

RURAL ECONOMY AND CONNECTIVITY COMMITTEE

SUBMISSION FROM SCOTLAND'S RURAL COLLEGE (SRUC)

THE DRAFT CLIMATE CHANGE PLAN (RPP3)

Introduction

SRUC (Scotland's Rural College) welcomes the publication of the Scottish Government's Draft Climate Change Plan (RPP3), and values the opportunity to comment on the proposals for the agriculture sector. SRUC is an innovative, knowledge-based organisation that supports the rural sector through research, education and expert consultancy services. SRUC wishes to see, and contribute significantly to delivering, a sustainable agricultural and rural land use sector in Scotland.

SRUC staff work in a broad range of areas¹ and our response to the call for evidence to review the third Report on Proposals and Policies (RPP3) for the Scottish Government's Climate Change Plan reflect this broad expertise drawing on research and consultancy knowledge and experience where appropriate. Several SRUC staff members have contributed to this submission² which has been coordinated by SRUC's Rural Policy Centre³.

We recognise that the ambitious targets set for national greenhouse gas (GHG) reduction will require significant efforts from the agriculture sector to reduce emissions and increase carbon sequestration. This is an area in which SRUC is heavily involved in research and consultancy activity, and we outline how this can support changes required in agriculture to deliver lower environmental impacts alongside an economically and socially sustainable industry. Indeed, SRUC have been heavily involved in providing scientific evidence on climate change mitigation to the Scottish Government³ and the Committee on Climate Change⁴ directly, and in collaboration with other Institutes in Scotland through the Scottish

¹ For more information see www.sruc.ac.uk

² Compiled by Steven Thomson, Vera Eory, Michael MacLeod, Jim Campbell, Rebecca Audsley and Chris McDonald: with further contributions from Kairsty Topp, Bob Rees, Mizeck Chagunda, Siobhan MacDonald, Janette Sutherland, and Joshua Bird. ³ <http://www.sruc.ac.uk/ruralpolicycentre/>

³ <http://www.gov.scot/Publications/2017/01/5347>

⁴ www.theccc.org.uk/publication/scotlands-rural-collage-sruc-ricardo-energy-and-environment-2015-review-and-update-of-the-uk-agriculture-macc-to-assess-abatement-potential-for-the-fifth-carbon-budget-period-and-to-2050/

Government's Strategic Research Programme, and through the Centre for Expertise on Climate Change (CXC)⁵ and through the new Centre for Knowledge Exchange and Impact.

In a similar vein to the Doing Better Initiative⁶ to reduce red-tape in farming and land management, undertaken by Brian Pack, we are keen that the Scottish Government exhaust voluntary or incentivised approaches (i.e. linked to support measures) to encourage wider uptake of mitigation measures before any regulated measures are introduced. This approach will give the industry time to promote the virtues of mitigation measures and facilitate voluntary uptake, against the backdrop of the threat of regulated actions. In relation to this we would also like to stress that cumulative effect of the proposed actions (if regulated) on agricultural business need to be considered, rather than thinking of each measure in isolation – for example, under the current RPP3 proposals an arable farmer may have to: (a) add legumes into their rotation; (b) add livestock grazing into their rotation; (c) use varieties that have improved nitrogen uptake; (d) plant trees; etc. that cumulatively may have significant business management consequences.

Our response considers the four overarching questions posed, and then our position on each of the policy outcomes, policies and measures are provided in Appendix 1 and some evidence on Farming for a Better Climate (FFBC) provided in Appendix 2.

⁵ <http://www.climatexchange.org.uk/>

⁶ <http://www.gov.scot/Topics/farmingrural/Agriculture/doingbetter>

Overarching Questions:

1. Progress to date in cutting emissions within the sector/sectors of interest and implementing the proposals and policies set out in the RPP2.

- Available evidence reveals that progress in cutting emissions from the agriculture sector has slowed in the past 4 years. In the most recent reporting year (2014), there was a small rise in nitrous oxide emissions. Historically, falls in emissions from the sector have not been as a result of direct climate policy interventions, depending instead on reduced fertilizer use⁷ driven by higher prices and changing management practices, or reduced livestock densities in upland areas⁸ driven by economics and the decoupling of the Common Agricultural Policy (CAP) support.
- A key contribution to the progress in agriculture cutting its emissions relates to the number of ruminants farmed in Scotland. Between 1990 and 2014 dairy cow numbers fell by about 23%, breeding ewes fell by around 34% and beef cow numbers fell by around 7%. In the dairy sector genetic improvements and improved management have led to more efficient milk production, and in the sheep sector changing management systems and breeds (less sheep farmed extensively) have led to productivity gains (around 5% more lambs per sheep / heavier lambs).
- In order to deliver the scale of emission reductions required by policies there is a need for the development of additional interventions to support reductions in the sector as it becomes a more important component of overall emissions. The main policy for agricultural decarbonisation set out in RPP2 was the FFBC programme, aiming to achieve around 50% uptake for most measures in the five key areas¹⁰. Though RPP2 included developing a monitoring framework for the uptake, there is no indication yet of progress in comprehensive monitoring of policy effectiveness or the uptake of the measures.

