



COMMONWEALTH OF AUSTRALIA

Official Committee Hansard

**HOUSE OF
REPRESENTATIVES**

STANDING COMMITTEE ON PRIMARY INDUSTRIES AND
RESOURCES

Reference: Assisting Australian farmers to adapt to climate change

WEDNESDAY, 1 JULY 2009

SYDNEY

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HOUSE OF REPRESENTATIVES
STANDING COMMITTEE ON PRIMARY INDUSTRIES AND RESOURCES

Wednesday, 1 July 2009

Members: Mr Adams (*Chair*), Mr Schultz (*Deputy Chair*), Mr Bidgood, Mr Champion, Mr Forrest, Mr Haase, Ms Livermore, Mr Perrett, Mr Sidebottom and Mr Windsor

Members in attendance: Mr Adams, Mr Schultz, Mr Sidebottom and Mr Windsor

Terms of reference for the inquiry:

To inquire into and report on:

- Current and prospective adaptations to the impacts of climate change on agriculture and the potential impacts on downstream processing.
- The role of government in:
 - augmenting the shift towards farming practices which promote resilience in the farm sector in the face of climate change;
 - promoting research, extension and training which assists the farm sector to better adapt to climate change.
- The role of rural research and development in assisting farmers to adapt to the impacts of climate change.

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Committee met at 10.24 am**GREGSON, Mr Andrew, Chief Executive Officer, New South Wales Irrigators Council****MOORE, Mr Mark, Policy Analyst, New South Wales Irrigators Council**

CHAIR (Mr Adams)—I declare open this public hearing of the House of Representatives Standing Committee on Primary Industries and Resources. We are inquiring into the role of government in assisting Australian farmers to adapt to the impacts of climate change. Today the committee will hear from the New South Wales Irrigators Council, Horticulture Australia Ltd, Horticulture Australia Council, New South Wales Department of Primary Industries, Nursery and Garden Australia, the School of Earth and Environmental Science at the University of Wollongong, and the University of New South Wales Climate Change Research Centre.

I welcome witnesses here today. I take on board your comments about getting a bit ‘submitted out’ but that is the way the democratic processes of our country go. Although the committee does not require you to give evidence under oath, I should advise that this hearing is a formal proceeding of the parliament and warrants the same respect as proceedings of the House. Giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. The committee has received your submission and has numbered it submission No. 30. I invite you to list any corrections or amendments you would like to make to that submission and then to make a brief introductory statement.

Mr Gregson—There are no corrections that need to be made to that submission at this stage. I will make a very brief opening statement. Thank you very much for the opportunity to address the committee today. We do greatly appreciate it. The New South Wales Irrigators Council is the peak body representing water access licence holders in New South Wales in both coastal and inland systems right across the commodities spectrum. We are in fact celebrating our 25th year this year. As I am sure you would appreciate, for a peak body to achieve that sort of longevity is in fact a feat in itself. We represent some 12,000 water access licence holders in this state.

As the committee would appreciate, irrigated agriculture is a very different beast to dryland agriculture. In particular, when talking about adapting to climate change—and, of course, drought support, which may become a factor in climate change—it is important to recognise what those differences are. In particular, irrigated agriculture is characterised by very high levels of capital investment and, as a result, a very high reliance on the availability of the water to put through those capital investments. The financial nature then of irrigated agriculture is quite different to the financial nature of dryland agriculture.

I have only half a dozen points to make before discussions commence, if that is all right with you, Mr Chair. The first of my points is in relation to the policy of consecutive Australian governments—and indeed of the current one—to treat the market as a mechanism to adapt not only to policy changes but also to climate change. Irrigators recognise the market as a mechanism to adapt to changes and are in fact in favour of it, having pushed the issue of water being recognised as a property right separate from land—which has now occurred.

We recognise that the market attempts to use move to the highest value uses, but at the same time we ask the committee to be mindful—and in fact the government to be mindful—of the fact

that that economic theory is fine if the market is allowed to operate. As I am sure you would appreciate, there are a range of barriers that exist within the water market right across Australia. Obviously at present much of the government's attention is focused on the Murray-Darling Basin—and of course a lot of our members are within that Murray-Darling Basin. We ask that you recognise that, whilst trade barriers exist, the market solution is far from perfect and those trade barriers need to be addressed if markets are to be the sole solution.

We would also ask the committee to be mindful of a very simple underlying mathematical equation—that is, the price of water equals the price of food. If policy to deal with climate change drives up the price of water, which is what we can see empirical evidence pointing towards at the moment, Australia needs to recognise that the price of its production—the price of its food and the price that it must pay—will indeed be higher. On behalf of our constituents, we would like to see some conscious effort on behalf of government to have the Australian population understand that. At the same time, it is not only the price of water that equals the price of food but also the availability of water. If water is to be removed or productive capacity is to be removed—particularly from irrigated agriculture—then the availability and of course the quality of the production that comes out of irrigated agriculture will necessarily be lower.

Talking specifically about drought support, our submission has highlighted the necessity for some targeted support. As I said when I commenced my statement, irrigated agriculture is a very different beast to dryland agriculture. We have maintained that, as we transition through a climate change policy environment, drought support policy needs to be targeted specifically at irrigated agriculture.

We are talking in particular about the fixed charges that irrigators face—not only to maintain their equipment and to finance their equipment but also the fixed charges they are required to pay on their water access licenses. We have asked government of all flavours to ensure that social and economic considerations are listed at least as importantly as environmental considerations in moving through a climate change environment. That of course is being seen at a cutting-edge level at the moment in the Murray-Darling Basin. We have asked that the social and economic considerations of the regions and communities that irrigated agriculture supports be given at least equal weighting in policy decisions as environmental considerations.

Finally, I would ask that a common notion of the Australian environment be set aside. There is a common notion that our river systems and indeed our farms operate in a similar fashion to the northern hemisphere—and in particular to where so many of our traditions, quaint as they may be, have come from. A river system in Australia is not like a river system in Europe—it does not flow deep and long and go forever; it does not start at one end and have the same amount come out at the other. Australia effectively exists in one of two states: drought or flood. From all the science that surrounds climate change, the suggestions are that those two events will simply become more severe—that is, droughts become more severe and potentially last longer but so do rainfall events. As a result, the very nature of irrigated agriculture is potentially one of the areas of agriculture which can grow in Australia. With a greater capacity to store water, the productivity of irrigated agriculture can remain at least where it is at the moment if not become high. We would ask that the committee keep that difference in mind in terms of Australian river systems.

Can I say, given that a third of the committee members here are from Tasmania and that I also am from Tasmania, while irrigated agriculture—

CHAIR—No need to apologise.

Mr Gregson—That certainly was not an apology. Given that Tasmania is headed towards an agricultural future in irrigation, we would ask that the committee pay very close attention to what is happening within New South Wales and in particular the Murray-Darling Basin. Tasmania is moving towards exactly that same future and these issues are likely to be raised across the states. This is not just all about the Murray-Darling Basin. That concludes my opening statement.

CHAIR—Thank you very much for that. I guess one of the issues that has come through to me over the years is the very matter that you raise—that is, Australia does not have pristine flowing mountain streams. In Tasmania we do have some of those but the inland water catchment basins are not like that. I think we have had a perception that has been a bit wrong. But we have had less water, especially over the last 10 or 12 years I think, and drought has affected everybody. Coming back to the infrastructure, we are interested in adaptation strategies et cetera. What are the new technologies and new infrastructure that could help with the impact of climate change on Australian irrigation farming? Where can government play a role in that?

There seems to be a move away from exceptional circumstances and drawing lines on maps. There seems to be a trend saying that we are all equal and if somebody gets into trouble then we will have a safety net for everybody, including farmers. So we will not let anyone starve but we have to find enterprise based solutions outside exceptional circumstances situations. So where do we go, in your view, in relation to government funding of enterprise based level funding to improve farmers' storage or improve their infrastructure and fit in with climate change policy?

Mr Gregson—There are two facets to that question. The first is in terms of assistance to maintain irrigated agriculture and the second is in terms of drought support for irrigated agriculture. I will address the first facet. There are effectively three elements to water use in irrigated agriculture—bulk storage, delivery and use on farm. Those latter two categories, the delivery and the use on farm, are currently the target of a range of government programs to allow for effective investment to increase the productivity of individual farms and also the delivery systems.

I can indicate that nationally irrigators are delighted that those schemes are now starting to roll out. We have been disappointed over how long it has all taken but we are very pleased to see them now rolling out. This is not necessarily about doing more with less, as some would have you believe. In our opinion, this is about doing more with the same amount. It is about maintaining the productivity of the farm. It is about producing the same amount whilst using less water, to allow that to be diverted to alternative uses, in particular environmental uses.

CHAIR—So the same productivity but with less water?

Mr Gregson—That is correct.

CHAIR—And the technology?

Mr Gregson—A lot of people would have you believe it is all about high levels of infrastructure and changing everything to drip irrigation and so on and so forth. That is not necessarily the most efficient operation depending on what it is that you are attempting to grow. What we are seeing is a much greater concentration on how water is used on an individual farmer's operation from monitoring soil moisture levels to research into the sort of moisture that plants need for optimum growth and so on and so forth. It is about realigning delivery systems to avoid seepage. It is about ensuring that on-farm storages are the most efficient that they can be. It is about looking at the operation as a whole and understanding where the water is being used and where it could be used more effectively. We are delighted that investment is occurring on the farm. We are delighted that it is occurring in the delivery systems. We would ask that consideration be given to both on-farm systems and delivery systems outside the Murray-Darling Basin. Whilst that is obviously a political hotspot, one that the government must focus on, there is also the opportunity for increased productivity outside of the basin and in particular, from our perspective, in the coastal regions of New South Wales.

A role of government as to those three facets—storage, delivery and on farm—is not so much a financial consideration as much as a policy position in terms of bulk storage. There needs to be a recognition that if climate change models are correct and rainfall events will be more severe then we need to be able to capture and hold that run-off for longer than we have done traditionally. As an example of this, with the Snowy Mountains, which feed the Murray and the Murrumbidgee and a range of other rivers, there is consideration at the moment of shutting down some of the smaller parts of the system, to return to wild rivers et cetera. From our perspective, that is utterly absurd. In particular I am talking about the Mowamba aqueduct, which is just below the Jindabyne dam wall on the Snowy River. There is a suggestion that that should be shut down. From our position, that makes no sense. It undermines what the entire Snowy system was about: capturing water and diverting it to the west for irrigation. As a matter of interest, power generation out of the Snowy was in fact a secondary consideration. To start shutting down storage options at a time when we need to be focusing on greater storage capacity is nothing short of absurd.

The second part of your question was about how drought support for individual farming operations ought to put together by government. We recognise that the exceptional circumstances model, as we noted to the Productivity Commission, is flawed. That is why we have asked for tailored support for irrigation activities. They are not the same as dryland activities in any way, shape or form. Irrigators are ideally equipped to survive the first portion of a drought. That is why they store water both on and off farm. But when an irrigation drought occurs—in this instance say two or three years into a natural drought—the impact is so much greater. That impact is not only in terms of zero revenue effectively. It is also in terms of massive outlays to maintain the asset base. The irrigators' asset base includes charges that are paid to state governments by way of fixed charges on their water access licences. The proportion of those fixed charges, despite our protestations, is likely to increase as the ACCC moves into the area of monitoring prices not only within the basin but by an opt-in provision right across states, and we understand that New South Wales will opt in. I hope that answers your question.

CHAIR—That was very good, thank you. Are you seeing any investment going into coastal areas where opportunities exist?

Mr Gregson—Yes. One of the key considerations in coastal areas is completely different to that in the rest of the country, being the population shift out of the major cities into some of those regional areas and, obviously, then there is competition for water resources. But at the same time there is significant production in those coastal areas but, unfortunately, the level of public investment has been minimal whilst the level of private investment has remained quite substantial particularly as to on-farm efficiency given the cost of the water resourcing.

CHAIR—Going back to Tasmania, I note that the University of Tasmania, through its farm at Cambridge, is doing quite a lot of work on pivots, and on where the water goes, with a lot of sensors. It is about new technology and using sensor technology to find out actually where the water ends up after it is put on a paddock.

Mr Gregson—You are exactly right: it is not just about the delivery efficiency; it is also about the usage and about monitoring what happens on farm. We are delighted that the Department of Agriculture, Fisheries and Forestry has recently agreed to fund a project that our council has been operating to share knowledge from individual farming operations right around Australia, so rather than having agronomists or the like telling farmers what to do this is farmers telling other farmers what they are doing.

CHAIR—I will let my colleagues take up questions, but this is exactly one of the things that we want to focus on: our farmers. There are a lot of farmers doing innovative things. It is about how we get the science to help them and how we get people on board to help the farmers who have got ideas and are doing things so that it is not a university-down thing but a shared thing through which people will need to write up the science that is being done by farmers.

Mr Gregson—Mark has been running the program I talked about through the New South Wales Irrigators Council. I will ask him to give us a quick idea of the feedback that we have received on that.

Mr Moore—The first program that we ran was excellent. We went to six different locations throughout New South Wales. The feedback that came from the farmers who were attending them was on the ability to listen to individuals who were actually trialling things on their farm or had successfully completed trials and had supporting data. Farmers were being advised of this information not in the sense of ‘this is what you should be doing’ but in the sense of ‘this is what I have been doing and it has worked so you might be able to take away some ideas and new innovative ways of looking at things that might assist you when you look at your operation’. There was 100 per cent positive feedback from it. We did not expect to receive that much. It was not a forced survey result. People came back and it was 100 per cent, and we have now had many follow-ups from people, individuals who participated in the program. Those people have been coming back to us and asking when we are going to operate the next one. So we are happy that we are now going to be able to do that and we have actually expanded it to nearly all of Australia. We are going to be going to Tasmania, Western Australia, South Australia, Victoria and Queensland.

CHAIR—That is great. Thank you, Mr Moore.

Mr Gregson—I suppose the key message from that is that farmers are very keen to listen to farmers.

Mr SIDEBOTTOM—I was interested in your earlier comments on the water market and on using the market mechanism. You were talking about a range of barriers, including trade ones. I note that on page 6 of your submission you say:

There are potentially significant impacts on agriculture—and irrigated agriculture in particular—due to increased levels of “forestry” in order to obtain carbon credits.

I am interested in arguments as to synergy between forestry and agriculture and of course the implications of that in terms of water: the use of water, the need for water and irrigation in particular. Maybe you might want to expand a little bit on the impacts of forestry on agriculture, specifically irrigated agriculture.

Mr Gregson—One of our greatest concerns with an increase in plantation forestry—and I think we can take it as a given that under an emissions trading scheme there will be an increase in plantation forestry; in fact, I think that is one of the aims of it—is that it tends to be focused on catchment areas. Obviously, plantation forests have a great demand for water in the same way that any plant will have a demand for water. The difference is that if it is in a catchment area there is no need for there to be a licence. There is necessarily no extraction going on from a surface or a groundwater system. The run-off in the catchment area is instead being diverted to plantation forestry. The result is that less water is available for licensed users downstream who are paying for their licences. So what we see happening is increased plantation forestry in catchments, less run-off and hence less water downstream, which is obviously a massive third party impact, one that the party causing that impact is not required to pay for in any way, shape or form. We would ask the government to consider policy responses as a result of that.

One of the other consequences that we see in terms of the definition of forestry is: what constitutes a forest? As we understood it from the green paper, plants as diverse as almonds and pecans, even some types of vines and orchards of all sorts are potentially considered to be forests and hence qualify for carbon credits. They are all permanent plantings. In New South Wales, in particular, we have recognised that there is a need for both permanent plantings and for annual cropping, and we have done that by splitting the type of water allocations, particularly in the basin, into both high- and general-security. High-security would generally be used on a permanent planting and general-security for annual cropping.

If through a policy mechanism we have given a preference for plants that need annual water—that need permanent water—then effectively we have had an impact on the market and all of a sudden have increased the amount of high-security water that is required. Obviously, that has some significant third-party impacts, not only in terms of the current growers but in terms of what it is that Australia grows. Do we want to design an emissions trading scheme that effectively asks people to plant almonds. It is one of the consequences that need to be thought through.

One of the other things that we would like to be considered in terms of the emissions trading scheme is that Australian soils are, as I am sure you are all aware, very low on carbon and carbon sequestration; it is something that we would like to see significant research done on to see how it can work on the farm and to give some encouragement to it through the emissions trading scheme.

