

18th 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 capita 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 researcher 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?

Witnesses

Bojana Bajželj	Doctoral Researcher, Low Carbon & Materials Processing group, Department of Engineering, University of Cambridge
Professor Ian Bateman	Professor of Environmental Sciences, School of Environmental Sciences, University of East Anglia
Professor Theresa Marteau	Director of the Behaviour and Health Research Unit, Institute of Public Health, University of Cambridge

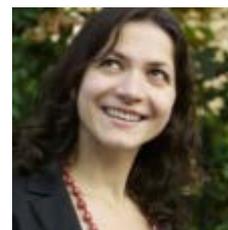
Biographies

Bojana Bajželj

Bojana is interested in the global food security, climate change and land use. Her research points to the importance of addressing food waste and sustainable diets from climate mitigation perspective. She is also contributing to the resource-nexus model called Foreseer, integrating a range of land-related topics: urbanisation, agricultural production, biodiversity and the role of land in global carbon and water cycle.

Before joining University of Cambridge, Bojana worked as environmental consultant. She holds an MSc in Environmental Technology from Imperial College London and a degree in Landscape Planning from University of Ljubljana.

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Professor Ian Bateman

While it is human economic activity which has resulted in the major global environmental problems facing present and (to a greater extent) future generations, it is clear that reform of that economic activity provides the only viable solution to such problems. Ian Bateman's interests lie in attempting to achieve this reform by bringing the environment into everyday decision making whether at the highest level, by informing government policy, or at the supermarket checkout by ensuring that prices reflect the true resource costs of production. Much of his research therefore seeks to value the true cost of pollution and the true worth of environmental improvements.

He is the Director of the Centre for Social and Economic Research on the Global Environment (CSERGE). Based at the University of East Anglia, CSERGE is a leading interdisciplinary research centre in the field of sustainable development and decision making. Recently completed research projects include: ChREAM (land use); AQUAMONEY (water quality); VERHI (impacts on child health).

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Professor Theresa Marteau

Professor Theresa Marteau is director of the Behaviour and Health Research Unit, the Department of Health funded policy research unit in behaviour and health.

She is also Professor of Health Psychology at King's College London and Director of the Centre for the Study of Incentives in Health (with the London School of Economics and Queen Mary, University of London) . She studied psychology at the London School of Economics and Political Science and the University of Oxford.

Her current research focus is upon developing ways of changing behaviour at population levels, drawing on neuroscience, behavioural economics as well as psychology.

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Setting the scene

Ian Bateman, Professor of Environmental Sciences at the University of East Anglia came to help us to think about how to bring the environment into everyday decision making, both at the highest level, by informing government policy, and at the supermarket checkout by ensuring that prices reflect the true resource costs of production.

His background paper was published in *Science* last year as part of the work underlying the UK National Ecosystem Assessment - also known as the UK NEA - and it shows the significance of land-use change not only for agricultural production but also for emissions and sequestration of greenhouse gases, open-access recreational visits, urban green space, and wild-species diversity.

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

He joined **Bojana Bajželj**, who leads the land use components of the BP FORSEER modelling project in the Department of Engineering. For her PhD, she has been exploring linkages between our diet, food security and climate change. Her paper was published in September this year in *Nature Climate Change* and using the BP FORSEER model, she and her co-authors suggest that healthier diets and reducing food waste are part of a combination of solutions needed to ensure food security and avoid dangerous climate change.

As a part of the wider *FORSEER* project, Bojana has been developing a model that maps out the connections between land, water and energy. By making certain assumptions regarding e.g. population growth, yield trajectory and the future food supply and demand, Bojana has been able to map out and calculate land use scenarios for 2050. The result is rather pessimistic as it indicates that future demand is substantially higher than future supply. As an expansion of agricultural land is undesirable due to further biodiversity loss and increased emissions, it is necessary to find an alternative.

Theresa Marteau, the Director of the Behaviour and Health Research Unit (the Department of Health funded policy research unit in behaviour and health), who is particularly interested in our diets, the choices consumers make and their health. She recommended we read a paper she published as part of a special issue in *Science* on disease prevention, and it focuses on how interventions that target automatic processes underlying behaviours such as overeating, smoking, excessive alcohol consumption, and physical inactivity could enhance global efforts to prevent disease.

