Paper 5/3 Land use session
For information

1. Purpose

1.1 To provide Commissioners with background information on agenda item 5, an information gathering session exploring land use changes.

2. Background

2.1 This note provides detail of the participants who have been invited to give evidence as part of this session along with a list of suggested questions. Further background information is also included in the Annex to help inform the session.

What	Agenda item 5: Land Use information gathering session
Who	Vicki Swales, Head of Land Use Policy, RSPB Hamish Trench, Chief Executive, Scottish Land Commission Stephen Young, Head of Policy, Scottish Land and Estates Eleanor Harris, Policy Researcher, Confor
Why	An opportunity to examine the opportunities and challenges relating to the change in land use required to meet the 2045 net-zero target. Participants have background in land use policy, management of land and governance structures relating to land use. A selection of possible questions are included below: • How can communities be involved in decisions around land use changes that affect them? • Can you point to some examples of good land management around the country that could be built on going forward (or bad examples that should be avoided)? • How can we make sure communities benefit from changing patterns of land use? • How should competing interests for land uses be managed? • What skills do land managers need to support changes to the way land is used and managed in Scotland? How can they be supported? • Is the current ownership structure of Scotland's land an enabler or barrier to changing land use? • How can changing patterns of land use deliver economic benefit at the same time as offsetting emissions • Does changing patterns of land use present opportunities to improve resilience among marginalised/vulnerable rural communities?

Additional background information	• Annex A: submission from RSPB Scotland • Annex B: submission from Scottish Land Commission • Annex C: submission from Confor • Annex D: submission from Forest Policy Group • Annex E: submission from Scottish Natural Heritage • Annex F: submission from Tweed Forum • Annex G: submission from SCCS • Annex H: submission from Scottish Land and Estates

Annex A: submission from RSPB Scotland

1. Introduction

There is now widespread recognition and understanding that we face a climate emergency. Perhaps less widely recognised is the crisis facing biodiversity. Thankfully, this too is now on the political and public radar thanks to a number of assessments such as that by the UN Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services[1], the recent State of Nature[2] report and popular TV programmes. The climate and nature crises are intertwined, each exacerbating the other and with many of the same underlying causes and drivers; equally, the solutions are inter-twined. This relationship is acknowledged by the Scottish Government in its most recent Programme for Government[3] where it states:

'*We recognise the importance of biodiversity and the complexities and challenges that tackling its loss presents. Biodiversity loss and the climate emergency are intimately bound together: nature plays a key role in defining and regulating our climate and climate is key in shaping the state of nature*.'

Adopting nature based-solutions to climate change must be a core part of any overall climate strategy. What this means in practice and what policies and measures are required to achieve it are explored in more detail in the following sections.

There is a third crisis that should be recognised when considering our response to the climate and nature crises and to issues around just transition – that of health. Some aspects of physical and mental ill health have links to our food system and the natural environment in which we live and therefore to land use more broadly. For example, diet related ill health such as diabetes and heart disease which are factors of rising overweight and obesity and respiratory diseases linked to air pollution. Meanwhile, access to greenspace or lack of it and the quality of the natural environment in which we live can affect mental health and wellbeing. Choosing the right strategies to deal with climate change and biodiversity loss could also be of

[1] IPBES. 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondizio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany.

[2] Hayhow DB, Eaton MA, Stanbury AJ, Burns F, Kirby WB, Bailey N, Beckmann B, Bedford J, Boersch-Supan PH, Coomber F, Dennis EB, Dolman SJ, Dunn E, Hall J, Harrower C, Hatfield JH, Hawley J, Haysom K, Hughes J, Johns DG, Mathews F, McQuatters-Gollop A, Noble DG, Outhwaite CL, Pearce-Higgins JW, Pescott OL, Powney GD and Symes N (2019) The State of Nature 2019. The State of Nature partnership.

[3] Scottish Government 2019 'Protecting Scotland's Future: The Government's Programme for Scotland 2019-2020. The Scottish Government.

huge benefit to physical and mental well-being through, for example, the adoption of more sustainable food systems, reducing pollution and the creation of greenspace.

How we use and manage land now, and in the future, will have a major bearing on how successful or not we are in dealing with these crises. The main focus of this submission is on rural land use and the primary sectors of farming and forestry given that together they occupy the majority of Scotland's land area. But we also discuss the wider food system and how legislative and policy reform could drive progress. We touch on sporting land use e.g. grouse shooting and deer stalking which frequently overlaps with other land uses, especially farming. We also refer briefly to land use in urban areas – in our towns and cities – and the contribution this can make to responding to the climate, nature and health crises.

Evidence suggests that how we currently use and manage much of Scotland's land, both rural and urban, is not sustainable. If we are to achieve net zero emissions by 2045, halt the loss of nature and aid its recovery and take action to improve health, we need transformational change in land use and management. Business as usual is not an option. RSPB Scotland believes that the changes required present significant opportunities and have the potential to create substantive benefits in terms of jobs created, income generated and costs avoided. But we also recognise that some changes could threaten the livelihoods and prospects of some of those who currently live on and work the land and those of the rural communities of which they are part. Ensuring a just transition to environmentally sustainable economies and societies is therefore necessary.

2. Transforming land use in Scotland: what needs to happen and how do we get there?

In order to consider how to move forward, it is helpful to start with an understanding of the current socio-economic and environmental situation in Scotland's rural areas. Scotland's Rural College (SRUC) biennial series of reports 'Rural Scotland in Focus' provide helpful analysis and we refer the Commission to these as a source of relevant data alongside the earlier cited State of Nature report and data contained on Scotland's Environment Web. Rural Scotland in Focus 2016 offers a detailed overview of the farming and forestry sectors and includes information on estates (including those with sporting interests) as well as NGO land ownership and the wider rural economy. It highlights that the rural land use sectors are significant employers in rural areas and contribute to our economy but it also illustrates the dependency on subsidy and public support and a number of negative trends such as declines in the labour force and an ageing farming population.

The socio-economic challenges facing Scotland's rural land use sectors, and the rural economy more widely, have been explored more recently by a number of advisory fora and working groups established by government. The most recent

include the Agriculture Champions[4] and the National Council of Rural Advisors[5]. Their reports present helpful analyses of many of the problems and challenges facing rural areas, identify some solutions and make some useful recommendations which the Just Transition Commission will, no doubt, consider as part of its deliberations.

The climate and biodiversity crises bring a new imperative to deliberations about the future of key sectors such as farming and forestry and Scotland's rural economy and have, in our view – so far – been insufficiently factored in. Going forward, we need rural policy – and related public funding - to put the climate and nature challenges centre stage and to seek to deliver genuinely sustainable rural development. This means creating a more mixed economy with traditional land uses and businesses operating alongside new and innovative businesses, building on growing sectors such as nature-based tourism and the demand for artisan and high-quality food and drink products, ensuring supporting infrastructure is in place e.g. broadband and doing all this in carbon neutral and nature positive ways. Land based businesses are, in our view, well placed to benefit from a refreshed rural development approach.

In the following sections, we identify some of the key policy and legislative developments that are needed to transform rural land use and respond to the climate and nature crises whilst also providing benefits for health and well-being. Delivered in the right way, it is possible for these to facilitate change in ways that maximise opportunities and minimise risk for individuals and communities, involve them in decision making and ultimately make us and the world we live in more resilient and adaptable.

2.1 Build on the existing Land Use Strategy and make better choices about future land use

The requirement to produce a Land Use Strategy – to be revised every 5 years - was contained in the Climate Change (Scotland) Act 2009 for the purpose of establishing how land use could help address climate change and contribute to sustainable development. The first Strategy was laid before Parliament in April 2011[6] and a revised version laid in 2016[7]. The original Strategy set some very welcome high level objectives and principles for land use in Scotland including the following vision:

'A Scotland where we fully recognise, understand and value the importance of our la nd resources, and where our plans and decisions about land use deliver improved a nd enduring benefits, enhancing the wellbeing of our nation.'

[4] Agriculture Champions 2018, A Future Strategy for Scottish Agriculture. The Scottish Government.
[5] National Council of Rural Advisors 2018, A New Blueprint for Scotland's Rural Economy: Recommendations to Ministers.
[6] The Scottish Government 2011, Getting the Best from Our Land: A Land Use Strategy for Scotland 2011-16. The Scottish Government.
[7] The Scottish Government 2016, Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021. The Scottish Government.

The 2016 Strategy recognised the challenges of climate change and biodiversity loss and sought to build on two regional land use pilots that had been undertaken in the Borders and Aberdeenshire during the life of the first Strategy. These pilots set out to test how to work with local stakeholders to develop land use frameworks which could be used to inform local decision making and to understand the wider implications of specific decisions. As such they provided valuable lessons about this kind of approach.

The 2016-2021 Strategy included the following policy and a proposal:

'*Policy 7 - We will encourage the establishment of regional land use partnerships*.'

In explanation, the Strategy states:

'*In order to progress better integration of land uses and better understanding of land use and climate change issues there is clear value in bringing together local people, land users and managers into regional or local partnerships…..land use partnerships have the potential to focus effort on climate change objectives where appropriate. They could assist local communities in building community resilience to climate change issues and addressing particular mitigation or adaptation issues…the area where they can have a significant role and impact is in leading or being closely involved in work to develop regional land use frameworks (see Proposal 1 below). The use of a regional land use partnership to take forward this work gives a clear remit and also provides a mechanism to begin to discuss and address issues around future land uses for an area within the context of better understanding the interactions, the opportunities and the aspirations of local communities.'*

'*Proposal 1 - We will further explore the development of regional land use frameworks for rural areas of Scotland*.'

In explanation, the Strategy states:

'The independent evaluation and the feedback from the pilot projects themselves show that such frameworks have the potential to:

- *Assist in the assessment of how changes in land use and land management may impact on a broad range of ecosystem services;*
- *Bring stakeholders together and build understanding about competing interests;*
- *Involve local communities in decisions about their local area;*
- *Provide context and wider input to a range of local authority responsibilities such as development planning and flood risk planning; and,*
- *Assist in targeting the use of finite financial resources to where they may have most impact.'*

RSPB Scotland and Scottish Environment LINK have been strong advocates of Regional Partnerships (RPs) and Regional Land Use Frameworks (RLUFs) but progress has stalled and neither are yet in place. However, there is now a requirement in the new Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 to revise the current Climate Change Plan and, in that, set out how Regional Partnerships will be established by 2021 in order to complete RLUFs by 2023. This is very welcome and we understand that the Scottish Land Commission has now been tasked with considering how best to take these forward.

In our view, RLUFs should: help to identify the current situation in relation to land use and management activities and the environmental, social and economic trends arising from these in a region; scope alternative land use scenarios and assess the opportunities and risks associated with these; and, identify priorities for action and funding. Local authorities have a key role to play in leading RPs and the development of RLUFs, working with local communities and relevant stakeholders. Together, RPs and RLUFs can help us make better, more strategic decisions about land use and ensure we address the climate and biodiversity crises whilst responding to socio-economic needs. In turn, this should enable the Scottish Government to improve the allocation and targeting of public funding to serve this purpose.

