Exploring present and potential integration of Natural Capital into policy processes – insights from Agricultural policy in Scotland

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Contents

List of figures

List of Tables

List of acronyms

AAP	Academic Advisory Panel
ARP	Agricultural Reform Programme
CAP	Common Agricultural Policy
ENCA	Enabling a Natural Capital Approach
DEFRA	Department for Environment, Food & Rural Affairs
JAC	June Agricultural Census
LiDAR	Light Detection and Ranging
LUC	Land Use Consultants Limited
M&E	Monitoring and Evaluation
MRV	Measurement, Reporting and Verification
NC	Natural Capital
OECD	Organisation for Economic Co-operation and Development
RESAS	Rural and Environment Science and Analytical Services Division
ROAMEF	Rationale, Objectives, Appraisal, Monitoring, Evaluation and Feedback
SAF	Single Application Form
SEA	Strategic Environmental Assessment
SEPA	Scottish Environmental Protection Agency
WFP/WFPs	Whole farm plan/Whole farm plans

Summary

Agricultural policy is a policy area with strong dependence on nature; and also with great influence over the state of our natural resources. In Scotland, agricultural policy is undergoing a significant transition. The Scottish Government has been developing a new agricultural policy which includes an envisioned commitment to support 'Natural Capital' (Scottish Government, 2022). 'Natural Capital' is a representation of nature intended to make nature's values better reflected in decision-making.

This report builds on a collective discussion in late 2025 with Scottish Government staff involved in the development and future evaluation of agricultural policy, reflecting on data needs, gaps and how a natural capital approach can be connected with agricultural policy. It also incorporates insights from a set of 2024 interviews with Scottish Government staff involved in this process, and our desk analysis of agricultural policy process.

The **aim** of this process was **to explore if and how Natural Capital (NC) data or tools are or could be used in policy processes, especially future monitoring and evaluation, related to Scotland's future agricultural policy**.

We asked:

- *What are the current key issues in the use of NC evidence in policy development for agriculture in Scotland?* We found the use of NC evidence in the Scottish agricultural policy development is currently shaped by the **need for clearly defined indicators and baseline data**, that depending on topic it might still need to be collected or harmonised. As a result, the integration of NC evidence on different topics poses different types and extent of challenges, and is happening at different paces.
- *To what extent is NC-related evidence or tools seen as salient to agricultural policy evaluation in Scotland?* NC-related evidence is seen as particularly relevant for evaluating objectives related to pro-environmental goals (e.g. on-farm nature restoration, on-farm climate mitigation) or changes in the management of natural resources (e.g. regenerative agriculture), and it might be **best integrated into policy evaluation as cross cutting evidence base**.
- *What is the potential to incorporate existing tools related to NC into future agricultural policy development?* Existing tools such as Defra's Enabling a Natural Capital Approach (ENCA) toolkit hold considerable potential for supporting policy development; but using ENCA requires knowledge transfer and capacity building efforts.

Our findings highlight the importance of considering both different topics related to NC and also different stages of the policy cycle for understanding the potential use of NC evidence in agricultural policy. Discussion with our participants noted several priorities to address:

- **NC is potentially related to several objectives for agricultural policy**, including adoption and use of sustainable and regenerative agricultural practices and on-farm nature restoration, climate mitigation and climate adaptation.
    - Therefore, clearly delineating how its connection to a monitoring and evaluation framework is needed, to clarify the purpose of monitoring and help make any choices about accessing or collecting new data.
- **Integrating NC into policy development is limited by the lack of clearly defined baseline data**. A baseline would fulfil different roles across the policy cycle: evidence to inform strategic direction and goals-setting (rationale and objectives), support decision-making on the definition of targets and the definition of indicators (appraisal and formulation), specification of support schemes (choice and application of policy instruments), and required

point of reference for monitoring and assessing progress and impact of the policy (monitoring and evaluation).

- A framework for monitoring and evaluation (M&E) of the new agricultural policy is currently under development by Scottish Government, so should show the connection with NC topics, to supports its meaningful integration across the policy cycle.

- **The NC data identified by the participants in the agricultural policy cycle was varied and diverse** in topic, source, scale, and scope. A range of specific NC aspects referring to regulating ecosystem services and aggregated ecosystem services were considered regarding data needed in the agricultural policy cycle: soil health, water quality, habitat, nutrients, biodiversity, vegetation, designated sites and carbon storage. In 2020 DEFRA began curating a collection of datasets and tools for enabling a natural capital approach to help decision-makers, known as 'ENCA' (Enabling Natural Capital Approach'). ENCA is especially oriented to support decision making in the public sector, especially but not exclusively analysts supporting policy appraisal, yet it was not familiar to the staff we engaged with.
  - Capacity-building about ENCA and sharing detail of its integration into real-life policy development would help to understand how to select and work with its tools; complemented by insights about what data are relevant to or separately available for Scotland.
- **Different topics that comprise NC data have the potential to be integrated at different paces** depending on the availability of existing data or clarity of metrics and methodologies for monitoring, or ability to access information. There are many potentially relevant sources of data, ranging from earth-observation systems such as light detection and ranging (LiDAR) to on-farm level microdata captured through the Whole Farm Plans (WFP), or administrative data captured through the Single Application Forms (SAF) and statistical data from the June Agricultural Census (JAC). National level NC data (e.g. National NC accounts) were not mentioned. What is easiest to monitor may tends not to lead to a balanced insight on all relevant aspects of NC.
  - Accessibility and robustness of some potential new sources – especially from the WFP, but also from new technologies – needs clarity. Then, understanding the pros and cons of accessing data across the different topics (in terms of cost, reliability, coverage etc) needs joint appraisal, to identify a monitoring mix that gives balanced and feasible coverage of NC in evaluation.

Overall, there is not yet a strong connection between NC and the practices of policy development: despite the opportunity posed by reforming agricultural policy, coupled with promotion of NC ideas and tools. However, there are clear opportunities and interest to do more.

Recommendations and next steps:

The general insights about what may help staff work with NC in policy development – e.g. capacity-building, real-life examples, and self-appraisal of current processes – should also be relevant to other policy areas. **RESAS and research providers** can have a key role to play in provision of data and expert support to analysis that can be used in policy development, but **policy teams** need to work with them to identify the opportunity to link to specific tasks in different stages of the policy cycle for their specific domains, which may need endorsement from **leaders** in and above those teams and connection with expertise and initiatives for change management. There are also opportunities to work with **actors beyond Scotland** to support Scottish policy development that links with natural capital. In particular, liaison with DEFRA and any UK government policy teams who have used NC

evidence in policy development, and academic experts. In the coming year we plan to discuss these ideas with staff working in other policy areas; we also hope to support capacity building on ENCA with agricultural staff.

Introduction

Natural Capital (NC) is a representation of nature in anthropocentric and economic terms, intended **to allow nature to be better accounted for in decision-making** (Bateman and Mace 2020). A natural capital (NC) approach is increasingly being endorsed as a means to help better consider the natural environment within decision making processes. By demonstrating the importance of services provided by nature, it should enable wise allocation of public sector resources to support these services and generate long-term societal value (Binner et al., 2025).

The Scottish Government has endorsed working with NC (Claret et al. 2018). In the Scottish Government, the term Natural Capital or related terminology is used within hundreds of strategic documents issued by various policy teams (Claret et al., 2018). Scotland has two sets of national-level metrics available explicitly framed in terms of Natural Capital (Scottish Government, 2024b; (McKenna et al., 2019) that feed into 2018 Scotland's National Performance Framework[1], the means by which Scotland's public sector holds itself to account (Mackie, 2018). However, recent research has found a lack of confidence in working with NC amongst policy-makers in the Scottish Government (Waylen et al. 2026).

Agricultural policy is one of the policy areas which is especially affected by and affecting the quality of the natural environment (Maes et al., 2020). However, agricultural policies worldwide often have not been strongly linked to NC data or tools (Martino et al., 2026).

In Scotland, the agricultural sector has over £7 billion of its direct and indirect outputs dependent on natural capital, with over £3 billion of this total due to the industry's dependence on ecosystem services such as climate regulation, soil quality, and pollination (Scottish Government 2026a). Scottish agricultural policy has been undergoing a significant transition, as Scotland is no longer obligated to follow the structures and processes of the European Union's Common Agricultural Policy (CAP). Since 2021 the Scottish Government has been developing a new agricultural policy (Scottish Government 2021), via an Agricultural Reform Programme (ARP). The vision for the new agricultural policy includes a commitment to supporting natural capital (Scottish Government, 2022). Thus, exploring if and how NC is accounted for and integrated into the agricultural policy offers a unique opportunity to understand the integration of NC into policy processes.

The aim of our study was to explore if and how natural capital data are used in policy processes and might be used in future policy monitoring and evaluation processes, specifically in the agricultural policy context. We asked the following research questions:

- What are the current key issues in the use of NC evidence in policy development for agriculture in Scotland?
- To what extent is NC-related evidence or tools seen as salient to agricultural policy evaluation in Scotland?
- What is the potential to incorporate existing tools related to NC into future agricultural policy development?

To answer these questions, we studied Scotland's developing agricultural policy, and discussed the views on NC and agricultural policy with staff involved with this process. In the first stage ('Agrichats

[1] The National Performance Framework is under review. The draft National Performance Framework proposals as per February 2026 (Deputy First Minister and Cabinet Secretary for Economy and Gaelic, 2026) includes a new national outcome referring to "living in a healthy environment, enjoying the natural environment and protect it for future generations". However, the terminology "Natural Capital" does not appear in the draft proposals at this stage.

1.0') in late 2024 we conducted qualitative interviews with staff connected with the ARP to see if and how they are familiar with or using the concepts of natural capital. This has already been reported in detail in Valero et al (2025). Then in a second stage of work ('AgriChats 2.0') a collective discussion in late 2025 deepened reflection on data needs, gaps and opportunities to connect NC with agricultural policy, especially in evaluation. This report describes the detail of AgriChats 2.0, then looks across both phases to summarise insights and explore implications for connecting NC into policy.

Background to this study

In the following section we introduce the bodies of work that shaped this study. First though, we briefly review the meaning of the 'term' Natural Capital then we review the concept of the policy cycle, and literature on how environmental data is used in agricultural policy processes. We combine these literatures to answer our research questions, as described in the methodology.

1. Natural Capital and agriculture

This section provides a very brief precis of the topic: for more information about the concept of Natural Capital and its relevance to Scottish policy development, see the prior output Valero et al. (2025).

Natural Capital is a term with many definitions (Ozdemiroglu, 2019), and is essentially **a way to represent nature in terms of how it provides humans with many social, environmental and economic benefits** (Scottish Government, 2023b). These benefits, the provision of goods and services to people, are usually described as ecosystem services. The ability to sustain these flows of ecosystem services in turn depends on the extent and condition of underlying natural assets. Scotland tracks the state of its NC at a national level, in terms of Natural Capital Accounts (Scottish Government, 2024) and the Scotland's Natural Capital Asset Index (McKenna et al, 2019, NatureScot, 2025): the former includes the values of non-renewable resources, whilst the latter focuses more on the state of ecosystems.

There are many and varied ecosystem services. In this report we use the categories used in a toolkit developed by DEFRA for enabling a Natural Capital approach among decision makers known as 'ENCA' (for more on this toolkit see page 33). These categories are: 'provisioning services' (i.e. direct outputs obtained from ecosystems that meet human needs), 'abiotic flows' (i.e. services that are not dependent upon functioning ecosystems (e.g. energy)), 'regulating services' (i.e. processes that regulate and reduce pollution and other damages), 'cultural services' (i.e. enablers of cultural interaction and activity like education, or recreation), and 'bundled and aggregated services' (i.e. those that are combine other services) (DEFRA, 2023: p. 16).

A NC approach gives a bit more prominence to the idea of the **underlying stocks and assets** which are supporting the flows of services. A clear example is soil, which is a crucial input for agriculture. Another one might be water or freshwater. If such NC supports the development of agriculture, considering the extent and quality of the NC available together with other capitals, might support decision-making.

Looking very specifically at what it could mean for policy sectors and different domains in Scotland and the UK, researchers have identified a wide range of policy areas that either affect or are affected by NC (Maes et al. 2020). **The Scottish Government Agriculture and Rural Economy Directorate was explicitly identified as an institution whose objectives are affected by NC** i. Some policy areas might be critically *dependent on* NC (e.g. National Parks); others might *impact on* NC (e.g. transport policies); and some policy areas are both dependent on and affected by NC, as it is the case of agriculture.

Agriculture is one of the most important sectors for the Scottish economy while also being one of the sectors most dependent on NC (Lochhead 2025). At the same time, agricultural land use and management has the potential to affect NC critical for targets such climate change mitigation - for example, peatlands are critical carbon sinks (or sources) that have degraded partly as a result of drainage for agriculture (Lochhead 2025).

The new Scotland's Fourth Land Use Strategy lists the ecosystem services that enclosed farmland landscapes and semi-natural land provide (Scottish Government 2026b). In terms of the ecosystem services that agricultural land can sustain, these will vary depending on the underlying terrain as well as land management decisions. However, their management has traditionally been focused on food - crops, fodder or livestock are all examples of provisioning services. Agricultural land does – or could – also sustain other services, such as pollinator populations, or drainage that affects downstream water quality and flood risk (examples of regulatory services), scenic and valued landscapes (examples of cultural services). Table 1 summarises the ecosystem services provided by enclosed farmland and semi-natural land and for more information on ecosystem services supported by UK land use, see Bateman et al, (2013). In general, restoration actions that reverse degradation and improve ecosystem resilience are generally associated with higher flows of ecosystem services to society: for an analysis of the benefits of healthy soils in Scotland, see McVittie & Glenk (2025).

Table 1. Ecosystem services provided by farming and crofting landscapes

Ecosystem services		Enclosed farmland	Semi-natural land
Provisioning services	Food and drink	Yes	Yes
	Materials	Yes	Yes
	Natural medicines	--	Yes
	Water supply	--	Yes
	Timber and wood products	--	Yes
Abiotic services	Renewable and non-renewable energy	Yes	Yes
Regulating services	Clean air	Yes	Yes
	Carbon storage	Yes	Yes
	Flood management	Yes	Yes
	Erosion control	Yes	Yes
	Water purification	--	Yes
	Disease and natural pest control	Yes	Yes
	Pollination	Yes	Yes
Aggregated/ supporting services	Healthy soils	Yes	Yes
	Photosynthesis	Yes	Yes
	Nutrient cycling	Yes	Yes
	Space for wildlife	Yes	Yes
Cultural services	Physical health and mental wellbeing	Yes	Yes
	Tourism	Yes	Yes
	Knowledge and learning	--	Yes
	Recreation	Yes	Yes
	Sense of place	Yes	Yes
	Inspiration	Yes	Yes
	Spiritual and religious connection	Yes	Yes

Source: Own elaboration from Scotland's Fourth Land Use Strategy (Scottish Government 2026b) and ENCA (DEFRA 2023).

