

## 15<sup>th</sup> October 2014: Taking a global view



### Aims

This was the first meeting in the series, and the aim of it was to help lay the foundation for the rest of the year by taking a global view of the connections between food security, biodiversity and bioenergy. The three witnesses also used their research and interests to think about some of the research pathways that will help us to prepare for and address these future challenges.

### Witnesses

**Ariel Brunner**, the Head of EU Policy at BirdLife International travelled over from Brussels. He joined **Tina Barsby**, the CEO of the National Institute of Agricultural Botany (NIAB) in Cambridge and **Paul Dupree**, Professor of Biochemistry in the Department of Biochemistry.

### Research gaps

Tina Barsby talked about ways in which research is driven by the market, particularly how/what crops get on to the market. She argued that there is a **tension and a gap between the commercial value of supply and the public demand for crop varieties**. Balancing populations demands for energy and food security will increasingly demand local solutions for local people so she very interested in participatory plant breeding and how to farmers in the collection and preservation of genetic diversity. Many of these new crops are developed for commercial purposes so she calls for more research into ways to transfer technology developed for commercial gain into non-commercial areas. She highlighted 'orphan crops' such as sweet potatoes, cassava, bananas which reproduce vegetatively and are locally important but where relatively little work has been done.

In his introduction, Ariel outlined some of the **tensions between agriculture and biodiversity**, between asking questions about both of these at global compared to local scales and between the perceptions and needs of the developed and the developing world. He argued that although there is a real interest in sustainable farming and in sustainable intensification, more research is needed into what these mean in practice and what impact they would have on biodiversity and ecosystem services.

Paul argued that there is huge potential for creating biofuels from the sugars in plant cell walls. For example, it is now feasible to convert these sugars into ethanol and it is becoming more economically viable. He recommended research focused on the **opportunities for renewables using waste materials**. New methods to produce these fuels would part of this. However, he wondered what the effects of developing these technologies could be on land use and on the land itself, particularly if those waste materials, such as straw, are currently ploughed back into the soil to improve its condition.

### Wicked problems and questions generated by the open discussion included:

**There were strikingly different views about the role that technological advances such as genetic modification (GM) could play in offering 'solutions'**. Some saw genetics as the solution to problems of food security and environmental degradation (i.e., we can just use genetic tools to breed better crops that use fewer chemical inputs); whereas others saw GM as one of the major threats to both of these (i.e., the success in creating high-yielding crops has narrowed our diet to a few crops which are inbred and require uniform environmental conditions and high inputs). Technological fixes are never as straightforward as is initially imagined but we were left asking the question: how can we reconcile these very different views about the role of technological solutions in the future of agriculture?

**What sustainable farming is and what it means in practice for biodiversity and the environment as well as for the crops themselves** was first raised here and kept coming up throughout the year.

**Are we complicit in optimising a food production system that needs fundamental change** or should we all continue on a path that makes 'baby steps' that we hope will collectively shift us in the right direction? In other words, how do we find questions that are narrow enough to allow real research but that answer the bigger problems that clearly cannot be addressed through the sum of small improvements?

**Food security today is a local, not a global issue**, so how can we bring scale into this discussion and develop holistic sustainable farming scenarios for specific locales?

## 18<sup>th</sup> November 2014: Drivers of demand



### Aims

The three witnesses who joined us this month helped us to think about some of the drivers of demand including economics and politics, and the impacts of consumer choices on health and the environment.

### Witnesses

**Professor Ian Bateman**, Professor of Environmental Sciences at the University of East Anglia joined **Bojana Bajželj** who leads the land use components of the BP FORSEER modelling project in the Department of Engineering and **Professor Theresa Marteau**, the Director of the Behaviour and Health Research Unit.

### Research gaps

In his introduction, Ian assumed that our ultimate objective is to ensure non-declining wellbeing over time. He admitted that this seems negative, but argued that as people's long term welfare depends on natural systems, focusing on human wellbeing means that those natural systems have to be safeguarded. He focused on:

**The demand and supply of food:** While accepting that research is needed into the supply side – the role of land management, GM, agritech and precision agriculture – he argued that more research is needed into the demand side and the role that spatial and temporal variation in economic drivers and their impacts will play.