2.2 Radically overhaul the current farming and land management subsidy system

For very many years, RSPB Scotland and Scottish Environment LINK have called for radical overhaul of the Common Agricultural Policy (CAP) and the funding streams associated with it in order to address environmental concerns. If we leave the EU, we will also leave behind the CAP and will need to develop new farming and rural policy for Scotland. The Scottish Government is proposing a period of 'Stability and Simplicity' between now and 2023/4 during which it will seek to largely maintain CAP payments as well as piloting some new approaches. From 2024 it proposes a 'new rural policy' but there are, as yet, no suggestions as to what this might look like or the kind of financial support it might encompass. The Food and Farm Production Future Policy Group - set up to advise Scottish Ministers – will, we hope help to identify a way forward that we can all unite behind.

In terms of what RSPB Scotland would like to see next, our views are as set out in the LINK paper 'Renewing Scotland's Rural Areas'[8] which we co-authored. In summary, we argue the need to:

- **Retain... current levels of public investment in our rural areas.** If we leave the CAP behind, this must not be used as an excuse to lower the level

[8] Scottish Environment LINK 2017 Renewing Scotland's Rural Areas: A Role for Future Farming and Rural Land Use Policy. SEL, Edinburgh and Perth. http://www.scotlink.org/wp/files/LINK-Future-of-Farming-and-Rural-Land-Management_March2017.pdf

of public expenditure in the rural sector. The challenges facing farming, crofting and other rural land use businesses and the environment are too great to ignore. Without public investment, these challenges will not be met and opportunities will be missed.

- **Reshape... how we spend public money**, allocating resources in three main ways:
  - ***public money for public goods*** with the lion's share of resources focused on this. This means providing financial incentives to land managers to maintain or encourage the production of environmental and social goods and services provided by agriculture and forestry that are not rewarded through the market. These public goods include biodiversity, cultural landscapes, high quality water, air and soil, a stable climate and resilience to flooding.
  - ***investments to facilitate change*** such as helping farming, crofting, forestry and other rural businesses adapt and develop, improve business efficiency and explore market opportunities; and,
  - ***investments in supporting activities*** including research, knowledge transfer, advice and training.
- **Renew... our rural areas for the benefit of all of us**: rewarding farmers, foresters and other land managers for the full range of goods and services they provide and helping rural businesses become more profitable and sustainable; protecting and enhancing the environment and the natural resources that underpin economic activity; and, spending taxpayers' money effectively, helping to create good livelihoods and jobs and contributing to our health and wellbeing.

The analyses and proposals set out in this LINK paper are, we believe, consistent with the principles of just transition and offer a way forward for achieving an environmentally sustainable rural economy in ways that benefit those who work and manage the land as well as the wider rural community. We have therefore submitted this paper alongside this briefing prepared for the Commission for its session on land use in Melrose.

2.3 Adopt nature-based solutions to climate change

A key component of the approach set out above by LINK is that of targeted agri-environment payments. Such payments are needed to conserve priority species and habitats, to ensure the appropriate management and condition of designated nature conservation sites and to support habitat recreation and restoration e.g. peatlands and saltmarsh. Woodland grants should also support both the management of existing woodland resources and new tree planting in appropriate locations.

Peatlands, coastal habitats such as saltmarsh, native woodlands and forests are some of the most important places for wildlife in Scotland. These nature areas also hold vast stores of carbon, adding up to more than 33 times Scotland's annual carbon emissions. This carbon needs to be kept locked away, and more carbon sequestered and stored through habitat protection, restoration and expansion, helping us to meet our emissions reduction targets and avoid dangerous climate heating. The UK Committee on Climate Change (CCC) recommendations for Scotland's new target of achieving net-zero GHG emissions by 2045 was explained as feasible in part because of Scotland's 'greater potential for emissions removal', given its capacity for nature-based carbon sequestration through peatland restoration, and afforestation.

The RSPB recently produced Carbon in Nature Maps[9] to show how much carbon is already stored in the UK's nature areas on land in our soils and vegetation, for instance in our peatlands, woodlands and forests, but also important coastal habitats like saltmarsh. By identifying these areas, recognising their value and funding their protection and restoration Scotland can take some of the urgent action needed to meet our climate targets.

We used the Land Classification Map (LCM) 2015 to identify Scotland's key nature areas and the World Soils Map and standard figures for information on the amount of carbon stored in soils and vegetation in these nature areas. The new maps show carbon stored in soil up to a depth of 30cms. This is a limitation of the project, as peat soils are in many places in Scotland much deeper than this and therefore hold much more carbon. However, the top 30cms of soil are most at risk from degradation through poor land management and loss of the carbon to the atmosphere and have therefore been the focus of this mapping.

The maps do not tell us about the condition of these areas of high carbon and nature value, and hence how good they are for wildlife or the climate. We know that not all of these important nature areas are in good condition. For example, estimates show that 80% of Scotland's peatlands are in a damaged state or poor condition[10], releasing carbon rather than storing it and cannot support many of the species which make healthy peatlands such a nature-rich habitat.

The results of this mapping work can be summarised as follows:

- Analysis shows around 2 GtCO2 are stored in the UK's carbon and nature rich areas, around four times the UK's annual emissions.
- The maps show that the majority of this carbon (1.26 GtCO2) is found in Scotland's nature rich areas – 65% of the UK total.

9 https://rspb.maps.arcgis.com/apps/Cascade/index.html?appid=2b383eee459f4de18026002ae648f7b7

10 https://soils.environment.gov.scot/resources/peatland-restoration/

- The carbon stored in the top 30cms and in vegetation in these areas is 33 times greater than the amount of greenhouse gas emissions from the whole of Scotland in 2016.
- This vulnerable top layer of soil and vegetation must be protected and restored where damaged to prevent huge and catastrophic carbon loss.
- 63% of this huge amount of carbon is in an area of land which is not designated for its nature value and therefore not protected.

Significant work is already underway to restore Scotland's degraded peatland but much more remains to be done. The UK Biodiversity Action Plan (UK BAP) has a target for blanket bog restoration, of which Scotland's share is around 600,000 hectares. The Scottish Government's own target for peatland restoration is 250,000 ha by 2030 which would leave significant areas of peatland in a degraded state. Publicly funding activities such as managed realignment and saltmarsh recreation at our coasts, wetland creation, native woodland expansion and increasing the area of non-farmed habitats (field margins, hedgerows, copses) on farms across Scotland would all deliver nature and carbon benefits. These activities have the potential to employ significant numbers of people and create livelihoods, in some cases for those currently employed in the farming and forestry or other rural land use sectors.

2.4 Manage, protect and expand trees, woods and forests

As highlighted above, trees, woods and forests should be key components of nature-based solutions to climate change. Much needs to be done to protect and manage our existing woods and forests – such as our Atlantic Oak woods and Caledonian Pine forests - to ensure they are in the best condition for nature and helping to sequester and store carbon. The invasion of non-native species such as rhododendron and Himalayan Balsam as well as the increasing threat from pests and diseases (some of them linked to climate change) means that many of our existing trees, woods and forests already face challenges that need addressing. But attention is increasingly turning to woodland and forest expansion as part of our response to the climate emergency.

The area of woodland in Scotland has expanded over the past 90 years, from around 5% cover just after the First World War, to 18% today but this has happened at the cost of important open upland and grassland habitats. Between the 1940s and 1980s, expansion of comercial forestry and associated drainage resulted in the loss of 44% of Scotland's blanket peat bog. Lowland raised mires were lost at a similar rate. During the same period and despite an overall increase in tree cover, the area of broadleaved and mixed woodland fell by 23% and 37% respectively, and native Caledonian pine forests remain in just over 6% of their original range. Much woodland expansion has instead favoured commercial conifer plantations of non-native species.

Today 18% of Scotland's land area is currently covered with forests and woodlands, of which 74% is coniferous and 26% is broadleaf. A quarter of woodland in Scotland is publicly owned. Forestry is the only industry which currently acts as a net carbon sink, absorbing more carbon than is emitted, so woodland expansion has been highlighted as a key climate mitigation measure. For this reason, Scotland's current Climate Change Plan set out ambitious woodland expansion targets stating: woodland cover will increase from 18% to 21% by 2032 with annual tree planting targets increasing over time to 15,000ha per year in 2024-2025. The Programme for Government 2019-2020 has however committed to a planting target of 12,000 ha this year and promised to accelerate planting targets from 2021. The UK Committee on Climate Change also proposed significant afforestation of 30,000 ha of planting per annum under a high ambition scenario in its recent net-zero assessment[11].

RSPB Scotland supports sustainable woodland expansion and we recognise the wide range of environmental, social and economic benefits that sustainably managed native woodlands and commercial forestry can deliver. Achieving a significant level of new planting requires a strategic approach and direction to ensure that it maximises delivery of sustainable, integrated woodland and contributes to climate change mitigation but without impacting biodiversity and other ecosystem services. Such woodland expansion should not be considered in isolation but taken forward as part of wider land use considerations through the LUS and completion of RLUFs. Expansion should not compromise the conservation of existing priority habitats and species. In this context that means those species which are dependent upon native woodland habitats or would be affected by the loss of open habitats, such as certain types of grasslands and peatland, due to woodland expansion.

With climate change already occurring, new planting should aim to deliver genetically diverse mixed woodlands, including native species of local and diverse genotypes, which are likely to be more resilient to climate change, pests and disease and adapted to local soils and climate. We want to see woodland expansion integrated with other land uses, delivering multiple benefits, such as appropriate riparian planting (avoiding valuable wet grassland habitat, fen, mire etc. which is important for breeding waders and other wildlife) and catchment-scale planting schemes that filter pollutants, stabilise sediment, provide shade, slow water flow and reduce flood risk downstream.

Sustainable deer management will also be required if woodland establishment is to be achieved without recourse to deer fencing. There are also significant opportunities in Scotland to deliver urban greenspace and new generations of trees outside woodlands, such as hedgerow trees and in-field trees (where appropriate),

[11] Committee on Climate Change May 2019 Net Zero The UK's Contribution to Stopping Global Warming. Committee on Climate Change, London.

wood-pasture, parkland and orchards, that sit within and complement a wider ecological network.

Public access to our woods and forests and interpretation should be facilitated, supporting recreational use, tourism and delivery of health and well-being benefits. On our own RSPB nature reserves where native woodlands are an important feature, we will seek, where appropriate, to expand the areas of nationally important and scarce types of native woodland as a demonstration of best practice. And, we will also continue to work with partners to make these areas of native woodland larger, and better connected; for example the Great Trossachs Forest Project and Cairngorm Connect.

Investment in the management and expansion of Scotland's trees, woods and forests has – similar to new kinds of investments in the farming sector - great potential to support good jobs and livelihoods and utilise the strengths of the existing land-based workforce.

