examples without quantifying effects. In general, published information tends to give a positive gloss on economic effects, emphasising benefits while giving little consideration of disbenefits. Further issues are that some projects have limited economic impacts because of their small size, while many are also at an early stage and their main benefits and impacts are anticipated in the future. Overall, most of the case studies do not have quantitative data to enable us to assess overall net effects on employment/income on the land affected or in the wider economy compared with the baseline.

Most of the detailed case study projects resulted in change in employment associated with management of the land in question. There was typically a loss of a relatively small number of 'conventional' agricultural jobs, and the creation of a range of new positions in land and habitat management, visitor management and education and in diversified businesses. Information was not collected on the relative salaries of the positions lost and gained, however it is worth noting that, in some cases such as Pumlumon and Wild Ken Hill, the employment that was lost tended to be in business models that were recognised as increasingly economically unsustainable. The Wallasea Island project led to the loss of two arable jobs but created three RSPB team jobs in addition to work for contractors and graziers. The Ken Hill project created new employment opportunities in the management of the estate, through the sale of wild meat, provision of visitor accommodation and operation of wildlife safaris and a bike business, with plans to accommodate additional local businesses on the estate and to create an events and education facility. The Forsinard Flows project was expected to create up to 26 FTE posts during the project and 10.9 FTEs in subsequent years. Although some jobs were provided throughout the project, in some cases local recruitment proved difficult (e.g. for forestry operations) and no additional jobs have been directly retained upon project completion. The organisations that make up the Cairngorms Connect partnership employed 9 FTE to service the partnership over a five-year period. The Tweed Forum focused on local delivery of projects and its emphasis on marginal land made it less likely existing employment in agriculture would be displaced. The Northern Upland Chain LNP created new employment opportunities in what was described as a 'restoration economy' through training in rural crafts such as drystone walling and management of hay meadows. Most projects aimed to make use of local contractors wherever possible, though this was more difficult in remote areas such as Caithness where the Forsinard Flows project had difficulty in finding local forestry contractors, for example.

Many projects highlighted opportunities for nature-based tourism and economic diversification, by improving environmental quality alongside investments into new visitor infrastructure, access or interpretation. As noted above, this is part of the Ken Hill Estate business model, with visitor accommodation, holidays and events contributing to the

estate's income. Several projects have led to further investment in environment-based tourism. These include the Pumlumon Project which led to the Dyfi Osprey Project (which attracts 40,000 visitors per year, brings up to £500,000 to the local economy per year and generates over 1.7m unique visits from 50 countries to their live streaming of nesting ospreys (Wildlife Trust Wales, 2014)) and the work of the Tweed Forum, which helped secure funding for the £20m Destination Tweed project. The project has a combination of funders, with over half coming from the UK and Scottish Governments' Borderlands Inclusive Growth Deal, and additional funding from the National Lottery Heritage Fund and the council. The project aims to provide a significant tourism boost by creating a world-class long-distance route based around the River Tweed. Other projects, including the Holnicote Estate, Forsinard Flows and Northern Upland Chain LNP are recognised as making a broader contribution to nature-based tourism and the local economy.

Several projects have been important in supporting agricultural activity and placing it on a more sustainable footing. This was noted with respect to upland projects (e.g. Pumlumon and Northern Upland Chain LNP) where hill farming had become increasingly unviable and Ken Hill Estate in the lowlands, where changes in agricultural support and challenges on maintaining productivity spurred the change in direction. The changes brought on the Ken Hill Estate and Holnicote Estate were judged likely to make remaining agricultural activity more resilient and productive. Whilst tenant farmers within the Ennerdale Valley are not part of the Wild Ennerdale partnership, it has had some influence over their land management practices through Natural England's role in the partnership. This has enabled agri-environment scheme agreements to be tailored to support the purposes of the project and maximise biodiversity gains. Transparency over income from these schemes has meant that rents for the tenant farmers have been matched to the farmers' income. Furthermore, a few projects highlighted the focus on developing and marketing high quality, local products as a means of enhancing agricultural income. It should be noted here however that most examples which illustrate this point are typically more marginal and less profitable areas of agricultural production (e.g. the uplands) where there is a lower opportunity cost from changes in land use for LSNR.

Sale of meat with a premium on the basis of the production methods and quality is identified for Great Fen and Knepp Castle; venison sales are noted in relation to Glen Tanar. The case studies also identify other products associated with the 'branding' of the area such as toiletries, and other food products. Timber sales are also identified for Forsinard Flow, Bunloit and Sunart, which are associated with the removal of existing non-native conifers, which then may not provide long-term income. Economic benefits identified for the farmed landscapes of Knepp Castle and Balcaskie arise from lower input farming. These examples reduce volumes of agricultural output and replace it with lower volume, higher value production, altering local supply chains.

Other projects, such as Cairngorms Connect, Tweed Catchment, the northern Upland LNP and Pumlumon Project, resulted in economic benefits as a consequence of reductions in flood risk or changes in the management of flood defences. It is likely that the natural flood management (NFM) measures implemented on the Holnicote Estate, for

example, have already prevented flood damage to properties which could have resulted in insurance claims higher in value than the cost of the work undertaken. This was shown in an extreme rainfall event in 2013 whereby NFM interventions reduced the flood peak by 10% and resulted in no properties affected by flooding. The offline storage bunds on the floodplain upstream of the vulnerable properties had a capital cost of £163,000, a small cost compared with the combined insured value (£30million) of the 98 properties at risk. The Wallasea Island Project involved the creation of new intertidal habitats, removing the need to maintain an existing flood wall, and the costs of this maintenance for infrastructure which was in poor condition.

The Pumlumon Project has been successful in securing private and public/private blended funding which has helped bring investment into the area. This has included carbon market investment in safeguarding and enhancing carbon locked up in blanket bogs.

Finally, although not a project, the South West Norway example points to an alternative and economically sustainable model of land management. It is based around owner occupation, farming (agriculture, wood fuel and timber, hunting, tourism), high levels of economic support and a range of income streams from on- and off-farm activities (e.g. small-scale arable, livestock, hunting, forestry – on farm totalling 60%; teaching, administration, small businesses, power companies, plumbing, carpentry – off-farm totalling 40%). Strongly rooted in local communities, the average Norwegian farm has an annual income of £60k.

Social benefits

Social benefits are identified from the high-level case studies in relation to the creation of local employment opportunities, although as highlighted in relation to some of the detailed case studies, such as Forsinard, these may not always be long-term opportunities. However, it is clear that some aspects of the projects do provide ongoing employment opportunities, particularly where the project brings about diversification such as through tourism and recreation. Recreational opportunities are also a common benefit identified in relation to Glen Affric, Glen Tanar, Great Fen, Great Trossachs Forest, Steart, Sunart, and Temple Farm. This principally includes increasing recreational provision but also improving the quality of the recreational experience from the wider landscape change associated with the project.

The educational role of the projects is also mentioned in relation to Alladale, Great Fen, the Great Trossachs Forest, and the Greater Coa Valley. Alladale is noted as having a specific educational initiative, the Highland Outdoor and Wilderness Learning programme, which promotes engagement of school children with the environment. Within the Central Apennines, education includes improving understanding of the Marsican bear among communities to minimise human-wildlife conflict and support the intended increase in Marsican brown bears. Alongside education and volunteering, projects including Sunart,

the Greater Coa Valley and Central Apennines highlight community involvement in the projects. For Sunart, funds were accessed to train local people in the skills necessary to undertake habitat restoration work within the LIFE project.

Most - if not all - the detailed projects reviewed created new opportunities for engagement with nature and sustainable land management. These ranged from the Wallasea Island project which created new access to the coastline for surrounding communities in Rochford, Southend and Burnham-on-Crouch, to the Wild Ken Hill project which has plans for nature-rich well-being retreats alongside informal access for visitors and local people. Creating new opportunities for people to gain access to the river has been an aim of the Tweed Forum.

Many of the projects, such as Cairngorms Connect, Forsinard Flows and Wild Ennerdale, have created new opportunities for volunteering and citizen science, including through the provision of study and field centres for visitors. The Holnicote Estate aims to increase awareness of flood management and the benefits of good land management, alongside improved opportunities to understand and enjoy nature. The Forsinard Flows project has included the provision of accommodation for volunteers as part of a new Field Centre. The project also used community arts commissions to encourage engagement and raise understanding of carbon and peat issues.

The projects provide educational opportunities, ranging from on-site interpretative information, school visits, field centres to opportunities for remote learning and research collaborations with academic institutions. The Forsinard Flows project provided community learning opportunities including school programmes (151 outreach visits to 25 schools, plus 61 school visits to Forsinard) and community activities (over 4,000 attendees at local events including walks, talks and workshops) both at Forsinard and throughout Caithness and Sutherland, as well as remote learning opportunities (The Flow Country, n.d.). It also included the establishment of a peatland science centre (as part of the Field Centre) for education and research and now collaborates with national and international universities to further research the role of peatlands as a carbon store, and peatland restoration and biodiversity. The Tweed Forum has an established range of co-operative research partnerships delivering innovative solutions and impact across a range of topics and works closely with statutory agencies and policy makers to inform legislation.

Several projects have resulted in wellbeing and mental health benefits as a result of reductions in flood risk affecting downstream communities (Philip et al., 2020). This benefit was identified in relation to the work of the Tweed Forum, Holnicote Estate and the Pumlumon Project. Forsinard Flows was described as providing similar health benefits as a consequence of creating full time and secure jobs for local people in an area where part-time and casual employment is common.

A number of projects have engaged with local communities, creating opportunities for involvement in project planning and decisions about the local area. Examples include:

- the Pumlumon Project which has taken an economic approach to LSNR to ensure the farming community are on board and has worked with the farming community to deliver pilot projects to test the feasibility of approaches;
- Northern Uplands Chain LNP which integrates the Northern Hill Farming Panel (representative of the farming community) to ensure all stakeholders have representation, are heard throughout the process and projects are delivered in partnership; and

What lessons are there in terms of optimising community and local economic benefits associated with LSNR projects?

Most projects emphasised the importance of effective engagement in helping to overcome opposition and encourage involvement in the project. Local community involvement was a key aspect of the Holnicote Estate project, for example, helping to change public perceptions and secure increased support for the project. The Forsinard Flows project encountered some early opposition and it took three years of public engagement to get the community more fully on board. The Tweed Forum used early engagement and information to address early community concerns and help secure support for the project but highlighted the challenges in engaging effectively at the scale of a catchment. These and other projects highlighted the importance of engagement early in the lifetime of the project, and frequent and regular meetings thereafter so issues can be identified and addressed, and community support maintained. The Wallasea Island project, for example, established a liaison group that met every six months over a ten-year period.

Cairngorms Connect and Tweed Forum projects, in particular, emphasised the importance of maintaining good communications over the lifetime of the project, using a range of different methods, including village hall meetings, film nights, dinners and talks, social media, regular contributions to local publications, volunteering events and arts-based outreach programmes. The choice of communication channel needs to be tailored to the stakeholders in question, with one-to-one meetings being resource intensive but the most effective with respect to landowners and key influencers.

The Holnicote Estate project found that having a locally based project manager was important in building and maintaining trust and encouraging easy communication. Several projects, including Tweed Forum, Forsinard Flows and Cairngorms Connect highlighted the importance of having project staff who 'speak the right language' – whether that is a local focus, a farming background or previous involvement in shooting – in order to help build local trust. This could be perceived as a hindrance to young people from different backgrounds wanting to work in the field in rewilding and LSNR in a public-facing role, and is an issue that is worth exploring further.

A lesson from the Wallasea Island project is that a degree of flexibility is needed, allowing projects to adapt and evolve in response to community and stakeholder concerns and suggestions. Furthermore, the importance of not over-promising what could be delivered was emphasised as failure to deliver can undermine community trust in the project.

Securing long-term benefits - How do you ensure achievements and benefits are secured long-term? How do you avoid losing benefits derived from the project? Does this require loose/adaptive management?

Several key points were raised to ensure achievements and benefits are secured long-term:

- Engagement with landowners and land managers to ensure they buy into the project and understand the long-term value. For example, with regards to peatland restoration through soft engineering works for the Pumlumon Project, it is vital to ensure the landowning community understands the benefits and that there is a framework in place for long-term land management and maintenance of features. Soft engineering works are not irreversible, so it takes engagement with landowners from lead organisations (e.g. Wildlife Trust) to dissuade them from reversing works and highlight that doing so can be both time-consuming and detrimental.
- Learn, adapt and evolve novel approaches to restoration to ensure benefits are maximised long-term. The examples of Forsinard for peatland restoration and Holnicote Estate for river restoration both highlight how approaches and techniques need to be trialled, adapted and built-upon throughout a project's lifetime and indeed beyond. The approach at Holnicote for instance has evolved from in-channel NFM interventions to a more natural restoration approach. Lessons learnt from an earlier project (which had required ongoing management to repair interventions and sustain benefits), alongside a willingness to review and change approach if required has led to a wider range of benefits (e.g. to biodiversity). Wild Ennerdale is another example demonstrating the need for a flexible management approach in order to achieve sustainable benefits.
- Ongoing deer management is key to maintaining the success of the woodland case studies in the Scottish Highlands and ensuring that benefits are secured in the long term. Once lower deer levels are achieved, this needs to be sustained to avoid loss and damage to planted and regenerating woodland.
- Financial viability and sustained finance. Closed funding loops are detrimental because restoration projects are typically long-term, and this creates uncertainty and difficulty in forward-planning. It would also be helpful to avoid the 'boom-bust' cycle of job creation for short periods of time where a project is funded by grants. There is a need to move away from grants and instead have mechanisms in place that can leverage sustained finance (e.g. carbon market, biodiversity offsetting). The extent to which these have been pursued is discussed in What kinds of funding models have proven successful in delivering projects? What novel models offer potential to combine public and private finance, tapping into emerging markets for carbon or other environmental ‘goods’? section.
- A strong and motivated team on the ground, and continuity of staff helps to develop, facilitate and maintain project momentum. The Forsinard Flows, Tweed Forum, Holnicote Estate and Wallasea Island case studies all suggested that this is integral to success for a number of reasons which are discussed in Delivery mechanisms section.

- Communicate success. Although stakeholder engagement and consultation are often important during project development, it was noted that throughout a project, and indeed after, there needs to be better communication with the public to share successes, to enable them to keep up to date and encourage them to continue engaging with the project. This ensures social benefits (e.g. mental health and wellbeing) are delivered long-term, and the community remains supportive of similar projects that may be delivered in future, which is particularly important where there have been past conflicts or disagreement. Lack of time and resource can limit a project's ability to achieve this, which highlights the importance of planning project promotion in the early stages and ensuring resource is set aside to deliver successful communication and engagement long-term.
- The role of effective partnerships and sustainable funding models are also essential and further discussed in Delivery mechanisms section.

Several LSNR projects have the ambition to move towards a restored natural ecosystem where there is as little human intervention and management required as possible. This should reduce long-term costs and ensure that the interventions are sustainable and long term. The detailed case studies have varying timescales and thus are at different stages of the restoration 'journey', but case studies such as Forsinard Flows, the Northern Upland LNP and Wallasea have discussed that ongoing management and maintenance have been and will be necessary into the future. The shift in restoration approach at Holnicote Estate has largely been influenced by the lessons learnt from the earlier conventional, in-channel natural flood management approach. The active management required to assess the system and repair features (e.g. offline storage, leaky dam and peat grip blocking bungs) is hoped to be avoided through the National Trust's shift in approach of 'Stage 0' river restoration which works with natural processes to rehabilitate a modified channel network and restore water connection to its floodplain, delivering multiple benefits for people and nature.

Similarly, soft engineering methods implemented for peatland restoration at Pumlumon do not require arduous maintenance but ongoing monitoring by land managers is required to ensure the system is functioning as it should. The project noted that discrete funding windows limit the ability for the Wildlife Trust to oversee landowner management in the long-term; however, the Trust have initiated their own paid long-term management agreements with landowners and land managers to ensure longevity. As discussed above, the main issue with peat maintenance at Forsinard has been that of adjacent conifer plantations and non-native woodland regeneration most notably on peat that is less rehydrated. Continuous efforts are required to manage this but even with the help of volunteers, the issue is extremely costly and threatens to reverse restoration success in some areas.

Various ongoing management interventions are required at Wallasea. The managed realignment area is self-sustained by the sea and works well at present. However, other areas require more focused management including activities such as annual vegetation removal on some islands, weekly monitoring and regulation of water salinity and water

levels to optimise bird habitat on the regulated tidal exchange elements and tidal lagoons, fencing maintenance to keep herbivores, predators and/or people away from certain areas, and, ongoing maintenance of the footpath network.

For the Cairngorms Connect partnership, it is anticipated that deer management is likely to always be required in order to maintain deer at low numbers to allow woodland and heathland habitats to flourish.

South West Norway illustrates a situation where a number of factors have come together to create the conditions for successful, long-term woodland regeneration. The region has a sustainable and welfare-led approach to deer management to enable successful natural regeneration of woodland. Beyond this, little intervention has been required owing to key factors including owner occupation, diverse farm (and non-farm) incomes, more equitable distribution of land and strong and vibrant local communities who have agency over the land.

Summary

- The projects potentially have a range of economic impacts, direct and indirect, positive and negative. Most of the case studies do not have quantitative data to enable assessment of overall net effects on employment/income on the land affected or in the wider economy compared with the baseline. These data do not appear to be routinely captured.
- Social benefits are identified in relation to employment, volunteering, recreation, education and engagement, with mental health benefits from employment and flood risk reduction.
- Learning from other projects nationally and internationally is beneficial for project management and development, and knowledge sharing needs to be supported.

Issues and Barriers

Translating the vision into action

The discussion about issues and barriers experienced in the detailed case studies is organised by the type of issues and illustrated with examples from both the high-level and detailed case studies. Additional barriers related to specific environments e.g. uplands, coastal or lowlands, are discussed in Delivery mechanisms section.

A persistent barrier to effective implementation is that of translating a vision into a functional delivery framework that is supported by sufficient funding and staff. There has sometimes been pushback from the environmental sector and community where new approaches are employed, for example during the early days of the Pumlumon Project where there was some concern from the traditional conservation sector about the project's economic approach to restoration. Not only do projects need to translate the

value of proposed projects to ensure stakeholder buy-in, but it is vital to have a flexible project design to ensure stakeholder voices can be incorporated, as was the case for Wallasea.

Restoration projects of this scale appear to be leading the way in new approaches and techniques to land management and maximising environmental benefits, such as the experimental approach outlined in Cairngorms Connect. Therefore, learning about similar technical projects both nationally and internationally is an important part of project design: it helps to set a clear project framework, and identify and avoid potential barriers to maximise opportunities for effective delivery. In addition, seeing what is achievable and successful elsewhere creates greater buy-in and motivation from stakeholders. The following projects have all benefitted from taking time to see what has been successful elsewhere: the Wallasea Island project team visited the Netherlands, Germany, Donana National Park in Spain, Hong Kong and Shanghai; Wild Ken Hill maintains a close relationship with Knepp Estate (the only other similar lowland LSNR project) and Holnicote Estate is piloting the Stage 0 approach to river restoration which has been implemented at Fivemile-Bell in Oregon. The conservation evidence website is noted as a potential source of information and site for knowledge sharing.

Legislation

Legislation and regulation more widely can impact project delivery with some suggesting that it is 'too heavy-handed', creating a 'stumbling block', for instance when planning river restoration in the Tweed catchment. Likewise, the Pumlumon Project found that the biggest issue to overcome was the regulator being risk adverse; this meant it was a struggle to obtain necessary licenses (e.g. to begin restoration works on a SSSI) despite the project obtaining suitable investment and securing landowner engagement.

Continuity in government and policy is also needed. There needs to be a shift in focus from short-term, snappy sounding schemes towards policy which supports sustainable, long-term restoration interventions that can address long-term issues like climate change.

On a project level, existing legislative framework can influence project implementation. For example, controls in relation to large predators, and requirements around animal health and welfare such as for the livestock at Knepp Castle. Animal welfare was also a key community concern in relation to Oostvaardersplassen and the initial reliance on natural processes to control the populations of large herbivores within the enclosure.

Community / public opposition

Within the high-level case studies, there were some conflicts with the local community on the project aims. This was a particular issue for Alladale due to the project’s aspirations to reintroduce large predators. Within the Great Coa Valley, conflict is also noted between landowners and wolves, while in the Central Apennines engagement was key to allow an increase in the bear population. This illustrates that large predators are a key focus of

potential community concerns and conflict. None of the case study projects were identified as having involved the community in the development of the project vision, only in involvement once the project aims were established.

Several detailed case study projects have faced some resistance from local communities that live in proximity to the site. This has included moving access paths to make way for the 'rewilding area' at Wild Ken Hill; community objections to the new field centre at Forsinard due to the perceived visual impact; and a number of conflicts at Wallasea including flight safeguarding, access for equestrians and oyster fishing. However, it has typically not hindered project progress and has been ameliorated over time through early and ongoing community engagement to translate project ambitions and enabling communities to understand and experience the range of benefits derived, allowing projects to evolve in response to stakeholder inputs whilst being careful not to over promise. The caveat to this is the time commitment, incurred costs and the necessity of having clear and factual information. One interviewee recognised that you cannot always get everyone on side:

"realising and being comfortable with the fact that you are not going to take everyone with you (…) it's about having the confidence to say “we are not going to convince everyone it's a good idea” (…) but the majority of people you’re working with think (…) it is the right thing to do, and having the courage and conviction to just go ahead and do it." [Holnicote Estate]

With regards to the landowning and farming community, restoration projects must overcome several hurdles. It is vital to ensure their buy-in but this is often difficult where restoration projects require a radically different approach to land management and loss of productivity. A range of approaches have been adopted depending on who is involved, the quality of the existing relationship and the scale of change proposed. Successful engagement relies upon regular 1:1 contact, financial incentives, community / farming groups and demonstration sites. Several case studies found that given enough time, there tends to be a 'domino-effect' of buy-in from the farming community once a few key players are on board. Some good examples of successful (whilst recognising some projects took longer to achieve success) community engagement are illustrated by the case studies including Cairngorms Connect, Forsinard Flows, Tweed Catchment, the Northern Upland LNP, Wild Ennerdale and the Pumlumon Project.

Overcoming the 'silo' mentality that remains between conservation (largely being led by NGOs), production (farming and forestry) and recreation (e.g. sporting estates) is important. On farmland, this requires ongoing engagement with farmers as well as structural change within policy and subsidies to promote nature-friendly farming (on the basis that it is not a trade-off: both farming and nature can work harmoniously). The example of South West Norway illustrates how the silos of agriculture, forestry, hunting and community can be blurred and broken down.

Funding

In relation to issues associated with funding there are mixed findings from the high-level case studies. For example, there were issues linked to misalignment of the project's objectives with requirements for agri-environment funding (Knepp Castle). However, for Temple Farm, the actions are identified as providing positive alignment, although it was identified that there is a limitation from a current lack of Payment for Ecosystem Services (PES).

A predominant barrier is that of closed, short funding cycles (approx. 5 years) which serves to make long-term, sustainable project planning difficult. Where there are extremely large budgets and project ambitions, this creates a challenge to deliver at such pace and scale. This can also negatively impact on job security and staff retention. Funding applications absorb valuable project team time and are often complex and time-consuming to apply for. This results in vision, aims and objectives often changing over time to 'fit' with funding requirements. It can also impact the longevity of restoration benefits, due to the inability to fund long-term management, as has been the case at Forsinard.

Issues regarding the alignment of funding with project aims/needs include for example, EU rural development programmes which work to 7-year medium term budget cycles, and have been a barrier to funding long-term restoration projects (e.g. Knepp). There are also rules relating to eligibility for Basic Payments which may have served as a barrier to changes in land management. Some of these barriers may reduce now that the UK has left the EU and the ability of devolved administrations to devise their own scheme. Other sources of funding such as the EU LIFE programme and National Lottery Heritage Fund (NLHF) are time-limited and are suited to restoration projects focused on capital works (e.g. work to restore peatland or remove plantations), rather than low-intervention rewilding type projects such as Knepp. However, these sources cannot guarantee long-term funding (although some restoration projects have secured funding from LIFE in different phases through new project applications).

The five-year Endangered Landscapes Programme (ELP) funding which currently supports Cairngorms Connect has taken an approach to restoration that explores 'tipping points'. Projects under this funding scheme are asked to explore interventions that could be delivered within a five-year window that would create enough change to reach a tipping point in the ecosystem. Examples include restructuring plantations, removing non-native species, dense tree planting and deer control. The aim here is to reach a point where natural processes are restored to a point where the ecosystem is self-sustaining rather than requiring intensive human intervention.

The accessibility of funding has been a barrier for some projects, such as those led by government partners who have been unable to access agri-environment scheme funding. Similarly, ensuring new private market investment is socially/publicly acceptable has also been a barrier to some projects. What kinds of funding models have proven successful in delivering projects? What novel models offer potential to combine public and private

finance, tapping into emerging markets for carbon or other environmental 'goods'? section further explores the role of private sector investment and Payments for Ecosystem Services schemes, and the identified barriers.

Land ownership and land value

The selection of case study projects includes examples of owner-occupied estates, tenanted estates, NGO owned projects and wider partnership projects with diverse, multiple patterns of ownership and tenancy. LSNR projects by their very nature extend across large areas, which can create challenges for decision-making where multiple landowners, tenants and local communities are involved.

Land management requires collaboration and participation of landowners in decision-making. For example, in Great Fen, there are 40 private households located within the boundaries of the project area and it was crucial to get them on board for the success of the project. At Holnicote Estate, the National Trust has worked on a 1:1 basis with tenant farmers to ensure they buy-in to the project and to mitigate any financial losses to farm businesses as a result of restoration.

The most straightforward pattern of project implementation appears to be for owner-occupied estates which, subject to the influence of regulators, are under the control of a single owner. Ken Hill Estate and Knepp Estate fall into this category and have been able to develop their land management scheme without reference to other land managers or NGO partners. The Forsinard Flows project is similar, with the entire project contained within the RSPB nature reserve despite being neighboured by a number of large estates. In the case of the Wallasea Island project, a single landowner granted a purchase option to the RSPB which allowed two years to design, obtain consents and secure funding. Once these were in place, the RSPB was able to manage the project as owner of the land.

Partnership projects between large landowners such as Forests and Land Scotland, National Trust and United Utilities in Wild Ennerdale had few issues with project implementation. A shared vision, and having project partners who were sufficiently senior to make decisions over land management during partnership meetings, unified partners and aided progress. Cairngorms Connect had a similar experience in this regard.

By contrast, on the Holnicote Estate, which is owned by the National Trust but farmed by tenants, implementation has been less straightforward with the need for demonstration projects and incentives to bring some tenants on board. Land tenure within the Pumlumon Project area includes a number of absentee landowners, with land being under the control of farm managers who have generally been open to new ideas once proven via demonstration projects. Within the Northern Upland Chain LNP area, there is a multiplicity of landowners including traditional hill farming families who are sometimes reluctant to change, and large estates who are often focused on maintaining income from

shooting. Both circumstances slow the process of implementation, emphasising the importance of early engagement and winning hearts and minds through practical demonstration.

In the South West Norway example, the tradition of small-scale, owner-occupied farms, together with a broad definition of farming and the strong sense of community, all contribute to a pattern of land management which has developed a balanced approach to deer management and natural woodland regeneration alongside farming and forestry.

Several issues relating to land value are also apparent. First, LSNR / rewilding involves some permanent change in land use, often to a perceived less productive use of land. This can be a widespread barrier, especially given the uncertainties raised above regarding long-term funding and revenue streams, and current obstacles to developing effective PES schemes. The evidence suggests that these projects can enhance the productivity of the land if multiple services are taken into account, but not necessarily the returns to the landowner if revenue streams do not reward those services. However, payment for ecosystem services would create a reliable income that may increase the capital value of the land. Secondly, there can be issues with capital land value and the ability to borrow against that capital. This is partly because of an inconsistent approach at present to the valuation of ecosystem services; some are valued (e.g. timber) whilst others such as flood protection and carbon sequestration are not at present. Finally, a standalone problem raised by the privately owned Ken Hill Estate is the lesser value of 'restored' land (e.g. arable land to woodland) from an inheritance tax perspective.

The Scottish Government has investigated the potential for introducing some form of land value based tax in Scotland to reflect the rising value of land, and a new Expert Advisory Group on Tax on Land and Property has been set up to advise the Scottish Land Commission and shape the recommendations that it will put to Ministers. Land value tax is a tool for raising public revenue through an annual charge based on the value of a given parcel of land. Unlike other types of property tax, land value taxes are based on the unimproved value of land, and not related to any property or infrastructure that is on it. One of the main theoretical benefits of land value taxation is that it should encourage land to be used more productively. This is because land value tax is based on the value of land in its optimum use as opposed to its actual use. As the tax liability on any site would be the same regardless of what it is used for, this should (in theory) create an incentive for land to be used as productively as possible. One of the areas where land value tax could help deliver Scotland’s land reform objectives to improve the productivity, diversity and accountability of the way Scotland’s land is owned and used is to move to support a move to a more productive and diverse pattern of rural land ownership and use (Scottish Land Commission, 2018). However the incentive for improved productivity would also need to reflect the natural capital value of low intensity uses, or would disincentivise these uses

Partnership working and project scale

Working in partnership tends to be beneficial to project delivery (see Are there particular partnership / delivery models that make it easier or more difficult to initiate and deliver projects? section for evaluation of successful partnership approaches and for the value of such approaches for maintaining project momentum). However, the downside is that partnerships require extra effort to bring everyone on board. The partnerships established under the Tweed Forum and Northern Uplands Chain LNP extend across a large land area and are spearheaded by a partnership approach. Two issues raised through discussion with these two projects were: firstly, the time taken to persuade landowners to change historical land management practices; and secondly, polarised views within the partnership (e.g. on moorland management or beaver reintroduction) which can make it difficult to find resolutions and channel time and resource into effective projects. However, the benefit of full representation is that all relevant stakeholder views are captured in the early stages of project development.

An additional issue is that of competition, for example in the environmental NGO sector to secure funding with partners. A partnership approach has been advocated within the Pumlumon Project which has worked hard to promote learning, knowledge exchange and working collaboratively with similar projects elsewhere. There have also been challenges with government bodies as key partners (e.g. regarding regulatory legislation – as discussed above), although these tend to be project specific as opposed to conflicting objectives of the organisation as a whole. The relationship was described by Pumlumon Project's interviewee as the 'push and pull of being both an investor and regulator'.

Monitoring and reporting

Most projects are required to monitor and report progress to fit with the requirements of their funding sources. Detailed monitoring programmes have been undertaken for the Holnicote Estate, the Pumlumon and Cairngorms Connect projects. There is a recognisable value to good quality monitoring and evaluation data within all the case studies, particularly where innovative projects influence government policy and private investment requires risk analysis. The issues faced include cost, time, spatial coverage and length of data collection, choosing appropriate monitoring techniques, and having sufficient knowledge and expertise within the team to analyse data. Ken Hill Estate, for instance, outsource time-consuming and technical (e.g. ecological) baseline monitoring work, whilst keeping informal records and completing bird surveys themselves, often with the help of volunteers.

Project funders vary significantly in their administration and reporting requirements and although some appear burdensome, most of the detailed case studies did not suggest it had been a barrier to project delivery, viewing it as a 'useful burden' given its value in justifying future investment and developing approaches on the ground, although specific economic data is not usually required. The main issue with regards to funding sources is the bureaucracy associated with funding applications as opposed to monitoring and reporting. Furthermore, it is necessary to understand and confirm workable monitoring

and reporting requirements at the beginning of projects especially where these are framed by legislation (e.g. for Wallasea Island where EA and Crossrail requirements were framed by legal agreements).

It can often be difficult to capture changes at the scale at which projects operate because monitoring data is typically spatially discrete. However, techniques such as satellite imagery and high-resolution drone imagery from frequent flyovers have been incredibly helpful and, in the case of the Holnicote Estate, have supplemented site-specific hydrological monitoring data to aid understanding of catchment-scale change. A further issue is the inherent interlinkage of ecosystem services and environmental benefits. As a result, it is incredibly complex to unpick the value of restoration interventions into discrete categories with economic value.

Projects need to strike a balance between the amount of monitoring data required to demonstrate value to funders versus the value restoration provides more widely which may be evident without needing extensive data. Further to this, it is often the simplest data that is the most useful to share restoration progress and benefits with the wider community: photography and drone footage have proven the most effective means, being engaging and relatable, as illustrated by Cairngorms Connect, the Northern Upland LNP, and Pumlumon Project.

Some projects have involved academics in monitoring and evaluation of benefits. Holnicote Estate for example co-funded a PhD study to work on the project to evaluate the effects of current and future land management change in the agricultural Aller catchment. Forsinard established a peatland science centre of excellence at the reserve through provision of a small laboratory and accommodation within the new Field Centre, as part of the Flows to the Future project which is designed to facilitate further research on the role of peatlands as a carbon store and on peatland restoration and biodiversity. There are several studentships who are evaluating the effect of restoration on carbon balance through the ‘forest-to-bog’- restoration across the Flow Country, which includes the Forsinard Reserve. A final issue is dealing with scientific uncertainties in quantifying future benefits when projects are in the planning stage.

Are there specific barriers or opportunities that apply to schemes in lowland agricultural areas, in the Highlands, in areas with crofting or common grazing, on the coast or close to large urban areas?

For Ken Hill Estate and Knepp Estate, the only lowland agricultural projects that are explicitly about rewilding, the role of agri-environment scheme funding is significant. At Ken Hill Estate, the stewardship agreement is vital to forego the arable income lost and to support capital works. This induces uncertainty around the longevity of funding - usually being 5- or 10-year agreements, plus uncertainties around the future format of schemes after EU exit – and the ability to deliver longer-term changes. The quick turnaround of their Countryside Stewardship scheme in late 2018- early 2019 was fundamental to delivery and was enabled by a supportive, knowledgeable and invested Natural England adviser who provided the necessary advice and guidance. Lack of access to such advice

and guidance was recognised as a potentially limiting factor for similar projects elsewhere. The buy-in and motivation from Natural England staff for these kinds of projects is perceived as variable across the country, each area having advisers with differing professional experience. Furthermore, the Wild Ken Hill and Knepp teams are pioneering LSNR in lowland agricultural systems which brings an element of trial and error. General agricultural productivity (and hence opportunity costs / income foregone) is a barrier in many lowland areas, although these case studies have focussed restoration largely on 'more difficult to work' land. Lowland land ownership patterns tend to be smaller than those in the Scottish Highlands. In terms of delivering LSNR / rewilding, this means that additional actions are required to enable collaboration and cooperation between land owners.

The coastal realignment case studies of Steart Marshes and Wallasea Island highlighted several barriers. For Steart Marshes, where significant engineering was required as part of the realignment project, key barriers included negotiation with surrounding landowners, overcoming engineering challenges, and managing impacts on archaeology and protected species. At Wallasea Island, there were issues with protected species translocation and mitigation, physical constraints being low-lying land, opposition from coastal recreation groups (e.g. sailing) and overcoming issues with the Marine Management Organisation.

Overall, there were not significant issues raised in the upland case studies regarding croft / common grazing. At Wild Ennerdale, there has been some tension on common land where there is a long tradition of hefted grazing as a result of the project, which is removing sheep and replacing with free roaming cattle. However, it was felt that more farmers understand the purpose of this than those who disagree, and it again reiterates the importance of community engagement and consultation to ensure there is buy-in from the land management community. Although the Pumlumon Project area does not have extensive grazing pressure issues (e.g. from deer like in the Scottish examples or overgrazing from sheep), they too have tried to instigate greater cattle production in the area with the hope of grazing cattle in the uplands in summer and bringing them into the lowlands in winter. Their pilot trials have proven fairly successful at a small scale, but it requires further motivation and incentives for farmers, and greater administrative support to be practical at a large scale.

The main barrier specific to the Highlands is concerned with deer management and forestry. The Forsinard Flows project has experienced issues with adjacent plantation seedlings causing unwanted regeneration. The Cairngorms Connect project - underlined by the principal aim to expand the natural forest to its altitudinal limit without deer fencing – has found that deer management requires increased resources as deer numbers fall. Without the introduction of apex predators and the challenges associated with this, there is no alternative but to cull deer with ongoing resource inputs required to enable woodland expansion. The example of South West Norway demonstrates how a very different pattern of land ownership, allied to a centrally determined but locally delivered approach to deer management, can have very different outcomes, with woodland

regeneration occurring naturally across a very wide area, without the requirement for project-based intervention. It has not been identified from this project how the costs of deer management differ in the two locations.

Did the projects encounter any cultural barriers, for example perceptions around the role of land managers or established land uses – and how were these overcome?

The case studies highlighted the value of a locally based project manager, such as on the Holnicote Estate project. Several projects, including Tweed Forum, Forsinard Flows and Cairngorms Connect highlighted the importance of having project staff who 'speak the right language' – in order to help build local trust.

The predominant issue faced is perceptions surrounding land use, for food production versus conservation. Case studies which involved some of the land being removed from food production to 'make way' for nature – Wallasea Island, and the Holnicote and Ken Hill Estates – had to seek alternative mechanisms to deliver successful land-based businesses, which was mainly achieved through effective consultation, diversification and the financial support of agri-environment schemes. It is hoped natural capital accounting approaches (see Delivery mechanisms section) will help to alleviate these issues in future by enabling thorough quantification and demonstration of the benefits nature restoration can provide (beyond food production) and thus an alternative income for the landowner.

There may be disagreement amongst key stakeholders over the restored land use, for instance a non-woodland habitat over woodland creation. A future land use conflict was raised in the context of the Tweed catchment where it is felt by some that commercial forestry is coming in at the expense of traditional sheep farming.

Conflicts within some of the large partnership projects occurred due to contrasting conservation interests, including the preferred approach to moorland management, differing opinions on beaver reintroduction and management, and conflict over removal of some non-native species such as larch. However, the benefits of the partnership often were felt to outweigh any tensions. For Cairngorms Connect, the common goal and trust between the individual decision-makers were such that any conflicts were approached as opportunities to challenge and learn from one another, but not to lose sight of the overarching vision.

Projects within agricultural landscapes identified a number of significant cultural barriers that projects needed to overcome:

- Most projects entail a significant change in the way that land is managed, in many cases reversing the land management approach that generations of farming families have practiced over many decades. The case studies such as Pumlumon and Tweed Catchment included examples of land managers' reluctance to consider change even where the existing business model is unviable and farmers are consistently running at a loss.

- There was a perception by some land managers that LSNR projects would lead to wider changes in land management that would be imposed on surrounding land holdings, for example at Wallasea and Pumlumon. This may have been underlined by EU exit and broader discussions about the replacement of rural support under CAP.
- There were concerns about species reintroduction, particularly beaver in Scotland, in relation to Cairngorms Connect, reflecting concerns about loss of productive farmland to local flooding.
- In some cases, such as for example the Northern Upland chain LNP, land managers and other stakeholders held negative views about NGO involvement in projects.
- Large-scale projects encountered a resistance from land managers to collaborate whether in terms of landscape-scale changes or in common marketing initiatives. The motivations for this resistance are likely to include both cultural attitudes and perceived economic risk.
- For many land managers, for example as illustrated in Pumlumon, there is a significant separation between their production of agricultural products and their consumption, limiting opportunities to innovate and to move to high quality, high nature value forms of production.
- Some parts of the land management community posed particular challenges. In some cases, such as the Northern Uplands Chain LNP and Tweed Forum, it was noted that field sports interests did not always engage fully, preferring to represent their interests rather than develop an integrated approach. In an example where the persecution of birds of prey was an ongoing issue this was a major barrier to engagement and trust. In another, a fishing organisation was focused solely on fishing despite an evident decline in fish stocks and the impact of wider catchment management on ecological condition.

Most of these cultural barriers were overcome by careful engagement and measures to build understanding and trust. The following points reflect the experience in case study projects:

- Projects can be easier to implement, and face the fewest barriers, where control of the land is guaranteed. This can include private estates or NGO ownership. In the case of Forsinard Flows, initial concerns from local land managers were to some extent mitigated by a focus within the RSPB reserve. The Ken Hill Estate was similarly focused within a single land holding and, interestingly, decided against an NGO or agency partnership since this could limit the estate's freedom to pursue its own vision. Owner occupation is understood to be an important factor in shaping the way land is managed across South West Norway. These examples highlight therefore that the intended scale of the project, relative to the structure of local landholdings, is one factor which can influence the ease of project delivery and ultimately project success.

- Most projects invested significant amounts of time and energy into engaging with land managers, using a variety of techniques including events, dinners, fora and one-to-one meetings. The latter was almost universally identified as critical to building trust and ensuring project success. An important part of this engagement should be about providing clarity about the project and its aims and the extent to which land managers will be affected.
- Demonstration projects were used as a key way of changing land managers' attitudes. The Pumlumon Project encountered initial resistance to new ideas and used demonstration projects which fairly quickly changed farm managers' views. Wild Ken Hill had limited input from local land managers early in the project, but now it is established, and the benefits can be demonstrated, they have spoken to 40-50 interested landowners to explain the project. At Holnicote, the project has worked with one of its more supportive tenants to demonstrate the effects of beaver reintroduction, helping to allay the concerns of others across the estate. Visiting demonstration projects was also reported by many of the projects to be the most effective method of engaging decision-makers and funders and encouraging advocacy, including in Cairngorms Connect, Wild Ennerdale and South West Norway.
- The Pumlumon Project has prioritised bridging the gap between production and consumption, demonstrating that by selling beef boxes direct to consumers, farmers can triple their income. This requires investment in high quality production and co-operation between producers but can unlock income to support nature-based changes in land management. The Norwegian example also demonstrates the importance of establishing the link between the way land is managed and the income derived from it. In this case, relatively high and diversified incomes are derived from activities that are more balanced with the natural environment.
- Several projects, such as for example Forsinard Flows and Tweed Catchment, pointed to the critical role that project staff play in building trust and changing attitudes. Key aspects of this are having people embedded in local communities who speak the right language / have the right experience and have longstanding involvement (low staff turnover). However, it was also highlighted that hiring people with experience in the area and sectors relevant to the project may be a challenge.

It is important for land managers (and other stakeholders) to see that they have real influence over a project. This requires projects to be truly collaborative, neither top down nor bottom up, and for management to be flexible and able to demonstrate how projects have evolved in response to concerns raised.

The review also identified a number of tensions within conservation interests. Issues included nature restoration projects which affected designated sites, particularly SSSIs. Here there was sometimes a concern that the licensing regime was being applied very strictly, potentially making it difficult to deliver significantly enhanced outcomes for nature. A similar issue was encountered with respect to the Wallasea Island project where loss of arable land would have negatively impacted populations of corn bunting, leading to a solution which retained some arable and rank vegetation alongside wetlands which now

support significant numbers of overwintering and breeding birds, including the UK's largest population of avocet. Advice from the projects is to agree ecological principles at the outset, keep things simple and work with a spirit of compromise and flexibility.

The review also identified a number of tensions with regulators, particularly those who also act as project partners. In some cases, such as for example Pumlumon Project, regulators worked as part of the project team, helping to identify solutions to issues which also met regulatory requirements. In other cases, the relationship was more distant and created significant barriers to development and implementation of the scheme in question. In one example, decisions were made by a project officer whose professional background meant they failed to consider the wider objectives of the project, leading to escalation of the issue to achieve resolution. This again underlines the importance of good partnership working, education/training, communication and effective liaison throughout the lifetime of the project.

Was deer management critical to the establishment of the LSNR project? How was management of deer achieved and funded? Is deer management placed on a sustainable footing for the future?

Deer management was identified as relatively minor issue for most of the English and Welsh case studies. The Holnicote Estate carries out limited deer culling focusing on sick animals. Ken Hill Estate culls around 200 non-native deer (Muntjac and Chinese Water Deer) each year. Roe and red deer are both native to the region and fallow deer are naturalised.. The estate had wanted to use deer fencing to control grazing intensity, but Natural England disagreed. Upland projects had relatively minor concerns about deer in England. In the Northern Upland Chain roe deer are present in large numbers but significantly lower densities than in Scotland. The concern here is to manage stock grazing levels to allow vegetation recovery. The Pumlumon Project would welcome higher deer densities / grazing rates in order to manage regeneration caused by seeding from conifer plantations. The project is encouraging farmers to cooperate to increase cattle grazing on the open hill. Wild Ennerdale had looked to introduce red deer to introduce a large grazing animal to the valley. However, given the damage that red deer can do to other habitats, not just woodland, and the difficulty of containing them in the valley, cattle were chosen as a preferred alternative. Roe deer are culled within the valley with vegetation monitored to inform levels of control.

The situation in Scotland is rather different. The Forsinard Flows project places considerable emphasis on deer management to keep densities at a level that maintains healthy peatland habitat and the vegetation structure required for some key wader species. All culling on RSPB properties is leased to third parties. Cull targets for the number of stags and hinds which should be taken in each year are agreed with tenants. Culls are reduced on areas where raised densities are required to counteract unwanted conifer regeneration and aggressive grasses. The aim is to achieve a balance, with deer numbers at levels appropriate to deliver beneficial impacts but not so high as to cause damage through excessive trampling/tracking or grazing impact. Around 20km of deer fence have been removed to re-instate natural deer movements and grazing patterns and

allow access to felled forest areas, and 2.5km of new deer fence has been erected to prevent open hill deer populations from entering woodlands. It is recognised that more research is needed to identify the best ways of managing deer to benefit peatland restoration. Deer management is recognised as a key challenge with differing perspectives held by a number of neighbouring estates.

The expansion of woodland to its natural limit (without deer fencing) is one of the fundamental principles underlying the Cairngorms Connect partnership. Deer management has been undertaken within the project area for up to 70 years by some of the partners, however the approach now is more targeted with a three-pronged approach: firstly, to manage deer within the forest; secondly, to manage deer at the forest edge where there is most potential for natural regeneration; thirdly to manage deer populations in more remote locations such as on the higher ground. Focus on this third element is the greatest change in deer management within the project area. Deer management is a collaborative process between the partners, who have set up a practitioners' group that meet regularly to discuss the approach. Control is primarily undertaken by the partners employing contractors to stalk deer on their own land. There are also some informal arrangements where individuals are granted a licence to shoot in specific areas on a 'no pay no fee' basis, where the stalker then benefits from selling the carcass. It was noted however, that the reduction of deer in the area had a negative impact on neighbouring estates with commercial stalking enterprises. This has led to some neighbours turning away from deer stalking to focus on other modes of land management income. For the Cairngorms, management will always require investment, and in absence of natural predators, continued management of deer will always require some other sources of funding, particularly given that the lower the numbers of deer, the greater resource required to maintain population at that desirable low level.

The contrast with the situation in Norway is instructive. The success of natural forest regeneration across South West Norway may be instrumental in identifying some of the barriers relevant to LSNR in Scotland, as the region bears many similarities with the north of Scotland, in terms of climatic and biophysical conditions. An issue of particular interest is the approach to deer management, which is designed to keep deer numbers at a level which is compatible with wider land management objectives and ensures the health and welfare of the animals themselves. Deer culling quotas are set nationally and allocated to farmers who may exercise their right to hunt or sell their quota on to third parties. As keeping deer numbers at the right level is important for farmers for managing their woodlands, they have an incentive to use their quota. The result is evident in high rates of natural woodland regeneration and deer health, the latter being around 40% heavier than their Scottish counterparts. This is reflected in higher survival rates during harsh winter weather. Part of the success of this approach is that those who are impacted negatively by deer (grazing, road accidents etc.) are those who have the rights to hunt them and so the incentive is there to control them. Hunting also forms part of the income of the small, owner-occupied farms that are typical across Norway and which generate diverse

incomes from on-farm (agriculture, timber and wood fuel, hunting and tourism) and off-farm activities. This provides an example of how direct benefits to landowners could support delivery of LSNR projects.

Summary

- A persistent barrier to effective implementation of LSNR / rewilding is that of translating a vision into a functional delivery framework that is underpinned by sufficient staff and funding.
- Engagement with local stakeholders is important to overcome areas of potential conflict or perceptions of impacts of land management change on surrounding areas. This needs to be supported by ongoing engagement.
- Funding related barriers include lack of alignment of project aims with existing funding schemes and short-term funding cycles being out of step with the long-term project aims.
- Project funders vary significantly in their administration and reporting requirements and although some appear burdensome, most of the detailed case studies did not suggest it had been a barrier to project delivery. It can often be difficult to capture changes at the scale of at which projects operate because monitoring data is typically spatially discrete, although some projects have involved academics in monitoring and evaluation of benefits.
- Upland projects typically face fewer barriers than in the lowlands, however deer management is an issue for the Scottish Highlands, particularly where projects focus on woodland expansion, but also in relation to peatland restoration.

Delivery mechanisms

Are there particular partnership / delivery models that make it easier or more difficult to initiate and deliver projects?

The most straightforward implementation model appears to be where a single landowner is involved and no partnership is required. Ken Hill provides an example of this where there was a positive decision not to establish a partnership with wildlife NGOs or agencies so that the project aims would not be compromised.

The model of a single estate with several tenants can mean there is some inertia and resistance to change. In the case of the National Trust's Holnicote Estate, it was necessary to use tenancy renewals and agri-environment scheme agreements to incentivise changes in land management practice and to provide compensation for losses of production. Even with these sticks and carrots, the Trust needed to win hearts and minds, using demonstration projects to bring tenants around.

Other projects relied on partnerships to develop, facilitate, and deliver nature restoration projects. The most extensive partnership examined was the Northern Upland Chain LNP, led by protected landscapes including the North Pennines AONB and Yorkshire Dales National Park Authority, and bringing together representatives from all relevant agencies,

NGOs, water companies, the NFU representing landowners and tenant farmers and the Moorland Association representing estates / shooting interests. In tandem with this, the Northern Hill Farming Panel was set up to work with protected landscapes and Defra, focussing on training and dissemination. The panel feeds into the LNP and has helped get hill farmers on board with the project. The large number of organisations can slow down decisions but does mean all interests are understood. In this model, the protected landscapes take the lead, with professionals working together, brainstorming, and developing pilot projects to disseminate more locally. Papers on projects go to the board and are disseminated via the Forum. The LNP aims to bring people together to facilitate rather than deliver projects itself.

The Tweed Forum provides a similar partnership model, also covering an extensive geographic area. While the Forum has a wide and growing membership, it is designed to be light on its feet and to avoid being weighed down by the baggage of individual partners. Partnership working does require extra effort to bring everyone on board though. Organisations can come and go, reflecting the involvement of individuals or the range of projects on the go at any one time. The Forum avoids the bureaucracy of some organisations and has a good reputation among land managers, farmers and foresters. As a result, it is often used by NatureScot, SEPA and other organisations as a delivery mechanism. Without statutory responsibilities, the Forum is often able to draw on good will and enthusiasm rather than rely on a top-down approach. Partnership brings opportunities for sharing knowledge and resources – it helps to have everyone on board and multiple buy in. Monitoring and reporting requirements comprise a significant amount of work with a lot of time spent applying for funding and subsequently reporting on it. Delivery is a relatively small part of the work. Benefits, however, include the scale and effectiveness of outcomes. It was noted that the area covered by the Tweed Forum coincides with the local authority boundary, comparing favourably with other catchment-based projects which have covered several authorities and where administrative and regulatory processes are therefore more complicated.

The benefits of the partnership model were championed by Cairngorms Connect and Wild Ennerdale, with both projects profiting from the additional skills that their partners brought to the project. For the Cairngorms, the partnership is:

"not so much about influencing what the partners want to do, it's about enabling things to happen. The ways in which the partnership helps is (...) to do with funding (…) working together to talk with partners, (…) maximising value from existing grants, improving contract value for money through packaging together works for contractors. And also in the way in which we can interpret what we are doing, and talk about it collaboratively rather than as individuals, and then promote it." [Cairngorms Connect]

The review highlighted examples where agencies were members of partnerships whilst being responsible for regulation. It was noted that some regulators tended to be risk averse, adopting a regulatory approach which conflicted with the objectives to which the agency in question had signed up as partners. Examples included managing change within a SSSI and accepting the temporary landscape impact of fencing required to

manage grazing levels. Strong project leadership and political support may be needed to help move the project along and to emphasise that maintaining the status quo is often not an option. By contrast, the Wallasea Island project was developed as a partnership between RSPB, the Environment Agency (EA) and Crossrail and the EA supported the project as a way of developing a regional habitat compensation scheme and provided 'light touch' regulation to assist design and implementation.

The final example relates more to sustainability and project legacy. The Forsinard Flows project was implemented by the Peatlands Partnership with strong project leadership and management from the RSPB. All partners signed up to the scale and ambition of the project with only minor issues arising during the lifetime of the project. However, the project was time limited so a key issue is how its work should be protected and maintained in the medium to longer term. This suggests that all projects should be designed with long-term sustainability in mind.

How are successful projects facilitated and developed? How is momentum maintained?

The majority of case studies have employed a partnership approach which ensures all relevant stakeholders are involved and adequate funding is acquired. Moreover, there is a necessity for restoration projects of this scale to have a clear, long-term ambition that is supported by a strong and motivated team on the ground with project roles that maximise the skills of existing staff. Forsinard Flows, Tweed Forum, Holnicote Estate and Wallasea Island case studies all highlighted the importance of the project team as an integral component to success for a number of reasons, as illustrated below:

"It all comes down to people and that is how you will get stuff done (…) it's about developing relationships that enable people to feel comfortable working in those grey areas to deliver the aims and objectives that you want." [Holnicote Estate]

Several projects have been led by large conservation NGOs for example at Forsinard Flows (RSPB), Pumlumon Project (Wildlife Trust), Holnicote Estate (National Trust) and Wallasea Island (RSPB), or have an NGO as a key partner for example at Wild Ennerdale (National Trust) and Cairngorms Connect (RSPB). Effective engagement and buy-in from tenants and land managers working in the project area is fundamental to the success of partnership working for restoration projects. This is less of an issue where the partnership organisations or sole project instigator own and manage the entirety of the restoration area as is the case at Forsinard Flows and Wild Ken Hill. The notable achievement of landowner buy-in for the Pumlumon Project stemmed from the unique economic approach of the project as well as the project team having farming experience. Although a farmer-led (or 'bottom up') approach to projects may be considered preferable, what is demonstrated through the case studies is that effective delivery tends to rely on a partnership combining landowners, land managers, conservationists and relevant public sector bodies (and consultants who often lead research). Such an approach ensures project objectives are united, information is shared, issues are overcome, and opportunities are maximised.

It is essential that stakeholders are involved from the outset to establish a working relationship. The Holnicote Estate has required collaborative working between Natural England, Environment Agency (being focused on river restoration), Local Planning Authorities and NGOs (e.g. Somerset Trust). The Wallasea Island project highlighted that trust with agencies and key players has been essential for effective delivery. Empowering existing mechanisms such as local Wildlife Trusts is important because they are generally embedded in the local landowning community and understand a local area well.

The importance of understanding the wider function of a landscape and its broader relevance for people and place as well as wildlife was highlighted by the Tweed Forum. For example, although fish are indicators of a functioning river, widening the focus to look at the whole river, rather than fish only, makes it possible to improve fish populations, but also gain support from a greater number of people, achieve wider benefits and attract more funding. This change in approach has proven to be highly successfully for the Fisheries Trusts in England, which has transformed into a network of impressive multi-million-pound organisations achieving ambitious projects on a large scale.

