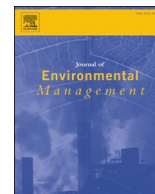


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Research article

Exploring policy coherence for land use transformations: The case of Scotland



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ABSTRACT

The multiple crises (climate, biodiversity, austerity) facing our socio-ecological systems require ambitious responses; with much of the responsibility for protecting public goods and developing sustainably lying with public policy. To tackle these wicked problems, there are increasing calls for policy coherence: to use the levers of government in a more holistic and systemic manner. Land use transformation is crucial to achieving these ambitions. However, there is limited scholarship that takes a comprehensive approach to analysing policy coherence (both horizontal and vertical). Common to many nation-states, the Scottish Government has made ambitious pledges to address climate action (mitigation and adaptation) and nature, with an emphasis on leaving no one behind e.g., net zero by 2045 using Just Transitions. In this research we examine the policy coherence of 66 Scottish land use related policies in addressing land use transformation, as well as an in-depth coherence analysis of 11 agricultural policies. We address three research questions on the synergies and problems in policy coherence for land use transformation, as well as opportunities for improvement. Overall, we found that half of the 66 policies examined advanced land use transformation, but we query the possibility of hidden conflicts. The in-depth coherence analysis highlighted that when looking at the agricultural policies as a collective, coherence was clear, however, on the individual level it was not. Our paper shows that whilst challenging to implement, paying attention to multiple forms of policy coherence can highlight opportunities to consider when revising or designing policies for these pressing problems.

1. Introduction

There are multiple calls to address simultaneous crises that characterize the Anthropocene e.g. (Rockström et al., 2017) resulting in regular international pledges such as COP15 on ecosystem restoration or COP28 on climate action. At their heart is the need to consider how we use land; including mitigation of impacts arising from human use and/or enhancing ecosystem recovery through working with, instead of against, nature (van Oosten et al., 2018). However, for such approaches to be legitimate and socially acceptable, land use change needs to consider the social, cultural and economic implications of such change (Long et al.,

2021). Increasingly, there is the need for transformational thinking (Dorninger et al., 2020; Jacob and Ekins, 2020; Sachs et al., 2019) that takes a holistic and systemic approach to resolving interconnected and long term challenges; and recognises that incremental adjustments may not achieve the required changes before potential socio-ecological tipping points are reached.

Research has illustrated that siloed approaches to addressing global crises, such as climate change, biodiversity, inequality, food, and energy are problematic (Farmery et al., 2019; Muscat et al., 2021; Nilsson et al., 2012). For example, public policy initiatives that mitigate climate change may have adverse impacts on biodiversity, such as monoculture

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tree planting (Brown, 2020). This represents a conflict of policy objectives. As the current multiple crises are interlinked and are relevant to all aspects of our society, it is important for governments who make public policy to consider aspects such as biodiversity, equity and climate in a range of policies. This will help to ensure policy objectives are coherent across sectors. However, the literature suggests policy silos are a problem (Scott et al., 2022), and not all the objectives of government easily cohere with climate and biodiversity aspirations (Muscat et al., 2021). This coherence requires careful management and consideration by government to ensure that necessary trade-offs are minimised and possible synergies are maximised (Farmery et al., 2019; Muscat et al., 2021). Enhancing policy coherence is, therefore, crucial for governments to avoid working in silos (Nilsson et al., 2012). What's more, whilst there is much literature highlighting the need for policy coherence (Farmery et al., 2019; Peters, 2018; Söderberg, 2016), there is limited literature exploring how coherence happens in practice. In this paper, we address this gap.

This paper focuses on dismantling policy silos through transformational thinking towards rural land use. Transformational thinking refers to considering substantial, system wide, proactive change (Patton, 2019) and is used to address wicked problems. For example, transformations of various forms are discussed throughout this journal (c.f. Li et al., 2024; Yang et al., 2024; Zhou et al., 2024). Land use is a contested term. For the purpose of this research, we understand land use to mean the use of land by humans to produce a range of multiple benefits (EPA, 2023). Land use, therefore, incorporates a wide range of policy interests and sectors. Whilst both urban and rural land use transformation are key to addressing global crises, we focus on rural land use to enable in-depth analysis of a bounded set of policies. This focus allows us to better explore the alignment of agricultural and environmental policy objectives (Pe'er et al., 2020), whilst also considering justice and equality commitments.

The literature highlights the complexity around land use choices and therefore stresses the need for an integrated approach to land use (Mann et al., 2018). This is particularly important due to the possible land use conflicts and trade-offs apparent in policy (Brown, 2020; Mann et al., 2018; Ogawa et al., 2023). Ogawa et al. (2023) highlight how farmers in the EU may face difficulties in deciding whether to prioritise economic or environmental objectives when deciding whether to join agri-environment schemes. Scholars have also explored conflicts within other forms of land use, such as the conflict between woodland and peat (Brown, 2020). Considerations over land use span out into multiple other sectors of policy and is why a broad definition of land use is used in this research. The possible conflicts between land use and the environment are so widely recognised as an important issue of our time that international frameworks, such as the one adopted by The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (IPBES, 2013), have been established to prevent these conflicts occurring on an international level. Moreover, there are emerging conflicts, such as with renewable energy production and uncertainty around future energy production (Karlilar Pata, 2024). Indeed, the complexity and variety within land use means careful consideration is needed to ensure that policy is effective (Brown, 2020). It requires the collaboration across various sectors, so that there can be a shared understanding of the multiple considerations involved in land use and a move towards a more comprehensive shared understanding and policy coherence.

This paper arose from a wider project considering land use transformation in Scotland. Although rich in natural resources, Scotland, like many countries, is struggling to meet national and international climate and biodiversity targets (Perino et al., 2022) whilst maintaining viable rural populations and addressing socio-economic inequalities, leading the current Government to recognise the need for overall transformative thinking (Scottish Government, 2022). Due to the UK's exit from Europe, a range of land use policies are being revised and are trying to incorporate some of this transformational thinking to

address the thorny issue of ensuring climate and biodiversity targets are met and rural populations prosper. Thus, the research presented here is particularly timely.

Therefore, this paper explores policy coherence in the context of Scottish Land Use policies. We focus on the role of public policy in managing the various priorities involved in land use. First, we examine the broad coherence between 66 land use related policies to analyse their transformative impact. Next, we focus on the coherence of 11 agricultural policies to explore if and how coherence is happening in further detail. This addresses the current silence in the literature regarding policy coherence in practice.

2. Policy coherence

This paper understands policy to mean 'the sum total of government action, from signals of intent to the final outcomes' (Cairney, 2019: 2). Policy therefore covers all forms of formalised government processes including primary and secondary legislation, strategic steering documents (discussion papers, consultation documents, route maps) and policy instruments that support implementation (incentives, plans, technical guidance etc.) (see methodology). Moreover, we also understand it as encompassing a range of different stakeholders, including trans-national stakeholders for international policies. However, in this paper, from herein, 'policy' refers to public policy and in the context of our empirical data, Scottish Government policy. Policy analysis often presents a clear 'policy cycle' (Hansson et al., 2015), however, as policy is complex, multifaceted political mechanism involving various actors and stages (Hill and Varone, 2021) this research uses an interpretive policy process approach to incorporate the messiness involved in establishing and implementing policy (Hill and Varone, 2021).

We draw on the definition of policy coherence as the 'attribute of policy that systematically reduces conflicts and promotes synergies between and within different policy areas to achieve the outcomes associated with jointly agreed policy objectives' (Nilsson et al., 2012: 396). It enables governments to ensure that there is no unplanned duplication or unanticipated conflicts. Policy coherence is also referred to as policy integration (Nilsson and Persson, 2017; van Oosten et al., 2018). Integration is often used when attempting mainstream a particular topic into other policy areas, such as mainstreaming environmental policy (Farmery et al., 2019; Lafferty and Hovden, 2003; Nilsson and Persson, 2017; Persson et al., 2018). Whereas policy coherence often refers to within one domain (Pimenta and Kamruzzaman, 2024), such as land use. There are multiple dimensions of policy coherence as will be explained below.

It is well established that policy design does not exist in a vacuum. Indeed, the success of a policy often depends on the success of other policies (Peters, 2018). Analysing policy coherence allows the exploration of that process in more detail. Understanding the state of policy coherence highlights areas of duplication, contradiction, displacement, differing demands and cross cutting problems (Farmery et al., 2019; Peters, 2018; Söderberg, 2016). However, despite the agreement that policy coherence is generally needed, there is limited research analysing policy coherence or how to improve it (Nilsson et al., 2012). This research addresses this by analysing policy coherence for land use policy: a policy area with significant scope for synergies and conflicts for many nations, given the current biodiversity, climate, and austerity crises.

