

Chapter 3

What is at risk?

3.1 This chapter will cover what is at risk should these proposed cuts to CSIRO staff go ahead. This includes: Australia's ability to obtain and utilise climate data; using climate data to produce effective adaptation and mitigation policies; industry and organisations that rely on CSIRO climate data and the lasting impacts for Australia's educational sector and Tasmania's economy. The chapter also considers the effects the proposed cuts will have on Australia's international standing and environmental obligations and examines an identified trend of reducing investment in public good research.

Climate monitoring, modelling and data collection

3.2 While there was consensus among witnesses that 'no-one is arguing that the CSIRO should not do more in the area of mitigation and adaptation,'¹ scientists disagreed² with the Chief Executive of the CSIRO, Dr Larry Marshall's contention that as climate change was proven to be real, CSIRO could shift its focus to adaptation and mitigation.³

3.3 Dr Marshall, in a question-and-answer style video to staff on, 10 February 2016, indicated that the climate change science was proved and commented that:

CSIRO's direction has changed, and in the climate area we're shifting from measurement and modelling to mitigation, because that's where we believe we can have the most impact and deliver the most benefit.⁴

3.4 Dr Marshall's assertion that climate change has been established was refuted by Australia's leading scientists. Professor Richard Eckard, climate change agriculture expert appearing in a private capacity, for example, informed the committee that 'science is not static' and that climate measurement needs to continue.⁵

3.5 Moreover, witnesses explained that climate modelling is critical to the development of effective adaptation and mitigation strategies.⁶ Dr Barrie Pittock PSM, former CSIRO physicist, appearing in a private capacity, explained:

1 Professor Haymet, *Proof Committee Hansard*, 11 March 2016, p.60.

2 Mr Tim Moltmann, *Proof Committee Hansard*, 8 March 2016, p. 4.

3 *Estimates Hansard*, 11 February 2016, p. 56. See also Michael Slezak, "Senior CSIRO scientist derides chief executive's claim climate change is answered", *The Guardian*, 5 February 2016.

4 Video, Dr Marshall accessed via <http://www.smh.com.au/federal-politics/political-news/maybe-im-naive-csiros-larry-marshall-tries-again-to-explain-deep-staff-cuts-20160210-gmr03b.html#ixzz4329V9000> (accessed on 16 March 2016).

5 *Proof Committee Hansard*, 11 March 2016, p. 15.

6 Dr Peter Craig, *Proof Committee Hansard*, 11 March 2016, p. 44.

Crucial local effects need to be identified and quantified and relevant input data fed into impacts models so that adaptation can occur at minimum costs and risk.⁷

3.6 Professor Trevor McDougall, oceanographer, appearing in a private capacity also explained that successful climate research is a precursor to successful climate adaption.⁸ In addition, Dr John Church, CSIRO Fellow appearing in a private capacity, also stressed that:

Successful and cost-effective mitigation and adaptation require ongoing and, indeed, strengthened climate science. This is specifically recognised in the Paris agreement, in their call for strengthening scientific knowledge on climate.⁹

3.7 Dr Gwen Fenton, Chief Scientist, Australian Antarctic Division (AAD), from the Department of the Environment, used the Antarctic ice sheet and the Southern Ocean as examples to argue the connection between data collection and adaptation, emphasising that it is critical to know the rate of change:

Understanding the changes and how that could contribute to the globe is very important. The science for that is not all in. There is a lot of information that we still need to gather on that. The natural variability alone is quite impressive. You have to unpick all of that to understand the true signals, what is happening and the rate of change. The rate of change is probably the most important thing that we have understanding for regarding adaptation and mitigation in the future.¹⁰

3.8 Regarding the rate of climate change, on 21 March 2015, the World Meteorological Organization (WMO) released the 'Statement on the Status of the Climate in 2015'. At the release, the WMO Secretary-General Petteri Taalas stated that '[t]he alarming rate of change we are now witnessing in our climate as a result of greenhouse gas emissions is unprecedented in modern records'.¹¹

3.9 Professor David Karoly, atmospheric scientist, appearing in a private capacity echoed the need to continue monitoring climate change to effectively adapt:

The only proofs in science are in pure mathematics, and the only absolute statements come in mathematics. Science is about the collection of evidence, testing it over and over again, and using observations to test models as well as to update information...

7 Dr Barrie Pittock PSM, *Submission 78*, p. 1.

8 Professor Trevor McDougall, *Submission 77*, p. 2.

9 *Proof Committee Hansard*, 8 March 2016, p. 27.

10 *Proof Committee Hansard*, 8 March 2016, p. 11.

11 Available from: <http://public.wmo.int/en/media/press-release/state-of-climate-record-heat-and-weather-extremes> (accessed 29 March 2016)

...If you want to do mitigation, you need to know the system—you need to know how the system will respond—and you have to monitor whatever mitigation action you do.¹²

3.10 The Climate Alliance emphasised that Australia's atmosphere and ocean modelling for weather and climate forecasting are a result of close collaboration between CSIRO, Bureau of Meteorology (BOM) and the academic sector and 'continuity of service delivery is critical'.¹³

3.11 Dr Marshall explained the intent behind his statement on climate change, that it was proven to be real:

...my intent was simply to say there is no question that the climate is changing. There is no question. It is changing, and we have to do something about it. It absolutely was not saying that we do not need to continue doing modelling and measurement but, given the fact that it absolutely is changing, we need to start thinking about what we do to try and mitigate—ideally mitigate or, if we cannot mitigate, adapt.¹⁴

3.12 At an Additional Estimates hearing on 11 February 2016, Dr Marshall clarified that climate measurement would continue:

As I have said, we are continuing our measurements. It is not that we are stopping measuring. We are not the only people doing measurement. You are quite right: in order to know the impact of what we do in mitigation we need measurement, but there are also some things that we can do that we know will improve outcomes.¹⁵

3.13 However, Dr Marshall admitted that climate measurement and modelling would be reduced by approximately half.¹⁶

3.14 Dr Wonhas explained to the committee at a hearing in Hobart on 8 March 2016 that CSIRO are in discussions with key stakeholders regarding their measuring capability:

In those discussions, [with key stakeholders] what we are trying to achieve—given the constraints...—is to identify what the most appropriate capability is that we can maintain in Australia to conduct the vital work that we need to do in measuring and projecting our future climate.¹⁷

3.15 While CSIRO claims to be changing focus to adaption and mitigation, some of the cuts are to adaption too. In response to questions on notice CSIRO confirmed that part of the Land and Water business unit's role was to help Australian cities adapt

12 *Proof Committee Hansard*, 11 March 2016, p. 16. See also The Climate Alliance, *Submission 97*, pp 2-3.

