

The Ruby Country Net Zero Beef Farming Forum



Image: Ruby Red Cattle at Summerhill Farm, Devon, photo courtesy of Mel Wright

Final Project Report
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Acknowledgments

Forum participants: the Ruby Country Farmers and farming stakeholders

Sincere thanks to all our forum participants who gave up their time to take part in the project, especially during a busy time of the farming calendar. Names have been removed to protect participants' anonymity but we are deeply grateful for their contributions. Participants' willingness to share their knowledge, experiences, ideas and concerns and to engage with peers, project members and expert witnesses made the forum an extremely constructive and enjoyable process.

Expert witnesses: We would also like to thank all the expert witnesses who shared their knowledge and gave up their time to pre-record presentations and to take part in the forum Q&A. In particular:

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The presentations of these guest speakers do not feature in this final project report but instead can be accessed electronically via the project website which has been established as a legacy resource for use by other farmers, farming stakeholders, policymakers, and researchers. See <https://blogs.exeter.ac.uk/rubycountrynetzero/>

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Project Team

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Digital Assets

Project website

See <https://blogs.exeter.ac.uk/rubycountrynetzero/about-the-project/>

Video presentations from the expert witnesses

See <https://blogs.exeter.ac.uk/rubycountrynetzero/>

Short film providing a visual depiction of the Ruby Country

<https://blogs.exeter.ac.uk/rubycountrynetzero/ruby-country-3/>

Interviews with ruby country beef farmers

The project worked with local filmmaker Tom law to create a series of short films with beef farmers in the Ruby Country. Click on the links below to hear directly about their experiences, motivations and concerns regarding 'Net Zero' farming.



Rob & Liz Priest: <https://youtu.be/Ji2itFTxhC0>



Keith Hutchings: <https://youtu.be/ovzs8ZeQobo>



Ben Hutchings: <https://youtu.be/udufvwqIXZc>



Henry Andrews: <https://youtu.be/ICKigethv3M>

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Executive Summary

The UK livestock sector is facing multiple pressures arising from post-Brexit policy, changing consumer demand for red meat and government targets for Net Zero emissions. How the sector can meet these challenges whilst still maintaining a healthy, thriving rural economy is a key concern for policymakers and rural communities alike. Government and farming organisations including the NFU have independently outlined potential pathways to achieving Net Zero emissions but there is little understanding on how this would translate at a local level.

The [Ruby Country](#) is the name given to the rural inland area of north-west Devon, UK. The area remains heavily economically reliant on agriculture and the grassland livestock sector. Socially and culturally too, dairy and meat production and its associated landscape continue to play an important role in terms of community cohesion and local identity. This strong reliance on, and identification with, livestock production, especially beef production, makes the Ruby Country disproportionately vulnerable to changes within the sector.

The Ruby Country Net Zero Farming Forum ran for six-weeks between April and May 2021 to explore novel public engagement approaches to the question of “How can beef farming in the Ruby Country transition to Net Zero GHG emissions by (or before) 2050?”. Through a combination of online workshops, pre-recorded expert testimonies and deliberative sessions, the forum provided a space for those engaged in the wider Ruby Country beef sector to explore the research and guidance around different aspects of Net Zero production, share their experiences and perspectives on these topics, and identify the support necessary to aid their transition to Net Zero.

Key findings

The findings in this report are based on the project team’s analysis and distillation of a large and rich set of qualitative data from the forum. Key thematic areas which emerged from the Forum are outlined below (it should be noted that some of the issues raised by forum members may have been addressed since the Forum took place as the Government clarifies its plans for post-Brexit agricultural policy):

Perceptions of Net Zero farming and willingness to engage

- Forum participants believed in the importance of Net Zero and environmental agendas
- Many were already engaged in farming practices that promote biodiversity and soil health
- Participants believed in the value of mixed farming systems that integrate livestock with arable
- Participants felt there was a lack of clarity about developing policy agendas and future incentives, and encountered difficulties in measuring carbon footprints and benchmarking progress. Some participants were therefore reluctant to take further steps towards Net Zero goals until greater clarity about these issues emerged
- There was very high quality and sustained engagement with the Ruby Country Net Zero Farming Forum, and clear interest in learning more from research and peers about farming practices that support Net Zero goals

Barriers to change & challenges inhibiting the transition to Net Zero beef farming

- Concern about taking land out of food production or reducing the size of fields for grazing
- Financial barriers inhibiting the use of practices that would further promote environmental and Net Zero goals, such as sufficiently large manure storage systems, machinery and

necessary smaller or specialist equipment. Low profit margins in the sector and concerns about the withdrawal of the Basic Payment Scheme (BPS) were at the forefront of people's minds

- A lack of clear, practical guidance from research about how to farm in ways which meet Net Zero goals; lack of information about diverse farm types with different soils, sizes, and business models; conflicting science
- Challenges of measuring and benchmarking carbon footprints of farms (practical, financial and knowledge-based)
- The labour-intensive nature of some of the practices that promote biodiversity and Net Zero goals (e.g., hedge laying, harvesting wood, mob grazing practices which require continual adjustments to fencing paddocks)
- Lack of localised infrastructure such as smaller abattoirs
- Need for agronomists and contractors to be supportive of environmental agenda and to have access to the relevant training, information and equipment

Actions already underway to support environmental and Net Zero goals

Most forum participant farmers were already undertaking practices that were perceived to promote environmental and Net Zero goals. These included:

- **Farming practices:** Restoration and management of Culm grasses, the use of mixed herbal leys to promote soil health and encourage biodiversity, protection and management of wildflower meadows; mixed farming systems, reducing compound/ bought-in feeds and using grass-based livestock diets, use of manures and reduction or avoidance of artificial fertilisers, organic farming; rainwater catchment systems; use of biomass boilers on the farm; reducing plastic wrapping through the production of hay rather than silage, attempts to actively measure organic matter in soil, carbon sequestration through hedgerow expansion and management, protection of riverbanks, in-field practices to promote soil health and maximise carbon sequestration such as the 'min till' approach. Promoting animal health through grazing practices; regenerative grazing practices including mob grazing approaches; selection of breeds with low input requirements to improve efficiency of production. A minority were actively developing silvopasture systems¹. Many were already integrating livestock into existing wooded areas, allowing animals to graze hedges and trees. No forum participants were growing bioenergy crops.
- **Education, marketing & access to land:** Many participants were marketing their produce direct to customers to support the consumption of local produce with lower food miles and lower intensity production methods, also providing an educational function to the wider public; others were part of educational programmes (often informal) bringing school children onto their farms or were engaging in tourism involving farm stays for the public.

Support and actions needed from local policy makers/ local authorities

- Support for discussion forums, advice and information provision to assist with the transition to Net Zero farming, reflecting a desire among forum member to learn from research about the best ways forward; desire for better support from qualified advisors to aid access to new grant schemes and inform management
- Local planning systems that encourage and support the development of appropriate infrastructure to support Net Zero goals (smaller and local abattoirs, appropriate sheds for manure storage or animal housing, renewable energy infrastructures)

¹ Integration of trees into pastures

- County wide leadership, strategic and joined up approach to green agendas, which makes the most of county assets, including council-owned farms and land; use of procurement powers to support consumption of sustainably produced food
- Collaboration between local/ regional/ national level policy makers to inform the development of new, integrated, policy agendas about food and agriculture
- Support for peer learning and equipment sharing
- Enhancing the role of Councils with public education to help farmers tell their stories to the public; facilitating public and school access to farms

Support and actions needed from national policy makers

- Greater clarity about the new payment system and emerging policy frameworks to support expedient and necessary changes to farming practices
- Fewer bureaucratic processes and more support when applying for grant schemes
- Schemes which reward not only new but existing agricultural practices which are environmentally beneficial
- Payment schemes which provide support for smaller farms
- Payment schemes which provide support appropriate to the local/ regional farming landscapes – areas of the country characterised by smaller farms (e.g., support for smaller planting areas of woodland)
- Regulatory frameworks which recognise differences in local/ regional farming landscapes
- Use of both carrot and stick to reward good practice and penalise damaging practices
- Provision of affordable access to loans and other finance to support Net Zero infrastructure
- National planning frameworks which permit local planning processes to support infrastructure development promoting Net Zero goals
- Concern about trade deals undermining Net Zero goals and promoting the consumption of food produced with lower standards
- National approach to public education about food
- Monitoring and evaluation of the full implications and effects of planned Net Zero measures on ecosystems, farm productivity and food security

Support and actions from within local communities

- Role of peer learning and discussion forums, as well as equipment sharing
- Encouraging education of local consumers and members of the public through storytelling, access to farms, appropriate marketing; developing ownership of, and pride in local produce; increasing routes to localised markets
- Collaboration with regards to the potential role of Ruby Country produce branding for local and national markets
- Potential role of carbon trading across farms in the County

Research and information needs

- Research which is tailored to different farm types and sizes represented in the Ruby Country
- Research and advice which is practical and clear about which approaches are most beneficial to allow farmers to keep up-to-date with new and emerging findings
- Assistance with measuring carbon footprint and sequestration, to facilitate benchmarking; standardisation of approach
- A range of more specific research needs related to animal management, land management and sequestration as outlined at the end of each substantive chapter, and in chapter 6

Chapter 1 Introduction

1.1 The Challenge of Net Zero

We know with a high degree of certainty that climate change is happening, accelerated by greenhouse gas (GHG) emissions resulting from human activity. The accumulation of GHG in the atmosphere has warmed the world by about 1 °C since pre-industrial times and the impacts are being felt across the world, albeit not uniformly. In the Paris Agreement, world leaders set the goal to limit warming to well below 2 °C, and pursue efforts to stay below 1.5 °C. To achieve the 1.5 °C goal, net GHG emissions need to be reduced rapidly this decade, and as close to zero as possible by the middle of the century. The state at which the greenhouse gases going into the atmosphere are balanced by removal out of the atmosphere is known as '**Net Zero**'.

In June 2019, the UK government became the first major economy in the world to set a legally binding target of achieving Net Zero greenhouse gas emissions by 2050. In June 2021, a further ambition to reduce GHG emissions by 78% (compared to 1990) levels by 2035 was also enshrined in law. At the local government level too, many councils have declared a climate emergency and are taking action to reduce their own GHG emissions and are working with partners and local communities to tackle the impact of climate change on their local area. In Devon, a range of public, private and voluntary organisations from across the county came together in May 2019 to form the Devon Climate Emergency Response Group, to declare a climate emergency, and to produce the [Devon Carbon Plan](#), a roadmap for how Devon will reach Net Zero emissions by 2050 (at the latest).

Climate change is widely recognised as the greatest existential threat of our time. Meeting the challenge will require considerable and concerted effort. All sectors of the economy and society will need to play their part.

1.2 Agriculture's GHG Emissions

Agriculture is responsible for around [10% of Greenhouse Gas emissions](#) in the UK, and is the fifth largest emitter after the transport, energy, business, and residential sectors. Of the agriculture sector's total GHG emissions, [56% are methane \(CH₄\) emissions and 31% are nitrous oxide \(N₂O\) emissions](#). While anthropogenic emissions of carbon dioxide (CO₂) are identified as the primary cause of global heating, methane, which is 30-times more potent than CO₂ as a heat trapping gas, and nitrous oxide, which is up to 300-times more potent than CO₂, have increasingly [come under the spotlight](#).

The vast majority (87%) of UK agriculture's methane emissions originate from ruminants (i.e., sheep and cattle) as part of their natural digestive process. This means, therefore, that [almost half \(49%\) of all UK agricultural emissions come from ruminant livestock](#). Moreover, livestock manure management, the application of nitrogen fertilisers, and the production of imported livestock feedstuffs, such as soya, are also major sources of nitrous oxide emissions. It is worth noting too that the emissions *pre* farm-gate, mainly associated with rumen digestion, feed and fertiliser, far outweigh emissions *post* farm-gate, including transport, processing, etc.

For UK agriculture therefore, while reducing its own CO₂ emissions is, of course, important, the key challenge in terms of reducing GHG emissions requires a particular and urgent focus on methane and nitrous oxide.

1.3 Agriculture's Opportunity

The need to reduce methane and nitrous oxide poses a difficult challenge for the livestock sector, as these greenhouse gases are released as part of natural and unavoidable animal and soil microbial processes. Methane, for example, is produced by microorganisms in the rumen as cattle and sheep break down the cellulose in their diet in the process of producing milk and meat and is thus, to a degree, a largely unavoidable part of livestock rearing (although as we will see measures can be taken to reduce the amount of methane released during enteric fermentation).

The livestock sectors capacity therefore to reduce its own GHG emissions to zero may be somewhat limited. Emissions reductions, however, are only one side of the Net Zero equation. As a sector, agriculture is uniquely placed to capture and sequester large quantities of the preeminent greenhouse gas carbon dioxide from the atmosphere and convert it, with the help of farmers, into a wide range of '[foods, fibres and fuels](#)'. In so doing, the sector has the opportunity and potential, in theory at least, to not only reach Net Zero, but to generate negative GHG emissions, balancing not only its own emissions, but the GHG emissions emitted from other sectors too.

1.4 Introducing the Ruby Country

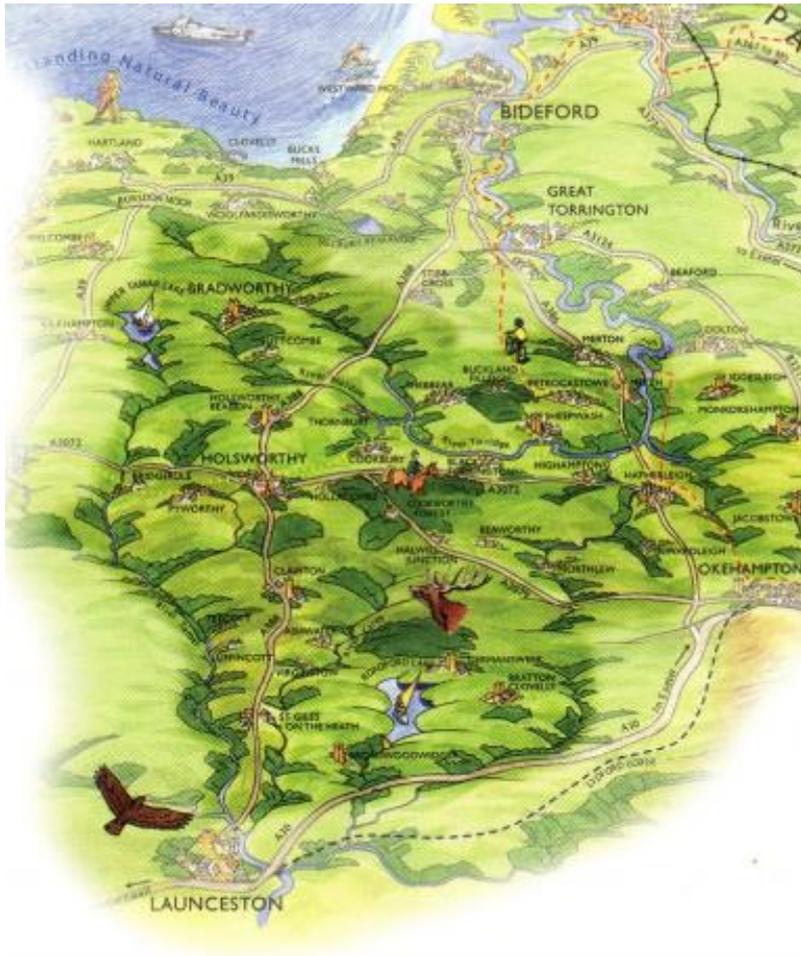
The [Ruby Country](#) is the name given to the rural inland area of north-west Devon, UK (see map below). It straddles the West Devon and Torridge District local authority areas, covers 45 parishes, and is typified by small, dispersed farming communities. It is centred on the small market towns of Holsworthy and Hatherleigh and encompasses parishes which are amongst the UK's 30-40% most deprived neighbourhoods, according to UK Indices of Multiple Deprivation.

The area derives its name from the [Red Ruby Devon Cattle](#) [as shown on the front cover of this report], reflecting the historical importance and prevalence of agriculture in the area, particularly dairy and meat production. Today, with limited alternative industries in the area, the Ruby Country remains heavily economically reliant on agriculture and the grassland livestock sector. Socially and culturally too, dairy and meat production and their associated landscapes continue to play an important role in terms of community cohesion and local identity. This strong reliance on, and identification with, livestock production, in particular beef production, makes the Ruby Country especially and disproportionately vulnerable to changes within the sector.

As a largely agricultural area with a high reliance on beef production, the proportion of GHG emissions generated by the agriculture sector are significantly above the 10% national average figure. For Devon, a largely rural county, around [17% of its GHG emissions come from agriculture](#).² For the Ruby Country it is [upward of 30%](#), making agriculture the single largest sector in terms of GHG emissions in the area.³ Agriculture in general, and beef farming in particular, therefore have the potential to play a significant part in helping the county meet its GHG reduction targets and Net Zero ambitions.

² Agriculture with Forestry and Land Use (AFOLU)

³ Based on an average figure for AFOLU across the Torridge and West Devon District Council areas. Torridge AFOLU emissions 35.6%, West Devon AFOLU emissions 28.3%, giving an average of 32%. For comparison, the average 'on-road transportation' emissions (the next largest sector) across the two districts is 25%



The Ruby Country - Image from <https://www.ridetherubycountry.co.uk/home/>

1.5 Meeting the Net Zero Challenge from a beef farming perspective

The path to Net Zero for the beef sector is extremely challenging. Farmers must negotiate several significant additional obstacles in terms of recent changes in agricultural policy that are yet to fully play out, as well as a growing public debate around the role of meat and dairy in our diets. How can beef farming in the Ruby Country navigate this new landscape? How can beef farming, a sector so intrinsic to the Ruby Country that it gives it its name, make the move to Net Zero whilst continuing to support a healthy, thriving rural economy? Put simply:

‘How can Ruby Country beef farming best transition to Net Zero GHG emissions by (or before) 2050?’

