Barriers and Enablers for Water, Nature and Climate-Friendly Farming

June 2026

SAC CONSULTING
Part of Scotland's Rural College (SRUC)

Grounded INSIGHT

This report has been prepared for WWF Scotland and RSPB Scotland

Barriers and Enablers for Water, Nature and Climate-Friendly Farming

Date: June 2026

Prepared by: Fiona Salter, Dr Lorna Cole, Ellie Brodie and Jack Zuill

This report has been prepared exclusively for the use of WWF Scotland and RSPB Scotland based on information supplied by from 3rd party sources outlined within report. This work was supported through the FORTH$_2$O Commissioning Fund. The FORTH$_2$O Partnership (Stirling Local Policy Innovation Partnership) was funded by the Economic and Social Research Council (ES/Y502364/1).

All information is correct at time of writing.

We would like to thank WWF Scotland and RSPB Scotland for their comments and support throughout this project within the project steering group.

We gratefully acknowledge case study farmers and those participants to our questionnaire and focus group sessions.

Contacts:
Fiona Salter
Fiona.Salter@sac.co.uk

Environment Team
SRUC Edinburgh
Kings Buildings Campus
West Mains Road
Edinburgh
EH9 3JW

Revision Number	Date	Version	Author	Reviewer	Checker
1.1	26/05/26	DRAFT	L Cole	E Brodie	F Salter
1.2	24/06/26	FINAL	L Cole	E Brodie	F Salter

Contents

Introduction

Tackling climate change, biodiversity loss, while maintaining food production and protecting water resources are some of the most significant and interconnected challenges facing society. Following the Second World War, UK agricultural policy placed a strong emphasis on self-sufficiency in food production with a clear focus on increasing yields. This was supported through policies that encouraged intensification, alongside greater use of mechanisation, new technologies and agrochemical inputs. While this approach was effective in increasing production, it contributed to the long-term degradation of natural resources including soils, rivers, farm woodlands, species-rich grasslands and hedgerows.

These natural assets underpin food production by providing essential ecosystem services, including nutrient and water cycling, energy capture, pollination and the regulation of pests and diseases. Nature-based Solutions (NbS) protect, enhance and restore these natural resources to enhance ecosystem service delivery and are crucial to help us balance the demands of food production with environmental sustainability and climate resilience (IUCN, 2020). Within an agricultural context, NbS are typically delivered through water, nature and climate friendly farming practices, combining regenerative approaches to agricultural management with actions to protect and restore semi-natural habitats (Figure 1).

To respond to these challenges, water, nature and climate friendly approaches are now being reflected consistently across Scottish policy areas. This includes the Agricultural Reform Programme, the Scottish Biodiversity Strategy to 2045, River Basin Management Planning, the Scottish National Adaptation Plan (SNAP3), Net Zero Nation, the Good Food Nation (Scotland) Act and the National Strategy for Economic Transformation (NSET). Across these policy areas we are seeing ambitions to align outcomes for agriculture, water, nature and climate.

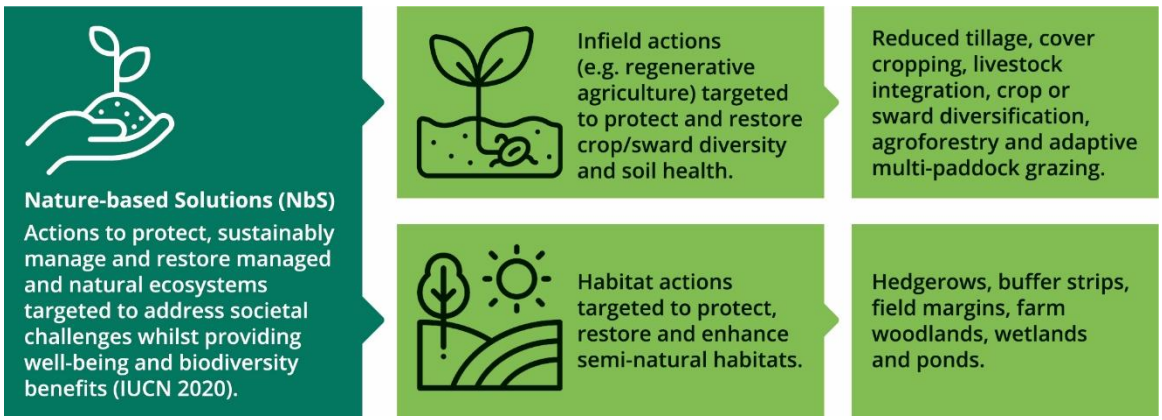

Figure 1: Nature-based solutions in the agricultural context

Alongside policy ambition, there is a need for practical, viable implementation on the ground to drive change and make meaningful progress. This requires a robust evidence base, effective advisory systems, and the skills, knowledge, and commitment of farmers and crofters. It also requires the financial resilience to manage the risks and costs associated with transitioning to new practices.

Using the Forth Basin as a focal area, this project examines the factors influencing farmers' decisions to adopt water, nature and climate friendly practices. Through stakeholder engagement, we explore the drivers of change, identify the barriers to adoption, and identify practical solutions to address these challenges. We focus primarily on NbS, whilst also recognising the role of technological (e.g. rainwater capture systems, nutrient budgeting) and social approaches (e.g. peer-to-peer support) as enablers of change. The project highlights key enablers of adopting NbS and through case studies it showcases examples of how farms putting NbS into practice.

By strengthening understanding of these enablers and constraints, the research will help build the evidence base helping WWF Scotland and RSPB Scotland inform and influence the direction of future policy. Ultimately, it will help to bridge the gap between policy ambition and delivery on the ground, ensuring that agricultural support, funding and policy are fit for purpose to support the uptake of water, nature and climate friendly practices.

Methodology

This project comprised of four key phases outlined below. All stakeholder engagement activities were reviewed and approved by SRUC's ethics committee ensuring adherence to ethical research principles (e.g. informed consent, voluntary participation, right to withdraw, accessibility). To ensure accessibility we gathered information through multiple formats (i.e. online/telephone interview, online workshops, questionnaire). Data collection, use and storage was compliant with GDPR and SRUC's institutional Data Protection Policy.

Through discussion with the Steering Group, all stakeholder activities were targeted to the Forth Basin, as shown in Figure 2, and to arable, mixed and productive grassland enterprises in this location. These systems represent a significant proportion of agricultural land use and offer the greatest opportunity to deliver measurable improvements for nature, climate resilience and water management at scale within this area.

Figure 2 Forth Basin Catchment study area

Advisor workshop

To provide a broad overview and inform the design of the questionnaire and land manager workshops, an initial online workshop was held with SAC Consulting advisors. Advisors included those specialising in farmland ecology with knowledge of the Forth Basin, alongside advisors carefully selected to ensure representation from Natural Capital and Women in Agriculture.

The aim of this workshop was to identify barriers and enablers for key practices, with information captured via Padlet[1] (an online visual collaboration tool). With advisors working across a range of farms, estates and crofts they bring a sound understanding of the challenges and opportunities facing different farming systems within the Forth Basin. This broader perspective complements the more detailed personal farmer insights gathered through the questionnaire survey and land manager workshop.

Advisors were first tasked with inputting thoughts on the perceived benefits that key practices provide (Table 1). Following this, advisors were then asked to identify barriers to implementation. Information was primarily captured via Padlet (Figure 3), with more informal discussions supplementing this information.

Farmer questionnaire

Following the advisors' workshop, a questionnaire was designed to further explore the reasons farmers implemented key measures and to identify key enablers and barriers. The questionnaire focussed on identifying the rate of uptake, reasons for uptake, alongside barriers to uptake of water, nature and climate friendly farming practices including actions to protect and enhance semi-natural habitats alongside regenerative practices (Table 1). The questionnaire also aimed to identify key enablers of uptake. The questionnaire was widely circulated through a variety of channels including email, webinars and on farm meetings. Circulation specifically targeted farmers in the Forth Basin, with arable, mixed or intensive grassland systems.

Table 1: Water, nature and climate friendly farming practices included in the questionnaire. Practices included in the initial advisor workshop are noted in bold.

NbS category	Actions
Habitat actions	Buffer strips over 3 m in width, Riparian woodlands (i.e. planting woodland along rivers), Hedgerows, Ponds, Wetlands
Infield arable actions	Cover crops, Reduced tillage or direct drilling, Incorporation of straw or organic matter, Livestock integration, Nitrogen-fixing crops, Variable seed or nutrient management, Agroforestry
Infield grassland actions	Strip grazing, Adaptive multi-paddock/mob grazing, Multi-species swards, Species-rich grassland, Agroforestry

[1] https://padlet.com/

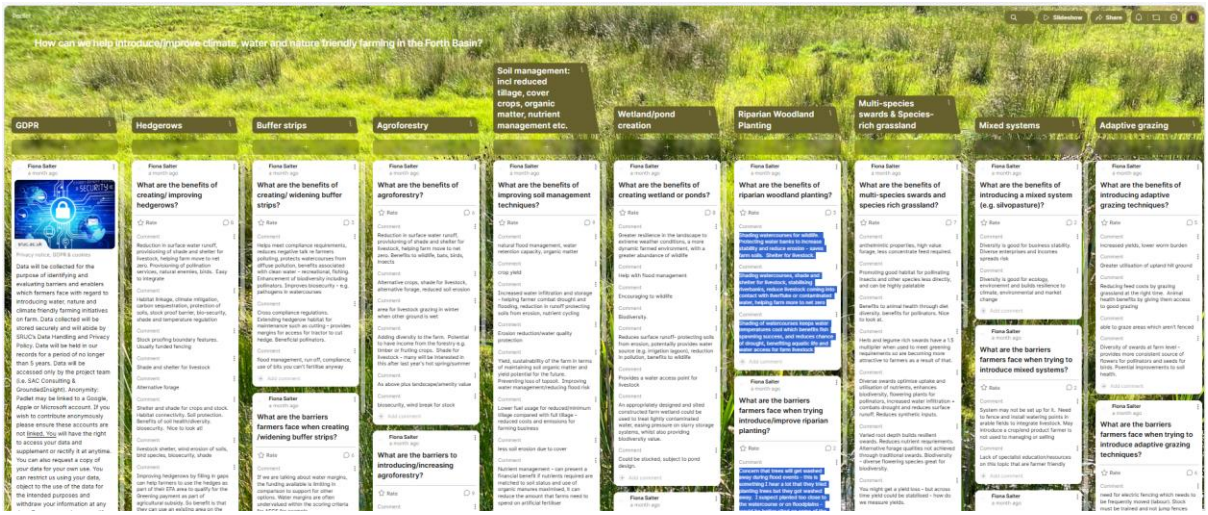

Figure 3: Example of the Padlet board used to capture advisory thoughts

One-to-one interviews

To increase accessibility and to provide more in-depth information on challenges farmers face when adopting more water, nature and climate friendly farming practices a series of one-to-one interviews were held via Teams or phone. In addition to determining challenges, these interviews also delved deeper into how individuals overcame these challenges. Through these interviews, we identified suitable case studies, which were written up to showcase uptake and innovation of NbS in Scotland.