13 *Submission 97*, pp 2-3.

14 *Proof Committee Hansard*, 7 April 2016, p. 23.

15 *Estimates Hansard*, 11 February 2016, p. 59.

16 *Proof Committee Hansard*, 7 April 2016, p. 25.

17 *Proof Committee Hansard*, 8 March 2016, p. 39.

to climate change. When questioned why the CSIRO was cutting jobs in an adaptation unit, CSIRO commented:

CSIRO's work on adaptation and climate change is conducted across several business units and is not confined to one program.¹⁸

3.16 CSIRO acknowledged that the Land and Water business unit works to improve urban systems and networks critical to GDP and productivity in cities. While changes will occur across the entire Land and Water business unit, the CSIRO outlined that:

...the majority of the redundancies will come from three research programs: Liveable, Sustainable and Resilient Cities, Biodiversity Ecosystems Knowledge and Services, and Adaptive Social and Economic Systems. The extent of impacts on all seven Land and Water research programs are not yet clear as CSIRO is still working through the details of the changes.¹⁹

Climate centre announced

3.17 On 26 April 2016, Dr Marshall announced the establishment of a National Climate Research Centre, employing 40 full time CSIRO scientists in Hobart, with 10 years of guaranteed research capability.²⁰

3.18 When queried about the choice of location, Dr Wonhas confirmed that climate modelling and projections, which are the core of this new centre, are currently done in Melbourne.²¹

3.19 Dr Marshall acknowledged that there has been a lot of 'external pressure' on CSIRO to maintain climate science research²² and outlined that the decision was a collaborative effort between CSIRO, BoM and the Chief Scientist Dr Alan Finkel AO:

The Chief Scientist had an idea for an Australian version of the Hadley Centre or Hadley down-under. We had an idea internally prior to that as one of the options we were looking. The Bureau of Meteorology had an idea about transferring people and setting up something slightly different to either of those. Largely speaking, they were three of the options that we looked at.²³

3.20 Dr Marshall outlined what the establishment of the National Climate Research Centre will mean:

It will mean a number of things; primarily the decadal commitment is a major shift. Generally our science programs are locked in for three years.

18 CSIRO, answer to question on notice, 7 April 2016 (received on 18 April 2016).

19 CSIRO, answer to question on notice, 7 April 2016 (received on 18 April 2016).

20 <http://www.csiro.au/en/News/News-releases/2016/CSIRO-Climate-Science-Centre-a-win-for-Australias-future?featured=27F6622E2C954B819F5E36ECE881FA68>

21 *Proof Committee Hansard*, 27 April 2016, p 25.

22 *Proof Committee Hansard*, 27 April 2016, p. 3.

23 *Proof Committee Hansard*, 27 April 2016, p. 18.

Locking it in for 10 years enables really long-term planning, securing all of the assets associated with that in addition to supporting the 40 dedicated climate scientists. For me, our new strategy, which is to substantially deepen our collaboration across innovation system, creating if you like a hub where all of the broader climate science community across the nation can actually come to visit, work collaboratively, will be really important. And then there will be the overarching independent steering committee, made up of people from across the nation who are experts in climate science, looking at not just what the CSIRO does but what the entire innovation system does and providing an independent perspective, independent coordination of national climate research.

Finally, there will be a deeper partnership with the UK meteorology office, possibly even having an exchange of staff between the two locations, giving us access to some of their unique modelling capability, particularly around decadal and seasonal modelling.²⁴

Areas that rely on CSIRO data

3.21 Witnesses outlined to the committee that CSIRO's research was not purely academic and that there are a number of practical applications which rely on CSIRO data, including in the areas of agriculture, wine and defence.

3.22 Professor Eckard explained that Australian agriculture is highly dependent on a stable and predictable climate and noted that:

Australia has some of the highest levels of naturally occurring climate variability year on year. We are 22 per cent more climatically variable than any other country in the world.²⁵

3.23 Professor Eckard indicated that he had spoken with both the National and Victorian Farmer's Federation who expressed their concern about the proposed job cuts.²⁶

3.24 Professor McDougall outlined that Australian industries are looking to CSIRO climate researchers to assist with their response to the climate:

How should we respond? Should I change my farm from being this type of farm to being this type of farm, because I know, as a farmer, I cannot withstand more than two years of drought every 10? If I go to three or four, I have got to change my farm. It is that information which needs to be provided.²⁷

3.25 Professors Stephen Wilson, Clare Murphy and David Griffith emphasised that as a result of the staff cuts to climate science, the real consequence will be a reduction in:

24 *Proof Committee Hansard*, 27 April 2016, p. 18.

25 *Proof Committee Hansard*, 11 March 2016, p. 15.

26 *Proof Committee Hansard*, 11 March 2016, p. 16.

27 *Proof Committee Hansard*, 8 March 2016, p. 34.

