Reducing Victoria's bushfire risk

Fuel management report
2016–17

The department pays its respect and proudly acknowledges the contribution and continued commitment to land and resource management by Victoria's Traditional Owners, their rich culture and the intrinsic connection they have to Country.

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Foreword

Welcome to *Reducing Victoria's bushfire risk: Fuel management report 2016–17*, the fifth annual report of the achievements of Victoria's Bushfire Fuel Management Program.

Victoria is one of the most fire-prone areas in the world. In past decades, Victorians have seen the disastrous effects bushfires can have on communities. Fuel management is the most effective way to reduce fuel on large areas of public land and the main way we manage bushfire risk.

Forest Fire Management Victoria — 'we' in this report — represents the state's lead agencies for fuel management on public land. Our team includes staff of the Department of Environment, Land, Water and Planning and of Parks Victoria, VicForests and Melbourne Water. Our job is to achieve the two primary objectives of the Code of Practice for Bushfire Management on Public Land 2012, which are:

- to minimise the impact of major bushfires on human life, communities, essential and community infrastructure, industries, the economy and the environment: human life will be afforded priority over all other considerations
- to maintain or improve the resilience of natural ecosystems and their ability to deliver services such as biodiversity, water, carbon storage and forest products.

This is the first year of implementing our Safer Together policy and our *Community Charter*. These direct us to understand what the public considers important about our work and the outcomes they expect from interacting with us. Our staff spend thousands of hours working with communities, learning from their local knowledge and wisdom, and finding solutions to work towards our objectives. Together, we pursue a common goal: protecting life, property and the environment, and keeping everyone and the things we value safe.

This year also saw the completion of the transition to a risk-reduction target for fuel management. Under this new approach, we'll measure how effective our fuel management activities are, not just how much we have burned. Over the next few years, with input from communities and stakeholders, we expect to expand our risk-based planning to include strategies for bushfire prevention, preparedness, response and recovery. We will also continue to improve how we identify and manage risk using best-available data and research.

The 2016-17 planned burning season saw poor weather conditions that prevented planned burning on many occasions. Despite this, residual risk was estimated at 63%, which met the Victorian Government's policy of maintaining residual risk at or below 70%.

Among the many achievements for the year, I want finally to mention our teams' groundbreaking efforts to bring Aboriginal cultural burning practices into our planned burning program: our teams, including our Aboriginal staff, are making history as cultural burning again becomes a valued part of Country.

Thank you for taking the time to read this report and for your interest in reducing Victoria's bushfire risk through fuel management.

Stephanie Rotarangi
Chief Fire Officer

Introduction

About fuel management

Victoria is one of the most fire-prone areas in the world. In past decades, Victorians have seen the disastrous effects bushfires can have on communities.

Under the *Forests Act 1958* and in line with the *Code of Practice for Bushfire Management on Public Land 2012*, the Department of Environment, Land, Water and Planning (DELWP) is responsible for managing bushfire risk on public land. We manage bushfire risk, primarily through fuel management, to implement the two code of practice objectives. They are to:

- minimise the impact of major bushfires on human life, communities, essential and community infrastructure, industries, the economy and the environment: human life will be afforded priority over all other considerations
- maintain or improve the resilience of natural ecosystems and their ability to deliver services such as biodiversity, water, carbon storage and forest products.

To do this, we work with a broad range of organisations and individuals — including other Victorian Government agencies, local governments, emergency management organisations, environmental organisations, water companies and industry organisations, and with Traditional Owners through land management partnerships — to manage bushfire risk on approximately 8 million hectares (ha) of public land on behalf of all Victorians.

Forest Fire Management Victoria — 'we' in this report — represents the state's lead agencies for fuel management on public land. Our team includes staff of the DELWP, Parks Victoria (PV), VicForests and Melbourne Water.

Fuel management is the most effective way to manage bushfire risk on large areas of public land. Fuel management reduces the amount of fuel available to a bushfire, which can reduce its intensity and rate of spread and so increase opportunities for firefighters to suppress it. We mainly manage fuel by planned burning, and also by mechanical treatment. For fuel management purposes, Victoria is classified into four fire management zones:

- Asset Protection Zone (APZ): an area around properties and infrastructure where we intensively manage fuel to provide localised protection to reduce radiant heat and ember attack on life and property in the event of a bushfire
- Bushfire Moderation Zone (BMZ): an area around properties and infrastructure where we manage fuel to reduce the speed and intensity of bushfires and to protect nearby assets, particularly from ember attack in the event of a bushfire
- Landscape Management Zone (LMZ): an area where we manage fuel to minimise the impact of major bushfires, to improve ecosystem resilience and for other purposes (such as to regenerate forests and protect water catchments)
- Planned Burning Exclusion Zone (PBEZ): an area where we try to avoid planned burning, mainly because ecological assets in this zone cannot tolerate fire.

Metrics and reporting scale

This report uses three scales — statewide, bushfire risk landscape (BRL) and region — to report activities and outcomes. Each reporting metric is represented at the scales that most appropriately represent the activity or outcome. Table 1 shows the scale at which each metric is reported.

Table 1: Metrics and reporting scale

Metric	Statewide	BRL	Region
Residual risk	✔	✔	✔
Ecosystem resilience	✔	✔	
Community engagement	✔	✔	
Monitoring, evaluation and reporting (MER)	✔	✔	
Costs	✔		✔
Burn planning	✔		✔
Site preparation	✔		✔
Fuel reduction	✔		✔

We translate our risk reduction targets to hectare targets for delivery purposes across the regions. Our fire operations plans (FOPs) illustrate this translation of our risk targets into hectare-based activity targets.

Regions represent areas where we carry out ground activity (such as fuel management including planned burning). For management purposes, Victoria is divided into six regions, each of which comprises two or more fire districts. Figure 1 shows the regions and fire districts.

In 2016-17 we divided Victoria into seven BRLs and we modelled risk and strategically planned for bushfire management in each landscape. Figure 2 shows Victoria's BRLs in 2016-17. In the future we will be realigning our risk modelling and strategic bushfire management planning to the regional scale to align with our on-ground activities.

Figure 1: Regions and fire districts

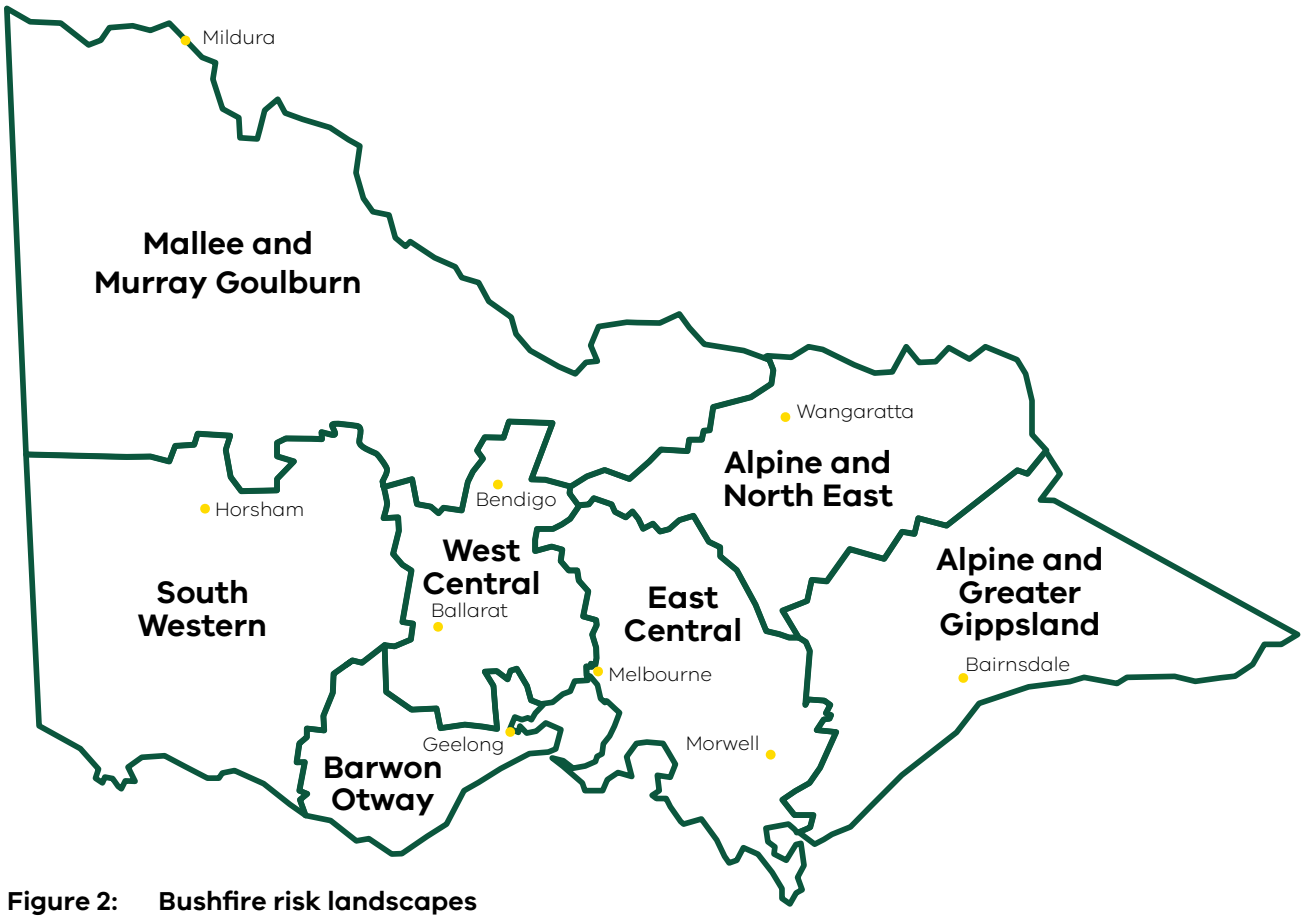

Figure 2: Bushfire risk landscapes

Improving our residual risk estimates

Through our *Bushfire Science Strategy 2013–17*, we invest heavily in research to improve the modelling and other tools we use to analyse risk and to improve the quality of our data. Improvements in bushfire science and modelling tools and access to better data have led us to recalculate Victoria's residual risk in 2016–17. This improved calculation accuracy now shows residual risk at 63%.

In 2016, we updated the inputs into the Phoenix RapidFire bushfire simulation software and the residual risk calculation process by:

- improving fuel-type mapping by more accurately mapping the extent of woody vegetation across Victoria; by updating plantation, irrigation area and water-body mapping; and by expanding fuel-type mapping into South Australia and New South Wales
- deploying a new version of the Phoenix RapidFire software — version 4007 — which improves bushfire spread simulations by better accounting for convection, spotting and ember density
- expanding the Phoenix ignition grid by 40 km into South Australia and New South Wales to complement the expansion of the fuel-type mapping
- improving the accuracy of address point locations, which are used to estimate residual risk, across Victoria.

These improvements resulted in updated residual risk profiles, which show risk to be about 10% less than estimated using the previous version of the Phoenix software and previous data.

As part of our commitment to continuous improvement, we will continue to refine our residual risk estimates over time as our modelling becomes more accurate. We will also continue to communicate changes to residual risk, whether the changes result from improvements to the residual risk assessment process or from the combined effects of our fuel management program and bushfires.

This report contains technical terms and references to other documents, including legislation.

The main technical terms and documents referred to in this report are printed on their first use in green and are underlined. As many of the technical terms relate to the fuel management achievements, they are also hyperlinked in Table 2 and in the reports of achievements in the 'Regional fuel management planning and activity' section of this report.

If you are reading this report on a screen, click on the underlined, green words to hyperlink to the explanation of the technical term in this report, or to go to the relevant web page. If you are reading a printed version of the report, the explanation of technical terms is in 'Definitions and further information' at the end of the report.


FOREST FIRE
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What we achieved statewide

Residual risk

Bushfire risk is the likelihood of a fire starting, spreading and affecting people, property and the environment. Fuel management activities (including planned burning as well as bushfires) reduce fuel, and this helps reduce the size, speed and severity of major bushfires. Residual risk is the amount of bushfire risk which remains to life and property after bushfires and fuel management activities have reduced fuel.

Figure 3 shows the modelled residual risk profile for Victoria for the period 1980–2017, using historic records of bushfires and planned burning. It also shows projected changes in residual risk until 2020. We estimate residual risk was 63% in 2016–17, which met the Victorian Government's policy of maintaining residual risk in Victoria at or below 70%. The residual risk increased slightly from last year, as a result of unfavourable weather conditions during the year. Fuel management activities included in fire operations plans (FOPs) across the state are expected to maintain residual risk in the range 61–64% until 2020.

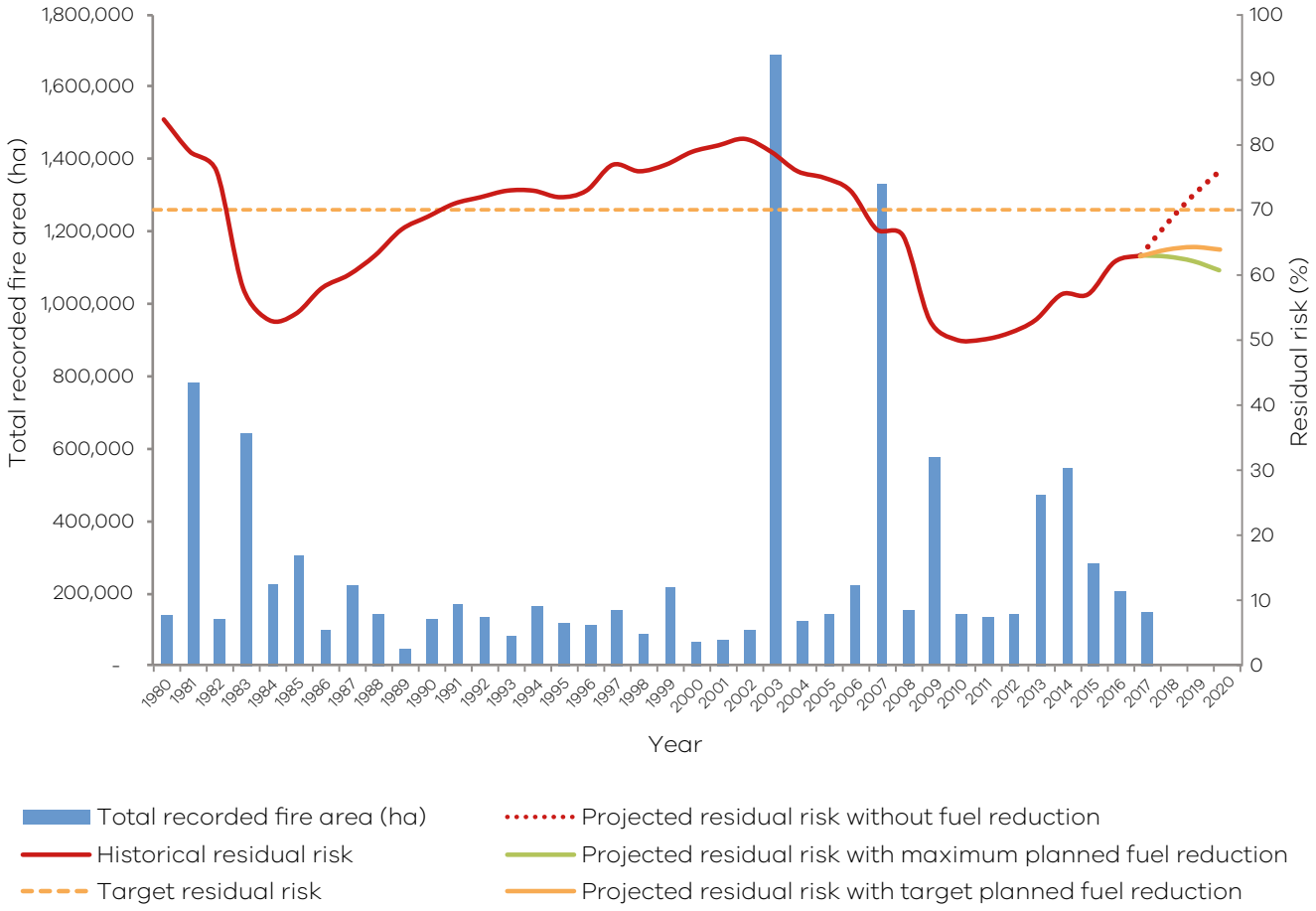


Figure 3: Residual risk profile, Victoria, 1980–2020

Figure 3 shows that residual risk across Victoria:

- fell after the 1983 Ash Wednesday bushfires, which caused large losses of life and property
- rose steadily after 1983 as fuel re-accumulated across the state, reaching a peak of 81% in 2002
- fell significantly as major bushfires in the 2000s, particularly the 2009 Black Saturday bushfires, reduced fuel: this reduced risk came at a cost of large losses of life and property
- in recent years has increased to 63% as fuel has re-accumulated.

The figure shows how re-accumulating fuel in Victoria's forests can quickly increase bushfire risk, if the fuel is not reduced with a continual fuel management program. If we complete the fuel management activities in FOPs, we will hold residual risk to 61–64% by 2020. If we cannot carry out our planned fuel management activities, modelling indicates residual risk will rise steeply to 76% within three years.

At the time of finalising this report, the 2017–20 FOPs had not yet been approved. The residual risk estimates have been calculated using the preliminary 2017–20 FOPs.

Ecosystem resilience

We also manage fuel and conduct ecological burns to maintain or improve ecosystem resilience. To understand the effect of fuel management on ecosystem resilience, we measure and monitor the tolerable fire interval (TFI) and growth stage structure (GSS) of the vegetation in areas we treat through the Bushfire Fuel Management Program. We also partner with universities and institutes to undertake research to improve how we measure and represent ecosystem resilience. This research includes how to best use the metric geometric mean abundance to represent ecosystem resilience. In 2016–17, we continued testing and refining our method for calculating geometric mean abundance, which will be adopted statewide in the future.

Vegetation tolerable fire interval status

Figure 4 shows the tolerable fire interval (TFI) status since 2007 of the vegetation on public land across Victoria. It shows about 50% of the vegetation was below its minimum TFI in 2016-17, as it has been for a decade. This trend is mainly a legacy of the 2003, 2006–07 and 2009 bushfires. The amount of vegetation below minimum TFI will remain consistent for a long time because many bushfire-affected vegetation types have relatively long TFIs: between 15 and 80 years. Despite an increase in the amount of planned burning since 2009, the trend of vegetation within TFI has remained steady. This is a result of our strategic planning to reduce the effects of the planned burning program on TFI and ecosystem resilience more broadly.

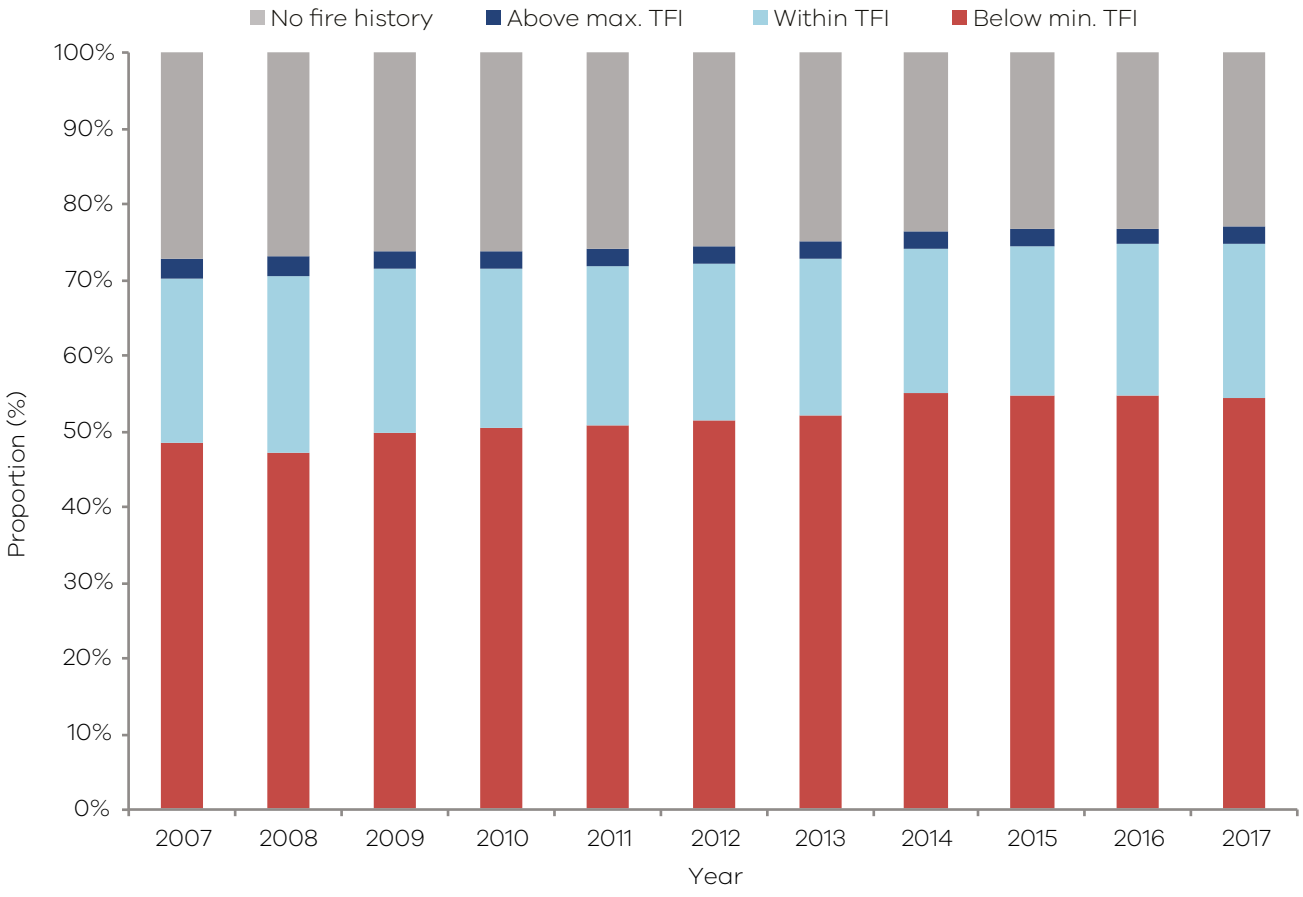


Figure 4: TFI status of public land vegetation, Victoria, 2007–17

Figure 5 shows the area of public land burnt by bushfires or planned burning while below minimum TFI in the period 2007–17. We try to minimise the amount of area that is burnt while below minimum TFI because it can be detrimental to ecosystem resilience. However, planned burning may be needed in some areas already below minimum TFI to reduce bushfire risk to life, property or priority ecosystems. In 2016–17, less than 2% of the vegetation in Victoria was burnt by bushfire or planned burning while below TFI. The area burnt while below minimum TFI in 2016–17 was lower than the previous year, with almost all of it a result of planned burning.

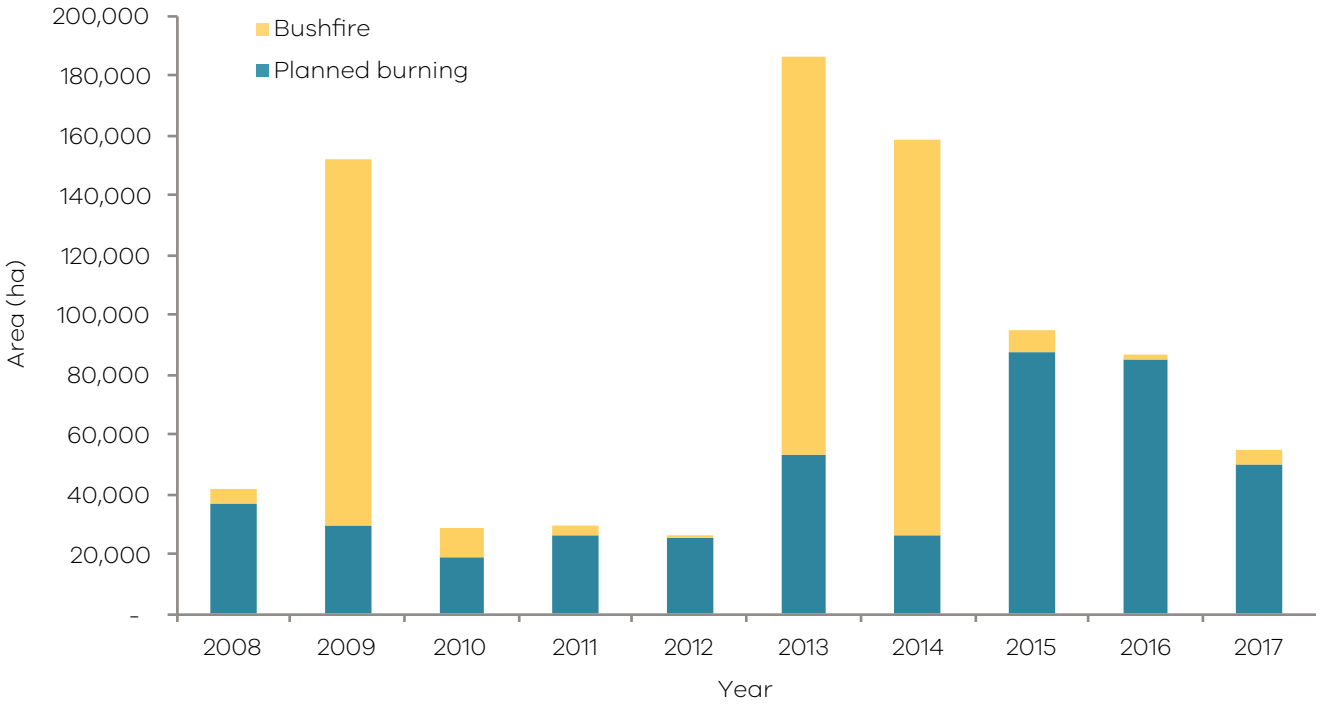


Figure 5: Area of public land burnt while below minimum TFI, Victoria, 2008–17

Figure 6 shows the area of each fire management zone treated by planned burning while below minimum TFI between 2008–17. Figure 7 shows the proportion of each zone treated by planned burning while below minimum TFI over the same period.

Figure 6 shows the greatest areas treated while below minimum TFI are in LMZ and BMZ, with smaller areas treated in APZ. However, Figure 7 shows that the proportion of area treated by planned burning while below minimum TFI is greatest in APZ. This is because APZ is relatively small in area and because we burn more frequently in APZ to protect life and property. The proportion of landscape burnt while below minimum TFI in LMZ and BMZ is low compared with APZ. Overall, the proportion of fire management zones treated by planned burning while below minimum TFI was very low in 2016-17 (<5%). This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI.

The code of practice requires us to manage bushfire risk to protect people and property as well as to maintain or improve environmental values. It is important that we find the right balance between reducing fuel in the various fire management zones and minimising planned burning impacts on environmental values: doing so is part of the strategic planning process.

