REPORT OF PROCEEDINGS BEFORE

STANDING COMMITTEE ON NATURAL RESOURCE MANAGEMENT (CLIMATE CHANGE)

———

At Sydney on 16 May 2008

———

The Committee met at 9.30 a.m.

———

PRESENT

Ms K. L. Paluzzano (Chair)
Mr M. J. Daley
Mr G. F. Martin
Mr R. J. M. Oakeshott
Mr R. C. Williams

ANDREW JOHN PITMAN, Co-director, Climate Change Research Centre, University of New South Wales, affirmed and examined:

CHAIR: I welcome Professor Pitman of the Climate Change Research Centre, University of New South Wales to provide evidence on the Standing Committee on Natural Resource Management (Climate Change) inquiry. I am advised that you have been issued with a copy of the committee's terms of reference and also a copy of Standing Order 291, 292 and 293 of the Legislative Assembly that relate to the examine of witnesses. Is that correct?

Professor PITMAN: That is correct.

CHAIR: In what capacity do you appear before the committee?

Professor PITMAN: I am happy to appear in the capacity as co-director or in a personal capacity. I do not have a view on that.

CHAIR: I draw your attention to the fact that your evidence is given under parliamentary privilege and you are generally protected from legal or administrative action that might otherwise result in relation to the information you provide. I should also point out that any deliberate misleading of the committee may constitute a contempt of the Parliament and an offence under the Parliamentary Evidence Act 1901. Do you want to make an opening statement?

Professor PITMAN: It is useful for me to declare what I have expertise in. I am a climate research scientist. My expertise is understanding what is being projected as a consequence of the global warming effect on global and regional climates. I have been in that game since 1989, before it was popular, so I am not new to climate change science. I am a lead author on the past two Intergovernmental Panel on Climate Change [IPCC] reports. In case you think that offers bias because it is pro-global warming, it is quite the contrary. That is a scientifically well-established assessment process that I take part in. I am going to respond to questions today in a personal capacity, which is not necessarily precisely the IPCC consensus. Where I can, or where it is useful, I will try to differentiate between those two things.

Mr GERARD MARTIN: Would you provide a brief overview of the type of work in which you have been involved and where it has led you?

Professor PITMAN: Most of my work is focussed on reducing uncertainty in how we project how global warming will impact on global and regional scales. I have worked on improving how we actually model some processes and I have worked on methods to identify those climate models that are, for want of a better phrase, not competitive and differentiate between those that are really abnormally impressive tools. We have recently had some work published that fine tunes regional projections from climate models to tease out what is real and what is not real. I have also worked on looking at how various issues affect the predictability of regional climates. For example, does building Sydney impact on the regional climate of Sydney? Can we identify the fact that the city has been built? Does it affect temperatures, rainfalls and storms?

I do not know how much this committee knows about climate change but there is a general sense that global warming will be a nice smooth incremental process, and there is no evidence to support that. The evidence is that change occurs abruptly, as we have seen in various parts of the world. So I am also looking at what mechanisms trigger rapid change in climate.

Mr GERARD MARTIN: Have you been involved in any work on the heat island effect?

Professor PITMAN: The urban heat island effect—I do not know the details of when it was identified but it was in the nineteenth century. It is a very old thing, it is one of the things that we got drummed into us as undergraduate students. It is very real. I know that the committee has had a submission from a particular group in Western Sydney. I have looked at some of their stuff, and broadly concur with it. There is no doubt at all that urban areas warm the environment substantially. Indeed mega cities almost certainly warm the environments that they exist over more than global warming will. They are not taken into account in global climate models. We do not build urban

systems into the projections. So if you think the global average projected warming is, on the average, 3¼° some areas under global warming will cool, it is not surprising, other areas are going to warm substantially more than 3¼° and most importantly amongst those are urban areas which are likely to be very much more vulnerable to global warming than the majority of areas. Do you want a briefing on the urban heat island effect?

CHAIR: The committee has had one.

Mr RAY WILLIAMS: Does that not play a large role on what you said before about the built design of Sydney and its effect on the climate?

Professor PITMAN: The urban design has never to my knowledge systematically taken into account climate, and that is natural climate, natural climate variability and the impacts of global warming. That is not a whinge at Sydney because as far as I know, no urban planners have ever had training in anything to do with climate, climate variability of climate change. It is just not part of their tool kit.

Mr RAY WILLIAMS: We can see that in Western Sydney.

Professor PITMAN: It is a bit of a worry. I have been quoted in the newspaper being worried about Western Sydney. As you know we are putting the major population growth centres in Western Sydney. The further you go from the ocean the more warming we will get under global warming. The further you head west the hotter it is anyway and because of the nature of the geometry of the Sydney Basin we get a Los Angeles style recirculation of the atmosphere over Sydney. If we put cars and industry out there we have a recycling of air pollution. One of the areas that has not been explored very systematically in my communities is interaction between global warming and air pollution. We think there are feedbacks that will exacerbate the impacts on health of air pollution under global warming. In the Sydney Basin if you wanted to locate a population in the most vulnerable region possible for global warming and urban heat island and air pollution you would put them in Western Sydney.

Mr RAY WILLIAMS: No-one ever takes into consideration that the smaller the blocks of land and the more natural vegetation cleared the less one can grow and the greater the heat island effect because of the hard surfaces.

Professor PITMAN: Leaving native vegetation helps to reduce the urban heat island effect and regrowing vegetation helps to offset the urban heat island effect.

Mr RAY WILLIAMS: But it must also have an effect on reducing the urban heat island effect—

Professor PITMAN: It does.

Mr RAY WILLIAMS: —once there is that coverage. So it is a win-win situation.

Professor PITMAN: Yes. If the focus is the urban heat island effect, revegetating large regions is a really good idea. There is a small problem of bushfire risk, to say the least. I do not know how you balance those two things, particularly in Western Sydney where the temperatures are already extreme. There are two other feedbacks with revegetation. One is carbon sinks, which can be significant. The other is the fact that there are hints—I emphasise "hints"—of a very interesting feedback between large-scale revegetation and rainfall. If you can revegetate large areas, there may be a link to enhanced rainfall.

There are theories—I emphasise "theories"—suggesting that one of the reasons we are seeing substantially less rainfall in Western Sydney is that we have cleared the landscape and that tends to focus the rainfall nearer the coast. That theory has never been systematically evaluated. However, it is a much more reasonable theory than cloud seeding increasing rainfall.

Mr RAY WILLIAMS: The catch-22 with development in Western Sydney is the added effect that air conditioning is now no longer a luxury; it is a necessity out there because of the temperatures. That increases the use of electricity, carbon emissions and so on.

Professor PITMAN: In climate science we traditionally said it will warm by a certain amount. We are now looking at vulnerability. There are places that can warm by five degrees and it will not matter much and there are other places that can warm by two degrees and that will have a catastrophic effect. It all depends on the nature of the environment. Out in Western Sydney, for example, there is considerable vulnerability because of the way the climate operates. We try to minimise that vulnerability using air conditioning. But then we introduce more vulnerability because if, under extreme heat stress like that we saw in Europe in 2003, the grid fails, we have substantially exacerbated that vulnerability because we have tuned the people living there into having air conditioning. So, the more we build an environment dependent on air conditioning, for example, the more vulnerable they are should the air conditioning break down. We are building more and more threshold vulnerabilities into our environments. That is not a good idea.

Mr RAY WILLIAMS: The irony is that history shows that Julius Caesar predicted problems with his soldiers being vulnerable when matching to war in the heat. He planted massive tracts of trees that shaded his soldiers. He recognised the benefits of vegetation in shading and cooling centuries ago.

Professor PITMAN: My expertise is not history, but I was reading a paper while waiting for the hearing to start in which the message was that we have known about heat and health since Hippocrates. I think he lived in ancient Greece. It is not be exactly new. However, explicitly, planners who are phenomenally well trained in many sectors do not plan for things like heat extremes. Mr Martin, are you from Armidale?

Mr GERARD MARTIN: No, Bathurst.

Professor PITMAN: That will do. The houses built in Bathurst in the 1870s were vastly more able to deal with heat loading than the buildings we build today. We have made a lot of progress! We know how to build buildings and regions to be sympathetic with the nature of the climate, but we have chosen not to do that for the past 50 years.

Mr RAY WILLIAMS: That blows the environmental credentials of planners out of the door.

Professor PITMAN: I do not think planners claim environmental credentials.

Mr RAY WILLIAMS: That is all we have rammed down our throats at the local government level: We need to protect the environment, not increase our urban footprint and so on. Blocks in the Rouse Hill regional centre are now down to 275 square metres. That means householders can plant about six daisies at the most. There are no backyards; it is entirely hard surfaces. There might be a tiny patch of grass. That is extraordinary. There will be no added vegetation to cool those areas. We might be reducing our urban footprint, but what catastrophic effect are we having on the environment in terms of the heat island? Are we not better off having larger blocks land and encouraging more natural vegetation to be retained and regrown?

Professor PITMAN: There is a very famous photograph of Lane Cove just after it was developed. It looks like a wasteland. Of course, it is now very green. That is related to the size of the blocks and people feeling that they have the space to plant trees. I do not know, because no-one has done the work, but my guess is that the urban heat island effect over Turramurra, Pymble and all the way down through those nice green leafy suburbs is negligible.

Mr RAY WILLIAMS: Greening Australia told the committee that it is 10 per cent lower than in Western Sydney.

Professor PITMAN: No-one has done that work. Greening Australia has looked at the amount of warming over Western Sydney relative to eastern Sydney. No-one has the capacity to

fingerprint those warming patterns down to the scale of individual suburbs. That technology does not exist and I suspect that it will not exist until the satellite record is a century long.

Mr GERARD MARTIN: If you had influence over planning legislation, what key things would you do to get in on the agenda? Is the resistance to it the cost imperative?

Professor PITMAN: That is a really tough question to ask a scientist. Green space has been understood to be environmentally important since at least the 1850s in London. I know that some of the developments in Western Sydney have preserved green space. It seems to me that the more you can maintain or replace canopy cover—the trees—within reason noting the bushfire risk and the really scary scenarios about bushfire risk, the better.

In direct health effects, because the trees remove some of the aerosol particulates that cause lung problems, in the cooling effect, reduction in energy demand and general ambience effect that people want—there are feel good factors in looking at green rather than brick. How you implement that into planning structures that look at increased density, I do not know. If you go to much more open space, you expand the city further, which goes into the green space. We have a real challenge.

As I said, I live in Pymble, where the plan is to build blocks of units close to the highway. That is a good planning response in many ways because it helps to deal with these things. However, you then need roads to move people around. In terms of its urban planning, Sydney has reached a point at which brighter people than me need to think of a holistic solution. It is a real mess, to put it politely.

This committee is not solely about Sydney. In terms of climate, there are benefits to be had from revegetating large areas that have lost vegetation. That would have a positive effect on regional temperatures and potentially on rainfall, and a range of other issues, including salinity. Some people could make a lot of money out of that strategy in terms of carbon sequestration and so on.

Mr ROBERT OAKESHOTT: I hope you have had some input into the Garnaut study at some point.

Professor PITMAN: I have

Mr ROBERT OAKESHOTT: Good. My concern is that the focus is heavily on carbon emissions and not on what you have been talking about, which is biodiversity outcomes. That leaves open the question of green space or revegetation rather than having a more economic focus on offsets from carbon. A number of different outcomes are achieved by placing the economic focus on biodiversity outcomes rather than carbon emission trading. Do you have a view on that? How is that view surviving the ruthless politics of focusing on carbon emission trading?

Professor PITMAN: I do not think there is a silver bullet to the global warming problem. I think there will be a whole suite of partial solutions. Carbon trading, I think, has to be part of the equation. So do very active strategies on reducing CO_2 in the atmosphere by sequestration. That can be biological sequestration or geosequestration. For the record, I have real problems with geosequestration. I do not know if any of you have ever looked at the technical side of it, but what I have seen suggests a leakage rate of no more than one per cent a year, which sounds pretty small. If your bank balance leaked at one per cent a year you would be pretty happy, I think.

Mr RAY WILLIAMS: Not if you had a million dollars in the bank.

Professor PITMAN: Fair enough. The problem is that one per cent a year means all of the carbon you have sequestered is lost in a century. That means it does not in any way significantly contribute to the solutions to the problem because if you are losing carbon at that rate you will have lost half of it in 50 years. Fifty years from now is 2060, when we are expecting the major consequences of global warming to be seriously problematic. Unless the leakage can be reduced to near zero, I cannot see how carbon sequestration, in terms of geology, is going to work.

Mr MICHAEL DALEY: Is the leakage around the seal?

Professor PITMAN: Yes. Gas leaks—not very fast—and natural gas in the ground leaks quite slowly. But the rate of leakage depends on exactly how they undertake the carbon sequestration technologies. It is not my expertise but when I talk to experts they say, "It's no problem. We can get it down to one per cent a year." That is no use. You might as well not bother at one per cent a year. I have looked in detail at offsetting my own carbon emissions because I fly more than I like. When I have looked at how the offset companies invest, a lot of them invest in forestry—as in growing plantations. That has no impact on global warming. If you plant a forest, grow it and chop it down after 50 years, that wood disappears. It decays. It may take another 50 years to decay. You might build a house, which is positive, but ultimately that carbon gets back into the atmosphere. If it gets back into the atmosphere there has been no net benefit from doing that. It is absolutely true that carbon offset companies buying up land and replanting old growth forest helps. People who are preserving existing forests—that is a positive. People who are replanting some of the tropical forests that have been cleared—that is a positive. But I do not see how plantations, which have lots of economic benefit and lots of positives etc, are relevant to global warming.

Mr ROBERT OAKESHOTT: Just on that, this is my point. I agree. How can we make the biodiversity argument survive what is looking to be more and more an economic response to climate change? The economic response in many ways is monoculture planting, which has questionable outcomes.

Professor PITMAN: I think if carbon trading takes off and is properly configured the values of old growth forests, for example, or revegetating regions with native vegetation that is going to be left there and sustained, could become considerable, which would be beneficial to biodiversity. My guess is that the scale of the warming that is coming regionally—in the regions where it is particularly intense—will dwarf any measures that we can implement to maintain the current biodiversity in those regions. I do not think people have understood yet. Most people know the temperature in Sydney on New Year's Day two years ago. I do not know if you remember—

CHAIR: I was in Penrith.

Professor PITMAN: Right. I was in a pool at Dee Why.

CHAIR: Lucky you! I was in a house in Penrith without air-conditioning.

Professor PITMAN: The current projections suggest 30 to 60 days a year hotter than that by 2050.

Mr ROBERT OAKESHOTT: And you think it is going to get worse before it gets better as far as a response is concerned. You think we are not really taking it seriously enough.

Professor PITMAN: Europe says two degrees warming protects us from dangerous climate change. Some other people suggest it is more like 1.7 degrees.

Mr MICHAEL DALEY: Sorry, I do not understand that.

Professor PITMAN: There is a community that says that if the total global warming can be kept below two degrees the impact of a two-degree warming is not dangerous to human activity. There are arguments about that. For instance, two degrees pretty much means you lose Greenland, and one can argue about whether that is dangerous to humans or not. Leaving that aside, there is another community, of which James Hansen is a member, that says it is not two degrees but more like 1.7. To keep global warming below 1.7 degrees, 50 per cent cuts in emissions are not enough. They really genuinely have to be down at 70, 80 or 90 per cent. If you ask me what the chances are—

Mr MICHAEL DALEY: By what year?

Professor PITMAN: I would need to check that number.

Mr MICHAEL DALEY: Well, ballpark.

Professor PITMAN: By 2040. My feeling—and I am a cynic—is the chances of achieving cuts of that level are nil.

Mr RAY WILLIAMS: Impossible.

Professor PITMAN: It is inconceivable that we will not undergo dangerous climate change. In fact, the 30,000 people who died in Europe in 2003 in a heat event that cannot be explained other than through global warming would suggest that dangerous anthropogenic climate change is already here. We are confronted by a problem that we have not yet even begun to contemplate. The Himalayan glaciers will be gone by 2050. A billion people depend on fresh water flow from the Himalayan glaciers for their agriculture and fresh water. I do not know where a billion people are going to move to. These are the scales of the threats that have not yet neatly translated into global policy response. My guess is it really is in the too-hard basket, but I am happy to be proven wrong by the political leadership.

Mr MICHAEL DALEY: Nice pass!

Professor PITMAN: This is not a science problem anymore. The global warming science is done and dusted. There is no credible hypothesis that suggests there is anything wrong with basically anything you would read—

Mr RAY WILLIAMS: Why would so many of the scientists that were involved with the Intergovernmental Panel on Climate Change [IPCC] come out and reject that?

Professor PITMAN: They do not.

Mr RAY WILLIAMS: My information is that they do.

Professor PITMAN: Then your information is wrong.

Mr ROBERT OAKESHOTT: On the grounds that the world heats up and cools down?

Mr RAY WILLIAMS: They have just raised great speculation in relation to the claims of the IPCC and have said that the people who made those claims actually were not representative of the professors and scientists that actually sat on the panel.

Professor PITMAN: So if this Committee chose to have a review on evolution, my assertion would be that if you went and got the experts who looked at that in a scientifically valid way you would find no experts who found any evidence to suggest evolution was not right. However, if you sourced everybody you could find, you would find some people who said Earth was invented in 6006BC—Bishop Usher said it was thus. You can go to people who do not believe global warming. I am going to assert on record that none of them are qualified to make that assertion.

Mr RAY WILLIAMS: Whether anybody has said that they actually disagree with global warming or that they disagree with climate change—however, whether or not it has been affected, as so many would claim, by manmade forces. I was going to get your opinion on this: given that over the past 10 years we have seen massive industrial growth and massive carbon emissions through that growth, the climate between 1998 and now—a decade—has virtually stabilised and there is even some theory now that it may be dropping.

Professor PITMAN: It is.

Mr RAY WILLIAMS: How, therefore, do you raise an argument that by 2050 we could actually increase the temperature of the globe by two or three per cent?

Professor PITMAN: Radiative forcing CO_2 and methane drives an average global response upwards. Superimposed on that longward trend are ups and downs called natural variability.

Mr RAY WILLIAMS: Is man the greatest producer of CO_2 and methane?

Professor PITMAN: Do you mean additional or in total?

Mr RAY WILLIAMS: No, I mean in total.

Professor PITMAN: Oh, absolutely not.

Mr RAY WILLIAMS: Man is the greatest, is that right?

Professor PITMAN: No. Most CO_2 cycles around the atmosphere naturally.

Mr RAY WILLIAMS: That contradicts your last point.

Professor PITMAN: No. I shall explain. I give you $1 billion a year, and I take $1 billion away from you—it makes no difference to you. If, however, I start giving you $1.1 billion but still take $1 billion from you, you benefit. Naturally, the earth emits, through volcanic activity and a range of other processes, many thousands of gigatonnes of carbon dioxide per year, and it takes up exactly the same amount. It is a natural process that has been going on for a mere 4.2 billion years. On top of that, humans are releasing several cubic kilometres of carbon into the atmosphere a year—

Mr RAY WILLIAMS: Which only equates to 5 per cent of all atmospheric gases—

Professor PITMAN: It does not matter. If I give you $1 billion plus 5 per cent but I take $1 billion from you, you will pop the champagne and be very, very happy. It is not how much it circles around the system; it is how much is being added and then not circulated through the system that counts. The rate of increase in CO_2 in the atmosphere is unequivocally due to human activity.

Mr RAY WILLIAMS: I will go back to my previous question. Given that you have said that the small percentage increase has come from man-made activity, how over the last decade, when it has been at its most extreme point of emissions in the life of man on this earth, has the temperature stabilised or even decreased?

Professor PITMAN: With respect, that is the wrong question. It does not matter what happens on a timescale of 5 to 10 years. The correlation between temperature and CO_2 is absolutely robust in the medium to long term, but superimposed on that are wiggles. It is the same as the stock market. You have seen the stock market increase over the last 20 years, but there are wiggles on that: that is why you invest in the long term. The long-term trend is unequivocally upwards, but there are wiggles on that upward trend caused by natural variability.

Mr RAY WILLIAMS: If we go back over a century, the greatest amount of this half a per cent increase in temperature that we are seeing at the moment—

Professor PITMAN: Half a pert cent?

