**Ideas and Society**

**Can We Feed 9 Billion in 2050?**

**John Scott Meeting House, La Trobe University**

**Wednesday 10 April 2013, 12.30pm**

**John Dewar**

Thank you very much. It’s a real pleasure to welcome you all here for today’s Ideas and Society forum entitled How Can We Feed 9 Billion People in the Year 2050, a topic which I'm sure you’ll all agree is a really important one and that will look at the challenge of feeding a growing global population in a context of soil degradation, climate change and encroachment of urban development on rural farming landscapes.

It’s no coincidence that this forum is taking place today, because yesterday here at La Trobe we were very pleased to open and officially launch the new AgriBio Centre for AgriBio Science, just over there on our Research and Development Park, which will be a major part of Australia’s contribution to the solution of issues of productivity, of livestock and crops, which will be one part of the solution to how we achieve this goal of feeding 9 billion people in 2050. But of course the answer to this question is much more complicated than that and I'm delighted to say that we have a wonderful panel of experts assembled for you, to help tease out the complexities of all of these questions.

I'm particularly delighted that we have as our Chair for today, the Reverend Tim Costello, who I'm sure is immediately recognisable to everyone here. He’s CEO of World Vision Australia but just as important as that, has played such an important role in keeping issues of global poverty and international development right at the heart of the national conversation. And I was just saying to Tim beforehand that you’re doing a great job of inspiring the younger generation, because my seventeen-year-old daughter met you recently Tim, and you’re now one of her personal heroes. So you’re doing a fantastic job.

We also have our own Reader and Associate Professor Philip Keane, from the Department of Botany in the Faculty of Science, Technology and Engineering. Philip has a really strong interest in agricultural development, especially in Papua New Guinea and Indonesia and I think will be able to shed some really interesting perspectives on the question we’re looking at today.

From the University of Melbourne, my former colleague, I'm delighted to welcome Professor Snow Barlow who’s a plant physiologist and agricultural scientist, who’s been a driving force in understanding the impacts of climate change on agriculture and does a lot of public policy work for government and other bodies in this really important area.

And finally, Dr Elizabeth Finkel, former research scientist at the University of California and now a Melbourne-based science writer and editor of *Cosmos* magazine and as of an announcement that we’re making today, I'm delighted to say that she’ll be joining us as a Vice-Chancellor’s Fellow here at La Trobe University. Welcome Elizabeth to La Trobe, we’re really delighted to have you as a member of the La Trobe community, although listeners to Radio National’s Breakfast Program at approximately 6.23am yesterday morning would have heard this announced slightly in advance of our media release that’s going out today. But Elizabeth, it’s a real pleasure to welcome you here.

One of Elizabeth’s roles as Vice-Chancellor’s Fellow will be to contribute to a science and technology stream in the Ideas and Society forum program that she and Robert will be working to develop. And having said that of course I warmly and sincerely acknowledge the presence of Emeritus Professor Robert Manne here today. As some of you might have heard me mention at Rob’s farewell event here this year, given that he’s continuing his association with La Trobe, through his Chairmanship and continued drive behind the Ideas and Society Program, then his farewell on that occasion had all the qualities of those farewell concerts that rock promoter Glenn Wheatley regularly organises for Johnny Farnham. But Rob, we’re delighted that you remain a part of the La Trobe community and that you will be continuing to lead the Ideas and Society forum.

So with that introduction, it’s a real pleasure now to hand over to you Tim, to take us through these very complex issues. Thank you.

**Tim Costello**

Well, thank you very much, and let’s thank the Vice-Chancellor for opening.

It’s a pleasure to be here. I haven’t had a formal association with La Trobe. I went to a, I guess no name insignificant university just south of La Trobe called Monash, and I have had a number of formal engagements there, but I am pleased to say that now I'm the Chair, taking over from Steve Bracks, of the Centre for Dialogue, that Joe Camilleri set up and Professor Albert Gomez I think’s here, so now I do have a formal legitimising connection with La Trobe.

A great pleasure to be here. I thought for a moment the Vice-Chancellor was going to announce that La Trobe’s solving the 9 billion and feeding people with yesterday, but on a serious note, this is a huge challenge. People know that Millennium Development Goal 1 was to eradicate extreme poverty and hunger and it’s a goal sadly, that is still off track. 870 million people worldwide, the vast majority in developing nations, were chronically under-nourished in the year 2010 and 2012. Yet we know that reducing hunger since 1990, we have made significant strides, just the proportion of children around the world that suffered stunting from poor nutrition has dropped from 40% to 20%, 1990 till today. And whilst the global financial crisis and the global food crisis, two GFCs went hand in hand in 2008, the food crisis surged by 36% in June 2008, after two decades of relative stability and we saw some of the social and political unrest that flowed in dozens of countries from a food crisis. We also know that the GFCs particularly hit Europe and there has been perhaps surprisingly less devastation maybe in developing countries and Europe is continuing in troubles, anomalies some of us didn’t necessarily predict.

But the question this afternoon is can we feed 9 billion people in 2050? I'm very pleased to invite Elizabeth Finkel, who’s author of *Stem Cells: Controversy at the Frontiers of Science* and *The Genome Generation*, a contributing editor to *Cosmos* magazine and I think its 50th issue out this week and Elizabeth has a piece in this. She’s had ten years as a professional research scientist before becoming a journalist and was named 2011 Higher Education Journalist of the Year. So would you welcome Elizabeth.

**Elizabeth Finkel**

Well, hello and it’s wonderful to be here and it’s wonderful to give this presentation as my first act as a Vice-Chancellor’s Fellow, which is a great, great honour. Tim’s just told you a little bit about me, so I am originally acculturated as a research scientist, I spent five years at the University of California in San Francisco, working on the genes that make a fruit fly. When I came back to Australia I moved into journalism as a career that was a little bit more compatible with raising my children. The alternative career I would have picked would have been to go into development, an area that always attracted me, but then I would have had to have done another degree in economics, and no, I've had enough of that.

But, as a journalist, the wonderful thing about being a journalist and being ... I should say that both careers, as a scientist and as a journalist, have really used the same skill set – that ability to do research. And the other wonderful thing about being a journalist is you can follow your passion, which means that I can actually follow a lot of my interests in development through my science journalism, and for that reason I've developed a special interest in agriculture, as the driver of development and poverty alleviation and basic human rights all over the world, the right to be fed.

So, what do I want to talk about? Primarily I want to talk about some of the arguments that are out there when it comes to how we’re going to feed the planet. And there are some arguments which are out there which are fantastic and really constructive, and Phil Keane and Snow Barlow will talk about some of those arguments – arguments about what the perspectives are of small holders versus large holders, like the farmers in Australia, and what might be the appropriate balance between very high tech approaches and just deploying what we already have, the things that have worked already so well for us.

So let me start by saying that by the year 2050 we’re expecting another 2 billion people to come for dinner, and what nobody disagrees with is that’s going to be a challenge, how we’re going to feed 9 billion people? Apart from Brazil, which has vast tracts of savanna, called the Cerrado, which it is still developing, most of the rest of the world is pretty ... has reached peak farmland a long time ago. And what’s worse than that, we’re losing farmland due to erosion, due to salinity, and not to mention that a lot of great farming land is being smothered under the concrete of our cities and golf courses. Water supplies can’t keep up, the wells are drying up. Saudi Arabia was self-sufficient in wheat for twenty years. Now they’ve thrown in the towel. They’ve used up their aquifer. And other countries are going the same way. The wells for India’s wheat belt, the Punjab, are running dry. And mighty rivers like the Nile, the Colorado, and our Murray-Darling, are turning into trickles, as cities and farmland compete for that water.

