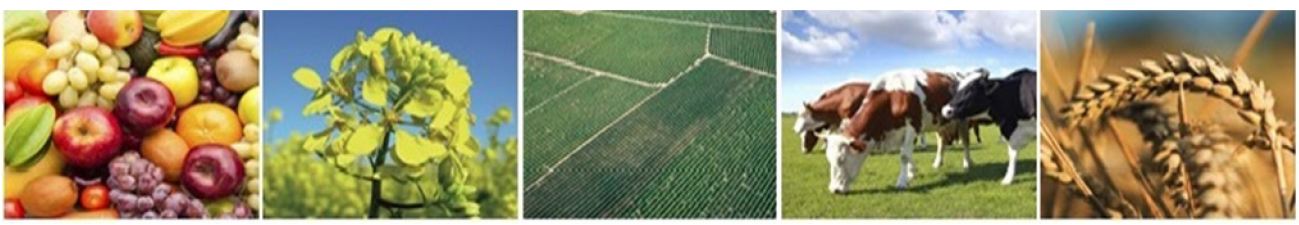
TempAg
SCIENCE FEEDING
TEMPERATE AGRICULTURE

TempAg Foresight Workshop

Research, shaping policies for sustainable agricultural food systems in temperate areas.

5-7 October 2016

The Tower Hotel
St Katharines Way, London, E1W 1LD



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DIRECTIONS

The Tower Hotel, St Katharines Way, E1W 1LD

By Road

East of Tower Bridge, on the north side of the River Thames. At the traffic lights on the junction of Tower Hill, Tower Bridge Approach, East Smithfield and Mansell Street, turn into St Katherine's Way: The Tower Hotel is at the far end.

By Rail

Mainline rail: Fenchurch Street station is 0.5 miles away

London Underground: Take the District or Circle line to Tower Hill station. Leave the station via the entrance on the left, go down the steps and through the subway. Turn left and walk past the Tower of London. Another subway takes you under the next road, then simply follow signs for The Tower Hotel.

London Bridge Tube and rail stations are just a short walk away over Tower Bridge.

By Air

From London City airport, The Tower Hotel is six miles away: take the Docklands Light Railway (DLR) to Tower Gateway station, which is about seven minutes' walk from the hotel.

From London Heathrow, we recommend the Heathrow Express: this runs direct from the airport to London Paddington in just 15 minutes (20 from Terminal 5) and there's a train every quarter of an hour. The Gatwick Express runs a similar service into Victoria. From either terminus, you can take the Underground (Circle Line) to Tower Hill: The Tower Hotel is less than 7 minutes' walk away.

TempAg AIMS

TempAg is an international research collaboration network established to increase the impact of agricultural research and inform policy making in the world's temperate regions.

In contrast to many research consortia, TempAg does not conduct research alone but produces assessments and insights of the state of science regarding sustainable agricultural production systems at multiple levels across the temperate zones. This mapping of existing findings and outstanding knowledge gaps provides a basis for policy, funding and other decision-makers to align national and transnational research programmes in the best possible ways and to create a coherent pathway from research to implementable innovations and appropriate policy interventions for sustainable agriculture in temperate zones. TempAg consists of scientists and research managers from TempAg Member countries working closely with policy maker communities.

TempAg aims to:

- Increase the impact and return on investment of national research programmes
- Bring together national competencies and work to meet goals of transnational mutual interest
- Enable communication and alignment of existing and new research and technology
- Identify areas of research relevant to science and policy which are currently insufficiently addressed at an international level.

After 18 months of existence, TempAg is hosting a Foresight workshop in London on October, 5-7, to determine priorities for its second phase, based on current and prospective scientific and policy perspectives of the countries in temperate regions.

WORKSHOP AIMS

The workshop's aims are to:

- Review current and emerging priorities for policy shaping communities in temperate regions.
- Inform TempAg's priority themes based on the most current science and policy contexts

AGENDA

Wednesday 5 October

17.30 Welcome & Registration

18.30 Keynote Talk: Franck Jesus, Head of Natural Resources, Policy Division, OECD

TempAg's development and relevance with the OECD priorities.

19.00 Dinner & Networking

Thursday 6 October

Morning Session:

- Introduction to TempAg
- TempAg's activities and achievements to date.
- Issues of agricultural sustainability, research approaches in temperate areas.

Afternoon Session: What are the policy & industry research priorities in temperate Sustainable Agriculture?

Friday 7 October

Morning Session: How do we deliver sustainable, productive and nutritious food systems within temperate regions?

- What are the knowledge gaps and areas where further interventions are needed?
- What are the capabilities & barriers for achieving this goal
- What types of research assessments may be needed? What should TempAg do to address priority areas?

Conclusions: Peter Gregory & Jean-Francois Soussana

Lunch & Meeting Close

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WORKSHOP PROGRAMME

Thursday 6th October

09.30-10.00	**Arrival & Coffee**	
10.00-11.10	**TempAg's priority areas and current activities in sustainable agriculture**	
10.00-10.15	**Peter Gregory (TempAg President)**	Introduction to TempAg
10.15-10.30	**Fleur Marchand, ILVO**	Theme1 & Activity Outputs
10.30-10.45	**Janne Benggtson, SLU**	Theme2 & Activity Outputs
10.45-11.00	**Martin van Ittersum, Wageningen UR**	Theme3 & Activity Outputs
11.00-11.10	Q&A	
11.10-12.00	**Addressing issues of agricultural sustainability: research approaches in temperate areas**	
11.10-11.15	**Lin Erda,** Chinese Academy of Agricultural Sciences, **China** (video recorded presentation)	
11.15-11.25	**Balthazar Antonio**, NARO, **Japan**	
11.25-11.35	**Prof Heikki Lehtonen**, Luke, **Finland**	
11.35-11.45	**Prof Ajuruchukwu Obi**, University of Fort Hare,	
	Prof Phatu Mashela, University of Limpopo,	
	Prof Bongani Ndimba, Agriculture Research Council & University of Western Cape, **South Africa**	
11.45-11.55	**Marja Clausen**, Division of Research & Innovation, BMEL, **Germany**	
11.55-12.05	**Ivar Pettersen**, NIBIO, **Norway**	
12.05-12.15	Q&A	

12.15-12.30	**Coffee Break**
12.30-13.00	Break-Out: **Key issues in sustainable agriculture in temperate areas**. *Groups to consider key issues in sustainable agriculture and how these map on TempAg's priority themes.*
13.00-13.15	Feedback to Group
13.15-14.15	**Lunch Break**
14.15-15.00	**What are the policy & industry needs for temperate Sustainable Agriculture?**
14.15-14.30	**Bruce McCallum**, Science & Innovation Counsellor to EU, New Zealand
14.30-14.45	**Freija Van Duijne**, Ministry of Economic Affairs, Netherlands
14.45-15.00	**Bram Moeskops**, TP Organics
15.00-15.15	**Dave Hughes**, Global Head of Technology Scouting, Syngenta
15.15-15.25	Q&A
15.25-15.40	**Coffee Break**
15.40-16.40	Break-Out: **What type of research is needed to meet the policy & industry objectives?**
16.40-17.00	Feedback to Group & Open Discussion
17.00	**Close of Day 1**

Friday 7th October

09.30-10.00	**Arrival & Coffee**
10.00-10.20	**Jean-Francois Soussana, INRA**: Future priorities for TempAg: Delivering assessments for meeting policy & industry objectives.
10.20-10.40	**Tim Benton, GFS**: What are the knowledge gaps & areas where further interventions are needed for sustainable food systems in temperate regions?
10.40-11.00	**Stefan Lange, Thünen Institute**: What are the capabilities (enablers) & barriers for sustainable, productive & nutritious food systems in temperate regions?
11.00-11.15	Q&A
11.15-11.30	**Coffee Break**
11.30-12.30	Break-Out: **What should TempAg do to address key priority issues for research and policy for sustainable, productive & nutritious food systems?**
12.30-12.55	Feedback to Group & Open Discussion
12.55-13.00	Closing Remarks
13.00-14.00	**Lunch & Meeting Close**
14.00	**Close of Day 2**

TempAg THEMES & SCIENTIFIC PRIORITIES

TempAg THEME 1

Delivering resilient agricultural production systems at multiple spatial and temporal Levels:

Scientific questions explored under this theme include:

- How can conceptual frameworks be developed for defining agricultural sustainability at multiple levels?
- How can temporal variability in production be reduced, and how can this be managed as one of the causative agents of price volatility?
- What are the implications of change in multiple socio-economic and environmental drivers for delivering sustainable intensification?
- How can policies and strategies be optimised to promote agricultural systems that are resilient and that can adapt to climate change, economic and environmental shocks?
- What are the limits to and trade-offs within sustainable production systems, and how are they best governed?

TempAg THEME 2:

Optimising land management to produce food and other ecosystem services at landscape level

Scientific questions explored under this theme include:

- How can tensions between competing land uses be resolved? (includes existing and changing land use and natural resources; across temporal levels)
- How can land use systems be designed to optimise synergies which satisfy social, economic and environmental goals, and the provision of ecosystem services?
- How can scale, location, diversity and complementarity of rural enterprises be optimized to enhance the provision of complementary activities within a landscape?
- What are the limits to and trade-offs within sustainable production systems, and how are they best governed?

TempAg THEME 3:

Sustainably Improving Food Productivity at Farm/Enterprise Level

Scientific questions explored under this theme include:

- What practices (including uptake of existing and novel technologies) can be developed and adopted to maximise resource-use efficiency in different contexts (space and time)
- What knowledge and information can be delivered to sustainably improve the quality of crops at the farm/enterprise level (what/where/how)?
- What knowledge and information can be developed to sustainably deliver improved quality of livestock products (what where how) and welfare considerations and feed issues?
- How can interactions between genetic resources, environment and management (GxExM) in different locations be optimised?
- What strategic and tactical tools and practices can be developed and adopted to adapt to and mitigate consequences of extreme events/increasing volatility including those related to climate variability and other changes?

BENCHMARK OF TEMPERATE COUNTRIES' AGRICULTURE RESARCH AND INNOVATION

Below we incorporate assimilated information, following a benchmark analysis amongst TempAg member and associate countries. The following high level questions have been explored:

A/ What are your country's strategic priorities for agricultural production?

B/ What are your country's strategic priorities for agricultural innovation?

C/ What are your country's priorities for sustainable agricultural production?

Information on the above has been received from Belgium, France, Germany, United Kingdom, Japan, New Zealand, Norway, Spain and Sweden.

BELGIUM

A/ What are the strategic priorities for agricultural production?

Agriculture is an activity at a crossroad of natural processes and human systems, and the sector is, as a consequence, liable to a very broad and complex network of influencing factors:

(i) A rising demand for food products, which is (for several reasons) not followed by the supply of agricultural products.
(ii) The depletion of fossil fuels, which leads to the need to rethink the energy infrastructure and to reflect on the possibilities and restrictions of agriculture as a supplier of bio-energy crops.
(iii) The need to improve the balance between human activities and the ecological needs, the climate and the restricted natural resources
(iv) The restricted availability of arable land and the rising pressure from other functions in the countryside.
(v) The globalisation of commercial flows, which connects prices with the world market, but also leads to higher price volatility; and,
(vi) The possibilities of new technologies, provided that a social consensus can be found to implement these.

Based on the priorities for an innovative and competitive agricultural sector, three future needs, from which society expects that they are addressed by agriculture, were identified:

(i) the need for a knowledge production which enables increased productivity and cost-effectiveness of agricultural production;

(ii) the need for a knowledge production which helps agriculture to raise the social appreciation and to reduce the impact of negative externalities which are linked to its activities; and,

(iii) the need for an anticipative (foresight) capacity that allows to align research activities with unexpected developments in the matrix of external factors.

