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AND TRANSPORT

Reference: Climate change and the Australian agricultural sector

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**SENATE STANDING COMMITTEE ON
RURAL AND REGIONAL AFFAIRS AND TRANSPORT**

Monday, 30 June 2008

Members: Senator Sterle (*Chair*), Senator Siewert (*Deputy Chair*), Senators Heffernan, Hutchins, Hurley, McGauran, Nash and O'Brien

Participating members: Senators Abetz, Adams, Arbib, Barnett, Bernardi, Bilyk, Birmingham, Bishop, Boswell, Boyce, Brandis, Bob Brown, Carol Brown, Bushby, Cameron, Cash, Colbeck, Collins, Coonan, Cormann, Crossin, Eggleston, Ellison, Farrell, Feeney, Fielding, Fierravanti-Wells, Fifield, Fisher, Forshaw, Furner, Hogg, Humphries, Johnston, Joyce, Kroger, Ludlam, Lundy, Ian Macdonald, Marshall, Mason, McEwen, McLucas, Milne, Minchin, Moore, Parry, Payne, Polley, Pratt, Ronaldson, Ryan, Scullion, Stephens, Troeth, Trood, Williams, Wortley and Xenophon

Senators in attendance: Senators Fisher, Heffernan, Hutchins, McGauran, Milne, Nash, O'Brien, Siewert and Sterle

Terms of reference for the inquiry:

To inquire into and report on:

- i. the scientific evidence available on the likely future climate of Australia's key agricultural production zones, and its implications for current farm enterprises and possible future industries;
- ii. the need for a national strategy to assist Australian agricultural industries to adapt to climate change; and
- iii. the adequacy of existing drought assistance and exceptional circumstances programs to cope with long-term climatic changes.

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Committee met at 9.03 am

CHAIR (Senator Sterle)—I declare open this public hearing of the Senate Standing Committee on Rural and Regional Affairs and Transport. The committee is hearing evidence on the committee's inquiry into climate change and the Australian agricultural sector. I welcome you all here today. This is a public hearing and a *Hansard* transcript of the proceedings is being made.

Before the committee starts taking evidence, I remind all witnesses that in giving evidence to the committee they are protected by parliamentary privilege. It is unlawful for anyone to threaten or disadvantage a witness on account of evidence given to a committee, and such action may be treated by the Senate as a contempt. It is also a contempt to give false or misleading evidence to a committee. The committee prefers that all the evidence be given in public, but under the Senate's resolution witnesses have the right to request to be heard in private session. It is important that witnesses give the committee notice if they intend to ask to give evidence in camera. If a witness objects to answering a question, the witness should state the ground upon which the objection is taken and the committee will determine whether it will insist on an answer having regard to the ground which is claimed. If the committee determines to insist on an answer, a witness may request that the answer be given in camera. Such a request may of course also be made at any other time. I also ask witnesses to remain behind for a few minutes at the conclusion of their evidence in case the Hansard staff need to clarify any terms of reference. Finally, on behalf of the committee, I would like to thank all those who have made submissions and sent representatives here today for their cooperation in this inquiry.

[9.05 am]

HOWDEN, Dr Stuart Mark, Theme Leader, Climate Adaptation Flagship, Commonwealth Scientific and Industrial Research Organisation

CHAIR—Welcome. Do you wish to make any amendments or alterations to the submission?

Dr Howden—No.

CHAIR—I now invite you to make a brief opening statement and then the committee will ask questions.

Dr Howden—There is clearly a need for an increased focus on adaptation right across the globe. What we are seeing at the moment is that past greenhouse gas emissions have already committed the globe to global warming over the next several decades, let alone future emissions. The level of the emissions that we are already seeing is higher than was forecast just a few years ago and, as a consequence, global temperatures and global sea level rises are increasing faster than we foresaw. What we are tracking on is the IPCC's worst-case emissions scenarios of as little as a decade ago. There are significant challenges in reducing greenhouse gas emissions globally, and Australia is taking a very proactive stance on that but, nevertheless, getting those emissions down is a significant challenge. The high end of the greenhouse emissions and the climate change scenarios have also increased over time, and those high-end emissions scenarios are the ones that will particularly cause problems for agriculture.

Lastly, early action on adaptation can actually bring benefits, according to analyses that have been done in Australia and overseas. In the CSIRO we see that adaptation is a critical part of a portfolio for responding to the climate change challenge ahead of us and, in response, CSIRO is adapting itself to deal with climate change. One of those adaptations is forming a new flagship, which is a cross-organisational portfolio of work called the Climate Adaptation Flagship, and I am here today as a representative of that. Consequently, CSIRO welcomes the opportunity to participate in this inquiry.

CHAIR—I will now go to questions from the committee.

Senator MILNE—I will start by looking at your report. Frequent mention is made of the Stokes and Howden review. Has that been released and circulated?

Dr Howden—That was released just last week. A media release was launched fairly simultaneously in Brisbane, Sydney, Adelaide and Perth. The report is available from the CSIRO website, and we anticipate publishing it as a book later this year.

Senator MILNE—One of the issues for me is that the submission is virtually a summary of the report. I was waiting for it, having thought it would be coming out in mid-April. I will move on now to some of the issues you have mentioned. You say that we are tracking now on the worst-case IPCC scenarios. Are you thinking about starting to monitor for more severe scenarios

than the worst of the IPCC? How does that impact on the report you have just brought out? Is that covered in it?

Dr Howden—A process is underway internationally to revise those scenarios. It will take into account the new trajectories of economic growth and population growth that we are seeing, as well as the changes in technology which are coming online in terms of managing emissions and which are being developed even as we sit here. I am not too sure about the delivery date of those, but we can find out if you need it. In the Stokes and Howden report we tried not to construct particular scenarios of climate change or greenhouse gas emissions or the impact they are likely to have. We tried to work systematically across different agricultural industries and assess the prospective adaptation options that may be available to those industries at a farm level, a regional level and a national and state level and identify which of those were in common across the industries so we would have a base from which to work in improving adaptation prospects.

Senator MILNE—I recognise that the inquiry is about agriculture, but in your executive summary there is not very much emphasis on maintaining biodiversity and ecosystem health. You talk about adaptive capacity in terms of agricultural production and you talk about integrated catchment management as being critical, but you do not talk very much about linking that up. Is CSIRO geared up for public interest research, or is it essentially looking at this from private sector investment research?

Dr Howden—The intent of that report was to look very much at the agriculture sector and the resource base on which it relies, and that was the focus of the report. Whenever adopting any particular adaptation, there is clearly a need to look at a triple bottom line assessment of it, so that needs to meet environmental, social and economic criteria. We would see that a criterion to add here would be that it needs to be positive in terms of greenhouse gas emissions. So we need to not have adaptations which actually increase greenhouse emissions. Those are some of the criteria we would look at in terms of assessing whether any given action is adaptive or maladaptive. Some of the potential activities that you could take in relation to climate change might actually be maladaptive, and those would be dealt with on a case by case basis, I would assume, as those actions were considered.

CSIRO recognises that biodiversity, ecosystem services work and research issues are important. CSIRO participated with then Environment Australia to develop the first biodiversity and climate change action plan in the world. We were participants and partners in the development of that plan. We have maintained a strong input into the development of climate change and biodiversity activities, policies and management options. One of the three delivery themes that the climate adaptation flagship focuses on is biodiversity and ecosystem services. So, clearly, it is in our sights.

Senator MILNE—At this stage, I cannot see it being reflected and, with it, a maladaptive scenario. There is a lot in the report about forestry, which we will get to in the course of this inquiry, but there is nothing much about native vegetation or the pros and cons of restoration of native vegetation or the restoration of forestry compared with that of plantations. Nor can I see much in terms of water scenarios for the plantations when I look through the report under 'forestry'. How is the ecosystem services water catchment management integrated with the forestry recommendations?

Dr Howden—I think your points are well made, and we will address them as we go through this process. As I mentioned before, the focus of this report was particularly on the agriculture sector. We have not yet got a good assessment of how climate change is going to impact on water resources and how those impacts are going to be reflected in other land use changes. Until recently, the only national scale assessment of climate change and water resources were those which were drawn from overseas work rather than Australian work. CSIRO is participating in things like the sustainable yields activity, which provides a much more robust assessment of how climate change might affect water resources and how different activities, including plantation activity, might impact on that.

Senator MILNE—Won't that mean you will need to review all this work? Looking through it, you are making all sorts of claims about what will happen in various places to yield and so on, without that underpinning work on water.

Dr Howden—We were working off a very limited information base to start with. As noted in the report, only a handful of the vast array of possible adaptations have been assessed to date and only a couple of those have been assessed in terms of their broader cost-benefit options. Clearly, in Australia, we have a lot of work to do to more effectively assess those costs and benefits.

Senator HEFFERNAN—This is your best guess?

Dr Howden—That is a systematic assessment of the possible adaptation options available for different agriculture industries.

Senator HEFFERNAN—That is code for a guess.

Dr Howden—It is a way in which we understand the processes that are likely to be impacted by the projections of climate change.

Senator HEFFERNAN—I understand that. But a farming person would say that you are making your best guess.

Dr Howden—That may be the case.

Senator MILNE—One of the main reasons that we moved for this inquiry was to try to look at this issue of people still thinking in terms of one in 100 year extreme weather events. Firstly, there seems to be a general consensus that there is no point in looking at things like that anymore, and that certainly would be my view. Secondly, there is this constant view that we should be going out there with relief programs until it rains again or until things change, without an acceptance that there is a high probability they will not change. Why isn't there more focus in your work on being up-front about the fact that there are some current land uses—for example, in the semi arid zone or in the marginal areas—which just cannot continue? Why isn't there more crossover about proposing alternative land uses like renewable energy instead of grazing, or less grazing and more renewable energy? Why aren't you working with the energy sector to look at transition strategies, or are you?

Dr Howden—The question of climate change and the viability of land usage is a very complex one, and it impinges quite strongly on policy activities which may be undertaken by the

states and the Commonwealth. With respect to the work that has been done so far, as I mentioned before, we have not yet done comprehensive analyses of costs and benefits across Australia for most of the industries or for most of the adaptation activities. What I would anticipate is that there remain viable agriculture options, even in many situations where there is extreme climate change. For example, we still have viable agriculture enterprises in Alice Springs, which is very harsh country with high temperatures and low rainfall. They can be sustainable in both an economic sense and an environmental sense. We have seen some very good examples of that.

We would anticipate that, as climate changes—and we do not know whether that is going to be slow and steady or fast and discontinuous—individual enterprise managers, whether they are family farms or corporate farms, will make the best assessment they can at the time, using the information available to them of what their most viable propositions are in terms of the agriculture activities. Sometimes that means selling up. We have seen examples of farms being sold to organisations like Bush Heritage Australia, where they transfer that use from agriculture production to conservation use. Clearly, that remains a prospect across the nation. But that is, in a sense, a little separate from climate change.

In relation to the renewable energy area of work, again, we can see that there could be potential for that type of activity, but there is a technological hurdle to overcome here—that is, lignocellulosic breakdown of wood products to produce ethanol or similar products. At the moment, the biofuels are generated largely through by-products or through direct use of grain, which has a food value as well. Separating out the difference between or the impact of usage of those types of grains for biofuels versus food is a global concern at the moment—one which is occupying the minds of people across the globe. We would see that, out into the future, the competition or potential competition for biofuel versus food is going to be a politically important one and, generally speaking, the impacts of climate change will make that debate more pointed.

Senator MILNE—I was not thinking in terms of biofuels; I was thinking more in terms of solar thermal or wind, for example, where the CSIRO is in an ideal position to bring together all of its thinking. Rather than giving drought relief, it might be better to take the transmission lines out of some of those areas so that solar thermal becomes a feasible farming option, so you are farming renewable energy as opposed to sitting there waiting for it to rain or trying to adapt in some other way.

Dr Howden—I have talked to some farmers about these sorts of opportunities, and some of them are thinking constructively along those lines. I am giving a presentation to the CSIRO energy sector advisory committee later this week, and I will raise these points with them.

Senator MILNE—Sorry, I was a bit distracted. When did you say that you were giving a paper on that?

Dr Howden—I am giving a presentation to the CSIRO energy sector advisory committee on Thursday, and I will raise some of these points with them for potential interactions between the sort of work that we are doing and the sort of work that they do.

Senator MILNE—One of the issues for us is getting some creative thinking going across the various sectors for replacing essentially primary industry at one level with other industries that

can be as, or if not more, lucrative in the current circumstances, and also that there are better land use options for people.

Senator NASH—I am going to have to declare my interest as a farmer, too. One of the things that seems to be coming through at the moment is a sense that research could be better coordinated; that it is a bit hotchpotch; that it is all bit cobbled together. Is that your view? Or do you think the research that is being done in this area is all fine and dandy?

Dr Howden—There are several processes at the moment to increasingly coordinate work on climate change across Australia. These include the Climate Change Research Strategy for Primary Industries, called CCRSPI. I imagine that Dr Michael Robinson will be presenting on that later this morning. There is a climate change and natural resources management action plan, which was previously formulated by DAFF and others, that is under review and being further developed. The National Climate Change Adaptation Research Facility, hosted by Griffith University, has a series of coordination activities, including development of national research plans. There are also the adaptation networks, which are being established under that facility. Again, they provide coordination of research activities across the nation. At the moment, there is no lack of processes which are aimed to increasingly coordinate the work in this area.

Senator NASH—In your submission, you point out that regional indications of climate change impacts are highly uncertain. What communication have you had with the agricultural community to put to rest any of their concerns that, with all of this going forward at a 100 miles an hour, it may not necessarily be so when the basis of a lot of the outcomes have been worked off data that, as you say, might well be highly uncertain? When you are declaring that some of these indications are highly uncertain, how can you have a black and white view to move forward? Going back to the first part of the question, what community consultation have you had with the agricultural sector on their view of that uncertainty?

Dr Howden—We do not have a black and white view of moving forward. We have a much more nuanced view of that, and that carries through to a whole series of new methods which we have been developing to enable people to make more effective decisions in the face of uncertainty. We are drawing from the finance sector techniques that they use and putting them in the context of agricultural management. The reason why we raise the question of uncertainty is that there are a series of sources of uncertainty in the climate change scenarios. Critical uncertainties include those associated with different emissions scenarios—whether we keep on producing greenhouse gas emissions at the current rate or whether we reduce those significantly. Roughly speaking, they constitute about half of the uncertainty. So a significant portion of the uncertainty we are talking about is not associated with the science and that type of uncertainty; it is actually what trajectory the earth goes in as a globe in terms of reducing greenhouse gas emissions.

Over and above that is additional uncertainty associated with the science of climate change, which says: for a given amount of carbon dioxide, how much warming are we going to get across the globe and what does that mean in terms of things like rainfall? To some extent there is a bit of irreducible uncertainty associated with this. In terms of climate change, yes, there is uncertainty associated with that, but uncertainty does not stop people making decisions. Uncertainty is just an integral part of making decisions on an everyday basis. It is part of how governments make decisions.

Senator HEFFERNAN—Can I make a point of order?

CHAIR—Certainly.

Senator HEFFERNAN—We have only an hour.

CHAIR—Your colleague has the call.

Senator HEFFERNAN—I realise that, but you are talking in circles, in meaningless garbage. We really need to just get to the black and white of all this. Talking about uncertainty and going around in circles is going to take us nowhere. We have a lot of questions to ask and we want shorter answers if we can. That is my view anyhow.

Senator NASH—On that point about uncertainty—and you are saying that that uncertainty is taken into account—what if, by the time you get to the end of the process, if you like, just being very blunt, that premise was wrong and that that uncertainty can actually lead to an incorrect analysis in the beginning of what might be an adaptation process? How do you predict the likelihood of getting it wrong?

Dr Howden—The intention is to have what we call ‘adaptive management’—not making really solid decisions in the face of uncertainty where we can avoid it. As we go along over the next decade we will have a clearer idea of what will happen with climate change and people will make improved decisions over time. What we are suggesting is that for very long-term investment activities, such as infrastructure investment, we need to start taking into account the possibility that the climate is going to change, and perhaps has changed already, and start to factor that into decisions, including things like building dams.

Senator NASH—When you talk about marginal land, what definition are you using for ‘marginal’ and what research have you used for that definition?

Dr Howden—Marginal lands are lands where you infrequently make a profit.

Senator NASH—What do you define as ‘infrequent’?

Dr Howden—Generally speaking, farms make profits in a few years out of 10—perhaps four or five years out of 10—and once you start to get down to making profits in, say, two years out of 10, you start to be in a position where you have a marginal activity.

Senator HEFFERNAN—With great respect to you, make a profit doing what?

Dr Howden—Whatever activity you are engaged in at the time. It may be grazing, cropping or mixed farming activities.

Senator HEFFERNAN—Can I say with great respect that some blokes will make a loss every year because they are mug managers and some people will never make a loss because they stock at the rate at which mother nature sends the signal to stock and will move cattle away and have a mixed enterprise. One person’s marginal land, with great respect, Senator Nash, is

another person's prime land. It depends on how you manage it. It is like a government. It is not the circumstances in which you find yourself; it is how you manage them.

Dr Howden—I agree.

Senator HEFFERNAN—This is a fantastic submission and I am going to get to it in a minute.

Senator NASH—Absolutely; you will get to it in a minute. You make a very good point, which is—

Senator McGAURAN—If I could add to that, 'profit' is different from making a living.

Dr Howden—That is right.

Senator NASH—That is exactly right. With regard to the two years out of 10—and Senator Heffernan is absolutely right—in, say, a hypothetical case you might have one particular area of land where one farmer is making a profit and his neighbour is not, so how do you classify that whole region as marginal? I think this is really important, because there has been a lot of discussion around marginal land and whether or not these farmers should be operating on marginal land. Senator Milne referred to this earlier, and I think this is going to be one of the major considerations throughout this inquiry. If the definition of marginal land is as you say, how can you be sure that it is the land itself that it is not able to cope when you are using human endeavour, if you like, to measure it?

Dr Howden—The senator raises a good point. Simply, we have not done that research and there has been no opportunity yet to do that research. Clearly, it is something we would want to consider in future research activities.

Senator NASH—So has CSIRO made any comment on whether or not farming practices should still continue on what is determined to be marginal land?

Dr Howden—No, simply because we think that market forces should decide that. As the senator has commented, one person's ordinary and degraded land is someone else's vision for a sustainable future. We have seen that happen many times in Australia and I think we have some fantastic stories to tell the world in respect of that.

Senator NASH—So CSIRO's view, then—just to be absolutely clear—is that it should be market forces and not government intervention which dictates—

Senator SIEWERT—There is government intervention in one way or another, in terms of drought assistance et cetera. Where do you draw that line?

Senator NASH—Hang on, Senator Siewert! We are going to do this the whole way through. There are two sides to this.

CHAIR—Senator Siewert, Senator Nash has the call. Senator Nash, I will have to move to other senators' questions soon.

Senator NASH—Thank you, Chair. So CSIRO's view is that it should be market forces and there should not be government intervention in terms of determining arable land or non-arable land in those marginal areas?

Dr Howden—CSIRO is a research organisation. We do not prescribe policy. But that may be something that could be considered.

Senator NASH—You mentioned biofuels before. What percentage of grain in the world is going into biofuel production?

Dr Howden—I could not tell you but it certainly is increasing.

Senator NASH—But that is quite an important point as well. If you cannot tell me what percentage of grain is going into biofuels, how do you know that it is having such an enormous impact in the food-for-fuel debate?

Dr Howden—We can take that question on notice if you need us to, but there are FAO reports which identify what is happening there.

Senator NASH—I would like you to take that question on notice. The point that is important here is that we are having a rising debate about food for fuel in terms of biofuel production, and if that debate is going on with contributions that do not have research based analysis behind them then we are going to end up with a very skewed debate. So if you could provide that to the committee that would be very helpful.

CHAIR—And that is on notice.

Senator HUTCHINS—Dr Howden, in your submission the word 'uncertain' appears on a few occasions. I cannot blame you for that; it is an uncertain period we go into. This inquiry is looking at the impact of climate change on the Australian agricultural sector. I have read that in some reports it is claimed that Australian agriculture is the third greatest emitter of carbon into the air, however you want to refer to it—would that be correct? Is the agricultural sector the third greatest emitter?

Dr Howden—On a national basis?

Senator HUTCHINS—Yes.

Dr Howden—My understanding, from the greenhouse gas inventory, is that that is correct. Stationary energy is the biggest one and then transport and agriculture—direct emissions from agriculture are roughly even, and they tend to go up and down a little bit over time.

Senator HUTCHINS—Is CSIRO able to identify for us how much of the emissions in Australia that are affecting climate change are from Australian sources, like power, transport and agriculture? Is it 100 per cent? Is it 80 per cent? Is it 70?

Dr Howden—Coming from—sorry?

Senator HUTCHINS—You have mentioned in your submission the CO₂ concentration; is there any way to identify how much of that is Australian made, Australian owned? Is that possible?

Dr Howden—It is, in a sense, through our greenhouse gas inventory, which provides an assessment of the total emissions from Australian activities which are what we call anthropogenic—that is, human sourced. They can be compared with those from other countries and compared with the global total. That provides a consistent basis on which to assess national greenhouse gas emissions. It is important to note that some activities and emissions, such as from aircraft and fuel for ships, called bunker fuels, are not included in that component.

Senator HUTCHINS—Is that a simple sheet, like the one that was handed out to us, that would let us look at how much Australia contributes to that in our part of the world?

Dr Howden—There would be information available to calculate the Australian contribution to global emissions.

Senator HUTCHINS—Do you know what it is, off the top of your head?

Dr Howden—Not exactly, but I think it is around 1½ per cent. I could not be 100 per cent sure of that, but we can find out if you need us to.

Senator HUTCHINS—How would you compare that to the United States?

Dr Howden—On a per capita basis, our emissions are roughly the same as those of the US.

Senator HUTCHINS—Can I ask about the uncertainty that you mentioned and the maladaptive scenario. Can you just run us through one of the scenarios that you have identified that we should be conscious of.

Dr Howden—There are many different types of maladaptations. You could have an adaptation activity to, say, maintain production for an industry converting grassland to crop land. One of the maladaptive elements there could be that you tend to lose a lot of soil carbon once you go from grassland through to crop land. You lose between 40 and perhaps even up to 60 per cent, depending on the soil type. That is an adaptation to climate change which actually produces more greenhouse gas emissions, which feeds back to the underlying issue there. That is one example of that. Similarly, you could have maladaptations that involve activities that have biodiversity impacts or ecosystem service impacts.

Senator HEFFERNAN—Congratulations on your submission. But at this stage it would be fair to say, just looking at it, that it is sort of a summary of a whole lot of guesses on what might happen. There will not be time today, but in the future we will have a select committee looking at how we are going to produce food that is affordable, with an environment that is sustainable and a farmer that is viable. I am hoping that the CSIRO will sharpen its game considerably before we get there. There have been some recent announcements that CSIRO is going to go away from actual research on production to climate policy research. How do you gather climate policy research?

Dr Howden—I am not entirely sure what the senator is referring to here.

Senator HEFFERNAN—There has been a reconfiguring—it was on *Landline* this weekend—of the CSIRO's work. You are not aware of it? It does not matter if you are not. Just say you are not.

Dr Howden—I did not see *Landline*.

Senator HEFFERNAN—Okay. When you do your work, and in putting this document together, do you actually talk to other divisions and other modelling groups in the community? There was a whole lot of modelling done on the north, for instance, which appears to have gone to bed at the moment, because there is nothing happening—although there was a meeting in Darwin the other day at which they concluded, I think, that there should not be a development of the north. Do you have input into, for instance, the CSIRO study into the sustainability of our rivers? Have you got that in this work?

Dr Howden—No. That was not released at the time.

Senator HEFFERNAN—So this really is very early work here. I have to say it is well written but it does not say a lot to a practical farmer. There is a consideration, for instance, now the CSIRO is looking at the resource operating plan for the lower Balonne. There has been press over the weekend that Cubbie Station up there is for sale to the Chinese, as is Tandow. I guess it would be based on the resource operating plan which is in draft form being implemented and giving them 420 gigs of overland flow water licence, because the bulk of the water that is there at the moment—we are talking about food production, and you are talking about potential—is overland flow. At the present time the bulk of the water that is drawn in the lower Balonne is unmetered, unlicensed, unregulated and absolutely free. It does not cost anything.

The thing that is peculiar about a river system like that is that, unlike a terminal river like the Lachlan or Macquarie, and to a certain extent the Gwydir, most of the water that goes overland, once it leaves St George in the lower Balonne and splits up into the Birrie and the Narran—with the exception of the Narran, which finishes up in the Narran Lakes—finishes up back in the river; it is someone else's river water downstream. In making the predictions that you have made defined by geographic areas, did you take into account the fact that, if you corrected that system, the productive land downstream would become more productive?

Dr Howden—We do not actually make those sorts of analyses in that report. The issues about allocation of water across the Murray-Darling Basin are clearly of critical importance, and I can imagine that you will be directing some questions to the Murray-Darling Basin Commission representative later today.

Senator HEFFERNAN—But surely, if you are going to put out this document, it will be flawed if you do not take into consideration those sorts of effects.

Dr Howden—We did in the water resource section of the document identify that there needs to be consideration of how we are going to operate in terms of water allocation and water trading, noting that those are very active areas in terms of debate and institutional change at the moment.

Senator HEFFERNAN—Your predictions on cropping and cotton et cetera are just bald motherhood statements—and that is fair enough; we are at the motherhood statement part of the research. Have you given consideration to the take-up of water—root zone versus furrow, for instance—with cotton and the difference in production?

Dr Howden—Yes, there has been a significant amount of work on improving water efficiency in cotton systems. CSIRO has a research station at Narrabri, where that work has been progressed.

Senator HEFFERNAN—Is that included in the report?

Dr Howden—Yes.

Senator HEFFERNAN—Could you describe for the committee what you think a carbon sink is?

Dr Howden—A carbon sink in an agricultural system?

Senator HEFFERNAN—Yes.

Dr Howden—It is where you increase the net stocks of carbon in your landscape.

Senator HEFFERNAN—Last week we had a bit of a heave-ho in parliament on legislation to give a tax deduction up front, which is all well and good, for a carbon sink, but without any definitions around. They put the cart before the horse, as it were. What do you think is a reasonable scientific snapshot of a carbon sink planting? How much per hectare is going to be put into the soil—

CHAIR—There is an inquiry coming up about this, Senator Heffernan. I am just thinking of time. Everyone wants to ask questions and there will be a full day on this.

Senator HEFFERNAN—Righto. Does the CSIRO have a reasonable definition of a carbon sink—how many years the trees have to stay in the ground et cetera?

Dr Howden—A significant part of that is defined by the Kyoto protocol and the Marrakesh Accords, so it is not just about CSIRO making its mind up.

Senator HEFFERNAN—Hang on. I have been through the OIE thing with beef. They blamed the OIE protocol for importation of bloody foot-and-mouth disease potential from Brazil. The government does not know; the opposition does not know. In the Senate no-one knew. If I take a contract for a carbon sink, either as a leaseholder or a freeholder, no-one knows what it is I am supposed to be doing by definition. You do not know either.

Dr Howden—A significant amount of institutional development is needed to make those things real.

Senator HEFFERNAN—Anyhow, I surrender.

CHAIR—There will be another day for that, Senator Heffernan. If there are no other questions for CSIRO—

Senator HEFFERNAN—There are plenty, but I will let someone else go.

Senator SIEWERT—I would like to go to the issue around adaptation strategies. It seems to me, from some of the comments you made earlier and also the submission, that you are really looking at adaptation scenarios around existing industries. This sort of picks up from where Senator Milne was going with her questions. How much work has been done around new industries? The Future Farm Industries CRC is appearing later, but I would like to know how much CSIRO is looking at that. It links with the issue of lignocellulose, going to tree species and getting around the argument for food for fuel. How much of that is CSIRO looking at?

Dr Howden—It is still early days. We have a contract with RIRDC. The Rural Industries Research and Development Corporation are looking at new industries under climate change right now. At the moment, I think it is a one-year research project scoping what is available there.

Senator SIEWERT—One year looking at what is available in terms of the potential for new industries?

Dr Howden—That is correct.

Senator SIEWERT—Are they looking at what is currently being researched or doing a bit of a brainstorm about the potentials?

Dr Howden—It is much more a scoping analysis.

Senator SIEWERT—Are you helping to fund that?

Dr Howden—That is correct.

Senator SIEWERT—When is it expected to report?

Dr Howden—The contract is being signed about now, so about a year from now.

Senator SIEWERT—The work you are doing at the moment is obviously not incorporating some of the potential for new industry—and I will touch on the issue around ‘marginal’ or not later. That is not factored into any of the work you are doing at the moment—is that correct?

Dr Howden—No, the report which we were drawing on here largely focuses on an industry by industry set of adaptation options. We identify that there are clearly intersections between those and between the issues, such as with irrigated cropping and water resource management. Similarly, there is a section in there on forestry where we identify the implications of climate change for forestry and farm forestry activities. The whole climate change area is one where we have multiple layers of interaction between different areas of activity. It is not just about the climate side of it but also about the energy and greenhouse gas emissions side of it. This requires a comprehensive and integrated approach, which we are trying to develop within CSIRO. We are trying to develop that through the adaptation flagship, through additional activities like the

energy transformed flagship, which deals with new energy technologies, and through the greenhouse gas emissions side of things, where we are coordinating work particularly in the agricultural and forestry areas of activities. So, by looking at some of the intersections across those different areas of work, we will start to explore the issues you have raised.

Senator SIEWERT—How much of the adaptation flagship work will be directed to looking at new industries once that initial project has been done?

Dr Howden—In the primary industries sector?

Senator SIEWERT—Yes.

Dr Howden—It will remain a small component of the total.

Senator SIEWERT—So you are really not looking at moving out of the more traditional agricultural activities we are carrying out now to look at new agricultural industries? Who is doing that for Australia if you are not?

Dr Howden—We would be looking particularly at changes in land use, changes in land management and changes in practice and exploring opportunities to significantly transform Australian agriculture in a sustainable way. Part of that will be looking at new industries, but the focus of that work initially is small simply because the demand for that work is small.

Senator SIEWERT—How can you say that demand for that work is small when you are talking about the significant climate change impacts we are going to have?

Dr Howden—In many cases, at least for relatively small amounts of climate change such as less than two or three degrees—I should not say that that is relatively small because it is quite significant—over the next several decades, we think there is significant adaptation capacity to cope with the changes. It is the larger scale changes that might occur several decades out that are going to be extremely challenging for Australian agricultural.

Senator HEFFERNAN—Are you doing frontier research?

Dr Howden—Yes, we are.

Senator HEFFERNAN—Would you like to describe some of your frontier research.

Dr Howden—Frontier research includes looking at how to significantly transform activities within the agricultural landscape, including things like using polymers to control the environment of crops, particularly intensive crops. It looks at new crop varieties and similar activities and how to more effectively integrate climate information into on-farm decisions. We also have work which is significantly transformative in the sense that we are starting to much more effectively incorporate social and economic aspects into climate change adaptive capacity, including through rural livelihoods analyses. So we are looking at much more than just the economics; we are looking at the total livelihoods picture for farmers.

Senator SIEWERT—And that is part of your flagship. Okay. I would love to pursue that a bit more but we are running out of time and I have a couple more urgent questions. In your report, you talk about the potential for five million hectares of biosequestration. Where do you foresee those five million hectares being?

Dr Howden—I cannot give you an immediate answer to that, but it would have been drawn from another assessment.

Senator SIEWERT—Could you take that on notice please?

Dr Howden—Sure.

Senator SIEWERT—You make a lot of comments throughout the report about the uncertainty around regional predictions, but there are also a lot of comments about the need to look at catchment management and regional decision making. Could you expand a little bit more on that? I am quite focused on this issue because of some of the decisions that are being made elsewhere by government that seem to be undermining regional decision making at the moment on NRM and I was very taken with the comments that you made throughout your submission.

Dr Howden—There are different levels of uncertainty depending on what you are looking at and how fine a scale you are looking at. In terms of, say, global temperature and national temperature trends there is a lot of consistency and lower uncertainty associated with that. Once you go down the scales, down to catchment or farm level, those uncertainties expand simply because of science's capacity to deliver at that scale. Rainfall tends to be a difficult climate variable to forecast or predict, and that is where a lot of the uncertainties arise. We can say that there is a strong degree of congruence in the forecasts about increases in temperature, which can be slated back to regional implications. At a catchment scale, clearly increases in temperature by themselves can impact on agriculture activities and water resource availability. When we look at forecasts, particularly for southern Australia, there is again a fair bit of congruence in terms of predictions of lower rainfall, although there still remains uncertainty as to whether that is a small or large amount of reduction. Again, there are fairly direct implications for catchment management across that. In terms of the government policy on that, I will not comment except to say that the Caring for our Country program does have climate change up there in its mission statement. But in terms of the questions that you are raising about how effective that is, that is not for me to comment on.

Senator SIEWERT—No, I appreciate that.

Senator O'BRIEN—On pages 21 and 22 of your submission is table 1.1, a 'Summary of climate change adaptation issues'. Would it be fair to say that the research and development work which is going to be needed in those areas will by necessity spread across a range of publicly funded and privately funded for-community and for-profit sectors?

Dr Howden—Yes, and that is the way CSIRO operates.

Senator O'BRIEN—Where would you see organisations like CSIRO fitting best into that range of adaptation issues in terms of solution development and research.

Dr Howden—We sit across that spectrum. We have strategic research, which is much more general in its nature, which could be considered to have a public good element and is internally funded. The main part of our work is through co-investment activities, where we have contracts with groups like research and development corporations and others. There is a small amount of consulting work that we do as well, which we try to keep as a small component. That has very much a private good element in there. So we cover the spectrum.

Senator O'BRIEN—Could you give us some more detail about the work that is being done now and where that work fits into the headings that you have in table 1.1? I am sure there are a great many of them.

Dr Howden—The activities, which happen on a project by project basis, often cover several of those different elements, so there is no clear one-to-one mapping of where our work is going to go. The majority of our co-investment work will be with research and development corporations and industry groups, and they will be specifically covering their issues and the policy context of that.