And then there’s the rising costs of farming. The cost of nitrogen fertiliser, of fuel, and dwindling resources like phosphate. And let’s not forget climate change. It’s turning our farming systems on their head. According to Lester Brown, the President of the Earth Policy Institute in Washington, for every one degree rise in temperature, you lose about 10% of your yield to your wheat, rice and corn, when that happens during the growing season. So those are abstract numbers but we saw it last October in the heat wave that hit America’s corn belt. Some places recorded the lowest yield in 25 years.

So, all these factors are making farming a poor business. Look at Western Australian wheat farmers, selling up after being hammered by drought and the high Australian dollar. Even icons of success like John Nicoletti, who’s Australia’s biggest wheat farmer, is selling out. In Asia, men are leaving farming to women and the elderly, and even in Australia, the average age of farmers I've been told, is 60. And it’s very hard to renew the pipeline. Our agricultural colleges are struggling to fill their places. I've been told we have 700 students nationwide. Tiny Israel by contrast, has 2,300.

So, everybody agrees it’s going to be tough to feed everyone in the year 2050, but as I said, we have all sorts of convulsed arguments about how we’re going to go about it. And Phil and Snow are going to engage us in some great arguments. What I'm going to do here is tell you about the arguments we should really just get over and move on.

So, the most terribly destructive argument that I want to talk about is the argument over GM crops versus organic. My own voice, which I've developed through the books I've written and through the magazine articles I write, a writer has to develop a voice. And I think my voice generally is a calm voice. But sometimes you have to get up and shout. That’s what Mark Lynas did. He’s a one-time anti-GM campaigner and he did it recently, in January, at the Oxford Farming Conference. He got up and his first words were “I want to apologise to you all for spending the last ten to fifteen years ripping out GM crops”. He’s a great rhetoratician so I will use some of his turns of phrase. He said that in the 90s his knee jerk response to GM was, here was a big American corporation, Monsanto, with a nasty track record, putting something new and experimental into our food without telling us. Lynas’ conversion came with the climate change debate. He had to form an alliance for the first time with science, and with evidence-based thinking. And he found he was in a very strange position, an untenable position. When he applied the same standards of scientific rigour and balance to the GM issue that he was to the climate issue, he discovered that “one by one, my cherished beliefs about GM turned out to be little more than green urban myths and that conversely the embrace of organic food as the way to grow food sustainably for the planet, was indulgence of our aesthetic illusions”. So you can find his riveting mea culpa on the web.

But I think his main point is this. As someone who cares about the planet, he was suddenly horrified to realise he’d been in the wrong camp. The view that organic agriculture is the sustainable solution for the planet is certainly beguiling and easily convinces people. Natural is best. Meanwhile, high tech, intensive agriculture is the bad guy. Indeed, there are problems with pesticide and fertiliser overuse and irrigation overuse. And indeed, I think before the current escalation of this sense of a food crisis, the very fashionable thing to do if you talked about the Green Revolution, was to talk about all the side effects, all the fertiliser run-off, all the problems of irrigation, and salinity, and I have to say, it did a great thing, that dialogue, because it really forced the agenda of research development everywhere. Indeed, every research institute you go to, whether it’s Monsanto or all the public institutions, they are all focused on developing sustainable high-tech solutions, addressing the things that the Green Revolution was not able to address at the time.

But before we ... even those people who’ve been fashionably trashing the Green Revolution, they ... what I didn’t notice enough of in some of these diatribes was two very, very important caveats and they are being talked about more now. One is that the Green Revolution where we intensified agriculture by technologies, by introducing new varieties of seeds that doubled or tripled yields because they were dwarf varieties of wheat and rice which sped the resources instead of going into tall wheat plants the size of a man’s shoulder, they were dwarf wheat plants and all the resources went into the grain. So these sort of plants didn’t fall over and when you applied fertiliser, when you applied irrigation, all those resources went into the grain, to double and triple yields.

And what did that Green Revolution achieve? Well, in the 1960s, India was facing mass famine. I visited India about, not last January, but the January before, and there were people I spoke to in the agricultural institutes who told me they remembered as youngsters queuing in line for food aid. It was ship to mouth – that’s how people were being fed in India in the 1960s. And when ecologist Paul Erlich visited in the ‘60s and ‘70s, and he saw the population bomb, he predicted hundreds of millions of people were going to die in mass famines, as they had before, in Bengal in 1943. Three million people died of famine.

It didn’t happen. It didn’t happen, thanks to the Green Revolution. The Green Revolution spread from India to Pakistan to all over the world. Everywhere now you’re not going to find wheats that are tall any more. Go around the Wimmera – you will find little dwarf wheats that are just slightly taller than your knees. And what would have happened if we didn’t have the Green Revolution? Okay, millions of people would have starved to death. But there’s another benefit that is not that well recognised – the ecological benefit. So ecologist Jesse Ausubel at Rockefeller University recently did these calculations, that if India had stayed with the largely organic techniques of 1961, they’d have needed to cultivate an additional area the size of France, 65 million hectares to make the same gains. So they didn’t. What has India done instead? India is actually increasing its forests. Since 1980, sorry, since 1990, deforestation in India has reversed. They’re actually increasing forested land. And overall the figure that Jesse Ausubel uses is that since 1961, we’ve increased crop yields by 300%, but we have increased our agricultural footprint by 12%.

So, who in this audience is not on the side of preventing millions of people from starving? And who is not on the side of preserving forests? That is why Mark Lynas changed camps. He ended his talk with one statement. “The GM debate is over”. Sadly, it’s far from true. If you Google under Mark Lynas’ talk you will find such a huge diatribe trying ever so hard to pick pieces into the details of his talk that Mark Lynas just had to shut down the dialogue.

For me, the very bizarre thing in the anti-GM opposition is that many of those who oppose GM claim to be representing the interests of the planet and of people. Like Greenpeace and like a slew of GM NGOs. So this is opposition to GM crops with a mission to reduce human malnutrition like the Vitamin A rice that will make a dent in stopping half a million, sorry, 500 million children, sorry half a million children, I beg your pardon, from going blind each year. Crops that will play a role in making, sorry, crops that will be more drought tolerant, crops that will raise yields, crops that will reduce nitrogen consumption, crops that will reduce the use of toxic pesticides.

All these things, either in development or already being deployed, having to run this incredible resistance from anti-GM groups over the last fifteen years. The story of Vitamin A rice just is unconscionable. And I am flummoxed. I'm just flummoxed.

I'm just going to end with an egregious example of Bt cotton. So Bt cotton, used all over the world, used in Australia, and introduced into India in 2002. So what is Bt cotton? Bt stands for Bacillus thuringiensis. It’s a bacteria that naturally produces a protein that is toxic to insects when they consume this bacteria. So organic farmers will grow up vats of Bt bacteria, and they will spray it on to their crops. Or you can do what the genetic engineers have done. They have given that same gene to plants, to have as their own inbuilt protection.