Mr RAY WILLIAMS: Half a per cent, or just over.

Professor PITMAN: No, we are using Kelvin now, not centigrade. The percentage matters on what the units are, so it is a non-issue to do it as a percentage.

Mr RAY WILLIAMS: If I can rephrase the question, over the last century. The greatest percentage of increase in the half a per cent increase in temperature that we have experienced in the last century was in the first part of the century, when the industrial revolution was at its absolute lowest, to the point up to 1970 when we cooled to a rate that we were looking at global cooling and the catastrophic effects of maybe slipping into another ice age, and that all of the sudden it spiked upwards, but we have got to 1998 and, as I said before, now we have levelled off or it has dropped down. Are we not looking at a naturally occurring phenomenon that has happened over 650,000 years, which our ice cores even tell us?

Professor PITMAN: I hope so. We are not, but I hope so. I really, really hope—

Mr RAY WILLIAMS: With that hope, are we not now placing a burden on every person in the developed world to now contribute to something that we, hopefully, do not think is going to harm us?

Professor PITMAN: I hope we are wrong. I would die for the publication I could write to prove that, because I would get a Nobel Prize—and I would really like another one of those. But there is no evidence to support that assertion. The shrug of the shoulders is very interesting.

Mr RAY WILLIAMS: I did not shrug my shoulders; I just raised an eyebrow. I sit on the fence purely and simply because I can hear scientific argument for both sides on this.

Professor PITMAN: Actually, you cannot, with respect. Who are the scientists who are making those claims, and where is the scientific literature to support those assertions?

Mr RAY WILLIAMS: Many of the ones on the Intergovernmental Panel on Climate Change.

Professor PITMAN: That is a myth. There are people on the Intergovernmental Panel on Climate Change who have publicly raised doubts about some of the conclusions in the report. More have raised doubts to suggest that the Intergovernmental Panel on Crime Change has underestimated the threat, rather than overestimated. I am aware of, I think, one IPCC scientist who has queried what is in the report. It is a complete myth that more than one or so of the thousand or so scientists on the Intergovernmental Panel on Climate Change think the report is not a reasonable reflection of the state of the science.

In terms of your suggestion "but we are not warming", there is no suggestion in the scientific community of a linear relationship between CO_2 and temperature. That means that if you increase CO_2 by this amount, you do not expect immediately a response in temperature of the same amount. It is about the long-term global trend in temperature, which is directly correlated with greenhouse gas emissions, except in about the 5,000 to 10,000 years at the end of an ice age. And there is absolutely an argument that at the end of an ice age—indeed the geologists have shown that as you come out of an ice age, temperature leads carbon dioxide. Past that period, say over the last 15,000 years, I do not know of anybody who has ever suggested that it is other than greenhouse gases driving temperature.

Mr RAY WILLIAMS: That is greenhouse gases, not CO_2?

Professor PITMAN: Yes, greenhouse gases: CO_2, methane, nitrous oxide—

Mr RAY WILLIAMS: That is only a very small percentage of greenhouse gases?

Professor PITMAN: What is?

Mr RAY WILLIAMS: Carbon dioxide and methane gases.

Professor PITMAN: It is almost all of them.

Mr RAY WILLIAMS: That is not my understanding. My understanding is that of all greenhouse gases, it represents only a very minor amount, about 9 pert cent.

Professor PITMAN: Then you need to update your information. CO_2 and methane represent—I would have to double check—90 per cent of the released greenhouse gases. There is also nitrous oxide, which is I think around 5 per cent. I might have the numbers slightly wrong. But CFCs, nitrous oxide, methane and CO_2 would be 95 per cent of the total greenhouse gas concentrations in the atmosphere, bar water vapour. I am not sure where you are getting your information from.

If you go to the blogs on the Internet, there are completely fascinating thoughts from people. The science community do not respond to blogs on the Internet; that is not a legitimate way to articulate your science. You articulate your science through peer review publications in the literature. That is not grey literature, that is not CSIRO reports that are published, that is not stuff coming out of advocacy groups; it is peer review publications in the scientific literature. And I am not aware of any

credible science, published in the last 5 to 10 years, that casts any doubt whatsoever on the basic science about warming.

Mr RAY WILLIAMS: Would scientists and professors be financially better off studying and exploring the effects of climate change and global warming rather than putting their efforts into research into and development of ways of minimising air pollution?

Professor PITMAN: I do not know. I do not get any money from research on global warming.

Mr RAY WILLIAMS: I am saying, in general?

Professor PITMAN: University professors, on the whole, do not get money for climate change research. The previous Federal Government did not resource climate science in this country very effectively. I cannot speak for the CSIRO and the bureau, but I do not see them sipping Dom Perignon of an evening.

Mr RAY WILLIAMS: In the United States, in George Bush Senior's reign as President, some $200 million was spent per year on studies relating to climate and climate change.

Professor PITMAN: Yes.

Mr RAY WILLIAMS: And now, under George Bush Junior's reign, we are seeing some $2 billion spent across America. That is a significant increase—somebody is getting the money.

Professor PITMAN: Indeed. Maybe they have begun to recognise the scale of the challenge that confronts them.

Mr RAY WILLIAMS: I think that goes back to my previous question.

Professor PITMAN: With respect, the Republican Party in America—which is not, shall we say, the most environmentally focused on the planet—if they are putting that amount of money into climate change research one thinks that they have been convinced that the sceptics do not know what they are talking about, with respect. If the sceptics had an argument, I think George Bush Senior, or George Bush Junior, would have used it to not invest in that area. In any case, by the way, an awful lot of that money goes into numerical weather predictions, disaster forecasting and satellite technologies that are used for everything from mapping the surface through to sea level rise projections. It is not global warming research—I wish it were.

Mr MICHAEL DALEY: They are spending $12 billion a month but there is still not a lot of money.

Professor PITMAN: If you would like a thorough briefing—and I have offered this to others—on why what you are hearing from interested quarters is fundamentally and scientifically flawed, I am more than happy to provide that. I have made that offer to a number of people because advocacy groups have misled policymakers. I do not see science as an advocacy group, but others might.

Mr RAY WILLIAMS: I would be happy to have that if we could get the alternative for those indulging in that scepticism.

Professor PITMAN: That is always the problem. The scientific community is required to inform people who are not required to uphold science standards. I assert that the Earth is flat and it is bloody hard to prove anything to the contrary.

Mr ROBERT OAKESHOTT: I think we should take up your offer. If you read today's *Sydney Morning Herald* you would find that that is not just the position of the Opposition. Government members have also expressed concern in response to the Garnaut report. Many people in New South Wales have expressed concern about this issue. Have you had a chance to read today's *Sydney Morning Herald*?

Professor PITMAN: No. There are a lot of myths. A couple of weeks ago there was a lovely piece in the *Australian* from Australia's astronauts who took a single January data point and a second January data point a year later, drew a line between them and said, "We were heading into an Ice Age." My seven-year-old said, "You cannot draw a straight line between two data points", yet it was published in the *Australian*. It is unbelievable. Unfortunately, opinion pieces do not have resolve around scientific credibility.

Mr ROBERT OAKESHOTT: This is the New South Wales Government's response to the Garnaut report, which is a bit embarrassing.

Professor PITMAN: The biggest problem with responses to global warming is the lost opportunities. When I have briefed boards of major companies they are also nervous about this issue until they begin to look at the opportunities. By 2011 the carbon training market in Australia will be worth $1 trillion. Frankly, I would get out of bed in the morning for $1 trillion. In New South Wales we are putting at risk hosting that carbon trading market, relative to Victoria and Queensland, by not grabbing the opportunity for a couple of trillion dollars and going for it. I would not give a stuff whether or not global warming was right when $1 trillion was on the table.

Mr RAY WILLIAMS: Who is paying the $1 trillion?

Professor PITMAN: It is coming out of the market.

Mr RAY WILLIAMS: It is coming out of consumers.

Professor PITMAN: Who pays the money coming out of the financial markets?

Mr RAY WILLIAMS: The taxpayers.

Professor PITMAN: The answer to your question, "Who will pay the $1 trillion" is the taxpayer.

Mr RAY WILLIAMS: Do you think it is all right to subject taxpayers to paying that money?

Mr ROBERT OAKESHOTT: The taxpayers of London.

Mr RAY WILLIAMS: I understand that perfectly. I am the greatest advocate for minimising air pollution. I live that dream. I hate air pollution. I come from north-western Sydney where the air is crisp, clean and lovely every morning. When I come into Sydney it sickens me to walk down the streets. I cannot stand air pollution and what the people in Sydney are subjected to every day. If we could find something productive I would do anything to remove the carbon emissions from the air. I do not believe that the $1 trillion you are talking about will reduce air pollution. That is the worry that I have.

Professor PITMAN: Global warming and air pollution are separate issues. CO_2 is not a gas that contributes to the air pollution that you are talking about.

Mr GERARD MARTIN: The big issue we are looking at is the emission trading scheme, what sort of shape and size it will take, and what impact it will have on the energy market and a host of other things. What is your prediction about where Professor Garnaut will go with that, given that we are only months away from the final model?

Professor PITMAN: Obviously I do not know the detail. There will be a carbon trading scheme.

Mr GERARD MARTIN: How do you think it should operate? What would be your model?

Professor PITMAN: That is an incredibly complicated question. I am not an economist. I think that the evidence to suggest that we need to get CO_2 and other greenhouse gas emissions down

rapidly is absolutely unquestionable. The problem is that it has to be global. Somehow we need a global trading scheme that engages Indonesia, Malaysia, China, India and America. It is true that there is nothing Australia can do on its own to make a significant global dint on emissions. I think there are some really confronting political questions in all that.

Mr GERARD MARTIN: Irrespective of whether or not you think Kyoto is good, bad or indifferent, we need Kyoto.

Professor PITMAN: Yes, and it has to include developing countries. One of the things with which I entirely concur is that if the developed world cut its emissions by 50 per cent but the developing world did nothing, it really would not help much. There is a strong argument that we might have more money to invest in mitigation and adaptation to protect society if we did not attempt to cut CO_2 omissions and allowed economies to grow using carbon. Where the carbon will come from in the long term I am not sure because of peak oil and all that. I think these are really confronting questions. I am absolutely certain on the science and I will happily take it back to a case of Dom Perignon with you any day. But on what we do about it, I think that is deeply political. I sympathise with you in respect of the challenges confronting you.

Mr ROBERT OAKESHOTT: Do you think that the 1990 date, which was not addressed in Kyoto or Bali, is a political global question? Does it have to be addressed? Is that the way to bring developing countries to the table? They are sitting on goldmine, that is, land that has not yet been cleared. Where is the incentive to protect existing trees rather than create a scheme that is all about planting new ones?

Professor PITMAN: It needs to be incentive driven. It needs to be biased towards where the problem will come from, which is the developing world. In other words, we have to find ways to bring them into the deal. Probably the only way to do that is to make painful cuts in the developed world. I am not sure whether we are willing to do that.

CHAIR: We will take up your offer of a briefing.

Professor PITMAN: It does not have to be me; it has to be somebody who is scientifically literate in this field—not just random selections of people. But I will leave that in your capable hands. I have a quick story. Alexander Downer was a sceptic on global warming. He believed it was urbanisation and a range of other things. Somebody showed him some data that revealed a warming trend and he said, "Yes, urban." They said, "But this is a kilometre deep in the Central Pacific. It is difficult to attribute that to building cities." He reformulated his whole mindset, understanding that it could not be what he believed it to be. He is now one of the people who recognises the threat most clearly. Once you change your mindset and you look at the evidence systematically, it all falls neatly into place. It is a question of updating the foundations of where you are in an opinion framework. It is fairly straightforward to fix if people come at it with an open mind.

Mr MICHAEL DALEY: That is the easy part.

Professor PITMAN: Oh yes, absolutely. The science is easy. It is doing something about it, which comes to the issues that you raised. With respect, you cannot put all your eggs in one basket. You are right to draw attention to other issues of an environmental nature that need to be accounted for at the same time, like the air pollution problem. But if we close our eyes and put our heads in the sand on global warming, future generations will curse us.

Mr MICHAEL DALEY: This is a problem for western economies. We can decimate ourselves all day long if we want to. China is opening up or commissioning a new coal-fired power station every eight days.

Professor PITMAN: It has been said that, if you want to create an environmental catastrophe, you do it with colourless, odourless gas that takes decades or longer to establish its impact on the climate. But you make sure that the gas underpins our entire economic system. Welcome to CO_2!

Mr MICHAEL DALEY: Thank you very much.

CHAIR: Thank you, Professor Pitman.

(**The witness withdrew**)

RACHEL WALMSLEY, Policy Director, Environmental Defenders Office, affirmed and examined, and

ROBERT GHANEM, Policy Officer, Environmental Defenders Office, sworn and examined:

CHAIR: We welcome you as representatives of the Environmental Defenders Office of New South Wales. Thank you for appearing today to provide evidence to the Natural Resource Management (Climate Change) Committee inquiry. I am advised that you have been issued with a copy of the Committee's terms of reference and also a copy of the Legislative Assembly Standing Orders Nos 291, 292 and 293 that relate to the examination of witnesses, is that correct?

Ms WALMSLEY: Yes.

Mr GHANEM: Yes.

CHAIR: Before we proceed to questions, do you wish to make an opening statement?

Ms WALMSLEY: Yes. The Environmental Defenders Office [EDO] welcomes the opportunity to address the review committee on this important issue. For those of you who are not familiar with us, we are a community legal centre specialising in public interest and environmental law and policy. I would like briefly to reiterate our main recommendation and add additional comment on recent developments. As you know, our submission addressed terms of reference (b) regarding options for ensuring ecologically sustainable natural resource use, taking into particular account the impacts of climate change. Our key recommendation is that natural resource management laws in New South Wales must better implement the principles of ecologically sustainable development [ESD] in order to address the impacts of climate change.

National and international policy developments have progressed since this inquiry began with recent developments highlighting that natural resource management has a vital role for both mitigation of climate change—for example, avoided deforestation and offset projects; and adaptation to climate change—for example, water management in variable climatic conditions and management of vulnerable species.

The five elements of ESD are a fundamental consideration in both areas. First, the precautionary principle will be a fundamental consideration for new and untested technologies such as carbon capture and storage for proposed offset projects and carbon sequestration projects, and to properly consider cumulative impacts. Second, intergenerational equity is a relevant factor in approving new coal-fired power stations, increasing investment in renewable energy development and managing our rivers for the long-term benefits of rural communities.

Third, regarding the conservation of biodiversity, the Commonwealth Government recently invested $180 million for research into species' vulnerability and strengthening the national reserve system. However, retaining the ban on broadscale land clearing in New South Wales and establishing biolinks and biodiversity refuges on private land will be of vital importance. There may be an important role for private land conservation and stewardship in New South Wales to assist and benefit.

Fourth, the "polluter pays" principle is being recognised to some degree with the Garnaut recommendation to auction permits under the emissions trading scheme [ETS]. This principle is relevant to the funding of offsets, which must be transparent, rigorous and environmentally effective so that the practical result is not industry buying questionable offsets to discharge their obligations. Finally, in relation to market mechanisms, it is clear that an emissions trading scheme is heralded as the centrepiece of federal climate policy with clear impacts for New South Wales.

Detail on how an Australian ETS would look has slowly been clarified but has not yet been confirmed. Other market mechanisms remain valid to natural resource management and climate change. We note that a range of complementary legislative and policy measures are required to tackle climate change in addition to an emissions trading scheme.

CHAIR: You mentioned that natural resource management tools are a way of addressing climate change impacts. What laws in particular need to be addressed to create and tackle climate change for natural resource managers in New South Wales?

Ms WALMSLEY: Water law is an obvious area. It has been estimated that by 2030 surface water availability will decrease by up to 11 per cent with longer periods between inundation events, and then in other areas there actually will be increased rainfall—there will be flood events. So, it is very variable. I think the current approach of water law setting long-term extraction targets based on historical data is not realistic in this time of increased variability. So, just how we approach water law, for example, we need to focus more on sustainability and flexibility to accommodate these different impacts in different areas. As I said in my opening statement, the native vegetation laws need to remain strong in the State to prevent future broadscale clearing. That is an important part. In terms of energy law, it is difficult to say. We are all holding our breath waiting for the Garnaut final report to outline how the ETS is going to look. Obviously that is going to have implications for New South Wales.

In terms of natural resource management in New South Wales, we strongly support incentives for private land stewardship and conservation measures so that there can be payments for ecosystem services to private land managers. However, having said that, the offsets and sequestration schemes that have been developed in the lead-up to the ETS need to be rigorously checked against environmental sustainability criteria and offset criteria to make sure they are genuine and that they are going to have a benefit for the environment and the community.

Mr GERARD MARTIN: Given that most of what we do is framed under our legislation and, therefore, the legislation has to be effective, in your submission you to talk about 60 pieces of New South Wales legislation including ESD on paper but much of it not being enacted rigorously. Can you give a few examples of some omissions?

Ms WALMSLEY: That is right. While a standard definition of ESD is included in over 60 pieces of legislation, some of those Acts just say that a decision maker must have regard to ESD, or it is one of a number of factors that is taken into account; it is not the overriding factor. So, for ESD to be better implemented it would require strengthening of the legislation to make sure that decision making was in accordance with the principles of ESD, not just as a factor to have regard to, because then it can easily be dismissed by the decision maker. Whereas we are saying that there will be long-term benefits if you factor it in properly at the decision-making stage.

Mr GERARD MARTIN: So, we would have had to be a lot more prescriptive about it. Would you do that through the regulations that go with it?

Ms WALMSLEY: It can be done relatively simply, with the wording in the legislation. Instead of having "have regard to ESD" you could have "in accordance with ESD", and operationalise that. Within natural resource legislation you could say, "the key consideration "or "this part of the Act must be implemented in accordance with ESD". You just need to strengthen the language, so it has flow-on effects. It needs to be a priority strategy.

Mr RAY WILLIAMS: Is the Environment Defenders Office an incorporated entity, or do you work under a government department?

Ms WALMSLEY: We are independent, we are a community legal centre. Our funding is from the Public Purpose Fund of the Law Society, which is independent. We get a small amount of State and Federal government funding but we also raise our own funding through conferences, publications and some litigation cases. We are a non-government, independent, community legal centre.

Mr RAY WILLIAMS: Given what you have stated in relation to some natural resource management, would you elaborate on some of the natural resources that you see having a big impact on climate? What things do you believe we are doing wrong in relation to our natural resources and how we are managing those?

Ms WALMSLEY: As I have already mentioned, overallocation of water resources is probably a key one, that really needs to be addressed because it is getting worse. Our submission focuses more on what is about to happen in the next two years. This is obviously a growth time where every one will be looking at carbon sequestration projects, offset projects and wanting a benefit there. We need to get the principles and the framework in place to make sure that they are sustainable. For example, I believe you have speakers on plantations coming up on carbon sequestration. While the EDO supports exploring sequestration projects, we are saying that a filter of ESD principles needs to be applied to those. For example, if you put a plantation in an upper reach of the catchment it can have huge implications for water diversion in that catchment and that will affect the environment and other water users within the catchment.

Even though you are getting a carbon benefit from a plantation it may not be ecologically sustainable in terms of the environmental impacts. Similarly with soil, the soil carbon, if you have a monoculture that obviously has biodiversity impacts and may require additional fertiliser use for weed management. We are saying that you need to think not only about sequestration but about the health and sustainability of the whole catchment. The best projects that New South Wales should be working for is where there is a co-benefit, so you get your carbon sequestration benefit and also biodiversity benefit and there are not the adverse outcomes such as with water.

Mr RAY WILLIAMS: On the desalination plant, how would you view that as being sustainable where we are producing water but yet electricity is necessary to run that desalination plant. How do you see that progressing? How do you consider the claims that it can be run from green energy? Could you add anything to that and to the sustainability of that?

Ms WALMSLEY: Our primary concern with the desalination plant is that it seemed to be a bit of a quick-fix option. There are other things that can be done for water conservation and water management in houses. Stormwater management, grey water recycling, rainwater tanks and several things that could be done more broadly for water conservation that should be done first before using a high-energy intensity option such as a desalination plant. It is a similar argument to the one we raised in relation to carbon offsets and so forth. There is an awful lot of focus on CCS technologies and so forth. We are saying that you have to first invest in renewable energy. In New South Wales we should be developing the renewable energy industry, involving rural areas, before we look at untested technologies, things that may or may not work.

