

Chapter 3

Assessment and modelling capacity

3.1 This chapter examines the adequacy of fire assessment and modelling capacity for the Tasmanian Wilderness World Heritage Area (TWWHA).¹ The committee heard that the current fire models do not consider the unique vegetation types found in the World Heritage area and there are no plans to rectify the situation. This chapter discusses the use of Australian fire models and Tasmania's layered map of fire sensitive vegetation communities (TASVEG), before examining current efforts to provide a Tasmania-specific fire model.

Australian fire models

3.2 In Australia, fire assessment and modelling has traditionally focused on specific fire models for each general class of vegetation in which bushfires occur.² This approach contrasts with other countries—such as the United States of America—where a general fire spread model (the Rothermel model) is used, with fuel specific models employed to make more precise predictions.³

3.3 According to the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Australian approach has the advantage of enabling development and refinement of a model for a specific fuel type, without affecting predictions for other fuel types (a fault of the Rothermel model). The downside to this approach is that the known effect of a particular fuel type on fire behaviour is required before a fire behaviour model can be developed for that fuel type.⁴

TWWHA fire model

3.4 CSIRO advised that Tasmania has fuel types for which there is no fire model or no suitable model for wildfire conditions:

These include peat, rainforest, wet heath, alpine forest, alpine scrub and wet eucalypt forest, which represent many of the predominant fuel types found in sensitive and Tasmanian Wilderness Heritage Areas. The only fire behaviour model that has been developed specifically for a Tasmanian fuel type is the Buttongrass model of Marsden-Smedley and Catchpole (1995).

1 Fire assessment and modelling attempts to predict 'fire behaviour', a descriptive term for various aspects of a bushfire—such as its rate of spread, the fireline intensity, flame height, angle and length, and spotting distance: Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission 1*, p. 10.

2 There are four major vegetation types (grassland, native forest, shrubland and plantation) combined with 13 fuel types (for example, buttongrass, temperate shrubland and radiata pine).

3 CSIRO, *Submission 1*, p. 10.

4 CSIRO, *Submission 1*, p. 10.

The applicability of existing wildfire behaviour models to other Tasmanian fuel types is unknown.⁵

3.5 Dr Andrew Sullivan from CSIRO indicated that, as a result, Tasmanian fire agencies cannot make accurate predictions of fire spread in the TWWHA.⁶ Professor David Bowman, an environmental change biologist, agreed that the inaccuracy of the fire models is challenging for fire managers.⁷

3.6 In relation to the 2016 bushfires, the Tasmanian Greens said:

The modelling available to the State Government predicted the fires would not progress through these vegetation types [alpine vegetation and rainforest], as the inputs to this modelling defined these landscapes as too moist to burn. Put simply, the fires burnt where they were not meant to burn.⁸

3.7 Some witnesses, including Dr Tony Press from the Tasmanian Wilderness World Heritage Bushfire and Climate Change Research Project and Mr Geoff Law from The Wilderness Society (Tasmania), contended that there is a critical need for a fire model based on the vegetation types and organic soils found in the TWWHA in order to manage its ecosystem.⁹

3.8 Dr Sullivan agreed:

You need to be able to determine the conditions in which fires are likely to begin to spread—so the initiation. There is lots of dry lightning that occurs that does not start fires, so we need to be able to determine when it is likely that dry lightning is going to start a fire. When that fire does start, we need to know how fast it is going to move and where it is going to spread to. We also need to know under what conditions it is likely to go out.¹⁰

3.9 Professor Bowman indicated that the precursor to developing a specific fire model for the TWWHA is targeted landscape ecology research. Such research would

5 CSIRO, *Submission 1*, p. 12.

6 Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 2.

