



Aims

The aim of our topic this year is to draw connections between food security, biodiversity and bioenergy and to use the meetings to think about the research pathways that will help us to prepare for and address the challenges we will face in the future.

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

Agenda

All the witnesses will give a 10 minute introduction and their perspective on the two core questions followed a general discussion:

- 5:00pm Welcome by the Chair and an introduction to the topic
Each witness gives a short introduction and thoughts about the questions (10 mins)
Questions and beginning the open discussion
- 6:00pm Coffee break
Continue the discussion in three groups and then come together for final thoughts
- 7:15pm Reception and dinner, which will include a working session

Witnesses

This month, the two witnesses are:

Dr Toby Gardner	Research Fellow at the Stockholm Environment Institute, Sweden
Dame Barbara Stocking	President of Murray Edwards College, University of Cambridge
Professor Tim Wheeler	Deputy Chief Scientific Adviser at the Department for International Development and Professor of Crop Science at the University of Reading

Questions

The witnesses have all been asked two core questions:

- 1) What do you perceive as being the main gaps in our knowledge?
- 2) What would you include in the 'next generation' of research questions?

Each of these questions will be posed to everyone and their answers will then be used as a springboard for further discussion. The main points raised will then sent to everyone to use as a starting point for the next meeting.

Witness profiles

Dr Toby Gardner

Research Fellow at the Stockholm Environment Institute, Sweden

Toby Gardner joined the Stockholm Environment Institute in January 2014 as a Research Fellow funded by the Swedish Research Council, Formas. His primary focus is on transitions towards more sustainable land-use systems in Brazil.



Toby has over 10 years' experience in science and science-policy issues in human-modified landscapes across the tropics, with a strong emphasis on the management and conservation of biodiversity and ecosystem services in multiple-use agriculture-forestry landscapes, and the challenges of balancing environmental concerns and rural development priorities.

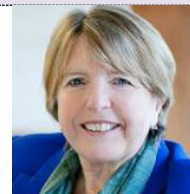
Before joining the Institute Toby was a research fellow at the University of Cambridge for five years, and helped found and coordinate the Sustainable Amazon Network. He is an affiliated researcher at the Goeldi Museum in Belém (Pará) and the International Institute for Sustainability (Rio de Janeiro). He has previously led research projects in Belize, Tanzania, and in Caribbean coral reef ecosystems.

He has authored more than 80 peer-reviewed publications, including a reference book on the monitoring and management of biodiversity in forest ecosystems (Earthscan, 2010). In 2012 he was awarded the biannual British Ecological Society's Founders' Prize for significant contributions to the science of ecology.

Dame Barbara Stocking

President of Murray Edwards College, University of Cambridge

Dame Barbara Stocking became the 5th President of Murray Edwards College, founded as New Hall, in July 2014.



Prior to taking up her post at Murray Edwards College, Barbara was Chief Executive of Oxfam GB from May 2001 until February 2013. During this time she led major humanitarian responses including the Horn of Africa and the West Africa food crises, as well as the Haiti earthquake, Pakistan floods, and Tsunami. On campaigning, Barbara led Oxfam's work on Make Poverty History, and more recently their work on climate change and the current Grow campaign on food justice in a resource constrained world. Barbara regularly spoke at major global meetings; for example at the UN, in New York and Rome, and at the World Economic Forum in Davos.

Previously a member of the top management team of the National Health Service, in her eight years with the NHS Barbara worked as regional director for the South East of England, and then as the founding Director of the NHS Modernisation Agency. Barbara has a Masters degree in physiology, and has broad experience of healthcare systems, policy and practice, including periods at the National Academy of Sciences in the USA and with the World Health Organisation in West Africa. She was awarded a CBE for health services in 2000 and a DBE for humanitarian services in 2008, and was elected an Honorary Fellow of Murray Edwards College in 2010.

Professor Tim Wheeler

Deputy Chief Scientific Adviser at the Department for International Development and Professor of Crop Science at the University of Reading

Tim Wheeler is Deputy Chief Scientific Adviser at the DFID and he is on secondment from the University of Reading. At DFID, Tim provides science advice to Ministers and oversees the research portfolio of the Research and Evidence Division. He has extensive experience of working with policy-makers in the UK and internationally and was Specialist Adviser to the House of Lords in 2010.



Tim has published more than 170 scientific papers over the last 20 years on how climate change could impact on the sustainability of agriculture and food, undertaking research in Bolivia, Honduras, The Gambia, Uganda, China, India and elsewhere. His research group identified how temperature extremes reduce annual crop yields under climate change, developed novel ways of modelling climate change impacts on crops at a global scale and produced the first crop model to be coded within a global climate model to allow the study of land-surface-climate interactions over croplands.

He has provided advice on the sustainability of food and farming to agri-businesses and food multi-nationals, often up to Board level. In 2005 he delivered a Royal Society Public Lecture titled 'Growing Crops in changing climate' and co-authored a Royal Society Statement on Climate Change and Agriculture tabled at the G8 Summit in Gleneagles.

Transcript

Duration: 1:24:06

Martin Rees (MR)

Ian Hodge (IH)

Kristen MacAskill (KM)

Therese Rudebeck (TR)

Nicky Bartlett (NB)

Helen Curry (HC)

Gemma Cranston (GC)

Lara Allen (LA)

Liz Curmi (LC)

Nigel Leader-Williams (NL-W)

Liz Watson (LW)

Barbara Stocking (BS)

Toby Gardner (TG)

Tim Wheeler (TW)

Camilla d'Angelo (CD)

Charlie Kennel (CK)

Howard Griffiths (HG)

Alison Smith (AS)

Bhaskar Vira (BV)

Peter Guthrie (PG)

Hildegard Diemberger (HD)

Rosamunde Almond (RA)

Main Meeting

MR:	Welcome everyone and welcome in particular to our three speakers: Barbara Stocking, Toby Gardner and Tim Wheeler and an apology in particular from Paul Linden our Director, he's at an examiner's meeting and he hopes to turn up in time for dinner. Let's hope he manages that, but he sends his apologies and we hope to see him later. What we normally do is we go around the table very quickly with introductions. I think we should do that because we have a floating population so let's go round, but very quickly just one sentence each before we start.
IH:	I'm Ian Hodge from the Department of Land Economy and I'm a rural institutional economist.
KM:	Kristen MacAskill from the Department of Engineering and the Centre for Sustainable Development. I'm a civil engineer looking at post-disaster recovery.
TR:	I'm Therese Rudebeck and I'm a PhD student in Geography looking at global water governance.
NB:	Nicky Bartlett from the Cambridge Institute for Sustainability Leadership and I work with companies on climate change issues.
HC:	I'm Helen Curry from the Department of History and Philosophy of Science. I'm a historian of agriculture and conservation and the life sciences in general.
GC:	Gemma Cranston, I'm from the Cambridge Institute for Sustainability Leadership as well but I work with business on natural capital.
LA:	I'm Lara Allen from the Humanitarian Centre and we are interested in development and the environment [inaudible 0:01:41].
LC:	I'm Liz Curmi, I work in the Department of Engineering on water, food and energy access.
NL-W:	I'm Nigel Leader-Williams in the Department of Geography and I run the Masters in conservation leadership.
LW:	I'm Liz Watson from the Department of Geography. I work on people/environment relations.