The primary aim of this project has been to answer this question and to understand what achieving Net Zero beef farming might mean in practice for beef farmers and wider stakeholders in a strongly beef farming area.

1.6 The Project

The Ruby Country Net Zero Beef Farming Forum project was funded by UK Research & Innovation (UKRI) as part of their [‘Enhancing Place-based Partnerships in Public Engagement’](#) theme and was led by a consortium of project partners from [Rothamsted Research](#), [University of](#)

[Exeter](#), [Ruby Country Partnership](#), [West Devon Business Information Point](#), and [Devon Communities Together](#). The project officially ran from January 2020 to September 2021, although this period included a Covid-related six-month hiatus between March and September 2020. The Net Zero Beef Farming Forum itself took place over an eight-week period during April and May of 2021.

1.6.1 The Ruby Country Net Zero Beef Farming Forum

There was a strong consensus among the project partners that the people best placed to answer the project's key question: *How can Ruby Country beef farming best transition to Net Zero GHG emissions by (or before) 2050?* were Ruby Country beef farmers and beef farming stakeholders themselves. To that end, the project established the Ruby Country Net Zero Beef Farming Forum, a space for beef farmers and those associated with the industry to explore evidence relating to aspects of achieving Net Zero, share their experiences and concerns associated with these topics and to collectively identify and discuss the challenges and opportunities associated with working towards Net Zero beef farming in the area.

The Forum model was an innovative and hybrid form of democratic engagement which took elements of the Citizens' Jury approach and other deliberative methodologies to establish a unique and bespoke method for engaging and listening to underrepresented farming communities in the Ruby Country. It provided an occasion and space for the local beef farming community to share examples of good practice, and to collectively identify the key issues and challenges they face and the messages that they would like to communicate to both policy makers and researchers about the information and help they urgently need to make the difficult transition to Net Zero.

1.6.2 The Forum Members

In early Spring of 2021, the project issued a call for beef farmers and those working in the wider beef farming supply chain in the Ruby Country and adjacent areas to join the Forum. In response to this call thirty Expressions of Interest were received. From this 'long-list', twenty-four individuals were selected by the project partners and invited to join the Forum. Of these, roughly two-thirds were beef farmers and one-third worked in the wider beef farming supply chain (e.g., as vets, feed specialists, agronomists etc.). While the Forum was *not* a fully representative sample of beef farmers in the Ruby Country, across its 24 members there was a relatively good mix of farm size and occupier type (i.e., owner occupiers, wholly rented and mixed tenure types), age and gender represented.

1.6.3 The Forum Process

Due to Covid-related restrictions on in-person meeting, the Farming Forum process itself was conducted entirely online using the Zoom online meeting platform. There was no requirement for Forum members to have any prior experience of using Zoom as training was offered in advance of the first Forum session by project partners Devon Communities Together. The Forum convened for six sessions over an eight-week period beginning the week commencing the 20th of April 2021. Session 1 provided a general introduction to the project and the challenge of Net Zero; sessions 2 and 3 focussed on research and strategies to reduce on-farm GHG emissions; sessions 3 and 4 on opportunities for on-farm carbon sequestration; and session 6 on identifying actions, recommendations and next steps (see Section 2 below for more detail on each session).

Ahead of each session, Forum members were presented with 'evidence' from a number of 'expert witnesses' about the very latest research and thinking on a given issue/topic. These expert witnesses included various agricultural scientists, particularly those with an interest in cattle and

livestock farming, and others working more broadly in the fields of conservation and land management.

Each expert witness 'evidence' submission took the form of a narrated PowerPoint presentation. Given the very specific format and membership of the Forum, expert witnesses were given gentle guidance and steer by the project team on the possible structure and tone of their evidence. Presentations, it was requested, were to be no more than fifteen minutes long and delivered in language that was appropriate for the Forum audience, which the project team suggested might best be described as 'knowledgeable practitioners'.

For Forum sessions 2, 3, 4 and 5, expert witness presentations were recorded in advance and posted on the project's [YouTube channel](#). Before each of these sessions, Forum members were asked to visit the channel and watch the relevant presentations and to make a note of any questions and comments they might have for the expert witnesses. For Forum sessions 1 and 6, expert witness presentations were delivered 'live', in-person, through the Zoom platform, in the now familiar way.

Each of the six Forum sessions took place on a Tuesday morning and lasted around two hours. Typically, the first hour of each session focussed on the expert witness presentations with Forum members given the opportunity to question and 'cross examine' each of that week's witnesses. Following a comfort break, the second half of each session involved the Forum splitting into three small, facilitated, break-out groups to further discuss and deliberate that week's topic amongst themselves and with facilitators.

The main 'plenary' part of each session (i.e. the expert witness Q+A) was recorded using the Zoom record function, while each break-out group was recorded individually by the group facilitator on a separate manual recording device. In total, the Forum generated around twenty hours of recorded dialogue and discussion across the six sessions.

The findings presented in this report are based on the project team's analysis and distillation of this large and rich dataset of qualitative data from the forum⁴. In each chapter, we present key themes that arose from each workshop after analysing and coding the full range of transcripts from each. We present a range of quotations from the workshop discussions, to show the diversity of opinion as well as common themes which emerged.

1.7 Content of the Forum: The Six Forum Sessions

1.7.1 Session 1: Setting the Scene

This session was an introduction to the forum which included information and discussion about the Net Zero concept and about agriculture's environmental impact, as well as about the Devon Carbon Plan. Given the importance of agriculture both to the Devon economy and to its overall carbon emissions, the outputs of the Ruby Country Forum were anticipated to provide valuable information to help inform steps that could help reduce the sector's impact in the County and indeed enhance its potential for positive net impacts, which could be feed into the Devon Carbon Plan. This session also covered the challenges faced by farm businesses in the Ruby Country in a time of change. These challenges included forecasted reductions in red meat consumption, reductions in the Basic Payment Scheme (effectively, a loss of subsidies) resulting from Brexit, but also discussion of some

⁴ Ethical approval for conducting the forum and associated research was obtained from the University of Exeter's Ethics Committee.

new opportunities – in particular, the environmental grants and incentives being introduced over the so called ‘agricultural transition’, a period of time during which current farm payment systems will be phased out to be replaced by payments which will ultimately focus government financial support on the delivery of public goods such as biodiversity net-gain, carbon sequestration and natural flood management, with additional schemes to incentivize the transition to renewable energy production. An overview of the opportunities and risks for mitigating farming carbon footprints in the Ruby Country was provided, as a precursor to the subsequent focused workshops on mitigation and sequestration.

Presentations for the whole workshop can be viewed [here](#) or individually at the links below:

- [Introduction to the Project and Net-Zero](#)
(Melanie Wright, Rothamsted Research)
- [Devon Carbon Plan/Citizens Assembly](#)
(Emily Reed, Devon Climate Emergency)
- [Farm Businesses in the Ruby Country Face Change](#)
(Stewart Horne, West Devon Business Information Point (BIP))
- [Farm footprints: identifying opportunities and risks for mitigation](#)
(Prof Adie Collins, Rothamsted Research)

1.7.2 Session 2: Greenhouse Gas Mitigation 1: Animal management, grazing & feed

This session focused on how animal management, feed and grazing could help improve livestock efficiencies and mitigate on-farm methane emissions. Presentations for the whole workshop can be viewed [here](#) or individually at the links below:

- [The impacts of genetics and feed on methane emissions in beef](#)
(Dr Paulo de Meo Filho, Rothamsted Research);
- [Re-thinking efficiency in livestock systems](#)
(Dr Andrew Cooke, Rothamsted Research);
- [Stabiliser genetics and management practices](#)
(Seth Wareing, Stabiliser Cattle Company);
- [Maximising the value of grazing for production and environment](#)
(Dr Sarah Morgan, Rothamsted Research);
- [Maximising the value of silage](#)
(Kate Lecocq, Rothamsted Research).

1.7.3 Session 3: Greenhouse Gas Mitigation 2: Land and Manure Management

Session 3 explored research related to the impact that land management, soil health and pasture type have on greenhouse gas emissions from soils and the tools and practices available to farmers to reduce emission associated with manure use, storage and application. Presentations for the whole workshop can be viewed [here](#) or individually at the links below:

- [The Impact of land management on GHG emissions](#)
(Dr Laura Cardenas, Rothamsted Research);
- [Managing soil organic carbon to reduce greenhouse gas emissions](#)
(Prof Andrew Neal, Rothamsted Research);
- [Managing livestock manures to reduce emissions](#)
(Tom Misselbrook, Rothamsted Research);
- [The Farm ‘Crap App’](#) (Dr Robert Dunn, Rothamsted Research)

1.7.4 Session 4: Carbon sequestration 1: Carbon Capture in Grassland Soils

Building on the previous two workshops which looked at strategies to reduce on-farm greenhouse gas emissions, workshop 4 and 5 explored opportunities to sequester and store greenhouse gas emissions on-farm. In workshop 4 the forum explore the role of soils and grassland to sequester and store carbon from the atmosphere, the impact of grassland management on soil carbon and the tools available to calculate carbon footprints and changes in carbon stocks. Forum participants also heard from experts working on Culm grassland, a key priority habitat within the Ruby Country, which is rich in carbon. Presentations for the whole workshop can be viewed [here](#) or individually below:

- [The Soil Carbon Project and farm carbon accounting](#)
(Becky Wilson, Farm Carbon Cutting Toolkit)
- [What is a “good” level of soil organic carbon? \(Carbon Index for UK Soils 2021\)](#)
(Dr Stephan Haefele, Rothamsted Research);
- [Culm grasslands and wildflower meadows in North Devon](#)
(Lisa Schneidau, Devon Nature Improvement Area/ Devon Wildlife Trust)
- [Carbon storage and natural flood management in Culm grassland](#)
(Nicola Ellis, University of Exeter)

1.7.5 Session 5: Carbon sequestration 2: Hedgerows and Trees in the Farmed Environment

In the second of the workshops focussing on natural carbon sinks, the Forum looked at the potential of trees, hedges, and perennial bioenergy crops to sequester and store carbon on-farm. Forum members heard from experts about opportunities and support available to create new woodland in the Ruby Country, how hedgerow management can be adapted to maximise carbon storage, how trees can be integrated alongside grazing to create silvopasture within the Ruby Country and the potential of perennial bioenergy crop to contribute towards Net Zero targets. Presentations for the whole workshop can be viewed [here](#) or individually below:

- [Expanding Devon’s woodlands with the right tree in the right place](#)
(Jon Burgess, Forestry Commission);
- [The potential of Devon’s hedges to contribute towards Net Zero](#)
(Dr Matthew Axe, Devon Hedge Group)
- [Silvopasture: Integrating trees into pasture systems](#)
(Ben Raskin, Soil Association)
- [Bioenergy crops](#) (William Macalpine, Rothamsted Research)

1.7.6 Session 6: Actions, Recommendations, Next Steps

The final session explored the end stage of production: processing and marketing, including a case study of a company marketing their sustainable produce direct to consumers, and discussion of carbon labelling within meat production and manufacturing. This session also included discussions that brought together themes from the entire forum, including messages for policy makers, local authorities, and research institutions about support and knowledge needs to enable the transition to Net Zero farming. Presentations for the whole workshop can be viewed [here](#) or individually below:

- [Farm Wilder: Direct to Consumer Sales](#) (Tim Martin, Farm Wilder)
- [Meat Processing and Net Zero](#) (Julie Finch, Kepak)
- [Carbon footprints and livestock: are current methods the real challenge?](#)
(Graham McAuliffe, Rothamsted Research)

Chapter 2 Mitigating methane emissions: Animal management, grazing and feed

The following chapter summaries experiences and feedback from participants in the three breakout groups of [workshop 2](#) of the Ruby Country Net Zero Farming Forum. This session focussed on the impact that improvements in livestock efficiency, grazing management and silage production can have on mitigating on-farm methane emissions. Methane accounts for over half (53%) of the emissions from UK agriculture and is therefore a key focus for efforts to decarbonise this sector. The majority of these methane emissions are the result of enteric fermentation associated with ruminant livestock, with additional sources derived from livestock manures. Methane is a by-product of digestion in ruminants and its production is strongly correlated to the growth efficiency of individual animals. Key focus areas to reduce methane from the livestock sector have therefore focussed on identifying and managing emissions hotspots and improving livestock efficiency.

Summaries were produced for each breakout group by scribes from project partner Devon Communities Together. These were used in conjunction with session transcripts to identify steps and actions already taken by Forum members, barriers and challenges to making change, support needed and further research/knowledge needed.

2.1 Steps and actions already taken

2.1.1 Tailoring production systems/ routes to market

Forum members had adapted and tailored their production systems and routes to market to suit their farm types. Although this theme does not relate directly to mitigating methane emissions, it relates to efficiencies and farm business models suited to smaller farm types producing in non-intensive systems which most forum members were involved with. Yet within these farms, business models varied. Several Forum members had suckler herds where weaned calves and youngstock were sold and finished off-farm; others were breeder/finishers taking their animals all the way through to slaughter. Some Forum members had set up direct sales schemes including meat boxes or were supplying local butchers in response to consumer demand for greater traceability of products and the perception that the current carcass grading system penalises smaller, traditional breeds unfairly. Benefits of this sales route included higher premiums for their produce, closer relationships to their consumers and more control over their production systems. The following quotes were illustrative:

ID1: " We sell the bulk of our beef direct, in boxes. And therefore, we have a very close relationship with our customers. And they are interested in the quality of the beef and the animal welfare and also the environment."

ID2: "When the abattoirs were penalising the beef farmer two years ago with the crap prices, I got a bit miffed and started pushing to the consumer more. The consumer has now started buying the meat off me, they tasted a difference. They've got a taste for it, then coming back every time they're realising that the price isn't much different. They know the farmer, they know its local, they know that we're farming with the environment at heart. And I think that's the way I'm going anyway"

2.1.2 Improving on-farm efficiencies

The second dominant theme which emerged during discussion of this topic related to participants' practices aimed at improving efficiency which participants regarded as an important aspect of farming sustainably. The following two quotes summed this up:

ID3: "I'm always thinking about the efficiency of my farm" "there's more than one angle to look at how to become efficient, it doesn't have to be all output based at the end. It's cutting your costs along the way and maintaining the health and productivity of your cows as well as what you're finishing."

ID4: "we've made amazing progress over the last three years in terms of efficiency and block calving and rotational grazing and so many things which we think we're doing better now than we were a few years ago."

Under the theme of farm efficiency, five key sub-themes arose, including: optimising grazing management; improving animal health and fertility; breed selection; better utilisation of performance data and metrics; improving forage quality/ reducing concentrate use.

Optimising grazing management

A number of Forum members have taken steps to optimise their production from grass to utilise the good grass growth in the Ruby Country and minimise input costs. This includes the adoption of more intensive paddock and cell grazing systems to maximise grass utilisation and output per hectare. Other farmers favoured a more extensive system with low input pastures or herbal leys. As some participants noted:

ID5: "We've just decided to go organic.. very much mob grazing. the cattle being moved every day at the moment into two paddocks, including experimenting with an automatic gate release."

ID6: "I think most farms, apart from the really small ones, can combine a paddock grazing type system, which is intensive for production purposes, with areas that are used less efficiently for producing the forage, which can improve the carbon side of things by cutting later, getting the herbs growing in them, and keeping them there without using the fertilizers."

ID3: "It's interesting and all the different intensive management approaches of mob grazing and whatever, but I'm almost going the other way and looking at herbal leys for my sucklers"

Improving animal health and fertility

Forum members reported that they had taken steps to improve animal health and fertility to drive their efficiencies. This included better livestock performance monitoring and removing cows which don't get into calf or have issues with their udders or feet. One Forum member had reduced their age of first calving to boost production per cow but this was not widely practised by other Forum members. The following quotes are illustrative:

ID7: "we've gone into calving down at about two years. Here is a trade-off between the age we finish and the concentrates we have to feed them. So, there's definitely trade-offs to be had."

ID8: "Now I'm afraid she goes immediately if she's not in calf or has a dead calf or whatever. And we're a bit more ruthless about cows with bad feet or bad udders or anything like that. So that's one way we hopefully increase your efficiency."

ID9: "in the UK, on average, we have 7% of calves born dead or die within 24 hours of birth. So actually, if you improve your management there, then you can keep fewer cows and produce the same amount of calves. So you're not increasing yield, per se. And also things like bull fertility to make sure that your cows are getting in calf and you're not running cows on for too long. And then weaning calves appropriately and all of this system."

Breed selection

A number of forum members have transitioned away from larger continental breeds to smaller, local breeds such as Reds Rubies or newer composite breeds such as Stabilisers⁵. Both breeds finish well under the climate and grass-based systems present in the Ruby Country, have fewer calving issues and were in demand by the consumer. As members commented:

ID2: "Now going over to more Red Ruby Devon's, just the fact that they are performing well here on lower inputs. I'm not buying in as much fertilisers, I'm not buying concentrates, I can do it off the grass. I think that's the main factor here in the area we are, we grow a lot of grass, we have the rainfall. So yeah, we're moving more that way."

ID10: " I'm sticking with Devons. I love them. They've got a place and a heritage in in Devon itself. And we must sell that story."

ID6: "I don't see that the Continental type beef cattle are going to have a place in the future like they have done in recent years. It is going to be more the native breeds to get the product that they want for efficiency."