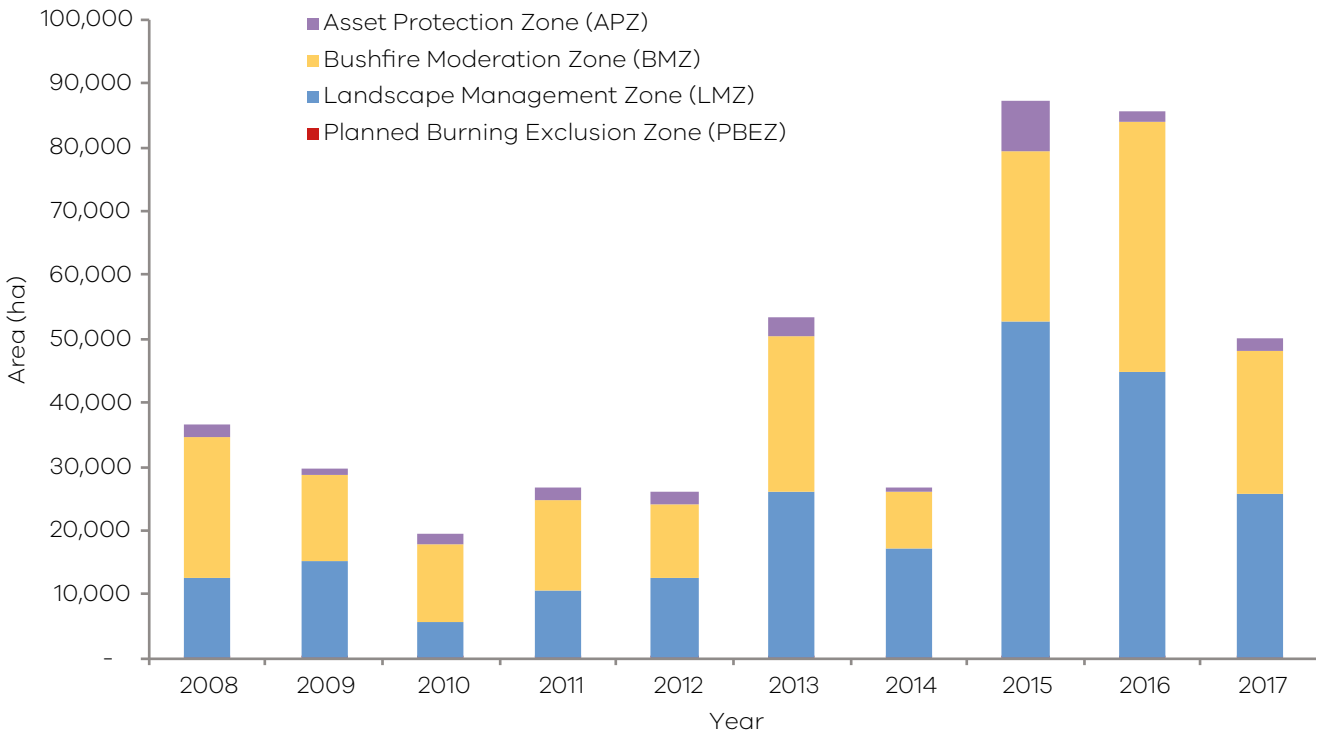


Figure 6: Area treated by planned burning while below minimum TFI, by fire management zone, 2008–17

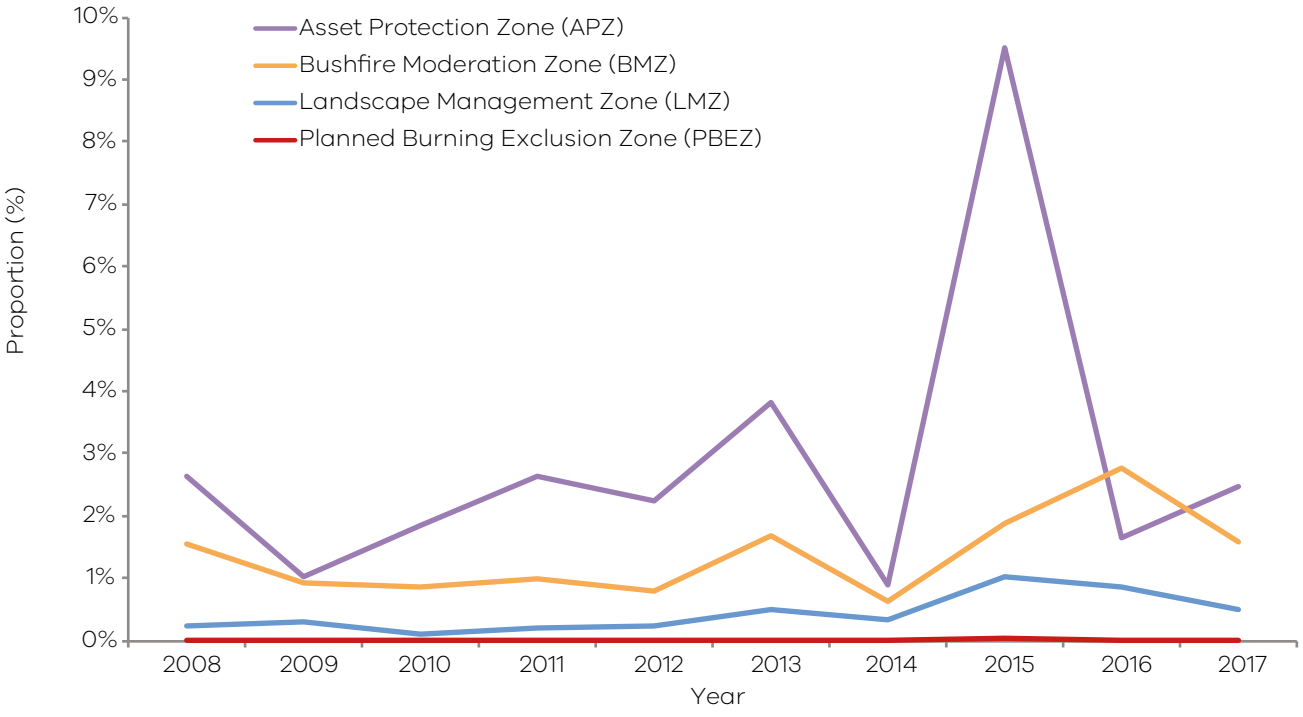


Figure 7: Proportion of each fire management zone treated by planned burning while below minimum TFI, 2008–17

We will continue to improve our understanding of TFI by monitoring the responses of different species of vegetation to fire and by investing in research that improves our ability to predict these responses. We are currently testing minimum TFI thresholds by collecting data about species that are sensitive to short inter-fire intervals (such as *Banksia spinulosa var. cunninghamii*).

We are also improving the mapping of TFI through the use of species distribution models for key flora species that define minimum TFI. This enables TFI to be mapped according to the areas where those species occur, rather than simply where those species may be found.

Vegetation growth stage structure status

Figure 8 shows changes in statewide vegetation growth stage structure (GSS) in the period 2007–17. It shows that as vegetation on public land across Victoria has aged, some vegetation has moved from the juvenile growth stage (down by 2% since 2016) to the adolescent growth stage (up by 1% since 2016).

A relatively high proportion (about 25%) of public land has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

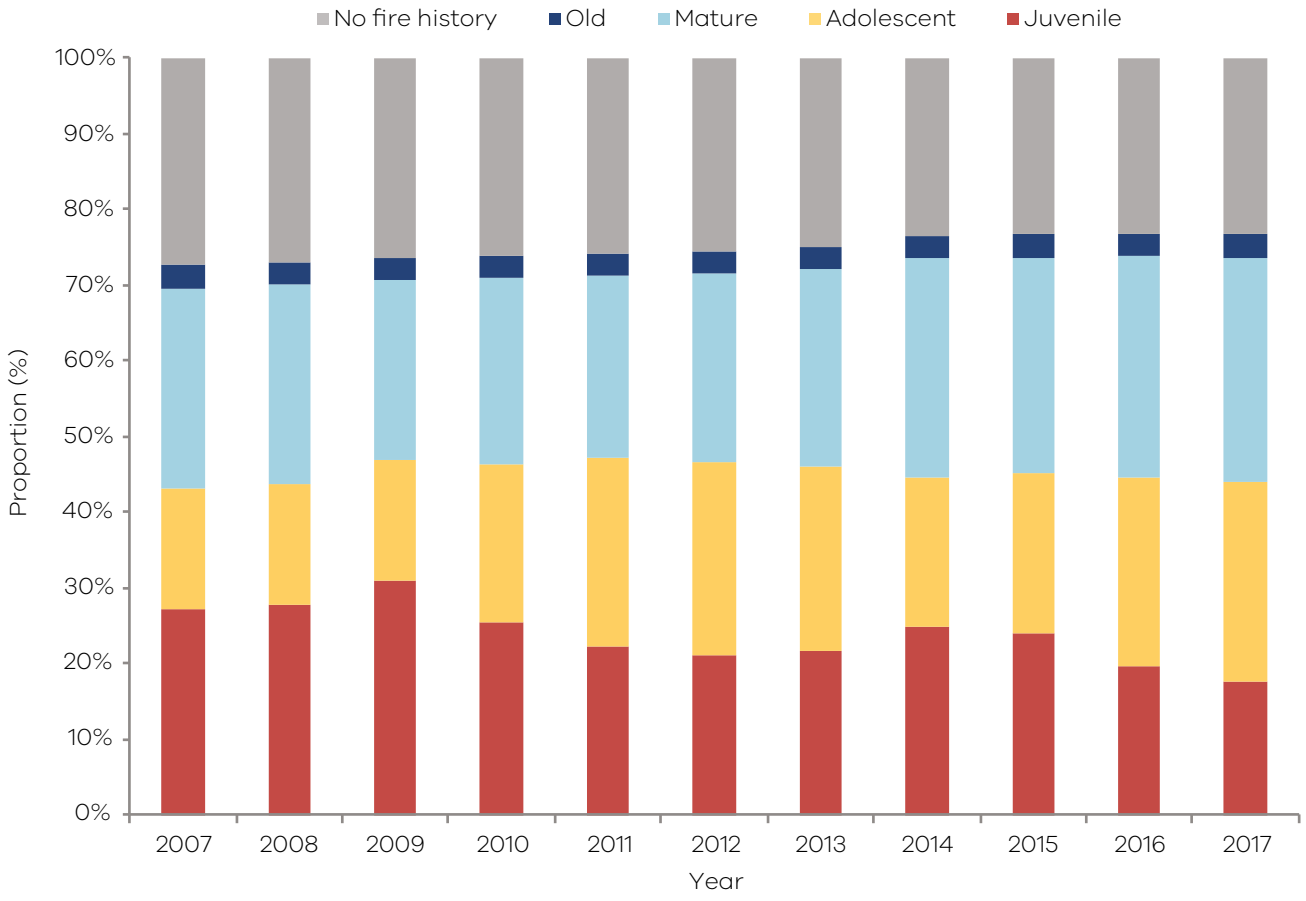


Figure 8: GSS status of vegetation on public land, Victoria, 2007–17

Weather

In 2016–17, weather conditions and climatic trends were not favourable for planned burning. While late winter provided opportunities in the dry, open forests of western Victoria, spring was one of the wettest on record; fuel moistures were high and drying periods were too short to provide burning opportunities. Late February usually sees the start of the autumn planned burning program but extended hot and dry conditions saw bushfire-like conditions in most areas. Conditions became favourable in late March to early April but opportunities were limited by widespread rain. Despite the limited planned burning season, we better prioritised burns to reduce risk as much as possible.

Working with communities

Both Safer Together and DELWP's *Community Charter* set communities at the centre of what we do. Our engagement approach is to understand what the public considers important about our work and the outcomes they expect from interacting with us. Our staff spend thousands of hours working with communities, learning from their local knowledge and wisdom, and finding solutions to work towards our objectives.

This year, we implemented a new process for evaluating the effectiveness of community engagement activities before, during and after planned burns. The process gathers feedback about how we engaged with communities affected by planned burning, identifies what worked well and how we might improve things in future.

Throughout the autumn planned burning period, we worked closely with agency partners including the Environment Protection Authority, Country Fire Authority (CFA) and the Department of Health and Human Services to assess the effects of planned burning on communities and stakeholders. We aimed to give them early notice of planned burns to help them mitigate the impacts.

We also worked with Traditional Owners and other partner agencies, peak industry groups, peak health groups and other stakeholder groups to ensure communications about the planned burning program were consistent and appropriate and to develop statewide tools, strategies and approaches that would improve outcomes for those affected by the program.

During the year, we also continued to implement a place-based approach to community engagement. Place-based approaches are those that are tailored to meet the unique circumstances and requirements of a local community and aim to involve and strengthen communities. They acknowledge the benefits of people working together as well as the benefits of them achieving outcomes. Our approach saw emergency management agencies working together to strengthen relationships and community connections to promote a shared understanding of bushfire risk and to develop local solutions to mitigating risks.

2016–17 was the first year of our community-based bushfire management planning approach, and an independent preliminary review of the approach was completed in May 2017. The review concluded that the approach was beneficial, and identified several steps to consolidate the work done to date and make it an even more innovative and effective way for agencies to work together to build trusting and effective working relationships.

Traditional Owners partnerships

In our commitment to *Munganin – Gadhaba* 'Achieve Together', we partner with Traditional Owner groups to deliver our Bushfire Fuel Management Program. This partnership increased our synergies between our focus on fuel management objectives and the role of Aboriginal burning practices.

During 2016–17, our combined efforts included local Aboriginal group input into planned burning and the delivery of cultural burns (such as the Walpa Dyurrita cultural burn at the base of Mt Arapiles and the Dja Dja Wurrung cultural burns near Maryborough and Bendigo).

We are working with Victorian Aboriginal leaders to develop a statewide traditional burning strategy. The Aboriginal Fire Strategy will seek to restore thousands of years of land management practice with a focus on embedding traditional burning practices into fire regimes in Victoria. These traditional burns do not take away from other risk reduction practices, but add Aboriginal knowledge and skills to the delivery approach. These traditional burns represent achievement towards the *Munganin – Gadhaba* 'Achieve Together' goal to increase the participation of traditional owner groups in the management of Country.

Celebrating the return of traditional burning

Earlier this year, in an historic moment for Victoria, Aboriginal traditional burning practices were integrated into the state's planned burning program.

Forest Fire Management Victoria (FFMVic) Loddon Mallee is on the Country of the Dja Dja Wurrung people. With them, we have begun a unique collaboration to incorporate their connection to Country into our planned burning and fire management programs.

While there have been ceremonial lighting of fires by Aboriginal Elders and exploration of traditional burning practices for some years, planned burns near Maryborough and Bendigo in May marked the first time traditional burning practices have been applied as part of our ongoing planned burning program. As the practices were integrated into our Safer Together program, they are now included as an integral part of the broader planned burning program.

Traditional burning uses no lighters or accelerants. Flames from a single fire are carried into the bush in bowls and with fire sticks to transfer the fire to fuel on the forest floor. This results in a cool, gentle, creeping fire that is allowed to take a natural path through the bush. Under suitable conditions, the fire will burn gently, finding its own course, connecting with other fires to create a mosaic effect.

The introduction of traditional burning was possible thanks to the close relationship between FFMVic and the Dja Dja Wurrung Clans Aboriginal Corporation and members of the Dja Dja Wurrung community.

We are fortunate to have Michael Bourke, a proud Dja Dja Wurrung man, work at FFMVic as a District Planner. Mick's work and passion for Country has helped the rest of our team develop a deeper understanding of the important role of traditional burning in Aboriginal culture and land management. Dja Dja Wurrung Clans Aboriginal Corporation and PV Dja Dja Wurrung rangers have also been an integral part of this process.

Led by our Aboriginal colleagues and with the ongoing advice of Dja Dja Wurrung Elders, we'll continue their work to safely embed Aboriginal traditional burning into the planned burning program.

Smoke management

In 2016–17, after years of investment, Victoria tested a new prototype smoke forecasting system to better manage the impacts of smoke on communities, public events and industry. Using planned burns scheduled for the following day, the system predicts the hourly spread and concentration of key pollutants (including smoke) across Victoria.

We received very positive feedback about the system: the scientific community recognises it as a world-class system and users commend its ease-of-use. The system is now guiding the deployment of on-ground smoke monitoring equipment, informing decisions to ignite planned burns and improving the promptness of health messages and precautionary advice to communities.

The system was developed in collaboration with CSIRO, Bureau of Meteorology and Melbourne, Monash, Wollongong and Macquarie universities. We work closely with Environment Protection Authority Victoria and other partner agencies to better manage the impacts of smoke on Victorian communities. We continue to invest in the technology and research that underpins it.

Strategic bushfire management planning

In 2016–17, the Bushfire Risk Landscape (BRL) teams continued to work closely with regional and district operations staff to develop fire operations plans (FOPs) and prioritise fuel management activities to reduce bushfire risk in their landscape. This included:

- updated statements about how the long-term strategic priorities in their strategic bushfire management plans were delivered through the FOP
- the projected residual risk reduction and ecological outcomes of their FOP for the next three years
- maps of priority fuel management areas for the FOP
- details of priority planned burns in the upcoming calendar year
- advice about planned burning activity required in each fire management zone to be consistent with the strategic bushfire management plan
- maps and guidance to help prioritise burn units, based on the latest information about fire history and on updated bushfire risk modelling.

Updating the Barwon Otway fire management strategy

The Future Fire Management Project is a pilot project for a risk-based approach to bushfire management that started in 2008 in the Otway District in the Barwon Otway BRL. In 2011, the project developed a fuel management strategy, which was documented in the BRL's 2014 strategic bushfire management plan.

In 2013, the BRL started its Strategic Bushfire Risk Assessment and Strategy Selection (SBRASS) Project. The project aimed to improve the 2011 strategy by incorporating new knowledge and technology, better decision-making processes and a greater understanding of stakeholder aspirations and values.

Over its four-year life to date, the SBRASS Project has developed a structured, robust, transparent and replicable decision-support process including trade-off evaluation to arrive at a recommended fuel management strategy. The process uses:

- over 50 alternative fuel management strategies based on different spatial, temporal and tenure arrangements
- innovative methods of measuring the predicted effects of the alternative strategies to reduce risk, and the predicted effects on environmental and social values
- the expertise of FFMVic and other agency staff, university academics, members of the public and consultants.

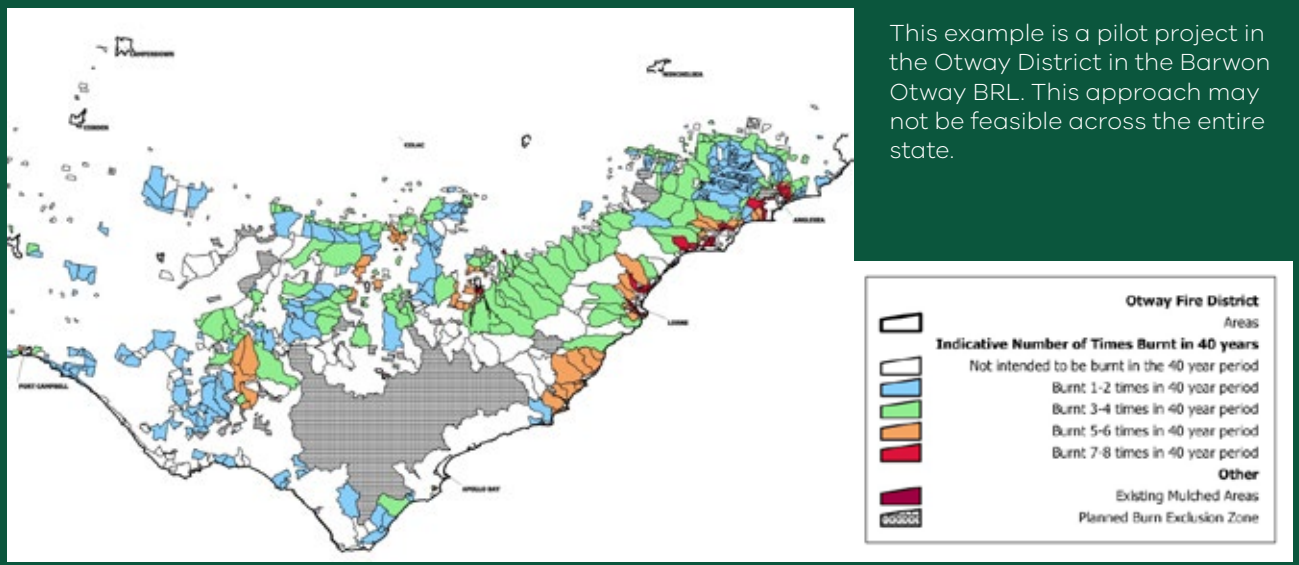
This work has resulted in the 2017 SBRASS fuel management strategy for the Barwon Otway (Otway District) area, a landscape-scale, long-term (more than 40 years), cross-tenure fuel management strategy for the Otway Ranges that balances the competing interests and values we must manage of communities and government. The process to develop and select the strategy represents a step change in fuel management planning in Victoria.

The strategy indicates where and when planned burning is needed to achieve our residual risk target. It informs the operational and tactical planning we do for planned burns as part of developing FOPs each year.

Some key features of the SBRASS fuel management strategy are that it:

- aims to manage risk to high-risk townships by regularly burning arcs within 2 km of them, including on 10% area of private land (as an annual average)
- optimises environmental and ecological outcomes for multiple plant and animal species at the landscape scale
- addresses operational feasibility as well as strategic planning by using local knowledge extensively
- demonstrates similar or better achievement of every objective the project analysed
- seeks to reduce the size and impact of major bushfires that might start, spread and damage the things the Otway community values most.

Figure 9 shows the ideal frequency and location of planned burning in the Otway District. Burn units have black outlines. Different frequencies of treatment for each unit are in different colours: warmer colours indicate more frequent treatment. Uncoloured burn units are not proposed for burning during the 40-year strategy. The grey-shaded crosshatching indicates a planned burning exclusion zone (PBEZ) where we try to avoid planned burning, mainly because ecological assets in this zone cannot tolerate fire.



This example is a pilot project in the Otway District in the Barwon Otway BRL. This approach may not be feasible across the entire state.

Figure 9: SBRASS fuel management strategy

Our continuing work with Country Fire Authority

We have a long history of working collaboratively with CFA to plan and undertake burns on public land and on private and other land (such as roadsides). In 2016–17, we delivered 21 cross-tenure burns covering 16,941 ha.

Under Safer Together, we will continue to integrate the planning and delivery of bushfire management on public and private land. Our FOPs increasingly include more cross-tenure planned burns, and planned burning teams are continuing to include personnel from CFA and other partner agencies. We are also continuing to improve our systems and processes to support the integrated planning and delivery of planned burns across multiple land tenures.

Victorian Bushfire Monitoring Program

The Victorian Bushfire Monitoring Program (VBMP) guides FFMVic to monitor, evaluate and report on the effectiveness of bushfire management on public land. This year, VBMP activities continued to focus on implementing the *Monitoring, Evaluation and Reporting (MER) Framework for Bushfire Management on Public Land*. The program is mainly delivered through each BRL's MER plan. To support the delivery of each MER plan, we developed a monitoring implementation plan to guide monitoring activities in each fire district.

In 2016–17, the program priority was to monitor overall fuel hazard (OFH) to measure the effectiveness of our activities in reducing risk to life and property. To support this priority, we trained staff to use an improved and updated smart device app to better collect and manage OFH assessment data.

We also developed a five-year strategy to provide guidance for bushfire MER and to allow us to continuously improve bushfire management over time. More-transparent reporting about whether we met risk reduction and ecological resilience objectives will help build community trust in the bushfire fuel management program. The strategy includes an action plan and we will review and update it annually.

We conducted a pilot project to improve the accuracy of Phoenix models. The project aims to assess several types of fuel where the OFH for the fuel that Phoenix models disagrees with the OFH measured in the field. We collected OFH measurements on the ground at plots chosen to fill gaps in our data about fuel types and time-since-fire intervals. The data will give us a better picture of how modelling aligns with actual on-the-ground measurements. We will be able to combine the data the project collects with our existing OFH data to test the accuracy of Phoenix modelling and to increase the number of data points for plotting fuel accumulation curves. The project is the first step to a better understanding of where, how and why modelled OFH does or does not align with what is measured on the ground. The project will continue into 2017–18, when we will complete data collection, analysis and evaluation and report the results.

2016–17 saw the continuation of our three-year research project with La Trobe University to develop a scientifically rigorous approach to measuring the ecosystem resilience data needed to answer some key evaluation questions in the MER framework. This year we sought to identify design, data and analytical approaches we require, to answer the key evaluation questions. La Trobe University proposed a two-tiered program of biodiversity monitoring comprising a statewide tier assessing fire regimes and a region-based tier assessing fire events. The regional tier would be more flexible, to focus on ecosystems, vegetation types and species that are locally important or that won't be covered by the proposed scope of the statewide tier. The university has begun to identify sites for the statewide monitoring program, and has worked with staff from the East Central and Barwon Otways BRLs on pilot studies for the region-based monitoring. These pilots will inform the development of templates for the region-based monitoring.

Bushfire response

During the 2016–17 fire season, we responded to 1,015 fires that burnt 13,530 hectares.

Although there were wet seasonal conditions leading up to the 2016–17 fire season, there were severe, long-term, soil-moisture deficiencies in many parts of Victoria. Also, grass growth was generally prolific and there was a grassfire risk across much of the state. The delayed curing meant that high-risk activities (such as crop harvesting) were likely to occur during very hot weather.

In the 2016–17 season, we had 2,767 staff who could undertake fire and emergency management duties. This included 600 firefighters and 280 regionally based forest and fire operations officers.

We contracted 51 aircraft for the 2016–17 fire season, and we brought two large air tankers to Victoria for a minimum 12-week period to provide high-volume firebombing capability. These large air tankers were also deployed interstate to support major firefighting efforts in NSW.

Several lightning strikes in Gippsland before Christmas had significant potential but aggressive first attacks using rappel crews from the Gippsland and Hume regions, and ongoing deployments over the Christmas period, saw these fires quickly suppressed.

Lightning started the only fire of significance on public land for the season on 12 March in remote bushland in the Macalister fire district in Gippsland. The Crooked River – Wonnangatta Rd fire affected 3,066 ha and took 12 days to suppress.

In 2016–17, we controlled 93% of bushfires to under 5 ha and contained 87% of fires by 8 AM the following day. Both these achievements exceeded our key performance indicators.

Although Victoria had a relatively quiet fire season, senior incident management staff and specialist firefighters were deployed to help Victoria State Emergency Service for some flood, storm and severe weather events. The largest event lasted 112 days. Senior incident management staff were also deployed to help with Cyclone Debbie recovery operations in Queensland.

Cost

Table 2 shows DELWP's costs for managing fire and other emergencies in 2016–17. The cost of the entire fuel management effort was $251.4 million. Of this, direct fuel management costs were $40.0 million and indirect fuel management costs were $67.9 million. Other (non-fuel-management) activities including fire and emergency response, recovery, prevention and preparedness activities cost $143.4 million.

Table 2: Fuel management costs, by region and group, 2016–17

Region	Direct fuel management ($)	Indirect fuel management ($)	Non-fuel management ($)	Total
Barwon South West	4,442,196	4,532,802	8,769,490	17,744,488
Gippsland	9,416,524	8,858,041	30,148,332	48,422,897
Grampians	4,038,603	4,980,947	8,721,285	17,740,835
Hume	8,479,418	9,230,409	13,462,546	31,172,373
Loddon Mallee	4,107,116	4,481,362	11,705,138	20,293,616
Port Phillip	3,174,573	3,465,473	5,408,134	12,048,180
Chief Operating Officer Directorate	1,399,373	119,391	3,534,050	5,052,814
Forest, Fire and Regions Directorate	4,986,551	12,751	6,250,860	11,250,162
Subtotal Regional Services	**40,044,354**	**35,681,176**	**87,999,835**	**163,725,365**
Office of Chief Fire Officer (OCFO)		4,339,052	2,745,734	7,084,786
Strategy, Capability and Innovation (SCI)		27,696,486	34,684,528	62,381,014
Other corporate functions		178,484	18,002,963	18,181,447
Subtotal SCI, OCFO, other corporate		**32,214,022**	**55,433,225**	**87,647,247**
Total	**40,044,354**	**67,895,198**	**143,433,060**	**251,372,612**

Table 3 shows the indirect fuel management costs as per the guidelines developed for the budgeting and accounting of fuel management activities. The table is a dissection of the $67.9 million total in Table 3 for indirect fuel management costs. The table shows that the largest cost items were equipment and infrastructure and resource management.