Land managers' workshop

The final workshop focussed on trying to identify solutions and enablers that could help to overcome barriers identified through the advisor's workshop and questionnaire. For this workshop, a small number of farmers were targeted who had successfully implemented water, nature and climate friendly farming practices. This workshop focussed on five key practices, which either showed low uptake (e.g. agroforestry, wetland/pond creation) or where multiple barriers were identified (e.g. cover crops, integration of livestock, strip/adaptive grazing).

Results

Advisor workshop

The workshop was attended by seven advisors with experience ranging from three to 25 years, and included male (two) and female (five) advisors.

Perceived benefits

The perceived benefits of implementing key water, nature and climate friendly farming practices are summarised in Table 2, with a more in-depth overview provided in Appendix 1. It is important to note that this reflects the perspectives and discussions captured during the workshop rather than an exhaustive assessment of all potential benefits. For example, practices such as cover crops (considered under soil management) can contribute to Greening requirements. Nonetheless it provides strong insights into the benefits different practices provide.

All measures evaluated were perceived to have benefits for farm resilience with several also perceived to benefit the farm business indicating that benefits extend beyond environmental outcomes to increase the sustainability and long-term viability of farms. Additionally, nearly all actions were perceived to benefit water, nature and climate outcomes. This clearly demonstrates the multi-functional nature of NbS. Several benefits were associated with most or all practices including the protection and restoration of soils, water management, enhanced biodiversity, flood management, water flow regulation and mitigation of diffuse pollution.

It is important to note that this does not mean that these practices have the same impact. For example, soil management practices are likely to deliver greater outcomes for soil health than hedgerows. Similarly, practices may deliver similar outcomes through different mechanisms. For example, cover crops and the integration of organic matter reduce diffuse pollution by improving soil structure, increasing water infiltration, and reducing soil erosion and surface water runoff. In contrast, buffer strips intercept sediments and provide a buffer against infield practices reducing the risk of pollutants entering the watercourse. Similarly, different practices will support different elements of biodiversity with riparian woodland supporting aquatic life, and diverse swards supporting insects, pollinators and birds.

These findings additionally demonstrate that while many outcomes are delivered by multiple practices, others are delivered by a restricted number of practices. For example, the regulation of water temperature was primarily attributed to the creation of riparian woodland, with income diversification delivered by agroforestry and ponds (i.e. if stocked with fish). Different practices are complementary in the benefits they provide, thus a diversity of different practices is required to deliver a comprehensive suite of benefits.

Table 2: Benefits of habitat and infield measures as identified through the workshop with advisors (Please view Appendix 1 for additional detail)

	Farm resilience							Farm business					Nature			Climate			Water			Total identified benefits
	Shade and shelter	Alternative forage	Protects restores soil health	Biosecurity	Resilience: Pests, disease	Income diversification	Water management	Greening/Cross compliance	Public perception	Funding	Increased yields	Reduced inputs	Enhanced biodiversity	Habitat diversity	Connectivity	Carbon capture/storage	Flood management	Reduced emissions	Regulates water flows	Mitigates diffuse pollution	Regulates water temperature	
Hedgerows	■	■	■	■				■	■	■		■	■	■	■	■	■	■	■	■		16
Agroforestry	■	■	■	■		■	■	■					■	■		■	■		■	■		13
Diverse swards		■	■		■		■	■			■	■	■				■	■	■	■		12
Riparian woodland	■		■	■	■		■						■			■	■		■	■	■	11
Adaptive grazing			■		■		■				■	■	■	■			■		■	■		10
Buffers			■	■			■	■	■				■				■		■	■		9
Soil management			■		■		■				■	■					■	■	■	■		9
Ponds/ wetlands			■			■	■						■	■			■		■	■		8

Perceived barriers

Advisors were also asked about potential barriers to implementing key water, nature and climate friendly practices. Findings are summarised in Table 3 with a more in-depth overview provided in Appendix 1. As with benefits, this summarises the perspectives and discussions captured during the workshop, rather than an exhaustive assessment of all barriers. However, it provides strong insights into the broad barriers advisors have encountered across the Forth Basin, and wider.

Impact on productivity, costs associated with establishment, impact on pest, weeds and diseases, alongside policy and regulations, were the most common barriers identified. Additionally, lack of knowledge on establishment, interference with farming practices and costs and knowledge on maintenance were often frequently identified. Other barriers were consistently identified across measures, however, for particular measures these barriers could be quite significant (e.g. time commitment in adaptive grazing management, or lack of evidence for multi-species swards).

Table 3: Barriers for habitat and infield measures as identified through the advisor's workshop (Appendix 1 for additional detail)

	Impact on productivity	Impact of land value/ BPS	Costs of establishment	Costs of ongoing maintenance	Capital costs machinery	Labour/time	Pests, weeds, disease	Policy (e.g. EFA, GAEC, AECS)	Interference with farming practices	Risk of failure	Lack of knowledge: establishment	Lack of knowledge: maintenance	Difficultly in securing funding	New supply chains	Doesn't fit all situations	Public: Risks/perceptions	Lack of evidence
Hedgerows	■		■	■	■		■	■	■	■	■						
Agroforestry	■		■		■			■	■		■		■	■			
Diverse swards	■		■	■			■	■			■	■					■
Riparian woodland	■	■	■					■			■		■				
Adaptive grazing			■	■		■	■					■				■	■
Buffers	■		■	■			■	■	■			■	■				
Ponds/ wetlands	■	■	■				■	■			■	■	■			■	
Cover crops	■						■	■	■	■					■		
Reduced tillage	■				■		■		■	■					■		

Farmer questionnaire

Demographics

A total of 25 participants completed the survey of which 24 were farmers with 22 of these owning their land and two tenanted. The final participant was an advisor who ran a mixed farming system. Farms ranged in size from 54 to 2,500 hectares. The number of years in farming ranged from three years to 55 years, with 80% of participants being in farming over 10 years. While this demonstrates a high level of experience in participants, it does suggest that the views of new entrants may be underrepresented.

Most participants were farming either arable (48%) or mixed (36%) systems, with other systems (e.g. dairy, upland hill, lowland beef and sheep, cattle and hay systems) only represented by single participants. This reflects the focus of the study and subsequent targeting of participants to intensive farming systems within the Forth Basin where mixed and arable systems represent a substantial proportion of agricultural land use.

Nearly half the farmers (48%) had participated in Agri-environment and Climate Schemes (AECS), with a fifth entering the Forestry Grant Scheme. Participation in other schemes was relatively rare with only two participants securing funding from NatureScot's Nature Restoration Fund and one being involved in the Leven LENs. No participants had received funding through Peatland Action or SEPA's Water Environment Fund indicating the narrower scope of activities funded.

All participants were involved in at least one farm assurance or certification scheme, with 64% of participant in multiple schemes with Scottish Quality Cereals and Quality Meat Scotland the most frequent schemes (Figure 4). Additionally, over half of participants (52%) were involved in collaborative groups and again many farmers were involved in multiple groups including Leven LENs, Farm Advisory Service Groups, SAC Consulting Groups, RSPB's Corn Bunting Partnership, BASE UK, Tayforth Machinery ring, Women in Agriculture, Pasture for Life, NFUS, Regenerate Outcomes, Organic farmer WhatsApp, Dreel Burn, innovative farmers, and Carse of Stirling Partnership.

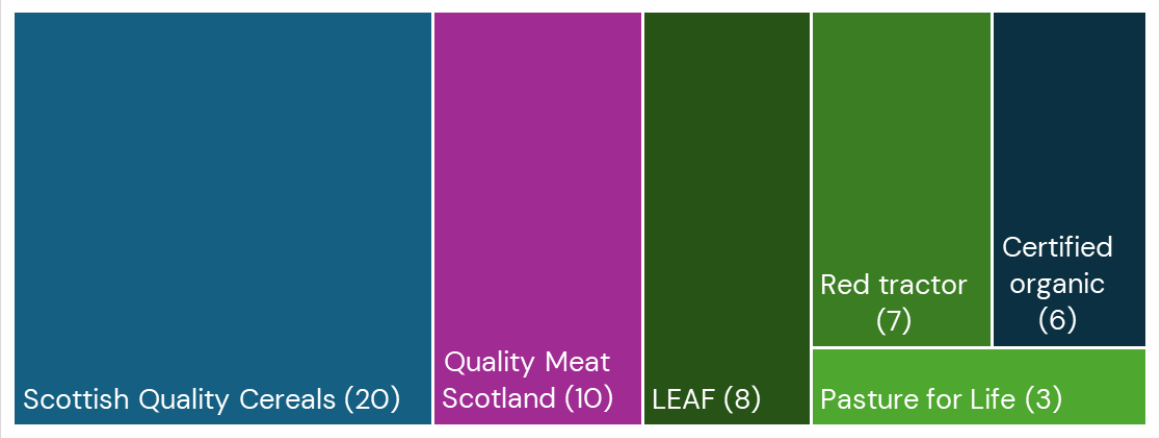

Figure 4: Number of farmers participating in specific farm assurance or certification schemes

Participants in the survey were well on the way towards completing their whole farm plan with 60% of participants completing all audits required for their holding. Across audits there was a high rate of completion, with the highest rate found for soil analyses

with 96% of participants had completed this, and the lowest rate for the biodiversity audit with 76% completion.

Collectively this demonstrates that within respondents there was a high level of farming experience and strong engagement with assurance schemes, collaborative initiatives and agri-environment schemes and initiatives. With participation being voluntary, the survey is likely to attract farmers already interested in, or practicing water, nature and climate friendly management and thus findings may not reflect the wider farming community. In addition, the number of respondents was low compared to the land area of the Basin.

Changes in biodiversity in the last 10 years

When asked how wildlife has changed on their farms over the last 10 years, 76% of farmers indicated positive changes with the remaining 24% indicating no change. There was little difference between farmers participating in environmental schemes (e.g. AECS, Forestry Grant Scheme or Nature Restoration Fund) and those who were not, with 77% of funded farmers and 75% of non-funded farmers reporting positive changes.