B/ What are the strategic priorities for agricultural innovation?

Agricultural innovation is needed in five research fields to address the societal needs for agriculture:

(i) genetics and biodiversity. the sustainability of production and products not only requires an improved understanding of the development of plants and animals, but also of the role of genetic factors and environmental conditions. Research should therefore develop the correct techniques, methods and strategies to maintain and use the existing agricultural biodiversity, improve local niche species or races, and develop new crops.;

(ii) optimization of growth and production factors. Knowledge of the intrinsic potential of the different processes is of vital importance and can contribute to the development of new technologies that optimally exploit the potential. Given the evolving consumer demand, there are also possibilities for new products, diversified production and the processing of primary raw materials into energy. Sustainability of new and existing production processes, described by clear criteria, must be the guiding principle. Important issues in this field are more eco-efficient production processes and waste reduction in supply chains. The efficiency of individual farms must be raised through the optimal use of production factors and support for company-specific management decisions.;

(iii) enforcing supply chains. To valorise products maximally, demand-driven supply chains, which innovate in response to social, technological and environmental developments, must be developed. Research must also contribute to the (safe) valorisation of secondary and waste streams and support farmers' value creation efforts through a performing chain organisation. To reinforce the chain position of the primary producers, new mechanisms should be developed to distribute value and risk over all chain actors and to improve both horizontal and vertical cooperation.;

(iv) improving quality and the societal role of agricultural food products. Product quality, food safety and consumer perception are central issues in the optimisation of food production. The development of quality standards, performing quality and control systems, criteria to monitor the sustainability of production and consumer research are essential. There are also possibilities to extend the market through the exploitation of the intrinsic heterogeneity of agricultural products and the creation of added value for region-own products. Agriculture can furthermore provide raw materials for the agro-food industry and other sectors. Sustainability criteria must be used to communicate with consumers and other stakeholders on food, diet, sustainable food production and

(v) the social importance of the agro-food production chain. By doing so, consumers receive arguments for a more justified food choice and a safer use of food.; and,

(vi) multifunctional agriculture. multifunctional farmers also produce outputs which are requested but often not remunerated by society. At present, the farmer's efforts are almost exclusively valorised by the government. New instruments must be developed that help to recognize the non-commodity outputs of agriculture and to measure their value. Other important topics are the enhancement of the synergy between urban and rural areas and the optimal use of the available area by means of integrated production models.

C/ What are the research priorities for sustainable agricultural production?

Agricultural research should realize developments in three main innovation areas:

(i) the deepening of the existing processes and competences in order realize an efficient production system;
(ii) the broadening of the value creation model of agriculture; and,
(iii) an amelioration of the sustainability of production.

Traditional contrasts such as the contrast between main and secondary flows, urban and rural space, and commodity and non-commodity goods will be transcended into a new holistic concept that considers agriculture as the integral value creation on the basis of natural resources. The rise of concepts such as bio-based economy, multifunctional agriculture and metropolitan agriculture already announce this transformation.

The transformation cannot be realised through substantive work only, but should also be impregnated in the organisation of research and knowledge production. Four challenges should be addressed: (i) to realize a higher degree of participation through cooperation with institutions, companies and related fields, (ii) to make research more anticipative so that it proactively searches for new opportunities or the prevention of possible risks, (iii) the creation of a body that provides meta-coordination on financing, cooperation and competences and (iv) the development of new strategies to valorise research results.

FRANCE

In France the paradigm of eco-efficiency (or sustainable intensification) and the paradigm of agro-ecology (and organic farming) as an alternative are both acknowledged and present in the research and innovation strategies as well as in the legislations, national strategies and plans in agriculture. But there is still no consensus on their relative weight. Nevertheless the weight or organic farming is steadily increasing: a doubling of the production between 2007 and 2012 has been observed and organic farming represented more than 4% of the agricultural area (1.1 million hectares) in 2015.

A/ What are the strategic priorities for agricultural production?

Source: French Law on the Future of Agriculture, 2014.

The law comprises six chapters.

1. **Economic and environmental performance of agri-food chains**

Engage in agro-ecologic transition in territories, drawing on the strength of the collective and bottom-up approach from territories: reinforcement of the cooperative sector; integration of agro-ecology in dialogue and governance instances; amplification of contract agreements, better representation of inter-branch organizations; better defense of quality and origin labels.

2. **Protection of natural, agricultural and forest areas and generational renewal**

Facilitate and ensure generational renewal of farmers and preserve spatial planning by an increasing protection of agricultural, natural and forest areas.

3. **Food policy and safety performance**

Strengthen the French food model through a food policy refocused on youth priorities, more voluntary for social justice, restoring the place of actors in territories as well as a safety performance acknowledged and valued, fully part of the agro-ecological transition of production methods.

4. **Education, training, research and agricultural and forest development**

Support the agro-ecological transition in territories thanks to a dynamic technical and higher agricultural education dynamic, open and innovative, facilitating social advancement as well an agricultural and, veterinary top research on the international stage.

5. **Forest**

Respond the challenge of a sustainable and competitive forest-based sector in France and internationally

6. **Overseas**

Integrate and develop agro-ecology principles in overseas agricultures by combining economic and environmental performance while at the same time strengthening local sectors and diversity.

B/ What are the strategic priorities for agricultural innovation?

Source: Report 'Agriculture – Innovation 2025', October, 2015

This report includes 30 projects structured in 3 priorities and 9 axes.

(1) **Develop a systemic approach and made agriculture part of the solution to tackle climate change**
   (i) Accompany and stimulate the agro-ecology transition;
   (ii) Develop research and innovation for bio-economy.

(2) **Allow full development of new technologies in agriculture**
   (iii) Continue the digital revolution;
   (iv) Accelerate the development of robotics;

(v) Mobilize the genetic wedge and biotechnologies;

(vi) Support the emerging sector of biocontrol.

(3) **Ensure the cohesion of all research actors, of agricultural experimentation and development in order to support competitiveness**

(vi) Promote open innovation;

(vii) Assess multi-performance and innovate in agricultural economy;

(ix) Support training activities.

C/ What are the research priorities for sustainable agricultural production?

Source: National Strategy for Research 'France and Europe 2020' + INRA Orientation Programme

The National Strategy for Research is structured in ten large societal challenges. Food security is present in the challenge '*Food Security and demographic challenge'* However, little attention is given to demography in this challenge where food security is much more considered from the supply side point of view than from the demand side point of view. The priorities of this challenge are the following:

- A healthy and sustainable diet
- Integrated approach of production systems
- Biomass: from production to diversification of uses.

Food security is also present in the challenge *'Health and well-being'*

As well as in the challenge '*Sober use of natural resources and adaptation to climate change'*, in particular in the following axis:

- Sustainable management of natural resources
- Assessment and control of climate and environmental risk
- Eco-technologies and biotechnologies to accompany the ecological transition.

Source: INRA Orientation Document, 2016-2025

A major challenge brings together all orientations: global food security in the context of transitions and global changes. This challenge comprises four priorities:

- Multi-performance and diversity of French agricultures, enriched by approaches of scientific agro-ecology developed since 2010.
- Climate change, natural resources and agro-systemic services, research works that also enriched by agro-ecologic approaches.
- Development of healthy and sustainable food systems, including their consideration in the urban context and including more explicitly the links between health and agro-food systems.
- Complementarity and competition of biomass for food needs primarily, but also for chemical and energetic needs.

GERMANY

Currently a Superior Research Strategy Concept of German Ministry of Food and Agriculture is under discussion and construction. It shall be subdivided into 4 thematic clusters and a cross-sectional cluster:

Cluster I: Future of rural areas (high quality of life, strong & prospering economy, efficiency of funding)

1) Fostering labour, work conditions and added value in rural regions
2) Ensuring and developing attractive living conditions and und sustainable services for the public
3) Maintaining and developing environment and recreational functions of rural areas
4) Revision and adaptation of control and implementation procedures in rural development

Cluster II: Healthy life (healthy nutrition, safe products)

1) Shaping the pathway of nutrition and food into the digital age
2) Identifying and anticipating future trends of development and behavior
3) Developing efficient prevention models
4) Developing up-to-date safety / traceability / proof of origin systems under globalized conditions

Cluster III: Sustainable Agriculture (responsible and und resource efficient land use and animal husbandry)

1) Active monitoring and developing changing shaping der production processes
2) Gearing plant production towards best possible efficiency of resources
3) Responsible handling of farm animals
4) Raising societal acceptance of processes and products

Cluster IV: Global Responsibility (global food security and responsible management of resources)

1) Increasing productive efficiency of agriculture, fisheries and forestry globally
2) Improving efficiency, effectiveness und inclusivity of agricultural markets, trade and vaue added chains globally
3) Supporting implementation of Sustainable Development Goals (SDG – Agenda 2030 of United Nations) and of the right to food
4) Considering societal expectations and assuming responsibility

Cross-sectional cluster (horizontal tasks & topics, especially capacity building):

1) Big Data
2) Demography and immigration
3) Cooperation and transfer
4) Internationalization
5) Regional issues
6) Participation und transparency
7) Supporting / funding small and medium-sized enterprises (SME)

JAPAN

The basic plan for agricultural production in Japan focuses on initiatives to enable agriculture and the rural areas to accurately respond to structural and other changes in the economy and society. The strategic priorities are implemented every five years as the “Basic Plan for Food, Agriculture and Rural Areas” of the Ministry of Agriculture, Forestry and Fisheries.

Source: http://www.maff.go.jp/e/basic_law/basiclaw_agri/basiclaw_agri.html

A/ What are the strategic priorities for agricultural production?

Strengthening the capability of agricultural production and farm management. We are addressing urgent issues facing the agriculture and food industry, such as the decreasing number and aging of farmers, to contribute to the enhancement of the base of agricultural production, to promote the development of farm management through innovative technologies, and to achieve vigorous productivity in paddy-field farming, upland farming, livestock production etc., by taking advantage of regional conditions. The research priorities include the following :

- Establishing highly productive paddy-field farming, dry-field farming etc., in accordance with the climate and soil conditions of a given region
- Utilization of robotics technology, Information and Communication Technology (ICT) to develop innovations in agricultural production
- Strengthening the production base and enhancing the competitiveness of the livestock industry
- Developing and implementing technological beef-production and cattle-breeding systems in accordance with the specific conditions of a given region

B/ What are the strategic priorities for agricultural innovation?

Development of new varieties and agricultural products towards realization of a strong agriculture and creation of innovative industries. We are promoting the development of novel crops and new agricultural products through genomic and agro-biological research, innovative research focusing on new elementary biological materials such as high-quality silk products which can factor in the development of new industries, and communicating the merits of such products to producers, users and consumers. The research priorities include

the following:

- Development of leading crop varieties with superior yield and quality
- Advancement of genomic breeding techniques in various crops
- Improvement in agro-biological productivity and the production of useful substances and new functional materials.

Producing high-quality and healthy food and ensuring the safety and reliability of agricultural products. We are pursuing extensive research to provide delicious, healthy, safe and reliable food and agricultural products to consumers, and contribute to the maintenance and improvement of health.

- Research targeting high value-added fruit trees, tea, vegetables and flowers
- Research seeking public health-oriented, high-quality, easy-to-eat food products
- Research aimed at ensuring the safety and reliability of food, livestock products, and agricultural crops
- Research on animal diseases and crop pests which constitute a threat to domestic industry and public health

C/ What are the research priorities for sustainable agricultural production?

Resolution of environmental issues and sustainable use of local resources. We pursue various research initiatives aimed at developing a sustainable and resilient agriculture for adaptation to climate change and other environmental problems.

- Research to address global issues such as climate change as an initiative for agriculture of the future
- Research to increase the fundamental strength of agricultural production, and establish a strong agricultural foundation
- Research to mainstream sustainable agriculture in harmony with nature

NEW ZEALAND

A/ What are the strategic priorities for agricultural production?