BS:	Barbara Stocking, Murray Edwards College, previously Oxfam which is where I'm sort of speaking lately from as it were.
TG:	Toby Gardner, Stockholm Environment Institute, formerly Department of Zoology here in Cambridge. I work mostly on land use and science policy relationships around that.
TW:	Good evening everyone. My name is Tim Wheeler, I'm a crop scientist from the University of Reading and also Deputy Chief Scientific Adviser at DFID.
CD:	I'm Camilla d'Angelo, I'm from the Department of Psychology.
CK:	Charlie Kennel, I'm visiting the Centre for Science and Policy at Christ's College from the Scripps Institution of Oceanography. I'm interested in climate change.
HG:	Howard Griffiths, Department of Plant Sciences and Co-chair of the Strategic Initiative in Global Food Security for the University here.
AS:	I'm Alison Smith also from Plant Sciences. I'm interested in algal biotechnology and I represent the Energy Forum at Cambridge.
BV:	I'm Bhaskar Vira from the Department of Geography. I work on political economy and environmental development. I'm also the Director of the Conservation Research Institute.
PG:	I'm Peter Guthrie from the Department of Engineering in the Centre for Sustainable Development there.
HD:	I'm Hildegard Diemberger, the Director of the Mongolia and Inner Asia Studies Unit, so I'm interested in climate change in all possible dimensions.
RA:	Hi, I'm Roz Almond, I'm originally a conservation biologist and I'm based with Paul in Mathematics.
MR:	And Roz does all the work as probably everyone realises if you've been here before.
RA:	E-mails everybody.
MR:	And sends out lots of documents. Well the format for those who haven't been before is we're going to hear from our three distinguished guests and then there'll be discussion and we'll have a tea break and we'll have that at about 6.15pm and then at 6.30pm we reconvene in subgroups. Sadly Barbara has to leave about then we'll reconvene in two subgroups, one around each of the other two remaining speakers, Toby and Tim.
	So let's go straight on unless you have something you want to say Roz?
RA:	No, I don't think so.
MR:	I talked beforehand with the three guests about the order and it was thought that Barbara would like to start off. So thank you very much.
BS:	My time I'm just going to spend in three parts. One is the issue about natural resources and the extent in a way to which poor people have access to them; the second one is something about food security, although I'm going to leave quite a lot of that to Tim I think and then the third one is climate change and its impacts on poor people. So you will see that...you wouldn't be surprised about this coming from Oxfam but what I know about is poor people and how these things affect poor people and that's really what I'm going to be talking about.
	So I want to talk...if you can just see this, this is a doughnut and I want to talk about living within the doughnut first of all. Now this isn't my concept, it's a woman called Kate Raworth's concept so I want to give proper recognition to this. But what this says is that actually there are boundaries to our world and the natural resources that there are that we can live and the boundaries which we cannot break, or at least we do it at our peril. Of course there are a number of those but there are a couple that already we are really putting far on in and of course one is CO2 emissions and the other one is actually the



	<p>nitrogen cycle, and there are others which are...you know, they are getting redder, they are getting nearer the edge that we are breaching. Then you can argue about what the exact numbers are, parts per million of CO2 or anything, but undoubtedly at some point there are boundaries to which this planet can work.</p>
	<p>Now that's all of us needing to live within the natural resource environment of this planet. The other bit for people like me is that actually there are a whole load of people who never even get to square one if you like. If you think about water needs or food or whatever there's a lot of poor people who are not even reaching the absolute base boundary. So what you've got is a world in which some people are not even at base level but there are other people who have actually been the cause of the breach that is taking place in our natural resources. In the end what we want is everybody living within the doughnut which means that poor people have got to have the ability to use up some of those resources to move into this, the comfortable zone, but equally all those of us who already live in this have got to find ways if you like to bend our trajectories back round and into that doughnut, which is sustainable for all of us to live within that world. Now to me that's a wonderful model of what we're actually trying to do. Easier said than done but at least that's something about where we're going.</p>
	<p>Now the only other sort of bits of points I'd make about that are of course as well as technical solutions, sort of what can you do for low carbon growth for poor people etc and how do you make it relevant to poor people by thinking about what resources they have like solar, wind and all those other sorts of things. The other question in all this is well, what is driving all this and then that starts to be a whole set of questions about measurement and what measurements matter in the world. Because as you know at the moment the only thing sort of matters for all of us to feeling like we're in the right place and things are working out are GDP measures. And yet they are measures of an economy which is all about growth and it does raise some questions about can you continue on doing the GDP measure of what we want at the same time as actually producing it all in a low carbon way. I'm not going to pretend to be an expert in this and I'm not going to go on about it but I think it's about a whole challenge of the questions that need to be asked about what it is that we are aiming for? What is the economy doing to us? The economy, the GDP measures are driving us to more and more growth but the question is is that very healthy or happy for us given some of the things we know about...you know, all the work that has been done on the spirit level about what sorts of income make people happy or don't make people happy, lots of big questions about that. But if we're looking about what are the research questions, the research thinking, there is a big set of questions about this model that we have to live within and can we start thinking of other ways to measure the drives on our economies and therefore on our natural resources to bring them into line so that... You know, speaking from where I come from actually poor people can have the natural resources that they need.</p>
	<p>Now that's just a rather general thing but I think it's quite important in these discussions to be thinking about the bigger picture. The more particular picture obviously that I was working on a lot was particularly the issues, things around food security and interestingly on that base model at the moment the what 870 million people who don't have enough calories, I think it would only take 1% more of the world's production to actually get... [inaudible 0:09:21] of that extra bit and gave all that to the poor people it would only be 1% of the growth in productivity across the world's production in food. So these are not necessarily big measures and as you know the big issue with food is not so much that we don't have enough of it now, but it is actually who gets it and the distribution of that and the fact that poor people don't get it. Okay, so you say that's fine and we'll all keep trying to help poor people, we'll try and increase productivity, we'll give them agricultural extension workers and we'll look at irrigation systems that work for poor people and the many things...we'll help them organise inter-cooperatives and produce organisations so that they can actually sell their produce well when they've got it. You can do all of that and help poor people actually increase their food security but if we now move to a climate</p>

change world then of course the question is what happens then and given the increase in population, you know the 9 million at 2050, plus there are many things about the way we are living, you know more middle-class people eating more meat and all the rest of it, plus climate change, then you're starting to talk about really significant issues about the amount of food that you're going to need to produce come 2050. Again for people like us that might not matter so much because it means that food prices will go up quite a lot but we will probably find a way to do that. That is not the same for poor people who are already spending 70%, 75% of their income on food and certainly they can never deal with food price spikes. You know if you double food prices because you've got shortages somewhere they can't do that, they can possibly manage slight prices over time but you just can't do that with poor people.

So I'll leave a lot of this for Tim to say but there are real questions now about food security, not really for poor people but for all of us in this climate change world and how this system is going to work. Some of the things that particularly affect poor people though, the particular one I'd like to mention because it fits in with the natural resources, are things like land and water and in a sense they are almost sort of interchangeable. Because actually what land means is that in terms of production that is coming through natural rainwater then you're actually...what you're catching on that land is actually your water. And what we're seeing of course because of these concerns about food security is that in effect there is a run on land. There is a run on land because people are buying it in the developing world, particularly in Africa because actually it's quite a good investment and you might want to buy some in Nepal or get some, acquire some somehow and actually just leave it. It's worth it, the prices are going up so much. You can do it and you can be producing your own food. For instance all the food that is being grown now and shipped to places like Saudi Arabia and China and what is that? You are actually in effect transporting water around the world, that's what you're doing. Saudi Arabia has no water falling on it, Africa does, you grow the food there to ship the food back to Saudi Arabia.

So you've got that system going on and you've got it as many of you know in countries where actually the land rights, the land ownership and so on, all of those things, systems are very weak and in fact many of the people who are taking the land are doing it without first of all any agreement from the people who are on that land and certainly no compensation and that is causing major, major problems. I've seen it particularly myself, well Africa in particular where we had a major campaign in Uganda where a British firm actually pushed 22,000 people...two villages, two areas...off their land and gave them no compensation whatsoever and similarly there have been terrible scenes in Cambodia and the government actually finally came out and said it was not going to actually allow companies to buy up large tracts of land. So in the natural resources end land is a very big issue for poor people.