Land use and agriculture are also tightly **connected with the achievement of a Just Transition** in Scotland, with NC featuring prominently in the description of economy and environmental outcomes in the consultation paper for the Land use and Agriculture Just Transition Plan (LUAJTP) (Scottish Government 2025e). The responses to the LUAJTP consultation highlight a "strong support for integrating biodiversity, soil health, water quality, and air quality into land use and agriculture systems" (Scottish Government 2026c: p. 10).

An approach that considers NC in agricultural policy alongside environmental and community-wealth policies is seen as the way forward to link wider agriculture, environment and social policy areas in support that of the Just Transition in Scotland (Scottish Land Commission 2023)

In summary, representing natural capital for agriculture entails understanding many aspects of nature's functions (not 'just' biodiversity, for example), representing their benefits in anthropocentric and even economic terms; ideally, there should also be an understanding of how interventions can change the condition of natural assets and the services they sustain.

2. The policy cycle

The policy cycle is a heuristic **representing the policy stages** that encompass planning, implementation and evaluation, connecting scholarly theory with practice (Althaus and Threlfall, 2021). While it is a framework that has been widely criticized among public policy scholar for its simplicity and lack of analytical capacity (Sabatier, 2019) it is still widely used among practitioners and when introducing researchers and students into policy analysis because it is relatable (Lindquist & Wellstead 2019).

Theories of the policy process tend to agree that policy usually follows a life cycle, from conception to evaluation. A number of stages are imagined as feeding into one another, whilst acknowledging that links between stages might not always be linear, with overlaps and iterations. Different versions of policy cycle frameworks focus on certain aspects of the policy process over others. However, stages of the policy cycle widely used among public policy scholarship usually all account for Agenda setting, Policy formulation, Decision-making, Policy Implementation and Policy Evaluation (Howlet et al. 2009).

Outside of academia, the ROAMEF framework (Figure 1, next page) is widely used in the UK Government (e.g. Green Book, Magenta Book) and Scottish Government (e.g. Evaluation Action Plan). The stages accounted in this framework are Rationale, Objectives, Appraisal (assessing the best ways of delivering a policy or programme, and estimating the costs and benefits), Monitoring (check the progress of the policy), Evaluation (assessment post-policy implementation for the effectiveness and impacts of the policy) and Feedback (into the implementation and the design/re-design within the policy).

The Scottish Government informs its policy development with the HM Treasury's guidance from the Green and Magenta Books. The "Green Book" (HM Treasury 2022) is guidance on appraisal of options in the development of policy decisions. Policy evaluation activity is informed with the HM Treasury's (HMT) guidance on evaluation known as "the Magenta Book" (HM Treasury 2020) and in 2024 developed an Evaluation Action Plan (Scottish Government 2024a) with a view to strengthen a "culture of evaluation" that deliver high quality evaluations. The plan includes ensuring that "Theory of Change / Logic Models are completed for every new policy or interventions".

The policy cycle provides a way to break down and think about complex processes of policy development, that is salient to both academics and policymakers. Therefore, in Agrichats 2.0, we decided to frame the discussions with a slightly simplified version of the policy cycle accounting for

the stages acknowledged in research and using ROAMEF terminology: Rationale and Objectives, Appraisal and Formulation, Choice and application of policy instruments, Monitoring, and Evaluation and Feedback. This was hoped to be helpful for navigating the myriad ways in which policy development could or should link to data and tools related to NC.

Figure 1. The ROAMEF Policy development cycle. Source: HM Treasury 2022, p. 15[2]

3. Environmental data in agricultural policy processes

Obtaining and using **high quality environmental data is a priority for agricultural policy development** across the globe (OECD 2025). In this section we summarise insights from global literature on the role and challenges of environmental data, and NC in particular, in agricultural policy in general and in its evaluation in particular.

The OECD highlighted last year the need for improving data collection in agricultural policy monitoring to better capture environmental features, including "detailed information related to voluntary agri-environmental payments, environmental cross-compliance modalities and characteristics of input subsidies" (Lankoski et al. 2025). Tallis et al. 2024, on the mainstreaming nature in US policy pointed out to the need of robust evidence and data "on the changing status of biodiversity and ecosystems and their connections to the economy and society at a national scale".

The discussions on data available and needed for agricultural policy evaluation are not often presented explicitly in terms of NC. However, recent reports and policy briefs make explicit reference

[2] The UK Government has recently updated the Green Book, with a new version published on the 5th February 2026 and previous editions of the Green Book are now withdrawn. Figure 1 and references in this report correspond to the previous version (HM Treasury 2022) which is the one that the authors used during the research. We consider that changes from one version to another do not change the messages relevant for this report. However, we are aware that the figure representing the ROAMEF cycle has been updated, but without changes on the number of labelling of stages. More significant for the consideration of Natural Capital in policy development, the way NC is introduced has changed, and references to the NC Framework have been dropped. Still, the message for practitioners regarding considering NC impacts remains, as it does the reference to the supplementary material for enabling a NC approach (ENCA). ENCA is introduced and discussed in the section 'Potential use of tools to connect a NC approach with agricultural policy'.

to how NC's integration would benefit agricultural policies. The 2025 EU Knowledge Centre for Biodiversity Science for Policy Brief "From nature to numbers: integrating natural capital accounting into decision-making" (Grammatikopoulou et al., 2025) highlights that NC accounting "can play a key role in enhancing the effectiveness and sustainability of the new CAP by supporting the CAP's green transition through evidence-based design and implementation of voluntary environmental actions". In England, a report by the Parliament Environmental Audit Committee (2025) discusses the need for and importance of a NC baselining beforehand in order to assess the extent of impact (particularly when focusing on nature restoration work).

Focusing on the evaluation of agricultural policies, literature highlights a number of **data challenges**: need to expand the monitoring of land use, biodiversity and ecosystem services (El Benni et al. 2023), and the need for environmental data to follow the rules applied to core national statistics (Tallis et al. 2024). 'Big data' coming from remote sensing and satellite imagery is usually highlighted as one of the **potential solutions** for improving the capturing of environmental data and solving data gaps (e.g. El Benni et al. 2023, Wuepper et al. 2026). In particular, Wuepper et al. 2026 make the case for the use of satellite data as "game changer" in the monitoring and evaluation of agri-environmental policies but also opening the door to develop new types of policies (Wuepper et al. 2026).

However, literature also notes a number of challenges that increased digitalisation of data capture can create for the policy teams and for farmers. A report of the European Court of Auditors pointed out that the policy delivery side might require important changes to IT systems and the need to create or enhance expertise about the new technologies (ECA 2020). Existing governance framework would have been seen as a constraint for the application of remote sensing for monitoring in the CAP, with staff involved in monitoring compliance not seeing how the new systems could work (van der Velden et al. 2025).

Regarding the impacts of **increasing digitalisation of monitoring** in the farmers side, studies point out challenges like increasing bureaucratic demand on farmers (Forney and Epiney, 2022), farmers being removed from the policy process (Forney and Epiney, 2022), and farmers being "afraid" of remote sensing technologies upon feelings of losing freedom over decisions in their farms (van der Velden et al. 2025). The impacts of the increasing digitalisation of monitoring, added to changes to support schemes could translate in deeper changes in the relationships between farmers and governments (Grohmann, and Feindt 2024).

The evaluation of agricultural policy in terms of natural capital is therefore not 'just' a task of finding reliable insights about how biodiversity and environment benefit to society and economies, and how these link to agricultural interventions; but also, ideally, a task of finding and reporting insights in terms that are salient to stakeholders and society.

Methodology

Findings in this report result primarily from a participatory workshop with policymakers in the Scottish Government involved in the development of the new agricultural policy or their evaluation (Agrichats 2.0) and build on a series of qualitative interviews carried out in a previous stage of the research (Agrichats 1.0). Details on the workshop and the interviews are summarised below.

To complement these interactions, the team also performed a desk review of documentary evidence on the development of the agricultural policy reform in Scotland in order to characterise the agricultural policy cycle and the connections with NC work (section 1 of findings).

Data from the workshop was subject to content analysis guided by the research questions and was triangulated with results from the interviews. Both phases of research had received prior checks and approvals from The Research Ethics Committee of the James Hutton Institute, and all data generated was managed in accordance with UK GDPR. We use quotes from the workshop to illustrate this report, but the identity of participants is confidential, so these are referred to just by numbers (e.g. workshop participant #4).

1. Interviews – "Agrichats 1.0 "

The focus of Agrichats 1.0 were **qualitative interviews** carried out between September and October **2024**. We carried out 14 semi-structured interviews held online with individuals connected with the ARP. These came from within the Agriculture Policy Division of the Agricultural and Rural Economy Directorate, also from RESAS and NatureScot. We sought to interview individuals in a range of a roles, to understand different perspectives and opportunities to work with NC. Insights gathered from these interviews helped the research team develop the workshop in the following stage. Further details on the interviews are in Valero et al. (2024). A summary of relevant insights from Agrichats 1.0 is in section 2.1.

2. Workshop – "Agrichats 2.0"

The focus of Agrichats 2.0 was an interactive **online workshop** held on the 20th of November **2025**, informed by the insights and contacts of Agrichats 1.0. This provided an opportunity for the research team to connect with 7 **participants from the Scottish Government** who were **involved in the agricultural policy development** and the Agricultural Reform Programme, of which 6 were policy officials and 1 policy analysist. The aim of our meeting was to discuss the monitoring and evaluation of agricultural policy, share information about natural capital concepts and tools, and explored if and how opportunities arise to integrate natural capital into this process.

Participants were contacted via email with information about the workshop and once they expressed interest, a further email was sent containing an information sheet and consent form. No specific NC materials were shared prior to the workshop. A small number of participants were also involved in Agrichats 1.0, however new participants were also contacted.

The aim of the workshop was to explore how natural capital can be used in an ex-post approach in the agricultural policy context and so build on the work carried out in Agrichats 1.0. The workshop was conducted by Diana Valero, Kerry Waylen, Karolina Trdlicova and Rebecca Gray and was hosted online using the platform MSTeams. Participants were asked to engage with other interactive online tools, both Miro boards and Slido polls were used throughout. The workshop was audio-visually recorded and transcribed, these materials as well as any notes taken are securely stored within The James Hutton drives only accessible to the research team.

The workshop included presentations about natural capital and involved group discussions and individual activities. An evaluation form created using questionnaire building software Qualtrics, was circulated the following day to gather final thoughts. Four participants completed this form.

Workshop activities were organised in three blocks.

1. The first block was dedicated to introduction to Natural Capital and Natural Capital data. It included a brief presentation from the research team recapping Agrichats 1.0, and introducing what Natural Capital and a Natural Capital approach means. It was followed by an activity using Miro to discuss in plenary the data related to Natural Capital used or needed across in agricultural policy across the policy cycle.
2. The second block was dedicated to introducing the set of Natural Capital tools known as ENCA (more about ENCA in section 4 on potential use of tools to connect a NC approach with agricultural policy). It included a short presentation given by Dr Kerry Waylen and demonstration about how to access and navigate the ENCA resources. This was followed by an activity in groups to discuss if/how these tools could be used in evaluation and/or other policy stages.
3. The third and final block of the workshop focused on Natural Capital in the evaluation of the future agricultural policy. It included a group activity using Miro and a plenary discussion on how NC could be considered in the evaluation of the agricultural policy. This was focused around identifying possible future uses potential gaps.

Findings

We start our findings (section 1) by summarising the results of our desk review of documentary evidence on the development of the agricultural policy reform in Scotland, using publicly available documents to characterise its agricultural policy cycle and potential connections with NC work

We then summarise (in sections 2 to 4) what we know about how and why NC is (or is not) being connected into agricultural policy development, based our discussions with staff. The findings in this section are drawn primarily from the workshop discussions, but prefaced by a short summary of what we already knew from Agrichats 1.0 (reported in Valero et al 2025). In our exploration of that workshop discussion we do make explicit reference to insights from the Agrichats 1.0 interviews– i.e. to specify, supplement, or offer a comparison point.

1. The Agricultural Policy cycle in Scotland and potential connections with NC

Scottish agricultural policy is being reshaped through the Agricultural Reform Programme (ARP). The Vision for Scottish Agriculture (2022) emphasises climate action, nature restoration, and productivity, and introduces natural capital (NC) as a guiding concept, though the Agriculture and Rural Communities (Scotland) Act 2024 does not explicitly use the term.
The Strategic Environmental Assessment (SEA) of the ARP refers frequently to NC and ecosystem services, particularly regarding soil health, biodiversity, upland grazing systems, and the expansion of Ecological Focus Areas (EFAs) from 5% to 7%.

The ARP is structured around different **tiers** of support, with some NC-related measures:

- **Tier 1 (Base):** Mandatory Whole Farm Plans (WFPs) include audits on biodiversity, soil, carbon, pest management, and animal welfare.
- **Tier 2 (Enhanced):** Payments for additional climate and nature actions, including "Enhanced Greening" through expanded Ecological Focus Areas (EFAs).
- **Tier 3 (Elective):** Targeted grants, particularly the Future Farm Investment Scheme, supporting investments that enhance environmental performance.

Monitoring and evaluation frameworks are still being developed. Stakeholders emphasised the need for a baseline of natural capital on farmland and improved, multi-layered data collection. Scottish government commissioned research has recommended using Theory-of-Change models and integrating remote sensing (LiDAR) and on-farm data to measure environmental outcomes effectively.

When talking about agricultural policy in Scotland in 2025, we refer to a policy area of large tradition, that is immersed in a process of reform shaped by the ARP, and so creating de facto a new policy. Within the ARP different strands of the Scottish Agricultural Policy are at different stages of the policy cycle. While some instruments are still being designed (e.g. tier 4), others are already under implementation (e.g. tier 1) and the future evaluation of agricultural policy is also in design stages, as it is described in the following sections.

1.1 Rationale and Objectives

Following the UK's withdrawal from the European Union, the Scottish Government committed to a substantial Agricultural Reform programme (ARP) following the need for a new agricultural policy that was not bound to follow the rules of the Common Agricultural Policy (CAP).

The Vision for Scottish Agriculture (Scottish Government, 2022) specifies the goals in detail, and explicitly **includes the term Natural Capital**. In this vision, NC is referred to as something to benefit

from the policy, another way of seeing farms and crofts, and is also used when discussing private sector opportunities and markets that may also affect land-manager decisions. In mid-2024, an Agriculture and Rural Communities (Scotland) Act was passed by Parliament with the intention of "enabling the support of agriculture, rural communities and the rural economy through the creation of a framework for that support; to make provision for continuing professional development for those involved in agriculture and related industries, to make provision in relation to the welfare and identification of animals, to repeal spent and superseded agricultural enactments; and for connected purposes". This **primary legislation** that enables the Vision **does not mention NC, although one of its five objectives are "on-farm nature restoration, climate mitigation and adaptation"**.

1.2 Appraisal and Formulation

We do not have knowledge of an ARP appraisal case, as such. However, there have been specific assessment studies and specific assessments about different elements of the ARP even since the publication of the Vision (and in the case of Thomson et al. 2023, before) (see list below). In addition, there is a plan in place for "assessing new policy proposals as they are taken through secondary legislation" (RESAS 2023).