Better utilisation of performance data and metrics

Forum members have taken steps to better utilise data and metrics to drive livestock efficiencies. This included improved recording of livestock productivity, fertility and yields to inform future management, as well as selection of breeds such as Stabilisers which are a highly data driven breed. As participants noted:

ID2: "we try and keep as much as we can. And I'm doing more to the data of different breeds to suit in the farm. So we scanned all our cows."

ID8: "we have started doing is calculating the meat yield from each animal. And I noticed with most of the research, it either goes on live weight or dead weight. And that's very different from meat yield, which is, is sort of what you need at the end of the day isn't it, it isn't all the bits that you're going to throw away, or will get made into meat and bone meal or whatever. It's the actual meat that people are going to eat. And it seems that researchers don't use that as a sort of measurement so much as live weight and dead weight."

ID9: "Just talking about the metrics, the main one for suckler farms, if sending them away for stores, is kilo of calf weaned per cow put to bull. So that includes cows that you originally put to breed on day one last year, how many of them actually got in calf, how many of those then

⁵ A specialised breed of suckler cattle brought to England from the USA in the late 1990s which is a four-way cross between Hereford, Red Angus, Simmental and Gelbvieh

actually made it to calving? How many of those had a live calf? And how many of those calves then actually weaned? And what was the kilos of meat produced at the end..."

Improving forage quality/ reducing concentrate use

Many Forum members have taken steps to improve grazing management and silage quality with the aim of finishing their livestock without the need for bought-in feeds or concentrates. This is motivated by a desire to cut inputs costs, reduce their carbon footprint and fulfil consumer demand for grass-fed beef. Some sample quotes include the following:

ID12: "I think silage is a big part. So really trying to boost the MEs and the sugars and the proteins in the silage at winter."

ID14: "I am trying to just cut down the amount of concentrate I can use and just use it when it is efficient and looking for other things, say like the grasses that we've got here."

2.2 Concerns and barriers to change

2.2.1 Concerns about the drive to intensify beef production

Forum members were generally highly opposed to the concept of intensification within the Ruby Country beef sector. The forum workshops had highlighted animal production practices that would promote carbon reduction and efficiency, such as having more, smaller animals and slaughtering younger. In contrast, participants favoured producing for quality over quantity and reducing carbon footprints via greater efficiencies and enhancement of the farm natural environment, for example through hedgerows, multi-species swards, and silvopasture. Several subthemes related to intensification emerged, including the impact of younger slaughter age on the nutritional value of the end-product; challenges of producing from larger numbers of smaller animals due to abattoir penalties; unintended consequences of intensification; a concern that the drive toward intensification was out of step with consumer demand; differentiation of the beef sector; and finally, the challenge of intensification and 'finishing' animals from solely grass-based systems.

Impact of younger slaughter age on eating quality/nutritional value of product

The Forum members generally felt that measures to intensify the beef sector such as finishing and slaughtering animals younger were not in line with the beef sector in the Ruby Country as this penalised traditional, slower-growing breeds which are synonymous with the area and might negatively impact the eating quality and nutrition of the products produced, qualities which are particularly important in the premium market which many are targeting. The following quotes summed up this perspective:

ID11: "those of us that are producing for the taste, we need our animals to be quite old. In some ways, the older the animal the better. The nicest meat I've tasted is a 15-year-old cow."

ID1: "all this business about finishing animals younger. From the point of view of what we do, it's not appropriate. " "we also sell to high quality butchers, one in particular ... who deals in very high-quality meat and gives me information on finishing and the quality of beef. He's the one telling me that we really must not finish too early because it destroys the quality."

ID15: "I think when I saw the presentations, the only thing which got me was the drive for the animals to be younger and younger and killed earlier and earlier. If you're facetious, you could say, do they just want poultry units? Because they're the most efficient converter."

Guidance for more, smaller animals not in line with abattoir specifications

From a solely carbon emissions perspective, it is better to have more, smaller animals than larger animals which have higher maintenance costs. However, many Forum members felt that this would be difficult to adopt given the specifications which are required by the abattoirs which penalise smaller animals, irrespective of the amount of meat they produce. As forum members commented:

ID3: "this sort of concept of more, smaller animals coming through would be nice if some of the mainstream abattoirs accepted that they might need to change their approach as well."

ID2: "the meat to bone ratio on these Devon's is actually quite high so I can take Charolais through and I can meet the guides that the abattoirs want however, when it comes down to meat, if I was to butcher all those myself and take back the meat I nearly have the same amount of meat but out of a 50 kilo, heavier carcass but that's just bone. Why are the abattoirs pushing for that? Why are they paying for bone?"

Unintended consequences of intensification

The Forum felt that calls to intensify and drive efficiencies may cause unintended consequences in other areas such as animal welfare, biodiversity, etc. Forum members highlighted the dangers of chasing a single metric such as carbon. As participants noted:

ID10: "And where people talk about integrating cell-grazing and other things, well you just need to be more holistic in your planning. We need see more widespread adoption of agroforestry, and suchlike, to retain soil and water and nutrients and shade."

ID11: "it's really about the whole farm approach, in terms of carbon foot-printing."

ID17: "We do have an obsession with carbon in our soils and one could say that we over-obsess about it."

Drive to intensify out of step with consumer demand

The Forum generally felt that the intensification of the beef sector was not well suited to the farms and livestock breeds in the Ruby Country and was out of step with consumers who are demanding better traceability, high welfare and environmental standards as well as good eating/nutritional quality.

Sample quotes:

ID16: "from the experience that we have customers are now more and more wanting provenance. And they want more and more what we're talking about with the omega three, the health benefits, and so on."

ID17: "The Ruby country is all the about grass, the customer wants stuff that's fed grass. Grass is where you get your best nutrients from. I cannot go out and sell lot-fed beef."

ID18: "ultimately this whole thing is driven by consumers really, that they're wanting to eat meat that it's more technically environmentally friendly, has a lower carbon footprint. But I also find it interesting because I think the same sort of consumers would really struggle with the idea of the

intensification and that style of farming will be driven in the blanket call for everything to be more environmentally friendly, but perhaps from a welfare point of view [this wouldn't be the case]"

ID8: "And the use of electric fencing and having animals in small groups bound by electric fencing doesn't really sit very well, with lots of members of the public. Having access to land and seeing these animals bound by electric fencing. I think there could be, you know, the public perception of it, even if you know, it is okay. Welfare wise, I think we've got to be a bit careful on that front as well."

Differentiation of the beef sector

The Forum members predict that the beef sector may differentiate with intensification measures appropriate for the mass market but that the beef produced in the Ruby Country was more targeted at the premium market whose customers prioritise taste and nutritional value of products, traceability, and high on-farm environmental and welfare standards.

Sample quotes:

ID19: "I think going from one extreme or the other, they're going to be highly intensive. or, going back to your local breeds, it is a lot slower. It's going to be one or the other. I don't think it's going to be just one system. Both systems are going to have a play."

ID5: "we are making quite big strides in identifying three key areas that creates differentiation and that's what I think we really need, the suckler grass base beef. The way it's produced, suckled, natural, mother, grass, low antibiotic use."

Ability to intensify/finish off solely grass-based systems

Forum members generally did not favour more intensive measures such as use of concentrates, younger age of slaughter, changing livestock genetics or GM. Instead they wished to continue to finish their animals off predominantly grass/forage-based systems. Whilst this is the aspiration for most, some highlighted concerns about their ability to finish animals in a timely manner without the use of concentrates and whether the longer time to finish animals would negate carbon savings from reducing inputs etc. Forum members also flagged that whilst there are some areas within the Ruby Country that might be suitable for the production of corn for livestock feed, not every farm would have this option and in which case strategic use of compound feeds might be advantageous.

Sample quotes:

ID17: " it's difficult to get marbling in beef without a little bit of concentrate, a bit of home-grown and concentrate and make do."

ID13: " And there are a lot of people on this forum currently that are pretty anti-compound. Now, it's not something that we should be anti, we need to use it in the right measure... You know, if you need to use it, we need to use it. As the Ruby area, there are some fantastic corn growing areas, but not every part of the Ruby area can grow corn"

ID13: "compound does have to be used in certain areas. But yeah, use it sparingly and trying to work from the bottom up on the grass-based system is what we should all be aiming to do. And we can do that with Devon cattle, that's not a problem, but I think we can't completely discount the fact that concentrate has to be used in certain areas or a product of some sort."

2.2.2 Access to research and knowledge

Many Forum members noted that they struggled to keep up with the research and advice and that there was no single place to go to for farmer-facing advice and information. It was also noted that the members of the Forum might not be representative of the wider Ruby Country farming sector which generally has quite low levels of engagement with discussion groups, research institutes, etc.

Sample quotes:

ID17: "One of the barriers for change is just actually having enough time to keep up with the independent science and the knowledge which is coming through."

ID13: "The problem with the area that we work in is the fact that everyone's very closed. And that often people don't involve themselves so much in these discussion groups, and like everyone's saying, don't involve themselves in Rothamsted or anything like that. So the people, us as a whole, are the problem. We need to get out there and, be part of these discussion groups."

ID20: "There's been such a wide gap between research and farming for the last 30/40 years. And we need to re-establish those links."

ID20: "Farmers that take advice and go to meetings they are improving all the time. But those that don't, there is so much for there to be got at."

2.2.3 Low profits/costs of measures to reduce carbon or intensify systems

With profits for beef production very low and the imminent withdrawal of the BPS (Basic Payment Scheme), many Forum members were nervous about investing in measures to cut emissions or intensify their systems.

Sample quotes:

ID17: "one of the other barriers to change is the fact we never quite get enough money for our produce and we don't really get recognised for the quality of what we produce. In our breakeven exercise, it doesn't really allow you to invest in going forward a lot of the time"

ID14: "to put in a big Bokashi full store system, you are talking a lot of money to store it."

ID15: "I'm just cautious. I guess. You don't want to spend too much money if you're going down the wrong route. So just waiting a little bit, I think for me."

2.2.4 Impacts of climate change

Whilst the impact of climate change did not feature highly in discussions around mitigating methane, the uncertainties and impacts of climate change were listed as another variable which was challenging the sector and causing knock on impacts for factors such as animal health.

Sample quotes:

ID19: "The hardest thing is managing the variables that are outside our control and it is trying to work out and work together to try and bring that order. "

ID8: "I suppose not only TB, but other diseases might be coming in due to climate change, or whatever, will have a big impact on efficiency. " "so yes, I think disease is a big factor in efficiency."

2.3 Support needed

2.3.1 Where to start and de-risking the transition to Net Zero production

Forum members said that they found the topic of Net Zero overwhelming and needed support to know where to start, what steps to take first, and where to invest. Forum members would like more support to help offset the costs and risks associated with transitioning to Net Zero production. As two participants commented:

ID19: "I think its knowing where to go first and where to start because at the moment, everyone is telling you all these ideas. You haven't got the funds to completely change the system overnight. Go buy all this infrastructure. So, it's knowing which one to go first, then start. And actually where to put your funds in first. "

ID18: " it would be nice to have known where to start first. I come across a lot of farms where they're quite traditional and been in the family for generations .. and they are a little bit stuck in their ways. And I think for some people, it's not that they're not willing to but it can be quite a bit scary to come in and try and change things dramatically. And I think the understanding is lacking a little bit as well. So they might struggle to see what the effect is going to be."

2.3.2 Accessing research/ knowledge

Many Forum members stated that they would like more support accessing and interpreting the research related to this topic. SRUC was held as a good example of a research organisation which has well-developed links with the farming sector in Scotland.

Sample quotes:

ID20: "I think we need to have more open access information and probably working more closely with North Wyke (a Rothamsted Research grassland livestock research campus). I think we probably should emulate the SRUC model and actually having more practical research and knowledge transfer integrated."

ID10: "(SRUC) The scientists that they can attract, I mean, many farmers call them friends, and there'll be welcome on their farm lots. And there'll be good farm walks which are really, really well attended."

ID10: "We really got to up our game in the farming sector, there's no excuses. It can be done. It's just about being innovative and passionate about it. And then the knowledge transfer.

ID17: " we've been missing independent science for 40 years and we just desperately need it. And also we haven't really been looking for the right areas for what we're now trying to achieve and I

think there's a lot of science being done and it's just, as ID10 says, the YouTube channels are a great way of doing it, discussion groups are a great way of doing it. All of us in exposure to these ideas is so valuable and is supercharging our change into where we need to go"

2.3.3 Assessing/demonstrating real value of suckler systems

Forum members commented that the narrative driven in the media about suckler beef production was that it was damaging to the environment and not financially viable, however this was not backed up by clear, independent data. Forum members wanted more independent support and research to assess the value of beef production, for the environment and its financial viability.

Sample quotes:

ID5: "Along with kind of demonization of beef, there's an awful thing going on, which is saying that sucklers are a complete waste of time. With all the changes of ELM's and BPS, you're in a really bad sector, you're going to lose money hand over fist, and yet they are the solution in terms of grass management, what we're going to in terms of zero and in terms of nature, in producing a nutrient dense product. I really feel there's a tremendous opportunity. If we can actually get some recognition within industry, within government and Defra for these ELM schemes and for the ELM support systems to really recognise and support suckler beef. So it's turning it completely the other way."

ID5: "he measured our profitability per hectare our total land acreage...and what we actually earned, and this was based actually on last years beef price per head. And we found that by system, we actually made much more money per hectare on our suckler herd and our beef sector than we did on our arable, and it was so illuminating."

2.3.4 Educating consumers on true costs/benefits of UK grassland beef production

It was felt that the beef sector has been widely demonized in the media and that much of this is based on data from non-UK and intensive feedlot beef production systems. The Forum would like more support to help educate consumers about the grassland beef systems in the UK/Ruby Country and the role that they can play in meeting Net Zero targets and delivering other public goods. As one participant commented:

ID1: ". a lot of this is to do with public perception and trying to educate the public a bit more into the nuances and the differences between what we're all trying to do. "

2.3.6 Driving efficiencies/ maximising the value of grazing and quality of home-grown forage

Many Forum members were more supportive of the need to drive efficiencies and maximise the value of your grazing and home ground forages rather than intensify or totally change their systems.

Sample quotes:

ID13: "Let's maximise the grass intake, let's maximise the forage intake or maximise the quality of those two. And what do we have to do? Farmers want answers. They want to know what do we have to do to achieve that. To get better growth rates from forage. And that would be the first things to be concentrating on, on both the grass side and the forage side."

ID18: "there's loads of things that we can do with management to make things more efficient without necessarily swapping to different breeds or, you know, each farm is sort of individual, but I think there are ways we can do that without necessarily having to compromise pasture-based, forage-base systems"

2.4 Further research/knowledge needed

There was a strong feeling amongst Forum members that more could be done to utilise the research expertise of Rothamsted Research North Wyke for the benefit of local farmers, be this visiting the facility to hear about research, more in-person or virtual Knowledge Exchange activities and collaboration with research. One person summed this up in the following way:

ID20: "we've got one of the most renowned Research Stations right within the Ruby country. So it'd be a shame not to use their facilities."... "what they should be doing is actually disseminate that information, finding out what soils and what farming practices give the most carbon and how can we emulate that within the Red Ruby country? "

There were also some specific research areas that participants felt should be priorities, as follows:

2.4.1 Novel feed additives to reduce methane emissions

There was a lot of interest in recent research on the potential of red seaweeds to reduce methane emissions however there was also concern about the sustainability of its production. As one forum member noted:

ID20: "we should be including bromoform in our plant breeding. And going forward, why should we be harvesting seaweed from the seashore or from Iceland, or Ireland, when incorporating our plant breeding. There's so much potential there to be had."

2.4.2 Carbon footprint of Ruby Country, low input/traditional beef management systems

The majority of the farmers in the Forum were practising low input, grass-based production systems using local beef breeds or those selected to finish well off a forage-based diet. They therefore felt that much of the data being presented on the carbon footprint of the beef sector was not representative of their farming systems and would therefore like more locally tailored data to guide their management decisions and communicate with policy makers, consumers and those in the wider supply chain.

Sample quotes:

ID4: "we would be really interested to know the difference between emissions, methane emissions created by concentrates and herbal leys and permanent pasture and that sort of thing, to see if there is a difference."

ID15: "I'm keen to know how does this carbon sequestration and methane emissions tie up with, I suppose very, very traditional method of grazing.

ID8: "we've had to install a big freezer and I'm just wondering, I think I know the answer to this, but it would be quite interesting to do a study into it, you know, what the carbon footprint of

freezing meat for, you know, up to a year is rather than having the animal live or here out in the field for a few more months"

2.4.3 Metrics

Forum members expressed frustration with the metrics of live and dead weight used to calculate the productivity of production systems and which are currently used by abattoirs to evaluate whether animals are within specification. They proposed a number of new metrics which they felt were more informative and relevant to their production systems which they would like to see used in research more. The following quotes are illustrative:

ID8: "we have started doing is calculating the meat yield from each animal. And I noticed with most of the research, it either goes on live weight or dead weight. And that's very different from meat yield, which is, is sort of what you need at the end of the day isn't it, it isn't all the bits that you're going to throw away, or will get made into meat and bone meal or whatever. It's the actual meat that people are going to eat. And it seems that researchers don't use that as a sort of measurement so much as live weight and dead weight. "

ID9: "Just talking about the metrics, the main one for suckler farms, if sending them way for stores, is kilo of calve weaned per cow put to bull. So that includes cows that you originally put to breed on day one last year, how many of them actually got in calf, how many of those then actually made it to carving? How many of those had a live calf? And how many of those calves then actually weaned? And what was the kilos of meat produced at the end? So a lot of things" "if you think about kilo of calf weaned per cow put to bull you think about all of the metrics, low fertility, growth rates, disease, so are they getting scour, are they getting over all these different things? "

Chapter 3 Land and manure management

Agricultural soils and manure management are other key sources of emissions from agriculture, accounting for 21% and 16% of total emissions respectively. Key sources of emissions from land include nitrous oxide emissions from the application of nitrogen to soils in the form of urine, dung, and synthetic fertilisers, as well as methane from the storage of livestock manures

Workshop [three](#) considered how land and manure management can be optimised to minimise carbon emissions and associated negative environmental impacts. Participants were asked to reflect on practices they were already undertaking in this regard (Section 1 below), as well as challenges they faced (Section 2 below), support they might need (Section 3) and further research/ knowledge that would help them to move towards Net Zero goals and reduce environmental impacts (Section 4).