CHAIR—We have had evidence to that effect—trade-offs in dairying and forestry and whole-farm planting and that sort of thing—but I think you are quite right to identify that it needs some more work in that area.

Mr Gregson—I think that some more work in terms of agriculture's role in the emissions trading scheme in general needs to be undertaken because, as it is at the moment with agriculture sitting outside the benefits but inside the costs, I do not think that agriculture has fared particularly well in that respect.

Mr WINDSOR—On this issue of the collision course between a food economy and a carbon economy, you have just highlighted a few of the points of conflict that are going to develop there. On the point you made in terms of forestry, even as recently as about 10 days ago the carbon pollution reduction legislation was in the lower house and there were amendments to the effect that it will actually encourage forestry as part of emissions reduction. The board of the Murray-Darling Basin Authority has just been put in place. Part of the mandatory content of the plan they have to put in place incorporates water interception. We think of that as an irrigator taking more than he is entitled to or putting up various banks or whatever. But has the Irrigators Council done any work in terms of the interception of water in various catchments that agroforestry could have on the end-of-valley caps that will be put in place under that plan?

Mr Gregson—Have we done any work directly? No, we have not. We do not have the capacity to do that, as a member funded organisation. We were instrumental in having a requirement of the authority to identify what the level of interceptions was likely to be. From our position, identifying the levels of interceptions, particularly from increased forestry operations—and I should say that we are not against increased forestry operations in any way shape or form; we are just noticing that they will be an impact on our sector—is only the first step in what needs to happen. That is currently where the authority will sit; they will identify what the interceptions are. What needs to happen after that is an assessment of what the impacts are from those increased interceptions and to understand how it is that those impacts can be offset. One of the things that we would like considered is a requirement for licensing of the water that is used by plantation forestry in particular. We are not saying that that is necessarily a solution, but it is time for a range of solutions to those third-party impacts to be investigated. Simply identifying what they are is only the first step.

Mr WINDSOR—The other question is adapting to so-called climate change or reduced run-off or whatever we want to call it. Lake Alexandrina and Lake Albert at the end of the Murray system, the evaporation rate on the surfaces of those two lakes is equivalent to the total amount of water the New South Wales cotton industry uses, for instance. Menindee Lakes in New South Wales if re-engineered could in fact create new water. I just ask for a comment on that. And a massive amount of evaporation takes place in on-farm storages as well. Has the Irrigators Council looked at below ground storage for water rather than above ground storage? I know the South Australians have done some work in terms of below ground storage. Has the Irrigators Council done any work on that? If so, what sort of water can we create, in a sense, through reduce evaporation?

Mr Gregson—The answer to your question is yes, we have done a little. The New South Wales government at the moment is working on an aquifer reinjection policy. Obviously that has some potentially severe consequences in terms of water quality, so we want to ensure that

aquifer reinjection is not in fact destroying the aquifer as it is prior to that reinjection. That is particularly important in mining operations, as I am sure you would be only too well aware. The Menindee Lakes, yes, they most certainly can and should be more efficient. We are aware that funds exist to enable that to occur. We are frustrated by the delay in getting on with that. Prior to the last 12 months obviously those lakes were on the verge of dry, which would have been an ideal opportunity to engage in those engineering works. There is now some water in them, which has made that a little more difficult, but there is still time to get on with it.

In terms of the Lower Lakes, I am delighted to say that we represent irrigators in New South Wales and they are in South Australia. We do not currently have a position in terms of the way that the Lower Lakes should be managed. Our position is that each state has a share of water resources and ought to be left to allocate those water resources as that state sees fit. Of course, the entitlements under that are tradable across particularly the southern basin.

In terms of increasing efficiency of storages, we would support any moves to contemplate any options that are available. That might be something as simple as splitting a ring tank in half to minimise the amount of surface area that is on it when it is half full. It might be in terms of aquifer reinjection, depending on where the aquifer is, what it does and what the rules would be around re-extraction to ensure that third-party impacts are limited. But the way in which Australia stores water generally needs to be considered in terms of efficiencies because we are losing an awful lot in evaporation. It is not only in the Lower Lakes, it includes as far away as the Snowy Mountains, where last year run-off was limited because the snow pack evaporated. There have to be some further options to look at to ensure that run-offs and storage are as efficient as delivery and use.

CHAIR—That is those gone back into the system, I guess, so there was an environmental gain.

Mr Moore—Excuse me, I have to go back to the office.

CHAIR—I have got a couple of questions. You talked about alternative funding models in research and training. Do you have a view on R&D corporations, how they are going? Also, how is the CRC into irrigation futures et cetera assisting farmers?

Mr Gregson—We are concerned at an emerging flaw in the funding model for research and development, which is on a dollar for dollar basis, industry levies then matched by government funds. What it means is that when production is at a low ebb as it is at the moment after consecutive years of drought then government funding also reaches exactly the same low ebb, which means that those research institutions have now faced consecutive years of low resources. Most of them are based in rural and regional areas where it is difficult to attract staff in the first place and nearly impossible to retain them if you do not have funds in the second place. Once you take staff out of those places, particularly highly qualified staff, not only do you lose the work that they have been doing and not complete the projects that they had been working on, it is very hard to get it restarted when they recognise if you go back into another drought cycle you lose it. So the funding of research and development needs to be, in our opinion, looked at to even out those peaks and troughs. There is enough uncertainty in agriculture as is. To then have institutional peaks and troughs as well that could be evened out is not a difficult policy response and is one that we would encourage.

CHAIR—And the CRC on irrigation futures?

Mr Gregson—We are aware that there are a number of research institutions not only across commodities but also directly related to irrigation, and we have our full support behind all of them.

CHAIR—It is a bit like state treasurers realising that GST is great when the economy is booming but when it is in a downturn—

Mr Gregson—It is not so good.

CHAIR—you have to cut the cloth a little wide. Thank you very much for your submission. Your submission touches on the way we govern Australia, with state governments having the power over water and land, the Commonwealth's role et cetera. That gets frustrating for us, but it is all pushing and shoving and public debate and discussion. Thank you very much; we appreciate it.

Mr Gregson—Thanks very much for the opportunity to speak with you. It is greatly appreciated. If you need to have a hearing in Tasmania in the future, do not hesitate to let us know and, if we can provide any assistance in speaking to people or viewing sites in New South Wales, do not hesitate to ask.

CHAIR—Thank you very much.

Proceedings suspended from 10.56 am to 11.11 am

NEWTON, Ms Kris, Chief Executive Officer, Horticulture Australia Council

TURNBULL, Ms Alison Karina, Natural Resources and Climate Manager, Horticulture Australia Limited

CHAIR—Welcome. Do you have any comments to make on the capacity in which you appear?

Ms Turnbull—I am the Natural Resources and Climate Manager for Horticulture Australia Limited, which is the rural research and development corporation for horticulture.

Ms Newton—I am the CEO of Horticulture Australia Council, which is the peak national body representing the horticultural industries.

CHAIR—Thank you very much for your submission. Although the committee does not require you to give evidence under oath, I would advise you that this hearing is a formal proceeding of the parliament and warrants the same respect as proceedings of the House. Giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. The committee has received the Horticulture Australia Limited and Horticulture Australia Council submission as No. 62. If there are any corrections or amendments that you would like to make, you can do so.

Ms Turnbull—No.

CHAIR—You might like to make a brief statement or overview of your mission, and I am sure we have some questions for you. Is that okay?

Ms Newton—That is fine; thank you.

Ms Turnbull—Thank you for the opportunity to come here today and for being able to put in that submission. It is a joint submission from HAL and HAC on behalf of the horticulture members that we represent. Horticulture Australia members are the peak industry bodies for the horticulture industry, and we implement the research priorities on behalf of those peak industry bodies. The submission that we made goes into detail on the impacts of climate change on horticulture and, as we have gone into the detail, it has shown that there will be impacts for the horticulture industry. The feeling from the industry is that we are already feeling those impacts, they will be ongoing and they will actually increase over time. The adaptation measures that we have been implementing to date mainly equate to practice change and efficiencies, but obviously there will be a limit to how many of those efficiencies we will be able to implement. As such, we would like to try and work with government on implementing further research to improve those efficiencies over time.

Some of the potential adaptation responses that we provided were: crop management, including timing of plantings; variety selection, such as for heat tolerance; water management, for on-farm storage and efficiency; site selection, for providing spatial climatic modelling for industries; new technologies, such as shade nettings; looking at the incidence of pest and

diseases and understanding how those incidences will change over time; looking at elevated CO₂ and the effect that that can have on water and nutrient requirements for plants; looking at consumer behaviour and options for flexible marketing strategies for industry; integrating knowledge and experience, trying to identify the gap between science and growers on-farm; risk management, trying to look at farm management practices and environmental management practices on-farm; and improved seasonal forecasting and tools for industry. So what we are trying to look at is really both a proactive and a reactive strategy to address adaptation.

The other strategies that Horticulture Australia is trying to implement on the research side are to do with mitigation and awareness and communication. We also think that they should go hand in hand with adaptation. On mitigation, we suggested that there were opportunities for looking at carbon footprinting. While we acknowledge that the horticulture industry is a low emitter compared to other agriculture industries, it still needs to be better understood what those emissions are. As I mentioned, there is the opportunity for on-farm improvements to mitigate emissions and potential to look at renewable energies and ongoing measurement of those emissions. The final one was awareness and communication. As I mentioned, there is a need to bridge the gap between the science of climate change and what can actually happen in practice.

CHAIR—Ms Newton?

Ms Newton—That is fine. We are happy to answer questions if you wish.

CHAIR—Thank you, and thank you for your submission. One of the things you have just touched on is your carbon footprint as an industry. I guess energy is a pretty big one, pumps and things like that, so solar and wind could play a bigger role. Maybe you could comment on that. And the issue of pests and biosecurity challenges, if you have views in that area and the way we need to look at that, we are certainly interested in that as well. You have touched on some of the measures that you thought could take us in a new direction facing up to climate change. I do not know how much science we have got in some of those. There is a lot of work being done in the plants we grow, where we will go in the future, which areas we will do that in. The north and the south are looking better than some other areas possibly. We will have debates and discussions about that. New South Wales seems to be in the middle. I would really appreciate any comments on those.

Ms Newton—I am happy to lead off. On the issue of energy, can I take you back to one of your earlier comments, which is carbon footprinting for horticulture. I wish it was that easy. You are probably aware that we have got well over a hundred different commodities within horticulture and the requirements for a strawberry versus a mango versus an almond and the micro climates, the soil types, the natural rainfall, the irrigation requirements and so on are as diverse as you would expect under all those circumstances. Having said that, we are working as an industry to support an initiative by the vegetable industry, and specifically Houston's Farms in Tasmania, working on a carbon footprinting for green leafy vegetables. They are attempting to analyse their entire both supply chain and life cycle, because that is a big issue for our industry. Taking an individual snapshot at a point in time to give a plus two or a minus three figure is not particularly helpful when you are actually talking about the full cycle of any of our horticultural crops. So there is no one size fits all.

However, we are hoping that future research can take the Houston's Farms model, and they are doing very intensive research sponsored with international benchmarking and major research institutions, to get this as wide as we possibly can, delving into every detail of their operations. We are hoping that that can at least be spread to other ground crops within horticulture. The next stage will be the permanent plantings, the trees, vines and so on, which will have completely different requirements in some respects although some of the issues in the supply chain—transport to market and those sorts of things, and power, which you raised, energy consumption—will be similar. Obviously horticultural growers are keen to reduce their energy consumption because the margins for horticulture certainly and probably most of agriculture are generally very tight. We are price takers, not price makers, and that means that, given that labour is approximately 50 per cent of the input costs for horticulture, any savings that can be made are obviously pursued with some vigour.

There are experiments around. You may be aware of the work that is being done by Growcom in Queensland on the banana car; it uses on-site, on-farm microgeneration of biofuels to power vehicles on the farm, transport to market, energy production and so on. It uses banana waste and green banana waste. So we are looking at the whole range, whether it is solar, thermal or whatever. The difficulty is that all that does is reduce the costs to the growers. It will not impact significantly on the carbon footprint.

That takes us back to the central issues that horticulture faces, which is that whether we are included in the CPRS or not, for example, we will still have those increased input costs. Because our footprint, as Alison stated, is marginal we are not expecting to be able to mitigate, significantly, most of those greenhouse gas emissions. As Alison has already stated, some of the work that has been done to date has been in the mitigation and adaptation arena. To give you an example, in fertigation—I do not know if you are familiar with that process in horticulture—most of the progressive horticulture growers now do triple irrigation and the fertilizer is actually included in a micrometered, drop by drop amount into the irrigation, which is why it is called fertigation. So there is no flying over with small planes and dropping great loads of nitrogen fertilizer. But, as Alison pointed out, once all of horticulture moves wherever possible to in-line drip fertigation for permanent plantings and so on, any additional measures are going to be very much at the margins; there is not a lot of extra increases in efficiency, given known technology, that growers can actually make beyond the point of moving to that new technology, which many of them have already done over the last 10 to 15 years. So the prospects for adaptation and mitigation at that level are actually quite small.

To move on—

CHAIR—Can I just raise with you the issue of adaptation and emissions reduction. Maybe that is some of the science, and I think we are going to have a lot of science in horticulture looking at where we can go—other plants, other products that could be grown et cetera. Maybe there is a gap there. I think agriculture is looking from a perspective of what we have at the moment without looking at what might emerge and what might come forward. Would you think that would be—

Ms Newton—We certainly require more research in that area. However, having said that, Australia's range of climates is enormous. If you are going to grow lettuce, for example, you need different cultivars to cope with a slightly cooler climate than with a slightly warmer and

wetter climate and with the different the pests and diseases that might impact on those. You might need to go to greenhouse, hydroponics or whatever it might be to mitigate frost or what have you.

CHAIR—You talked about waste to fuels. Maybe government could play a role in this to mitigate some of the input costs in this area.

Ms Newton—Certainly. If you can use the green waste that comes off production, mostly of food, there is a nice life cycle. Using that to reduce fuel is a nice, tit-for-tat arrangement where everyone benefits, including the environment.

Ms Turnbull—There are actually a number of industries that are keen to look into that. The macadamia industry, in regeneration of husks—

Ms Newton—Biochar is a good example.

Ms Turnbull—is one example. But currently Horticulture Australia do not have projects in that area. So I would say that is quite a good opportunity to look at.

CHAIR—For where government and industry could work together?

Ms Turnbull—Yes, definitely.

Ms Newton—Absolutely.

CHAIR—And research in the local areas will overcome what we have to do.

Ms Newton—Yes.

Mr WINDSOR—You mentioned hydroponic vegetable production. In my electorate, we have a tomato production greenhouse where they are using coal in a furnace to provide the heat, energy et cetera, but they are actually capturing the carbon from that process and reinjecting it into the greenhouse. Are there other people turning what we might see as an issue, a problem, a negative, into a positive in your industries?

Ms Newton—Certainly—as I understand it, in some of the large greenhouse operations in particular. We are aware that, to a certain threshold, increased CO₂ in the atmosphere when horticultural crops are growing is actually of benefit. The difficulty is that we are not sure what happens past that threshold if carbon emissions keep on increasing and the general atmosphere saturation of carbon dioxide increases beyond what is acceptable to horticultural plantings. That is another area of research that we desperately need. As is pointed out in the submission, probably the most critical factor for horticulture is temperature. There are tipping points for our hundred or so various commodities—and of course they vary from commodity to commodity—in terms of the capacity of the plant to cope with the new environment that it finds itself in. Much more research needs to be done from our various industries' points of view to determine what they might be.

Mr WINDSOR—You mentioned right at the start that climate change was an issue. What is the issue? Is the issue the impact of an emissions trading scheme—that we currently do not have but that we may have—or is the issue really about the climate changing?

Ms Turnbull—I think with the horticulture industry it is the urgency of the issue that is the problem at the moment. They have been adapting over time and they have been improving efficiencies over time, but all of a sudden there is this big jump in expectation and information. There is both overload and need for information, so there are those two gaps that are happening. But the industry also is getting quite frustrated because climate change can be happening obviously at all different levels and the issue that we have is that we are getting global information that is driving the media and government to act, but the tailored, relevant information for them to actually make a change on farm is not there for them yet. The issue is the gap between what they are perceiving and being told by the media all the way down to ‘What can I do to my farm and what does it mean to me?’ Unfortunately we do not have an answer for everybody at the moment. We do not have that bridging of the gap between, as I mentioned, the science and the happenings on farm. So it is more that issue at the moment. They are able to adapt to incremental change; it is those scary long-term big jumps that are the concern.