As well as paying for planning, preparing and conducting planned burning, the amounts in the table also paid to:

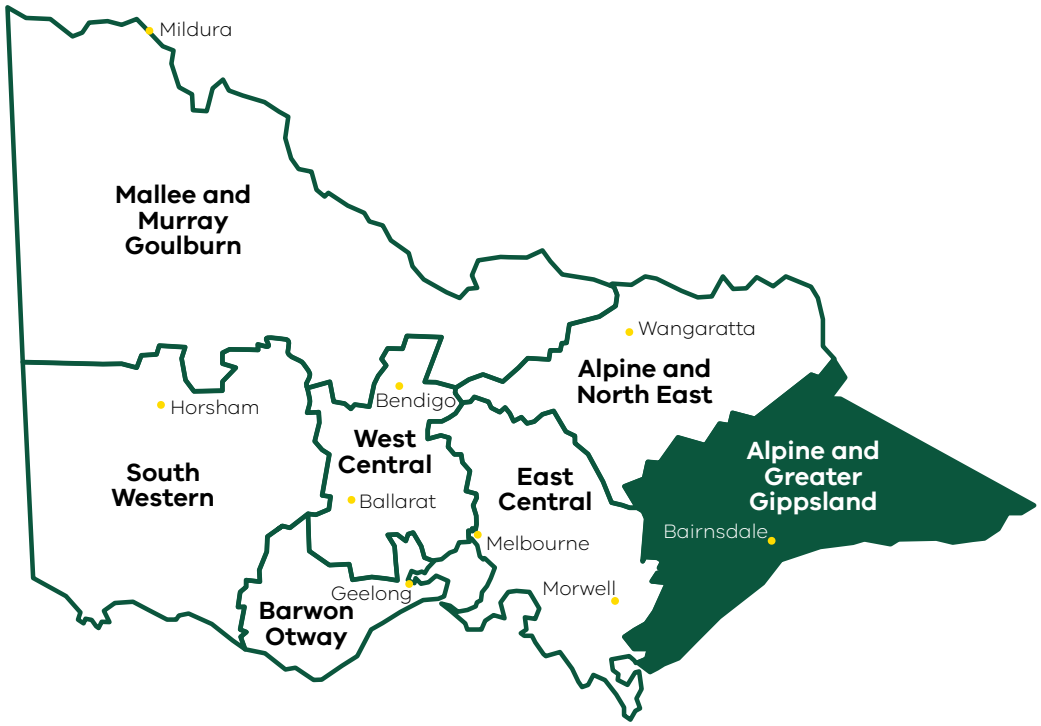
- implement the recommendations of the independent investigation of the Lancefield – Cobaw fire including community awareness training, investigating greater use of emerging technologies and developing an audit and quality assurance framework
- implement the Safer Together policy and the transition towards a risk-based approach
- increase staff capability and mobility with stand-by and overtime pay and training and medicals, and to move taskforces around the state
- provide more equipment and vehicles to support field activities
- improve the engagement of stakeholders through roundtables and other forums.

Table 3: Indirect fuel management costs, by cost item, 2016–17

Item	% of indirect costs	$
Business management	10.77%	7,313,980
Capability	3.74%	2,540,744
Engagement	4.48%	3,041,819
Equipment and infrastructure	43.35%	29,435,176
Monitoring, evaluation and reporting	5.14%	3,487,239
Operational planning	1.38%	934,230
Research and learning	0.26%	178,473
Resource management	21.23%	14,414,765
Strategic planning	9.65%	6,548,772
Total	**100%**	**67,895,198**

Bushfire risk landscape reporting

Alpine and Greater Gippsland



The Alpine and Greater Gippsland Bushfire Risk Landscape (BRL) extends from Port Albert in the west along the coast to Lakes Entrance and east to Mallacoota. It extends northward to the Great Dividing Range, includes Heyfield and Licola in the west and borders NSW in the north-east. It also includes the Dargo High Plains and the High Country around Omeo.

The landscape is about 3.3 million ha, or 14% of the state's total area: 70% of it is public land and 30% private land. It includes a very high proportion (32%) of Victoria's fire-management-zoned public land.

The landscape has many small towns and settlements in rural and coastal settings. Many of these are close to forested areas of public land, meaning planned burning is very important to reducing risk to human life and property.

The public land in the landscape is largely uninterrupted forest and parks, and much of it is remote or difficult to access. The landscape has a substantial proportion of Victoria's biodiversity including hundreds of threatened species. Also, several vegetation communities in the landscape are fire-sensitive and listed under conservation legislation. These communities are often in small, isolated patches and include littoral rainforest, coastal vine thickets, warm temperate rainforest, Alpine sphagnum bogs and Alpine snowpatch.

Residual risk

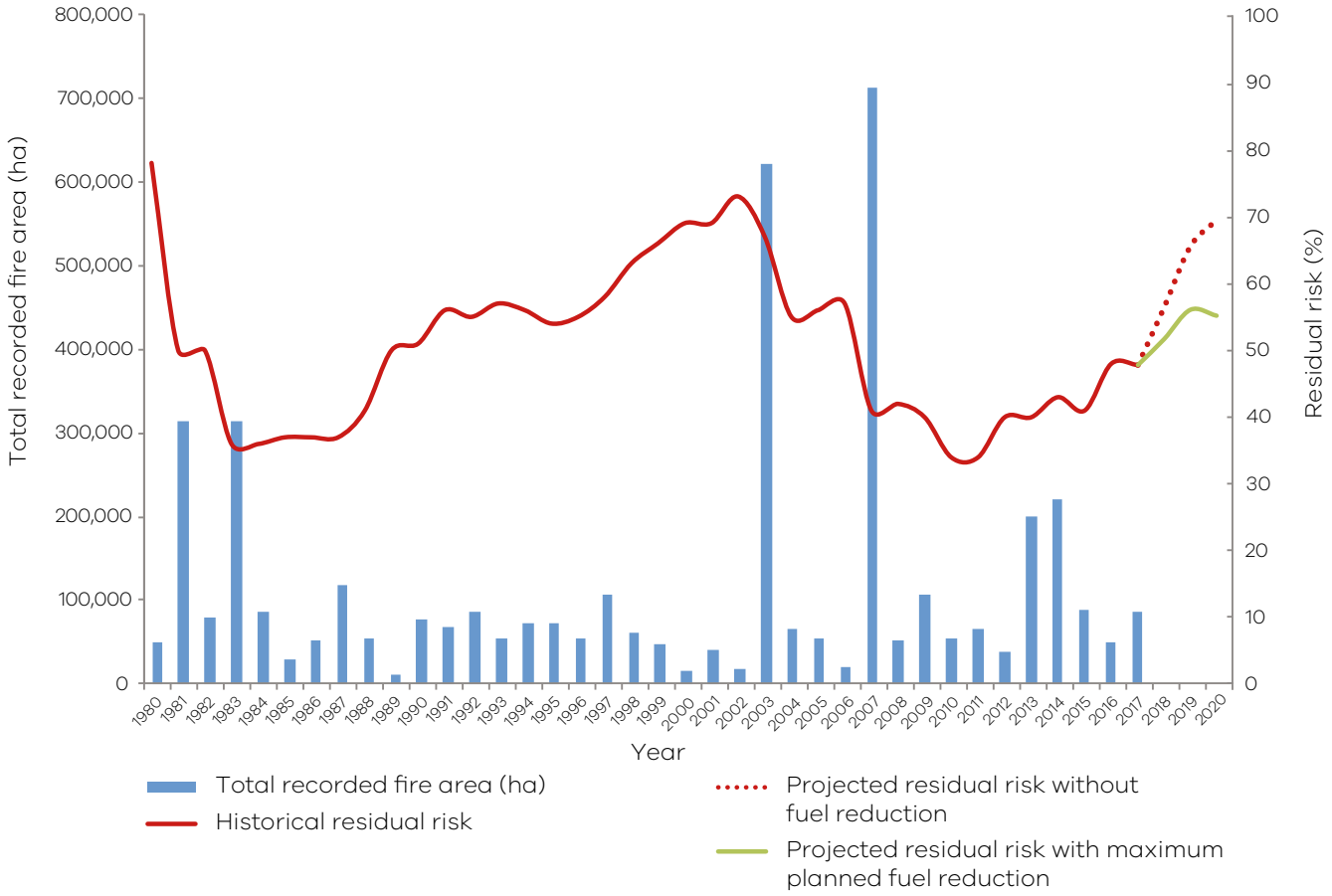


Figure 10: Residual risk profile, Alpine and Greater Gippsland BRL, 1980–2020

Figure 10 shows the modelled residual risk profile for the Alpine and Greater Gippsland BRL for the period 1980–2017, and projected changes in residual risk until 2020. It shows that:

- residual risk in the landscape in 2016–17 was 48%
- residual risk fell sharply after major bushfires in the early 1980s and then increased as fuel slowly re-accumulated
- residual risk fell again in the period 2003–10 to historically low levels after major bushfires in alpine areas
- planned burning and large bushfires in 2013 and 2014 kept residual risk down but it has since increased as fuel has re-accumulated in bushfire-affected areas
- we project that implementing our fuel management strategy on public land will keep residual risk below the levels seen before the 2003 and 2006–07 bushfires
- if conditions allow us to do all the planned burning scheduled in the FOP for the next three years, we project residual risk will increase to about 55% by 2020: without planned burning, we project residual risk will be approaching 70% by 2020.

Many towns and settlements in the landscape are close to extensive areas of forested public land, so are exposed to the risk of major bushfires. We can manage fuel on most of this public land by planned burning, which will reduce bushfire risk across the landscape.

Ecosystem resilience

Figure 11 shows the tolerable fire interval (TFI) status and Figure 12 the growth stage structure (GSS) status of the vegetation on public land in the Alpine and Greater Gippsland BRL for the period 2007–17.

Figure 11 shows that in 2016–17 about 72% of the vegetation was below minimum TFI. It also shows that over the past four years, the proportion of vegetation below minimum TFI has been about the same. During 2016–17, only 1.8% of the vegetation in the landscape was burnt while below minimum TFI. This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI.

Figure 11: TFI status of public land vegetation, Alpine and Greater Gippsland BRL, 2007–17

Figure 12 shows about 67% of the landscape was in the juvenile and adolescent growth stages in 2016–17. The landscape will have a large proportion of young vegetation for some time because it can take decades for many types of vegetation to move through the growth stages after significant disturbance.

The relatively low proportion of vegetation in the mature and old growth stages is a legacy of the 2006–07 bushfires. In recent years, the proportion of vegetation in the landscape in these growth stages has stabilised at about 23%. Maintaining older vegetation growth stages in the landscape is important for many reasons, such as to provide habitat for animal species that rely on hollow-bearing trees or on coarse, woody debris.

A small proportion of this landscape has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

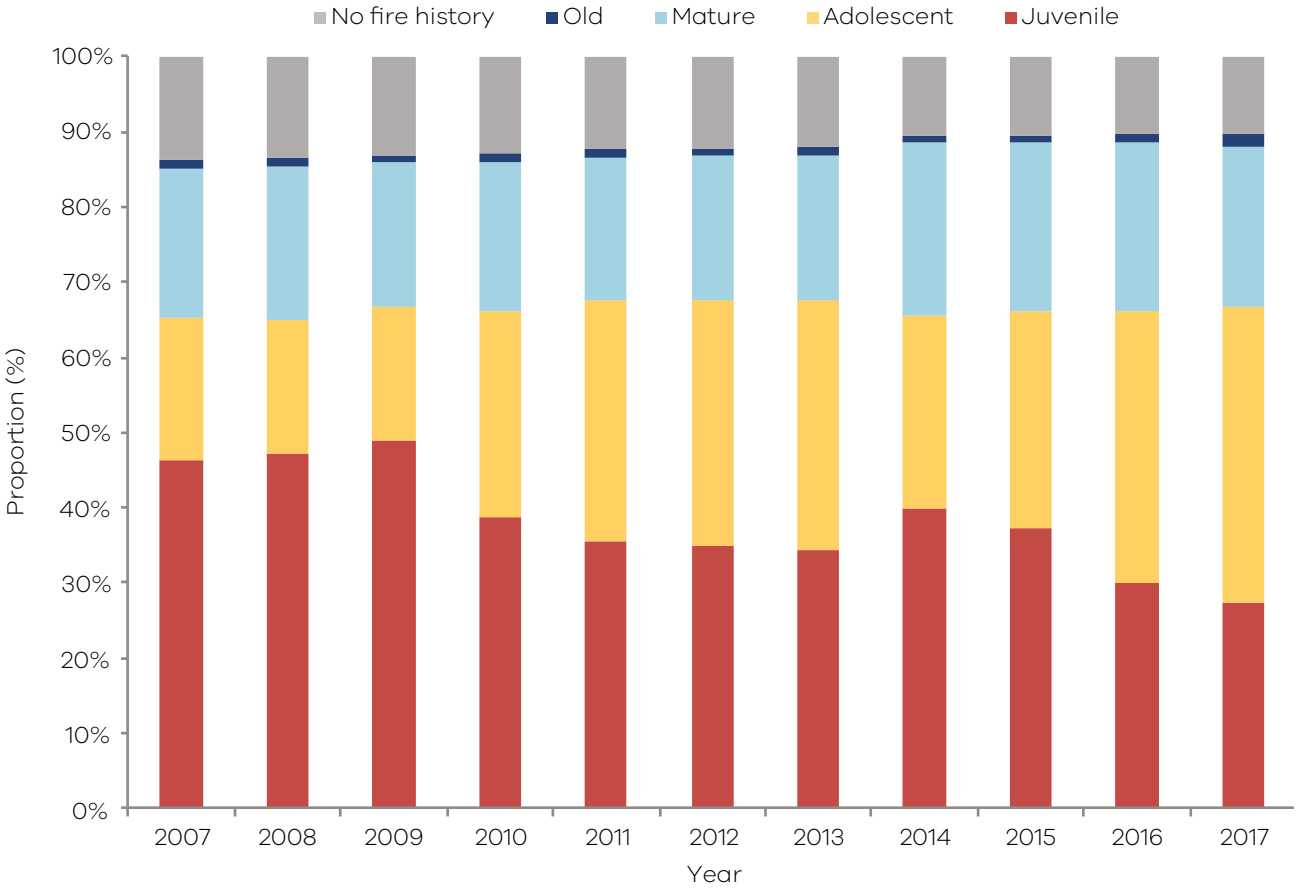


Figure 12: GSS status of public land vegetation, Alpine and Greater Gippsland BRL, 2007–17

Community engagement

In 2016–17, ran targeted, local, engagement events centred on community interests and capacity, and we also collaborated with and contributed our expertise to processes led by other agencies.

In the Macalister, Snowy and Tambo fire districts, we held engagement activities at about 30 community locations before the planned burning season. Where community interest was particularly high — at Bruthen–Wiseleigh, Macleods Morass and Loch Sport – Lake Reeve — we held pre- and post-burn events so people could walk through sites and question our staff. We also worked closely with the Wattle Point community and the East Gippsland Shire to address concerns about burns scheduled in the FOP. This led us to review our fuel treatment options and consider alternative fuel-reduction methods (such as mulching) close to areas of particular concern to the community.

During the year, we worked with partner agencies (including through regional strategic and municipal fire management planning committees and the Working Better with Communities Forum) to conduct and support joint engagement activities and events. This included a community-based bushfire management planning process in Mallacoota where

we worked with the East Gippsland Shire to update the local incident management plan. The Buchan community held a bushfire scenario event that led to it reviewing and updating its community plan: we contributed our technical modelling and planning expertise.

We also worked in partnership with the Gunaikurnai Land and Waters Aboriginal Corporation, supporting the continued training of Aboriginal fire crews and their involvement in planned burns and fire deployments. We continued to involve other stakeholders (such as vignerons, apiarists and recreational four-wheel drive clubs) in fire operations planning, and we informed them about upcoming burns. We attended agricultural shows, community health days, primary school fairs and CFA brigade events, all of which provided opportunities to start conversations with members of the public who might not otherwise engage with fire management agencies.

Monitoring, evaluation and reporting

The Alpine and Greater Gippsland Monitoring, Evaluation and Reporting (MER) plan describes how we will monitor the implementation and effectiveness of our fuel management on public land in reducing risk to life and property, maintaining or improving ecosystem resilience and improving our processes for these things.

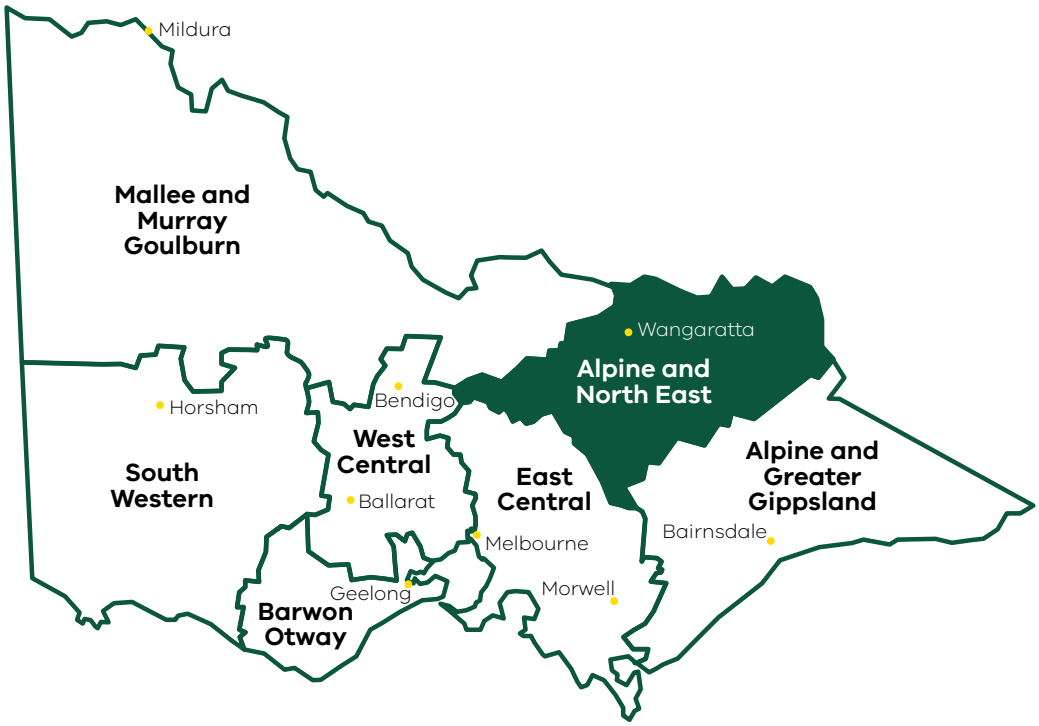
Our priority in this first year of implementing the MER plan was to monitor the reduction of risk to life and property through overall fuel hazard (OFH) assessments and fire severity mapping. Staff from all three districts — Snowy, Tambo and Macalister — were involved in monitoring activities including more OFH assessments. We recorded our data collection effort, reviewed our reporting formats for pre- and post-fuel-hazard data and held a field day to evaluate the planned burning season. We conducted more pre-burn than post-burn OFH assessments: we could not ignite some burns because of unfavourable seasonal conditions.

We also continued developing the ecosystem resilience monitoring program, and we initiated new projects to investigate the fire management needs of various animal and plant species.

During the year, we:

- improved our data collection and curation practices by starting to use the Fuel Hazard Collector app which uploads data and photos taken in the field into ArcGIS online, and training staff from the Snowy, Tambo and Macalister fire districts to conduct OFH assessments using the app and the *Overall Fuel Hazard Guide*
- conducted 329 detailed pre-burn and 230 post-burn OFH assessments
- captured imagery for more than 37,000 ha of planned burns using aerial photography
- mapped fire severity (at high spatial resolution) at priority areas during planned burns in autumn, using aerial photography and on-ground assessments
- continued monitoring the demography of *Banksia spinulosa* in relation to fire and conducted analyses and made recommendations about managing planned burning to maintain populations of this species
- started a pilot project to investigate the distribution, demography and vital attributes of *Banksia canei* in relation to fire
- conducted a trial deployment of remote cameras to monitor the occupancy of suitable habitat by New Holland mouse before and after a planned burn and developed other projects for this threatened species.

Alpine and North East



The Alpine and North East Bushfire Risk Landscape (BRL) extends north of the Great Dividing Range and the Victorian High Country to Corryong in the north-east, Wodonga in the north and the floodplains and grasslands of the Goulburn and Murray rivers in the west.

The landscape is about 2.6 million ha, or 11% of the state's area: 52% of it is public land and 48% private land. Most people in the landscape live in the major centres along the Hume Freeway.

The landscape contains important assets including nationally significant cultural heritage sites, nationally critical water catchments and important infrastructure (such as Dartmouth Dam, the largest water storage in Victoria). It also contains the critically endangered Mountain pygmy possum that lives in the Australian Alps and the endangered Spotted tree frog that lives in mountainous areas. Alpine areas are also home to endangered and threatened vegetation communities (such as Alpine sphagnum bogs and associated fens), animal species that are sensitive to fire and fire-sensitive wet forest (such as Alpine ash).

Residual risk

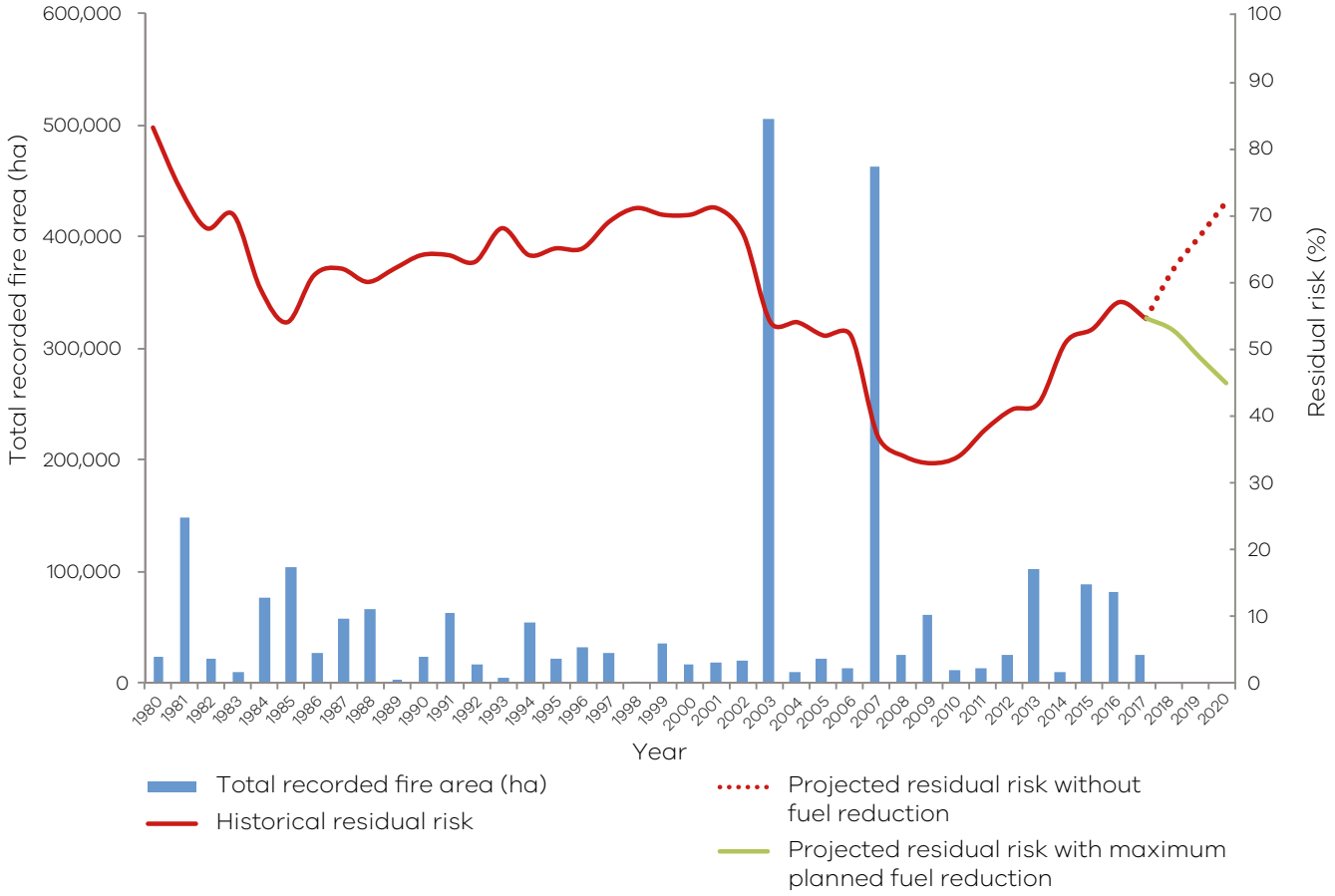


Figure 13: Residual risk profile, Alpine and North East BRL, 1980–2020

Figure 13 shows the modelled residual risk profile for the Alpine and North East BRL for the period 1980–2017, and projected changes in residual risk until 2020. It shows that:

- residual risk in the landscape in 2016–17 was 55%
- residual risk fell sharply after major bushfires in the early 1980s including the 1985 Mt Buffalo fire and then increased as fuel slowly re-accumulated
- over the last few decades, residual risk has fallen sharply in response to several large bushfires including the 2003 Alpine fire, the 2006–07 Great Divide fires and the 2013 Harrietville fire
- after 2006–07, planned burning kept residual risk below 40% for five years, but in recent years residual risk has been increasing again due to fuel re-accumulating in large areas burnt by bushfires
- since 2012, bushfire risk analysis has informed annual fire operations planning to better target fuel-reduction activities and maintain residual risk below 60%, despite the smaller-than-average planned burn program achieved in 2016–17 due to limited weather conditions for burning
- without planned burning, we project residual risk will rapidly increase to 72% by 2020.

Ecosystem resilience

Figure 14 shows the tolerable fire interval (TFI) status and Figure 15 the growth stage structure (GSS) status of the vegetation on public land in the landscape for the period 2007–17.

Figure 14 shows that in 2016–17 about 74% of the vegetation was below minimum TFI. It also shows that over the past ten years the proportion of vegetation below minimum TFI has remained about the same. This is a result of regeneration over the past 15 years after several major bushfires including the 2003 Alpine fire, the 2006–07 Great Divide fires and the 2013 Harrietville fire, regeneration that has affected the TFI and GSS trends.

In 2016–17, less than 1% of the vegetation in this landscape was burnt by bushfire or planned burning while below TFI. This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI.

Figure 14: TFI status of public land vegetation, Alpine and North East BRL, 2007–17

Figure 15 shows about 62% of the landscape was in the juvenile and adolescent growth stages in 2016–17. In recent years, the proportion of vegetation in the mature and old growth stages has increased to about 26% of the landscape. Because the affected vegetation types take a relatively long time to reach maturity, there will be a large proportion of younger vegetation for some time.

