Science & Technology Facilities Council

Food Network+

Sarah Bridle

University of Manchester

SFN PI

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My motivation

- 20 years as a cosmologist, analysing images of millions of galaxies to learn about dark matter and dark energy, but…
- (Hopefully) the biggest challenge facing civilization is climate change and its impact on food security
- Food production is (arguably?) the biggest "single" contributor to climate change
- The STFC Food Network+ offers a way for people like me to get involved and use STFC capabilities to help solve these problems

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Overview of this Talk

- Overview of the SFN
- The Science and Technology Facilities Council
- Food Challenges
  - Food Security
  - Food Assurance
  - Food Impacts
- SFN Members
- How to get involved in the SFN

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Objectives of the SFN

- To build an inclusive, dynamic, interdisciplinary network of researchers focused on innovative ways to use the skills and facilities funded by STFC.
- To kickstart inter-disciplinary collaborations and research projects working towards sustainable food systems both in the UK and developing countries.
- To enhance the impact of STFC/food multidisciplinary collaborations by encouraging codesign with the non academic sector.

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SFN Co-Investigators

- Sarah Bridle (PI, Manchester, astronomy),
- Lenny Koh (Sheffield, supply chain)
- Katherine Denby (York, N8 Agrifood Academic Director, plant systems biology)
- Bruce Grieve (Manchester, sensors for agrifood)
- Mark Reed (Newcastle, impact, ecosystem services)
- Kieran Flanagan (Manchester, nuclear, laser spectrometry)
- Jason Halford (Liverpool, psychobiology, obesity)
- + Alison Fletcher (Project Manger, Manchester)

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SFN Steering Committee

- Peter Atkinson (Lancaster University)
- Hywel Owen (University of Manchester)
- Peter Lee (Acting Director, Research Complex at Harwell)
- Peter Allan (Head of Strategy, RAL Space)
- Robin Pinning (Chief Technology Officer, Hartree)
- Tim Williams (Project Coordinator, Farming Futures)
- Alastair Taylor (CEO, IAgrE)
- Myles Bremner (Consultant to Jamie Oliver Foundation)
- David Flanders (CEO, Agrimetrics Center)
- Stefan Seuring (University of Kassel, Germany)
- Ernesto DR Santibanez Gonzalez (UFSB, Brazil; Talca, Chile)

SFN Pre-Launch Survey

Highlights:

- Over 640 responses
- 75% of respondents were from STFC research or facilities
- 285 people said 'I would like to join the SFN mailing list to receive updates every few weeks'
- 82 people said 'I am considering attending the SFN launch meeting on 28/29 June in Manchester

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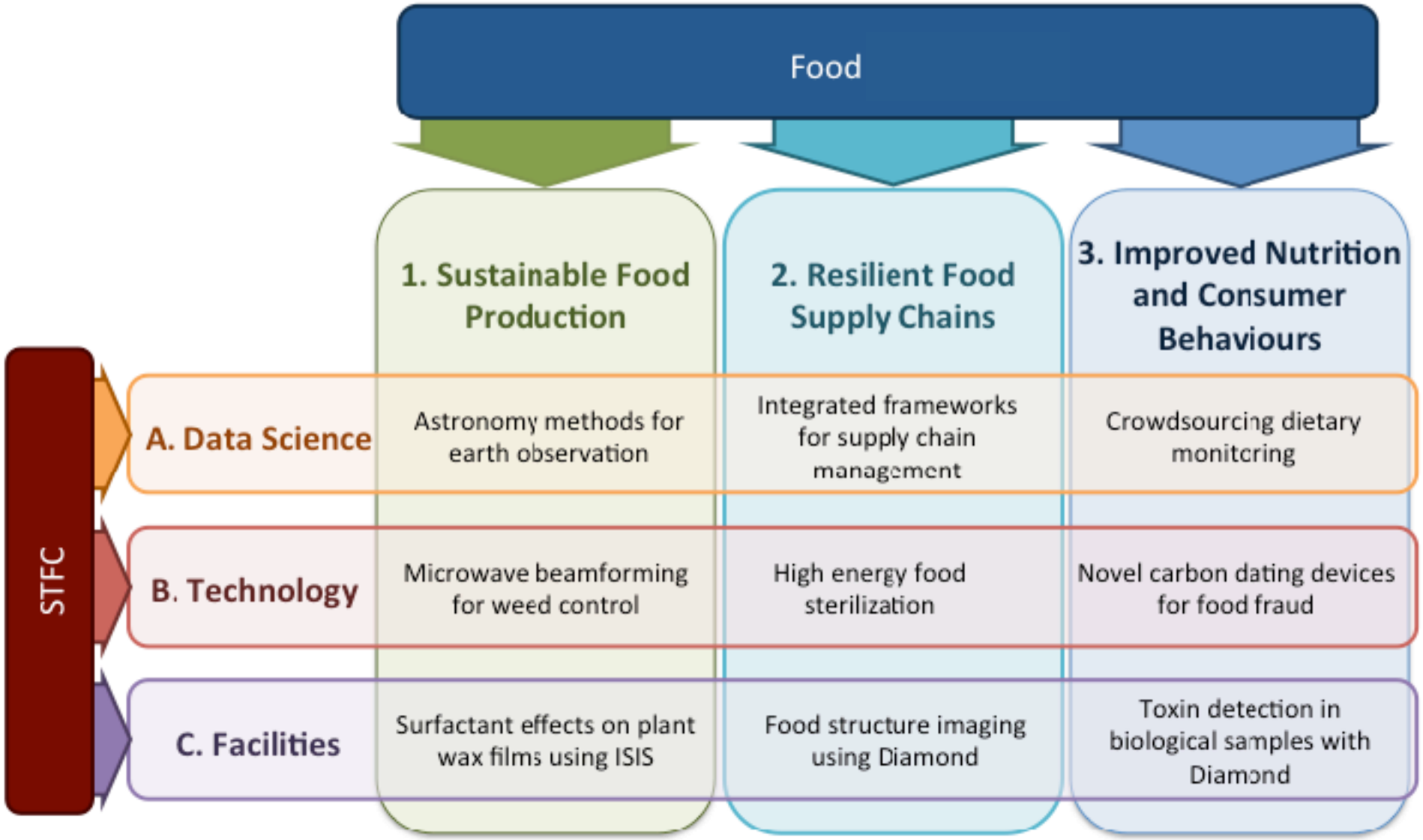

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Beyond the SFN

- We want the SFN to instigate new collaborations between STFC researchers and food researchers
- We want these collaborations to expand beyond the Network to even greater successes
- E.g. UKRI interdisciplinary pot, Global Challenges Research Fund, Industry Strategy Fund, REF Impact cases….