Theresa focused her introduction on behaviour change around consumption, through a lens of reducing pressure on natural resources. Behaviour is driven largely by immediate gratification and our environment (true both of individuals and of policy makers). She stressed that the impact that people have on the environment (a direct consequence of their behaviour) is driven less by their values than by their personal affluence.

Background papers

Bojana Bajželj, Keith S. Richards, Julian M. Allwood, Pete Smith, John S. Dennis, Elizabeth Curmi & Christopher A. Gilligan (2014) Importance of food-demand management for climate mitigation *Nature Climate Change* 4, 924–929

Ian J. Bateman, Amii R. Harwood, Georgina M. Mace, Robert T. Watson, David J. Abson, Barnaby Andrews, Amy Binner, Andrew Crowe, Brett H. Day, Steve Dugdale, Carlo Fezzi, Jo Foden, David Hadley, Roy Haines-Young, Mark Hulme, Andreas Kontoleon, Andrew A. Lovett, Paul Munday, Unai Pascual, James Paterson, Antara Sen, Gavin Siriwardena, Daan van Soest and Mette Termansen (2013) Bringing ecosystem services into economic decision making: Land use in the UK, *Science*, 341: 45-50

Theresa M. Marteau, Gareth J. Hollands and Paul C. Fletcher (2012) Changing Human Behavior to Prevent Disease: The Importance of Targeting Automatic Processes (2012) *Science* 337, 1492

- One complication which often isn't taken into account is how people's affluence will change their behaviour and in turn, how that will change diets and land use
- While accepting that research is needed into the supply side – the role of land management, GM, agritech and precision agriculture – more research is needed into the demand side and the role that spatial and temporal variation in economic drivers and their impacts will play

2) The impacts of the choices we make on the environment

- There are many fundamental natural science questions about impacts still to be answered
- Many of these impacts are interrelated and non-linear – climate change, ecology
- A lot of research concentrates on adaptation but not enough on the dynamics of adaptation and the secondary effects those will have. For example, how people will respond to the changes in climate and how those will change land use and water availability

3) Trying to make better decisions based on what we know about demand, supply & impacts

- a) Develop truly integrated models which combine natural sciences, economics and policy and include both temporal and spatial dimensions of changes in natural capita
- b) Model multiple impacts of change and how we use land
- c) None of these models will ever be perfect but at the moment, different facets of this area are still very much in silos
- d) 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
- e) What are the impacts of alternative land use strategies & land be used in a more intelligent way?

Theresa Marteau: There are, broadly, two options for changing behaviour:

Providing information to change peoples' minds (e.g. poster campaigns):

- This has driven public health policy for last 60 years.
- Generally not that effective (although some evidence that providing information can change attitudes, which can then make people more susceptible to other influences).

Changing the environment to make something less easy or more immediately rewarding

Reducing food waste (could find no academic review of interventions):

- Change environment and associations, for example decrease portion size, change packaging and alternative pricing (sell less for less money)
- Provide information, such as labelling (e.g. Love Food Hate Waste)

Reducing meat consumption (note parallels with alcohol and tobacco):

- Change environment and associations
 - Decrease availability (e.g. why do we subsidise its farming)
 - Modify associations (e.g. McDonalds in hospitals has been shown to influence perceptions of how unhealthy it is)
 - Increase price
- Provide information
 - E.g. health or environmental campaigns on damage caused by beef industry

BUT. Although interventions have potential to modify behaviour, these options are constrained by the political and economic space that is available (e.g. how to ask companies to sell less).

Key points emerging from the discussion in the Original Forum and the Parallel Forum

The key themes emerging from both discussions included:

- 1) Integrating ecosystem services
- 2) Reducing waste
- 3) The role of agricultural production
- 4) Modelling and scenarios

- 5) Changing the behaviour of consumers
- 6) The impacts of the choices we make
- 7) Quantifying and communicating risk and uncertainty
- 8) Questions of scale
- 9) Making connections between research, businesses and policy makers
- 10) The next generation of research questions

Questions included:

At the moment, we are not rewarding other uses of land in the same way as land used for agriculture - how should we address this?