3.1 Steps and actions already taken

Several key themes and subthemes emerged around practices that farmers were already undertaking to improve soil structure, yield, and reduce environmental impact. These included: The use of cattle manure or other manures, which was part of integrating livestock within mixed farming systems; a variety of specific measures being used to improve soil structure and fertility (including minimum tillage ('min till'); the use of cover crops; a reduction or elimination of inorganic fertilisers through planting of long-term herbal leys and measurement of carbon in soil/ soil health. There were also a variety of other measures being undertaken to reduce other kinds of environmental impacts, including practices around manure management/ storage; and changes to bedding practices.

3.1.1 The role of manure in improving soil fertility in mixed farming systems/ marginal land

Forum participants were keen to stress the positive impacts of manure as an alternative to synthetic fertilisers and the role of cattle within mixed farming systems, while being aware of the need to manage manure carefully to minimise emissions and other environmental impacts. In organic systems where no synthetic fertilisers are used, and in mixed farms, animal manure plays an important part in maintaining soil health, and building fertility to improve crop yield, thus effective use of manure to improve their soils was important to all farmers in the forum.

Farmers pointed out that native cattle breeds and suckler herds are useful for grazing marginal land (e.g. rough grazing, poor soil quality), and can be integrated effectively into arable systems. Mixed farms were considered, both by the farmers and scientists present, as bringing benefits for sustainability and regenerative farming. As one of the scientists on the panel stated:

ID21: "That's the thing we've lost, the small integrated mixed farming. My impression is there was a lot of good going on there. But it was never accounted for, it was never studied, and it was never documented about all the benefits of having a mixed system. And all these arguments took over for these highly specialised systems, and the soil was forgotten about in all those processes. And we're now starting to realise that there was a lot of knowledge in those old-fashioned systems"

It was suggested that arable farmers were beginning to recognise these benefits:

ID1: "I think there is an increased use of beef animals in the arable areas as people begin to realise the benefits for sustainability and regenerative farming."

One farmer suggested that more presence of beef cattle units in arable areas could improve the fertility of such land:

ID15: "The only thing I was thinking also was, maybe got this wrong, but there is more use in arable or tilled land because of the increase in the organic matter. And it got me thinking, well, do we actually need more cattle in and around the country in different areas? So areas that are primarily arable, should you be looking into putting in beef units?"

Another farmer noted that with the coming decline in the BPS (Basic Payment Scheme) payments, there could be an opportunity for beef farmers to integrate their animals into mixed systems on arable land:

ID5 "... the East of the country, and where they've been on growing crops. It's been intensive production, very mechanical, and artificial fertilisers and marginal land being ploughed up and tilled. I ... given the suckler sector and suckler beef has a vulnerability about it because of their historic BPS payments, I think there's real opportunity for native breeds and suckler herds that can graze marginal land that isn't tilled, but can actually integrate into an arable system, which is what we're doing now rotations and cover crops as well, actually grazing the cover crops. So I see that as a real opportunity... And it's sustainable. You know, that's the key thing.

Others noted the practice of using other types of manure to improve the soil, such as chicken manure, including from other farms. As one participant stated:

ID5: "We're taking organic chicken manure from a producer, it's straw based, chicken producer.. we've just invested in a second-hand muck spreader that really chopped it up finely... that's what we're doing now and some of that it is going on pasture land as well as on the arable now which is really helpful. We pay for it, but it's not a huge amount"

3.1.2 Other specific measures being used to improve soil structure and fertility

'Min till' approach

Aside from adding manure to soil, farmers described additional practices that helped maintain good soil structure and fertility. One common practice was the 'min-till' (minimum tillage) approach which minimises soil disturbance (e.g., by avoiding use of the plough) to maintain soil structure. A second was the use of cover crops which are grown between the main crops, for the benefits they bring to the soil; adding nutrients, reducing erosion, and for animal forage or grazing. A third issue was the reduction (or elimination) of the use of inorganic/ synthetic fertilisers through planting of long-term herbal leys. Finally, farmers were actively trying to measure and monitor soil health, although see the 'barriers' section further below on support that they would like in this regard.

One farmer commented on how not tilling and adding organic matter had both contributed to better soil and higher fertility:

ID5: "We're not decimating a shedload of worms ... we're not massacring them ploughing, they're not being chopped up. And the soil is undisturbed.... And then because we're putting more fibre,

and there's more fibre and manure going on, they've got more and more.... we've seen our soil structure improve significantly, we're using cover crops as well of course, and we've been using types of crops that are also helping to break up soil..”

The same farmer commented on the benefits this brought for biodiversity as well as yield:

ID5: “And then we've actually seen in the top of our arable fields, what's called the armour, the stubbly bit, we're just seeing that there's so much more food there. So the other species, from birds right through to beetles and other invertebrates, are just getting a food source as well. So that's happened really quickly. Which has really surprised us. And we haven't seen a fertility drop either... I think it's because the manure has been going on... and we've also seen incredible improvement on the bottom line. it's dramatically improved our margin and sustainability on the (arable) crops.”

Yet others commented that they had tried it but that a ‘min till’ approach had been challenging due to the climate:

ID1: “Well, we're trying to move across to min till and actually, we've had a really bad time this spring, because we went from that very wet period when we can't do anything, to being bone dry. And then the contractor said they couldn't min till because he couldn't get the drills in sufficiently far. So this year, we've ended up with a mixture of some min till and we haven't seen the crop emerge yet. And there's an awful lot of stuff on seen on the surface, which is quite worrying. It should have been in the ground, this is pea and barley. And some we just gave up and said, okay, you can plough it. So we're waiting to see how it changes. I fear the min till may not be a great success due to the weather last time.”

Reduction in use of inorganic fertilisers through planting of long-term herbal leys

Several farmers commented that they were using herbal leys which bring benefits for soil health and structure, reduce the need for inorganic fertilisers due to the biological fixation of nitrogen by legumes such as red and white clover in the herbal mixes, increase carbon capture from the atmosphere, and reducing runoff due to better soil structure and increasing soil organic matter. These leys also provide additional benefits such as food sources for pollinators and other beneficial invertebrates such as beetles and worms. Herbal leys were also considered to be more resilient and consistently produced similar or, in some cases, better yields compared to conventionally managed pastures with fewer species:

ID5: “We have actually started integrating legumes into our pastures. We're basically a pasture-based system.... we put in quite a good mixture of legumes and herbs .. and that has vastly improved the ground over the last year or two and it's vastly improved the yield again ... the fields where you have a mixed pasture are looking a lot better than the fields that are just older pasture that's mostly grass and a little bit of white clover.”

ID15: “We are permanent pasture pretty much so we've been comb harrowing and putting in clover and putting in chicory and putting and planting different things. so yeah, the benefits of clover, clearly it is what they want you to have in taking up yeah, it is reducing your nitrogen requirements, isn't it?”

The overall approach of using manure and herbal leys as part of a mixed farming system and the consequent ability to reduce reliance on synthetic fertilisers was nicely summed up by one participant who seemed proud of the amount of organic matter in their soil, but also aware of the need to improve:

ID2: “I think spreading it (the muck) and leaving it for a good amount of time hopefully will be the best options for us. To then graze on again or whatever later on... we put Culm grasslands where we can. We've put in a lot of native special species grasslands over the last few years, trying that with the Devons (i.e., Red Ruby Devon cattle). Make wildflower hay and stuff so there are no fertilisers. And also we started growing pea, barley and grass, well we've done it for several years, but we have stopped artificial fertilisers altogether, and we've probably doubled our farming scale... So I am all for reducing it... I keep speaking to our agronomist, because I've always wanted to improve. He tells me I'm already doing (good). But I always want to improve, like the organic matter, you know, we're around 10- 12% of organic matter in our soils. The arable boys are like 1 or 2% and they're always drying out and everything else.”

Measuring carbon in soil/ soil health

Some farmers were also actively trying to measure soil health, through activities like worm counts, in some cases using fairly straightforward manual approaches:

ID5 “I come in here on a much cheaper implement which is a spade, and doing some worm counts ... Our son has been going around doing worm counts, getting the spade out, going through, seeing how crumbly it is, and counting the worms, literally counting the worms. And that's come from the agronomist.”

3.1.3 Measures to reduce other environmental impacts

Practices around manure management/ storage

It was recognised that manure had to be stored well to minimise environmental impacts. Participants in the workshop swapped best practice about manure storage and management. Good practices included storing muck in barns until it was needed for spreading (also a practical solution for those with limited muck storage facilities which were costly). They were also very aware of the benefits of storing manure safely to avoid pollution into watercourses. As one farmer noted:

ID5: “Of course we've got our own housed cattle dung, which is used on the arable and we tend to keep it in the shed undisturbed apart from then putting it into what is covered manure stall”

There was an interest expressed from several Forum members in bokashi systems⁶ which are proposed as a more efficient solution than traditional manure management systems, with less associated greenhouse gas emissions and stated benefits for plant and soil health. As one participant stated:

⁶ A system traditionally used in Japan, the Bokashi system is a method of fermenting organic wastes (including cow manures) as a supplement or alternative to conventional composting systems, to manage and improve soil quality. It involves fermentation (excluding oxygen) rather than aerobic composting (i.e. excluding oxygen) and produces organic fertiliser quickly and efficiently. It is considered to be associated with reduced GHG emissions.

ID14: "going forward if it was put more towards being more efficient, and that was the main reason why I've been looking at the bokashi system, is something that I think is a more efficient way of using and neutralising your dung to get the maximum out of it."

Practices around bedding

Some participants commented on practices being used to minimise the use of bought-in bedding or to reduce the quantity of bedding required, bringing both cost-related and environmental benefits, such as the use of wood chip under straw or gorse.

ID10: "A half of our old cattle shed we put about 15 tonnes of wood chip in under the straw this year. And I think I used significantly less bedding material on that side of the shed."

ID17: "We had a contract with the local sawmill to take on sawdust as opposed to wood chip, and that we did for 20 years. But we had cattle on it but they work as a very good bedding and very good soil conditioner afterwards. So sawdust was fine. That's just a different novel bedding. And yeah, you're with the gorse. Protein content, of gorse is spectacular. So there's just a great machine to be built by somebody sometime."

ID14: "What they had done like around here on Dartmoor, they always did use gorse for lining the base of sheds just because it was cheaper. Rather than having to buy in.. they used to use ferns, quite a lot of it was gorse, and then they cut the ferns off as well they use that instead of straw."

3.2 Concerns and barriers to change

When asked about the main barriers or challenges to addressing changes in land and manure management that they wanted to make to reduce environmental impacts and reach Net Zero, several themes emerged. These included: (i) Challenges to carbon measurement in soil and carbon footprint measurement; (ii) Barriers in terms of soil types for sequestering carbon; (iii) Weather related challenges with moving away from inorganic fertilisers/ applying manure; (iv) Animal health related challenges with manure spreading; (v) Challenges with manure storage; (vi) The role of agronomists and contractors; (vii) Promotion of intensification being at odds with traditional low stocking extensive systems.

3.2.1 Challenges to carbon measurement in soil/ carbon footprint measurement

It was recognised that measuring their carbon footprint was something that retailers were increasingly demanding. But many participants commented on the challenges of undertaking these:

ID5: "Something that's made me think a little bit more about this, and its Morrison's. ...by 2025, I think they're going to have carbon assessed beef, in terms of labelling. And that has made me think quite hard about what we would do on this farm to demonstrate and evidence that we are achieving or working our way to Net Zero. And we certainly won't be doing it by 2025... But it did make me really think, blimey, that's another target to have to aim for... I mean, that really made me sit up a lot. If we had other retailers go that route. I think that's going to be enormously challenging for our suckler beef sector.

ID15: “Just to say, with our lambs, Marks and Spencer are already asking that question about. Just a question about how many trees you're planting? And do you have a carbon footprint. I don't know how they work it out? So they're already looking at that. I don't think you have to do it, but it's clearly coming. I've got no idea how we will do it. I suppose we'll have an advisor and someone come in from time to time to do it, I guess. It's very hard to quantify.”

3.2.2 Barrier of soil type or long-term pasture in sequestering carbon

Some commented that some soil types were less effective at sequestering carbon.

ID16: “I think an awful lot of you are and you're on sort of clays, and we're gonna come on to sequestering carbon, aren't we? But I just think it's really interesting, because I don't know that our soils are necessarily going to be that good at that”

Another farmer reflected on what they had learned in the Forum about permanent pasture reaching a saturation point for storing carbon. Lack of knowledge about this could be one possible barrier to farmers achieving maximum sequestration from their land. This participant felt they may have to change their practices in light of this new information gained on the forum:

ID15: “I think I was quite surprised by what one of the scientists was saying about organic carbon levels in permanent pasture if it's been around for quite a long time, how they get to a saturation point. I must admit I look at old fields and think oh, they're doing a lot of good for the planet. And now I'm thinking well, should we be comb harrowing them or doing something to encourage growth of crops or the grass, so that in some way more carbon can be locked up.”

3.2.3 Weather related challenges to moving away from inorganic fertilisers/ applying manure

One of the challenges with moving away from inorganic fertilisers was related to changing weather patterns which posed risks for doing things regeneratively or without the use of liquid fertilisers.

ID5: “So much depends on the weather. Dry springs are challenging, without a doubt, like rain, timing. Spring crops can, when we've regeneratively done a spring oats, it can be a disaster. So, you had to take an element of risk with what we're doing in a sense, because we're not putting on the level of liquid fertiliser that we were before.”

ID8: “We were actually organic for 10 years around the Millennium time and we just found our grass didn't grow. We are at 1000 feet here up on Exmoor. The reason why we came out really was we just couldn't get enough grass in the growing season that we had, without a little bit of, I mean we really don't hardly put any artificial fertiliser on at all. Especially now it's so expensive. But we have to put it on our cutting ground in order to get the growth in time. Or that's what we find anyway. And we did try various organic fertilisers, and they just didn't do the same job, really.”

Relatedly, weather patterns made it difficult to apply manure at the times of year when farmers might most want, which meant greater manure storage capacity was needed and some took the practical approach of keeping manure in cattle sheds for longer.

ID18: “Generally, we try to spread straight out the shed. But if the weather conditions don't suit, we have to heap it up and put a sheet on it *I think it's going to become a point where we'll have to have a specific manure store if it's not really easy to spread it.*”

ID3: “The weather plays such an important factor in when I can spread, because I am on a hillside as well which doesn't help if it is greasy on top, you're going to end up down the bottom of the hill with a full spreader. So that has a big factor on timing. Finally after years, I've got a cattle shed that stays drier than what I started out with which means I try and leave it in and then spread straight out into the field, partly because it helps reduce the cost of not multi-handling everywhere and I don't have a covered dung store, so in effect it's doubling up as a covered store... But that means I can't really spread it early in the season. It's usually, at the moment putting a whole lot on a field that I'm planning on putting a new grass lay in, and on my silage it's so difficult to find the right answer when there's so many ins and outs.”

One person farming on Dartmoor commented that it was hard to get the planning permission to create adequate dung storage, as well as cattle housing facilities:

ID14: “I've had cows out on the moors for 10 years now. I've got a hell of a job to fight him (the planning) to put up a shed to house them and I say we're in an area where you just get colossal rain, out-wintering animals is just not practical in any way, shape, or form...”

3.2.4 Challenges with manure storage

More generally, the costs of creating manure storage facilities or a lack of large enough storage was commented on by a number of participants, including this farmer:

ID1: “we've actually been struggling with manure for some years. We have small manure heaps near sheds, and they are never have enough capacity for the whole winter. So then at some point we have to spread it, which is usually fine. But with the winters getting wetter, it's more of a problem. And we're thinking of investing in another shed and an enormously large manure storage area with a lid on it, so with a roof on it effectively. So that we can store throughout the winter, and then spread at more appropriate moments. Very expensive job.”

3.2.5 Manure spreading creating problems for animal health

Although spreading farmyard manure was common to most farming participants on the Forum and was regarded as an important element in a mixed system that would reduce reliance on fertilisers and improve soil health, there were some animal health related concerns with this.

ID9: “I'm a vet and don't personally farm, but I'm quite interested in looking at the alternatives to just muck spreading from an animal health point of view. So we know that Johne's disease and TB lasts in farmyard manure for over a year. And if you're then spreading that onto grazing pasture, there is reasonably high risk of you causing and increasing your incidence on Johne's, and possibly TB, on farm. So ... injecting or using other methods, would actually help to improve disease and reduce disease on your farm as well.”

ID2: “Yeah, really good point. We've always been spreading dung, but we've been hiring dung spreaders in the past. And we were worried that we were bringing in trouble. So we've actually bought our own dung spreader, which is a massive cost. But we are hoping that we can utilise the nutrients in our own dung, spread more and more often, and try and reduce any bought in disease from spreaders that we could have hired in. Our cows, TB can be an issue now and again, but a deer or a badger can go across the field and just do the same damage as a dung spreader.”