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Science & Technology Facilities Council

- One of the 7 UK Research Councils
- Runs major facilities underpinning UK science
  - Massive lasers (e.g. Diamond, CLF…)
  - Neutron, muon sources (ISIS, …)
  - Computing facilities (SCD, Hartree)
  - Precision equipment (ATC, Boulby, Chilbolton) + Higgs
- Funds fundamental research
  - Astronomy, particle physics, nuclear physics, space science

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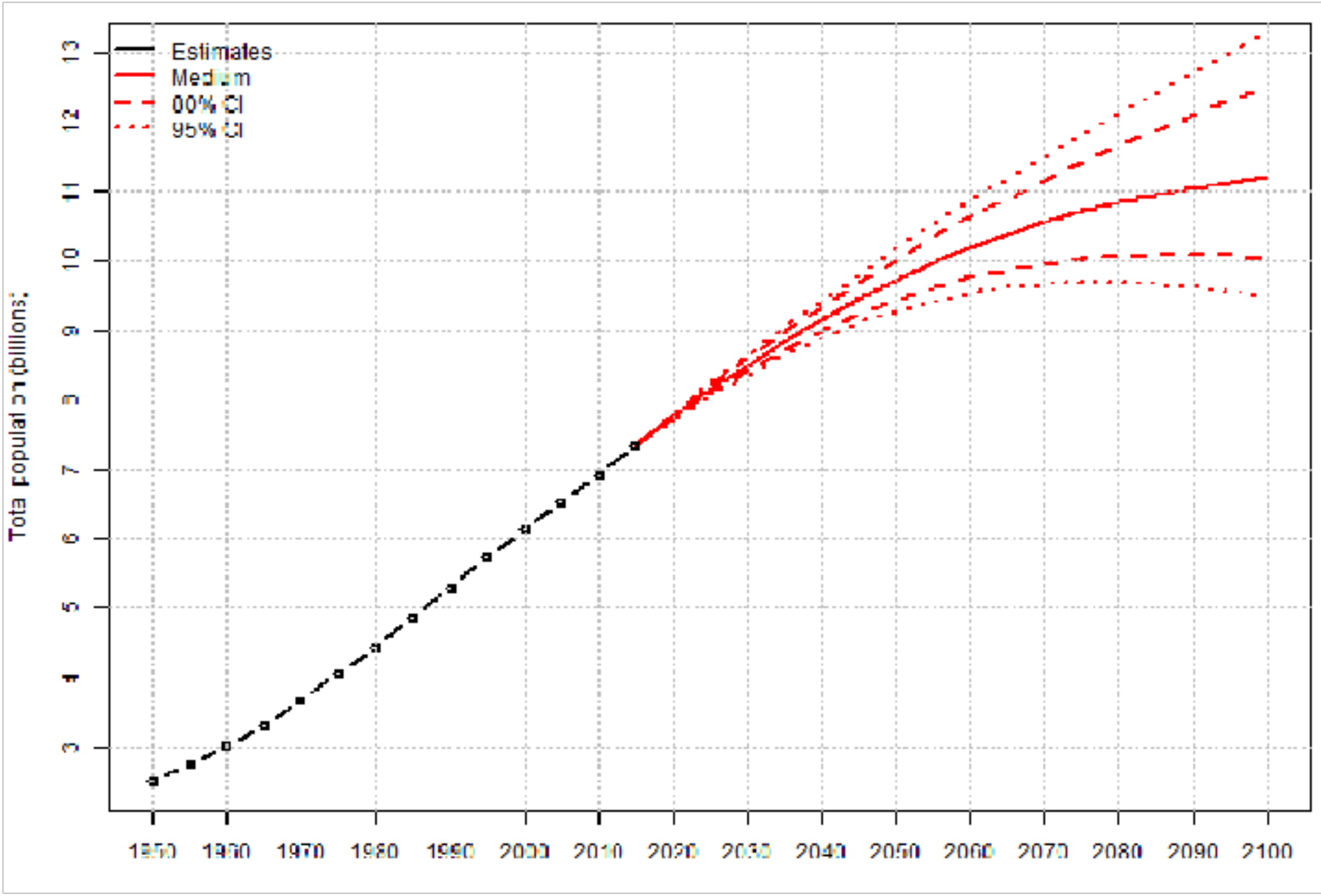
Food Security: The Challenge

"having access to affordable, safe and nutritious food, today and tomorrow"

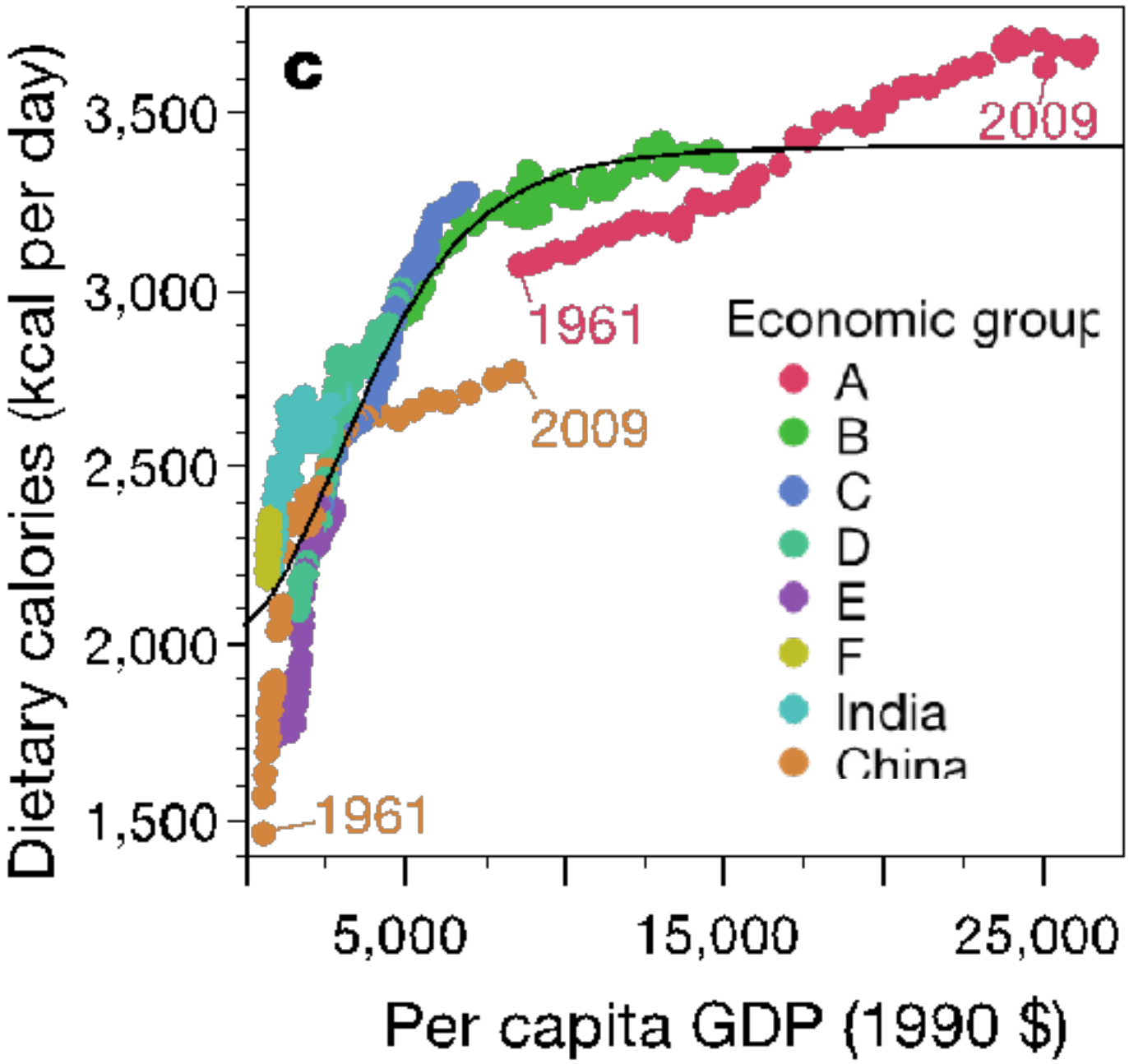
- Feeding a growing population
  - Predicted to be >9 billion by 2050 = 36% increase
- Increasing demand for quantity and quality
  - Correlation between GDP and total food per person