Ms Newton—To give you an example: after we made the submission, our industry was dealing simultaneously earlier this year with four or five major natural disasters which were clearly the result of some kind of climate variability. These are becoming more extreme, more frequent and more unpredictable. I do not need to tell anybody about the bushfires in Victoria earlier. We also had cyclones in Far North Queensland, followed by major flooding down the Queensland and Northern New South Wales coasts. We had the ongoing irrigation drought in the Murray-Darling Basin and at the same time we had a 10-day extreme event of heat wave—heatstroke, effectively—that impacted on the productivity and the actual produce itself of most of our growers in southern Australia, right across all of the forms.

I guess the answer to your direct question ‘Is it more the actual impact of climate change itself or is it the impact of the CPRS?’ is that it is both. Probably at the moment it is more the former, because the latter is a hypothetical at this point, not a fact. But the reality is that both of those, along with all of the other regulatory changes and so forth in the environment, have an impact on the viability of a horticultural business—where it is sited, what the climate is, what you know about the modelling of the microclimate in your region and how you can then adapt to that. All of those impact on the physical viability of the business, but there is also the financial viability of the business that impacts as well.

That is our concern with the CPRS, because it will have an impact on our people, whether we are included or not. I find it difficult to think of any one of our horticultural businesses who would actually be meeting the current threshold for the CPRS to be required to have permits, but they will still have to pay increased bill costs, increased energy costs and so on. In that regard, Mr Adams was talking earlier about the potential for on-site energy generation and so on, which is certainly being taken up by some growers.

Mr WINDSOR—Fertigation was not a response to nitrous oxide in the atmosphere, was it? It was a response to some business pressures and the operation of a better business into the future.

Ms Newton—Absolutely.

Mr WINDSOR—But I think it is a good example of where you can actually be more competitive and more environmentally sensitive as well.

Ms Newton—At the same time.

Ms Turnbull—Actually, one of the comments in the submission was about how much investment we have made to date into research for the horticulture industry, which is about \$18.8 million. A lot of that is related to that exact issue. It is efficiencies, it is competitiveness, it is efficient use of resources, probably not with a climate change focus but definitely with a win-win focus. That has been one of the key drivers to date for the horticulture industry in terms of practice change.

Mr SIDEBOTTOM—Going on from Tony's interesting fertigation example is adaptation to climate change. You keep talking in your submission about offering incentives rather than regulation. I would just like to explore that a bit more, both as a principle and how that works. It is apart from necessarily looking at handouts; it is a relationship thing. And then there are the barriers to adaptation you think currently exist in your industry. Would you like to comment on that a bit more? I found it interesting in your submission.

Ms Turnbull—The first point is incentives versus legislation. As we have mentioned before, the practice change that has been implemented to date has been mainly out of a business decision, and the horticulture industry is focused on improving the environmental credentials of the industry—do not get me wrong, by any means. But I guess it is one of those industries where it has been making changes. There is the potential for further innovation. The use of technologies is quite high. I do not think that there is a horticulture industry that would not be looking at further opportunities to implement further efficiencies available to them. So I think incentives are a good opportunity to improve that and to actually get adaptation and adoption of those best practices that are currently available.

Ms Newton—Can I follow that up with two examples. One is the farm management system developed out of Queensland by Growcom and Queensland Farmers Federation. It is currently being rolled out nationally by one of our industries, the Nursing and Gardening Industry, through their EcoHort accreditation program. It is essentially a risk management tool, and it can be done on any topic. The topics that have been done to date have tended to be around the natural resource management environmental credentials area, but it could be used for anything. What it does is assist a grower to identify where there are potential risks or liabilities for their industry on that particular topic of interest. You talked earlier about the difference between the stick, regulation, versus the carrot. Here is a classic example. Businesses around all of the horticultural growers in Queensland have been trialled for the last couple of years, as I understand it. Certainly it has now rolled out nationally for nursery and garden. Rather than governments forcing people to do something because it is in legislation or part of regulation, this is a way for growers to identify how to improve their own business viability and long-term profitability by plugging gaps or meeting requirements. It also offers the possibility, through a similar system, to look at, say, fresh care or the organics accreditation system for third-party auditing. So you can have independent third-party auditors. You might want to use that for, say, carbon footprinting your business to see where your potential risks are. That might be a requirement of the supermarkets, it might be to make your product more desirable to consumers in a marketing niche, it might demonstrate your good environmental credentials—it might be for a whole range

of drivers. There might be a range of reasons you might want to do that. But you could accurately measure your carbon footprint, for example, and have that accredited at a third-party level.

That takes us back to, for example, the CPRS. One of the issues that the agricultural industries in general are concerned about is one of the complementary measures. If the CPRS is not going to be the most effective way to get behaviour change in horticulture—which it will not be—what is an alternative measure that we could use? We think an alternative measure could be best management practice—and here is one example that is already alive and kicking that could be utilised, in our view—right across agriculture, if necessary, to identify for the grower where the benefits are, where the carrot is, in making those changes on-farm, benchmarked and audited if necessary. There is a model there that could potentially be used.

Ms Turnbull—The other question you had, Mr Sidebottom, was about the barriers to adaptation. I had a bit of a think while Kris was going through that, so I will answer that. There is currently a bit of a feeling of inertia because of the focus there has been on the policy front and the overload, but not relevance, of information for the industry. They are feeling overwhelmed. They often come to Kris and me and go to their peak industry bodies wanting information about how they can respond, what it means for them and what the long-term lag times are, and there is just no tailored information for them ready to go. It will take a bit of time for that information to come about. That is one of the potential barriers.

Another is the lack of capacity in the industry. Because it is such a diverse and big industry and goes across almost every region in Australia, that could potentially impact on the adoption of adaptation. Kris mentioned a really good program, the Farm Management Systems. I think there is an opportunity to go through existing programs and networks to influence that capacity and address that gap.

The other thing, and it has been touched on, is the lack of information and understanding within the horticulture industry of the impacts at a regional and commodity level, and also the forecasting opportunities that there are for the industry and what that equates to in a risk management approach—how they can link it to the rest of their business as well. I do not think I am giving all the answers, but there is quite a number of barriers that could be there already.

Ms Newton—Another example in terms of barriers is that insurance is a huge risk for our industry. There was a major series of hailstorms, from before Christmas in 2006 to early 2007, right up and down the east coast of Australia. Some of the hailstorms were so severe that all but one, I understand, of the existing hail structures collapsed. That meant that people either could not afford or were not allowed to access commercial insurance—the insurers considered that their risk was too high. I know that many of our industries, the apple and pear industry included, are currently working on taking the one product that did actually survive and adapting that to a range of circumstances. But, as you would appreciate, protective cover for one reason or another is a major issue for us—whether that is wind protection, sun protection, evapotranspiration protection, hail protection, frost protection, bird protection or flying fox protection.

It may well be that some significant investment—and that might be a co-investment by government and industry, not just individual industries in their own little pots but the broader industry as a whole—could eventuate in some kind of protection that might cover some, or

indeed all, of those levels of protection that are required. In addition to that, something that government could do—and we put this in our submission—is to assist with encouraging commercial entities to offer insurance protection if all of the appropriate measures are in place for our people, because it is a huge business risk. With the climate variability of the last few years, no-one in horticulture is in any doubt that these are increasingly severe and unpredictable events. Some partnership—even if it were government underwriting some commercial entities—once we were assured that the research outcome was predictable in terms of its capacity to cope with those events, would be a huge step forward. That is a barrier that currently exists for many of our growers.

Ms Turnbull—I have one more point there. One mention within the submission was about the linkages and collaboration that we are able to have with other RDCs in this area. That includes Land and Water Australia, which obviously will finish up very shortly. One of the main avenues through which we have been able to get collaboration in climate research is the Climate Change Research Strategy for Primary Industries, CCRSPI. One of the areas of uncertainty—we are unsure of where to go to, I suppose, and unsure what the next couple of years will divulge—is how we can link in with collaborative programs like that going forward. That is causing concern for Horticulture Australia in particular, because we have relied on collaborative approaches to date.

Horticulture Australia is a bit different to the other RDCs in that we focus our investment through commodities. We have a small across-industry program—and I really do want to emphasise ‘small’—for the size of the industry, but the majority of research projects are commodity specific. So our real opportunity, we saw, for getting collaborative approaches to, for example, looking at the impact of the CPRS or some of the seasonal forecasting tools that are available was through programs that Land and Water Australia managed, such as the Managing Climate Variability Program and CCRSPI. So the uncertainty there is obviously of concern to us, because that was one of our main avenues for learning from other agricultural industries and putting in our research needs.

CHAIR—I think things will emerge there to give you the opportunity of seeing where you will go. This committee took evidence from Land and Water Australia, but there has been a bit of a change in policy direction with them finishing up. But I think other things will emerge.

I just want to take up your system about insurance based risk management finding better decision making and more information for decision making. I guess all enterprises have those problems—and they are business decisions from the enterprise level—but in Australia agriculture has grappled with that for a long time and we have not come up with anything. I understand that the Canadians have a system which works in broadacre farming et cetera, but they do not have exceptional circumstances—which we are going away from. People are looking at that to find that. There is a lot of work going on in forecasting and where the models of climate change are taking us. There is a lot of money being spent in that area to try to find those management tools at the enterprise level. Are you aware of that?

Ms Turnbull—As I mentioned, we have got linkages with the Managing Climate Variability Program. But historically we have not invested a lot into forecasting, because of what I mentioned previously—that it is commodity-specific funding. As the manager of the natural resources and climate portfolio for six years, I know that only in the last three years have we

invested in climate-specific projects. We have not currently put any funding into forecasting, but we did have collaboration with the Managing Climate Variability Program to look at opportunities for transferring tools that were developed in other agricultural industries for horticulture. They were identified. I am not sure if you are aware of the WATL, Water and the Land, system. That is one that has been identified that could be useful for horticulture, but we have just not gone down that path yet. If there is opportunity for co-investment in that, that would be great.

CHAIR—I want to ask about R&D corporations and how the system works. Small industries have some difficulty with the bulk of money that we have available. Do you have any comments on that?

Ms Newton—It certainly has been difficult. As Alison has explained, the structure of HAL is effectively 44 different buckets, if I can phrase it that way. So apple, pear and banana have their own bucket, and it goes down to zucchinis with their own bucket. That effectively means that each of those industries has tended to focus, understandably, on those aspects which are of interest to them, which is excellent, and there has been some work done on those commodity-specific temperature tipping points and water use efficiency requirements and so on.

The downside, as Alison has indicated, is that the capacity to collaborate across those commodity boundaries has not really been tested to date and the across-industry program has a very small amount of money compared to the capacity of the industry overall. That has been a barrier for the industry to move forward. Certainly Alison's intent is to use, for example, that Houston farm's work and to then see if we can piggyback other industries' work on top of that so that we can get a better picture of what it might be like for other ground crops or, for that matter, for permanent plantings, if that is appropriate. It has been an issue for our industry; there is no question.

CHAIR—It has emerged as an issue for you in Horticulture Australia—to really get that collaboration where we are getting a focus on that. This committee did quite a big report on the honey bee industry, as you know. The bee is an insect, we think, but the issues of science between the insect, the plants and who falls in between—getting that collaboration—is a significant matter which has not really been dealt with, and we still have not dealt with it from a pollination-industry point of view. So we still have a long way to go in that area.

Ms Newton—That illustrates exactly the sorts of issues that we have within the current model of funding for research and development within our industry.

Ms Turnbull—And from my experience, we have been able to get really significant collaboration through co-investment with Australian government. So, for example, I have worked with the Caring for our Country program and before that the EMS pathways program to develop environmental practice guidelines for the industry. That was obviously put in with the industry as the first major step in addressing EMS across the industry and was really successful. So with that co-investment we have been able to achieve things, but we would not have done that without it. We would have had individual, commodity-specific practices but they would not have been able to be cross-cutting.

CHAIR—Maybe that lays down some beginning for where we could start going.

Ms Newton—Absolutely. We believe so.

Mr WINDSOR—You might take this question on notice. Given that horticulturalists tend to have smaller areas and generally look after their soils pretty well, has there been any attention paid to the accumulation of soil carbon, humus, organic matter over time—growth or changes in soil?

Ms Turnbull—Not historically. The vegetable industry has done an about-face and has come back to look at soil research again, which seems to be what has happened to all the rest of the industries. The reason we focus on the vegetable industry is that they have got a much bigger investment portfolio because they do collaborate in their own area. Taking them collaboratively, they are actually Horticulture Australia's biggest member. So they often have more discretionary funds and they often put money into things like climate change, which other industries do not jump on quite as quickly. But they have been really keen on looking at the soil health side of things. One of the things that they identified in a recent project is looking at the parameters of soil health. They identified that carbon was one thing in that whole picture, and the next step is how they can extend that research to look at issues of accumulation. We have not previously looked at that specifically.

Ms Newton—There is certainly some real interest in the industry, ranging from work that originally came out of the cane industry in Northern Queensland and a collaboration between the banana industry there and the cane folk for the reef rescue plan, which you are probably aware of, in terms of soil nutrient run-off. Some fascinating research was done around the normal application of nitrogen and its interaction with microbes in the soil. What they have discovered, if I can put this crudely and briefly, is that at the higher levels of nitrogen application you actually kill off the soil microbes. I forget what the normal application is, so I will say 100 kilos per hectare. What nobody ever looked at was zero to 50 kilos per hectare, and at that level you actually got productivity levels as good as or better than the levels you got at the normal application of 150 to 200 kilos per hectare. So, in addition to reducing cost, which is a big imperative for our people, we have also reduced nutrient run-off and it has actually improved soil health. There is real interest in biochar, there is real interest in humus. Many of our people, with permanent plantings, will do grass or sorghum or whatever it might be down the centre of rows. They will mulch down the sides of the irrigation pipes and so on. But not enough research is being done across all of the 100-plus different commodities to see whether there are synergies between ground crops versus permanent planting, for example, even at that crude level.

CHAIR—So there is an opportunity in the science area—

Ms Newton—Potentially. But, again, as Alison has pointed out, that would need to be at the level of collaboration with other agricultural industries and partnership with government to achieve.

CHAIR—Soil health is certainly emerging as one of those issues, along with accumulation of carbon in the soils and where we go with that.

Ms Newton—Can I raise one other issue that you mentioned earlier in your comments about pests and diseases and their ranges. It is a real concern for us. I do not know how many of you are familiar with fruit fly, but it is probably Australia's biggest horticultural pest and we have our

own unique variety of fruit fly called Q fly, which is of major interest to most of our importing countries and indeed domestically. So it is potentially one of the biggest threats to trade that we currently have, whether that is domestic or export earnings. We are aware that the range of fruit fly—I think there are 243 different varieties of fruit fly—will change. There is no question. What we do not know is exactly what their potential range is in terms of temperatures, humidity, hosts and so forth. So Plant Health Australia is equally interested in this issue, for fairly obvious reasons. There is much more research that needs to be done. It is all very well to talk about moving a particular product north or south or whatever it might be, but there are a whole range of other issues that go with that other than just climate and water.

CHAIR—Thank you very much. We do appreciate it. We will send you a copy of the transcript. Thank you very much for your attendance and for your submission.

[11.53 am]

DAVENPORT, Mr Scott, Chief Economist, Department of Primary Industries, New South Wales

YOUNG, Mr Robert Thomas, Director, Climate and Water Research, Department of Primary Industries, New South Wales

CHAIR—Welcome. Do you have any comment to make on the capacity in which you appear today?

Mr Davenport—The department we are with is soon to be known as the Department of Industry and Investment.

CHAIR—I wish you well in your new roles with your new superdepartment. I thank your minister for the submission and your department's work. We really do appreciate it. Every state government is on board with this. We hope to bring down a report which will be useful to everybody.

Although the committee does not require you to give evidence under oath, I should advise that this hearing is a formal proceeding of the parliament and warrants the same respect as proceedings of the House. Giving false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. The committee has received the submission from the New South Wales Department of Primary Industries as submission 68. If you have any corrections or amendments, you can make them if you wish. I know it was a little while ago when you made the submission. You might like to make a brief statement, and then I am sure we have some questions that we would like to ask you on the submission.