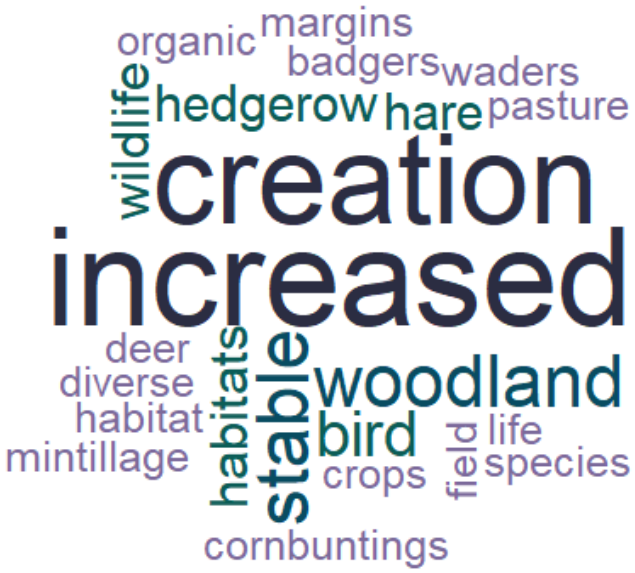

Figure 5 Word cloud reflecting farmers' perceptions on how wildlife has changed on their farm in the last 10 years

Open text answers are summarised as a word cloud (**Error! Reference source not found.**). This positive change was primarily related to actions on the ground including habitat creation (e.g. woodlands, ponds, hedgerows, and field margins) and the adoption of more regenerative agriculture (e.g. reduced tillage, cover crops, livestock integration and more diverse rotations/ swards). Increases in certain taxa were less frequently mentioned, however, these did include farmland birds (particularly wading birds and corn buntings), beneficial insects and brown hare. Several respondents expressed concerns over the rise of species that might adversely impact biodiversity such as predators (e.g. badgers, foxes, magpies and buzzards or deer). These concerns reflect findings in the literature demonstrating adverse impacts of increased predators on

ground-nesting waders and gamebirds (Roos *et al.* 2018) and the impact of deer on woodland creation and natural regeneration (Weaver *et al.* 2026).

Impacts of extreme weather in the last 10 years

96% of farmers indicated that in the past 10 years their business has been impacted by extreme weather with 36% of farmers considering impact to be slight, 56% moderate and 4% severe.

Where crop yield was applicable, 79% of farmers reported impacts of extreme weather with flooding and drought being most frequently identified (56% of respondents). 72% of respondents reported impacts on crop quality with the primary factor being drought (56% of respondents) followed by flooding (32%). Impacts on crop failure and the prevalence of pests, weeds and diseases were less common noted by 22% and 13% of respondents respectively. Where noted these tended to be associated with flooding.

For livestock, most land managers reported that extreme weather had little impact on production either with respect to milk yields (75% of respondents where this was applicable) or daily weight gain (81%), and where found this was typically relating to impacts of drought on daily weight gain (Figure 6). Similarly, most respondents indicated that extreme weather was not impacting on health (68%) or welfare (73%), and where impacts were noted these tended to be associated with flooding and extreme temperatures.

The question primarily reflected on negative impacts of extreme weather, with other impacts left to open text answers. These comments indicated the value of multi-species swards and longer rest periods in combatting drought, and the importance of soil health in building resilience. Additionally, one respondent posed concerns on how environmental regulations can reduce the ability to safeguard against extremes. One respondent highlighted positive impacts of extreme weather for both livestock and crops due to warmer drier summers noting “Cattle are doing better due to warmer summers, grain yields are up because there is more sun when grain seed is filling, harvests are easier as crops aren’t falling over due to rain in August”. This farmer further indicates the importance of good soil management in helping to deal with more extreme weather patterns.

Figure 6: Impact of extreme weather on farm outcomes. Depth of colour and counts reflect the number of respondents selecting a specific option with respondents able to select multiple options. Blank cells indicate a count of zero.

Uptake of water, nature and climate friendly measures

The most frequently implemented habitat-based measures were buffer-strips (84% of respondents), hedgerow enhancement (64%) and hedgerow creation (56%). Wetland creation had the lowest uptake with only 24% of respondents implementing this measure.

In arable land the most common infield actions were nitrogen-fixing crops (86% of respondents), cover crops (82%), reduced tillage (82%) and incorporation of organic matter (77%). Uptake of infield measures tended to be slightly lower in grasslands with 60% of livestock farmers adopting multi-species swards, and 53% adopting species-rich grasslands and adaptive multi-paddock grazing. In both arable and livestock systems, the least commonly implemented measure was agroforestry, and no livestock farmers implementing this measure.

The relatively high rate of uptake most likely reflects the farmers who participated in the survey, with those already interested in nature restoration and regenerative agriculture more likely to participate in the questionnaire.

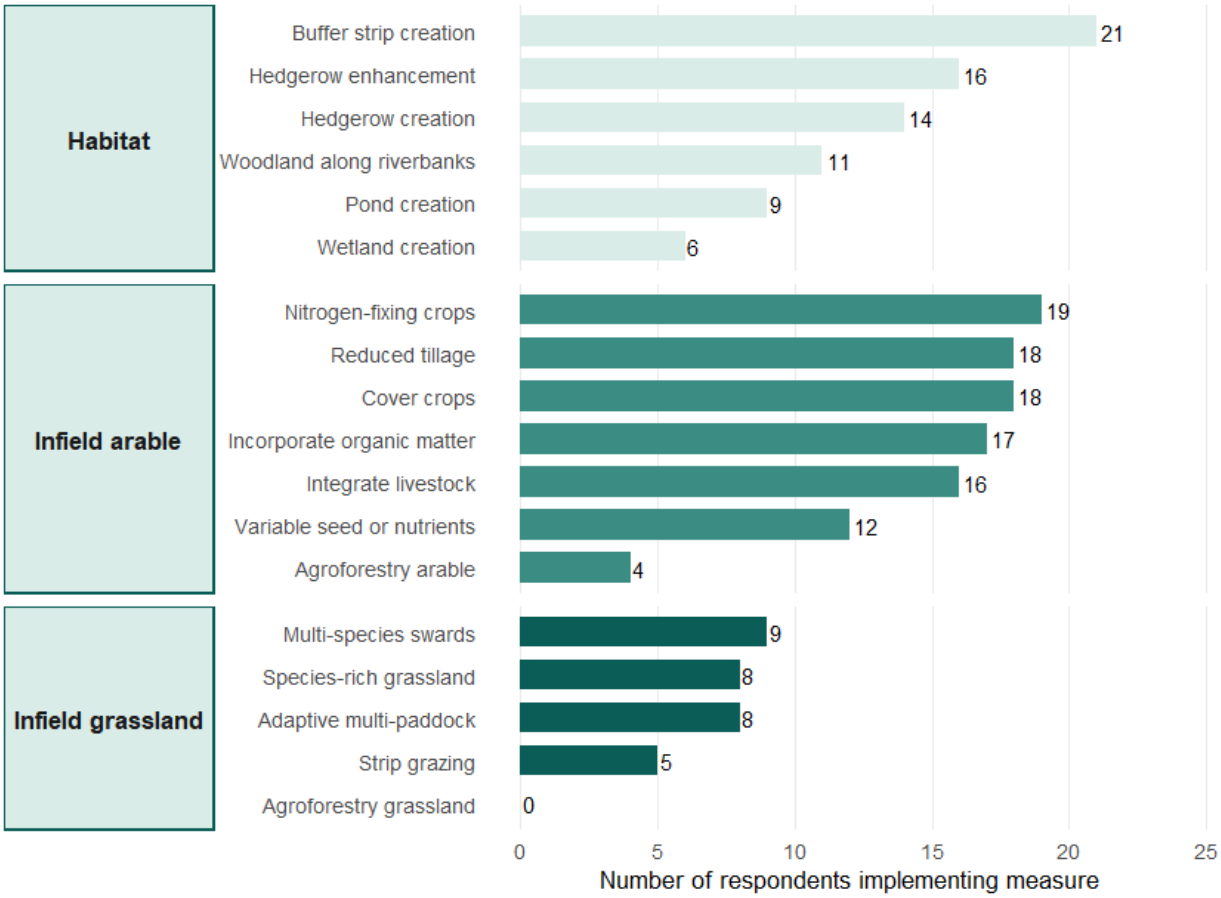

Figure 7: Frequency of uptake of different water, nature and climate friendly farming practices. For infield measures 22 respondents completed this for arable and 15 for grassland.

Key drivers of implementation

Respondents were then asked their primary reasons for implementing each measure, with farmers being able to select multiple options.

Habitat-based measures

For habitat-based measures protecting wildlife was a dominant reason across the board with other drivers deviating between different measures. For example, protecting rivers was a key driver for creation of woodlands along riverbanks and buffer strips. The importance of funding in driving decision making was also frequently mentioned, particularly for the creation of hedgerows and buffer strips. Buyer contract was rarely identified as a driver (i.e. one dairy farmer for pond creation, one arable farmer for buffer strip creation) highlighting that currently supply chain drivers were not major factors driving the implementation of habitat-based measures.

In addition to the reasons listed above, farmers were also provided with the opportunity to include additional reasons. These included the value of buffer strips in controlling public access (one respondent), and the value of hedgerows when it comes to stock proofing fields (one respondent), their amenity value (one respondent) and as shelter for both crops (one respondent) and livestock (three respondents).

Figure 8: Key factors driving the implementation of habitat-based measures.

Infield measures

In arable systems, the most common reason identified for implementing infield measures was to improve soil health, which was identified as a strong driver for all measures, except for agroforestry (Figure 9). Similarly, except for agroforestry the reduction of inputs and increased productivity/profit margin were also frequently identified. For infield measures, improving farm resilience was also identified relatively frequently, reflecting findings of the advisor workshop. While the protection of wildlife was a key factor in habitat-based actions, it was less frequently observed for infield arable measures (most frequently associated with cover crops). In agreement with habitat-based measures, buyer contract was not a key driver and was only mentioned by one arable farmer with respect to variable seed and nutrient management.

Additional reasons for implementation noted by farmers included experimentation noted by one farmer for agroforestry and one organic farmer noted that measures (i.e. cover crops, reduced tillage, incorporation of organic matter, livestock and nitrogen-fixing crops) were integral to organic their system.

While improvement of soil health remained a strong driver for most grassland interventions, increased productivity /profit margin tended to be the most frequent reason to implement measures, apart from species-rich grasslands where protection of wildlife was the most common reason. As with arable systems farmers noted the importance of infield measures at improving farm resilience with this measure frequently being mentioned except for strip grazing. Buyer contract was not mentioned as a key driver for the implementation of any infield grassland measures, reflecting findings for arable systems.

Protection of wildlife were also identified as important when it came to species-rich grasslands, multi-species swards and adaptive multi-paddock/mob grazing. With a reduction of inputs primarily associated with multi-species swards and adaptive multi-paddock grazing. In agreement with arable infield practices, buyer contracts were not driving decision making. Within free comments benefits to livestock and livestock productivity was mentioned for agroforestry.