7 Professor David Bowman, *Committee Hansard*, Launceston, 2 November 2016, p. 13.

8 Tasmanian Greens, *Submission 22*, p. 7.

9 Dr Tony Press, Chair, Tasmanian Wilderness World Heritage Bushfire and Climate Change Research Project, *Committee Hansard*, Launceston, 2 November 2016, p. 18; Dr Richard Thornton, Chief Executive Officer, Bushfire and Natural Hazards Co-operative Research Centre (BNH CRC), *Committee Hansard*, Launceston, 2 November 2016, p. 22; Mr Geoff Law, Consultant, The Wilderness Society (Tasmania), *Committee Hansard*, Launceston, 2 November 2016, p. 46. Also see: Professor David Bowman, *Committee Hansard*, Launceston, 2 November 2016, p. 13, who advised that there is currently some research being undertaken in relation to fire hazard fuel loading in wet eucalypt forests.

10 Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 4. Dr Sullivan noted that it would take some time to build a specific fire model for the TWWHA: p. 2.

enable detailed assessment of how fire sensitive vegetation has been affected by recent fires:

Specifically, I recommend landscape ecology analyses...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.¹¹

3.10 The committee notes that, in addition to ecology and fire management, there is an argument for the adequate modelling of fire behaviour for 'life safety' reasons.¹²

Phoenix RapidFire

3.11 Submitters commented on Phoenix RapidFire, a computer program used by the Tasmanian Government to predict the likely spread of a bushfire. One of the developers of the program, Kevin Tolhurst, a Forestry Professor at the Melbourne Sustainable Society Institute, has published how the program simulates likely fire spread:

Within seconds, the program crunches data on weather, wind, vegetation, the slope of the land and how dry the bush is. It turns this into a map of where the fire is likely to go, overlaid on Google Earth, and displays the results as a video. The program also diagnoses the type of fire—how hot will it burn? How high will the flames go? Where might embers land? Trained fire analysts monitor and act on the results.¹³

3.12 One of the program developers—the Bushfire and Natural Hazards Co-operative Research Centre (BNH CRC)—described Phoenix RapidFire as 'one of the best [simulators] available in Australia'.¹⁴ Its submission acknowledged however that 'empirical fire spread models are only as good as the observations and fire behaviour models which have been used'.¹⁵

3.13 Further, Phoenix RapidFire has known limitations:

These limitations primarily occur at extreme fire danger levels, where there is substantial interaction between the fire and the atmosphere, which is why the Bushfire and Natural Hazards CRC has extensive research underway to produce better fire spread models. However, the simulations can also prove

11 Professor David Bowman, *Submission 13*, p. 4.

12 Mr Greg Cooper, Branch Secretary, United Firefighters Union of Australia–Tasmania Branch, *Committee Hansard*, Launceston, 2 November 2016, p. 29. Also see: Mr Chris Arnol, Chief Officer, Tasmania Fire Service (TFS), *Committee Hansard*, Launceston, 2 November 2016, p. 58.

13 K. Tolhurst, 'Predicting the path of bushfires', Melbourne Sustainable Society Institute, <http://sustainable.unimelb.edu.au/tolhurst> (accessed 14 November 2016).

14 Phoenix RapidFire is currently used in several jurisdictions other than Tasmania (Victoria, New South Wales, Queensland, South Australia).

15 BNH CRC, *Submission 4*, p. 2. Also see: CSIRO, *Submission 1*, p. 11.

difficult at very low fire danger ratings levels in the types of fuels seen in these fires. The models may predict the fires should not spread and go out, but in peat they may continue to smoulder and reignite.¹⁶

3.14 The committee notes that Phoenix RapidFire is currently being 'updated' to improve its accuracy, particularly in the areas of landscape dryness measures, weather forecasting and the use of remote sensing products.¹⁷

TASVEG

3.15 The Department of Primary Industries, Parks, Water and Environment (Tas) (DPIPWE) has mapped the fire sensitive vegetation communities of the TWWHA. According to DPIPWE, this mapping enables Tasmanian fire agencies to develop plans for priority protection in the event of fire.¹⁸

3.16 However, the Tasmanian National Parks Association expressed concern that the database and published map (TASVEG) contain errors. Its submission described a sample review of the underlying data that it found to contain a number of spatial and coding errors:

If this is the case in this small sample area then it is possible that many more such errors occur elsewhere. This has major implications for GIS-based assessments of fire impacts (e.g. areas of sensitive vegetation types burnt) and it is self-evident that it is impossible to effectively prioritise fire-fighting efforts if the locations of the values being protected are not accurately known. It is therefore essential that a state-wide review of the accuracy of mapping of all fire sensitive natural values is undertaken, and resources made available to improve the quality of such data if it is determined to be deficient.¹⁹

3.17 To illustrate the inadequacies of TASVEG, Mr Nicholas Sawyer from the Tasmanian National Parks Association provided a photograph, said to show a hillside marked by TASVEG as an extensive Pencil Pine forest.