-> projected 50% increase in demand for food by 2050

In the face of a changing climate



Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision*. New York: United Nations.



Tilman, Clark 2014 Nature 515 p518

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Food Security: Types of Solution

- Sustainable intensification
  - Reduce crop stress: biotic (pests, disease) and abiotic (dehydration, competition)
  - Improved crop varieties (plant breeding, GM)
  - Improved conditions (soil, pollination)
- Reducing food waste
  - On farm, supply chain, supermarkets
  - Consumer waste including obesity

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Food Impacts

- Impact on the planet
  - Greenhouse gas emissions
  - Biodiversity, acidification
  - Resources e.g. land, water
- Impact on our bodies
  - Obesity epidemic
  - Hunger, malnutrition, …
- Animal welfare and human exploitation

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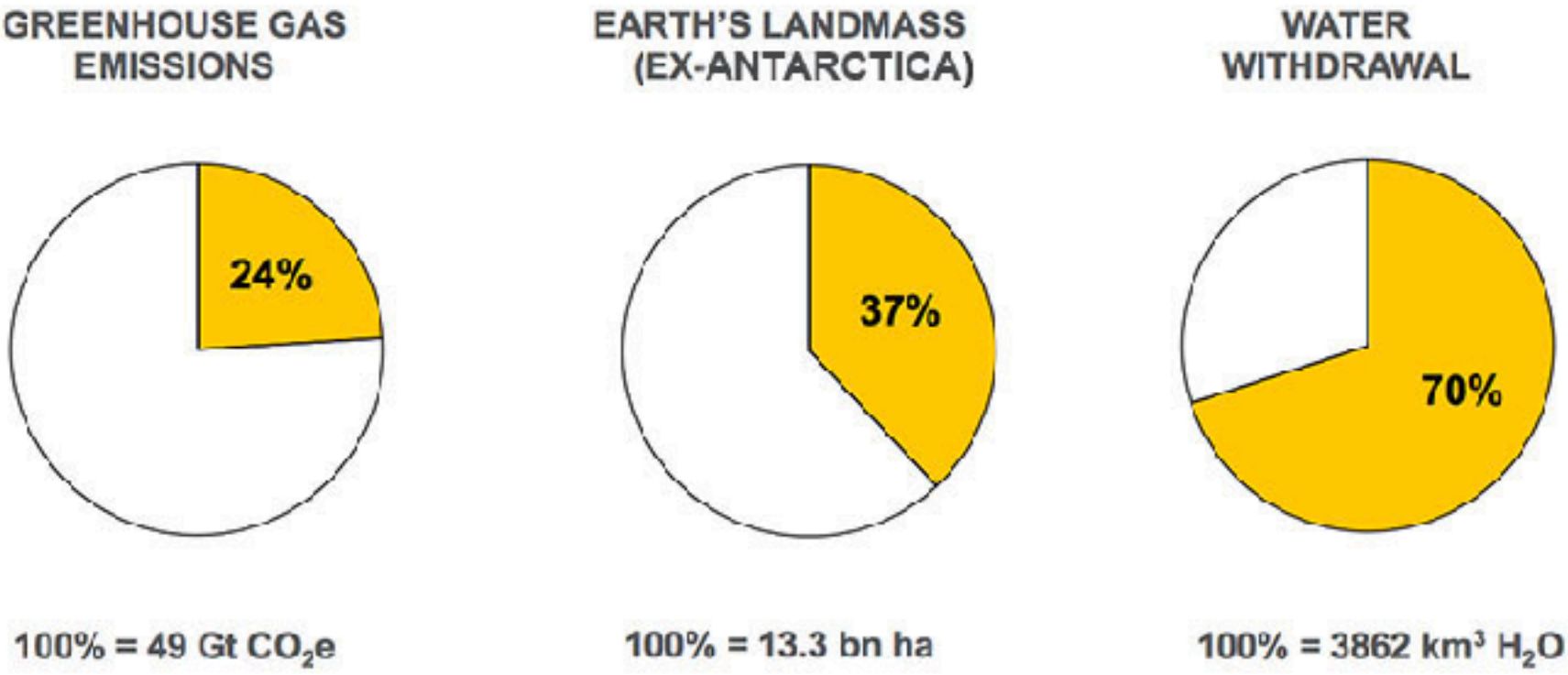
Impact on the planet

Agriculture's Share of Global Environmental Impact (2010)