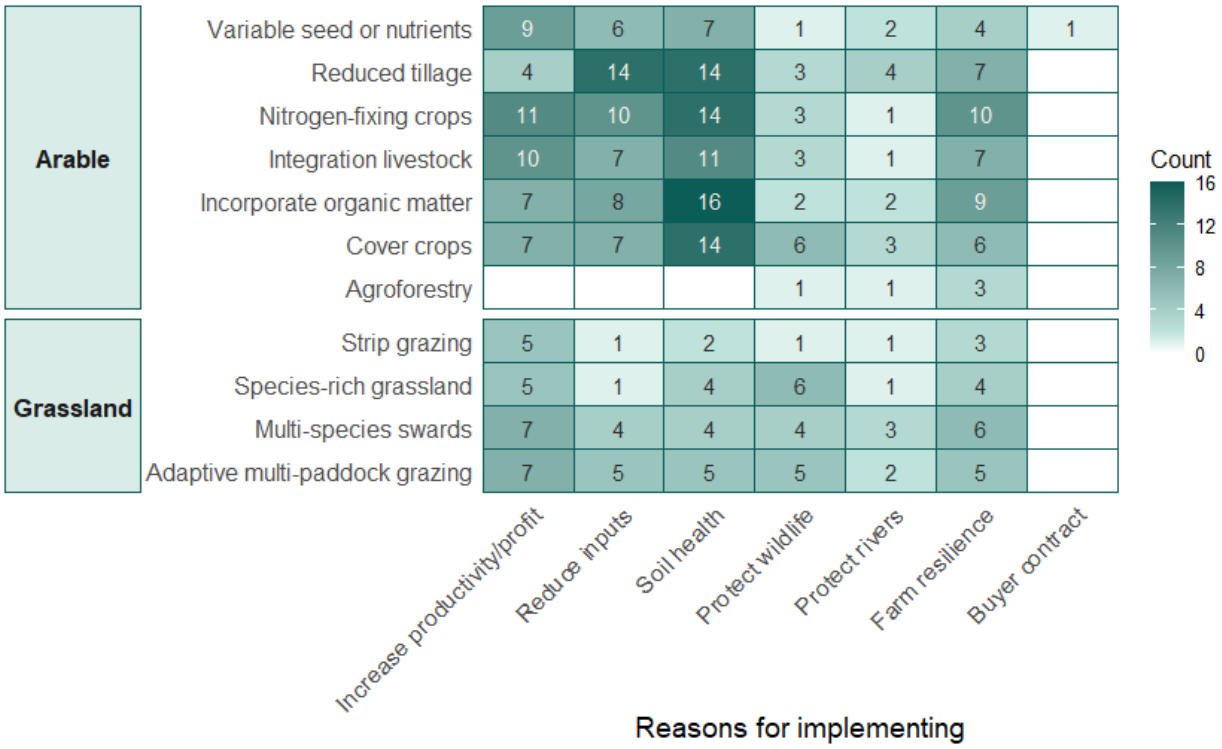

Figure 9: Key factors driving the implementation of infield measures. As agroforestry was not implemented in grassland fields this option is not included.

Challenges

Habitat-based measures

Most farmers faced challenges with respect to implementing habitat-based measures. The fewest challenges were reported for buffer strips with 28% of farmers facing no challenges (Figure 10). In contrast the highest challenges were reported for pond and wetland creation with 96% of farmers reporting difficulties in implementing these measures, this agrees with the comparatively low level of uptake of these measures.

Across habitat-based measures, the most frequently identified challenge was cost, with lack of time also identified as a key challenge particularly for hedgerow creation and enhancement. Impact on production was also frequently identified, however, this challenge was rarely noted for hedgerow creation or enhancement. Challenges relating to lack of advice, materials/contractors or knowledge were less frequently identified and when identified tended to relate to pond and wetland creation. The lack of evidence of benefits was more frequently noted for wetland and pond creation and the planting of woodland along riverbanks. Interestingly paperwork was only identified as a challenge when it came to implementing woodlands along riverbanks.

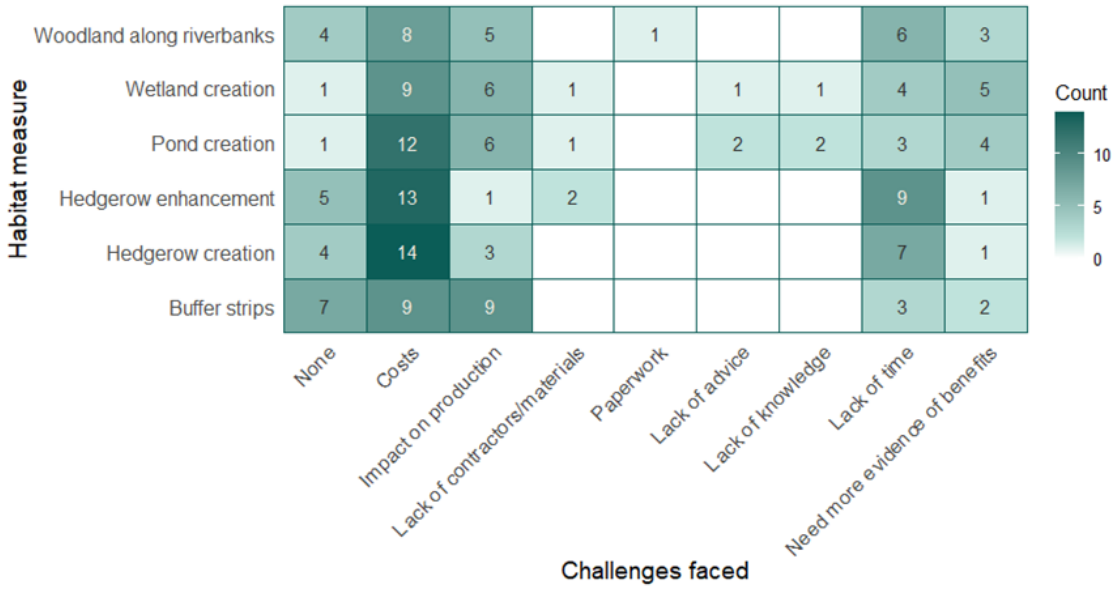

Figure 10: Frequency of challenges faced by respondents implementing habitat-based measures. Respondents could select multiple options.

In-field measures

For infield arable measures, the percentage of respondents reporting challenges varied between measures, ranging from 36% for nitrogen-fixing crops to 73% for agroforestry. This is in line with the low uptake of agroforestry in arable systems. For arable measures, the most frequently observed challenges were capital costs particularly for variable seed/nutrient management, integration of livestock, use of cover crops and agroforestry.

Several farmers expanded on challenges faced for infield arable measures. For cover crops the tight turnaround required between harvesting the main crop and establishing the cover crop was a highlighted by three respondents. Other challenges included the need for cover crops to be nutritionally beneficial to livestock and machinery requirements, with one organic farmer also highlighting difficulties in terminating cover crops in organic systems. Challenges to livestock integration primarily focussed on farm infrastructure (e.g. fencing and watering points) (two farmers), with lack of funding and restrictions on areas managed under the AECS also mentioned. Government restrictions on grazing cover crops were mentioned by one farmer, which most likely relates to previous restrictions on Ecological Focus Area cover crops (i.e. no grazing permitted before 31 December), a restriction that was removed in 2026[2]. With respect to reduced tillage, one farmer indicated difficulties when vegetables are included in the rotation (particularly when the land is rented out). For the incorporation of straw, one farmer mentioned that this is best done by nature, leaving stubbles overwinter to protect the soil, another farmer mentioned the fuel cost associated with chopping and incorporating straw.

[2] Greening guidance (2026)

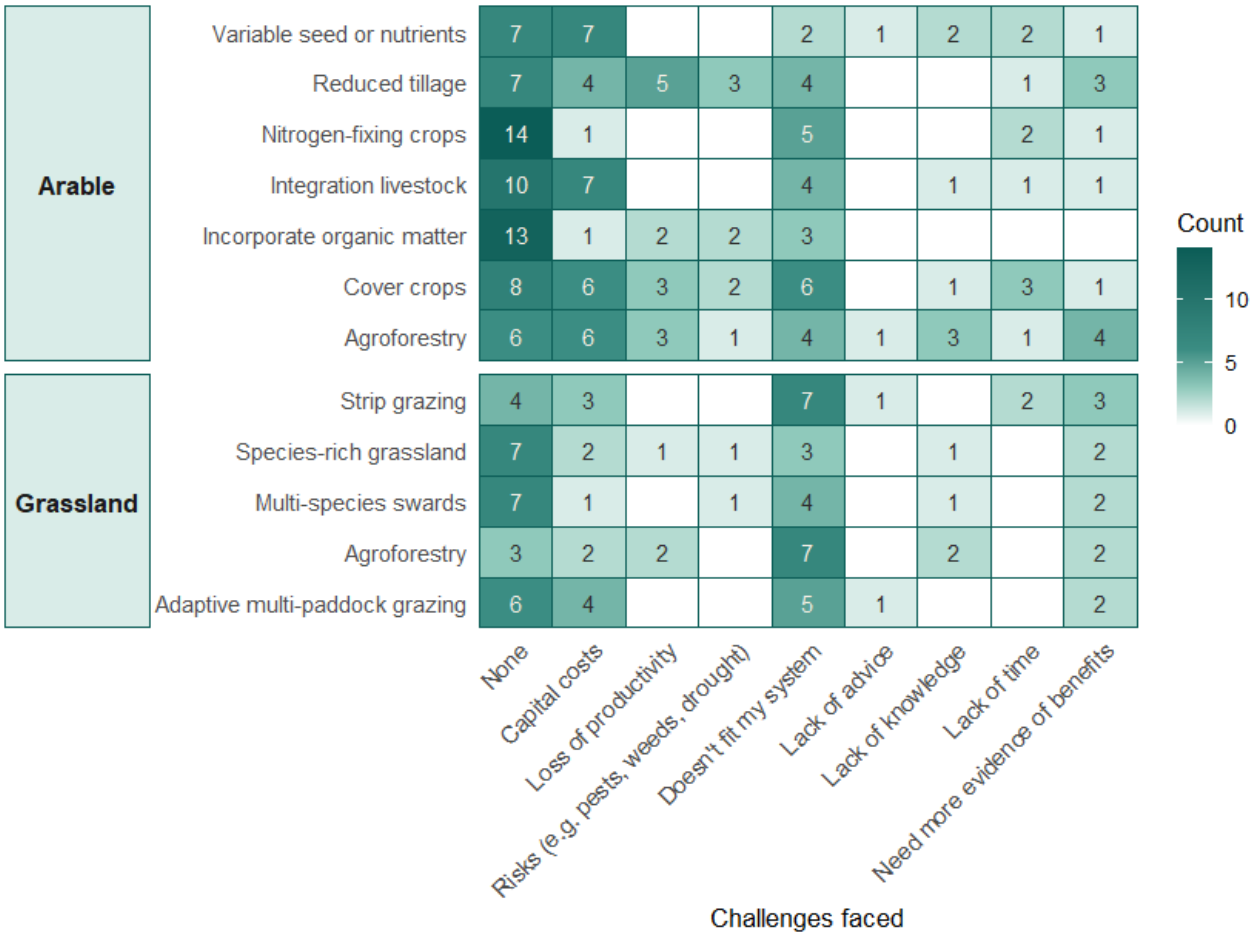

Figure 11: Frequency of challenges faced by respondents implementing infield measures. Respondents could select multiple options.

When it came to agroforestry, one farmer highlighted that funding was too prescriptive and didn't align with what their ambitions, this barrier was also identified in the advisor workshop. Climatic conditions and local issues reducing benefits to marginal levels were also mentioned for agroforestry.

As in arable situations, the number of respondents perceiving barriers to infield grassland measures also varied between practices (Figure 11). Multi-species swards and species-rich grasslands had the highest proportion of farmers reporting no challenges (47%), while agroforestry had the lowest (20%).