- The Scottish Government commissioned work in 2021, when the Vision was being prepared, to provide expert advice and analytical support to help consider future policy options available for Scotland. The results of this work were synthetised in the report 'Evidence to Support Development of a New Rural Support Scheme for Scotland: A summary of written outputs' (Thomson et al. 2023). The concept 'NC' does not appear in the synthesis report, although considering of nature restoration to enhance biodiversity does.
- The Agriculture and Rural Communities (Scotland) Act, entered Parliament as Bill with a Financial Memorandum that set out the costs associated with the measures introduced by the Bill (Scottish Parliament 2023). While there is no explicit mention to NC in the Memorandum, it makes repeated reference to deliver for nature and nature outcomes.
- The Agriculture and Rural Communities (Scotland) Bill – Supporting Evidence and Analysis (RESAS 2023) "provides information on the Scottish Government's approach to assessing new policy proposals as they are taken through secondary legislation, to ensure they are balanced, coherent and deliver against intended objectives".
- A **Strategic Environmental Assessment (SEA) of the ARP** is required by the Environmental Assessment (Scotland) Act 2005 for plans and programmes likely to have significant effects on the environment. This was Commissioned to Land Use Consultants Limited (LUC) and the resulting report was published in October 2025 (LUC 2025). In this assessment, **NC is mentioned used on several occasions, in reference to two aspects**:
    - The Scottish Upland Sheep Support Scheme (Tier 1) and the need to make it simpler for small farmers/crofters: "*allowing small units to comply with a simpler set out rules may offer positive environmental effects, as **a disproportionate amount of valued natural capital is located on small units**"* (LUC 2025: p26).
    - Progressing from 5% Ecological Focus Areas (EFA) requirements to 7%: *"The existing 5% threshold was introduced **to strike a balance between productive agricultural output and the need to safeguard and enhance natural capital on farmed land**. While the policy has resulted in the establishment and maintenance of thousands of hectares of semi-natural habitats within intensively farmed landscapes, evidence from the Scottish Government's Agricultural Reform indicates that further gains are necessary to meet national targets for biodiversity recovery and climate resilience"* (LUC 2025: p. 272).

  Terminology closely related to NC, such as "ecosystem services" is more common in the SEA, that includes references to specific aspects of NC such soil health and biodiversity (see table 2).

Table 2. Mentions to ecosystem services in the Strategic Environmental Assessment of the ARP

NC aspects	Reference
Soil health	• "*Soil biodiversity is vital for ecosystem services*" (LUC 2025: p. 85) • *"The ability of soils to support ecosystem services, store carbon, and contribute to climate adaptation*" (LUC 2025: p. 87) • "*While Scotland's soils are rich in carbon and important for climate and ecosystem services, they are under pressure from erosion, compaction and loss of organic matter*" (LUC 2025: p. 318)
Biodiversity	• "*Biodiversity […] helps to provide the ecosystems services that are the basis of life including the regulation of air and water, soil formation, nutrient cycling, flood regulation and pollination, amongst many others*" (LUC 2025: p.65).
Ecosystem services in general	• "*Rough grazing, improved grassland, and woodland found in LFAs support ecosystem services, carbon sequestration, and habitat connectivity*" (LUC 2025: p. 99) • "*Actively enhance the biodiversity, carbon storage, and ecosystem services provided by permanent grassland across Scotland"* (LUC 2025: p. 281)

The Vision specified four tiers of funding potentially available to farmers, and this structure has continued to shape agricultural policy development (see figure 1). Design and delivery of these tiers is a large and complex task that therefore involves hundreds of staff in the Agricultural Policy Division with assistance or information from colleagues in other divisions, primarily analysts in RESAS, and also the statutory agency NatureScot.

NC is being considered across tiers 1, 2, and 3, with NC-related measures being introduced progressively.

- In **Tier 1**, that provides direct payments to support active farming, one of the main changes already introduced are the "**Whole Farm Plans" (WFP)**. WFP is a measure aimed to provide a holistic view of a farm or croft by establishing their current performance and activities and it will condition access to agricultural support schemes. A WFP comprises audits and plans in five different topics that connect with NC: Animal Health and Welfare, Biodiversity, Carbon, Integrated Pest Management, and Soil Analysis. By 15 May 2025 all farmers and crofters who wanted to receive the Basic Payment Scheme had to have at least two of the audits and plans, being up to the farmer to decide which ones they wanted to do depending on their relevance for their agricultural activities. By 15 May 2028, farmers and crofters will have to have carried out all the audits (Scottish Government 2025f).
- **Tier 2**, also known as "***Enhanced***", refers to supplementary support for farming going beyond the basic requirements on delivering greater climate and nature outcomes. Eligibility is dependent upon successful undertaking of Tier 1 and demonstrating sufficient contribution against Tier 2 requirements to be eligible for an Enhanced payment. (Scottish Government 2023a). **"Enhanced Greening"** is a NC-related measure in this tier. This measure requires increasing the arable land managed for the benefit of the climate and environment (areas known as Ecological Focus Areas (EFAs). EFA options include a number of land management strategies for the farmers and crofters to choose (e.g. leaving land uncultivated, creation of margins around arable lands, having 20 metres hedges, planting trees as part of a Scottish Forestry agreement, planting catch crops, temporary autumn crops (green cover), or nitrogen-fixing crops, having herb and legume-rich pastures, keep unharvested crop, having low input grassland for grazing or cut for folder, or low density tree areas) (Scottish Government 2025b)

- In **Tier 3**, known as ***"Elective"***, is to provide targeted support for actions that address climate change, nature restoration, innovation and supply chain resilience, including grants to invest in equipment. Grants for farmers and crofters will be available to invest in equipment for reducing emissions or other key policy aims. (Scottish Government 2023a). The main NC related measure put in place under this tier so far is the "**Future Farm Investment Scheme" (FFIS)**, to offer flexible capital grants to support investments in efficiency, nature and climate friendly farming. In particular, FFIS support is intended for on farm/croft capital investments that will deliver at least on one of the following objectives: i) improving business efficiency and sustainability; ii) protecting, restoring or enhancing the environment; iii) reducing greenhouse gas emissions; iv) mitigating climate change effects (Scottish Government 2025c).

The measures in the different tiers relate, creating a complex system of agricultural support in which NC considerations are weaved. For example, eligibility for FFIS is seen dependent on farmers considering necessary information for deciding on the changes needed in their agricultural practice - information targeted with the WFPs in Tier 1. However, at the time FFIS opened in 2025, WFPs were not yet to be complete. Thus, the FFIS required compliance with the WFP only for applicants who had claimed Basic Payment Scheme (tier 1 support) in 2025, as they were required to have at least two WFP audits by 15 May. Non-BPS claimants applying for FFIS would have to complete at least two WFP audits/plans before submitting evidence of having carried out their investment (Scottish Government 2025d).

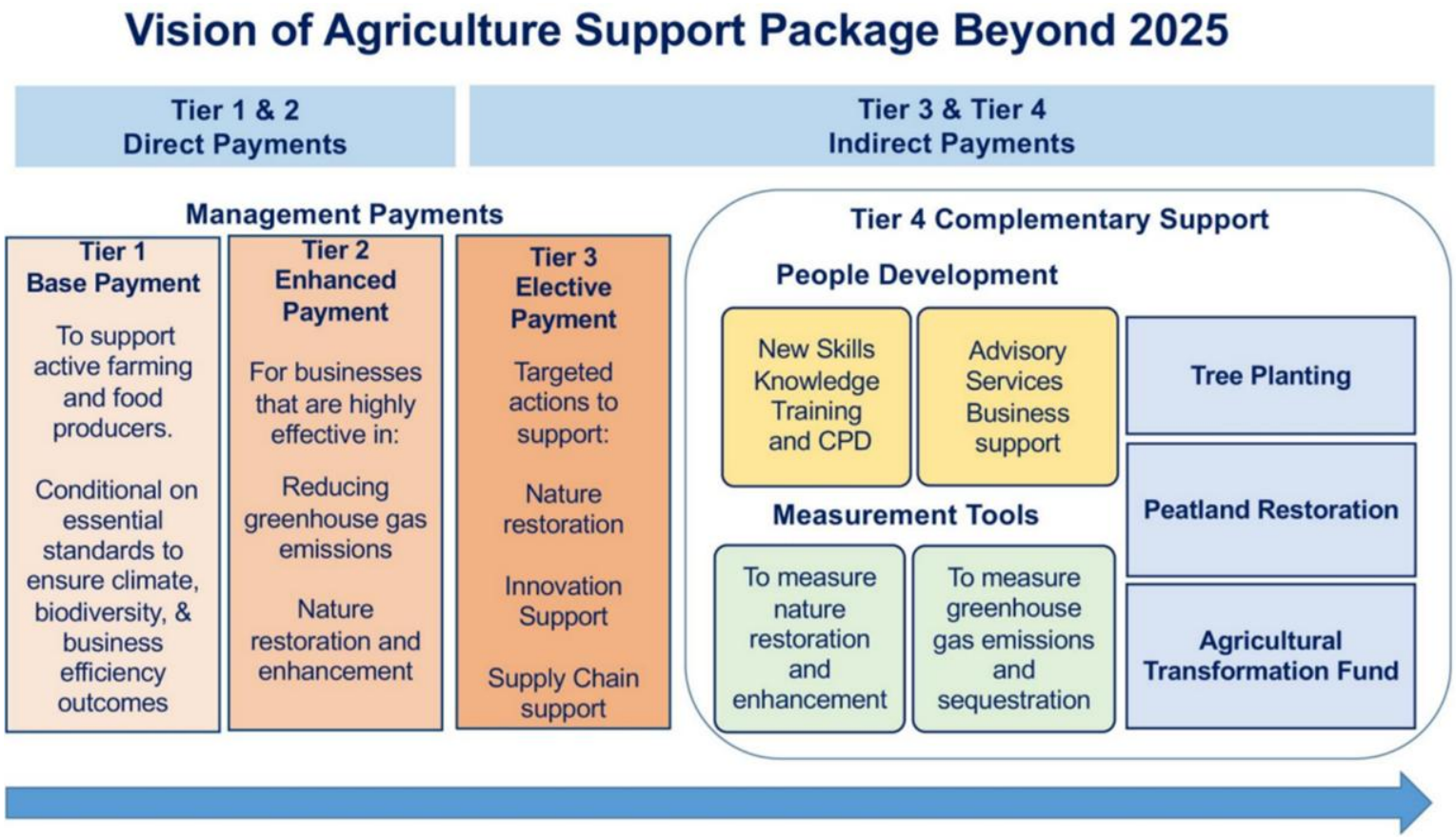

Figure 2 Representation of the main tiers of future agricultural support as specified in the 2022 Vision for Agriculture.

1.3 Choice and application of policy instruments

The specific design of the four tiers, and allocation of resources across these tiers, are key means of influence on land-manager decision-making. Agrichats 1.0 looked in detail into how NC and related data was taken into account in the development of instrument choices; focusing particularly on the micro-level and the development of specific measures, goal targets and instrumental calibrations (Valero et al. 2025):

- The definition of the implementation needs for delivering the outcomes of the four-tier model was expected by participants in Agrichats 1.0 to hold the key to the consideration of NC in the ARP. Many participants cited NC as relevant to the whole farm plan (WFP) required from farmers, a new instrument introduced in the ARP. The WFP was seen as a good place to situate the discussions about NC as it was expected to help farmers understand their impacts on climate, biodiversity and nature. Other specific measures mentioned by the participants in which they saw links with NC were the 'new good agricultural environmental condition', the 'voluntary cattle support in the beef sector', the 'green mechanism 2026', and tier 3 more generally.
- NC was also seen as one criterion being considered in the adjustment of the ARP instruments, but there was a critical question mark regarding how the concept is going to be considered on the ground, given the lack of a baseline (more on this in the following subsection).

A staged approach was designed for the implementation of the tiers, with changes being introduced gradually. For example, 2025 saw the start of the WFPs, new protections for peatlands and wetlands, and a new calving interval requirement for the Scottish Suckler Beef Support Scheme; and in 2026 the main change is the introduction of 'Enhanced Greening' with the increase in the number of arable businesses required to manage EFAs, with a view of increasing the percentage of land required for EFAs from 5% to 7% in 2027 (Scottish Government 2025a). The Agricultural Reform Route Map (Scottish Government 2025a) does not refer explicitly to NC, neither it does the Greening Guidance 2026 (Scottish Government 2025b). However, the concept of **NC appears in the Whole Farm Plan Guide, in relation to the biodiversity audit/habitat map**: "*The Biodiversity Audit/Habitat map will identify important habitats/natural capital on farms and crofts that is already being managed alongside existing agricultural practices and identify areas for the creation of new habitats such as unimproved grass banks or unproductive areas within fields that can be used to meet future Tier 2 (enhanced) requirements or could be managed under Tier 3 (elective) as well as potentially sequester carbon, reducing the farm or crofts carbon footprint"* (Scottish Government 2025f).

1.4 Monitoring, evaluation and feedback

The agricultural policy evaluation is under design and development at the moment of writing this report, with a **monitoring and evaluation (M&E) framework** being **under development** by the RESAS Division (LUC 2025: p29). Until such new framework is ready, the agricultural policy continues using existing CAP metrics for monitoring purposes (LUC 2025).

Monitoring the new agricultural policy with a focus on NC was discussed in Agrichats 1.0. About this, almost all participants had questions about how NC was going to be operationalised and highlighted the need to have a baseline, given that existing data would be insufficient for monitoring NC on agricultural land (Valero et al. 2025). For Agrichats 1.0 participants, capturing and monitoring NC information seemed quite difficult and unclear, and existing monitoring processes presenting limitations for capturing and understanding existing habitats within farms or the systemic consequences changes in farming practices. All participants noted the need for developing a baseline of NC in agriculture, to inform a new monitoring and evaluation system.

According to the SEA of the ARP, the developing of the monitoring and evaluation framework for the ARP is "grounded" in the requirements of the Agricultural and Rural Communities (Scotland) Act 2024, with the **strategic outcomes forming the "backbone" of the emerging monitoring and evaluation approach** (LUC 2025). "The proposed approach will create a suite of metrics and indicators assigned to the outcomes in order to link modelling results to outcomes which will allow them to be quantified. This will include alignment, where possible, to National Performance Framework" (LUC 2025: p29). Regarding the integration of NC considerations, the ARP SEA states that "the development of a new M&E framework offers key opportunities to incorporate the monitoring of unforeseen environmental effects" and that "it should reflect environmental indicators which reflect the SEA topics" (LUC 2025: p29).

The design of the policy evaluation framework seems to be **underpinned by academic inputs and evidence.** The Scottish Government has commissioned further research to provide evidence that supports the designing of framework (e.g. Thomson et al. 2025, Blackstock et al. 2025) and heard from experts through the Academic Advisory Panel (AAP) for Agriculture Reform Implementation Oversight Board.