Prior to 2002, India’s very poor cotton farmers were struggling with bollworm infestation. Now India is a country whose icon is the cotton loom, an icon given to them by Ghandi, but they were forced to import their cotton, and those who did grow cotton had to fight the bollworm with the most toxic of pesticides. The image of farmers walking through the paddy fields, barefoot, spraying pesticides from perforated cans is horrific. So Bt cotton came on to the scene in 2002. It was first tried in experimental plots. It hadn’t been approved yet by the government but it got pirated. Obviously farmers, who are very savvy business people, saw the results. These amazing fields were producing higher yields, and you didn’t have to spray as much and you didn’t have to endure these toxic pesticides.

So ten years later, India’s cotton farmers, whose farm fields the size of ... mostly the size of football fields, from one to ten hectares, have voted with their feet. 97% of cotton today is planted to Bt cotton. So 97% of the cotton farms are growing Bt cotton. There are many refereed scientific publications that will detail the consequences. So these poor farmers are spending less on pesticides and getting higher yields. What does that mean? Their incomes are going up by 50%. When some of these researchers have gone round visiting their homes, they’re seeing TVs and other consumer goods going in, obvious signs of rising affluence.

What else does it mean? It means 2.4 million Indian farmers are not being admitted into hospital each year with pesticide poisonings, because they’re not using the nasty stuff like endosulfans. What else does it mean? India is now a net exporter of cotton. So, Bt technology is brilliant, says Keshav Kranthi, the Director of the Central Institute for Cotton Research in Nagpur, and I visited Kranthi’s Institute in Nagpur in January. And as I walked through the fields with some of his researchers, I saw the latest varieties of GM cotton that were incorporating not just one Bt gene, but several Bt genes to combat future resistance, which is inevitable with any crop. I also saw, growing in the fields there, organic cotton. I also saw a novel variety of cotton that could be grown more densely and could possibly increase yields that way. And I thought, this is sanity. This is what you do if you’re a public good research institute. You give the farmers a suite of tools, and they’ll pick what they want for their conditions and for their markets. If they can find a premium on an organic cotton market, great, go for it. Farming is tough business and all power to them.

But take a look at the internet and what you find is insanity. Much of it, tragically, pedalled by people who associate themselves with Greenpeace. So what you’ll find in these reports is Bt cotton seeds with the epithet, suicide seeds. The claim is that Bt seeds are responsible for farmer suicides. Now, does that strike anyone as a strange thing to say? Of course it’s true that Indian farmers go into debt and they commit suicide. It’s a tragedy that’s been documented since the ‘90s. And suicide rates are high everywhere. They’re not just high in the farming community. According to one report, they’re much higher in other communities. But why the hell would anybody try to lay the blame for suicides on a seed, rather than a social system?

For me, it’s flummoxing, flummoxing. Who’s side are the NGOs on? Are these NGOs on, let us say, and I hope those of you in the audience will ask yourselves the same question. Thank you.

**Tim Costello**

Thank you very much. Very stimulating. It will be a good discussion. Philip is an Associate Professor here at the Department of Botany, a strong interest in agricultural development in PNG and Indonesia, currently leads an Australian centre for international agricultural research project on management of cocoa health in Sulawesi and Western Papuan Indonesia. Would you welcome Philip.

**Philip Keane**

Good afternoon. Will we be able to feed 9 billion in 2050? I would add without further destroying the world’s natural resources or further polluting the environment. I'm going to take a slightly different tack to Ella and talk a little bit more about the involvement of the small holder farmers in this problem. And this is a really great challenge when you consider that, one, we are not adequately feeding our current 7 billion now. Approximately one billion people are hungry and under-nourished. Two, the rate of destruction of the natural world, especially tropical rainforest, freshwater resources and wild fish resources, is increasing. And three, the rate of emission of greenhouse gases, about a third of them coming from agriculture, is increasing.

These three problems are inextricably linked I think, and at this point it’s more towards a conservation equity ethic rather than the current industrial extractive exploitative paradigm as a guide for action to address them. Note, points us more in that direction.

I maintain that we could feed 7 billion people now and 9 billion in 2050 and reduce greenhouse gas emissions to some extent and destruction of the natural environment, if all the currently underused farmland in hungry countries can be put into the hands of farmers, including women, to grow food intensively. It’s interesting that Ella said that women are increasingly taking over the production of food from men. They have for a long time done most of the hard yards in that regard, but they own very little of the land. And yes, here I'm talking about land reform. When you look at the lack, the underuse of land in say, Latin America, in the hands of an elite where it’s just not used intensively to grow food.

So that’s an issue that’s been off the agenda since the ‘60s and we still try to sweep it under the carpet. And we denigrate the countries that actually do something about it, such as Cuba and Venezuela. I think a second contributing factor is that if all the severely degraded farmland on which about a billion people live at present, can be restored and farmed, using the current best management practices based upon ecologically sound methods of conservation agriculture. This would require greater government investment in farmer education, incentives for good practice and local farm-based research, all of which has been decreased in recent years as a result of neo-liberal attitudes around the world.

And finally, if the food produced can be traded equitably at a price that adequately rewards farmers for producing it and managing the land sustainably. I think this could be done now with sensible government policies and using current knowledge and well-tried methods. It doesn’t require or await the development of some miraculous new technology, although of course new technology such as DNA based digital and new engineering technologies will help and may help very greatly. For example the wider application of well-known methods to build up soil, organic matter and soil quality, could increase food production, reduce erosion, and sequester carbon in the soil, which is where much of it has come from. A carbon trading scheme could reward farmers for doing so. It’s interesting to read that after thirty years of research showing the benefits of conservation tillage around the world, only 45% of farmers in Australia, and 20% in the United States use it currently. There is much room for improvement everywhere in the basic agricultural methods.

Improvements in broad acre farming in Australia and North America will be important for land protection, carbon sequestration and feeding the affluent, but the answer to feeding the hungry, I think, lies overwhelmingly with the small farmers themselves, who currently suffer hunger. It’s amazing to read that of the 1 billion hungry people on the planet, estimated now, 0.7 billion are small farmers and farm workers. And I'm pleased to see that the United Nations agencies increasingly recognise this point.

Australia and North America won’t feed the hungry. Only 10% of the world’s grain is traded internationally, and of that, only 1% is traded to poor countries. Most of the world’s food is eaten where it’s grown. People can’t afford to buy, poor people can’t afford to buy our expensive food, but interestingly we can afford to buy their cheap farm produce. In fact, often more farm produce leaves poor societies than is sent into them. Also, we can afford to subsidise our farmers while the poor countries can’t afford to subsidise theirs.

I think an important global problem is the lack of a solid land-food ethic in the dominant urban societies of the world, which leads to one, the belief that food should be cheap and easily wasted. About 30 to 40% of the world’s food is wasted and actually a lot of it’s put into land tip, landfill, where it creates massive greenhouse gases. It’s been estimated that if all the food that was dumped in land tips in the United Kingdom was kept out of land tips, it would be equivalent of taking 20% of the UK cars off the road. And there’s an ethic there that we just waste food in the affluent societies, not only in affluent countries but in the poorer countries.

And secondly, this lack of a solid land-food ethic I think, results in a lack of understanding of the precariousness of the living systems that produce food, and consequently a lack of political will to support public investment to sustain these systems. Witness the current dismantling of the grassroots extension and research capability of Departments of Agriculture around Australia.