There have been several approaches to analyse policy coherence (Nilsson and Weitz, 2019; Nilsson et al., 2012; Pimenta and Kamruzzaman, 2024; Ruddy and Hilty, 2008; Vogeler et al., 2021). Vogeler et al. (2021) conducted a discourse network analysis of German agricultural and water policy. This allowed them to analyse the development of discourses within and across policy areas. Other scholars have managed the complexity involved in studying policy coherence by taking a case study approach (Pimenta and Kamruzzaman, 2024; Ruddy and Hilty, 2008). Pimenta and Kamruzzaman (2024) for example, use national,

state and local governments in Australia as their case study areas to assess the vertical coherence of climate change action plans. Nilsson and Weitz (2019) take a broader perspective, with a framework that explores the inputs, process, and outputs of policy to examine the coherence, building on Nilsson et al.'s (2012) framework. Nilsson et al.'s (2012) generated a framework that identifies policy objectives, used a screening matrix, and finally carried out in-depth analysis of policy interactions. In this way, their framework allows for in depth analysis and it is because of this, that we use this framework in our analysis. They focus on the presence of conflicts or synergies at the policy objective, instruments, and implementation levels, whilst also being aware of the outcome and impacts (Nilsson et al., 2012).

Research has highlighted how objectives need to be clearly defined at all levels of policy (van Oosten et al., 2018). We research this through the exploration of vertical coherence, which we define as the relationship between objectives, instruments, and implementation of a policy. We also explore the alignment between the objectives of different policies, which we refer to as horizontal coherence. This is set out diagrammatically in Fig. 1.

Existing literature exploring vertical and horizontal coherence illustrates that both are essential to policy coherence (Di Gregorio et al., 2017; Farmery et al., 2019; Pimenta and Kamruzzaman, 2024). De Gregario et al. (2017) illustrate how a country-specific focus for policy coherence analysis, yields relevant findings internationally. Hence, this paper presents an extensive review of a Scottish policies and highlights the relevance for other countries facing similar difficulties of addressing synergies and conflicts within land use policy.

The literature indicates how policy coherence is particularly necessary for policy areas, such as land use, whilst also highlighting that there is limited scholarship assessing policy coherence (c.f. Di Gregorio et al., 2017). This research gap is likely because of the complex nature of policy coherence, which makes it easier to discuss what shouldn't happen rather than what does happen. Of the literature available, the most common approach is to explore horizontal coherence, examining the synergies, trade-offs and conflicts between objectives, instruments and implementation (Pimenta and Kamruzzaman, 2024). Additionally, the literature also states that transformational thinking is needed within the land use sector to address the current crises (Dorninger et al., 2020; Jacob and Ekins, 2020; Sachs et al., 2019). This paper draws on these

themes for the formation of the research questions, set out below. First it looks at the synergies with regard to land use transformation, next it assesses whether there are any issues with policy coherence within the policies analysed, before producing some recommendations and assessing the implications. In this way, it brings something new by taking an interpretative approach to analysing the policy process, exploring vertical and horizontal policy coherence of land use, to produce internationally applicable recommendations.

2.1. Research questions

1. Are there synergies in the way current land use policies are supporting land use transformations?
2. Using Nilsson et al., 's 2012 framework, what are the problems of horizontal and/or vertical coherence within existing Scottish land use policies?
3. What needs to change to improve policy coherence across land use policies?

3. Methodology

This research used a three-step methodology to explore different aspects of coherence. This is adapted from Nilsson et al.'s (2012) framework, which was chosen due to its suitability for assessing synergies and trade-offs of a broad sample of Scottish policies related to land use, and for the researchers' skillset (interpretative policy analysis). First, a rapid screening of the coherence of 66 land use policies was conducted. Next, a detailed analysis of coherence relationships within 11 agricultural policies was carried out. Finally, the data were visualised to bring both components together and highlight key findings. As mentioned in the literature review, this paper understands policy as 'the sum total of government action, from signals of intent to the final outcomes' (Cairney, 2019: 2). We understand horizontal coherence as the relationship across policies, where the objectives of the policies are aligned, and vertical coherence as the relationship between objectives, instruments, and implementation of a policy.

The analysis was informed by interpretative policy analysis. It took a qualitative approach, using documents as dynamic artefacts expressing arguments that were influenced by social constructs and can be 'read' in

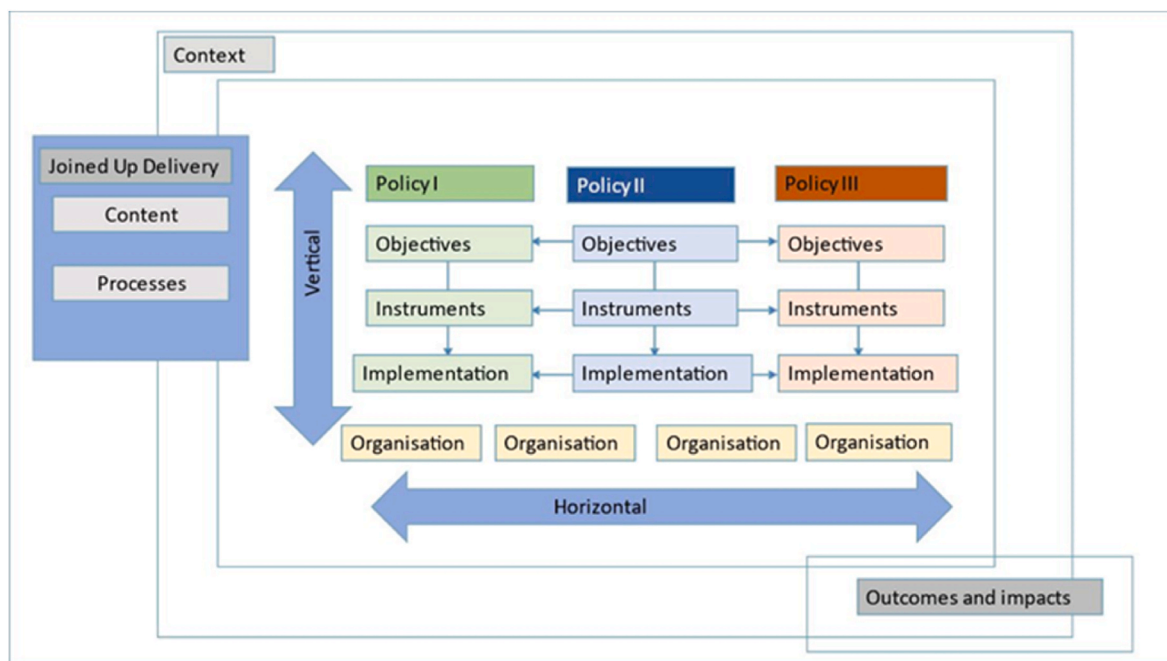


Fig. 1. Diagram of vertical and horizontal policy coherence relationships.

multiple ways (Hajer and Wagenaar, 2003; Yanow, 2007). It therefore does not fall under traditionally quantitative policy assessments (Bogers et al., 2022; Schmidt and Fleig, 2018). We chose an interpretative approach to analyse policy coherence as it enables exploration of the ‘messiness’ and complexity of the policy process for land use discussed above (Hill and Varone, 2021). To minimise bias in our analysis, the sample selection was checked with Scottish Government stakeholders and the researchers reviewed each other’s analysis to ensure methodological rigor.

3.1. Rapid screening for coherence

Screening is ‘the evaluation or investigation of something as part of a methodical survey, to assess suitability for a particular role or purpose’ (Oxford Languages, 2023). To examine the coherence of land use relevant policy, we carried out a broad screening of 66 policies between September 2022 and March 2023. As mentioned, we understood policy as incorporating multiple government actions and were not restricted to legislation, as can occur with some policy coherence analysis (Fischer et al., 2023). We identified the 66 policies collaboratively within the interdisciplinary research team. It was a dynamic sample, with policies from a variety of sectors, and newer versions of policies being added as they were developed. Initial searches generated a long list of 134 policies related to land use and land use change in rural Scotland, taking a broad approach to cover multiple types of rural land use. These were reduced to 60 policies through a prioritisation process by the research team to generate a more tractable sample to work with. The short list was checked during interviews with key land use policy stakeholders (see below), to ensure no significant policy was missed. An additional four policies were added based on interviewee feedback. We therefore established our sample by expert elicitation. A further two relevant policies were added as they were published in early 2023. For a full list of the policies studied, see Appendix A: List of Policy Documents used in Broad Screening.

To assist the analysis, we split the varied sample of land use policies into different topic groups and policy mechanism groups. The topic groups were Agriculture, Forestry and Fisheries (AFF) land use; Environment; Climate Change; and Socio-Economic land use. The policy mechanisms were: Primary legislation, Steering Strategies, and Instruments. The composition of the 66 policies studied is visible in Tables 1 and 2 below:

To explore whether the policies were advancing land use transformation, we defined 5 overarching Scottish Government policy goals with which to screen them against. These goals were drawn from the Scottish Government policy commitments such as Bute House Agreement, 2022 Programme for Government and National Strategy for Economic Transformation. These goals were.

1. Contribution to the Scottish Government Net Zero goal of 100% reduction on 1990/1995 baseline Greenhouse Gas (GHG) emissions by 2045, which is intended to limit global temperature rise.
2. Contribution to the Scottish Government’s commitment that by 2045 we will have substantially restored and regenerated biodiversity across our land, freshwater and seas, by ensuring species and habitats are diverse and healthy.