- A rapid evidence review of M&E frameworks for agricultural support was produced in 2025 by Thomson et al. The authors of this report note the importance of utilising "indicators that adequately reflect the full extent of the Scottish Government's policy ambitions for agricultural policy" while supporting informing other policy domains, and the National Performance Framework and recommends following an approach based on the SNAP3 and Theory of Change Models.
- The AAP noted in May 2025 that if agricultural payments are based on outcomes, these outcomes must be measured accurately and that "robust measurement and high-quality data will be essential for monitoring and evaluation of outcomes and providing farm-specific information" (AAP 2025). The panel recognised the complexity of measuring environmental benefits and that it requires "collection of high-quality data". Thus, the panel suggested "a multi layered approach that combines different sources of data collection (LiDAR, satellite imaging via Copernicus, on-the-ground sensors) as the "the best, cost-effective chance of understanding biodiversity and creating predictive models for ecosystem health and function" (AAP 2025).

2. Participants' views on the potential to use NC data across the agricultural policy cycle

2.1 Insights from Agrichats 1.0

Agrichats 1.0 highlighted a number of aspects to consider regarding NC evidence in agricultural policy development (including the design of the monitoring and evaluation). For a full exploration of the findings from that phase of work, see Valero et al. (2025):

- Issues were identified in existing data about the NC that related to farmers' land-holdings: data gaps, including the lack of baselines and qualitative data; data being disconnected from the farmers' experience; unsuitability for accounting for the diversity of habitats and farming practices; inconsistency of data and models; and challenging timeframes for data generation.
- There was a desire for more comprehensive baselines on NC on agricultural systems, particularly building on possibilities of acquiring or gathering new data (e.g. remote sensing data, data from the WFPs) and integrating existing datasets.
- The design of the delivery of the monitoring and evaluation of the policy seems to be a critical pillar for the integration of the NC approach. While strategic aims and objectives are set up at high or programme policy level, it is the work done to configure policy instruments at the operational level which allows the new agricultural policy to become feasible. This echoes

observations that high-level policy statements by themselves are necessary but not sufficient to achieve policy integration (Candel & Biesbroek, 2016): with a focus on individuals and process, work at all levels is needed before innovation such as NC can be embedded.

While Agrichats 1.0 focused on the design and development of new policy, Agrichats 2.0 looks at the whole policy cycle and particularly into evaluation.

2.2 Connecting NC with the agricultural policy cycle

The workshop explored how NC data is used and needed across the agricultural policy cycle:

- **Rationale and Objectives:** Participants highlighted the need to understand the complexity and unintended consequences of actions, and the **importance of having a baseline to set meaningful strategic objectives.**
- **Appraisal and Formulation:** Participants stressed the **need for clear, early definitions of NC criteria to guide indicator design** and avoid excessive or unfocused data collection later. A consistent farm-level approach to measuring NC (e.g. KPIs or a balanced scorecard) was seen as crucial. Baseline data, especially on soil health, water quality and habitats, was viewed as fundamental for targeting and for designing appropriate indicators.
- **Choice and Application of Instruments:** Participants emphasised the importance of evidence to support instrument choice, including comparative analysis of policy options and targeted research. They also noted the future potential of Whole Farm Plan (WFP) data for informing choices and improving monitoring.
- **Monitoring**: This was the most discussed stage. While some existing data (agricultural census, designated sites, SEPA water quality data) is useful, significant **gaps remain**. Four NC areas were highlighted: **Water quality, Soil health, Biodiversity and Farm-level carbon emissions.**
- **Evaluation and Feedback:** Participants stressed the **need for data on intervention uptake and effectiveness,** and for a simplified framework (e.g., rating scales) to support evaluation and farmer decision-making.

Participants also highlighted data that is required across multiple stages. Participants emphasised the need consistent indicators, a clear plan for data collection, and the ability to use single datasets across multiple policy stages.

As explained in the background section, in Agrichats 2.0, we decided to frame the discussions using a slightly simplified version of the policy cycle accounting for the stages acknowledged in research and using ROAMEF terminology: Rationale and Objectives, Appraisal and Formulation, Choice and application of policy instruments, Monitoring, and Evaluation and Feedback.

We asked workshop participants to think about the NC data used and needed in the different stages of the agriculture policy cycle, and map them into the cycle using an online board with the labels outlined above. Our summary of their discussions is shown in Figure 3.

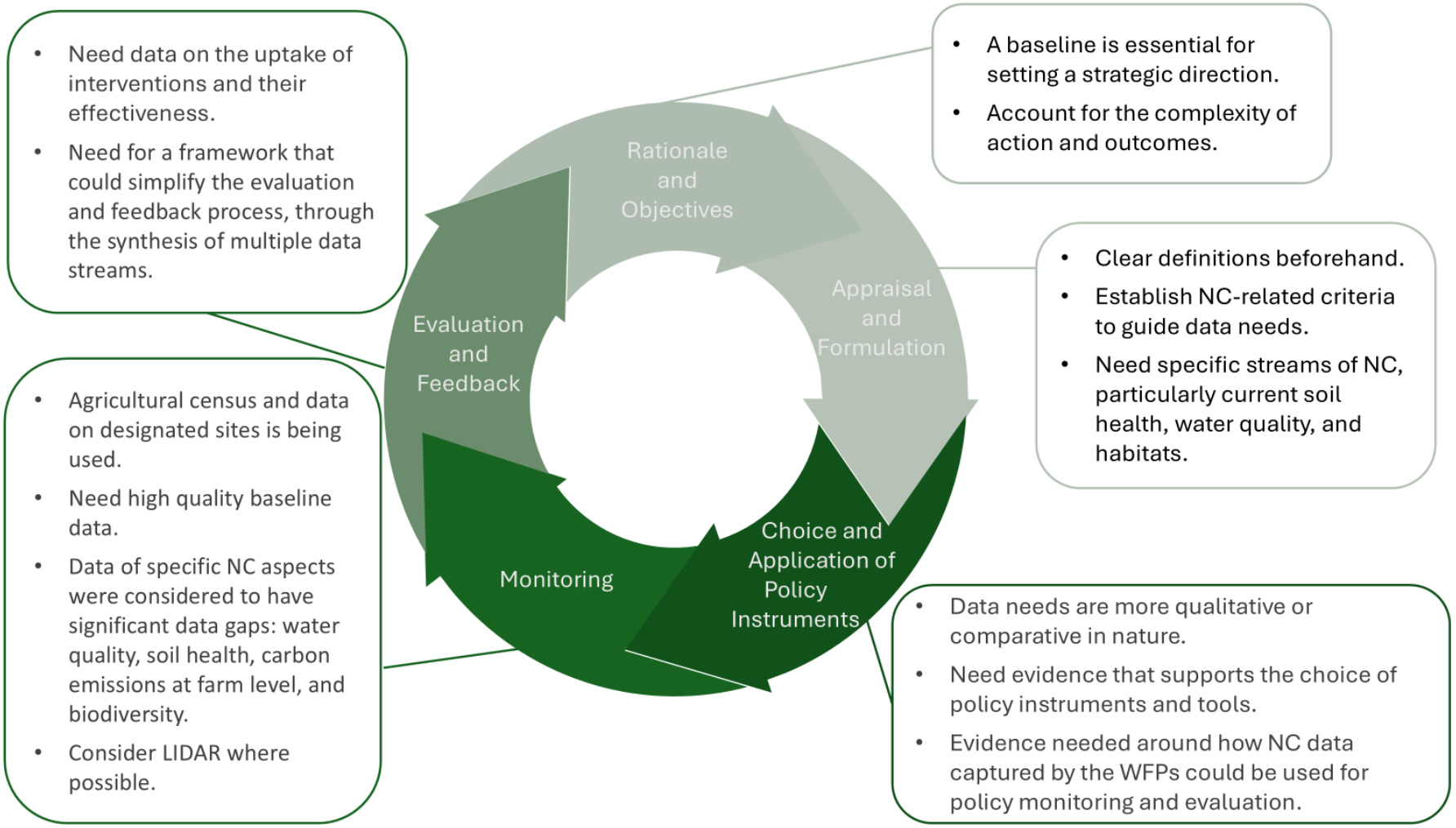

Figure 3. How NC was seen as potentially relevant throughout the agricultural policy cycle, by participants in the AgriChats 2.0 workshop in late 2025

NC Data in the setting of Rationale and Objectives

Participants did not discuss this stage of the policy cycle at length. This is unsurprising giving the political nature of the stage and the role of the participants in the policy cycle. Rationale and Objectives setting is understood as high-level policymaking as it sets strategic direction for a sector.

Still, two aspects were pointed out as relevant for this stage regarding NC data:

- First, the need to account for the complexity of action and outcomes, considering that some actions might have unintended consequences.
- Second, that having a baseline is needed for setting objectives and strategic direction.

NC Data in Appraisal and Formulation

A greater degree of attention was paid to the appraisal and formulation stage. Here, participants reflected on the **need to establish NC-related criteria to guide the data needs in policy formulation and following stages**. In this stage of the policy cycle, it seems critical to **provide clear definitions of criteria to be measured later**, creating the basis for a consistent approach to assessing and scoring of NC assets at farm level (farm level MRV for natural capital assets). For example, one participant pointed out to the need for a suite of key performance indicators (KPIs) or a balanced scorecard on NC.

If definitions are not clear or specific enough beforehand, this might impact data collection, forcing it to go wider than needed in order to create flexibility within the system.

> "*We don't change the definitions halfway through the process and so one of the challenges is that if we ask people to capture data, […] we might actually ask them to capture more rather than less at the beginning on the basis of that gives us more flexibility.*" (Workshop Participant #3)

Still, even for defining such indicators and approach, the **need for specific streams of NC capital** were pointed out as necessary, in particular regarding current **soil health, water quality and habitats**. Having baseline data on these seems critical to establishing where and what targeting might be needed and help to define indicators. While data in some of the topics (e.g. water quality) would be available in other policy domains (e.g. SEPA), lack of data on habitats would be an issue relevant for other policy areas beyond agricultural policy. In addition, the need to look at the data that exists at farm/croft level was highlighted, in order to understand what (new or different) data might be needed.

NC Data in Choice and Application of policy instruments

Data needs in the choice and application of policy instruments seems to be more qualitative or comparative in nature and needs to be supported by targeted research.

The workshop flagged up the need for evidence that supports the choice of policy instruments and tools, providing a better understanding of the impacts of different options. **Clear criteria are required to guide instrument choice**, for example in helping to target where the greatest initial gains are possible.

A possibility to use forthcoming data was also highlighted: regarding how NC data captured by the WFPs could be processed and analysed for policy monitoring and evaluation. Given the many aspects of NC, accessing and using all existing data sources should be prioritised. One of the participants summarised it as "*how can we make best use of the data that we capture and capture it more sufficiently is part of the plea*" (Workshop Participant #3).

Incorporating NC data into Monitoring

Monitoring is the policy stage that got the greatest amount of attention from participants. Some NC-related data is already in use at this stage. This includes data from the agricultural census and data on designated sites. Still, most of the discussion focused again on NC data that was needed.

Firstly, a repeated mention of **the need for baseline data**. For this stage there was a subtle difference from previous references to baseline data around the accuracy required – the level of detail and precision required for monitoring purposes is higher. This reference to accuracy mirrors a note on the need for clear criteria for monitoring and assessing change-both tools are required for this process. For the participants it was clear that "*there might be some work required to establish the baseline before we even start the monitoring*" (Workshop Participant #3).

Second, **data about specific aspects of NC** was discussed, all referring to different **types of gaps** in what was currently measured or evaluated in agricultural policy (see table 1).

- On **water quality**: It was acknowledged that there are "quite good monitoring mechanisms at the moment" in the Scottish Environmental Protection Agency (SEPA) and these should be used ["*We should be trying to make good use of them*" (Workshop Participant #3)]. These could be perhaps revisited if some adjustment is needed ["*there's data out there already that we can use and you know some of it might need to be either maintained as it is or, or, or adjusted slightly*" (Workshop Participant #3)]. This data should be considered in the baseline[3].
- On **soil health**: Data on soil health, particularly linked to nutrient management, was discussed. On this topic, it was noted that "*there is relatively established what is needed*" but the teams would be "*still figuring out what's the mechanism to get it*" (Workshop Participant #7). Options being considered at that moment for covering this data gap included the use of LiDAR. LiDAR data was mentioned as a required dataset for multiple topics: soil health (mentioned above), vegetation/tree planting (e.g. riparian planting). While for some participants the use of LiDAR data was an obvious source for datasets, the workshop discussions also raised concerns about its high monetary cost and the need to exercise caution about over-reliance on it (see section on data sources and types, page 28).
- On **biodiversity**: Measuring biodiversity-linked NC would pose a different type of challenge for some of the participants. In this case, the approach to monitoring biodiversity in the agricultural context, through the use of an appropriate set of indicators is still up for discussion.

  "*in the biodiversity space, we're still kind of establishing what is a reasonable biodiversity indicator, especially in the agricultural space. […] I think we're still sort of grappling with what that even means, let alone getting the data on that. So I think that's a slightly bigger problem*" (Workshop Participant #7).
- On **carbon emissions** at farm level: WFP wouldn't be capturing carbon emissions, with results of carbon audits not being completely reliable/comparable. It is seen as necessary to get an agreement on a "consistent measure" that is used universally. This point was later discussed as an issue that was generated because farmers have a multitude of options available to them at through consultancies etc. and are not required to follow any one specific approach.

[3] The workshop participants did not explicitly refer to specific water-related datasets. However, the discussions suggest that they may have been thinking of data collected and reported under River Basin Management Planning (e.g. information on aquatic classification (see https://www.sepa.org.uk/environment/water/aquatic-classification/) or spatially representation of current water quality data (see https://informatics.sepa.org.uk/WaterClassificationHub/).

These four NC topics represent **four very different types of data gaps and challenges** that need to be addressed to establish adequate monitoring of all aspects of NC (Table 3).

Table 3. Types of evidence gaps identified in the workshop

		Perceived clarity of data needs, indicators, and how to access or collect data	
		Yes	No
Perceived availability of datasets	Yes	Water quality data. *Datasets already known to exist and it is 'only' a matter of adapting and integrating them*	Carbon emissions *Some data is expected to be available from the WFP but there it might not be harmonized and there is no clear plan to use it*
	No	Soil health *Soil information needs were understood, but there was a need to acquire/collect the data*	Biodiversity *The selection of indicators was reported to still be under discussion*

When considering information needs, the concept of NC needs to be broken down into different topics or thematic areas that pose different degrees of challenge and complexity in the agricultural context. These pose different challenges, from issue definition, choosing appropriate data and indicators, and practically how to best capture such data. Of course, connecting and synthesising data is also a key challenge for using insights about NC in decision-making.

Using NC data in Evaluation and Feedback

The workshop participants noted the need for data on the uptake of interventions and their effectiveness, to get a better understanding of impact. However, the specifics of what such data could entail was not discussed.