Mr RAY WILLIAMS: Prior to the last State election there was a statement that if just 5 per cent of Sydney homes had been fitted with rainwater tanks that would have negated the need for a new dam or a desalination plant for the next decade. That backs up exactly what you have said.

Mr MICHAEL DALEY: Given the statement by the member for Hawkesbury, how effective are rainwater tanks when it does not rain?

Ms WALMSLEY: If it does not rain—I do not have any data on that. I know people who have them say they are great. Even if you just use them on your garden or your washing.

Mr MICHAEL DALEY: But if it does not rain on your house, how effective is a rainwater tank?

Ms WALMSLEY: Well, it does rain in Sydney still, we are getting rain.

Mr RAY WILLIAMS: Madam Chair, could I answer that by saying that I have not had to purchase water in the past five years.

CHAIR: No. My brother who lives outside the Sydney Basin has had to purchase water. However, you mentioned the Metropolitan Water Plan, of which the desalination plant is just one part. There are many parts of the jigsaw, it is not a silver bullet as in climate change. There are those aspects being addressed as we speak. I turn now to intergenerational energy, a principle that you have outlined. Can you explain your definition of that concept?

Ms WALMSLEY: It is a problem in climate policy, because climate policy will require long-term solutions that need to start now. As you know the electoral cycle is quite short, it takes a

certain bravery to set in place what is needed. Of three examples we have, deciding whether to approve a new coal-fired power station is a long-term decision. It is future generations that will live in the country with even higher emissions; whereas an alternate decision would be increasing investment in renewable energy. If you put in place now a sensible, strongly invested, renewable energy industry, the benefits might not be immediate because it takes a little while to establish a technology. Future generations will benefit from that because there will be a lower carbon economy. Setting that up now will definitely benefit future generations.

Mr ROBERT OAKESHOTT: Have you explored any demand-side issues as well? It seems to be a dirty word in the current political environment to talk demand-side and increasing pressures, or increasing incentives, for consumers to save more and therefore lessen basically the use of electricity? Are there any legal avenues that you have explored that can provide some direction on that as to whether it is genuinely a dirty word to talk demand-side, or whether it is a political convenience?

Ms WALMSLEY: Because of our area of expertise we have looked sometimes at the barriers to creating incentives for people to cut down, some of the legal barriers and subsidies and so forth. In terms of people looking at demand-side management, it is often the social interest groups who are worried about consumer bills and the consumer side of things. They have done a lot of work on that. The Total Environment Centre has looked at demand-side management and the importance of that.

Mr ROBERT OAKESHOTT: I wonder whether the principle of intergenerational equity is just a simple choice between renewables or coal-fired today; whether there are some other avenues you have explored under that principle?

Ms WALMSLEY: We are in the process of that, we can forward more information to you.

Mr ROBERT OAKESHOTT: That is fine.

Mr GERARD MARTIN: Earlier you commented in relation of the coal-fired power stations. I should put in a disclaimer: My electorate has two major power stations and numerous coalmines and I had worked in the coal industry before I came here. Having said that, the issue really is about baseload power at this stage. As valuable as renewables can be, if they are an adjunct they will not provide baseload power. Where do you see that going in the immediate future, given that we are on the cusp of having to make a decision in New South Wales about our next baseload capacity? At the moment it seems to be either gas or coal, and that will depend on what Professor Garnaut comes up with as a carbon price, I imagine?

Ms WALMSLEY: We have had discussions with scientists who have worked in renewable energy who believe that renewable energy will at some point be able to provide the base load, so it is a kind of chicken and egg. If you invest in the renewable energy to get it up to that level it will be a significant contributor but we are not at that stage yet. So it is absolutely a difficult decision at the moment. That is why we are saying investment in renewable right now in significant amounts is absolutely essential.

Mr GERARD MARTIN: But we will still have to invest in something else in the meantime, will we not?

Ms WALMSLEY: Yes, but when decision makers are deciding what to invest in, we are saying they have to run these criteria, they have to think through these criteria more. They are not currently thinking in terms of the principles of ESD in the long-term principles. So what we are saying is considering any new project, whether it is a new coal-fired power station, a renewable, a sequestration project, an offset project, it should be run through these filters to see if it is sustainable in the long term.

Mr GERARD MARTIN: Does your organisation have a view on nuclear power in terms of environmentally?

Ms WALMSLEY: Our position is that we are opposed to it at this stage, just because of the risks involved. Applying the precautionary principle, we are still not convinced that there is an

adequate way of dealing with the waste. Applying the intergenerational equity principle, future generations that will have to cope with leakage if it turns out there is not a safe way of dealing with the waste. So again if you apply these principles nuclear just does not add up. We were disturbed in the Garnaut report that nuclear was seen as an option for Australia.

Mr RAY WILLIAMS: I just wanted to explore that, when you talked about nuclear. Given that Britain runs 30 per cent of its power from nuclear power generators and that it has dealt with its waste since World War II, some 50 years now, do you not think that adds to the argument that nuclear should be explored? When you look at the size of the country, I guess that is what I am saying. When you look at the amount of waste that they produce each year—I know it was in some of the comments that came back from the parliamentary trip to the United Kingdom; if you measured it in bus loads, I think they suggested that there would be something like 30 bus loads of waste per year, which sounds like a significant amount but in a country like Australia it seems very insignificant when you look at the area we have. I am just playing devil's advocate.

Ms WALMSLEY: What do they do with their waste?

Mr RAY WILLIAMS: That is what I do not know. Obviously they have to remove it and put it somewhere, but they have been doing that for the past 50 years and never ever had a problem with nuclear power.

Ms WALMSLEY: But I understand they have closed down Sellafield now because it was getting a bit old. The argument that it has been running—

Mr RAY WILLIAMS: A third of their power still runs on nuclear.

Ms WALMSLEY: But the argument that it has been running for 50 years is not necessarily an argument because obviously they were using it in Russia and there was a problem. We are just sceptical. We are not convinced that that is a long-term, safe solution because in the Australian context a lot of the discussion has been the way we will deal with waste is we will put it somewhere in the desert or out and that will have impacts on the Northern Territory environment and the people who live there. I do not think that has been thought through enough from social or environmental impacts that we do. We can just bury waste in the desert. That is not satisfactory.

Mr RAY WILLIAMS: Given that we are now looking at geosequestration and we have just heard from the last speaker that they are looking at a leakage rate of 1 per cent. Are we better to explore the opportunities with storing nuclear waste a long way away or do we go down the risks of leakage of some 1 per cent of carbon geosequestration?

Ms WALMSLEY: We are also sceptical about CCS technologies for the same reasons; they are unproven and untested, so again the precautionary principle comes into play. Again we have to think about leakage, we have to think about whether this will be a problem for the next generation to clean up. We are saying that in all these you just have to apply this filter of considerations to make sure you are not making a mistake.

Mr ROBERT OAKESHOTT: Is there tort law that can sort out some of these issues? Rather than these being top policy decisions, are they not legal decisions? If we do start burying stuff and it has impacts, there must be some big potential actions hanging around.

Ms WALMSLEY: Absolutely, there would be liability. It has been proven with the contaminated lands management legislation in New South Wales just how hard it is sometimes to prove liability when the company that may have caused it has disbanded and so forth. There would definitely be liability. Our concern is that by then the damage is done, by then the leak has happened. So why not put in place robust projects now that are more likely to be safer long term? That is kind of addressing after the fact, whereas we are trying to say it should be proactively planned.

Mr ROBERT OAKESHOTT: That is the problem with the law.

Ms WALMSLEY: It is. That is why we work in policy.

Mr RAY WILLIAMS: It is just amazing. We looked at the problems with nuclear waste, yet we continue down the track of coal and here we are arguing the problems with coal emissions, the problem with getting rid of it, the problems now that are arising, untested geosequestration and yet we have seen a proven product in somewhere like Britain in a relatively small country that is obviously dealing with its waste, producing a third of its power. We have all the stuff that makes it here in this country and we do not explore it. I just think that is ironic.

Mr GERARD MARTIN: The New South Wales Farmers Federation, in its submission, talks about the impact that climate change is having in the farming industry. They are talking about capturing or retaining the carbon in the soil. Obviously the yardstick to measure seems to be the real question. Do you have any views on that? It would seem to be a pretty simple solution in some ways, but do you have any view at all?

Ms WALMSLEY: I certainly think carbon soil sequestration is something that should be explored. As I said, we strongly support payments to private landholders for ecosystem services like carbon sequestration and incentive payments for people to manage their land sustainably. We strongly support that. Our concern would be with soil sequestration. Your next speaker, the Carbon Coalition, I notice on their website they had a quote saying, "One acre of pasture sequesters more carbon than one acre of forest". I bring back my earlier point that while young plants are growing fast they sequester more carbon. If you have a monoculture you can have water implications for that. That is a biodiversity deficit. In no way would we support conversion of forest into pasture for a carbon benefit. I think it should be explored to see if it has a carbon benefit, but you cannot ignore the other sustainability issues.

If you can get a project that has a carbon benefit but also has the co-benefits, like it is low in water usage and there is a biodiversity co-benefit, then I think that kind of thing would be great. But if you just focus on the carbon benefit and your argument is convert into pasture, I am concerned that that is not a long-term sustainable plan. For instance, with a forest, there is carbon in there. If that remains as a forest that carbon remains there, whereas once a pasture is grazed it could be converted into methane, which is also one of the six Kyoto gasses and incredibly problematic to measure. So you have to look at the future use of the area and just look at the whole picture in accordance with these principles.

Mr ROBERT OAKESHOTT: This is music to my ears because this is what I have been raising. Why are we not talking biodiversity trading schemes rather than carbon trading schemes?

Ms WALMSLEY: I attended the Bali meeting in December, and there was a lot of discussion there around the avoided deforestation mechanism, reduced emissions from deforestation. A lot of groups have seen that as a fantastic opportunity to get carbon and biodiversity co-benefits, so you are getting your carbon credit. But they are saying if you can add on a biodiversity credit to that then that is a benefit to the host country because they are getting more money for preserving their natural resources and you are getting the benefit for both. I think it makes a lot of sense for countries to meet their international obligations not only under the climate change convention but also the biodiversity convention and so forth. It is better, holistic ecosystem management. So certainly at an international level they are looking at co-benefits, and I hope that trickles down in Australia.

Mr ROBERT OAKESHOTT: Why 1990, why has that remained unaddressed, if you attended Bali? What was the reason?

Ms WALMSLEY: Using the baseline data?

Mr ROBERT OAKESHOTT: Yes. Following just what you said, surely there should be a value placed on existing biodiversity, and there is not.

Ms WALMSLEY: Yes. One of the problems with international law is that it is so hard to get agreement. It is absolutely laborious to get even the smallest things agreed at an international level so I think because that 1990 was set some time ago for some reason it was not raised again for discussion.

Mr ROBERT OAKESHOTT: Are we heading back to deal with that?

Ms WALMSLEY: For developing countries?

Mr ROBERT OAKESHOTT: For everyone.

Ms WALMSLEY: I am not sure.

Mr ROBERT OAKESHOTT: Particularly for developing countries where land clearing is an issue and is there no value for them to protect—arguably I keep saying they should be sitting on a goldmine in the current debate.

Ms WALMSLEY: That is the point of the REDD—reducing emissions from deforestation and degradation—mechanism to set up a mechanism that does create the incentive for countries not to clear, because some of these developing countries are under massive pressure. They have been offered investment to clear their forests and grow biofuels, and that is arguably to reduce emissions but at the same time that is losing their forests, their biodiversity. I think the REDD mechanism that is being hotly debated right now, and will be decided by the Copenhagen meeting, the idea of that is to set up the incentives that you are talking about, regardless of date, to actually preserve the tropical forests in particular that are there. I think Australia will have opportunities to work within the region and PNG and Indonesia to actually do some really good financing of avoided deforestation.

Mr ROBERT OAKESHOTT: Internally I do not think our hands are clean. The relationship with Forestry NSW long term and wood supply agreements. Hopefully we can see better value for a public tree than just turning it into a chair.

Ms WALMSLEY: Yes, I think in the New South Wales context carbon credits from plantations from that date onwards is a bit limited. I think from a farmer's point of view it should be explored whether they can get carbon credits for vegetation and that kind of thing. I am on the Biodiversity Banking Ministerial Reference Group so we are talking about biodiversity credits there. There have been conversations about how that will fit with any future carbon credits and whether farmers will be able to get a carbon credit and a biodiversity credit for their remnant bush. So long as they are robust offsets and robust credits, we think it would be great if the incentive payments could go to farmers to manage these co-benefits.

Mr RAY WILLIAMS: In relation to the farming of grasslands, as the member for Bathurst mentioned, is it ever taken into consideration the benefits of food production, the local economy, jobs et cetera? Is it considered that if it is not done we will have to import those goods, which adds to our carbon footprint? When it is studied do they go into the absolute nth degree of the outcomes versus the biodiversity outcomes and the offsets for carbon?

Ms WALMSLEY: That is a very valid consideration. The soil sequestration project is fine for existing cleared agricultural land. Our concern is that it does not extend to clearing further land. So with existing agricultural land, I think every effort should be made to make sure that that is sustainable and that food produced locally in New South Wales is obviously preferable to having to import something because that has massive greenhouse implications.

CHAIR: The committee will be speaking to the Sydney Coastal Councils group with whom you have recently conducted work, and audited legislation and policy instruments to determine the responsibilities of potential liabilities of coastal councils for climate change. Will you tell us more about that project from the organisation's point of view?

Mr GHANEM: As you said, the Coastal Councils group commissioned the Environment Defenders Office to look at legislation and policy in New South Wales and at a Federal level. The project involved an audit of legislation identifying where the words "greenhouse", "sea level rise" and "climate change" appeared. The second step was to look at what responsibilities those provisions we identified placed on coastal councils. Then we also had to look at the common law obligations on councils. We are happy to provide you with a copy of that report. Our conclusion was that, I think, only 16 out of the 160 pieces of legislation we looked at mentioned those terms, and of those that did, they placed very minimal obligations on councils to address climate change, from a legal perspective.

CHAIR: Would you submit a copy of that report to the committee?

Mr GHANEM: Sure.

Ms WALMSLEY: One of our key conclusions was that there is a real lack of guidance and framework in New South Wales for councils to know what they should and should not be doing. There is just an absolute lack of information out there. I am sure Coastal Councils will discuss it further. We have had a very high level of interest in that report. A lot of people have said that they should be looking at guidance or a framework for better management along the coast.

CHAIR: That is for the Sydney Basin?

Ms WALMSLEY: Yes, across New South Wales.

CHAIR: Did you then look at what the councils were doing outside the legislation or what they have to do? Have you done any analysis of what some of those councils are doing as innovative within their communities?

Ms WALMSLEY: The scope of the project was, first of all, just to see what the legal instruments said. But the project is ongoing with consultation with councils. We are still working with the Sydney Coastal Councils group and we are also doing a large submission on the Federal inquiry into climate change and coastal communities. As part of that we are having a meeting in Byron Bay to look at their retreat plan and see if there are any pros and cons of that. We are talking to councils about innovative measures that they have taken because some councils have done great things, other councils have actually decided not to do things in case that increases their liability. Like if they build a structure against their level rise, will that increase their liability later? We are working with councils now as subsequent steps.

Mr RAY WILLIAMS: You have raised the issue of biobanking, which interests and concerns me greatly. As a councillor in one of the rapidly growing areas in the north-west at the moment we have been able to maintain and sustain significantly conservative conservation areas during the development phase. I shudder to think when a developer can just get a credit somewhere else for purchasing some other land that we lose a sensitive area in a development. I say that because, first, if it is that sensitive it should be retained, and that is the end of the story, because I think that is important for the local area and environment. Second, if you get a biobanking and that is stripped and developed and it is put somewhere else, there is nothing to stop down the track that other area getting developed in the future. Whereas if the sensitive area is retained within that development, whether it is attached to as parkland, playing field or whatever it is, and it is there and it is sustained now for perpetuity and it will never be developed in the future. If you leave it to someone else down the track, like biobanking will do, I have a great fear that that could be subjected to change years down the track.

Ms WALMSLEY: We share a number of those concerns and that is one of the reasons why we have been involved in the biobanking debate. We have been very sceptical of offsetting, if it is possible, biodiversity at all. It can work in a pollution context but when you apply that to a living ecosystem it is far harder to get it down to a fungible credit. The things we have been arguing for on the biobanking committee is that if this scheme is going to be up and running, there have to be strong red light areas. As you say, some areas of development where there is just a fragment of the only remaining bit of that bush, that absolutely has to stay: you can't clear that under biobanking. So we have been strongly arguing that there has to be these red flag areas that are just no-go. On the biobank site they have to be managed in perpetuity and they can't be then developed at a later stage. The agreement on the land should bind future landowners so that the benefit lasts for the duration of the impact, which is in perpetuity.

Mr ROBERT OAKESHOTT: Is that legally possible?

Mr RAY WILLIAMS: No, no guarantee.

Ms WALMSLEY: Currently the Act says it is in perpetuity and the trust fund set up for management payment, I think the modelling is up to 70 years.

Mr ROBERT OAKESHOTT: Legally that would stack up if title had changed?

Ms WALMSLEY: There is some debate about that but the idea is that it can be in perpetuity. There are provisions in the Act saying that the biobank site cannot be developed, except for a few exceptions that have concerned us a bit. The idea is that the offset site is in perpetuity.

Mr GERARD MARTIN: In relation to work you have done for Sydney Coastal Councils do you see a conflict between the planning instruments in relation to coastal development as opposed to other environmental legislation? Are there contradictions?

Ms WALMSLEY: Part 3A is a pretty big contradiction in environmental planning in our opinion!

Mr GHANEM: Some of the policies had very good climate change goals but when you look at the legislation there is very little implementation of them. As Rachel mentioned, with ESD there is simply a requirement to consider and have regard to climate change impacts but not a positive obligation to implement any measures or prohibit activities that may have significant impacts.

Mr ROBERT OAKESHOTT: I do not know where I heard it but I raised it at the last Committee hearing—it was either from the Growth Centres Commission or from a particular council—but for the first time in New South Wales a development application process was asked to consider climate change. I am not sure whether it was for a residential or a commercial subdivision. Do you know anything about that and what do you think about it? It sounds pretty interesting.

Ms WALMSLEY: We ran a case about Sandon Point in Wollongong. We can send you the judgement, but it said there was an implied obligation to consider climate change in terms of inundation, because it is on a flood-prone area.

Mr ROBERT OAKESHOTT: Was it a residential subdivision?

Ms WALMSLEY: Yes. The failure of the decision maker to consider climate change and its possible impact meant that we actually won that case. It is quite a good judgement, but it is being appealed at the moment. We can send you that judgement.

Mr ROBERT OAKESHOTT: Which council was that?

Ms WALMSLEY: That is Wollongong. It is the Stockton residential development on Sandon Point.

Mr ROBERT OAKESHOTT: When is the appeal date? That will have implications for all councils, won't it?

Ms WALMSLEY: Absolutely. In our opinion it was a great judgement, so that may be why the Minister for Planning is appealing it.

Mr GHANEM: It is an innovative judgement because most cases have looked at how a development will contribute to climate change whereas this one actually looked at how climate change will affect a development. It is quite innovative and we are very happy with it.

Mr RAY WILLIAMS: Would you have had any involvement with the Jackman development in Penrith or the Sweetwater development in the Hunter on similar issues in relation to conservation?

Ms WALMSLEY: I do not think we have had direct involvement. We have phone-in advice lines and often community groups from areas of development will call us. I am not sure that we have at the moment.

Mr ROBERT OAKESHOTT: What is the timing of the appeal? When will it be heard?

Mr GHANEM: It is in July. We are not in the litigation team.

Ms WALMSLEY: We can find out for you.

Mr ROBERT OAKESHOTT: I would be interested in how it lines up with some significant planning reforms that are going through in New South Wales. We are in for some fun months!

CHAIR: Enough said on that! Thank you very much Rachel and Robert for your submission today.