Senator O'BRIEN—How does that work? Do you obtain funding and then look to work with a specific research group in a particular area? For example, I am guessing that you might do work with the Grains Research and Development Corporation, so funding that comes to the CSIRO is matched with funding that might already be available in GRDC to research a particular project that is relevant to the grains sector.

Dr Howden—That is correct.

Senator O'BRIEN—What work, if any, is CSIRO involved in in the biotechnology area of grains?

Dr Howden—That largely sits outside of the Climate Adaptation Flagship. That work is mostly done within CSIRO Plant Industry. There is a long history of working with industries like cotton and grains to develop new varieties and new ways of solving problems.

Senator O'BRIEN—I asked the question because, with some of the debate about genetically modified crops and the like, there is an argument that is raised within the farming sector about the relevance of gene technology to climate solutions, particularly the better use of moisture profiles in the soil by accessing them immediately rather than using more potent chemicals and waiting for the destruction of weeds before planting. CSIRO is not involved in that?

Dr Howden—CSIRO has been involved in a large range of activities which are aimed at making better use of soil moisture, amongst other things. That has been extraordinarily effective in boosting yields in places like Western Australia as well as, more recently, eastern Australia. Water is a core resource that farmers look after. They conserve it where they can and use it as best they can. There are a range of different management activities and agronomic options which are available, including things like stubble retention and using varieties which more effectively use the moisture in the soil. Australia has some of the best accelerated breeding programs in the world, which are aimed at improving that gene by environment by management interaction.

Senator HEFFERNAN—Does the CSIRO do anything on that?

Dr Howden—Yes.

Senator HEFFERNAN—We have just been told in the last day or two that you are going to lose it.

Senator O'BRIEN—Given that we are a major cereal-producing nation—and, in terms of the world, we are a major exporter rather than a subsistence economy, as some economies are—how significant is the funding that CSIRO puts into the grains area from its budget? Would you say that it is significant, insignificant or a very small part? How would you categorise it?

Dr Howden—I think it is a significant component of our research portfolio, but that changes over time depending on the relative importance of that activity versus others. At a global scale, Australia has been extremely productive in terms of producing new varieties which are suited to the challenging climates which we experience here. Increasingly over the next decades as climate change occurs, if the projections are correct, other nations will be experiencing the sort of conditions we have had to deal with. In a sense, we will have intellectual leadership and the capacity to export our knowledge to those nations.

Senator O'BRIEN—And in terms of the knowledge base, would you say that we have an adequate education framework and skills base developing to provide what we need for the future in this area?

Dr Howden—No, I think we are still starting out on this process. We have had significant interactions with the farming community. Personally, I have probably spoken to about 5,000 farmers on climate change issues over the last decade or so, and I imagine that interaction would continue.

Senator O'BRIEN—They are very engaged, aren't they?

Dr Howden—They are.

Senator O'BRIEN—If we are going to develop that, are there any special initiatives that need to be put in place to give Australia the knowledge base, the science capacity, to provide that level of input for our industries and for international purposes?

Dr Howden—I think so. In a large sense, it is actually boosting what we already have going. So, we have some really effective means of getting information out to farmers, including through Landcare. We have a fantastic research and development base across the Commonwealth and the states, and it is a matter of just building on what we already have in most respects.

Senator O'BRIEN—I imagine the profile of the issue is likely to generate more scientific interest from those coming through the educational system.

Dr Howden—I think it is already. In fact, most PhD students now want to do topics on climate change.

Senator HEFFERNAN—Did you say that Landcare was one way of getting the message out there?

Dr Howden—I think so.

Senator HEFFERNAN—But they are pulling the rug out from under Landcare funding.

Senator O'BRIEN—No, we are not.

Senator HEFFERNAN—Yes, you are.

Senator O'BRIEN—No, we are not.

Senator McGAURAN—You sought to take on notice a question from Senator Nash on the percentage of grains that go into biofuels worldwide, which would of course, even in another committee inquiry we have with regard to food supply, be a very useful guide in relation to how biofuels are affecting the food supply. But if you could add to that the tonnage, I think that would give us a better guide to the supply and demand effect. Given that the finger is pointed towards the United States' policy in relation to corn, it is my understanding that the corn production has increased to meet that new demand. So could we also have, in relation to that, the tonnage figure—at least in regard of the United States and corn, if not worldwide—so we can conclude one way or the other whether the supply has met the new demand. Has CSIRO undertaken any work for Professor Garnaut or the government with regard to the emissions trading scheme?

Dr Howden—CSIRO has been involved in several different components of the Garnaut review, feeding information into the Garnaut inquiry. That includes some of the economic analyses, some of the assessments of climate change impacts on the beef industry, the grains industry and the dairy industry, and there are a few other components there as well.

Senator McGAURAN—As distinct from the impacts, which you have given us in your own submission, have you undertaken any work—modelling, if you like—as to be able to gauge and measure emissions within the rural sector?

Dr Howden—Greenhouse gas emissions?

Senator McGAURAN—Yes.

Dr Howden—We have contributed over the years to the development of the national greenhouse gas inventory and the national carbon accounting system, so those are our major contributions there. CSIRO was also a partner in the CRC for Greenhouse Accounting when that was running. That was contributing to more effective ways of assessing greenhouse gas emissions and reducing those.

Senator McGAURAN—I am just trying to gauge whether CSIRO have refined the measurements to the point where the rural sector—the farmers—will be included in the emissions trading scheme. Is it measurable at the farm gate?

Dr Howden—Certain aspects of farm emissions are measurable with a great deal of confidence. Other ones have significant uncertainty. So, for example, nitrous oxide emissions are

inherently variable in space and time and so they are very difficult to estimate with accuracy at the farm level, but other emissions are more easily assessed.

Senator McGAURAN—Was it your assessment that the rural sector, farms, will be included in the emissions trading scheme?

Dr Howden—That is a policy question, which I am not prepared to—

Senator McGAURAN—But you have done enough work to bring it to a stage where it is measurable and can be included in the emissions trading scheme?

Dr Howden—I think you would probably want to refer to the Department of Climate Change, who actually run the greenhouse gas inventory and the national carbon accounting system, the question of how they view the robustness of their evaluations.

CHAIR—What are CSIRO's views on soil carbon sequestration?

Dr Howden—I do not think there is a single CSIRO view. Soil carbon is essentially a function of how much carbon goes into the system, so it is really a function of the ecosystem production, and how much goes out of the system, which is a function of various breakdown rates, degradation rates—which can be caused by people using, say, windrowing or burning, or just part of natural processes. The balance between those is what is left in the system, and that is the soil carbon. It can go up or go down. We know with a great deal of certainty that certain conversions of agricultural land from one form to another have significant carbon implications in the soil. Within each land use, the flexibility to improve carbon content is often small, but sometimes it can be larger. There is a need to be cautious about the prospects for incorporating soil carbon into some systems, because that carbon can be quite labile, which means it can be easily lost, and there can be significant overestimates of how much carbon can be incorporated into agricultural systems as well.

CHAIR—Have you done any study or trials?

Dr Howden—Yes. There is a group down in Adelaide, for example, whose expertise is in this area and measurement of soil carbon. That is run by Geoff Baldock. They have extremely good ways of measuring carbon in soils.

CHAIR—Bearing in mind the time, we will have one very quick question from Senator Nash and then Senator Heffernan.

Senator NASH—I will be very quick, I promise. In one of our previous inquiries—I cannot remember which one—we raised the issue of lignocellulose research for ethanol. At that time, there was no research being undertaken within Australia on lignocellulose. Has that changed at all? Are we doing any research in Australia at all on it?

Dr Howden—Not that I am aware of, but I may not have covered that entirely.

Senator NASH—I know it was only meant to be one question, but is there any reason—

CHAIR—You have done it to me again, Senator Nash. One becomes seven.

Senator NASH—It was just that, given how important this is and what it could provide as a future fuel, why are we not doing research within Australia on this ourselves?

Dr Howden—I could not comment on the full reasons why, but there is work going on overseas which is making advances in this area. I think there is an expectation that we would take that technology and use it here.

Senator HEFFERNAN—It would be pretty dopey if we were not doing something on lignocellulose, given the reputation of CSIRO. Aren't you sort of ashamed? Food is going to win the grain argument with energy. There is no question about that. The food task on the planet is going to double in the next 40 years. The productive land of Asia is going to reduce by 30 per cent. Surely to God someone has enough influence to see that CSIRO—and I am about to come to this report here in a second—should be doing some work on lignocellulose.

Dr Howden—I think your assessment of the different competing factors is reasonably robust and clearly we need to think about the position of this in relation to the broader research portfolio. Again, I can raise that within CSIRO.

Senator HEFFERNAN—It has been in the press in recent days that there is going to be a change of direction. You had some woman on the telly over the weekend saying that CSIRO are going to go away from the practical sorts of things, like producing a crop that is more efficient or whatever, to the theory of climate change. There is a mountain of theory here this morning which does not come to a mouthful of anything practical. Have you blokes done any modelling on what it will do to the viability of agriculture when carbon gets to \$20 a tonne? The unknown of the carbon market is going to determine how land is used in future. It has got to be cleared land and, the higher the market, the better the land use. Have you blokes modelled any of that?

Dr Howden—In the agriculture sector, I think there has only been limited research on that.

Senator HEFFERNAN—In other words, you have not.

Dr Howden—There has been activity in other domains. In relation to the work which was in those reports, we did engage with the farm sector in developing those.

Senator HEFFERNAN—With great respect, I have just read the cotton thing in here. It does not mention anything about the potential of the north or the potential for conflict that, for instance, the Western Australian government has or the influence the CSIRO with its might of science might have on the Western Australian government as to why they should go to GM and not have a ban on it, or why there should be some agricultural land allowed in the Northern Territory and not a ban on it. Not only in Western Australia has cotton got the same status as marijuana; in the Territory agriculture is banned in most areas.

You have to admit that this report, which is an overview of climate change adaptation in Australia, is a pretty heavy document—pretty thick. Where is the frontier work in it? There is nothing. This is as silly as when the New South Wales government, when we did a water inquiry and were in Griffith, gave us the river management plan for the Murrumbidgee River. It did not

have one sentence in it on the implications of interception by the 2020 vision of plantation forestry in the top of the catchment. I just flicked through that report in Griffith and I thought, 'There's nothing in here.' There is nothing in this either about the north. They said, 'Oh, God, it was an oversight, Senator.' When are we going to get fair dinkum with the CSIRO about fair dinkum frontier work? Eric Ripper in Western Australia is tearing his bloody hair out.

CHAIR—You have raised a question, Senator. Dr Howden, do you have an answer to Senator Heffernan's question?

Senator HEFFERNAN—I will give you the question. The implications due to the vagaries and the unknowns in the value of the carbon market for future food production are something you fellows ought to take on big time. Do you have any understanding of the impact of the carbon market on the availability of food production?

Dr Howden—We simply have not done all of that work as yet. But I take your point.

Senator HEFFERNAN—That is fair enough. You have been very patient—congratulations.

CHAIR—Thank you for your time.

[10.13 am]

COUGHLAN, Dr Michael James, Chief Climatologist, Bureau of Meteorology

POWER, Dr Scott Brendan, Principal Research Scientist, Bureau of Meteorology

CHAIR—I welcome our next witnesses. Would you like to mention anything about the capacity in which you appear?

Dr Power—Apart from my role with the bureau, I am acting research group leader for a group called Climate Change Projections Science in the Centre for Australian Weather and Climate Research.

CHAIR—The Bureau of Meteorology has lodged submission No. 7 with the committee. Do you wish to make any amendments or alterations to the submission?

Dr Coughlan—No amendments or alterations, thank you.

CHAIR—I invite you to make it a brief opening statement and then the committee will ask questions.

Dr Coughlan—Thanks very much. The Bureau of Meteorology, as most members of the committee will be aware, is the national agency providing weather, climate, hydrological and oceanographic services to the nation. In the current context, I would like to highlight the bureau's climate services and in particular the recently established Water and the Land component, aptly called 'WATL' in-house, which aims to draw together all the bureau's information and forecasting capabilities relevant to the agricultural sector and is available through the World Wide Web.

The bureau also has a vigorous climate research program ultimately aimed at improving our ability to predict climate over the coming seasons, decade and beyond. The bureau and CSIRO have recently formed a major research partnership called the Centre for Australian Weather and Climate Research, for which Dr Power works. The aim of that is to bring a critical mass to tackle important climate change research issues, among other things earth system modelling development. Continued maintenance of the climate record in perpetuity, which involves the routine sampling of meteorological and related hydrological and oceanographic data across the nation and surrounding oceans, remains the cornerstone to understanding and adapting to climate change and variability. Data is needed to keep track of trends, to assess climate models and in the development of down-scaling methods that will provide more information on our future climate at spatial scales smaller than what the climate models can do directly.

The bureau's observational networks for establishing the climate record have served Australia well for the past 100 years. The bureau would particularly like to draw the attention of the committee to the need to maintain this critical component of the nation's basic infrastructure. We know what we know about climate and climate change largely as a result of these observing systems. We also wish to emphasise that further improvements to the dissemination of climate

information via the web and further climate research, including the development of an improved earth system modelling capability, are an essential contribution towards Australia's management of climate change. Thank you very much, Chair.

CHAIR—Thank you, Dr Coughlan.

Senator SIEWERT—In your submission you make some comments about run-off, saying in relation to rainfall:

As a result, the corresponding decrease in annual mean runoff by 2100 is also projected to be within the range 10-20% ...

In Western Australia it is already much higher than that. I am just wondering where those figures come from. You have said that is a mean figure. Is that across Australia or have you gone down to look at regions and what it means in those regions? I ask this because in Western Australia, from 1995 to sometime in the noughties, rainfall had decreased by 21 per cent and run-off had decreased by 64 per cent. So there had been a triple decrease in run-off compared to the decrease in rainfall.

Dr Coughlan—Of course, measuring rainfall is a lot simpler than measuring run-off. In measuring rainfall we put a bucket out there and measure how much rain falls into it. What happens to the rain after it falls is a pretty complex process. You cannot—or it is difficult—to measure it directly, except what then ultimately ends up in the rivers. So that generally has to be done through some modelling process and if that modelling process is 'uncertain'—and we have heard that word used already this morning—often what we ultimately observe will differ from what we actually model. Getting the modelling right is a difficult process. It often depends very much on the particular catchment for which you are doing your modelling. So what you might observe as effective run-off in, say, Western Australia might differ quite markedly from, say, in south-eastern Australia. Those figures probably are an average—I would have to check—but that will vary significantly, depending upon the catchment and depending upon of course the land use practices that are going on in that area: how many dams there are and who is capturing the water before it gets into the rivers.

Senator SIEWERT—This is absolutely critical for the issues we are talking about, so I would be interested to know the basis for the figure. There is no footnote here, so I cannot tell where the information came from. I think it is quite a dangerous figure, because it is downplaying the significance of the decrease in run-off. That is not really discussed in your submission. So if you could provide where those figures came from, I would appreciate it. I would also like you to provide a better understanding of where the change in run-off differs across Australia because, as I said, I know in the south-west of Western Australia it is certainly outside the 10 per cent to 20 per cent range. I have also heard other scientists, in relation to the Murray-Darling system, saying it is higher than that. So I am concerned to see that figure, because I do think it is sending a false message. If you could take that notice, that would be appreciated.

Dr Coughlan—We will certainly do that.

Senator SIEWERT—The other comment that you made in your submission was:

The Bureau would particularly like to draw the attention of the Committee to the need to maintain and indeed expand this critical component of national infrastructure.

That is, the observational network. Is there a possibility that that network is in fact being wound back? I entirely agree with your comments here about the need to maintain it. Did you put that in your submission because there is a threat of it being wound back or is that just as a message to make sure that we keep it going?

Dr Coughlan—That is a complex question because it is not just a matter of numbers, it is a matter of technology as well. The ability now to use satellites can mean that we often do not need as many systems on the ground as we perhaps had in the past simply because we can measure things effectively from satellites. The danger, of course, is that we do go too far and that we start to reduce the ground truthing required of ground based systems to the point where we do start to lose information. Again, like most scientists, the more information, the more data we get the better we are at providing information out of the data. When it comes to getting the resolution that perhaps farmers want—and they want to know what is happening in their back paddock—if those networks do start to get more dispersed then our ability to provide information at that level is degraded.

Senator SIEWERT—Thank you for your very diplomatic answer. While I do appreciate the information that you gave me, it did not actually address the issue that I specifically asked—that is, is something going on? Is the system currently being—‘wound back’ probably is not the appropriate expression—changed so that you are not able to ground truth the information? If I am interpreting correctly what you were saying earlier, then the need here is to make sure that we ground truth the information we are getting from satellites. Is funding for that being reduced? Is the government not funding it to the capacity that is required to maintain the network at a satisfactory level?

Dr Coughlan—What we are attempting to do, of course, is to provide the best networks that we can with the resources that we are provided with. Of course there is a tension there between us being complacent with what we have got and working to make those observing systems more effective—again through the introduction of new technology. There are often swings and roundabouts with this. For example, if one had two or three ground based observers and you then replaced them with one or two or somewhat fewer automatic weather stations, what have we lost and what have we gained? We may have lost a little bit in terms of the spatial resolution, but we have offset that a bit by having satellites help us with some of that spatial resolution. One of the things that we have gained through the automatic weather station is the ability to take, in effect, observations, or data, every minute. In the case of the ground based human observer, that person at best would be taking observations every three hours. Now the automatic weather station can take observations every minute. So often it is difficult to say where the balance is. Have we lost overall or have we gained overall? I think, given the technology, we are probably producing—and I should not even say ‘probably’—far more information from the system that we have now than we have produced in the past.

Senator SIEWERT—Okay. Is this producing the information needed to address the impact of climate change?

Dr Coughlan—At a certain level. At the farm paddock level, probably not, simply because there is enormous variation. Anybody who works on the land knows that if you are on one side of the mountain you get a certain level of rainfall, and on the other side of the mountain you do not. It is very difficult, of course, to get observations that are going to pick up that very high level of discrimination that is needed to pick up those sorts of changes. But again, it can be done with an understanding of the way the system works and particularly an understanding amongst farmers themselves—they are often able to make those interpretations. So again it is a very complex system. We are out there and we have to sample it. It is just a practical fact that we cannot measure everything everywhere all the time. We have to sample it and then do our best with modelling and a basic on-the-ground understanding—which many farmers, of course, do have.

Senator SIEWERT—I have a question going back to the run-off issue. Does the bureau do work on run-off or are you basically using data that others generate?

Dr Coughlan—That is an interesting question, given that the Bureau of Meteorology has taken on a whole new water role. In the past, most of our water role was related to flood forecasting. Because we did take measurements for that, we did have some understanding of the rainfall run-off issue, but it was mostly in a flooding context. With the new water role that we have, we will certainly have the responsibility now for producing water assessments and water accounts. In the next two to three years we will start to produce a lot more detailed information on where the water is, where it is going and how it is being used.

Senator SIEWERT—Could you just remind me when the first water accounts will be produced.

Dr Coughlan—I would have to check, but I think it is somewhere within the next one to two years. Clearly the first water accounts will be not as detailed as the water accounts that follow. It is a fairly new area, so I understand. It is not directly my responsibility in the bureau. It is a fairly new area and clearly there will be a learning process during the first two or three sets of water accounts that the bureau produces. Just to respond to your previous question, on the data collected: the bureau, of course, will continue to use its existing rainfall network, but it now has the capacity to tap into all the other observing networks—

Senator SIEWERT—The states.

Dr Coughlan—The state based observing networks as well.

Senator NASH—On the issue of the measurement of run-off—and this might be a question for somebody else entirely—have the changed farming practices, in moving to minimum tillage-type practices, which have an effect on run-off, been taken into account in the changes in run-off measurement?

Dr Coughlan—Again, it is probably not a question that I am in a position to answer. I would prefer to defer that—

Senator NASH—Where could you direct me as an appropriate place to ask that question over the next couple of days?

Dr Coughlan—I can certainly pass it to my colleague Dr Rob Vertessy, who is now the Deputy Director, Water, in the Bureau of Meteorology. He may deflect it to somebody else, but I can certainly assure you I will endeavour to get an answer.

Senator NASH—That would be very useful, thanks. In your submission you say:

Better understanding of climate variability ... will be critical to interpreting and applying climate change projections of Australian climate.

What do you think will lead to that better understanding? What is not currently being done that you see would lead to that better understanding?

Dr Power—One centrepiece in this new partnership between CSIRO and the bureau, in CAWCR, the Centre for Australian Weather and Climate Research, is another acronym, ACCESS, the Australian Community Climate Earth-System Simulator. This is a mathematical model of the way the atmosphere and the climate system work. In that system, we are going to be able to simulate the El Nino-La Nina cycle. What we have found in the past is that earth system simulators are fantastic tools but there are imperfections. One of those imperfections is the inability to accurately simulate El Nino-La Nina cycles. They are there, but they are not perfect. So what we are really striving to do is to improve the depiction of that phenomenon in our model. Once we have got that, we can start to bring in not just climate change, global warming, but also the variability, because they both are important in the Australian context.

Senator NASH—What are the ramifications for you in your work that you are doing now in not being able to simulate that as well as you would like?

Dr Power—There are two main things. One is an imperfect understanding of the way the climate system works. We are obviously working as hard as we can to reduce uncertainties and improve our knowledge. Another one is computing power, because with these earth system simulators you basically break the world up into little bits and the smaller you make those bits the more accurate you can get your simulations to be. But the trouble is that the more bits you have the more calculations you have to do. Currently, the world does not have computers which are powerful enough for us to break the world up into bits as small as we would like to have, so we are always greedy for more and more computing power. One thing which is really pleasing to report is that the bureau, CSIRO and ANU are just putting out a tender for a big upgrade in our computing capability.

Senator NASH—Sorry, I should know more about what the bureau does, but do you do assessments, if you like, on an ongoing basis of research and projections and then do assessments at the point in time to see how right you got it, how wrong you got it and how far off the mark you were?

Dr Power—On an ongoing basis it is done quite infrequently because it takes a long time to get these new projections up and running. Mark mentioned the IPCC report and—if I can give it a bit of a plug—this technical report that came out late last year addresses climate change in Australia and addresses some of these sorts of issues. What Mark Howden alluded to here earlier today was that some of the scenarios that we use for future climate change have greater emissions than others, and he mentioned that currently we seem to be tracking upon one of the

higher scenarios. In that respect you could say that some of the lower scenarios are less appropriate for the current situation, so I guess that is a form of verification.

Senator HUTCHINS—I have a few quick questions. I have read—and you may be able to confirm this for me—that in January 2008 global temperatures fell by 0.67 degrees from the previous year. Is that correct?

Dr Power—I am not sure of the exact figure, but are you going to allude to the fact that it is not the record temperature and some people have been—

Senator HUTCHINS—Yes.

Dr Power—In the climate system there are two things going on. One is human induced global warming, but then on top of that, as I mentioned previously, there is also this huge amount of natural variability. So climate scientists are not at all perturbed by the fact that you do not break a record every year. In fact, we do not expect records to be broken year after year because you have basically got a signal wrapped in this large amount of noise. If you look at the last decade or two, or the last 50 years, it is the warmest we have seen in the Northern Hemisphere for at least 1,400 years. If you look at the amount of greenhouse gases in the atmosphere, it is higher than we have seen for 800,000 years. So if you are looking at one year out of thousands of years, then you can be misled. It is a bit like looking at what happens in a cricket tournament. If Australia loses a game, you might conclude that they are no longer the best team in the world. It is just not the sensible interpretation of what has happened.

Senator HUTCHINS—The thing is it did happen. The other thing I want to ask about—and you may wish to comment on this—is that I have read we may be in for a repeat of very low temperatures, or what is called the Dalton Minimum. Do you want to comment on that?

Dr Power—I am not familiar with the term.

Senator HUTCHINS—From 1795 to 1820 the temperatures of the Northern Hemisphere did not increase. I am interested in terms of where our concern is Northern Hemisphere temperatures. Is that essentially where you are coming from as well?

Dr Coughlan—I think you might be referring to the little ice age. There is a lot of discussion in the literature as to whether the little ice age itself was a global phenomenon or whether it was peculiar to parts of the inhabited Northern Hemisphere. So, again, one has to be very careful about extrapolating those very early records to the globe itself.

Senator HUTCHINS—I would say that you would have to be very careful about extrapolating that on the other side as well.

Dr Coughlan—Particularly in the Southern Hemisphere, where enormous parts are covered by oceans of which we have absolutely no observations at all. Even the paleoclimatic record is of little use for the large ocean areas of the Southern Hemisphere.

Dr Power—We definitely need to take natural variability into account, and it is taken into account. But one thing is absolutely clear: the world has warmed up to higher levels than have

been seen for over a thousand years. CO₂ is at higher levels than it has been for hundreds of thousands of years. And sea level has definitely risen. The only way these earth system simulators are able to simulate the rapid acceleration in warming that we have seen is if you put in these anthropogenic, or human forced, increases in greenhouse gases. We talked about uncertainties before; there are uncertainties in some things, but some things there are no uncertainties about.

Senator HUTCHINS—I remember reading a book called *The Year 1000*, which came out at the beginning of 2000. It said Europe's temperature was about three degrees warmer than it is now.

Dr Power—Yes, there is lots of natural variability in there. But now we have this new kid on the block, human induced global warming, which is adding to this rich array of natural causes.

Senator HEFFERNAN—On natural observations, we have not had a frost at June this winter. That is pretty unusual weather.

Senator HUTCHINS—We had one in the Blue Mountains.

Senator HEFFERNAN—Sorry, old mate, but we haven't! In a former life I used to be the chairman of the Northern Australia Land and Water Taskforce—which I am pleading with the government, by the way, to get back on because it is not doing anything—and the Bureau of Met and the CSIRO are going to be a very important part of our plans to develop a frontier snapshot of Australia in terms of food production. The world has been busying itself for many generations with energy production while ever so slowly but ever so surely the food cycle has been going downwards, against a backdrop of 6.2 billion to nine billion people. Do you see a role that you do not have but that you should have in assisting the Australia—and we have an inquiry coming up looking at food, which you will be part of—in modelling food production and the availability of opportunities in what I would describe as the more immature farming areas of Australia? For instance, the Gilbert River, up there in the gulf, was pegged out in 1957 as an irrigation area and no science has been done on the system. I understood that you were going to be given some money to bring together all the information on the north that was available, scattered throughout the scientific community, in silos everywhere. Have you blokes done any work on that?

Dr Coughlan—Not specifically on the north. Again, we have been given money to collect information on water itself—water information—which is a pretty critical part of anything that one wants to do in the north or elsewhere. So to the extent that we have resources within the \$450-odd million allocated over the next 10 years we will endeavour to bring together what information is available. But at the moment there are no resources to increase the observations. At the moment we have been given resources to gather water data from what systems are already out there, which are mostly state and territory based systems.

Senator HEFFERNAN—I have to say that the most important part—and I speak from having been there and done that—is new observations on understanding the systems that are there. There are a whole lot of fragile soils and a lot of environmental things that we have to be careful of, such as hotter fires in the north. The average annual wildfire in Cape York is five million hectares, the biggest was 11 million hectares and there are 2½ million hectares below

that which would be suitable for carbon sequestration planting. Who directs how you spend that money?

Dr Coughlan—It is fairly clearly laid down in the Water Act, I understand, what the bureau's roles and functions are with respect to what it does in the processing and generation of water accounts and water assessments. So, to that extent, we do have our marching orders on what we are to do with respect to water.

Senator HEFFERNAN—Assembling what is already there rather than looking for what is not there?

Dr Coughlan—At the moment, we can certainly provide advice on areas where we believe we are deficient, but those assessments have probably not been done to the extent that they ought to be.

Senator HEFFERNAN—You see, my trouble is that this very thick CSIRO document is just assembling what we already know. There is nothing about the future in it. With the food task doubling in the next 50 years globally, I would have thought that a very important task for the bureau would be to assist the government to model the food cycle—and it seems to me that that is not happening.

Dr Coughlan—There is some interesting research that one can do to assess the impact of more information. Again, it has to be a modelling exercise. One can run a model with all sorts of different extra information, whether that information is real or not, and then one can do an assessment to see what effect that has on the information content coming back from the modelling. In fact we apply that, in a sense, retrospectively—in other words, we would run it on the observing systems we have and then say: 'Let's take out half a dozen of our observation systems. What effect does that have on our modelling results?' There is no reason why we could not run that the other way.

Senator HEFFERNAN—In farming type language in which Australian farmers talk about the weather, is it fair to say generally that the weather is moving south and in a slightly anticlockwise direction?

Dr Coughlan—If you look at the rainfall trends, one does get that impression. One gets the impression that the tropics are expanding. Rainfall is becoming more summer based than it is winter based. There is certainly some evidence for that. Rainfall has been increasing particularly across north-western Australia and decreasing across southern Australia. Of course, across southern Australia the rainfall tends to be largely winter rainfall, and that has been decreasing during both autumn and winter. The rainfall across the north, of course, is wet season, summer based rainfall. So there is some suggestion that what you propose is the case.

Senator HEFFERNAN—I know you have said it is harder to model run-off, especially against the background of the unknown quantification of cleared farmland being planted out. But, generally, would it be fair to say, in simple farmer language, that there will be a decline of somewhere between 10 per cent and 15 per cent in rainfall in the south if the modelling—

Dr Power—Yes, by 2070 under what is called a high scenario in the CSIRO-Bureau of Meteorology climate change technical report, but is in fact the scenario that we seem to be tracking at the present time.

Senator HEFFERNAN—There has been a bit of a wake-up call for the likes of plantations in terms of modelling the impact of the run-off—and the furphy about planting more trees in higher zones allegedly giving you a salinity credit when it does not; it gives you a salinity deficit, as the Loddon study showed. Would it be fair to say, then, that the run-off is going to decline by somewhere between 20 and 40 per cent, given the impact of reduced rainfall in some catchments?

Dr Power—To be frank, I think run-off might be best referred to the witnesses from the Murray-Darling Basin Commission. We basically provide information that people can then go away and calculate run-off estimates against, or at least some of that information, but it is not something that we focused on in this report.

Senator MILNE—I want to discuss the access system—the new simulator system that you are building—particularly from the point of view of time frame. The issue I am really interested in is the ability of the simulator to look at the full carbon cycle, particularly with vegetation. Kyoto accounting, as you are aware, does not go to what I would refer to as full carbon accounting, so you are not getting the real emissions from land use regardless of whether there is land use change. When can we expect to see this simulator model built, operational, starting to give us meaningful data et cetera?

Dr Power—The aim is to have it operational in 2009, but it is an extremely challenging endeavour. I suspect we are going to get there, but we may want to modify components after that and make improvements. I think it will be ongoing. Basically it will be a thing that we will be doing ad infinitum, getting better and better at looking at the individual components. There is a new land surface scheme that is being developed within CAWCA to incorporate changes in the land surface and so on. Some of the biogeochemical cycles are being developed as well. So it is a very ambitious project. Up till now we have concentrated more on the atmosphere, the ocean and a little bit on the land surface. Now we are really expanding in the sorts of directions that you alluded to.

Senator MILNE—In the absence of this simulator being built and online between now and 2009, is there anywhere where we can go which is starting to give any real data on the terrestrial carbon cycle—vegetation change et cetera?

Dr Power—It is not an area of expertise for me, but in the latest IPCC report, which came out last year, a lot of research is discussed. I am not sure if that is exactly what you want to know. It may be, but I do not know.

Senator MILNE—I want to know in Australia.

Dr Power—I can chase that up.

Senator MILNE—If you would. The second thing is that there was a news report recently saying that the buoys that had been used to measure ocean temperature for the last 40 years, or

up until about the early 2000s, had had some manufacturing fault and had been measuring ocean temperature lower than they should have been. Does that mean you now have to recalibrate all of your data on ocean temperature? How is the Bureau of Meteorology dealing with that or doesn't it impact on you?

Dr Power—There was an excellent study—it was an international study but it had two people from CSIRO involved, John Church and Susan Wijffels—and it meticulously went back through the record. Every measurement has error bars. What people have done over the last 10, 15, 20 years is to go back and meticulously look at measurements. We do the same thing in Australia for our temperature records. People spend literally years looking at how those observations were taken and whether there were any reasons for any concerns at particular times, and they adjust those things very carefully. This is one instance where they have identified a new source of error and they have been able to remove that from the estimate of upper ocean heat content. There was a bit of a glitch, a bit of a warming anomaly, several decades back, and that now seems to have been largely removed. That increases the rate of heat content for the upper ocean over the last 50 years and it slightly reduces it over the last 10.

These sorts of things are going to happen all the time. There was another study, probably 10 or 15 years ago, where people looked into the differences in the ways temperatures were taken in the ocean. In the old days they used to use canvas buckets and the water would evaporate a little bit, so there was a little bit of a temperature correction required for that, because they no longer used them. They would do modelling studies where they looked at this effect and take it into account. We can expect to see adjustments, but it has not changed the fact that the world has warmed up, sea levels have risen and upper ocean heat content has risen over the last 50 years, and the only way we can account for it is if we put in human induced greenhouse gases.

Senator MILNE—I just wondered if it made any difference. If everything has to be recalibrated, what it is essentially showing is that increased surface temperature is higher than we thought for that period.

Dr Power—The rate of warming of the upper ocean—not just the surface but the upper ocean—is greater over the last 40 or 50 years than we had thought.

Senator MILNE—Dr Coughlan, I would like to come back to the issue that my colleague Senator Siewert asked you about and ask you about it in a more direct way. Twice in your submission, twice in only a few pages, you draw this committee's attention to these observational records. In my view, what you are saying in code is that something is under threat. In your answers to two questions you have not actually identified what it is we need to be worried about. I notice the last line in your submission says:

As such, it is imperative that they receive the strongest ongoing support possible.

You talk about a 'priceless database of historical observations'. You say that we need 'to ensure the data's archival, quality control, analysis and dissemination' et cetera. Can you please just tell us: what is the threat? What is going wrong here? What are we losing and what does this committee need to do? You are amongst friends here. We actually would like to know what it is we need to be drawing attention to.