...the ability of Australians, especially farmers, those living on the coast or in areas threatened by bushfires, and those threatened by increased mortality from heatwaves, to adapt to climate change.²⁸

3.26 They argued that this information needs to be continually kept up to date, as:

Australia needs the best available information to plan for food security. This requires an understanding of the earth system that is underpinned by the work of CSIRO scientists.²⁹

3.27 Professor Snow Barlow used data from Brown Brothers wineries to show how climate modelling data helps to determine the sensitivity of the industry or region to projected changes in climates. He stressed that adaptation research is an iterative process for industries and communities.³⁰

3.28 Professors Barlow, Karoly and Eckard informed the committee that their research focuses on giving the agricultural and viticultural industry options to cope with changing climate and is therefore heavily dependent on the most up-to-date data to underpin adaptation assessment reviews:

We take the data from the CSIRO-BOM collaboration on regionally downscaled specific climate scenarios and apply that to various agricultural commodities. For example, we have been looking at the pastoral industry. I have some examples here of the scenarios we were running about five years ago showing how climate change would impact the pastoral industry. We have recently run the last 10 years of pasture growth in Victoria—and pasture growth in Victoria looks like our previous 2050 projections. The point is that science is not static. We are actually seeing climate change advancing faster than we thought and agriculture is starting to suffer the impacts already. If we were using projections from five years ago in what we are doing now, we would be wrong.³¹

3.29 Mr Tim Moltmann, Director of the IMOS, University of Tasmania, and Dr Peter Craig, Director, Collaboration for Australian Weather and Climate Research, respectively told the committee that climate modelling is important to Australia's national security. Australia's defence forces, particularly the Navy, use the up-to-date environmental information, provided by CSIRO for defence purposes:

So we are getting climate quality data but we are also getting operational quality data that can be used to give our Defence Force best environmental information in the field, which is incredibly important.³²

3.30 In relation to defence, Dr Matear stated:

28 Professor Neville Nicholls, *Submission 80*, p. 3-4.

29 Associate Professor Stephen Wilson, Associate Professor Clare Murphy and Professor David Griffith, *Submission 79*, p. 1.

30 *Proof Committee Hansard*, 8 March 2016, p. 14.

31 *Proof Committee Hansard*, 11 March 2016, p. 15.

32 *Proof Committee Hansard*, 8 March 2016, p. 6, 9 and *Proof Committee Hansard*, 11 March 2016, p. 44.

...the observations, again, are the same observations I have been talking about in the climate variability space, and this ocean information, this oceans intelligence we are delivering, will be fundamental to the Navy.³³

3.31 Professor Haymet spoke about other practical applications of this data to assist with adaptation over the longer term:

...there is no use setting up a group to help us adapt to climate change if we do not know whether we have 20 years or 50 years. How long do we have before all of our ports have to raise their infrastructure a metre? How long do we have before we have to recraft all the sewers on the east coast of Australia because their outlets are too low and they are going to get flooded at an average high tide? How long do we have before the Royal Australian Navy has to redo all of its facilities, which, not surprisingly, are all built at sea level? We have billions and billions of dollars of infrastructure issues, and the question is: how long do we have? If we have 10 years, we are in big trouble. If we have 50 years, it is a better story because we were probably going to replace that infrastructure over that time scale anyway. Sure, we can adapt to climate change—as long as we know what we are adapting to and how long we have to do it. That is exactly what this fundamental climate measurement and modelling will do for us.³⁴

3.32 Dr Matear emphasised that he viewed CSIRO's observations and modelling of our oceans and atmosphere as providing an insurance policy for Australia:

...I look at the work we are doing as providing an insurance policy for Australia. We have a huge economy, a trillion-dollar economy, with multitrillion dollars worth of infrastructure, and to think that we cannot invest a little bit into the fundamental research that will help maintain and support that effort and make us a more resilient and more productive nation is ridiculous.³⁵

ACCESS model

3.33 The Collaboration for Australian Weather and Climate Research is a partnership between CSIRO and BoM which has developed a climate model for Australia known as the Australian Community Climate and Earth System Simulator (ACCESS).³⁶ Dr Craig told the committee that the model:

...provides the basis for the bureau's weather forecasts every day, as you have heard; it is being set up for their seasonal forecasting, as you have heard; and CSIRO is taking primary responsibility [for] the development of the climate projection system. There are significant differences in the way ACCESS was set up for these different purposes. As you have heard again, CSIRO ran the greenhouse gas scenarios for the IPCC Fifth assessment

33 *Proof Committee Hansard*, 8 March 2016, p. 28.

34 *Proof Committee Hansard*, 11 March 2016, p. 62.

35 *Proof Committee Hansard*, 8 March 2016, pp 28-29.

36 See <http://www.csiro.au/en/Research/OandA/Areas/Assessing-our-climate/CAWCR/ACCESS> (accessed 22 March 2016)

report, and ACCESS is now being prepared for the next assessment report, which will be in the early 2020s.³⁷

3.34 Dr Craig also told the committee about the importance of a feature of ACCESS for land practice mitigation called CABLE:

That has been developed specifically for Australian conditions. It describes the soil, water and vegetation dynamics and it is used stand-alone as well as coupled into the ACCESS model. It has 103 registered users from 51 institutions in 13 countries. It is a widely acknowledged and accepted model. In Australia, CABLE is critical for our assessment of climate mitigation through changes in land practice.³⁸

3.35 In addition to CABLE there is a natural resources management website which has 750 registered users.³⁹

3.36 Dr Craig outlined the cuts to the area over the last 10 years which have seen staff numbers go from 26 to 18 and surmised that it is probable this number may be halved.⁴⁰

3.37 Professor Karoly questioned whether it will be possible to maintain and develop ACCESS:

The commitment and capabilities for the development and maintenance of the ACCESS model cannot be met by the Bureau of Meteorology, because their interest is in weather forecasting. It cannot be met by the universities, because they do not have that long-term capability. The ACCESS model will not be able to be maintained and developed in Australia in the future without significant funding commitments.⁴¹

3.38 Professor Karoly emphasised that maintaining and developing the system is critically important:

...because improved computing power allows there to be improvements in the representation of smaller scale processes through higher resolution. The model can be developed to take account of the advances in understanding of specific processes like extreme weather events, like tropical cyclones, like heavy precipitation and convection, like the link of cloud systems over the Southern Ocean, which are relatively poorly represented. The biggest biases in the current climate models are in the representation of clouds over the Southern Ocean. That is critically important to Australia, to Tasmania, and the water resources that have not been met in Tasmania recently.⁴²

37 *Proof Committee Hansard*, 11 March 2016, p. 43.