3.2.6 Role of agronomists and contractors

Some noted that other key people that they relied on in the farming sector were not always moving forward with the Net Zero agenda as quickly as might be needed. For instance, one participant noted that the agronomist who had formerly advised them was focused on chemicals as a means of improving soil, although others were more progressive in this regard:

ID5: "I think one of the frustrations we might have had, our agronomist.. was very conventional in his inputs, you know, and he was learning along with us for the last five years, but it was very much chemical applications, chemical means of getting rid of weeds. As good as he was, we just felt that he wasn't ready to look at other systems. So our new agronomist who is actually based in another county actually comes down and does a number of farms in this area. And it's entirely about bio products what will actually get the microbes and the bacteria and help the worms as well and get that really working in the soil to get the yield."

Similarly, local contractors were considered by some to be resistant to change and quite wedded to conventional approaches that might not be supportive of environmental goals:

ID1: "The problem is both with advisors/ agronomist and with contractors. And to try to change the system, you've got to persuade the contractors that it might be a better way of doing it. And they're all very traditional, too. And it depends on what equipment they've got. Our experience with local contractors, they're still very nervous of changing things. And, you know, they blame others if it all goes wrong and stuff. And it is quite a challenge we're finding."

3.2.7 Promotion of sustainable intensification at odds with traditional low stocking extensive system

Finally, a theme which emerged as a barrier to environmental goals was the idea of sustainable intensification which was being encouraged in some government policy and in some scientific research, to create efficiencies and maximise yield from the same area of land, a sentiment also reflected in the discussions during workshop 2. Intensification, participants felt, seemed to be at odds with other goals important to the producers focused on low stocking extensive systems as well as other parts of government policy focused on environmental stewardship:

ID2: "A lot of the figures in an extensive system, maybe we looked at the problems on a per acre/ per hectare basis, when it comes to your point about efficiencies and becoming more intensive, I would still advocate there is value in lower stocking rates and traditional breeds."

ID9: "It's clear that as Defra have started to pull together the standards for the next lot of subsidies through ELMS, and through the sustainable farming initiative ... Clearly from the work that we've been doing recently, they see your individual farms as having two aspects, really. So one way they're going to push you to take up options that will mitigate some of the climate activity. So you'll be putting in some ELMS and other bits, so basically, the less productive areas and farms, they're pushing you to take out of production. But on the other hand, the standards that they're producing, are trying to incentivize you to be more intensive on the better parts of the farm."

Relatedly, one farmer, reflecting on what they had learned on the forum, commented that the trend toward cell or mob grazing, which while good for efficiency, may have negative impacts in other respects:

ID16: "The other thing that I thought was very interesting was the whole thing about intensive grazing, which we're doing mob grazing, which I don't know if that's what is called cell grazing. But that's what we're doing and have been for about the last three years. And there's the sort of anxiety about compaction, and therefore, you know, there's sort of reduction in the ability of the soil biology to work. And I just thought that is a really interesting thing. Because, you know, in a way, the sort of trend is to go to more, this mob grazing, cell grazing kind of systems. And, you know, that was the sort of thing of saying, well, hang on a minute, maybe we're not doing quite the right thing."

3.3 Support needed

When asked what type of support participants felt would assist them in taking steps to address some of the issues covered in this forum session, many of these related to the barriers already identified. Two key themes included financial help with farmyard manure storage options and help with soil testing.

3.3.1 Help with incentives for farmyard manure storage

ID1: "I think we are meant to have our manure covered one way or another within the next few years. *But they're not going to help with FYM (farm year manure) storage I don't think.*"

ID5: "I don't know the whether the *Westcountry Rivers Trust can help because they facilitated this for us here through Southwest Water.* And I don't know if they're catchment sensitive, but I know it can be very specific to river valleys."

ID1: "We have talked to them quite a lot. They're practically telling us what we are not to do, but they're not very good at putting any financial incentives. I mean, they're not very keen on our budget growth, which I think we are planning for. Because the last two winters have been very, very difficult."

3.3.2 Support to undertake more on-farm soil testing or audits

Although all Forum members were interested in cutting their carbon footprint, none had completed a carbon audit of their farms. Several stated that they would like support in undertaking these as they were unclear which to choose and what information would be required to complete them. There was also some desire from Forum members to have more access to low cost soil testing to assess on-farm carbon stocks.

Sample quotes:

ID11: "I feel now that I should what I should be doing is going into a carbon calculator, or whatever it's called, to tell me what I actually need to do."

ID17: "I think help for us would be to have more availability and possibly less expensive testing."

ID17: “this is why I'm interested in the (soil) testing regime, and who pays for it, and whether it can be made more efficient, because ... you know, *if we're going to do what we want everybody wants us to do, then it needs to be made easier.* I just can't see it getting down to the end of a long lane at the back end of Devon, sometimes to get their soils tested and to match the nutrient demands to that...”

3.4 Further research/knowledge needed

When asked about which areas further research was needed, several specific suggestions were made that would assist farmers in meeting Net Zero goals. Most of these themes related to the need for more knowledge about environmentally friendly methods to improve soil nutrition as well as information about the nutrient content of one's own soils. Some specific areas of research and knowledge generation suggested were: (i) Advice/ knowledge about when/ how to spread manure; (ii) Advice/ knowledge on how to measure compaction and carbon stocks in soil; (iii) Research into the link between worms and organic matter; (iv) More research into less harmful inorganic fertilisers; (v) Research into intelligent reactor composting; (vi) Research into the sustainability of woodchip

3.4.1 Advice/ knowledge about when/ how to spread manure

A learning point for some people on the forum was about the nutritional losses and environmental impacts from manure, depending on how/ when it was spread. For most people, muck spreading practices were governed by practical factors like weather conditions, and space for storage. As one member commented:

ID8: “didn't realise quite how much might be lost in the farmyard manure, we fed our cattle up in the winter on quite deep straw. And what we do actually is muck out about twice in the winter, and spread it directly onto the fields, if there's a nice frosty time and I don't know whether other people do that as well. Perhaps we might have to change what we do in the property an awful lot then gets lost because it hasn't been taken up by the grass because it isn't warm enough. But it just suits our system really. So a lot to think about.”

3.4.2 Advice/ knowledge into measuring carbon stocks in soil and soil compaction

One participant raised the issue of compaction on the Ruby Country's clay soils, particularly when saturated. A need for knowledge regarding how to measure compaction as part of a soil testing regime was identified.

ID19: “I'm really interested in how we measure all these things. I'm particularly interested in the compaction side of things. And obviously, a lot of us just look at that and go, yes, that's been compacted, etc. But it would be really good to know of a simple way that us farmers can measure compaction, because that's such an important part of how we can mitigate emissions, especially the Ruby country, because it does get so wet. And because of the clay soils, etc. So I would be interested in how we can, we can measure these things quite simply and then give ourselves a baseline from which to move forward on.”

3.4.3 Research into Earthworms and their relationship with soil and organic matter

Some forum participants were keen to know more about how earthworms impacted on soils, and the relationship between worms and organic matter.

ID5: "I was thinking that there needs to be some research on worms. Isn't there? we've decided worms are kind of a bit sacrosanct, you know... To be precise about how we don't decimate worms in ploughing and how we encourage them, because they're our friends.

One of the expert witnesses also commented on this as part of the discussion:

ID21: "Well, that's partly my point of view. There's been quite a lot of work about worms and the AHDB have done a large trial of different organic amendments to soils on this. I think the issue is that the studies we have a very inconclusive, and that may be more about how we measure worms than actually what's going on. ... So we don't know whether the worms are following your addition of organic matter or whether the increase in organic matter is due to the increased number of worms. ... Although there's been a lot of studies, perhaps they haven't been studying the correct thing, or they haven't been as comprehensive as they should be."

3.4.4 Research on better inorganic fertilisers that are less harmful to the environment

A forum participant reflected on whether more research could be done on how to create inorganic fertilisers that were less harmful to the environment:

ID8: "Perhaps it just strikes me that we're using the same fertiliser that was invented about 100 years ago. And perhaps if somebody could invent a different type of artificial fertiliser that doesn't produce so many emissions, where the nitrogen and everything is more readily available and, you know, combined with oxygen and just disappear into the atmosphere. I'm not a chemist, but it just seems interesting that fertilisers haven't really progressed very much, artificial fertilisers haven't really progressed very much in a lot of years...."

3.4.5 Research into intelligent reactor composting

One participant was particularly interested in the use of 'intelligent reactor composting' a technology used to compost organic matter/ manure which is considered to reduce environmental impacts and reduce the loss of nutrients such as nitrogen. This was linked to a concern that several forum members had expressed about the nutrient 'losses' incurred depending on how and when manure is spread and was perhaps considered a way of mitigating this.

ID2: "What I did find really interesting in the last couple of presentations was the intelligent reactor composting, I thought that was very clever. I'd like to know a lot more about that."

3.4.6 Research into the sustainability of woodchip

There was interest in other methods to maximise nutrient retention and absorb carbon in soils, such as the use of woodchip/ biochar (charcoal produced from plant matter and stored in the soil as a means of removing carbon dioxide from the atmosphere).

ID10 "it's frustrating that there is no ongoing research on woodchip as a sustainable or, you know, and also the biochar element as well that was brought up I mean, I went to some biochar seminars up in Scotland about five or six years ago and yeah.. the nutrient rich retention and the

moisture retention was a really exciting part of that. So what it was actually doing that would just make soils more resilient.”

3.4.7 More research needed that is of relevance to smaller farms and beef farmers

There was also a general desire for more research that is relevant to smaller farms and beef farms particularly those with native breeds as most existing research, guidance and solutions are based around larger farms with bigger budgets. Many commented that much of the existing research studies were based upon more intensive systems with bigger herd sizes and larger breeds.

ID3: “Some of the ideas talking about anaerobic digesters and slurry and injecting slurry into this, you know, there's quite a lot of stuff that isn't necessarily in our budget. I would be very surprised if many people had any of those things going on. And I think I am an example of a small farm that has heavy ground.”

ID9: “I think part of the problem with using all this research all the time, is that when you're conducting a scientific study, you need a certain number of animals, or subject matter. And the smaller farms you're testing on with fewer animals to do your testing, then you can't get the numbers to make it repeatable or have any value. So perhaps, all the evidence is saying we need to go intensified is coming from these big farms, where you've got the numbers to allow the studies to be conducted on, which isn't necessarily considered when you then think about the benefits of small native breeds, because we just can't do studies on those farms particularly well.”

Chapter 4 Carbon sequestration in grassland

Mitigating greenhouse gas emissions alone will not achieve Net Zero carbon targets for the livestock sector. Adoption of best practice, including those discussed in workshops 2 and 3, is projected to result in a 30% improvement across the ruminant livestock sector however this falls well short of the 64% reduction required to achieve Net Zero. To make up this shortfall, farmers will therefore need to sequester and store carbon on-farm in addition to reducing their emissions.

Grassland soils represent a valuable natural carbon store and potential sink. In [workshop 4](#) Forum members heard about tools to help calculate on-farm carbon footprints and explored research to assess what a “good level” of soil organic carbon is for particular land uses and soil type combinations; what the potential is for grassland soils to sequester additional carbon; and methods that can be used to measure and monitor changes in on-farm carbon stocks. In addition, this session explored the potential of Culm grassland, a key priority habitat within the Ruby Country, to sequester and store carbon as well as deliver a range of other public goods including biodiversity and natural flood management.

Participants were asked in the break-out group discussions to comment on the actions and practices already being undertaken to utilise grassland as carbon sinks, the barriers and challenges entailed, support needed and knowledge and research needs. Each of these is discussed in turn below, with illustrative sample quotes provided.

4.1 Steps and actions already taken

A number of steps were already being taken among forum participants in terms of grazing practices and soil management, notably environmental grazing; carbon testing and farmer collaboration.

4.1.1 Environmental grazing

In terms of practices already being undertaken, farmers commented on types of grasses they were farming on or had planted. Several had fields with Culm grassland and commented on the benefits of these in terms of wildlife, but also highlighted the need for proper management, including protecting against invasive species, swaling⁷, and the use of cover crops. Others noted the benefits of multispecies grasslands, such as their ability to withstand drought due to deeper rooting. Some had seen their grasslands strengthen over time, highlighting the medium and long-term nature of grassland management. They discussed the impact of ploughing on soil carbon which was noted as particularly detrimental for Culm grasslands associated with the Ruby Country.

Participants with cattle on Dartmoor commented on their use of environmental grazing rather than intensive grazing. They noted the nutritional needs of different types of cattle, different ages of cattle and cattle at different times of the year. From this discussion it was clear that grazing systems are complex, requiring continual management over time, and that while farmers had to make best use of what they had at appropriate times of year, they also had to continually adapt and to try and improve and maintain their grassland. Some illustrative quotes included:

ID20: “In regards to ploughing, ploughing is the last thing you want to be doing on the Culm grassland”

⁷ Controlled burning of vegetation. A practice that helps to manage vegetation on overgrown heathland, clearing the ground of dead vegetation to allow new growth to appear.

ID1: “We planted up a handful of fields last year with multi species forage, and they did remarkably well ... in the drought compared with our permanent pasture I think because the deeper rooting species in there helped a lot. I think that's part of it. Maybe it opens up the soil, they say the soil can then hold more, is more like a sponge, it can hold more water. It's just so much greener even now, even while we're waiting for the rain to have an effect.”

ID2: “We’ve got the Culm grassland that we run with Devon Wildlife Trust, we've got one of our own. We then we've got about 120 acres of low input grasslands. And we put 50 acres of wildflower Meadows ... we planted some 50 acres, they're really coming on really well. We make some good, better, hay, as long, as well as the cattle graze it afterwards, and we can put some sheep on it through the winter. No fertilisers, no sprays, so yeah, all really good. We're yet to see a real big flush of flowers because we're about a third or fourth year into it now so it's coming on but every year it's getting stronger and stronger when they told me to start we're like, what we're gonna do to establish them I told them, they're absolutely mad. But I've come to love them and it's working really well.”

ID2: “it can be really damaging for a Culm grassland to be overgrown. so we bought a piece eight years ago, and it was just a wilderness and you couldn't even walk through it and now we're gradually it's a magnificent place for the wildlife and we've got Marsh fritillary butterfly and we are encouraging that and that's why the wildflower Meadows to get a corridor for them and different things. So you know, we got the wildlife, the environment and everything at heart. ..but it's the cattle (that) are doing the work to maintain it..”

4.1.2 Carbon testing and sampling

Participants discussed carbon cutting toolkits and measurement practices that they had been using, and some commented on their carbon footprint results being disappointing, in terms of the amount of carbon in their soils. Some illustrative examples included these two participants, showing how difficult it can be making the desired impact:

ID17: “we tested for the first time this year, and we're deeply disappointed with how little we had, which maybe it's a really good thing, who knows, but it's very, very low is about 1.3 - 1.7%.”

ID4: “Yes. So we've done herbal lays now for many, many years, and we don't plough up at all. And we did test my soil carbon last year. Organic matter, soil organic matter. Yeah. And we only done two or three fields, but one was 10.1. On it, the other one was in ten, or nine. I don't know where that should be...I found it well, maybe disappointing isn't the word. But, you know, as we think we're trying to do all the right things like, you know, herbal lays, which we'll be doing forever, and you know, deep rooted plants. And then, you know, if this isn't increasing our sequestration, or soil organic carbon thing, then all of our hard work and having got these methane emissions, it just seems like we're fighting a losing battle.”

4.1.3 Farmer collaboration

One farmer commented on attempts to establish a cooperative which would entail working with younger farmers collaboratively to farm ecologically, and to get conversations going with local landowners about this:

ID10: “In my farming practice, I'm trying to call out some landowners locally, and actually get them to, well we're thinking in terms of like an ecological land rescue cooperative. It's sort of, you know, we're banding out, we're talking a little bit to FWAG about it as well. You know, we can take on land collaboratively with other young farmers and look after it properly.

4.2 Concerns and barriers to change

Yet there were related barriers and challenges to achieving Net Zero and working with grasslands which brought biodiversity and other benefits. The first three of these were practical in nature and related to (i) sampling and monitoring; (ii) weather related practical limitations to land management; (iii) issues with Culm management and animal health. Other challenges were related to (iv) a perception that financial and stewardship schemes were inaccessible; (v) farming culture.

4.2.1 Sampling and monitoring

While some participants commented on the carbon and soil measurement they had been doing, others noted the difficulties of doing this accurately. As one participant noted:

ID18: “If you got limestone in soil, that's carbon as well. So if they take analysis, but if taking the limestone bit out, then you've got a completely false reading on carbon in the soil. So one thing you know sampling is definitely the biggest issue and I think in Stephan's presentation he said, you know, sampling is probably the biggest hurdle to overcome on soil carbon. Everybody likes to baseline as long as we do the same thing, same place, same lab, and then you know exactly where we go, but you need to take the sampling.”

Another forum participant who was involved in the wider agriculture sector, although not a farmer himself, commented on the need to measure, have a baseline, and to benchmark with other similar farms in order to have an understanding of your own carbon footprint, partly to provide evidence that might be needed for future farming payments:

ID9: ... I'd strongly encourage you all to do the same with either carbon calculating and soil assessment. So that we know where we are, both as a livestock industry, you on your farm, you can benchmark against other similar producers, but also then benchmark against arable and other systems, which then, you know, you're saying you're going to lose out payment wise here that you might then be able to say, look, this is where we are, we deserve this money up front ... and without that, you know, knowledge is power ... if you don't know where you are to start, it's going to be difficult to have these discussions. And, you know, you might find actually you're very good, and be might go down a route of carrot versus stick payments and things as well. So just try and get involved, I guess.

4.2.2 Weather related practical limitations of land management

As with manure management, weather caused problems for grazing or managing grassland in the way that farmers would like to:

ID1: “We graze it [Culm grasslands] with our Devons fairly lightly. Try not to overdo it We do have quite invasive willows and brambles, like to get in with a topper on top those off. But in

theory we're not allowed to go in when we can get in [because going in the summer with machinery is too difficult]. And by the time we're allowed to get in, it's too wet to get in without making terrible mess. So that's a bit of an issue. I mean, we can do it by hand, but it's kind of big job."

