The potential for nature-based solutions in Scottish agriculture

November 2023

Ellie Brodie
Independent Consultant
M: 07817 269473 **E**: ellie@brodieconsultancy.co.uk **W**: www.brodieconsultancy.co.uk

Foreword

Farming holds a vital place in Scotland's culture, history and economy. It has shaped its landscapes and identity, rural economies, culinary traditions and iconic food and drink – from Scottish beef to single malt whisky. Yet farmers, crofters and land managers are at the forefront of threats on multiple fronts, from climate change and the loss of biodiversity to global political and economic volatility. These intersecting crises have wide-ranging impacts for them, from failed crops and stressed livestock to prohibitive fertiliser costs. These threats look set to remain and worsen without urgent and decisive action.

The choices and actions of those managing Scotland's land can unlock solutions for the climate and nature crises at the same time as producing high-quality food. But a paradigm shift is needed – a shift away from business-as-usual food production, and a shift away from thinking that only those living in rural areas care about farming[1].

Governments are taking some positive steps – with the global biodiversity pledge and commitments to carbon net zero being two. But more needs to be done, at pace and at scale. The Scottish Government needs to urgently match actions with rhetoric on net zero and nature restoration. In a climate of scarce financial resources, inflation, the threat of recession and over a decade of austerity, they need solutions, and affordable ones at that. New approaches to integrating and delivering policy on land are desperately needed. This report speaks to that need.

Taking a nature-based approach is, we argue here, an essential weapon in responding to the warming planet and freefall in biodiversity. Nature-based solutions within fields, between farms and across whole landscapes, can help us – giving a win for farming businesses by buffering them against the volatility of changing global markets and the changing climate, whilst also helping tackle nature loss and climate warming, often at a fraction of the cost of human-made 'solutions' involving machinery, concrete and chemicals.

The Scottish Government has set out a Vision for Agriculture, which aims to see Scotland leading the way in regenerative and sustainable food production. I support this vision.

Esmeé Fairbairn's funding of regenerative and nature-positive farming initiatives, combined with the Scottish Wildlife Trust's leadership on nature-based solutions helped to create this report. I hope the findings and recommendations it contains will be useful for everyone who wants to see a viable future for Scotland's farmers, crofters and land managers, that compliments a thriving and resilient natural world.

Signed

Jo Pike

Chief Executive

Scottish Wildlife Trust

Contents

Glossary

AECS – Agri-Environment and Climate Scheme

ARP – Agriculture Reform Programme

CAP – Common Agricultural Policy

CCC – Climate Change Committee

CO2 – Carbon dioxide

CO2e – Carbon dioxide equivalent

EFA – Ecological Focus Area

EU – European Union

FAS – Farm Advisory Service

FIRNS – Facility for Investment Ready Nature in Scotland

GhG – Greenhouse Gas

GhGs – Greenhouse Gases

ICVCM – Integrity Council for the Voluntary Carbon Market

IRNS – Investment Ready Nature in Scotland

IUCN – International Union for Conservation of Nature

NbS – Nature-based Solution

NGO – Non-governmental Organisation

RLUF – Regional Land Use Framework

RLUP – Regional Land Use Partnership

SAC – Scottish Agriculture College

SRUC – Scotland's Rural College

SEPA – Scottish Environment Protection Agency

TNFD – Taskforce on Nature-related Financial Disclosures

VCMI – Voluntary Carbon Markets Integrity Initiative

Executive Summary

The Scottish Wildlife Trust is committed to advancing the uptake of nature-based solutions (NbS) across Scotland. This report lays out the findings from discussions with farmers, land managers and crofters, farm advisors, policymakers, environment and farming sector representatives, academics and funders and investors in NbS. It highlights the key challenges hindering the widespread uptake of NbS, and the key policy enablers that could help unlock these.

It is directed at policy leaders and designers across Scottish Government and its relevant statutory agencies, particularly those working across the Agricultural Reform Programme (ARP) and beyond to all policy areas that intersect with how Scotland's land could be managed to better benefit the climate, nature and all people.

Understanding Nature-based Solutions in Agriculture

- We are in a climate and nature emergency. Scotland has lost nearly half of its terrestrial biodiversity, ranking in the bottom quartile of countries globally[2], and large reductions in GhG emissions are needed across all sectors of the Scottish economy to meet Scotland's legally binding net zero targets.
- Farmers, crofters and land managers are in the frontline of climate change and nature loss, experiencing some of the most challenging conditions they have ever faced, whilst some farming practices can exacerbate the climate and nature crises.
- Through deploying NbS, farmers, crofters and land managers can leverage the natural environment to increase their farm business resilience and enhance its productivity, whilst also mitigating climate change and helping nature to recover.
- NbS aim to maximise the ability of nature to provide ecosystem services that help address a human challenge, from climate change adaptation and mitigation to nature's recovery and food security. There is huge potential for NbS across Scotland's uplands and lowland farming systems, from peatlands and woodlands to grasslands and arable land. Understanding how the uptake of NbS can be enabled is vital for the success of wider government policy.
- Nature Networks help address the nature and climate crises by connecting fragmented habitats. NbS in agriculture lend themselves to connectivity, through whole farm approaches that consider what happens within and around fields, in continuous and connecting habitats between farms, and at landscape level through connecting healthy river systems and peatland across whole catchments.

Drivers for NbS on Scotland's farmland

- There are multiple policy drivers to better integrate NbS on Scotland's farmland. National strategies, targets and plans include the Scottish Government's National Outcomes, enshrined in the National Performance Framework, and the Vision for Agriculture. The Scottish Biodiversity Strategy and Climate Change Plan and the Just Transition are important policy drivers for NbS.
- The main driver of decision-making for farmers and land managers was the Common Agricultural Policy (CAP) which is being replaced with the Agricultural Reform Programme (ARP) – the programme for implementing the Scottish Government's Vision for Agriculture and the changes to agriculture policy and replacement for the CAP.
- Current funds for NbS on farmland include the Nature Restoration Fund, Peatland Action Fund and Agri-Environment and Climate Scheme (AECS). These are not resulting in the delivery of the level of NbS required on Scotland's farmland to meet Scottish Government ambitions.

Challenges hindering the uptake of NbS

- Interrelated issues are hindering the development and uptake of NbS including limitations in research and evidence alongside shortcomings in political leadership and contradictions in policy design.
- There is a lack of quality data that provides farmers, crofters and land managers with an understanding of what they are already delivering in terms of NbS and natural capital, and of the impact this is having on their business (for example, improving soil health and carbon sequestration) and of a common, universally agreed metric to measure baselines. This translates into a reluctance to invest in changes to farm businesses.
- The proposed structure and content of the Agricultural Reform Programme is reminiscent of the CAP and the timetable for roll out is lengthy. These two factors weaken the ability of famers, land managers and crofters to adopt NbS and respond to the urgency of the climate and nature crises. The uncertainty of the overall budget and split between the proposed tiers, alongside the leadership vacuum is creating frustration and inertia amongst farmers, crofters and land managers, as well as investors and the environmental and farming sectors.
- Any transition to, or incorporation of, NbS into agriculture brings costs and risks, and a change in practice. These costs and risks combine with issues around evidence, data and metrics, and political inactivity, and contribute to reluctance amongst farmers, crofters and land managers to adopting NbS.

Enabling NbS through policy and investment

- The Scottish Government could further enable the widespread uptake of NbS through improving the design and content of the ARP, better enabling finance and investment in NbS, and creating a holistic policy framework and increasing the role of Regional Land Use Partnerships (RLUPs) within this.
- Five design principles should run throughout the ARP to enable NbS: Start with outcomes; Pay for public benefits; Incentivise NbS in all farming systems; Work at the right scale in the right place; and Support advice, facilitation and peer-to-peer learning.
- It is very difficult to precisely estimate the finance gap for nature in Scotland for the next decade, but it has been estimated by the Green Finance Institute to be in the order of £15 - £27 billion[3], in addition to public funding. This is one estimate – the extent of the funding gap is still being debated.
- The Scottish Government has committed to ensuring private markets for NbS are values-led and high-integrity but needs to go further to create governing standards and integrity for responsible investment, drawing on global initiatives and frameworks.
- Attracting revenue and investment in other ecosystems services besides carbon is an important next step for increasing investment in NbS, for example, in newer markets such as biodiversity net gain.
- NbS projects, especially those which span multiple farmers, landowners and crofters, require considerable development work to get off the ground. There is a strong case for funders and governments to work with investors with a longer-term time horizon and provide upfront investment, and for clarity on additionality and how different payment structures and sources will work together. Two Scottish Government-supported grant schemes, the Facility for Investment Ready Nature in Scotland (FIRNS) and Investment Ready Nature in Scotland (IRNS), are helping with upfront NbS development costs and with the pipeline of projects.

Recommendations

Ambitions for net zero, nature's recovery, a just transition, green economy and a progressive vision for regenerative agriculture are hard-wired into Scottish Government policy, yet current policy commitments are not being delivered at the necessary scale or pace. We make 17 recommendations to policy makers and politicians to overcome the barriers to NbS and better support their uptake.

1. Make a commitment on the face of the Agriculture Bill to the Vision for Agriculture: that the Bill is to enable the transformation of support for farming and food production in Scotland so that it can become a global leader in sustainable and regenerative agriculture.

2. Create outcomes and metrics for the ARP aligned with Scotland's National Outcomes and Performance Framework. This will require quantifying the contribution of the ARP towards net zero and nature recovery targets and allocating the necessary budget for the ARP. Tiered budgets should then be weighted and apportioned according to their contribution towards the delivery of national outcomes and targets.

3. Public benefits from nature-based solutions (NbS) should be incentivised through Tiers 1 to 3 of the ARP whilst business benefits should be incentivised through other transitional, time-limited mechanisms such as capital investment, skills development or business support, including via Tier 4. Baseline requirements should be increased and weightings within Tier 1 should be prioritised to deliver environmental outcomes. NbS must be incentivised across all farming scales, systems and within all Tiers.

4. Set long-term timeframes and budgets for the ARP and contracts within the proposed Tiers so that the sector can safely pivot towards delivering NbS. The risk in changing farming business models to increasing the uptake of NbS cannot be borne solely, or even primarily, by the sector.

5. Commit to resolving inconsistencies in policy and to enhancing existing mechanisms. This includes: Elevating the status and power of the Land Use Strategy; Following the recommendations of the Scottish Land Commission by enhancing the power and geographic coverage of Regional Land Use Partnerships and by integrating Nature Networks within them; Strong enforcement of existing regulation, for example on deer management; and Strengthening and implementing forthcoming Muirburn legislation.

6. Improve the quality of and access to habitat data, location data and farm-level environmental baselining data. The initiatives currently underway, such as Tier 1 baselining metric tools and NatureScot's landscape scale data modelling, should be given more impetus (e.g. through the ARP's National Test Programme).

7. Prioritise and integrate NbS into research institutes and government programmes such as the Monitor Farm Scotland Programme and the Strategic Research Programme 2022 – 2027 to provide stronger evidence on how NbS can improve agricultural practices to develop a resilient, productive sector that is abreast of transformative opportunities.

8. Learn from elsewhere. Defra in England, for example, has carried out considerable research on their post-CAP scheme and Environmental Land Management, including on incentivising uptake, blending and stacking public and private finance, and paying for outcomes.

9. Prioritise knowledge sharing and peer-to-peer learning within the ARP's National Test Programme (e.g., through Monitor Farms) and as an integral part of the ARP roll out. Farmers, crofters and land

managers need to know how NbS can support their businesses; not just how NbS can deliver government targets on climate and nature.

10. Increase the number of skilled advisors by clear signalling to the advisory sector about the direction of travel in agriculture policy regarding a pivot towards NbS. This includes the Farm Advisory Service (FAS) through the content of Scottish Government advisory contracts, and to institutions offering agricultural and land-based training (e.g., SRUC) that climate and nature must be integrated within 'standard' agriculture courses with NbS as a golden thread.

11. Communicate what is expected from the sector, and by when, within the terms of the ARP. It is currently unclear and that is creating inertia and entrenchment.

12. Gear Scottish Government communication to the sector about NbS towards the business benefits they bring, such as providing resilience to economic and climatic volatility, supporting food production and increasing profit. Rhetoric in sector media of NbS being an add-on rather than core to the farm business needs to be challenged with compelling stories of those using NbS in their farm business being made available to media outlets such as Scottish Farmer and Landward.

13. Include more people with farming, crofting and land management experience in the ARP policy design and testing process.

14. Follow the recommendations of the Scottish Land Commission to quickly put in place stronger regulation of emerging carbon markets. Whilst the Scottish Government's Interim Principles on Responsible Investment in Natural Capital are a good start, they need backing up with regulation.

15. Create a mandatory system of certification of carbon credits, drawing on existing recommendations of global initiatives such as the Voluntary Carbon Markets Integrity Initiative (VCMI), Integrity Council for the Voluntary Carbon Market (ICVCM) and Taskforce on Nature-related Financial Disclosures (TNFD).

16. Help to leverage investment in NbS by supporting collaboration across multiple landholdings. This means being clear about who benefits and how, the mechanisms for aiding collaboration across land parcels, and how to blend and stack public and private finance. The Riverwoods initiatives should be looked at for ideas and solutions on this.

17. Continue to and increase support for the development of new markets for ecosystems services besides carbon such as Biodiversity Net Gain. The Facility for Investment Ready Nature in Scotland (FIRNS) and Investment Ready Nature in Scotland (IRNS) are a great start with this.

About this report

The Scottish Wildlife Trust is committed to being solutions-focused and to putting forward practical policy recommendations on enabling nature-based solutions (NbS) on Scotland's farmland. We commissioned Ellie Brodie Consultancy to conduct this research with a view to creating considered, evidenced and practical proposals for enabling NbS on Scotland's farmland.

This research aims to evidence the potential of NbS on Scottish farmland to contribute to the Scottish Government's nature and climate targets alongside agricultural productivity, as well as the potential for NbS to deliver on wider Scottish Government aims. It aims to understand the opportunities and challenges of delivering NbS across Scotland's farmland by exposing synergies and inconsistencies between different stakeholders and developing practical policy recommendations for delivering NbS across more of Scotland's farmland. To meet these aims, the research was guided by six key questions:

1. Why are NbS important when considering the climate and nature emergencies, and future food production?
2. What is the potential of Scotland's farmland to deliver NbS?
3. What current policy drivers could help deliver NbS across Scotland's agricultural land, supporting the delivery of Scottish Government climate and nature targets and agricultural productivity and resilience?
4. What are the challenges, barriers and enabling factors for delivering NbS on Scotland's farmland?
5. How can NbS be delivered in CAP-successor schemes?
6. What other factors and mechanisms, especially private finance, could support NbS?