Mr Davenport—Thank you, Chair. I would also like to thank the committee for this opportunity to talk directly to you in relation to our submission to the inquiry. As previously stated, the submission was prepared by the former Department of Primary Industries, which is now the newly formed Department of Industry and Investment. That submission was prepared on behalf of the New South Wales Minister for Primary Industries, the Hon. Ian Macdonald. Rather than simply reiterate the content of our submission, I would like to take the opportunity to emphasise some key, overarching themes that we have put forward. Mr Robert Young will in turn expand on some of those if that is appropriate.

In talking about the issue of market failure, which is critical to this inquiry, obviously it is important for us to be very clear about the role of government in assisting farmers to adapt to climate change. The market failure rationale underpinning the role of government in this area is apparent. It is useful, for example, to consider the range of values that the broader community now attaches to the farm sector. As well as being an important income, export revenue and employment generator, the sector is increasingly being recognised as a source of significant community, environmental and amenity values. Farmers therefore occupy the unique and increasingly challenging position of managing what we might refer to as the public-private interface of natural resource management over much of the state. There is a clear expectation and support for our farming businesses not only making a strong economic contribution but that they will do so in a manner that takes into account the broader environmental and community

concerns. Helping farmers respond to those public expectations clearly presents a compelling case for government involvement.

A further point relevant to the role of government in relation to this issue is the integral role that high-quality government information and advisory services play in efficient whole-of-government responses to instances of market failure. By facilitating, for example, private behavioural change, these services minimise the need for more blunt, and often less efficient, forms of intervention.

In addition to the market failure issues and the respective roles of state and Commonwealth governments and industry, there are a number of complexities associated with adaptation to climate change. These include the need to achieve an appropriate balance between responses to climate change, responses to short- and medium-term climate variability as well as farmer responses and adaptation to the range of other factors that otherwise influence the sustainability and profitability of our farm businesses.

Let me quickly turn to the CPRS. A further important yet complicating factor raised in our submission in relation to climate change is that the viability of adaptation strategies available to farmers may well be heavily influenced by the policy settings associated with the proposed CPRS. For example, while the agricultural sector will no doubt need to contribute to emissions reductions, it is also the case that, the higher the CPRS related costs imposed on the sector, the greater the adaptation task will be. An important consideration in terms of adaptation will therefore be the extent to which the CRPS offers mitigation options sensitive to the individual circumstances of our farm businesses. It is also apparent that adaptation strategies will need to consider their implications for emissions and that a farming systems approach may well be the appropriate vehicle to manage emissions and adaptation responses.

Let me briefly comment on RD&E coordination among stakeholders. This point—one which Rob will expand on—is that, given the importance of the issue of climate change adaptation to farmers, regional communities and the broader public and given some of the complicating factors discussed, the role of government in this area is one that necessarily will require an ongoing, highly focused and coordinated RD&E partnership across government and with industry.

While governments have responded quickly to put climate strategies in place, this is an issue where changing policy settings and information needs will require highly responsive government RD&E priority-setting processes. The issue is also one that warrants long-term effort by government, and therefore a strategy that builds necessary expertise and capacity within Commonwealth, state and territory agencies is essential. Clearly adaptation strategy development will be an iterative process needing to be done in close association with industry, and therefore state agencies are ideally placed to undertake this particular role for government.

In conclusion can I say that the New South Wales department of Industry and Investment is extremely supportive of the focus of the inquiry and the work of the committee and therefore welcomes the opportunity to be of any further assistance. Reflecting that importance, let me table a recent action plan developed by the former DPI. That action plan developed in March identifies four focus areas, those being climate variability, water, biodiversity and land use planning. Under the climate variability action plan, we have a remit that is virtually exactly the

same as the focus of your inquiry, which was primary industries adapting to climate change. Thank you. I refer you to Rob Young.

CHAIR—Thank you very much for that.

Mr Young—I would just like to expand on Scott's comments in relation to the ongoing coordination of R&D effort. I think that is important not only among research providers but also linking that to farmers in terms of getting adoption of those outcomes. While there are a number of high-level research priorities, I guess a good example is the broadscale climate modelling where you need a very focused response. I strongly support the initiative between CSIRO and the Bureau of Meteorology through the Centre for Australian Weather and Climate Research, or CAWCR. I think that is a great initiative.

A lot of the adaptive responses by landholders will be largely systems based. We heard a fair bit about that in the previous discussion, with Horticulture Australia. That is typically the area where state agencies have done a lot of work in the past. I am arguing that I think state agencies need to be a critical part of that integrated RD&E framework.

You might be aware that the Primary Industries Ministerial Council has endorsed a national RD&E framework for primary industries. That framework facilitates RD&E across various primary industry sectors and it establishes a process where there would be a 'lead, participate and link' approach by the various players within RD&E. The Primaries Industries Standing Committee identified back in 2007 that climate change was probably one of the most important issues that they wanted that group to come to grips with, so they asked for that strategy to be developed in climate change first up. We did that through the group that Horticulture Australia also referred to, which is the Climate Change Research Strategy for Primary Industries, or CCRSPI. Back in 2007 CCRSPI developed a strategy for primary industries. I should say that CCRSPI folds in all of the state departments of primary industries, the CSIRO, all of the rural RDCs and the Council of Deans of Agriculture at the universities.

CHAIR—It would be a big meeting!

Mr Young—It is a fairly big meeting. I am on the steering committee for that group, and we have been getting together virtually monthly up until now, which I guess leads me to the issue that Horticulture Australia also raised—that CCRSPI was hosted by Land and Water Australia and we are a little unsure about where that is going to go following the demise of Land and Water Australia yesterday. I know there is some activity underway through PISC and through the council of RDCs to try and develop a way forward. The point I would like to make there is that I think we need an approach that gets the RDCs and state agencies at the table rather than perhaps just a very insulated approach—'insulated' is not the right word, but I think we need a broader, expansive integrated approach, if you like.

The other thing that is particularly relevant for the inquiry today is that CCRSPI in fact also put up a bid under the National Climate Change Adaptation Research Facility, and as you are probably aware NCCARF has nodes that deal with medical research infrastructure; there is a whole range of bids or groups within that. Primary industries were successful in getting up a bid called the 'primary industries adaptation research facility', which was announced by Minister Wong a couple of months ago. The head of that group is Melbourne University's Professor Snow

Barlow. But, again, the secretariat's support for that bid was to be run by Land and Water Australia. So there is another issue there where we are left wondering how that is going to proceed. I have recently been advised that in fact the Department of Climate Change has decided not to proceed with the Adaptation Research Network for Primary Industries and later this week they are going to call for bids to host a new centre for primary industries adaptation research as part of the NCCARF network. So I am a little perplexed about why some of those decisions were made and how we might move forward in terms of trying to pull the various players together within primary industries there.

CHAIR—Was some of that looking at food and health?

Mr Young—Yes, certainly looking at food. The CCRSPI strategy has developed a broad strategy for how primary industries as a whole should respond, and over the last 12 months we have been developing sectoral strategies for how each of the sectors—cotton, rice, et cetera—could get into more detailed work. We have had a number of those. I think the workshop for cotton is on in July—later this month.

CHAIR—Thank you for that. You answered some of the questions I wanted to ask you about interstate research and cooperation and collaboration. That sounds like a big body. You are going into different areas. You feel that there needs to be some sort of body to coordinate the collaboration between the states and the Commonwealth and other agencies you identify.

Mr Young—Yes.

CHAIR—There are some new ones emerging in the met bureau and the CSIRO, especially in water. I think some of the \$460 million has come back to the states to allow them to go where we want to go in that area. I would be interested in what you think is needed in that collaborative process.

Mr Young—Do you mean in terms of structures or specific activities?

CHAIR—I think I would like to deal with structures

Mr Young—I guess we were a fan of the CCRSPI structure itself because it got all the players around the table—the state agencies, the CSIRO and all of the rural RDCs. A structure like that that brings most of the players to the table is useful. Now that Land and Water is gone, how we develop a strategy to move forward from that is where we are at at the moment. That might be finding another logical host for that structure, like RIRDC or a more generic RDC, if you like, rather than an industry specific one. That might be one option to move forward. I know DAFF are currently considering whether they want to host that facility. I guess I am saying I am quite comfortable in terms of who hosts it; the key thing is that people actually get to have a say in how it operates.

CHAIR—Sure. But you are happy with how things are going at the moment, bringing in the university, the deans?

Mr Young—I am delighted. In fact, we took the initiative to fold the universities into that arrangement through the Council of Deans of Agriculture, as I said. They have been a very good contributor to that.

CHAIR—Over the years the ag departments have taken some new directions, as the private sector has emerged into agriculture at the state level. This is probably another way of us looking in new directions in dealing with the climate change imperative.

Mr Young—Yes.

Mr WINDSOR—I have a question about the impact on the atmosphere of legumes and nitrous oxide. We are being told that the application of nitrogenous fertilisers, with leakage into the atmosphere, has a more significant impact than carbon or methane. What about legumes? Have we got any evidence to suggest that legumes are as bad as a nitrogenous fertiliser badly applied? Where do they fit in terms of the scale?

Mr Young—There are a couple of issues here. The first one is just the amount of energy that goes into producing nitrogenous fertiliser. The latest information that I saw on that was from the CSIRO, which suggested that you are releasing five tonnes of CO₂ in manufacture, transport and utilisation for every tonne of nitrogen fertiliser that you are applying. So it is quite emissions intensive to produce. Legumes give you a major advantage there because they are organically generating nitrogen from the atmosphere themselves. That is a major advantage.

In terms of release of nitrogen from the farming system, I understand there is not much difference between whether the nitrogen is generated from legumes or artificial fertilisers, except that the release of the nitrogen from legumes is more likely to occur over time. It will occur more gradually, and that might better match the uptake requirements of plants. I do not have any more specific information, but I could take that on notice if you wanted me to get back to you with more information on that.

Mr WINDSOR—If you could. There is another issue I want to ask about. Recently in Canberra we talked to a plant breeder from Western Australia—he was not at this committee, but I think some of the members of this committee might have met with him—who was looking at methane and had developed a legume with high tannin levels in the leaf and better leaf drop-off than lucerne. The tannin levels were such that, for a ruminant animal that ate the plant, there was a 25 per cent reduction in methane emissions. Is New South Wales DPI doing any similar sort of work in how we counter some of these potential problems with methane?

Mr Young—Yes, we are. We have some of Australia's leading researchers on methane emissions in livestock. In fact, Roger Hegarty at Armidale and some of his colleagues up there are probably leading Australian research on this issue. We received approximately \$1.6 million of DAFF funds in the recent round of funding that they announced earlier this year, through our collaborative partners the University of New England.

You may be aware that we have established a collaborative research arrangement called the Primary Industries Innovation Centre with the University of New England. We have a number of similar collaborative partnerships with other universities. We received \$1.6 million through that arrangement from DAFF, to undertake research on how we might reduce methane emissions

from ruminant livestock. That research again is part of a national collaborative program, so different groups around Australia are doing different components of that. Meat and Livestock Australia are also integral to it.

Our parts of the program are to look at the genetic capacity of both cattle and sheep, through breeding, to reduce methane emissions and to look at feeding strategies and ruminant manipulation as options to reduce methane emissions. That is the area that Roger Hegarty is working on in particular.

To give you some examples, there is about a 20 per cent difference between high-emitting methane livestock and low-emitting methane livestock just because of their genetics. Methane is a net loss to the system, if you like. If you can stop that methane emission you could convert that into wool or meat or milk or whatever. It is a deadweight loss. If we can improve the adoption of the livestock that are predisposed to low-methane emissions—sheep, goats et cetera—there are significant gains. In the area that you specifically mentioned, which was tannins in legumes, yes, we recognise there are a number of options—and not just in legumes. There are a number of shrubs as well that have high tannins with the capacity to reduce methane emissions from livestock. We are also looking at a range of rumen additives and a number of other factors. Fundamentally, our research is looking at what the level of emissions is at the moment. On the document that Scott just handed around there is probably a picture of a cow with a little cylinder on its back. It has a methane-capturing device near its nostrils.

CHAIR—Part of the research—okay.

Mr Young—I have probably gone into that a little bit too much.

Mr WINDSOR—Would it be possible to follow that up a little bit? I know this is a theoretical question, in a sense: if you have an advantage through having a legume to produce nitrogen in the system through the production process, and even if it was neutral in terms of the farm process, what is the percentage of the problem that is fixed in relation to that? And if you have this methane effect as well, what would that mean in that production system? And what if you add the value of it being a better legume than lucerne in its productive capacity? We are just trying to get some concept of where all this leads. The current concept out there is that farmers believe that the emissions debate for agriculture is all bad, that it is all negative—it will come on in a certain year and through compliance costs et cetera there is going to be a double whammy—and we are major emitters. Some of the things we are hearing suggest that (a) we might be able to turn some of these emissions into a positive and (b) there is work being done that reduces the level of the problem from 16 per cent to maybe eight per cent—and we have not even started yet. That is one example. I am just trying to get a bit of an idea conceptually of what it could mean if you applied that tannin—I do not know whether it is low or high—

Mr Young—High tannin.

Mr WINDSOR—If you applied that high-tannin plant to a production system and it worked, what impact could that have on this total equation? I am not asking for an answer now, but you might be able to think about it.

Mr Young—I can get back to you with some more data on that. Essentially you are asking: what is the net impact on a farming system in terms of its emissions profile if you adopt the range of options that we have? Is that right?

Mr WINDSOR—Yes.

Mr Davenport—I would like to make a comment on that. One of the options we need to consider is whether there are technologies already available or technologies at the margin that might give us the very things that you are talking about—that is, sustainable and profitable outcomes. Certainly strategically, when you look at CPRS policy, it would be a great shame if we did not exploit those things before we started throwing more heavy-handed regulation at the rest of it. It is really about focused extension, and you would have to say that R&D certainly has some potential to reduce that 16 per cent and avoid the transaction costs associated with a CPRS.

Mr Young—I might just add that a lot of the technologies that we are looking at at the moment are more prospective than very hard. We are still very much in the early days of going down that path. I do not want to leave you with the message that we have the solutions now and we can fix it; but we are heading down paths that will, hopefully, lead us to those outcomes. To reiterate my earlier point, that work is being done in an internationally collaborative sense. We are working with colleagues in New Zealand and the US, for example, on methane abatement from ruminant livestock. The need for collaboration needs to be highlighted again.

Mr WINDSOR—Yes, that is a good point to make because the figures are out there at the moment—22 per cent for wool, 20 per cent for beef et cetera—without any adaptation or emissions trade-offs. People are looking at those figures, and you get headlines such as ‘\$80 a beast to be grown out’ and that sort of thing. It is early days and it is hard to have views come in other than those we are talking about now. Some people are very positive, and a lot of people who have given us submissions, farming communities, are really moving in a good direction, but if there is anything you could suggest to us that is happening New South Wales, we would be very happy to take that as evidence.

Mr Young—There are a couple of specific things I would like to mention. To follow up that question from Tony, I would like to mention the farm gas calculator. That is a whole-farm greenhouse gas calculator that is actually linked to the department’s gross margin budgets, which are on the web. We have developed that with funding from the Department of Climate Change, I think, rather than DAFF, through the Australian Farm Institute. They were funded to deliver it and they contracted us to develop the program. Some of Scott’s people prepared that, and it has been done for a little while now. I understand that there are a few issues with the web based modelling, so it is not yet up on the AFI website, but if you go to the AFI website you will see it mentioned. It says: ‘Coming soon’. That is one example of the work that we have been doing.

CHAIR—I will look forward to that.

Mr Davenport—Perhaps I could butt in there quickly. Obviously, it is at the early stages, but it is a little bit exciting. In terms of awareness, people can know where they are and they can manipulate the model for their own enterprises just to get a feel for how significant those footprint changes can be on a farm. As a follow-up to my earlier comment to Tony, this is something that can be further developed. We are going to have a very focused workshop

program on that. It is something that I think is very important, and I am sure that there are lots of other information initiatives. We need to get out there and make sure that we are exploiting those privately profitable options without having to go further.

Mr SIDEBOTTOM—I notice in your recommendation 3 that you are looking at Commonwealth funding for your life cycle assessment program. I was pretty interested in that because I see this as part of that. Can you take us through it a little bit more—what you believe is the importance of the mitigation and adaptation side to agriculture as it is inevitably coming to 2015.

Mr Young—Life cycle assessment is more a methodology for how you can get an overall picture of the carbon footprint of an activity from cradle to grave. It would include, for example, the issue that I mentioned earlier of how much CO₂ is embodied in a tonne of nitrogen fertiliser, how much is included in the transport to get it, how much diesel you would burn on farm while you are applying it, how much is lost from the system and carrying the produce to market, and then disposing of the waste products at the end of it. So it is that cradle to grave concept of adding up the range of emissions at every step of the way.

