

Sustainable and Healthy Food Production

*Research Symposium and workshop by the UoC
Global Food Security IRC and Cambridge Zero*

The '**Sustainable and Healthy Food Production**' **Symposium** will highlight ground-breaking research within the food security sphere happening across the university. The symposium will challenge and stimulate new ideas about ways of growing, synthesising, and managing existing and alternative food sources, from industrialised to orphan crops, as well as alternative protein sources. Building on the outcomes of the symposium '**Towards a Better Food System: challenges and opportunities**' held in July 2023, this event will focus on topics around integrating biodiverse and sustainable cropping systems, healthy food consumption, reducing greenhouse gas emissions from food production, and supporting and increasing the sustainability and resilience of diverse small and large food production system through economics, policy, and outreach.

Date and time: 21st March 2024, 9.30-14.00

Venue: Room East 1, West Hub, JJ Thomson Ave, Cambridge CB3 0US

Chair: Dr Erik Mackie, Head of Research Engagement, Cambridge Zero

Sessions consist of successive 10min presentations followed by 15min Q&A and discussion.

9.00 **Arrival and Registration**

9.30 **WELCOME**

Dr Erik Mackie, Head of Research Engagement, Cambridge Zero
Francesca Re Manning, Programme Manager Cambridge Global Food Security IRC

09.35 **Opening note**

Sue Pritchard, Chief Executive, The Food Farming & Countryside Commission

SESSION 1

09.45 **Keynote: Redesigning farming systems for sustainable agriculture**

Prof Lynn Dicks, Professor in Animal Ecology, Agroecology Research Group Lead, Department of Zoology

A transition to more sustainable agriculture is needed, to reverse biodiversity loss and slow climate change, but there is not agreement on how to do this; it requires two apparently conflicting goals to be met simultaneously – increased crop yields and reduced environmental impacts. Research to inform this transition without unwanted ‘off-site’ impacts on biodiversity must be conducted at farm-to-landscape scales, in partnership with farmers and agronomists operating in real world conditions, taking account of economic and environmental outcomes. I will use our research projects in the UK and India, to illustrate how this approach can reveal solutions, driving sustainability from the ground up.

09.55 **Keynote: Does size matter? Sustainable production through farmer producer organisations and digital platforms**

Dr Jagjit Singh Srail, Director of Research, and Head, Centre for International Manufacturing

Our research investigates the development dynamics of Farmer Producer Organizations (FPOs) as an alternative sustainable agriculture model by facilitating responsible resource use, equity between supply chain stakeholders, and scale thereby providing social-welfare to smallholder marginalized farmers. However, FPO development, transition dynamics, and operational trade-offs are not well understood resulting in both adoption challenges and tepid performance.

A fundamental question that has emerged concerns the development and size of FPOs and the operational factors and policies that influence optimality. At a socio-economic level, the research explores bargaining power and equity in food supply chains, new business models through digital platform enabled FPOs, operational trade-offs and managing transitions. Further, FPO development and growth dynamics are heavily influenced by policy instruments that dictate scale requirements which are often arbitrarily set.

Currently, models are being validated through our involvement in East Punjab, India (through the TIGR2ESS project) and follow-on research in a recently awarded project on FPOs in West Punjab, Pakistan. These two geographies provide alternative regional and national policy contexts, providing generalizability opportunities with potential impact on FPO development and policy formulation.

10.05 Keynote: Frugal Innovation: Doing More and Better with Less

Prof Jaideep Prabhu, Jawaharlal Nehru Professor of Indian Business & Enterprise

Over 3 billion people in the developing world live outside the formal economy and face significant unmet needs in core areas such as health, education, energy, food, and financial services. For years this large population was either the target of aid or came under the purview of governments. More recently, however, private sectors firms and NGOs, both large and small, have begun to develop market-based solutions to meet the unmet needs of these vast millions.

Meanwhile in the developed world, declining real incomes accompanied by greater concerns about the environment, are making consumers both value and values conscious. Further, more and more people in the West are now empowered to do with limited resources what only large firms could do in the past. Ubiquitous tools such as smart phones, cloud computing, 3D printers, crowdfunding, and social media, have given rise to grassroots innovation and entrepreneurship exemplified by the maker movement and the sharing economy.

In this talk, I will discuss how the phenomenon of frugal innovation—the creation of faster, better and cheaper solutions that employ minimal resources—can help employ more people creatively and solve some of the big problems of poverty, inequality and climate change that stalk the planet. I will particularly focus on the implications for sustainable and healthy food production.