The research employed qualitative methods to answer these questions, starting with an evidence review on the role of NbS in tackling the climate and nature emergencies, the potential of Scotland's farmland to deliver NbS and the current key policy drivers that could help deliver NbS and Nature Networks. In-depth interviews with 20 stakeholders took place across the following sectors:

- Farmers, land managers and crofters
- Scottish Government policy makers
- NbS funders and investors
- Academic research
- Farming, land and environment sector representatives.

Interviews aimed to gain insight from people who can influence the uptake of NbS on Scotland's farmland through policy change: whether directly through their own farming practices, or indirectly through advising on, influencing, researching or making policy and funding decisions on agriculture support schemes and the private financing of NbS.

A standard interview guide was used with all interviewees to ensure sufficient evidence for comparative analysis, with some tailored questions to draw out people's respective expertise. To maximise the number of interviews we could do, all were conducted online. Thematic analysis was conducted across the literature and interview data, with trends and themes drawn out amongst the different stakeholders, as well as points of difference.

The five farmers, land managers and crofters we interviewed wore several 'hats', whilst several other interviewees have farmed in the past, or are heavily involved with the farming sector through their work in the NFUS and the Farm Advisory Service. Given that 20 interviews were conducted across a range of stakeholder groups, and given the diversity of these sectors, specifically farming, we do not claim to represent any sector, in whole, or in part.

An online discussion with environmental sector representatives and policy makers from the Scottish Government took place to sense check the emerging recommendations from the research.

We are extremely grateful for the insight of all those interviewed for this report, and the attendees at the policy recommendations workshop (see Acknowledgements). The report draws on all their contributions through thematic analysis, highlighting the areas of consensus and tension.

The individual recommendations are however those of the author, and therefore may not always represent the view of every research participant. To maintain their anonymity when their words are used in quotes, we divide stakeholders into five categories: (1) policy maker; (2) sector representative; (3) academic; (4) funder/investor; (5) farmer/crofter/land manager/farming adviser.

This report lays out the findings from these discussions, including the key challenges hindering the widespread uptake of NbS, and the key policy enablers that could help unlock these.

We acknowledge that issues of consumption are not independent from discussions about farming, crofting and land management. The food system is global, and the impacts of climate change are experienced unequally across the globe. The agriculture sector itself is a big emitter of Greenhouse Gases (GhGs). The world population is growing, with global protein demand set to rise by 135% by 2050 according to estimates by the United Nation's Food and Agriculture Organisation.

Yet around a third of all food produced for human consumption is lost or wasted from farm to fork. How food is produced is dependent on government decisions about trade. Tensions over how land should be used – for food production, climate change mitigation, nature conservation, housing, energy production – are all part of a complex system which the Scottish Government needs to chart a course through, managing conflicts and trade-offs along the way.

These wider systemic issues, the complexity of the global food system, the multiple demands and consequent trade-offs that are demanded from our land and the economic constraints the Scottish Government faces are acknowledged. But our focus is on the production end of the telescope; and on one specific question: how can NbS be better enabled in Scottish agriculture?

Whilst the focus of this report is informing and influencing policy, in particular the emergent Agricultural Reform Programme, its relevance and applicability goes well beyond this. We hope that it has useful insights for funders, investors, communicators and farmers, crofters and land managers themselves.

Understanding Nature-based solutions in agriculture

We are in a climate and nature emergency. Scotland has lost nearly half of its terrestrial biodiversity, ranking in the bottom quartile of countries globally[4], and large reductions in GhG emissions are needed from all sectors of the Scottish economy to meet Scotland's legally binding net zero targets.

Farmers, crofters and land managers are in the frontline of climate change and nature loss, experiencing some of the most challenging conditions they have ever faced. Changing temperatures, rainfall patterns and extreme weather events have wide-ranging impacts, from changing the suitability of crops and growing seasons to heat stress on livestock and increased pests and diseases. Both too little and too much water has disastrous effects, damaging crops, eroding soil and harming livestock, whilst the decline of pollinating insects on farmland threatens the viability of many different crops reliant on pollinators[5].

Yet some farming practices can exacerbate the climate and nature crises. Livestock farming, synthetic fertiliser production and the degradation of peatlands and soils release GhGs, contributing to climate change, with agriculture the second largest source of GhG emissions in Scotland[6]. Chemical run-off from fertilisers and pesticides pollute freshwater systems, harming aquatic biodiversity and creating clean-up costs. Habitat loss and fragmentation limits the space for species to feed, breed and shelter – and combined with intensive farming practices, such as the use of agri-chemicals, has created catastrophic losses in farmland birds, insects and small mammals[7].

Through deploying NbS, farmers, crofters and land managers can leverage the natural environment to increase their farm business resilience and enhance its productivity whilst also mitigating climate change and helping nature to recover.

Benefits of NbS in agriculture

'Nature-based solutions' (NbS) is a broad and inclusive term. The goal of all NbS is to maximise the ability of nature to provide ecosystem services that help address a human challenge, for example: Climate change (adaptation and mitigation); Disaster risk reduction; Ecosystem degradation and biodiversity loss; Food security; Water security; Human health, and Social and economic development[8].

NbS address more than one challenge at once, providing multiple benefits. These benefits may be private to an individual or business, e.g., trees providing shelter for livestock; benefits to wider society, e.g., carbon sequestration through peatland restoration; or – like most NbS – provide both private and public benefits, for example. riparian planting protecting against soil erosion, enhancing water quality, sequestering carbon, boosting freshwater biodiversity and providing shelter for livestock. NbS flow from healthy ecosystems and therefore much of the work involved in implementing NbS is about working with nature and natural processes.

In agricultural settings, NbS can help farmers, crofters and land managers to buffer the impacts of a changing climate by enhancing soil health and water retention, reducing soil erosion and providing protection against wildfires, floods and heatwaves. They can help reduce the need for expensive and polluting imported artificial feeds, fertilisers and pesticides and enhance food and nutrition security through diversified production systems and sources of income.

NbS can help reduce carbon emissions through adapting livestock management practices and changing arable practices to help keep carbon in plants and soils. At a global scale, it is estimated that 37% of global emissions could be mitigated by NbS[9]. They can also help restore biodiversity and intact ecosystems by increasing the amount and diversity of habitat and restoring freshwater habitats.

In economic terms, investment into nature restoration adds €8 to €38 in economic value for every €1 spent, thanks to the ecosystem services that support food security, ecosystem and climate resilience

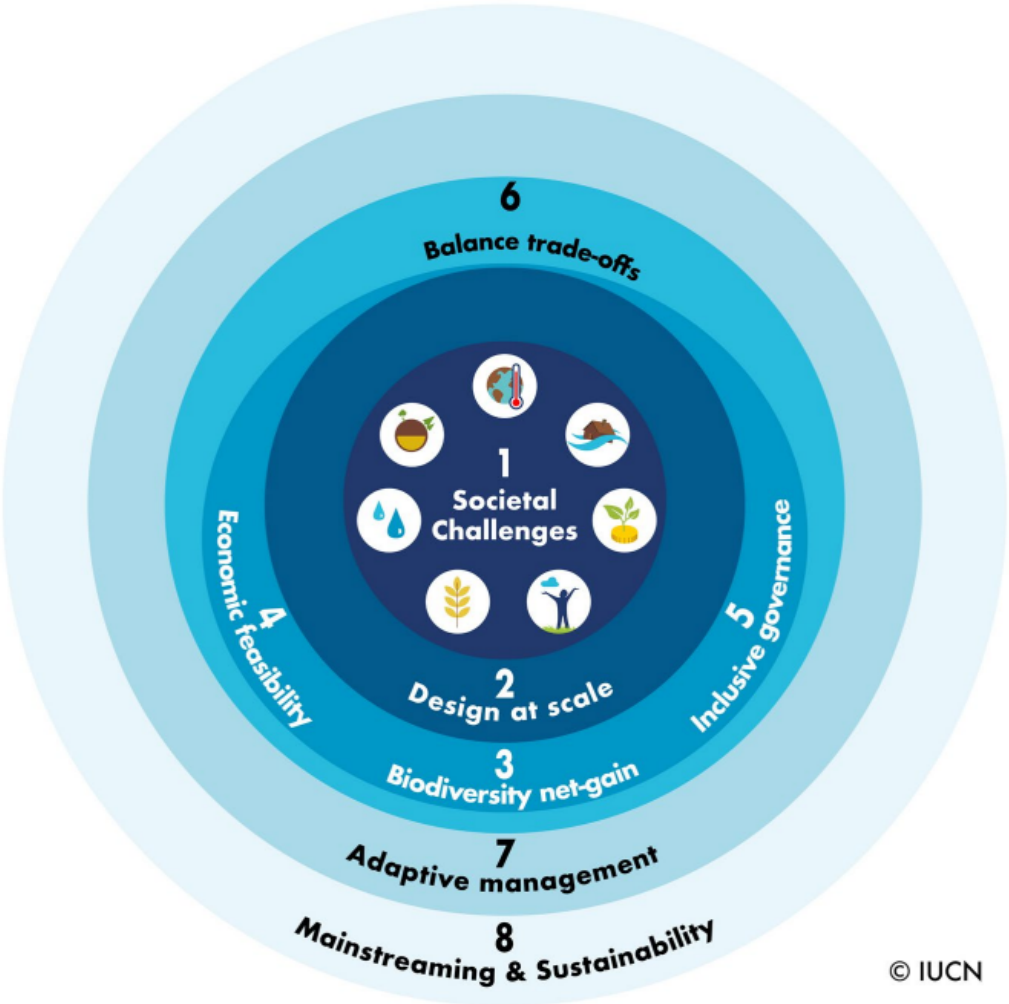
and mitigation, and human health[10]. The Office of National Statistics estimates that even when considering just a limited number of ecosystem services, Scotland's natural capital had an overall asset value in 2016 of £196 billion, and supported nearly 200,000 jobs[11].

One of the most common and widely used of NbS is from the International Union for Conservation of Nature (IUCN): *'Nature-based solutions are defined as actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits'*[12]. The United Nations Environment Programme builds on the IUCN's definition by specifying the ecosystems in question and adding in a critical point about ecosystem resilience. This is the definition we adopt throughout this report, of NbS as:

> *'Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits'*[13].

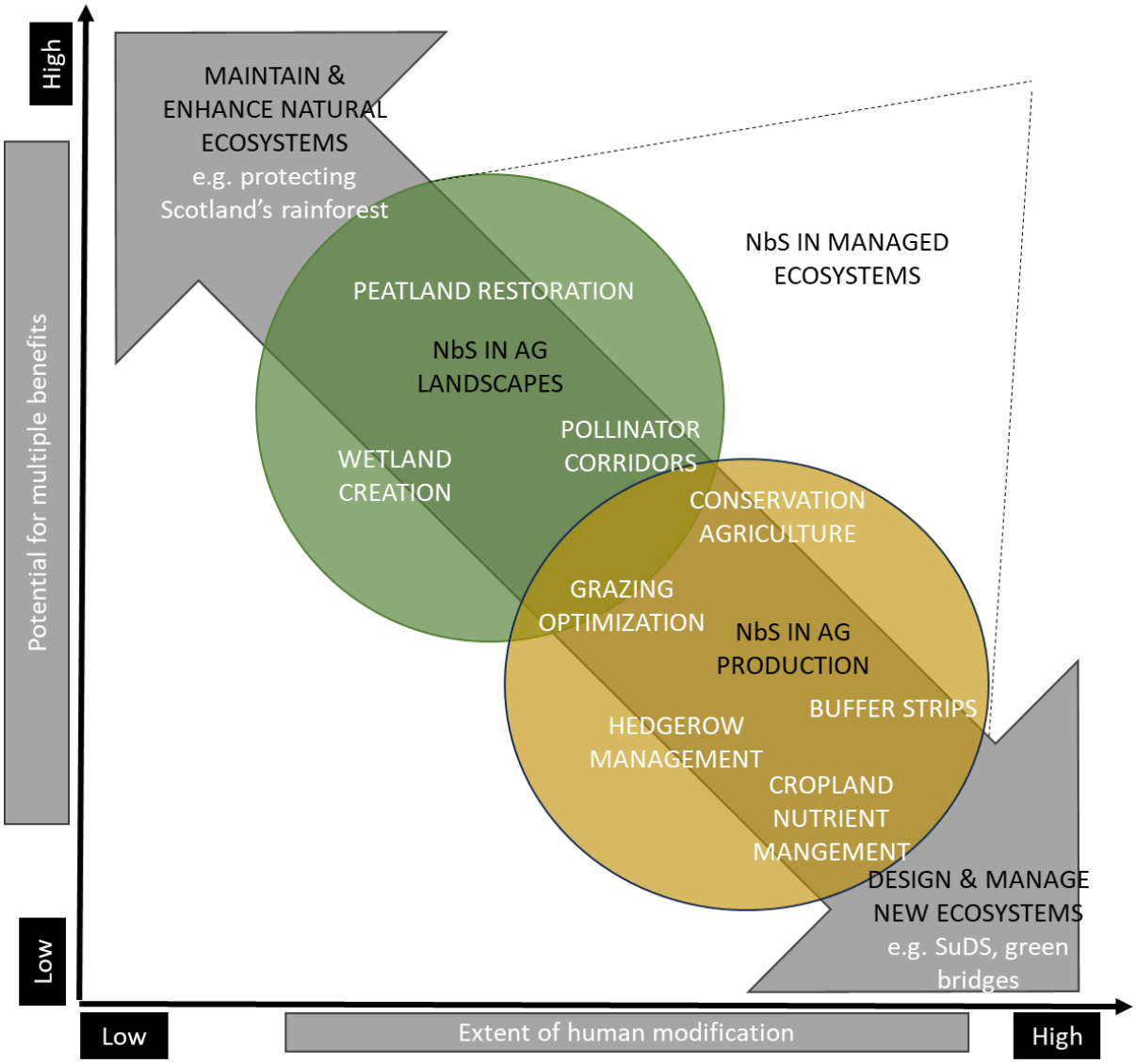
The IUCN Global Standards for Nature-based solutions[14] provide a framework for verifying, designing, and scaling up NbS. The Standards comprises eight interconnected criteria (see Fig. 1) and 28 indicators which help reveal the different rationale, type, scale and scope of NbS and considerations such as economic feasibility and trade-offs.