We submitted a project to the DAFF funding round that did not get up through the Rural Industries Research and Development Corporation. They are the leading RDC on this life cycle assessment process. The RMIT in Melbourne is probably the university that is most advanced with this process. There is a national initiative called the AusLCI initiative—LCI stands for life cycle inventory. That is a process where the whole range of industries, everything from manufacturing to primary industries, have developed a framework for how you should undertake a life cycle assessment, and they are now trying to collect data from a range of different industries around Australia to populate their database. That would then be accessible by everyone for collecting information. You can imagine that Woolworths or Coles, or whoever in the future, might want to use the black footprint that have been seen on some of the European marketing options. The process would provide a database so that that sort of thing could be implemented. We have a project where we are trying to develop a life cycle assessment for the key agricultural industries in New South Wales at the moment. We have quite a bit of expertise through our forestry research group, who did a lot of this work under the old CRC for Greenhouse Accounting. They are now working with our agriculture people to develop the framework so that we can populate it with data from key agricultural systems in New South Wales.

CHAIR—Would this be what our officials are talking to the world group about for what we take to Copenhagen?

Mr Young—I do not know that there is too much debate still around life cycle assessment methodology. An ISO standard has been developed in Europe which essentially outlines the methodology behind life cycle assessment.

CHAIR—That would support Europe; it would not support us.

Mr Young—Anything developed by the Europeans supports Europe. Essentially, the methodology is the thing. It is an approach for how you go about counting emissions from every sector.

CHAIR—It is a tool.

Mr Young—Yes, it is a tool.

Mr WINDSOR—Does it include the export of carbon—for instance, the starch in wheat?

Mr Young—I could not answer that question off the top of my head.

Mr WINDSOR—Conceptually, again, if the globe starts to adopt this sort of thing, we will be an exporter of carbon in some of our grains. If there is a cost to that, who pays for it? If it is the farmer, will that drive land use away from food, biofuels, forestry and other land use that has a positive carbon footprint rather than a negative one?

Mr Young—There is a huge debate in the Copenhagen negotiations at the moment around where the liability lies for emissions. We have had this debate with coal as well, and Australia is pushing the perspective that the country that imports and actually burns the coal is responsible for those emissions rather than the country that exports it. Depending on how that debate pans out, presumably the same thing would apply to food or wool or other agricultural commodities. But it is a significant debate that needs to be had. How that pans out will have a major impact on Australian agriculture.

CHAIR—Yes, these debates do merge, don't they? My understanding is that food and carbon miles were really a marketing exercise in Europe or England to give somebody an advantage. Maybe that is starting to peter out now.

Mr Young—I think that maybe the food miles issue has been discredited for some time now. It was a marketing strategy, I think by the Europeans, who were trying to argue against the imports of butter and milk and whatnot from New Zealand. The New Zealanders did quite a lot of work on that to say that the greenhouse gas emissions from one very large ship carting lamb to Europe were actually much less than the emissions from those very intensive housed systems that they had. The whole life cycle assessment approach is designed to overcome some of the difficulties in that earlier work.

CHAIR—Thank you very much for your submission and thank you for your presence.

Mr Young—I just want to add one more thing before I go. We have talked a lot about mitigation rather than adaptation. I did not want to get into too much detail about the adaptation issues because, as I think you highlighted to the previous speakers, New South Wales is a very complex system. We are at the interaction of climate zones and there is a huge difference in our soil types et cetera. With the range of systems we have in the New South Wales we probably face much greater challenges in adaptation than most of the other states.

I want to table a bit of information about a project that we are doing that is designed to provide estimates of some of the future climate modelling and what that actually means for different agricultural enterprises and different regions within New South Wales. I have just handed out a single page and I apologise for the pictures on it as they are a little bit small because they are just downscaled copies of a PowerPoint presentation. I think the challenge with global circulation models, which are the 23-odd large models that are used to project what is

likely to happen to the future in Australia, is that they are very broad scale. The pixels within that are 300 kilometres by 300 kilometres and it is very difficult for people to get a good understanding of what that actually means for them. So we have developed a model here that actually takes the global circulation models and links them to historic Bureau of Meteorology data for New South Wales. The global circulation models, for example, ignore topography and all those sorts of things. So people, whether they are at Orange or Tamworth or wherever, do not really understand what it means for them.

The historical record of climate gives us a pretty good picture of what the key climate parameters are for them. So what we have done in the top left hand corner of the document I am showing you is develop a model that takes the output from global circulation model data from the existing models—DPI is not undertaking global circulation modelling; it is a huge job that is CSIRO's and the Bureau of Meteorology's—and linking it to historical climate data so that we can actually provide some maps that give people a bit of a better idea of what is likely to happen in their local area. The really neat thing about that is that you can pick some of the key phenological phases in the different crops or pastures that you are looking at. For most temperate crops, for example, 28 degrees Celsius is a fairly important number because you start to get a decline in production over that—I am generalising here because there is a lot of variability, but generally 28 degrees is the magic number. On the three bottom graphs on the document I am showing you, going from the top left, across the page and then down—

CHAIR—You said that 28 is the key, is two degrees Celsius another key? Once you get below two degrees, is that another minimum?

Mr Young—Yes, that is another minimum.

CHAIR—Things get a bit messy with frosts and it starts to affect productivity and production.

Mr Young—Yes, that is right. There are a number of key climate parameters that will influence the performance of a range of crops and pastures and even livestock in terms of heat stress et cetera. If you can find out what some of the key triggers are for those, you can then use the projections to work out what is going to happen to those key triggers in future and that will give you an idea for how your industry is likely to perform and whether it is likely to need to move to higher altitudes, or to the east or west or whatever.

CHAIR—Or how it is going to affect that region.

Mr Young—Yes.

Mr WINDSOR—As an example, can you tell us what is going to happen to Tamworth? These guys are going to be there tomorrow so I wanted to know whether to take a coat or not.

Mr Young—If you were coming to Orange, where we are from, I would strongly suggest that you bring a coat, but I think you might be okay at Tamworth.

Following that through, the graph that I have given you shows the number of days on which the temperature was over 28 degrees Celsius and how that is likely to change from the current scenario, which is on the middle left, to 2050, which is on the middle right, and then to 2100, which is on the bottom left. You can see that the very high frequency of days that occurred in the top north-west corner of the state start to migrate south and east. The dotted line that you might

be able to vaguely make out is the wheat production zone of New South Wales, coarsely speaking. You can see that there will be much larger areas of New South Wales that will face a larger number of days over 29 degrees Celsius given the current climate projections.

I hasten to add that we probably have a lot more precision here than what we have in reality. We get precision from the historic bureau of meteorology data, but the climate projections again are still on this 300 by 300 kilometre grid cell. So what we are looking for, I guess, is that the fairly large investment the Commonwealth government is putting into the Bureau of Meteorology and CSIRO will develop much finer scale resolution data that we can then feed into this. Over time that will progressively produce better results for industry to try to—

CHAIR—Make the decisions.

Mr Young—Yes, make decisions. It is really a decision tool for industries to say, ‘There are issues here for us. We need to develop crops that are more heat tolerant or what have you,’ so that will then guide their future investment decisions in R&D.

CHAIR—It is about the tools for enterprise decision making, and governments can play a role in getting that stuff together.

Mr Davenport—Just one final point of information for the committee: you no doubt have had much representation about the CPRS; we have raised it in our own submission. So I would like to quickly update you on where some of those agricultural policy developments are. You will probably be aware that there is something called the work program for agriculture, which the Commonwealth has in place. It was mentioned in the white paper. Its task was to look at complementary measures and alternative policy settings pre the 2013 decision. That work program for agriculture is moving ahead now and a very recent development is the formation of what is referred to as the technical options working group. The Commonwealth and industry are essentially going to look at alternative coverage options for agriculture. An issues paper will be released later in the year that will go to public consultation. Also, importantly from our perspective, my minister and his Victorian counterpart are also doing a study on alternative coverage options to the CPRS. Through the high-level officers group on climate change mitigation and adaptation, we are looking to feed some of that alternative policy work into the Commonwealth’s process. So I think that is pretty positive.

CHAIR—It is terrific to see collaboration while we are trying to deal with this enormous issue as a nation. That is how we will have to use our resources. Thank you very much for your submission and your appearance today.

Mr Young—Thank you for the invitation.

CHAIR—Mr Sidebottom, would you move that the documents presented by the New South Wales Department of Primary Industries be accepted as an exhibit to the inquiry and included in the committee’s records.

Mr SIDEBOTTOM—I so move.

CHAIR—There being no objection, it is carried.

Proceedings suspended from 12.38 pm to 1.34 pm

KACHENKO, Dr Anthony George, Environmental and Technical Policy Manager, Nursery and Garden Industry Australia

CHAIR—Although the committee does not require you to give evidence under oath I should advise you that this hearing is a formal proceeding of the parliament and warrants the same respect as proceedings of the House. Giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. The committee has received your submission from Nursery and Garden Industry Australia—our submission No. 37. Are there any corrections or amendments you would like to make to that?

Dr Kachenko—No, I do not have any.

CHAIR—Would you like to make a brief statement on your submission and then I am sure there are some questions that the committee has for you.

Dr Kachenko—I would like to convey my thanks to the committee for enabling me to attending this hearing today and present Nursery and Garden Industry Australia's position. I should make mention at this point that we support and fully endorse the submission that you heard this morning from the Horticulture Australia Council and Horticulture Australia Ltd. Although we endorse their submission, as a non-edible industry, we feel that there are certain needs and areas that justify the separate submission before you today. For example, at the farm gate we produce a living, photosynthesising product. This product will inevitably sequester carbon and through photosynthesis act as a natural carbon filter. We are a diverse industry and provide green life to a variety of sectors including forestry, fruit and vegetable production, cut flower growers and of course the end product that you see in front of consumers. Businesses are also widespread across Australia from semirural to open environments.

Before I provide a brief overview of the specific needs from the nursery and garden industry I would just like to make a point that the Carbon Pollution Reduction Scheme as we see it is very likely to impact on our industry. However at this point in time economic data is greatly needed to determine to what extent this impact will be.

In recent the nursery and garden industry has embraced the concept of urban forestry. This term encompasses the planning, design, establishment and management of trees and green life in the urban and near urban environments. I should emphasise that there is much more than amenity value associated with green life in the urban environment. Urban forests provide a multitude of environmental, human health and well-being benefits. Several of those include reducing air temperatures, lowering heat costs, lowering cooling costs, storage for carbon dioxide, reducing hydrocarbon emissions, increasing property values, providing a sense of place for the community in enhancing aesthetics, increasing physical activity in the community and also possibly a reduction in the crime rate. In USA and Europe the term 'urban forestry' has been widely established and there have been several peer reviewed scientific publications encompassing urban forestry.

Greg McPherson who is a director at the Centre for Urban Forest Research at the University of California has pioneered the development of certain tools such as STRATUM which provide a

cost benefit analysis of trees in the urban environment. Validating this tool is urgently required in Australia. Why is it necessary? Simply put, this technology will enable landscape architects, designers, engineers and so on to analyse the constant benefits associated with city trees. It will unmask the value of green life in towns and cities across Australia. I should stress at this point that healthy urban trees are good economics and good politics. Greg McPherson was a plenary speaker at our Urban Greenscapes symposium in February this year. I have provided an overview that arose from that symposium, which is in front of you, entitled, *The nursery paper*. He discussed an example from Minneapolis in the US where a \$6.8 million saving in energy costs was associated with green life in the urban environment, a \$9.1 million saving in water treatments and a \$7.1 rise in property value.

The second issue I would like to briefly state this afternoon relates to the proposed US Waxman-Markley bill, which proposes to provide farmers with carbon credits which could be sold and traded to offset on-farm emissions. I should emphasise again that we as an industry produce a photosynthesising commodity that can sequester carbon. I should point out that not only is there no recognition for the product we produce in terms of carbon sequestration but there are several production industries across Australia which have native habitat in their sights, which is also not recognised in terms of carbon sequestration, furthermore, new trees planted on properties is also not recognised under any legislation. It would be sensible policy to reward growers for planting and conserving native bush on properties. The nursery garden industry would be supportive of a similar provision to enable growers to claim carbon offsets. These could help offset emissions on the property and alleviate the burden that is likely to result following the Carbon Pollution Reduction Scheme.

In summary, our industry is willing to work closely with all levels of government to ensure the best interests of the industry are upheld and to enable the industry to successfully embrace the multitude of challenges ahead.

CHAIR—Thank you very much. There was some interesting information there. The nursery industry has played a very good role in educating the public on weeds and a weed strategy for Australia, and you have probably got that into your training programs for employees in your industry. On research and development, and priorities for the delivery of extension and training, where do you see that going—that is, research in general, in that area we have been talking about? Also I see from your submission that:

... a research unit of the United States Department of Agriculture (USDA) Forest Service's Pacific Southwest Research Station, have developed a comprehensive scientific model that quantifies these benefits in 16 different climatic zones across America. This model provides a dollar value for the environmental benefits created by urban green-life ...

as you have just been mentioning. Have we done any research in that area in Australia? Also I guess that goes to climate zones and things like that, and change in that area.

Dr Kachenko—The two key priorities for industry in moving forward are obviously dealing with climate change and also biosecurity. We see biosecurity as a major issue arising from the changes in climate and the variability that will be thrust upon the industry. We have a strong relationship with Plant Health Australia and we are a signatory to the Emergency Plant Pest Response Deed. There are 40-odd incursions each year that affect our industry. When they occur,

we are called in to consultative committees to deal with those and ascertain how they will impact upon our industry.

In terms of the urban forestry work, there has not been any in Australia to date. That was the premise for the industry symposium that we held back in February. We felt that there was a need to get this important issue on the table and start garnering some support in the community and in government and so on, in terms of the true values associated with green life. So we as an industry are working with the University of Melbourne to perhaps start ground-truthing the models from America. However, obviously, grants and funding are required to successfully embrace those tools.

CHAIR—So that is one way that government could play a role with your industry?

Dr Kachenko—It certainly could, by providing the necessary options for seeking grants and R&D support to invest in ground-truthing these tools that have been developed in America. We have a continuing relationship with Greg McPherson, and he is happy to collaborate but, again, it is the dollar value associated with the work.

CHAIR—Of course. And do the members of your industry see the need for this sort of research?

Dr Kachenko—Yes they do, because, at the end of the day, our main goal is to have greater uptake of plant life in the environment and to sell more products for our growers. They see it as a way of increasing the credibility of green life and embracing and solving an issue at the same time.

CHAIR—Thank you for that. We will now go to further questions.

Mr SIDEBOTTOM—That was fascinating. Thank you. I was going to ask something similar to what the chair has asked, to do with Dr McPherson. Are there no other, Australian, models, apart from—

Dr Kachenko—There are not, no.

Mr SIDEBOTTOM—Melbourne University may be looking at a part model.

Dr Kachenko—That is right.

Mr SIDEBOTTOM—But of course it is also an issue not just of having a model as a template—and I assume this New York one could be modified et cetera—

Dr Kachenko—Yes.

Mr SIDEBOTTOM—but also of having the funding with it, which you have raised. And then there is this whole issue, which you might take us through, of greenhouse gas abatement and carbon sequestration, through amenity horticulture—it is the term ‘amenity horticulture’ which is interesting. It is an area that just does not seem to appear on the radar, because it is backyard by backyard—I think that is the term you use, isn’t it?

Dr Kachenko—That is right; it is backyard by backyard. It is also what you see in the city streets and the parks and nature reserves that are located in the vicinity of urban centres.

Dr Kachenko—That is right; it is backyard by backyard. It is also what you see in the city streets and the parks and nature reserves that are located within the vicinity of urban centres. As I said before, the main requirements for that tool is to see how it works in the climatic regions within Australia and also the diversity of species that we have in Australia that are not present in the United States of America. This will again give credibility to the value of green life. The amenity value, which is basically a pretty tree or a colourful display of flowers on a city street, has widespread consumer appeal but there are hidden messages that are associated with the benefits. The carbon sequestration benefit is obviously particularly relevant to perennial trees and perennial plants that have longevity. The carbon is stored in the biomass, whether it is leaf material or cambium tissue—wood material. It is locked away, effectively. Approximately 40 per cent or 50 per cent of green life is carbon so it can save considerable amounts of emissions, if you look at it in that regard.