WORLD RESOURCES INSTITUTE

Sources: http://ow.ly/rptMN

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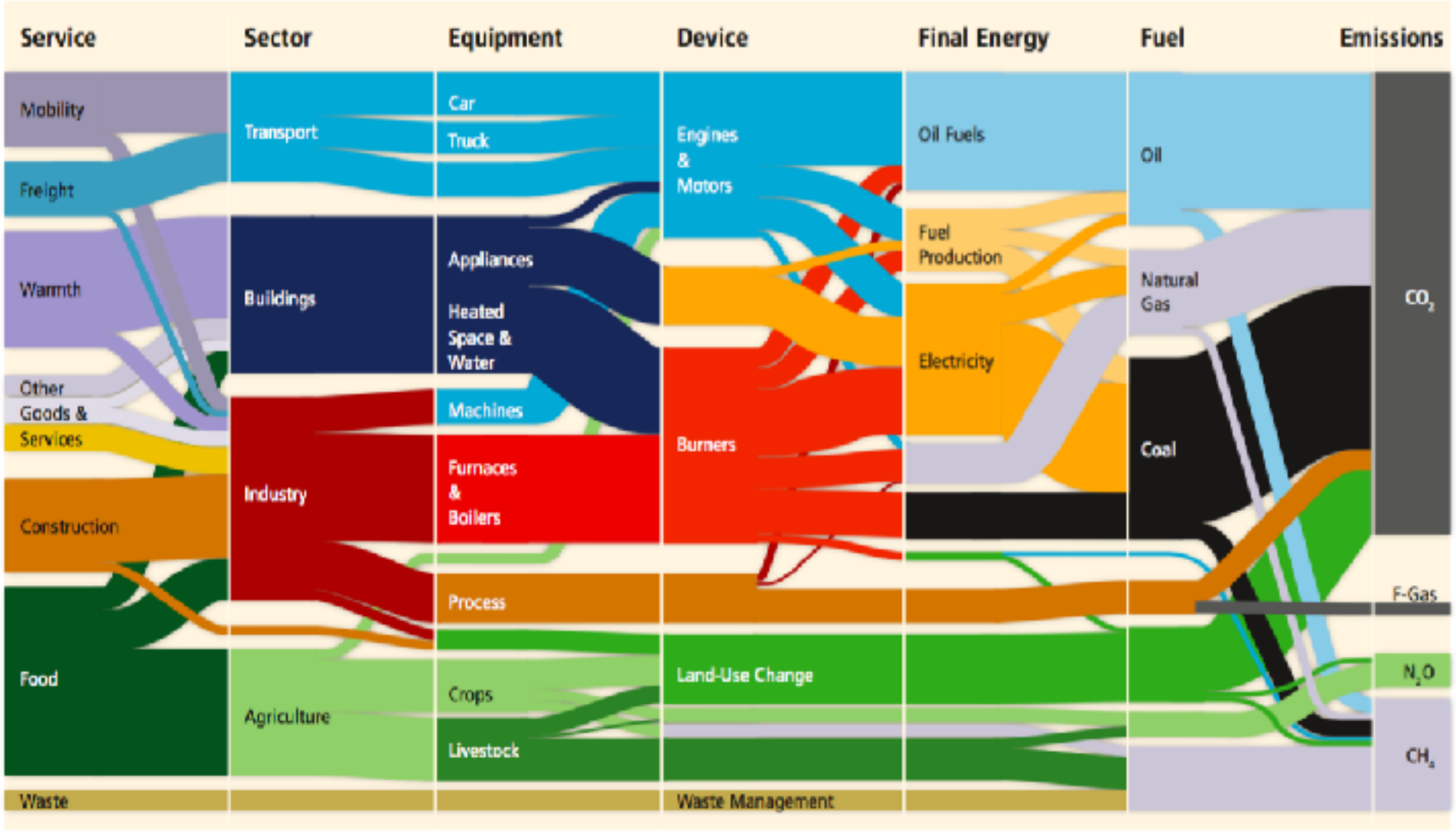
Food contributes >20% to greenhouse gases



IPCC 2014, report WGIII

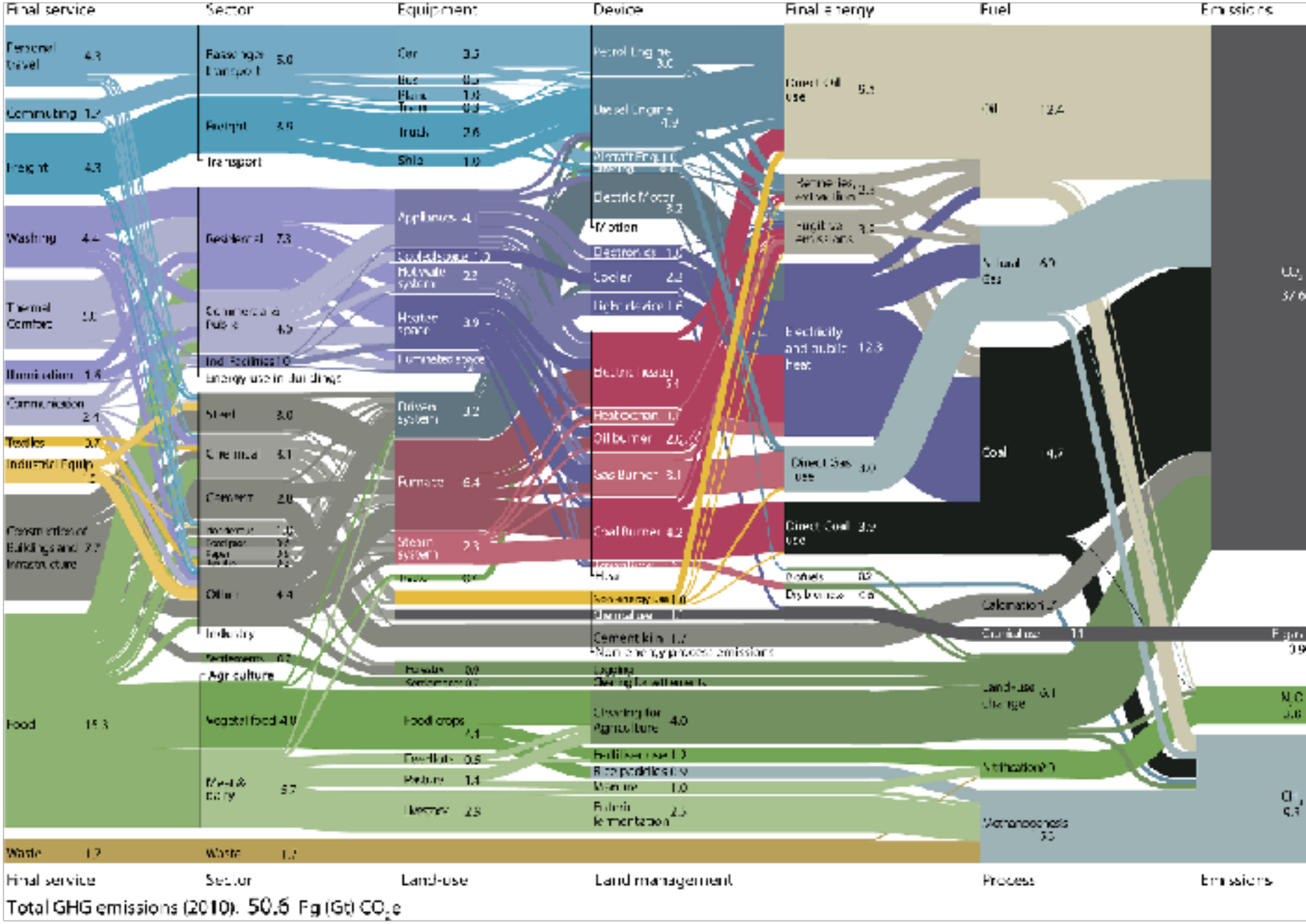


Figure 1. The proposed data structure represented as a Sankey diagram for all anthropogenic global GHG emissions in 2010.

