Farming for 1.5°

Independent inquiry on farming and climate change in Scotland

Recommendations to Scottish Government on funding priorities for the Agricultural Modernisation Fund

June 2020

Context

Climate change is already affecting Scottish farmers and land managers and their ability to produce food and other products in the same way as in the past. The Scottish Government's agricultural transformation fund, with initial funding of £40 million

"will support the agricultural industry to undertake a range of potential actions to reduce greenhouse gas emissions and support sustainable farming and land use.It will also seek to improve the environmental sustainability of the sector by protecting and restoring natural habitats and building sustainability through business practices that encourage productivity, innovation and inclusion."[1]

To understand the need for this transition it is important to think of the future context that Scottish farmers and land managers will be working in. From a consumer/ citizen expectation, as the second largest emitter of GHG's Greenhouse Gases (GHG) in Scotland, agriculture needs to reduce its emissions but equally without simply exporting those emissionsthem. Long term changes in diet preferences of the population will continue, but this is now coupled with the repercussions of covid-19. Where people eat is changing, as is the increased demand for local food - both in provenance and in retail spaces.

Management of future risk is key to all business continuity. Parallel to the current risks posed by the pandemic, changes in weather and climate will continue to dominate the success of Scottish agriculture. For the most recent decade (2008-2017) Scotland has been on average 11% wetter than 1961–1990[2]. Winters are expected to be as much as 31% wetter[3], although cold or dry winters will still occur at times. Summers are projected to become hotter and are more likely to be drier, although wetter summers are also possible. By 2050, heatwaves like that seen in 2019 are expected to happen every other year. In all seasons much of the precipitation will be in heavy events rather than spaced out over time. In May this year, Eastern Scotland recorded its driest ever May while Achnagart on the West Coast recorded the highest rainfall accumulation at a Met Office site. February was the wettest February on record for the country as a whole[4].

This makes clear that it is already not business as usual and a much higher level of flexibility is and will be needed by businesses and communities directly reliant on and/or exposed to the weather. In 2017 the UKCCC advised that "more action is also needed to encourage the wider uptake of management practices that help to reduce the impacts of low and high flows."

Hotter weather and higher levels of CO2 may make growing some crops easier while limiting others, or even allow us to produce new ones. However, with more droughts expected, water may not be as easy to access or to reply on, making it harder for farmers to plan the growing season.

General Principles

The Farming for 1.5°C Panel is a group of scientists, academics, farmers and environmental NGOs looking for consensus on how Scottish agriluture can positively contribute to limiting global warming to 1.5°C. It is co-sponsored by the National Farmers' Union of Scotland and Nourish Scotland and is hearing evidence from a range of experts and stakeholders with a view to produce a final report at the end of 2020. The panel sees the Agricultural Modernisation Fund as an important tool in supporting Scottish agriculture, our rural communities and our natural systems as we meet the obligations of the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.

1 https://news.gov.scot/news/moving-to-low-carbon-farming
2 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-overview-summary.pdf
3 https://documents.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Scotland-National-Summary.pdf
4 https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2020/2020-spring-and-may-stats

Although this year's fund is focused on capital spend, the Farming for 1.5°C Panel urges that any spend must be part of a longer-term budgetary commitment that includes training, skills, advisory services and capacity building which will feed directly into a Green Recovery. Specifically, training and re-skilling for new approaches and technology such as Precision Agriculture technology[5/6], farm level decision support systems and Monitoring Reporting and Validation (MRV). This should cover both 'tech' in terms of on-farm monitoring equipment and online user interfaces. Support needs to include advisory services, training and the expansion of the advisory capacity to allow for 1-2-1 level support in implementing new approaches and technologies. This can then serve as the basis for a move to new financial support systems that align with net zero.

Further, it is crucial that baseline data is better collected across all sectors so that the effectiveness of actions can be measured in GHG emission reductions and improvements in environmental sustainability. Methods that could be used to collate this include soil testing, a water management plan, a herd health plan, a carbon audit and nitrogen balance sheet base line data.