**The impacts of the choices we make on the environment:** A lot of research concentrates on adaptation but not enough on the dynamics of adaptation and the secondary effects those will have e.g. how will people respond to the changes in climate and how will those responses change land use and water availability?

**Trying to make better decisions based on what we know about demand, supply & impacts:** Economics has an important part to play, both in how we build 'value' into models (as opposed to price - the amount of money we pay) and how we use them to make decisions. He argued that developing truly integrated models that combine natural sciences, economics and policy and include both temporal and spatial dimensions of changes in natural capital will also be crucial.

Bojana's models indicate that future demand for natural resources is substantially higher than future supply. Her future research questions focused on **finding alternatives to expanding agricultural land** such as reducing agricultural waste, ways to value non-agricultural land. She also asked whether sustainable intensification has the potential to close the yield gap and this question was a recurring theme over the year.

Theresa focused her introduction on **demand and behaviour change** and ways in which our behaviour is driven by immediate gratification and the environment we live in. She argued that there is an inevitable tension between generating wealth – selling us goods we don't need – and generating planetary health and human health. Further research related to shifting consumption and changing behaviour needs to be connected to the politics, economic, commercial and philosophical issues surrounding why and how these choices are made.

### Wicked problems and questions generated by the open discussion included:

- **How far can models be expected to answer questions related to sustainability?** Do we push them too far and expect too much of them? Not everything can be modelled, so what happens when there are elements of a system which are important drivers of change or influencers but which cannot be included?
- **The dangers inherent in simplifying complex systems versus the need to do it**, both in order to construct models and explain what we see in the world and to be able to communicate messages about sustainability.
- Discussions about consumer choice and behaviour highlighted **inherent tensions between some of the questions that researchers want to answer and those of interest to companies and retailers**.
- What are **the impacts of alternative land use strategies & how can land be used more intelligently?**
- At the moment, **we are not rewarding and valuing other uses of land in the same way as land used for agriculture** - how could we address this?
- **How will people's affluence change their behaviour?** How will that change diets and land use?
- **What are the 'levers' for changing people's behaviour** towards making more sustainable choices?

## 2<sup>nd</sup> December 2015: What can we tell from above?



### Aims

This was the third meeting in the series and the three witnesses helped us to think about the kinds of data sets we can use to look at land use and land use change and links between these and policy implementation.

### Witnesses

**Alan Belward**, the Head of the Land Resource Management Unit at the EC Joint Research Council (JRC) Institute for Environment and Sustainability (IES) came over from in Ispra, Italy. He joined **Lucas Joppa** from Microsoft Research, now based in Redmond, and **Jon Hutton**, the Director of the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) in Cambridge.

### Research gaps

Alan began his introduction by highlighting the rapid advances in remote sensing technology driven by the democratization of space, increased resolution of satellite images (from 80 m to 30 cm) and free and full access to satellite data archives. These open up for new possibilities of research and mean that we have huge capability to obtain high resolution data. However, our ability to understand change on a global scale is still limited and he identified the three main gaps in our knowledge related to land use and land use change: **the nature of land cover, the nature of land use, and the nature of land ownership.**

He added after the meeting that **finding common ground between the observation and reporting standards of the three Rio Conventions** - on Biodiversity, Climate Change and Desertification - would be hugely beneficial. Identifying commonality between them will help to both determine the observations needed and to make policy links between biodiversity loss, desertification and climate change.

Lucas focused on **land ownership and difficulties associated with finding out who 'owns' a plot of land and who has rights to use it.** Very high resolution satellite image acquisitions provides some information about land use but in order to be able to understand the processes at work, physical data needs to be connected to human/ social/ institutional data. Finding ways to bring satellite data together with data from the ground, including characteristics of the land – soil type, climate, geographical features and ecology - and land tenure will provide a much more comprehensive picture of how land is being used now and in the future.

Jon gave an overview of the **challenges of collecting and interpreting remote sensing data in the specific context of biodiversity preservation.** He argued that as habitat loss is the main driver for the loss of biodiversity in all (terrestrial) biomes, an understanding of changing land uses is imperative. He stressed that even though new technology, such as the instruments being used by the Copernicus Programme's Sentinel satellites, will allow us to measure future changes, our ability to quickly and effectively measure land use change is lacking. This is both because land use change outpaces our data collection and processing but also because we do not have an efficient and holistic approach for conducting retrospective analyses.

