

Conference Agenda

Oxford Cambridge Food Forum 2016: Technological Frontiers in Food Security and Sustainability

9.30-10.00 **Registration**

10.00-10.10 **Welcome**

10.10-11.00 **Opening keynote**

Dr. Monika Zurek (Environmental Change Institute, Oxford) - "Technological Frontiers in Food Security and Sustainability: Which direction should technological change take?"

11.00-12.30 **Session 1 Technological Advances in Breeding: Opportunities and Impact**

Robert Jackson (National Institute of Agricultural Botany (NIAB)) "Making genomic selection work for practical wheat breeding"

Rachel Wheatley (Oxford) "Nature's Nitrogen Fixers"

Albert Boaitay (University of Alberta) "Biodiversity And Livestock Producer Acceptance Of Genomics: Evidence From Three Producer Surveys In Canada"

12.30-1.30 **Lunch**

1.30-2.50 **Session 2 Innovation in Natural Resource Management**

Alyssa Menz (Oxford) "A Means to Alleviate the Bushmeat Crisis? The Feasibility of Establishing Sustainable Grasscutter Farms in Kenya"

Celine Jennison (Oxford) "Agroforestry Restoration in Hawai'i"

2.50-3.30 **Tea Break and Poster Session**

3.30-5.00 **Session 3 Disruptive solutions? Barriers to Social Acceptance of New Technologies**

Karolina Rucinska (Cardiff University) "Enviropig affects. On constructions and disclosed moral worlds of biotechnological innovation in pig farming"

Daphne Page (City University London) "Reinventing the wheel and missing the mark in policy overlap: Rooftop Urban Agriculture as a community innovation in Toronto, Canada"

David Rose (Cambridge) "Understanding the factors affecting the uptake and use of decision support tools in agriculture"

5.00 **Closing of Conference**

Post Conference Drinks at the Royal Oak

POSTER PRESENTERS

Deberson De Jesus (Warwick) "Commodity Governance in a Cosmopolitan World"

Catherine Price (Warwick) "Coverage of Genetically Modified Food: The Role of UK News Website Online Articles and Associated Comments and Twitter in Shaping Public Perceptions"

Amir M. Sharif, Zahir Irani (Brunel University London) "Dynamics of Food Waste: a systems-based perspective on systemic Food Security issues"

Franziska Gaupp (Oxford) "Dependency of Crop Production Losses between Global Breadbaskets: A Copula Approach for the Assessment of Risk Pools"

Claire Agius (Cambridge University) – TBC

Presenter Bios

Keynote Speaker

Dr Monika Zurek.

Dr Monika Zurek is a senior researcher at the Environmental Change Institute at the University of Oxford and a member of the ECI Food Systems Group. For more than 15 years she has worked on food systems, environment and development interactions in research and international organizations as well as in the consulting and the philanthropic sector.

Prior to joining ECI, Monika worked with Climate Focus, a consulting firm focusing on climate change mitigation and land use issues. Before that, she was part of the Agricultural Development Team of the Bill & Melinda Gates Foundation managing grants to improve the environmental sustainability of agricultural systems and risk management in agriculture. She also served as an economist at the Food and Agriculture Organization (FAO) and supported the Scenarios Working Group of the Millennium Ecosystem Assessment. Monika started her career as a researcher at the International Maize and Wheat Improvement Center (CIMMYT), working on agricultural sustainability projects in Costa Rica and Mexico. She was also a lead author for various environmental assessments such as the Intergovernmental Panel on Climate Change (IPCC, AR4), the Millennium Ecosystem Assessment and the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD).

Monika holds degrees from the University of Hohenheim (MSc equivalent/Diploma in agricultural biology) and Justus-Liebig-University Giessen, Germany (PhD in agricultural economics).