(The witnesses withdrew)
(Short adjournment)

MICHAEL BRIAN KIELY, Uamby, RMB 384 Uamby Road, Goolma, 2852, sworn and examined:

CHAIR: I welcome Michael Kiely, a representative of the Carbon Coalition Against Global Warming, and thank him for appearing today to provide evidence to the Standing Committee on Natural Resource Management (Climate Change). Mr Kiely, I am advised that you have been issued with a copy of the Committee's terms of reference and a copy of Legislative Assembly Standing Orders 291, 292 and 293 that relate to the examination of witnesses. Is that correct?

Mr KIELY: Correct.

CHAIR: In what capacity are you appearing before the Committee?

Mr KIELY: I am the convenor of the Carbon Coalition Against Global Warming.

CHAIR: Would you like to make an opening statement before Committee members proceed with questions?

Mr KIELY: I would like to table a document in the form of slides that supports my presentation.

CHAIR: Do you want to take us through that?

Mr KIELY: Yes, as far as we need to go for you to get the feel of what we want to talk about. The opening slides show what we experience as climate change—isolated and extreme events. The first frame is particularly dramatic. You can see in the second frame that we have a sheep pen for crutching. We would never order a shearer to come to crutch if there were any hint of rain, so that rain came out of the blue. At the time John Howard was telling us to adapt to climate change, which my son took literally and got out his kayak. But the point of the matter is more the aerial photos that were taken two weeks later, which compare and contrast the areas being farmed under carbon farming techniques with areas being farmed traditionally during the drought.

The bottom photograph, which is the most dramatic, reveals the essential element time in grazing, and how the time of animals on the pasture is the key to healthy pasture or to devastation. The Carbon Coalition has been going for two years. Those are the milestones. We have been running conferences and engaging with scientists because there is a scientific debate about soil, and we take some of the glory for Prime Minister Rudd's statement that he is looking into soils. It was a great and glorious time for us. Our mission is to see soil carbon trading and farmers paid for what they grow. That is a key incentive to regenerating rural landscapes. The domino package featured on the third slide is our entire argument.

Soil carbon credits are necessary to see an increase in soil carbon. An increase in soil carbon will mean less erosion. All these things are inevitable: improved soil structure, better water use—we call that hydrology—reduced salination, and soil fertility. Biodiversity is automatic; it follows soil carbon increases as night follows day. A healthy ecology means a healthy profit and farm families and communities are the winners. I could go into the processes of making carbon, which is fascinating and we love to talk about microbial communities, but I will leave that for now. Believe me when I refer to the pulsing of the roots. When a plant is grazed its roots die back proportionately. That sets off a feeding frenzy in the microbial community, which enables that plant to regrow its roots as deep as possible.

Native perennials are the only plants that do that to the extent that they do. That sets off another major catalytic event in the microbial community and the by-product of all that is soil carbon and eventual repositories in the soil where it can stay locked up for 100 years. A lot of people say that Australian soils cannot store carbon. Our members are storing it every day. We live in a parallel universe with conventional science and we have been trying to bridge that universe. Just to give you some sort of idea about the value, a 1 per cent increase in carbon at $5 a tonne can be worth $770 a hectare; at $25 a tonne $3,850 a hectare, currently $40 a tonne on the global market. So the numbers are quite significant.

There is an old saying, "What is fastest way to get a message to a farmer?" The answer to that is: on a cheque. We agree with that statement. The next slide shows the characteristics of a carbon farm. These are things that you would notice if you ever visited one. I extend an invitation to Committee members to visit our farm and the farms of our members. I can arrange such a visit. Some of the characteristics of a carbon farm include: critical groundcover; deep-rooted perennials; vegetation stability; no-till cropping; grazing management—I referred earlier to the time—high levels of humus; low recharge; grassy woodlands; and species diversity. You might wish to read that later. It contains a quote about the importance of hoofed animals for pasture health and rangeland, and promoted biodiversity.

I refer, next, to the miracle of soil carbon, which is what we call it because it is the beginning. The soil is the origin and eventual destiny of us all. I have taken the liberty of extracting the catchment action plan from our catchment management authority. I put a star beside all the areas that we could help it achieve. In fact, given a full trading system and widespread take-up of the soil carbon challenge, I vouch that vast amounts of resources could be redeployed from the push-pull processes of trying to get farmers involved. I have some observations to make about that, but a polluter-funded private enterprise solution to achieving the following catchment targets. I will not necessarily need to go into them, but I have put a star against all of them and I am willing to defend all of them using the evidence I have. We can return to any individual one.

The farmer chap pictured on the page with the bell curve is Col Doherty, he is our shearer. He is also a mixed farmer. These words have come out of his mouth or those of our neighbours. Carbon farmers are considered strangers; we are considered to be wrong. When we grow more grass our neighbours say it is because we get more rain than they do. We have an amusing interplay. Col is our touchstone. The day we change to Col's approach we will have won the battle. He is very strong. My dad was the best farmer I know. Col has made the following comments: "Take CMA money and they put handcuffs on you." CMA officers have told me they could not give away money, $500,000. They could not give it away in the Spices Creek district to get people to change their habits. No-one would talk to them, which is not surprising because they are very suspicious.

Further comments from Col are: "What are they going to teach me about farming?" This is a very traditional position. He said also, "Landcare is about planting trees next to roads with signs up to say 'Look how good we are'." The country round here bounces back always; there are very low levels of belief in climate change out our way and we live in a very traditional area. It is a parallel universe to the city and some of the yuppie farming districts. Col has also said, "Farmers are opportunistic, market-driven, proud of their output, proud of their knowledge of farming, conservative, slow to adopt new ideas from outside, inventive and innovators, suspicious, and trust themselves and a few farmers they admire."

We do not believe that you will ever get to them by putting on seminars and telling them this is going to improve their productivity. People who have never been on farms or look too citified do not come across as credible. But give them something to grow, like carbon, and give them a good return for it and you immediately have their attention. They do not care what they grow. There are some who, like ourselves, are sticklers for wool—a bit sort of touched in the head. But they will put in any opportunistic crop and soil carbon would be seen as just another crop.

The first curve on that page represents soil carbon credits speeds from research that eventually ended up in the diagram to the right called the Bell Curve of Adoption tracing the hybrid seed for adoption in two Iowa communities. It shows just how slow things happen, until the tipping point, which is the early adopters. So, we do not have to convince everyone; we have to convince only between 10-15 per cent to 20 per cent to turn the whole community. I have some quotes about that. The next page has three bell curves. The critical importance of soil, which I will explain in a second, means that we have to deploy it to start sequestering as much carbon as possible. So if we can make that long pointy curve the adoption curve, we have achieved relative success, and the right incentive will speed behaviour change.

The 900-pound gorilla in the kitchen is what we call the legacy load. Everyone is talking about avoiding emissions, but no-one is talking about getting rid of the ones that are already there. What is up there is already more than we can deal with. There is only one process known to man to remove that and that is photosynthesis. Forests take 10 to 15 years to start sequestering. So, we have

not got enough time. According to Nick Stern we have 10 years. We cannot plant enough trees. According to researchers from the University of Tasmania, we need seven planet Earths covered in trees to do the job. So what have we got left? We have 5.5 billion hectares of agricultural soil. With the vegetation that grows out of it, which we can sock away, even small amounts per hectare, like half a tonne of carbon per hectare, would result in 10 gigatonnes being removed from the atmosphere each year.

We are currently pumping out 8 gigatonnes more than we should. Eight gigatonnes is a lot, but 10 gigatonnes is a lot more. I just wanted to point out to you that eventually you will remember this conversation because the world will wake up and the headlines will say "Soils, the salvation of the world." I hope it is not too long. The impact on greenhouse gas loads looks at all the different popular solutions to sequestering and avoiding greenhouse gases. Nothing is deployable in the time that we have, and that would be agreed to by the people who are behind them.

The next section is really the low input, almost unbelievably silly things that we do to grow soil carbon. We farm our grass like a gardener would tend his garden. We nurture the soil, we see the use of concentrated numbers of animals. The first photograph is not how we graze animals, that is just an opportunistic photograph when I had them all in the yards. In 24 hours you can really do damage to a piece of ground: till the ground with the hooves of the animals, manure the ground, clean up the ground, and then six weeks later you have fresh pasture.

Mr GERARD MARTIN: Is planned grazing the same as cell grazing?

Mr KIELY: There are important differences. We do it with cells, but it is all to do with time. You have to be on the ground assessing how much feed is there, because cell grazing can overgraze. The critical thing is to undergraze, or graze sufficiently as a balance. You are right. Cell grazing, time-controlled grazing management. Mulching is a simple thing. We came out of the city 10 years ago and we did not know we were making a mistake when we were told that we could not grow topsoil. We just mulched and topsoil appeared. If it was there before us, we could not see it. The important thing is that bare earth is out. Bare earth emits carbon dioxide, kills the microbes, destroys the manufacturers of carbon.

Also, too much vegetation is unproductive of carbon. We do not slash, we mulch. You can see in the photographs that our mulch is beautiful, it is springy, and all the bugs underneath love it because they have a roof to keep out the sun. Our grass grows immediately. Pasture cropping was invented in the Central West of New South Wales by a man called Col Seis in Gulgong. It means direct drilling of an annual cereal such as oats or rye into dormant perennial pasture. You leave the pasture, you do not plough. It looks like ploughing in the photograph because we were a bit naïve and let our manager have his head. He was not our manager for much longer. It should be direct drilled, which is minimum tillage.

The crop comes up and you can harvest the crop, or feed the crop out—and what happens to the pasture is miraculous. You can triple the number of what we call "crowns", which are the neoperennial grasses. We use that technique to renovate pastures and it is good to give flocks a mixed diet rather than a monoculture, which we try to avoid at all times. We have tried other things. Nitro-humus, which is treated human biosolids. At the moment we are doing tests on natural fertilisers. We know that the big problem with nitrous oxide is superphosphate, we are not going to be able to use superphosphate. The natural fertiliser industry is not going to be ready for the demand, they still do not have their footprint calculated. We are trying to work with them to make them see some sense.

The results are there. We are not very scientific, we took a 50-metre strip through the length of a paddock and I photographed the perimeters of that strip. Restoring grassy woodlands is another. When the explorers found the great pasture lands they called them park lands because they were scattered with trees. The prevalence of trees is critical for the high carbon scores. Shade is needed for animals, and they are homes for bugs. Everyone needs a home. If you want microbiological life, and they are the manufacturers of carbon, you have to provide no cleaning up of fallen trees. Those fallen trees are the housing estates.

At the end I have biodiversity indicators. The magic of living on a farm that is going through its seventh or eighth year of carbon farming, that is when biodiversity starts to explode. Carbon takes

a long run up, but when it kicks in it is like a hockey stick. Straight up. The first thing we noticed was a plague of spiders. But if you have a plague of one species in the food chain there has got to be movement everywhere else.

The birds increased, as did one of the spiders feeding on them. We are very proud of the return of the kangaroo grass, which is a very difficult grass to grow because it is easily abused. It hates being ploughed, it hates being overgrazed. Our CMA has it planted in its garden at the front of the building in Wellington—it is so precious. Two little wood swallows have come from Queensland; they should now be down so far this way. The diamond dove had not been seen for 10 years, and we keep our eyes pretty close to the ground.

For carbon farmers to be genuine they have to conduct biodiversity surveys and do so because a carbon farmer is given permission to respect the soil, whereas with industrial farming he would get up in the morning and ask, "I wonder what I can kill today". They spend most of their days killing things, instead of making them grow. That is basically in our submission.

Mr GERARD MARTIN: Have you had any interaction Peter Andrews?

Mr KIELY: There will be a statue of Peter erected in the Hall of Heroes of carbon farmers on the day that we come marching in. Peter is a natural sequence farmer, of carbon farming technique. The definition of "carbon farming" is, and we are broad church, you can use any means whatever and people sometimes put coal fines on a cotton field. You can put a tonne of coal on a hectare of cotton and increase your productivity by a tonne a hectare.

We do not understand that, we do not try to understand that, we just do what we think is logical. The principles we follow are more naturally based, to mimic Mother Nature. If we see a natural process we try to use that natural process. Peter has a vision, he is a landscape psychic. He can see how the water moves in ways that we cannot. We have to take his word for it. When we put his strategies in place things work.

Mr GERARD MARTIN: I imagine a property that is managed like that would be more drought resistant than conventional industrial farming?

Mr KIELY: True. It is called "buffering". If you have good strong support in your humus you still have a drought. We go into drought later and come out sooner, but we do go into drought. We cannot avoid that. There is no rain coming in, nothing but blistering westerly winds, we should have as much vegetation cover as we can. We try to keep the microbial community as comfortable as possible.

Mr GERARD MARTIN: What incentives do you need from government to help you spread your word and become a serious player in this?

Mr KIELY: I have to be careful here, because we are building bridges for scientists. I am sure there are scientists listening. The science has been a scandal. We had to spend weeks in a literature search to find the source of the myths about Australian soils being too old and too ancient and degraded to sequester soil carbon. And we found them. They have gaps in them. There should be a royal commission into the Australian Greenhouse Office soil science. We believe that if farmers are to be penalised on the basis of figures produced on methane, nitrous oxide—that is on the negative—and not being allowed to have access to their soil carbon credits, before farmers can be confident that they are getting a fair deal there should be a complete audit and independent review of that science.

The word is "unsound". It is not the scientists' fault; it is the way that the research was structured. There are gaps in the data sets. They studied only conventional, what we call "carbon mining or "carbon depletion", techniques and concluded that all farmers were that way inclined.

The question was: What potential does Australian soil have? They cannot make proclamations about potential unless they study the limits of best practice, and they did not do that. They are rushing to backfill the gaps in the data sets now, saying that they had that in their minds all along, but the fact is that the boat is about ready to leave the pier and we will not be on it. If we are not on it, there is every chance we will end up with some watered down, government-funded

stewardship payment that could end at the next election that no-one would be particularly interested in taking because governments tend to have an iron fist. We want freedom. We want a market solution that we can trust and that we stand and fall by. We are particularly angry—well, we are not angry any more. That is no good. We are particularly disturbed at the way the scientists are treated like oracles when they are just merely human.

Mr RAY WILLIAMS: How do you measure the success? If we put a rate on that per hectare and it is paid to a farmer, how do you measure those outcomes—in terms of yield? Do you measure it in terms of going out and ground truthing it? What are the checks and balances for a government to assess the benefits of what you are saying if the money is provided at a per hectare rate on behalf of the farmers?

Mr KIELY: There are trials going on all over Australia at the moment, 20 hectare plots are being overmeasured. The core samples are 110 centimetres. It was originally funded by Rio Tinto; it is now being funded by private money. It is being conducted by Dr Christine Jones, who is one of the founders of the Carbon Coalition and has toiled for 10, 15 years in the vineyard of soil carbon. On the issue of measuring soil carbon, one of the objections is that it is hard to measure. It is not hard to measure. You can measure it; it is just very flexible. If I measure it in the morning and measure it in the evening it will be different. If I measure 100 different core samples in a paddock I will get 100 different measurements. The famous American soil scientist, whose name escapes me, said, "If you measured 100 trees in a forest you would get 100 different measurements for the amount of carbon. All trees are done on estimates."

Blair Connelly, the assistant secretary of Penny Wong's department of climate change, said at a conference two weeks ago that everything to do with reporting and measuring in climate change is done on estimates. So why are soil people so obsessed with direct measurements and accuracy? We are not obsessed. The people who do not want us to be part of the game are obsessed. We believe in estimations. There are so many different techniques for measuring soil, one of which is satellite remote sensing. They have data that goes back to 1970 of above-ground vegetation which they can use as a formula for calculating soil carbon. Soil carbon is not hard to measure. There are many different techniques. It is just a question of how committed you are to seeing it deployed as a solution.

Mr RAY WILLIAMS: How do you see the way forward?

Mr KIELY: We have been called to intervene in the battle in New Zealand at the moment. The New Zealand government has gone completely off the rails. We think the simplest way forward is for the Government to decree that we will start a market and give the people who can design a market—scientists are not equipped to design markets; commodity traders, lawyers and the people who work in the market should decide the market. In science there is a thing called framing the question. If you frame the question in a particular way you get a particular answer. They have always framed the question—and they cannot help it—how can we more accurately measure soil carbon? That will always give you an outcome that says we cannot trade soil carbon because we have got to be more and more accurate. The question should be: How can we measure soil carbon such that a person buying it as an offset and an organisation accepting it as an offset can be confident they have achieved their objective? I found a paper that said, "Soil carbon flux"—which is all that movement—"has statistical properties, hence it is manageable". Magic words! We use statistics to manage averaging and smoothing to manage every other transaction but there seems to be a deep fear of mother nature among the market makers. They feel that she is out of control.

Mr GERARD MARTIN: Do you think part of your problem in selling your message is that it is too simplistic a message for some people? It seems to be basic commonsense, or is that being too simplistic on my behalf?

Mr KIELY: You are right. It is not scientific. It is not technological. It is not anti-scientific. It is primitive; it is returning to primitive approaches. We cannot see if there is an agenda working against us. We believe that everyone involved is acting in good faith but you could whip up a conspiracy theory between the suppliers of all the inputs, which are now superphosphate at $1,500 a tonne—no-one can afford to put it on—all the poisons and herbicides, the Monsanto's with their GM. We are not like the organics movement which has a perpetual sense of persecution and paranoia. I have noticed that they are that way inclined. There could be others not like that. We believe that it is

largely ignorance. People cannot believe that in such a simplistic—and the same thing with Peter. The things that Peter Andrews talks about are so simple they have got to be wrong. Nothing can be that simple.

We represent a huge reduction in the billions of dollars spent on trying to conserve the landscape, on trying to teach farmers. You will never teach farmers to do things. It just does not happen. To be a farmer is to only believe in yourself. You are the only person you can trust. They used to think they could trust their families and their families are falling apart on them under the pressure of drought. Peter Andrews is a good example. They are just becoming more and more resistant to messages from outside. But flash the possibility of making some money, they do not care whether it will save the planet. They do not care if it will save the kangaroos. But it is amazing what 10 or 15 years of carbon farming will do to a generation of farmers. It will transform them because when you feel the energy of a farm that has come alive, where the microbial community has sparked, you never want to go back.

Mr RAY WILLIAMS: With all due respect to the farmers and what you have said, if you look at the landscape of central western New South Wales and in particular the farming areas, that landscape has changed significantly over the past two decades. Where farmers now embrace the replanting of sensitive areas along riverbanks and things like that. There has been an extensive planting out of natural vegetation in significant corridors. When you drive around the countryside that is blatantly apparent, so I do not think they are completely averse to embracing technology and improving themselves. It might be a little slow coming but I think it needs to be sold.

Mr KIELY: I am not saying that they are averse to embracing technology. They are seeing what is happening over the fence. That picture I showed you of the green side and the grey side, he has changed. He got a lawyer to send me a letter saying that I should not use that photograph in public because it was denigrating his farming techniques, because he had changed his farming techniques. He was ashamed of it but he was forced into it. We call it the vortex when you are forced into it or you have one or two things to sacrifice—your animals or your soil. They always sacrifice the soil because they think it will just come back. The central west is a particular district. There is a high number of conservation farmers. I have been travelling widely throughout Australia talking to farmers, getting them ready for the day when we will be trading soil.

I can tell you that 85 per cent of this Continent is devastated in terms of soil health, vegetation. Farmers are desperate. They are ready for a new way, but the incentive is not there for them. They believe they are going to be done in because the so-called $10 billion in avoided deforestation based on the legislation to stop people clearing land, they thought that was their money. They think the same thing will happen with soil. There is no hollow log for Kevin Rudd to reach up to find an answer to the next period of Kyoto, but soil is a very big solution.

This is a bit of paranoia but we were at a meeting in Yass where a string of government and semi-government people told the farmers how methane and nitrous oxide were going to stand them up against the wall, and we are not going to give them soil carbon to protect themselves. These very gentlemanly farmers were about to lynch some of the people in that room. There is a high sense of suspicion.

Mr RAY WILLIAMS: I can understand that after 10 years of drought. They are on the bones of their back sides and are suffering enormously through the drought and certainly do not want to hear anything at the moment that may impact them further.

Mr KIELY: A lot of them see this as their last roll of the dice.