Stakeholder engagement more widely is considered fundamental to the success of restoration projects. Wild Ennerdale involved the community very early in the process of project development, prior to the vision being refined by the partners. Whilst in some ways, this caused some concern amongst the local community due to a lack of clarity from the partners, it has meant that the project has developed with their involvement so that today it is more widely accepted. Local liaison groups can be a helpful vehicle for regular community contact. The Wallasea Island project had a local liaison group which built links with key stakeholders to encourage ownership and involvement. The Tweed Forum has many staff who are embedded within the catchment and build up local trust, while Cairngorms Connect host open meetings, drop-ins, pop-up displays and have a Communications and Involvement Manager and several rangers to provide visible presence. Wild Ken Hill focuses on community engagement and recreation through services offered on-site and Holnicote Estate has involved all stakeholders at the outset and have regular community events. Finally, Forsinard Flows had Engagement and Activity Officers to work with local communities and built a new field centre to support engagement activity.

An essential part of this stakeholder engagement is the importance of building trust to enable projects to progress and develop. Wild Ennerdale cited the importance of regular contact and maintaining an open dialogue about the project to ensure understanding. This enables the project to try new things and bring the community on the journey of discovery rather than coming up against opposition whenever something new is proposed. For Cairngorms Connect, trust is also vital between the Board members; having only four Board members positively impacted decision making and enabled honest and challenging discussions. Trust is also a key element of why deer management and woodland regeneration has been so successful in South West Norway. The policy for devolved management whereby farmers are set quotas and given the responsibility of achieving maintains a positive feedback-loop. The authorities trust that farmers will

undertake management, and the farmers have the agency to achieve their quota as they see fit. The importance of people and relationships is an integral part of large-scale landscape restoration. This is reflected in many of the projects presented in the case studies focusing part of their vision on people; Cairngorms Connect, for example, are currently developing a 60-year vision for people to reflect the importance of local agency over decisions about land management.

Wild Ken Hill did not explicitly employ a wider partnership approach as it is a privately owned estate. The strong ambition of the project team at Wild Ken Hill has helped maintain momentum and there has been little conflict between partners to interfere with delivering action on the ground.

Although it brings challenges, it is also important to recognise the benefits of managing projects over an extensive area, as highlighted by the partnership / stakeholder groups of Northern Uplands Chain LNP and Tweed Forum. First, working over a large area enables delivery of larger landscape-scale projects and thus increase the extent of benefits derived. By having a more widespread impact, nature restoration and conservation can be made more economically viable which it is hoped will open up new funding mechanisms. For example, the Northern Uplands Chain LNP hope that by having a more visible impact and scale of benefits, this will create greater inward investment from the private sector (BNG, carbon market, corporate natural capital). Second, stakeholder groups effectively bring together the necessary partners (e.g. land managers, NGOs, specialists, public sector) to propose, develop and implement projects on the ground which effectively drives momentum and overcomes conflicts of interest at early stages. Finally, as a result of those benefits, such groups are likely to be in a stronger position to leverage finance for project delivery.

In terms of funding, key member support in partnerships is extremely important. This is highlighted by Tweed Forum where NatureScot provides annual core funding. Despite this only being a fraction of the running costs, such funding provides the building blocks for continuity and security in an increasingly challenging financial climate. Although the Northern Upland Chain LNP has a similar partnership approach to Tweed Forum, it has to date only delivered pilot projects as opposed to successful LSNR. This could be a result of the partnership being in early years of establishment compared to the Tweed Forum but is also largely reflective of it not having paid staff. Sustained funding including funding dedicated posts therefore is vital to enable such partnerships to lead effective delivery of LSNR on the ground.

Perhaps South West Norway points to the ultimate goal, whereby a set of social, economic and environmental factors result in nature restoration that has restored habitats and led to a more biodiverse balance of nature and human activity.

What kinds of funding models have proven successful in delivering projects? What novel models offer potential to combine public and private finance, tapping into emerging markets for carbon or other environmental ‘goods’?

A variety of funding sources have been utilised to fund the delivery the projects. As discussed in the Issues and Barriers section, funding is often a barrier to the scale and legacy of a restoration project. Most projects draw upon grant funding which - being time limited - serves to create uncertainty for projects which have long-term visions and objectives. Most LSNR are likely to require funding for capital restoration works (e.g. LIFE and HLF, as well as capital grants provided from woodland grants and agri-environment schemes and increasingly government climate and nature funds) and ongoing revenue funding (to pay for management and income forgone from changes in land use) – for which the rural development programme has been the main source. There would be benefits from longer term schemes and more private investment in PES.

A project that recognises the need to move away from the cyclical grant funding problem is the Pumlumon Project, who have pioneered PES approaches to the suite of ecosystem services deliverable within the project area and are continuing to research the role of private sector finance. Other projects (e.g. Northern Uplands Chain LNP) are exploring similar mechanisms, noting the value in making nature restoration and conservation more economically visible to ensure there is sustained finance in future (e.g. through the carbon market, BNG and corporate natural capital credits). There is significant potential to increase funding for LSNR / rewilding projects through PES schemes which attract private money for private benefits alongside public money for public benefits and could provide a more secure and sustainable form of funding in future. However, there are few examples, including Pumlumon Project and Holnicote Estate, of achieving this at scale with the main barriers relating to lack of evidence and scientific uncertainties, difficulties in designing payment mechanisms, and a tendency for public schemes to crowd out private investment ('free rider' problems). PES must be supported through the development of robust processes of accreditation and assurance, (Welsh Government, 2014) and not simply based on the ‘now and then’ corporate social responsibility investment.

Agri-environment schemes are important to supplement project delivery, most notably for Ken Hill Estate which has a multi-million-pound Countryside Stewardship scheme over its lifetime. Multi-annual funding through both Countryside Stewardship and the earlier Environmental Stewardship schemes, which are implemented on some of the Estate's arable land support project delivery. At Wild Ennerdale - private landowners - although not part of the project itself - have agri-environment schemes, and as Natural England is one of the project partners, there is some influence over the options taken up within these schemes to support the projects’ objectives.

Several projects, such as Forsinard Flows and Tweed Catchment, have been financially supported by government and government bodies. Although the Tweed Forum is supported by 'a cocktail' of funding, the partnership is reliant on the sustained income from the Scottish Government for its continued operation and staffing costs. Likewise, the pioneering PES approach taken by the Pumlumon Project has been continually supported by the Welsh Government through its Sustainable Management Scheme.

By contrast, Northern Uplands Chain LNP is funded solely by small contributions totalling approximately £25,000 annually from the lead protected landscapes across which it functions, and all member activity is voluntary. Other sources of funding include charitable grants and funding obtained for specific projects within the partnership area albeit not directed explicitly to the functioning of the LNP.

As key partners in facilitating and delivering projects, NGOs often provide additional funding to supplement projects both in terms of direct capital funding and staffing. For example, the Wildlife Trust does so for the Pumlumon Project and the National Trust for restoration projects on the Holnicote Estate.

The example of Forsinard Flows (Flows to the Future) demonstrates some of the challenges that occur with fixed term funding and the importance of considering project legacy when bespoke funding comes to an end. It was felt to be very important to plan for legacy before the end of a project by seeking further funds to ensure continuity of beneficial work.

Cairngorms Connect has successfully secured £5million of funding through the Endangered Landscapes Partnership. This funding is to be spent over 5 years and has been hugely useful in changing how the partnership approaches delivery of large-scale landscape restoration. It has encouraged the partners to be more structured and logical in their delivery approach and has focused their attention on identifying tipping points where resources can be concentrated in order to achieve a greater impact with the resources available.

Cairngorms Connect highlighted the lack of funding for floodplain restoration projects that focus on restoring natural processes rather than creating flood defences or dredging. With the rising threat of flooding due to climate change, this is an area which government could be supporting to ensure long-term sustainable solutions to floodplain management are secured.

Although a variety of funding sources have supported nature restoration projects across the UK and beyond, what emerges is the necessity of funding continuity to ensure project delivery is sustained and there is a long-term legacy. This is underlined by the Norwegian example, where a combination of various sources of income appears to have resulted in a sustainable equilibrium. This suggests that there is value in exploring the development of a route map that would integrate various sources of funding over time.

Summary

- The most straightforward pattern of project implementation appears to be for owner-occupied estates which, subject to the influence of regulators, are under the control of a single owner.
- Partnership working tends to be beneficial to project delivery, however this requires significant time inputs to influence landowners to bring about land management change.

Fitting large-scale nature restoration and rewilding within the wider policy context

What policy changes are needed to make it more attractive to landowners, land managers and communities to bring forward LSNR / rewilding in Scotland?

All case studies indicated that funding is essential, albeit recognising that cyclical funding predominates and ensuring sustained long-term investment is incredibly difficult. Funding needs to be longer term to ensure it favours delivery of the long-term aims and objectives of LSNR projects. Continuous funding alongside clear signals of future funding sources will enable project planning. In the case of large delivery bodies such as partnerships and NGOs, the case studies suggested that the process to accessing funding should be streamlined and it be made simpler for organisations to access funding, especially for projects which are directly beneficial to addressing the main crises of our time - climate change and biodiversity loss. A possible approach could be having direct agreements with partnerships or NGOs, such as framework grants between NatureScot and NGOs, rather than each organisation having to continuously seek funding.

Not only were there suggestions for direct funding for LSNR projects, but there were other indirect recommendations, identified by the interviewees, regarding funding such as governments could prioritise financing education around LSNR and the benefits derived and ensure that existing finance legislation does not pose a barrier to delivery (as has been the case with inheritance tax at Wild Ken Hill). Furthermore, there should be funding for research to develop thinking and challenge current frameworks of thought by for example funding joint research projects internationally (the contact for the South West Norway case study felt that research needs to be undertaken on natural capital analysis of woodland regeneration to value socio-economic aspects).

The case studies also suggested the need to continue to develop natural capital accounting and ecosystem services approaches to ensure future funding is sustainable and the benefits of LSNR projects are sufficiently valued. There is need for a robust framework which enables an accurate calculation of ecosystem services that can be delivered through a project allowing project teams to prioritise those benefits. Such an approach would overcome issues currently faced where restoration results in a 'loss' of productive land (e.g. at Wallasea). With future land management funding, it is vital to have fair and ambitious schemes, recognising the inherent multifunctionality of landscapes and supporting a move towards production and nature working harmoniously.

Further to this, government can help to facilitate collaboration across catchments to streamline long-term delivery which effectively maximises ecosystem benefits. In the case of partnerships, financial support would be helpful to maintain their important functional role in bringing partners across large areas together to spearhead projects.

Not only are mechanisms to promote funding and collaborative partnership working a necessity, but government have an important role in sharing the successes of projects to increase community support, involvement of potential partners and funders. Advocacy is key: the more that work is seen in action, the more key decision makers will be able to carry influence to streamline mechanisms for effective and more widespread LSNR / rewilding.

Government has a key role to play in ensuring legislation does not act as a hindrance to projects, as described at Wild Ennerdale with issues over National Vegetation Classifications definitions and a number of examples where 'heavy-handed' legislation, or its application slowed project implementation. It was also identified that government could ensure regulatory frameworks for management and funding do not restrict the predominant stakeholder organisations involved with projects (e.g. Environment Agency, Natural England and protected landscape authorities). At present, regulation means organisational objectives sometimes struggle to align. This includes scenarios where agencies are simultaneously project partners and regulators and where, in the discharge of their regulatory role, a risk averse approach creates challenges for project implementation. A final point here is promoting trust between government agencies and key players particularly to deliver ambitious, long-term projects. Land reform in Scotland could play a role in influencing the way that land is valued and therefore managed in Scotland.

A specific recommendation raised through the South West Norway case study is to promote the strength of community relationships with their local regulators and governance. It was suggested that agency within local society is crucial to the success in Norway, with vibrant rural communities determining their own future. This was contrasted with the situation in many Scottish rural communities where confidence, and ability to influence outcomes is more limited. It is recognised this has started to change with growing examples of community ownership of land (e.g. Langholm) and the development of community trusts. Enabling a greater sense of community ownership and control aligned with the aims of government policy could allow greater benefits to be derived (e.g. carbon sequestration, increasing biodiversity and economic productivity) providing local income streams as well as potential sources of tax revenue.

How can LSNR projects form part of 'farming with nature' initiatives? Should LSNR focus on low quality or marginal farmland?

Farming with nature is used here as the all-encompassing term for agroecology, regenerative agriculture, high nature value farming etc.

The detailed case studies vary in the approach to restoration, but a commonality is that the previous and/or current use of land tends to be farming. Some projects have removed traditional farming / food production altogether e.g. Wallasea, and rewilding areas at Wild Ken Hill, whereas the others seek a harmonious balance between nature and farming and have successfully struck this balance.

Wild Ken Hill's three-pronged approach to land management, based on soil type, supports an approach to nature restoration that does not focus solely on low quality or marginal farmland. Although the rewilding area is located on the lowest quality soils, a significant proportion of the estate practises regenerative agriculture which implements nature-friendly practises whilst still being productive for food. A similar philosophy underlies both approaches with nature playing more of a role in how the land is farmed.

Arguably, there should not be a sole focus on the lowest quality land, despite this generally being land where there is least resistance to restoration since there is less immediate financial loss to farm businesses. Where there is high quality agricultural land, continued evolution of natural capital and ecosystem services approaches as well as adequate financial support through agri-environment schemes should support delivery of LSNR projects in a context where food production will continue to play a key role. The approach taken by Ken Hill Estate provides an example of this, whereby there is a transition towards regenerative / agroecological farming to maintain production on the highest quality agricultural land, in parallel with the creation of nature-rich areas or restoration of permanent habitats on less productive land. There is, of course, a need to continue to produce enough food for consumption, but it is not as simple as a trade-off between conservation and food production, rather promoting a system that can work in harmony. There is increasing recognition, as demonstrated at Ken Hill Estate that land farmed under regenerative agriculture can address biodiversity loss and increase business resilience, continuing to produce high yields (and the food we need) despite facing threats from climate change (as was noted by the estate during the 2020 summer drought). There is however a point to be raised regarding a sole focus on low quality and marginal farmland for LSNR, in that this could intensify issues faced currently around 'land sparing' approaches which may serve to intensify detrimental practices on remaining higher quality agricultural land. Not only this, but it may not result in LSNR maximising ecosystem services. For this reason, the approach taken at Wild Ken Hill, where agricultural production through regenerative/agroecological practices sit alongside rewilding is very interesting to explore how land use changes to improve wider ecosystem health may also work towards more resilient farming systems (such as improved soil health).

In some instances, such as Wallasea, land may previously have been used for food production but in an unsustainable and uneconomic way for the land manager. In this case, arable farming was reliant on a sea wall which had come to the end of its economic life and would be costly to maintain, raising the risk of serious flooding. The project took much of the land out of arable cultivation but an area of arable land was retained, largely as a result of its importance for corn bunting. This example highlights the need to strike a balance between productivity lost and nature gained, where the richness of habitats created needs to be set against productive land lost. A natural capital approach here would be beneficial.

The Tweed Forum has generally focussed on marginal land to ensure it does not displace employment or income.

South West Norway also provides a working example of how farming can work alongside nature in this region which has undergone natural woodland regeneration. One of the mechanisms which support this balance is that the forest is owned by local landowners as opposed to large commercial corporations, and they largely manage the forests themselves. Managing the deer at a sustainable level allows harvesting on rotation after 20-30 years using natural regeneration whilst keeping the understorey suitable for farming of sheep, cattle and deer which provide a regular income stream. It is worth noting that farmers are heavily reliant on agricultural subsidies which represent nearly 60% of gross farm income. In Scotland, most farmers are also reliant on subsidies, to varying degrees depending on the type of enterprise and structure of individual holdings; the way rural support is developed and implemented will clearly influence the potential for successful LSNR.

LSNR by and large works at the catchment / landscape scale and therefore will cover varying land quality. The growth in interest and support of Nature Recovery Networks (NRNs) - to which nature restoration is integral - is inherently linked to farming. Therefore, farming which employs nature-friendly practices will play an important role in enabling these networks to be delivered across a variety of landscapes. This has been demonstrated in the Northern Uplands Chain LNP where there have been pilots for high nature value farming in Teesdale and Swaledale, recognising the natural capital value of this approach. Within the partnership area (albeit not a LNP project as such), there is the recently started Tees-Swale naturally connected programme (HLF funded) which is leading nature recovery work. The initiative works with farmers and landowners across an 845km2 area by integrating nature into farming and land management. The conservation work is varied and includes rush management, wetland creation, woodland creation, hay meadow restoration, peatland restoration, instream/riparian buffer management and diffuse metal pollution management. It is significant that a number of upland projects (outwith Scotland) are aiming to use stock grazing as an integral part of nature restoration, using selected livestock types or specific breeds, in some cases linking this to the production of higher value, high quality local meat products.

A final point to note on where restoration should be implemented, is that with new markets developing including for natural capital, it may not be a question of whether to develop projects based on the quality of the land, but rather on the environmental benefit and value that can be gained from implementing a project in a given area. Attributing value to the ecosystem services derived will give greater leverage and prioritisation of where and what projects should be delivered, be it river restoration to reduce flood risk or address water quality, peat restoration and woodland planting to sequester carbon, or realignment of coasts to avoid impacts of sea level rise and maximise biodiversity. It is often difficult to attribute a value (and create a market) for biodiversity. This was highlighted in the Dasgupta Review (2021) which states that nature’s worth to society is not reflected in market prices because much of it is open to all at no monetary charge. The Review notes the institutional failure by governments that exacerbate the problem by

paying people to exploit nature rather than to protect it. This highlights the need to develop a mechanism to value biodiversity to attract private finance for nature-based solutions that truly deliver for biodiversity.

Some stakeholders in the case studies identified that there is an ongoing issue related to a 'silo' mentality of nature conservation and the feeling from local communities and farmers that things are being 'done to them and not with them'. Therefore, it is important to have collaborative partnerships and balanced representation in projects to deploy ecological principles that all stakeholders buy-into and benefit from as successfully illustrated by the Tweed Catchment project. Moreover, continuing to share the success of implementing 'farming with nature' approaches (e.g. high nature value farming and regenerative agriculture / agroecology) will hopefully encourage the farming community to embrace the fact that nature and production can be mutually beneficial. Farm diversification is also key and as new markets become available; businesses will be able to do this in a way that is financially beneficial to the business whilst maximising environmental benefits.

Summary

- In lowland agricultural LSNR projects, the role of agri-environment funding remains significant in the delivery of the projects which reduce the area of productive agricultural land.
- Coastal realignment projects can include significant engineering work to reflect the dynamic coastal edge and management of natural processes. The disruptive nature of significant engineering work may require additional mitigation for protected species impacted by the works.
- Green finance is evolving, both for wider environmental outcomes and specifically within nature restoration. One of the main challenges with ecological financial markets is that they are not yet widely understood in terms of the benefits they deliver and the investment vehicles that are required to support them.

Review of ten Detailed case studies against Carver et al. rewilding principles

Each of the ten detailed case studies has been reviewed against the rewilding principles defined by Carver et al. (2021), and this review is included in Annex 7 - Review of case studies against Carver et al. principles of this report. The scoring is not a reflection of the quality of a project, and only provides an assessment of its characteristics against the rewilding principles proposed by Carver et al. (2021). There is an inevitable element of subjectivity in scoring the case studies against Carver et al. (2021) rewilding principles. This exercise was undertaken by Land Use Consultants towards the end of the project and after the interviews were held, hence interviewees did not have the opportunity to comment on these scorings.

A large number of the case studies seek to restore trophic interactions, through habitat restoration to support key species. The approach of habitat restoration is also reflected in the third principle, i.e. that rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems. Within the case studies the upper trophic level is typically fulfilled by hunting/culling as illustrated by Cairngorms Connect, Forsinard Flows and South West Norway. There is typically limited species introduction within the case studies.

Several of the case studies cover extensive land areas and include, or are in close proximity to, protected areas. In some locations they are also related to longstanding projects, which have supported a shift in the co-existence of humans and nature over a long time period. Other examples such as Northern Upland Chain Local Nature Partnership and Tweed Forum are large-scale partnerships, bringing about incremental change at a landscape scale.

The case studies illustrate a clear awareness of the dynamic and changing character of ecosystems, and the influence of climate change in contributing to future change. As an example, this is illustrated by the open objectives for Wild Ennerdale, and the recognition that the coastal defences at Wallasea provide future protection for the settled part of the island.

For some case studies it is harder to establish the alignment with the Carver et al. (2021) principles due to lack of detailed information about community engagement, and any use of traditional ecological knowledge. Other examples such as Pumlumon provide greater detail on the level of community engagement. However, the levels of community engagement required varies by case study depending on the nature of the restoration project.

Being based on science is a key aspect of several of the case studies, as is monitoring which is critical to inform the success of interventions, such as for Wallasea and future management such as for Wild Ennerdale. However, there are some challenges with accurate monitoring for example for deer numbers for Cairngorms Connect.

The principle of ‘rewilding recognises the intrinsic value of all species and ecosystems’ is less strongly realised through the case study examples, which are typically reliant on higher levels of human intervention, reflecting the lack of apex predators.

Green Finance

Context for green finance mechanisms

Introduction

This section of the report sets out some of the existing and emerging green finance models, their mechanisms and drivers, and how they could be applied to supporting LSNR projects.

As stated in the Green Finance Strategy (BEIS, 2019) to tackle climate change and environmental degradation, unprecedented levels of investment in green and low carbon technologies, services and infrastructure are needed. Green Finance is the vehicle in which the flows of capital will be attributed to achieving sustainable outcomes to address this challenge. Green finance is evolving, both for wider environmental outcomes and specifically within nature restoration. Projects are actively seeking funding that is both sustainable and sufficient whilst investors seek profitable, shovel-ready, projects for investment. The growth in Environmental, Social and Governance (ESG) investment and the performance in sustainable bonds – an investment instrument in which a fixed income loan is offered - have gained traction, helped by their resilience in times of market volatility (Financial Times, 2020).

As noted in **section 3.2**., identifying relevant sources of green investment and potential funding is integral to being able to mainstream LSNR. The green finance field is evolving dynamically as new seed funding (for new start-ups/ propositions) is identified, new funds are announced, and public/ private partnerships emerge. To help identify and assess funding, a rapid, critical review of potential funding and financing models and individual funding sources took place to cover this expansive topic quickly and efficiently within the project. Within this chapter, policy surrounding green finance is explored before detailing the research methodology used to identify models for mainstreaming. This includes explanation of the long-listing and short-listing process and the key findings. The chapter is rounded off with a discussion on the high growth areas and potential strategies for scaling up finance for LSNR.

The current state of green finance for the natural environment

One of the main challenges with ecological markets is that they are not yet widely understood in terms of the benefits they deliver and the investment vehicles (i.e. the delivery mechanisms for funding) that are required to support them. For nature to be institutionally investable either the intrinsic value or the benefits that flow from it need to have a market price, requiring monetisation that is not yet fully established. The policies that are required to provide regulatory support need further refinement, and as such they can be a barrier to private sector investment.

As part of this research, the current funding opportunities that either exist or are in development are evaluated for their efficacy for mainstreaming LSNR. As part of the analysis, the developments required for mainstreaming are highlighted in terms of the regulatory and market requirements. Some of the funding identified looks to address market failures (e.g. where nature is inappropriately priced for the benefits it provides) whilst others are vehicles for private sector investors who seek sustainable investment opportunities. There are also schemes that act as pilot funding, whereby government grants provide funding to set-up systems where private capital can then be leveraged for nature-based investment. Our research focused on those sources with the greatest potential for mainstreaming LSNR. An example of this includes funding that encourages

long-term sustainable investment, for example ‘evergreen’ funds. These are funds that have long-term monetary benefits or have a diverse range of projects within the portfolio so investors can come and go with the fund lasting indefinitely.

One current development that is being explored within Green Finance is the concept of an ‘Investment Readiness Fund’ (IRF). An IRF looks to build successful investable models by using public funds to provide projects with funding to create the financial infrastructure required to show investors that the natural environment can generate revenue from schemes, such as via their ecosystem services. The need for IRFs is due to the limited number of real-world examples whereby nature projects have provided revenue to private investors. The reasons for a lack of practical case studies include the high costs for transaction/ structuring that are required to generate revenue from nature. These activities include surveying land, estimating its value or creating a market in which the services it provides can attract investment. One example is the £10 million Natural Environment Investment Readiness Fund launched by the Environment Agency on behalf of the UK Government in 2021. By providing funding to explore how revenue can be generated from nature-related projects, investors should be encouraged to provide funding and the examples should help to justify the risk.

In the UK, policies regarding the natural environment are evolving rapidly, not least in line with the emerging UK Environment Bill. This bill is subject to change but places significant emphasis on biodiversity as one of the four priority areas. Each priority area needs a long-term (15-year minimum duration) target to be set – with biodiversity targets aiming to create clear legally binding goals and deadlines. Whilst this is currently outlined for England and Wales, it provides an indication to the emphasis the bill places on the natural environment. For this objective to be realised, appropriate public and private sector funding will need to be mobilised. Whilst this is a challenge, it is also an opportunity to leverage new policy mechanisms to encourage investment in nature. For example, Environment Bill regulations are expected to require businesses such as property developers to deliver biodiversity net gain, which is likely to support the establishment of market-based mechanisms for offsetting through nature-based projects.

Green Finance Research Methodology

Developing the research framework

In order to assess how green finance could be utilised for large-scale nature restoration, assessment criteria were needed that could appropriately evaluate the current funding landscape across the market. The first stage was therefore the development of a qualitative assessment framework that could be used to assess each funding and financing model and individual funding source in terms of its characteristics, merits and pitfalls. Once this framework was created, and feedback received from stakeholders on the assessment criteria, it was used to identify and analyse a diverse range of funding being used in the UK and internationally. Whilst some of the models have been tried and tested, others are emerging and are conceptual; however, including these helped to ensure the review was forward facing. As models and funding sources were added to the

framework, the criteria used for assessment were refined and expanded based on their application to the first group of models identified. The assessment framework covered aspects including scope, scalability, duration, engagement, requirements and security of each funding model and source.

The mechanisms that currently exist vary between funding that is already established, such as public sector grant schemes, and funding that is emerging and is in the demonstrator phases of investment that exist more in the private sector. There are also conceptual funding models and sources, for example the innovative funding explored as part of SEPA's £1 billion challenge (Scottish Conservation Finance Project, 2020), such as marine funds that can possibly provide sustainable sources of funding but have not yet been put into practice.

Approach to long-listing and assessing funding models

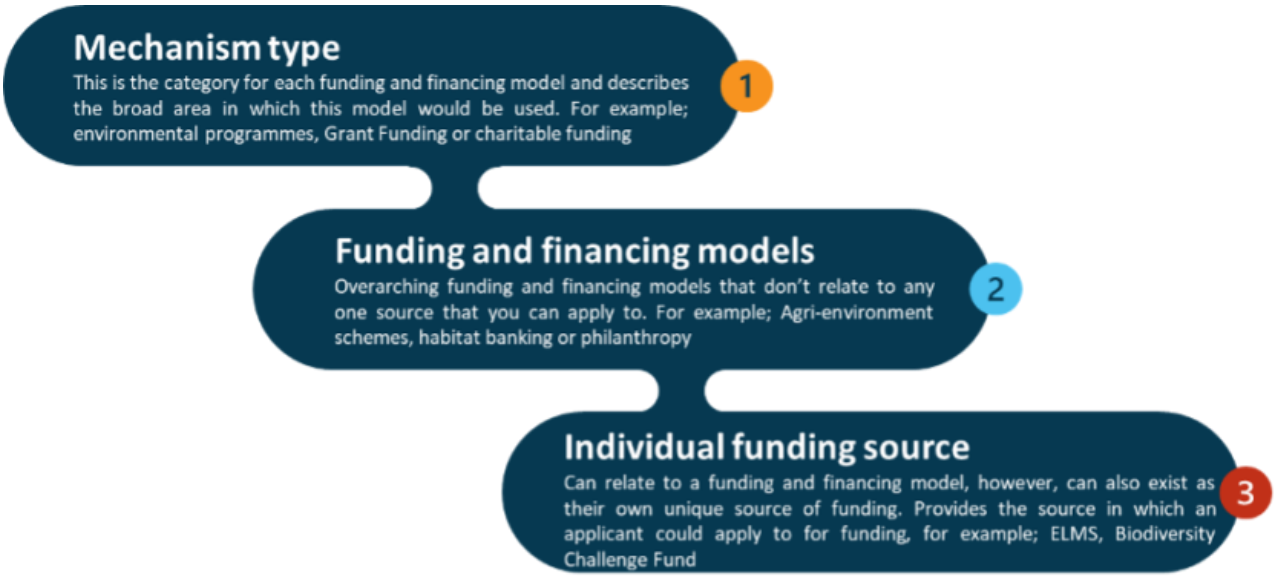
Desktop research helped to establish the emerging areas in green finance which formed part of the long-list of funding and financing models and individual funding sources. The desktop research was supplemented with inputs from the case studies and interviews with green finance specialists. The financing aspects of the case studies explored in What kinds of funding models have proven successful in delivering projects? What novel models offer potential to combine public and private finance, tapping into emerging markets for carbon or other environmental 'goods'? section helped to identify some of the funding opportunities and challenges faced by nature restoration projects.

To understand the latest developments in green finance that has potential relevance to LSNR in Scotland, stakeholder interviews were undertaken with specialists who have experience in either seeking finance for nature restoration or in understanding policy requirements and frameworks. Structured interviews took place with:

- Green Finance Institute
- Rewilding Britain
- Scottish Development International
- Scottish National Investment Bank
- Conservation Capital (in relation to the £1 billion SEPA roadmap (Scottish Conservation Finance Project, 2020))

These discussions helped to provide further insights into funding models and their practical application. Some of the questions discussed can be found in Annex 5 - Green Finance Stakeholder Interview Discussion Points , however this list is not exhaustive as there were also some stakeholder-specific areas of discussion. From the research, the funding list can be categorised and catalogued as shown in Figure 11.1. For example, to explore a mechanism such as Environmental programmes (1), we could look at a range of funding and financing models such as an Agri-Environment scheme (2) or explore a particular source of funding within this area such as the Environmental Land Management Scheme (3). This categorising was provided to allow for more appropriate comparison, and to also assess the opportunities for financing within each category. Where there was

sufficient information on the funding and financing model, this was used for assessment as part of the framework. Where there was insufficient detail, a case study was chosen from an individual funding source within the model to help complete the assessment. This helped to provide an indication of what various financing mechanisms have been used for, and therefore contribute to the assessment of their applicability for LSNR.



1. **Mechanism type** - This is the category for each funding and financing model and describes the broad area in which this model would be used. For example; environmental programmes, Grant Funding or charitable funding.
2. **Funding and financing models** - Overarching funding and financing models that don't relate to any one source that you can apply to. For example; Agri-environment schemes, habitat banking or philanthropy.
3. **Individual funding source** - Can relate to a funding and financing model, however, can also exist as their own unique source of funding. Provides the source in which an applicant could apply to for funding, for example; ELMS, Biodiversity Challenge Fund.

Short-listing of funding models most applicable for LSNR

Short-listing was undertaken to choose which funding was to be explored in more detail and create the profiles listed in Annex 4 - Short-Listed Profiles Chosen for Further Research, drawing out their relevance to mainstreaming LSNR in Scotland and the conditions/ limitations for transferring the approach into that context. Those models and sources that had the highest potential in terms of scalability, durability, longevity and revenue generation were explored as part of the short-listed profiles. The models and sources were evaluated in the scope of the following questions:

- In its current form, is the funding scalable?
- Is the source of funding sustainable?
- Is the funding long-term, and is there a potential for funding to be self-fulfilling (evergreen)?
    - For this to be achieved, does the scheme provide revenue?

Green Finance evaluation for theoretical landscape settings

For the three landscape settings explored in Green Finance section, the applicable funding and financing models are highlighted below, including any opportunities and barriers associated with these models. Where the models are at later stages in their development, examples have been provided about how such models could be implemented within the landscape setting. The models focus on the unique characteristics of each landscape setting relating to their corresponding ecosystem services.

Coastal (incl. rivers and water bodies)

The green finance mechanisms surrounding coastal, river and water bodies are commonly centred around three ecosystem services, and these are often caught up as part of a 'catchment market' that looks to incorporate all services in one financing model. These ecosystem services look to improve water quality, reduce flood risk and manage the water supply. The concept of a catchment market is explored in Annex 4 - Short-Listed Profiles Chosen for Further Research, with the aggregation of water-based ecosystem services meaning they can be packaged as one financial product. There are other ecosystems surrounding coastal landscapes that are explored below in table 11.1. The following models can utilise the attributes of the landscape setting to maximise the ability to attract green finance:

- **Catchment markets:** A payment for ecosystem service based around water that is often geographically restricted to those within a river catchment. The approach packages up the ecosystem services within the area to buyers and sellers that are brought together to trade environmental credits (e.g. a water company pays for reedbeds that improve water quality).
- **Marine funds:** A marine fund is financed by contributions from industries that rely on the marine environment which focuses on improving marine health. Revenue comes from a variety of industry sources and could be in the form of contributions or voluntary levies.
- **Blue Carbon Fund:** The protection and restoration of coastal habitats to help maximise the amount of carbon sequestered. Blue carbon sinks cover only a fraction of the seabed but are among the most efficient carbon sinks known (British Ecological Society, 2021), therefore carbon credits can be used to fund projects that help increase the ability of the marine environment to capture carbon.
- **Environmental Impact Bond:** Not restricted to just coastal landscapes, this kind of bond is analogous to a social impact bond in which the government typically pays for the achievement of a cost saving conservation outcome. Beneficiaries of natural capital interventions (e.g. water or insurance companies) could be contracted to become payers for a positive outcome arising from specific interventions.

- **Ecosystem green bonds:** A bond covering an ecosystem at a larger scale, deemed worthy of protection, and using the proceeds to finance any conservation-related activities in this ecosystem. The protected ecosystem could be a system of marine parks, whereby risk can be reduced by a guarantee by the sovereign or an international finance institution (but not always).

Table 11.1. Funding and financing models for coastal landscape settings.

Funding Model	Opportunities	Barriers	Case studies
Catchments markets	• Ability to package up a selection of ecosystem services • Easily identified contributors (water companies/ Scottish Environment Protection Agency) within geographic boundary • Multiple outcomes from one targeted ecosystem intervention • Can also be adapted to on-farm environmental projects (e.g. to reduce nutrient losses)	• Restricted to areas within a catchment • Need to ensure cooperation between organisations within a catchment • Can be hard to measure impacts (e.g. how flood resilient an area is) until an event happens	Entrade/ Wessex water
Marine funds	Large number of coastal areas that are productive that could be targeted	• Can be difficult to identify beneficiaries • Need to establish frameworks, markets and regulation	Marine Fund Scotland

Funding Model	Opportunities	Barriers	Case studies
Blue Carbon (Carbon sequestration)	• Opportunity to reduce emissions • Protection of critical coastal ecosystems • Large natural capacity for carbon sequestration	• Danger that habitats that provide the greatest carbon sequestration may be favoured leading to reduced diversity • No established markets exist where this has been tested	Blue Carbon initiative
Environmental Impact Bond	• Wide range of beneficiaries of ecosystem services where funding can be obtained • Well-established means of securing a range of benefits • Can be adapted to meet the need of the ecosystem service	• Difficulties in appropriately valuing the land that considers both the natural benefits of the land and the cost saving that a well-maintained landscape can provide • Ensuring a fair market price in ecological markets which are often volatile as they are not yet well established. • Impacts aren't always locally felt	Landscape Enterprise Networks (LENS), Environmental Defence fund (EDF)
Ecosystem green bonds	• Proven track record that can be used on several ecosystem services • Provides revenue to investors • Number of financial institutions looking to invest in green bonds	• Requirement on sovereign to guarantee any investments for short term set up • Need an aggregator to facilitate	Anglian Water Green Bond

Enclosed Farmland and Semi-natural land

There is a strong case for the development of green finance mechanisms that can support the agricultural industry's transition to ensure sufficient nature restoration. At present, there is much discussion surrounding how finance can be blended to ensure that farmers can still utilise land effectively to grow crops and support their livestock, but also to develop the environmental value of the land. The way in which agricultural land can be used for multiple purposes is the key in ensuring appropriate action is taken. Models such as those that encourage environmental stewardship from landowners must co-exist with private investment models to ensure sufficient funding sources. **Agri-environment schemes** exist whereby farmers are paid for environmental stewardship to help tackle climate change. The Agri-Environment Climate Scheme (AECS) looks to promote land management practices to protect and enhance Scotland's natural heritage, improve water quality, manage flood risk and mitigate and adapt to climate change. The scheme is open to farmers, groups of farmers and other land managers with land in Scotland.

Semi-natural land provides the greatest opportunity for large-scale nature restoration. The wide-ranging landscape category that is the predominant landscape in Scotland and the diverse nature of this landscape means that the models that look to nature-based solutions are most applicable. The following models have been identified based on typical land use activities in semi-natural land as amongst the most suited for this landscape setting and are explored in table 11.2.

- **Woodland and Peatland carbon credits** – Organisations and individuals committed to reducing their emissions overall and wanting to go further by offsetting any unavoidable emissions would be able to purchase nature-based carbon credits and other bundled benefits, using recognised carbon market standards such as the Peatland Code and Woodland Carbon Code.
- **Woodland equity fund** – Drawing in a blend of philanthropic funding alongside repayable finance to invest in woodland projects before they are revenue generating. Modest investor returns could be generated through agri-forestry schemes and cross-subsidisation from mature woodland and increase to commercial returns in the long-term.
- **Biodiversity net gain/ habitat banking** - An ecosystem service whereby credits in biodiversity units are sold to organisations that are looking to offset their own removal of habitats (e.g. trading credits with property developers to achieve 10% net gain).
- **Grants for peatland restoration**: Restoring degraded peatland to prevent carbon release, supported by carbon credits.
- **Place-based portfolio models**: Created by leasing green and blue infrastructure (or natural capital) assets to Trusts which could then exploit new revenue opportunities.

- **Natural capital bond**: A bond that is structured to lead to environmental net gain to allow for investment into natural assets. A bond that is defined by location whereby a framework can be created to develop an equity-based product to improve conservation. This could be done through the boundary of a national park for example, or by an entire region. Revenue could come through any number of ecosystem services (e.g. tourism).

Table 11.2. Funding and financing models for enclosed farmland and semi-natural landscape settings.

Funding Model	Opportunities	Barriers	Case studies
Woodland carbon credits	• Changing price means that it may increase potential funding available • Well established code with a market price • Large areas of suitable land for converting into woodland • Existing woodland management can also be considered	• Danger that habitats that provide the greatest carbon sequestration may be favoured leading to a reduction in diverse landscapes • Woodland Carbon Code has helped to establish a standard; however this requires strong accreditations and enforcement which requires funding • Stringent requirements around measuring the carbon captured, this includes being restricted by a set number of years any assets created would need to stay in place	• Clyde climate forest • Forest Carbon Ltd

Funding Model	Opportunities	Barriers	Case studies
Woodland equity fund	• Helps to develop woodland in its infancy • Wide range of revenue services available once woodland is established • Can increase social value through community engagement	• Requires buy in from a blend of financial sources (philanthropic and private investment) • Requires someone to take the role of forest management	Forestry investments, community forests
Biodiversity net gain/ habitat banking	• Biodiversity net gain requirements through the Environment Bill may require developers (infrastructure project promoters) to ensure active improvement of biodiversity, which would work as a regulatory driver for habitat banking • Enhanced outcomes for nature conservation with a strategic network of sites with improved habitat connectivity	• Where losses are local, there is a danger that the compensation may not take place locally leading to environmental degradation. • Habitat banking is a one-off asset purchase (compensating for a lost biodiversity habitat) • The ecological and planning rules to deliver Biodiversity Net Gain need to be co-developed with the requirements of the finance model • The revenue models for both are currently reliant on voluntary markets	Conservation Credit Purchase Agreements

Funding Model	Opportunities	Barriers	Case studies
Agri-environment schemes	• Can help support farmers and land managers whilst also supporting biodiversity, the landscape and improving the quality of water, air and soil. • Helps to support appropriate management for vulnerable species and habitats	• Currently, agricultural land use opportunities face uncertainty over the shape of post-EU exit rural support. • Encouraging landowners to sign up to the platform and ensuring there is an independent verification process to ensure land is being managed to standard for others to benefit. • Support under the scheme is geographically targeted – which can be quite restrictive for some locations. • Ongoing compliance can be onerous but encourages active monitoring.	Agri-Environment Climate Scheme (AECS)/ ELMS/ CSS
Grants for peatland restoration	Ability for land to sequester large amounts of carbon	• Requires policy support for carbon prices • Need to adapt grant to ensure they're linked to carbon credits	Nature for Climate Peatland Grant Scheme

Funding Model	Opportunities	Barriers	Case studies
Place-based portfolio models	• Ability to aggregate ecosystem services at a large geographic boundary (e.g. National Park) • Can gain economies of scale • Links into other ecosystem services	• Requires finding an appropriate manager of the fund • Would require legal conditions for leasing • Requires endowment and transitional funding	
Natural capital bond	Can be blended with other finance models	• Few real-world examples in action • Need to define an area in which the bond would be bound to	Malmö green bond framework

Urban (settlements)

Whilst green finance is often focussed on nature-based solutions in rural areas, there is a role for cities, towns, villages and hamlets. Delivering on climate resilience and biodiversity is a key element for attracting green finance and whilst for large-scale nature restoration the focus will mostly be on the other landscapes, urban areas still have a role to play. The development of green and blue infrastructure such as green walls, roadside tree planting and the maintenance of green and blue spaces are amongst a host of small-scale nature developments that can help contribute to the provision and enhancement of nature. Most of the previous models in table 11.2 are applicable in an urban/ semi-urban context and therefore are listed below. The models that can most readily be tailored for the appropriate markets are explored in table 11.3.

- **Community investment funds** – Similar to the recently launched ‘local climate bonds’ by the Green Finance Institute – these are finance products often launched by councils to offer local people an opportunity to invest in the local community in a crowdfunding style to help achieve decarbonisation or other environmental outcomes (e.g. residents investing in a bond that will provide new renewable energy sources that they will get cost savings from and then revenue from contributions to electricity grid).

- **Woodland Carbon Credits –** Can work alongside the creation of small-scale woodland in city centres.
- **Habitat banking –** As there is increased focus on 'local' habitats created when calculating biodiversity net gain, the importance of habitat creation within urban environments will be key – particularly for offsetting habit destruction through urban developments.
- **Place-based portfolio models**: Can be used by local authorities to lease green and blue infrastructure (e.g. city parks) to a management body who can focus on exploiting new revenue opportunities alongside land management.

Table 11.3. Funding and financing models for urban landscape settings.

Funding Model	Opportunities	Barriers	Case studies
Community investment funds	• Enables community involvement in local schemes • Ability to engage with several investments • Can be quick to mobilise and targeted with local action • Help achieve a council's climate targets	• High upfront cost • Recognition of projects that can both decarbonise and provide revenue at a local scale	Warrington, Berkshire and Leeds councils
Place-based portfolio models	• Ability to aggregate ecosystem services • Can gain economies of scale • Allows for a focussed approach to be taken that may not be possible through local authority management	• Requires finding an appropriate manager of the fund • Would require legal conditions for leasing • Requires endowment and transitional funding	Newcastle Parks Trust

Funding Model	Opportunities	Barriers	Case studies
Woodland carbon credits	• Utilisation of green space • Help improve local air quality through sequestration	Small scale given the landscape setting and land opportunity	City Forest Credits
Biodiversity net gain/ habitat banking	• Local credits have additional value when targeting biodiversity net gain • Help with local authority climate emergencies	• Limited space to create habitats • Habitats need to have a purpose for access to green spaces so maximising environmental value may not be a priority	

Financing nature restoration outcomes and themes

Findings

Combining the stakeholder interviews, desktop research and case study responses, **48** funding and financing models and individual funding sources were identified for evaluation within the framework. The results are summarised in Annex 3 - Long list of funding models, and the full list of approaches is found in a separate Excel spreadsheet.

In developing the long list of funding, the stakeholder engagement informed what should be evaluated as part of the criteria, and which funding to investigate, but also identified the gaps in the current private finance investment market. As part of our engagement, we found the following common themes for green investment:

- Whilst there are both nature restoration projects that are seeking funding, and investors who are looking for nature-based investment, the mechanisms that exist to leverage private investment for nature restoration are in their infancy, and more is required to help facilitate this type of funding e.g. policy changes.
- To help encourage private sector investment, the regulatory environment should be conducive for investment by making the process accessible for investors.
- Finding successful demonstrator projects that have evidenced financial returns are hard to come by due to the lack of the maturity in the market, and therefore it can be difficult to engage with investors who are looking for financial returns on their investments.

- Natural capital, and nature restoration to enhance natural capital, are increasing on the environmental agenda for investors, however, this could gain more attention by linking nature recovery to helping organisations to achieve their sustainability objectives such as their Net Zero targets.
- Emerging schemes and seed funding have been identified that help show a path to sustainable funding, however unless they are supported by guarantees (e.g. from the public sector), they are not viable considering the short-term setup costs and having no track record of investable returns.
- A coordinated approach is required that involves all relevant stakeholders to be involved in financing models for a restoration project to be successful.

Funding models and sources can relate to private investment to generate revenue, but also funding that seeks to generate outcomes in nature such as from government grants or philanthropy. For investment to be sustainable and evergreen, philanthropic or funding provided by the public sector on its own is not the optimal solution. Models that exist in the form of a single fund are unlikely to have the scale needed for LSNR / rewilding, and therefore the funding and financial models were the preferred option for further investigation, rather than the individual funding sources. Charitable giving and philanthropy, including crowdfunding, are examples of funding that have provided significant outcomes for nature restoration, but that may not be scalable and sustainable in the long term. However, they could provide valuable contributions as part of a blended model to help with short-term facilitation costs, which is explored later.

Each model and source is at a different stage in its lifecycle, with some more developed than others. An invasive non-native species loan is an example of a conceptual funding and financing model that needs further applied research and ideally case studies to evaluate its efficacy. Other funding and financing models are aggregating platforms rather than funding sources, such as place-based portfolio models which leases out green assets, often from public landowners to private organisations to create revenue and help in the provision of public goods. The long list of funding indicates the diverse range of funding and financing models that currently exist within green finance, and therefore each will need a different approach in developing it for LSNR. The short list approach takes a sample of these for assessment to help understand which models and sources have the greatest potential for LSNR / rewilding.

The resultant short-list consists of **7** approaches that have potential for mainstreaming based on the criteria selected. These are explored in greater detail in Annex 4 - Short-Listed Profiles Chosen for Further Research and comprise:

- **Payments for ecosystem services** – The overarching term for providing nature-based solutions and taking payment for the benefits/cost reductions that this solution provides (e.g. reduction in flooding from improved water retention of local land to receive payments from those that benefit).

- **Catchment Markets** – An example of an ecosystem service, but geographically restricted to those within a river catchment. The approach packages up the ecosystem services within the area to buyers and sellers that are brought together to trade environmental credits (e.g. water company pays for reedbeds that improve water quality).
- **Habitat and Carbon Banking** – An example of an ecosystem service, whereby credits in either carbon or biodiversity units are sold to organisations that are looking to offset their own emissions/ removal of habitats (e.g. trading credits with woodland carbon offset providers).
- **Agri-Environment Schemes** – Schemes that look to provide funding for farmers to improve and maintain agricultural land so that it has a greater environmental value beyond its purpose within agriculture (e.g. ELMS).
- **Crowdsourced Funding (incl. community investment funds)** – An example of philanthropic funding, however rather than having a sole source of funding, funds are raised often by a community of people that have an interest in the project objective and can often provide both monetary and non-monetary returns to the investors (for example eco-retreats, merchandise or an opportunity to be part of the restoration).
- **Ecosystem Green Bonds** – An investment vehicle that can either be managed by an organisation with a vested interest in improving nature, or by an investment manager. Can be used to pool together funds to invest in projects that improve environmental outcomes and provide a return (often fixed term) to those who invested.
- **Tax Credits/ Levys** – A public sector financing vehicle, a tax credit/ levy can be used to provide tax incentives either towards environmentally friendly processes or away from those that have a negative impact on the environment. The funds raised from these processes can then be pooled to invest in environmental outcomes.

The short-listed funding and financing models all provide potential as mechanisms to encourage public-private partnerships, or a blend of funding methodologies that can be stacked together. However, until the schemes are better established, first movers are required to mitigate the risk associated with a project. Due to the funding level, required this will most likely need to be a public body or philanthropy/ charitable donations on a large scale.

Growing high-potential ideas – strategies for scaling finance

One of the findings from this rapid research is that for nature restoration to be successful at a large scale, there will need to be a strategic approach towards green finance. As the mechanisms for structuring finance towards nature restoration are still in their infancy, one of the key challenges to mainstreaming will be to ensure the high transaction and structuring costs are addressed. A blended approach to finance could help provide the short-term funding requirements to make nature ‘marketable’ (e.g. surveying land to

ascertain value and then marketing this value to investors), and this will allow the funds from private investors to focus solely on the nature-based outcomes (e.g. creation of new habitats).

Two features are likely to be important to having a more systematised and strategic approach:

Firstly, replicating and expanding an established and homogenous project type to achieve gains in efficiency and economies of scale. For those projects with similar features (i.e. a project with a single asset type and benefit such as tree planting for carbon banking), lessons can be learnt and applied by repeating this process on a large scale across Scotland. By taking an ecosystem service and turning it into an investable product, if proven successful those models with similar characteristics can be repeated on a large-scale across Scotland. This includes the project management approach, the valuation techniques up to the creation of the investment model and how to take it to market. Projects that can be grouped together by ecosystem service or habitat type will provide the greatest opportunity for replication across the region. The first project would provide a proof of concept and a track record to support the financing case for areas to be set up subsequently. This scaling model is likely to work best for project types within Scotland as they operate in a similar regulatory and political environment, however considerations are required for the degree of tailoring to local circumstances for land ownership. This can be achieved beyond a singular ecosystem service – and could be categorised geographically. Projects that begin as a demonstrator can provide lessons that could then be later applied to other regions and programmes. Refining the process for making nature marketable by learning from past experiences and understanding the flow of benefits is similar to approaches taken in other industries, i.e. when improving processes to help improve the sale of underlying assets.

Secondly, achieving aggregation of projects that have several features in common so that they can be bundled into a single financial product with a tailored risk and return sharing vehicle. By aggregating projects with distinct but complimentary cash flow and risk profiles, the vehicle diversifies the possible risk of single transactions. This has been done in numerous other markets, such as the housing market diversifying mortgage portfolios into tranches (which is a way to structure finance) dependent on the risk profile of the loans. The same could be done within nature restoration with the likes of biodiversity and carbon credits, alongside woodland management and timber sales. All can be done within the space of one national park, but with risks diversified and offset due to the facets of the project. This approach should lead to the crowding-in of a broader investor base by attracting a variety of investors, allowing more return-oriented investors to provide less risky tranches of financing (Credit Suisse Group, et al., 2016). This can complement the aggregation of project types in the first approach, and whilst it does not entirely eradicate the risk for investors, it will help to create attractive markets. This could be done as part of a place-based portfolio model whereby assets are leased together as one to ecosystem managers who can then take them to market. A practical example of this model would be the Landscape Enterprise Networks (LENS).

Considerations for further exploration

This study was undertaken in parallel to the NatureScot Research Report 1260 (NatureScot, 2021), which looks at the literature for facilitating Local Natural Capital Investment. A lot of the themes emerging from this study are mirrored within that research report, particularly in relation to the funding landscape. This study complements the outcomes of that research report by providing further clarity and understanding around the emerging financing structures and mechanisms and the supporting tools that are required to deliver the significant investment required in the natural environment, with particular regard to LSNR. One common theme is the different ecosystem service markets that have been recognised as having potential to support conservation finance opportunities. A clear requirement for an established market is the need for net positive cashflows in order to encourage and harness this potential.

There were a number of criteria that formed part of the assessment framework used in this research that can provide useful insight in assessing financial models for LSNR / rewilding. However, the data required to apply these criteria are inconsistent, with categories such as verification, requirements for recipients, monitoring and oversight not having sufficient publicly available information to draw clear conclusions. They have remained within the framework in the hope that as more demonstrator projects take place, more information is publicly available than can be used to inform future projects of a similar vein. Due to the information not being available or consistent, some criteria could not provide much value in assessing the model's applicability for LSNR / rewilding.

In order to provide an accurate picture of the current funding landscape for nature restoration, a wide variety of funding and financing models were explored, alongside individual funding sources to serve as case studies. One piece of further exploration would be how these funding and financing models would complement each other to provide a blended finance approach. Due to the diverse landscape in both the natural environment and funding markets, a combination of different models that stack and work in unison may be needed to provide the funding for LSNR / rewilding. Once the market has been established and the revenue streams are clear, then less mature structures and conservation areas may find fertile soil to grow, but until this point, it will take a range of different models to address the challenges facing the natural environment.

Conclusions and Recommendations

Overview of recommendations

The conclusions and recommendations are based on the review of the ten detailed and fifteen high level case studies which provided a range of perspectives on LSNR / rewilding. The case studies all are all based around improving the nature value of these land areas, and as such they are 'nature rich' areas set within the wider landscape.

The case studies provide insights into a number of issues affecting LSNR / rewilding, but do not provide a comprehensive picture and represent an incomplete evidence base, which is reflected in the recommendations to NatureScot for research and evidence gathering.

The conclusions are structured as the following bullet points:

- Defining, communicating and demonstrating the role of LSNR / rewilding
- Embedding and articulating LSNR / rewilding within policy
- Planning and facilitating
- Funding
- Knowledge exchange, demonstration and capacity building
- Land ownership, project partnership and leadership
- Maximising local benefits
- Managing the role of large herbivores.

These are followed by the recommendations which are grouped in the following four categories:

- Engaging with partners
- Research and evidence gathering
- Funding
- Deer management.

Defining, communicating and demonstrating the role of LSNR / rewilding

> Communication on LSNR / rewilding needs to be clear and inclusive of the spectrum of project types in Scotland in order to achieve wider understanding of LSNR / rewilding and their applicability to a wide variety of settings and environments.

Embedding and articulating LSNR / rewilding within the policy landscape

- All of the projects within the study have demonstrated strong links with significant policy themes such as climate change and the biodiversity crisis. Clearly demonstrating these policy links will give validity to the development of projects to support their understanding by individuals, organisations, partnerships and communities and assist with mainstreaming the concept, and the required supporting actions.
- Demonstrating the public goods which the projects can provide and the linkages to the policy landscape will provide a core foundation for policy communication on LSNR / rewilding.
- Critical to this is the need to identify and address potentially conflicting policy aims and funding streams particularly in relation to the proposed shift from payment for production to payment for ecosystem services.

- The case studies also highlighted the frequent relationship of projects with areas designated for their conservation value. This illustrates the potential role of LSNR / rewilding in supporting protected areas through providing high quality habitat in surrounding areas. This may be particularly important in light of pressures from climate change.

Plan and facilitate

- The case study projects have a range of motivations and some relate to the interests of particular landowners or are responses to the challenges of working difficult sites. Cairngorms Connect and the Northern Upland Chain Local Nature Partnership have a larger scale strategic vision and bring together local partners to achieve this and have the opportunity to maximise environmental and socio-economic benefits through landscape scale conservation and delivery of ecosystem services such as water purification and flood management. This could be maximised by identifying regional priorities for ecosystem service delivery.
- Although the case studies didn't include community-led projects, this approach is illustrated through other project approaches such as the Heritage Lottery funded Local Landscape Partnerships and the Defra Countryside Stewardship Facilitation Fund, which support bottom-up development.
- The role of the Regional Land Use Partnerships and Frameworks is likely to provide a key mechanism to provide a strategic framework for bringing forward co-ordinated action at a regional level. The RLUF can provide the guidance for the key policy priorities within the region and provide a facilitating mechanism to co-ordinate large projects and maximise the environmental, social and economic benefits.