How do we mainstream-ise Payments for Ecosystem services so that market forces are more aligned with what would be the 'optimal use of land' for society?

How can we reduce agricultural waste? What strategies are appropriate for various parts of the world where the waste might occur at different stages of the production-consumption chain?

Can sustainable intensification close the yield gap? Which practices are most effective?

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

How will the land use scenarios change under the uncertainty of climate change? With increased groundwater depletion? With improved technology?

What are the impacts of alternative land use strategies and how land be used in a more intelligent way?

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

Developing truly integrated models that combine natural sciences, economics and policy and include both temporal and spatial dimensions of changes in natural capita

Much research concentrates on adaptation but not enough on the dynamics of adaptation and the secondary effects those will have.

How will people's affluence change their behaviour? In turn, how will that change diets and land use?

Integrating ecosystem services

- At the moment, we are not rewarding other uses of land in the same way as land used for agriculture, how should we address this?
- The definition of "ecosystem services" is often framed from a biological perspective but could be expanded to include geological and hydrological services as well
- How do we mainstream-ise Payment for Ecosystem services, so that all beneficial land-uses are rewarded relative to the services they provide: not only food production, but also recreation, continuous carbon storage, carbon sequestration and biodiversity protection; so that market forces are more aligned with what would be the 'optimal use of land' to the society?
- Ecosystem services, both the definition and integrating together biodiversity, water and physical attributes such as soil

Reducing waste

- How can we reduce agricultural waste? And what strategies are appropriate for various parts of the world where the waste might occur at different stages of the production-consumption chain?
- Exploring interventions to reduce food waste (Theresa could find no academic review of this):
- Change environment and associations
- Decrease portion size, change packaging and alternative pricing (sell less for less money)
- Provide information
- Labelling (e.g. Love Food Hate Waste)
- Waste in developing countries, such as lack of storage facilities, and the need for more efficient storage

The role of agricultural production

- Can sustainable intensification close the yield gap? Which practices are most effective?

- What are the impacts of alternative land use strategies and how can we use land in a more intelligent way?
- Linking together the energy costs of farming and biodiversity
- The process of making fertilisers – trade-offs, inefficient farming, matrix of sustainability
- Farming and landscapes
- Improve the output of production – connected to the benefits
- Crop management
- Exploring the potential for cities to produce food

Modelling and scenarios

- How will the land use scenarios change under the uncertainty of climate change? With increased groundwater depletion? With improved technology?
- Develop truly integrated models which combine natural sciences, economics and policy and include both temporal and spatial dimensions of changes in natural capital
- Model multiple impacts of change and how we do and will need to use land in the future
- None of these models will ever be perfect but at the moment, different facets of this area are still very much in silos so overcoming these silos will be increasingly important
- A model that has a bigger vision is worth doing, even if it isn't perfect
- There is merit in a baseline set of principles/parameters for each type of model so they can be compared
- There are absolutes, not everything in a model is dependent of the perspective of the modeller or a particular political agenda
- The publicity surrounding Bojana's paper picked up on the idea that they were advocating reducing population size (when they weren't of course) indicates that it is the context/value of the reader not the modellers that causes variability in the models
- The issue of how to model multiple outputs from land areas (both private and public goods)
- Whether a capacity to model at smaller spatial scales has implications for the level of which we can make (social) decisions.
- Models and research (not just around sustainability) are based on many assumptions and simplifications. How can we properly account for variability or at the very least work to a common set of 'sustainability assumptions'?
- One thing that really stuck with me from last week was the discussion around the usefulness of modelling and how people use the information that is produced by models to support a certain narrative. As with Bojana's experience - the results can be used to support unexpected narratives/views.
- Cautious about believing the results of models too much and the way in which both them and the evidence by interest groups can be politicised
- How to translate abstract modelling into policy
- 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