Capital costs were less frequently mentioned as a barrier in livestock systems with this primarily relating to implementing alternative grazing systems (e.g. adaptive-multi paddock/mob grazing or strip grazing). Across infield practices the most common challenge was a lack of fit to their farming system particularly for strip grazing, agroforestry, and multi-species swards. With 53% of livestock farmers implementing adaptive multi-paddock grazing, the lack of fit of strip grazing could be attributed to farmers already implementing an alternative system.

With respect to livestock measures, fewer farmers added additional comments. Those relating to agroforestry echoed arable systems, with respect to funding being too

prescriptive and not aligning with the farm's goals. Additionally, one farmer also mentioned the need to ensure that agroforestry fits with livestock farming, while another noted expense (assumption that this is non-capital expenses relating to ongoing management). One farmer indicated the overall challenge of livestock systems being capital intensive.

Loss of productivity or risks such as pests, weeds, disease and drought were rarely mentioned as challenges to implementing infield measures, with the exception of reduced tillage in arable systems (mentioned by five farmers). Lack of advice, knowledge, time and needing more evidence of benefits were again infrequently identified as a challenge for infield measures, with perhaps the exception of agroforestry in arable systems where the need for more evidence as mentioned by four farmers.

Enablers of adoption

Respondents were asked what would make it easier for them to adopt or expand on the water, nature and climate friendly farming practices outlined in the questionnaire. The two most frequently identified enablers related to funding, with both capital grants to cover upfront costs, alongside payments during transitioning. Furthermore, over half of respondents (56%) highlighted the need to simplify application processes. Again, relating to financial viability, market recognition or premiums were also mentioned by over half of respondents (56%).

Additional comments highlighted that public funding focussed primarily on implementation costs and failed to adequately account for income forgone or indeed the risks associated with change. The important role that supply chain initiatives could play in meeting this shortfall through market incentives was also noted by several respondents with one farmer noting *that "supply chain buy in is important for profitability"*. This demonstrates how a blended finance approach where supply chain initiatives. The value of landscape scale incentives at sharing learnings, and potentially reducing costs, alongside the importance of expert advice were also mentioned.

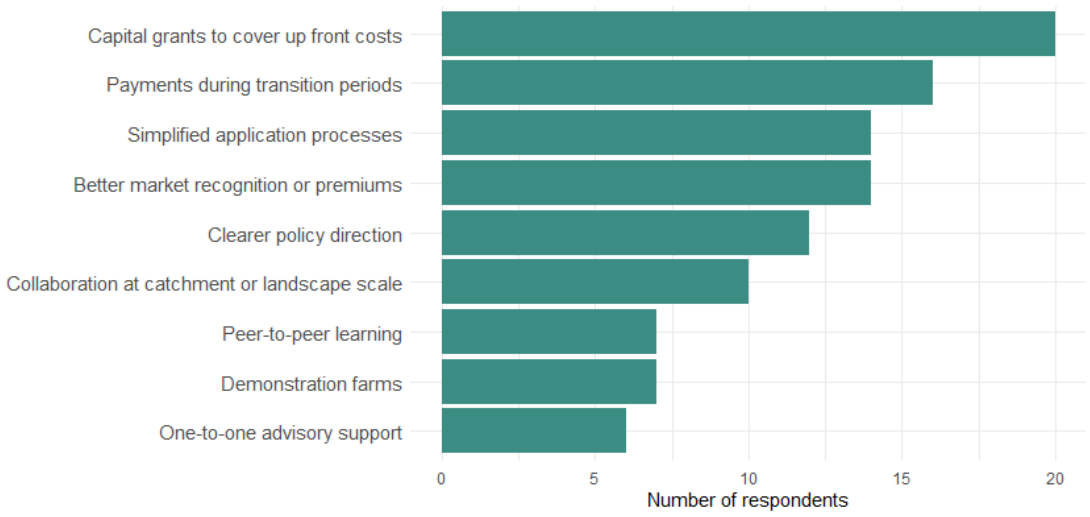

Figure 12: Enablers of adoption

Additional comments had a strong focus on the tight margins in agriculture and the need to buffer financial risks associated with change. One respondent's response captures these concerns "*Margins are razor thin and we simply do not have the ability to fund the investment or the flexibility to take risks with projects that will either take land out of production for a period or to cover the transition and inevitable mistakes we will incur moving to a different management practice.*"

Knowledge-exchange vehicles including demonstration farms, peer-to-peer learning and one-to-one advisory support were less frequently mentioned perhaps highlighting the high level of existing vehicles in Scotland. Such vehicles can play a clear role in promoting uptake and in reducing risks associated with change with one farmer highlighting that *"Change requires incentives and also expert advice"*.

Clearer policy direction was also mentioned by almost half of the respondents (48%) and comments related primarily to lack of stability and shifting goal posts. For example, one respondent noted that "*committing to something could end up being futile, unrecognised and unrewarded in the future."* As nature takes time to respond to change, there is a need for polices to recognise and reward continued commitment.

Facilitating collaboration

In response to question *What would encourage greater collaboration between farmers in the Forth Basin?,* a common theme that emerged was the importance for farmers to have shared goals. Many respondents also mentioned the importance of having supporting organisations and committed facilitators to advise, coordinate and drive action on the ground. The value of support in securing funding and navigating the complexity of different funding streams was further highlighted in the Land managers workshop (see below). The Forth Basin benefits from having several NGOs actively supporting landscape-scale action including Forth Rivers Trust, RSPB and Fife Coast and Countryside Trust. However, these organisations themselves rely on securing both project and organisational funding to maintain capacity and support delivery.

Several respondents touched on the importance of initiatives having clear benefits for farmers including recognition of results and financial incentives either through grants or supply chain initiatives like Leven LENS.

Collaboration not only requires commitment from facilitators but also from participants and several respondents identified lack of time as a major constraint with one farmer noting farmers "*are really really busy for most of the year*". Other aspects were the need for clarity and certainty on Scottish Government policy. One respondent highlighting that collaborative AECS can be difficult as neighbouring farms have contracts that start and end in different years.

Farm goals

When asked about the top three goals for their farm, respondents overwhelmingly emphasised maintaining financial viability with 22 out of the 23 farmers who responded to this question referencing profitability, income security, debt management or reducing costs. Environmental stewardship was another key theme, particularly improving soil health and sustainability, with water quality and biodiversity also mentioned. Several

farmers highlighted improving efficiency, retaining high welfare standards and building resilience within the farming system. A smaller number referenced social and personal outcomes such as family security, staff wellbeing, succession planning and work–life balance. Overall, responses highlight that alongside maintaining financial viability, farmers place considerable value on environmental stewardship and long-term sustainability.

Land managers' workshop

The final land mangers workshop was held to delve deeper into enablers and solutions to adopting key measures.

Wetland and pond creation

While the questionnaire identified costs as a key a barrier to pond and wetland creation, workshop participants highlighted that creation could often be achieved relatively easily onsite in areas prone to waterlogging. However, additional challenges relating to environmental regulations were noted associated with tree felling and potential impacts on rivers and drainage systems. Participants noted that advice and support from local organisations (e.g. Forth Rivers Trust, Fife Coast and Countryside Trust) are important enablers to help navigate environmental legislation and complete funding application. Furthermore, resources such as the Pond Creation Toolkit[3] can also help guide farmers through the required environmental checks and approvals.

The questionnaire also identified reductions in productivity as a key challenge, including increased risks of pests and diseases, land taken out of production (therefore removed from eligible BPS land), and restrictions associated with cross-compliance requirements (e.g. limitations on the application of manures and slurries within 10 m of a wetland). Workshop participants highlighted the wider biodiversity benefits provided by ponds and wetlands and suggested that such features should remain eligible for BPS funding. Participants also noted that while ponds and wetlands may take land out of production, they can increase resilience to climate change. For example, participants noted that ponds and wetlands can help reduce flood risk across a field through providing more concentrated water storage, similarly ponds can provide a water source for crop irrigation or livestock, potentially buffering against future restrictions on water abstraction licences.

In comparison to temporary measures such as species-rich field margins or bird cover, wetlands and ponds are more permanent features that once established are protected through environmental legislation. As such, they were perceived as particularly vulnerable to shifting policy. For example, new requirements introduced under GAEC 6 (Maintenance of soil organic matter) in 2025 now prohibit a range of activities around wetlands, including application of fertilisers/pesticides, planting of trees, or drainage/disrupting water flows.[4] This demonstrates the importance of long-term and consistent policy support, alongside management frameworks that balance environmental protection with the practical and economic viability of agricultural production.

[3] Pond Creation Toolkit - Freshwater Habitats Trust

[4] What's new from 2025 onwards?

Pond creation with Andrew Bayne-Jardine, Humbie Mains Farm, East Lothian

Humbie Mains Farm, is a predominantly arable farm focusing on barley and wheat, with areas rented out for livestock and potatoes, extending over 450 acres. The farm currently has three ponds. The first created historically for Humbie Mill is now a fishing pond. The other two ponds were created to deal with infield waterlogging in consistently wet areas allowing the farm to manage the land more efficiently. The newer ponds were created five and 15-20 years ago, respectively.

Figure 13 Humbie Mains Fishing Pond.

The ponds offer biodiversity improvements and are providing the farm with resilience to water scarcity. With extreme weather and predictions showing that periods of water scarcity may occur more often, the ponds provide a reserve of water to use at times of water shortage. While they have yet to use this resource, knowing that they have this back up provides reassurance in a changing climate.

The ponds have been self-funded and installed, using minimum equipment. The digging itself was conducted by a contractor who had access to a large digger, which made installation quicker. Following initial drainage problems, which needed to be addressed, the ponds have been excellent additions to the farm. The larger fishing pond requires maintenance work to ensure that leaks are addressed quickly but otherwise the ponds have been low maintenance providing aesthetically pleasing hubs of biodiversity on the farm.

While the farm is part of an AECS, these ponds were self-funded due to the arduous paperwork and time to gain funding limiting access to funds for pond creation. This is despite the AECS application for the farm being completed by local advisors, who have the experience and are able to negotiate the bureaucracy and complications of these applications. Due to the complexities of the application, farmers are hesitant to complete them themselves with Andrew noting:

"if I tried to do it on my own, I would undoubtedly fall at some hurdle. I'd fail at putting in the right tick in the right box. And, you know, I'd have then wasted 40 hours of my life failing to get the funding."

Having the right advice to access these schemes is great, however, for smaller projects it does not make financial sense, and farmers are left to implement the features

themselves, if they have the means and determination to do so. The Future Farm Investment Scheme (FFIS) has the potential to provide capital funding for actions such as pond creation, however, in 2025 this scheme was oversubscribed with many farmers left disappointed. Furthermore, as the FFIS does not account for income foregone farmers are left out of pocket. The high number of farmers applying for the FFIS demonstrates the will of the sector to improve efficiency, environmental sustainability and climate resilience. Sufficient funding for farmers to make small improvements on farm, collectively would make a big difference, with relatively low costs.