Existing delivery bodies as demonstrations of delivery

- The UK case studies included some examples which overlapped with other management vehicles, such as the Great Trossachs Forest which nests within Loch Lomond and the Trossachs National Park.
- Larger scale partnership approaches which were created as overarching bodies to support the project delivery are illustrated through the examples of the Tweed Forum and Northern Upland Chain Nature Partnership which also overlapped with a number of designations. The international example of the Central Apennines also has significant overlap with larger scale designations including a national park and surrounding areas. However overall, there was a higher proportion of single land ownership models within the case studies.

Enabling Community-led projects

- None of the case study examples were community-led projects, although the case studies have illustrated some of the barriers potentially faced by this type of LSNR / rewilding projects. Principally barriers relate to the need for control over significant areas of land, need for strong leadership for projects, and the ability to co-ordinate access to funding.

- The South West Norway example illustrated a scenario in part resulting from vibrant rural communities with a high degree of agency over their future, where small landowners control their land, and are incentivised to manage the land sustainably.
- In Scotland there is now greater opportunity for communities to take ownership of land and a number, including the recent acquisition at Langholm, include an element of nature restoration. There are opportunities for a community generated approach, however this is likely to require a framework of support and guidance to build consensus and deliver the project to provide appropriate capacity and skills, and alignment with government policy aims. There is potential for this to be supported through the Community Land Fund and linked to a package of support and advice.

Funding

Public funding, AES, Payment for Ecosystem Services, long term cycles

- New sources of finance are necessary, alongside maintaining and enhancing existing public payment and financing schemes.
- The case studies highlight the limitations of the agri-environment programme which has until now been constrained by medium term EU budgeting cycles.
- Post-EU exit, there are new opportunities to develop long-term incentive schemes which provide greater certainty to landowners/ managers contemplating long-term changes in land use and management.
- There is a requirement for a package of AES measures which support the spectrum of habitat restoration from that undertaken as a minority land use, to that carried out as a majority land use.
- Linked to the maintenance and enhancement of existing incentives and grant mechanisms, better targeted incentive schemes are needed. These schemes should support restoration to take place where it offers greatest benefit, reward restoration at scale and encourage enhanced connectivity of habitats and designated sites.
- The case study examples show that landowners have utilised a range of funding sources for LSNR / rewilding, many of which were not necessarily designed for this purpose. As a result, new targeted policy approaches could enhance the effectiveness and benefits of funding. The proposed third “Landscape Recovery” tier of the new ELM scheme in England is an example of this and will support the delivery of landscape and ecosystem recovery through long-term, land use change projects, including projects to restore wilder landscapes in places where that is appropriate.
- The case studies also demonstrate the importance of the EU LIFE programme in funding large-scale nature restoration projects, and this was also a finding of an evaluation of the LIFE programme in the UK for Defra and Natural England (ICF Consulting Services Limited, 2019). The prospects for LSNR / rewilding will partly depend on similar programmes capable of financing large-scale capital projects in future.

- The research has identified the potential for the rapidly evolving green finance sector to provide a source of funding for nature restoration initiatives, possibly alongside public funding streams. While a number of challenges remain, the project identified seven funding models which could be explored further, and others may emerge as the sector matures.

Private and blended finance

- LSNR / rewilding is able to deliver a range of ecosystem services and the case studies include examples of improved water quality, flood management, carbon sequestration and recreation as well as benefits for landscape, biodiversity and climate resilience.
- These multiple benefits offer opportunities to develop new payment mechanisms by attracting finance from buyers of ecosystem services such as water companies, developers, insurers and carbon traders. The case studies are indicative of the current state of funding nature restoration, often relying on several funding sources that result in a blended approach.
- Developing payment mechanisms which attract private finance alongside public payments for public goods is challenging but could significantly enhance finance for LSNR and incentivise its delivery in locations where benefits are greatest. This coincides with the opportunity to develop mechanisms using public funding to help initiate the start-up costs of valuing ecosystem services, so that the private finance sector can inject once the market is more established.
- This would also support the move away from existing payment schemes which support land management practices which essentially conflict with current high-level policy aims.
- Payment for public goods would provide a longer-term basis for funding, but needs to be balanced against issues such as climate vulnerability which could impact on the long-term viability of payment for services such as carbon storage.

Knowledge exchange and demonstration projects The case studies highlighted the role of vision, knowledge and information sharing, including sharing best practice between projects within Scotland, UK and Europe and the knowledge exchange and inspiration which this brings

- Showcasing demonstration projects within Scotland could provide a forum for LSNR / rewilding projects to support adaptive views of traditional land management and address perceptions around the role of land managers or established land uses. These projects could provide an evidence base for key land use changes and their ecological and financial benefits.

- The identification of demonstration projects could be achieved through issuing a ‘call for projects’ which could be passed through a selection process. This could include building on ongoing (for example, by bringing several landowners together) or new projects which were not yet established due to current barriers and could be supported by a development officer who supports the project process and ensures monitoring and evaluation of the process in relation to a set of defined criteria. This would include investigating different funding sources, land tenure issues, socio-economic benefits and barriers. Demonstration projects could be administered at a national or regional level, providing further links to the developing RLUF.
- Demonstration projects should include identifying models of sustainable tourism that minimises environmental impacts of tourism.
- It is important to identify examples of land management changes which can bring about cost benefits, and associated timescales of these benefits, in order to support interest and engagement/.

Land ownership, project partnership and leadership

- Existing projects are typically led by organisations or individuals with clear understanding of environmental issues and confidence in the wider benefits which the project will bring. The most 'successful' or simplest examples within the UK seem to be owner occupied and characterised by having a clear vision and direct control over all aspects of the project and no need to compromise with partners.
- Partnerships are necessarily more of a balancing act or focus on co-ordination and facilitation. NGO led projects can sometimes have difficulty in building trust and large-scale projects are more likely to involve multiple land ownership models.
- Several of the case studies illustrate the challenges faced when bringing a number of land managers together, and the mechanisms required to overcome these.
- There is a need for clarity over agency roles where they are partners to a project and also the regulator.
- A clear overview is required to balance ecological and environmental effects, for example, decisions regarding locally important habitats for key species.
- The projects indicate that a strong lead is important in partnership projects although this may be illustrative of the stage of projects within the case study sample.
- The case studies have demonstrated that engagement needs to be carried out in the right way and be tailored to stakeholders to ensure credibility and draw on local knowledge. In order to bring projects forward, project partnership and leadership needs the right skills and tools to engage. There is need to engage throughout the process with key partners, land managers, neighbours, communities.

Maximising local benefits

Skills

The case studies highlight that there may be a mismatch between existing land management skills in an area and those needed for nature restoration.

High value products, direct to consumer

The case studies include a number of references to the sale of high value products associated with the land management of = LSNR / rewilding. Key examples include saltmarsh fed beef and lamb. The case studies did not identify the significance or extent of the sale of these products to the overall economic benefit from the projects, which is a key research gap. However some examples highlighted the lower costs of less intensive production.

Economic diversification

- The case studies have demonstrated that LSNR can play a role in supporting and reinvigorating the economy, with benefits for tourism and recreation although there may also be impacts from LSNR / rewilding on existing land use and employment patterns.
- Replacing land management income with tourism or recreation-based income and employment will change the character of the local economy, creating new seasonal patterns or vulnerability to short- and medium-term economic impacts such as those caused by the Covid-19 pandemic.
- Larger scale projects have potential to enhance tourism activity at scale. There may be benefits in a co-ordinated approach to tourism development and nature restoration through encouraging restoration in areas where it can enhance tourism growth and ensuring that tourism infrastructure and marketing facilitate this growth and provide opportunities from the marketing associated with a larger area offering a range of experiences.
- It is important to achieve a diverse and resilient rural economy associated with LSNR / rewilding. This should reflect agricultural production, forestry products, food and drink businesses, tourism and payment for ecosystem services.
- However, overall, the case studies have not provided significant evidence on the community and local economic benefits of the projects beyond anecdotal reporting from the interviews and some limited evaluation.
- Effective consultation and engagement with local communities and land managers in all projects seeking to reinstate ecological processes will ensure that social and economic benefits are maximised, local knowledge and skills are harnessed and support paradigm shifts.

Rural repopulation

- The case studies suggests a role for LSNR / rewilding in maintaining rural population and employment, however there is a lack of evidence for the extent to which projects maintain and support populations long term, and in the light of wider economic and policy impacts on these areas.

- LSNR / rewilding projects can provide new opportunities for local enterprise, including repopulation of some areas and can bring about local social and economic change in response to a previously declining rural context. This may lead to a rural economy which is more dependent on tourism, which brings new challenges to rural areas.
- The example of South West Norway illustrated an alternative rural population model, in a landscape with similar physical characteristics to Highland Scotland. This model supported a higher population density with a diverse rural income stream, but similar to Scotland is also experiencing issues of an aging rural population. The land management approach illustrated where a number of conditions have come together to create the conditions for successful, long-term woodland regeneration. The region has a sustainable and welfare led approach to deer management to enable successful regeneration. Beyond this – and the 60% state subsidy for small farm enterprises that are typical of the Norwegian system - little intervention has been required owing to key factors including owner occupation, diverse farm (and non-farm) incomes, more equitable distribution of land and strong and vibrant local communities who have agency over the land. However, the land ownership pattern in Scotland is very different to Norway, and this is a major barrier to achieving the outcomes demonstrated in Norway. Land reform may be a key mechanism for bringing about similar outcomes.

Managing the role of large herbivores

- All LSNR / rewilding projects in Scotland need to include management of existing deer populations and this may be alongside the introduction of other large herbivores as appropriate to manage the required habitats within the area, through maintaining areas of open ground or grazing unwanted regeneration.
- All large herbivores require some form of management to control population levels (where mixed herds are introduced) and for semi-wild herbivores to ensure basic welfare needs and legislative requirements are met.
- The case studies have demonstrated a wider area-based approach is necessary for effective deer management. Other sustainable models of deer management are possible through maintaining lower numbers of higher quality individuals. For this specifically, partnership approaches are important to support LSNR / rewilding in the light of the relatively high costs of deer management
- Having single and smaller scale projects focusing on controlling deer numbers may disproportionately increase costs to the operation, if other landowners from the area are not involved in addressing this issue. In line with the funding recommendations, a shift in land management funding towards PES will support funding for land management practices which deliver public goods.
- In line with the recommendations in The Management of Wild Deer in Scotland (2020), and the recommendations of the policy review to identify and address conflicting policy aims, it is clear that there are tensions within the existing land management funding framework for the reduction in deer numbers required for successful LSNR / rewilding.

- Relevant data collection and analysis is also critical to ensuring effective deer management and policy development.

Recommendations

The research has identified the following recommendations to NatureScot.

Engaging with partners

1. Engage with Scottish Government and the Scottish Land Commission to ensure that LSNR / rewilding are considered as a mechanism within Regional Land Use Frameworks to deliver the objectives of the Land Use Strategy.
2. Identify and support demonstration projects to provide examples for knowledge exchange, information sharing and learning for the mainstreaming process and linked to the development of delivery mechanisms
3. Engage with the Scottish Land Commission (and Crown Estate Scotland for coastal projects) and to identify how these organisations can facilitate the identification and implementation of LSNR / rewilding.
4. Engage with the regional marine planning partnerships to identify how LSNR / rewilding could be implemented to further address or showcase approaches to addressing the issues identified in each region.
5. Work with coastal communities and regional marine planning partnerships to identify how LSNR / rewilding can support climate change adaptation to support a strategic approach to reflect the interconnected and dynamic properties of the coastal environment.
6. Develop collaborative projects engaging land managers, ecologists/ restoration specialists and local communities, to develop skills and scientific knowledge for ecosystem restoration, incorporating local knowledge and feedback for adaptive management.

Research and evidence gathering

1. Undertake research (potentially connected to the development of RLUP) to explore the appetite from communities for community-led LSNR
2. Explore the role of existing delivery bodies (such as national parks, biospheres, Central Scotland Green Network (CSGN)) as enablers or delivery mechanisms for LSNR / rewilding within the context of RLUP
3. Undertake a detailed review of existing Scottish rural skills training programmes and alignment with the range of skill requirements for LSNR / rewilding.
4. Gather further evidence to explore the economic role of specialist products from LSNR / rewilding, including food and drink but also other products, and to provide linkages to existing marketing bodies and initiatives such as Scottish Food and Drink.

5. Establish demonstration projects to explore the potential of landscape scale restoration projects ifor tourism development including links to national parks, and national long-distance routes or establishing new projects with their own identity and ‘brand’.
6. Gather further evidence on, and monitor, the role of LSNR/ rewilding in providing rural employment, maintaining rural population and attracting/keeping young people.
7. Continue to evidence and raise awareness of the economic and social benefits of ecosystem restoration, including with respect to long-term resilience and to climate change mitigation and adaptation.
8. Ensure monitoring of the project’s progress is put in place to establish quantitative information gathering on LSNR / rewilding. This would include environmental and socio-economic data.

Funding

1. Develop a separate community support fund for LSNR / rewilding to provide additional support for the management and specialist skills required to take community led projects forward, alongside development of guidance for communities.
2. Perform a review of funding opportunities that can be blended or stacked to provide greater opportunities for LSNR / rewilding (e.g. agri-environment schemes to be blended with carbon/ habitat banking).
3. Review the funding and finance framework to understand the relative benefits of the different funding models used in LSNR / rewilding and their role in supporting different approaches. This could include examining those models with high growth potential (such as the ones listed in Annex 4 - Short-Listed Profiles Chosen for Further Research) that can be explored further by developing case studies and performing applied research.
4. Identify financial models which support changes in land management productivity in relation to tenants in order to support land management changes on tenanted land.

Deer management

1. Establish the influence of the current policy context for deer management on the success of LSNR / rewilding across Scotland.
2. Identify conflicting policy and land management funding.

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Annex 1 - Detailed Case Studies

South West Norway

Case study summary

This is not a specific project as such, rather a reference area for successful natural woodland regeneration. It makes for a useful comparison for potential opportunities for Scotland given the climates and geology are very similar. South West Norway was largely a deforested area for centuries resulting from livestock grazing, muirburn and felling for timber. The earliest evidence of natural regeneration occurring is from the 1860s, and since then, with the exception of some commercial forestry planting (most significant during the 1950s and 60s), the spread of trees has been largely natural regeneration. There has been a snowball effect in the last 50 years as more trees have established and spread seed, with around half of the naturally regenerated woodland (in biomass terms) having occurred since 2000.

The main approach to land management is to maintain a viable rural society with small-scale landownership.

The key issues/opportunities include:

- Most of the land is privately-owned by farmers, owner occupation is legally required;
- Land use (farming) properties are much smaller than those in Scotland, and multi-purpose, providing more sustainable income. Forestry is typically an element in farming operations;
- The overall population in rural areas is much larger than in Scotland and of greater density (proving that woodland regeneration and farming can work harmoniously to support incomes of those living there).

Partnership models/funding:

- Forestry cooperatives – most forest owners belong to regionally-based forestry cooperatives, which are responsible for the bulk of timber management, harvesting and sales.
- Deer management is undertaken by a system where the government sets quotas for the number of deer (of a given species, age, sex) to be taken from hunting areas (areas are much smaller than Scottish Estates). Farmers then sell quota on free market or use themselves or combination. The landowner is responsible for achieving the quota, and it is usually achieved at district level.
- Norwegian society is much more egalitarian – greater agency over life.

Lessons learnt from SW Norway for Scotland (Armstrong et al., 2014) include:

- South West Norway provides a good example of the positive economic and ecological effects of reductions in grazing and muirburn over the last one hundred years.
- The area of non-commercial woodland in coastal West Norway (Rogaland, Hordaland, Sogn and Fjordane, and More and Romsdal; total area 62,043 km^2), all naturally regenerated, increased by 1,000 km^2 in the 8 years 2005-2012. It now comprises 12% of the region's land area and is predicted to increase greatly in extent particularly in the coastal and montane areas. In particular, Rogaland in the extreme SW, formerly the most deforested province in all Norway, is on the same latitude as northern Scotland. It has closely similar landforms and geology, and a mild hyperoceanic climate with temperature and precipitation patterns closely similar to those of Highland Scotland. Woodland, already 2,400 km^2 in extent today (26% of the land area), has the capacity to reach c. 4,000 km^2 (52%) through continued natural regeneration, most of which is predicted to occur. This has resulted mainly from the steep decline in the intensity of domestic stock grazing and associated human activities such as muirburn.
- Natural forest regeneration and afforestation in recent decades have clearly indicated the ecological potential for forests in semi-natural heaths and meadows throughout Norway.
- Making similar changes in Scotland (reducing stocking/grazing pressure and muirburn) would see a similar pattern of woodland regeneration, which would occur more rapidly if actively managed to that end.
- SW Norway holds greater population density then the Scottish Highlands.

Administrative and socio-economic context

The South Western (hereafter SW) part of Norway is not a specific project as such, rather a reference area for comparison with the Scottish Highlands given the similar range of climates and landscapes. The entirety of SW Norway has regenerated natural woodland on a huge scale as a result of social and economic changes, none of which was intentional.

Landscape and land use context for the surrounding area

SW Norway had been largely deforested for centuries, and it was mainly caused by livestock grazing, associated land uses such as muirburn and felling for timber and fuel. Natural regeneration of woodlands took place after these practices went in decline. Most of the land nowadays is owner occupied and holdings are small. Nature restoration is not a specific project as such, rather a reference area where a set of circumstances over time have enabled successful natural woodland regeneration. Research into land management practices in this area make for an interest comparison to the Scottish Highlands.

Environmental baseline prior to the LSNR restoration

Scale: SW Norway – approximately 33,318 km^2 (3,331,800 ha). Highland Scotland – 26,484 km^2.

The landscape history in SW Norway prior to the 20th century was similar to Scotland from the arrival of agriculture (Neolithic period) until the 19th century when land use was dominated by subsistence pastoralism and associated land uses. Land tenure however differs from Scotland. Most agricultural land is privately owned. There are few large estates outside those belonging to the State Forestry Agency (Anderssen A., 1998). It is illegal to own land if you don't live there. It was for centuries a largely deforested area as a result of anthropogenic influence including grazing, muirburn and use of woodland for firewood. Deforestation began to reverse around the beginning of the 20th century due to mass (voluntary) emigration to North America in the later 19th and early 20th centuries.

The climates of SW Norway and Scottish Highlands are very similar: highly oceanic, mild, and wet; precipitation varying strongly depending on nearness to west coast, topography, and rain shadow effects; and with similar seasonal temperature ranges. The geology of the two areas is also very similar: hard, volcanic or metamorphic rocks (largely from the same mountain building episodes) predominate, and soils' fertility is generally poor. There were also similar land use patterns until the late 18th century, when commercial sheep ranching, followed by management for deer and grouse, became prominent in Scotland.

Level of ambition in restoration/rewilding

As it is not explicitly a project, there is no specific vision or objectives for the case study. Data from SW Norway shows that within a century, an area similar in size to the Scottish Highlands and of similar climate and geology has re-wooded, mainly by natural regeneration. This length of time could be shortened to 20-30 years by planting interventions.

Land management in SW Norway focuses on creating sustainable rural communities. This is supported by laws which require owner occupation of rural properties, and policies that ensure that farms are passed on to the next generation, or another family member, or failing that, are retained by a new owner as a working farm operation (normally including forestry).

The word usually translated as ‘farming’ is an umbrella term for all kinds of land use and land management. Farm income is sustained through multiple land uses from within the same holding. Although farming is heavily subsidised by the government, farm income before subsidy is considerably higher than in Scotland. This is largely due to multiple strands of income. On average, most farmers earn up to 40% of their income working off-farm. Farm produce is also multi-produce with small scale arable cropping, livestock, woodfuel, forestry, hunting, the sale, rental and upkeep of holiday cabins, all providing monetary income. In addition, heating is mainly from their own woodfuel, base meat is venison shot within their own farm, and foraging is another culturally prevalent activity which brings a supply of berries and mushrooms.

Active woodland restoration projects are not commonplace. However, one unique example was a project in Hjerkinn (not in SW of Norway). The largest nature restoration in Norwegian history, it saw the incorporation of an old firing range into the national park in Dovrefjell (which is similar to the Cairngorms plateau). The area was used as a military range for more than 80 years, with significant impacts on a vulnerable habitat. The Defence Department then moved the range to another part of Norway and Hjerkinn, an area of 165 km^2 (16,500 ha), was restored. Funded by the government, the first 10-year phase of the project was completed in 2020. In places, all vegetation had to be removed to remove unexploded munitions and a huge amount of scrap metal was collected. Replanting of willow and other associated species had to be done wearing flak jackets in case of any remaining unexploded ordnance. The unvegetated areas, at 1000m above sea level in a climate where scrub gives way to tundra, presented difficult conditions for restoration. The successful restoration provides methodologies in relation to the practical techniques of restoring tracks, blanket bog, and montane willow and birch habitat associations, which could be highly relevant in a Scottish context.

Environmental and Ecological benefits

Environmental and ecological benefits relating to the significant woodland expansion:

- The total area of forest increased in SW Norway by 55% between 1963 and 1993. There was an additional 5% increase in area of woodland between 2009 and 2014;
- Annual carbon sequestration has increased by 0.99MtC/year;
- Increased protection from strong wind in coastal areas;
- Reforestation took place due to reductions in grazing intensities and associated land uses (muirburn, fuel wood), and natural reforestation is continuing at a rapid rate, enhancing biodiversity.
- Becoming a major habitat for wildlife, increasingly so as it matures (Blom, 2007)
- Beneficial impacts on soil conservation and development, and reduced erosion.

Social benefits

The regeneration has brought a wide range of social benefits from recreation opportunities, education and outdoor sports. The pattern of land tenure also influences the benefits due to the requirement for the farms to be owner occupied with farms owned

by families who all work part-time on the farm which increases the time and interest in the land. Rural population density is higher than in Scotland and the communities are described as having greater vibrancy.

Economic impacts

Economic benefits relate to the sustainable land management approach which includes:

- Game industry (hunting). Farmers who do not exercise their own hunting quota (an in-kind contribution to their incomes from venison and other products), then cash income from hunting can be significant.
- Land use is more diversified, typically with multiple income streams from the same property including agriculture, grazing (at modest intensities with shelter for animals in woodland during poor weather), forestry, game shooting (deer, moose, grouse), fishing, non-hunting recreation, woodfuel production (a renewable energy industry) as well as cabin sales and rental (also a major source of income for the rural economy in cabin service industries).
- Multi-purpose income that is more sustainable, and mixed land-use means that land is more productive per unit area.
- Breeds of sheep that can be supported are typically heavier (c.2.5 times larger than Scottish blackface) so turn higher profit, perhaps due to more varied landscape supporting sheep of that size. Trends are towards keeping sheep out all-year on the coast, and towards use of *villsau* (Soay sheep) in coastal areas in recent times due to their minimal requirement for shepherding.

Funding

- Farming is heavily subsidised by the government. Average income for a farm owner-occupier from all sources is around £60,000.
- Farmers are incentivised to control deer due to directly seeing the benefits of deer control, and being directly affected by the negative impacts of deer overpopulation. There are socially accepted norms to work with neighbouring farms to meet quota to be harvested.
- In addition, farmers have greater agency and engagement with what happens on their land. Tight forestry blocks are not useful for hunting and therefore harvesting tends to favour 'continuous cover' forestry or small coup rotational cropping. Both allow for natural regeneration, retain an understorey for livestock and deer, and provide a more even income stream.
- Most of SW Norway’s woodland and forestry resource is within private farming units. In winter, farmers will often take a small crop of timber from continuous cover areas and haul to road edge for collection by cooperative lorries in spring. Coup felling is usually done using cooperative-supplied machinery. These cooperatives provide much needed economies of scale for farmers; they provide access to equipment to undertake forestry and allow for the aggregation of timber from many farmers to be sold as a wholesale unit. Cooperatives dominate the forestry industry making up around 80% of the market.

Lessons learned

- In contrast to Scotland, most land is privately owned by farmers with owner-occupation typical and encouraged by government policy;
- Land use (farming) properties are much smaller than the typical holding in Scotland, with production on average around 60% of the farm household income.
- Reversing the historic, and continuing, degradation of the Scottish uplands through the reinstatement of woodland and scrub would deliver a more productive and biodiverse landscape.
- It would also provide enhanced ecosystem services as well as having the potential to provide the wide range of economic outputs that are now enjoyed by the people of South West Norway.
- A variety of woodland structures, from closed canopy through wood pastures to montane scrub, would provide the ecological and structural diversity necessary to support a wide range of integrated land-uses. The resulting landscape, through its diversity of species, habitats and land uses, would be resilient to future changes and would be capable of underpinning the sustainable, productive rural economy and enhanced food security that will be important for Scotland in the coming decades and centuries.
- Research has shown that nearly 2.7 million hectares of land in Scotland could be available for woodland expansion. The experience from south west Norway, where the climate, topography and previous land use are very similar to the Highlands today has shown that woodland can regenerate surprisingly quickly given a reduction in burning and grazing pressure (Armstrong et al., 2014). There are also some examples of widespread tree regeneration through removing sheep grazing, reducing deer numbers and restricting burning at several sites in the Scottish Highlands including at Abernethy (Beaumont et al., 1995; Roberts 2010), Creag Meagaidh (Putman et al., 2006), Glen Affric (Featherstone, 2013) and Glenfeshie (Evans, 2009; McNeish, 2014). At some of these sites, natural tree regeneration has been augmented by planting.
- The overall population density on the land is higher than in the Scottish Highlands. There is an argument in Scotland that promoting large-scale natural regeneration of woodlands will cause population decline - there is no evidence to support this from the Norwegian experience. Employment per unit area in Scotland is likely to increase if mixed land use was developed.

Partnership models that could be considered for application in Scotland include:

- Forestry cooperatives – most forest owners belong to regionally-based forestry cooperatives, which are responsible for the bulk of timber management, harvesting and sales.

- Small, owner-occupied, mixed produce farming communities are supported through subsidy, but also through laws preventing absentee landowners, and the sale and conversion of small farms to large-scale farming. Managing the land in relatively small units by owner-occupiers leads to more sophisticated and varied (and sustainable) land management. When the land manager is investing their life in an area, it transforms level of interest and commitment to employing land management practices that make the most of the land.

Cairngorms Connect

Case study summary

Cairngorms Connect stretches over 60,000 ha and works to realise common aspirations for the landscape between the partnership organisations at a landscape scale. It is committed to a bold and ambitious 200-year vision to enhance habitats, species and ecological processes across a vast area within the Cairngorms National Park. The project covers approximately 20% of the catchment of the River Spey, ranging in altitude from 200m to 1,309m above sea level. The area boasts the second highest summit in Britain.

The unique landscape qualities include mountains and plateaus, moorlands, glens and straths, woodlands and forests, wildlife, less tangible visual and sensory qualities (such as evocation of wilderness, naturalness, remoteness), culture and history (lower altitudes have a rich history of human occupation, and higher ground has more natural landscapes), and recreation (climbing, walking, outdoor sport, deer-stalking, grouse shooting, fishing, bird watching).

The area is home to more than 5,000 recorded species, 20 per cent of which are nationally rare or scarce. The project includes designated sites such as Abernethy and Invereshie and Inshriach National Nature Reserves (NNR) and Insh Marshes RSPB reserve.

The main aims/vision of the project include:

- To work at a landscape scale with a 200-year vision.
- To reduce deer damage, restore woodlands, peatland habitats and natural hydrological processes and significantly improve the livelihoods of the local population.

The key issues/opportunities include:

- Accurate deer monitoring.
- Community engagement.
- Accessibility of funding.

Partnership models/funding:

- Funded by the Endangered Landscapes Programme (ELP), which is funded by Arcadia, a charitable fund, and is managed by the Cambridge Conservation Initiative.
- The project is delivered by a partnership of neighbouring land managers including RSPB, Wildland, Forestry and Land Scotland and NatureScot providing contiguous landownership across the project area. The partnership is separate from the Cairngorms National Park Authority, though the project area is entirely within the National Park and the Cairngorms National Park Authority is a supporting partner.
- Other key partners include governmental bodies, universities and NGOs.

Administrative and socio-economic context

Cairngorms Connect lies entirely within the boundaries of the Cairngorms National Park which is within the administrative area of the Highlands Local Authority. In 2015, there were 18,000 people living in the National Park, out of which 9,400 were employed within the boundaries of the Park (4.5% increase since 2010) (Cairngorms National Park, 2019).

The Park has a unique rural economy with a particularly strong tourism sector which accounts for 43% of employment. Annually, the park is visited by approximately 1.4 million people (Cairngorms Connect, n.d.). The second biggest sector in terms of employment is the public sector (17%) followed by services and activities (14%) (Cairngorms National Park, 2019).

Landscape and land use context for the surrounding area

The Cairngorms National Park is Britain’s largest National Park and contains a unique range of landscapes, wildlife, habitats and people. Approximately, 50% of the Park is designated as important for its nature and landscapes.

There is a rich palette of geology, landform, vegetation and land use in the park. Individually and collectively, these characteristics combine to give the National Park its outstanding scenery and special places. The unique landscape qualities include mountains and plateaus, moorlands, glens and straths, woodlands and forests, wildlife, less tangible visual and sensory qualities (such as evocation of wilderness, naturalness, remoteness), culture and history (lower altitudes have a rich history of human occupation, and higher ground has natural, wild landscapes under the dominion of nature), and recreation (climbing, walking, outdoor sport, deer-stalking, grouse shooting, fishing, bird watching). However, the health of ecosystems found in the Cairngorms is not as good as it could be, due the impacts of grazing from wild deer, preventing natural regeneration, degraded peatlands and modified rivers.

Cairngorms Connect

Cairngorms Connect (CC) works at a landscape scale and stretches over 60,000 ha. It is a landscape of ancient woodlands intersected by rivers and lochs, encircling an Arctic-like mountain massif – the most extensive of its kind in Britain. There are extensive tracts of

blanket bog, wetlands and woodland bogs. The park attracts eagles, wildcats, red squirrels and many other plants, insects, birds and mammals found in few other places in the UK.

The project is within the catchment of the River Spey, and ranges in altitude from 200m to 1,309m above sea level, the area boasts the second highest summit in Britain, Ben Macdui. The project area lies entirely within Cairngorms National Park, a popular area for wildlife-watching and outdoor activities. The site is of key biodiversity importance; its main habitats include extensive floodplains (wet grassland, fen and carr), Scots pine forest, birch, bog and riparian woodland, lakes and sub-alpine heaths. The area is home to more than 5,000 recorded species, 20 per cent of which are nationally rare or scarce. The Cairngorms provide a home for Britain's only known non-coastal pair of white-tailed eagles, include the highest 'natural' treeline in the UK, are the national stronghold for capercaillie and saproxylic (dead wood) invertebrates, and provide some of the best sites in the UK for twinflower, and sub-Alpine plant communities (Cairns P., n.d.).

The project originated in 2014, as a result of informal discussions between what are now the group partners about common aspirations to restore the landscape. A loose partnership began and was formalised in 2016 with a Memorandum of Understanding. The four partner organisations are the RSPB (Abernethy and Insh Marshes reserves), Nature Scot, Wildland Ltd, and Forestry and Land Scotland.

The Board meet once a month to discuss the project. One of the Board's key strengths is the seniority and commitment of the individuals which enables management decisions to be made within those meetings. The small size of the group made for a close partnership of trust, honesty, and openness to challenge one another. The Cairngorms National Park has become a supporting member (non-Board member).

Each organisation has its own staff on ground, amounting to around 50 – 55 full-time employees (FTE). The partnership secured £5 million from the Endangered Landscapes Programme in 2018 and has appointed nine FTE to service partnership for the period of 5 years. This includes a Programme Manager.

All partners have a unifying focus with subtle differences; however, the partnership is underlined by fundamental principles. The three key themes of the partnership's work include: reducing carbon emissions (from degraded peat and to a certain extent deer), increasing carbon sequestration, and adaptation to the effects of climate change.

Environmental baseline prior to the LSNR restoration

Scale: 60,000 ha (the total project area of Cairngorms Connect)

Type of project: Uplands

Sites included within Cairngorms connect:

- Abernethy – RSPB is restoring and expanding one of Britain's largest remnant of pine woodlands. Abernethy is an almost 13,000 hectare nature reserve sitting within the Cairngorms National Park and is an important site for ancient Caledonian pine trees, and species such as capercaillie and crested tit. Abernethy has suffered deforestation over the centuries, sheep and deer continued browsing preventing new tree growth, and blocks of commercial conifer plantations have been sown. RSPB has a 200-year vision to expand the forest to its natural limits, including the recovery of rare montane scrub habitats, and to restructure plantation forests into a more natural old Caledonian Forest. The aim is to achieve this without fencing, so deer numbers can be maintained at a level the land can sustain. Broadleaved species have all disappeared from the edge of the existing forest (birch, aspen, alder and willow).
- Insh Marshes – Also managed by the RSPB, it covers 1,000 haof the River Spey floodplain between Kingussie and Kincraig in Badenoch and Strathspey. It is one of the most important wetlands of Europe, supporting populations of breeding waders including curlew, lapwing, redshank and snipe. The historical attempts to drain some of Insh Marshes and the decline of grazing in the area has allowed the open floodplain habitat to deteriorate, with too much encroaching of willow scrub and rank grassland. Natural regeneration of semi-natural woodland is encouraged, and there is also collaboration with farmers to restore sustainable grazing by sheep, cattle and ponies.
- Invereshie and Inshriach National Nature Reserve - lies on the western edge of the Cairngorms mountains, 10km southwest of Aviemore. Invereshie was once part of a much larger Cairngorms NNR. In 2007, along with part of the adjacent Inshriach Forest, it was declared as a new NNR. The Reserve is owned and managed in partnership by NatureScot and Forestry and Land Scotland (FLS). It has been designated for its wildlife interest at UK and European level. It forms part of the larger Cairngorms Site of Specific Scientific Interest (SSSI), Cairngorms Special Area of Conservation (SAC), River Spey SAC, and Cairngorms Special Protection Area (SPA). Historically, the land had been used for timber production during the first and second World Wars. Sports hunting was popular in the area, leading to muirburn, and winter deer feeding to increase the grouse population which has also led to a reduction in natural regeneration of the native woodland.
- Glen Feshie - managed by Wildland Limited, a private body owned by the Danish multi-billionaire and rewilding enthusiast Anders Povlsen.

Level of ambition in restoration/rewilding

Cairngorms Connect is not a rewilding project that plans to take a lead on the reintroduction of large predators. It is a rewilding project in that its focus is on the restoration of habitats and natural processes. The project focuses on three main themes: sequestering carbon, restoring nature and building resilience to climate change.

Specifically, the project aims to deliver habitat restoration in three main areas:

- through restoring woodlands to a natural state, through improving structural diversity, removing non-native species, expanding forest to natural limits (there is potential to double the forest area including high altitude woodland).
- restoring peatlands across approximately 10,000 ha, many of which have been drained and planted with commercial forestry.
- restore rivers and wetlands in order to enable natural processes within river systems and floodplains.

The project also aims to enhance understanding of the initiative amongst the local community and offer opportunities to engage local communities and visitors with the landscape to ensure awareness of the importance of nature (economically, culturally, through ecosystem services – what it means for flood risk, water quality, and businesses). The project aims to align with the Scottish Government's objective to enable people to participate in making decisions regarding land management which may directly affect them. Scottish Land Commission has produced guidance (Scottish Land Commission, 2021), which is followed, and Cairngorms Connect is currently working on a 60-year vision for people.

This project is focused on enabling things to happen to support the partners' aims. The partners have good track records with restoration work already, and therefore the partnership assists with getting funding (e.g. ELP). Such collaboration is also more beneficial improving contract value for money through packaging of works for contractors, and also for marketing of project successes. As a partnership, the team can interpret what is happening on a much larger scale and collaboratively promote their message with greater influence.

Each landowner has their own land management plan with a unifying management intent across the four landowners. One aim is to bring all four plans together so that they sit together cohesively and improve understanding across the whole area. Individual sites will retain their own plans but there will be a greater understanding of the work being achieved, and focus for identifying areas where the forest can expand.

Vision and objectives

By 2216:

- Cairngorms Connects' woodland habitats are the best examples in NW Europe of an oceanic boreal forest.
- The forest has extended well towards its natural altitudinal limit, including montane woodland achieved principally by natural regeneration in the presence of grazing animals.
- Woodlands including some plantations have a high degree of naturalness, with structural variety and high deadwood content.
- Wetlands have water tables at near-natural levels. Features of more-natural floodplains and river systems are well established.

- Peatlands have recovered and there are no longer extensive areas of ‘hagging’ - the blanket bog is actively building.
- The vast area covered by the partnership is internationally recognised as a success in landscape–scale restoration.
- Its value for rare and diverse wildlife, spectacular landscapes, sustainable recreation, and for delivering a wealth of well-understood ecosystem services is appreciated by many of those who live near, work in, and visit the Cairngorms Connect partnership area.
- For those willing to take a sustainable approach to agriculture, silviculture and deer management, there are opportunities to make a modest living from the land – through small-scale, low intensity farming and forestry enterprises.

Aims

The project will:

- Reduce deer damage across the entire 60,000 ha project area.
- Restore woodland habitats and processes, including removal of non-native conifers from nearly 7,000 ha of forest and restructuring of over 1,700 ha of Scots pine plantation.
- Restore key peatland habitats – 400 ha of blanket bog and 900 ha of bog woodland.
- Restore natural hydrological processes over 1,000 ha of floodplain.
- Significantly contribute to and enhance the livelihoods and wellbeing of local people, through direct employment, contracting local services, creating apprenticeships and enhancing ecosystem services for local communities.

Environmental and ecological benefits

Environmental and ecological benefits of the project include:

- Restoring watercourses and floodplains to a more natural state by removing drainage such as ditches, channels, floodbanks and obstructions, allowing accumulation of woody materials in watercourses, allowing water to flood naturally within the project area;
- Enhancing native woodlands (managing herbivore impact, eradicating non-native trees, enrichment of tree species);
- Restructuring Scots pine plantations;
- Restoring bog woodlands;
- Restoring blanket bogs;
- Managing deer populations to enable recovery of damaged habitats;
- Expanding native woodlands to their natural limit;
- Restoring high altitude woodlands and montane scrub.

Controlling deer populations is a fundamental intervention for achieving the aims of the project. Deer management is undertaken using a threefold approach that consists of managing deer within the forest, managing deer at the forest edge where there is the best potential for natural woodland regeneration, and control of deer in more remote locations.

Deer control is achieved through in-house deer management with stalking undertaken by either staff or contractors (most significant element of deer control); commercial stalking (although this rarely occurs, if at all); and allowing third parties on a ‘no pay no fee’ basis to shoot in a particular area under strict guidelines. The latter helps reduce deer numbers by incentivising the stalker to complete their quota to benefit from the sale of the carcass.

So far, the biggest challenge has been where neighbouring estates are impacted by the level of deer reduction where they maintain a stalking interest on their own land. The reduction in deer numbers has led to some neighbouring estates changing their focus from stalking to woodland management, as the only other options would be to fence off their land to retain deer which is costly and largely undesirable.

There are a number of elements used for monitoring which primarily look at deer and habitat condition:

- Helicopter and on-foot counts on open ground (NatureScot undertook the last count around 6 years ago which showed low numbers against other areas in the National Park). This does not include deer in forest areas which is much more difficult to include).
- Deer dung counts, however, there are differing views over its accuracy.
- Transect counts which are prohibitively expensive and time consuming.

The partnership is still in the process of identifying the best approach to counting deer effectively. The most important indicator of appropriate numbers of deer is how woodland is regenerating. However it should be noted that deer management is not just about woodland expansion but also about reducing browsing impact on bogs, and moorland. Woodland monitoring is undertaken through:

- Sample plots to get a sense of age and species diversity.
- A remote sensing project funded by ELP which is looking at how to track tree regeneration over decades using satellite imagery.
- Browsing damage through fixed monitoring points – looking at where leaders on trees have been browsed out. At Abernethy, for the last 10-12 years the proportion of browsed leaders on Scots pine is less than 5% so here deer control has been largely successful so far.

The future impacts of climate change are reflected in the need to expand habitats as a response to and resilience action against climate change. This includes increasing habitat to reduce the overall impact of increased fire risk, and expanding habitat into areas at higher elevations.

Social benefits

Cairngorms Connect brings benefits to local people by creating wilder places, richer wildlife, and opportunities for access. Additionally, the project offers opportunities to volunteer and deliver paid contract work. Partners in the project also undertake

apprenticeships.

In terms of measuring socio-economic impacts in the Cairngorms Connect area, there have been three indicators established which include: public attitudes to restoration, public empowerment and influence, and an economic indicator. For the public attitudes, the partnership measures (using interviews) the proportion of respondents who indicate preferences for restoration activities and/or scenes of restored habitat to see how understanding of the project and acceptance of the benefits of restoration are growing in the community. To aid public empowerment, Cairngorms Connect is aware that stakeholder engagement can become a one-way process and tries to minimise this by informing the public of the restrictions around the project whilst asking for feedback and suggestions in areas where there is flexibility (for example, visitor management and access). The economic indicator is used to measure the direct and additional economic impact of the Cairngorms Connect project on the economy of the local area. The real market economic impact can be measured in terms of jobs and value added to the local economy. These indicators are vital to demonstrate the benefits of conservation initiatives to local communities to gain support and understanding (Dobson F., 2020).

Cairngorms Connect have designed three types of apprenticeship/traineeship programmes. These include Restoration Ecology, Restoration in Practice, and Communicating Restoration. Depending on the interests and aptitudes of the candidates, it may be possible to develop a multi-disciplinary apprenticeship, with an opportunity to experience all three of these work areas. The partnership is also in the process of scoping a Youth Panel for the project as the partnership is inspired by the Welsh Government's vision for 'the wellbeing of future generations' (Dobson F., 2020). Volunteering opportunities are also a key element of the project.

Economic impacts

The project brings economic benefits through land management jobs, and the apprenticeship programmes. The impacts of deer management on other economic activities include the impacts of reduced deer numbers within the project area on neighbouring estates, and their stalking activities. There are direct and wider employment opportunities associated with ecotourism from the project and the recreational opportunities. Within the project area, the RSPB centre at Abernethy provides employment and revenue and there is also revenue from timber and venison sales. A study of socioeconomic impacts within environmental NGO owned and managed land in Scotland (UHI, 2013) stated that RSPB Abernethy directly employs over 20 people (12.2 FTEs), supports a range of local employment with an estimated 69 jobs created locally associated with visitors to the reserve, and local spend by visitors is around £790,000. The report highlighted that the site is one of several well-known and heavily visited sites where LSNR (in this case native woodland restoration) is taking place in areas of existing high biodiversity value.

Key barriers and opportunities

There have been some challenges with bringing local communities on board with the aims of the project. All partners to varying degrees have a track record of engaging with local communities, however at times it is difficult to bring a community on board. Modes of community engagement include open meetings, drop-in sessions, formal consultations, meetings with particular interest groups, outdoor activities. Drop-ins allow for discussions with a smaller number of people whereas large meetings can be dominated by a small number of louder voices. There are some good examples of successful engagement at Abernethy, where the RSPB has held open days with volunteers running tea mornings to meet staff and then have a tour around the reserve. This approach was quite successful as there were 50 people from the local community that wanted to know more about what was happening. Regular communication of project achievements is also helpful (Dobson F., 2020).

There are some challenges related with accessibility of funding. For example, government bodies such as NatureScot and Forestry and Land Scotland are not eligible for agri-environment schemes and Scottish Forestry grands. There is little funding available for floodplain and river restoration, even though it is such an important area for climate change adaptation. There is some funding available for deer control, however they come with expectations that the project will deliver tree recovery at a particular density within a particular timeframe. This has proven to be difficult especially in remote locations and high altitudes, particularly where there is poor seed source. The fixed timeframes of the ELP funding has presented a challenge with the capacity to spend the money in time. The pace and scale of delivery for the project has been rather overwhelming for the delivery manager. As a learning point for the future, it was noted that there is a need for greater support for delivery of work when there is a big budget to spend.

There is a need for incentives that encourage (or are scaled to favour) the removal of barriers to restoration: reward work at a big scale; reward connected holdings, where land is contiguous and management creates a seamless landscape for wildlife; reward long-term commitment (funding programmes for 3-5 years are less effective than those that secure commitment for 20-30 years); support effort to bring together and cement long term partnerships; and establish a strong and inspiring vision that captures hearts and minds across generations. Importantly, local communities must be informed and included in the conversation.

Partnership and funding

Cairngorms Connect is part funded by the Endangered Landscapes Programme (ELP), which is subsidised by Arcadia, a charitable fund, and is managed by the Cambridge Conservation Initiative. The project is delivered by a partnership of neighbouring land managers including RSPB, Wildland, Forestry and Land Scotland and NatureScot, providing contiguous landownership across the project area. The partnership is separate from the Cairngorms National Park Authority (CNPA), although the project area is entirely within the National Park. The objectives are aligned with those of the CNPA, and the

partnership works closely with the Park staff to help inform delivery on the ground. Other key partners include governmental bodies, universities and NGOs who provide support and advice.

Cairngorms Connect are looking to explore alternative models of funding such as carbon credits and Payment for Ecosystem Services. However, the project is more interested in developing a range of work with various funding mechanisms, rather than just funding for carbon sequestration. It is important that criteria are developed in order to ensure robust outcomes from any offsetting schemes for biodiversity and genuine climate change mitigation, and to avoid incentivising perverse outcomes. Besides, there is the concept of 'charismatic carbon' which is becoming more popular, in which a company does not simply buy the carbon credit, but also buys into another aspect of the project they are supporting, e.g. significant ambitions for biodiversity or for the benefits a community gains from their environment. It may be that projects such as Cairngorms Connect will be able secure a premium because companies wish to be associated with the scale, character and biodiversity benefits of the project (Dobson F., 2020).

Forsinard Flows

Case study summary

Located in Caithness and Sutherland, the project comprises the RSPB-owned Forsinard Flows National Nature Reserve. Forsinard Flows is part of a vast expanse of blanket bog, which makes up almost 5% of the world's blanket bog and is one of the world's rarest habitats. The nationally and internationally important peatlands cover 400,000 ha of the area: together with associated areas of moorland and open water, they are designated as SSSI and Special Protection Areas (SPA) and Special Areas of Conservation (SAC).

There has been a long history of peatland restoration at Forsinard by the RSPB since 1993. However, this case study explores the Flows to the Future project which ran from 2013-2018.

The main aims/vision of the project included:

- Restore areas of blanket bog that have been damaged by non-native forestry planting and drainage for agriculture by removing forestry blocks, crushing brash, blocking furrows and drain blocking.
- To protect adjacent designated sites, biodiversity and carbon stores.

The key issues/opportunities included:

- Deer management.
- Non-native woodland regeneration from adjacent plantations.
- Overcoming barriers to effective team working, ensuring buy-in from all staff.
- Operational delivery constraints on lorry volume using roads (council restriction).
- Community opposition to the new field centre although continued community events and engagement helped to overcome this issue.

- Question over the legacy - loss of staff after the project means there has been less community engagement and knowledge sharing (that had been successful during the project lifetime).
- Ongoing peatland restoration efforts via an annual grant of £0.5 million and RSPB hopes to secure longer-term funding agreement through the Scottish government.

Partnership models/funding:

> Delivered by the Peatlands Partnership, led by RSPB Scotland, and predominantly funded by the National Lottery Heritage Lottery Fund (HLF). The project also involved many other organisations and supporters.

Administrative and socio-economic context

Forsinard Flows is located in Caithness and Sutherland, the northern part of the Scottish Highlands. The nearest settlement, Melvich, is located 20km north from Forsinard Flows while the nearest large town, Thurso, is 46km by road to the north east.

The site is in Highland Council area which covers a third of the land area of Scotland including the most remote and sparsely populated parts of the United Kingdom. The Highlands have the 7th highest population of the 32 authorities in Scotland (235,540) while having the lowest population density at 8 persons per km^2. This is lower in Caithness and Sutherland District at 5 persons per km^2. Since 1998, the population of the Highlands has increased by 13%, which is much higher than the Scotland-wide increase of 7%. There is an ageing population and those aged over 75 has increased dramatically (58%) over the 20-year period 1998 to 2018 (The Highland Council, n.d.).

A large extent of the Forsinard Flows reserve spans across four Highland wards, including the western part of North, West and Central Sutherland; the northern part of East Sutherland and Edderton ward; the western part of Wick and East Caithness ward; and, the southwest of Thurso and Northwest Caithness ward. Population data is summarised below (City Population, 2019).

-	Population 2011 (census data)	Population 2019 estimate	Area (km^2)	Density (people per km^2) based on 2019 population estimate	Working age population (%) based on 2011 census data	Over 65 (%) based on 2011 census data
North, West and Central Sutherland	6130	5830	4820	1.2	59	24

-	Population 2011 (census data)	Population 2019 estimate	Area (km^2)	Density (people per km^2) based on 2019 population estimate	Working age population (%) based on 2011 census data	Over 65 (%) based on 2011 census data
East Sutherland and Edderton	7630	7590	1466	5.2	56	26
Wick and East Caithness	13260	12860	1163	11.05	61	19
Thurso and Northwest Caithness	13230	12500	580	21.56	60	20

The population is not ethnically diverse, with 99.2-99.5% of the population identifying as white. English is the first language spoken by 95-97% of people.

Those of working age comprise around 60% of the total Highland population (Nomis, 2019). Of these, 88% are economically active, and for those economically inactive (12%) the predominant reason is long-term sickness (29%) followed by looking after family (20%) and retirement (19%). Most businesses are micro-businesses (>80%). The main industries are human health and social work (19%), wholesale and retail trade (14%), accommodation and food services (13%) and education (8%). Around 31% of jobs are on a part-time basis which is higher than the national average of 26% (based on 2015 annual population survey (Ekosgen and HIE, 2017)). The economies of Caithness and Sutherland are highly dependent on tourism, with 25% of employment being in the distribution, hotel, and restaurant sector. As a result, unemployment rates, which are above the average for the Highlands and Islands, show a strong seasonal pattern (Shiel A., Rayment M., and Burton G., 2002).

Landscape and land use context for the surrounding area

Forsinard Flows is part of a vast expanse of blanket bog which is a rare type of peatland that makes up almost 5% of the world's blanket bog and is one of the world's rarest habitats. Along with sheltered straths and mountains, this area is known as the Flow Country. The Flow Country includes Caithness and Sutherland and is one of Scotland's most important natural treasures. The nationally and internationally important peatlands

cover 400,000 ha of the area: together with associated areas of moorland and open water, they are designated as Sites of Special Scientific Significance (SSSI) and part of the European sites (Special Protection Areas and Special Areas of Conservation).

The area is known for its varied topography and vegetation. The bulk of the ground is open moorland which is dominated by blanket bog vegetation with many scattered bog pools and lochans, and is home to some of the UK's rarest breeding birds. These are the key reasons why RSPB manages the reserve. The landscape is scattered with areas of wet heath, classic *Calluna* heath (dry heath), acid and marshy grassland on better drained and more mineralised slopes and knollier ground within the peat flats. Forsinard also includes 70ha of inbye fields on Forsinain Farm. Riverside grasslands are present elsewhere on the reserve, along with scrubby woodland south of Forsinain Farm. The RSPB also owns several areas of non-native coniferous plantation within the area, on which they are removing the non-native trees and restoring them to their former bog/moorland status as part of their peatland restoration work. The purpose is to protect adjacent European sites, biodiversity and carbon stores. Overall, the landownership holds all or part of 13 SSSIs: within the main Forsinard/ Knockfin block this includes parts of both East and West Halladale SSSIs (and a very small corner of the adjacent Skelpick Peatlands SSSI); Forsinard Bogs; part of the Ben Griams SSSI; part of the Slethill Peatlands site; part of the Knockfin Heights SSSI and Rumsdale Peatlands SSSI (Putman R. J., 2018).

Some of the key environmental services provided by the Forsinard Flows area include:

- Carbon sequestration through peatlands;
- Water storage and water purification;
- A globally rare habitat including peatland vegetation and bog pools, although the reserve is diverse with varied topography and vegetation. The peat is interspersed with areas of wet heath, classic Calluna heath (dry heath), acid and marshy grassland on better drained and more mineralised slopes and knollier ground within the peat flats; and
- Many rare species including birds (red- and black- throated divers, common scoter) and otters.

Environmental baseline prior to the LSNR restoration

Scale: 21,000 ha

Type of project: Uplands/Peatland restoration

The environmental baseline prior to the project included areas of habitat value but often degraded as blanket bog vegetation with scattered bog pools and lochans, as well as large areas of land which had been subject to drainage to plant non-native forestry in the 1970s and 1980s o as well as land claimed for agriculture.

Level of ambition in restoration/rewilding

Flows to the Future was an ambitious project which aimed to restore 7 square miles of blanket bog in the heart of the Flow Country that had been damaged by non-native forestry planting and drainage for agriculture. Timber producing plantations cause damage by drying out peat, releasing stored carbon and losing special wildlife.

The project tested the relative effectiveness of leading approaches to ‘forest-to-bog’ peatland restoration in delivering key ecosystem services (biodiversity, carbon storage, and water quality). The approach comprised of removing forestry blocks, crushing brash and blocking furrows in areas where forestry has already been felled, and drain blocking. It compared the provision of the key ecosystem services provided in restored areas, with those provided by comparable areas which were never damaged by afforestation and those that remain as standing commercial forestry on deep peat.

The project also aimed to significantly increase the level of conservation management and promotional activities previously undertaken in the Flow Country. It aimed to promote and develop knowledge about the role of peat in carbon storage and involve and connect people everywhere with this precious habitat, delivering economic benefits for one of the least densely populated areas in Scotland.

Environmental and ecological benefits

Environmental and ecological benefits centre around carbon storage and climate change mitigation from peatland restoration, water quality and habitat restoration. Specific habitat benefits included re-establishing rarer wetland habitats for birds and other species including upland waders and birds of prey. Bird species such as dunlin, greenshank, black/red throated diver have also benefitted from the project.

In addition, the project enabled specific approaches to peatland restoration to be tested, a vital part of the learning process within a continually evolving field.

Social benefits

Social benefits include information sharing, education and learning, community engagement and employment, and includes:

- Hosting showcase days on the different techniques for peatland restoration.
- Increased volunteering opportunities alongside the provision of new volunteering accommodation (through the new Field Centre).
- Improved facilities for visitors including a new viewing tower (the Flows Lookout) and boardwalk on the Dubh-lochain Trail. Also, updated visitor information at the Field Centre along with improved interpretation along trails and at roadside points to enhance visitor experience.
- Establishment of a peatland science centre for education and research at the Field Centre, and collaboration with universities nationally and internationally to further research the role of peatlands as a carbon store and on the benefits of peatland restoration for biodiversity.

- Community learning opportunities for people across the Flow Country, including through a schools programme and community activities. This included outreach visits to schools, school visits to Forsinard and events such as walks, talks and workshops.
- Remote learning and awareness raising opportunities, e.g. through an interactive website, film, online landscape model of the Flow Country and carbon capture game.
- Community engagement through the arts including community arts commissions and a travelling exhibition about carbon and peatlands. The 'Below the Blanket' immersive art event held at the 2019 Edinburgh Festival demonstrated the powerful result of collaboration between artists and scientists to raise awareness of the globally important blanket bogs of The Flow Country and particularly their importance in addressing the climate crisis (The Flow Country, 2019). This was vital to share important work with the public and reach key decision makers.
- Employment during the project lifetime through provision of full-time jobs, although jobs were lost after funding ended.