10.15 Global tipping points, AI-assisted food productions modelling and policy making in least developed countries

Dr Jerry Chen, Postdoctoral Researcher, Department of Land Economy;
Elisapeththu Hoole, PhD Candidate, Department of Land Economy

Policy-making in least developed countries (LDCs) is an approximate process due to data availability limitations. With drastic climate changes and low resilience capacities, LDCs face severe, inter-connected and life-threatening environmental conditions under a 1.5C increase. Consolidating meteorological data, we utilise AI to (1) transparently model/communicate long-term causal climate impacts on food production in LDCs guided by different climate tipping points (2) visualise modelled outcomes at the local-level using generative AI to craft qualitative, relatable, human-centric narratives for policymakers. Communicating data is key to designing appropriate, long-term policies that increase sustainability and resilience of LDC food production systems. Data is also essential for LDC agency at international policy forums, e.g. raise awareness of risks and advocate for climate justice.

10.25 DISCUSSION

10.40 BREAK

SESSION 2

10.50 Reutilising fava bean as functional food for better mental health

Dr Nadia Radzman, Research Associate, Sainsbury Lab

Abstract TBD

11.00 Keynote: Farming for food security and environmental sustainability in the East of England

Rob Wise, Environmental Advisor, NFU East

Farmers in the East of England represent both the bread basket and salad bowl of UK food production. Most of the nation's cereal production is concentrated in the east and the Fens produce a third of the nation's vegetables. Peat, sandy and mineral soils play their part in defining the specialisation of production and each come with attendant threats to the environment: greenhouse gas emissions from the peat, high water demand for production on the sand lands, and increased flooding threats everywhere due to changing weather patterns. The challenge for farmers is to maintain productivity while lessening the negative environmental consequences. Novel uses for crops outside of the food system are also developing and some of these crops can help mitigate negative environmental impacts. For example, there is great interest from policymakers in the potential for paludiculture on peatlands but there is currently a gap in the scientific evidence base on its practical and financial viability. It is through working with the wider scientific research community that farmers will find the solutions and deliver the desired outcomes.

11.10 Keynote: Minimising the environmental consequences of farming

Prof David Edwards, Professor of Plant Ecology, Department of Plant Sciences

We are faced by the dual global crises of climate change and biodiversity extinction. In response, there is an increasing drive to make farmland more wildlife friendly and to restore natural ecosystems. Yet both of these conservation interventions can drive yield losses, which could result in perverse market feedbacks that result in the spillover of demand to deforestation-driving tropical crops at massive net cost to biodiversity and carbon stocks. I will first discuss whether making farmland more wildlife friendly would deliver more carbon or biodiversity than producing the same amount of food on a smaller land area by maintaining or increasing yields, coupled with sparing the remaining land for conservation. I then investigate the need to generate more land for restoration, highlighting the cost-effective potential of taking extensive ruminant (i.e. cattle and sheep) grazing land out of production, which can be coupled with meeting protein demand via producing less land-extensive protein sources such as soy, chicken or pork. Only by appropriately accounting for unforeseen spillover impacts of farm management actions and ensuring that production is maximised on a smaller land footprint – including by promoting

dietary change – can we ensure that high-level global targets for food accessibility, climate action, and biodiversity protection are met.

11.20 Plant virus spread in crops: why modelling insect vector behaviour is important for prediction and control

Elin Falla, PhD Candidate, Department of Plan Sciences

Plant viruses threaten global food security by reducing crop yields, and are often transmitted by insect vectors. Non-persistently transmitted (NPT) plant viruses are almost exclusively transmitted by aphids, and are characterised by a very short virus retention time in the aphid. Many NPT viruses can alter their host plant's phenotype to change the behaviour of the aphid vectors in a way that often optimises virus transmission. Mechanistic epidemiological models of this phenomenon have historically overlooked a key feature of NPT virus transmission: probing or feeding on a plant is often what causes an infective aphid to lose the virus. My talk presents a new compartmental mathematical model that captures this feature of NPT virus transmission, and I use it to show that previous models underestimate the effects of virus manipulation on epidemic size, with implications for virus prediction and control in the field.