Dr Coughlan—Clearly, I am a climatologist. My lifeblood is the climate record. If we do not maintain that and if we do not maintain the observations at the required accuracy and with the required coverage, then we degrade that record. And as we go forward in the future we just have to protect that even more. If we do not—

Senator MILNE—Are you saying it is not being protected?

Dr Coughlan—What I am saying is that if the funds that we have to maintain that were to be reduced, then our ability to maintain that record becomes at risk. Ultimately, as all governments do their budgets, there are pressures to be more efficient everywhere. As a climatologist, I am very protective of the climate record and I would hate to see that efficiencies would lead to a degradation of that record.

Senator MILNE—Okay. I think that is a little clearer as to what we should be looking at. There are now so many websites, reports and research programs on agriculture, climate change, forecasting, potential impacts and so on, how are you meant to make sense of that if you are living in a rural community or on the land producing something? On this issue of making all of this stuff accessible to the people who really need it, I thought the NAM System was meant to bring that together so people could go to that and get a real sense of what is going on. Is there any effort to coordinate all the information and these websites onto something that is accessible to people in rural communities, rather than leaving them to try to find their way through this mishmash of information?

Dr Coughlan—I would agree that the World Wide Web has been a blessing and a curse. The amount of information is just enormous, and finding your way through it is hard enough for us who are reasonably adept at doing it. The Bureau of Meteorology got behind the NAMS very strongly. All the information that the Bureau of Rural Sciences requested from us was provided to the NAM System and we will continue to do that as long as the NAM System continues to function.

In addition, we do provide a number of other services. The NAMS has no seasonal forecasting capability within it; it is purely factual information on what has occurred in the past and the state of the system now. With seasonal weather forecasting, we attempt to provide that information to the farmers, as well as our normal forecasting information. At the moment there is no one website that has it all.

Senator HEFFERNAN—The average cocky would just like to know if it is going to rain in the spring, if they are in a winter rainfall area. We do not have the capacity to—

Senator MILNE—To just go to somewhere and find that.

Senator HEFFERNAN—There are umpteen variations but there is no—

Dr Coughlan—That is the nature of the World Wide Web, Senator.

Senator HEFFERNAN—Is that to avoid class actions by cockies who say, ‘You said it was going to rain and it didn’t’?

Dr Coughlan—We provide our seasonal forecasts at the moment. They are a statistically based system, and we do them to the best of our ability.

Senator HEFFERNAN—I had nine farmers in my office the other day. Seven of them are on antidepressants.

ACTING CHAIR (Senator Siewert)—Senator Heffernan, it is Senator Fisher's turn.

Senator FISHER—Gentlemen, I want to ask you a bit more about resources. You went close to that issue in your answers to questions from Senator Milne. On page 2 of your submission, you talk about the bureau's observational networks for establishing the climate record, and the foundations of those being laid down 100 years ago. You note that they have 'served Australia well and must be secured for future generations, yet they are gradually being eroded'—so your submission says. And then you say:

The Bureau would particularly like to draw the attention of the Committee to the need to maintain and indeed expand this critical component of national infrastructure.

How much additional funding has the government allocated to the Bureau of Meteorology since December 2007, particularly in respect of monitoring the effects of climate change?

Dr Coughlan—The funds supplied to the Bureau of Meteorology are, of course, in the budget papers. We are on the last day of the last financial year, so I would have to take the question—as to how those funds will actually be distributed to the maintenance or enhancement of our observing systems—on notice at the moment. We can compare the 2007-08 with the 2008-09 figures once those have been decided.

Senator FISHER—If you could take that on notice, that would be appreciated.

Dr Coughlan—Yes, certainly.

Senator FISHER—You do, importantly, talk about, firstly, the need to maintain and, secondly, in your view, the need to expand this component. So what additional services, infrastructure and funding does the bureau consider necessary to achieve this?

Dr Coughlan—I think that what is required to provide the level of detail that the farming community wants will—again, it is a little bit of an open-ended question, and I suspect that—

Senator FISHER—Focus on agriculture.

Dr Coughlan—Yes. As Senator Heffernan said earlier, there is probably some work to be done there to make those assessments—to say, 'All right: what level of detailed information is needed?' Then we have to ask, 'Can we afford that?' And I suspect that those investigations have yet to be done. What level of information does the farming community want? Once you have decided that, then you have to say to yourself, 'Well, can we afford that level of information or do we have to back off?' I think that iterative work has yet to be done.

Senator FISHER—I guess that is right, in terms of the farming community. But also, from my perspective, the government and, in particular, the Prime Minister have committed to the formulation of evidence based policy to take Australia forward. So I am attempting to drill down to the extent to which the Bureau of Meteorology feels equipped and funded for the future to help inform the government to prepare evidence based policy to deal with climate change and, particularly, climate change impacting the agricultural sector. So, have you had discussions with the government? And what indications have you had from the government about your ability to plan for the future? If you are still assessing it—and that is what I hear you say—then the subsidiary question is: how quickly are you going to be able to do this work, both in terms of maintenance and in terms of expansion, to inform the government so they may properly formulate evidence based policy?

Dr Coughlan—We have a capacity to do those sorts of studies. We have people who understand, particularly those in the Centre for Australian Weather and Climate Research—there is a whole group there that is concerned with what sort of observing systems one needs in place in order to be able to do assessments and, particularly, to do predictions on different timescales, whether they be weather forecasts or seasonal forecasts or assessments on climate change. The ways in which one can get that information are quite various, as I indicated. One can go out there and put expensive systems on the ground or one can do a lot of it from satellites. The issue of soil moisture, for example, is a tough one because it is a highly variable quantity. To get good aerial assessments of that can be difficult but there are now satellite based systems which will enable you to do that. But getting that mix right is a real assessment effort that is underway.

Senator FISHER—Indeed. In the interests of time constraints, you have said you will get back to me on notice about the funding thus far. Could you also take on notice whether or not your organisation has requested of the government further funding to ensure the maintenance and, indeed, enhancement of the infrastructure to which you refer on page 2 of your submission in that paragraph I read out. Also, what indications have you had from the government in response to those requests, if you have made them? My final question is on average global temperatures and, in particular, the way they impact on agriculture and Australian agriculture, but what has happened with average global temperatures from, say, 2002 till now?

Dr Power—I think the highest global temperature was probably in 2005, that particular year. In climatology we typically use the period 1961-1990 as a reference period and the temperatures have all been above that average since that period. In the media, and I think we talked about this before, some stories have been coming out saying: ‘Oh, this is interesting. Maybe global warming is not taking place because we have not seen records set every year since that last record.’ But in fact it is perfectly consistent with our understanding of climate science, because global warming does not exist on its own. Global warming is wrapped up in a large amount of natural year-to-year variability. Sometimes that variability is going to enhance the signal and sometimes it is going to reduce it. When you—

Senator FISHER—Okay. But what has happened—

ACTING CHAIR—Senator Fisher, you said that was your last question.

Senator FISHER—Two more, Chair, if I may, but they are on the same issue.

ACTING CHAIR—You are as bad as Senator Nash!

Senator FISHER—I am trying to get an answer. What has happened to average global temperatures from, say, 2002 to 2008?

Dr Power—They have remained above the 1961-1990 average. So, they have all been anomalously warm, but they have not been as warm as the record that was set in 2005. That has no bearing on the science of climate change.

Senator FISHER—To the extent that there is a trend indicative from 2002 to now, what is that trend?

Dr Power—If you are trying to paint a picture saying, ‘This is evidence against global warming,’ it is very weak evidence, because, like I said, the global warming signal is wrapped up in an enormous amount of year-to-year variability. So, taking trends over such short periods is not a revealing thing to do. But I can tell you the trend is probably—I can see it here—sort of either flat lining or—I am not sure. Maybe it has gone up a little bit. I can show you the figures here, but it is not that revealing one way or the other.

Senator FISHER—Can you take that question on notice?

Dr Power—Yes.

Senator FISHER—And what period of reassessment does the Bureau of Meteorology use to reassess what is happening with the warming of the planet and the trends and what is happening with temperatures? Now, the Prime Minister has said ‘evidence-based policy’, so I am asking you as experts: what is your assessment of the evidence thus far? And the question I am asking you now is: what period of time do you use within which to reassess this evidence to inform us for the future?

Dr Coughlan—Can I just comment? If you have a record in the past and you do not exceed the record in the following year than the trend in that record will be downwards, inevitably. It has to be. In fact, as long as that value remains the record value and is not exceeded by a higher record value, the trend will be downwards.

Senator FISHER—Thank you, Dr Coughlan. Is the Australian community told that though, do you think? That essentially means that in that period of time I have asked you about, the trend in average global temperatures has not been upward, which would be contrary, I would have thought, to what many in the Australian community think. Do you think they are informed of that?

Dr Coughlan—That is the problem; that is where the fallacy comes in. You cannot take a trend over such a short period. It is meaningless statistically. If one were to do the statistical significance tests on that then they would not be significant.

Senator FISHER—Then what period would you take?

Dr Coughlan—We typically take 30 years as being a standard period for calculating some sort of statistical average. As we decrease that 30-year period we would get less and less confident about the nature of that trend as the time got shorter and shorter. So by the time you get down to taking a trend over five years, it ceases to become statistically significant.

Senator HUTCHINS—I understand there are a number of climate models used to predict the atmospheric temperatures. Is that correct—about 20?

Dr Coughlan—Yes.

Dr Power—In our report we refer to about 22. For some things we use less.

Senator HUTCHINS—All of them identify atmospheric carbon dioxide concentrations, I would imagine. Would that be correct?

Dr Power—All of them incorporate changes and increases due to human activity.

Senator HUTCHINS—To look at this thing called ‘carbon signature’ it requires, I gather, significant warming to take place in the troposphere—is that correct?

Dr Power—There is a warming.

Senator HUTCHINS—But it requires significant warming—is that correct? I understand that in tropical latitudes at altitudes of about 10 kilometres you can identify whether there has been this phenomenon called a ‘greenhouse signature’. Is that correct?

Dr Power—You have to look at the whole climate system. They are highly sophisticated tools. They are the best tools by far for the job of trying to work out what has caused climate change, but they do not account for every detail of what the observations say. But to be honest, I think it is a little bit like looking at the trends since 1998. You have to put everything into context. You can look at the imperfections and some of the mismatches between what the models are telling us has happened and what has been observed. You can focus on the one or two areas where there is not agreement, or there may be less agreement, but then it paints a highly distorted picture of what is going on because we are not talking about the other 98 per cent of the agreement. Again, it is like judging the performance of the Australian cricket team on one game; it is just not a sensible thing to do.

Senator HUTCHINS—But aren’t all models assessing the troposphere at altitudes of about 10 kilometres—and they have found no increase in temperatures at all—

Dr Power—I would have to refer to the technical report—

Senator HUTCHINS—along with radioscope balloons and satellites and they have found no temperature increase. You would dispute that? If you want to come back to us—I know I am taking up time—

ACTING CHAIR—Could you take it on notice, because we have run out of time. Thank you very much. You have taken some questions on notice and if you could provide that information to the committee that would be really useful.

Proceedings suspended from 11.09 am to 11.20 am

JONES, Dr Christine Ellen, Private capacity

WILEY, Mr Tim, Private capacity

WILSON, Mr Robert, Private capacity

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

Mr Wilson—I am a farmer from Lancelin, which is in the northern agricultural region of Western Australia, about 150 kilometres north of Perth.

Mr Wiley—I am employed by the Department of Agriculture and Food, Western Australia, although today I am not necessarily presenting the views of the organisation that I work for.

Dr Jones—I am the founder of the Australian Soil Carbon Accreditation Scheme.

CHAIR—Thank you. Mr Wiley and Mr Wilson have lodged submission No. 41 with the committee and the Australian Soil Carbon Accreditation Scheme has lodged submission No. 42 with the committee. Do you wish to make a brief opening statement before we go to questions?

Mr Wilson—As a farmer, in 1985 I realised that the traditional annual based agricultural system that we were working with was failing. I moved to trial some new and innovative perennial systems that were based around a fodder shrub called tagasaste, which is a deep rooted perennial shrub. Over a period of years we planted around 1,000 hectares on the farm. By 2003 we started planting some subtropical perennial grasses, again to try and adapt what was happening with our past system so as to move from an annual based system to a more perennial based farming system. In 2007 we measured some of the soil carbon under these systems and we compared them with the soil carbon levels that were under our annual based pasture system. It showed indications of a sequestration rate on an annualised basis of around seven tonnes of CO₂ equivalent per hectare per year. If you consider that we had 1,000 hectares of tagasaste, that equates to around 7,000 tonnes of CO₂ equivalent per year being sequestered. A rough figure, to give you an indication, is that half of my farm would be taking out the equivalent of the emissions of around 1,000 cars. We then decided that we had better try and look at emissions versus sequestrations on a whole farm budget. Through some fairly rough figuring we came up with our emissions for the farm at that stage being about 2,000 tonnes. So we are working on about 5,000 tonnes actually being sequestered. We feel that we have the potential under these systems to actually make a difference.

Farming needs to change. We keep operating in the same way. If soil carbon is given the opportunity to be part of the new emissions trading scheme then I think that the farming industry can change and can adapt much quicker. In the 20 years that I have been growing tagasaste, about 100,000 hectares have been planted in Western Australia. In the five years that we have been mucking around with subtropical perennial grasses, probably about 30,000 hectares have been planted. That is great for a start, but if climate change is happening as quickly as we believe

it is then that will not cut the mustard. We have to adapt quicker, and farming has the potential to be part of the solution and not the problem.

Mr Wiley—I am a development officer with the Department of Agriculture and Food based in Geraldton in Western Australia, so the very northern part of the Western Australian wheat belt cleared agricultural areas. Unfortunately, it looks like we are the first and perhaps the worst to be really hammered by climate change. The coastal regions of southern Western Australia had the most reliable rainfall in the country, which meant our farmers could have high input-output systems because they knew it was going to rain. Unfortunately, things have changed. From 1970 to 2000, rainfall declined by about one to two millimetres per year, which is not a lot, but over 30 years that adds up. It now appears that we may have had a second climate shift in 2000. This is still very contentious amongst the climate scientists and, as you were hearing previously, eight years is not a lot of data. But the shift appears to be so great that the evidence is suggesting we are actually into a completely different climate from last century. So far this decade, our rainfall for the very northern agricultural wheat belt has fallen by 25 per cent compared with last century. If that really is the case, we are in a totally new ball game.

In our region particularly—we are a bit biased—we have a very adaptable agricultural sector: good farmers, good resources and good agribusiness. While rainfall declined over that 30-year period, wheat yields actually went up—by about four per cent per year over a two decade period. That is a pretty remarkable achievement. They are now dropping. So you cannot adapt if you have had this significant change in climate, if this turns out to be correct. We have had this big drop, but in 2006 we had the mother of all droughts. You are talking about places like Northampton that have never had a drought before. The Binu bin did not open that season because there was not one grain to be delivered—not one grain. Eighty per cent of the stock had to leave the district. All the lambs had to be put down that season and the stock remaining had to be hand fed. Because it is mostly sand plain, the degradation meant it was like the beach for about 10 months. Unfortunately, we are 500 kilometres north of Perth, so not too many of the experts or decision makers in Perth got up there and saw it, but it was a disaster.

In terms of the economics, the banks are not saying too much at the moment. There have been very few sales so officially we have not had a collapse in land values, but I cannot see how we will avoid it. If land values collapse, equity collapses. Earlier this year, probably 25 per cent of the farmers had been told they would not get finance to put the crop in this year, but we had a bit of summer rain in the north and record wheat prices early in the year, so most of them did get finance. It is on a knife edge back there at the moment, depending on the rain. I have been away for two weeks. If it rains, we might get a crop. If it does not rain, there could be whole districts where they will have to walk off the farm. It has got to that point and, unfortunately, we are the first. But one of the farmers, Chris King, who chairs NACC, the Northern Agricultural Catchments Council, said a couple of weeks ago, ‘Australian agriculture is lucky because if anyone can deal with it, we will be able to’—because it is an area of innovation.

Bob was talking about the perennials. That is what I have been talking about. We had a project that started in 2006 in the Binu area, the worst affected area, where we got the farmers to record the actual stock movements so we could work out exactly how much each paddock carried for a 12-month period. We picked farmers who were just starting to put in the perennials—the first innovators. It turned out to be the mother of all droughts. What that data said was that it did not matter what we did, any traditional annual pasture would not have grown enough to prevent the

wind erosion we saw over the 10-month period. Even I was surprised how good the perennials were. We were actually carrying four to six sheep per hectare equivalents and had ground cover and had no erosion. So these innovations carried more stock in the worst drought ever than those farmers carried on annual pastures in a normal year. That gives us hope for the farmers but even for me. The only thing that kept us sane during that drought was to go out and see those patches of green.

One of the other innovations we did only last year was to do with approaches to cropping. There is a farmer over here doing pasture cropping and growing wheat over these summer-growing perennial pastures. Bob and I came over and saw it last year and we went back and put a trial in and, remarkably, we found that the wheat on certain perennials out-yielded the wheat on annual pastures. It was one trial, one year, one season. We are at the point where there is a bit of light at the end of a very dark tunnel. We do not have a lot of hard evidence in terms of scientific data—we have a limited amount—but it looks like there could be some solutions. We are talking about a complete revolution in the way we farm. In the last six months farmers' attitudes have changed. I guess you have heard comments about climate change like, 'We are probably just in a dry spell and it will come good again.' The farmers in the north-east are no longer thinking that way. They now accept that this is the future and the question for them is: will they be on the farm next year and beyond?

We see some hope and systems that could work in the future. The problem is finance—the equity is shot; the banks' nerves are shot. So if these things work, how do we actually redevelop agriculture? How do we fund it? I cannot see that government would pay the bill for what is required to totally redevelop agriculture even in our little part of the world. What does look promising is storing carbon. As Bob was saying, the figures from him, and we have got other figures—though we have not had the money to do the intense sampling that is required—are in the range of five to 10 tonnes CO₂ equivalent. The older trial data on annuals, the old farming system, had a maximum of three and probably at best about one tonne. We are talking about a quantum difference, if it is right.

I am not totally certain that it is right, and at the moment we are taking more samples to see if this is real. If it is, then it could be the thing that finances the change in agriculture to more sustainable systems. I have extrapolated from the numbers that we do have to the Western Australian examples I know pretty well, because I was curious to find just how big this is. My extrapolation is in the report and included in the submission that we gave you. It effectively says that we could soak up all the Western Australian emissions on cleared agricultural land in WA with those sorts of systems. You must be careful about how you take those figures. This is an extrapolation—it is my best guess at the moment. We really need to work out if that is possible or not.

Senator HEFFERNAN—The CSIRO's is only a guess too.

Mr Wiley—It looks promising. We are drawn between the positions: this is disaster and this decade is the future in our part of the world. The old game is over. It is time to stop talking about it; it is now time to take action. It will need to be radical action if agriculture in our part of the world is to keep going. But there is hope.

Dr Jones—I am the founder of the Australian Soil Carbon Accreditation Scheme and my PhD research was on the chemistry of the carbon compounds that come out of plant roots and into the soil. Soluble carbon entering soil from plant roots is rapidly humified if appropriate microbial associations are in place. This humified carbon is not labile and is not easily lost, as was suggested this morning by Dr Mark Howden. The main pathway for soil to act as a permanent carbon sink is through the perennial grasses and perennial shrubs that have been referred to by Bob Wilson and Tim Wiley this morning.

The humification pathway for soil carbon increase is not included in any current models used by CSIRO or other organisations in Australia. I have spent my whole adult life in tertiary education and in working with farmers to find better ways of doing things. Building soil carbon, restoring healthy topsoil and improving resilience and productivity in agriculture equates to win-win—for the atmosphere, for the soil and the Australian economy.

Currently, field days and workshops on soil carbon readily attract 100 to 200 farmers, whereas if we ran field days on soil health we may get 30, and it is always the same ones who turn up. So we are accessing a whole lot of farmers who never came to field days before. If a financial incentive were to be provided for farmers to increase their soil carbon, all of Australia's carbon dioxide emissions could be easily and permanently sequestered in soil. Our emissions are predicted to be 603 million tonnes this year. A 0.5 per cent increase in soil carbon, which would be readily achieved under perennial agriculture, on only two per cent of our agricultural land would sequester 685 million tonnes of carbon dioxide, which is a greater amount than our total national annual emissions. There is no need for the agricultural sector to be a net emitter of greenhouse gases. In fact, agriculture provides the only viable and immediately available solution to excess carbon dioxide in the atmosphere.

All of the major greenhouse gases—carbon dioxide, methane, nitrous oxide and water vapour—are cyclical. The way land is managed has an enormous impact on this cycling process. For example, the amount of water lost as evaporation is directly affected by the amount of carbon and nitrogen sequestered in soil as humus, and that humification pathway is the one that we find under perennial agriculture. We do not find that in conventional business-as-usual agriculture. So providing a financial incentive to farmers to increase levels of soil carbon would have a beneficial effect on reducing all four major greenhouse gases.

CHAIR—For the benefit of the committee we are talking about a trial in New South Wales with the perennials—and I must admit I had a conversation with Mr Wilson on the way up in the lift. There is a grass being grown on which you graze your cattle and then for half the year you can grow wheat on top of it—and that trial in New South Wales has proved successful.

Senator O'BRIEN—What are the issues with weeds? With all of these systems—the cropping perennials and the like and the tagasaste issues—we have got all sorts of chemicals that are used to control weeds. But what is happening with management of weeds in the sort of systems that you were talking about?

Mr Wiley—The perennial grasses we are talking about are subtropical; in fact, you will hear them referred to as C4. They grow in summer and are dormant in winter. The C3s, or temperates, are the other way around. We have tried the winter-growing perennials north of Perth and they did not work. Lo and behold, these things that grow when it does not rain do work, but they are

dormant when it does. In 1990 we started the first trials. We are seeing, very interestingly, that in the targeted very poor sands—we call them the Western Australian silver loams or beach sands and they are pretty shocking stuff that would not grow a crop and would not grow very good annual pasture—the perennials actually make the annuals grow a hell of a lot better. It takes about three or four years and we get this dramatic improvement in how the annual pasture grows on top of the perennials in winter. We get a shift in the composition of the species. We lose all of the broad leaves—cape weed, doublegee, Paterson's curse. The perennial replaces those and we get a shift in the annual grass component away from silver grass and brome and towards rye grass and others.

I am not sure if we fully understand what is happening but we are getting some fundamental changes in the ecology of the pasture. Christine knows more about the soil. So Colin Seis, who developed pasture cropping over here and has been doing it for 17 years, told us that he really does not have much of a weed problem at all. It is a bit early to say that for us but I suspect, on the observation, we will at the very least dramatically reduce our requirement for herbicides under these systems.

Senator O'BRIEN—How do herbicides intersect with the pasture?

Mr Wiley—The prices of fertilisers and herbicides have doubled or tripled and are not going to come down in the next couple of years because the world does not have the capacity. So our farmers are very interested in systems that reduce the input of those two things. This system certainly seems to do both of those. The challenging part is that it does not fit within our understanding of agriculture. I have seen too many weird things happening; there is something really going on. We need to rethink some of the basics of agriculture. Personally, the only thing that fits is soil biology. We have changed the soil biology. We have gone from a system where we had plants growing for six months of the year and then nothing growing for six months of the year and cooking the soil for six months over summer to having green plants year round. It seems to have created some fundamental change. So the sequestration rates do not fit the models. We have talked to Geoff Baldock from CSIRO who has developed the Roth C model, and Jeff says that you cannot do it. We said, 'We think we are.' He said, 'Send us over your data'—because he has no data from the systems in Western Australia—'and we'll fix the model.' So we are right at the point at trying to collect good, vigorous, scientific data to find out whether we are really right, although I myself have some uncertainty about that. Once we have that data, that will create a whole pile of challenges for the scientists to try to figure out how it is happening.

Senator O'BRIEN—On the one hand you are talking about a system that is moving from cropping to pasture grazing—

Mr Wiley—I started with the department in 1990 specifically to look at the poor sands in the coastal area north of Perth, because our traditional annual based agricultural systems were failing. It is not well known but about half a dozen of the worst sand plain farms were abandoned in the mid-1980s, not due to climate change but due to the soils being too poor. We discovered that these weird perennials worked and we have spent a lot of time developing them to a viable commercial system. But we have targeted these very poor sands where cropping fails. So the farmers say, 'I've got this poor sand; nothing works so I will give that a crack,' and it

does work. With the price of wheat, we are now at the point where farmers do not like to give up any wheat country, but they have been forced to in the north-east because it has not rained.

Senator O'BRIEN—It costs a lot to put it in if you do not get a crop.

Mr Wiley—Yes. This year a lot of them have rolled the dice for the last time, and it is the biggest wheat crop I have ever seen. So now we are starting to think, 'Can we grow it on good cropping country?' As I said, we had one trial of pasture cropping one year but we have a lot of guys who are going to give it a crack this year. It could be the breakthrough.

Dr Jones—Could I make a comment from the eastern side of Australia. We actually have pasture cropping data going back to 15 years. We have trials on some of the best soils in Australia, and we have found that soil carbon can be increased—doubled or tripled—on good soils with pasture cropping. To get to Senator O'Brien's question on the herbicides, most of these crops are grown with no herbicide whatsoever because perennial grass prevents weeds from coming through; you have complete ground cover. The better the ground cover, the better the crop. So we find that the thicker the perennial grasses, the more vigorously they grow, the more they condition the soil and the better the crop grows—that is, the annual crop that you plant into the perennial pasture.

Senator O'BRIEN—In what parts of eastern Australia have the trials been conducted?

Dr Jones—We have trials in western New South Wales through to the north of Clermont in Queensland. I can give you specific locations.

Senator O'BRIEN—It is a matter of interest in terms of climatic conditions.

Dr Jones—Rainfall is generally around 300 to 700 millimetres, depending on where the trials would be. In the lower rainfall areas it is actually extremely successful. Our crop yields are the same or better than under conventionally managed farming, and the improvement in yield is better the more marginal the area because perennials provide so much change to soil biology. We have seen places where soil carbon, if you are talking about tonnes, has gone from something like 150 to 500. It is far more than you could ever sequester in trees, and in those marginal areas the trees would not have sufficient rainfall to grow.

CHAIR—You might want to take it on notice to provide that information to the committee, Dr Jones.

Dr Jones—Yes. It has already been published; we can provide it to the committee.

Senator O'BRIEN—On your submission about chemically based zero-till farming, could you explain why that actually works against the outcome that we are trying to achieve?

Dr Jones—Because there is a carbon pathway from gas, as carbon dioxide has to be fixed in leaves as glucose, which is liquid. It goes through the plant and then, to come out of the roots, you have to have microbial associations around the roots that then take that into the soil, in particular, mycorrhiza that use that carbon. They can use 60 per cent of the carbon that is fixed in the green leaves, and 80 per cent that can be turned into humus, so it is a huge equation, a huge,

huge amount of carbon that can be fixed. That is why we are seeing the sequestration levels that we are seeing. Also, it is carbon that is not then subject to oxidation, so it does not break down and go back to the atmosphere. But if you knock out those microbes that are part of that pathway, it does not happen. If you use herbicides and if you use conventional fertilisers, you kill the microbes in the soil that are the endpoint of the pathway.

What happens in a conventional zero-till type cropping is you would have stubble that would break down into the soil and form what they call labile carbon, which is very readily decomposed, and within 12 to 18 months most of that goes back to the atmosphere as carbon dioxide. So it is a very rapid cycling of carbon, and the reason that that happens is that the microbes necessary for humification are not there because the chemicals used in zero till have knocked them out of the system. This is why we have experts across Australia telling us we cannot build soil carbon because they are looking at conventional zero-till systems where the microbes that you need to build the carbon simply are not there. They are actually quite correct that you cannot build carbon in those systems. But if we go to perennial based agriculture and change the soil biology and get the microbial associations, we can build carbon at rates faster than people will actually acknowledge is possible. The Australian Soil Carbon Accreditation Scheme was established to measure those levels so that we can say this is happening and use rigorous science to measure that and record that.

Senator HEFFERNAN—To take the halfway ground, in a mixed farm where there is a chemical regime, what would be a reasonable sit-down period for the perennial pasture before it comes back into crop?

Dr Jones—It can be cropped every year. The perennial pasture grows better if it is cropped. Putting the annuals into the perennial pasture actually improves the perennial pasture.

Senator HEFFERNAN—We obviously now plant crop with lucerne because we have found that clover and such disappears when you have a decent lucerne paddock. Would that be part of a success model? Do you blokes use lucerne over there?

Mr Wiley—Not so much north of Perth as south, but it tends to be grown as a phase in rotation: you will plant your lucerne, have pure lucerne for four or six years, kill it out, go back into crop for a phase—

Senator HEFFERNAN—Yes, that was my question.

Mr Wiley—This is very different. This is—

Senator HEFFERNAN—A six-year cycle for lucerne—is that a waste of time when it comes to—

Mr Wiley—This system is very different because you are deliberately aiming to keep the perennial under the crop. It is a different mindset.

Senator O'BRIEN—You mean it is 'really' perennial?

Mr Wiley—Yes.

Dr Jones—Yes, you actually plant your crop into the perennial grass; you do not kill the perennial grass. It is better if it—

Senator HEFFERNAN—So which perennial grasses are we talking about? Is it fescue or bloody phalaris?

Mr Wiley—North of Perth, I have tried the temperates, the C3s—phalaris, perennial rye-grass, cocksfoot, all of those—and they do not seem to be able to handle the heat.

Senator HEFFERNAN—Cocksfoot is a waste of time.

Mr Wiley—Yes. They just get cooked by the heat, so it has been these subtropicals, the C4s, and they really have grown over summer with up to, probably, eight months of no rain but on these deep sands. Part of the secret is the rooting depth. We have not actually found the bottom of the roots yet. We took a core sample 12 months ago at the end of the worst drought ever and we got a core from 4½ metres and there were still live roots at the bottom of it. That seems to be part of the secret. A summer-active perennial over a winter-growing annual is the system.

Dr Jones—And in the eastern states a lot of our work has been into native perennial grasses. They have been there but they have recently been encouraged to proliferate. We have done things to encourage getting more and more grasses into cropping systems, and we now have a complete cover of native grasses.

Senator HEFFERNAN—I see you did one here in the central west. Is that wire grass. What sorts of grasses were involved in that paddock in the central west?

Dr Jones—We got colonisation of native grasses after the rain that fell on 23 December last year in the central west and that continued into January. The primary grass in those photographs is *chloris truncata*, which is a native perennial grass, but there are about 10 other native grasses in that paddock.

Senator HEFFERNAN—Tell me the district again.

Dr Jones—It is Warren. They photographed it from Warren.

Senator O'BRIEN—So the transition from conventional farming to this sort of farming would require at least a season recreating the perennial pastures?

Dr Jones—In that situation, that farm had been conventionally zero tilled for 15 years prior to the rain this summer. It was then miraculously covered in perennial grasses that just appeared. Scott McCalman, who was the farmer in question and who was New South Wales Farmer of the Year in 2005, has excellent credentials as a farmer and is very highly respected around Australia. He decided that he was not going to kill his grasses, that he was actually going to crop into them. He had heard about pasture cropping, and he just decided that he was going to do that. He saved \$70 a hectare by not spraying out those grasses. When we measured the nutrient levels in his paddock this year prior to him sowing his crop, the phosphorous levels had gone up by a factor of five. The agronomist actually thought there was a laboratory error in the data. We relooked at

that and at bare areas compared with areas under the grass, and it was correct that available phosphorous had gone up by a factor of five.

Senator HEFFERNAN—And that is the microbes releasing it.

Dr Jones—Yes. Phosphorous fertilisers had been used over time, under 15 years of zero till in that area, and they just formed a phosphorous bank that had been inaccessible. A fortune has been spent on phosphorous fertilisers. That farmer will not need to apply phosphorous fertiliser, we do not know for how long but for several decades, because the microbes are releasing what has been built up. You mentioned before the issue with your conventional zero till and why it is that carbon does not work, nitrogen does not work and phosphorous does not work. Nothing works because you have to have a microbial bridge between plants and minerals in the soil. Plants cannot actually access those unless that is in place. Normally the carbon from plants feed the microbes that in turn bring nutrients back to the plants. We have destroyed all those associations in soil by loading it with toxic chemicals, basically. What has been in favour of its adoption is not only climate change but the rapidly increasing price of phosphorous, nitrogen and herbicides. That has encouraged farmers to look for alternatives to that system.

Senator MILNE—I am delighted that you are here. Congratulations for realising that we need a radical shift and not just incremental change, which is what we have been hearing about until now. I am particularly interested in the research you have been doing and any connection with CSIRO, the Bureau of Rural Sciences, Land and Water Australia or anyone anywhere in the research body across Australia in looking at the potential of building resilience in soils as an adaptation strategy to climate change and maintaining food security. Is CSIRO actually looking at this in any way? Is anyone supporting you in developing field trials across the country and in helping to get the data together—doing all that—or are you battling on your own?

Mr Wiley—What we are talking about is radical.

Senator MILNE—Yes, it is a radical shift.

Mr Wiley—For me, it has been driven from the farmers' paddocks. From my perspective, there has been limited support—I have a job, which is great, and the Western Australian state government pays my wage—but these things really are off the scale of what was thought possible. What we have been saying has been very contentious in the scientific community. But I do believe that, probably only in the last 12 months, there has a considerable change in attitude and there is now real interest. We are certainly starting to talk to people in CSIRO. Some are completely sceptical about what we doing; others are really interested. The future farm CRC is showing interest and their budgets have just been signed off in the last few weeks. One of those projects is called EverCrop—

Senator SIEWERT—Is this the CRC?

Mr Wiley—This is the Future Farm Industries CRC, and I think Kevin Goss is in later today. The staff in the future farm CRC will actually do most of their work in Western Australia up to the north in our region, looking at these pasture cropping systems. I am optimistic that there has actually been a change. We are in the middle of a significant change in thinking. It has already happened for our farmers in the north but I am not sure if the rest of Western Australia believes

that this is real and that we are going to get dinkum. I think that the scientists and the scientific bodies are in the process of going through a very big change in thinking, from: 'It is only minor; we'll deal with it' to 'Maybe this is the disaster that a few people are saying it is.' It is a difficult process to rethink; we are talking about a very big shift in thinking. I am really pleased with what has happened recently. There is a lot further to go and we do have the problem that we have very limited data that does not stand up to detailed scientific rigour, and I have never claimed anything else. We actually need to get that data and we need those scientists involved. They need the funds to be able to do it properly.

