Submission to the Senate Enquiry "Funding and Resources for CSIRO"

Submission by Trevor J McDougall AC FAA FRS

This submission concerns CSIRO research in the fields of atmosphere, ocean and climate research, the areas with which I am familiar.

The need for climate research in Australia has never been more pressing. Given the 2015 Paris Accord and the observed changes of Australia's temperature and rainfall records, Australian climate research capability is essential to enable Australian industries to adapt to the changing climate in the most cost-effective manner. The type of long-term climate research that has been conducted by CSIRO is vital for Australian businesses and without it climate change will prove to be a much larger burden on our businesses and communities than it needs to be. Successful climate adaptation requires answers to the fiendishly difficult questions such as

- Will Australia's bread-basket, the Murray Darling Basin, experience increased or decreased rainfall in the future?
- Will El Nino strengthen or become more or less frequent in the future?
- How fast will drying occur in those parts of Australia that are drying?
- Where are the largest flash floods likely to occur?
- Where will our dams and irrigation channels need to be modified to handle more intense rainfall events?
- How fast will Australia's most populated cities warm; we need to know this so that we can sensibly set new engineering standards to ensure longevity of costly infrastructure?
- Where will the sea-level rise be largest over the next 50 years around the Australian coastline?

Water management, bushfire control, agriculture, the insurance sector, infrastructure, fisheries and emergency services all need answers to these questions to best deliver quality of life to Australians and to minimize the damaging impacts of global warming to our economy. Given the state of science in the world today these questions are challenging, and they are just the type of questions that CSIRO has been working towards. It is vital for the Australian economy that this research is continued.

If this country-specific climate research is not done in Australia then it will not be done anywhere, and we in Australia will be living through the increasing effects of global warming with little clue of how we should be best adapting. Other nations will not do this country-specific climate science for us. The Paris Accord recognised the importance of climate research as a precursor to successful climate adaption. A country without the ability to predict its future climate would have an economy whose steering wheel is only loosely connect to the front wheels, and whose engine is limping along on three cylinders rather than all four.

Climate research is a public good and needs to be funded from the public purse. Because of the vagaries of external funding, the amount of climate research carried out in CSIRO has varied wildly over recent decades. These swings of support are incompatible with the long-term nature of climate research and of the length of time it takes to train capable research scientists. In this field of public good research CSIRO has become an employer of last resort where one cannot pursue a career in science, and appointment into an 'indefinite' position means little. Rather, even the most senior of research scientists with world-leading reputations have been made redundant by CSIRO. Even worse, young scientists of the highest calibre have not been attracted to work at CSIRO. The management ranks of CSIRO are not populated with first class scientists, and in some cases, by folk with little experience of scientific research. Over the past two decades this CSIRO management culture and the declining funding has resulted in an aging research workforce with fewer and fewer scientists with world-leading reputations.

Given this history, what can and should be done in the national interest in the area of ocean, atmosphere and climate research in CSIRO? Any recommendation and decision on funding these areas of science need to also take into account that the world's largest funder of scientific research, the Unites States of America, is actively exiting their leadership role in climate research and is reversing what progress it has made to wean society off the burning of fossil fuels. Amidst the shuttering of top research laboratories in the US, and the defunding of NSF-funded climate research programs, we in Australia need to substantially bolster our research in these areas, in our national interest.

The first priority for the allocation of scarce CSIRO funding must be to maintain the capabilities in the climate space that, in the national context, only CSIRO is best placed to do well. These include ocean observations of physical and chemical oceanography, including ship-borne observations, and also the

observations of the constituents of air at Cape Grim and the constituents of ice in Antarctica. The running of climate projections (the so-called IPCC climate projections) is something that other research institutions such as universities are ill suited to doing. Hence a top priority is the retention and bolstering of the ability to perform these climate projections for the government, recognizing that the State Governments rely on these climate projections to inform decision makers in their states as to what the future holds.

Beyond these essential capabilities, CSIRO should embark on a new way of supporting public good science of this nature and expanding it. As Australia experiences more intense flooding, more heat waves and more droughts, there is a continuing need for scientific research of the long-term, patient variety, so that the effects of climate change and climate variability on all aspects of society are known well in advance. If the present CSIRO budget does not stretch this far, and it is obvious that the work is needed and thus necessary, it is the responsibility of the CSIRO board to ensure that the national interest is served by finding a way to fund this work. Australia should be significantly expanding our climate research, given the disastrous trajectory of the USA in this regard.

Yours sincerely,

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