

SCOTLAND'S GLOBAL FOOD SECURITY CONFERENCE

EDINBURGH | 5-7 NOVEMBER 2025

GLOBAL FOOD SECURITY:
CLIMATE CHANGE, COLLABORATION,
AND COMPARATIVE ADVANTAGE

NOTE OF PROCEEDINGS



Scottish
Government
Riaghaltas
na h-Alba

SEFARI
Gateway



In an era of climate change, volatile trade, and supply chain disruption, what is the role of comparative advantage? How can different countries and regions collaborate and make best use of our natural resources to further global food security? Hosted by the Cabinet Secretary for Rural Affairs, Land Reform and Islands and SEFARI Gateway, Scotland's Global Food Security Conference 2025 explored commonalities and differences between Scotland and other countries and regions to establish how collaboration, knowledge exchange, and top-quality scientific research can enable all countries and regions to play a critical role in achieving global food security.

1. **'Achieving progress on global food security: innovation, trade and finance,' Ruth Hill, Director of Markets, Trade, and Institutions at the International Food Policy Research Institute IFPRI)**

- **Global progress on food insecurity:** Over the last 30-35 years incredible progress has been made globally reducing the numbers of people living on less than \$3 a day, which is the amount needed for people to meet their basic calorie requirements, but progress has stalled, and numbers of food insecure people have been increasing in sub-Saharan Africa.
- **Climate impact:** IFPRI modelling suggests food production will continue to increase globally as it keeps up with population growth, but climate change is reducing our ability to increase production and limiting what we expect to be able to achieve in the future. Agricultural production per capita is actually expected to fall in Sub-Saharan Africa.
- **Risk of multiple breadbasket failure:** If there are multiple weather shocks, as is becoming more likely, modelling shows that the impact of multiple breadbasket failure in the global south is very high in low and middle income countries in terms of the impact on their national income and therefore on the prevalence of undernourishment, but there is less shock to global incomes. A multiple breadbasket failure in the global north would result in much larger global income shocks and price rises in the global north.
- **Innovation:** Without the Green Revolution it is that estimated GDP/capita would be about 17% lower, and innovations such as CGIAR breeding work has impacts across different countries including the UK even though the innovations were targeted at the global south. While we need new technological developments also important to remember that for seeing some productivity growth, for meeting some of the global food security needs in Africa, innovation might look different – not just developing new practices but helping farmers adopt them.
- **Risk management:** Risks need to be reduced for farmers to invest in new practices. AI-enabled advisory services may help in areas where it's hard to get extension services. Smartphone data and remote sensing may also facilitate better access to insurance and credit for very small-scale farmers.
- **Financing:** Public R&D spend is declining and there is likely to be a gap in developing country food system spend without USAID. The share of GDP spend on energy and agricultural spend is fairly consistent in countries of all income categories, making that financing 12x larger than any external flow. There are opportunities to make sure that spending is more effective. Private sector financing offers new opportunities, both for financing and for the uptake of practices that are better for the environment and productivity. Standards and data will be important.
- **Trade:** Lower trade costs are key to increasing agricultural production and reducing the impact of climate change; trade is a climate adaptation mechanism and can reduce the welfare losses that are expected to come from climate change. Ideally we would get to a point where agriculture production is taking place in the places where it's best suited, and then we'd be trading between ourselves. Improved agricultural markets and trade in Ethiopia have reduced the effect of bad weather on local food prices since the famines of the 1980s. Pursuing a national self-sufficiency strategy can have negative impacts on others: India dominates the small proportion of global rice that is traded, and its export ban on rice a couple of years ago significantly raised prices in Africa.