The NZ Government's Business Growth Agenda sets target of increasing the total value of primary production by 50% by 2025 (New Zealand Government, 2012).

B/ What are the strategic priorities for agricultural innovation?

In addition to the NZ Government's Business Growth Agenda, primary production is to occur set against a backdrop of maintaining and improving NZ's water quality(Ministry for the Environment, 2013). Legislation is already enacted to ensure this occurs and that all catchments (termed freshwater management units) are achieving a set of National Bottom Lines (Ministry for the Environment, 2014; Ministry for the Environment and Ministry for Primary Industries, 2014).

C/ What are the research priorities for sustainable agricultural production?

The Ministry for Business, Innovation and Employment (NZ body responsible for government science funding) has partitioned large scale research questions into 11 National Science Challenges. One of these is "Our Land and Water" (www.ourlandandwater.nz) which has the mission to double the total value of production while maintaining our land and water resources for future generations. After a national stocktake of research (McDowell et al., 2015), 230M (over 10 years) is being considered for investment in high level programmes to:

Trace the source and flowpaths of water quality contaminants from mountains to sea (including aquifers)

Move from a system that only considers land use capability to one that considers suitability and the full economic, environmental, social and cultural impacts.

The development of next generation systems that produce 50% greater value than current systems, but with 20% of the environmental footprint.

The optimal value chain to enact change (on land) and share the value along the chain more equitably from consumer to producer.

Determine the best form of interaction (e.g. collaborative processes) that lead to more accepted, robust and enduring catchment management decisions.

References

McDowell, R.W., M.E. Wedderburn, J. Quinn, M. Hedley, C. Saunders, A. Mowat, J. Turner, M. Beare, D. Whitehead, P. Mudge and P. Dalziel. 2015. Research landscape map for the National Science Challenge: Our Land and Water. AgResearch, Mosgiel, New Zealand. p. 60.

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NORWAY

A/ What are the strategic priorities for agricultural production?

Source: Ministry of Agriculture and Food. Environmental Strategy (2008- 2015)
https://www.regjeringen.no/globalassets/upload/lmd/vedlegg/brosjyrer_veiledere_rapporter/miljostrategi_2008_2015_m_0739_b_engelsk.pdf

Agricultural and food policy goals

Agricultural and food policies shall enable the sustenance of a viable agriculture throughout the country. Policies - to enable increased value creation and welfare based on the sustainable management of agricultural and rural resources. The main features of the agricultural and food policies shall be maintained and further developed in order to secure:

- food safety,
- value creation,
- rural employment and settlement,
- sustainable resource utilisation.

The main goals of the agricultural and food policies are subdivided into the following subsidiary goals:

- Secure food safety
- Enhance diversity and other consumer considerations related to food production and marketing
- Promote good plant and animal health and good animal welfare
- Ensure sustainable resource management, incl. stringent land conservation measures, conservation and management of cultural landscapes and safeguarding biodiversity
- Develop sustainable forestry as a basis for increased value creation through use of wood, bioenergy and commercial utilisation of non-cultivated land
- Maintain a viable agriculture that contributes to employment and settlement throughout the country, and which enables increased value creation from innovative business activities

- Secure national food supply, a competitive food industry and innovative, sustainable production of goods and services
- Maintain a viable reindeer industry with sustainable use of grazing resources, and which contributes to maintaining the distinctive character of the Sami culture

Source: White Paper to Parliament No. 9 (2011- 2012). Landbruks og matpolitikken. Velkommen til bords. (Agriculture and food policy goals. Welcome to the table)
https://www.regjeringen.no/contentassets/adb6bd7b2dd84c299aa9bd540569e836/no/pdfs/stm201120120009000dddpdfs.pdf

Four main priorities for Norwegian policies on agriculture and food production.

1. Food security
2. Agricultural activities througout the country
3. Increased value creation
4. Sustainable agriculture

For each of these main prioities there are 4- 5 subgoals listed and decribed (can be translated if needed)

A main focus in the White Paper and a basis for the current agricultural policy is the goal that national agricultural production should increase in line with increased population. In Norway it was in 2011 expected that the population would increase by 20 % within 2030 – so national agricultural production should also be increased by 20 %. This is a big challenge as current yields are stganatinf or even declining. It is given priorities for production based on national resources of forage and pasture. The goal of increased production has been followed up by research priorities from The Norwegian Research Council (NRC) in «The Bionær programme» . The report also refer challenges with cllimate cange and the Report No. 39 (2008-2009) to the Storting *Climate Challenges – Agriculture Part of the Solution,* including emissions reduction, adaptation to climate change, and renewable energy.
https://www.regjeringen.no/contentassets/1e463879f8fd48ca8acc2e6b4bceac52/no/pdfs/stm200820090039000dddpdfs.pdf
It is given priority to increased carbon storage in agriculture and forestry, biogas from manure.
An important goal in this report was the priorities for having agricultural production in the whole country. It is followed by subsidy and support systems to acchieve this. Agricultural employment is important for rural development and living in districts.

It is a political goal that organic farming should contribute to 15 % of the food production and food consumption and spesific support is give to such production systems. (In 2010 it was 4,7 %)

The new government in Norway from 2013 has also given high priority to increased food production- but has given more priorities to support full time farmers and larger production units. In 2016 there is a ongoing work with a new White paper to the parliament about agricultural policies- agricultural production and new priorities. Many stakeholders have given contributions to the new priorities. It is expected that the work will be finalized in 2016.

The incorporation of Bioeconomy and innovation is expected to be important part of these priorities.

B/ What are the strategic priorities for agricultural innovation?

Source; White Paper to Parliament No. 9 (2011- 2012). Landbruks og matpolitikken. Velkommen til bords. Chapter 11.5. (Welcome to the table, pdf link given above)
Innovation in the agricultural sector has a high priority in the White paper (2011- 2012). The agricultural sector in Norway has had larger structural changes and higher innovations that many other industrial sectors. It is foreseen a continuos development for innovation in agricultural sector It is a close cooperation between Research Council, Innovation Norway and SIVA (Company for industrial growth) and a lot of acteurs within municipalities, county level administrations, regional administration levels to support innovation. The cooperation includes support systems, structures and institutions to support profitable innovations. The innovation political platform is based on three elements:

- Entrepreneurship and market thinking in the whole value chain
- Cooperation and synergies between agriculture and other sectors
- Cooperation in networks and development of well- functioning innovation systems

Each of these priorities is further described and followed up. E.g there is an Action plan for entrepreneurship in education (2009- 2014), support systems (Regional Development Funding programs) training courses to follow up new initiatives and ideas and increased research. Innovation is being priortised higher by different programs in the Research Council. «Innovation Norway» has a central function in the innovation work , both for financing but also for training, information e.g.

In 2014 the first national conference on Bioeconomy was arranged by Innovation Norway, Research Council, Ministry of Agriculture and food and Ministry of Fisheries .

A national strategy for Bioeconomy is now (2016) under development and innovation will be part of this. As a part of the new priorites - in 2015 the Institute « Norwegian institute for Bioeconomy research « NIBIO was established (A merge of Bioforsk, Norwegian Institute of Agricultural Economics (NILF) and Norwegian Forest and land Inventory Planning). A main goal for the new Institute is to contribute to the Green Changes- and the shift from an oilbased economy to a green economy based on renewable resources, bioeconomy. The Bioeconomy promotes innovations in agriculture, but also increased innovations based on forest and marine products. So - compared to the White paper from 2011- 2012, there are both changes and new priorities much more focused on utlization of production possibilites, innovations and use of all biological resources. This will be detailed in2016 with the 2 new reports about Bioeconomy strategy and the new policies for agriculture and food.

Source; White Pater to Parliament No. 31 (2014- 2015); The farm as a resource –the market as a goal .

https://www.regjeringen.no/contentassets/a01332bd91cd4261a439fc27397c483d/nn-no/pdfs/stm201420150031000dddpdfs.pdf

The white paper focus on possibilities for increased value creation within agriculture and forestry outside the traditional production systems. Many farms in Noway are relatively small and have limited possibilities for increased traditional production. The White paper focus on policies for growth and development and new ideas that are not dependent of the farm size. Some examples: Renting out «hunting and fishing « , renting out mashinery- entrepreneur harvesting, shovel snow etc, sale of firewood, bioenergy, travel based accomodation, guiding, local food, fruit , alcohol.

The strategy is followed up by;
Support system: Development programme for agricultural and reindeer growth and development. Innovation Norway is responsible for follow up the acticities and it is given financial support.
Mentorsystem , Incubator system
Increased focus on education and research programmes
Support for research based innovation programmes
Support for increased cooperation between research and agricultural based agrobusiness
The report is detailed for a number of subgoal about how the government will follow up the priorities.
Examples are given of Partnership agreement for Sweden and Austria (financed by EU structural and investment funding programme).

Source:White paper the Parliament. Med. No 7 (2014- 2015) Langtidsplan for forskning og høyere utdanning 2015- 2024. (Long term plan for research and education 2015 - 2024).
https://www.regjeringen.no/contentassets/e10e5d5e2198426788ae4f1ecbbbbc20/no/pdfs/stm201420150007000dddpdfs.pdf

The government will increase research that can contribute to innovation and changes through new establishments, new establishments and conmmersialism. It includes increased use of incentives as «SkatteFUNN «, FORNY 20120 and VRI. Companies and industry that support and participate in research will benefit from taxes (skatteFUNN) and receive support from regional research and development (VRI). It is given support form licensing, commersialising, new establishment.
In addition to supporting research the government support that education also focus more on innovation as an integrated part of the education.
Strengthening of networks and more cooperations between research, eduaction and agricultual industri, agrobusiness is part of the strategy.

C/ What are the research priorities for sustainable agricultural production?

Source; White Paper to Parliament No. 9 (2011- 2012). Landbruks og matpolitikken. Velkommen til bords. Chapter 11.4.

Main priorities for research:

- Sustainable production – of enough food , anad food security to met national challenges in the food area
- Climate- reduced emissions of greenouse gases, adaption to climate change, renewable energy resources
- Innovations and increased competness in the agricultural and food sector
- Increased knowledge base for the agricultural administration

Within the priorities for sustainable production it is given priorites to agronomic research to increase yields (that are stagnating and even declining), especially within cereal production. The increase in production should should also take care of the environmental issues, both for water quality and emissions of greenhouse gases.

Source:White paper the Parliament. Med. No 7 (2014- 2015) Langtidsplan for forskning og høyere utdanning 2015- 2024. (Long term plan for research and education 2015- 2024).
https://www.regjeringen.no/contentassets/e10e5d5e2198426788ae4f1ecbbbbc20/no/pdfs/stm201420150007000dddpdfs.pdf

Some points from the report:

Participation in Horizon 2020 is given high priority.

Knowledge based bioeconomy is the new platform for targeted reseach, this is given high priority. (described under B- above)

Climate change will give new challenges for adaptation of production systems and at the same time reduce greenhouse gases . Products based on renewable biological resources can reduce GHG emissions.

Source: Landbrukets klimautfordringer (Climate change- agricultural challenges). Report to Ministry of Agriculture and food in February 2016.

https://www.regjeringen.no/contentassets/416c222bde624f938710ff36751ef4d6/rapport-landbruk-og-klimaendringer---rapport-fra-arbeidsgruppe-190216.pdf

The report is based on the the latest IPCC results (5th report), downscaled results for Norway (Climate in Norway 2100) and evaluations from different research groups. It gives an overview of expected changes in climate for production possibilities for different production system in different parts of the country and need of adptation. A main focus in the report is how to increase production and reduce greenhouse gas emissions both for livestock and plant production. Possibilities to store carbon both for agriculture and forestry is high focused.