2. The scale of reductions proposed within their sector/s and appropriateness and effectiveness of the proposals and policies within the draft RPP3 for meeting the annual emissions targets and contributing towards the 2020 and 2050 targets.

- The draft RPP3 represents a considerable improvement from the previous RPPs relating to agriculture, particularly in terms of the details and the coverage of the

⁷ <http://www.gov.scot/seso/DatasetSearch.aspx?TID=71>

⁸ www.sruc.ac.uk/info/120484/archive/81/2011_response_from_the_hills and www.sruc.ac.uk/info/120484/support_to_agriculture_archive/54/2008_farmings_retreat_from_the_hills ¹⁰ <http://www.scotland.gov.uk/Publications/2013/06/6387>

policies and proposals. The suggested 0.8 Mt carbon dioxide equivalent (CO₂e) reduction is in line with the estimates provided to the TIMES modelling⁹ which suggested 1.2 Mt CO₂e mitigation in 2030 assuming 45% uptake of all the assessed measures (including 0.7 Mt CO₂e from afforestation).

- It must be noted that part of the mitigation proposals in RPP3 cannot currently be accounted for in the national inventory and contribute to national emission targets, in other words GHG progress cannot be directly recorded for all proposed policies / proposals (e.g. livestock feed additives, agroforestry)¹⁰.
- The fact that some on-going mitigation directly relating to agricultural activity (e.g. renewable energy installation, and biomass grown for energy generation) is not attributed to agriculture's envelope means that the true GHG mitigations efforts adopted by the agriculture sector are under-represented within the 'Agriculture and Related Land Use' inventory category. This needs to be taken into consideration in any burden sharing decisions related to agriculture or the non-Emission Trading System sector.
- There is no direct evidence whether two policies/proposals (soil testing and soil carbon sequestration) would indeed reduce GHG emissions. Although we know that there is a negative relationship between pH and nitrous oxide emissions (more nitrous oxide is produced from acid soils), increasing soil pH would probably not be reflected in lower reported emissions in the inventory, since this relationship is not represented in inventory modelling. There would, however, probably be a reduction in emission intensities given higher crop yields and lower nitrous oxide emissions; although the precise nature of this change requires some further research.
- Soil carbon sequestration not associated with a land-use change is not currently reported in the inventory. This is recognised as a gap, and current research being undertaken by SRUC and Ricardo-AEA is attempting to quantify carbon stock changes in grassland soils.
- With regards to the 2050 targets of zero net emissions, the draft RPP3 could be more ambitious: the suggested policies and proposals might be insufficient to bring down agricultural emissions enough in the longer term to achieve net zero emissions

⁹ SRUC have undertaken research for the Scottish Government on mitigation potential in agriculture, which has not been published at this time.

¹⁰ Moran, D., MacLeod, M., Wall, E., Eory, V., McVittie, A., Barnes, A., Rees, R., Topp, C. F. E., & Moxey, A. (2011) Marginal abatement cost curves for UK agricultural greenhouse gas emissions. *J Agric Econ* 62, 93118.

across the sectors. There is no clear indication on how efforts can be scaled up if the voluntary based policies do prove insufficient.

- Opportunities to redesign agricultural support, arising from Brexit, that link climate policy and agricultural and environmental policy are not considered in the plan, nor is the need to move from “provider gets” to “polluter pays” principle considered (e.g. the expansion of the carbon payment scheme to cover non-CO₂ gases could provide a strong signal to farmers to reduce emissions further).
- There is limited evidence on consumer demand for low carbon food products, and this is an already crowded area regarding quality assurance, animal welfare, environmental credentials, etc. It is likely that any consumer demand for such products will be adequately addressed by retailer schemes and some processors and farmers will react to price premiums / supply contracts accordingly. More emphasis on the consumption side, particularly on livestock product consumption, could help to reduce consumption-based emissions significantly - this approach can provide clear signals about Scotland’s commitment to environmentally sustainable food production and consumption and it is worrying that there is no cross reference to the proposed Good Food Nation Bill within the agriculture section of RPP3 (i.e. a lack of joined up policy development)

3. The appropriateness of the timescales over which the proposals and policies within the draft RPP3 are expected to take effect.

- The timeline drawn up in the draft RPP3 is feasible, though for a few number of policies/proposals shorter timescales could be possible. Quicker delivery could perhaps be achieved through greater uptake of on farm measures that improve technical efficiency of production, reduce GHG emission intensities and improve farm profitability - such as those demonstrated through the Scottish Government’s FFBC initiative. The one-to-many component of the Scottish Government’s Farm Advisory Service¹¹ (FAS) will promote key FFBC messages to the wider agricultural community, with the intent of facilitating more rapid uptake of GHG mitigation measures.
- Allocating funding for evaluating the impact of suggested policies and measures could provide valuable insights on the behaviour of all actors in the supply chain, thus improving the effectiveness of forthcoming policies.

¹¹ See <https://www.fas.scot/>

- It is hard to assess whether the £6.5M allocated to agriculture in the 2017-2018 Climate Change Budget is sufficient or not to cover the activities planned for that year. In particular, one of the items planned for 2017 (*Improve emissions intensity through genotyping, improving fertility, ...*) is a very broad topic and not well defined.

