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The Southwest Tasmania Fires of Summer 2018-2019

A Post Event Review Capability Study

Dr Adriana Keating and Prof John Handmer

Firefighters using fire beaters to fight the Gell River fire in the Tasmanian Wilderness World Heritage Area. Credit: Warren Frey, AFAC, supplied.

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Foreword: Tim Plant

Core of my heart, my country! Land of the rainbow gold,
For flood and fire and famine, she pays us back threefold.
Dorothea Mackellar: "My Country"

Weather events are natural, but disasters are not.

Bushfires are a natural part of the Australian summer landscape but pose a real threat to property and lives. We don't have to cast our minds too far back to remember the devastating bushfire season during the summer of 2019-2020. The impact and pain from that bushfire season is still being endured by many Australians 12-months on.

In addition to the direct impact, we are beginning to realise the indirect and long-term impact bushfires have on industries and livelihoods – including the tourism, agriculture and viticulture industry, just to name a few. As green shoots begin to appear in our land, it is often the societal and financial impacts that endure within the community.

What's more, the Australian bushfire season is increasing in duration and severity in some regions. Traditionally cool climate areas of Australia are beginning to experience bushfires of a treacherous nature for the first time. Longer bushfires seasons have also left authorities with limited time outside of the bushfire season to practice good land management and bushfire prevention strategies.

Insurance is an important aspect of financial recovery following disaster, but there are other ways in which risk can be mitigated. Preparation and planning are key to prevention, and this is at its most successful when there is harmonic rhythm and collaboration between government, community, small business, and the insurance and financial sector.

With the above in mind, Zurich Insurance has officially launched a Post-Event Review Capability (PERC) in response to the 2018-2019 Tasmanian Bushfires. This PERC has been formed based on research, endorsement and review from a range of internal and external experts.

Originally developed by the Zurich Flood Resilience Alliance, Zurich's PERCs are a systematic framework for analysing disaster events, including understanding how a hazard became a disaster, and identifying where and how resilience can be built. A PERC does not recommend specific interventions, rather, it identifies critical gaps and actionable opportunities to reduce risk and build resilience. This includes a particular focus on specific local stakeholders who can then design and implement interventions grounded in the local context.

Zurich PERCs have traditionally focused on floods and storms. However, given the significant impact recent bushfires have had on Australian communities and industries, Zurich has turned its attention to the topic of bushfires for this latest PERC.

We have embraced much of what is highlighted above to create a truly unique PERC, focusing on a natural hazard that we are beginning to see occur with increasing severity and frequency in an area not usually associated with this type of event.

I am proud to contribute the foreword to this PERC, and I hope that it will help us all reflect on how we can better plan and prepare for future disasters as a nation, community and industry.

Tim Plant
Chief Executive, General Insurance (Australia & New Zealand)
Head of Commercial Insurance (Australia & New Zealand)
Zurich Financial Services Australia

Foreword: Richard Thornton

This report highlights the importance of understanding all aspects of the impacts from natural hazard events. In this case a series of Bushfires (Wildfires) in south-western Tasmania in 2018-19.

Most analyses of events take a narrow view looking at specific aspects, such as response or preparedness or impact. This report highlights the power of the Zurich Flood Resilience Alliance's Post Event Review Capability (PERC) methodology in providing a more wholistic view of the events. It also highlights how the principles of the PERC methodology can be applied to the Bushfire context.

The methodology applies a resilience lens to the topic of evaluation, in particular it focuses on community and business resilience. In doing this it considers what risk reduction and preparedness measures had been implemented prior to the events. It goes on to consider the community response and then community and business recovery.

Importantly, the study identifies opportunities to further develop the resilience of Tasmanian communities, as well as extrapolates to where these opportunities can be applied more widely in Australia and globally.

In a time where there is a rising risk across most of Australia, and globally, as the result of climate change and demographic and societal shifts, it is vitally important that we can examine past events to help to learn lessons that help to mitigate the impacts of the increasing severity and frequency of natural hazards.

It is important that these risks are considered from a multifaceted viewpoint, as single siloed solutions are not going to see the reductions in exposure and vulnerability needed. This will require a whole of community approach and using methodologies such as PERC can help to better achieve the required learnings.

The Authors have done an exceptional job of bringing together the views of community members, business owners and government officials to craft meaningful conclusions and recommendations. I would recommend this report to anyone who has an interest in better understanding the diverse interplay between different sectors of the community in the lead up to, during and after a major event.

Richard Thornton
Chief Executive Officer, Bushfire and Natural Hazards Cooperative Research Centre

Executive Summary and Recommendations

The summer of 2018-19 (December 2018 – February 2019) was devastating for the Australian state of Tasmania. Fire services were overwhelmed by the multiple, large fires that burned over 200,000 ha across the western half of the island from the end of December through to early March. This report analyses these fires using the Zurich Flood Resilience Alliance's Post Event Review Capability (PERC) methodology. It focuses on community and business resilience; while there have been several reviews into firefighting operations, a more systemic view of resilience is less common.

The summer 2018/19 fires officially began on 24 December 2018, in one of the hottest and driest summers on record. On 15 January 2019, 2402 dry lightning strikes hit the state, igniting 70 fires that formed into four massive fire complexes. More than 210,000 hectares burned, including 95,000 hectares in the Tasmanian Wilderness World Heritage Area (TWWHA). Fortunately, no deaths were directly attributed to the bushfire, although an unknown number of people are believed to have died due to smoke and 114 injuries or accidents were recorded.

The event saw a significant and protracted evacuation, with the Huonville evacuation centre open for 15 days, accommodating up to 700 people daily. The lingering effects on impacted communities are still being felt. It resulted in the destruction of tourism assets, forestry resource and globally precious, protected ecosystems of the TWWHA. Smoke from the fires impacted health and the burgeoning viticulture industry in Tasmania. These impacts, along with others, have had significant flow-on effects to the already-struggling Tasmanian economy and communities.

There is much to learn from this event for Tasmania and other jurisdictions which will likely face similar events. This report outlines the risk landscape in southwest Tasmania, examining trends in climate-change charged bushfire conditions, exposure of people and assets, and their vulnerabilities. It outlines what happened during the event, with a focus on the community safety response. Direct and indirect impacts on people and economies are explored. Key insights are identified across all phases of the disaster cycle. Below we present an abridged version of the final recommendations of the study.

Risk Reduction and preparedness

Support for PWS as it develops a bushfire management plan for the TWWHA.
The first need identified by this review was a multi-stakeholder process for the development of an adaptive bushfire risk management plan for the TWWHA. Since the event, PWS has initiate the development of a fire management plan. We find that across the board there is a strong desire to work collaboratively to preserve the TWWHA, which provides a robust foundation for multi-stakeholder dialogue. While the details of PWS's plan have not been released yet, ideally it would ultimately encompass a holistic risk management approach that includes all steps of the disaster risk management cycle.

Slow the growth in bushfire risk via land-use and building regulations.
Increasing bushfire risk in Tasmania could be mediated by more action to prevent further build-up of assets in high risk areas. Tasmanians would benefit from investment in high quality modelling of current and future bushfire risk to update the bushfire-prone overlays and roll them out across the state.

Implement a risk reduction plan that complements risk-based prescribed burning with other strategies.
Further investigation into the options for prescribed burning in wilderness areas, including the TWWHA, is needed. Increasing risk means that, like all Australian states, Tasmania would be well served by complementing its prescribed burning program with other hazard management strategies, such as fuel breaks, particularly to protect townships and other important assets and infrastructure.

Support strong working relationships between fire agencies, land owners and conservationists.
There is considerable mutual respect and alignment in perspectives between fire agencies, landowners and conservationists in Tasmania. We recommend that these strong working relationships be reinforced, and potentially formally codified, to support further movement towards a comprehensive and adaptive bushfire risk management scheme in Tasmania.

Expand community engagement in bushfire resilience and preparedness programs.
The Bushfire Ready Neighbourhoods Program run by TFS is based on best practice for community resilience and preparedness programs, and is delivering positive results. Key factors in the success of this program include support from TFS leadership, a foundation based on long-term community development principles and engagement with local researchers.

Climate change adaptation planning for Tasmanian industries.
The tourism, wine and apiary industries were identified by this review as being impacted by this event. These industries – and no-doubt others – require climate change adaptation action plans. We know that climate change adaptation planning is most likely to be successful and efficient when it is comprehensive, integrated and long-term.

Adopt stringent CO2 emissions reduction targets.
A key driver behind the devastation of this and other recent bushfires is climate change. While Tasmania's contribution to global emissions is small, it has a responsibility to contribute to the global effort. The Tasmanian Government can also play a significant role in contributing to Australia's commitment to emissions reductions, which could have a more significant impact on the global stage.

Emergency response

Augment the emergency warnings system to operate in prolonged events.
Prolonged 'campaign' fires are becoming more frequent right across Australia. The experience of this bushfire provides an ideal learning opportunity to review the effectiveness of the current warnings system in these circumstances.

Clarify bushfire suppression priorities in the TWWHA.
Future management planning for the TWWHA would be enhanced by a stakeholder process to reach agreement between PWS, STT and other key stakeholders regarding suppression priority areas in the TWWHA and a process to resolve challenges that arise in the future. This could also include a consideration of when environmental assets should take priority over infrastructure and questions of risks to firefighters.

Contribute to the national conversation on the impact of bushfire smoke on health.
Because of its comprehensive air quality monitoring, Tasmania is in a strong position to be a frontrunner in understanding and addressing the nationally and globally significant issue of the health impacts of bushfires, which has also come to the fore with the 2019/20 mainland bushfires.

Embrace comprehensive resolutions to this complex problem.
Much of the public debate around these bushfires was centred on calls for more remote area firefighters and/or aerial suppression resources (waterbombers). While these will likely play an expanded role in bushfire response as risk increases, they will by no means "solve" the problem. Under certain climatic conditions – that we are seeing more and more of – it may become impossible to put out some bushfires in the Tasmanian terrain. Everyone within and adjacent to the Tasmanian emergency management sector rather continue to advocate to the general public that there is no single solution.

Community response and recovery

Prepare for a longer phase of community response, including evacuations.
The prolonged nature of this bushfire event, and the subsequent 2019/20 mainland fires, highlighted the need for community response preparations to include plans for longer lasting events.

Local Governments and Local Councillors should plan for emergencies together.
The relationship between the Huon Valley Local Government and the Huon Valley Local Council was very effective during the crisis and could be a good model for other LGAs.

Cross-LGA secondment agreements should be incorporated into community response planning.
Another success of the Huon Valley's community response was the secondment of municipal area coordinators from other LGAs to the Huon Valley. This provided much-needed staffing relief and at the same time provided hands-on, practical experience to secondees. It would be highly beneficial if in-principle arrangements for these secondments could be made ahead of time, so that they could be activated when needed.

Clarify and codify the role of the community sector in emergencies and resolution processes.
We find that in regard to community sector contribution to response operations, roles need to be more clearly delineated beforehand and processes for quickly resolving issues established. Cost-recovery arrangements also need to be transparent. Action already underway in this regard is to be commended and should be supported. The role of the community sector in disaster risk management in Tasmania could also be more comprehensively considered at the State level and within regional recovery committees.

Update the strategy for emergency volunteers.
Volunteering is a manifestation of, but also a source of, community disaster resilience. Yet the disaster volunteering landscape is changing rapidly with the emergence of social media and other changes. As such, the relationship between players in the emergency sector and volunteers is ever-evolving and the sector could consider updating the strategy for volunteers.

Identify and implement lessons regarding the provision of recovery grants.
The provision of individual, business, and community recovery grants is a mainstay of disaster recovery in Australia. There was considerable confusion with the provision of grants following this event. Recovery grants can be a powerful tool and this experience should inform the design of future grant schemes. Future grant schemes should also consider eligibility on the basis of smoke exposure as well as direct threat from fire.

Provide support to complete the learning cycle after event reviews.
Fire and emergency services agencies are diligent in initiating and engaging with post-event reviews. Typically, the majority of the findings and resultant recommendations from these reviews are accepted by governments and agencies. Recent advancements in learning and knowledge management indicate that institutional and operational changes are not cost-neutral; in order to complete the learning cycle and implement lessons learned, agencies require congruent resourcing.

Introduction

The summer of 2018-19 (December 2018 – February 2019) was devastating for the Australian state of Tasmania. Fire services were overwhelmed by the multiple, large fires that burned over 200,000 ha across the western half of the island from the end of December through to early March. This report analyses these fires using the Zurich Flood Resilience Alliance's Post Event Review Capability (PERC) methodology [1] (see Box 1). The PERC methodology has been applied to disaster events across the globe, including for wildfires in Canada [2] and the USA [3]. It seeks to understand what worked well and what should be improved for next time to support disaster resilience.

Dialogue with authorities, organizations and affected community and business groups finds that Tasmania has entered a new era of bushfire risk. Since the turn of the millennium, climate change and land use change have converged to bring about a new fire regime in Tasmania. The state has fought severe bushfires in 2006, 2010, 2012, 2013 and 2016 - and these fires in 2019. Severe fire seasons are predicted for the coming years.

This report focuses particularly on community and business resilience in relation to the fires in the southwest of Tasmania in January 2019. It explores risk reduction and preparedness measures in place before the event, community-based response, and community and business recovery. It identifies opportunities to further build resilience in Tasmania, across Australia, and globally. As climate change increases the frequency and severity of extreme fire weather and drying increases fuel loads [4], lessons from events such as this are not only critical for areas with a history of wildfire, but also areas in the expanding high-risk zone.

The fires in southwest Tasmania in January 2019 provide an important case study for several reasons. While there have been several reviews of firefighting operations in response to previous fires i.e. in 2013 [5] and 2016 [6], much less attention has been paid to community and business resilience before, during and after wildfires. This event saw the destruction of tourism assets, forestry resource and globally precious, protected ecosystems of the Tasmanian Wilderness World Heritage Area (TWWHA). These impacts, along with others, have had significant flow-on effects to the already-struggling Tasmanian economy. Smoke from the fires impacted health and the burgeoning viticulture industry in Tasmania. The event saw a significant and protracted evacuation, well-managed by the municipal government. There is much to learn from this event for Tasmania and other jurisdictions who will likely face similar events.

The summer 2018/19 fires officially began on 24 December 2018, in one of the hottest and driest summers on record. On 15 January 2019, 2402 dry lightning strikes hit the state, igniting 70 fires that formed into four massive fire complexes[1]. More than 210,000 hectares burned, including 95,000 hectares in the TWWHA. The Huonville evacuation centre was open for 15 days, accommodating up to 700 people daily. Fortunately, no deaths were directly attributed to the bushfire, although an unknown number of people are believed to have died due to smoke. 114 injuries or accidents were recorded, 22 of which were serious enough to warrant a worker's compensation claim. Significant environmental and cultural assets were lost. The tourism industry – which is highly significant for the Tasmanian economy – suffered major losses, while the viticulture and apiary industries were also impacted.

Following the PERC approach, this report aims to undertake a holistic analysis of how a natural hazard event became a disaster. It is at the event-level and focuses on identifying lessons to inform disaster resilience. The analysis looks across the disaster risk management cycle, analysing how risk built up in the landscape, risk reduction, preparedness, response and recovery. Researchers gathered information via desk-based research and in-depth interviews with emergency services personnel, foresters, municipal authorities, local leaders, community and civil society organisations, and experts. The Australian National Council for Fire and Emergency Services (AFAC) released a detailed review of the emergency response [7] that focuses on fire suppression operations - henceforth "the AFAC report". This report draws on and complements the AFAC report, and while there are some overlaps it is mainly focused on wider issues of community and business resilience rather than operations.

[1] A fire complex is "Two or more individual incidents located in the same general area which are assigned to a single incident commander or unified command." [80]

Box 1: What is the Post-Event Review Methodology?

The trends are clear: Impacts from natural hazard events are intensifying. These trends inspired the Post-Event Review Capability (PERC), a methodology developed by the Zurich Flood Resilience Alliance. Post-event reviews are a proactive effort to learn from weather-related disasters soon after they happen, through research and dialogue with authorities, affected people and organizations. The studies seek to answer questions related to aspects of hazard resilience, risk management and catastrophe intervention. They look at what has worked well and what has gone wrong during large-scale hazard events, resulting in actionable recommendations for the future. Since 2013, the PERC methodology has been used to analyse flood events across the globe, including in Western Europe, the U.S., Nepal and Peru. In 2019, the award-winning* PERC methodology was extended to study wildfires in the U.S., Canada and Australia. For the library of post-event reports, please visit **https://floodresilience.net/PERC**.

*2019 Business Insurance Innovation Award; 2019 National Hurricane Conference Outstanding Achievement Award.

The report is structured as follows: section I describes the physical context of the wildfires, including significant previous events, conditions in the landscape leading up to the event, and how the fires were ignited and spread. Section II outlines the institutional arrangements pertinent for this event and explores the exposure and vulnerability of affected communities and assets, before outlining prospective and corrective risk reduction, and preparedness actions taken before the event. Section III describes what happened during the event, particularly regarding the community-focused response. Direct and indirect impacts of the fires are presented in section IV, as is an analysis of community and business recovery to-date. Section V presents key insights from the study, and section VI makes recommendations particularly pertinent to Tasmania and with salience for all wildfire exposed areas.

Section I: Physical Context

Previous Bushfires in Tasmania

Table 1 presents significant previous bushfire events in Tasmania's history, since colonisation [5].

Table 1: Significant previous bushfires in Tasmania

Date	Location	Impacts
January 1854	Huon and port Cygnet	Destroyed homes, equipment, 14 deaths, many injured.
Summer 1897-98	Around Hobart and across the Mount Wellington ranges	Extensive property damage, 6 deaths.
Summer 1933-34	Derwent and Huon Valleys	Details limited; timber mill lost.
February 1967	Southeast Tasmania	Known as Black Tuesday and the worst event in Tasmanian history, 1400 homes, 128 buildings, 62 deaths, 900 injuries, bridges, fencing, vehicles, 62000 stock losses.
February 1981	Threatened the town of Zeehan	No significant damage.
February 1982	Kempton and Broadmarsh	1 death, 2 injuries, 8 buildings, 38 outbuildings, equipment, fences, 3000 livestock.
February 1993	Town of Coal River Valley threatened.	Minor damage.
January 1998	Ridgeway	50 injured, 7 homes.
January 2003	Broadmarsh, Mount Dromedary, Brighton (suburb of Hobart)	No property losses but did threaten Hobart.
October 2006	Risdon Vale and Meehan Range	Threatened houses and communities, minor losses including impacts on transmission lines.
December 2006	East coast near St Marys, Scamander and Four Mile Creek as well as other smaller communities; Kellevie.	26 houses, 28 outbuildings, 1 death, disruption of tourism peak season; $50 million worth of production forest.
March 2008	Heemskirk	Threatened Savage River mine.
Summer 2009-10	Wayatinah (Upper Derwent Valley), Dolphin Sands, York Town, Lake Macintosh, Montagu.	3 houses, regenerated forest and pine plantation, farming infrastructure, timber reserves, threatened Beaconsfield.
January 2013	Dunalley	1 death, 203 homes destroyed, significant economic impact (see details below).
January 2016	Northwest	Approx. 125,000 ha burned, much of it in the TWWHA, Indigenous heritage impacted (see details below).

More recent significant events were the fires of 2013 and 2016:

Dunalley bushfire, January 2013 [5]

The Dunalley bushfires in January 2013 were a devastating event. Approximately 40 fires burnt throughout the state, with the main fire near Forcett causing significant damage to the town of Dunalley. Some 2000 people were ferried by boat to safety. One person lost their life and 203 homes were destroyed. Hundreds of businesses were impacted, including the largest employers in Dunalley which devastated local livelihoods. Economic cost of the fires is very conservatively estimated to be at least $89 million (AUD2014).

2016 Northwest Bushfires [6]

The bushfires in northwest Tasmania that began in January 2016 saw another devastating bushfire season for Tasmania. A total of 124,724 hectares burned, much of it in the TWWHA. The firefighting campaign continued for more than two months, drawing on all available resources including those from interstate and overseas. The fires damaged highly sensitive ecosystems and impacted Aboriginal and historic heritage areas. However, there was no loss of life and minimal destruction of property.

Bushfire history in the TWWHA

The TWWHA (see Box 3 is a nationally and globally significant wilderness area that is increasingly threatened by bushfires. Press [8] finds that since the 1930s the TWWHA has been threatened by at least 12 bushfires of more than 20,000 hectares. The AFAC report [7] details the significant extent of bushfires that have burnt in the TWWHA between 2010 and 2019. This includes 95,430 ha of TWWHA burnt in the 2018/19 event [7], 19,800 ha in 2016 and 40,468 ha in 2013 [8]. Considering that the TWWHA is 1,383,863 ha in size, this means that at least 11% of the TWWHA has been burnt since 2013.

Box 2: Learning from previous fires

Tasmanians interviewed for this report raised the subject of the adoption of recommendations from reviews of previous fires, or 'lessons learned'. The 2016 AFAC review [6] contained 12 substantial recommendations, while the 2013 review [5] contained 103, many of which apply to the state's fire fighting forces, namely the Tasmania Fire Service (TFS), Parks and Wildlife Service (PWS), and Sustainable Timber Tasmania (STT).

AIDR [9] distinguish between a 'lesson identified' and a 'lesson learned' as follows:

"A lesson identified articulates a positive or negative experience and a clear course of action based on analysis. A lesson learned articulates how a lesson identified has been learned through a demonstrated change in behaviour."

Overall, it was reported that in regard to previous reviews, in particular in response to the 2013 and 2016 events, while response agencies are diligent in undertaking learning reviews and many lessons have been identified, achieving the lesson learned status by affecting change is more challenging. This is partly due to the fact that implementing changes is typically not cost-neutral. Further to this, successive severe and prolonged fire seasons are squeezing the non-operational time available to implement lessons identified.