But the final bit I just want to mention is the whole issue about climate change and poor people because this is all completely interrelated and poor people are affected I think at two levels in climate change: the ongoing day-to-day level is actually the changes in the seasons, the number of times I went to developing countries and some people would say to me 'We don't know what's happening, the seasons have changed', that's the words they used, farmers would use that all the time. And that's an enormous problem for them, they don't know when the rains are coming so they plant and they lose the seeds, everything is all higgledy-piggledy basically, there is no pattern any more to what's happening with the weather and that is enormously difficult for people who have no resources to replay the thing that they've just lost really. So you've got that problem of ongoing day-to-day needs in adaptation to climate change but then of course in terms of, you know, well Oxfam's humanitarian work, the biggest part of all was the extreme weather events which have more than doubled now since 1990 and that is horrific really. Because of course the extreme weather events...what makes a disaster? It's the event, if you like, times the vulnerability. So we have events in this country, we've had some extreme weather events but the disasters realistically have not been huge, even those



	<p>floods in Somerset, but if you put that together with the vulnerability of poor people on the coast or with flimsy houses and all the rest of it you really get hit. I think the time it really hit me the most was actually in 2010 when I happened to be in Pakistan just as the monsoon rain started and I would never have thought the few days that I was there then that it would end up with 14 million people being affected in the Pakistan monsoon floods. At that point you almost throw up your hands. Basically Oxfam could manage to do about one and a half million people, you know, the water, sanitation, public health in that circumstance, the global capacity is about three and a half million across the UN and so on. That's three and a half out of 14 million, these things are just affecting in absolute scale now that is making a response to a humanitarian crisis extremely difficult and of course this is likely to go on and keep increasing.</p>
	<p>So I don't want to leave you depressed, just all it says to me is it's climate changing here guys, you know, we had the discussions of the Conference of Parties in Paris and we're sitting in the University and we'd better get all these University students out there campaigning and doing something about it because it's in every...well not just here obviously, right across the world. But for me, I suspect climate change will be dealt with ultimately but for me the issue is how many poor people have got to suffer before we actually do something about it.</p>
	<p>So thank you.</p>
MR:	<p>Any specific questions for Barbara?</p>
AS:	<p>Could I ask something? We were actually talking about this a bit and being picky about the forum generally and just really interesting your description, it's so vivid about the two things that poor people have to deal with. One of the points made - I'm sorry, I don't remember who it was, so you can shout at me if I get it wrong - is that the trouble is with climate change it's always about is it anthropogenic or is it natural and so on, so there's a sort of blame culture and really we should move on from that and say 'How are we going to deal with it?' not how did it get there in the first place. How do you think that should play out, how can you move forward from saying 'This is somebody's fault' to 'This is happening, how are we going to solve the issues?'</p>
BS:	<p>Yeah. Well I think...and a part of that is you can only move on from the fault if actually you recognise that poor people are going to have to use up more of the CO2 before they can get what they need and that's what they're mostly worried about in the negotiations. 'Are you telling us we can't have any growth even though you've got all of what you had?' Now if you can find a way to say 'No, we are going to do some things and that will allow you to accommodate and get at least somewhat nearer to where we are', then you've got some chance of not blaming but getting over it and getting on. But if you're not prepared to do that then I can't see how...you know, why wouldn't they blame us for this? I think we would blame them for it so you've got to find the solutions for those countries I think is what I'm saying and the solutions are allowing them some growth, but also actually dealing with the adaptation costs that are needed just to cope with all this. So you've got to show willing on those I think if you're going to get any deals in the end.</p>
AS:	<p>So just to follow up the...I think you said that growth, is growth a good thing. Are there any other ways that you can envisage that poor people can move out of the middle of the doughnut that doesn't involve growth?</p>
BS:	<p>Probably not, but then I would love it if all sorts of people debated that who are far more economically minded and knowledgeable than me, put it like that.</p>
AS:	<p>So maybe there needs to be two different terms, one is the growth of the people from the middle out and the other is the people who are already in the doughnut.</p>
BS:	<p>Yeah. And of course all of this...I mean the other way to help is of course...and I don't want to overstate technology because I don't think it solves all our problems but it can help, you know, and particularly if you can get poor people to get the sorts of things that</p>



	will allow them low carbon growth, that's got to be a good thing as well.
MR:	We have just two more questions and [inaudible 0:19:08].
HG:	It was a reaction to that in the sense that we presumably we want the people in the doughnut to have growth, we want the people on the outside to have de-growth and we haven't had much of a debate about de-growth and I'm not even sure I quite know what it is, I'm not sure de-growth is the right word, maybe a-growth.
MR:	Or a de-consumption.
HG:	Well maybe, yes, so we've got less physical material consumption of some sort and I think what's really depressing about that, just in case we aren't depressed enough, is the way in which the government at the moment is so manically pursuing growth against everything and it seems whereas we should be thinking almost the opposite.
CK:	I'd like to ask a question if I might about the relationship between the inside and the outside of the doughnut. My colleague [inaudible 0:19:54], who is deeply concerned with the fate of the bottom one third of this world, has argued that they should be allowed additional access, accelerated access to energy resources in order for them to get to the inside edge of the doughnut if you will. A question I have is you could probably calculate how much carbon they could be allowed to bring them to the edge of the doughnut in terms of a middle-class existence and from there recalculate, as you suggest, the rate of de-consumption or the targets for mitigation that are placed on the top one billion. Has that computation been done?
BS:	Not that I know, but I doubt it to be honest. I think that's very good and I don't know that it has certainly.
HG:	I think only in aggregate.
BS:	Yeah, yeah. I mean the interesting thing for me [inaudible 0:20:48], you know Nick Stern and all his work on all of this, and I don't know, even since the time I left Oxfam I was talking to him and his argument now is actually in future nobody is going to be able to have any carbon except in agriculture. That's everything else...it's got to be no carbon, you've got to have a no carbon economy except for agriculture, that's the only way to survive. That says it fairly severely actually, I mean I'm sure you can argue that there's...you know, look at all the elements but it feels like that's the sort of thing we've got to face up to really if we're going to get out of this.
BV:	One brief comment on that. In this idea of contracting [inaudible 0:21:29] which is sort of what we're talking about here, is also this internal difference between consumption patterns within countries. So I think one of the difficulties when the debate is couched in international negotiation terms is that countries in aggregate which have a huge amount of inequality within themselves actually hide behind that inequality. So there's a great Greenpeace support from 10 years ago which is hiding behind the poor in terms of India's consumption and the richest classes in India can do four and a half times the amount in terms of their carbon footprint compared to the poorest classes. When India negotiates internationally in the global treaties it's negotiating on the average and the average is significantly pulled down by the fact that you've got 250 million poor people who are actually not consuming at all and then the consumption patterns of the richest Indian are at the same level as Europeans. So that inequality actually hides this average consumption discussion. So actually when we're focusing on the consumption patterns of the poor we need to disaggregate from the country because that's the wrong unit of analysis.
BS:	I agree with you. The real problem is that is the unit of analysis that does the negotiations.
BV:	Yeah, and the poorest Europeans are consuming less than the richest Indians.
MR:	Okay, let's go on to Tim Wheeler who straddles academia at Reading and government in



	DECC.
TW:	Great, thank you Martin and thanks very much for the invitation to come here tonight hot from Whitehall literally.
	I want to talk a little bit about the impacts of climate change on global food security which is in my academic career something I've worked on for about 25 years since the publication of the first IPCC report drew our attention to what was then quite a shaky evidence base on whether or not our changes in climate were due to human influences. And according to Roz's instructions concentrate on gaps in knowledge and then a little bit on where the next generation of questions are coming from. And of course like all academics having set those two questions I thought I'd throw my own in just to balance them up. So I would start by perhaps asking in terms of evidence gaps who is looking for the gap and I give you one answer, one from my academic career and one from my government career and then I'll get to the two questions as set.
	So I think in terms of a researcher looking for evidence gaps essentially you're looking for the gaps in past knowledge. They may be either methodological or they may either be through hypothesis setting and interpretation of data, but you are primarily seeking new knowledge and that's where I've spent most of my career in that situation.
	In government though you work from a slightly different perspective. You start with in terms of working in a developing organisation such as DFID, what is the development challenge that I'm trying to either solve or make progress on? What is the knowledge that I need to make progress, either through technology or improving the ways of working or through improving knowledge more generally and then what evidence do I need to do it? So you sort of come to the evidence gap from a slightly perverse way but nevertheless focus very much on the problem you're trying to solve rather than through generating evidence or new knowledge. In doing so you quite often get stuck, or at least I seemed to over the last six years or so, quite often get stuck because you're confronted with this phrase 'Well there isn't enough evidence' or 'The evidence base is too thin', and then I sort of ponder and think 'Well is the evidence base too thin or is it that we don't know it?' I don't mind if you go away and think about it for a while but I need to have a little bit of confidence in that statement that actually we don't know how to do X, Y and Z. So a question I just throw out for discussion is how do you evidence an evidence gap? I have some suggestions but I'm going to leave it there at the moment.
	So I will go confidently on and talk about evidence gaps from that point. The paper I'm going to talk to quite fortuitously we published in Science in 2013 actually looked at the evidence gaps in climate change impacts on global food security, so I sort of felt that that was either good preparation for tonight or just that we were thinking along the same lines. But let me take you through some of the arguments. So this paper concluded as headline conclusion that climate change could potentially interrupt progress towards a world without hunger. A statement that I think would be hard to disagree with but taking a broad view over the topic I think we can say that quite confidently and I think Barbara has picked up some of those points. But then it sort of dived down into the components of food security and food insecurity and split it into its usual components that the FAO definition from some time ago set up and everyone generally follows which is that you can think of food security as the availability of food, access to food, utilisation or nutritional utilisation of food and the stability of food systems either at an aggregate level or an individual or a household level.
	So what do we know so far? Well when you take a broad sweep over it we actually know a lot about the availability part of that food security definition and going back to the very first attempt to do a projection of what the availability of food would look like under climate change in the year 2050, that was 20 years ago, the message hasn't really changed. If you stack up those graphs, well one you see a massive increase in resolution, as your methods get better the data gets better, the computing power gets better and the visualisation gets better. So you go from having this murky picture of the globe with some