Only a few measures actually have absolute delivery dates attached to them.

4. The extent to which the proposals and policies reflect considerations about behaviour change and opportunities to secure wider benefits (e.g. environmental, financial and health) from specific interventions in particular sectors

- RPP3 has put a strong focus on maximising behavioural change through information provision schemes across the sector. It recognises the difficulties in generating change and addresses this issue by emphasising those aspects of mitigation activities which are of importance to farmers, like efficiency gains and cost savings. SRUC has been following this approach in its knowledge exchange (KE) activities, like when promoting the carbon calculator AgRE Calc©¹².
- Initial steps have been made towards joint up policies across the sectors, maximising the leverage co-benefits can provide between policies¹³. However, agricultural policies and proposals in RPP3 have made little effort to utilise some key policy links, for example regarding healthier diet (Good Food Nation policy¹⁴ and evolving approaches around Creating a Healthier Scotland¹⁵) and reducing waste and increasing recycling or materials and energy (Circular Economy Strategy for Scotland¹⁶). Mitigation effort in agriculture have been benefiting from environmental policies targeting nitrogen based pollutants (air and water pollution), particularly from the Nitrates Directive, Water Framework Directive, Integrated Pollution Prevention and Control Directive. These policies are defined at the EU level, and their effects in maintaining and improving agricultural and environmental conditions have been considered as a baseline policy. There is an urgent need to assess potential afterBrexit alternatives to these policies – as embedded in restructuring the full rural – agricultural – environmental policy landscape.

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<http://www.agrecalc.com/>

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<http://www.gov.scot/Publications/2017/01/5347>

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<http://www.gov.scot/Topics/Business-Industry/Food-Industry/national-strategy/good-food-nation>

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<http://www.gov.scot/Topics/Health/Policy/Healthier-Scotland-Conversation>

¹⁶

<http://www.gov.scot/Publications/2016/02/1761>

Appendix 1 - Evidence on Specific Policies and Measures

Policy Outcome 1 - Improved awareness: SRUC wholeheartedly support this approach before any regulated measures are introduced. It is of interest that the EU Commission is currently funding a suite of KE measures around agriculture that includes GHG mitigation¹⁷ from which best practice may be identifiable for uptake in Scotland. This Commission approach links to recommendations to the EU for using Rural Development Programme to support GHG mitigation in agriculture¹⁸.

Communication: The Scottish Government's Farming for a Better Climate initiative (FFBC) and the Soil and Nutrient Network (SNN) are examples where focus farms are used to showcase the benefits of adopting GHG mitigation and sequestration techniques on farms. Both the FFBC initiative and the one-to-many component of the Scottish Government's Farm Advisory Service (FAS) are delivered by SAC Consulting¹⁹ and efforts are ongoing to disseminate the positive messages arising from FFBC (and SNN) to a wider audience, through a range of appropriate media, that should facilitate more rapid uptake of mitigation measures.

- FFBC²⁰ is a network of 9 climate change farms across Scotland where the voluntary focus farms engage in assessing options and uptake positive climate change actions suited to their farming business over three years. The first tranche of FFBC ran from 2010-2013 with 4 focus farms and the current tranche (9 farms) runs from 2014 to 2017. A very wide range of measures have been assessed on the focus farms with uptake of numerous, practical, measures that have reduced carbon footprints, improved technical efficiency, with the added benefit of improving farm profitability. From 2010 to 2016 there have been around 150 FFBC events with around 3,000 attendees and evaluation feedback from 2014-15 suggest that a very high proportion (88%) of farmers providing feedback proposed to make changes on their own farm as a result of participation in events. Evidence from the first tranche of farms

¹⁷ <http://ec.europa.eu/eip/agriculture/>

¹⁸ http://bookshop.europa.eu/en/mainstreaming-climate-change-into-rural-development-policy-post-2013pbML0614002/?CatalogCategoryID=IPKep2Ix.xIAAAEn5nxL_IUy

¹⁹ A constituent part of SRUC

²⁰ www.farmingforabetterclimate.org

suggest carbon footprint savings of around 10-12% are achievable with average cost savings of around £20,000 to £25,000²¹ (See Appendix 2 for more details).

- SNN²² is a network of three focus farms (there have been more historically) that is to be expanded to 12 under the FAS. Farms act as exemplars for 1 to 2 years where full soil sampling and analysis is undertaken, soil biodiversity is examined, and soil and nutrient management plans established. This approach highlights the importance of understanding soil structures and nutrients and highlights approaches that can improve on-farm technical efficiency, reduce input costs and reduce GHG (and wider environmental) impacts.²³ Under the new, FAS funded, expanded SNN focus farms attendees at events will qualify for a reduction in soil sampling costs.

Agri-tech group: It will be essential to ensure that an appropriate mix of science and industry are represented on such a group, and full use should be made of existing centres of expertise (such as CxC), the agri-tech centres and representation from the Scottish Government's Affairs, Food and the Environment (RAFE) Strategic Research Portfolio 2016-2021. Consideration of stakeholder fatigue must be considered in the establishment of such a group, particularly in a period of agricultural policy change.