Figure 1: The eight interconnecting criteria making up the IUCN Global Standards for NbS



Given that agriculture makes up around 80% of Scotland's land area, understanding how the uptake of NbS can be enabled is vital for the success of wider government policy. NbS can be typologised on a spectrum according to the extent of human modification in the ecosystem and the potential of multiple benefits from them. NbS within agricultural landscapes and in agricultural production can be plotted within the 'managed ecosystems' part of the spectrum (see Fig. 2).

Figure 2: NbS in a spectrum of ecosystem conditions[15]



In agricultural contexts, NbS include interventions which take place in different farming systems, on different types of habitats and which vary in scale. They may vary according to their focal purpose, implementing actors, funding and finance, societal challenge addressed, benefits generated, costs incurred and complexity to implement[16].

Potential for NbS on Scotland's farmland

> *'The opportunities for NbS in Scotland are immense – for such a small country there's a fantastic array of different landscapes and farming systems… there is massive potential [for different] types of NbS and scale across different geographies.' (Policy maker)*

Scotland's land cover is dominated by mountains, moorlands and heath, enclosed farmland, woodland and semi-natural grasslands (see Table 1).

Table 1: Extent of habitats in Scotland[17]

Broad habitat type	**hectares**	**% of Scotland's land cover**
Mountains, moorlands and heath	2,058,752	26
Enclosed farmland	1,990,014	25
Woodland	1,409,222	18
Semi-natural grassland	1,259,000	16
Freshwater, wetlands and floodplains	887,640	11
Urban	200,194	3
Coastal margins	185,908	2
Marine	14,434	0
Total	**8,005,164**	**100**

The majority land use in Scotland is agriculture (80%), which can broadly be split into four categories[18]:

- Arable agriculture – land is capable of being used to produce a wide range of crops – 8% of Scotland's total land area.
- Managed grassland – land limited to grass production due to circumstances such as slope – 18% of Scotland's total land area.
- Mixed agriculture – land able to produce a moderate range of crops including cereals (primarily barley), forage crops and grass – 20% of Scotland's total land area.
- Rough grazing – land with very severe limitations that prevents improvement by mechanical means – 51% of Scotland's total land area.

The potential for NbS in agriculture can simply be divided between the **uplands** and the **lowlands** due to the different topography, soils and climate and the different farming systems and land uses found there. The potential for NbS in the marginal farming systems dominating the uplands of Scotland can be considered within the 'agricultural landscapes' zone of the NbS Spectrum (see Fig. 2); whilst the potential for NbS in the more productive lowland farming systems can be considered in the 'agricultural production' zone of the NbS Spectrum.

NbS and marginal agricultural landscapes of the Scottish Uplands

The uplands cover around half of Scotland's land area and comprise land above the limits of enclosed farmland[19] including moorland, rough grassland, blanket bog, woods and species-rich grasslands.

Its main farming systems are extensive sheep and cattle farming. High Nature Value farming covers around 44% of Scotland, mostly in upland areas, and is defined as land with a high proportion of semi-natural vegetation, low-intensity management and which supports populations of rare or threatened species[20].

Patterns and combinations of landownership vary across the uplands and include large estates, tenanted farms and crofting. More than 750,000 hectares of land in Scotland is in crofting tenure, with 33,000 people living in crofting households in the 'crofting counties' of the north and west[21].

Crofting tends to be associated with High Nature Value farming because of the rich mosaic of habitats created by traditional small-scale cropping, hay production and grazing, providing food and habitats for many species, particularly birds and bumblebees[22]. Other major land uses are conifer-based forestry, grouse rearing/shooting and deer stalking, plus renewable energy, nature conservation and amenity.

Upland management practices which drive environmental decline

Upland and peatland habitats have been lost and degraded due to management practices including peatland drainage and cutting, erosion caused by high stocking densities of sheep and heavy impacts of grazing, browsing and trampling by deer. Muirburn, the practice of burning vegetation to promote new growth and more palatable vegetation, is mainly associated with managing land for grouse shooting, deer management and sheep farming. These management practices have a range of impacts on biodiversity, carbon emissions and sequestration, water quality and water management (see Box 1).

Box 1: Examples of detrimental impacts of upland management practices

- At least 25% of wider uplands are in poor condition[23].
- Peatlands store around 3 billion tonnes of carbon in the UK but are emitting an estimated 23m tonnes of carbon dioxide equivalent (CO2e) annually (c. 5% of all UK emissions) as a result of drainage and degradation[24].
- An estimated 80% of Scotland's peatlands are damaged[25].
- Over 50% of wildfires with known causes may themselves be caused by loss of control of prescribed burns[26].
- It estimated the overall, net GhG emissions from UK peatlands could exceed the equivalent of around 20m tonnes of carbon dioxide (CO2) each year[27].
- The amount of dissolved organic carbon, which creates the brown colour of peaty water, is increasing due to damaged peatlands[28].
- In the last 40 years, 12% of ancient woodland, much of which is in upland areas, has been converted to open ground through the grazing activity of deer[29].
- Around a third of ancient woodlands are under threat of eradication due to being subject to heavy grazing so that natural regeneration does not occur[30].
- A range of upland species and habitats are declining, especially waders, hen harriers, mountain willow and juniper. Upland bird populations have declined by 18% since 1994[31].

NbS and productive agriculture of the Scottish Lowlands

The farmland of Scotland's lowlands is made up of four main habitats: Arable and horticultural fields, Field margins and hedgerows, Grasslands (including managed pasture, as well as machair, neutral and species-rich grasslands) and Lowland heath. Woodlands and wetlands are also common lowland farmland habitats. The main farming types are livestock and dairy farming, which use temporary and permanent grasslands, and arable farming.

Lowland farming management practices which drive environmental decline

Management practices in intensive arable systems include dual cropping, frequent ploughing and inputs of fertilisers and pesticides. Intensive livestock and dairy systems require high livestock numbers, grasslands reliant on fertiliser and associated heavy grazing and browsing.

The loss and fragmentation of farmland habitats, including hedgerows, trees, woodlands, orchards, ponds, meadows and floodplains, that has happened because of the intensification associated with these agricultural systems has led to fewer insects, pollinators, small mammals and farmland birds.

Management practices have a range of impacts on biodiversity, GhG emissions, carbon sequestration, water quality and water management (see Box 2).

> *'In the Lowlands you still have mixed farms but in the East of Scotland there has been a lot of specialisation which has driven yields up but has created farming landscapes that are not resilient – high performance systems but with a propensity to see a big impact if weather is bad over a long period of time – flooding, drought, snow. Creating a bit more room for nature in them would create benefits for the farmers and they might not see in a good year the same yield but averaged out I think they'd see their cumulative yield higher as they wouldn't get hit so hard in the bad years.' (Farmer/land manager/crofter/advisor)*

Box 2: Examples of detrimental impacts of lowland farming management practices

- The State of Nature for Scotland report showed that from 1994 to 2016, 49% of Scottish species have decreased[32].
- The drainage of farmland ponds and marshes has increased the rate and extent of wetland loss, reducing water storage capacity and soil compaction and intensifying flood risk[33].
- Soil erosion through cultivation and trampling by animals close to watercourses has added individually small, but cumulatively large, pollution loads to freshwater bodies[34].
- There are substantial long-term decreases in species-rich grasslands, for example, a 39% loss of lowland meadows[35]. Farmland bird populations have substantially decreased: since 1994 declines of more than 50% for greenfinch, kestrel, and lapwing and 25 - 50% declines in oystercatcher and rook since 1994[36].
- A 2019 study showing that moth abundance had fallen by almost 50% over the previous 25 years[37]. Moths pollinate a wider range of plant species than bees, and they are more efficient pollinators[38].
- Nitrogen pollution and nutrient enrichment of water courses and bodies is linked to a reduction in the diversity of aquatic plant and animal life. The Scottish Environment Protection Agency (SEPA) currently classifies only 66% of Scotland's water environment (rivers, lochs, estuaries, groundwater and coastal waters) in good overall condition.
- In the European Union (EU), animal feed accounts for 80% of all nitrogen inputs, largely in the form of N fertiliser[39].

The opportunities for NbS on Scotland's farmland are significant, from landscape-scale peatland restoration and whole-scale system change such as moving to a High Nature Value or organic production through to individual field-level actions. Two key NbS opportunities in the uplands are peatland restoration and woodland creation, and in the lowlands are integrating NbS on grassland and arable farming systems.

Peatland and Woodland: key NbS opportunities in the uplands

> *"There have been lost habitats in the Uplands, but the primary focus is assuring management is appropriate for the type of habitats we have. We still have overgrazed habitats by red deer and sheep and we're seeing some under-grazed habitats – both are detrimental to biodiversity and ecosystem value. . . the big NbS win in the uplands is to target the peatland that is degraded." (Academic)*

Peatlands

The UK's peatlands store over 3 billion tonnes of carbon, around the same amount as all the forests in the UK, France and Germany put together. Around 60% of the UK's peatland is in Scotland[40]. Up to 70% of Scotland's drinking water is sourced from catchments dominated by peatland habitat[41] and peatland is essential in helping slow water flow during storms. Near natural bog areas account for 0.49m hectares

(ha) (6%) of Scottish land. Degraded peat soils also cover a sizeable proportion of Scotland at approximately 1.45m hectares at 50 centimetres depth, roughly 19% of the country's landmass[42].

The big opportunities for peatland restoration are mainly in the uplands, with their associated land uses and farming systems. Examples of NbS include rewetting and restoring peatland by reversing drainage, reducing grazing, reducing burning and slowing the flow of water to ensure the right level of water saturation and growth of peat forming plants. If there are bare peat and gullies, re-vegetation may be required[43].

Woodlands

In 2016, around 12m tonnes of CO2 was removed from the atmosphere by Scotland's forests and woodlands[44] and for each new hectare of forest and woodland created, it is estimated that, on average, seven tonnes of CO2 will be removed from the atmosphere each year[45]. Forests and woodlands support a diverse range of species and are rich in biodiversity; over 1,000 species are associated with Scottish forests[46]. Woodlands can help reduce flood risk and provide shade and cooling for livestock, and new native woodland increases woodland biodiversity and robustness to climate change[47].

There are significant opportunities for woodland creation and regeneration, but choice of site, species and establishment method is key in delivering the full suite of NbS in woodlands, both native and designed/structured commercial forestry. As with peatlands, managing herbivores to ensure sustainable levels of sheep and deer grazing on open moorland and woodland is key.

> *'In the uplands there is still a lot of scope to re-establish trees and woodlands without totally destroying the open habitats that exist from a conservation or aesthetic perspective by protecting and allowing natural regeneration across gullies and gorges without interfering or block planting.' (Academic)*

> *'In the West [of Scotland] we need to challenge the view that 'trees don't grow here': well, they grow to 900 metres in Norway if you give them a break. Deer control is mixed in with this as well.' (Farmer/land manager/crofter/advisor)*

Large-scale afforestation should avoid peatlands and habitats of high conservation value. In the uplands, managing grazing and stocking densities of domestic livestock and grazing by deer and grouse are key to restoring native woodland[48].

> *'The majority of farms across the West Coast are grazed to 1-inch flat pasture – it's a 2D flat field, there's hardly anything in the soil. There's so much more potential to go down by going up [by planting] taller herbs and trees which don't have to be permanent or go very high. There [would be] so much more solar capture and shelter within this which creates microclimates for everything else.' (Farmer/land manager/crofter/advisor)*

Grassland and Arable land: key NbS opportunities in the Lowlands

> *'The lowlands are generally talked about as a loss of habitat and fragmentation of habitat. So here in intensified lowland dairy and arable, NbS are about managing remnant habitats and seeking to put them back at a level of connectivity that has been missing. . . a hedgerow, wetland, species-rich grassland, etc – NbS primarily involves putting things back.' (Academic)*

Grasslands

Neutral (semi-managed) grasslands are richer in species than improved grasslands and contain marginally more soil carbon in the top 15 cm of soil. Maintaining and improving species diversity in neutral grassland is critical for mitigating GhG emissions and increasing wider biodiversity[49]. Restoring permanent grassland via reversion from managed grassland or arable land is a key NbS, and some types

of grassland may be suitable for carefully selected tree planting with native species, for example, for agroforestry or wood pasture.

As well as decreasing animal numbers overall, grazing by a more diverse range of animals including sheep, cattle, horse, goats and alpaca, on the same pastures can also have positive effects on grassland sward diversity and resultant GhG emissions. Shifts in grazing patterns, for example, the adoption of rotational or mixed grazing, can also reduce emissions compared to continuous grazing.[50] Such targeted grazing models can encourage species diversity. Riparian planting, buffer strips and shelter belts are also examples of NbS in grassland livestock systems.

> *'Further up the hill NbS can protect against extreme weather, making sure it doesn't flood or floods as little as possible or it's sheltered or also not over-relying on expensive inorganic inputs, so you can get as much production out of that land as possible. Clover leys or multi species swards or things that can be rich in biodiversity can also make you money and make sheep happy.' (Farmer/land manager/crofter/advisor)*

Arable

Arable land has huge potential for NbS. Hedgerows are some of the most important sites of semi-natural habitat on lowland farms which support a wide range of species and store carbon – stocks of which are 22% higher under hedgerows and 6% higher next to the hedgerow than in fields without hedgerows[51]. Likewise, field margins are 37% higher soil carbon in the upper 30 centimetres soil layer, compared to arable fields without a grass margin[52]. In the lowlands, the opportunities for continuous areas of woodland and agroforestry, such as silvopasture systems that combine tree growing with the production of livestock and silvoarable systems which introduces trees on cropland, can bring biodiversity, climate and economic benefits - and animal welfare in pastural systems [53].

Natural pest management can include yield gains and reduce the need for pesticides, indirectly reducing the GhGs associated with pesticide manufacturing, which are about 9% of the total associated with UK arable crop production[54].

Practices associated with soil and nutrient management, including mixing crops and intercropping, crop rotation and fallowing, cover crops and mulching and reducing tillage, can increase soil organic carbon sequestration, as well as helping maintain soil structure, reducing use and runoff of agrochemicals and the need for pesticides.

Nature Networks and NbS

Lost ecological connectivity is one of the major global threats to biodiversity[55]. A crucial response to this threat is the concept and implementation of Nature Networks. These coherent ecological networks connect areas of good quality habitat so that wildlife can move easily across the landscape, thereby decreasing the risk of extinction, increasing genetic exchange and improving ecosystems' health and resilience to climate change[56]. Nature Networks include core areas of good quality habitat, buffer areas beyond core areas and linking corridors between the core and buffer zones. They are a commitment of the Scottish Government's 2021 Programme for Government and a key component of helping to deliver the Scottish Biodiversity Strategy and its commitment to protect at least 30% of land and sea for nature by 2030. Nature Networks also align with the EU Biodiversity Strategy which proposes to integrate ecological corridors, as part of a Trans-European Nature Network.

