Wednesday 13 April 2016
Dear Sir/Madam,

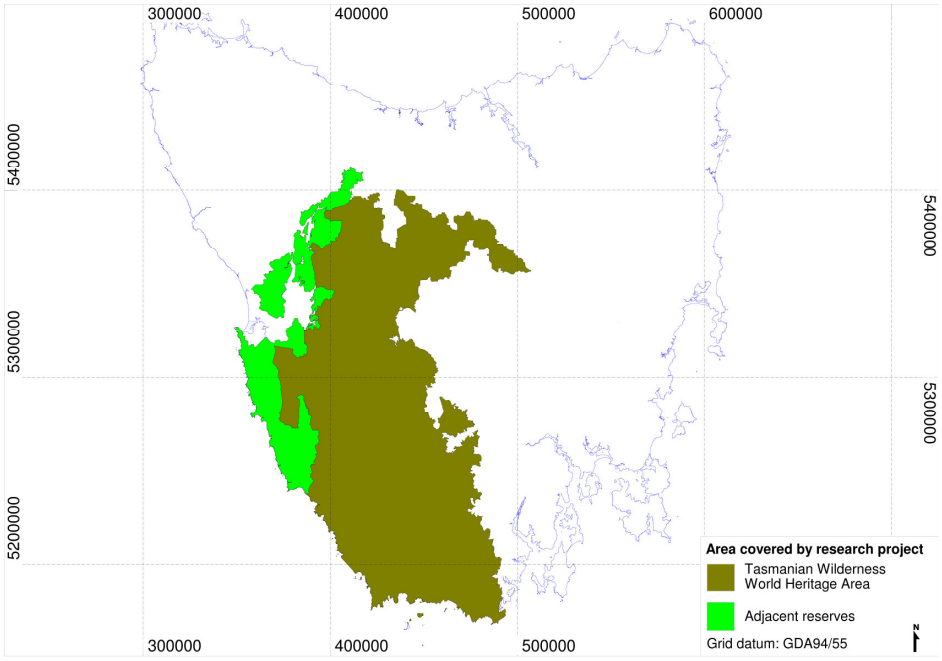
I understand that the Senate Environment and Communication Committee is holding an inquiry titled: *Response to, and lessons learnt from, recent bushfires in remote Tasmanian wilderness*[1] and that this inquiry has a number of terms of reference.

My background is mainly in the area of fire research and operational fire management. I have spent about 20 years working as the Tasmanian Wilderness World Heritage Area (TWWHA) Fire Management Officer for the Tasmanian Parks and Wildlife Service, completed a PhD on the fire history of the TWWHA and developing buttongrass moorland fire management systems, and post-PhD have assisted with the development of fire regime models for the TWWHA (see CV).

Due to uncertainties with the Committee's status (in particular, the potential for an election), in this submission I will restrict my input to issue a. However, if required I am willing to also provide input into issues c and e.

Along with a number of co-workers, I am currently setting up a research project titled: *Changes in the climate patterns in western and southwestern Tasmania: bushfires, snowpack and the implications of climate change*.

This project aims to examine the influences of climate change on lightning fire incidence and its implications for the ecology and management of the TWWHA and its adjacent areas in western Tasmania (Map 1).



Map 1. Study site location for: *Changes in the climate patterns in western and southwestern Tasmania: bushfires, snowpack and the implications of climate change*.

[1] See: http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Tasmanian_Bushfires

In order to examine the issue of climate change in the TWWHA, we are researching four sub-projects:

1 climate change since 1960:
   - analysis of the mean path of high and low pressure systems, including the presence of blocking high pressure cells in the Tasman Sea (summer) and possibly, the Great Australian Bight (winter);
   - changes in rainfall patterns, atmospheric stability and potential for dry lightning;
2 predicted climate change out to 2100:
   - changes in weather patterns, in particular, rainfall in spring, summer and autumn, dew point temperatures during summer and the potential for dry lightning;
3 changes in:
   - incidence of lightning fires since about 1970;
   - increased fire in rainforests and alpine areas along with impacts to organosols;
   - reductions in low altitude winter snowpack and increases in high altitude snowpack since about 1980;
4 review paper discussing the implications these changes on the ecology and management of western and southwestern Tasmania.

In summary, our hypothesis is that reductions in Antarctic ozone since the 1970s and to a lesser extent, increases in other greenhouse gasses since the 1960s has resulted in a south-ward movement of the mean track of high and low pressure cells along with an increase in mean circumpolar wind speeds. Similar changes have also been documented in the northern hemisphere. These changes have been reflected in an increased prevalence of the positive phases of both the Southern Annular Mode (SAM) and the Indian Ocean Dipole (IOD).