The politically powerful urban elites extract food from farmers, who all lack economic and political clout, at prices below the cost of producing it sustainably. If farmers were paid more for their produce they would grow more of it and grow it more sustainably. Why is it that the world’s farmers, with all their knowledge, skill, hard work and risks, are the poorest of the poor in many countries? And struggle to make an equitable living even in countries like Australia?

We certainly see this in the tropical countries with commodities like coffee and cocoa. The cocoa farmers we work with in Sulawesi aren’t paid enough for their cocoa to enable them to grow it sustainably. We can recommend very simple methods to control the serious pest and disease problems they’re facing and to maintain soil fertility, but a sociologist involved in our project in interviewing the farmers, is told that they just can’t afford the extra labour to implement those methods, and so we realise that basically we’re not paying them enough for the cocoa for them to grow it sustainably. And what this will mean is that they’ll move on to clear more rainforests, to plant more cocoa on fresh fields. And basically cocoa has been a sort of a form of shifting agriculture on a global scale, whereas when one area is exhausted, the centre of cocoa production just moves to new areas of rainforest, and we see this currently happening on the Ivory Coast.

It’s worth remembering that a cocoa farmer gets about 8 cents of a $4 block of chocolate, and a coffee farmer gets about 3 cents of a $3 cup of coffee.

I think a land-food ethic in the dominant urban societies has to be built up through education and the pricing of food to cover its real cost of production, as we’re beginning to do with water, fuel and carbon emissions.

A shining example held up in a recent UN forum of what can be achieved, as a shining example, Turkey has trebled its agricultural production from small holders over the last ten years, through government action to increase the use of good farming methods on all farms. They have installed agricultural extension or education officers to live among the farmers in all 35,000 villages and promote well-understood use of very well-tried agricultural methods, such as drip irrigation, soil testing to guide fertiliser application, certified seed and pest management, which has reduced pesticide use by 30%. In Turkey, they’ve also opened up the government research stations to use by farmers’ groups and the private sector.

This is not rocket science. It is just the good common sense extension to as many farms as possible, of methods that have been tried and tested for decades with scope to improve on these with applied research at the local level. Any newly developed crop varieties such as those coming from GM technologies, new agronomic methods or mechanical aids, can be incorporated readily into such an already well-functioning system. In fact, more readily than into the fraught farms that presently dominate much of the world’s agricultural landscape.

I'd just like to finish with a few slides to illustrate some of these points. Now, there’s one up there. I wish I knew it was up there, I could have referred to it.

This is a photograph I took back in the early ‘90s in Guatemala and it illustrates a very, very clear point, that you see in the mountains a very unsustainable form of farming. It’s highly predicable that a lot of that land will be eroded. But these are the indigenous Guatemalan people who have been pushed up into farming this sort of rugged country by an elite that is under-using a lot of the more fertile lowland farmland, much less intensively. A lot of it for growing coffee, and so that refers back to the point I made about land redistribution, putting land in the hands of farmers who will farm it intensively. And that’s a situation that’s very common throughout Latin America, increasingly common in Asia, with over the last twenty years or so, the major economic paradigm, of economic rationalism, forcing this sort of situation, and avoiding the problem of land distribution or redistribution.

Agriculture is a major driver for the destruction of natural plant communities, and especially at the current time, rainforest. There’s massive clearing of rainforest for extension of agriculture. Now this is one of the better conversions I would maintain, in West Papua and Indonesia, where transmigrants have cleared the rainforest. You see in the background there for planting rice. But if you go to the Amazon, a lot of the clearing of rainforest is for cattle production, not to feed the hungry.

And this is the situation with cocoa, the clearing of magnificent Sulawesi rainforest for cocoa planting. Sulawesi has become the third biggest producer of cocoa in the last twenty years, and that’s involved a lot of clearing of rainforest. And as the cocoa yields decline, there’s a tendency for these farmers to move in and clear more rainforest. What our ACR project is aimed at doing, is to try and stabilise production on existing farms. But that really involves us paying those farmers more for their cocoa, to enable them to practise sustainable practices.

This is the farming I've seen a lot of in Indonesia. Intensive small holder rice farming in Java, Bali, Sulawesi. This is the farming system that’s fed the great population centres of the world. We in Australia like to think we’re the world’s leading farmers, and Americans the same, but really, these are the people who are the most magnificent farmers, and the evidence for that is the populations they’ve sustained over centuries. And this is where there is a lot of poverty, not so much in these systems, but these are the systems that are under pressure and once again what you find is that these farmers are really not being paid enough for their produce to grow it sustainably. They’re squeezed, the cost of the inputs, the fertilisers, the pesticides, increase all the time, and the price the farmers get for their rice is squeezed down. This applies to farmers around the world. They’re in this squeeze, including Australian farmers by the way.

And so the tendency to assume that the rice should be cheap, to feed the urban elite, I think is a fallacy, because you’re just squeezing these farmers who are the most magnificent farmers in many respects. This is intensive mixed cropping with incredible water fertility and erosion control. One of the brilliant aspects of this farming system is that the flooded paddies protects the soil from the erosive effect of the tropical rains. You can see there the control of the flow-off from the paddies. You also see there multiple cropping, so these people are getting probably three crops a year.

So these are the magnificent ... these are the real food bowls. You hear talk of Australia becoming the food bowl of Asia, and I think that’s a joke. In fact we probably import more food from Asia than we ... certainly from the Asian farmers than we export there. These are the people who have to be supported by new agricultural technologies and improvements. And as an example, this is a development in China where the farmers are led by a Professor of Agriculture who was to some extent trained at the University of Sydney. The farmers wanted to grow the taller, more traditional rice, you can see there ripening already, but it was susceptible to a particular disease. They preferred that rice to the hybrid rice which is the one in between here. What they worked out was that they could grow both together every sixth row was the traditional rice, and as a result that reduced the disease on the traditional variety by 90%, it also reduced the disease on the hybrid rice and it enabled a doubling of farmer incomes, just with a rather simple agronomic innovation in the cropping system.

So there are many, many potential innovations, I would say, as well as GM innovations that can be brought into these cropping systems. There’s a recent, there’s a lot of recent publicity about a so-called system for rice intensification, which is being hyped up quite a bit, but when you look at it, all it’s doing is looking at ways in which even these magnificent rice production systems can be improved through improvements in agronomic methods, cultural methods and that sort of thing.

So there’s many improvements apart from GM and high tech improvements that are on the table already that can be used to increase food supply and especially in these poorer countries where the poor people are actually living and where they’ll have to be fed. So, thanks very much.

**Tim Costello**

Thank you Philip. And our final speaker is Snow Barlow, Foundation Professor of Horticulture and Viticulture at the University of Melbourne. He convenes the Primary Industries Research Adaptation Network of the National Climate Change Adaptation Research Facility. He’s a Fellow of the Australian Academy of Technological Sciences and Engineering and the Australian Institute of Agricultural Science and Technology. Welcome, Snow.