16 BNH CRC, *Submission 4*, p. 2.

17 BNH CRC, *Submission 4*, p. 2.

18 Department of Primary Industries, Parks, Water and Environment (DPIPWE), [TASVEG – The Digital Vegetation Map of Tasmania](http://dpiipwe.tas.gov.au/conservation/flora-of-tasmania/monitoring-and-mapping-tasmanias-vegetation-(tasveg)/tasveg-the-digital-vegetation-map-of-tasmania), [http://dpiipwe.tas.gov.au/conservation/flora-of-tasmania/monitoring-and-mapping-tasmanias-vegetation-\(tasveg\)/tasveg-the-digital-vegetation-map-of-tasmania](http://dpiipwe.tas.gov.au/conservation/flora-of-tasmania/monitoring-and-mapping-tasmanias-vegetation-(tasveg)/tasveg-the-digital-vegetation-map-of-tasmania) (accessed 14 November 2016).

19 Tasmanian National Parks Association, *Submission 16*, p. 3.

Figure 3.1: Frozen Lagoon, south-west of Lake Mackenzie on the Central Plateau



Source: Additional Information provided by Tasmanian National Parks Association, received 11 November 2016

3.18 Mr John Whittington, Secretary of DPIPWE, responded to this concern, saying that TASVEG is an amalgam of data from a range of sources and is not designed to pinpoint the location of vegetation: 'it is at a coarser scale than that'. Mr Whittington went on to comment:

People run into trouble with TASVEG when they use it for a purpose that it is not capable of supporting. I am confident that TASVEG is as good as any vegetation-mapping capacity around the nation, but it needs to be used appropriately.²⁰

3.19 The committee notes the Tasmania Fire Service's response that finer scale vegetation mapping would be of assistance.²¹

Current efforts to develop a Tasmania-specific fire model

3.20 Submitters and witnesses indicated that there is no research currently being undertaken to support the development of a Tasmania-specific fire model.

3.21 When the committee sought further evidence of specific fire modelling, from CSIRO, a representative stated that CSIRO was not aware of any proposal to conduct ecology landscape research, although the organisation has a long history of bushfire research, including the development of tools to predict the behaviour and spread of bushfires.²²

3.22 Dr Sullivan told the committee that ecology landscape research has not been prioritised, with research focusing on 'life safety' in the past 10 years. This focus has

20 Mr John Whittington, Secretary, DPIPWE, *Committee Hansard*, Launceston, 2 November 2016, p. 58. Also see: Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 6.

21 Mr Chris Arnol, Chief Officer, Tasmania Fire Service, *Committee Hansard*, Launceston, 2 November 2016, p. 58.

22 Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 2.

been accompanied by a policy shift away from management toward a response-driven approach.²³

3.23 Dr Sullivan suggested also that the development of fire spread models may have decreased in recent years due to reliance upon existing models that are assumed to work 'well enough'. He described how experienced individuals often fill the gap but forewarned against the retirement of these individuals:

Because we do not have formal fire behaviour models does not mean that an individual who has experience cannot undertake their own predictions. So quite often the gap gets filled by well-experienced people who have been doing it for many years. The problem is that, when they retire and move on, that gap becomes evident and people assume, 'Oh, they were just using whatever model was available at the time,' and continue on without actually identifying that there is a gap in the knowledge, because the expert knowledge that had been contained in that individual filled that gap for them.²⁴

3.24 CSIRO advised that a multi-agency approach would produce a practical fire model for Tasmania, and CSIRO was in a prime position to lead such research. However, this would require governments to prioritise ecology landscape research, including through additional funding:

There is only so much that can be done given the scale that we have, and in order to ramp up and solve the problem as comprehensively as it needs to be it may need a larger scale, which could be beyond CSIRO's capacity at this point.²⁵

3.25 Other witnesses spoke about research funding difficulties. For example, Professor Bowman told the committee that there are various funding models such as collaboration with industry partners, competitive Australian Research Grants or funding through the BNH CRC.²⁶

3.26 Dr Richard Thornton, Chief Executive Officer of the BNH CRC, indicated that funding is always difficult, with its budget largely allocated through forward years. This allows only for 'elements that we can do in the short term'.²⁷

23 Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 2.