Senator MILNE—Do you want to comment on this, Dr Jones?

Dr Jones—My comment would be that I have been applying for funding for this for 10 years at least. I have folders full of reject letters saying that it was an extremely well worded application, that it has possibility but the current science does not support it and it is not possible to actually increase carbon to the levels that we were documenting on farm. I would have to say that that has changed very quickly recently. In fact in the last week even, there have been huge changes. I think we have just finally got to the tipping point. We have 2,000 farmers involved in this. It is a huge grassroots revolution that the scientific establishment for some reason seems to be completely unaware of or, if they are aware of it, have totally discounted as irrelevant.

I travelled to Central Queensland last week with a professor from the University of New England, where I formerly worked. He is the head of the beef CRC and a professor of meat science. He was going there to talk about tenderness in beef. He does not get to interact with farmers because he goes to conferences and talks to people at that level. Over 200 farmers came to this workshop and they got up and talked about and gave presentations on pasture cropping and presented their data with very professional PowerPoint presentations. They have data, but it is considered anecdotal because it does not fit into the scientific model. The professor was blown away. All he could talk about was what he had seen that day and this farmer revolution. He said, 'How come I have never heard about this?' The scientific establishment have been talking among themselves and, out there, farmers all over Australia are doing this other amazingly innovative stuff. Now, all of a sudden, this bubble here seems to have burst and we are getting through. DAFF are now very interested in what we are doing and suggesting that if we talk to them and give them some case studies then they might be able to provide some funding. I think we are going to see an explosion in this area. I am feeling very positive as of last week, I would have to say.

Senator MILNE—I would like to hope that that is the case. What sort of formal interaction are you having with Dr Geoff Baldock and the CSIRO in Adelaide on soil carbon? It seems to me that if he is doing a whole project on soil carbon and is dismissing this as irrelevant or whatever, then we are not making any further gains. Is this embedded in the CSIRO yet, in terms of data collection and proper studies, or not?

Mr Wiley—Bob, Christine and I met with Jeff at Mudgee last November. Jeff has heard of some of these figures and what he has done is run it backwards through the Roth C model. He has run it back and said, 'You would need to be growing 30 tonnes of dry matter per hectare per year to get that level of sequestration; you cannot do it,' and we would agree entirely—we cannot. So our data is not fitting with his model. Either our data is wrong or his model needs readjusting. Basically, what is good about this is that if this is real I will go and change the

model to fit what is actually happening in the paddock. That is what we have lacked, good hard data, and that is what we are trying to get right at the moment—but it will still be limited—so that they can make the model fit what is actually happening in the paddock.

Getting the model right is absolutely critical for Australia. A lot of people are saying that soil carbon is not part of Kyoto. That is just total rubbish. It is in there; it is in all the rules. It is probably the biggest uncertainty in our current national accounts and the biggest risk for this government in that, if we are actually running down our soil carbons and we have to count it properly, for every tonne we go over budget the federal government will have to pay, and we will be able to sell every tonne that we go under budget. But we will need a very large investment to get those models right so they are reliable.

Senator MILNE—One of the big issues for us is the conflict between food security and the push for offsetting through trees, whether it be oil mallee or plantations and so on. It seems to me that there will be no prospect of farmers staying on the land farming food if they get all these up-front tax deductions and stuff for biosequestration, so to speak. In fact, what you are telling us is that if you want food security then you need to account for carbon in soils properly to give farmers who want to farm food a fair chance of competing on an even playing field. Is that really what you were saying?

Mr Wiley—Yes. Caroline Peek and Megan Abrahams out of the Geraldton office have been doing some whole-farm economic modelling on a model they have developed called STEP and they have put carbon into that model—and it may be an Australian first, though I am not certain. It is very informative. Farming is business—you have got to make money. The idea is to optimise your income. We practise mixed farming. We have crops and pastures and will have trees and oil mallees, if they fit together, to optimise the profit and the environmental benefits. And under carbon trading, under the future emissions trading scheme, if it is allowed, we will reduce our emissions.

So to say that it is all going to be wheat or grazing or trees is not the right way to go about it. What we would really like to see is that the emissions trading scheme rules that are passed through this place next year are written to keep the options open. I am quite concerned that some of the state carbon rights acts—not the Western Australian one but the other ones—have been prescriptive and restrictive. They have basically said that they will pick a winner—trees—and exclude everything else.

Senator MILNE—Exactly.

Mr Wiley—We are not saying that the system with its pasture cropping or rotational grazing or oil mallees is the be-all and end-all. We need to do good science to be able to do good modelling so that farmers can make the best decisions possible and optimise all those things. Critical to that are the rules of the emissions trading scheme. So I guess we are begging: keep the door open.

Senator MILNE—Whose model is it? Can we just have a factual answer about that model they fed the carbon into? Who has done that model? Where can we access that data?

Mr Wiley—Caroline Peek and Megan Abrahams, two of my colleagues in the Geraldton office of the Department of Agriculture and Food, have developed a model called STEP, a whole-farm economic model. There is another one called MIDAS.

Senator MILNE—That is fine. We will try to access that, thank you. I just wanted to know who and where.

CHAIR—I am sure there are a couple of farmers who may wish to ask a question or three.

Senator NASH—Definitely. Thank you all very much for your submissions—they have been very interesting. We are out in the central west and last year we had a pretty ordinary year and, by accident, ended up sowing some grazing wheat into a pasture paddock to do nothing more than bulk it up. We ended up stripping it and it was probably the best paddock on the farm. It was all purely by accident. With the trials in the east that you have been doing, what crops are you using, Dr Jones?

Dr Jones—So far we have only been using cereals—wheat predominantly because of the price for wheat, oats, barley and triticale. We strongly recommend against using canola because it is antimycorrhizal and actually kills the bugs in the soil that you need for the carbon highway. So we are recommending for farmers that want to build soil carbon that they do not use canola, but otherwise any of the winter cereals are great.

Senator NASH—What sort of yields are you getting? I understand it would vary from area to area.

Dr Jones—Yes, they do vary. We have 28 trial sites in eastern New South Wales. Last year our yields ranged from two to 4½ tonnes per hectare. Where we got the 4½ tonne per hectare crop, nobody else in that region got a crop.

Senator NASH—I am getting at the moisture issue and the impact it is having on this type of cropping. For that 4½ tonne result, what sort of rainfall did that area have?

Dr Jones—I would not be able to give you that rainfall.

Senator NASH—Would you mind taking that on notice?

Dr Jones—Yes, I could.

Senator NASH—It would be quite interesting to know. Are you finding that there is an optimum rainfall level to produce the best results?

Dr Jones—What we have found is that if the rainfall is very low the only people that get a crop are the ones that cropped into perennial grasses. If the rainfall is marginal, it is the perennial grass that makes the difference because it changes soil-water relationships completely. The crop can survive and produce to grain if it is sown into perennial grass. If it is sown into bare ground it will fail in a very low rainfall year.

Senator NASH—Perhaps I could ask Mr Wiley about Western Australia and what you have been doing over there. Obviously it has been dry since you started this particular trialling. Are you planning on comparatively trialling it in a wet area?

Mr Wiley—In terms of the pasture cropping, this EverCrop project will be the one and we will do it in a medium and a low rainfall area to try and get the contrast due to rainfall. Also, because this really has excited farmers, we have got farmers who are going to go out and do their own trials—a bit more simplistic—so if we get enough of those we will get a feel for it. You asked the good questions: where does it work and how do we do it? These are all issues that we do not have the answers to. Like I said, we only started pasture cropping in WA 12 months ago, but we have had some really interesting observations through the drought that are difficult to understand. It seems that some of these perennial grasses actually make the soil wetter rather than drier.

CHAIR—That is a large statement, Mr Wiley.

Mr Wiley—It is. A farmer out the back of Una, which is in the far north-east, took me out there with a shovel and said, ‘Have a look at this!’

Senator HEFFERNAN—The difficulty with that is he might have had a thunderstorm, old mate.

Mr Wiley—No, this was in the drought.

Senator HEFFERNAN—Yes, but that is how it works here and there.

Dr Jones—No, we are talking about a metre apart.

Mr Wiley—We are talking about a plant here and a plant two metres away, in a drought. He said: ‘Here’s a shovel. Have a look at that.’ It was as dry as bone in between the plants but the plant was wet, and it has not rained for five months. It is a concept I had not heard of called hydraulic lift. There is some science to support it. When you start doing weird things and having a look, you find out that some really weird things happen. In terms of some of these radical systems, we have had early indications that have us totally excited. Our farmers are desperate and I cannot exaggerate how bad things are.

Senator NASH—I know.

Mr Wiley—So they are prepared to listen to nut cases like us and have a crack, and things seem to be working. That does not mean there is not a long way to go before we come up with commercially viable packages. But they do not have a choice—the ‘do nothing’ option at the moment does not exist. They will not be there in two years time so there is no risk in being a radical when you are guaranteed to fail, and that is where we are at.

Senator NASH—That is exactly right. Dr Jones, given that you have had 15 years over here now, are there any particular soil types where it is apparent that the process works best, or is it not really indicative?

Dr Jones—It has worked in every soil type that we have tried. The photographs of the trial paddocks in the submission from Warren are actually representative of the three major soil types in the central west. We are comparing soil types from fairly light sandy soil through to heavier soil. We also have a sodic soil in there and we are looking at what we can do about sodicity. That is a huge factor and a constraint to farming in the central west.

Senator HEFFERNAN—Did you say heavy clays?

Dr Jones—If it is sodic, it is high in sodium. We have heavy clays through to very light sandy soils in western New South Wales. In Queensland they tend to be generally heavier soils like the black self-mulching clays. We have a range from heavy soils through to very light. It does not seem to make any difference. We still get the same result in that it is better no matter what kind of soil you are using.

Senator NASH—You mentioned before those years where if you get a tonne the people next to you, if they have not done it, get nothing. In contrast, in the wet years that we have had, what has been the difference in the yield from the paddocks nearby that have not had the perennials in, say, what you would class as a ‘normal’ wet year?

Mr Wiley—Could you organise a normal year for us?

Dr Jones—Just casting back over the last 10 years, I do not think we have had one.

Senator NASH—That is right. It has been the same where I am—and I did use my quotation fingers there for Hansard to pick up.

Dr Jones—The central west have had, as you know, seven dry winters and this year was going to be our eighth until it did rain in June.

Senator HEFFERNAN—But this one at Warren has only been going for this wet summer—is that right?

Dr Jones—Yes, just one—just that particular trial.

Senator HEFFERNAN—It was a paddock that had not been farmed or had been farmed and all the grass was shot from the freak summer rain—or not? What was in the paddock the summer before?

Dr Jones—The paddocks have been farmed continuously for 15 years and they have had all living ground cover removed continuously for 15 years, apart from when the crop is there, so they have been maintained as bare fallows over summer. This year they are covered in perennial grasses because it just rained—it was an act of God, if you like—and they decided to leave them there rather than spend a lot of money trying to get rid of them.

Senator HEFFERNAN—So we have not really tested out at Warren what is going to happen in the spring when the perennial grasses that are presently dormant start to grow?

Dr Jones—No. We will know in November.

Senator HEFFERNAN—Good. I will see you then.

Dr Jones—But we certainly have lots of anecdotal evidence from not very far from there. By anecdotal I mean, for example, that Colin Seis, who is one of the originators of pasture cropping, is just slightly east of there—not that far removed, if you look at Australia as a whole—and he has found that he has always had the same as or better than the district average.

Senator HEFFERNAN—But if you—

Senator NASH—Can you wait your turn, Senator Heffernan.

Senator HEFFERNAN—Righto.

Senator NASH—Thank you. In the work that you have done, Dr Jones, is there any potential restriction from the perennial grass scenario if you, say, have a wet year? Is there any kind of a ceiling on potential yield if you have a normal year?

Dr Jones—All I can say is if the grass grows better, the crop grows better. That is all I can say. We have not found a contradiction to that to date. Where you look at the drill lines of the crop going through the paddock, wherever patches of grass are thicker the crop grows better. In a year when the grass grows better, the crop grows better.

Senator NASH—I understand that. What I am trying to do is get a comparison with a normal year—if we ever again get a reasonable, normal year. You may well not have any data on this as yet. To put it very simplistically: in the same year, if you had a paddock next door that had none of the perennial grasses, that you had just sown a straight crop in, and you had 26 inches of rain that year and this one grows 2½ tonnes an acre, have you got any data under that scenario that there is any kind of restriction in the yield potential from having that perennial grass underneath it?

Dr Jones—We do not have any data, but the perennial grass is building the soil and building all of the things that you need in soil to make a crop grow. So the better the perennial grass is, the better the crop will grow, as a generalisation. But, no, we do not have any data from high-rainfall years because we have not had any high rainfall.

Senator NASH—Are you planning on doing that, if we ever have one again?

Dr Jones—If we get any high rainfall? We are monitoring so that if it ever does rain we will get the data from under high rainfall.

Senator NASH—But even some of the areas up north in New South Wales this year have had some pretty reasonable rainfall. I think the work you are doing is extremely interesting, but it would also be interesting to have that comparative data in one of those so-called normal years.

Dr Jones—Guess what we need: money. We need money to do that.

Senator NASH—That brings me to my next point, which is this issue of finance and money and if, hypothetically, all of us who are farmers were to go down this road. I think Mr Wiley

mentioned before how absolutely devastating it is, and I guess I am posing this in terms of where government can assist when farmers have their backs to the wall and nobody has any money because we have had years and years of drought. If we are going to do something a bit adventurous, if we are planning—hypothetically—to do this across the board, how will we get some funding arrangements in place to move as an industry towards this type of farming?

Mr Wilson—Can I just say that, certainly in Western Australia, we have had a lot of interest from certain mining companies that are looking for carbon offsets. If soil carbon is allowed to become part of the emissions trading scheme, these mining companies have said to us that they will pay the farmers to plant these perennial grasses—in Western Australia we need to actually plant these subtropical perennial grasses; we do not have a base of native C4 perennial grasses, so we are going to have to seed them down. We work on around a \$200 per hectare cost to plant them. The mining companies have said that they could pay the farmers to do that as long as they have got a certain amount of carbon that they can use as offsets. So, rather than the government having to pay for all of this if soil carbon is allowed to be part of the emissions trading scheme, that will be a heck of a good way of financing large-scale change. If climate change is the way that we are hearing from the experts, we need to act quickly.

To add a point to your previous question about the yields on more conventional farming systems versus the perennial farming systems, yields may or may not be important, but the whole thing is that if we are farming under a perennial based farming system and we are sequestering CO₂ from the atmosphere we are helping the planet, whereas if we are farming under the old conventional system, where we are emitting carbon from the soils, we are just going backwards.

Senator NASH—So whether there is climate change or not it is sensible practice from the point of view of looking after the ground to get the most benefit out of it. I have a last question for Dr Jones. Since nothing is perfect, what sort of pitfalls or negatives have you come across in the work that you have done? Or is it all absolutely perfect?

Dr Jones—I am going to give you an emotional response and say that for some of the farmers I have worked with it is almost like a love affair, because they get so excited. They send me amazing emails saying: ‘Christine, you would not believe what is happening on our place. We are so excited and we have not been this happy for a long time.’ I am sorry but that is not a scientific answer. On the other side of that, I will give you another emotional response and that is that we get outright antagonism, anger and dismissal from the scientific fraternity, saying that it is absolutely not possible to do what you say you are doing. So there is a real polarisation. One group of people are saying that it cannot happen and the others are actually doing it and getting a whole new attitude to farming. We have now got children in a lot of these families going out and collecting grasses that they find on the side of the road and sending them to me in the mail to ask what they are because they want to plant them on the farm. They say: ‘Will this be good for Dad to plant wheat into? Is this one a weed or is it a good grass?’

Birds have also started to come back onto their farms. People have got thousands of little grass-feeding birds like cisticolas—which, honestly, I had never heard of—on their farms. Apparently they were very common at one time. And now that we are providing this habitat, little ground-foraging native animals like bettongs, which are like little rat kangaroos and live in grasslands, are coming back onto farms that at one time were sprayed from one end to the other

and had no ground cover. So we are getting this whole biodiversity thing. I cannot remember what your question was!

CHAIR—That does not matter.

Dr Jones—But it is very exciting. There is this polarisation of views, with one part of the community saying, ‘It cannot happen,’ and the other part of the community saying: ‘We are so excited about this that it has changed our whole attitude to farming. The kids want to come back and it is good. We have put the glyphosate in the shed and we are never using it again. This is just wonderful.’

CHAIR—Let me tell you, Dr Jones, it is pleasant to have an emotional lot at this committee. We have thoroughly enjoyed it and we do not experience it very often.

Senator NASH—The waffle is not usually anywhere near as interesting.

Senator HEFFERNAN—Chair, I think the best way to solve this mystery will be to go and have a look.

CHAIR—I was going to suggest that.

Dr Jones—Yes, that would be wonderful. We would love you to come and have a look.

Senator HEFFERNAN—What intrigues me is the plant density. I am a farmer and I have one native paddock left, which has kangaroo grass and stuff that high from the summer rain we had. But if you get reasonable plant density to make it an economic thing to put a few cattle on that then I cannot see how your crop would survive.

Mr Wiley—Interesting things have been happening.

Senator HEFFERNAN—Take buffel grass, for instance; it is a perennial. If you get a decent stand of buffel grass, there is no room for another weed, as you know, so how do you get the weed of wheat?

Dr Jones—We are actually growing wheat in buffel grass in Central Queensland. If you would like to come and have a look, we would love you to come and have a look—thousands of hectares of it.

Senator HEFFERNAN—But is it a reasonable density of buffel grass?

Dr Jones—Yes. There is actually a guy who grows it for seed. He is a seed producer and he has paddocks of Biloela buffel, Gayndah buffel and all these different sorts of buffel grass which are one metre high and as thick as thick. He is planting wheat into that, so he gets income from his grass seed production and income from his crop. He is also a beef cattle producer, and he grazes it as well. He now has three tiers of income, if you want to look at resilient agriculture.

Senator HEFFERNAN—When does the buffel turn on—in September?

Dr Jones—It is actually still green right now. It still has some green in it. It does not matter whether it is green. You can still grow it, in green paddocks—

Senator HEFFERNAN—I was just wondering if you had a dry finish which would win the race—the wheat or the—

Mr Wiley—That is a very interesting point. There was just one trial, with 250 millimetres for the year. This was right on the coast where it was really dry.

Senator HEFFERNAN—This is the sandy soil over there?

Mr Wiley—That particular site was on one of our better soils, a better loam. We are a fair way north, so the perennials were cranking up and coming back to life during grain filling. We did not get pinched grain. That fascinates me. We should have, but it did not happen. We are just seeing these things that do not fit with our current understanding, and we keep seeing more and more of them.

Senator HEFFERNAN—I think we had better have a look.

Mr Wiley—The most frustrating thing that I have found, probably over the last 18 years, is going down to the big smoke, talking about this stuff and being told I am a complete idiot. I say, ‘Come and have a look and see for yourself,’ but they do not. If you come and look at these things, you get blown away.

Senator HEFFERNAN—I can see that little bump on your shoulder where they took your second head off!

Mr Wiley—It is in there somewhere, apparently. But you have to see for yourself and make up your own mind. I guess that is all that we ask.

Senator HEFFERNAN—We do it now with lucerne all the time.

Senator SIEWERT—In WA specifically, we have a soil acidity problem. Has this been tried in acidic soils?

Mr Wiley—No. Because, as you well know, the worst soils in the world are down the Western Australian coast, my work and the work of the Evergreen group—and Bob is the vice-president of that group—has tended to focus on those very poor soil types that are too poor to grow a crop; whereas inland we have better quality sands and a low rainfall but the soils are extremely acid, and that district has been dominated by cropping. There has not been the support to try out things there. There is some interest now, so that will change. We have a strategy for the north-east agricultural region, and we will clearly be looking at all these alternatives. We just need to get out there and see. I will be surprised if we do not find something, because every time we try something radical we tend to find something that we did not expect to find. The soil acidity itself is a very interesting question. My colleague Ahmed Hasson has data he is grinding over at the moment. There seems to be something very unusual going on in terms of soil acidity and pH change, but it is a little bit early to make a call.

Senator SIEWERT—Because this seems to be changing things so dramatically, there seems to be a potential that it could be trialled there as well.

Mr Wiley—There are always mad ideas but if you do not try them you never find anything. When you try some mad things you almost inevitably find something. You just have to go and have a crack at it. As I said, I am an eternal optimist.

Senator SIEWERT—We talked a bit about lucerne but, with regard to general perennial legumes, have you been focusing mainly on grasses in the trial so far?

Mr Wiley—In the east it has been a lot more on native grasses. We have been looking at introduced exotics. We are looking at legumes. We are also looking at native shrubs as—

Senator SIEWERT—I was going to ask about saltbush as well.

Mr Wiley—The saltbush story, as you well know, is a project called Enrich. I think they started off with about 300 native shrub species. We now have 15 that we will put out this year into three sites in the north-eastern wheat belt. Other work is going on through the CRC, and the university is looking at native perennial legume species. We have just scratched the surface, and I think we are going to see big changes not just in the way we think and farm but also in the species that become available. I think we are on the start of a bit of a revolution.

Senator SIEWERT—I am interested in the funding from (a) a research point of view and (b) a farming point of view. We identified the issue around helping farmers get into it—if there is a price on carbon and if soil carbon is counted, it seems to me we need to get over that hump of enabling farmers to get into it. But I am not necessarily convinced at the moment that there is enough funding around on the research side of it. It seems to me that, instead of having to scout around for a bit of funding—and it is good, Dr Jones, that you have had a positive response this year—

Dr Jones—Just in the last week. It is starting to change, which is very heartening.

Senator SIEWERT—It seems to me that it is more ad hoc and more by good luck than good management. I am aware that the CRC is doing some work but, from what I can tell, the CRC is one of the more creative bodies that are doing this work and there are very few others. Would that be a correct analysis?

Mr Wilson—Certainly in the realms of perennial pastures, in my opinion, there has been very little research in the past. But the whole focus of the Future Farm Industries CRC is on perennials. Maybe at the start there was not a big focus on the cropping side of it, but I think that they are now looking at it much more seriously. I was talking to a researcher from the CSIRO just recently who said that soil carbon is on their agenda now. They are now looking at some funding going towards some researching, which definitely needs doing, as we talked about with regard to the modelling before. A lot of the modelling data that is being put into the Roth C model is coming, we believe, from trials that were in the eighties or nineties. Farming systems have changed since then and will change even more in the future, so a lot of that data is out of date.

Senator SIEWERT—Where would we go with an overview of who is funding what on soil carbon?

Mr Wiley—Michael Robinson, who I believe is speaking this afternoon, has just done a review of the research, so he will have the best idea of what is currently happening around Australia. I think you are dead right in saying that it has been limited and it has been very fragmented. There is a bit of a network around Australia and you are seeing part of it on these alternatives, but what really is lacking is a coordinated approach both to adaptation and to mitigation. I think what Michael Robinson is trying to do with CCRSPI is absolutely critical and essential to making that happen.

CHAIR—Dr Jones, Mr Wiley and Mr Wilson, thank you very much for your time. The secretariat will be in touch with you, and we will take up the offer of a visit on both sides of the country. Hopefully you will have some more data available for us in the next month and, Dr Jones, you will have something by November.

Senator NASH—I have a question on notice. I was interested in the funding situation for the trial work—how much of it is farmer self-funded and how much of it is assistance you get financially. Would you take that on notice and come back with information on any financial assistance you do get apart from the farmer input.

Proceedings suspended from 12.29 pm to 1.03 pm

NELSON, Dr Sam, Executive Officer, Corporate Strategy, Land and Water Australia

ROBINSON, Dr Michael, Executive Director, Land and Water Australia; and Chair, Joint Strategy Team, National Climate Change Research Strategy for Primary Industries

CHAIR—Welcome. On behalf of the Joint Strategy Team for Development of a National Climate Change Research Strategy for Primary Industries, Land and Water Australia has lodged submission No. 3 with the committee. Do you wish to make any amendments or alterations to that submission?

Dr Robinson—No, we do not.

CHAIR—I now invite you to make a brief opening statement, after which we will go to questions.

Dr Robinson—I am sure you are aware that Land and Water Australia is one of the 15 Rural Research and Development Corporations. One of our key roles is to lead partnerships and develop new strategies or initiatives amongst the RDCs in the research community and, indeed, the agricultural community. We have a significant focus on adoption and informing debate in the community. In that vein, we undertook to chair and lead the development of this National Climate Change Research Strategy for Primary Industries. We commenced it about nine or 10 months ago. The partnership is pretty unique, as it involves all the RDCs, all the states, the Commonwealth and CSIRO.

The initiative looked at what exactly were the national and collaborative research needs of primary industries, including development and adoption—this is not just about the pure research end—including both the direct and indirect impact of climate change; that is also the biophysical, social and economic. We also undertook to look at mapping existing and developing research activity in this space, to look at the short- and longer term research priorities and to see where the collaborative coordination opportunities exist around Australia for this existing and new research. We then wanted to develop implementation options for making this happen in order to have a truly national coordinated and collaborative research effort in response to climate change.

As we say in our submission, the first phase of this initiative has now largely been completed. We developed a draft strategy that went out to all partners in March. Since then, we have been collating comments and reviewing the strategy in light of those comments. The process we undertook was fairly comprehensive not only in getting scientific input from the likes of CSIRO and others but also in consulting directly with industries.

One of the key points we found from our consultations was the great desire of the agricultural community for better climate projections on a much finer scale and with much greater certainty—uncertainty was a real issue—including around short-term or seasonal forecasting. As expected, that was found to be a major issue. Better management of risk and uncertainty flows from achieving those things. The audit that we did identified some 404 projects around Australia. We are unsure how comprehensive that audit is, but I think we can make an assessment. The

analysis that we did of that audit said that, as a nation, our research is fairly ad hoc and uncoordinated, with there certainly being significant room for improvement—although quite a bit is being done.

Perhaps I can pre-empt some questions around soil carbon. We have identified approximately 26 research projects that are directly related to soil carbon, with various investors. But those research projects are part of a broader suite of work around agricultural production and sustainability, and carbon accounting or nitrous oxide emissions. A significant number of those projects are associated with the Healthy Soils for Sustainable Farms Program, which again is a partnership program we have been running at LWA.

That activity and the decision we made as a partnership some nine to 10 months ago to do this initiative just reinforced the need for the initiative. Under CCRSPI, we identified six themes associated with national collaboration and coordination. Firstly, in relation to providing better access to information to the primary industry sector, there is a lot of misinformation and a lot of uncertainty. We looked at how we could improve that and get nationally consistent messages, not only regionally but also industry-specific messages. We need a much stronger effort with shared dialogue between industry policy and research; there are big gaps there and that needs to be improved.

As a group, we decided that we needed a theme of work around facilitating change or the transition period. I think everybody appreciates fairly strongly that we are going into transition. We are not sure what we are transitioning to, but we need better ways to facilitate that transition for our primary industries. The hardcore or, perhaps I should say, harder core science themes are, firstly, around climate prediction. The two aspects of that are reducing uncertainty with finer scale predictions, both in the long term and for seasonal forecasting, and managing climate variability from improved forecasting, which is critical. The second theme is the very broad and deep area of adaptation. The final theme is around mitigation or management of greenhouse gas emissions and opportunities in that area.

In terms of adaptation, there is an awful lot of work to do there, but a lot of the adaptation work that needs to be done is over and above existing activity. For example—you talked a lot about soil carbon before the break—just focusing a program on climate change for soils cannot be done at the expense of understanding our soil system, so it is in addition to it. Climate change is another layer of activity, over and above a whole bunch of existing research that is going on, whether it be soils, weeds, breeding or whatever it might be. Also in the emissions theme, the key point there was that there are opportunities to mitigate emissions through offsets and that we need to look at those. It was not simply that we need to do the accounting, although that is certainly a part of it.

I have the first phase of the reports in draft form here. We said that we would submit them to this committee when they were completed and we still intend to do that. That is still a few weeks away. We are now building the second phase of CCRSPI. The second phase aims to do a numbers of things. Primarily, it is designed so that in 12 months time we will have a way to implement a national research strategy with all partners around the nation who are interested and need to invest in research for primary industries in the face of climate change, understand what needs to be done and how they can maximise their investments by linking with others who have the same issues. We need to invest in some fairly urgent and important research, which was

identified in the first phase. That is primarily around emissions management and the implementation of the Emissions Trading Scheme.

Thirdly, there are three enabling themes to support that activity. Firstly, we need to provide a mechanism to increase or improve the dialogue between research, industry and policy. Secondly, we need to provide the primary industries sector with much better quality information to help reduce uncertainty as much as possible. Thirdly, we need to start thinking about the transitions, and in the first year that included thinking about transitions for an ETS.

We are just about to kick off the next phase, which, I might add, also includes application for funding under the National Climate Change Adaptation Research Facility being hosted by Griffith University for the primary industries research network.

CHAIR—Thank you. Dr Nelson, do you wish to make a brief opening statement?

Dr Nelson—No. I am here in support of Michael.

Senator SIEWERT—Dr Robinson, you did effectively pre-empt my question on soil carbon, so I want to start there if I can. You said there were 26 projects?

Dr Robinson—Through analysis, we think there are about 26. There are some limitations to that data. We are unsure exactly whether we have picked up 80 per cent or 50 per cent of the research projects around the country. We are also just picking up the metadata, so, for example, we do not have a good indication of the total value of the investments. On what we have got, we have picked up about 26 projects focused on soil carbon.

Senator SIEWERT—So you cannot tell me how much that involves in research dollars in investment?

Dr Robinson—No.

Senator SIEWERT—Is there a way of finding out?

Dr Robinson—It would be my intention that we do that at some stage. The current partners have not identified that as an urgent and important priority for the next 12 months, but it is something that we are pretty keen to do at some stage before too long.

Senator SIEWERT—So we do not know whether they are major products that are being carried out, or if they are a series of smaller projects?

Dr Robinson—I think, of the 26, they are a real mix.

Dr Nelson—The 26 number was arrived at really through a scan of the list of projects. The list of projects we have developed does not necessarily include all projects from CSIRO. Soil carbon can be looked at as a component of a range of different research projects—things like understanding just general production system sustainability, noxious oxide emissions, broader carbon accounting work and carbon cycling. It is difficult to tell from the analysis we have made

whether or not more work is included under some of those other broader topics. That is an issue we will face with any analysis or audit that we try to undertake.

Senator SIEWERT—Who were carrying out those 26 projects? What range of organisations?

Dr Nelson—The work was funded by a range of different organisations. The Australian Greenhouse Office has invested in this area; the Australian Research Council also invests through the universities in a number of projects on soil carbon; Land and Water Australia has invested; the Grains Research and Development Corporation; and the Cotton Research and Development Corporation.

Senator SIEWERT—Sorry, what was the last one?

Dr Nelson—The Cotton Research and Development Corporation. A number of the other RDCs have made some investments in these areas. The state governments have also played quite a strong role in this area. The work has been commissioned by a range of those agencies and undertaken by CSIRO, the universities, state departments of primary industries and so forth.

Senator SIEWERT—Thank you. So will the list which I can see in that folder there—the research that you are going to table—include the projects and names of the projects and who is carrying them out?

Dr Nelson—That is right.

Senator SIEWERT—Okay. And we will get that in a couple of weeks?

Dr Robinson—That is the plan, yes.

Senator SIEWERT—Thank you. Could you tell me how many of those projects in a broad sense, or what percentage, you think are actually looking at future industries rather than just that adaptation?

Dr Nelson—It is very difficult for me to give you a very quick answer on that. I think there has been a lot of work done looking at managing climate variability and how production systems can maintain their productivity under extremes of drought and so forth. So there has been a body of work that has gone on to support that. Looking at alternative industries is an area of investment for the Rural Industries Research and Development Corporation. So, although not directly related to climate change, there is some work that would be undertaken that may be relevant in those areas.

Senator SIEWERT—Do I take it then that you mean there is little work being funded on future industries under the banner of climate change?

Dr Robinson—Yes, I think we can make that call. I would not say absolutely—there is relatively little, yes.

Senator SIEWERT—Are you able to take notice to tell me what percentage of research being done is actually looking at future industries? Is that something that is accessible through the data?

Dr Robinson—Yes, but given the limitations of our dataset, we really do not know whether we have captured it—whether we have 60 per cent, 80 per cent, 90 per cent or 50 per cent of the projects that are being done out there. We had a fairly limited time frame. It was the first cut at doing it and we just do not have confidence at all that this is a complete dataset of the projects. So any number we would give you would have that enormous caveat on it.

Senator SIEWERT—How do we as a committee confidently report to the Senate what is being done in terms of research and climate change? Who do we go to? If you say there are limitations to your confidence—‘We don’t know if we got 50 per cent, 80 per cent’—how do we know?

Dr Robinson—My guesstimate is that it is the best data we have got as a nation, but it is not very good data.

Dr Nelson—The exercise of developing research strategy was something that was done in a relatively short amount of time. We see this ongoing, I suppose, audit and understanding of what work is being undertaken as being an ongoing role. It is something that we have to develop systems or just get on top of in order to do this. In order to generate appropriate collaboration we need to provide people with information about who shares similar interests or who is doing similar work in that area. So to keep on going and to make sure that we achieve this value adding is one of the key functions that this will have to play if it keeps going on into the future.

Dr Robinson—That is the key point. What we are trying to build and hopefully come out with in the next nine to 12 months is the overarching structure. We do not think it is a new entity, but what is the overarching structure that will be the national coordination of primary industries research in response to climate change? That will include things like being able to have a decent database of what research is being done by who so that we can connect all the dots as appropriate. My personal vision for that is that it is an overarching structure. There will be lots of existing activity or networks or clusters of activity that is already happening—say, the Managing Climate Variability Program or the Elevated CO₂ Research Network that is going on at the moment. They are existing activities that we want to build on and complement through this overarching structure. In terms of build on and complement, there are other agencies or other interested parties who should be parts of those networks that we need to put in touch to get the most value out of a fairly limited research dollar, I would say.