More encouragingly, those in the conservation movement reported that progress has been made since 2016 regarding the prioritization of environmental values. Several respondents informed the study team of an incident during the 2016 fires in which a half complete replica hut was protected by back burning a highly environmentally significant stand of 1000 year old trees. Indeed, as discussed below, we find a growing appreciation within the fire services for the need to have processes and information in place to prioritize environmental assets and values alongside built assets.

The capacity of the sector to translate lessons identified - from reviews such as this one and the AFAC review - into lessons learned is a primary consideration.

Landscape

Southwest Tasmania is a sparsely populated and remote corner of the globe. As shown in Figure 1, the region is dominated by TWWHA national park, boasting globally precious and unique ecosystems that serve as the foundation for the Tasmanian tourism area. Outside of the TWWHA the region is home to private forestry plantations and those managed by STT. Agricultural land includes a long history of apple growing and other fruit orchids, and a growing wine grape sector.

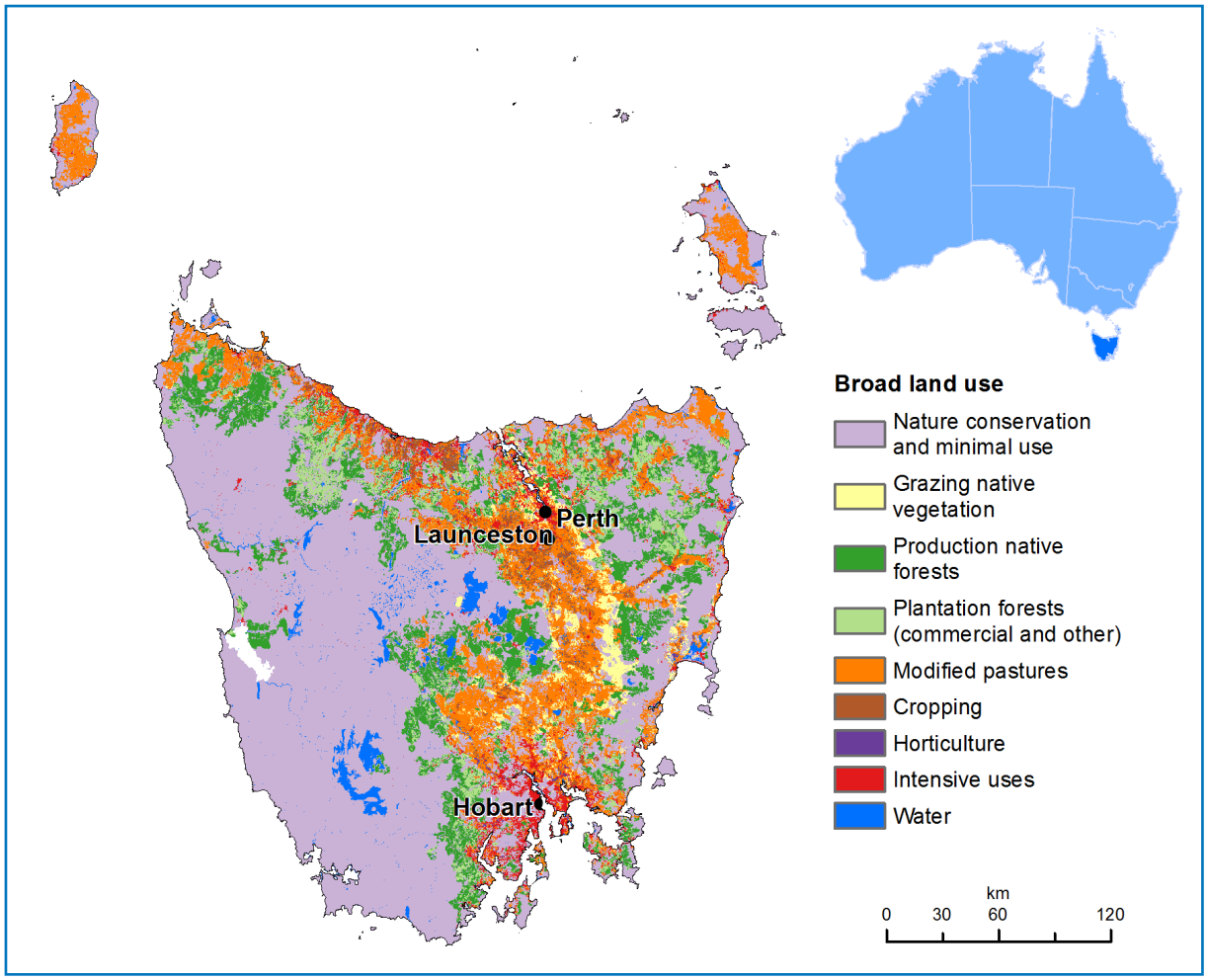

Figure 1: Catchment scale land use of Australia - Update December 2018 [10]

The local government areas (municipalities) of Huon Valley and Derwent Valley are situated in the southern tip of Tasmania (see Figure 2) and have a combined population of approximately 26,000 people, living in approximately 12,500 households [11], with major population centres in the towns of Huonville and New Norfolk. The Huon Valley is sparsely populated, with the majority of the population is concentrated on the eastern border of the region, with TWWHA occupying the rest of the region.

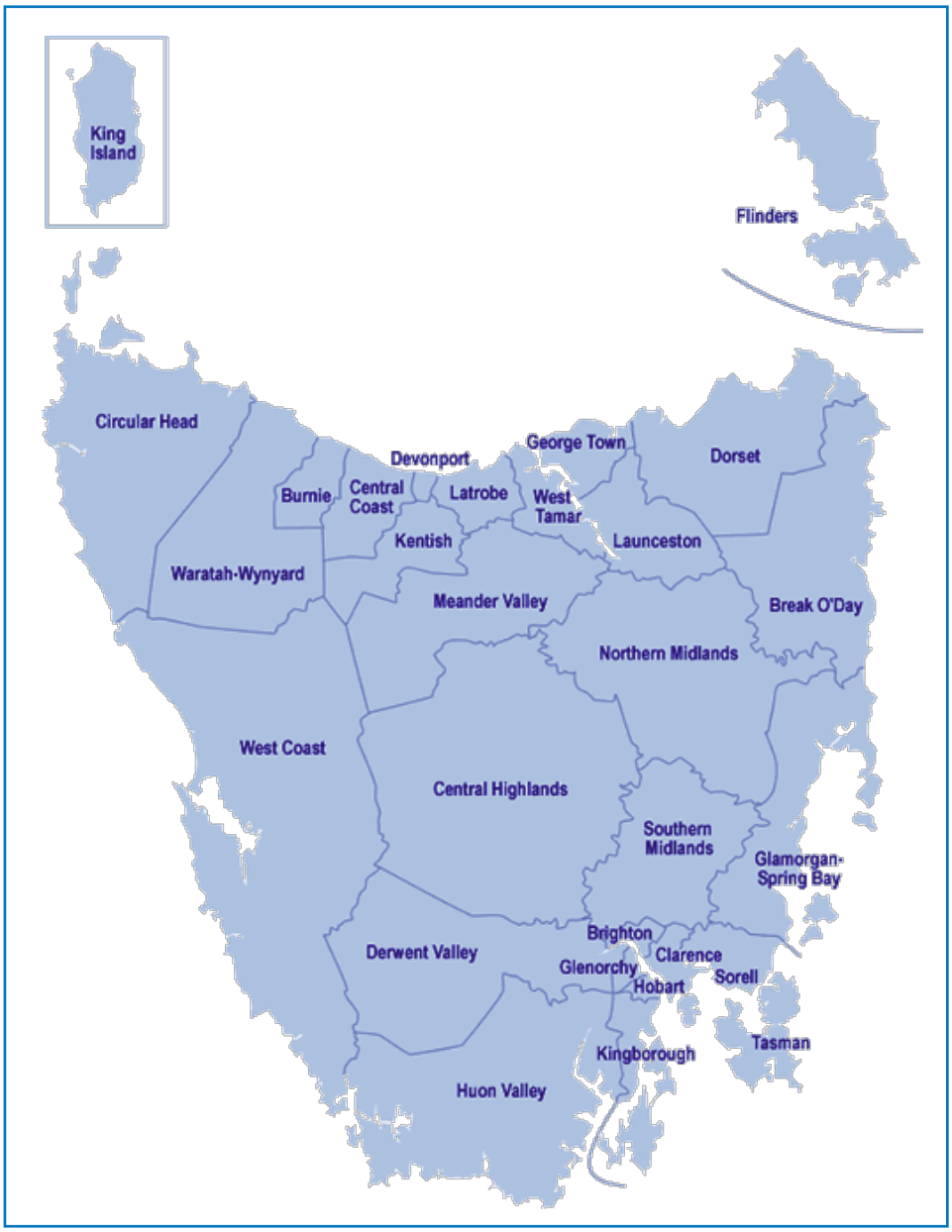

Figure 2: Tasmanian Local Government Areas [12]

Box 3: The Tasmanian Wilderness World Heritage Area

The TWWHA became a UNESCO World Heritage site in 1982. While most sites meet only a couple of criteria for inclusion on the World Heritage List, the TWWHA meets seven; Mount Tai in China is the only other site in the world that meets as many criteria [13]. The TWWHA covers an area of more than 1 million hectares and represents one of the last significant regions of temperate rainforest globally [14]. With some of the last stands of Gondwanan vegetation left in the world, the region is not only environmentally important, but also has significant cultural heritage. There is evidence that Indigenous people lived in the area for more than 20,000 years before colonization in the early 1800s. As discussed throughout this report, the TWWHA is the foundation for Tasmania's growing tourism industry, which is a key pillar of the economic development strategy for the region.

Figure 3: Aerial view of bushfire damage to King Billy pine forest on the slopes of Mt Bobs. Photo credit: Rob Blakers.

Figure 4: Tasmanian Wilderness World Heritage Area [15]

The Huon Valley Land Use and Development Strategy, adopted by the Huon Valley Council in 2007 [16], describes the physical and environmental setting of the Huon Valley as making it particularly susceptible to bushfire. The presence of volatile Eucalyptus together with steep topography have resulted in several major bushfires in the region's history. The Strategy further argues that bushfire risk may be increasing due to landscape change as former grazing land is repurposed to forestry plantation.

Climatic conditions

Styger et al [17] argue that education campaigns such as the 'fuel stove only' policy have been very successful in reducing human ignited fires in the TWWHA. Yet the area burnt by wildfire has increased rapidly since 2000 (see Figure 5), largely as a result of dry lightning ignitions. A fire responder interviewed for this study commented that **"before 2000 our major concern was arson, now it's dry lightning."**

Many studies [17] [8] [18] have found that climate change is increasing the frequency and severity of wildfire across Tasmania. Fox-Hughes et al [18] found that under the high emissions climate change scenario we are currently on, Tasmania will see a steady increase in fire danger, particularly in spring. The fire season will lengthen and the number of days where the forest fire danger index (FFDI) is extreme will increase.

The southwest fires of summer 2018/19 were ignited by lightning. Evidence is mixed as to whether changed weather patterns from climate change are resulting in more frequent lightning during summer, or if monitoring is simply picking up more lightning strikes. What is uncontroversial is that climate change is leading to historically low soil and vegetation moisture - and hence flammability - in what has typically been wet vegetation [7] [8]. Not only is this resulting in an increased proportion of lightning strikes igniting fires [17], but also fires burning through wet, tall Eucalyptus regnans forest and rainforest ecotone vegetation, which have traditionally served as natural control lines [7]. One interviewee stated:

> **"The lightning strikes ignite something and they'll sit there until the bad weather comes and the smouldering trees just ignite fires. Until they come out you can't deal with them. And then they all ignite at once with the weather."**

Fire ignitions from lightning can smoulder in the landscape for several days until hot, dry and windy weather conditions turn them into wildfires, which can quickly expand and combine.

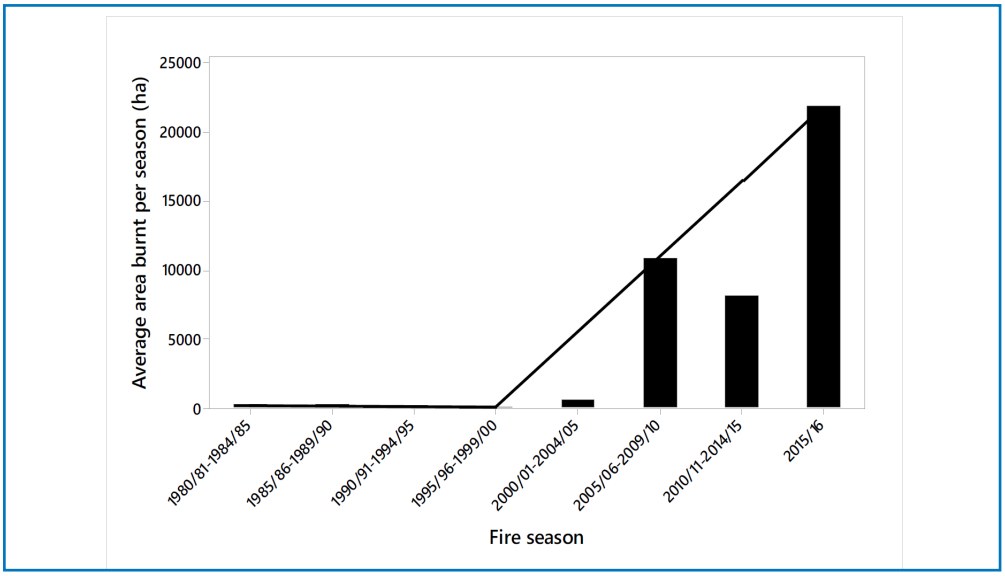

Figure 5: Average area burnt per fire season (ha) by lightning fires for five yearly periods between 1980/1981-2014/2015 and 2015/16. Lowess (segmented regression) line is shown. Reproduced from Styger et al [17]

The Tasmanian branch of the United Firefighters Union of Australia stated in its submission to the AFAC report [19] that:

> **"Firefighters do not profess to be climate change experts or scientists, but firefighters' experiences are that the fire seasons are longer, with days of extreme temperatures resulting in more protracted and intense bushfires."**

This perspective is congruent with the discussions the PERC study team had with experienced Tasmanian firefighters. This experiential evidence or anecdotal reporting is backed up by the science - the AFAC report [7] clearly and strongly states that:

> **"Consistent with strong scientific evidence and following the significant fire events in Tasmania in 2013, 2016 and 2019 there is broad acknowledgement and acceptance that projected changes to climatic conditions will result in longer, more severe fire seasons for the State, as with other parts of the country."**

The perspective from both the fire and emergency management sector in Tasmania, and the scientific literature, is that since about the year 2000 Tasmania has entered a new fire regime, driven largely by climate change. This new fire regime has profound implications for fire risk management and firefighting operations, including in the TWWHA.

Section II: Socio-Economic Disaster Risk Management Landscape

Institutional arrangements

Tasmania's formal bushfire management framework, as shown in Figure 6, sets out the roles and responsibilities of government organisations. However, bushfire risk management involves much more than this. It involves a network of state and local government entities, private sector corporations, non-government and community-sector organisations, and individuals.

At a general level, exposure of property and infrastructure is largely under the formal control of state and local planning authorities, with involvement of private sector infrastructure providers. Building regulations, which are developed by the National Building Codes Board and implemented locally, set out requirements to manage the vulnerability of the built environment. Construction is undertaken by private contractors often with minimal oversight, and this is important in determining the actual risk. Householders often make alterations to their properties and surrounding landscapes after the initial build, in turn changing the fire risk. During a bushfire, all fire and emergency service organisations are usually active in advising and evacuating those at risk.

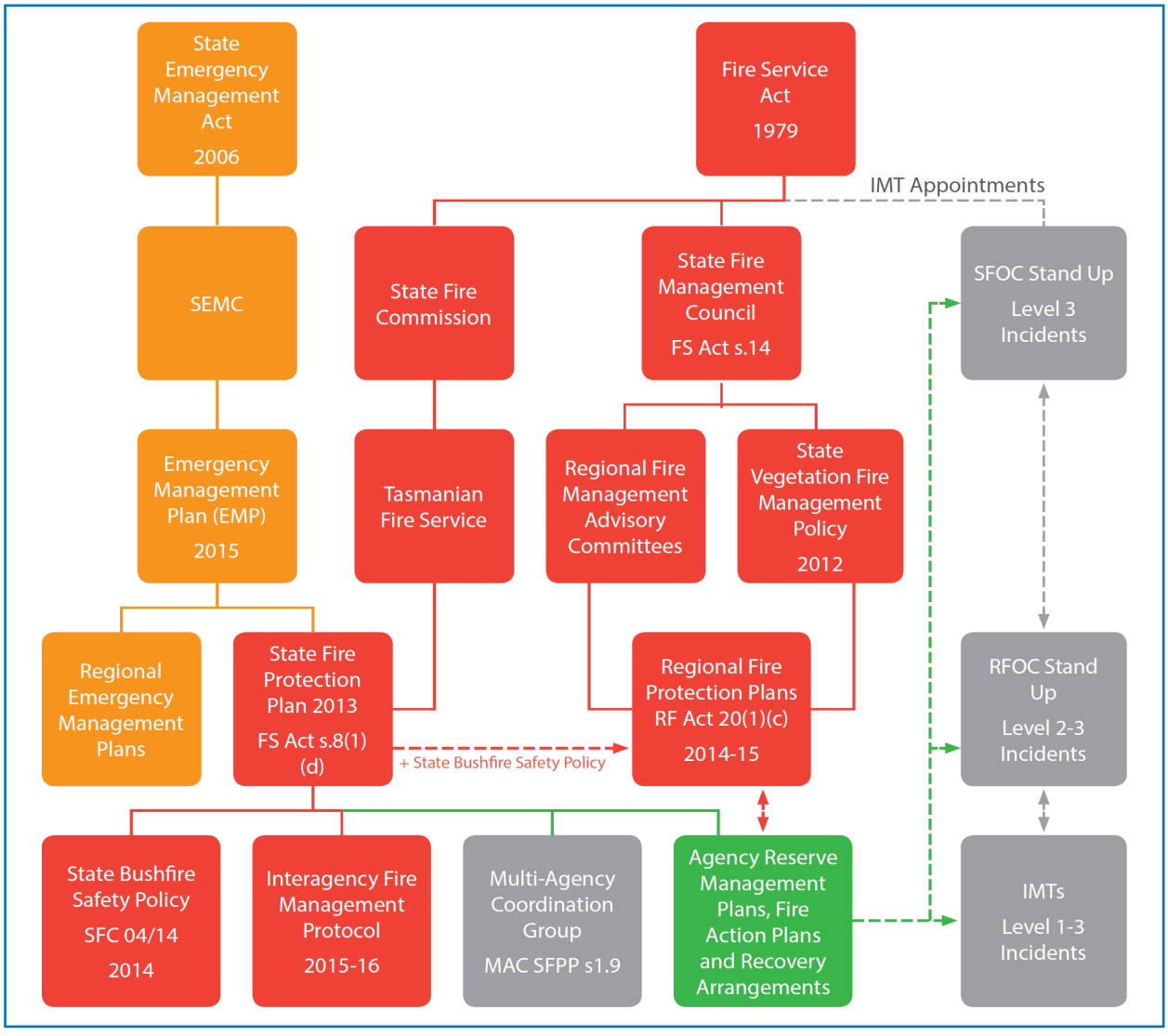

Figure 6: Tasmanian Bushfire Management Framework. Source: reproduced from [7].

The AFAC review sets out the formal arrangements for managing a fire crisis:

> **"The Emergency Management Act 2006 is the primary overall piece of legislation relevant here, and where there is an inconsistency, it prevails over other legislation relating to emergency management (Emergency Management Act, 2006, at s.5)." [7]**

Emergency management committees are established at three levels mirroring the three levels of government: state, regional and municipal. The roles of the different levels are essentially the same, however, the hierarchy of the different levels of government is maintained in the committee structure:

> **"to institute and coordinate, and to support the institution and coordination of, emergency management including the preparation and review of the … Emergency Management Plan and Special Emergency Management Plans that relate to [the jurisdiction] (Emergency Management Act 2006, at ss. 7-9 and 19-22 respectively)" [7]**

In addition, the government has discretion to establish a Ministerial Committee chaired by the Premier, including the State Controller. This committee has the power to operate as determined by the Premier and set out in the Emergency Management Act 2006 (at s. 12).

Initial responsibility for firefighting operations sits with the organisation - TFS, PWS or STT - who have jurisdiction over the land where the fire is burning. STT has approximately 220 staff and contract firefighters and is responsible for fires on state forest. PWS has approximately 200 firefighters and is responsible for fires in reserves. TFS has approximately 250 career firefighters and 4800 volunteers, and is responsible for all other land. TFS is made up of four career brigades in major towns and 232 volunteer stations throughout the State. Volunteer firefighters are not monetarily compensated when they take part in fire risk reduction or suppression activities.

Incident Management Teams (IMTs) are activated by Regional and then State Controllers when bushfires escalate beyond the control of the initial agency responsible, with level 3 IMTs being multi-agency under the coordination of TFS, as set out in the Tasmanian Interagency Protocol. During such a significant bushfire the State Crisis Centre is activated with the state Emergency Management Committee in overall command - in close communication with the Tasmanian cabinet.

The Tasmanian Emergency management Arrangements (TEMA) sets out the key roles and responsibilities for emergency response [20], see Figure 7. As a fire threatens, and during a fire, evacuation shelters and related services for evacuees are run by municipal government and a range of NGOs. Short-term relief and longer-term recovery are coordinated by regional recovery committees, chaired by the Health Department, consisting of a mix of government and NGO members. The Southern Regional Social Recovery Committee (the region relevant to the fire examined in this report) is made up of all NGOs drawn on in an emergency. It meets every three months and undertakes practice in "peace-time". Under the relevant legislation, the Health Department is the lead agency for disaster recovery, providing services and staff. There are three regions in the state. In a bushfire event, local councils are in charge, but they can be overruled by state agencies. It is notable that the private sector, including insurers and groups with potentially useful resources that could benefit national and local businesses, are not formally engaged in these arrangements.