Changing the behaviour of consumers

- Behaviour is driven largely by immediate gratification and our environment (true both of individuals and of policy makers). Your environmental impact (a direct consequence of your behaviour) is driven less by your values than by your personal affluence.
- How will people's affluence will change their behaviour? In turn, how that will change diets and land use?
- Although interventions have potential to modify behaviour, these options are constrained by the political and economic space that is available (e.g. how to ask companies to sell less)
- Changing eating habits from the predicted increase in meat to a more plant-based diet will be very important for reducing impact on land and the environment
- Although we can see the impact of red meat, it isn't yet clear that there is a viable alternative to it
- Knowing the limits on our understanding of how we make consumption decisions and how they are influenced

The impacts of the choices we make

- While accepting that research is needed into the supply side – the role of land management, GM, agritech and precision agriculture – more research is needed into the demand side and the role that spatial and temporal variation in economic drivers and their impacts will play
- Many of these impacts are interrelated and non-linear – climate change, ecology

- A lot of research concentrates on adaptation but not enough on the dynamics of adaptation and the secondary effects those will have. For example, how will people respond to the changes in climate and how will those responses change land use and water availability?
- As the link between healthy diets, sustainable diets and meat moderation becomes clearer and robust, how do we bring about institutional changes (in schools, universities, hospitals, via public spending ...), that will make the healthy, sustainable food choice the most convenient and 'automatic', given that most choices we make in life are not influenced by knowledge and values, but the behavioural environment and instant gratification?
- How do we identify potential 'losers' of the transition to healthy, sustainable diets (livestock farmers, retail, food industry) and identify potential compensations to them (e.g. jobs in land-stewardship), so that they do not feel threatened and oppose the transition?
- Who are the winners and losers in particular interventions, for example the effects of displacing agricultural production in one country to protect biodiversity?

Quantifying and communicating risk and uncertainty

- How can the issue of uncertainty in science be addressed to help policymakers act on import issues such as climate change?
- Quantifying and communicating uncertainty

Questions of scale

- At what spatial and temporal scale is sustainability investigated?
- Given that sustainability implies long-term, is this defined and does everyone design/plan/research using the same scales in time and space? I feel there's a lot of variability in its application - site/local/national/international, now/next year/50 years/70 years. If you take the example of designing buildings, the sustainability of them is probably considered over the life cycle of the building (~ 50 years), but what about beyond?
- As a starting point, view connections between global and local, for example in food security

Making connections between research, businesses and policy makers

- Policy implementation – how to make research work within the constraints of time, finances etc
- I thought the recognition that researchers could work on developing solutions for businesses was a novel one. We often assume that businesses are going to innovate and that it is businesses that are progressive and cutting edge, perhaps with regards to sustainability businesses are actually conservative and not inclined to try out new things if the old things seems to be working for them. What role then do academics have in innovating for business? And gathering evidence for business to show that there are alternatives to the way in which they are currently operating?
- Who are we trying to influence and what are the 'levers' which will change behaviour or move towards more sustainable choices?

The next generation of research questions

- Be interdisciplinary and connect disciplines together, both within one field and also very different areas, such as natural, physical and social sciences
- Find ways to represent and quantify cross-disciplinary roles and how to integrate different disciplines together
- Recognise the need to be more multidisciplinary/cross-disciplinary at answering questions and for breadth as well as depth in research (where currently depth seems much more valued in academia). Although interestingly, someone made the point that the job market in academia is so competitive that people can find their career moves through different disciplines as they take the jobs where they are offered (they themselves had experienced that).
- Think about how to achieve inter-disciplinarity, going beyond ticking the boxes to do actual research
- Strike a balance between breadth and depth
- Link together policy making and human behaviour
- Think about scaling, from a global scale to a local level
- Explore cross-cultural differences, particularly in relation to people's behaviour, and highlight differences between countries as well as giving a global perspective

Full references

Bajzelj, B., Richards, K. S., Allwood, J. M., Smith, P., Dennis, J. S., Curmi, E. & Gilligan, C. A. 2014. Importance of food-demand management for climate mitigation. *Nature Clim. Change*, **4**, 924-929.

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