2. **'Underutilised Species Delivering Nutrition, Climate Resilience & Economic Value for sub-Saharan Africa,'** by Jules Griffin, the Director of the Rowett Institute, and Sylvester Madzvoza, Zimbabwean economist

- **Nutrients from agriculture and seafood:** Nutrient production should be considered as well as calories in land use. Modelling can estimate the impact on nutrients if certain products are reduced or removed. Seafood could play a bigger role in a sustainable diet; Scotland is a net importer of certain fish but a significant exporter of oily fish – rich in Vitamin D, which Scots are recommend to take as supplements.
- **Moringa as a 'nutriceutical' in Malawi and Zimbabwe:** The moringa plant is a high protein and high micronutrient crop that grows well in Sub-Saharan Africa but has been underutilised. Human trials showed improved amino acid profile and gut health as a substitute for soya. SEFARI carried out in-country engagement to support the development of national strategies and policies on plant genetic resources and grain.
- **Economic benefits of collaboration.** Supply chain analysis identified that although moringa was commercially viable, the return was poor and the bitter flavour a barrier to consumption. Most production happened at small scale and was exported, with approximately half the consumer price going to online retailers and only 5% to growers. Work with the Rowett on palatability resulted in a patented formulation being licenced with an agreement that the profits would be invested in initiatives in sub-Saharan Africa. Moringa was raised at a Zimbabwean workshop on food security and the Rowett has been influential in increasing uptake of the crop, and improved and diversified diets.

3. **'Adapting Crops for Climate Change - Technological and Social Innovation',** by Colin Campbell, the CEO of the James Hutton Institute, and Ian Barker, CGIAR UK Board Director

- **International collaboration:** This is key with the James Hutton Institute collaborating with over 35 countries, supporting food and nutrition security worldwide with conservation and crop diversity. JHI always pairs a social scientist with a crop scientist to ensure local impact.
- **Comparative advantage:** Globally and regionally, crop comparative advantage will change. Scotland's advantages are its potential for renewable energy, abundant fresh water, quality soils, and temperate climate. Some of its land capability is expected to change (and in some scenarios, improve) with climate change and stables crops might be grown further north in the UK. However there will also be more climate variation/extremity.
- **New plant science technologies:** JHI is moving to start breeding for different traits valued in regenerative agriculture, and simulating the effects of future climate scenarios on potatoes. It's also looking at alternative technologies like vertical farming, which works well with renewable energy.
- **Potatoes as an opportunity:** Potatoes are a great crop for food security, as it is highly nutritious, is land and water efficient, and yield increases have not plateaued like other crops. Consumer-facing traits are also improving, with heat-tolerant, fast-cooking potato varieties intended for Malawi and Kenya (to reduce the labour burden on women collecting firewood, useful in other places too).
- **Knowledge exchange for climate adaptation:** Climate change has brought a pest called the potato cyst nematode (PCN) to Kenya and Easter Africa and the search for PCN-free land is leading to deforestation. PCN is well-known in Scotland and the James Hutton Institute has released two new varieties in Kenyan that are resistant to PCN. Potatoes are important there as both a cash crop and a subsistence crop. In Malawi, the government is multiplying seeds for these potatoes locally. Partnership models have facilitates this.

4. Q&A with Ruth Hill, Jules Griffin, Sylvester Madzova, Colin Campbell, and Iain Barker.

- Moringa is at a proof-of-concept stage. It's been shown to be viable but there are regulatory hurdles that would need to be met for it to be added to the World Food Programme, for example.
- Derisking environmentally sustainable production has two aspects – innovation in carbon financing during the period of investment for farmers (especially small farmers) and moving away from using output measurements to cheap indices for payments, and managing the remaining risk through insurance.
- On working with local institutions and doing capacity development, CGIAR are working with the DARS in Malawi and their business model works on building capacity in BRICS breeding programmes. For example, managing intellectual property of governments releasing varieties in their country – work is done with the Kenyan government to licence publicly bred varieties to Kenyan seed companies, with royalties funding more research.
- Efficient trade can help with food loss and waste, as can innovation in transportation, storage, and packaging.
- Cooperatives can help with derisking for small-scale farmers.
- Blue food has a big contribution to make to food security including on nutrient content, for example Vitamin A.