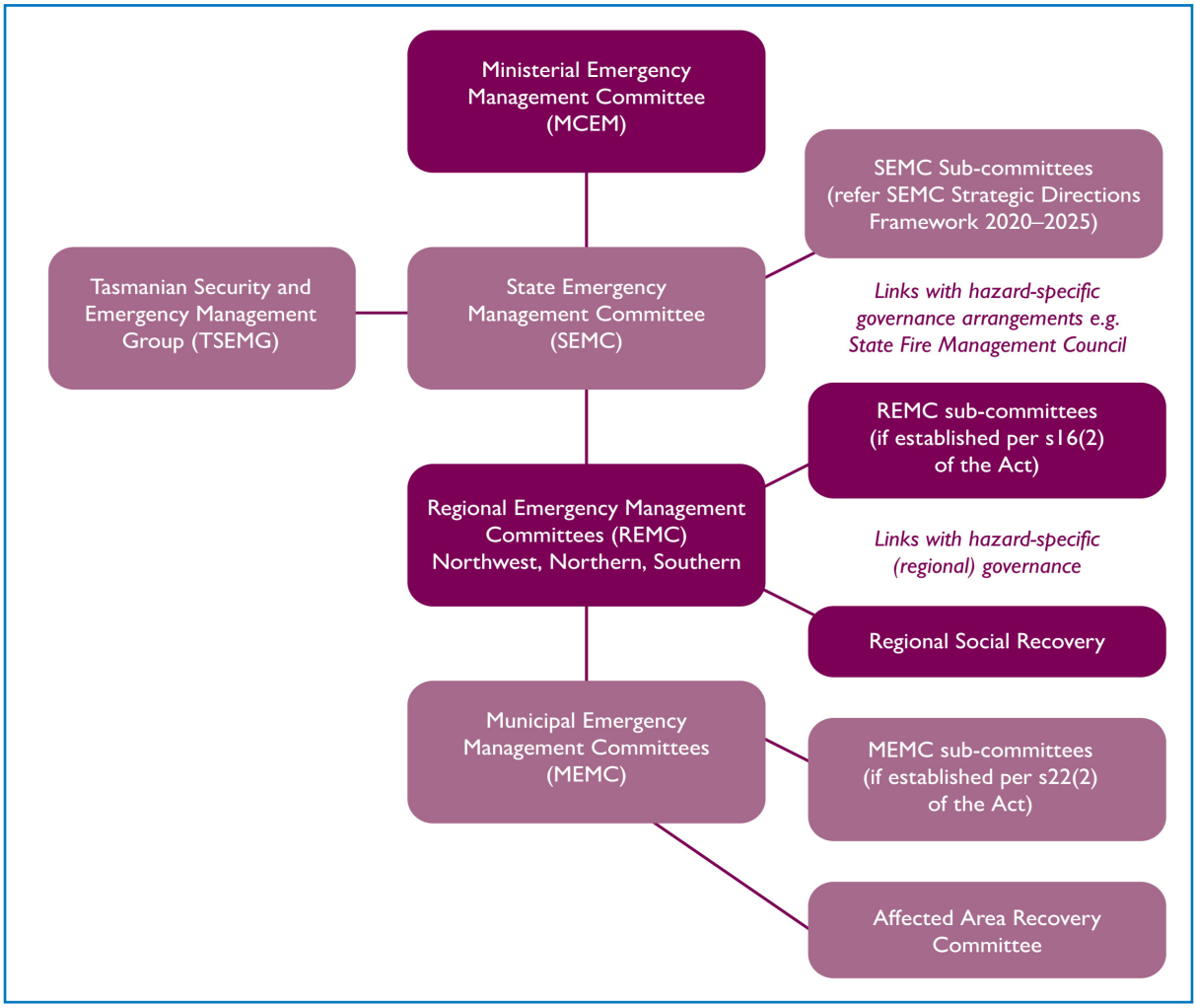

Figure 7: Tasmanian emergency management governance structure [20]

Exposure and vulnerability

Socioeconomic conditions

The socioeconomic conditions in southwest Tasmania, in particular the Huon Valley Council area, form an important part of the story about wildfire risk in the region. Located in the southern region of Tasmania (see Figure 2), the Huon Valley is a sparsely populated rural municipality with a population of approximately 17,500 [21], a high proportion of whom are elderly [22]. Almost all interviewees spoke of the strong sense of community in the region, and peoples' willingness to trust and help each other.

According to the Australian Bureau of Statistics (cited in [21]) there are 1,255 local businesses in the Huon Valley. The largest industry is Agriculture, Forestry and Fishing; aquaculture employs approximately 20% of employed residents (having almost doubled since the 2012/13 financial year), followed by agriculture at 9%. In contrast, forestry and logging account for only 0.8% of jobs in the Huon Valley, with the number of jobs more than halving in the last 5 years [21]. The Mayor of the Huon Valley also identified the tourism sector as of growing significance; statistics [21] show that food retailing, accommodation, and food and beverage services are growing modestly and providing many jobs in the region.

While there is established wealth and prospering businesses in the region, only approximately 42% of residents in the Huon Valley are reportedly employed [21]. While this does not account for informal employment, un- and under-employment – particularly reliance on casual, seasonal jobs – is a concern for the region, resulting in many people being economically vulnerable. Compared to the national average, Tasmania has lower income levels, a higher level of unemployed people than the mainland states and lower levels of literacy and educational attainment [22].

Exposure

The United Nations Office for Disaster Risk Reduction [23] defines exposure as: "People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses."

Here we look specifically at trends in exposure to bushfire in southwest Tasmania, starting with population trends. The population in the Huon Valley is growing modestly. Unlike other regional areas in Tasmania, the Huon Valley has seen consistent population growth of approximately 0.7% per annum between 2005 and 2015 [22]. The Huon Valley Economic Development Strategy 2015-2020 [22] identifies retirement migration, consisting of older people, and low housing prices that are attracting young families, as two key drivers. Interviewees also reported that a portion of the population growth in the region comes from hobby farmers or 'tree changers'. The influx of new residents is resulting in new development in rural areas, which is increasing exposure. GHD [16] reports that these lots are often located right on the forest boundary, are difficult to access and lack water supplies sufficient for fire suppression.

The tourism industry in the Huon Valley is also growing. NIEIR [21] estimate that in 2017/18 the value of the tourism and hospitality sales sectors to the Huon Valley Council area was $23.8m. Indeed, growing the tourism sector is the first pillar of the Huon Valley Economic Development Strategy 2015-2020 [22]. The Strategy recognises the proximity to Tasmania's pristine wilderness as a key drawcard for tourists. Growth in environmental tourism further necessitates growth close to what the tourists have come to see - the forest.

In interviews a town official stated that *"a lot of roads are not accessible by emergency vehicles. 70% of our roads are unsealed. (On) many you can't pass another vehicle at all."* Narrow and unsealed (unpaved) roads were also raised by several respondents as an issue for the capacity of community members to evacuate and for emergency vehicles to access fires.

Vulnerability

The PERC Manual [1] follows UNDRR [23] to define vulnerability as "The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard." It then adds that "Vulnerability is driven by a combination of physical, social, economic, and political factors."

In southwest Tasmania the prevailing socioeconomic conditions and demographic trends may be increasing the vulnerability of people and businesses to bushfire. Interviewees at the Huon Valley Council highlighted concern that an ageing population together with an influx of new residents - including those who may not have experience with bushfire risk - may be increasing the vulnerability of residents during fire events. These residents are considered by interviewees to be less able to manage the risk around their property, evacuate or defend their property. The average age of rural firefighting volunteers has also increased substantially as the local population has aged.

The fact that a significant proportion of population growth is made up of elderly people and children is a concern for increasing vulnerability to the impacts of smoke. ONE interviewee – an epidemiologist who works on the impacts of bushfire smoke on health – warned that people over 65, smokers, those with chronic health conditions, pregnant people and young children are particularly vulnerable to even small air quality reduction from smoke. Startlingly, they estimated that 30-60% of the population of southwest Tasmania falls into this vulnerable category.

With regard to the vulnerability of businesses, it is important to note that poor economic growth in the region indicates that many businesses are already struggling. As a tourism industry expert stated: *"Many tourism operators are marginal anyway, a downturn [for example caused by a bushfire in the region] can push them over the edge."* There is also concern that Tasmania's growing viticulture industry is vulnerable to economic loss from both burnt vine and smoke taint of wine grapes. The suggestion of smoke taint in one area carries a reputational risk for all vineyards across the state.

The community residents that work under these economic conditions are particularly vulnerable when bushfire impacts the region. A social services employee reported that many residents are casual employees who depend solely on the summer tourist season: *"That's where the casual workers get their income, a few months over the summer and that tides them over."* Under these already precarious conditions many residents are highly economically vulnerable to the type of downturn that a bushfire can bring to tourist numbers in the region, even if they or their employer are not directly impacted by the fires. Tourists, who typically swell southwest Tasmania during summer, are themselves highly vulnerable to bushfire. Tourism experts and the AFAC report [7] highlighted that tourists may not speak English, nor be aware of the need to, or how to, monitor warning messages.

Prospective risk reduction

Prospective risk reduction is a term used in disaster research and refers to "actions taken to avoid the build-up of new or increased risks" [1]. In the case of wildfire, prospective risk reduction is often thought of as involving land use and building regulations intended to prevent more vulnerable assets being placed in areas at high risk of wildfire.

In regard to prospective risk reduction in the form of land-use planning and building regulations relating to wildfire risk in Tasmania, overall we find these to be present but limited. Across Tasmania there are building regulations that apply to new developments, subdivisions and changes in use type in 'bushfire-prone areas'. These are defined at the Local Government Area (LGA, municipal council) level, where local planning decisions are made. TFS states [24] that:

A 'bushfire-prone area' for the purposes of Tasmanian planning and building legislation includes:

- **Land that is within the boundary of a bushfire-prone area shown on an overlay on a planning scheme map; or**
- **Where there is no overlay on a planning scheme map, land that is within 100m of an area of bushfire-prone vegetation equal to or greater than 1 hectare.**

These building regulations apply in the Huon Valley [25]. When there is a planning application for a new development, subdivision or change of use within a bushfire-prone area, applicants must comply with building regulations set out in 'Australian Standard AS3959: Construction of buildings in bushfire-prone areas' [26] and submit a certified bushfire hazard management plan. These requirements include provisions such as ensuring the property is accessible to emergency vehicles, clearance zones between the property and vegetation, and reliable water supply. TFS holds ultimate responsibility for the certification of bushfire hazard management plans and run an accreditation scheme for building surveyors and planners to be able to certify plans. An interviewee from TFS stated that *"people complain about the work involved [to gain accreditation], we just hold strong 'this is about community safety'. We're not making a profit, if anything it costs us."*

According to interviewees, the bushfire-prone area building restrictions are the extent of prospective risk reduction for bushfire in Tasmania. Critically, there are no land-use restrictions that might prevent the placement of new assets in high bushfire-risk areas. Our review of planning regulations concurs with this, although there do seem to be restrictions on placement of highly vulnerable building types - such as schools, aged care and detention facilities - in high risk areas.

The need for economic growth creates a disincentive for restricting asset growth in bushfire-prone areas. Particularly in regard to the tourism industry, which is a target growth industry for the state, locating assets in bushfire-prone areas has economic benefit because these are the areas visitors come to see. At the same time, as discussed above, slow economic growth is driving vulnerability to bushfires. Development in at-risk areas is therefore a wicked problem within the disaster-development system [27].

When it comes to the TWWHA, the question of prospective risk reduction takes on a different form. Instead of prospective risk reduction being about avoiding the build-up of more assets in at-risk areas, it is a question of avoiding the creation of more risk to the (ecological) asset; an asset that would ideally be increasing. Unfortunately, beyond reducing emissions, options for arresting increasing bushfire risk in the TWWHA are limited, because bushfire weather and dry lightning strikes are the main drivers of increasing risk. One, less commonly considered option, could be to increase the size of the TWWHA to bring in precious but less protected areas on the borders of the TWWHA.

Corrective risk reduction: prescribed burning

Corrective risk reduction is "Actions taken to reduce risk to already at-risk assets" [1]. Other common words include disaster mitigation and ex-ante risk reduction.

In southwest Tasmania prescribed burning, also known as fuel reduction burning or planned burning, is the mainstay of corrective risk reduction. Considered the most cost-effective risk reduction strategy [28] [29], prescribed burning is the deliberate setting of fires by fire services and private landowners in times of low bushfire risk. It is designed for "reducing the rate of spread and intensity of fires, for minimising the damage caused by bushfires, and to provide fire-fighters with safe opportunities to contain and extinguish future fires" [29].

Prescribed burning in Tasmania is overseen by TFS via the Fuel Reduction Program, who work in cooperation with PWS, STT, local councils and private landowners. TFS [28] states that the "cross-agency, whole-of-state fuel reduction program includes both public and private land, focusing on those areas that pose the greatest risk of bushfire, regardless of who owns the land." Tasmania's 10 Fire Management Area Committees, together with the SFMC, identify high risk locations. Risk assessments draw on both local knowledge and computer modelling utilising Phoenix RapidFire and SPARK, as well as the Bushfire Risk Assessment Model (BRAM) tool [7].

The program determines areas for prescribed burning treatment according to the priorities of preservation of life, protection of critical community infrastructure, residential property, business assets and the natural environment [28]. Program effectiveness is assessed in terms of risk reduced – measured as a function of a fuel load – rather than hectares burnt, with the aim to reduce the State's risk rating level to below 80% [7]. Despite this risk-reduction target, "this notionally includes a minimum annual target of over 30,000 ha but typically around 20,000 ha is achieved" [7].

It is important to note that not all vegetation types are suitable for prescribed burning treatment, including rainforest, wet eucalypt forest and alpine vegetation. TFS [28] states that 42% of land in Tasmania is suitable for prescribed burning. shows the treatability of land in Tasmania. Note that much of southwest Tasmania, including in the TWWHA, is untreatable (see Figure 8).

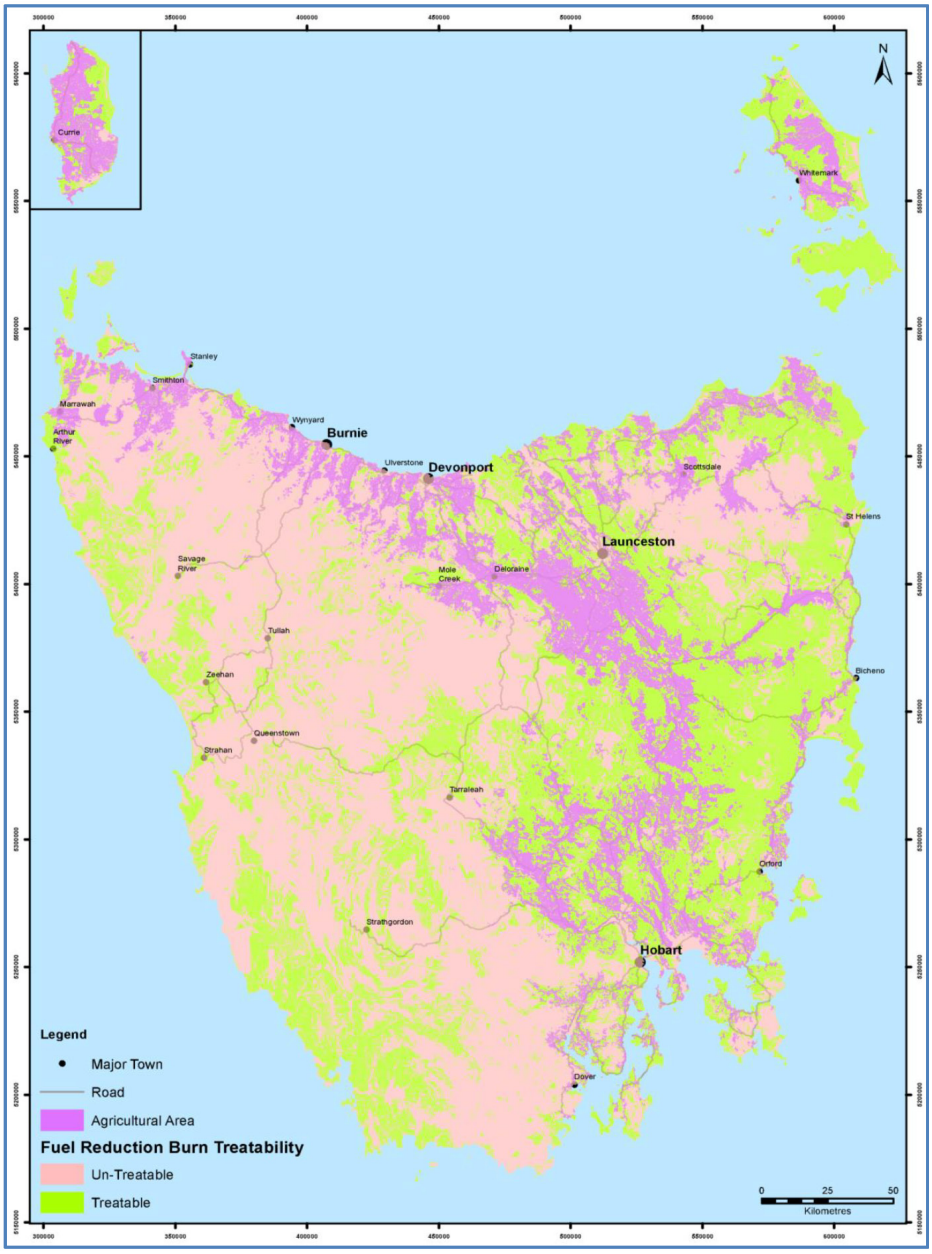

Figure 8: Treatable fuels across Tasmania [29]

$45 million AUD was allocated for The Fuel Reduction Program from 2017 and 2022, $0.5 million AUD of which is dedicated annually to strategic landscape burning in the TWWHA to protect precious ecological assets [7]. The AFAC report found that overall, the program is meeting its core objective of reducing Tasmania's risk rating level. Across Tasmania risk was reduced by 4% over the last four years, with 34 burns covering nearly 14,000 ha conducted in Spring 2018 [7]. The AFAC report considers that these prescribed burns reduced the rate of spread and extent of the 2018/19 bushfires.

The investigation team found consensus across the political spectrum regarding the importance of prescribed burning for bushfire risk management in Tasmania. Environmentalists, experts and firefighters all agreed that it has an important role to play. However, prescribed burning is not without controversy. Several contentious issues were identified which we now explore.

Prescribed burning on private land

Prescribed burning on private land is a point of contention. As discussed above, the Tasmanian Fuel Reduction Program has the objective of reducing risk to protect values (lives, property etc), and this risk reduction should be conducted regardless of land tenure. A former Fire Manager for STT (formally Forestry Tasmania) suggested that prescribed burning on private land can be *"very NIMBY (not-in-my-back-yard) - people recognise the need for prescribed burning but don't want their block burnt."* While TFS does have the authority to compel burning on private land, we found that this authority is rarely if ever invoked. There appears to be sufficient risk reduction to be done on public land and with willing private landowners such that there is no need to create tensions with community members.

On the other hand, in a submission to the AFAC report the Central Highlands Council [30] argued that *"[n]umerous examples exist of property owners not being permitted to conduct controlled burns in some cases years before this fire, the values being purported to be protected (plants and eagles nests) have now gone."* This submission is a prime example of a perception of some in Tasmania that environmental considerations have restricted private risk reduction activities, specifically prescribed burning by private landowners.

We did not find corroborating evidence for this position; quite to the contrary, environmentalists expressed their support for the planned burning program, and environmental assets are identified as being protected by prescribed burning by TFS. The submission to the AFAC report from the Institute of Foresters Australia [31] provides a clue as to what may be underlying the perceived restriction of prescribed burning by private landowners. They state:

> **"The private landowner's liability for fuel reduction fires is a point of confusion for landowners and is a factor in their involvement in fuel reduction. An understanding is that if a permit is issued, and a burn plan adhered to, the land owner is not liable for fire-fighting costs in the case of an escape. However, there is uncertainty as to whether this extends to civil liabilities for property damage…Landowners have possibly lost fuel reduction burning skills and are very hesitant to responsibly light fires because of the insurance/ liability issues."**

Private landowners must always register their burns with TFS, but are only required to obtain a permit during Fire Permit Periods, which are "are usually in force during the dry summer period from November to March" [32]. The permit system exists because the chance of escape is high during the hotter months, and many consider this to be a reasonable precaution. What is clear is that there is confusion and misunderstanding regarding prescribed burning on private land, with the perception that it is being unduly restricted.

More or less prescribed burning?

There is an ongoing debate in Tasmania and indeed across Australia regarding whether conducting more prescribed burning would be effective for risk reduction. Meander Valley Council Councillor King is quoted in The Examiner [33] calling for more prescribed burning in the TWWHA: *"I am calling on the state government to protect the assets of all landowners by managing the fuel load that has built up with the lack of management of the TWWHA."* Similarly, Randall Trethewie, the owner of a 6000 acre property adjacent to TWWHA in the Central Highlands stated in his submission [34] to the AFAC report that *"[i]n 1961 there was a wild fire that swept through the conservation area …..no burning has been conducted there since. Some 58 years with no preventative fire management!"*

Conversely, Tasmanian bushfire experts argue that while prescribed burning is important, it is not the answer to increasing bushfire risk. One prominent bushfire expert stated in our interview *"you need to look at the problem in its totality. Prescribed burning is fine and useful, but it shouldn't be the only tool. It should be a small part of a strategic plan."* A study by Furlaud et al. [35] found that "realistic, implementable prescribed-burning plans to reduce fine fuel loads in fire prone Tasmanian grasslands, sedge-lands and dry eucalypt forests have little potential to substantially reduce the extent and intensity of wildfires at a state-wide scale." An interviewee from TFS suggested that prescribed burning in the urban fringe was the most effective.