24 Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 6. Also see: Mr Gavin Freeman, Deputy Chief Officer, TFS, *Committee Hansard*, Launceston, 2 November 2016, p. 58.

25 Dr Andrew Sullivan, Principal Research Scientist and Team Leader, Bushfire Behaviour and Risks, CSIRO, *Committee Hansard*, Canberra, 1 November 2016, p. 5. At present, the CSIRO's Bushfire Behaviour and Risks team is working on four projects: CSIRO, answer to question on notice, received 7 November 2016.

26 Professor David Bowman, *Committee Hansard*, Launceston, 2 November 2016, pp. 13–14.

27 Dr Richard Thornton, Chief Executive Officer, BNH CRC, *Committee Hansard*, Launceston, 2 November 2016, p. 22.

3.27 In addition, Dr Thornton explained that, for the BNH CRC, the 'focus has always been on the national issues that get to the heart of some of the systemic problems that we see, not so much on the local issues'. He indicated that, for Tasmania-specific issues, the Tasmanian Government could fund a research portfolio but it would still be 'a balance' of priorities.²⁸

3.28 Finally, Professor Bowman argued that the Commonwealth Department of the Environment and Energy (DEE) and DPIPWE are not well integrated with the university sector, resulting in ad hoc management and research for the TWWHA:

...there is no real go-to place for research in the World Heritage area. It is just a whole lot of very committed people who are doing things and shift shaping as the opportunities arise. There is not really a central organising principle and there is not a reliable income stream for sustaining the research—certainly in the university sector.²⁹

Government responses

3.29 In February, the DEE informed the Senate Environment and Communications Legislation Committee that the department has not undertaken any modelling to prepare for and manage increased fire risk in the TWWHA. An officer advised that this is the responsibility of the Tasmanian Government.³⁰

3.30 For this inquiry, Mr Chris Arnol, Chief Officer of the Tasmania Fire Service, explained that a specific fire model was never developed for the TWWHA, as the need was not anticipated. However, Mr Arnol recognised:

...it would be better to have modelling for Tasmanian environments ...What has been modelled in New South Wales does not necessarily apply in Tasmania...so we have to ground-truth them or check them...When we look at the range of models, there is, in my view, a fair bit of work that we could do there.³¹

3.31 A representative from the Attorney-General's Department (AGD), Mr Mark Crossweller, warned however that modelling is a recent phenomenon that does not necessarily supplant or surpass the assessment of a professional firefighter:

...firefighters are trained to read the fireground to anticipate fire conditions, rates of spread, intensities and all that comes with it, separate from technology. Technology can assist. It is becoming more useful. Some

28 Dr Richard Thornton, Chief Executive Officer, BNH CRC, *Committee Hansard*, Launceston, 2 November 2016, p. 22.

29 Professor David Bowman, *Committee Hansard*, Launceston, 2 November 2016, p. 14.

30 Mr Stephen Oxley, First Assistant Secretary, Wildlife, Heritage and Marine, Department of the Environment and Energy (DEE), *Estimates Hansard*, 8 February 2016, p. 158. The DEE then noted that it has been working with the South Australian and Victorian Governments to conduct a strategic assessment of their fire practices: Mr Dean Knudson, Deputy Secretary, Environment Protection Group, DEE.

