



scottish universities insight institute

mobilising knowledge for a better Scotland

Problems and solutions in food security- from surf to turf

Main objectives and context



Food security is a global issue. Predicted increases in the world population mean that the demand for food is expected to double by 2050 but the increase in temperature and extreme weather conditions expected due to climate change and resource depletion make our food production systems vulnerable. Scotland is a large producer of seafood and has some of the highest yielding crop land on earth, so it has a great deal to contribute to finding solutions to the food security problem both in the UK and globally. Vulnerable nations that will be able to produce less food in the future, will become increasingly reliant on Scottish produce. This programme was organised by the Scottish Food Security Alliance (SFSa) and uniquely brought together expertise in production, processing and distribution. It was multi-sector and interdisciplinary in nature, bringing together HEI academics with industry, policy and government institutes.

The original aims and objectives outline in the application were:

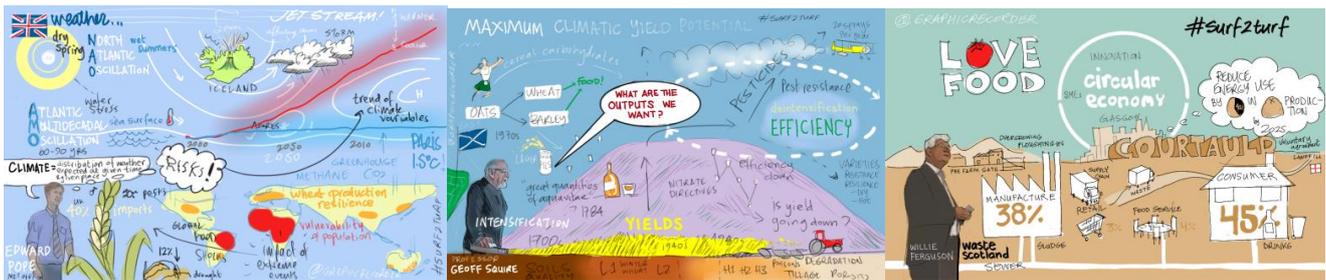
Aim:

To make an international impact by applying Scotland's world-leading expertise in seafood and crop systems to address the key challenges and opportunities facing food security, bringing together Academics, Industry and Policy-makers so that practical solutions to food security can be identified.

Objectives:

- i) Address key challenges facing food security in Scotland and internationally, through a series of workshops.
- ii) Set the research agenda for the future by bringing major HEIs and stakeholders together to identify practical solutions to food security
- iii) Provide immediate solutions to current food security concerns by promoting the dissemination of state-of-the-art approaches and recent research findings across production systems. This will address both supply and economic returns to industry through more efficient practices.
- iv) Provide solutions for more impoverished regions taking into account our position in the international food system market and the potential of our research and practices.
- v) Remove barriers and constraints between fish and crop research, addressing for instance land-based food production for fish feed, resource recycling between these sectors and integrated farming systems.

An account of the insights resulting from the programme



We held five workshops over a seven month period. These were entitled “Scotland’s role in Global Food Security”, “Technology in Food Security”, “Safe and Nutritious Food”, “Resource Efficiency and Minimising Waste” and “Problems and Solutions in Food Security – from surf to turf”. The first workshop included a presentation from Denise A'Hara, Head of Food, Nutrition and Crop Sciences for the Scottish Government. She presented the Scottish Government’s perspective on food security. Their vision is that “Communities across Scotland will enjoy better access to affordable, safe, healthy and fresh seasonal produce” she presented some relevant ideas from the 2016-2021 strategic research portfolio which sit under the headings of “Productive and Viable Land Use”, “Ecosystem Services” and “Health and Wellbeing”. We also heard about opportunities to develop links with Industry through the Innovation centres, and in particular the work of the Scottish Aquaculture Innovation Centre (<http://scottishaquaculture.com/>); about the current state of capture fisheries from Paul Fernandes of Aberdeen University and about the role of Plant Science and Crop Breeding in food security from Jonathan Snape of the James Hutton Institute. We then carried out a SWOT analysis. We also produced a video in which we asked people what they had learned from the meeting (<https://vimeo.com/145663491>). We concluded that one of Scotland’s strengths is the reputation and quality of its Scottish branded products. We also have strong infrastructure, research expertise, policy and funding. One of our weaknesses is our reliance on imports for some food products. The main threats, which apply globally, include climate changes, conflicting demands for water and soil health. The other threat which is more (although by no means exclusively) specific to Scotland is the issue of healthy diets and wellbeing. This includes problems with inequality of financial access to healthy food.

The next three workshops were more focussed. In the technology workshop we had presentations from Archie Gibson, Executive Director of Agrico UK Limited and from Callum Harvey from the Knowledge Transfer Network as well as looking at the engineering behind fishing gear. We also discussed the role of mathematical modelling in food security. In the “Safe and Nutritious Food workshop” we discussed pathogen risks to and from our food. Conclusions included the fact that food safety is an issue across both terrestrial and aquatic systems. The impact of food borne pathogens on human health is different in different regions of the world. The opportunities for food safety issues are equal globally but the impacts are not. We also concluded that Aquaculture is behind terrestrial systems in our understanding of the host pathogen interactions. However, we can vaccinate fish which cannot be done for crops. We can use selective breeding to breed for resistance in both terrestrial and aquatic systems as well as using GM techniques.