Bajzelj et al 2013

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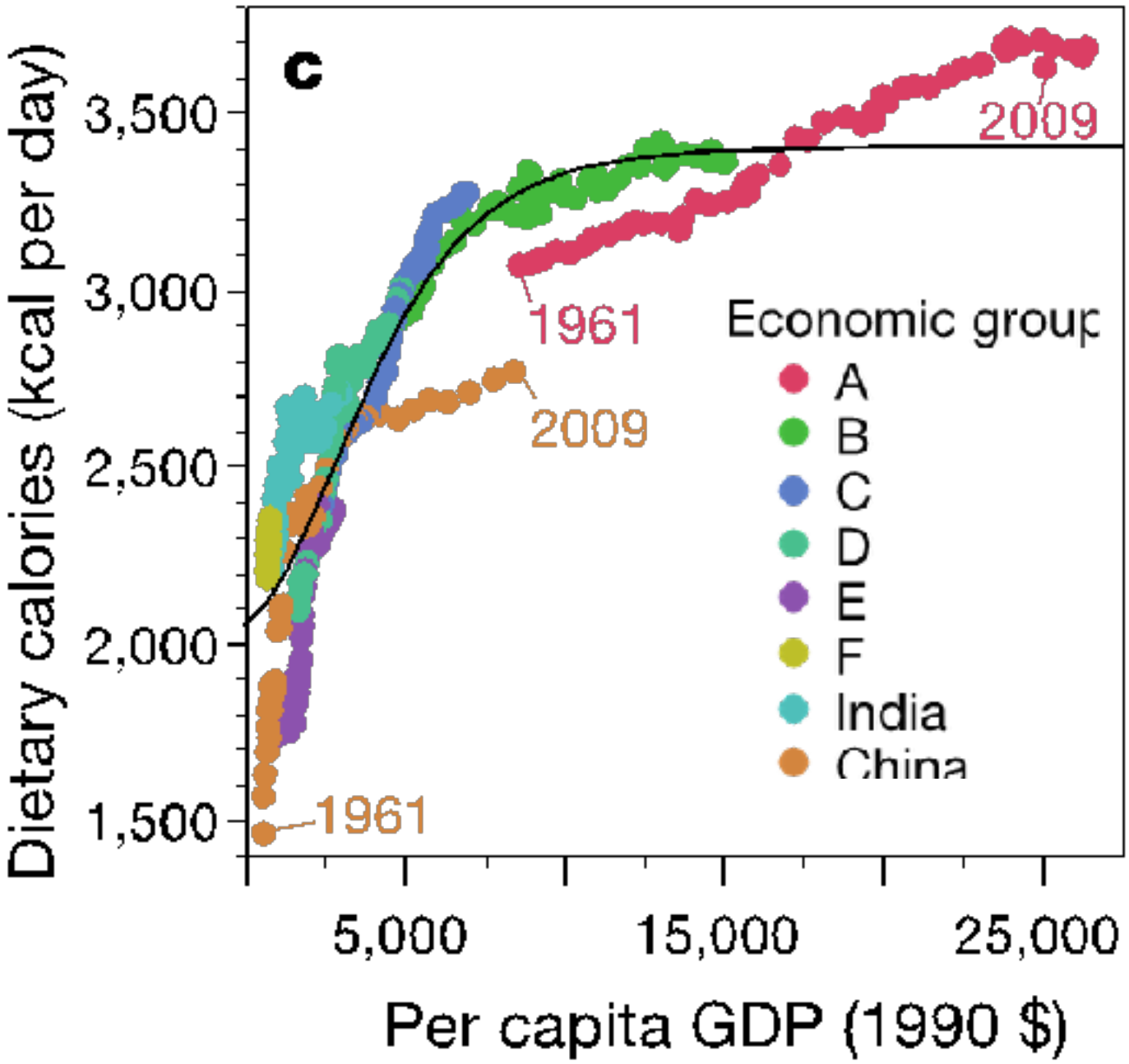
Food Impact on Climate Change

- Feeding a growing population
  - Predicted to be >9 billion by 2050 = 36% increase
- Increasing demand for quantity and quality
  - Correlation between GDP and total food per person
  - Correlation between GDP and total meat per person
  - -> CO_2e emissions from crop and livestock production would increase 32% per person from 2009 to 2050