Figure 14: Humbie Mains wet area on field before pond creation

Figure 15: Humbie Mains Pond creation

Images courtesy of ABayne-Jardine

Agroforestry

Costs and perceived impacts on productivity were identified as key constraints to implementing agroforestry. The land managers workshop highlighted a lack of suitable markets for agroforestry products alongside limited experience engaging with these markets. One farmer noted that "*Market access is the key to unlocking trees on farm*". There is a need to identify viable outlets for tree-based products and to increase awareness of appropriate tree species, and market opportunities to support agroforestry as an economically viable enterprise. Participants highlighted they have seen silvoarable systems where arable crops were integrated with apple trees both in Sweden and in Fife[5].

Participants also emphasised the importance of ensuring grants are fit for purpose. Suggested improvements including increasing payment rates and recognising the long-term nature of agroforestry through longer funding agreements. In the advisory workshop, an advisor highlighted the potential of more flexible, scale-based, payments adapted to topography and land capability, noting that current planting density bands can be overly prescriptive. Additionally, workshop participants indicated there was often a short turnaround time between receiving funding and the deadline for completing the work. This short timeframe makes it difficult to source suitable tree species with local provenance and contractors, and there is a need to ensure that sufficient time is given to undertake the work.

Workshop participants highlighted that the more permanent nature of agroforestry means that potential future impacts must be carefully considered, and as with wetlands, they were perceived to be more vulnerable to changing policy. One farmer identified a "*mismatch between policy-changing timeframe and landscape-changing timeframe (policy changes much more quickly than landscape - so cannot be relied upon)*". This reinforces the important of long-term and consistent policy support.

The importance of research and knowledge-transfer and exchange in addressing skills and knowledge gaps was also highlighted. Participants identified a need for long-term studies to evaluate impacts on soils, crops and livestock health across varying weather conditions including "*the benefits for crops of agroforestry in a drought year versus a wet year"*. The value of peer-to-peer learning was also emphasised with suggestions for a FAS Connect group to share practical experience and best practice particularly "*for establishing trees in arable settings"*. Workshop participants felt this would be particularly valuable for silvoarable systems where the greater challenges were perceived.

Cover crops

A key barrier to the introduction of cover crops identified through the questionnaire was the short turnaround time between harvesting the main crop and establishing the cover crop, alongside the additional time commitment during an exceptionally busy period. To overcome these barriers, one participant described under sowing cereals and leaving the grass under-crop post-harvest to provide continuous ground cover post-harvest. Another farmer had mounted a broadcast seeding unit onto a cultivator, allowing seed distribution and incorporation in a single pass to enable quicker establishment whilst

[5] Growing apple trees and barley together in a silvoarable system

also reducing labour. The same participant was also considering "*broadcasting the cover crop into the standing crop*" to improve establishment opportunities within the narrow window. While adapting establishment techniques may help reduce these barriers, workshop participants highlighted the need for flexibility with weather varying from year to year. In some situations, participants suggested that establishing winter wheat, or simply retaining stubble, may be more practical than attempting to establish a cover crop under poor conditions. Peer-to-peer learning and knowledge exchange provide important mechanisms for sharing practical experiences and lessons learned from early adopters.

Participants reflected concerns raised through the questionnaire regarding cover crop termination in organic systems and potential implications of future restrictions on glyphosate use. One participant noted that grazing could provide an alternative to chemical termination, while another was trialling termination with a crimper and sowing directly into the residue, with the retained mulch helping to suppress weeds.

Workshop participants indicated that grazing of cover crops can both provide an economic return, whilst also increasing soil health and organic matter with one farmer highlighting it is "a win-win situation" if you can get the cover crop established. Cover crop selection was considered important to ensure palatability with participants identifying oil radish and buckwheat as less palatable, while rye and vetch were more readily grazed. 2026 changes to EFA green cover regulations give greater flexibility in management and remove some barriers to livestock integration, including increasing the number of plant species permitted and removing restrictions on grazing of EFA cover crops before 31st December[6]. However, participants noted additional restrictions for farmers in AECS with some infield arable options still restricting grazing either entirely (e.g. beetle banks), or until after 1st March (e.g. Unharvested Conservation Headlands for Wildlife, Wild Bird Seed for Farmland Birds).

Integrating livestock

Costs associated with fencing and water infrastructure were identified as key barriers to livestock integration. While AECS funding can support fencing when linked to hedgerow creation, participants support is unavailable where hedgerows are already present in addition to a cap that restricts the length eligible for support. Participants suggested that standalone support for fencing and watering points could facilitate livestock integration within arable systems, whilst also reducing grazing restrictions for some infield AECS options (see above).

Participants highlighted that electric fencing can provide a lower cost alternative to permanent fencing, although concerns were raised around reliability and risks associated with livestock escaping. Consequently, electric fencing was generally considered as only suitable when subdividing an existing stock proof area. One farmer suggested a perimeter fence around larger blocks of land (i.e. consisting of multiple fields) with electric fencing used to subdivide this block. This would reduce infrastructure costs whilst mitigating the risk of electric fences failing. Participants also stressed ongoing maintenance costs, with one farmer trialling metal fence posts due to

[6] Ecological Focus Areas

their longer lifespan. While capital costs are higher, this is somewhat counteracted by lower labour and maintenance costs.

Lack of knowledge of livestock husbandry, regulations and supply chains was also identified as a constraint to livestock integration for solely arable farms. However, participants highlighted growing collaboration between arable and livestock farmers including contract grazing arrangements and "*flying flocks"*. This allows arable farmers to gain many of the benefits of livestock integration without directly managing livestock. Workshop participants also highlighted the value of exchanging straw for livestock manure, where direct livestock integration was not practical. This would allow arable farmers to benefit from organic inputs without the infrastructure and management requirements associated with keeping livestock on site. One farmer described this as *"conceptually like virtual livestock integration*".

Participants noted collaboration can improve resilience in both livestock and arable systems. For livestock farmers this can help buffer the impacts of poor growing seasons through access to additional forage/straw. In arable systems increased in organic matter inputs can improve the water holding capacity of soils helping to reduce drought risk while also reducing reliance on synthetic fertilisers.

Alternative grazing systems

Costs associated with fencing and water infrastructure were also identified as key barriers to implementing alternative grazing systems (e.g. strip, adaptive multi-paddock or mob grazing). This was reinforced by workshop participants with one adopter indicating "*It is very expensive getting hold of fencing and water infrastructure*" while another highlighted logistical challenges including "*where to site fencing and water troughs and working out how big an area you need*". AECS funding for hedgerow creation was again identified as a vehicle to fund fencing alongside stock proofing larger land blocks, with electric fencing then used to subdivide paddocks to reduce infrastructure costs and risks associated with electric fence failure.

The questionnaire and advisor workshop identified time constraints as a barrier to implementing alternative grazing regimes. However, workshop participants who had adopted these systems didn't perceive time as a major barrier indicating that moving fencing, waterpoints and livestock took less than an hour a day. One farmer commented "*we all inspect our livestock daily so moving them takes little extra time and allows us to pick up problems with individual animals*". Another participant suggested that rather than increasing workload they just "*spend time doing different things*" noting that they had increased the length of their grazing season reducing the need for silage.

The perceived complexity of adaptive multi-paddock grazing systems was also identified as barrier to uptake, particularly with respect to determining stocking densities, grazing durations and rest periods. However, participants felt that these systems were becoming increasingly common, with growing availability of peer-to-peer support, case studies and advisory resources. Several participants suggested that while grazing calculations can initially appear complex, most farmers would develop an understanding of what works relatively quickly through practical experience, trial and error.

Kate Sankey, West Moss-side Organic Farm, Thornhill

Figure 16: Hay in the making. Image courtesy of KSankey

West Moss-side is a certified organic farm within the Carse of Stirling, situated beside the largest raised bog in the British Isles, Flanders Moss National Nature Reserve (NNR) and with the Goodie Water (tributary of R Forth) as one boundary. With a focus on conservation and peatland restoration, the farm aims to improve the ecosystem services provided by the land. Kate, with an environmental science and education background, began her journey at West Moss-side in 1991. When she took over the farm in 1999 it was a traditional Carse mixed arable, hay and sheep enterprise, but as a result of changing weather patterns, she now focuses only on the growing of hay/ haylage for sale, and for winter feeding for the small herd of rare breed Shetland cattle. The cattle are conservation graziers on the NNR in the summer months and play a role in peatland restoration. They are finished on farm and the beef sold direct from the farm. The hay fields and herbal ley support breeding farmland waders, in particular curlew and snipe as they are managed for hay and not silage, thus no cutting before 1 July. They are a rich resource for pollinators, and this grassland management is also enhancing the health of the soil.

Over the past 20 years Kate has embarked on several farm diversification ventures. The West Moss-side Centre is a converted hayloft and steading to create a workshop for Kate's basketry and a venue for craft courses, meetings and exhibitions. West Moss-side has benefited from many government agri- environment schemes (Countryside Premium Scheme, Rural Priorities SRDP, Farm Woodland Schemes -WGS/FWPS, and AECS) as well as the business diversification scheme (FBDS).

Figure 17: Shetland calves. Image courtesy of KSankey

The prime focus of the farm is on regenerative agriculture and nature restoration, but Kate's knowledge and experience extend beyond just the practice of farming the land. While running a functional farm she also has a deep attachment to the

landscape which is expressed through her creative basketry and weaving. On-farm, Kate has spent time and effort planting woodlands and trees (2.1 hectares in two parcels 1995 and 2000 together with willow and alder on the river edge), alongside actively aiding peatland restoration and flood management (with Scottish National Heritage[7] lag fen creation scheme 2015), and river restoration works leading to the arrival of beavers.

Kate began this journey by seeking government funding targeted through schemes and initiatives to improve water quality, biodiversity and reduce the impact of climate change on her farm. Through this process she successfully managed to gain funding, or part funding to deliver action on the ground. However, from experience and implementation she has witnessed the growing number of hurdles to jump through in pursuit of competitive grants. She has now moved away from applying for these schemes with Kate highlighting:

"filling in the form for a variety of different options in AECS has become too onerous specially as I have on principle resisted using a consultant as I believe it should be possible for a farmer to be able to make the application him/herself. I also found the requirements for the options too rigid - leaving no ability for making a decision based on local knowledge, experience or weather conditions. So, I then gave up with the government schemes apart from Organic Maintenance (AECS) and just have continued doing what I feel is beneficial to the environment."

From experience, the time taken to complete the forms, the complexity and requirements, alongside the rules and lack of flexibility when schemes are in place, has reduced the attraction to begin new projects through these schemes. West Moss-side is a small holding, and the requirements of the AECS options are not sufficiently flexible to suit the business size and needs. For example, with our changing and unpredictable climate the ability to make management decisions based on practicalities is becoming increasingly important. For example, having the freedom to make the decision to cut for hay on the basis of weather forecasting, rather than on a set date. Here on the farm, they are monitoring farmland wader breeding and they know when the birds have departed. Equally - mowing in a bird friendly way has major disadvantages – the cost of diesel to make extra runs and the resulting compaction on ground overrun. Understanding the breeding pattern of farmland waders is of course critical.