Table 1
Policies split by policy topic groups.

Policy topic group	Count
AFF land use	23
Environment	21
Climate Change	5
Socio-Economic land use	17

Table 2
Policies split by policy mechanism.

Policy mechanism	Count
Primary legislation	18
Steering Strategy	36
Instrument	12

3. Contribution to recognition of climate adaptation pressures, so the implementation measures actions remain feasible as climatic conditions and ecological responses change.
4. Contribution to the maintaining or increasing the economic prosperity of land-based rural industries.
5. Contribution to ensuring there is procedural and distributional justice considerations for those managing and using rural land.

MS-Excel spreadsheet templates were set up with each policy document having its own row, and a series of analytical criterion across the columns. Metadata included the name, date and web link to the document(s) read for the row. The analytical criteria were as follows.

- Objectives of each policy.
- Type of policy mechanism.
- Topic areas covered by the policy and the relationships between them.
- Appraisal of how well the policy addresses each of the goals and whether the policy was judged to be transformational.
- Responsibilities in relation to the policy (I.e. ownership²).
- Coherence relationships with other policies.

We split the 66 policy documents between the research team of 8. The possible answers given for whether a policy addressed a goal was yes, no, or other, with space for explanation in the next column. This aided with our overall assessment as to whether the paper advanced land use transformation, was neutral, or retarded it. We defined land use transformation as: The degree of change to meet these goals is substantial, system wide, beyond incremental and is initiated rather than reacted to (contrasting with system collapse). This definition was inspired by ideas of transformation in evaluation (Patton, 2019). The focus was on coherence as expressed by the policy documents, therefore claims about outcomes were taken at face value and we did not assess empirical data to evaluate if the policies were effective. We conducted an internal team review of these initial findings to improve the consistency of our analysis. As with the choice of policies, the evaluation was supplemented by Scottish Government participants to peer review our analysis: we conducted six interviews with stakeholders in Scottish government involved in developing land use related policies. In these interviews, we checked our initial findings to gauge their opinion on the analysis. Where concern over the screening of a particular policy was raised, we revisited that policy and changed answers where appropriate. The interviews also highlighted four missing policies that were added to our analysis and screened, as mentioned above. Additionally, we presented the findings to Scottish Government twice during the analysis, where there was the opportunity to provide feedback.

Moreover, whilst we used numbers and percentages in this rapid screening to convey relative importance of different policies and goals, and to allow us to explore patterns, they are not interval or ratio data and should be viewed as indicative. The rapid screening mainly focussed on the horizontal coherence to help illustrate synergies that may impact

² We defined ‘owners’ as the entity that is currently responsible for each policy. This was not always clear on the policy documents, as the body responsible may be different to the one that wrote it, or that was initially responsible for it. We therefore looked beyond the policy documents, for indications in the Scottish Government webpages.

land use transformations, research question 1, now we turn to the complementary vertical coherence analysis.

3.2. Agricultural policy coherence

Due to the fast-paced policy environment during this period we sought to enhance the relevance of our coherence analysis by further interrogating a subset of 11 land use policies associated with the agriculture support programme. This was a rare policy window as the agricultural support programme was being reformed due to the UK leaving the EU and therefore no longer implementing the EU Common Agricultural Policy (Greer and Grant, 2023). Agriculture is a devolved policy matter for Scotland, and accounts for a large proportion of the Scottish Government's expenditure. The subset of 11 policies included.

- Scottish Rural Development Programme (SRDP)
- Agriculture (Retained EU Law and Data) (Scotland) Act 2020
- The Common Agricultural Policy (Cross-Compliance) (Scotland) Regulations 2014
- Good Agricultural and Environmental Conditions (GAECs)
- Less Favoured Area Support Scheme (LFASS)
- Agri-Environment Climate Scheme (AECS) 2022
- Delivering our vision for Scottish Agriculture, 2022:: Proposals for a new Agriculture Bill
- Sustainable and regenerative agriculture statement 2022 (also known as the Vision Statement)
- Agricultural Reform Route map 2023
- Land Use and Agriculture Just Transition Plan Discussion Paper 2023.
- Agriculture and Rural Communities (Scotland) Bill 2023

Note that the Scottish Rural Development Plan (SRDP), Less Favoured Area Support Scheme (LFASS), Agri-Environment Climate Measures (AECS), Good Agricultural and Environmental Conditions (GAECs), and Cross compliance were included as separate rows even though they nest together, as there were different documents analysed.

The data for these 11 policies from the MS-Excel spreadsheet and interviews were then considered in more depth, including going back to the original policy documents to check specific aspects. For each of these policies we explored the various types of coherence occurring, using a template of research questions. These included questions of vertical coherence (such as the objective of each policy, how primary legislation fits with instruments, who is responsible for delivering it, and how it is implemented and monitored), and questions of horizontal coherence (such as other topics the policy links to, and other policies it refers to or that refer to it). Research summary memos (cf. Lee et al., 2019; Mohajan & Mohajan, 2022) were written for each document, considering the vertical and horizontal coherence relationships; coherence diagrams created for the current and proposed agricultural support arrangements. Four researchers were involved in this analysis and, similarly to the initial coherence analysis, we conducted an internal team review of our findings to check the consistency of our analysis. The draft findings were also shared with stakeholders from the Scottish Government in June 2023 for feedback. This feedback confirmed the findings and did prompt further additions or re-analysis.

3.3. Visualisation of coherence relationships

Having completed these analyses, we explored ways to visualise the findings and present them in a way that enabled holistic observations of coherence across the entire sample (NVivo, 2015). This was to enable an 'hourglass' analysis, where we started broad, went in depth, then went back to a broad analysis to help answer our research questions.

We used R 4.3.3 to visualise the connections between the policies in our sample (Iannone and Roy, 2024). Through the creation of a spreadsheet that included the data on policy domain, type, and

connections, we were able to use R to illustrate all these aspects within the diagrams (Figs. 3 and 5) presented in section 4, Results. We used these visualisations not only to present the data but also as part of our analysis, as it helped us identify patterns and links between the policies, as well as issues with the data that needed to be further investigated. To better visualise our results, we abbreviated the policy names. The table of abbreviations can be seen in Appendix B: Policy Abbreviations.

4. Results

Here the results cover the coherence screening exploring transformation advancement; and the in-depth coherence analysis of the 11 agricultural policies including their horizontal coherence with non-agricultural policies at present; and under the proposed agricultural policy programme.

4.1. Rapid screening for coherence

The analysis focussed on whether the policies were working towards the common goals³, set out in the methods. (i.e., horizontal coherence of objectives). Initial analysis (shown in Fig. 2) suggested that most policies were addressing climate mitigation (Goal 1), biodiversity restoration (Goal 2) and economic prosperity (Goal 4), but there were fewer policies addressing climate adaptation (Goal 3) or inclusion/social justice (Goal 5). This suggests a dominance of net zero (mitigation) approaches over adaptation responses. Policies regarding 'socio-economic' issues tended to be less likely to address biodiversity objectives; and even this category, focussed on energy, planning, tourism etc, did not always address issues of prosperity or social justice. Although the age of a document had some bearing, with climate and justice concerns becoming more apparent in later documents, this was not always the case.

This can be illustrated by some examples: we found that A Scotland for the future: opportunities and challenges of Scotland's changing population (2021) Strategy does not address climate mitigation, adaptation, biodiversity or social justice despite being relatively recent; but there are older policy documents in our sample, that do address such topics. The Land Reform (Scotland) Act 2003 addresses both prosperity and justice goals; and the Climate Change (Scotland) Act 2009 addresses climate mitigation, adaptation and biodiversity directly, with some implied attention to prosperity and justice. These older comprehensive and transformative policies laid the foundation for more recent complementary legislation to continue their trajectories.

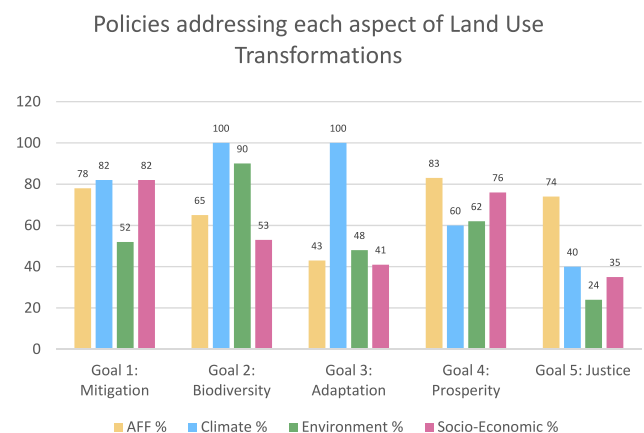


Fig. 2. Breakdown of which types of policies address each goal. The percentages show the percentage of policies within that policy domain addressing each goal. AFF refers to 21 policies for agriculture and forestry; Climate for 5 climate change policies; Environment for 21 biodiversity and environment policies; and socio-economic for other 17 land related policies (e.g. energy, planning, tourism).