Senator SIEWERT—You have identified the connection or the shared dialogue between industry policy and research. As I understand from what you have said and from what is in your submission, that is pretty disconnected and uncoordinated. What are the main barriers to fixing that that you have identified? As I understood it, you have said that is one of the three key things that need to be worked on in the strategy over the next 12 months.

Dr Robinson—Yes. That is what we are calling one of the three key enabling themes. There were three research themes around climate science, adaptation and mitigation, and one of the enabling themes was facilitating dialogue. Key barriers? I think, probably, everybody’s time. In

the CCRSPI process, we had a reference group, for example, which included industry and policy and the research community in the RDCs. Getting people to get around the table is always difficult, but we see that as a key role of CCRSPI, just trying to make that happen, be it with the NFF or AgForce, and getting DAFF and the state bodies around the table. I should say at this point that the Primary Industries Standing Committee, the R&D subcommittee, is the vehicle which CCRSPI is being initiated or driven from as well as the council of chairs, so the states are very supportive of being part of that dialogue through that mechanism. We have had a lot of support from the likes of NFF, AgForce and New South Wales farmers to be part of this dialogue, so the barrier is actually just getting the time. I would think we have actually been reasonably successful in getting people engaged. I think there is a general sense, particularly in the last 12 months, of the urgency and importance of the issue. So, in that respect, one of the biggest barriers we face every time we run a workshop or a joint meeting is getting people up to speed, improving their knowledge levels on things so that we can actually have a discussion and move forward.

Senator SIEWERT—Thank you.

Senator HUTCHINS—Can I just ask a question in relation to industry. You mentioned NFF, DAFF and all that. I am just reading an interesting article on climate change and the supply chain and logistics. Do you involve them at all?

Dr Robinson—No, I do not think we have at this point.

Dr Nelson—The Rural Research and Development Corporations have some links to their supply chain and understanding where value can be got for their industry constituents. We have not been directly involved in that but have worked with the RDCs to try and see if there are any strong messages that might be coming through.

Senator HUTCHINS—So they are the more appropriate body. You are dealing with the NFF—is that correct?

Dr Robinson—Yes. The NFF have been involved in the various workshops around the strategy, as have some of the state industry bodies. Through, I guess, the networks that we have created, we are also very keen that those industries are representing their industries more broadly. That is the way we pick up the rest of the value.

Senator HUTCHINS—The NFF represents farmers. Who represents the people who do the food miles, as I think they are called?

Dr Robinson—We are reliant on a number of our industry partners to get those people, but food miles is an interesting issue that has come up quite strongly around the emissions management theme. We have received a very clear, very strong message that we need to do full life cycle analysis on agricultural products so that we do not get inappropriate, I guess, or the wrong answers out, and so that we do not get perverse outcomes.

Senator HUTCHINS—If you think that is crucial, which obviously you do, then you should involve them rather than have them as sort of a client of the NFF or any other agricultural producer. That is for you to take on board.

Dr Robinson—We are happy to take that on board. We certainly have no intent to exclude.

Senator HUTCHINS—Thank you.

Senator MILNE—I am interested in the planned research because there does not seem to be any intersect with maintenance of ecosystems, ecosystem services and biodiversity. There is a lot of talk about adapting to climate change and a lot of talk about measuring emissions, but there is not much talk about the impacts of climate change on the underlying systems to be able to sustain ongoing production in whatever field it might be or the ways in which real change has to occur to maximise the resilience of ecosystems to survive and therefore produce anything. In your list of six key areas I do not see any intersect with the issue—and especially given the evidence we had before lunch—that, if you go back to enhancing soil carbon and more natural systems, then you enhance biodiversity, moisture retention and so on. I would like to know where that is in the mix of six.

Dr Robinson—That is a good question. It is something we are conscious of, but we are also very conscious of trying to bring our various partners along with us in that regard. There are things like, for example, our Grain & Graze program in LWA, which is winding up at the moment. It has an integrated pest management aspect, where we are specifically looking at better managing the resource base in the long term. It is fair to say that we are keen to build that thinking more explicitly into the themes particularly around adaptation but also around the energy and water aspects of managing for soil and soil carbon. They have been put on the table but it is fair to say that we have grappled with exactly how you would isolate them in terms of the theme rather than build them into a farming systems type thing. There are a number of discussions that we have had about building new programs that would fit under CCRSPI around sustainable farming systems, looking at exactly what you are talking about. We would also like to build better links with the NRM Ministerial Council through the PISC process. I think that is an area that we could improve, but it is one of those areas on which we need to bring our partners with us a little more strongly.

Senator MILNE—In relation to research to understand emissions from primary industries and appropriate standards and methodologies, one thing which is completely distorting the whole discussion of ETS and the carbon market at the moment is Kyoto accounting, which does not take into account the emissions from a land use change if you still continue the same thing. So, for example, if you log a native forest and put in regen or plantation you do not get the emissions accounted for. What work is Land and Water doing to make sure that we go to, as you say, a full carbon accounting rather than a distorted one that leads to perverse outcomes and indeed will lead to more perverse outcomes unless it is fixed?

Dr Robinson—As part of leading this CCRSPI initiative, the approach that we have taken is to identify clearly what needs to be done—and needs to be done thoroughly—so that we do not get these perverse outcomes. To my knowledge, in LWA we have not invested specifically in looking at accounting systems, but we are keen and have been quite supportive of this push to get full life cycle analysis on a range of products and systems, including in forestry. Forestry is one of our partners and comes under the primary industries banner. To my knowledge we have not invested in that space, but it is clearly the intent of the CCRSPI initiative. It is not clear yet exactly how we will do that under the CCRSPI umbrella in the future. But it was a very strong message through the theme on managing emissions: let's do LCA so we do not have perverse

outcomes. Food miles, which Senator Hutchins mentioned, was raised as a very serious issue. Certainly our New Zealand colleagues are feeling the heat on that one.

Senator MILNE—I know you want to move on.

CHAIR—Thank you, Senator. We are pushed for time and I do appreciate your patience. We did put you behind. Senator Nash, you have probably about half a minute if you wish to ask a very quick question.

Senator NASH—That is fine. I just have a couple of very quick ones following on from Senator Siewert's questions about the research projects. The ones you do not know about—are they essentially private enterprise type projects? What actually are the ones you do not know about?

Dr Nelson—Through the development of the research strategy, we went out to the states, the research and development corporations and CSIRO and tried to get as many responses as we could. There are a number of groups that did not respond or responded with data which was difficult to drill down into. There is probably a range of work that CSIRO—because they are such a large organisation—might be doing that may have been missed out in our audit. Also, a number of the states were unable to respond in time, so there is a range of work that might be being done at a state level as well. They are some examples of the sorts of projects that we might not have been able to capture through our process.

Senator NASH—It would seem sensible, given that they are, as you seem to indicate, either government agencies or have government funding—I think Senator Siewert has raised a really good issue here—with an issue as important as this, why is there not an obligation on any body, if you like, doing research into this particular area to give that information to you? It just seems ridiculous. It cannot be that hard, surely, for them to go and have a look at a list of their research projects and forward it on to you.

Dr Robinson—I take your point. I guess they are not obligated, although we put some pretty heavy pressure on people to get answers to us. But, in some respects it is difficult for a single person or several people to be assessing a project title and say whether that is a climate change related one or not. Many projects have climate change embedded in them, but you do not recognise it from the title or even an abstract. Vice versa, you are seeing an awful major trend at the moment where every research project title has climate change on it, but that is only to get funding. So it is actually not that simple to detect from the data, even looking at what projects are soils projects. They may well not be soils projects when you drill down into them.

Senator NASH—Yes.

Dr Robinson—We did get a commitment from all our partners to attempt to do this. We got all the states on board, but that is the primary industries departments, not so the environmental or climate change departments. So, you do not necessarily capture everything going on in a state. The universities are, I think, a significant gap. They were not engaged. Again, you simply do not know who to contact in the university, short of contacting every researcher. So it is actually not an easy exercise.

Senator NASH—I had some other questions, but I am happy to move on.

CHAIR—Senator Nash, do you wish to put some on notice?

Senator NASH—No. I think it will come out in the wash, thanks, Chair.

CHAIR—On that, then, thank you very much.

[1.34 pm]

ALEXANDRA, Mr Jason, Director, Water Policy Coordination, Murray-Darling Basin Commission

MAGUIRE, Ms Katrina, Senior Manager, Climate Change Program, Murray-Darling Basin Commission

CHAIR—Welcome. The Murray-Darling Basin Commission has lodged submission No. 35 with the committee. Do you wish to make any amendments or alterations to that submission?

Mr Alexandra—We do not wish to make any amendments. We do wish to make a brief opening statement.

CHAIR—Please proceed.

Mr Alexandra—The commission is the managing partner of the South Eastern Australian Climate Initiative, which is a research program. It is worth emphasising that most of the focus or investment that the commission has made in the last few years has been in research, trying to get a better understanding of what are the drivers of the climate of south-eastern Australia and whether we can attribute climate change impacts already. That work is due to be completed by 2008, and we are receiving some of the preliminary findings.

There is a clear signal coming out of a range of research projects that we should be anticipating a drier climate for south-eastern Australia, and in particular for the headwater streams of the Murray system, and that it is quite likely that the variable climate of the northern part of the basin, the Darling system, will remain variable and will continue to get episodic summer rains driven by the weather systems that affect the east coast of Australia.

SEACI is a collaborative venture between a number of agencies. As I mentioned, it has been focused only on the climate of south-eastern Australia, trying to get this understanding in the area where there is such a big investment in irrigation and the economic crops dependent on it and also on the water supply for major cities.

I will go through some of those findings and then I would like to finish with a brief comment on the implications of them. What we have at the moment with the current situation is the 10 lowest rainfall years on record, and so average inflows into the Murray system have dropped dramatically. The year 2006-07 was the driest on record. But perhaps more importantly there has never been a period of regularly dry seasons one after the other, so there is really no precedent for managing the Murray in the 115 or 116 years of record to cope with three or four dry years.

The pattern we have been seeing is that rainfall has been reduced during the autumn. The effect of this is that the catchments do not wet up in the same way as they did previously and so there is a much greater decline in run-off than in rainfall. There could be a number of contributing factors for this. One is the seasonality of the rain. The second is the increasing temperatures that are experienced over the autumn-winter period, so greater evapotranspiration.

The third is that there are contributing factors in terms of land use change. The temperature record demonstrates that we have seen an increase of about one degree centigrade over the 100 years, and that one degree does have a substantial impact on the amount of evapotranspiration.

As I mentioned, the reductions in stream inflows are significant. The average inflows for the last 10 years have been approximately half those of the 116 years of records. There have been previous droughts not dissimilar to the current one, and the years 1937 to 1946 had a rainfall reduction of 14 per cent that was associated with a run-off reduction of 22 per cent. During that period the decrease in the rainfall was evenly spread over the autumn-winter-spring periods. That is quite different from what we are seeing now, which is this substantial decline in the autumn rains.

Finally, some of the work of SEACI has been looking at the global climate models and trying to down-scale them and understand what the implications are for the basin. Of the 16 models that have been tested, there are variable findings, quite divergent findings, but all of them predict drying in the south-east part of the basin, which is these high-rainfall, high-yielding catchments.

Much of the irrigation development has occurred in the period after the Second World War, which also corresponds with the wettest period on record. The period from 1961 to 1990 is what the World Meteorological Organisation defines as the baseline period. So a lot of the scientific work compares using a baseline which we know is the wettest on record. With the current drought, the consequences of the decreased rainfall are that the irrigation water available is much reduced. One of the policy mechanisms that have been put in place which has enabled adaptation is the ability to trade water. In the last water season we have seen that about a third of all water used in the basin is water that has been traded. That has enabled the high-value industries to go into the market and purchase water to sustain permanent plantings—viticulture and horticulture. So despite this low availability of water we have seen, for example, a near record wine grape crop in southern Australia.

I mentioned that I would talk briefly about the implications. If the current situation is in fact a step change—so we have gone through some kind of change and into a new climate regime—then the whole way in which we manage water resources in south-eastern Australia will be required to change. Currently the approach has been one of contingency planning, or drought measures, water savings and so on. What we are currently working towards is putting forward the implications of this research to the commission and to other water resource agencies to try to adopt a more long-term or strategic approach to managing under greater uncertainty.

CHAIR—Thank you, Mr Alexandra. Ms Maguire, do you wish to make brief opening statement?

Ms Maguire—No, I am here to support Mr Alexandra.

Senator HUTCHINS—I was reading in a publication the other day where a person was advocating getting rid of some of the weirs and allowing some salt water to come into the Murray. That would mean that the people that far down the stream, I suppose towards the east or whatever, would have to be compensated. What is the commission's view of that?

Mr Alexandra—I think what you are referring to is allowing the salt water into the lower lakes, which are maintained as a freshwater system through the barrages. At the moment the lakes are under significant duress because of low inflows and are suffering from acid sulphate processes—the acidification of the soils as they dry. There is currently a substantial program within the commission, and in conjunction with the states, identifying what the options are for the management of the lakes. I believe those options will be put to the next COAG meeting and, if not, to the next ministerial council meeting, and decisions taken. All we are aware of at this stage is that the options and the different consequences of those various options are being actively investigated.

Senator HUTCHINS—Are you involved in the options?

Mr Alexandra—No, our area is not directly involved in that.

Senator HEFFERNAN—In the Murray-Darling Basin, as you would be aware, 38 per cent of the run-off comes from two per cent of the landscape. Would it be fair to say that under the modelling that has been done that is the area that is most impacted for a decline in run-off?

Mr Alexandra—My understanding is that almost 90 per cent of the run-off of the stored water resources comes from about three per cent of the total catchment. The climate modelling is not able to get the resolution down to that scale. We are really talking about the relatively small headwaters of the Murray, Murrumbidgee and Mitta systems.

The hydrological and the climatic modelling do suggest that there will be a significant reduction from those catchments. I am not sure if proportionally it is greater than other catchments. I think there are some parts of the medium rainfall area where the reduction might be almost 100 per cent. But the importance of it is not really the percentage reduction, it is the gross yield, if you like, or the available water resource.

The consequences of having both a decline in autumn rainfall and long periods of extreme dry are that when there are substantial rains it takes a long time to wet up those catchments so there are reduced inflows. What we do not really know is whether we should be drawing too many conclusions from the approximately 120-year record we have got. We are actively investigating work to do a climate reconstruction to see whether in fact 30-year wet sequences may be followed by 15- or 20-year drought sequences, and that that may be part of the natural variability, or whether in fact we are seeing a departure from the relatively stable climate that has occurred since the last ice age.

Senator HEFFERNAN—How long have you worked for the Murray-Darling Basin Commission?

Mr Alexandra—Since January.

Senator HEFFERNAN—You are let off. How long have you worked there, Ms Maguire?

Ms Maguire—About three years.

Senator HEFFERNAN—How come in the 2020 planning for plantation forestry they did not include in their early assumptions the impact on run-off? Are they just dunces or what?

Mr Alexandra—The 2020 plan was developed by other government agencies. It may be worth while asking them about it. I think there has been—

Senator HEFFERNAN—I am not going to go into a sledge on what has happened in the past, and you have only been there for three months so you are off the hook. This is all part of the impact on where we are and where we are headed, and I will come to that in a second. But I find it difficult to come to terms with the fact that we pay all these people, including scientists, and what has been completely overlooked is that (1) you have got an exemption from environmental planning under the 2020 vision and (2) there is absolutely no consideration of the impact on the interception of the run-off—yet people still get paid. You would agree that it has a serious effect?

Mr Alexandra—Within our directorate we have another program that explicitly deals with the major interception risks, including plantation forestry, increased groundwater extraction, increased farm dams and so on. The cumulative impact of those will be, or is, substantial in terms of reducing flow.

Senator HEFFERNAN—So included in that also is the groundwater interception?

Mr Alexandra—Groundwater interception and reduced return flows. What we are really seeing is—under scarcity of water—that there is increasing demand. There are a whole lot of ways of accessing that available water resource, and the systems we have for allocating water have only developed to deal with part of the extraction cycle.

Senator HEFFERNAN—But you are the water coordinator, right?

Mr Alexandra—Yes, I am the water policy coordinator.

Senator HEFFERNAN—Have you modelled the declining run-off to determine the amount of water that has got to be returned to the system to have the system still run. As run-off declines, you are going to have to return more water to the system and away from the work to make the system work. Do you know what I mean?

Mr Alexandra—Yes.

Senator HEFFERNAN—So have you modelled that?

Mr Alexandra—Not personally, but within the commission there is now, or within the general—

Senator HEFFERNAN—Would you like to table that information for this committee.

Mr Alexandra—Just so I am clear about the question: it is the amount of water that is required to maintain what we could call the conveyancing water.

Senator HEFFERNAN—The disproportionate return of water back to maintaining the system so that the fish can still swim in the river, versus the water in the decline that would have gone to work. What I am saying is that if you lose 50 per cent of your run-off you are going to lose more than 50 per cent of the water that is available to irrigate a crop somewhere.

Mr Alexandra—Right. There was work done by the Victorian Department of Sustainability and Environment as part of the northern region water strategy—and I think I am clear about the nature of your question—that looks at the reduction of inflows under a range of scenarios and then how that would play out in terms of reductions to irrigation and to environmental flows. When referring to ‘maintaining the system’ you are referring to environmental flow water. For example, for the Murray, under the medium impact of climate change scenario, they have modelled a 25 per cent reduction in inflows, a six per cent reduction to irrigation and a 33 per cent reduction to the environment. So that is assuming that, if you like, the rules are not changed and you will get that disproportionate impact for the environmental water.

Senator HEFFERNAN—But is that sustainable? Obviously if there is a 50 per cent impact, which is the high side of their prediction—11,000 gigs—and you use that model, there would be no bloody fish.

Mr Alexandra—That is right. If the extreme of aridity is realised, there will be an intermittent river. I think that that is perhaps—

Senator HEFFERNAN—But if mother nature is going to take somewhere between 35 and 11,000 gigs out of the river anyhow, doesn’t that make a mockery of the plan to return 500 gigs or 1,500 gigs to the system for the health of the river? Why are we mucking around pretending that we are going to fix it by returning 500 gigs, with all the bloody emotion and garbage—

Mr Alexandra—The Living Murray initiative is deemed to be the first step. So 500 gigs was, I think, acknowledged as a first step initiative.

Senator HEFFERNAN—Yes, but against the background of the science that you have just talked about, where the lowest model is for a 25 per cent reduction in the run-off, where will that leave us in 30 or 40 years time?

Mr Alexandra—One of the things that I would like to say with respect to the models is that they are models and they do have a great deal of prospect for error or bias within them.

Senator HEFFERNAN—Yes, I understand all of that.

Mr Alexandra—I think that we should not confuse managing the real river system with what the modelling tells us. The modelling is a way of giving us a warning as to the kind of future—

Senator HEFFERNAN—We are trying to heed the warning with this inquiry. It beggars belief that the Murray-Darling Basin Commission has not actually modelled the impact of those science predictions.

Mr Alexandra—We have. We have another program and I am happy to provide the information on the range of impacts from afforestation, increased farm dams and so on.

Senator HEFFERNAN—For the full basin?

Mr Alexandra—For the full basin. The work that we had done under what is called the risks program—

Senator HEFFERNAN—Who is ‘we’?

Mr Alexandra—The Murray-Darling Basin Commission. If I can just finish. That work in part has provided some of the information that has led to the CSIRO sustainable yields project, which is the most comprehensive modelling of river flows that we have had in this country.

Senator HEFFERNAN—So they are doing work for you?

Mr Alexandra—No. They are doing it on behalf of the department of the environment and water and the National Water Commission.

Senator HEFFERNAN—All right. In the media in the last few days there has been speculation about the financial impact of issuing one of the largest water licences that will have ever been issued—420 gigs—for the lower Balonne, against the background of the CSIRO study that was to look at the flow of the Condamine-Balonne. I understand that that study is complete.

Mr Alexandra—I think that most of the work is complete. It was due to be completed on 30 June.

Senator HEFFERNAN—But I understand that it is just on the flow, it is not on the environmental impact.

Mr Alexandra—I think that it is reasonable to say that that modelling program had specific terms of reference about flow and that is what they have done.

Senator HEFFERNAN—But that is bloody garbage, with great respect, and I intend to make quite a fuss about it when it hits the deck. The set-up up there is that the person who is chairing the advice line to the government is on the licence issued under that advice from the management committee of the lower Balonne. She is going to be a major beneficiary herself when she has got no infrastructure, no capacity et cetera—and I am sure that she has heard me say it many times so she will not be distressed. Four hundred and twenty gigs of overland flow is what is in the draft plan. I do not know how anyone in the CSIRO or the Murray-Darling Basin Commission has not gone absolutely bonkers about it, because it would be a disgrace to let that through when I know and you know—well, I presume you know—that that system is unique in that a lot of the overland flow in the Condamine-Balonne ends up back in the river. Are you familiar with that?

Mr Alexandra—I am broadly familiar with the Condamine-Balonne; I am not familiar with the particular licensing case. Perhaps I can point out though that, under the federal system, it is up to Queensland to issue the licences and we have limited powers to restrain any of the states until the new water plan is put in place.

Senator HEFFERNAN—In 2014 or 2011 or whatever. That is the greatest insult to ordinary Australians of all time. That you would sit there and calmly say what you have without trying to do something about it is an absolute national disgrace. It is a disgrace—the prospect of allowing the legalising and formalising of water licences in a system that is seriously deficient. You would agree that we are in decline, wouldn't you?

Mr Alexandra—Yes, I would agree that the rivers are in a state of decline.

Senator HEFFERNAN—Right. In the Condamine-Balonne, the law is silent. No-one has broken the law. There has been absolutely no environmental planning. We now have a draft resource plan to issue a whole lot of licences based on past earthworks' capacity to intercept water. In that draft plan we have allowed 1,500 gigalitres of on-farm off-river storage to be built into a system that has a median flow of 1,200 gigalitres, which is nutcase stuff.

CHAIR—Senator Heffernan, is there a question?

Senator HEFFERNAN—Yes, there is. This goes to the responsibility of—

CHAIR—I am aware of that, Senator Heffernan, but other senators wish to ask questions rather than put statements. Questions would be appreciated.

Senator HEFFERNAN—We are going to allow serious consideration based on flow of a 420-gigalitre water licence. That is a disgrace.

CHAIR—What is your question, Senator Heffernan?

Senator HEFFERNAN—This bloke is—what are you?

CHAIR—Director of water policy.

Senator HEFFERNAN—It sounds pretty flash. You are the water policy coordinator for the Murray-Darling Basin. What do you have to say for yourself?

Mr Alexandra—As I have already said, I am not familiar with the specifics of that.

Senator HEFFERNAN—Why are we paying you then if you are not?

CHAIR—If there are no other questions, Senator Heffernan, Senator Siewert is waiting to ask—

Senator HEFFERNAN—Can I tell you, Mr Chairman, this is a pretty serious issue.

CHAIR—Senator Heffernan, you can. But you have sat there and made statements for the last five minutes. I appreciate that you do want to ask questions, but time is valuable.

Senator HEFFERNAN—I appreciate that, Mr Chairman.

CHAIR—Senator Milne?

Senator MILNE—I want to follow on from the questions on plantations. You have mentioned that your group assessing risk has done some work and you have said that you are going to table some of that.

Mr Alexandra—Yes.

Senator MILNE—You would be aware of the discussion now, ahead of the ETS, about the potential for offsets through tree planting. CSIRO, this morning in their evidence, have said that there is the potential for five million hectares of plantations, without indicating where they might be or what the water ramifications are. Can you tell me what the water ramifications of plantations in the Murray-Darling Basin have been, in particular since the MIS scheme came in?

Mr Alexandra—No, I simply cannot tell you those figures off the top of my head.

Senator MILNE—Would those figures be in the risk assessment that you are going to provide?

Mr Alexandra—The risk is based on prospects of further growth plantations rather than on a benchmark date. But, again, I am happy to bring forward that information.

Senator MILNE—If you would not mind.

Mr Alexandra—Yes.

Senator MILNE—Is the Murray-Darling Basin Commission involved in discussions about the whole issue of financial incentives for the planting of carbon sinks and the water ramifications? As the policy coordinator, where do you fit into that policy debate?

Mr Alexandra—I am a member of the COAG working group on interception, which is addressing those issues and bringing forward advice to COAG on regulatory options as to how and under what circumstances plantations should be regulated for their water yield.

Senator MILNE—Perhaps I can just get clarity here: when would you expect that COAG process to report?

Mr Alexandra—That is required to report to a September deadline. Some of the working groups had a July deadline and they should have reported already; the next ones have a September deadline.

Senator HEFFERNAN—In connection with that reporting, you would have to be a dunderhead not understand the interception impact. The interception of a monoculture in the run-off is 2½ megalitres per hectare per annum at about 42 inches. Have the Murray-Darling Basin and you as the policy water coordinator—I do not know what you are supposed to do—given any consideration to this prospect: if you are going to have growth in this interception, wouldn't it make sense for the promoters of these schemes to have to buy a water licence as part of the development?

Mr Alexandra—There is already a similar regime in place in south-eastern South Australia, where the South Australian government has brought in a regime of limiting—

Senator HEFFERNAN—I am aware of that.

Mr Alexandra—plantations in certain groundwater areas and then requiring expansion over a stated amount to purchase water licences.

Senator HEFFERNAN—Why haven't we done that? Doesn't anyone have the moral courage to say, 'Up here, where the bulk of the run-off occurs, where a lot of plantations are going in, those plantations are just as effective as a 15-inch pump at Hay and are going to take water out of the run-off. Why doesn't someone have the moral courage to put up the argument to go to full accounting of that interception by way of issuing a licence?'

Mr Alexandra—I think that argument has been put up on numerous occasions in the past.

Senator HEFFERNAN—So they have all dogged it—they are all gutless, are they?

Mr Alexandra—I was going to say that ultimately it is a policy decision of governments.

Senator HEFFERNAN—They are gutless.

Mr Alexandra—It is a policy decision of government—

Senator MILNE—I think it must be your own government, Bill.

Senator HEFFERNAN—Yes, well, they are all bloody gutless—I don't care who they are. Go on.

Mr Alexandra—That is all.

CHAIR—Thank you, Mr Alexandra. Senator Siewert did have the call, Senator Heffernan. I think we have established that some guts were lacking under someone's administration.

Senator HEFFERNAN—Don't take it personally, by the way.

Senator SIEWERT—You said earlier that you are hoping to have an idea of what the new rainfall and run-off patterns are—whether the old patterns are being repeated or we have had a long-term step change. I do not think you have said what time frame—or, if you did, I missed it. In what time frame are we going to have that information available?

Mr Alexandra—Given the caveats I put on relying on modelling, I guess the ultimate answer will be: as it is borne out by the weather that we experience rather than any future predictions.

Senator SIEWERT—Okay.

Mr Alexandra—If we project forward the last 10 years, they in fact are the levels that were predicted at about 2060 under a high-emissions scenario.

Senator SIEWERT—The last 10 years climate?

Mr Alexandra—The last 10 years climate. That is how severe the last 10 years were. The climate and run-off records show us that the period 1937-45 had an equivalent reduction in rainfall. So I would be wary of jumping in and saying, 'What we have been experiencing in the last 10 years is necessarily a consequence of climate change.' The first lesson is to say that it is naive to think that because we have 120 years of records we understand the climate of south-eastern Australia and what it has done historically. So it depends on what we understand the historic climate to be as to what we will think of as the deviation from some average. The pertinent thing is not to have absolute certainty about what future climate will do before acting; it is really to start to learn how to operate under much greater levels of uncertainty.

Senator SIEWERT—One of the scenarios you were talking about with the 20 per cent drop in run-off was a six per cent drop in the water availability to irrigators. Is that correct?

Mr Alexandra—Yes, that is from the Victorian Northern Region Sustainable Water Strategy—

Senator HEFFERNAN—Which is obviously not sound. I mean, that is lunacy.

Senator SIEWERT—Hang on!

Senator HEFFERNAN—Go on.

Senator SIEWERT—(a) I am in the middle of questions and (b) I am deputy chair, so hang on—and the chair has gone.

CHAIR—No, I'm here.

Senator SIEWERT—The 33 per cent drop in environmental water flows—what is that information based on?

Mr Alexandra—I think that is used to illustrate that without changes to the rules under which water is allocated that would be the consequence.

Senator SIEWERT—Yes, okay.

Mr Alexandra—That is at 2050 and there are numerous opportunities to have those rules changed in the intervening period.

Senator SIEWERT—Yes, okay. That was the point I was trying to get to—that that was based on the current rules?

Mr Alexandra—Yes.

Senator SIEWERT—I want to move to the sustainable yield work that CSIRO has been doing. If possible, could you tell me how the information you have today compares with the water sharing plans that are currently operating in those catchments where you have already completed sustainable yield studies?

Mr Alexandra—It is probably worth while to ask CSIRO directly, but I will try to explain it.

Senator SIEWERT—We ran out of time with CSIRO; I hope that we will get them back.

Senator HEFFERNAN—They did not know anyway.

Mr Alexandra—I will try to explain it as I understand it. The yields' modelling work that they have done has taken the existing water use patterns or entitlement framework as a given and therefore assumed that, where it could be met, it would be met. They have put in, if you like, both the laws of physics—water flows downhill—and the laws of water access entitlement as a rules' set into their models. The models are expressing the current entitlement framework. They have copped flak for that from two directions. In some cases people say that water entitlements are not used fully as there is more water in the river; in others they say that the entitlement rules could or would be changed in the future.

Senator SIEWERT—What worst case scenario are you using to model the decrease in run-off?

Senator HEFFERNAN—It is 11,000 gigalitres.

Ms Maguire—Yes. It goes up to about a 40 to 50 per cent reduction out to 2030.

Senator HEFFERNAN—My understanding of the parameter is that it is 3,500 to 11,000 gigalitres.

Mr Alexandra—The average of the inflows to the Murray-Darling is 11,000 gigalitres, which would come close to a reduction of 100 per cent.

Senator SIEWERT—From your previous answers, I understand that it differs across different catchments.

Ms Maguire—Yes.

Senator SIEWERT—A lot of the run-off occurs in some of the key catchments—is that correct?

Mr Alexandra—That is right.

Senator SIEWERT—What scenario ranges are you are using in those key catchments?

Mr Alexandra—By 'key catchments', do you mean the catchments that supply the storages?

Senator SIEWERT—Yes.

Mr Alexandra—At the moment I think the worst case scenario is 30 to 40 per cent.

Senator SIEWERT—What modelling is that based on?

Mr Alexandra—It is based on a range of both climatic and hydrological models.

Senator HEFFERNAN—That includes forest fires. There is 600,000 gross from the interception of a plantation and there is about 800 gigalitres net from the Snowy fires. That is all in that equation.

Senator SIEWERT—Thank you, Senator Heffernan.

Mr Alexandra—I mentioned before that just a one per cent increase in average temperature is deemed to have a significant impact, because it means that the longer, warmer period of active plant growth—those forested catchments—will use more water and, therefore, less will go as run-off. That is just one of the significant factors. Again, seasonality is important. Even if we maintained average rainfalls but it shifted to more, say, late spring to summer, you would also get a significant reduction in rainfall.

Senator SIEWERT—After this project reports, which will be at the end of this year, what do you have planned?

Mr Alexandra—Do you mean SEACI?

Senator SIEWERT—Yes.

Mr Alexandra—I failed to mention that. Katrina and her staff have been actively negotiating with a range of other partners around a continuation of similar work on climate science as well as expanding it into other areas—for example, looking much more actively at the adaptation strategies.

Senator SIEWERT—When you are looking at those adaptation strategies, do you model alternative land uses?

Ms Maguire—To date, we have not. As Jason said at the beginning, most of our investment in climate change has been in understanding the climatic influences of this region and their impacts on water resources. At the moment we are developing and designing a research investment strategy that will look much more broadly across the issues affecting the basin, not only looking into the adaptation and mitigation side of the equation but also taking a much stronger look at the impacts on the environment, particularly the Living Murray initiative and its iconic sites. So we have not done that modelling to date. We anticipate that the future SEACI will continue to look at the climate science. At the moment, that is really the country's only investment in regional climate for the basin, so it has been very important on a local scale. However we will be looking at research questions associated with impacts on environment and potential adaptations into our future research and investment.

Senator HEFFERNAN—But aren't you saying that 25 per cent reduction, which is, you know, 3,500 gigs or whatever, is going to lose 30 percent from the environment and six per cent from the work? Is that what you said earlier?

Ms Maguire—That was based on some modelling done in Victoria, out to 2055—

Senator HEFFERNAN—Yes.

Senator SIEWERT—That is if they do not change the rules, Bill.

Ms Maguire—and under the current scenarios—

Senator HEFFERNAN—That is nut case, though.

Senator SIEWERT—Yes, but that is if they do not change the rules.

Ms Maguire—But in designing our research investment strategy, we are also anticipating the management policy questions in order to develop and implement the basement plan. One of the fundamental questions will be about water allocation, so that will include modelling different management and water allocation scenarios to see what different effects the changes in water resources will bring.

Senator SIEWERT—So who does that?

Ms Maguire—We will be commissioning that work. At the moment, I think the Murray-Darling Basin Sustainable Yields Project is the primary tool that exists and we are deciding whether we should extend our investment in that or whether there is another tool that would be more appropriate to do it.

Senator SIEWERT—That goes back to the question I asked earlier on the water sharing plan and sustainable yield work. If that is based on existing plans, is there data there for you to then do the modelling on different water sharing plans?

Mr Alexandra—We are currently negotiating with CSIRO and the state governments about the potential for continuing the sustainable yields work into a new phase or new phases as a platform for the development of a basin plan. So there are many variables and one of those variables is the way in which the water is allocated: either in the north, under different rules, or in the south, in terms of shares and storages. That has not been done to my knowledge, but it needs to be done.