Panelists

Albert Boaitey

Albert is a PhD candidate at the Department of Resource Economics and Environmental Sociology, University of Alberta. His research examines the economic and environmental impact of livestock producer adoption of genomic technologies. Albert enjoys working in multi-disciplinary teams and developing decision making models. In his spare time, he likes cooking and going for walks.

Claudia Havraneck

Robert Jackson

Celine Jennison

In 2014, Céline graduated from Cornell University with a BSc in Plant Science and developed a passion for perennial edible landscapes because of their potential to resolve food insecurity. As food systems are deeply intertwined with other systems in society, she enrolled in Oxford's Environmental Change and Management MPhil program to better understand the 'big picture'.

She has completed the first year of her coursework and is now researching tropical agroforestry in Hawaii. She is part of the Ecology Lab at Oxford and is supervised by Prof. Yadvinder Malhi.

Over the last 5 months, she has been working with Becky Ostertag from University of Hawaii to better comprehend the trade-offs and complementarity between yield, carbon sequestration and 'bioquality' in hybrid ecosystems. She is interested in the question: Can we restore forests while providing food, Non-Timber Forest Products (NFPs) and optimizing carbon sequestration?

Alyssa Menz

Daphne Page

Daphne Page is a PhD Researcher at City University London's Centre for Food Policy. She is also completing a MA in Academic Practice in Higher Education through City University's Learning Enhancement and Development (LEaD) Centre. At Ryerson University in Canada, Daphne completed her Master's research, which investigated Toronto's emerging rooftop urban agriculture network and its links to local policy.

Her research focuses on the links that are being made between urban agriculture and sustainability within local food strategies across the UK, specifically by members of the Sustainable Food Cities Network. Since a growing number of municipalities (towns, cities, regions, etc) are creating strategies under the umbrella of sustainability, Daphne is interested in how those writing the policies are associating urban agriculture (as just one part of the overall strategy) with local sustainability objectives. Since what is sustainable can be 'fuzzy' as a concept, and vary greatly from one place to the next, she is interested in exploring how this varies amongst food policies. Specifically, she would like to determine how this differs based on the type of governance model driving the creation of the strategy, whether it is a fully council-led and embedded strategy, or a completely independent civil society organization, or a hybrid of both.

David Rose

David Rose is an environmental geographer at Cambridge University working at the interfaces between knowledge, policy, and practice. He is interested about the ways in which knowledge (scientific or lay) comes to impinge on policy and practice. For his PhD he studied interactions between knowledge and government policy in UK nature conservation, and he worked to provide tangible advice for conservation scientists seeking to improve the knowledge-policy interface for evidence-based policy-making. David's last research post formed part of Defra's Sustainable Intensification Platform, specifically addressing how scientific knowledge in the form of decision support tools was taken up and used by farmers.

Karolina Rucinska

Karolina Rucinska is a PhD student and a free-lance researcher at Cardiff University's School of Geography and Planning. As a PhD researcher she looks at the creation of the first GM farm animal intended for human consumption and environmental protection - the Enviropig™. In her research she asks what is the role of biotechnology in shaping human-animal relations in pig farming and how it may be affecting the understanding of environmental sustainability of animal farming. As a freelancer, she worked on projects related to farm animal welfare, biosecurity, biopatents and religious slaughter. Her research interests encompass concepts such as human-animal-technology entanglement, history and philosophy of science, embodiments, animal farming and meat consumption, and animal welfare.

Rachel Wheatley**Christiana Wyly**

Abstracts

Session 1: Technological Advances in Breeding: Opportunities and Impact

Robert Jackson (National Institute of Agricultural Botany (NIAB)) "Making genomic selection work for practical wheat breeding"

Genomic selection (GS) is a relatively new plant breeding method for improving quantitative traits such as grain yield in large plant breeding populations. Genetic marker data are combined with phenotypic and pedigree data; computer simulations show this can increase the accuracy of the prediction of breeding values and accelerate the selection cycle, thus reducing the time required to bring a new variety to market. However, it has not been tested thoroughly in practice. Our current project 'GplusE' focuses on addressing some of the obstacles. It is a collaborative project among researchers and four commercial wheat breeding companies, using a large (3000 line) reference population of elite UK wheat lines. A powerful aspect is the combination of high throughput phenotyping in the field (employing in part remote sensing techniques) with large-scale, low cost genotyping and advanced statistical methods. The project will provide selection algorithms and data to pump-prime the application of genomic selection to wheat breeding. The wider implications of this and other new breeding technologies on food security and sustainable food production will be discussed.