Source: Research priorities- Norwegian Research Council.

The research council has several reseach programmes with priorities for sustainable production. The most important is the Bionaerprogramme, but also within environmental research, Miljø 21 (environment 21) sustainable production methods are adressed.

Sustainable innovations in Food and Biobased industries (Bionaer programme): english version as attachment.

BIONÆR/BIONAER is the Research Programme on Sustainable Innovation in Food and Bio-based Industries. The programme will work user-oriented and in a continuous learning mode in order to solve challenges through financing research and innovation promoting the bioeconomy.

Objectives of the programme:

The scope of the BIONÆR programme encompasses:

- agriculture, forestry and nature-based value chains;
- seafood, from the time the raw materials are taken out of the sea until they reach the consumer.

Primary objective:

The BIONÆR programme will promote research and innovation that enhances value creation in Norway's bio-based industries.

In keeping with this, the programme will:

1. Strengthen and develop
    1. knowledge and expertise in selected areas to promote sustainable bio-based industry in Norway;
    2. research-based innovation in bio-based companies and bioresource management.
2. Implement innovative work forms that involve players in the research community, trade and industry, the public administration and special interest organisations.
3. Use coordination and dissemination activities to enhance the benefits of knowledge and expertise gained by the industry and public administration.
4. Participate in international cooperation in order to strengthen knowledge-building and innovation in priority areas.

The following perspectives specifically apply to food production:
Food security: Norway must help to secure the global food supply. Taking greater advantage of the opportunities relating to seafood is of key importance. Knowledge is required to ensure that land-based food production increases at a pace with the needs of a growing Norwegian population.

Safe and healthy food: Safe food that promotes good health must be the aim in all stages of the production cycle.

The closed-loop systems perspective described above must underlie the approach to be employed in all industries and activities within the scientific scope of the BIONAER programme. For practical reasons it is nevertheless necessary to divide the programme's area of responsibility into four thematic priority areas:

Basis for production and framework conditions
Primary production
Processing, marketing and the consumer
Service-based value creation

The boundaries between these four thematic priority areas will be flexible.

SPAIN

A/ What are the strategic priorities for agricultural production?

- The global strategy for food policy is to improve the marketing and quality of agri-food products.
- Support for the values of agri-food quality and organic farming, as well as a balance in the value chain, are aspects of this policy that help frame the basic rules for this economic sector.
- The Ministry of Agriculture, Food and Environmental Affairs is working to improve the structure and operation of the food chain so as to enhance the effectiveness and competitiveness of the agri-food sector and thus achieve a better balance in trade relations between the various operators in the value chain. In the summer of 2013, these efforts culminated in the approval of two laws: Law 12/2013, of 2 August, on measures to improve food chain operations and Law 13/2013, of 2 August, on fostering the integration of cooperatives and other associative entities of an agri-food nature.
- Law 12/2013, of 2 August, created the Food Information and Control Agency (Spanish acronym: AICA) to monitor failures to comply with the law. This body was also given powers to propose penalties. The enactment of this law was completed on 6 February following approval of two Royal Decrees by the Council of Ministers: Royal Decree 64/2015, of 6 February, partially developing Law 12/2013, of 2 August, on measures to improve food chain operations, and modifying the Regulation of Law 38/1994, of 30 December, governing inter-professional agri-food organisations, approved by Royal Decree 705/1997, of 16 May; and Royal Decree 66/2015, of 6 February, governing the regime of controls to be applied by the Food Information and Control Agency, provided for by Law 12/2013, of 2 August, on measures to improve food chain operations, which gives the AICA all the powers it needs to correct any imbalances in the trade relations of companies that operate in the food chain.

- A further goal is to follow the recommendations issued by the National Competition Commission in its Report on relations between manufacturers and distributors in the food sector of 5 October 2011.
- Source: Ministry of Agriculture, Food and Environmental Affairs based on Customs Statistics (AEAT)

B/ What are the strategic priorities for agricultural innovation?

- There is a need to advance in the preservation of natural resources, especially the efficient use of water, combating soil erosion, droughts, forest fires, protecting our agro-ecological systems, its biodiversity and the preservation of seas, oceans and the coast line.
- So, the RDi-related priorities considered include:

I. COMPREHENSIVE, EFFICIENT AND SUSTAINABLE PRESERVATION AND MANAGEMENT OF THE AGRO-ECOLOGICAL SYSTEMS AND OF THE AGRO-FORESTRY, WATER AND FISHING RESOURCES, including relevant aspects such as: (i) technological improvements, improvements in management, handling and efficient use of water for irrigation, in agro-forestry and agro-industrial systems and in all industrial production processes; (ii) comprehensive management of agricultural land; (iii) optimisation in managing forest fires and adopting advanced solutions regarding the prevention, extinction, restoration and assessment of impacts; (iv) the impact of global change on the expansion of colonising species, plagues and crop diseases as well as the determination of efficient techniques for controlling them; (v) application of the GIS, remote sensing and ICTs in the management of natural resources and agrifood, forestry and fishery systems and (vi) sustainable management and handling of water resources.

II. SUSTAINABLE IMPROVEMENT OF THE AGRICULTURAL, LIVESTOCK AND FORESTRY PRODUCTION SYSTEMS: (i) productive and reproductive efficiency and genetic improvement of agricultural, livestock and forestry species, promoting the knowledge and application of biotechnology and genetic, genomic and molecular tools and the development of new sources of plant proteins and the development and improvement in the efficiency of consumable goods; (ii) plant-diagnostic protection, epidemiology and integrated plague and disease control and models in the use of phytosanitary products; (iii) animal and plant health; (iv) animal and plant production systems, including consumable goods, machinery, technologies and systems; (v) production of biomasses, bioproducts and bioenergy and (vi) economic, environmental and social valuation and modelling of agri-forestry systems.

III. IMPROVEMENT AND DEVELOPMENT OF NEW SYSTEMS, PROCESSES AND TECHNOLOGIES FOR AGRI-INDUSTRIAL PRODUCTION AND CONTROL, BIOPRODUCTS AND BIOREFINERIES: (i) processes and technologies for preparing, transforming and preserving foods, forestry and fishery products and agri-industrial bioproducts; (ii) bioproducts, biolubricants, biofuels and others for human and animal consumptions and other industrial uses; (iii) integration of industrial and production

engineering, including new biorefineries; (iv) use of residual biomass as raw material in biorefineries for obtaining biofuels, fine chemical products or petrochemical raw materials; (v) smart, flexible and sensitive production systems, within minimum processing technologies and other emerging technologies and (vi) new designs, formats, materials and technologies for bottling, packaging and packing as well as developing containers with specific functionalities (active and smart).

IV. INCREASE THE QUALITY AND SAFETY OF THE FOODS AND NEW FOOD PRODUCTS: (i) developing safe foods, new functional foods, "nutraceuticals" and other products adapted to the market and techniques for standardisation and certifications; (ii) preservation processes, repercussion on food and nutritional safety, useful life of the food products and relation with sensory quality; (iii) nutritional quality of foods and bioactive substances, relation between the foods and the health and wellbeing of the consumers (iv) diet and nutrigenetics and (v) developing new systems for early detection of emerging risks, as well as the optimization of food safety management systems.

V. ARTICULATION AND OPTIMISATION OF THE AGRI-FOOD CHAIN for generating and improving the distribution of added value developing new organisation and management and marketing models and new distribution chains, as well as to increase its flexibility and safety to advance in environmental sustainability of the chain, improving the efficiency in the use of raw materials, waste reduction and reuse, use and valuation of sub-products, energy efficiency and carbon and water footprint.

VI. SAFETY, TRACEABILITY, ALERT AND RISK MANAGEMENT: (i) safety and harmlessness of the foods, identification and assessment of emerging risks, most efficient sanitisation technologies throughout the chain; (ii) smart traceability models, alert systems, crisis management, new labelling technologies, etc. and (iii) research into agriculture, livestock and forestry insurance models.

VII. IMPROVING COMPETITIVENESS AND SUSTAINABILITY IN THE FISHERY AND AQUACULTURE SECTORS using measures designed to promote RDI in: (i) efficiency in food, reproductive capacity and handling aquatic species; (ii) development and production of new aquaculture species and marketing presentations for fishery products;

(iii) technologies for exploiting seaweeds for human consumption and for producing bioenergy and bioproducts; (iv) energy efficiency on vessels; (v) new distribution technologies incorporating advanced smart packaging techniques.

VIII. MARINE RESEARCH: (i) obtaining knowledge on the seabed to use our seas appropriately and implement correct environmental protection which includes aspects such as bathymetry, bionomics of the seabed, natural resources and others; (ii) maritime spatial planning and integrated management and the compatibility of uses of the seas and coast lines, and (iii) prevention of marine geological risks.

C/ <u>What are the research priorities for sustainable agricultural production?</u>

- To respond in a sustainable and smart manner to the challenges related to food safety, the quality and harmlessness of foods, the competitiveness of the agrifood, forestry and fishery sectors in national and international markets, to the need for creating jobs, improving the management of the natural resources used by the different productive sectors, as well as of the coasts, seas and oceans, all of which belong to the area of bio-economy.
- To deal with increasing the production and the added value of foods, food products and non-food products and to reduce overseas dependence on raw materials, consumer goods and technologies; of adapting the foods to new consumer demands, by means of research, innovation and developing new processes for production, transformation, packaging and distribution and guaranteeing safety and quality throughout the entire food chain.

SWEDEN

Some years ago a governmental inquiry on “the future priorities for agriculture and the food sector” was set up. The final report was presented last year (SOU 2015: 15, Attraktiv, innovative och hållbar – strategi för en konkurrenskrafig jordbruks- och trädgårdsnäring), under a title of something like; ”Attractive, innovative and sustainable – a strategy for a competitive farming sector”. The inquiry focus on four areas; Business, (increased efficiency and profitability in production, market orientation, and more flexible roles for ownership and land use), Market conditions (increased focus on markets and consumers, increased export and labeling) Knowledge and innovation (more “need driven research, and innovation”, increased private initiatives in R&D, increased cooperation in the whole value chain), Rules and framework conditions (EU as the foundation for rules, special regulation based on scientific grounds, increased flexibility and focus on effects). The inquiry also stress the importance of continuously high ambitions regarding sustainability and global challenges and the role that the Swedish farming sector can play in this context. For the first time in many years it is, however, a clearly expressed ambition to increase the Swedish production in farming and of agricultural products. Since Sweden, at least in many areas, lack conditions that would enable an internationally competitive production based on low costs, the alternative is to focus on high value added, quality and specific consumer niches.

The Swedish government has continued the work with the inquiry and the minister of rural affairs has declared a clear interest in an increased production in Sweden. The governmental response on the inquiry has, to a large extent, been an acceptance of the main ideas and conclusions presented. The government has arranged a series of workshops and a rather ambitions process of preparation of a coming governmental bill on farming. This bill is planned to be sent to the parliament in June and even if we do not know the final outcome it seems highly likely that the governmental bill will follow the inquiry in is significant parts.

A/ What are the strategic priorities for agricultural production?

Source: SOU 2015: 15 and other governmental initiatives.

As mentioned above the inquiry focus on four areas, under a general heading of sustainable production and consumption in relation to global challenges. If the ambitions in the inquiry is to be fulfilled, the productivity in Swedish farming needs to increase and individual farms and firms will need to develop. Continuous structural change and market orientation is also needed. To enable such processes there is an identified need for a "restart" of "need driven R&D", cooperation within the whole value change, new business models and knowledge transfer.

Parallel to the development of the coming governmental bill there has been a number of governmental initiatives towards the milk sector and the "milk crises". One of the outcomes of these initiatives is a "platform" with a number of actions and activities. In a Swedish context the milk sector and active milk producers are important also for the significance of milk heard in a regional context, and especially for biodiversity in the forest dominated Swedish landscape.