2.5 Transform Scotland's food system through Good Food Nation legislation

Our food system, both here in Scotland and globally, is being impacted by climate change and biodiversity loss but itself is a key driver of these crises giving rise to significant greenhouse gas emissions and causing habitat loss and degradation. We need nothing less than a transformation of our whole food system to address these challenges and whilst Scotland can't necessarily change the global system, there is much that can be done domestically to drive progress.

RSPB Scotland is working as part of the Scottish Food Coalition to highlight the challenges we face and calling for policy reform and solutions to address these. The SFC's hope and expectation for the future as set out at Chapter 2 of 'Plenty'[12] states:

'*Our food production systems work with nature, not against it; farming, fishing, processing, transportation and storage of food all maintain and enhance our environment, at home in Scotland and in those countries we import from. The agroecology approach to producing food, including certified organic production, conserves our soils and seas, mitigates climate change, and protects our wildlife, genetic diversity, landscapes and cultural heritage.*'

[12] Scottish Food Coalition March 2016, Plenty: Food, Farming and Health in a New Scotland. Scottish Food Coalition.

The report identifies four key steps to making progress on the environmental front as follows:

- Establish agroecology as the underlying principle of farming in Scotland, and set out a programme to transform farmer education, training, advice and research accordingly.
- Champion a reform of the Common Agricultural Policy that supports and develops truly sustainable production, directing money to where it delivers most for Scottish citizens in terms of our environment and the food we eat.
- Ensure more effective implementation and enforcement of existing environmental legislation throughout the food supply chain in order to reduce impacts.
- Take a whole system approach to reducing the impact of our food on the climate, measuring consumption as well as production emissions and setting ambitious targets for reducing them.

Overall, 'Plenty' called for a number of things to happen to respond to food system challenges including: greater policy co-ordination and coherence; Government, its agencies and all public bodies to drive up standards, 'demonstrate by doing' and lead the way to better food systems; a more democratic and inclusive food system; a new 'sustainable development' approach throughout the food chain; people with knowledge and resources (financial and otherwise) able to make good food choices; and, leading the way and learning from best practice, beyond our borders.

The SFC has campaigned for Good Food Nation legislation to be introduced and after making a number of commitments that were never followed through, the Scottish Government has again committed to bringing forward draft legislation – a Good Food Nation Bill - within the next year. The SCF has 5 key asks[13] for this legislation including setting a requirement for Government to produce a National Food Plan setting out the policies and proposals that will tackle problems such as food poverty, diet related ill health, conditions for food workers, and the climate and nature crises. We are also calling for ambitious targets for reducing the use of chemicals and preventing obesity and demanding the establishment of a formally recognised Scottish Food Commission to provide independent scrutiny of our food system and drive progress.

Transforming our food system has the potential to not only provide a response to climate change and biodiversity loss but to deliver significant socio-economic benefits. As argued in 'Plenty',

'*Our current models of food production, distribution and supply are increasingly large scale and industrialised. Fewer and fewer individuals benefit economically from this system while many of us bear its social and environmental costs. Increasingly, we lack connection to our food. Relatively few people are engaged directly in producing*

[13] http://www.foodcoalition.scot/good-food-nation-bill.html

or harvesting food and the majority of us are largely ignorant of the practices and processes by which food comes to our plate. Our food system could be very different with significant benefits for all.'

Diversifying food production, identifying and developing new markets and shortening supply chains should be part of any future food strategy. More effort is needed to help farmers identify new or alternative markets, diversify what they produce and, ultimately, become less dependent on income support payments. Very few farm businesses in Scotland (c. 2-3%) process and add value to the raw materials they produce, opting to sell their produce on to others in the food supply chain. This has a number of impacts, not least if which is to ensure that farmers receive a low share of the final consumer pound spent on food. It also means that the majority of farmers are disconnected from the consumers of what they produce and poorly understand consumer requirements. More farmers need to be encouraged, supported and up-skilled to process, add-value and directly sell their produce, with an emphasis on supplying local and domestic markets. As well as having the potential to improve farm viability, we also believe greater progress in this area could have social and environmental benefits, helping to connect people to what they eat, where it comes from and how it is produced and reducing food transportation. We consider there is great potential for those farmers producing food in environmentally friendly ways to use this in their marketing and branding.

Much of the food produced in Scotland is sold as raw commodities to businesses located elsewhere, often outside of Scotland, which process and add-value to it. This means lost revenue for Scotland's economy and fewer jobs in the food sector than might otherwise be the case. Greater investment in infrastructure such as abattoirs, grain mills, creameries and other processing facilities is required to build capacity and retain more of the value-added from what we produce. This should contribute to shorter supply chains, less waste and less food transportation resulting in further environmental improvements as well as economic gains.

2.6 Put greater emphasis on knowledge transfer, advice and training to encourage and promote uptake of best environmental practice.

One issue raised in the earlier cited Scottish Environment LINK paper to which it is worth drawing particular attention in the context of achieving just transition in the rural sphere is the need for greater emphasis on supporting activities including ***knowledge transfer, advice and training***. The paper states:

> *'This should build on the significant investment of public funds in agricultural, forest and other land use research and do more to ensure the results of this reaches those who could benefit most from it. Low levels of formal education and training in the land use sectors need to be addressed.'*
>
> *We see a particular need to strengthen knowledge transfer, advice and training with respect to farming and the environment. Funding for knowledge transfer programmes*

that can bring together land managers, researchers, specialists, and policy makers must continue. Such programmes must have an emphasis on sustainable farm practices rooted in agroecological principles that contribute to climate change mitigation, reductions in diffuse pollution, and reverse biodiversity decline. Whilst there are a number of existing mechanisms and initiatives designed to provide information and advice to farmers, too few have an explicit environmental remit. The Farming for a Better Climate initiative is one positive example but the number of farmers reached by it is small. Monitor Farms have also proved a successful mechanism for knowledge exchange but again, reach a relatively small proportion of the farming population and, to date, have been limited in terms of the environmental issues they explore. Where environmental issues have been considered these have tended to be in relation to climate change and renewable energy with little focus on biodiversity or water quality. Existing measures for knowledge transfer and advice under the current Scotland Rural Development Programme may help to address the environmental challenge but more is likely to be needed in future if faster progress is to be made.

Currently only 27% of farmers in Scotland have any formal agricultural training (Scottish Government, 2015). This seems very low for a sector that needs increasingly to embrace innovation and new technologies, be more market orientated and adopt greener farming methods. Much higher rates are likely to be required if the sector as a whole is to undergo transformational change. It is also vital that land management courses at Further and Higher Education level include environmental content and promote agroecological principles within all modules rather than as optional dedicated modules. Continuing Professional Development should become the norm for those working in the farming, forestry and land use sectors and be a requirement for receiving public money.'

2.7 Put some aspects of sport shooting and related activities onto a statutory footing

Grouse and pheasant shooting and deer stalking are significant land use activities in Scotland's rural areas providing jobs and bringing money into local economies. But some aspects of these activities and their land management regimes have come under scrutiny in recent times and are under review or have previously been legislated for. In the context of responding to the climate and nature crises, we highlight the following issues:

A Review of Grouse Moor Management is currently being undertaken by Professor Alan Werrity and due to report soon. In submitting evidence to this Review RSPB Scotland – amongst other things- called for:

- Recognised best practice to be linked to an effective statutory licensing system for driven grouse shooting with this being subject to periodic updating to take account of the findings of new research, legal requirements and public standards.

- Compliance with the muirburn code to be a statutory requirement. Muirburn can damage peatlands as well as releasing significant amounts of CO2 into the atmosphere. As springs have become drier in recent years due to climate change, the risks from prescribed muirburn for both game management and agricultural purposes, becoming wildfires have become significantly larger, and with commensurate additional costs to the taxpayer through the work of the Scottish Fire Service. The current primary legislation regulating muirburn is the Hill Farming Act 1946, which was set at a time when converting hill land to productive agriculture in the post WWII era was a primary concern. Times and requirements have changed. This legislation should be reformed, updated and have primary regard to muirburn's context in tackling climate change.

High populations of deer in many parts of Scotland are a cause of significant damage to protected areas, native woodlands, and peatlands, through browsing and trampling. Deer damage to public interests is a major impediment to Scottish Government in relation to a number of public policy targets for improvements to protected nature conservation areas; woodland expansion; and tackling climate change. Tackling the issue of unsustainable deer management is also important in meeting Aichi and Scottish Biodiversity Strategy 2020 targets. In the absence of natural predators of deer, effective management measures need to be in place to keep deer populations at sustainable levels. At the moment, an undue burden of deer management falls on Forest and Land Scotland (and therefore the public) as they take one third of the national deer cull each year. There are also other costs to the public from high deer numbers including deer fencing, vehicle collisions, and impacts on agricultural crops and private gardens.

Whilst we recognise the sporting interest in deer, tackling the problems caused by high populations requires more private landowners to help by maintaining deer populations at sustainable levels. Whilst some progress has been made with improvements to deer management planning, there is still a substantial amount of work to do to ensure that these plans are implemented, and that gaps in the voluntary deer management network are filled, particularly in lowland areas. Scotland is still some way off having a modern, evidence-based management system of wild deer fit for the 21st century, capable of responding to the changing environment and growing challenges, including the need for woodland and forest expansion.

2.8 Green our towns and cities

Much of the discussion of land use and its role in addressing the climate and biodiversity crises centres on rural areas and traditional sectors of farming and forestry. But how we use land in our towns and cities - beyond that used for housing, development and infrastructure - can deliver significant environmental and public

health benefits, generate economic activity and has the potential to help address problems of inequality. Some areas worthy of further consideration include:

- Creating more wildlife habitat in our public parks, gardens and greenspaces to benefit nature and store carbon
- Planting more trees in towns and cities to provide shade and cooling benefits, store carbon and help reduce flood risk
- Using vacant and derelict land to create more greenspace and community growing areas
- Providing more land for allotments and community growing space, especially in cities and areas with high demand
- Expanding innovative food production methods and technologies such as vertical greenhouses which can utilise renewable energy, have minimal land requirements and the products of which require access to distribution networks.

Much of this could already be achieved under national and local planning and development policy with appropriate funding and investments for local authorities and the support of relevant agencies.

Annex B: submission from Scottish Land Commission

The Scottish Land Commission is an NDPB established in 2017. Our role is to stimulate fresh thinking about the ways Scotland's land is owned and used. We advise Scottish Government on a programme of land reform spanning urban and rural Scotland, and support good practice and culture change on the ground.

The Commission's work seeks to improve:

- Productivity – in the broad sense of public value from land embracing social, economic and environmental benefit;
- Diversity – in the ownership of land and the spread of benefits from land;
- Accountability – in the way decisions about land are taken.

The Commission's current work focuses on:

a) Land for housing and development – unlocking opportunities for public value including land assembly, land value capture, vacant and derelict land, housing land supply;
b) Modernising land ownership – addressing the concentrated pattern of land ownership, normalising community ownership, reforming common good ownership and exploring new governance models for land;
c) Land use decision making – supporting good practice in land rights and responsibilities, community engagement, tax and fiscal influences, regional land use partnerships;
d) Agricultural holdings – supporting the Tenant Farming Commissioner in improving agricultural landlord/tenant relationships, addressing availability of land for farming, new entrants/land matching service.