38 *Proof Committee Hansard*, 11 March 2016, p. 44.

39 *Proof Committee Hansard*, 11 March 2016, p. 44.

40 *Proof Committee Hansard*, 11 March 2016, p. 44.

41 *Proof Committee Hansard*, 11 March 2016, p. 22.

42 *Proof Committee Hansard*, 11 March 2016, p. 22. See also Dr Sophie Lewis, *Submission 92*, p. 2.

3.39 Dr Wonhas acknowledged that the job cuts are a catalyst for realigning how ACCESS is used:

There will be a reduction in activity. I think that, as I said before, with the current investment we will probably move ACCESS more into a delivery-mode model where we can still run and operate the model but probably we will not have the resources to do blue-sky science around that. And that is a loss.⁴³

Others cannot do this work

3.40 The committee discussed the suggestion that other institutions may be able to take up some of the work that is to be cut from CSIRO.⁴⁴ This was rejected in evidence to the committee. Dr Paul Durak, climate modelling research scientist, appearing in a private capacity, responded that universities do not have the longer funding time horizons required:

One of the key functions of government laboratories, such as the Lawrence Livermore laboratory [United States government funded laboratory]...is that these government labs generally have longer funding time horizons than a university-based researcher would have. Consequently it enables an institutional memory, which means that you can tackle some bigger, more ambitious questions than you would be able to on a much shorter funding time horizon.⁴⁵

3.41 Professor Karoly also made this point:

It would be inappropriate to think that universities could pick up the activities and capability that CSIRO has essentially done over the last 20 years in terms of climate science. Universities have a core role in undergraduate education, graduate education and research, but research is typically funded on a three-year cycle. It is almost impossible to develop very long-term projects or capabilities in universities because the funding cycles are designed around research and pushing the boundaries of research. In fact, blue sky research is the area that the minister for science, the former minister for science and others have said that the universities are best at. I would not expect universities to be able to develop any sort of major long-term capability that will replace the CSIRO capability. The universities would be happy to partner with any long-term institution, but it needs to be funded long term, and universities cannot do that on their own.⁴⁶

3.42 These views were echoed by Dr Karl Taylor:

I might add that, especially on the observational side, there are not a lot of substitutes, and it is hard to move things from a big organisation like CSIRO. I do not know who would take it over in Australia. With climate

43 *Proof Committee Hansard*, 8 March 2016, p. 46.

44 Dr Wonhas, *Proof Committee Hansard*, 8 March 2016, p. 41.

45 *Proof Committee Hansard*, 11 March 2016, p. 3. See also Dr Peter Craig, *Proof Committee Hansard*, 11 March 2016, p. 46.

46 *Proof Committee Hansard*, 11 March 2016, p. 18.

modelling, which is my interest, there is a certain amount of infrastructure that goes into supporting the modelling activity. It is not just the research scientists; it is the computers; it is a bunch of things. Again, you need to have a scale of effort and a longevity of effort to support something like that to make it viable. It is hard to support it. You could not do it at a university, for example. That has not happened successfully anywhere in the world.⁴⁷

3.43 The committee explored greater collaboration and working with the British Met Office for modelling capability [UK's national weather service]. It was emphasised to the committee that although CSIRO has a good relationship with the Met Office,⁴⁸ Australia would have to pay for such work and that the Met Office's current models have a focus on Europe and the UK, not Australia.⁴⁹

3.44 Dr Ayers spoke to the suggestion that outsourcing of the modelling could go to the Met Office:

[It] would not be consistent with my experience in negotiating with the Met Office. My memory of the unified model—I do not know what the current arrangements are—from when we first wrote an agreement with them, when I was with the bureau, is that the office is protected by Her Majesty's Stationery Office, and its use can be sold to other people. But the British taxpayers are not going to be permitted by the British government to produce intellectual property in that form and for that to be given away freely. They have to get the return on investment. That is quite reasonable for any country. Originally, when we first spoke to them, the cost of bringing the unified model to Australia was quite high, at what might be called a commercial rate or something like that. How the arrangement then went was for us to use it and become partners in the development and assist the Met Office itself in developing the model. Having it tested in Australia...the Met Office is focusing heavily on Europe and the UK, of course—is a great advantage to them, to have CSIRO and the bureau [BoM] and potentially university folks involved in the centre of excellence, all providing scientific advances that can flow back to the Met Office. That is precisely how we ended up writing the original agreement.⁵⁰

3.45 In addition, Professor McDougall emphasised to the committee that country and region specific climate change research will not be done by other nations:

No-one overseas has any reason to start playing with the way the clouds, the topography or the mountain ranges are affecting the climate in the

47 *Proof Committee Hansard*, 11 March 2016, pp 3-4.

48 Dr Taylor, *Proof Committee Hansard*, 11 March 2016, p. 4.

49 Professor Karoly, *Proof Committee Hansard*, 11 March 2016, p. 22; Dr Gregory Ayers, *Proof Committee Hansard*, 11 March 2016, p. 29.

50 *Proof Committee Hansard*, 11 March 2016, pp 28-29.

Murray-Darling Basin, except Australia. And they will not. It is only our local scientists who will do that.⁵¹

3.46 In an answer to questions on notice, regarding the outsourcing of climate modelling to the UK Met Office, the CSIRO indicated:

There are no plans by CSIRO to outsource the provision of climate modelling to another country. CSIRO is involved in ongoing discussions with a number of partners and collaborators, including the UK Met Office, about creating synergies climate science.⁵²

Knowledge base

Loss of capability

3.47 The committee was informed that there was a real risk that staff cut from CSIRO would leave Australia taking decades of climate research experience with them which would erode Australia's knowledge base in this area.