-> projected 80% increase in CO_2e from food by 2050



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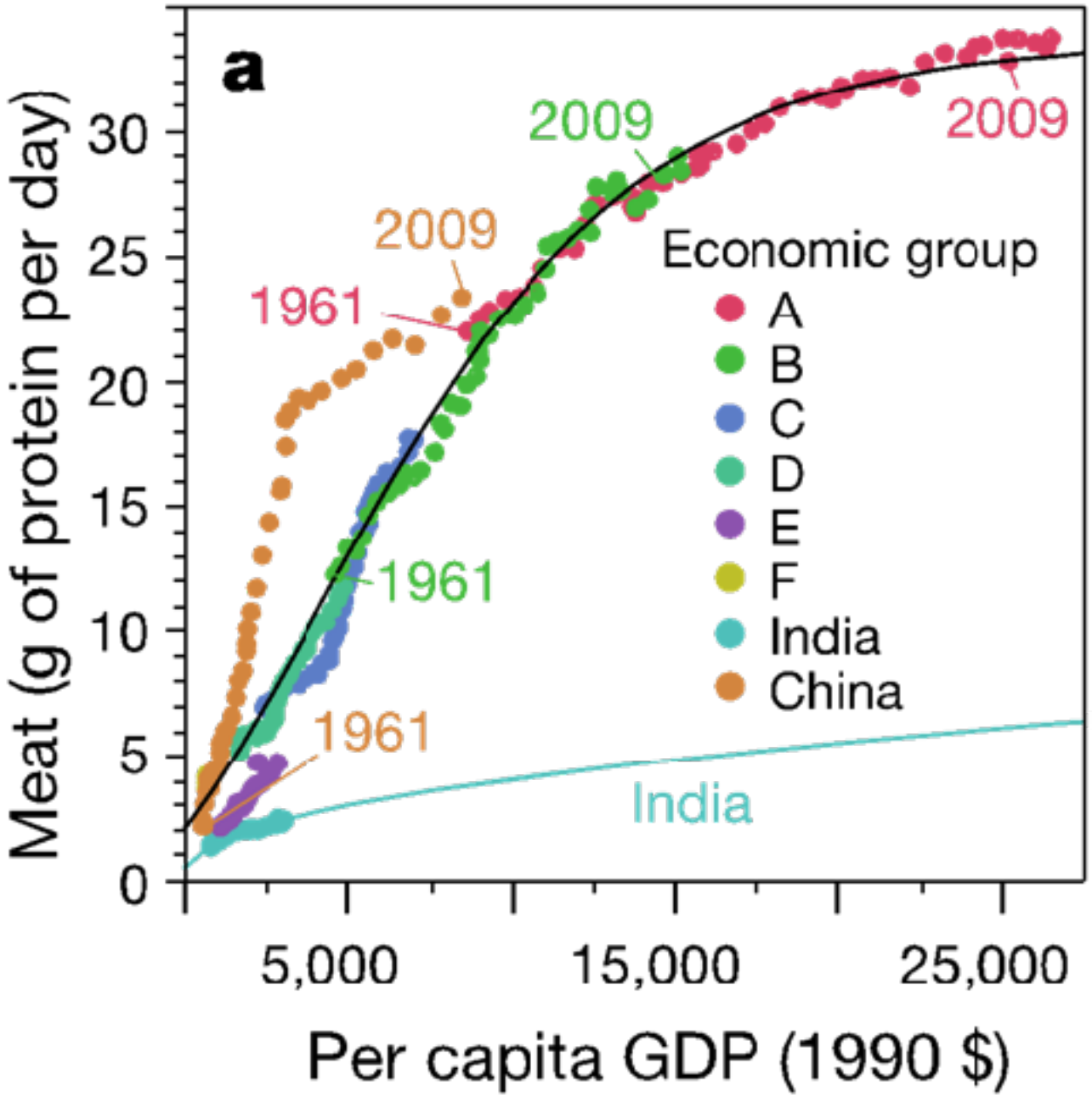
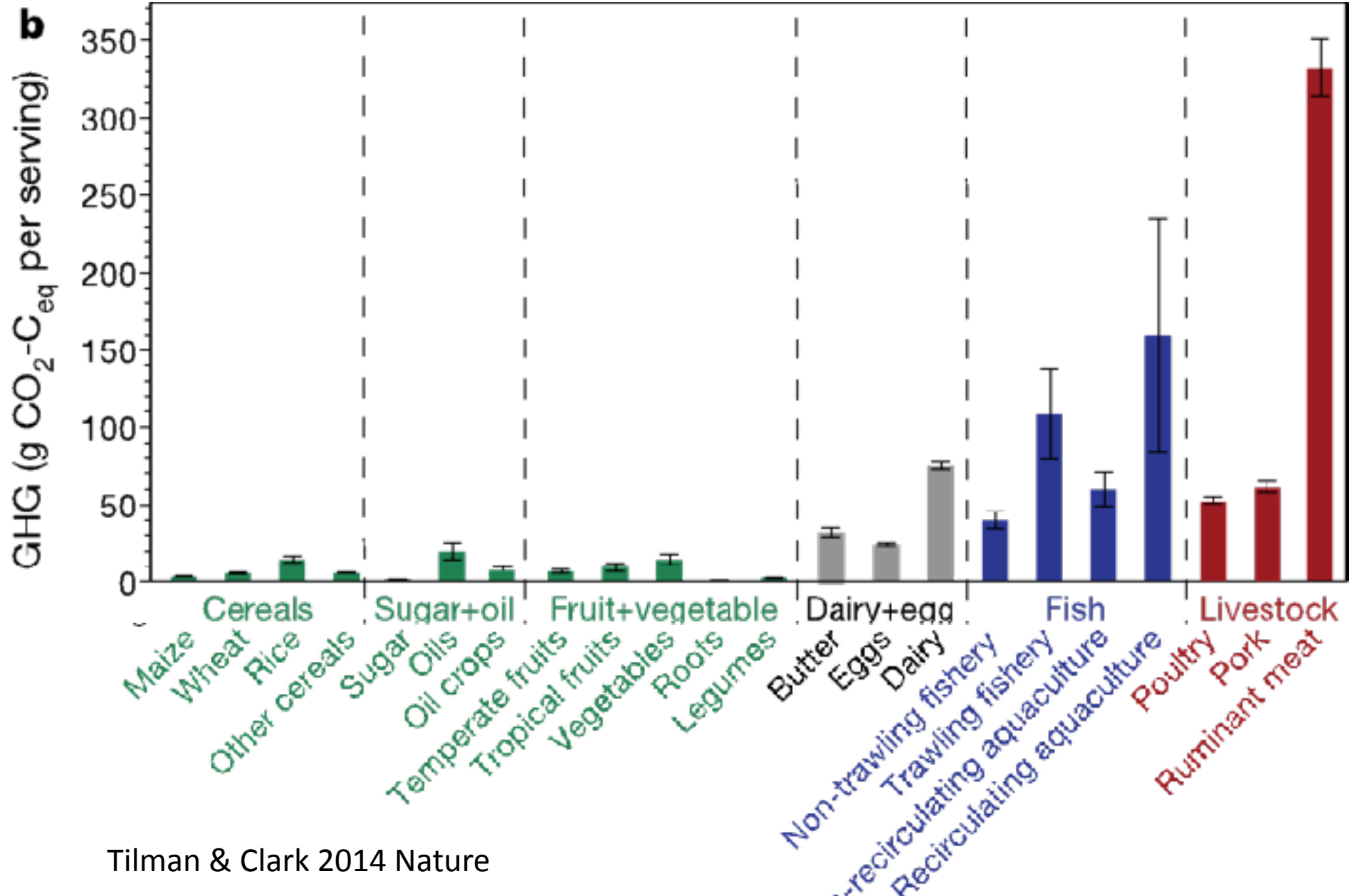


Tilman, Clark 2014 Nature 515 p518



Tilman & Clark 2014 Nature

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SFN Members

- The following slides show contributions from existing SFN Members illustrating
  - Existing interactions between STFC and food
  - Food challenges in need of a solution
  - STFC capabilities in search of a food challenge

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Understanding UK consumer food waste
Bojana Bajzelj and others at WRAP

- "WRAP works with governments, businesses and communities to deliver practical solutions to improve resource efficiency… Between 2010 and 2015 in England alone, WRAP initiatives reduced greenhouse gas emissions by nearly 50 million tonnes (Mt), which is equivalent to the annual carbon dioxide emissions of Portugal."
- An example of a project that needs person-power:
  - WRAP have detailed data from Local Authorities on food waste
  - About half of these Local Authorities provide food waste collection
  - Q. Is there a correlation between food waste and waste collection?