Climate change young farming champions: It is important to link this activity to existing programmes of formal education in the agriculture sector. We are unsure of the rationale for focusing purely on young farmers, who may be more aware of climate change issues already, and instead some wider climate change champions may have a greater positive impact in a shorter timeframe.

Carbon audits: We are unaware of existing evidence on the uptake of carbon auditing in agriculture across Scotland, particularly as there are a number of different commercial carbon calculators that farmers/crofters/wider land managers can use. Uptake of carbon auditing under the new Farm Advisory Service²⁶ has been relatively limited to date, although the programme is in its infancy. Some demand side action already

²¹ For examples of efficiency savings under the first tranche of FFBC please see the information sheets for [Torr farm](http://www.sruc.ac.uk/downloads/file/2745/torr_organic_dairy_-_efficiency_findings) (http://www.sruc.ac.uk/downloads/file/2745/torr_organic_dairy_-_efficiency_findings) and [Glenkilrie farm](http://www.sruc.ac.uk/downloads/file/2752/glenkilrie_-_benefits_from_reducing_emissions) (http://www.sruc.ac.uk/downloads/file/2752/glenkilrie_-_benefits_from_reducing_emissions).

²² http://www.sruc.ac.uk/info/120605/soil_and_nutrients/1355/soil_and_nutrient_network

²³ A number of information sheets are available highlighting the activities and impacts on SNN farms (http://www.sruc.ac.uk/info/120605/soil_and_nutrients/1355/soil_and_nutrient_network)²⁶
<https://www.fas.scot/carbon-audits/>

exists in that some retailers are insistent suppliers undertake carbon audits, but again, information on changing farm practice as a result of such audits is missing.

Consideration of how to better capture the collective engagement of carbon auditing and uptake of mitigation measures would appear to a priority (although the practicalities of this may be difficult due to the range of commercial, and free, carbon auditing products available).

Engage tenant farmers: Whilst we acknowledge that some tenant farmers may have difficulty in adopting mitigation measures (particularly where leases / tenancies are short-term) we believe that the focus should be all encompassing, including tenants, landowners and crofters. Generating evidence on barriers to uptake of GHG mitigation measures in the tenant sector would appear to be a priority to focus endeavours to improve uptake in this sector.

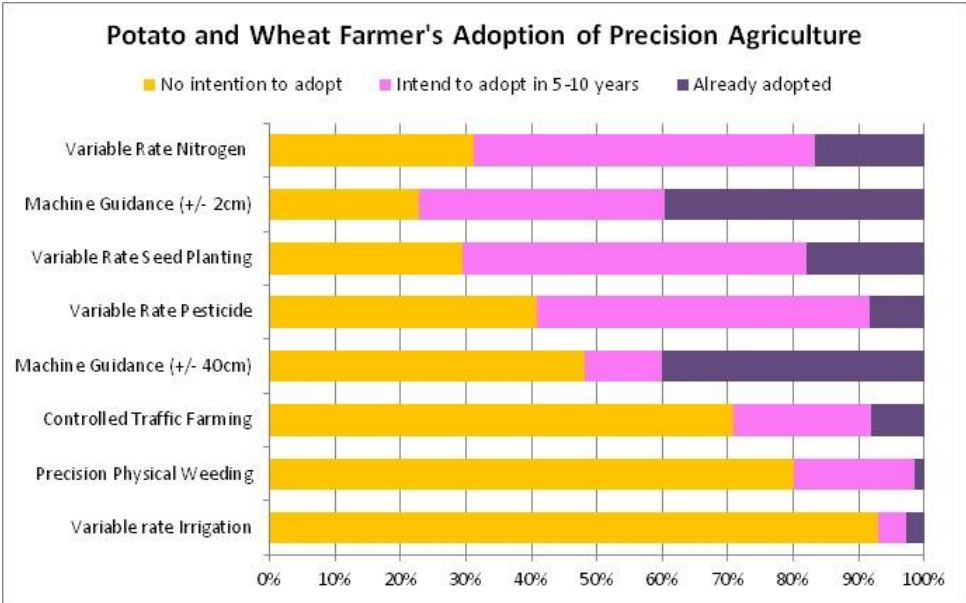
Marketing scheme: Before any steps are taken towards a low carbon marketing scheme the Scottish Government should provide evidence that it will have the intended effect: i.e. is there convincing evidence that consumers want information on the carbon footprint of their food, or that the provision of such information would influence consumer behaviour? It may be worth considering a (revenue neutral) carbon tax on foods as an alternative, although this would be technically and politically challenging.

Policy Outcome 2: Emissions from nitrogen fertiliser. SRUC are supportive of the policy outcome to have more targeted fertiliser use and improve soil structures across Scotland. We believe that voluntary approaches should be used in the first instance, with improved KE on the benefits from adapting farmland practices, such as nutrient budgeting and soil sampling before any regulatory approach is considered. It is noteworthy that that the Scottish malting barley sector is based on producing low nitrogen malting spring barley (that may lead to lower potential nitrous oxide emissions). Opportunities also exist to increase the use of cover crops²⁴ something that can be encouraged through more demonstrations and trials followed up with effective KE demonstrating the efficiencies farmers can achieve from such practices.