Rachel Wheatley (Oxford) "Nature's Nitrogen Fixers"

The world population is estimated to reach 9 billion by 2050; the UN Food and Agriculture Organisation have predicted food demand will grow by over 70%. Nitrogen is essential for plant growth; a key element in amino acids, the building blocks of proteins. Approximately 78% of the Earth's atmosphere consists of nitrogen; however, plants are unable to assimilate this abundantly available atmospheric form. Plant biomass, and as a result, crop yield, are often limited by nitrogen availability.

Rhizobia are soil-dwelling bacteria that have evolved a symbiotic relationship with leguminous plants, such as agriculturally significant peas and beans. The bacteria attach to and colonise the rooting systems of leguminous plants to form 'nodules' on the roots, within the nodules they carry out a process known as biological nitrogen fixation; the conversion of atmospheric nitrogen into an ammonia form usable by the plant.

Biological nitrogen fixation, as achieved by *Rhizobium*-legume symbioses, constitutes the single largest nitrogen input into the biosphere. The symbiosis plays an important role agriculturally; increasing crop yields and relieving the requirement for nitrogenous fertiliser addition to leguminous crops. Nitrogen fertilisers are applied to soils to provide plant nitrogen and increase crop growth. However, nitrogen fertiliser runoff can leach into the soil and water supplies, and this excess nitrogen contributes many health and environmental problems; eutrophication and acidification, contamination of drinking water, aquatic organism death and the depletion of soil nutrients. Increases in food production need to occur in environmentally sustainable ways, and this is where 'nature's nitrogen fixers', rhizobia, come in to play.

Research in this field is aimed at improving the existing symbiosis, to increase crop yields and relieve requirements for nitrogenous fertilisers, and to extend this symbiosis into non-legume crops. Biological nitrogen fixation in non-legume crops, such as major crop plants like maize, wheat and rice, would be a

monumental breakthrough for food security and the development of sustainable agricultural systems. In order to achieve these goals, there is need for a better understanding of these rhizobia from a genetic perspective; to fully understand the genes and genetic regulation required for a successful legume symbiosis. My research is focused on a strain from this *Rhizobiaceae* family; *Rhizobium leguminosarum* biovar *viciae* strain 3841 (Rlv3841). I am utilising transposon insertion sequencing (INSeq) as a method of high-throughput genetic screening. This is an exciting genetics technique that can be applied to investigate rhizobial gene fitness on a whole genome scale. This has so far allowed us to study carbon metabolism and oxygen utilisation, and is currently being used to identify genetic prerequisites for successful root attachment to host legumes.

Albert Boaitay (University of Alberta) “Biodiversity And Livestock Producer Acceptance Of Genomics: Evidence From Three Producer Surveys In Canada”