Mr GERARD MARTIN: In relation to that photograph, what is a "sacrifice paddock"?

Mr KIELY: They are rather big sacrifice paddocks but we felt the psychology is important as well as their physiology. A sacrifice paddock is a paddock on which you concentrate your sheep and treat it as a feed lot so that the rest of your pastures can recover, or at least not be damaged beyond repair. A sacrificed paddock should be small. We are softies, we think an animal's state of mind affects its wellbeing and productivity. We do not want to run a torture chamber. We actually use two large paddocks which are struggling to come back basically because when you leave animals on a

piece of land for a long period of time, what you get is devastation. In a community like us if someone came and smashed our houses down, which is what is happening in Asia at the moment, that is what you can do to the microbial community with a plough or over-grazing.

CHAIR: You said work was being done with organic fertilisers?

Mr KIELY: Yes, natural.

CHAIR: Waste Services Management or Waste Services NSW—

Mr KIELY: Same people. The Australian native landscapes are very progressive. The Wyland company in Young or Yass, I can't remember where it is, but there are not enough of them. On every street corner someone has a formula for a natural fertiliser in his or her back pocket, but we do not have enough manufacturers.

CHAIR: You are aware of Waste Services NSW?

Mr KIELY: We are engaged with them.

CHAIR: Because that is the city giving something back to the country—that is my waste being shipped out your way.

Mr KIELY: We have a big problem: transport. We were offered paramagnetic rock dust—you may not know what it is. It is dust that is created in the mining process of volcanic rock and it is magnetised. If it is applied to soil with reasonable fertility it can speed up the catalytic iron exchange which is the electrical process whereby nutrients are attached to the roots of plants. It can speed it up so dramatically that people do not believe the results. It is all to do with—this sounds a bit weird—but capturing cosmic rays and aligning the polarity of the particles in the soil.

Boral has tonnes of this dust in its quarries and offered us 30 tonnes to try on a paddock. We are a sort of display home of carbon farming techniques, but it would have cost $30,000 to truck it in. It is the cost of transport. We recommended empty coal trains returning across the Blue Mountains as a solution. That is the big problem and that will stop a lot of the natural fertiliser organisations. Natural fertilisers are largely based on composts and compostees and inoculants. This is a beautiful area of the science, what you do is take a snapshot of your soil, microbiology, find out what communities are missing, and then build a compost that will inoculate and include those communities and increase them. We need local manufacturers. We need the City of Mudgee to have its own natural fertiliser unit. There is one being built on a vineyard just outside town—and every city should have its own natural fertiliser unit. All it is is a piece of flat ground with a tractor and a machine on it that turns it over.

Mr RAY WILLIAMS: That is already done with green waste.

CHAIR: That is what Waste Services NSW does.

Mr RAY WILLIAMS: That is exactly right.

CHAIR: When you look at it as part of a trading scheme, and the uncertainty about the measuring of the carbon cycle and ensuring the performance of soil carbon, do you want to make a statement?

Mr KIELY: The Kyoto part one was full of mistakes. Kyoto has got a principle of learning by doing. It says, don't wait for perfect knowledge, dive in the pool and learn it as you go because we have a major disaster on our hands if we do not do something soon. We believe that approach should be taken with soil carbon. We should just get into the market and be ready to make mistakes, and assume we have been wrong and look for the problem. You only pay people for what they grow: it is as simple as that. No-one will run off with a bag full of money because they have sold a bunch of smoke and mirrors. It has got to be proved that it is there. We are willing to be part of the most rigorous regime. No-one as yet taken it upon themselves to sketch out what a regime would look like. They only list all the problems. I keep saying to them "If the energy that had been expended in finding

reasons why we can't trade soil carbon in finding had been expended in finding solutions to how we could, we would be trading it now and pulling 10 giga tonnes out of the atmosphere." It is a great psychological mystery to me why we are not doing it.

CHAIR: I hope it is a step in your journey. Thank you for addressing the committee.

Mr KIELY: It has been honour and I wish you well.

Mr GERARD MARTIN: At some time if the committee wants to look at some projects would you be happy?

Mr KIELY: Yes, the Central West is open for business. Our websites are the best repository of information, particularly the blog site. We will be building a new website in the next month.

CHAIR: Maybe if you took out the word "blog" the scientists might come flocking.

(Witness Retired)

WARWICK CHARLES RAGG, Chief Executive, Australian Forest Growers, 29 Torrens Street, Braddon, ACT, sworn and examined:

CHAIR: Thank you for appearing today to provide evidence on the Natural Resource Management (Climate Change) Committee's inquiry. I am advised that you have been issued with a copy of the Committee's terms of reference and a copy of the Legislative Assembly's Standing Orders Nos 291, 292 and 293 that relate to the examination of witnesses. Is that correct?

Mr RAGG: That is correct.

CHAIR: Would you like to make an opening statement before the Committee members ask questions?

Mr RAGG: Briefly. In the interests of disclosure—I stress I do not appear in any of these capacities—I am also a member of the Australian Landcare Council and an alternate member of the Natural Resources Advisory Council in New South Wales, and I have had some input into their submission to this Committee. For my sins I am also a member of the National Gorse Taskforce, which is charged with controlling or eradicating gorse.

I commend the Australian Forest Growers' [AFG] submission to you. While we do not resile from anything in that submission as at 2007, the debate on climate change and emissions trading is, as you would undoubtedly be aware, very fluid. While some of the things in here are still relevant they have perhaps moved on a bit and hopefully we can address those during the course of the discussion.

I have technical difficulty on whether I can table this document. It is a summary position submission to the Garnaut climate change review on emissions trading and I am not aware it has been published by Garnaut yet, so I may be unable to table it until such time as that is the case. By way of background I will give you half a dozen key points of what we are seeking from an Australian emissions trading scheme [ETS], which you may find of relevance to the Committee's deliberations.

Essentially we are seeking an Australian emissions trading scheme that allows optional participation of post-1990 reafforestation projects through either an offset or a New Zealand-style inclusion from scheme commencement, which is 1 July 2010; incorporates carbon in stored wood products during use and after disposal as a priority; provides incentives for the use of bioenergy and does not create unnecessary impediments to the use of forest-based material for energy; includes measures to maintain the competitiveness of trade-exposed yet emissions-intensive elements of the forests processing industry, for example pulp and paper and reconstituted board products; and contains an assessment of the merits of the future coverage of pre-1990 plantations on the proviso that the ETS incorporates carbon stored in wood products. Significant work needs to be undertaken to assess the implications of any form of inclusion of native forests in an ETS. With respect to those last two points, we have some strong concerns about any proposals for the immediate inclusion of native forests. There is some surrounding topping and tailing detail in the document, but I think that is probably sufficient to give you a picture.

I am more than happy to have a discussion. In the context of overarching comments and what the impacts of an emissions trading scheme might be on the forestry sector in respect of natural resource management, fundamentally the answer is it depends. It depends on what the trading system looks like; who is eligible and the timing of that eligibility; the transaction costs of being able to comply or participate in an emissions trading scheme; and varying levels of market distortions which may or may not become obvious during the course of the development and implementation of an emissions trading scheme.

Having said that, we believe that a range of opportunities exist, particularly for forests on private lands. They are probably best summarised as follows: We think there are substantial opportunities for utilisation of forest residue for biomass energy. By way of example, there is currently a plant being piloted in northern New South Wales by a company called EthTech, which is looking to extract ethanol from woody residues through a process called ethanol via lignocellulosics. We also believe there are opportunities—we hope this is the first of a suite of market-based instruments for biophysical assets; that is, carbon. We still see capacity for similar markets to be established—not controlled—by governments for other biophysical assets such as biodiversity, water

quality etcetera. We believe there is substantial opportunity for greater focus on integrated establishment of forestry in the agricultural landscape, both to assist the competitive neutrality of agriculture in a carbon sense and to provide feedstock to those biomass and other types of measures.

I refer to some of the threats from climate change—I prefer to talk about it in the context of managing climate variability rather than climate change because it is probably a little bit long term for some immediate investment decisions. The nature of forests is that it is a long-term crop so our difficulty in making changes is enhanced. If there are some rapid climate variability changes such as temperature, rainfall and increased pest pressure, our capacity to change to a different feedstock is perhaps much more limited than for other agricultural pursuits. If we do not get formal recognition of carbon sequestered in harvested wood products we believe that will be outside the purity of the market because it ignores part of the cycle of the carbon, if you like. It will be a lost opportunity for the forests sector. We are strongly of the view that the emissions intensive sectors of the industry that I referred to before need to be addressed adequately so that their international competitiveness can remain. We are also concerned that the climate predictions—and everyone has a different one—may be over- or understated and we may act pre-emptively in a direction that subsequently proves to be the wrong direction.

The final point I want to make before our discussion is that we are also concerned that in the design of an emissions trading scheme there could be market and other impediments in a distortive capacity that may undermine the competitive capacity of products from the forest industry; for example, the capacity for ethanol derived from woody biomass to compete in the marketplace.

Mr GERARD MARTIN: I have a question about the emissions trading scheme which is obviously—

Mr RAGG: The one that we do not know what it looks like yet!

Mr GERARD MARTIN: Exactly. Given that you have made a submission to Garnaut, what sort of model would you suggest?

Mr RAGG: Our fundamental model at the moment is that post-1990 plantations—afforestation—should be able to at least participate as an offset in an emissions trading scheme. We believe substantial resources should be made available to finalise this and ensure we have statistically robust data for measurement and allocation of carbon sequestered in harvested wood products. We think further work should be done on pre-1990 forests and native forests to pursue their capacity to participate and what that really means. Can I just say that some of the work we have had done by forest scientists suggests that in forests, particularly native forests, carbon balance is essentially neutral. I am talking about production native forests here. Carbon builds up, you harvest, it builds up and, depending on the estate size, it will affect how flat that sawtooth becomes. I think that diagram is in our submission.

From my core constituency's perspective, we are concerned that the cost of compliance may be more than the carbon benefit in-forest, because of the cost of measurement and the comparative neutrality of the carbon balance of the forest. Regarding the previous speaker, we are also interested in seeing how carbon can be measured and whether there is a benefit to that for forestry. We see some scope there for that, given that there is very little disturbance in forestry for a long time, which I understand would do soil carbon very well; it would seem to enhance its sequestration and the soil. We want a scheme we can operate in, we want a scheme that does not hurt us financially to comply with, and we want one that is equitable.

CHAIR: At the last hearing we heard that there are risks to agriculture and water availability of forests planted solely to sequestered carbon. Does your association have any view on these planning requirements?

Mr RAGG: In respect of water, we of course do not deny that trees use water. We think some of the debate about water use of trees is drastically overstated. Clearly, there are other enterprises that use more water, perhaps for less economic return. You take which scientist you like and put him on the table to support your case. We are not yet convinced by ABARE's modelling that says there are going to be 40 million hectares of forest established for carbon only, that it is in any

way likely. We, as an industry, are focused on plantation establishment signatories to the Plantations for Australia: The 2020 Vision, which contemplates the establishment of up to three million hectares by 2020. We are just over halfway now, and that started in 1997.

We cannot see where the economic value is in carbon-only plantings, unless it is in very low rainfall areas and very low land cost. Arable land in Australia is a finite resource. I would have thought, without being a market or an analyst, that it is unlikely that there is going to be sufficient economic value in a carbon-only crop to sustain large tracts of land being taken out of agricultural production.

Mr GERARD MARTIN: In relation to the science in this whole debate on climate change, as someone who is out there in the market or trying to develop policies and so on, you have to go looking for information. Do you think there is enough credible science out there? We have heard varying conflicts that it is all manufactured—

Mr RAGG: Are you talking about the science on whether the globe is warming, or the science on how to deal with that?

Mr GERARD MARTIN: Both, but if you could start with the first one.

Mr RAGG: In respect of the first one, I cannot help but make the observation that apparently our warmest year was 1998. I will leave you to draw your own conclusions about what that means. Having said that, it is difficult not to be compelled by the capacity of the scientists who have been involved in the IPCC process. The concern we would have is what the likely outcome is, rather than what the predicted outcome is. Because it is a model, and because it is a model of several models and the error must expand, I guess we are of the view that we need to play the part we can play in the removal of carbon from the atmosphere, and that is our focus. If the science is telling us that it is going to be warmer, then we need to take that into account—or warmer and drier, depending on where you are. We need to take that into account in the context of what sort of investment decisions our industry makes.

Having said that, it would seem to me, from some of the science I have been exposed to, that there are also opportunities in previously underutilised areas of the continent—not so much in New South Wales but certainly, as I understand it, there is expected to be more rainfall in the tropical areas and it would seem to me to be logical to explore what sort of opportunities that might present for a whole range of industries. We would consider ourselves to be part of that.

In answer to the second part of your question, the science of how to adapt to climate change seems to be more vague to us, and all our submissions have said that we need to have a lot more work done on a range of issues. The example I have given you is in the context of carbon sequestered in harvested wood products. It would seem to us that, whilst we are confident that there is carbon in this table, and it is pretty obvious that it has been there for a while, to continue to sustain that argument we need better statistically robust science than we currently have. We have proved it is there. We have had people out there digging in rubbish tips and landfills and finding newspapers that are 20 years old, et cetera. So it is clearly there, but as good scientists we need to make sure that we can stand behind those claims that agree it is possible.

Mr MICHAEL DALEY: Have any of your members had any involvement or participation in the New South Wales Government's GGAS Scheme?

Mr RAGG: Only to the extent that NSW Forests is a member of Australian Forest Growers, but not by any mechanism that Australian Forest Growers has negotiated with them. The depth of that question is probably best addressed to NSW Forests.

CHAIR: The Department of Water and Energy released a consultation paper regarding the transitional arrangements for the Greenhouse Gas Reduction Scheme. Did NSW Forests report on that?

Mr RAGG: I cannot speak for NSW Forests, and I was not aware that the discussion paper was out. But I will have look at it. More generically, a couple of the fundamental issues we are

concerned about in a scheme like GGAS are that because our core membership is small growers on small estates, the issues of the requirements of permanence and the demonstration of additionality would seem to make it difficult for us to participate. We have not got the scale in a lot of our members holdings to have a regular enough harvest, nor a big enough estate to ensure that we can participate and have carbon sequestered for 100 years, which is the case with GGAS.

If afforestation were to be a covered sector rather than an offsetting sector, it is our understanding that those issues of additionality and permanence become null and void because you are in a full open trading market, so you pay for your emissions and get credits for your sequestration.

CHAIR: Your submission advocates the facilitation of the pooling of carbon credits under an emissions trading scheme. You pointed out the cost of small-scale operators.

Mr RAGG: Yes. There are a couple of models out there now that are beginning to do that, to recognise that the compliance costs and the measurement costs, and the access to the market for that matter, are problematic for a small individual. But if has an "agent" who is able to act on his behalf and market his carbon, then we find that attractive. We are starting to see that become more and more prevalent—more so in Victoria, but I note that New South Wales is getting some engagement.

The two that are in my mind—and I do not want to be necessarily promoting two and not others—are Landcare Australia's CarbonSMART, which seems to be getting some traction in northern New South Wales. The other one is the model that we are probably more reliant to because it contemplates harvesting of the product, and that is the TreeSmart model. The TreeSmart model pools carbon sequestered and then only markets once it is there in a tree, and they take responsibility for the measurement, the pooling, the marketing, et cetera.

(The witness withdrew)

GEOFFREY MORSE WITHYCOMBE, Executive Officer, Sydney Coastal Councils group, sworn and examined:

CHAIR: I thank Geoff Withycombe, representative for the Sydney Coastal Councils Group, for appearing today to provide evidence to the inquiry of the Standing Committee on Natural Resource Management (Climate Change). I am advised that he has been issued with the Committee's terms of reference and also a copy of Legislative Assembly Standing Orders 291, 292 and 293, which relate to the examination of witnesses.

Mr WITHYCOMBE: I have.

CHAIR: Mr Withycombe, in what capacity are you appearing before the Committee?

Mr WITHYCOMBE: I am executive officer of the Sydney Coastal Councils Group and I am representing the group in that capacity.

CHAIR: Would you like to make an opening statement before Committee members ask you questions?

Mr WITHYCOMBE: Yes, thank you. I would like to give a brief introduction to some of the summary points that are highlighted in our submission, quickly review some of the climate change impacts in the coastal zone and their implications for the State, and then submit some additional evidence for the Committee on three key projects that we are currently undertaking that will be of interest to the Committee, in particular, reports that we have released since preparing our submission. Recognising that coastal areas arguably will face some of the greatest impacts from enhanced climate change, it was a little surprising that the terms of reference were seemingly focused around rural issues. However, from our invitation today, it is apparent that coastal issues will be addressed, and Sydney Coastal Councils, is thankful for that.

Evidence and opinion conclude that coastal areas require a significant focus in any assessment and investigation into climate change vulnerability and the associated management responses. It is well acknowledged that the New South Wales coast is a significant contributor to the State's gross domestic product and requires specialist and focused attention to ensure that this is sustainable, including the consideration of climate change impacts. The coastal zone contains much of the State's critical infrastructure, both of State and national significance, and the New South Wales coast also consists of about 80 per cent of the State's population. The New South Wales coastal zone is also facing some alarming population growth, with the Department of Planning estimating a 60 per cent growth in population over the next 20 to 25 years, creating many significant planning and environmental pressures.

The Sydney Coastal Councils, therefore, strongly encourages the Committee to ensure full consideration of climate change issues in the coastal zone, with a particular focus on vulnerability and the associated issues and needs to increase the resilience of the environment through natural resource management [NRM], the resilience of the community and industry, and the environmental and amenity values of the coast that are cherished by all.

If it is appropriate, I will quickly review some of the climate change impacts facing the coastal zone and some of their implications for the State. Obviously, we will get more intensive storms in our coastal zones, both through east coast lows and potentially tropical cyclones, creating increased storm surges, inundation and some significant erosion problems along our coast. Sea level rises are predicted to increase, with the Australian Insurance Group estimating some 700,000 properties at risk nationally. New South Wales, which is only second behind Queensland, has some 200,000 properties that are classified at risk. In 2005 the Department of Natural Resources estimated that about $1 billion worth of coastal properties are at risk from coastal erosion and flooding over the next century. I am pretty sure that this report had no account for public infrastructure, utilities, open space and environmental goods and services in these areas. In 2005 Risk Frontiers from Macquarie University also estimated that in the Sydney Basin alone some 20,000 properties are at risk, being located less than one kilometre from the shoreline and less than three metres above sea level.

Obviously we will get significant changes in rainfall with a lot of regional uncertainty. Droughts and floods will have significant impacts on all aspects of natural resource management, and including impacts in relation to the infrastructure capacity of both State and local government assets. Temperature is predicted to increase in both means and peaks, with increases in heat waves and associated issues such as energy demand and heat island effects, particularly in urban areas, with associated health concerns. It is surprising to know that in Sydney it is estimated that currently 176 people die each year from heat-related stress. This is predicted to increase from 432 to 1,042 deaths each year over the next century. Obvious increases in this bush fire intensity due to less rainfall and increased heat, and that will have significant impacts on some of the ecological values of our environment across the State, including economic functions, and the community will be burdened with related economic impacts.

The Sydney Metropolitan Catchment Management Authority estimated that councils spend some $200 million each year on natural resource management alone. We must ensure that this investment is wise for the future. As I said previously, the biggest climate change impact in the New South Wales coastal zone relate to the significant population increases that will occur over the next 20 years, being up to 60 per cent. I have a whole list of issues, needs and limitations of local government, but I will not run through those unless I am requested to do so.

I would like now to table my first piece of additional evidence—a project we are undertaking in partnership with the CSIRO called, "A systems approach to regional climate change adaptation and strategy in a metropolis." Its aim is to develop and trial methods for a systems approach to regional climate change adaptation strategies in large urban areas. I have here the full report that was released to the public and to stakeholders three weeks ago, and also some summary reports that members might like to look at.

This very significant project, part of one of five national flagship projects, is a four-stage program. The first stage, which I released to the Committee today, is the creation of vulnerability templates or vulnerability mapping. The second stage is a series of 15 local government workshops, which we held with all our councils at the end of last year to determine regional vulnerabilities, drivers, barriers and opportunities. Currently we are undertaking the third stage of this project, which is a case study analysis of local government properties and capacities for adaptation, including existing adaptation measures and adaptive capacity of those councils.