Precision farming and nitrogen-use efficiency: SRUC are supportive of the policy to improve KE, and demonstrate benefits of precision farming on soils and nitrogen use efficiency. It is a rapidly evolving sector and there are a number of new precision

²⁴ SRUC have on-going work exploring the effects of cover crops on N dynamics

farming techniques being developed, however more research (currently underway) is required to fully evaluate their mitigation potential. There is perhaps a role to link some of the work being done by the agri-tech centres, in particular the Agricultural Engineering Precision Innovation Centre (Agri-EPI) and its network, to ensure that GHG mitigation potential is routinely assessed in technological developments. In 2012 surveys in England reported that between 2% and 22% of farms reported using various precision farming technologies (mostly Global Positioning Satellite- GPS for autosteering, variable rate applications and soil / yield mapping)²⁵. Ongoing research at SRUC for the EU's Joint Research Council shows the uptake of various precision agriculture options in the wheat and potatoes sector in Scotland, where machine guidance has the highest level of existing adoption. The results also reveal that planned future adoption of machine guidance is relatively high alongside use of variable rate planting, pesticide and nitrogen applications, suggesting that the cropping sector, through natural progress, will adapt to some climate change mitigation measures



relating to precision farming.

Science-based target for reducing emissions from nitrogen fertiliser: SRUC

welcome a scientific approach to setting targets, in particular drawing on the evidence that has been, and is being, developed across the Scottish Institutes working on the Scottish Government's (RAFE) Strategic Research Portfolio 2016-2021. In particular, it would be beneficial to ensure that any reduction targets are SMART (Specific,

²⁵ <https://www.gov.uk/government/statistics/farm-practices-survey-october-2012-current-farming-issues>

Measureable, Achievable, Realistic and Time-based) for different soil types. To that end, nitrogen-use efficiency benchmarking for different soil types, based on use-intensity (i.e. per unit of output), would provide farmers meaningful targets to move towards. A key to this is generating greater uptake and use of nutrient planning and nutrient balancing (i.e. understanding latent soil nutrients, what nutrients are applied through organic and inorganic fertilisers, and what nutrients are removed from the soil through farming activities). Improved KE and greater awareness of best practice²⁶, through monitor farms, FFBC, SNN, FAS, etc. would help move towards this objective through a voluntary approach. This policy will deliver important outcomes beyond GHG mitigation (e.g. water and air quality, biodiversity and soil quality) and it is important to ensure links to those wider policy objectives are made, and efforts are made to quantify these GHG mitigation actions may have on other priority policies.

Soil testing: We would advocate that a voluntary approach to improving soil sampling uptake is utilised initially, with industry support, before any regulatory requirement is implemented. Data collected by the Scottish Government²⁷ reveals that nearly a third of farms routinely conduct soil sampling on grassland, with nearly two thirds conducting pH tests on cultivated land. Evidence from SRUC's Analytic Services Department²⁸ shows that of 10,000 field soil samples in 2015-16, 34% were below pH6 (target for grass) with 40% between pH6 and pH6.5 (target for cropping)²⁹. The issue with stand-alone pH testing is that it does not take account of the organic matter of the soil, which plays a critical role in determining liming recommendations to maximise nitrogen use efficiency. Best practice advice should, therefore, include a recommendation for routine analysis that would assess organic matter and also phosphorus and potassium although there is a trade-off with cost (roughly double a soil pH cost). Additionally, it may be necessary to support farmers undertaking soil sampling to ensure the appropriate action is undertaken on receipt of results (e.g. appropriate application of lime and reduced nitrogen fertiliser application) and perhaps in undertaking a nutrient plan from the farm. It would also be worth considering how monitoring of changes in management practices will be undertaken. Whilst such soil sampling could potentially reduce nitrous oxide

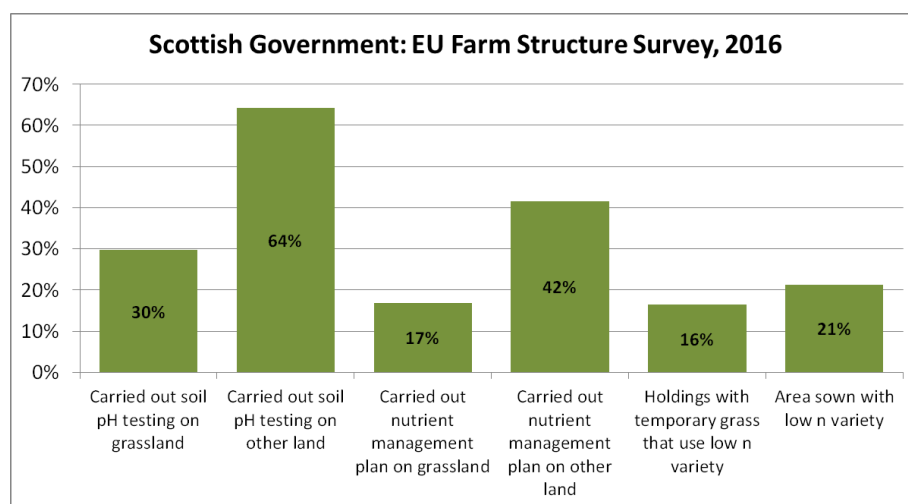
²⁶ For example SRUC have a suite of Technical Notes that demonstrate across a wide range of topics, that includes fertiliser use and nutrient budgeting, etc. See: <https://www.fas.scot/publications/> and http://www.sruc.ac.uk/downloads/120202/technical_notes