A small proportion of this landscape has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

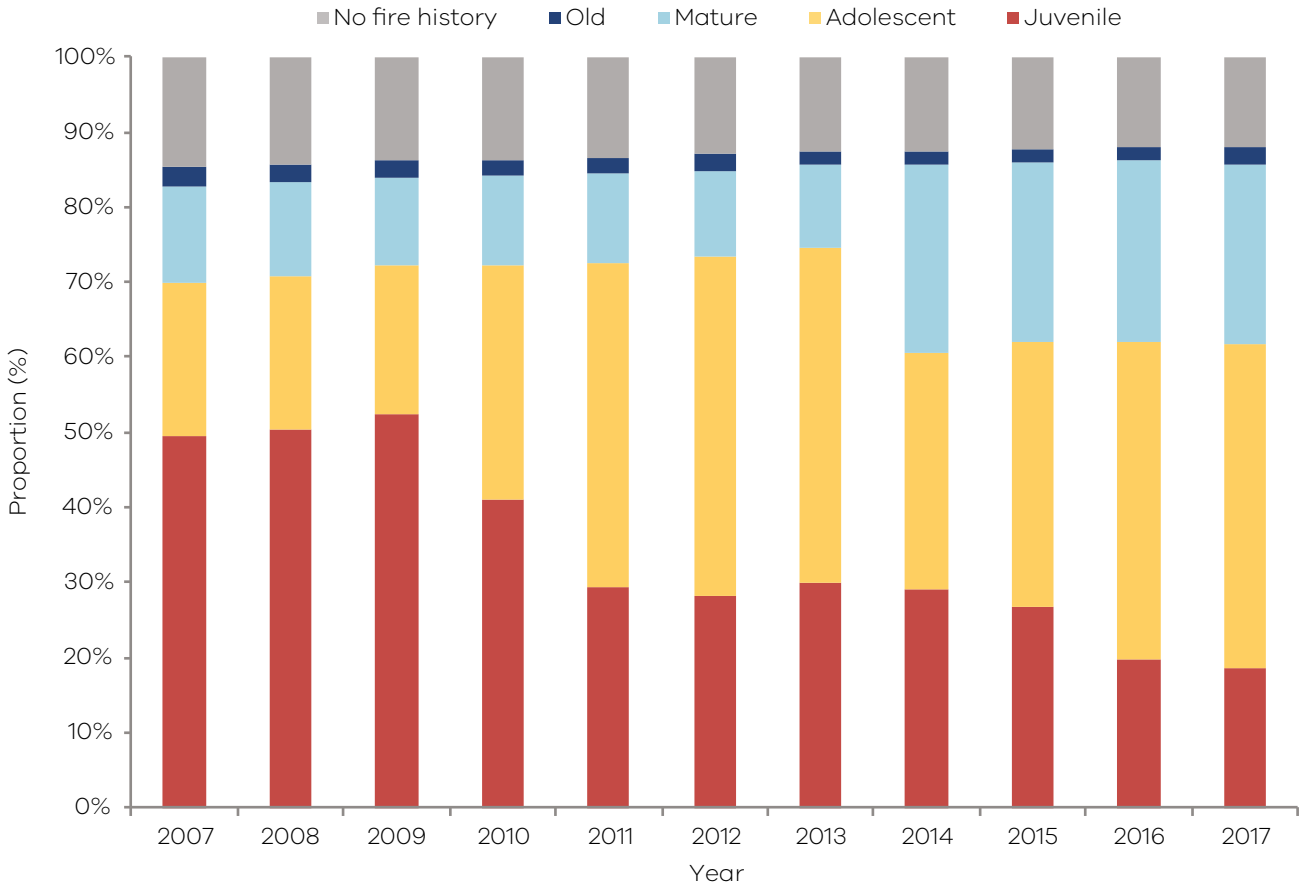


Figure 15: GSS status of public land vegetation, Alpine and North East BRL, 2007–17

Community engagement

Before the 2017 autumn planned burning season, we met with industry stakeholders including the North East Victorian Apiarists Association, Tourism North-East and regional wine industry groups. Our annual regional vigneron forum included a session on smoke taint research. This led to a communication and coordination agreement to allow the Department of Economic Development, Jobs, Transport and Resources to conduct smoke research close to vignerons during planned burning.

Our community engagement activities included:

- community meetings before planned burns
- community hub conversations and distribution of information (such as posters, maps and ignition postcards)
- regular articles in community newsletters
- face-to-face conversations with landholders and interest groups
- consultation with stakeholders about the timing of planned burns and operational considerations
- resource-sharing with other organisations (such as Hancock Victorian Plantations).

During the year, we sought input into fire planning from eight local Aboriginal groups: Bangerang Aboriginal Corporation; Duduroa-Waywurru, Duduroa local traditional custodians; Mungabareeba Aboriginal Corporation; Rumbalara Aboriginal Cooperative; Yaitmaithang; Taungurung Clans Aboriginal Corporation; and Yorta Yorta Nation Aboriginal Corporation.

To improve our practices, we seek feedback from stakeholders and the public after each planned burning season about how we delivered the program. We use this feedback to improve how we conduct planned burning in future and how we engage with the community.

The Safer Together policy continues drive us to reduce bushfire risk and increase community awareness in this landscape by strengthening partnerships between fire agencies and land managers, focusing on our highest-risk communities. The Hume region has a regional subcommittee and working group with representatives of FFMVic, CFA, Emergency Management Victoria and local governments to implement Safer Together across the region's 12 local government areas and four alpine resorts. A bushfire scenario event held with Bright tourism businesses, local governments, tourism industry representatives and CFA was a highlight of the year. It increased knowledge of local bushfire risks and encouraged participants to test and revise their bushfire plans to improve community safety and resilience. Other community events also used DELWP's analysis of bushfire risk and its information to increase bushfire awareness.

During the year, we established a community-based bushfire management planning group in the Strathbogie area to strengthen relationships between the local community, Forest Fire Management Victoria (FFMVic), local governments, CFA and industry and to advise local land managers and fire agencies about planning and operations approaches to minimise bushfire risk. In 2016–17, we held five meetings of the group to define shared goals and to share understandings of local values, fire history and bushfire risk. The group endorsed the burns proposed for the 2016–17 planned burning season and agreed on a process to review fuel management strategies.

In 2016–17, we increasingly used social media to communicate with broader audiences. In the Murrindindi and Ovens fire districts, we conducted field walks with primary school children and parents. We also held information sessions with local Landcare groups about how we use monitoring and evaluation to assess the effectiveness of our fuel management activities and their effects on biodiversity.

Monitoring, evaluation and reporting

In 2016–17, we began implementing our first Monitoring, Evaluation and Reporting (MER) program after the landscape's MER plan was approved in July 2016. Our monitoring program included overall fuel hazard (OFH) assessments, hollow-bearing trees, Greater glider, older growth stage and landscape mosaic burning (LMB).

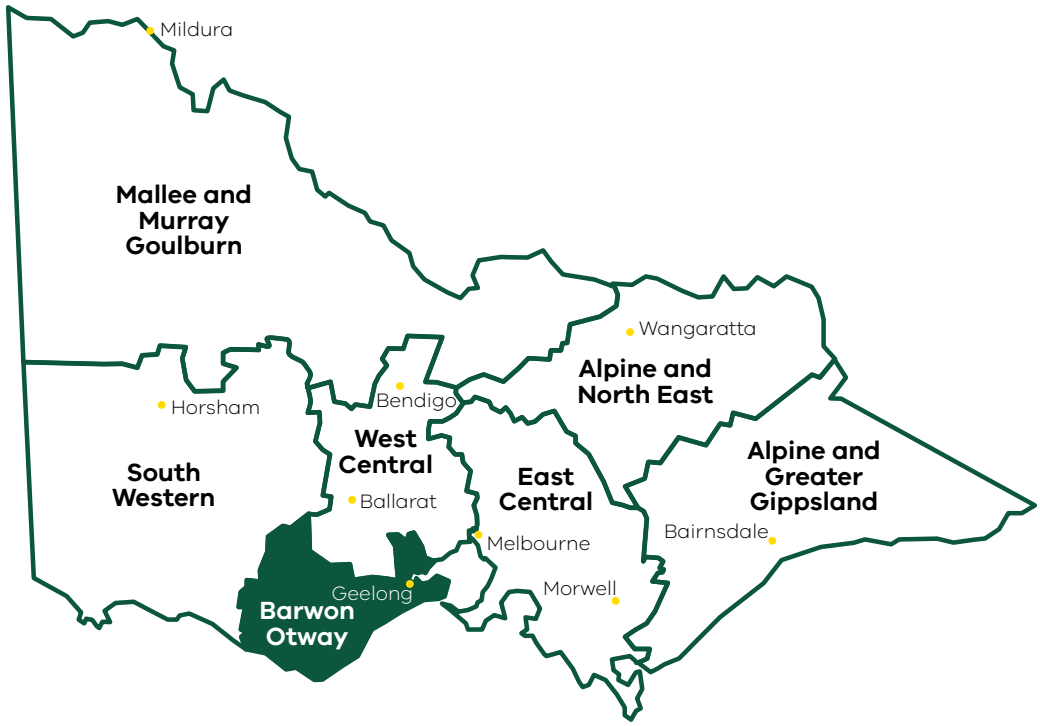
We prioritised OFH assessments, to measure the effectiveness of our fuel management activities. In mid-October 2016, 25 district and regional staff were trained to conduct OFH assessments using the new Fuel Hazard Collector app which uploads data and photos taken in the field into ArcGIS online. Across the landscape, we completed 188 pre-burn OFH assessments across 14 burns. We ignited nine of the burns and completed 111 post-burn OFH assessments. We also completed burn severity mapping to complement field-based fire severity assessments we conducted at four of the burns.

There is community concern about the damage planned burning does to hollow-bearing trees. Tree hollows provide important habitat for many animal species including the Greater glider and the Powerful owl. In 2016–17, we ran a pilot project to determine the collapse rate of these trees after planned burning. We completed pre-burn hollow-bearing tree assessments in March 2016 on two burns in the Strathbogie State Forest. We did not ignite one of these burns because of public concerns; we collected and analysed post-burn data at the Strathbogie South – Dry Creek burn site.

In early 2017, Greater gliders were nationally listed as vulnerable and in July 2017 was listed as threatened in Victoria. Our data records for Greater gliders and other rare species are incomplete, as there have been few surveys since the early 1990s. We secured funding in early 2017 for a project to monitor changes in the relative abundance of Greater gliders before and after planned burning. We are conducting the project in consultation with La Trobe University. Pre-burn surveys were completed in July 2017. Further surveys of the Greater glider and its habitat will be undertaken in 2017-18 after sites are prepared for burning, and after they are burnt, in 2017–18.

As part of ongoing LMB in the Upper Murray fire district, we completed 22 post-burn LMB assessments for Scrubby Thowgla LMB, which we ignited in autumn 2016. In 2017–18, we will again monitor the Mountain Creek LMB, which we ignited in 2012.

Barwon Otway



The Barwon Otway Bushfire Risk Landscape (BRL) is in south-west Victoria. It extends north to Skipton, south to Cape Otway, east to Queenscliff and west to Port Campbell.

The Otway Ranges are the landscape's main geographic feature, and they contain the state's westernmost extent of tall, wet forest. North of the ranges' forests are plains, which become drier as they extend north. South of the ridge, to the coast, is mostly forested and much wetter. To the east, the Anglesea heathland dominates, and it has one of the state's most diverse ecosystems. It's a highly productive landscape with higher rainfall than many other parts of Victoria. It has a diverse mix of coastal, mountain and farm communities and areas, and its ecosystems are diverse.

The landscape is about 1.1 million ha, or 5% of the state's area: 22% of it is public land and 78% private land. The Barwon Otway landscape has about 20% of Victoria's total bushfire risk, as many of its people and much of its property are close to forests.

Residual risk

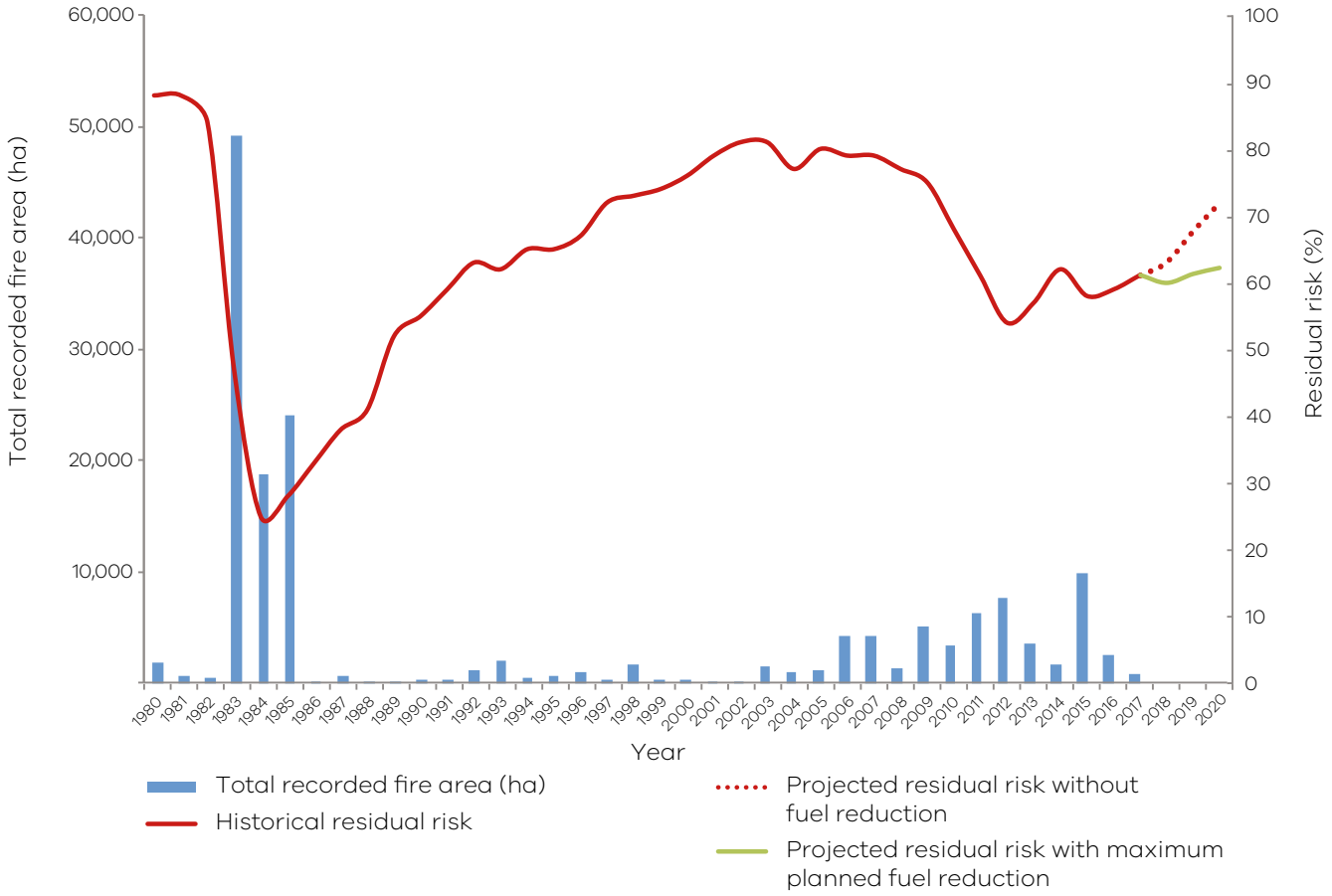


Figure 16: Residual risk profile, Barwon Otway BRL, 1980–2020

Figure 16 shows the modelled residual risk profile for the Barwon Otway BRL for the period 1980–2017, and projected changes in residual risk until 2020. It shows that:

- in 2016–17, residual risk in the landscape was 61%
- residual risk fell sharply in 1983 after the Ash Wednesday bushfires, which caused devastating losses along the Surf Coast and in the eastern Otways
- residual risk steadily increased after the Ash Wednesday fires as fuel re-accumulated across the landscape, reaching a peak of 82% in 2003
- since 2008, residual risk has fallen by 20–25% as a result of delivering a strategic, risk-based approach to fuel management
- through to 2020, we project fuel management will limit the increase in residual risk to about 62–64%, but that without fuel management it would increase rapidly to 72%.

Since 2008 when the Future Fire Management Project started, this landscape has adopted a strategic, risk-based approach to fuel management that has focused planned burning within two to three km of high-risk towns and along the northern slopes of the Otway Ranges. This, as Figure 16 shows, has reduced residual risk by 20–25%.

There have been limited planned burning opportunities in three of the last four years, mainly because of unsuitable weather. This is starting to affect the trend of the landscape's residual risk trajectory. As Figure 16 shows, implementation of the current FOP maintains residual risk at about its current level (61–62%), rather than reduces it. This is a consequence of limited burning opportunities in past years.

Also, sites that were planned burnt in the period 2010–12 (such as at Lorne, Hendersons Track and Aireys Inlet – Distillery Creek) have since re-accumulated fuel, which increases residual risk. In line with the specified burn frequencies in the landscape's fuel management strategy, these sites are now back on the FOP to be re-treated.

In 2017-18 and beyond, we will align our FOP and planned burning program with the 2017 SBRASS fuel management strategy for the Barwon Otway (Otway District) BRL. This strategy aims to reduce risk across the landscape and to maximise the number of high-risk towns that benefit from fuel management, these two aims being the basis of our 2017–20 FOP. Updating the Barwon Otway fire management strategy has more information about the SBRASS Project.

Nearly half (47%) of the planned burns on the current FOP include areas of private land. As a result, we work closely with CFA, PV, local governments and other authorities to ensure fuel management is effective and complementary across all land tenures.

Our fuel management strategy emphasises planned burning around high-risk towns. Sites burnt in the period 2010–12 are now coming back onto the FOP to be burnt again, including areas around Lorne, Aireys Inlet and Moggs Creek. In particular, planned burns around Lorne will be a high priority in the future.

Ecosystem resilience

Figure 17 shows the tolerable fire interval (TFI) status and Figure 18 the growth stage structure (GSS) status of the vegetation on public land in the Barwon Otway BRL for the period 2007–17.

Figure 17 shows that about 26% of the vegetation is below minimum TFI, and that the area of vegetation below minimum TFI has steadily increased since 2007. In 2016–17, a small (35 ha) area was burnt by planned burning while below minimum TFI, and no area was burnt by bushfires while below minimum TFI. This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI.

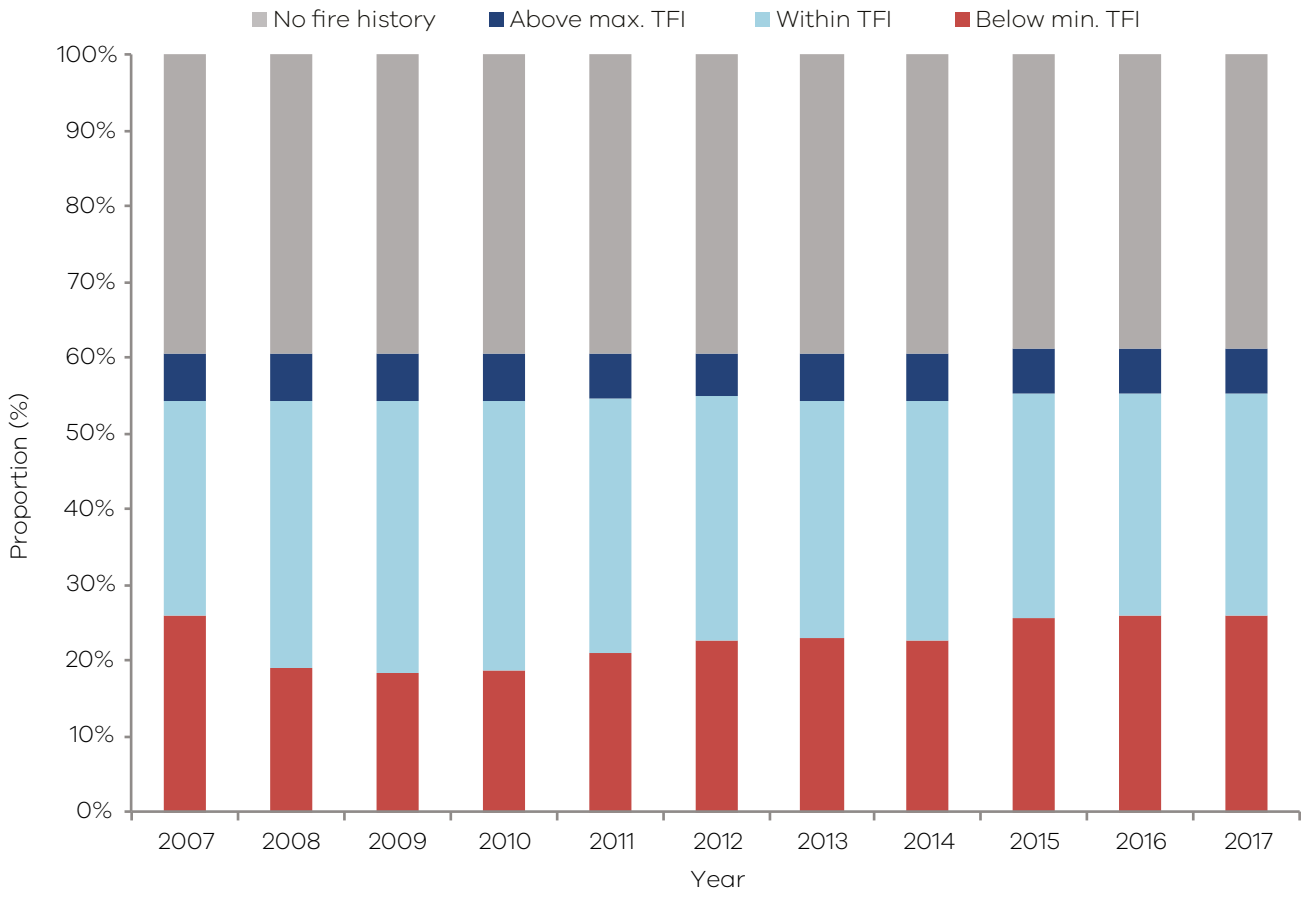


Figure 17: TFI status of public land vegetation, Barwon Otway BRL, 2007–17

Figure 18 shows about 18% of the landscape was in the juvenile and adolescent growth stages in 2017. This is the result of increased levels of planned burning in recent years. As the proportion of the vegetation in the younger growth stages has risen over the past six years, the proportion of the vegetation in the older (mature and old) growth stages has fallen, from about 48% in 2009–10 to about 43% in 2016–17.

The current area below TFI and the proportion of the landscape in the younger and older growth stages is within the range set out in the landscape's fuel management strategy.

We project that the area burnt while below minimum TFI and the amount of vegetation in the juvenile and adolescent growth stages will increase over the next decade because of planned burning in higher-risk areas. An increase in the area of younger (juvenile and adolescent) growth stages affects animals by reducing the abundance of important habitat (such as vegetation cover, logs and hollow-bearing trees), although plant diversity may increase in many vegetation types after fire disturbs them.

A large proportion of this landscape has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

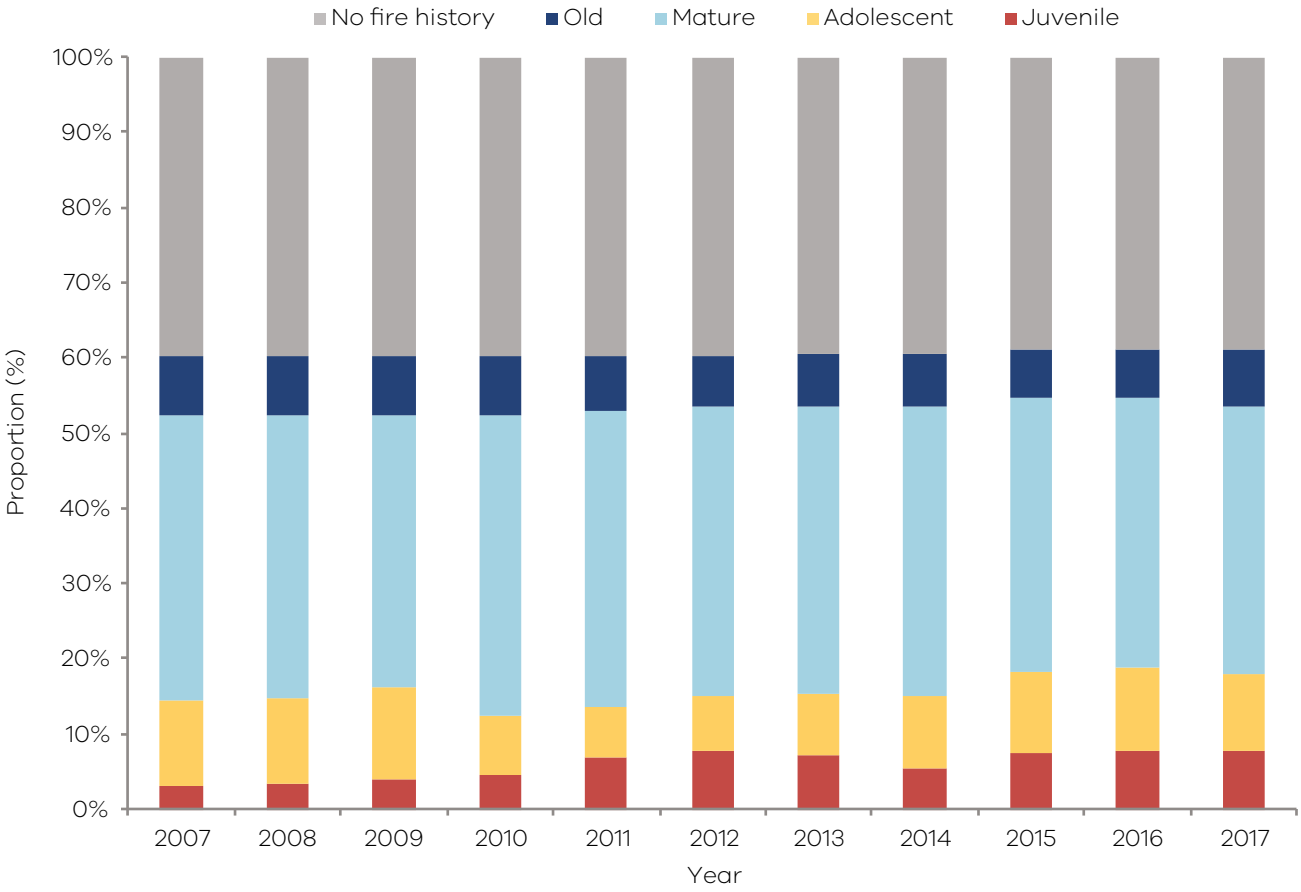


Figure 18: GSS status of public land vegetation, Barwon Otway BRL, 2007–17

Community engagement

During the year, we worked to ensure our engagement approach was consistent with Safer Together and DELWP's *Community Charter*. Our engagement approach is to form constructive partnerships with the community and relevant agencies by identifying shared goals and aspirations, and by building understanding and trust.

During the year, we implemented the community-based bushfire management approach in Lorne and in localities around Wye River — Wye River, Separation Creek, Kennett River and Grey River. We worked together with CFA and local governments to operate as an emergency management sector to implement Safer Together. We:

- convened a Lorne Community Working Group which agreed on its vision, objectives and operating principles
- developed with the working group a method to survey and monitor community resilience and identify strengths and weaknesses in this resilience, and used the findings to decide on community-based bushfire management initiatives
- worked with Wye River CFA and the Wye River Community Planning, Building & Fire Working Group to determine community-based bushfire management priorities and opportunities, and to plan and hold community events about bushfire awareness, fuel management and preparedness planning.

As explained in Updating the Barwon Otway fire management strategy, during the year we finalised the SBRASS fuel management strategy for the Barwon Otway (Otway District) BRL. The updating process of the previous fuel management strategy benefited from input by the landscape's Bushfire Strategy Advisory Group which helped develop the alternative fuel management strategies and supported the trade-off evaluations for these strategies.

During the year, we conducted the Pilot Bushfire Social Survey Project which saw 1,200 members of the public surveyed by market researchers Australian Survey Research. The project presented respondents with some of the alternative fuel management strategies and identified their preferences for and attitudes about them. It also explored the trade-offs participants would be willing to make to achieve particular fuel management outcomes. We used the survey results to:

- ensure the range of alternative fuel management strategies we considered in the SBRASS Project reflected the breadth and diversity of our communities' values and attitudes
- develop a measure of how well alternative strategies aligned with community expectations and preferences.

In 2016, DELWP conducted a project to determine the costs and benefits of creating APZ fuel breaks around Wye River and Separation Creek. Engagement activities included an Otway field trip, eight on-site meetings with different groups of members of the public and open-house events at Wye River and Melbourne. The events involved facilitators, independent geology and bushfire experts, town planning consultants and fire planning staff of DELWP, CFA, local governments and PV. There was strong community interest and involvement in the project and it was a very useful way to explore values and issues. The project evaluation found members of the public felt they understood fuel break planning better and that their ideas were understood and valued.

To support delivery of the fuel management program, we further strengthened relationships with community hubs across the Otways. The hubs distribute through their own networks information we provide about the fuel management program, and they also tell us what information the community needs.