Through the workshops we identified three crosscutting issues that will be investigated as part of the workshops. These are community, infrastructure, and decision making/planning. The report I tabled is additional evidence and provides some details of the climate change basics, climate change predictions in the Sydney Coastal Council's region, defining what is meant by vulnerability and vulnerability assessment, and provides regional results on vulnerability assessments for five key areas being heat related or human health, sea level rise and coastal management, extreme rainfall and stormwater management, bushfire, and natural ecosystems and assets.

The vulnerability assessment and mapping component was framed as the manner presented by the Intergovernmental Panel on Climate Change [IPCC], which is the degree to which a system is susceptible to and unable to cope with adverse effects of climate change, including climate variability and extremes. I shall quickly review some of the key results and uses of this significant report. Climate change vulnerability is driven as much by the physical changes in the climate as factors such as the demographics, economy, landscape and infrastructure that influences the sensitivity of places and people to climate changes and their capacity to respond to reduce the risks. Different areas in Sydney will experience different climate change in different ways, depending on the geographical location, their demographics and the resources and tools at their disposal to manage future climate risks.

Vulnerability is closely correlated with human development patterns, indicating human agency or human activity and decision making as core components of vulnerability. The last key result is that landscape diversity associated with large urban councils creates additional burden on having to cope with different types of vulnerability scattered across large geographical areas. Obviously, this is particularly relevant to western New South Wales. The key uses of the report are as follows. Firstly these were used pretty much as stimulus as part of the 15 council workshops, but stakeholder feedback via the workshops suggested that the approach taken to mapping vulnerability offered a number of

advantages, particularly with respect to communicating the spatial dynamics of risk as well as the diversity of factors that contribute to vulnerability.

The assessment indicated where some of the key challenges for each council are and where councils may adopt to do more detailed assessments. The vulnerability assessment is an essential first stage to understand the impacts of climate change on any region and to help move towards effective and adaptive management. Combining the vulnerability assessment results with the council's own knowledge and risk management experience will improve the understanding and thinking behind the implications of climate change and what will be needed for communities to respond.

The second piece of evidence I table today is another project we are doing. It is just a fact sheet, but might be of interest to the Committee. It is a project we are undertaking in partnership with the University of New South Wales through a PhD program entitled "Quantifying the Value of Sydney Beaches in order to assess the cost benefit of necessary coastal protection/abatement measures as a result of enhanced climate change impacts." The aim of this project is to perform a true, complete valuation of Sydney's beaches to develop a process to assist both State and local governments to make more informed decisions on how to protect coastal infrastructure and beach amenity at threat of coastal erosion due to enhanced climate change.

The outcomes will provide a greater efficiency in the allocation of management resources and improve transparency and decision making as local and State governments must soon respond to coastal erosion risk and other predicted climate change impacts. It is hoped also that the methodology produced as part of this report will be very useful for other man-made and natural systems. The last bit of evidence I table before questions is a report that we have done in partnership with the New South Wales Environmental Defenders Office [EDO]. I understand the Committee had a presentation from the EDO this morning. The report is entitled, "An assessment of Australian and NSW legislation and government policy provisions relating to climate change relevant to regional and metropolitan coastal councils."

The project aims to identify where the terms "climate change", "greenhouse" and "sea level rise" occur in all Acts, regulations, environmental planning instrument and policies at Commonwealth, New South Wales and local government levels, to provide an analysis and interpretation of responsibilities necessary and the necessary actions of councils in New South Wales to implement those provisions, and also to examine some common law liability issues.

In conclusion, in some of the summaries of the audit, it must be noted that the audit did not include the term "sustainability", which has implications in its own right, The outcomes of the audit include that very few instruments in New South Wales even mention climate change. Those that do, place very few obligations on councils. Councils are potentially open to liability only where climate change is not considered at all. Unreasonable decisions obviously are not protected. There is a clear case for reform. Lastly, the summaries of outcomes in terms of the common law liability, is that the law of negligence and nuisance are most relevant to climate change, and this is significantly modified by legislation, particularly under section 733 of the Local Government Act, where councils are indemnified if they follow and develop coastline and flood management plans under the relevant State manuals in good faith. It is strongly suggested that the committee consider these provisions. These types of provisions may need to be further considered for application in other future hazards of climate change.

Mr GERARD MARTIN: Obviously you are funded by your member councils?

Mr WITHYCOMBE: Yes, we are.

Mr GERARD MARTIN: In the Federal Government, Minister Wong announced funding for coastal councils to look at the impacts. There was talk about the Newcastle area, the Central Coast and further up. Have you had any involvement with that?

Mr WITHYCOMBE: Yes. We have some knowledge of that. We were hoping to put in a tender to look at the Sydney coastal region. They have picked six regions across the country to look at as part of the National Coastal vulnerability assessment. That will be concluding by the end of this year. There are some concerns about the resolution and outcomes of those projects; will they be useful

for local government and what is their intended use? Are they mainly to look at where Federal Government and State agency funding in particular may be required? These will provide demonstration projects for other areas on key issues such as estuarine processes, key infrastructure and other natural resource management [NRM] issues. The six sites are predetermined. The tender is currently being advertised.

Mr GERARD MARTIN: You are hoping for good information out of that?

Mr WITHYCOMBE: I think there will be some great information, particularly as the six case study sites will look at different aspects of vulnerability in climate change. I have however some significant concerns in relation to the information that will be provided. There is no doubt that in New South Wales we have some limited information, particularly geospacial information, such as the necessary information layers such as LIDAR, the high-resolution laser scanning of the landscapes. An excellent project has just been completed by the Department of Planning on that process. It provides very accurate elevation of the coastal zone.

We need this information desperately for councils to be able to properly strategically plan for development, and also natural resource management. There are some back-of-envelope estimates that this would cost up to the 10-metre contour line just $6 million to do the whole State and another $6 million to do the necessary near-shore waters that would be required to do the necessary modelling. An investment of $12 million across the whole State to allow councils to more accurately predict where things like sea level rise will occur, is a bargain. Some of the assets on the New South Wales coast, single houses are worth way more than $12 million. So I strongly encourage the Government to think about undertaking that process for the State.

As part of regional planning processes and under the standard LEP, there is very limited guidance for councils to implement proactive adaptive management measures. It is almost critically impossible to undertake these processes and modelling requirements without some fundamental information. A $12 million investment for the future will be critically important. One of the key things that I keep saying is that we need to make sure we do not build liabilities for the future. We should make sure that our investment in natural resource management is also appropriate. Without some of these fundamental data layers and the modelling to go with it, we will have significant trouble to address climate change in the future.

Mr GERARD MARTIN: Perhaps part of the dilemma you have is if councils undertake work that they see as mitigating, could they end up being a potential liability down the track if they do not work?

Mr WITHYCOMBE: Yes, the big black cloud of liability. That is something we need to address significantly. As we know the regional strategies released by the New South Wales Government have a whole series of development, aspirations I suppose, for the New South Wales coast to deal with the 60 per cent predicted growth. You would have to consider whether it is appropriate and responsible government to keep issuing 117 directions for councils and simply allow them to work out where development should go, without providing some of the necessary information and guidance that they require.

We have some development proposals already in existence, and for the future, around our estuaries and our coastal lagoons, which inevitably will be inundated in future climate change. Without that level of data in the modelling, how will we make wise investments for the future? It is a really significant issue. The other significant issue, one that needs to be addressed, is the inconsistencies between the natural resource management targets and the planning strategies undertaken by the New South Wales Government.

I strongly encourage the New South Wales Government to ensure the incorporation of the NRM targets into the planning process, at the moment they are not, and also encourage the Government to listen more closely to Dr John Williams, their appointed natural resource management commissioner, who has been advocating for the need to incorporate these targets into the planning system. Again, issuing 117 directions for councils to try to work out the conflicting issues of both those strategies is of concern. We need more guidance and consistency across those two fundamental strategies for the future of the New South Wales environment.

CHAIR: Earlier you noted that the terms of reference may have been a little light on for coastal regions, or did not focus on rural areas. How could the committee rectify that? What would be your specific issues that coastal councils would like addressed?

Mr WITHYCOMBE: As I mentioned before, what is required is to make sure the coastal zone is developed sustainably and that we protect the amenity and environmental values that we have. There was no criticism there. It was a general observation of the salinity issues, farming practices and other NRM issues. We have significant pressures on the existing environment in the coastal zone, let alone some of the infrastructure provisions, including our major ports and other industries and all the housing issues. These areas are probably most at risk in terms of future impacts.

There is a whole series of things that the committee could do. I just encourage that. The coastal zones are probably facing the greatest pressures, in terms of our population growth and environmental management. We specifically need to focus in that zone as well as deal with some major rural issues, salinity and other issues in western New South Wales.

Mr MICHAEL DALEY: In your brief introduction of the report, The Systems Approach to Regional Climate Change Adaptation Strategies in Metropolitan Policies, the phrase you used was that there were significant drivers and opportunities. What are some of the opportunities?

Mr WITHYCOMBE: It is interesting that some of the results we had from the workshops are that some impediments and opportunities are similar. Some of the opportunities include increasing the political will to provide clear leadership to address these issues; opportunities for key education and awareness raising; the need to make sure that we have consistent messages in relation to climate change, often there is a lot of noise out there, particularly a lack of guidance; more guidance on model policies and programs that councils can implement; the availability of funding and research, particularly the need for increased partnership between government, community, industry and the research sector.

Other opportunities include new technologies and innovative ideas, particularly looking at some international examples and across jurisdictional examples with other States; and opportunities to provide a regional approach to these issues. I think the Sydney Coastal Council provides a great overarching regional entity to help a group of councils to do that. We need to look at other regional processes and support mechanisms for regional councils to get together to work collectively. We need to make sure that new development is appropriate and does not provide us with any liabilities for the future. There is an opportunity there to look at building codes, zoning issues, and even the scary concept for governments about down zoning areas. We need to look at greater regional advocacy to make sure we have the players out there encouraging governments and local members to take on issues. There are significant opportunities to enhance State and Federal government policy on these issues. Again, I highlight the need for increased partnerships with government, utilities, education and business.

Mr GERARD MARTIN: You used the term "downzoning".

Mr WITHYCOMBE: Yes.

Mr GERARD MARTIN: Can you elaborate on that?

Mr WITHYCOMBE: I am probably not the best to speak on this, but basically where an area is currently zoned residential there may have to be opportunities in the future where that needs to be reduced to open space because if we do develop in those areas in the future they may be critically at risk, which obviously will be a burden on all.

Mr GERARD MARTIN: Sure to be controversial—

Mr WITHYCOMBE: Rather controversial and it is not something the State Government wishes to do, Again it pushes back to the point that without the data, without these maps to look at where the future impacts will be and the models, how do we predict where this will occur? It is something we seriously need to consider.

Mr MICHAEL DALEY: Leading on from that, how would you like to see section 733 of the Local Government Act reformed?

Mr WITHYCOMBE: I think section 733, which provides indemnifications where councils follow a State policy, is a useful provision. Obviously it encourages councils to take a proactive approach in terms of providing the strategic approach to these critical issues such as floods and coastal management. There are ample provisions to increase the level of coverage of those manuals. We could have manuals on all types of natural impacts of climate change, where councils are encouraged through some partnership funding and government policy to implement strategies for the local areas. We currently deal with coastal issues. We could deal with forestry issues, NRM issues, bushfire issues—a whole range of different natural resource management criteria that we should be looking at to provide indemnifications for councils or incentives for councils to look at this proactively and strategically to ensure that we are addressing it to reduce their liability but to give them incentives to start doing what they need to do.

Again, this requires State Government policy on these issues. It provides guidance and also there will be some aspects that will require some investment from State Government to partner with councils to undertake these processes. It is a real opportunity. It is concerning that some councils even in the New South Wales coast still do not have coastline management plans. So there is potential liability there where they are not looking strategically and providing a strategic approach in good faith to protect assets and other environmental values of the coast.

Mr GERARD MARTIN: Just on the timeframes that the Government needs, do you agree that the clock is ticking pretty quickly?

Mr WITHYCOMBE: I think it is. In particular, we have some significant issues where infrastructure is already in place that is, as we know, at threat. That is a major issue for the community. For example, Narrabeen-Collaroy is classified as the third most critical coastal employment at threat of coastal erosion in the country. We have some $300 million worth of assets on that beach. So the timeframes are obviously critical. One thing we need to do is to start looking at the NRM targets as well as the regional strategies to ensure that we are not building liabilities for the future. We have enough issues to deal with in the future in terms of what is already there. If we start building infrastructure, utilities, residential development in potential future flood plains or inundation zones we will have real strife. So we need to address these issues strategically to make sure that we are not building anything inappropriate now. I think the time has ticked in terms of that. We need to address that and then we need to somehow get back into the critical hot spots to address existing values.

Mr MICHAEL DALEY: In my council area, which is Randwick council, council officers—I must be careful what I say here—have started to pay particular heed to things like one in 50 and one in 100 year flood levels in the past decade. They will all have to be reviewed. It makes it very difficult to forecast.

Mr WITHYCOMBE: They will indeed. I think the Minister for Planning is currently seeking an appeal in the High Court exactly in relation to this issue, for a planning provision at Sandon Point. The court had determined—I am not an expert on this, I would like to reaffirm—but the Land and Environment Court made a decision that the State Government had not included climate change when it imposed a one in 100 year flood zone. So it needed to add extra, they were inferring, to the climate change impacts. This is why again we need the basic data were flooding will occur but we also need some of the modelling, so we can run different scenarios about these things. Obviously this is a very controversial issue for governments and the community when we increase flood layer levels.

Mr MICHAEL DALEY: It is a very inexact science.

Mr WITHYCOMBE: It is an inexact science but we can make good predictions. One key concern I have personally is that we need to ensure that we have proper disclosure to our communities. Often communities will accept a level of risk. If these flood plain levels increase in time because of climate change, which they will, we need to have proper disclosure to the community to

allow them to have the knowledge that they are on the edges of a flood zone and therefore have the associated building codes and other emergency service provisions to cope with that risk of a hazard when it occurs. So we need proper disclosure. We need to tell people what things will happen, and at this stage in some respects we do not.

CHAIR: It was a concise but informative report. You should note that the EDO did submit to us earlier this morning so we did discuss that aspect of your collaboration. We note that your approach to regional climate change adaptation strategies for metro policies hit metro media.

Mr WITHYCOMBE: It did indeed.

CHAIR: Was it Randwick or Rockdale?

Mr WITHYCOMBE: No, basically Rockdale and the Botany area were quite focussed on in the media.

CHAIR: Thank you for your submission.

Mr WITHYCOMBE: Thank you for your time. I look forward to seeing the report.

(The witness withdrew)

(Luncheon adjournment)

CHRISTOPHER DAVIS, University of Technology, P.O. Box 123, Broadway, 2007, and

CAROLINE GAY PALMER, Director, Institute for Water and Environmental Resource Management, University of Technology, P.O. Box 123, Broadway, sworn and examined:

CHAIR: Have you been given a copy of the terms of reference of the committee?

Mr DAVIS: Yes, that is right.

CHAIR: Have you also received a copy of Standing Orders 291, 292 and 293 of the Legislative Assembly in elation to the examination of witnesses?

Mr DAVIS: Yes.

CHAIR: In what capacity do you appear before the committee?

Mr DAVIS: Originally I am an engineer but my role at the moment is sustainability, business development manager for the University Of Technology. It is in that the capacity that I am appearing.

Ms PALMER: I am an ecologist and I am the Director of the Institute for Water and Environmental Resource Management at the university. It is in that capacity that I am appearing.

CHAIR: Do you want to make an opening statement?

Mr DAVIS: I would like to make two quick caveats and then make three points about our submission and then we would be happy to take questions. First of all I was briefed when making the submission by a scientist from the Faculty of Science at UTS who subsequently left. So I was left a little like a shag on a rock. I am not convinced that I have the scientific depth to probe some of the concepts fully, but Tally Palmer is an expert ecologist and I am hoping she can back me up where I fall short.

We made a reasonably succinct submission to the committee, and I would like to pull out three points that I would like to make this afternoon, if I may, before we start. Our feeling is that emission reduction is the key to the State dealing with climate change, with rigorous carbon accounting and prudent land management. That cannot be substituted for by trying to manipulate natural systems to achieve the same amount of carbon sequestration to balance. The second point I would like to make is that we really need to exercise caution in developing natural resource base interventions because you can create unstable or perverse outcomes. That is an area where I do not have particular expertise but Tally can certainly back me up if we would like to explore that. It is something people have fairly simple intuitive ideas about what might be a good thing in terms of sequestration but you can create a very perverse result by so doing.

Finally, given the real depth of greenhouse gas emissions reductions we need to aim for in the fullness of time, we do not really have the luxury of doing a little bit of this or a little bit of that. We really have to look at every single emission reduction and amelioration step that we can take and invoke them all full tilt because that is the only way we are going to make any real difference. That is all we wanted to say for opening. We would be happy to answer questions.

CHAIR: Today the committee heard from the Carbon Coalition Against Global Warming in relation to increasing the carbon loading in soils. Is there any research that you know of at the University of Technology, Sydney that is looking at soils?

Ms PALMER: We have a researcher who is looking at fly ash as a remediation agent for soils which may also contribute to the carbon content in soil. It would be unlikely to be applicable at a very large scale in terms of a Continental landscape scale. The scale of application of that kind of technology is likely to be in agricultural circumstances where the added aspects—it is very often used to mitigate pH imbalances in the soil, but it would not be something you would be likely to use as your major way to increase carbon in soil content.

CHAIR: The person referred to that research or some other farmers using coal by products on their farm. The transport costs of the materials was prohibitive. I note the caveat at the beginning of the submission but there is a lot of uncertainties surrounding the effects of climate change will really be on a local level and that stakeholders need to be briefed about the ambiguity. Who should be responsible for briefing those stakeholders. How should that be done?

Mr DAVIS: There is a lot of modelling work going on because the global models that have been done by the IPCC are at a very crude resolution, something like 200 kilometre grid which does not help anyone in a micro climate at all. CSIRO scientists are currently running very detailed models that are resolving down to a grid of a few kilometres, I think. I know it has been done for south-east Queensland and it has been done, I think, for Western Australia as well. That starts to provide detailed information for farming regions and for natural resource management areas as such. But there are many different models and they tend to give different results. So what they try to do is run many models and come up with the sort of consensus outcome and then take that. People like to have a degree of certainty but the modelling cannot provide certainty; it provides a balance of judgement as to where things might go but never a definitive answer.

Mr MICHAEL DALEY: You mentioned that manipulation of natural resource management would lead to some perverse outcomes. What are some examples of what those outcomes might be?

Ms PALMER: When you are dealing with the way in which vegetation mediates carbon sequestration you need to also remember that vegetation also mediates water balance. So in Australia most of the water that falls ends up being transpired by the vegetation up to 80 per cent.

As you look at vegetation in terms of its ability to sequester carbon both above ground in its biomass and below ground in soil processes you might look at either clearing or planting or a range of activities that would increase carbon sequestration and you would also affect water balance issues and vulnerability to fire. As soon as you have fire involved in the ecosystem carbon balance issues are severely affected. I think the point we are making is that when somebody comes up with a submission that says, "If we plant these sorts of plants we will sequester this many tonnes of carbon", it requires an ecosystem-wide critical approach as to whether on balance that will affect water balance and whether it will achieve carbon sequestration in the long term.

Mr MICHAEL DALEY: That would not be the case for rehabilitative planting on a large scale though, would it? If you were rehabilitating denuded land—

Ms PALMER: No, if you were rehabilitating natural vegetation. The natural bush is the greatest asset in terms of both water balance and carbon sequestration, so rehabilitation is unlikely to have a perverse effect.

Mr MICHAEL DALEY: One of the comments you made, Chris, was that we should not do a little bit of this and a little bit of that, we need to do them all; yet one of your conclusions says that emissions reduction, rigorous carbon accounting and prudent land management practices must take precedence over attempts to manipulate natural systems. Are they not exclusive statements?