ID19: ..."We don't tend to get any problems .. until later on when it starts getting wet... the hardest thing is like the rushes thing. Now we're not allowed to go and top them till later on. And actually, we can't get in and cut it or top it off, so then they are spreading more. It's hard to manage it when actually you're not allowed to go in when you can get in there. I do think they forget that sometimes. Actually that sort of ground, when they're allowing you to go in, it's too wet. There are very few autumns you can actually get in and sort it out. You can certainly farm it with the right breed. And actually the cows do quite well and actually enjoy it. But every farm is different.. yeah, it's managing it well and doing the best of what you can do."

4.2.3 Culm management and animal health

Some points were raised about potential animal health considerations associated with grazing the Culm grassland, related to wet conditions and the proliferation of flies and midges. As one of the forum vets commented:

ID9: "My main concern with the Culm was the rising water level, and that that's going to create wet ground, which is going to form a lovely habitat for things like flies and midges. And they spread flies will spread *Moraxella bovis*, which causes New Forest eye, you know, that will then spread like wildfire through the group, if you're not maintaining fly control, be that with ear tags or spot-ons or pour-ons, which will, you know, increase your Permethrin use, which then has the impact on all the all the other invertebrates and everything else."

4.2.4 Accessibility of stewardship schemes

There was concern that existing stewardship schemes did not reward, and perhaps even disincentivised, certain environmental practices. In some cases because woodland on farms or other areas of the farm did not fall under the classification for agricultural schemes, making it difficult to qualify for existing and historical incentive-based schemes:

ID8: "Well, we have got some rushy, boggy areas. I think it basically comes down to economics. They really don't pay that well. And from what's been said today, it doesn't really look as if that's going to change hugely, you know, we have them because we love having them, and we love the wildlife, and then probably they're not actually terribly economic to do anything else with but it does seem that farmers aren't rewarded for having these wildlife areas, it's a bit like we've got quite a lot of woodland at the moment that the cattle graze through. It isn't really proper woodland, but it is a mixture of trees and grass and things. Well, in the past, it's been so difficult to classify that we haven't actually paid anything for it because it doesn't come on to BPS, because we've got too many trees to be grantable. And because we wouldn't fence around it, treat it like woodland we didn't get agri-environment schemes for it. So farmers have got to make a living. And I think that is a huge barrier to managing things in a more environmentally friendly way."

In another case it was felt that, in the past, gaining entry to higher level stewardship schemes was difficult. There was a perception that there was not a level playing field, and a suggestion that those farms affiliated to powerful organisations or landowners more likely to gain access to these:

ID5: "It's also political in some of the countryside stewardship schemes. So for example, we farm right next to the National Trust coalition. And those tenants were able to, in identical river meadows go into high level tier schemes on identical pasture. And we were not able to do that. So cynical or not, I do think the National Trust do have very close links with Natural England on a number of projects, it's kind of clout and political gain."

4.2.5 Farming culture

The Forum recognised that participants were amongst the most motivated by environmental goals and might not be typical of farmers in the area, and that a change in mindset may be required. Examples were given of younger farmers that were surprisingly less concerned about environmental issues than forum members thought they might be:

ID8: "most of us who've come on this have come on because we're really interested in achieving Net Zero. And we're all thinking along those lines, anyway. But there is a definite feeling I find, which was quite surprising, amongst the youngsters on Exmoor, the farmers coming through at sort of 30ish. They want to get on and they want to produce animals. They're not as worried about the environment as you would have thought they might be, being the next generation. And they're very traditional, in their view.,,, And I think that's a real risk."

ID10: "my neighbour's got a young son, probably under 25. He's driving around in a sort of £125,000 tractor, because that's what he wants to do at some finance, and in order to pay for that tractor he's just got to keep the damn thing moving. And every hedge is trimmed within an inch of its life. And often a landowner is coerced into sort of rolling over and you know, in return for their hedge been trimmed, the grass is taken, then it's heavily fertilised. It's just a mind-set that has absolutely nothing to do with an understanding of the microbiology of soil or the nuances of the life which is beneath our feet, it's just a sort of, grandfather did this and will carry on business as usual approach."

4.3 Support needed

The support that participants suggested was required followed on naturally from some of the barriers discussed in section 2 and included: support with measuring carbon capture and footprint; greater recognition and reward for existing environmental management practices; facilitation and incentives to support local collaboration and sustainable practices.

4.3.1 Measuring carbon capture and footprint

Forum participants were very keen to undertake more soil carbon testing to measure their carbon footprint but needed support with this in order to improve methods used and access to testing kits to improve the accuracy of their testing:

ID1: "I'd like to try it [soil carbon testing]. I mean, we do a bit of worm counts. And we do a bit of just looking at the soil, getting it out and looking at it. Some people seem to have a fix so they can say, "Well, we've got 18% or whatever." How do you get that? How do you

actually get a number attached to it which you can then use as a baseline? ... I'd love to get a baseline that we can use to build on. Otherwise, all this stuff is just sort of theoretical."

ID4: "It seems to be that you need one of those proper calculators that Becky is talking about, to get that sort of metric. And I'm not sure, maybe we can find out kind of what support there is available for using those [soil carbon testing kits] or getting hold of them or getting some advice to get someone to, to sort of do it do it with you, especially for the first time."

4.3.2 Greater recognition and reward for environmental management practices

Several Forum participants commented on the lack of reward in existing agricultural payments systems for work they were already undertaking to farm in more sustainable ways, and the difficulty of entering schemes like Higher Level Stewardship schemes, commenting on the need for better support on this. Participants were also anxious that ELM (Defra's new Environmental Land Management programme) would not recognise or reward farmers that were already farming in sustainable ways and may even penalise them⁸. The following quotes were indicative of this view:

ID1: "We're trying to go down the route of improving the quality of our soil, whether or not we got a grant for it, but obviously, it would be a nice to get a bit of support, or at least not get penalised by the system."

ID11: "I do find it really, really depressing. Because quite a few of us have been trying to farm in a very low impact way and have, you know, I've got most of my land is permanent pasture, I've got trees around every single field. Now, a lot of the stuff I do is very traditional, I think traditional, generally is never a bad way to go. Because it always works over the past sort of few 100 years. So I just find it depressing that in actual fact, when the people that have been doing the right thing, just there is there doesn't seem to be any reward really" ...

ID2: "We seem to be getting hammered for something we're trying to improve on. We've not personally tested masses of our soils, but our rented ground, he's an agronomist, he's been doing his, and his are all 10 - 12% organic matter, which is great. And he says like, instead of trying to encourage people to produce more organic carbon, it should be a payment on the percentages already. So then people will gradually instead of being incentivized to increase it, like we'd be straight in at 10 12% being paid on that amount. The more we encourage the higher end more people get the better organic matter."

ID17: The early adopters always get the worst deal with all of these things. And somehow government has realised, but if we're going to pay for it, they do need to pay to maintain it, as well as pay to add to it. So yeah, I think that's the take home message from all of these, but I think that what Becky said about the additional benefits to your yields and everything else, I mean, apart from by running a relatively low profitability business in the first place, but you know, the additional benefits but we get out of out of actually this adoption, adopting a higher carbon soil strategy is probably as important as the payments which will loitering around waiting for."

⁸ It should be noted that since the forum views were collected, Defra's emerging policy framework suggests that it is Defra's intention to reward certain existing good practices under ELM.

4.3.3 Facilitation and incentives to support local collaboration and sustainable practices

Some commented on the need for more support from facilitators to help farmers collaborate and identify financial support available to them to incentivise and reward sustainable practices:

ID5: “But I think if you want to accelerate collaboration, you actually do need to have facilitators and pots of money, and then do it in a strategic way, such as the Exe valley, such as the Ruby country and the Culm measures. And I think that's how you bring everybody with you.”

ID8: “We definitely need facilitators, certainly our sort of minor experience of trying to get a bit of common land into a HLS. And you've got various different landowners wanting different things. And it's really, really difficult to get agreement without some sort of facilitation, especially when there's money involved.”

4.4 Further research/knowledge needed

In terms of the knowledge and research needs of forum participants, some key topics were suggested, including (i) resolving contradicting advice; (ii) Culm grassland; (iii) soil management; (iv) controlling ticks; (v) questions concerning the circular economy and farming by-products; (vi) ethical questions.

4.4.1 Resolving contradictions in advice/ determining which advice is best

The first theme related to the need for clear, consistent advice, given contradictory research and advice given on various matters. These reflections of participants related to topics covered throughout the forum, not only relating to carbon sequestration in grasslands. Examples included advice about farmyard manure, intensification versus reduced stocking density, and how long to keep animals to maximise efficiency (related to farm methane emissions).

ID1: “With regard to farmyard manure, we're told that the best way to reduce the carbon loss from farmyard manure is to plough it in as soon as we spread it. But we should be reducing the amount of ploughing we do in order to maintain the quality of the soil and the carbon sequestration in the soil? So these seems to be two opposite requirements.”

ID22: “We've been told to intensify breeding and feeding and now we're told to have native breeds to reduce stocking density on culm. So I am at a bit of a loss.”

ID4: “It [keeping cows for longer] sort of contradicts some of the things that were being said in the earlier sections about, you know, not keeping stock till they're older. So it goes to show there, there are all these contradictory aspects that we'd have to consider.”

ID8: “There's a lot of conflicting things to think about and make decisions about. You know, if you do one thing, it affects another thing, either for or against, and we've all got to sort of sit down and work out what's better our farm what, especially our businesses.”

4.4.2 Culm management

Some commented more generally on their desire for advice on improving biodiversity on Culm grassland or on corridors between Culm grassland.

ID11: "I've got one field which about 20 years ago went into countryside stewardship as Culm ... I followed the management religiously for about 15 years but it never improved from that in terms of biodiversity. No other seed sources came up through and I think there wasn't the seed in the ground on that particular area. So I'd be interested in whether you just sort of say okay, well if this hasn't worked for that, or whether it's there's a sort of import of sort of more a wider variety of seeds into that particular system."

ID20: "would it be possible to develop wildlife corridors between areas of Culm grass"?

4.4.3 Soil management

There was also a desire to understand more about soil management to improve carbon capture including on different soil types, as the following quotes suggested:

ID20: "A few questions I had after viewing the presentations... what is the ideal balance in my grasslands of carbon to clay issue. Because our clay issue is a lot higher. And I think, you know, we've got the potential to sequester more carbon."

ID20: "The other thing as well is more research, as well, is that what do we really have to do on our grassland to increase soil organic matter? Like ID1 said, by applying grassland and putting dung in or is about applying dung in the spring or applying dung in the autumn, and how to incorporate that."

ID5: "Can you do research on worms and how they work, you know, in terms of the microorganisms and bacteria, because I've been doing some myself and there seems to be quite a lot in the US about how they interact and how, they're all part of soil structure and and sequestering more carbon."

ID10: "Re-looking at the research on woodchip. And I think that certainly would link any kind of biomass input into soil will link with worm populations and I'm looking at this catching, or on farm pilots for very nice compost that can really bolster soils, not just feed them but actually bolster them."

4.4.4 Controlling ticks

An animal welfare issue affecting Ruby Country cattle related to ticks and how to reduce the incidence of these.

ID1: "Were asking about what Rothamsted could do, by way of animal welfare research. There was an issue raised in the main session about other diseases that ticks currently carrying, perhaps ought to get ahead of that one."

ID18: "It is a problem we see but definitely having homebred cattle pretty much you know gets rid of it. Definitely they build up their own immunity and problems come in with buying and stuff and definitely breed."

4.4.5 Circular economy and farming by-products

One person wanted to know more about how farms could benefit from using a circular economy approach – i.e. recycling and reusing by-products within the farming system:

ID10: “the circular economy of how you can get different enterprises stacked on farms to produce by-products, woody biomass or whatever, which would help in the production of those.”

4.4.6 Ethics of offsetting

An ethical question raised by a Forum participant related to climate justice issues concerning some business or communities polluting and others such as farmers being responsible for sequestering these. This linked to scepticism expressed elsewhere in the Forum about carbon trading.

ID16: “[what about] the ethics of companies polluting the atmosphere elsewhere and then storing it somewhere where there is low level pollution [sequestration by farmers, whereas other communities or businesses are busy polluting and the kind of the fairness and justice element of that perhaps].”

Chapter 5 Carbon capture in trees, hedgerows and bioenergy crops

Greater integration of trees into the farmed environment forms a key part of the Government's plan to combat climate change and achieve Net Zero carbon emissions by 2050. To this end the UK Government has committed to accelerate tree planting, with a target of 30,000 hectares of new woodland being created annually by 2025, rising to 50,000 ha yr⁻¹ by 2035. In addition, the Committee on Climate Change (CCC) has recommended the integration of trees onto 10% of farmland and extending the length of hedgerows by 40% by 2050, as well as improved woodland and hedgerow management. Government and industry roadmaps for achieving Net Zero also include releasing agricultural land to grow domestic energy crops such as short rotation willow, *Miscanthus* and short rotation forestry, with targets of up to 60,000 ha yr⁻¹ by 2034.

In [workshop 5](#) the Forum heard from experts about opportunities and support available to create new woodland in the Ruby Country, how hedgerow management can be adapted to maximise carbon storage, how trees can be integrated alongside grazing to create silvopasture within the Ruby Country and the potential of perennial bioenergy crop to contribute towards Net Zero targets. Although session 5 included separate presentations on woodlands, silvopasture and hedgerows, in the subsequent breakout group discussions it was clear that the differentiation between these kinds of 'treescape' is blurred at best. For example, some Forum members described allowing cattle into woodlands to graze and browse, while others considered cattle browsing on hedgerows a form of silvopasture. For this reason, the terms 'trees' or 'treescapes' are used in the summary below unless specific terms are given.

5.1 Steps and actions already taken

5.1.1 Using treescapes for non-carbon benefits

Many forum members have already considered, or are considering, integrating more trees on their farm in various forms e.g., woodlands, hedgerows and silvopasture. The main motivations for doing so are not principally for carbon sequestration, but for other perceived benefits such as water management, riverbank stabilisation, forage, wood fuel provision and biodiversity. Where carbon sequestration is a motivation, it is generally seen as one of several benefits.

Woodland

The main reasons given by forum members for planting woodland were use of land that was marginal, or uneconomic to use for grazing or crops, especially land that has a tendency to waterlog. In some cases forum members specifically discussed planting trees to help dry otherwise wet areas of land. Planting to protect riverbanks was also discussed by several members:

ID7: "We are planting quite a lot of trees on the riverbanks to stop soil erosion, because it's quite bad ... we can just see where farms have taken away trees from the riverbank. They just lose land, so it's very important that we get the benefits of carbon sequestering. And replace habitat for it. We are in the processes of thinking about planting more trees."

ID1: "... we've been planting trees on and off ever since we've been farming in Devon, it's been over 30 years. Sometimes with grants and sometimes without. The only times we planted lots of trees, as in as forestry, where the land is just too wet to support anything else. We've planted trees along the riverbanks to try and hold the riverbanks. Sometimes it's successful, sometimes it actually ends up falling in and pulling the riverbank with it. I'm

not sure that you can control the movement of rivers, I think it's probably best to just let them let them do their thing.”

ID6: “I created a few hectares of woodland several years ago now. Mixed deciduous woodland..... I wasn't established with grants at the time. The reason for doing it was, it was a field of marginal use to agriculture due to its wetness.....once I stopped dairy farming, it wasn't worth my putting the input in to keep it in good condition for agriculture. The return wasn't there. So I reverted to woodland on five acres, or two hectares.”

Silvopasture

Several forum members were using various forms of silvopasture, from allowing animals to browse hedgerows, to planting trees in pasture, to grazing woodlands. Perceived benefits include reduced input and management costs (and associated emissions), improved animal nutrition, shelter, health and wellbeing, and consequently easier management:

ID1: “The last few years they have quite a lot of experience about letting the cattle into the woodland. When things are bad. And they're very happy in the woodland. When we had a drought a few years ago, and that was great because all the grass is brown, but the woodland was still very green..., they stripped all the algae off the trees, which is brilliant, and then ate the undergrowth. We did it again in a very wet winter and they did actually poach the ground badly so that was a bit of an issue. But I mean they do love living among the trees. They do very well there. So we do plant trees in our pastures quite a lot.”

ID12: “... In the presentations, we heard how cattle are more comfortable in woodland shelter, and I've definitely found that with my cattle is once they are amongst the trees and not as flighty. They're more comfortable. They are constantly lying down and they seem generally much happier. So, in my view, I think silvopastures has roots in every problem I have on the farm. It's welfare, it's carbon capture, it's the water quality, it's the air quality. I don't think I can quantify how much benefits, it has on my farm.”

ID9: “There was the former president of the Sheep Vets Society has just done a research project looking at managing and controlling liver fluke by planting trees and certainly the right tree right place has made a massive difference on farms that have suffered from liver fluke. So they both prevented rain hitting you know, the canopy reduces rainfall on the ground, but then also those trees massively increase the absorption of water out of the pasture which then removes the mud snails habitat. So you certainly are right there with seeing the dry ground in the wet woodland. As well as the carbon impacts, there is this wider benefit for liver fluke worms and so on.”

Hedgerows

Many forum members described using hedgerows effectively as a form of silvopasture. In small, hedged fields, common in the Ruby Country, hedgerows are an efficient way of integrating trees in pasture, providing animals with shelter and nutritious browse while also maintaining barriers and providing wood fuel. The benefits of hedges for flood prevention were also noted. Other forum members were actively engaged in hedgerow restoration and receiving funding to support this, and many commented on the manual work involved. Few cited carbon sequestration as a reason for hedgerow management.