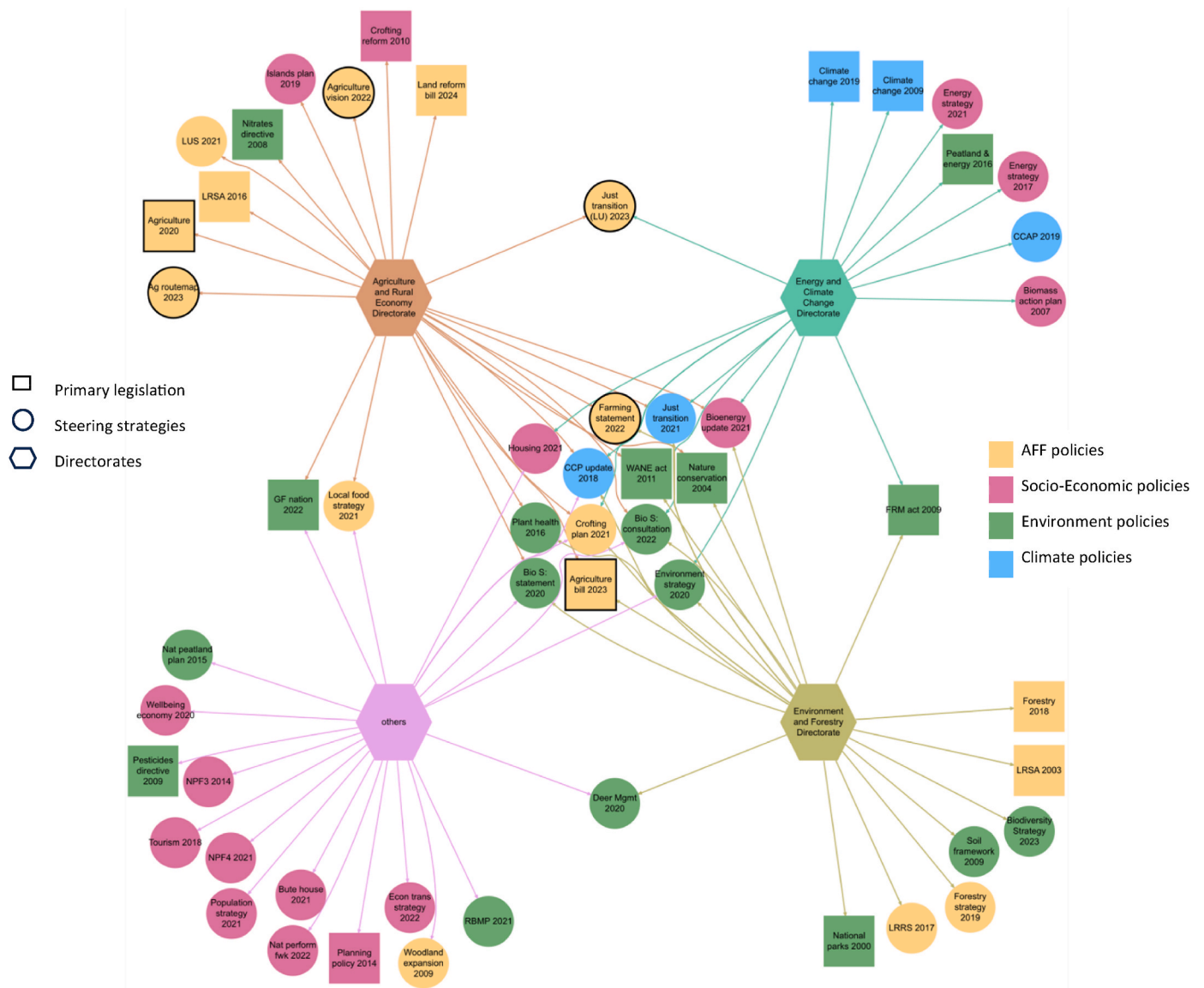


Fig. 3. Scottish Government Directorates responsible for the policies in our sample. Here only primary legislation and strategies are shown. The policies in the bold border are the policies analysed in the agricultural focus. Hexagons represent three named directorates and 'Other' representing 17 other directorates and national agencies. The policy abbreviations can be found in [Appendix B](#).

Furthermore, there were differences in whether goals were addressed depending on the focal domain of the policy, as shown in [Fig. 2](#). The 'traditional' land use policies were assessed, based on the claims within the official policy documents, as supporting many goals, with all goals bar climate adaptation (goal 3) being addressed by over 50% of the AFF policies; whereas the socio-economic policies (energy, recreation, planning) did not cover as many goals, in particular, there were only 35% of these policies addressing inclusion and justice (goal 5).

The 66 policies were also screened to see if they were contributing towards transformation. Here, only a few (18%, n = 12) of the policies addressed all five goals. In total, we judged half the sample as trying to advance transformation. No policy was judged as retarding transformation, but half the sample were neutral, including some recent policy documents. The documents with more transformational ambitions tended to be steering strategies with limited, if any, targets, indicators or dedicated funding available to them.

One reflection on the analysis of horizontal coherence between policy objectives was the lack of any explicit recognition of actual or potential conflict between objectives as stated in the policy documents.

As presented, where multiple policy goals were being sought, the information in the documents suggested that these multiple goals do not conflict, could be synergistic and can be achieved with the instruments available. However, whilst conflicts might not be declared in the narrative of the policy documents, we are not suggesting that conflicts would not occur. Indeed, potential conflicts between policy objectives were asked about in the interviews, and here some references were made to tensions between food production and environmental goals.

The broad screening coherence analysis did not have the capacity to address the relationships between 66 policy documents across **all three levels** (objectives, instruments, implementation). Rather the focus was on whether there were shared **objectives** pulling towards the same 'vision' for transformation in the land use sector. In this way we viewed this analysis as assessing the broad horizontal coherence, and particularly helped to address the first two research questions.

4.1.1. Policy owners

To explore the extent of the presence of siloed policy making within the policy analysis and opportunities for improved collaboration, we

analysed the policy owners. This particularly helps to answer research questions 2 and 3, around problems of coherence and possible improvements. We defined ‘owners’ as the entity that is currently responsible for each policy. This was not always clear on the policy documents, as the body responsible may be different to the one that wrote it, or that was initially responsible for it. We therefore looked beyond the policy documents, for indications about responsibility in the Scottish Government webpages. There were a relatively wide range of different parts of government involved as owners of our policy documents. Regarding the details of different owner organisations, there are 19 different owner organisations either owning or co-owning our sample of policies (see Appendix C: Table of policy owners). Most of the owner organisations are Scottish Government Directorates (n = 13), but there were also other public and international bodies as well. There are three main entities that are responsible for most of the policies in our sample. These are the Agriculture and Rural Economy Directorate (n = 29 policies), the Environment and Forestry Directorate (n = 26 policies), and the Energy and Climate Change Directorate (n = 17 policies) (see Fig. 3). Next is the Marine Scotland Directorate (n = 6 policies). The remaining bodies all own 3 policies or fewer.

We also considered the connectivity between owners of each policy in our analysis in R, as shown in Fig. 3. The figure suggests that directorates do link to policies beyond their immediate policy domain. For example, not all policies relating to productive land use originate from the agricultural directorate. Out of our 66 policies sampled, 43 of them are owned by a single body. The remaining 23 policies are co-owned by two or more bodies. Fig. 3 also shows that there is a small number of policies that are highly connected by being owned by two or more bodies (in centre of the figure). There appear to be more shared policies between Agriculture and Rural Development and Environment and Forestry directorates than between the other policy owners. These many-to-many relationships suggest a strong foundation for policy coherence if these links are actively working collaborations and there is sufficient signposting within policy documents.

4.2. Agricultural policy coherence focus

The in-depth analysis of the 11 agricultural policies allows for a more detailed understanding of the coherence occurring within them. In this way, it helps to address all three research questions. Our analysis shows

the way that Scottish agricultural policy must comply with UK and global policies, but not with EU policy anymore, since the UK withdrawal from the European Union. We found there was a raft of documents with different (sub)objectives (shown in Fig. 4) sitting below the primary legislation Agricultural (Retained EU Law and Data) (Scotland) (2020). This Act had objectives relating the procedural aspects associated with the EU withdrawal, rather than providing a coherent objective that provides a framework for the instruments’ objectives as shown in Fig. 4. However, the Agriculture and Rural Communities Bill, supporting the developing agricultural reform programme has ambitious and wide-ranging objectives that we expect will provide the framing for the proposed tiered policy instruments (see Fig. 4 below).

We found that the degree of vertical policy coherence was difficult to assess, as the policy documents did not always explicitly cross-reference one another, or their parent policies under which they were nested. This makes the relationships between them quite opaque to non-experts on agricultural policy. This lack of explicit linkage matters if one is seeking effective coherence between the many land-related policies being developed. The different policy initiators, advisers, designers and implementers need to understand the structure of the web of policies they might influence or be influenced by.

Additionally, following the Aarhus principles (OSCE, 2023) and general Scottish Government commitments to democratic inclusion, this can make public engagement with policy more difficult if the connections between legislation, consultations and the final instruments being implemented on individual farms are not obvious to non-farming stakeholders. Additionally, understanding such connections could help in monitoring and appraising the efficacy of implementation in meeting the goals of higher-level legislation.