Economic impacts

Economic benefits brought about by the project relate principally to employment, tourism and timber sales:

- The project intended to provide additional employment for local people including up to 26 full time equivalent (FTE) posts for the duration of the project and then 10.9 FTEs thereafter. This is important given 40% of workers in the Highlands are employed on a part-time basis. Posts created by the project included 5 direct posts as well as 5 summer contracts for field ecologists. Local contractors were involved with peatland restoration work due to their local experience as well as for the construction of the Field Centre and Lookout Tower. The interview highlighted that the intended retention of FTE posts has not been delivered.
- The project generated additional demand and opportunities for local services on completion of the Field Centre, and benefits for tourism. An estimated £4.3 million has been spent within Caithness and Sutherland businesses as a result of the project.
- Calculations anticipated Gross Value Added (the financial impact in addition to the initial investment cost) ranging from £740,000 in year 2 and stabilising to £190,000 in the year after the project itself finished. Over a 30-year period, the Gross Value Added across Caithness and Sutherland was estimated to be £6.3 million.
- Income from the sale of felled timber as part of restoring peatland habitats (The Flow Country, n.d.).

The project also funded an advisory service, which has enabled many land managers to secure funding for peatland restoration work.

Key barriers and opportunities

The key barriers included:

- Deer management and the impacts of wild grazing are an ongoing issue. RSPB put considerable effort into deer management given that it is one of the important factors influencing peatland habitat management. All stalking is leased to third parties. Culls are reduced where unwanted coniferous regeneration and aggressive grasses are a problem, but this requires careful management to assess deer impacts. Some removal of some deer fencing to re-instate natural deer movements and grazing patterns has helped to reduce deer impacts in some areas.
- Non-native woodland regeneration from adjacent plantations is an ongoing issue. The removal of which is both time-consuming and extremely costly to contract out.
- Operational delivery constraints on the lorry volume able to use roads due to council restrictions. This meant that felled timber was left on ground and lost quality quickly which reduced the potential income from its sale.
- Overcoming barriers to effective team working between the Peatlands Partnership project team and RSPB staff. This highlighted the importance of team working from the outset and ensuring the skills of staff are valued and utilised to their fullest.
- There was community opposition to the new Flows Lookout Tower and Field Centre over concerns that it would be an 'eyesore' and draw increased numbers of people into a remote and fragile area. This issue was largely overcome through approximately 3 years of continued engagement to engage the community through events, meetings and networking locally.

Key opportunities include:

- Ensuring there is a legacy to the project - loss of staff (e.g. Communities and Education Officers) after the project means there is now less community engagement and knowledge sharing (that had been successful during the project lifetime). It was felt to be very important to plan for legacy before the end of a project by seeking further funds to ensure continuity of beneficial work through smaller project(s), such as: continued community and educational role for organising community engagement and events; continued advisory role to help estate owners get into an agri-environment scheme and/or access Peatland Action funding; find a permanent 'home' for the travelling exhibition; maintain and update the project website; and, maintain the viewpoints and interpretation that were put in throughout the course of the project.
- Secure ongoing funding to maintain and enhance the benefits of restoration – There is an ongoing peatland restoration effort via an annual grant of £0.5 million and RSPB hopes to secure longer-term funding agreement through the Scottish government.

Partnership and funding

The £10.6 million project was delivered by the Peatlands Partnership, led by RSPB Scotland, and funded by Lottery players through the National Lottery Heritage Fund. The project also involved many other organisations and supporters. including Scottish Natural

Heritage (now NatureScot) Peatland Action, Forestry Commission Scotland, Highlands and Islands Enterprise, The Highland Council, WREN and Scottish Rural Development Programme. Further funding came from the sale of felled timber.

There are ongoing efforts by the RSPB to seek available funding to continue peatland restoration. Given the long history of successful restoration at the reserve, it is hoped that the RSPB can secure a 5-year programme of funding for peatland restoration from the Scottish Government to provide a funding source where a long-term project can be developed. This would enable better project planning and provide greater security for local contractors who are then able to make investments into necessary equipment.

Tweed Catchment

Case study summary

Tweed Forum is the umbrella organisation dedicated to integrated management of the Tweed and its tributaries. It initially formed in 1991 as an informal liaison group in recognition of the cross-border nature of the Tweed catchment and the clear need for better coordination. In 1999, it was able to employ a dedicated team of staff due to the support of key members and, importantly, the Heritage Lottery Fund. The support from the latter lasted 7 years and was linked to the Forum delivering the £9 million Tweed Rivers Heritage Project.

The Forum has earnt a reputation as an exemplar partnership approach to managing land and water in a holistic and strategic way. The Forum has built up a track record for delivering action on the ground, as well as promoting the way partners can work together in an efficient, innovative and cost-effective way. Increasingly, the Forum is inputting to the national policy arena and helping raise awareness of the project at a national level.

The River Tweed is a major economic and environmental resource, playing a vital role in the landscape, offering tourism, wildlife, water supply and recreation. There is a predominance of arable agriculture in the lower catchment, with hill farming and forestry in the upper catchment. The condition of the catchment has been affected by drainage, habitat loss, agricultural intensification, development, and invasive species.

Today, management is guided by the Tweed Catchment Management Plan (TCMP), a complex and ambitious strategic document that synthesises the 25 members' aspirations with regards to the river into one cohesive vision and plan of action.

Members: Tweed Forum is an umbrella organisation and membership is open to those with a legitimate interest in the river and its management. It currently has 25 members, drawn from statutory, private and voluntary sectors.

Area of operation: Tweed Forum's work is focused on the Tweed catchment, which covers an area of over 5000 square kilometres with just under 20% of the catchment lying in North Northumberland. The fact that the Tweed is a cross border river is one of the main drivers for the Forum – to ensure that two differing legal, fiscal and administrative systems

meet effectively in the middle to achieve an integrated approach. Over the last decade, the Forum has developed a strong track record and performance in delivery and adding value in the field of integrated catchment management. Testament to this is the fact that SEPA and the EA utilise existing Forum structures to reach stakeholders under their River Basin Planning duties, as well as the local Flood Liaison Advisory Group (under the Flood Risk Management Act). They were also selected to be an exemplar of best practice under the UNESCO HELP programme (Hydrology for the Environment, Life and Policy).

The main aims/vision of the project include:

- To work in partnership with member organisations, stakeholders and local landowners to protect, enhance and restore the natural, built and cultural heritage of the River Tweed and its tributaries.
- To work at both the strategic and project level to deliver integrated land and water management measures throughout the catchment.
- Communicating and promoting collective aims.

The key issues/opportunities include:

- Landowner engagement can be a challenge. This often includes overcoming deep rooted attitudes to land management.
- Facilitating projects which include multiple stakeholders, promoting integration, coordination and cooperation.
- Seeking out funding opportunities and filling in gaps.
- Overcoming administrative barriers to deliver works on the ground.
- The importance of local knowledge of natural assets and also, crucially, local social context is central to the successful delivery of projects by the Forum.

Partnership models/funding:

- Tweed Forum is a company limited by guarantee and a charitable trust.
- The Catchment Management Plan has been developed by the Tweed Forum, a partnership of 25 organisations, including the Scottish Borders Council, Scottish Environment Protection Agency and NatureScot (Scottish Natural Heritage).

Administrative and socio-economic context

The Tweed Catchment straddles the national and administrative border between Northumberland (England) and the Scottish Borders (Scotland). A population of around 130,000 lives within the catchment area. The main industries supporting local jobs and the economy are tourism, farming (sheep and cereals), salmon fishing, rugby and Tweed woollens. Employment is partly dependent on tourism and recreation.

The value of the River Tweed for tourism and recreation has become increasingly significant, forming a vital part of the area's economy and supporting the health and wellbeing of local communities. The area is renowned internationally for salmon fishing, with other opportunities for recreation including cycling, mountain biking, canoeing,

walking, access to reservoirs for water recreation and education, horse riding, canoeing, as well as a wealth of heritage sites. A survey in 2015 found the value of recreational fishing to the local economy to be £24 million, providing 513 (FTE) jobs (Tweed Forum, 2021b). Tourism within the Tweed catchment could be further expanded, as often this region is overlooked with most tourists heading straight to the Highlands.

Landscape and land use context for the surrounding area

The Tweed Forum's work is focused on the Tweed catchment, which largely follows the Scottish Borders Council region. The River Tweed is 160 km long and the second largest river basin in Scotland (and 6th largest in Britain) and covers 5000km^2. It is bounded to the north and west by the Lammermoor and Moorfoot Hills, and to the south by the Cheviots, which form part of Northumberland National Park.

The Borders are noted for their diverse and traditional landscapes. The upland areas are characterised by rounded hills with steep valleys, or cleuchs, eroded into their sides. The uplands eventually give way to the more open, rolling lowlands to the east, featuring flatter, more fertile land. These habitats have helped sustain a rich variety of species. The River Tweed and its major tributaries are designated as both a SSSI and SAC (Tweed Forum, 2021a).

The south of the Tweed catchment within the English border is part of the Cheviot Fringe NCA (Natural England, 2013). Through this landscape, the River Tweed transitions through three distinct habitat types:

- The fast-flowing, nutrient poor, upper reaches above Peebles;
- The more moderately flowing, slightly richer in nutrients, middle section between Peebles and Kelso;
- The deep, slow flowing, more nutrient rich stretches, found below the confluence of the Teviot Water and River Tweed at Kelso.

The upper stretches of the Tweed are characterised by lower-intensity extensive land use, mostly sheep grazing, heather moorland and significant coniferous forestry. Through the middle reaches, the shifting geology affects the surrounding land use bringing with it more intensive pastoral land use, although forestry remains a significant land use in the upper part of this section. In the lower reaches, the river becomes much deeper and slower flowing. Here, the Tweed lies in the bottom of a broad, low-lying intensively farmed river valley.

Key ecosystem services provided by the River Tweed include:

- Cultural services such as recreation, tourism, aesthetic value, education, cultural heritage;
- Environmental services such as flood control, carbon storage, water purification and nutrient removal;
- Provisioning services such as food and water supply.

To protect the special qualities and unique character of the River Tweed and ensure the range of ecosystem services are sustained, a balance must be achieved between the conflicting demands of agriculture, tourism, recreation and development. The Tweed Catchment Management Plan (TCMP) was first published in 2003, and was reviewed and updated in 2006, 2010 and 2015 to reflect relevant changes and development, and to evaluate the delivery of actions. The current TCMP runs for the period 2015-2021 (Tweed Forum, 2015).

The TCMP provides a management framework to deliver the aims of the Tweed Forum. The seven strategic aims cover water quality, water quantity, habitats and species, river works, flood management, tourism and recreation, and TCMP delivery and development. The Tweed Forum delivers a wide range of projects, from small-scale local tree planting schemes to ambitious whole catchment restoration initiatives. With a focus on ensuring the right projects are delivered in the right place and at the right scale, the Forum delivers lasting, practical measures that achieve multiple benefits for the environment and society.

Environmental baseline prior to the LSNR restoration (Tweed Forum, 2015)

Scale: 5,000km^2

Type of project: River restoration and catchment management (from uplands to lowlands)

The Tweed is one of the least polluted rivers in the UK and is a nationally important example of an easterly flowing eutrophic (nutrient-rich) river system. Average rainfall decreases markedly from west to east. Around its source in the Tweedsmuir Hills, average rainfall is 2000mm per annum, whilst around the lower reaches on the Merse of Berwickshire, average rainfall is 650mm per annum. Flow rates vary considerably; on the lower Tweed the average is 78 cubic metres per second but this can vary dramatically between just 10 cubic metres during periods of low flow and exceeding 1500 cubic metres per second during periods of high flow.

The catchment is home to a variety of important species including otter and many breeding and overwintering birds especially mute swans (4% of British population), goldeneye, dipper, grey wagtail, common sandpiper, oystercatcher, black-headed gull and mallard.

The condition of the catchment has been affected by drainage, habitat loss, agricultural intensification, development, and invasive species (Restoring Europe’s Rivers, n.d.). The presence of invasive non-native species poses a threat to naturally occurring plants and animals. The Tweed Biosecurity Plan aims to reduce the threat of species such as giant hogweed, Japanese knotweed, Himalayan balsam, American skunk cabbage, monkey flower, rhododendron species, Australian swamp stonecrop, curly waterweed, Canadian pondweed, Nuttall’s pondweed, bullhead, American signal crayfish and American mink.

Key challenges for the Scottish Borders from climate change include:

- Reductions in river flows and water availability during the summer

- Increased risk to agriculture and forestry from pests and diseases
- Increase in flooding which could affect properties, infrastructure and people
- Changes in, or loss of, species and habitats; and
- Increased disruption from extreme weather events.

Level of ambition in restoration/rewilding

Working at a catchment-scale, the ambition of restoration by the Forum is large-scale. It currently has 25 members, drawn from statutory, private and voluntary sectors, including:

- Borders Angling Federation
- Borders Forest Trust
- Department of the Environment, Food and Rural Affairs
- Environment Agency
- Forest & Land Scotland
- National Farmers Union Scotland
- Natural England
- Northumberland County Council
- Northumberland National Park Authority
- Northumbrian Water
- Northumberland Wildlife Trust
- Royal Society for the Protection of Birds
- River Tweed Commission
- Scotland's Rural College
- Scottish Borders Council
- Scottish Environment Protection Agency
- Scottish Forestry
- Scottish Government
- Scottish Natural Heritage
- Scottish Land & Estates
- Southern Uplands Partnership
- Scottish Water
- Scottish Wildlife Trust
- Tweed Foundation
- Visit Scotland Borders

In close partnership with its members, Tweed Forum staff work to protect, enhance and restore the rich natural, built and cultural heritage of the River Tweed and its tributaries. The Tweed Forum achieves its aims by working at both the policy level (influencing legislation and working practices) and project level (delivery of physical outputs on the ground). It complements and adds value to the work of its members through:

- Facilitating and Enabling
    - mediator/honest broker – defusing potential conflicts
    - promoting integration, coordination and cooperation
    - pooling resources and secure funding

- Seizing Opportunities
    - funding
    - forming partnerships
- Filling Gaps
    - encouraging others to action, or
    - taking direct action
- Communicating and raising awareness
    - improving flow of information
    - articulating and promoting collective aims and objectives

Since the Tweed Forum's inception as an informal liaison group, the Forum has grown to become a leader in the field of integrated land and water management. It is a UNESCO Demonstration Catchment and in 2015, the Tweed Forum was awarded the inaugural UK Rivers Prize. In 2017, the Forum was further recognised by being awarded second place in the Thiess International River Prize. The Tweed made it through to the final four in recognition of the unique partnership approach developed by the Tweed Forum in order to protect and conserve the natural, built and cultural heritage of the river and its 5000km^2 catchment.

In addition, the impact of the Tweed Forum has also reached beyond its 'core work' and has helped to deliver a large number of diverse projects, many of which would not have happened without the Forum. Some recent projects include: Tweed Invasives Project, Wetland Filtration Systems, Ponds for Biodiversity, Great Crested Newt Ponds, Craik Natural Flood Management Project, Till Floodplain Restoration Project, Till Wetland Project, Wetland Vision Project, Tweed Water Vole Initiative, Tweed Aerial Survey and Habitat Mapping, Cheviot Futures, Coldingham Priory and Community Garden, Fatlips Castle, Ale Wetlands Project, Eddleston Water Restoration Project and Bowmont-Glen Flood Risk Management.

Environmental and Ecological benefits

The projects undertaken through the Forum provide a range of environmental and ecological benefits:

- Identification and agreement, across a broad range of stakeholders, of priority issues within the catchment, with accompanying strategic delivery of practical measures and projects to deal with those issues including loss of habitats and biodiversity, diffuse pollution control, natural flood management etc.
- Leading the way in catchment scale control of invasive plant species at a UK level. Being able to work at scale is required to make a meaningful impact on this issue and that is something the Forum is able to achieve.
- Coordinating and developing two of the first Natural Flood Management demonstration sites in Scotland (Craik and Eddleston) with the Bowmont-Glen project also championing this approach.
- Demonstrating the widespread application of the wetland filtration systems approach to controlling diffuse pollution.

- Employing a facilitator to ensure that the SRDP environmental measures pertaining to water management are rolled out in a collaborative way and, crucially, ensuring that the right measures are taken up in the right places at the right scale.
- Selected as one of 2 pilots in Scotland to test the application of the Land Use Strategy using an ecosystem services approach to natural asset management.
- Delivered a framework and pragmatic mapping tool that could help inform better land management decisions and underpin agri-environment support of the future.

In recent years, the Forum has achieved:

- 1.25 million trees planted (1262 ha);
- 355 ponds, scrapes and wetlands restored;
- 300 km of river enhanced including re-meandering in places;
- 4599 ha of peatland restored;
- 321 km stock exclusion fencing;
- Over 400 ha of floodplain and wetland restored;
- 216 engineered log jam structures installed;
- Over 20 listed buildings and monuments restored (23 in total);
- 1923 km of paths upgraded/created;
- 105 interpretation boards; and
- 31,789 people engaged in over 1200 events (talks, conferences, agricultural shows, etc.)

Social benefits

Social benefits range from specific infrastructure to education and knowledge exchange. These benefits have been achieved through:

- Identification and agreement, across a broad range of stakeholders, of priority issues within the catchment, with accompanying strategic delivery of practical measures and projects to deal with those issues including loss of habitats and biodiversity, diffuse pollution control, natural flood management etc.
- The servicing of working groups - such as the Riverworks Group - to help ensure streamlined regulation between agencies, on both sides of the border.
- Inputting at a policy level to key policy consultations as well as contributing to national steering/working groups in key catchment management areas.
- Ensuring integration of TCMP with other planning processes through inputting to the LBAP, River Basin Planning (WFD), Flood Risk Management Planning, Community Planning (A Working Countryside), Land Use Strategy.
- Focusing on work that delivers multiple benefits on multiple strategic fronts (i.e. fulfilling targets under the Habitats, Water Framework and Floods Directive) and championing the ecosystem services philosophy.
- Assisting SEPA and the EA in engaging stakeholders in the River Basin Planning process through co-delivery of the Tweed AAG.
- Communications with all stakeholders from small communities through to Ministerial level.

- Establishing a trading arm of the Forum to enable consultancy work to take place outside our immediate remit and thus raise funds to help ensure the continuation of the Forum.
- Education – with schools, colleges, local interest groups etc.
- Training – with Training colleges (Scotland's Rural College), NatureScot, RRC etc.; on-site best practice
- Awareness raising – Agricultural shows, newsletters, press, conferences, talks etc.
- Research – strong portfolio of co-operative research partnerships delivering innovative solutions and impact across a range of topics, and ecosystem services.
- Science into Policy – with statutory agencies and policy makers to improve the legislation, providing the evidence and test-bed for the acceptability and applicability of new initiatives environmentally, economically and socially.
- Community engagement through village hall meetings and one-to-one meetings.

Economic impacts

- Tweed Forum has brought in a range of funding that has supported management of the catchment. Economic achievements and gains include: the development and delivery of the £9 million Tweed Rivers Heritage Project on time, to budget and to standard (underspend of £2,144 or 0.00023%). This is still considered a blueprint for partnership working at the landscape scale by the National Lottery Heritage Fund.
- Focusing on work that delivers multiple benefits on multiple strategic fronts (i.e. fulfilling targets under the Habitats, Water Framework and Floods Directive) and championing the ecosystem services philosophy.
- Establishing a trading arm of the Forum to enable consultancy work to take place outside our immediate remit and thus raise funds to help ensure the continuation of the Forum.
- Facilitating and sourcing funding for a wide range of projects and crucially, multiplying contributions to achieve significant gearing and leverage. This is one of the most compulsive arguments/justifications for the Forum approach. For example, over the last few years for every pound that SEPA contributed to the Forum a further, £13 was added in terms of work (physical restoration, communication, education, research etc.) that fulfils their strategic aims. Likewise with NatureScot (formerly SNH), the gearing is 14 to 1.
- Established and running the Fallago Environment Fund that gives grants (up to £200k per annum) to protect and enhance the natural built and cultural heritage. Over £1.2 million were donated to 66 projects amounting to some £13.8 million.
- Ensuring a joined-up approach and efficient use of available resources to maximise 'bang for buck'.
- Employing local people to implement projects from design, modelling, implementing – there is usually a large number of people involved which is outsourced.

- The Forum secured £20 million of funding in 2020 for a new Destination Tweed project, 50% of which will be funded through the Borderlands Growth Deal. The project is geared towards tourism but will also deliver habitat and education improvements too. It is anticipated that the project will deliver a significant increase in economic activity based on a natural asset.

Key barriers and opportunities

The main challenges have been in engaging and persuading landowners and farmers to change the way they manage the land. The older generation were paid to canalise rivers and streams, and drain wetlands, and now the Forum are requesting they do the opposite. Therefore, changing attitudes and understanding is a long-term process.

The challenges of raising and securing financial support are constant. The Forum currently use a number of different sources with a 'blended finance' approach. The bureaucracy of funding applications and administering grants is also a challenge as it occupies a significant proportion of staff time and resource. Legislation in terms of consenting processes has also increased in recent years with even relatively simple projects challenging to implement due to the need for planning consent, SEPA or EA consent, etc.

Security over funding has declined in recent years, as funding agreements used to be longer-term. This has an impact on job security for staff and longer-term planning.

The regional value of the Tweed Forum has been significant as it has become a trusted intermediary. The Forum can only do things through good will, persuasion, education and enthusiasm. It has the experience to integrate restoration measures without impinging on the farm business, whilst cutting through paperwork and managing work on the ground.

Local knowledge amongst staff is key, both for understanding natural assets and also, crucially, the social context to understand who owns what and where opportunities might lie.

During the interview, it was also highlighted that Tweed Forum's achievements were possible thanks to the staff who have been engaged in the project for a long time. Building a team of personable staff that can 'speak the language' of the land managers and understand the economics of topics such as farming, forestry and fisheries enables relationships of trust to be developed with the community, landowners and local organisations. Having an honest broker or trusted intermediary who is not regulatory or statutory is beneficial to help enact change through good will, persuasion, education and enthusiasm. Staff retention is also important to maintain these important relationships as change, particularly in regard to changing attitudes to land management, is a gradual process over time.

Early engagement and information sharing is vital – and helps dissipate any opposition. The decline in traditional sheep farming, and influx of Sitka forestry means that there is a growing tension over land use in the area where forestry is replacing agriculture. The goal

is to get a balance of land uses and deliver something for landowner and for society and environment.

Working at scale can be both highly beneficial as it creates largescale impact, but also a challenge as projects can often involve several landowners. This was the case for the re-meandering at Cringletie and Lake Wood which involved six separate landowners and the river as a property boundary. Altering the route of a physical entity such as a river that acts as a property boundary requires a practical approach that can be proofed by local experts who know the land and understand the local issues for land management. Again, the importance of building relationships of trust with local landowners in delivering this type of project cannot be over-stated.

Partnership models

The Tweed Forum is an example of a successful partnership model involving many partners. The Catchment Management Plan was produced in response to increasing pressures and demands from a wide range of activities such as agriculture, tourism, recreation and development. A single management framework was required to deal with the many interacting and interdependent environmental resources in the catchment in order to preserve the special qualities and unique character of the Tweed.

In the late 1990s, the Forum led on a big Landscape Partnership bid which was the first of its type that looked at large-scale area-based schemes. The project consisted of over 50 initiatives involving an extremely diverse range of partners and was developed over two phases with Phase I beginning in 1999, amounting to £4 million, and Phase II starting in 2002 with a spend of £5 million. The £9 million total spend was largely funded by the Heritage Lottery Fund (45%) with the remaining match funding coming from a wide range of sources (including support from NGOs, government grants and BNG). The project championed a truly partnership approach due to the fact that all stakeholders were involved, and all areas of the rivers' rich heritage were addressed. As such it was seen at a national level as a blueprint for holistic and integrated catchment management (Tweed Forum, 2021).

The initial investment from the Lottery meant the Forum received 70% of its core funding in its early days which helped the Forum to get established. However, when this funding ended, there was a period of adjustment. The Forum has continued to grow due to its relevancy to its membership. It has built a reputation for getting things done which has inspired confidence from its members, the community and funding bodies.

Key members like NatureScot and SEPA, use the Forum as a delivery mechanism to meet their own objectives as the Tweed Forum is 'light on its feet' and can implement projects more quickly.

The Northern Upland Chain Local Nature Partnership

Case study summary

The Northern Upland Chain Local Nature Partnership (LNP) was set up in 2012 and includes over 50 key organisations. It spans a huge area of land (over a million hectares) across the Pennine uplands including the protected landscapes of Northumberland and Yorkshire Dales National Park, areas of Kielder and the Tyne Gap as well as North Pennines, Nidderdale and Forest of Bowland AONBs. The area is rural in character, there is a legacy of mining and agriculture, and most of the land is used today for traditional upland farming (of sheep and some beef). The area is characterised by semi-natural wildlife habitats of which around 180,000 hectares have been designated for national and international importance.

The main aims/vision of the partnership, and the projects which are delivered through key partners, include:

- To plan and deliver strategic environmental action enabling the recognition of the value of biodiversity in social and economic as well as environmental terms.
- To help to create a place where special natural qualities, including breeding wading birds, blanket bogs, hay meadows, tumbling rivers and upland woodlands, are valued for their beauty, and for their contribution to the nation's economic, physical and spiritual well-being.
- To support a living and working upland landscape, a place where an environment-based economy thrives and where development and growth take place in balance with the conservation of the natural world on which they are reliant.

The key issues/opportunities include:

- All key partners represented in the partnership to facilitate restoration projects, but this can often be slowed by conflicts of opinion.
- Engagement of the farming community through the Hill Farming Panel.
- Peatland and Woodland Natural Capital Investment Plans have been developed.

Partnership models/funding:

- The LNP is a large partnership, funded via small annual donations from the protected landscapes (alongside some charity funding) and runs on a voluntary basis.
- It sees the value in making nature restoration and conservation more economically visible to ensure sustained finance in future (e.g. carbon market, BNG, corporate natural capital credits).

Administrative and socio-economic context

The Northern Upland Chain Local Nature Partnership (LNP) was established in 2012 and includes over 50 organisations. It encompasses a vast area of the Pennines including:

- Northumberland National Park which is the northernmost national park in England. It covers an area of more than 1,050km^2 between the Scottish border in the north to just south of Hadrian's Wall;

- North Pennines AONB which at almost 2,000km^2 is the second largest of the 49 AONBs in the United Kingdom;
- Yorkshire Dales National Park which covers 2,179km^2 straddling the central Pennines in North Yorkshire, Cumbria and Lancashire;
- Nidderdale AONB which covers 603km^2 of Northern England in the county of North Yorkshire;
- Forest of Bowland AONB which is situated in North West England, covering 803km^2 in the counties of Lancashire and Yorkshire; and
- It also includes the extensive National Nature Reserve of Kielderhead and Whitelee Moor, Kielder Forest and Water and the 'Tyne gap' – a narrow corridor of land centred on the River Tyne that separates the uplands of the North Pennines from Northumberland National Park.

The area is largely rural in character with an ageing, low-density population scattered in small settlements. There tends to be limited access to facilities and services given the rurality. Most of the land is used today for traditional upland sheep (and to some extent beef) farming and grouse shooting is also important. Tourism and recreation are vital for the local economy with a huge number of visitors to the National Parks and AONBs every year. There are also quarries, production facilities, energy and food production, and transport and distribution businesses.

The key socio-economic characteristics are:

- Low density, rural population often dispersed across villages and small settlements
- Ageing population;
- Sparsely settled often with a long distance to local services;
- Importance of tourism and leisure sector (e.g. grouse shooting – though not necessarily generating widespread economic value) and, agriculture, forestry and fishing;
- There are also quarries, production facilities, energy and food production, transport and distribution businesses and use of land for military training.

Landscape and land use context for the surrounding area

The Northern Upland Chain LNP covers a huge area of land across the Pennine uplands and is enabled by landscape commonalities across the five protected landscapes, including the types of upland habitats and species, ecosystem goods and services delivered, landscape character and upland agricultural and land management issues. The key upland habitats are:

- Calaminarian grassland;
- Calcareous grassland;
- Hay meadows and other species rich grassland;
- Heathland and mountain health;
- Blanket bog and valley mire;
- Flushes, fens and swamps and reedbeds

- Limestone pavement;
- Native woodland; and
- Open water (including ponds).

The protected landscapes within the Northern Upland Chain span several NCAs and some areas have their own LCAs. Their landscape character and environmental conditions are broadly similar although further detail is provided in the following sections.

Northumberland National Park encompasses Border Moors and Forest NCA (Natural England, 2013) and Cheviots NCA (Natural England, 2013) as well as having a LCA (2007) (Julie Martin Associates, 2007). The Border Moors is an extensive, sparsely populated upland plateau, with long-distance views and a strong sense of remoteness and tranquillity. The uplands are drained by small rivers in enclosed valleys, with the larger valleys sheltering upland hay meadows, scattered farmsteads and copses of broadleaved woodland. The Cheviots, although too an open upland landscape, is dominated by distinctive smooth, rolling moorlands; there are extensive mosaics of heath, blanket bog and grassland, managed for sheep and cattle rearing and grouse moors. There is widespread use of the uplands for military training as well as conifer afforestation.

Yorkshire Dales National Park and Nidderdale AONB are within the Yorkshire Dales NCA (Natural England, 2013). The National Park also has its own LCA (Yorkshire Dales National Park Authority, n.d.) This area comprises a landscape of high, exposed moorland dissected by sheltered valleys or dales. There are large areas of actively managed grouse moorlands. It is also geologically important for ‘karst’ (limestone) landforms, cave systems and exposures of Carboniferous rocks. The sheltered dales have intricate patterns of walled fields, containing meadow grasses, and small villages and farmsteads. The steepest slopes tend to be marked by the presence of sparse woodlands and open rock scree.

The North Pennies AONB is within the North Pennines NCA (Natural England, 2013) which is marked by remote upland moorlands divided by quiet dales. It is characterised by a sense of remoteness, with few settlements, slow change and cultural continuity. It comprises some of the highest and most exposed moorland summits in England, with several major rivers, including the South Tyne, Wear and Tees.

The Forest of Bowland AONB encompasses parts of the Bowland Fells NCA (Natural England, 2012) and Bowland Fringe and Pendle Hill NCA (Natural England, 2013). Bowland Fells is a wild upland landscape, with steep escarpments, upland pasture and expansive open moorland. Moorland is designated as a SPA due to its international importance for breeding hen harrier, merlin and lesser black-backed gull, as well as peregrine, ring ouzel and breeding waders. The peat soils of the fells, including the deep columns of peat associated with blanket bog, store significant volumes of carbon and are important for water storage. High-quality species-rich meadows can be found in the limestone areas to the east. There are also a large number of important waterbodies and some extensive conifer plantations. The Bowland Fringe is a transitional landscape that

wraps around the upland core of the Bowland Fells. It is a diverse landscape of herb-rich hay meadows – several of which are nationally and internationally designated – lush pastures, broadleaved woodland, parkland and waterbodies (including rivers and streams supporting nationally and internationally protected species). There are numerous river valleys and associated woodlands. The influence of human habitation and activity, and the area's long farming history, contribute significantly to its character.

Environmental baseline prior to the LSNR restoration

Scale: approximately 6635 km^2

Type of project: Upland

The area is characterised by semi-natural wildlife habitats of which around 180,000 hectares have been designated as of national and international importance, although there are areas damaged or at risk which tend to be the focus for LSNR. The uplands have vast areas of blanket bog and heather moorland, contain most of the UK's upland hay meadows, and most of England's limestone pavement. These habitats contain important species like red squirrel, curlew, yellow wagtail, otter, rare orchids, and most of England's remaining black grouse population. These are largely open landscapes, but naturally there would be potential for larger areas of native woodlands with associated benefits for biodiversity.

Pressures and forces for change as highlighted within the NCA/LCAs include: demographic change (e.g. ageing population, increased commuting); development pressures; climate change (e.g. shifting to public goods in agri-environment schemes, Biodiversity Net Gain, water resources, demand for renewable energy); land management (e.g. moorland management, woodland planting, natural flood risk management, degrading heritage); changing public attitudes (e.g. expectations, tranquillity, re-wilding, grouse shooting); requirements for sustainable recreation and access; and economic drivers (e.g. sustainability of upland farming, tourism, commercial forestry). Many of these pressures are incredibly complex but it is a necessity for partners to come together to understand the issues facing the rural uplands and explore opportunities to implement successful nature restoration alongside farming.

Level of ambition in restoration/rewilding

The Northern Upland Chain LNP acts as a strategic body with clear priorities focused on securing practical benefits for nature and the natural economy of the uplands. The area covered by the partnership includes the protected landscapes of the National Parks and AONBs. It aims to plan and deliver strategic environmental action enabling the recognition of the value of biodiversity in social and economic as well as environmental terms. It facilitates coordinated decision-making on the natural environment and members aim to act jointly to deliver integrated outcomes that provide a wide range of benefits and ecosystem services. Some of the key ecosystem services are carbon storage in peat soils; carbon sequestration through restoration, protection and enhancement of blanket bog and tree planting; and water storage and purification.

The LNP's overarching objectives are to:

- Conserve and enhance the natural heritage of the northern uplands, increasing resilience and ensuring these landscapes can meet the challenges of the future;
- Support the economic and social well-being of upland communities in ways which contribute to the conservation and enhancement of natural beauty;
- Promote public understanding and enjoyment of the nature and culture of these areas, encouraging people to take action for their conservation;
- Value, sustain and promote the benefits that the NUC provides for society, including clean air and water, food, carbon storage and other services vital to the nation's health and well-being.

The vision for farming and the environment is to produce locally distinctive, high-quality food in a way that delivers a range of public benefits, so as to secure the long-term economic viability of High Nature Value (HNV) farming that is found in some of the uplands. HNV farming systems are characterised by low-intensity, traditional land management that typically supports high levels of biodiversity and delivers other important ecosystem services such as carbon or water storage. The Northern Uplands Chain have been working on a HNV pilot project in Teesdale and Swaledale with foresight to roll this out across the uplands. The partnership is also working collaboratively on five additional themes:

- Habitat opportunities monitoring;
- Great Upland Forest;
- Hay meadow restoration;
- Peatlands; and
- Biodiversity offsetting and creation of environmental markets involving corporate natural capital accounting.

The aims of the partnership stem from the vision and objectives and are to:

- Help to create a place where special natural qualities, including breeding wading birds, blanket bogs, hay meadows, tumbling rivers and upland woodlands, are valued for their beauty, and for their contribution to the nation's economic, physical and spiritual well-being; and
- To support a living and working upland landscape, a place where an environment-based economy thrives and where development and growth take place in balance with the conservation of the natural world on which they are reliant.

Environmental, ecological social and economic impacts

Given that the LNP have to date facilitated small pilot trials as opposed to LSNR there is limited analysis of the benefits derived, but those intended to be delivered are outlined in the aims above.

Key barriers and opportunities

Key barriers and opportunities identified include:

- The partnership brings together all key partners (e.g. land managers, protected landscapes, NGOs, specialists, public sector) to propose, develop and implement projects on the ground that can effectively drive momentum. However, conflict in opinion can impact on progress of project development (e.g. over moorland management techniques).
- It should be noted that the function of the LNP is to help curate projects and act as a conduit to bring the right stakeholders together to facilitate delivery, rather than leading and delivering projects themselves. Specialists/organisations propose projects to the board, and it is then determined which to prioritise for delivery. This method works well to shortcut fragmented discussions across the area and averts the risk of a siloed approach to conservation.
- Information is shared from the board to others via board papers and the annual forum. These methods have been helpful to share work amongst the farming community, including through demonstrations.
- Northern Hill Farming Panel (which has NFU involvement) is voluntary but has been successful in engaging the wider farming community and to overcome issues of reluctance to restoration. The group feeds into the LNP through a quarterly report.
- The LNP has explored opportunities for climate change mitigation through peatland and woodland habitats. Peatland restoration has been spearheaded by North Pennines AONB, Yorkshire Dales National Park and Moorlands for the Future. The LNP have developed Peatland and Woodland Natural Capital Investment Plans for the area. These were designed to stimulate stakeholders to propose suitable projects, but it is felt these need reviewing to become more beneficial and be better targeted to buyers.
- Working over a large area enables delivery of larger projects with the potential for more widespread impact and greater visibility to attract funding in future. However, in this case, the predominant barrier to a more widespread delivery of nature restoration projects is actually the lack of funding for the partnership.

Partnership models and funding

The LNP acts as an overarching partnership through which to develop and facilitate individual projects. It is funded solely by small contributions totalling approximately £25,000 annually from the lead protected landscapes across which it functions, and all member activity is voluntary. Other sources of funding include charitable grants and funding attained for specific projects within the partnership area albeit not directed explicitly to the functioning of the LNP.

Although not represented directly on the Board, an integral part of successful working is the Northern Hill Farming Panel. The' bottom-up approach' of the LNP has been at the forefront of the creation of innovative systems to better deliver environmental outputs whilst supporting hill farmers. The LNP sees value in moving away from short-term, grant-

based solutions for nature. There is a need to make nature restoration and conservation more economically visible to ensure sustained finance is available (e.g. PES, growth of the carbon market, BNG and corporate biodiversity credits.

Wild Ennerdale

Case study summary

The project is located within the Ennerdale Valley in Cumbria covering an area of 4,400ha in a dramatic upland landscape, with peaks, ridges and open fells, separated by U shaped valleys with a lake and rivers.

The key challenges for this area include flood management, increasing pressure on water resources, water quality, habitat condition and connectivity, visitor/transport pressures, landscape resilience, adaptation to climate change and supporting sustainable and resilient hill farming systems and businesses.

The main aims/vision of the project include:

> To allow for natural processes to shape the landscape and ecology.

The key issues/opportunities include:

- Acceptance of the project among local people.
- The flexible approach to the management of the area.

Partnership models/funding:

- Wild Ennerdale is a partnership between the main landowners in the valley - the Forestry Commission, National Trust and United Utilities. Natural England, the government's advisor on nature conservation, is also a partner.
- The partnership approach to the future management of the valley recognises that people are a significant part of a 'wild' landscape. (The Wild Ennerdale Stewardship Plan 2018-2028 describes wild as managing land in harmony with nature and to delivery greater public goods within and beyond the boundary.)
- The Stewardship Plan is the core partnership document which helps steer and influence decisions. It represents the day-to-day work and longer-term aspirations of the four partners to help deliver a cohesive and effective approach. The plan covers the combined partnership owned land of 4,400 ha (10,872 acres).

Administrative and socio-economic context

Wild Ennerdale (Rewilding Britain, n.d.) is located within Ennerdale Valley, on the north western edge of the Lake District National Park in Cumbria, North West England.

Cumbria Local Nature Partnership covers the entire county of Cumbria. The Local Nature Partnership is a collaboration between the Cumbria Local Enterprise Partnership, Cumbria Health and Wellbeing Board, and Cumbria County Council.

In 2019, there were 924 people living in Ennerdale Valley, of which the biggest demographic group was represented by people aged between 50 and 69 years old (Cumbria Intelligence Observatory, 2019), indicating generally an ageing population. In 2011, 66% of the Ennerdale's population was economically active (Ibid.). Tourism is an important sector for the local economy. In 2018 Cumbria and the Lake District received over 47 million visitors, out of which 40.4 million were day trippers and 6.6 million were overnight visitors. There are also quarry and mining activities in the region.

Landscape and land use context for the surrounding area

The Wild Ennerdale project is located within the Cumbria High Fells NCA (Natural England, 2013), which is characterised by a dramatic upland landscape, with peaks, ridges and open fells, separated by U shaped valleys with lakes and rivers. This area is of national importance for its extensive mineralisation and the resultant mining heritage, dating back to the medieval period.

The key challenges for this area include flood management, increasing pressure on water resources, water quality, habitat condition and connectivity, visitor/transport pressures, landscape resilience, adaptation to climate change and supporting sustainable and resilient hill farming systems and businesses.

It is the most biologically diverse suite of upland habitats in England with internationally important fell habitats, rivers, lakes, unimproved grassland, and native woodland.

Within this NCA, land is primarily used for pastoral hill farming, open fell grazing, and tourism and recreation.

Some of the key ecosystem services of this NCA include:

- Provisioning services such as food and timber production, and water availability;
- Regulating services such as climate regulation, regulating soil erosion, regulating water quality, regulating water flow; and
- Cultural services such as sense of place/inspiration, sense of history, tranquillity, recreation, biodiversity and geodiversity.

For over a decade, the landscape here has been evolving more naturally. This is thanks to less intensive human intervention and more reliance on natural processes. Greater local community involvement has helped the process.

Environmental baseline prior to the LSNR restoration

Scale: 4,400 ha

Type of project: Uplands

In 2000, the National Trust appointed a new property manager for their land in the Ennerdale Valley. He was given the responsibility of revising the National Trust property management plan. The land in the valley was largely split between the National Trust and

the Forestry Commission (now Forestry England), and at the time the two organisations did not collaborate over its management. Working together, the National Trust and Forestry Commission invited United Utilities to join the partnership as they managed the lake. Natural England soon joined the discussion, and alongside early consultation with local communities, gradually the project and their aspirations for more integrated management of natural processes within the valley began to develop. By 2006, it was clear the partnership needed a partnership management plan to demonstrate how management of the valley could work.

The approach to landscape management within the valley is based on the following:

- Thinking big > landscape scale
- Working as one > beyond ownership & management boundaries
- Giving nature freedom > natural processes shaping the landscape
- Planning long term > no fixed end point or prescriptive targets
- Self-sustaining > low input systems and redirecting existing valley funding

Level of ambition in restoration/rewilding

The partnership's vision is *'to allow the evolution of Ennerdale as a wild valley for the benefit of people, relying more on natural processes to shape its landscape and ecology'*.

The guiding principles include:

- Protect and enhance the sense of wildness.
- Give freedom for natural processes to enable more robust, resilient and better functioning ecosystems to develop.
- Only intervene where complementary to the vision or where a threat to the vision is posed.
- Operate as a partnership in all aspects of decision-making, implementation and research proving mutual support across partners.
- Celebrate and apply the learning experiences that all partners gain from their involvement.
- Promote Wild Ennerdale and its constituent partners' involvement within it.
- Focus practical management, monitoring and decision making at a landscape scale using the Stewardship Plan as the main tool for guidance.
- Strive to put people at the heart of the environment through public enjoyment, engagement and connection with nature.
- Support business opportunities that are appropriate and fitting with branding and vision.
- Promote the management of partner assets within the valley to reflect the vision.
- Promote improved structure and diversity of habitats to sustain healthy wildlife and functioning ecosystems based on the Lawton principles of 'more, bigger, better and joined up'.
- Consider, respect and continue to monitor the historical and cultural assets of the valley.

- Promote the natural capital approach to further understand the broader value of Wild Ennerdale.
- Share information and promote case studies to demonstrate and inspire others, prompting engagement across a wider sphere of influence.
- Protect and enhance the distinctive landscape and character of Ennerdale.

Wild Ennerdale is not trying to recreate a past point in time but rather enable a ‘future natural’ which is a hybrid mix of what will happen. For example, Sitka spruce has been naturally regenerating and it was allowed to do so as long as it doesn’t dominate the future forest species mix. Therefore, it was important to ensure that management plans are high level and at a landscape-scale to allow space for natural processes to occur and allow for dynamic and perhaps unexpected change.

Environmental and ecological benefits

Since the official formation of Wild Ennerdale, the conifer forest has seen significant change. It is becoming more diverse and interesting. Native broadleaves are extending and increasing through planting and natural regeneration.

Sheep numbers have been reduced across the valley. Areas of intensive grazing in the valley bottom and forest have given over to beneficial, extensive, all year round cattle grazing by Galloway cattle. This has allowed the valley bottom to become more open and wilder. The removal of some boundary fences has helped blurring of the open space/forest boundary.

There has been a successful reintroduction of the Marsh Fritillary butterfly into Ennerdale, which had been previously extinct in Cumbria. The partnership has also been restoring natural aquatic processes through removal and re-engineering of bridges to allow fish passage and gravel movement. The River Liza is now able to find its own path, and a piped watercourse has been restored to its original course to benefit surrounding protected habitats.

In the 1990s, acid flushes in the river were caused by needle litter from the conifers entering the water during periods of high rainfall. If this occurred when fish were spawning and coming up the river it led to widespread fish death. The project has undertaken work to push conifers back from the water’s edge. As a result, fish populations have increased significantly, with Arctic charr (which was considered on the brink of extinction 30 years ago) now sustainable and resilient.

Carbon sequestration has increased through woodland expansion and expanding valley bottom mires. United Utilities’ purchase of a riverside farm has enabled a project to restore freshwater mussels.

Deer management practices keep the numbers of roe deer low to enable natural regeneration of native woodland species. Free roaming cattle now graze in three separate areas: a 150ha area at Silver Cove SSSI, and two further much larger areas of around 1000ha and 2000ha which are largely fenced. Fences were installed where they

would not impact on natural processes, for example on higher ridges in the valley to allow the river to naturally fluctuate rather than impact on farmed land. The grazing contract is tendered every 10 years. At the moment the tenant farmer manages all three herds. The tenancy is let as a Farm Business Tenancy (FBT) with a list of outcomes to be achieved which are in line with Natural England outcomes. Future aspirations are for fences to be removed completely and potentially for the cattle to run as a mixed herd; currently the herd is all female with a bull introduced once every 2 years. This is to reduce stress on the animals and ensure the cows only have to feed either a foetus or calf through winter. Ultimately it would be good to have a mixed male-female herd to allow the herd to behave more naturally.

Social benefits

Social benefits relate to direct involvement in the management of the site, through to wider reaching benefits:

Participation opportunities include volunteering, recreation, learning and employment;

- Community engagement directly informs the Partnership to ensure that the benefits of Wild Ennerdale reach far beyond the geographical ‘valley boundary’. Contact with the local community includes regular meetings of a liaison group which was established to discuss project management, community events (Easter egg hunt) and project updates published through a church newsletter;
- Tranquillity and wellbeing.

Economic impacts

External funding for the project is sought on a project-specific basis. Funding for the project officer is supported by contributions from each partner organisation and additional support through their own annual budgets. Income from the land is based largely on rents from tenant farmers and sale of timber, although these are minor sources for partners.

The project has not sought to maximise income as there has been no pressure from partners to do so. The focus instead has been on maximising biodiversity gains. [Overall, the farmed area within the valley has increased by allowing cattle grazing within the woodland, and the project has seen some minor increases in employment through farming and project management, and work generated for contractors to undertake. Some local businesses have begun to use the Wild Ennerdale brand for local produce which could be contributing to local economic gains. Finally, the Stewardship plan aims to improve tourism opportunities by enhancing the quality of the experience with a view (sensitively) to encourage more visitors into the valley. Where the aims of the project have impacted on agricultural productivity, rents have been negotiated to reflect reduced income.

Some of the management of the land is funded and secured through agri-environment schemes with tenant farmers. This includes Higher Level Stewardship and Countryside Stewardship. The Ennerdale's objectives and scheme contents are brought together through Natural England's involvement with the partnership. Many of the lessons about natural process-led extensive management, learnt in Ennerdale, are then applied to schemes on adjacent land or land elsewhere in Cumbria.

Key barriers and opportunities

The project partners engaged with local communities at an early stage of the project development. There was little support or local understanding initially, and some suspicion that there was an underlying agenda. However, this was largely due to the team struggling to describe what it was they were trying to achieve as there was no defined end point. This led to some anxiety amongst landowners. Today the message of the project is much clearer, people understand better, even if they may disagree with it for some. There is acceptance and support of the project from many local people, though there are some concerns that farming is less valued, and the valley is less managed in appearance (Convery I., Dutson T., 2008). In the interview, it was highlighted that some of the key challenges include changes over time in organisation focus or allocation of partner time, bureaucracy demands, developing trust amongst the community, staff turnover in partnership organisations and working with long-term timescales. There were some examples of staff turnover which has led to lack of continuity and changes in levels of commitment to the project. Outside factors, such as Covid-19 has had a particular impact on the National Trust and the resources available to the project.

There has been some tension between commoners and traditional hefted sheep grazing and because of the project removing sheep from the fells. Normally the presence of surrounding flocks helps keep sheep in particular parts of the fells. As sheep numbers fall, the hefting process becomes less effective. One of the main concerns from neighbouring farmers was that their sheep would stray into Ennerdale. To help combat this fear, Wild Ennerdale committed to rebuilding a stone wall on a high ridge to prevent stock coming into the area.

The positive benefits of the project on ecosystem services has not yet been fully understood. The project is building clear evidence of the benefits of the project to biodiversity, for example through bird surveys undertaken before and after the removal of sheep and introduction of cattle. The intention is to feed the information into natural capital accounts, though this is yet to be undertaken. Forestry England is developing a set of natural capital accounts for all land holdings which could help inform how this might be achieved for Wild Ennerdale.

Partnerships and funding

Wild Ennerdale is a partnership between the main landowners in the valley - Forestry England, National Trust and United Utilities. Natural England, the government's advisor on nature conservation, is also a partner.

Each partner plays an equal part in the project, with all members contributing towards funding a project officer. The benefits of a multi-organisational partnership include the different skills each partner is able to contribute, for example, Forestry England have good mapping systems, United Utilities and Natural England have ecologists, and National Trust have greater skills in historic environment. Therefore, it enables access to skills that might have been lacking in one organisation to support the project as a whole.

The partnership approach to the future management of the valley recognises that people are a significant part of a 'wild' landscape and that the extent to which people can interact, and indeed become part of a natural process, is dependent upon appropriate levels of access and types of activities permitted. Without some intervention to regulate access however, there is a danger of destroying the very qualities we look for in a 'wild' place: untamed nature, solitude, adventure and the quiet enjoyment of spectacular landscapes (Wild Ennerdale, n.d.).

The Partnership is focused on two principal activities:

- Reducing and removing features and activities that detract from the sense of wildness and at the same time inhibit natural processes.
- Ensuring that natural processes are operating at their most functional and introducing missing natural features where they are not represented already.

The Stewardship Plan is the core partnership document which helps steer and influence decisions. It represents the day-to-day work and longer-term aspirations of the four partners to help deliver a cohesive and effective approach. The plan covers the combined partnership owned land of 4,400 ha (10,872 acres).

The first Stewardship Plan was completed in 2006 to document and share the thinking and practical approaches to enable a more natural process-led approach in Ennerdale. It replaced the first Forestry Commission Ennerdale Forest Design Plan from 1996 and saw an important shift from management focused on separate land ownership to a holistic landscape-scale plan representing all three major landowners. In 2018 the Stewardship Plan (Forestry Commission et al., 2018) was reviewed, updated and widely consulted and it outlines plans for the next decade.

The Stewardship Plan is not a typical management plan with prescriptive targets and deadlines, as there is no endpoint. The emphasis is on moving away from traditional land management and instead demonstrating the broader concepts for change and ‘direction of travel’ in Ennerdale. Importantly, the project takes an opportunistic approach, to reflect natural processes; hence some of the results may be unexpected.

In addition to the partnership, a liaison group consists of Cumbrian organisations who have an interest in the Ennerdale Valley and which meets on an irregular basis to share and discuss the project, for example when a new Stewardship Plan is published.

Pumlumon Project

Case study summary

The Pumlumon Project is a longstanding project on the uplands in Wales (Cambrian Mountains) spanning over 40,000 hectares involving multiple landowners. The ongoing project began on the ground in 2007 and is led by Montgomeryshire Wildlife Trust (MWT). (It should be noted that there is another, more recent project (commenced 2017) in a similar area to the Pumlumon Project. 'Summit to Sea' is being hosted by RSPB Cymru. The Montgomeryshire Wildlife Trust - who lead the Pumlumon Project - are one of the project partners alongside many other partners (e.g., The Woodland Trust, PLAS Marine Special Area of Conservation, Marine Conservation Society, Whale and Dolphin Conservation). The projects are two separate projects and have clear differences (principally around 'rewilding'), but they do share a similar vision around PES).

The main aims/vision of the project include:

- The project radically rethinks how the landscapes of upland Britain can work.
- PES approach to peatland restoration with the use of soft engineering approaches for ditch blocking.
- The project aims to deliver a number of ecosystems service benefits, including: safeguarding the store of carbon locked in upland peat soils; carbon sequestration; reductions in flood risk through increased water storage; improved water quality through erosion control; enhanced ecosystem function and biodiversity through more appropriate management; improved access and interpretation for visitors and residents; and the creation of a new wildlife-based visitor attraction.

The key issues/opportunities include:

- Community and landowner involvement from the outset.
- Socioeconomic approach to restoration has ensured buy-in and success as restoration has had to improve nature as well as make business sense for the upland farmers.
- The need for improved metrics, new governance and contractual structures, time to establish new relationships between actors and intermediaries, difficulties in identifying and engaging potential buyers and geographical distance between suppliers and beneficiaries.
- Funding challenges to enable long-term restoration as opposed to short-term funding cycles. There is ongoing research to value the ecosystem services provided, understand how this can open new markets for future funding (both public sector and private e.g. carbon market), how to engage the investment community in the establishment of ecosystem services markets and to influence Welsh Government policy.

Partnership models/funding:

- The Wildlife Trust, led by the Montgomery Wildlife Trust, working with local communities, land managers, statutory agencies, and both local and national businesses.

- It is a private, layered PES scheme. Funding has largely been provided by charitable trusts (including the Waterloo Foundation, JP Getty, Biffa and The Wildlife Trusts), with additional contributions from the Welsh Government (through REF, ERDF and most recently, the Nature Fund) and statutory agencies including the Forestry Commission, Countryside Council for Wales and Environment Agency.
- Funding has also been provided by the National Lottery for tourism infrastructure.
- Income also comes from the donations from visitors to the Project's Dyfi Osprey Project Visitor Centre.

Administrative and socio-economic context

Pumlumon Project encompasses a large area in mid-Wales spanning the north part of Ceredigion and the west of Powys. The boundary of the project area is marked by the largest town of Aberystwyth (west) as well as smaller towns of Machynlleth (north) and Llanidloes (east).

The project area is home to 15,000 people, spread across 11 local communities. There are 250 farms in the project area and upland farming, forestry and tourism are the main economic activities.

The area includes several wards in Ceredigion as well as Blaen Hafren ward in Powys. Spread across 11 small rural communities, there is a low population density particularly in the more rural wards e.g. Ceulanamaesmaw (14.37 people per km^2) and Blaen Hafren (8 people per km^2) and increasing westwards towards the main town of Aberystwyth. Around 25-27% of the population are over 65 years whilst 55-58% are of working age (18-64 years).

Landscape and land use context for the surrounding area

The Pumlumon area is the largest watershed in Wales and supplies water to the Wye, Severn, Rheidol, Dyfi and Leri. The land encompasses over 9,000 hectares of locally, nationally and internationally important habitats and associated species, including dry and wet dwarf-shrub heath, heather moorland, blanket bog, semi-natural woodland, unimproved acid grassland and several oligotrophic lakes. The land is also characterised by agriculturally improved grassland, broadleaved woodlands and forestry plantations. Overall, woodland cover is low, and native woodlands are scarce, though biophysical conditions are suitable in large parts of the area. At the core of the area is the 5,000-acre Pumlumon SSSI currently in unfavourable condition and declining.

Intensive land use activities have resulted in a significant loss of biodiversity, with many of the upland habitats being lost or degraded over time. Historical over-grazing and land use change (ploughing and drainage) has induced soil compaction, which results in diffuse pollution and increased flooding in the lowland areas.