Across the varied upland and lowland farming systems, we can see that connectivity is a central theme in the application of NbS which tend to lend themselves to:

- whole farm approaches, considering what happens within and around the field, including field and riparian margins and agroforestry;
- along riverbanks, across and between fields in mosaics of pollinator strips and continuous corridors of hedgerows;

- working at landscape level, for example, riparian creation across river systems, peatland creation across whole catchments.

Achieving connectivity across fields, farms, catchments and landscapes is challenging and needs a supportive framework of policy, regulation, funding and investment to happen. Regional Land Use Partnerships (RLUPs) are an important test for the realisation of Nature Networks and the restoration of ecological connectivity across Scotland.

A central goal of the five RLUPs is to produce a Regional Land Use Framework (RLUF). Driven by the experience of different sectors and using the latest data available, RLUFs are intended to reflect the best possible use of each parcel of land within the region, contributing to tackling the twin climate and environment crises. The RLUF would then be used to guide land use decisions within the region, as well as other regional plans cross-complying with the standards set in the RLUF. Consistent with the principles and objectives in the Land Use Strategy, these RLUFs will help to deliver on national targets by leveraging changes at regional and local scales.

Drivers for NbS on Scotland's farmland

Alongside producing food, Scotland's farmers, crofters and land managers are under ever-increasing pressure to adopt regenerative practices and to work together to adopt NbS at scale. There are multiple policy drivers for this transformation to better integrate NbS on Scotland's farmland – from international agreements on climate change and nature recovery to sector-specific plans.

The Scottish Government was one of the first governments to declare a climate and nature emergency in 2019. It has developed an increasingly busy and complex policy space that reflects this through national strategies, ambitious targets and sector-specific plans. It provides some financial incentives and funding for NbS for individual farmers, crofters and land managers and is developing the financial governance to provide more clarity and confidence for private investors in NbS.

National strategies, targets and plans

Sitting at the highest level, driving Scottish Government policy, are its National Outcomes, Scotland's way to localise the United Nation's Sustainable Development Goals, which are enshrined in the National Performance Framework. These commit Scottish Government to enhancing and protecting Scotland's natural assets and heritage, environmental justice, preserving planetary resources for future generations and to be at the forefront of carbon reduction efforts and biodiversity practice.

The Shared Policy Programme or Bute House Agreement between Scottish Greens and Scottish Government and Programme for Government articulates a Vision for Agriculture that,

> *'Scotland should be a global leader in sustainable and regenerative agriculture. We will ensure the sector makes the emission reductions required to contribute to Scotland's world-leading emissions targets, to support and deliver nature restoration and a just transition to net zero, and to produce high quality food.'*

The Shared Policy Programme also includes commitments to introduce a Land Reform Bill, an Agriculture Bill and a Natural Environment Bill, and introduces plans to pilot five Regional Land Use Partnerships (RLUPs) to adopt a natural capital approach to land use change and take into consideration the delivery of statutory climate and nature targets on a regional basis. Further, it commits to stay aligned with new EU measures and policy developments regarding net zero, the restoration of nature and the sustainable production of high-quality food.

Scotland's National Strategy for Economic Transformation commits to establishing a 'values-led, high-integrity market for responsible private investment in natural capital … supported by a national project pipeline for nature-based solutions.'

The Environment Strategy for Scotland sets the framework for Scotland's strategies and plans on the environment and climate change including six long-term goals and highlights NbS as important in contributing to outcomes of protecting and restoring nature and in tackling the climate emergency.

The Scottish Biodiversity Strategy to 2045 sets the framework which includes the proposed Natural Environment Bill which, in turn, will set targets for the overarching goal of the Strategy, of halting biodiversity loss by 2030, and restoring Scotland's natural environment by 2045.

The Climate Change Plan sets out actions to meet emissions reduction targets to 2032 to meet Scotland's legally binding 2045 Net Zero target, and the 75% target by 2030 and provides a route map for agricultural transformation. It includes measures and indicators for peatland restoration and native woodland and forest creation, as well as support for farmers and land managers:

- increase new woodland creation from the current target level of 12,000 hectares annually in 2020/21 up to 18,000 hectares in 2024/25
- increase the woodland carbon market by at least 50% by 2025
- commitment to invest more than £250m over 10 years to support the restoration of at least 20,000 hectares of Scottish peatland annually, towards a total of 250,000 hectares by 2030.

Just Transition is how to get to a net zero and climate resilient economy in a way that delivers fairness and tackles inequality and injustice. The National Just Transition Planning Framework sets out eight National Just Transition Outcomes, distilled into four themes to support the coherence of sectoral Just Transition Plans – including for Land Use and Agriculture[57]. This will set out how agriculture, land integration and land use change can follow the Just Transition principles.

Scotland's Third Land Use Strategy 2021 – 2026 is a framework strategy, articulating the objectives and the long-term vision for sustainable land use in Scotland, bringing together the key policies for delivery. The National Peatland Plan provides a framework for recognising, communicating and, where appropriate, quantifying the benefits of healthy peatlands; whilst the Forestry Strategy gives a 50-year vision for Scotland's forests and woodlands and sets out a 10-year framework for Government and partnership working on forestry.

Appendix 1 includes more information on these plans and strategies and highlights ways in which NbS are included within them.

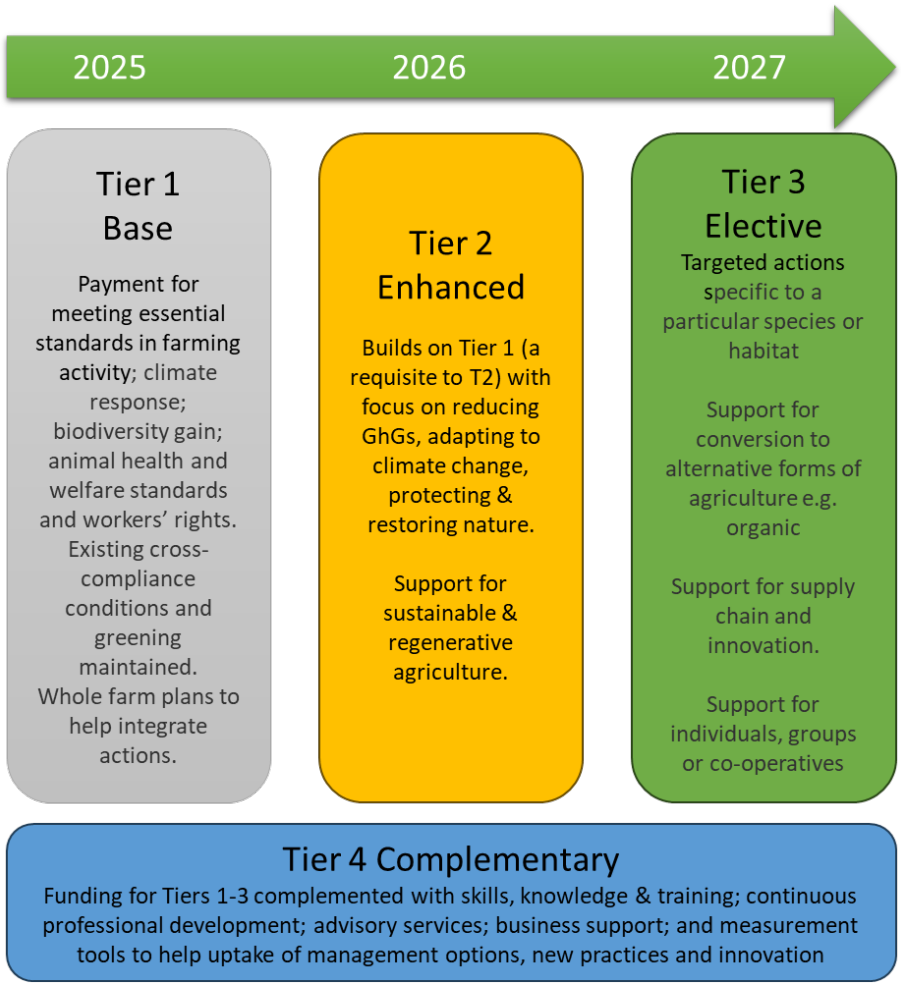
The Agricultural Reform Programme

The Common Agricultural Policy (CAP) has driven decision-making for many Scottish farmers for half a century and has around 18,000 claimants and £500m annual budget. The Scottish Government's Agricultural Reform Programme (ARP) is the programme for implementing the Vision for Agriculture, changes to agriculture policy and replacement for the CAP[58].

The ARP includes the Agriculture Reform Route Map,[59] which sets out the timescales, key dates and support available to farmers, crofters and land managers for implementing change; and the Agricultural Reform list of proposed measures[60]. Key proposals of the ARP are that:

- the existing framework of support (i.e., the CAP) will continue in 2023 and 2024
- future support be structured around four tiers (see Fig. 3)
- from 2025, new conditionality on half of all funding (Tier 1) will be delivered under existing powers
- from 2026, with the approval of Parliament, new powers from the new Agriculture Bill will be used to launch the new Enhanced Payment (Tier 2)
- Tier 3 (Elective) and Tier 4 (Complementary) will be introduced from 2027 including incarnations of Agri-Environment and Climate Scheme (AECS) and the Farm Advisory Service (FAS).
- From 2022 to 2025, the National Test Programme[61] will invest up to £51m to help farmers and crofters transition to more sustainable farming.

Figure 3 - Tiered structure proposed for farm support from 2025



The ARP was viewed by interviewees as a primary driver for farmers, crofters and land managers regarding their uptake of NbS:

> *'[The] Primary one is whatever replaces CAP as this has always directed farming for better or for worse.' (Farmer/crofter/land manager/advisor)*

As well as agricultural support funding, two key Scottish Government funds exist to incentivise NbS:

- Nature Restoration Fund – a £65m competitive fund which encourages applicants with projects that restore wildlife and habitats on land and sea, and address the twin crises of biodiversity loss and climate change. This fund is a key part of the Bute House Agreement and multi-year funding across the 2021-26 parliament[62].
- Peatland ACTION Fund – a £250m multi-annual national programme to restore peatlands across Scotland by 2030, supporting on-the-ground peatland restoration activities and open for applications from eligible land managers who have peatlands that would benefit from restoration[63].

Given the range of policy drivers for NbS, as well as the direct benefits they can bring to farmers, crofters and land managers, we might expect to see NbS being implemented widely across Scotland's farmland. This is unfortunately not the case.

The Scottish Government has a target of restoring 20,000 hectares of peatland a year, yet the latest review indicates that restoration rates are less than half this and significantly off track; and the recommendation of the Climate Change Committee (CCC) is that restoration rates were 45,000 per year by 2022. The CCC recently concluded that the impact of Scotland's lower restoration ambition is

significant, resulting in 1m tonnes of CO2e greater emissions than the CCC's Balanced Pathway in 2030, rising to 3m tonnes of CO2e in 2045[64].

New woodland creation figures are also falling short. In the year to March 2022, for example, just under 10,500 hectares of new woodlands were created in Scotland – a dip on the 10,660 hectares planted in 2020/21 and 3,000 hectares off the annual 2021/22 target of 13,500 hectares. In existing woodland features, ineffective deer management is contributing to recent increases in unfavourable condition status[65].

AECS is cited by NatureScot as 'the most important investment for securing environmental benefits for Scotland's land'[66], yet the amount of funding it receives and the level of uptake of AECS contracts by farmers and land managers do not reflect this. AECS receives just 6-8% of the £500m farming budget and less than a fifth of CAP claimants hold AECS contracts on around 20% of total farmland area[67].

How can we make sense of this? Our research highlighted several challenges that are hindering the uptake of NbS on Scotland's farmland.

Challenges hindering the uptake of NbS

Several interrelated issues are hindering the development and uptake of NbS including limitations in research and evidence alongside shortcomings in political leadership and contradictions in policy design. These challenges exacerbate a resistance to adopting NbS by farmers, crofters and land managers.

Research and evidence

Recent research highlights data as a key issue in financing a transition to regenerative agriculture[68]. Interviewees reflected on a lack of 'robust' evidence and evidence base on the effectiveness of NbS, for example, in terms of natural flood management, the evidence is limited around the extent to which it provides the same results as traditional hard infrastructure:

> *'There's an evidence base that needs to grow still, it's a big deal for a water company to do a constructive wetland rather than just putting chemicals in the water. We're doing a big project on Nature Flood Management – to show that it can add as much as a cement wall.' (Policy maker)*

There is a lack of good quality data that gives farmers, crofters and land managers understanding of what they are already delivering in terms of NbS and natural capital; of the impact this is having on their business through, for example, improving soil health and carbon sequestration; and of common, universally agreed metrics to measure baselines. This translates into a reluctance to invest in changes to farm businesses.

> *'Often there's a lack of evidence about how effective NbS can be… [we need] a level of demonstration, taking people on the journey and showing them how a particular measure in the right location can work. So, making NbS more mainstream and the go-to option rather than something you do after the intensive intervention or traditional approach. We need a mind shift to see NbS as the first option, the most sustainable option.' (Policy maker)*

Political leadership

The ARP was criticised by interviewees as lacking political leadership due to (a) its content, which is an adaptation of, rather than a departure from, the CAP; (b) the timetable, which was felt to be too slow given the urgency of the climate and nature crises; and (c) the uncertainty of the overall budget and split between the tiers.

The CAP has two main components, or Pillars: Pillar 1, which funds area-based direct payments and Pillar 2 which funds agri-environment and rural development programmes. Over three quarters of

Scotland's £500m farming budget is currently paid through direct payments to farmers based on the amount of agricultural land they own. Direct payments are inequitable, as payments go to those farmers who own the most land and who may already be profitable without income support; and inefficient, as direct payments are not targeted on specific policy outcomes such as those for a just transition, net zero or nature's recovery[69]. This model of agricultural support has led to increasing emissions and a loss of biodiversity[70].

The outline content of the ARP's tiered support model is very similar to the pillars within the CAP. Whilst this aligns with the Scottish Government priority of policy harmonisation with the EU, and is a familiar design to farmers, crofters and land managers, it risks perpetuating the flaws of the CAP, missing the scale of the challenge and the opportunity NbS provide:

> *'We have a huge amount of CAP dependency… You have a reluctance to engage in massive change [by] developing the future scheme out of the present one, trying to tweak it to deliver better outcomes. But you wouldn't start from where we are if you want good outcomes for NbS.' (Sector)*

The ARP timetable also lacks the urgency that a meaningful response to the climate and nature emergencies demands. For example, Tiers 3 and 4 are not timetabled to commence until 2027 – just three years before the 2030 net zero and nature targets. This is too late: Tier 3 is where the large, landscape- and catchment-scale NbS would sit, and Tier 4 where the support with skills and advice in Tier 4 that would help with the transition to NbS.