The advent of genomics in livestock breeding presents enormous opportunity for the selective breeding of livestock with a wide array of traits (disease resistance, milk productivity, feed efficiency etc.) of economic significance to different livestock producers-dairy, beef, hogs etc. With genomic selection, the rate of genetic change can be accelerated through the reduction in generation intervals, i.e. the ability to select younger animals for breeding, and increases in the accuracy of selection. The opportunity to attain accelerated improvement in specific traits directly linked with the economic outcomes of farmers is not without some downside. The huge number of producers selecting for the same traits could result in the loss of genetic diversity, possibly resulting in increased vulnerability to new disease outbreaks for example. The impact of livestock producer knowledge and awareness of biodiversity on their acceptance of genomic selection given the potential to quickly change genetic diversity has not been previously studied. If producer understanding of biodiversity is important to their decision making, then education on biodiversity can provide a basis for mediating the risk of too much emphasis on specific traits. In this study we evaluate the role of knowledge and awareness about biodiversity on the acceptance of genomic selection by dairy, cow-calf and hog producers in Canada. Three national producer surveys focussed on producer valuation of genomic information on different traits: feed efficiency (beef cattle); disease resistance (hogs); and, productivity and disease traits (dairy). Each of these surveys included two biodiversity scales- a knowledge scale, and a biodiversity awareness scale. Questions on producer sociodemographic characteristics, farm practices and attitudes were also included. We report results of logistic regression estimates of the effect of biodiversity awareness and knowledge scores on acceptance of genomics using a self-reported acceptance scale that measures producers' perceived usefulness of genomics on a 7-point scale for each producer group surveyed.

Session 2: Innovation in Natural Resource Management

Alyssa Menz (Oxford) “A Means to Alleviate the Bushmeat Crisis? The Feasibility of Establishing Sustainable Grasscutter Farms in Kenya”

In Africa, the unsustainable, illegal hunting of wild animals for food, commonly referred to as the bushmeat crisis, causes multiple problems for ecosystems and human health. Given the lack of management of bushmeat hunting and rapidly expanding human population densities, the potential for overharvesting, driving populations of native species to local extinction, is of major concern unless effective and feasible alternatives can be developed. The farming of desirable native species offers one solution to reducing the demand for bushmeat, but farms must be economically viable, environmentally sustainable, and socially acceptable. This research uses Geographic Information Systems to examine the feasibility of establishing large native rodent

(*Thyonomys swinderianus*) farms in Kenya. Given their high protein content, these rodents, commonly known as grasscutters, are a highly sought bushmeat species and have been successfully farmed in West and Central Africa. I performed an extensive literature review and consulted with grasscutter and sustainable livestock farm experts located in sub-Saharan Africa to determine physical and socio-political geographic factors most likely to constrain the development of sustainable grasscutter farms in Kenya, before using ArcGIS to map these criteria and a weighted overlay analysis to identify potentially favorable locations for establishing future farms. These maps identified three suitable geographic locations: the Western and Nyanza provinces; the Central province; and the southeastern tip of the Coastal province. The majority of Kenya reflects moderately suitable locations that are feasible for establishment as grasscutters are adaptive, low-intensity livestock, and previous studies have identified some of these moderately suitable locations as accepted livestock centers. These results are encouraging for the implementation of sustainable grasscutter farming in Kenya and the diversification of protein sources and economic development opportunities for rural dwellers. While the maps created are specific to Kenya, the methodology developed in this study is useful to global stakeholders attempting to alleviate the bushmeat crisis, combat food insecurity in a sustainable manner, and/or provide means of economic development to developing countries.

Celine Jennison (Oxford) "Agroforestry Restoration in Hawaii"

In the current age of the Anthropocene, many natural ecosystems have been heavily altered, containing new species mixes. Restoration/rehabilitation is possible in these ecosystems but not back to a historic state, and therefore creative approaches are required. One of these approaches is using the concept of "functional restoration" being carried out by the Liko Nā Pilina Project in Hilo, Hawaii whereby scientists have used technology to develop and establish a 'hybrid ecosystem' that maximises carbon storage in the landscape, supporting native biodiversity and resisting invaders. As the plantings include agroforestry species that can be evaluated for their benefits beyond restoration, i.e., non-timber forest products such as fruit, the subject of my research involves calculating biomass and fruit yield of this restoration site in comparison to two common land uses found in Hawaii: papaya farms and eucalyptus plantations.