This is all possible with continued monitoring and allows business decisions to be made that suit both the environment and the business. However, the schemes do not allow this flexibility. In addition, the schemes were felt to be lacking sufficient follow-up and evaluation. Farmers put in extensive time and work to implement improvements on their farm through environmental schemes, however, there is no auditing process, or follow up visit to allow farmers to provide evidence that they have made real improvement through these schemes. Without evaluation farmers are left feeling that their actions are not fully recognised and appreciated.

The natural environment is not going to change significantly in five years, yes you can start to make good progress, but nature takes time to respond. Despite this, a lot of

[7] Now known as NatureScot

schemes are based on five years of funding. This timescale is not sufficient for nature, nor is it sufficient for the business enterprise, which often relies on management payments to maintain and further enhance habitats. At the end of the five years, there could be a shift in policy or funding resulting in schemes being abandoned, which is detrimental for the farmers and the environment. Time wasted and potential for making a true difference hindered. There needs to be longevity built into these schemes, such as the Nature Reserve Agreement for the NNR. Currently running for 25 years, with five-year reviews. This allows for long term meaningful management decisions to be made and implemented to the benefit of nature and the farm. The Lag Fen Creation scheme took more than five years to complete all the necessary surveys, feasibility studies, tendering process etc. The result was a demonstration of what can be done
The farmer sees win-win on both sides "*That's how we should be managing our land*".
A source of support for the long-term vision is through being a Northwood Partner (Scotland the Big Picture).

With future ideas of catchment scale projects to improve the Goodie Water and to continue the peatland restoration of Flanders Moss, West Moss-side Farm has great ambition and focus. The major barrier that Kate sees is that of executing that catchment scale approach. Bringing farmers together through a Farmers' and Land Manager's Network for the Upper Forth is being actively promoted with farm walks and events designed to share experience. The Carse of Stirling Partnership in collaboration with Forth Rivers Trust, Propagate Scotland and Glasgow Caledonian are funded (Forth$_2$0 and KTIF) to take this forward. However, how these plans will be implemented in practice is still uncertain. Securing financial investment and cooperation within an industry where most businesses are pushed to the limit, alongside the pressure of a changing climate presents significant challenges for regenerative farming and progress towards a Just Transition.

Figure 18: restoration works. Image courtesy K Sankey

Discussion

Over the course of this research, the factors influencing farmers' decisions to adopt NbS in the Forth Basin have been explored. This section draws together key findings and themes across the research.

Motivations and enablers to adopting NbS practices

Research participants identified financial viability as being their primary farm goal along with increasing both productivity and profit margins. Most participants in this study were already adopting positive practices, with almost half in AECS compared to 1 in five nationally[8] and the majority involved in one or more farmer-focussed Knowledge Transfer Exchange (KTE) groups. This suggests that the sample may represent farmers with a higher level of environmental awareness than the wider farming community and findings should be interpreted with this in mind. Despite this high level of environmental engagement, participants consistently framed decision making in business terms, with environmental action generally viewed as complementary to, rather than separate from, farm profitability and long-term business resilience.

Improving soil health emerged as a key driver for implementing in-field NbS including cover crops, reduced tillage and nitrogen-fixing crops. Given soil is the core business asset for arable and mixed farming systems, which made up most of the research participants, this finding is unsurprising. Healthy soils, underpin productivity through improved nutrient cycling, water retention and long-term agricultural performance demonstrating a direct link between NbS and business viability.

The importance of building resilience was further demonstrated with 96% of participants reporting impacts of extreme weather on production. With 2025 recorded as the driest year since 1971 [9], these findings indicate the vulnerability of the industry to extreme weather. NbS targeted to improve soil health can increase the soils capacity to uptake and retain water helping to buffer against drought and flooding thus supporting long-term business resilience (Cole et al. 2026).

In contrast to in-field actions, protecting wildlife was identified as the primary driver of uptake for habitat-based NbS including buffers strips and hedgerows. This could indicate that habitat-based measures are perceived to deliver fewer direct benefits to productivity when compared to in-field measures and are instead more about taking action for wildlife and biodiversity. However, these measures are also commonly supported through AECS funding, which may reduce financial barriers to adoption, and this may help account for their relatively high uptake among participants in this study.

Consistent with this, the two most frequently identified enablers of NbS adoption related to funding, with capital grants to cover upfront costs alongside payments during transitioning away from existing practices towards NbS (Mills et al. 2018).

[8] Evaluation and monitoring of the Agri-Environment and Climate Scheme | NatureScot

[9] Autumn water situation report 2025 | Beta | SEPA | Scottish Environment Protection Agency

Barriers and risks of adopting NbS practices

Although participants demonstrated a high level of environmental awareness and commitment, they nonetheless identified substantial barriers to adopting NbS which spanned financial, practical, and policy dimensions.

Financial viability and risks to productivity were identified as the most significant barriers. Participants highlighted concerns around the potential impact of NbS on farm productivity, the challenges associated with integrating new practices into existing farming systems, and the costs and financial risks associated with transitioning to NbS. Concerns were also raised regarding the potential threat of increased pressures from pests, weeds and diseases under alternative management approaches. Previous research has also demonstrated risks to production, and transition costs as key barriers to the implementation of environmentally friendly practices (Wreford et al. 2017).

Participants recognised that nearly all NbS actions deliver benefits across nature, climate, and water outcomes, with many also contributing to farm profitability and resilience, demonstrating the inherently multi-functional character of NbS (Miralles-Wilhelm 2023). However, the research indicates that current policy, regulation and scheme design fail to incentivise NbS effectively, which hinders their adoption.

Public funding for NbS remains focused primarily on implementation costs and does not adequately account for income forgone or the risks associated with change. Consideration should be given to enhancing options and payment rates for NbS, which support regenerative farming. In terms of scheme design, for example, the prevailing action-based approach does not reflect the holistic, systems-based and often unpredictable nature of ecological processes; nor the time required for benefits to materialise. Tailored approaches are needed for different NbS, especially where they involve change, which (a) may take years to bring benefits, such as agroforestry; (b) takes land out of production, such as wetland creation; (c) involves adopting new practices, such as integrating livestock into an arable system, and (d) is an unclear fit with the existing farming system and/or farm goals.

Over half of respondents (56%) called for simplification of scheme application processes. There is also a need for policy to recognise and reward continued commitment, given that working with nature can be unpredictable, non-linear and take considerable time for the benefits to be experienced (Reed et al. 2014).

At the policy level, a lack of clarity, instability and shifting goalposts undermines farmer confidence and incentive to adopt NbS. This uncertainty can disproportionately and inadvertently penalise early adopters of NbS who typically bear the highest levels of risk. Opportunities to blend public and private finance through supply-chain initiatives and other mechanisms could help reduce this risk and support longer-term implementation. However, opportunities to blend public and private finance are limited in Scotland, suggesting a role for policy to create enabling conditions (Cole et al. 2026).

Participants also cited regulatory requirements as creating additional constraints to NbS implementation. Environmental regulations were perceived to increase administrative

burden and, in some cases, reduce flexibility to implement actions in ways that align with business goals and operational needs.

Overcoming Barriers and Harnessing Enablers for Greater Uptake of Nature-based Solutions

Despite recognising significant barriers to adoption, many land managers in this study were already implementing NbS. However, our research suggests that many were doing so despite the prevailing system rather than because of it. Significant reforms are needed to move from the current context, which can constrain NbS uptake to one that actively enables it.

Risk allocation and systemic incentives

A central problem is that the financial and operational risks of adopting NbS are currently borne almost entirely by individual farmers. This is especially pronounced for permanent landscape features such as wetlands, ponds and agroforestry, which are precisely the interventions capable of buffering agricultural land, and the wider public, against extreme weather and long-term climate change. The public goods generated by such features, alongside benefits accruing to private actors such as insurers, water companies, and infrastructure providers, are not being distributed equitably across the system.

This misalignment of risk and benefit is a primary inhibitor of widespread NbS adoption. Consistent with WWF-Scotland's prior research,[10] nearly all participants reported direct experience of extreme weather events and, while not necessarily their primary motivation, many linked NbS practices explicitly to enhancing the resilience of their land.

Financing the transition

Estimates suggest that transitioning Scotland's land management sector to deliver on climate and nature objectives requires between £1.5 and £1.8 billion annually over the next decade.[11] This requirement sits in direct tension with anticipated reductions in Scotland's agriculture budget and real terms cuts to AECS funding.

Private finance such as natural capital markets and supply chain investments will be crucial to filling the funding gap, working with the Scottish Government and financial institutions to create an enabling environment that supports farm businesses in implementing NbS at scale. Mechanisms such as WWF's Agricultural Transformation Fund, which underwrites transition risk and distributes it more broadly across the system, is one example of how the burden on individual land managers can be reduced.

Knowledge, evidence, and advisory capacity

This research identified a clear role for evidence creation, knowledge transfer and exchange (KTE), and peer-to-peer learning in both overcoming barriers and enabling

[10] WWF Scotland. The Economic Impact of Extreme Weather on Scottish Agriculture, 2019. https://www.wwf.org.uk/sites/default/files/2021-04/Impact%20of%20extreme%20weather%20on%20Scottish%20Farmers%202018%20 FINAL.pdf

[11] https://www.wwf.org.uk/sites/default/files/2025-01/regenerative-agriculture-transition-scotland-roadmap.pdf

NbS adoption. Participants cited insufficient knowledge as a constraint, particularly regarding the establishment of NbS measures and their long-term effects on soils, crop productivity, and livestock health across variable weather conditions. Longitudinal, field-based research is needed to fill these evidence gaps.

Peer-to-peer learning emerged as a valued and underutilised resource. Participants suggested mechanisms such as Farm Advisory Service (FAS) Connect groups to facilitate the sharing of practical experience and established practice. WWF Scotland has previously called for year-on-year growth in the Scottish Government's budget for training, skills development and advisory services so that all farmers and crofters can identify opportunities and understand how climate change and the net zero transition will affect their businesses.[12]

Landscape-scale coordination and governance

Participants also highlighted the value of landscape-scale approaches in reducing costs, fostering learning, and enhancing the coherence of NbS implementation. Challenges extend beyond farm-level risks and costs to encompass market access, machinery rings and collaboration across catchments and landscapes. With a remit to deliver integrated land use, Regional Land Use Partnerships (RLUPs) have a clear role in this respect in coordinating investment for landscape-scale, catchment-wide delivery of the public goods which flow from the adoption of NbS by farmers and land managers.

[12] https://www.wwf.org.uk/sites/default/files/2025-01/regenerative-agriculture-transition-scotland-roadmap.pdf

Recommendations

By strengthening understanding of these enablers and constraints, the research aims to help build the evidence base to inform and influence the direction of future policy. Our recommendations focus on bridging the gap between policy ambition and delivery on the ground to help ensure agricultural support, funding and policy are fit for purpose to support the uptake of water, nature and climate friendly practices.