While no one linked the **baseline** to the evaluation and feedback stage in the board, the discussions refered back to it once again. One of the participants pointed out that not having been "*very good at establishing the baseline*" in the past in relation to Agri environment schemes had been "*one of the biggest challenges*" at the time of evaluating the policy.

Beyond data itself, participants noted a need for some sort of framework that could **simplify the evaluation and feedback**, which would link to the synthesis of multiple data streams. It was mentioned that such a framework could follow a simple 5 points rating scale. This is seen as something that would be useful in the evaluation of the policy, but also useful for supporting farmers' and crofters' decision-making.

> *"Given that natural capital is pretty much all-encompassing in the natural world, it'd be useful if people could view particular areas, for example, and see a star rating for how that area performs in terms of a rounded approach. It takes account of landscapes, takes account of water quality ecosystems generally."* (Workshop Participant #4)

NC data beyond stages

Participants in the workshop also identified challenges for incorporating NC data and concepts that were not specific to beyond any individual stage. This is not surprising given that different policy stages must be coherent and consistent, and the policy cycle is anyhow a simplified heuristic.

Information seen as relevant to both the monitoring and the evaluation and feedback stages comes from the Single Application Form (SAF). This data is already in use for monitoring and evaluation purposes. Additionally, information noted as relevant both in the application of policy instruments

and in monitoring were the measurement of carbon stores and opportunities, and habitat mapping. With regards to habitat mapping data, **there is a plan in place to collect some information via the WFPs**:

> "*There's a reasonable mechanism which we can anticipate will get that data over the coming years, like whole farm plan for example. Currently, that's sitting on shelves, on farms and we don't have access to it, but we would hope that over the coming years we would be able to have access to that and analyse that*." (Workshop Participant #7)

Overall, the participants' discussion highlighted a **need to identify indicators that are used consistently across the policy cycle, with a clear plan for obtaining data on each.** Ideally, a single dataset can fulfil different roles across the policy cycle, linked to a baseline that allows later evaluation. Therefore, the needs of specific policy tasks or stages of the policy cycle should influence how other policy stages commission or collect or connect information. This challenge is complicated by different topics or aspects of the NC concept being variable in how well they are currently reported in datasets or attended to in policy development.

2.3 Characteristics of the NC data considered in the agricultural policy

A diverse range of natural capital (NC) data relevant to the agricultural policy cycle was identified. These datasets vary significantly in topic and scale. Most relate to key ecosystem services, particularly **soil health, biodiversity, water quality, and carbon storage**. Important additional services, such as pollination, water supply, waste processing, air filtration, flood regulation, and cultural services were not considered in the discussions.

The use of **several major data types** was discussed in relation to agricultural policy. Light detection and ranging (LiDAR)**,** offers detailed spatial information but raises concerns due to its high cost and the need for a clear justification before investment. Whole Farm Plans (WFPs) were identified as valuable sources of on-farm microdata, capable of improving understanding of environmental impacts and trade-offs, though these data are not yet available and represent a missed short-term opportunity. Administrative data, particularly the Single Application Form (SAF), remain central to monitoring support schemes and could be further developed to better capture environmental features. Statistical data, including Scotland's agricultural census, provide structural information but lacks sufficient detail on production practices important for NC assessments.

Finally, participants emphasised that NC data alone is insufficient: **policymakers also require evidence on NC approaches, tools, prioritisation criteria, monitoring technologies, and methodologies for assessing change**. This broader evidence base would need to be developed through further research and the use of case studies.

The NC data identified by the participants in the agricultural policy cycle is varied and diverse in topic, source, scale, and scope. It is important to understand that different types of data might have specific limitations and trade-offs, and will be best suited to provide evidence for different evaluation aspects.

NC topics: data related to ecosystem services

A range of specific NC aspects were considered regarding data needed in the agricultural policy cycle: **soil health, water quality, habitat, nutrients, biodiversity, vegetation, designated sites and carbon storage.** These refer to a number of ecosystems services, considering mostly aspects of bundled/aggregated ecosystem services (biodiversity, soil health, water quality) and regulating services (carbon storage).

Still, the consideration of NC in Scottish agricultural policy does not contemplate the wider range of ecosystem services that are to be accounted for in farmland and upland farming that are noted in ecosystem services classifications in DEFRA's toolkit for enabling a NC approach (ENCA toolkit, more on it in section 4 'Potential use of tools to connect a NC approach with agricultural policy'). Additional ecosystem services that agricultural policy could consider include provisioning and abiotic services such as pollination and water supply, regulating services such as organic waste disposal, air filtration and flood regulation, negative environmental effects (air pollution, greenhouse gas emissions, water pollution, flood damage, invasive non-native species) and a range of cultural services.

Data sources and types: big data, micro data, administrative and statistical data.

The range of NC data considered in the agricultural policy has different origins and characteristics that will shape its usability. LiDAR data is big data, WFPs are micro data, the agricultural census is statistical data, and SAF (Single Application Form) is administrative data.

Big data: LiDAR

Data coming from earth-observation systems such as light detection and ranging (LiDAR) is considered 'big data'. As mentioned above in the earlier 'Incorporating NC data into Monitoring' section (page 255), the workshop noted **concerns about relying excessively on using LiDAR data** due to its high monetary cost. Concerns about the high cost of LiDAR data were also raised during the 2024 interviews.

Using LiDAR data could mean trade-offs outwith agricultural policy. Before deciding on investing in LiDAR data, it is seen as necessary to be as part of a clear framework that identifies data and use.

> *"A lot of the data capture that we're talking about is really expensive. […] so we need to make sure and things that we're actually getting value for money from the work that we're asking either individuals to do in capturing information for their own businesses or collectively. So that's not to say we shouldn't use LiDAR. It's just to say that we need to make sure […] that we don't go rushing off doing stuff and things at the beginning, demanding lots of input from people if either we're not going to use it in the long term or if it transpires that there was a more efficient way of doing it. It's just a plea on the basis that we just need to make sure that the options that we use are clearly identified at the beginning, they're practical and pragmatic and actually we get value for money for doing them."* (Workshop Participant #3)

Microdata: Whole Farm Plans

On-farm level microdata is needed to improve the evaluation of trade-offs between environmental impacts and other objectives of the agricultural policy that need to be traced back to specific farm-management decisions (Poppe and Vrolijk 2017). The tool introduced in the ARP for capturing such type of data is Whole Farm Plans (WFPs).

The WFP aims to provide a **holistic view of a farm or croft by establishing its current performance and activities**. It comprises five audits and plans: Animal Health and Welfare Plan, Biodiversity Audit, Carbon Audit, Integrated Pest Management Plan, and Soil Analysis. A great focus was placed on this instrument in the discussions of Agrichats 1.0. Comparatively, much less attention was paid in the Agrichats 2.0 workshop.

The case of the WFP illustrates well how the value and accessibility of potential datasets depend on actions taken at different stages. While it is expected that "*WFPs will contain useful data*" for monitoring and evaluation (Workshop Participant #4), **data is not available yet** as it is an instrument

that is just being implemented, and so it is still the application of instruments stage. One of the participants described this as a "missed opportunity just now" (Workshop Participant #4).

Text box 1. Main points about WFPs discussed in Agrichats 1.0

- The WFP is an information gathering tool that engages farmers in thinking with the terms used in the new approach to agricultural policy.
- The hope was that carrying out the WFP could generate improved understanding of existing NC to allow for making informed land management decisions.
- Establishing adequate guidance for the farmers on how to develop the WFP is key along with the early communication of the new approach.
- Data gathered through the WFP is not optimising being complementary with the information already held in the mapping systems.

Source: Valero et al. 2025

Administrative and statistical data

Administrative and statistical data are two data sources whose use across the policy cycles might be usefully extended (HM Treasury 2020).

Regarding administrative data, participants noted **Single Application Form (SAF) data**, which is data captured for the claims associated to the different agricultural support schemes. From the perspective of NC, it is important to note that the **WFP are submitted as part of the SAF**. The information on the SAFs is primarily used to determine the eligibility for schemes farmers apply to. This type of primary data is traditionally one of the most important data sources for the monitoring of agricultural policy, and it is recognised as holding valuable data for evaluating environmental and sustainability aspects (Lankoski et al. 2025, Poppe et al. 2024).

Improving the development of administrative data to provide environmental information has received increased attention from policy and academia. The OECD noted in 2025 the importance of improving data collection for better capturing "granular features of producer support programmes relevant to the environment" and reflecting them in "international statistics" (Lankoski et al. 2025). Poppe et al. (2024) include recommendations for the design of systems equivalent to SAF: minimising the administrative burden (e.g. by allowing uploading information directly from farmers' software, reducing double manual data entry), creating systems and indicators that feel useful also for management of the farms, and guarantee auditability.

Statistical data refers to quantitative informative systematically gathered that provides a comparable overview of a topic, usually at country level. Regarding this type of data, the **agricultural census** was mentioned as relevant data in the monitoring of agricultural policy. The agricultural census periodically captures data on farm structure and agricultural inputs and outputs. However, in 2007, the OECD flagged up that such census provided a low level of detail "on the use of inputs and production practices, even though such information is valuable for considering environmental implications of agricultural practices," data collection systems should be adapted to meet policy priorities (Blandford 2007).

In Scotland, the agricultural census is developed as an annual survey with fixed questions on crop areas, livestock and labour and a modular section that changes every year (e.g. in 2025 was on irrigation practices).

It is notable however that other statistical data closely related to NC such as for example, National NC accounts, were not considered. This might merely reflect a lack of focus on it in the framing of our workshop, or might reflect that the detail or resolution of these statistics do not make obvious links with the agricultural policy domain. However, some researchers have suggested that environmental

accounting has potential to enhance the monitoring and evaluation of agricultural policy, for example in Europe (Grondard et al. 2021).

Other types of information and evidence needed for supporting policy development and evaluation

In addition to NC related datasets, the workshop discussions flagged up that including NC data in the development and evaluation of agricultural policy must be sufficiently supported. This support comes in various forms; information and evidence on NC approaches and related tools/policy instruments and their effects, criteria for how to prioritise among them, how to monitor and assess or score change and impact. Also, it was flagged that there is a need for information on technology that could support monitoring and scoring.

These are data needs that refer to enhancing the understanding of NC, how NC is integrated in policy and policy evaluation from an applied perspective. Evidence on these might come from dedicated research through case studies, comparative studies, and synthesis reviews.

3. Focusing specifically on the potential to connect NC with future policy evaluation

Referring to the five statutory objectives from the Agriculture and Rural Communities (Scotland) Act 2024, **NC evidence was seen as most relevant for evaluating the 'Adoption of sustainable and regenerative agricultural practices', 'On-farm nature restoration' and 'Climate mitigation and adaptation'**. For these objectives, participants highlighted the **need for**:

- **baseline data on soil health** (including carbon storage), **biodiversity, and climate impacts; improved habitat and species data**;
- **better spatial data on restoration** activities;
- **consistent carbon accounting methods**;
- and **farm-level MRV on land-use and management**.

Existing datasets, such as Whole Farm Plans (WFPs), designated-site data, GHG emissions statistics, and June Agricultural Census information (e.g., irrigation, cover crops), were seen as useful but often incomplete.

Challenges identified include a lack of baseline NC data across soil, biodiversity, carbon, and adaptation metric, an issue widely recognised. There was a degree of frustration that the WFP carbon audit approach allows multiple tools, reducing comparability and limiting evaluation value. Significant concerns were also raised about farm-level data privacy, which can restrict data sharing even within government.

With the future evaluation of agricultural policy under design and development, exploring to what extent is NC-related evidence or tools seen as salient to agricultural policy evaluation in Scotland gives a unique opportunity for understanding how NC might integrate in policy evaluation.

The Agriculture and Rural Communities (Scotland) Act 2024 set five overarching objectives of Scottish agricultural policy: adoption and use of sustainable and regenerative agricultural practices; production of high-quality food; promotion and support of agricultural practices that protect and improve animal health and welfare; facilitation of on-farm nature restoration, climate mitigation and adaptation; and enabling rural communities to thrive. Taking such objectives as reference, we asked participants in the Agrichats 2.0 workshop to identify the nature and environmental data needs and gaps and what relevant data or tools they considered relevant to evaluate the specific outcomes.

This exercise revealed **different areas of saliency for NC data**. NC data seemed relevant for the evaluation of objectives "On farm climate adaptation" and "Adoption and use of sustainable and regenerative agricultural practices", with several NC data needs identified common to both areas.

However, NC data seemed to be less salient for evaluating the objectives "Enabling rural communities to thrive" and "Agricultural practices that protect and improve animal health and welfare", as their focus might be less on the environment.

During the discussion, participants highlighted that identifying specific data needs was more or less difficult depending on the topic [e.g. "*nature and biodiversity are easier to deal with than climate adaptation*" (Workshop Participant #1)]. When discussing climate adaptation further, soils, hedges, and trees were particularly emphasised as important for flood prevention measures relevant to other outcomes and biodiversity.

3.1 Objectives where NC evidence is less salient: Agricultural practices that protect and improve animal health and welfare, Production of high quality food, and Enabling communities to thrive

There was noticeably less engagement with these three objectives with less NC-related evidence seen as necessary to evaluate them.

Regarding **agricultural practices that protect and improve animal health and welfare**, participants noted the need for data that accounts for local variations and practices, and called for greater recognition of the implications of farm data privacy.

Regarding **production of high-quality food**, participants emphasised the need for a clear definition of high-quality food production. On this point, the SEA of the Agricultural Reform (LUC 2025) would have already identified four sub outcomes for this objective: value of produce, diversity of output, environmental impact, and animal health and welfare.

Regarding **enabling rural communities to thrive**, no specific data gaps, needs, or existing datasets were identified. However, it was noted that it would be good to explore the value of on farm nature restoration and adaptation activities for local communities.

3.2 Objectives where the role of NC evidence might be more salient: Adoption and use of sustainable and regenerative agricultural practices (Regenerative agriculture), On farm nature restoration, climate mitigation and climate adaptation.

Regarding **adoption and use of sustainable and regenerative agricultural practices,** participants considered that agricultural policy might already have some data that ties with such practices and that it was necessary to identify and assess. For example, the 'Code of Practice'[4] was mentioned as providing guidance on options and types of practices, with the caveat that it is not mandated. Specific data gaps identified for evaluating this objective were on baseline data for biodiversity, soil quality and climate change. To fill such gaps, it was suggested using data collected through the Whole Farm Plans. It was also highlighted the potential of the Strategic Research Programme to better inform approaches to evaluate the adoption and use of regenerative agriculture.

Regarding **on-farm nature restoration**, participants identified that NC data already exist related to key species, designated sites, and habitat mapping. Baseline data on biodiversity and soils -including carbon storage- were again highlighted as a missing and needing datasets. Participants also raised the need for improving data -including spatial data- on activities supported by the Agricultural

[4] The Code of Practice refers to a guidance about the types of activities that can be adopted on a farm or croft, that will contribute to the development of sustainable and regenerative agricultural practices in Scotland. It is available at https://www.gov.scot/publications/code-practice-sustainable-regenerative-agriculture/

Reform, and emphasised the importance of reviewing data needs so that only appropriate and necessary data are collected.

