Senate Environment and Communications References Committee inquiry into the response to, and lessons learnt from, recent bushfires in remote Tasmanian wilderness

Submission by Professor David Bowman

Summary

- Climate change driven fires are a threat to the integrity of Tasmanian Wilderness given the unique fire sensitive vegetation and widespread organic soils
- Ignition patterns are changing with an increasing occurrence of dry lightning storms
- I recommend
    - Better detection of lightning strikes and ignitions using a improved lightning sensor networks and aerial reconnaissance: using drones for surveillance would reduce risk to pilots
    - Better prioritisation of fire-fighting capacity relative to threats to biological values
    - Improving predictive models of the vulnerability of organic soils to combustion, supported by better coverage of meteorological stations in western Tasmania
    - Increased numbers of remote area fire-fighters, possibly in partnership with environmental non-government organisations and land managers from the Tasmanian Aboriginal Communities
    - Increase fine-scale mosaic burning in fire-adapted treeless sedge-heath communities ('buttongrass moorlands') would reduce the areal extent of landscape fires. Burning could be undertaken on foot by remote area fire crews outside the fire season
    - Tasmanian Wilderness World Heritage Area should be recognised as a World Heritage Property at risk from fires driven by climate change
    - Increased investment in targeted landscape ecology research designed to allow managers to adapt to rapidly changing environmental conditions.

The impact of global warming on fire frequency and magnitude

The Tasmanian Wilderness is threatened by increased fire frequency and extent as a result of climate change for the following reasons:

Vulnerable plant species

There is a high concentration of fire sensitive vegetation made up of 'palaeo-endemic' plants species, which occur in alpine vegetation and temperate rainforests. These species were once widespread in geological time but are now restricted to cool, wet climates and *fire-free environments*.

There is scientific evidence that infrequent past fires in the last 10,000 years caused the loss of 'palaeo-endemic plants'. These changes to vegetation in the Tasmanian mountains were possibly associated with the El Nino climate phenomenon (Fletcher et al. 2014). Scientific studies demonstrate the extremely slow rate of recovery following fire, indeed there is a positive feedback whereby fires promote vegetation that is more flammable, increasing the risk of fire (Holz et al. 2015).

Organic soils

The landscapes of western Tasmania are characterised by a mantle of organic soil (peats), which are combustible if dried out. These soils take thousands of years to form (Wood et al. 2011a). Future warmer and drier climates will restrict peatlands to very localised landscape settings.

Changing ignition patterns

Despite continuous occupancy of the Tasmanian landscape for over 30,000 years, including periods of abrupt climate change, Aboriginal fire use caused *limited damage to fire sensitive vegetation* compared to the impacts of European colonisation. It is likely that skilful patchy burning practiced by Aborigines protected fire sensitive vegetation through the control of fuel loads and creating mosaics that limited the occurrence large-scale destructive fires except under extreme fire weather conditions (Trauernicht et al. 2015).

By contrast, changed fire regimes following European settlement have caused the destruction of fire sensitive species and peatlands in western Tasmania. In this context the Tasmanian Wilderness World Heritage Area (TW WHA) has successfully reduced the incidence of human-caused fires, particularly through the 'fuel stove' only policy that prohibited campfires supported by track rangers and education campaigns: over the last decade reduced funding for the latter programs possibly increasing risk of accidental ignitions. There has also been a steady reduction in arson. However, since the 1990s a new feature of the western Tasmanian climate is the increasing importance of dry lightning storms which have become the predominant cause of large fires in the TW WHA (see http://www.parks.tas.gov.au/file.aspx?id=41886).

World best practice in remote area fire management

Detection

The dominance of combustible organic soils and large areas of closed canopy vegetation make early detection of lightning fires difficult. Organic soils can smoulder for long periods underground before spreading under favourable (favourable or unfavourable?!) fire weather conditions. Closed canopies can obscure small surface fires. Detection of fires in trackless areas is difficult and relies on *aerial surveillance and remote sensing*. However, the region's rugged terrain and variable weather can create hazardous flying conditions, preventing immediate reconnaissance to identify fires soon after they start. Cloud cover can preclude the use of satellite detections. Increased lightning detection networks could help improve pinpoints areas where surveillance should be prioritized. In the future there is scope for using drones for surveillance, reducing the risk to pilots.

Rapid Attack

By definition Tasmanian Wilderness is remote, making fire fighting logistically challenging. The terrain, weather, occurrence of organic soils and closed canopy vegetation present formidable challenges for fire suppression. Even with helicopters it is difficult, and sometimes impossible, to safely insert crews quickly enough to stop the fires spreading before they reach a point where they it is no longer practical to put them out.