In the Tasmanian region, our theory is that these changes have resulted in an increase in the number of high pressure cells and a decrease in the number of low pressure cells crossing Tasmania. In summer (ie December to February) this has resulted in an increase in blocking high pressure cells in the Tasman Sea. In winter (ie June to August) there has been an increase in the latitudinal pressure gradient in the Tasmanian region with a marked decrease in atmospheric pressure south of Tasmania and an increase in the mean strength of westerly winds.

These changes have resulted in marked changes to Tasmania's weather, especially to rainfall patterns in southwestern and western Tasmania.

In summer, the presence of a blocking high in the Tasman Sea results in a predominantly northwest to northeast airflow over Tasmania, resulting in a decrease in summer rainfall. In addition, due to the direction of the airflow, the airstream tends to have relatively low dew point temperatures and hence, when the airstream is unstable, an increase in the potential for lightning to occur without significant rainfall (ie dry lightning). These factors increase the potential for lightning fires, and if fires start, the predominantly dry conditions results in a significant increase in the potential for large fires (eg greater than 10 000 ha) in all vegetation and soil types (eg fires in rainforests, alpine areas and peat).

In winter, the predominantly westerly airflow is forced to rise over the mountain ranges, where it cools at the adiabatic lapse rate. However, due to the rise in temperature over the past about 50 years, this airstream has had an increase in its vapour pressure (ie an increase in moisture content). The increased temperature

results in a decrease in low altitude snowfall but since the airstream still cools sufficiently to create snow at higher altitudes, there is an increase in high altitude snowfall. This has resulted in a decrease in snowfall at lower altitudes (eg below about 1400 m) but an increase at higher altitudes (eg above about 1400 m).

The major outcomes of this research are anticipated to be:

- explanation for the increase in lightning and rainforest fires over the past 45 years;
- explanation in an apparent decrease in low altitude snowpack and an increase in high altitude snowpack over about the past 35 years;
- likely impacts from future climate change on ecological processes, lightning fires and snowpack.

For example, when lightning fire number, size and area burnt are compared for the 20 years between 1980/81 and 1999/00 versus the 16 years between 2000/01 and 2015/16, there has been about a 20 times increase in lightning fire number, about a 70 times increase in average lightning fire size and about a 570 times increase in the area burnt by lightning fires (Figure 1).

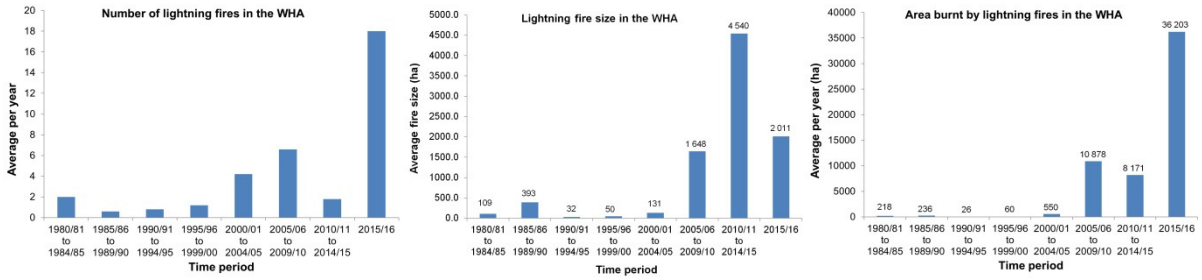


Figure 1. Lightning fire average number, size and area burnt per year for the period 1980/81 to 2015/16 in Tasmania's World Heritage Area and its adjacent regions.
Data source: www.listmap.tas.gov.au.

It is anticipated that this research will be conducted in two stages.

The first stage will be an analysis of changes in the Tasmanian region's atmospheric pressure and stability since about 1960 along with an analysis of the Climate Futures data[2] in order to extend these predictions out to 2100. The target timeframe for this first stage of the project is to have draft results by the end of June 2016.

The second stage of the project is to compare the changes in the region's climate against changes in fire history since 1970. This will provide insights into the effects of climate change on the management of the TWWHA along with it's impacts on ecological processes, rainforests, alpine areas, oganosols and the cost of management. The target timeframe for the second stage of the project is to have draft results by the end of 2016.

The results will then be published in the scientific literature.

As such, this project is highly relevant to this Senate inquiry. Also note that this research may be performed in conjunction with the Tasmanian government's inquiry in the 2015-16 summer's lightning fires[3].

[2] See: http://www.dpac.tas.gov.au/divisions/climatechange/climate_change_in_tasmania/impacts_of_climate_change.

[3] See: http://www.premier.tas.gov.au/releases/research_project_to_protect_wilderness_areas