> *'There's a massive risk posed by the timetable if you look at the nature targets for 2030, and carbon is a 75% reduction by 2030 which is seven years from now. We're not seeing decisions made quickly enough. We won't be able to meet the targets unless we move quickly.' (Sector)*

The uncertainty around the overall budget pot for future farm support, and the split between the proposed tiers, are related challenges which are making it difficult for farmers to plan, and for all interested groups to be able to critique the proposals for tiers and measures. Without knowing the budget, it is not possible to understand the potential impact of funded actions to contribute to the climate and nature targets.

> *'It's impossible to know what it will deliver if we don't know overall budget and how it will be split between the tiers.' (Sector)*

The politicisation of the farm support budget and lack of ringfencing with the departure of the seven-year funding programmes the CAP guaranteed is an issue for farmers, crofters and land managers across their businesses, but especially with transitioning to NbS which by their nature are more long-term and less guaranteed over an annual basis:

> *'Creating a bit more room for nature in the farmed landscape would create benefits for the farmers and they might not see in a good year the same yield but averaged out I think they'd see their cumulative yield higher as it wouldn't get hit so hard in the bad years' (Farmer/crofter/land manager/advisor)*

Also, even if the budget were to be maintained it would not meet the scale of the challenge. The latest research suggests that £1.2bn a year is needed in Scotland to meet environmental land management commitments[71]. This is in comparison to the current £30-40m annual spend on AECS, the total £65m Nature Restoration Fund and the projected £25m per year spend over 10 years of the Peatland Restoration Fund.

Overall, the lack of innovation and evolution from the CAP in the proposed tiered structure, lack of urgency in the timetable and lack of clarity on the overall budget and split between the tiers prompted many interviewees to point to a political leadership vacuum on the ARP.

> *'It's unclear from Scottish Government what farmers should do – we're living in limbo and it's creating inertia, fear, entrenchment – it's unhelpful.' (Sector)*

A comparison was made between the energy transition, described as having had a 'long, loud and legal' policy and regulatory framework which gave people confidence to invest in energy, and the absence of this in the farming transition. This was putting off the very people who are needed to both invest in and implement NbS.

> *'Just get on with it – we need clarity and some certainty and even if we don't like some of the things coming at us, we can get on with it and deal with it.' (Farmer/land manager/crofter/advisor)*

Policy design and coherence

Several challenges were identified in relation to policy design and coherence including issues with AECS, with the creation and enforcement of regulation and with the co-design approach of the ARP.

The relatively low take up and low spend of AECS points to wider issues that have been identified with agri-environment schemes in general which include poor design, inadequate systems and processes, a dominance of low value for money options and poor targeting, amongst others[72]. In terms of woodland management, research highlights the complexity of applying for grants, the length of time that it takes, the cost that this involves, and the uncertainty that an application will be approved rather than rejected at an unrecoverable cost to the applicant[73]. Further, unless a substantial area is involved, the Forestry Grant Scheme and AECS grant for deer control are generally considered inadequate to sufficiently reduce deer numbers[74].

There are inconsistencies between the ambitions for net zero and nature recovery and the reality of what is happening on the ground. On peatland, for example, the current voluntary status of the Muirburn Code means it can easily be ignored without consequences, which places the large amounts of public money invested in peatland restoration to help deliver net zero targets at risk[75]. The forthcoming Wildlife Management and Muirburn legislation, and its mandatory muirburn licence and review of the Muirburn Code, will need to be effectively implemented and enforced to address this.

Another example of policy discord is evident in Scotland's rainforests. Research on deer management in the rainforests highlights that whilst Scottish Government recognise that sustainable deer management is essential, deer numbers continue to rise, and there is a hesitant approach to enforcing existing regulations when deer management works against its stated principles[76].

This disconnect between policy and practice was also highlighted in relation to the 'co-design' approach of the ARP. Many comments were made from interviewees that there needed to be more involvement of farmers, crofters and land managers in the design of the agricultural support scheme for the Scottish Government's ambition of co-design of the ARP to be meaningful.

> *'For policy makers it's important they have insight into what farming consists of on the ground – there's a perception that they are civil servants, and they don't know what it's like to run a farm and a business – they don't run a farm and don't understand the practicalities. So, we need a closer relationship between those setting the policy and those implementing.' (Sector)*

Resistance to NbS from farmers, crofters and land managers

Resistance amongst farmers, crofters and land managers to adopting NbS was highlighted as a key barrier to the uptake of NbS for reasons including language and communications; potential economic costs and risks and a 'productivist' mindset.

Whilst the practice of NbS was felt to be widely understood in terms of, for example, peatland restoration or woodland creation, the language of 'nature-based solutions' was criticised by some interviewees as being mechanistic and jargony, meaning different things to different people, unclear

and off-putting for farmers, crofters and land managers. The contested nature of the term, who is using it, and its implications were highlighted:

> *'It depends who is using this ['Nature-based Solutions'] language. If it's coming from NGOs it's unhelpful. FAS are trusted on the whole. If it's mentioned in Farmers Guardian, or Farmers Weekly, it's weaponised as conservation language that wants to get rid of farming or dial it back.' (Farmer/crofter/land manager/advisor)*

> *'Communication [about NbS] needs to be policy driven – government communicating directly with farmers, not just through social media or Ministers' statements or through challenging comments in the NFUS magazine leader or cynical comments from the Scottish Farmer.' (Farmer/crofter/land manager/advisor)*

Any transition to, or incorporation of NbS, into agriculture brings costs and risks, and a change in practice. In some cases, in more productive agriculture, the period of transition can result in a short-term reduction in crop or livestock and an increase in yield variability[77]. In landscapes in which NbS may be implemented at scale, the trade-offs and financial implications are long-term and consequential whilst the benefits may take years to manifest. There is good reason for this: the biological processes and knowledge required to restore agricultural ecosystems and leverage natural processes to replace synthetic agricultural inputs take time[78].

> *'You can't guarantee outcomes [from NbS], there are concerns about not getting payments. It's risky as in some cases the farmer perceives there will be things that could happen – "Is the weed burden in that field going to go through the roof as I've made a big field margin?", or "If I've put in a woodland buffer in the margin of my field, is there going to be a risk here if there's a bit of public access?" It can turn into something where you create a margin, and it becomes a dog walking area and cattle get disease due to what's left behind.' (Farmer/crofter/land manager/advisor)*

Besides the uncertainty, many interviewees identified a cultural resistance to NbS because they go against mainstream practice which views using NbS in farming as regressive and a deviation from modern, productive food production.

> *[NbS are] seen as rolling back the clock against productivity. . . farming crofters here will be reading Farmers Weekly, seeing the big tractors. More and better is the rhetoric: the weights of cattle as they come in, same with sheep – bigger, heavier animals. Output and productivity. Anything that uses nature within this seems to be a dial back and not in a productivist mindset.' (Farmer/crofter/land manager/advisor)*

Interviewees also noted that often NbS tend to be viewed as being about land sparing rather than land sharing; about adding nature onto the margins of the farming system rather than integrating it within the system.

> *'A lot of people think the food element has been left behind… There's discord here on how they see the issue and how policy can solve it.' (Sector)*

> *'Locally in arable situations… [some say] "Should we not be maximising the productive part of the country and let the more extensive parts carry the environmental burden?" (Farmer/crofter/land manager/advisor)*

This perception of NbS as land sparing rather than land sharing was felt to miss the fundamental point that working with rather than against nature and integrating NbS on farmland can create multiple benefits – including private and business benefits to the individual farmers, crofters and land mangers by increasing resilience and the viability of the farming system.

'We're focused on presenting evidence and arguments about how this is a necessary thing for the viable future for farming. The rapid increase in fertiliser price from the Ukraine war [is what we should focus on] – it got people thinking about their current business model.' (Farmer/crofter/land manager/advisor)

'[Promoting NbS] needs to respect farmers' right to run a business – so you need to say how NbS could make them more profitable, and if nature-based funding can contribute to their balance sheet.' (Farmer/crofter/land manager/advisor)

Unless farmers, crofters and land managers can see the benefit of NbS to their business, NbS were felt likely to continue to be considered an add on, rather than being integrated into the farming system.

Enabling NbS through policy and investment

Three themes emerged regarding how the Scottish Government could further enable the widespread uptake of NbS. Firstly, through the design and content of the Agricultural Reform Programme; secondly through better enabling finance and investment in NbS; and thirdly through creating a holistic policy framework and increasing the role of RLUPs within this.

Agricultural Reform Programme design principles and content

We propose five design principles that should run throughout the ARP to enable NbS:

- Start with outcomes
- Pay for public benefits
- Incentive NbS in all farming systems
- Work at the right scale in the right place
- Advice, facilitation and peer-to-peer learning

Suggestions of how these design principles could translate into content for the four proposed tiers and examples of current projects and practice bring the principles to life.

Start with outcomes

Scottish Government policymaking has a clear source in the National Outcomes and National Performance Framework and there is a bold Vision for Agriculture setting the long-term expectation for regenerative and sustainable farming.

The ARP should flow from these sources rather than be based on an outdated mid-20th-century model of the CAP which incentivised food production at the cost of environmental degradation. Instead, the ARP should be built on the broader outcomes we need from land heading into the mid-21st-century. This means delivering meaningful social and economic benefits to communities from land as well as reducing GhGs and helping nature recover. The advancement of NbS would therefore be more effectively realised through:

'…identifying the challenges we face and designing the policy to meet those challenges. We have a huge amount of CAP dependency… You have a reluctance to engage in massive change [by] developing the future scheme out of the present one, trying to tweak it to deliver better outcomes. But you wouldn't start from where we are if you want good outcomes for NbS.' (Sector)

'In England [they are] not set up for outcomes payments, its actions, but this is not the best way to do it. So, the Scottish Government need to give clear messaging on outcomes – if you say you're looking for biodiversity improvement, everyone can work to that. This will help focus funds from the private market.' (Funder / investor)

Pay for public benefits

Public benefits from NbS should be incentivised through Tiers 1 – 3 of the ARP, whilst business benefits should be incentivised through other transitional, time-limited mechanisms such as capital investment, skills development or business support, including via Tier 4.

> *'…We need to make sure we're not paying for things farmers could get money for from the private market, e.g., for woodlands, peatlands, and hedgerows….' (Policy maker)*

Interviewees suggested learning from recent developments in agriculture scheme design in England, which was felt to be the right idea in terms of setting the bar on a nature-based approach but suffered from poor design and delivery. Setting rates that genuinely incentivise, learning from low uptake of the Sustainable Farm Incentive in England[79], will be key.

> *'They [Defra] have learnt a lot about what could be paid for, levels of payment to incentivise. Good stuff in it regarding [Scotland's proposed] Tier 3 – landscape-scale schemes. There are good bits in England that could be applied to a Scottish context very well. So, learn from the mistakes in England and don't repeat them. Pick the good bits that have come through.' (Funder/investor)*

Incentivise NbS in all farming systems

Around 18,000 farmers and land managers currently claim through the Single Farm Payment. If these were all required to integrate some NbS into their farming system, it would make a significant contribution.

> *'If every farmer in Scotland is required to do something more on their farm to qualify for their direct payment, this would lift the bar at a wider Scottish landscape level.' (Academic)*

Strengthening the baseline over time with 70% conditionality rather than the proposed 50% could make a significant impact. The current Greening requirements, including Ecological Focus Areas (EFAs), could be better designed for NbS, for example, rather than equal weightings across all hectares there could be higher weightings to incentivise actions for nature and climate and regenerative farming, such as for planting more leguminous crops.

> *'If we could have changed the weighting [of EFAs] and made logical choices you would have had a heck of a lot of people growing peas and legumes – so policy choices are really important. The issue we had with EFAs is that we couldn't control the weightings and the money going into them was relatively small, so the Greening element of 30% was weak. And in grassland areas you had nothing to do.' (Academic)*

Part of regulating activity will be to ensure a mechanism exists to protect the NbS into the future, for example, protecting grassland restoration so that it is not ploughed up. Likewise, penalising those already implementing good practice needs to be avoided.

The Scottish Government is currently looking into creating three tools for the 'enhanced conditionality' of Tier 1: a carbon auditing tool (e.g., AgriCALC), livestock efficiency (e.g., My Herd Stats to measure GhG emissions) and a third 'farmer-friendly habitat condition assessment' or biodiversity auditing tool which NatureScot is developing.

Soil sampling, business planning and increased Good Agricultural and Environmental Conditions (GAEC) measures on peatland and wetland protection (as per new requirements for EU Member States), including a muirburn plan were also proposed by interviewees. There is a substantial and growing body of evidence that creating three-dimensional riparian buffer zones which include more complex vegetation, height (i.e., through trees) and width (to at least 6 metres) improves almost all ecosystem functions, from soil health to reducing thermal stress to aquatic life – as well as improving farm business[80].

Ensuring there are options for *all* farming systems is important as currently, not all are well represented in AECS nor in the proposed list of measures for the ARP.

Work at the right scale in the right place

The need for spatial targeting and prioritisation to ensure that the right actions are happening in the right place and limited public funds are used for maximum effect flows from setting national outcomes.

This will involve leadership at a regional level to deliver integration and accountability in land use planning and priorities – and a need for strengthened regional land use planning. Regional Land Use Partnerships (RLUPs) have a key role here and should be empowered to integrate the priorities and funding of land use planning at a regional scale, as per the recommendations of the Scottish Land Commission[81].

Spatial prioritisation will help to establish which activities can and should happen in specific areas due to the different habitats and ecosystems across the country. It is currently envisaged that AECS will move into Tier 2 and that this will be the main way to deliver climate and nature targets. Given the low numbers of farmers, crofters and land managers within AECS and the low budget it currently receives, this must be reconsidered as a matter of urgency to enable the uptake of NbS.

> *'Currently in Tier 2 we've got the AECS offering and envisage what we put in place to replace will be a similar offering. So, Tier 2 will carry the policy weight for delivering the nature and climate targets. If AECS is currently doing what it's doing, it won't hit those targets. So, we need a new thing in our framework drawing down quite a bit of the cash…' (Policy maker)*

The need for evidence and data to support an outcomes-based approach was clearly stated, with a lack of robust, 'gold standard' evidence on the effectiveness of NbS. Recent research highlights data as a key issue in financing a transition to regenerative agriculture[82]. Improving the quality of, and access to, habitat data, location data, farm-level environmental baselining data, is critical.