4.2.1. Coherence relationships

We conducted an analysis in R of the connectivity between the 11 selected agricultural policies and other policies in the full sample. We took links made from our 11 selected agricultural policies as a starting point. In this way, similar to the policy owners section above, it helps to visualise any silos, missed linkages or possible opportunities for future coherence. This is useful for answering all three research questions. As illustrated below (Fig. 5), the R analysis revealed 78 links between a total of 42 policy documents. This suggests good awareness of the need for policies to connect with one another.

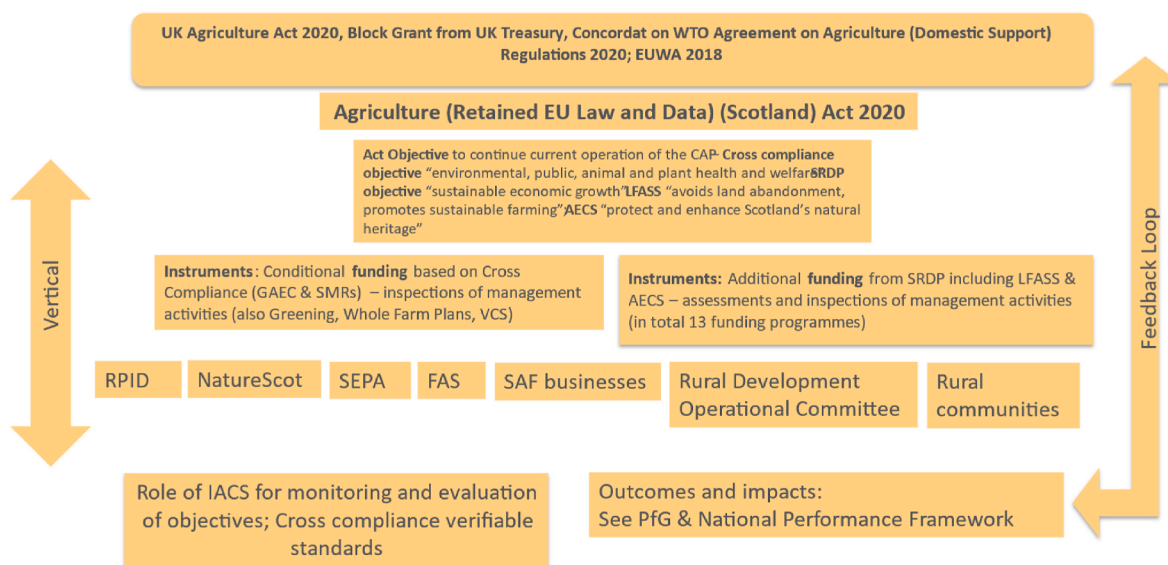


Fig. 4. Current vertical coherence within Scottish Agricultural Policy.^{1, 42} The figure shows that Scottish agricultural policy must cohere with supra-Scottish processes (at the top); that there are a range of policy objectives related to different instruments (third row down); and these instruments are implemented by a range of policy actors in different institutions (fifth row down). The boxes at the bottom relate to different forms of monitoring and evaluation in use to provide feedback loops to the Scottish and supra-national primary legislation.

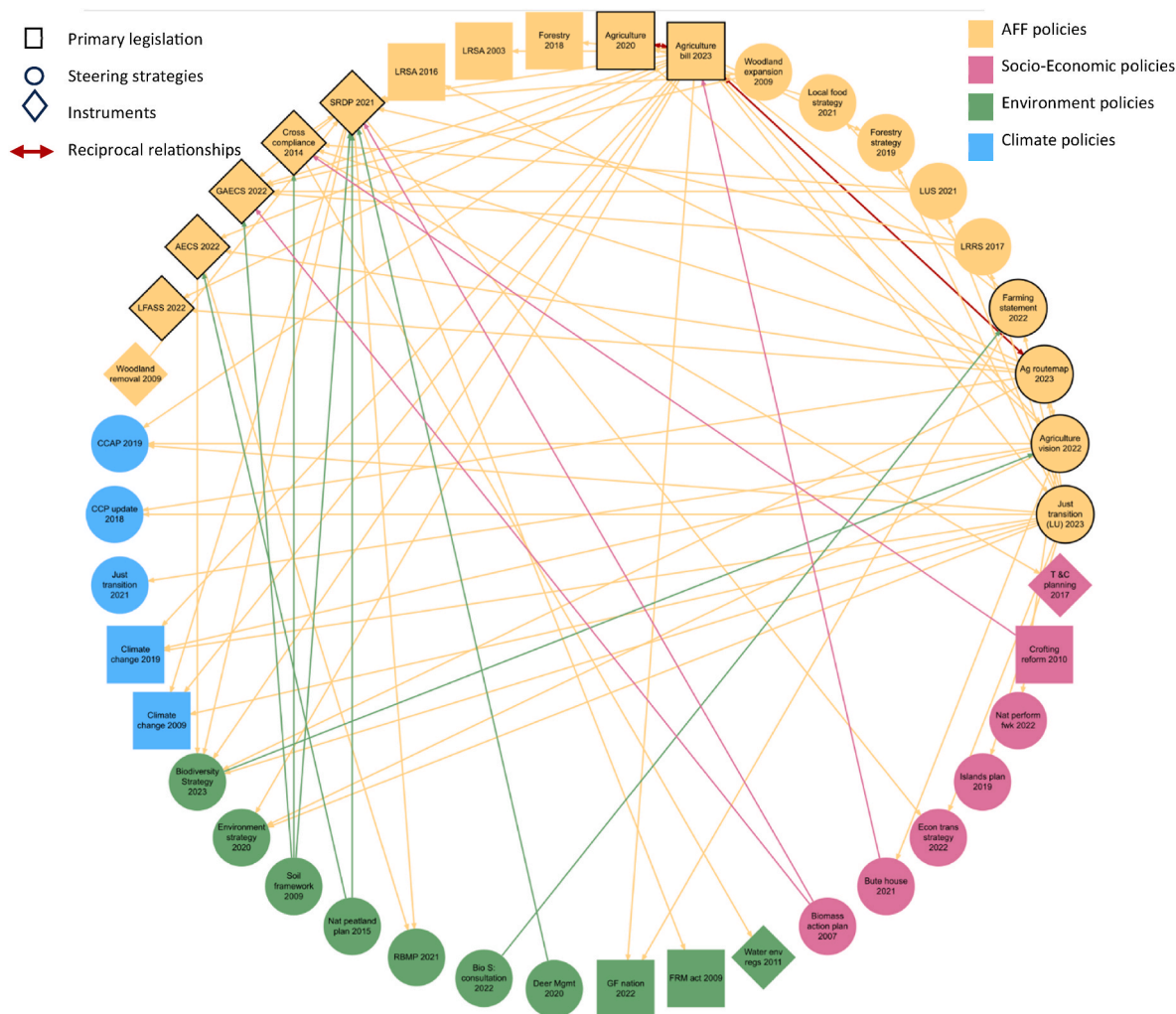


Fig. 5. Links between selected agricultural policies. The squares represent primary legislation, the circles represent steering strategies, and the diamond shapes represent policy instruments. Gold refers to Agriculture, Fishery and Forestry policies; Pink to Socio-Economic policies; Green to Environmental policies; and Blue to Climate policies. The policies in the bold border are the policies analysed in the agricultural focus. Coloured arrows show references between the referencing policies and the policies that are referenced. Red arrows show reciprocal relationships. See [Appendix B](#) for policy abbreviations.

This analysis revealed links between our 11 selected agricultural policies (framed with bold borders in [Figs. 5 and 3](#)) and other policies in all four domains. Most of the links are with other AFF policies (shown in gold), as one might expect as these 11 policies are within the AFF. There are links to or from all five climate policies in our sample, but only with 10 of the 21 environment policy documents; and with 7 of 17 socio-economic policy documents. Furthermore, there are no references in the climate change policy documents to the agricultural policies; and only four references made by socio-economic policies to the agricultural policies. We noted that two of AFF policies do not have any document references made from our selected 11 agricultural policies. This might suggest that there is a well understood need for agricultural policies to work with climate, environment and socio-economic policies to advance a coordinated and transformative policy agenda, but that there are still some areas where links could be strengthened.

[Fig. 5](#) shows only two reciprocal relationships between the agriculture policies and others in our sample, and both were between policies in the AFF domain (between Agriculture Act, 2020; and the Agriculture and Rural Communities Bill, 2023; and between the Agricultural Routemap, 2023 and the Agriculture and Rural Communities Bill, 2023). In part, the small number of reciprocal policies can be explained by the timing of different policies, in that policies generally do not refer to future policies (unless imminently expected), but one might expect to

see more cross-referencing particularly within the slew of documents relating to the changes in the policy area between 2020 and 2024. This reiterates earlier findings that there is limited cross-referencing among the AFF policies. Combined with the finding that most of the links are uni-directional references in the AFF policies to policies in the other domains and not vice-versa, it seems important to ensure that the referenced policies recognise the connections for the coherence to work in practice.