Senator HEFFERNAN—But how much of your work is taken up with what I would consider that flawed proposition that 30 per cent be taken away from the environment and six per cent—a 25 per cent reduction. I mean, that is not sustainable, obviously.

Mr Alexandra—No, that—

Senator HEFFERNAN—I mean, if you put on top of that the Goulburn high security water going back to Melbourne to flush the toilets, it is sort of—

Mr Alexandra—As I mentioned, that is the work of the Department of Sustainability and Environment from the Victorian government, one of our partner governments. I used that to illustrate the likely reductions.

Senator HEFFERNAN—So when you said earlier there were 11—I was referring to the Murray-Darling Basin in the predictions of reduced run-off from between 3,500 and the doomsday scenario of 11,000 gigs, not out of the Murray. I think you said the Murray-Darling Basin has a run-off of 11,000. The Murray-Darling Basin has a run-off of 23,000 gigs. You were referring to the Murray system.

Mr Alexandra—The River Murray system has an average run-off of 11,000, so the—

Senator HEFFERNAN—I am talking about—

Mr Alexandra—The total.

Senator HEFFERNAN—The total system.

Mr Alexandra—Yes.

Senator HEFFERNAN—So you do have those figures. That is the potential. The top end prediction is 11,000 gigs reduced run-off?

Mr Alexandra—No, because, as I mentioned in my introduction, it is different in the Northern Rivers that are driven—

Senator HEFFERNAN—No, I understand that, but haven't you got a paper that says the potential reduced run-off in the complete Murray-Darling Basin by 2050 will be somewhere between 3,500 and 11,000? I mean, 11,000 would be—I don't know what we would do if it happened, but—

Mr Alexandra—Yes.

Senator HEFFERNAN—It might have been the CSIRO that has the paper.

Mr Alexandra—We commissioned some CSIRO work in about 2005-06—

Senator HEFFERNAN—It might be that work.

Mr Alexandra—which was one of the preliminary studies looking at the potential range of impacts, so you may be referring to that.

Senator HEFFERNAN—They may have produced it to calm people down.

Mr Alexandra—Yes. Well, the sustainable yields work is certainly not predicting a 50 per cent reduction across the whole of the basin.

Senator HEFFERNAN—Oh, no, and neither was that earlier work. In fact, some of them might show an increase up in the north-west corner.

Senator FISHER—Putting on your policy hat, Mr Alexandra, should Adelaide—I am a senator for South Australia—be drawing on the Murray?

Mr Alexandra—I am not sure what you mean by ‘should it’. It is currently dependent—

Senator FISHER—It currently is.

Mr Alexandra—It is currently dependent on the Murray.

Senator FISHER—I heard your earlier answer about options being developed for alternatives in general, but you might care to comment on options for weaning Adelaide off the Murray to make your job, what I would have thought, easier.

Mr Alexandra—I do not have a position on that. As far as I am aware we have not been asked to do any work on that.

Senator FISHER—So you have not been asked to investigate any options for weaning Adelaide off the Murray?

Mr Alexandra—My understanding is that with the intergovernmental agreement the focus is on giving priority to what is called critical human needs. I thought that, as part of that, there is a view that South Australian communities are part of that critical human need.

Senator FISHER—My question was about Adelaide as opposed to South Australian communities and, indeed, those who may live along the Murray. My question is about weaning Adelaide off, so do continue your answer.

Mr Alexandra—As I said, as far as I know the commission has not been asked to investigate that. It may be something that the South Australian government would be willing to have a look at.

Senator FISHER—I would have thought so, but thank you.

Senator HEFFERNAN—Considering that this time last year we were looking at what I would have considered a doomsday scenario, and I bet that this year is the same as last year and next year will be the same as this year, do you have that contingency planning? You are the water policy coordinator. What do we do if this year turns out like last year and next year is the same? Do you have a contingency plan for that sort of a doomsday scenario?

Mr Alexandra—No. That is the short answer.

Senator HEFFERNAN—With great respect, why not? It is a distinct possibility given the forecast.

Mr Alexandra—It is. The—

Senator HEFFERNAN—Don't go any further. So why wouldn't you plan on it? It is a distinct possibility. That is my point.

Mr Alexandra—It is a distinct possibility and the work of the climate change group within the commission has, and continues to, put forward the view that planning for a worst case scenario is what is required. There is currently a process called the operations review—

Senator HEFFERNAN—But this time last year we were having this conversation with you mob. And you are still saying—

Senator SIEWERT—And the year before.

Senator HEFFERNAN—This is pretty serious negligence in my book. It is a question of sovereign neglect.

Mr Alexandra—The way in which the water resources of the basin have been managed through the current drought is through the senior officials group—they have been making those decisions—representing each of the partner governments.

Senator HEFFERNAN—That is playing the political bullshit out. With great respect, it is going to be of no comfort to the people who depend on it—as Senator Fisher said with regard to Adelaide—if you have not planned it. I understood that this time last year they were going to go into lockdown on having that plan. You are the pea in the pod and you are saying, 'We have not done the work.' And, yes, there is a fair chance that that will happen. So what are we supposed to do, shift Adelaide! Absolutely, how could you go to bed at night knowing that you have not got the work underway?

ACTING CHAIR (Senator Siewert)—Senator Heffernan, we are running behind time. I am not saying it is not an important question but I think perhaps we had better get the senior officials from the commission. Thank you to the witnesses. I think you have taken some questions on notice. It would be appreciated if you would provide the answers to the secretariat.

[2.19 pm]

GOSS, Mr Kevin Frederick, Chief Executive Officer, Future Farm Industries CRC Ltd

ACTING CHAIR (Senator Siewert)—Welcome. Would you like to make a brief opening statement?

Mr Goss—Thank you for the opportunity to speak to our submission, which we made back in April. I want to focus my remarks on the farming part of the agricultural sector, which is the part that we are very familiar with. I am very conscious that I do so as a science manager who has been looking at research in sustainable agriculture over a long period of time, but also on behalf of two cooperative research centres: one that has just finished its six-year life and one that is a year into its new seven-year life. It is on that basis that I wanted to speak to some of the things that we are now doing that I think are very relevant to this question of adaptation to climate change.

I think there are three things that farmers face today that they should be considering as really important. The first one is how they adapt to increasing drought frequency and climatic variability. That is an issue today; it is not an issue for the future. It is on them now. The second one is to understand and to reduce farming's greenhouse gas footprint. That is a long-term issue and very challenging. The third one is to engage in and prepare for the climate change policy that is coming to them. I am being quite deliberate in saying those three areas, because I think they get confused in the debates, at least those that I track. And then I will come to the question of a national strategy. So I will start with adaptation to drought and climatic variability. You will notice that I have not mentioned climate change as such, because this comes to farmers year-on-year and they have to play this out tactically with the options they have to be able to cope with seasonal circumstances. Climate change comes to them as a long-term trend, but we concern ourselves with science and with policy; for farmers, it is a much more immediate issue and they would be much better served by having not only better seasonal forecasts but particularly by having technologies and farming systems that they can adopt immediately. I know you have heard some examples earlier today, and I can give you more examples of some of those farming systems that are in play right now. The Future Farm Industries CRC is very much working on these. We have a particular approach, which is the role of perennial plants in farming systems, both in grazing systems and in cropping systems, and also the potential for new woody crops. We set ourselves very ambitious targets for them and we measure them for their adaptation, for their productivity. We measure them for their biodiversity responses and we measure them for water use as well.

Besides looking at farming systems and farming options for their straight adaptation to climate change, there is a sleeper in this. It amazes me that this does not come to the fore more often. It was played out in the ABARE national outlook conference earlier this year, and that is, if farming is going to continue to adapt well into the future, the underlying productivity growth based on technology change in farming is crucially important. If I take you back to some of the predictions that have been made—and this goes back to ABARE work and some of the work that they quoted—ABARE made an assumption that productivity growth would continue at 2.2 per cent a year into the future, which is down from the historical three per cent and, on that basis,

under a conservative climate change prediction, we would see grain and meat production fall by nine per cent against the ongoing productivity growth. There are two things about that. The first one is it is not an absolute reduction. That is really important. The second one is that it assumes an ongoing productivity growth at a time when it is falling; recent figures show the rate of growth is declining right now. So, there are two parts to this strategy. One is to have options for farmers that deal with climatic variability and drought now. The other is to continue to invest in agriculture in those areas of technology change, productivity growth and ongoing improvement. That, I think, is a really important insurance policy that goes into the future. The policy risk is that there are impediments put in the way of that.

On the greenhouse gas footprint, which I would like to comment on as well, in this case it is incredibly important now that there is work done to understand emissions and sequestration associated with farming practices and to internalise that within the farming system. At the moment, there is discussion about elements of this and what can be sold as carbon credits and so on. The really important thing, from my perspective, is that, while we can talk in aggregate terms about agriculture being this percentage through methane emissions and this percentage through nitrous oxide and the aggregate, it means very little to farmers. What we need to do is understand what happens at the farming level on the base of the systems that are there and then to internalise that within our understanding of the cyclical nature of greenhouse gases, both on the sequestration and the emissions side.

I would like to comment on carbon for a moment, particularly on the discussion about soil carbon. The way that I find really helpful to understand this is that carbon is a very important resource within agriculture. It is like water. The plant-soil combination can make better and better use of carbon, as it does with water, and we end up with productivity improvement; we end up with better soil structure; we end up with more efficient water use; we can reduce soil degradation and these sorts of things. It is much more than simply a commodity of potential carbon credits. It is that total picture of carbon that we urgently need to get to grips with. It does range from labile right through to inert, and getting that sorted is a very urgent issue.

I would just like to talk a little about the fact that, in this area of greenhouse gas emissions and the life cycle nature of them, again, there are policy risks. If we are going to deal with climate change policy on the one hand and allow agriculture to continue to be productive on the other—there is already a reaction against work that says we can have high-performance grazing systems, which is a very good thing, but there is this reaction of, ‘That just puts more methane into the air.’ It ignores the subtleties of better utilisation of the pastures that we are developing, better metabolism and therefore, on a net basis, it can be an improvement, not a net emission.

I have tried to create a picture about both the importance of adaptation in the short term and the importance of understanding, at a farm level, what the life cycle picture is. I might just comment on national strategy for a moment, if I could. I recommend that there be four goals that we should be thinking about right now when it comes to agriculture and climate change. The first one is more technology and farming systems options for farmers to adapt right now. The second is to boost productivity growth with a target range of three to four per cent per year, which is restoring an ongoing performance record. The third one is to target a reduction in greenhouse gas footprint in farming itself in the way I have just described. The fourth one is to ensure that policies are not a disincentive for innovative adaptation, and there is a real risk of that.

Regarding a national strategy, one already exists for R&D. You heard that from Michael Robinson. CCRSPI exists. We have engaged with it, as have the R&D corporations, the state agencies and the universities. There is some unevenness about that at the moment, but, to my mind, it is the best thing going and I see that as a foundation for an ongoing R&D strategy. There are some risks to it, and the risks are non-engagement by some parties. I should also say that, right now, CCRSPI requires very strong leadership from the Commonwealth agencies and also a strong coordinated leadership by them—that is, coming together and providing that leadership. They are my opening remarks. Thank you.

Senator HEFFERNAN—So what are you to Premier Goss?

Mr Goss—I am not a relative of Premier Goss, not that I know of.

Senator NASH—In a practical sense, what needs to happen to increase the productivity growth?

Mr Goss—It comes down to innovation, which comes from farmers—it comes from scientists; it comes from all quarters—and then proving that with research and development and having it adopted within farming over the following 20 or 30 years. That is the pattern. It would be best if I illustrate it. In grain cropping, the productivity growth has been greater over the last 20 or 30 years. One of the dominant reasons for that is zero till farming and, now, controlled traffic farming where farmers are getting above average yields from below average rainfall years. By any measure, it is a very efficient system in fuel, in water use and in conversion of fertilisers into product. On the livestock side, there have not been the same changes. If I look to what could happen in livestock, to illustrate the point, one possibility is a much more productive pasture base, which is what we are working on. Another possibility is improved animal genetics that provide for greater growth and the ability to deal with other issues and the third is the very management system that farmers adopt to be a specialist livestock operator with greater, more efficient turn-off. It is individual technologies, such as improved genetics, but it is also the system itself, in terms of managing an enterprise in a more productive, more efficient way. It may surprise some people to know that agriculture as a sector has exceeded other sectors in its track record in this area.

Senator NASH—In your submission you also talk about what options there are or are going to be for farmers in the near and long term. You indicated that you would be happy to brief the committee more on that. Would you like to do so?

Mr Goss—Yes. Thank you for the opportunity. I will go to some of the work that we are doing, which is what I was referring to. We are well advanced with a prime lamb livestock production system called EverGraze, which is for the high rainfall environments.

Senator HEFFERNAN—What do you call ‘high rainfall’?

Mr Goss—High rainfall is a rainfall zone between 500 and 600 millimetres. To picture that, we bring in perennial pasture plants in unique combinations—including perennial legumes, summer active perennial grasses, winter active perennial plants like chicory—we bring in much improved animal genetics capable of lambing percentages way above current levels and we introduce a tall perennial grass or shrub to provide a much better nursery environment for the

many more lambs that are involved so that we do not see the deaths of twins and triplets. The management system is a much tighter rotation that matches the livestock's nutritional requirements with the feed availability. To be able to do that requires a higher management skill and to be on the job because you are moving animals around and you are monitoring things very closely. That is in its fourth year of research right now. That is close to being adoptable by farmers. Our benchmarking in western Victoria demonstrates that it is running at about 50 per cent above best practice in production in the district and it is also making a major reduction in leakage to groundwater in that environment, which is a very good thing from a dryland salinity viewpoint. That is the high rainfall package.

In the wheat belt we have started a program called EverCrop, which is looking at what you do in the whole rotation and it is introducing drought tolerant perennials in the non-crop phase. But it is particularly looking at broadening the footprint of legumes, which we increasingly see as being important because farmers at some point may have to substitute legume generated nitrogen to some extent for applied nitrogen if oil prices stay the way they are. There are also other important considerations in soil structure and building soil carbon and those sorts of things. That is a low to medium rainfall option. If we take some of these predictions on board, a farmer will have cropping areas on parts of their farm that will not be able to sustain cropping because the soil types are marginal. The question is: what do they do on that part of their farm? What do they do in their rotation? So we are now evaluating new plants that are not available yet to be able to fit that into a cropping system.

The final example that I will give you is one called Enrich—and I know that I am giving you names here. Enrich is looking at situations in which cropping is probably not going to be an option. These are more marginal soils. What can you do on a sustained and permanent basis? This is looking at new perennial forage plants. They can be standing forages. They might be in alley formations, or they might be more widespread on the farm. These provide a much more drought hardy feed source for the animal. Again, they fit the seasonal circumstances a whole lot better. They can respond to summer rain and all those sorts of things. Interestingly, they bring in new nutritional factors and other beneficial factors, such as the potential to reduce methane in the animal or suppress internal parasites—these sorts of things. It is a very new, out there proposition.

Senator HEFFERNAN—What rainfall is that?

Mr Goss—That would range from 500 down to 350. It depends on the plants.

Senator HEFFERNAN—Typical saltbush country is probably 300; 12 inches. So you do not go down into that?

Mr Goss—Yes, we do.

Senator HEFFERNAN—Saltbush country out our way is all dead. The perennial saltbush is as dead as a doornail—tens of thousands of acres of it.

Mr Goss—That is news to me, I have to say. I am disappointed to hear that.

Senator HEFFERNAN—It is not news to me.

Mr Goss—The plants that we are looking at are adapted to different rainfall environments.

Senator HEFFERNAN—I thought saltbush was tough.

Mr Goss—With the standing forages, we see it more between 500 and 350. We do have some other herbaceous perennial plants that we are evaluating for a lower rainfall environment as well. That would be down to 300 to 275.

Senator HEFFERNAN—If you go from halfway to Booligal passed One Tree out for 50 miles and go west, all that saltbush country is dead. There is an odd plant left.

Mr Goss—My answer is that we do have other plants under evaluation that would be adapted to drier conditions and also to more erratic rainfall, including summer rainfall.

Senator NASH—In your submission, I thought it was very interesting that you indicated that there might be tensions and potential delays in making some of the government initiatives operational. It is a key thing to discuss. Would you like to expand on that for the committee?

Mr Goss—I have to say that it has changed a bit since I made the submission. That has a lot to do with the CCRSPI. Back at that time, it was uncertain whether the R&D corporations would commit to it. Since then, they have. Some of my concerns have been placated by the fact that the R&D corporations, with the agencies, have come together. I still would like to see a very strong expression of the Commonwealth's agencies commitment to CCRSPI. That to me would settle my concerns. As I think that you learnt from your questioning earlier, these things take a while to fall into place. If you take something like CCRSPI—and, as I said earlier, it is the thing that we must support—when you look within it it is a very large initiative with a lot of internal variability. It is ranging from small irrigated agricultural pursuits through to large dryland farming pursuits. Then there are questions about things up and down the supply chain as well. From a coordination viewpoint, it is a very large challenge. I would leave it at this: that is the challenge. My concerns expressed earlier have somewhat been answered.

Senator NASH—Okay. Thanks.

Senator HEFFERNAN—Will the recently announced plan to reconfigure the CSIRO away from productive research to climate research be offset somewhere in the research bank that you were talking about? You know what I am talking about, don't you? It got a run over the weekend.

Mr Goss—My understanding—and I stand to be corrected on this—is that what got a run over the weekend was the launch and promotion of the climate adaptation flagship. Would that be correct?

Senator HEFFERNAN—Which was defined as redirection away from or as less emphasis on productive research. There were critics of that who said that their research stations—one up in the north and one down in the south, I think; one in Mildura and one in Rockhampton or something like that—are losing funding for productive research, that that is being redirected into climate research.

Mr Goss—I think there are two things there. The first one is that CSIRO has made some decisions to cut those research farms as part of its budget strategy, and I am not familiar with the details of that. But there is another matter, which was announced on Friday, and that is the climate adaptation flagship, which is very relevant. So CSIRO has continued its internal prioritising of investing in these flagships, one of which is focused on climate adaptation. Now, I think that is an important initiative—

Senator HEFFERNAN—I have no doubt about that.

Mr Goss—which we are trying to work in with.

Senator HEFFERNAN—But there is a great difficulty for me—and I have to declare an interest: I am a bloody farmer, even if I am worn out. At lunchtime I ducked down to the CSIRO farm just out here along the road. They have 1,500 acres that they do not own, fortunately, or they would not have it because they would have sold it. The Commonwealth actually owns it and the CSIRO use it. It seems to me to be a great shame if a great organisation like the CSIRO has to be involved, for budgetary purposes, in selling down its asset base, which includes these experimental farms et cetera. I was just talking to some blokes out there and they said, ‘We would not have this if we owned it; it would be sold.’ What does that say about the government’s priorities? I do not give a bugger who the government is.

Mr Goss—I would invite you to pursue CSIRO over this matter. When I heard this a month ago, I made an inquiry for my own information and found that one of those research stations that was going to be put on the market was at Bakers Hill, east of Perth. I happen to know that area reasonably well from my past responsibilities, and my immediate reaction was that that would be no loss to their research effort, because it is a research farm that is probably not being used heavily and is not in the environment where most of these issues now have to be researched. I cannot speak for anything else that CSIRO has done, but I know that, in that particular case, I would see that as having a very marginal impact on their work.

Senator HEFFERNAN—But the test of that proposition you have put, which no doubt is true, is: did they acquire a place somewhere where it is?

Mr Goss—I do not know. Let me just comment from our perspective, and that is that we will do our research on research stations where it is convenient and where it is in the right environment for us to do it. But increasingly, we do our work on farms and I think we get a better result out of that. Farmers certainly identify with it more closely and, just to give you an example, in that EverGraze work that I spoke about we now lease 70 hectare and 50 hectare sites on farm, and that is how we do our research these days.

Senator HEFFERNAN—Everything that you have talked about there this morning, we do on our farm. We have gone to perennials. We have a little block set aside for blokes to play around with perennials. So the answer is that what the CSIRO is in decline on—that is. the productive research—others like you may be in ascension on.

Mr Goss—From my perspective, they are not in decline in agricultural research; they are dealing in partnership with us. I guess you know this, but let me just restate it: a cooperative research centre is built up of contracted researchers provided by participants who agree to go on

that journey with you over seven years. In our case, CSIRO, across four divisions, are a very important participant in the CRC and there is no decline in their commitment from our perspective.

CHAIR—Senator Heffernan, there are other senators wanting to ask questions. Do you have many more?

Senator HEFFERNAN—No, I am all right.

Senator MILNE—Mr Goss, you mentioned before climate policy risks, and one of the risks that I am seeing is in the need to reduce emissions. People are not looking at the perverse outcomes for biodiversity and other land uses and so on, so I have been interested in the work that you are talking about and the work that you are doing on finding native vegetation types that might be able to sustain agricultural production whilst having biodiversity offset benefits, like the oil mallees, for example. But we have also had quite a lot of anecdotal evidence that oil mallees, of course, are doing well in areas with higher rainfall and so displacing other forms of agriculture—that is what I am getting to. What work are you doing around how to use native vegetation to enhance options not only for farming but also for biodiversity, while making sure that they then do not encroach on other agricultural systems that can still be profitable doing other things?

Mr Goss—Thanks for that question. There are several parts to what we do, and therefore several parts to the answer. The first thing is that we are selecting among native plants for potential productive plants on farms. Some of these are known but some are very new. We have people who have been out plant collecting and looking afresh at a whole suite of Australian native plants and then putting them through an assessment. We have got this down to, let's say, tens of plants that we think are worth a closer look, and some of them are planted out already. Some are leguminous; some are not. They are all perennial and they are selected because they are very well adapted to what we see as the climate they are going to face in the future. You could conclude that that is a good thing from a biodiversity viewpoint, but—and I think this is behind your question—our job is not to assume that. Our job is, when it is in these potential productive systems, to actually observe that and then build some capacity to predict what the biodiversity benefits might be. That brings me to oil mallees. Firstly, oil mallees today in Western Australia are on 13,000 hectares in 16½ million hectares of cleared agricultural land, so it is a very small percentage. We are working on oil mallees; in fact, we had an announcement just this morning that the state government of Western Australia is backing us to develop the harvester for the oil mallees, which has been a big impediment for that industry. But, in all our projections for oil mallees, we are not looking beyond 10 to 15 per cent of the landscape. I think that is important. Shall I answer on biodiversity?

Senator MILNE—Yes.

Mr Goss—From a biodiversity viewpoint, we have had a research group out in oil mallee plantings for two to three years now, observing what is happening in different configurations of oil mallees, according to whether or not they are adjacent to remnant vegetation. They are observing, certainly, some good signs of increased foraging behaviour out into the oil mallee belts, particularly when it is adjacent to rem veg, and that can be small marsupials or reptiles, and it is providing some benefit to bird passage as well. We will continue that work. In the other

pasture areas we are working in, and I come now to EverGraze, we are looking at a stronger role for native perennial grasses in a low-input system. This is in four sites in eastern Australia now. We have not got the project off the ground yet, but we plan on having a project that looks at the subtlety of that, of having a much greater perennial grass component in a low-input farming system. As a general principle, we would look to observe and then build a capacity to predict biodiversity responses with all the farming systems that we develop.

Senator MILNE—Just finally and quickly—I notice something here from the Canary Islands, some grass that you have imported that looks like it is a prospect. What about its weediness, though? How do you test the weediness of these things before we get too excited about them?

Mr Goss—A good question. The plant is called *Bituminaria bituminosa* and it was one of the plants I had in mind when I was answering Senator Heffernan about plants that may be very well adapted to much lower rainfall environments. We have a weeds protocol that the CRC has adopted and that we implement. The weeds protocol has been worked out in a joint project with the CRC for Australian Weed Management, which finishes today. We apply that to all that we do. That, importantly, is not simply about bringing plants into the country, which is a matter for Biosecurity Australia and AQIS; that protocol extends to how we manage the sites internally and to our ongoing observation of those sites and dealing with any issues that arise.

Senator MILNE—Thank you.

CHAIR—Senator Fisher, we have approximately seven minutes to go.

Senator FISHER—Mr Goss, I am a Liberal senator from South Australia, but I do come from a wheat and sheep farm in the central wheat belt of Western Australia, so I want to ask you a bit about salinity. Clearly I have a familial vested interest because the family still farms and salinity is a critical issue for my family. But, that aside, I note some comments reportedly from you in the *West Australian* on 4 April this year where, if quoted correctly, you said:

... salinity was once touted as Australia's biggest environmental threat, but that had been superseded by concerns about water over-allocation and climate change.

What is your view of that?

Mr Goss—I stand by that statement. The thing that really intrigues me here is the way that we get this claim and counterclaim about who is behind the biggest environmental problem or who is making the call on that. I would suggest to you that we should be well past comparing costs of environmental problems: 'Salinity is a \$1 billion problem,' and 'Weeds is a \$3 billion problem,' and so it goes on. That is very unhelpful in this day and age. The real issue with these problems is what have we got to manage them and what is the net benefit of doing the research and then getting that outcome? The people involved in salinity have been very responsible—

Senator FISHER—Exactly.

Mr Goss—in looking at what can practically and reasonably be achieved—

Senator FISHER—And have been for many years.

Mr Goss—and then addressing that, including the benefit-cost analyses and other things you do. So I stand by the statement for two reasons. One is that if you look at what can be achieved by research and development and even management strategies in all these areas, it is a really modest outcome for salinity, and there may be much bigger outcomes in those other areas. The second point is that the threat of salinity has changed, and that needs to be recognised and it needs to be communicated. There was a time in 2001 when there were large figures quoted for the risk of salinity arising from high watertables. Those threats have been re-examined and now—and I may have done it in that article—there are now fairly reliable predictions that salinity in Western Australia today is about one to 1.1 million hectares, and nationally about 1.9 million hectares, and may double over the coming decades. That is a much smaller outcome than was talked about seven years ago, and one of the reasons is that watertables have stabilised and in some cases they are falling, and that is due to the dry years.

Senator FISHER—From bad news elsewhere, is what it is due to. But to a farmer who is affected by salinity, water allocation is a fanciful concern; they do not even get to first base. If land is lost to salinity, then it is lost for production. I note that the federal government has moved from the National Action Plan for Salinity and Water Quality to this Caring for our Country grant, which the environment minister, Peter Garrett, has said will encompass assistance for salinity. What is your view of that?

Mr Goss—In the Caring for our Country, there is a theme called sustainable agriculture, or words to that effect, and I focus immediately on that area when it comes to dryland salinity. The CRC for salinity, which I was the CEO of for three years until this one took over, was very influential in providing advice through the Natural Resource Management Ministerial Council to really change the principles for addressing investment in salinity. The thinking there is that we need to see salinity in a broader context and we need to focus on the technologies and the farming systems that can address those multiple benefits of which salinity is now one.

From my perspective, what is important is that we maintain our effort on the plant based solutions that we have been focused on all this time, recognising that the net benefit in salinity is less than we once thought but the benefits in other areas are much greater than we once thought, and that is why I am talking about climate change adaptation today. On the other hand, for those farmers that are badly affected by salinity—and we should recognise that—we must also maintain our resolve to provide them with options for salt affected land. So it is a two-part strategy at that point. I am hopeful that that can be handled within the sustainable agriculture component of Caring for our Country. If it cannot then I think that would be a poor outcome. That is where I am focused at the moment.

The other thing about dryland salinity which is also very important is that it remains a very significant threat to biodiversity, particularly in the wheat belt of Western Australia—

Senator FISHER—Absolutely.

Mr Goss—and so to that extent we need to maintain a very strong focus on that. We are doing what we can within the CRC to build a better planning and decision approach to identifying those areas at risk, with high values at risk, and then to address them with very direct action. I cannot confirm how that would be handled under Caring for our Country, but that is still very important.

Senator FISHER—In respect of Caring for our Country, are you aware that the application time frame now must be down to some three weeks? I think applications have to be in by the end of July and the government announced the program not two weeks ago. Some may say there is a rather limited window of opportunity for interested organisations and for farmers, to the extent that they are contemplated as applicants, in terms of their ability to apply. You might want to be aware of that, if you are not already.

Mr Goss—Thank you for that. We are aware of it to the extent that, although we are not a player in it, some of the NRM groups and catchment management authorities see us as a research partner. To that extent they have been talking with us and we know they are under pressure to get their applications in.

Senator FISHER—There is one further thing I would ask you to comment on a little bit further. To the extent that forecasts were made in the past about the threat of salinity, they were based on the best available data at the time. You have described a scenario where we are reassessing the threat, based on what we now think we know about the watertable. If that variable were to change in a favourable way, contrary to expectations, then the threat of salinity may again resurrect itself in material terms at the other end. Is that correct?

Mr Goss—That is very correct. I think we need to be really alert to that. That was my concern, that while the overall threat is diminished in hectare terms it has not diminished as much in value of assets at risk. That was my point about biodiversity, terrestrial and aquatic, and also high-value assets such as towns and infrastructure. We need to focus on them rather than straight hectares. And, of course, just as the mobilisation of salt on the River Murray with a flow or an episodic flood event in the wheat belt of Western Australia can do an enormous amount of damage with salinity. So we should not step away from our resolve to do something about it. We believe that we have got a very good technology farming systems base to go forward, but we are now applying it to broader matters as well as salinity.

CHAIR—Thank you very much, Mr Goss.

[3.00 pm]

PRESTON, Associate Professor Christopher, Program Leader, Cooperative Research Centre for Australian Weed Management

CHAIR—Welcome. The CRC for Australian Weed Management has lodged a submission with the committee which we have numbered 19. Do you wish to make any amendments or alterations to that submission?

Prof. Preston—I would like to make a few comments on the submission as opening remarks and then perhaps talk about one issue that is not in a submission but I think might be pertinent.

CHAIR—I invite you to make a brief opening statement before we go to questions.

Prof. Preston—In our submission we have looked at a range of issues involving climate change and the weed flora. The weeds CRC does not get involved in climate research per se but we are involved in trying to predict what is going to happen with changing climates on weed populations. Part of this involves the use of models that predict weed distributions and it is our concern that these models need to have a fairly rigorous review conducted upon them because they do not necessarily predict the outcome that we would think should occur.

The other issue that we feel is an important issue in the climate change discussion is the issue of weed risk assessment. Currently we have a good weed risk assessment process in Australia both at the national and regional levels, but we have been unable to predict the impact of sleeper weeds. These are weeds that are in the environment at the moment which we would say, at the moment, probably are not going to cause a problem but they may well do so under changing climate systems. There are some specific things that we do perhaps have a better ability to predict about weeds. We do know that with increasing temperatures certain weed species, particularly subtropical and tropical weed species, may well move south in their distribution and they may well move to higher elevations and in fact cause problems in places where they do not already occur.

I think the biggest issue with climate change or climate change predictions and weed distributions is the issue of water. At least for us here in Australia, water is going to be our big issue. Rainfall patterns in the south are already changing. Over the last decade in South Australia and in the western parts of Victoria and, indeed, in southern Western Australia, we have seen rainfall patterns that have changed from what they were prior to 1990. They are going back to the sort of rainfall patterns that were seen at the beginning of last century. They have quite significant potential impacts both on farming systems and on the weed flora and how the weed flora is managed.

One of the issues that arise is the inability to have good pasture coverage because of lower rainfall patterns at various times, and that allows weed invasion into pastures. The second one that is quite important in the grains industry has been the change in rainfall pattern from one almost entirely dominated by winter rainfall to having increasing amounts of summer rainfall. Farmers are needing to spend more time, effort and money controlling summer weeds because

they need that moisture to grow a crop. Severe weather conditions can also be a major issue because they create gaps in the environment for weeds to invade.

Another issue that I think is related to the whole climate change and water issue is the one of structural adjustment: how do we actually manage farmers through this system? The majority of farmers in Australia have most of their equity in land and their land is only as valuable as the water that they can get. So with declining water resources, whether that is declining irrigation or declining rainfall, there is the chance that for many of these farmers their land will become less and less valuable. That makes it more and more difficult for them to move out of the industry or move into different industries and it creates the issue where, instead of changing industries, the land is just abandoned and allowed to go to waste. Again, that is an opportunity for weed invasion.

I mentioned one topic that was not in our submission that I would like to touch on. It was not in our submission because it is somewhat peripheral to the climate change debate, but I think it actually is to some extent driven by the climate change discussion. It is the issue of biofuels. The Australian environment is littered with examples of industries which seemed like a good idea at the time but which, for one reason or another, never really made it. In many of those situations we have plant species that have become weeds and animal species that have become feral. Rubber vine is probably a good example of this; olives are another example that I am very familiar with, coming from South Australia—these sorts of boom and bust industries. I think we need to be very careful about how we go forward with the biofuels sector. Many of the species that have been touted as prominent biofuels species, like jatropha, are well known worldwide for being weedy, and if the industries do not take off we could well be left with a legacy of weeds on our hands. I think that is something we do need to put a bit of thought into. Thank you.

Senator O'BRIEN—We heard earlier today the suggestion that farming a mix of perennial grasses and winter cropping is acting to suppress weeds normally in pasture. I know some of your submission is about weeds in bushland and forests, which is a different problem entirely. Have you had a chance to look at the suggestions that we can deal with some of the weeds that are problems for farmers, particularly cropping, by changing our farming methods?

Prof. Preston—It is quite well known that if you change your farming system you will change the suite of weeds that you have. Certainly some of the weeds that are major issues in our cropping system become largely nonissues if you go to pasture. Perhaps our worst weed of agricultural cropping in southern Australia is a weed called annual rye grass. It is absolutely fabulous sheep feed. So, yes, certainly changing the system will change the suite of weeds and make some of those that we consider bad weeds now into nonweeds or even valuable plant species. But on the other side of that you actually get other species that will come into that environment. If you change to pasture system and cannot keep that pasture intact then it will be invaded by other species.

Senator O'BRIEN—The woody weeds.

Prof. Preston—Yes, principally in perennial pastures the sorts of weeds we see are woody shrubs.

Senator O'BRIEN—In terms of the fit with climate change and the weed problem, and the size of the problem, where should we be investing most in terms of the research effort?