> *'[We need] data modelling systems that can punch data in around NbS to do scenario modelling so you can see what landscape scale NbS could look like in Scottish landscapes – having visual platforms that allow people to play around with data and show where the strengths and weaknesses are.' (Policy maker)*

Better enabling collaboration across different landowners so NbS have greater effect is also important, as is the length of contracts and commitments which need to reflect the nature of land use change happening through NbS. The length of contracts will have a big impact on how attractive the NbS approach will be for farmers.

> *'Supporting farmers understanding what the different options available to them are – this is not about sparing land but sharing land with nature – farmers need to be confident that if they switch their business model it will work for them – this is a gap the globe over' (Funder/investor)*

To better enable NbS at scale, the funding should be weighted from Tiers 1 towards Tiers 2 and 3:

> *'For coherence and resilience, the scheme needs to be turned upside down. We need more investment into NbS, nature- and climate-friendly farming, and need this to be maintained over a five-year period, more like forestry grant scheme which is decades rather than years. This will be the only way to see effective implementation over space and time.' (Sector)*

Advice and facilitation, peer-to-peer learning

There is a big role for advisory services, knowledge exchange and peer-to-peer learning, and for educational courses and training to enable a greater uptake of NbS across the ARP and in general.

The Just Transition Land Use and Agriculture Discussion paper states the 'Scottish Government must ensure farmers and crofters are prepared and supported well in advance of changes to future farm support, by increasing public investment in technology and training, including expanded capacity for rural advisory services and training for advisors' [83].

The Climate Emergency Response Group (CERG) made proposals for increasing land-based skills which include:

- refresh and extend mandatory CPD on climate and biodiversity for all new and existing farm advisors
- mandatory advice into farm-level support and capital grants (including through the National Test Programme)
- kickstart the strengthening of the land-based training and education system in response to the Commission on Land-based learning
- include training of trainers approach to roll out to other local trusted professionals (e.g., vets, agronomists) to cascade knowledge, reinforce messaging, and provide follow-up
- increase year-on-year combined budget for training, knowledge sharing and advice – scaling up to reach £20m per annum by 2027[84].

Interviewees emphasised the importance of peer-to-peer learning and noted monitor farms, pilot schemes, peer-to-peer training and advice, the farmer-led group initiative and practical demonstration through local place-based schemes.

> *'More monitor farms, pilot schemes – if you had one or two farms in every area that other farmers could go and look at, see if they are making tonnes of money or losing money, etc. They have all the help, so other people can learn from their mistakes. It will take longer overall but if you take people with you, it might be better. Farmers will respond to this kind of thing – they need to see it.' (Farmer / land manager /crofter/ advisor)*

> *'Start at the farm with farmers in a way that is respectful of their business and culture, and that they need to make a living and are operating in a business context. We have funded and supported a lot of peer-to-peer training and advice – farmers hearing from their peers about changes they can make that are good for their business and good for nature. Advice, support and skills start with this conversation.'* (*Funder / Investor*)

The Farm Advisory Service (FAS) which currently holds the contract to deliver farm advice on behalf of the Scottish Government would need to change to deliver more NbS advice:

> *'Advisory systems – whether as SAC or FAS – cannot be turned on and off like a tap. It takes years to train people up, build their credibility locally. So, if we were to say FAS is about NbS, we'd need to find the people…we'd try our best. It's about course correction.' (Farmer / land manager /crofter/ advisor)*

> *'We only currently have 15-20 people who can do biodiversity audits in Scotland. They aren't there, they aren't on the ground. Scottish Government are trying to devise perfect solutions that are getting in the way of good solutions as they don't think it will get us to our target.' (Academic)*

The Farming Advisory Service support FAS Connect Groups such as Net Zero Arran[85] – a group of farmers on Arran working together to try and reduce the carbon footprint of the island, starting with their own GhG emissions. They are using a tool to benchmark and measure the GhGs they emit through farming – methane, carbon dioxide and nitrous oxide – and will then act together to reduce those emissions. The Scottish Government has been supporting knowledge sharing in agriculture through

seven projects funded through the Knowledge Transfer and Innovation Fund. This includes a project led by Nourish Scotland to widen and deepen understanding of agroecology, specifically through a farmer to farmer/crofter to crofter cooperative learning programme[86].

To work across landholdings and at scale requires support and facilitation:

> *'As a funder, farmers are willing to work together in clusters and at scale. They see an opportunity. . . I think there's a need to pay for the glue, facilitation, to help farmers come together on their terms to engage in NbS.' (funder/investor)*

Finance and investment for NbS

It is very difficult to precisely estimate the finance gap for nature in Scotland over the next decade, but it has been estimated by the Green Finance Institute to be in the order of £15 - £27 billion[87], in addition to public funding. This is one estimate; the extent of the funding gap is still being debated.

Financing Nature Recovery UK found that the main obstacle to private sector investment in nature at scale is not a lack of available capital. It is simply that under current policy and regulatory settings, the risks of investing in nature at scale outweigh the returns. It identifies four major barriers to scaling investment in UK nature[88]:

- Limited sources of revenue from nature
- Disincentives to invest in nature
- Insufficient certainty to price long-term risk
- Limited project pipeline and scale

Various initiatives exist in Scotland to address these barriers.

Governing standards and integrity for responsible investment

Investors need a clear governance framework to have the confidence to invest in NbS, with clarity about how action on the ground relates to net zero and nature's recovery. Interviewees highlighted concerns about corporate investment in NbS, that the private sector makes money off the land, pushing up land prices and pushing local communities out.

> *'NbS can conjure fear about the availability of land…some farmers will hear 'Nature-based Solutions' and think of land being purchased by corporations and it being something they can't get in on, can't do. People feel very angry about who is buying up land and what they are doing with it.' (Sector)*

The Scottish Government has committed to ensuring private markets for NbS are values-led and high-integrity, and have created 'Interim Principles for Responsible Investment in Natural Capital'. This has been done to support the delivery of integrated land-use and public and community benefits through 'inclusive engagement and collaboration in projects that are ethical and values-led, and which demonstrate high environmental integrity and support diverse and productive land ownership'[89].

The Principles are being applied in the Borderlands Inclusive Growth Deal in the south of Scotland, where it is establishing the first Natural Capital Innovation Zone in the country, with the aim of driving the Just Transition and delivery of the Wellbeing Economy[90] .This project is supporting applied research on natural capital data auditing and mapping, and the development of an investment plan to unlock blended and innovative finance opportunities. It will include projects in biodiversity, habitat management and agriculture, for example, by trialling natural capital whole farm plans and facilitating farmers to change their practice and monitor and assess their activities to measure whether making the land management changes results in natural capital changes.

Whilst the Principles are a positive development, serving to hone minds that investment in Scotland's land should be for the people, interviewees noted that they do not go far enough in providing a strong governance framework for investment: they are principles, not regulation. The Scottish Land Commission recommends that stronger regulation of emerging carbon and nature markets is put in place quickly by Scottish Government[91].

The Just Transition Land Use and Agriculture Discussion paper proposes that a mandatory system of certification for carbon credits needs to be considered to provide credible scrutiny of sellers and buyers[92]. Three global initiatives could help guarantee standards and integrity:

- On the demand side, the Voluntary Carbon Markets Integrity Initiative (VCMI)[93] is looking at how a business or company can use carbon credits in reporting.
- On supply-side integrity, the Integrity Council for the Voluntary Carbon Market (ICVCM)[94] is looking at how to make sure the credit is additional, permanent and measured.
- The Taskforce on Nature-related Financial Disclosures (TNFD)[95] is a reporting framework for companies to list their impacts and dependencies on nature.

These global initiatives could be used to strengthen financial investment in NbS in Scotland, for example, by mandating the use of TNFD to force companies to invest in NbS as they would have to start offsetting their impact. This would help to overcome the current gaps in standards and a lack of clarity on market rules and transparency around the price of carbon[96].

> *'There are still some big gaps in standards and clarity on market rules. If I were a farmer, I would be wary of taking money for carbon credits from Tesco, and then Tesco wanting to take my carbon. This is important for everyone – it's about high integrity and avoids greenwash. It's a major barrier and needs resolving – farmers may think there's too much uncertainty now, so decide 'I won't sell' as they may regret it later.' (Funder / investor)*

Corporates, especially those in the food and drink industry which use 'brand Scotland' in their marketing, could better support nature through their supply chains, for example, by providing initial funding for NbS and helping farmers engage in NbS. This would also strengthen their supply chain and future resilience.

> *'Scottish Government need to stop thinking they can design agriculture policy in a market vacuum. What the supply chain is doing is very important but Scottish Government isn't aligning what they are doing to the supply chain to get a better result – they think it is policy that drives what farmers do but it is about the supply chain and market too.' (Sector)*

Quality assurance

Quality assurance standards can provide assurance and clarity for buyers regarding the quantity and quality of benefits created through NbS. Two codes exist for quality assuring carbon sequestration which are supported by the Scottish Government:

- The Woodland Carbon Code is the quality assurance standard for woodland creation projects in the UK, generating independently verified carbon units. Backed by the Scottish Government, the forest industry and carbon market experts, the Code is internationally recognised for high standards of sustainable forest management and carbon management, and is endorsed by International Carbon Reduction and Offsetting Accreditation, the global umbrella body for carbon reduction and offset providers in the voluntary market[97].
- The Peatland Code is part of the IUCN UK Peatland Programme. It is a voluntary standard for UK peatland projects wishing to market the climate benefit of restoration which aims to provide assurance and clarity for business and other investors in peatland restoration projects through independent validation and verification. The Code recognises that carbon benefits arise for many years after the initial restoration activities are implemented, so ensures the carbon

benefit will be regularly measured and monitored over the lifetime of the project (minimum 30 years). Buyers can therefore be confident in purchasing peatland carbon units upfront, enabling the restoration project to take place[98].

Attracting revenue and investment in other ecosystems services besides carbon is an important next step for increasing investment in NbS. One way to do this would be to develop mechanisms for newer markets such as biodiversity net gain to pump the private sector demand side.

Funding NbS project development

NbS projects, especially those which span multiple farmers, landowners and crofters, require considerable development work to get off the ground. This work includes, for example: baseline data and monitoring; support designing NbS interventions and working out who will buy the ecosystem service. It is important to also consider the role of the Peatland or Woodland Carbon Code or private markets and how payments are blended and stacked. There is a strong case for funders and governments to work with investors with a longer-term time horizon and provide some upfront investment; and for clarity on additionality and how different payment structures and sources will work together.

> *'Additionality comes in strongly when thinking about how the payment structures will be set up. If you're going to get finance from agriculture payments for maintaining peatland and from the Peatland Code for selling carbon credits, and potentially from another code for selling other outcomes like flood risk or water quality – does it mean that the person doing the work breaks even or do they make loads of money?' (Policy maker)*

The Scottish Government and NatureScot, with National Lottery Heritage Fund support, have created an investment readiness fund, the Facility for Investment Ready Nature in Scotland (FIRNS)[99]. FIRNS is about building the supply and pipeline of NbS projects and developing structures that work at scale because farms typically are not of the size that can create the revenue stream that will attract a corporate or an investor, and limited capacity in the supply chain means that projects cannot be aggregated to a scale that would attract investment[100].

> *'England has one that's been running a few years, the Natural Environment Readiness Fund, which has been very successful in developing the supply. There are lots of investors and buyers who want to buy carbon, but it isn't clear what the investment chain is. Hopefully farmers will be engaged in the engagement process advising on how the [FIRNS] fund process is structured.' (Funder/investor*)

> *'There's no projects. Investors have money to invest but when there are projects, they're so small – they [investors] won't get out of bed for less than £20m. This is where the FIRNS programme and developing models of investment to work across different parcels of land comes in. (Policy maker).*

To further help develop the project pipeline, NatureScot, the Esmée Fairbairn Foundation and the National Lottery Heritage Fund have launched Investment Ready Nature in Scotland (IRNS) a grant scheme to help organisations and partnerships develop projects in Scotland that use private investment and market-based mechanisms to help finance the restoration of the natural environment in Scotland[101]. Projects must develop replicable and scalable business models that derive revenue from natural capital and biodiversity, and which could be used to attract and repay the investment. Seven such projects have been identified so far[102].

Several IRNS-funded projects are looking at developing ways of verifying other ecosystems services besides carbon, including biodiversity. The Glencripesdale temperate rainforest restoration project, for example, is looking at the applicability of Biodiversity Net Gain projects and credits in Scotland's Rainforest. The Loch Lomond and The Trossachs National Park Authority is working in partnership

with the Landscape Finance Lab to develop and monetise ecosystem services beyond carbon, specifically targeting biodiversity, agriculture and eco-tourism to build applicable financial and business models[103].

Spotlight project: Riverwoods

Riverwoods is an initiative to create a network of riparian woodland and healthy river systems throughout Scotland, delivering a range of benefits including flood protection, improved water quality and improvements for salmon fisheries, as well as helping to tackle the twin challenges of climate change and biodiversity loss[104].

It illustrates how NbS can be enabled at scale through applying many of the enabling factors we have identified. For example, Riverwoods is supporting landowners to carry out practical work, identifying and addressing evidence gaps, showcasing best practice and exploring novel forms of financing to enable riparian restoration to be carried out at scale. This Blueprint Project is at the heart of the initiative, creating a practical guide for river woodland restoration across Scotland, and which aims to deliver:

- 100 hectares of tree planting
- new funding mechanisms to support development of woodland creation and restoration projects at different scales
- a digital centre for excellence to share knowledge and data, best practice guidance and centralised resources, including financial and advisory opportunities
- standardised measuring and monitoring

Its Investment Readiness Pioneers project stream is looking at how communities, landowners and other stakeholders can work together to identify Riverwoods projects that have the potential to be financed using new mechanisms beyond traditional grants. It is investigating how to bundle and sell the benefits of natural flood management, water quality, biodiversity and engagement with nature and carbon. The project will provide investment readiness and project development support, and support a just transition through community engagement. For example, through participatory decision making, two development projects were selected on the Upper Tay and River Ericht.

Creating a holistic policy framework

Ambitions for net zero, nature's recovery, a just transition, green economy and a progressive vision for regenerative agriculture are hard-wired into Scottish Government policy – from the international Sustainable Development Goals and various EU policies – through Scotland's National Outcomes and into its economic, environmental and social policies.

Yet interviewees questioned whether current policy commitments were being delivered in practice, identifying challenges with 'turning the words into deeds' through delivery mechanisms. They also highlighted the volume of activity within the policy environment which can result in contradictory outcomes, confusion, feelings of being overwhelmed and a desire to stick with what is known. This can in turn result in inertia, which is the antithesis of what is needed to face the urgency of the climate and nature emergencies.