Mr SIDEBOTTOM—Yes. And this is my observation: you learn about this when you look at gardening programs, backyard by backyard, but if you did a snapshot of a complete neighbourhood the footprint would be quite enormous.

Dr Kachenko—It is. That is exactly right.

Mr SIDEBOTTOM—It really is understated. Individually we are getting the message about our backyards but when you look at it collectively it is massive.

Dr Kachenko—That is right but it is something that the community can take for granted. They do not realise the untapped reserve of carbon that is in their backyards, and the associated benefits of green life. Research in America shows that green communities have lower crime rates. Green communities in shopping precincts increase retail spending and so on. So there are all those associated benefits. In Western Sydney, for example, where you have high density urban dwellings appearing you get this tremendous heat island effect, where the bitumen and the hard surfaces increase the temperature around the vicinity of buildings and houses. So by simply putting in trees you can indirectly reduce the energy needs for a house—by alleviating air conditioning, for example, or providing simple shade to the perimeters of the house. All those indirect benefits need to be quantified. They have been quantified elsewhere but not in Australia at this point of time.

Mr WINDSOR—Isn't the policy measure going back the other way, in a sense, in that the backyard is getting smaller rather than bigger and there is dual occupancy and high rise?

Dr Kachenko—That is true. That is happening. The diminishing backyard is a big problem facing industry along with the education of the next generation to move into horticulture in general and to embrace growing plants. A lot of them cannot identify where a plant comes from. They think it just appears on the shelf. It is much like the commodities in your supermarkets—the fresh fruit and vegetables. They have no idea where it comes from. Education is going to be a key role for our industry—programs not just educating our industry but educating the public as to what they can do in their back yards and the value of green life in their local communities.

Mr WINDSOR—Have you done any backyard carbon emissions budgets?

Dr Kachenko—Not at this point in time. We have some rough data that says that, depending on the type of plant, it is 40 or 50 per cent carbon but modelling is required to start projecting what carbon load we can get from backyards and urban environments. This tool that I mentioned—the stratum tool from America—actually does that. They take measurements of plants and so on, and work out the biomass. They can calculate the direct carbon load. So the resources are there; it is just a matter of embracing them in an Australian context.

CHAIR—You mentioned health and wellbeing. I guess the growing of vegetables is becoming an issue, right through to school, where we are encouraging people to get back to understanding food, as you just mentioned. Is there much going on in your industry with your members at the moment with regard to where this is going to go in a market sense?

Dr Kachenko—We have developed a program called KidsGrow, which is designed for primary school kids and introduces them to the garden. It has been tested with state and federal curriculum as a measure to encourage kids to embrace gardening. It goes through vegetable gardening and sustainable gardening, depending on their age level, and so on. That project requires some support to roll it out in the community. It is beyond the resources of a shoestring association but we need to get that program out and it is a key avenue in moving forward.

CHAIR—The federal minister for health is going to get a report pretty soon dealing with preventative health strategies and whatever for Australia. I think that probably has implications right through to wheat farmers and everyone else. We have had evidence about how we grow wheat, its nutritional value and growing things differently can give us a better response to our health. I think there is still a long way to go in the sciences but these are things that are starting to emerge, which could run into things we are talking about as well.

Dr Kachenko—That is right. It goes beyond that as well because there are reports in peer reviewed scientific literature that say that greener communities encourage people to get out and physically exercise, for example. There are also reports that say that indoor green life can reduce the number of sick days taken by staff compared to offices where there is not green life. There are also studies that show that green life in offices can purify the volatile organic compounds. Again, it is those indirect health benefits that are not apparent to the widespread public but exist in documented literature.

CHAIR—Your office must be an interesting place, Anthony, to visit?

Dr Kachenko—It certainly is. We have a lot of green life inside, that is for sure, and very few sick days.

CHAIR—We will have to visit you.

Dr Kachenko—It certainly does work. Even in hospitals, for example, they have found that the recovery of patients after extensive surgery is lessened with the presence of green life in the hospital environment and if they have a vista looking onto nature. There are a lot of benefits tucked away.

CHAIR—There are always a few negatives to these things. I suppose you have mop up the water after you have done some watering if you have not got the system right. It is a bit like the dogs in nursing homes; it is okay if they have not got fleas. There are always issues that we have to deal with. What I am saying is that I guess we need evidence based science to help us carry policy decisions, but it is only early days.

Dr Kachenko—Yes, that is correct. I completely concur with that.

CHAIR—Is your association endeavouring to move towards more research?

Dr Kachenko—Yes, that is true. We are hoping to forge some collaboration with Melbourne university and, like I said, we have ongoing discussions with Greg McPherson to drive the value of green life in the urban environment. Then, obviously, we have funding through Horticulture Australia Ltd to ensure that our R&D program encompasses the key issues that will affect the growing side of our industry. How will they embrace climate change and what issues may arise from climate change? At the moment we are developing a carbon calculator to work out the carbon emissions from site to site, from nursery to nursery. The key avenue we have found is that nurseries and growers are embracing more energy efficient means in moving forward, which is a no-brainer. But it is, again, supplying them with grants and assistance to implement these renewable technologies such as solar, wind and so on.

CHAIR—It is also a lifestyle situation for the public, isn't it? They change their lifestyle somewhat as well.

Dr Kachenko—Yes, that is true. Our structure at the national office has a marketing PR department which looks at consumer PR and tries to engage the trends with consumers out there in the wider media. For example, to grow your own vegetables and so on is a big theme at this point in time and we are pushing that into the consumer and mainstream media.

CHAIR—Is there much information in relation to what plants absorb more carbon? Will certain plants emerge as the ones that will be the pluses more than other plants? Will we lose species because of that?

Dr Kachenko—There are a lot of unknowns there. If we get the rises in temperatures that are predicted, species that might exist in one locality may not exist in another locality due to those rises. There is not a lot of documented literature in Australia about the carbon content of particular species, but it is quite apparent that the more woody perennial species and the larger trees will obviously store the greater load of carbon. There are also documented reports that show that young forests, for example, capture more carbon than old-growth forests or forests that are hundreds of years old. With the lines of crops that we support, a significant portion would fall within the high-carbon capacity plants.

CHAIR—In the biosecurity area do your members play a role in this by collecting insects or doing any studies? Do they record details of any pests that may invade their nurseries or anything like that?

Dr Kachenko—The industry has developed a farm management system, which is a three-tiered system. It covers best practices for the farm and it encompasses an environmental

management system and then on-farm biosecurity. As part of that third level, the biosecurity level, the onus is on the grower to monitor their site regularly for pests and diseases and maintain all the recording required to meet—

CHAIR—It is world-best practice?

Dr Kachenko—That is correct. It is an industry developed accreditation program, but it is being recognised by government. The first government to recognise it was the South Australian government. It is currently implementing the Plant Health Bill and has recognised the accreditation program as a mechanism to alleviate the need for AQIS inspections, for example, and regular health inspections. So it is another avenue to streamline efficiencies between government and industry.

CHAIR—Is there anything else you would like to tell us?

Dr Kachenko—The second document I presented to the committee, the industry snapshot, is from the Victorian association. That is basically a position from the Victorian association much along the lines of what I spoke about in my opening statement and in the written submission.

Mr WINDSOR—Has your group done any work on soil carbon in terms of deep-rooted grasses?

Dr Kachenko—Not a lot. That is one avenue that I would like to investigate more, particularly the use of biochar as an organic amendment in potting media. I visited a few sites in northern New South Wales where they are trialling it broadacre with some maize plantations and so on. But in a potting media substrate it could prove quite valuable in locking in carbon.

Mr WINDSOR—In certain parts of the mid-west of the United States, for instance, is the original prairie grass. That has a greater capacity to hold carbon at depth, apparently.

Dr Kachenko—Yes.

Mr WINDSOR—One of the issues with soil carbon is how long it can be held—

Dr Kachenko—That is right.

Mr WINDSOR—and whether the net effect really makes any difference.

Dr Kachenko—There are not a lot of broadacre possibilities in the nursery and garden sector—the soil carbon side of it is not so much of an important issue. I personally feel that it is a big issue in addressing climate change and variability. Work in northern New South Wales with the sugar farms has found those phytosilicates, which, as you just mentioned, can lock in the carbon for quite some time. It is particularly the grass, the sedges and the annual type plants that have those phytosilicates in their chemistry. For ornamental horticulture and for a lot of the other lines—the fruit trees, the nuts and so on—it is not as big an issue, unfortunately. It is almost like comparing pears and apples.

Mr WINDSOR—In some areas they are experimenting with these deep-rooted grasses on-road verges and in public places, and they are mowing them from time to time. They are suggesting that they will get a carbon storage impact.

Dr Kachenko—It is possible. Again, the research focus in Australia maybe for the past two or three years has been shifting towards what is happening in the environment with carbon storage and so on, but historically there is not a lot of data out there, in an Australian sense, to back up these claims.

Mr WINDSOR—Only recently—and I do not know whether you two guys got to see it—we had what is called a gasifier brought to parliament. A gasifier is essentially a charcoal burner that produces energy. During the Second World War some of the vehicles were powered by gasifiers. They have adopted a newer technology for this particular one. They were producing charcoal and producing biochar as an end product but also producing hydrogen and powering a petrol engine direct from the burner. So some of those technologies are fairly close.

Dr Kachenko—I agree; they are. They are getting there; the science is nearly there in many cases. You have got geodynamics, which is looking at the below-ground heat energy—the geothermal energy. It is very close. I think that our industry will have to embrace whatever options are on the table to move away from the coal-fired power that we are currently accustomed to.

We are very small. Agriculture is 16 per cent of emissions and the total for horticulture is about one per cent of that 16 per cent and then we as an industry are a fraction of that. But nonetheless we have to try to do what is right by the environment and we have done so in the past. Historically, we have developed all the various tools for farmers for environmental management and so on, but it is a matter of keeping our finger on the pulse with this issue. It is ready to be fired up.

CHAIR—Thank you for your evidence and your submission. We will send you a copy of the transcript and we may contact you again in the future.

The committee wishes to accept the document submitted by Nursery and Garden Industry Australia as an exhibit for the inquiry and include it in the committee's records. Could someone so move?

Mr WINDSOR—So moved.

CHAIR—There being no objection, it is so ordered.

Proceedings suspended from 2.03 pm to 2.13 pm

GATES, Dr Alison, Research Fellow, School of Earth and Environmental Sciences, University of Wollongong

CHAIR—Although the committee does not require you to give evidence under oath I should advise you that the hearing is a formal proceeding of the parliament and warrants the same respect as proceedings of the House. Giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. The committee has received your submission. Are there any corrections or amendments you would like to make?

Dr Gates—No corrections or amendments.

CHAIR—You might like to make a statement to us on your submission, and then we probably have some questions for you.

Dr Gates—Unfortunately, due to the stage that we are at in our publication process we have been unable to make a full submission to the committee. So the results that we rely on are subject to copyright issues.

CHAIR—Okay.

Dr Gates—In spite of that we are really grateful and we thank you for inviting us to address the hearing. We are grateful for the opportunity to offer our research to you for your consideration.

CHAIR—This committee made some recommendations in a report many years ago in relation to some of this issues of where the science needed to change and that scientists needed to be able to get some of those copyright issues sorted out. That was a long time ago, I remember.

Dr Gates—Sadly, the same issue is still around. When this publication is published, we would obviously be happy to forward it to you if it is something you are interested in.

CHAIR—Thanks.

Dr Gates—What I thought I might do in these brief introductory comments is just outline what our project is about and how it came to be.

CHAIR—Please.

Dr Gates—As far as we are aware, there is very little, if any, of this kind of social cultural approach being taken and being used to think about Australian farmers. This may not be the kind of research that you are commonly used to hearing about in this kind of setting. Our research is taking a very different tack to the other submissions that you have heard today. We are addressing the social and cultural aspects of climate change adaptation. Many of our research colleagues are pointing to that as a really crucial aspect, but there are not terribly many people actually working on those social and cultural dimensions. We are just here to talk about the kind of research that we are doing and the results that are coming from that.

CHAIR—We have received some evidence along those lines.

Dr Gates—That is encouraging.

CHAIR—Yes.

Dr Gates—The wheat project at the University of Wollongong is run by Professor Lesley Head, with the assistance of an ARC grant. There are two post docs working on the project as well—me and Dr Jennifer Atchison, who wrote the submission that you have read. The project started out being about the cultural ecology of wheat. We were interested in wheat because it is an economically important crop in Australia but also because it is culturally significant in our history as a wheat and sheep forged country and it has been a significant agent of environmental change in Australia. So we were really interested in taking some social and cultural methods out into the field and seeing what kind of results we could yield from a paddock to plate type of approach.

We have looked at the production of a bowl of pasta or a loaf of bread and we have gone to people all the way along the chain in that story and we have been using a series of interviews and other quantitative and qualitative approaches to talk to people about what it takes to get that loaf of bread or bowl of pasta onto the table. My personal contribution to the study has probably erred on the side of the farmers, which are the interviews that I have been most interested in and involved in, and other people have taken up different aspects along the production chain. The reason Lesley thought it would be appropriate for me to appear today is because I can speak a little bit more to the farming side of that story, but our research of farming and climate change does contribute to a bigger picture of wheat production.

We have done somewhere in the order of 35 of these interviews I talked about across the New South Wales wheat belt. We essentially drew a transect in the wheat belt and we took three study areas. We looked at a group of farmers around Gunnedah and Tamworth, particularly those growing pasta wheats. Then we took to study areas in the south of the New South Wales belt—the central one around Parkes and Forbes and the southern one from Wagga and Temora extending south to Corowa. We have interviewed, as I said, 30 to 35 farmers. We have interviewed them several times over a three-year period. The project started in 2006 and we have been repeatedly visiting these same people.

When we started out, we were very interested in what drove farmers, what the challenges were for them and what they thought about the products that they were growing; climate change was not necessarily the key question we were asking about. But in the course of the study, over the last few years, the public discourse on climate change has really accelerated far beyond what I think any of us expected—and rightly so. It has been really interesting to track that change as we have gone back and interviewed farmers over subsequent years, and one of the richest parts of our results has come from looking at how attitudes have changed, through tracking them with the same farmer over a period of seasons.

Typically we have been in the field at harvest time and—sadly for the farmers but fortunately for us—the December period has been quiet over the last few years, so they have had time to sit down and talk with us. I am not sure how our research would have gone had the seasons been better, and obviously we had hoped that they would be. In the course of that research the views

on climate change in the public domain have changed, but I think that also the farmers' own consideration of climate change has changed. There are still many in the cohort of our participants who are resistant to ideas about climate change but there are many who have really taken it on board, so we are representing lots of different views. I could not say to you that the farmers who we have spoken to have had any one particular view on climate change and whether or not it is happening. But that is not what we are asking them about; we are asking them: 'How do you deal with the changing climate?' and 'How do you deal with risk?' and 'What are your responses, your adaptations and your attitudes to that?'

Whilst it did not necessarily start off as a set of direct questions about climate change, it sort of emerged that way from us asking questions like, 'So what do you do on an average day or an average week or an average year? What does it look like?' We asked those questions and then we listened to the responses that we got from farmers talking about what it is to do their business of farming. A number of patterns have emerged that we have found particularly interesting, and responses to climate change has been one of the key ones.

What we propose is that, regardless of what farmers actually think about climate change, farmers daily negotiate the complexity of climate as a cultural and crucial element of their farm business. Further, because of the very nature of farming as an interaction between humans and their environment, Australian farmers have been dealing with and thinking about climate change for very much longer than perhaps the rest of us have. So they are a really good place to start as we turn our attention to thinking about adaptation. We think that those core resiliences that we are looking for might be there in our farmer sample, and we are looking to the farmers to harvest—pardon the pun—some of those ideas and resiliences around climate change and climate change adaptation.

An earlier witness who I heard talking this morning said that farmers are very interested in listening to farmers, and that has certainly been our experience from walking in as a group of academics to a farm kitchen. Farmers have been quite surprised that we want to listen to what they think rather than to tell them what we think. We would argue that our research is very useful and relatively rare because it is farmer driven. So we are reflecting on what the farmers have to say rather than pulling together a group of abstract research ideas and imposing them from the top down. We are looking to capture the experience of farmers in the way that they deal with climate risk.

In terms of looking at what we can really learn from the study that we have done, climate is one—albeit an important one—of a series of risks that farmers deal with on-farm. That is the way it has emerged in the conversations that we have had with farmers—that it is a risk. We have been really interested in gauging the range of responses to that risk. Our results talk about a group of very reactive farmers, who react to the risk, are relatively unprepared and do not have high levels of resilience, and the group of traits that go with that set of more reactive farmers. And then our results talk about the strategic farmers, who have a much more strategic approach to dealing with that risk and see that as part of their business.