The government has also signaled a clear ambitions to increase the export of Swedish farming and food products, within a general export strategy.

The general development within the farming sector in Sweden is, however, not positive, with obvious problems in e.g. the milk sector.

The final outcome of the governmental ambitions within agricultural production will be expressed in the coming bill, but the signals this far is clear: in a Swedish context the clear focus on increased production and export is "new" and with these ambitions follows increased governmental interest for R&I&D (research, innovations and development) and collaboration among actors within the broadly defined "agrarian and food sector".

During the process of the formulation of the governmental bill there has been an active discussion on Swedish production and consumption, in relation to global challenges, such as emissions of CO2 and other environmental problems (as e.g. problems with antibiotic resistance), and the "risk" that Swedish consumers increase their environmental footprints if they "export environmental problems if the import of e.g. animal food increase".

In the inquiry there was also a recommendation that Sweden would turn to the OECD and ask them to produce a report on the Swedish agricultural innovation system. The government has shown a clear interest of such a report.

B/ What are the strategic priorities for agricultural innovation?

Source: SOU 2015: 15.

In addition to the coming governmental bill on agriculture and food, the government will present a new R&I&D bill this autumn (it might be presented as an R&D-bill or with another "label"). The government presents such bills every fourth year. It is still unclear if the coming bill will have specific initiatives related towards agricultural and agricultural innovation, but it would come as no surprise if that would be the case. There are at least expectations of some kind of initiative directed to sustainable food production and innovations within the agricultural/food area.

C/ What are the research priorities for sustainable agricultural production?

Source: En hållbar framtid genom stark forskning och utveckling. Formas – forskningsrådet för hållbar utveckling. Ett underlag till Sveriges forskningspolitik 2017 – 2027. Oktober 2015 (Formas is the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning and this report is their contribution to the preparation of the coming Swedish R&I&D-bill).

http://www.formas.se/sv/Om-Formas/Regeringsuppdrag/En-hallbar-framtid-genom-stark-forskning-och-utveckling/

formas.se/PageFiles/15378/Formas Slutrapport Växtskyddsforskning. (Formas report on the future of researchin plant protection.

http://www.formas.se/PageFiles/5074/Strategy_Biobased_Ekonomy_hela.pdf. (This report from Formas presents a strategy for research related to a biobased economy in Sweden.)

Formas (the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning) identifies global challenges such as increased food demand, climate change and environmental pressure (e.g. increased water scarcity) and they stress the need for initiatives to tackle such challenges. They also point to the need for an increased focus on a transformation to a more biobased economy.

Formas also mention an increased need for research directed towards harmful chemicals and a clean environment, biodiversity, eco-systems services and plant protection. Formas express an ambition to focus more on these areas.

In addition Formas recommend the government to increase funding of research in the following areas: climate change, food and urbanization, in order to increase the possibilities to reach a more sustainable development of the society.

With direct reference to the coming governmental food bill Formas identifies a need for production related research within the food and agricultural area, as a way to increase competitiveness in the sector.

UNITED KINGDOM

A/ What are the strategic priorities for agricultural production?

Current emerging themes and priorities for **UK Agri-Food Research** include:

- **Resilience and sustainability of food and farming systems:** (resilience to climate change, pests, diseases, crop/livestock health)
- **Improving food and farming system productivity and environmental performance:** (exploit genomics, optimal management of soils, crops, livestock, understand supply and demand drivers and address food waste)
- **Enhancing food quality and manufacturing :** (breeding, sustainability of raw materials, food processing, flexible automation, packaging)
- **Safe and nutritious Great British *food*:** (food quality, nutrition, safety, traceability)
- **Cross-cutting themes**
  - Technologies such as big data, informatics, internet of things, robotic
  - Attitudes and acceptance (behaviours, food, choice, acceptability)
  - Environmental resilience (increasing agricultural productivity with improved environmental impacts)

B/ What are the strategic priorities for agricultural innovation?

Feeding the Future**, published June 2013:**

The industry roadmap 'Feeding the Future' sets out the innovation requirements for primary food production in the UK to 2030 in eight priorities for research:

1. Use modern technologies to improve the precision and efficiency of key agricultural management practices.

2. Apply modern genetic and breeding approaches to improve the quality, sustainability, resilience and yield-led profitability of crops and farm animals.

3. Use systems-based approaches to understand better and manage interactions between soil, water and crop/animal processes.

4. Develop integrated approaches to the effective management of crop weeds, pests and diseases within farming systems.

5. Develop integrated approaches to the management of animal disease within farming systems.

6. Develop evidence-based approaches to value ecosystem service delivery by land users and incorporate these approaches into effective decision support systems at the enterprise or grouped enterprise level.

7. Extend the training, professional development and communication channels of researchers, practitioners and advisors to promote delivery of the targets above.

8. Improve the use of social and economic science to promote the development, uptake and use of sustainable, resilient and profitable agricultural practice that can deliver affordable, safe and high-quality products.

UK Strategy for Agricultural Technologies**, published July 2013**

This high level government strategy highlights the following set of actions:

1. Improve the translation of research into practice through a £70 million Government **investment in an Agri-Tech Catalyst** which will provide a single fund for projects, all the way from the laboratory to market. This will include £10 million to deliver international development objectives

2. Increase support to develop, adopt and exploit new technologies and processes through £90 million of Government funding for **Centres for Agricultural Innovation**

3. Help the UK exploit the potential of **big data and informatic**s and become a global centre of excellence by establishing **a Centre for Agricultural Informatics and Metrics of Sustainability**

4. Provide stronger leadership for the sector. The Leadership Council gives industry a stronger and more cohesive voice with Government and the science base

5. Build a stronger skills base through industry-led actions to attract and retain a workforce who are expert in developing and applying technologies from the laboratory to the farm

6. Increase alignment of industry research funding with public sector spend by increasing understanding of what is being spent and where

7. Increase UK export and inward investment performance through targeted sector support

C/ What are the research priorities for sustainable agricultural production?

BBSRC is currently updating its 2016-21 Strategic Framework in Agriculture and Food Security (under preparation, to be published in 2016), research priorities include:

1. **Sustainable Intensification (SI):** produce more food more sustainably and more resiliently research is required to enable SI: enhanced production with improved resource use efficiency and better environmental outcomes, balancing output with other ecosystem services and maintenance of natural capital, in the face of unpredictable, potentially extreme, impacts of climate change
2. **Crop and farmed animal health:** Crop and livestock disease is a major economic burden and a lack of effective controls is a source of inefficiency in agricultural production. Major outbreaks of pests and diseases have devastating long-term socio-economic impacts. Climate change and global trade are driving new threats, and

3. resistance to control measures presents an increasing challenge to farming resilience. New tools and strategies are urgently required, using the latest knowledge from biological research.
4. **Food safety and nutrition:** Interventions to improve the productivity and sustainability of farming must not be at the expense of safety or nutritional quality of the food produced. We need to better understand key requirements for health and possible food system trade-offs. There are also opportunities to improve the nutritional value of staple foods and feeds, and to develop novel functional foods that can promote health.
5. **Reducing waste:** To make the food system efficient and sustainable we must address the significant levels of food waste. A significant proportion of waste could be controlled and reduced through biological interventions in the food chain - from farm to fork.
6. **Understanding and exploiting traits:** To meet future needs for food and non-food agricultural products we have to exploit the genomics revolution in crops and farmed animals, and be able to predictively translate this to beneficial phenotypes in "real world" environments. Understanding the "genes x environment (inc. management) = phenotype" relationship.
7. **Agri-technology and its supporting precision engineering:** To fully exploit the new biology, biotechnology and supporting tools and data management are required. These will act as enablers for researchers to maximise developments in the biosciences, and to translate novel technologies to agriculture and food systems. Novel technologies and improved data management**.**

The UK's main public funders Global Food Security Programme, highlights three areas in its GFS 2011-2016 Strategic Plan:

1. **Resilience:**
    - Understanding of the critical factors affecting the resilience of households, world trade and global food supply and how economic, social and environmental drivers affect resilience.
    - Developing and enhancing economic models of trade flows, agriculture and hunger that capture the impacts of within year shocks.
    - Modelling the impact of environmental change on agriculture, and agriculture on the environment to improve resilience.
    - Developing evidence to inform policy recommendations around improvements in infrastructure (and other public goods), governance and broad economic development that contribute to food security.
    - Developing a better understanding of the effects of existing systems, markets and regulatory frameworks with a view to enhancing their effectiveness, in particular in relation to managing unexpected shocks and perturbations.
    - Developing insights that inform how policy might underpin risk management strategies to help build resilience for producers and suppliers in the developing world.

2. **Sustainable Production and Supply :**

- Enhancing production and productivity of crops, farmed animals and fish while minimising losses and adverse environmental and social impacts, maintaining high standards of animal welfare and maintaining essential ecosystem services.
- Reducing greenhouse gas and other emissions from the farming and food sectors with more efficient use of resources and reduced waste.
- Improving understanding of the interaction between the agricultural system and the wider environment, understanding and quantifying 'natural capital' as it relates to the agricultural system.
- Optimising the use of resources (e.g., water, land, energy, nutrients and other inputs) while increasing crop and animal productivity (per unit input) and taking account of climate change.
- Improving sustainable soil management to deliver agricultural production and other ecosystem services.
- Understanding how fat, sugar, preservative and salt content of foods could be reduced while ensuring that palatability is maintained, waste is minimised, and food remains safe and does not spoil.
- Understanding how the nutritional content and functionality of materials can be optimised to help in the development of formulation and manufacturing strategies.
- Improving understanding of the attitudes, habits and practices that affect current patterns of food production and supply (including resource use and associated waste) in the food system, with a view to embedding more sustainable practices in the short and long term (including resilience to climate and other environmental change).

3. **Nutrition, Health and Wellbeing :**
    - Microbial and chemical food safety and food intolerance – including current priorities of reducing the incidence of key food-borne pathogens throughout the food supply chain (notably Campylobacter); identifying and addressing emerging and re-emerging food safety risks; and the challenges and opportunities (technological, social and economic) arising from the proposed application of emerging technologies.
    - Nutrition and malnutrition – including improved understanding of how foods interact with the body; micronutrient requirements; and the differing nutritional needs of various groups who are subject to the challenges posed by food security-related issues.
    - Developing a better understanding of what a healthy, sustainable and safe diet is and how this can be achieved in the context of variable consumer access to resources and limited ranges of food stuffs.
    - Responsible innovation in the development of emerging technologies.
    - Improved understanding of:
        - Individual/group behaviour throughout the global food supply chain (from producers to consumption and waste management) in the context of a broad range of food security drivers, such as environmental change, government intervention and technology development.
        - Food choice as determined by social and contextual factors (for example attitudes, values and cultural influence; demographic profile; the role of preference, habit and social practice; public understanding,

- advertising and marketing strategies), economic factors such as affordability, aand biological factors (for example cognitive; food-reward mechanisms; satiety; palatability; and preference).