Table 4. NC data used and data needs for the evaluation of specific agricultural policy objectives as per workshop discussion

	Regenerative agriculture	On-farm		
		Nature restoration	Climate adaptation	Climate mitigation
Existing/in progress datasets	WFPs data	Data on key species and their habitats WFPs data	JAC (June Agricultural Census) data (i.e. irrigation, cover crops)	Annual GHG emissions data WFPs data
Data needs	Baseline on soil health (including carbon storage)			
	Baseline on biodiversity*			Carbon accounting
			*Specific aspects on effectiveness of natural hazard mitigation, trees for water management, and data on plant and animal health	

Regarding **on-farm climate mitigation,** existing data already include the annual GHG emissions statistics, though these are published with a two-year delay. For example, the Scottish Government published the 2023–24 agricultural GHG emissions and nitrogen use statistics in June 2025, reporting total agricultural emissions of 7.5 MtCO2e. Still, the lack of baseline data to assess this topic was highlighted. In particular, baseline data on soils is also seen as needed, with improved soil health measurements that include carbon storage. Participants stressed the need for consistent implementation or agreement on variables used in carbon audit calculators and methods. Data needs were also identified regarding farm-level MRV (Measurement, Reporting and Verification) on farm business activities and land use (e.g. trees grown on farms).

Regarding **on-farm climate adaptation**, existing data from the June Agricultural Census (JAC), such as data on irrigation or cover crop use, was identified as useful. However, participants emphasised the need for a better understanding of how to measure adaptation (i.e. in terms of measures or effectiveness in mitigating natural hazard events) and for establishing baselines.

3.3 Cross-cutting challenges and concerns

Overall, there was agreement that **one of the underlying issues is the lack of baseline data for most of the relevant NC topics.** The lack of baseline data for evaluation is not new: dissatisfaction was expressed with previous attempts to collect baseline data through the Rural Development Programme, quoting "*It's a thing that we're consistently bad at. We're currently bad at it*" (Workshop Participant #4). However, it seems to be particularly frustrating given the opportunity to build a completely new monitoring and evaluation framework.

A **note of caution** was also expressed **regarding not establishing in advance clear criteria for the collection of some data and indicators**. Participants expressed frustration that collection of NC data through the WFPs (carbon audits) had become a "*missed opportunity*" (Workshop Participant #4). This was due to the possibility for using a number of different tools/methods for fulfilling those audits instead of establishing specific required criteria, what would make comparisons more difficult.

In addition, another challenge discussed particularly around the WFPs refers to **privacy concerns around farm level data.** A key issue, mentioned both in discussion and written comments, was data

privacy, described as a major concern among farmers and land managers. Commitments to confidentiality of land-manager identities can result in great difficulties in sharing or accessing any information from or related to farm-level holdings, even within Government.

4. Exploring potential to use ENCA tools to connect NC with agricultural policy

The **ENCA** (Enabling a Natural Capital Approach) toolkit, developed by DEFRA, **is a comprehensive collection of data, tools and guidance designed to help decision-makers integrate natural capital (NC) evidence into policy.** Although recommended by the UK Treasury's Green Book, ENCA is largely unfamiliar to Scottish agricultural policy teams. Participants discussed the metaphor of ENCA being a large "pantry" of ingredients, offering examples of how NC evidence has been applied elsewhere. They identified two main attractions: ENCA contains resources linked to existing Scottish data gaps (such as biodiversity), and it showcases case studies where NC tools have supported land-based policy.

However, participants stressed the **need to understand how transferable these tools are to a Scotland specific context and how they might need to be adapted**. Several challenges were raised. Many found ENCA complex, non-linear and difficult to navigate, potentially reinforcing perceptions that NC is overly complicated. Differences in scale also limit applicability: tools developed for local projects may not translate easily to national-level policy. ENCA may also miss Scotland-specific datasets or duplicate tools being developed elsewhere (e.g., Scottish biodiversity metrics).

Despite these issues, participants saw strong **potential in ENCA**. It could support consistency across policies, offer valuable prompts for NC assessment, and provide lessons from previous initiative. Participants suggested further research could be beneficial to assess how ENCA tools could be adapted and applied effectively within Scottish agricultural policy.

In 2020 DEFRA presented a curated collection of tools for enabling a natural capital approach to help decision-makers, known as 'ENCA'. In the Agrichats workshop, we introduced this set of tools and discussed if and how it could be used in the agricultural policy cycle.

4.1 What is ENCA and how may it connect with agricultural policy?

The **'Enabling Natural Capital Approach' (ENCA) toolkit** (DEFRA 2023)[5] is a collection of resources (data, tools and guidance) to help decision-makers in public sector organisations (and private practice) to understand how to take into account evidence on the natural environment. ENCA is recommended for use by the Green Book (HM Treasury 2022) and is represented within its supplementary guidance. As per the researcher teams' knowledge, no other European country has a dedicated policy toolkit similar to ENCA, what makes the UK front runners in considering integration of NC in policy, despite natural capital being of great interest across Europe.

ENCA is intended to meet the needs of various public and private users, and so different sections and tools are intended for different sets of users. For example, sections 3.2 and Annex 1 of the Guidance and the ENCA Case Studies are intended for people interested in how ENCA can support policy priorities.

Still, ENCA is not a well-known resource among teams working in agricultural policy development in Scotland. During the AgriChat 1.0 interviews there was not much familiarity with it, and all the

[5] ENCA was first published in January 2020 and it has been updated several times since then. Last update is from 2023, although separate pieces might have been updated later (e.g. guidance updated in 2025).

participants in Agrichats 2.0 said that they could not recall prior learning about ENCA. One of the participants qualified this lack of awareness as 'concerning' [*"The fact that earlier on we're saying that we weren't really aware of the concept at all concerns me"* (Workshop Participant #2)].

Regarding agricultural policy, table 12, Annex 1 of the Guidance document includes a column on ENCA resources for agriculture. It says that "*NC can contribute on: resilience, diversification, environmental land management*" and points toward a number of case studies, tools and tabs in the Services Databook (DEFRA 2025) and the Assets Databook (DEFRA 2025) that could be relevant:

- Relevant tabs in the Services Databook: Food, Soil, Water quality, Regulating Services, and Cultural Services.
- Relevant tab in the Assets Databook: Farmland.
- Relevant case studies: VN6: Value for Money of Additional investment in agri-environment schemes in the Rural Development Plan for England 2014-2020; FR4: Online Auction for Natural Flood Managemen to generate payments to landowners for ecosystem services; FR5: Reverse Auction for Nitrogen Reduction developed by Wessex Water; and FR6: Upstream Thinking, developed by South West Water and partners to prevent harmful substances from entering into rivers.
- Relevant featured tools: NEVO- Natural Environment Valuation Online (LEEP 2021) and MESER - Managing Ecosystem Services Evidence Review (Natural England 2015).

During the workshop, ENCA was described metaphorically as a big 'pantry' with many goods and an associated cookbook with recipes that illustrates how others have used some of those ingredients. Some of the ingredients in the pantry will be familiar while others might be more exotic. There were two types of ingredients that were of particular interest to participants:

1. The ENCA toolkit includes resources focused on some of the topics where data gaps have been identified in the agricultural policy cycle (e.g. biodiversity). Thus, it is logical that the workshop participants wanted to know more about the specific cases those resources refer to.
2. Participants also noted that the ENCA resources "*would be of real value*" in cases where they have been used in agricultural or land-based policies (Workshop Participant #2). Still, it would be necessary to assess up to what point a resource could be successfully used in Scotland and the adaptations that it might require [*"what bits of it don't work for Scotland and why and how we could change it"* (Workshop Participant #1)].

ENCA it is not a fixed recipe or instructions manual. Accordingly, the participants suggested that research on how the ENCA resources have been used would be necessary and valuable. Evidence seems necessary about how resources were developed and applied in first instance before being included in the ENCA toolkit, and about how they might have been used and adapted by others since being included in the ENCA toolkit. Thus, it is not just about exploring the case studies included in ENCA, but – continuing with the pantry metaphor – to develop ideas for recipes, by sharing case studies about how others have used and adapted resources taken from the ENCA pantry.

4.2 Challenging aspects of ENCA

A quick look through the ENCA toolkit could feel a bit intimidating for policymakers that have not engaged with it before and who might still feel a lack of clarity regarding NC.

- Participants in the workshop noted that "*one needs knowledge to navigate it and understand it*" (Workshop Participant #3). Enough time to look at it thoroughly was deemed necessary in order to be able to identify elements of interest [*"I haven't been able to get my head around*

all of the different tools and it's really difficult to make an assessment in such a short period of time" (Workshop Participant #3)].

- The ENCA tools -that is, the spreadsheets- are considered "**extremely complex**" and disorientating due to their non-linear nature and organisation through hyperlinks. ["*You quite easily get lost by clicking a link. Then we'll need another link and another link and you end up putting a place where you forgot where you started off from but on the face of it*" (Workshop Participant #4)]. The complexity of the toolkit could add to the perception that working with NC is difficult and so have unintended discouraging effects. ["I*t's just all complicated. It just adds to the everybody's impression that the natural capitals are the complicated and really difficult*" (Workshop Participant #1)].
- The use of layman terms could be used to make the toolkit more accessible.

Many resources – particularly the case studies – **refer to specific levels of scales**. This could pose challenges for their transferability and applicability in other cases with different characteristics ["*This won't work here because and it's something that it was quite unique maybe to that particular landscape or, or catchment or whatever and that plays into it*" (Workshop Participant #2)]. In particular, it was noted that some tools look great for working at project level, but difficult to adapt at national level, this puts a question mark on how useful they could be for policy development ["*I think a lot of these tools look great at that project level but it's challenging to think about how you would use them at a national scale"* (Workshop Participant #7)*].*

Although ENCA contains a wide and potentially daunting range of data and resources, it may **not** be **a completely comprehensive catalogue of all possible resources relevant to NC**. There might be other resources (e.g. case studies, datasets, tools) already developed or under development across the UK that have not been included in the ENCA toolkit that could offer suitable alternatives. Awareness of this is needed before using some ENCA materials.

- This was illustrated in the workshop with the case of biodiversity metrics. While some participants found the resources on this promising, others flagged up that there was work to develop biodiversity metrics specific to Scotland such example. In this case, relying on ENCA could be unhelpful and slow down or cause inconsistency across policy areas ["*There's been work underway to look at the DEFRA one and actually create a Scottish [a biodiversity metric]. That's one thing that we have looked at […] and kind of felt it wasn't really appropriate for Scotland, but what could we learn from the DEFRA one?"* (Workshop Participant #1)].
- It was also noted that some specific data for Scotland might not yet be in ENCA, especially in relation to soils data. ENCA already contains other datasets derived from or relevant to some specific contexts – with the generalisability or relevance of data signalled within the ENCA presentation – so it looked possible to suggest data be added to ENCA.

4.3 Promising aspects of ENCA

Despite the challenges that were flagged up, the general impression among the participants in the workshop was that the ENCA toolkit holds considerable **potential for supporting policy development** consistently across the country through knowledge transfer. The toolkit is considered *"extremely comprehensive"* (Workshop Participant #4) and containing useful tools ["*there are some useful tools in there"* (Workshop Participant #4)].

The toolkit allows for **learning from other experiences** across the country, usually piloting or front runner initiatives. Knowing about these experiences would help to develop policy instruments without having to 'reinvent the wheel'. *["If there's work that's been done and, and they've been*

demonstrated to work, certainly that's a good starting point" (Workshop Participant #3)]. It also supports the generation of consistency across the country, particularly in the use of definitions and indicators ["*Because one of the other things we would want to do is to make sure that any reports and definitions we have are consistent with other standards across other countries and things as well"; "I like the idea of having conformity and consistency across the country".* (Workshop Participant #3)]

Along with the case studies, another element of the ENCA toolkit which generated interest was the assessment template. One of the participants noted that the prompts that this tool use could be useful for considering NC and finding additional resources. *["The four step Natural Capital assessment template includes a range of different prompts. It doesn't give the answers […] but it gives prompts and allows you to ask questions […] [about] what you're doing and gives you pointers as to where you should look, the research to find the answers you might be looking for"* (Workshop Participant #4)].

Two topics mentioned within the ENCA resources were identified 'at a first glance' as of potential interest for the development of the agricultural policy. These were biodiversity metrics and peatland restoration: "*the one that keeps drawing me in is something to do with peatland restoration is the one I can probably most identify with in terms of, like my understanding, the natural capital and how it can be improved and protected and whatnot*" (Workshop Participant #2)]

Overall, the participants appeared to judge that there was potential for ENCA resources to be relevant in the evaluation of agricultural policy. In particular, participants asked whether ENCA could help improve understanding of the value of efforts for nature restoration. For example, the value to food production, or how improved soil health and biodiversity could enhance yield and reduce inputs, contributing to long term resilience. ENCA was seen as potentially useful for aspects of on-farm climate mitigation, and also of nature restoration, especially in relation to the missing biodiversity baselining.

However, it was discussed that in order **to unlock the potential of the ENCA toolkit, it would be necessary to better understand the transferability of these tools in Scotland, and the extent to which resources used for projects could be applied at a national level**. One of the participants suggested that "*maybe it could be looked at within the strategic research programme to determine how useful or otherwise it might be to Scotland*" (Workshop Participant #4).

Discussion

We used an exploratory approach to provide insights on how Natural Capital considerations are currently being integrated in the Scottish Government's ARP with a focus on related data needs and considerations for future policy monitoring and evaluation. The findings allow us to respond to the research questions:

- *What are the current key issues in the use of NC evidence in policy development for agriculture in Scotland?* The use of NC evidence in the Scottish agricultural policy development is currently shaped by the need for clearly defined indicators and baseline data, that depending on topic it might still need to be collected or harmonised. As a result, the integration of NC evidence on different topics poses different types and extent of challenges, and is happening at different paces.
- *To what extent is NC-related evidence or tools seen as salient to agricultural policy evaluation in Scotland?* NC-related evidence is seen particularly relevant for evaluating objectives related to pro-environmental goals (e.g. on-farm nature restoration, on-farm climate mitigation) or changes in the management of natural resources (e.g. regenerative agriculture), and it might be best integrated into policy evaluation as cross cutting evidence base.
- *What is the potential to incorporate existing tools related to NC into future agricultural policy development?* Existing tools such as the ENCA toolkit hold considerable potential for supporting policy development consistently across the country as part of a cross-cutting evidence base, but using ENCA requires knowledge transfer and capacity building efforts.

Discussions about NC in agricultural policy are shaped by the need for clearly defined indicators and baseline data

At the end of 2025, there was still some uncertainty about the definition of NC among Scottish Government staff involved in the ARP, although this seems much lower than during our 2024 interviews. Our study demonstrates how this shapes the current moment in policy development as there is a **need to identify and define indicators to appropriately capture NC** criteria for monitoring the impacts of different policy instruments and evaluate the policy in the future. Participants perceived a **need for applied research** (case studies, comparative studies, and synthesis reviews) that shed light on how NC might be integrated in agricultural policy.