**Snow Barlow**

Thank you Tim and thank you to Ella and Robert for inviting me to speak at this forum. I guess we won’t probably have as much disagreement as many of you might be hoping for today. I will sleep very soundly knowing that Ella is out there as a very rigorous science journalist because I think we do need to pursue the truth in these things and get away from the rhetoric. At the end of what I have to say today I'll go back to that theme of what we really need to do about, to address what I think is a big challenge actually. I have little to disagree with what Philip said and so I think we can have a very constructive discussion.

But I want to begin to say I don’t know whether we’ve quite framed the problem properly yet. We’re talking about 9 billion today and what for me, as an agriculturalist and we, you know, we use agricultural statistics and we know that the figure is actually probably 9.3 or 9.5 billion, projections at this point, 2050. But also that’s got a confidence interval around it. So while it might be 9, we shouldn’t kid ourselves, it also might be 10, and that’s just the people in this. The other thing we’ve got to think about this in whether it is 2 billion more people for dinner in 2050, or as I've just said, whether it is 3 billion more people for dinner in 2050, those people are going to want ... a significant portion of those people are going to want to eat something a bit different than rice. And they will assert their moral right to eat animal protein as we eat animal protein and is part of our society. So when you think about what the challenge is of the changing diets in the world, quite apart from population, you need to add, in broad terms and don’t quote me on this, about another billion on to that because when you change the diets and change from eating either noodles, you know, wheat as a food, or rice as food, or maize as a food, and put it through an animal, the best you’re going to do is about a two to one conversion ratio if you grow chickens and the worst you’re going to do, is if you want to grow red beef and eight to nine. So that’s where you have that extra challenge coming forward.

And that’s not over. There’s more. The other more is that the other part of this equation on the globe is energy, and sovereign nations adopt some rather skewed energy policies as the US has, to grow bio-fuels. And the reality is the first generation of bio-fuels is really using food crops. We call them first generation and that means you’re producing ethanol from either corn or wheat, probably not rice, or you’re producing bio-diesel from canola that could otherwise be part of a direct food chain. And of course as Tim began by saying, the food riots that occurred in the first food spike together with the GFC, the tortilla riots in Mexico, were really about the fact that a George Bush policy on bio-fuels had sucked with subsidies, 30% of the US corn crop into bio-fuels. And the price of food items like tortillas across the border in Mexico went through the roof. And of course there was riots in Italy about pasta as well. And then one could talk as we were talking last night, about the Arab Spring, which was actually begun by some food riots in Egypt about the price of bread. And it’s sort of interesting, without getting off this topic, having dinner with the British Chief Scientist last night, and he was saying, not that climate change is off the agenda, but food security is very clearly on the agenda, even for Great Britain.

So I'm saying to you, this is a challenge we have. It’s a challenge I think we should all be up with, because I think we can do it. But the thing that we must always remember in doing it is that we don’t want to leave a trail of destruction in the globe in feeding this sort of nine and a half billion individuals with a food demand in today’s terms that might be 10 to 11 billion. So, we can’t destroy the environment doing it because there is only one globe and only one habitable globe that we know about, and that’s our future.

So, putting that around that, and indeed the father of the Asian Green Revolution, a magnificent Indian called MS Swaminathan, and he told me a lovely story about the first application of, as Ella was talking about what we call the short straw wheats, in the Punjab, that they actually couldn’t believe how much wheat they grew. And the first year, the storage facilities were entirely inadequate so they sent all the kids home from school and filled up all the school houses – that was the first deal. So, let’s now just try and take that example which is part of my sort of incentive to become an agricultural researcher was born of the Green Revolution. I was sort of a post-grad student in the middle of the Green Revolution and in fact I would have joined the International Rice Research Institute if it had not been for martial law in the Philippines when I had a wife and two young kids who were all that keen to go there.

Let’s look at what happened. Ella has said, and this is a slide I've just thrown up and we don’t want to deal with it in detail – fundamentally we doubled the global world food production from 1960 to 1990, last century, through the application of the norum 2 gene which is the short straw in both rice and wheat. The application of fertilisers, the usage of fertiliser on the globe went from effectively 10,000 tons of nitrogen fertilisers to 100 million, and irrigation water, and as Ella has said, there was more land as we’re reflecting here but it was a fairly smallish amount, probably 10, 12% of land.

So that was the Green Revolution. Fabulously successful. So the question for us ... I'm an agricultural scientist technologist ... is, can we do it again? And how would we do it again? And that’s the real question today.

MS Swaminathan says, you know, it will be the next Greener Revolution. It’s no longer a Green Revolution – that’s really just water, nitrogen and good genetics. This one’s going to be more difficult. And why is it going to be more difficult? Well, looking here, there isn’t the land there. Basically as Ella has said, the land area is as it is in terms of our arable cropping on the globe. We might sneak a bit here, sneak a bit there, but we’ll lose some here, lose some there. And if you look at land use in the globe, fundamentally about 30% of the globe is forest, 30% of the globe is used by agriculture, and 30%, or about a third each, is either too dry, or too stony, or too cold to use for anything in this area.

So do we want to clear that 30% of forest to grow food on the globe? And I think there’s a resounding no, so I think we have to look at the paradigm now of how do we feed the globe using the land resources we currently have, currently are using? That leads you to an argument from us agriculturalists there are some nuances in that that Phil was talking very interestingly about, but it’s that nuance now of what the FAO are calling sustainable intensification. How do you move with this land to effectively double food production? We’ve either got to double food production or change our diets, or in other words, change that expectation of the animal protein we want to eat, or maybe tone down on bio-fuels which we all hope might happen.

So, the current prospects aren’t good. In the heyday of the Green Revolution, that thirty to forty years beginning in 1960, ending say ... the last forty years of the 20th century. The major cereal crops that sort of provide probably 70, 80% of the energy in the global diets, are boomed along at annual productivity increases that went somewhere between 2 to 3%. So every year, the yield globally of those food crops went up by 2 to 3%. If you look at this graph, this is the CGIR graph I've thrown up here now and I don’t want you to focus on it but basically what is happening since in the beginning of the 21st century, this first ten years of post-2000, those 2 to 3% annual productivity increases are now in the 1 to 1.5 range. And if you do, and I'm not going to show you the figures, but if you put together people, bio-fuels, change of diet and figure out how much food you need, what you come with in annual productivity increase that you’ve got to hit something like 2.5 to 2.8%. So fundamentally, what’s happening at present is, with the current investment in agricultural research, the current investment in people which Phil very wisely brought out, we’re doing about half what we need to do to feed the world by 2050. That’s where we are.

So what do we do about it? One of my, I should say colleagues, an economist Brian Fisher, used to head up ABARE for years, had a very simple economic view of the world and he would say, you know, if the price is right, even the roosters will lay. And I don’t think that’s true. And we had a lot of arguments about that. So I think the challenge of ... you know, I think we do need further investment, certainly, but we need more than just investment in this food and agricultural system, because I don’t know whether our current vehicles in there really have those productivity increases left in them. I mean, you never say never in science and technology, but I have some doubts.

Ella asked me to bring this back to home. Where are we in Australia? To make some comments at these end of these comments about where is Australia? Where do we fit in this? And Phil’s already made some comments that we’re hardly a food bowl of Asia nor will we be one. But we always have been an advanced agricultural country and indeed, many of my fellow colleagues actually did have quite a role in the international agricultural system and the Green Revolution. We contributed a lot of technology to the Green Revolution and a lot of human capacity to the Green Revolution. I just threw this thing up on the graph now which basically shows Australia is a food secure nation. The only area where we do import much more than we produce is seafood. And dairy products, but with dairy products, that’s just across the ditch. It’s not really a big import. And with the CR, we are the one country, or are we?