It is worth adding that any improvement in "productivity, innovation and inclusion" should improve the productivity and animal welfare of the livestock sector in Scotland but not with the aim of increasing total numbers. Our recommendations are for improvements in total productivity, not merely in emissions intensity of production. These should reduce the inherent waste in the system from the outset. Further innovative thinking such as using sexed semen and fertility checks as standard will create further financial and GHG savings.

Restrictions and Allowances

Public money should be for public good with clear connections between the two. As such we recommend the following restrictions and allowances (as well as those included under specific activities) to try to reduce any unintended consequences. Continuous learning by the policy actors throughout this programme is crucial to ensure it truly is transformational.

- Individual farm businesses, groups of farm businesses and agricultural contractors should all be eligible but there should be some scrutiny of affordability.
- Co-operative applications from two or more farmers should have preferential scoring and/or a higher intervention rate.
- Waste/slurry management initiatives should be supported by a requirement for biosecurity protocols to avoid disease risk. The conditions of climate change mean increased disease risk and this needs to be managed appropriately.
- Grants should be part of a whole farm plan, with overall reduction in on-farm emissions. Even in the first year, before 'whole farm plans' come into force, applications need to be written with the whole farm in mind.
- These capital grants should not include tree-planting or peat restoration which are and should be funded elsewhere.
- Total grants per business should be capped at £100 000.
- There should be a follow up at years 1 and 3 to measure whether there have been any improvements in GHG savings, sequestration or greater biodiversity. This can inform future fund management and determine the success of different measures. Potential savings in GHG emissions, sequestration, biodiversity should be quantified into a target when funding is awarded.

[5] https://sefari.scot/blog/2019/04/08/is-smart-farming-a-solution-for-scottish-agriculture

[6] https://ec.europa.eu/jrc/en/publication/contribution-precision-agriculture-technologies-farm-productivity-and-mitigation-greenhouse-gas

Pilot scheme suggestions

The fund also has huge potential for supporting pilot schemes which we list below.

- Converting organic residue streams to biochar and using this to sequester carbon on farm and/or to sell to other farms
- Testing feedstocks and biochar production methods to result in the best material for methane reduction when used as a feed additive.
- Testing of 3NOP feed additives across a range of production systems.
- Identification of traits that are key to reducing GHG emissions. Support on-farm evaluation and development of genomics as a National programme.
- Development of agroforestry corridor models to optimize timber quality, alternative products and grazing value.
- Whole farm planning including the inventory of sequestration and key habitats.
- Linking on-farm management changes to regional land use frameworks.
- Support the Pig Health initiative (see Annex 1).
- Develop a database to support a national Johne's disease control programme. MAP/ Johne's disease has been identified by ADAS and the Scottish Climate Change disease group as one of the most important GHG cattle diseases. Johne's disease impacts production efficiency, causes premature culling of breeding stock, can be a welfare issue and may be linked to Crohn's disease. Livestock Health Scotland is piloting a matrix-based risk reduction programme in beef herds delivered through farm vets. This could be linked with the CHeCS Health schemes and the Dairy Johne's programme.

List of recommendations

The list below has been collated from suggestions from the Farming for 1.5°C Panel. The Panel includes farmers from a variety of sectors, scientists from a range of specialisms and civil society actors[8]. The list of recommendations below is divided into measures that would

a support system change

b improve infrastructure, including nutrient and water management

c improve equipment, including precision technology, energy efficient technology

d and other interventions.

In all of these categories there are overlaps, particularly with individual measures supporting system changes, but we have tried to reduce repetition for brevity sake. We have tried to indicate where these measures correlate with the aims of the fund but have not gone into much detail. We have also highlighted where the panel recommends there are particular restrictions.

The Panel understands the potential unintended consequences of distorting the market in providing financial support to some things and not to others, as well as the potential for some farmers to have already invested in equipment who will now miss out on this assistance. However, in the context of the climate and nature emergencies it is crucial to support Scottish Agriculture to reduce its GHGs and environmental impacts as quickly as possible, for its own success.

[8] The Panel's details are available in Annex 2.