The **limited baseline of agricultural NC data** offering information both at national and farm level is still a challenge for the integration of a NC approach in agricultural policy. This is a critical point as the baseline would fulfil different roles across the policy cycle: evidence to inform strategic direction and goals-setting (rationale and objectives), support decision-making on the definition of targets and the definition of indicators (appraisal and formulation), specification of support schemes (choice and application of policy instruments), and required point of reference for monitoring and assessing progress and impact of the policy (monitoring and evaluation). While the lack of a comprehensive baseline would have been navigated through the first stages of the ARP drawing on datasets and studies provided by the Scottish Government research providers, the monitoring and evaluation stages requires a more univocal and accurate approach. Without baseline data and clarity on the indicators to measure, monitoring progress is not possible. This highlights the salience of the M&E framework currently under development for the integration of NC in the agricultural policy.

At the moment, the SEA of the ARP (LUC 2025) provides an environmental baseline at national-level that considers biodiversity, flora and fauna; population and human health; climate change; air quality; soil; water; cultural heritage; landscape, townscape and seascape; and material assets. Still, there are important gaps in the baseline "*where baseline information is unavailable or*

unsatisfactory" the SEA recognises (LUC 2025: pp 62). The existing data gaps identified in the SEA focus around soil health (soil sealing, contamination from modern contaminants, soil biodiversity, soil compaction, and emerging issues - (LUC 2025: pp 86-86). In any case, the SEA also states that "*the collection and analysis of baseline data is regarded as a continual and evolving process"* as information can change or be updated (LUC 2025: pp 62).

Integration of different aspects of NC may happen at different paces

Discussions about connecting NC with agricultural policy, especially in relation to evaluation, quickly lead to conversations about evidence and data gaps. However, not all gaps are the same. Our study has identified **four different types of data or evidence gaps that shape the integration of NC considerations in agricultural policy in Scotland**. This integration is happening at different pace for different NC topics, depending mostly on the state of the type of existing evidence gaps:

- The easiest evidence gap to solve should be where **there are agreed indicators and other agencies or researchers might already have relevant datasets**. In this case, the work to be done to bridge the data gap is on setting up data sharing agreements as necessary and adapt/harmonise the data to measure the specific metrics or indicators of interest for agricultural policy. Water quality would be a NC topic/topic according to the information discussed at the workshop.
- When **there is agreement about the metrics/indicators of what should be measured, but there are no datasets available**, the work focuses on data collection/acquisition (e.g. through remote sensing data). Solving this data gap might be a matter of funding. The data gaps about soil health illustrate this example (as seen above, those are well identified in the SEA assessment, but workshop participants pointed out that options for acquiring the data are still being evaluated).
- For some topics (e.g. carbon audits), there is expected to be **some data collected at farm level** via the WFPs. However, there is still some **lack of clarity regarding the measurement of progress**. This poses the risk that the data collected is not useful.
- The gaps that seems the most challenging are in those topics perceived to be relevant to understanding effects on and dependence on NC when there is perceived to still be **uncertainty and lack of definition about the criteria to be measured and lack of datasets from agricultural land**. An example of such as topic was biodiversity. However, these topics also offer the most scope for innovation.

Thus, the integration of NC evidence in agricultural policy is happening at different paces depending on the agreement on metrics and indicators and the availability of data. At the time of writing this report, in the case of Scottish agricultural policy, some NC topics were perceived as being closer to integration into agricultural policy evaluation (e.g. the topic of water quality as it was perceived as having data available), while others seen as more challenging (e.g. biodiversity). For some topics there is a plan set (e.g. soil health), and there are some that have been considered but require further consideration about measurements (e.g. audits in the WFP). From the policy cycle perspective, this means that the integration of some NC topics is still in the policy formulation stage (e.g. biodiversity and carbon audits), as indicators are still to be defined clearly; while the integration of other NC topics is in the choice of instruments stage (e.g. soil health) or almost in application (e.g. water quality).

A need to clarify the objectives of using NC-related data in evaluation

When focusing on the evaluation of agricultural policy, the relevance of NC data varies depending on the nature of the objectives to be evaluated. For evaluating its objectives related to pro-

environmental goals (e.g. on-farm nature restoration, on-farm climate mitigation) or changes in the management of natural resources (e.g. regenerative agriculture), NC data may seem more directly relevant than for socio-economic objectives (e.g. thriving communities).

In cases where there might be complex trade-offs between objectives, taking a NC approach might help to connect and reconcile topics, providing common reference baseline points. In our workshop discussions, it became clear that **data on specific types of NC was a common need for evaluating different objectives**. For example, NC data on soil health was considered necessary for evaluating climate mitigation (relating to soil carbon storage), on-farm nature restoration (in relation to healthy soils enabling a wider range of species to be grown), and the adoption and use of sustainable and regenerative agricultural practices. Similarly, a biodiversity baseline was identified as a key data gap for evaluating the objectives on regenerative agriculture, on-farm nature restoration, climate adaptation, and the production of high-quality food, as it is central to understanding the role of nature restoration in food production. Therefore, **NC-related data is best integrated into policy evaluation as part of a cross-cutting evidence base**, and can be used as the enabler for evaluating different outcomes through providing data, without which this would be difficult.

Particular challenges of using farm-level NC data for baselining

Among the types of NC data discussed, there are administrative and on farm-level datasets considered relevant for assessing the NC baselines (and eventual progress) at farm level (e.g. WFPs). However, there are a number of challenges associated with their use.

The data collected through the WFP is seen as valuable to the future evaluation of agricultural policy. As part of the WFP, from 2025 land-managers have had to complete at least two of five key audits; for carbon, biodiversity, soil, animal health, and/or pest management. All five, plus nutrient management, are required by 2028. The information reported by land-managers is not of the same detail or coverage as more intensive scientific monitoring, but could still be a valuable source of information at the farm-level. Particularly relevant to the future evaluation is the data on soil and carbon which were explicitly mentioned in relation to the objectives of regenerative agriculture, on-farm nature restoration and climate mitigation. The evaluation of the regenerative agriculture objective could also benefit from using the WFP data to better understand the baseline on biodiversity, and climate change. However, using the WFP data in this way is challenging, particularly when considering data harmonisation and data privacy.

There was some worry that there might be **variation in methodologies** underlying the information reported by land-managers. For example, if farmers hire consultants to do carbon audits, that might provide farmers with discretion about how audits are fulfilled, but may also mean that data from different farms is not directly comparable and easy to integrate in a harmonised dataset at regional or national level. Thus, efforts of data harmonising might be needed for integrating data from the WFPs in a large-scale baseline dataset, which not be possible if variation in the methodologies is unknown. Thus the specification of methodologies to be used by land-managers is important; also that land-managers communicate back not just data but also any methodological choices, if they have discretion in measurement approaches.

Data privacy concerns might relate to farm resources and business choices that could be considered sensitive. While the calculation of aggregated indicators might not seem problematic, privacy might be jeopardised when representing baseline data geospatially with a high level of granularity. Thus, it is important to establish an agreement on the level of detail with which data is going to be used for baselining and what level of data is considered confidential; and to communicate it to the farmers transparently beforehand.

In any case, it is important to reflect on if and how the collection of NC data through WFPs and other new administrative micro-level datasets resulting from the implementation of new schemes could affect the relationship between farmers and government. This has been studied in Europe – see Grohmann, and Feindt 2024 regarding the impact of changes in Germany, where farmers had traditionally been seen as "deserving beneficiaries" of subsidies, who became seen more as unruly subjects, needing control. While for evaluation purposes it is important to create harmonised and consistent datasets, this should be balanced out with minimising bureaucratic demands on farmers (Forney and Epiney, 2022).

Incorporating existing tools related to NC into future agricultural policy development requires capacity building among agricultural policy staff

While some degree of advancement regarding knowledge about NC was noted from Agrichats 1.0 to Agrichats 2.0, it was still evident that there are knowledge gaps regarding NC, NC approaches in policy, and existing NC tools for policy, like for example, the ENCA toolkit.

The **need to build capacity in government to strengthen NC informed policymaking** is not unique to the Scottish Government, but is something that the OECD and the European Commission highlighted in a joint report last year (OECD and European Commission 2025). In particular, training and building capacity of 'mid-level bureaucrats', that is, staff who work across policy formulation, choice definition of policy instruments and operational implementation, would be key when working in the development of policy integration (Alam et al. 2025), as is the case of integrating NC in agricultural policy. Building such capacity can be developed simultaneously by different approaches. This can include training and knowledge transfer to learn from specific tools and experiences (e.g. ENCA tools), and also by 'learning by doing' while creating spaces for reflecting on the current practice on integration of NC, (as for example created by Agrichats 2.0 discussion).

Insights relevant beyond agricultural policy

While the focus of this study has been agricultural policy, there are some insights likely relevant when considering if and how to integrate NC approaches into other policy areas.

- **The importance of capacity building** within policy development teams around NC and NC tools is critical to enable working with a NC approach. One of the main barriers identified in Agrichats 1.0 was the lack of common understanding of NC and related terminology, and the need to build capacity about specific NC tools has been discussed in depth in Agrichats 2.0. Thus, it seems logical to presume that dedicating time and resources to build capacity around NC in other teams is a key enabler for the integration of NC approaches. This was also supported by respondents to a 2023 survey of Scottish Government staff (Waylen et al, 2025). While internal turnover might help to transfer organically some of the NC expertise between departments, it still would be important to build capacity about how NC might underpin or contribute to specific policy sectors.
- **Sharing real-life examples is helpful** for thinking how to work with NC in practice**.** When looking into the knowledge about NC data resources such as the ENCA toolkit, the discussions in Agrichats 2.0 have highlighted a desire for examples of how the ENCA toolkit is used to develop or evaluate policy. Examples about the use of NC data in Scotland would be particularly useful. Thus, there is value in creating a repository of case studies describing in detail precisely how teams have used NC data or resources to develop policy and develop a NC approach. Such case studies would support the spread of NC approaches to other areas, thus developing a positive feedback loop.

- **Self-appraisal of current processes** may constrain or enable future attempts to work with NC. In particular, it is important to consider how legacy and tradition in specific policy areas regarding the understanding of their relationships with nature and environment and the use of environmental data might smooth or hinder the integration of a NC approach. In our study of agricultural policy, it became clear that even though this is a policy undergoing change, there was still a strong path-dependency on how the relationship between agriculture and natural resources was represented or monitored, and how to engage with farmers. This has shaped the development of the ARP and shapes current opportunities to integrate a NC approach. For other policy areas, where the consideration of natural resources has been limited or peripheral until now, integrating NC in their development may pose new challenges or opportunities. It might actually be easier to connect NC ideas or embed new NC datasets in 'fresh' policy areas where there has not already been much consideration of any environmental issues, particularly if relevant baseline datasets have already been developed for other sectors that can be adapted for the new 'fresh' areas. However, further research would be needed to ascertain what attributes help or hinder such changes.

Next steps

The ideas shared during the Agrichats 2.0 workshop show that staff working on agricultural policy development see potential in working with NC ideas, data and concepts, but would value seeing the detail of real-life policy application to understand more about how this could be connected with NC. Building on this enthusiasm, the authors have offered to 'matchmake' in 2026 - i.e. to check, find and help broker connections between staff working on agricultural policy with ENCA experts.

A large part of our discussions focused on 'data gaps' that impeded working with NC. However, working with and reflecting the full values of nature is not likely to instantly happen just as long as NC relevant datasets are available. Instead, agricultural policy processes themselves may also need to adapt in order to work properly reflect new data or concepts. In this study we were not able to discuss much the specific processes and practices that might need to change; but doing so may become easier when NC-specific datasets and case studies are more familiar. It will also be necessary to understand how ENCA might support the work of different policy roles along the policy cycle and define the part that policy analysts and analytical teams (e.g. RESAS) might play in the identification and analysis of tools and data. In addition, the general insights that may help bring NC into closer consideration by staff working on policy development – e.g. capacity-building, real-life examples, and self-appraisal of current processes – will be combined with insights from other parts of this project to discuss with other policy areas opportunities to embed working with NC in policy processes.

Conclusions

Ongoing changes in Scottish agricultural policy provide an **opportunity to strengthen how the policy development takes account of NC**. We have discussed perceptions of NC and opportunities to work more closely with it, with staff associated with agricultural policy reform. It seems that there is some opportunity to connect ideas or data on NC with policy development, especially evaluation, but actually achieving this requires more reflection and capacity building about how to use existing NC data and resources, and how to procure any additional data needed (especially from farm scales).

The lack of a clear baseline of agricultural NC, at both national and farm level, is a cross-cutting challenge that will impede future evaluation of how and how well NC has been reflected and supported by agricultural policy. The monitoring and evaluation stages require a more unequivocal and accurate approach to baselining in terms of NC.

When considering specific aspects of NC, it is useful to distinguish between different types of 'gaps' or challenges. We have identified four types 'data gaps' depending on the clarity of metrics and methods needed to collect information; and the availability of that information to agricultural policy makers. For example, suitable information on water quality may already be available as collected for the requirements for other policies, and 'just' needs connection into agricultural policy development, whereas for agricultural biodiversity, the information is neither available nor the metrics clearly defined. The pathway to filling some of these data gaps is thus easier for some topics than others.

The implications for the existing specific practices in policy development, especially beyond evaluation – the 'gaps' in challenges or practices that need to be adapted – remains a challenge to identify in collaboration with policy colleagues responsible for those practices.

References

Academic Advisory Panel (AAP) (2025) FMEC recommendations for Agriculture Reform. Advisory note from the meeting of the group on 4 July 2025. https://www.gov.scot/publications/academic-advisory-panel-fmec-recommendations-for-agriculture-reform/

Alam, S., Larisu, Z., Arsyad, M., Kadir, A., Taufik and Sudirman, F.A. (2026) Strengthening local asset management through an integrated policy ecosystem: The role of mid-level bureaucratic connectivity. *Public Money & Management*, 46(1), pp. 66-76. https://doi.org/10.1080/09540962.2025.2504574

Althaus, C. and Threlfall, D. (2021) The policy cycle and policy theory: From theory-building to policy making. In Handbook of public administration, pp. 283-292. Routledge. https://doi.org/10.4324/9780429270680

Bateman, I. J., Harwood, A. R., Mace, G. M., Watson, R. T., Abson, D. J., Andrews, B., Binner, A., Crowe, A., Day, B. H., Dugdale, S., Fezzi, C., Foden, J., Hadley, D., Haines-Young, R., Hulme, M., Kontoleon, A., Lovett, A. A., Munday, P., Pascual, U., Paterson, J., Perino, G., Sen, A., Siriwardena, G., van Soest, D. and Termansen, M. (2013). Bringing Ecosystem Services into Economic Decision-Making: Land Use in the United Kingdom, *Science,* 341(6141)**,** 45-50. https://doi.org/10.1126/science.1234379

Bateman, I.J., and Mace, G.M. (2020) The natural capital framework for sustainably efficient and equitable decision making. *Nat Sustain* 3, pp. 776–783. https://doi.org/10.1038/s41893-020-0552-3

Binner, A.R., Addicott, E.T., Balmford, B., Day, B.H., Mancini, M.C., Williamson, D., and Bateman, I.J. (2025) Using the natural capital framework to integrate biodiversity into sustainable, efficient and equitable environmental-economic decision-making. *Philos Trans R Soc Lond B Biol Sci* 9; 380 (1917). https://doi.org/10.1098/rstb.2023.0215

Blackstock K.L., Hare M., Trdlicova K. and Matthews, K.B. (2025) Discussing Modelling Results to inform RESAS Monitoring and Evaluation Framework for the Agriculture Reform Programme: Workshop Report for Land Use Transformations Project (JHI-C3-1), p36. (not for public distribution – advice to government only).