3.48 Dr Tony Press, Adjunct Professor at the Antarctic Climate and Ecosystems Cooperative Research Centre, appearing in a private capacity, commented that CSIRO's best climate scientists would most likely be looking to work in other leading institutions around the world rather than staying in Australia.⁵³ Professor Anthony Worby, Chief Executive Officer, Antarctic Climate and Ecosystems Cooperative Research Centre, outlined:

The primary opportunities would be in Europe and the United States. There may be opportunities in any number of the Asian countries as well. There are emerging universities with deep pockets in many of the Asian countries. There may very well be interest from those countries in picking up world-class people. They are very much trying to establish their credentials as authorities in different fields of research, so there may be opportunities there. There is clearly a huge amount of climate research done in Europe as well as in the US, notwithstanding political and budget pressures in both of those places.⁵⁴

3.49 Mr John Brennan, Chair, Tasmanian Polar Network (TPN)⁵⁵ agreed that these qualified individuals are likely to leave Tasmania:

51 *Proof Committee Hansard*, 8 March 2016, p. 36. See also Professor Trevor McDougall, *Submission 77*, p. 2.

52 CSIRO, answer to written question on notice 19, 7 April 2016 (received on 18 April 2016).

53 *Proof Committee Hansard*, 8 March 2016, p. 66.

54 *Proof Committee Hansard*, 11 March 2016, p. 11.

55 The Tasmanian Polar Network was formed over 20 years ago between the industry that was supplying goods and services to the Antarctic and Southern Ocean sector and the state government. The TPN has upward of 70 members and works to promote further collaboration and partnership with other countries. The TPN promotes Tasmania and what it has to offer to the Antarctic and Southern Ocean sector. *Proof Committee Hansard*, 8 March 2016, p. 75.

...if we lose 100 people and they are educated people who are sought elsewhere, we are going to have a brain drain. They are not going to sit there and go on the dole. I would suggest that they are going to go out there and they are going to get into the market. They will either go to the mainland or they will be headhunted [by] international players.⁵⁶

3.50 Dr Forgan highlighted that CSIRO was facing a loss of corporate knowledge which would take years to recover.⁵⁷ Professor Karoly commented that the loss of corporate knowledge, research and expertise is estimated:

...in the order of 1,000 person-years of experience—20 years of experience and approximately 50 people, or more—which is at least \$100 million of investment. That is just directly, in salaries, and not counting the other things. It appears to have been thrown away or put into a rubbish bin.⁵⁸

3.51 In relation to the movement of affected staff, Dr Marshall, when discussing the long standing expertise of his CSIRO staff, suggested that those unable to be reallocated into a different area within CSIRO could be transferred to other employers:

It's completely understandable that someone who's spent 20 years, for example, studying climate change, measuring climate change or modelling climate change, it's perfectly understandable that they don't want to stop doing that and we must respect that, and we must find a place for them in the rest of the innovation system, perhaps in an university, where they can continue to pursue their passion.⁵⁹

3.52 Dr Press outlined that none of CSIRO's current collaborators had been consulted about transitioning some of CSIRO's science capability in climate measurement and monitoring to their research organisations. Further, Dr Press suggested that:

The University of Tasmania cannot absorb anywhere near whatever the figure is; I still could not work out today whether it was 70 or 100. But, whatever the figure is, there is no way that the University of Tasmania could take that number of people and there is probably no way that all of the universities in Australia combined could take that number of people...

...none of the institutions that I know that have the national mandate to do that kind of work have the capacity to take that number of people.⁶⁰

3.53 Dr Fenton recognised that the AAD would be incapable of taking on the climate scientists from CSIRO:

56 *Proof Committee Hansard*, 8 March 2016, p. 77.

57 *Proof Committee Hansard*, 11 March 2016, p. 38.

58 *Proof Committee Hansard*, 11 March 2016, p. 14.

59 Video, Dr Marshall accessed via <http://www.smh.com.au/federal-politics/political-news/maybe-im-naive-csiros-larry-marshall-tries-again-to-explain-deep-staff-cuts-20160210-gmr03b.html#ixzz4329V9000> (accessed on 16 March 2016).

60 *Proof Committee Hansard*, 8 March 2016, p. 66.

As it is, we only have 100 in our whole science branch. Our whole premise is to work collaboratively. It is a hybrid model of bringing in scientists with the expertise to help on all the questions. They are all funnelled through the same process to address the science strategic plan, and we draw in all these collaborators to do that. We do not have the capacity or funding to bring in that sort of number of people.⁶¹

Impacts on students

3.54 The committee heard that the job losses would affect students in several ways. The CSIRO staff in areas facing job losses supervise students across a range of academic fields and the announcement has caused great uncertainty for them. For example, Professor Worby outlined that the Antarctic Climate and Ecosystems Cooperative Research Centre relies on CSIRO staff to supervise early career researchers and students.⁶²

3.55 Professor Brigid Heywood Deputy Vice-Chancellor (Research), University of Tasmania noted that about a third of current science students would require major reconsiderations of the constitution of their supervisory teams if the proposed cuts proceed:

I recognise that that is quite disturbing if you are quite a long way into your program and, as a doctoral candidate, you have built up a particular relationship with a particular researcher, academic scientist et cetera.⁶³

3.56 Noting the collaboration between the CSIRO and the University of Tasmania the committee heard that students are now considering whether to attend the University of Tasmania. Professor Richard Coleman, Executive Director, Institute for Marine and Antarctic Studies (IMAS), The University of Tasmania, outlined to the committee that:

If Hobart is not seen as the site for Southern Ocean and Antarctic research, the students will go somewhere else. We have now developed a brand, and IMAS is part of that. It is now drawing—and I think we are up to—about 185 PhD students within the institute. We have just about filled the building. So, at some level, the capacity will continue to grow, and it is being able to say: it still the place that you can do this sort of science.⁶⁴

3.57 Professors Coleman and Nathan Bindoff, University of Tasmania, informed the committee that the University of Tasmania's relationship with CSIRO is vital with Professor Bindoff, Head, Oceans and Cryosphere Program, IMAS, reporting that students see a possible career progression from PhD to work with CSIRO. He also

61 *Proof Committee Hansard*, 8 March 2016, p. 11.