Following the 2019 Programme for Government, the Scottish Government has asked the Land Commission to advise on developing proposals to establish Regional Land Use Partnerships, and on policy improvements to the Land Use Strategy and Land Rights and Responsibilities Statement to support climate action.

Key themes and connections emerging from current work

Land use is a key sector in delivering climate action and the next few years will see significant changes and decisions to be made in relation to land use change. How these changes are navigated in a fair and productive way will be important. We see the following connections between the work of the Land Commission and the issues the Just Transition Commission are considering.

Land Use Decision-Making & Engagement

Scotland's Land Rights and Responsibilities Statement provides a clear framework for the relationship between land and people, principles and expectations of good practice. The Land Commission supports practical implementation of land rights and responsibilities

through a programme of guidance, protocols and casework – for example in relation to improving community engagement in decisions about land. Through the Land Reform Act 2016, and the Government's Guidance on Engaging Communities in Decisions About Land, there is a clear expectation of a step change in the way people are able to be engaged in decisions. This is not just about being able to influence, but also able to benefit from decisions about land.

The responses to a public call for evidence on the impacts associated with concentrated land ownership indicated twin issues of power and participation. Our recommendations to government included the need for better and more accountable mechanisms to enable communities to benefit from decisions about land use change.

Land Use Strategy - Regional Land Use Partnerships & Frameworks

The commitment in the Programme for Government to establish regional land use partnerships and frameworks, 'to maximise the potential of every part of Scotland's land to contribute to the fight against climate change', provides the opportunity to establish effective and accountable mechanisms to drive delivery and consider the opportunities, priorities and trade-offs inevitable in future decisions about land use change.

We see the key issues to consider being principally around governance – how to establish partnerships that will be able to deliver at the pace and scale required, and do so in a fair and productive way. The rural-urban connection will be important to consider, as will the strategic fit in relation to Regional Spatial Strategies and Regional Economic Partnerships. The balance between 'top-down' co-ordination and empowering local action will also be a key consideration.

The Land Commission intends to publish a scoping paper early in 2020 to begin stakeholder engagement in considering these issues.

Land Ownership

The Land Commission published a report on scale and concentration of land ownership in 2019, which found the core issues relate not simply to scale of ownership, but to the concentration of power of decision making. Our research found that most of the benefits associated with the current pattern of ownership relate to economies of scale, while the disadvantages relate to deficits in power and participation.

In relation to management for environmental benefit, it is sometimes claimed that large scale ownership delivers better management for climate or environment action. Large scale and concentrated ownership can undoubtedly create ease of administration, but there is no evidence it necessarily leads to better environmental outcomes. The power inherent in concentrated ownership can be used in ways that either support or act against the public interest. Our recommendations focus on ensuring there is sufficient public interest framework to address these risks, as well as working towards a more diverse pattern of ownership.

There are many examples of landscape scale collaboration across land ownership boundaries, implying that ownership need not be a determining factor in the ability to deliver large scale environmental enhancement. However, it seems clear that policy and support

mechanisms enabling collaborative action need to be more comprehensive and simpler to implement.

Agriculture

The role of the Land Commission in relation to agriculture, and specifically the Tenant Farming Commissioner, is principally on agricultural tenure. We seek to improve relationships between agricultural landlords and tenants, and promote better ways of making land available to farm in order to support dynamism and innovation in the sector (eg joint ventures, land matching service).

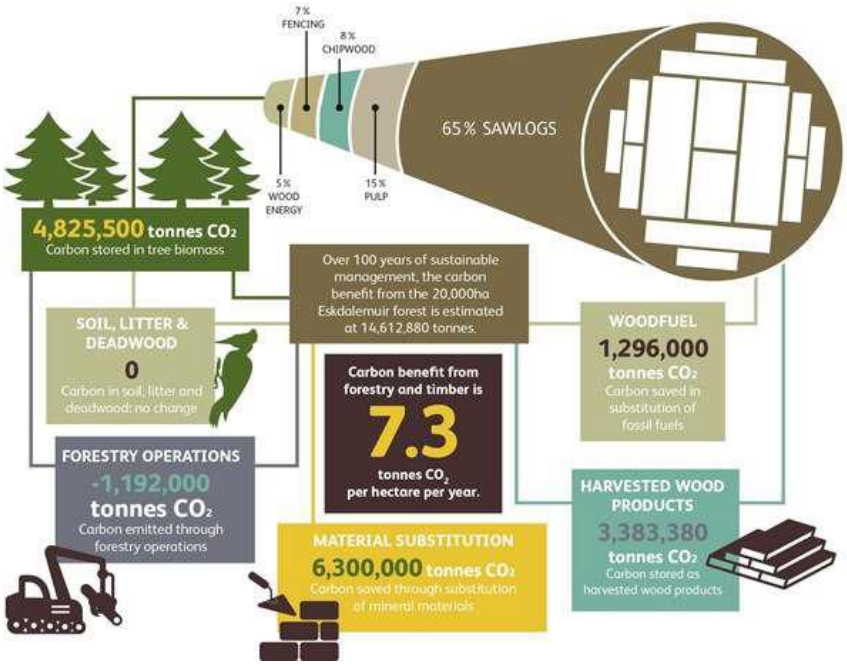
The Tenant Farming Commissioner publishes Codes of Practice (which have a statutory basis), and Guidance, and has a 'casework' role to help broker good solutions where there is a dispute or an alleged breach of a Code.

Annex C – Submission from Confor

1. What are the main economic opportunities and challenges related to the change in land use required to meet the net-zero 2045 target?

Forestry represents a major economic opportunity to align economic growth and decarbonisation, resolving many of the issues faced when they are regarded as opposing forces.

Forestry and timber are the only proven large-scale carbon capture and storage (CCS) technology at our immediate disposal; and unlike other CCS alternatives, it can simultaneously decarbonise our economy itself. Commercial forests can transform around 16 to 24 tonnes of atmospheric carbon dioxide per hectare per year into useable wood products. The retention of carbon in timber products for various lengths of time means that the forest's total store of carbon at any given time is almost doubled. Yet it is material substitution – the avoidance of cement, steel, oil and plastic – where the enormous carbon gains are almost doubled again. Over the long term, although eventually the carbon returns to the atmosphere through burning or decomposition, the growing store of wood products and the shrinking reliance on mineral materials for construction, fencing, packaging, energy generation and high-tech materials, means that forestry is estimated to deliver a continuous carbon benefit of 7.3 tonnes per hectare per year.



Graphic from Eskdalemuir: carbon benefit from forestry and timber

The world's timber requirements are expected to treble by 2060, even with greater recycling and efficiency. Reducing mineral use would increase demand even more[14]. The UK, with high demand and low production, is the second biggest net importer of timber products in the world[15], and will struggle to retain the share of global resource

[14] OECD Materials Resource Outlook to 2060.
[15] Forestry Statistics, chapter 9 p.17

it currently enjoys as other countries develop. Producing more of this valuable resource will be central to Scotland's prosperity in future, and, as there is high demand for timber at home, will multiply opportunities for economic growth through timber processing and new technologies such as offsite timber construction[16].

Forestry is a renewable resource, but it is not unlimited: it relies on a finite area of land, which must also provide our food, biodiversity habitat and space for human wellbeing. However, a well-designed forest will not merely subtract land from the available resource but multiply the benefits from one area. Despite the controversies surrounding the plantation forestry of the twentieth century, comparisons of closed canopy conifer plantations with ancient woodland in Ireland[17], and upland and lowland plantations with native woodland in England and Scotland[18] have found that commercial forestry sustains as wide a range of biodiversity as native woodlands. Thanks to the UK Forestry Standard, based on extensive scientific research and agreed between conservationists, public sector and industry, all UK forests since 1997 have been designed to deliver environmental benefit. The Standard requires all forests to diversify 25% of their total area with alternative species, native trees and open space; to avoid planting on sensitive sites such as deep peat, SSSI grassland or stream banks; and to incorporate management measures such as diversified age structure and deadwood retention: all of these measures ensure that the forest does not cause environmental damage and quickly creates rich wildlife habitat.

2. What are the likely wider social (health, community etc.) opportunities and challenges associated with the land use change required to meet this target?

Forestry provides an opportunity to enhance access and recreation opportunities. Visiting a forest can improve mood and concentration and reduce stress[19]. Many more people can experience a sense of solitude and tranquillity in a forest than on the same area of open land, infrastructure such as car parks and tracks are hidden; there is minimal danger of dogs harming livestock or mountain-bikes causing erosion; and the climate remains more stable in windy, wet, hot or cold weather, making forests a more attractive way for more vulnerable visitors to access the outdoors such as the very young or old. Under the UK Forestry Standard, any new forest is required to maintain existing paths and access routes and take opportunities to enhance access.

Land use change for forestry changes patterns of land ownership and employment in the countryside. Like all economic shifts, this represents an opportunity which is often experienced as a disruptive and threatening challenge by communities in the short run, in particular by landowners and land managers who have enjoyed many

[16] For more information, see the Scottish Forest and Timber Technologies Initiative.
[17] Irwin et al, The value of plantation forests for plant, invertebrate and bird diversity (Biodiversity and Conservation, 2014).
[18] Quine & Humphrey, Plantations of exotic tree species in Britain: irrelevant for biodiversity or novel habitat for native species? (Biodiversity and Conservation, 2010).
[19] Forest Visits and Mental Health (Ecologist, 17 May 2019).

years of subsidised agriculture. There is an opportunity for farmers to diversify by integrating forestry into their production: the shelter of trees results in feed costs going down and lamb survival going up, and land which is marginal for livestock can produce a valuable crop. Investment forestry brings significant new money into a rural community, often including activities such as the restoration of deserted buildings as well as the planting of trees[20]. All forestry creates jobs: around one job for every 40 hectares of mixed productive conifer. These include a wide range of professional careers and small business opportunities at local and regional level, including planting, fencing, deerstalking, forest management, harvesting, haulage, marketing and wood processing. Mills are major rural employers and rely entirely on a sustainable supply of timber from their surrounding forests. Finally, there are opportunities to diversify and localise land ownership in rural communities for example, through community forest ownership and community interest companies.

Two significant challenges of land use change for forestry should be noted. The first is the impact of forestry operations on local communities, including the visual impact of harvesting and the transport of timber on minor roads. The minor rural road network is aged and has limitations in terms of freight haulage but forestry does provide a clear economic demand for improvements which are anyway required for the wider rural economy and can provide benefits in terms of increased connectivity for remote communities. The second is the difficulty of enabling tenant farmers to participate in a form of production which may run in cycles longer than the period of their lease.