This does come up in other literatures. It comes up in conversations about exceptional circumstance and whether drought is a part of normal climatic business risk, if you like, or whether it is something exceptional that we need to provide some help for. So this is a normal part of these conversations, but we are looking at it specifically in terms of climate change.

Mr WINDSOR—If it were just about drought would the answers be any different? If you substituted: ‘What do you think about drought policy in dealing with the vagaries of climate’ rather than ‘climate change’ do you think the answers would have been any different?

Dr Gates—That is a really interesting question and it is a hard one to answer. One of the things that I found very interesting is that whenever you talk to a farmer about drought inevitably he leaves the kitchen for a moment and goes into his study out the back where he has his father’s and his grandfather’s rainfall records for that particular block of land. Farmers have an incredible environmental knowledge about the place that they have been farming for a very long period of time. They do not think about drought the way that urban Australians think about drought. For them drought is actually tied to climate over a longer term because they look at drought cycles connected to their property. I am not answering the question, unfortunately—but I do think that there is a real connectedness between the place that they are farming and the history of knowing what climate has been like on that place. They naturally draw connections.

One of the first things that came up in our research was that when we started talking about the very poor year in 2006-07, when we were looking at that harvest in December 2006, they were saying, ‘This is like the drought that my grandfather talked about in 1944.’ There was a connection between those two different experiences—what it was like and how farming practices have changed over that time. The connection with place makes it very difficult for them to think about drought as anything other than a part of the process of climate change.

I have said that I think that climate is one of a basket of risks that farmers deal with and that the way that farmers respond to risk in general is quite interesting. They do not just turn up in the strategic basket for climate risk; they also turn up in the strategic basket for other forms of risk. Resilience comes from saying that farmers are strategic in enough of the key elements of risk that they are getting by okay. The reactive groups of farmers tend to be reactive on multiple risks—on climate but also on other business risks. They react and they are not strategic, and that is where they are floundering a little bit, perhaps.

The other thing that is particularly interesting here is that the farmer becomes the relevant unit of viability in our study. So, rather than saying: ‘In terms of climate change we are going to go out and study wheat’ or ‘In terms of climate change we are going to go out and study commodity prices or soil type, these small elements of the many dimensions of farming’, we say that the relevant unit of viability for our study is the farmer and the farming family. That then incorporates all of those scientific understandings that the farmer has about soil and water and the elements of the farm but also about the social dimensions of the farmer and his or her lifestyle, family, and social and cultural connections to the place where they are farming.

There are a number of small qualifications that academics love to make, so I should make those. One of the qualifications is that we are talking about a relatively small group of farmers. I understand that it is not necessarily comparable to what is going on in Far North Queensland. We do not have answers about that, but we have sufficient replication and sufficient comments coming up multiple times to be quite comfortable that, at least within the New South Wales wheat belt, we are seeing some saturation in our data.

Also we are talking about three small regions so how that relates to the story of wheat farming in Western Australia or the South Australian wheat belt remains to be seen. We have connections

that we would like to continue to draw there as our research continues. I guess then the take-home point from our submission that we wanted to just to throw into the ring is that there is a range of social and cultural approaches that also tell a story about climate change and agriculture, particularly those that are farmer driven—listening to what farmers have to say about the experience of mitigating risk and adapting to risk on farm. Then there is this issue of the farmer being the viable unit in the study. By nature, the traditional approaches tend to be one-dimensional. We have really enjoyed the multidimensional approach that interviewing farmers has brought to our results.

CHAIR—You have been tracking the farmers' responses in talking to them over this period of time when the marketing of wheat in Australia has changed. That would be a really big issue.

Dr Gates—Yes.

CHAIR—Have they talked about that giving them another dimension, especially now that we are starting to talk about health and food those sorts of issues? Is that within their spectrum yet or is that still a bit outside that? I guess I am talking about growing other species of wheat which may fit into a changing pattern of world consumption and Australian consumption.

Dr Gates—When I talked about these two kinds of groups—the reactive and the strategic groups—what we found was that people did not always clearly fit into one group or the other; they were reactive in some areas and strategic in others. One of the areas for the really strategic thinking farmers was the question of wheat marketing. So, for example, one of the farmers who we interviewed between Temora and Junee was growing a kind of wheat that no-one else in the region was growing. He was able to do this because he had bought himself a truck and he was able to drive that truck himself to Newcastle. He was following a non-conventional route to sell this particular kind of wheat because he saw that as an opportunity. Whereas potentially some of the reactive farmers might be more inclined to continue with the pattern of driving to the nearest silo and offloading their wheat at whatever the spot price is on the day. So I think farmers do not neatly fall into one category or the other, but as long as they have a number of strengths in the strategic basket they tend to fare very well. The farmers who are faring less well are the ones who have the multiple risks in the reactive basket.

CHAIR—Politicians understand those people quite well in that they have multiple ideas in their head and talk to us about those things. They are not always of the same group. The other thing is that whereas academics qualify their words politicians say that we need a bit of 'wriggle room'.

Mr WINDSOR—I found what you had to say really interesting. The chair was talking about the politics of things. I think it is quite interesting to see that you are actually talking to the people who control most of the land mass that might control most of the solution if we ever come down to having a real go at this particular problem. I found it interesting that you are actually looking at the wheat industry because the farmers who grow wheat have probably been at the forefront of the greatest change in terms of adapting to the vagaries of climate that we have seen in grain production in this country—that is, a move to no-till farming.

The basis, the very start, of that was not to plough in wheat stubble. Over time there has been the development of machinery to put summer crops and other crops into that wheat stubble. That

was not an adaptation to carbon, methane and nitrous oxide emissions; that was an adaptation to the risk of having a dry year. What it means in that Gunnedah-Tamworth area, for instance, is the equivalent of six to eight inches more rainfall. In a circumstance where we are trying to deal with less rainfall in the future, that particular piece of technology has been astronomical in terms of adapting to a change. My question is: in terms of your research, were people talking about no-till, minimum-till or conservation-tillage practices?

Dr Gates—Yes, it came up in almost every interview. I did not say this before but we interviewed mostly family farmers but also some corporate farmers. We interviewed mostly broad-acre conventional farmers but we also interviewed organic farmers. It was very interesting. For organic farmers obviously tillage is the only means that they have to control weeds so they cannot go down the conservation-farming track—they cannot go down the no-till track and control weeds in the way that they need to with tillage. That was a particularly interesting thing: conservation farmers talking about looking after the soil and reducing their dependence on additional water and also the benefits from a weeds point of view and lots of other things. That is suddenly quite in opposition to organic farmers, who have similar environmental goals in mind but are taking a very different pathway. So, as an aside, I personally found that very interesting.

In terms of conservation farming and no-till farming, I found that came up all the time. Again, the strategic farmers, the ones who were doing well, were amongst the first to adapt to that kind of technology and to be prepared to jump on board with the innovation and to buy the new machinery. It is not just about someone who goes out and buys the whole lot in one go; it is usually a progression. So, yes, there is a lot of really positive feedback about it; and the people who do it are so keen to tell us about it. Usually we turn up for a one-hour interview and we may spend two hours in the kitchen and then another couple of hours driving around the farm, kicking the tyres and looking at fancy machinery. They are really keen to share that progress with us.

CHAIR—Turning to the issue of international research projects in this field, are there others that you have seen? Have you done a search or tried to work out what is happening in other parts of the world?

Dr Gates—Mostly other parts of the world are looking at different commodities. There are some people doing things with corn and with soya beans.

CHAIR—Are the Canadians doing anything on this?

Dr Gates—We have mostly found things happening in the United States—using the same sort of approaches that we have been using. We have not found anyone else looking at wheat per se. Because of the peculiarities of Australia and the drought over the last few years, the other research about these other commodities tends not to be as vocal about climate change as we intend to be. That is something that has come out very strongly from our ethnographic process—our interviewing process.

CHAIR—One of the issues that have come up in other parliamentary reports is getting the research to the farmer base. There has been some criticism that in the past we have done a lot of

academic work that has never really got down to the coalface. How do you intend to disseminate your work?

Dr Gates—Because we have an ARC grant, our initial obligation is to produce a range of academic publications, and we are doing that, but as a team our goal has always been to produce a book for a much more popular audience. Our book, which still does not have a title—but we are well on the way towards that—has been aimed at everyday Australians. Particularly, farmers are interested in something that talks to urban Australians about what it takes to get that loaf of bread or bowl of pasta on the plate. But farmers are really keen to hear what other farmers are saying, and so we are very much committed to the book that we are writing. Our process of going back to farmers year after year and season after season, and at different points in the season, has really benefited that dialogue process because we get to talk about what we have been learning with them. We talk to the farmers about other things that we have seen and we gauge what they think they hear about what we are learning. Whilst I realise that that is just a set of conversations with 35 farmers, it is a process that has been really productive.

CHAIR—Without weeds and without potatoes to feed the workers in the factories, the Industrial Revolution would not have happened. In these sorts of things we have got away from people's understanding, haven't we? Is there a need for us to connect why we grow wheat, how we grow wheat and the bowl of pasta or the loaf of bread?

Dr Gates—Yes. The connections are becoming really distorted. Even if you tried, you could never trace a grain of wheat through the whole process. Wheat is quite hidden. So, yes, we are writing a lot about that and how the process is now so complex. Wheat is in everything; it is in plastic and it is in clothing. Parts of wheat are in so much of our daily lives that it is very hard to make those connections. But, where we cannot make those connections, we are trying to talk about where the hiddenness of wheat lies.

CHAIR—Are the farmers in your study aware of the issues of food and health and what we grow and how that fits into a broader debate? Do you think that these are emerging issues? We had evidence a week or so ago about the way wheat is grown—that there are better ways that will increase the nutrition value et cetera. Is there any of that awareness within your cohort of research?

Dr Gates—We have a final question, a wrap-up question, at the end of every interview. We ask everybody, whether they are a truck driver or a farmer: 'If you think about the person who eats the loaf of bread or the bowl of pasta at the end of the production chain, what is it that you would like that person to know about you and what you do in the production chain of wheat?' As a group, one of the most common responses of farmers is that they would like the person in the city to know that they are getting a quality product that is of high nutritional value, that is clean, that is healthy, that is good food, that is nutritionally important. That is part of the answer to that.

There is another dimension of our research that I did not mention. We have found that one of the most effective ways of tracing wheat through these connection points is through coeliacs, the group of people who are allergic to wheat. Because they have to avoid it they are much more aware than the average person of where it is. Because they cannot have it for medical reasons, they know exactly where wheat is. They know what ice-cream they can have; they know what they can or cannot buy at the supermarket. We have done quite an interesting study with a group

of people who have coeliac disease. One thing that has come from that is that there is a lot of stuff in the popular press and the women's magazines saying that gluten-free is healthy, that getting away from wheat is a healthy thing—and nutritionally that is just not the case.

Coeliacs find it very frustrating that their diet might be seen as a fad diet or a healthy diet when actually grain is a really significant and important part of a healthy diet for a healthy person—not for a person with coeliac disease; I am not suggesting that. I think that is another element where there are frustrations about how wheat fits into health and how people see that. I think there is a real frustration around people trying to go for this gluten-free diet when it is not medically indicated.

Mr WINDSOR—Have you asked the 35 farmers whether they actually believe that there is a climate change occurring because of carbon equivalent emissions?

Dr Gates—We started asking them in our most recent round of interviews at the end of 2008. That specific question—what do you think about climate change—started to come up more and more. In the beginning we did not ask it specifically but it would come up in other ways. What we saw happening over the course of our study was that people were very sceptical at first. People had particular weather forecasters, particular scientists that they tended to talk to or get information from—

CHAIR—Believe in.

Dr Gates—or follow. They had certain ideas about what was happening and they would base their farm decision making around that sort of information. They would say, 'This person says it's going to rain, so this is what I'm going to do in terms of fertiliser application. This is what I'm going to do in terms of when I plant. This is what I am going to do in terms of how much I plant and my rotation.' All of their decisions were based on that information. Across the course of the study what we saw was that people became quite unsure about the particular people that they were following. Farmers changed whom they were following or they started to have much more open ideas because of the public conversation that was going on. They were looking to many more sources; they were reading much more widely.

I think now most farmers have formed a view one way or the other. If you ask them they will tell you, 'This is what I think' whereas in the past they might have been more likely to say: 'I'm a bit unsure about the climate change thing, but I know that this is what is happening on my farm. This is what has happened through time with my dad's records and my grandpa's records and so forth.' I do think that there is a change in the way that they are thinking and the farmers that we have spoken to have certainly become much more open-minded to an extent. They listen much more to the public discourse and it is an issue that they have all grappled with and thought about. It is at the front of what they are reading, thinking and doing.

CHAIR—Do you think that there is a need for a coordinated body to keep the research together and get it out to the farmers that there is a lot of research going on in climate change? Do you think there is a need for us to have a national approach to that?

Dr Gates—I have not thought about that before. My initial reaction is that farmers tend to have quite established pathways where they get their information from and that maybe setting up

a new approach might be counterproductive. I think it is important to make sure that the information gets down through the pathways that they are using. For a lot of people that is even simple things like the *Land* newspaper. Making sure that good information goes down existing pathways would be the place where I would be inclined to think that you start. I need to mull that over a bit more

CHAIR—I read that 27 per cent of farmers did not believe in the forecasts that they got, so they make their own decisions. We need to make sure that they are comfortable with the forecasting. It is an issue of risk management that you have to meet as a farmer. If they cannot accept what is out there now, it leaves a bit of a hole in how they make the decisions and whether then there is exceptional circumstances assistance. Instead should people make business decisions about what information is available and stand and fall on the decisions that they make.

Dr Gates—There is a lot of room for personality in farming—that is what I have learned. There is a lot of room. If you give two people the same scenario—their neighbours, microclimate and soil are almost exactly the same—those two different people with different make-ups will do two entirely different things. Both might be successful at what they do or one might not. I think that the approach that each individual takes is based a lot on personality and personal preference. Even if we could come to an agreement about a standard method for forecasting, for example, I am not sure that necessarily both or either of those farmers would take it on because they have their own way of looking at the sky and understanding the place where they work. One of the things I have taken from the study is just how much intrinsic environmental knowledge these farmers have of the places where they farm. They know their country better than anybody else. There is as much to be learnt from them about how to predict and manage and look at those landscapes as there is to learn from outside and to bring to them.

CHAIR—Thank you. As you said when you began your comments to us, that is a totally different dimension and it is probably something that we do need to be going out there into the farming community. Thank you very much for that, and please thank your colleagues.

Dr Gates—I shall. Thank you.

Mr SIDEBOTTOM—‘On our selection’ is a good title, when you think about it.

Dr Gates—Yes.

Mr WINDSOR—Or ‘A grain of truth’.

Dr Gates—Thank you. I will take both of those suggestions home.

CHAIR—We will send you a copy of the transcript of evidence for today.

Proceedings suspended from 2.52 pm to 3.21 pm

Evans, Dr Jason Peter, private capacity

CHAIR—I welcome Dr Evans. Do you have anything to add about the capacity in which you appear?

Dr Evans—I work at a climate change research centre at the University of New South Wales.

CHAIR—Although the committee does not require you to give evidence under oath, I should advise you that this hearing is a formal proceeding of the parliament and warrants the same respect as proceedings of the House. Giving false or misleading evidence is a serious matter and may be regarded as a contempt of the parliament. The committee has received a submission from the climate change research centre of the University of New South Wales, submission No. 18. Are there any corrections to your submission that you would like to make?

Dr Evans—No.

CHAIR—I invite you to make a brief statement on your submission and then I am sure that we will have some questions for you.

Dr Evans—I work on how you take these global-scale climate change projections that others are making and make sense of them at a local or regional scale so that managers and people on the ground—farmers and so forth—can make use of that kind of information. From my perspective, when you talk about what farmers are going to need to help them cope in a future that includes a changing climate you need to look at a whole swathe of things that the government does already, largely in terms of climate variability, such as how you cope with droughts and so forth. Climate change introduces a few new things that we have not experienced before, one being that farmers are likely to experience climates that they have not experienced before, so their risk management based on climates that they have previously explained are likely to fail in the future climate. Also, there is the idea of actively accounting for carbon in the future, which is something that they have not generally considered in the past. Those are the two major new activities, I guess.