²⁷ <http://www.gov.scot/Publications/2016/11/4283>

²⁸ http://www.sruc.ac.uk/info/120148/analytical_services/645/soils

²⁹ This does not include over 40,000 soils samples from points in fields taken using GPS to provide a more accurate soil mapping picture.

emissions (and increase yields / lower emissions intensities) the current inventory does not reflect this and further research is required to establish the magnitude of emissions reductions and fully understand the nutrient requirements for the range of grassland types present in Scottish agriculture.



Minimum leguminous crops in rotation: The existing Ecological Focus Area (EFA) Greening rules for Pillar I of the CAP encourage farmers to sow legume crops. However, the EFA rules could be improved to encourage greater uptake in rotations by relaxing the requirement to plant two different legume crops and removal of the 1st August harvest date. Harvesting of legume crops such as protein peas and beans can be difficult in wet seasons and is a need for more research on how to best retain nitrogen following a legume crop (e.g. use of cover crops, specific cultivation methods). Consideration will need to be given to the agronomy skills required to grow legumes successfully (may be lacking on some arable farms) and any additional costs that this approach may require farmers to undertake.

Plant varieties with improved nitrogen-use efficiency: Whilst this move appears sensible there would need to be cost effective varieties for farmers to utilise that do not compromise the market potential of the crop. It is likely that this approach will be important in longer term mitigation and it could also involve more extensive use of newly developed plant mixtures and intercrops. An important indicator is to ensure a reduction in nitrous oxide emissions per unit of nitrogen input.

Policy outcome 3: Work to improve red meat and dairy emissions intensity. SRUC are currently developing a benchmarking system for the Scottish Government³⁰ and have been involved in assessing emissions intensity in both research and on-farm environments³¹. The emphasis on the benchmarking should be to identify ways with which to improve the efficiency of a particular system, i.e. keep it pre-competitive. Using the benchmarking as a marketing tool for a particular commodity, system or location could prove counter-productive as the lowest GHG system is not always the one that provides the greatest social benefit once all externalities (e.g. water quality, animal welfare, biodiversity etc.) are accounted for. It is worth noting that QMS published emissions intensities for cattle and sheep³⁵ in 2016 using SAC Consulting's AgREcalc³⁶. The QMS results revealed "the wide diversity of emissions within and between enterprise types, and the correlation between emissions and financial performance". Care must be taken in comparing different systems, particularly lowland and upland systems, as farming opportunities are more constrained in the latter. Publishing figures could have a detrimental effect if consumers perceive red meat to have high figures – especially lamb from remote hill areas – and there are no balancing good points communicated, such as the benefits of High Nature Value farming systems.

Encourage improved emissions intensity through genotyping, improving fertility, reducing animal mortality and improving farm management practices: SRUC support these approaches, particularly in the adoption of best practice and uptake of benchmarking to act a stimulus for farmers outwith the top quartile. The current Beef Efficiency Scheme (BES) aims to achieve similar goals but whilst the scheme has been bedding-in it has proven challenging for some farmers to implement in practice. A modified BES and similar scheme for sheep, with easy recording, could improve uptake to help attain this objective. We would suggest that the efforts to reduce emission intensities needs to go beyond working solely with Quality Meat Scotland (particularly as they do not cover the dairy sector) and include

³⁰ See Benchmarking the emissions intensity of Scottish livestock
<http://www.climatechange.org.uk/reducingemissions/emissions-livestock-production/>

³¹ See Ross, et al. (2014) Effect of cattle genotype and feeding regime on greenhouse gas emissions intensity in high producing dairy cows. Available at:
www.sciencedirect.com/science/article/pii/S1871141314004788 ³⁵ See QMS (2016) Cattle and Sheep Enterprise Profitability in Scotland. Available at:
<http://www.qmscotland.co.uk/cattle-and-sheep-enterprise-profitability-scotland-2016-edition> ³⁶
<http://www.agrecalc.com/>

a wide range of institutes (e.g. Moredun, SRUC, NFUS, Scottish Crofters Federation) and delivery mechanisms (e.g. FFBC, FAS, Monitor Farms).

Establish target for reduction in the emissions intensities: SRUC firmly believe that any targets should be based on robust evidence that is grounded in research. Current and previous work has shown some important trade-offs and synergies with other traits that need to be taken into account. Previous research, undertaken at SRUC³², on reducing methane emissions per kilogram of milk showed an increase in nitrogen loss.

Consult to determine the nature of livestock health measures: Recent research³³ suggests that improving health could reduce GHGs in Scotland costeffectively, with some diseases being more tractable and more cost-effective to control than others.

Livestock feed additives to reduce methane: A recent CxC report³⁴ suggest that there is some mitigation potential in this which merits further study given the scale of enteric methane emissions in Scotland.