The project area encompasses a large part of NLCA 21 'Cambrian Mountains' (NRW, 2014) as well as a small part of NLCA 23 'Rheidol and Ystwyth Hills and Valleys' (NRW, 2014) to the southwest near Aberystwyth.

Environmental baseline prior to the LSNR restoration

Scale: 40,000 ha

Type of project: Uplands

The need for the project came about when a habitat condition survey of the Pumlumon SSSI in 2000 revealed that these upland habitats of acid grassland, peat bog, heath and lakes were in a less than favourable condition (and declining). Subsequent discussions between Montgomeryshire Wildlife Trust (MWT) and the statutory agencies between 2000 and 2004 concluded that to restore the condition of these habitats would require a socio-economic solution. The main premise for this socio-economic approach was from the understanding that the main issues in the project area for declining wildlife and SSSI condition related to underlying economic factors. Therefore, the land - in its semi-natural state - was unable to provide enough income to support the landowning community so they were driven to change it in order to access the only available market (food production). If there was a market for the delivery of other ecosystem services, this drive would shift.

Level of ambition in restoration/rewilding

Established in 2007, the Pumlumon Project is an ongoing project which radically rethinks how the landscapes of upland Britain can work. Across 40,000 hectares of the Cambrian Mountains, the project is pioneering an upland economy built around wildlife, ecology and long-term sustainability.

The ethos of the project is based around understanding that the declining wildlife is intertwined with the declining demography and economy. The project therefore aims to drive economic benefits for local farmers, foresters and tourism businesses through the establishment of robust markets for the delivery of sustainable and high quality ecosystem services, with the local community having a stake in maintaining a high quality natural environment. It is anticipated that the project should provide ecological benefits for the whole landscape over time extending far outside the initial project area boundary.

Aims

The project aims to continue to deliver a number of ecosystems service benefits, including:

- Safeguarding the store of carbon locked in upland peat soils;
- Carbon sequestration from increased growth of restored bogs, tree planting and natural woodland regeneration;
- Reductions in flood risk through increased water storage;
- Improved water quality through erosion control;
- Enhanced ecosystem function and biodiversity through more appropriate management;
- Improved access and interpretation for visitors and residents; and

- The creation of a new wildlife-based visitor attraction.

Within the first five years, it was demonstrated, using good science and economic analysis, that large-scale ecological restoration on peatlands (namely through blocking ditches to increase the water table and reduce emissions) can bring economic, social and environmental benefits. Ongoing work has been undertaken to continue to alter public attitudes and expectations and explore new mechanisms of funding to enable these new ideas to become firmly established (Permaculture Association, n.d.).

The most recent round of funding has not been invested in project delivery on the ground, but rather to investigate the social and economic value in restoring nature and analyse supply chains to inform changes to Welsh Government economic policy and engage the investment community in the establishment of ecosystem services markets. The main complexity has been translating academic research/published information of ecosystem services into actual meaning on the ground in terms of investment of £/ha for a specific ecosystem service and what investors and public bodies are willing to pay for delivery of that service. There has been growth in business investment through the Peatland and Woodland Carbon Codes, as well as Biodiversity Net Gain (BNG). Carbon is currently the predominant driver for investment with carbon brokers seeking to invest money domestically for carbon offsetting.

Active peatland restoration work on the ground is due to begin again in 2021 through the investment afforded by the active Peatland Carbon Code registered project in the area.

Environmental and Ecological benefits

The project has improved the capacity of the habitats to deliver ecosystem services for water supply, recreation, water quality regulation and flood regulation. The project has demonstrated ‘proof of concept’ by delivering ecosystem services through visible and sustainable changes in landscape quality, biodiversity, access and economic well-being throughout the project area but principally in the uplands, on the flanks of the Pumlumon Mountains and in the Dyfi Valley.

Carbon storage is a key element of the project, as the project area includes extensive peat resources. Peatland restoration has always been a key ambition of the project, and the area includes significant degraded areas. Benefits are identified from peatland restoration and in one holding alone the project has blocked 11km of ditches, restored 105 hectares of peat bog and safeguarded 82,500 tonnes of carbon. The value of this land in carbon terms is around £210/ha (but likely higher given that this value assumes a carbon trading value of £5/tonne).

The interview highlighted that the area forms the upper catchment for drinking water supplies but does not include any drinking water reservoirs, and has naturally good water quality. The peatlands are important for water storage. However channelled uplands watercourses mean that sediment load has been an ongoing issue with impacts on the Rheidol hydropower station, although there have been challenges to engaging with the power company to seek solutions to this issue. The sediment also impacts on a

downstream SAC, and it is noted that the area receives over 3m of rainfall per year which is changing as a result of climate change (seeing more intense heavy bursts of rainfall with periods of drought).

Grazing had historically impacted on the soils of the area, with impacts exacerbated by climate change and the project has implemented changed grazing patterns which reduce these issues. Cattle were introduced for habitat enhancement; from their different grazing habits to sheep, they have helped restore the diversity of grassland, providing more and better niches for species. The interview highlighted the risks associated with some of the changes of introducing cattle on the mountain. This included btB (bovine tuberculosis (btB), the cost of beef production in the uplands, the need to acquire a cattle handling system and to demonstrate the practicality and economic viability of upland cattle.

Recreating lost habitats and reconnecting existing areas of habitat is a key aspect of the project. The project has a total 1,013 hectares of habitat under conservation management including 309 hectares of restored peatland and 65 hectares of regenerating woodland.

Social benefits

Social benefits include opportunities for community involvement and learning, physical and economic benefits from reduced flood risk and the provision of access and interpretation.

- In addition to the collaborative learning group set up to share ideas between lay public and private sector stakeholders, a community group has been set up in the project area to enhance landowner engagement and knowledge sharing. The collaborative approach is essential to the success of the project as it ensures a full understanding of landowner interests and what works from a business perspective.
- The project has delivered a practical demonstration of the PES approach to land management; landscape management techniques to deliver ecosystem services in upland areas; an evidence base of habitat and species change; heightened public profile of the PES approach and what it can achieve; new skills among land managers and contractors; and, contributions to the development of government policy. The project has brought over 652.3ha into active habitat management which has had an effect over 1,135ha of the catchment so helping to secure and enhance the supporting services provided by this land (Defra, 2014):

Economic impacts

The project has pulled together new ecological thinking with the economics of supply chains and continues to influence policy development in the Welsh Government. Defra (2014) identified the following economic benefits:

- Since 2006, the project has delivered a wide range of ecosystem services valued at £893,243. At current costs in 2012 of £80,000pa for staff, contractors and materials, the output of ecosystem services across the pilot project area (from 309 hectares of peatland) amounts to £266,333pa (£2.1 million is the estimated value of potential benefits from combined livestock sales, carbon, water and recreation benefits if similar land management practises were implemented across the whole project area i.e. 3732 hectares). All these outputs are additional as the actions taken would not have happened without the project and equates to a return on investment of 1:3.
- Off-site visitor expenditure is estimated to have added £350,000-£500,000 to local incomes, supporting around 10 jobs in the local economy (indirect and induced effect).

There has been an increase in ecotourism and investment into tourism infrastructure projects (e.g. Dyfi Osprey Project) which received substantial capital funding from the National Lottery in 2014. This development had a significant impact on the local community (valued at £612,500/year) and highlighted the economic opportunities associated with nature-based tourism. Other developments include:

- Cors Dyfi 360° observatory developments;
- New audio/e-trail (Glaslyn/Bugeilyn);
- Maesnant Ecohostel;
- Dyfi Biosphere developments (linking wildlife attractions);
- Joint marketing with tourism businesses and Lloyds Coaches; and
- Website development and social networking.

The interview also identified the role of private sector investment in funding project delivery, with the predominant growing market being carbon. Besides carbon sequestration, there is need to focus on safeguarding existing carbon stocks (some areas within the project area have a huge 13m of peat) by valuing this and finding ways of incentivising the maintenance of what is already in the ground.

Key barriers and opportunities

Defra (2014) also identified the following issues with future funding, noting that in the long term, with improved monitoring and better evidence on return on investment, an exploration of the following potential funding mechanisms must be made with government and other organisations:

- Integrated support packages from government funds;
- infrastructure investment from general taxation;
- ecosystem services premium on insurance policies;
- ecosystem services premium on water and other utility bills;
- payments through new agri-environment schemes;
- enterprise/innovation grants to stimulate purchase/construction of new stock and infrastructure to produce new marketable products from the landscape;
- take up of carbon, biodiversity, peat and woodland offsetting by the private sector;

- promotion of corporate social responsibility funding in the provision of natural capital; and
- visitor experiences opportunities to be explored by local tourism providers.

Specific practical agreements have yet to be established between land managers and those benefiting from the delivery of enhanced ecosystem services. This does not reflect any inherent unfeasibility in any of the actual projects or unwillingness from landholders to participate. Rather, the challenges have reflected the need for improved metrics, new governance and contractual structures, time to establish new relationships between actors and intermediaries, and difficulties in identifying and engaging potential buyers (Keenleyside C.B. et al., 2019). The geographical distance between suppliers and beneficiaries is also a challenge, both in terms of the impact this has on relating the efficacy of the land management intervention to the ecosystem service delivery as well as demonstrating the opportunities to the investor (i.e. that alterations to a mountain landscape in Wales can impact on flooding issues in a much more distant location).

The interview identified that funding through blended finance (public and private) can be problematic. However, private investment (e.g. carbon market) is a huge opportunity to enable nature restoration through a PES approach and could provide a more secure and sustainable form of funding in future (providing these are supported through the development of robust processes of accreditation and not simply based on the ‘now and then’ corporate social responsibility investment).

Challenges were identified in relation to the ongoing need for advice and support for farmers to ensure restoration interventions are maintained and function long-term. For instance, there have been some issues with high rainfall immediately post restoration resulting in some peat dams not holding and requiring repair. Securing sustained funding to support ongoing management is therefore vital given agreements within the funding windows can be short-lived (5-years). MWT have themselves drawn up some management agreements with land managers to ensure work is sustained. Other payments for management can come through agri-environment schemes (e.g. Glastir).

Other challenges relate to the role of Natural Resources Wales given it is both an investor and regulator; communicating the project to landowners; and, the controversial nature of the language used around nature conservation and 'rewilding' impacting buy-in from stakeholders.

There was some resistance to the project from the regulator based upon the potential impacts on the SSSI so the issue needed to be escalated to achieve resolution. This was concerned with the regulation of ‘potentially damaging operations’ and the evidence base available for altering the habitats.

The value of ongoing monitoring data has been important to promote knowledge transfer and exchange, to influence government and support private investment (as data enables analysis of risk).

Partnership models and funding

The project has been led by MWT working with local communities, land managers, statutory agencies, and both local and national businesses to restore and enhance the resilience of the ecosystem within the project area; piloting an integrated approach whereby the ecosystem services (i.e., water quality, flood risk reduction, carbon safeguarding) can be better delivered via sustainable land management.

Funding has largely been provided by charitable trusts (including the Waterloo Foundation, JP Getty, Biffa and The Wildlife Trusts), with additional contributions from the Welsh Government (through REF, ERDF and most recently, the Nature Fund) and statutory agencies including the Forestry Commission, Countryside Council for Wales and EA.

In recent years substantial capital funding has been provided from the National Lottery for tourism infrastructure projects such as the Dyfi Osprey Project Visitor Centre, with income also being generated from the donations from visitors to the centre.

Although the project has received cyclical 5-year funding since 2007, it is hoped that the focus on PES and private sector investment will enable the project to move beyond closed funding loops.

Holnicote Estate

Case study summary

The project area is located in Somerset, on the edge of Exmoor National Park. National Trust owns 12,500-acre estate with two river catchments including multiple tenant farmers, uplands wooded combes and lowland vale. There have been two river restoration projects: the earlier multi-objective flood risk management demonstration project (2010-2015) which focused on in-channel intervention; and, the current National Trust Riverlands Project (2018-2023) focused on working with natural processes to deliver multiple benefits for people and nature.

Water management has shaped the landscape through drainage ditches, irrigation gutters and relict water. The river has been fragmented and disconnected from the natural floodplain through changes in land management practices and watercourse maintenance activities. Transport infrastructure has also impacted the landscape and has increased the speed and volume of surface water run-off.

The main aims of the project:

- Earlier project: Reducing flood risk using Natural Flood Management (NFM) measures.
- Current Riverlands project: Producing a range of wider environmental and social benefits while still delivering reduced flood risk for downstream communities.

The key issues/opportunities include:

- Community engagement (especially with tenant farmers).

- Importance of a locally based, knowledgeable project manager to establish strong working relationships.
- Conflict of opinions within partnerships may be beneficial to a project as it enables robust debate to ensure the approach and methodology are right.
- Pioneering projects such as these have few examples to learn from: it is about the project team working comfortably in the 'grey areas'.
- Existing legislation / regulation can be a barrier which slows project progress.

Partnership models/funding:

- Initial project: National Trust, Defra, Environment Agency (EA), Somerset Rivers Authority, Penny Anderson Associates and JBA Consulting / JBA Trust. Mainly funded by Defra with additional funding from National Trust and Somerset Rivers Authority.
- Current Riverlands project: Led by the National Trust, working in partnership with the EU Interreg 2 Seas Co-Adapt programme (funder), Somerset Rivers Authority (funder) and EA (partner and funder), with input from a wide range of other partners, National Trust tenant farmers and other landowners in the local area.

Administrative and socio-economic context

The National Trust Holnicote Estate (National Trust, n.d.) is situated near Minehead in West Somerset, South West England, on the north-east edge of the Exmoor National Park. The Estate lies between the settlement of Porlock to the west and the larger settlement of Minehead to the east. It falls into the administrative boundary of Somerset West and Taunton Council (established April 2019, replacing the Taunton Deane and West Somerset councils), within the Porlock and District ward (part of West Somerset).

Porlock and District covers an area of 105km^2 and has a small population of 2338 (ONS, 2011) dispersed through the small villages and hamlets. (Based on 2011 Census, and is estimated to have reduced to 2282 in 2019). The ward is reflective of those across West Somerset which is characterised by sparse populations with 66.5% of residents living in rural areas. The population density of 0.22 people per hectare is well below the Somerset and England averages of 0.5 and 4.1 per hectare respectively. The area has an old population profile: around one third of residents are aged over 65 and around half are of working age. This is reflective of the wider West Somerset area which has the lowest working age population across Somerset at 54.5%. Projections suggest that by 2030 (ONS data), the population in West Somerset will increase and the age structure will also change, with an increase in those over 65 from 10900 in 2014 to 14000, whilst experiencing a decline in those of working age.

The older population in West Somerset, including Porlock and District, contributes largely to the area having the highest proportion of economically inactive residents (26.6%) across Somerset due to retirement. By contrast, the rate of unemployment in West Somerset is both lower than the averages for Somerset and England.

For the economically active, the wholesale and retail sector provides a large number of jobs for residents in Porlock and District (17%), followed by accommodation and food service (16%), human health and social work (10%), education (8%), agriculture, food and fishing (8%), construction (8%) and manufacturing (5%) 9ONS, 2011). Across West Somerset, many residents are self-employed (43.4% of the workforce) which is more than double the proportion of the other Somerset districts. Part-time working is also quite prevalent, with 31.9% of the workforce employed in this way. The area also has the highest proportion of micro-businesses, with 77.7% of businesses in the district employing fewer than 5 people.

Housing affordability in Somerset is worse than at national level, and West Somerset is the least affordable district.

The area is influenced significantly by tourism being part of Exmoor National Park which attracts a large number of visitors every year. Exmoor National Park visitor survey 2018 (Exmoor National Park, n.d.) showed that most visitors found scenery/landscape the main determinant behind their visit, closely followed by tranquillity, peace and quiet. Other factors include opportunities for outdoor activities and the coastline and beaches. The main activities undertaken included walking, general sightseeing and relaxing, as well as visiting attractions and eating out. The project could impact on reasons for people visiting as well as activities they undertake, possibly providing a greater draw to the Holnicote Estate as a key visitor attraction.

Nearby Porlock is a focal point for visitors, with Porlock Vale a draw to tourists for its varied landscapes of moorland, rivers and rugged coastline. The renowned South West Coast Path follows the coastline approximately 2km north of the Estate with important views including Hurlstone Point and Selworthy Beacon. Minehead is also an important destination, with the Butlins holiday complex, one of the largest in the country.

Landscape and land use context for the surrounding area

The National Trust Holnicote Estate is situated adjacent to the uplands of Exmoor and comprises around 40km^2 of land draining the catchments of the Aller (18km^2) and Horner Water (22km^2), from the higher topography in Exmoor northwards through woodland, grassland and arable areas towards Porlock Bay at sea level. The lower Aller catchment floodplain is wider than that of the Horner and has previously been actively managed as flood meadows. The confluence of the Aller and the Horner is between Lynch and Bossington where it flows to the sea at Bossington Beach.

The key flood risk receptors in the catchments are the villages of Allerford, West Lynch and Bossington. There are nearly 100 properties in these villages at risk of flooding from the watercourses, which are influenced by a legacy of flow constrictions within the drainage networks, such as narrow historic stone bridges, and the lack of undeveloped channel and floodplain capacity through the built-up areas.

The estate is within the north east of Exmoor NCA (Natural England, 2013). The landscape character of the area is that of Farmed and Settled Vale (Exmoor National Park, 2018), a gentle, enclosed and settled pastoral landscape, with an irregular patchwork of hedged fields, woodlands and villages nestling in the sheltered valley below the high moors and enclosing woodlands. It is a rich historic landscape, with medieval farms, bridges, churches, lanes and paths still in daily use. Historic estates (including Holnicote) continue to have a strong influence on the landscape through their distinctive buildings (creamy-yellow render), landscaped parkland and woodland. The quiet, rural lanes are narrow and winding, creating a sense of disorientation, particularly where views are enclosed by hedgebanks. Away from the main roads (namely A39) and larger settlements (Minehead and Porlock), there are areas of tranquillity and dark skies. Despite the nearby coastal path, much of the area is difficult to access on foot as there are few other footpaths and little access land.

Environmental baseline prior to the LSNR restoration

Scale: 40km^2

Type of project: Uplands, woodland and water catchment management

Water management has played a large part in shaping the historic landscape, ranging from drainage ditches on the upper moorland, irrigation gutters on upland farms, relict water meadows, at least 3 mills and associated leats. Functioning water meadows around the Aller ceased in the early 20th century and the river has increasingly become disconnected from the natural floodplain through changes in land management practices and watercourse maintenance activities. Later, construction of tarmac roads across the moorland and the widening and improvement of the main A39 through the floodplain in the 1970s are likely to have increased the speed and volume of surface water run-off reaching the main watercourses. The whole catchment lies within Exmoor National Park and the area is an attractive destination for visitors. Tourism provides key direct and indirect employment in the area through, for example, B&Bs, caravan and camp sites, tea rooms, pubs and riding stables (Hester N. et al., n.d.)

At the start of the project, the Environment Agency Flood Map indicated that nearly 100 properties were at high risk of flooding. There is an early warning siren system on both the Aller and Horner watercourses, triggered by rapid level changes at the Environment Agency gauging stations, which was upgraded recently. Properties are at risk from flooding from these watercourses, which have become constricted through road and bridge construction and through the lack of connected floodplain capacity. There is also evidence of increased run-off from a drainage network of roads, paths and tracks in the upper catchment and from inappropriate and/or untimely soil and land management activities on vulnerable farmland. The most recent rainfall event that caused serious flooding was in 2000, when a significant number of properties were flooded and the A39 road became impassable. Since the project started, a property level protection scheme has been put in place to improve resilience in the most vulnerable properties (Ibid.).

Most watercourses in the catchment have good ecological status apart from the Horner Water which is at moderate due to low light levels from overshadowing in Horner Wood. The majority of the Horner catchment has protected status as a Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR) and Special Area of Conservation (SAC). Water is a significant contributor to the high ecological value of the catchment both directly (mires, flushes and pools) or indirectly, for example, through creating temperate rainforest conditions in Horner Wood, resulting in more than 330 species of lichen.

Level of ambition in restoration/rewilding

The multi-objective flood risk management demonstration project was the initial project which focused on reducing flood risk by using nature-based solutions, working with natural processes (WWNP) using natural flood management (NFM) measures. The project was driven by Defra, supported by the EA and managed by the National Trust, and aimed to demonstrate that by looking at whole catchments and strategically targeting shifts in rural land management practices, sustainable support to flood management may be achieved. It was intended to highlight that through rural land management change and intervention, additional ecosystem services could be delivered within catchments, for example landscape quality, biodiversity, carbon stewardship, water quality, amenity and recreation.

The subsequent Porlock Vale Streams Riverlands Project at Holnicote (2018-2023) is a landscape scale initiative which started in 2018 for an initial funding period of 5 years and aims to “restore healthy rivers and catchments, rich in wildlife, enjoyed and cared for by all”. One of the key river restoration schemes being delivered as part of the project is restoration to Stage 0 of sections of river catchment. The aim is to reconnect sections of stream and river to the surrounding landscape, re-establishing the connection between terrestrial and aquatic ecosystems. The project covers 4 hectares of land involving a tributary of the River Aller but, if successful will be developed over a 15-hectare site on the River Aller itself. The project pioneers a 'Stage 0' reset approach to natural river restoration in the UK (learning from the experiences in Oregon, USA (Powers P.D., Helstab M., and Niezgoda S.L., 2019) where successful restoration of multiple streams and rivers to slower flowing systems has led to multiple, smaller channels, pools, riffles, and wetlands, supporting a richer diversity of both animal- and plant-life) (River Restoration Centre, 2020).

Other examples of nature-based solutions being delivered by the Riverlands project include a beaver release into two enclosures, upland drainage restoration, road and path flow diversion, woodland creation (tree planting and natural regeneration), hedge planting, pond creation, lower Hawkcombe river re-naturalisation, working with farmers to develop alternative land management practice, Stage 0 process approach (using low-tech tools such as beaver dam analogues (BDAs) and post-assisted log structures (PALS) to restore watercourses) and catchment/site scale hydrological monitoring.

Vision, aims and objectives

The principal objectives of the initial project were:

- To establish a robust hydrological monitoring programme across the study area;
- To identify potential catchment (hillslope and floodplain) interventions that may contribute to managing flood risk;
- To demonstrate the practical implementation of catchment interventions (e.g. changes to land use, land management practices, and hydrological connectivity);
- To assemble evidence, both from recorded datasets and hydrological/hydraulic modelling, about the impact of the catchment interventions on runoff and flood dynamics; and
- To assess what the evidence reveals about the potential or actual benefits, in terms of flood risk management and the delivery of a range of other ecosystem services.

The main aim was to provide evidence to demonstrate how WWNP, implementing NFM measures at the catchment scale, can contribute to reducing flood risk while delivering a range of other environmental and social benefits. A hydrological monitoring network was installed to provide high quality, high resolution rainfall, stage and flow data for assessing the impacts of the NFM measures throughout the entirety of the project. A range of NFM measures were implemented including upland drainage attenuation features, woody dams, woodland creation, leaky weirs and offline storage areas.

The initial project focused on traditional in-channel NFM techniques but - through rapid evolution of thinking in river restoration approaches - the project helped to initiate the current Riverlands project which began in 2018. The principal aim of the Riverlands project is to restore natural processes, to create complex habitats, to link aquatic and terrestrial habitats, to enable uplands restoration and to restore natural hydrogeology and reconnect floodplains.

Environmental and ecological benefits

In addition to the direct flood risk benefits, the project has highlighted that there are significant soil erosion issues on the Holnicote Estate, particularly on the steeply sloping uplands of the Horner catchment and some of the ploughed fields in the upper Aller catchment. Land interventions carried out to improve soil management and reduce surface water run-off are likely to benefit water quality and agricultural productivity by controlling erosion and trapping sediment. Other benefits include reduced loss of soil/peat particles, increased carbon sequestration and improved water quality downstream. Baseline work carried out by Exeter University has shown no significant water quality issues apart from high levels of suspended sediment following storm events.

The estate's rich biodiversity resource increased as a result of the project, expanding the extent of habitats including wet woodland (by 7 hectares), deciduous woodland (5 hectares) and wet meadow (by 10 hectares). New habitats were created including 12 scrapes on the floodplain and 150 catch pools on the uplands.

The subsequent Riverlands project has focused further on restoring natural processes. As an integral part of this, in early 2020 the estate released a pair of beavers with the intention of making areas of the river more resilient to climate change and the extremes of weather it will bring. The dams beavers create are effective for holding water in dry periods, lessen flash-flooding downstream, reduce erosion and improve water quality.

Social benefits

Social benefits include:

- Reduced flood risk to properties in hamlets/villages including Allerford, Bossington and West Lynch. These areas were previously vulnerable to flash flooding as the water cascaded down from the uplands of Exmoor into Porlock Bay.
- Increased awareness of flood management across the community.
- Increased understanding amongst communities and land managers of the many wider benefits of good land management. This included one-to-one engagement, and film nights on beaver reintroduction.
- Volunteering opportunities for the local community.
- Understanding and enjoyment of nature, both experiential and educational for local community and visitors.

Economic impacts

Since the project began, there has been no flooding in the vulnerable downstream villages that had experienced regular flooding in the past, even during the extreme rainfall events of winter 2013 to 2014, where measured hydrological data clearly showed a significant reduction in flood peak. This was confirmed when the same data were run through 'before' and 'after' NFM implementation scenarios in the hydraulic flood model of the catchment. During an extreme rainfall event on an already saturated catchment in late December 2013, NFM interventions reduced the flood peak by 10%. With a combined insurance value of £30 million, none of the 98 properties at risk were affected by flooding then, or during any subsequent flood events. The capital costs of constructing the offline storage bunds on the floodplain upstream of the vulnerable properties were £163,000, a small cost compared with the insured value of the properties at risk of flooding.

Furthermore, by bringing more wildlife into the area, the projects are anticipated to have a positive effect on the tourism industry, increase visitors and enhance the rural economy through business diversification, especially given its proximity to Exmoor National Park and the coast.

Other benefits include use of local contractors for key project works e.g. for groundworks or regional consultants for feasibility assessments.

Key barriers and opportunities

Buy-in from communities and key stakeholders who influence land management decisions is essential. Although the National Trust owns 90% of the catchment area, much of this is managed by 14 tenant farmers and those with commons rights in the uplands. There have been some issues with community engagement, particularly with tenant farmers. A key aspect of the project has been engagement, education and working closely with the local community by organising local events. Strengthening personal relationships via one-to-one meetings with tenant farmers has been the most effective method to overcome resistance and ensure restoration efforts do not detriment farm businesses. Agri-environment schemes have been important here to counter income lost from production. Further to this, a key success factor is having a dedicated, locally based project manager who is familiar with the area and has good relationships with partners and the local community.

There was some concern from Natural England that the current project could have negative impacts in terms of heritage and landscape character. Existing legislation and regulatory frameworks therefore can act as more of a hindrance than a help in delivering LSNR projects.

Monitoring requirements of some funders can be costly and time consuming, although such data is essential to quantify and translate the benefits of projects and the return on investment. However it was noted that the ability of discrete spatial data to be scaled up to the catchment/landscape scale needs improving. Besides, the estate has found that lower cost monitoring methods such as photographs and drone footage have been more effective when engaging with the community and wider public given they are more understandable and relatable forms of data.

A future opportunity highlighted during the interview was the approach to grazing management in floodplains. It is vital for the right grazing to be in the right place and the Estate is exploring the potential introduction of native breeds of cattle (lower numbers but of better quality) in order to deliver improved habitat outcomes. There are opportunities for low input farming with a well-managed grazing system and a move away from the use of swales, with some support from local land managers.

Natural flood restoration remains an evolving field of work meaning there is no set structure for delivering restoration. Given projects like these pilot new ideas and face unforeseen challenges, a strong project team and buy-in from partners and stakeholders are important as well as being comfortable working with a degree of uncertainty ('grey areas').

Although the approach to restoration has evolved rapidly since the earlier NFM project, some key lessons were learnt that have helped shape the approach taken in the current Riverlands project:

- Soft-engineered, earthwork bunds on connected floodplains are a highly effective and environmentally sustainable method of preventing flooding by attenuating the peak stormflow.

- Allowing natural woody dams to develop wherever possible within woodland areas.
- The importance of early and regular engagement regarding consents/approvals, and with catchment stakeholders and local communities to gather local knowledge, discuss issues and report plans/progress.
- Regular dialogue with farmers to highlight the value of implementing good agricultural practices that prevent soil compaction/degradation, rapid run-off and associated sediment transport issues.
- Engineering in channels e.g. storage cells and weirs require ongoing management intervention and thus does not necessarily allow the environment to return to a natural, self-sustaining state. Such approaches interfere with the natural functioning of the ecosystem while additional time and costs are incurred to maintain the system. Therefore, thinking has evolved to encourage a more naturalised approach to restoring the rivers in the Aller and Horner catchment through the Riverlands project, which hopes to achieve a natural ecosystem that is self-sustaining and resilient in future.
- There is a need for continuity of funding so projects can be long-term.
- Importance of aligning project aims across all stakeholders at the outset of projects to enable effective delivery.

A Defra pilot of Payment for Ecosystem Services (PES) for the initial project showed that raising the profile of the efficacy of nature-based solutions and building awareness among beneficiaries is key to the long-term success. It recommended a renewed campaign to raise awareness of NFM solutions amongst landowners and the general public. The pilot established how PES could be used to generate funding as part of a package of potential funding sources given it would unlikely be a sole funding mechanism for such projects. Although potential buyers (such as the Environment Agency, consumers and local communities) were supportive of the concept of NFM, it remained difficult to engage them with the key reason being the feeling that they are not responsible for managing flood risk. The study highlighted that visitors to Holnicote are a major untapped source of funding and it is likely that a Visitor Giving Scheme could encourage donations, capitalising on public interest in NFM and biodiversity gains in particular (Rogers et al. 2015; Defra, 2016).

The interview highlighted that funding for such projects would be more sustainable where an ecosystem services approach is taken, ensuring benefits provided by a project are sustained long-term. Landowners being paid for example for the carbon value of soil, water stored and public access would ensure LSNR projects are financially viable and support farm business diversification.

Partnerships and funding

Project partners for the initial NFM project were the National Trust, Defra, EA, Somerset Rivers Authority, Penny Anderson Associates and JBA Consulting / JBA Trust. The project was core funded by Defra (£722,000) with additional funding from the National Trust and Somerset Rivers Authority.

The current Riverlands project, with a value of £10 million, is led by the National Trust, working in partnership with the EU Interreg 2 Seas Co-Adapt programme (funder), Somerset Rivers Authority (funder) and EA (partner and funder). (Unforeseen circumstances such as Covid-19 have been an issue as it has affected the ability of contractors to get to site and carry out works. Fortunately, this has been overcome by a funder approved project extension of 6 months). There is input from a wide range of other partners, National Trust tenant farmers and other landowners in the local area.

Sustained funding is an issue in terms of its relatively short-term nature and because project aims and objectives must align with those of the funding criteria. Some funding sources also have strict monitoring requirements which can prove costly and time consuming.

The interview highlighted that although there may be conflict of opinions within partnerships, this is usually beneficial to a project as it enables robust debate to ensure the approach and methodology are right.

Wallasea Island Wild Coast Project

Case study summary

Wallasea Island lies within the Crouch and Roach estuaries which are in the top five most important coastal wetlands in the country. It is designated a Special Protection Area (SPA) for its wintering Brent Geese and waterfowl assemblage, and a Special Area of Conservation (SAC) for its intertidal habits and as a wetland of International importance through the Ramsar designation. The project demonstrates an innovative approach to adapting to climate change, and how nature conservation and industry can work together to benefit the environment.

The main aims/vision of the project include:

- To create new intertidal habitats to compensate for losses in the Crouch/Roach Estuaries and to offset historic losses of coastal habitats and species in the UK.
- To avoid the flood damage risks to the Crouch/Roach Estuaries and Wallasea Island that exist from a future unmanaged breach of the existing seawalls.
- To create an extensive area of accessible coastal land for the quiet enjoyment of nature and open space, reconnecting people with their coastal heritage.
- To demonstrate, through a large-scale practical example, adaptation to climate change and sea level rise on the coast.

The key issues/opportunities include:

- Habitat creation
- Reduced flood risk
- Tourism and recreation benefits
- Re-use of construction materials for nature conservation

- Enhancing conditions on sites under existing international designations for habitats and species
- Technical challenges to the construction process

Partnership models/funding:

- Partnership between RSPB (who own Wallasea Island), Crossrail and Environment Agency. Engineers and consultants working on the project included BAM Nuttall, ABPmer, Faber Maunsell, Aecom and Halcrow (now part of Jacobs). Collaborative working was vital to complete the project.
- Work to restore the final 269 hectares on the southern half of the island began in 2018, funded with contribution from Viridor Credits and Enovert Community Trust.

Administrative and socio-economic context

Wallasea Island is located in the district of Rochford, Essex, South East England. It is located on the Crouch Estuary, bounded to the north by the River Crouch, to the south east by the River Roach, and to the west by Paglesham Pool and the narrow Paglesham Creek.

Rochford district has a population of around 85,000, mainly in the settlements of Rochford and Rayleigh. The population of Wallasea Island is included in the civil parish of Canewdon, which has a total population of around 1,100. The population density is low at around 0.5 people per hectare, much lower than the Rochford average of 3.1 people per hectare. The average age of residents is 42.3 years. The village of Canewdon is approximately 4 km west of the Wallasea Island reserve: it is a small village with a shop, a pub and a primary school. There are bus services to the village but no train station. The main services are in the nearby town of Rochford (4 miles south west of Canewdon) where there is a rail station on the London Liverpool Street line, while Southend-on-Sea is 6 miles south and the City of Chelmsford is 18 miles away. Both offer a wide range of shops, facilities and schooling.

Much of Wallasea Island was farmland with wheat as the main crop, prior to the purchase by the RSPB of what is now largely the Wild Coast. A small settlement at its western end is linked by road to the mainland and is home to a campsite and marina. It is linked by a ferry to Burnham-on-Crouch (on the north side of the River Crouch).

Landscape and land use context for the surrounding area

The Essex estuaries are one of several important coastal wetlands and protected by national and European law. Wallasea Island lies within the Crouch and Roach estuaries. The international importance of this area has been recognised by European designations as an SPA for its wintering Brent Geese and waterfowl assemblage, and as a SAC for its intertidal habits and as a wetland of International importance through the Ramsar designation. The predominant habitat types are saltmarsh, mudflats, islands, saline lagoons and coastal grazing marsh. The surrounding farmland is flat low-lying land predominantly under arable farming.

Environmental baseline prior to the LSNR restoration

Scale: 850 hectares (8.5 km^2)

Type of project: Coastal

Wallasea Island is characteristic of the Greater Thames Estuary NCA (Natural England, 2013) within which it sits. The latter is a predominantly remote and tranquil landscape of shallow creeks, drowned estuaries, low-lying islands, mudflats, and broad tracts of tidal salt marsh and reclaimed grazing marsh. It contains some of the least settled areas of the English coast, which provides a stark contrast to the busy urban and industrial areas towards London where population density is high and development pressures are increasing. Sea defences protect large areas of reclaimed grazing marsh and its associated ancient fleet and ditch systems, and productive arable farmland.

In the 15th century, the Dutch constructed a sea wall and drained the first parcels of land at Wallasea for agriculture; over time, what used to be at least four separate islands were claimed and joined, eventually forming Wallasea Island. At the end of the 20th Century, the sea wall fell into disrepair at the same time as the risk of flooding increased (1:5 risk of catastrophic flooding each year).

The landscape used to be marked by a rectangular network of fields with tracks and drainage ditches. Parts of the island outside of the RSPB reserve are still being farmed; crops include wheat, rape and peas. Within the reserve, arable farming reduced over time and stopped in 2017, when construction on the final wetland phase commenced.

The island was considered an ideal landscape to undertake such a vast project given the large area of low-lying, former intertidal land and little pre-existing infrastructure on the island.

Level of ambition in restoration/rewilding

The Wallasea Island Wild Coast Project is an example of a new approach to flood management in coastal areas. It is the largest, and arguably the most innovative, coastal wetland recreation project in the UK, designed to create the UK's largest man-made marine wetland. It demonstrates an innovative approach to adapting to climate change, and how nature conservation and industry can work together to benefit the environment. It is a model for coastal habitat creation and natural flood risk management, demonstrating how coastal areas can be future-proofed against sea-level rise and coastal erosion, at the same time as delivering benefits for wildlife and people.

The more traditional approach of building hard defences such as sea walls is being replaced, where appropriate, through a sustainable managed realignment approach. This is an intertidal habitat creation technique, using breaches (holes) in the sea wall to allow the sea in to recreate intertidal habitats. The approach has several benefits, including: reduced costs for provision and ongoing maintenance of hard defences; less visual impact on the landscape; creation of river, estuary or coastal habitats which helps to

absorb wave energy and store water, and reduce the risk of flooding; and creation of natural intertidal habitats or replacement of habitats being damaged or lost elsewhere because of climate change impacts (e.g. rising sea levels and coastal erosion). The range of habitats include mudflats, saltmarsh, saline lagoons and brackish marsh. The project required some of the low level land to be raised, with the habitats created being dependent on the height of the land being flooded. This is where the partnership with Crossrail began in 2008, as there was opportunity to reuse clean spoil (clay, chalk and gravel) from their tunnelling in London.

The design (split into five cells constructed in project phases) allows up to 2 million m^3 of water to enter and leave parts of the site (and thus the estuary). This volume of water exchange will facilitate the creation of a wetland that replicates natural tidal cycles. The scheme was designed to improve the flood protection of buildings located on the west of the island by the construction of a new counterwall. The counterwall was designed to help shorten the line of defence and reduce long-term seawall maintenance costs. One of the cells was designed to act as a flood storage area that would help to reduce flood risk across the estuary system, especially during the largest surge tides. The five cells are divided by internal bunds (which were aligned to follow old marsh 'island' boundaries). To allow for the development of varied saline and brackish habitats, three of the five cells were designed for full realignment and one cell was designed to be a regulated tidal exchange (RTE) area. RTE is similar to managed realignment, but rather than breaching a seawall, it included the design of water control structures such as weirs, culverts or sluice-controlled pipes within seawalls to control regular tidal inundation (RTE particularly lends itself to saline lagoon creation). However, for various reasons, not enough fill was available to facilitate managed realignment in Cells 2 and 4 in the end, leading to a re-design whereby these two cells are now mostly RTE cells, with water coming in through a repurposed drainage pipe from the Roach estuary. Cell 5 was designed to contain mitigation habitats and visitor access facilities (Cross M., 2017). The project timeline has been longer than originally anticipated and is summarised below:

- 2006: Wetland restoration began when sea walls were breached on the northern edge of the island.
- 2007: Land purchase agreement (2 year option/freehold purchase).
- 2008: Partnership with Crossrail.
- 2011: Habitat restoration commences in earnest (399 hectares restored between 2011-2018).
- 2015: Cell 1 managed realignment (Jubilee Marsh, 115 ha) completed and breached. Cell 3 RTE also functional.
- 2017/18: re-design applications for Cells 2 to 4 approved (from managed realignment to RTE due to fill shortfalls).
- 2018: Work to restore the final 269 hectares on the southern half of the island (i.e. Cells 2 to 4) completed (this included 55 hectares of brackish marsh, 82 hectares of freshwater marsh, and 132 hectares of tidal saline lagoon).
- 2025: Expected project completion incorporating all project elements.

Aims

The main aims of the project were to create new coastal wetland habitats of high value for wildlife, avoid the flood damage which would occur following any unmanaged breach of the existing seawalls on the island and create an extensive area of accessible coastal land for the quiet enjoyment of nature and open space.

A range of societal benefits are being delivered, including carbon sequestration, reduction in flood risk, increased human health and well-being through outdoor recreation, as well as providing nursery areas for commercially important fish.

Over the course of the project, the plan was to create / restore a total of around 670 hectares of coastal wetland habitats. The works also include an expanse of grassland (including grazing marsh and seawall) and a small area of rotational arable land (namely 'wild bird cover'). These habitats are supporting an array of nationally and internationally important bird populations, as well as a host of other wildlife.

Under the aim to reconnect people with their coastal heritage, there are plans for a visitor centre and five birdwatching hides; some 15 km of new footpaths and cycle routes have already been completed which allow people to get closer to the Island’s wildlife.

Environmental and ecological benefits

Environmental and ecological benefits are primarily focused around habitat improvements and flood risk management:

- Habitat restoration and creation: The conversion of the land from arable farmland into a wetland reserve has improved habitat for a variety of species. There is a total 670 hectares of intertidal habitat, saltmarsh, saline lagoon and grazing marsh which is home to breeding birds such as Avocet, Lapwing, Little Ringed Plover, Common Tern, Corn Bunting and Skylark. In winter, the site also attracts thousands of waders (such as Dunlin, Wigeon and Curlew) and wildfowl including Brent Geese. Other species include Water Vole, Brown Hare, Adder, Shrill Carder Bee, Oil Beetles and wintering raptors such as Hen Harrier and Short Eared Owl.
- Plants such as samphire, sea lavender and sea aster have established and are expected to thrive further in future. It is hoped the new reserve will provide the perfect habitat for newly colonising species to the UK, such as spoonbills and black-winged stilts.
- Saltwater fish such as bass, herring and flounder are using the wetland as a nursery.
- The environmental sustainability ethos of the project was carried through to the earthworks. Low emission earth-moving plant was utilised to transport the soil across the site. As a requirement of the planning permission, ahead of the construction works, up to 30 ecologists were employed at any one time, with some 8,200 protected reptiles, including 45 snakes, relocated to a purpose-built series of hibernacula; and 180 water voles were trapped and displaced to new enhanced habitats (Bam Nuttall, n.d.).

- The site has now national (and international) visibility and recognition.

Social benefits

Social benefits include:

- Reduced flood risk to people's homes and businesses.
- Community involvement through 20 volunteers in addition to staff.
- Partnership collaborations between private and third sector.
- Recreational benefits to local communities particularly in the nearby towns of Rochford, Southend and Burnham-on-Crouch. The reserve offers a huge open space environment and area of wildness, including footpaths and wildlife encounters.
- Bike shelter which displays posters and information on upcoming events and about RSPB Wallasea Island, benches and visitor shelters found at several points within the reserve.
- A new access route, especially significant for populations of Southend and Chelmsford.
- Eco tourism.
- Some work done on developing a tourism strategy for Wallasea Island making connections to local coastal heritage, such as the last resting place for HMS Beagle.

Economic impacts

The economic benefits are closely related to the high level of investment in the project i.e. over £50 million. The project is also an example of the circular economy in the built environment, where construction materials have been reused in a high-value conservation project providing benefits for both people and wildlife (Cross M., 2017) i.e. more than 3 million tonnes of earth was brought by boat from the tunnels and shafts created by the Crossrail scheme in London, and were used to raise land levels by approx. 1.5m on average in a way that created 115ha intertidal area of saltmarsh, islands and mudflats (cell1, Jubilee Marsh). This negated the requirement for excavation arisings to be disposed as waste to commercial landfill sites.

The partnership with the RSPB was a key part of Crossrail's sustainability strategy and demonstrated the benefits that can be achieved when the construction industry and environment groups work together creating a positive environmental legacy. In addition, Crossrail helped to create saline lagoons, a creek network and grazing marsh in Cells 3 and 5. Once Crossrail left post completion of Cell 1, the RSPB led on the construction/completion of the project. All of which means that nearly all of the arable farmland within the project area has been transformed into wildlife-rich habitat.

In relation to local employment, the interview clarified that two farm workers were made redundant; however, the project has provided three job opportunities for RSPB staff and additional short-term work for the contractors involved in the implementation process.

However, it was also highlighted that such project requires staff who are flexible in approach and working hours, at least at the outset. This illustrates the flux in economic benefits created by the development of the project.

Key barriers and opportunities

A key opportunity for the site was the presence of a single landowner which facilitated the project in terms of negotiation and communication. The landowner was a private farming trust based in Leicestershire who acquired land at Wallasea Island in 1952, but it flooded the following year leaving them unable to farm for a few years. As a result of the land being held by a landowning trust with extensive landholdings elsewhere in England, the landowner had a more strategic approach to its farming assets and recognised there was not a long-term future for their farming at Wallasea Island (due to the deteriorating long lengths of seawalls and drainage infrastructure).

The RSPB gained insights from learning from experience elsewhere, with visits to projects in the Netherlands (Tiengemeten), Germany (Beltringharger Koog), Denmark (Margarethe Kog), Spain (Donana National Park), Hong Kong (Mai Po) and Shanghai (where useful conversations around introducing water on flat land for rice production helped inform and inspire work at Wallasea Island). These visits highlighted the importance of being able to see and understand existing projects, and being able to ask questions of project staff involved. The importance of seeing projects elsewhere not only informed project development but was important in securing confidence that the end result could be achieved. UK experience was limited, and the RSPB wanted to learn from looking further afield. Taking stakeholders and key community representatives to see successful projects and meet wider communities in project areas to talk to them about concerns was also considered to be transformative.

People and management skills are identified as important in achieving the project. This includes capable, experienced, committed project leadership with strong focus on outcomes, relationship building, problem solving, teamwork, communication and negotiation. The project was supported by a team with expertise in legal and land agency issues, ecology, communications and regulatory understanding. Management support is needed to ensure capacity, sufficient project development resource and to encourage outside the box thinking and solutions.

Key challenges faced at Wallasea Island were as follows:

- The international significance of the site and presence of protected species were a significant challenge for the project due to scale of site. This included limiting the spread of sand lizards to enable works and consents to happen. There was also the requirement for translocation of some species due to the flooding of the area with saline water, notably water voles.
- Community concerns around recreational traffic and access to the site.

- Concerns around impacts from the project on sailing during construction due to higher levels of vessel movement bringing material to site, and the impacts of increased bird populations on aviation.
- Technical challenges from the scale and location of the site; low lying land, 1 metre below mean high water, was a physical constraint.
- There were concerns about changes in coastal processes outside of the site, although robust modelling was undertaken.
- The farming community had concerns over loss of farmland and a precedent being set.
- Oyster fisherman became more vocal about their concerns towards the end of the project – highlighting the importance of a flexible approach to consultation as new stakeholders may appear outside of consultation period as they realise projects might have an impact.
- The securing of planning consent within 12 months for creating the new nature reserve, including the importation of up to 4.5 million m^3 of suitable material, jetty construction, habitat construction work. There was also the environmental impact assessment and public consultations. This amounted to a major undertaking in terms of volume of work and complexity.
- Working with the Crouch Harbour Authority to address their concerns and commercial interests was a challenge as was obtaining timely consent from the MMO.

Partnership models

The project was a partnership between RSPB (who own Wallasea Island), Crossrail and Environment Agency. Engineers and experts working on the project included BAM Nuttall, ABPmer, Faber Maunsel, Aecom and Halcrow (now Jacobs). Collaborative working was vital to complete the project. Work to restore the final 269 hectares on the southern half of the island began in 2018, funded with contribution from Viridor Credits and Enovert Community Trust.

The interview highlighted that establishing a range of partnerships with different organisations requires having to understand the different requirements of what is needed.

The project team established a local liaison group. This was part of requirements for planning, but the RSPB also drew in stakeholders from a wider reach than the planning perspective to help inclusion. The group met every six months throughout the development stages (for 10 years). This group was important as it built links with key stakeholders to encourage a sense of ownership and involvement.

The project team also established a technical panel to bring in key regulators. The group was initially set up 2007, but remained effective throughout Crossrail involvement. Again, this highlighted the importance of understanding regulatory issues to help shape project planning and decisions at an early stage to inform development phases. It is important to agree reporting arrangements at the beginning and ensure that these are workable and sensible from the outset.

In terms of funding provided for the project, the interview clarified that the project has benefited from a tax credit scheme as part of the project approval from ENTRUST with monies from both Viridor Credits and the Enovert Community Trust. Some further funding has come from the Landfill Communities Fund which has helped to complete works on lagoons and the purchase of a tractor. Crossrail funded much of the implementation of Cells 1, 3 and 5. (The Landfill Communities Fund is an innovative tax credit scheme enabling operators of landfill sites in England and Northern Ireland to contribute money to organisations enrolled with ENTRUST as Environmental Bodies (EBs). EBs are able to use this money to deliver projects).

Wild Ken Hill

Case study summary

Ken Hill Estate is a 1600-hectare estate located in Norfolk located within the North West Norfolk NCA. It is a lowland arable landscape that stretches towards to coast. The Wild Ken Hill project began in late 2018 with a Countryside Stewardship agreement, central to project delivery, beginning in early 2019.

The project is based on a three prong-approach to land management which includes a 425-hectare rewilding area of formerly unproductive arable land, traditional conservation on the marsh and regenerative arable agriculture on the productive arable land.

The main aims/vision of the project include:

- The vision is to be a national exemplar in land management, leading the way in how to manage land to deliver public goods whilst overcoming inherent land management conflicts.
- The mission is to drastically change the way land is used at Wild Ken Hill, showing how farmland can deliver multiple benefits by producing food, providing space for nature and people, managing air and water quality and helping to tackle climate change.

The principal motivations for the project were:

- To address the worsening biodiversity and climate crises;
- To future proof operations from Brexit and other commercial challenges.

The key issues/opportunities include:

- Regenerative agriculture improving climate resilience
- Rewilding of unproductive land
- Knowledge sharing
- Volunteering and educational opportunities
- Tourism, leisure and recreation benefits.

Partnership models/funding:

- The Estate does not work as a partnership as such, being privately owned.
- A significant proportion of work is funded by agri-environment schemes.
- The Estate is exploring diverse methods of income to become more self-sustaining in future.

Administrative and socio-economic context

The Ken Hill Estate (Wild Ken Hill, 2021) is north of King's Lynn, West Norfolk in eastern England. King's Lynn is a popular tourist destination in Norfolk and is the nearest large town lying 15km south of the estate. The 1,600 hectare estate is within the area administered by the Borough Council of King's Lynn & West Norfolk, spanning across Heacham and Snettisham wards. The estate has been in the same family since the 1870s and includes an expanse of woodland west of the main A149 coast road, former arable land and reclaimed freshwater marsh stretching down to the shores of The Wash. The Sandringham Estate and Country Park is approximately 6km south.

The combined population in Heacham and Snettisham is 8,632 (Norfolk Insight, 2019), with a large proportion of the population aged over 65 (42%) and a small working age population at 46% (compared to 58% for Norfolk and 62% England wide). The population is predominantly white British (99%). Those economically active account for 57% of the working age population, and are comprised mainly of skilled trades, elementary and caring, and leisure and service. 1.2% are long term unemployed, below the Norfolk (1.5%) and England (1.7%) averages. The Index of Multiple Deprivation (IMD) scores the area around average nationally. The IMD integrates several domains, of which the area scores lower (is more deprived) for health, education and employment, and scores higher (is less deprived) for the living environment, income, crime and barriers to housing and services.

The West Norfolk Local Plan (review of Core Strategy undertaken in 2019 (King's Lynn and West Norfolk Borough Council, 2019)) is important to consider with respect to the rewilding project and the influence it may have on the local people and economy. The project can go some way to achieving some of the strategic policy objectives for key places including for Hunstanton (which is a focus for growth in tourism), rural areas (to protect attributes of the locally distinctive countryside and support social and economic needs of those who live there, as well as promoting agricultural sector diversification into other activities) and coastal areas (reducing threat of coastal erosion and flooding and balancing improved accessibility with landscape and ecological protection).

Landscape and land use context for the surrounding area

The Ken Hill Estate is located within the North West Norfolk NCA (Natural England, 2013), which is characterised by open and rolling topography which contrasts with the surrounding coastal, fenland and other lowland NCAs.

This NCA is very important for agriculture with a large-scale arable and grassland landscape comprising extensive arable cropping and some areas of mixed farming. The main ecosystem services provided include:

- Provisioning services such as food provision, timber provision, water availability and biomass energy;
- Regulating services such as climate regulation, water and soil quality regulation, and soil erosion regulation; and
- Cultural services such as sense of place/inspiration, sense of history, recreation, biodiversity and geodiversity.

Key sites of conservation interest include internationally important heathland areas and acidic mire systems supporting equally important populations of natterjack toads and nationally important populations of nightjars. Moreover, the area hosts important deposits of peat in the south west of the NCA. There are several biological, geological and mixed-interest Sites of Special Scientific Interest (SSSI) within the NCA. Dersingham Bog is designated internationally and nationally as National Nature Reserve and SSSI. Approximately 20% of the NCA is within the Norfolk Coast Area of Outstanding Natural Beauty.

The key pressures on this NCA arise from tourism, traffic and development, especially along the boundary with the North Norfolk Coast NCA and from King's Lynn to Hunstanton (where the estate lies).

The West Norfolk LCA (Chris Blandford Associates, 2007) shows the majority of Wild Ken Hill to be wooded slope with estate land. This area is bound to the south by farmland with woodland and wetland, and to the west by drained coastal marshes and the town of King's Lynn. To the north it is met by coastal slopes and to the east by rolling open farmland. The sloping landform forms the transition between the low-lying coastal marshes to the west and the elevated rolling open farmland to the east. The LCA has a mature landscape structure, with fields and paddocks delineated by generally mature hedgerows. There are traditional buildings materials (such as carstone) within several traditional/older buildings, mature woodland copses and larger areas of woodlands and plantations (including Ken Hill Wood).

Environmental baseline prior to the LSNR restoration

Scale: 425 ha restoration ('rewilding') area (plus 200 ha freshwater marsh, 570 ha enclosed farmland, remainder is non-farmed conservation e.g. hedgerows)

Type of project: Lowland (ex-arable)

The Wash runs along the western boundary of the estate and is a SPA, SAC and Ramsar site. The site also has two internationally significant wildlife sites; forms part of the Norfolk coastal Area of Outstanding Natural Beauty (AONB) and includes three County Wildlife Sites (site numbers 478, 479 and 481). The CWS system in Norfolk is managed by a partnership of organisations with the Norfolk Wildlife Trust taking a lead role. The aim is to protect, maintain and enhance these sites, ensure their recognition by landowners, target agri-environment schemes in these areas, encourage their sympathetic management and improve habitat connectivity. There are no SSSIs on the estate, although two geological SSSIs border the boundary; Snettisham Carstone Quarry and Heacham Brick Pit.

Wild Ken Hill sits at the intersection of several soil types. The holding consequently takes in a diverse set of habitats and landscapes: undulating terrain with good, base-rich soils capable of supporting arable farming, sandier soils where arable farming is possible but difficult, deciduous woodland, acid heathland, grazing meadows, freshwater marshes, and areas of coastal park.

There has been a long history of nature conservation and ‘sympathetic farming’, even prior to 2018 when the estate embarked on the 'Wild Ken Hill' project. The site was of international significance for arable plants and bats (although not designated as such) and use of insecticide on any of the farmland was stopped many years previous (Avery M., 2020).

Level of ambition in restoration/rewilding

The vision is for Wild Ken Hill to be a national exemplar in land management, leading the way in how to manage land to deliver public goods whilst overcoming inherent land management conflicts. The mission is to drastically change the way land is used at Ken Hill, showing how farmland can deliver multiple benefits by providing space for nature and people, managing air and water quality and helping to tackle climate change, whilst continuing a productive arable enterprise on part of the estate. There are two principal motivations for the project:

1. To address the worsening biodiversity and climate crises in a more radical fashion – steering away from harsh agricultural and forestry techniques that have contributed to record emissions and species loss - and support improvements in public health by satisfying societal needs for access to nature.
2. To future proof operations from Brexit and other commercial challenges. Wild Ken Hill want to demonstrate the power of a 'rewilding' approach, both as a tool for environmental good, but also as a way for landowners and managers to reinvigorate their businesses especially in such uncertain times.