Measure	Reduce GHG emissions	Support sustainable farming and land use	Protect and restore natural habitats	Encourage productivity, innovation and inclusion	Need for restrictions?
Supporting system change					
Certification costs to convert to organic farming methods	WWF Scotland report *Delivering on Net Zero*[9] shows that organic farming has most potential for reducing GHG emissions as a system in Scotland	Yes, it is the basis of the organic farming system	Yes through reduced chemical and input use		
Converting to cow with calf schemes	Fewer livestock for more product as both milk and beef produced	Higher animal welfare		Fewer livestock for more types of product. Innovative approach to dairy farming	
Development of Integrated Health Data for strategic disease control (as shown by the Scottish pig industry – see annex 1)	Better health reduces GHG emissions. Output per sow has risen by 30%, thus reducing GHG emissions per kg output	Fewer antibiotics used and healthier animals. Disease risk will increase as the climate warms		Improved productivity reduces costs	
Supporting organic supply chain (right size processing – milling, veg washing, milk pasteurising and bottling)	Indirectly through supporting organic production	Indirectly through supporting organic production		Yes	

[9] https://www.wwf.org.uk/sites/default/files/2019-12/WWF%20Net%20Zero%20and%20Farming.pdf

Measure	Reduce GHG emissions	Support sustainable farming and land use	Protect and restore natural habitats	Encourage productivity, innovation and inclusion	Need for restrictions?
Infrastructure					
Fencing to support reintroduction of livestock on arable farms	Reduced inorganic nitrogen fertiliser used and reduced emissions from stored slurry	Increasing soil carbon	Reduces ammonia from storing manure thus reducing air and water quality risks	Improved soil health meaning reduced inorganic nitrogen and manure requirements	No increase in stocking levels for 5 years
Fences for mob grazing		Potential for increased soil carbon	By providing more space for nature	Increases productivity of the grass	Not with a view to increased overall stocking – Eg carry same stock on 80% of the land, put 20% into woodland, natural regeneration, peat restoration, wetland etc)
Fences and troughs to allow arable farmers to work with livestock farmers who can provide animals to graze leys and increase diversity on farm through rotations		Better adaptive businesses to deal with changing water needs		Increase collaboration and encourage new entrants who may be more open to alternative approaches	Enhanced rate if the new break crop grazing enterprise is managed by a share farmer (new entrant)
More internal fencing (electric or permanent) to allow more days at grass and better access to get slurries and FYM back onto the land more easily	Lower use of imported feed, reduced housing emissions, reduced slurry storage and associated emissions				
Better fencing to protect trees as part of agroforestry schemes	Increasing sequestration potential in trees, increasing carbon storage in soils, increasing potential water storage capacity of soils		More trees in the landscape with a multifunctional use and planted in a diverse polyculture would support a diversity of fauna and flora	Potential to support innovative product development such as nuts, woodcrete, herbal medicines, beauty products and more	
Fencing off wet areas to allow natural regeneration and water filtration		May support natural flood protection and reduces soil compaction	Yes	Improved adaptation to drought and intense precipitation events.	
Better tracks		Adapt to intensive precipitation events			Requires water run-off management plan
New gate-ways		Reduce soil compaction, reduce run-off pathways thus reducing soil erosion	Reduces nutrient overload in water courses		

Measure	Reduce GHG emissions	Support sustainable farming and land use	Protect and restore natural habitats	Encourage productivity, innovation and inclusion	Need for restrictions?
Nutrient Management					
Scrappage scheme for splash-plate slurry tankers	Increased retention of applied N in soils using alternative technology		Reduced ammonia emissions	Improved nutrient use productivity leading to greater productivity	Will need some restrictions
Upgrading of slatted sheds with rubber facings	Better waste management	Better animal welfare		Better animal welfare leading to higher productivity	
Covers for slurry stores	5-7ktCO2e[10]	Reduced eutrophication risk	Reduced ammonia emitted during slurry storage	Yes	Explicit condition of pairing with precision application
Innovative/integrated approaches to keep livestock at pasture longer. E.G. easier access to spreading farmyard manure and slurry	Reduces emissions from waste storage			This can reduce slurry store requirements.	
Collaborative waste hubs for groups of farms using low emission technology, including separation systems and Anaerobic Digestion.	Yes			Yes	Requirement for disease control management programme. Restricted to feedstock only from waste materials
Covers for middens	Reduces nitrous oxide emissions.	Adaptation to changing weather patterns, improved local environment	Reduce run-off and potential for diffuse pollution		Explicit condition of pairing with precision application