5. Address from the Cabinet Secretary for Rural Affairs, Land Reform, and Islands

- The conference is timely with the passing of the Land Reform Bill in the Scottish Parliament, and the publication of the draft Climate Change Plan.
- International trade has a key role in addressing concerns with food security, nutrition and sustainable agriculture, improving the availability of diverse healthy foods and contributing to price stability, but it cannot alone ensure global food security. Balance must be found.
- Science and evidence is extremely important for this, in understanding what Scotland can produce and how that may change, and how that will change in other countries. Food production in Scotland is only one part of the puzzle; its knowledge and expertise can also help other countries in producing food and using their natural resources to best effect.
- Scotland wants to be a good global citizen and the UN statistic that 8.4% of the global population experiences hunger in 2024 is unacceptable. Scotland's Programme for Government confirmed its intention to meet its commitments to the global south to grow its international development budget to £15 million a year.
- Most of Scotland's land is used for agriculture, primarily rough grazing producing world-renowned beef and lamb. Around 90% of the barley required for the Scotch whisky industry is sourced domestically, supporting exports valued at £5.4 billion in 2024 - nearly three quarters of Scotland's food and drink exports and 22% of the UK total. Alongside whisky and livestock, potatoes remain a staple product, while seafood also plays a major role, with Scotland producing world-class, low-carbon seafood that contributes significantly to both domestic supply and international exports.
- Recent water scarcity highlighted the need for resilience. Abstraction licences were suspended, affecting crops and yields. In response, Scotland is introducing scheduled abstraction plans and promoting investment in water-saving measures such as irrigation lagoons and precision systems.
- The Vision for Agriculture aims to transform support, positioning Scotland as a leader in regenerative farming. Farmers and crofters are central to this vision. Direct payments will continue, with 70% of future funding allocated to them, alongside incentives for sustainable practices and resilience measures such as whole farm plans.

- Land and natural capital are vital assets. A new Land Use Strategy will further integration, while marine resources are equally important to food security and international trade.
- Aquaculture is a key part of Scotland's rural economy, providing skilled jobs and supporting the transition to net zero. The Vision for Sustainable Aquaculture, published in 2023, sets ambitions for the sector's growth. Seafood is nutritious but under-consumed domestically.
- The Scottish Government invests around £45 million annually in the Strategic Research Programme reflecting its commitment to building climate resilience, restoring ecosystems, and supporting rural livelihoods. Priorities for 2027–2032 include climate adaptation, biodiversity, land use, rural resilience, water management and food system resilience.
- The Scottish Government has legislated to require a food security statement every three years, ensuring that food security is given due attention.

6. Panel discussion on 'Collaboration and comparative advantage: The international perspective', hosted by Professor Liz Baggs, Chair of Food and Environmental Security at the University of Edinburgh. Panellists: • Edwini Kessie, Director of the Agriculture and Commodities Division, World Trade Organisation • Jamie Morrison, Senior Adviser for Policy and External Relations, Global Alliance for Improved Nutrition • Hillary Curnow, Agriculture Counsellor, New Zealand High Commission • Hubertus Gay, Senior Agricultural Policy Analyst, OECD • Raschad Al-Khafaji, Director of the Food and Agriculture Organisation Liaison Office with the European Union and Belgium

- Global food systems face the interconnected challenges of ensuring sufficient and nutritious food, reducing environmental impacts, and sustaining livelihoods. These issues are universal, though their relative importance varies across countries. Innovation, productivity gains, and adaptation to local contexts are essential, supported by collaboration and knowledge transfer across borders.
- Trade plays a central role in food security, acting as a conveyor belt moving food from surplus to deficit regions and raising farmer incomes. Rules-based systems founded on comparative advantage have underpinned the expansion of global agriculture, though there is growing emphasis on strategic autonomy. Balancing local supply chains with international trade is not a dichotomy; most countries operate along a continuum shaped by agro-ecological potential, cultural preferences, and economic structures.
- Nutrition is a critical dimension. While trade effectively moves calories, it is less effective at shifting nutrient-dense foods. Healthy diets remain unaffordable for billions, with stark differences between regions. Rising food prices have widened the gap between cheap, nutrient poor foods and more expensive, nutritious options, creating challenges for governments in both developed and developing countries. A well-nourished population supports productivity, stability, and resilience, making nutrition a global priority.
- Climate change and environmental pressures demand that agriculture be part of the solution. Farmers are innovators, and sustainable practices, including aquaculture and "blue foods," are vital to meeting protein needs. Research and agri-tech to reduce emissions are critical, requiring close cooperation between governments, industry, and researchers. Productivity must rise significantly while emissions fall, necessitating widespread adoption of new technologies.
- Anticipatory action is essential to strengthen resilience against shocks. Proactive measures save resources compared to emergency responses and help communities sustain food production during crises. Insurance mechanisms and monitoring systems can mitigate predictable threats such as locust infestations, while maintaining agri-food systems during conflict or disaster prevents deeper insecurity.