Where we examined the types of references from the subset of agricultural policies to others in the sample, it became clear that connections are often made between AFF Acts and the steering strategies or instruments that sit beneath other non-AFF Acts. For example, the new Agriculture and Rural Communities Bill 2023 makes references to 17 policies. However, these references to older climate, environment and socio-economic (i.e. non AFF) policies only include four primary legislation documents. Some of the remaining connections with non-AFF policies are mediated through these acts and some are mediated through agricultural steering strategies and instruments, rather than linking directly between the Acts. This indicates the different types of vertical and horizontal coherence occurring with reference to one example policy.

5. Discussion

The research presented here has reiterated the complexity of land use policy (Mann et al., 2018). We identified 66 policies covering four broad topic categories that were relevant for land use transformations. Much of the literature highlights the possible conflicts and trade-offs within land use policy (Brown, 2020; Mann et al., 2018; Ogawa et al., 2023). However, our research did not find explicit evidence of conflicts or trade-offs recognised in the policy documents. Indeed, in the first stage of analysis, the five goals set out for land use transformation were relatively well addressed by the policies. These five goals broadly covered the themes of climate mitigation, biodiversity restoration, climate adaptation, rural economic prosperity, and procedural and distributional justice. They were chosen to represent the Scottish Government's priorities of addressing the climate and biodiversity crises, with the latter two goals on economic prosperity and justice bringing in the Just Transition approach. The lack of evidence for conflict may be associated with the research taking the policies at face value, and not querying the extent to which the policies delivered on their objectives. Our stakeholder interactions confirmed that conflicts were absent in policy documents, but conflicts may nevertheless exist at the implementation stage.

Indeed, previous research on Scottish AFF policy instruments (Blackstock et al., 2021) suggests that policies are designed to be coherent at the level of objectives and instruments, with any difficulties arising at the level of implementation. However, given the difficulty of 'doing it all' with limited resources and potential resistance from the land-based sector to radical land use change (Roberts et al., 2021), this assertion deserves more attention and more explicit attention to trade-offs might be warranted in policy documents. This reiterates the need to also model socio-ecological outcomes of policy coherence to identify potential conflicts even if the policies do not recognise trade-offs. This was beyond the scope of this paper but is being addressed in the wider project, and we recommend this aspect for future application of this methodology.

The first research question queried the presence of synergies in the way current land use policies are supporting land use transformations. The analysis suggests that the Scottish Government, like other governments (Kangas et al., 2022; van Oosten et al., 2018), and international organisations (Di Gregorio et al., 2017), is attempting to align their environmental and agricultural objectives. These policy areas are known to face conflicts through balancing the food production and livelihood pressures with the nature conservation, biodiversity restoration, greenhouse gas emissions reduction (Huttunen, 2015; Mann et al., 2018; Ogawa et al., 2023; Ribeiro et al., 2016). However, within the policies analysed, there were possible synergies that could occur between the two policy areas, through a focus on how the agricultural policies would help address the biodiversity and climate crises and through an intention for further, stronger coherence, suggested in the vision statements and supporting documents analysed in the in-depth agricultural sample. Therefore, the policies were suggesting that they resolve well known conflicts between agriculture and environment and in this way be transformational. Research focusing on agricultural in Southern Portugal, has found that these synergies are possible, but that the implementation is not straightforward (Ribeiro et al., 2016). Indeed, research in Costa Rica indicates that weak implementation negatively impacts the transformative ambitions of agricultural policy (Rodríguez-Barillas et al., 2024). There is thus a need, as previously mentioned, for more research is needed to explore if synergies occurs in practice in the Scottish context.

Indeed, these recent agriculture policy documents analysed establish high ambitions for the Scottish Government, broadening out agricultural objectives to include climate and conservation actions and issues of justice and inclusion. These high ambitions put further pressure on the need for policy coherence. The regulation (cross-compliance) and funding within the current agricultural policies were already helping to

deliver the objectives of other policies, such as those related to the environment, and this requirement is likely to increase with the proposed reformed agricultural support programme (Scottish Government, 2023). Therefore, there is a strong intention for horizontal coherence with policies outside of agriculture. However, whilst the existing vertical coherence relationships within the agricultural policy is sometimes explicit, more often it is implicit arising through analysis of the document, rather than clearly stated with roles, responsibilities and expectations for how these interactions would be sustained. This shows where synergistic aims may be falling short and in part helps to answer the second research question.

The second research question queried whether there were problems of horizontal and/or vertical coherence within the existing land use policies. There were no significant problems that came out of the initial broad coherence screening, apart from a reliance on steering strategies, which raises questions over the follow through of objectives set out in these. Moreover, the in-depth coherence screening of the agricultural policies highlighted the lack of signposting as to how individual policies were situated within the agricultural policy landscape. This means that non-expert readers are at a significant disadvantage in understanding how one agricultural policy may work towards broader objectives, such as sustainable food production and therefore, may not understand the point or purpose of the document. The literature highlights the need for priorities to be clearly stated at all levels of policy for coherence to occur (van Oosten et al., 2018). Additionally, the lack of cross-referencing between documents, with few reciprocal relationships identified, makes it harder to monitor the efficacy of policies in achieving broader objectives. When policies contain targets and indicators it can assist with assessing coherence with other policies that may reference the same targets or indicators (Scown and Nicholas, 2020). Similar to other analysis (Scown and Nicholas, 2020), we found scope for further monitoring and use of targets and indicators to help with assessing coherence, especially as the agricultural policy is connected to substantial amounts of data. This would also assist with further research exploring whether the synergies promised in policy are occurring on the ground.

Our data can be read as either problems for policy coherence, or significant opportunities, and in this way answer our third research question, on what needs to change to improve policy coherence. For instance, we illustrated how several policies shared ownership and responsibility across different directorates (see Fig. 3). This indicates key areas where coherence is already occurring at one level. However, for this to be effective these coherence relationships need to be brought into the policy documents, so these processes are clear to those who are engaging with the policy documents outside of the specific policy directorate. This is a key area of improvement for policy coherence.

Moreover, the broad screening coherence analysis did highlight two gaps, and subsequent opportunities, for land use transformation. These were climate adaptation (goal 3) and procedural and distributive justice (goal 5). The interviews indicated that these were emergent policy areas and that this 'gap' for land use transformation was likely to be filled in the coming years. A further gap and area for improvement highlighted from the in-depth coherence analysis of the 11 agricultural policies, was the lack of non-environmental policies in their policy coherence relationships. This was reiterated in the broad screening, where a lower percentage of socio-economic paper addressed the five goals. The literature highlights that not recognising the role of socio-economic policies within land-use transformation inhibits the transformational possibilities (Brown, 2020; Pröbstl et al., 2023). Therefore, further inclusion of wider socio-economic policies is advisable. This reiterates the need for research on land use policy coherence to be interdisciplinary (Kauark-Fontes et al., 2023; Kern et al., 2019; Scheer et al., 2022).

As mentioned, the analysis focused on objectives and instruments and implementation as discussed in policy documents but does not include evidence of implementation 'on the ground' (cf. Ribeiro et al., 2016). Including research on implementation practices and outcomes on

the ground could help to assess whether the synergistic ambitions of the objectives are following through to the implementation. We also expect that exploring these data might raise questions at the implementation level, such as how coherence can work with land being managed by those who do not claim agricultural payments. This matters if policy objectives are delivered through emergent landscape scale outcomes, requiring coordinated if not collective action by land managers. There is also little to no reference to the role of private finance or blended finance on influencing how coherence is being or will be practiced by land managers (Havemann et al., 2022), and this remains an important aspect to consider. Future research could explore these factors further.

An additional focus not yet explored in this research but recognised in the literature as significant for policy coherence, is the role of the individuals in making coherence work (Blackstock et al., 2023; Peskett et al., 2023; Svensson, 2019; Wamsler et al., 2020). This research has not yet included the role of policy actors and stakeholders in establishing policy coherence and whose responsibility it is to ensure policy coherence, although former research on policy coherence with a sub-set of the policies has shown this to be important (Blackstock et al., 2023). Further, in-depth interviews or ethnographic methods with policy actors could assist with this although this is constrained by the time and availability of these actors. However, this perspective would allow insight into how policy coherence is practiced in the everyday and what this means for policy decision making. Further research that explored the everyday practices of policy coherence by policy makers could assist with exploring how effective this is in practice, as could improve monitoring and evaluation. Along with attention to implementation, more analysis of these roles and responsibilities; and the role of monitoring in our data set is planned.

5.1. Recommendations

As part of answering the third research question, on improvements to coherence, this research has produced the following recommendations, which are tailored for an international audience.

1. Ensure that emerging areas of policy, in the Scottish case this would be climate change adaptation and social and economic justice, are integrated quickly within the broader transformative framework that is being applied to land use.
2. Ensure that it is possible to assess how well objectives set out in policies can be implemented, to see whether ambitions objectives are being played out on the ground. This requires the appropriate use of targets and indicators that will make monitoring and evaluating easier. The monitoring framework should address both vertical and horizontal coherence.
3. Assess implementation on the ground to explore the presence of synergies and conflicts in practice at an 'everyday' scale. This could include engaging with a variety of stakeholders.
4. Ensure coherence relationships are brought into policy documents by cross-referencing and signposting connected policies.
5. Ensure that land use transformations are interdisciplinary. Land use covers a multitude of policy sectors. Therefore, transforming land use will require the involvement of policies from these different sectors; and corresponding expertise from a variety of research disciplines.
6. Explore the role of blended and private finance in policy coherence.