[10] https://www.climatexchange.org.uk/media/2035/review_of_options_for_reducing_greenhouse_gas_emissions_via_cattle_slurry_management_in_scotland.pdf

Measure	Reduce GHG emissions	Support sustainable farming and land use	Protect and restore natural habitats	Encourage productivity, innovation and inclusion	Need for restrictions?
Water Management					
Rainwater harvesting systems	Reduction in GHG emissions if using mains water or if pumping on-farm	Improved adaptation to changing weather patterns	Reduced abstraction from local environment and reduced massive additions to local water courses during high rainfall events	Reduced water and electricity bills	
More efficient irrigation systems including variable rate irrigation	Less pumping reduces energy and water use	Improved adaptation to changing weather patterns	Reduced abstraction from the local environment	Better use of resources	
Clean/dirty water separation infrastructure including recycling of clean water	GHG reduction if using mains water and/or pump		Reduces toll on local aquatic systems		
Systems allowing greater flexibility for watering livestock such as fitting isolation valves to assist leak identification	Greater water use efficiency reduces energy and water use	Increases resilience in the face of climate change impacts	Reduces toll on local aquatic systems	Reduces water bills, more efficient use of labour and increases business flexibility	
Equipment					
Alternative weed control including field scale sensor targeted weed targeting		Supporting system change such as min till and organics		Supporting innovation and reducing costs	
Soil mapping equipment to establish baseline and monitor progress	Potential for reduced inputs	Better able to match soil and crop needs with inputs thus reducing diffuse pollution risk		Critical to calculate correct input types and quantities thus saving money and improving productivity	Soil testing needs to include a wide spectrum of measurements beyond pH, N, P and K

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Precision agriculture kit					
Upgrading of application equipment to Variable rate Application Technologies (VRT) for seeding, spreading, spraying.	Reduced inputs and reduced tractor passes. An EU study found average reductions of 2.8% on fuel use and 8% input use (9)	Reduced diffuse pollution risk, reduced waste	By increasing yields in existing fields, may reduce pressure on future land conversion	Raise yields and reduce inputs. Studies in the US[11] show 8% increase in wheat yields for 10% reduction in N use. UK farmers have found an average increase in winter wheat yields of 6.45%[12] using a variable seed rate.	Funds provided to machinery rings to maximise cost-effectiveness. SEFARI reported that the main barrier is the high cost of entry[13]. Another study showed that peer to peer learning is the most effective way to increase uptake[14]. Data about how the tech is used and its impact should be fed back to Scottish Govt to inform future policy.
Equipment such as slot seeders and other minimum/ zero till kit. (The combination of min till with VRT and machine guidance produces best effects)	Lower soil disturbance reduces soil emissions and maintains carbon. Fewer machinery passes reduces fossil fuel use.	Better soil health supporting healthier ecosystems.		Encourages collaboration and knowledge transfer. Reduces fuel costs.	Funding should be provided to collaborative groups of farmers, inclu machinery rings to maximise the use of the fund, with the expectation of demonstration events.
Provision of free detailed geospatial mapping		Encourage take up of precision agriculture technologies		Supports innovation and increased productivity.	
Machine guidance/autosteer (GPS and/or GNSS adapted machinery)	Reduced inputs (-2.9%) and tractor fuel consumption (-5.4%)[15]	Match crop with needs. Reduced soil compaction and damage	Reduces nitrogen waste thus protecting habitats	Improve input efficiency	