Session 3: Disruptive solutions? Barriers to Social Acceptance of New Technologies

Karolina Rucinska (Cardiff University) "Enviropig affects. On constructions and disclosed moral worlds of biotechnological innovation in pig farming"

The Enviropig project started in 1990s and ended officially in 2012. Within those years the research team and key stakeholders created transgenic pigs who were able to digest phosphorus thus reduce the pollution of groundwaters while retain their marketable and edible value. However, despite patents, funding, and approval for production over the years the eco-friendly narrative of these transgenic pigs has lost its promise. The threat and fear of GM food was one of the reasons to end the project. This presentation is based on qualitative research which attempted to explore the making and ending of the Enviropigs.

Analysis of interview data revealed constructions of public, farmers, sciences and pigs used by different stakeholders (chief scientists, funder, NGO, risk assessor, tech transfer officer). Reflecting on the findings with the literature in social studies of science and animal geography this presentation suggests that although this particular innovation did not have economic or environmental impacts it has "disclosed moral words by design" (Driessen and Khortals 2012). These worlds point to a) a perception of animals as "fixable" and b) a

misunderstanding of both science and the public. The author closes by arguing that studies of biotechnological innovations in livestock farming no matter how 'CRISP(er) or unrealistic they may seem' offer an entry into the underlying deep seated problems surrounding animal farming and thus ways to address them.

Daphne Page (City University London) "Reinventing the wheel and missing the mark in policy overlap: Rooftop Urban Agriculture as a community innovation in Toronto, Canada"

For decades, Toronto has been a progressive advocate of Urban Agriculture policy, and more recently, Green Roofs, being the first North American City to adopt a Green Roof Bylaw. Where these two policy areas overlap, in the innovative and increasing practice of Rooftop Urban Agriculture (RUA), there is surprisingly little policy support. Despite this, those who practice RUA in Toronto have been doing so creating unique models, mostly with a focus on education and community building, regardless of whether they are corporate or civil society-led. This research provides an analysis of the Rooftop Urban Agriculture (RUA) community in Toronto by taking an inventory of participants and key players, and revealing network connections to explore the level of cohesion of the RUA community in Toronto. Consideration is given to the implications that this has on its growth, representation, and potential areas of engagement with other actors, including municipal decision makers. Semi-structured interviews reveal the driving values expressed by RUA practitioners and others involved with the practice, and the characteristics of this group's formation. Based on this information, RUA is identified in this work as an emerging Civic Food Network (CFN). Based on the findings of the network assessment, this research argues that the lack of an organized and cohesive RUA Network is hindering the progress of this emerging group and innovative practice, and the potential for valuable knowledge sharing that would enable its growth. Finally, recommendations are provided to address how those practicing rooftop agriculture can seek to maximize knowledge sharing within the RUA community and build connections to the City of Toronto to strengthen this emerging CFN.

David Rose (Cambridge) "Understanding the factors affecting the uptake and use of decision support tools in agriculture"

Decision support tools, typically software-based, dynamic systems, (Dicks et al., 2014) are likely to have a key role in delivering the scientific knowledge and best practice protocols that will be required if individual farmers are to negotiate the transition to sustainable intensification (improving productivity and/or environmental outputs). Such tools are designed to help users make more effective, productive decisions by illustrating the likelihood of different outcomes, either visually or numerically, and lead users through clear decision stages. However, despite their apparent value and availability in a wide range of formats, uptake of computer-based decision support by farmers and advisers in the UK and elsewhere has been low. This paper presents the results of a one-year study which forms part of Defra's Sustainable Intensification Platform. Using a mixed methods approach involving focus groups, interviews, and surveys, the research identifies fifteen factors that affect whether a farmer or adviser uses a decision support tool on farm. It also questions whether the research community has afforded enough attention to 'human' decision support tools, which are trusted more than software systems. A better understanding of the fifteen factors by manufacturers of decision support tools, including researchers, will help to inform the future design of tools.