	<p>red and some green and some brown areas to this very sharp image that you get nowadays. But the pattern hasn't changed. The methods have changed, different ways of approaching the question have changed but the pattern hasn't changed. There is this difference in the impact of climate change on crop productivity across the world and the big negative impacts tend to be in those areas where we already have high prevalence of hunger and it maps almost exactly onto the hunger index that is generally used.</p>
	<p>So you get parts of the world where a moderate amount of climate change will be beneficial and we happen to be sitting in one, not in Cambridge but in northern Europe and some of the southern parts of Canada again a small degree of warming will be beneficial to agricultural productivity and you get these large swathes of the continent of Africa, across into Southeast Asia and Latin America and Australia where even a moderate degree of climate change will have a negative impact on productivity.</p>
	<p>So that's all well and good and I spend a lot of my time now in government actually saying what we can say with some confidence rather than saying what we don't know and this paper gives some examples of that, so that's one thing we can say.</p>
	<p>So coming onto the evidence gap that also gives us a little bit of a clue as to where the first evidence gap is, because as part of this paper we did a bibliographic survey and we said 'Okay, all of the academic papers in the last 20 years since the first IPCC review, how many deal with the availability part of food security? How many deal with access, utilisation or stability?' We put them into neat little bins, of course some did a bit of both, but we put them into bins. We found that actually three quarters of the evidence is in the availability part of food security. So the first evidence gap is that those tough areas of utilisation, access and stability are really under researched and you can imagine why, I mean these are quite difficult questions to ask whereas some of the more direct influences of climate change on crops, on food, on fodder, on livestock health, on pests and diseases are the sort of things that you can investigate reasonably easily using standard research methods.</p>
	<p>So that was the first gap. Now the second gap is that okay, we can have some confidence that there is a rather coherent global picture but of course a lot of decisions are made at farm level, farm enterprise level and slightly bigger scales, what can we say at that very fine level of detail? There I did a little experiment which I used to show in a slide until those that recognised their studies on the slide started being a little alarmed about this demonstration. If you pick different studies that are of the same area and of the same crops and using projections that are basically the same thing they all have sort of little pixels, some were red with negative impacts, some were green with positive impacts and we put them side by side. My conclusion is there's just noise, there is no coherence at that very fine scale. There's many reasons for that but at the level at which many decisions are made about how to adapt and how to cope with climate change, the standard sort of scientific methods making these predictions completely break down for a number of reasons that we can go into later.</p>
	<p>So that's the next gap. Those who are making decisions at small scales really don't have a lot of skilful information on which to base their decisions. The two other gaps I'll perhaps say rather less about is that of course agriculture is a lot about growing things and feeding animals and knocking out pests and diseases but humans are involved in virtually all forms of agriculture, you might feel we are not, but the difficulty here is how to integrate the human decision-making process, human behaviour, human incentives into these big food security questions of because they are absolutely part of this. Barbara mentioned farmers perceiving their climate changing reminded me of one student of mine who spent 18 months in a village in Uganda looking at farmers' perceptions of climate change and it completely bears out your conclusion. Farmers said the climate is warming, the rains, whether it's the first or second rains, are coming earlier, when they come they are more erratic, all these really important influences of the environment on their livelihoods. She got hold of the meteorological records and if you go down them not a single one was</p>



	<p>borne out by the weather records. So what does this tell you? It doesn't tell you that those farmers have got it wrong in any way or they're stupid in any way, but it tells you that their perception of their climate and the way in which they adjust their livelihood strategies to their perception of how climate is changing is just as important as what the met records, the climate records are saying. So you've got to integrate sort of more formal assessments of what's happening in terms of climate change with the behaviour of those who are impacted and responding to it.</p>
	<p>Then lastly a lot of these indirect influences of climate change that don't impact directly on what you're growing or how it's facing up to diseases and pests are the ones that really there are not good methods of trying to investigate, so there's a big methodological gap there.</p>
	<p>So finally going onto the next generation of questions, well in the same way as fortuitously I wrote a paper on the evidence gaps 18 months ago, for the last 12 months I've been involved in an international programme to - and this is the exact term 'define the next generation of agricultural modelling'. Now what we're trying to do through that discipline is provide at least some projections where we may be going and some assessment of the uncertainties around that and that will change from different parts of the world and different scales as I've already covered. One way of doing that if you are an optimist I would suggest is to say right, okay, we've got some chaps who can model crops, let's have them. We've got some livestock modellers over there and then we've got these agricultural economists, we've got the micro guys and the macro people. We've got all the people doing the right little components, if we stick all of their predictive models together and we fire up with the weather models and we run them out to 2030, that surely will give us the answer. And of course it does give you an answer, the problem is there's no skill in the answer and that's because there's so many errors around the system that if you put all these models of various sorts together you can get an answer but it has, I would suggest, zero skill. So the answer to the next generation question is how do you answer some of the big questions about food security and encompass both biophysical, economic and social behavioural aspects of food security, but you don't do it in a way that simply propagates all of the errors and uncertainties amongst each of those components.</p>
	<p>A phrase I've used in my research is 'appropriate complexity'. You've got to think of some way of answering this question that encompasses all the myriad of factors that we know are important for food security without losing all the skill of prediction. I certainly don't have an answer to that but I can appreciate the problem.</p>
	<p>So just to conclude there are a lot of evidence gaps out there. Most of the week - I only spend one day a week in my university so most of the week that I spend in Whitehall I'm actually more concerned about what can we say with some level of confidence rather than what can't we say and what should we do about it. It's only where a problem is set or a problem is asked by a minister usually where we go back to the evidence and say 'Okay, we don't know, we'll commission some research in two, three, four years' time, at least we'll be better prepared for that question again or we'll be able to move that advice into a development programme'. This paper ends with a number of sentences that are of the sort that are on the surface reasonably simple and broad but are very much firmly based on the evidence that sits underneath them. It tends to compress the uncertainty and say 'Okay, we know it's very complex, we know it's very difficult, but what can we say with at least some degree of certainty in a reasonably simple and robust way that can then underpin action which is where we want to get to'.</p>
MR:	Thank you very much. Next question?
HC:	I was wondering if I could just press you a little bit maybe on that last comment and the gap that you identified in the middle about needing closer resolution to actually identify what adaptation [inaudible 0:36:18] right level, I guess a kind of scale. Because it seemed both in that case and then this idea of needing to bring together models but not