62 *Proof Committee Hansard*, 11 March 2016, p. 6.

63 *Proof Committee Hansard*, 8 March 2016, p. 55.

64 *Proof Committee Hansard*, 8 March 2016, p. 25.

indicated that they have had at least one student inquiry seeking advice about whether they should even start the PhD program.⁶⁵

3.58 Dr Church, also told the committee about an international student who has decided not to come to Hobart as a result of the proposed job losses:

We had a Chinese student lined up to come in a couple of month[s] time. Since this announcement, that student has decided they will not come to Australia, to Hobart; they will instead go to the USA. That is an example, and we are still in the very early stages of this.⁶⁶

3.59 In broader terms, Dr Taylor commented that the proposed cuts were having a negative impact on future generations of scientists:

...it is clearly a signal to those younger scientists in Australia coming up that this is not the land of opportunity anymore where you can become a climate scientist and make your mark. I think that would be a shame because it would mean that that scientific reputation that has been built over decades would be pretty quickly dissipated.⁶⁷

Tasmanian economy

3.60 Professor Worby noted that climate science research is now an 'integral part of the Tasmanian economy'.⁶⁸ Similarly, Mr Brennan informed the committee that CSIRO's presence in Hobart for Antarctic climate research contributes significantly to the Tasmanian economy and that Tasmanian jobs losses will result in a considerable financial impact.⁶⁹

3.61 Professor Worby and the TPN, respectively, reported that the Antarctic sector delivers \$5.50 of total economic return for every dollar invested in the sector.⁷⁰ The TPN indicated their view that the decisions being made by CSIRO were at:

...a level where there is little or no grounded understanding about the interconnectedness of CSIRO to the Antarctic and Southern Ocean sector and the importance of its role to the Tasmanian economy and its community. State Growth figures indicate that the Antarctic and Southern Ocean organisations contributed.⁷¹

65 *Proof Committee Hansard*, 8 March 2016, p. 23. See also *The Young Earth Scientists, Submission 90*, p. 1.

66 *Proof Committee Hansard*, 8 March 2016, p. 31.

67 *Proof Committee Hansard*, 11 March 2016, p. 5.

68 *Proof Committee Hansard*, 11 March 2016, p. 7.

69 *Proof Committee Hansard*, 8 March 2016, p. 74.

70 Tasmanian Polar Network, *Submission 81*, p. 4. *Proof Committee Hansard*, 11 March 2016, p. 7.

71 Tasmanian Polar Network, *Submission 81*, p. 1.

3.62 The TPN stressed the need for the CSIRO executive to understand the significant financial impact the proposed cuts would have on the Tasmanian economy.⁷²

3.63 In a similar vein, Professor Bindoff, told the committee that currently 70 percent of students in the PhD programs were international students, which contributes significantly to the Hobart economy.⁷³

International standing

3.64 The committee heard that the proposed reduction in climate researchers would damage Australia's reputation as having an 'Olympic gold team' which is providing a leading role in many aspects of climate research.⁷⁴ The World Meteorological Organisation stated that if key research programs were lost:

Australia will find itself isolated from the community of nations and researchers devoting serious attention to climate change.⁷⁵

3.65 Professor Bindoff⁷⁶ and Mr Moltmann recently attended the Ocean Sciences conference in the United States, run by the American Geophysical Union attended by 4,200 international ocean scientists. Mr Moltmann noted that:

[T]here was a lot of surprise and shock expressed by international colleagues that that would happen. One thing it stressed for me was how highly valued the work that the CSIRO had done in this area by the international community.⁷⁷

3.66 Witnesses such as Mr Moltmann suggested that given Australia is reliant on international collaborations we should be mindful of maintaining our contribution:

...I am quite concerned about how this affects our international relationships. As I said, the IMOS [Integrated Marine Observing System] program and many types of science that we do here are highly reliant on those international collaborations. Australia has no domestic satellite capability and we have a very modest vessel fleet, given that we have the third largest ocean territory on earth. We are highly reliant on these international collaborations, and we have to be pulling our weight at some level, otherwise I think the world sees us as freeloaders. We are not and should not be and, scientifically, we are much better than that. We are actually seen as a valuable partner in the global enterprise.⁷⁸

72 Mr John Brennan, *Proof Committee Hansard*, 8 March 2016, p. 74.

73 *Proof Committee Hansard*, 8 March 2016, p. 23.

74 Dr Durack, *Proof Committee Hansard*, 11 March 2016, p. 3.

75 Peter Hannam, 'Australia to be 'isolated' from global research after CSIRO climate cuts:WMO', *Sydney Morning Herald*, 9 February 2016.

76 *Proof Committee Hansard*, 8 March 2016, p. 19.

77 *Proof Committee Hansard*, 8 March 2016, p. 8.

78 *Proof Committee Hansard*, 8 March 2016, p. 4.