To promptly distribute information about our planned burning program, we used social media and deployed community liaison officers before and during burns. Using community hubs, social media and community liaison officers allowed us to better plan and deliver complex fuel management activities along the Great Ocean Road, in particular the Big Hill burn near Lorne and the Kennett – Wye Jeep Track burn near Kennett River.

The Wye River – Kennett Wye Jeep Track burn was the first burn since the Wye River – Jamieson Track bushfire to bring smoke close to the communities devastated by the Christmas 2015 bushfire in the area. This burn reduced risk particularly to the people of Kennett River. In this area of the Otways, ideal burning conditions are rare and often occur only in late February. We spent a lot of time on community engagement which helped put the community at ease before and during the burn, and it reaffirmed the strong relationships we have with Otway coast communities.

We also worked with CFA to plan and deliver cross-tenure burns, improving the interagency relationship that underpins Safer Together.

Our current FOP relies heavily on burning on private land to manage risk: 47% of the burns on the plan include some area of private land, and the plan covers more than 2,000 ha of private land in total. To enable these burns on private land, we have made more than 100 landholder agreements in the Otways. Arranging these agreements requires a considerable engagement effort with private landholders.

Monitoring, evaluation and reporting

The Monitoring, Evaluation and Reporting (MER) program helps us make well-informed and strategic decisions, validate our modelling approaches, measure the success of our fuel management program and build trust with our stakeholders.

In 2016–17, we continued to implement our MER plan. We developed a monitoring implementation plan to guide MER activities throughout the year. We also purchased monitoring equipment and supplies, started to use the Fuel Hazard Collector app which uploads data and photos taken in the field into ArcGIS online, and we engaged in learning and development activities to build the knowledge and skills of staff doing fieldwork.

During the year, we:

- conducted overall fuel hazard (OFH) assessments across 26 burns, resulting in 257 pre- and post-burn monitoring events, to quantify changes resulting from burning and to ensure we are meeting our objectives
- undertook fire severity mapping of all eight completed burns to gather spatial information to support ecological and risk modelling.

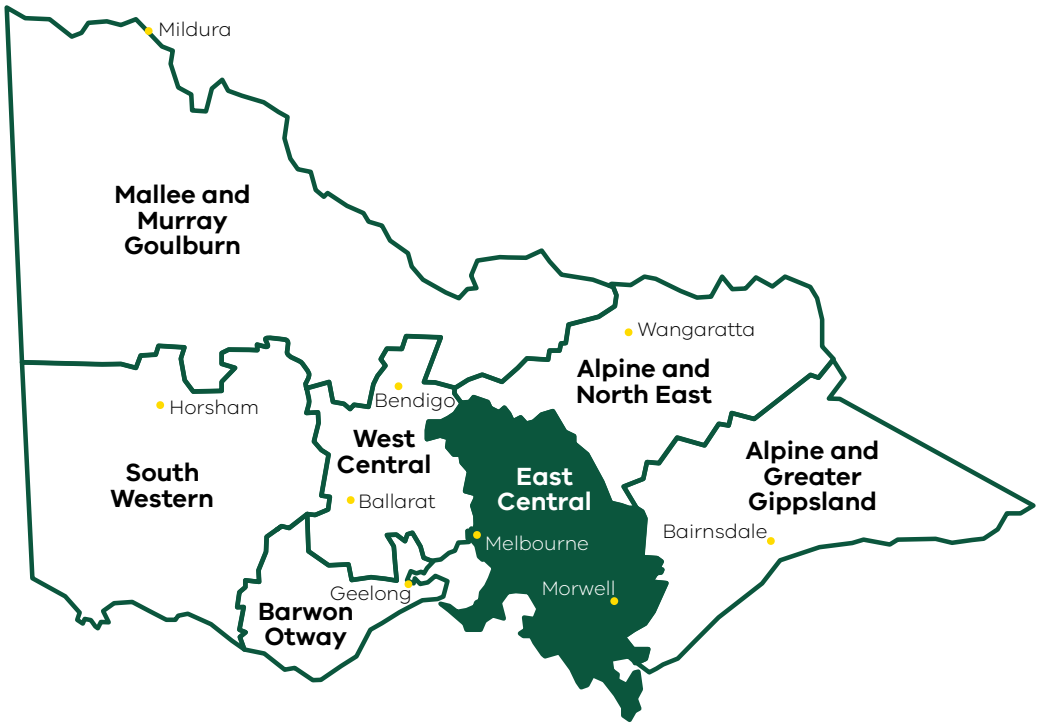
We monitored 48 sites in the Wye River – Jamieson Track fire area and 12 sites in the Wye River – Kennett Wye Jeep Track planned burn area, collecting data about fuel hazard and vegetation structure and comprehensive imagery. This data helps us better understand how fuel accumulates differently after a high-intensity bushfire compared with a lower-intensity planned burn. This helps fill an important gap in our knowledge about the forest, herb-rich type of fuel throughout the landscape. We can use this information to make better decisions about fuel management and be better-informed about risk after bushfires.

During the year, we conducted pre-burn surveys of the plant species in heathland vegetation that are most sensitive to being burnt below minimum TFI. In 2017–18, we will assess the post-burn mortality of individual plants to determine the vulnerability of younger plants to fire and the species sensitive to being burnt below minimum TFI.

We continued the Hawkeye Project, which started in 2010, to better understand how frequent burning affects ecological values in the eastern Otways. We completed camera monitoring of the 90 Hawkeye sites, resulting in nearly 2,000 days of imagery. This work complements monitoring by The University of Melbourne's Fire, Landscape Pattern and Biodiversity Project.

We also started a project to consolidate existing MER datasets into one database. This will result in data from a range of external and internal sources stretching back over 30 years being in one location and in a common format useful for decision-making.

East Central



The East Central Bushfire Risk Landscape (BRL) extends north-east of Melbourne to the High Country around Lake Eildon, south-east to the Latrobe Valley and south to Wilsons Promontory. It includes the Yarra Valley, the Dandenong Ranges, the Thomson and Upper Yarra catchments, Mount Baw Baw and the Mornington Peninsula. The landscape is about 2.3 million ha, or 8% of the state's area: 35% of it is public land and 65% private land.

The East Central BRL contains a third of Victoria's total bushfire risk. Of all Victoria's BRLs, this landscape has the most risk, reflecting its high population density close to forests.

The landscape contains many of Victoria's 28 bioregions, each comprising a unique set of landscape properties and associated plant and animal assemblages. From the tall Mountain ash forests of the Great Dividing Range to the dry foothill forests and grasslands, this landscape has some of the most flammable types of vegetation on earth.

Residual risk

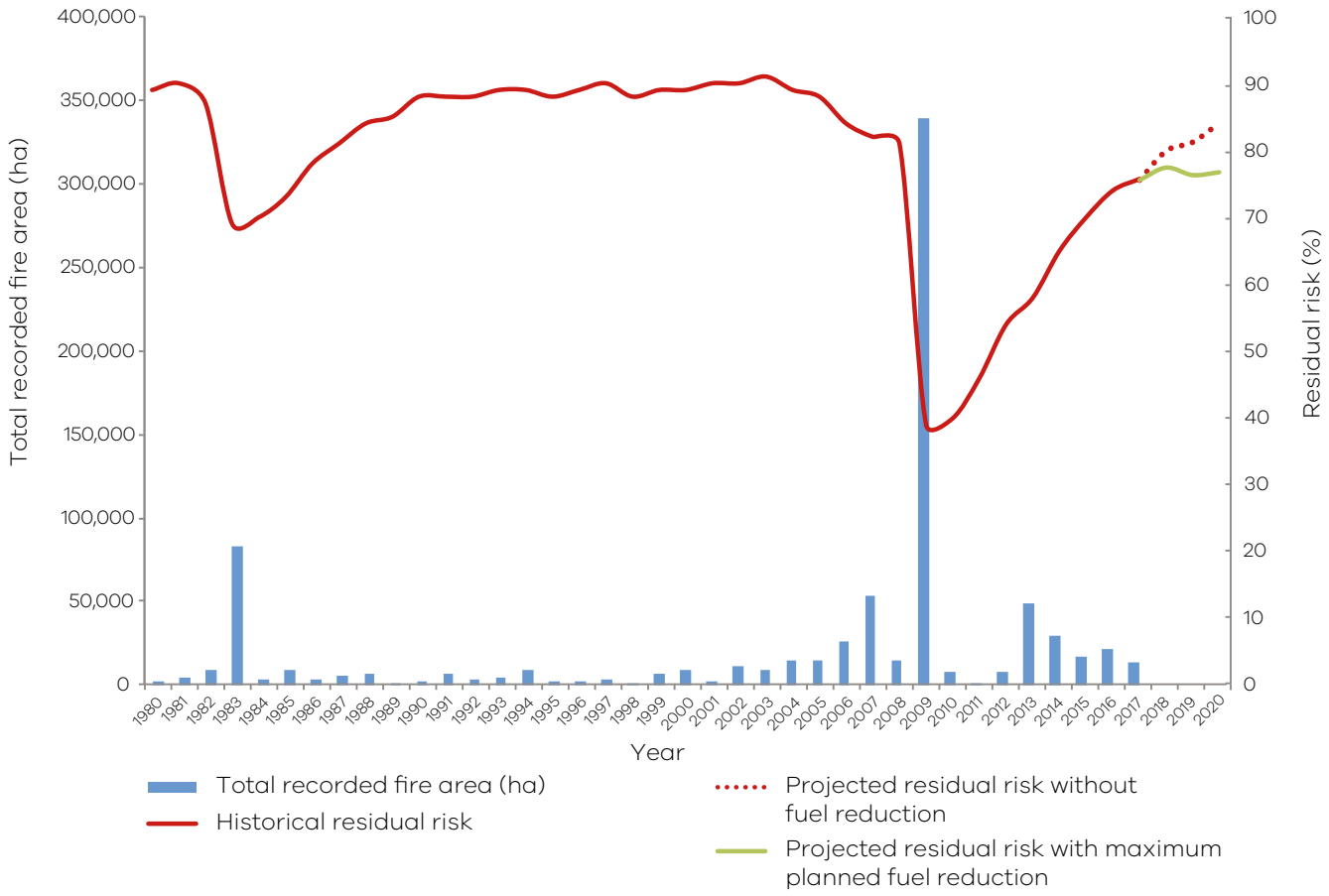


Figure 19: Residual risk profile, East Central BRL, 1980–2020

Figure 19 shows the modelled residual risk profile for the East Central BRL for the period 1980–2017, and projected changes in residual risk until 2020. It shows:

- residual risk in the landscape in 2016–17 was 76%
- residual risk fell sharply after the 1983 Ash Wednesday bushfires and again after the 2009 Black Saturday bushfires, reaching less than 40% in 2010
- since 2009, residual risk has rapidly increased as large areas of fuel have re-accumulated in wetter, mountainous forest areas, which are normally too damp for planned burning, and several high-risk towns in this landscape adjoin forest that cannot be safely fuel-reduced with planned burning, making other activities (such as mechanical works, improved preparedness and community education) essential
- fuel management activities in the FOP will slow this increase to a projected 77–79%, but without planned burning residual risk will continue to rise, to a projected 84% by 2020.

Ecosystem resilience

Figure 20 shows the tolerable fire interval (TFI) status and Figure 21 the growth stage structure (GSS) status of the vegetation on public land in the East Central BRL for the period 2007–17.

Figure 20 shows that in 2016–17 about 65% of the vegetation was below minimum TFI. This percentage has been almost the same since 2009. In 2016–17, less than 1% of the vegetation was burnt by bushfire or planned burning while below minimum TFI: mainly by planned burning. This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI. The large increase in the area below minimum TFI in 2009 was a result of the Black Saturday bushfires.

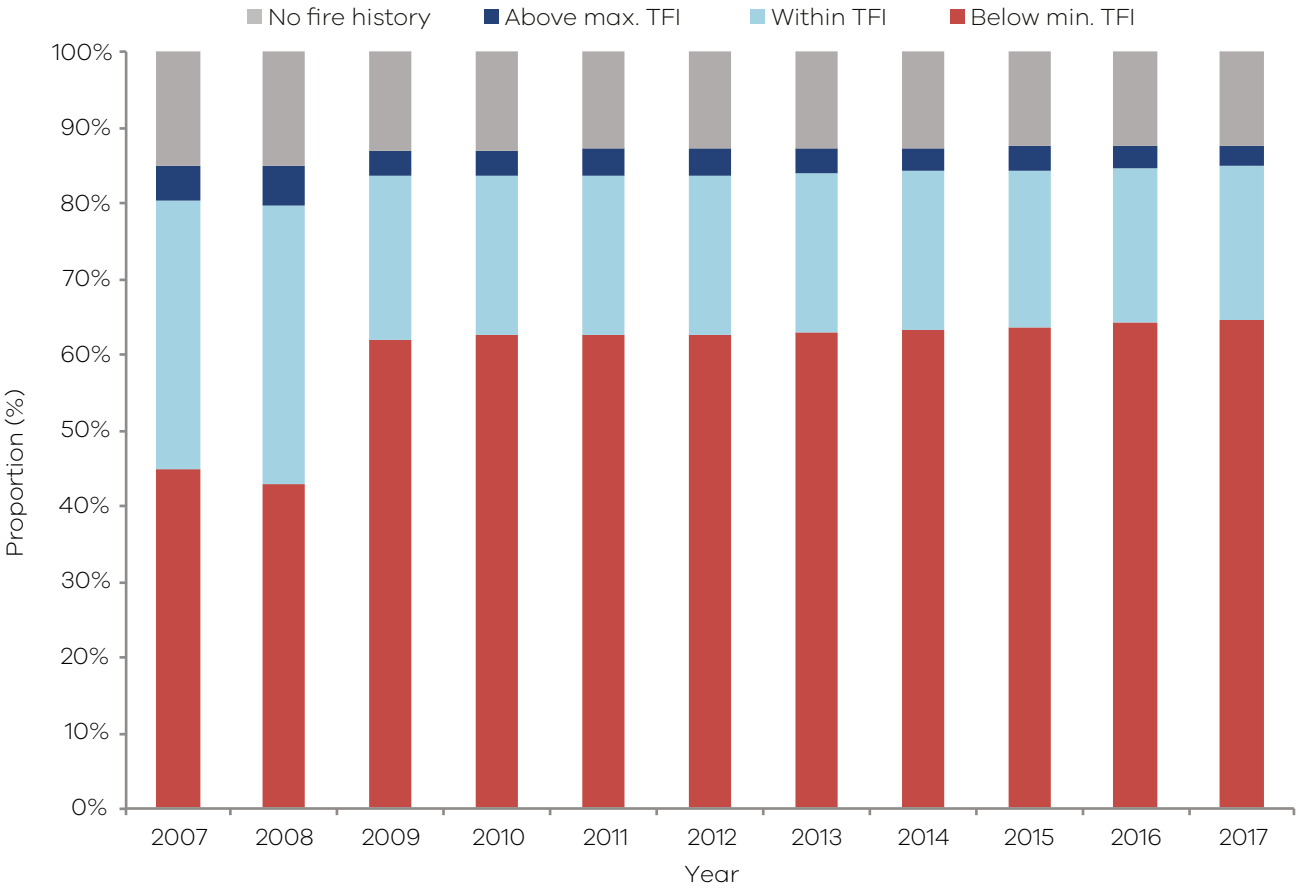


Figure 20: TFI status of public land vegetation, East Central BRL, 2007–17

Figure 21 shows about 52% of the landscape was in the juvenile and adolescent growth stages in 2017 and about 35% was in the older (mature and old) growth stages. The distribution of growth stages across the landscape has remained reasonably constant since 2012–13 with the landscape favouring a younger growth stage distribution. The 2009 Black Saturday bushfires remain the main cause of the current growth stage distribution in the landscape.

Threatened species (such as Leadbeater's possum and Smoky mouse) rely on vegetation in the mature and old growth stages for habitat (such as hollow-bearing trees and coarse, woody debris). It will take a long time for the landscape to recover to these growth stages as some vegetation communities can take up to 50 years or more to reach maturity.

A small proportion of this landscape has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

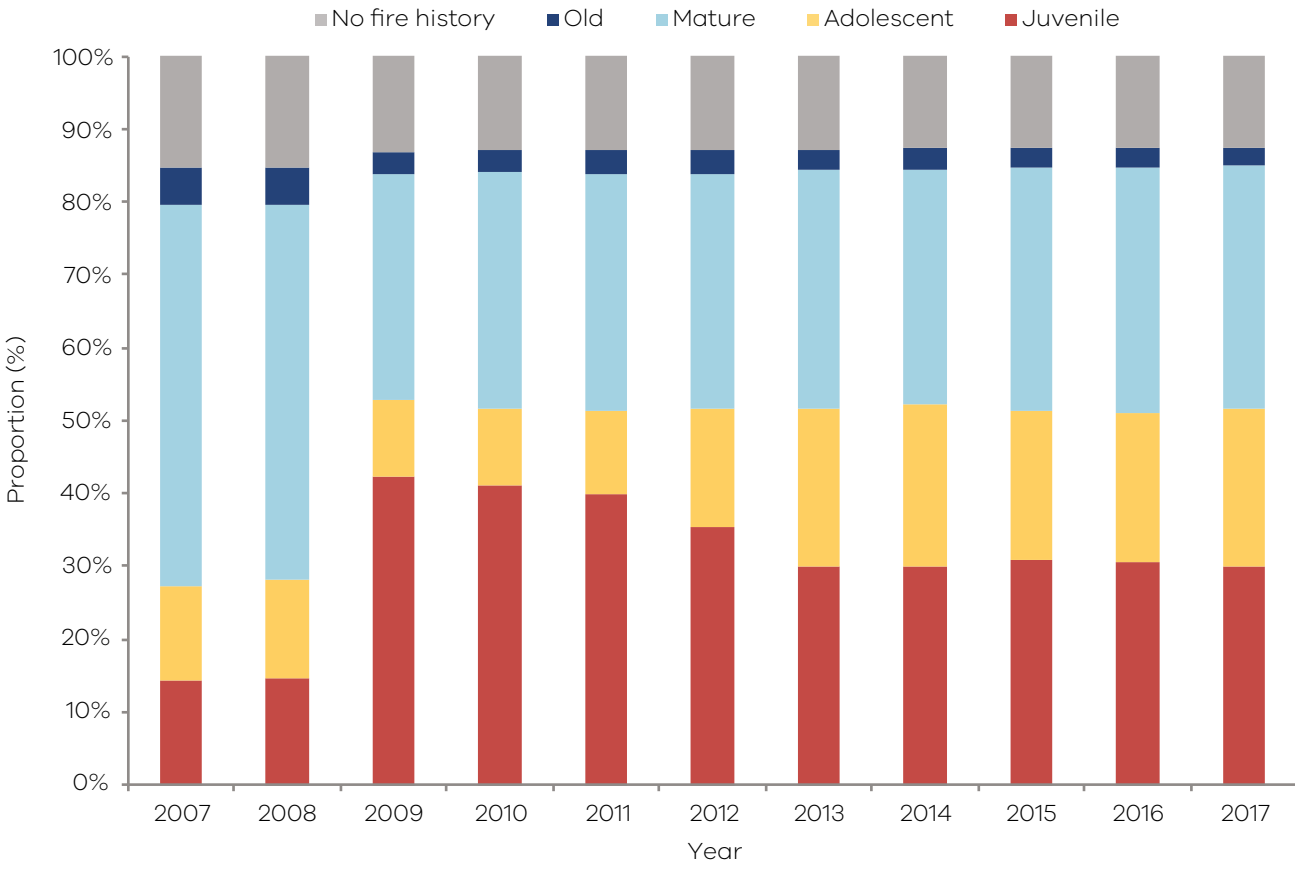


Figure 21: GSS status of public land vegetation, East Central BRL, 2007–17

Community engagement

In 2016–17, we worked to engage with the community in line with Safer Together and DELWP's *Community Charter*. This included working with Traditional Owners, partner agencies and the general community.

We continued to build relationships with Traditional Owner groups by including cultural burning opportunities in the FOP, by educating staff about how to provide opportunities for Aboriginal people to connect to Country, and about the importance of protecting Aboriginal places of significance.

In collaboration with Nillumbik Council, we continued the monthly 'St Andrews conversations', a community-based bushfire management planning process under Safer Together. These conversations allow us to explore with the community emergency management issues, particularly bushfire-related issues. Participants in the conversations organise the 'St Andrews collective sigh', a community event at the end of the fire season.

The Fire Learning Network continued this year. The network shares the knowledge of agencies and community members including new bushfire management research. Highlights were a presentations to the network about the Monbulk fuel management planning process and about social science research into bushfire planning by individuals.

The Healesville Safer Together Working Group met regularly in 2016–17. It organised workshops to discuss bushfire safety around Healesville, using a bushfire scenario, that brought staff of CFA, Shire of Yarra Ranges, Victoria Police and DELWP together with the general community: 150 members of the public attended the workshop.

Our staff were members of the organising committee of the annual Living with Bushfire Community Conference, joining with staff of Yarra Ranges Council, PV, CFA, Box Hill Institute and Victoria Police to deliver this two-day conference for members of the public and agency staff. The conference reviews agency and community initiatives, and new research and policy.

Changes are proposed to fire management zones in some parts of the landscape to better align the zones with our understanding of where the bushfire risk is. We held online conversations, online surveys, staff forums, community information sessions and other community events to gather feedback from the community to help refine the proposals for change.

During the year, we sought to improve how we engage with the community around planned burning. We had engagement staff at more than half of the planned burns in the landscape. They interacted with hundreds of residents and park users, and there was much positive feedback from people who liked the easy access to information.

This year we completed two complex, high-profile burns at Mt. Toolebewong and Mt. Little Joe. Both required us to engage extensively with residents in the lead-up to the burns, and we set up community information sites on the burn days to keep residents and tourists updated about burn operations.

The regional communications team increased its use of social media to provide information and gather feedback about planned burns, and it reviewed its social media use at the end of the season so as to improve it next year.

To continue to improve how we engage with communities around planned burning, we conducted a project with CFA and Wyndham Council to engage with people in Truganina, which is close to ecologically important grassland reserves, to better understand community values about the area and the reserves. We designed the project in collaboration with The University of Melbourne.

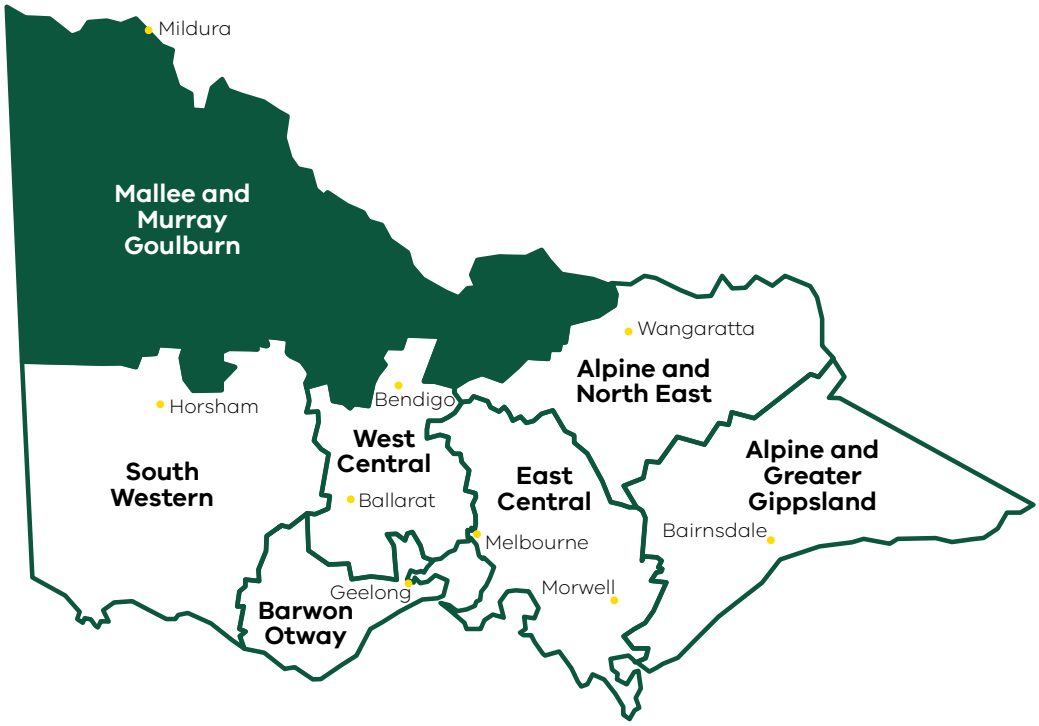
Monitoring, evaluation and reporting

2016–17 was the second year of implementing our Monitoring, Evaluation and Reporting (MER) plan across the landscape's four fire districts. Activities under the plan included:

- measuring overall fuel hazard (OFH) as part of our pre- and post-burn monitoring in autumn 2016
- training 41 DELWP and PV staff to use the Fuel Hazard Collector app which uploads data and photos taken in the field into ArcGIS online to conduct OFH assessments
- completing 34 pre-burn OFH assessments and 16 post-burn assessments across four fire districts
- capturing aerial imagery across 14,000 ha to map and digitise the fire severity of 14 burns, imagery we will use with our fire history records to improve our future fire behaviour and ecological modelling.

We expanded our monitoring activities to better understand how fuel management activities influence biodiversity values. We surveyed for Smoky mouse and small mammals in the Yarra Ranges National Park with remote sensing cameras pre- and post-burn, to inform how best we can monitor animal species in future. We also contracted the Arthur Rylah Institute to continue monitoring a key fire-response species, *Banksia spinulosa*, to better understand the species' seed production and seedling recruitment, which will improve our understanding of optimal fire intervals. We expanded our strategic bushfire risk analysis for the Leadbeater's possum in the Central Highlands, and we are identifying areas suitable for planned burning that would reduce the bushfire risk to the population and its habitat. We continued to identify areas of long-undisturbed habitat in the landscape, and we incorporated these high ecological values into our fire operations planning process to ensure we exclude them from planned burning as best we can.

Mallee and Murray Goulburn



The Mallee and Murray Goulburn Bushfire Risk Landscape (BRL) comprises the north-west area of the state. It has the South Australian border on its west side and the River Murray on its north, and it extends beyond Echuca in the east and to Dimboola in the south. It contains the Little Desert, Murray Sunset and Wyperfeld national parks and the Big Desert State Forest.

The landscape is about 7.7 million ha, or 33% of the state's area: 27% of it is public land and 73% private land. Most of the public land is in the three national parks, which are largely intact blocks of native vegetation. The rest is mainly in the River red gum forests along the River Murray or in scattered, isolated reserves throughout the landscape. The vegetation in the Mallee parks is very flammable.

The northern Mallee parks contain some of the last remaining habitat of several nationally threatened species including the Black-eared miner, the Mallee emu-wren and the Millewa skink. Nearly 40% of all the landscape's threatened plant and animal species are only found in this landscape. It also includes sizeable areas of non-eucalypt, semi-arid woodlands. These woodlands are endangered and are home to a unique range of wildlife.