A false sense of security?

The Levee Effect

In flooding research the 'levee effect' was a phenomenon first recognised in 1945 [36], that occurs when "the presence of flood protection structures such as levees leads to greater development in the floodplain or in the 'shadow of the levee', and increases potential losses and damages during floods if the protection structures fail. The levee effect increases long-term risk while reducing potentially short-term risk, and possibly increases total risk due to a false sense of safety behind a protection structure" [1].

While differing in several ways, it has been suggested that prescribed burning may be similarly problematic, for wildfire. An interviewee stated that *"Fuel reduction burns lull people into a false sense of security – you did four fuel reduction burns around us this year so we're safe."* This false sense of security may act as a disincentive to undertake individual risk reduction actions such as having a bushfire plan, cleaning guttering and clearing land.

This issue is compounded when we consider that fire severity is increasing, and increasing winds mean structures are increasingly likely to be lost due to ember attack, the risk of which cannot be mitigated by reduction in ground fuel achieved by prescribed burning. As an interviewee stated:

> **"The first property we lost [in this event] was a historic fishing shack up in the great lakes. It was completely surrounded by grass and burnt down by ember attack – the pattern in the grass shows that the fire didn't burn up, it was embers. We also had active protection there with equipment. The owners were happy for us to show the photos and show that it was ember attack. They thought they were prepared but they had no idea about the intensity. This helps people not be lulled into a false sense of security about their preparedness."**

Prescribed burning and smoke

The impact of smoke from prescribed burning on human health was raised as a controversial issue regarding Tasmania's prescribed burning issue. An interviewee suggested that *"planned burns kill people – maybe more than fires – from the smoke."* The most vulnerable groups are the elderly, young children, and those with underlying health conditions. Smoke from prescribed burns also has an impact on wine grapes.

The organisations that conduct prescribed burning, namely TFS, SST and PWS, consider the impact of smoke when deciding when and where to conduct prescribed burns, and advice on smoke management is also available to private landowners [37]. Weather forecasts are used to inform prescribed burn planning to maximise smoke dispersal [29]. An interviewee from the Tasmanian wine industry stated that they have *"a very good relationship with the fire service, we work closely on communication and they've been very good in making sure prescribed burning isn't done without consultation. There's a good relationship and we've worked hard on it."*

Despite these precautions, there remains considerable division within the community regarding smoke from prescribed burns, with some suggesting that it is an argument for fewer prescribed burns, and others arguing that this would further unduly restrict them. On the one hand, a former employee of PWS who conducted prescribed burns stated that *"I would come into work every day to 20 abusive emails [regarding smoke], eventually I got sick of the abuse."* On the other hand, submissions to the AFAC review contended that smoke management requirements are restricting prescribed burning in Tasmania, however the review found that "[n]o evidence was presented to suggest smoke management restrictions curtailed any planned burning that would have influenced this fire event."

Prescribed burning under climate change

The key challenge facing the future of prescribed burning in Tasmania is that of climate change. Climate change is reducing the appropriate weather windows for prescribed burning and making conditions generally more unpredictable and complex. An interviewee from TFS said that *"the window [for prescribed burning] is getting shorter with climate change. If we get a wet spring or autumn things won't burn. Or if it's too dry then it's too risky."* The AFAC report [7] concurs, stating that:

> **"Consistent with strong scientific evidence and following the significant fire events in Tasmania in 2013, 2016 and 2019 there is broad acknowledgement and acceptance that projected changes to climatic conditions will result in longer, more severe fire seasons for the State, as with other parts of the country. This will only become more challenging as the weather windows open for prescribed burning shift with changing climatic patterns, adding uncertainty and complexity to burn planning."**

Preparedness

Preparedness is "precautionary actions taken prior to potential disasters" [1]. While risk reduction is about reducing exposure and vulnerability to hazards, preparedness is about individuals, communities, businesses and other organisations getting ready for bushfire events that may occur.

Our investigation highlighted several key preparedness activities occurring in southwest Tasmania prior to the 2018/19 bushfire season: evacuation centre and animal refuge preparations undertaken by the Huon Valley Council, and the Bushfire Ready Neighbourhoods (BRN) program run by TFS. We also comment on household preparedness.

Evacuation Centre Preparations

The Huon Valley municipality has been widely acknowledged for the thorough and effective planning and running of the Huonville evacuation centre (see below for more details). It is a requirement under the Emergency Management Act 2006 that all municipal councils have an emergency management plan, and that it is reviewed at least every two years. The robustness of these plans varies across municipalities, with several interviewees suggesting that the Huon Valley is likely a leader in this regard, potentially because of their frequent experience with flooding. A common refrain from interviewees was that *"they were exceptionally well prepared...this level of preparedness was unusual."* At the same time, issues that emerged during the event in relation to the relationship between local government and NGOs (discussed below) indicate planning could be improved in some regards.

The Huonville evacuation centre was located in the PCYC (Police and Community Youth Club) building in the centre of Huonville. The PCYC was the obvious choice for the evacuation centre, being a large recreational and sporting facility with lots of space, bathrooms with showers, kitchen and dining facilities. It is located next to the cricket club which contains a commercial kitchen, so further people could be catered for if needed. Planning extended to an established plan in place to evacuate the PCYC evacuation centre (and animal refuge, see Box 3) if required.

Huon Valley municipal emergency management planning included detailed plans and wide stakeholder engagement. Critically, in the months prior to the event the Emergency Management Coordinator gave a presentation to the Mayor and elected Councillors about emergency response plans. As discussed below, this ensured everyone was on the same page about roles and responsibilities when the event occurred.

In regard to the provision of services by community sector organisations within the evacuation centre, the Emergency Management Act 2006 assigns some general responsibilities, while leaving exact arrangements up to municipal and regional planners. At the regional level, the Southern Regional Social Recovery Committee includes state government representatives, municipal councils and four NGOs. Representatives from the community sector indicated that the

planning at this level for engagement with the community sector was, in hindsight, somewhat vague. Hindsight also revealed that planning neglected to consider the impact of heat and smoke on the population at the evacuation centre.

Box 4: Good Practice Example - Huon Valley Animal Refuge Preparations

The quality of the preparations for an animal refuge, or animal evacuation centre, in the Huon Valley was high and unusual. While very few municipal governments prepare for livestock evacuations, the relatively high percentage of Huon Valley residents with multiple types of animals, such as hobby farmers, made it a necessity. The availability of appropriate facilities in the form of the Ranelagh grounds also made this possible.

Planning for the animal refuge began after the 2013 fires when local woman Lisa Phohl recognised the need for livestock to be accommodated in the event of an emergency. Lisa utilised her connections within the Huon Valley council, local agricultural society and pony club, to bring together the stakeholders needed to plan for the animal refuge. The Ranelagh grounds are owned by the agricultural society, with adjoining space owned by the pony club. The agricultural society and pony club were also the source of volunteers during the event.

The animal refuge was designed to accommodate pets and animals from small-scale businesses, not large commercial enterprises who were responsible for their own arrangements. The plan included activation protocols that mirrored the human evacuation trigger, which is called by the SES. Planning included DPIPWE (Department of Primary Industries, Parks, Water and Environment), who provided advice regarding biosecurity, and animal health via the head veterinarian. TFS was also consulted regarding the defensibility of the location. The plan was scalable for different levels of demand or even severity.

Community education workshops were run in the year prior to the event, informing people about how to be prepared, what to bring to the animal refuge and what to expect.

Bushfire Ready Neighbourhoods

The Bushfire Ready Neighbourhoods (BRN) program, run by TFS, has won numerous awards and was identified as an example of excellent community-based preparedness. In 2009 TFS embarked on a joint research project with the University of Tasmania to understand the factors influencing households' planning and preparedness for bushfire, in order to improve their community education approach [38]. This research led to the development of the BRN program. The program is now based on the concept of 'shared responsibility' and a sustainable community development approach where TFS takes a facilitating rather than leading role.

The BRN program is run in rural and regional communities who face high bushfire risk and focuses on community actions to prevent and prepare for bushfires. Activities include:

- information sessions;
- community forums;
- workshops;
- field days;
- bushfire rehearsals;
- women's programs;
- bushfire ready neighbourhood groups;
- and property assessments [39].

The program is run in two-year periods, with 20-25 communities in each round. Communities are selected based on risk, viability, community interest, networks, interest from local volunteer brigades, etc. Interest and involvement from the local council and other strong community leaders is seen as critical to success. Existing community groups and networks such as Land Care groups and Community Houses are a core part of the program, with the Red Cross also playing a role in many communities. A rigorous monitoring and evaluation process is contributing to program effectiveness.

Not unlike other community-based initiatives, challenges faced by the BRN program include the fact that many people are time poor and hence struggle to be involved with more intensive preparedness activities. As noted above, Hobart and Laun are generally higher socioeconomic areas than the rest of Tasmanian. In these circumstances, building community cohesion - which is essential for the program to succeed - is challenging. Finally, these issues mean that it is a challenge to maintain the structures and activities set up by the program after the two-year TFS involvement period.

Figure 9: BRN priority communities for the 2018-20 period [40]

Figure 9 shows the priority communities for the 2018-20 period. Note that four communities are in the southwest, close to where the 2018/19 fires occurred.

Individual preparations

This investigation was not able to undertake a comprehensive review of household or business level bushfire preparedness activities. However, several interviewees mentioned the general state of individual preparedness in relation to the communities and businesses impacted by these fires. Overall, within TFS there is the impression that while some people take extensive action to ensure their property is as protected as possible, many do not.

Lack of action on the part of households and businesses to protect their property is a source of great frustration for those within the emergency management sector. Several interviewees from TFS noted that in a bushfire event resources are stretched, and they are not able to save everyone's property. Individual actions can make the difference between whether a property is defendable or not, and firefighters are – not unexpectedly – unwilling to risk their lives for a property that is not defendable. Access routes in and out of the property are a key factor in determining whether it is defendable, in addition to clearing of vegetation and keeping gutters (eaves troughs) clean.

At the same time, there is a limit to the impact individual preparations can have. As one interviewee stated, *"you can clear all around your house, but it doesn't protect you from ember attack."* Risk awareness is essential for motivating individual preparedness and includes understanding that even with preparations risk cannot be eliminated.

This section provides an overview of the event, including regarding the firefighting operations as well as what happened for affected community members. This is a factual account of the event as drawn from reports (in particular the AFAC report), media and interviews, and does not include interpretation or evaluation.

Section III: What Happened

"The total area burned in the 2018-19 fire season in Tasmania was 210,311 ha with a perimeter of 1,854 km. This makes the 2018-19 season the largest since at least 1967 for hectares burned in the State." [7]

Risk reduction and preparedness activities prior to the event are discussed in detail above. The AFAC report finds that the prescribed burning program had been effective in reducing the fuel load in west and southwest Tasmania. The fires were ignited following months of low rainfall and high temperatures. Despite this, the AFAC report [7] states that: "Although there were concerns about bushfire risk in east coast areas, up until December there was little to indicate a particularly bad fire season ahead for the State." This is because weather conditions did not significantly worsen until summer. A total fire ban was in place at the start of January 2019.

Bushfire ignition

Set against the backdrop of the new fire regime, the summer of 2018/19 was extreme. In terms of temperature, 2018 was the fifth-warmest year since 1910 when records began. Rainfall had been average but varied by region. However, conditions became more extreme as summer arrived, with 2018/19 being the secondary-warmest summer on record for Tasmania and seeing almost no rain between late December and February. January 2019 was the second driest January on record. Extremely warm and dry conditions meant that vegetation usually too wet to burn, such as rainforest, was transformed into bushfire fuel [7].

Extensive dry lightning struck western and southwestern Tasmania on 14-15 January; a major event on the 15th saw over 2400 dry lightning strikes, as shown in Figure 10. Dry lightning ignited the already dry vegetation in extremely hot and dry conditions, resulting in over 70 fires. Several of these combined to become the four major fires complexes that dominated the bushfire season.

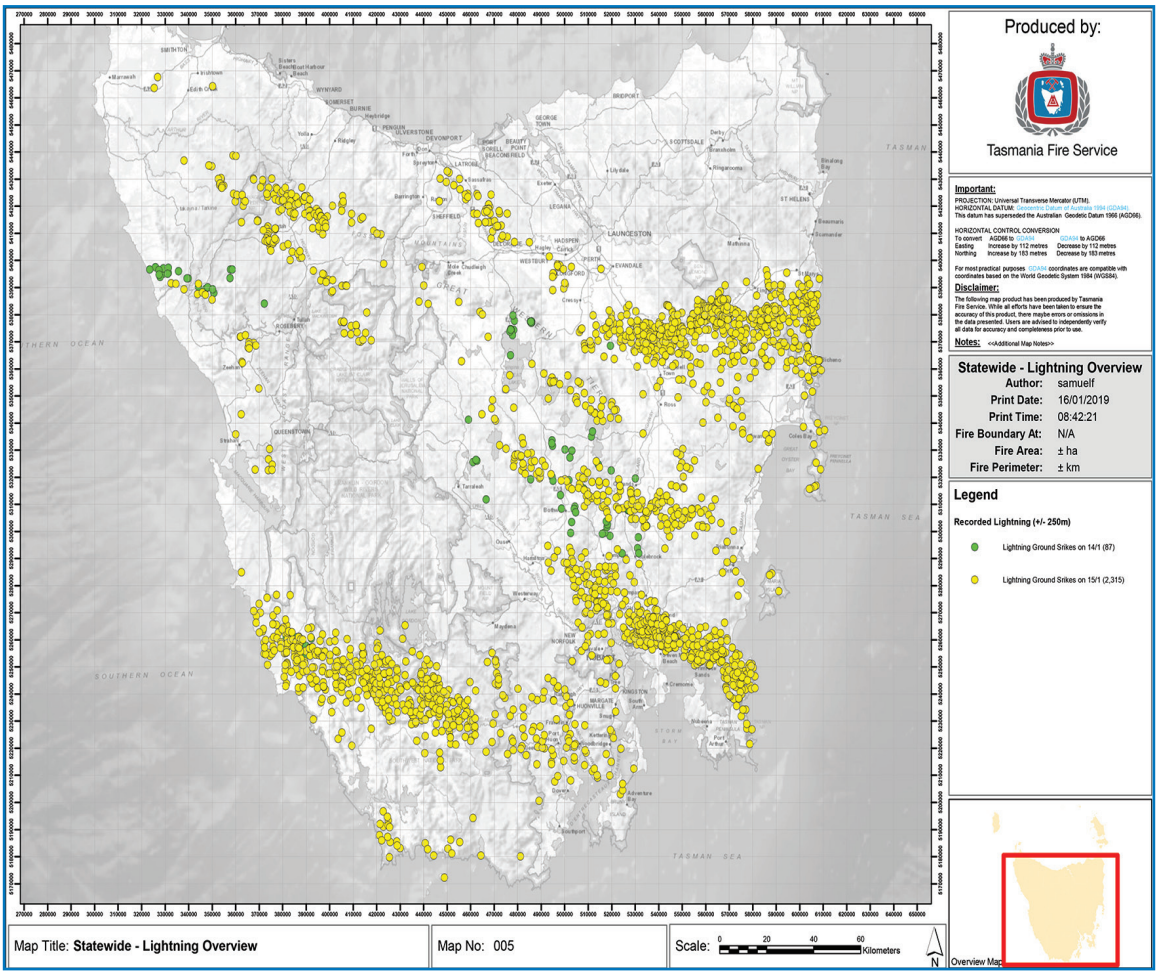

Figure 10: Lightning strikes in Tasmania, 14-15 January 2019, supplied: [7]

The Fires and Firefighting Operations

The AFAC report is an in-depth review of the firefighting operations, unless indicated otherwise the information presented here is drawn from that report.

The 2018/19 fires are recorded by TFS to have started on 24 December 2018, with a deliberately lit fire at Conleys Point on South Bruny Island. This fire resulted in residents and visitors evacuating and caused loss or damage of a few structures. On 27 December dry lightning ignited several fires in the Franklin-Gordon Wild Rivers National Park that merged to become the Gell River fire.

On 15 January 2019, there were 2402 dry lightning strikes across the state, which caused the ignition of over 70 fires. Weather conditions and inaccessible terrain meant that many of these fires could not be extinguished before spreading. As the fires spread and merged they formed four fire complexes:

- South-west Complex, including the Riveaux Rd fire and the Gell River fire
- Rosebery Complex
- Great Pine Tier Fire
- Moores Valley (no active fire suppression because of remote location)

In regard to the TWWHA specifically, 36 fires started in the TWWHA, several of which joined the four fire complexes.

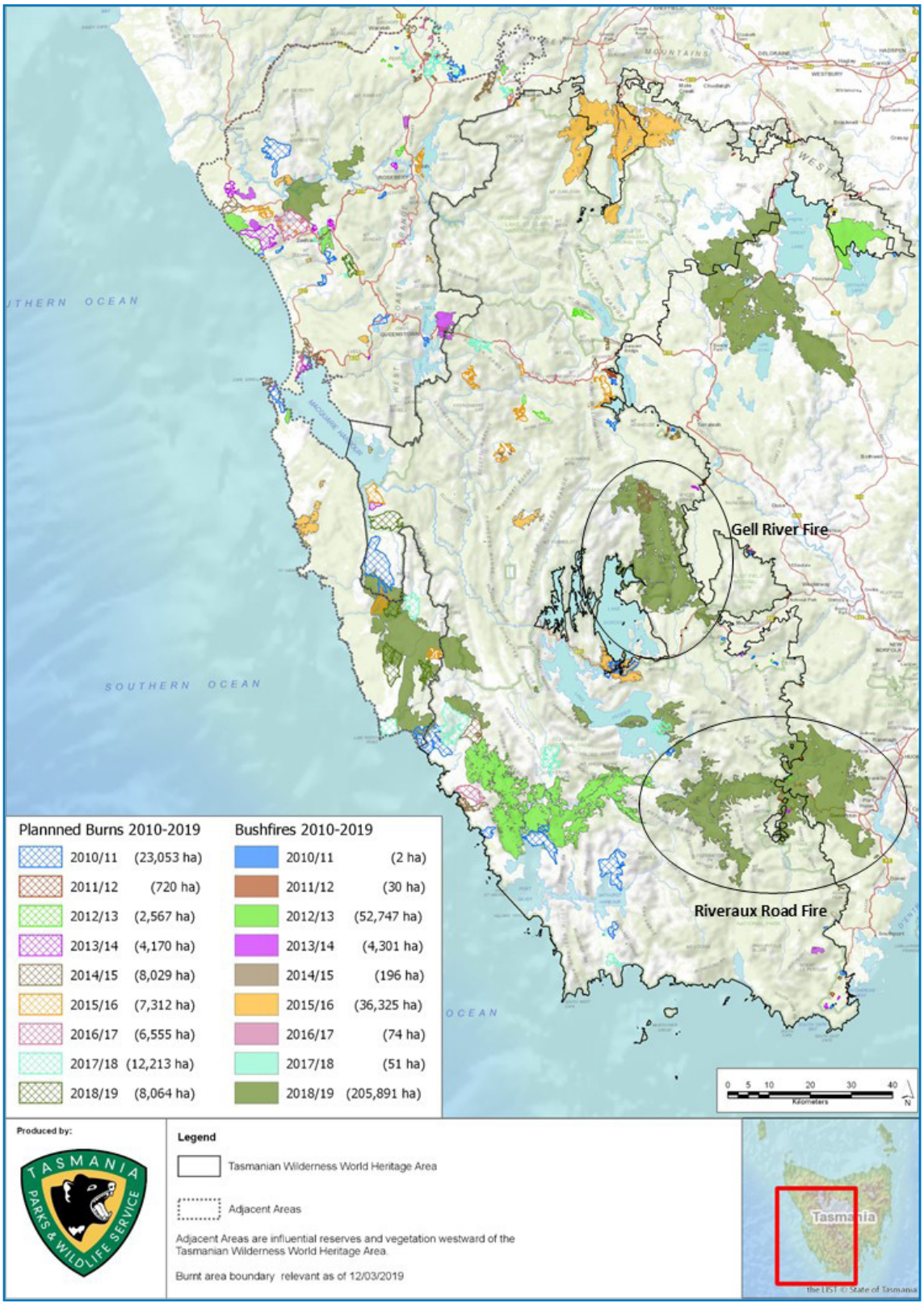

Figure 11: Bushfires in the TWWHA with Gell River and Riveraux Road Fires marked, supplied: [7]

The southwest complex fire, which included the Riveaux Road fire (shown on Figure 11), is the focus of this report. We focus on this fire because it was the most significant in terms of impacts on the people of Tasmania. In addition to Riveaux Road (also shown in Figure 11), the southwest complex was made up of the Gell River, Celtic Hill, Mount Solitary, Anne Gorge and Lake Pedder fires. The incident management team for the southwest complex was in Cambridge, near Hobart [7].

The Gell River fire was the first fire of the bushfire event, starting in late December in the TWWHA and timber plantations. It spread to burn 35,062 ha with a perimeter of 607 km [7]. AFAC [7] reports that there "were several fire-sensitive values present in the area, including the Alpine Plateau above Lake Rhona and areas of mixed forest and temperate rainforest. Heritage cultural sites and commercial values as well as key telecommunication infrastructure and power transmission were at risk."