The objectives are to have resilient and recovered soils, increased growth of natural vegetation, increased biodiversity and the return of nature and wildlife. The project has been influenced by the successes of Knepp Estate in Sussex, the only other large lowland rewilding project that has demonstrated the impact of nature restoration in improving biodiversity and providing natural climate solutions like carbon capture and flood defence (Conservatives, 2020).

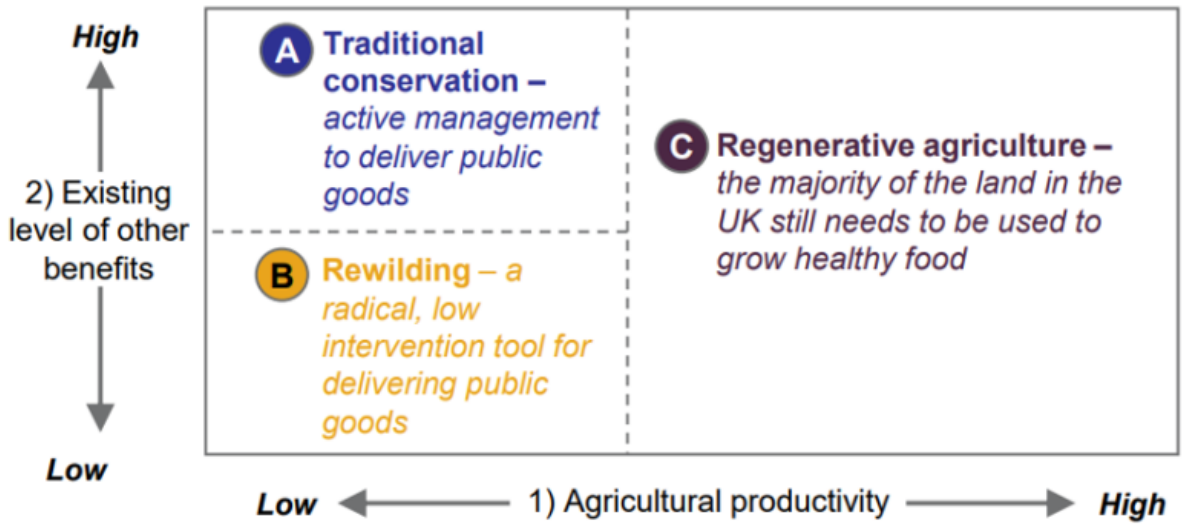
The focus on immersing people with nature is a key aspect to the long-term vision. The estate hopes to provide an attraction for people interested in wildlife where they can stay, go on safari and practise photography. Offering nature-rich well-being retreats is also being considered alongside more leisure and recreation activities Bentley R., 2019).

Aims

The aim is to restore a mixture of agricultural land and woodland toward a mosaic of woodland pasture, heathland, and other habitats while productive land will be managed under a regenerative agriculture approach. A large area of mixed woodland in the centre of the rewilding area was historically classified as 'fen' so is being restored, enabling the area to become a wetter, wilder set of ecosystems (Buscall D., 2020).

The project takes a balanced approach to land management across the 1600-hectare estate, and the project has marked the end of any harsh, conventional and linear agricultural approaches, with some of the land being handed back to nature, while the more productive land is farmed under a regenerative approach (Conservatives, 2002). Resilience to climate change is also a key driver and the project aims to enable greater carbon sequestration through carbon storage in the ground and also in the biomass of the rewilding area. The project combines three approaches to land management in different, adjacent areas according to soil type:

- Rewilding;
- Regenerative agriculture; and
- Traditional conservation techniques (on the marsh).



Wild Ken Hill Land use model 2020 (Source: Wild Ken Hill, 2021)
Click for a full description

The rewilding of around one quarter (425 hectares) of the Ken Hill Estate is mainly upon sandy soils which were less productive for conventional arable production. The freshwater marsh (around 200 hectares) is above clayey soils and is under traditional conservation (managing water levels and grazing), whilst pioneering regenerative arable agriculture for food production is undertaken on the rest of the holding which is typically Grade 3 (and some Grade 2) agricultural land.

The three-prong model has received interest from the UK policymakers as an example of rewilding unproductive land to produce biodiversity, climate and community benefits, while producing food sustainably on productive land (given that Norfolk contains some of the best productive farmland in the UK).

Environmental and ecological benefits

The project brings about a range of environmental benefits related to climate change and biodiversity:

- Maintaining carbon sinks and increased carbon storage.
- Establishment of the three-pronged approach which allows nature restoration and food production to work harmoniously. There are win-wins by using fewer inputs and having greater soil health and productivity. The regenerative agriculture approach is helping the farm to be more climate resilient with the benefits already being noted during the 2020 drought (yields remained good).
- Relying on beneficial invertebrates instead of pesticides.
- Flagship species: beaver, fallow deer, feral cattle, feral horses, red deer, roe deer.
- Rewilding unproductive land to produce biodiversity with a greater variety of habitats (including priority habitats) and accompanying species.
- Reintroduction of beavers in March 2020. This is the first time that beavers have existed in Norfolk for hundreds of years, and they play a role in enhanced biodiversity (encourage other species such as goshawk), help prevent flooding (through dams/channels), restore wetlands (mitigate extremes i.e. extreme wet and extreme dryness).

Social benefits

Social benefits include local involvement, wider influence and knowledge sharing:

- Knowledge sharing of the Ken Hill Estate's land management practices locally and Europe-wide as a member of the European Rewilding Network.
- Community involvement and volunteering, eco-tourism, education, recreational activities, opportunities for research and the sale of local sustainable products.
- Contribute to redefining rural society and conservation.
- Increased opportunities for volunteering and to bring children into nature and educate them as part of school visits. This effectively educates local people and adds vibrancy around nature conservation and sustainable farming.
- Managing public footpaths.
- The Ken Hill Estate offers free school visits and organises adventure parties for children and provides support for local charities and food banks.

Economic impacts

The economic benefits are largely based around tourism, leisure and recreation:

- The Ken Hill Estate generates other economic returns (in addition to government funding through CS) to help sustain the project. For example, through the sale of wild meat and provision of visitor accommodation, and in future through the introduction of safaris and educational wellness retreats. The growth of these over the coming years is expected to employ a number of local people, in addition to the 1.25 FTE jobs already provided by the project (from the tourism element).

- June 2020 saw the opening of a new cycling hub for North West Norfolk: Open Sky Cycles. Open Sky Cycles is operating at Wild Ken Hill, providing repairs, selling parts, accessories and new bikes.
- There are plans to enable additional local businesses (e.g. leisure and recreation) to set up on the Estate.
- Opportunities for other leisure and recreation businesses, such as guided walks.
- The project has a long-term aim to create a multi-purpose events and education space.

Key barriers and opportunities

- Challenges linked with non-native species of deer (Muntjac and Chinese Water Deer). There has been disagreement with some stakeholders on deer management in relation to fencing.
- Invasive species e.g. rhododendron – there have been longstanding efforts to remove.
- Challenges linked with the ongoing compliance with CS: monitoring is time consuming and costly and there have been issues submitting evidence to the Rural Payments Agency.
- Issues linked with inheritance tax and the value attributed to different land uses.
- Lack of alignment between government agencies and how they regulate funding and management.
- Lack of understanding of technical ecological aspects from a private landowner perspective e.g. species, monitoring and hydrological analysis. The Ken Hill Estate outsource most of the baseline monitoring work which is more complex whilst undertaking some informal, routine monitoring work themselves with the help of volunteers.
- There has been only one issue with the local community regarding moving an access path on the estate (not legally a Public Right of Way). This has been resolved since an alternative route was provided and the public are beginning to appreciate the value of the rewilding area (which was the reason for the path alteration).
- Knepp Castle Estate has provided advice on what works best in lowland agricultural landscapes and all practical aspects of project delivery.
- The Ken Hill Estate are expanding self-sustaining methods of finance to become more financially resilient in future, for example through nature-based tourism, recreation, businesses on site, natural capital payments (woodland carbon guarantee) and private markets (e.g. carbon credits).
- Scope to incorporate leisure and recreation businesses with more education.
- Demonstration of regenerative agriculture working alongside rewilding in the lowlands.

Partnerships and funding

Although sustainable farming had been a longstanding focus, the Ken Hill Estate team were approached by Natural England in 2018, which was influential in the decision to make the changes to the holding as part of the Wild Ken Hill project. The involvement of Natural England kickstarted the rapid creation of the multi-million-pound CS scheme which has been important to fund delivery of these changes (Rewilding Britain, 2020). The project is primarily financed by the CS scheme which covers all ex-arable land with financially competitive options. There are additional options implemented on the marsh and arable land (through ES) and payment for capital works. The estate are also expanding self-sustainable methods of finance, as outlined above.

The Estate does not operate as a partnership for delivering the project but it is part of West Norfolk LEADER group and Wild Anglia Local Nature Partnership.

Annex 2 - High Level Case Studies

Alladale Estate, Caithness

The Alladale Estate is a private 9,000-hectare uplands estate. The owner, Paul Lister, hopes to recreate the wooded landscape of the traditional Caledonian forests including habitat restoration including large-scale woodland planting and peatland restoration and the re-introduction of many native species which have been lost from the landscape including predators such as Scottish wildcat. A longer term aspiration is the re-introduction of the wolf, which is no longer exist in the wild in Britain.

Alladale is a member of the travel industry certification protocol It Must Be Now, meaning it follows the UN Sustainable Development Goals and uses the Earthcheck programme to benchmark all Alladale's business, operational, and rewilding efforts. This consists of an annual independent audit monitoring its commitment, performance, governance, risk and communication (Now Sustainability, 2020).

The surrounding areas were once managed by rural communities using a sheiling system of mixed agriculture, where livestock was moved seasonally. However, in the 18th and 19th centuries rural populations were removed from the area by landlords to make way for the introduction of more profitable sheep grazing. Many of these sheep grazed areas have since been converted to sporting and game estates after profitability of sheep decreased (Swales M., 2014). The overgrazing of the landscape by sheep and now predominantly deer has been linked to the degradation of habitats in the area.

Environmental baseline

The condition of the landscape prior to the restoration project was that of a traditional sporting estate, with large swathes of open habitats, but also incorporating the Alladale Pinewood and Amat Forest SAC which together form the largest expanse of ancient Caledonian Pinewood in Scotland (The Highland Council, 2011). It is noted that a previous owner of the estate had begun a small-scale re-forestation project (Agilitypr.News, 2020).

Level of ambition in restoration/rewilding

The project is highly ambitious with the aim to restore complex ecosystems, including by re-introducing species, many of which have been lost from the UK for centuries. The project has been met by fierce opposition due to the aims of re-introducing species such as wolves. The owner stated in 2006 he hoped the re-introduction of predators such as wolves could happen as early as 2009, something that it still yet to happen and a topic of much dispute (Fraser C., 2010). However, other actions to rewild the landscape such as restoring peatlands and native woodlands are less controversial, and are being implemented, leading to improved biodiversity and ecosystem health.

Aims

The project aims to re-create a rare Scottish landscape of Caledonian forests through the re-introduction of native plants and animal species including some large predators. The project aims to rewild this area and reverse biodiversity decline whilst promoting ecotourism.

Vision and objectives

The project entailed the re-planting of lush forest across the site including Caledonian pine, rowan, birch, oak, willow, and aspen totalling almost 1 million trees. The project has also restored peatland habitats through the blockage of drainage channels over 224 ha of land. There are hopes for the reintroduction of species such as wildcat, wild boar, European elk and wolves some of which are already housed at the estate (although in experimental enclosures). There are also plans for red squirrels and capercaillie. The Alladale Wilderness Reserve Sustainability Policy outlines the estates sustainable management commitments (Alladale Wilderness Reserve, 2019). 7.5% of all Alladale bookings go to The European Nature Trust (TENT), an independent charity committed to protecting and conserving wild areas (Now Sustainability, n.d.).

Environmental and Ecological benefits

The re-wildling project and management of the estate has the following environmental benefits:

- Hydroelectricity: allows the site to have zero grid electricity consumption all year, as well as producing some surplus energy which is fed back into the grid.
- Carbon capture as a result of tree planting/natural regeneration and peatland restoration.

Several ecological benefits to the project have already occurred, including:

- Native woodland enrichment planting (juniper, hawthorn, crab apple, rowan, aspen, scots pine) and Alpine planting (dwarf birch and dwarf willow) totalling nearly one million trees;
- Peatland restoration over 224ha of land;

- Aiming to keep deer numbers to below 5 per square kilometre, allowing for natural tree regeneration;
- As part of the project, there is active monitoring of the flora and fauna found in the reserve;
- There are plans for the re-introduction of species, including keystone species, which would naturally manage the landscape, help promote habitat diversity and restore ecosystem health.

Economic impacts

The estate brings in economic returns from the following activities:

- Tourism - the project houses a successful ecotourism business, in 2019 Alladale received an award as Europe's most eco-friendly hotel by the Boutique Hotel Awards;
- The estate runs a range of activities (guided hiking, clay pigeon shooting, angling, mountain biking, whisky tasting, safaris);
- The estate produces its own range of organic thistle-based toiletries.

Social benefits

The project aims to be socially beneficial for both local communities and visitors through:

- Providing the educational HOWL (Highland Outdoor and Wilderness Learning) programme, which promotes engagement of school children with the environment.
- Actively engaging with local communities and developing collaborations with small, sustainable local businesses;
- Promoting local communities and local businesses to Alladale’s guests;
- Recruiting locally and supporting staff development through training schemes.

Key barriers and opportunities

Barriers:

- Conflict with locals over plans of re-introducing large predators.
- Fears that large predators cannot be contained and may put livestock in the surrounding area at risk.
- Objections to electrical fencing required to contain the animals, and conflict with the right to roam.
- Issues with keeping predators due to the Dangerous Wild Animals Act, meaning the project requires a zoo licence which bans the keeping of predators and prey in the same area.

Opportunities:

- Future opportunities (although constrained) to re-introduce species into the landscape allowing a more diverse selection of habitats to be created. If predators were released there would be less need for human control of deer.

- Continued surveying of new locations suitable for peatland restoration and reforestation.

Partnership models

It is a private project; however it has so far collaborated with 19 different organisations including the Forestry Commission, the European Nature Trust, the Carbon Trust and Now Transforming Travel. A full list of partners can be found here: https://alladale.com/partners. Funding has been obtained from the European Nature Trust, one of the project partners.

Conclusions

The project has been a pioneer in Scottish re-wilding, although it has not been a straightforward journey. The Alladale Estate has already seen large successes including native woodland expansion and peatland restoration, as well as supporting a successful ecotourism business and an educational resource. However, there have been many obstacles to the project, in particular opposition from locals and land users. These conflicts highlight the importance of local community involvement, to harbour good relations and help minimise opposition, though, as things stand, some topics are inherently more likely to generate tensions (e.g. wanting to re-introduce a large predator) than others (habitat restoration). The project also raises issues with the viability of keeping predator species such as wolves in the UK due to the need for enclosure and associated legislation.

Balcaskie Estate

Balcaskie is a modern working 1,800-hectare agricultural lowland estate at the heart of the East Neuk of Fife. The Balcaskie Estate is not a re-wilding project per se but instead looks at a more sustainable approach to traditional agricultural methods. It was decided to look at this example, as such transition towards more regenerative agriculture, might play an important role in nature restoration at the landscape-scale, particularly in the lowlands.

The approaches on the farm include organic farming and conservation using a "wild farming" approach. The project aims for "efficiency and high standards within the clear framework of farming as part of a sustainable environment" (Balcaskie Estate, 2021). The conversion to this management approach began in 2016.

The East Neuk of Fife is a highly fertile area bound by the sea on three sides, and therefore home to a variety of farming produce. Produce traditionally grown in this area includes "soft fruit, vegetables and milling wheat along the coastal strip, malting barley and pastures feeding livestock inland" (Balcaskie Estate, 2018).

Environmental baseline prior to the LSNR restoration

The process of buying the current farm started in 2005 with the purchase of separate parcels that were not farmed as one holding before. Since then, more land has been added. The mixed farm, which includes arable, beef and sheep enterprises, is now largely organic.

Level of ambition in restoration/rewilding

The project is focused on sustainable land management, enhancing habitats and reducing agricultural inputs thereby supporting conservation and environmental improvements within a productive farming landscape.

Aims

The project aims to:

- Deliver efficiency and high standards in farming;
- Manage the environment and wildlife to increase the vitality of all of the land (ibid.);
- Demonstrate a self-supporting sustainable farming system through reducing its inputs;
- Promote a balanced ecosystem through conservation and best practice, where animals prosper with access to feed, habitat and freedom from predators.

Vision and objectives

Objectives of the project include;

- Low-input organic livestock farming;
- Ensure a variety of management practices over the four let farms;
- Species-rich grazing – with a low stocking density;
- Planting of an estate woodland - providing shelter for wildlife and livestock as well as fuel for biomass boilers;
- Planting new hedges and grass margins;
- Beetle banks;
- Rotation of conservation headlands with no artificial chemicals on arable ground;
- Reduction in water pollution and surface water run-off through buffer strips and the exclusion of livestock.

Environmental and Ecological benefits

The following environmental and ecological benefits are identified:

- Reduction in water pollution;
- Increased soil retention through reduced surface water run-off;
- Use of sustainable energy in the form of biomass boilers and installation of solar PV;
- Management of the 180 ha of estate woodland providing habitat and shelter for wildlife and livestock, plus fuel for two of the biomass boilers;
- Over 45km of new hedgerows;

- Grass margins surround many fields;
- Larger fields split using beetle banks;
- Boosting beneficial invertebrates reduces requirement for artificial pest control;
- Tufted grass and wildflower mix create a haven for bees and other wildlife;
- Annual rotation of conservation headlands allowing an annual carpet of weeds- as well as food and shelter for farmland birds;
- Mini dung middens attract insects;
- Bird feed hoppers provide for farmland birds over winter;
- Buffer strips of grass reduce spray drift and surface water runoff;
- Excluding livestock from the burn and working with Scottish Environment Protection Agency (SEPA) has helped reduce pollution in the burn to such a degree that Brown Trout, Otter and Kingfisher have returned.

Social benefits

One of the main social benefits identified is that the estate has a close relationship with local communities, including provision of premises, and participation in beach cleaning and tree planting.

Economic impacts

Economic benefits relate to employment, tourism and agricultural production:

- The estate employs over 20 full-time staff across each of the different enterprises;
- Continued economic viability of farming practices;
- The sales of crops and meat production;
- Food tourism.

Key barriers and opportunities

The estate has achieved Wildlife Estates Scotland accreditation, which provides a means to demonstrate biodiversity benefits from their day-to-day practices. Around 750ha of the estate has Soil Association organic accreditation and the arable land is under organic conversion. The produce is quality assured by Scottish Quality Crops.

Partnership models

The estate collaborates with RSPB and Bumblebee Conservation Trust and the Scottish Environment Protection Agency (SEPA), the Fife Barn Owl Project and Fife Beekeepers' Association. It also has close relationships with the villages surrounding the estate and work in partnership with local farmers to achieve common goals. The partnership instigated and funds the East Neuk Community Action Plan. The estate lets four farms and works in partnership with these tenant farmers to manage the land.

Conclusions

Since its launch in 2016, the project has already seen marked improvements including increased water quality of the burn to an extent that there has been a return in some notable species. In summer 2020, the estate began its transition into a fully organic enterprise. This project is a good example of how intensive conventional farms can transition to more agroecological/regenerative forms of agriculture, still producing food while enhancing biodiversity, soil and water.

Bunloit Estate on Loch Ness

Bunloit Estate is situated south of Drumnadrochit and overlooks Loch Ness. It comprises an upland estate of 500ha including farmland, sporting rights, native woodland, moorland and commercial woodland. The project looks to advance rewilding to show how restoration of the natural world can become a profitable and environmentally friendly means of land management. The owner, a former scientific director at Greenpeace, is driven by the hope of the estate becoming an "open laboratory" to fight the climate crisis and promote biodiversity. The owner is still in the process of creating the master plan, with a launch date set for April 2021. The project is based on the wider narrative of creating a new norm of land management "engineered for the survival and prosperity for the many" (Cockburn H., 2020). Surrounding land uses are similar to those found within the estate and include areas of moorland, forestry and sheep grazing.

Environmental baseline prior to the LSNR restoration

The owner states that "the estate is a collage of broadleaf woods, native Scots pine woods, mixed woodland, non-native coniferous woodland, peatland and pasture" (Campsie A., 2020) The estate is currently typical of the Scottish Highlands with a varied landscape, diverse wildlife, and high deer numbers.

Level of ambition in restoration/rewilding

The project is ambitious in scope. Although constrained by the small land area, the ambitions are helped by the relatively healthy baseline condition. Future aims include scaling up the project and providing a role model for future rewilding projects “The Bunloit management approach has significant scalability potential,” said Rob Stoneman, Rewilding Europe’s area coordinator (Cockburn H., 2020).

Aims

The project aims to restore peatlands, return commercial plantations of non-native species to mixed woodlands, and significantly increase biodiversity (Ibid.). The project hopes to increase the landscape’s capacity as a carbon sink to tackle the current climate crisis. One of the principal aims of the project is to create new livelihoods. It is hoped that the project will provide a role model and financial mechanism for further rewilding projects (Rewilding Europe, 2020).

Vision and objectives

As this is a new project, the objectives are still being developed.

Environmental and Ecological benefits

Anticipated environmental and ecological benefits include restoration of peatland habitats and planting of mixed woodlands to increase biodiversity, carbon sequestration within restored peatland and woodland habitats, which will allow the landscape to act as a carbon sink.

Social benefits

The project aims to create new livelihoods. A key focus of the project is about rethinking economic structures in the rural environment, so they benefit the many rather than the few.

Economic impacts

It is intended that profits from revenue streams including forestry, nature-based tourism and income from carbon offsetting will be reinvested to undertake further rewilding, and potentially acquire more land in the area.

Key barriers and opportunities

At its current stage, no major barriers have been identified for the first phases of the project, although the owner acknowledges there is the potential for opposition in the future, particularly should he pursue the re-introduction of predatory species.

Partnership models

The project is being run by the owner in partnership with Rewilding Europe. The purchase of the estate was aided by the Rewilding Europe Capital which is supported by the European Investment Bank and the Dutch Postcode Lottery which invested 75,000 euros in a Bunloit green bond to assist with the estate purchase.

Conclusions

In conclusion, despite the initial limited land area, the project has an ambitious approach to rewilding with widespread support. The proposed inclusion of local communities and the provision of jobs would help promote the project. Monitoring once the project commences will help determine the viability of this approach and assess opportunities for scaling up.

Glen Affric

Glen Affric is a highland project, managed by Forestry and Land Scotland (formerly Forest Enterprise Scotland) since 1959. It is the oldest restoration project in Scotland, and it covers an area of 14,500 ha. Since 2001 the project is managed for restoration purposes only. The project was declared a National Nature Reserve in 2002. The project aims to promote natural processes and foster a return to a more natural woodland. The

project has a long-term vision for 150 – 200 years. The project is managed at Glen Affric as a partnership between Forestry and Land Scotland and Trees for Life. Pre-restoration, the project area was cleared and used for conifer plantations. There was high grazing pressure from deer which limited natural regeneration, and areas of peatland had been historically drained. The landscape included remnant Caledonian pine forest.

Level of ambition in restoration/rewilding

The project is ambitious, and it has paved the way for other restoration projects in Scotland. The primary management aim in Glen Affric is to promote natural processes and foster a return to a more natural woodland.

Aims, vision and objectives

The main aim of this project is to gradually restore ancient woodland, by removing non-native trees and invasive shrubs. Plantations are also being restructured to give a more natural structure and species composition. Habitat networks are being developed both within the glen and on neighbouring ground; with woodlands and open ground networks being integrated.

Environmental and Ecological benefits

Environmental benefits focus on establishing large, robust populations of woodland species and creating large-scale woodland habitat networks comprising both woodland and open habitats. At the same time, existing biodiversity values of heathland and montane habitats are being enhanced.

The project's environmental benefits include carbon sequestration from woodland planting and regeneration. Ecological benefits arise from restoration of native pine woodland, connecting habitats, 'treeline transition zone' at the natural treeline, recreating habitat for plants, birds and insects, subalpine heaths, blanket bog, dry and wet heaths, tall herb communities, and management of deer.

Social benefits

Social benefits include recreation opportunities within the area and Trees for Life support conservation volunteer opportunities while lottery-funded rewilding traineeships were introduced in 2018.

Economic impacts

Economic benefits arise from employment creation. Recreation is important as the area typically attracts over 100,000 visitors a year.

Key barriers and opportunities

The main challenges faced include:

- Developing and implementing a new format of complex forest plans with a high volume and quality of ecological data.
- Understanding relative importance of different habitats and species and the various competing demands they have.
- Dealing with such a large landscape unit; this required splitting into subunits.
- Implementing deer management via the deer management plan with the aim of achieving a density of 5 deer per 100ha (Forestry Land Scotland, 2020).
- Reliance on perimeter fences.

Opportunities include:

- The relative long history of the project provides lessons to be learned
- Demonstration of gradual transition to a rewilded landscape in Scotland

Partnership models

The partnership model is a collaboration between Forestry Land Scotland, Trees for Life, Forest Research and NatureScot.

Conclusions

Glen Affric is a pioneering example of how Scottish pine woodlands can be restored by implementing deer management practices and planting new trees. Glen Affric was declared a National Nature Reserve in 2002, and now it attracts over 100,000 visitors a year, bringing significant economic benefits to the local community.

Glen Tanar

Glen Tanar is an upland country sporting estate and wedding venue, which offers luxury eco-tourism. The 10,000ha estate is situated in Aberdeenshire extending from the River Dee to the summit of Mount Keen. Land use within the estate is split with roughly 50% moorland, 40% forest and 10% farmland (Glen Tanar, 2019). The estate is managed using a sustainable approach with a long-term forestry management plan. The estate contains the Glen Tanar National Nature Reserve, designated in 1979, Site of Special Scientific Interest, Special Area of Conservation, designated 2005 and Special Protection Area, designated 1994, an extensive area of Caledonian pinewood. The area also forms part of the Cairngorms National Park.

Environmental baseline prior to the LSNR restoration

As a land management approach by the estate owners who have lived in the glen since 1986, there is no specific start date to the approach. The quality of the environmental baseline is only indicated by the dates of designation of the NNR, SPA and SAC.

Level of ambition in restoration/rewilding

The restoration project is based on gradual change, aiming to improve practices already in place and make them more environmentally focused.

Aims

The estate is run with a strong emphasis on sustainability, conservation and responsible land management. The long-term aim of the forestry at Glen Tanar is "woods that balance the needs to generate income through commercial forestry with biodiversity, landscape and amenity"(Ibid.). Forestry areas are managed using a long-term sustainable management plan. The latest rendition of the plan includes the expansion of the forest at Glen Tanar by over 2,500 acres.

Vision and objectives

- To grow a high yielding crop of quality timber and other forest products in a sustainable way;
- To create the right conditions for natural regeneration to occur without the need for deer fences;
- To enhance the extent and diversity of the woodland and its associated wildlife habitats, with particular attention given to the needs of qualifying species;
- To enhance the biodiversity interest of water and river features, with particular attention given to qualifying species;
- To protect the qualifying plant and wildlife species from significant detrimental impacts;
- To make provision for sporting use of the woodland;
- To make provision for informal public recreational use;
- To maintain the aesthetic and amenity value of the woodland;
- To conserve archaeological features (Glen Tanar Estate, 2019).

Environmental and Ecological benefits

The management measures of the forestry will allow for:

- Increased habitat diversity;
- Continued expansion of native pinewood: the natural regeneration of native pinewood has expanded by 32ha per year between 1979 and 2019 (Glen Tanar, 2019).
- Increased resilience of woodlands: through strategic planting to minimise the impacts of climate change including disease, wind, fire and flood.

Social benefits

Social benefits include volunteering and Glen Tanar involve numerous groups in practical conservation tasks. Groups include Junior Rangers, the John Muir Trust’s North East members group, Scouts, Guides, and DofE, as well as students on placements. They also receive Community Service and literacy groups, as well as people with mental health issues referred by social workers (Cairngorms Nature, 2021). Other benefits include recreational uses of the estate and creation of job opportunities.

Economic impacts

Glen Tanar generates income from a range of economic activities including:

- Timber production;
- Holiday Cottage lets;
- Events (wedding & sporting events location hire);
- Country Sports (Fishing & Hunting);
- Wildlife photography;
- Other Estate Activities & Safaris;
- Honey sale;
- Venison production; and
- Biomass energy production.

Key barriers and opportunities

Ensuring that forest management is appropriately timed so that it does not disturb key species particularly in the breeding season.

The necessity for deer and bracken management is a continuous problem.

Partnership models

The private estate works in close partnership with NatureScot, Forestry Commission Scotland and the Cairngorms National Park.

Conclusions

The Glen Tanar estate is an example of how a profitable estate can be managed to ensure space for nature. Management of the estate is heavily focused on sustainable practices. These allow the landscape, including a large part of the estate which is a designated National Nature Reserve, SAC and SPA, to be a profitable working estate while balancing needs of biodiversity, landscape and local amenity.

Great Trossachs Forest

This unique, landscape-scale project at the Loch Lomond and The Trossachs National Park is one of the most significant native woodland projects in the UK for a generation, presenting the opportunity to restore a large area of different woodland types offering a mosaic of habitats. The project was launched in 2009 by the Scottish Forest Alliance and covers over 4,400 ha. The site stretches from RSPB Scotland's Inversnaid reserve on the eastern shores of Loch Lomond, across the 9,500 hectare Forestry Land Scotland estate at Loch Katrine, to the ancient hunting forests at Glen Finglas, owned and managed by Woodland Trust Scotland, and beyond (Loch Lomond and the Trossachs, n.d.).

The restoration of this upland resource has already led to a significant improvement in the diversity and connectivity of woodland habitats; in 2015 the area was designated as one of the largest National Nature Reserves in the UK.

Environmental baseline prior to the LSNR restoration

The area surrounding Loch Katrine was previously grazed by sheep, which was stopped after a bacterium source potentially excreted by a sheep polluted the loch (which is Glasgow's main water source). The project is using the Integrated Habitat Management approach to provide a strategic framework for creating functioning habitat networks across the area.

Level of ambition in restoration/rewilding

The project is highly ambitious due to the scale of the restoration. The large group of partners working together and contributing funding towards a common goal, as well as widespread support and public engagement, help to make these goals achievable.

Aims

The Great Trossachs Forest project's main aim is to create a forest landscape large enough to include a range of habitats and a diversity of wildlife. The project will create an area of 16,650 hectares (166km^2) of forest and open ground containing a mix of habitats, returning ecosystems which have been damaged by over-grazing and human exploitation to a more natural state. Large areas of diverse and high-quality habitat will help species to adapt in the face of climate change. In 200 years, the woodland will stretch over 160 km^2 at the heart of Scotland's Loch Lomond and Trossachs National Park (The Trossachs Forest, 2021).

Vision and objectives

In 200 years, this landscape will be transformed, returning heavily grazed land and plantation forestry to a more natural mix of habitats, including areas of moorland, montane, wetland and pasture. The vision is described as:

Imagine a spectacular landscape, stretching from loch shore, through pasture and wooded glens to open moorland, with high peaks in the far distance. At the woodland edge, black grouse display on a spring dawn. Cattle graze among the trees and butterflies frequent the plentiful wildflowers. An eagle soars high above the mountains (The Trossachs Forest, 2021).

Activities on the ground include:

- Non-native species removal including spruce and rhododendron.
- Creation of new access opportunities.
- Tree planting.
- Development of an outdoor learning resource for schools; and
- Installation of deer fencing.

Environmental and Ecological benefits

Environmental and ecological benefits include:

- The new planted woodland will act as a carbon sink.

- Secure and improved water quality of Loch Katrine.
- Planting two million trees within the first ten years of the project.
- Substantial increase in black grouse populations.
- Pearl-bordered fritillary butterfly identified in 2011 for the first time in 25 years.
- New otter holts have been recorded.
- Golden eagles breeding nearby.
- The Trossachs remains a stronghold for red squirrels.
- In 2015 the Narrow-bordered Bee-Hawk moth was recorded for the first time.
- New areas of woodland have been created through planting of native trees and managing grazing to allow natural regeneration of the forest in other areas.
- Increased connectivity linking fragments of existing woodland.

Social benefits

Social benefits focus around recreation, education and volunteering:

- Recreation opportunities (walking, cycling, guided trail walking), including an extensive path network for recreation purposes.
- An art and literature trail provides an opportunity for people to discover the rich literary history of the area.
- A new series of short films profiles the rich history of the area, the background to The Great Trossachs Forest project and the work of the Park's staff.
- Volunteers are helping with conservation work on the ground.
- Two new visitor gateways provide information on what to see and do in the area and provide public toilet facilities.
- Education packs for schools and school visits.

Economic impacts

Economic benefits are focused around nature-based tourism and employment opportunities.

Key barriers and opportunities

A key challenge and opportunity is that natural regeneration and functioning ecological processes allow the project to be self-sustaining in the long term.

Partnership models

The Great Trossachs Forest is the result of a unique collaboration between energy company BP, Forestry Commission Scotland, RSPB Scotland and Woodland Trust Scotland.

By working together through the Scottish Forest Alliance and with other partners, the collaboration has enabled the project to have a large budget and demonstrates what partnerships can achieve. The project has also been funded through two grants through the Heritage Lottery Fund.

Conclusions

The scale of this project makes it a landmark woodland restoration programme. As the project lies within a national park, meaning public understanding and enjoyment are at the heart of the development. The collaboration and investment from multiple partners have allowed the project to have a large budget and ambitious aims. Successes of the project are evident from the scale of woodland restoration that have been achieved, which in turn have facilitated the return/increase in population of several iconic species. The designation of the site as a National Nature Reserve in 2015 further highlights the success of the project.

Great Fen

Great Fen is a large-scale and long term (50 year) wetlands restoration project in a lowland environment, delivered by a partnership between five different organisations. The project began in 2002 and plans to restore an area of over 3000ha (The Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire, n.d.) of largely arable land into a wildlife rich fenland landscape. The area is situated within Cambridgeshire between Huntingdon and Peterborough. The overall aim of the project is to re-generate a lost fenland landscape and introduce connectivity between the two National Nature Reserves within the project area (Woodwalton Fen and Holme Fen) which in turn will support a variety of threatened or rare fen species.

Environmental baseline prior to the LSNR restoration

Prior to the 17th century, the landscape was a 'wild fen' however it was drained in order to create peat-rich farmland. The majority of the Great Fen project area (79%) is now under arable or horticulture, with most other habitats confined to the two blocks of the National Nature Reserves. Land cover in the NNRs is overwhelmingly allocated to broadleaved woodland, fen/march/swamp and improved grassland. There are also some scattered fragments of broadleaved woodland in the arable land between the Fens as well as two patches (Riddy and Gamsey Woods) on the upland to the south.

The landscape surrounding the Great Fen project area is within The Fens National Character Area, distinguished by its large-scale cultivation of arable and horticultural crops. Much of the landscape is below sea level and relies on pumped drainage and sluices to maintain its agricultural viability (Natural England, 2013). The peat within these agricultural areas is now in rapid decline and continued farming of these areas is not sustainable in the long term.

Project areas

The project comprises existing National Nature Reserves that include:

- Woodwalton Fen (managed by Natural England): became a National Nature Reserve in 1911, supporting a wide variety of wildlife, including butterflies, dragonflies and birds such as bitterns and marsh harriers. Common cranes intermittently use the site, since being lost from the fen area around 400 years ago. Darlow's and Middle Farms are visible from the reserve, some of which are being converted from arable fields into species-rich wet pastureland.
- Holme Fen (managed by Natural England): is a large National Nature Reserve of silver birch woodland surrounding two open meres. The area supports many species including a huge variety of fungi. The Holme post here shows how ground levels have fallen dramatically since the Fens were drained. Near Holme Fen, more former arable land is now under restoration.

Areas of restoration

- The Countryside Centre at Ramsey Heights (managed by the Wildlife Trust) is an education and community work centre, set in an area of reeds, meadows and pools rich in aquatic life including water stick-insect, several rare beetles and great crested newts.
- Great Fen Information Point at New Decoy Farm: Fields here are being restored with grazing cattle and newly profiled ditches and scrapes. The area contains ponds, wet meadows and trees.
- Rymes Reedbed: This area is the site of Trundle Mere, an offshoot of Whittlesea Mere (south England's largest lake before it was drained in the 19th century) and has been subject to major construction of drains, dykes, new reedbeds and open areas of water to re-wet the landscape. A new tower hide enable visitors to see the restoration work and view the bird life that is already beginning to use the new habitats.
- Kesters Docking: Previously 12 farmed fields, which has since been sown as species-poor grassland to improve soil condition and structure. Physical and ecological studies have indicated the area is most suited to a mixture of reedbed, open water, and wet and dry grassland integrating with the adjacent Rymes Reedbed. This mixture of habitats should encourage species such as bittern and water vole.
- Engine Farm: an area at the beginning of its restoration journey which will become a mixture of wet / dry grassland and a wildflower meadow habitat.

Level of ambition in restoration/rewilding

The goal is to create a 3000ha wetland nature reserve on land that was previously largely arable farmland (Mountford J.O. et al., 2002). This area would not only extend the area of wetland habitat, but also secure the survival of those represented within the National Nature Reserves. A new reserve of this size would allow a full range of fenland habitats to be restored, including reedbed, wet grassland and carr (wet woodland), as well as fen meadow and tall-herb rich fen in the long term.

Aims of the project

The aims of the project are clearly stated within the Great Fen Management Plan (Environmental Agency et al., 2010). This Living Landscape will be achieved by obtaining land that links or is adjacent to the two existing National Nature Reserves, Holme Fen and Woodwalton Fen. Connecting these two vitally important nature reserves will provide a haven for wildlife and create a massive green space for people, providing new opportunities for recreation, education and business.

- **Nature and historic environment:** to create a new resilient fenland landscape which delivers major wildlife and heritage benefits and achieves high standards of sustainability in all respects.
- **Social:** to create an accessible, inspiring and tranquil environment for recreation, education, health and wellbeing.
- **Economic:** to contribute to diversification and development of the local economy, consistent with environmental and social objectives.
- **Climate change adaptation and mitigation:** to plan, design and manage the Great Fen to benefit climate change adaptation and mitigation.

Vision and objectives

- An ambitious 50-year habitat restoration project, with 14 square miles of land restored to wild fen, creating a huge nature recovery network.
- Connection of the two National Nature Reserves giving the specialised species they hold enough space to thrive.
- An area large enough to support threatened fen wildlife, such as bittern and otter.
- A mosaic of different wetland habitats that will support a wide variety of speciality wildlife, such as dragonflies, butterflies and amphibians.
- Suitable habitat for flowers and other plants found almost nowhere else in the UK, such as the Fen Violet and the Fen Woodrush.
- Sensitive areas and wildlife protected from heavy disturbance through zoning (Great Fen, 2021).

Environmental and Ecological benefits

The project will have significant environmental benefits including:

- local water management, flood mitigation and control;
- Reduction of peat loss, saving an estimated 325,000 tonnes of CO_2 from being released each year.

The ecological benefits of this project are widespread and one of the key drivers for the project; they include:

- Creating an area large enough to support species such as bittern and otters;
- A mosaic of habitats able to support a variety of fenland species;
- Protection of sensitive areas from disturbance through zoning.

Social benefits

The project will bring benefits to the local communities as well as encouraging visitors and tourism. Social benefits of the project include:

- Reduced risk of flooding in the locality, with particular areas providing extra water storage after heavy rainfall and helping to protect surrounding towns, villages and farmland from the risk of flooding.
- Local communities linked together and connected with nature through creation of miles of new footpaths, cycleways and bridleways.
- Celebration and preservation of fen heritage through education and outreach programmes.

Economic benefits

In the transformation from an arable agricultural landscape, the changes from the project include diversification of rural economy from agricultural employment and production to a wide range of other goods and services:

- Creation of new jobs and awarding contract expenditure locally; provision of volunteering opportunities.
- Tourism, branded grass-fed meat production, renewable energy generation, angling and reed for thatching as well as providing access and quiet recreation for local people (Environmental Agency et al., 2010); all together deliver between £1.4 and 3.25 million turnover annually (Huntingdonshire District Council, n.d.);
- Provide significant skills development and volunteering opportunities;
- Significant business opportunities include native breed beef and lamb production and nature conservation contracting.

Key barriers and opportunities

- There is a need for collaboration as the area includes about 40 dwellings which remain in private ownership.
- Brand development was identified as a delivery tool for economic development.
- Major access and tourism opportunities were seen as a key part of the project to stimulate economic diversification.

Partnership models

The Great Fen is the result of a partnership project by the Wildlife Trust with Natural England, the Environment Agency, Huntingdonshire District Council and the Middle Level Commissioners (a statutory body responsible for 120 miles of major watercourses) (Great Fen, 2021). A series of stakeholder engagement processes were used to ensure the maximum amount of input. They included consultation with the following groups:

1. **Specialists**. The partners established a contract with Atkins and the Centre for Ecology and Hydrology to undertake the studies required to provide guidance to the project partners. This includes water level measurements, eco-hydrological modelling, flow modelling and outlining engineering proposals.

2. **Stakeholder organisations.** A range of organisations have an interest in the outcomes of the Great Fen Project. Representatives were met either on a one-to-one basis or in thematically arranged group sessions to comment and advise on project proposals.
3. **General public.** Local people need to be made aware of the project's proposals so they can have their say. The involvement of local people is vital where any significant changes to a local environment are planned. Sessions where the public could meet partner representatives were held throughout the project area and beyond (Climate Proof Areas, n.d.).

Funding for the project includes the Project Partners, Grant Giving Trusts, Landfill tax, EU funding (such as Interreg and LIFE programmes), business sponsors, individual and private donors, and most significantly, the Heritage Lottery Fund. The Great Fen has been awarded over £9 million by the HLF; in 2007 a grant of £7.2 million (the largest grant ever given to an environmental project) and in 2013 a further grant of £1.89 million, funding work up to the end of 2016. The project also notes the role of land management in generating future schemes for the project (Great Fen, 2021).

Conclusions

The Great Fen project shows how a collaborative approach between several organisations and the local community can achieve landscape-scale habitat restoration. The Great Fen Project is an example of changing the landscape to allow full functionality of the restored habitats. The project already shows promising progress towards creating a diverse habitat mosaic, which in turn will have ecological benefits through its provision of habitats, environmental benefits through flood mitigation and carbon capture, social benefits through new public Rights of Way and Education programmes as well as economic benefits from tourism.

Knepp Castle Estate

The Knepp Castle estate comprises of 1,416 hectares of lowland farmland in West Sussex. The project, which commenced in 2001, aimed to convert an area of intensive arable farming to one of near-natural grazing to examine how the introduction of grazing livestock would alter and increase habitat diversity. The estate homes a number of features of archaeological, cultural and geological interest, including the remains of the original 11th century castle.

Landscape and land use context for the surrounding area

The Estate is located within the Low Weald National Character Area (NCA) (NE450), characterised by a broad, low-lying clay vale which largely wraps around the northern, western and southern edges of the High Weald.

Within this NCA, land is primarily used for agriculture, supporting mainly pastoral farming, with arable and horticulture on some lighter arable soils. The majority of the grassland has been agriculturally improved, but fragments remain unimproved, and here floristically-

rich meadow and pasture are still present. The fields are generally small and irregular, many formed by the woodland clearances of the medieval period. Many of the especially species-rich hedgerows in this area may be remnants of larger woodland and often follow the pattern of medieval banks or ditches.

Some of the key ecosystem services include:

- Provisioning services such as food provision, timber provision, water availability and genetic diversity;
- Regulation services such as climate regulation, regulating water quality, regulating water flow and pest regulation; and
- Cultural services such as sense of place/inspiration, sense of history, tranquillity, recreation, biodiversity and geodiversity.

Environmental baseline prior to the LSNR restoration

The estate originated in the Middle Ages, at which point it was one of King John's hunting parks. Subsequent land uses within the estate have included iron workings and mixed farmland and woodland. Post-WW2 it became an area of increasingly intensively managed arable land. Unusually, despite the intensive arable land use, many historic field boundaries had been retained within the estate.

Level of ambition in restoration/rewilding

The project is ambitious in its rewilding approach, with targets not being driven by specific goals or target species and the re-establishment of ecological processes to deliver a functioning ecosystem. It is a pioneering rewilding project in the lowlands of the UK.

Aims

"The overall aim of the Knepp Castle near-natural grazing project is to record and evaluate changes in the biodiversity and vegetation structure following the reversion of land under intensive arable management to a more natural grazing regime (Knepp Estate, 2011)". The emphasis of the project was research driven, looking at the processes that introduced landscape-scale change. The brief of the project was not set in stone and has evolved with the project.

Vision and objectives

The vision of the Knepp estate is to establish a functioning ecosystem where nature is given as much freedom as possible. It followed a ‘process-led’ approach as an alternate effective, low-cost method of ecological restoration. The project is informed by the model of grazing ecology promoted by the Dutch palaeoecologist Frans Vera. The outputs intend to show how this kind of landscape conversion supports surrounding established nature reserves and wildlife sites, which may also support future landscape scale projects. To reach this aim, introduced grazing animals receive minimal human intervention allowing them to become ‘de-domesticated’ and, creating a near-natural

grazing regime. Breeds introduced are considered "hardy" breeds including Old English longhorn cattle, Exmoor ponies, and Tamworth pigs as well as non-native fallow deer, and native roe and red deer. The principle behind introducing near-natural razing regime is that it can foster habitat change and nature restoration.

The River Restoration Centre, in conjunction with the Environment Agency and Defra, also proposes to ‘re-wild’ part of the River Adur as it crosses the Estate. This involves restoring the Adur floodplain to its natural function and the river itself as far as possible to its original course before it was subjected to canalisation.

Environmental and Ecological benefits

The project presents opportunities for wider environmental benefits including flood risk management and improving water quality by reducing the amount of agricultural nutrients and pollutants entering watercourses. The Knepp project has had a number of positive biodiversity outcomes including:

- Supporting the only recovering population of turtle doves in the United Kingdom.
- The return of various species of fungi, orchids, earthworms, dung beetles, several locally extinct bird species, bat and insect species as well as thirty-two species of butterflies, including the purple emperor.

These results are due to the top-down trophic effects of the introduction of herbivores and the lack of strict management of the land by the owners (Tree, 2018a).

Social benefits

There is no research available into the social benefits. The conversion of the landscape from an intensive arable area to one with a high species diversity is likely to have improved the experience for users of public rights of way crossing through the Knepp Estate, though sometimes conflicts may emerge as familiar landscapes change. The project is likely to have improved the human health benefits of the landscape, particularly in terms of its potential to contribute to improved mental health.

Economic benefits

Through the selling of meat from cattle, pigs, etc. (roughly 75 tonnes of organic, pasture-fed meat per year), the opening of ecotourism activities on the estate and renting their post-agricultural buildings, the owners have seen a net increase in their profit margin compared to the arable enterprise before the project. The low human interference management approach also had an impact on keeping the costs low in comparison to other restoration projects. The changes in farming practices will have had other impacts on the local economy through impacts on local supply chains associated with the estate.

Key barriers and opportunities

Opportunities:

- All of the land in the hands of one owner who is actively involved and supportive of the project – makes it easier to impose certain solutions;
- No strict project aim, allowing it to evolve over time;
- Reduced costs (where enterprises are currently unprofitable), new sources of income (tourism) or grant support, for example for biodiversity gains;
- There might be some benefits to water companies from reduced agricultural nutrients in water supplies.

Barriers:

- Animal health – risk to farm livestock from spread of diseases such as foot-and-mouth disease;
- Animal health – issues include loss of condition in winter, supplementary feeding that reduces the ‘near-natural’ ethic; dealing with ill, injured or very old animals, use of preventative treatments;
- Control of animal numbers – lack of predators means less fit animals are not weeded out of the system naturally, stock may suffer progressive loss of condition and health unless they are ‘artificially’ culled;
- Herbivore corpses – by law these have to be removed, which also remove any opportunities to provide carrion to support wildlife;
- Public acceptance by the local community – people are often reluctant to embrace changes in what they perceive as their ‘natural surroundings’, or their perception of productive farmland;
- Potential danger to humans – some breeds are more aggressive, or more aggressive at particular times of year, than others. Dangerous animals have to be extracted and not allowed to breed;
- There are also potential increased costs/reductions in income, though this was not the case in Knepp - the direct loss of production income, and loss of Single Farm Payment if Good Agricultural and Environmental Condition rules are compromised, in particular because land is no longer in agricultural production. This issue was particularly relevant under the Common Agricultural Policy, but future rural support may alleviate some of these constraints;
- Transitions can be challenging at time as there is need to explore and implement a different economic model for the farming enterprise.

Partnership models

This project has been funded by Sussex Wildlife Trust, English Nature, Charlie Burrell (owner) and the Environment Agency. Sussex Local Nature Partnership represents 25 organisations from different sectors, working together to enhance ecological systems and protect the environment in Sussex.

Conclusions

The Knepp Estate project has been a landmark rewilding project and has been the inspiration for many more recent rewilding projects. The successes of this project have been widely reported and are re-enforced by the high diversity of species the estate now supports. The project is a good example of how the current agricultural system can be modified, allowing yields of traditional produce (in this case meat) but changing the way in which it is produced to have a better impact on the species diversity of the area. All in all, Knepp estate is an example of the positive impacts natural grazing and rewilding on farmed land can have on soil health, biodiversity, water quality and on the reinstatement of an array of ecosystem services.

Steart Coastal Management project

The Steart Coastal Management project, implemented in 2014, established a new wetland nature reserve through opening up 400 ha of land to deliberate tidal flooding. It lies on the Steart Peninsula in Somerset (England), which sits just at the point where the River Parratt flows into the Severn Estuary.

Environmental baseline prior to the LSNR restoration

Prior to the scheme being undertaken, the land was used for both pasture and arable farming. Protected and notable species on site included water voles, badgers, great crested newt and bats. Comprehensive mitigation measures were undertaken for these, and other species, including the implementation of a dedicated freshwater wetland area.

Scale

Steart Marshes incorporates three distinct areas; firstly, the main Steart Marshes managed realignment site, which measures 262 ha. There is also an 84 ha brackish area fed through an open pipe to the estuary, known as Otterhampton Marsh, and a freshwater grazing marsh, called Stockland Marshes.

Level of ambition in restoration/rewilding

The Steart scheme is one of the UK's largest coastal management schemes. It is an example of taking a 'working with nature' approach to addressing the challenge of flood risk from rising sea levels and increased frequency of storms.

Aims and objectives

The Steart Coastal Management project is a compensatory scheme thus aimed at the creation of intertidal wetland habitat that directly supports the designated interest features of the Severn Estuary nature conservation sites, also offsetting losses of intertidal habitat that are occurring across the wider Severn Estuary. Furthermore, the project has led to reduced flood risk to neighbouring communities through the construction of substantial new embankments.

Ecological benefits

The ecological benefits of the project are numerous. For example, saltmarshes provide feeding and breeding grounds for commercially important species of fish. Surveys at the Steart Marshes have recorded common eel, flounder and sea bass in the Reserve. The fish in turn have attracted birds such as heron and egret. Overwintering birds have been visiting in large numbers. For example, in the winter of 2018-19, 53 species of waterbirds were surveyed totalling 29,309 individuals, including nationally important numbers of avocet, dunlin, golden plover, lapwing and shelduck. The extensively grazed saltmarsh is important for breeding skylark and within an area of saline lagoons, a population of 31 breeding pairs of avocet now occur (when prior to the scheme there had not been breeding avocet in Somerset for a long time). The freshwater area also merits recognition as a Priority Site of National Importance for its dragonfly assemblage. A minimum of nine bat species have also been recorded regularly in the reserve.

Environmental benefits

Various other ecosystem services are fulfilled by intertidal habitats, such as water quality improvements and carbon sequestration. The latter is thought to be particularly pronounced at this site, due to the large, suspended sediment concentrations in the waters of the adjacent Parrett Estuary and Inner Bristol Channel. This has led to one to two meters of sediment having been accreted at the managed realignment site to date.

Social benefits

The site, which is managed by the Wildfowl and Wetlands Trust (WWT), is a popular place for visitors. There is a network of disability accessible paths, with ample signage provided, and there are several covered hides. Numerous health and well-being benefits are thus being realised. In addition, the WWT is encouraging volunteers with physical and mental health conditions to work and benefit from the wetland environment.

The scheme has furthermore been valuable with regard to academic research, with numerous students having chosen the site as their subject for studies researching subjects such as ecosystem services provision and carbon sequestration. Another feature of the site is that wastewater from the public conveniences (as there is no sewage or mains connection) goes through a treatment wetland, a more natural way to treat waste and itself creates additional habitats for wildlife.

Economic benefits

Steart Marshes continues to be farmed with livestock by local graziers who are able to market saltmarsh lamb and beef for a premium. WWT has full time staff at the reserve, and many volunteers are also engaged.

The Natural Capital for the Reserve has been valued as around £43.8 million yr-1; noting that additional data collection is being undertaken, and a more accurate valuation is expected over time giving a glimpse of the potential value of investing in wetlands.

Key barriers and opportunities

Implementing the site was not without its challenges. The scheme had to be carefully designed in order to minimise impacts on the adjacent estuary. Furthermore, negotiating with the various landowners was a lengthy process. Engineering conditions on site were challenging, for example, a test embankment was constructed to gain insights into settlement rates, and 500,000m^3 of material were ultimately moved to create the new flood embankments. Unexploded ordnance (UXO) and archaeology also posed a significant challenge to the earthworks. Comprehensive species translocation was undertaken prior to the main works where appropriate. The presence of a large badger population on the peninsula proved particularly challenging in this respect. Wet conditions during construction delayed breaching.

The implementation of the scheme led to a number of key opportunities, including the learning of important lessons that can be transferred to future projects. A ‘one team’ approach between the Environment Agency, WWT and the main consultancy was considered key to success. This allowed problems and credit to be shared and key decisions to be made swiftly. A holistic understanding of all the constraints and how to avoid them, with ownership given to parties best able to manage the risk was vital. Collaboration between the designer and construction contractor ensured that the design considered all potential constraints.

Early, continual and effective stakeholder engagement was needed to ensure that the community were kept informed, understood the changes and felt engaged. Early collaboration between key stakeholders enabled common objectives to be identified preventing costly changes during design of construction. This also helped to eliminate any potential objections at the planning stage. The community continued to be closely involved with the project through the construction, and even came up with the name: Steart Marshes. Today, many of the volunteers that help manage the reserve, monitor wildlife and welcome visitors live in the villages that fringe Steart Marshes.

Partnership

The site was implemented by the Environment Agency, with input from the WWT, who now manage the wider Steart reserve on behalf of the Environment Agency. During implementation, a joint agreement was reached with the Internal Drainage Board (IDB), and a close working relationship with Natural England was also considered essential to the project success.

Conclusions

The original project driver is the creation of compensatory habitat, however as a large-scale coastal project, this is an example of where climate change is a key element of the project, to address sea level rise and coastal flooding. The project also illustrates how successful partnership working, decisive project leadership and community engagement help overcome challenges during the development phase.

Sunart Oakwoods

The Sunart Oakwoods project includes a 10,000ha area of upland woodland. The conservation management project was supported by two LIFE-Nature projects (European Commission, n.d.).