Blandford, D. (2007) Information deficiencies in agricultural policy design, implementation and monitoring. OECD Food, Agriculture and Fisheries Working Papers, No. 6, OECD Publishing. https://doi.org/10.1787/067228574571

Claret, C., Metzger, M.J., Kettunen, M. and Brink, PT. (2018) Understanding the integration of ecosystem services and natural capital in Scottish policy, *Environmental Science & Policy,* 88, pp. 32-38. https://doi.org/10.1016/j.envsci.2018.05.019

DEFRA (2023) Enabling a Natural Capital Approach (ENCA). Biodiversity and ecosystems. https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca

Deputy First Minister and Cabinet Secretary for Economy and Gaelic (2026) Update on the National Performance Framework - Letter of 16 February 2026 to the convener of the Finance and Public Administration Committee. https://www.parliament.scot/chamber-and-committees/committees/current-and-previous-committees/session-6-finance-and-public-administration-committee/correspondence/2026/update-on-the-npf-letter-of-16-february-2026

ECA (2020) Using new imaging technologies to monitor the Common Agricultural Policy: steady progress overall, but slower for climate and environment monitoring. ECA special report pursuant to Article 287(4), second subparagraph, TFEU. European Court of Auditors. European Union. https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=52913

El Benni, N., Grovermann, C. and Finger, R. (2023) Towards more evidence-based agricultural and food policies. *Q Open*, 3(3). https://doi.org/10.1093/qopen/qoad003

Environmental Audit Committee (2025) The role of natural capital in the UK's green economy. First report of session 2024-25 HC 501. House of Commons. https://committees.parliament.uk/publications/47712/documents/249328/default/

Forney, J. and Epiney, L. (2022) Governing Farmers through data? Digitization and the Question of Autonomy in Agri-environmental governance. *Journal of Rural Studies*, 95, pp. 173-182. https://doi.org/10.1016/j.jrurstud.2022.09.001

Grammatikopoulou, I., La Notte, A., Pisani, D. and Nucci, M. (2025) From nature to numbers: integrating natural capital accounting into decision-making. Science for Policy Brief. European Commission. https://publications.jrc.ec.europa.eu/repository/handle/JRC143088

Grohmann, P. and Feindt, P.H. (2024) Realigning state-farmer relations in agricultural post-exceptionalism: Direct payment implementation in the Common Agricultural Policy post-2022 in Germany. *Journal of Rural Studies*, 110, pp. 103363. https://doi.org/10.1016/j.jrurstud.2024.103363

Grondard, N., Hein, L. and Van Bussel, L.G. (2021) Ecosystem accounting to support the Common Agricultural Policy. *Ecological Indicators*, 131, pp. 108157. https://doi.org/10.1016/j.ecolind.2021.108157

HM Treasury (2020) Magenta Book. Central government guidance on evaluation. https://www.gov.uk/government/publications/the-magenta-book

HM Treasury (2022) The Green Book. Central government guidance on appraisal and evaluation. https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government

Howlett, M., Ramesh, M. and Perl, A. (2009) Studying Public Policy, Policy Cycles and Policy Subsystems, Oxford University Press, Toronto. https://doi.org/10.2307/2952394

Land Use Consultants Limited (LUC) (2025) SEA of the Agricultural Reform Environmental Report. Report commissioned by Scottish Government. https://www.gov.scot/binaries/content/documents/govscot/publications/impact-assessment/2025/11/sea-agricultural-reform-environmental-report/documents/sea-agricultural-reform/sea-agricultural-reform/govscot%3Adocument/sea-agricultural-reform.pdf

Land, Environment, Economics and Policy Institute (LEEP) (2021) Natural Environment Valuation Online. The University of Exeter. https://www.leep.exeter.ac.uk/nevo/

Lankoski, J., Nales, E. and Valin, H. (2025) Assessing the impacts of agricultural support policies on the environment: Economic analysis, literature findings and synthesis. OECD Food, Agriculture and Fisheries Papers No. 223. OECD Publishing. https://www.oecd.org/en/publications/assessing-the-impacts-of-agricultural-support-policies-on-the-environment_808f110c-en.html

Lindquist, E.A. and Wellstead, A. (2021) The policy cycle: From heuristic to a theory-informed research and advice. In Handbook of public administration, pp. 303-322. Routledge. http://doi.org/10.4324/9780429270680-31

Lochhead, R. (2025) Making the Case for Nature: Insights from Scotland's Natural Capital Analyses. Report prepared for Scottish Government. AECOM. https://www.gov.scot/publications/making-case-nature-insights-scotlands-natural-capital-analyses/documents/

Mackie, B. (2018) The Scottish Government's System of Outcome-Based Performance Management: A Case Study of the National Performance Framework and Scotland Performs. Outcome-Based Performance Management in the Public Sector. Springer. https://doi.org/10.1007/978-3-319-57018-1_5

Maes, J., Vallecillo, S. and Teller, A. (2020) Mapping and Assessment of Ecosystems and their Services: An EU ecosystem assessment. 10.2760/757183. https://doi.org/10.2760/757183

Maes, M.J., Jones, K.E., Toledano, M.B. and Milligan, B. (2020) Accounting for natural capital has cross-cutting relevance for UK public sector decision-making. *Ecosystem Services*, 44, p.101127. https://doi.org/10.1016/j.ecoser.2020.101127

Martino, S., Patil, I., Martinat, S., Ballesteros, A. and Waylen, K.A. (2026). Where is natural capital being used in policy-making? Results from an international review. *Ecosystem Services*, 78, p.101825. https://doi.org/10.1016/j.ecoser.2026.101825

McKenna, T., Blaney, R., Brooker, R.W., Ewing, D.A., Pakeman, R.J., Watkinson, P. and O'Brien, D. (2019) Scotland's natural capital asset index: Tracking nature's contribution to national wellbeing, *Ecological Indicators*, Volume 107. https://doi.org/10.1016/j.ecolind.2019.105645.

McVittie, A. and Glenk, K. (2025). Valuation and mapping of cultivated soil ecosystem services. Scotland's Rural College (SRUC). https://doi.org/10.58073/SRUC.29196905.v1

Natural England (2015) Managing Ecosystem Services Evidence Review (Formerly Ecosystem Services Transfer Toolkit NECR159) (JP033). https://publications.naturalengland.org.uk/publication/5890643062685696

NatureScot (2025) Natural Capital Asset Index (NCAI) – 2025 https://www.nature.scot/doc/scotlands-natural-capital-asset-index-2025-data-2022-update-summary

OECD (2025) Agricultural Policy Monitoring and Evaluation. Making the most of the trade and environment nexus in agriculture. In OECD Publishing. https://www.oecd.org/content/dam/oecd/en/publications/reports/2025/10/agricultural-policy-monitoring-and-evaluation-2025_354e7040/a80ac398-en.pdf

OECD and European Commission (2025) Strengthening National Evidence-Informed Policymaking Ecosystems: Lessons from Seven European Countries, OECD Publishing, Paris, https://doi.org/10.1787/855c5286-en

Ozdemiroglu, E. (2019). Natural capital - a practitioner's overview of concepts and applications, *Journal of Environmental Economics and Policy,* 8(4)**,** 343-352. https://doi.org/10.1080/21606544.2019.1639220

Poppe, K.J., Vrolijk, H.C. and van Asseldonk, M.A. (2024) Innovation in the Farm Office for Smart Sustainability Reporting. *EuroChoices*, 23(3), pp.42-47 https://doi.org/10.1111/1746-692X.12427

RESAS (2023) Agriculture and Rural Communities (Scotland) Bill – Supporting Evidence and Analysis. https://www.gov.scot/publications/agriculture-rural-communities-scotland-bill-supporting-evidence-analysis/

Sabatier, P.A, (2019) The need for better theories. In Theories of the Policy Process, Second Edition pp. 3-17. Routledge. https://doi.org/10.4324/9780367274689-1

Scottish Government (2021) Agricultural Transition in Scotland: first steps towards our national policy. The Scottish Government, Edinburgh, Scotland. https://www.gov.scot/publications/agricultural-transition-scotland-first-steps-towards-national-policy-consultation-paper/

Scottish Government (2022) Delivering our Vision for Scottish Agriculture. Proposals for a new Agriculture Bill, The Scottish Government, Edinburgh, Scotland. https://www.gov.scot/publications/delivering-vision-scottish-agriculture-proposals-new-agriculture-bill/

Scottish Government (2023)a Agriculture Reform Glossary. The Scottish Government, Edinburgh, Scotland. https://www.ruralpaymentsandservices.org/topics/agricultural-reform-programme/arp-glossary/

Scottish Government (2023)b Recognising the Importance of Scotland's Natural Capital, Produced for The Scottish Government by APS Group Scotland, Edinburgh, Scotland. https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2023/06/scottish-natural-capital-accounts-2023/documents/recognising-importance-scotlands-natural-capital/recognising-importance-scotlands-natural-capital/govscot%3Adocument/recognising-importance-scotlands-natural-capital.pdf

Scottish Government (2024)a Scottish Government Evaluation Action Plan. The Scottish Government, Edinburgh, Scotland. https://www.gov.scot/publications/scottish-government-evaluation-action-plan/

Scottish Government (2024)b Summary of Scottish Data from UK Natural Capital Accounts, Environment and Forestry Directorate, Scottish Government, Edinburgh. https://www.gov.scot/publications/summary-of-scottish-data-from-uk-natural-capital-accounts-2024

Scottish Government (2025)a Agricultural Reform Route Map Agricultural Reform Route Map, The Scottish Government, Edinburgh, Scotland. https://www.ruralpayments.org/topics/agricultural-reform-programme/arp-route-map/

Scottish Government (2025)b Greening Guidance 2026. Overview. The Scottish Government, Edinburgh, Scotland. https://www.ruralpayments.org/topics/all-schemes/basic-payment-scheme/basic-payment-scheme-full-guidance/greening---bps/greening-guidance-2026/

Scottish Government (2025)c Future Farm Investment Scheme full guidance. The Scottish Government, Edinburgh, Scotland. https://www.ruralpayments.org/topics/all-schemes/ffis/future-farm-investment-scheme/

Scottish Government (2025)d Future Farming Investment Scheme (FFIS) Frequently Asked Questions. Version 19 December 2025. The Scottish Government, Edinburgh, Scotland. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.ruralpayments.org%2Fme

dia%2Fresources%2FFuture-Farming-Investment-Scheme-Guidance---Frequently-Asked-Questions---19-December-2025.docx&wdOrigin=BROWSELINK

Scottish Government (2025)e Supporting Scotland's transition - land use and agriculture: consultation. The Scottish Government, Edinburgh, Scotland. https://www.gov.scot/publications/supporting-scotlands-transition-land-use-agriculture-consultation/

Scottish Government (2025)f Whole Farm Plan Full Guidance. The Scottish Government, Edinburgh, Scotland. https://www.ruralpayments.org/topics/all-schemes/whole-farm-plan/

Scottish Government (2026)a Importance of Natural Capital to the Scottish Economy -Marine and Terrestrial, The Scottish Government, Edinburgh, Scotland. https://www.gov.scot/publications/importance-natural-capital-scottish-economy-marine-terrestrial/documents/

Scottish Government (2026)b Scotland's Fourth Land Use Strategy 2026-2031. The Scottish Government, Edinburgh, Scotland. https://www.gov.scot/publications/scotlands-fourth-land-use-strategy-2026-2031/documents/

Scottish Government (2026)c Supporting Scotland's Transition Land Use and Agriculture. Consultation Analysis Report. The Scottish Government, Edinburgh, Scotland. https://www.gov.scot/publications/supporting-scotlands-transition-land-use-agriculture-consultation-analysis-report/documents/

Scottish Parliament (2023) Agriculture and Rural Communities (Scotland) Bill: Financial Memorandum (SP Bill 33–FM). Session 6. https://www.parliament.scot/-/media/files/legislation/bills/s6-bills/agriculture-and-rural-communities-scotland-bill/introduction/financial-memorandum-accessible.pdf

Tallis, H., Fenichel, E. P., Petes, L., Hsiang, S., Levin, P. S., Levy, H., & Lubchenco, J. (2024) Mainstreaming nature in US federal policy. *Science*, 385(6708), pp. 498–501. https://doi.org/10.1126/science.adp5394

Thomson, S., McMillan, J., Glendinning, J and Vesser, S. (2025) A Rapid Evidence Review of Monitoring and Evaluation Frameworks for Agricultural Support in Selected Jurisdictions. A SRUC report to the Scottish Government DOI: https://doi.org/10.58073/SRUC.29160611

Thomson, S., Moxey, A., and Matthews, K. (2021) New Rural Support Scheme development - evidence: outputs summary. Evidence to Support Development of a New Rural Support Scheme for Scotland: A summary of written outputs

Valero, D., Gray, R., Waylen, K. (2025) Views on Natural Capital and Evidence Use in Policy Processes associated with Scotland's Agricultural reform Programme. The James Hutton Institute. https://www.hutton.ac.uk/wp-content/uploads/2024/05/260326_JHI-D5-3_D2.2AgriChats.pdf

Van der Velden, D., Klerkx, L., Dessein, J. and Debruyne, L. (2025) Governance by satellite: Remote sensing, bureaucrats and agency in the Common Agricultural Policy of the European Union. *Journal of Rural Studies*, 114, pp. 103558. https://doi.org/10.1016/j.jrurstud.2024.103558

Waylen, K., Patil, I. and Carmen, E. (2026) Can natural capital help national-level policy-makers to embed sustainability considerations? Insights from Scotland. *Ecological Economics*, 240, pp. 108815. https://doi.org/10.1016/j.ecolecon.2025.108815

Wuepper, D., Wegner, J.D., Mileva, N., Bouchat, J., Chen, S., Ortiz-Bobea, A. and Finger, R. (2026) Harnessing satellite data for the next generation of agri-environmental policies. *Environmental Research Letters*, 21(1), pp. 011002. https://doi.org/10.1088/1748-9326/ae2d77