CHAIR—What was the last point that you made there? I missed that.

Dr Evans—Accounting for carbon—especially, as I am sure as everyone here is aware, in terms of having agriculture become part of the CPRS in the future and so forth. These activities are not simple activities. There remain significant uncertainties in these areas.

Building the capacity to try and address both having reasonable certainty associated with climate change projections in particular locations and the ability to project how carbon sequestration or release from soils and so forth might be affected by changes in agricultural practice or crop types and so forth is another area that remains largely uncertain at this point. Of course, they are related to each other. Changes in land cover—changes in crop types or management practices—has an influence on the local climate and vice versa.

Establishing the framework to allow you to investigate potential interactions and impacts of changing those activities is the sort of area where we see the government playing a major role and the sort of area where individual farmers cannot do it for themselves.

CHAIR—In your submission you say that, currently, Australia does not have the capacity to produce climate change impact projections, which is what you have been talking about. What is it going to take for us to have a capacity to be able to produce that sort of data?

Dr Evans—Largely, when you talk about climate change projections today, you are talking about these global models—for instance, the IPCC report. There are groups around the world that do this.

CHAIR—I think the CSIRO are involved in those groups too, aren't they?

Dr Evans—They in fact have global models that they actively ran and gave the IPCC, absolutely. On the global scale, which is controlled by very large-scale atmospheric circulations and radiative effects of the atmosphere and so forth, these models produce quite good projections, quite reasonable agreement with each other. But of course that scale is not particularly useful for a farmer or a catchment manager. The Victorian Murray does not look the same as the Lachlan River basin, but in these models they are the same. What we are really talking about is how you down-scale from these very broad scales that we have reasonable confidence in to scales that are meaningful to these people.

CHAIR—To allow people to make decisions.

Dr Evans—That is right, and actually become a decision tool. I do a lot of this in a dynamical sense—how you try and down-scale these global projections to the scales that are useful, taking into account all the dynamics of the atmosphere and the land surface interactions.

CHAIR—And the local knowledge that we already have?

Dr Evans—Absolutely. That comes into how you talk about the land surface. I am still talking in a modelling framework. How you talk about the land surface in these models very much is determined by what we know locally. You can find the idea that you do not just have ground cover determined by a satellite picture that tells you how green it is, but you can actually be aware of the exact type of vegetation that is there. If it is an agricultural area, you can be aware of—

Mr SIDEBOTTOM—The soils.

Dr Evans—the soils, the dominant practice, so you can know something about growing and harvest times, and all these things impact on the local and regional climate.

CHAIR—Does that have historical water records, run-offs? Councils have been collecting things for a long time—stormwater and these things. We have a lack of capacity in Australia to have that data in a database which is useful, they tell me.

Dr Evans—In a way, yes. A lot of that data is around if you know where to find it. I think one of the bigger problems is that, to date, there has not been any central data warehouse, if you like. But I believe this is one of the things the bureau is actively working on. This AWRIS capacity that they are working on hopefully will be that bridge.

CHAIR—It is a bigger level as well—so they tell me. There is the issue of what they are doing in other parts of the world. Are they bringing this down in, say, the States or Canada? Are they doing similar to what you are doing relevant to their regional bases?

Dr Evans—Yes. There are some quite large groups elsewhere in the world that are working on this. In the States there are several groups. NASA has a group and the National Centre for Atmospheric Research has a group. There is a group in the Goddard Space Flight Center. There are several groups in Europe: there is the Hadley Centre in the UK, the Max Planck Centre has a group and there is a French group in IPSL. There are quite a number of groups around the world actively pursuing this sort of regional scale climate modelling paradigm. A number now have even started to try to bridge the gap between regional climate modelling and crop modelling and bring these things together, which is where I think this really needs to go.

Mr SIDEBOTTOM—If I read your paper correctly you are saying that the Australian government needs to be proactive in developing a model. So I assume it is at both a policy and a funding level. Maybe you want to comment on that. There are a few words saying all this but I am not sure that is exactly what you are saying. Secondly, you are somewhat critical in relation to our inability at this stage to bring this any further, particularly in undergraduate training. You talk about an Australian Community Climate and Earth-System Simulator launch group. What on earth is that?

Dr Evans—That is an initiative through the bureau and CSIRO. They essentially brought over the global model from the UK and are actively adapting it for both weather forecasting and future climate projections in Australia. That is ACCESS.

Mr SIDEBOTTOM—I am aware now; I did not know what it was called. Do you want to elaborate a little more? You are effectively saying it in the submission. You have a lot of references to support each of these areas. I think that is what you are saying. Am I correct in summing it up like that?

Dr Evans—Yes. I am saying that developing a capacity like that is a serious investment which probably is not possible outside the government and not likely to be made in private industry at all. We are talking about an investment in a facility that both has the infrastructure in terms of computing and so forth to actually do this sort of thing at the high-resolution scales of interest and is big enough to bring people with the expertise in all the various areas together to establish that sort of discourse that allows this sort of modelling framework to really work.

The idea here would not be to develop one grand model that does everything. In a way, the pieces of this model are actively being developed by many groups around the place. There are people working specifically on crop models to look at the growth of pastures, for instance. There are people working on improving the hydrological modelling connections between surface and ground water and that kind of stuff. What I believe needs to be done is to have a place where you build a framework that allows these different models to talk actively with each other and be used

together to holistic look at these questions. The idea would be, for instance, that the atmospheric dynamics part of this model would actually be the same model that ACCESS is working on, but that might not be the only one. We could also look around the world and take another atmospheric model component from another group elsewhere in the world that has worked hard on that. The same goes for the land surface components and the crop modelling components. By having that sort of framework up there you can do multiple modelling simulations and projections and have a much better handle on the uncertainty associated with these projections, because there is always some uncertainty associated with them and if you want to make decisions based on those projections you need to have some idea about that.

Mr SIDEBOTTOM—What branch of government, as it currently exists, would you think could auspice this, assuming that there was policy agreement and funding and whatever else.

Dr Evans—The Department of Agriculture, Fisheries and Forestry, for instance, has a managing climate change program and this might fit nicely under something like that. Their focus does not seem to be at all on this side of the issue. They seem to be much more interested in on-the-ground things. But everything on the ground needs to be informed by these sorts of things behind the scenes. People actively in the area right, like the Department of Climate Change, are now funding the large-scale side of things, which absolutely needs to be done. If the global projections are no good, it does not matter what you do to take those down to a scale of interest; you cannot magically make them better. So you do need to have those global scale things worked on and those projections would be better, to the benefit of everyone. It is bridging the scale gap between these two areas that is the difficult area and one that has not received a lot of attention.

Mr SIDEBOTTOM—Global to local?

Dr Evans—Yes.

Mr WINDSOR—Have you had any contact with Dr Christine Jones at all about pasture coverage technologies and pasture cropping technologies?

Dr Evans—I have not.

Mr WINDSOR—She has got some interesting things to suggest about soil carbon and microclimate and how we tilt at a few of the traditional windmills. Some of the things she is talking about are being attempted now at a micro level on farms and, irrespective of whether there is climate change or not, she believes that some of these technologies should be there to take out the troughs in terms of our climate variations. The other issue is that you said here in the document I have that, more worryingly, we are not developing an understanding of the opportunities for agriculture to affect climate via reductions in emissions. We are therefore failing to explore all possibilities that agriculture offers to offset greenhouse gas emissions. Could you elaborate on that a bit, but partly in the context of the carbon footprint that traditional agriculture is, we think, going to have, particularly being geographically placed as we are and having to transport some of our produce a long way to those who buy it. That will have a footprint of its own, particularly given if it is in the grain market—the starch in the grain is carbon as well, so we are actually exporting a carbon product. I would like to think about it in this context: what if these sorts of models drive a land use change where we do not grow food on

that land? In a carbon economy it might pay us not to grow food; it might pay us to grow third-generation biofuels or to plant trees.

Dr Evans—Yes, that is absolutely correct.

Mr WINDSOR—Is that the sort of thing you are talking about—that we do now know?

Dr Evans—Yes, that is right.

Mr WINDSOR—Why don't we know?

Dr Evans—Because to date people have looked at this in terms of it being more like experimental situations—experimental plots or experimental farms—and how do you extrapolate that out over the Australian region. If you talk about particular river basin areas and so forth, you need to be able to understand what limitations there are for various crops or forestry or biofuel things that you can do and how that works in terms of what soils are available and what climates different parts of catchments have. You need to understand exactly how feasible making those sorts of changes is. In a way, having the modelling tools available means that you can play a whole lot of 'what if' games and look at different combinations of various activities to find the ones that really manage to optimise things in terms of carbon, for instance.

Mr WINDSOR—But surely that is no different from what the farm sector does now—making a decision based on a whole range of variables such as water, soil, paddock history, location from port and the distance from such and such.

Dr Evans—That is a true story. That is absolutely right.

Mr WINDSOR—If you talk about it in terms of land use policy rather than climate change policy, wouldn't it just fit into existing models?

Dr Evans—The issue is that in the past it has not been considered. It has not been included in existing models in general. It is actually quite a new thing to try and put the full carbon cycle into these models. The models themselves have only recently started to pay attention to the carbon in the crops and in the soils and how that is affected by the cropping technique. When you till your soil and so forth you can actually release the carbon from the soil—various things like that. So in the past, no, that has not been considered. It is a new thing. People are still working on it. Like I said, it is largely at an experimental stage. When you do model development you have to do that. If you are going to develop some new capacity you need to have the data available to evaluate how your modelling is working. That is absolutely the first step that has to be taken. The next step is to try to incorporate that into a larger framework holistically with all the other activities that are happening as well and be able to apply it over a large area. That is the stage that I am talking about.

Mr WINDSOR—I have difficulty taking it away from the idea that this is another form of land use that we are talking about, with the objective of cutting down on emissions. We can put trees or wheat on 100 acres. The costs and the carbon accounting will be different from the trees to the wheat crop, as they would be if you were not transporting the grain halfway around the world to exchange it to buy energy to bring it back halfway around the world. I would not have

thought you would need a new model to do that. You might need some new science, but why would you need a new model? You could run that sort of thing with a linear program, surely, to find out which is the best land use?

Dr Evans—You can look at things very simply and say, ‘Trees will sequester carbon more than pasture. Therefore, the answer is trees.’ Of course, the real situation is actually much more complex than that. Carbon is about more than just the plant on the surface. It is about the soils as well. It is about how that vegetation impacts the local climate. If you plant some trees here so that you can sequester carbon here, that is great, but if that means that you lower the water table further down there and you end up killing the trees down there because they cannot get the water anymore then this is actually not a very useful thing to do. A simple model cannot tell you things like that. There are a lot of nonlinearities in the real world, unfortunately. In the end, if you want to pay attention to what we do know about all these interactions, it means bringing things together in one of these larger, holistic models that tries to look at all these interactions as they happen.

Mr WINDSOR—I will not take issue with you, but I think a lot of things you are talking about will be the assumptions that you base your model on—that is, that there is a relationship between 50 trees and groundwater two miles away. They will be the assumptions that you will base your model on. You will have to assume something.

Dr Evans—In these models you study the trees and you understand how much moisture they use under various climatic conditions. Therefore, if you put a tree somewhere you can calculate, knowing the climatic conditions that you are projecting into the future, how much water this tree is going to use and how much it is going to take from the water table or from the rain that falls. Knowing the physiology of the plant, we can say how the stomata on the leaves will react to more carbon dioxide in the air, which changes how much water the trees will use, which changes how much water will reach the water table, which eventually will affect other vegetation that relies on the water table elsewhere.

Mr WINDSOR—The issue you are raising: is that information not available or is it available but there is no model to put it into? I am just trying to get to what the problem is.

Dr Evans—This information is available for some species. Experiments are ongoing. There is a big experiment happening in the Hawkesbury area just outside Sydney, where they are artificially increasing the CO₂ in the air around various plants and looking at how they respond under various climatic conditions. From that kind of data we can incorporate that into a model. People are working on that and doing that. You take this model and you apply it at a location—which is all very interesting and useful if you happen to be at that exact location. If you are wanting to look at management decisions that are going to affect catchment-wide areas or something, then you need to have a handle on not just what happens in each particular location but how each location interacts with each other.

Mr WINDSOR—The objective is to have a land use policy in a carbon economy. Is that the objective?

Dr Evans—The objective is to have a framework where you can play these ‘what if’ games with land use policy which takes into account all the interactions between land and the

atmosphere, agricultural practice and carbon. Bringing all those things together is the thing that is missing. Each part has been worked on and is actively being worked on in various locations.

CHAIR—Did you ask a question? Doesn't science ask the question and then go out to prove or disprove it?

Dr Evans—Sure.

CHAIR—What question would you ask to answer Mr Windsor's question?

Dr Evans—The question is: How do you project into the future under a climate change scenario? What is going to happen given changes in land use and so on, and knowing in the future that this interacts with economics of the situation that is becoming a carbon based economic decision.

Mr WINDSOR—So we could say a scenario where, because of the methane issue that ruminants have taken out of the equation, because of the nitrous oxide issue, crops that need high levels of nitrogen be taken out of the equation, we could end up with a sort of grass based land use with positives in terms of soil carbon and positives in terms of renewable fuels rather than food.

Dr Evans—I guess it is feasible, but I would assume that policy decisions are based on many other things as well, and this would be a tool for informing them rather than creating.

CHAIR—Always based on evidence—policy decisions. Have you got any ideas on who should be responsible for funding research in these areas to find the answers to make policy decisions?

Dr Evans—I guess it is not very obvious, in the sense that, certainly at the federal government level you have the Department of Climate Change, which maybe should be the responsible body, but then there is the Department of Agriculture, Fisheries and Forestry, who already have a climate change program and who are probably actually closer to the land policy.

CHAIR—I guess when we talk about the stimulator and those sorts of issues, if we were asking any industry to find tools to make decision we would ask them to pay for some of that, and we would have to find the public good. The public might pay for the good for the public but we would ask industry to pay for tools to help them make risk decisions about whether they could make any money or not. So I guess I am trying to find those sorts of answers. Do you have any ideas on that?

Dr Evans—My experience with industry is that they tend to be interested in particular questions. So they might be happy to invest in one piece of this—

CHAIR—Yes, sure.

Dr Evans—that is of particular interest to them.

CHAIR—That is legitimate.

Dr Evans—That is fine. That is what you see happening, and that is why you have many groups working on pieces and no-one working on bringing the pieces together.

CHAIR—Is there a need for more coordination, do you think? As a nation do we need more coordination in this research area to give us a bit more of an overview of whether we are doing the right research and not duplicating and so that we have the right collaboration happening and are not going down all sorts of different lines? Do you feel that there is a need to have a body to do that?

Dr Evans—I guess my answer to that is: yes and no. What you see—

CHAIR—That sounds like a politician!

Dr Evans—In terms of agriculture there are certainly quite a few groups working on various modelling techniques and so on, around Australia. And they are looking at the same crops. There are a number of different people working hard on pasture growth and how it is impacted on by climate and changes in nutrients and so on. I do not necessarily think that it is bad that there is more than one group doing that. In fact I think it can be good, because, as I said, whenever you do these projections there is uncertainty associated with them, and having several more or less independent projections allows you to have a better idea of the uncertainty associated with those projections. I guess what I am envisaging here is a framework that allows those multiple groups to bring their models into a framework and together produce projections that now have associated uncertainties with them.

CHAIR—Sure.

Dr Evans—So I do not think the individual groups should necessarily be brought together—

CHAIR—I understand.

Dr Evans—but some group or place that does bring them together is the level that I am looking at.

CHAIR—So we can make the big decisions on where to fund the next stage using that information. Is that what you mean?

Dr Evans—Yes. But that sort of modelling framework could then be used to look at a situation where some particular farmer is talking about changing to something else and to give him an estimate of how it would affect his carbon accounting or how it would affect—

CHAIR—It would be in another region, as well. We might be talking about northern Australia or southern Australia or a different area—

Dr Evans—Exactly.

CHAIR—for a different plant species or whatever.

Dr Evans—Yes.

CHAIR—Thank you for your submission and for being here today. I think we are okay with everything. We will send you a copy of the transcript to deal with that. Thank you.

Resolved (on motion by **Mr Sidebottom**):

That this committee authorises publication, including publication on the parliamentary database, of the transcript of the evidence given before it at public hearing this day.

CHAIR—I thank Hansard and the secretariat.

Mr WINDSOR—Yes, thank you, Hansard.

Committee adjourned at 3.55 pm