31 Mr Chris Arnol, Chief Officer, TFS, *Committee Hansard*, Launceston, 2 November 2016, p. 58.

modelling has been very inaccurate compared to manifest circumstances, so to rely only on modelling could be more dangerous than having no modelling at all. Modelling is getting better, but I do not think that one can assume that modelling supplants or surpasses the capacity for understanding fire behaviour, as a practitioner.³²

3.32 Mr Crowweller noted that Australian, state and territory governments are currently collaborating on the National Fire Danger Rating System–Probabilistic Framework Project. This project is being managed by the NSW Rural Fire Service and aims to develop:

...a new consequence-based fire danger rating system able to integrate a wide range of variables and link their complex interactions to the probability of *property loss*. The project aims at delivering a spatially-explicit framework capable of generating daily maps representing the distribution of the probability of property loss at 10Km spatial resolution.³³

3.33 Mr Crowweller stated the project demonstrates that 'much research and investment is going into fire modelling in predictive analysis and behaviour to apply to multiple vegetation types across the landscape of Australia'.³⁴

3.34 The committee notes that the first phase of the project will deliver a prototype National Fire Danger Rating System based on the 'best currently available science'. This means that the prototype will not encompass TWWHA vegetation types for which there are no fire behaviour models (peat rainforest, wet heath alpine forest, alpine scrub or wet eucalypt forest).³⁵

Committee view

3.35 Fire assessment and modelling is a highly important tool for Tasmanian fire agencies, enabling them to more accurately predict fire behaviour and manage fires within their jurisdiction. However, CSIRO—and several others—highlighted that there is no fire model suited to the specific needs of the TWWHA. The committee is of the view that, had such a model been available, the Tasmanian fire agencies would

32 Mr Mark Crowweller, Director General, Emergency Management Australia, Attorney-General's Department (AGD), *Committee Hansard*, Canberra, 1 November 2016, p. 14. Also see p. 15.

33 G. Caccamo, T.D. Penman and R.A. Bradstock, *National Fire Danger Rating System Probabilistic Framework Project, Final Report for Year 1*, Report for the Attorney-General's Department and the Bushfire Cooperative Research Centre, October 2012, p. 4, http://bushfirecrc.com/sites/default/files/managed/resource/probabilistic_framework_project_final_report_1112.pdf (accessed 14 November 2016) (emphasis added). The framework includes a range of variables—other than weather elements—such as fuel load and type, the nature of the terrain and housing density in a particular region.

34 Mr Mark Crowweller, Director General, Emergency Management Australia, AGD, *Committee Hansard*, Canberra, 1 November 2016, p. 15.

35 AGD, answer to question on notice, pp. 1–2, received 9 November 2016. The response notes that the development of new fire spread models for Tasmania is out of scope for the prototype phase.

have been better prepared to respond to the 2016 bushfires. The committee considers that this deficiency should be addressed as soon as possible, commencing with the necessary groundwork in ecological landscape research.

3.36 In this context, the committee notes that the Tasmanian Government simulates fire behaviour using Phoenix RapidFire, a software program that requires, and will always require, current data. The committee has some concerns that reliance upon such a program could exacerbate the challenges currently facing Tasmanian fire agencies, especially as the program has known limitations in relation to organic (peat) soils.

3.37 While several submitters and witnesses highlighted the critical need for a Tasmania-specific fire model, the committee was surprised to learn that there are no current plans for research to support the development of such a model. One key reason for this appears to be a lack of funding. The committee considers that the Australian and Tasmanian Governments should prioritise ecology landscape research in the TWWHA, with long-term funding provided to enable the CSIRO to lead a multi-agency research project on this issue. The committee notes that the TWWHA is home to a number of endemic fauna species (see chapter one) and that predicting fire behaviour and spread is important also to the protection and conservation of fauna values.

Recommendation 2

3.38 The committee recommends that the Australian Government, in cooperation with the Tasmanian Government:

- **recognise the need to identify the ecological and biodiversity impacts of fire on fire sensitive vegetation communities, organic soils and endemic fauna species in the Tasmanian Wilderness World Heritage Area; and**
- **allocate long-term funding to the Commonwealth Scientific and Industrial Research Organisation and/or the Tasmanian Government to assist with the development of fire assessment and modelling specifically suited to the Tasmanian Wilderness World Heritage Area.**