3. What actions do you think Government should take to manage the opportunities and challenges mentioned above?

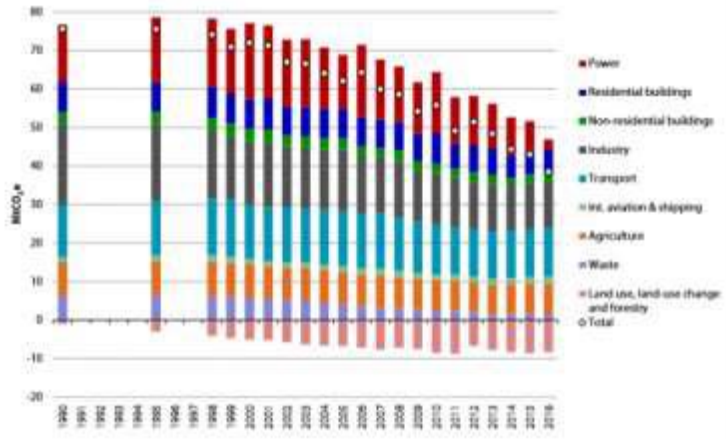
Government should continue to regard forestry and timber as an industry at the heart of a just transition to a zero carbon economy, not only as a carbon-negative land use and the only carbon-negative line on the graph, but, by providing a zero-carbon material suitable for both manufacture and energy generation, as the key to decarbonising many of the other sectors and ensuring quality of life for all, in particular through the provision of warm, timber-rich zero-carbon homes.

Government should continue to ensure forestry meets the UK Forestry Standard and engage with industry to discuss where further evidence on carbon or biodiversity delivery may be required. It should be noted that any change in restrictions on forestry activity for environmental reasons should be based on sound evidence, as there is a risk that, rather than delivering the benefits intended, it will limit investment in this key industry.

[20] Forestry and Local Economy: case studies of Westwater and Larriston (Confor 2018).

Government should consider opportunities under future rural support payments to partner with forestry investors to improve access infrastructure in forests where appropriate, or to site forestry in locations of amenity benefit to communities such as near towns, where land prices would be prohibitive for investment for the market alone.

Figure 1.1. Scottish greenhouse gas emissions (1990-2016)



Source: *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland 1990-2016*, NAEI (2018).
Notes: No inventory data are available for devolved administrations for 1991-1994 or 1996-1997.

Government should continue to provide integrated advice on forestry through the farm advisory service, to ensure farmers and land managers are aware of the opportunities available through growing trees.

Government should continue to support the upgrading of timber haulage routes through the Strategic Timber Transport Fund and consider increasing investment in this vital infrastructure which provides co-benefits to remote communities. Government should work with tenants and landlords to design ways to enable tenants to engage in forestry.

Annex D – Submission from Forest Policy Group

1. What are the main economic opportunities and challenges related to the change in land use required to meet the net-zero 2045 target?

Economic Opportunities

- Expansion of forestry and timber processing in ways that increases the ownership, management and participation by "people of ordinary means" in Scotland in all aspects of forestry. This would provide economic benefits to parts of society largely excluded from forestry by the current patterns of ownership.
- Changes in timber processing so more timber is processed closer to forests, to avoid excessive haulage and to increase local employment. Focus more on jobs per log, and less on logs per job and generate 'sticky money' (money that recirculates within the community).
- Grow more of the type of trees which lend themselves to local processing. This measure to also include increased emphasis on reducing the number of deer to the level at which these higher value trees can be grown and to move more towards forestry systems which fit a changing climate e.g. Alternatives to Clear Fell and natural regeneration.
- Increasing focus on high quality, long lasting timber products that lock up carbon for longer periods.
- Development of novel low-carbon forestry machinery and methods of working.
- Development of agro-forestry for Scotland: enhancing shelter and keep for animals and reducing the economic costs of flooding.
- Change of land use from large sporting estates to more diverse land uses will open up opportunities for larger numbers of people. For instance, the current artificially high population of anthropogenically managed Red and Roe deer in Scotland generate some 250MtCo2e per annum. Allowing community deer stalking syndicates and clubs would produce new opportunities for local venison sales and processing.

Economic Challenges

- A high proportion of forests are owner by wealthy individuals and organisations, such that forestry is already unequally structured. A just transition to low carbon forestry will limit ownership of forests in Scotland by wealthy individuals and external investors.
- The price of forestry, sporting and farming land has been bid up by land being used as an investment vehicle by the wealthy, putting it beyond the means of most ordinary people (except in the smallest parcels).
- Subsidies and tax benefits have been capitalised in land values. Debt, especially in the agricultural sector has grown commensurately. Removing the support mechanisms will leave the sector exposed to insolvency.

- Reform of subsidies and tax regimes for all rural land use ought to be considered
- Several forestry and timber working practices are particularly fossil fuel intensive such as intensive cultivation, timber harvesting and haulage, production of board material, and travel to and from forests by remotely located managers and contractors.
- A just transition to net zero will require a significant expansion of forest cover, supported by appropriate incentives – as being touted by political parties in the General Election campaign. Without change, existing fiscal arrangements could result in already wealthy (large landowners) becoming more so, at the expense of ordinary tax payers.
- The established industrial forestry sector has developed a convincing message around the benefits of continued support for plantations which are dominated by a single non-native species, citing carbon benefits from both growing the tree, and from substituting timber for other higher carbon materials. This message chimes well, however it is an oversimplification, and it makes discourse and action around new and innovative types of forestry difficult. Framing climate change as an economic opportunity will cause economic challenges.

2. What are the likely wider social (health, community etc.) opportunities and challenges associated with the land use change required to meet this target?

Social opportunities

- Expanding the ownership and management of forests by communities and local people will increase the resilience and capacity of those communities as they adapt to climate change.

Social challenges

- Low current participation and capacity in forestry due to historic exclusion.
- Aging sector: both agriculture and forestry are dominated by men of a certain age
- Sector tends to be conservative and resistant to change
- Forestry has focused on “lowest common denominator” type management, with every increasing specialisation and also every increasing centralisation of management responsibility. For example, FLS now discourage employees from holding a Fire Arms Certificate unless they are deer controllers, and they are now actively averse to appropriately qualified chainsaw operators using saws unless they do so on a full time basis. They have also steadily reduced the number of districts, moving instead to uber regions – this scale of State forest working means a remote and detached management culture.

- Lack of a 'Forest culture' means the opportunity to maximise local benefits from forests is being missed

3. What actions do you think Government should take to manage the opportunities and challenges mentioned above?

- A robust, large scale and long-lasting programme of land reform and allied fiscal incentives could make land less available and attractive to the wealthy, and so reduces the value of land, making it more available to more people. In some instances, this could lead to less public subsidy being needed to effect land use change.
- The share of community-owned forest needs to be increased, alongside encouraging greater ownership and management of forests by people of ordinary means (farm forestry, individual small-scale private ownership).
- Local processing of timber could be strengthened by capacity building and financial support and limits placed on the transport of "green" i.e. freshly felled timber especially by road. In this respect, subsidising timber transport should cease except in specific, defined situations: at present it is often used to subsidise mainstream forestry and 'export' jobs from local areas
- Small scale local forestry organisations and businesses need to be better supported
- Low carbon methods of working need to be incorporated into the UK Forestry Standard, Certification and good practice guidance.
- Large sale timber processing needs to be encouraged to adopt low carbon methods of working.
- Financial incentives which are not universally available may be viewed as socially unjust and should be reviewed. An example of this is Agricultural Property Relief (for both agriculture & forestry) from Inheritance Tax
- Scottish Government needs to follow through on its commitment to 'put public land at the heart of land reform'. This could include ensuring disposals of public land always seek to diversify ownership as a priority; and creating opportunities for individuals to lease public land (in a forestry context, via woodland crofts & woodlots)
- Greater emphasis needs to be put in UKFS on minimising ground disturbance and its associated loss of soil carbon
- In relation to the above, a move away from clearfelling to Low Impact Silvicultural Systems should be adopted.
- An emphasis needs to be placed on natural regeneration for expanding tree cover; the current focus on new planting and generous levels of grant in the Woodland Creation Grants Scheme leads to investment driven, lowest common denominator forestry. This in turn fuels Greenhouse Gas Emissions from soil disturbance – a product of low cost, traditional establishment techniques such as ploughing, mounding and draining. This effectively means that year on year tree planting in Scotland is carbon negative.

4. How can communities be involved in decisions around land use changes that affect them?

- Expanded land reform which places a greater proportion of land in the ownership of communities. SG set an ambitious target for 2020, but without increased State funding the ScotGov will not meet this target. This is in part a product of the process of Community Asset Transfer - communities are often subjected to "trial by bureaucracy" which needs to be made simpler and less onerous.
- Reforming land fiscal support to give communities a say in how public subsidy is allocated. This might involve totalling the historic subsidy payable to a catchment or sub catchment and inviting landowners to lodge a bid with their community for a share of the support. Flood prone communities could thus make decisions around measures which increased or reduced the risk of flood management in their vicinity. Access, community supported agriculture, community woodlands generating employment in a local sawmill might also be preferred to, for example supporting "tick mop" sheep on grouse moors.
- Forestry & Land Scotland management could be made locally accountable, with greater emphasis on meaningful local engagement, and its strategic and land management plans could reflect local priorities more clearly.

5. How can we make sure communities benefit from changing patterns of land use?

- The measures above apply.
- The single most important change to land use which would benefit communities is to introduce a focus on prioritising local needs. Often, communities local to a resource, such as forests, are excluded from potentially carbon reducing activities, such as ready access to firewood, and they are subject to the consequences of centralised timber processing e.g. road hazards and the local infrastructure impacts of timber haulage.

6. How should competing interests for land uses be managed?

- By careful development of the existing Scottish Land Use Strategy
- With more emphasis on maximising public rather than private value

7. What skills do land managers need to support transformation of the way land is used in Scotland? How can they be supported?

- A complete cultural shift is required both by land managers and their support sector.
- In relation to forestry, managers need to recognise the underpinning climate change objectives of forest management and reflect this in their approach to managing forests, such as sustainable husbanding of soil carbon.

8. Is the current ownership structure of Scotland's land an enabler or barrier to changing land use?

- The current ownership structure of Scotland's land is a barrier to changing land use; ownership brings control and fiscal incentives may not be enough to promote land use change where money is not an issue.
- An example is country sports – particularly deer and grouse. Grouse moors and deer forests represent at least one quarter of Scotland and through der methane emissions and grouse moor burning are a significant source of rural GHG emissions. These areas of land are suitable for upland native woodland and montane scrub and could function as a stimulus to local economic expansion – through local sporting use - increase biodiversity and green tourism, and act as a net carbon sink.

Annex E: Submission from Scottish Natural Heritage

Summary

Agriculture and Related Land Use contributes 23.9% of total GHG (territorial) emissions (excl. forestry, which is a sink). Transformation in land use will be needed to reduce GHG emissions in Scottish farming if the 2045 Net Zero Emissions (NZE) target is to be reached. With over 70% of land in Scotland under some agricultural use, farmland offer significant potential for carbon sequestration.
Integrated land use is important to make best use of land to meet multiple objectives and ensure that the NZE target does not drive unforeseen adverse effects, and synergies and trade-offs are anticipated.