Prof. Preston—One of the things about weeds that we know really well is that the most cost-effective way of managing them is to not have them in the first place. If we can find ways where we do not bring in weeds or we do not allow weeds to spread into areas where they are potentially going to be damaging, then that is probably the most cost-effective thing that we can do. Unfortunately, there has been a tendency for a long time to actually deal with weeds once they are a problem rather than trying to stop the problem occurring in the first place. From my perspective going forward, I see the whole area of weed risk assessment, distribution prediction—those sorts of areas—and, if we can get that right, we can certainly minimise the potential problems that we will have down the track.

Senator O'BRIEN—That is about the future weeds. What about the present weeds?

Prof. Preston—What do we do about the present weeds? That is a really difficult question. One of the issues that we currently have with weeds is that we have some very bad, intractable weed problems simply because we do not have the technology to actually fix it. Or, if we do have the technology, we do not have the funds to deploy it on the scale that it is needed. What really needs to be done here is some sort of assessment of the problems that you have got and which ones you can do something about, and then putting the effort there. In terms of our research needs, we need two things: good assessment capabilities and new tools. We need to develop new strategies for managing weeds.

Senator O'BRIEN—What will be the source of that information?

Prof. Preston—It all depends on what your problem is, and therein lies part of the issue. In the grain sector, what we are looking at is a farming system that is increasingly built on no-till farming and highly dependent on herbicides. They are the sorts of tools that we are looking at, apart from the potential of getting new herbicides—but eventually the chemistry bucket is going to run dry. The issue really is: how do you actually build a sustainable cropping rotation in that system? What crops do you put in that system where you can deal with the weeds that are causing the problems? I have described these to farmers as weed control crops. It is a sort of a farming system, a rotational type strategy, that you need to develop. I do not think we are going to have a new silver bullet that is going to solve all our problems.

Senator MILNE—You mentioned in your submission that recently a major agency could not put out a map on risk assessment of weeds because the data was not good enough. We have also had the Productivity Commission look at the CRCs and recognise that the decision to take out the public interest research has led to us not having the work done. I understand your CRC finishes tomorrow and there has now been a new proposal for weeds. Can you tell us how the whole weed research is now going to fit into the CCRSPI model and whether we are going to be able to go back to this risk assessment public interest research. How do you move forward in this area?

Prof. Preston—At the moment it is fair to say that the situation is a little bit uncertain. We have been told of the announcement of new funding for weed research from the current government. We do not have a lot in the way of details about how that is going to operate. It is

going to be a little bit difficult for me to get into specifics. I will say one thing: I think the fact that government has recognised that there needs to be a semipermanent or permanent research program in the area of weeds is testament to the fact that these are large-scale, long-term and intractable issues. They are not the sort of things that you can solve overnight.

There are other players in the funding market who are taking up some of the slack, as it were. In the grains industry, GRDC is talking about how it is going to invest in the future in weed research and try to keep some of the things that the weeds CRC did, going into the future. So it is not all doom and gloom. What we will get to, if we are not careful, is going back to the days of pre 1995 and that sort of disorganised weed research across Australia, where you had the same research going on in different states, simply because of the way the whole area was being managed.

Senator MILNE—What engagement did your CRC have with Biosecurity Australia and AQIS in terms of preventing the weeds coming in the first place?

Prof. Preston—Our CRC has been deeply involved in the weed risk assessment processes and in the development of those plans. We have been involved in developing a standard for risk assessment in weeds. We have had a continuing dialogue with AQIS about their particular strategy going forward and how we viewed that. One of the things that we were unhappy about was the permitted list. We did a lot of work to get the loopholes—as far as we saw them—in that permitted list closed. We have had a long and continuing association with AQIS and Biosecurity Australia over this. They recognise the need for the research that the weeds CRC did and the value that that produced. I would be very unhappy if this area did not turn up in the new government's priorities in its new research program. I think this is where the potential to make the biggest gains is.

Senator MILNE—And Rachel McFadyen is going to head up this initiative, the new program? How is that working?

Prof. Preston—No, Rachel is retiring in a couple of months so she was just getting involved in talking to the department about going forward. How it is exactly going to work, as I have said, is a little bit uncertain because we have not been given information as to exactly what this research centre is going to provide.

Senator HEFFERNAN—Is this your last day?

Prof. Preston—Yes. We have asked for a short extension of time so that we can cross some t's and dot some i's, but sort of officially this is our last day of operation.

Senator MILNE—Thank you. We will watch with interest because we want to make sure that that goes on, particularly as it pertains to climate.

Senator HEFFERNAN—What can you tell me about pongamia?

Prof. Preston—You might have to give me some more names; it is not one I am totally familiar with.

Senator HEFFERNAN—It is a legume which, I am told, has potential as an oil alternative crop, from a seed. But, if you are not familiar with it, I will not—

Prof. Preston—It is not one that I am totally familiar with, I am sorry.

Senator HEFFERNAN—I would not describe it as a weed—put it that way; it is a tree.

Senator McGAURAN—You mentioned intractable weeds. What are they? Given climate change or not—

Prof. Preston—These are problems that we already have for which we do not have good management strategies and sometimes for which we are probably unlikely to develop a good management strategies in the near term.

Senator HEFFERNAN—What would be some examples—fireweed?

Prof. Preston—Fireweed is an example. I am going to give you another example that I am really familiar with, a weed called silverleaf nightshade.

Senator HEFFERNAN—I know that one.

Prof. Preston—It is deep-rooted perennial—

Senator HEFFERNAN—Sure is.

Prof. Preston—that is spreading dramatically across southern Australia.

Senator HEFFERNAN—I have got a little patch about a yard by about three yards. I spray it with Roundup and I dig it out and the bloody thing comes back again. She is a mighty weed that one.

Prof. Preston—The issue with it, first of all, is that it has got a root system that goes down three metres deep and several metres across and it is very difficult to deal with it with herbicides. It is impossible to kill with tillage—all you do is spread it—and we do not actually have any other good strategy. The ideal strategy, given where it is located and the sorts of environment it is in—it is on roadsides and in other disturbed environments as well as on farms—would be biological control. That would be the ideal type of strategy and there are agents out there. But our ability to get one of those agents into Australia is extremely low because, firstly, they are eggplants—though I believe we could solve the eggplant issue.

Secondly, we have a large number of native solanums and the testing protocol would mean that they would all have to be tested and if an insect ate one of them that would be the end of the biological control agent. To actually achieve a biological control agent for silverleaf nightshade would be a multimillion-dollar program. That is why I am suggesting that we have weeds out there that really are quite intractable. We do not have good management strategies and we are probably unlikely to get good management strategies in the near future. We need to work out how to slow it down rather than how to get rid of it.

Senator SIEWERT—I do not know if you were here earlier when we were talking about soil carbon and the issues around pastoral cropping. Everyone has got really excited around here because it sounds like a way to move forward. I am wondering whether you have been involved in that concept as it is developing and whether you have looked at it in terms of the potential for ways to develop through that process.

Prof. Preston—I have been a little bit involved in the carbon sequestration issue from a cropping perspective where no-till stubble retention agriculture was seen as being able to sequester quite a bit of carbon. It just turns out that it is not quite as much as we would have hoped and the sequestering ability falls away pretty quickly. You raise the soil carbon up to a certain level and then it sort of stops rising, at least in that environment. If you were to change the species you had there and potentially had things with more and bigger roots, maybe you could sequester more carbon into the soil that way. Of course, there is a danger whenever we change the species and develop a new agricultural system. We need to watch out that the species that we are bringing in are not well-known weeds that are going to escape from cultivation and cause damage.

Senator SIEWERT—I think you were here when Kevin Goss from the Future Farm Industries CRC was giving evidence. That CRC has a weed risk assessment code. Have you and similar research bodies got a similar code? It seems to me that you are dealing firstly with those issues of weediness through the code and that that is a good way to go. Have you got a similar code to other research bodies?

Prof. Preston—We did it particularly with Salinity CRC and then with the Future Farming Industry CRC because of their real interest in perennial legumes. One of the things we know about our environment from work that has been done in the past is that perennial legumes are high risk for weediness, so that when you start using the weed risk assessments they always come out as really bad. We wanted to look at that and work out whether all woody legumes were bad weeds, or were some of them not really bad weeds but just minor weeds or insignificant weeds? So we did a lot of work with the Future Farming CRC on that legume issue and we came up with some rules that they can move forward on about avoiding the worst of the weeds.

We have not done it much with other industries because many of them are not terribly interested in it. It would be really nice to do it with the perennial grazing industry on grasses. Perennial grass species generally end up being weeds, but they are not all bad weeds. Some of them get out a little bit and do not cause too much environmental damage. How do you choose which ones you want on your farm? I think it would be good to have done that sort of work as well; but we have not done it. It is partly because there is no interest on the other side.

Senator HEFFERNAN—Is spiny acacia considered a weed?

Prof. Preston—Yes. We see prickly acacia as being a major weed of range lands in Queensland.

Senator HEFFERNAN—There are about two million hectares of it in the lower gulf.

Prof. Preston—Yes. It is one of the Weeds of National Significance—

Senator HEFFERNAN—Given the fact that it is a weed, wouldn't it make sense to have a project to replant that country? Given that the spiny acacia in that area gets to a point where you cannot enter because it is so dense, wouldn't that be an ideal situation for a carbon sink?

Prof. Preston—There are a lot of things that you could conceive of doing with country that has become weed infested like that. The real limitation is money. It is about the people who manage the land having the funds to do any of this—and therein lies part of the problem.

Senator HEFFERNAN—That will depend on the cost of the carbon market. The carbon market can make all of that doable. I am worried about prime agricultural land being taken up under the little episode we had last week. In that one block up there, there are 2½ million hectares of spiny acacia, which is a weed. We could get rid of that and replant it as a huge carbon sink.

Prof. Preston—These things are certainly possible. But of course the issue is making it happen. Certainly, if the carbon credits come to fruition in a way that makes it attractive for the people who own that land to plant it with something else, then they will do so. But part of the problem that we have with instruments like that is that they tend to be a little non-targeted. If we make it too attractive, prime agricultural land will be planted with all these things because it is really attractive for those people.

Senator HEFFERNAN—That was the point we made last week.

Prof. Preston—It is certainly an issue with these sorts of blunt economic instruments that they do tend to be a little bit untargeted.

Senator HEFFERNAN—Mr Chairman, those comments would be quite useful comments for you to make to the select committee that is coming up on how we produce food that is affordable in an environment that is sustainable and on a farm that is viable.

Prof. Preston—We certainly have an interest in that too.

CHAIR—Senator Siewert, did you wish to continue your questions?

Senator SIEWERT—I did want to finish on the issue of working with other research organisations. It seems to me that it would be better to do that research up-front so that we do not get a significant way down the track of finding suitable grasses and then discover that they are weeds. I am thinking of some work that went on in WA a couple of years ago on—was it called tumbleweed?—a bush that was brought in—

Prof. Preston—Kochia.

Senator SIEWERT—Yes. That turned out to be a significant weed. We had to spend money to get rid of it in Western Australia. It would be better if we have protocols up-front for this work rather than at the other end.

Prof. Preston—Now, in Australia, we certainly do. We have gone from a situation where we had a prohibited list of plant species to a permitted list of plant species. If it is not on the

permitted list you cannot bring it in, unless you do a weed risk assessment. Part of the issue that we have is how those weed risk assessments work. We have what they describe in Biosecurity Australia as the 'weed black hole'. These are plant species that do not actually count as being either acceptable or totally unacceptable. They fall in the middle, where it says that more research is needed. Mostly, nobody ever bothers to do the research, which is okay because it keeps them out; but it does have a potential impact on industries that could use those species.

Senator SIEWERT—It is not just what we are bringing in. We are strong proponents of using native species, but we all know that native species can also become a weed and a pest.

Prof. Preston—This is why we have been working with a range of organisations on regional weed risk assessments. Again, a lot of this work came out of South Australia. We developed regional weed risk assessment packages for the NRM boards in South Australia, and we are trying to spread this concept more widely. We have done a bit of work with a couple of catchments in Queensland as well as on weed risk assessment.

Senator SIEWERT—Who is going to do that in the future without you being there?

Prof. Preston—This is why I hope that this new research centre, however it is structured, has this as one of its key research areas. I see that, biological control of weeds and management of these intractable species as being the key issues.

Senator HEFFERNAN—There is what people term fodder grass of the wrong species. If it invaded the savanna country to the north, it would produce a very hot fire. It would definitely be an invasive weed up there, whereas it might be a feed plant down here.

Prof. Preston—Again, these conflict of interest species do cause real problems. I think part of the issue is to work out up-front: what is the actual risk of this species becoming a major weed in Australia? Describe where the risk is. Then you can start asking the questions: can you actually manage that risk? Can you keep that plant in the south instead of letting it out into the savanna country? Is that actually physically possible? If the answers are no, then I think you have to ask this question: why are we having it at all? Of course, a lot of the species that are now causing these problems were brought in well before we had these processes in place.

Senator HEFFERNAN—Senator Nash and I have been wondering what the weed is that has a yellow flower and is medicinal?

Prof. Preston—St John's wort.

CHAIR—I am glad. Now we will all sleep well tonight. Associate Professor Preston, thank you very much:

Proceedings suspended from 3.28 pm to 3.45 pm

de JONGH, Mr David Roland Patrick, Senior Forest Policy Analyst, National Association of Forest Industries

HANSARD, Mr Allan, Chief Executive Officer, National Association of Forest Industries

CHAIR—I now welcome representatives from the National Association of Forest Industries and Tree Plantations Australia. Mr Hansard is now in *Hansard*.

Senator HEFFERNAN—Did they name Hansard after your old man?

Mr Hansard—A distant relative, Senator.

CHAIR—The National Association of Forest Industries and Tree Plantations Australia has lodged submission No. 6 with the committee. Do you wish to make any amendments or alterations to that submission?

Mr Hansard—No, thank you, Mr Chairman.

CHAIR—I now invite you to make a brief opening statement before we go to questions.

Mr Hansard—On behalf of the National Association of Forest Industries, I would like to express my gratitude to the committee for the opportunity to discuss our submission to the inquiry into agriculture and climate change today. The agriculture and forestry industries are Australia's oldest and most traditional industries. While the agriculture industry fed our growing nation, the forest industry literally built our nation. We have coexisted as complementary land use activities in this way and our futures are tied together. We share a common land base and are both the custodians of the natural resources they contain. This inquiry is perhaps timely given the development of an emissions trading scheme in Australia and the most recent government figures on Australia's national greenhouse gas inventory for 2006. It is also timely given the focus that the current petrol price issue has placed on the dependence of our economy on fossil fuel based resources rather than renewable resources.

The forest industry is a sustainable and renewable industry. The forests and plantations we grow and manage are renewable. They are carbon stores; they provide other environmental benefits such as biodiversity and salinity abatement; and they provide a sustainable, long-term economic underpinning to a growing number of rural and regional communities. The products we produce from these forests and plantations are also renewable. They are carbon stores and have a lower carbon footprint than fossil fuel based alternatives such as steel, cement and plastics. The fuel and energy we produce from our water and waste is also renewable and has a lower emission footprint than fossil fuel alternatives.

Let us have a look at the national greenhouse gas inventory figures that were released last week. The key outcome here from these figures is that agriculture is Australia's second-biggest emitting sector behind stationary energy and it surpasses transport. Forestry is Australia's only carbon positive industry and our contribution to the emissions abatement effort increases every year. Agriculture now amounts to 16 per cent of our national emissions. However agriculture is

playing its role in reducing emissions. Land clearing, largely for agricultural purposes, has dropped by 54 per cent since 1990, from 136 million tonnes of CO₂ equivalent to 62.9 million tonnes of CO₂ equivalent.

Forestry is also playing a role. Plantations established since 1990, largely through MIS companies, have soaked up over 23 million tonnes of CO₂ equivalent in 2006. These plantations are expected to make a similar contribution towards our 2010 Kyoto target. In the longer term, our economy has a far bigger task if we are to reduce greenhouse gas emissions, and we believe some fresh thinking is required here. The government is on record as setting an emissions reduction target of 60 per cent of 2000 levels by 2060. Though the government is still discussing how it will meet the 2060 target and what trajectory will minimise the impact of our economy, whatever trajectory is chosen will mean that a significant reduction in emissions is required. On a straight line estimate, this will mean that we will have to reduce emissions by around 397 million tonnes of CO₂ equivalent by 2020 from the government's estimated business-as-usual emissions levels of 837 million tonnes.

The forest industry can play a significant role in assisting our economy to adjust to a low-emissions trajectory in a low-cost way. Our estimated abatement contribution by 2020 is 81 million tonnes of CO₂ equivalent, or 20 per cent of the total economy abatement task. This contribution includes an enhanced effort from our plantation sector, continued contribution from our production and native forests, contribution towards biofuels and bioenergy and recognition of the scientific fact that wood products store carbon. The forest industries have developed a joint position on emissions trading to realise this potential based on full inclusion of the industry in an emissions trading scheme by 2010. We want to play our role in assisting the economy to reach a low emissions trajectory. Every sector of the economy will have to pull its weight to reduce atmospheric concentrations of CO₂ if we are to minimise the impacts of climate change.

The agricultural sector and the government are still discussing the situation in relation to emissions trading and the agricultural industry. However, given the government's policy objectives of maximal coverage for the emissions trading scheme, it is likely agriculture will be part of an emissions trading scheme. The question is when and how. We are continuing to work with the agriculture sector in this regard. My colleague, David de Jongh, will run through how we are doing that.

Mr de Jongh—I would like to make some brief comments on the adaptation side of the forestry sector and how the forest industry can deal with adaptation in the face of climate change. Both native forestry and plantations offer significant opportunities to adapt to climate change and to assist agriculture in that process. These opportunities are mainly in the form of the different active and adaptive management regimes and options which are available to forest managers. These types of activities include prescribed burning, which can be conducted in native forests to reduce the risks of severe wildfires when they occur, and also to protect the timber, ecological values and carbon values of forests. Another option is thinning of dense stands of both native forests and plantations to improve the health and productivity of these stands and also to improve the carbon sequestration potential of these forests. In plantations, species selection can play an important role in selecting species that are able to adapt to climate change and that are potentially more drought tolerant than other species. The application of certain fertilisers and pesticides is also an important management tool in forestry. The actual chemical use in forestry is quite low compared to other forms of agricultural production. Also, different harvesting

methods and silvicultural regimes can be adopted in both plantation and native forestry to assist in addressing climate change.

The benefits of all of these types of management regimes, as my colleague Allan has just referred to, broadly include carbon sequestration and addressing land degradation in agricultural lands to improve the soil and water quality of degraded land. Addressing dryland salinity, where it has occurred, is another important benefit of plantation forestry. The benefits of carbon-storing wood products versus more emissions intensive alternative materials are obvious. Bioenergy from wood waste is another important contribution that can be made by the forest industry. In terms of susceptibility to climatic variations, plantations, or tree crops, are seen as a long-term proposition and are a lot less susceptible to other forms of agricultural production, particularly annual crops.

I would just like to draw to the committee's attention a recent study by the University of Queensland which was conducted by Dr Clive McAlpine and other researchers. What this study shows is that the extensive land clearing of native vegetation in Australia has had an influence on recent droughts in Australia which has led to an increase in temperatures. In the recent 2002-03 El Nino drought in eastern Australia, according to this research, the average summer temperatures were two degrees hotter than normal and there was a decrease in summer rainfall by between four and 12 per cent during this same period.

What the research shows is that woody vegetation can play an important role in moderating climate fluctuations, due to the fact that it holds moisture which evaporates as rainfall. Woody vegetation also reflects into space less shortwave solar radiation than broadacre crops and pastures. This process helps keep the surface temperature cooler and aids cloud formation, which will eventually lead to rainfall. So putting plantations back into the landscape and sustainable management of our native forests can play a very important role in assisting the agriculture sector to deal with climate change. So we see that there is a mutual benefit between the sectors in that regard.

Senator HEFFERNAN—The prospect of an MIS originally on the 2020 vision—I have come through and worked with the 2020 vision—was that it was the only way we were going to get people to plant the trees, to give them a tax deduction up front. Now, let us get it on the record here: if you are Great Southern Plantations and I am the investor who puts in the 50 grand at the end of the financial year, certainly for the first three rotations—1994, 1995, 1996—if you had not propped up the return I would not have got one. But you actually own the land, you get the capital appreciation, don't you—that is, the promoter of the scheme. Why do you need a tax deduction up front if, given the history of MISs, you then switch—they all did it and they are still doing it—into the annual crops? If it is such a good thing, why do you need a tax deduction up front?

Mr Hansard—I do not understand your question. All forestry activities have a deduction in relation to deductibility.

Senator HEFFERNAN—I am talking about the management investment scheme.

Mr Hansard—A deduction for investment?

Senator HEFFERNAN—Up front.

Mr Hansard—That is to induce investment in the activity.

Senator HEFFERNAN—If that were the driver then, if you were putting in the 2020 vision, why did you then switch to all these other things?

Mr Hansard—I think we have to go back before the 2020 vision. If we have a look at the development of plantations in Australia, basically before 1990 a lot of it was done by state forest agencies using loans from the Commonwealth. When those loans stopped, plantation development stopped in Australia. There was a period when we had very low plantation development. The MISs have been very effective in bringing investment into plantation development in Australia.

Senator HEFFERNAN—So the answer is: you need the tax deduction.

Mr Hansard—We need some mechanism to get—

Senator HEFFERNAN—That is all I wanted, that you still need a tax deduction up front to make it viable.

Mr Hansard—We need some way to bring investment into rural Australia for plantation development to increase the resource so we have got a good resource base.

Senator HEFFERNAN—But because you switched to other rivers of gold, as it were, with the managed investment in annualised crops, you are not going to meet the 2020 target, are you?

Mr Hansard—What do you mean by that, Senator?

Senator HEFFERNAN—The 2020 vision target, trebling by 2020—you are not going to meet it.

Mr Hansard—We hope we will. As part of—

Senator HEFFERNAN—All right; that is the answer. Have you seen the Loddon study?

Mr Hansard—No.

Senator HEFFERNAN—How long have you been in the business?

Mr Hansard—In what business, Senator?

Senator HEFFERNAN—Whatever you are doing now, representing the forests.

Mr Hansard—I have been in NAFI for two years.

Senator HEFFERNAN—Well, you want to acquaint yourself with the facts of the Loddon study. You talked earlier about the salinity issue. The Loddon study certified a lot of the original understanding in plantation forestry. Going up into better country with higher rainfall makes your trees grow better, would you agree?

Mr Hansard—Yes.

Senator HEFFERNAN—That actually increases salinity. You didn't know that? I got nodding at the back of the room, by the way.

Mr Hansard—It depends—

Senator HEFFERNAN—No, it does not depend at all.

Mr Hansard—It depends where you put plantations in the landscape.

Senator HEFFERNAN—I have heard all the bullshit about only using 20 per cent of the landscape. With great respect, if you plant the high-rainfall country, you absolutely increase the discharge at the bottom of the system, in a salinity sense.

Mr Hansard—I think we have to go back to the real key here, and that is climate change. It is the reduction in vegetation that the scientists are saying has really brought climate change around. So putting trees back in the landscape would have to be seen as a good thing, would it not? Would it not, Senator?

Senator HEFFERNAN—Duh!

Mr Hansard—You agree with that then?

Senator HEFFERNAN—If you can put them where you get a salinity credit, I would agree with you. Instead of that, you are putting them where there is a reasonable case to be made out for you, the forest person, to pay for the water you are intercepting. Why shouldn't you be obliged to buy the water that you are going to intercept if you want to go up into the high-rainfall country?

Mr Hansard—I am pleased that you agreed with me on that because the strategy for the forest industry going forward is based on being smart about where we put trees in the landscape so we can reduce salinity—

Senator HEFFERNAN—I have been arguing that with your industry for two or three years.

Mr Hansard—because this really will help agriculture. As we know, we cannot grow food crops with saline water. However, if we are smart about where we put trees in the landscape we can actually decrease salinity—

Senator HEFFERNAN—Go on!

Mr Hansard—and actually increase our ability to grow food.

Senator HEFFERNAN—Good-o. My question is: why shouldn't you have to pay for the interception of water? We are talking about climate change and how you are the saviour of climate change, but at the same time you are a huge interceptor under the 2020 vision. How far through the program are you now?

Mr de Jongh—We currently have 1.8 million hectares of plantations in Australia.

Senator HEFFERNAN—What is your target?

Mr de Jongh—Three million hectares by the year 2020.

ACTING CHAIR (Senator Siewert)—Could you tell us where the current 1.8 million hectares is planted?

Mr de Jongh—Most of those plantations occur in concentrated forestry regions. The more recent growth areas have been the south-west of Western Australia, in the Great Southern region; the Green Triangle area, which is in south-west Victoria and south-east South Australia; and northern Tasmania. Then we have more traditional softwood plantation areas such as the Tumut-Tumbarumba area and the Oberon-Bathurst-Orange area in New South Wales. Those are some examples. There are also extensive softwood plantations in Victoria.

ACTING CHAIR—Are you able to provide us with an inventory of that?

Mr Hansard—We certainly can.

Senator HEFFERNAN—What environmental planning requirements are put round that, given the exemption that is available under the 2020 vision?

Mr Hansard—What exemption is that?

Senator HEFFERNAN—What environmental planning is put around those plantations, given the exemption that you have been given under the 2020 vision?

Mr Hansard—What exemption is that under the 2020 vision?

Senator HEFFERNAN—Mate, you do not have an environmental plan.

Mr Hansard—But what exemption are you talking about?

Senator HEFFERNAN—In the original 2020 vision, you were given an exemption not to have to have environmental planning.

Mr Hansard—I do not think that is the case.

Mr de Jongh—There is actually an extensive environmental framework that exists around plantations. There are state based regulations and codes of practice, and the majority of plantation forestry in Australia is underpinned by third-party certification as well.

Senator HEFFERNAN—The original document did not include the classes 3 and 4 streams, and you have planted straight across the lot. You talked about chemical earlier. I went up to Delegate the year before last. There is a beautiful stream up there. I said to the local farmer, ‘Do you mind if I catch a trout in that stream?’ He said: ‘You won’t catch any trout in that stream, mate. They’re all dead’—because they sprayed up the headworks in the forest. I think there needs to be some accountability in the grand vision. I do not have a problem with forestry, but it has to be fully accountable, including water accounting and sustainable environmental accounting. If you say you have worked for them for two years and you do not even know about the Loddon study, mate, you want to get yourself up to speed.

Mr Hansard—Senator, what I do know is that if you are smart about where you put plantations in the landscape, you can have a win-win situation.

Senator HEFFERNAN—That is right, and where they are going now is not the smart place to put them in a lot of cases, and I include the top end of Gobarra-long. Some of the stuff you are doing up there is environmental vandalism and that is why they are kicking up a fuss. Are you familiar with the Gobarra-long stuff?

Mr Hansard—No, I am not sure which area is ours.

Senator HEFFERNAN—It is bloody hopeless.

Mr Hansard—There is plenty of independent research by the CSIRO. The commercial environmental forestry project which has been conducted by them within the last couple of years has extensive documentation on the benefits of plantations environmentally and in commercial and socioeconomic terms in the agricultural landscape. There is plenty of that research available that is independent of the forest industry.

Senator MILNE—I am just interested to know what you estimate to be the annual emissions from native forest logging in Australia.

Mr Hansard—I will refer to the Australian government’s *Forestry sector greenhouse gas emissions projections 2007*, and I would like to table this, if that is okay. Emissions from managed native forests are actually positive. They run a table here from 1990 through 2020—

Senator MILNE—That is not the question. You are giving me a net response. I am asking you to separate the emissions from logging from the uptake from regrowth or plantations or whatever. I am asking you what the emissions from the logging of native forests are, and that includes the regen burns. What are the actual emissions?

Mr Hansard—Senator, you would have to look at these figures here. It has got ‘Removal of CO₂ due to growth of managed native forests’—that is one heading.

Senator MILNE—That is the uptake.

Mr Hansard—And there is ‘CO₂ moved from managed native forests to wood products’ and ‘Emissions of CO₂ due to decay of forest slash’, and then it gives a total net figure.

Senator MILNE—And it does not do soil carbon—isn't that right—or regen burns?

Mr Hansard—I am not sure what it includes in relation to soil carbon, but I understand that it does include CO₂ associated with native forest activities.

Senator MILNE—The issue I am getting to here is the accounting. We all know that under Kyoto accounting if you do not change the land use, if you log an old-growth forest and then it is regenned or goes into a plantation, it is regarded as neutral. But all the science is telling us that there is a massive loss of carbon, and that does not go into the accounting system. So would you support in an emissions trading system the accounting to be separated so that the full emissions are on one side of the ledger and the uptake is on the other side of the ledger? That would clarify things enormously in terms of the actual impact of the logging industry. Is that a position that NAFI would support—separating those emissions?

Mr Hansard—Firstly, I would like again to table for you a graph that was done by the Forests and Wood Products Research and Development Corporation in 2006 that shows the comparison of carbon storage relative to a harvest regime and wood products storage status. It looks at unharvested forests. It looks at harvested forests where there is no storage in wood products and then looks at a situation where wood products are included. That graph shows that the best outcome for carbon storage is where we sustainably manage our native forests rather than leave them in situ, because it builds up the carbon stocks in the growing stock as well as the carbon stocks in the wood products.

Senator MILNE—Thank you, but I asked you: would NAFI support not the Kyoto accounting but an accounting system in an emissions trading scheme which separates out all emissions from native forest logging, including soil carbon and the uptake, instead of having them as a net figure and instead of being Kyoto accounting, which means there is no accounting if there is no change of land use?

Mr Hansard—We would support accounting based on the IPCC international guidelines, which is the accounting that the government uses now. That sets the guidelines for the international emissions trading scheme, as well, and I understand that is a scheme that we want to be a part of. I am comfortable with the use of guidelines that are built on the IPCC guidelines and I think a lot of people are, in relation to the development of emissions trading and climate change policy more generally. Where we see deviations on that are really from people who do not believe in Kyoto.

Senator MILNE—No, it has nothing to do with believing in the Kyoto protocol—it is about full accounting of carbon. I have to go, but I will put in a few questions on notice later.

Senator NASH—In your submission you refer to the potential for an increase in bushfires. I was speaking to some of the fellows in Tumut after the fires had been through down there and I gather there is a certain amount that is able to be salvaged, even after a fire. What actually happens, what is the process, and how much is able to be salvaged?

Mr de Jongh—I know of the Tumut example, but I am not totally familiar with the specifics of that case. In that situation quite a proportion of pine plantations were burnt in that area. Basically, pine is a very sensitive species to fire so a lot of those trees were actually killed by

that fire. The process from there was to salvage harvest the dead trees that were a result of that fire. The process from then on is to re-establish those plantations, because the majority of those plantations were managed by Forests New South Wales, a state government agency. The process was to re-establish those plantations and to regrow them again.

Senator NASH—I am interested in that burnt timber. How much is reclaimed and what is the loss compared to an ordinary standing forest?

Mr de Jongh—The critical thing in a situation such as that—the same thing occurred here in the ACT with the Canberra fires—is to salvage that timber as soon as possible because there are certain types of rot and fungus that can get into the timber once it has been burnt. The objective was to salvage it within a certain time frame—a matter of a few months—because once the rot and the fungus become set into the timber potentially it can be non-utilisable.

Senator HEFFERNAN—What is the accounting exercise on the fire versus timber that is retrieved?

Senator O'BRIEN—What sort of accounting?

Senator HEFFERNAN—The emissions from the fire versus the—

Senator O'BRIEN—I just wanted to be sure you were not talking about some other form of accounting.

Mr de Jongh—What do you mean, Senator?

Senator HEFFERNAN—When the forest burns there are emissions. What is the balance on the emissions from the fire versus the alleged benefit from the timber that is left? If you do not know the answer, just say so.

Mr Hansard—I do not know the answer to that but the emissions associated with Victorian fires in 2003—you are probably aware of those—were equivalent to around a quarter of our total emissions, roughly 120 to 130 million tonnes. It was fairly significant.

Senator HEFFERNAN—One of the things that you are putting forward is that, in a plantation situation—good on plantations, depending on where they are; there is plenty of country in the north you could put them in—the carbon is stored in the timber that goes into the house?

Mr de Jongh—That is right, Senator.

Mr Hansard—That is correct.

Senator HEFFERNAN—Just leave it at that, then. We will get a proper answer to that question in a minute. You don't really believe that, do you?

Mr Hansard—Sorry?

Senator HEFFERNAN—Do you really believe what you just said?

Mr de Jongh—We have got some good independent research that backs up that claim.

Mr Hansard—We are happy to provide the scientific basis for that, Senator.

Senator HEFFERNAN—You might table that for us.

Mr Hansard—We will.

Senator O'BRIEN—You talked about a study—I do not think you tabled the study from the University of Queensland.

Mr de Jongh—I have got that here as well.

Senator O'BRIEN—Were you intending to table that for the committee?

Mr de Jongh—Yes.

Senator O'BRIEN—Thank you. In terms of the CSIRO research on salinity impact and water uptake, what is the best accepted convention on the proportion of the catchment that should be under trees, plantation-wise, before it will affect water run off?

Senator HEFFERNAN—It is 20 per cent.

Mr de Jongh—I think Senator Heffernan is right there. The research that we have here, by the CSIRO, shows that if anything less than 20 per cent of the catchment is under plantation then it is not deemed to have a significant impact on water yields.

Senator HEFFERNAN—I think that is flawed—it depends where the 20 per cent is, with great respect, Senator O'Brien.

Mr de Jongh—We also have that research here, if you would like us to table that as well.

Senator O'BRIEN—Certainly. If the reference is publicly available we can get it but a copy for the secretariat would be good. In terms of the further development of the plantation sector, how would you propose that we be could certain that the development of plantations in catchment will not exceed 20 per cent, or will not be in the wrong areas? How should that be managed?