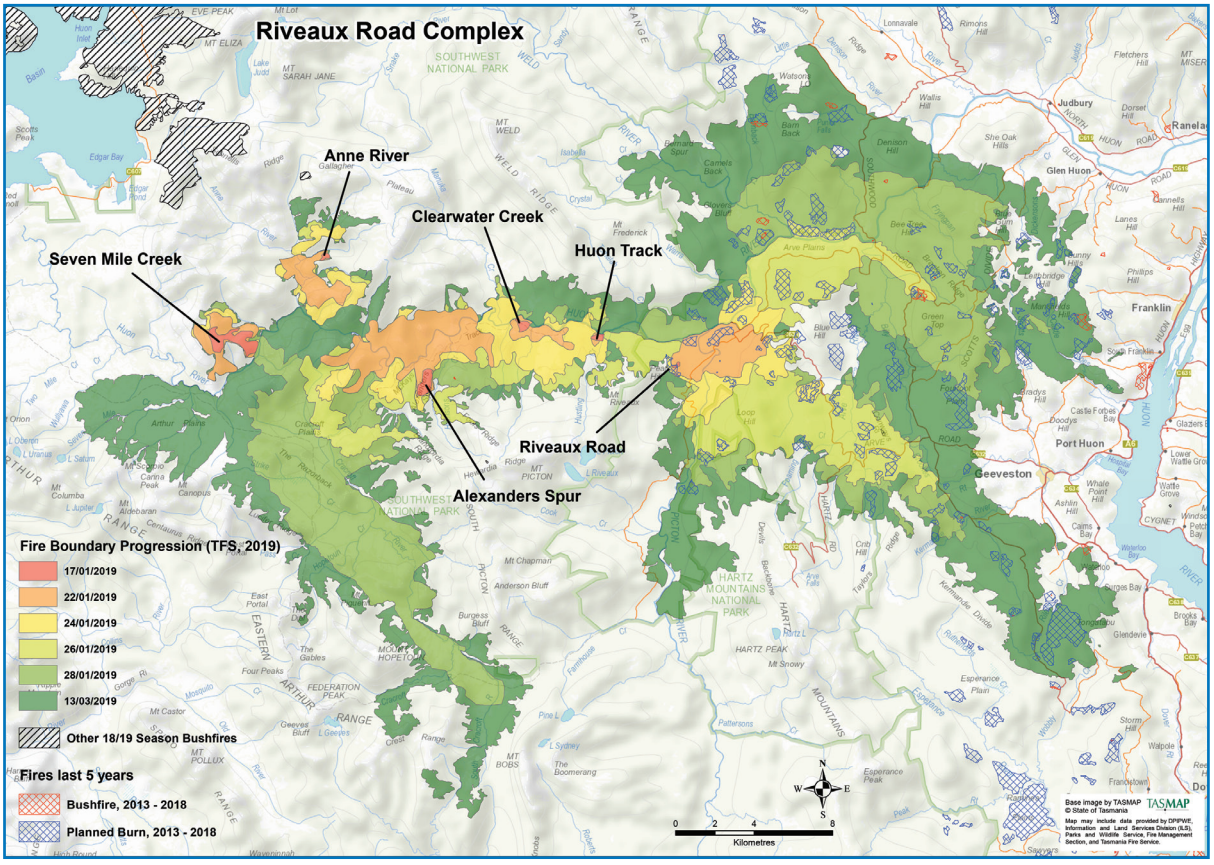

Figure 12: Riveaux Road Fire progression map, supplied: [7]

The Riveaux Rd fire started on 15 January with several ignition points joining to make up the fire complex. As shown on the fire progression map in Figure 12, the fire spread eastward towards Huonville and Geeveston, and southwest through the South West and Hartz National Parks. On 30 January the fire threatened settlements in Castle Forbes Bay and the Port Huon area, where five properties were lost. In total, the fire burned 63,769 ha and had a perimeter of 932 km [7].

Information on firefighting operations have been drawn from AFAC [7], which can be referred to for further details. The Southern Regional, Northern Regional and State Operations Centres were all activated, or 'stood up', on 3 and 4 January. When the Gell River fire started in late December, a Level 2 PWS IMT was activated. On January 4 a Level 3 IMT in Cambridge was activated to manage the fire, taking the lead responsibility from 6 January. Because the Riveaux Rd fire started in a conservation area, it too was initially managed by PWS. However, proximity to timber plantations meant that STT worked with PWS in fighting the fires. On 16 January the Level 3 IMT in Cambridge was expanded to manage the South West complex of fires, and over several days, the management of the Riveaux Rd fire was transitioned to this IMT.

AFAC [7] reports that in total for the event:

> **"Approximately 2,000 employees and volunteers from TFS and the State Emergency Service (SES), 248 PWS, 116 STT personnel and 127 STT firefighting contractors/machinery operators were deployed during the 2018-19 firefighting campaign."**

These were supported by personnel from "Victoria (23), New South Wales/Australian Capital Territory (765), Queensland (77), South Australia (93), Western Australia (94), New Zealand (81) and Emergency Management Australia and AFAC (11)" [7].

A base camp, deployed from New South Wales, was set up to support the management of the Gell River fire and enable efficient rotations of firefighters. Seven airbases were also established, supported by four aviation management teams across Tasmania. The Level 3 IMT in Cambridge was stood down on 23 March, which is considered the end of the event.

Community Safety Response

Alongside the firefighting operations was the community safety response operations, including the issuance of warnings and communications, and the activation of evacuation centres. This section outlines what happened for the community during the event.

Warnings and Information

In Tasmania official bushfire warnings and information are distributed via the TasALERT website (alert.tas.gov.au), which is administered by the Tasmanian Department of Premier and Cabinet. During emergency events, the purpose of TasALERT is to "provide a single source of clear and consistent emergency and resilience information from across government in an easy-to-use and high performing interface" [41]. TasALERT provides information on current incidents across the state, including aggregates of social media feeds from emergency services (such as TFS and SES) and Government departments. ABC local radio stations also broadcast warnings information.

Across Australia the states and territories have adopted a harmonized approach to warnings, which was developed after the 2009 Black Saturday bushfires in Victoria (based on the existing approach). The TFS alert/warnings system has four levels [42]:

- No Alert Level: An incident has occurred. There is no immediate danger to the general public.
- Advice: An incident has started. People in the area should keep up to date with developments.
- Watch and Act: A heightened level of threat. Conditions are changing; you need to start taking action now to protect you and your family.
- Emergency Warning: You may be in danger and need to take action immediately. Any delay now puts your life at risk.

During the event, the TasALERT system worked as expected, providing up-to-date warnings and advice as the fires progressed [7]. While it is important not to detract from this success, several issues emerged that are important to note. Firstly, warnings fatigue was a concern due to the length of the event. As one interviewee stated:

> **"We had communities on heightened alert for three weeks, it's designed for a few hours! This is because the fire was sitting really close and the fire behaviour had been so unpredictable, and the evacuation routes were single lane roads so would take ages, so they had to be on alert."**

The Australian warnings system described above is designed for sudden and short events. An interview from TFS claimed that the warnings being in place for so long was "unprecedented around the country." Not only did warnings fatigue result in frustrations throughout affected communities, there is also suggestion that it contributed to complacency and people increasingly ignoring warnings over time.

The issue of warnings fatigue was potentially compounded by frustrations with the ICT platform of the TasALERT webpage (see also [7]). The Institute of Foresters Australia submission to the AFAC review [31] pointed out that *"unlike most other states, Tasmania does not have a mobile phone app for engaging with fire warnings and that the map on the TFS website is difficult to use on a mobile device."* Tasmanian commentator and author Andrew Darby agreed in his AFAC submission [43], stating that:

> **"The public struggle with the TFS website, which has not had a full overhaul in over a decade…in internet terms, these listings are archaic. People, particularly when under pressure, find it a frustrating website to navigate. And they want a dedicated app. One that will give them immediate answers."**

Furthermore, the warnings via TasALERT and ABC local radio were reported to be somewhat indiscriminate and lacking in required local information. The Huon Valley Residents and Ratepayers Association AFAC submission [44] stated:

> **"The TFS and Sentinel websites provided valuable information during the emergency but much of the TFS information was generalised and did not pinpoint specific locations of concern and/or firefighting activity. This led to many people believing themselves to be in imminent danger when they were not…This may lead to complacency ("the boy who cried wolf syndrome")."**

Tourism operators reported confusion and frustration regarding the accuracy of TasALERT information, particularly regarding road closures. Road closures were also not updated on Google Maps, as expected by some. As a tourism industry representative stated: *"Sometimes people would get 30km in before hitting a road closure and having to turn around."*

A further key issue raised in relation to warnings and information is some residents and particularly visitors not receiving warnings at all. AFAC [7] pointed out that not everybody has access to the internet, while the Huon Valley Residents and Ratepayers Association [44] suggested that even radio reception is patchy in more remote areas. There were reports that some residents in threatened areas did not receive text-message warnings to evacuate, for example Mark Geary, a Surges Bay resident, stated in his AFAC review submission [45]:

> **"My wife and I live at Surges Bay. We both have Telstra mobile phones on plans. We never received any warning texts during the course of the fires whilst at home at all. Our neighbours who live less than 2 kilometers away from us were the ones who did get all the emergency texts and rang us to tell us when to leave our property."**

Because the bushfire event naturally occurred in summer, there were many visitors in the region and people in remote and wilderness areas undertaking recreational activities such as bushwalking, camping and fishing. AFAC [7] found that PWS ran a largely successful campaign for ensuring visitors received warnings and information. Yet this issue was still raised as a concern from those familiar with the tourism industry, who point to the fact that visitors often do not monitor warnings information such as TasALERT, listen to ABC local radio, and may not speak English.

Evacuation Order / Stay or Go

TFS staff reported that recommendations from the Bushfire Royal Commission 2009 into the Black Saturday bushfires in Victoria were applied in Tasmania. One of the key issues was the 'stay or go' policy[2], which has influenced warnings in Tasmania. On 25 January, 2019, The Mercury [46] reported that:

> **"Echoing earlier comments from TFS chief officer Chris Arnol, [Tasmania Fire Service district officer] Mr McGuiness strongly urged people to leave fire-affected areas before it was too late. "The challenge from emergency services is to provide people with the best possible information so that they can make an educated decision on whether they stay or go," he said. "Certainly our advice to them is that they should go. "It's too late when the fire's in your backyard to be making decisions that I've got to go."**

Overall, approximately 1,400 people (Tasmanian residents and visitors) presented to evacuation centres throughout the event [7]. Uniquely for this event, in addition to the advice to evacuate because of threat of fire, there was also evacuation advice issued for several towns based on smoke hazard. Residents vulnerable to smoke impacts (elderly, children, and people with chronic health conditions) were also advised to evacuate the region, and many went to stay with friends and family in Hobart and other parts of Tasmania.

The evacuation order is not compulsory, and while most people followed the evacuation advice some chose to stay. A recurring theme from emergency management staff was that people who refuse to evacuate must be aware that they cannot expect a fire truck to come to defend their property if they are under threat. Refusing evacuation advice can also divert resources from more strategic firefighting operations, as one TFS employee stated in reference to people who did not follow evacuation advice: *"It was a real strain on us to make sure they are safe. I understand they don't want to leave their house. We put ourselves at risk to make sure they're safe – that's our job but they need to know."*

2 TFS, like all fire agencies in Australia, emphasizes the importance of residents making an early and informed decision to 'stay or go' when a bushfire is in the area. Residents are advised that the safest option is always to leave early rather than to stay and defend, that not all homes are defendable in all circumstances, and that people choosing to leave should do so early [82].

Community Information and Briefings

According to AFAC [7], 41 'community forums' were held throughout the affected region. Community forums were designed to provide up-to-date information to residents in affected regions regarding the progress of the fire and fire suppression operations, current modelling predictions, community safety and assistance, and provide an opportunity for community members to ask questions and provide feedback. Regarding the Rivaux Rd fire, community forums were held in Geeveston (22 and 27 January, 9 and 14 February), Huonville (27, 28, 29, 30 and 31 January, 1, 3, 4 and 5 February), Dover (30 January) and Cygnet (31 January). Community forums were live streamed on the internet. The Huonville community forums were held in the primary school adjacent to the PCYC evacuation centre, and were also streamed to a screen set up on the football oval so that evacuees and local people who could not fit in the forum could watch. The information provided at the community forums was supplemented by daily media briefings during the height of the event, and a TFS spokesperson on ABC local radio.

Like the AFAC report, this investigation found significant support for community forums and in particular the decision to live stream them. The presence of multiple people involved in the response operation across several organisations (TFS, Tasmania Police, Huon Valley Local Government, etc.) was highly valued by the community. The community appreciated information about not only what was going on but also the rationale behind operational decisions. Also, highly beneficial was the capacity to ask questions - both live and via the internet - about local conditions; this may have gone some way to mitigating the frustration with the TasALERT website, which some saw as not providing specific enough information.

In addition to these official sources of information, several interviewees highlighted the extensive yet very clear and constructive messaging in the media from the Mayor of the Huon Valley, Bec Enders. Mayor Enders credits this success to the presence of a highly experienced media coordinator, she said:

> **"I had up to 13 interviews one days, and the ability for a media person to be able to take command of all of those radio and television stations and actually have them working for her, made a world of difference. She gave me constant updates of what had happened, we'd put it in a succinct way – no more than 8 dot points – which enabled me to focus on the main points and focus on my delivery."**

Evacuation Centre

Following Tasmanian emergency management arrangements, several evacuation centres were directed to open (and close) during the event. The Huon Valley evacuation centre (Huonville PCYC) was the only significant service to be activated in response to the event and as such this report focuses on this, together with the Ranelagh Animal Refuge. On 21 January TFS issued an emergency-level warning in response to the fire near the Tahune Airwalk, and at this point the Huon Valley Council Municipal Emergency Coordinator decided to open the PCYC evacuation centre. The PYCY evacuation centre accommodated 19 people, but conditions eased, and the centre was closed that evening, with people returning home. On 24 January the Huon Valley Council again activated the PCYC evacuation centre and the Ranelagh Animal Refuge [47].

After that second opening, the Huonville PCYC evacuation centre was open for 15 days, closing on 6 February, and in that time the centre accommodated up to 700 people daily, plus nearly 100 domestic pets (dogs and cats). The THS found an additional 308 people with high needs accommodation outside of the evacuation centre. The Ranelagh Animal Refuge accommodated over 400 animals and 59 people. Evacuees came from the towns within the Huon Valley that were threatened by fire and/or smoke [47].

Many people sought shelter at the evacuation centre because they did not have family or friends they could stay with, could not afford to leave the region, or wanted to remain close to their properties and family remaining in the area to defend. Despite prior evacuation warning, some evacuees arrived at the centre with only the clothes on their backs, and in some cases did not have IDs with them.

As discussed above, planning for the evacuation centre was of a high standard, and the PCYC location was fit for purpose. The Huonville PCYC evacuation centre was under the responsibility of the Municipal Area Coordinator of the Huon Valley Council, with 54 council officers staffing the centre round the clock [48]. As part of the preparations everyone involved was aware of the chain of command; Mayor Enders stated that:

> **"One thing I've been really conscious of throughout this experience is that there can only be one boss cocky, and that wasn't me, it was the Municipal Area Coordinator. Just knowing who was in charge was important. I knew that I was a spokesperson for the council, but I'm not in charge."**

The Huon Valley Council was supported by multiple community sector organisations including:

- Red Cross - Evacuee registrations
- St John Ambulance – First aid
- Social Support – Social workers
- Housing Tas/Colony 47 – Housing Support
- Dept Community Services – Financial Support
- Save the Children – Children's activities
- Salvation Army – Catering
- Rural Alive and Well – Counselling
- Tasmanian Council of Churches – Chaplaincy
- Tasmanian Health Service – Mental health services and some medical supplies
- Huon Valley Health Centre – Medical services
- Volunteering Tasmania - Volunteer registrations
- Telstra – Information

Emergency management coordinators from four other Councils were seconded to the Huonville PCYC evacuation centre. This not only provided additional skilled personnel but also gave these emergency management coordinators experience that will be highly useful should their LGA need to provide an evacuation centre. Additional support from THS was provided via the Regional Emergency Coordination Centre.

Staffing the evacuation centre put considerable strain on Huon Valley Council staff [48], yet having local people at the centre was seen as highly valuable for the community. Mayor Enders stated: *"You don't want to exhaust your own staff, but having that local knowledge, particularly in the HV where people know each other – arriving at the evacuation centre and seeing someone you knew was extremely comforting. It made things a lot more relaxed."*

In addition to the thorough planning, the success of the Huonville PCYC evacuation centre is widely credited to the close-knit Huon Valley community. Organisers were able to quickly identify and contact the people needed to provide services to the evacuees, and many needed goods were donated by local businesses. An interviewee involved with the evacuation centre stated *"Everything we wanted was provided by the local Woolworths…We did 10000 meals in 13 days."*

Further food was provided by local businesses, including donations such as 90 boxes of chickens, and 30 crates of cherries. Local bakeries donated bread rolls, bread and tarts daily, and a local restaurant provided 100 meals every night.

Planning for the Huonville PCYC evacuation centre included an evacuation plan for the centre and plans for further upscaling if necessary. Organisers shared that one thing they had not planned for, but were able to organise, was clean air rooms to give vulnerable people respite from the smoke. The pet accommodation at the PCYC centre was not considered to be overly successful, as one key organiser stated:

> **"There were also dogs, cats and birds at PCYC. This didn't work particularly well as people would put their dogs in kennels out the back and forget them. It was extremely hot. There were 54 dogs, 37 cats and a few birds. The volunteers had to chase people up to feed and clean their animals. The local vet tranquilised some upset dogs."**

Many individuals volunteered to assist at the Huon Valley PCYC evacuation centre, both from the local community and from amongst the evacuees themselves. Approximately 100 'spontaneous volunteers' presented to the evacuation centre, some as individuals and some staff from TasNetworks and a local football club. While this manifestation of community solidarity was valued, the Huon Valley Council was not equipped to manage the number of volunteers eager to assist. Volunteering Tasmania was contacted to aid registering volunteers, identifying their skills, and rostering them into shifts.

Animal Refuge

The Ranelagh Animal Refuge was activated on 24 January at the same time as the PCYC evacuation centre. It was located at the Ranelagh showgrounds and Pony Club, with thorough preparations having been made between the Huon Valley Council and community organisations including the Pony Club in the years/months prior. There was an evacuation plan for the animal refuge had it been needed, and arrangements made with TFS who considered the site to be defendable.

In total, the Renelagh animal refuge hosted over 400 animals, including horses, goats, chickens, ducks and dogs amongst other animals, and 59 people. The refuge required owners to stay with, and take care of, their animals, with the council accepting no liability. They were assisted by over 80 animal friendly volunteers. The Lions Club provided catering for owners and volunteers on an informal basis.

The refuge instructed people attending the animal refuge to bring:

- Tape and treadins/pickets to construct individual yards
- Portable electric fence unit if available
- Water buckets
- Feed [49]

As discussed above, the animal refuge was for hobby farmers and pets (including chickens), rather than large husbandry operations that required their own evacuation plans. The 'Lend-A-Paddock' community network – run via Facebook [50] to help evacuate animals to safety and ensure they had feed when relocated – was essential for accommodating many animals in the region that would have otherwise overwhelmed the animal refuge. Over the evacuation period clean air rooms were set up to provide relief, as were small swimming pools to allow ducks to bathe. Several interviewees reported that the atmosphere at the animal refuge was relatively relaxed compared to the PCYC evacuation centre.

Section IV: Impacts and Recovery

Direct impacts

When it comes to stocktaking the impacts of disasters such as wildfires, impacts are typically understood to be direct or indirect. Direct impacts are those that arise "through a direct interaction between a shock or stress and a physical, economic, social, or political component" [1]. In the case of wildfire, this includes people injured or killed and homes and infrastructure destroyed due to contact with the fire (flames and/or smoke) itself. Indirect impacts (discussed below) are the result of the flow-on effects of direct impacts.

In this section we outline the direct impacts of the Tasmanian bushfire, including the size and type of area burnt, physical assets damaged or destroyed, mortality and morbidity from both fire and smoke, and damage to wine grapes from smoke taint. We also outline the loss of cultural and environmental values, called intangible losses because they are not easily counted or monetized.

Area burnt

AFAC [7] reports that the fires burned a total of 210,311 hectares, with a fire perimeter of 1,854 km. Significantly, this makes the 2018/19 bushfires the most extensive in Tasmania since the devastating fires of 1967. Of the total area burned, 95,000 hectares were in the TWWHA, representing 6% of the total TWWHA area. Also burned was 39,398 hectares of forestry land managed by STT, and 32,901 hectares of private forest [7]. Wood [51] and several interviewees report that most of the area burned was flammable or 'fire-adapted' vegetation, including dry eucalypt, wet eucalypt and buttongrass moorland, see Figure 13.