### Wicked problems and questions generated by the open discussion included:

- **So many countries and companies are launching environmental satellites that harmonising and calibrating the data between them is very challenging.** One risk is that some of the changes we are looking for are very small and calibration problems may make those changes impossible to detect.
- **A lot of the information we need to know about land use change and climate change is fairly mundane** and the cutting edge research attractive to academics (who need intellectual incentives) and companies (who need financial incentives). Who is going to do this boring but important research and who will fund it?
- **How can we make sure that that the 'haystacks' of data being collected is turned into something that can be measured or modelled,** and contributes to both into policy and action on the ground?
- **How can we enable 'cross-mapping' between different mapping projects,** such as between biodiversity mapping and land use, and ensure that data is collected consistently?
- **How do we manage large data flows** and how do we deal with the fact that many globally, existing datasets are not uniform?

**What data are missing** and what can we do now to lay the foundations for collecting it in the future?

## 20<sup>th</sup> January 2015: Changing our thinking

### Aims

This month, the meeting asked 'Does the way we think need to change?' and our aim was to use the interests of the panel of three witnesses to explore new ways of thinking about the impact of land use change on the supply of natural resources and drivers behind the demand for them.

### Witnesses

**Charles Godfray**, Hope Professor and Director of the Oxford Martin Programme on the Future of Food at Oxford University joined **Georgina Mace**, Professor of Biodiversity and Ecosystems and Director of the Centre for Biodiversity and Environment Research (CBER) at UCL, and **David Nally**, a Senior Lecturer in Human Geography in the Department of Geography.

### Research gaps

Charles focussed on food production and as **“now is the endgame on land allocation”, production on existing land needs to be expanded through intensification**. He argued that other competing land uses such as those for bioenergy production are not as important and should therefore be curtailed and food production through sustainable intensification must be prioritised. During the open discussion, he stressed that in his view, diet is a "small player" in the challenge to meet food demand. Instead, the macroeconomics of food and developing win-win scenarios for biodiversity and for food production should be our focus.

Georgina finds the current way of framing discussions about land use too narrow and argued that **there is a need to put the discussion in broader context that looks at the entire suite of benefits that we get from the land**. She does not see the need to view biodiversity as something that we have to tension food production against. Instead, we need a more sophisticated view of both the demand side from society and the supply side from ecosystems and to find ways to overlay them onto each other at relevant spatial and geopolitical scales so that we can harness all the benefits that ecosystems can provide. She wants to see a renewed focus on the regulating and cultural benefits of ecosystems and how to manage these in concert with provisioning services to increase the capacity of landscapes to support resilient & productive human societies.

David's introduction also focused on framing, particularly the **framing of the global food security debate**. He argued that myths surrounding food security overlook the underlying structural dynamic that causes hunger and starvation in the first place, indicating that the efforts are in the best case only treating the symptom of the problem – the amount of food available - and in the worst case making matters worse by assuming technology can fix the problem. He led a series of small group discussions in the Parallel Forum and they agreed that the assumption 'more people = more requirement for food' is a simplification and may even be used to make people fearful and justify inappropriate use of land.

### Wicked problems and questions generated by the open discussion included:

- This month, **some argued strongly that addressing food distribution was crucial to food security whereas other meetings have focused more on food production or consumption**. Are we in danger wrestling with artificial distinctions and how can we think about questions and narratives that address and leverage change across all of them?
- **Within any discipline, there is a tendency to simplify a solution and bring it into a framework that it is familiar with** so social scientists will generate one solution, political scientists another. If we are going to either look at a landscape scale or for place-based solutions and policies, how can we escape from this way of thinking in silos and get to the heart of the problem?
- **The ‘elephant in the room’ in food security discussions is always consumption**. This prompted David to ask - is development about raising the floor or lowering the ceiling?
- **Food supplies and markets**: how can we manage land to ensure that it delivers what it does best, at the right time in the right place as well as providing other benefits?
- **How do the local or the micro-level needs and issues of ‘sustainable intensification’ link with concerns at the global, macro level?**



## 17<sup>th</sup> February 2015: Cotton – from source to shop



### Aims

This month, two multi-national companies brought a business perspective into this debate. Cotton was used as a case study to look at how companies respond to the demands being placed on their supply chains and the greatest challenges they can see on the horizon.