The Scottish Land Commission highlights a 'gap in leadership at a regional level to deliver integration and accountability in land use planning and priorities at a time when the multiple demands on land are growing and the impacts of land use change are potentially far-reaching'[105]. One potential vehicle for strengthening the implementation of policy ambitions is Regional Land Use Partnerships (RLUPs). They can translate national outcomes to regional and local outcomes by utilising spatial planning and prioritisation for nature and climate targets, local democratic engagement for a just transition, and funding, including agriculture support funding in the ARP.

Integrating Nature Networks into the RLUPs Regional Land Use Frameworks would provide an important mechanism for planning and delivering the imminent legally binding nature targets as well as net zero:

> *'If we recognise that NbS would help Scottish Government achieve both sets of legally binding targets [i.e., nature and net zero] this would help them be implemented at the scale needed. From a climate change perspective, it doesn't matter where you do something, you'll have a benefit – but from a biodiversity perspective it is hugely important.' (Academic)*

Recommendations

There is much to be lauded about the Scottish Government's policy commitments to tackle the nature and climate emergencies whilst ensuring a just transition. Yet the deeds are not matching the words. The size of the challenge is not being met with the supporting structures needed for policy to be effectively implemented. Here we set out recommendations for policy makers and politicians to tackle this disconnect. They are clustered around four themes:

- Leadership, coherence and commitment
- Learning and demonstration
- Winning hearts and minds
- Financial governance and integrity

Leadership, coherence and commitment

To align policy implementation and delivery with the Scottish Government's vision, targets, and ambitions for agriculture, nature recovery, net zero vision and a Just Transition, and to avoid a reinvention – or worse, a watering down, of the status quo (i.e., the CAP) – we recommend that the Scottish Government:

1. Make a commitment on the face of the Agriculture Bill to the Vision for Agriculture, and make clear that the Bill is to enable the transformation of support for farming and food production in Scotland so that it can become a global leader in sustainable and regenerative agriculture.

2. Create outcomes and metrics for the ARP to be aligned with Scotland's National Outcomes and Performance Framework. This will require quantifying the contribution of the ARP towards net zero and nature recovery targets, and allocate the necessary budget for the ARP.[106] Tiered budgets should then be weighted and apportioned according to their contribution towards the delivery of national outcomes and targets.

3. Incentivise public benefits from NbS through Tiers 1 – 3 of the ARP whilst incentivising business benefits through other transitional, time-limited mechanisms such as capital investment, skills development or business support, including via Tier 4. Baseline requirements should be increased and weightings within Tier 1 should be prioritised to deliver environmental outcomes. NbS must be incentivised across all farming scales, systems and within all Tiers.

4. Set long-term timeframes and budgets for the ARP and contracts within the proposed Tiers so that the sector can safely pivot towards delivering NbS. The risk in changing farming business models to increasing the uptake of NbS cannot be borne solely, or even primarily, by the sector.

5. Commit to resolving inconsistencies in policy and to enhancing existing mechanisms. This includes: elevating the status and power of the Land Use Strategy; following the recommendations of the Scottish Land Commission by enhancing the power and geographic coverage of Regional Land Use Partnerships and by integrating Nature Networks within them; strong enforcement of existing regulation, e.g., on deer management; and strengthening and implementing forthcoming muirburn legislation.

Learning and demonstration

Evidence and metrics are needed alongside advice about, and demonstration of, NbS to help meet the Scottish Government's climate and nature targets, and thereby unlock private finance for NbS. We recommend the Scottish Government:

6. Improve the quality of and access to habitat data, location data and farm-level environmental baselining data. The initiatives currently underway, such as Tier 1 baselining metric tools and NatureScot's landscape scale data modelling, should be given more impetus, e.g., through the ARP's National Test Programme.

7. Prioritise and integrate NbS into research institutes and government programmes such as the Monitor Farm Scotland Programme and the Strategic Research Programme 2022 – 2027 to provide stronger evidence on how NbS can improve agricultural practices to develop a resilient, productive sector that is abreast of transformative opportunities.

8. Learn from elsewhere. Defra in England, for example, have carried out considerable research on their post-CAP scheme, Environmental Land Management, including on incentivising uptake, blending and stacking public and private finance and paying for outcomes.

9. Prioritise knowledge sharing and peer-to-peer learning within the ARP's National Test Programme (e.g., through Monitor Farms) and as an integral part of the ARP roll out. Farmers, crofters and land managers need to know how NbS can support their businesses; not just how NbS can deliver government targets on climate and nature.

10. Increase the number of skilled advisors by clear signalling to the advisory sector about the direction of travel in agriculture policy regarding a pivot towards NbS. This includes the Farm Advisory Service (FAS) through the content of Scottish Government advisory contracts, and to institutions offering agricultural and land-based training (e.g., SRUC) that climate and nature must be integrated within 'standard' agriculture courses with NbS as a golden thread.

Winning hearts and minds

Winning the hearts and minds of the farming, crofting and land management sector, its sector bodies and the sector press is key to increasing the uptake of NbS. We recommend the Scottish Government:

11. Communicate what is expected from the sector, and by when, within the ARP. It is currently unclear and creating inertia and entrenchment.

12. Gear Scottish Government communication to the sector about NbS towards the business benefits they bring, such as providing resilience to economic and climatic volatility, supporting food production and increasing profit. Rhetoric in sector media of NbS being an add-on rather than core to the farm business needs to be challenged with compelling stories of those using NbS in their farm businesses being made available to media outlets such as Scottish Farmer and Landward.

13. Include more people with farming, crofting and land management experience in the ARP policy design and testing process.

Financial governance and integrity

There is an important role in creating the conditions to enable more private investment in NbS. We recommend the Scottish Government:

14. Follow the recommendations of the Scottish Land Commission to quickly put in place stronger regulation of emerging carbon markets. Whilst the Scottish Government's Interim Principles on Responsible Investment in Natural Capital are a good start, they need backing up with regulation.

15. Explore the creation of certification of carbon credits, drawing on existing recommendations of global initiatives such as the Voluntary Carbon Markets Integrity Initiative (VCMI), Integrity Council for the Voluntary Carbon Market (ICVCM) and Taskforce on Nature-related Financial Disclosures (TNFD).

16. Help to leverage investment in NbS by supporting collaboration across multiple landholdings. This means being clear about who benefits and how, the mechanisms for aiding collaboration across land parcels, and how to blend and stack public and private finance. The Riverwoods initiative should be looked to for learning on this.

17. Continue and increase support for the development of new markets for ecosystems services besides carbon, such as Biodiversity Net Gain. The Facility for Investment Ready Nature in Scotland (FIRNS) and Investment Ready Nature in Scotland (IRNS) are a good start with this.

Acknowledgements

We extend our sincere thanks and appreciation to all our research participants for their time, expertise, and insight. Without you, this report would not have been possible.

Interviewees

Name		Organisation	Job title
Helen	Avery	Green Finance Institute	Director, Nature Programmes
Andrew	Bauer	SAC Consulting (part of SRUC)	Head of Food & Footprint
Louise	Bond	SEPA	Innovation Principal Policy Officer
Sarah	Cowie	NFUS	Environmental Policy Manager
Harriet	Donald	Loch Lomond & The Trossachs National Park Authority	Land Management Programme Manager Farmer
Kate	Dowen	Scottish Government	Head of Sustainable Nature Finance Team
Ross	Lilley	Nature Scot	Head of Natural Resource Management
Ross	Johnston	Scottish Government	Head of Natural Capital Policy & Valuation
John	Kerr	Scottish Government	Head of Agricultural Policy Division
Phil	Knott	Nature Friendly Farming Network Sleat Peninsula, Isle of Skye	Vice chair Crofter & land manager
Deborah	Long	Scottish Environment LINK	Chief Officer
Davy	McCracken	SRUC	Head of Department of Integrated Land Management
Jackie	McCreery	Yester Farm Dairies Scottish Land and Estates	Director Legal Advisor
Liam	McLeese	Esmée Fairbairn Foundation	Director, Our Natural World.
Andrew	Midgley	RSPB Scotland	Senior Land Use Policy Officer
Pete	Ritchie	Nourish Scotland	Director
Ruth	Taylor	WWF Scotland	Agriculture and Land Use Policy Manager
Steven	Thomson	SRUC	Reader in Agricultural Economics & Policy
Willie	Thomson	Wheatrig Farm	Farmer
Denise	Walton	Peelham Farm	Farmer

Policy recommendations workshop

Name		Organisation	Job title
Ross	Lilley	Nature Scot	Head of Natural Resource Management
Ross	Johnston	Scottish Government	Head of Natural Capital Policy & Valuation
Dan	Paris	Scottish Environment LINK	Advocacy Manager
Andrew	Midgley	RSPB Scotland	Senior Land Use Policy Officer
Ruth	Taylor	WWF Scotland	Agriculture and Land Use Policy Manager
Kirsten	Beddows	Scottish Government	Head of Agriculture Transformation for Environment and Climate Change
Bruce	Wilson	Scottish Wildlife Trust	Head of Policy and Advocacy
Rebekah	Strong	Scottish Wildlife Trust	Nature Based Solutions Policy Advisor

Appendix 1 Scottish Government Strategies and Plans for NbS

Name	Description	Relevance to NbS
Scottish Government National Outcomes and the National Performance Framework	Scotland's way to localise the UN's Sustainable Development Goals. Enshrined in the National Performance Framework.	Sets vision that economy is ecologically accountable and socially responsible. The green economy and rich ecological capital are viewed as a valuable development opportunity and the Scottish Government actively progress advancements in these areas. Commits to enhancing and protecting Scotland's natural assets and heritage, ensuring all communities can engage with and benefit from nature and green space. Sets commitment to environmental justice, preserving planetary resources for future generations and to be at the forefront of carbon reduction efforts and biodiversity practice.
Shared Policy Programme between Scottish Greens and Scottish Government and Programme for Government	Sets the shared policy programme to be delivered over the current parliamentary term (2021 – 26), which each annual Programme for Government translates into a delivery plan.	Articulates the vision for agriculture 'that Scotland should be a global leader in sustainable and regenerative agriculture. We will ensure the sector makes the emission reductions required to contribute to Scotland's world-leading emissions targets, to support and deliver nature restoration and a just transition to net zero, and to produce high quality food.' Includes commitment to introduce Land Reform Bill, an Agriculture Bill and a Natural Environment Bill. Introduces plans to pilot five Regional Land Use Partnerships (RLUPs) which adopts a natural capital approach to land use change and take into consideration the delivery of statutory climate and nature targets on a regional basis. Commits to 'stay aligned with new EU measures and policy developments' regarding 'net zero, the restoration of nature and the sustainable production of high-quality food'.

Delivering Economic Prosperity Scotland's National Strategy for Economic Transformation	Sets the economic priorities & actions for Scotland to become a wellbeing economy and a global leader in delivering a just transition to a net zero, nature-positive economy, and rebuilding natural capital.	Sets economic imperative for restoring nature and investing in natural capital and land-based economy. Commits to establishing a 'values-led, high-integrity market for responsible private investment in natural capital' 'supported by a national project pipeline for nature-based solutions.'
Just Transition and Just Transition Plan for Land Use and agriculture.	Just transition is how to get to a net zero and climate resilient economy in a way that delivers fairness and tackles inequality and injustice. The National Just Transition Planning Framework sets out eight National Just Transition Outcomes, distilled into four themes to support the coherence of sectoral Just Transition Plans – including for Land Use and Agriculture. This will set out how agriculture, land integration and land use change can follow the Just Transition principles.	Discussion paper on Just Transition for Land Use and Agriculture includes: - Farmers and crofters are supported throughout the transition to net zero (e.g., finance, advisory and skills provision support) developing the skills needed for regenerative and sustainable farming, changes of land use management and adaptation to the changing climate. - Support for upskilling, reskilling, business diversification and where appropriate financial support has helped people to deliver nature-based solutions. - Agriculture is sustainable and regenerative from farm to fork and contributes to our circular economy by reducing waste and pollution. - Natural capital / nature-based solutions projects not only help meet climate change and biodiversity targets but deliver value and opportunities for local communities.
Environment Strategy for Scotland	Sets the framework for Scotland's strategies and plans on the environment and climate change including six long-term goals.	NbS highlighted as important in contributing to outcomes of protecting and restoring nature and in tackling the climate emergency.
Scottish Biodiversity Strategy to 2045	High level strategy for Vision for biodiversity for 2045. Sets the framework which includes the proposed Natural Environment Bill which will set targets for the overarching goal of the Strategy, of halting biodiversity loss by 2030, and restoring Scotland's natural environment by 2045.	Sets the vision that nature-based solutions such as tree-planting and peatland restoration will be central to efforts to deliver Net Zero and adapt to climate change. Includes soil as an NbS to flooding, erosion and biodiversity loss. Re-states the priority action of the Economic Strategy to establish a market for responsible private investment in natural capital, supported by a national project pipeline for nature-based solutions.