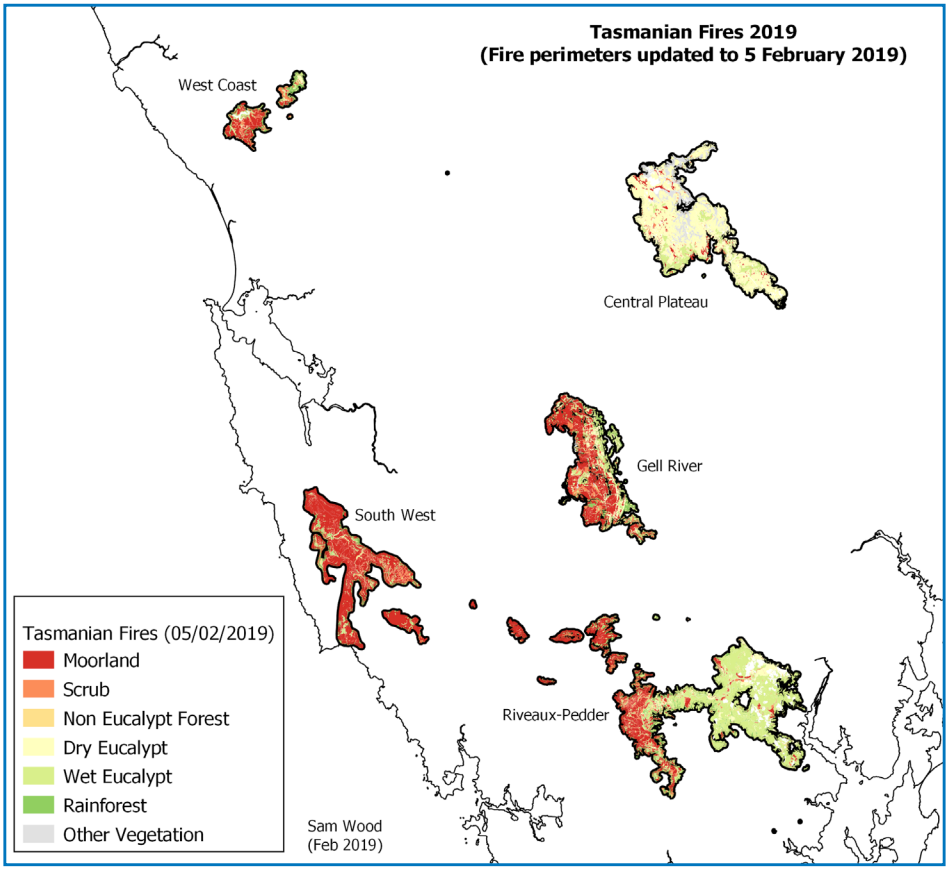

Figure 13: Vegetation communities burned in the five major fire complexes in Tasmania up to 5th February 2019. The colour scale (red to yellow to green) represents a decrease in flammability [51]

Mortality and morbidity

While no deaths have been directly attributed to the bushfire, recent research estimates that the smoke caused by this event resulted in: 8 (95% confidence interval: 3-13) premature deaths, 18 (95% confidence interval: 9-30) asthma emergency department visits, 15 (95% confidence interval: 3-28) cardiovascular hospital admissions and 24 (95% confidence interval: 0-52) respiratory hospital admissions [52]. A leading epidemiologist in Tasmania, suggested that the air quality was at hazardous levels, far higher than highly polluted Beijing. It is important to note that smoke can travel hundreds of kilometres in the right wind, expanding the impact of the fires across the state (see for example [53]).

Many firefighters and residents, such as farmers, who stayed to defend their properties suffered serious injuries as a result of fighting the fires. AFAC [7] reports 114 accidents, injuries or illnesses, 24 hazards and 18 near misses. 22 injuries or illnesses have resulted in workers compensation claims from TFS and PWS employees. AFAC argues that while no injury is unimportant, these statistics represent a high level of safety consideration and professionalism.

Physical assets damaged or destroyed

While the fires were extremely damaging and caused much disruption, loss and damage to physical assets, such as homes and infrastructure, were small considering the size of the event. Devastatingly for their inhabitants, six houses were destroyed in the event, along with several sheds and outbuildings [7].

Several assets with cultural significance and/or related to Tasmania's tourism industry were also destroyed. Churchhill's Hut, a popular site for bushwalkers and history buffs, was destroyed in the Gell River fire: listed on the Tasmanian Heritage Register, it was an historic hut where the last Tasmanian Tiger (Thylacine) was thought to have been captured. The hut was lost despite PWS investing over $20,000 in fire suppression and a sprinkler system to protect the hut[3] [54].The Great Pine Tier fire also destroyed the Skittle Ball Plains Homestead and Berry Lodge, both tourist accommodations in Miena.

The most significant loss for the Tasmanian tourism industry was the destruction of the Tahune AirWalk, a steel canopy walkway in the Tahune Forest close to Geeveston in the Huon Valley (55). The canopy walkway was the major tourism drawcard for southwest Tasmania, attracting more than 80,000 visitors per year. The AirWalk was closed for approximately one year, reopening in February 2020.

The fire also destroyed transport infrastructure, including 1,358km of roads and vehicle tracks, the Weld River Bridge, road signage and guideposts [7]. Communications infrastructure was also affected, with the Tim Shea Communications Tower forced to operate on generator power and power lines damaged [7].

In addition to the approximately 72,000 hectares of forestry resource destroyed by the fires, several forestry industry assets were also lost. Most significantly, the Ta Ann timber veneer mill at Lonnavale was severely damaged and closed for close to a year. Phil Smith, TFS deputy operations officer, was reported [56] to have told a Huonville community meeting that "We've been able to contain the fire but it has damaged some of the machinery, it's damaged extensively the outside and other parts of Ta Ann" and that "preparations at the site [weren't] ideal."

3 It is interesting to note that there is controversy about whether the hut that was destroyed in this event was actually the hut of Elias Churchill, the man who trapped the last Tasmanian Tiger. A Tasmanian historian with Heritage Tasmania has argued that it was not in fact Churchill's Hut [83].

Significant for environmental research was damage to TERN's Warra Tall Eucalypt SuperSite, one of the country's longest running ecological research sites. While the carbon flux tower was initially reported to have been destroyed, TERN reports that the tower and many instruments at the top survived; unfortunately, instruments on the ground were destroyed. Fires also burnt three smaller 1 ha ecosystem surveillance plots and a remote sensing calibration site. While this loss is significant, researchers point out that the long time-series of data will provide a robust baseline for measuring recovery [57].

AFAC [7] and representatives of the apiary industry reported that several beehive sites were destroyed by the fires, as well as critical Leatherwood trees. AFAC [7] states that it is "likely to take approximately four years for beekeepers who have lost hives and bees to recover their bee colonies to similar levels." One beekeeper interviewed for this study suggested that several beekeepers have lost all their hives and will not recover.

Vineyard smoke taint

Viticulture is an important industry for the Tasmanian economy, contributing an estimated $115 million annually [58]. It is an industry that holds much growth potential for Tasmania as climate change is predicted to make it an even more attractive location; Tasmania is predicted to retain its cold winters, which are desirable for wine production, while the mainland is becoming too warm. However, this positive story of climate change adaptation is threatened by the risk of smoke taint[4] from increasing frequency and severity of bushfires. Media about the January fires reported the risk of smoke taint on Tasmanian wine grapes. Because smoke taint can completely ruin the drinkability of the resultant wine, this type of media creates a reputational risk for the whole industry, regardless of actual impacts (discussed below). Monitoring reported to use by interviewees suggests that approximately 10% of vineyards in Tasmania were impacted by some smoke taint during these fires, only 5% severely enough to cause significant loss.

Severely affected vineyards were in the Huon Valley region. One such business was the Home Hill Winery in Ranelagh. While the winery itself was not threatened by fire, smoke travelled 10 kms, tainting wine grapes. Home Hill business owner stated in the media that "Our wines now have smoke taint as a result of the fires. It has affected our pinot noir grapes so badly that we will not have a 2019 Estate Pinot Noir or Kelly's Reserve Pinot Noir, which are the core of our business" [59].

Loss of intangible assets

Intangible assets are those that are not, or at least not easily, measurable in monetary terms [60]. Intangibles such as human lives (discussed above), cultural and environmental heritage are frequently omitted from economic estimates of disaster events. Therefore, it is important that these losses are recorded. Methods exist for monetizing these losses, although there is considerable ethical debate regarding these. Here we simply stocktake some of the intangible losses recorded for these bushfires.

In regard to cultural heritage, AFAC [7] reports that the fires impacted an unspecified number of Aboriginal Heritage sites stating that "[f]urther investigations will be required to determine the degree to which they have been impacted." Our review has not uncovered publicly available material regarding any such further investigations. The only other reference to loss of cultural heritage is in the loss of Churchill's Hut discussed above.

4 Smoke taint occurs when grapes on the vine are exposed to smoke, such as from a bushfire, and the resultant wine acquires a smoky, burnt, ashy or medicinal flavour. Free volatile phenols produced from burning wood are absorbed by the grapes and bind to the grape sugars, where they are not detectable. During fermentation however, the volatile phenols are released and corrupt the flavour of the wine. Factors impacting whether a vineyard becomes smoke tainted include the grapevine growth stage, grape variety, smoke composition and length of smoke exposure [85].

The loss of invaluable environmental heritage in the TWWHA was a major concern during and following this bushfire event. Twenty-two fires burned 95,000 hectares, or 6% of the TWWHA [7]. Wood [51] found that contrary to fears expressed in the media, only 3.5% of the total area burned was in rainforest. While 3.5% is arguably a small number, this represents approximately 7,000 hectares of globally significant and unique Gondwanan vegetation/rainforest that the Tasmanian National Parks Association [61] argues will take centuries to recover, if it does at all. AFAC [7] finds that the fires burned 14% of Tasmania's very tall eucalypt forest, which is globally rare.

Thirteen Threatened Native Vegetation Communities[5] in the TWWHA have been identified as growing within the burned areas, although the majority have low-moderate fire sensitivity (meaning they are relatively less vulnerable when exposed to bushfire as compared to species with higher fire sensitivity). While only small areas of highly fire sensitive and precious King Billy Pine Athrotaxis selaginoides and Pencil Pine Athrotaxis cupressoides were burned, these will never recover [7].

There are an estimated 180 trees in Tasmania large enough (in height or volume) to qualify for protection. Giant tree enthusiasts estimate that these bushfires destroyed 15 of these trees [62]. This includes the "Arve Big Tree" – a key tourism drawcard and "Bigfoot" shown in Figure 14. Originally over 20m in girth and 82m to the top, the giant Bigfoot tree is now dead and likely collapsed.

Figure 14: Bigfoot tree, left side phto taken in 2007, right side taken shortly after fires and now likely collapsed. Photo credits: Brett Mifsun, supplied

The Central Highlands Wildlife Group [63] highlighted that much wildlife was also lost due to both direct contact with the fire, and starvation following the fire. Interviewees informed us that lost wildlife was likely to be smaller animals and reptiles who could not outrun the fires, as well as baby birds who could not fly. No estimates exist of how much wildlife was lost, or which species.

5 Threatened Native Vegetation Communities are defined by Schedule 3A of the Nature Conservation Act 2002 which lists the native vegetation communities in Tasmania considered to be threatened [86].

Indirect impacts

Indirect impacts are those that occur from secondary interaction between the wildfire (fire and smoke) and physical, economic, social and political components, or result from complex pathways of impacts. In the aftermath of a wildfire, indirect impact could include business losses arising from customers spending less money as they recover, or other indirect consequences due to fire (adapted from [1]).

Like intangible impacts, indirect impacts are often omitted from disaster impact assessments because they are more challenging to monetise. Below we outline, in qualitative form, the indirect impacts on Tasmanian communities and key impacted business sectors.

Impacts on Community

The indirect impacts of the bushfire on the communities of the Huon Valley were significant. Below we outline the two impact areas that were highlighted most prominently in our investigation - the cost of the evacuation to the Huon Valley Council, and the mental health impacts to the residents of affected areas.

Costs to Council

Huon Valley Council state that the all-inclusive cost of the bushfire event to Council was $430,000 as of the end of the 2018/19 financial year [64]. A summary of this expenditure is shown in Figure 15.

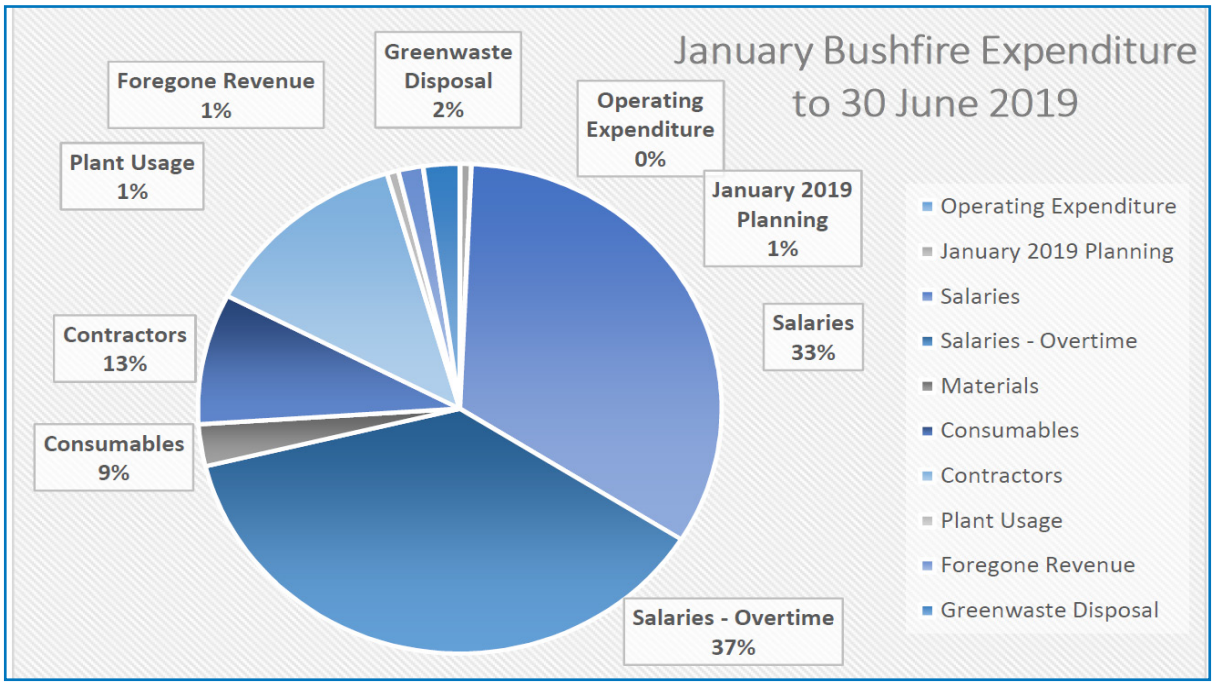

Figure 15: Summary of Huon Valley Council expenditure associated with the January 2019 fires. Source: [65]

As described above, because of the Huon Valley Council's high level of preparedness, they were able to track the costs associated with the bushfire event, which is necessary for making a reimbursement claim under the Tasmanian Relief and Recovery Arrangements (TRRA). The TRRA scheme, run by the Tasmanian State Government, reimburses Local Governments 75% of the costs associated with responding to disaster events.

Mental Health Impacts

The mental health impacts of this event were significant, but not widely acknowledged. One interviewee who worked on the response and recovery phases said:

> **"The perception was that nobody died and not many houses were lost, and there is a perception that people will get over it. That negates the experience of people who were scared for their lives repeatedly because this went on and on. That constant hypervigilance. People are exhausted, anxious. Those effects don't often play out until much later."**

Several interviewees suggested that the length of the event resulted in people being on high alert for a long time, and this can be quite traumatising. Similarly, the length of the evacuation was considered to be an exacerbating factor:

> **It was open for about 21 days. Evacuation centres aren't meant to be open for that long...Having kids at the evacuation centre for 3 weeks was traumatic.**

One interviewee noted that in many cases those suffering the most acute mental health impacts are those who had pre-existing physical and/or mental health concerns i.e. people who were already vulnerable. The mental health impacts of this trauma are still being felt nearly a year after the event, and there is considerable concern that affected community members will suffer in subsequent summers, particularly if there is a threat of fire.

Stigma around accessing mental health services was an issue faced in the response phase; services were co-located in the hub in the Huonville library so that it would not be obvious which service somebody was accessing. The fact that the fires did not directly cause any deaths, and very few properties were lost, meant that mental health services were not well funded in the recovery phase. THS was able to provide an extra social worker in the Huon Valley region, who an interviewee reported was seen by the community as effective but outstripped by demand.

The costs of the bushfires to the Huon Valley Council were not only financial. There was a significant impact on council workers who worked extreme amounts of overtime in a highly stressful situation. Following the event, they faced significant administrative and financial pressure. Several interviewees mentioned the mental health impacts on council staff as a concerning, and often overlooked, impact.

Interruption to business and economic slow-down

The Mayor of the Huon Valley said:

> **"Interruption to business and resultant economic slow-down, which stem from both direct impacts on businesses as well as disruption to supply networks, prolonged road closures, destruction of the Tahune Airwalk tourism drawcard and general disruption to the area, are often invisible yet long-lasting and profound. Often it is not until a year or two after the event that the impacts of the slow-down are fully revealed."**

As of August 2019, several businesses in the Huon Valley had already closed due to the fire impacts; these included two restaurants/cafes, one pub, one soft furnishings company, and some businesses reliant on the timber industry. Disruption to, and closure of, local businesses not only impacts business owners, but also their employees. It is also important to note that disruption to business can occur because small business owners are fighting fires during peak tourism time. A resident said in a submission to the AFAC review: *"My local fire chief spent every day for weeks firefighting, and being self-employed, never earned a penny in the meantime."*

We now provide detail on the impacts on the tourism and forestry industries - key economic drivers in the region - as well as the wine and honey industries because these have growth potential and are interesting cases from a climate change adaptation perspective.

Impacts on the Tourism Industry

As outlined, tourism is an important industry for southwest Tasmania and is a target area for regional economic development. Proximity to the TWWHA is the key tourist drawcard yet its proximity also means the industry is exposed to bushfires. As discussed above, economic conditions were precarious before the bushfires, with many businesses already struggling and casual workers reliant on the summer tourist season. Overall, we find that the impact of the bushfire event on the tourism industry was profound and sustained. Direct impacts on businesses, road closures, evacuations and warnings, and the closure of the Tahune Airwalk, meant tourist numbers were extremely low during the summer peak season, a situation that continued from January through to the Easter holiday period [30]. One interviewee summed up the impacts with this statement:

> **"I think sometimes the natural disaster is a final blow – many businesses were already struggling, this is a bit of a nail in the coffin. Many operators are marginal anyway and don't have business continuity insurance. Taking the Tahune tourist drawcard out has meant people aren't going to Geeveston anymore, which has knocked already marginal businesses out. They [the tourists] went for like a month so they lost all their summer income."**

Tourism industry experts emphasised that the key tourism draw for Tasmania is the wilderness, that this is the iconic brand that must be protected. There appears to be some tension between a desire to raise the profile of bushfires in order to incentivise action to protect the industry from future impacts, and an incentive to playdown bushfire impacts in order to protect current operators from 'bad press'. This is because the ongoing impacts on tourism come more from tourist perception of an area rather than direct damage by bushfires themselves. One tourism expert stated that:

> **"This year we got lucky that the Queensland floods happened at the same time and is more photogenic and hence the media focus was off us. Keeping it quiet is good for tourism. The less noise about damage the better."**

One key issue raised by several respondents was that messaging about what is and is not accessible could be improved. Tourists were advised about where they could not go but could not easily find out what was still safe and accessible, and much of the region was. Hobart airport and some airlines got involved with protecting tourists by distributing warnings on flights and at the airport; while this was successful initially, these warnings inadvertently continued for three weeks after the area was safe again, multiplying impacts on the tourism industry.

Impacts on Forestry Industry

While the forestry industry has historically been significant for the Tasmanian economy, the impacts of these bushfires are set against the backdrop of an industry already in decline, especially in the southern region. It is however important not to discount the value of forestry to the state, the Tasmanian Forest and Forest Products Network estimate that the point of sale value of the approximately 39,000 hectares of forests impacted by this event is more than $100 million AUD [66]. When the 39,000 hectares burnt in this event are added to the approximately 40,000 hectares burnt in 2016, the total comes to approximately 10% of the forestry estate in two events in four years.

The loss of timber resource, in addition to damage to the Ta Ann and Neville Smith Products processing mills, resulted in indirect impacts including: numerous job losses and forced leave, costs associated with relocating harvest operations, transport costs resulting from road closures, and longer-term impacts on forestry harvest plans [66]. A representative from STT said:

> **"The Ta Ann mill not being operational has impacts on employment, then flow on effects with the timber not coming out. At least 100 people work there. Flow on effects for harvesting and processing. They can't store what they've got because it dries out."**

The forestry industry operates on a sustainable harvest plan. Loss of resource due to the fires means that other trees will be harvested to make up the shortfall, however this has longer term impacts on the sustainability of the stock, one interviewee described it as *"robbing from the future."*

Several interviewees, together with several submissions to the AFAC review, suggested that the value of forestry resource is not adequately considered in bushfire impact assessments or risk management planning: *"People say there wasn't a huge amount of property lost, but that's because nobody considers forestry resources property." The SFMC [67] argued that the "economic impacts of the loss of private forests, or major processing facilities damaged by fire, and the flow on effects to local communities needs to be recognised and taken into account during bushfire management planning processes."*

Impacts on the Wine Industry

The wine industry is of growing importance to the Tasmanian economy, is actively supported by the Tasmanian Government [68], and Tasmania is promoted as an ideal location for production of cool-climate wines [69]. As outlined above, direct loss of vines during this event was minimal, and smoke taint is estimated to have severely impacted 5% of vineyards. The indirect impacts of this fall into two broad categories: those stemming from impacts on tourism and possible reputational impacts.

As of 2016 Tasmania had 90 cellar door outlets attracting more than 233,000 tourists to wineries every year [68]. These businesses, whether affected by smoke taint or not, were impacted in the same way as other tourism-focused businesses. A vineyard owner quoted in the press said that: "The Tasmania Fire Service was appealing to visitors to stay away from our area, and the consequences were no customers, no income and still needing to pay our staff during that time."

While smoke taint only severely impacted 5% of wineries, there has been some suggestion that this may have an impact on the reputation of the entire state's crop for 2019. Grape buyers may be wary to purchase grapes if there have been fires in the area; although doing a small 'test ferment' to screen for smoke effects can help allay fears. In the longer term, large and repeated bushfires may call into question the desirability of Tasmania as a premium wine growing region, hampering long term industry growth.