Residual risk

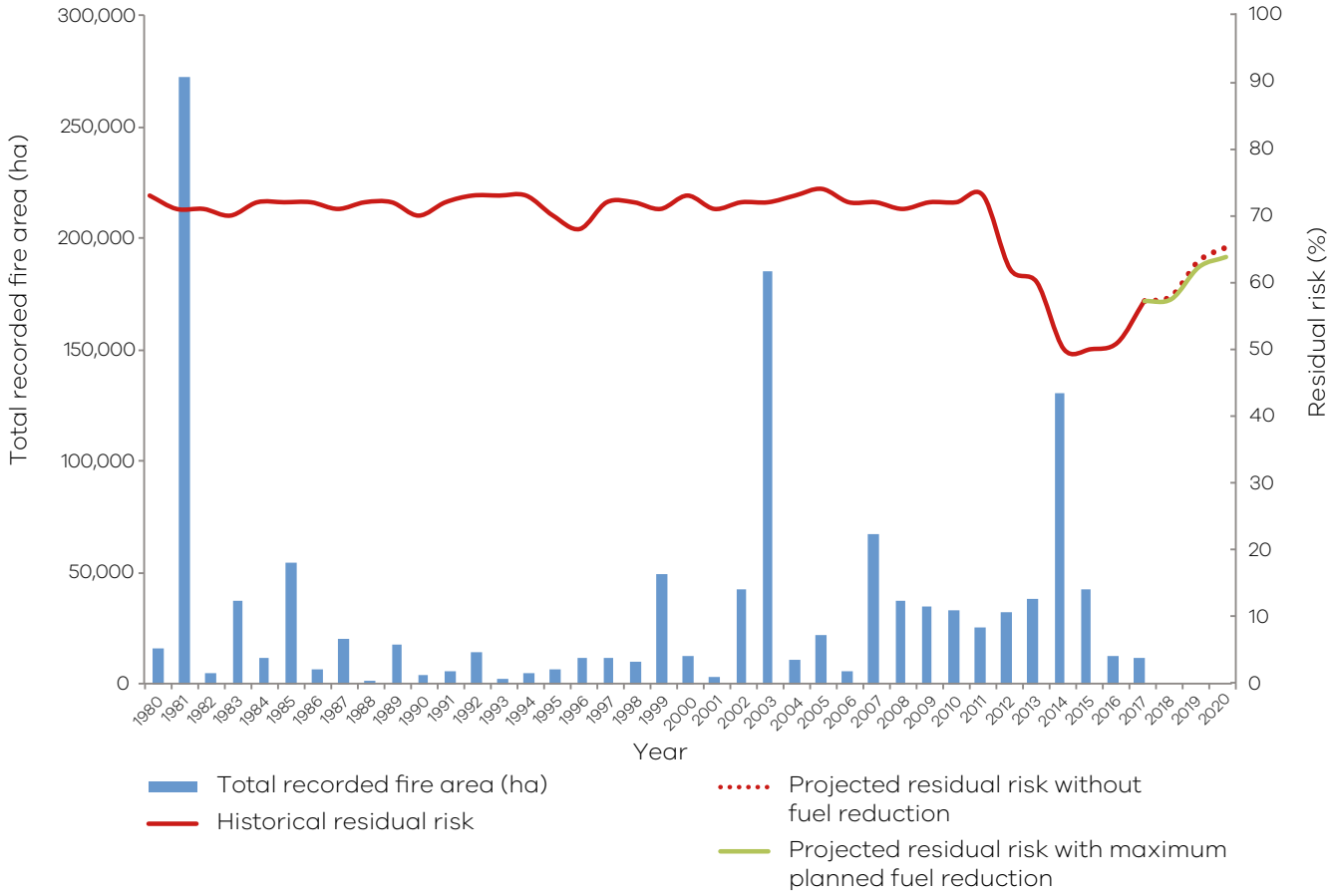


Figure 22: Residual risk profile, Mallee and Murray Goulburn BRL, 1980–2020

Figure 22 shows the modelled residual risk profile for the Mallee and Murray Goulburn BRL for the period 1980–2017, and projected changes in residual risk until 2020. It shows that:

- residual risk in the landscape in 2016–17 was 58%: most of the remaining risk arises from private farming land and small parcels of vegetation, where it is more difficult to manage fuel with planned burning
- from 1980 to 2010, residual risk was stable at around 72%
- after 2010, more planned burning in smaller, vegetated blocks around larger, higher-risk communities (such as Inglewood, Wedderburn, Tarnagulla and Rushworth) led to a big fall in residual risk, toward 50%
- residual risk has been increasing since 2014, and is projected to rise to about 66% by 2020: we believe this results largely from inaccurate fuel mapping for this landscape, and we will investigate if this is the case.

Ecosystem resilience

Figure 23 shows the tolerable fire interval (TFI) status and Figure 24 the growth stage structure (GSS) status of the vegetation on public land in the Mallee and Murray Goulburn BRL for the period 2007–17.

Nearly 78% (or 1.62 million ha) of the landscape is comprised of the largely intact Mallee land systems, namely Murray–Sunset — Hattah–Kulkyne, Big Desert – Wyperfeld and the Little Desert. Natural fire regimes and strategic planned burning in these ecosystems drive the trends shown in these figures.

Figure 23 shows the amount of the vegetation below minimum TFI in 2017 was 29%, which is an increase of 3% in the last 10 years that is due to bushfires and increased planned burning. In 2016–17, less than 1% of the vegetation was burnt by bushfire or planned burning while below minimum TFI. This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI. To enhance ecosystem resilience, the proportions within and above maximum TFI both need to be larger than the proportion below minimum TFI.

Figure 23: TFI status of public land vegetation, Mallee and Murray Goulburn BRL, 2007–17

Figure 24 shows the proportion of the landscape in the juvenile and adolescent growth stages has fallen over the last 10 years from about 19% to about 13%, while the proportion of mature and old vegetation has risen from about 33% to about 45%. Improvements in fire history mapping may further reduce the proportion of the vegetation with no recorded fire history. To achieve optimal ecosystem resilience in the Mallee land systems, the proportion of mature and old growth vegetation combined need to be approaching 90%.

A large proportion of this landscape has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

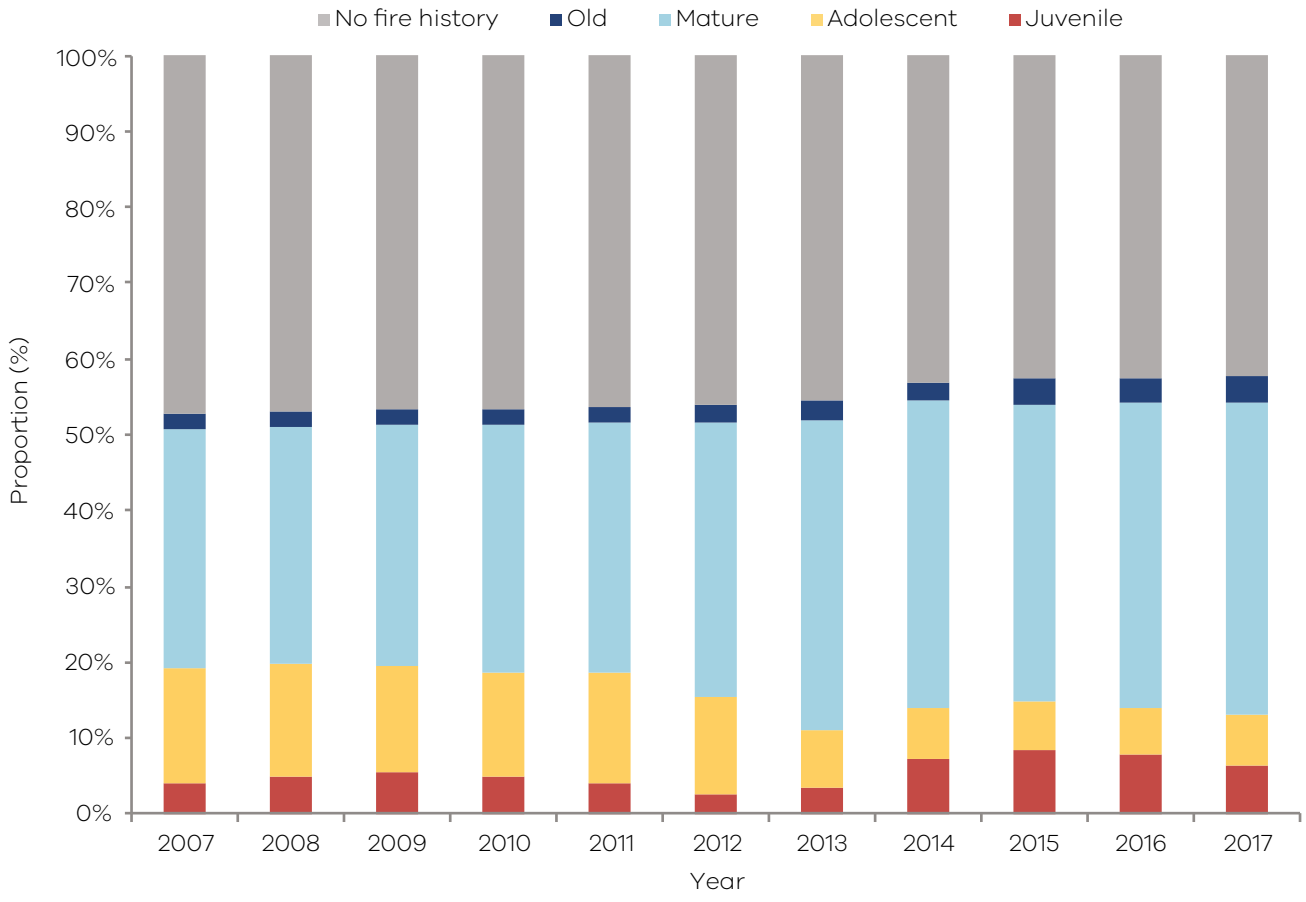


Figure 24: GSS status of public land vegetation, Mallee and Murray Goulburn BRL, 2007–17

Community engagement

In 2016–17, we continued to work with the Mallee Fire Advisory Committee, a regional, stakeholder-based committee established in 2014 that gives the Mallee community a voice in fire management. Its members are local landholders, apiarists, environmentalists, CFA members and government employees. In 2016–17, the committee discussed planned burn breaches, fire operations planning, strategic bushfire breaks, bushfire research and MER. We also hosted a scenario workshop with the committee and representatives of other agencies. The workshop provided an opportunity to assess planning and preparedness for a major bushfire in an experiential and interactive way.

During the year, we prepared cross-tenure fuel management risk assessments for two priority communities and are implementing these with CFA, shires and landholders. The assessments were informed by site visits at which we discussed cross-tenure planning and identified locally significant attributes with members of the public. We also continued to work closely with environmental groups in our region, which included explaining how we support ecosystem resilience through our fire management strategies.

Monitoring, evaluation and reporting

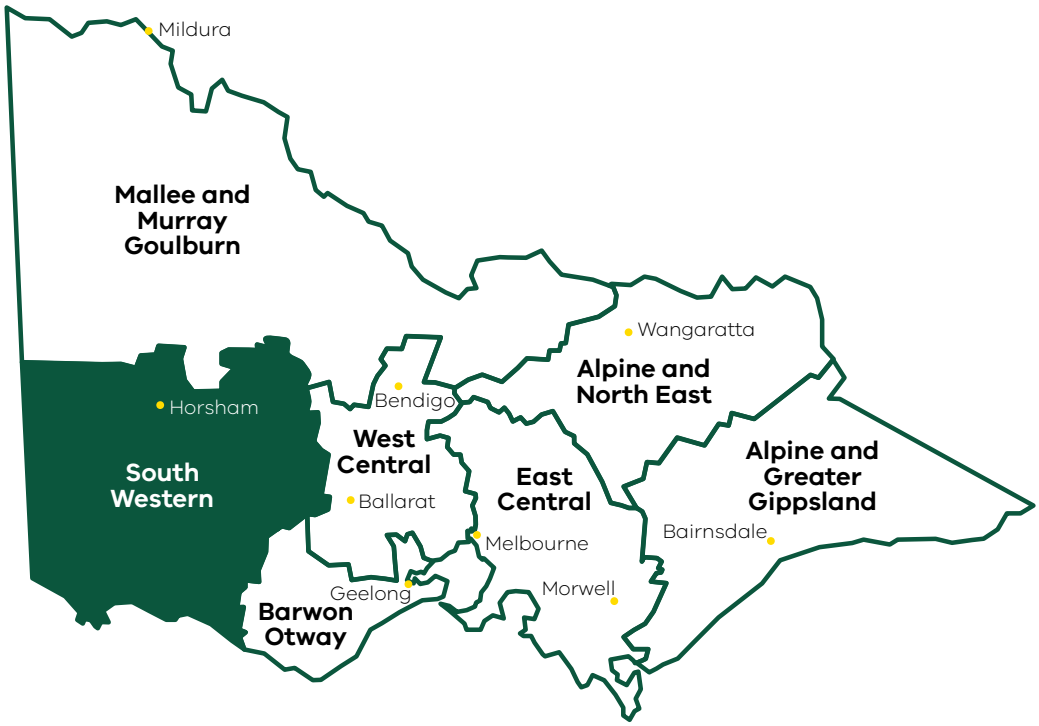
In 2016–17, we moved to implement the landscape's Monitoring, Evaluation and Reporting (MER) plan, with a focus on monitoring changes in fuel after planned burns in high-priority areas. We are currently expanding the MER program to monitor fuel management impacts on biodiversity.

During the year, we:

- prepared a detailed MER implementation plan
- conducted pre- and post-burn overall fuel hazard (OFH) monitoring at a total of 12 burns across four fire districts — Wimmera, Mallee, Murray Goldfields and Goulburn — in spring and autumn, and we assessed 230 monitoring points across these burns
- trained 20 staff to analyse satellite images, so we can maintain consistently high standards of fire history mapping; and we provided district staff with specialised digitising equipment to more efficiently map fires
- conducted detailed burn severity mapping with ground truthing for all three burns in taller forests in the south-eastern corner of the landscape
- started a project with the Royal Melbourne Institute of Technology to investigate if we can use remote sensing methods to quantify changes in fuel in the extensive, untracked areas of north-west Victoria, with the results expected next year
- worked with PV and Goulburn fire district to develop a study to determine the best method to protect large River red gums (*Eucalyptus camaldulensis*) during planned burning
- trained staff to use the Fuel Hazard Collector app which uploads data and photos taken in the field into ArcGIS online.

We also supported La Trobe University's Mallee emu-wren (*Stipiturus Mallee*) fire ecology project with surveys in the Big Desert – Wyperfeld park complex. The university has now made 10 survey trips for this species across the Mallee parks of north-west Victoria involving 2,300 visits to 800 sites and resulting in 185 detections of Mallee emu-wrens. The probability of Mallee emu-wren occurring increases with higher coverage of hummock-grass (*Triodia scariosa*) tussocks more than 45 cm tall. We plan our fuel management strategically around this species, including by establishing fire breaks in the Mallee parks to protect the most important habitat for the Mallee emu-wren.

South Western



The South Western Bushfire Risk Landscape (BRL) extends from west of Ballarat to the South Australian border and from Portland in the south to St Arnaud in the north. It contains diverse communities, values and landscapes including the Grampians National Park.

The landscape is about 4.1 million ha, or 17% of the state's area: 17% of it is public land and 83% private land. The public land in this landscape is highly fragmented.

The landscape contains many endemic and rare species. It also contains Stringybark woodlands which are the main feeding habitat of the South-eastern red-tailed black cockatoo, a threatened species. The Kara Kara National Park in the north-east of the landscape contains many fire-sensitive animal species, many of which depend on old trees and their hollows for habitat.

Residual risk

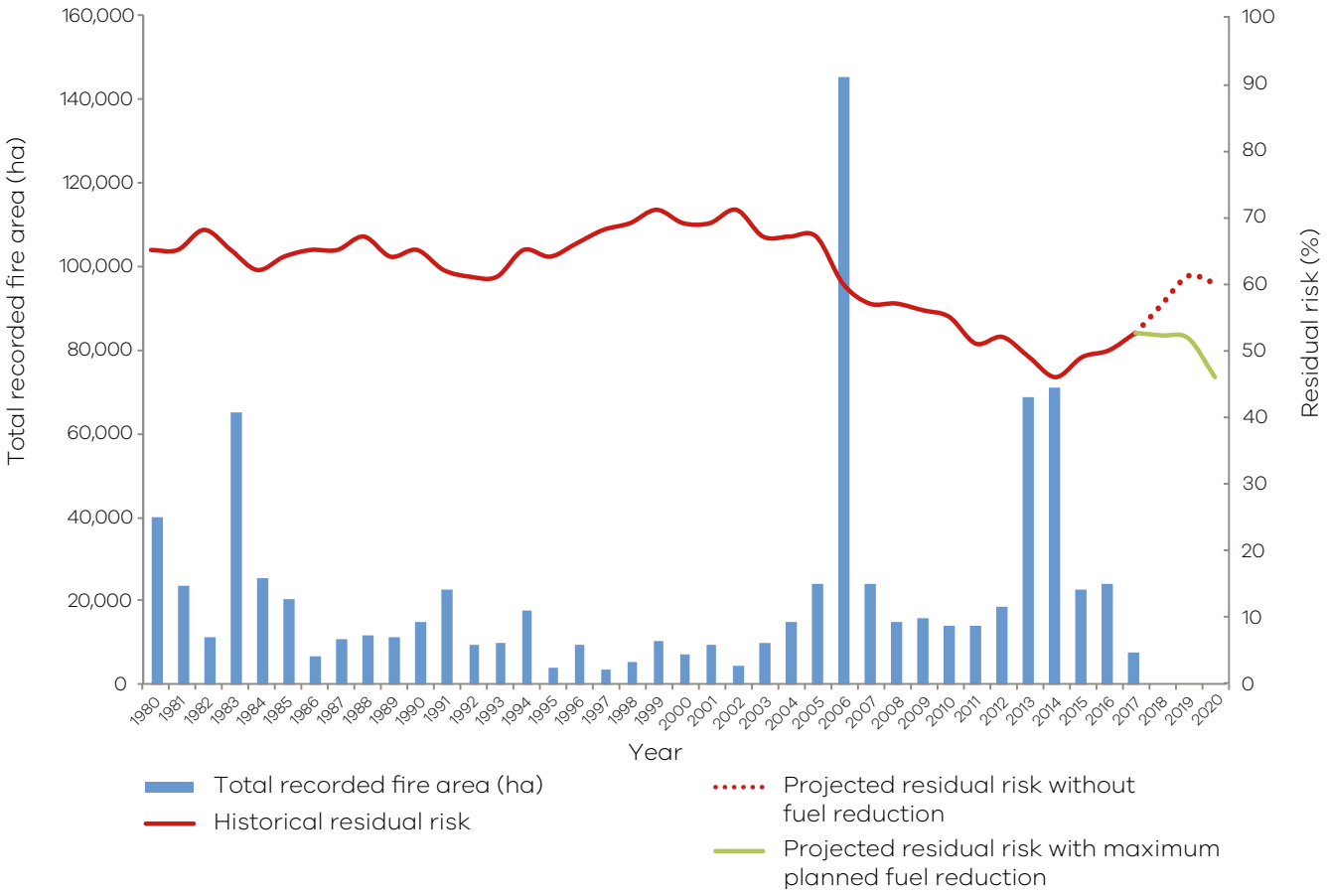


Figure 25: Residual risk profile, South Western BRL, 1980–2020

Figure 25 shows the modelled residual risk profile for the South Western BRL for the period 1980–2017, and projected changes in residual risk until 2020. It shows that:

- in 2016–17, residual risk in the landscape was 53%
- residual risk was mostly stable after 1980 in the range 60–70%, but it fell sharply to about 57% with the 2006 Mt Lubra bushfire in the Grampians, and it has continued to gradually fall as a result of planned burning and more-recent bushfires in the Grampians
- residual risk has begun to increase in recent years as fuel re-accumulates in fire-affected areas
- we expect fuel management activities on the FOP to decrease residual risk to around 46–49%, but without planned burning residual risk would return to a projected 60% by 2020.

Ecosystem resilience

Figure 26 shows the tolerable fire interval (TFI) status and Figure 27 the growth stage structure (GSS) status of the vegetation on public land in the South Western BRL for the period 2007–17.

Figure 26 shows that in 2016–17, 42% of the vegetation was below minimum TFI. Between 2007 and 2015, the proportion of the vegetation below minimum TFI increased from 30% to about 40% as a result of major bushfires in the Grampians in 2006, 2013 and 2014 and in the west of the landscape in 2006 and 2012. In 2016–17, a small (about 734 ha) area of the vegetation was burnt by bushfires or planned burning while below minimum TFI. This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI.

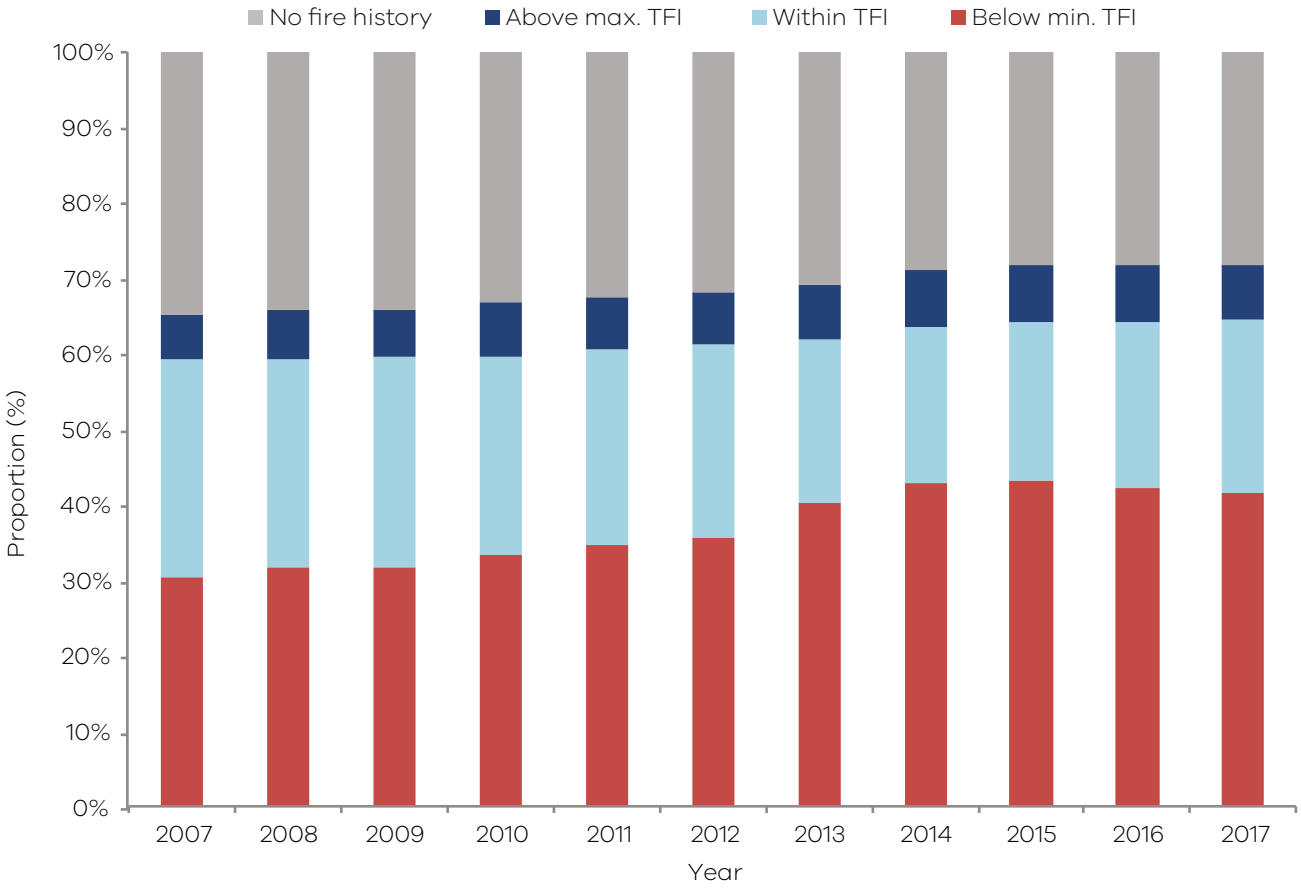


Figure 26: TFI status of public land vegetation, South Western BRL, 2007–17

Figure 27 shows that in 2016–17, 30% of the landscape was in the juvenile and adolescent growth stages, and about 41% was in the older (mature and old) growth stages. Over the decade to 2015, major bushfires increased the proportion of vegetation in the juvenile and adolescent growth stages from about 27% to about 40%. In recent years, some of this vegetation has started to grow to the mature stage.

A large proportion of this landscape has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

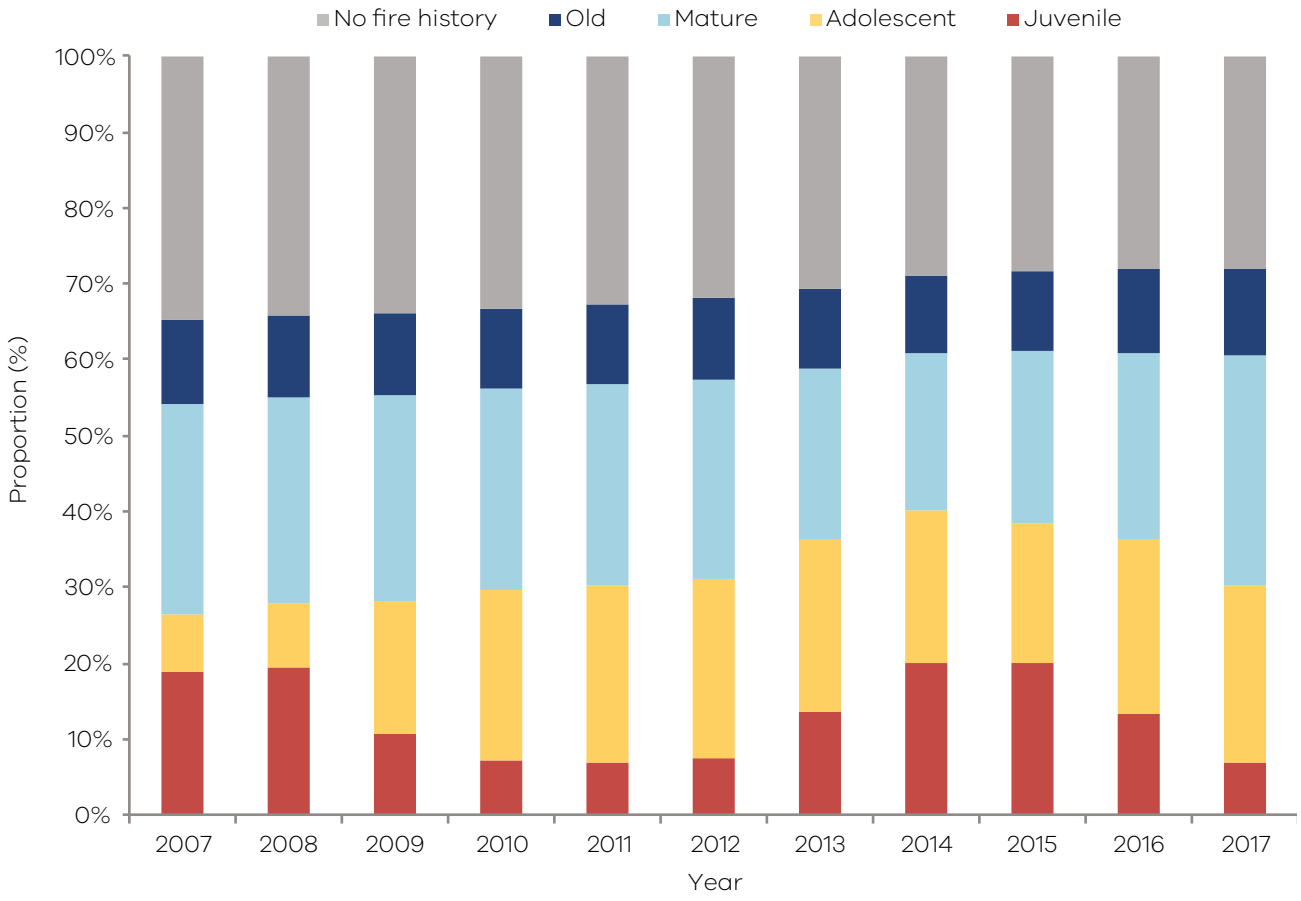


Figure 27: GSS status of public land vegetation, South Western BRL, 2007–17

Community engagement

In 2016–17, we continued to work with the Western Border Stakeholder Reference Group. We also held regular workshops to discuss local fire management issues with representatives from a range of organisations. The knowledge shared helped to inform our fuel management activities, and this engagement also built strong relationships with the community.