Mr DAVIS: I can understand that it might come across that way. I guess the point was that we do not see any merit in people trying to duck responsibility for emissions control by using offsets or manipulating the environment. Having done what you can in emissions control you should still do whatever sensible actions can be done in natural resource management to achieve better results. It is not a trade-off; it is both, but the priority is emissions first and manipulation second.

Ms PALMER: Could I just go back to your question for a minute? One of the things to understand is that as plants grow the rate at which they sequester carbon changes.

Mr MICHAEL DALEY: Does it increase or decrease?

Ms PALMER: It decreases with time, so the longer a vegetation area has been in place, the less it is increasing the rate of sequestration. As you newly rehabilitate an area, the rate of sequestration will be higher than when that area reaches a stable condition. I think the point we were

making is that it is not an area where you simply say that just planting things is going to help. It needs quite a careful analysis of which plants in which area and over what time frame you are likely to achieve the end points that you are going to say you have achieved.

Mr MICHAEL DALEY: But as a bald principle it is much better to have as many trees as possible in the ground than not, regardless of their rate of uptake. As a permanent sequestration model, it is better to have them.

Ms PALMER: Yes, the tree will be holding carbon.

Mr DAVIS: If you harvest the timber and use it in construction and encapsulate it and preserve it, you have locked that carbon away pretty effectively. If it is in the natural environment and can degrade, then the carbon gets back into the cycle and there is a steady state instead of a locking-up or an accretion of carbon.

CHAIR: Getting back to the submission from the Carbon Coalition Against Global Warming, the type of crop is important if we are looking at some sort of trading scheme or how the soil can enter that biodiversity market. What is farmed or cropped is important.

Ms PALMER: Yes. Different species have different capacities for increasing the carbon in the soil. I do not know the actual research to hand but I would be able to look it up. I would be interested in terms of the scale of these effects. The difference between species is going to be much smaller than the level at which you might be interested as a trading level. I think that is a true statement, but I would question whether the scale of the statement is sufficient to be material.

CHAIR: In the submissions today and at a previous hearing we have talked about emissions trading in carbon rather than biodiversity trading. Do you have any thoughts on using biodiversity trading rather than trading in carbon?

Mr DAVIS: I think that gets quite esoteric and it is very hard to compare apples with apples in that sphere. I think there is a general concern that people have latched onto forestry as being a cheap "out" for dealing with carbon amelioration. Some forestry activities are better than others and I think the tax angle has made that a more perverse play than it was initially, so it is a very fraught area as to whether that proposition is sustainable or whether it is a combination of a tax lurk and a soft landing for an energy hungry industry.

CHAIR: The representative from the University of New South Wales this morning said that in another way. The carbon offsets to try to make flying carbon neutral are huge, but is it as beneficial to the emissions trading schemes that we will need to have in the future?

Ms PALMER: When you raise the question of biodiversity you are raising a kind of accounting that is qualitatively different. Some of the reasons that we promote biodiversity are qualitatively different from the carbon issue. I agree with Chris: it would be a difficult area to be crisp about. Earlier, you referred in your very first question to how you thought you would delegate or make sure that information about land management was dispersed at the landholder level. Australia has pioneered land care internationally.

In both New South Wales and Victoria a catchment management authority model of catchment management has been established. So there has been a lot of investment and capacity in that kind of communication. Organisations like Land and Water Australia have an excellent amount of knowledge in management and knowledge exchange. We should not underestimate the capacity of our Australian nation to engage in wise land management if the right directions and incentives are in place.

Mr MICHAEL DALEY: Ultimately, land care management would be a matter of economics, would it not? A lot of that is economically driven now, is it not? You said that we should not underestimate Australia's capacity to do things like that.

Ms PALMER: I was talking about whether you wanted to do so. It was about how you would get information. If you wanted to use the landscape in carbon sequestration in wise land

management, the institutional structure exists for correct information to be disseminated. It is not that the decisions are easy; the decisions are complex and difficult. Once there is a direction and a decision, the capacity to communicate that information is in place.

CHAIR: The Committee received your submission before two major events occurred, that is, Professor Garnaut's report and the Prime Minister signing the Kyoto protocol. Would you like to add anything to your submission, or would you like to add anything else, as there is a discussion paper on emissions trading schemes?

Mr DAVIS: Very simply, I think we were glad to see the Kyoto protocol signed. That was quite a powerful gesture on part of the new Government. I am quite interested to see how some sectors are trying to vilify Professor Garnaut for his advice, but so far as I can see he is pretty straight and he is producing an excellent report. So we endorse both those directions.

CHAIR: Can you outline some of the research that you are doing in the climate change area—research that you have not included in your submission?

Ms PALMER: At the moment the issue on which I am concerned about putting a proposal to the Australian Research Council is the link between ecological and social systems, the strong evidence that managing systems as social ecological systems and looking at governance and institutional responsiveness to ecological information are likely to enable us to respond to climate change challenges better than we can at the moment.

In Australia we have a lot of information and a lot of capacity. We have not managed to translate our knowledge and institutional capacity into an improved quality of landscape. Our landscapes are deteriorating and climate change is a strong exacerbating factor. It seems that the gap is in the ability of managing institutions to implement the information in a way that fits in with the social, institutional and political landscape of the time. An area in which research is quite thin on the ground is how we bridge those gaps—those knowledge or process gaps.

Mr DAVIS: Another dimension of research, not under Tally's area but in the Institute for Sustainable Futures, is energy efficiency. The way the institutions work in energy is that the grid providers are simply reimbursed for whatever grid they provide; they have no incentive to make things more efficient. That means hot spots that are underresourced for energy are serviced by building more expensive grid, whereas another way to do it is to make that little hot spot more efficient with energy, or to use alternative forms of energy to cut their demand. That is something that the energy industry really needs to take on board and internalise so that it can deliver a better outcome and lower greenhouse gas emissions.

Mr MICHAEL DALEY: Do you have examples of any geographical areas?

Mr DAVIS: No, not specifically. We have a Geographical Information System [GIS] map of Sydney that is coded red for bad and green for doing well. They are very small.

Mr MICHAEL DALEY: Does it relate to usage?

Mr DAVIS: It relates to having enough energy to get to that area. I can send you a copy of the GIS.

Mr MICHAEL DALEY: I would be interested to see that.

Mr DAVIS: It relates to pockets: it might be a corner of Chatswood and a bit of Maroubra. The detail is very fine. The knee-jerk reaction is to spend $1 billion on more transformers and more cables, whereas if you did an efficiency exercise with that community you would remove the need and you would have less carbon emission. I can certainly send the GIS to the secretariat.

Ms PALMER: Large-scale global climate change models that have been used to estimate the effects in Australia are underusing biological information. A lot of research in our climate change focus is to put the biology or ecology into the large-scale models, both terrestrially across the landscape and also in the oceans with phyto-plankton. So that is a strong modelling component.

CHAIR: We have Hydrilla depressa in the Penrith Lakes to monitor little mussels.

Mr DAVIS: An invasive species?

CHAIR: They are native to the upper reaches of the Nepean. They have been put into the Penrith Lakes to restore the balance. It is a purpose-built lake. They want to ensure that the ecology is as good as it can be. One of the indicators is the Hydrilla depressa that go in and do what have they have to do in a natural state. They are comparing the two. I think another university is helping us out with that one. Those are the sorts of biological approaches that we need. We could all engineer a lake system, but are we engineering an ecological and functioning lake system and, when humans arrive at the Penrith Lakes, will the water be of the quality to which we aspire?

(**The witnesses withdrew**)

COLIN DAVID WOODROFFE, Coordinator, GeoQuest Research Centre, School of Earth and Environmental Sciences, University of Wollongong, New South Wales, sworn and

ROSS ANDREW BRADSTOCK, Director, Centre for Environmental Risk Management of Bushfires, University of Wollongong, affirmed and examined:

CHAIR: I thank Professor Woodroffe and Professor Bradstock, representatives of GeoQuest Research Centre, University of Wollongong for appearing to give evidence to the inquiry of the Standing Committee on Natural Resource Management (Climate Change). I am advised that you have received a copy of the terms of reference of the inquiry and also a copy of Legislative Assembly Standing Orders 291, 292 and 293 that relate to the examination of witnesses. Is that correct?

Professor WOODROFFE: Yes.

Professor BRADSTOCK: Yes.

CHAIR: Would you care to make a presentation first and some opening statements before we proceed to questions?

Professor WOODROFFE: Thank you. The University of Wollongong is one of Australia's major research institutions, and within the university's Faculty of Science the three academic units—the Schools of Chemistry, Biological Sciences, and Earth and Environmental Sciences—there is research that focuses on the science and the consequences of climate change, and the adaptive management strategies that might best deal with those consequences. We have also developed an extensive network of contacts in the region and provide expert advice in terms of natural resources policy, research and management to a large number of community groups, government agencies and industries. I speak on behalf of my colleagues in the Faculty of Science, and also as a lead author on the Intergovernmental Panel on Climate Change [IPCC] Fourth Assessment report, published last year, in which I wrote on the impacts, vulnerability and adaptation of coastal systems.

In our submission to the Standing Committee on Natural Resource Management (Climate Change), we stress that it is important that governments continue, and indeed expand, the current funding available for research and monitoring activities related to the condition of the State's natural resources, because the consequences of climate change are likely to be substantial, but remain difficult to predict in precise terms. There are limits to the extent to which science will be able to provide information about the precise extent of changes that will occur and the type of management and policy options that could be applied. This situation demands an adaptive management approach.

Absolutely critical to understanding the likely consequences of human-induced climate change on land, water and other natural resources in New South Wales, and how to best manage these resources under conditions of climate change, is to project with the best possible precision how average and extreme temperatures and precipitation will change in each region of this State. It is important to separate the short-term conditions of the current drought over the past five or six years from the longer-term effects that climate changes will bring.

Researchers in the GeoQuest Research Centre are studying the geologically recent past, and in particular an episode known as the hypsithermal—about 8000 to 3000 years ago—which appears from pollen evidence to have been warmer than now. Their preliminary interpretations indicate that it is likely to have been wetter, probably with larger rivers and higher and more permanent lakes than is currently the case. Such palaeoclimatic studies augment projections from different global climate models. The global climate models all indicate a warming trend, but they show a range of results in how precipitation will change.

The Centre for Atmospheric Chemistry at the University of Wollongong is monitoring and quantifying greenhouse gas concentrations—carbon dioxide, methane and nitrous oxide—as part of the international Network for Detection of Atmospheric Composition Change. These researchers have developed Fourier Transform Infrared spectrometry technology and the site at Wollongong is the only one in New South Wales where this approach is used to monitor these atmospheric gases. They are examining also how agricultural management practices might change greenhouse gas emissions of

methane and nitrous oxide at sites such as cattle feedlots in Victoria, New South Wales and Queensland.

Our researchers are investigating also climate-change implications of whole-of-catchment issues through measurement and modelling of soil erosion, and through the re-use of effluent on land and the management of nutrients on farms. Effluent reuse will retain water on the land and ensure that some of the included nutrients are utilised by plants, limiting their loss into waterways. A large proportion of the population of New South Wales is concentrated along the coastline. It is clear that climate change will have significant impacts on coastal settlements and ecosystems.

I have been involved with the preliminary stages of a national coastal vulnerability assessment as part of the National Climate Change Adaptation Framework. This has been focused on identifying sections of the coast that are more at risk from climate change than others. However, further scientific research is needed to integrate this preliminary classification of shoreline stability with our scientific knowledge of the processes of erosion and deposition along the shore, and also to incorporate modelling and monitoring of past and current change. Although a rise in sea level is being experienced along the New South Wales coast, our preliminary results indicate the potential effectiveness of careful management of beaches, dunes and their vegetation as approaches to adaptation, and reinforce the value of establishing monitoring programs in typical settings and along critical developed coasts.

Other researchers in the School of Biological Sciences are investigating the impact of climate change on vegetation, with the aim of understanding how plants might deal with the predicted increases in extreme temperatures, probable decreases in water availability and the altered incidence of bushfires. My colleague Professor Ross Bradstock will summarise this component of our submission.

Professor BRADSTOCK: I shall emphasise some of the points in the submission regarding issues with plant growth and bushfires. As we noted in our submission, it is important to emphasize that bushfires are an integral part of the Australian environment. Effects of bushfires on ecosystems and natural resources are complex and multi-faceted. Fires are cyclical in our environment and the frequency with which they occur as well as their intensity can have both positive and negative effects on ecosystems and human assets. For example, many plants in the Australian bush are dependent on relatively regular fire for their persistence. While there may be short-term effects of fires on, for example, yield of water from catchments, that yield in the longer-term will be dependent on maintaining vegetation with a favourable cycle of fire. This small example is indicative of the subtle power of fire in shaping our environments and the resources that they yield.

Fires are a property of the climate and vegetation that we live within. They are the outcome of plant life and the natural processes that shape it. Because of this we can anticipate important but complex effects of global change on fire activity. The trend toward increased drying and more frequent drought along with associated increases in temperature will possibly make landscapes in the wetter eastern half of New South Wales more ignitable. This is because forest-litter fuels will be drier and thus available to burn more often. Conversely, the same general effects of decreased moisture and increased drought frequency may make parts of western New South Wales less ignitable by decreasing the growth of grasses and herbage that are primary fuel for bushfires in the dry country.

Poorly understood effects of elevated carbon dioxide on plant growth and the breakdown of dead plant material, which makes up bushfire fuel, may either exacerbate or ameliorate these scenarios—we do not really know. Researchers are beginning to piece together the elements of the problem but are a long way from reaching a definitive solution. In particular, the task of unravelling the joint effects of increased temperature, changes to moisture—both the amount and seasonality of rainfall—and elevated carbon dioxide is formidable. This problem requires extensive experimentation, which is currently lacking.

Understanding the problem not only has relevance to bushfires via effects on plant growth and fuel, but also is relevant to understanding the capacity per se of our natural ecosystems to cope with global change. The quirks of our indigenous ecosystems, such as our low fertility soils and the unique evolutionary heritage of our biota, mean that solutions derived overseas may not be applicable to our local environments. I emphasise that as being particularly important. We have highlighted some

of the research strengths in the School of Biological Sciences and the Institute for Conservation Biology and Law in this regard.

Days of extremely high temperature, experienced in recent summers, may become more frequent in future and may push plants and animals beyond normal limits of tolerance. Gaps in vegetation created by this source of mortality may exacerbate potential invasion of exotic species, particularly if exotic plants are more able to cope with high temperature events. Changes to the season of rainfall under climate change may have important effects of changes on native, exotic and crop plants. Predictions suggest that we may see a pronounced shift to summer rainfall through much of New South Wales. This may alter the balance, for example, between tropical and temperate grasses in some of our native ecosystems and open up opportunities for exotic species. Again, research is in its infancy to understand the implications of these predictions.

I have merely hinted at some of the effects of bushfires and native vegetation resources. A preliminary national assessment of the vulnerability of our reserve systems was recently completed by CSIRO, and I commend it. It highlighted a number of regions in southern Australia as being most at risk. This conclusion is somewhat contrary to previous predictions. These include much of the tablelands and slopes of New South Wales. The rapidity of predicted climatic change is unprecedented in recent ecological history, for example the last 20,000 years, in many local ecosystems.

While there have been times in the past when we have experienced warmer and wetter conditions than at present, there is considerable concern that rapid climate change is taking us into a warmer and drier epoch—perhaps beyond the range experienced by many ecosystems over recent evolutionary timescales. This places considerable pressure on science to rapidly solve highly complex problems. I have hinted at a few of those. Needless to say, appropriate resources must be provided to meet the challenge. Equally, we need to up the ante in the way that we manage our natural ecosystems and the resources that they yield. A universal conclusion of the many reviews and assessments directed at effects of climate change is that our capacity to measure and monitor the effectiveness of management actions needs considerable improvement.

Also there are opportunities, particularly in the management of ecosystems in a carbon trading and emission offset economy, and at the moment there are examples in the Northern Territory that have been developed to manage fire in a landscape in ways which initially offset nitrous oxide and methane emissions by changing the way that things are done. There is considerable interest in extending that approach to southern Australia. The university is involved in a proposal.

Mr MICHAEL DALEY: On your concluding issue, the Chair and I attended a conference in Darwin last year hosted by the Parliament. The theme of the conference was Ancient Knowledge and Science in Contemporary Resource Management. We saw some of their exercises, particularly where indigenous people burnt off in the wet season to better control resources. That has an effect on carbon being released into the atmosphere. Are there any potential applications for that in New South Wales?

Professor BRADSTOCK: Yes. It has been suggested and it is fair to say that there are some projects on the drawing board to look at the feasibility of that. We think that amongst the interested researchers we have sufficient data to do a viability assessment.

Mr MICHAEL DALEY: Has anything been published yet?

Professor BRADSTOCK: No. A fair bit of work has to be done but it could be done in a reasonably short time frame, about 18 months. There are some holes in the information that we need. It is well to emphasise that the Northern Territory model has been based on decades of solid research.

Mr MICHAEL DALEY: In 40,000 years of practice?

Professor BRADSTOCK: Yes. There are still many unknowns in the equation.

Mr MICHAEL DALEY: Such as?

Professor BRADSTOCK: They are still not totally sure that the styles of land management will yield the benefits in offsetting emissions through change in areas burnt. It is an hypothesis.

Mr MICHAEL DALEY: But in land management it is sound?

Professor BRADSTOCK: It is worth a go. They still had to measure definitively the outcome of those sorts of practices.

CHAIR: The research that has been ongoing obviously could be paralleled here?

Professor BRADSTOCK: Yes.

CHAIR: Our land management would also have an impact on World Heritage, as does the Northern Territory. In my area of Penrith and the lower mountains we have burn off for keeping down the fuel load, and when and where it occurs, and how it occurs, obviously would be part of that research for our eastern seaboard?

Professor BRADSTOCK: Yes. That is a long-standing problem. How much burning to do, where to do it, to mitigate risk to all sorts of things. It is a complex problem.

Mr MICHAEL DALEY: It is also very unemotional.

Professor BRADSTOCK: It is, it is an emotional and political issue, but it is a formidable scientific problem. The solutions to that are still being worked on in local environments. The literal solution in the Northern Territory will not translate here. We have to work out the analogous solution because of the rate of all the things which drive fire down here are different from the Northern Territory. The vegetation is different.

Mr MICHAEL DALEY: There are more than two seasons down here as well.

Professor BRADSTOCK: That is right.

CHAIR: Your submission stated that through your research you believed that climate change will create more rainfall and permanent flows into rivers and streams rather than more arid conditions. What impacts will they have?

Professor WOODROFFE: We did not say that, what we said was that researchers looking at the past have interpreted that the one time in the past, the most recent time, when the temperature appears to be warmer, that it appears to have been wetter.

Mr MICHAEL DALEY: Globally?

Professor WOODROFFE: No, just in this part of New South Wales. For instance evidence from Lake George, which seems to contain much more water. There is evidence of shorelines on Lake George that imply that there was a wetter set of conditions at those times. The research on Lake George is quite old, it was from several decades ago. My colleagues based their similar results on the fact that alluvium in floodplains seems to be absent at that time. So the floodplains have been building up sediment since about 3,000 years ago. But they found a lack of those sorts of floodplains and they infer that rivers may have been bigger when it was warmer in the past.

Whether that translates directly into an analogy of what would happen in the future, as you would be aware, the climate models actually show wetter conditions and some show drier conditions. There is a large range in what the different models show.

Mr MICHAEL DALEY: Overall or in certain parts?

Professor WOODROFFE: Both globally, and particularly in this part of Australia. For instance, the Sydney Coastal Councils Group released a report earlier that was based on CSIRO modelling that showed consistent predictions that temperatures for 2030 and 2070 will rise, but the predictions on precipitation are both increases and decreases. It is more complex again because it may

simply be that rainfall occurs less frequently but in more intense storms. There is less certainty of the modelling outcomes, or less consensus. Different models show different responses for precipitation. I think we are still unclear, although in south-eastern Australia the drying seems to be the most likely outcome.

In south-western Australia in the 1970s there was a very pronounced decrease in rainfall around Perth. That has been picked up historically. For the projections for the future there is a large variability in whether it is wetter or drier.

CHAIR: In your research you looked at plant species in New South Wales and the effect that climate change would have on them. You said that no research has been conducted on which native species are most likely to be at risk of temperatures. Do you think that research needs to be conducted urgently into that, so that natural resource managers can formulate plans to combat these losses?