[11] https://www.usda.gov/oce/climate_change/mitigation_technologies/GHG_Mitigation_Options.pdf
[12] http://www.ipf-af.com/precision-farming/media/enews-oct14.pdf
[13] https://sefari.scot/blog/2019/04/08/is-smart-farming-a-solution-for-scottish-agriculture
[14] https://ec.europa.eu/jrc/en/publication/contribution-precision-agriculture-technologies-farm-productivity-and-mitigation-greenhouse-gas
[15] https://ec.europa.eu/jrc/en/publication/contribution-precision-agriculture-technologies-farm-productivity-and-mitigation-greenhouse-gas

Measure	Reduce GHG emissions	Support sustainable farming and land use	Protect and restore natural habitats	Encourage productivity, innovation and inclusion	Need for restrictions?
Precision agriculture kit					
Injection spreaders	Reduced nitrogen waste	Yes, better recycling of nutrients in the system	Reduced diffuse pollution in water and air	Reduced waste	
Precision feeding/ nutrition	For housed livestock, this would increase feed conversion ratios reducing any waste and associated GHG emissions[16]	Reduce imported feed and pressure on land use change	Reduce pressure on land producing animal feed	Increase profits	Ongoing results in changes would need to be provided
Electronic ID/ sensors/ auto drafting to monitor behaviour and performance. Diseases that can benefit from this include parasitic gastroenteristis (PGE)	Ensures health and welfare[17] are safeguarded indirectly reducing GHG. Auto-drafting supports precision nutrition management, breeding and health intervention. E.g. if PGE was reduced from 20% to 0% would reduce GHG emissions by 9%[18]	Better health and welfare		Better health and welfare reduces vet and medicine bills and increases productivity	
Functional Capacity Evaluation Monitoring kit for assessing feed conversion efficiency of defined genotypes under commercial conditions utilising forage-based rations.	Reduced emissions from feed production & reduce emissions/ kg			Yes	Data to be shared with breeder and made available for genetic evaluation. Kit to be of modular design so that it can be moved to new sites.
Upgrading weighing and recording facilities on cattle feeding units including auto-weigh systems linked to water point or feed stall.	Better monitoring of animals supports better health, reducing disease burden. Climate Exchange have reported that particular GHG intense diseases cannot be properly dealt with due to a lack of effective monitoring[19].			Yes	This should be conditional to data being shared with calf producer (feeding period and prior to sale/ slaughter) and being made available for genetic evaluation. Potential link to add-value to BES Data.

[16] https://www.climatexchange.org.uk/media/2031/livestock_health_and_ghg.pdf
[17] https://www.climatexchange.org.uk/media/2031/livestock_health_and_ghg.pdf
[18] https://www.climatexchange.org.uk/media/2031/livestock_health_and_ghg.pdf
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Measure	Reduce GHG emissions	Support sustainable farming and land use	Protect and restore natural habitats	Encourage productivity, innovation and inclusion	Need for restrictions?
Energy saving technology examples					
Heat recovery/ exchangers	Reduced energy needs			Reduced costs	
Solar-assisted grain dryers	Reduced fossil fuel use	On farm renewable energy production and use		Reduces drying costs over time	
Battery powered machinery	Reduce fossil fuel use			Integration with on farm renewables	
Investment in better electric connections to enable switch to electrified machinery	Reducing fossil fuel use			Future proofing for a low carbon energy system	
Development of on farm hydrogen production	Reduce fossil fuel use			Integration with on farm renewables. Supports innovative systems thinking.	Original source of energy must renewable ie. renewable energy already exists on farm or contract in place with renewable energy provider
Energy efficiency surveys for pig and poultry units	Potential for huge improvements as housed units rely heavily on heat and light			Reduced costs	
On farm renewable energy generation, particularly in collaborative contexts	Increases availability of clean energy	Part of the Green Recovery		Alternative income source	