6. Conclusion

There is strong agreement globally that policy coherence can enable the transformation needed to address the multiple crises we face, yet

there is limited evidence on how this does and can occur. We have attempted to address this through our research. Our analysis indicates that there is an intention to improve policy coherence within Scottish land use policy, particularly between agricultural and environmental policy areas. However, there are several areas we identified within agricultural and environmental policy that require further attention to deliver coherence, particularly the possibility of hidden conflicts. The paper illustrates how the research team sought to operationalise a multi-dimensional policy coherence framework, addressing horizontal and vertical coherence relationships simultaneously. To add to the challenge, this was applied to both a broad range of policies related to land use, covering more than the traditional focus on productive agriculture and forestry to recognise the breadth of influences from tourism to bio-energy. Additionally, the framework was harnessed to respond to a policy window whereby decisions on how to achieve land use transformations were being opened for deliberation. Whilst our findings are specific to the Scottish context, the paper contributes to the somewhat limited international examples whereby the concept of policy coherence has been applied empirically, particularly considering both vertical and horizontal of coherence. Indeed, the challenges with aligning land use priorities are felt globally. Indeed, we have produced recommendations that are relevant beyond Scotland. Therefore, this paper illustrates a pragmatic methodology to uncover areas for policy action is relevant to other countries facing the same drive for transformation, as well as for international and transnational policies.

CRedit authorship contribution statement

Hebe Nicholson: Writing – review & editing, Writing – original draft, Visualization, Methodology, Data curation. **Kirsty Blackstock:** Writing – review & editing, Visualization, Methodology, Data curation, Conceptualization. **Jean Boucher:** Methodology, Data curation. **James Glendinning:** Methodology, Data curation. **Alexa Green:** Methodology, Data curation. **Alba Juarez-Bourke:** Writing – review & editing, Visualization, Methodology, Data curation, Conceptualization. **Stan Martinat:** Methodology, Data curation. **Graciela Martínez Sánchez:** Visualization, Software. **Keith Matthews:** Visualization, Funding acquisition, Conceptualization. **Ian Merrell:** Methodology, Data curation. **Sam Poskitt:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Steven Thomson:** Methodology, Data curation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. List of Policy Documents used in Rapid Screening

Agriculture, Forestry and Land Use (23)

Agriculture Reform Route Map (2023)
 Agriculture (Retained EU Law and Data) (Scotland) Act 2020
 Agriculture and Rural Communities (Scotland) Bill (2023)
 Agri-Environment Climate Scheme (2022)
 Crofting Reform (Scotland) Act 2010
 Crofting: national development plan 2021
 Delivering our Vision for Scottish Agriculture: Proposals for a new Agriculture Bill (2022)
 Forestry and Land Management (Scotland) Act (2018)
 Good Agricultural and Environmental Conditions (GAECs) 2022
 Just Transition: Land Use and Agriculture (2023)
 Land Reform Act (2003)
 Land Reform Act (2016)
 Land Use Strategy (2021)
 Less Favoured area Support Scheme (2022)
 Local Food strategy consultation (2021)
 Proposed new Land Reform Bill (during 2023)
 Scotland's Forestry Strategy 2019–2029
 Scottish Land Rights and Responsibilities Statement (2017)
 Scottish Rural Development Programme (2021–2024)
 Sustainable and regenerative farming - next steps: statement (2022)
 The Common Agricultural Policy (Cross-Compliance) (Scotland) Regulations 2014
 The Scottish Government's Policy on Control of Woodland Removal (2009)
 The Scottish Government's Rationale For Woodland Expansion (2009)

Climate Change (5)

Climate Change (Emissions Reduction Targets) (Scotland) Act 2019
 Climate Change Act (2009)
 Climate Ready Scotland: Second Scottish Climate Change Adaptation Programme 2019–2024
 Just Transition - A Fairer, Greener Scotland: Scottish Government response (2021)
 Update to the Climate Change Plan 2018–2032

Environment (21)

Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) (Habitats Regulations)
 Flood Risk Management (Scotland) Act 2009
 Interim Principles for Responsible Investment in Natural Capital (2022)
 National Parks (Scotland) Act 2000
 Nature Conservation (Scotland) Act 2004
 NatureScot's Scotland's National Peatland Plan (2015)
 Nitrates Directive: The Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations 2008
 Peatland and energy: Draft policy statement (2016)
 River Basin Management Plan (2021–2027)
 Scotland's Biodiversity strategy: a consultation (June 2022)
 Scottish Biodiversity Strategy to 2045 (December 2022)
 Scottish biodiversity strategy to 2045 - Tackling the nature emergency (2023)
 Scottish Soil Framework (2009)
 Sustainable Use of Pesticides Directive (2009)/128/EC
 The Conservation of Salmon (Scotland) Regulations 2016
 The Environment Strategy for Scotland: vision and outcomes (2020)
 The management of wild deer in Scotland: Deer Working Group report (2020)
 The Scottish Plant Health Strategy (2016)
 The Water Environment (Controlled Activities) (Scotland) Regulations 2011
 The Water Environment (Miscellaneous) (Scotland) Regulations 2017
 Wildlife and Natural Environment (Scotland) Act 2011

Socio-Economic (17)

A Scotland for the future: opportunities and challenges of Scotland's changing population (2021)
 Bioenergy Update (2021)
 Biomass Action Plan (2007)
 Good Food Nation (Scotland) Act (2022)
 Housing to 2040 (2021)
 National Performance Framework (2022)
 National Planning Framework 3 (2014)
 National Planning Framework 4 (consultative draft) 2022
 Scotland's Energy Strategy Position Statement (2021)
 Scotland's National Strategy for Economic Transformation (2022)
 Scottish Energy Strategy: The future of energy in [Scott et al. \(2022\)](#)
 Scottish Planning Policy 2014
 The National Plan for Scotland's Islands (2019)
 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017
 Tourism in Scotland: the economic contribution of the sector (2018)
 Towards a Robust, Resilient Wellbeing Economy for [Scown and Nicholas \(2020\)](#)
 Working Together to Build A Greener, Fairer, Independent Scotland (AKA The Bute House Agreement) (2021)

Appendix B. Policy Abbreviations

In order of Fig. 3, with instruments added in alphabetical order at the end of each domain.