	reproducing their kind of errors and uncertainties to really know what to change. I guess I'm curious from your presentation whether you think either of those things is at all possible and if we were to pour the resources needed into them would they actually influence people to act differently? Is creating that knowledge going to be powerful because it seems as though it would need a lot of resources put into it.
TW:	Yeah, sure. I don't have the answer but I have a gut feeling, it's a little bit more than a gut feeling. I think it's a combination of using some of the more formal simulation techniques to set the boundaries of the change in some way, whether that's at a geographic scale, whether that's a certain time projection, and then actually using other methods to fill in the detail. I'm less clear what those other methods are but you can think about what are the livelihood challenges to communities. If you think about a poor community, communities that are living within shall we say a grey cell for sake of argument, what are the challenges that they are facing and how is their climate going to change in a broad sense over one, two, three, four decades. [inaudible 0:37:41] maybe to illustrate that approach, so I mean there are some parts of the African continent where you can say with confidence, not many, but there are some parts you can say with confidence which direction of change there will be in rainfall. You can say across the whole continent what the direction of change in temperature will be with reasonable confidence and you can say something generally about the frequency of extreme events, how that will change over time. So there is some information that you can provide at quite a large scale and somehow you've then got to fit that together with methods that fill in the detail.
CK:	If a minister asked you about a story I saw in the paper in the last week that showed food being produced indoors, I think in Korea, and the author of the article making pretty impressive claims about the potential for indoor production, what can you say about what's known about that approach at this point in time, especially to the extent that it might buffer the effects of weather, rainfall and so forth by having artificially produced levels of moisture and light? And is that a kind of black swan that if that took off it would totally change the kinds of variables you're looking at?
TW:	What I would immediately do would be to look at the level of inputs into that particular productivity. So you can get very high productivity in I mean almost experimental conditions, artificial conditions, but you think of the energy input and the other inputs that go into those systems, it would be enormous. So it would be high productivity at the sort of input efficiency that you couldn't then replicate at large scale.
CK:	But if he's making money in Korea manufacturing cereal on shelves, hundreds of shelves stacked indoors, and you don't have windstorms blowing it all down and that sort of thing.
TW:	Yeah. If you're making money on a small scale then clearly that's worth it for that enterprise but I don't think you can then roll that out on a global basis and say 'Okay, we can feed the world on 1,000 times these little confined spaces.'
CK:	But you won't roll it out unless all of the evidence you would need, which might include for example solar energy or biomass as a way of generating energy for the indoor food production. Aren't a lot of these things very hard to calculate even five, 10 years out because we don't know about the innovations and the technologies, as Hermann Hauser was talking about at Darwin on Friday night.
TW:	Yeah. The standard or a standard reply to some of the challenges that agriculture faces through climate change is that it's okay because technological progress in the past has been rapid, I'm sure that we can cope with these issues through technology generation. I think history tells us we can get a little bit, we can get some way with that but actually it is only some way. The statistic that Barbara hinted at there in her presentation saying actually if we stacked all the food up on top of each other around the globe and spread it out artificially evenly there are almost enough calories and the figures I have actually puts it at almost enough calories to feed everyone sufficient calories. Of course that's an artificial situation because the access to that food varies enormously. So I would say that



	would be an inefficient system and in terms of global food security would only be addressing that productivity pillar and the other three, particularly for those living in low income settings, are the dominant barriers to them achieving sufficient and high enough quality nutrition.
MR:	Just one more question.
SO:	I've got a question which I think might speak to some of the things you've talked about as well, but it's to talk a little bit about I suppose the politics of integrating those staler analyses in the sense that...you know you're both saying the local [inaudible 0:42:00] and that's where the poor people are and that's where the issues are going to come to bite really in a sense, and yet I suppose the imaginary of what you're talking about in terms of climate change and the technologies, I mean we are analysing more and more the global network. So I suppose my question is really...and it's...because you worked for Oxfam and you work for DFID, there's been a shift away from the local to larger scale solutions, technologies and so on and so forth, so should we be moving back to a more localised set of solutions because that's the only place we can address those problems where we're actually having some meaningful effect from what I understand. But at the same time it seems that we're looking for bigger solutions, bigger technologies. So how do you see that from your professional...? Do you understand my question?
TW:	Oh yeah, no entirely. I've sort of puzzled on this myself really and I've sort of satisfied myself with the argument... If we think about agriculture technology just as an example, there are some aspects of generating new agricultural technologies, whether that's machinery, whether that's new varieties, whether that's new ways of controlling pests and diseases, that are reasonably generic and require quite large inputs of capital, time, resources in order to generate. So the new wheat, maize and rice varieties that underpinned the green revolution essentially they were developed to cover big parts of the world, big mega environments. But there are additional parts...
SO:	Larger [inaudible 0:43:41] with participatory approaches and integrating with local knowledge.
TW:	Yeah. So actually to pick up that point there are now ways of working where you can generate that selection of a range of varieties using participatory approaches because then they match local both consumer and producer needs for what they want to grow in that particular environment. So I wouldn't rule either out and in a sense different organisations work at different scales and almost their competitive advantage is working in one or other of those areas. In DFID's research programme that I mostly oversee it obviously works at a large scale, I think it has to really, but others will be working at a smaller scale on more local solutions.
MR:	Okay, I think we should move on to Toby who comes from Stockholm.
TG:	Thank you very much. Thanks again for the invitation to be here, it's a pleasure and a privilege to be back in Cambridge and this is a very wonderfully diverse forum and it's great to see.
	My remarks feel very much on this last discussion about the interplay between local and the global and taking the two starting points that we were given, the focus of the series so far has been on concerns regarding biodiversity conservation and food security and bioenergy and the fate and trajectory of all three of these concerns are for better or worse inextricably linked to land use, that's my first starting point. The second regarding the global to the local is that this for me resonates with an untapped area of research endeavour and looking at the interconnectedness across multiple scales. I was struck by a colleague in Stockholm who summarised his interpretation of what many now classify as the emergence or the one of the Anthropocene, in three broad ways in which humans are exerting an increasing influence on the world. One is the increasing spatial scale and my background is in ecology and I work in tropical forests for the most part and it's arguable



that there are no tropical forests left that are not untouched in some way by human influence, that's quite well accepted. The speed of course is another one, that we talk a lot about the great acceleration and it's easy to find plenty of graphs with [inaudible 0:46:03] shaped curves and the third dimension is increased connectedness. So that's the focus of what I'd like to reflect on and I think that it's here that perhaps some of the greatest rewards that can come from greater research and thinking about what these frontier questions are. So I'd argue that we know already quite a lot about the environmental and social implications of very specific land uses in the local context and we know quite a lot as well about the global big picture as Tim has ably demonstrated in his recent Science paper. But in this interplay I think we need to be moving towards this uncomfortable middleground in both research and policy that seeks to untangle and address some of the concerns that link the global and the local and are so critical in devising lasting solutions without losing ourselves in what that complexity is and I think we have a long way to go here in that regard.

So I want to take a look, starting out with the global and think about what the imprint of global dynamics is on the local, from the global to the regional to the local and then zoom back out and reflect on the way in which I think increasingly local dynamics are scaling back up to reshape the global picture. So globally there's been a lot of work on footprinting. I now live in Sweden for the last year and I can tell you that the Scandinavians were shocked by the recent WWF Living Planet Report that highlighted Denmark and Sweden in particular that pride themselves on being quite green countries on having some of the largest global footprints, and that's of course because they are import dependent. However we're only just starting to really scratch the surface of what these footprint type analyses really mean. We need to go into much finer scale geographies. Going back to Bhaskar's point, there's so much heterogeneity within some of these countries that mean so much. Brazil where I work a lot it's no good to talk about Brazilian soy production, where in Brazil, it's a vast area. So recent work is starting to allow us to say certain parts of Brazil is where the soy that is consumed in China is produced and certain parts of Brazil is where the soy that is consumed in Norway is produced. And that is an entry point for a whole series of discussions that can have quite profound implications, because that relationship, if it's consistent and reliable which it often is, of China to a particular area and Norway to a particular area reveals a lot about the nature of those underlying contracts or relationships. Water, we've talked about water footprints as Barbara alluded to very well, but it's shocking to me that in the two analyses of water footprints globally don't take into account local conditions of water scarcity. Asking about how much water is embedded within a product is irrelevant unless we know how important water is to that particular area. If it's the north-east of Brazil it's one thing, if it's from the Amazon it's another. And another dimension in thinking about climate change that Tim has flagged, this close and worrying correlation between direct climate impacts and poverty, but there are myriad indirect climate impacts that we are only starting to tap into as well. Recent work by some colleagues of mine is looking at some of the indirect pathways, whether through migration or whether through trade in particular. So drought in Bangladesh for example can drive price shocks in rice in Senegal where people now depend almost exclusively on imported rice.