11.30 Keynote: Forgotten crops and Knowledge Erasure in Communities: Addressing the gaps between food production, consumption and nutrition

Prof Shailaja Fennell, Professor of Economic Security and Resilience, Department of Land Economy

This talk will examine the differential impacts of climate change in communities in different geographies, and how that intersects with changes in food production. It will interrogate why there still exist gaps in examining how production, consumption and nutrition gaps play out in communities across social axes of gender, age and social group. The talk will highlight the missed opportunities for engaging in richer and more textured methods of co-learning that can reveal community knowledge of 'forgotten crops' that can significantly reduce consumption and nutrition gaps. Such methods of investigation facilitate the garnering of the plurality of ecological sustainability that can improve a community's resilience in the face of the climate crisis.

11.40 DISCUSSION

11.55 BREAK

SESSION 3

- 12.05** **Keynote: Towards a Better Food System through Industrial Resilience**
Dr Mukesh Kumar, Associate Professor in Operations Management, Institute for Manufacturing

Abstract

- 12.15** **Constraints on Climate Mitigation in Global Rangelands**
Robert Powell, PhD Candidate, Plant Sciences Department

Soil carbon sequestration is considered critical for climate change mitigation, particularly in grazing- and rangelands. Yet current estimates of sequestration potential rely on crudely derived relationships between management and soil carbon stocks. In rangelands, where a majority of ecosystem carbon is stored below ground, grazing intensity affects plant biomass stocks and thereby carbon inputs to soils. By synthesising globally distributed empirical data, we have created a novel dataset relating changes in plant biomass with those in soil carbon stocks under altered grazing intensity. This dataset has allowed us to constrain estimates of soil carbon sequestration in global rangelands and compare the magnitudes of mitigation through increases in soil carbon and decreases in ruminant methane emissions.

- 12.25** **Coproducing Millet Futures**
Pei Jiang, PhD Candidate, Department of Geography

My research adopts the notion of ‘co-production’ to analyse the interactions between human and non-human actors in foxtail millet conservation in China. The cases presented involve multiple stakeholders, including seeds, breeders, NGOs, farmers, cooperatives, consumers, and the marketplace. My research finds that relying on a single actor, such as the government, for landrace conservation is inadequate. Peasants are not incapable of seed conservation; In contrast, they possess expertise in seed saving and can – and do – serve as seed guardians. Collaborations and co-productions between human and non-human stakeholders generate more system-aware outcomes and contribute to diverse millet futures.

- 12.35** **Policy interventions to promote sustainable food consumption**
Clara Ma, PhD Candidate, Cambridge Centre for Environment, Energy and Natural Resource Governance

Global greenhouse gas emissions from animal-source foods are twice those of plant-based foods and account for roughly 20% of total anthropogenic greenhouse gas emissions. Shifts to plant-based diets are an important demand-side climate change mitigation solution that could lead to substantial decreases not only in greenhouse gas emissions but also in land use, water use, air

pollution, and nutrient losses to the surrounding environment, among other environmental and public health benefits. Financial incentives and behavioural nudges are tools that could be used to influence decision-making around food consumption, and evidence on how individuals react to these interventions in real-world settings, the extent to which they change their behaviour, and what measures could improve their acceptance, is needed to inform climate and environmental policymaking. Using a quasi-experimental approach, we evaluate the effects of CO₂ emissions labels and small price changes, separately and in combination, on the meal choices of individuals in university cafeterias in the context of food sustainability.

12.45 Seafood for Societal Health

Jessa Belle Garubay-Yayen, MPhil student, Conservation Research Institute

By 2050, the world population is expected to reach nearly 10 billion, making it crucial to ensure sustainability in food production, especially in the seafood industry. However, current food consumption trends in the UK and globally indicate a worrying uniformity, with a heavy reliance on a limited range of food sources. Such poses significant risks to food security, environmental well-being, health, and cultural heritage. In the seafood industry, this trend results in the underutilisation of several species and parts that could provide nutritional, ecological, and economic benefits.

My study aims to discover ways to shift consumer preferences toward a more diverse range of seafood choices, with particular emphasis on underutilised species and seafood parts. I aim to investigate the barriers to diversified seafood consumption and propose interventions to raise awareness and appreciation for these underrepresented resources. I aim to contribute to a more robust food system, safeguard marine biodiversity, support local economies, and preserve cultural and culinary traditions while reducing the seafood industry's environmental impact in the UK.

12.55 DISCUSSION

13.10 CLOSING REMARKS

Prof Mario Caccamo, Chief Executive, NIAB
Francesca Re Manning

13.20 LUNCH

14.00 END