Sample quotes:

ID4: "We've got about seven kilometres of hedges, we've got so many little fields...And we put electric fencing around ... but the bullocks can eat above and below so that we're trying to let them have the benefit of the trees and the leaves. But still not letting them go and ruin the hedges. we find that works quite well for us."

ID12: "Yes. I think hedges, everyone here is doing some pastures and hedgerows are the easiest way to have that and when we strip graze the fields, cattle always go to the hedges first, to browse them. So I think if you want to be a part of the silvopasture then you are probably doing that already through having the hedgerows."

ID2: "Hedgerow management, the road hedges we keep trimmed for safety on the roads but all the inland and downward hedges we have let up over the last five years/ six years ... we've got biomass boiler so we've got rotations after 25/30 years hedges up being cut off and re-laid and letting go again. We have some hedges that were just not very easy to get to with machines and horses and get left for many years and then get tidied up again after. So we're always trying to, well we just have so many hedges."

ID14: "We got lots of two/ three acre fields... They've all got hedges and fences. So 10s of 1000s of metres of hedges and tonnes worth of wood ... it's so much easier when you're lambing with high hedges You got dry ground for the lamb to get up against by the hedge. There's lots of benefits."

ID14: "Lots of hedges were taken out around us, not so many on our farm, but lots were taken out. And now you got lots of flooding and things happening. Whereas, we've got ones where when the fields are ready for cutting, no water comes out of the fields at all."

Related to this, as one participant noted the reticence of forum members to engage in agroforestry, suggesting that practices appropriate to the Ruby Country might be more or equally environmentally beneficial, suggesting the need for localised approaches:

ID16: 'One of the things I found really interesting about last week's workshop was that there didn't seem to be that much interest, I felt, in silvopasture, agroforestry. And certainly planting of trees. And I think one of the things that was driving this in the first place was that was something that, you know, national policy was wanting to do. And it's very interesting to hear what everybody felt about that whole idea because, you know, there will be better carbon sequestration with forest. But actually, maybe if that isn't what the people of the Ruby country want, then maybe, you know, we need to work out how we do Net Zero and carbon negative in a different way, but in a way that is more appropriate to the people of the Ruby country.' (ID16)

Reflecting this viewpoint, for another participant, one the most interesting thing about the forum had been learning about carbon storage and the benefits of different types of hedgerows.

ID14: 'For myself, it was a managing manures, and the hedgerow carbon and actually the benefits of the different types of hedges, and how the carbon got stored, and it is quite amazing, really.'

5. 2 Concerns and barriers to change

5.2.1 Long-term commitments

Planting trees in farming landscapes is naturally seen as a long-term commitment. While many Forum members were keen to invest in the long-term health of their farms, the nature of farming business models introduced several concerns and challenges linked to uncertainty in payback times and government follow-through on incentive and regulatory schemes. Other Forum members were concerned about simply the long-term commitment to a management decision making it difficult to be flexible about re-purposing land in the future:

Uncertain payback time – also linked to land tenure

ID15: “As a tenant farmer, very small acreage and a short tenancy, I think we'd have to be very careful what we got into regards to getting any reward out of it.... by the time it was getting established we would be moving on somewhere else. So these things are probably good if you own a farm, but if you are a tenant, I'm not sure that they stack up.”

ID7:” Well, for me, for someone in my 30s doing long term project, it looks different from retirement funds. But someone my dad's age is still farming, I think he probably wants, he wouldn't look at that sort of thing, because it's too long-term for him to see any benefit. In fact he would have to put money in, I know there is funding, but he would have to give the money.”

Carbon credit business models require long-term commitment to particular management decisions, which reduce flexibility in the future

ID1: “And the other issue is the long term one, I mean it depends, you get these, you get that locked up for a period of time. In a scheme, because you've sold the carbon credits, you may not want to keep running the land in that way, I wouldn't dream of selling carbon credits myself.”

ID15: “My slight issue with the silviculture side of it, is just the time really. And I know with trees, having a reasonable amount of experience with them, you only need those cattle to get in once, or to be left in once too long or something not to be done right. And there can be a lot of damage to the tree. So management wise, I think it's critical that these kinds of systems that have to be spot on and people do need to realise that they will take time to get up to the level they need to.”

Uncertainty/mistrust in future regulatory/incentive framework

Widespread uncertainty or lack of trust in the ability of government to deliver effective incentives and regulatory frameworks for farm carbon trading (and other environmental benefits), was also exacerbated by lack of understanding and confusion over concepts such as ‘additionality’.

ID17: “Yeah, I mean, what we're looking at is a classic, incompetent government where they promised jam tomorrow. And as consequence, we are all waiting for jam and never do anything... So we've left it partly, because it is possible that there may be funding in the future, there is a chance that it won't just be additionality but we will actually get some form of recognition.”

ID2: “We're kind of the opinion, we'd like to do stuff, we got some steep ground that we can't really farm that great. Probably best thing, we're all gonna have to plant some trees then I've like earmarked places to go. But waiting for them to really pay me to do it. Because we've done stuff in the past where I've been in the front, paid to do it and then we don't get any benefits from not doing it so we are kind of just waiting.”

ID17: I think there's also a danger that we all become grant junkies, and just sit around waiting for the cash. And it does slow you down and stop you moving. And you need to find value in other ways.

5.2.2 Existing regulatory barriers – perceived or real

Regulatory bodies are seen as intractable and inflexible, lacking in local contextual knowledge about how regulation and incentives apply in different landscapes. Some rules create barriers to integrating cattle into woodland, and to planting trees and hedges.

ID2: “Natural England wanted us to fence off all the woodlands, the woodland can't be grazed. So I don't know why they don't want that to be grazed. We have fight for one because it's grazed sheep woodland and we managed to keep the fence down. But they currently want to keep that fenced off. I'm wondering why. Because the stock loves it in there. We did it for generations before and they don't really want it and sometimes you're fighting against a lost cause with that lot.”

ID22: “just picking up on that as well. We did get hedgerows and boundaries grants. We found, the thing with these grants, unless it's just us being numpties, but it was an absolute nightmare with Natural England, working out all these, the codes and what exactly they want you to do, and messing about trying to ring someone and there's only one bloke that dealt with it in Bristol, and it's his day off. So we're going to transfer you to Newcastle and then they don't know anything about it, and it just put us off more than anything.”

ID1: “Natural England are difficult to work with. And I only hope that with this new ELM scheme, we might have a more cooperative. But I doubt it. It's partly their attitude. When it comes to claiming a grant all they're trying to do is prevent you getting the grant. And making sure you fill in all the little bits of paperwork. If you don't fill it in, you don't get the grant and then they're happy about that because it saves money.”

5.2.3 Labour and equipment requirement

Labour and capital expenditure on equipment were especially seen as significant barriers for improved hedgerow management. When using contractors, issues with timing (both regulatory and availability of contractors) also compound this. Labour requirement was also cited as an obstacle for establishing woodland, alongside potential problems with rodent and deer damage to saplings.

ID1: “We lay them occasionally. I'd actually like to lay more, but it's an enormously labour-intensive job compared to just running around with the flail.”

ID14: “We got lots of two/ three acre fields. They've all got hedges and fences. So 10s of 1000s of metres of hedges and 1000 and 1000 tonnes worth of woods, like colossal just the amount of wood I'm always having to deal with”

5.2.4 Perceived loss of productive area/competition

Loss of productive area was also seen as a barrier to hedgerow expansion, and also woodland creation.

ID19: “Yeah, I mean we properly got two big fields ... you take too much of the area you then get too small a paddocks to work.”

ID7: “And it's like, it seems like a whole, quite big part of acreage of the farms. If it was just little corners here and there, which could be accumulated to reach the target acreage you need to be part of the scheme. I think plantations, on what a lot of farmers would consider like really fertile land, I don't think most of them would really go for that... Okay, so thinking about that, then, obviously, if we don't want to completely take areas out of grazing, then obviously silvopasture is kind of one of the options that's really being looked at as that opportunity to integrate trees into pasture-based systems. That means that you can maintain your grazing but get some of those benefits from trees.”

5.2.5 Challenge of integrating cattle into woodland related to existing land use

Integrating cattle with woodland was desirable for many, and it was recognised that this brought benefits to cattle as well as to the environment, but there were some barriers to putting this into practice. One participant noted that their local native woodland tended to be prioritised for shooting rather than cattle:

“The one thing that is always on my mind, in the landscape I'm part of, as somebody with a suckler herd of Red Rubies, I would love to have a nice big woodland with my cattle on, rather than bring them all indoors (in Winter) and I think it might come up when we get onto the agroforestry type things, but I do think that, no offence (to anyone who) really loves their shooting, but it's almost as though woodland has to be for shooting and not for cattle these days which is a bit of a shame. (ID3)

5.2.6 Barriers/concerns to bioenergy production

Currently no Forum members are growing bioenergy crops on their farms and there were generally low levels of enthusiasm for this type of production in the Ruby Country, with perceived barriers around competition for land, logistics of getting crops to biomass plants and the impact of the harvesting machinery on the land.

Competition with food production

ID7: “Well, I mean, it's all very well that the worldwide population needs more energy. But you're also taking this land away from food production. And the growing population will still need food. I think energy can come from other ways. We have solar panel, we got wind turbines. We got tidal... And bioenergy crops, like I said, it would look fine but they're just

taking away from the food production and much of the Ruby Country is planted for grazing animals. And it may well also be good for growing bioenergy crops. But this for instance, Ruby County is grown for that.”

Fears over large harvest and transport machinery to make biomass processing viable

ID15: “I wanted to mention with the bio-energy is, I think we're in the Ruby Country, have to be very, very careful about going down the route of having one massive great plant, which everyone supplies. I know, 15 years ago, they had one in Winkleigh. And they worked out that there would be a vehicle going through the village very three minutes delivering this. I think there's big impacts in very small communities like Ruby country, with big machinery, problems with damaging the land when they're getting the crops out. And I think that's probably one of the biggest things is big machinery, damaging the land and nitrous oxide would be produced from that. So I think we need to have much smaller, smaller machinery. And be very careful about how big we make it. It's very easy for, say, the Devon County Council to go and have this massive project. It looks wonderful in terms of the publicity, but we need to be very careful, I think not to go down that route.”

5.3 Support needed

Although it was acknowledged that further research is needed around measuring and verifying carbon sequestration through changed management, it was clear that the most necessary and direct support needed by farmers is frameworks for incentivisation and regulation, and good support and guidelines for transitions to these.

5.3.1 Support and clarity for transition to new regulatory/incentive frameworks

Given the concerns around uncertainty over regulatory and incentive frameworks highlighted above, clear and timely guidance for a transition to ELM, farm carbon schemes etc. was highlighted as an immediate need for farming communities. If these are navigated effectively, forum members showed enthusiasm for the potential to adopt and implement new practices.

ID15: “From a cattle tenant’s point of view, I think that mindset change, whereby when we come out of the tenancy, we won't get [penalised as] dilapidated for letting our hedges go.”

ID14: “There's quite a few possibilities to make money on it, so long as it's geared up in the right way for it.”

5.3.2 ‘Storytelling’ to support access to markets for carbon and biodiversity markets

Forum members were interested in the idea that being able to tell a positive story about environmental impacts, particularly carbon and biodiversity, is an effective marketing strategy especially when supporting sales direct to consumers.

ID17: “Basically, you've got worlds full of people that are really concerned about the climate ... the way to empower them is to allow them to buy something which has a genuine background in carbon sequestration and biodiversity increase is surely the best way to take your product to the market... And I just think this is a big niche of the future, of the next 10 years. To be successful, you probably have to have a better story than the other 10 people. It's having a really solid grounding in the facts and good foundations.”

ID17: “And interestingly, from the point of view of the [silvopasture] establishment here, I put out the word locally that I wanted volunteers, I had 60 volunteers. To me that’s interesting because I got 60 volunteers so the cost of establishment was cheap, but there is a bit of market research... does the general public think that farmers who produce meat in an environmentally responsible way, I mean I have about 60 people who will probably buy my meat and I only went down to the parish. So it really does show that by engaging with the public on these things, you get a greater understanding of what the public actually want to be buying into.”

5.3.3 Peer sharing of best practices, and equipment

In regard to changing hedgerow management, forum members cited access to suitable equipment, and problems with contractors, as barriers to adoption. A proposed solution was supporting peer investment in, and sharing of, equipment, knowledge and management best practices.

5.3.4 Accessing research/knowledge

This theme related to the importance of, and need for, effective ways of communicating research and knowledge to a dispersed group of people who are willing to adapt farming practices in light of new information and research:

ID17: “Just gonna say given the motivation for doing the silvopasture, of course, is based on research done by people like Rothamsted and everyone else, which is where you’re really just getting new information and when the facts change, you change your mind. I think one of the problems with farming is we are all down very long lanes and getting the information down at the end of a long lane informs people and helps them make decisions to move in a more refined direction.”

5.4 Further research/knowledge needed

Two areas for research and knowledge were suggested that forum members felt would assist them in the area of carbon sequestration and the use of forms of silvopasture, as follows:

5.4.1 Understanding/developing business/incentive models that are sustainable for Carbon sequestering treescapescapes

ID14: “For myself, it would be making this short term one actually viable. If it's financially viable, go straight in. If you have a hedge, you can say well I am going to start producing chip biomass wood from it, and doing this in a responsible way, going forward. Not that you have to wait 20 years and lots of money from anyone. You're making money straight away from doing it, and they're also what you're doing, your letting it grow back, you're agreeing to let it grow back, but it's set up by a farm because if somebody just cut it off and have issues with 10 years to grow up, then it's back again to where it was when you just cut it off.”

5.4.2 Nutritional benefits or browsing and mixed systems

Many forum members cited nutritional and health benefits of browsing of trees and hedgerows by cattle. It was felt that more research to quantify and understand benefits would support adoption of treescape integration.

Chapter 6 Support from local and national policy makers, researchers and communities

[Workshop 6](#), the final workshop, focused on the support needs of farmers in terms of things that would help them in terms of local and national policy, but also support needs in terms of knowledge and research. This workshop drew together themes that cut across all the workshops as well as issues related to processing and retailing the end-product that farmers were producing.

6.1 Getting support from policy makers locally; key messages for local policy makers

Participants were asked for their general reflections on what policy makers in Devon could do to support farmers in achieving Net Zero and help drive forward the Net Zero agenda within the farming sector. Key themes that emerged included:

- Devon policy makers need to be engaged and aligned with national (Defra) policy makers at an early stage. This is to ensure that local policies fit with the new emerging national scheme, but also so Devon policy makers' expertise can enhance the national policy framework. Participants had benefited in the past from European grant schemes that Devon Council leadership had taken a lead role in (e.g., Leader Programme) and recognised the need for close collaboration with Defra as new national schemes set up.
- Lack of local, small-medium scale infrastructure, especially slaughterhouses. Local planning authorities perceived to have a role to play in this respect. E.g., the need for greater support for the creation of new slaughterhouses which have diminished substantially in recent decades, to reduce food miles, promote animal welfare, create efficiency and provide appropriate-sized infrastructure for smaller producers. Better routes to market are needed.
- Planning – new ways of doing things requires new infrastructure, e.g., support for small scale renewable energy on farms. Local planning authorities could potentially make this easier.
- Local infrastructure and education on the where, how and value of local farming and local meat production. Support for local branding and marketing of produce to local schools, tourists etc.
- A desire for Devon local authorities and council departments to think strategically about the issues raised in the forum on a County-wide level. For instance, how can the carbon that Devon produces be sequestered most effectively in the soils that Devon (County Council) has control over? Can carbon be traded between farms on a countywide basis?
- A need for support with carbon footprint measurement so that farmers have clear and consistent measurements on their own farm and across farms in Devon.
- More joined-up cross departmental thinking at local government level (perception that different departments pursuing own green agendas); more use of county farms, for example to train farmers in practices like silvopasture or involve schools.

ID2: 'I think farmers are all going to have to do carbon footprinting. And from what I understand, there are different ways of measuring it. I think whether Devon can help to standardise those measurements, and whether they actually employ the people that do the footprinting, they can go on to the farm. So every farm has got the same people working for the numbers.'

ID22: 'maybe at our local levels, if we were to do like a Ruby country brand, maybe Devon County could make sure the local schools in that serve Ruby country beef and that type of things.'

ID14: "Locally, it's planning. Make it more flexible and easier to do planning. A lot of it comes down infrastructure, like reducing emissions from slurry or dung or whatever... And if you want to go away from silage, it's more like herbal ley hay and things like that, well you need a shed to put the hay in. Especially if you're in the National Park area, they say what do you need a shed for? So you have to fight to try and get the thing"

Key Messages

- The need for more **local infrastructure** and for planning authorities to recognise that need and facilitate it
- The need for **joined up approaches** (at a county level and at a local authority departmental level, but also collaboration between local and national policy makers)
- More emphasis on **marketing local produce**, public education, supporting different routes to market
- **Support and advice** with carbon footprint measurement
- More creative use of **County assets** such as county farms; strategic county wide thinking on Devon farming's carbon footprint as a whole

6.2 Getting support from policy makers nationally; key messages for national policy makers

Participants were asked to reflect on the key messages for UK policy makers based upon the forum discussions and their own experiences as farmers to support them to facilitate the transition toward Net Zero goals.