Measure	Reduce GHG emissions	Support sustainable farming and land use	Protect and restore natural habitats	Encourage productivity, innovation and inclusion	Need for restrictions?
Other interventions					
Alternative grass/clover mixtures for grazing to test what best suits the particular field/farm	Reduce need for inorganic fertiliser so reducing GHG emissions in its manufacture and the emissions from its use.	Rothamsted Research found urine from animals reared on pasture with white clover releases over half the amount of nitrous oxide previously assumed[20]		Reduces farmer risk to try out something new	
Legume seed costs for arable rotations, including intercropping to test what would suit the particular field/ farm	Reduce need for inorganic fertiliser as above	Yes		Yes by reducing farmer risk to try out something new	
Innovations to reduce on-farm food waste and loss and emissions from food waste	Reduces wastage of inputs and methane as the waste decomposes			Less waste in the system produces greater savings and rewards	
Funding to develop a standard for sharing pig feed composition and environmental data with the aim of developing lower impact feeding regimes[21]	A recent SRUC study found that pig farming's largest GHG burden was from feed but lacking in sufficient information to create a benchmark	Improving knowledge about the components of pig feed and its impacts will allow farmers to make more sustainablechoices	Better knowledge of the protein sources and content of feed supports the reduction of ammonia emissions that cause damage to local habitats	Better information can support better information for the farmers' customers	
Funding to create Tier 2 models for pig farms collating existing data	These models would estimate the GHG emissions from the pig farms supporting improvements			Using existing data would reduce burden on farmers. Outputs would show potential improvements, leading to cost savings.	

[20] McAuliffe et al. (2020). Elucidating three-way interactions between soil, pasture and animals that regulate nitrous oxide emissions from temperate grazing systems. Agriculture, Ecosystems & Environment 300 https://doi.org/10.1016/j.agee.2020.106978

[21] SRUC – WPS pig carbon emissions draft report 2020

Annex 1

Information from Andy McGowan (Scottish Pig Producers) on the potential for an Integrated Livestock Health Plan learning from the gains made in the Scottish Pig Industry.

Integrating Health Data for Strategic Disease Control

The key sources for the Scottish pig industry system are:Veterinary reports required quarterly for the QMS farm assurance scheme

- Quarterly abattoir monitoring and salmonella surveys undertaken by Wholesome Pigs (Scotland).
- Ad-hoc health surveys, such as the PRRS blood survey.
- Antibiotic usage.
- Location and movements from ScotEID.

This provides secure real-time access to data online about any commercial pig unit in Scotland. Here's a few examples of how they have been able to use it:

Understanding Causes of Pleurisy

Scotland has stubbornly high levels of pleurisy so there is a project underway to understand the differences in environment and health of high and low incidence units

Rapid Response to Disease Outbreaks

There was an outbreak of dysentery last year. The mapping system allowed Scottish Pig Producers to get in direct contact with other units at risk within 5 minutes of receiving the first notification. As a result, the disease did not spread beyond the initial production pyramid and has now been eliminated.

Control and Elimination of Porcine Reproductive and Respiratory Syndrome (PRRS)

Mapping disease allows a collaborative approach to controlling and potentially eliminating disease. Positive units have reduced by one third compared to the previous survey in 2013, current ambitions are for national control within the next four years.

The combination of these efforts plus individual actions have seen an output per sow increase by 30% since 2010. This is estimated to have reduced carbon emissions (per kg product) by 15-20% in the process. This has been done on a shoe-string but it does demonstrate a potential value in joining up health data that goes well beyond the pig sector, a concept that George Caldow has been developing as part of his Disease Surveillance Intelligence Unit.

Annex 2

List of Panel Members

Co-chairs

Mike Robinson

Mike is the Chief Executive of the Royal Scottish Geographical Society (RSGS) based in Perth. He has worked in the Scottish charity and environment sector for the last 25 years, initially with RSPB as Head of Marketing, and later with the Royal Botanic Gardens in Edinburgh as Director of Development.

In a voluntary capacity Mike has held more than forty board/advisory roles, mostly for environment and human rights bodies, including as previous Chair of Stop Climate Chaos Scotland (SCCS). He also chaired the Scottish parliament's short life working group on annual targets, sits on the advisory groups for Air Passenger Duty & Scotrail, and the board of Transform Scotland. He is a member of the Arctic Strategy Forum & Perth City Development Board & is heavily involved in promoting climate change solutions. He holds two Honorary Fellowships (Scottish Environment Link and RCGS) and several awards for his services to the environment.