Dropping down to the regional level it's ever more clear in ways that are hard to disentangle how the shifting patterns of demand and the price of land juxtaposed on a highly heterogeneous landscape of regulation enforcement can result in profound interconnections as to how landscapes change between neighbouring regions. Again a Brazil example, some analysis that we are involved in now and not yet published shows quite clearly that if you go out from São Paulo you can see three waves of agricultural expansion in haloes. The first one is sugarcane which can't be competed with in terms of its value, the second one is soy which is one down and then the third is cattle and you can't not look at that picture and realise that Brazil has a deeply interconnected agricultural system and dealing with environmental enforcement in the Amazon as if it's isolated from the rest of the country is the wrong way. And furthermore much of the

	<p>acclaim rightly levelled at Brazil for the drops in deforestation in the Amazon needs to be set against the fact that deforestation has risen in the neighbouring Sahara that few have heard about and it's also leaked into Bolivia and into Paraguay. Most of the soy grown in Paraguay is owned by Brazilians with much lower levels of regulation.</p>
	<p>At the local level I work a lot on what I would term to be frontier landscapes and here it's...these are the spaces for me, novel spaces, where the local and the global really do collide. So I work with farmers, neighbours literally, one of whom has only recently heard of artificial synthetic fertiliser and manually tills his small field and his neighbour has a GPS guided tractor which deposits bits of phosphorus [inaudible 0:51:17] and depending on the spatial map that he did from last year's sampling, and they are neighbours. So what are the ways in which we can better understand the interconnections that shape the future of that landscape and the people that live in it, given that those actors do not live in isolation. But hitherto a lot of the research and a lot of the policy lines have very much focused on individual actors. Of course they need to be tailored towards the specific needs of individual actors but they need to set a policy or a research [inaudible 0:51:46] context as to what the side-effects are, or better still how can we consider from the outset the diverse needs and opportunities for that diversity which will rapidly change and lock itself in to a particular quite rigid system in a matter of decades if no interventions are taken. How can we marshal and exploit that heterogeneity to a better outcome?</p>
	<p>Then finally zooming back out it's all well and good to think...it's tempting to think that the local as we've been reflecting upon is completely dominated by the global and acts locally don't have much agency. But I think it's increasingly clear that we can see lots of local scale initiatives that are rapidly scaling up to reshape the global.</p>
	<p>Recent work from Brazil illustrates how deforestation has fallen but if you unpack that and ask how different actors have been associated with that deforestation then you get a radically different picture and you see that deforestation has fallen but deforestation associated with smallholder farmers is starting to increase in relative terms, because they haven't been able to reduce their deforestation because they are so dependent on the forest. So the local dynamics are reshaping what the regional picture in that case is. Another example, the municipality of Paragominas where I work has become the poster child for land use sustainability in Brazil nationally after a local initiative and now the mayor of that town regularly travels the world and expounds the story of that particular place which has had a lot of success, it still has work to do but it's an example of how a state programme was founded and initiated on a local context. On a negative side the UN Red Cross programme recently was thrown out of Panama by the indigenous communities of Panama because they rejected the lack of attention and respect that was given to customary rights. They've come back in now but they've got to rethink through how that's going to be done.</p>
	<p>So the main point that I would like to make is that in tying these connections between the local and the global we can't avoid but moving into this uncomfortable and awkward middleground for devising solutions. I think some of these effects that ricochet across different scales, originally kind of complex systems theory looked very much at fast local dynamics scaling up and then hitting slow, larger scale dynamics, but actually we are also starting to see examples of very fast large scale dynamics. A teleconnection for example of price shock ricocheting down and then hitting and being deadened by actually quite slow local scale dynamics. We've reflected upon the need to change behaviour, so changing the mindset of the behaviour of cattle farmers in the Amazon is incredibly hard as it is often with farmers anywhere around the world. But the shocks that they're subjected to are actually quite fast, so we're seeing a tipping in the nature of that dynamics.</p>
MR:	<p>Thank you very much Toby. Any questions for Toby particularly first?</p>
	<p>Okay. Any comments from the other speakers on what the others have said?</p>



TW:	I think this teleconnection point is a really interesting and important one and we see it in price shocks. Well we see it in ways that we don't necessarily expect and I remember seeing one example where the price shock in agricultural commodities influenced the constituency of diets, I think it was in Bangladesh this case study, that those are affected by it so they tended then to buy less nutritious food under high price conditions. So it sort of permeates throughout the system and I think we can't always anticipate quite how widely and how that goes.
MR:	Barbara?
BS:	I have a couple, one very quick one, it's really nailed on to Tim's and it was all about agricultural productivity and what's going to happen under climate change and as I understand it from the IPCC, once you get above about 3°C it goes down everywhere, once you get a bit beyond that, between 3°C and 4°C, everywhere goes down in productivity. And I only say that because to get away from this sense that it's all just about poor people. Agricultural productivity, if it goes down everywhere and we need just on baseline 70% more food by 2050 that is a real issue for everybody. So I just want to put that on the table.
	The other one is just the local and global. The only thought that came to me as you were talking was...which none of us have done really, none of us talked about power and who has the power in this and that's the big issue in the local to global because once you get lots of global rev...well going down, then it's what power do you have to resist that or adapt to it. So all that power might go with money, your nice rich Brazilian farmer who can buy some new kit and does something different, but it's who owns what, who's got the power to influence and sadly we're still in the position in so many places where poor people don't have very much power at all so they are just the recipients of the rain if you like, not people who can adapt and really change to it very easily.
TG:	I think that just to follow on from that, I mean that's been very much my experience in reflecting on these frontier areas, because it is the imbalance in power that results in rapid changes perhaps with undesirable outcomes when the global and the local do collide. Because you only have a very narrow window which any endogenous process has a chance of establishing new pathways or resilient pathways for local farmers who were there before export led agriculture arrived. So absolutely.
CK:	Just on this point, is it possible that you could model the power relationships to things like deforestation? In Indonesia there's a lot of work going on to try to stop the corruption in the Navy with all of the logging the causing deforestation there. Other places where if you modelled some strategy to control corruption, to enforce existing laws regarding these issues and how that might change the food security and I'm thinking about it in the context of talking to Indonesian police chiefs and trying to tell them in very specific ways how less corruption and more enforcement of these laws could help to save lives in Indonesia or feed people. Is any work at the nexus of power and food supply being done in relation to corruption and enforcement?
TG:	Not that I know of, but that doesn't mean that it doesn't exist, it's an interesting challenge. There is work, the problem is that you need to be epistemologically agile in marshalling the evidence because the kind of approaches and methods - Bhaskar could speak with much greater authority than me to this - but the kind of methods that you need to untangle power relationships are alien to the kinds of methods that people used to model deforestation dynamics and vice versa. So that's in many ways I think a conceptual and methodological barrier that we need to overcome because it's a huge and fruitful area to tap into. I mean I was astounded, the analysis that I led to we published last year, it was for the first time mapping deforestation dynamics against the distribution of different actors. These are both Brazilian government datasets, they monitor deforestation and they ask 'Who is where?' We just did a simple typology of smaller farmers, medium farmers and large farmers, [inaudible 0:59:57] power and agency and if you do that then