It is important to note that water bombing can be of limited effectiveness because peat fires can burn underground for many weeks, often under a dense forest canopy. Cutting firebreaks is difficult because heavy machinery cannot be used in most areas given the remote and intractable terrain. To stop peat fires from spreading it is sometimes necessary to dig trenches, but this approach will cause significant and ongoing environmental impacts.

Planned burning

Because the TW WHA is largely trackless the most effective way to create firebreaks is through elective planned burning of treeless buttongrass moorlands. There is evidence that fires burning under *moderate* fire weather conditions will stop on recently burnt buttongrass moorlands. Targeted burning of buttongrass moorlands is therefore a critical preventative methodology to reduce the extent of large fires. However, this approach requires care and flexibility, and an acknowledgement that under extreme fire weather condition this technique may not effectively limit the spread of fires, and carries risk some fires may escape control.

The current reliance on aerial burning of large areas lacks the precision that can be achieved by properly trained crews on foot. Compared to aerial burning approaches crews on the ground tasked to create fire-scale patch burns have greater situational awareness and can work under a wider range of weather conditions. There is scope to use properly trained remote area fire-fighting personnel (possibly drawn from NGOs and Tasmanian Aboriginal Communities with a stake in land management) working outside the fire season to undertake such targeted burning.

The availability and provisions of financial, human and mechanical resources

Given these complexities, we need to enhance current decision support tools to help *prioritise* where fire-fighting efforts are best directed. Employment of specialists with expert ecological knowledge is essential in decision-making teams to identify areas potentially threatened by fires and vulnerable to impacts by fire-fighting programs.

Increasing the number of both professional and volunteer fire fighters with the appropriate skills to work in the Tasmanian Wilderness for many days is required. Training courses should also cover the vulnerability of the vegetation and soils in the Tasmanian Wilderness. There is scope for the University of Tasmania to provide such training in partnership with Tasmanian land management agencies.

Involvement of properly trained personnel from environmental non-government organisation environmental organisation and the land managers from the Tasmanian Aboriginal Communities as volunteers, or under casual employment, also warrants consideration.

Australia's obligations as State Party to the World Heritage Convention

I suggest the Tasmanian Wilderness World Heritage Area should be recognised as a world heritage property at risk from climate change-driven fires. Since 2007 I have been concerned that this risk has been under-estimated relative to other Australian World Heritage properties (Bowman 2007).

The adequacy of fire assessment and modelling capacity

Targeted landscape ecology research designed to allow managers to adapt to a rapidly changing environmental conditions is essential. In this context I consider increased investment in predictive climate change modelling, which is not closely tied to landscape management, as a lower priority. Instead, detailed assessment of the impact of recent fires on fire-sensitive vegetation is critical to understand their legacy effects into the future.

Specifically, I recommend landscape ecology analyses (such as Wood et al. 2011b) are required to understand the spread and impact of the recent fire in western Tasmania. This will help us better understand the effect of weather conditions, vegetation and terrain and land management history including wildfires and planned burns. Such analyses enable the development of evidence-based management and scrutiny of claims that logging increased the impact of these fires (Marris 2016), and that patch-burning emulating Aboriginal fire management can reduce extensive fires (Marsden-Smedley and Kirkpatrick 2000).

Improved understanding of the threat to organic soils is required to better understand the degree that the very substrate of the Tasmanian Wilderness is under threat by increased landscape fire in a warmer and drier climate. Research is required to (a) evaluate the relationship between organic soil moisture and likelihood of combustion, (b) determine how this is affected by antecedent meteorological conditions and (c) quantify how fire intensity influences the vulnerability of organic soil loss due to combustion during fire and erosion afterwards. Given the complexity of the problem, this research requires both laboratory and field experimentation. Short-term predictive modelling using meteorological data is required to determine the vulnerability of peatlands during fire seasons. Such models require better coverage of automatic meteorological stations across western Tasmania.

Such applied research requires closer collaboration with various Tasmanian agencies and the University of Tasmania. Currently, research effort is disjointed and poorly resourced. The research should be peer reviewed and published in open source journals to ensure the quality of the science and allow broader community scrutiny of findings and policy recommendations. Currently, a large amount of literature on the ecology and management of the TW WHA that emanates from the Tasmanian Government agencies in in the 'grey literature' being neither readily accessible nor peer-reviewed.

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10 April 2016

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