We co-hosted this meeting with the Natural Capital Leaders Platform at the Cambridge Institute for Sustainability Leadership (CISL) who are developing a cotton focus for their Platform Members. This work also relates to the ESRC funded Nexus Network, which CISL is leading in collaboration with the University of Sussex and UEA.

### Witnesses

**Dr Chris Brown** is the Sustainable Business Director at Asda, a British-based, American-owned supermarket chain. In 1999, Asda became a subsidiary of the American retail company Walmart and today is the UK's second-largest chain by market share.

**Dr Helen Crowley** is the Head of Sustainable Sourcing Innovation at Kering, a family-controlled, listed company and a world leader in apparel and accessories, which develops an ensemble of powerful brands. Focused on a single business, they design, manufacture and market desirable products across two fast growing segments: Luxury (including Gucci, Stella McCartney, Saint Laurent and Alexander McQueen) and Sport & Lifestyle (including Puma, Volcom, Cobra, Electric and Tretorn)

### The challenges for cotton

The two witnesses highlighted the following challenges for the cotton and clothing industry including:

**Low customer awareness** of sustainability and environmental impacts compared to food commodities

**Supply chains are currently very opaque** and its complexity makes it very difficult to trace where a batch of cotton is coming from

**A lack of clarity about the impacts of different production systems** (organic vs. 'better' vs. conventional)

**The lack of availability of financing systems to smallholder cotton farmers**

**Organic cotton farming in general is declining as there is not enough support for farmers** and although there is a significant premium for it but smallholder farmers are not receiving that premium.

**Developing meaningful impact indicators:** A reductionist focus on a particular issues such as food miles, organic to child labour makes it difficult to know how different aspects of the system connect together.

### Questions generated by the open discussion included:

- **Where do we leverage to make cotton production better**, both for the environment and for the people who grow and harvest it?
- **How can smallholder farmers get access to good quality seed** and what are the best seed varieties to grow in different areas?
- **How can we unpick supply chains** and create new business functions that allow traceability throughout the cotton supply chain from source to shop?
- **Choices about whether to choose organic or GM cultivation will become increasingly urgent as competition for land increases and land quality decreases.** Can we develop indicators to help us to determine the impacts of different cotton production systems on the environment - organic vs. 'better' vs. conventional - and to make direct comparisons between them?
- **There are cost issues associated with organic cotton** as it is more expensive than conventional cotton. What incentives would farmers need in order to grow it and how do these vary from one region to another?
- **Could we open questions of sustainability out to think about whether a commodity like cotton is sustainable more generally**, rather than just concentrating on cotton production?

## 10<sup>th</sup> March 2015: From local to global



### Aims

This month, our theme was 'From global to local' and we explored questions that focus on the impacts of changes in land use, climate change and the demand for resources at a range of scales.

### Witnesses

**Toby Gardner**, a Research Fellow at the Stockholm Environment Institute joined **Barbara Stocking**, the Principle of Murray Edwards College and **Tim Wheeler**, the Deputy Chief Scientific Adviser at the UK Department for International Development (DFID) and Professor of Crop Science at the University of Reading.

### Research gaps

All the witnesses agreed that despite the ever increasing influence of global dynamics, local dynamics matter and can have a profound influence on large-scale processes, yet they are often ignored.

In her introduction, Barbara first focused on Kate Rayworth's 'doughnut' economic model where every person has the resources they need to meet their human rights, while collectively living within the ecological means of our planet. Kate joined the Parallel Forum over Skype to discuss this model with them in more detail. Barbara then turned **to measures of growth and called for more research into finding alternatives to GDP** and argued that the poorest people will be affected the most by changes in climate so need to be our focus.

Toby's introduction drew on Chapin et al's three approaches to sustainability - managing risks, building resilience to change, and achieving transformation. He argued that **researchers should in mind the adage "think global act local"- the fact that we live in an increasingly interconnected world means that acting locally can influence global conditions whether or not we are "thinking globally"**. Using examples from his work in Brazil, he added that ricocheting effects across scales are overturning common assumptions – such as fast local dynamics shaped by slowly changing global drivers – and these need to be increasingly recognised and accounted for in our work.