We believe that to address the Climate Emergency, it will be essential to simultaneously reduce GHG emissions, adapt to climate change that is already locked in and address the state of nature. This is the triple challenge of the Climate Emergency.

It is important to approach the NZE target in the context of what it can also do to address the biodiversity crisis, and for the well-being of the people of Scotland. Similarly, fulfilling the ambition to achieve Net Zero (territorial) Emissions should not result in an offshoring of GHG emissions, environmental and social impacts to third countries.

The Climate Emergency is an acute challenge for the land-based industries, because it is here that the transition to a net zero economy, adapting to the impacts of climate change that is already locked-in and the state of nature and the benefits that people derive from it, all come together.

The European Common Agricultural Policy (CAP) has had a very strong influence on the structure of farming and rural land uses in Scotland. Future agricultural/land use policy will be crucial to the delivery of the 2045 NZE target, and the associated social and economic implications.

Scottish agriculture is largely dominated by ruminant livestock on relatively poor quality land. Due to the methane emissions from ruminants, the sustainability of keeping domesticated ruminants is being questioned. Though the number of animals, as well as the area of land under livestock farming, may change, there are opportunities to improve the sustainability of pasture-fed livestock while delivering social and economic benefits, through tourism (nature-based, local food /farm tourism) and shortened food supply chains, tapping into the production of a high quality product.

In farms in the lowlands, the high quality of agricultural land precludes large-scale land use change. However improvement in sustainability can offer gains in

profitability to farmers, while some carbon sequestering activities should increase landscape diversity improving the amenity value of the lowlands.

Large-scale habitat creation/restoration for peatlands, native woodlands, scrub and semi-natural grasslands can be envisaged in less productive land. This would offer great potential for sequestering carbon while creating new opportunities for nature-based tourism and recreation.

Well-designed commercial forestry in the right place, on the basis of a clear understanding of place-quality and landscape character can have positive landscape and amenity benefits. Regional land use plans should help ensure the expansion of commercial forestry is well balanced with other needs.

Many native woodlands are in poor condition mostly due to overgrazing, predominantly from wild deer. Fencing is costly and only a temporary measure. A better approach is to develop appropriate deer management with land managers and other stakeholders to reach more sustainable population levels. Some measures may carry a cost for land managers, which would need to translate into government's financial support as the reduction in deer population numbers is in the public interest.

The approach envisaged in the Land Use Strategy, through development of regional land use partnerships and regional land use frameworks could be the best way to guide the delivery of the NZE target. These could provide the basis for the Place Principle and more effective alignment of effort and resources across public and private sectors. We believe that future support schemes for farmers and other land managers need to be based on investment in natural capital, including at the landscape-scale. There are also opportunities for the development of private markets for carbon and other public goods. There could also be a role for government to encourage and facilitate these.

Background

Agriculture represents a significant share of Scotland (territorial) greenhouse gas emissions. The most recent GHG reporting by the Scottish Government showed that Agriculture and Related Land Use contributes 23.9% of total emissions[21]. This does not include land under forestry and woodlands, which is reported separately and is currently a net sink.

In the Climate Change Plan 2018-2032, a number of policies are outlined, which are concerned with awareness raising, research and direct engagement with farmers to drive change in emissions reduction and carbon sequestration. The overall approach has been based on voluntary commitments by farmers to reduce their GHG emissions.

[21] https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2017/pages/3/

Ambition will need to be scaled up to reduce GHG emissions in Scottish farming if the 2045 Net Zero Emissions (NZE) target is to be reached. In doing so, it has to be acknowledged that some GHG emissions are inherent to the biological processes occurring in farming and cannot be eliminated entirely. Concomitantly, with over 70% of land in Scotland under some agricultural use, farmland offer significant potential for carbon sequestration, therefore providing a useful role in offsetting unavoidable GHG emissions in the farming sector but also society at large (though this should not detract from the need to continue reducing emissions).

The Climate Emergency is an acute challenge for the land-based industries, because it is here that the transition to a net zero economy, adapting to the impacts of climate change that is already locked-in and the state of nature and the benefits that people derive from it, all come together.

Transition to a net zero economy requires a transformation in how we use the land, and a transformation in the distribution of costs and benefits associated with those choices.

What are the main economic opportunities and challenges associated with meeting the 2045 net-zero target in relation to the agriculture sector and wider land use changes?

Summary: Future agricultural/land use policy follows will be crucial to the delivery of the 2045 Net Zero Emissions (NZE) target and the nature of its economic and social impacts. There is the opportunity (and need) to simultaneously reduce emissions, adapt to climate change that is already locked in and address the state of nature. Rewilding or large-scale habitat creation/restoration for peatlands, native woodlands, scrub and semi-natural grasslands would offer great potential for sequestering carbon and reducing GHG emissions from degraded land. Changes in agriculture towards more agroecological practices (alongside new technologies) combined with a degree of land use change towards habitat restoration and forestry could create new opportunities for nature-based tourism, the provision of high quality food products and local food tourism. The potential co-benefits of achieving the 2045 NZE target could help to diversify the agricultural sector and bring employment opportunities, especially in remote rural areas with poor quality agricultural land.

The European Common Agricultural Policy (CAP) has had a very strong influence on the structure of farming and rural land uses in the UK and the EU at large. The CAP which was originally designed to support increases in food production, has broadly had a negative impact in other areas, including on the environment and fair access to land and resources. The correlation between subsidies and land prices in the EU

has been very high, even though some other factors have also been at play[22]. Land access is a critical barrier for new entrants to agriculture, not least in Scotland, which has faced a rapid decline in the tenanted land sector[23].

Without presuming the outcomes of the exit from the EU, whatever agricultural/land use policy follows will be crucial to the delivery of the 2045 Net Zero Emissions (NZE) target and the nature of its economic and social impacts.

Shifts in payment regimes may alter how money becomes distributed in rural areas. Any transition away from CAP should be managed very carefully in order to avoid unintended consequences and externalities of any new payment system. A report for the RSPB estimated the cost of paying farmers to deliver public goods at £729 million in Scotland[24], including the costs of delivering on environmental land management priorities, protecting vulnerable high nature value farming, advice to land managers and securing long-term benefits.

A lot will have to change in the way the land is managed, through a combination of carbon sequestration and changing GHG emitting practices. Three sectors where Scotland holds a comparative advantage are in energy (including renewable), food and drink and sustainable tourism. These are all sectors that rely on rural settings and can represent opportunities for farmers. The biophysical constraints of the land have implications for the type of land use and measures that might be taken[25].

Large-scale habitat creation/restoration for peatlands, native woodlands, scrub and semi-natural grasslands would offer great potential for sequestering carbon and reducing GHG emissions from degraded land. It would also create new opportunities for tourism, substantially adding value to the current nature-based tourism offer. Total visitor spending attributable to nature-based tourism per year (rounded and after displacement is deducted) is £1.4 billion with 39,000 associated (Full Time Equivalent) jobs. Tourist spending on nature based activities is already worth nearly

[22] European Parliament (2013) 'Possible effects on EU land markets of EU direct payments', http://www.europarl.europa.eu/RegData/etudes/STUD/2013/495866/IPOL-AGRI_ET%282013%29495866_EN.pdf

[23] Mackee, A et al (2018) 'Increasing the Availability of Farmland for New Entrants to Agriculture in Scotland', A report for the Land Commission Scotland, the James Hutton Institute. https://landcommission.gov.scot/wp-content/uploads/2018/05/McKee-et-al.-Final-report-to-SLC-Increasing-land-availability-for-new-entrants-2.5.2018.pdf

[24] Rayment, M (2019) Paying for public goods from land management: How much will it cost and how might we pay?, A report for the RSPB, The National Trust and the Wildlife Trusts, Rayment Consulting Services.

[25] About 80% of the agricultural land in Scotland is in Less Favoured Areas where sheep and cattle farming predominates. In the east of Scotland, arable farming covers 10% of agricultural land for circa 8% of farmers. There are also relatively smaller horticulture, pig, poultry and dairy industries, though in land area terms, dairy is more important. See: Scottish Agricultural Statistics 2019 https://www.gov.scot/publications/agriculture-facts-figures-2019/pages/1/

40% of all tourism spending in Scotland[26]. Hence, we can speculate that well thought out natural carbon storage would result in a further boost to Scotland's tourism sector.

Rewilding can offer nature-based solutions for adaptation to a changing climate (contributing to more resilient landscapes) in addition to carbon storage. Rewilding approaches can be largely 'vegetation-based' or may also include the use of large grazing animals where appropriate. If the concept is taken further, the introduction of animals that are no longer found in Scotland (having been exterminated in the past), though more controversial, might also be considered. Re-introduction, which can offer very substantial ecological benefits, can also have potentially significant implications for the land-based industries, which need to be well understood and managed. There are lessons which may be drawn from the introduction of beavers in Scotland as well as projects across the European continent, in terms of dealing with economic costs and opportunities, and stakeholder engagement[27]. For land managers to undertake such large scale habitat restoration/creation, which would deliver numerous public benefits, it is reasonable to expect public money to support such activities. Difficulties may arise if this initial funding for areas to restore then stops. A system of payments that work on a long-term horizon is therefore necessary to secure benefits.

Many native woodlands are in poor condition mostly due to overgrazing, predominantly from wild deer. There are unresolved concerns associated with the delivery of Scottish Biodiversity Strategy targets for native woodland condition and restoration. Any successful expansion or restoration of native woodlands needs low levels of grazing impact to allow regeneration or planted saplings to grow, and while this can be provided by deer fencing, this is an expensive and temporary measure. A better approach is to develop appropriate deer management with land managers and other stakeholders to reach more sustainable population levels. We will support the development of regional land use plans as set out in the Programme for Government to help address the deer issue. Some measures may carry a cost for land managers, which would need to translate into government's financial support as the measures are in the public interest.

Commercial conifer forestry on better ground is another way to sequester carbon and there is already substantial interest from investors in commercial forestry as a long-term investment. Forestry and timber processing contribute £771 million (GVA) and employ 19,555 (Full Term Equivalent) people. Long-term, woodland expansion should result in additional jobs in forestry and in related timber-based industries. However this also has implications for farming and wider rural communities. Land

[26] Bryden, D.M., Westbrook, S.R., Burns, B., Taylor, W.A., and Anderson, S. (2010) Assessing the economic impacts of nature based tourism in Scotland Scottish Natural Heritage Commissioned Report No. 398. https://www.nature.scot/snh-commissioned-report-398-assessing-value-nature-based-tourism-scotland

[27] See Rewilding Europe https://rewildingeurope.com/rewilding-in-action/nature-based-economies/ and Rewilding Britain https://www.rewildingbritain.org.uk/rewilding/rewilding-projects/

that is currently used for livestock is becoming afforested, either through farmers undertaking afforestation directly, or through sale of land. This may have both positive and negative effects on surrounding rural communities including through other actors in the agricultural industry and food supply chain. Regional land use plans should help inform and direct land use change.