In the fourth workshop we talked about food waste across the production sectors and had presentations from Eve Keepax of Keep Scotland Beautiful as well as discussing the implications of discards in capture fisheries and the some current research on reducing waste in global Aquaculture systems.

The final workshop took a broader overview. We also had an artist who drew our discussions, these are included in this document.



Main outcomes and (expected) impact

We brought together a range of researchers, policy makers and stakeholders from crop, capture fisheries and aquaculture systems. There were a lot of free ranging discussions throughout the workshops and we identified a number of areas in which there is either a direct link between terrestrial and aquatic systems or some common problem for which solutions could be developed together. Specific examples include:

Climate: In all of the systems considered there are vulnerabilities to anticipated climate change and climate variability this may mean that some geographical regions become less suitable for the species we currently farm and we will have to be adaptable and plan for anticipated changes. We also talked about breeding species for robustness to variability.

In both cases it is very important to get better at predicting extreme weather events or making better longer term climate predictions. These then need to be communicated clearly and to the right people in order to allow individual farmers or fishers to be able to respond appropriately to the risks posed.

Waste: All three production systems have to deal with waste at different stages. At the production stage one of the most important issues for capture fisheries is that they are currently having to deal with new rules around discards. That sector is, amongst other things, developing technological solutions to try and solve this problem. Discards in fisheries are in many ways equivalent to ugly vegetables being rejected by supermarkets for terrestrial farmers and in both cases we need to find innovative and efficient ways to use these “waste” products.

Once we get off the farm or boat then all three systems have similar issues around minimising waste all the way through the processing and retail stages to the table. In Scotland 45% of food waste comes at the household stage so any programmes aimed at reducing this level of waste will be equally important for all of the production systems.

Nutrients: One of the limitations to the growth of the aquaculture industry globally, and in the UK in particular, is the need for sustainable source of feed for the fish. Many of the fish species which are farmed require fish meal and fish oil for optimal growth and this is a limited resource. A great deal of research has gone into developing replacement feeds which use, for example, plant-based substitutes.

So how do we optimise healthy diets and protein production if we are feeding crops to fish instead of directly to people?

This brings out one of the most obvious direct links between aquaculture and plant systems. The Beans4feed project, for example is investigating the use of fava beans to feed pigs, poultry and salmon. Another example of this link is the Camelina project in which a genetically modified crop has been engineered to produce omega-3 fish oils which could be fed to fish.

Of course this question of feeding crops to livestock is much broader than fish with, for example, 40% of cereal in the US being used for livestock feed.

In my world of asking “why are plants like fish?”, the equivalent issue of sustainable feeds to fish is fertilisers for crops, in this case it is nitrogen and phosphorus that are the limiting resources. With ‘peak phosphorus’ looming, we need to develop ways of reducing losses and recycling these nutrients more efficiently.

Summary: Over the course of five workshops we had some fantastic interactions, and our thinking extended to several different areas. These included genetics and disease control. With respect to genetics, selective breeding, genetic modification and gene editing are technologies being used in both terrestrial and aquatic systems. In terms of disease control, disease risk and emerging diseases are problems in both arenas – mathematical modelling, breeding for resistance and improved biosecurity are relevant to both and the similarities between them mean that solutions in one arena could be applied to the other.

Key recommendations for end user / policy communities

We have lots of expertise across the whole breadth of food security in Scotland. There is an opportunity here to consolidate expertise across food systems locally and then transfer that knowledge to the appropriate places globally. However, we urgently need to involve the livestock sector in the discussion.

The question of optimal protein use, getting the balance between eating it directly or feeding it to fish or livestock is an important question when we have limited resources. We have to weigh up human health and environmental costs.

An interesting and topical area to pursue is the microbiome, which is being studied in terrestrial and aquatic systems and there is the opportunity for sharing of techniques. This is true for many of the other common areas we identified such as gene editing. Opportunities to share knowledge in these areas would be helpful.

Planned follow up activities

We have had a number of follow up activities with others planned:

1. The first activity which came directly from discussions at the final workshops was an application to the BBSRC Global Challenges Research Fund call on “Global Agriculture and Food Systems Research” to set up a network with China which brings together aquatic and terrestrial researchers. From the UK side this involves many of the workshop attendees and would not have come about without the opportunities afforded by these workshops. We have submitted an outline application and wait to hear whether we will be invited to submit a full application in August. This funding source provides an opportunity to carry out our first key recommendation.
2. We have just written a blog for the RCUK Global Food Security (18th July 2016) <http://www.foodsecurity.ac.uk/blog/2016/07/surf-and-turf-bringing-crop-and-fish-people-together/> Which summarises some of the ideas which have come out of workshop discussions.

There were a number of suggested follow on activities which are currently being pursued:

3. One is to continue to develop the Scottish Food Security Alliance through joint studentships or more joint meetings.
4. It was suggested that we hold a showcasing event in Scottish parliament to highlight the expertise currently available in Scotland in this area.
5. Another suggestion was to develop a website that is updated frequently with news articles, press articles, text picture, videos, linked to blogs and tweets etc. This could include collated information on the research in food security that is going on in Scotland- this would make that information accessible to the wider world.

A full version of this report with details of the SWOT analysis carried out and summary of discussions can be requested by contacting info@scottishinsight.ac.uk. Presentations from each of the workshops are available at <http://www.scottishinsight.ac.uk/Programmes/Programmes20152016/FoodSecurity.aspx>