The area was planted with non-native coniferous trees under a previous policy, limiting the expansion of the oakwood species (Association of Scottish Visitor Attraction, 2021). The first LIFE-Nature project was part of a strategic project on seven Sites of Community Interest (SCI sites) proposed by the UK for the habitat type 'Old oak woods with Ilex and Blechnum in the British Isles'. The project set out to restore these SCIs to a more favourable condition by removing the threats compromising the habitat. The second LIFE project took the conservation issues one step further by focussing on finding long-term management solutions for the forests. Both projects were run by the Caledonian Partnership, itself an innovative partnership between Government forestry and conservation agencies, conservation NGOs and research bodies to promote large-scale conservation projects in Scotland.

Sunart is bounded to the south by Loch Sunart and Morvern, to the west by Ardnamurchan, to the north by Loch Shiel and to the east by Ardgour. The ancient oaks on the south facing hillsides form one of the best surviving remnants of the ancient Atlantic oak forest which once extended across the west coast of Scotland. Inland the landscape consists of a rough, hilly landscape of mainly moorland, peat bog and woodland.

Environmental baseline prior to the LSNR restoration

The area was traditionally managed as coppice and wood pasture. In the mid-19th century, the area was excessively grazed by sheep; alongside rising deer numbers in the mid-20th century, conifer plantations began to expand, replacing some native and traditional oak woodlands (Caledonian Partnership, 2003).

Level of ambition in restoration/rewilding

Two EU LIFE-Nature projects have focused firstly on restoring the condition of seven sites of Community Interest to a more favourable condition. The main actions were the removal of rhododendron or under-planted conifers to allow the natural regeneration of oaks and other native trees. Wherever possible this was combined with the control of deer populations. The second project focused on finding long-term management solutions for the forests.

Description of work carried out / methods and methodology

The woodland management can be broadly categorised into the following five approaches:

- Ancient Oak Forest (Long-rotation high forest model);
- Native Timber Stands (Standard-rotation high forest model);
- Coppice (Coppice model);

- Wood Pasture (Wood pasture model);
- Natural Reserves (Minimum intervention model).

Within these five management regimes, the following were also implemented:

- Control of grazing levels through deer fencing, and culling as well as the removal of sheep and cattle, with the exception of small-scale trials of cattle grazing within woodlands;
- Removal of invasive rhododendron *ponticum*;
- Removal of non-native conifers which are used as timber, felled-to-recycle where the felled trees are left in the forest;
- Mink control through trapping followed by humane despatch;
- Construction of access facilities (paths; car parking; wildlife hide).

Vision and objectives

The vison and objectives of the project are:

- To bring existing semi-natural woodlands and other habitats into favourable condition;
- To increase the area of such habitats;
- To restore degraded habitats by removal of the threats to them;
- To engage local communities in these activities;
- To manage habitats collectively over multiple ownerships;
- To realise the potential of the habitats as an educational and recreational resource, for both local communities and visitors;
- To derive rural development benefit from the above activities (Natura 2000, n.d.).

Aims

The aims of the project are to integrate conservation management and rural development in a fragile area allowing for the extension and regeneration of Atlantic oakwood habitats.

Environmental and Ecological benefits

The environmental and ecological benefits of the project include:

- Carbon storage in expanded woodlands.
- Restoration of oak woodlands.
- Eradication of invasive and alien species.
- Reduced deer pressure though levels are still too high for the woodlands to regenerate.
- Improvement of habitats for key species including otter, pine martin, wildcat, common seal, fresh water pearl mussel and black-throated diver among others.

Social benefits

The social benefits of the project include:

- Benefits to landowners - EU LIFE has acted as a complimentary fund to help get environmental projects the needed start-up capital and provided objectives (European Commission, n.d.).
- Re-connecting local communities with their forests and supporting the development of local woodland management skills.
- The provision of an outdoor shelter and classroom, used for events, training and educational activities.
- Local training initiatives focusing on skills relating to woodland management and utilisation.

Economic benefits

Economic benefits include the sale of timber from removal of non-native conifers, although this is a short-term benefit as part of the restoration process. Woodland management actions have also included improvements to access, interpretation and visitor facilities thus helping to support the development of a local ‘green’ tourism industry. The development of the local skills and the infrastructure, as well as the development of a strategic view for the sustainable management and development of these woods could guarantee the future conservation and protection of these European sites and their forest habitats.

Key barriers and opportunities

- Woodland - encouraging landowners and managers to pursue different land management practices including bringing woodland areas back into active management, the removal of non-native invasive species such as rhododendron *ponticum* and non-native conifers, and reducing livestock and deer grazing pressure. The impacts of wild grazing and invasive species are two key threats to native woodlands in Scotland.
- Heathland - barriers to management of heathland habitats include determining and maintaining the balance of grazing on the site and managing invasive species such as bracken and rhododendron.
- Marine areas - management issues relating to ensuring that current and any future development activities, be it commercial (e.g. fish farming) or leisure related are compatible with the reefs and otter population.

Partnership models

A strong management partnership has been formed between neighbouring woodland owners, with the aim of managing a significant area of the SAC collectively, known as the North Sunart Woodland Group. The group has developed a joint management plan, and also invested in training and equipment for the small-scale and sensitive management of the woodland SAC, supported by Leader+ and local funding. The group manages nine areas of public forest (Forestry and Land Scotland), nine private ownerships, and crofters common grazing.

The steering group of the Sunart Oakwoods Initiative, comprising representatives of local agencies and community groups, oversees its work and integrates those activities which relate primarily to management of the designated area, as well as activities relating to the wider stakeholders' agendas. Stakeholders targeted as part of management action include:

- Local community groups including community councils (Acharacle, Sunart, Morvern, West Ardnamurchan, and latterly Ardgour, Community Councils);
- Schools;
- Private landowners, mainly those along the north shore of Loch Sunart; some bigger private estates in Morvern have also been involved;
- Local contractors;
- Relevant public agencies: Forestry and Land Scotland, NatureScot, Highland Council and Lochaber Enterprise;
- Tourism providers.

Conclusions

The Sunart project illustrates how the combination of community and landowner involvement can be a catalyst for large-scale habitat restoration. There are still ongoing threats to the woodlands in particular from wild grazing and the oakland woodlands at Sunart are an example of where active management in the longer-term is essential to sustain these important habitats that support a variety of species. In managing the woodlands the project supports the local community through job provision as well as providing a recreational and educational resource.

Temple Farm Estate

Over 30 years the landlord Konrad Goess-Saurau has transformed an 800ha intensive arable farm in Wiltshire into an award-winning combination of profitable agricultural business and lowland wildlife haven. Twenty five percent of the estate is devoted to conservation. The farm is managed as a shooting estate and made profitable by the contributions from environmental management stewardship schemes. The land use surrounding the Temple Farm Estate is typically one of large-scale, open arable agriculture. The fields have mostly lost their hedgerow boundaries and offer a very limited range of habitats.

Environmental baseline prior to the LSNR restoration

Intensive arable farm owned by English Farms, designed to maximise agricultural production after WWII.

Level of ambition in restoration/rewilding

The development of the project was focused around increasing habitat for game birds and has been an ongoing project where 25% of the land is given to conservation.

Aims

The owner strives to prove it is possible to make a profit from agriculture whilst still leaving space for nature.

Vision and objectives

- To plant more than 23 miles of hedges and 1 million trees;
- To use the mix of areas of long grass and grazing by rare breed White Park cattle;
- To sow the higher grounds with traditional grasses and left to revert to scrub;
- To create ponds to attract wildfowl - nine traditional, clay-lined dew ponds have been created and the area now boasts breeding populations of threatened birds.

Environmental and ecological benefits

The project brings about environmental benefits from the carbon sequestration in planted trees and hedgerows; in mineral soils in the lowlands, carbon sequestration starts very quickly after planting, providing useful climate mitigation effects at the outset. The planting of 23 miles of hedgerows; 1 million of trees and creation of 9 traditional, clay-lined dew ponds bring about wider habitat creation and connectivity benefits. Wildflowers have returned.

Social benefits

Improving the quality of the landscape around public rights of way, makes visiting the area a more enjoyable experience. Visits from local schools and universities are also encouraged.

Economic benefits

The farm relies on funding from agri-environment schemes to make it financially viable, covering multiple costs including tree planting and maintenance, and the drilling of annual cover crops.

Key barriers and opportunities

One of the identified barriers is the restrictive approach from government agencies to rewards PES; for example, on one occasion when they planted trees on a 3m-by-3m basis to ensure even growth, the grant was declined because it wasn’t planted 2m-by-3m).

The project is dependent on agri-environmental stewardship schemes to be financially viable. The owner acknowledges that in order for the management to have nature conservation benefits, he had to accept a slight reduction in the profits that could be achieved with intensive management methods (Damment E., 2019). However, it is not recognised how the nature conservation benefits may contribute to longer term economic benefits for future land management and climate resilience.

Partnership models

Funding grants from: HLS, forestry Commission, NIA, SWFBI, north Wessex downs AONB.

Conclusions

The estate shows how a farm can be managed to benefit both production and nature conservation. By allowing a quarter of the estate to be managed for nature conservation interests, it has successfully supported a range of species including many that had previously been lost from the area as well as a number of threatened bird species. This project is different from, for example, Wild Ken Hill in intent on rewilding but is an interesting example of creating high nature value areas alongside areas of production in a lowland arable landscape.

Thorneythwaite Farm in the Lake District

Thorneythwaite is a small (122ha) uplands farm in Borrowdale, the Lake District, purchased by the National Trust in August 2016 for its nature conservation value. The project aims to use sustainable farming practices in the area to increase its nature conservation value. The management of the farm is part of the Natural Trust's wider goal of restoring nature. The surrounding farms are generally under traditional sheep grazed pasture management. However, increasingly farmhouses are sold or re-purposed for holiday lets.

Environmental baseline prior to the LSNR restoration

When purchased, the farm included traditionally managed hay meadows, internationally important oak woodland with veteran trees and rare species and habitats, and communally managed fells. Due to the previous land management approach, there was very little natural regeneration within the existing woodland areas. The Upper River Derwent at Thorneythwaite is channelled and effectively a drainage culvert, and the National Trust aims to naturalise the riverbed.

Level of ambition in restoration/rewilding

The project has modest and achievable aims to improve the management of the land for its nature conservation interest whilst maintaining tenant farming on the land. The National Trust already manage much of the surrounding land in Borrowdale, and the acquisition of the farm contributes to the landscape-scale management of the surrounding area. The National Trust also aims to improve the natural character of the Upper Derwent.

Aims

"To continue farming and at the same time deliver healthy soil, natural water management, thriving natural habitats and continued public access (National Trust, 2016)".

Vision and objectives

Research could not identify the specific objectives of this project; however, the project is managed by the National Trust who are working towards their wider goal of 'nature-friendly' farming, containing protected hedgerows, field margins, ponds, woodland and other habitats allowing plants and animals to thrive (National trust, 2017).

Environmental and Ecological benefits

The environmental and ecological benefits include water management and mitigation of flood risk and improved habitat management.

Social benefits

- Opportunities to prevent/reduce flooding downstream at Keswick and Cockermouth through river management;
- Improvement in access.

Economic benefits

Research has not identified any economic benefits from the project. The project is managed by a charity and therefore economic profits are not necessarily a key driver. The farm employs a shepherd to manage the herd of sheep.

Key barriers and opportunities

There was a controversy over the purchase of the land, and criticisms of the price bid put forward by the National Trust, which was almost double what local farmers were offering (Farming Online, n.d.). Local farmers were concerned over land management, and a fear that traditional Herdwick sheep farming will be lost and replaced with rewilding. The Natural Trust has maintained its intention to continue farming the land.

Partnership models

The National Trust owns the land and intends to work with partner organisations, local communities and farmers to explore the options to enhance this landscape of worldwide cultural significance (the Lake District being designated as a UNESCO World Heritage Site).

Conclusions

This project illustrates the importance in communication and involvement with locals to ensure conflict and controversy do not occur. The project experienced serious backlash after fears the management would step away from traditional sheep rearing. In time the project will hopefully show the societal benefits from allowing more space for nature and how this is compatible with sustainable grazing.

Greater Coa Valley, Western Iberia, Portugal

The Greater Coa Valley occupies a mountainous region in western Iberia, Portugal. The abandonment of a large part of the valley has brought a new opportunity for rewilding and the comeback of wildlife. More than 100,000 hectares of land here have already been set aside for conservation in the form of European designated sites, with an interesting mix of natural and semi-natural habitats. After large scale land abandonment, the landscape has begun to naturally regenerate, however the lack of herbivores has led to a landscape that is particularly susceptible to fire. The project therefore looks at the viability of introducing semi-wild herbivores to manage the landscape.

Montados, mountain ranges and river gorges are popular with cliff loving animals such as vultures and eagles, together with river valleys inhabited by otters and pond turtles. On the poorer soils on granite bedrock, the landscape is dominated by very small land holdings that have had cultivation based on olives, almonds, and cereals – which are now also increasingly being abandoned.

Environmental baseline prior to the LSNR restoration

Rural depopulation and associated land abandonment have led grazing livestock numbers to decrease, and landscape to change without an influence from grazing. The proliferation of bushes, coupled with the close planted of pine and eucalyptus trees makes the landscape more susceptible to fires, with this problem exacerbated by long hot summers driven by climate change. Although fire is a natural process, the frequency and intensity of fires not only causes severe habitat loss and environmental degradation, but also serious economic losses and even loss of human life (Rewilding Europe, n.d.).

Level of ambition in restoration/rewilding

This is an ambitious project to connect a broad expanse of areas. The inclusion of multiple local communities which are likely to be hesitant about encouraging predatory species such as wolves that may threaten livestock also highlights the ambitious nature of this project.

Aims

The aim of the project was to re-introduce grazing, using introduced semi-wild herbivores, thus reducing the areas susceptibility to wildfires and creating a more diverse mosaic of habitats. These habitats in turn will support a wider range of species.

Vision and objectives

- Increasing habitat connectivity by strategically purchasing core areas to revive ecological processes such as herbivory, carnivory and scavenging.
- Reintroducing and restocking roe deer, encouraging the return of scavenging and predatory species such as vultures, raptors, Iberian lynx and wolf.
- Reducing threats such as poaching, poisoning and fire and mitigating human-wildlife conflicts between wolves and livestock owners.

- Investing in education programmes and training courses for wildlife guides and supporting local, nature-based enterprises.
- Organising events and festivals to celebrate local natural and cultural identity of the area (Ibid.).

Environmental and ecological benefits

Long term rural depopulation has led to heightened wildfire risk through vegetation growth. The main environmental benefits include the use of grazing animals (horses and cattle) as a low impact way of managing fire risk and improving local biodiversity. This is achieved by the herbivores consuming plant matter which would otherwise accumulate as fuel. The grazing animals create a mosaic landscape with open spaces which act as effective firebreaks and also reengineer the soil and litter layer. The creation of mosaic habitats also helps to enhance biodiversity and species such as European rabbit and red-legged partridge which provide prey for Iberian lynx and Bonnelli's eagle; the increase in wildlife also results in more carrion for vultures.

There are resident wolf populations which are currently impacted by habitat loss, low connectivity between packs, conflict with humans and lack of prey. The reduction of conflict between wolves and humans will increase the role of the wolves in the functioning of the ecosystem. This is currently being taken forward through a specific project which supports increases in wolf numbers alongside conflict reducing measures.

Social benefits

Work has been undertaken to promote coexistence between Iberian wolves and people in the Greater Côa Valley through community involvement and education. The development of nature-based tourism provides local employment in an area which has experienced de-population. The area has also been used for education including an Erasmus Intensive programme on European Wilderness Entrepreneurship. A new education programme has also been established helping local schoolchildren to form a bond with nature as well as teaching them about rewilding and how people can live alongside wildlife. The area also hosts events and festivals celebrating the cultural heritage of the area, facilitating economic activity and tourism.

Economic benefits

The rewilding project included the launch of a 200km walking trail across the area which led to the expansion of the rewilding vision to include a 120,000 hectare wildlife corridor. Business opportunities for rewilding-focused enterprises include the development of a new business Vale Das Lobas, a nature-based tourism resort, focused on wellbeing, discovery and biodiversity which is scheduled to open in 2021. Nature-based enterprises including wildlife safaris are supported within the area. These tourism enterprises work alongside food production including olives, almonds, and cereals.

Key barriers and opportunities

The project has successfully demonstrated that wildlife comeback and land abandonment present an opportunity rather than a problem and the project is working to overcome the conflicts between landowners and wolves. The return of nature is also recognised as an opportunity to development more equitable and less exploitative connections with the land.

Partnership models

The project is in partnership with;

- The board of Portuguese NGO Associação Transumância e Natureza (ATN) regarding the development of the Côa Valley as a major rewilding initiative.
- Research and feasibility studies with the University of Aveiro.
- Wildlife watching businesses Wildlife Portugal, Star Camp, Casa da Cisterna and Miles Away.

Conclusions

This project is similar to many other rewilding projects in which herbivores are introduced to increase habitat diversity. Greater Coa Valley is particularly interesting because the change in habitat is paramount to increasing the areas resilience to fire. The scale of the project is also notable as it will have a large impact in the region. The project takes a positive approach to the inclusion of local communities who are important for the support and success of the project, by ensuring their inclusion and facilitate opportunities for economic benefit for example from ecotourism.

Central Apennines, Italy

The project commenced in 2013, aiming to provide "coexistence corridors" for wildlife between the national parks of Abruzzo, Molise and Lazio and Majella to the Sirente Velino Regional Park. The project focuses on working with local communities to permit co-existence between them and wildlife and promoting wildlife-based enterprises. It is led by Rewilding Europe and local partners, and the area includes a 100,000ha area of land in the mountainous Central Apennines. The project focuses on allowing ecosystems to naturally regenerate and encouraging locals to harness the benefits of these regenerated areas though ecotourism, local food products and other local products, as traditional land management has become uneconomically viable. The surrounding landscape includes diverse habitats such as mountain grasslands, alpine grasslands, beech forest, oak forest, limestone canyons and caves, mountain streams, woodland pastures.

Environmental baseline prior to the LSNR restoration

A landscape in which traditional human management including livestock herding and mountain farming is being abandoned, allowing natural ecosystems to regenerate.

Level of ambition in restoration/rewilding

The project is ambitious due to the necessity to change pre-conceived negative attitudes towards Marsican brown bears in the local communities, allowing them to be seen as a species that brings socio-economic profits to local communities rather than damage and hinder people's efforts to make a livelihood.

Aims

Rewilding Europe favours the comeback of wildlife and natural processes in the mountains of Central Italy, reconnecting the existing protected areas and providing new economic opportunities to the local communities (Rewilding Europe, n.d.). The project is heavily focused on the protection of the critically endangered Marsican brown bear as its flagship species. Despite being a priori safe within the national parks, these bears are at risk from poaching, poisoning, traffic collisions and conflict with locals. The project provides local communities with an economic incentive to protect and allow the passage of the bears to pass though these corridors.

Vision and objectives

The vision for the area includes the creation of a biodiversity hotspot, with thriving populations of Marsican brown bear, grey wolf, Apennine chamois, red deer, golden eagles, vultures and endemic flora. Nature has rebounded due to the abandonment of traditional livestock herding and mountain farming. Large herbivores, carnivores and scavengers are returning in numbers within a rich mosaic habitat. Local people have found new, additional or alternative sources of income from the wild nature, and people are returning to the area. A number of large core rewilding areas have no-take regimes, are connected through wildlife corridors and surrounded by zones with different kinds and levels of sustainable use. Business activities include wildlife tourism, traditional food products and local arts and crafts.

Environmental and Ecological benefits

The primary environmental benefits arise from the creation of large wildlife corridors linking the national parks and allowing wildlife migration. The rewilded corridor will also act as a carbon sink. It is estimated that 5,000 ha of this land is capable of capturing 85,000 tonnes of carbon over a five-year period. One of the main benefits will be to increase the Marsican brown bear population and their role within the ecosystem. The project also aims to re-introduce the white-clawed crayfish, a keystone species in freshwater ecosystems.

Social benefits

Social benefits from the project included the regeneration of settlements suffering from rural depopulation and lack of economic opportunities. Benefits from reducing human – bear conflict have been obtained through establishing "bear smart communities" to increase co-existence between humans and bears and reduce damage caused by bears. This involved hiring three people from local villages as 'bear ambassadors'. They work

with livestock owners and stakeholders to monitor bear and human conflict. More widely, raising awareness in rewilding has been undertaken through educational outreach, public events and meetings.

Economic benefits

Nature based tourism is key to the economic benefits from the project. This includes hiking, trekking and wildlife watching, and the opening of a mountain refuge in the region. Several tourism packages have been developed to attract visitors, focusing on areas connected to the Abruzzo National Park. There has also been the development and sale of local sustainable products. The creation of ‘coexistence corridors’ aims to connect the local economy with wilder nature, supporting the range and abundance of wildlife within the national and regional parks.

Key barriers and opportunities

A particular challenge has been to drive a shift in pre-conceived mindsets to value a species, the Marsican Brown Bear, which had once been widely considered a nuisance in society. Acceptance of the species then can translate into socio-economic opportunities, through business creation, and reverting de-population.

Partnership models

In the Central Apennines, the European Wilderness Society and two local organisations, Salviamo l’Orso and Rewilding Apennines, are setting up a cooperation with the objective to enlarge the audited wilderness in this region. The Salviamo l’Orso and Rewilding Apennines have wide experience in minimising human-wildlife conflicts in the anthropogenically shaped zones situated in between the protected areas.

Conclusions

This project is interesting due to its natural regeneration approach, over a large-scale area. It takes into consideration the necessity for large-scale habitats and habitat connectivity, particularly when target species are larger animals. The involvement of local communities and commitment to ensuring they also benefit from the project e.g., ensuring less damage to produce by bears, has helped it gain favour, and contribute to changing perceptions of controversial animal species.

Oostvaardersplassen, Netherlands

The Oostvaardersplassen rewilding project took place on a 5,600ha area of reclaimed coastal wetland in the Netherlands an hour away from Amsterdam. This area of reclaimed land was unusually fertile and attracted large populations of wetland birds. The project was led by the ecologist Frans Vera who saw the introduction of herbivores as a way of preventing this wetland habitat from regenerating into woodland. The project was managed with a hands-off approach, allowing populations of herbivores to naturally stabilise. Initial small populations of herbivores were brought into the fenced project area

in the 1980s and 1990s. The surrounding landscape of the man-made wetlands area consists of urban development, industry and intensive agriculture, bound by the sea to the north-west. The area became part of Nieuw Land National Park in 2018.

Environmental baseline prior to the LSNR restoration

A rewilding project developed on a man-made polder of land reclaimed from the sea in 1968, the area was originally meant to become an industrial park. However due to an economic downturn and the habitat potential of the area which had attracted large populations of wetland birds, it was instead designated as an SPA and Ramsar Site.

Level of ambition in restoration/rewilding

A highly ambitious and controversial project in which there was no human intervention. This project was largely experimental to determine if herbivore populations could naturally stabilise.

Aims

The project aimed to create a landscape resembling what was common before human intervention. The reserve was designed to manage and maintain the new wetland habitat for birds and other species displaced from the region by human activities.

Vision and objectives

The project took a non-intervention approach, after introducing a number of grazing animals, in order to study how they impacted the character of the landscape. The project initially introduced 32 Heck cattle, 18 Konik horses, and 40 red deer into the enclosed area. These animals multiplied and by 2016 had a joint population of 5,300 animals. Populations were permitted to rise and fall depending upon food availability and as a result a series of mass herbivore deaths occurred.

Environmental and Ecological benefits

Environmental and ecological benefits include the role of grazing animals to maintain open habitats for bird species. This has further increased soil fertility through nitrogen deposits in livestock excrement and carcasses. Currently the park attracts 78 species of birds (including graylag and barnacle geese, spoonbill, cormorants, egrets and several species of duck).

Social and Economic benefits

Much of the nature reserve is closed to the public to allow the wildlife to live undisturbed, but it allows for some tourism including a hiking route, observation hut and visitor centre.

Key barriers and opportunities

Barriers:

- Social unacceptance towards seeing dying animals and their corpses;
- Fenced area with no migrating corridors and uncontrolled numbers of herbivores who pose threat to the biodiversity of the place;
- Animal welfare with episodes of starvation among herbivores due to lack of predators to control populations;
- Climate change creates its own imperative for species adaptation and migration which traditional small-scale nature reserves may become increasingly unable to deliver.

Opportunities:

- A proposed expansion to double the area of Oostvaardersplassen in partnership with the Province of Flevoland. However, the 200-million-euro programme to purchase high-grade agricultural land is currently on hold (Wild Europe, n.d.);
- Substantial areas of marginal farmland of far lesser value than Oostvaardersplassen may become available; this land will continue to be uneconomic for agricultural production as subsidy cuts take their toll from CAP reform over the next 15 years;
- Growing realisation that the economic, social and environmental benefits from large natural habitat areas can now offer an increasingly significant alternative livelihood for landholders and local communities – whether rural or urban;
- Rising sea levels are managed by economically cost-effective coastal retreat, with creation of new salt marshes in large littoral restoration initiatives.

Partnership models

The project was founded by Dutch ecologist Frans Vera. After the mass herbivore deaths in 2005, the international committee ICMO1 was established to manage the area.

Conclusions

The Oostvaardersplassen project is a landmark project in terms of its approach to rewilding. It shows that populations of introduced herbivores will stabilise in response to habitat and environmental conditions but illustrated how this can result in mass die-offs in absence of predators to control herbivore populations. This sparked controversy affecting the social acceptability of the project. The project was interesting as unlike others, it approached rewilding in close proximity to heavily developed areas. Weaknesses of the project included its small-scale closed area, in which the herbivores could not migrate away from the unfavourable conditions. This project shows the issues associated with having large wild/semi-wild herbivore populations without carnivores to control their numbers. The hands-off approach to management can result in adverse impacts on animal welfare, and also on the ecology of a landscape, if other keystone species are absent. In absence of natural predators, careful stocking of large herbivores and a clear management approach for managing issues such as food availability should be given from the start in such rewilding projects.

Annex 3 - Long list of funding models

Due to the number of evaluation criteria used for the assessment, the long list of funding models is presented in an accompanying excel spreadsheet. To review the full range of criteria used, and the outcomes from this evaluation, please refer to the spreadsheet. The table below provides a list of the mechanism types and both the funding/ financing models and individual funding sources. The funding models listed in bold have potential for mainstreaming and are explored in greater detail in Annex 4 - Short-Listed Profiles Chosen for Further Research.

Environmental programmes

Funding/ Financing Models & Individual funding sources
Nature for Climate Fund
Biodiversity Challenge Fund
Green Recovery Challenge Fund (Made up of nature recovery and nature for climate funding)
Natural Capital Pioneer Fund
Environmental Land Management Scheme (ELMS)
Net Positive for Nature
Multilateral Climate Funds
Natural Environment Impact fund
Countryside Stewardship Scheme
Local Nature Partnership funding
Marine Fund
Strategic priorities fund
Catchment markets

Funding/ Financing Models & Individual funding sources
Agri-Environment Schemes
Natural Capital Investment Fund
Woodland Equity Fund

Economic development funding

Funding/ Financing Models & Individual funding sources
Scottish National Investment Bank
European investment bank
National Lottery Heritage Fund
International Climate Fund

Grant Funding

Funding/ Financing Models & Individual funding sources
Grants for peatland restoration
Government Grant Partnership
EU-LIFE Scheme

Landowners

Funding/ Financing Models & Individual funding sources

Funding/ Financing Models & Individual funding sources

Self-funding

Eco luxury tourism

National Trust

Business Transactions

Funding/ Financing Models & Individual funding sources

Habitat and Carbon banking

Invasive non-native species loans

Place based portfolio models

Charitable Funding (NGO's)

Funding/ Financing Models & Individual funding sources

Endangered Landscapes Programme

Philanthropy

Charitable Trusts

Alternative finance

Funding/ Financing Models & Individual funding sources

Crowdfunding

Funding/ Financing Models & Individual funding sources

Community investment funds

Payments for ecosystem services

Cooperative Funding Models

Insurance payments for risk mitigation

Mature Conservation Markets Fund

Substitute’s fund

Tax

Funding/ Financing Models & Individual funding sources

Tax credits

Tax Levy's

Green Bonds/ Financial Capital

Funding/ Financing Models & Individual funding sources

Natural Capital Bond

Environmental impact bond

Ecosystem Green Bond

Nature Climate Bond

Sustainable drainage systems

Funding/ Financing Models & Individual funding sources

Special purpose vehicle (SPV)

Public Private Partnerships

Funding/ Financing Models & Individual funding sources

The Green for Growth Fund

The Community Development Carbon Fund

Annex 4 - Short-Listed Profiles Chosen for Further Research

Model 1: Payments for Ecosystem Services (for further examples see habitat/ carbon banking)

Introduction to the model	• 'Payment for Ecosystem Services' (PES) schemes involve paying for services provided by nature. For example, carbon that is absorbed and stored by forests and peatlands can be sold on carbon markets, thereby creating a payment for the carbon storage that these natural assets provide. • The term 'trade' is used, but no property changes hands. It is viewed as a sponsorship to maintain and ultimately enhance the ecosystem services through mutual agreement. • There has been widespread adoption of private measures between 'suppliers' and 'beneficiaries' through commercial trading schemes and private agreements.
Source(s) of funding	Beneficiaries of ecosystem services (including business such as insurers, water utility providers, energy providers, food/drink markets such as fisheries, other landowners, national or regional/ local government agencies, carbon trading, tourism providers).

Case studies	• Water Quality Trading policy implemented by the Environmental Protection Agency (EPA) to counter the trend for reductions in water body quality. • Pumlumon project uses Landscape Enterprise Networks (LENs), an aggregation platform in which funding is packaged up to be used on a range of ecosystem services to provide greater scope from multiple sources. A similar approach is taken by the Northern Upland Chain who use it to blend investments in with public funding.
Impact on nature	Well-established means of securing a range of benefits including watershed protection, wetland management, landscape quality, biodiversity and carbon sequestration and purpose driven ecological restoration (careful design is required to consider perverse outcomes such as lack of species mix for biodiversity to maximise carbon gains).
Limitations/ challenges	• Difficulties in appropriately valuing the land that considers both the natural benefits of the land and the cost saving that a well-maintained landscape can provide. • Ensuring a fair market price in ecological markets which are often volatile as they are not yet well established. • Encouraging landowners to sign up to the platform and ensuring there is an independent verification process to ensure land is being managed to standard for others to benefit. • Challenge in verifying benefits obtained from ecological restoration. • Ensuring there is sufficient business benefit on sparsely populated/remote land for example a rural area in the highlands may have an indirect impact on water quality downstream alongside flood resilience, but this needs to be better understood.
Development and future directions	• A range of mechanisms (state & private) are being investigated to help develop closer links between the ‘supply’ and ‘demand’ sides. • Scoping potential to combine with carbon markets, which is explored in greater detail in the habitat trading model. • For scale, it is important to develop a mechanism which allows the market in ecosystem services to regulate itself, which can act as a trading platform to use market prices to value and execute trades. One such example is the NaturEtrade platform which assesses the ecological potential of land and then allows for ‘trading’ of these services. • Ensuring “income foregone + cost + profit margin” is included as part of the valuation.

Considerations for applying this for a large-scale approach in Scotland

One of the main challenges of this type of funding is understanding the value of ecosystems within an area. To be able to apply this to LSNR, a valuation would be required of the land systems and the services that they provide. Only once this is done can transparent business engagements begin to approach the benefits that each organisation derives from the land. What is needed for this approach is a platform that assesses the land, to be led by landowners themselves. They can benefit from maintaining their land through these agreements, but a system needs to be easily accessible. Such a system may require public funds to contribute to the scheme, including setup and cooperation to ensure fair value and oversight of land quality. This can then be sustained by private funding.

Model 2: Catchment Markets

Introduction to the model	• A catchment market is where buyers and sellers are brought together to trade environmental credits within the catchment area. • A relatively new form of funding to the market, it uses payments for ecosystem services but is defined by a geographical boundary within a corridor which allows for a more targeted approach for engagement. • The model looks to create credits around ecosystems services such as water quality improvements, flood prevention, and water supply efficiencies through improvement to land such as from improved agriculture practices; this is often paid for by the water providers. • These on-farm environmental projects are required to reduce nutrient losses to water from farming activities. They can also be used to offset biodiversity losses incurred by other industries. Buyers include water companies and building developers within the local catchment. • Projects like overwinter cover crops lend themselves to short term contracts of between 1-5 years, whereas projects like woodland and wetland creation lend themselves to longer contracts of up to 30 years.
Source(s) of funding	• Water utilities, water users, other industries and private companies within the catchment area provide funding to help improve water-based habitats and water quality. • This helps organisations find more cost-effective ways of meeting their environmental obligations such as flood prevention or improving water quality. • Public bodies, such as local authorities, and investors who are willing to invest in nature-based projects to generate environmental credits that can then be sold for future revenue and achieve environmental outcomes. • Farmers can potentially generate multiple environmental credits from the same nature-based project, and therefore the same project can attract investment from a variety of buyers all interested in different environmental outcomes.

Case studies	EnTrade is operating a catchment market in parts of the River Tone and Parrett catchments (as part of the Somerset catchment).
Impact on nature	• To improve water quality and biodiversity, particularly associated with watercourses and wetlands within the catchment due to local requirements. • Prevent diffuse pollution.
Limitations/ Challenges	• Restricted to catchment areas that have sufficient links and value from improving water quality for organisations within the area. • Currently, agricultural land use opportunities face uncertainty over the shape of post-EU exit rural support.
Development and future direction	• Digital mapping of catchment areas to set boundaries as to which land belongs in a catchment so that financial credits can be provided. • Could be integrated within SEPA's river basin management plans (RBMPs) to achieve co-benefits. • Would create a long-term funding system, whereby there is a continual flow of benefits as water quality improvements are felt alongside associated benefits in soil quality and other ecosystem services, meaning restoration phase funding and then funding provided for maintenance. • Currently discussions around whether this can be stacked with a habitat banking approach for organisations that have biodiversity targets (such as housing developers) that require offsetting to meet their obligations to the environment.

Considerations for applying this for a large-scale approach in Scotland

This approach is a water-related payment for ecosystem services model, defined by the boundary of a catchment market. It may include habitat or carbon banking, but the primary aspect of this model is the changes in water quality and/ or water supply. Those responsible for water quality, or those who directly benefit from improvements to the catchment can buy into the fund to create a larger resource base. Further work is required in market-based approaches like that developed by EnTrade, and the encouragement for Scottish Water based utilities to be involved in the development of catchment management. This could help contribute funding to the improvements to water quality from Scottish Water's sustainable land management programme. The catchment could be packaged into a LENs to provide a range of ecosystem services within one area.

Model 3: Agri-Environment Schemes

Introduction to the model	• Agri-environment schemes provide funding to farmers and land managers to farm in a way that supports biodiversity, enhances the landscape, and improves the quality of water, air and soil. • An example within the Environmental Land Management Scheme (ELMS) for England and Wales is adapted depending on tiering, with tier one looking to encourage farmers to adopt environmentally sustainable farming and forestry practices, whilst tier two would focus on delivering locally targeted environmental outcomes. The third tier pays for large scale, transformational projects- such as restoring peatland.
Source(s) of funding	• Government grants. • Tax incentives/ subsidies for farmers that are maintaining and restoring the natural environment.
Case studies	• Agri-Environment Climate Scheme (AECS) – Rural Payments Scotland (Scottish Government, 2021)/ alongside ESA, countryside premium, rural stewardship and rural priorities. • ELMS/ Countryside stewardship scheme – DEFRA.
Impact on nature	• Improve water quality, manage flood risk and mitigate and adapt to climate change. • Help to support appropriate management for vulnerable species and habitats, strengthen ecological networks, control invasive non-native species and enhance the condition of protected nature sites. • Under ELMS, farmers will be paid for work that enhances the environment, such as tree or hedge planting, river management to mitigate flooding, or creating or restoring habitats for wildlife.
Limitations/ Challenges	• To maximise environmental outcomes and ensure value for money, support under the Agri-Environment Climate Scheme is geographically targeted – which can be quite restrictive for some locations. • The AECS was previously funded by both Europe, the UK government, Scottish Government and other devolved administrations; due to EU exit, a different rural support is being put in place, and many aspects remain to be confirmed. • Ongoing compliance can be onerous but encourages active monitoring. • Government grants have to balance spending priorities and therefore can have a limit on the work that they can fund depending on priorities. • Agri-environment schemes have not historically been outcomes based, and this would need to become a priority objective to be successful in restoring nature.

Development and future direction	• Exploring how AECS could be incorporated into other suggested financial models, ideally so that these models can be stacked to provide a wider catchment of landowners who participate in conservation – in particular to ensure that if environmental management is taking place, then habitats are used that could create the greatest value to other models e.g. carbon sequestration. • The Scottish Government through farmer-led Climate Groups for the various sectors will be running a series of trials on new schemes, starting in 2021 with pilot schemes running from 2021 to 2024. • The level of support for the delivery of environmental outcomes moving forward remains uncertain. • It is anticipated that schemes will move towards a more outcome-based approach.

Considerations for applying this for a large-scale approach in Scotland

Though not a sole solution to large scale nature restoration, due to their impact mostly on farmland, agri-environment schemes can form part of the solution for LSNR. They have been a consistent part of agriculture, with farmers having greater experience with such schemes than some of the other forms of funding. With agriculture a major land use in the UK, and intensification of agricultural practice being linked to declines in wildlife – these schemes can help to protect and enhance biodiversity, landscapes and historic features on top of promoting public access. To support LSNR, agri-environment schemes need to work in conjunction with other schemes that improve environmental outcomes so that landowners can maximise their environmental assets and ensure they are appropriately incentivised to do so.

Model 4: Habitat and Carbon Banking

Introduction to the model	• Habitat and Carbon Banking providers sell credits from actions that increase biodiversity or store carbon to organisations who want to compensate for their impact on the environment. • It is a type of a payment for ecosystem service as described in Model 1. • These credits are calculated, for example by using the DEFRA Biodiversity 2.0 metric, which takes data around the area, connectivity and so on for habitats lost/ created as a result of a change to the landscape to create a unit figure which can be used to ascertain a value against the current market price. Subject to statutory ecological protections and in accordance with satisfying the mitigation hierarchy, any residual losses in units from a site will require offsetting elsewhere through the purchase of credits equal to the value of lost units. • Projects generate habitat/ carbon benefits that can be stacked as credits. • Biodiversity net gain requirements through the Environment Bill may require developers (infrastructure project promoters) to ensure active improvement of biodiversity, which would work as a regulatory driver for habitat banking. • Farmers, landowners and conservation bodies are paid per hectare per year, and habitat banks are then monitored against the objectives of a biodiversity management plan.
Source(s) of funding	• Private organisations who are looking to offset or provide a net gain for their biodiversity losses, using grant funding to establish a working system. • The habitat bank can also leverage the funds received through selling credits to raise money from private investors, who receive returns from surpluses generated and therefore can continue to raise further equity.
Case studies	• Conservation Credit Purchase Agreements e.g. Tees estuary (Tees Estuary Partnership, 2018) • Forest Carbon – voluntary woodland creation scheme using the woodland carbon code to provide an indicative pricing source.
Impact on nature	• Habitat creation and restoration – with the Environment Bill planning on introducing a 10% net gain requirement for developments, it will lead to an overall increase in biodiversity. • Carbon sequestration. • Enhanced outcomes for nature conservation with a strategic network of sites with improved habitat connectivity- this can be achieved by using the in-built weighting and priorities for connectivity and location value as part of the DEFRA biodiversity 2.0 metric.

Limitations/ Challenges	• When residual losses are quantified, compensation for schemes that have large impacts should be specifically designed to match that impact. • Where losses are local, there is a danger that the compensation may not take place locally leading to environmental degradation. • Danger that habitats that provide the greatest carbon sequestration may be mainstreamed and lead to a reduction in diverse landscapes. • Woodland Carbon Code has helped to establish a standard, however this requires strong accreditations and enforcement which requires funding. • Stringent requirements around measuring the carbon captured, this includes being restricted by a set number of years any assets created would need to stay in place.
Development and future direction	• Current credit markets remain voluntary, but carbon emission reduction has political, regulatory and reputational backing. • Habitat banking is a one-off asset purchase (compensating for a lost biodiversity habitat), but carbon revenue is an ongoing requirement to maintain assets. There is an opportunity to stack credits to achieve both carbon sequestration and improvements to biodiversity. • Both carbon and biodiversity credit markets can potentially increase in scale, meaning economies of scale could lead to reduced unit costs. • Such bank sites are already being set up so that conservation credits can be quickly and easily sold from large wildlife schemes. • Their feasibility for working in liaison with Scottish Forestry Grants and Woodland Equity Funds should be explored.

Considerations for applying this for a large-scale approach in Scotland

The potential for landowners to be able to create revenue is a clear incentive to encourage progress in this area. For this to take place across Scotland, further market development is needed to establish an active trading platform where private investors can choose to directly invest in funds that accumulate carbon capture in land and biodiversity enhancement. This would involve the creation of a fund, like that of a hedge fund whereby investments are managed by one entity, that is solely focussed on investing in the creation of habitats or carbon sinks. It would consist of several private and corporate investors looking to improve their environmental impact or those looking for a return on investment, which can be accessed through a trading platform to appropriately price carbon/ woodland credits against demand (e.g. such as a carbon trade exchange). Better accounting by using a tested national metric that assesses the loss of biodiversity is now being implemented by several local authorities, but this needs to be widespread for habitat banking to be mainstreamed. The incentives for clear, sustainable revenue streams provide confidence that this would be applicable for LSNR. There is a lot of potential for carbon banking within Scotland, as Scottish peatlands store a great deal of

carbon and provide fresh water and a variety of valuable biodiversity-related services. Ultimately it requires a system for nature valuation, a method for creating ecological opportunity maps, and an institutional setting in which habitat banking can be operationalised.

Model 5: Crowdsourced funding (including community investment funds)

Introduction to the model	• Local authorities/ conservation owners would issue bonds directly to the public via a crowdfunding platform. The initial capital investment would come from a broad range of interested investors who could invest from as little as £5. • The best example of this is by local authorities who have sought to install renewable energy within its boundary. To gather the up-front cost, residents could choose to invest and in return receive renewable energy (e.g. solar panels). The returns would then come from energy generation and cost savings. The example within Warrington Council is a 5-year term and pays investors 1.2% per year on a twice-yearly basis. • Other more philanthropic crowdfunding has shown to provide non-monetary returns on investment such as eco-retreats or visits, or bespoke offerings based on the site of investment. • The return to investors would come from a combination of long-term savings made by some of the interventions and income generated by others. • Due to the low-cost nature of crowdfunding, this type of bond can be issued via a low-risk, easy-to-use online process with attractive borrowing rates and terms. • Traditionally used as a way in which to provide philanthropic funding, it can be adapted so that returns can be provided to those who provide investment.
Source(s) of funding	• Crowdsourced (private donations/ investments) through platforms such as Abundance. • In certain circumstances, secured bonds that are guaranteed by the local council.
Case studies	• Community investment funds – Swindon Borough Council/ Warrington Council (Abundance Investment, 2020). • Philanthropic crowdfunding – Langholm Moor (The Langholm Initiative, 2020). • Abundance is currently working with the City of Edinburgh Council to develop this model.

Impact on nature	• Project specific existing schemes have looked to boost nature restoration, tackle climate change and generate renewable energy, as in the case of Langholm Moor to create a new nature reserve that aims to help tackle climate change, restore nature, and support community regeneration. • Existing projects of community municipal funds such as Swindon Borough Council now generate enough energy for around 1,200 homes and residents benefit from reduced carbon emissions, cleaner energy and returns on their investment.
Limitations/ Challenges	Often funds are set up for a single project, so would need adapting to be achieved for a large-scale initiative aggregating multiple projects
Development and future direction	This funding is still in relative infancy; however, community municipal investment funds are increasing in popularity, and this type of funding is moving from conceptual to a viable source of funding and therefore these projects and their revenues may be key for future funding approaches.

Considerations for applying this for a large-scale approach in Scotland

Community investment funds can be mobilised to ensure that local communities can invest directly into environmental projects that can have outcomes that either provide a return on their investment, and/ or provide cost savings. Crowdfunding has also been used in a similar vein to raise charitable funds for projects that often provide non-monetary rewards for investors. For LSNR and the level of funding required, these funds need to be mobilised on a scale that encourages investment not only from the local community, but from further afield and encourage investment on a larger scale. To be able to do this, investors that have greater access to capital will look for tangible returns on their income which will require ecosystem services or habitat banking type solutions as described. Alternatively, engaging communities who have an interest in conserving Scotland's habitats can be engaged (crowdsourcing is not restricted geographically).

Model 6: Ecosystem Green Bond

Introduction to the model	• A sovereign-issued bond covering an ecosystem at a larger scale, deemed worth of protection, and using the proceeds to finance any conservation-related activities in this ecosystem. • The ecosystems could be a system of terrestrial national/ marine parks. • The size of the bond is dependent on the relevant ecosystem. • Investors get returns through payments for ecosystem services, such as carbon sequestration, water quality, and timber sales.

Source(s) of funding	• Funds gained through investment in the bond. • Repayment would be cash-flow generated activities by the ecosystem. • To reduce risk and costs and increase appeal, full or partial repayment can be guaranteed by the sovereign or an international financial institution.
Case studies	• Netherlands euro green bond – focusing on using coastal and river ecosystems as a safeguard for negative climate impacts such as high flood risk. Uses the Water Infrastructure Criteria of the Climate Bonds Standard (Alliance for Global Water Adaptation, 2019). • Anglian Water Green Bond (Anglian Water, 2020) – looking at innovative water abstraction technology, drought and flood resilience schemes, and progressive water recycling and water resource management projects. The first utility company to issue a sterling Green Bond, the £250 million, eight-year bond will mature in 2025 with a return to investors of 1.625%. • Tideway – The company building London's sewer has issued a £250 million UK public bond to construct the Thames Tideway Tunnel (Tideway, 2017).
Impact on nature	Can be quite broad, but existing green bonds have looked to contribute to environment objectives such as climate change mitigation/adaptation, natural resource/ biodiversity conservation, pollution prevention and control.
Limitations/ Challenges	• Lack of awareness from investors of the benefits of green bonds. • Initial costs relating to building market knowledge and establishing procedures for issuing a green bond (namely governance, management of proceeds, external review and reporting) (Federal Ministry for Economic Cooperation and Development, 2017). • Setting a standard as to what qualifies as a green project or asset. • Long term nature of returns.

Development and future direction	• There has been strong growth, driven predominantly by the issuers' ability to enhance their reputation and attract a new investor base. • Infrastructure developers, water companies and other public bodies could explore the raising of a green bond through the municipal bond market to invest in green and blue infrastructure. • By integrating grey and green investment plans, corporates could potentially obtain a lower cost of capital as well as other benefits from raising a green bond compared to regular financing for grey infrastructure. • There could be developments through pension markets that are targeting more sustainable investments through green bonds and ESG investing. • With the development of the Task Force on Climate-related Financial Disclosures (TCFD) and the Task Force on Nature-Based Financial Disclosures (TNFD), which are intended to help shift finance from destructive activities towards nature-based solutions, interest in green bonds may increase as organisations look for sustainable investments.

Considerations for applying this for a large-scale approach in Scotland

The successful placement of such mainstream investment products in the market could be crucial in lifting conservation finance to its next stage due to its potential to attract private investors at scale and provide a guaranteed longevity to funding. It is currently the best example that exists of leveraging large amounts of private finance for environmental outcomes. Leveraging these market-based mechanisms is key to ensure there are sufficient green bonds and investable projects to meet demand. As identified in the £1 billion route map (Scottish Conservation Finance Project, 2020), as a 'Nature-Climate bond', proposals already exist within Scotland as to how this would operate. The projects that could be targeted by the bond are similar to those developed as part of the Green Investment Portfolio, which can help serve as an aggregator.

Model 7: Tax Credits/ Tax Levy system

Introduction to the model	• Environmental tax levies encourage businesses to operate in a more environmentally friendly way by placing a levy on environmentally degrading practices. • Landowners/ businesses that contribute to environmental conservation can gain financial benefits through tax breaks/credits.

Source(s) of funding	• Paid for by industries performing environmentally degrading practices, or negative externalities (known as Pigouvian taxes) that are ring-fenced for environmental conservation projects, meaning they are tax neutral in the long run. • Through the funds raised by tax levies on environmentally degrading practices that have been ring-fenced for environmental conservation projects. • Reducing capital gains tax for nature-based conservation in the stock market can increase investor interest and make investment more attractive. • Reducing capital gains tax on assets should a conservation covenant be included in the transfer of ownership.
Case studies	• Mostly in other sectors. • Climate change Levy – A tax on the electricity, natural gas, coal and LPG used by business, agriculture and the public sector. • Scottish Landfill Communities Fund: By contributing money to approved community and environmental projects, landfill site operators can receive tax credits up to 5.6%. Landfill operators can claim a tax credit equal to 90% of any qualifying contribution made. • Aggregates Levy: Environmental tax introduced in 2002 to reduce the extraction of fresh aggregate, whereby extraction was taxed at a rate of £2 per tonne (15% of total annual revenue came from Scotland) • Aggregates Levy Sustainability Fund, which is funded by the aggregates industry, enabled over £10.8 million to be distributed across 194 projects (under which Landscape and Nature Conservation was a key area) (Natural England, 2010).
Impact on nature	• Previously used to reduce extraction of natural capital, encouraging recycling and the use of by-products. • However, in the correct circumstances, can be applied to projects that seek to enhance the natural environment. An example would be to tax a carbon intensive practice to encourage organisations to use a practice that is more environmentally friendly. The taxes raised from the negative externality could then be used to fund investment into carbon capture technology.
Limitations/ Challenges	• A crude funding method which can often have several exemptions that can cause legal issues as with the Aggregates Levy (classification of state aid and the exemption on shale) (Scottish Legal News, 2020). • Requires public approval, planning and organisation on a large scale. • Quantity based instruments, such as emission quotas, are often favoured on the ground they bring forth more certainty in reaching given environmental targets than price-based instruments (Kosonen K., 2009).

Development and future direction	Governments could earmark part of tax revenues for specific environmental purposes, such as financing eco-efficiency or eco-innovation investments.

Considerations for applying this for a large-scale approach in Scotland

A contentious form of funding for industry, however tax credits may be best placed to fill the short-term funding gap for nature restoration and incentivise businesses to target more environmentally friendly practices. For this funding to be mainstreamed, it would need to be national policy and public consultations to be considered, however a similar approach to the Aggregates Levy could be taken. Requirements would need to be set as to what qualifies as preserving or enhancing the environment sufficiently to justify a tax credit. Using complimentary instruments to address market failures and negative externalities would help ensure any market failures are addressed (such as establishing a sufficient carbon credit trading scheme) as a longer-term solution.

Annex 5 - Green Finance Stakeholder Interview Discussion Points

Theme	Questions
Financing	What work are you doing currently on financial methodology and models that could apply to the natural environment?
Financing	What mechanisms currently exist to leverage private investment for nature restoration - there seems to be lots of private funds ready for sustainable investment, and a lot of projects that need funding - what are the blockers to this in terms of frameworks?
Financing	As part of this, where do you see greater potential in public or private funding and what needs to be progressed with each for nature restoration projects?
Financing	How do you look to demonstrate the potential return on investment from nature restoration in the short time period that would be considered for a demonstrator project, when most of restoration projects are long term investments?
Financing	What do you see as the key to making financing available for rewilding projects?
Case studies	Have you got any materials/case studies that can be shared with us that are examples of financing nature restoration?

Theme	Questions
Case studies	Do you have any examples from Scotland or large-scale habitat equivalents?
Case Studies	What is the priority in nature restoration currently? Are you working on any existing restoration projects and if so, how were they financed? Is there any prioritisation as part of the Green Investment Portfolio?
Scottish National Investment Bank	In terms of the new National Investment Bank, what will this look to do for nature restoration in the UK? Would you expect tied deliverables and a strict list of requirements for funding?
Scottish National Investment Bank	Set the scene around what the Scottish National Investment Bank are currently working on, what are their ambitions around the nature restoration and what timescales are you working to?
Scottish National Investment Bank	In terms of the new Scottish Investment Bank, what will this look to do for nature restoration in Scotland? Would you expect tied deliverables and a strict list of requirements for funding?
Regulation	How will the Task force for Nature related Financial Disclosures support companies who are looking to create a positive impact on nature? How will the financial flows trickle down?

Annex 6 - Case Studies Interview format

The case study questionnaires were based on project specific issues and tailored to each case study. The main areas of questions focused on:

- Project aim and timescale
- Site management and climate change
- Socio-economic impacts
- Community impacts
- Tenure and land ownership issues
- Partnership working
- Funding
- Summary questions on advice to similar projects, achieving long term achievements, and government support.

Annex 7 - Review of case studies against Carver et al. principles

Each of the ten detailed case studies was reviewed against the rewilding principles defined by Carver et al. The scoring is not a reflection of the quality of a project, and only provides an assessment of its characteristics against the rewilding principles proposed by Carver et al. There is an inevitable element of subjectivity in scoring the case studies against Carver et al's rewilding principles. This exercise was undertaken by Land Use Consultants towards the end of the project and after the interviews were held, hence interviewees did not have the opportunity to comment on these scorings.

Cairngorms Connect

With respect to the principles that '*rewilding utilises wildlife to restore trophic interactions'* and '*rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems*' this project, at its core, has unique landscapes including mountains, plateaus, moorlands, glens and straths, woodlands and forests, and wildlife which include ecosystems prior to more recent significant anthropogenic land use changes. The current state of the ecosystem includes unbalanced or missing tropic levels. The role of deer in the ecosystem has become unbalanced due to actions such as supplementary winter feeding and a lack of apex predators. The current role of deer control has not fulfilled the role of apex predators.

Deer play a significant role in overgrazing and preventing natural regeneration of native trees and vegetation. This further exacerbates the issues associated with deforestation and expansion of agriculture and grouse moor management. This project does not aim to reintroduce large predators, due to the practical and societal challenges associated with this. It rather focuses on restoration of habitats and natural processes. Specifically, it aims to restore woodlands, peatlands, rivers and wetlands to their natural states. The aims of the project have influenced deer numbers to the degree that neighbouring estates have had to change their sporting activity.

Physical barriers to restoring the damage to the existing ecosystems by managing grazing pressure included the scale of the project and unsuitability of fencing such a large area of land off to restrict deer access and allow for natural woodland restoration. The project is managed by a partnership of four organisations who have agreed on the aim of the project and control the land area, however, there have been issues with getting the local community on board with the project.

In relation to the principle '*rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* Cairngorms Connect is located in an area with numerous designations, including the Abernethy and Invereshie and Inshriach National Nature Reserves (NNR) and Insh Marshes RSPB reserve. Moreover, the project is fully located within the boundaries of the Cairngorms National Park. It is assumed that Cairngorms Connect provides additional connectivity to and supports the surrounding designated areas. Therefore, this project includes both core areas, and provides connectivity to other core areas of habitat.

Concerning the two principles of '*rewilding recognises that ecosystems are dynamic and constantly changing*' and '*rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts*', the key drivers for the project were to address the known threats of fire risk in areas where the habitats have been destroyed. The project also included expanding habitat into areas of higher elevations to ensure survival of new forests under changing climatic conditions. Moreover, it addresses climate mitigation through peatland restoration, which also contributes to flood management as a way of future proofing against future climatic risks.