	<p>you start to get a quite useful picture of who is, if you like, in inverted commas responsible or associated with deforestation dynamics in different places. But without that then you can just have narratives. So the agribusiness lobby likes to say deforestation has fallen in view of the ones that were hit by all the embargoes, therefore we've done our bit, deforestation is now entirely down to the smallholders. Well they mention that in relative terms it's gone up but in absolute terms it's still exactly the same picture, the larger properties are still responsible, but you didn't have this very, very simple data so it's often sometimes the most obvious questions that aren't being answered.</p>
HC:	<p>I think that's partly answered my question. Because I was going to ask the work at the Stockholm Institute, you know it's the Stockholm Environment Institute but you talk about it's actually understanding the behaviour of the farmers and getting them to change their behaviour. Is that influencing your research in terms of historically you've been like modelling environment, but that's less of a sort of social side and a social behaviour. Like have we got enough evidence around the environment and it's really about social behaviour and influencing it that is the gap in knowledge?</p>
TG:	<p>I completely agree with your last suggestion. I mean I've only been in the Stockholm Environment Institute for a year, I can't talk about its background and history but a lot of my colleagues would prefer it to be called the Stockholm Environment Development Institute. I'm one of the actual relatively few that has a background in ecology so most of the work that...maybe 5% to 10% of value in Stockholm works on issues to do with behaviour change around things to do with access to alternative energy sources for cook stoves in Africa for example. Because it's not a technological problem, often it's a cultural barrier and the kinds of cook stoves that are brought in just haven't been thought through, so the external ways in which people use them to cook and how they like to have them and so it's, yeah...I mean I agree.</p>
MR:	<p>Bhaskar, do you want to say anything in response to this?</p>
BV:	<p>I was going to ask Toby to talk about the Brazilian study that he just mentioned because the other [inaudible 1:02:04]. I thought the other striking aspect of that paper was that deforestation in places like...well outside of the [inaudible 1:02:12] monitoring grows dramatically. So it's essentially about where is the monitoring taking place and how are people behaving in recognition of the technology that exists to monitor and including a sort of possible explanation for your finding that it might not necessarily be smallholders who are responsible for increased deforestation but small plots. Because what you are picking up is small plots and as you fragment your holding so that you [inaudible 1:02:40]. Because the unit of monitoring is the larger plot you might actually not be picking up the smallholder area as much. I mean your data could be compatible with the explanation that large landholders are effectively fragmenting their holding to avoid detection.</p>
TG:	<p>I think both of those things are true. I mean it's a relative result, I try and always give the absolute context, but there are data that...agricultural census data that say that these are smallholders and have been smallholders for quite some time, so you can be confident about that picture, at least with some of them. But the change in behaviour, people subdividing their plots and also that makes them smallholders in inverted commas, and then also having smaller patches of deforestation, that picture, or moving to Bolivia is another option, it's a bit easier.</p>
BS:	<p>That comes back to your point about in Indonesia and corruption and everything, the problem is if you've got money and other forms of power then actually you can subvert, avoid, find ways which sometimes costs you money to be able to do that, to move to Bolivia or whatever, but they are all perfectly possible. So dealing with this sort of...you know, you always find ways around it for those who have the ability to do so, that's the difficulty.</p>
PG:	<p>I know that you're leaving soon Barbara so I wanted to sort of come back to what you were saying. At the risk of being completely depressing I just wondered whether</p>



	<p>the...what you were describing and what the other two excellent presentations covered was actually almost accepting the status quo and trying to work within the framework of global society that we currently have. It allows the poor to become a little bit less poor, not much less poor obviously because we don't want them to get wealthy, but we want them to just not be quite so inconveniently poor and for us to be a little bit less profligate and utterly obscene in our consumption, but not terribly much. So that we don't seem to have any kind of radicalism to the model and actually it just feels as though we are completely missing the evidence that is in front of us that the changes that are required if we're going to allow people into the doughnut from the inside, the numbers involved are really very, very significant that we're going to have to make such incredibly radical changes on the outside of the doughnut to get them back in from the far side that societal challenges are far greater than you were alluding to. Is it just because you're not...are you just nervous about frightening the horses?</p>
BS:	Yes, partly.
PG:	But surely this is the environment in which we can take the gloves off?
BS:	<p>Well yes. I suppose...well now I speak as a campaigner rather than, you know...this is how you bring about change really and the environment movement is very clear that say on climate change and the wider environment questions that in the whatever...the late...the 90s and so on and into the early 2000s that they terrified people and consequently no change happened. These problems are so big that people are very easily terrified by them, they just keep their heads down because they feel like they can't do this and that's the worry. Now I think we had say on climate change a sort of period where things looked good...just pre-Copenhagen actually frankly, things were beginning to look a bit more positive. What do I mean by positive? All sorts of people around the world were beginning to see that this was a very serious problem but they thought there might be a solution to it, i.e. the conference in Copenhagen and you can say that 'Okay, well Campaign has overplayed what could be done in Copenhagen when anything would really happen', but there was definitely a sense of people...certainly in the UK and Europe, America was still on its journey to realise there was any climate change, but anyway... But nevertheless in some of the countries there was an acceptance that this was happening but there was a way to deal with it. Now Copenhagen ended up being such an absolute disaster that people...you feel it in this country, the mood in this country with conversation about climate change in this country just went absolutely zank down. It's not that people don't believe it anymore, you look at all the surveys, they absolutely...there's a few that don't, but most people do, but the sense of any ability to do anything about it sort of seems to have disappeared and with that it's the heads down, 'I know this is happening but there's nothing I can do about it and therefore I'd better just ignore it, that's the only way to survive.'</p>
	<p>So I suppose perhaps if I sound a bit sort of pragmatic rather than sort of, I don't know, highly optimistic it's because of trying to understand the moods of people, what can be done. I mean I think all the climate change people, well you will all know too, but we got into the point where people talk much more about what the cities can do, what individual places, where are the enthusiasts who could do something about this? Can we now stop thinking about the bigger ground because we've lost it, there isn't the government will and there isn't the popular will to push the governments to do it so are there other ways? Now they may not solve it in the long term but they get us back on to there are things that can be done and there are people who want to do it to give us more optimism. So I suppose I am in the more moderate change and realistic change of what could happen because I just feel that it's sort of in some ways the mood of the moment actually. But I'd be really interested in your views because that's a very personal sentiment.</p>
TG:	Yeah, I would entirely agree with that peak around Copenhagen. There was also a peak in the evidence about the same time as well actually and a lot of the underpinning science has now become more confirmatory than groundbreaking. So a lot of things happened at



	<p>the same time and climate change sort of went off the boil, but where I'm an optimist which is my position in life is that I think a lot of perhaps the sustainable aspects of adapting and mitigating climate change have sort of come in in a different way. A lot of the sourcing models that some of the big commodity businesses are using have taken on some of the what they don't recognise as sort of climate or sustainability practices, they've taken them on because they make sense for another reason and you can make the same argument in terms of energy efficiency. So when McKinsey drew up what they call those MAC curves, I don't know if people were familiar, there's that easy end and there is that really tough end and I think actually the progress at the easy end because there are shared incentives and other reasons for undertaking those investments or actions actually there's good progress there. At the bottom end there's probably no way we are ever going to get there. So I'm slightly more optimistic but I do recognise there was that distinct peak and it permeated across everything. It was astonishing again the southern US droughts of only a couple of years ago that had such a devastating effect on farmers and yet every survey showed that only a minority of them changed their view on whether one, it was due to climate change which of course you can't say with any confidence but there's a chance and two, whether there was any human influence and these were people who were in a developed economy and very much at the forefront of a climate event.</p>
PG:	This was the Congress you're talking about?
TG:	No, no, no, Congress, no.
MR:	Charlie Kennel has argued coming from South West USA about these issues arguing that the focus should be on the minor contributors to warming, like methane and black carbon which give a local shorter term benefit. Do you want to comment a bit on that Charlie?
CK:	We published a paper about three years ago in which we tried to inject some optimism into the mitigation part of the study and this is due to the work I'd done at Scripps and elsewhere where you knew that 40% actually of the greenhouse gases that we put into the atmosphere are not carbon dioxide, carbon is very hard to deal with and we are not doing well, but all these other gases, methane, the nitrous oxides, the black carbon and so forth all have atmospheric lifetimes in the order of 10 years, so if you work on them your politicians will see a positive result and during their term of office it will be measurable. In addition it slows down the rate of climate change which means that it defers for some time in the future the adaptation risks that you will assume...they will either come sooner or later. From sea level rise for example they're out there but if you slow down the rate at which energy is going to the ocean you can defer the time that we reach one metre by 10, 15, 20 years and that time in this timescale society is valuable. The other remark that we made was that we thought that this would change the dialogue because it was something you could do. Then the final remark was we said 'What would people say about the seriousness, your seriousness if you knew that you could do these things now and you weren't doing it? You weren't mitigating these short lived constituents.' Then they would say 'How serious are you about climate change? Are you really in fact dealing with the problems that we are going to be facing in agriculture in the community? So if you can help us even for 20 years that's a good thing', and in fact partly as a result of that there is a climate and clear air coalition that I think Stockholm Institute plays a big role in and UNEP and of course members of the climate science community.
NB:	It strikes me that this piece about the bottom-up...well there's a kind of governance overlap or parallel with this in terms of the Copenhagen peak and also this thrust to do things which we know have co-benefits, they are easier to do, we can gain some ground, you know, some win stories so therefore there is more confidence in the top-down governance piece again. We've been doing quite a bit of research in sort of initiatives, bottom-up initiatives that do this in the climate space, whether it be in energy efficiency, whether it be in the short term climate forces, where they have co-benefits, therefore folks voluntarily getting together and doing some stuff, the mayors, the cities, the companies around deforestation. What strikes me about it is it can...like with your regional piece in