In addition to the above and in relation to food, health and nutrition more broadly, the below strategic frameworks and cross-council visions have been co-developed and published in parallel, in March 2015:

BBSRC 2015-2020 Strategic Framework in Food, Nutrition and Health, **published March 2015 - Highlighted Research Challenges within include:**

1. To establish how food and nutrition can optimise health and reduce disease risk
2. To understand how diet interacts with external and internal factors to modulate phenotypic responses that influence health
3. 3. To understand the contribution of dietary patterns, individual nutrients, whole and processed foods and food structures to promoting and maintaining health
4. 4. To understand the biological determinants of personalised behavioural responses and attitudes toward food, nutrition and health

New Cross Council Vision for Food Nutrition and Health, **published March 2015 – Research Areas include:**

Food, nutrition and health research across Council remits in supporting integration between:

1. basic biological and medical science; gaining a deep understanding of how nutrition influences states of health and disease (with particular reference to research in populations with subclinical phenotypes)
2. fundamental, medical and clinical nutrition science; creating a translational pipeline from research to clinical application
3. mechanistic and epidemiological approaches; ensuring they are mutually informing
4. cultural studies, epidemiology and public health approaches
5. human physiological and behavioural approaches; elucidating the interactions between physical, neurological and behavioural dietary decisions and responses
6. human, plant and animal (livestock) biosciences; understanding the relationships between nutrient and bioactive content (including bioavailability and bioaccessibility) and health implications, informing agricultural research aims
7. human and food microbiology; understanding their interactions in the GI tract in relation to health and disease

Key **high-level challenges** and approaches for multidisciplinary research in food, nutrition and health highlighted here include:

Health and Resilience:

1. Characterisation of the healthy phenotype and short and long-term effects of nutrition
2. Understanding how diet interacts with external (e.g. infections) and internal factors (e.g. microbiome) to modulate phenotypic responses that influence health
3. Understanding the mechanisms by which nutrition and dietary components promote healthy development and function
4. Understanding the trajectories of dysregulation (e.g. metabolic) and the tipping points between health and disease (e.g. Type 2 diabetes)

5. Understanding the role of diet in determining chronic disease endpoints
6. Improved understanding of the role of dietary components in maintaining gut health, mucosal immunology and the development of food allergy and intolerance

Dietary intake, nutrient status and bioavailability:

1. Understanding the contribution of dietary patterns, individual nutrients, whole and processed foods and food structures to promoting and maintaining health
2. Understanding the relationships between nutrient content, bioavailability, bioaccessibility and food processing methods
3. Measuring and effectively relating nutrient status to physiological function

Nutritional requirements over the life course and relationship to health and disease:

1. Understanding nutritional requirements at key stages across the life-course, including infant feeding, adolescent nutrition and nutritional needs of older people
2. Understanding inter-individual and inter-group (population and social) differences in nutritional requirements and preferences
3. Understanding nutritional requirements for healthy brain development, cognitive function and onset of neurological disorders

Behaviour and food choice:

1. Understanding the gut-brain axis and the psychobiology of food choice, and satiety based on gut-mediated endocrinology
2. Elucidating the interactions between physical, neurological and behavioural food responses (including plasticity)
3. Understanding the role of the genome and epigenome in food choice predisposition
4. Understanding the economic, social and cultural context of 'food choice', including the roles of public information, the retail environment, marketing and labelling
5. Understanding how complex interventions that lead to sustained behavioural change and improved health can be developed and implemented
6. Understanding food-related inequalities
7. Understanding how behavioural economics - including the use of financial (dis)incentives - may impact on the consumption of specific foods and food groups

Other pertinent documents include: Future of Food and Farming:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/288329/11-546-future-of-food-and-farming-report.pdf

SPEAKER PROFILES

Obi Ajuruchukwu, Professor, Department of Agricultural Economics and Extension, University of Fort Hare, South Africa

Professor Ajuruchukwu Obi obtained degrees in Agricultural Economics, Economic Policy Management, and Human Rights Law from the University of Nigeria, McGill University, Canada, University of Fort Hare, and University of the Free State, South Africa. He taught Agricultural Development Policy and Planning at the University of Nigeria before joining the United Nations system, working in Nigeria, Switzerland (Geneva), and Lesotho, with short-term assignments across Africa. He is Book Review Editor for International Journal of Agricultural Management and Managing Editor (Africa Region) for International Food and Agribusiness Management Review. He is a member of the Rutgers' University Consortium on smallholder transformation under USAID's Feed-the-Future programme. He is a frequent consultant to the Forum for Agricultural Research in Africa (FARA) for the Comprehensive African Agricultural Development Programme (CAADP) and Science Agenda for Africa's Agricultural Development. Professor Obi has supervised 10 PhDs, 5 Post-Doctoral Fellowships, 44 MSc, and 70 Honours candidates. His peer-reviewed publications number more than 60.

Bal A. Antonio, Senior Principal Researcher, National Agriculture and Food Research Organization (NARO) in Tsukuba, Japan.

Dr Antonio has been involved in research projects on rice genomics starting with the Rice Genome Research Program (RGP) of the National Institute of Agrobiological Sciences (now integrated into NARO), and the International Rice Genome Sequencing Project (IRGSP), a collaboration of 10 countries that released the map-based high quality sequence of the rice genome in 2005. He then pursued projects focusing on the development of genomics resources for characterization of gene functions in rice, construction of gene expression databases, and sequencing of chemically-induced mutant lines of rice. Currently, Dr Antonio is in-charge of various initiatives aimed at fostering research collaborations with various organizations as part of NARO's globalization program. He is also the managing-editor of *Rice*, an open access scientific journal for rice genomics and biology.

Janne Bengtsson, TempAg Theme Lead, Professor, Swedish University of Agricultural Sciences, Sweden

Professor Janne Bengtsson's research is focused on biodiversity, ecosystem services and community ecology in production (agricultural and forest) landscapes, and on the linkages between population and ecosystem ecology, both in theory and in applied contexts. Janne is also a member of the steering group for the SLU program on 'Future agriculture, and has contributed to the Mapping and Assessing Ecosystem Services (MAES) in Europe.

Tim Benton, GFS Champion, Professor University of Leeds, UK

Professor Tim Benton is the "Champion" for the UK's Global Food Security (GFS) programme, leading, facilitating and coordinating its activities. Tim is also a leading researcher, based at the University of Leeds, on agri-environment interactions and finding ways to make agricultural production more sustainable.

Tim facilitates knowledge exchange between research and stakeholders in government, industry and society. He worked in the University of East Anglia, then the Universities of Stirling and Aberdeen before moving to Leeds in 2005. At Leeds, he has been head of his department and Pro-Dean for Research in the Faculty of Biological Sciences, and the Chair of Africa College, a University partnership with the International Institute for Tropical Agriculture in Africa. He has published over 100 papers, most tackling the core themes of agriculture's environmental impact and more generally how ecological systems respond to environmental change. Tim is also a vocal advocate for the issues of how to manage increasing demand for food in a way that is sustainable.

Maja Clausen, Research and Innovation Division (EU & International), Federal Ministry of Food and Agriculture (BMEL), Germany

Since October 2015 Maja Clausen holds her current position within the Research and Innovation Division of the Federal Ministry of Food and Agriculture (BMEL), where she is in charge of the European and International Research Portfolio.

In her previous assignment as the Research, Science and Innovation Counsellor at the German Embassy in Pretoria (South Africa), she was responsible for the facilitation of the German – South African collaboration in the areas of Research, Science and Innovation as well as Vocational and Higher Education.

From 2002 to 2005, she worked at the Food and Agriculture Organization (FAO) of the United Nations (UN) in Rome (Italy) with a particular focus on „Alternative Livelihoods for Opium farmers in Afghanistan" and „HIV/AIDS and Food Security in Complex Emergencies in Southern Africa".

She holds a Masters (M.Sc.agr.) degree in Agricultural Sciences of the Tropics and Subtropics from the University of Goettingen, as well as a B.Sc. in Human Nutrition and lives in Berlin (Germany), together with her husband and their two children.

Lin Erda, Chief Scientist & Former Director General, Chinese Academy of Agricultural Sciences, China

Prof. Lin was a member of standing committee of 11th National Committee of Chinese People's Political Consultative Conference, and a member of its Sub-Committee for Population, Resources and Environment.
Since 1988, Lin Erda has served as Deputy Director and Director-General of the Institute for 15 years. He is also a member of standing committee of China Economic and Social Council, a Member of Executive Board of All-China Environment Federation. Professor Lin Erda has Applied Meteorology degrees. His current research focus is on climate change both impacts, vulnerability and GHG emission mitigation, especially for agriculture, including as Lead authors of National Reports on Climate Change Impact and Adaptation, IPCC 1-5 assessment reports, National policy reports, and 13 scientific books and 185 journal publications.

Peter Gregory, Professor Emeritus, University of Reading, TempAg President, UK

Professor Peter Gregory is Chair of the TempAg network. He is a soil scientist by profession and is currently a Visiting Scientist with the Institute of Bio-and Geosciences (Plant Sciences programme) at the Forschungszentrum, Jülich in Germany. He is a Professor Emeritus at the University of Reading (UK) where he recently retired as Professor of Global Food Security. He was Chief Executive of East Malling Research from 2011 until 2015 and Chief Executive at SCRI, Dundee for six years (2005 until 2011). Peter is employed in various consultancy roles developing science and research strategies. He is engaged with the UK agriculture and horticulture industries via his chairmanship of the Recommended List Board for the AHDB and the Science Advisory Committee of the Royal Horticultural Society. He also chairs the Advisory Committee for Novel Foods and Processes (ACNFP) for the Food Standards Agency which undertakes risk assessments to inform the Agency's position in European forums.

Dave Hughes, Global Head of Technology Scouting, Syngenta

Dave is a synthetic organic chemist by training. After finishing his post-doctoral position in the USA, Dave returned to the UK to join the agrochemical industry as a chemistry team leader, designing and synthesizing new potential pesticides. After ten years he moved to head a biochemistry and genetics group investigating the mode of action of pesticides. Five years later he moved to a role in external collaborations, and is now global head of technology scouting for Syngenta: responsible for seeking the company's strategic relationships with universities and other companies around the globe in order to collaborate and co-develop new technologies for use in agriculture.

Franck Jésus, Head of the Natural Resources Policy Division of the Trade and Agriculture Directorate, OECD

Mr. Franck Jésus is Head of the Natural Resources Policy Division of the Trade and Agriculture Directorate at OECD, a Division dealing with policies related to Agriculture and Environment, Trade and Environment, and Fisheries.He has more than 20 years of experience working on climate change, environmental and agricultural policies and projects.

Prior to working at the OECD, he has worked at the Global Environment Facility (GEF) as Senior Climate Change specialist; at the French Treasury, as head of the Environment and Agriculture Department; and at the French Environment and Energy Management Agency as head of the Economics Department.

Prior to that, Franck spent ten years in South-East Asia designing and implementing projects for agricultural development and natural resource management.

Franck holds a Master's degree from Paris-Grignon National Agronomic Institute (INA-PG) and a Post Graduate degree from the National School of Rural, Forest and Water Management (ENGREF).

Stefan Lange, Research Director, Thünen Institute - Federal Research Institute for Rural Areas, Forestry and Fisheries, Germany

Stefan is an agricultural scientist and works as Research Director at Thünen Institute - Federal Research Institute for Rural Areas, Forestry and Fisheries. Together with the President he is responsible for conceptual alignment and strategic development of Thünen Institute as well as for policy advice regarding research planning, funding priorities etc. So at national level he is deeply engaged in activities of German Agricultural Research Alliance (DAFA). On European scale he counsels German Horizon 2020 and FACCE-JPI representatives. On international scale he is delegate to G20-MACS (Meeting of Chief Agricultural Scientists of G20 States) and German representative in TempAg Governing Board. After working at university and before joining Thünen Institute, Stefan headed agricultural research funding schemes for several years. His experiences based on this repeated change of perspectives between science, funders and policy form the background for his current activities.

Heikki Lehtonen, Professor Natural Resources Institute, Luke, Finland

Heikki Lehtonen, a research professor in Natural Resources Institute Finland (Luke) /Economics and Society, is experienced in evaluating policy impacts on agricultural production, land use and farm income. The sector model, used in a number of policy analysis studies since 2001, is detailed in agricultural policy representation, and includes

endogenous structural change of dairy farms. Farm level models based on optimization account for economic and risk aversion behavior, crop rotation dynamics, crop yields, and greenhouse gases. Modeling applications include animal disease economics and integration with hydrological and economic CGE modeling. Lehtonen has written expert reports to European Commission and is regularly involved in policy support for the Ministry of Agriculture and Forestry of Finland. He has given expert statements to Finnish Parliament since 2002. Lehtonen is currently involved in European research projects OPAL-Life, FACCE SURPLUS SUSTAg, and leads North Savo case study in FACCE MACSUR.