In relation to the principle '*rewilding requires local engagement and support'* the community were invited to participate in a number of community activities such as open meetings, drop-in sessions, formal consultations, meeting with particular interest groups, and other outdoor activities. The project highlighted the importance of continued engagement with the local community, to raise awareness of the importance of self-sustaining ecosystems and gaining community's acceptance for the project. The project text highlights that there have been issues with community engagement, as the local community has not been fully supportive of the project.

With respect to the principle '*rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge*', it is assumed that existing knowledge from the surrounding designated areas was used to inform the design of the project. Scientific knowledge of the deforested areas and deteriorated peatlands and bogs informed the development of the project. Scientific knowledge and expert knowledge from partner organisations (RSPB, NatureScot, Wildland and Forestry and Land Scotland) was useful to agree on the measures for tackling deer over-population. However, it is unclear what impact community knowledge and Traditional Ecological Knowledge had on the development of the project from a habitat or species perspective.

In relation to the principle '*rewilding is adaptive and dependent on monitoring and feedback*' monitoring is being undertaken to assess deer distribution and their numbers. A range of methods were used from helicopter and on-foot deer counts, through deer dung counts to transects counts. However, there is some uncertainty about the accuracy of the methods used. The project text also highlights that monitoring activities are not carried out regularly, as the latest deer count from a helicopter and on-foot took place 6 years ago and was delivered by RSPB. Another initiative undertaken by Cairngorms Connect was the Predator Project which aimed at obtaining information on predator and prey species, monitoring predator and prey populations, and gaining and understanding of how predators and prey co-exist and how different predator species interact.

Concerning the principle '*rewilding recognises the intrinsic value of all species and ecosystems'* without human intervention, and without large predators, controlling deer numbers would have been impossible. Uncontrolled deer numbers pose significant risks to existing woodlands and forests and disable their natural expansion. The project plays an important role in balancing the needs of the deer, forests and woodlands, and the local population. Due to the fact that this project does not foresee becoming a purely rewilding

scheme, human intervention in controlling deer numbers will be required. The project represents a balance between an ecocentric and anthropocentric focused scheme which recreates habitats and secures protection of threatened habitats.

In relation to the principle '*rewilding requires a paradigm shift in the co-existence of humans and nature'* the case study presents an approach to the threat of climate change and to human-caused changes to the animal food chain to ensuring restoration of natural ecosystems. The project presents a managed approach to climate change risks and an over-population of a large herbivore species that required fundamental change in the land use. The case study highlighted that neighbouring farmers and sporting estates raised concerns that the project can negatively impact on their activity. However, it was important to realise that overpopulation of deer has, among other reasons, led to the loss of forests and peatlands. This accordingly increased the risk of fire in the higher altitudes and the risk of flooding and soil erosion near rivers under the changing climatic conditions. Restoration of the natural habitats could have positive impact on the local community by attracting more tourism to the area and enhancing its business activity. Therefore, the project illustrates how nature focused solutions can also deliver social and economic benefits.

In terms of achieving the rewilding principles set out by Carver et al., the project aims to restore a balanced presence of large herbivores and recover ecological processes by removing non-native conifers, restructuring Scots pine plantations and restoring key peatland habitats. The project is clear that it will not restore apex predators and will rely on human intervention to fulfil this role and supress deer numbers. The restoration is also employed at a landscape-scale enabling greater connectivity of species and habitats. The project aims to address the damage to the ecosystem by ensuring that trees regenerate to higher altitudes in the uplands to ensure their survival in the face of the warming climate. The project engaged with the local community, however it is likely that more engagement will be required in the future to ensure continued support for the project. In order to gain an ongoing support from the local community, there is a need for employment opportunities for the local community. Moreover, additional effort could be put towards including community knowledge and Traditional Ecological Knowledge into the ongoing development of the project to broaden the understanding of the area with knowledge that has been passed on generation by generation. This knowledge could enhance the understanding of species and habitats. Especially in highly degraded ecosystems, more local knowledge can ensure that an appropriate alternative land management approach will be chosen to ensure the most benefits. The project may need to invest more time and finances into regular monitoring of the area to assess its impacts and to identify any arising and unforeseen problems. It is recognised that all species and ecosystems play important roles and this approach needs to be continued. Considering the fact that in the project area and the surroundings, there already were a number of designated sites, work to change a paradigm shift in the co-existence of humans and nature has been already happening. Land has been given to nature and protected for its unique habitats and species and this work has only been continued by the project.

Summary of alignment of the Cairngorms Connect case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	**-**	**-**	**<—>**	**-**	**-**	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	X	-	-	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn't work to a relevant reference ecosystem	-	-	-	X	-	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	-	X	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn't allow for future climate change	-	-	-	-	X	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	-	X	-	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc	-	-	-	X	-	Well informed by science, TEK etc

-	**Weaker alignment with principles**	-	-	**<—> **	-	-	**Stronger alignment with principles**
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	X	-	-	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	X	-	-	-	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	X	-	-	Project supports understanding of the co-existence of humans and nature

Forsinard Flows

With respect to the principles that *'rewilding utilises wildlife to restore trophic interactions' and 'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* the project area was historically a blanket bog habitat. Over the years, the area was planted with non-native conifer plantations and was drained for agricultural activities. Deer were the largest herbivores, and important to the surrounding sporting estates. There are no apex predators influencing deer numbers, which are controlled only by deer management actions.

The project aimed to re-establish and regenerate degraded peat to create suitable habitat for many unique bird species. The project removed non-native conifers and blocked drainage to enable natural regeneration. However, it was not a rewilding project in itself, but rather a managed approach to recreate reference habitat that can attract appropriate species which will fill the tropic levels, and sphagnum moss is a keystone species within a bog habitat. As a wetland project, mobile birds have been colonising the area. The project is surrounded by other designated sites, and it appears that they have supported species colonisation of the newly created habitat.

The ecological barriers to the habitat creation included the threat of non-native conifer woodland regeneration from adjacent plantations that required costly and time intensive removal work. Deer trampling and grazing due to high deer numbers also impacts on the habitat restoration. Physical barriers to restoring the damage to the existing ecosystems

included the council's restrictions on lorry volume allowed on the connecting roads for the operations of the project. This has undermined the possibility of timber sale from the trees that have been felled for the restoration and has led to a loss of a potential income stream for the project.

The project was under single landownership, and therefore this facilitated the execution of the project. At the start, the local community raised concerns over the impact of the project related to the potentially increased recreational traffic and access to the site. The biggest concern related to the project was the construction of a new viewpoint that could attract an increased amount of visitors to the area. However, the area is located within the context of other designated sites, hence there was already some understanding about the importance of nature conservation within the local community.

Concerning the principle '*rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* Forsinard Flow is located in an area with numerous national and international designations, including Forsinard Flows National Nature Reserve (NNR), Caithness and Sutherland Peatland Special Area of Conservation (SAC) and Special Protection Areas (SPA), Ben Griams Site of Special Scientific Interest (SSSI), West Halledale SSSI, Caithness and Sutherland Ramsar site, and River Thurso SAC. Within this context, it is assumed that Forsinard Flows enhances connectivity to and supports the surrounding designated sites, however the extent to which this relationship was important to the project is unclear. Therefore, the project includes both core areas, and provides connectivity to other core areas of habitat.

In relation to the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing' and 'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the key driver for the project was to restore the largest peatlands in Scotland to enable greater carbon sequestration in the face of the climate emergency. Having healthy and self-sustaining ecosystems of peat and bogs allow for climate mitigation and adaptation through water capture within the vegetation that prevents from flooding further downstream. It is unclear how future climate change and threats such as drier summers and risk of wildfire have been reflected in the management of Forsinard Flows. Rewetting will help to reduce the risk of wildfire, however periods of drought may increase wildfire risk and impact on the functioning of the peatland habitat.

The project area is one of the least populated areas in the UK. In relation to the principle *'rewilding requires local engagement and support'* the community were invited to participate in various community events, talks, workshops, and volunteering opportunities. The project highlighted the importance of continued engagement throughout the project, as it was noted that with the end of the project there was less engagement due to the lack of funds, and that could have negative impacts on the legacy of the project. There is limited information on whether the community events mainly focused on raising local people's awareness of peatlands or they enabled them to actively participate in the decision-making and the project design.

In relation to the principle *'rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'*, it is assumed that existing knowledge from the surrounding designated areas was used to inform the design of the project. Scientific knowledge of the damaged and declining peatlands, alongside the soft engineering knowledge of the potential design solutions informed the development of the project in terms of blocking drainage and removing non-native trees. Scientific knowledge was therefore critical to the development of the project. However, it is unclear if community knowledge had a role in informing the development of the project from a habitat or species perspective.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'* the project has organised volunteering weeks during which participants were helping with vegetation monitoring. Other monitoring activities focus on deer indices, birds and the water table. From the case study text, it is unclear how comprehensive and regular the monitoring is, however considering the fact that the project receives its finances from an external funder, it can be assumed that monitoring is required as a part of reporting for the funding organisations.

In relation to the principle *'rewilding recognises the intrinsic value of all species and ecosystems'* without human intervention, the threat of carbon soil loss to productive forests was a key driver for the project. The project site is crucial for carbon sequestration on a national scale as it can significantly reduce or reverse emissions from degraded peatlands. Uncontrolled deer population would have led to a greater loss of remaining peats and blanket bogs. Allowing for more productive forests in the area would also have had negative impacts on peat soils. It is assumed that human control will be required until self-sustaining habitats are fully established. However, in the face of the lack of apex predators, human intervention may be required to continue controlling deer numbers. The project represents a balance between an ecocentric and anthropocentric focused scheme which expanded a habitat and also encouraged more nature-related tourism and economic benefits to the local community.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* the case study represents a solution to the threat of climate change by enabling greater carbon sequestration, enhancing biodiversity and protecting surrounding designated sites. The project therefore illustrates a managed approach to climate change risk which required the fundamental change of the existing land use and the creation of new habitat. The project illustrates how nature focused solutions can also achieve societal benefits, further exemplified by providing employment opportunities for the local population. However due to the sparse population of the project area, issues of human and nature co-existence focus on the different uses of land and the surrounding land, and less on direct conflicts between people and land use.

In terms of achieving rewilding principles set out by Carver et al., the project aimed to restore a peatland habitat by removing non-native conifers and managing deer populations. The restoration was employed at a landscape-scale in relation to surrounding designated sites and enabling greater connectivity of species and habitats.

The most recent anthropogenic land use changes were recognised, and the project aimed to address these by ensuring non-native species are removed to enhance the role of the project area in climate mitigation. The project engaged with the local community, and the case study notes that the trust and relationship between the project team and the community was developed over time, emphasising the need for an ongoing and long-term engagement. Limited information is provided on how community knowledge and Traditional Ecological Knowledge have been included into the ongoing development of the project. Similarly, limited information is also provided on the monitoring activity within the project it is assumed that some monitoring is carried out for the reporting purposes. It is recognised that all species and ecosystems play an important role and this attitude needs to be continued. This project highlights how nature must be given space as a way of shifting a paradigm in the co-existence of humans and nature, however such approach has been already present in people's minds considering the existence of other designated sites in the area. It was also noted that over time local community has supported the project aims, however, taking into account the short-term scales and uncertainty of the funding, it will be important to ensure continuation of the engagement.

Summary of alignment of the Forsinard Flows case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	**-**	**-**	**<—>**	**-**	**-**	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	X	-	-	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn't work to a relevant reference ecosystem	-	-	-	X	-	Works to create a relevant reference ecosystem

-	**Weaker alignment with principles**	-	-	**<—>**	-	-	**Stronger alignment with principles**
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	X	-	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn't allow for future climate change	-	-	-	X	-	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	X	-	-	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	X	-	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	X	-	-	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	X	-	-	-	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	-	X	-	Project supports understanding of the co-existence of humans and nature

Holnicote Estate

With respect to the principles that *'rewilding utilises wildlife to restore trophic interactions'* and *'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* this project area had been experiencing deteriorating ecosystem quality from the impact of water management including drainage and irrigation. One of the key aims of this restoration project was to reduce the risk of flooding in villages downstream from the project area through encouraging functioning water meadows and natural floodplains. It is a multi-objective flood risk management demonstration project rather than a rewilding project aiming to restore trophic interaction and bring keystone species back. However, the project works with nature-based solutions and natural processes using natural flood management techniques. Restoration of this area provides a range of additional benefits such as improved landscape quality, biodiversity, carbon sequestration, improved water quality, amenity, and recreation opportunities.

The project is managed by a partnership of several organisations with agreement on the aims of the projects. The case study text highlighted that even though there were disagreements between the partners, this has often led to discussions that ensured the appropriate approach and methodology were applied. In terms of social barriers to enhancing the ecosystems, at first, there was a level of hesitation especially from tenant farmers towards the project, however these were overcome with time through engagement.

In relation to the principle *'rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* Holnicote Estate is adjacent to the Exmoor National Park and is in an area with existing nature designations, including Exmoor Coastal Heaths SSSI, and in proximity to Exmoor Heaths SAC. It is assumed that Holnicote Estate provides additional connectivity to and supports the surrounding designated areas. Therefore, the project includes both core areas, and provides connectivity to other core areas of habitat.

Concerning the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing'* and *'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the key driver for the project was to address the threats of flooding which can be further exacerbated by the changing climate if actions are not taken to restore ecosystems. This project provides climate mitigation through reducing future flood risks and also by offering additional carbon sequestration.

In relation to the principle *'rewilding requires local engagement and support'* the local community were engaged in the project through local events and one-to-one meetings of which the latter were the most successful as they enabled more personal discussions. This case study text has highlighted the importance of personal relationships with the local community to ensure the buy-in and having a chance to explain and raise awareness of the importance of the project to everyone. One tenant farmer also provided an example of a low input farm, which demonstrates the principles to others.

With respect to the principle '*rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'*, monitoring is a key element of the design of the project. Scientific knowledge of the nature-based solutions and natural flood management informed the development of the project. Scientific knowledge and expert knowledge from partner organisations (National Trust, DEFRA, Environment Agency, Somerset Rivers Authority) was useful to agree on the measures for reducing flooding and blocking drainage. However, it is unclear of the impact community knowledge and Traditional Ecological Knowledge had on the development of the project from a habitat or species perspective. In the case study text, it is highlighted that one of the key lessons learnt is the importance of early engagement with local community to gather local knowledge, what could indicate that there were some challenges with accessing these during the projects delivered so far.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'* monitoring of the project has been undertaken through hydrological monitoring programme across the study area. A hydrological monitoring network was installed to provide high quality, high resolution rainfall, stage, and flow data for assessing the exact impacts of the natural flood management measures across the project.

Concerning the principle *'rewilding recognises the intrinsic value of all species and ecosystems'* and the stage of the degraded ecosystem, human intervention was required to change the management practices to reduce flood risk. Lack of natural flood management and interventions would have led to increasing risks of flooding in villages downstream. The project plays a crucially important role in balancing the needs of the local population and the ecosystems by enabling farmers and landowners to refocus their land activity on nature regeneration while providing them with finances that compensate for the lost income from agricultural activities.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* the case study presents a managed approach to reducing flood risks and enhancing ecosystems while keeping farmers engaged in land management. This project required a shift in the approach to agricultural land use after decades of exploitation of the land for commercial purposes. The case study text indicated that there was a degree of scepticism from the local farmers towards the project, however it has been overcome through open engagement. The project is not a purely rewilding scheme, but a multi-objective flood risk management project that requires human intervention. Restoration of the natural processes will not only have positive effects on communities at risk of flooding, but also on landowners for whom the project may deliver multiple ecosystem services. Accordingly, the area which is already a tourist destination, may attract more tourism and benefit the local economy. This project illustrates how nature focused solutions can also deliver social and economic benefits.

In terms of achieving the rewilding principles set out by Carver et al., the project aims to restore catchment ecosystem and reduce the risk of flooding by implementing interventions on hillslopes and floodplains. This project relies on human intervention as the driver of the increased flood risk was anthropogenic land use change. The restoration

is employed at a landscape scale enabling greater connectivity of species and habitats. The project aims to address the damage to the ecosystem by implementing nature-based solutions to flood management. The project engaged with the local community, which has influenced the project design. From the case study text, it is uncertain however, how the community knowledge has informed the project in terms of habitats and species. The project highlights that there is a need for continued engagement with the community to ensure that everyone is on board with the project and also to resolve any issues that may arise. As the project is partially funded by the agri-environmental schemes it important to provide the farmers with necessary information about the funding availability to ensure that they are financially capable to carry out necessary activities of the land they manage. Monitoring activities are carried out regularly to assess the impact of the project and to inform the funders about the progress. It is recognised that all species in the ecosystem play an important role and this approach needs to be continued. Considering the fact that in the project area and the surroundings, there already were a number of designated sites, work to change a paradigm shift in the co-existence of humans and nature has been already happening. Land has been given to nature and protected for its unique habitats and species and this work has been further encouraged by the project.

Summary of alignment of the Holnicote Estate case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	-	-	**<—>**	-	-	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	-	X	-	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn’t work to a relevant reference ecosystem	-	-	X	-	-	Works to create a relevant reference ecosystem

-	**Weaker alignment with principles**	**-**	**-**	**<—>**	**-**	**-**	**Stronger alignment with principles**
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	-	X	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn't allow for future climate change	-	-	-	-	X	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	-	X	-	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	X	-	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	-	X	-	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	X	-	-	-	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	X	-	-	Project supports understanding of the co-existence of humans and nature

The Northern Upland Chain Local Nature Partnership

With respect to the principles that *'rewilding utilises wildlife to restore trophic interactions'* and *'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* this project aims to enable restoration of habitats and species across the partnership area which includes numerous unique landscapes. The project does not aim at any specific restoration, neither aims to reintroduce apex predators, but rather at improving the ecosystems through a range of smaller projects undertaken across the area. Due to demographic change, development pressures and climate change, the range of ecosystems within the project area have been declining. The project encompasses over 50 partners; therefore, management of its actions is challenging. One of the key barriers to achieving of the aims is lack of funding for the partnership.

In relation to the principle *'rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* the Northern Upland Chain encompasses a landscape scale as it covers approximately 180,000 ha of land. The project is within or adjacent to numerous designated sites, including Northumberland National Park, North Pennies AONB, Yorkshire Dales National Park, Nidderdale AONB, Forest of Bowland AONB and a number of National Nature Reserves such as Kielderhead and Whitelee Moor, Kielder Forest and Water and the 'Tyne gap'. It is assumed that the Northern Upland Chain provides additional connectivity to and supports the surrounding designated areas. Therefore, this project includes both core areas, and provides connectivity to other core habitats.

Concerning the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing'* and *'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the project recognises that the areas from across the partnership are at risk of fires and increased flooding. Restoring of these varied ecosystems has the potential to alleviate the potential impacts. The project has the potential to significantly increase vegetation which will also enable greater carbon sequestration and water storage.

In relation to the principle *'rewilding requires local engagement and support'* the community including land managers, NGOs, specialists and public sector have been engaged with the project in proposing, developing and implementing projects on the ground. One of the objectives of the project is to promote the benefits that the project provides for society, and promote public understanding and enjoyment of the area. These aims support local engagement. However, the case study text provides limited information on how this has been achieved through the individual projects.

With respect to the principle *'rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'*, it is assumed that existing knowledge from surrounding designated sites was used to inform the design of the different projects. Considering the nature of the partnership and the aim to bring all stakeholders during the proposal and development of a project, it is assumed that community knowledge and Traditional Ecological Knowledge inform the project design.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'* the case study text does not refer to monitoring activities being undertaken in the area. However, considering that most of the individual project are financially supported by different funding organisations, it is assumed that funders require a level of monitoring during the timeframes of the project.

Concerning the principle *'rewilding recognises the intrinsic value of all species and ecosystems'* and the nature of the partnership, it is impossible to determine how much of human involvement can be removed, as it will differ on the case by case basis. It can be assumed that within projects which purely focus on rewilding this intervention will significantly decrease over time. Whereas in more agricultural areas human intervention will be part of the activity.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* the project provides an opportunity to engage with local communities and enable them to witness the positive changes nature restoration may deliver. As a partnership project, it contributes to incremental restoration of nature, rather than a more dramatic paradigm shift.

In terms of achieving the rewilding principles set out by Carver et al., the project aimed to encourage nature restoration across a large area by enabling smaller scale projects delivered by local stakeholders. The project is not a rewilding scheme, and it does not aim to reintroduce apex predators or other keystone species in itself. However, it may support smaller schemes that focus on such aims. The project is employed at a landscape scale and it encompasses a wide area in northern England. The project actively engaged local community and enabled the local community to inform projects' designs. The case study text does not note any information on monitoring activities, however it is assumed that monitoring is carried out for the individual projects. In terms of changing people's perceptions on degraded nature and ecosystems, it will be important to use existing projects to showcase nature restoration measures to other landowners.

Summary of alignment of the Northern Upland Chain Local Nature Partnership case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	-	-	**<— >**	-	-	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	X	-	-	-	-	Fully functioning tropic interactions

-	**Weaker alignment with principles**	-	-	**<—>**	-	-	**Stronger alignment with principles**
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn't work to a relevant reference ecosystem	-	-	X	-	-	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	X	-	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn't allow for future climate change	-	-	-	X	-	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	-	X	-	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	X	-	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	X	-	-	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	X	-	-	-	Self-sustaining ecosystem

-	Weaker alignment with principles	-	-	<— >	-	-	Stronger alignment with principles
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	X	-	-	Project supports understanding of the co-existence of humans and nature

Pumlumon Project

With respect to the principles that *'rewilding utilises wildlife to restore trophic interactions'* and *'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* the project is located within the Pumlumon area which is the largest watershed in Wales. The land is characterised by agriculturally improved grassland, broadleaved woodlands and forestry plantations. Woodland cover is currently low and native woodlands are very limited. Due to intensive land use activities, many habitats have been lost or are declining. Historical over-grazing and land use change (ploughing and drainage) have resulted in soil compaction, which increases diffuse pollution and flooding. The project aims to restore a number of ecosystem benefits such as locking carbon in upland peat soils, increasing carbon sequestration, reducing flood risk, improving water quality through erosion control, and enhancing the ecosystem function and biodiversity. The project was not a purely 'rewilding' scheme, and it neither aimed to restore trophic interactions nor bring keystone species back. As in other places in the UK, deer also increased the challenge of nature restoration through wild grazing that slows regeneration process, as there were no apex predators in the area.

Ecological barriers to the project included the resistance from the Pumlumon SSSI project regulator as it was believed that the Pumlumon Project may have some potential impacts on the SSSI. Official assessment was undertaken to resolve this barrier. Social barriers to restoring the damage to the existing ecosystems by managing peatland restoration and water storage capacity included a lack of buy-in into the project by the local community of farmers and stakeholders, which was overcome with time.

In relation to the principle *'rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* the Pumlumon Project area encompasses locally, nationally, and internationally important habitats and associated species. At the core of the area, there is the Pumlumon SSSI which was in unfavourable and declining condition. Within the project area there also is Coedydd Llawr-y-glyn SAC and SSSI, Pencreigiau'r Llan SSSI, Ceunant Twymyn SSSI, and River Wye (upper Wye) SSSI. It is assumed that Pumlumon Project provides additional connectivity to and supports

surrounding designated areas, although this is not explicitly stated. Therefore, this project includes both core areas and provides connectivity to other core areas of habitat. The project is working at a landscape scale, and the most recent funding focuses on demonstrating the social and economic benefits of restoring nature.

Concerning the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing'* and *'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the key drivers for the project were to address the known threats of flood risk in downstream towns and villages. The project also focused on climate mitigation through enhancing peatland soils to ensure carbon sequestration, and support flood management to provide benefits in relation to the future climate risks.

In relation to the two principles *'rewilding requires local engagement and support'* and *'rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'* the community were invited to participate in the project. There has been a collaborative learning group set up to share ideas between public and private sector stakeholders. Moreover, there has been a community group set up within the project area to enhance landowners' engagement and knowledge sharing. In terms of scientific knowledge. Although not explicitly stated, it is assumed that existing knowledge from surrounding designated sites was used to inform the design of the project. Scientific knowledge of deteriorated peatlands informed the development of the project. Expert soft engineering knowledge of flood mitigation and blocking ditches was useful to select methods that would be the most suitable for the context of this project. Although a community group was set up to inform the project, it is unclear what impact community knowledge and Traditional Ecological Knowledge has had on the development of the project from habitat and species perspectives.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'* the Pumlumon Project carried out scientifically validated habitat and hydrological monitoring to ensure any changes in the delivery of ecosystem services. Provision of information from monitoring has been essential to the project, especially when working with policy makers and the private sector to influence future funding schemes.

Concerning the principle *'rewilding recognises the intrinsic value of all species and ecosystems'* the project focused on enhancing ecosystem function and biodiversity through more appropriate management. Human intervention was required for the restoration of the degraded peatlands and reductions in flood risk, and this project played an important role in balancing the economic needs of the local population and the requirements of healthy ecosystems. The degradation of the land within the project area was mainly caused by the centuries of human intervention such as agricultural activity. The project is about maintaining a working landscape and illustrates striking a balance between ecocentric and anthropocentric scheme that focuses on the recreation of habitat and ensures economic activity for the local population.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* the case study presents an approach to the threat of changing climate and to anthropogenic land use change through regeneration of the ecosystem in a way that will enable a level of economic activity for the local community. This project explores the potential of Payments for Ecosystem Services (PES) that would allow local farmers and landowners to refocus their land activity from purely agricultural to restorative while ensuring their income is maintained. Financially enabling local farmers to focus on nature restoration has positive effects on reducing flood risk, protecting peatlands and enhancing carbon sequestration that can benefit the wider society.

In terms of achieving the rewilding principles set out by Carver et al., the project aims to restore carbon rich peatland soils to ensure that carbon stored remains in the ground, enhance water storage and reduce flood risk. The project does not aim to restore trophic interactions or bring apex predators back to the area. The restoration is delivered on a landscape scale to enable greater connectivity for habitats and species. The project focuses on the delivery of climate mitigation and also adaptation activities to future proof the area for the changing climatic conditions. The project is a good example of successful engagement with the local community, farmers and landowners, through the creation of a community group that informed the project design. The case study text provided limited information on the details of community knowledge used in the project design. Due to the challenges with the funding schemes, it can be suggested that ongoing engagement with the local community will be required to ensure their continuous support. Monitoring of the area is carried out regularly to assess the progress of the regeneration and also to feed information back to policy-makers and funding providers. Some of the land within the project area has already been given to nature and is protected for its unique habitats and species and this work has been expanded by this project. This project has also enabled this shift in the co-existence of humans and nature by including the farmers and local landowners and providing them with finances to deliver this work.

Summary of alignment of the Pumlumon Project case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	**-**	**-**	**<— >**	**-**	**-**	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	X	-	-	-	-	Fully functioning tropic interactions

-	**Weaker alignment with principles**	**-**	**-**	**<—>**	**-**	**-**	**Stronger alignment with principles**
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn't work to a relevant reference ecosystem	-	-	X	-	-	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	X	-	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn't allow for future climate change	-	-	-	-	X	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	-	X	-	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	X	-	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	-	X	-	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	X	-	-	-	Self-sustaining ecosystem

-	Weaker alignment with principles	-	-	<— >	-	-	Stronger alignment with principles
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	X	-	-	Project supports understanding of the co-existence of humans and nature

South West Norway

With respect to the principles that *'rewilding utilises wildlife to restore trophic interactions'* and *'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* this project includes woodland regeneration which creates habitats that support native species. This project did not aim at restoring trophic interaction neither bringing any keystone species back. However, due to the fact that apex predators have existed in the surrounding areas before, restoration of woodlands have encouraged them to extend their habitat, though their numbers were insufficient to effectively control deer numbers. Therefore, deer culling is an important part of this project.

Norway has a specific legislative context in regard to land ownership and occupation responsibilities, and deer quotas. In terms of land ownership, landowners need to occupy their property full time which prevents landowners owning large pieces of land and living elsewhere. In terms of deer quotas, landowners receive a quota for deer culling per year which they can either use themselves or sell it in a form of sport hunting opportunities to other enthusiasts.

In relation to the principle *'rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* South west Norway is not a formal initiative implemented within specific boundaries; however it is at a large landscape scale.

Concerning the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing'* and *'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the convergence of a number of factors allowed the recovery of damaged ecosystems previously adversely impacted by human actions. Natural woodland regeneration offers climate mitigation as it enables greater carbon sequestration. Moreover, having more forests along rivers reduces the potential risks of flooding.

In relation to the principle *'rewilding requires local engagement and support'* and considering that it is not a formal project, the case study text does not include information on community engagement. However, there are strong rural communities with devolved powers, and the rewilding is a product of community and individual agency.

With respect to the principle *'rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'*, it is assumed that existing knowledge from the surrounding designated areas was used to inform the design of the initiative. It is unclear what impact community knowledge and Traditional Ecological Knowledge had on the initiative. It is known that a significant proportion of the local population have emigrated to the U.S. in the end of the XIX century. It could suggest that some of the local knowledge of the land has been lost.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'*, Norwegian Institute for Nature Research (NINA) carries out regular monitoring activities, as the initiative has become an exemplar for other countries.

Concerning the principle *'rewilding recognises the intrinsic value of all species and ecosystems'* human intervention has been limited to deer numbers control through releasing quotas on how many deer should be culled within an area by a landowner per year. Besides this, the woodland is left to naturally regenerate, apart from areas which are designated as productive forests. There are timber plantations in the area which are managed by farmer cooperatives, however strategically important areas are left to nature. This project is not a rewilding scheme, however as a result of removing human intervention and activity it has led to a degree of rewilding. This project represents how local population can co-exist with nature, and simultaneously yield economic benefits from nature without over-exploiting it.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* it was recognised that if the land use does not fundamentally change within the area it will lead to increasing biodiversity deterioration and may exacerbate climate change impacts. The case study provides little information on the interaction of people with nature beyond the high level of owner occupation, however it indicated that historically this relationship has been exploitive. It can be assumed that this paradigm has shifted towards a more sustainable and balanced approach to nature, based on the results on the ground.

In terms of achieving the rewilding principles set out by Carver et al., this case study is an example of an approach to large scale nature restoration that does not involve establishing an official initiative to achieve nature restoration results. However, in support of the initiative there were two key policy areas that made the success possible, including owner occupation legislation and quotas on deer culling. The woodland restoration was enabled at a landscape scale as there were no formal boundaries of the project. The reference ecosystem was the woodland that has hugely disappeared from the area due to human activity. The project addresses climate mitigation by offering greater carbon sequestration, reducing flood risks and offering increased water storage. It can be

assumed that the community was encouraged to partake in this initiative through the implementation of the policies regarding land ownership and deer hunting. Since it is not a formally established initiative, it is unclear whether scientific and community knowledge and Traditional Ecological Knowledge have informed the design, or were potentially used on ongoing basis. In terms of climate mitigation, this project offers enhanced carbon sequestration and biodiversity, and reduced flood risks enabling future proofing from the potential climate risks. Monitoring is carried out regularly and comprehensively by NINA and results directly inform the project and also provide evidence and knowledge for other similar initiatives across the world. Currently, the only human control includes deer number management and management of productive forests in certain areas across the project area. These two interventions are likely to remain as they provide opportunities for economic activity for the local population. Woodlands have already largely regenerated within the area and this provides the proof for the local community that if the ecosystems are enabled to be healthy, there is also more scope for economic activity to support their livelihoods.

Summary of alignment of the South West Norway case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	-	-	**<—>**	-	-	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	-	-	X	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	X	-	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn’t work to a relevant reference ecosystem	-	-	-	X	-	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	-	X	-	Project is adaptive and fluid

-	Weaker alignment with principles	-	-	<— >	-	-	Stronger alignment with principles
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn't allow for future climate change	-	-	-	-	X	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	-	-	X	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	X	-	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	-	-	X	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	-	X	-	-	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	-	X	-	Project supports understanding of the co-existence of humans and nature

Tweed Catchment

With respect to the principles *that 'rewilding utilises wildlife to restore trophic interactions'* and *'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* the project area covers the catchment of the River Tweed. The river is one of the least polluted in the UK and it is home to a variety of important species such as otters and many breeding and overwintering birds. Due to drainage, habitat loss, agricultural intensification, development and invasive species the

area has been declining in condition. The project aimed to protect, enhance and restore the natural, built and cultural heritage of the River Tweed. The project did not aim, however, to restore trophic interactions and reintroduce any keystone species.

The ecological barriers to the habitat creation included the presence of non-native invasive species, which pose a threat to naturally occurring plants and animals, such as giant hogweed, Japanese knotweed, Himalayan balsam, American skunk cabbage, monkey flower, rhododendron species, Australian swamp stonecrop, curly waterweed, Canadian pondweed, Nuttall's pondweed, bullhead, American signal crayfish and American mink. Physical barriers to restoring the ecosystems of the catchment included canalised sections of rivers and streams and drained wetlands. Tweed Forum is an umbrella organisation delivering projects within Tweed catchment. There were multiple stakeholders and landowners involved in the project which posed challenges in securing engagement and building consensus and support at first. However, because Tweed Forum is a non-governmental organisation that employs local people, trust has been developed relatively quickly.

In relation to the principle *'rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* the Tweed Forum works at a catchment scale that covers areas within administrative borders of Northumberland (England) and the Scottish Borders (Scotland). The Tweed catchment is adjacent and partially within several designations, including the River Tweed SSSI, the River Tweed SAC, and Cheviot Fringe NCA. It is assumed that Tweed catchment provides additional connectivity to and supports the surrounding designated areas. Therefore, this project includes both core areas, and provides connectivity to other core areas of habitat.

Concerning the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing'* and *'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the key driver for the project was to address the known threats of fluvial flooding within the catchment. Tweed Forum takes a long-term perspective on addressing the issues to future-proof the area, buildings, premises and agricultural land that could be lost to flooding considering the potential of increased flood risk exacerbated by the changing climate. Climate adaptation and mitigating flood risk are at the core of the project's activities and aims.

In relation to the principle *'rewilding requires local engagement and support'* the local community and stakeholders were actively involved in the development of the project. Tweed Forum, having a long-term plans linked with the catchment area, managed to build strong relationships with the local community. The case study text notes that engaging local farmers has been challenging and it took time for the stakeholders to recognise the importance of this project, especially for the older generation. However, the project employed local people from the area who are familiar with the 'language' used by the landowners enabling stronger relationships and engagement.

With respect to the principle *'rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'*, it is assumed that existing knowledge from the surrounding designated areas was used to inform the design of the project. Scientific knowledge of the deforested areas drained wetlands and canalised rivers informed the development of the project. Scientific knowledge and expert knowledge from partner organisations were also useful. Local knowledge has served the project team in gaining a better understanding of natural assets and the social context that are crucial for the success of the project.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'* the Tweed Forum carries out a range of monitoring activities depending on the specific project's needs. Some of the key methods used include hydromagnetic network, groundwater monitoring, water quality measurements and ecological and geomorphological surveys.

Concerning the principle *'rewilding recognises the intrinsic value of all species and ecosystems'* the project focuses on restoring river ecosystem through managing of the catchment. Without human intervention protection of the catchment would have been impossible. Forest harvesting and degraded wetlands along the river exacerbate the risks of flooding. Moreover, lack or limited vegetation increases the risk of water shortages in the summer months. Due to the fact, that this project does not foresee becoming a purely rewilding scheme, continued human intervention in the catchment will be required. The project represents a balance between an ecocentric and anthropocentric focused scheme which recreates habitats and secures protection of threatened habitats.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* this case study presents an approach to tacking human centred land use in the face of the changing climate which poses an increased risk from flooding especially during winter months and water shortages in the summer months. The project acknowledges the historical human-centred approach to land use and aims to shift this view to highlight the importance of biodiversity, carbon sequestration and restored habitats. Restored habitats and ecosystems not only deliver environmental but also societal benefits, as the area has the potential to attract more tourism and increase the resilience of the place.

In terms of achieving rewilding principles set out by Carver et al., the project aimed to restore river catchment through engagement with stakeholders and local landowners. The project is undertaken at a landscape-scale enabling greater connectivity of species and habitats. The project actively engaged with the local community, and the knowledge of the local stakeholders has been fed into the design of the project. This case study is an exemplar of how community engagement can be successfully executed in a project of a similar scale where the land is owned by multiple landowners with often contrasting interests. Monitoring is an integral part of the project to assess the impacts and observe potential unforeseen issues. The project recognises the roles of all species in the ecosystem; however, it does not aim to bring any keystone species back and restore trophic interactions. There is a recognition of the importance of a paradigm shift in the co-

existence of humans and nature, and this project showcases an approach of doing so. The local community realised the degradation of the land, and the risks it poses to their lives and have taken action to address it.

Summary of alignment of the Tweed Catchment case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	**-**	**-**	**<—>**	**-**	**-**	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	X	-	-	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	-	X	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn’t work to a relevant reference ecosystem	-	-	-	X	-	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	-	X	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn’t allow for future climate change	-	-	-	-	X	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	-	-	X	Community fully engaged

-	Weaker alignment with principles	-	-	<— >	-	-	Stronger alignment with principles
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	-	X	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	-	X	-	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	X	-	-	-	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	X	-	-	Project supports understanding of the co-existence of humans and nature

Wild Ennerdale

With respect to the principles that *'rewilding utilises wildlife to restore trophic interactions'* and *'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* the area offers a biologically diverse suite of upland habitat with internationally important fell habitats, rivers, lakes, unimproved grassland and native woodland. Due to the historical and more recent changes in land uses of the area, flooding has begun posing significant risks. The quality of the ecosystems had been declining mainly due to intensifying agriculture, hill farming and wild grazing. If the climate impacts were not addressed, flooding might have posed even more significant negative impacts on the biodiversity, ecosystems, local community, agriculture and businesses.

The project aims to be low intervention and to allow for restoration of natural processes. The area lacks apex predators and deer are the largest herbivores that slow the nature regeneration process down through grazing. The case study text does not refer to rewilding in the description of the project, however the project focuses on restoring

habitats that will then encourage species to establish. The project does not set specific targets, neither does it set any deadlines in order to allow for nature to take its course. At first, this approach of unspecified and undefined objectives led to some confusion among the local community, farmers and stakeholders.

Physical barriers to restoring the damage to the existing ecosystem included the lack of a stone wall on a high ridge that would allow sheep to come into Wild Ennerdale area and graze. The wall was accordingly built to prevent the movement and enable restoration of natural processes. The project was under the management of four organisations that have created a liaison group. Farmers from the area were tenants of the organisations and were directly encouraged to undertake activities that align with the management plan. At the start, there was a level of hesitation from the local community and farmers mainly due to the uncertainty of what the project is trying to do, although this has been overcome with time.

Concerning the principle *'rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* this project covers a somewhat smaller area of 4,400 ha, however, it is partially situated within the Lake District National Park. Wild Ennerdale is located in an area with national biodiversity designations, including Bowness Knott SSSI, Ennerdale SSSI, Pillar and Ennerdale Fells SSSI, and Lake District High Fells SAC. It is assumed that Wild Ennerdale provides further connectivity to and supports the surrounding designated sites. Therefore, the project includes both core areas, and provides connectivity to other core areas of habitats.

In relation to the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing'* and *'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the key driver for the project was bringing natural processes back to the valley to regenerate ecosystems and enhance biodiversity. By doing so, there is the potential for climate mitigation through reducing the flood risks and enhancing carbon sequestration. The flexibility inherent in the project structure allows future change to be accommodated.

In relation to the principle *'rewilding requires local engagement and support'* the community was initially sceptical towards the project, however with time and effort put in by the management team to ensure that the message and project aims are clearly outlined the project has gained more support and acceptance amongst the local population.

With respect to the principle *'rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'*, it is assumed that existing knowledge from the surrounding designated areas was used to inform the design of the project. Scientific knowledge of the damaged ecosystems alongside of the hill farming informed the development of the project in terms of removing sheep from areas designated for restoration and planting trees. Scientific knowledge was therefore critical to the development of the project. It is unclear what role community knowledge had in informing the development of the project from a habitat or species perspective.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'* one of the aims of the project included a focus on monitoring at a landscape scale. The project sees monitoring as important because it can help informing the partners about levels of unacceptable change and sharing the results of allowing natural processes to develop. Monitoring is carried out comprehensively and regularly, it assesses the drystone walls, vegetation change and bird species distribution and impact. Some other methods applied use fixed photo points across the valley, forest and woodland development monitoring survey, comparison of dead wood composition and side wood survey.

In relation to the principle *'rewilding recognises the intrinsic value of all species and ecosystems'*, the project involved very limited human intervention with an aim that this intervention can be reduced even further. However, issues such as Sitka spruce natural regeneration needed to be managed to avoid having forests dominated by this species. Moreover, deer management requires human intervention in light of the lack of apex predators. This project represents a balance between ecocentric and anthropocentric focused scheme that enable natural processes to regenerate and allow for a level of for-profit agricultural activity in the surrounding area.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* the case study represents an approach to reduce flood risk and increase carbon sequestration of the area, enhancing biodiversity and protecting surrounding designated sites. The project required a fundamental shift in the land management which could have had less chances of being implemented under a more fragmented land ownership structure. Another reason for the success of the project, is the fact that the partnership organisations did not seek to create any direct income streams from this land, an approach which could have been unviable for private landowners or tenant farmers. The project illustrates how nature focused solutions can also achieve social benefits, by enhancing the environment, encouraging more tourism, and offering employment opportunities.

In terms of achieving rewilding principles set out by Carver et al., the project aimed to restore natural process in Wild Ennerdale by removing sheep from the land and reducing flood risk through planting more trees and enabling natural regeneration of forests. The restoration was implemented at a landscape scale, and even though the project was limited to about 4,400 ha, it took advantage of surrounding designated sites to enable greater connectivity of species and habitats. The most recent anthropogenic land use changes were recognised, and the project aimed to address these by enhancing the role of the project area in climate mitigation. The project engaged with the local community, however, gaining local community's support and acceptance took time. Limited information is provided on how community knowledge and Traditional Ecological Knowledge have been included into the ongoing development of the project. The project has a good record of monitoring activities which are carried out regularly and comprehensively to inform decision-making of the liaison group. It is recognised that all species and ecosystems play important roles and this attitude needs to be continued.

This project illustrates how nature must be given space as a way of shifting a paradigm in the co-existence of humans and nature, as the land was no longer in productive use but left to regenerate.

Summary of alignment of the Wild Ennerdale case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	**-**	**-**	**<—>**	**-**	**-**	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	X	-	-	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn’t work to a relevant reference ecosystem	-	-	-	X	-	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	-	X	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn’t allow for future climate change	-	-	-	-	X	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	-	X	-	Community fully engaged

-	Weaker alignment with principles	-	-	<— >	-	-	Stronger alignment with principles
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	X	-	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	-	X	-	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	X	-	-	-	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	X	-	-	Project supports understanding of the co-existence of humans and nature

Wallasea

In relation to the principles that '*rewilding utilises wildlife to restore trophic interactions'* and '*rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems*' the basis of this project is coastal wetland and intertidal areas, which is the ecological reference point prior to the historic creation of the sea wall and land drainage works. The project replaces an existing farmland habitat with intertidal habitats through significant engineering works and uses managed realignment to create areas of reference habitat whilst ensuring protection of parts of the island with new sea wall. It also focuses on creation of the appropriate habitat in order to attract the appropriate species to fill the tropic levels. As a coastal project, mobile bird and fish species are able to colonise the area once the appropriate habitat has been created. The project does not specifically identify keystone species. From the case study text, it appears that appropriate habitat in the surrounding high quality designated areas supported species colonisation of the newly created habitat.

The ecological barriers to the habitat creation included managing the existing protected species on site during the construction works, due to the significant change in habitat being brought about by the project. Physical barriers to restoring the damage to the existing ecosystem included the significant and complex engineering works required for the landraising. The project was under single landownership, and therefore this facilitated the execution of the project. There were some community concerns over the impact of the project related to recreational traffic and access to the site, but these were overcome.

In relation to the principle '*rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* Wallasea Island is located in an area with numerous designations, including the Essex Estuaries SAC and the Crouch and Roach estuaries SPA, Ramsar sites, and parts of the project site overlap with these designations. Many of these coastal sites are facing pressure from rising sea level, which will impact on these important intertidal zones. The project was developed against this backdrop of regional coastal change and Wallasea Island provides further connectivity to and supports the surrounding designated areas. Therefore, this project includes both core areas, and provides connectivity to other core areas of habitat.

In relation to the two principles of '*rewilding recognises that ecosystems are dynamic and constantly changing*' and '*rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts*', the key driver for the project was to address the known threats of sea level rise and coastal erosion. Part of the project included the design of one of the cells to provide flood storage across the estuary system. However, the degree of future proofing against future sea level rise and changes in coastal erosion within the project design is unclear from the project information. It is assumed that the degree of land raising required was based on the best available data on future sea level rise.

The island has a small number of properties at the western end of the island, and stakeholders included local residents on the island, local fishermen, local farmers, and local recreational interests, including sailing. In relation to the principle '*rewilding requires local engagement and support'* the community were engaged through a local liaison group, established by the project team as part of the planning requirements. The project highlighted the importance of continued engagement throughout the project, as some issues related to impacts on the oyster fishermen were only identified later in the project process. There is limited information on the extent of the community and stakeholders engaged through the local liaison group, and the overall success of these.

In relation to the principle '*rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge*', it is assumed that existing knowledge from the surrounding designated areas was used to inform the design of the project. Scientific knowledge of the deteriorating sea wall and the potential impacts of this on the island, alongside the engineering knowledge of the potential design solutions informed the development of the project. Scientific knowledge was therefore critical to the development of the project. It is unclear of the role of community knowledge in informing the development of the project from a habitat or species perspective.

In relation to the principle '*rewilding is adaptive and dependent on monitoring and feedback*', the adaptive approach to the project is within the context of the recognition that the lagoons that have been created will have a limited lifespan due to sea level rise, and a greater quantity of fill material was hoped for than was received. Monitoring is being undertaken to assess patterns of accretion, erosion and habitat development over time. The standard monitoring of bird species by the RSPB on the reserve ensures that this data is collected. Post implementation monitoring of the mitigation habitat success was also undertaken. Monitoring requirements as set out in the Environmental Statement covered three main aspects: (1) impact verification monitoring (pre and post breaching); (2) sediment settling and ecological functioning monitoring (ongoing and post-breach), and (3) mitigation habitat success monitoring (post implementation). This case study highlights the role of the planning system and EIA in ensuring monitoring.

In relation to the principle '*rewilding recognises the intrinsic value of all species and ecosystems'* without human intervention, the threat of significant sea wall breach, with far reaching impacts on the use of the island was a key driver for the project. An uncontrolled sea wall breach would have led to the greater loss of land to flooding and creation of alternative habitat to that brought about through the designed project. The scheme plays a role in maintaining flood protection for the western end of the island, and there are three regulated tidal exchange structures which will require ongoing maintenance. Due to the engineered design of the project, it is assumed that human control through the maintenance of these structures will be required. The project represents a balance between an ecocentric and anthropocentric focused scheme which created new habitat and also secured protection of part of the island.

In relation to the principle '*rewilding requires a paradigm shift in the co-existence of humans and nature'* the case study represents a solution to the threat of climate change potentially causing uncontrolled change to this area of land through the potential breach of the sea wall. The project therefore illustrates a managed approach to climate change risk which required the fundamental change of the existing land use and the creation of new habitat. The case study noted that the project raised concerns amongst other farmers in the vicinity that it would set a precedent for the loss of agricultural land to intertidal habitat. As former agricultural land, historically created by a sea wall, this suggests there was perception that the status quo habitat should be maintained. The project ensured the protection of part of the island by the creation of a new sea wall. Therefore, the project illustrates how nature focused solutions can also achieve anthropogenic benefits, further exemplified by the use of Crossrail spoil in the land raising.

In terms of achieving rewilding principles set out by Carver et al., the project aimed to create new wetland and intertidal areas, whilst strengthening protection to other inhabited parts of the island. The project therefore represents a balance between ecocentric and anthropocentric objectives. The restoration was a major engineering project, involving large quantities of fill material. It supports surrounding designated sites, which are under threat from sea level rise. The project engaged with the local community, and a number

of challenges from different interest groups were addressed through the project. Technical knowledge was a key part of the design and implementation of the project, and involved detailed modelling and monitoring. The project illustrates how achieving ecological benefits can also deliver socio-economic benefits, however the design of the project is reliant on continued human intervention due to the engineered component of the work.

Summary of alignment of the Wallasea Island case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	-	-	<— >	-	-	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	-	X	-	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn't work to a relevant reference ecosystem	-	-	-	-	X	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	-	-	X	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn't allow for future climate change	-	-	-	-	X	The project allows for future climate change

-	**Weaker alignment with principles**	**- - <— > - -**	**Stronger alignment with principles**
6. Rewilding requires local engagement and support.	Community not engaged	- - X - -	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	- - - X -	Well informed by science, TEK etc.
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	- - - X -	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	- X - - -	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	- - X - -	Project supports understanding of the co-existence of humans and nature

Wild Ken Hill

With respect to the principles that *'rewilding utilises wildlife to restore trophic interactions'* and *'rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems'* this project area has been a site of international significance for arable plants and bats, and use of insecticide was stopped many years ago. This project combines aspects of rewilding, regenerative agriculture and traditional conservation and it aims to change land use to show how farmland can deliver multiple benefits by providing space for nature and people, manage air and water quality and help tackle climate change. The project aims to deliver resilient and recovered soils, increased growth of natural vegetation, increased biodiversity and lead to a return of

nature and wildlife. This project has reintroduced beavers into the area to reduce flood risks and restore wetlands. Rewilding is applied to less productive land to enhance biodiversity, create habitats, encourage species and increase carbon sequestration.

In relation to the principle *'rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence'* Wild Ken Hill is located in an area with numerous designations, including the Wash SPA, SAC and Ramsar which is adjacent to the western boundary of the estate, and Snettisham Carstone Quarry and Heacham Brick Pit SSSIs. It is assumed that Wild Ken Hill provides additional connectivity to and supports the surrounding designated sites. Therefore, this project includes both core areas, and provides connectivity to other core areas.

Concerning the two principles of *'rewilding recognises that ecosystems are dynamic and constantly changing'* and *'rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts'*, the key drivers for the project were to address known threats of the flood risk and declining biodiversity in areas where the habitats have been destroyed or significantly changed. The project took a three-fold approach to nature restoration taking into consideration the land quality and its potential to deliver other benefits and services. Moreover, it addressed climate mitigation by enhancing vegetation that not only reduces flooding but also enhances carbon sequestration as a way to future proofing against the future climatic risks. The restoration of nature across large parts of the estate appears to have contributed to climate resilience of the remaining agricultural areas from impacts such as drought.

In relation to the principle *'rewilding requires local engagement and support'* the case study text provides limited information on community engagement. It is noted that the project offers volunteering opportunities and educational visits to the estate for schools. The project has originally faced some opposition from the local community mainly because of the removal of a footpath, however this was resolved by the provision of an alternative path. With time the project has gained more local support as the local community has witnessed the improving biodiversity in the area. Moreover, the project has increased tourism to the area with positive impacts on the local economy and population.

With respect to the principle *'rewilding is informed by science, Traditional Ecological Knowledge and other local knowledge'*, it is assumed that existing knowledge from the surrounding designated areas was used to inform the design of the project. Scientific knowledge of the natural flood management and wetland restoration informed the development of the project. It is unclear what impact community knowledge and Traditional Ecological Knowledge had on the development of the project from a habitat or species perspective.

In relation to the principle *'rewilding is adaptive and dependent on monitoring and feedback'* it is highlighted in the case study text that the project outsources monitoring to experts, which is used to inform the project and it also carries out less formal monitoring activities with the volunteers.

Concerning the principle *'rewilding recognises the intrinsic value of all species and ecosystems'* the project recognises this principle by reintroducing beavers into the area. Moreover, some of the land is given to nature with very limited human intervention. Nevertheless, without human intervention, flood management and wetland restoration would not have occurred recognising the state of the ecosystems. However, with time human intervention will decrease in 'rewilding' and 'traditional conservation' zones of the project. This project plays a crucial role in balancing the needs of nature, local community and the landowner as it presents a managed approach to keep all of the aspects in balance.

In relation to the principle *'rewilding requires a paradigm shift in the co-existence of humans and nature'* the project presents a managed approach to climate risks, biodiversity loss and restorative agriculture which required fundamental change in land use. The project is located within an area with other designated sites, and the project site has been recognised for its uniqueness pre-project establishment. Therefore, there was a high level of understanding of the need for this project within the area and by the landowner. The project is an exemplar of how agricultural food production can be continued while enhancing biodiversity and ecosystems. Therefore, this project illustrates how nature focused solutions can also deliver social and economic benefits.

In terms of achieving the rewilding principles set out by Carver et al., the project aims to restore river and wetland ecosystems through rewilding and implementing regenerative agriculture practices. The project has reintroduced some of the keystone species (e.g. beavers), it is unclear from the case study text whether it also wants to reintroduce apex predators to re-establish trophic interactions. The restoration is employed at a landscape scale enabling greater connectivity of species and habitats. The project aims to address the damage to the ecosystem by ensuring that rivers are naturally managed, and wetlands are restored. The project engaged with the local community, especially with local schools, however it is likely that more engagement will be required in the future to ensure continued support for the project. It is unclear how much of community knowledge and Traditional Ecological Knowledge has been fed into the ongoing development of the project to broaden the understanding of the area. The project outsources monitoring of the progress to other expert organisations and it only carries out limited volunteer-based observations. It is recognised that all species and ecosystems play important roles and this approach needs to be continued. Considering that within the surroundings of the project, there are several designated sites, this project represents a paradigm shift from traditional land management to land management alongside nature conservation. Land has been given to nature and protected for its unique habitats and species and this work has only been continued by the project.

Summary of alignment of the Wild Ken Hill case study with the Carver et al. rewilding principles

-	**Weaker alignment with principles**	**-**	**-**	**<—>**	**-**	**-**	**Stronger alignment with principles**
Principle	-	1	2	3	4	5	-
1. Rewilding utilizes wildlife to restore trophic interactions.	Missing tropic interactions	-	X	-	-	-	Fully functioning tropic interactions
2. Rewilding employs landscape-scale planning that considers core areas, connectivity and co-existence.	Isolated project	-	-	-	X	-	Project is integrated with other areas
3. Rewilding focuses on the recovery of ecological processes, interactions and conditions based on reference ecosystems.	Doesn’t work to a relevant reference ecosystem	-	-	X	-	-	Works to create a relevant reference ecosystem
4. Rewilding recognizes that ecosystems are dynamic and constantly changing.	Project is rigid and not future proofed	-	-	-	X	-	Project is adaptive and fluid
5. Rewilding should anticipate the effects of climate change and where possible act as a tool to mitigate impacts.	The project doesn’t allow for future climate change	-	-	-	-	X	The project allows for future climate change
6. Rewilding requires local engagement and support.	Community not engaged	-	-	X	-	-	Community fully engaged
7. Rewilding is informed by science, Traditional Ecological Knowledge (TEK) and other local knowledge.	Not informed by science, TEK etc.	-	-	-	X	-	Well informed by science, TEK etc.

-	**Weaker alignment with principles**	**-**	**-**	**<— >**	**-**	**-**	**Stronger alignment with principles**
8. Rewilding is adaptive and dependent on monitoring and feedback.	No or limited monitoring or feedback	-	-	-	-	X	Comprehensive monitoring and feedback
9. Rewilding recognises the intrinsic value of all species and ecosystems.	Significant intervention required to maintain created ecosystem	-	-	X	-	-	Self-sustaining ecosystem
10. Rewilding requires a paradigm shift in the co-existence of humans and nature.	Project does not support understanding of the co-existence of humans and nature	-	-	-	X	-	Project supports understanding of the co-existence of humans and nature