Professor BRADSTOCK: It is a very pressing need for experimental research. We can infer certain things by looking at patterns, the way plants are distributed across the environment now in relation to things like rainfall and temperature. So we can glean something, and there is a considerable amount of work going on looking at those patterns but the sort of experimentation component that is needed to back that up is one of the critical things that needs to be done. It is not only temperature change and the effects of, say, extreme temperatures, which we have a little bit of work going on at Wollongong, particularly through my colleague Professor Sharon Robinson. It is not only the temperature and moisture effects. I would highlight the need to do work on elevated carbon dioxide. That is where experimental work needs to be done. There is a lot of work going on overseas but that sort of thing is in its infancy in Australia. It is well worth emphasising that carbon dioxide is the variable which we know is changing pretty quickly. That is actually measured. The other changes to climate are predicted on the basis of those changes in carbon dioxide so pinpointing the carbon dioxide effects on plant growth are particularly important.

Mr MICHAEL DALEY: That was one of the things I would like you to have elaborated on a little bit more—how the different changes in atmospheric carbon dioxide might have an impact on plant growth.

Professor BRADSTOCK: One theory is that carbon dioxide can be regarded as a fertiliser. It can increase plant growth because plants use water more efficiently.

Mr MICHAEL DALEY: The higher the carbon dioxide.

Professor BRADSTOCK: Yes. But that is not an open-ended effect. There is a considerable body of theory to say that other factors such as the availability of phosphorus and nitrogen in the soil—that phosphorus and nitrogen are essentially the fertile elements in the soil—will constrain that effect so in soils with low phosphorus and nitrogen it is speculated that the fertilisation effect may not be as strong in terms of plants growing in those soils. It is interesting because most Australian ecosystems are low fertility systems. Our soils are very poor in phosphorus and nitrogen naturally, so our plants have been adapted in an evolutionary sense to cope with that. So the question is: Will the fertilisation effect on plant growth of elevated carbon dioxide play out under our local environmental conditions in our poor soils, in our species of plants and animals which have evolved over 100 million years to cope with those soils? No-one really knows that. Experiments are being done overseas on different plants under different soils to scrutinise that but those results may not necessarily translate effectively to our local soil.

Mr MICHAEL DALEY: Is there a possibility that, given the relationship between those three chemicals that you get, if you like, the fertilisation effect and high atmospheric carbon dioxide could slow plant growth?

Professor BRADSTOCK: No, I do not think so. If it does play out, if the fertilisation effect does play out, one of the twists in the tale is that essentially plants will grow in such a way that the ratio of carbon to nitrogen in their leaves will change. They will grow by fixing more carbon—in other words, increasing the amount of carbon relative to the amount of nitrogen in their tissues—

Mr MICHAEL DALEY: That is a good thing, is it not, for sequestration purposes?

Professor BRADSTOCK: It may be for sequestration but consider this aspect. Leaves that are higher in their ratio of carbon and nitrogen do not break down as quickly. So in terms of bushfire fuels, it means more fuel.

Mr MICHAEL DALEY: And that would have an application for native animals that eat them, too, would it not?

Professor BRADSTOCK: Yes, that is right. In other words they are less palatable.

Mr MICHAEL DALEY: Does it have a positive application potentially for agriculture? Their lettuces might grow more quickly.

Professor BRADSTOCK: Or be more chewy.

Mr MICHAEL DALEY: Bad example.

Professor BRADSTOCK: They are speculative possibilities that people are talking about.

Mr MICHAEL DALEY: Who is leading that research in Australia?

Professor BRADSTOCK: There is a number of experimental facilities going on around the place. For example, there is local research at the University of Western Sydney.

Mr MICHAEL DALEY: We might pay a visit to one of those facilities.

Professor BRADSTOCK: They have growth chambers set up with trees, with eucalypts. They are trying to grow trees under elevated carbon dioxide. That is one of the leading experiments in the country and on our doorstep. It would be well worth checking that out.

CHAIR: You mentioned that research also investigated whole-of-catchment issues related to land and water resources. Can you tell the Committee a little about that research and some of the whole-of-catchment solutions you have come up with?

Professor WOODROFFE: There are some issues in relation to soil erosion and soil loss that will presumably change under climate change, but again that will be very dependent on the changes in precipitation. So if rainfall events are more intense I would anticipate a larger run-off of soil from catchment areas. Again, we have already indicated the uncertainty about the precipitation trends. The other area of research that has been undertaken at Wollongong is looking at recycling of effluent on farms. That has been an experimental piece of work that I think has shown that it is a worthwhile practice to promote.

CHAIR: What is the source of the effluent?

Professor WOODROFFE: I am not absolutely sure. I think it probably varies from industrial effluent from the Shoalhaven region where we have done quite a bit of research.

CHAIR: From an STP?

Professor WOODROFFE: Sorry?

CHAIR: From a sewage treatment plant.

Professor WOODROFFE: There are programs looking at that in the Shoalhaven but I was thinking also of the starch and dairy processing plants on the Shoalhaven River. I think the work has been related to that but I could follow that up. I am not familiar with the details of the projects.

CHAIR: The previous speaker from the Carbon Coalition Against Global Warming related to the increase of products from Waste Services New South Wales where a lot of the putrescible waste

is ripped up, aerated, conveyed, end product is being experimentally poured into farms in western New South Wales. So that reuse of biproduct is out there. That is a similar type of research.

Professor WOODROFFE: Yes. I cannot expand on that, I am sorry.

CHAIR: What you are doing is looking at using it as a natural fertiliser rather than purchasing?

Professor WOODROFFE: That is right, although perhaps less from the fertilisation point of view than from the management of the waste that is generated. So I think it is particularly in those areas.

CHAIR: So it is focusing on the land itself and land form and the reuse of effluent rather than what it is doing to soil?

Professor WOODROFFE: Yes, I think that is right at this stage.

Mr GERARD MARTIN: In relation to the science about climate control in general, I know you say in your submission that you cannot be precise about predictions. Are you as professionals comfortable about the integrity or the rigour of the scientific data that you are using?

Professor WOODROFFE: I can probably respond to that as a lead author on the IPCC, the Intergovernmental Panel on Climate Change. I would have to say that that is a unique scientific process. It is the Intergovernmental Panel on Climate Change so it is a process whereby the science is done by the scientists, peer reviewed on several occasions and then reviewed by governments so yes, I believe that the contents of the Fourth Assessment report are as close as you can get or have ever got in terms of scientific consensus.

Professor BRADSTOCK: I certainly endorse that.

Mr MICHAEL DALEY: Professor Andy Pitman was strongly endorsing it as well this morning.

Professor BRADSTOCK: I am sure he was.

CHAIR: So did the representatives of the University of Technology, Sydney. You made your submission prior to the Kyoto Protocol being signed and also the discussion paper of Professor Garnaut's on emission trading schemes. Do you have a concluding comment about those two matters?

Professor WOODROFFE: I noticed you had the inquiry into emissions trading schemes and I am a scientist and representing scientists across the Faculty of Science. We had no particular submission to make on that. I think it is probably beyond the expertise that we have to make a serious comment.

Professor BRADSTOCK: Obviously we are proposing to do work looking at fire management, land management, emissions and the carbon consequences of that, particularly as we have discussed it and extension of models to southern Australia, so that is an area of interest to me.

CHAIR: Across the Eastern Seaboard, you are not looking specifically to Wollongong?

Professor BRADSTOCK: Put it this way, I suppose we are looking at it from the point of view of the broad sweep of southern Australia fire prone vegetation. There are about 20 million hectares plus of forest across southern Australia. So if you look at that as a whole, that is highly fire-prone country. The potential for managing that in a way that fits into a carbon trading economy at some stage is something worth checking out.

Mr MICHAEL DALEY: I do not understand that as a carbon sequestration theory. For example, in the Northern Territory a grassland of about 10 centimetres high has a certain bio mass and therefore a certain amount of carbon sequestrated in it which, when burnt, is released into the atmosphere. The grass grows back to be 40 centimetres high, which captures more carbon, the same

biomass, and it is burnt down. Are you not just continually capturing and releasing the identical amount of carbon?

Professor BRADSTOCK: Yes, you are right.

Mr MICHAEL DALEY: How is that a useful sequestration tool?

Professor BRADSTOCK: The key is not above ground but what is below ground. It is the soil. My colleagues, for example, at CSIRO in Darwin have estimated, they like to say, 1 tonne per hectare per year potential sequestration in the soil.

Mr MICHAEL DALEY: It is keeping the roots healthy.

Professor BRADSTOCK: That is right. There is a potential relationship between what goes on above ground in terms of disturbance by fire and what is happening underneath. So that potential in southern Australia needs to be looked at.

CHAIR: Is that indicative of native species? This morning a person said that the potential for native root storage is far greater than others?

Professor BRADSTOCK: Yes, that needs to be understood.

CHAIR: Do we need more science on that as well?

Professor BRADSTOCK: Yes, that is right.

Mr MICHAEL DALEY: When will that be ready?

Professor WOODROFFE: When it is funded.

CHAIR: You mentioned the name of a scientist in that field of soil science? Was it Robinson?

Professor BRADSTOCK: I mentioned Sharon Robinson. Sharon is in Biological Sciences at the University of Wollongong. She is interested in temperature affects on plants. She is not working necessarily on carbon sequestration.

CHAIR: Who is?

Professor BRADSTOCK: There are a variety of players around the traps. Some work is going on at Monash and also at CSIRO looking at these questions, at least, in southern forests.

(Witnesses Retired)

LEISL MARIE BAUMGARTEN, Deputy Director General, Department of Water and Energy, 227 Elizabeth Street, Sydney, and

DAVID FRANK HEMMING, Manager, Sustainable Energy, Department of Water and Energy, 227 Elizabeth Street, Sydney, affirmed as under:

CHAIR: I thank you for appearing today to provide evidence before the Natural Resource Management (Climate Change) committee inquiry. I am advised that you have been issued with a copy of the terms of reference and also Standing Orders 291, 292 and 293 that relate to the examination of witnesses. Is that correct?

Ms BAUMGARTNER: It is.

CHAIR: In what capacity do you appear before the committee?

Ms BAUMGARTNER: I appear as an officer of the department.

Mr HEMMING: I am one of the architects of GGAS—Greenhouse Gas Reduction Scheme. I appear as an officer of the department.

CHAIR: Do you want to make any introductory remarks?

Mr HEMMING: We will only be addressing issues relating to terms of reference (b) transitional arrangements for participants in the New South Wales emissions scheme to a national scheme, in the context of natural resource management. The New South Wales emissions scheme—the Greenhouse Gas Reduction Scheme [GGAS]—commenced in 2003. It is established under part 8A of the Electricity Supply Act 1995. Its focus is fairly solidly on the electricity sector in New South Wales. The aims of the scheme are to reduce greenhouse gas emissions associated with the production and use of electricity and to encourage participation in activities to offset the production of greenhouse gas emissions. That is taken straight from the objects of the legislation.

The reason for appearing is that one of the range of eligible activities, one of several, relates to sequestration of carbon by planting trees on eligible lands. I do not know whether you want me to talk any more about the way the scheme operates?

CHAIR: Yes.

Mr HEMMING: Reliable parties under GGAS are electricity retailers licensed in New South Wales and some other parties. Reliable parties meet their obligations under GGAS by surrendering abatement certificates to the scheme regulator. Those abatement certificates can be created by a range of activities, including improved efficiency of electricity generation or greater use of low greenhouse intensive fuels, actions that reduce the consumption of electricity, actions that reduce greenhouse emissions from industrial processes and sequestration of carbon by planting trees on eligible lands.

Electricity retailers are able to pass on the costs of their compliance to customers, however GGAS aims to bring forward the lowest cost abatement to meet annual greenhouse targets. GGAS was originally established to operate until 2012 but in November 2006 the Electricity Supply Act was amended to extend GGAS to 2021 unless and until a national emissions trading scheme was implemented. The amendments provided a legislative trigger for GGAS to be brought to an end. The purpose of the New South Wales Government in extending GGAS was to provide greater investment certainty by ensuring that greenhouse gas abatement projects continue to be encouraged through a price signal either through the New South Wales emission scheme or through a national scheme.

Mr GERARD MARTIN: Could you give us some comparison between what Professor Garnaut is proposing and GGAS? Is that possible?

Mr HEMMING: GGAS is a baseline and credit scheme whereas what is proposed by Professor Garnaut and had been proposed by a number of earlier studies, both by the States and the

Prime Minister's task group, was a cap and trade scheme, which effectively caps emissions and allows trading of permits to meet those emissions. GGAS operates by providing credits for activities that achieve greenhouse abatement relative to a baseline.

CHAIR: I note there is now a consultation paper out that the Minister put forward in relation to the transitional arrangements. How do you see New South Wales or the GGAS scheme fitting in with the national policy framework now being developed?

Ms BAUMGARTNER: It is a bit of an iterative process for us. The process of determining how the transition from GGAS to a national emissions trading scheme [NETS] will work is one that requires some information about what the NETS will actually look like. We need to have an understanding of what we are transitioning to so that we can sort out what that transition path will look like. By the same token, as we have outlined in the paper, the process of development of the NETS will be alive to the issues of transition from GGAS. It is a process that requires a fair amount of close cooperation between New South Wales and the Commonwealth and we are working through that process at the moment. Until we have a clearer understanding of what NETS will look like, that transition process cannot be finalised. It will take some time.

Mr GERARD MARTIN: Is there not any feedback from the Federal people?

Ms BAUMGARTNER: We are working with the Commonwealth at the moment through the various Council of Australian Governments [COAG] working group processes and we are participating in the Commonwealth's process. It is a process that will take some as we sort through and the Garnaut process proceeds. As we get further down the track the transition process will become much clearer. It is certainly one where there is a high level of cooperation.

Mr GERARD MARTIN: Given that the Federal scheme is to come in—in 2010 is it?

Ms BAUMGARTNER: That is the plan.

Mr GERARD MARTIN: Are we months away from getting the model?

Mr HEMMING: The Commonwealth is releasing a green paper in July this year—I do not remember the exact details of the timetable—with draft legislation coming forward towards the end of this year and expected to be passed some time around March next year.

Mr GERARD MARTIN: So at this time next year we will be sitting here picking it to pieces or praising it.

Ms BAUMGARTNER: We will have a much better idea of what that looks like and we will have a very clear understanding of how that transition process will work. For us it is about ensuring that the transition process continues to ensure that we have the right investment signals for the right kind of investment.

Mr GERARD MARTIN: You might have answered this in your opening statement. Have you had any direct input into Garnaut's musings?

Mr HEMMING: The New South Wales Government has made submissions to papers that have been released by Garnaut. We have had discussions with Professor Garnaut over a number of issues, including GGAS transition.

Mr MICHAEL DALEY: What was the gist of those submissions?

Ms BAUMGARTNER: The New South Wales submissions to the Garnaut process, as I understand it, are publicly available. They run through the gamut of issues that we think NETS should be alive to. The Garnaut process is looking at the shape of NETS. The transition process is part of the work that the New South Wales Government is doing with the Commonwealth Government and that is probably the area where that transition work is happening more intensively, and part of those COAG subgroups. There is a COAG Working Group on Climate Change and Water and that is one area where a key part of the discussions is occurring at the moment. I think the December timeline

they are looking at means we will then have a much clearer picture. The Garnaut work can then feed back into the Commonwealth and New South Wales work, and that is really where the two dovetail.

CHAIR: What types of organisations made submissions to the consultation paper about the transitional arrangements for GGAS that closed in April?

Mr HEMMING: A wide range. We had something like 27 submissions, of which 20 indicated they were not confidential so in due course they will be on the Department of Water and Energy website. The types of organisations included generators, retailers, a carbon sequestration provider, and several companies active in energy efficiency measures. There were quite a number of generators, both large and small, and a number of operators of landfill sites with generation, and waste mine gas generation.

Mr GERARD MARTIN: What is the next step in the consultation process?

Mr HEMMING: As part of the consultation process the Minister established a GGAS-NETS transition working group with again a broad range of stakeholders in the outcomes of the transition. That working group is chaired by Leisl.

DEPUTY CHAIR: Who is on that working group?

Mr HEMMING: How long have you got?

Ms BAUMGARTNER: It is a very large and broad working group.

DEPUTY CHAIR: Not the people, just some of the groups that are represented.

Mr HEMMING: I will just run through the organisations. They include: CO2 Australia Ltd, which is one of the participants in GGAS; Origin Energy, Energy Developments Ltd, Energy Supply Association of Australia; TRUenergy; Australian Aluminium Council; Energy Retailers Association of Australia; Australian Financial Markets Association; Australian Plantation Products and Paper Industry Council; Centre for Energy and Environmental Markets at the University of New South Wales; and the New South Wales Minerals Council.

There is a second working group looking at energy efficiency, and the chair of that working group is Martijn Wilder of Baker & McKenzie Australia. Other organisations include the Asia-Pacific Emissions Trading Forum, Climate Action Network Australia, the Energy Users Association of Australia, the Cement Industry Federation, the Total Environment Centre, the Clean Energy Council, the National Generators Forum, Environment Business Australia, the ACT Government, which has a similar scheme which we will also be transitioning, and a range of New South Wales Government agencies with interests in the issues. Even with that wide membership, we were being lobbied for other people to come on, but we have run out of room in our boardroom.

Ms BAUMGARTNER: We have made sure that we have a representative group and, where possible, the industry associations so that all the key players are represented. I think everyone would acknowledge that everyone is represented.

ACTING-CHAIR (Mr Michael Daley): So the outcomes of that working group will really drive the process?

Ms BAUMGARTNER: That is right.

Mr HEMMING: Their terms of reference are to provide a report to the Minister, so that is the next step.

ACTING-CHAIR (Mr Michael Daley): With regard to the submissions to the consultation paper, did any submissions bring to light any issues that you had not foreseen?

Mr HEMMING: Really only at the margin. There was broad acceptance of the positions that were in the consultation paper.

ACTING-CHAIR (Mr Michael Daley): What about with respect to the transitional arrangements?

Mr HEMMING: What particular transitional arrangements do you mean? The consultation paper covered the whole range of issues.

Ms BAUMGARTNER: One of the issues for us is that the stakeholders are facing the same issues we are facing: that until they know better where they are going, it is difficult to give us really detailed comments. So at the moment, as David says, we have comments back from stakeholders that are pretty much raising the issues we thought they would raise, but until we get into that really detailed step once we have a much better idea of the destination, that is where it I think we will get into the nitty-gritty with individual participants raising issues with us that want to make sure that in the new world order with the nets they continue to see a similar regime or issues that they want resolved, resolved. At this stage it is still quite high level; once those submissions are made public you will be able to see that they are quite high level. We are also still going through them, because we still have one or two submissions dribbling in at the moment. There is nothing to say that someone might come up with something that is quite significant.

ACTING-CHAIR (Mr Michael Daley): Would either of you like to add anything in conclusion?

Mr HEMMING: We said that this is about natural resource management. In terms of the whole gamut of the operation of GGAS, the carbon sequestration to date has been a relatively modest part. Of something like 67 million abatement certificates that have been created to date, only of the order of 2 per cent are represented by carbon sequestration. There might be a variety of reasons for that, but certainly prior to the commencement of GGAS the expectation was that there might be significantly more coming through this. But that has not proven to be the case.

Mr GERARD MARTIN: Is that to do with a lack of incentives?

Mr HEMMING: In a sense, GGAS was the only incentive in town. Part of it, I suspect, could be to do with the rigour that is implied in the particular rule that applies to carbon sequestration. GGAS was one of the first, if not the first, emissions trading schemes in the world, and certainly trying to estimate to the extent necessary for prices to be paid for carbon sequestration, again it was very much cutting edge. So, not surprisingly, the scheme design took a relatively conservative position.

Ms BAUMGARTNER: The other issue there is that percentage wise we also had, I think, a higher degree of success with some of the demand side abatement than we had originally expected. 67 million certificates created is far more than we needed to meet the target, so we have a fair amount of surplus there. A large proportion came from demand side abatement, which we were not necessarily expecting, so it pushes that proportion down a little as well.

(The witnesses withdrew)

(The Committee adjourned at 2.45 p.m.)