3.67 Concerns were also expressed by Dr Church and Dr Richard Matear in relation to the impact of the proposed cuts on Australia's international reputation.⁷⁹ The committee also notes the open letter from the international climate community to the Australian Government and the CSIRO Board conveying the alarm of the global climate research community at the proposed cuts.⁸⁰

3.68 Concerns were also raised that the cuts would affect Australia's ability to meet international obligations.⁸¹ Dr Church commented that the agreement reached in Paris indicates that climate science is more important than ever and it is critical to cost-effective mitigation and adaptation. He argued that:

The proposed cuts in CSIRO would break commitments made in Paris just last December, only a few months ago.⁸²

3.69 In relation to criticisms from overseas institutions such as Scripps, Dr Marshall responded:

I have spent 26 years in the United States and I have spent some time at Scripps. It is a wonderful research institution. The reason I was surprised about the comments from the US was that it is a matter of fact that the United States invests 75 per cent of its dollar investment in the environmental area into mitigation, and only 25 per cent into modelling and measurement. Over the last decade, the investment in the US into modelling and measurement has changed hardly at all—roughly four per cent a year—while in contrast the investment in mitigation technologies has increased 40 per cent per year. Given the US are playing a lead in a major shift in research priorities, this was a big part of our thinking in following that leading trend, so it surprised me to be criticised by someone who led the trend.⁸³

3.70 Dr Marshall indicated that he was surprised at the international response and emphasised that the CSIRO was not planning to completely withdraw from measuring or modelling, but to redirect its attention to mitigation:

We are not saying that modelling and measurement are not important. We are saying that modelling and measurement is not more important than mitigation, and we have chosen to shift our emphasis to mitigation...⁸⁴

79 *Proof Committee Hansard*, 8 March 2016, p. 30.

80 Dr Paul Durack, *Submission 86*.

81 Cape Grim's capacity as a public good research base was important in providing data and analysis for Australia's commitments under the UN Framework Convention on Climate Change. Several witnesses told the committee that Australia's commitments and reporting on international conventions either will not be possible or will be severely handicapped by the proposed cuts. See: Dr Bruce Forgan, *Proof Committee Hansard*, 11 March 2016, p. 37; Dr Paul Fraser, *Proof Committee Hansard*, 11 March 2016, p. 34.

82 *Proof Committee Hansard*, 8 March 2016, p. 27.

83 *Estimates Hansard*, 11 February 2016, p. 55.

84 *Estimates Hansard*, 11 February 2016, p. 55.

3.71 Regarding the ability of Australia to contribute to international bodies such as the IPCC, Dr Wonhas responded:

...I do understand that the reduction of investment in the climate science space will reduce, but certainly not eliminate, our capability to contribute to things like the IPCC process. So that is maybe a down-tick. However, I very firmly believe that we can do a very meaningful contribution in the adaptation and mitigation space, and that is what we are driving towards. That is kind of like the up-tick.⁸⁵

Public good research

3.72 Professor Worby expressed a view that the CSIRO strategy reflected a wider trend of moving away from investment in public good research.⁸⁶

3.73 Similarly, Professor Karoly indicated that he thought the shift away from public good research was in response to the need to make money:

...has shifted over the last 20 years from public-good science into research that can make a buck, and particularly make a buck for industry, not demonstrate that this research will avoid costs—for instance, avoid the costs of climate change—but directly make a buck, develop a new product, a new widget or a new activity. I think that the decision appears to have been made by the chief executive of CSIRO that the S in CSIRO is no longer important, and it should be C-I-R-O, with an emphasis on industry research.⁸⁷

3.74 Professor McDougall told the committee that he had seen a reduction in the prioritisation of and funding for public-good science over the years and that this is accelerating:

So, 25 years ago there was no requirement to earn any external money, and then, under a previous CEO, called John Stocker, a rather small target of 20 per cent was introduced, and now, from the point of view of the researcher, it is basically 50 per cent; you have to match dollar for dollar. The upshot of that is that when the external funding goes down then this area of research needs to be abandoned...In 2003 the division of atmospheric research retrenched 15 or so really top people with world-class reputations, and then there was my redundancy in 2011, and then following that, in Hobart, 30 or so have been let go in the past two or three years. So yes, there has been a steady drip of people leaving, so that the effort now is far below where it should be to give industry credible indicators for the future.⁸⁸

3.75 Dr Fraser offered the suggestion that '[p]erhaps...CSIRO has to decide whether it is going to be involved in the public good research or not'.⁸⁹

85 *Proof Committee Hansard*, 8 March 2016, p. 45.

86 *Proof Committee Hansard*, 11 March 2016, p. 6.

87 *Proof Committee Hansard*, 11 March 2016, p. 19.

88 *Proof Committee Hansard*, 8 March 2016, p. 35.

89 *Proof Committee Hansard*, 11 March 2016, p. 32.

3.76 Dr Church outlined to the committee CSIRO's extensive history of producing public-good research to address major issues facing Australia:

Under the Science and Industry Research Act 1949, CSIRO is charged with doing research to assist Australian industry but also to contribute to the achievement of national objectives or the performance of national and international responsibilities. These functions and also the science strategy clearly include research on major issues facing Australia, such as climate change, and other public-good research.⁹⁰

3.77 In response to this contention Dr Wonhas responded:

I think, in this debate, it can appear that CSIRO is pulling out of public-good research. I really want to categorically say, 'This is not our intent.' I think public-good research has been absolutely the foundation of what CSIRO has been doing over its very long history. [I] would say several thousand of our employees are committed to continuing to do public-good research. It is probably a fair criticism that we maybe have not articulated that position sufficiently well, especially in the last couple of weeks. But I can assure you that that is something that we are working on and that we endeavour to rectify.⁹¹

3.78 Dr Marshall told the committee that with the establishment of new strategic direction CSIRO's forward budgets substantially increase the investment in pure science.⁹²

3.79 Ms Bennett further outlined the future financial investment by CSIRO in public good science:

Currently we have approximately eight or nine underpinning science platforms that we believe need to form a large part of our investment. In that program we estimated that investment in 2015-16 would be in the order of \$4 million. As Dr Marshall has said, that will increase so that in 2019-20 that investment will be in the order of \$40 million. That is in that year. So it will move up in its per-annum-spent trajectory.⁹³

External revenue

3.80 The committee noted the emphasis on external revenue in the documents made available as part of the Order for the Production of Documents process. However, Ms Bennett did not agree with suggestions that the CSIRO is driving an increase in external revenue:

It is incorrect to assert that we have been driving—which I think is a very strong word—an increase in external revenue and external earnings. It is a really important part for us to maintain the scale and the quantity of our research...and we certainly acknowledge that fact. But I think to try and

90 *Proof Committee Hansard*, 8 March 2016, p. 27.