So we produce about enough food for 60 to 80 million people depending what diet you want to use, and we’re, you know, we’re only 20, 25 million, so we’re okay, so what role are we going to play in this? What role and where’s our social responsibility? Where’s our global responsibility? And how do we want to be seen in this? And how do our farmers actually want to operate? Because as Phil has said also, the Australian farmers aren’t all that rich either. Some of them are, but a lot aren’t.

So what are we going to do about, as we’ve seen already, Australia's biggest cotton farm is now owned by the Chinese. People are coming to Australia's shores to invest in our land. This is a paper by Derek Byerlee, actually, a colleague of mine who works for the World Bank. But showing that Australia, even though we probably don’t have a huge amount of land available for new arable land, we are an extremely attractive investment area. One is the land is not that dear yet. Two, we’ve got a very stable political system, give or take the last couple of years I suppose. Three, we have an advanced agriculture. So people want to invest here.

But we haven’t really had a good national debate about, how should they invest here? There’s some xenophobic stuff going on, well we shouldn’t have any foreigners here but yet we want to sell them our products under free trade, which doesn’t seem to fit. But we do need to have policies that make sense globally, make sense to us and make sense by having a clear vision of how do we want to play in this global food security argument, in the full knowledge that we’re not going to make a big impact with our own commodities. But, I think we can make a large impact in terms of the technologies in terms of the methodologies and in terms of the human capacity that we have to offer. And really just to finish, and talking about how we might do that. I guess my plea to this group is that, let’s try and put aside as we walk in to the room, now, the ideologies, the rhetoric and all get in the same vehicle and try and work on this global problem. But try and work in this global problem to make, you know, an Australian contribution which will be as much about knowledge, technology, as it will be about physical foodstuffs, in fact probably more I hope, and why I threw this slide up here is the Bt cotton example, which is always ... and I have great debates with my students about this ... you know, as you can see on your left there, is a crop killed by Helicoverpa the common bollworm, the crop on the right is a GM crop. But the crop on the left, or the crop on the right, could be an organic cotton crop, because if you bought, and you can buy, the Bt protein as a spray, you can buy it as a spray. If you sprayed that on your cotton crop and controlled Helicoverpa, because it is not a synthetic chemical, it’s a natural chemical, albeit it coming from a bacteria that Ella told you about, that would be organic cotton. But if you put the gene in the cotton crop, which means you don’t have the wastage of spraying it on the soils, spraying it everywhere else, it’s persona non grata to the organic movement.

So it seems to me that’s just an example of where we have got caught up with the rhetoric, caught up with the ideology, and really have forgotten what the goal is. And finally, Phil mentioned and I couldn’t be up here as a climate change person and not talk about it – the footprint of agriculture in greenhouse gas emissions is quite large. Phil’s right, somewhere between 25, 35% depending on whether you count the energy on it. So one of the other co-objectives in this is, that as we move forward in the technologies we develop, it’s not that we’re going to get rid of all greenhouse gas emissions from agriculture, we won’t do that. We need food. But we need to have a clear eye on what we develop and with a clear goal of decreasing the greenhouse gas intensity of the agricultural products we produce and this is one area where I think we can play a key role in the world. Getting into this argument, very quickly, about greenhouse gas intensity of the products rather than absolute greenhouse emissions, because the problem you come with absolute greenhouse emissions if you don’t try intensity, you say you’ve got to double food production means you’ve also got to double greenhouse gas and we’ve got to find a solution somewhere in there. So I'll leave it there Tim.

**Tim Costello**

Thank you.

So we’ve got a little under fifteen minutes before we finish. I'll just begin with a few questions and I've been very stimulated by what we’ve just heard, and I'm sure you’ve got some questions also that will allow a little bit of time. But let’s start where Ella started and Snow really finished. The charge often made by those who don’t believe in the science of climate change, or argue that it’s doubtful, is that people who believe in climate change are really almost religious, and they’re passionate. And there’s some identity issue going on here, whereas you’re making the point, those same groups actually are very suspicious of science when it comes to GM crops. How do we actually think our way through this issue? Is it just on evidence based alone and the energy zones around beliefs and natural are actually unhelpful? How do you unpack this?

**Elizabeth Finkel**

I think it’s very challenging. It’s something that exercises me a lot. So as an example – last year you might remember headlines all over the world, GM Corn Causes Cancer. With these pictures of rats with huge bulging breast tumours. And I saw these headlines and I thought, what is going on here? All the reports that have been coming out after fifteen years of doing study after study, and study aggregating the different studies, what you’re seeing is all the food safety authorities of the world coming out with recommendations saying, like the European Food Safety Authority, find one that’s more hard core than that. Saying that genetically modified crops are as safe as traditional crops. Traditional crops aint safe either. But what you do have, I mean, witness the deaths from organic bean sprouts, but where fifty people died in Germany last year from eating organic bean sprouts and thousands had severe kidney damage. But I digress.

The point is about GM crops is that unlike traditional crops, they have to go through this incredible safety testing. So nothing gets out there until it’s been run this incredible gauntlet that doesn’t exist for organic food, that doesn’t exist for traditional crops.

Anyway, so I see this headline and I think, what the hell is going on? It’s across all the major newspapers. And it seems to be in a bona fide scientific journal, Gilles Séralini, University of Caen, so all the criteria that I apply, a bona fide scientist, bona fide journal, peer review, well, gee this flies in the face of everything I've been reading. What do I do about this?

Then I started unpacking this story. And it’s staggering. So Gilles Séralini, first of all he did this deal with all the media outlets and said, you can only have a scoop to my story if you sign a confidentiality agreement. You’re not allowed to go and talk to any other independent expert. And that’s why he got 24 hours, free rein, on the media. He got ... the story got free go on Jon Faine, and there was no independent person to counter it.

Anyway, it’s very challenging for me. What do I do when bona fide scientists in a refereed journal disagree? And I think what you do, you do what the judge in the courtroom does. So the judge in the courtroom has to guide the jury. There may be conflicting evidence from experts and what you do is you say, okay, we’ll look at the calibre of the experts, we’ll look at what 90% of them say, and we’ll evaluate. Is this a fringe view or is this a majority view? Recognising that sometimes the fringe people come good. But at any particular moment, I think that’s the best we can do. Say this is what the majority of scientists are saying.

**Tim Costello**

So let me throw that to Snow, first.

**Snow Barlow**

I think we watch our language in the beginning Tim. I don’t talk about a belief in climate change. I talk about the science, a belief in the science of climate change, because I'm a scientist and to me, it’s about evaluating evidence. Now that’s just a language thing.

In order to try and get traction around, and just take an issue, which we all ... I think you need to work with communities to find, because I find there’s a basic goodness in people who want to address issues, but their frustration is often about ... you can’t tell them how to address, you know, how do you tell someone, change your light globe, when it’s the bloody great huge power station that’s the problem. So I think we’ve got to work with people to find a solution, you know, it works with us in the rural areas because we talk about how you’re going to adapt to climate change and they are also now talking about how they’re going to mitigate climate change. So you begin the discussion really around what can you do to this, both to help yourself, but also to help society? So to me, I think we need to have those discussions at all levels of society. We know there are people with vested interests who take the sceptic or denier’s point because of their vested interest. But to me, the evidence and the momentum will ultimately be overwhelming as we confront climate events, we confront the need to mitigate, and when that happens, we need to have things that people can do, otherwise you know, we lose the opportunity. It rains and everyone forgets about it.