Nigel Miller

Nigel is a graduate of the Royal Dick School of Veterinary Studies. He worked in the Highlands in a mixed farm animal practice before returning home to the family farm partnership in the Scottish Borders.

The present-day farming operation in Galawater carries 170 breeding cows and 800 breeding ewes; with a limited area of winter and spring barley. Two sons are now part of the partnership and through their work the business has diversified into wood processing.

Nigel is a past chair of FWAG Scotland and the NFUS Livestock Committee, and held the position of NFU Scotland President over the period of the last CAP Reform. Since the years spent with NFUS he has been a Board Member of SRUC and SAC Commercial and today is a Board Member of the Moredun Research Institute and Chair of Livestock Health Scotland.

Panel members

Andrew Barbour

Andrew runs a livestock enterprise with his wife and family in Highland Perthshire. As well as managing livestock, he has experience in forestry, deer management and aquaculture. He was recently Acting chair of the Deer Working Group, which was set up to report to Government on the steps to be taken to achieve sustainable deer management in Scotland.

Dave Reay

Dave is Executive Director at the Edinburgh Centre for Carbon Innovation, Professor of Carbon Management at the University of Edinburgh and Director of Policy at ClimateXChange. Dave has authored over 100 articles on climate change, including 5 books including Climate-Smart Food and is also an advisor for the Scottish Government on rural policy and climate change. His latest project involves managing his farm on the West Coast of Scotland to sequester a lifetime's carbon emissions.

Deborah J. Long

Deborah is Chief Officer at Scottish Environment LINK, the umbrella organisation for Scotland's environmental charities. LINK aims to conserve, protect and restore wildlife and nature; to enable access to nature and landscapes, and to defend environmental rights. Prior to this, for 14 years she was director of Plantlife in Scotland, a small NGO conserving native plants, fungi and habitats. She also ran a Europe-wide project on sustainable food growing.

As a palaeo-ecologist, her outlook is based in a detailed understanding of ecological relationships that have developed over millennia and are deeply influenced by human activities. With 16 years of experience in ecosystem and habitat conservation, with a focus on ecosystem health and functioning as well as 16 years of experience in policy making in the environment sector, she hopes to be able to contribute to the panel by providing perspectives based on long-term temporal and large-scale spatial scales.

Geoff Simm

Professor Simm is Director of the Global Academy of Agriculture and Food Security at the University of Edinburgh. This is one of five Global Academies that aim to galvanize interdisciplinary teaching, research and translation on key global challenges.

The agrifood academy provides a suite of BSc and MSc programmes to equip graduates to contribute to global food and nutritional security and wider Sustainable Development Goals. Geoff's research is in sustainable farm animal breeding and sustainable agri-food systems. He is a Fellow of the Royal Agricultural Societies and a Fellow of the Royal Society of Biology.

John Smith

John and his wife Ruth run Drumalea Farm in Campbelltown on the Kintyre peninsula where they farm 840 acres of productive grassland and some wholecrop; to support the dairy herd and followers along with some cattle being reared for beef.

John has recently stepped down as chair of the NFUS milk committee, where the priorities were addressing mandatory written contracts, presenting the dairy industry as part of the solution in the climate change debate, and promoting the real health benefits of dairy as part of a healthy lifestyle.

Philip Sleigh

Philip farms, in partnership with his wife Gill, in the North East of Scotland, 350 acres of crops, and run a 450 sow unit, all progeny finished on farm.

He is a past board member of NFUS, and at present sits on the board of Scottish Pig Producers, and on the board of QMS.

Robert Fleming

Robert farms at Castle Sinniness and associated farms near Glenluce in South-West Scotland. The farming enterprise comprises 240 ha of grassland on the coast, stocked with suckler cows, 500-800 growing cattle, 300 finishing cattle and Roussin sheep. Robert utilises a paddock grazing system, with the focus on home grown forage. Robert sits on the Simplification Taskforce for Scottish Government for CAP reform. He was a former member of the Scottish Cattle Industry Group (SCIG) for QMS, was the host farmer for Agrii's first Forage iFarm and is

a 2015 Nuffield Scholar. The title of his Nuffield study was 'Efficiency Gains Through Improved Beef Genetics'. Robert is married to Claire and has two young children.