In his introduction, identified a number of evidence gaps related to: **the utilisation of food, access to it and the stability of production and supply chains and how to scale this information and apply it to help people make decisions at a local level**. Turning to the next generation of research questions, he highlighted the need to bring together different types of data – social, biophysical and economic – when modelling the impacts of climate change on food security.

### Wicked problems and questions generated by the open discussion included:

- When talking about climate change or even sustainability, **how do we move from saying 'This is somebody's fault' to 'this is happening, how are we going to solve these issues?**
- Reducing consumption has been a recurring theme this year and Barbara added to this the concept of de-growth where those who currently consume a lot, consume less. Many discussions focus on specific actions that individuals can make, for example eating less meat and using less energy to heat our homes, but **how do we put principles like this into practice on a large enough scale to make a tangible difference?**
- **We only really touched on the role of power**, for example power relationships between different actors and the nexus of power and food in relation to consumption and enforcement. Toby argued that the models needed to disentangle power relationships are alien to those who model deforestation, for example, and visa-versa. How can we overcome these huge intellectual and methodological barriers?
- Does **building resilience to physical, economic and social shocks into societies** also imply some degree of greater insulation between countries (or sectors) within the global system?
- **How do you answer some of the big questions about food security** and encompass biophysical, economic and social behavioural aspects of it, without propagating all of the errors and uncertainties amongst each of those components?
- **Often scientists working at different scales have different ontologies or world views** i.e. solving global hunger vs. food sovereignty – how can we reconcile these views?

## 28<sup>th</sup> April: Looking into the future



### Aims

This month, we looked into a specific resource - wood - and the panel of witnesses explored how shifts in the way we use wood may change and by focusing on timber in buildings, we generated questions related to both forestry production and the kinds of materials that architects, designers and engineers will be looking for.

### Witnesses

**Peter Freer-Smith**, the Chief Scientist for Forest Research and Forestry Commission, joined **Jon Kirkpatrick**, the Head of Sustainability, Europe, for Lend Lease and **Michael Ramage**, a Senior Lecturer in who is leading a new Centre for Natural Materials Innovation in the Department of Architecture.

### Research gaps

Peter argued that **the UK has moved from a past focus on woodland creation to an agenda driven by climate change adaptation and protection from pests and pathogens, both couched in terms of resilience.** Climate adaptation work focuses on the silviculture of different species - the practice of controlling the establishment, growth, composition, health, and quality of forests to meet diverse needs and values – as well as the properties of the wood itself. He finished by stressing the need to value woodlands not only in terms of the resource they provide, but also in terms of their conservation, their landscape, recreational value, their forest protection, their soil protection, their water management qualities, even flood defence. If all of these are considered, the price may be a loss of production – is this one we are willing to pay?

Jon said that it is clear there are considerable sustainability and construction benefits to using timber. Although he agreed with Michael that **some of the barriers to using more natural building materials are technical, he stressed that there are also considerable challenges associated with people's perceptions** of whether they are a viable and competitive alternative to steel and concrete. In his experience, some of these are practical such as fire risk, strength or durability which in turn impact mortgages and insurance. Others relate to economics, changes to the design and construction of the building and the environmental impact of the materials. This catalysed a discussion related to how the 'true' costs and benefits of natural material could be explored throughout the supply chain from where it is grown to where it is used.

Michael's new Centre aims to develop new sustainable applications for plant-based natural building materials such as bamboo and cross-laminated timber. Ultimately, he wants to use these materials like this to create skyscrapers more than 10 storeys high. When thinking about what these buildings will look like, he argued that **a paradigm shift is needed in the way buildings are designed rather than simply applying steel and concrete-based design expertise.** The properties, strengths and weaknesses of these new plant-based materials will allow architects to experiment and create new structural forms.