The Greater Grampians Roundtable continued to provide useful expertise and local input into fire management in the area. The group continued to explore strategic fuel management options across the Grampians National Park.

The Glenelg Fire Emergency Conference in Portland discussed the importance of land, fire and emergency agencies working together in partnership with communities, including the importance of working together to manage fuel.

We held open houses and other events about planned burning, cross-tenure fuel management and local fire issues in high-bushfire-risk localities and towns including Bolwarra, Cavendish and Halls Gap. These events helped the community to better understand the work we do with CFA in their area and to plan what they should do to reduce risk in the event of a bushfire.

May 2017 saw the start of a traditional burning program in the landscape. The Walpa Dyurrita cultural burn, at the base of Mt Arapiles, took place in partnership with Barengi Gadjin Land Council. The crew lighting the burn were Traditional Owner staff of FFMVic and two Barengi Gadjin staff, watched over by Wotjobaluk Elders.

Monitoring, evaluation and reporting

The landscape's Monitoring, Evaluation and Reporting (MER) program priority in 2016–17 was monitoring to determine how effectively fuel management activities reduce risk to life and property. Activities included:

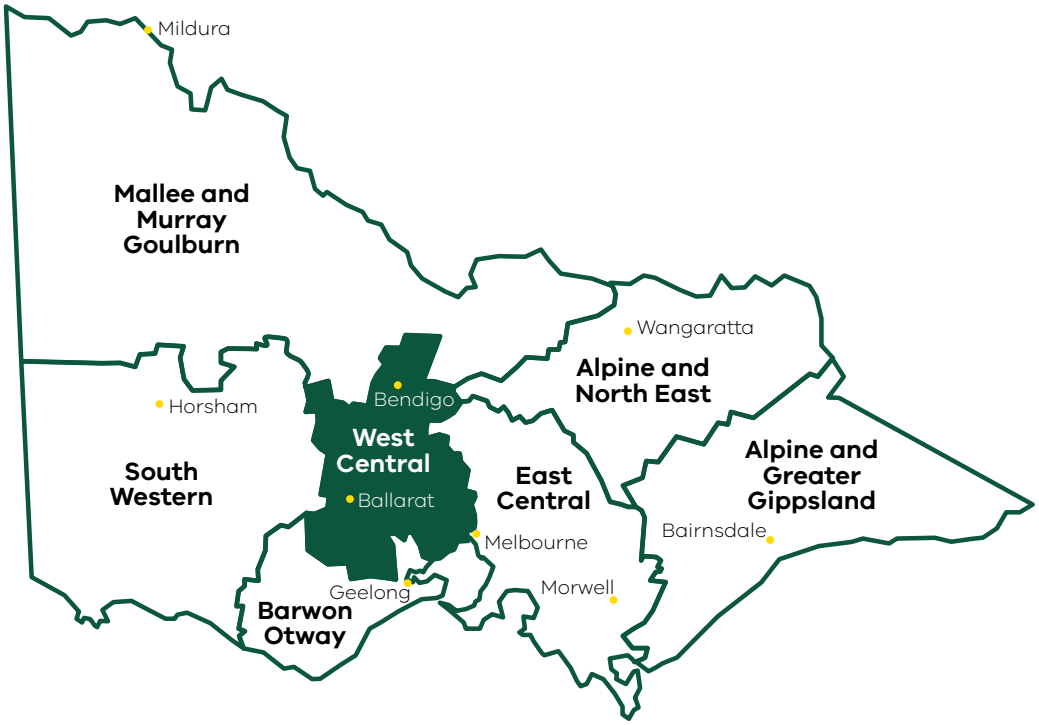
- training 16 staff in overall fuel hazard (OFH) assessment guidelines to improve the consistency of assessments
- training 24 staff to use the Fuel Hazard Collector app which uploads data and photos taken in the field into ArcGIS online
- pre-burn OFH monitoring at 15 sites and post-burn OFH monitoring at six sites, with sites not burnt this year to be finalised in 2017–18
- severity mapping of 70% of the planned burns.

We placed remote cameras and did OFH surveys to assess the effects of small, patchy fires on the habitat of small mammals in the Wannon Falls area of the Grampians National Park. The Wannon Falls area is important for small mammals due to its long-unburnt condition, high productivity and ability to provide refuge in hot, dry years and during wildfires. We are trialling small fuel-reduction burns to maintain habitat quality and ensure fuel-reduced refuge areas are available in the event of a bushfire.

We undertook a study in the Jilpanger Nature Conservation Reserve to assess changes in plant composition and habitat value over time in areas with poor fire-history information. The results show that long-unburnt areas need fire to promote key fire-response species (such as Desert Banksia, *Banksia ornata*).

In collaboration with The University of Melbourne's Bushfire Behaviour and Management Group, FFMVic started a study to examine more closely rates of accumulation of a major type of fuel across the south of the state. This study will help improve the accuracy of bushfire risk modelling across several BRLs.

West Central



The West Central Bushfire Risk Landscape (BRL) is in central Victoria. It straddles the Great Dividing Range and extends north to Elmore, south to the Hamilton Highway, west to Maryborough and east to Craigieburn.

The landscape is about 1.7 million ha, or 7% of the state's area: 18% of it is public land and 82% private land. It has 17% of Victoria's total bushfire risk to life and property, which reflects its high population density close to forests.

Residual risk

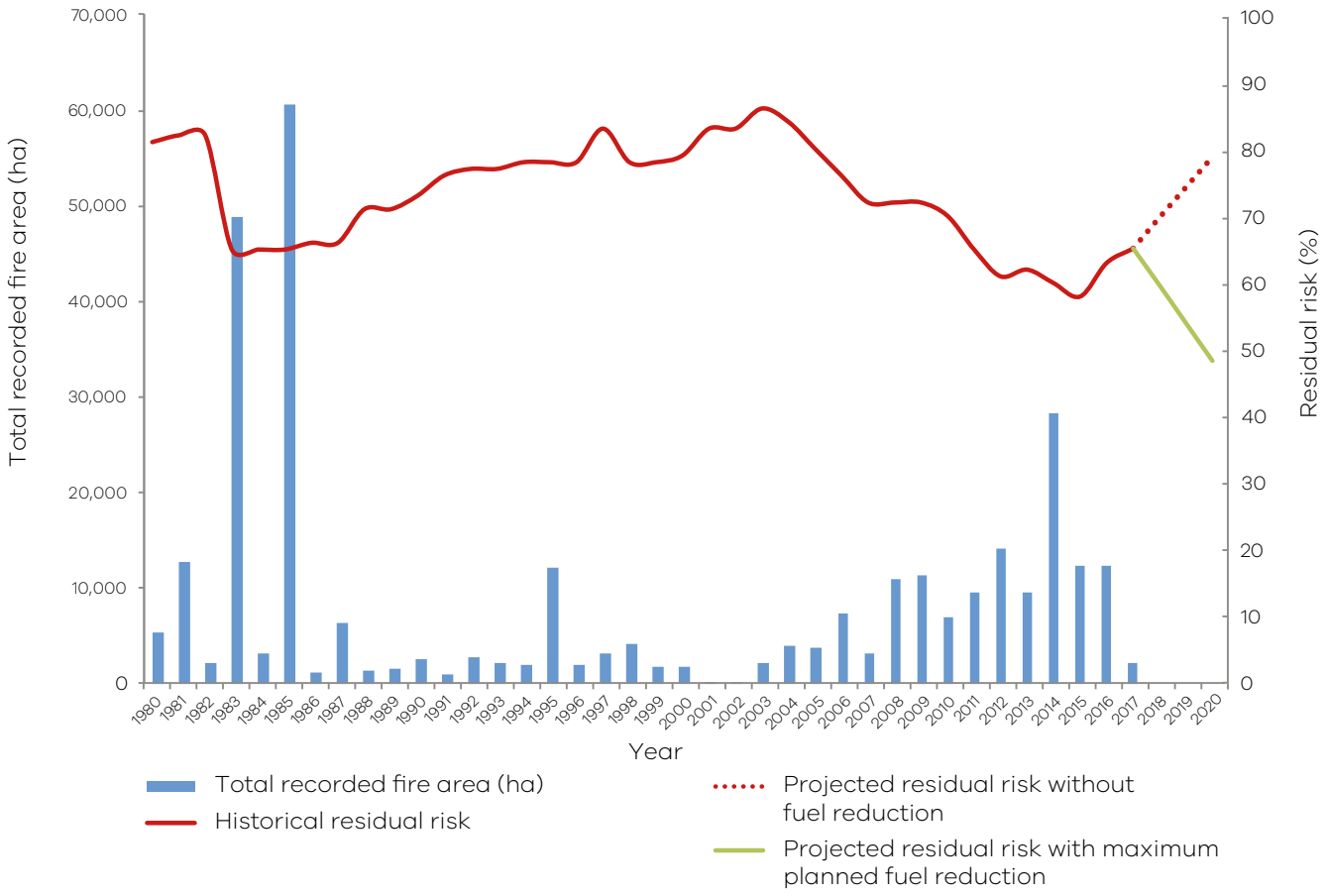


Figure 28: Residual risk profile, West Central BRL, 1980–2020

Figure 28 shows the modelled residual risk profile for the West Central BRL for the period 1980–2017, and projected changes in residual risk until 2020. It shows that:

- in 2016–17, residual risk in the landscape was 65%
- residual risk fell sharply in 1983 after the Ash Wednesday bushfires, which caused large losses of life and property in the Mt Macedon area
- residual risk steadily increased after the Ash Wednesday fires as fuel re-accumulated across the landscape, peaking at 86% in 2003 before steadily falling, due to an increased and more strategic planned burning program, to a low of 58% in 2015
- in recent years, reduced opportunities for planned burning have led to a sharp increase in residual risk to 65%
- we project the fuel management activities in the FOP will decrease residual risk to around 48–55%, but without planned burning residual risk would increase rapidly to a projected 79% by 2020.

Ecosystem resilience

Figure 29 shows the tolerable fire interval (TFI) status and Figure 30 the growth stage structure (GSS) status of the vegetation on public land in the West Central BRL for the period 2007–17.

Figure 29 shows that in 2016–17 about 29% of the vegetation in the landscape was below minimum TFI. The proportion of vegetation below minimum TFI has increased over the last decade, from about 23% in 2007. In 2016–17, a small (about 372 ha) area of the vegetation was burnt by bushfires or planned burning while below minimum TFI. This shows our strategic fuel management planning is resulting in carefully considered planned burning to reduce impacts on vegetation below minimum TFI..

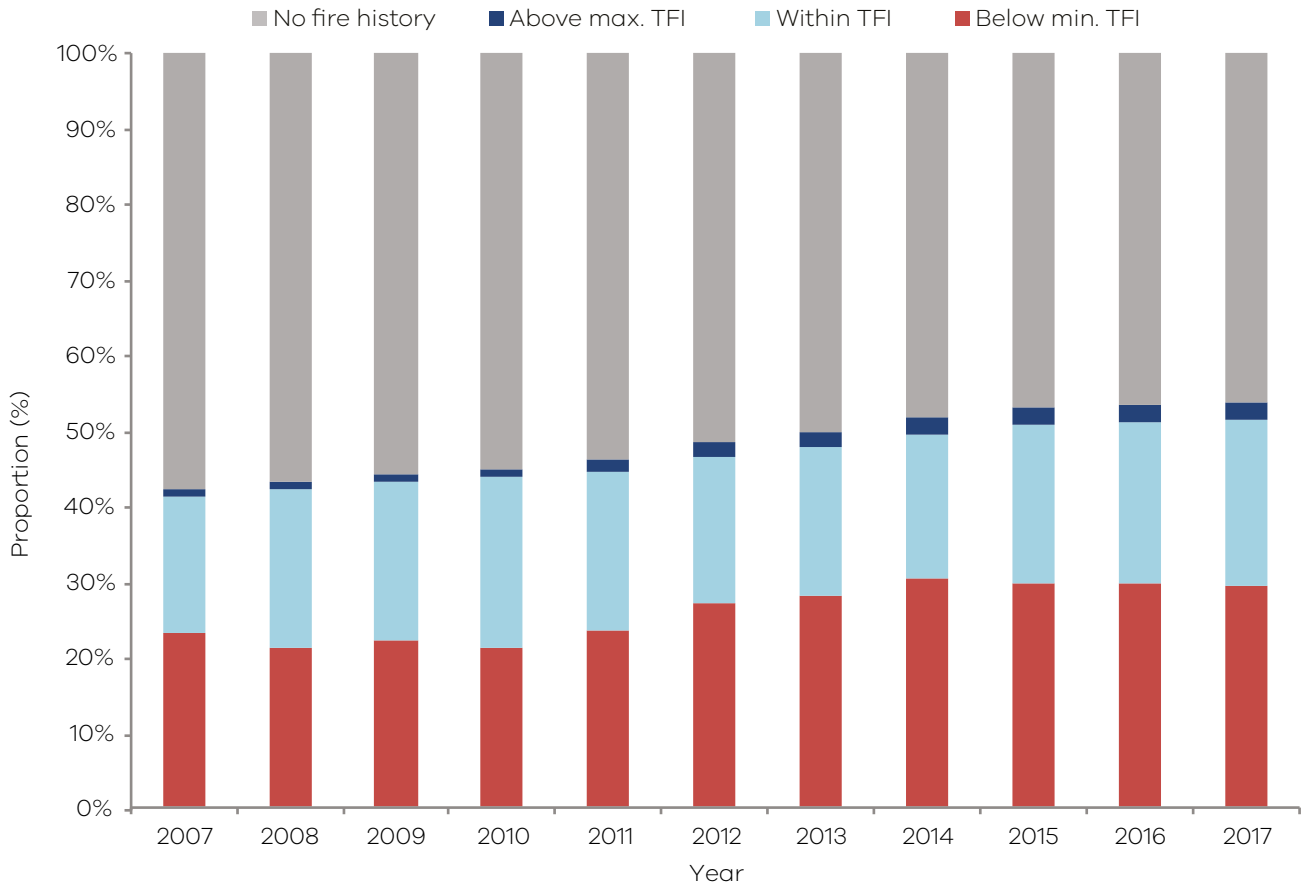


Figure 29: TFI status of public land vegetation, West Central BRL, 2007–17

Figure 30 shows 29% of the landscape was in the juvenile and adolescent growth stages in 2016–17, and about 25% was in the older (mature and old) growth stages. The proportion of vegetation in the younger growth stages (juvenile and adolescent) has increased over the last decade from 15% to 29% currently. This rise in the proportion of younger vegetation is due to more planned burning, particularly in 2011, 2014 and 2015.

A large proportion of this landscape has no recorded fire history. Nothing can be inferred about the TFI and GSS of public land with no recorded fire history.

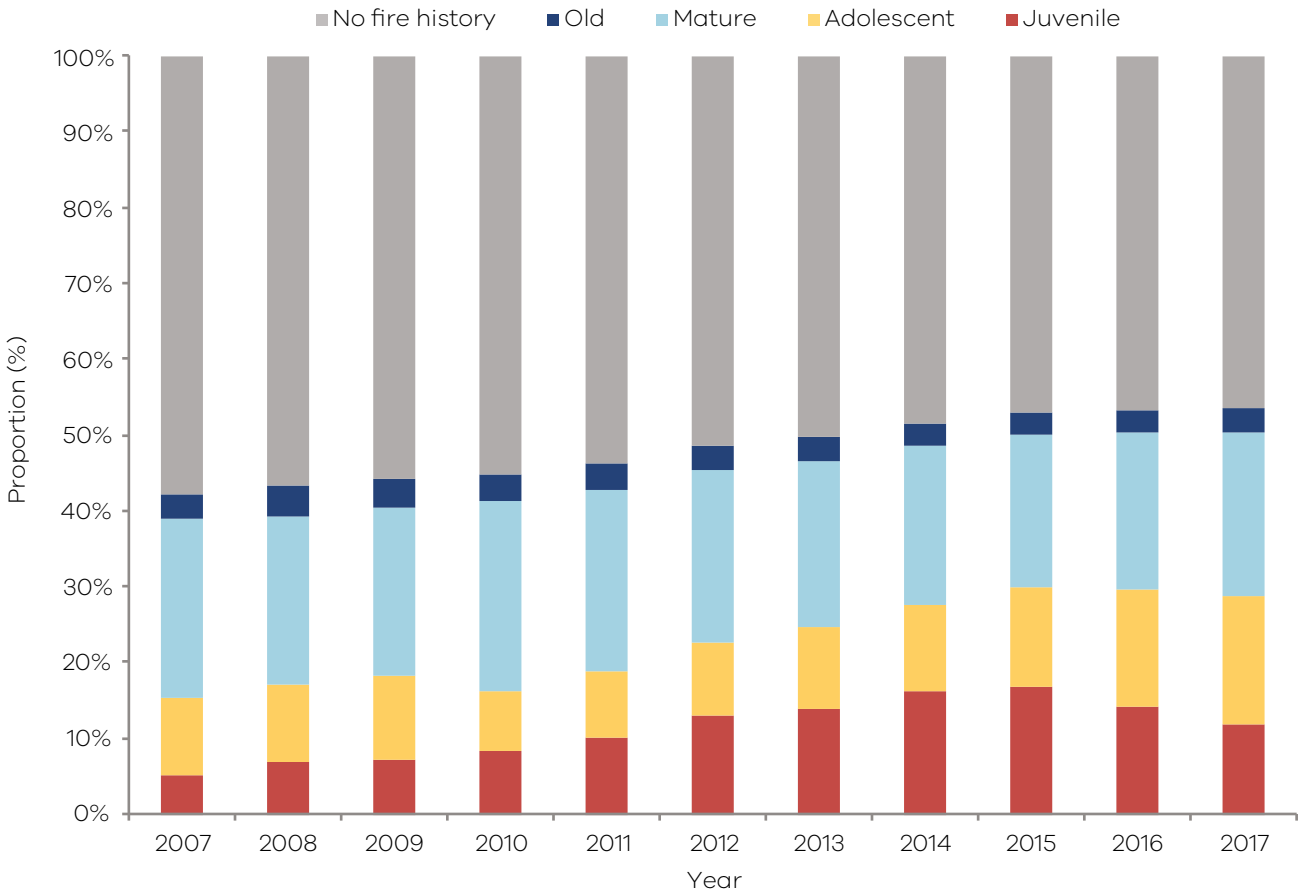


Figure 30: GSS status of public land vegetation, West Central BRL, 2007–17

Community engagement

In 2016–17, we worked with fire agencies, local governments and communities to further implement Safer Together across the landscape.

FFMVic, partner agencies and local community leaders established three community-based bushfire management projects — for Benloch and the Macedon and Daylesford corridors — to better understand local knowledge and what communities value, and to share fire planning and response information. We used what we learned in our fuel management planning and fire-response processes.

Since the 2015 Lancefield–Cobaw fire, the Benloch community has been meeting with agencies to understand bushfire risk in the landscape and agree on actions to better protect landholders. They have provided the fire brigade with information about their properties to help fire responses, managed roadside vegetation and run a community program to reduce fuel loads on private property.

In the Macedon corridor, agencies and the general public have worked together to develop relationships and a shared understanding of risk. Activities are planned to engage landholders in the Heskett–Kerrie area and eventually in other parts of the corridor according to the risk to and fire readiness of communities.

In the Daylesford corridor, there is a lot of bushfire risk around Daylesford and Hepburn, particularly to nearby communities to the south and east. During the year, agencies worked to manage fuel to the north of Hepburn Springs where major bushfires are most likely to start, and on building community readiness and resilience.

During the year, we reviewed fire management zones and received 14 submissions from members of the public and community groups. We made changes to fire management zones to improve the effectiveness of fuel management activities in reducing bushfire risk to life, property and the environment.

Monitoring, evaluation and reporting

In 2016–17, we started implementing our Monitoring, Evaluation and Reporting (MER) plan, emphasising fuel monitoring. We also established plans for ecosystem resilience monitoring to occur next year.

During this year, we:

- prepared a detailed MER implementation plan
- monitored pre-burn overall fuel hazard (OFH) at 23 sites and post-burn at the 11 sites where planned burning occurred, equating to monitoring 200 plots across the landscape up to two times
- undertook severity mapping with ground validation for six burns
- trained staff to use colour infrared aerial photography and field validation to map the extent and severity of fires
- trained staff to use the Fuel Hazard Collector app which uploads data and photos taken in the field into ArcGIS online
- provided feedback to operational staff about the outcomes of the burns they conducted, as shown by monitoring activities
- continued to evaluate return rates of fuel in the Box Ironbark Experimental Mosaic Burn Project area
- monitored fuel return rates in the Pink-tail worm lizard experimental burn area close to Bendigo, where the Arthur Rylah Institute continued a post-burn survey of ant and Pink-tailed worm lizard habitat
- introduced members of the public from Benloch to OFH assessment techniques, so they can understand risk on their own properties.


CFA
CFA

Fuel management operational activity

Statewide

Fire operations planning

Under Safer Together we now implement a risk reduction target for bushfire management. For operational purposes, we translate our risk reduction target to activity targets for delivery across the regions. Our fire operations plans (FOPs) illustrate this translation of our risk targets into hectare-based activity targets.

In August 2016, FOPs for 2017–20 were updated and approved. Our *Approved fire operations plan* web page has an interactive map showing all fire operations activities approved in current three-year FOPs. This includes planned burning, slashing, mowing and clearing works, creating and maintaining fuel breaks and carrying out maintenance on fire infrastructure (such as fire dams and lookout towers).

Community at the centre

When planning and delivering the planned burning program, we place the community at the centre of everything we do. Delivering a program that effectively reduces bushfire risk without adverse impacts on communities is a complex and often contentious task. We have various ways of managing competing demands: for example, we might delay where possible igniting a particular burn until it has less effect on an industry or community, even though this may cause us to lose some of an available burn window. But sometimes negative impacts may be unavoidable if a burn is a high priority for reducing bushfire risk and if delaying the burn in a particular area is not feasible.

Burn planning, site preparation and fuel reduction

Table 4 shows the 2016–17 activity targets for burn planning, site preparation and fuel management, and our achievements across Victoria. It shows that across the state we prepared burn plans for 151% of the target area for fuel management (TAFM) and made sites ready for 145% of that area. The TAFM for 2016–17 of 230,195 ha reflects our risk-reduction target in terms of an activity target for operational delivery, in accordance with Safer Together. We plan and prepare more sites than the target because unfavourable weather during the year may prevent us burning some sites. Having more than enough sites planned and prepared gives us options should the weather be unsuitable in some locations. It also maximises the likelihood we will achieve the biggest risk reduction outcome.

The table also shows the actual total fuel-reduced area was 54% of the activity target, of which 49% was by planned burning. We also reduced fuel by other methods (such as mowing, slashing, mulching and using herbicides). Fuel was also reduced by bushfires burning through areas that were ready for planned burning. These areas are only counted on sites with a burn plan in place and made ready for ignition, and only if the burn objective was achieved.

Table 5 shows the TAFM and the actual fuel-reduced area for each year since 2007.

Table 4: Burn planning, site preparation and fuel reduction, Victoria, 2016–17

Measure		Ha	Ha toward TAFM	% of TAFM
Target area for fuel management (TAFM)		230,195		
Burn planning and site preparation				
Area for which burn plans were prepared (over the three-year FOP)	Target	276,234		120%
	Actual	348,411		151%
Area of sites made ready	Target	276,234		120%
	Actual	333,228		145%
Fuel reduction				
Area treated by planned burning: • ecological burns 25,324 ha (36 burns) • fuel-reduction burns 86,212 ha (186 burns) • other burns 1,963 ha (131 burns)		113,498	113,498	49%
Area treated by other fuel management methods		11,551	11,551	5%
Total area treated by the Bushfire Fuel Management Program		**125,049**		**54%**
Area suitable for planned burning burnt by bushfires		19,179		
(including area planned for burning on a current FOP)			48	0%
Actual fuel-reduced area (total)		**144,228**	**125,097**	**54%**

Table 5: TAFM and total fuel-reduced area, 2007–17

Financial year	Planned burnt (ha)	Other fuel management method (ha)	Area on a FOP but burnt by bushfire (ha)	Total fuel-reduced (ha)	TAFM (ha)	Fuel-reduced / TAFM (%)
2007–08	156,473			156,473	130,000	120.4%
2008–09	154,260			154,260	130,000	118.7%
2009–10	146,106			146,106	130,000	112.4%
2010–11	188,997			188,997	200,000	94.5%
2011–12	197,149			197,149	225,000	87.6%
2012–13	255,227	6,757	19,966	281,950	250,000	112.8%
2013–14	82,022	12,686	52,333	147,041	260,000	56.6%
2014–15	234,614	13,616	6,377	254,607	275,000	92.6%
2015–16	184,693	13,247	2,541	200,481	275,000	72.9%
2016–17	113,498	11,551	48	125,097	230,195	54.3%

Table 6 shows the number and area of planned burns we conducted through the year in partnership with CFA.

Table 6: Planned burns conducted in partnership with CFA, 2016–17

Region	Number	Area (ha)
Barwon South West	5	1,418
Gippsland	7	5,995
Grampians	1	118
Hume	8	9,410
Loddon Mallee	0	0
Port Phillip	0	0
Total	**21**	**16,941**

Weather effects on planned burning

Weather is one of the most important determinants of when and how much fuel management activity can occur. Short-term weather influences the safe window for planned burning and longer-term weather conditions impact the fuel moisture content of the areas planned for burning. Appropriate fuel moisture conditions must align with suitable weather conditions before we can do planned burning safely and effectively. We cannot do so if it is too hot, too dry, too wet or too windy: in some forests, the window for safe and effective planned burning may be only a handful of days each year.

In 2016–17, weather conditions and climatic trends were not favourable for planned burning. During the year there were long periods when there was less alignment than normal of suitable fuel moisture and favourable weather conditions, and the periods in which they did align were shorter than normal.

Late winter provided opportunities in the dry, open forests of western Victoria (such as in the Grampians) for considerable planned burning. Victoria's spring was one of the wettest on record; fuel moistures were high and drying periods were too short to provide burning opportunities. This lack of opportunity is shown by the fact that during July to December 2016, we only burnt 4000 ha in 50 burns.

Late February usually sees the start of the autumn planned burning program of specific burns (such as small, asset-protection burns; grassland burns; and regeneration and other burns in high elevation areas). Late February to early March saw us ignite 23 burns but extended hot and dry conditions saw a return to bushfire-like conditions in most areas.

Over 80% of planned burning in Victoria occurs in autumn because fuel moisture conditions are suitable and fire danger indices are falling. However, we did very little planned burning until late March 2017. Late March and early-to-mid-April was the busiest and most productive period of the year for planned burning. We ignited 240 burns during two burn windows, both of which were ended by widespread rain. During May, shorter days and cooler conditions greatly reduced the dryness of fuel, but we ignited 50 burns in May. Over the year, we ignited 353 burns covering 113,498 ha.

Planned burning breaches

A planned burn is considered to have gone beyond control lines if it spreads beyond the area designated in the burn plan, cannot be readily controlled with on-site or planned resources and compromises the burn objectives.

A planned burn beyond control lines is classified as a breach or a bushfire depending on its extent and effect on the community. A breach is likely to be controlled within reasonable timeframes for fire response and does not pose a significant threat to, or have a significant effect on, assets or the community. As part of our continuous improvement processes, we review all breaches. The Inspector-General for Emergency Management (IGEM) is notified of all planned burn breaches.

A bushfire is declared when a planned burn goes beyond control lines and threatens or is likely to threaten public safety or private assets, and it is likely to have a greater effect on the environment. The IGEM will investigate the cause of such a bushfire.

In 2016–17, one out a total 353 planned burns across the state (about 0.3% of all planned burns) went beyond control lines and was declared a bushfire. This bushfire burnt public land only. We joined with IGEM staff to investigate this bushfire.