Policy outcome 4: Emissions from the use and storage of manure and slurry will have been reduced: SRUC sees the improved treatment of manure and slurry an important contributor to goals of circular economy, also contributing to GHG mitigation, energy efficiency and improved recycling of nitrogen and phosphorous.

Feasibility of self-financing large-scale anaerobic digesters. Due to the large capital cost of anaerobic digestion equipment, this solution is likely to be more successful than supporting small scale digesters. To date some higher value feedstock such as energy crops have been used in most farm scale plants so that a higher yield can be achieved; an increased incentive payment for the use of wastes would improve the use of waste products. The integrated approach suggested by the Scottish Government (looking at feedstock availability, grid connectivity, use of digestate) is essential in developing long term solutions. Crop types and seasonal availability of spreading land also need consideration.

³² See Chagunda, et al (2009) Effect of genotype and feeding regime on enteric methane, non-milk nitrogen and performance of dairy cows during the winter feeding period.

³³ See Skuce et al. (2016) Livestock Health & Greenhouse Gas Emissions. Available at: <http://www.climatexchange.org.uk/reducing-emissions/emissions-livestock-production>

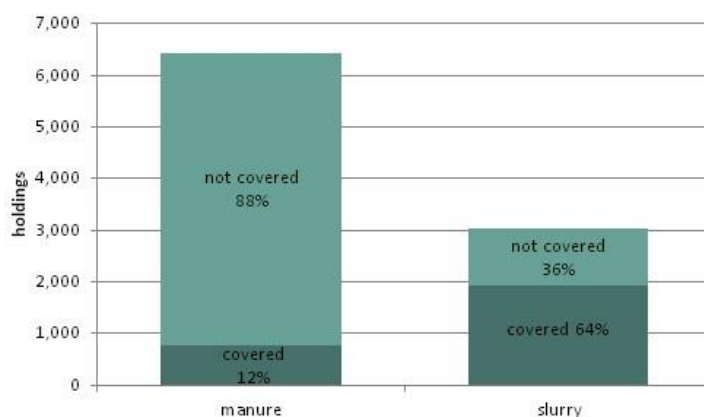
³⁴ See Rooke et al. (2016) Nutritional strategies to reduce enteric methane emissions. Available at: <http://www.climatexchange.org.uk/reducing-emissions/emissions-livestock-production/>

Improving the use and storage of manure and slurry: Sampling of slurries and digestates has been encouraged by various Scottish Government initiative, such as FFBC and SNN, and the resulting appreciation of the reduced need for mineral fertilisers is appreciated by many farmers. Manure storage improvements should be coupled with increased use of low ammonia emission spreading equipment and manure planning (to match crop requirements) to fully utilise the nutrients saved during storage.

Inclusion of livestock grazing in rotation on current arable land: This option could be feasible where the arable farm still has the infrastructure for livestock (including fencing solutions) and grass management. However, this should only be encouraged as best practice and should not be implemented as a statutory requirement. If the farms do not have adequate infrastructure it would require a significant investment in capital. Furthermore, husbandry skills, biosecurity and livestock transportation issues need to be fully considered. Slurry/manure and/or digestate exchange could be a more practical solution in many cases³⁵.

Determine how to consistently minimise emissions from slurry storage:

A consideration of all options including covers and also anaerobic digester where a new storage facility is planned could be made³⁶. Opportunities to share best practice with other European countries exist (e.g. Denmark). Scottish Government data from the European Farm Practice Survey³⁷ reveals relatively low levels of covering of manure and slurry in Scotland.



Policy Outcome 5: Carbon sequestration and expanded woodland/forestry and hedgerows: SRUC fully support the aspirations of this outcome.

³⁵ See Macleod, et al (2016) Review of options for reducing greenhouse gas emissions via cattle slurry management in Scotland http://www.climatexchange.org.uk/files/3114/8120/1143/Review_of_options_for_reducing_greenhouse_gas_emissions_via_cattle_slurry_management_in_Scotland.pdf
³⁶ <http://www.climatexchange.org.uk/reducing-emissions/farm-technologies-reduction-greenhouse-gasemissions-scotland/>
³⁷ <http://www.gov.scot/Publications/2016/11/4283>

Increasing planting of trees and hedgerows: Shelterbelts could be encouraged to provide nitrogen fixing as well as farm shelter in pastoral systems and agro-forestry systems can contribute to this goal considerably. Therefore the recent announcement that: (a) Hedges will be able to count as a separate type of EFA and (b) Agro-forestry supported under the Forestry Grant Scheme and located on temporary grassland will be able to count as EFA are most welcomed.³⁸

Payment for carbon sequestration: Voluntary schemes for forestry and peat in Scotland already exist³⁹, a government run official regulated scheme could encourage uptake. Expansion of the carbon payment scheme to cover non-CO₂ gases could provide an economic incentive to farmers to reduce their emissions further. Payments for afforestation should ideally be linked to the *net* GHG benefit, taking into account any indirect emissions induced by loss of production in Scotland.