**Tim Costello**

The dams are full again. Philip?

**Philip Keane**

Yeah, I think it gets back to an understanding of science and unfortunately in recent times in the public domain, science has suffered a little bit in credibility. And this is used against us in many respects. But you know, you’ve just got to go with the science and it’s the same with GM – it’s an amazing technology. I would never have believed it’s possible to chop up bits of DNA and stick them into other organisms and have them expressed. I mean, it’s incredible. But there’s a sense that there’s a distrust, a public distrust against it in a way, because it’s tinkering with the natural realm of things and some people say, well it’s just the same as we’ve doing in traditional plant breeding but it’s more than that. We are tinkering around with genomes and we’ve got to worry about viruses and so forth, which we don’t really understand where they’re coming from and that sort of thing.

But I think the science is just truly amazing and it may produce some remarkable new varieties that can tie into agriculture, but I think the other aspect of the science of what we’re talking about is to take a much broader view of how we’re going to produce more food. And that’s a lot more than just increasing productivity per hectare. It’s a lot to do with the whole structure of the economy. I mean some people will say that the world is awash with food now. It’s just that it’s not distributed well. It’s being fed to dogs and cats and pigs and cattle and bio-fuels and so forth.

So there’s a whole structural area there, so when you talk about using science and rationality, you’ve got to look at the broader picture. And there’s a feeling that the GM debate has sort of skewed that a bit. You know, that the concentration is on the hope for some miraculous cure for this problem, and it may eventuate. But in the meantime there’s a lot of very down to earth things that can be done to improve agriculture, for instance, in Africa, where a lot of the land is just not farmed properly for a variety of reasons, a lot of them economic. Farmers aren’t rewarded. And infrastructure – they just can’t sell the stuff. They can’t get it to town. Even in Papua New Guinea, there’s an incredible problem in just getting the food from farms down to the big towns, you know. So there’s a hell of a lot of other things that can be done around GM.

**Tim Costello**

Without waiting for the technological big bang. Let’s throw it open in the last five minutes. Down the front here.

**Fran Morell**

Thank you very much. I'm Fran Morell from *Madge* and I'd just like to say that in the biggest state in India, Maharashtra, last year, 40% of the GM cotton failed. That affected 5 million farmers. There was a two-year Indian parliamentary report into GM crops. It was incredibly thorough. It looked at the science and there’s some very amazing Indian scientists who have looked at this, and one of them specially completely, you know, showed how weak the safety studies are etc. Anyway, there has been scientists and farmers protesting against GM crops in India and as I said, there is a 40% failure of the GM crop, so this is a failing technology. Regarding feeding India, I ...

**Tim Costello**

Sorry, I'm chairing this. There’s another question over here. Absolutely taking ...

**Fran Morell**

But I just want to say, I have had to listen to a lot of misinformation around GM ...

**Tim Costello**

We’ve heard it. Thank you. Over here.

**Tim Carroll**

Tim Carroll, from Research Services. I was just interested in the panel’s comments. It struck me vividly when the Americans first started regulating GM crops, and I remember seeing the first 18 and three of those organisms on the list were tobacco. And I think one of the big global drivers against, I guess, food security in non-developing countries is the hunger and greed for animal-based proteins that can be seen as food wastage, is really the lack of social conscience and the free market economy. How do we get around that?

**Philip Keane**

Just on the Bt point. Yes, I mean, I've seen a Bt cotton crop crash in Indonesia because it was susceptible to something else, but I think that’s what’s going to happen is that science progresses in such a way that these things will be tested. Now maybe they’re implemented on a massive scale very early on because of the ... they’re used on big farms and that sort of thing. But that sort of problem will sort itself out I think when it’s tested on a wide scale, and we know in agriculture some technologies that are developed on research stations, when they’re tested on a very wide scale, then reveal problems. That happened with insecticides for instance.

**Muffled Question**

That’s basically different. Are you aware of the UN research into health of [inaudible]. It was a three year, four hundred scientists ...

**Tim Costello**

Let’s ask the question. The question, that’s fine. Are you guys aware of that?

**Question**

... which basically said to feed the world we need ...

**Tim Costello**

No, no, no, you’ve asked a question. Sorry. Let’s put it. Are you aware ...

**Philip Keane**

Just what did they say?

**Questioner**

Are you aware of the IAAST ... which basically said we need agro ecological [inaudible]

**Philip Keane**

Yeah, and that’s what I was talking about in my whole talk.

**Questioner**

It said there’s a negligible role for GM.

**Philip Keane**

I think GM can be part of it. I mean, why turn your back on remarkable science. And it’ll be tested. It’ll be like the pesticides.

**Elizabeth Finkel**

By all means. If it fails, that will be the end of it. Well, let’s see. You know, according to what you’ve said. If what you’ve said is true, we show see the end of GM cotton in India, and I don’t care. Let people be free to choose what they want.

**Tim Costello**

We’re not going to go into a debate. Chris, I think over here has got a question.

**Questioner**

... the Institute for Human Security here at La Trobe. I mean, clearly the problem of feeding the world is going to take science, it’s going to take political science, it’s going to take economics, it’s going to take a multi-disciplinary approach and it’s going to need new configurations of partnerships, universities, some NGOs, and others. How well does the panel think Australian universities are currently doing at building that multi-disciplinary understanding and building new configurations to address the problem.

**Philip Keane**

Well I think La Trobe has developed a research focus in agriculture, environment and water which is designed to bring a lot of those disciplines together. I agree with you, you need a multi-disciplinary approach. The problem is not just technical, it’s economic, it’s social. I mean the problem with our cocoa farmers, we’ve got very simple technical solutions but they just look at us and say, look, we can’t afford to do what you’re asking us to do.

**Tim Costello**

Snow?

**Snow Barlow**

I'll throw something back to you in that way. This is an area in which I've sort of grappled with for a long time. I agree. I don’t think we’re at variance at all on the need for multi-disciplinary approaches, the need for approaches to come on the ground. But the fundamental thing in terms of food production systems in Australian universities is, the Australian universities are not funded by the federal government to actually deliver solutions on the ground in agricultural extension. In the US there’s a thing known as the Hatch Act, that has significant funds run into every land managed institution in the United States, one in every state, that actually provides money to extend that out to the field. So we are stuck in this thing that, and John’s gone, but I don’t know what he would say, but our sort of promotion criteria, our KPIs in universities for academics are about international peer refereed publications. And because we don’t earn any money for taking that out, and whether it be in Sulawesi or whether it be in, you know, Horsham, it’s not part of the Australian system. And I think, you know, that’s something that a federal government could address.

**Philip Keane**

State government departments are increasingly getting out of that extension and research role. I mean, the money’s just not going into the sort of extension that you saw in the Turkey case, the Turkish case, where they’re just getting knowledge out to farmers to improve agriculture using current well-tried and tested methods. That’s a model for many of the third world countries, just to get farmers educated to apply the current best methods, and you would find an incredible increase in production.