Mr de Jongh—The current figures that we have—and we also have some research from the Bureau of Rural Sciences—show the proportion of those catchments that are under plantation forestry. Typically, those proportions are around five per cent. There are a couple which are a little bit above and below five per cent. There is nothing anywhere near that 20 per cent figure. I guess if we are looking through to 2020 we are talking about an extra 1.2 million hectares of plantations. It is less than a doubling of the current plantation area. It is also worth noting that the current plantation area is only half a per cent of total agricultural land, so it is quite a small percentage.

Senator HEFFERNAN—It is very good propaganda. What it does not say is that there is absolutely no plan as to where, in the catchment, those trees are going to go. The trees will go where they can buy the country.

Senator O'BRIEN—It may be where they buy the country. I wanted to ask about farm forestry. What work is your organisation doing about the development of farm forestry rather than broad scale plantation development?

Mr de Jongh—Yes, we certainly see a very important role for farm forestry and encouraging farmers to be involved in plantation forestry, certainly as a means of diversifying their income and also, as we have talked about today, drought-proofing their activities. We are currently involved in a project which is looking at getting certification for small, private forest growers because forest certification is mostly being taken up by the larger industry players and the state government organisations that own and manage the forests. We are working with small growers to—

Senator HEFFERNAN—Are you going to hub that? What I mean is, if you grow 10 acres of trees on my farm, and I am 200 miles from the mill, it ain't going to pay me to cart them to the mill. Are you going to do that in a way that you hub? Or is this just a jimmy-jam?

Mr Hansard—Do you mean to run a cooperative sort of arrangement?

Senator HEFFERNAN—The reality with the costs of transportation today is that if you get outside an economic zone it does not pay you to cart the trees to the mill. If you do not have enough trees, it does not pay you to put the mill to the trees.

Mr de Jongh—True.

Senator HEFFERNAN—So what is the plan you have got there?

Mr de Jongh—They are certainly issues in private forestry—the economies and the scale of those operations.

Senator HEFFERNAN—It is a con job. Some people think that they are going to—

Senator SIEWERT—Let him finish.

Senator O'BRIEN—Hang on, let him answer. You go and jump over there and give the evidence.

Mr de Jongh—There are other alternatives available to small, private growers. For example, there is mobile sawmilling, which can be used by farm forestry people to mill up their timber on site, which takes out the costs of transporting to a mill that is a long distance away and all those sorts of things. These are the sorts of issues that farm foresters deal with on a day-by-day basis and we are quite willing to work with them to achieve some of these.

Mr Hansard—We have also found that where, say, an industrial resource is developed you do get farm forestry occurring around that as well, basically being able to take advantage, as the

senator said, of the economic haulage distance that is created by the industrial resource that benefits the farm forester as well.

Senator HEFFERNAN—Which is my point, Senator O'Brien, that when that happens, because there is no real environmental planning around it, you are talking about the 20 per cent, but a five per cent plantation in a certain zone can absolutely destroy the run-off in that system. That is what is happening in Gobarralong, up the back of Red Hill. There are no rules.

Senator O'BRIEN—If you want to have a debate, we heard earlier—

Senator HEFFERNAN—Don't ask me what the solution is.

Senator O'BRIEN—We earlier had evidence about the fact that not only have we had a reduction in rainfall but we had a more than proportionate reduction in run-off. There was no suggestion in that evidence that it was predicated on there being plantations. It was more general evidence.

Senator HEFFERNAN—I am sorry, with great respect, in that particular study it is climate change, the wildfires and the 2020 impact.

ACTING CHAIR—And dams.

Senator HEFFERNAN—And farm dams, yes. It is all in there, and it has a huge impact: 2½ megalitres per hectare, at 42-inch rainfall, is what they take out.

Senator O'BRIEN—That is a suggestion that you are making.

Senator HEFFERNAN—They do not want to account for that and I am saying they should.

ACTING CHAIR—Senator Heffernan, can you let Senator O'Brien finish, because we are running out of time and I have a couple of questions to ask, too.

Senator O'BRIEN—I would like to know the potential for plantations of very slow growing species in more marginal land where the ability to grow to sawlog in a commercial time period is unlikely to be there. What is the potential for that sector, given all that you are saying about carbon sequestration and the industry and the storage in that sector? What do you see as the future for that sector?

Mr Hansard—We are starting to see an increase in longer rotation plantations happening now, albeit from quite a slow base. That is largely driven by resource needs. It is being driven by increased reductions in the availability of wood from our native forests, so it is by necessity that these plantations have gone to long rotation in some areas. It is true that basically—and this comes back to the investment discussion we had earlier—investors are less likely to invest in a long-term project like a sawlog plantation than in a pulpwood plantation or even in a shorter period investment, so we have this issue where it is very hard to attract long-term stable investment to long rotation plantations. With the new taxation arrangements that were introduced last year with secondary markets, we are hoping that that will start to induce longer rotation

plantations because that makes the investment more liquid and that makes it more attractive for people to invest in that, albeit for a shorter period of time.

ACTING CHAIR—I want to go back to the issue about the water because Senator Heffernan kept interrupting your answer. The study to which Senator Heffernan was referring was, as I recall, modified again—and I will acknowledge that they did decrease the amount of water they said was being intercepted, but they also said there was still a large amount of water being intercepted by plantations. The question remains: do you think that the industry should be required to buy up licences to account for that water?

Mr Hansard—I think this comes back to an issue of equity and sustainability in relation to the way you look at water use. Forestry plantations have been identified as being a water user, more than other vegetation types. But, if you start to look at this issue, perhaps we should also be looking at other vegetation types, such as pasture. This becomes a scale issue. Forestry in scale is not very big compared to agricultural crops. I will give you an example. We have 140,000 hectares of plantations in south-east South Australia. They want the industry to look at water licences for those plantations. However, if you look at water used for those plantations versus, say, pasture, you will see that pasture uses roughly half to three-quarters of the water that the plantation uses per hectare, but there are 2.5 million hectares of pasture in that area.

Senator HEFFERNAN—What is the rainfall?

Mr Hansard—Around that area? It depends on what part you are talking about.

Senator HEFFERNAN—Give us an example.

Senator O'BRIEN—Can we get the answer and follow with a question later.

Mr Hansard—The rainfall figures do not make a lot of sense in that area because, as you are aware, the water actually flows through. The water catchment area is in Victoria. It flows through to the south-east, because it is ground water.

Senator HEFFERNAN—But what is the rainfall?

Mr Hansard—I do not have the rainfall figure in front of me. I cannot see the point of having it. But I can certainly get it for you, if you like.

ACTING CHAIR—Is the pasture being irrigated?

Mr Hansard—There is irrigated pasture there and there is also deep-rooted and irrigated lucerne.

ACTING CHAIR—At what levels of groundwater?

The **Mr Hansard**—The ground water table varies from one to six metres in the area. Again, it is quite variable. The thing about plantations and water use is it is quite variable. It is not like an irrigator that has a pump and it is metered. Each hectare of trees probably uses a different amount of water to the next. So what you are trying to do is to find water based on a natural

system. What we are saying is that, if you are doing that, perhaps you should be looking at all vegetation types when you are doing that, because if you do not, questions about the real sustainability of the water balance starts to come into it.

ACTING CHAIR—You are saying that, if we did water accounting across the whole catchment, forestry would be prepared to pay? Is that what you are saying?

Mr Hansard—I think we need to do the science first. That is what I am saying.

Senator HEFFERNAN—You betcha.

ACTING CHAIR—The science is being done—that is the point.

Senator HEFFERNAN—You are in for a shock, though. You will get the sack if you say yes.

ACTING CHAIR—So, if we can tag water use to all those different land uses, which we can, would you be prepared to pay?

Mr Hansard—We would want to see the science first, based on all water uses by all vegetation types.

Senator SIEWERT—I will note that we have asked this question about five times and you still have not answered it in one way or another. I think Senator Heffernan, again, interrupted the answer to another question that he asked himself. Or it might have been Senator Milne who asked the question. At the beginning of your session you were talking about forestry being in the positive.

Mr Hansard—It is positive sequestration.

Senator SIEWERT—Yes, positive sequestration, I am sorry. So what you are saying is, in fact, that it is accounting for its own emissions and it is also providing a sink—is that right?

Mr Hansard—Yes.

Senator SIEWERT—Is that information contained in the information that you tabled?

Mr Hansard—It is in the government document that we tabled, yes.

Senator SIEWERT—Does that include stored carbon?

Mr Hansard—Stored carbon in—?

Senator SIEWERT—The trees.

Mr Hansard—In the trees, and there are also figures their associated with stored carbon in wood products.

Senator SIEWERT—Yes, okay, so it is both?

Mr Hansard—Yes.

Senator SIEWERT—Okay. Thank you.

Senator HEFFERNAN—You stand to be corrected on that, I take it?

Mr Hansard—On what aspect?

Senator HEFFERNAN—What you have just said. It does not matter; we will get to that in a minute.

Mr Hansard—I do not understand.

Senator HEFFERNAN—You will shortly.

CHAIR—Do you understand, Senator Siewert, because I don't.

Senator SIEWERT—I understood what he meant, yes.

Senator HEFFERNAN—She understands.

Senator O'BRIEN—Ignore the interjections—they are disorderly, as someone once said.

Senator SIEWERT—Can you tell me, in terms of accounting and looking at plantations and accounting for its carbon, do you see that there becomes a point where that plantation is more valuable as a carbon sink than for its timber?

Mr Hansard—That is a question that will really depend on the carbon price. We do not know what the carbon price will be.

Senator SIEWERT—Have you not done any modelling on that?

Mr Hansard—We have not done any modelling based on the variation between carbon price and wood prices. The thing that we do not understand just yet, when you start an emissions trading scheme and you have a carbon price in there, is what will be the associated effect on world prices, which you also have to take into account. So, unless you do some extensive modelling—and in a global sense, because we trade wood internationally—we do not know the exact answer to that.

Senator SIEWERT—Okay, so you have not done any of that modelling?

Mr Hansard—We as an association have not, no.

Senator SIEWERT—I appreciate that you may not have done any modelling. Have you done any thinking about the fact that you may get to a point in the future where that plantation becomes more valuable for its carbon?

Mr Hansard—Again, you would have to know the relationship with wood products. Until we determine that, we could not answer that.

Mr de Jongh—It is probably important to note that the two—growing trees for carbon and also for wood products—can go hand in hand. If we are talking about harvesting a plantation, we are basically looking at regrowing that plantation. So any carbon that is emitted at the harvest of that plantation is resequenced from regrowing that plantation. We also have the added benefit of the carbon stored in the wood products which, as the research has shown, lasts for significant periods of time.

Senator SIEWERT—I think you will agree that, on some accounting methods, in fact people will not agree with your analysis on that one—depending on which accounting method you choose to use.

Mr Hansard—We are happy to use the government's accounting measures on that one.

Senator SIEWERT—Are you talking about the ones based on Kyoto.

Mr Hansard—Kyoto and the UNFCCC accounting framework, yes.

Senator SIEWERT—Thank you.

CHAIR—Are there any other questions? If not, I thank Mr Hansard and Mr de Jongh.

[4.33 pm]

BLAKERS, Ms Margaret, Coordinator, Green Institute

CHAIR—Welcome. The Green Institute has lodged submission No. 10 with the committee. Do you wish to make any amendments or alterations to the submission?

Ms Blakers—I have given the committee assistant a supplementary submission. The submission I put in previously was very much focused on the accounting system and not fully focused on the terms of reference of this committee. So I have made a one-page summary of some of the implications of the deficiencies of the accounting system to make it more relevant.

CHAIR—Thank you. I invite you to make a brief opening statement, if you wish, and then we will go to questions.

Ms Blakers—Thank you very much. What I will do is run through this supplementary submission and elaborate on it—although I will note, given the previous discussion, that the accounting system is fundamental to this. Just in the same way that financial accounting is fundamental to managing a business or an economy, carbon accounting is fundamental to managing a carbon accounting system. The system that we currently have—

Senator HEFFERNAN—Listen up, boys!

Ms Blakers—has significant deficiencies. Just so that people are clear about it, there are all kinds of acronyms thrown around, but the IPCC—the Intergovernmental Panel on Climate Change—sets the methodology. It says how to measure the carbon. Then there are two ways of reporting the accounts. One is the Kyoto reporting and the other one is what is called UNFCCC accounting. That is attempting to be more like a full carbon accounting report.

The Kyoto accounting is a partial report. It was designed 10 years ago when the Kyoto protocol was negotiated. It looks only at land use change, in particular at land use change that relates to forests, because the assumption was that that was where the biggest emissions and uptake would happen. So, for example, it does not look at soil carbon, it does not look at degradation of rangelands and it does not look at logging native forests.

The UNFCCC account is more comprehensive. It does look at logging native forests. It still does not look, in the way that it is done in Australia, at soil carbon, rangelands or any kind of non-forest vegetation. In the Australian version it does not even look at conservation land. That is not counted. It does not look at wetlands, for example. So even the UNFCCC accounting—and it is understandable; this is an evolutionary process—is not yet anything like full carbon accounting, particularly the way in which it is implemented in Australia.

We are about to embark on a major economic change—namely, emissions trading. I do not know on which accounting system it will be based but, whichever accounting system it is, it is not going to be full carbon accounting. That leaves the potential for very major what people call ‘perverse outcomes’ because, if you are not counting everything properly—and, in particular, if

you are not disaggregating it; looking at the emissions on the one side and the uptake on the other side—you do not know what you are dealing with. It is like a shop trying to work out what to sell and what stock to get in when all it knows is that it has had so many dollars worth of sales in the last six weeks but it does not know whether it sold oranges or barley sugar. It is the same problem with the carbon accounts. If you only have net figures, you do not know what you are dealing with—you do not know where the emissions are, you do not know where the uptake is and you cannot make policies to get rid of the emissions, which I would say is the primary objective, along with encouraging uptake where that is appropriate.

Furthermore, the accounts do not look at all at the stocks. You have to have a very clear differentiation between stocks on the one hand and then the fluxes, the pluses and minuses, on the other. And when you are talking about biocarbon—which is the word I am going to use for carbon associated with living systems, which is different from fossil carbon precisely because it can take carbon out of the atmosphere as well as create emissions, whereas fossil carbon goes one way: up in the air—biocarbon goes both ways. If you disaggregate the emissions from the uptake, so that you can see what size the emissions are, if you look globally, the figures that are tossed around are 20 per cent for deforestation, for example. In Australia, emissions from deforestation and what they call degradation, which is lowering the carbon-carrying capacity of land, for example by clearing forests, and logging native forests in particular, probably account for around 20 per cent of Australia's emissions. So it is big; it is huge. We need to look at biocarbon emissions in their own right, as a separate factor from fossil fuel emissions. We need to treat the two separately and the biocarbon side, if it accounts for 20 per cent of emissions, needs to have 20 per cent of the resources, of the money, of the research, of the policy attention—and it is just not getting that at the moment; it is treated as a sideline.

Moving away from the carbon accounting for a moment, what are we looking at in the way things are trending at the moment? First of all, by failing to do the accounting system properly we are heading for a system that promotes rapid expansion of new plantations, and they gobble up water at the expense of agricultural land particularly. At the same time greenhouse gas emissions will continue at high levels because existing stocks of stored carbon in native forests and woodland are being destroyed by clearing and logging.

As I said, those biocarbon emissions are large; they are probably over 20 per cent of the total. The critical thing to recognise here is that storage for biocarbon is on the earth's surface, unlike fossil carbon, which is stored underground in coalmines and things. Biocarbon occupies the surface of the earth. So where are the stores for these things? The biggest stores are where you have the oldest and the most productive native vegetation. The reason that they are big stores is that they have accumulated over centuries. The storage space is limiting, and that is what the competition is for. The competition is for space—for land and for water. What you want to do under that circumstance is protect your existing stores at all costs, because you cannot replace them inside centuries at the density at which they currently exist.

The only way you could replace them would be by occupying much, much more land with new planting, whether of plantations or revegetation of native species. But, as land is limiting, it makes arithmetical sense—it makes absolute sense—that you protect the stores where they currently exist, because they are not replaceable in any sensible time frame. The time scales that we are looking at for reducing our emissions are the next decade or so to try to turn the corner and to start getting the emissions trending down. Under that kind of time frame we cannot afford

to allow those existing carbon stores to be destroyed, because we have no way of getting them back.

You cannot talk about carbon neutrality for activities such as logging native forests or even older plantations because the time frame for recapturing the carbon is decades, and the critical policy time frame is years—the next 10 years in particular. It is said that we can offset this side of things by growing more plantations, but that is very slow. Photosynthesis is not the most efficient way of capturing the sun's energy, I am afraid. It is maybe one per cent of, say, the efficiency of a photovoltaic cell or a wind farm. It is just not very efficient. It occupies land and it uses water, which is what we have been hearing about during the day.

I will give you some round figures on this by looking at the accounts for the period from 1990 to 2005. In this case, I have just added up the total of the Kyoto plantations—that is, 800,000 hectares of plantations have been planted since 1990. The total uptake by those plantations over that 15- or 16-year period is about 200 million tonnes of CO₂. That is less than half of one year's emissions. By comparison, there have been 900 million tonnes of CO₂ in emissions from native forest emissions from land clearing. That is a net figure, too, by the way, which I can elaborate on if you are interested. Again, that is not just emissions. My estimate of emissions from native forest logging in that same period is around 600 million tonnes, but that could be way under because there is new work coming out from the ANU that shows that the amount of carbon that is stored in native forests is up to 10 times what is currently assumed in the accounting system. The bottom line of all of that is that we have to keep those carbon stores where they are. That is the top priority, and then we have to look at other ways of increasing the uptake. Agricultural soil is a really important component of that.

The problem with emissions trading is that it does not look after the stores. By definition, it is about emissions—it is about fluxes; it is about change—so it is not going to provide any income stream to look after the stored carbon and make sure that it stays where it is. By way of a footnote, the sorts of proposals that have been put forward by the forestry sector would exacerbate the problem, because they want to basically net out or ignore the emissions from native forest logging—from logging pre-1990 plantations and bioenergy production—by assuming that all of those are carbon neutral, and then they want offsets for the post-1990 plantations. They get all the upside and do not worry about the downside—the emission side. And that, of course, is where we get this potential conflict or actual existing conflict between plantations and agriculture. I have recommended that the objective in dealing with climate change is that all emission sources have to be reduced or eliminated.

We do not have full carbon accounting to identify what all of those emissions are, and it is absolutely essential that we get that sooner rather than later. It has to disaggregate emissions and uptake and it has to cover all sources and sinks. We need a package of measures to protect existing carbon stores and that should include provision of long-term management funding so that there is some sort of permanent income stream for people who are looking after native vegetation. Tree planting should generally not be allowed to offset credits except for legally protected permanent revegetation to enhance the resilience of the existing stores or where there is specific cultural or amenity value. There should be incentives for improving the carbon-carrying capacity of agricultural soils. Thank you.

Senator SIEWERT—I want to go back to the issue about whether overall we are talking about positive or negative values in terms of emissions—and you were here listening to the previous evidence—and ask you to explain how your evidence differs from the evidence we were given then.

Ms Blakers—It depends what you count in and what you do not. Essentially, what makes the figures in the accounts positive is counting in the regrowth of native forests which have been logged over the last 200 years. Once you log you set in train a process of regrowth—you have destroyed the store but you have started regrowth. If you add in the uptake by those forests, then each counterbalances to a large degree the emissions from current logging and the other bits and pieces—fuel-wood burning and so on. In effect, what that is doing is giving to one industry sector the uptake that is available from what I would argue should be—

Senator SIEWERT—Access for everybody.

Ms Blakers—I am not sure that you should call it anthropogenic, in the sense that, as of now, it is uptake generated by actions in the past, not actions now, and I think that should belong to the community as a whole not necessarily to one particular sector. That is where the plus comes from.

Senator SIEWERT—What degree—and I do not have the report in front of me—are we talking about with sink value or CO₂ value coming out of that regrowth of those previously logged forests?

Ms Blakers—It is a very interesting number. The answer, whichever year you look at and from now into the future, is 57.3 million tonnes per annum of CO₂. The reason that it is 57.3 million tonnes is because when the accounts started to be done somebody took the regional forest agreement forest areas, made an assumption about their growth rate, multiplied it out, got that answer, and that has been the number that has appeared in the accounts ever since. So the bottom line is that it is not based on any measured uptake rate anywhere. It could be way out by orders of magnitude in either direction.

It was done from the time when the accounts started. I do not know when they actually did it, and you cannot look it up because it is not actually written out in this way. If you look at the methodology you will see that there is a table in there which says: from the regional forest agreement assessments there are so many hectares of this kind of forest and so many hectares of that kind of forest. Then they said: 'Let us assume that the growth rate of this kind of forest is 6,000,000 tonnes per annum. Multiply it all out and you come up with 57.3 million.' The whole issue with native vegetation, particularly native forests, is that the data are really poor. Some work is going on now to try to remedy that but you cannot rely on any of the data.

Senator SIEWERT—I will go back to the issue about the various accounting methods, the UNFCCC. I do not know whether you were here this morning when we had a substantive discussion about soil carbon. What I understood from that was that it could be counted, but what I understand from what you are saying is that it is not counted. Could it be counted if there were a will?

Ms Blakers—Yes, but it is not reported. You have to distinguish between methodology—the way in which you calculate something—and what is reported. There is no reason why Australia could not report soil carbon if it wanted to; if it can be measured, it can be reported.

Senator SIEWERT—If we get our act together there is nothing to stop Australia developing a rigorous process for carbon accounting, and including that in our accounts?

Ms Blakers—Absolutely.

Senator SIEWERT—But it is just not happening at the moment.

Ms Blakers—No. If we are going into an emissions trading scheme and it is going to be based on Kyoto accounting, attention has gone into the uptake by new plantations, so the growth rates of those are quite well measured and probably reasonably reliable; and there has been a lot of work on measuring losses from clearing because, again, that counts for Kyoto. But where the land use stays the same so it is not counted, it has not been looked at. So for native forests, agricultural soils, rangelands and all those areas there has just not been the impetus. On the wood products side of things that raises a really important issue: the treatment of time in the accounts. The accounts are annual accounts so anything that is replenished within one year—within 12 months—is counted to be zero.

Senator SIEWERT—Neutral.

Ms Blakers—Yes. The forestry industry is saying, ‘That’s not fair because wood products decay over a period of time, they do not all just disappear like that.’ That is true but if you are going to account for time in the decay rate of wood products you must also account for time in the accumulation time that it takes to get your carbon store in the first place. And that is centuries.

Senator HEFFERNAN—In the Tasmanian experience of old growth forest, which I have experience of and which Senator O’Brien is also interested in, there was about a 20 per cent recovery from a lot of those forests and the rest was burnt. I struck people down there making a nice living out of the wood that was rejected because of the specification issues on the timber. There would be a huge carbon negative there when they burnt all the timber to prepare the forests for monoculture.

Ms Blakers—Yes.

Senator HEFFERNAN—Have you done any figuring on that?

Ms Blakers—If you try to extract the information from the accounts it is very hard. The accounts are not presented in a way where you can just go and look up the emissions from slash, which is what that is—the aboveground vegetation which is left behind when the logs are taken out.

Senator HEFFERNAN—It is 20 per cent. Most people do not understand that—80 per cent of that old native growth is wasted.

Ms Blakers—Yes, exactly. Furthermore, in the accounting system as it currently stands, when you take the logs off the site the carbon in those logs is not counted either. If it is exported then it is assumed to be processed elsewhere than in Australia so it goes straight off the books. Even if it is processed in Australia because, as I say, of a misinterpretation of the IPCC methodology, the carbon content of the logs is not appearing in those accounts anywhere at the moment. That means that if Gunns pulp mill were to get up it would be producing emissions onsite from the logging, emissions from burning wood to make power, and emissions from the wood that is actually processed into pulp, which is 10 million tonnes-plus per annum. That is huge in the Australian emissions context, and not one bit of that would actually appear in the accounts.

Senator HEFFERNAN—I wish them all well in coming to terms with carbon trading.

Senator SIEWERT—You mentioned, and NAFI also mentioned, that we are using the Kyoto system rather than the UNFCCC system. What, for Australia would be the best system to use? It seems to me that Kyoto is not a full carbon accounting system. If we are going to go into this properly we should be using a proper accounting system.

Ms Blakers—Absolutely. We should be using UNFCCC accounting, and I cannot see any justification for going into such a major thing as emissions trading using a partial accounting system which you know does not deal with all the emissions and uptake that you want to be able to deal with.

Senator SIEWERT—How likely is it that we will move to the UNFCCC accounting system?

Ms Blakers—That is going to be the subject of the negotiations for the post-Kyoto arrangements. Given that deforestation and degradation are already on the agenda internationally—degradation being essentially logging—it seems to me that it would be very hard to justify why you would not go to a full carbon accounting framework post 2020, which means, at most, two years of a Kyoto framework for Australia's system followed by going into a full carbon accounting system.

Senator SIEWERT—I asked the previous witness about the issue of the value of carbon versus the value of timber. Is that a likelihood, in your opinion?

Ms Blakers—Totally. You just have to think about. A lot of the misperceptions about this are from thinking about the issue in terms of fossil carbon rather than thinking about the characteristics of biocarbon. With fossil carbon, you can eliminate emissions by going to higher efficiency or by turning to renewable energy. With biocarbon—with wood, for example—the carbon is in the wood. You can never have wood that does not have carbon in it. You are always going to have emissions associated with wood. If you follow that through logically to some time in the future, it may be that if you have your steel produced with renewable energy that will be in fact, in greenhouse terms, preferable to wood. If you think about the near future and the value of carbon versus the value of wood, my understanding is that the value of wood is not increasing very quickly and possibly decreasing, whereas carbon prices are intended to go up and they will go up. So the question of having wood as a joint product with carbon is a really critical one. If you end up with a plantation and the current rules for permanence say 70 years—that is, under the government's greenhouse-friendly rules—if you are committed to holding your plantation or your pool of plantations for 70 years, then the price of carbon will have gone up enormously but

the price of wood very likely will not have, and so you might very well end up with plantations that you can never afford to cut down because the carbon emissions cost will be too great. That means that you would be in a very bad situation, because you would have plantations that still require management not being as sustainable or as permanent or as self-perpetuating as native natural vegetation yet you would have to hang on to them.

Senator SIEWERT—You hear around the traps quite frequently that all that a mature native forest is doing is storing carbon and so you might as well cut it down; that you have the carbon stored in the wood and, in fact, if you have more trees growing you are sequestering more carbon.

Ms Blakers—Yes. This is a stocks and flows problem. The stock is what matters. Keeping the stock out of the atmosphere is what matters. The proportion that ends up in wood products is rather small, out of the total CO₂ that is emitted when you log a forest of any age, really. You have to keep an eye on the quantity of the stocks. I cannot think of the right way to say it, but you have money in the bank and you are saying that, instead of having money in the bank, you would rather get rid of all of that and rapidly put in a few dollars every week for the next 20 years. You will never get back to the amount that you had in the bank inside a century—or inside several centuries in the case of an old growth forest. You have to separate out the stocks and flows and be clear what you are talking about. The reason we keep on forgetting about the stocks is that we are talking about emissions trading, which ignores the stocks.

Senator O'BRIEN—But as an old growth forest starts to degrade it starts to emit carbons, doesn't it?

Ms Blakers—It may do, but it depends on the circumstances. The measurements that I have seen indicate that they keep on accumulating for between 400 and 500 years.

Senator O'BRIEN—Some of the eucalypt species will be in decline after about 150, won't they?

Ms Blakers—They may well be, but what happens is that they get replaced. You are looking not just at the tree but at the total system: the soil and the vegetation above and below ground.

Senator O'BRIEN—So you are looking at the whole forest?

Ms Blakers—Yes, absolutely.

Senator O'BRIEN—With a plantation or a series of plantations you are looking at the plantation that has been harvested and the plantations that are growing at the same time, aren't you?

Ms Blakers—If you have a pooled estate, yes.

Senator O'BRIEN—As a nation, as an industry, or as an entity, you have got a series of plantations at different stages. While they are growing they are accumulating carbon.

Ms Blakers—Correct.

Senator O'BRIEN—When they are harvested, depending on the end product, they may still store some carbon, more or less, and will emit some.

Ms Blakers—Yes.

Senator O'BRIEN—Some of the soil carbon will be disturbed in harvest and some will remain in the soil. Whilst other plantations are growing that is the nature of the equation that you have to look at, as to whether you are putting on or shedding carbon from the industry.

Ms Blakers—Correct. For example, the two things you can look at in the accounts, as we have them at the moment, are the pre-1990 plantations which are mostly the older softwoods, or the post-1990 which are mostly young eucalypts. The pre-1990 plantations, if you look at the graph, starting from 1990, were net absorbers of CO₂. For the last three or four years they have been net emitters. Those plantations are apparently being logged quite a lot faster than they are regrowing—that is, the pre-1990 plantations.

Senator O'BRIEN—They are the older ones that have reached maturity, I take it?

Ms Blakers—And are being logged.

Senator O'BRIEN—The other thing that is happening with plantations is that some species are being processed into sawn timber, which effectively extends the life of the plantation as well. I am trying to think of the name of the species but I am sure you can tell me.

Ms Blakers—I think there are several that they are looking at.

Senator O'BRIEN—The main one in Tasmania is not globulus, it is—

Ms Blakers—Nitens.

Senator O'BRIEN—Nitens, that is right. There is an expectation that that will proceed into other hardwood plantations subject to research?

Ms Blakers—Sure, but that does not change the point. The point is that the amount that ends up in wood products is rather small. The priority is to protect the existing native vegetation which has got the densest carbon stores. The density of carbon stored in a young plantation is low. If you want to store biocarbon to reduce the emissions or to eliminate them—which should be the aim—stop clearing and stop logging native forests.

Senator O'BRIEN—Native forests in regenerating lay down carbon as well, don't they?

Ms Blakers—Yes, but that is the flow, not the stock. When you log it that is when you get the emissions. They are huge, if you have got a very dense carbon-storing native forest.

Senator O'BRIEN—If you have got a native forest which is a million hectares and you log a thousand, then you have lost a tenth of one per cent of the carbon, whilst the other 99.9 per cent of the forest is laying down more carbon. That's right, isn't it?

Ms Blakers—Yes, but that is not the correct comparison. If you want to eliminate or reduce the emissions then keep all of the native forests right where they are and transfer the industry to the plantations where the emissions per volume of logs produced will be much, much lower.

Senator O'BRIEN—So it is an either/or. What you are suggesting is that you cannot have an account for native forests where the rate of growth will match or exceed the rate of removal by logging. Is that what you are saying?

Ms Blakers—No, you can, but that is not the point. The point is that you want to reduce or eliminate the emissions. If you want to be most efficient at doing that, then you are much better off to get your wood from a plantation which is much younger and where the side emissions will be much less, because the whole point about a plantation is that you are trying to maximise the amount of usable wood per hectare, or per input. Whereas, a native forest is a messy mixture of different species of different ages and all kinds of stuff that you really do not want at all. So, per log volume—

Senator O'BRIEN—Can you selectively log?

Ms Blakers—No, I do not think so.

Senator O'BRIEN—Can you manage for the best outcomes?

Ms Blakers—No, because that is not the best outcome. The best outcome is to maintain the carbon store. The priority has to be to maintain the carbon store. If you do not, then you are simply saying that to get that carbon back we need to expand the area under plantations.

Senator O'BRIEN—The corollary is that, if we have a carbon-emitting transport mode, we cannot offset that with some other sequestration method.

Ms Blakers—I think that is a really serious question, as to what extent you allow any kind of offsetting, because to the extent that you allow offsetting you are permitting those industries to offload their problem to another industry.

Senator O'BRIEN—It is a bit like a balance sheet: expenditure out, income in.

Ms Blakers—Correct.

Senator O'BRIEN—And what you end up with determines whether you make a profit or a loss. So, in an emissions accounting system where you have emissions that are unavoidable, surely you should be able to look to balance the ledger or put the ledger back into the black by sequestering carbon in some form as an offset.

Ms Blakers—I think the missing piece in that equation is the target—what is your target? You have to have full carbon accounting, you have to set the target related to that set of accounts and not to the one that we currently have and then you have to look and see whether you are going to allow offsets and, if so, what kind. Permanence is really, really crucial. To the extent that an offset is not permanent, you are basically setting up a blackmail opportunity for the future. As the price of carbon goes up, if someone wants to emit clear, say, in 10 or 20 years time, they are

going to be able to ask a high price to stop that from happening because by that time the value of carbon will have gone up enormously. Permanence is important in relation to native vegetation because it is built in. That is what native vegetation does: it stores carbon permanently, it is adaptive, it regenerates itself, it is resilient. Permanence in relation to agricultural land—

Senator O'BRIEN—We agree it is resilient.

Ms Blakers—Yes. Permanence in relation to other kinds of land uses is going to be much more difficult to get to grips with. The bottom line: full carbon accounting and keep the dense carbon stores where they are because there is no way of replacing them in any reasonable time frame.

Senator O'BRIEN—We may have an argument about balance.

Ms Blakers—I invite you to look at the pre-1990 plantations as an example. Excluding the carbon in the logs—the carbon that is taken offsite, so this is only the onsite—there are currently emissions to the tune of two, three or four million tonnes per hectare. So those older plantations are being logged much faster than they are growing. The only reason the post-1990 plantations are carbon positive, to the extent that they are, is that by and large they are not yet being logged as they are only 15 or 16 years old. Logging will cut in, so to speak, shortly. In fact, if we go down the Kyoto route and do not count native forest logging, we are going to have an enormous leakage of emissions because it will make more commercial sense to keep the new 1990 plantations, which count under Kyoto, keep growing them on, get your carbon credits for them and push the logging back into the native forests where the emissions do not count. That leakage is a very big danger.

Senator O'BRIEN—Thank you for that. I am curious: could you tell us what the Green Institute is?

Ms Blakers—With pleasure. At the moment it is me, but it is in the process of being established. It is 'Green' as in the Greens party, so that is the politics. It is not yet established as an organisation, but hopefully within the next few weeks it will be.

Senator O'BRIEN—I asked because I had not heard of the term.

Ms Blakers—It is in the process of being put together.

Senator O'BRIEN—Thank you very much.

CHAIR—That concludes today's hearing. I wish to thank all witnesses who have appeared today.

Committee adjourned at 5.09 pm