A further seven planned burns breached control lines in 2016–17 and were managed as breaches. In accordance with policy, these were not declared bushfires.

Table 7 shows details of planned burns that went beyond control lines in 2016–17.

Table 7: Planned burn breaches of control lines, 2016–17

Burn name	Location	Planned burn / bushfire or breach area (ha)	Impact
Grampians – Snells Rd	20 km north-east of Cavendish	1,233 / 2.65 (breach)	An ecological burn in a LMZ in the Grampians National Park was ignited on 16 August 2016 and we believe it breached control lines on the night of 19 August. We believe spotovers crossed an internal track as rain began to fall over the burn. The spotovers burnt in other areas of the planned burn and also into adjacent private forested land, burning 2.65 ha at low intensity before being suppressed by rainfall. The breach of control lines was discovered when we reviewed aerial imagery on 18 October 2016.
Erica – Telbit Crossing	5 km south-west of Erica	216 / 17 (breach)	A fuel-reduction burn in an APZ in state forest was ignited on 9 March 2017 and breached control lines on the same day. The fire behaviour in the burn led to several spotovers occurring outside the control line. We could not readily suppress these spotovers due to safety concerns and therefore considered it safer to contain the spotovers using an adjacent track. This resulted in about 17.0 ha of forested area (16.4 ha of state forest and 0.6 ha of private forested land) outside the planned burn control lines being burnt. 50% of the total area burnt at low-to-moderate intensity and 50% burnt at moderate-to-high intensity.
Wulgulmerang – Splitters Creek	10 km north-west of Wulgulmerang	3,871 / 704 (breach), 63 (bushfire)	A fuel-reduction burn in a BMZ in the Buchan Headwaters Wilderness Zone of the Alpine National Park was ignited on 11 March 2017. We identified three spotovers in remote parts of the planned burn contingency area on 13 March. Two of the spotovers remained in the contingency area and we managed them as breaches. They burnt 704 ha at a range of fire intensities. The third spotover burnt 63 ha beyond the contingency area boundary at moderate-to-high intensity.
Benambra – The Sisters Track	8 km south-east of Benambra	473 / 9 (breach)	A fuel-reduction burn in a LMZ in state forest was ignited on 4 April 2017. The burn breached the control line on 5 April and burnt 9 ha of natural pasture in adjacent private land.
Holey Plains – Long Ridge	7 km south-east of Rosedale	222 / 2.7 (breach)	A fuel-reduction burn in a LMZ in state forest was ignited on 5 April 2017. The burn breached the control line on 6 April after two spotovers landed in adjacent privately owned forested area. The spotovers resulted in 2.7 ha being burnt at low intensity.
Boolarra – Corky's Track	2 km south of Boolarra	28 / 14 (breach)	A fuel-reduction burn in an APZ in state forest was ignited on 5 April 2017 and breached control lines the same day when several spotovers occurred in adjacent state forest. The spotovers burnt 14 ha at moderate intensity.

Burn name	Location	Planned burn / bushfire or breach area (ha)	Impact
Derrimut –Fitzgerald Rd	Derrimut	56.6 / 31 (breach)	An ecological burn in a LMZ in the Derrimut Grasslands Nature Conservation Reserve was ignited on 6 April 2017 and breached a control line the same day: we believe it burnt through the control line. The breakaway burnt 31 ha of native grasslands.
Toolebewong – Old Coach Road	2.5 km north-north-west of Mt Toolebewong	149 / 5.69 (breach)	A fuel-reduction burn in a BMZ in state forest was ignited on 19 April 2017 and breached a control line the same day when a spotover landed in adjacent state forest. The spotover burnt 5.69 ha at a range of intensities.

Hazardous Tree Removal Project

Fire-affected falling trees and branches are dangerous for firefighters and for others working in and travelling through affected areas. The Victorian Government committed $7 million in the 2015–16 Budget to the Hazardous Tree Removal Project to remove fire-damaged and hazardous trees in high-risk and priority areas of state forests and national parks. The project focuses on priority areas of public land: strategic roads, firebreaks, recreation sites, dams and helipads. Some of the most dangerous trees are found along roadsides.

During the year, 680 km of roadsides and firebreaks and 266 ha of high-use sites on public land were treated to reduce risk. The program has treated 1095 km and 333 hectares of hazardous trees on public land and the activities funded under the program have now been completed.

Barwon South West region

Table 8 shows 2016–17 burn planning, site preparation and fuel reduction achievements in the Barwon South West region. It shows we prepared burn plans for 17,551 ha, or 132% of the TAFM. It also shows we prepared burn plans and made sites ready for 18,696 ha, or 141% of the TAFM. This resulted in residual risk decreasing from 60% to 58%.

The table shows we treated 26% of the TAFM by planned burning, which was 20 planned burns of a total 3,483 ha. We also treated 11% of the TAFM — 1,477 ha — by other methods.

The limited program was mainly because of unfavourable weather conditions in March. Warm conditions with regular rainfall persisted through the summer–autumn transition into March, resulting in fuel being unavailable for planned burning, and we treated only 303 ha. April saw improved conditions as the hotter days moderated and there were some quite good opportunities interspersed with disruptive rainfall events. As a result we treated 2,586 ha. Conditions in May were good, but as the days became shorter fuel was slow to dry from rainfall and limited burning — 869 ha — occurred. This trend continued into June as winter conditions set in with cool weather and short days, and we treated no area.

Throughout the season, we worked hard to keep the community informed and had engagement staff in the burn incident management team and community liaison officers in the field.

Our crews helped with several CFA burns (and vice versa) across the region in a practical demonstration of how Safer Together works on the ground. Our crews also helped with Gunditj Mirring Traditional Owner cultural burns in the Tyrendarra Indigenous Protected area east of Portland. In previous years, the Aboriginal rangers conducting these cultural burns have worked on our burns, so the learnings have flowed both ways.

Table 8: Burn planning, site preparation and fuel reduction, Barwon South West region, 2016–17

Measure		Ha	Ha toward TAFM	% of TAFM
Target area for fuel management (TAFM)		13,291		
Burn planning and site preparation				
Area for which burn plans were prepared (over the three-year FOP)	Target	15,949		120%
	Actual	17,551		132%
Area of sites made ready	Target	15,949		120%
	Actual	18,696		141%
Fuel reduction				
Area treated by planned burning: • ecological burns 7 ha (2 burns) • fuel-reduction burns 3,476 ha (17 burns) • other burns <1 ha (1 burns)		3,483	3,483	26%
Area treated by other fuel management methods		1,477	1,477	11%
Area suitable for planned burning burnt by bushfires		0		
(including area planned for burning on a current FOP)			0	0%
Actual fuel-reduced area (total)		**4,960**	**4,960**	**37%**
Residual risk				
Change in residual risk		**Down 2%, to 58%**		

Gippsland region

Table 9 shows 2016–17 burn planning, site preparation and fuel reduction achievements in the Gippsland region. It shows we prepared burn plans for 170,549 ha, or 165% of the TAFM. It also shows we made planned burning sites ready for 166,504 ha, or 161% of the TAFM. We exceeded both targets for burn planning and site preparation. Despite our achievements, residual risk increased by 1% from 60% to 61% during the year.

The table shows we treated 67% of the TAFM by planned burning: a total of 69,338 ha.

We continued to align our fuel management activities with Safer Together by starting a single, planned burning notification system for the media and general public using information from FFMVic, CFA and Hancock Victorian Plantations. CFA supported some planned burning on public land that adjoined private land, and it helped us with a total of 17 planned burns.

By ensuring burns were planned and prepared in advance, we were able to use every burning opportunity the season presented. Dry conditions in March delayed the autumn planned burning program. The VicForests coupe regeneration burn program also occurred much later in the season, with 53 burns completed. A bushfire in the Macalister fire district tied up many resources from middle to late March. We largely completed our planned burning across the region by April, although in some districts the season extended until late May.

Over half of the planned burns in the 2016–17 season were in APZs and BMZs, demonstrating our focus on reducing risk to higher-risk communities. We prioritised burning in the Latrobe fire district where residual risk is higher than elsewhere in the region as it includes the Latrobe Valley and some of the state's most essential infrastructure.

The planned burning program also helped protect other ecological assets and values important to the community (such as Leadbeater's possum and water supply catchments).

Table 9: Burn planning, site preparation and fuel reduction, Gippsland region, 2016–17

Measure		Ha	Ha toward TAFM	% of TAFM
Target area for fuel management (TAFM)		103,296		
Burn planning and site preparation				
Area for which burn plans were prepared (over the three-year FOP)	Target	123,955		120%
	Actual	170,549		165%
Area of sites made ready	Target	123,955		120%
	Actual	166,504		161%
Fuel reduction				
Area treated by planned burning: • ecological burns 23,657 ha (16 burns) • fuel-reduction burns 44,443 ha (51 burns) • other burns 1,238 ha (61 burns)		69,338	69,338	67%
Area treated by other fuel management methods		1,812	1,812	2%
Area suitable for planned burning burnt by bushfires		11,644		
(including area planned for burning on a current FOP)			11	0%
Actual fuel-reduced area (total)		**82,794**	**71,161**	**69%**
Residual risk				
Change in residual risk		**Up 1%, to 61%**		

Grampians region

Table 10 shows 2016–17 burn planning, site preparation and fuel reduction achievements in the Grampians region. It shows we prepared burn plans for 45,399 ha, or 171% of the TAFM, exceeding the target by 13,484 ha. It also shows we prepared burn plans and made sites ready for 43,312 ha which, at 163% of TAFM, was also above the target of 120%. The table shows we treated 32% of the TAFM by planned burning and a further 8% by other fuel management methods. This resulted in residual risk decreasing from 65% to 62%.

Although the area treated by planned burning across the region was limited to 8,527 ha, we conducted 37 planned burns. These included planned burns near the priority towns of Beaufort, Edenhope and Apsley and a cross-tenure burn at Stawell. Cultural burning was an important event for the region, and a burn at Mt Arapiles was conducted in partnership with the Traditional Owners. We scheduled other burns near the high-priority towns of Daylesford, Ballarat and Ararat, but we delayed them to allow for a late grape harvest and tourism activities over Easter; we were then unable to complete them due to the onset of unsuitable weather.

We treated six large mosaic burns in the Grampians National Park, to re-introduce fire into the area burnt by the 2006 Mt Lubra bushfire with the aim of enhancing the habitat of threatened plant and animal species. As well, we continued conducting planned burning to reduce the likelihood of large-scale fires in the Little Desert National Park.

Table 10: Burn planning, site preparation and fuel reduction, Grampians region, 2016–17

Measure		Ha	Ha toward TAFM	% of TAFM
Target area for fuel management (TAFM)		26,596		
Burn planning and site preparation				
Area for which burn plans were prepared (over the three-year FOP)	Target	31,915		120%
	Actual	45,399		171%
Area of sites made ready	Target	31,915		120%
	Actual	43,312		163%
Fuel reduction				
Area treated by planned burning: • ecological burns 1,309 ha (4 burns) • fuel-reduction burns 7,205 ha (33 burns) • other burns 13 ha (10 burns)		8,527	8,527	32%
Area treated by other fuel management methods		2,102	2,102	8%
Area suitable for planned burning burnt by bushfires		917		
(including area planned for burning on a current FOP)			7	0%
Actual fuel-reduced area (total)		**11,546**	**10,636**	**40%**
Residual risk				
Change in residual risk		**Down 3%, to 62%**		

Hume region

Table 11 shows 2016–17 burn planning, site preparation and fuel reduction achievements in the Hume region. It shows we prepared burn plans for 78,019 ha, or 136% of the TAFM. It also shows we prepared burn plans and made sites ready for 67,601 ha, or 118% of the TAFM. This resulted in residual risk remaining at 59%.

We conducted 81 burns across the region in 2016–17, treating 25,527 ha. This was a good achievement given the seasonal conditions, which resulted in a late drying period and limited burning opportunities. In the last seven years, we have treated 424,346 ha with 929 burns.

The seasonal conditions limited planned burning opportunities in higher areas, and we adjusted our program accordingly to best reduce risk and meet community needs. We carried out planned burns in high-fuel-hazard areas close to identified high-bushfire-risk towns that the BRL teams identified as being in the likely paths of major bushfires.

Fuel-moisture levels provided opportunities to conduct burns in high-fuel-hazard areas with sensitive ecological values and high stakeholder interest (such as the Strathbogie – Dry Creek burn in the Goulburn fire district).

Though seasonal conditions limited planned burn opportunities, good planning enabled us to adjust the program and treat areas in foothill forests and grasslands and still deliver priority burns near towns. We conducted five APZ burns covering 476 ha, 27 BMZ burns (13,948 ha) and 40 LMZ burns (10,689 ha). We also conducted nine other burns including heaps and environmental restoration burns, covering 414 ha. Treating 1,219 ha by other methods helped reduce risk where we could not burn, including in red gum woodland areas in the west and close to Yea, Kilmore and Broadford.

We started preparing for our next planned burning season by removing bark fuel from trees (such as stringybarks close to burn boundaries).

Table 11: Burn planning, site preparation and fuel reduction, Hume region, 2016–17

Measure		Ha	Ha toward TAFM	% of TAFM
Target area for fuel management (TAFM)		57,398		
Burn planning and site preparation				
Area for which burn plans were prepared (over the three-year FOP)	Target	68,878		120%
	Actual	78,019		136%
Area of sites made ready	Target	68,878		120%
	Actual	67,601		118%
Fuel reduction				
Area treated by planned burning: • ecological burns 14 ha (4 burns) • fuel-reduction burns 24,869 ha (46 burns) • other burns 644 ha (33 burns)		25,527	25,527	44%
Area treated by other fuel management methods		1,360	1,360	2%
Area suitable for planned burning burnt by bushfires		14		
(including area planned for burning on a current FOP)			1	0%
Actual fuel-reduced area (total)		**26,901**	**26,888**	**47%**
Residual risk				
Change in residual risk		**No change, maintained at 59%**		

Loddon Mallee region

Table 12 shows 2016–17 burn planning, site preparation and fuel reduction achievements in the Loddon Mallee region. It shows we prepared burn plans for 29,081 ha, or 120% of the TAFM. It also shows we prepared burn plans and made sites ready for 29,617 ha, which was 2% over the target. The table shows we treated 15% of the TAFM by planned burning and a further 15% by other fuel management methods. This resulted in residual risk decreasing from 61% to 59%.

In spring 2016, we conducted planned burns at Bendigo, Wedderburn, Rushworth and Heathcote. High fuel moisture and wet weather conditions limited opportunities for planned burning. The spring program quickly transitioned into an early fire season, with days of very high to extreme fire danger in October. Dry conditions persisted through summer and into autumn. We could not conduct planned burning safely until April 2017 as fuel remained too dry and weather conditions unsuitable. When conditions allowed, we did high-priority burns to deliver as much risk reduction as possible.

During the year, we conducted 27 planned burns, treating 3,570 ha, and we treated another 3,759 ha by methods other than planned burning. The Brights Lane and Happy Tommy Track cultural burns were significant and groundbreaking, bringing Aboriginal cultural practices into our burn program: our team, including its Dja Dja Wurrung members, have made history by returning traditional burning to Dja Dja Wurrung Country.

In the Mallee fire district, we conducted three burns in the district totalling 1,299 ha of a planned 25,700 ha, with all burns being priority burns. The district delivered 2,159 ha of a planned 3,000 ha by slashing, mulching and rolling in priority fuel management areas. In the Murray Goldfields fire district, we burnt 2,470 ha of a planned 10,555 ha for the district with planned burning focused on reducing risk to high-risk communities. These burns required substantial community engagement to build the community's support and ensure its safety.

Table 12: Burn planning, site preparation and fuel reduction, Loddon Mallee region, 2016–17

Measure		Ha	Ha toward TAFM	% of TAFM
Target area for fuel management (TAFM)		24,328		
Burn planning and site preparation				
Area for which burn plans were prepared (over the three-year FOP)	Target	29,194		120%
	Actual	29,081		120%
Area of sites made ready	Target	29,194		120%
	Actual	29,617		122%
Fuel reduction				
Area treated by planned burning: • ecological burns 0 ha (0 burns) • fuel-reduction burns 3,570 ha (27 burns) • other burns <1 ha (2 burns)		3,570	3,570	15%
Area treated by other fuel management methods		3,759	3,759	15%
Area suitable for planned burning burnt by bushfires		6,563		
(including area planned for burning on a current FOP)			6	0%
Actual fuel-reduced area (total)		**13,892**	**7,335**	**30%**
Residual risk				
Change in residual risk		**Down 2%, to 59%**		

Port Phillip region

Table 13 shows 2016–17 burn planning, site preparation and fuel reduction achievements in the Port Phillip region. It shows we prepared burn plans for 7,812 ha, or 148% of the TAFM. It also shows we prepared burn plans and made sites ready for 7,498 ha, which was 22% above the target. We treated 58% of the TAFM by planned burning and a further 20% by other fuel management methods. This resulted in residual risk decreasing from 77% to 74%.

The East Central BRL team reviewed the region's zoning last year to determine priority areas for planned burning, and we used their work to prioritise planned burning sites. We received feedback about the review's prioritisation through online conversations, online surveys, staff forums, community information sessions and other community events.

In the Yarra fire district, there were limited opportunities for burning. We completed five burns totalling 2,416 ha and comprising 65% of the planned area. These burns were hard to execute operationally but were extremely beneficial for reducing risk to towns including Warburton and Noojee and to Melbourne's water catchments. The burns were in APZs and BMZs identified in the landscape's strategic bushfire management plan as priority fuel treatment areas.

In the Metropolitan fire district, we completed four fuel-reduction and many ecological grassland burns to take advantage of different types of fuel being available at different times. These comprised 110 ha of the 203 ha treated and included planned burns at Lysterfield (to protect Upper Beaconsfield against a repeat of the Ash Wednesday fires) and in the Dandenongs (to protect lower Dandenongs communities — such as Monbulk — and the Melbourne Water Silvan Reservoir). Conditions on the west face of the Dandenongs remained unsuitable for the whole season but we continually monitored conditions on the ground to ensure we could burn if there was a suitable window.

Table 13: Burn planning, site preparation and fuel reduction, Port Phillip region, 2016–17

Measure		Ha	Ha toward TAFM	% of TAFM
Target area for fuel management (TAFM)		5,286		
Burn planning and site preparation				
Area for which burn plans were prepared (over the three-year FOP)	Target	6,343		120%
	Actual	7,812		148%
Area of sites made ready	Target	6,343		120%
	Actual	7,498		142%
Fuel reduction				
Area treated by planned burning: • ecological burns 337 ha (10 burns) • fuel-reduction burns 2,649 ha (12 burns) • other burns 67 ha (24 burns)		3,053	3,053	58%
Area treated by other fuel management methods		1,041	1,041	20%
Area suitable for planned burning burnt by bushfires		41		
(including area planned for burning on a current FOP)			23	0.4%
Actual fuel-reduced area (total)		**4,135**	**4,117**	**78%**
Residual risk				
Change in residual risk		**Down 3%, to 74%**		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Definitions and further information

Area of sites made ready

The total area (in hectares) of sites which, having had a burn plan prepared, were also made ready for burning when conditions permit. Making a site ready for burning can include building a mineral earth break, slashing, applying foam or retardants, managing hazardous trees, removing cuttings from adjoining areas and within spotting distance, and burning adjoining areas.

We prepare burn plans and make sites ready for a much greater total area than the TAFM. This ensures we have enough sites ready to burn if weather conditions don't allow for burning at some sites.

Area suitable for planned burning burnt by bushfires

The total area (in hectares) in an APZ, BMZ or LMZ that was burnt by bushfires, including planned burning breaches that turned into bushfires. The tables for each region show this total area in the hectare (Ha) column.

Usually, part of such an area turns out to have been included on a current FOP: that is, we intended to conduct a planned burn on it over the life of the current FOP. We count this part toward TAFM (by including it in the 'Ha toward TAFM' column) because if bushfires had not reduced fuel in the area, we would have done so. This part does not include planned burning breaches and escapes into areas not on a current FOP because although fuel was reduced in the area — by a bushfire — we did not intend it to be reduced.

Area treated by other fuel management methods

The total area (in hectares) where we manage fuel other than by planned burning — by mowing, slashing, mulching and using herbicides. We do this mostly to establish and maintain a network of strategic fuel breaks: these are strips of land with less fuel available to burn during a bushfire and where we can back burn ahead of an approaching bushfire.

Area treated by planned burning

The total area (in hectares) we planned burnt during the year. Most fuel management is by planned burning — lighting and managing planned fires at times of lower bushfire risk, mostly in autumn and spring — to reduce the quantity of leaf litter, twigs, bark and undergrowth. We classify planned burning into three categories: ecological burns, fuel-reduction burns and other burns. Our Planned burns for the next 10 days web page has a map of all the planned burns we intend to conduct over the next 10 days, weather permitting.

Burn plans

Each planned burn must have an approved burn plan, the requirements of which are specified in the *Code of Practice for Bushfire Management on Public Land 2012*. The plan includes the land management and burn objectives, the area of the burn, the type of fire management zone, how we will minimise impacts on particular values and how we will monitor and report achievement of the burn aims.

Burn window

Weather is one of the most important determinants of when and how much fuel management activity can occur. Appropriate fuel moisture conditions must align with suitable weather conditions before we can do planned burning safely and effectively. The burn window is the suitable alignment of appropriate weather conditions.

Community-based bushfire management

Community-based bushfire management follows the community-based approach used by Emergency Management Victoria to support communities and agencies to better connect and make more informed decisions. It includes working with communities to identify local priorities, develop mutual goals and solutions, build relationships and use locally tailored processes before, during and after a bushfire.

Ecological burns

These are planned burns to maintain and improve ecological resilience and help regenerate forests.

Ecosystem resilience

This is the capacity of an area to absorb natural and management-imposed disturbance but still retain its basic structure — the abundance and composition of its species, the function of its vegetation and its types of vegetation — over time.

Fire management zones

For fuel management purposes, Victoria is classified into four fire management zones:

- Asset Protection Zone (APZ): an area around properties and infrastructure where we intensively manage fuel to provide localised protection to reduce radiant heat and ember attack on life and property in the event of a bushfire
- Bushfire Moderation Zone (BMZ): an area around properties and infrastructure where we manage

fuel to reduce the speed and intensity of bushfires and to protect nearby assets, particularly from ember attack in the event of a bushfire

- Landscape Management Zone (LMZ): an area where we manage fuel to minimise the impact of major bushfires, to improve ecosystem resilience and for other purposes (such as to regenerate forests and protect water catchments)
- Planned Burning Exclusion Zone (PBEZ): an area where we try to avoid planned burning, mainly because ecological assets in this zone cannot tolerate fire.

Fire operations plans (FOPs)

FOPs outline where and when we intend to carry out fuel management activities on public land over the next three years. Our Approved fire operations plan web page has an interactive map showing all activities in FOPs to 2017–20.

Fuel management

Fuel management activities include:

- fire (including planned burning — lighting and managing planned fires on prepared sites at times of the year when bushfire risk is lower — and bushfires where they occur in areas preplanned for fuel management)
- mechanical activities (such as mowing, slashing and mulching) where identified on a current FOP
- chemical activities (such as by using herbicide) where identified on a current FOP
- grazing by domestic stock (typically by cattle or sheep), but it can only be accounted for as a fuel management activity if it is specifically undertaken to manage bushfire fuel (by reducing and/or compacting the vegetation, most commonly grasses) and is identified on a current FOP
- other fuel management activities approved by the Secretary of DELWP.

Fuel-reduction burns

These are planned burns to reduce the amount of fuel available to a bushfire, which can reduce its intensity and rate of spread and so improve opportunities for firefighters to suppress it.

Geometric mean abundance

This is the relative abundance of all known species within a particular ecosystem. It provides a measure of the biodiversity of an ecosystem, which is a good indicator of resilience. We use it along with GSS. Geometric mean abundance also allows us to consider the impact of different fire regimes on particular threatened species.

Growth stage structure (GSS)

The vegetation GSS of an area is its mix of vegetation of different ages, from juvenile to old. Vegetation's GSS depends on when it was last burnt or otherwise disturbed. We assume that a diversity of GSSs and habitats across a landscape ensures a diversity of species, which helps maintain and improve ecosystem resilience. We manage fuel to ensure there is an acceptable mix of growth stages in the landscape, and to protect important areas of older growth stages.

The growth stages we use are:

- **juvenile**: from immediate post-fire renewal to establishment, including when species are reproductive
- **adolescent**: when the vegetation is relatively young and all species are reproductive but not at the rate characterising mature vegetation
- **mature**: including when the dominant species are fully reproductive through to stasis, when vegetation structure and reproductive capacity stabilise
- **old**: when reproduction of the dominant species is declining and propagule banks are decreasing; if left undisturbed, vegetation may become senescent and is then unlikely to be reconstituted after fire.

There is more information about vegetation GSS on our Healthy environments web page.

Other burns

These are mainly regeneration burns after logging and the burning of heaps. We do many regeneration and heap burns each year but they contribute only a very small area to the total area treated by planned burning.

Residual risk

This is the amount of bushfire risk which remains after bushfires and fuel management activities reduce fuel. Our Understanding risk web page explains bushfire risk in more detail, and it explains how DELWP uses Phoenix RapidFire bushfire simulation software to model bushfire risk.

Safer Together

This is the government's new approach to reducing the risk of bushfire in Victoria, to implement the recommendations of the Inspector-General for Emergency Management's review of performance targets for fuel management on public land, including moving from a hectare-based performance target to a risk-reduction target.

Strategic bushfire management plans

Each of Victoria's seven BRLs has a strategic bushfire management plan. Each plan explains the fuel management strategy and other actions we will undertake in that landscape to minimise the impact of major bushfires on people, property, infrastructure and economic activity and how we will maintain and improve the resilience of natural ecosystems. The plans explain how fuel will be managed within each fire management zone — APZ, BMZ, LMZ and PBEZ — on public land, using planned burning and other fuel management activities.

Target area for fuel management (TAFM)

In 2016–17, we were transitioning from an annual target for the number of hectares to be fuel-managed — the TAFM — to a risk-based target. The state's TAFM was determined through the state budget process and we allocated the hectares to each region for 2016–17 using risk analysis.

Tolerable fire interval (TFI)

We report on ecosystem resilience using the TFI status of vegetation on Victorian public land as below minimum TFI, within TFI, above maximum TFI and with no fire history.

The proportion of public land **within TFI** is the percentage of Victorian public land that we currently record as having been last burnt by bushfire or planned burning within the recommended minimum and maximum TFIs for its ecological fire group (a group of ecological vegetation classes with common ecological requirements for fire and common fire behaviour characteristics). It is good for ecosystem resilience if vegetation is 'within TFI'.

The proportion of public land **below minimum TFI** is that percentage that was last burnt in less time than recommended for the vegetation on that land. For example, if it was last burnt 10 years ago and its recommended minimum TFI is 15 years, then it is now below minimum TFI and will be for another five years. That is, it doesn't tolerate fire more frequently than every 15 years well, and should preferably not be burnt for another five.

The proportion of public land **above maximum TFI** is the opposite: it has remained unburnt longer than recommended. Using the same example, if its maximum TFI is 30 years, then it won't be in that category for another 20 years. That is, it should preferably be burnt every 30 years and as it was burnt 10 years ago, it should ideally be burnt in another 20 or more.

The proportion of public land with **no fire history** is that percentage for which we do not have records, or the vegetation on that land does not have recommended TFIs.

The larger the areas in a landscape below minimum TFI and above maximum TFI, the less resilient ecosystems are likely to be. Burning regularly above maximum TFI or below minimum TFI increases the risk of fundamental changes in the structure and functioning of the vegetation. However, we sometimes decide to burn in particular areas below minimum TFI to manage bushfire risk to life and property and to reduce the potential damage to important ecosystems by major bushfires.

There is more information about TFI on our Healthy environments web page.


Parks

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