**Snow Barlow**

It works both ways. In a sense you began by talking about this dearth of graduates in Australia, seven or eight hundred a year, which, you know, I'm part of that. And we know that the demand is somewhere like three to four thousand. But by getting the universities closer to the ground, close to the agricultural ground and being able to be supported to do that, I think you’ll get a greater flow of students into those agricultural courses, because they will see the universities active in that area, and what they can do. And they don’t all have to be bench, you know, gene technologists. Many of them will be operating on the ground in a multi-disciplinary way.

**Tim Costello**

A question over here.

**Questioner**

Hi. I was just wondering if the panel could speak to agriculture and food security in Africa. I understand the population might double by 2050 and given that, yeah, the developing world seems to be the main area where food security is an issue, and Africa as well seems to have, yeah, a lot of food security concerns. I was wondering if the panel could speak to that. Thanks.

**Tim Costello**

Who’d like to have a go?

**Snow Barlow**

Maybe you should Tim. You probably know more about Africa than we do.

**Tim Costello**

You make a start. I'll make a comment.

**Snow Barlow**

Good, good. Well, I can only really define the problem. Your position is right. There are large projected population increases. The other position is also right and Phil has referred to it, is that if you look, in the last thirty, forty years, the sort of yield increases per unit area that have happened in China, that have happened in India, that have happened in South America, they haven’t in Africa. So we don’t know, and this is where Tim might make a comment. We know that there are infrastructure problems, we know there are resources problems, and we know there are governance problems. So where do you begin?

**Philip Keane**

And the other thing we know is there’s a lot of fertile land there.

**Snow Barlow**

We saw that graph, that Bali paper. There’s a lot of land in sub-Saharan Africa that is perfectly suitable to produce food for those people.

**Tim Costello**

So, putting all that together, the *Economist* just did a twelve-page spread on Africa. I don’t know if you saw it. Really saying the world doesn’t know that Africa’s been growing at 7 to 8% GDP growth, the number of countries with a free press, greater transparency, haven’t eliminated corruption but greater governance, is the great hope for even an agricultural leap forward in Africa. Getting alignment around that and energy is actually what the Chinese are now seeing in Africa, massive leasing and investing because of their food security issues. So Africa I think is on the cusp of something good. We have said this before. But there is at least now some pre-conditions for a really significant leap forward.

We promised to finish at two and we’re well after. Maybe we’ll take one more question, so everyone at least gets a chance, well, not everyone. A few people do.

**Questioner**

Thank you. Climate change was mentioned by I think all the speakers, as one of the important issues. But climate scientists are talking a lot about the changing effect of the climate on where we can grow food and do everything else. And do the projections of the panel take that potentially massive change of food productive areas into account? Thank you.

**Snow Barlow**

I do. That’s an area that I work in and certainly there will be changes. You know, Australia, as we all know, doesn’t get a good card in climate change, because you know, it’s getting hotter and other nations and other continents have the capacity to move south. Well, you know, if you’re in Horsham, moving into Bass Strait is not a good option. And so, but, as areas open up, you know, as areas sort of get more harsher, other areas will open up in other continents. You know, if you go to South America the situation is different. And while nationally in Australia, you know, we’re looking at ... and I think we are ... I believe this, we are looking at a drier future, a drier hotter future in southern Australia, it’s not necessarily that there’s going to be ... there is the same amount of water running around the globe and it’s just a matter of where it hits. And so there will be challenges and the modelling at present says that there are basically swings and roundabouts and individual nations will have some emerging problems, and some actually will have quite a lot of opportunities.

**Tim Costello**

Winners and losers.

**Snow Barlow**

Yeah, there’ll be winners and losers. We shouldn’t look at it that way.

**Elizabeth Finkel**

I just wanted to make one very quick comment about the issue of Africa and one interesting thing that came in a conversation with Robert Zeigler who’s Director of the International Rice Research Institute when we were doing this exercise as imagining agriculture in the year 2063, so this recent issue of *Cosmos*. So he focused largely on India and when I asked him, well, what about Africa? And he said, ooh, all the things we’re working on, they’re just not going to apply, because, you know, I'm paraphrasing him, not perfectly, but the point is that India is population dense. You can have small farmers and if you change the land titling system, perhaps those small farmers can get the right to aggregate farms, women can get the right to own farms, and then they can start making viable businesses. Like this character we imagine, Prajeet, who lives in 2063. In Africa, you don’t have the population density, so it’s hard to imagine small farmers managing an agricultural revolution there.

**Tim Costello**

Yep. Thanks for that comment.

Well, look I might call it to a close. I think this has been very stimulating. The fact that the post-2015 Millennium Goals ... a lot of us are saying there needs to be a merging of the sustainability and the poverty goals. SDG, Sustainable Development Goals, otherwise we’ll have a long shopping list. The MDGs, because they were concrete, focusing on hunger, and reducing infant and mother mortality, actually made great strides. But, whether we can actually find a simple set of integrated goals, that’s really feeding the world and dealing with climate change. And that literally is the challenge before us.

I'm now going to invite Professor Robert Manne to just come and conclude. Thank you.

**Robert Manne**

I really just partly wanted to thank very sincerely everyone on the panel. I think it’s been incredibly interesting. It might be perhaps the second most important problem we’re facing, global warming is the first.

Anyhow, it’s been a wonderful panel. Can I say, one of the things this discussion has stimulated me to think, while listening to it is, we need a parallel discussion either later this year or perhaps next year, at this forum, on politics, economics, and the international relation aspect of this, because we actually were hoping to have someone from the Australian government who specialises in this area today, but I think it’s been so rich to have people looking at it from the point of view of agricultural science and so on, that it would be a good idea to later have a quite different dimension. I might even ask Tim to come back.

One thing I want to say is the idea of Ideas and Society and this panel has been a great exemplar of what I have in mind, in it, is to be able to discuss in public at some depth that you don’t have normally on television or in public forums – issues that really matter.

Anyhow, that’s a segue into ... I'm going to advertise two events that are coming up which we’re associated with and I hope all of you make an effort to come along. An evening event on May 21st, 5.30, we’re going to be discussing ... it’s essentially an Australian who’s played a very big role in the area of how we communicate ideas freely in the world, Julian Assange, and WikiLeaks, and we’re looking at the legal aspects of his plight, with Julian Burnside, the political aspirations with Greg Barnes and one of his great supporters will play the role that Tim’s played. Mary Kostakidis will be the participating Chair and I'll be discussing the philosophy of WikiLeaks and the idea of how that might play some role in solving the world’s problems through free communication.

And on June 7th, in the city, around about ... I think it’s starting to six, I think the single most important activist in the area of climate change is coming to Australia, a man called Bill McKibben and he’s going to be speaking at the Athenaeum Theatre and I'll be involved in that event, as will Adam Bandt, so I'd like to invite you all to come along and listen. Bill McKibben essentially at the moment is arguing that we have a budget for how much fossil fuel we can burn and that the rate we’re going about burning it, we’re imperilling essentially not so much the earth, which can put up with a lot, but the kind of earth that’s been friendly to human beings and other species. So I would invite you all if you can, not only to come along on June 7th at the Athenaeum Theatre, but to invite friends and companions to come along as well.

So anyhow, thank the panel very much.