Implementing a lower CO2e diet
Jennie Macdiarmid

Science & Technology Facilities Council
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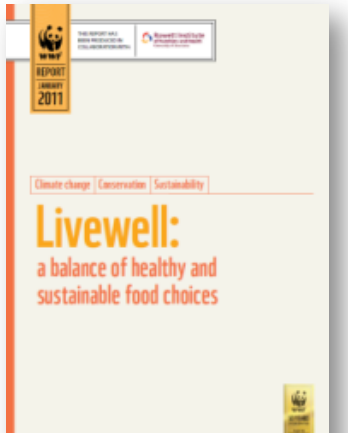
- What is a sustainable diet?
    - Livewell project (health, low greenhouse gas emissions diet.
    - variation in dietary changes need to achieve a sustainable diet
- How can we achieve them?
    - focus groups to explore willingness to reduce meat consumption.
- Example of methods: mathematical modelling, qualitative methods, discrete choice experiments, agent-based modelling, secondary data
- Awareness of the environmental impact of food and willingness to eat less meat



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The Rowett Institute

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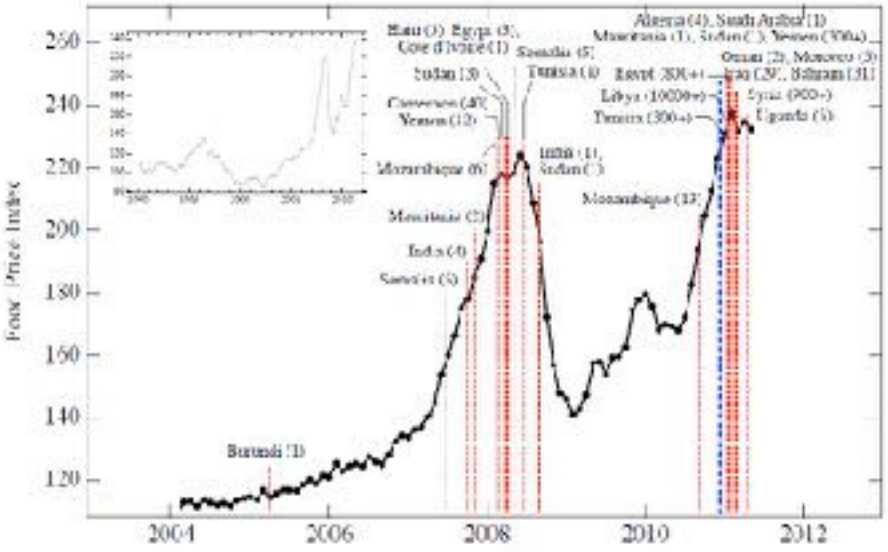
Assessing food shock impacts

Aled Jones

- Business cost risks
  - Increasing and volatile base costs for agriculture products – equity or corporate bond risks
- Political instability
  - High price linked to riots and political instability (Arab Spring)
- Economic risks
  - Political instability and business risks lead to a 'flight to quality' impacting government bonds/gilts (USA)
  - Ongoing risks (including link to energy prices) could lead to inflation
- Supply chain risks
  - Lack of stable supply chain for key grains leading to business risks (and equity risks)
- In country governance and stability
  - Changes to governance and political fragility can change risks from food impacts

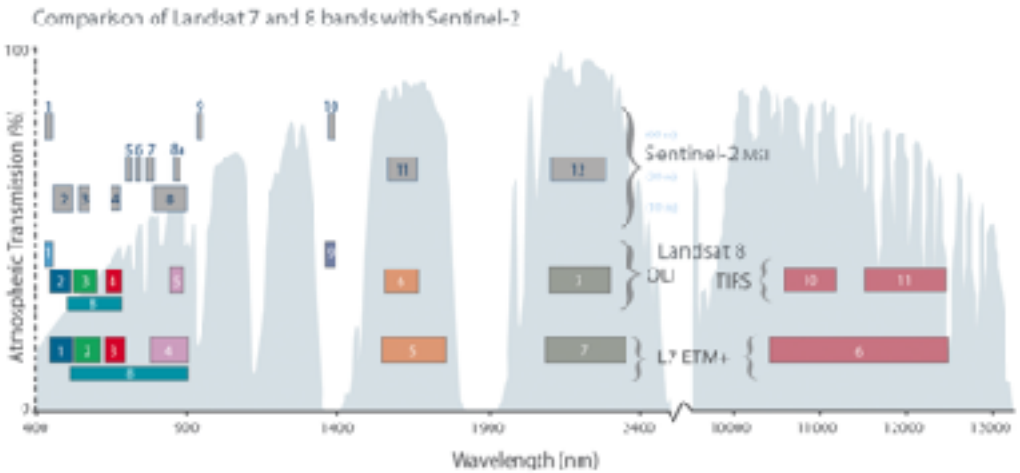


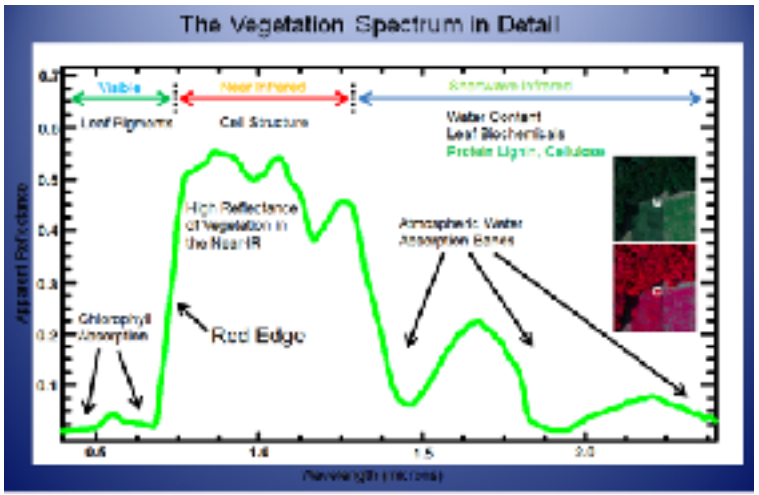
Anglia Ruskin University

Earth observation

Sarah Bridle, Peter Atkinson, Jadu Dash, Pete Bunting, Dan Morton, Mark Jarman, Paul Robinson, Simon Pearson, Joe Fennell

- A wealth of data exists
  - Satellite, cubesats, drones
- Questions to answer with this data include
  - Crop mapping - assessment of security
  - Crop stress interventions
  - Assessing plant breeding trials



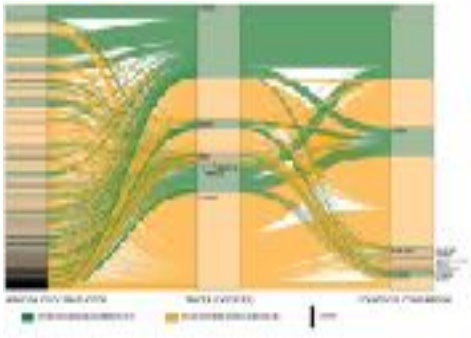


IKnowFood

Integrating Knowledge for Food Systems Resilience

Jonathan Ensor, Bruce Grieve, Peter Howley, Annemarieke de Bruin

- Identifying transformative social and technological on-farm innovations
- Developing tools to promote resilient food supply chains
- Influencing food choice for health and resilience at individual and household level
- Integrating knowledge for a more resilient food system



Q. Can new learning processes support a shift from information and technology provision, to on-farm knowledge development and the co-creation of innovations?