91 *Proof Committee Hansard*, 8 March 2016, p. 40.

92 *Proof Committee Hansard*, 27 April 2016, p. 4.

93 *Proof Committee Hansard*, 27 April 2016, p. 4.

indicate that our decisions are based on a drive for external revenue, the history does not bear it out and nor do our forward budgets.⁹⁴

3.81 Dr Marshall also spoke on revenue and the need for co-investment:

I want to address the market and revenues, as it is a key part of understanding this issue. In addition to indicating market demand, the co-investment financial support is also an important factor for us in a very practical way. You will understand from previous evidence that CSIRO's financial ability to conduct research activities requires co-investment funding.⁹⁵

Conclusion

3.82 The committee received powerful evidence in relation to the significant effects the proposed cuts would have in a variety of areas. Witnesses were very clear about the far-reaching consequences for the nation of decreasing CSIRO's climate measurement capability.

3.83 It was evident to the committee that the contention by Dr Marshall that climate change has been proven to be real so CSIRO can move to focus on adaptation is simplistic and naïve. Climate measurement data is not static. Robust data around the rate of climate change, for example, is critical to the development of successful and cost-effective adaptation and mitigation strategies.

3.84 The committee notes this data has real world applicability to many industries such as agriculture and wine production and for defence purposes. Moreover it assists in determining the sensitivity of an industry or region to projected changes. The committee understands that it is critical for these industries to know what climate change they are adapting to and how long they have to adapt.

3.85 It was clear to the committee that at the highest levels of the current CSIRO management there is a lack of understanding about the true value of maintaining decades of climate research and its return on investment for Australia in the long-term. Given the discussed range of risks to the nation from a changing climate in the areas of food security, energy security, infrastructure planning, and defence, the committee sees leadership decisions made by CSIRO management or the Federal Government without this understanding as a possible danger to the future economic and social wellbeing of Australia.

3.86 The committee is concerned that the job cuts planned for the CSIRO have been so rushed and without proper consultation that matters of national defence may have been overlooked.

3.87 The committee is thus greatly concerned that proposed cuts to the Land and Water business unit is directly contrary to CSIRO's new objective of focusing on climate change mitigation and adaptation. The committee believes that cuts to

94 *Proof Committee Hansard*, 8 March 2016, pp 43-44.

95 *Proof Committee Hansard*, 7 April 2016, pp 1-2.

CSIRO's climate change adaptation work evidences a hasty and ill-advised attempt to reduce CSIRO staffing numbers.

3.88 The committee believes the suggestion that other institutions can pick up some of this work is fanciful. It was emphasised to the committee that universities do not have the funding time lines to do this work. Funding time lines for University research of around three years make it almost impossible to develop long term capabilities that could replace what CSIRO has already developed in terms of knowledge and infrastructure for climate modelling. The suggestion that Australia could go to the British Met Office was also given short shrift by witnesses who emphasised that Australia would have to pay for information and pointed out the focus for the Met Office models is understandably the UK and Europe, not Australia. Very simply, if we are not measuring our climate, no other nation has a compelling reason to take this on. Furthermore, the committee cannot fathom how funding British scientists to conduct climate research for Australia would be value for money for Australian taxpayers.

3.89 The committee did not find CSIRO's assurances that they had no plans to outsource climate modelling to another country reassuring. The committee notes that CSIRO has indicated that it is involved in discussions with a number of partners and collaborators about climate modelling. The committee considers that CSIRO has failed to provide an adequate explanation as to who could provide critical, regional specific climate modelling better than Australian CSIRO scientists.

3.90 The announcement on 26 April 2016 of the establishment of a National Climate Research Centre in Hobart is clearly a response to the domestic and international criticism of the proposed cuts rather than some new collaborative effort that had been in the works for some time. From what the committee heard from witnesses, collaboration has always been the key foundation for this work.

3.91 The committee heard that if these proposed cuts go ahead Australia will lose scientists to other countries as institutions in Australia do not have the capacity to absorb such large numbers of scientists. The committee also heard troubling reports that students, particularly international students, are thinking twice about going to Hobart to study since the proposed cuts were announced. This is a great loss not only for the economy of Hobart but for the scientific community given the ongoing efforts to encourage more students to take up scientific studies.

3.92 It was very clear to the committee that the effective work in this area is collaborative, not only between institutions in Australia but also with international organisations. In order to continue to benefit from these collaborations Australia needs to maintain its contribution and commitments. CSIRO has acknowledged that the decreased investment will reduce Australia's capacity to contribute to forums such as the IPCC process and the committee is very concerned that this diminished capability will hinder Australia's ability to meaningfully participate and represent its national interest.

3.93 The committee is also very concerned that these proposed cuts are part of a wider trend to reduce public good research in favour of generating income. Retaining

this capability is critical to the nation and its ability to successfully adapt to climate change.

3.94 In short, the proposed cuts represent a very short-sighted approach in generating moderate savings to CSIRO in the medium term at significant cost to the nation in the long term.

Recommendation 4

3.95 The committee recommends that a suitable independent agency be tasked with investigating the economic value of CSIRO climate measurement and research, including the return on investment for Australia and the benefits of better timed and placed adaptation and mitigation measures.

Recommendation 5

3.96 The committee recommends that the Department of Defence reports to the Minister of Defence and the Minister for Industry, Innovation and Science on the future ocean intelligence requirements needed to maintain tactical advantages for all its operations, including the entire operating life of the future submarine fleet.

Senator Peter Whish-Wilson

Chair