Policy	Policy abbreviation
Scotland's Forestry Strategy 2019–2029	Forestry strategy 2019
Just Transition Land Use and Agriculture (2023)	Just transition (LU) 2023
Land Use Strategy (2021)	LUS 2021
Delivering our Vision for Scottish Agriculture: Proposals for a new Agriculture Bill (2022)	Agriculture vision 2022
Agricultural Reform Route Map (2023)	Ag routemap 2023
Crofting: national development plan (2021)	Crofting plan 2021
Sustainable and regenerative farming - next steps: statement (2022)	Farming statement 2022
Scottish Land Rights and Responsibilities Statement (2017)	LRRS 2017
Local Food strategy (2021)	Local food strategy 2021
The Scottish Government's Rationale for Woodland Expansion (2009)	Woodland expansion 2009
Agriculture and Rural Communities (Scotland) Bill (2023)	Agriculture bill 2023
Forestry and Land Management (Scotland) Act (2018)	Forestry 2018
Land Reform Act (2016)	LRSA 2016
Agriculture (Retained EU Law and Data) (Scotland) Act 2020 -analysed through the help of the policy memorandum	Agriculture 2020
Land Reform Act (2003)	LRSA 2003
Proposed new Land Reform Bill (during 2023)	Land reform bill 2024
Agri-Environment Climate Scheme (2022)	AECs 2022
The Common Agricultural Policy (Cross-Compliance) (Scotland) Regulations (2014)	Cross compliance 2014
Good Agricultural and Environmental Conditions (GAECs) (2022)	GAECs 2022
Less Favoured area Support Scheme (2022)	LFASS 2022
Scottish Rural Development Programme (2021–2024)	SRDP 2021
The Scottish Government's Policy on Control of Woodland Removal (2009)	Woodland removal 2009
Update to the Climate Change Plan 2018–2032	CCP update 2018
Climate Ready Scotland: Second Scottish Climate Change Adaptation Programme 2019–2024	CCAP 2019
Just Transition - A Fairer, Greener Scotland: Scottish Government response (2021)	Just transition 2021
Climate Change (Emissions Reduction Targets) (Scotland) Act (2019)	Climate change 2019
Climate Change Act (2009)	Climate change 2009
Scottish biodiversity strategy to 2045 - Tackling the nature emergency (2023)	Biodiversity Strategy 2023
The Environment Strategy for Scotland: vision and outcomes (2020)	Environment strategy 2020
River Basin Management Plan for Scotland (2021–2027)	RBMP 2021
NatureScot's Scotland's National Peatland Plan (2015)	Nat peatland plan 2015
Scottish Biodiversity Strategy post-2020: A statement of intent. (December 2020)	Bio S: statement 2020
Biodiversity strategy: consultation (2022)	Bio S: consultation 2022
The Scottish Plant Health Strategy (2016)	Plant health 2016
Scottish Soil Framework (2009)	Soil framework 2009
The management of wild deer in Scotland: Deer Working Group report (2020)	Deer Mgmt 2020
Good Food Nation (Scotland) Act (2022)	GF nation 2022
Nature Conservation (Scotland) Act (2004)	Nature conservation 2004
Flood Risk Management (Scotland) Act (2009)	FRM act 2009
Peatland and energy: Draft policy statement (2016)	Peatland & energy 2016
Wildlife and Natural Environment (Scotland) Act (2011)	WANE act 2011
Sustainable Use of Pesticides Directive (2009)/128/EC	Pesticides directive 2009
Nitrates Directive: The Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations (2008)	Nitrates directive 2008
National Parks (Scotland) Act (2000)	National parks 2000
Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) (Habitats Regulations)	Conservation regs 1994
Interim Principles for Responsible Investment in Natural Capital (2022)	Nat cap investment 2022
The Conservation of Salmon (Scotland) Regulations (2016)	Salmon regulations 2016
The Water Environment (Controlled Activities) (Scotland) Regulations (2011)	Water env regs 2011
The Water Environment (Miscellaneous) (Scotland) Regulations (2017)	Water env regs 2017
National Planning Framework 4 (2021)	NPF4 2021
The National Plan for Scotland's Islands (2019)	Islands plan 2019
Scottish Government and Scottish Green Party Shared Policy Programme WORKING TOGETHER TO BUILD A GREENER, FAIRER, INDEPENDENT SCOTLAND (AKA The Bute House Agreement) (2021)	Bute house 2021
Scotland's National Strategy for Economic Transformation (2022)	Econ trans strategy 2022
Housing to 2040 (2021)	Housing 2021
National Planning Framework 3 (2014)	NPF3 2014
A Scotland for the future: opportunities and challenges of Scotland's changing population (2021)	Population strategy 2021
National Performance Framework (2022)	Nat perform fwk 2022
Scottish Energy Strategy: The future of energy in Scott et al. (2022)	Energy strategy 2017
Bioenergy Update (2021)	Bioenergy update 2021
Biomass Action Plan (2007)	Biomass action plan 2007
Scotland's Energy Strategy Position Statement (2021)	Energy strategy 2021
Towards a Robust, Resilient Wellbeing Economy for Scotland: Report of the Advisory Group on Economic Recovery (2020)	Wellbeing economy 2020
Scottish Planning Policy (2014)	Planning policy 2014
Tourism in Scotland: the economic contribution of the sector (2018)	Tourism 2018

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Policy	Policy abbreviation
Crofting Reform (Scotland) Act 2010	Crofting reform 2010
The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations (2017) Schedule 1 + schedule 2	T & C planning 2017

Appendix C. Table of policy owners

	Owner (or co-owner)	Policy
European bodies	Council of the European Union, and the European Parliament (jointly)	<ul style="list-style-type: none"> • Sustainable Use of Pesticides Directive (2009)/128/EC
Non-departmental Scottish public bodies/Advisory groups	NatureScot SEPA SG Advisory Group on Economic Recovery Forestry Commission Scotland	<ul style="list-style-type: none"> • NatureScot’s Scotland’s National Peatland Plan (2015) • River Basin Management Plan for Scotland (2021–2027) • Towards a Robust, Resilient Wellbeing Economy for Scotland: Report of the Advisory Group on Economic Recovery (2020)
Scottish Government Directorates	Chief Economist Directorate Constitution Directorate Culture and Major Events Directorate External Affairs Directorate Performance, Delivery and Resilience Directorate Population Health Directorate International Trade and Investment Directorate Economic Development Directorate Local Government and Housing Directorate Marine Scotland Directorate Energy and Climate Change Directorate Environment and Forestry Directorate	<ul style="list-style-type: none"> • The Scottish Government’s Policy on Control of Woodland Removal (2009) • THE SCOTTISH GOVERNMENT’S RATIONALE FOR WOODLAND EXPANSION (2009) • Scotland’s National Strategy for Economic Transformation (2022) • Scottish Government and Scottish Green Party Shared Policy Programme WORKING TOGETHER TO BUILD A GREENER, FAIRER, INDEPENDENT SCOTLAND (AKA The Bute House Agreement) • Tourism in Scotland: the economic contribution of the sector (2018) • A Scotland for the future: opportunities and challenges of Scotland’s changing population (2021) (strategy/plan) • National Performance Framework • Local Food Strategy • Interim Principles for Responsible Investment in Natural Capital (2022) • Local Food strategy • Crofting: national development plan • Update to the Climate Change Plan 2018–2032 • Housing to 2040 • National Planning Framework 3 (2014) • Scottish Planning Policy 2014 • National Planning Framework 4 • Scottish Biodiversity Strategy post-2020: A statement of intent • Biodiversity strategy: consultation • Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) (Habitats Regulations) • The Conservation of Salmon (Scotland) Regulations 2016 • The Environment Strategy for Scotland: vision and outcomes (2020) • Good Food Nation (Scotland) Act (2022) • Biodiversity strategy: consultation • Flood Risk Management (Scotland) Act 2009 • Climate Ready Scotland: Second Scottish Climate Change Adaptation Programme 2019–2024 • Crofting: national development plan • The Environment Strategy for Scotland: vision and outcomes (2020) • Update to the Climate Change Plan 2018–2032 • Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 • Just Transition - A Fairer, Greener Scotland: Scottish Government response (2021) • Bioenergy Update • Biomass Action Plan (2007) • Housing to 2040 • Peatland and energy: Draft policy statement (2016) • Scotland’s Energy Strategy Position Statement • Scotland’s Energy Strategy: The future of energy in Scott et al. (2022) • Climate Change Act (2009) • The Water Environment (Controlled Activities) (Scotland) Regulations 2011 • Just Transition Land Use and Agriculture (2023) • Scottish Biodiversity Strategy post-2020: A statement of intent. • Biodiversity strategy: consultation • Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) (Habitats Regulations) • Flood Risk Management (Scotland) Act 2009 • Nature Conservation (Scotland) Act 2004 • The Water Environment (Miscellaneous) (Scotland) Regulations 2017 • Wildlife and Natural Environment (Scotland) Act 2011 • Crofting: national development plan • Interim Principles for Responsible Investment in Natural Capital (2022) • National Parks (Scotland) Act 2000 • Sustainable and regenerative farming - next steps: statement (2022) • The Environment Strategy for Scotland: vision and outcomes (2020) • Update to the Climate Change Plan 2018–2032 • Just Transition - A Fairer, Greener Scotland: Scottish Government response (2021) • Bioenergy Update

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(continued)

Owner (or co-owner)	Policy
Agriculture and Rural Economy Directorate	<ul style="list-style-type: none"> • The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 Schedule 1 + 2 • Forestry and Land Management (Scotland) Act (2018) • Land Reform Act (2003) • Scotland's Forestry Strategy 2019–2029 • Scottish Land Rights and Responsibilities Statement (2017) • Scottish Soil Framework (2009) • The management of wild deer in Scotland: Deer Working Group report (2020) • The Scottish Plant Health Strategy • The Water Environment (Controlled Activities) (Scotland) Regulations 2011 • Agriculture and Rural Communities (Scotland) Bill (2023) • Scottish biodiversity strategy to 2045 - Tackling the nature emergency (2023) • Scottish Biodiversity Strategy post-2020: A statement of intent. • Biodiversity strategy: consultation • Nature Conservation (Scotland) Act 2004 • Nitrates Directive: The Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations 2008 • Wildlife and Natural Environment (Scotland) Act 2011 • Agri-Environment Climate Scheme • Crofting Reform (Scotland) Act 2010 • Crofting: national development plan • Good Agricultural and Environmental Conditions (GAECs) 2022 • Interim Principles for Responsible Investment in Natural Capital (2022) • Scottish Rural Development Programme (2021–2024) • Sustainable and regenerative farming - next steps: statement (2022) • The National Plan for Scotland's Islands (2019) • Update to the Climate Change Plan 2018–2032 • Just Transition - A Fairer, Greener Scotland: Scottish Government response (2021) • The Common Agricultural Policy (Cross-Compliance) (Scotland) Regulations 2014 • Delivering our Vision for Scottish Agriculture: Proposals for a new Agriculture Bill • Bioenergy Update • Good Food Nation (Scotland) Act (2022) • Less Favoured area Support Scheme • Local Food strategy • Proposed new Land Reform Bill (during 2023) • The Scottish Plant Health Strategy • Land Use Strategy (2021) • Agriculture (Retained EU Law and Data) (Scotland) Act 2020 • Land Reform Act (2016) • Agricultural Reform Route Map (2023) • Just Transition Land Use and Agriculture (2023) • Agriculture and Rural Communities (Scotland) Bill (2023)

Data availability

Data will be made available on request.

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