- **Provide more flexible and accessible funding:** Funding schemes should better reflect the diversity of farming systems in Scotland by providing greater flexibility in commitment level, range and combination of supported actions. For example, capital grants could support enabling infrastructure such as fencing and watering points to facilitate livestock integration or alternative grazing systems. Alongside support for whole-farm action, there is also a need for simpler, more accessible incentives that encourage incremental uptake of water, nature and climate friendly practices across all farms, including those where environmental management is not currently a primary focus.
- **Share transition risks and reward long-term commitment**: There is a need for schemes to better account for both the risks associated with transitioning to more water, nature and climate friendly systems, and the time lag before environmental benefits are realised. With profit margins in farming razor thin, it is important that farmers are supported during this transition period especially where changes involve financial risks (e.g. reduced productivity, upfront costs). Policies and funding schemes should recognise and reward long-term commitment and continued delivery with longer-term stability of regulations and support across Tiers. Ultimately it is essential that farmers are not penalised in the future for permanent-land use changes undertaken to provide environmental benefits (e.g. woodland or wetland creation).
- **Invest in advice, research and knowledge transfer and exchange:** Increased investment in independent advice, demonstration farms and peer-to-peer learning is critical to improve knowledge and reduce risks associated with adopting NbS. As NbS play an important role in building resilience to environmental, geopolitical and climate-related shocks, greater efforts are needed to raise awareness of their benefits and opportunities across the agricultural supply chain. On-farm experimentation, alongside long-term research and monitoring also have a crucial role to play to build understanding on the impacts of adoption on farm economic viability, resilience to future challenges including climate, market volatility and geopolitical shocks.
- **Strengthen mechanisms to blend private and public investment**: With public finances for nature restoration limited, the Scottish Government should support the development of natural-capital markets and other payment mechanisms that complement agricultural support schemes and attract private investment into

NbS. This would enable farmers and crofters to blend public and private revenue streams to improve the long-term economic viability of adopting NbS.

- **Support landscape-scale delivery:** Delivering change at the landscape scale requires a shared vision and common goals, both amongst land managers and stakeholders with a vested interest in the benefits NbS can provide. Farmers are often constrained by time and capacity, and consequently effective collaboration can frequently rely on organisations with sufficient capacity, local knowledge and funding to drive on the ground action. Uneven capacity across Scotland risks inconsistent uptake of NbS and should be addressed through Tiers 3 and 4 of the Agricultural Reform Programme and full rollout of Regional Land Use Partnerships.

References

Cole, L.J., McCarthy, J., McVittie, A., Buckingham, S., Barthelmess, V., Stevens, B., Audsley, R. (2026). *Natural Capital and River Basin Management Planning Protecting and Improving Scotland's Water Environment*. Main report. CRW2024_04. Centre of Expertise for Waters (CREW).

Miralles-Wilhelm, F., 2023. Nature-based solutions in agricultural landscapes for reducing tradeoffs between food production, climate change, and conservation objectives. *Frontiers in Water*, *5*, p.1247322.

Mills, J., Gaskell, P., Ingram, J. and Chaplin, S., 2018. Understanding farmers' motivations for providing unsubsidised environmental benefits. *Land use policy*, *76*, pp.697-707.

Reed, M.S., Moxey, A., Prager, K., Hanley, N., Skates, J., Bonn, A., Evans, C.D., Glenk, K. and Thomson, K., 2014. Improving the link between payments and the provision of ecosystem services in agri-environment schemes. *Ecosystem Services*, *9*, pp.44-53.

Roos, S., Smart, J., Gibbons, D.W. and Wilson, J.D., 2018. A review of predation as a limiting factor for bird populations in mesopredator-rich landscapes: a case study of the UK. *Biological Reviews*, *93*(4), pp.1915-1937.

Weaver, J., Park, K.J., Waddell, E.H., Kent, E., Guy, M., Watts, K., Tonhauser, E., Gill, R. and Fuentes-Montemayor, E., 2026. Deer activity limits tree recruitment in woodland creation sites. *Journal of Applied Ecology*, *63*(5), p.e70417.

Wreford, A., Ignaciuk, A. and Gruère, G., 2017. *Overcoming barriers to the adoption of climate-friendly practices in agriculture*. OECD Food, Agriculture and Fisheries Papers, No. 101, OECD Publishing, Paris.

Appendix 1

Table 4: Benefits for habitat and infield measures as identified through the advisor's workshop

Action	Benefits
Creating and improve hedgerows	**Benefits to farm:** Easy to integrate, EFA area - Greening Payment without taking land out of production, Shade and shelter for livestock and crops, Alternative forage, Improved soil health, Improved biosecurity, Stock proofing boundary feature (funded fencing), Provisioning of pollination services and natural pest control. **Climate:** Carbon sequestration and storage, Climate mitigation, Shade and shelter for livestock and crops. **Water:** Reduced surface water runoff, Reduced soil erosion. **Nature:** Habitat for pollinators, natural enemies, birds, Habitat connectivity. **Wider:** Aesthetic value.
Creating and widening buffer strips	**Benefits to farm:** Good use of less productive areas. Helps meet cross compliance regulations, Natural flood management, preventing loss of topsoil, positive public perception, enhancement of pollinators, improves biosecurity (reduces risk of livestock coming into contact with pathogens in the watercourse) **Climate:** Natural flood management. **Water:** Protects water quality, natural flood management, reduced soil erosion, benefits associated with clean water - recreational, fishing. Enhancement of biodiversity including pollinators, reduces pathogens. **Nature:** Enhancement of biodiversity including pollinators. **Wider:** Benefits associated with clean water (e.g. recreational use, fishing).
Agroforestry	**Benefits to farm:** Reduction in surface water runoff, provisioning of shade and shelter for livestock and crops, alternative forage, preventing loss of topsoil, biosecurity, diversification of crops and income (e.g. timber or fruiting crops), area to graze livestock in winter when other ground is wet. **Climate:** Reduction in surface water runoff, provisioning of shade and shelter for livestock and crops, carbon sequestration and storage. **Water:** Reduced soil erosion. **Nature:** Benefits to wildlife, bats, birds, insects, Increases habitat diversity **Wider:** Landscape and aesthetic value.
Soil management (reduced tillage, cover crops, incorporation	**Benefits to farm:** Prevents loss of topsoil, natural flood management, improve water management, increased crop yield, sustainability of the farm in terms of maintaining soil organic matter and yield, nutrient cycling, lower fuel use (reduced costs and emissions), lower fertiliser costs, increased profitability.

of organic matter, nutrient management)	**Climate:** Natural flood management, increased water infiltration and storage, reduced emissions. **Water:** Increased water infiltration and storage, reduced soil erosion, protects water quality.
Creation of ponds or wetlands	**Benefits to farm:** Natural flood management, reduced surface water runoff, prevents loss of topsoil, water source for livestock and/or irrigation, constructed wetland could treat lightly contaminated water easy pressure on slurry storage, alternative income (e.g. fishing). **Climate**: Natural flood management, landscape resilience to extreme weather. **Water:** Natural flood management, reduced soil erosion, reduced surface water runoff. **Nature**: Benefits biodiversity, habitat diversity.
Planting woodland along riverbanks	**Benefits to farm:** Protects banks from erosion, shade and shelter for livestock, reduced risk of livestock coming into contact with liverfluke and pathogens, reduced drought, flood risks. **Climate:** Regulated watercourse temperature, sequestration and storage of carbon, natural flood management, reduced drought risk. **Water:** Regulate watercourse temperature, protect banks, reduced soil erosion. **Nature:** Regulate watercourse temperature, benefits fish and aquatic life.
Multi-species swards, species-rich grasslands	**Benefits to farm:** Anthelmintic properties, high value forage, diverse livestock diet, better uptake and utilisation of nutrients, less concentrate feed required, promotes pollination services, EFA to meet Greening requirements (1.5 multiplier), reduced risks of drought and flooding, soil health, reduced synthetic inputs, sward resilience, more stable yields over time. **Climate:** Reduces drought and flooding, sward resilience, reduced inputs. **Water:** Increased water infiltration. **Nature:** Benefits biodiversity including flowering plants and insect pollinators. **Wider:** Aesthetic value
Adaptive grazing techniques	**Farm benefits:** Increased yield, lower worm burden, increased efficiency in upland hill ground, reduced feeding costs, forage quality and health benefits, improved soil health, pollination services, reduced risk of drought. **Nature:** Structural diversity of habitats, biodiversity benefits including plants, birds and pollinators. **Water:** Reduced surface water runoff, reduced erosion

Table 5: Barriers for habitat and infield measures as identified through the advisor's workshop

Action	Barriers
Creating and improve hedgerows	Loss of productive land, GAECS regulations re land within 2 m of centre of hedge, difficulty in knowing the best species to plant, risks of failure (e.g. due to drought or grazing by livestock or wild animals), costs of establishment (fencing, planting) and maintenance (e.g. cost of contractor, hedge trimmer), shading crops, hedge species penetrating the field, not easy to get permission to remove.
Creating and widening buffer strips	Loss of productive land, costs of fencing, maintenance of fencing, width of drill, changing policy (e.g. Greening width of field margins in EFA), limited funding options and undervalued within AECS scoring criteria.
Agro-forestry	Loss of productive land, over prescriptive grants (two planting density bands that require uniform planting) and fail to cover costs, knowledge on suitable trees for alternative forage, toxicity of some trees, Lack of knowledge/skills on establishment/ management, navigating new income streams and supply chains, equipment costs, high costs associated with silvopastoral systems - individual tree guards, damage to field drains, permanency of land use change (planting trees might mean that you can't then change the use of that field from say PGRS to arable in future years), future policy change.
Soil management (reduced tillage, cover crops, incorporation of organic	General: Risks of change and loss of yield when refining techniques, impact on yield especially when combined with emerging extreme weather, issues in some soils. Reduced tillage: Lack of machinery, uncertainty over pesticide availability, risk of loss of yield/ income when transitioning. Cover crops: Tight turn around between harvest and requirement to replant, risk of pests/diseases Organic matter: Concern around using some organic materials (contaminants, biosecurity), lack of machinery.
Creation of ponds or wetlands	Cost of implementing, knowledge and skills on creation (e.g. suitable hydrology) and maintenance, process of acquiring permissions (where necessary), loss of productive land, safety (livestock, public), loss of eligible land (impact on BPS), difficulty in securing funding, pest and disease risks (e.g. liver fluke).
Planting woodland along rivers	Costs of establishment, difficulties in establishment, lack of knowledge on the right tree species, loss of productive land, loss of eligible land (impact on BPS), process of acquiring permissions.
Multi-species swards, species-rich grasslands	Cost of establishment, loss of productivity, can require more frequent reseeding (i.e. some species fail to establish or persist), not meeting requirements if fails (e.g. Greening), intensive sheep grazing reduces survival of certain species, lack of evidence regarding yield gap between multi-species sward and conventional ryegrass/clover swards, lack of knowledge on establishment and management, lack of understanding on different seed mixtures their costs, benefits, and management, Identifying an appropriate seed mix, risk of bloat/weeds.
Adaptive grazing techniques	Cost of establishing and maintaining infrastructure (fencing, watering points), labour to manage electric fences/move livestock, lack of knowledge on stocking densities and timing and frequency of moving, stock must be compliant, risks of electric fences breaking/failing, public perception - lots of animals in a small space, lack of evidence on benefits to production.