Climate Change Plan	Sets out actions to meet emissions reduction targets to 2032 to meet Scotland's legally binding 2045 Net Zero target, and the 75% target by 2030. Provides a route map for agricultural transformation.	Includes measures and indicators for peatland restoration and native woodland & forest creation and support for farmers and land managers: - increase new woodland creation from the current target level of 12,000 hectares annually in 2020/21 up to 18,000 hectares in 2024/25 (2020/21 Programme for Government) - increase the woodland carbon market by at least 50% by 2025 - commitment to invest more than £250 m over 10 years to support the restoration of at least 20,000 hectares of Scottish peatland annually, towards a total of 250,000 hectares by 2030 - Realign and enhance Farm Advisory Service, the Knowledge Transfer and Innovation Fund and Monitor Farm Programme to create a more cohesive approach to ensure advice and support is focussed on helping industry to professionalise to support sustainable farming. - A new and expanded peer to peer knowledge transfer initiative based on the Young Climate Change Champions work.
Climate Ready Scotland: Second Scottish Climate Change Adaptation Programme 2019 - 2024	Sets out policies and proposals to prepare Scotland for the challenges of a changing climate.	Highlights that nature-based solutions such as woodland creation and peatland restoration will reduce emissions and help Scotland adapt to the impacts of climate change.
Scotland's Third Land Use Strategy 2021 – 2026	Long-term vision for sustainable land use in Scotland, objectives and key policies for delivery.	Sets a vision of: - more land will be forested and increasingly integrated with agriculture. - more space for natural habitats, with more of them restored, connected and enhanced. - enclosed farmland and semi-natural land will contain more, better quality peatland habitats, and a wider range of wildlife thriving in wild areas. - Restates proposals for Regional Land Use Partnerships.
Scotland's National Peatland Plan	Provides a framework for recognising, communicating and,	Proposes building on existing initiatives to secure sustainable use,

	where appropriate, quantifying the benefits of healthy peatlands.	management and restoration of peatlands. Sets out proposals for research and for raising awareness. Reiterates target of 250,000 hectares restored by 2030.
Scotland's Forestry Strategy 2019 - 2029	Scotland's Forestry Strategy gives a 50-year vision for Scotland's forests and woodlands and sets out a 10-year framework for Government and partnership working on forestry.	Based on principles of sustainable forest management and the need for better integration of forestry with other land uses and businesses, reinforcing the principle of 'the right tree, in the right place, for the right purpose'. Supports the delivery of existing forestry commitments, e.g., woodland creation targets in the Climate Change Plan and native woodland and protected sites targets expressed in Scottish Biodiversity Strategy. Includes targets of: - 21% woodland cover by 2032. - Create 3,000–5,000 hectares of new native woodland per year - 15,000 hectares of forest and woodland created per year from 2024/25
The National Planning Framework (NPF4)	Long-term plan for Scotland that sets out where development and infrastructure is needed, in a way that safeguards nature and gives all of Scotland's people access to the wellbeing it provides.	Ensures that Local Development Plans (LDPs) integrate NbS where possible and protect, conserve, restore and enhance biodiversity and promote nature recovery and nature restoration. 'To respond to the global biodiversity crisis, nature recovery must be at the heart of future places. We will secure positive effects for biodiversity, create and strengthen nature networks and invest in nature-based solutions to benefit natural capital and contribute to net zero.'
Vision for Agriculture and Agriculture Bill	The Scottish Government's Vision for Agriculture (March 2022) outlines the vision to transform support for farming and food production in Scotland to become a global leader in sustainable and regenerative agriculture. The Agriculture Bill (Aug 2022) consultation includes proposals and powers to make the vision a reality.	Agriculture Bill commits to delivering four outcomes: high quality food production, climate mitigation and adaptation, nature restoration and wider rural development and will be the mechanism which gives powers to deliver the Agricultural Reform Programme's policy, regulatory and support mechanisms to help: deliver net zero; restore nature; benefit natural capital; promote the natural economy; adopt a just transition approach to land use change; and stay aligned with new EU measures and policy developments.

Good Food Nation (Scotland) Act	Framework legislation placing statutory duties on Scottish Government, local authorities, and Health Boards to produce systems-level Food Action Plans, each with inclusive and transparent consultation processes, overseen by a new independent Food Commission.	Includes key objective of tackling the climate and nature emergency through sustainable food and farming, and an end to food waste.

References

[1] 85% of the Scottish public want more spending on farming to support methods that restore nature and tackle climate change as well as producing food. Survation poll for Scottish Environment LINK, November 2022. Reported in https://farmforscotlandsfuture.scot/wp-content/uploads/2023/04/Farm-for-Scotlands-Future-full-report.pdf
[2] https://www.rspb.org.uk/globalassets/downloads/about-us/48398rspb-biodivesity-intactness-index-summary-report-v4.pdf
[3] https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2021/10/The-Finance-Gap-for-UK-Nature-13102021.pdf
[4] https://www.rspb.org.uk/globalassets/downloads/about-us/48398rspb-biodivesity-intactness-index-summary-report-v4.pdf
[5] Close to 75 percent of the world's crops producing fruits and seeds for human use depend, at least in part, on pollinators https://www.fao.org/world-bee-day/en
[6] https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-2021/pages/3/
[7] https://scotlink.org/files/state-of-nature-Report-Scotland_.pdf
[8] https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf
[9] https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/37318/NBSCCM.pdf
[10] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3746
[11] https://www.ons.gov.uk/releases/scottishnaturalcapitalecosystemserviceaccounts2020 cited in Land Use Strategy
[12] https://www.iucn.org/our-work/nature-based-solutions#:~:text=About%20Nature%2Dbased%20Solutions,simultaneously%20benefiting%20people%20and%20nature.
[13] https://www.naturebasedsolutionsinitiative.org/news/united-nations-environment-assembly-nature-based-solutions-definition
[14] https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf
[15] Figure 2 adapted from https://www.fao.org/documents/card/en/c/cb3141en
[16] https://www.fao.org/documents/card/en/c/cb3141en
[17] Table 1 provides headline figures for extent by area of the seven terrestrial habitats in Scotland, using the broad classifications from the UK National Ecosystem Assessment, with summary area statistics from UK Centre for Ecology and Hydrology Land Cover Maps (LCM). It is adapted from ONS's Scotland Natural Capital Accounts: 2023.
[18] https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2023/06/transition-land-use-agriculture-discussion-paper/documents/transition-land-use-agriculture/transition-land-use-agriculture/govscot%3Adocument/transition-land-use-agriculture.pdf
[19] Estimates on upland land cover vary from 44% to 85% depending on the definition used. This 'limit' is an economic threshold based on land capability for agriculture, the land above which it is unprofitable to cultivate (i.e., marginal) due to its poor soils, high exposure and high rainfall. In some parts of Scotland, especially in the west, the uplands come down to the shoreline. https://www.nature.scot/sites/default/files/2019-10/State-of-nature-Report-2019-Scotland-full-report.pdf
[20] https://www.rspb.org.uk/our-work/policy-insight/england-westminster/farming-and-land-use/high-nature-value-farming/
[21] https://www.nature.scot/professional-advice/land-and-sea-management/managing-land/farming-and-crofting/types-farming/crofting
[22] https://www.nature.scot/professional-advice/land-and-sea-management/managing-land/farming-and-crofting/types-farming/crofting
[23] Scotland's Biodiversity Strategy
[24] https://www.britishecologicalsociety.org//wp-content/uploads/2022/02/NbS-Report-Final-Updated-Feb-2022.pdf
[25] https://www.iucn-uk-peatlandprogramme.org/sites/default/files/2019-05/Peatland_Leaflet_ONLINE_V2.pdf
[26] https://www.rspb.org.uk/globalassets/downloads/nature-recovery-plan---scotland/rspbscotland_report_muirburnlicensing_oct2021.pdf
[27] https://naei.beis.gov.uk/reports/reports?report_id=980
[28] https://www.nature.scot/doc/peatland-action-case-study-whats-connection-between-peat-and-drinking-water-catchments#:~:text=Up%20to%2070%25%20of%20Scotland's,reaches%20a%20water%20treatment%20plant and https://www.iucn-uk-peatlandprogramme.org/about-peatlands/peatland-benefits/water-quality
[29] https://www.woodlands.co.uk/blog/woodland-economics/the-scottish-uplands-how-to-revive-a-degraded-landscape-a-talk-by-dr-helen-armstrong/

[30] https://www.woodlands.co.uk/blog/woodland-economics/the-scottish-uplands-how-to-revive-a-degraded-landscape-a-talk-by-dr-helen-armstrong/
[31] Scotland's Biodiversity Strategy
[32] https://www.nature.scot/doc/state-nature-scotland-report-2019
[33] Scotland's Biodiversity Strategy
[34] Ibid
[35] Ibid
[36] Ibid
[37] https://www.nature.scot/doc/trend-notes-scottish-moths
[38] https://www.livescience.com/animals/moths/ecologist-tim-blackburn-moths-pollinate-a-wider-range-of-species-than-bees
[39] Sutton, M. et al. (eds.) 2011. The European Nitrogen Assessment: Sources, Effects and Policy Perspectives. Cambridge: Cambridge University Press.
[40] https://www.iucn-uk-peatlandprogramme.org/sites/default/files/2019-05/Peatland_Leaflet_ONLINE_V2.pdf
[41] https://www.nature.scot/doc/peatland-action-case-study-whats-connection-between-peat-and-drinking-water-catchments#:~:text=Up%20to%2070%25%20of%20Scotland's,reaches%20a%20water%20treatment%20plant
[42] Brown et al., Greenhouse Gas (GHG) Inventory 1990 Baseline Peatland Condition Map
[43] https://www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/An%20Introduction%20to%20Restoration%20Techniques_booklet.pdf
[44] https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2016/
[45]https://forestry.gov.scot/component/edocman/373-scotland-s-forestry-strategy-2019-2029/download?Itemid=0
[46] The Woodland Creation & Ecological Networks (WrEN) project (1997) https://www.wren-project.com/
[47] https://www.britishecologicalsociety.org//wp-content/uploads/2022/02/NbS-Report-Final-Updated-Feb-2022.pdf
[48] Ibid.
[49] Ibid.
[50] Ibid.
[51] Van Vooren, L., Bert, R., Steven, B., Pieter, D., Victoria, N., Paul, P. and Kris, V. (2017). Ecosystem service delivery of agri-environment measures: A synthesis for hedgerows and grass strips on arable land. *Agriculture Ecosystems & Environment*, 244, pp.32-51.
[52] Ibid.
[53] https://www.soilassociation.org/media/24798/woodland-and-trees-in-farmed-landscapes-report.pdf
[54] https://www.britishecologicalsociety.org//wp-content/uploads/2022/02/NbS-Report-Final-Updated-Feb-2022.pdf
[55]https://ipbes.net/system/tdf/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf?file=1&type=node&id=36213
[56] https://www.scotlink.org/wp-content/uploads/2020/03/Nature-Networks-Briefing-FINAL-Updated-Oct-2020-1.pdf
[57] https://www.justtransition.scot/publication/communicating-change/
[58] https://scottishwildlifetrust.org.uk/our-work/our-advocacy/policies-and-positions/land-stewardship-policy/
[59] https://www.ruralpayments.org/topics/agricultural-reform-programme/arp-route-map/
[60] https://www.ruralpayments.org/topics/agricultural-reform-programme/arp-list-of-measures/
[61] https://www.gov.scot/publications/next-step-delivering-vision-scotland-leader-sustainable-regenerative-farming/pages/2/
[62] https://www.nature.scot/funding-and-projects/scottish-government-nature-restoration-fund-nrf
[63] https://www.nature.scot/climate-change/nature-based-solutions/peatland-action-project
[64] https://www.theccc.org.uk/publication/scottish-emission-targets-progress-in-reducing-emissions-in-scotland-2022-report-to-parliament/
[65] https://www.scotlink.org/wp-content/uploads/2023/06/Deer-Report.pdf
[66] https://www.nature.scot/doc/scotlands-agri-environment-and-climate-scheme-summary
[67] https://www.nature.scot/doc/scotlands-agri-environment-and-climate-scheme-summary
[68] https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2023/03/GFI-Financing-a-Farming-Transition.pdf
[69] https://farmforscotlandsfuture.scot/wp-content/uploads/2023/04/Farm-for-Scotlands-Future-full-report.pdf
[70] https://scotlink.org/files/state-of-nature-Report-Scotland_.pdf
[71] https://www.wildlifetrusts.org/sites/default/files/2023-06/Finance%20for%20UK%20Environmental%20Land%20Management%2C%20June%202023.pdf
[72] https://farmforscotlandsfuture.scot/wp-content/uploads/2023/04/Farm-for-Scotlands-Future-full-report.pdf
[73] https://www.scotlink.org/wp-content/uploads/2023/06/Deer-Report.pdf

[74] https://www.scotlink.org/wp-content/uploads/2023/06/Deer-Report.pdf
[75] https://www.scotlink.org/wp-content/uploads/2023/05/Wildlife-Management-Bill-LINK-consultation-response-1-1.pdf
[76] https://www.scotlink.org/wp-content/uploads/2023/06/Deer-Report.pdf
[77] https://www.fao.org/documents/card/en/c/cb3141en
[78] Ibid
[79] https://www.fwi.co.uk/business/business-management/agricultural-transition/slow-uptake-of-sfi-blamed-on-low-payments-and-lack-of-detail
[80] https://www.riverwoods.org.uk/wp-content/uploads/2022/06/Riverwoods-for-Scotland-Report-on-Scientific-Evidence_2022.pdf
[81] https://www.landcommission.gov.scot/downloads/648c2a7e6fbf0_Natural%20Capital%20and%20Land%20Reform%20Next%20Steps%E2%80%93Advice.pdf
[82] https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2023/03/GFI-Financing-a-Farming-Transition.pdf
[83] https://www.gov.scot/publications/transition-land-use-agriculture-discussion-paper/pages/6/
[84] https://cerg.scot/wp-content/uploads/2022/09/CERG-Main-Report-2022-Updated-080922.pdf
[85] https://www.fas.scot/connect/net-zero-arran/
[86] https://www.nourishscotland.org/wp-content/uploads/2022/07/Report-Agroecology-facilitating-Mindset-Change-partnership-project.pdf
[87] https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2021/10/The-Finance-Gap-for-UK-Nature-13102021.pdf
[88] https://www.financingnaturerecovery.uk/barriers
[89] https://www.gov.scot/publications/interim-principles-for-responsible-investment-in-natural-capital/
[90] https://www.southofscotlandenterprise.com/news/naturalcapitalinvestment
[91] https://www.landcommission.gov.scot/downloads/648c2a7e6fbf0_Natural%20Capital%20and%20Land%20Reform%20Next%20Steps%E2%80%93Advice.pdf
[92] https://www.gov.scot/publications/transition-land-use-agriculture-discussion-paper/pages/6/
[93] https://vcmintegrity.org/
[94] https://icvcm.org/
[95] https://tnfd.global/
[96] https://www.financingnaturerecovery.uk/
[97] https://woodlandcarboncode.org.uk/
[98] https://www.iucn-uk-peatlandprogramme.org/peatland-code-0#:~:text=The%20Peatland%20Code%20provides%20assurance,made%20through%20rapid%20emissions%20reductions.
[99] https://www.nature.scot/funding-and-projects/firns-facility-investment-ready-nature-scotland
[100] https://www.financingnaturerecovery.uk/
[101] https://www.nature.scot/doc/investment-ready-nature-scotland-irns-grant-scheme-successful-projects
[102] https://www.nature.scot/doc/investment-ready-nature-scotland-irns-grant-scheme-successful-projects
[103] https://www.nature.scot/doc/investment-ready-nature-scotland-irns-grant-scheme-successful-projects
[104] https://www.riverwoods.org.uk/
[105] https://www.landcommission.gov.scot/downloads/648b037d8923a_Natural%20Capital%20and%20Land%20Reform%20Next%20Steps%E2%80%93Advice.pdf
[106] The current entire agriculture budget of £500m is less than half of the £1.2b needed to meet existing commitments through environmental land management in Scotland. https://www.wildlifetrusts.org/sites/default/files/2023-06/Finance%20for%20UK%20Environmental%20Land%20Management%2C%20June%202023.pdf