Impacts on the Honey Industry

The impacts of the event on Tasmania's world-renowned honey industry come at a time when the industry is already under significant pressure from heat and drought, and clear-fell logging. There is some debate regarding the significance of the impact of the bushfires vis-a-vis the drought, however the loss of leatherwood trees – the most significant nectar plant for bees in Tasmania and leading to highly prized leatherwood honey – is devastating because they take at least 75 years to reach nectar bearing maturity. In addition, infrastructure damage and road closures caused by the bushfires restricted access to hives that did survive, meaning some apiarists could not produce their usual second crop. Some apiarists going out of business, with job losses at some of the larger producers [70].

Recovery

After disaster response comes recovery. The exact line between response and recovery is not a clear one, with recovery often beginning as soon as the event occurs - in Tasmania community response operations such as evacuations are referred to as 'recovery', perhaps in recognition of this fact. For the purposes of this study we consider response to be "The actions taken during and immediately after a disaster to contain or mitigate disaster impacts, including evacuation, search and rescue, emergency relief distribution and first aid", and recovery to be "The actions taken after a disaster (either in the short- or long-term) to help people cope with disaster impacts, reconstruct damaged physical systems (e.g., homes, roads, damaged flood protection structures) and restore services" [1].

Three areas of recovery were identified: the Tasmanian Government's recovery grants scheme, community recovery in southwest Tasmania, and business recovery initiatives (discussed in turn below).

In February 2019, the Tasmanian Government via the Department of Premier and Cabinet, established a Bushfire Recovery Taskforce to coordinate recovery assistance [71]. Running until 31 May 2019, the Taskforce served as a central point of contact for recovery coordination for the event. The Final Recovery Plan was released on 27 May 2019, overseen by the State Recovery Committee. The Recovery Plan included a $9.9 million AUD Community Recovery Fund (co-funded by the Australian Government under the Disaster Recovery Funding Arrangements), to pay for recovery of national parks, support the tourism industry (discussed below), and other recovery needs [71].

Recovery Grants

Financial assistance to affected community members and businesses was through a series of recovery grants, jointly funded by the Australian and Tasmanian Governments under the Disaster Recovery Funding Arrangements 2018.

Grants for affected community members

Eligible community members could apply for Emergency Assistance Grants of up to $2,000 per household to assist with essentials including food, clothing and personal items. Approximately 8580 such grants were paid at a total cost of approximately $6.2 million AUD. A small number of individuals and households who were unable to get to a location to access this grant, or were ineligible but still experiencing hardship, were granted Special Circumstance Emergency Assistance Grants. 15 Recovery and Restoration grants were also paid to people whose principal residence was uninhabitable or destroyed [71].

Interviewees reported considerable confusion and frustration regarding the provision of emergency assistance grants. Initially the grants were designed for people who had to evacuate, to cover costs associated with that evacuation. This bred resentment amongst community members who had stayed to defend their - and their neighbour's - property. It was also unclear whether these grants were available to people who had evacuated due to smoke rather than the threat of fire. In their submission to the AFAC review, the Huon Valley Council argued that the grant scheme could have been managed better:

> **The activation of the financial assistance grants came as a shock to the Municipal Emergency Management Coordinators, a discussion prior to announcing the grant would have been appreciated. The broad criteria of all Huon Valley residents being eligible which saw a dramatic increase in people presenting to the Evacuation Centre who were there only to access the grant fund. This in turn created management issues and security concerns for evacuees so the Municipal Coordinator moved the grant team to an external site. The associated need for increased security and traffic management arrangements caused additional costs for Council. There was not clear messaging to the community on eligibility of the grant and this did create confusion as to who was eligible to claim at what stage. (Huon Valley Council AFAC submission)**

Grants for affected businesses

Small businesses affected by the event were eligible to apply for the Bushfire Small Business Disruption Grant of up to $2,000; 345 businesses were provided this grant at a total cost of $650,000. 83 medium sized businesses were also awarded a Bushfire Business Recovery Grant of up to $25,000 each, at a total cost of $1.7 million AUD [71][6].

Similar to grants for community members, there was frustration regarding eligibility for the business recovery grants. Businesses outside of bushfire affected areas were ineligible, yet still impacted because of messaging to stay away from the whole area. Interviewees reported that in many cases local business owners were unaware of the availability of business recovery grants: *"What we heard was that a lot of people didn't know about the grants etc. Many people didn't hear about them despite huge publicity – people had bushfire brain and they're just getting through the day. It's often the marginal businesses too."* A further - unintended - impact of the goodwill towards evacuees was that because donations covered so much of their immediate needs (food, clothes etc), community members did not need to spend their grant money in local businesses, which would have helped support them.

Recovery Plan Grants

At the community level, Recovery Plan Grants were provided to contribute to community recovery and reduce future bushfire risk. Local governments, non-profit organisations and businesses were eligible to apply for a grant. Applications were open for approximately six weeks; while the desire to release funds quickly for recovery was appreciated, some believed this was not enough time and some worthwhile initiatives may have missed out.

A total of 17 projects were funded, at a total cost of approximately $500,000. These projects included repair and restoration of cultural heritage sites; tourism promotion initiatives; bushfire risk management and evacuation preparedness; and enhancement of community facilities [72].

6 Note that in 2019 there were a total of 1245 businesses registered in the Huon Valley Council area, 405 of which employed less than 20 people [21].

Community Recovery

Because of the minimal loss of building assets during this fire, community recovery was focused on assisting people to access grants, and psychosocial support for people in affected communities. The Bushfire Recovery Taskforce facilitated the setting up of Information and Service Hubs located in towns in the Huon Valley. These hubs were centralised locations where people could access support regarding applying for financial assistance, support from social workers, and access to non-government organisations such as the Red Cross and the Council of Churches.

The hubs were important for community recovery because, as one interviewee stated they provided much needed practical and psychosocial support: *"We have a lot of low literacy rates in a lot of Tassie. Also people are traumatised so they're not functioning the same. After the 2013 fires people talked about having bushfire brain, they can't fill out forms. So it was practical stuff like helping them fill out forms, connecting them with other parts of government and services."*

A key challenge for providing recovery support was the ready availability of budget at local and State department level to be activated in the aftermath of the event: *"One of the most challenging things was regarding resources for recovery support on the ground. I'd like a nominal budget to get people on the ground straight away. You need people on the ground right away, you can't wait until you get your budget. It would be good to have a structure you can call on."*

Even when budget is available to fund key positions such as social workers, there may not be suitably qualified people available to take on the work, and if they are it may take away from other vulnerable groups facing ongoing issues: *"I have family and friends who work in social services, child protection, who are always trying to recruit staff to work with people who face these issues all the time. How do you pull resources from one community and put them in another community?"*

After the Bushfire Recovery Taskforce was wound up at the end of May 2019, services returned to business-as-usual provision. Several people we spoke to raised concern that this may have been premature. The lack of deaths and loss of homes associated with this event may have given the impression that recovery support needs could, after this point, be managed with business-as-usual provision, yet this is not the case. Many longer-term impacts on individuals and businesses were still being revealed one year after the event, and the operations of the Huon Valley Council was ongoing [48]. At the same time, we found concern that providing support for too long might create 'dependency'.

Business recovery

Notwithstanding the challenges associated with the business recovery grants discussed above, the recovery of businesses in southwest Tasmania is largely a success. In particular, the agility of the tourism industry to expand the appeal of the region and recover visitor numbers while the Tahune Airwalk was being repaired, is impressive. What worked well in regard to business recovery was the concerted and coordinated efforts of businesses, business peak bodies, Local Councils, and the State Government. The community spirit of the region was also credited with contributing to recovery; in regard to the Huon Valley, one respondent said:

> **This community is very resilient, because of the love and care that people have for each other, and concern. The biggest asset in the Huon Valley is its people. So when these businesses were closed a lot of them were supporting each other. So through adversity you get something different than you would get in the metro area. If there was a disaster in the metro area people look after themselves, they don't even know their neighbours. But in Tassie it's like one huge country town really. In the Huon Valley you know your neighbours and your whole community. So business owners aren't just business owners, they're community members.**

Potentially due to the devastating impact of the fires on the tourism industry, business recovery was a major focus for the Huon Valley Council immediately after the emergency phase was over. Following a disaster event there can be a temptation to showcase the negative impacts on businesses in order to attract recovery grants and/or motivate sympathetic people to visit the region. However, input from both media advisors and tourism industry experts directed the focus of the business recovery promotion away from stories of devastation and towards showcasing what is on offer. The Mayor of the Huon Valley stated that "while media wanted to talk about hardship, we had some very good advice that it was best to focus on the great businesses in the Huon Valley who were open and ready for business, to promote recovery."

As discussed above, losses to the tourism industry during the bushfire event were further exacerbated by the closure of the Tahune Airwalk, which attracted approximately 80,000 visitors annually. Therefore, recovery of the tourism industry in southwest Tasmania focused around promoting alternative visitor attractions in the region centred on food and art. Huon Valley Council Minutes from April 2019 [73] stated that "Renewed interest and attention on the region as a result of the recent fire events, present the chance to position the region and to leverage off external investment and activity."

A tourism industry representative stated that:

> **"There was a lot of debate amongst tourism operators about what was needed straight away. Everyone agreed that we needed to invest in marketing to get people back to the region. Research from Tasmania and Australia more generally has shown that marketing campaigns that say 'we've had a disaster, please come back and support us' don't work because people just think 'it's burnt, I won't go there' – it backfires on you. What does work is identifying existing events or products which you can amplify the message about."**

The annual 'Taste of the Huon' event was used as the basis for the 'Love Autumn in the South' campaign, which showcased visitor attractions in the region and specifically did not mention bushfires. The Love Autumn in the South campaign (image shown in Figure 16) was supported by a $150,000 investment from the State Government. The 2019 Taste of the Huon event was the most successful it had been in several years, indicating the success of the campaign and what can be achieved with concerted effort.

Figure 16: Love Autumn in the South marketing image [74]

Interviewees elaborated on another highly successful initiative was a collaboration with MONA (Museum of Old and New Art in Hobart). Project X involved the installation of public art around the region and centred on the Dark Mofo Festival, held over three weeks in June 2019. $1.5 AUD million was provided by the Federal Government, and a further $500,000 AUD from the Tasmanian Government, were provided as bushfire recovery investment. At a smaller scale, because Australia Day (a national holiday on January 26) events were cancelled in the Derwent Valley, a very successful 'Australia Day Take 2' event was hosted.

Section V: Key Insights

A New Fire Regime in Tasmania

Climate change has resulted in what is widely termed a 'new fire regime' in Tasmania. Climate change induced increased frequency and severity of catastrophic fire weather is expected to continue to hasten over the coming decades. This is the scientific consensus ([7]; [8]; [17]; [18]) and the perspective of individuals working in the fire sector in Tasmania.

The impacts of the climate change induced new fire regime include a confluence of drier vegetation (drought), more heatwaves and higher winds, resulting in more days with high forest fire danger index (FFDI)[7], and higher and more extreme catastrophic fire weather. AFAC [7] states that:

> **"Consistent with fire events in Tasmania and other jurisdictions over the past decade or more we heard reports of firefighters witnessing unusual and unpredictable fire conditions they had not previously experienced. This included fires carrying through very tall 'wet' Eucalyptus regnans forest and burning through rainforest ecotone vegetation communities that would ordinarily provide natural control lines."**

Climate change is further increasing bushfire risk by reducing the window in which prescribed burning operations can be safely conducted [7]. Finally, bushfires themselves contribute to climate change by releasing stored carbon, as do prescribed burns.

The new fire regime of more extreme, frequent and longer fire events will have profound impacts for the response capacity of TFS, STT and PWS. Several respondents we spoke to expressed scepticism regarding the potential of Tasmania to effectively fight the fires it will face in the future, even with massive injections of resources. Tasmania, like much of Australia, is facing some very challenging questions about what is considered worth protecting.

In regard to impacts on communities, the unprecedented duration that the Huonville evacuation centre was open provides a glimpse at what Tasmania is likely to face in the future; one respondent noted that *"The Huonville centre was open for 3 weeks, that may be the new norm. Might have to have a bit of a paradigm shift."* The new fire regime highlights the need for extensive support for communities to manage risk, prepare for events, and prepare to recover well.

The new fire regime and the impacts it is having on Tasmania is at the forefront of the sector, resulting in demand for action at the national level to mitigate climate change as much as possible through emissions reduction. When asked what they see as the most pressing need for the sector in Tasmania, a respondent from the emergency services replied:

> **"I'd like to see Australia have a really genuine global emissions target, some genuine effort. I'd like to see our resources doubled but I feel like the emergency services get blamed for environmental policy failures….I'll do everything I can with planning and regulation, community resilience, but it's tinkering around the edges of a much bigger problem. Doesn't matter how much resources we throw at it, without action on climate change it means nothing."**

7 The FFDI is an index (from 1 to 100 plus) for measuring fire danger in Australia. It is based on temperature, wind speed, relative humidity, and a fuel availability component called Drought Factor [88].

The new fire regime and the TWWHA

Climate change and the new fire regime in Tasmania is having a particularly devastating impact on the TWWHA. As shown in Figure 17, the number of bushfires and area burnt has increased sharply since around 2000. This event saw more of the TWWHA burned than in all the fires from the ten years previous [7].

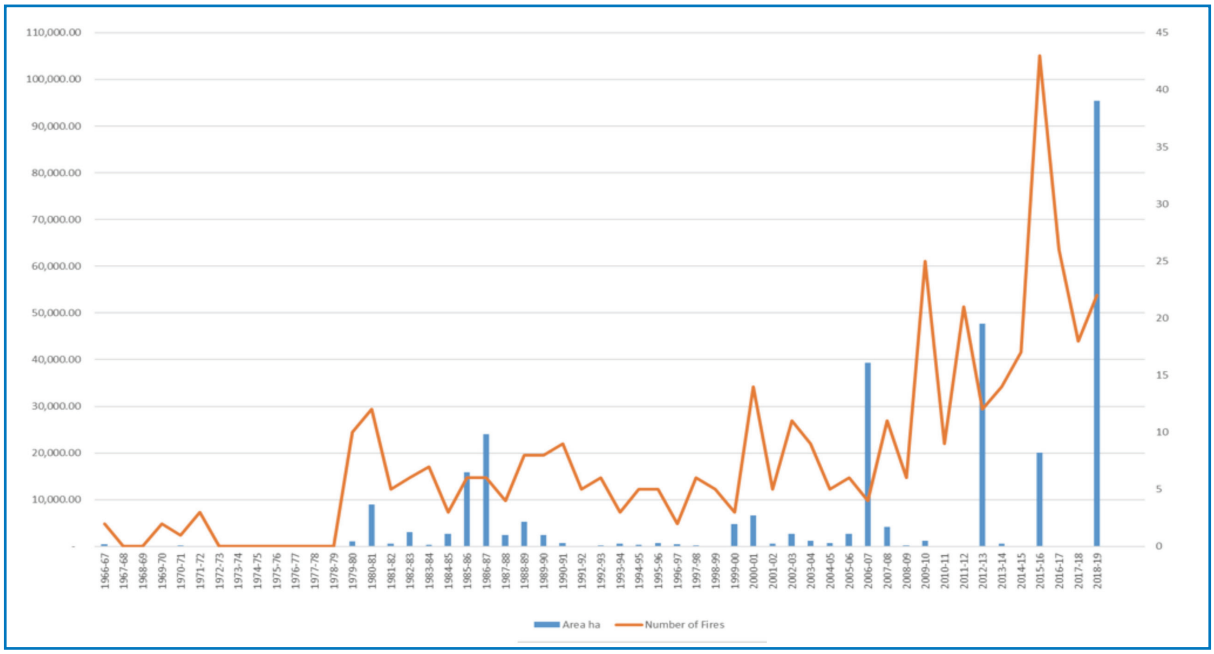

Figure 17: 50-year TWWHA fire history data, supplied: [7]

We found significant concern from fire agencies, researchers and conservationists that increased frequency, severity and scope of bushfires may lead to the eventual destruction of the TWWHA:

> **"We burnt 3-5% of the TWWHA this year, same in previous years. Another 30 years and it's all gone. It will never recover. The Commonwealth needs to work out how valuable this is. I'm not a greenie but it's just horrendous. Eventually, if we keep going…it's no good finding out in 50 years that it's gone."**

While much of what was burnt in this event was button grass and other 'fire-adapted species', even a small loss of the Gondwanan vegetation - such as King Billy Pencil Pine - that the TWWHA was created to protect is highly significant.

> "T**here's no doubt that the majority of what burnt was buttongrass plains etc, etc, which is pretty fire adapted. But even 2% if it was Gondwanan vegetation it's still incredibly precious. What we observed was that it could have been much, much worse – they were threatening the strongholds of Gondwanan vegetation – we dodged a bullet, it doesn't mean that it was well managed, it was possibly pure luck."**

Repeated burning of fire-adapted species is reducing the protection they afford to the old growth forest, at a time when that previously wet vegetation is likely to burn for the first time ever due to climate change induced weather:

> **"Button grass can burn many times, but our perspective is that it's not ideal to have those burning in the height of summer under climate change because it brings the fire to the non-adapted, precious trees at a time of year when it's Russian roulette. It's also much more damage to the "fire adapted" vegetation itself as well – the peat burns right down. It also acts as a conduit to the King Billy Pencil Pine which you don't want to burn ever. But in the height of a climate change summer they will burn."**

The continued destruction and eventual loss of the TWWHA would not only be an ecological calamity, it would also be an economic one. The significance of the TWWHA and surrounding wilderness to Tasmania's tourism industry and economy cannot be underestimated. Protecting the TWWHA - and the various values it embodies - under climate change brings into stark focus the challenges of allocation of constrained resources.

During this event, the extensive fire in the Moores Valley did not see any fire suppression because of its remote location and stretched resources. Across the sector there is frustration regarding the unmet need for an in-depth process, involving multiple stakeholders, regarding prioritisation of values. Questions raised include:

> **"Do we want to protect a 1000-year-old tree or a 5-year-old child?"**
>
> **"Rural area firefighting is really dangerous - are we willing to put people's lives at risk to protect the wilderness?"**
>
> **"Currently the priorities are life, then property, then environment - but should we protect a shed over irreplaceable trees?"**

Compounding this frustration is the fact that there does not appear to be the time to engage in such a process, because the time between high fire danger seasons is getting shorter. By the time one bushfire season is finished preparations are already being put in place for the next season. On a more positive note, we find mutual respect between fire agencies and conservationists, and a mutual desire to work together to protect the TWWHA.

A key site of agreement across the political spectrum in Tasmania is that the Commonwealth Government has a role to play in supporting fire risk management and suppression in the TWWHA. The argument is a convincing one, stating that since the Commonwealth is the signatory to the World Heritage Convention, they have a responsibility to provide resources for its protection:

> **"Tasmania is Australia's botanic gardens. They make half the state national park, but don't give us any money to reduce risk. They throw us some money when something happens but nothing before."**

Before the disaster strikes

Prescribed burning

Tasmania's fuel management approach is centred on prescribed burning, which is undertaken by TFS, STT and PWS depending on the land tenure. AFAC [7] recommendations 3 and 4 focused on prescribed burning, specifically the need for clarity around responsibility for strategic oversight of prescribed burning across different land tenures. The AFAC report also expressed concern regarding fuel loads around townships that were potentially putting lives at risk.

This report has highlighted that while prescribed burning is an important tool for fuel hazard management, it is not a panacea. Prescribed burning programs face challenges of land tenure, creating a false sense of security and generating smoke. Research has shown that the effectiveness of prescribed burning at inhibiting fire spread is limited when the FFDI exceeds 50 [75] [76]. Reliance on prescribed burning will become even more problematic as climate change reduces the available weather windows. Bowman [77] highlights complementary strategies such as *"mechanical fuel management ('green fire breaks'), subsidies for building and retrofitting of housing to become more bushfire resilient, improved planning of the wildland-urban interface, and public education programs"*.

Community preparedness

This review identified a clear gap in the level of community preparedness for bushfire across Tasmania. There is much more that can be done at the community level, by community members themselves with the support of government and agencies, to reduce risk and better prepare for bushfire events. We have identified several challenges and opportunities for improving community preparedness that have salience for southwest Tasmania, Tasmania as a whole and indeed all of Australia.

Several respondents identified lack of community engagement in bushfire risk management and preparedness as a central challenge in Tasmania. Several interconnected drivers of this complacency were identified. Firstly, communities can be starkly divided when it comes to attitudes towards environmental management. The most significant division identified in southwest Tasmania is that between "environmentalists and loggers". These divisions can hamper, or are seen to hamper, effective community engagement. Secondly, an attitude of "it won't happen to me" is viewed, at least amongst the people we spoke with, to be pervasive. One respondent described the situation:

> **"Communities that have recently had a fright or have been affected by a fire are much more likely to be aware of it. Dunalley people are still gun shy when they see smoke. For a lot of people - the further back in the past the last fire was near the less likely they are to take it seriously. People will come to town meetings about whether to allow dogs on a beach, but not about the fire management program. Once the fire threat has passed people have an amazing ability to say "it won't happen to me.""**

Thirdly, even when there is acknowledgement of risk, a common view is that some community members do not see that they have their own role to play in risk reduction and preparedness. Instead, these are seen as the responsibility of the fire agencies; several respondents suggested that community members think that the fire agencies have a seemingly unlimited supply of fire trucks and firefighters who will be able to save them and their property in the event of a bushfire. The presence of insurance was also raised as a potential disincentive for engagement in risk reduction or preparedness: *"There are people who think that "I pay my fire service levy so it's the fire service's problem". I've also heard people say "I have insurance so don't care.""*

Several opportunities were identified for more deeply engaging communities in risk reduction and preparedness. Long term education of children about bushfire risk, together with educating adults via marketing campaigns were crucial for long-term resilience. Messaging campaigns were raised by several respondents as important: *"There has been a little bit of messaging about communities getting prepared but I'd like to see a whole lot more...without being alarmist. I'd like to see a campaign like we had with driving or smoking."*

Several respondents identified a tension within the fire agencies between their paramilitary, top-down approach that works well in the response phase, and the long-term, bottom-up, community development approach needed for engaging communities in building preparedness. TFS's Bushfire Ready Neighbourhoods program was identified as being a best-practice example of overcoming this tension and effectively enhancing community preparedness. The success of this program is attributed to the long-term commitment and in-depth community engagement, utilising staff with community-development expertise.