Q. Can these processes identify new applications for agricultural sensors and automation technology?

Q. Can improved understanding of farmer risk perception support wider replication of findings?

assist

Achieving Sustainable Agricultural Systems

CEH, Rothamsted, BGS

- Aim: to develop and test innovative farming systems that increase food production & resilience to future perturbations, while reducing the environmental footprint of agriculture
- ASSIST is a 5+ year £11M National Capability* research programme that unites expertise from NERC and BBSRC institutes, with integral support from the farming industry
- Develop a large-scale network of study farms & new sensor networks to undertake hypothesis-driven experimentation
- Provide data, models, web portal, infrastructure & opportunities for complementary research programmes & Horizon topics

Agrimetrics:
The Big Data Centre of Excellence for the Agri-Food System

A Big Data Centre of Excellence

Agri-Tech Strategy
Innovate UK
£12m

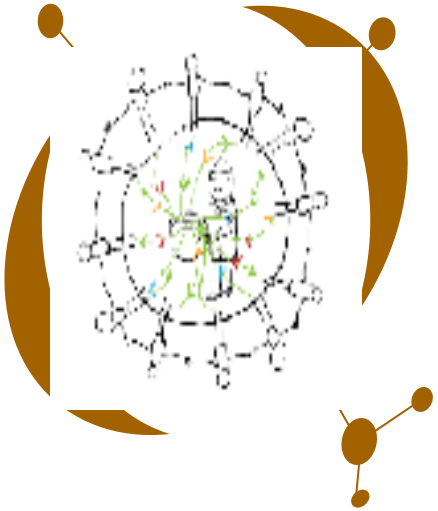
Collaboration

Rothamsted Research
University of Reading
NIAB
SRUC

A team of experts

Data Science
Crop & plant health
Livestock production
Sustainability

Independent, Not for Profit Broker



Trusted and secure
Making disparate data accessible
Facilitating sharing of data
Making data more valuable

Food manufacturing
Mark Swainson

Science & Technology Facilities Council
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- An experienced technical & operations manager well qualified in industrial food technology and food process & packaging systems, Mark is listed on the European Food Safety Authority's (EFSA) Food Safety Experts Database, is a qualified and experienced Lead Auditor, a member of the Knowledge Transfer Network (Food Advisory Group) and a member of the Institute of Packaging
- Key research areas include: Food Industry Quality, Safety and Hygiene Control Systems, Advanced Food Process Technologies, Robotics & Automation, Food Supply Chain Efficiency, Antimicrobial Materials, Microbiological Control and Shelf Life of Foods.
- Initiatives / focus areas include working on cutting edge projects supported by Innovate UK, FSA (Food Standards Agency), DEFRA (Department of Environment Food and Rural Affairs), EU Framework Programmes (including H2020 and Interreg) and wider International initiatives (including the Newton Fund). This often involves working directly with businesses, academia and government on bespoke projects to address specific food industry needs and issues.

Higgs Centre for Innovation

A new business incubation centre and specialist laboratories at the Royal Observatory Edinburgh supported by the expertise of the STFC's UK Astronomy Technology Centre

Run by STFC, and in partnership with the University of Edinburgh, this centre will apply business incubation best practice to *big data* and *space technology* – translating research into commercial impact. It will also support SMEs with state-of-the-art NanoSat test facility, particularly for Earth Observation.

The BIC will have 12 start-ups at any one time and will offer:

- *Business support services* to help companies grow and solidify their offering
- Access to *technical expertise* from STFC
- Access to *test and development facilities*

The Facilities at the Higgs Centre, designed for collaborative use by Industry, Academia and Research Institutions, will include a suite of space test facilities for micro/nano-satellites and components, as well as other specialist facilities.

Applications in EO for Agri-Tech are welcomed!

DISCUS

Data Intensive Science Centre
University of Sussex

- Department of Physics and Astronomy, Mathematics, Informatics. (Particle Physics, e.g. CERN and Astronomy, e.g. Dark Energy Survey, SKA, 4MOST, Statistics, Probability, Numerical modelling, Networks, Machine Learning, NLP.
- Major partner and Leading Role (Director) in STFC CDT Data Intensive Science Centre in SEPnet (>22 PhD students for 2017/2018)
- £10k pump-priming for GRCF activities (2017)
  - Sandpit events, hack-days, PhD placements, etc.
- Working with academics, commercial enterprises and third sector
- Funding e.g. from Welcome for ASTRODEM (applying probabilistic methods used in astronomy to diagnosis of dementia in GP patient records)
- Links with Brighton and Sussex University Food Network
- Links with Sussex Sustainability Research Programme
- Links with Institute of Development Studies (IDS)

UNIVERSITY OF SUSSEX

RANKED

wwwstage.sussex.ac.uk/discus

Brighton and Sussex Universities Food Network:

a multi-disciplinary network which was established in 2012, which has a particular interest in finding ways to improve the value of academic research on food for practitioners and policy makers

https://bsufn.com

Sussex Sustainability Research Programme:

supporting the sustainability of life on Earth through rigorous interdisciplinary research which stimulates action and influences policy. Two key research themes are addressing the trade-offs in achieving the UN Sustainable Development Goals for Health, Water and Food Security; and Food Security, Biodiversity and Rural Urban Dynamics

www.sussex.ac.uk/ssrp

US
UNIVERSITY OF SUSSEX

Sussex ranked #1 in world for development studies

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SFN Proposed Activities

- Run a kick-off Survey to advertise the network, identify potential active members, identify issues and skills
- Write Factsheets
  - On food challenges that need solutions
  - On STFC capabilities
- Appoint Champions to engage their communities in interacting with the Network+
- Open Annual Network+ Meetings
- Sandpit events including Impact Sandpit in final year
- Selection and award (<8k) of travel money and Small Scale Scoping Studies

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How to get involved in the SFN

- Become an SFN Member by emailing queries@stfcfoodnetwork.org
- We may invite you to contribute slides, contribute to writing factsheets etc
- Come along to the SFN Launch Meeting
  - 12pm Wed 28 - 1pm Thu 29 June
  - University of Manchester