The changing climate increases species' vulnerability to pests and diseases. This represents a risk for our woodlands. Commercial forestry is also exposed, particularly in monocultures where one species dominate, generally Sitka spruce. Introducing more ecological complexity to commercial conifer plantations is a key way to increase resilience and reduce economic risks.

Changes in consumer behaviour and technological improvements are likely to be confounding impacts. Consumer taste has begun shifting towards lower impact products, and as a result, the type, amount and impact of meat that is being consumed has and may continue to change. Sustainable products represent an opportunity for greater value added products, Ireland for example has now created a Sustainable Beef and Lamb Assurance Scheme (SBLAS). Technological advances may also change the demand for different products, meat substitutes and possibly even "lab-grown" meat may change the demand for livestock. Vertical farming – bringing farming into the urban environment - may also represent challenges and opportunities in the future.

Scottish agriculture is largely dominated by ruminant livestock on relatively poor quality land. Due to the methane emissions from ruminants, there is considerable debate surrounding the consumption of red meat. In the context of Scotland, and because a significant proportion of the land is not suitable for arable farming, the argument is made that grazing livestock is a suitable use of land. Of course, this results in an opportunity cost for other uses of the land that could yield other societal benefits. Another issue that needs consideration is the balance between supply and demand, so that environmental impacts are not just offshored in the drive to achieve carbon sequestration on land in Scotland. For this reason, we might assume that ruminant livestock farming will continue to an extent, though the number of animals, and husbandry may change as well as the area of land under livestock farming (i.e. there would be more commercial forestry and large-scale peatlands, native woodlands etc.). 'Agriculture, fisheries and forestry' accounts for 15% of employment in remote rural areas and 13% in accessible rural areas[28]. The survival of hill farms clearly has implications for agricultural jobs that depend on them and the wider rural community.

The Scottish Government has strong ambitions for the food and drink sector. This includes flagship products such as whiskey (from barley), oatcakes, Scotch beef and Scotch lamb, cheeses and other derived products. Animal products make a

[28] Rural Scotland: Key Facts 2018 https://www.gov.scot/publications/rural-scotland-key-facts-2018/pages/4/

significant part of the offer and a reduction in livestock farming might seem a threat to the food and drink sector. However, we could envisage changes that provide opportunities to diversify through nature-based tourism (based e.g. on high nature value farming and/or large-scale habitat restoration), the development of shorter food supply chains, as well as the provision of high quality food products and local food/farm tourism, in the context of a well branded Scottish food and drink offer.

In farms in the lowlands, the magnitude of change is likely to be less as afforestation or large scale habitat restoration are of lesser interest due to the good quality of agricultural land. Farmers on good land may achieve cost savings by improving efficiency in the use of inputs while reducing the volume of GHG emissions. The implementation of agroecological approaches can help optimise the use of resources present on farms, hence reducing the need for external inputs and nutrient loss to the environment. Other measures farmers can take include carbon sequestration e.g. shelter belts to protect from wind erosion, silvopastoral systems, hedges. Such landscape features can improve the amenity value of the lowlands. There are also opportunities for farmers to sequester carbon in soils, though this is a relatively complex issue. In doing so, farmers improve the soil health on their farms, which will provide economic benefits over the long-term. Where economic benefits are significantly delayed for the farmer, there might be need for public money to support adoption of measures initially.

Currently the environmental impacts of intensive farming and intensive grouse moor management are externalised i.e. society at large has to pay for the costs from environmental damage (e.g. cost of cleaning up for drinking water, flooding made worse by lack of trees in catchment). Paying land managers for the delivery of public goods while adhering to the polluter pay principle would help deliver a more equitable system for society at large.

While Scotland is on course to only generate carbon neutral electricity, delivering renewable heat is more complex to tackle and so far most heating remains based on fossil energy. Bioenergy is in theory one of the potential technologies that is appropriate for generating renewable heat. The benefits of bioenergy depends on a number of variables, and poses risks, hence the reason why legislative requirements include sustainability schemes[29]. Potential issues include adverse environmental impacts particularly from the production of feedstocks. It may not be the best use of a resource for example where wood is burned which could be used in construction, i.e. where the carbon is locked rather than being released in the atmosphere, or where crops are grown specifically to feed an anaerobic digester. However, in some circumstances, there are interesting opportunities to develop sustainable local woodfuel supply chains, which can generate revenue for land managers and benefit rural communities that are off the gas grid. Sources of woodfuel can include commercial forestry but also smaller farm woodlands, as well as hedges and trees in an agroforestry system. Uses of food waste and slurry in anaerobic digestion can

[29] See Ofgem https://rhi.ofgem.gov.uk

form part of the circular economy, with nutrients being recovered rather than lost in the environment.

What are the likely wider social (health, community etc.) opportunities and challenges associated with meeting this target, in relation to the agriculture sector and wider land use changes?

Summary: Measures that will be taken in the land-based industries to achieve the Net Zero Emissions (NZE) target will have an impact on visitors' perception and sense of place in local communities. There is evidence of the benefits nature can provide for people in terms of improved well-being and health. Hence there is potential for the NZE target to drive social improvements. Having said that, changes to the local economy can also be expected to affect the social fabric. Addressing the Climate Emergency will no doubt involve a number of challenges in balancing both threats and opportunities for local communities and economic actors. A key principle is that actions to achieve the NZE target are more likely to result in wider social benefits, if these are identified in the context of a wider set of objectives for a locale.

Among the general public, there is a high level of support for advancing environmental protection, in particular among young people[30]. Investment in Natural Capital, as a result of low-carbon targets and through the restoration and improvement of habitats, will have a positive impact on the communities living nearby. These benefits are hard to capture in traditional economic markets but greatly contribute to wellbeing; those living nearby will benefit from in-situ benefits while recreation opportunities will increase for visitors. There is a significant evidence base for the range of individual and wider social health and wellbeing benefits that can be achieved through outdoor activity and contact with nature[31]. Higher quality habitats, including these unfolding through large-scale restoration, will be able to produce higher quality and larger amounts of ecosystem services, helping communities to adapt to the changing climate. A more agroecological agriculture will result in enhanced farmland biodiversity and landscape features, which can also provide well-being to local communities and visitors, as well as reduce some environmental risks such as flooding. A key principle is that actions to achieve the NZE target are more likely to result in wider social benefits, if these are identified in the context of a wider set of objectives for a locale.

Productive forests are a large-scale land use, and any significant changes will have consequences for a large number of places and will impact on how tourists and others perceive Scotland as a place. Some conifer plantations are now locations successfully marketed for tourism and recreation (e.g. Galloway Forest Dark Sky

[30] Mark Diffley Consultancy & Research, Involve (2019) Citizens' Forums and Attitudes to Agriculture, Environment and Rural Priorities, Report for the Scottish Government https://www.gov.scot/publications/citizens-forums-attitudes-agriculture-environment-rural-priorities/

[31] "Health benefits from the outdoors and nature" https://www.nature.scot/sites/default/files/2019-10/Guidance%20-%20health%20benefits%20from%20green%20exercise.pdf

Park, 7stanes mountain biking); well-designed commercial forestry in the right place, on the basis of a clear understanding of place-quality and landscape character can have positive benefits.

As discussed above, there is likely to be changes that will affect the farming economy at least in its present form. It can be argued that the sheep industry currently is part of the maintenance of the social fabric in Less Favoured Areas. However there are also opportunities for diversification and growth in other sectors that will induce changes in the social fabric. The outcome is likely to be positive or negative depending whose point of view is considered, and managing change will unsurprisingly be a balancing act.

What actions do you think Government should take to manage the opportunities and challenges mentioned above?

Summary: As a result of declaring a Climate Emergency, the Scottish Government is taking important steps to put in place the conditions through which actions can be taken. This includes the role of regional land use frameworks to foster stronger place-based interventions for rural support mechanisms, and, potentially wider land uses such as development. These could provide the basis for the Place Principle and more effective alignment of effort and resources across public and private sectors. Codes, similar to the Woodland Code, for all major habitats could help guide land use practices to deliver multiple benefits that simultaneously address mitigation, adaptation and the state of nature. In the drive to achieve the 2045 Net Zero Emissions (NZE) target, it is important not to offshore GHG emissions and environmental impacts to third countries.

The First Minister declared a Climate Emergency and the Scottish Government by setting a target of Net Zero Emissions (NZE) by 2045, including a 75% reduction in GHG emissions by 2030, has set out an ambitious trajectory. Actions identified in the Climate Change Plan 2018-2032 are being reviewed to respond to the new target, and we anticipate a revised Climate Change Plan in 2020. As mentioned above, future land use policy is going to play a critical role in delivering the necessary changes in land management. For this to be achieved, we believe that support schemes for farmers and other land managers need to be based on three key principles:

- investment in natural capital, promoting good land stewardship and emphasising the delivery of public goods alongside more marketable goods, and contributing to the low-carbon economy
- investment in natural capital at a landscape scale including transformations in land use through landscape-scale restoration, expansion and connection of native woodland and other habitats.

- well-funded training and advice programmes to maintain and enhance the skills and capacity of land managers to invest in natural capital

Integrated land use is important to make best use of land to meet multiple objectives and ensure that the NZE target does not drive unforeseen adverse effects, and synergies and trade-offs are anticipated. For this reason, the approach envisaged in the Land Use Strategy, through development of regional land use partnerships and regional land use frameworks would be a good way to guide the delivery of the NZE target. This could provide the basis for the Place Principle and more effective alignment of effort and resources across public and private sectors.

There are also opportunities to change the way environmental schemes are implemented, moving away from a prescriptive approach. SNH is currently working with farmers on pilots to test the development of an outcomes-based approach, whereby farmers can decide how they will achieve specific environmental outcomes. By empowering land managers, their motivation will be greater, and the assumption is that good environmental outcomes are more likely to be achieved. Our discussions so far with farmers suggest enthusiasm for the approach.

Beyond the use of public money for public goods, there are also opportunities for the development of private markets for carbon and other public goods (e.g. water quality). There could also be a role for government to encourage and facilitate access to private markets for public goods through land management action (existing examples include Landscape Enterprise Networks, Woodland Carbon Code, Peatland Code). The potential for Environmental Net Gain approaches and the development of carbon trading for other habitats (than forestry and peatlands) could also be explored.

It is also important to remember that the NZE target is concerned with territorial emissions. Therefore all emissions embedded in products and equipment used in the land-based industries and which are imported are not taken into account. This includes for example soya meal for animal feed. It is essential not to lose sight of this so that GHG emissions are not just emitted in other countries to enable the NZE target to be reached in Scotland. This is an issue that applies to the entire economy. The Scottish Government publishes a regular report on UK consumption-based emissions[32]; this is high level. Regular and more detailed accounting and reporting of consumption-based emissions would be very useful in parallel to the main reporting of Scotland's territorial emissions, to determine whether there is carbon leakage emerging and for what categories of goods. Supply chain analysis is an active field of research with ongoing methodological improvements, which can help determine potential environmental and social impacts.