### Wicked problems and questions generated by the open discussion included:

- **How can we measure the 'true' costs and benefits of using timber in construction**, including the impacts of material processing (such as glue), methane and carbon emissions during shipping and transportation? Even though the carbon emissions from shipping are low, would it be more sustainable to source it from as close as possible to the construction site rather than producing it in another country?
- According to FRA 2015, planted forests make up 7% of the total global forest area but provide 45% of industrial round wood consumption. Peter argued that **planted forests could supply the bulk of our wood requirements and protect remaining natural forests.** Given changing uses, is this feasible?
- **What tree species are needed to supply the timber for future buildings and where in the world will it come from?** The most productive trees are fast growing eg eucalyptus, but how many and which aspects of construction are they suitable for? We tend to think about supply chains like this in global terms but would reducing the use of timber for paper really increase the supply of suitable grade wood for construction? As these forests already exist, can we – or should we - increase the use of such timber by material innovations?
- **What are the barriers to using natural material in buildings and how can they be overcome?**
- **Could the land sparing/land sharing debate be extended to forests and forest ecosystems?**





## 12<sup>th</sup> May 2015: Through an East African lens



### Aims

Sub-Saharan Africa is a critical hotspot of hunger and under-nutrition, and also an area whose food security is expected to be impacted seriously by future climate change. At a pivotal moment for agriculture and food security in East Africa, this meeting picked up themes from previous Forum meetings to explore questions related to the food security and future of agriculture, livelihoods and biodiversity conservation in the region. This meeting was jointly hosted with the Global Food Security Initiative and the Cambridge-Africa Programme.

### Witnesses

**Liz Watson**, a Senior Lecturer in the Department of Geography joined **Tinashe Chiurugwi**, a Research Associate from the National Institute of Agricultural Botany (NIAB) and **Alison Mollon**, the Acting Head of the Africa and Madagascar Regional Programme at Fauna and Flora International.

### Research gaps

Liz argued that **the rush to provide new sustainability solutions often ignores the complex realities and needs of those on the ground as well as their values, capabilities and adaptability**. As a result, technological 'fixes' are often mal-adapted to the socioeconomic and cultural context, and the theory on paper looks very different to what actually takes place on the ground. For example, some argue that we need to increase crop yields in Africa through new technologies and investment in infrastructure. However, increasing resilience, reducing risk and providing a stable, if lower, crop yield may be more important to local farmers and it is these characteristics that can often be found in indigenous farming methods/crops. Moreover, the expected outcomes of a system redesign can fall short of expectations and can have unexpected and unintended negative consequences. She ended by saying that **indigenous communities are a valuable resource for food security and future research should both strengthen and support them**.

Tinashe agreed and argued that **there is a critical gap in understanding how to communicate solutions using existing institutions and communication systems**. His work focuses on applying NIAB's expertise and knowledge to an East African context and one of his greatest challenges is to provide mechanisms for farmers to access the information they need, including information about new seed varieties, which varieties best suit the conditions on their land, and sowing rates when using seed saved from the previous season. He argued that information services need to be developed to connect researchers with farmers and that this discussion needs to also involve actors further down the food value chain.

Alison argued that one of the main priorities for future research is to **explore the potential for landscape planning approaches to resolve tensions between food and energy production and biodiversity conservation**. This led her to ask: What are the most appropriate scales at which such planning should be undertaken? One key area within this is the food versus fuel issue, and in particular how to reduce the demand for charcoal – doing so would take an enormous pressure off biodiversity. Another is to develop greater understanding of how the changing physical interface and proximity between protected parks and inhabited areas affects the spread of zoonotic diseases and threats to human health.

### Wicked problems and questions generated by the open discussion included:

- **There are often disconnects between discourses around competing demands for land and potential solutions** – why are they so persistent, and what is the best way to build bridges between them?
- **Narratives, success stories and storylines can be as powerful as evidence** and are important in raising people's awareness of the value of natural resources. Focussing on genuine success stories in discussion and evaluation of progress was agreed to be an important part of catalysing change.
- **It is easy to hold conflicting ideas about the situations we are trying to intervene in without thinking about the bigger picture**. In agricultural development we are aware of the need for increasing productivity of existing systems while reducing the environmental impact and preserving the systems' future capacity. In reality however, we do not always stop to think about what this means in practice and the effect it has on the people who live in those production landscapes. There is therefore a danger that sustainable intensification becomes a roof under which different disjointed (and sometimes contradictory) projects /activities are housed without much conversation between them – how can these be connected together?