Russell Brown

Russell farms in partnership with his wife Hilary and their two sons Robbie and Stephen. They farm mainly in NE Fife but have a farm in Perthshire. Since 1997 they have slowly expanded and now farm over 1000 ha of arable land which is a mixture of owned (380ha) and the rest contract farm arrangements with a number of local land owners.

They grow 440 ha winter wheat, 60 ha rye for AD plant, 110 ha spring barley, 160 ha winter and spring oats, 150 ha potatoes as well as calabrese, vining peas and energy beet.

Russell has been the Chairman of NFUS potato working group. At present he is the Chairman of the Scottish Potato Co-op, a group of 16 potato growers who have set up the co-op to market 70,000 tonnes of fresh potatoes.

Sarah Skerratt

Sarah is the Director of Programmes at the Royal Society of Edinburgh. Previously she was Professor of Rural Society and Policy Director of Policy Engagement at Scotland's Rural College (SRUC). For 30+ years, Sarah has researched rural community resilience, empowerment and disempowerment; poverty; leadership; and broadband. She has recently focused on rural mental health, working with the national charity Support in Mind Scotland.

Through her research, Sarah aims to enhance rural and national policy, and make a difference in rural communities. She works with the Scottish Government on numerous task forces, Scottish Parliament, universities, private, public and third sectors, communities and development agencies in Scotland as well as internationally. Sarah recently completed a two-year secondment with Audit Scotland, bringing a "rural lens" to their work, and is now retained as their rural adviser, having established their Islands Forum in 2017.

In 2018, she completed the "Recharging Rural" research for the Prince's Countryside Fund, gathering evidence across rural UK as to what makes rural communities sustainable to 2030 and beyond. In 2017, Sarah was appointed as a Fellow of the Royal Society of Arts (RSA) in recognition of her work in rural poverty and rural policy. In 2018, she was appointed as the new Scientific Director of the Scottish Consortium of Rural Research (SCRR).

Sheila George

After completing a PhD on disease dynamics of bovine TB, Sheila moved to the public sector in Ireland, developing sustainability and natural capital policy. For the last seven years she has worked in the NGO sector on landscape-scale conservation delivery, nature-based solutions, land use and environment policy. She recently moved to WWF Scotland as Food and Environment Policy Manager.

Steven Thomson

Steven is a Senior Agricultural Economist with over 25 years of experience in agricultural and rural policy analysis and has been involved in assessing agricultural change, particularly in reference to the Common Agricultural Policy (CAP), for a number of years.

Steven's ongoing work is heavily focused on considering how the UK's withdrawal from the EU will impact on Scottish agriculture and wider rural society. He has taken a proactive role in assessing the challenges and opportunities that Brexit may bring – delivering stakeholder seminars, farmer-focused events, and research on the topic.

In 2018 Steven lead an extensive review of the use of non-UK seasonal labour in the Scottish farming sector - providing the first quantification of the extent of use of seasonal overseas workers to the Scottish Government. Work for the Scottish Government on the Socio-Economic and Biodiversity impacts of grouse has also recently been finished and a three year investigation of the wider Rural Business base is ongoing for Scottish Enterprise and the Scottish Government where linkages to the land-based sector are one of the topics being investigated.

Steven supported Brian Pack's independent review of red-tape in farming and rural land management in Scotland. He has also been involved in projects relating to land reform, including research into the diversity of land ownership, agricultural tenure and seasonal grazing lets, the economic impact of Scottish Estates and the sustainable management of wild deer in Scotland.

Pete Ritchie

Pete Ritchie is Executive Director of Nourish Scotland, which he co-founded in 2013. He also runs Whitmuir Organics with his wife and business partner Heather Anderson, and is a trustee of the Food Ethics Council. Pete is a first-generation farmer and was previously founder and director of Scottish Human Services.

Secretariat

Keesje Avis is clerk of the Farming 1.5 Inquiry, employed by Nourish Scotland.

Ruth Taylor is the Climate Change Policy Officer NFU Scotland