Fleur Marchand, Scientific Coordinator, Professor, ILVO, Belgium

Fleur Marchand is coordinator of research in Agricultural and Farm Development, is also a doctor in science (UA, 2006), and an agricultural engineer (UGent, 2001). She has worked for the Social Science Unit at ILVO, from 2007. Fleur interacts with stakeholders from sustainable agriculture and food chains, and is responsible for different national and international projects on these topics. For example, she coordinates a EU-H2020 project AgriDemo-F2F in which peer to peer learning on open commercial farms is studied. Fleur is also responsible for 5 PhD students, that examine: collaboration in the agri-food chain; learning initiatives for sustainable agriculture and the use of sustainability assessment tools; and perspectives for agro-ecology within the beef and dairy sector. Furthermore, she is Professor at the University of Antwerp where she is responsible for courses on methodologies and techniques for interdisciplinary research.

William Phatu Mashela, Professor, University of Limpopo, South Africa

William Phatu Mashela is Senior Professor of Nematology at the Green Technologies Research Centre, University of Limpopo, South Africa. His major research interest is in plant-nematode-phytonematicide interactions with reference to tropical/subtropical and temperate crops in the context of climate-smart agriculture. Prof. Mashela trains PhD and MSc students in collaboration with the Flemish Interuniversity Council and their published work can be found in W Mashela google scholar.

Bruce McCallum, Science & Innovation Counsellor to the EU (Brussels), Ministry of Business Innovation and Employment, New Zealand

Bruce McCallum works for the Ministry of Business, Innovation and Employment, and has been New Zealand's Science & Innovation Counsellor to the European Union, based in Brussels, since October 2012. Prior to taking up his current position, Bruce managed the Ministry's science and innovation relationships with North Asia.
Secretary (Economic).

He was previously posted to Tokyo from 2006 to 2009, with the Ministry of Foreign Affairs and Trade, as First Secretary (Economic). Bruce has also held several roles in the New Zealand Department of Prime Minister and Cabinet, and previously worked for Keihin Corporation (Honda's largest subsidiary) in Japan on international joint venture projects during the 1990s.

Bram Moeskops, Senior Scientific Coordinator, TP Organics

Bram Moeskops holds a Msc. in Bio-Science Engineering, a Master in International Relations and Diplomacy and a PhD in Soil Science. Before joining the EU group of the International Federation of Organic Agriculture Movements (IFOAM EU) in 2012, he worked at the Flemish Platform for Sustainable Development and the umbrella organisation of the Flemish North-South movement. At IFOAM EU, Bram Moeskops is delegated to work as Senior Scientific Coordinator for TP Organics, the European Technology Platform for organic food & farming. TP Organics identifies research needs of the organic sector, agroecological and low-input farmers and communicates them towards policy-makers. In addition, Bram Moeskops is coordinating the OK-Net Arable project which seeks to promote exchange of knowledge among farmers, farm advisers and scientists in order to enhance organic arable cropping.

Bongani Kaiser Ndimba (NRF Rated PhD, Durham, England), Agricultural Research Council (ARC), South Africa

Senior Research Manager of the Infruitec-Nietvoorbij (Institute for Deciduous Fruit,Vines and Wine Research) of the Agricultural Research Council (ARC) in South Africa. The institute has >300 employees, 7 farms. Prof Ndimba worked as a Specialist Researcher heading ARC's Proteomics Research & Services Unit (2011-2014). He is an Extraordinary Professor at the University of the Western Cape (UWC). He completed his PhD studies at Durham University in England in 2001, and worked as a post-doctoral fellow until December 2005. He is a National Contact Point (NCP) for the H2020's Biotechnology and Food Security, Sustainable Agriculture, Marine and Maritime and Bio-economy Thematic Area. To date he has more than 40 internationally peer-reviewed publications supervised more than 30 Hons/MSc/PhD/Postdocs. He is co-investigator in a USAID funded consortium (worth $5m – 2014-2019), themed:"Feed the Future Innovation Lab for Climate-Resilient Sorghum". The research team includes partners from ICRISAT-Mali-India, Jimma University (Ethiopia), The Land Institute-USA and Georgia University.

Ivar Pettersen, Associate Professor, NIBIO / NMBU, Norway

Ivar Pettersen has studied international economics, competition policy and economics of distributive trades and was in 1981 offered a position as assistant professor in international economics. Later he joined McKinsey & Co., various shipowning companies, worked as senior officer with the European Free Trade Association and with ECON Analysis in Oslo. His experience covers a wide range of industries and public policy areas including industrial policies, welfare economics, strategy, spatial regulation, administration of research units, health care etc.

Ivar Pettersen joined the Norwegian Agricultural Economics Research Institute (NILF) as Director General in 2004. After nine years he shifted to a position as Special Advisor and Research Fellow. He also holds a position as Assiciate Professor in Food Economics and Policies at the Norwegian University of Life Sciences. Along with the positions mentioned, he has also held positions as Board member of private companies and enterprises in the voluntary sector.

Jean François Soussana, Scientific Director, INRA, TempAg Vice-President, France

Since 2010, Dr Jean-Francois Soussana has been scientific director for environment at INRA, Paris, France. He obtained his PhD in plant physiology at USTL Montpellier in 1986 after a degree in agronomy. After becoming a senior scientist he led an INRA research unit on grassland ecosystems and global change for 8 years. Since 1998, Dr. Soussana has been a member of the Working Group II of IPCC on Impacts, Adaptation and Vulnerability. He was Lead Author for the Third, Fourth and Fifth Assessment Reports in the field of agriculture, forests and ecosystems and shared with all authors of IPCC the Nobel Prize for Peace in 2007. He has contributed to international research programs (GCTE, Global Change and Terrestrial Ecosystems; GCP, Global Carbon Project) and to scientific expertise for FAO. He has coordinated research projects on climate change and agriculture and currently leads a large European (FP7) project on livestock and climate change involving four continents.

Freija van Duijne, Futurist, Strategic Foresight Expert, Ministry of Economic Affairs, Netherlands

Dr Freija van Duijne has been a professional futurist since 2006. She has been leading strategic foresight projects in various government organisations in the Netherlands. She has worked previously at the OECD strategic foresight unit to design a scenario based policy discussion for the Ministerial Council Meeting. Freija is co-founder and president of the Dutch Future Society, local chapter to the World Future Society. She is part of the ‘Trendrede’, a collective of trend researchers who present an annual trend analysis to contribute to society and the Dutch economy.

Freija obtained her degree in cognitive psychology at Leiden University and her PhD in applied ergonomics and design at Delft University of Technology. Her interest in risk governance and new technology made her pursue a career in strategic foresight. She has been leading foresight projects on a variety of topics including food and agriculture, natural resources, energy and the general economy. She is a regular blogger for several platforms and media.

Martin van Ittersum, TempAg Theme Lead, Professor, Wageningen University, Netherlands

Professor Martin van Ittersum holds a PhD (1992) in Agricultural and Environmental Science in Wageningen University. His research and teaching focus on research concepts and methods for the analysis, design, and integreated assessment of agricultural systems from field to farm, regional and global level. He has led and is leading a large number of (inter)national projects dealing with global food availability, integrated assessment of agricultural systems, yield gap analysis, phosphorus scarcity and climate change, furthermore he was the coordinator of the SEAMLESS project: System for Environmental and Agricultural Modelling; Linking European Science and Society; an EU FP6 project (2005-2009) with 30 universities and approximately 150 researchers.Currently he is co-leading the Global Yield Gap Atlas project (funded by the Gates foundation) and a large strategic programme of Wageningen University aiming to map options for sustainable intensification

DELEGATE LIST

Name	Country	Research/Work Area
Prof Obi Ajuruchukwu University of Fort Hare Professor aobi@ufh.ac.za	South Africa	Research into smallholder development focusing on technical and institutional constraints, market access, collective action and entrepreneurial development in the small farming sector. I am currently carrying research to review and evaluate appropriate development paths for expansion from homestead food gardening to smallholder irrigation farming, increased water use productivity of crop production and improved livelihoods on selected smallholder irrigation schemes in South Africa. The research has involved the evaluation of natural, physical, financial, human and social assets, entrepreneurial spirit and management capabilities within incentives of secure land tenure, water use rights and leadership in organisational structures. The research is also seeking to determine sources of livelihoods and opportunities to improve contribution by farming within available food value chains. It is also trying to determine the aspirations and goals of farmers to expand irrigation crop production from homestead gardens to irrigation plots and/or from one to more than one irrigation plot.
Dr Baltazar A. Antonio National Agriculture and Food Research Organization Senior Principal Researcher	Japan	Currently, I am a staff of the International Relations Office of the National Agriculture and Food Research Organization (NARO). Before assuming this position, I have been in research on rice genomics.
Prof David Barling University of Hertfordshire Director of the Centre for Agriculture, Food & Environmental Management (CAFEM) d.barling@herts.ac.uk	United Kingdom	Research focuses on food policy, food security and sustainability, and the governance of the agri-food sector. with particular reference to UK, EU and global levels.
Prof Jan Bengtsson Swedish University of Agricultural Sciences (SLU) Professor in ecology and environmental research jan.bengtsson@slu.se	Sweden	Ecosystem services and biodiversity in production ecosystems (agricultural and forest landscapes). Co-production of ecosystem services in social-ecological systems. Future agriculture and sustainability. Soil ecology and biodiversity.
Prof Tim Benton GFS/BBSRC UK Champion for Global Food Security tim.benton@foodsecurity.ac.uk	United Kingdom	Biography under speakers' profiles.
Riccardo Bommarco Swedish University of Agricultural Sciences (SLU) Professor Department of Ecology Riccardo.Bommarco@slu.se	Sweden	I study the ecology of insects and plants in agricultural landscapes. I explore how land use, landscape structure, and biodiversity conservation affect the distribution, abundance dynamics and functions of biodiversity, with focus on organisms that provide the ecosystem services biological control of agricultural pest insects, and crop and wild flower pollination by insects (bumble bees, solitary bees, hover flies and butterflies). I participate in interdisciplinary collaborations that aim to translate the attained ecological information into support for policies and development of land management that support biodiversity, ecosystem services and agricultural production.