Woodland cover targets for agricultural land: Grant rates would need to be increased to encourage any move from livestock or crop production, especially where fencing is required. Incentives should be targeted at existing land-owners/farmers, especially in the upland grazing areas, to provide support for farmers. This is to reduce dependence on livestock farming in the event that agricultural support is reduced after Brexit.

Appendix 2 Farming for a Better Climate

Farming for a Better Climate (FFBC⁴⁵) is Scottish Government initiative delivered by SRUC. FFBC works with farmers to find practical ways to move towards a more profitable, low carbon future, adapt to climate changing whilst securing farm viability for future generations. FFBC utilizes volunteer Climate Change Focus Farmers, and associated farmer discussion groups, to investigate the benefits a range of, practical, low-carbon activities can bring to farm businesses across Scotland.

³⁸ <http://news.gov.scot/news/common-agricultural-policy-update>

³⁹ <http://www.forestry.gov.uk/carboncode>, <http://www.iucn-uk-peatlandprogramme.org/peatland-code> ⁴⁵
https://www.sruc.ac.uk/info/120175/farming_for_a_better_climate

FFBC hosts a number of events across the year, both at the climate change focus farms and as one off efficiency events at farms across Scotland. Specialist consultants work with the host climate change focus farmer to identify and aid implementation of climate change mitigation measures; these are then shared with the visiting farmers at the farm meetings. Focus farms each host about 5 meetings per year, and other farmers are invited to hear from specialists and exchange practical ideas to mitigate climate change whilst improving farm efficiency.

The first round of climate change focus farms (2010-2014) demonstrated an average 10% reduction in the carbon footprint, with no loss of production, and an average saving of £24,000 through practical, low or no cost mitigation measures. This showed that even technically efficient farmers could still make both carbon and financial savings. SRUC are currently working with 9 climate change focus farmers, in the second round of focus farms that are due to report in 2017/18. Case study information sheets⁴⁶ are available for all past (see Glenkilrie⁴⁷, Torr⁴⁸, Upper Nesbit⁴⁹ and Stewart Tower⁵⁰), and current, FFBC focus farms that detail the wide range of GHG mitigating actions investigated and implemented along with details of the cost savings and reduction in carbon footprint achieved.

Over 30 FFBC events were held across Scotland in 2014/15 with 900 attendees. Evaluation feedback from farmers showed high levels of satisfaction in the with 88% of farmers returning an evaluation questionnaire stating that they would make changes to their business on the strength of the information presented at the meeting: The measures FFBC attendee farmers expressed that they would consider adopting included:

- Adding buffer zones
- Analysis of fodder
- Apply for AECS funding
- Attention to detail for colostrum
- Improve bull management
- Carry out more soil sampling
- Change grass varieties
- Use clover leys
- Evaluate renewable energy options
- Consider cover crops
- Improve grassland management
- Evaluate keeping cows inside
- Consider more drainage
- Look at ages for culling older stock
- Look at energy use
- Look at herd health planning
- Look at improving soil structure
- Look at water use
- Consider minimum tillage
- Monitor fuel use
- More aggressive focus on feed
- More colostrum given earlier
- More efficient grass use
- Nutrition/dietary changes for livestock
- Pay more attention to grass quality and growth

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http://www.sruc.ac.uk/downloads/120652/climate_change_focus_farms

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[http://www.sruc.ac.uk/download/downloads/id/2752/glenkilrie - benefits from reducing emissions](http://www.sruc.ac.uk/download/downloads/id/2752/glenkilrie_-_benefits_from_reducing_emissions)

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[http://www.sruc.ac.uk/download/downloads/id/2745/torr_organic_dairy - efficiency findings](http://www.sruc.ac.uk/download/downloads/id/2745/torr_organic_dairy_-_efficiency_findings)

[http://www.sruc.ac.uk/download/downloads/id/2760/upper_nisbet - beef and arable](http://www.sruc.ac.uk/download/downloads/id/2760/upper_nisbet_-_beef_and_arable)

[http://www.sruc.ac.uk/download/downloads/id/2744/stewart_tower_dairy - wind turbine](http://www.sruc.ac.uk/download/downloads/id/2744/stewart_tower_dairy_-_wind_turbine)

- Consider other sources of nutrients
- Consider paddock sizes
- Consider weed wiper
- Consider yield mapping
- Draw up specific rations for livestock
- Improve calf feeding
- GPS soil samples
- Finish cattle sooner
- Finish cattle to market specification
- Improve footcare
- Graze sheep better
- Install heat recovery from dairy
- Improve calf housing and floor ventilation
- Improve drainage
- Improve early calf care
- Improve handling facilities
- Improve rationing
- Improve use/understanding of nutrient budgeting
- Improve/increase soils knowledge
- Look at lime spreading practice
- Implement rotational grazing
- Seek drainage advice
- Select breeding heifers differently
- Semen test bull
- More regular soil analysis
- Soil management
- Soil nutrient mapping
- Spread manure on grassland
- Take advantage of EID
- Take note of grass heights
- Try to get a better pH balance
- Try to improve grazing practice
- Use grass better
- Use more slurry
- Weigh cows and calves more frequently

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- Possibly upgrade sheep fank
- Re-assess grassland requirements
- Reduce P levels
- Tighten calving period / remove bull sooner