	<p>Brazil where you ended up with the mayor having his small piece becomes the national story, it's that drive for regulation that is coming from the bottom in many ways because it's the thin edge of the regulatory wedge in many ways, the private sector would never see it that way but truthfully that's what they're doing with their responsible palm oil roundtable is regulation will follow that, that's...and you're creating a space [inaudible 1:14:08]. So it strikes me there's something about the governance overlay between the regional and the national and the global and then there's also this quick win piece, there's something in that, we've moved from one world into the other, I don't know if that's a good thing or a bad thing, there's no judgement on that but that's the reality of where we're going and where we are now and what that aim in that is.</p>
LC:	<p>I have something to say about that. Do you think the bottom-up approach is much better than [inaudible 1:14:43] because global institutions are not doing their work well enough? So they've been created a space to do something and over the years they haven't entered that space in order to solve these global problems. So that's my point - these global institutions have they failed because they haven't adapted over the years to how the world has developed and that's why bottom-up approaches are much better working slowly [inaudible 1:15:06] upwards. I'm not a governance person so I'm just throwing it out there, but [inaudible 1:15:12].</p>
NB:	<p>Huge question. I was too pragmatic for that I think. I mean the reality that that's where we are so therefore what can we do to accelerate that and what you'll find is the international institutions are acknowledging this. So they know...so they will see it inside their government story, so let's take the UNFCCC for example, they will see this under the parallel stream of negotiations which is about short term, so the ADP platform, it's called 2, workstream 2 which is about the pre-2020 stuff which we have huge problems with and we're not focusing... So it's not the Paris negotiations, it's not that treaty, it's the other stuff in the parallel forum, they will bring all these bottom-up things to the table because it shows movement between now and 2020 which keeps the negotiation for the long term on track, it builds momentum. So they have a way of seeing that and trying to bring it in formally to the discussion, so they are acknowledging it. Your piece about whether the international institutions have failed to adapt to the changing political scene, I don't know, I really don't know, yes and no.</p>
MR:	<p>Your question?</p>
GC:	<p>I was just reflecting on this kind of link between the national level...your example about in the LPR, Norway and Denmark and Sweden as being like the big nasties, but then giving the example that we can actually see where each of these countries are sourcing from Brazil, their soy is coming from this area whereas this bit of Brazil is being exported to China, and I was just thinking is there some sort of link that we need to make, not just from the global to the local but from the national to the national? To try and create finance that flows or change the way that people are sourcing or create some sort of framework that's enabling governments or international corporations to see where their sourcing is coming from and have greater transparency. I don't know if that was something that's been discussed.</p>
TG:	<p>Yeah, I think absolutely. I think there's a lot of...my personal experience is that there is a huge amount of frustration in the lethargy, not just of international institutions but of national ones as well so people have reverted, so RSPOs and other roundtables and other voluntarily led systems have reverted to state level or provincial level processes to try and leverage change and that's great because it's more agile. So a good example is the Governors' Climate Task Force which is a network of mostly tropical nation states that was partly a reaction to their frustrations with their own federal governments. So the Amazonian states of Brazil have quite a distinct...going to Copenhagen they had their own delegation and they were slightly at loggerheads with Brasilia, but of course far less powerful. So on the one hand the states often have a lot more agility and bilateral partnerships are formed with other states. For example California and the states of the</p>



	<p>Amazon have a bilateral...but they don't necessarily have the capacity so there's a trade-off there. So then you get the NGO communities coming in and often substituting the role of the state. So big conservation NGOs have come in and are now largely responsible for basic tasks of mapping farm boundaries which is a building block to understand tenure to then do anything, and NGOs are doing that for states and the federal government is some way behind. That's not sustainable or acceptable in some ways, how long can a non-governmental international organisation play that role. So it's a trade-off between capturing that agility and having the resources that maybe the federal government has but doesn't employ.</p>
TR:	<p>So yeah, it's more of a reflection really... So we all talk about this thing from the local to the global or global to local and we also accredit a lot more power to the global than to the local but what is actually the global? Because there aren't really...I mean there are actors that have quite global scope but there is no global government. You can look at [inaudible 1:19:17] or national governments or regional, EU, but there isn't really a truly global actor. So like when you speak of the global what is actually the global? As an actor is it more into issues and if it's in issues then I'm not entirely sure if we should see global as something on top but rather horizontal. Like this is very geography and scale and all that but rather a horizontal conceptualisation scale rather than a hierarchical one.</p>
CK:	<p>Corporations.</p>
BS:	<p>Just on some of that, I mean there's no answer to all that, I don't...but just random thoughts really which is I certainly...well I've been thinking about this, but on the global in terms of governance the global governance we have is so weak you should never ask them to do anything other than the one thing that they have to do, or one or two things. We've got to limit what we expect anybody to do at global level and we keep throwing everything up to global level and I don't think that's terribly helpful actually.</p>
	<p>Another point about this is of course it's us that isn't global, not just global governance. We are still very much...you know, I mean we are local people, we are national people, we are global people and I don't think we've adjusted to the fact that we're now starting to hit problems that are actually global problems. Now our governments don't help us much with that because they keep reverting to national all the time, but it is also about how the people feel and do they understand that this is a global issue that has to be ultimately resolved...not necessarily in a global governance discussion and some conference of parties or whatever the issue is that we're trying to solve, but that actually people are all in this together and we haven't grown up into this interconnected world either in the way we think. Two things: well one thing is going on and one thing I wish was going on, one thing that is going on of course is the greater transparency one, everybody knows much more about everybody else and knows the sort of life they live and that's a jolly good thing, a) for cutting out some of the rather evil things that are done because they become more exposed, but also making people actually have more empathy that they can see these things happening to other people. They begin to look like ordinary people much more, 'It could be me', all that side of things. When I was at Oxfam we spent quite a lot of time trying to work on how you encourage people to actually think in solidarity with poor people, not just in compassion, they give money, but how do you get into that... Solidarity actually means thinking globally actually, it means thinking beyond yourself into communities that you don't actually live in but you can see around and how do you use all the words or the terms that make people start thinking in those ways. We even started looking at the neocons for example and the way they use language. The neocon use of language, particularly the use of the word family, family is a good thing, family is a nice thing. So if you suggest all sorts of things are for the good of the family you can persuade people to believe in all sorts of things that aren't really very nice. Now what we were trying to find is, in a less Machiavellian way, but what are the things, what are the concepts and then what are the words that you use that are really about solidarity and making people think in these broader ways that it's a good thing to be thinking in solidarity rather than always thinking about...you know, the selfish issues of money, status and all those things, which</p>

	are also relevant to people, it's not that...they're not bad it's just the proportions of these and how do we get people much more into this solidarity mood. That's a rather big and rather general answer but it is all related to this sense of do we get it that we are in one globe.
MR:	It's 6.30pm and I didn't intentionally run on so we could make the best use of Barbara because she had to go and we'd like to thank her very much.
BS:	No, thank you, it was fascinating.
MR:	In the last comment it's hard-working families which is the mantra [inaudible 1:23:23], so we've got to support them. What we're going to do now is take a short break for some more tea and then the suggestion is that we reconvene for another half hour, we can perhaps run on until about 7.15pm in two groups. Any advice on logistics for that?
RA:	I suggest splitting the table down the middle actually and the people on this side and the end if you go with Tim and cluster in that part there and then everyone else can cluster with Toby here. It just gives more of a chance to talk more in depth about some of the things we've raised.
	END OF AUDIO