Dr Christoph Carlen Agroscope Executive Board, Head of a Research Unit christoph.carlen@agroscope.admin.ch	**Switzerland**	**Development of resilient farming systems that employ innovative technologies and diverse approaches to plant production in changing socio-economic conditions and environmental constraints, such as increasing temperatures and climatic injuries, along with threats from weeds, pests and disease. Understanding how plants (field and horticultural crops) function and respond to management and environmental factors under Swiss conditions. Development of effective and efficient use of finite resources by plant production procedures by considering the whole farm systems.**
Prof Dave Chadwick Bangor University Prof of Sustainable Land Use Systems d.chadwick@bangor.ac.uk	United Kingdom	Optimising nutrient use efficiency in farming systems; quantifying and mitigating diffuse pollutant losses to water and air.
Ms Marja Clausen Federal Ministry of Food & Agriculture (BMEL) Reearch & Innovation Division Maja.Clausen@bmel.bund.de	Germany	Biography under speakers' profiles.
Dr J.M. (Jasper) Dalhuisen Department of European Agricultural and Fisheries Policy and Food Security - Ministry of Economic Affairs Senior Policy Advisor j.m.dalhuisen@minez.nl	Netherlands	Working on the CAP (e.g. sustainable and competition in the food chain), OECD-working groups on agriculture and the environment. Cooperation is possible on new policy instruments.
Dr Jesus Escudero INIA Scientific Programme Manager jesus.escudero@inia.es	Spain	The National Institute for Agricultural and Food Research and Technology (INIA) is interested in broad sense in Agriculture, Food Technology, Forestry and Climate Change issues. It represents Spain in these areas concerning policy advice and international scientific relations.
Mr Erik Fahlbeck SLU Pro Vice Chancellor erik.fahlbeck@slu.se	Sweden	TempAg Governing Board member
Dr Kazuhisa Goto National Agriculture and Food Research Organization Principal Researcher / Economist gotok@affrc.go.jp	Japan	My research interests are Open innovation and Innovation management system for Food and Agribusiness fields.
Prof Keith Goulding Rothamsted Research Sustainable Soils Research Fellow keith.goulding@rothamsted.ac.uk	United Kingdom	I am a soil scientist. My research has included the supply to crops of potassium and phosphorus from the soil, ion exchange, acid rain, soil acidification and liming, nitrogen losses to air and water and climate change. My current focus is on nutrient, especially nitrogen, cycling, soil quality and sustainable agriculture.
Prof Peter Gregory University of Reading Professor Emeritus p.j.gregory@reading.ac.uk	United Kingdom	Global food security and root:soil interactions.
Dr David Hughes Syngenta Global Head of Technology Scouting dave.hughes@syngenta.com	United Kingdom	Creating relationships with external scientists and organisations, and leveraging those relationships to develop new science and technology for use in agriculture.

Dr John Ingram Oxford University ECI Food Systems Programme Leader **john.ingram@eci.ox.ac.uk**	**United Kingdom**	**John Ingram's interests are in the conceptual framing of food systems, the interactions among the many actors involved and their varied activities, and the outcomes of their activities for food security, livelihoods and environment. He has designed and led regional projects around the world on the links between food security and environment through the analysis of food systems.**
Mr Franck Jesus Head of Natural Resources Policy Division OECD **franck.jesus@oecd.org**	International Organisation	Biography under speakers' profiles.
Mr Stuart Knight NIAB Deputy Director **stuart.knight@niab.com**	United Kingdom	Primarily biological (agronomy and its role in improving crop/system performance), but includes environmental and social outcomes of farming systems. Currently project leader for Project 1 of the Defra Sustainable Intensification Research Platform (SIP) on Integrated Farm Management for improved economic, environmental and social performance. This is a transdisciplinary research programme, focused on England & Wales, and involving a community of 30 partners spanning academia, farming industry, environment and policy. It has been developing indicators and metrics for measuring farm performance; evaluating and demonstrating farm management practices for Sustainable Intensification; and investigating how to provide more effective guidance and decision support around IFM and SI.
Dr Peter Kuikman Wageningen Environmental Research (Alterra) Senior Researcher **peter.kuikman@wur.nl**	Netherlands	Land use, agriculture, greenhouse gas emissions and land use change, experience in the reporting and documentation of greenhouse gas emissions to UNFCCC and for the KP. His major research expertise is in the area of environmental assessments and policies, greenhouse gas emissions, microbial transformations of C and N and dynamics and sequestration of C in soils.
Dr Stefan Lange Thünen Institute - Federal Research Institute for Rural Areas, Forestry and Fisheries Research Director **stefan.lange@thuenen.de**	Germany	Responsible for strategic alignment of Thünen Institute incl. initiating appropriate interdisciplinary research approaches (e.g. efficient use of resources in agriculture, fisheries and forestries; societal expectations; options for policy framework & instruments) - consulting political decision-makers regarding respective research strategies and coherent funding tools - current personal research topics: adaptation of agriculture to CC; future of organic food & farming systems
Prof Heikki Lehtonen Natural Resoures Institute Finland (Luke) Professor **heikki.lehtonen@luke.fi**	Finland	I have been working with several projects related to agricultural and agri-environmental policy, sustainable agriculture, economic and environmental effects of policy reforms and climate change. In recent years I have been participating FACCE MACSUR http://macsur.eu/ ; http://macsur.eu/index.php/regional/regional-case-studies/northern-savo based on outcomes of various research projects, considering especially adaptation to climate change in Northern Europe, including a case study based analysis how policy contributes to adaptation to climate change and mitigation of climate change across Europe.

Prof Fleur Marchand ILVO Scientific Coordinator fleur.marchand@ilvo.vlaanderen.be	**Belgium**	**Prof. Dr. Fleur Marchand is coordinator of the research domain Agricultural and Farm Development within the Social Science Unit of ILVO. She is doctor in science (UA, 2006) and agricultural engineer (UGent, 2001). She builds her expertise mainly based on empirical case-studies of learning processes with stakeholders striving for sustainable agriculture and food chains. She uses mainly a transdisciplinary and system approach focusing on the following research topics: knowledge exchange, agroecology and transition of the food system. She is responsible for different national and international projects on these topics. Furthermore, she is professor at the University of Antwerp where she is responsible for courses on methodologies and techniques for interdisciplinary research. She is a member of the EIP Focus Group 'Benchmarking of Farm Productivity and Sustainability Performance'.**
Prof Phatu William Mashela University of Limpopo Senior Professor phatu.mashela@ul.ac.za	South Africa	Climate smart agriculture with emphasis on green technologies.
Mr Bruce McCallum Ministry of Business, Innovation and Employment Counsellor to the EU (Science and Innovation) bruce.mccallum@mbie.govt.nz	New Zealand	Enhance science and innovation co-operation between NZ and the EU, with agriculture and food system research a key focus area.
Dr Bram Moeskops TP Organics Senior Scientific Coordinator bram.moeskops@tporganics.eu	Belgium	European Technology Platform
Prof Bongani Ndimba Associate Professor, Department of Biotechnology Agriculture Research Council & University of Western Cape NdimbaB@arc.agric.za	South Africa	Biography under speakers' profiles.
Dr Lillian Øygarden NIBIO Research Manager lillian.oygarden@nibio.no	Norway	Research; Soil erosion during snowmelt and Winter conditions. Soil tillage and erosion. Monitoring of runoff, erosion and nutrient losses from Agricultural areas. Evaluation of Regional Environmental Monitoring Programmes in Agriculture. Project Coordinator for the Interdisciplinary Project AGROPRO-Agronomy for increased Food Production With focus on cereal Production, forage, soil quality, farm management Methods, economy and social science. Coordinator of the Norwegian consortium participating in MACSUR: Modelling European Agriculture With climate change for Food Security. Norwegian representative in the GRA - alliance for the Cropland Group. Member of secretariat, set by Ministry for Agriculture and Food for evaluating Agriculture and Climate change. Norwegian representative in TempAg governing Board.

Prof Pirjo Peltonen-Sainio Natural Resources Institute Finland (Luke) Professor pirjo.peltonen-sainio@luke.fi	**Finland**	**Crop scientist and agronomist with wide experience in large-scale research programmes, and in leading multidisciplinary collaboration projects. My research focuses on the adaptation of crops - and production systems - to conditions at northern latitudes and to climate change. Issues of sustainable intensification of production systems, self-sufficiency in Nordic regions and food security, lie behind my work on the influence of environmental, climatic and genetic variation on field crop production. As an expert in crop production, I have wide connections to industries operating at all stages of the food production chain.**
Mr Ivar Pettersen NIBIO / NMBU Associate Professor ivar.pettersen@nibio.no	Norway	Bio-industry, industrial convergence, industrial policy, climate policy, circular economy
Prof Simon Potts Director, Centre for Agri-Environmental Research s.g.potts@reading.ac.uk	United Kingdom	Understanding the relationship between land use, biodiversity and ecosystem services Food security: role of biodiversity and ecosystem services in food production Environmental drivers of biodiversity and ecosystem services, including: land use change, climate change, agrochemicals, invasive species and socio-economic factors Quantifying the economic and environmental value of pollination and other ecosystem services Developing evidence-based adaptation and mitigation options for policy and management applications Ecology and management of agro-ecosystems for the conservation of biodiversity.
Dr Karl Richards Teagasc Head of Department karl.richards@teagasc.ie	Ireland	My main research focus is on fate and transport of contaminants from agriculture and the development of sustainable agricultural practices in the area of greenhouse gas emissions and water quality.
Dr Till Seehusen NIBIO Researcher till.seehusen@nibio.no	Norway	Cereal production, soil structure, soil tillage, soil compaction, yield gap.
Prof Jean-François Soussana INRA Scientific Director for Envrionment Jean-Francois.Soussana@paris.inra.fr	France	Biography within the programme.
Mrs Dorri te Boekhorst FACCE-JPI / Wageningen University & Research dorri.teboekhorst@wur.nl	Netherlands	Member of the FACCE-JPI Sectretariat and support the development of the Knowledge Network on Sustainable Intensification.
Dr Lindsay Todman Rothamsted Research lindsay.todman@rothamsted.ac.uk	United Kingdom	I am currently working on the TSARA (Towards Sustainable and Resilient Agriculture) project. We are looking at how countries - currently UK, The Netherlands, France and New Zealand - can meet the Sustainable Development Goals (SDGs) that relate to domestic agriculture, and how they could achieve more by working together to meet the global goals. We are using a backcasting methodology that combines modelling work to identify how the agricultural landscape might look to meet SDG targets with stakeholder workshops to identify pathways to reach feasible options.

Dr Gerrie van de Ven, Wageningen University & Research Assistant Professor **Gerrie.vandeven@wur.nl**	**Netherlands**	**Plant Production Systems. Modelling and optimization of agricultural production systems, strongly related to environmental and economic issues. I worked in both Europe and Africa Areas of expertise: farming system analysis, optimization of land use systems, nutrient cycling, crop growth modelling, crop/livestock systems modelling, sustainability and its indicators**
Dr Tony van der Weerden AgResearch Scientist **tony.vanderweerden@agresearch.co.nz**	New Zealand	My area of expertise relates to understanding the drivers and processes regulating gaseous N emissions, particularly nitrous oxide (N2O) emissions, from soil that have been treated with excreta, effluent and fertiliser. I have led several national studies where emission factors have been developed, and mitigation options have been assessed. Some of this work is now included in the NZ national agricultural inventory. I am currently involved in field studies aiming to improve our estimates of N2O emission factors, as well as comparing the greenhouse gas footprint of contrasting pasture-based temperate farming systems.
Dr Freija van Duijne Ministry of Economic Affairs Senior Policy Maker **f.h.vanduijne@minez.nl**	Netherlands	Strategic research and innovation agendas for Agricultural, food and nature.
Prof Martin van Ittersum Wageningen University & Research **martin.vanittersum@wur.nl**	Netherlands	Plant Production Systems, Agricultural systems, integrated assessment
Prof Andrew Whitmore Rothamsted Research **andy.whitmore@rothamsted.ac.uk**	United Kingdom	Soil science, Sustainable Agricultural and ecological systems, resilience, mathematical modelling
Prof Christine Watson SRUC Professor of Agricultural Systems **christine.watson@sruc.ac.uk**	United Kingdom	My research focuses on nutrient management in agricultural systems and I have worked in a wide range of farming systems including arable, mixed farming, outdoor pig production and dairy systems as well as agroforestry. I work at a variety of scales from process based studies of nutrient fluxes associated with root turnover to crop rotation and farm scale nutrient budgets. I have recently been involved in estimating nitrogen fixation at the continental scale in the EU Legume Futures project. I am particularly interested in how we can apply interdisciplinary approaches to address global problems.

CONTACT INFORMATION

Dr Evangelia Kougioumoutzi
International Coordinator & Programme Manager
GFS
Email: Evangelia.Kougioumoutzi@foodsecurity.ac.uk
Tel: 01793 413235

Dr Claire Weill

Senior Advisor

INRA

Email: Claire.Weill@paris.inra.fr

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