Wine industry risk management planning

Smoke taint caused by bushfires poses a significant threat to Tasmania's growing wine industry and highlights the need for proactive climate change adaptation strategies. Fortunately, there is much that can be done to mitigate the risks to protect and grow the industry. An interviewee reported that researchers have been developing an early warning system for smoke taint that gives growers vital information about their exposure to smoke. If exposure is nil or low, then growers can feel confident in their crop. If it is intermediate, then they know to do further testing and/or a small test ferment. One interviewee stated that some types of sparkling wine are potentially less affected by smoke taint and that impacted vineyards may have the option to recoup some costs by making sparkling wine. If it is severe then they know not to generate further losses by harvesting and processing their crop.

By implementing a smoke taint monitoring system, the industry can provide buyers with the knowledge they need about the vintage, and thus reduce reputational risk. If results of monitoring of these fires had been more widely publicised, this would have protected the 90% of the vineyards that were unaffected, while allowing affected growers to access much-needed relief.

During the disaster

Warnings

Overall, the warnings system functioned well during the event, although there are lessons to be learned. As described above, the warnings system was not ideal for events of this duration. Some warnings were considered too generic, and the TasAlert webpage seen as somewhat outdated. These factors led to confusion and potentially complacency. Some visitors to the state did not receive warnings, and warnings that were received may have unnecessarily burdened the tourism industry. We concur with the AFAC report [7] in its conclusion that Tasmanian fire agencies are not at fault for these issues with the warning system, and that the experience of this bushfire should be considered by expert national committees regarding warnings.

Firefighting operations

The AFAC report [7] was focused on reviewing the firefighting response operations. Where respondents made comments regarding response operations, we find that they were largely in line with AFAC's findings and it is not the goal to reproduce this analysis here. There are several areas where our research can complement the AFAC report.

Value is not objective. During the bushfire event the fire agencies and chain of command had to make decisions about what assets to prioritise for protection. This was particularly challenging during this event due to the sheer number of bushfires occurring at the same time. The relative value placed on various assets (e.g. buildings, forestry resource, old growth trees) is a subjective decision. There is near-universal agreement that the protection of human life should be the top priority, yet there is significant divergence between stakeholders regarding the prioritisation of assets.

There are no panaceas. Two issues that were discussed extensively in the public debate around this event were those of a volunteer remote area firefighting force and the use of aerial suppression (water bombers). More remote area firefighters and more planes were both heralded as potential 'solutions' for the growing bushfire threat in the Tasmanian wilderness. In regard to these two issues we refer to the nuanced analysis of the AFAC report, and emphasise that there are no panaceas for wilderness protection in Tasmania. Both have a role, but investment in remote area firefighters and/or aerial suppression capability (leasing or buying more planes) must be undertaken with full consideration of the economic, social and environmental costs and benefits.

Implementing learnings requires resources. Following previous major bushfire events in Tasmania there have been in-depth operational reviews and resultant recommendations. This willingness to review, learn and implement learnings is resulting in continuous improvement and adaptation of operations. However, several interviewees raised the issue that the acceptance of recommendations is not always accompanied by resources to facilitate the changes that they recommend.

Response and recovery operations

Community sector arrangements

Overall, we find that the Huonville evacuation centre and community forums worked very well. This success can be attributed to the excellent planning by the Huon Valley Council, together with the community spirit of the Huonville and Tasmanian communities. NGOs played a pivotal role in this success and overall, their contribution was well coordinated and well managed. Our analysis did however identify some challenges associated with the contribution of NGOs to the response effort that are instructive for other Local Councils across Australia facing future evacuation events.

NGOs provide the surge capacity needed to respond to disaster events, particularly in Tasmania where the government is small and big events are rare. This is potentially part of the reason why the role of the community sector in the response operations and cost-recovery arrangements were not adequately prepared for before the bushfires occurred. The existing TEMA plan did include a protocol for engagement of NGOs in disaster response/recovery operations, yet there were no specific agreements with NGOs to "guide services and financial responsibilities" [48].

Across our interviews it became clear that the process by which NGOs would engage with response operations was not clear to all involved. There was confusion about what roles NGOs could or should play at the PCYC evacuation centre, and who bore responsibility for costs. In its submission to the AFAC review, the Huon Valley Council stated that *"At some stages it was unclear which agencies were in the Centre and under what capacity. This has also led to financial expenditure occurring without the Council's knowledge or prior approval"* [48]. Because the Huon Valley Council was the organisation ultimately responsible for the running of the PCYC evacuation centre, coordination and management problems arose when they did not have adequate oversight of NGO activities. Further to this, it compromised the Council's capacity to track and ultimately recoup costs (up to 75%). One interviewee noted that:

> **"It's been really tricky here, having a role for the community sector, I think because it's run out of PMC [Department of Premier and Cabinet] where they might not be used to working with the community sector. Also, the focus is on response and hence command and control and community sector doesn't really fit."**

This situation was also far from ideal for the NGOs, who desired to support the Council and Huon Valley community in the most efficient and positive way possible and did so in good faith. While not the experience for all NGOs, at the time of interviewing some had been unable to reach an agreement with the Huon Valley Council regarding cost-recovery, reportedly due to disagreements regarding formal activation and whether completed tasks were at the request of the Council. It is important to note that NGOs in Australia are typically funded via government and donations to deliver ongoing programs to the community, and as such do not have significant funds available for disaster response. If an NGO provides services in the event of a disaster, it is the expectation that these costs will be recovered. Without the guarantee of cost-recovery NGOs cannot commit to investing in disaster-response upskilling, nor indeed commit to being involved in response.

In 2020 it has come to light that many Councils in Tasmania are now in the process of agreeing on arrangements, either via MoUs or other agreements, with NGOs important for community response and recovery. This is highly encouraging and demonstrates a willingness from emergency management stakeholders in Tasmania to critically reflect on the experience of this fire, learn lessons and implement positive changes; the Tasmanian experience is something other States can look to.

Role and management of volunteers

Two key concerns were raised by interviewees regarding volunteers: organising and managing the influx of volunteers, and risk management. The Huon Valley Council was inundated with people arriving at the Huonville PCYC evacuation centre, as well as phoning Council offices and the centre. This diverted much needed staffing resources away from assisting evacuees. In response to this challenge, they sought assistance from Volunteering Tasmania. Management and responsibility for volunteers was not clearly defined between Council and the NGOs involved.

Issues surrounding risk management including risks to volunteers from undertaking volunteer work and risks to vulnerable evacuees from volunteers with nefarious intentions, were a concern for organisers. Community sector organisations needed to utilise spontaneous volunteers, but some were concerned about the reputational risk of untrained volunteers seeming to represent these organisations. One interviewee observed that:

> **"The sector is highly risk averse; they want to be able to have everything planned and everyone trained. Perhaps the extreme risk aversion comes from the threat of having to stand up in front of a public inquiry and say what your plan was and how you followed it. You lose control when you facilitate something rather than control it. You have to give up control to use spontaneous volunteers."**

At the same time, we found significant recognition for the importance of using volunteers, especially from within the evacuation centre population. One organiser said:

> **"I think that [spontaneous volunteering] is what community resilience is about. I think in an emergency situation the rules change a bit. I've worked in OHS and I understand all that…some of the comments were "we've got nothing to do, we're just sitting here, Council won't let us take out the rubbish". There's got to be a fine line, there's got to be common sense. People need to feel like they're contributing. 12, 13 days is a long time. Sitting in a centre where you have to stay inside 60% of the time. These are rural people, they're not idle - it's really important that people feel their worth. They couldn't go to work, couldn't even go home and look after their animals. I think it was really important they were involved in short term recovery for the longer-term community recovery."**

Considering the significance of volunteers for community resilience and the fact that volunteer represent a vast, untapped resource, management of volunteers, particularly in high profile events, is something that should be considered in future planning at all levels.

Support from other municipalities

We observe that a small but important success in the running of the Huonville PCYC evacuation centre was support provided from other Councils. The Huon Valley Council [48] states that:

> **"The support the Huon Valley Council received from other Councils to manage the Evacuation Centre was extremely effective and we relied heavily on this support in order to maintain the services and Evacuation Centre for the duration of the event. As a regional Council we could not have done it without them."**

This support was provided in the form of emergency management staff such as emergency management coordinators from other Tasmanian Councils. These staff resources were transferred at no cost to the Huon Valley Council and had several very positive outcomes. This support provided much needed staffing resources to relieve the already stretched Huon Valley Council staff. At the same time, it provided emergency management staff from other Councils with hands-on experience of an emergency response situation. Being able to observe and participate in the success of the Huonville PCYC evacuation centre motivated emergency managers to put enhanced plans in place in their own Councils. The success of this support arrangement is pertinent for all states across Australia.

The role of research and science

The role that research and science plays in the sector was a special interest of this review. Overall, we found that at the State level, agencies and staff drew heavily on research and science, as they need to be across current thinking and are committed to continuous improvement. Hower ome undertook training which was informed by research. NGOs presented a more mixed picture, with research and science being important for policymakers in their organisations, who in turn ensure that where relevant it is incorporated into practice. At the local level research and science were not drawn on directly.

As Tasmania begins to feel the impacts of climate change there are already some research projects being undertaken to model impacts at the local level. There is general demand for more climate change-oriented research, particularly that which translates modelling to information actionable by local decision-makers. In regard to bushfire risk management and community action, the Tasmanian sector is involved with several national-level research projects with the Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC) [78], and draws on national findings. Policymakers mentioned the Australian Institute for Disaster Resilience (AIDR) handbook series [79] as an important source of synthesised research and science. The small size of Tasmania makes national-level initiatives important for the state.

Section VI: Recommendations

Risk reduction and preparedness

Support for PWS as it develops a bushfire management plan for the TWWHA.
The first need identified by this review was a multi-stakeholder process for the development of an adaptive bushfire risk management plan for the TWWHA. Since the event, PWS has initiate the development of a fire management plan. We find that across the board there is a strong desire to work collaboratively to preserve the TWWHA, which provides a robust foundation for multi-stakeholder dialogue. While the details of PWS's plan have not been released yet, ideally it would ultimately encompass a holistic risk management approach that includes all steps of the disaster risk management cycle (prospective and corrective risk reduction, preparedness, response and recovery). This plan would take account of the new fire regime and be integrated with wider management plans. In addition to PWS, TFS and relevant Tasmanian Government departments, other important stakeholders include adjacent communities, STT, conservation groups and researchers. The status of the TWWHA as a nationally designated conservation area indicates a potential support role for the Australian Government and mainland state fire agencies.

Slow the growth in bushfire risk via land-use and building regulations.
Increasing bushfire risk in Tasmania could be mediated by more action to prevent further build-up of assets in high risk areas. Tasmanians would benefit from investment in high quality modelling of current and future bushfire risk to update the bushfire-prone overlays and roll them out across the state. The role of Councils in managing future development in high risk areas (exposure growth) and regulating current and future developments to minimise vulnerability, would be important. The important role that TFS already fulfills in providing advice to Councils and accrediting developments could be afforded an expansion of resources to meet growing demand.

Implement a risk reduction plan that complements risk-based prescribed burning with other strategies.
Prescribed burning is a central component of bushfire risk management in Australia, but it is not a panacea. Further investigation into the options for prescribed burning in wilderness areas, including the TWWHA, is needed. Increasing risk means that, like all Australian states, Tasmania would be well served by complementing its prescribed burning program with other hazard management strategies, such as fuel breaks, particularly to protect townships and other important assets and infrastructure. We find evidence that Tasmania is broadly following a risk-based approach to prescribed burning (burning to reduce risk) and this approach should be defended against calls for a hectare-based approach (burning a set number of hectares).

Support strong working relationships between fire agencies, landowners and conservationists.
There is considerable mutual respect and alignment in perspectives between fire agencies, landowners and conservationists in Tasmania. In previous years these relationships were strong and facilitated mutual understanding and positive collaborations yet have waned more recently. We recommend that these strong working relationships be reinforced, and potentially formally codified, to support further movement towards a comprehensive and adaptive bushfire risk management scheme in Tasmania.

Expand community engagement in bushfire resilience and preparedness programs.
The Bushfire Ready Neighbourhoods Program run by TFS is based on best practice for community resilience and preparedness programs and is delivering positive results. Key factors in the success of this program include support from TFS leadership, a foundation based on long-term community development principles and engagement with local researchers. As bushfire risk increases due to economic and population growth, and climate change, investment in this or similar programs is essential for the long-term disaster resilience of Tasmanian communities.

Climate change adaptation planning for Tasmanian industries.
The tourism, wine and apiary industries were identified by this review as being impacted by this event. These industries – and no-doubt others – require climate change adaptation action plans. For the wine industry, this would likely include investment in smoke taint detection and management. For the tourism industry, issues of sustainability, carrying capacity, future proofing and expanding beyond the current seasonal focus would need to be incorporated. There were many industries impacted by this and other events: we know that climate change adaptation planning is most likely to be successful and efficient when it is comprehensive, integrated and long-term.

Adopt stringent CO2 emissions reduction targets.
A key driver behind the devastation of this and other recent bushfires is climate change. While Tasmania's contribution to global emissions is small, it has a responsibility to contribute to the global effort. The Tasmanian Government can also play a significant role in contributing to Australia's commitment to emissions reductions, which could have a more significant impact on the global stage.

Emergency response

Augment the emergency warnings system to operate in prolonged events.
Prolonged 'campaign' fires are becoming more frequent right across Australia. The experience of this bushfire provides an ideal learning opportunity to review the effectiveness of the current warnings system in these circumstances. Such a review would consider whether and how warnings become less effective in a prolonged bushfire, and how messaging might be adapted to ameliorate this.

Clarify bushfire suppression priorities in the TWWHA.
While all of the TWWHA is precious, some areas/ecosystems are particularly significant. Future management planning for the TWWHA would be enhanced by a stakeholder process to reach agreement between PWS, STT and other key stakeholders regarding suppression priority areas in the TWWHA and a process to resolve challenges that arise in the future. This could also include a consideration of when environmental assets should take priority over infrastructure and questions of risks to firefighters.

Contribute to the national conversation on the impact of bushfire smoke on health.
This event highlighted the significant impact that bushfire smoke from sustained events can have on human health. It is likely that in this case mortality and morbidity from smoke far exceeded that from the bushfires themselves. Because of its comprehensive air quality monitoring, Tasmania is in a strong position to be a frontrunner in understanding and addressing this nationally and globally significant issue which has also come to the fore with the 2019/20 mainland bushfires.

Embrace comprehensive resolutions to this complex problem.
Much of the public debate around these bushfires was centred on calls for more remote area firefighters and/or aerial suppression resources (waterbombers). While these will likely play an expanded role in bushfire response as risk increases, they will by no means "solve" the problem. Under certain climatic conditions – that we are seeing more and more of – it may become impossible to put out some bushfires in the Tasmanian terrain, even with unlimited resources. Like prescribed burning, everyone within and adjacent to the Tasmanian emergency management sector must continue to advocate to the general public that there is no single solution.

Community response and recovery

Prepare for a longer phase of community response, including evacuations.
The prolonged nature of this bushfire event, and the subsequent 2019/20 mainland fires, highlighted the need for community response preparations to include plans for longer lasting events. To-date planning has largely been based on past experience where people have been able to return to their homes after a few days, rather than community response that lasts several weeks or even months. This additional preparation could include consideration that people may be in and out of evacuation centres if they are evacuating due to poor air quality (smoke).

Local Governments and Local Councillors should plan for emergencies together.
The relationship between the Huon Valley Local Government and the Huon Valley Local Council was very effective during the crisis and could be a good model for other LGAs. Emergency response planning should ensure that plans were known by all and institutionalise clear roles and responsibilities, linked to position descriptions, in the event of a disaster. This planning process could also consider management of potential staff burn-out in prolonged events.

Cross-LGA secondment agreements should be incorporated into community response planning.
Another success of the Huon Valley's community response was the secondment of municipal area coordinators from other LGAs to the Huon Valley. This provided much-needed staffing relief in the long response phase, providing a significant benefit and capacity boost to the Huon Valley Local Government. At the same time, this hands-on, practical experience in a complex evacuation scenario provided secondees with invaluable lessons that they could then incorporate into their own LGA emergency response planning. It would be highly beneficial if in-principle arrangements for these secondments could be made ahead of time, so that they could be activated when needed.

Clarify and codify the role of the community sector in emergencies and resolution processes.
We find that regarding community sector contribution to response operations, roles need to be more clearly delineated beforehand and processes for quickly resolving issues established. Cost-recovery arrangements also need to be transparent. The expectation for cost-recovery was met under the TEMA protocol, however this event demonstrated that the protocol could be complemented with further agreements between LGAs and NGOs, in the form of MoUs or otherwise. These agreements could be at Council level or LGAT (Local Government Association of Tasmania) level; they should be made well before disasters occur and revisited yearly. We note that advice has been released by the Southern Regional Social Recovery Committee on this issue, encouraging these types of arrangements to be put in place, and that many Councils are in discussion with NGOs around this issue. The role of the community sector in disaster risk management in Tasmania could also be more comprehensively considered at the State level and within regional recovery committees.

Update the strategy for emergency volunteers.
Volunteers have always been, and will continue to be, a crucial resource essential for emergency response. Volunteering is a manifestation of, but also a source of, community disaster resilience. Yet the disaster volunteering landscape is changing rapidly: people are organising spontaneously and informally via social media and have a different relationship with authorities and NGOs compared to times past. As such, the relationship between players in the emergency sector and volunteers is ever-evolving and the sector could consider updating the strategy for volunteers.

Identify and implement lessons regarding the provision of recovery grants.
The provision of individual, business, and community recovery grants is a mainstay of disaster recovery in Australia. There was considerable confusion with the provision of grants following this event. Much of this confusion and resultant dissatisfaction and even animosity was due to lack of clarity around who was eligible and under what circumstances. This confusion extended beyond grant recipients to local government and NGO staff supporting recovery. Recovery grants can be a powerful tool and this experience should inform the design of future grant schemes. Future grant schemes should also consider eligibility on the basis of smoke exposure as well as direct threat from fire.

Provide support to complete the learning cycle after event reviews.
The emergency management sector, in particular the fire and emergency services agencies, are diligent in initiating and engaging with post-event reviews after severe bushfire events. Typically, most of the findings and resultant recommendations from these reviews are accepted by governments and agencies. Recent advancements in learning and knowledge management indicate that institutional and operational changes are not cost-neutral; in order to complete the learning cycle and implement lessons learned, agencies require congruent resourcing.

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Glossary

AIDR: Australian Institute for Disaster Resilience

AFAC: Australasian Fire and Emergency Service Authorities Council

BFN: Bushfire Ready Neighbourhoods

BNHCRC: Bushfire and Natural Hazards COOPERATIVE Research Centre

BOM: Bureau of Meteorology

FFDI: Forest Fire Danger Index

IMT: Incident Management Team

LGA: Local Government Area

LGAT: Local government Association of Tasmania

NGO: Non-Governmental Organisation

PCYC: Police Community Youth Centre in Huonville

PWS: Parks and Wildlife Service

SEMC: State Emergency Management Council

SES: Tasmania State Emergency Service

SFMC: State Fire Management Council

STT: Sustainable Timber Tasmania

TEMA: Tasmanian Emergency management Arrangements

TFS: Tasmania Fire Service

TWWHA: Tasmanian Wilderness World Heritage Area

Interviewees

Below are the names of the interviewees who consented to being acknowledged. Sincerest thanks to these and also those who spoke anonymously.

Alex Heroys, Chief Executive, Destination Southern Tasmania, Hobart

Assoc Prof Anne Hardy, School of Social Sciences, University of Tasmania, Hobart

Blythe McLennan, Centre for Urban Research, RMIT University, Melbourne

Bronwyn Watson, Emergency Management, Tasmanian Health Service – South, Hobart

Bill Coad, Senior Station Officer, Southern Region, Tasmanian Fire Service, Hobart

Carole Owen, A/CEO, Public Health Services, Department of Health, Hobart

Dale Rayner, A/Regional Chief-South, Tasmanian Fire Service, Hobart

Prof David Bowman, Director, Fire Centre Research Hub, University of Tasmania, Hobart

Dean Sheehan, Fire Management Manager, Sustainable Timber Tasmania, Hobart

Assoc Prof Fay Johnston, Menzies Institute for Medical Research, University of Tasmania, Hobart

Gary Armstrong, State Coordinator Tasmania, The Salvation Army, Hobart

Geoff Law AM, World Heritage Campaigns Consultant, Hobart

Prof Ian Porter, Department of Animal, Plan and Social Sciences, La Trobe University, Melbourne

Lisa Phohl, Huon Valley Council, Huonville

Dr Lisa Surminski, CEO and Sarah Martin, Strategic Projects Manager, Volunteering Tasmania, Hobart

Paul Smart, Technical and Extension Officer, Wine Tasmania, Hobart

Peter Middleton, Coordinator Community Development, State Public Information Officer, Tasmanian Fire Service, Hobart

Peter Norris, President, Southern Tasmanian Beekeepers Association, Hobart

Rebecca Bell, Huon Valley Council, Huonville

Cr Bec Enders, Mayor Huon Valley Council, Huonville

Sandy Whight, General Manager Decision Support Services, Bureau of Meteorology; at time of interview: Director of Community Fire Safety, Tasmania Fire Service

Steven Richardson, District Officer, Northern Region, Tasmanian Fire Service

Vica Bailey, Conservationist, Hobart

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