- Collaboration remains the foundation for progress. Breaking down silos within governments, fostering international partnerships, and sharing best practices are crucial to overcoming common challenges. Platforms for exchange, global research alliances, and coordinated strategies can bridge differences between developed and developing countries, ensuring that solutions are adapted but universally relevant.

7. **'Genetics, Data and Innovation: Breeding for National and Global Food Security,' by Wayne Powell, Principal and CEO of Scotland's Rural College (SRUC) and Matthew Cleveland, Senior Director for Global Bovine Sustainability at Genus plc.**

- **Importance of research and innovation:** Demonstrating the economic impact of research investment is critical, alongside showing global reach and business connections. Inspiring the next generation of researchers is essential to address global challenges and sustain innovation.
- **Genetic innovation and data-driven breeding:** Genomic prediction now enables selection without direct phenotype measurement, accelerating genetic gain and unlocking progress on traits previously hard to measure.
- **Global and smallholder contexts:** Livestock productivity is vital for food security in low-income regions, particularly sub-Saharan Africa, where cattle numbers are projected to double. Genomic prediction tools are being deployed in smallholder systems, supported by Gates Foundation grants, translating research into global impact.
- **Digital innovation:** The digital twin programme relates a physical process to a virtual process. Digital twins of farms and dairies integrate sensor data, AI, and machine learning to optimise operations and monitor emissions, health, and costs in real time. These open source systems enable evidence based decisions, innovation, and research.
- **Microbiome-driven breeding:** Animals can be selected not only for traditional traits but also for the composition of their microbiome, unlocking access to traits that were previously difficult to measure. This approach enables progress on key objectives such as improving feed efficiency and reducing methane emissions without the need for constant direct measurement of these traits. Moreover, it offers a more accurate understanding of trait architecture, accelerating genetic improvement.
- **Scaling innovation:** Genetic improvement can achieve permanent, cumulative emissions reductions of 5–9% annually, scaling to 20–30% over five years. At national level, targeted breeding could avoid millions of tonnes of CO2 equivalent emissions, demonstrating the material impact of innovation when effectively scaled.

8. **'Livestock Disease Innovation for Resilient Food Systems in Sub-Saharan Africa,' by Tom McNeilly, Director of the Moredun Research Institute, and Lena Halos, Senior Programme Officer for Livestock Health at the Gates Foundation.**

- **Gates Foundation approach to livestock productivity:** Agriculture is a cornerstone for poverty alleviation, with over 75% of the poorest people relying on it for livelihoods. Livestock is central to rural income, nutrition, and food security. Improving productivity is the most direct way to lift smallholder farmers out of poverty. Strategic investments in animal health, genetics, feed systems, and climate-smart practices can transform the sector, enhancing economic mobility, sustainability, and reducing emissions.
- **Animal health and disease control:** A quarter of smallholder livestock deaths are due to preventable diseases, making health innovation fundamental. The Gates Foundation adopts an end-to-end approach from R&D to delivery, focusing on tailored veterinary products, inclusive business models, and enabling regulatory environments.

- **Future demand and resilience:** By 2050, Africa's population will nearly double, tripling demand for meat, milk, and animal-source foods. Livestock systems must become more resilient and sustainable through innovations in feed, health, and emission mitigation. Climate-smart practices and genetic improvements are critical to meeting this demand while reducing environmental impact.
- **Innovation in parasite and vector control:** Parasite-borne diseases impose an annual economic burden exceeding \$5 billion in sub-Saharan Africa. Current treatments rely on outdated chemicals, facing rising resistance. New strategies include safer drugs, targeted vector control using genomic tools, and accelerated parasite vaccine development. Vaccination remains the most sustainable and cost-effective solution.
- **Scottish leadership and global partnerships:** Scotland hosts world-leading research institutions driving innovations in livestock health and genetics, including the Moredun Institute and partners such as Roslin and SEBI Livestock. These collaborations underpin global efforts to deliver next-generation solutions for smallholder farmers.
- **Vaccine innovation and climate challenges:** Barbervax, the first commercial vaccine against *Haemonchus contortus*, demonstrates the impact of Scottish research. It reduces chemical use by up to 80%, offering a sustainable alternative to anthelmintics. However, scaling remains a challenge due to complex manufacturing. Gates-funded projects aim to develop synthetic vaccines using advanced antibody technologies, enabling scalable solutions for Africa and beyond.