Summary of themes raised by forum participants:

Recognising the needs of small farms, tenant farms, issues of succession

- Participants felt national policy needed to also reflect and take account of the needs and practicalities of small farms, which are different to larger farms. This includes support for access to smaller items of equipment that farmers can use themselves without the need to engage contractors who are expensive and may not themselves have the specialist equipment needed. Is there a role for regional equipment hubs/ tool libraries of some kind? Grant schemes including forestry schemes in the ELM framework also need to provide sufficient support for smaller farms, if they are to survive and contribute to Net Zero goals.
- The role and requirements of tenant farmers need to be explicitly recognized and considered in terms of policy measures to support the transition to Net Zero farming. Tenant farmers, especially those on shorter tenancies, find it more difficult to make the substantial financial long-term commitments that might be needed to support Net Zero goals, making substantial upfront investment that they won't ever recoup. Extra land that is rented on short term let (e.g., FBTs⁹, grazing licenses) needs to be included within carbon measurements and policy frameworks.
- Older farmers who will find it difficult to invest substantially and make major changes to their farms toward the end of their careers. Equally, younger farmers need support to ensure a future for small farms and to help new farmers drive forward the Net

ID 16: My message to policymakers is, we can only talk about sustainability if the next generation feel empowered, and inspired to take up farming. ...my feeling is, please can we get succession sorted. All things that are barriers to succession... , because if we're going to move this whole thing forward, we need the next generation, who are amazingly good at self-educating ...my generation aren't like that... The next generation needs to come in and be able to take the reins and drive this whole thing forward.'

⁹ Farm Business Tenancies (see glossary)

Zero and environmental agenda. Farm succession therefore needs to be considered when developing policy.

Rewarding and protecting environmentally beneficial practices that are already taking place/ penalizing and scrutinising those which damage

- Policy needs to recognize and value the work that has already been / is being done (i.e., not simply to reward those who make changes in future). There needs to be some support for people who are already 'doing the right thing', particularly smaller farmers. The concept of 'additionality' in new grant schemes is something that was of real concern to forum participants. As noted above, it does appear that the emerging ELM programmes will provide financial support and reward for existing good practices.
- There is a need to protect existing biodiversity, which includes greater scrutiny of things which are currently damaging biodiversity (e.g., farming practices which are contributing to flooding, damaging wildlife or soil health); potentially greater use of penalties for farms that are damaging the environment. Ensure incentive structure does not encourage farmers to rip out areas that are already sequestering carbon and benefiting wildlife (e.g., existing hedgerows and grasslands) and starting again with new environmental schemes.

Potential impacts of trade deals:

- Trade deals could undermine progress and goodwill, and only serve to export the problem.
- Relatedly, there are risks of importing goods produced with lower standards (both environmental and animal welfare standards).

New ELM framework and existing stewardship schemes/ grant application processes:

- More information is required about the [ELM framework](#) to allow farmers to make key decisions. Currently they are being held back from making changes due to waiting for the new schemes to be fine-tuned and implemented. More clarity and guidance are required before decisions can be made about what is the best option for each farm (e.g., in terms of what to prioritise for production and stewardship).
- Relatedly, ELM needs to be at a scale that works for smaller farms too in terms of the incentives provided¹⁰. Smaller scale forestry schemes, for example, would be more suited to the Ruby Country/ Devon area.
- Importance of Defra taking a more 'positive' approach to stewardship applications, a change of attitude at Defra.
- Bureaucracy and complexity are obstacles to farmers joining schemes. More straightforward application processes are needed; more availability and accessibility of advisors.

ID9: "there's no one point us being net carbon zero if we're just pushing the problem away elsewhere and there's no point us planting trees and not producing beef if we're then bringing in produce which is being fed with antibiotics and growth promoters and so on."

ID17: 'We need clarity of decision. Clarity, we are all confused at the moment. Everyone is hanging on. We were saying last week, we have this extraordinary thing where we're disincentivized from doing good, because we're waiting to be paid to do good. So it's just crazy'.

¹⁰ The needs of smaller farms are the focus of some of the Defra ELM pilot programmes

Monitoring, evaluation and data:

- The full implications and effects of planned Net Zero measures, on ecosystems and farm productivity and food security need to be monitored and evaluated.
- The need to standardise carbon sequestration measurements and support farmers to take these measurements, through affordable access to appropriate equipment.
- The need for policy makers to avoid making irreversible decisions based upon data that is still not fully developed. Allowing sufficient policy flexibility for changes to be made in light of new evidence.

Policy instruments and incentives:

- Farmers must be able to make a living, alongside delivering environmental benefits. This related to comments about the need for grant schemes to sufficiently incentivise changes to practice. New practices being promoted must be profitable to enable change to happen.
- Avoidance of nature becoming a commodity that can be traded (i.e., through carbon trading schemes and offsetting).
- Recognition that the move to Net Zero will require investment. Funding and financing considered crucial. Participants noted that the government can borrow money at lower interest rates than farmers; farmers advocated more affordable loans for farmers to facilitate the necessary changes.
- Farmers should have access to business opportunities involving land without having to own that land.
- Planning systems needs to allow farmers to make the changes necessary to deliver environmental benefits.

ID8: 'I'd say we've still got to be able to make a living. That's the main thing. It does seem that from what I've heard recently that Defra sort of going more down (the route of), well, farmers can trade their carbon, they can rely on private investment. Well, it seems to me that small-scale Devon farmers are pretty well reliant on sheep and cattle production. We're going to find it difficult to achieve Net zero, let alone have any spare carbon to trade. I think it's really important that farmers can make a living without going down that sort of selling yourself to trade carbon and other things.'

ID24: 'It is just so confusing in terms of what to do for the best. You try and benchmark yourself today, there's no standards at all. There's no way there's no real guidance .. to help us do it. And then going forward, if we start making improvements, there's no real way of capturing it. From an auditable point of view. We can do things which we believe are better. But there's no real way of capturing it at the moment. I think policymakers need to really put some clarity into this... otherwise we're just going to run out of time... and we're just not going to get there.'

Key Messages

- Policy needs to reflect and respond to the needs of **small-scale farming and farmers**
- Policy needs to **recognize, value and reward the work that has already been or is being done & protect existing areas of biodiversity**
- More **information, clarity, guidance and practical help** is required with respect to ELM
- Poor **trade deals** risk undermining the whole sector and process towards a Net Zero beef sector if they result in the carbon problem being exported and lower standards being imported
- Farmers still need to **make a living** – schemes need to provide sufficient incentive beyond break even, or the schemes will not sufficiently incentivise and drive change
- Damaging practices need to be **monitored and penalized**

6.3 Getting support from researchers

Participants were asked if there were areas that they felt required more research or knowledge. In addition to those areas already identified under each chapter, these more general themes emerged:

Participants suggested they needed the following:

- More research on how various Net Zero measures, e.g., silvopasture, work or don't on different land types.
- Research trials that use a more diverse range of farms to try and help understand what works where, including locally specific research that provides data about Devon soils.
- To make the research relevant to the Ruby country. A lot of the Forestry Research/ Rothamsted research focused on arable land and forested areas. Research is needed about a diverse range of farm types.
- More research on the interaction between organic matter, microbes, fungi etc in terms of carbon sequestration, and also soil health.
- To cover all bases and get as much information as possible before any policy is imposed upon the farmers who all work in very different areas.
- Getting more farmers through the doors of institutes like Rothamsted Research to benefit from advice and guidance.
- Support with benchmarking. Participants wanted to know more about how to measure carbon capturing and the quality of their ground to allow them to benchmark future progress.
- A complete guide written down on how to put all the information and practical guidance together. How to use these tools practically.
- More information about farming conventionally. Is there a win-win scenario where we can actually have grazing cattle, just by changing the type of grasses? Can changing from perennial ryegrass to multi species swards increase soil organic matter?
- A need for more independent science and government funded research on the new emphasis of Net Zero to help direct policy and practice. Also continued funding for existing research in this area.

Key Messages

- Participants wanted more research and data to make informed decisions, including practical guidance about carbon footprint benchmarking and other issues
- But research, they argued, needs to focus on a more diverse range of farm types and sizes and associated land/soil types
- Guidance about whether different farming models/ systems can be commensurate with Net Zero goals

6.4 Getting support from within the community

Own actions and need for further support, reward and recognition

Reflecting on the forum as a whole, participants were asked what actions they themselves would take to achieve Net Zero. The following themes emerged:

- Support for increasing wildlife on the farms. Recognition that the public would also support measures and produce that achieved this outcome, with its visual impact on the environment.
- Some commented that until there is a benchmark for effectively allowing them to measure their carbon footprint, they were hesitant to do much towards this goal.
- Recognition by some that although they are already doing a lot toward this goal, these efforts need to pay and a structural change in the market is needed, as well as grant schemes to support this work.

Key Messages

- Some are doing quite a lot already and are not waiting but they want to be recognised and rewarded for the work they have already done/are doing
- Others require more information/guidance and are reluctant to act/commit until a profitable route to Net Zero is clearer.

Collaboration within the Ruby Country

Participants were next asked how local cooperation between Ruby Country farmers and in the wider community could help the transition to Net Zero. Key themes included:

- Involving the community recognised to be important, alongside education;
- Wider community buy-in to the Ruby Country was considered important, through schools but also local customers and tourists;
- Participants suggested marketing of a unique brand in the Ruby Country that everyone should feel proud of, both the farmers themselves, and the wider community; marketing the wildlife benefits of their practices; the idea of a regional approach to meat boxes or direct sales;

- Educating local children in the schools and their families, through schemes to support school farm visits (e.g., idea of emulating Cornwall's Education Bus which takes primary school children to farms);
- Education also needs to be conducted on a bigger scale, e.g., government-led initiative to educate people about farming;
- Public procurement for schools considered an important approach to encouraging the consumption of local, Net Zero produce; idea of an app (as piloted in Bath and North Somerset) allowing school chefs to easily source local produce;
- Education and community support important but there needs to be a commercial uplift and gain for Devon Ruby farmers

Key Messages

- Education, but in creative ways, involving schools and wider community. Cooperation with wider community;
- Branding of Ruby Country produce; collaborative approaches to this;
- Public procurement (school meals)

ID11: 'One of the questions mentioned cooperation. I think.. rather than just looking at it between farmers, you know, it's community involvement has a role to play as well ... it might not just be schools, but in terms of the wider community, it goes alongside this marketing thing of our own brand in the Ruby country, that everyone should feel proud of that rather than just the farmers themselves, and try and encourage wider community to buy into it'.

ID23: 'If you tell the primary school children, educate them about the benefits of good nutrition, they're much more likely to go back home and change the feeding habits of the family as opposed to trying to change the feeding habits of the adults, which are almost impossible to do'.

Conclusion

Over the course of the six-week Ruby Country Net Zero Farming Forum, forum participants shared a range of actions which are already being undertaken on beef farms in the Ruby Country to reduce their greenhouse emissions including minimising the use of artificial fertilisers and greater utilisation of organic inputs; increased use of multi-species swards to improve soil health, biodiversity and animal health; minimising the use of bought in feeds and concentrates, with a clear focus on finishing animals from primarily grass-based systems. Whilst many positive actions were already being undertaken, the forum members identified a range of barriers to implementing some of the mitigation strategies discussed by the expert witnesses. These included a lack of locally tailored advice on Net Zero research and management practices, finance and planning issues preventing infrastructure improvements and purchase of low-carbon cultivation machinery which are key to cutting emissions; uncertainty in policy and financing which prevented some forum members from taking steps necessary to reduce their on-farm emissions.

There was strong resistance from the forum participants to the idea of intensification of the beef sector, with the majority stating that they felt that the Ruby Country was most suited to high quality, low-intensity production systems which utilised the region's good grass growth and high-quality natural environment to finish animals off on a predominantly grass-based diet. The use of traditional, locally adapted beef breeds such as the North Devon (also known as Red Ruby cattle) for which the region is named was also strongly favoured due to their ability to finish well off low-input grasslands such as the culm, their superior meat quality and their marketing potential.

As well as producing high-quality products in line with growing consumer demand for provenance, environmental impact and eating quality, the forum members also felt that the traditional beef farms of the Ruby Country had the potential to deliver considerable additional public goods such as biodiversity, carbon sequestration and flood management. Traditional and low-intensity management practices were also seen as key to maintaining the landscape character of the area which underpins its recreation and tourism offer.

Forum members wanted more support to help quantify and communicate the additional public goods delivered by their land and management practices, including assistance with carbon accounting and biodiversity monitoring. There was concern that the drive for Net Zero, combined with a changing policy and financial landscape, could force some smaller, less intensive farmers out of the industry, with these farms potentially incorporated into larger landholdings or used for carbon credit schemes linked to widescale afforestation.

There was interest from some forum members in opportunities to integrate more trees onto farms through systems such as silvopasture. However, participants generally felt that there was only limited scope for significant woodland creation on their farms due to the smaller average size of the beef farms in the Ruby Country, the high proportion of farm tenancies compared to owner-occupied farms, and uncertainties around future funding and policy. There was more support for carbon sequestration actions associated with hedgerow and grassland management which were felt to better integrate with the farm types and management practices within the Ruby Country. No forum members currently grow bioenergy crops and there were concerns voiced about the suitability of these to the Ruby Country, primarily linked to the costs associated with the specialist machinery, the impact on ground conditions during harvesting and transportation of crops to bioenergy plants.

The outputs from this forum are significant as they demonstrate the need to consider the local context when designing and implementing actions to achieve Net Zero for UK agriculture. Not all targets outlined by central government and national farming organisations were felt to be

appropriate or practical to the Ruby Country beef sector. Farming operates within a complex mix of financial, cultural, political and environmental factors. Each needs to be considered carefully when designing appropriate actions to achieve Net Zero outcomes. A focus on solely carbon is likely to lead to unintended negative consequences on other aspects of farming and land management and therefore it is imperative to look at the full range of public goods which are derived from our farmed environment before applying broadscale carbon targets.

The level of engagement, enthusiasm and passion shown by the forum members demonstrated that there is considerable desire within the local farming sector to engage in these discussions to ensure that mutually beneficial actions can be taken which not only deliver against Net Zero targets but also underpin a healthy, thriving farming sector for people and the environment. Evaluation undertaken with participants after the forum highlighted a strong desire to keep this conversation going and work together on the transition to Net Zero. Hopefully these farmers will be given a platform and opportunity to do so.

Glossary

Agroforestry - a land management system combining agriculture and trees – see [What is agroforestry? | Updated for 2021 | Soil Association](#) for more information.

Bokashi system - A system traditionally used in Japan to ferment organic wastes (including cow manures) that can be a supplement or alternative to conventional composting systems to manage and improve soil quality. It involves a fermenting (anaerobic) rather than an aerobic approach, i.e., excluding oxygen, produces organic fertiliser quickly and efficiently, and is considered to be associated with reduced greenhouse gas emissions.

BPS (Basic Payment Scheme) - the largest of the rural grants and payments to help the farming industry, previously funded via the EU. It will be replaced by the British Government from 2024 with the delinked payments scheme, which itself will be phased out by 2027 and replaced by other schemes including the ELM scheme (see below). See information about the [BPS here](#), and information on the [Delinked payments](#).

Culm Grassland - a priority grassland habitat found in North Devon on heavy, impermeable soils associated with the Culm measures, a geological stratum covering about a quarter of Devon which is comprised of mudstones, siltstones, sandstones, cherts and thin limestone deposited in the Culm Basin between the late Devonian and late Carboniferous period. Boggy and rich in biodiversity with a high potential for storing water, filtering pollution and retaining carbon. Sometimes known as 'Culm country', Culm grassland benefits from light summer grazing from traditional breeds with low protein requirement and low ground compaction such as Red Rubies. See: [Managing Culm Grassland – Devon culm](#) and a report by the [Devon Wildlife Trust](#).

ELM (Environmental Land Management) scheme - The ELM scheme is the Government's main agricultural payment scheme in England and Wales post-Brexit. This new financial incentive scheme replaces the previous Countryside Stewardship scheme and comprises three different schemes: the Sustainable Farming Incentive; Local Nature Recovery; and Landscape Recovery - see [Environmental Land Management schemes: overview - GOV.UK \(www.gov.uk\)](#) for more information.

FBTs – Farm Business Tenancies - at least part of the tenanted land is farmed throughout the life of the tenancy – see for the specific requirements of an FBT [Agricultural tenancies - GOV.UK \(www.gov.uk\)](#).

GHG Emissions – Greenhouse gas emissions. Greenhouse gases are gases whose molecules reduce the rate that solar heat energy in the Earth's atmosphere is lost back into space as infrared radiation causing a warming of global temperatures. Key greenhouse gases associated with agricultural production include carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O)

Net Zero - The state at which the greenhouse gases going into the atmosphere are balanced by removal out of the atmosphere. The British Government has set a legally binding target of achieving Net Zero greenhouse gas emissions by 2050.

Red Ruby Cattle/ 'Red Rubies' - traditional native beef cattle breed originating from Devon, also known as 'North Devons': see [Home - Red Ruby Devon Cattle](#) for more information

Sequestration – the process of capturing, removing and storing atmospheric carbon dioxide (CO₂), either by biological or geological means. Biological carbon sequestration occurs naturally in carbon sinks such as trees, soils, hedges, grasslands, peatlands, and the ocean. In an agricultural context,

carbon sequestration entails increasing the quantity and effectiveness of natural carbon sinks through various land management practices such as tree and hedge planting, and the restoration and protection of peatbog, woodland and grassland, as well as cultivation methods which promote carbon storage.

Silvopasture – A specific type of agroforestry which involves the integration of trees into pasture systems.

Stabiliser Cattle - A specialised hybrid breed of suckler cattle brought to England from the USA in the late 1990s which is a four-way cross between Hereford, Red Angus, Simmental and Gelbvieh: See [Home - Stabiliser Cattle Company](#) for more information

Swaling - Controlled burning of vegetation. A practice that helps to manage vegetation on overgrown heathland and grassland, clearing the ground of dead vegetation to allow new growth to come through.