[32] https://www.gov.scot/publications/scotlands-carbon-footprint-2015/

Annex F – submission from Tweed Forum

1. **What are the main economic opportunities and challenges related to the change in land use required to meet the net-zero 2045 target?**

- The main economic opportunities, lie in land use diversification, especially in the uplands. Delivery of nature based services will be key. The main challenges lie in creating an economic model for trading in natural capital. Mindset and behavioural change remains a huge obstacle.

- In Southern Scotland, most potential for land use change will occur on upland livestock (principally sheep) farms. Traditionally the Southern Uplands are hill sheep country with conifer shelterbelts with significant areas of commercial conifer plantations.

- What land uses does society value in the landscape and what do they want it to look like? How would they wish it to change? Why would they wish it to change? Integrating framing, forestry and conservation will be key.

- The land based sector will continue to require significant government support going forward.

- Incentives remain fundamental to land use but where do we incentivise and what do we incentivise?

- Tweed Forum would wish future rural support to be directed to farmers and land managers who create and manage significantly more wildlife friendly habitat. Farms don't just produce food and timber. Integrated Land Use would help deliver many of society's basic needs and also provide rural land managers with regular income.

- This could be facilitated through a tool such as the Land Use Strategy opportunity target mapping tool. Farmers could be paid for delivering more Ecosystem Services such as: Natural Flood Management, Soil carbon storage, Peatland restoration, Enhanced water quality, Reduced erosion, More wildlife habitat connectivity, More native woodland, Food production on appropriate land, Timber production on appropriate land and at the appropriate scale.

- **Example Question 1-** Where is the incentive for farmers at the head of a valley to undertake land use change to help reduce flooding 20 miles downstream?

- **Example Question 2-** If Salmon are being caught in the lower reaches of the river and shops and hotels are benefitting there, where is the incentive for

farmers in the upper reaches (ie the hills) to implement conservation measures to ensure that habitat are suitable for returning fish to breed.

- Regional Land Use Partnerships (RLUP's) should be established to help facilitate the debate on how to prioritise and incentivise Land Use Change.

- These RLUP's should have ring fenced budgets for their local regions. Regional Land Use Priorities and funding packages could be determined by the RLUP's. What role will these RLUP's fulfil? Will they offer Statutory & Regulatory Services or Advisory & Supporting Services? What budgets will the RLUP's have?

- Facilitators will play a key role. Advisors who have a broad range of knowledge of: agriculture, forestry, conservation, climate change and economics will be fundamental.

- Not all traditional hill farms will survive in future. Many traditional hill shepherds will adapt, some may retire and some may make way for land managers who would manage the land differently, for delivery of multiple benefits (ie delivery of nature based services/natural capital).

- Climate change mitigation and adaptation will drive most economic agendas. Creating and managing more semi-natural habitat will not just help with climate change mitigation but also help deliver Biodiversity gain, especially if undertaken at the landscape scale.

- Scale of delivery and connectivity of habitats will be important. The larger and more connected habitats are, the more effective they will be at delivering real benefits to the environment and climate.

- There is not enough public money in the system, to create and manage the scale of habitat creation required to deliver both significant climate and biodiversity gain. Private sources of funding will be essential.

2. What are the likely wider social (health, community etc.) opportunities and challenges associated with the land use change required to meet this target?

- The wider opportunities and benefits are crystal clear. It is not a question of if we need to change the way we manage land …..but how quickly we can make the changes. The climate is heating up and wildlife is in steep decline. Sustainable food production and food security requires both these systems to function effectively. All of society will benefit if solutions are found.

- Mitigating against the worst effects of climate change is not just about delivering green energy projects but also about landscape scale habitat creation and management. Biodiversity enrichment will come on the back of habitat restoration for climate change. However, there needs to be a market for nature based services delivery.

3. What actions do you think Government should take to manage the opportunities and challenges mentioned above?

- As a matter of urgency, undertake a Scotland wide programme of natural capital accounting (ie; mapping all existing natural capital resources and creating land use opportunity target maps for delivery of nature based services). The wide range of nature based services include: natural flood management, soil carbon storage, peatland restoration, enhanced water quality, reduced erosion, more wildlife habitat connectivity, habitat for pollinating insects, more native woodland, food production on appropriate land & timber production on appropriate land.

- Invest more time and effort in creating a market for delivery of nature based services. In the meantime, the public money should be directed towards delivery of public goods and services…that are not otherwise 'economically attractive' to deliver at present.

- Set up Regional Land Use Partnerships to help facilitate the land use opportunity target mapping programme outlined above.

- Incentivise farmers in the areas where the most practical and cost effective nature based services can be delivered.

- Experiment with different incentivisation tools ie; reverse auctioning, payments by results, etc.

- Produce a simple and usable online mapping system that everyone can access and use. Land use data gathered at the public's expense should be made available to the public. This would help determine (quickly and easily) where the best spend could be targeted.

Annex G: submission from SCCS

1. Negative emissions

Combined with carbon capture and storage (CCS), Scotland's land and its food and drink industry have the potential to deliver 'negative emissions', helping Scotland meet its net zero greenhouse gas emissions targets.

Carbon capture and storage (CCS) is the process of separating carbon dioxide (CO_2) from the flue gases of industrial operations, transporting it, then securely storing it in geological formations deep below the seabed.
CCS is crucial to reducing emissions from industry, where there are few other options for decarbonisation. CCS can also be used to avoid emissions from gas or coal fuelled power generation (unlikely to be necessary in Scotland) and applied to store CO_2 derived from biomass combustion for power, producing credits in negative carbon. CCS can be used to remove carbon from methane to produce hydrogen for heat and transport fuels. And CCS can capture CO_2 from anaerobic digestion of biogas and CO2 from fermentation industries, again producing credits in negative carbon.

Once it is in place, the infrastructure to transport and store CO_2 should be available to any organisation that can capture its CO_2 - this includes CO_2 from biogenic (non-fossil) sources, which are not counted in the emissions inventory and which therefore would count as 'negative emissions' if they were prevented from reaching the atmosphere, including:

- Biogas combined heat and power (including landfill and sewage treatment)
- Biomethane upgrading
- Biomethane combustion
- Biomass combustion
- Fermentation[33]

Negative emissions should not be seen as a replacement for measures to avoid or reduce greenhouse gases – all parts of the economy will need to do what they can to decarbonise. Negative emissions will be needed to offset emissions that can't be avoided, and by delivering them, Scotland's land and agriculture sector can help the rest of the economy in its transition to net zero. Importantly, the negative emissions from these biosources can be provided at small energy costs, often generating energy. By contrast, negative emissions from air capture or accelerated weathering will require very large energy inputs, making them much more expensive.

[33] See Brownsort (2018) *Negative Emission Technology in Scotland: Carbon capture and storage for biogenic CO_2 emissions*: https://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_08_Negative_Emission_Technology_in_Scotland.pdf

2. Biogenic CO_2

As plants and trees photosynthesize, they absorb CO_2 from the air and convert it to glucose. Through this process, carbon is taken out of the atmosphere and 'locked up' in the plant. However, this carbon sequestration is not permanent, lasting only 1 to 50 years, – the CO_2 is released when the plant dies and rots or is eaten or burned. By contrast storage of CO_2 for climate purposes will be for 1,000 - 10,000 years duration

One way to keep this carbon locked up for a long time is to use timber as a building material, where it will remain inert until the end of the building's life.

Another option is to capture the CO_2 when it is released – for example where wood is burnt for electricity generation or to fuel industrial processes; where organic waste is broken down in landfill or through anaerobic digestion, or where it is incinerated to create energy; or where the sugar is converted to alcohol in the production of whisky and other drinks.

3. Current opportunities for capturing biogenic CO_2 in Scotland[34]

3.1 Food and drink

Scotland has seven grain whisky distilleries, which account for around 0.25 MtCO_2 / year as well as hundreds of smaller distilleries and breweries. These fermenting processes give off a concentrated stream of CO_2 as yeast turns sugar to alcohol. In most cases, it would not be practical to capture this CO_2 because of the small size of the operations - but from the distilleries which operate at an industrial scale, it would be possible and, indeed, has already been done at the North British Distillery in Edinburgh. Similar distillery scale plants appear to be accessible in cost, and could remove CO_2 to a storage hub by road tanker or rail

3.2 Bioenergy with CCS

Bioenergy with CCS (BECCS) is the most well-developed approach to capturing biogenic emissions, and is currently being trialled at Drax power station in Yorkshire, which burns wood pellets to produce electricity.

Scotland has six major sites where biomass is burned for power generation, heat or both – they account for around 1.4 Mt CO_2/year – in addition to thousands of smaller sites. There is the potential to turn this to negative emissions using CCS.

Overall, research by SCCS found that there is the potential to capture 2.1 Mt CO_2/year of existing biogenic emissions in Scotland, from the 29 of the largest sites in the country.

[34] See Brownsort (2018). This report considered existing sources of biogenic CO_2 in Scotland, including energy from waste, which is less relevant to this evidence session, but nonetheless provides an opportunity for negative emissions. Further work on the greenhouse gas removal potential for energy from waste is being done through the European NEWEST-CCUS project, in which SCCS is a partner.

4. Future opportunities for negative emissions in Scotland

4.1 BECCS

The Committee on Climate Change found that demand for harvested biomass is likely to outstrip supply, so recommends that it "will be used most effectively where it maximises the removal and minimises the release of carbon into the atmosphere"; that is:

- More timber used in buildings
- No new subsidies for large-scale biomass to power plants unless with CCS
- Use biomass to produce hydrogen, electricity or industrial products whilst sequestering carbon with CCS
- Phase out biofuels in cars and vans in the 2030s
- Plan for up to 10% of aviation fuels as biofuel produced with CCS by 2050[35]

It has been estimated that there is the potential for dedicated short rotation coppice plantation on an area of 5,2000 km^2 of land which is described as "marginally suitable for food production", and which accounts for 26.5.% of agricultural land in Scotland. This could remove 5.73-22.9 $MtCO_2$/year[36], although competition with other land uses, and for water and nutrients, means that actual deployment is likely to be less than this.

4.2 Other options

Other options for greenhouse gas removal that could be considered by the land use and agriculture sector include:

- Increasing soil carbon – including peatland restoration and expanding forestry.
- Creating biochar – fixing carbon for long term storage by charring biomass.
- Enhanced geological weathering of rock minerals – intentionally accelerating processes that convert CO_2 in the air to rock.
- Direct capture of CO_2 from the atmosphere for geological storage.[37]

[35] Committee on Climate Change (2018) *Biomass in a low-carbon economy*: https://www.theccc.org.uk/publication/biomass-in-a-low-carbon-economy/
[36] Alcalde et al (2018), cited in Haszeldine et al (2019)
[37] For more detail on these, and their potential capacity for negative emissions in Scotland, see Haszeldine et al (2019) *Greenhouse Gas Removal Technologies – approaches and implementation pathways in Scotland*: https://www.climatexchange.org.uk/media/3749/greenhouse-gas-removal-technologies.pdf