9. Q&A with Wayne Powell, Matthew Cleveland, Tom McNeilly and Lena Halos

- **Diet and microbiome interaction:** Cow diets influence methane production, with high-fibre diets generating more methane. Feed additives can help in intensive systems, but genetics remains a key solution for reducing emissions globally, especially where animals graze on poor-quality diets.
- **Genetics and feed efficiency:** Genetic traits that reduce methane emissions appear consistent across different feeds, reinforcing genetics as a robust tool for sustainability alongside feed management strategies.
- **Communication and public trust:** Misinformation around methane inhibitors highlights the need for early, transparent communication on science and technology. Education at school level and honest discussion about limitations and benefits of feed additives are essential to build trust.
- **Natural variation and breeding:** Significant natural variation exists in methane emissions among cattle, with some animals emitting half as much as others. Microbiome-driven breeding aims to improve rumen efficiency, reducing excess hydrogen and methane while enhancing animal health.
- **Institutional innovation:** Translating technical innovation into practice requires institutional change - supporting research culture, technology diffusion, and collaboration between governments, academia, and business.
- **Commercial scaling and partnerships:** Genetic improvement and microbiome research need iterative collaboration with commercial systems to ensure scalability and global adoption. Sustainability depends on aligning innovation with profitability and supply chain incentives.
- **Bundled solutions for farmers:** Combining genetic selection and vaccines offers synergistic benefits for smallholder farmers. Delivery through cooperative models can improve access and adoption, supported by initiatives like GalvMed and Gates Foundation programmes.

10. Panel discussion on 'Collaboration and comparative advantage: The industry perspective', hosted by Lucinda Bruce-Gardyne, the founder of Genius. Panellists: Robin Manning, Director of the British Agricultural Bureau • Heather Kelman, Chair of Food Standards Scotland • David Thomson, CEO of the Food & Drink Federation Scotland • Andrew Connon, President of the National Farmers Union Scotland.

- **European trade and food security:** Post-Brexit trade barriers and regulatory divergence have led to a 20% reduction in UK food exports to the EU and increased uncertainty for EU imports into Great Britain. Climatic disruptions in southern Europe and North Africa further strain supply chains, highlighting the need for closer UK-EU cooperation like the forthcoming SPS agreement to maintain food security and market access.
- **Industry pressures and resilience:** The UK food and drink sector faces significant stress from domestic regulatory costs, including packaging reforms and tax changes, contributing to higher food price inflation compared to EU nations. Confidence among manufacturers is at historic lows. Despite these challenges, Scotland's food and drink sector - supported by strong government-industry partnerships – is resilient and offers a comparative advantage in driving innovation.
- **Food safety and climate risks:** Climate change poses emerging threats to food safety, requiring global intelligence sharing and coordinated responses. Balancing nutritional needs with sustainable production and climate goals is critical. Research must integrate food safety considerations alongside agricultural and nutritional strategies to build resilient systems.
- **Consumer trends and local supply:** COVID-19 temporarily boosted demand for locally sourced food, but this trend has waned. Sustaining consumer engagement with local, seasonal produce remains a challenge. Policy and industry efforts should focus on reinforcing the value of local supply chains to strengthen resilience and reduce reliance on imports.
- **Barriers to crop and livestock innovation:** Profitability and confidence are key constraints on production, particularly in sectors like beef. Trade deals, land-use competition (e.g., forestry, renewables, carbon offsetting), and policy uncertainty further undermine investment. Maintaining productive land for food production and supporting rural economies are essential to prevent offshoring emissions and shrinking domestic supply chains.
- **Research priorities for impact:** Future research should focus on methane reduction, climate-adaptive crop varieties, and gene editing to accelerate innovation. Translating academic research into practical solutions for SMEs remains a major gap. Integrated strategies aligning dietary goals, zero-carbon ambitions, and economic viability are needed to deliver a coherent Good Food Nation plan and global trade balance.